

# IRF840B/IRFS840B

## 500V N-Channel MOSFET

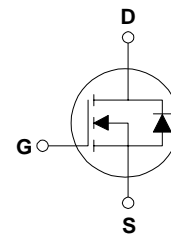
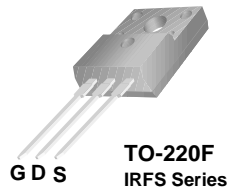
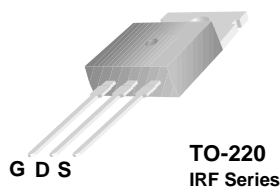
### General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supplies, power factor correction and electronic lamp ballasts based on half bridge.

### Features

- 8.0A, 500V,  $R_{DS(on)} = 0.8\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 41 nC)
- Low Crss ( typical 35 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	IRF840B	IRFS840B	Units
V <sub>DSS</sub>	Drain-Source Voltage	500		V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C) - Continuous (T <sub>C</sub> = 100°C)	8.0	8.0	A
		5.1	5.1	A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	32	32	A
V <sub>GSS</sub>	Gate-Source Voltage	± 30		V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	320		mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	8.0		A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	13.4		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5		V/ns
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> = 25°C) - Derate above 25°C	134	44	W
		1.08	0.35	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150		°C
T <sub>L</sub>	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		°C

\* Drain current limited by maximum junction temperature.

### Thermal Characteristics

Symbol	Parameter	IRF840B	IRFS840B	Units
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case Max.	0.93	2.86	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient Max.	62.5	62.5	°C/W

**Electrical Characteristics** $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	500	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.55	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 4.0\text{ A}$	--	0.65	0.8	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 4.0\text{ A}$ (Note 4)	--	7.3	--	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1400	1800	pF
$C_{oss}$	Output Capacitance		--	145	190	pF
$C_{rss}$	Reverse Transfer Capacitance		--	35	45	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{ V}, I_D = 8.0\text{ A},$ $R_G = 25\ \Omega$	--	22	55	ns	
$t_r$	Turn-On Rise Time		--	65	140	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4, 5)	--	125	260	ns
$t_f$	Turn-Off Fall Time		(Note 4, 5)	--	75	160	ns
$Q_g$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 8.0\text{ A},$ $V_{GS} = 10\text{ V}$	--	41	53	nC	
$Q_{gs}$	Gate-Source Charge		(Note 4, 5)	--	6.5	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4, 5)	--	17	--	nC

**Drain-Source Diode Characteristics and Maximum Ratings**

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	8.0	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	32	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 8.0\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 8.0\text{ A},$	--	390	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	4.2	--	$\mu\text{C}$

**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 9.0\text{ mH}, I_{AS} = 8.0\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 8.0\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

