

### Features

- High Peak Output Current
- Low Output Impedance
- Low Quiescent Supply Current
- Low Propagation Delay
- High Capacitive Load Drive Capability
- Wide Operating Voltage Range

### Applications

- RF MOSFET Driver
- Class D and E RF Generators
- Multi-MHz Switch Mode Supplies
- Pulse Transformer Driver
- Pulse Laser Diode Driver
- Pulse Generator

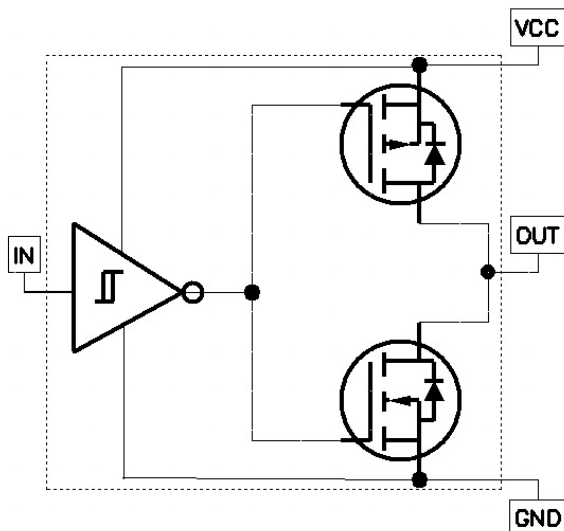
### Description

The IXRFD630 is a CMOS high-speed, high-current gate driver specifically designed to drive MOSFETs in Class D and E HF RF applications as well as other applications requiring ultrafast rise and fall times or short minimum pulse widths. The IXRFD630 can source and sink 30 A of peak current while producing voltage rise and fall times of less than 4 ns and minimum pulse widths of 8 ns. The input of the driver is compatible with TTL or CMOS and is fully immune to latch up over the entire operating range. Designed with small internal delays, cross conduction or current shoot-through is virtually eliminated. The features and wide safety margin in operating voltage and power make the IXRFD630 unmatched in performance and value.

The surface mount IXRFD630 is packaged in a low-inductance RF package incorporating advanced layout techniques to minimize stray lead inductances for optimum switching performance.



Fig. 1- Block Diagram and Truth Table



| IN | OUT |
|----|-----|
| 0  | 0   |
| 1  | 1   |

## Absolute Maximum Ratings

| Parameter  | Value                    |
|--|--------------------------|
| Supply Voltage $V_{CC}$                            | 30V                      |
| Input Voltage Level $V_{IN}$                       | -5V to $V_{CC} + 0.3V$   |
| All Other Pins                                     | -0.3V to $V_{CC} + 0.3V$ |
| Power Dissipation                                  |                          |
| $T_A$ (AMBIENT) $\leq 25^\circ C$                  | 2W                       |
| $T_C$ (CASE) $\leq 25^\circ C$                     | 100W                     |
| Storage Temperature                                | -40°C to 150°C           |
| Soldering Lead Temperature<br>(10 seconds maximum) | 300°C                    |

| Parameter  | Value           |
|--|-----------------|
| Maximum Junction Temperature                         | 150° C          |
| Operating Temperature Range                          | -40° C to 85° C |
| Thermal Impedance (Junction to Case) $R_{\theta JC}$ | 0.25° C/W       |

**Note:** Operating the device outside of the “Absolute Maximum Ratings” may cause permanent damage. Typical values indicate conditions for which the device is intended to be functional but do not guarantee specific performance limits. The guaranteed specifications apply only for the test conditions listed. Exposure to absolute maximum conditions for extended periods may impact device reliability.

## Electrical Characteristics

Unless otherwise noted,  $T_A = 25^\circ C$ ,  $8V < V_{CC} < 30V$ .

All voltage measurements with respect to GND. IXRFD630 configured as described in *Test Conditions*.

| Symbol       | Parameter                 | Test Conditions  | Min              | Typ         | Max            | Units          |
|--------------|---------------------------|--|------------------|-------------|----------------|----------------|
| $V_{IH}$     | High input voltage        | $V_{CC} = 15V$ for typical value   | 3.5              | 3           |                | V              |
| $V_{IL}$     | Low input voltage         | $V_{CC} = 15V$ for typical value   |                  | 2.8         | 0.8            | V              |
| $V_{HYS}$    | Input hysteresis          |  |                  | 0.23        |                | V              |
| $V_{IN}$     | Input voltage range       |  | -5               |             | $V_{CC} + 0.3$ | V              |
| $I_{IN}$     | Input current             | $0V \leq V_{IN} \leq V_{CC}$   | -10              |             | 10             | $\mu A$        |
| $V_{OH}$     | High output voltage       |  | $V_{CC} - 0.025$ |             |                | V              |
| $V_{OL}$     | Low output voltage        |  |                  |             | 0.025          | V              |
| $R_{OH}$     | High output resistance    | $V_{CC} = 15V$ $I_{OUT} = 100mA$   |                  | 0.25        |                | $\Omega$       |
| $R_{OL}$     | Low output resistance     | $V_{CC} = 15V$ $I_{OUT} = 100mA$   |                  | 0.17        |                | $\Omega$       |
| $I_{PEAK}$   | Peak output current       | $V_{CC} = 15V$   |                  | 28          |                | A              |
| $I_{DC}$     | Continuous output current |  |                  | 2.5         |                | A              |
| $t_R$        | Rise time                 | $V_{CC}=15V$ $C_L=1nF$<br>$C_L=2nF$  |                  | 4<br>5      |                | ns<br>ns       |
| $t_F$        | Fall time                 | $V_{CC}=15V$ $C_L=1nF$<br>$C_L=2nF$  |                  | 4<br>5.5    |                | ns<br>ns       |
| $t_{ONDLy}$  | ON propagation delay      | $V_{CC} = 15V$ $C_L=2nF$   |                  | 24          |                | ns             |
| $t_{OFFDLy}$ | OFF propagation delay     | $V_{CC} = 15V$ $C_L=2nF$   |                  | 22          |                | ns             |
| $PW_{min}$   | Minimum pulse width       | FWHM $V_{CC}=15V$ $C_L=1nF$  |                  | 8           |                | ns             |
| $V_{CC}$     | Power supply voltage      | Recommended  | 8                | 15          | 18             | V              |
| $I_{CC}$     | Power supply current      | $V_{CC} = 15V$ , $V_{IN} = 0V$<br>$V_{CC} = 15V$ , $V_{IN} = 3.5V$<br>$V_{CC} = 15V$ , $V_{IN} = V_{CC}$ |                  | 0<br>1<br>0 | 1<br>3<br>5    | mA<br>mA<br>mA |

