

IRDC5001-LS370W Active ORing Demo Board Evaluation Procedure

Using IR5001S Active ORing IC and new 100V IRF6644 DirectFET MOSFET
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Overview

This document describes how to connect and evaluate the supplied IRDC5001-LS370W Active ORing demo board. The purpose of this circuit is to demonstrate the Active ORing function for carrier-class system boards (in which two negative 48V inputs (-36V to -75V range) are OR-ed to provide redundant board power), and to show how the IR5001S can be used to implement Reverse Polarity protection for -48V input DC-DC converters. The front side of the demo board is shown in Fig. 1.

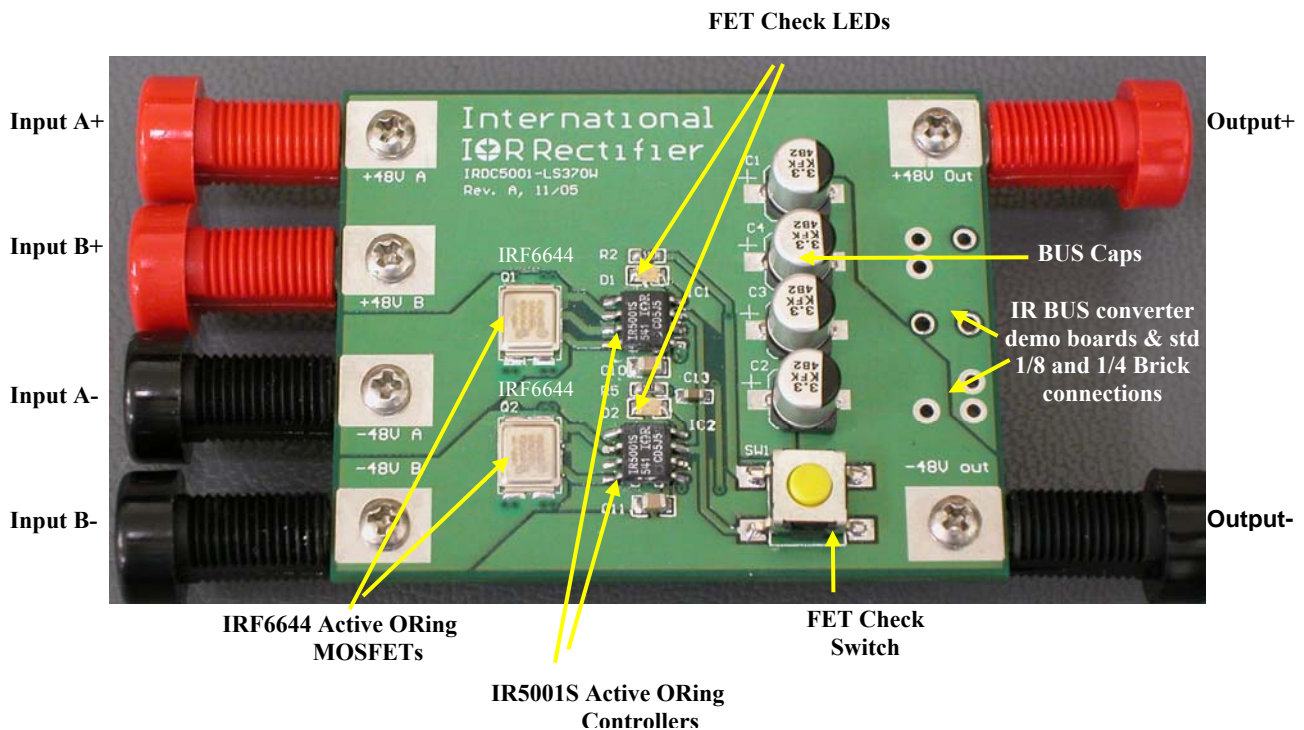


Figure 1. IRDC5001-LS370W Active ORing Demo Board

Active ORing Demo Board Quick Evaluation Procedure

The circuit schematic is shown in Fig. 2. The circuit incorporates two IR5001S Active ORing ICs (SO-8 package), and two IRF6644, 10.3mOhm typical $R_{ds(on)}$, 100V, N-Channel active ORing FETs, in the DirectFET MN package. The IRF644 power MOSFET's used in this circuit are capable of handling up to 370W of redundant power across a 36V to 75V range. The IRF6662, 17.5mOhm typical $R_{ds(on)}$, 100V, N-Channel active ORing FET is ideal for up to 200W applications, and this demo board can be

modified to test these devices also. For lower power applications, it is recommended to use slightly higher $R_{ds(on)}$ MOSFET's, to enable faster response time after a reverse current is detected. As a general design practice, the active ORing FET should be selected for a V_{sd} drop of greater than 50mV during conduction. Eight 3.3uF, 80V aluminum capacitors are connected on the redundant bus.

