



**Efficiency through technology**

**RELIABILITY REPORT  
1/06**

**Power Semiconductor Devices**

**January 2004 - December 2005**

**IXYS Corporation**  
3540 Bassett Street  
Santa Clara CA 95054  
USA

IXDN0007  
Published 2006

**IXYS Semiconductor GmbH**  
Edisonstrasse 15  
D-68623 Lampertheim  
Germany

---

## QUALITY AND RELIABILITY

---

IXYS is committed to setting a new standard for excellence in Power Semiconductors. Reflecting our dedication to industry leadership in the manufacture of medium to high power devices, reliability has assumed a primary position in raw material selection, design, and process technology.

Reliability utilizes information derived from applied research, engineering design, analysis of field applications and accelerated stress testing and integrates this knowledge to optimize device design and manufacturing processes.

All areas that impact reliability have received considerable attention in order to achieve our goal to be the # 1 Reliability Supplier of Power Semiconductor products. We believe IXYS products should be the most reliable components in your system.

We have committed significant resources to continuously improve and optimize our device design, wafer fab processes, assembly processes and test capabilities. As a result of this investment, IXYS has realized a dramatic improvement in reliability performance on all standardized tests throughout the product line.

Excellence in product reliability is "built-in", not tested-in. Moreover, it requires a total systems approach, involving all parties: from design to raw materials to manufacturing.

In addition to qualifying new products released to the market, life and environmental tests are periodically performed on standard products to maintain feedback on assembly and fabrication performance to assure product reliability. Further information on reliability of power devices is provided on [www.ixys.com](http://www.ixys.com).

---

## RELIABILITY TESTS

---

### High Temperature Reverse Bias (HTRB)

Failure Modes: Gradual degradation of break-down characteristics due to presence of foreign materials and polar/ionic contaminants disturbing the electric field termination structure.

Sensitive Parameters:  $BV_{DSS}$ ,  $BV_{CES}$ ,  $V_{DRRM}$ ,  $V_{RRM}$ ,  $I_{DSS}$ ,  $I_{CES}$ ,  $I_{DRM}$ ,  $I_{RRM}$ ,  $V_{TH}$ .

### High Temperature Gate Bias (HTGB)

Failure Modes: Rupture of the gate oxide due to localized thickness variations, structural anomalies, particulates in the oxide, channel inversion due to presence of mobile ions in the gate oxide.

Sensitive Parameters:  $I_{GSS}$ ,  $I_{GES}$ ,  $V_{TH}$ ,  $I_{DSS}$ ,  $I_{CES}$ .

### Temperature Cycle

Failure modes: Thermal fatigue of silicon-metal and metal-metal interfaces due to heating and cooling, causing thermal and electrical performance degradation.

Sensitive Parameters:  $R_{thJC}$ ,  $R_{DS(on)}$ ,  $V_{CE(sat)}$ ,  $V_T$ ,  $V_F$ .

### Humidity Test

Failure Modes: Degradation of electrical leakage characteristics due to moisture penetration into plastic packages.

Sensitive Parameters:  $BV_{DSS}$ ,  $BV_{CES}$ ,  $V_{DRRM}$ ,  $V_{RRM}$ ,  $I_{DSS}$ ,  $I_{CES}$ ,  $I_{DRM}$ ,  $I_{RRM}$ ,  $I_{GSS}$ ,  $I_{GES}$ ,  $V_{TH}$ .

### Power Cycle

Failure Modes: Thermal fatigue of silicon-metal and metal-metal interfaces due to heating and cooling can cause thermal and electrical performance degradation.

Sensitive Parameters:  $R_{thJC}$ ,  $R_{DS(on)}$ ,  $V_{CE(sat)}$ ,  $V_T$ ,  $V_F$ ,  $I_{DSS}$ ,  $I_{CES}$ ,  $I_{DRM}$ ,  $I_{RRM}$ ,  $BV_{DSS}$ ,  $BV_{CES}$ ,  $V_{DRRM}$ ,  $V_{RRM}$ .

---

## TERMS IN TABLES

---

### SUMMARY TABLES 1 AND 2:

#### AF: acceleration factor

$$AF = \exp \left\{ Ea \left[ \frac{T_2 - T_1}{T_2 * T_1} \right] / k \right\} \quad (1)$$

Ea: activation energy; @ HTRB Ea = 1.0 eV  
@ HTGB Ea = 0.4 eV

k: Boltzmann's constant  $8.6 \cdot 10^{-5}$  eV/K

T<sub>1</sub>: abs. application junction temperature (273+T<sub>j</sub>) K

T<sub>2</sub>: abs. test junction temperature (273+T<sub>j</sub>) K

#### UCL: upper confidence limit (60%)

##### Total Failures @ 60% UCL:

$$N = r + dr \quad (2)$$

r: number of failed devices

dr: additional term, depending on both r and UCL

MTTF: Mean Time To Failures = 1/Failure Rate

FIT: 1 FIT = 1 failure /  $10^9$  hrs

### TABLES 3:

#### $\Delta T$ : max T<sub>j</sub> - min T<sub>j</sub> during Test

---

## DEFINITION OF FAILURE

---

Failure criteria are defined according to IEC 60747 standard series

**Summary of Tables 1A - 1J: HTRB**

|   | <b>Table 1A</b><br>MOSFET/IGBT<br>discrete device *) | <b>Table 1B</b><br>MOSFET/IGBT<br>Module | <b>Table 1C</b><br>Thyr./Diode<br>Module | <b>Table 1D</b><br>Controller/<br>Rec. Bridge*) | <b>Table 1E</b><br>FRED<br>*) | <b>Table 1F</b><br>Schottky<br>Diode*) | <b>Table 1G</b><br>Thyr./Diode<br>discrete device*) | <b>Table 1H</b><br>ISOPLUS |        |
|---|--|--|--|---|-------------------------------|--|---|----------------------------|--------|
| Failure Rate [FIT] 125°C, 60% UCL                     | 456  | 49821                                    | 8213                                     | 8142  | 3142                          | 12995                                  | 2380  | -                          |        |
| Failure Rate [FIT] 90°C, 60% UCL                      | 27   | 2983                                     | 492                                      | 488   | 188                           | 778                                    | 143   | -                          |        |
| Total Lots Tested                                     | 144  | 14                                       | 26                                       | 15  | 26                            | 17                                     | 15  | 15                         |        |
| Total Devices Tested                                  | 4167   | 123                                      | 279                                      | 150   | 450                           | 310                                    | 250   | 289                        |        |
| Total<br>Failures                                     | <u>Actual</u><br>60% UCL {eq. (2)}                   | 1<br>2,00                                | 1<br>2,00                                | 1<br>2,00                                       | 0<br>0,92                     | 0<br>0,92                              | 1<br>2,00   | 0<br>0,92                  | 0<br>- |
| Total Equivalent Device Hours<br>@ 125°C {AF eq. (1)} | 4390560  | 40144                                    | 243512                                   | 113000  | 292800                        | 153901                                 | 386499  | 314282                     |        |
| MTTF<br>(Years)                                       | <u>125°C 60% UCL</u><br>90°C 60% UCL                 | 251<br>4185                              | 2<br>38                                  | 14<br>232                                       | 14<br>234                     | 36<br>607                              | 9<br>147  | 48<br>801                  | -<br>- |

**Summary of Table 2A - 2C: HTGB**

|   | <b>Table 2A</b><br>MOSFET/IGBT<br>discrete device *) | <b>Table 2B</b><br>MOSFET/IGBT<br>Module | <b>Table 2C</b><br>ISOPLUS |
|---|--|--|----------------------------|
| Failure Rate [FIT] 125°C, 60% UCL                     | 263  | 21140                                    | -                          |
| Failure Rate [FIT] 90°C, 60% UCL                      | 85   | 6819                                     | -                          |
| Total Lots Tested                                     | 118  | 11                                       | 5                          |
| Total Devices Tested                                  | 3471   | 110                                      | 95                         |
| Total<br>Failures                                     | <u>Actual</u><br>60% UCL {eq. (2)}                   | 0<br>0,92                                | 0<br>-                     |
| Total Equivalent Device Hours<br>@ 125°C {AF eq. (1)} | 3501200  | 43520                                    | 132560                     |
| MTTF<br>(Years)                                       | <u>125°C 60% UCL</u><br>90°C 60% UCL                 | 434<br>1347                              | 5<br>17                    |

\*) including ISOPLUS

### Summary of Tables 3A - 3H: Power Cycle

|                      | <b>Table 3A</b><br>MOSFET/IGBT<br>discrete device *) | <b>Table 3C</b><br>Thyr./Diode<br>Module | <b>Table3D</b><br>Controller/<br>Rec. Bridge*) | <b>Table 3E</b><br>FRED<br>*) | <b>Table 3F</b><br>Schottky<br>Diode*) | <b>Table 3G</b><br>Thyr./Diode<br>discrete device*) | <b>Table 3H</b><br>Isoplus |
|----------------------|--|--|--|-------------------------------|--|---|----------------------------|
| Total Lots Tested    | 19   | 6  | 7  | 10                            | 6                                      | 8   | 3                          |
| Total Devices Tested | 440  | 60                                       | 70   | 180                           | 120                                    | 140   | 60                         |
| Total Failures       | 0  | 0  | 0  | 0                             | 0                                      | 0   | 0                          |
| Total Device Cycles  | 3920000  | 1150000                                  | 310000   | 520000                        | 640000                                 | 480000  | 500000                     |

