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## IRLS640A

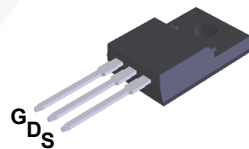
### N-Channel Logic Level A-FET 200 V, 9.8 A, 180 mΩ

#### Description

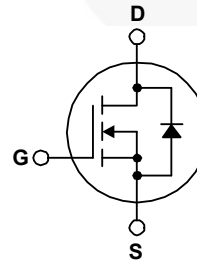
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supplies, DC-AC converters for uninterrupted power supply and motor control.

#### Features

- 9.8 A, 200 V,  $R_{DS(on)} = 180 \text{ m}\Omega @ V_{GS} = 5 \text{ V}$
- Low Gate Charge (Typ. 40 nC)
- Low Crss (Typ. 95 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- Logic-Level Gate Drive



TO-220F



#### Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	200	V
$I_D$	Continuous Drain Current ( $T_C=25^\circ\text{C}$ )	9.8	A
	Continuous Drain Current ( $T_C=100^\circ\text{C}$ )	6.2	
$I_{DM}$	Drain Current-Pulsed <sup>①</sup>	63	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy <sup>②</sup>	64	mJ
$I_{AR}$	Avalanche Current <sup>①</sup>	18	A
$E_{AR}$	Repetitive Avalanche Energy <sup>①</sup>	4.0	mJ
dv/dt	Peak Diode Recovery dv/dt <sup>③</sup>	5	V/ns
$P_D$	Total Power Dissipation ( $T_C=25^\circ\text{C}$ )	40	W
	Linear Derating Factor	0.32	
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	- 55 to +150	°C
$T_L$	Maximum Lead Temp. for Soldering Purposes, 1/8 " from case for 5-seconds	300	

#### Thermal Resistance

Symbol	Characteristic	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	3.13	°C/W
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
IRLS640A	IRLS640A	TO-220F	Tube	N/A	N/A	50 units

## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$BV_{DSS}$	Drain-Source Breakdown Voltage	200	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.17	--	V/ $^\circ\text{C}$	$I_D=250\mu A$ <b>See Fig 7</b>
$V_{GS(th)}$	Gate Threshold Voltage	1.0	--	2.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
$I_{GSS}$	Gate-Source Leakage, Forward	--	--	100	nA	$V_{GS}=20V$
	Gate-Source Leakage, Reverse	--	--	-100		$V_{GS}=-20V$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	10	$\mu A$	$V_{DS}=200V$
		--	--	100		$V_{DS}=160V, T_C=125^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	0.18	$\Omega$	$V_{GS}=5V, I_D=4.9A$ ④
$g_{fs}$	Forward Transconductance	--	13.3	--	S	$V_{DS}=40V, I_D=4.9A$ ④
$C_{iss}$	Input Capacitance	--	1310	1705	pF	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$ <b>See Fig 5</b>
$C_{oss}$	Output Capacitance	--	200	250		
$C_{rss}$	Reverse Transfer Capacitance	--	95	120		
$t_{d(on)}$	Turn-On Delay Time	--	11	30	ns	$V_{DD}=100V, I_D=18A,$ $R_G=4.6\Omega$ <b>See Fig 13</b> ④ ⑤
$t_r$	Rise Time	--	8	25		
$t_{d(off)}$	Turn-Off Delay Time	--	46	100		
$t_f$	Fall Time	--	15	40		
$Q_g$	Total Gate Charge	--	40	56	nC	$V_{DS}=160V, V_{GS}=5V,$ $I_D=18A$ <b>See Fig 6 &amp; Fig 12</b> ④ ⑤
$Q_{gs}$	Gate-Source Charge	--	6.8	--		
$Q_{gd}$	Gate-Drain("Miller") Charge	--	18.6	--		