**CAUTION:** These devices are sensitive to electrostatic discharge; follow proper ESD procedures when handling and assembling.

Fig. 2 Output Resistance vs. Supply Voltage

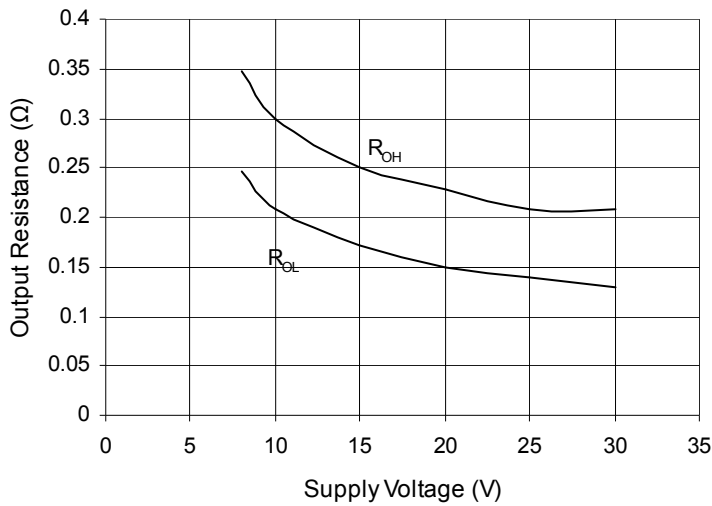


Fig. 3 Input Threshold vs. Supply Voltage

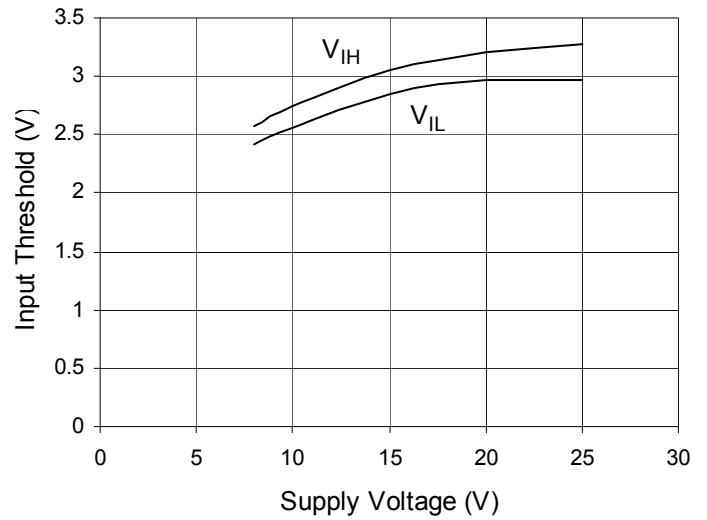


Fig. 4 Fall Time vs. Supply Voltage

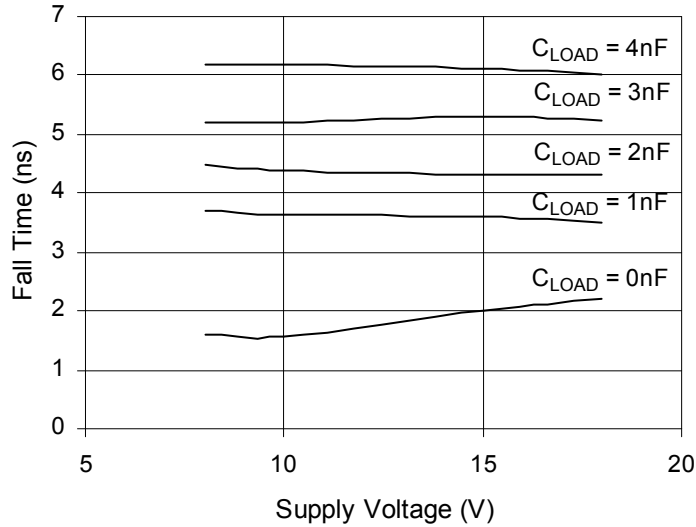


Fig. 5 Rise Time vs. Supply Voltage

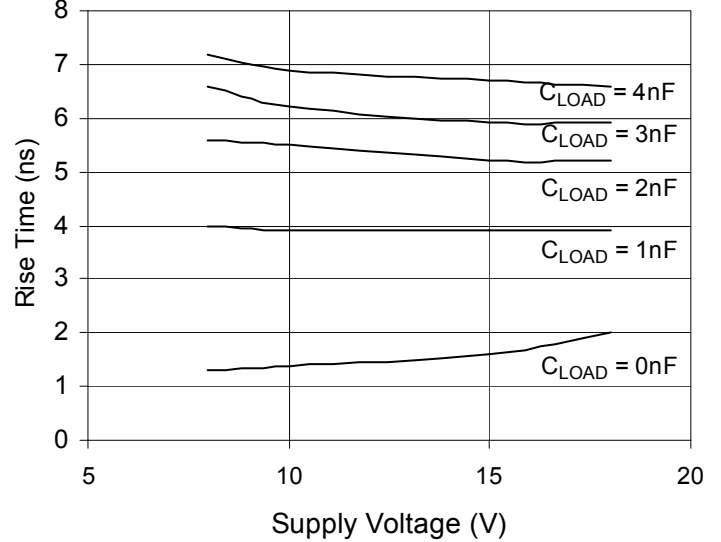


Fig. 6 Propagation Delay vs. Supply Voltage

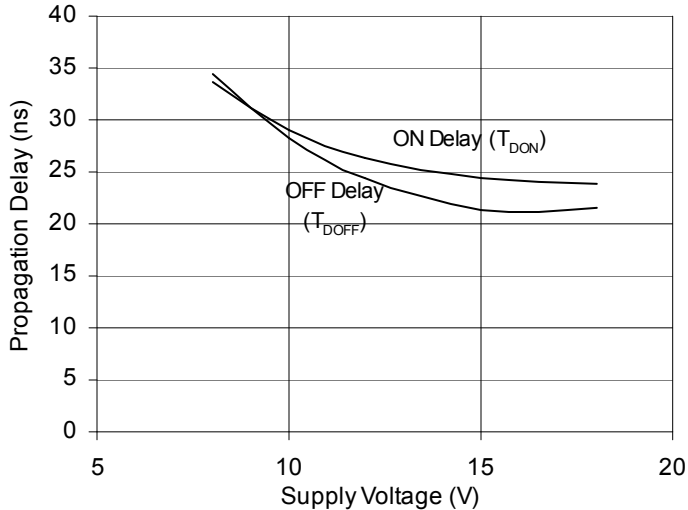


Fig. 7 Quiescent Current vs. Supply Voltage

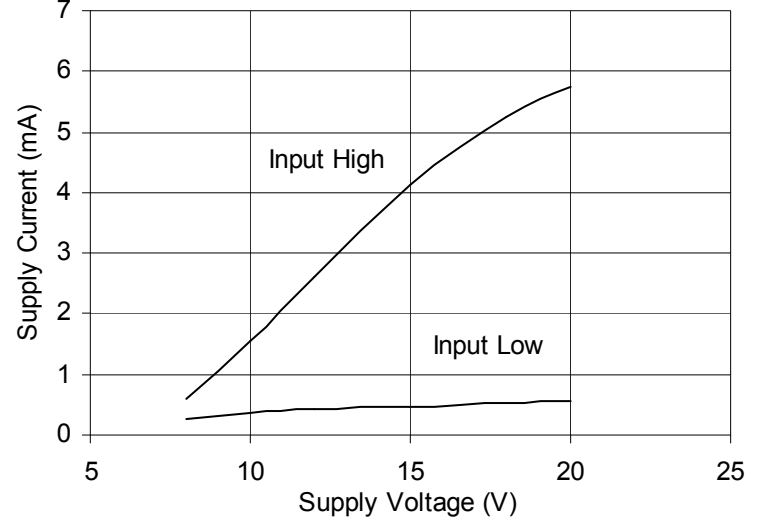


Fig. 8 Supply Current vs. Frequency  
 $V_{CC} = 8V$