### Summary of Tables 4A - 4J: Temperature Cycle

|                      | <b>Table 4A</b><br>MOSFET/IGBT<br>discrete device *) | <b>Table 4B</b><br>MOSFET/IGBT<br>Module | <b>Table 4C</b><br>Thyr./Diode<br>Module | <b>Table4D</b><br>Controller/<br>Rec. Bridge*) | <b>Table 4E</b><br>FRED<br>*) | <b>Table 4F</b><br>Schottky<br>Diode*) | <b>Table 4G</b><br>Thyr./Diode<br>discrete device*) | <b>Table 4H</b><br>Isoplus | <b>Table 4J</b><br>Breakover<br>Diode |
|----------------------|--|--|--|--|-------------------------------|--|---|----------------------------|---------------------------------------|
| Total Lots Tested    | 27   | 13                                       | 27                                       | 17   | 25                            | 19                                     | 24  | 25                         | 5                                     |
| Total Devices Tested | 706  | 130                                      | 315                                      | 170  | 410                           | 390                                    | 408   | 530                        | 100                                   |
| Total Failures       | 0  | 0  | 0  | 1  | 0                             | 0                                      | 0   | 0                          | 0                                     |
| Total Device Cycles  | 150600   | 9000                                     | 25000                                    | 11200  | 30400                         | 32000                                  | 24900   | 44000                      | 6000                                  |

### Summary of Tables 5A - 5H: Humidity Test

|                      | <b>Table 5A</b><br>MOSFET/IGBT<br>discrete device *) | <b>Table 5C</b><br>Thyr./Diode<br>Module | <b>Table5D</b><br>Controller/<br>Rec. Bridge*) | <b>Table 5E</b><br>FRED<br>*) | <b>Table 5F</b><br>Schottky<br>Diode*) | <b>Table 5G</b><br>Thyr./Diode<br>discrete device*) | <b>Table 5H</b><br>Isoplus | <b>Table 5J</b><br>Breakover<br>Diode |
|----------------------|--|--|--|-------------------------------|--|---|----------------------------|---------------------------------------|
| Total Lots Tested    | 4  | 5  | 5  | 7                             | 2                                      | 2   | 5                          | 4                                     |
| Total Devices Tested | 90   | 50                                       | 50   | 128                           | 40                                     | 40  | 100                        | 80                                    |
| Total Failures       | 0  | 0  | 0  | 0                             | 1                                      | 0   | 0                          | 0                                     |
| Total Device Hours   | 6720   | 33360                                    | 16720  | 8448                          | 3840                                   | 1920  | 5760                       | 3840                                  |

\*) including ISOPLUS

HTRB (Tables 1A .. 1J)

| TABLE 1A: MOSFET/IGBT single device |              |                           |                |               |               |                |          |              |              |
|-------------------------------------|--------------|---------------------------|----------------|---------------|---------------|----------------|----------|--------------|--------------|
| #                                   | Part Number  | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours | Remark       |
|                                     |              |                           |                |               |               |                |          | [hrs]        |              |
| 1                                   | IRF450       | CK0420                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 2                                   | IXBH40N160   | 1047                      | 1280           | 125           | 1000          | 20             | 0        | 20000        |              |
| 3                                   | IXBH9N160G   | 1103                      | 1280           | 125           | 168           | 20             | 0        | 3360         |              |
| 4                                   | IXBP5-N160G  | 1337                      | 1280           | 125           | 168           | 20             | 0        | 3360         |              |
| 5                                   | IXDH20N120   | 1436                      | 960            | 125           | 168           | 20             | 0        | 3360         |              |
| 6                                   | IXDH30N120D1 | 1007                      | 960            | 125           | 168           | 20             | 0        | 3360         |              |
| 7                                   | IXDN55N120D1 | 1393                      | 960            | 125           | 168           | 10             | 0        | 1680         |              |
| 8                                   | IXER35N120D1 | 1400                      | 960            | 125           | 168           | 20             | 0        | 3360         |              |
| 9                                   | IXFH12N100F  | N/A                       | 720            | 125           | 1000          | 30             | 0        | 30000        |              |
| 10                                  | IXFH12N80P   | SK0524                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 11                                  | IXFH13N50    | CK0539                    | 400            | 125           | 1000          | 30             | 1        | 30000        | IGSS @ 1000h |
| 12                                  | IXFH15N80    | MP0510                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 13                                  | IXFH20N60    | SK0446                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 14                                  | IXFH20N60    | MK0537                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 15                                  | IXFH20N60    | SK0544                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 16                                  | IXFH21N50    | SK0407                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 17                                  | IXFH21N50Q   | MP0423                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 18                                  | IXFH22N50P   | N/A                       | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 19                                  | IXFH23N80Q   | SK0401                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 20                                  | IXFH23N80Q   | MP0510                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 21                                  | IXFH24N50    | MP0419                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 22                                  | IXFH26N50Q   | MP0431                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 23                                  | IXFH26N50Q   | MK0532                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 24                                  | IXFH26N60Q   | SK0405                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 25                                  | IXFH26N60Q   | SP0403                    | 480            | 150           | 1000          | 30             | 0        | 30000        |              |
| 26                                  | IXFH26N60Q   | SK0446                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 27                                  | IXFH26N60Q   | SK0446                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 28                                  | IXFH26N60Q   | SK0451                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 29                                  | IXFH26N90    | AP0538                    | 720            | 125           | 1000          | 30             | 0        | 30000        |              |
| 30                                  | IXFH32N50    | SK0531                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 31                                  | IXFH36N50P   | SP0436                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 32                                  | IXFH40N30Q   | SP0543                    | 240            | 125           | 1000          | 30             | 0        | 30000        |              |
| 33                                  | IXFH44N50P   | SP0518                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 34                                  | IXFH48N50Q   | SP0434                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 35                                  | IXFH50N20    | SK0538                    | 160            | 125           | 1000          | 30             | 0        | 30000        |              |
| 36                                  | IXFH69N30P   | SK0527                    | 240            | 125           | 1000          | 30             | 0        | 30000        |              |
| 37                                  | IXFH6N100Q   | TK0401                    | 800            | 125           | 1000          | 30             | 0        | 30000        |              |
| 38                                  | IXFH80N10Q   | SK0416                    | 80             | 125           | 1000          | 30             | 0        | 30000        |              |
| 39                                  | IXFH80N10Q   | SK0510                    | 80             | 125           | 1000          | 30             | 0        | 30000        |              |
| 40                                  | IXFH9N80     | CP0423                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 41                                  | IXFK26N90    | AP0517                    | 720            | 125           | 1000          | 30             | 0        | 30000        |              |
| 42                                  | IXFK27N80    | CP0441                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 43                                  | IXFK30N100Q2 | SP0446                    | 800            | 125           | 1000          | 30             | 0        | 30000        |              |
| 44                                  | IXFK34N80    | SP0345                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 45                                  | IXFK34N80    | AP0526                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 46                                  | IXFK48N50    | SP0417                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 47                                  | IXFK64N50P   | SP0518                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 48                                  | IXFN48N50    | SP0417                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 49                                  | IXFR36N60P   | SP0517                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 50                                  | IXFX21N100Q  | SP0436                    | 800            | 125           | 1000          | 30             | 0        | 30000        |              |
| 51                                  | IXFX27N80Q   | SP0419                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 52                                  | IXFX34N80    | SP0422                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 53                                  | IXFX38N80Q2  | SP0403                    | 640            | 125           | 1000          | 30             | 0        | 30000        |              |
| 54                                  | IXFX48N50Q   | SK0543                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 55                                  | IXFX48N50Q   | ZP0545                    | 400            | 125           | 1000          | 30             | 0        | 30000        |              |
| 56                                  | IXFX48N60P   | SP0518                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 57                                  | IXFX52N60Q2  | SP0541                    | 480            | 125           | 1000          | 30             | 0        | 30000        |              |
| 58                                  | IXGH160N30P  | SP0433                    | 240            | 125           | 1000          | 30             | 0        | 30000        |              |

