

Isolated DC to DC converter.**IXAN0050**

Described is an isolated 6Watt DC to DC converter optimized to provide low cost yet efficient isolated power across 2500VAC potential barrier. Built using readily available power components, this isolated DC to DC converter presented in Figure 1 is designed from the onset to incorporate low cost, readily available components. yet of costs less than \$3 in in volume production quantities. The DC to DC converter can either provide two isolated 3Watt outputs or as connected in Figure 2, a single isolated 6Watt output.

The CD4001, a CMOS quad NOR gate is configured as an RC relaxation oscillator. The frequency is set at approximately,

$$F_{osc} = 0.6 / (R2 * C1) = 0.6 / (10K * 220pF) = 273KHz.$$

Actual measurement of the circuit gave 250KHz. R3, whose value may vary and may need to be terminated to V_{DD} or ground, is inserted to adjust the oscillator trip point so that a 50% duty cycle waveform is available at the output of U1A and its complement available at U1B. This square wave and its complement are connected to INA and INB inputs of the IXDD404SI, a 4Amp dual gate driver. The outputs, OUTA and OUTB of U2 are then applied to the primary of T1, a VAC #T60403-F4025-X142 transformer which is has a single primary and a 2500VAC isolated dual secondary windings.

The DC to DC converter is designed to function over 13.5V to 25V V_{CC} power range. C6, a low voltage – low ESR & ESL multiple layer ceramic capacitor, serves to block DC from T1 primary while D1 and D2, DDS10-40BA 1 Amp Schottky diodes, half wave rectify the resulting square wave output from T1. D1 and D2 are connected in an anti-parallel configuration, minimizing T1 saturation at high currents. For a single isolated output, the DC to DC converter is modified as shown in Figure 2 where D1 and D2 form a push-pull output. Because of the wide V_{CC} supply voltage variation, Z1, a 15V zener diode, is used to limit the voltage output voltage for U1 to +15V or less.

The total manufacturing volume costs for the isolated DC to DC converters given in Figures 1 or 2 are less than \$3 or approximately \$0.50/Watt. The Total volume of the solution is ~ 0.25in³ total. The VAC #T60403-F4025-X142 transformer is available from VAC Magnetics Corp. and their telephone # is (270) 769 1333. The Schottky diode, DDS10-40BA and the IXDD404SI are available from IXYS Corp. (408) 982 0700.