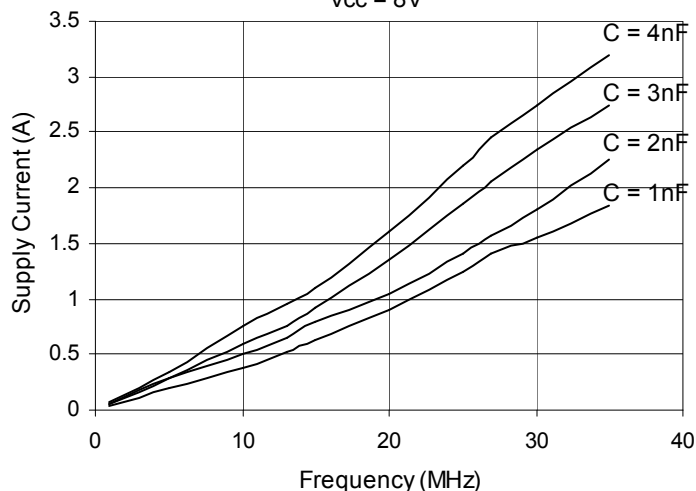


Fig. 9 Supply Current vs. Frequency  
 $V_{CC} = 12V$

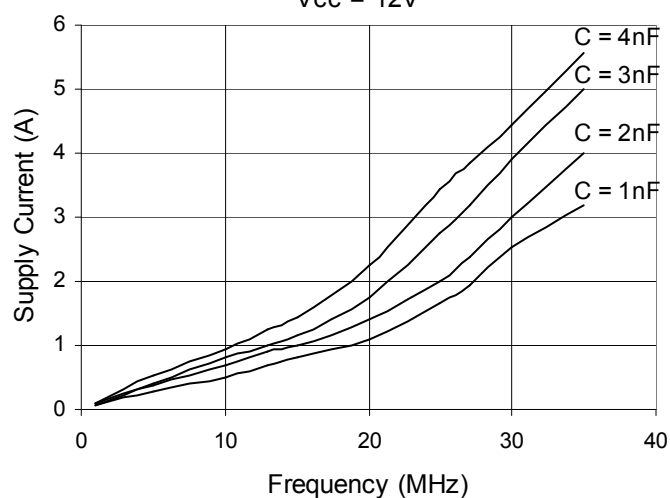


Fig. 10 Supply Current vs. Frequency  
 $V_{CC} = 15V$

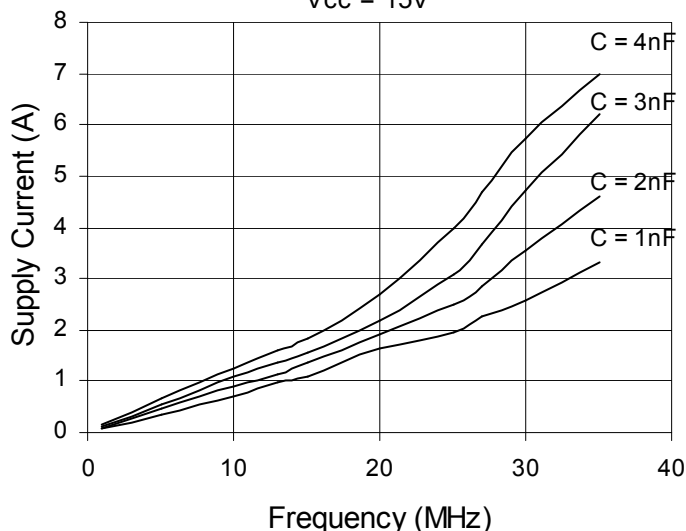


Fig. 11 Supply Current vs. Load Capacitance  
 $V_{CC} = 8V$

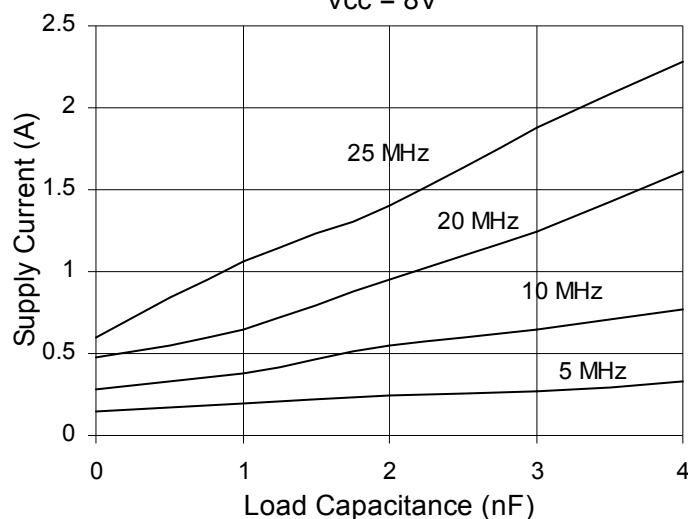


Fig. 12 Supply Current vs. Load Capacitance  
 $V_{CC} = 12V$

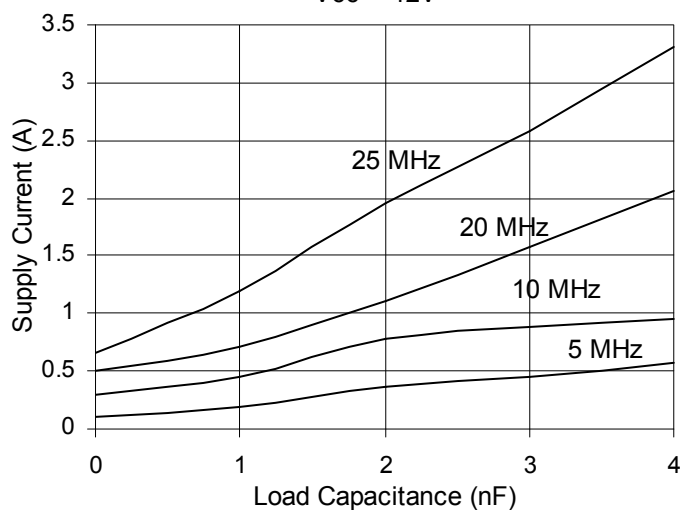


Fig. 13 Supply Current vs. Load Capacitance  
 $V_{CC} = 15V$

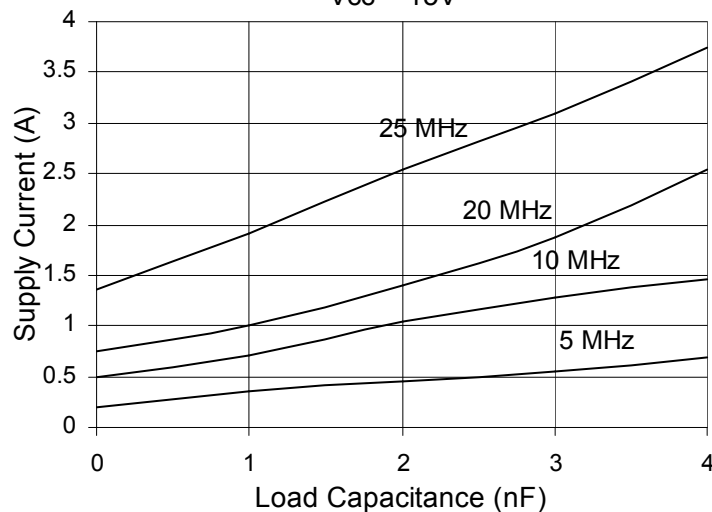


Fig. 14 Peak Sink Current vs. Supply Voltage

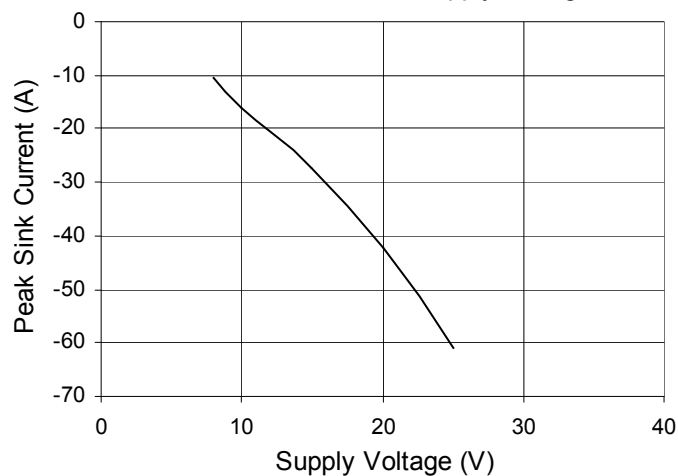


Fig. 15 Peak Source Current vs. Supply Voltage