**TABLE 1A (cont'd): MOSFET/IGBT single device**

| #   | Part Number   | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|-----|---------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 59  | IXGH240N30PC  | SP0537                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 60  | IXGH2N100     | TP0450                    | 800            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 61  | IXGH30N60A    | CP0423                    | 480            | 125           | 1000          | 27             | 0        | 27000                 |        |
| 62  | IXGH40N60C2   | CP0433                    | 480            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 63  | IXGH96N30P    | SP0433                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 64  | IXGP86N30PB   | SK0535                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 65  | IXGQ86N30PB   | K0543                     | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 66  | IXGQ86N30PBD1 | SK0534                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 67  | IXGQ86N30PCD1 | SK0534                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 68  | IXGR40N60C2   | SP0337                    | 480            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 69  | IXKC20N60C    | 1018                      | 480            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 70  | IXKR40N60C    | 987                       | 480            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 71  | IXLF19N250    | 1387                      | 1800           | 125           | 1000          | 20             | 0        | 20000                 |        |
| 72  | IXTA36N30P    | SK0509                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 73  | IXTA36N30P    | K0526                     | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 74  | IXTA36N30P    | K0537                     | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 75  | IXTA50N25T    | K545                      | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 76  | IXTA60N20T    | K545                      | 160            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 77  | IXTA75N10P    | K0531                     | 80             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 78  | IXTH04N100P   | TPN/A                     | 800            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 79  | IXTH04N100P   | TPN/A                     | 800            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 80  | IXTH20N60     | MP0419                    | 480            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 81  | IXTH75N15     | SK0402                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 82  | IXTH75N15     | SK0415                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 83  | IXTH75N15     | SK0425                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 84  | IXTH75N15     | SK0439                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 85  | IXTH75N15     | SK0442                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 86  | IXTH75N15     | SK0442                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 87  | IXTH75N15     | SK0442                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 88  | IXTH75N15     | SK0450                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 89  | IXTH75N15     | SK0515                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 90  | IXTH88N30P    | SK0348                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 91  | IXTK102N30P   | SS0349                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 92  | IXTK34N80     | SP0546                    | 640            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 93  | IXTK62N25     | SS0348                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 94  | IXTK62N25     | SP0414                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 95  | IXTK62N25     | SS0420                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 96  | IXTK62N25     | SS0428                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 97  | IXTK62N25     | SS0444                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 98  | IXTK62N25     | SS0516                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 99  | IXTK62N25     | SS0517                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 100 | IXTK62N25     | SS0517                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 101 | IXTK62N25     | SS0524                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 102 | IXTK80N25     | SS0347                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 103 | IXTK82N25P    | SS0403                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 104 | IXTK88N30P    | SS0403                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 105 | IXTN79N20     | 1140                      | 160            | 125           | 168           | 10             | 0        | 1680                  |        |
| 106 | IXTP08N100P   | SK0448                    | 800            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 107 | IXTQ100N25P   | SK0433                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 108 | IXTQ22N60P    | SK0539                    | 480            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 109 | IXTQ23N60Q    | MK0421                    | 480            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 110 | IXTQ26N50P    | SK0435                    | 400            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 111 | IXTQ30N60P    | SK0517                    | 480            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 112 | IXTQ36N30P    | SK0405                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 113 | IXTQ42N25P    | SK0405                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 114 | IXTQ50N20P    | SK0405                    | 160            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 115 | IXTQ62N15P    | SK0405                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 116 | IXTQ64N25P    | SK0405                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 117 | IXTQ64N25P    | SK0535                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 118 | IXTQ69N30P    | SK0425                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 119 | IXTQ69N30P    | SK0535                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 120 | IXTQ74N20P    | SK0403                    | 160            | 125           | 1000          | 30             | 0        | 30000                 |        |

**TABLE 1A (cont'd): MOSFET/IGBT single device**

| #   | Part Number | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|-----|-------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 121 | IXTQ74N20P  | SK0405                    | 160            | 150           | 1000          | 30             | 0        | 30000                 |        |
| 122 | IXTQ74N20P  | SK0515                    | 160            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 123 | IXTQ75N10P  | SK0405                    | 80             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 124 | IXTQ80N28T  | SK0519                    | 224            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 125 | IXTQ80N28T  | SK0518                    | 224            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 126 | IXTQ82N25P  | SW0435                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 127 | IXTQ82N25P  | SK0431                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 128 | IXTQ82N25P  | SK0450                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 129 | IXTQ82N25P  | SS0506                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 130 | IXTQ82N25P  | SK0514                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 131 | IXTQ82N25P  | SK0519                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 132 | IXTQ82N25P  | SK0519                    | 200            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 133 | IXTQ82N25P  | SK0538                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 134 | IXTQ82N27P  | SK0449                    | 216            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 135 | IXTQ88N30P  | SK0402                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 136 | IXTQ88N30P  | SK0515                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 137 | IXTQ88N30P  | K0525Z                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 138 | IXTQ88N30P  | SK0538                    | 240            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 139 | IXTQ96N15P  | SK0402                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 140 | IXTQ96N15P  | SK0449                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 141 | IXTQ96N15P  | SK0513                    | 120            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 142 | IXTQ96N20P  | SK0403                    | 160            | 125           | 1000          | 30             | 0        | 30000                 |        |
| 143 | IXTQ96N20P  | SK0405                    | 160            | 150           | 1000          | 30             | 0        | 30000                 |        |
| 144 | IXUN350N10  | 1354                      | 80             | 125           | 1000          | 10             | 0        | 10000                 |        |

**TABLE 1B: MOSFET/IGBT Module**

| #  | Part Number  | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark               |
|----|--------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|----------------------|
| 1  | MKI100-12F8  | 932                       | 960            | 125           | 1000          | 5              | 1        | 5000                  | L_CES @1000h (diode) |
| 2  | MKI50-12F7   | 932                       | 960            | 125           | 1000          | 5              | 0        | 5000                  |                      |
| 3  | MKI75-06A7T  | 1368                      | 480            | 125           | 168           | 8              | 0        | 1344                  |                      |
| 4  | MUBW15-12A7  | 964                       | 1120           | 125           | 120           | 10             | 0        | 1200                  |                      |
| 5  | MUBW25-06A6K | 1240                      | 480            | 125           | 1000          | 10             | 0        | 10000                 |                      |
| 6  | MUBW30-12E6K | 1127                      | 960            | 125           | 168           | 10             | 0        | 1680                  |                      |
| 7  | MUBW30-12E6K | 1127                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |                      |
| 8  | MUBW35-12E7  | 1242                      | 1120           | 125           | 168           | 9              | 0        | 1512                  |                      |
| 9  | MUBW50-06A7T | 1144                      | 480            | 125           | 168           | 10             | 0        | 1680                  |                      |
| 10 | MWI25-12E7   | 1013                      | 960            | 125           | 168           | 10             | 0        | 1680                  |                      |
| 11 | MWI50-12E7   | 1380                      | 960            | 125           | 168           | 6              | 0        | 1008                  |                      |
| 12 | MWI60-06G6K  | 1347                      | 480            | 125           | 500           | 10             | 0        | 5000                  |                      |
| 13 | VII130-06P1  | 1274                      | 480            | 125           | 168           | 10             | 0        | 1680                  |                      |
| 14 | VMM90-09F    | 1201                      | 720            | 125           | 168           | 10             | 0        | 1680                  |                      |

**TABLE 1C: Thyristor/Diode Module**

| #  | Part Number | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark     |
|----|-------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|------------|
| 1  | MCC 161-22  | 1416                      | 1540           | 125           | 168           | 9              | 0        | 1512                  |            |
| 2  | MCC122-16   | 1023                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 3  | MCC122-16   | 1023                      | 1120           | 130           | 1000          | 10             | 0        | 10000                 |            |
| 4  | MCC132-16   | 1509                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 5  | MCC162-18   | 874                       | 1260           | 125           | 168           | 10             | 0        | 1680                  |            |
| 6  | MCC162-16   | 1175                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 7  | MCC162-16   | 922                       | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 8  | MCC26-16    | 912                       | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 9  | MCC310-16   | 870                       | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 10 | MCC310-16   | 969                       | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 11 | MCC312-16   | 1170                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 12 | MCC44-18    | 1027                      | 1260           | 125           | 1000          | 10             | 0        | 10000                 |            |
| 13 | MCC44-18    | 1359                      | 1260           | 125           | 168           | 10             | 0        | 1680                  |            |
| 14 | MCC44-18    | 1359                      | 1260           | 125           | 168           | 10             | 0        | 1680                  |            |
| 15 | MCC44-18    | 1232A                     | 1260           | 125           | 1000          | 10             | 0        | 10000                 |            |
| 16 | MCC44-18    | 1232B                     | 1260           | 125           | 1000          | 10             | 1        | 10000                 | I R @1000h |
| 17 | MCC56-18    | 888                       | 1260           | 125           | 168           | 10             | 0        | 1680                  |            |
| 18 | MCC56-16    | 1246                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 19 | MCC95-16    | 1421                      | 1120           | 125           | 1000          | 10             | 0        | 10000                 |            |
| 20 | MCO100-16   | 1156                      | 1120           | 125           | 1000          | 20             | 0        | 20000                 |            |
| 21 | MCO25-16    | 1155                      | 1120           | 125           | 1000          | 20             | 0        | 20000                 |            |
| 22 | MCO50-16    | 1154                      | 1120           | 125           | 1000          | 10             | 0        | 10000                 |            |
| 23 | MDD26-16    | 1173                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |
| 24 | MDD26-16    | 1173                      | 1120           | 150           | 1000          | 10             | 0        | 10000                 |            |
| 25 | MDD95-16    | 971                       | 1120           | 150           | 1000          | 10             | 0        | 10000                 |            |
| 26 | MDD95-16    | 971                       | 1120           | 125           | 168           | 10             | 0        | 1680                  |            |

