



Efficiency through technology

**RELIABILITY REPORT
1/05**

Power Semiconductor Devices

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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.

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

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

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

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

T₁: abs. application junction temperature (273+T_j) K

T₂: abs. test junction temperature (273+T_j) 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:

ΔT: max T_j - min T_j during Test

DEFINITION OF FAILURE

Failure criteria are defined according to IEC 60747 standard series

DEFINITION OF RoHS COMPLIANT

Acronym RoHS stands for Restriction of Hazardous Substances (Directive 2002/95/EC).

There is a note in columns "Remark" only if the part was tested in a RoHS compliant status and if the family to which it belongs was non compliant before.

(see also <http://www.ixys.com/prodinfo.html>)

Summary of Tables 1A - 1J: HTRB

	Table 1A MOSFET/IGBT discrete device *)	Table 1B MOSFET/IGBT Module	Table 1C Thyr./Diode Module	Table 1D Controller/ Rec. Bridge*)	Table 1E FRED *)	Table 1F Schottky Diode*)	Table 1G Thyr./Diode discrete device*)	Table 1H ISOPLUS
Failure Rate [FIT] 125°C, 60% UCL	343	40140	6813	13241	10123	11039	3669	-
Failure Rate [FIT] 90°C, 60% UCL	21	2404	408	793	606	661	220	-
Total Lots Tested	91	7	26	18	16	14	10	13
Total Devices Tested	2616	65	270	180	300	250	180	270
Total Actual Failures	0	0	0	0	0	0	0	0
60% UCL {eq. (2)}	0,92	0,92	0,92	0,92	0,92	0,92	0,92	-
Total Equivalent Device Hours @ 125°C {AF eq. (1)}	2679480	22920	135035	69480	90883	83344	250734	293606
MTTF 125°C 60% UCL	332	3	17	9	11	10	31	-
(Years) 90°C 60% UCL	5552	47	280	144	188	173	520	-

Summary of Table 2A - 2C: HTGB

	Table 2A MOSFET/IGBT discrete device *)	Table 2B MOSFET/IGBT Module	Table 2C ISOPLUS
Failure Rate [FIT] 125°C, 60% UCL	487	32394	-
Failure Rate [FIT] 90°C, 60% UCL	157	10450	-
Total Lots Tested	65	5	3
Total Devices Tested	1866	50	50
Total Actual Failures	0	0	0
60% UCL {eq. (2)}	0,92	0,92	-
Total Equivalent Device Hours @ 125°C {AF eq. (1)}	1889440	28400	41680
MTTF 125°C 60% UCL	234	4	-
(Years) 90°C 60% UCL	727	11	-

*) including ISOPLUS

Summary of Tables 3A - 3H: Power Cycle

	Table 3A MOSFET/IGBT discrete device *)	Table 3C Thyr./Diode Module	Table3D Controller/ Rec. Bridge*)	Table 3E FRED *)	Table 3F Schottky Diode*)	Table 3G Thyr./Diode discrete device*)	Table 3H Isoplus
Total Lots Tested	22	6	7	13	3	10	4
Total Devices Tested	520	80	66	220	60	200	84
Total Failures	0	0	0	0	0	0	0
Total Device Cycles	4755200	1890000	260360	820000	180000	920000	540000

Summary of Tables 4A - 4J: Temperature Cycle

	Table 4A MOSFET/IGBT discrete device *)	Table 4B MOSFET/IGBT Module	Table 4C Thyr./Diode Module	Table4D Controller/ Rec. Bridge*)	Table 4E FRED *)	Table 4F Schottky Diode*)	Table 4G Thyr./Diode discrete device*)	Table 4H Isoplus	Table 4J Breakover Diode
Total Lots Tested	29	6	29	23	22	21	23	16	7
Total Devices Tested	746	60	360	225	420	470	350	370	120
Total Failures	0	0	2	2	2	1	0	0	0
Total Device Cycles	103800	4500	39500	18200	33600	34900	24400	40400	10000

Summary of Tables 5A - 5H: Humidity Test

	Table 5A MOSFET/IGBT discrete device *)	Table 5C Thyr./Diode Module	Table5D Controller/ Rec. Bridge*)	Table 5E FRED *)	Table 5F Schottky Diode*)	Table 5G Thyr./Diode discrete device*)	Table 5H Isoplus	Table 5J Breakover Diode
Total Lots Tested	12	1	5	8	3	8	6	3
Total Devices Tested	340	10	50	150	60	150	140	60
Total Failures	0	0	0	0	0	1	0	0
Total Device Hours	52560	10000	25040	11280	5760	12000	16320	2880

*) including ISOPLUS

HTRB (Tables 1A .. 1J)