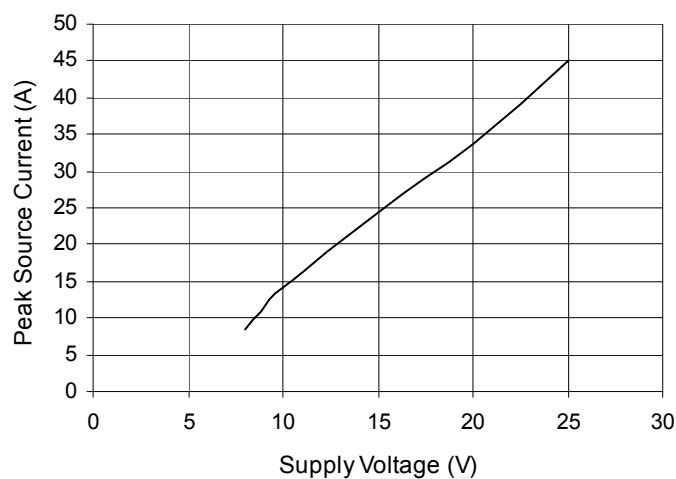


Fig. 16 Peak Source Current vs. Temperature  
V<sub>cc</sub> = 15V

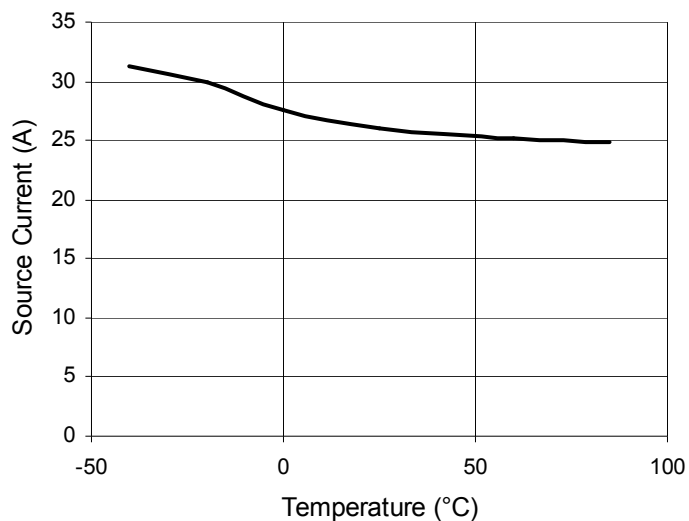


Fig. 17 Peak Sink Current vs. Temperature  
V<sub>cc</sub> = 15V

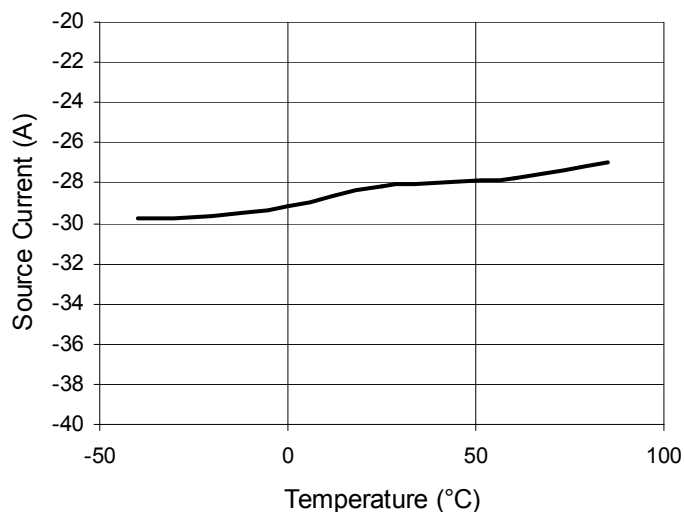


Fig. 18 Rise Time Normalized vs. Temperature  
V<sub>cc</sub> = 15V

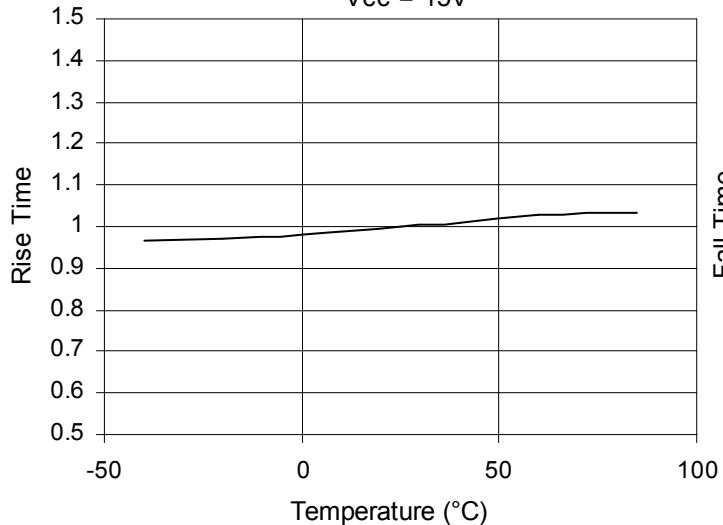


Fig. 19 Fall Time Normalized vs. Temperature  
V<sub>cc</sub> = 15V

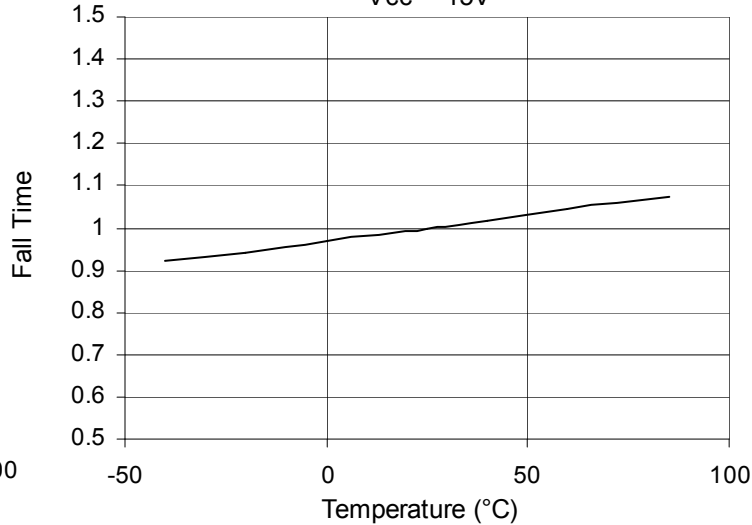


Fig. 20 Pin Description

| Symbol          | Function       | Description  |
|-----------------|----------------|--|
| V <sub>CC</sub> | Supply Voltage | Positive power supply voltage input. These leads provide power to the entire device.   |