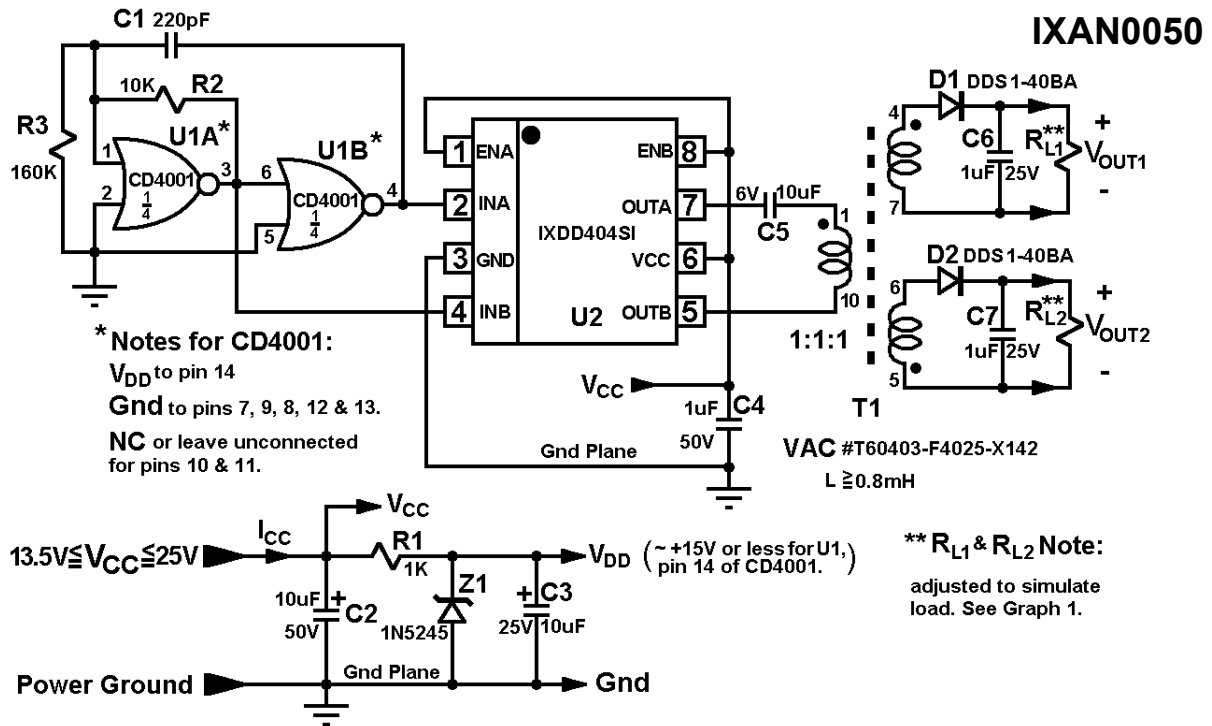


Figure 1. Dual Isolated DC to DC Converter

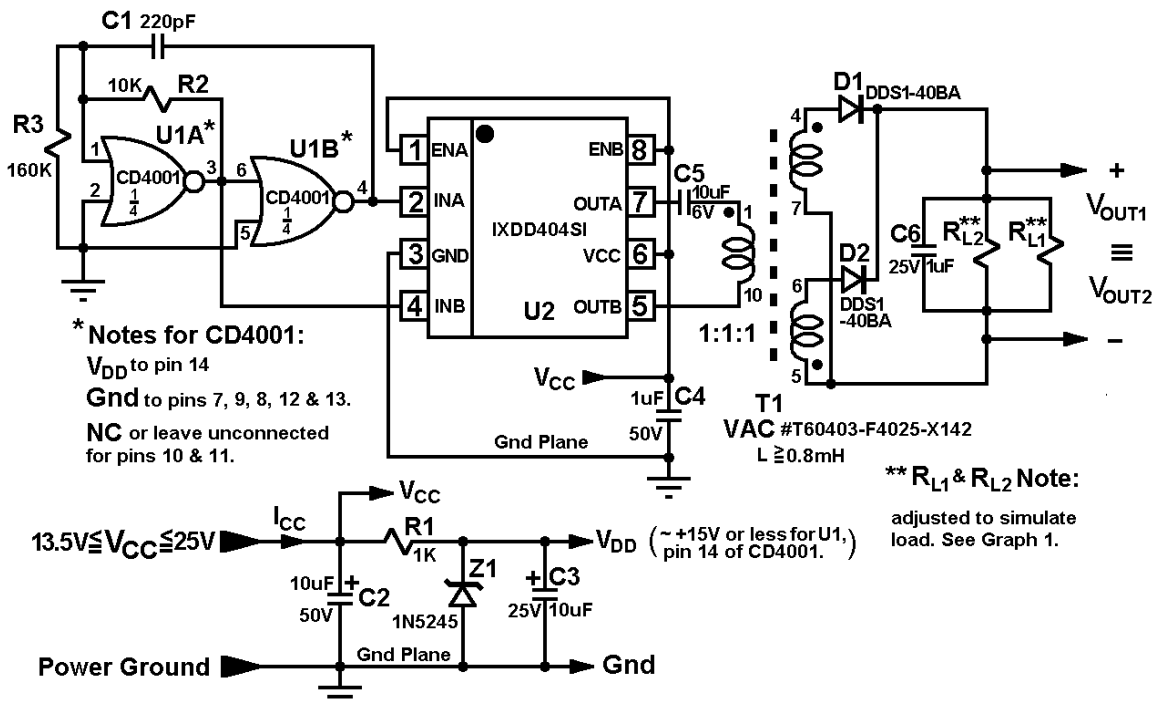
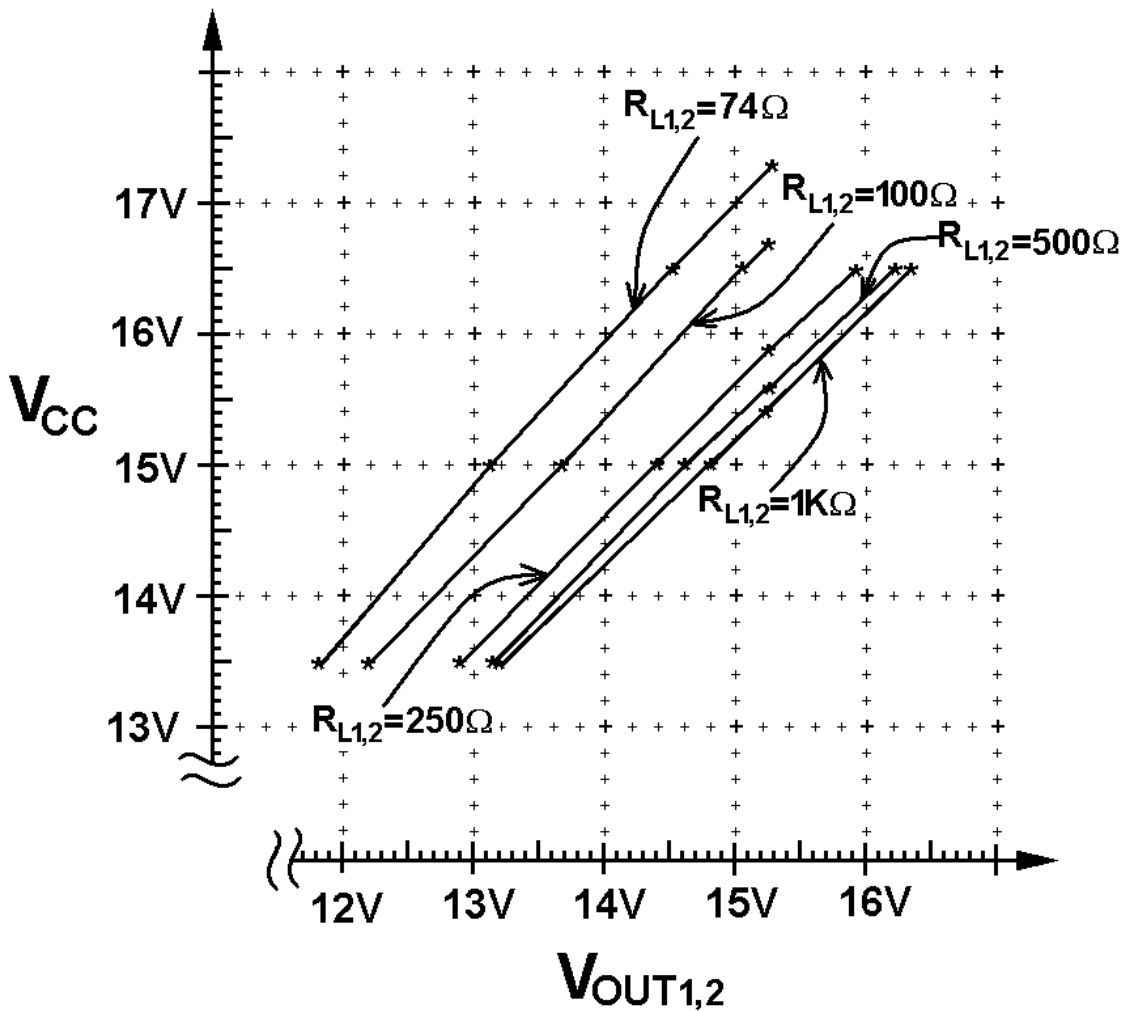


Figure 2. Single Isolated 6W DC to DC Converter

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Graph 1 shows V_{OUT1} and V_{OUT2} both loaded equally with $R_{L1}=R_{L2}$. Graph 2 plots DC to DC converter efficiency for various power outputs and V_{CC} voltages. Graph 2 shows over 80% efficiency for total V_{OUT1} and V_{OUT2} power levels at 6Watts or 200mA for V_{OUT1} and V_{OUT2} set at 15V.



