

## FEATURES

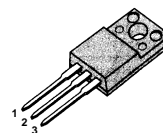
- Advanced New Design
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Very Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Unrivalled Gate Charge: 40nC (Typ.)
- Extended Safe Operating Area
- Lower  $R_{DS(ON)}$ : 1.5 $\Omega$  (Typ.)

$$BV_{DSS} = 900V$$

$$R_{DS(ON)} = 1.9\Omega$$

$$I_D = 3.4A$$

TO-220F



1. Gate 2. Drain 3. Source

## ABSOLUTE MAXIMUM RATINGS

Symbol	Characteristics	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	900	V
$I_D$	Continuous Drain Current ( $T_C = 25^\circ\text{C}$ )	3.4	A
	Continuous Drain Current ( $T_C = 100^\circ\text{C}$ )	2.1	
$I_{DM}$	Drain Current-Pulsed ①	13.6	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy ②	710	mJ
$I_{AR}$	Avalanche Current ①	3.4	A
$E_{AR}$	Repetitive Avalanche Energy ①	5.6	mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.0	V/ns
$P_D$	Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	56	W
	Linear Derating Factor	0.45	
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds	300	

## THERMAL RESISTANCE

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	-	2.25	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient	-	62.5	

**ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Characteristics	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$	Drain-Source Breakdown Voltage	900	–	–	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	–	0.96	–	V/°C	$I_D=250\mu A$ , <b>See Fig 7</b>
$V_{GS(th)}$	Gate Threshold Voltage	3.0	–	5.0	V	$V_{DS}=5V, I_D=250\mu A$
$I_{GSS}$	Gate-Source Leakage, Forward	–	–	100	nA	$V_{GS}=30V$
	Gate-Source Leakage, Reverse	–	–	–100		$V_{GS}=-30V$
$I_{DSS}$	Drain-to-Source Leakage Current	–	–	10	$\mu A$	$V_{DS}=900V$
		–	–	100		$V_{DS}=720V, T_C=125^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	–	–	1.9	$\Omega$	$V_{GS}=10V, I_D=1.7A$ ④
$g_{fs}$	Forward Transconductance	–	3.8	–	S	$V_{DS}=50V, I_D=1.7A$ ④
$C_{iss}$	Input Capacitance	–	1440	1880	pF	$V_{GS}=0V, V_{DS}=25V$ $f=1\text{MHz}$ <b>See Fig 5</b>
$C_{oss}$	Output Capacitance	–	140	185		
$C_{rss}$	Reverse Transfer Capacitance	–	17	23		
$t_{d(on)}$	Turn-On Delay Time	–	35	80	ns	$V_{DD}=450V, I_D=5.8A$ $R_G=50\Omega$ <b>See Fig 13</b> ④ ⑤
$t_r$	Rise Time	–	80	170		
$t_{d(off)}$	Turn-Off Delay Time	–	95	200		
$t_f$	Fall Time	–	55	120		
$Q_g$	Total Gate Charge	–	40	52	nC	$V_{DS}=720V, V_{GS}=10V$ $I_D=5.8A$ <b>See Fig 6 &amp; Fig 12</b> ④ ⑤
$Q_{gs}$	Gate-Source Charge	–	8.5	–		
$Q_{gd}$	Gate-Drain (Miller) Charge	–	20	–		

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristics	Min.	Typ.	Max.	Units	Test Conditions
$I_S$	Continuous Source Current	–	–	3.4	A	Integral reverse pn-diode in the MOSFET
$I_{SM}$	Pulsed-Source Current ①	–	–	13.6		
$V_{SD}$	Diode Forward Voltage ④	–	–	1.4	V	$T_J=25^\circ\text{C}, I_S=3.4A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	–	400	–	ns	$T_J=25^\circ\text{C}, I_F=5.8A, V_{DD}=720V$
$Q_{rr}$	Reverse Recovery Charge	–	4.3	–	$\mu C$	$di_F/dt=100A/\mu s$ ④

**Notes:**

- ① Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- ②  $L=116\text{mH}, I_{AS}=3.4A, V_{DD}=50V, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq 5.8A, di/dt \leq 400A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