To evaluate the operation and performance of the active ORing demo board, connect two 48V power supplies to the input terminals (labeled Input A and Input B), and power load to output terminals.

Caution: One of the IR5001S functional tests is the response to a short circuit of one of the sources. Before doing this test, it is important that the current limit function of each power supply be checked first. A safe way to test the current limit function is to set the desired current limit, then apply a short with a very low output voltage first (<5V), then remove the short, increase voltage by another 5-10V, apply the short again, and proceed with these steps until the final test voltage is reached. Extra precautions should be taken for older and larger power supplies where the current limit may not be fast enough so that shorting of the outputs can pose safety risks.

To probe the circuit waveforms use an oscilloscope probe with minimal length for the ground pin and connect directly to the pins of the IC / MOSFET device. Any standard current probe & amplifier can be used to measure reverse current flow.

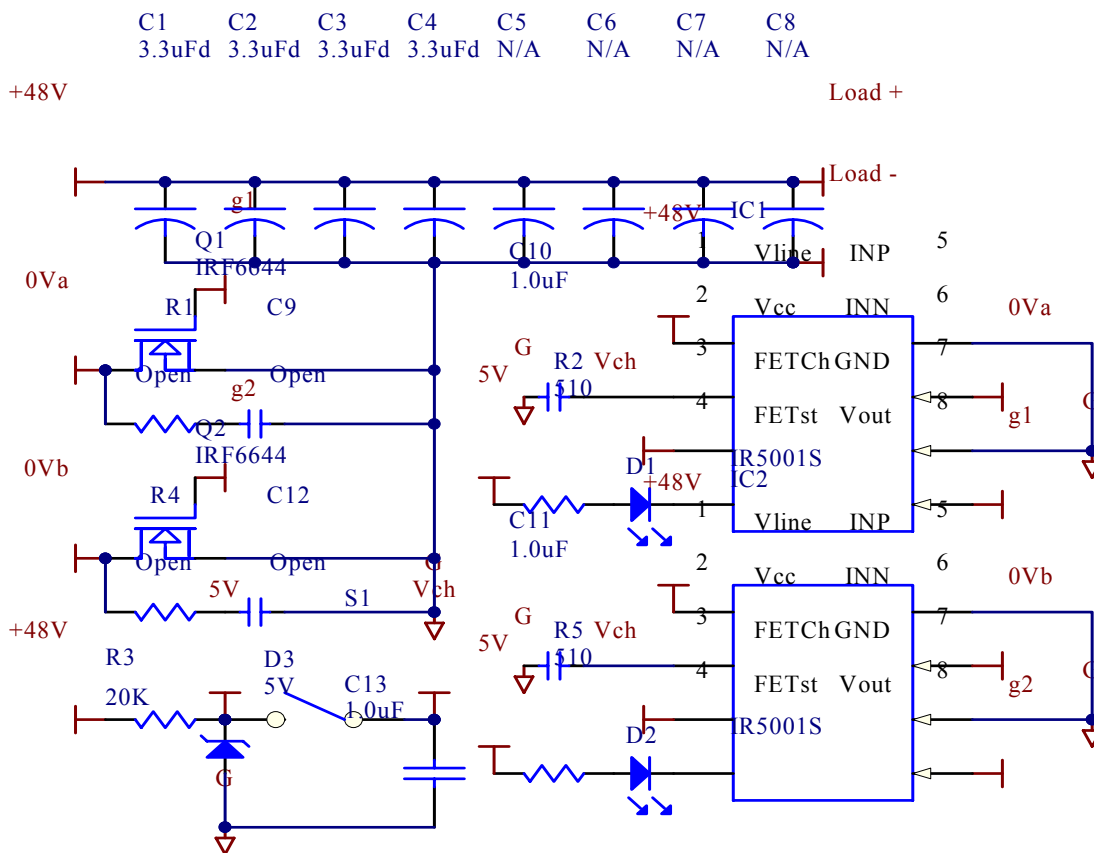


Figure 2. IRDC5001-LS370W Active ORing Demo Board Schematic

The procedure for checking the response time of the IR5001S to a simulated short circuit failure of one power source is shown in Fig. 3. The power supply B is set at about 1V higher output voltage than power Supply A. For example, $V_B = 49V$, and $V_A = 48V$. This guarantees that power supply B is delivering all the power to the load, while power supply A is on standby (has zero output current). A 150W IR2085S DC Bus Converter is used in this example on the output of the demo board.