Typical Characteristics

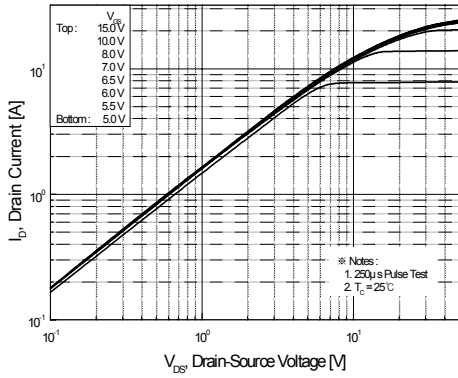


Figure 1. On-Region Characteristics

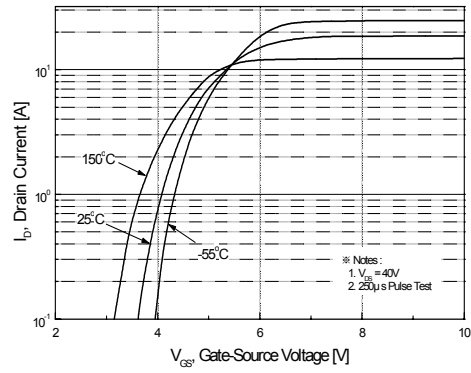


Figure 2. Transfer Characteristics

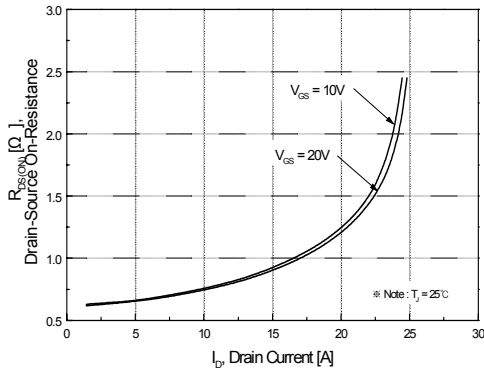


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

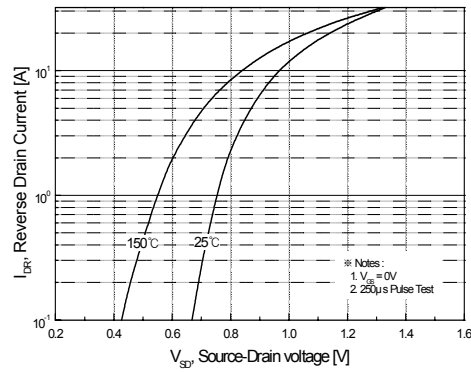


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

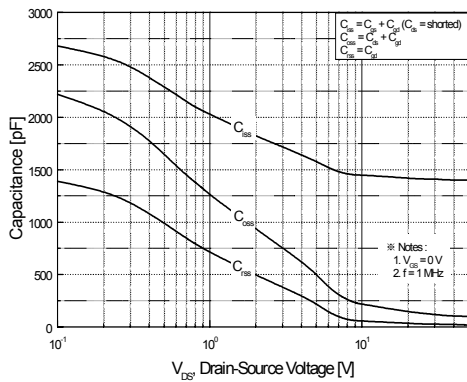


Figure 5. Capacitance Characteristics

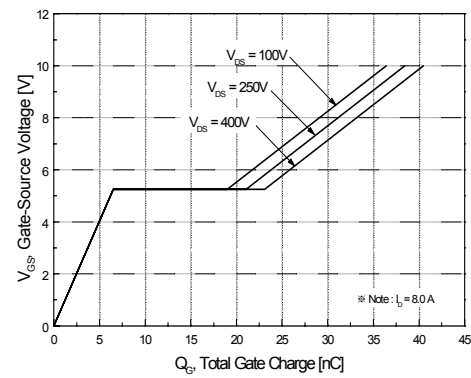