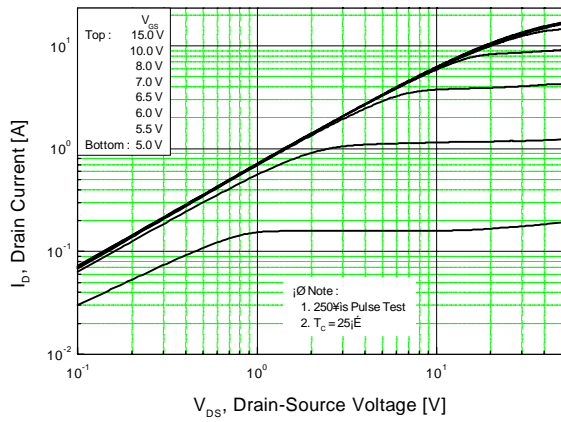


Fig 2. Transfer Characteristics

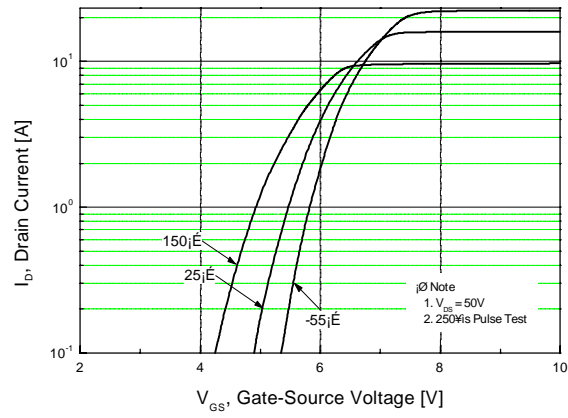


Fig 3. On-Resistance vs. Drain Current

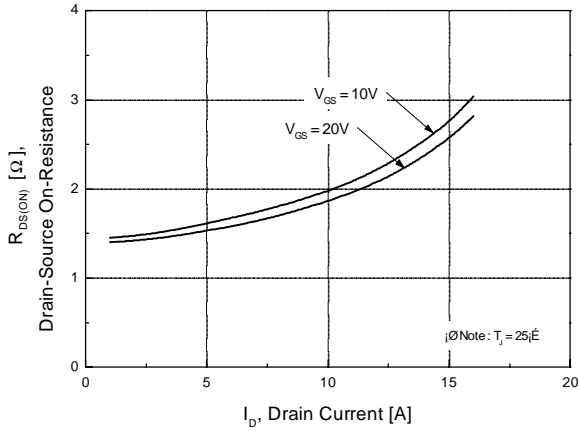


Fig 4. Source-Drain Diode Forward Voltage

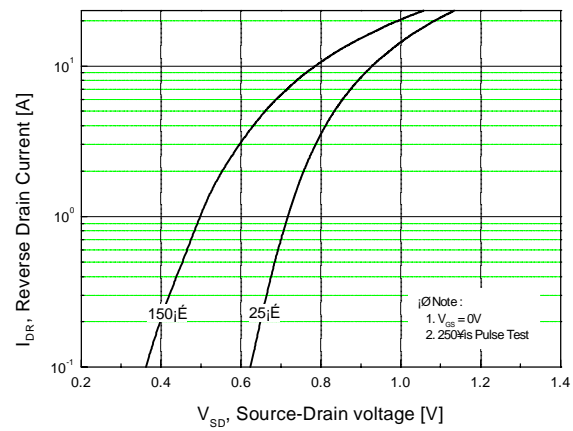


Fig 5. Capacitance vs. Drain-Source Voltage

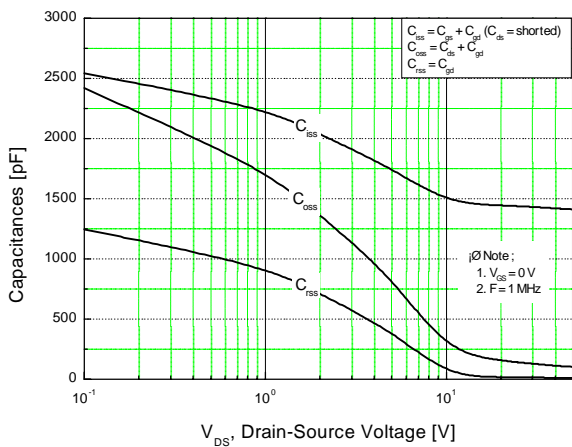


Fig 6. Gate Charge vs. Gate-Source Voltage

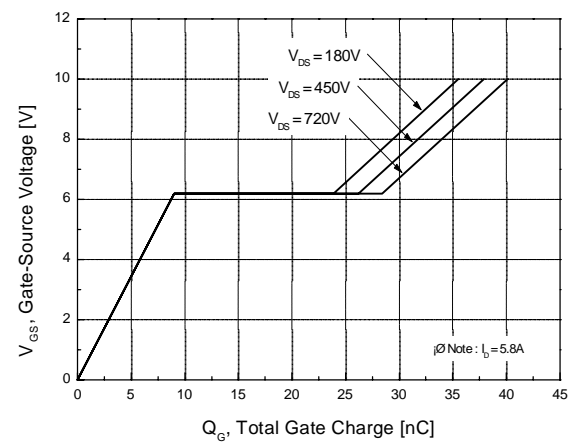