TABLE 1A: MOSFET/IGBT single device									
#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	IRFP450	CK 0420	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	IXDA20N120AS	757	960	125	1000	20	0	20000	
5	IXDA20N120AS	757	960	125	1000	20	0	20000	
6	IXDH30N120D1	1007	960	125	168	20	0	3360	
7	IXEH25N120	829	960	125	1000	20	0	20000	
8	IXFB70N60Q2	SP 0335	480	125	1000	30	0	30000	
9	IXFB80N50Q	SP 0251	400	125	1000	30	0	30000	
10	IXFH12N100F	SP 0130	800	125	1000	30	0	30000	
11	IXFH21N50	SK 0407	400	125	1000	30	0	30000	
12	IXFH21N50Q	SK 0245	400	125	1000	30	0	30000	
13	IXFH21N50Q	MP 0423	400	125	1000	30	0	30000	RoHS compliant
14	IXFH23N80Q	SK 0401	640	125	1000	30	0	30000	
15	IXFH24N50	SK 0313	400	125	1000	30	0	30000	
16	IXFH24N50	MP 0419	400	125	1000	30	0	30000	RoHS compliant
17	IXFH26N50	SP 0237	400	125	1000	30	0	30000	
18	IXFH26N50Q	SP 0308	400	125	1000	30	0	30000	
19	IXFH26N50Q	SK 0316	400	125	1000	30	0	30000	
20	IXFH26N50Q	MP 0431	400	125	1000	30	0	30000	RoHS compliant
21	IXFH26N60Q	SK 0310	480	125	1000	30	0	30000	
22	IXFH26N60Q	SK 0405	480	125	1000	30	0	30000	
23	IXFH32N50Q	SK 0330	400	125	1000	30	0	30000	
24	IXFH36N50P	SP 0436	400	125	1000	30	0	30000	RoHS compliant
25	IXFH50N20	SK 0325	160	125	1000	30	0	30000	
26	IXFH6N100Q	TK 0401	800	125	1000	30	0	30000	
27	IXFH80N10Q	SK 0313	80	125	1000	30	0	30000	
28	IXFH80N10Q	SK 0416	80	125	1000	30	0	30000	RoHS compliant
29	IXFH9N80	CP 0423	640	125	1000	30	0	30000	RoHS compliant
30	IXFK34N80	SP 0345	640	125	1000	30	0	30000	
31	IXFK48N50	SP 0309	400	125	1000	30	0	30000	
32	IXFK48N50	SP 0417	400	125	1000	30	0	30000	RoHS compliant
33	IXFK73N30Q	SP 0311	240	125	1000	30	0	30000	
34	IXFN48N50	SP 0417	400	125	1000	30	0	30000	RoHS compliant
35	IXFX21N100Q	SP 0436	800	125	1000	30	0	30000	RoHS compliant
36	IXFX27N80Q	SP 0419	640	125	1000	30	0	30000	RoHS compliant
37	IXFX34N80	SP 0422	640	125	1000	30	0	30000	RoHS compliant
38	IXFX38N80Q2	SP 0403	640	125	1000	30	0	30000	
39	IXFX48N50Q	SP 0339	400	125	1000	30	0	30000	
40	IXFX48N50Q	SP 0434	400	125	1000	30	0	30000	RoHS compliant
41	IXFX55N50F	SP 0305	400	125	1000	30	0	30000	
42	IXGH28N120B	SK 0301	800	125	1000	30	0	30000	
43	IXGH28N120B	SK 0305	800	125	1000	30	0	30000	
44	IXGR40N60C2	SP 0337	480	125	1000	30	0	30000	
45	IXKC20N60C	1018	480	125	1000	20	0	20000	
46	IXKN40N60C	838	480	125	168	10	0	1680	
47	IXKR40N60C	987	480	125	1000	20	0	20000	
48	IXTM1N100	TP 0423	800	125	1000	32	0	32000	
49	IXTM1N100	TP 0423	800	125	1000	32	0	32000	
50	IXTM1N100	TP 0424	800	125	1000	32	0	32000	
51	IXTH20N60	MP 0419	480	125	1000	30	0	30000	RoHS compliant
52	IXTH28N50Q	MK 0352	400	125	1000	30	0	30000	
53	IXTH41N25	SP 0311	200	125	1000	30	0	30000	
54	IXTH48N20	SP 0315	160	125	1000	30	0	30000	
55	IXTH72N20	SK 0306	160	125	1000	30	0	30000	
56	IXTH75N15	SK 0306	120	125	1000	30	0	30000	
57	IXTH75N15	SK 0338	120	125	1000	30	0	30000	
58	IXTH75N15	SK 0402	120	125	1000	30	0	30000	

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

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
59	IXTH75N15	SK 0415	120	125	1000	30	0	30000	
60	IXTH75N15	SK 0425	120	125	1000	30	0	30000	RoHS compliant
61	IXTH75N15	SK 0439	120	125	1000	30	0	30000	RoHS compliant
62	IXTH75N15	SK 0442	120	125	1000	30	0	30000	RoHS compliant
63	IXTH88N30P	SK 0348	240	125	1000	30	0	30000	
64	IXTK102N30P	SS 0349	240	125	1000	30	0	30000	
65	IXTK120N25	SP 0305	200	125	1000	30	0	30000	
66	IXTK250N10	SP 0318	80	125	1000	30	0	30000	
67	IXTK62N25	SS 0348	200	125	1000	30	0	30000	
68	IXTK62N25	SP 0413	200	125	1000	30	0	30000	
69	IXTK62N25	SS 0420	200	125	1000	30	0	30000	RoHS compliant
70	IXTK62N25	SS 0428	200	125	1000	30	0	30000	RoHS compliant
71	IXTK80N25	SS 0347	200	125	1000	30	0	30000	
72	IXTK82N25P	SS 0403	200	125	1000	30	0	30000	
73	IXTK88N30P	SS 0403	240	125	1000	30	0	30000	
74	IXTN79N20	1140	160	125	168	10	0	1680	
75	IXTQ23N60Q	MK 0421	480	125	1000	30	0	30000	
76	IXTQ26N50P	SK 0435	400	125	1000	30	0	30000	RoHS compliant
77	IXTQ36N30P	SK 0405	240	125	1000	30	0	30000	
78	IXTQ42N25P	SK 0405	200	125	1000	30	0	30000	
79	IXTQ50N20P	SK 0405	160	125	1000	30	0	30000	
80	IXTQ62N15P	SK 0405	120	125	1000	30	0	30000	
81	IXTQ64N25P	SK 0405	200	125	1000	30	0	30000	
82	IXTQ69N30P	SK 0425	240	125	1000	30	0	30000	RoHS compliant
83	IXTQ74N20P	SK 0403	160	125	1000	30	0	30000	
84	IXTQ74N20P	SK 0405	160	150	1000	30	0	30000	
85	IXTQ75N10P	SK 0405	80	125	1000	30	0	30000	
86	IXTQ82N25P	SW 0435	200	125	1000	30	0	30000	RoHS compliant
87	IXTQ82N25P	SK 0431	200	125	1000	30	0	30000	RoHS compliant
88	IXTQ88N30P	SK 0402	240	125	1000	30	0	30000	
89	IXTQ96N15P	SK 0402	120	125	1000	30	0	30000	
90	IXTQ96N20P	SK 0403	160	125	1000	30	0	30000	
91	IXTQ96N20P	SK 0405	160	150	1000	30	0	30000	