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

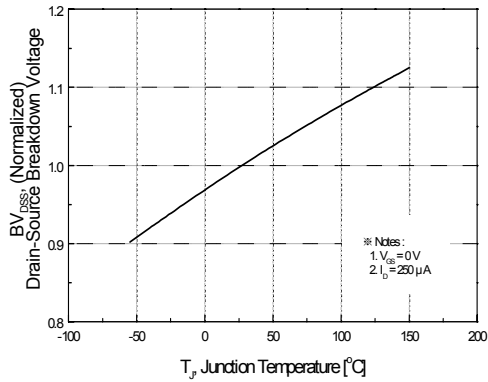


Figure 7. Breakdown Voltage Variation vs Temperature

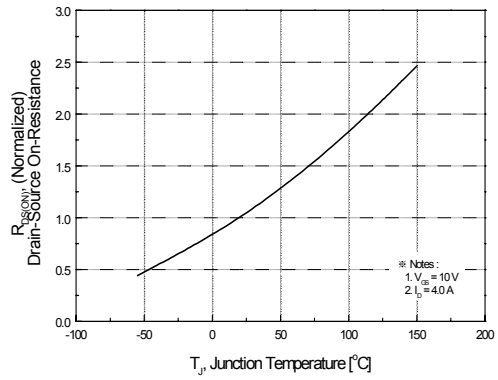


Figure 8. On-Resistance Variation vs Temperature

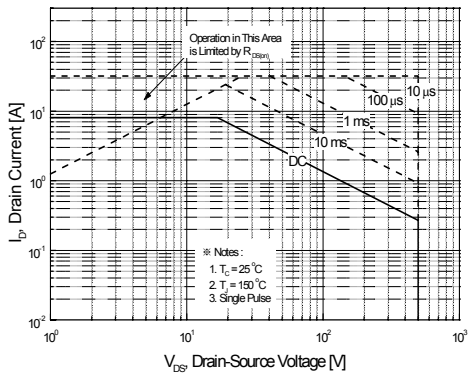


Figure 9-1. Maximum Safe Operating Area for IRF840B

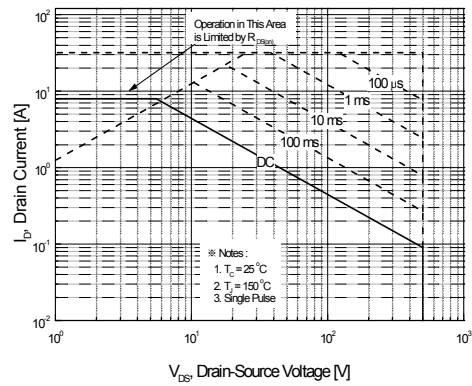


Figure 9-2. Maximum Safe Operating Area for IRFS840B

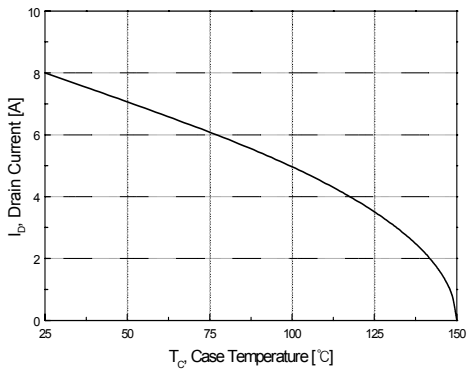


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (Continued)

