DVRFD615X2 Development Board

General Description

The DVRFD615X2 development board is a general-purpose circuit board designed to simplify the evaluation of the IXRFD615X2 gate driver and provide a building block for power circuit development. The IXRFD615X2 gate driver is factory installed on the evaluation board and is fully tested. The DVRFD615X2 150/275 configuration enables the user to drive DE150- or DE275-sized MOSFETs with their lower drive requirements. The board design allows both the driver and MOSFETs to be attached to a heat sink, and in doing so allows the board assembly to be used as a ground-referenced, low-side power switch.

Figure 1 shows the top of the DVRFD615X2 150/275 circuit board. The low-level input SMB connectors and their associated test points, as well as Vcc and ground test points, appear on the left. The Vcc test point provides power to the IXRFD615X2. The suggested value for Vcc is 12 V.

Figure 2 shows the bottom of the board. In the high-power configuration the exposed metallized bottom of the driver is shown. It can be placed in compression against a heat sink or cold plate facilitating the very high power dissipation capabilities of the package.

Mounting Orientation

As supplied from the factory, the IXRFD615X2 is mounted in the high-power configuration with the metallized substrate tab exposed (Figure 2). Mounting holes on either side of the driver and the MOSFETs allow the board to be screwed to a heat sink, clamping the devices to the heat sink and utilizing the high-power dissipation capabilities of the device package. A thin coating of thermal compound on the exposed substrate is recommended to provide a better thermal interface between the device and heat sink.

Figure 3 depicts the high-power configuration in a end view with the device sandwiched between the printed circuit board and heat sink. When using the circuit board to apply compressive force to the device, care must be taken not to overtighten any mounting screws that could cause the board to flex.

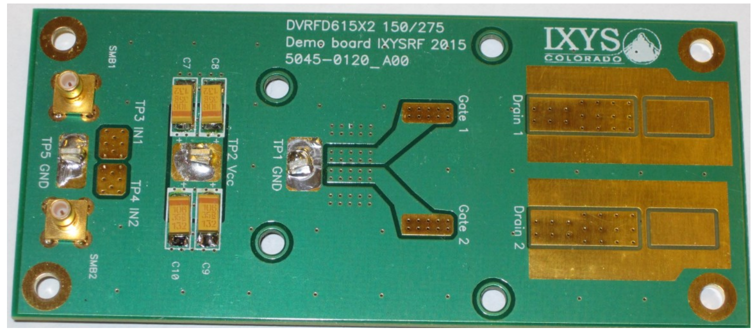


Figure 1– DVRFD615X2 150/275 Top Side

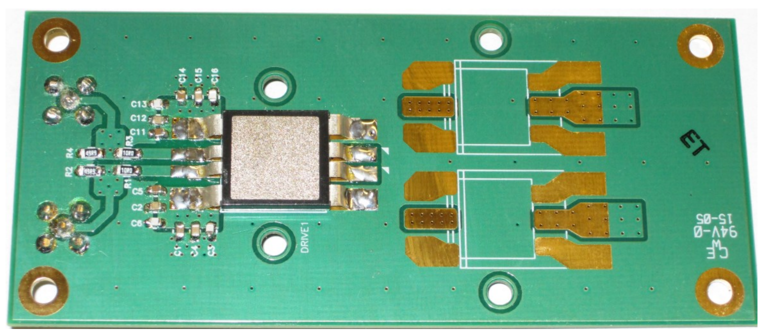


Figure 2– DVRFD615X2 150/275 Bottom Side

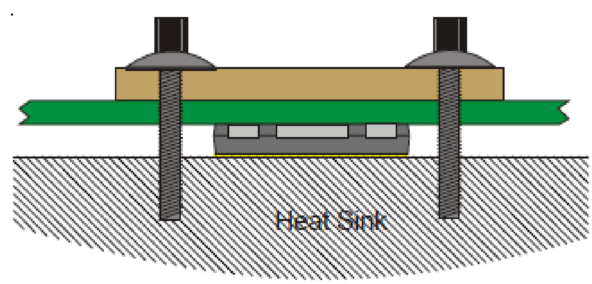


Figure 3– View of IXRFD615X2 mounted in a high-power configuration. For additional device installation instructions see technical note “*DE–Series MOSFET Mounting & Installation Instructions*” available on the IXYSRF website, www.ixyscolorado.com