## Source-Drain Diode Ratings and Characteristics

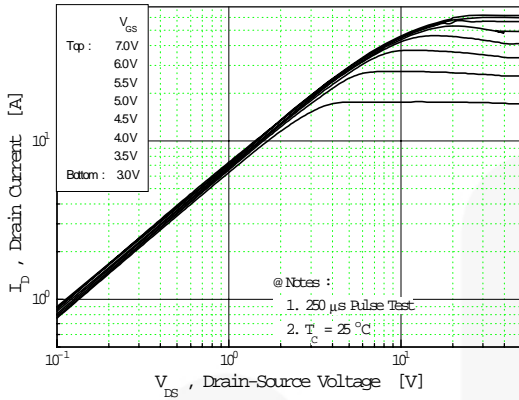
Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$I_S$	Continuous Source Current	--	--	18	A	Integral reverse pn-diode in the MOSFET
$I_{SM}$	Pulsed-Source Current ①	--	--	63		
$V_{SD}$	Diode Forward Voltage ④	--	--	1.5	V	$T_J=25^\circ\text{C}, I_S=9.8A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	--	224	--	ns	$T_J=25^\circ\text{C}, I_F=18A$
$Q_{rr}$	Reverse Recovery Charge	--	1.55	--	$\mu C$	$di_F/dt=100A/\mu s$ ④

### Notes ;

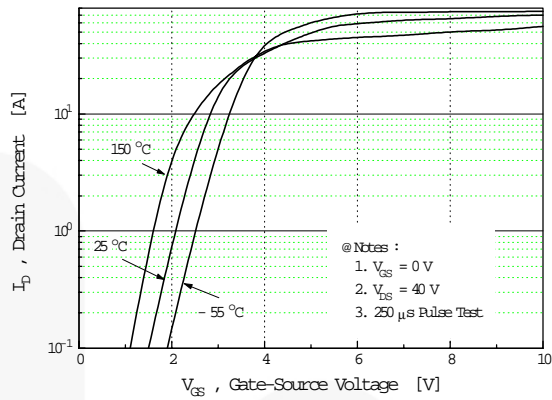
- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=1\text{mH}, I_{AS}=9.8A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD}\leq 18A, di/dt\leq 260A/\mu s, V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width =  $250\mu s$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

## Typical Characteristics

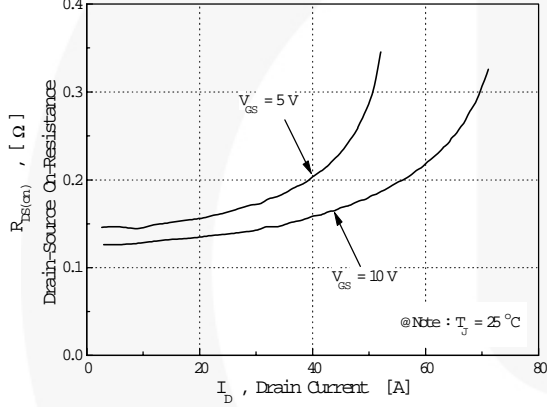
**Fig 1. Output Characteristics**



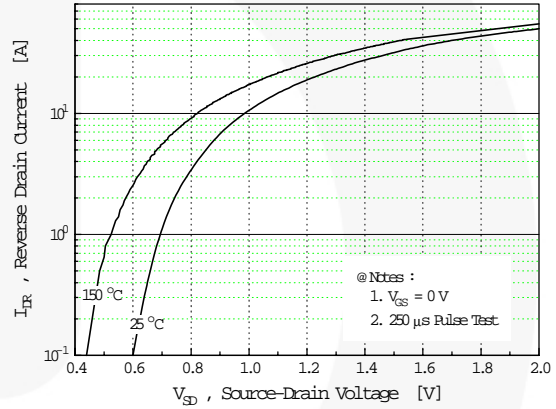
**Fig 2. Transfer Characteristics**



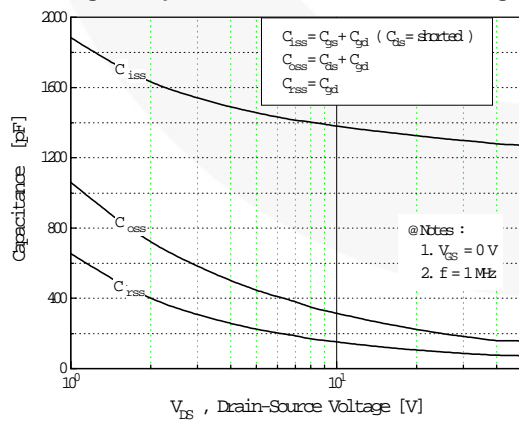
**Fig 3. On-Resistance vs. Drain Current**