TABLE 1B: MOSFET/IGBT Module

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	MKI50-12F7	932	960	125	1000	5	0	5000	
2	MUBW15-12A7	964	1120	125	120	10	0	1200	
3	MUBW30-12E6K	1127	1120	125	168	10	0	1680	
4	MWI25-12E7	1013	960	125	168	10	0	1680	
5	MWI75-12A8	677	960	125	1000	10	0	10000	
6	MWI75-12A8	677	960	125	168	10	0	1680	
7	VMM300-03FP	636	240	125	168	10	0	1680	

TABLE 1C: Thyristor/Diode Module

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	MCC122-16	1023	1120	125	168	10	0	1680	
2	MCC122-16	1023	1120	130	1000	10	0	10000	
3	MCC162	874	1260	125	168	10	0	1680	
4	MCC162-16	922	1120	125	168	10	0	1680	
5	MCC162-18	732	1260	125	168	10	0	1680	
6	MCC250-16	652	1120	125	168	10	0	1680	
7	MCC26-16	796	1120	125	500	10	0	5000	
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	MCC44	1027	1260	125	1000	10	0	10000	
12	MCC56	888	1260	125	168	10	0	1680	
13	MCC56-18	696	1260	125	1000	20	0	20000	
14	MCC72-16	727	1120	125	168	10	0	1680	
15	MCC95-16io1	598	1120	125	168	10	0	1680	
16	MCC95-16io1	599	1280	125	168	10	0	1680	
17	MCC95-16io1B	816	1120	125	168	10	0	1680	
18	MCD56-16io1B	809	1120	125	500	10	0	5000	
19	MCO150-12io1	607	960	125	1000	10	0	10000	
20	MCO150-12io1	607	840	150	168	10	0	1680	
21	MCO50-16io1	1154	1120	125	1000	10	0	10000	
22	MDD56-16	679	1120	125	168	10	0	1680	
23	MDD56-18	739	1260	125	1000	10	0	10000	
24	MDD95-16	971	1120	125	168	10	0	1680	
25	MDD95-16	971	1120	150	1000	10	0	10000	
26	MDO500-22	815	1540	125	168	10	0	1680	

TABLE 1D: Controller/Rectifier Bridge

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	MMO75-16	761	1120	125	168	10	0	1680	
2	MMO75-17AB	1002	1190	125	168	10	0	1680	
3	VBH40-05B	814	840	125	168	10	0	1680	Input - Rectifier
4	VBH40-05B	814	400	125	168	10	0	1680	Mosfet
5	VBO105-18NO7	1090	1260	125	168	10	0	1680	
6	VBO19-16DT1	794	1120	125	168	10	0	1680	
7	VBO25-16AO2	1057	1120	125	168	10	0	1680	
8	VBO40-16NO6	1014	1120	125	168	10	0	1680	
9	VUB120-16NO2	833	960	125	1000	10	0	10000	
10	VUB72-16	835	960	125	500	10	0	5000	
11	VUM24-05	846	560	125	300	10	0	3000	Input - Rectifier
12	VUM24-05	846	400	125	300	10	0	3000	Mosfet, FRED
13	VUO121-16NO1	709	1120	125	1000	10	0	10000	
14	VUO121-16NO1	999	1120	125	1000	10	0	10000	
15	VUO34-18	907	1260	125	1000	10	0	10000	
16	VUO36-16NO8	740	1120	125	168	10	0	1680	
17	VUO50-16	625	1120	125	168	10	0	1680	
18	VVY40-16	700	1120	125	168	10	0	1680	

TABLE 1E: FRED

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	DSEC240-04A	1148	320	125	168	20	0	3360	
2	DSEC30-06A	1049	480	125	168	20	0	3360	
3	DSEC60-02A	742	200	125	1000	20	0	20000	
4	DSEC60-03AR	600	240	125	168	20	0	3360	
5	DSEC60-03AR	1121	240	125	168	20	0	3360	
6	DSEC60-04A	889	320	125	168	20	0	3360	
7	DSEI2x61-12B	722	960	125	1000	10	0	10000	
8	DSEI2x61-12P	1004	960	125	168	10	0	1680	
9	DSEP12-12A	960	960	125	168	20	0	3360	
10	DSEP15-12CR	715	960	125	168	20	0	3360	
11	DSEP30-06A	1114	480	125	168	20	0	3360	
12	DSEP30-06A	1114	600	125	168	20	0	3360	
13	DSEP30-06CR	902	480	125	168	20	0	3360	
14	DSEP60-06A	791	480	125	168	20	0	3360	
15	DSEP60-12A	1118	960	125	168	20	0	3360	
16	DSS17-06CR	714	600	150	168	20	0	3360	

TABLE 1F: Schottky Diode

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	DGS15-018CS	984	144	125	168	20	0	3360	
2	DGS19-025CS	985	200	125	168	20	0	3360	
3	DSS1-40BA	789	32	100	1000	20	0	20000	
4	DSS160-01A	1143	100	125	168	20	0	3360	
5	DSS17-06CR	714	600	150	168	20	0	3360	
6	DSS2-40BB	790	32	100	1000	20	0	20000	
7	DSS2x41-01A	1065	100	125	168	10	0	1680	
8	DSSK48-0025B	1050	20	100	168	20	0	3360	
9	DSSK60-0045A	961	45	125	168	20	0	3360	
10	DSSK70-008AR	1111	80	125	1000	20	0	20000	
11	DSSK80-006B	676	50	100	168	10	0	1680	
12	DSSK80-006B	676	50	100	168	10	0	1680	
13	DSSK80-006BR	998	48	100	1000	20	0	20000	
14	DSSS35-008AR	910	64	125	1000	20	0	20000	

TABLE 1G: Thyristor/Diode single device

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	CS22-12	707	840	125	1000	20	0	20000	
2	CS30-16io1	1001	1120	125	168	20	0	3360	
3	CS60-14io1	594	980	125	1000	30	0	30000	
4	DSA17-16A	1092	1120	150	168	10	0	1680	
5	DSAI35-16A	900	1120	150	168	10	0	1680	
6	DSAI75-16B	668	1120	150	168	10	0	1680	
7	DSI45-16AR	823	1120	150	168	20	0	3360	
8	DSIK45-16AR	608	1120	150	1000	20	0	20000	
9	DSP25-16A	877	1120	150	168	20	0	3360	
10	DSP25-16A	886	1120	150	168	20	0	3360	