**TABLE 1D: Controller/Rectifier Bridge**

| #  | Part Number  | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|----|--------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 1  | MMO75-16io1  | 1379                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |
| 2  | MMO75-17AB   | 1002                      | 1190           | 125           | 168           | 10             | 0        | 1680                  |        |
| 3  | VBO105-18NO7 | 1090                      | 1260           | 125           | 168           | 10             | 0        | 1680                  |        |
| 4  | VBO25-16AO2  | 1057                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |
| 5  | VBO40-16NO6  | 1014                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |
| 6  | VHF36-16io5  | 1176                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |
| 7  | VHFD37-16    | 1184                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |
| 8  | VUO121-16NO1 | 999                       | 1120           | 125           | 1000          | 10             | 0        | 10000                 |        |
| 9  | VUO121-16NO1 | 1352                      | 1120           | 125           | 1000          | 10             | 0        | 10000                 |        |
| 10 | VUO34-18     | 907                       | 1260           | 125           | 1000          | 10             | 0        | 10000                 |        |
| 11 | VUO36-16NO8  | 1252                      | 1120           | 150           | 1000          | 10             | 0        | 10000                 |        |
| 12 | VUO36-16NO8  | 1252                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |
| 13 | VUO52 (DIL)  | 1010                      | 840            | 125           | 1000          | 10             | 0        | 10000                 |        |
| 14 | VUO52-18N01  | 1286                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |
| 15 | VVO140-16io1 | 1420                      | 1120           | 125           | 168           | 10             | 0        | 1680                  |        |



**TABLE 1E: FRED**

| #  | Part Number   | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|----|---------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 1  | DPG60C300QB   | 1481                      | 240            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 2  | DPG60C400QB   | 1446                      | 320            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 3  | DSEC240-04A   | 1148                      | 320            | 125           | 168           | 20             | 0        | 3360                  |        |
| 4  | DSEC240-06A   | 1215                      | 480            | 125           | 1000          | 10             | 0        | 10000                 |        |
| 5  | DSEC240-06A   | 1215                      | 480            | 125           | 1000          | 10             | 0        | 10000                 |        |
| 6  | DSEC30-06A    | 1049                      | 480            | 125           | 168           | 20             | 0        | 3360                  |        |
| 7  | DSEC59-02AQ   | 1159                      | 160            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 8  | DSEC59-03AQ   | 1266                      | 240            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 9  | DSEC60-03AR   | 1121                      | 240            | 125           | 168           | 20             | 0        | 3360                  |        |
| 10 | DSEC60-04A    | 889                       | 320            | 125           | 168           | 20             | 0        | 3360                  |        |
| 11 | DSEE15-12CC   | 1220                      | 480            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 12 | DSEI20-12A    | 1169                      | 960            | 125           | 168           | 20             | 0        | 3360                  |        |
| 13 | DSEI2x101-06A | 1235                      | 480            | 125           | 168           | 10             | 0        | 1680                  |        |
| 14 | DSEI2x61-12P  | 1004                      | 960            | 125           | 168           | 10             | 0        | 1680                  |        |
| 15 | DSEP12-12A    | 960                       | 960            | 125           | 168           | 20             | 0        | 3360                  |        |
| 16 | DSEP15-12CR   | 1168                      | 960            | 150           | 1000          | 20             | 0        | 20000                 |        |
| 17 | DSEP15-12CR   | 1168                      | 960            | 125           | 168           | 20             | 0        | 3360                  |        |
| 18 | DSEP29-06B    | 1263                      | 480            | 125           | 168           | 20             | 0        | 3360                  |        |
| 19 | DSEP30-06A    | 1114                      | 600            | 125           | 168           | 20             | 0        | 3360                  |        |
| 20 | DSEP30-06A    | 1114                      | 480            | 125           | 168           | 20             | 0        | 3360                  |        |
| 21 | DSEP30-06CR   | 902                       | 480            | 125           | 168           | 20             | 0        | 3360                  |        |
| 22 | DSEP60-12A    | 1118                      | 960            | 125           | 168           | 20             | 0        | 3360                  |        |
| 23 | DSEP8-02A     | 1362                      | 160            | 125           | 168           | 20             | 0        | 3360                  |        |
| 24 | MEK300-06"DA" | 1381                      | 480            | 125           | 168           | 10             | 0        | 1680                  |        |
| 25 | MEK95-06 DA   | 1312                      | 480            | 125           | 168           | 10             | 0        | 1680                  |        |
| 26 | MEO500-06DA   | 1279                      | 480            | 125           | 1000          | 10             | 0        | 10000                 |        |

**TABLE 1F: Schottky Diode**

| #  | Part Number  | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark     |
|----|--------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|------------|
| 1  | DGS15-018CS  | 984                       | 144            | 125           | 168           | 20             | 0        | 3360                  |            |
| 2  | DGS19-025CS  | 985                       | 200            | 125           | 168           | 20             | 0        | 3360                  |            |
| 3  | DSS160-01A   | 1143                      | 100            | 125           | 168           | 20             | 0        | 3360                  |            |
| 4  | DSS2x101-02A | 1225                      | 200            | 125           | 1000          | 10             | 0        | 10000                 |            |
| 5  | DSS2x41-01A  | 1065                      | 100            | 125           | 168           | 10             | 0        | 1680                  |            |
| 6  | DSS2x41-01A  | 1467                      | 100            | 125           | 168           | 10             | 0        | 1680                  |            |
| 7  | DSS31-0045A  | 1401                      | 45             | 125           | 1000          | 20             | 0        | 20000                 |            |
| 8  | DSS61-0045A  | 1238                      | 45             | 125           | 1000          | 20             | 0        | 20000                 |            |
| 9  | DSSK48-0025B | 1050                      | 20             | 100           | 168           | 20             | 0        | 3360                  |            |
| 10 | DSSK60-0045A | 961                       | 45             | 125           | 168           | 20             | 0        | 3360                  |            |
| 11 | DSSK60-015A  | 1256                      | 150            | 125           | 1000          | 20             | 0        | 20000                 |            |
| 12 | DSSK60-02A   | 1187                      | 200            | 125           | 1000          | 20             | 1        | 20000                 | I R @1000h |
| 13 | DSSK70-008A  | 1377                      | 80             | 125           | 168           | 20             | 0        | 3360                  |            |
| 14 | DSSK70-008AR | 1111                      | 80             | 125           | 1000          | 20             | 0        | 20000                 |            |
| 15 | DSSK80-0045B | 1261                      | 36             | 100           | 168           | 20             | 0        | 3360                  |            |
| 16 | DSSK80-006BR | 998                       | 48             | 100           | 1000          | 20             | 0        | 20000                 |            |
| 17 | DSSS35-008AR | 910                       | 64             | 125           | 1000          | 20             | 0        | 20000                 |            |

**TABLE 1G: Thyristor/Diode single device**

| #  | Part Number | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|----|-------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 1  | CS19-12ho1S | 1366                      | 840            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 2  | CS20-14io1  | 1364                      | 980            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 3  | CS30-16io1  | 1001                      | 1120           | 125           | 168           | 20             | 0        | 3360                  |        |
| 4  | DSA17-16A   | 1092                      | 1120           | 150           | 168           | 10             | 0        | 1680                  |        |
| 5  | DSA17-16A   | 1195                      | 1120           | 150           | 1000          | 20             | 0        | 20000                 |        |
| 6  | DSA17-16A   | 1195                      | 1120           | 150           | 1000          | 20             | 0        | 20000                 |        |
| 7  | DSA9-18F    | 1307                      | 1260           | 125           | 168           | 10             | 0        | 1680                  |        |
| 8  | DSAI35-16A  | 900                       | 1120           | 150           | 168           | 10             | 0        | 1680                  |        |
| 9  | DSI30-16A   | 1319                      | 1120           | 150           | 168           | 20             | 0        | 3360                  |        |
| 10 | DSI45-16AR  | 1264                      | 1120           | 150           | 168           | 10             | 0        | 1680                  |        |
| 11 | DSI75-16D   | 1164                      | 1120           | 150           | 168           | 10             | 0        | 1680                  |        |
| 12 | DSP25-16A   | 877                       | 1120           | 150           | 168           | 20             | 0        | 3360                  |        |
| 13 | DSP25-16A   | 886                       | 1120           | 150           | 168           | 20             | 0        | 3360                  |        |
| 14 | DSP45-16A   | 1167                      | 1120           | 125           | 168           | 20             | 0        | 3360                  |        |
| 15 | DSP8-08A    | 1146                      | 560            | 150           | 168           | 20             | 0        | 3360                  |        |

**TABLE 1H: ISOPLUS**

| #  | Part Number  | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|----|--------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 1  | DSEC60-03AR  | 1121                      | 240            | 125           | 168           | 20             | 0        | 3360                  |        |
| 2  | DSEE15-12CC  | 1220                      | 480            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 3  | DSEP15-12CR  | 1168                      | 960            | 150           | 1000          | 20             | 0        | 20000                 |        |
| 4  | DSEP15-12CR  | 1168                      | 960            | 125           | 168           | 20             | 0        | 3360                  |        |
| 5  | DSEP30-06CR  | 902                       | 480            | 125           | 168           | 20             | 0        | 3360                  |        |
| 6  | DSI45-16AR   | 1264                      | 1120           | 150           | 168           | 10             | 0        | 1680                  |        |
| 7  | DSSK70-008AR | 1111                      | 80             | 125           | 1000          | 20             | 0        | 20000                 |        |
| 8  | DSSS35-008AR | 910                       | 64             | 125           | 1000          | 20             | 0        | 20000                 |        |
| 9  | FBS10-12SCC  | 1021                      | 840            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 10 | FUO22-16N    | 1291                      | 1120           | 125           | 1000          | 20             | 0        | 20000                 |        |
| 11 | FUO50-16N    | 977                       | 1120           | 125           | 1000          | 19             | 0        | 19000                 |        |
| 12 | IXER35N120D1 | 1400                      | 960            | 125           | 168           | 20             | 0        | 3360                  |        |
| 13 | IXKC20N60C   | 1018                      | 480            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 14 | IXKR40N60C   | 987                       | 480            | 125           | 1000          | 20             | 0        | 20000                 |        |
| 15 | IXLF19N250   | 1387                      | 1800           | 125           | 1000          | 20             | 0        | 20000                 |        |