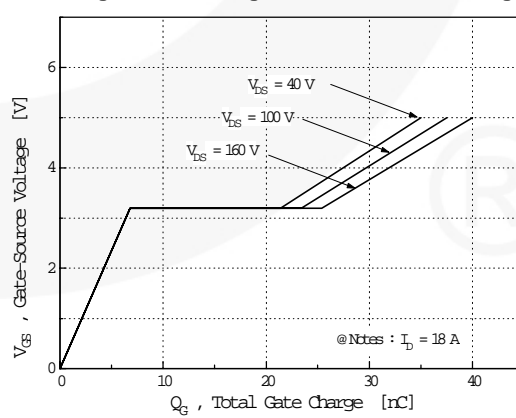
**Fig 4. Source-Drain Diode Forward Voltage**



**Fig 5. Capacitance vs. Drain-Source Voltage**



**Fig 6. Gate Charge vs. Gate-Source Voltage**



Typical Characteristics (continued)

Fig 7. Breakdown Voltage vs. Temperature

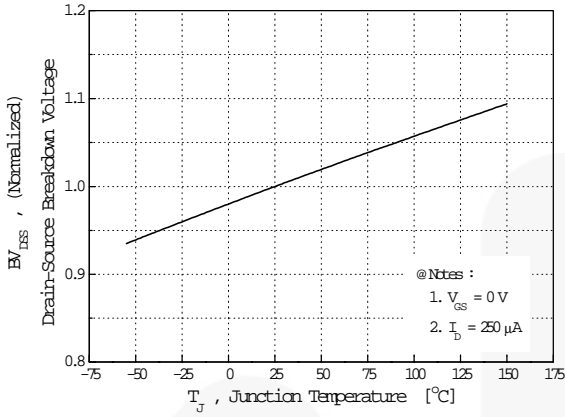


Fig 8. On-Resistance vs. Temperature

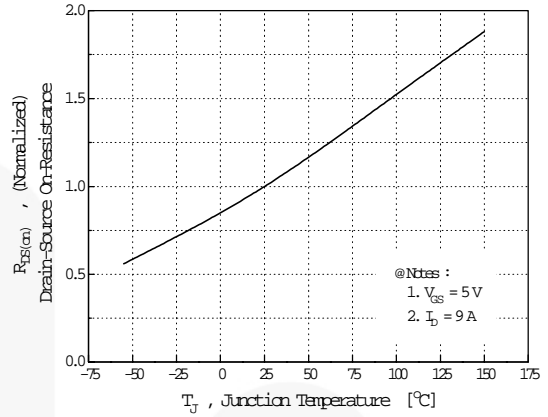


Fig 9. Max. Safe Operating Area

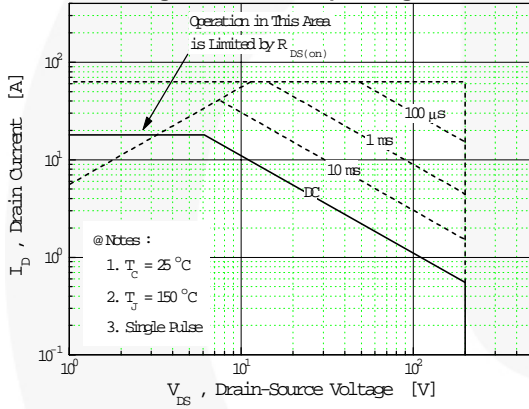


Fig 10. Max. Drain Current vs. Case Temperature

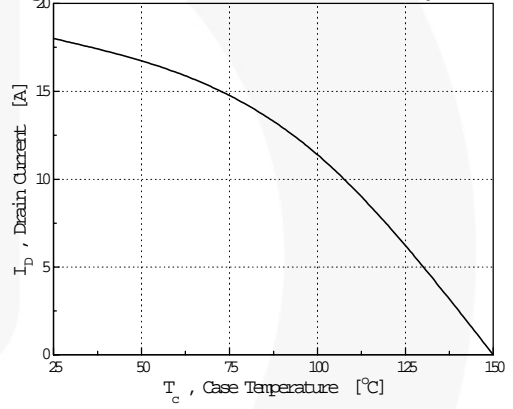
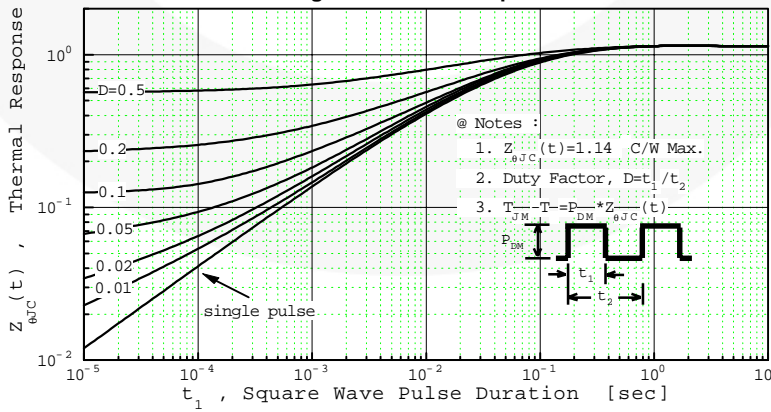