TABLE 1H: ISOPLUS

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	DSEC60-03AR	600	240	125	168	20	0	3360	
2	DSEC60-03AR	1121	240	125	168	20	0	3360	
3	DSEP15-12CR	715		125	168	20	0	3360	
4	DSEP30-06CR	902	480	125	168	20	0	3360	
5	DSI45-16AR	823	1120	150	168	20	0	3360	
6	DSIK45-16AR	608	1120	150	1000	20	0	20000	
7	DSS17-06CR	714	600	150	168	20	0	3360	
8	DSSK70-008AR	1111	80	125	1000	20	0	20000	
9	DSSS35-008AR	910	64	125	1000	20	0	20000	
10	FBS10-12SCC	1021	840	125	1000	20	0	20000	
11	IXKC20N60C	1018	480	125	1000	20	0	20000	
12	IXKR40N60C	987	480	125	1000	20	0	20000	
13	IXGR40N60C2	SP 0337	480	125	1000	30	0	30000	

TABLE 1J: Breakover Diode

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	IXBOD1-08	1085	640	125	168	20	0	3360	
2	IXBOD1-09	743	720	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 or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	FII30-06D	829	16	125	1000	10	0	10000	
2	IRFP450	CK 0420	16	125	1000	30	0	30000	
3	IXDH30N120D1	1094	16	150	168	20	0	3360	
4	IXDN55N120D1	596	16	125	168	10	0	1680	
5	IXFB80N50Q2	SP 0251	16	125	1000	30	0	30000	
6	IXFH12N100F	SP 0130	16	125	1000	30	0	30000	
7	IXFH21N50	SK 0407	16	125	1000	30	0	30000	
8	IXFH21N50Q	SK 0245	16	125	1000	30	0	30000	
9	IXFH21N50Q	MP 0423	16	125	1000	30	0	30000	RoHS compliant
10	IXFH23N80Q	SK 0401	16	125	1000	30	0	30000	
11	IXFH24N50	SK 0313	16	125	1000	30	0	30000	
12	IXFH24N50	MP 0419	16	125	1000	30	0	30000	RoHS compliant
13	IXFH26N50	SP 0237	16	125	1000	30	0	30000	
14	IXFH26N50Q	SP 0308	16	125	1000	30	0	30000	
15	IXFH26N50Q	SK 0316	16	125	1000	30	0	30000	
16	IXFH26N50Q	MP 0431	16	125	1000	30	0	30000	RoHS compliant
17	IXFH26N60Q	SK 0310	16	125	1000	30	0	30000	
18	IXFH32N50Q	SK 0330	16	125	1000	30	0	30000	
19	IXFH36N50P	SP 0436	16	125	1000	30	0	30000	RoHS compliant
20	IXFH50N20	SK 0325	16	125	1000	30	0	30000	
21	IXFH80N10Q	SK 0313	16	125	1000	30	0	30000	
22	IXFH80N10Q	SK 0416	16	125	1000	30	0	30000	RoHS compliant
23	IXFH9N80	CP 0423	16	125	1000	30	0	30000	RoHS compliant
24	IXFK48N50	SP 0309	16	125	1000	30	0	30000	
25	IXFK48N50	SP 0417	16	125	1000	30	0	30000	RoHS compliant
26	IXFN48N50	SP 0417	16	125	1000	30	0	30000	RoHS compliant
27	IXFX21N100Q	SP 0436	16	125	1000	30	0	30000	RoHS compliant
28	IXFX27N80Q	SP 0419	16	125	1000	30	0	30000	RoHS compliant
29	IXFX34N80	SP 0422	16	125	1000	30	0	30000	RoHS compliant
30	IXFX38N80Q2	SP 0403	16	125	1000	30	0	30000	
31	IXFX48N50Q	SP 0339	16	125	1000	30	0	30000	
32	IXFX48N50Q	SP 0434	16	125	1000	30	0	30000	RoHS compliant
33	IXGR40N60C2	SP 0337	16	125	1000	30	0	30000	
34	IXKN40N60C	838	20	125	168	10	0	1680	
35	IXLF19N250	1142	16	150	168	10	0	1680	
36	IXTH28N50Q	MK 0352	16	125	1000	30	0	30000	
37	IXTH41N25	SP 0311	16	125	1000	30	0	30000	
38	IXTH48N20	SP 0315	16	125	1000	30	0	30000	
39	IXTH72N20	SK 0306	16	125	1000	30	0	30000	
40	IXTH75N15	SK 0306	16	125	1000	30	0	30000	
41	IXTH75N15	SK 0338	16	125	1000	30	0	30000	
42	IXTH88N30P	SK 0348	16	125	1000	30	0	30000	
43	IXTK102N30P	SS 0349	16	125	1000	30	0	30000	
44	IXTK120N25	SP 0305	16	125	1000	30	0	30000	
45	IXTK250N10	SP 0318	16	125	1000	30	0	30000	
46	IXTK82N25P	SS 0403	16	125	1000	30	0	30000	
47	IXTK88N30P	SS 0403	16	125	1000	30	0	30000	
48	IXTM1N100	TP 0423	16	125	1000	32	0	32000	
49	IXTM1N100	TP 0423	16	125	1000	32	0	32000	
50	IXTM1N100	TP 0424	16	125	1000	32	0	32000	
51	IXTQ23N60Q	MK 0421	16	125	1000	MK	0	30000	RoHS compliant
52	IXTQ26N50P	SK 0435	16	125	1000	30	0	30000	RoHS compliant
53	IXTQ36N30P	SK 0405	16	125	1000	30	0	30000	
54	IXTQ42N25P	SK 0405	16	125	1000	30	0	30000	
55	IXTQ50N20P	SK 0405	16	125	1000	30	0	30000	