**TABLE 1J: Breakover Diode**

| # | Part Number | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|-------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 1 | IXBOD1-08   | 1085                      | 640            | 125           | 168           | 20             | 0        | 3360                  |        |
| 2 | IXBOD1-08   | 1248                      | 640            | 125           | 168           | 20             | 0        | 3360                  |        |
| 3 | IXBOD1-10   | 868                       | 800            | 125           | 168           | 20             | 0        | 3360                  |        |

HTGB (Tables 2A .. 2C)

| TABLE 2A: MOSFET/IGBT single device |               |                           |                |               |               |                |          |                       |        |
|-------------------------------------|---------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| #                                   | Part Number   | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
| 1                                   | IRF450        | CK0420                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 2                                   | IXDH30N120D1  | 1094                      | 16             | 150           | 168           | 20             | 0        | 3360                  |        |
| 3                                   | IXEH40N120D1  | 1482                      | 16             | 150           | 168           | 20             | 0        | 3360                  |        |
| 4                                   | IXFH10N80P    | SP0514                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 5                                   | IXFH12N80P    | SK0524                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 6                                   | IXFH13N50     | CK0539                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 7                                   | IXFH14N80P    | SP0525                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 8                                   | IXFH15N80     | MP0510                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 9                                   | IXFH20N60     | SK0446                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 10                                  | IXFH20N60     | MK0537                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 11                                  | IXFH20N80P    | SK0524                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 12                                  | IXFH21N50     | SK0407                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 13                                  | IXFH21N50Q    | MP0423                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 14                                  | IXFH22N50P    | N/A                       | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 15                                  | IXFH23N80Q    | SK0401                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 16                                  | IXFH23N80Q    | MP0510                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 17                                  | IXFH24N50     | MP0419                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 18                                  | IXFH26N50Q    | MP0431                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 19                                  | IXFH26N50Q    | MK0532                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 20                                  | IXFH26N60Q    | SK0451                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 21                                  | IXFH26N60Q    | SK0604                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 22                                  | IXFH36N50P    | SP0436                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 23                                  | IXFH40N30Q    | SP0543                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 24                                  | IXFH44N50P    | SP0518                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 25                                  | IXFH48N50Q    | SP0434                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 26                                  | IXFH50N20     | SK0538                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 27                                  | IXFH69N30P    | SK0527                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 28                                  | IXFH80N10Q    | SK0416                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 29                                  | IXFH80N10Q    | SK0510                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 30                                  | IXFH9N80      | CP0423                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 31                                  | IXFK34N80     | AP0526                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 32                                  | IXFK48N50     | SP0417                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 33                                  | IXFK64N50P    | SP0518                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 34                                  | IXFN48N50     | SP0417                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 35                                  | IXFR36N60P    | SP0517                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 36                                  | IXFX21N100Q   | SP0436                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 37                                  | IXFX27N80Q    | SP0419                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 38                                  | IXFX32N80P    | SP0531                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 39                                  | IXFX34N80     | SP0422                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 40                                  | IXFX38N80Q2   | SP0403                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 41                                  | IXFX48N50Q    | SK0543                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 42                                  | IXFX48N50Q    | ZP0545                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 43                                  | IXFX48N60P    | SP0518                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 44                                  | IXFX52N60Q2   | TM3849                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 45                                  | IXGD86N30PCD1 | SK0529                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 46                                  | IXGH160N30P   | SP0433                    | 24             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 47                                  | IXGH240N30PC  | SP0537                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 48                                  | IXGH40N60C2   | CP0433                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 49                                  | IXGH96N30P    | SP0433                    | 24             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 50                                  | IXGQ160N30P   | SK0503                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 51                                  | IXGQ160N30PB  | SK0601                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 52                                  | IXGR40N60C2   | SP0337                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 53                                  | IXKR40N60C    | 1287                      | 16             | 150           | 168           | 25             | 0        | 4200                  |        |
| 54                                  | IXLF19N250    | 1142                      | 16             | 150           | 168           | 10             | 0        | 1680                  |        |
| 55                                  | IXLF19N250    | 1387                      | 16             | 150           | 500           | 10             | 0        | 5000                  |        |
| 56                                  | IXLF19N250A   | 1292                      | 16             | 150           | 1000          | 20             | 0        | 20000                 |        |
| 57                                  | IXTA36N30P    | SK0509                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 58                                  | IXTA36N30P    | K0526                     | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |

**TABLE 2A (cont'd): MOSFET/IGBT single device**

| #   | Part Number | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|-----|-------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 59  | IXTA36N30P  | K0537                     | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 60  | IXTA36N30P  | SK0603                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 61  | IXTA50N25T  | K545                      | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 62  | IXTA50N25T  | SK0604                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 63  | IXTA50N28T  | K545                      | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 64  | IXTA60N20T  | K545                      | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 65  | IXTA60N20T  | SK0601                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 66  | IXTA75N10P  | K0531                     | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 67  | IXTM1N100   | TP0424                    | 16             | 125           | 1000          | 32             | 0        | 32000                 |        |
| 68  | IXTM1N100   | TP0424                    | 16             | 125           | 1000          | 32             | 0        | 32000                 |        |
| 69  | IXTM1N100   | TP0424                    | 16             | 125           | 1000          | 32             | 0        | 32000                 |        |
| 70  | IXTH100N25P | SK0347                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 71  | IXTH1785    | TP0403                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 72  | IXTH28N50Q  | MK0352                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 73  | IXTH75N15   | SK0450                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 74  | IXTH75N15   | SK0515                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 75  | IXTH88N30P  | SK0348                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 76  | IXTK102N30P | SS0349                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 77  | IXTK34N80   | SP0546                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 78  | IXTK62N25   | SS0444                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 79  | IXTK62N25   | SS0516                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 80  | IXTK62N25   | SS0524                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 81  | IXTK82N25P  | SS0403                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 82  | IXTK88N30P  | SS0403                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 83  | IXTQ100N25P | SK0433                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 84  | IXTQ22N60P  | SK0539                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 85  | IXTQ22N60P  | SK0604                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 86  | IXTQ23N60Q  | MK0421                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 87  | IXTQ26N50P  | SK0435                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 88  | IXTQ30N60P  | SK0517                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 89  | IXTQ36N30P  | SK0405                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 90  | IXTQ42N25P  | SK0405                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 91  | IXTQ50N20P  | SK0405                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 92  | IXTQ62N15P  | SK0405                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 93  | IXTQ64N25P  | SK0405                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 94  | IXTQ64N25P  | SK0535                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 95  | IXTQ69N30P  | SK0450                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 96  | IXTQ69N30P  | SK0535                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 97  | IXTQ74N20P  | SK0403                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 98  | IXTQ74N20P  | SK0405                    | 16             | 150           | 1000          | 30             | 0        | 30000                 |        |
| 99  | IXTQ74N20P  | SK0515                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 100 | IXTQ75N10P  | SK0405                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 101 | IXTQ80N28T  | SK0519                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 102 | IXTQ80N28T  | SK0519                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 103 | IXTQ82N25P  | SK0347                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 104 | IXTQ82N25P  | SW0435                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 105 | IXTQ82N25P  | SK0450                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 106 | IXTQ82N25P  | SK0514                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 107 | IXTQ82N25P  | SK0538                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 108 | IXTQ82N27P  | SK0449                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 109 | IXTQ88N30P  | SK0402                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 110 | IXTQ88N30P  | SK0515                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 111 | IXTQ88N30P  | K0525Z                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 112 | IXTQ88N30P  | SK0538                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 113 | IXTQ88N30P  | SK0605                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 114 | IXTQ96N15P  | SK0402                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 115 | IXTQ96N15P  | SK0449                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 116 | IXTQ96N15P  | SK0513                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 117 | IXTQ96N20P  | SK0403                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 118 | IXTQ96N20P  | SK0405                    | 16             | 150           | 1000          | 30             | 0        | 30000                 |        |

**TABLE 2B: MOSFET/IGBT Module**

| #  | Part Number  | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|----|--------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 1  | MUBW15-12A7  | 964                       | 16             | 125           | 1000          | 10             | 0        | 10000                 |        |
| 2  | MUBW25-12A7  | 873                       | 16             | 125           | 168           | 10             | 0        | 1680                  |        |
| 3  | MUBW30-12E6K | 1127                      | 16             | 150           | 168           | 10             | 0        | 1680                  |        |
| 4  | MUBW35-12E7  | 1285                      | 16             | 125           | 168           | 10             | 0        | 1680                  |        |
| 5  | MUBW50-12E8  | 1469                      | 16             | 125           | 168           | 10             | 0        | 1680                  |        |
| 6  | VII130-06P1  | 1274                      | 20             | 150           | 168           | 10             | 0        | 1680                  |        |
| 7  | VIO25-06P1   | 1087                      | 16             | 150           | 168           | 10             | 0        | 1680                  |        |
| 8  | VMO1200-01F  | 1442                      | 16             | 125           | 1000          | 10             | 0        | 10000                 |        |
| 9  | VMO440-02F   | 1308                      | 20             | 125           | 168           | 10             | 0        | 1680                  |        |
| 10 | VMO440-02F   | 1308                      | 16             | 150           | 168           | 10             | 0        | 1680                  |        |
| 11 | VWM350-0075  | 1288                      | 16             | 150           | 168           | 10             | 0        | 1680                  |        |