Circuit Description

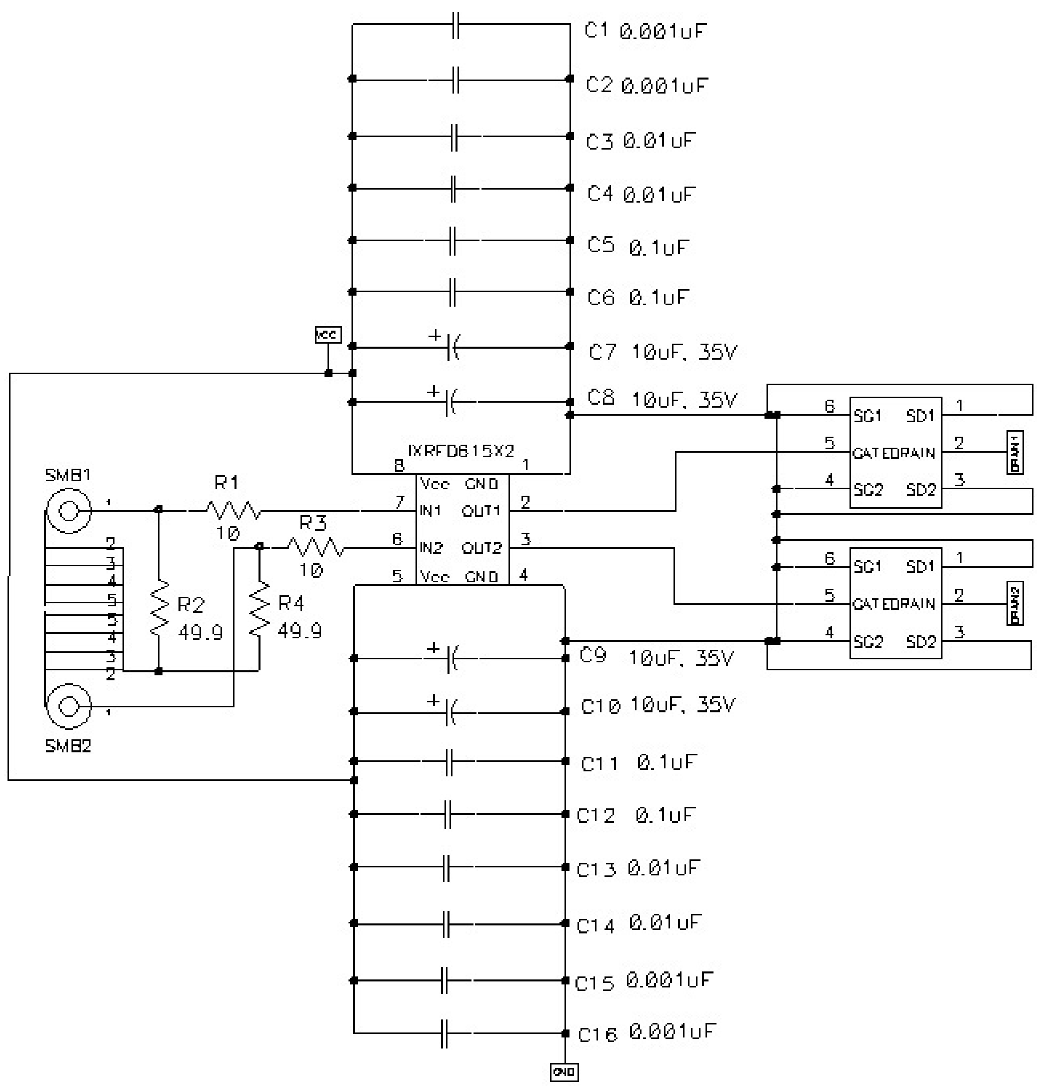
The schematic diagram for the evaluation board is shown in Figure 4 below. The circuit includes the IXRFD615X2 gate driver, input protection and impedance matching resistors, and bulk and bypass capacitance. While the MOSFETs are depicted in the schematic, they are not included with the board due to the variety of MOSFETs IXYSRF offers.

The test points and connectors to operate the board are described in Table 1.

Signal	Test Point	Function
GND	TP1	Circuit Ground
Vcc	TP2	Power Supply (8 V-15 V)
IN1	SMB1	Input Signal
IN2	SMB2	Input Signal
GND	TP3	Circuit Ground

Table 1– Test points and connector descriptions

Figure 4– Schematic diagram for DVRFD615X2, MOSFETs are not included.



The SMB connectors are used to supply input signals. Test points are straight forward, Vcc supply voltage, IN1 and IN2 input signals, GND ground for entire board. It is suggested to operate the board at 12 V for general testing.