Fig 11. Thermal Response



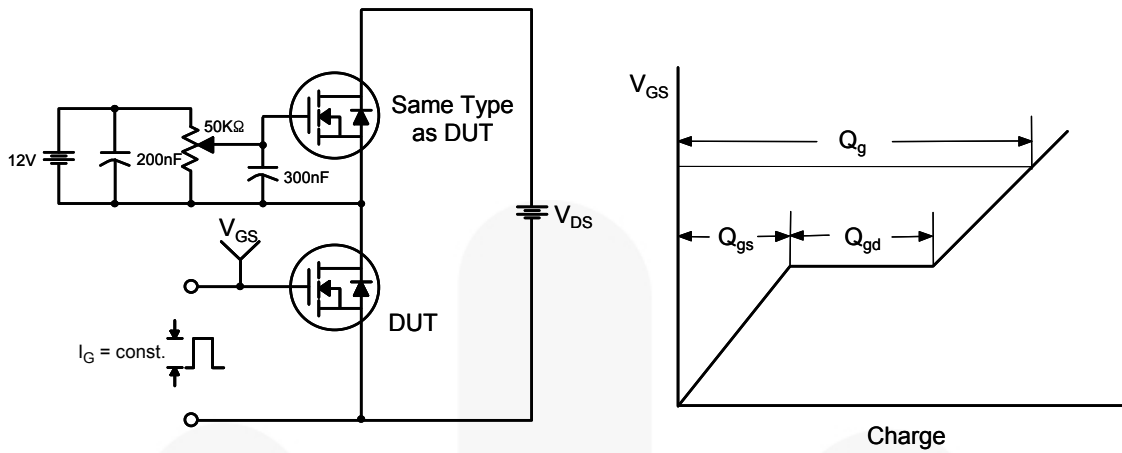


Figure 12. Gate Charge Test Circuit & Waveform

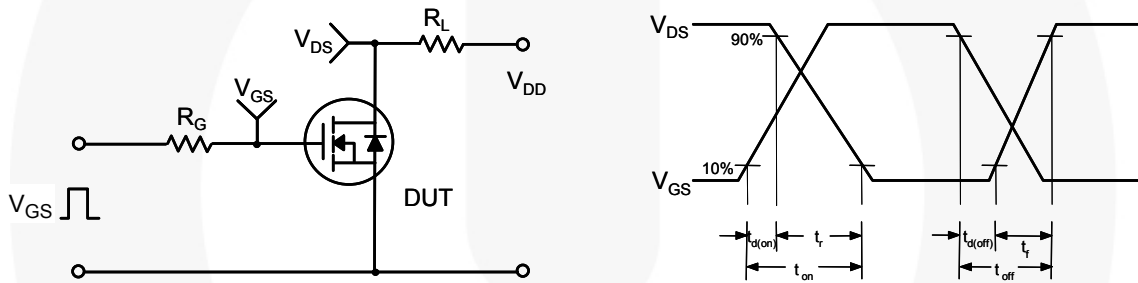


Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

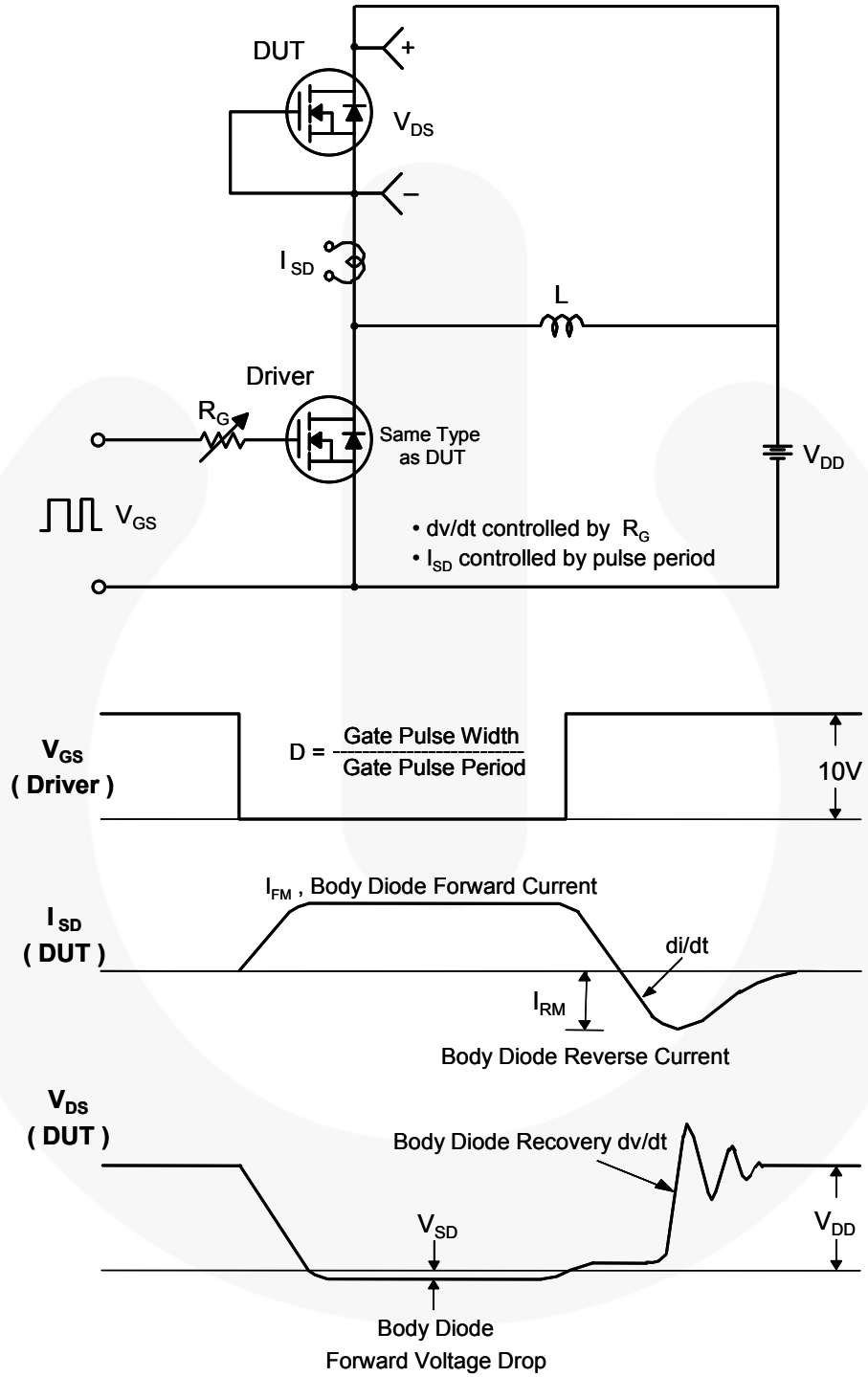