**TABLE 2C: ISOPLUS**

| # | Part Number | Date Code<br>or<br>Test # | Voltage<br>[V] | Temp.<br>[°C] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|-------------|---------------------------|----------------|---------------|---------------|----------------|----------|-----------------------|--------|
| 1 | IXGR40N60C2 | SP0337                    | 16             | 125           | 1000          | 30             | 0        | 30000                 |        |
| 2 | IXKR40N60C  | 1287                      | 16             | 150           | 168           | 25             | 0        | 4200                  |        |
| 3 | IXLF19N250  | 1142                      | 16             | 150           | 168           | 10             | 0        | 1680                  |        |
| 4 | IXLF19N250  | 1387                      | 16             | 150           | 500           | 10             | 0        | 5000                  |        |
| 5 | IXLF19N250A | 1292                      | 16             | 150           | 1000          | 20             | 0        | 20000                 |        |

**POWER CYCLE (Tables 3A ..3H)**

**TABLE 3A: MOSFET/IGBT single device**

| #  | Part Number  | Date Code<br>or<br>Test # | Tj(max)<br>[°C] | ΔT<br>[K] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|----|--------------|---------------------------|-----------------|-----------|------------------------|----------------|----------|---------------|--------|
| 1  | IXDH30N120D1 | 1007                      | 125             | 80        | 2000                   | 20             | 0        | 40000         |        |
| 2  | IRF450       | CK0420                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 3  | IXDH35N60B   | 1063                      | 125             | 80        | 2000                   | 20             | 0        | 40000         |        |
| 4  | IXEH25N120D1 | 1277                      | 125             | 80        | 2000                   | 20             | 0        | 40000         |        |
| 5  | IXFH21N50Q   | MP0423                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 6  | IXFH24N50    | MP0419                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 7  | IXFH26N60Q   | MK0436                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 8  | IXFH80N10Q   | SK0510                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 9  | IXFK27N80    | CP0441                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 10 | IXFX48N60P   | SP0518                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 11 | IXGQ160N30P  | SK0503                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 12 | IXLF19N250   | 1387                      | 125             | 80        | 10000                  | 20             | 0        | 200000        |        |
| 13 | IXTH75N15    | SK0442                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 14 | IXTK62N25    | DT0245                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 15 | IXTK62N25    | SS0420                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 16 | IXTK62N25    | SS0436                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 17 | IXTQ30N60P   | SK0517                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 18 | IXTQ82N25P   | SW0435                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |
| 19 | IXTQ82N25P   | SS0506                    | -               | 100       | 10000                  | 24             | 0        | 240000        |        |

**TABLE 3C: Thyristor/Diode Module**

| # | Part Number | Date Code<br>or<br>Test # | Tj(max)<br>[°C] | ΔT<br>[K] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|---|-------------|---------------------------|-----------------|-----------|------------------------|----------------|----------|---------------|--------|
| 1 | MCC162-14   | 1375                      | 125             | 80        | 10000                  | 10             | 0        | 100000        |        |
| 2 | MCC56-14    | 1472                      | 125             | 80        | 20000                  | 10             | 0        | 200000        |        |
| 3 | MCC95-12    | 1351                      | 125             | 80        | 10000                  | 10             | 0        | 100000        |        |
| 4 | MCD40-16    | 1474                      | 125             | 80        | 5000                   | 10             | 0        | 50000         |        |
| 5 | MDD172-16   | 992                       | 125             | 80        | 50000                  | 10             | 0        | 500000        |        |
| 6 | MDD172-16   | 1133                      | 125             | 80        | 20000                  | 10             | 0        | 200000        |        |

**TABLE 3D: Controller, Rectifier Bridge**

| # | Part Number  | Date Code<br>or<br>Test # | Tj(max)<br>[°C] | ΔT<br>[K] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|---|--------------|---------------------------|-----------------|-----------|------------------------|----------------|----------|---------------|--------|
| 1 | MMO36-16     | 875                       | 125             | 80        | 10000                  | 10             | 0        | 100000        |        |
| 2 | VBO25-12NO2  | 1192                      | 125             | 80        | 5000                   | 10             | 0        | 50000         |        |
| 3 | VBO68-16NO7  | 995                       | 125             | 80        | 2000                   | 10             | 0        | 20000         |        |
| 4 | VUO121-16NO1 | 999                       | 125             | 80        | 2000                   | 10             | 0        | 20000         |        |
| 5 | VUO28-08NO7  | 1249                      | 125             | 80        | 2000                   | 10             | 0        | 20000         |        |
| 6 | VUO60-12     | 993                       | 125             | 80        | 5000                   | 10             | 0        | 50000         |        |
| 7 | VUO82-16NO7  | 1328                      | 125             | 80        | 5000                   | 10             | 0        | 50000         |        |

**TABLE 3E: FRED**

| #  | Part Number   | Date Code<br>or<br>Test # | T <sub>j</sub> (max)<br>[°C] | ΔT<br>[K] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|----|---------------|---------------------------|------------------------------|-----------|------------------------|----------------|----------|---------------|--------|
| 1  | DSEC30-02A    | 1206                      | 125                          | 80        | 2000                   | 20             | 0        | 40000         |        |
| 2  | DSEI120-06A   | 956                       | 125                          | 80        | 4000                   | 20             | 0        | 80000         |        |
| 3  | DSEI2x101-06A | 1139                      | 125                          | 80        | 5000                   | 10             | 0        | 50000         |        |
| 4  | DSEI60-02A    | 1440                      | 145                          | 105       | 2000                   | 20             | 0        | 40000         |        |
| 5  | DSEI60-12A    | 1046                      | 150                          | 105       | 2000                   | 20             | 0        | 40000         |        |
| 6  | DSEP12-12A    | 960                       | 150                          | 105       | 2000                   | 20             | 0        | 40000         |        |
| 7  | DSEP15-06A    | 1378                      | 107                          | 105       | 2000                   | 20             | 0        | 40000         |        |
| 8  | DSEP2x31-12A  | 905                       | 125                          | 80        | 5000                   | 10             | 0        | 50000         |        |
| 9  | DSEP30-12CR   | 1045                      | 125                          | 80        | 5000                   | 20             | 0        | 100000        |        |
| 10 | DSEP60-06A    | 1262                      | 135                          | 90        | 2000                   | 20             | 0        | 40000         |        |

**TABLE 3F: Schottky Diode**

| # | Part Number  | Date Code<br>or<br>Test # | T <sub>j</sub> (max)<br>[°C] | ΔT<br>[K] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|---|--------------|---------------------------|------------------------------|-----------|------------------------|----------------|----------|---------------|--------|
| 1 | DSS61-0045A  | 1238                      | 125                          | 80        | 4000                   | 20             | 0        | 80000         |        |
| 2 | DSSK40-0015B | 1336                      | 125                          | 80        | 2000                   | 20             | 0        | 40000         |        |
| 3 | DSSK60-015A  | 1256                      | 125                          | 80        | 20000                  | 20             | 0        | 400000        |        |
| 4 | DSSK70-0015B | 901                       | 125                          | 80        | 2000                   | 20             | 0        | 40000         |        |
| 5 | DSSK80-003B  | 1071                      | 125                          | 80        | 2000                   | 20             | 0        | 40000         |        |
| 6 | DSSK80-0045B | 1223                      | 125                          | 80        | 2000                   | 20             | 0        | 40000         |        |

**TABLE 3G: Thyristor/Diode single device**

| # | Part Number | Date Code<br>or<br>Test # | T <sub>j</sub> (max)<br>[°C] | ΔT<br>[K] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|---|-------------|---------------------------|------------------------------|-----------|------------------------|----------------|----------|---------------|--------|
| 1 | CS19-12ho1  | 978                       | 125                          | 80        | 4000                   | 20             | 0        | 80000         |        |
| 2 | CS20-22moF1 | 952                       | 125                          | 80        | 10000                  | 20             | 0        | 200000        |        |
| 3 | CS35-14io4  | 1473                      | 125                          | 80        | 2000                   | 10             | 0        | 20000         |        |
| 4 | CS45-16io1  | 1165                      | 125                          | 80        | 2000                   | 20             | 0        | 40000         |        |
| 5 | DSA1-18D    | 1435                      | 150                          | 105       | 2000                   | 20             | 0        | 40000         |        |
| 6 | DSA17-16A   | 1092                      | 130                          | 100       | 2000                   | 10             | 0        | 20000         |        |
| 7 | DSI30-12A   | 1036                      | 125                          | 80        | 2000                   | 20             | 0        | 40000         |        |
| 8 | DSP25-16A   | 886                       | 150                          | 105       | 2000                   | 20             | 0        | 40000         |        |

