

NAppkin Note: Ultralow Power Isolation Using ADuM1100

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iCoupler® digital isolators consume considerably less power than conventional optocouplers. Even so, there are ways to configure these digital isolators so that they consume only a few microamps.

The ADuM1100 circuit below can be used in applications requiring minimal power consumption with a low duty cycle and minimum pulse width of about 1 μ s. As shown in the circuit in Figure 1, V_{DD1} is treated as the input and is driven using a square wave of 3.3 V or 5 V peak amplitude. This results in an input supply current that is proportional to the duty cycle of the input square wave and provides a large savings in supply current for low duty cycle applications. If the user can reduce the duty cycle of their serial data, they will achieve a large savings in supply current and power consumption.

The ADuM1100 is an edge triggered digital isolator with a refresh feature that ensures DC correctness in the absence of input logic transitions. The ADuM1100 sends a refresh pulse every 1 μ s across the internal transformer to preserve the level of the input at the output. These pulses consume supply current, so reducing the duty cycle of the signal that drives the ADuM1100 will directly reduce power consumption.

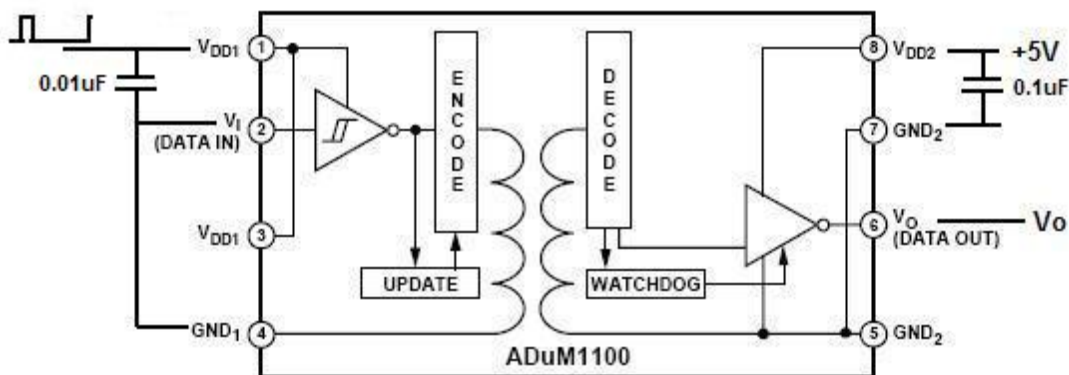


Figure 1 – ADuM1100 schematic for low power application

Figure 2 shows the data inversion and propagation delay associated with this circuit. Powering down the input side of the ADuM1100 will cause the refresh circuit on the input side to stop sending pulses to the output side. There is a watchdog circuit on the output side that will detect the absence of refresh pulses from the input and will set the output to a HIGH logic state after 3 μ s. These circuits create the 3 μ s inverted pulse width seen in Figure 2. The propagation delay, in this configuration, from input HIGH to output LOW is about 1 μ s. If the application can work with an inverted output, then this circuit alone will do. Otherwise, the user may need to add logic to invert the signal on the input or the output side.

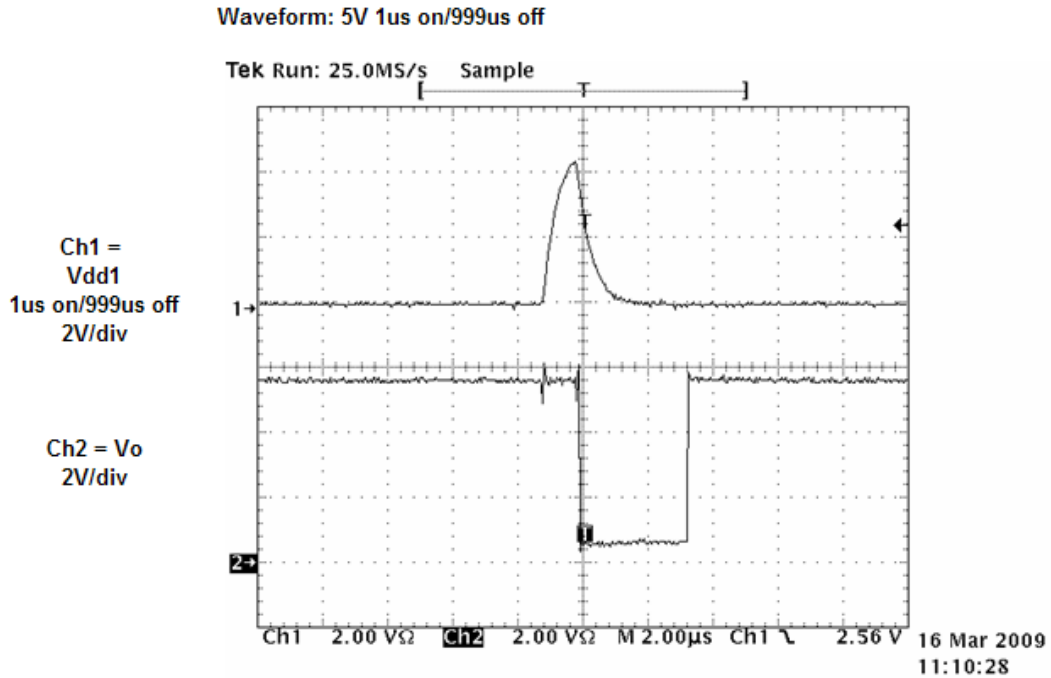


Figure 2 – ADuM1100 waveform

Table 1 shows average dc current data. On the input side, I_{DD1} varies with V_{DD1} conditions. For 3.3 V dc, I_{DD1} is 50% lower than the current at 5 V. Further reduction in I_{DD1} can be seen for reducing duty cycle from 50% to 0.1% which reduces supply current from 61 μ A to only 1 μ A. If the application allows for sending pulses with a low duty cycle, power consumption can be considerably reduced. On the output side, the current consumed by the ADuM1100 for I_{DD2} is already very low at less than 10 μ A for 5 V supply at V_{DD2} .

Table 1 – ADuM1100 Average DC Current Data

V_{DD1} Conditions	V_{DD2}	I_{DD1}	I_{DD2}
5 V _{DC}	5 V	244 μ A	9.9 μ A
3.3 V _{DC}	5 V	113 μ A	2.8 μ A
0 V _{DC}	5 V	0 μ A	5 μ A
0 – 5 V Sq Wave 1 kHz 50%	5 V	131 μ A	9.9 μ A
0 – 5 V Sq Wave 1 kHz 0.1% (1 μ s on, 999 μ s off)	5 V	2.4 μ A	9.9 μ A
0 – 3.3V Sq Wave 1kHz 50%	5 V	61 μ A	2.8 μ A
0 – 3.3V Sq Wave 1kHz 0.1% (1us on/999us off)	5 V	1.2 μ A	2.8 μ A

For more information on iCoupler products with please visit www.analog.com/icoupler or send an email to iCoupler_Isolation@analog.com.