To perform the test, apply a short circuit across the output terminals of power supply B. As the bus voltage drops below 48V (because both power supplies and the redundant bus caps are now shorted), a reverse current will start to flow through the active ORing MOSFET M2 (in line with source B). The IR5001S at source B will detect this reverse current flow and will turn M2 MOSFET off in about 120nS, while allowing only 4A of reverse current flow. This is shown in Fig. 4, which also shows Vds waveform for the MOSFET M2. When the MOSFET turns off, the energy stored in the stray leakage inductance is dissipated in the avalanche mode that last about 20nS. The calculated avalanche energy is about 5uJ, which is negligible compared to the 220mJ avalanche rating of IRF6644.

Another waveform shown in Fig. 4 is the redundant bus voltage (green trace). With 48V being delivered to a 150W bus converter load, with source B shorted, only 3V bus voltage disturbance is observed.

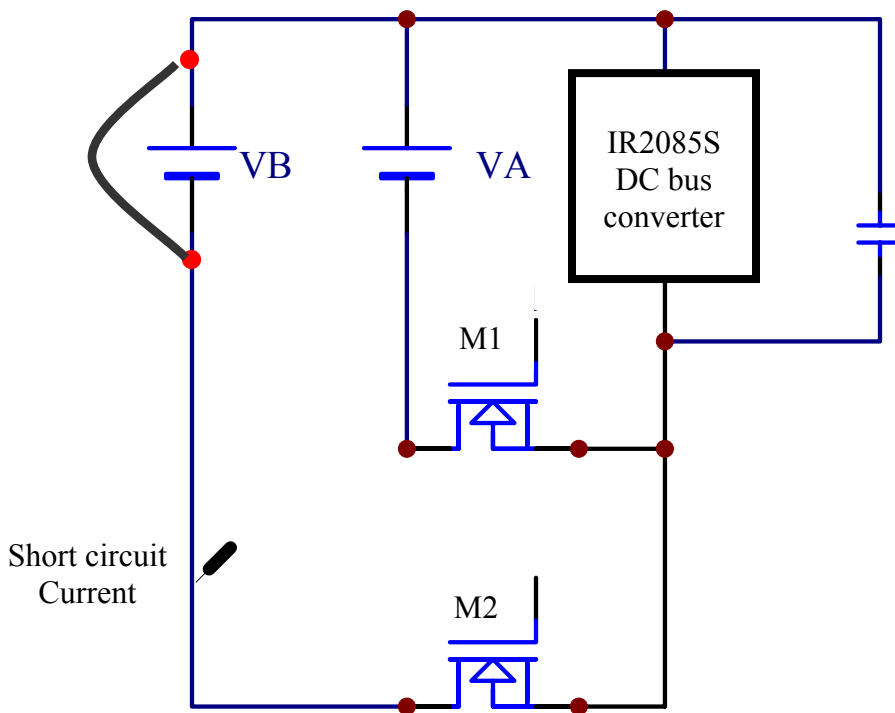


Figure 3. IR Active ORing functional tests

Table 1. Truth table for IR5001S “FET Check Feature”

Case	LED	Initial	During the check		Fet A	Fet B	Comments	
1	A	off	on	Vsd of fet A > 300mV Vsd of fet B < 300mV	good	N/A	VA>VB +0.4V	
	B	off	off					
2	A	off	on	Vsd of fet A > 300mV Vsd of fet B > 300mV	good	good	IVA-VBI < 0.4V	
	B	off	on					
3	A	off	off	Vsd of fet A < 300mV Vsd of fet B < 300mV	Short	N/A	VA>VB+0.3V	
					At least one is short		IVA-VBI < 0.3V	
	B	off	off		N/A	Short	VB>VA+0.3V	
4	A	on	on	Vsd of fet A > 300mV Vsd of fet B > 300mV	Open or diode	good	VA>VB+0.3V	
	B	off	on					
5	A	on	on	Vsd of fet A > 300mV Vsd of fet B < 300mV	Open	Short	VA>VB+0.3V	
	B	off	off		Diode	N/A	IVA-VBI < 0.4V	
6	A	on			Open or diode			
	B	on						