R1, R3 limits input signal current but is not mandatory for all driver applications; it is more for general protection of the driver. R2, R4 termination resistors matches the typical 50 Ω output impedance of most bench top signal generators. The input of the gate driver can operate without R1, R3 and R2, R4, where R2 and R4 can be removed, if desired, in the case that the input signal generator can't support the loading. In most cases the output level of the signal generator will have to be increased in order to compensate for the input termination load.

Bulk storage capacitors C7, C8, C9, C10 provide energy storage local to the driver. During switching of the output stage of the driver, parasitic inductance of any wire and trace between the power supply and driver can inhibit fast delivery of energy to the driver. This will result in a voltage drop along the inductance and will cause the voltage at the Vcc pins to sag. To counter this, large valued bulk storage capacitors are placed as close to the Vcc pins of the driver to supply energy right at the driver pins. Tantalum capacitors are used and suggested for use as they can release their stored energy very quickly into the Vcc pins. Aluminum electrolytic capacitors are not used or recommended for bulk storage capacitors due to their high values of ESR, or Equivalent Series Resistance, that slows energy delivery.

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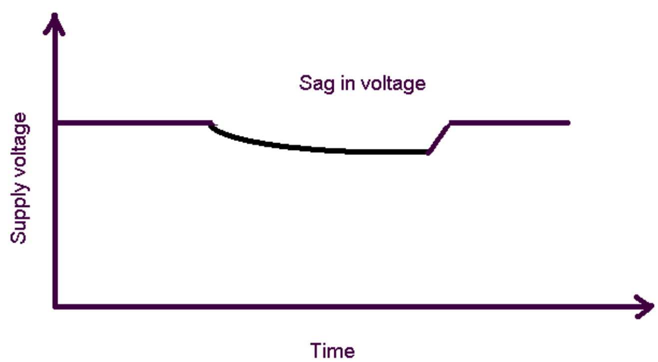

Figure 5– Sag in supply voltage at Vcc pins due to high series resistance from bulk storage capacitors

The network of bypass capacitors are made up of C1-C6, C11-C16 and includes a wide spread of values, 0.001 µF, 0.01 µF, and 0.1 µF. The purpose of the capacitance spread is to produce over-lapping response curves that lower the insertion impedance over a wider band. The bypass capacitors can be viewed as low pass filters, but the generally ignored series inductance causes a notch or V-shaped response in the impedance curve as frequency goes up. Figures 12-16 represent the progression of a single ideal capacitor response to the parallel combination of multiple capacitor networks.