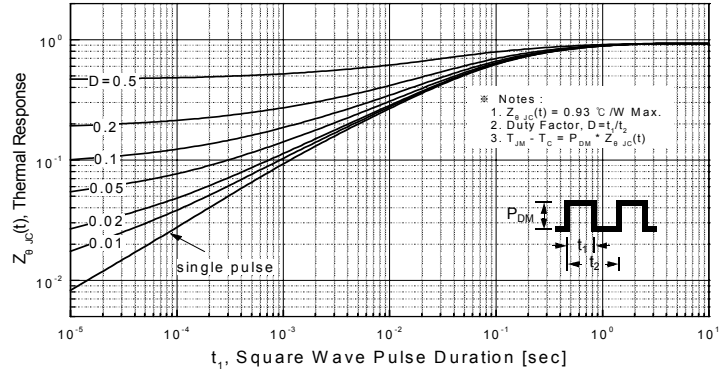


Figure 11-1. Transient Thermal Response Curve for IRF840B

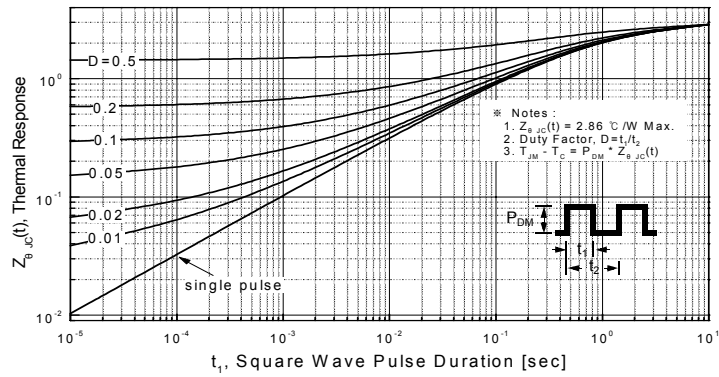
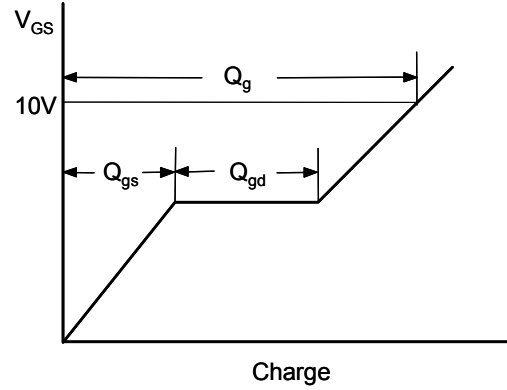
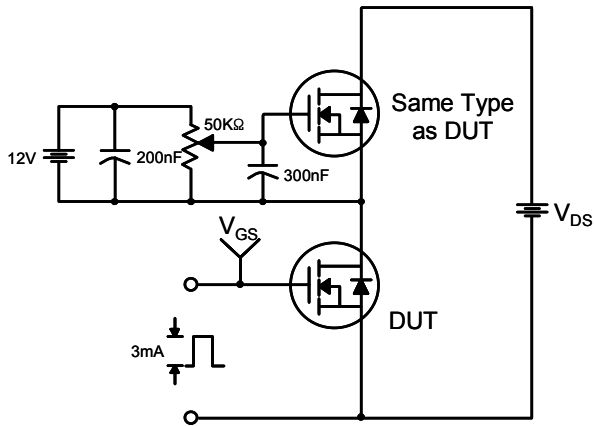
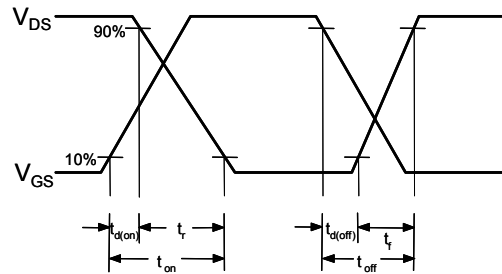
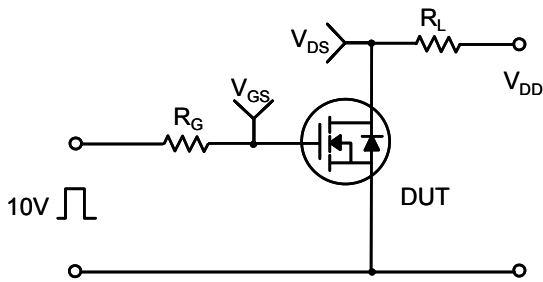


Figure 11-2. Transient Thermal Response Curve for IRFS840B

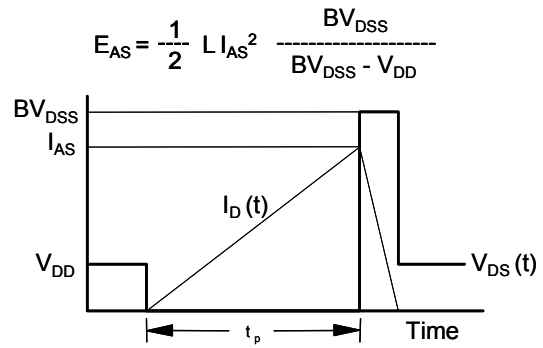
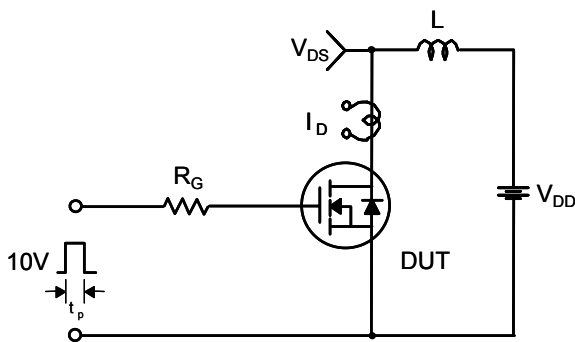
Gate Charge Test Circuit & Waveform