**TABLE 3H: ISOPLUS**

| # | Part Number | Date Code<br>or<br>Test # | T <sub>j</sub> (max)<br>[°C] | ΔT<br>[K] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|---|-------------|---------------------------|------------------------------|-----------|------------------------|----------------|----------|---------------|--------|
| 1 | CS20-22moF1 | 952                       | 125                          | 80        | 10000                  | 20             | 0        | 200000        |        |
| 2 | DSEP30-12CR | 1045                      | 125                          | 80        | 5000                   | 20             | 0        | 100000        |        |
| 3 | IXLF19N250  | 1387                      | 125                          | 80        | 10000                  | 20             | 0        | 200000        |        |

**TEMPERATURE CYCLE (Tables 4A ..4J)**

| <b>TABLE 4A: MOSFET/IGBT single device</b> |              |                           |                      |                       |                        |                |          |               |                |
|--|--------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|----------------|
| #  | Part Number  | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark         |
| 1  | FII50-12EL   | 1294                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 2  | FMM151-0075P | 1145                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 3  | IRFP450      | CK 0420                   | -55                  | 125                   | 100                    | 30             | 0        | 3000          |                |
| 4  | IXBH40N160   | 935                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 5  | IXBP5-N160G  | 1337                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |                |
| 6  | IXDA20N120AS | 967                       | -40                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 7  | IXDN404SI    | SC 351                    | -55                  | 150                   | 1000                   | 80             | 0        | 80000         | MOSFET Drivers |
| 8  | IXDR30N120D1 | 1411                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |                |
| 9  | IXER35N120D1 | 1207                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |                |
| 10   | IXFF24N100   | 1390                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 11   | IXFH21N50Q   | MP 0423                   | -55                  | 125                   | 100                    | 30             | 0        | 3000          |                |
| 12   | IXFH24N50    | MP 0419                   | -55                  | 125                   | 100                    | 30             | 0        | 3000          |                |
| 13   | IXKC20N60C   | 1018                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |                |
| 14   | IXKC20N60C   | 1074                      | -55                  | 150                   | 100                    | 40             | 0        | 4000          |                |
| 15   | IXKR25N80C   | 1189                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |                |
| 16   | IXKR40N60C   | 987                       | -40                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 17   | IXKR40N60C   | 1033                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |                |
| 18   | IXLF19N250   | 1387                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 19   | IXLF19N250A  | 1292                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |                |
| 20   | IXTM1N100    | TP 0423                   | -55                  | 125                   | 100                    | 32             | 0        | 3200          |                |
| 21   | IXTM1N100    | TP 0423                   | -55                  | 125                   | 100                    | 32             | 0        | 3200          |                |
| 22   | IXTM1N100    | TP 0424                   | -55                  | 125                   | 100                    | 32             | 0        | 3200          |                |
| 23   | IXTN79N20    | 1140                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |                |
| 24   | IXTQ64N25P   | SK 0414                   | -55                  | 150                   | 250                    | 30             | 0        | 7500          |                |
| 25   | IXTQ69N30P   | SK 0342                   | -65                  | 155                   | 100                    | 30             | 0        | 3000          |                |
| 26   | IXTQ69N30P   | SK 0411                   | -55                  | 150                   | 250                    | 30             | 0        | 7500          |                |
| 27   | IXTQ96N15P   | SK 0412                   | -55                  | 150                   | 250                    | 30             | 0        | 7500          |                |

| <b>TABLE 4B: MOSFET/IGBT Module</b> |              |                           |                      |                       |                        |                |          |               |        |
|-------------------------------------|--------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|--------|
| #                                   | Part Number  | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
| 1                                   | MKI50-06A7   | 1172                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 2                                   | MUBW15-12A7  | 964                       | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 3                                   | MUBW15-12A7  | 1466                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 4                                   | MUBW30-12A6K | 1373                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 5                                   | MUBW35-06A6  | 1244                      | -40                  | 125                   | 100                    | 10             | 0        | 1000          |        |
| 6                                   | MUBW35-12E7  | 1285                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 7                                   | MUBW50-12E8  | 945                       | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 8                                   | MUBW50-12E8  | 1082                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 9                                   | MWI50-06A7T  | 1144                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 10                                  | MWI50-12A7   | 1017                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 11                                  | VMM90-09F    | 1201                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 12                                  | VMO1200-01F  | 1442                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 13                                  | VMO440-02FL  | 936                       | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |



**TABLE 4C: Thyristor/Diode Module**

| #  | Part Number | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|----|-------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|--------|
| 1  | MCC162-14   | 1175                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 2  | MCC255-14   | 1120                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 3  | MCC26-12    | 1255                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 4  | MCC26-16    | 926                       | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 5  | MCC26-16    | 1324                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 6  | MCC26-16    | 1333                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 7  | MCC26-16    | 1389                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 8  | MCC310-12   | 970                       | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 9  | MCC312-16   | 1302                      | -40                  | 150                   | 200                    | 5              | 0        | 1000          |        |
| 10 | MCC312-16   | 1302                      | -40                  | 150                   | 200                    | 10             | 0        | 2000          |        |
| 11 | MCC44-12    | 1101                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 12 | MCC44-16    | 1181                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 13 | MCC56-12    | 1449                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 14 | MCC95-12    | 1389                      | -40                  | 150                   | 100                    | 40             | 0        | 4000          |        |
| 15 | MCC95-16    | 1278                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 16 | MCC95-16    | 976                       | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 17 | MCD310-12   | 1257                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 18 | MCD95-14    | 939                       | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 19 | MCD95-16    | 1342                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 20 | MCO25-16    | 1155                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 21 | MCO450-14   | 1418                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 22 | MCO50-16    | 1154                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 23 | MDD172-12   | 1083                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 24 | MDD172-16   | 1372                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 25 | MDD172-16   | 1133                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 26 | MDD95-16    | 1058                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 27 | VCC105-14   | 1115                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |

**TABLE 4D: Controller, Rectifier Bridge**

| #  | Part Number  | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark          |
|----|--------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|-----------------|
| 1  | VBE60-06A    | 908                       | -40                  | 150                   | 100                    | 10             | 0        | 1000          |                 |
| 2  | VBO19-16DT1  | 1113                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |                 |
| 3  | VBO19-16DT1  | 1272                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |                 |
| 4  | VBO25-16AO2  | 1028                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |                 |
| 5  | VHFD37-14    | 1003                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |                 |
| 6  | VUB120-16NO2 | 1300                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |                 |
| 7  | VUO121-16NO1 | 1070                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |                 |
| 8  | VUO121-16NO1 | 999                       | -40                  | 150                   | 100                    | 10             | 1        | 1000          | I R@ 100 Cycles |
| 9  | VUO28-08NO7  | 1249                      | -40                  | 150                   | 10                     | 10             | 0        | 100           |                 |
| 10 | VUO34        | 918                       | -40                  | 150                   | 100                    | 10             | 0        | 1000          |                 |
| 11 | VUO36-16     | 883                       | -40                  | 150                   | 20                     | 10             | 0        | 200           |                 |
| 12 | VUO36-16     | 1428                      | -40                  | 150                   | 40                     | 10             | 0        | 400           |                 |
| 13 | VUO52        | 887                       | -40                  | 150                   | 100                    | 10             | 0        | 1000          |                 |
| 14 | VUO52        | 887                       | -40                  | 150                   | 100                    | 10             | 0        | 1000          |                 |
| 15 | VVY40-16     | 913                       | -40                  | 150                   | 50                     | 10             | 0        | 500           |                 |
| 16 | VW2x60-14    | 1039                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |                 |
| 17 | VW2x60-14    | 1443                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |                 |

**TABLE 4E: FRED**

| #  | Part Number    | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|----|----------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|--------|
| 1  | DSEC29-02A     | 1037                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 2  | DSEC29-06AC    | 1204                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 3  | DSEC30-02A     | 1339                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 4  | DSEC30-06A     | 1269                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 5  | DSEC59-02AQ    | 1159                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 6  | DSEC60-03AR    | 1121                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 7  | DSEI 2x121-02A | 1397                      | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 8  | DSEI120-12A    | 1174                      | -40                  | 150                   | 200                    | 10             | 0        | 2000          |        |
| 9  | DSEI120-12A    | 1174                      | -40                  | 150                   | 200                    | 10             | 0        | 2000          |        |
| 10 | DSEI20-12A     | 1169                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 11 | DSEI2x121-02P  | 1005                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 12 | DSEI30-10A     | 1126                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 13 | DSEI36-06AS    | 1190                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 14 | DSEP12-12A     | 960                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 15 | DSEP15-12CR    | 1514                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 16 | DSEP29-06B     | 1263                      | -50                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 17 | DSEP2x25-12C   | 1468                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 18 | DSEP2x25-12C   | 1009                      | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 19 | DSEP30-06CR    | 902                       | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 20 | DSEP40-03AS    | 1268                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 21 | DSEP8-12A      | 1438                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 22 | DSEP9-06CR     | 1437                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 23 | MEK150-04E     | 1365                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 24 | MEK350-02DA    | 917                       | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 25 | MEO500-06DA    | 1279                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |