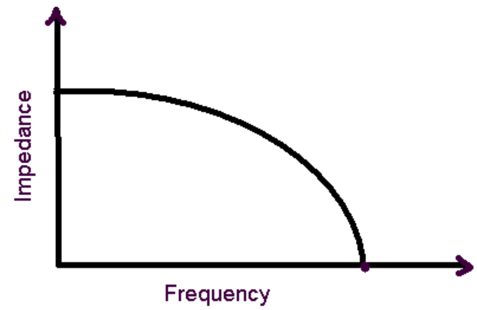

Figure 6– Ideal capacitor frequency response

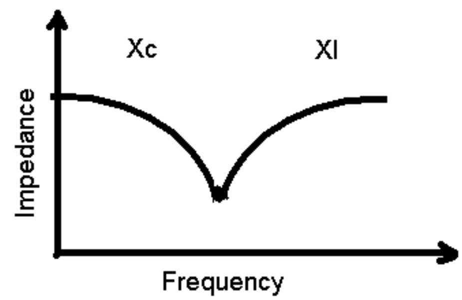

Figure 7– Capacitor frequency response due to self inductance

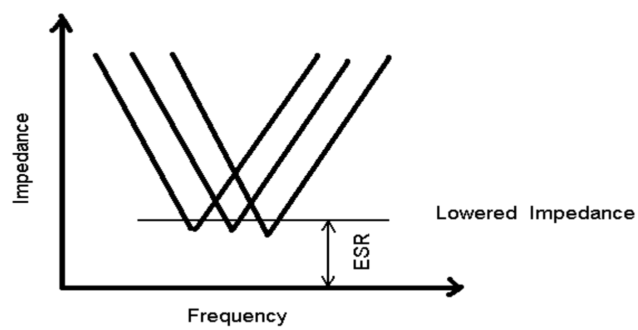

Figure 8– Over-lapping impedance curves

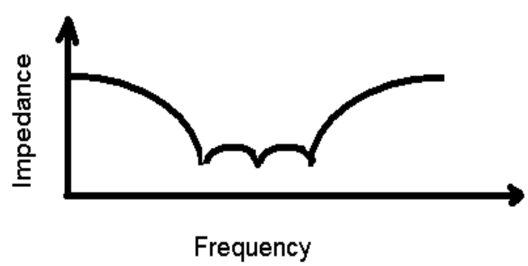

Figure 9– Broadband impedance lowered

The values of bypass capacitors are closely related to circuit performance and operation. Parasitic inductance is a characteristic of any circuit board and high drive currents cause high frequency ringing to occur at the corners of the rising or falling edge of the output signal as a result of this inductance. The value of this high frequency ringing is usually in the tens of megahertz and so the spread of capacitance values is in the tens of microfarads region. Each bypass capacitor is considered its own network with associated frequency response; replacing the individual capacitors with an equivalent capacitor of the total combined value does not have the same effect.

Circuit Operation

The inputs to the IXRFD615X2 have a positive going threshold of approximately 3.25 V with a hysterisis of 0.2 V. The typical input signal level range is 5 V up to Vcc.

Apply input signals to the SMB connectors with minimum suggested amplitude of 5 V. If a SMB type connector and cable are not available, it is possible to take a small coax, unwind the outer conductor braid, twist it together, and solder the center conductor to the input pin of the SMB connector and the braid to the ground pins.

Apply a supply voltage to the circuit, positive to the Vcc test point and ground to the GND test point. The suggested operating point is Vcc = 12 V.

Operation can now be observed by placing a scope probe on the output of the driver. Figures 10 through 12 show typical operation with no load attached to output of driver.

See the IXRFD615X2 datasheet for additional performance data at www.ixyscolorado.com

Ordering Information	
Part Number	**Device Layout**
DVRFD615X2 150/275	DE150 or DE275 series MOSFETs

Table 2– Ordering Information

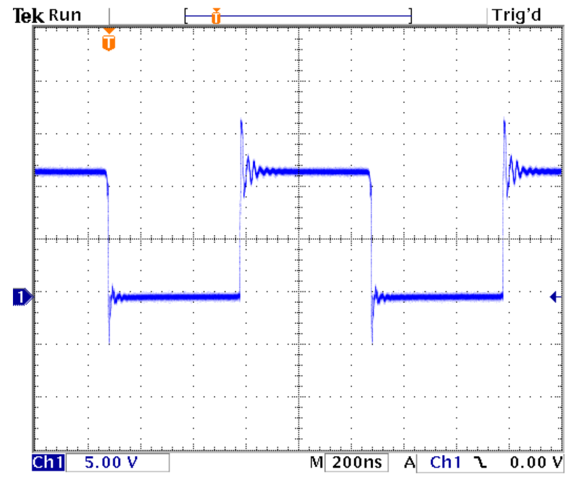

Figure 10– 1MHz output signal

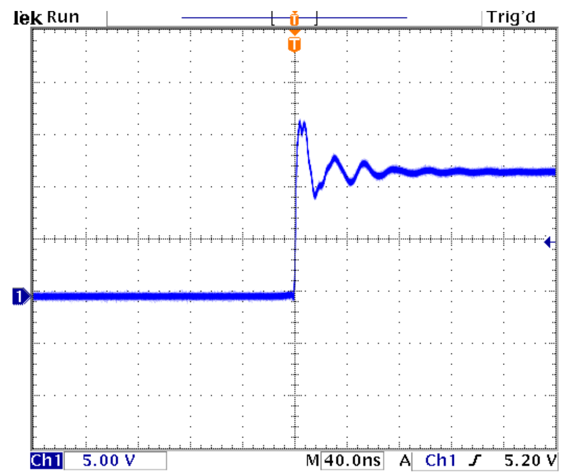

Figure 11– Rising edge of output signal

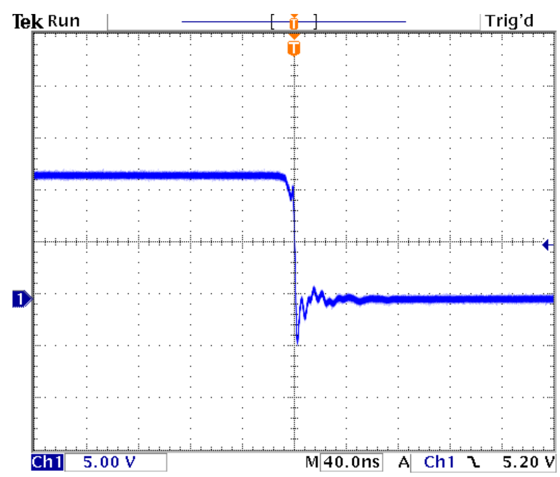

Figure 12– Falling edge of output signal

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