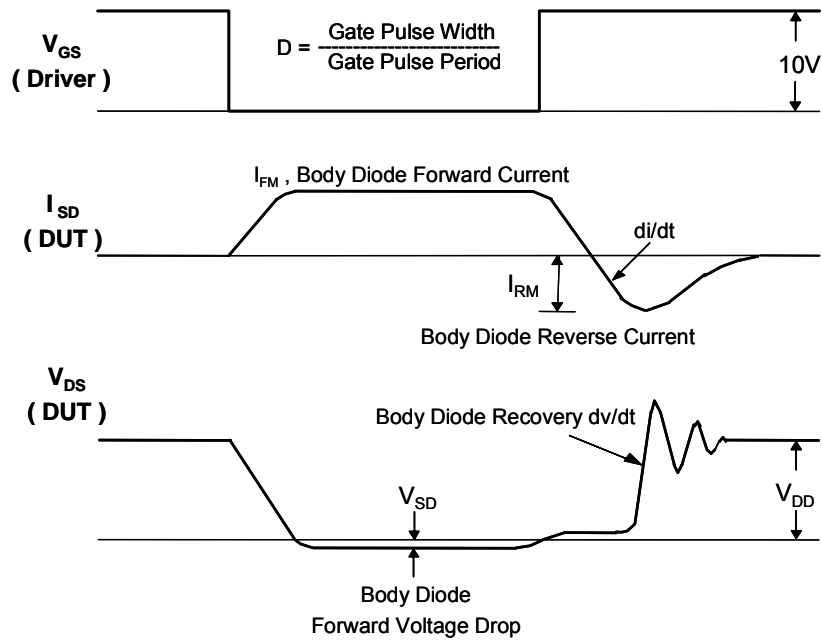
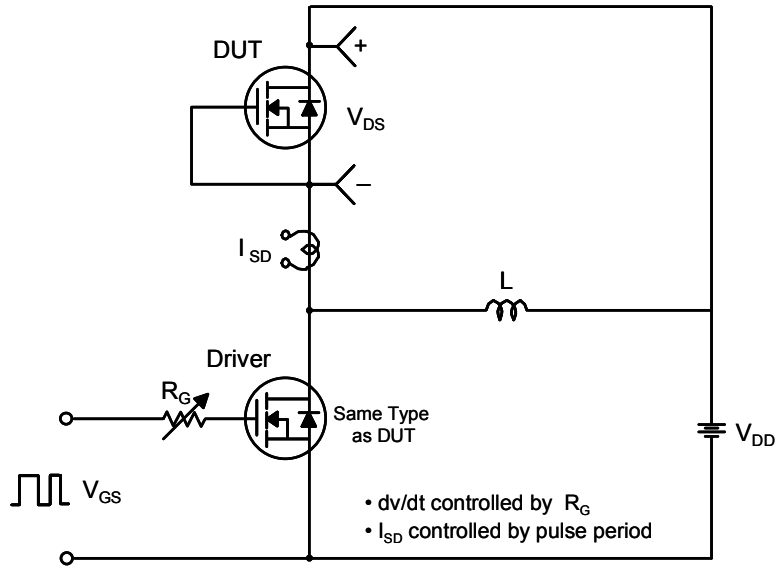
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