| IN              | Input          | Input signal-TTL or CMOS compatible.   |
| OUT             | Output         | Device Output. For application purposes, this lead is connected directly to the Gate of a MOSFET   |
| GND             | Power Ground   | System ground leads. Internally connected to all circuitry, these leads provide ground reference for the entire device and should be connected to a low noise analog ground plane for optimum performance. |

Fig. 21 Test Circuit Diagram

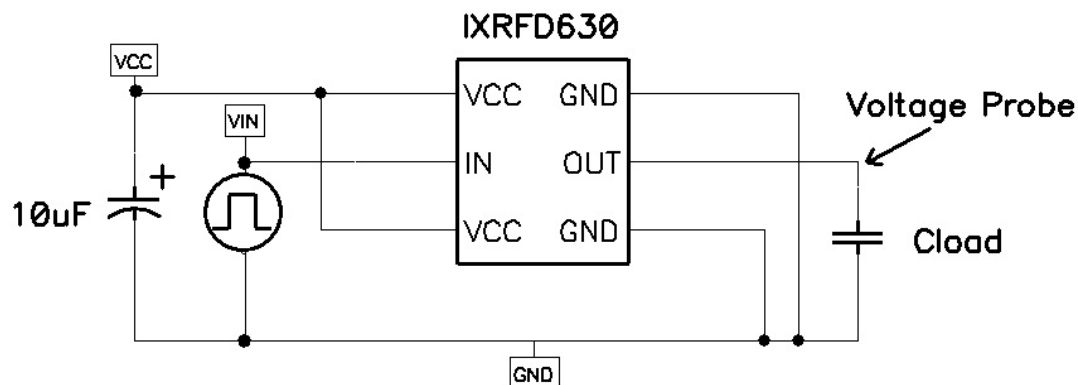
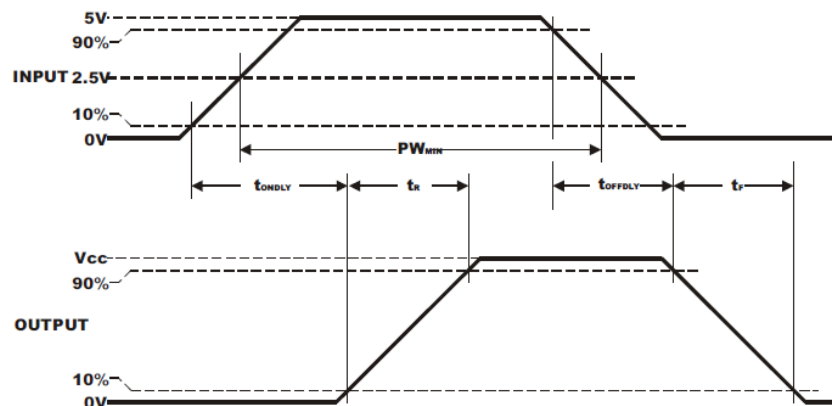


Fig. 22 Timing Diagram



**Package Diagram**

**Top View**

Dimensions (inches [mm]):