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

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
56	IXTQ62N15P	SK 0405	16	125	1000	30	0	30000	
57	IXTQ64N25P	SK 0405	16	125	1000	30	0	30000	
58	IXTQ74N20P	SK 0403	16	125	1000	30	0	30000	
59	IXTQ74N20P	SK 0405	16	150	1000	30	0	30000	
60	IXTQ75N10P	SK 0405	16	125	1000	30	0	30000	
61	IXTQ82N25P	SW 0435	16	125	1000	30	0	30000	RoHS compliant
62	IXTQ88N30P	SK 0402	16	125	1000	30	0	30000	
63	IXTQ96N15P	SK 0402	16	125	1000	30	0	30000	
64	IXTQ96N20P	SK 0403	16	125	1000	30	0	30000	
65	IXTQ96N20P	SK 0405	16	150	1000	30	0	30000	

TABLE 2B: MOSFET/IGBT Module

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [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	VIO25-06P1	1087	16	150	168	10	0	1680	
5	VMM300-03FP	636	16	125	1000	10	0	10000	

TABLE 2C: ISOPLUS

#	Part Number	Date Code or Test #	Voltage [V]	Temp. [°C]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	FII30-06D	829	16	125	1000	10	0	10000	
2	IXGR40N60C2	SP 0337	16	125	1000	30	0	30000	
3	IXLF19N250	1142	16	150	168	10	0	1680	

POWER CYCLE (Tables 3A ..3H)

TABLE 3A: MOSFET/IGBT single device

#	Part Number	Date Code or Test #	Tj(max) [°C]	ΔT [K]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	IRFP450	CK 0420	125	100	10000	24	0	240000	
2	IXDH30N120D1	1007	125	80	2000	20	0	40000	RoHS compliant
3	IXDH35N60B	1063	125	80	2000	20	0	40000	RoHS compliant
4	IXFB70N60Q2	SP 0335	125	100	10000	24	0	240000	
5	IXFH12N100F	SP 0130	125	100	4800	24	0	115200	
6	IXFH21N50Q	MP 0423	125	100	10000	24	0	240000	RoHS compliant
7	IXFH24N50	MP 0419	125	100	10000	24	0	240000	RoHS compliant
8	IXFH26N50	SP 0228	125	100	10000	24	0	240000	
9	IXFH26N50Q	SK 0316	125	100	10000	24	0	240000	
10	IXFH26N60Q	SK 0310	125	100	10000	24	0	240000	
11	IXFH50N20	SK 0325	125	100	10000	24	0	240000	
12	IXFK90N30	SP 0244	125	100	10000	24	0	240000	
13	IXFR4N100Q	TP 0149	125	100	10000	24	0	240000	
14	IXFX27N80Q	SP 0236	125	100	10000	24	0	240000	
15	IXFX48N50Q	SP 0339	125	100	10000	24	0	240000	
16	IXFX55N50	SP 0223	125	100	10000	24	0	240000	
17	IXFX80N25	SP 0326	125	100	10000	24	0	240000	
18	IXTH28N50Q	MK 0352	125	100	10000	24	0	240000	
19	IXTK102N30P	SS 0349	125	100	10000	24	0	240000	
20	IXTK62N25	SS 0420	125	100	10000	24	0	240000	
21	IXTK80N25	SS 0347	125	100	10000	24	0	240000	
22	IXTK80N25	SP 0406	125	100	10000	24	0	240000	

TABLE 3C: Thyristor/Diode Module

#	Part Number	Date Code or Test #	Tj(max) [°C]	ΔT [K]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	MCC200	747	125	80	20000	10	0	200000	
2	MCC56	685	125	80	35000	10	0	350000	
3	MCC56-16io1	820	125	80	10000	10	0	100000	
4	MCO150-12io1	607	125	80	4000	10	0	40000	
5	MDD172-16	992	125	80	50000	20	0	1000000	
6	MDD172-16	992	125	80	10000	20	0	200000	

TABLE 3D: Controller, Rectifier Bridge

#	Part Number	Date Code or Test #	Tj(max) [°C]	ΔT [K]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	MMO36-16	875	125	80	10000	10	0	100000	
2	VBO125-16NO7	741	125	80	2000	10	0	20000	
3	VBO68-16NO7	995	125	80	2000	10	0	20000	
4	VUE50-12	717	125	80	5000	10	0	50000	
5	VUO121-16NO1	999	125	80	2000	10	0	20000	
6	VUO36	766	125	80	60	6	0	360	
7	VUO60-12	993	125	80	5000	10	0	50000	

TABLE 3E: FRED

#	Part Number	Date Code or Test #	Tj(max) [°C]	ΔT [K]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	DSEC30-02A	795	125	80	4000	20	0	80000	
2	DSEC60-06A	664	150	105	2000	20	0	40000	
3	DSEI120-06A	956	125	80	4000	20	0	80000	
4	DSEI2x61-12B	722	125	80	5000	10	0	50000	
5	DSEI60-12A	1046	150	105	2000	20	0	40000	RoHS compliant
6	DSEK60-06A	720	150	105	2000	20	0	40000	
7	DSEP12-12A	960	150	105	2000	20	0	40000	
8	DSEP15-12CR	715	125	80	5000	20	0	100000	
9	DSEP2x31-12A	905	125	80	5000	10	0	50000	
10	DSEP30-12CR	1045	125	80	5000	20	0	100000	RoHS compliant
11	DSS17-06CR	714	150	105	5000	20	0	100000	
12	MEO450-12 "K"	830	125	80	5000	10	0	50000	
13	MEO450-12DA "L"	639	125	80	5000	10	0	50000	

TABLE 3F: Schottky Diode

#	Part Number	Date Code or Test #	Tj(max) [°C]	ΔT [K]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	DSS17-06CR	714	150	105	5000	20	0	100000	
2	DSSK70-0015B	901	125	80	2000	20	0	40000	
3	DSSK80-003B	1071	125	80	2000	20	0	40000	RoHS compliant