**TABLE 4F: Schottky Diode**

| #  | Part Number  | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|----|--------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|--------|
| 1  | DGSK36-03CS  | 996                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 2  | DGSK8-025A   | 1106                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 3  | DSS2x160-01A | 1117                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 4  | DSS2x41-01A  | 899                       | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 5  | DSS40-0008D  | 1131                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 6  | DSS61-0045A  | 1238                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 7  | DSSK40-008B  | 1260                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 8  | DSSK48-0025B | 1050                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 9  | DSSK50-01A   | 1166                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 10 | DSSK60-0045A | 961                       | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 11 | DSSK60-0045B | 1457                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 12 | DSSK60-015A  | 1256                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 13 | DSSK60-015AR | 1304                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 14 | DSSK60-02A   | 1187                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 15 | DSSK70-0015B | 901                       | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 16 | DSSK80-0008D | 1394                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 17 | DSSK80-0025B | 1119                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 18 | DSSS30-01AR  | 983                       | -55                  | 150                   | 100                    | 40             | 0        | 4000          |        |
| 19 | DSSS35-008AR | 910                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |

**TABLE 4G: Thyristor/Diode single device**

| #  | Part Number | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|----|-------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|--------|
| 1  | CS19-12H01  | 1404                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 2  | CS20-14io1  | 1364                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 3  | CS20-22moF1 | 979                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 4  | CS20-22moF1 | 979                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 5  | CS20-22moF1 | 952                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 6  | CS30-16io1  | 1001                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 7  | CS35-14io1  | 1011                      | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 8  | CS35-14io4  | 1473                      | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 9  | CS45-12io1  | 1199                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 10 | CS45-16io1  | 890                       | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 11 | CS45-16io1R | 1284                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 12 | CS8-12io2   | 914                       | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 13 | CS8-12io2   | 1388                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 14 | DS75-04D    | 1243                      | -40                  | 150                   | 50                     | 10             | 0        | 500           |        |
| 15 | DSA17-16A   | 1092                      | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 16 | DSA17-16A   | 1195                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 17 | DSA17-16A   | 1195                      | -40                  | 150                   | 100                    | 18             | 0        | 1800          |        |
| 18 | DSA2-18A    | 1398                      | -40                  | 150                   | 20                     | 20             | 0        | 400           |        |
| 19 | DSA75-18B   | 1388                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 20 | DSA9-18F    | 1307                      | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 21 | DSI30-16A   | 1075                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 22 | DSI75-16    | 1160                      | -40                  | 150                   | 20                     | 10             | 0        | 200           |        |
| 23 | DSP25-16A   | 1273                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 24 | DSP8-08A    | 1146                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |

**TABLE 4H: ISOPLUS**

| #  | Part Number  | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|----|--------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|--------|
| 1  | CS20-22moF1  | 952                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 2  | CS20-22moF1  | 979                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 3  | CS20-22moF1  | 979                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 4  | CS45-16io1R  | 1284                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 5  | DSEC29-06AC  | 1204                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 6  | DSEC60-03AR  | 1121                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 7  | DSEP15-12CR  | 1514                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 8  | DSEP30-06CR  | 902                       | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 9  | DSEP9-06CR   | 1437                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 10 | DSSK60-015AR | 1304                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 11 | DSSS30-01AR  | 983                       | -55                  | 150                   | 100                    | 40             | 0        | 4000          |        |
| 12 | DSSS35-008AR | 910                       | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 13 | FBS10-12SCC  | 1021                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 14 | FII50-12EL   | 1294                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 15 | FMM151-0075P | 1145                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 16 | IXDR30N120D1 | 1411                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 17 | IXER35N120D1 | 1207                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 18 | IXFF24N100   | 1390                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 19 | IXKC20N60C   | 1018                      | -55                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 20 | IXKC20N60C   | 1074                      | -55                  | 150                   | 100                    | 40             | 0        | 4000          |        |
| 21 | IXKR25N80C   | 1189                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |
| 22 | IXKR40N60C   | 987                       | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 23 | IXKR40N60C   | 1033                      | -40                  | 150                   | 100                    | 10             | 0        | 1000          |        |
| 24 | IXLF19N250   | 1387                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 25 | IXLF19N250A  | 1292                      | -55                  | 150                   | 100                    | 20             | 0        | 2000          |        |

**TABLE 4J: Breakover Diode**

| # | Part Number | Date Code<br>or<br>Test # | Low<br>Temp.<br>[°C] | High<br>Temp.<br>[°C] | Number<br>of<br>Cycles | Sample<br>Size | Failures | Device Cycles | Remark |
|---|-------------|---------------------------|----------------------|-----------------------|------------------------|----------------|----------|---------------|--------|
| 1 | IXBOD1-08   | 1085                      | -40                  | 150                   | 100                    | 20             | 0        | 2000          |        |
| 2 | IXBOD1-08   | 1248                      | -40                  | 150                   | 50                     | 20             | 0        | 1000          |        |

**HUMIDITY TEST (Tables 5A ..5H)**

**TABLE 5A: MOSFET/IGBT single device**

| # | Part Number  | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|--------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | IXBH40N140   | 1188                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 2 | IXER35N120D1 | 909                       | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 3 | IXLF19N250   | 1387                      | 121           | 100            | 96            | 20             | 0        | 1920                  |        |
| 4 | IXTQ69N30P   | SK 0342                   | 125           | 100            | 96            | 30             | 0        | 2880                  |        |

**TABLE 5B: MOSFET/IGBT Module**

| # | Part Number  | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|--------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | MUBW15-12A7  | 964                       | 85            | 85             | 1000          | 10             | 0        | 10000                 |        |
| 2 | MUBW25-06A6K | 1240                      | 85            | 85             | 1000          | 10             | 0        | 10000                 |        |
| 3 | MWI30-12E6K  | 1200                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 4 | VMO1200-01   | 1442                      | 85            | 85             | 1000          | 10             | 0        | 10000                 |        |
| 5 | VMO440-02F   | 1308                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |

**TABLE 5C: Thyristor/Diode Module**

| # | Part Number  | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|--------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | MCC250-16io1 | 1104                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 2 | MCC310-16io1 | 1171                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 3 | MCC44-18     | 1027                      | 85            | 85             | 1000          | 10             | 0        | 10000                 |        |
| 4 | MCD56-16io1B | 1193                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 5 | MCD56-16io8  | 1341                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |

**TABLE 5D: Controller, Rectifier Bridge**

| # | Part Number  | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|--------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | VBO160-16NO7 | 1091                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 2 | VHF36-16io5  | 1176                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 3 | VUO52-16     | 1079                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 4 | VUO82-16NO7  | 1151                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |
| 5 | VUO82-16NO7  | 1251                      | 85            | 85             | 168           | 10             | 0        | 1680                  |        |

**TABLE 5E: FRED**

| # | Part Number | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|-------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | DH60-18A    | 1297                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 2 | DPG60C400QB | 1446                      | 121           | 100            | 96            | 8              | 0        | 768                   |        |
| 3 | DSEC59-02AQ | 1159                      | 121           | 100            | 96            | 20             | 0        | 1920                  |        |
| 4 | DSEC60-03AR | 1121                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 5 | DSEC60-04A  | 889                       | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 6 | DSEI36-06AS | 1190                      | 121           | 100            | 96            | 20             | 0        | 1920                  |        |
| 7 | DSEP15-12CR | 1168                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |

**TABLE 5F: Schottky Diode**

| # | Part Number | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark    |
|---|-------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|-----------|
| 1 | DSS61-0045A | 1238                      | 121           | 100            | 96            | 20             | 0        | 1920                  |           |
| 2 | DSSK60-015A | 1256                      | 121           | 100            | 96            | 20             | 1        | 1920                  | I_R @ 96h |

**TABLE 5G: Thyristor/Diode single device**

| # | Part Number | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|-------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | CS45-16io1  | 890                       | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 2 | DSP8-12AC   | 1208                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |

**TABLE 5H: ISOPLUS**

| # | Part Number  | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|--------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | DSEC60-03AR  | 1121                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 2 | DSEP15-12CR  | 1168                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 3 | IXBH40N140   | 1188                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 4 | IXER35N120D1 | 909                       | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 5 | IXLF19N250   | 1387                      | 121           | 100            | 96            | 20             | 0        | 1920                  |        |

**TABLE 5J: Breakover diode**

| # | Part Number | Date Code<br>or<br>Test # | Temp.<br>[°C] | Rel. H.<br>[%] | Time<br>[hrs] | Sample<br>Size | Failures | Device Hours<br>[hrs] | Remark |
|---|-------------|---------------------------|---------------|----------------|---------------|----------------|----------|-----------------------|--------|
| 1 | IXBOD1-08   | 1085                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 2 | IXBOD1-08   | 1248                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 3 | IXBOD1-09   | 1340                      | 121           | 100            | 48            | 20             | 0        | 960                   |        |
| 4 | IXBOD1-10   | 868                       | 121           | 100            | 48            | 20             | 0        | 960                   |        |

**MSLA classification standard Table: according to IEC 60749-20**

| # | Part Number | Date Code | Sample<br>Size | Housing style | Passed<br>class* | Remark |
|---|-------------|-----------|----------------|---------------|------------------|--------|
| 1 | DSP8-08S    | K317      | 20             | TO-263        | C                |        |
| 2 | DSP8-08S    | K318      | 20             | TO-263        | C                |        |
| 3 | DSS6-0025BS | LSA408    | 20             | TO-252        | C                |        |
| 4 | DSSK18-025  | L405      | 20             | TO-263        | C                |        |

\* "C" storage allowed <30°C; 85% relative humidity (no DRY-Pack required)