- Pin 1 (Vcc) to Pin 2 (IN): 0.130 [3.30]
- Pin 2 (IN) to Pin 3 (Vcc): 0.070 [1.78]
- Pin 3 (Vcc) to Pin 4 (GND): 0.180 [4.57]
- Pin 4 (GND) to Pin 5 (OUT): 0.050 [1.27]
- Pin 5 (OUT) to Pin 6 (GND): 0.220 [5.59]
- Pin 6 (GND) to Pin 7 (GND): 0.580 [14.73]
- Pin 7 (GND) to Pin 8 (GND): 0.050 [1.27]
- Pin 8 (GND) to Pin 9 (GND): 0.220 [5.59]
- Pin 9 (GND) to Pin 10 (GND): 0.580 [14.73]
- Pin 10 (GND) to Pin 11 (GND): 0.050 [1.27]
- Pin 11 (GND) to Pin 12 (GND): 0.220 [5.59]
- Pin 12 (GND) to Pin 13 (GND): 0.580 [14.73]
- Pin 13 (GND) to Pin 14 (GND): 0.050 [1.27]
- Pin 14 (GND) to Pin 15 (GND): 0.220 [5.59]
- Pin 15 (GND) to Pin 16 (GND): 0.580 [14.73]
- Pin 16 (GND) to Pin 17 (GND): 0.050 [1.27]
- Pin 17 (GND) to Pin 18 (GND): 0.220 [5.59]
- Pin 18 (GND) to Pin 19 (GND): 0.580 [14.73]
- Pin 19 (GND) to Pin 20 (GND): 0.050 [1.27]
- Pin 20 (GND) to Pin 21 (GND): 0.220 [5.59]
- Pin 21 (GND) to Pin 22 (GND): 0.580 [14.73]
- Pin 22 (GND) to Pin 23 (GND): 0.050 [1.27]
- Pin 23 (GND) to Pin 24 (GND): 0.220 [5.59]
- Pin 24 (GND) to Pin 25 (GND): 0.580 [14.73]
- Pin 25 (GND) to Pin 26 (GND): 0.050 [1.27]
- Pin 26 (GND) to Pin 27 (GND): 0.220 [5.59]
- Pin 27 (GND) to Pin 28 (GND): 0.580 [14.73]
- Pin 28 (GND) to Pin 29 (GND): 0.050 [1.27]
- Pin 29 (GND) to Pin 30 (GND): 0.220 [5.59]
- Pin 30 (GND) to Pin 31 (GND): 0.580 [14.73]
- Pin 31 (GND) to Pin 32 (GND): 0.050 [1.27]
- Pin 32 (GND) to Pin 33 (GND): 0.220 [5.59]
- Pin 33 (GND) to Pin 34 (GND): 0.580 [14.73]
- Pin 34 (GND) to Pin 35 (GND): 0.050 [1.27]
- Pin 35 (GND) to Pin 36 (GND): 0.220 [5.59]
- Pin 36 (GND) to Pin 37 (GND): 0.580 [14.73]
- Pin 37 (GND) to Pin 38 (GND): 0.050 [1.27]
- Pin 38 (GND) to Pin 39 (GND): 0.220 [5.59]
- Pin 39 (GND) to Pin 40 (GND): 0.580 [14.73]
- Pin 40 (GND) to Pin 41 (GND): 0.050 [1.27]
- Pin 41 (GND) to Pin 42 (GND): 0.220 [5.59]
- Pin 42 (GND) to Pin 43 (GND): 0.580 [14.73]
- Pin 43 (GND) to Pin 44 (GND): 0.050 [1.27]
- Pin 44 (GND) to Pin 45 (GND): 0.220 [5.59]
- Pin 45 (GND) to Pin 46 (GND): 0.580 [14.73]
- Pin 46 (GND) to Pin 47 (GND): 0.050 [1.27]
- Pin 47 (GND) to Pin 48 (GND): 0.220 [5.59]
- Pin 48 (GND) to Pin 49 (GND): 0.580 [14.73]
- Pin 49 (GND) to Pin 50 (GND): 0.050 [1.27]
- Pin 50 (GND) to Pin 51 (GND): 0.220 [5.59]
- Pin 51 (GND) to Pin 52 (GND): 0.580 [14.73]
- Pin 52 (GND) to Pin 53 (GND): 0.050 [1.27]
- Pin 53 (GND) to Pin 54 (GND): 0.220 [5.59]
- Pin 54 (GND) to Pin 55 (GND): 0.580 [14.73]
- Pin 55 (GND) to Pin 56 (GND): 0.050 [1.27]
- Pin 56 (GND) to Pin 57 (GND): 0.220 [5.59]
- Pin 57 (GND) to Pin 58 (GND): 0.580 [14.73]
- Pin 58 (GND) to Pin 59 (GND): 0.050 [1.27]
- Pin 59 (GND) to Pin 60 (GND): 0.220 [5.59]