TABLE 3G: Thyristor/Diode single device

#	Part Number	Date Code or Test #	Tj(max) [°C]	ΔT [K]	Number of Cycles	Sample 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	CS22-12	707	125	80	4000	20	0	80000	
4	CS9444L	602	125	80	6000	30	0	180000	
5	CS9444LD	601	125	80	6000	30	0	180000	
6	DSA17-16A	1092	130	100	2000	10	0	20000	RoHS compliant
7	DSA75-16B	718	150	105	2000	10	0	20000	
8	DSI30-12A	1036	125	80	2000	20	0	40000	RoHS compliant
9	DSI45-12A	613	125	80	4000	20	0	80000	

TABLE 3H: ISOPLUS

#	Part Number	Date Code or Test #	Tj(max) [°C]	ΔT [K]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	DSEP15-12CR	715	125	80	5000	20	0	100000	
2	DSEP30-12CR	1045	125	80	5000	20	0	100000	RoHS compliant
3	DSS17-06CR	714	150	105	5000	20	0	100000	
4	IXFR4N100Q	TP 0149		100	10000	24	0	240000	

TEMPERATURE CYCLE (Tables 4A ..4J)

TABLE 4A: MOSFET/IGBT single device

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	FMM151-0075P	1145	-55	150	100	20	0	2000	RoHS compliant
2	IRFP450	CK 0420	-55	125	100	30	0	3000	
3	IXBH40N160	935	-55	150	100	20	0	2000	
4	IXDA20N120AS	967	-40	150	100	20	0	2000	
5	IXFC26N50Q	648	-45	150	250	30	0	7500	
6	IXFF55N50	623	-45	150	250	30	0	7500	
7	IXFG55N50	622	-45	150	100	30	0	3000	
8	IXFH21N50Q	MP 0423	-55	125	100	30	0	3000	RoHS compliant
9	IXFH24N50	MP 0419	-55	125	100	30	0	3000	
10	IXFH26N50Q	SK 0330	-65	155	100	30	0	3000	
11	IXFH75N10Q	827	-40	125	1000	10	0	10000	
12	IXFL55N50	621	-45	150	100	30	0	3000	
13	IXFN80N50	693	-40	150	100	20	0	2000	
14	IXFQ26N50Q	SK 0330	-65	155	100	30	0	3000	
15	IXKC20N60C	1074	-55	150	100	40	0	4000	RoHS compliant
16	IXKC20N60C	1018	-55	150	50	20	0	1000	
17	IXKN40N60C	838	-40	150	20	10	0	200	
18	IXKR40N60C	987	-40	150	100	20	0	2000	
19	IXKR40N60C	1033	-40	150	100	10	0	1000	RoHS compliant
20	IXTH75N15	SK 0330	-65	155	100	30	0	3000	
21	IXTM1N100	TP 0423	-55	125	100	32	0	3200	RoHS compliant
22	IXTM1N100	TP 0423	-55	125	100	32	0	3200	RoHS compliant
23	IXTM1N100	TP 0424	-55	125	100	32	0	3200	RoHS compliant
24	IXTN79N20	1140	-40	150	50	10	0	500	
25	IXTQ64N25P	SK 0414	-55	150	250	30	0	7500	
26	IXTQ69N30P	SK 0342	-65	155	100	30	0	3000	
27	IXTQ69N30P	SK 0411	-55	150	250	30	0	7500	
28	IXTQ75N115	SK 0330	-65	155	100	30	0	3000	
29	IXTQ96N15P	SK 0412	-55	150	250	30	0	7500	

TABLE 4B: MOSFET/IGBT Module

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	MUBW15-12A7	964	-40	150	100	10	0	1000	
2	MUBW50-12E8	945	-40	150	50	10	0	500	
3	MUBW50-12E8	1082	-40	150	50	10	0	500	
4	MWI50-06A7T	1144	-40	150	100	10	0	1000	
5	MWI50-12A7	1017	-40	150	100	10	0	1000	
6	VMO440-02FL	936	-40	150	50	10	0	500	

TABLE 4C: Thyristor/Diode Module

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	MCC162-16	847	-40	150	100	10	0	1000	
2	MCC21-14	725	-40	150	100	10	0	1000	
3	MCC255-14io1	1120	-40	150	50	10	0	500	
4	MCC26	526	-40	150	100	10	0	1000	
5	MCC26-14io8	723	-40	150	100	10	0	1000	
6	MCC310-12	970	-40	150	50	10	0	500	
7	MCC44	673	-40	150	150	10	0	1500	
8	MCC44-12	1101	-40	150	50	10	0	500	
9	MCC56	685	-40	150	100	20	0	2000	
10	MCC56	685	-40	150	300	20	0	6000	
11	MCC56	962	-40	150	100	10	1	1000	
12	MCC56	963	-40	150	100	10	0	1000	
13	MCC56	697	-40	150	200	10	0	2000	
14	MCC56-14	698	-40	150	200	10	0	2000	
15	MCC56-14	785	-40	150	100	10	0	1000	
16	MCC56-14	786	-40	150	100	10	1	1000	
17	MCC56-16	811	-40	150	100	30	0	3000	
18	MCC56-16	812	-40	150	100	30	0	3000	
19	MCC56-8	699	-40	150	200	10	0	2000	
20	MCC95-16io1	976	-40	150	50	10	0	500	
21	MCD162-16	803	-40	150	100	10	0	1000	
22	MCD56-16	783	-40	150	100	10	0	1000	
23	MCD95-14	939	-40	150	50	10	0	500	
24	MCO150-12io1	607	-40	150	50	10	0	500	
25	MDD172-12	1083	-40	150	100	10	0	1000	
26	MDD26-14	724	-40	150	50	10	0	500	
27	MDD95-08	637	-40	150	50	10	0	500	
28	MDD95-16	1058	-40	150	100	20	0	2000	
29	VCC105-14NO7	1115	-40	150	100	10	0	1000	