Graph 1: $V_{OUT1,2}$ as a Function of V_{CC} and $R_{L1,2}$ Loading

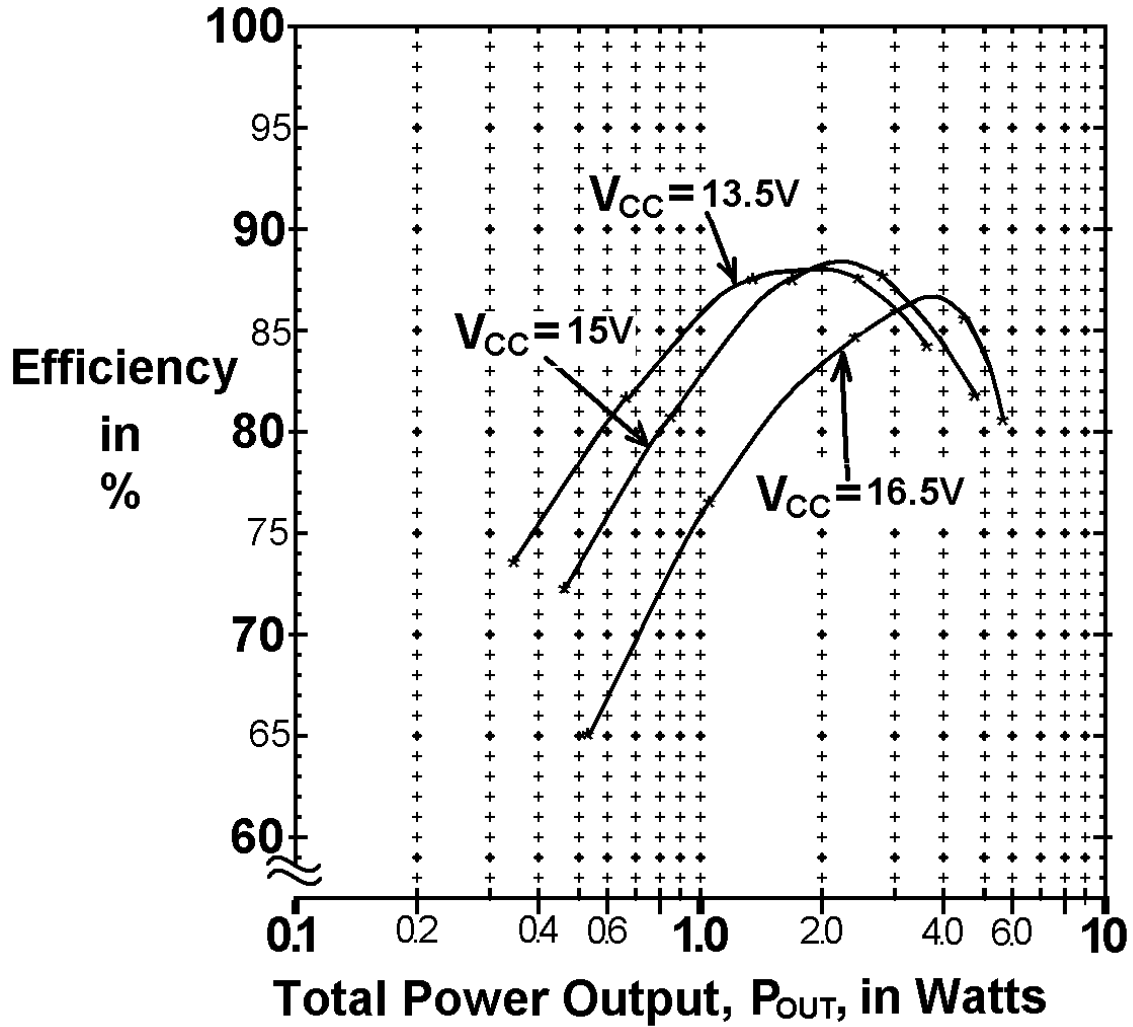
Graph2 shows the total power output efficiency, $(P_{OUT}/P_{IN}) * 100\%$ where:

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$$P_{OUT} = (V_{Float1})^2/R_{L1} + (V_{Float2})^2/R_{L2}, \text{ and } P_{IN} = V_{CC} * I_{CC}$$

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Graph 2: Total Power Output, P_{OUT}, in Watts as a Function of Equal Loads, R_{L1} & R_{L2} and V_{CC} supply