- Pin 60 (GND) to Pin 61 (GND): 0.580 [14.73]
- Pin 61 (GND) to Pin 62 (GND): 0.050 [1.27]
- Pin 62 (GND) to Pin 63 (GND): 0.220 [5.59]
- Pin 63 (GND) to Pin 64 (GND): 0.580 [14.73]
- Pin 64 (GND) to Pin 65 (GND): 0.050 [1.27]
- Pin 65 (GND) to Pin 66 (GND): 0.220 [5.59]
- Pin 66 (GND) to Pin 67 (GND): 0.580 [14.73]
- Pin 67 (GND) to Pin 68 (GND): 0.050 [1.27]
- Pin 68 (GND) to Pin 69 (GND): 0.220 [5.59]
- Pin 69 (GND) to Pin 70 (GND): 0.580 [14.73]
- Pin 70 (GND) to Pin 71 (GND): 0.050 [1.27]
- Pin 71 (GND) to Pin 72 (GND): 0.220 [5.59]
- Pin 72 (GND) to Pin 73 (GND): 0.580 [14.73]
- Pin 73 (GND) to Pin 74 (GND): 0.050 [1.27]
- Pin 74 (GND) to Pin 75 (GND): 0.220 [5.59]
- Pin 75 (GND) to Pin 76 (GND): 0.580 [14.73]
- Pin 76 (GND) to Pin 77 (GND): 0.050 [1.27]
- Pin 77 (GND) to Pin 78 (GND): 0.220 [5.59]
- Pin 78 (GND) to Pin 79 (GND): 0.580 [14.73]
- Pin 79 (GND) to Pin 80 (GND): 0.050 [1.27]
- Pin 80 (GND) to Pin 81 (GND): 0.220 [5.59]
- Pin 81 (GND) to Pin 82 (GND): 0.580 [14.73]
- Pin 82 (GND) to Pin 83 (GND): 0.050 [1.27]
- Pin 83 (GND) to Pin 84 (GND): 0.220 [5.59]
- Pin 84 (GND) to Pin 85 (GND): 0.580 [14.73]
- Pin 85 (GND) to Pin 86 (GND): 0.050 [1.27]
- Pin 86 (GND) to Pin 87 (GND): 0.220 [5.59]
- Pin 87 (GND) to Pin 88 (GND): 0.580 [14.73]
- Pin 88 (GND) to Pin 89 (GND): 0.050 [1.27]
- Pin 89 (GND) to Pin 90 (GND): 0.220 [5.59]
- Pin 90 (GND) to Pin 91 (GND): 0.580 [14.73]
- Pin 91 (GND) to Pin 92 (GND): 0.050 [1.27]
- Pin 92 (GND) to Pin 93 (GND): 0.220 [5.59]
- Pin 93 (GND) to Pin 94 (GND): 0.580 [14.73]
- Pin 94 (GND) to Pin 95 (GND): 0.050 [1.27]
- Pin 95 (GND) to Pin 96 (GND): 0.220 [5.59]
- Pin 96 (GND) to Pin 97 (GND): 0.580 [14.73]
- Pin 97 (GND) to Pin 98 (GND): 0.050 [1.27]
- Pin 98 (GND) to Pin 99 (GND): 0.220 [5.59]
- Pin 99 (GND) to Pin 100 (GND): 0.580 [14.73]
- Pin 100 (GND) to Pin 101 (GND): 0.050 [1.27]
- Pin 101 (GND) to Pin 102 (GND): 0.220 [5.59]
- Pin 102 (GND) to Pin 103 (GND): 0.580 [14.73]
- Pin 103 (GND) to Pin 104 (GND): 0.050 [1.27]
- Pin 104 (GND) to Pin 105 (GND): 0.220 [5.59]
- Pin 105 (GND) to Pin 106 (GND): 0.580 [14.73]
- Pin 106 (GND) to Pin 107 (GND): 0.050 [1.27]
- Pin 107 (GND) to Pin 108 (GND): 0.220 [5.59]
- Pin 108 (GND) to Pin 109 (GND): 0.580 [14.73]
- Pin 109 (GND) to Pin 110 (GND): 0.050 [1.27]
- Pin 110 (GND) to Pin 111 (GND): 0.220 [5.59]
- Pin 111 (GND) to Pin 112 (GND): 0.580 [14.73]
- Pin 112 (GND) to Pin 113 (GND): 0.050 [1.27]
- Pin 113 (GND) to Pin 114 (GND): 0.220 [5.59]
- Pin 114 (GND) to Pin 115 (GND): 0.580 [14.73]
- Pin 115 (GND) to Pin 116 (GND): 0.050 [1.27]
- Pin 116 (GND) to Pin 117 (GND): 0.220 [5.59]
- Pin 117 (GND) to Pin 118 (GND): 0.580 [14

