

High Efficiency DC-DC Isolated Converter

Systems peripheral functions often require separate 3.3V or 5V supplies. This function may require an isolated power supply, as the logic supply cannot sink or source enough current. Isolated DC-DC converters are readily available in the market place, however if there are some spare inverters available in the hardware design then a low cost solution can be configured.

The circuit in Figure 1 is a replacement for the MAX253 driver circuit. It uses the same transformer as recommended in the Maxim application circuit (part number 76253/55 for 5V-5V isolated conversion, and 76253/35 for 3.3V-5V isolated conversion).

The inverters produce an RC generated complimentary square wave output which in turn is used to drive Q1 & Q2 (FMMT617 SuperSOT transistors). These power the 'off the shelf' transformers specified above. The operation of the inverters and the transformer imitates the operation of the MAX253 IC and provides an oscillator frequency of 240KHz. The centre tap of the primary winding of the transformer is connected to the power supply (3.3 or 5V) and is de-coupled to ground via C4.

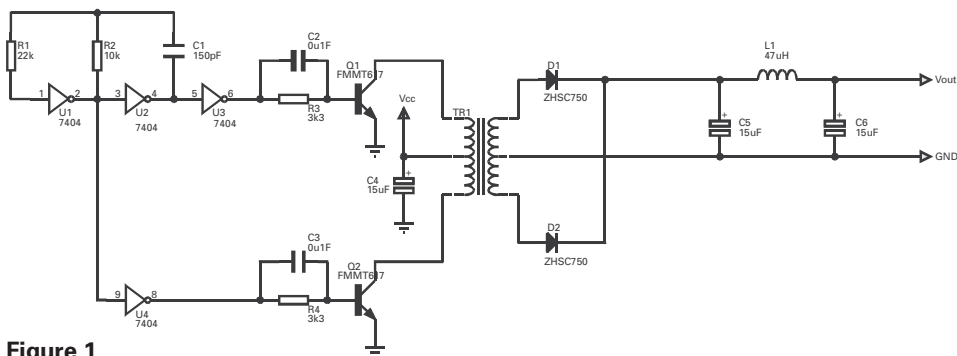


Figure 1

Two schottky rectifier diodes (Zetex ZHCS750) are then employed to reproduce the DC supply. The LC network acts as a filter to ensure a steady output signal.

Maximum efficiency of the transformer is approx. 85% so ideally the design needs to get as close to this as possible. This is achieved by careful selection of Q1, Q2, D1 and D2, and the driving frequency.

For Q1 & Q2 FMMT617 (surface mount) or ZTX618 (through hole) transistors have been chosen. These medium power devices require little base drive due to their high gain. Also they exhibit very low $V_{CE(sat)}$ characteristics making them ideal for this switching application.

For D1 & D2 ZHCS750 Schottky diodes have been selected. They have very low V_f (forward voltage drop) rating and fast switching speed. Consequently they consume very little power enhancing the overall efficiency of the circuit.

Setting R1 to 22K, R2 to 10K and C1 to 150pF the circuit will oscillate at 240KHz. This is the optimum frequency and gives the highest efficiency result.

Figure 2 shows the waveform as the transformer drives into D1(Trace 2), the upper waveform (Trace1) shows the output from the circuit driving into a 500mA load. As can be seen the frequency of operation is 240kHz, and the resultant output waveform is ripple free.

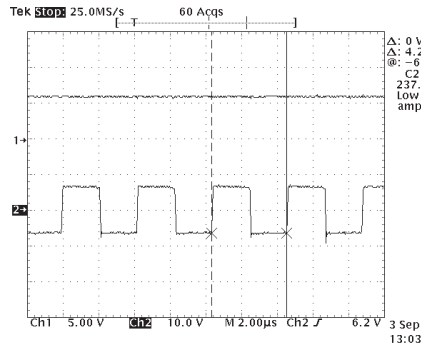


Figure 2

A circuit efficiency in excess of 80% was achieved. Also the circuit was able to drive a load at the maximum power rating of the transformer (1W for the /55, 500mA for the /35).

Typical applications include RS-485 and RS-232 data interface (transceiver) applications.

Both transformers are manufactured by Newport Components, Tel:+44(0)1908 615232.