TABLE 4D: Controller, Rectifier Bridge

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	MMO74-16io6	663	-40	150	20	10	0	200	
2	VBE60-06A	908	-40	150	100	10	0	1000	
3	VBO19-16DT1	1113	-40	150	50	10	0	500	
4	VBO25-12	658	-40	150	50	10	0	500	
5	VBO25-16AO2	1028	-40	150	100	10	0	1000	
6	VHFD37-14	1003	-40	150	50	10	0	500	
7	VUM24-05	846	-40	150	100	10	0	1000	
8	VUO110	617	-40	150	20	5	0	100	
9	VUO121	1070	-40	150	100	10	0	1000	
11	VUO27-12	792	-40	150	50	10	0	500	
12	VUO34	918	-40	150	100	10	0	1000	
13	VUO36-16	883	-40	150	20	10	0	200	
14	VUO52	887	-40	150	100	10	0	1000	
15	VUO52	887	-40	150	100	10	0	1000	
16	VUO52-16	762	-40	150	200	10	0	2000	
17	VUO52-16	770	-40	150	200	10	1	2000	
18	VVY40-16	913	-40	150	50	10	0	500	
19	VVZ40-14	841	-40	150	100	10	0	1000	
20	VVZ40-16	593	-40	150	50	10	0	500	
21	VW2x60-14	1039	-40	150	50	10	0	500	
22	VWO140-14	728	-40	150	20	10	0	200	
23	VWO140-14	842	-40	150	100	10	0	1000	

TABLE 4E: FRED

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	DSEC29-02A	1037	-55	150	50	20	0	1000	
2	DSEC60-02A	782	-55	150	200	20	0	4000	
3	DSEC60-02AQ	839	-55	150	100	20	0	2000	
4	DSEC60-03A	681	-55	150	100	20	0	2000	
5	DSEC60-03AR	1121	-55	150	50	20	0	1000	
6	DSEC60-03AR	600	-55	150	20	20	0	400	
7	DSEI2x121-02P	1005	-40	150	100	10	0	1000	
8	DSEI2x61-12B	722	-40	150	50	10	0	500	
9	DSEI30-10A	1126	-40	150	50	20	0	1000	
10	DSEI60-06A	705	-40	150	50	20	1	1000	I_R @ 50 Cycles
11	DSEI8-06A	778	-40	150	100	40	0	4000	
12	DSEK60-06A	720	-40	150	50	20	0	1000	
13	DSEP12-12A	960	-55	150	100	20	0	2000	
14	DSEP130-06A	616	-55	150	50	20	1	1000	I_R @ 50 Cycles
15	DSEP130-06A	616	-55	150	50	20	0	1000	
16	DSEP15-12CR	715	-55	150	100	20	0	2000	
17	DSEP29-06B	767	-55	150	100	20	0	2000	
18	DSEP2x25-12C	1009	-40	150	20	10	0	200	
19	DSEP30-06B	831	-55	150	150	20	0	3000	
20	DSEP30-06CR	902	-55	150	50	20	0	1000	
21	DSEP60-06A	791	-55	150	100	20	0	2000	
22	MEK350-02B	651	-40	150	50	10	0	500	

TABLE 4F: Schottky Diode

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	DGSK24-025CS	763	-55	150	100	20	0	2000	
2	DGSK24-025CS	763	-55	150	100	20	0	2000	
3	DGSK36-03CS	996	-55	150	100	20	0	2000	
4	DGSK8-025A	1106	-55	150	100	20	0	2000	
5	DSS1-40BA	789	-55	150	100	20	1	2000	I_R @ 100 Cycles
6	DSS2-40BB	790	-55	150	100	20	0	2000	
7	DSS2x160-01A	1117	-40	150	100	20	0	2000	
8	DSS2x41-01A	899	-40	150	10	10	0	100	
9	DSS40-0008D	1131	-55	150	100	20	0	2000	
10	DSS81-0045	744	-40	150	10	40	0	400	
11	DSS81-0045B	744	-40	150	10	40	0	400	
12	DSSK20-0045AM	854	-55	150	100	20	0	2000	
13	DSSK48-0025B	1050	-55	150	50	20	0	1000	
14	DSSK50-01A	665	-55	150	50	20	0	1000	
15	DSSK60-0045A	961	-55	150	50	20	0	1000	
16	DSSK70-0015B	901	-55	150	50	20	0	1000	
17	DSSK80-0025B	1119	-55	150	100	20	0	2000	
18	DSSK80-006B	729	-55	150	100	20	0	2000	
19	DSSK80-006B	729	-55	150	100	20	0	2000	
20	DSSS30-01AR	983	-55	150	100	40	0	4000	
21	DSSS35-008AR	910	-55	150	100	20	0	2000	

TABLE 4G: Thyristor/Diode single device

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	CS20-22moF1	979	-55	150	100	20	0	2000	
2	CS20-22moF1	952	-55	150	100	20	0	2000	
3	CS20-22moF1	979	-55	150	100	20	0	2000	
4	CS22-12	707	-40	150	50	20	0	1000	
5	CS30-16io1	1001	-40	150	50	20	0	1000	
6	CS35-14io1	1011	-40	150	20	10	0	200	
7	CS35-14io4	825	-40	150	20	10	0	200	
8	CS45	687	-40	150	150	20	0	3000	
9	CS45-16io1	890	-40	150	50	20	0	1000	
10	CS8-12io2	914	-40	150	20	10	0	200	
11	DSA17-16A	1092	-40	150	20	10	0	200	RoHS compliant
12	DSA9-16F	704	-40	150	20	10	0	200	
13	DSAI35-16A	735	-40	150	20	10	0	200	
14	DSI30-16A	1075	-40	150	100	20	0	2000	RoHS compliant
15	DSI45-16	764	-40	150	100	10	0	1000	
16	DSI45-16	764	-40	150	100	10	0	1000	
17	DSI45-16AR	823	-40	150	50	20	0	1000	
18	DSI75-04D	853	-40	150	50	10	0	500	
19	DSI75-04D	853	-40	150	50	10	0	500	
20	DSI75-16	1160	-40	150	20	10	0	200	RoHS compliant
21	DSIK45-16AR	608	-40	150	100	20	0	2000	
22	DSP45-16AR	645	-40	150	100	20	0	2000	
23	DSP8-08A	1146	-40	150	50	20	0	1000	RoHS compliant