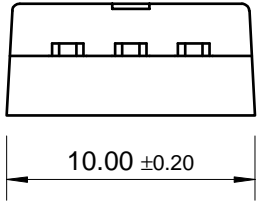
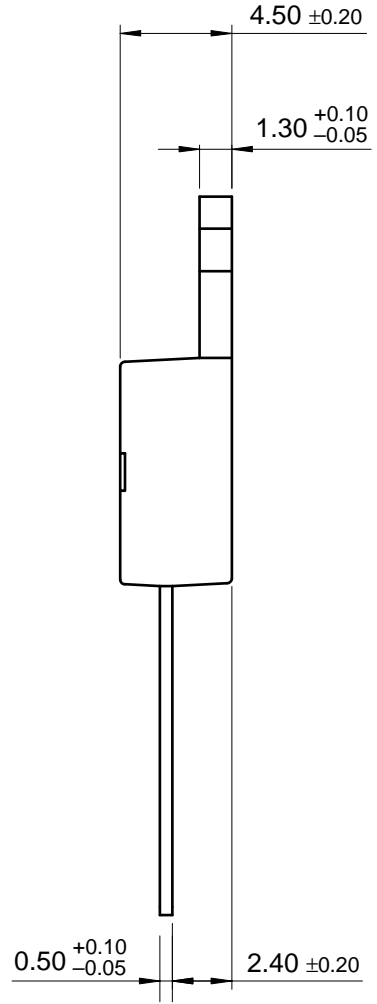
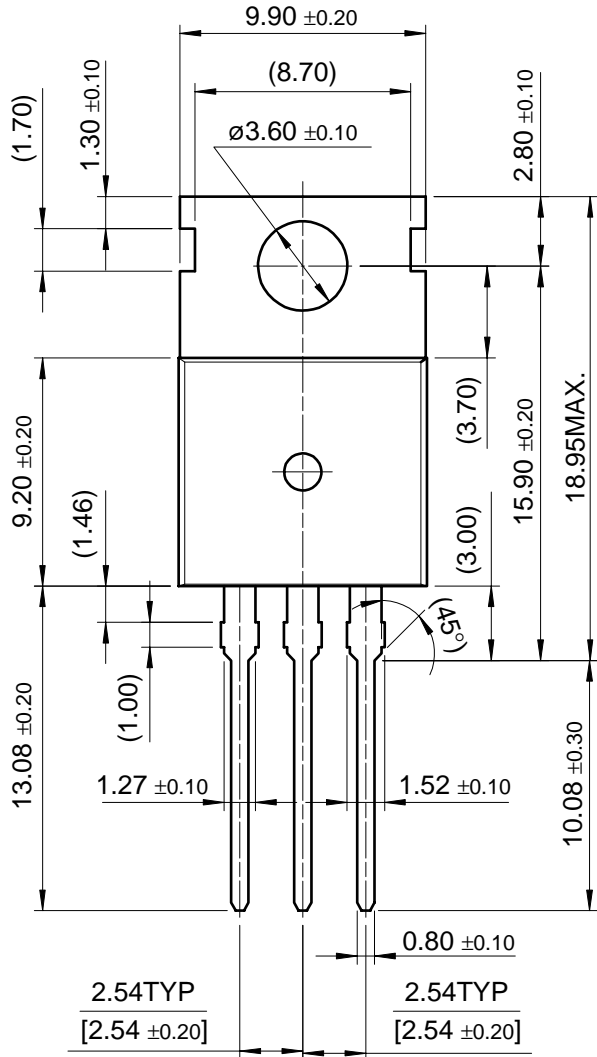
Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Package Dimensions