DCB – Direct Copper Bond under Nickel plate on an Aluminum Nitride substrate and is electrically isolated from any pin.

## Applications Information

### Introduction

Circuits capable of very high switching speeds and high frequency operation require close attention to several important issues. Key elements include circuit loop inductance, Vcc bypassing, and grounding.

### Circuit Loop Inductance

The Vcc to Vcc Ground current path defines the loop that generates the inductive term. This loop must be kept as short as possible. The output lead must be no further than 0.375 inches (9.5 mm) from the gate of the MOSFET. Furthermore, the output ground leads must provide a balanced symmetric coplanar ground return for optimum operation.

### Vcc Bypassing

In order to turn a MOSFET on properly, the IXRFD630 must be able to draw up to 30 A of current from the Vcc power supply in 2-6 ns (depending upon the input capacitance of the MOSFET being driven). Good performance requires very low impedance between the driver and the power supply. The most common method of achieving this low impedance is to bypass the power supply at the driver with a capacitance value much larger than the load capacitance. Usually, this is achieved by placing two or three different types of bypassing capacitors, with complementary impedance curves, very close to the driver itself. (These capacitors should be carefully selected for low inductance, low resistance, and high pulse current service.) Care should be taken to keep the lengths of the leads between these bypass capacitors and the IXRFD630 to an absolute minimum.

The bypassing should be comprised of several values of MLC (Multi-Layer Ceramic) capacitors symmetrically placed on either side of the IC. Recommended values are 0.01uF and 0.47uF for bypass and at least two 4.7uF tantalums for bulk storage.

### Grounding

In order for the design to turn the load off properly, the IXRFD630 must be able to drain 30 A of current into an adequate grounding system. There are two paths for returning current that need to be considered: Path one is between the IXRFD630 and its load, and path two is between the IXRFD630 and its power supply. Both of these paths should be as low in resistance and inductance as possible, and thus as short as practical.

### Output Lead Inductance

Of equal importance to supply bypassing and grounding are issues related to the output lead inductance. Every effort should be made to keep the leads between the driver and its load as short and wide as possible, and treated as coplanar transmission lines. In configurations where the optimum configuration of circuit layout and bypassing cannot be used, a series resistance of a few ohms in the gate lead may be necessary to dampen ringing.

### Heat Sinking

For high power operation, the bottom side metalized substrate should be placed in compression against an appropriate heat sink. The substrate is metalized for improved heat dissipation, and is not electrically connected to the device or to ground. See the technical note "DE-Series MOSFET and IC Mounting Instructions" on the IXYS Colorado website at [www.ixyscolorado.com](http://www.ixyscolorado.com) for detailed mounting instructions.