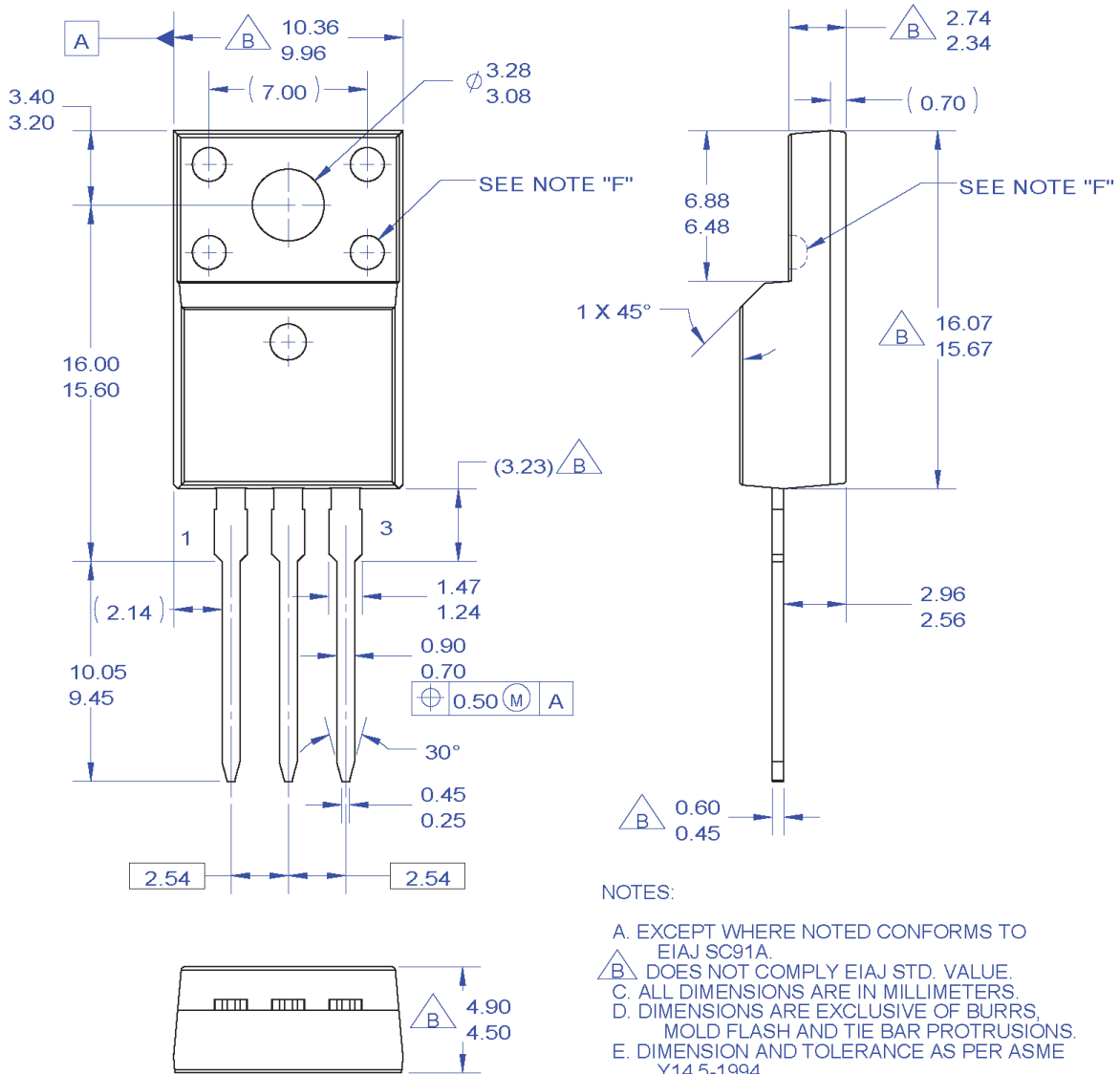


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



## NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.  
 B. DOES NOT COMPLY EIAJ STD. VALUE.  
 C. ALL DIMENSIONS ARE IN MILLIMETERS.  
 D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.  
 E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.  
 F. OPTION 1 - WITH SUPPORT PIN HOLE.  
 OPTION 2 - NO SUPPORT PIN HOLE.  
 G. DRAWING FILE NAME: TO220M03REV3

Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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