## TO-220

IRF840B/IRFS840B

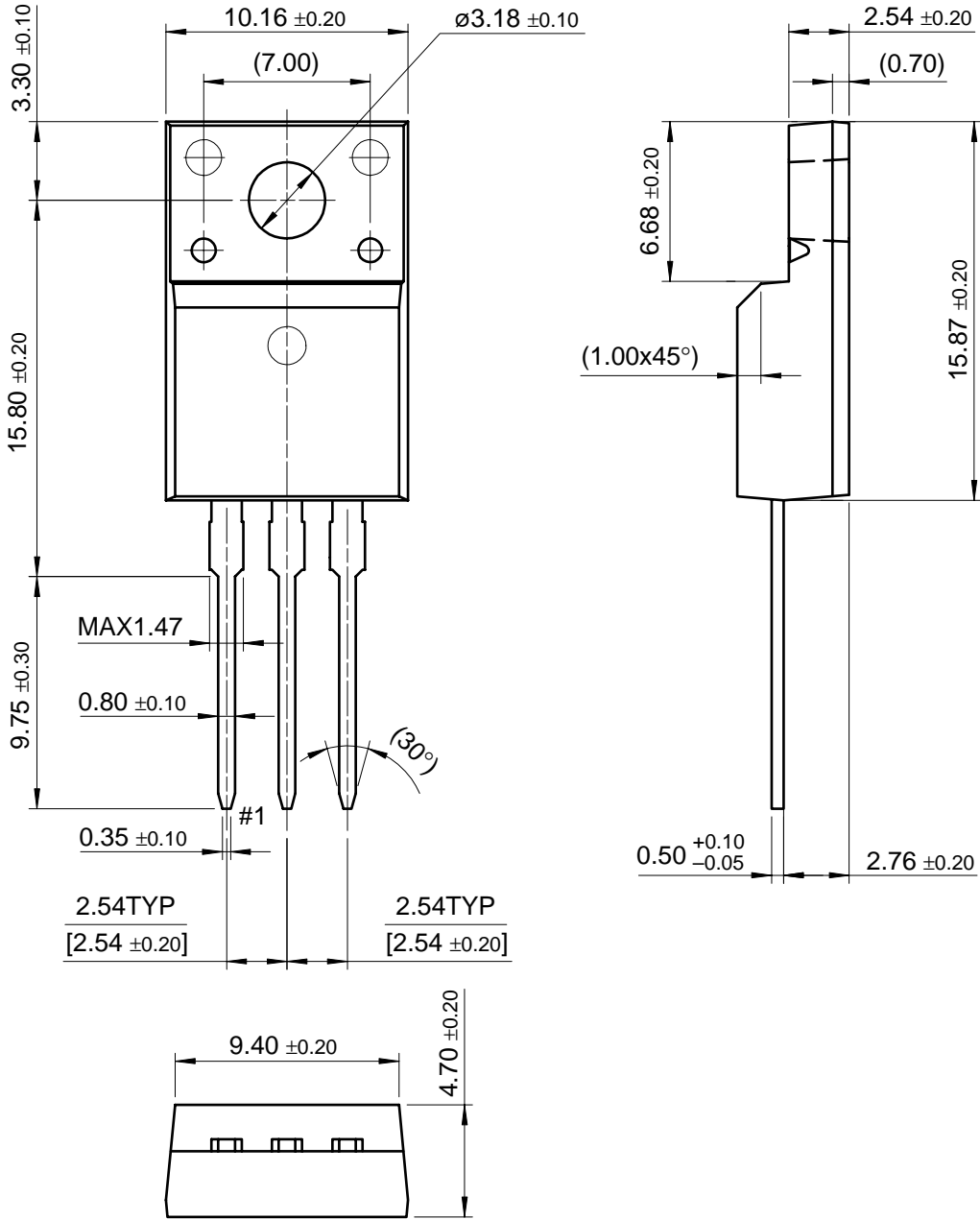


Dimensions in Millimeters



Package Dimensions (Continued)

TO-220F



IRF840B/IRFS840B

Dimensions in Millimeters

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CROSSVOLT <sup>™</sup>	GlobalOptoisolator <sup>™</sup>	MicroFET <sup>™</sup>	PowerTrench <sup>®</sup>	SuperSOT <sup>™</sup> -6
DOME <sup>™</sup>	GTO <sup>™</sup>	MicroPak <sup>™</sup>	QFET <sup>®</sup>	SuperSOT <sup>™</sup> -8
EcoSPARK <sup>™</sup>	HiSeC <sup>™</sup>	MICROWIRE <sup>™</sup>	QS <sup>™</sup>	SyncFET <sup>™</sup>
E <sup>2</sup> CMOS <sup>™</sup>	I <sup>2</sup> C <sup>™</sup>	MSX <sup>™</sup>	QT Optoelectronics <sup>™</sup>	TinyLogic <sup>®</sup>
EnSigna <sup>™</sup>	<i>i-Lo</i> <sup>™</sup>	MSXPro <sup>™</sup>	Quiet Series <sup>™</sup>	TINYOPTO <sup>™</sup>
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