TABLE 4H: ISOPLUS

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	DSEC60-03AR	600	-55	150	20	20	0	400	
2	DSEC60-03AR	1121	-55	150	50	20	0	1000	RoHS compliant
3	DSEP15-12CR	715	-55	150	100	20	0	2000	
4	DSEP30-06CR	902	-55	150	50	20	0	1000	
5	DSI45-16AR	823	-40	150	50	20	0	1000	
6	DSIK45-16AR	608	-40	150	100	20	0	2000	
7	DSP45-16AR	645	-40	150	100	20	0	2000	
8	DSSS30-01AR	983	-55	150	100	40	0	4000	
9	DSSS35-008AR	910	-55	150	100	20	0	2000	
10	FBS10-12SCC	1021	-55	150	100	20	0	2000	RoHS compliant
11	IXFC26N50Q	648	-45	150	250	30	0	7500	
12	IXFF55N50	623	-45	150	250	30	0	7500	
13	IXKC20N60C	1018	-55	150	50	20	0	1000	
14	IXKC20N60C	1074	-55	150	100	40	0	4000	RoHS compliant
15	IXKR40N60C	987	-40	150	100	20	0	2000	
16	IXKR40N60C	1033	-40	150	100	10	0	1000	

TABLE 4J: Breakover Diode

#	Part Number	Date Code or Test #	Low Temp. [°C]	High Temp. [°C]	Number of Cycles	Sample Size	Failures	Device Cycles	Remark
1	IXBOD1-07	597	-40	150	50	10	0	500	
2	IXBOD1-08	612	-40	150	200	20	0	4000	
3	IXBOD1-08	1085	-40	150	100	20	0	2000	RoHS compliant
4	IXBOD1-09	597	-40	150	50	10	0	500	
5	IXBOD1-09	743	-40	150	50	20	0	1000	
6	IXBOD1-10	868	-40	150	50	20	0	1000	
7	IXBOD1-10	991	-40	150	50	20	0	1000	

HUMIDITY TEST (Tables 5A ..5H)

TABLE 5A: MOSFET/IGBT single device

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	FII30-06D	829	121	100	168	20	0	3360	
2	IXER35N120D1	909	121	100	48	20	0	960	
3	IXFB80N50F	647	121	100	168	30	0	5040	
4	IXFC26N50Q	648	121	100	168	30	0	5040	
4	IXFF55N50	623	121	100	168	30	0	5040	
5	IXFG55N50	622	121	100	168	30	0	5040	
6	IXFL55N50	621	121	100	168	30	0	5040	
7	IXFL55N50	SP 0207	125	100	168	30	0	5040	
7	IXFG55N50	SP 0207	125	100	168	30	0	5040	
8	IXFF55N50	SP 0207	125	100	168	30	0	5040	
9	IXFC26N50Q	SP 0235	125	100	168	30	0	5040	
10	IXTQ69N30P	SK 0342	125	100	96	30	0	2880	

TABLE 5B: MOSFET/IGBT Module

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	MUBW15-12A7	964	85	85	1000	10	0	10000	

TABLE 5C: Thyristor/Diode Module

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	MCC250-16io1	1104	85	85	168	10	0	1680	
2	MCC26-16	796	85	85	168	10	0	1680	
3	MCC44	1027	85	85	1000	10	0	10000	
4	MCC56	631	85	85	1000	10	0	10000	
5	MCC95-16io1	821	85	85	168	10	0	1680	

TABLE 5D: Controller, Rectifier Bridge

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	VBO160-16NO7	1091	85	85	168	10	0	1680	
2	VUM24-05	846	85	85	168	10	0	1680	
3	VUM24-05	846	45	65	72	10	0	720	
4	VUO52-16	1079	85	85	168	10	0	1680	
5	VWO85-14	777	85	85	168	10	0	1680	

TABLE 5E: FRED

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	DSEC30-02A	795	121	100	48	20	0	960	
2	DSEC60-02AQ	839	121	100	96	20	0	1920	
3	DSEC60-03AR	1121	121	100	48	20	0	960	RoHS compliant
4	DSEC60-04A	889	121	100	48	20	0	960	
5	DSEP130-06A	616	121	100	96	20	0	1920	
6	DSEP130-06A	616	121	100	96	20	0	1920	
7	DSEP2x91-06A	787	121	100	48	20	0	960	
8	MEK350-02DA	793	85	85	168	10	0	1680	

TABLE 5F: Schottky Diode

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	DGS11-025C	807	121	100	96	20	0	1920	
2	DGSK24-025CS	763	121	100	96	20	0	1920	
3	DGSK24-025CS	763	121	100	96	20	0	1920	

TABLE 5G: Thyristor/Diode single device

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	CS45	687	121	100	96	20	0	1920	
2	CS45	687	121	100	96	20	1	1920	
3	CS45	687	121	100	96	20	0	1920	
4	CS45-16io1	890	121	100	48	20	0	960	
5	DSI45-16	764	121	100	48	10	0	480	
6	DSI45-16AR	823	121	100	48	20	0	960	
7	DSP8-08S	758	121	100	96	20	0	1920	
8	DSP8-08S	758	121	100	96	20	0	1920	

TABLE 5H: ISOPLUS

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	DSEC60-03AR	1121	121	100	48	20	0	960	RoHS compliant
2	DSI45-16AR	823	121	100	48	20	0	960	
3	FII30-06D	829	121	100	168	20	0	3360	
4	IXER35N120D1	909	121	100	48	20	0	960	
5	IXFC26N50Q	648	121	100	168	30	0	5040	
5	IXFF55N50	623	121	100	168	30	0	5040	

TABLE 5J: Breakover diode

#	Part Number	Date Code or Test #	Temp. [°C]	Rel. H. [%]	Time [hrs]	Sample Size	Failures	Device Hours [hrs]	Remark
1	IXBOD1-08	1085	121	100	48	20	0	960	RoHS compliant
2	IXBOD1-09	743	121	100	48	20	0	960	
3	IXBOD1-10	868	121	100	48	20	0	960	

MSLA classification standard Table: according to IEC 60749-20

#	Part Number	Date Code	Sample Size	Housing style	Passed 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	RoHS compliant
4	DSSK18-025	L405	20	TO-263	C	RoHS compliant

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