Fig 7. Breakdown Voltage vs. Temperature

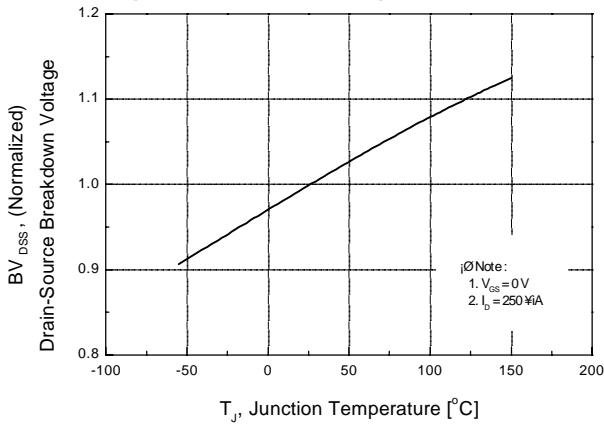


Fig 8. On-Resistance vs. Temperature

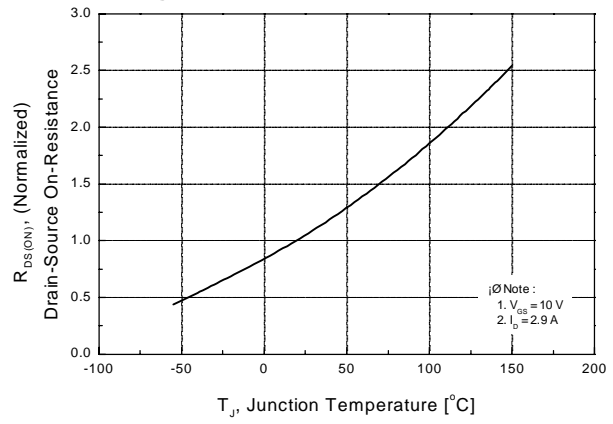


Fig 9. Max. Safe Operating Area

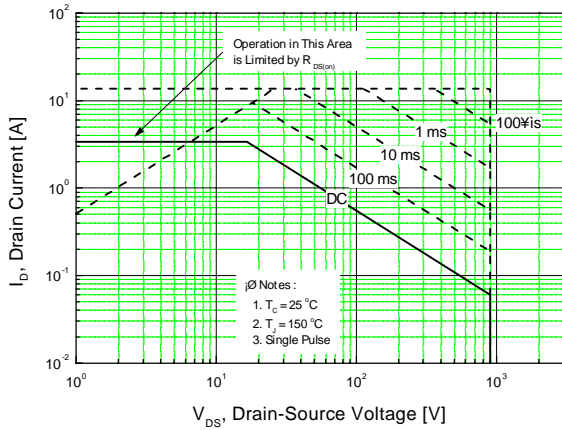


Fig 10. Max. Drain Current vs. Case Temperature

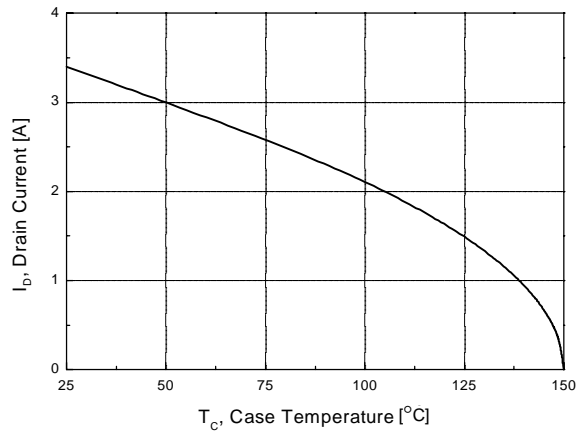


Fig 11. Thermal Response

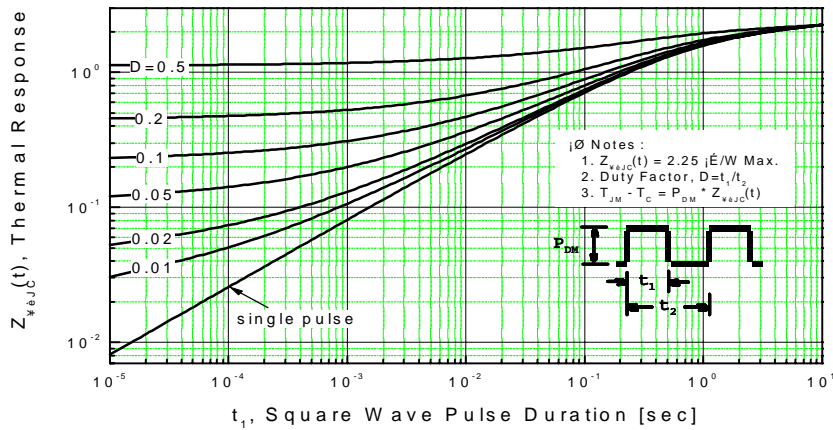


Fig 12. Gate Charge Test Circuit & Waveform

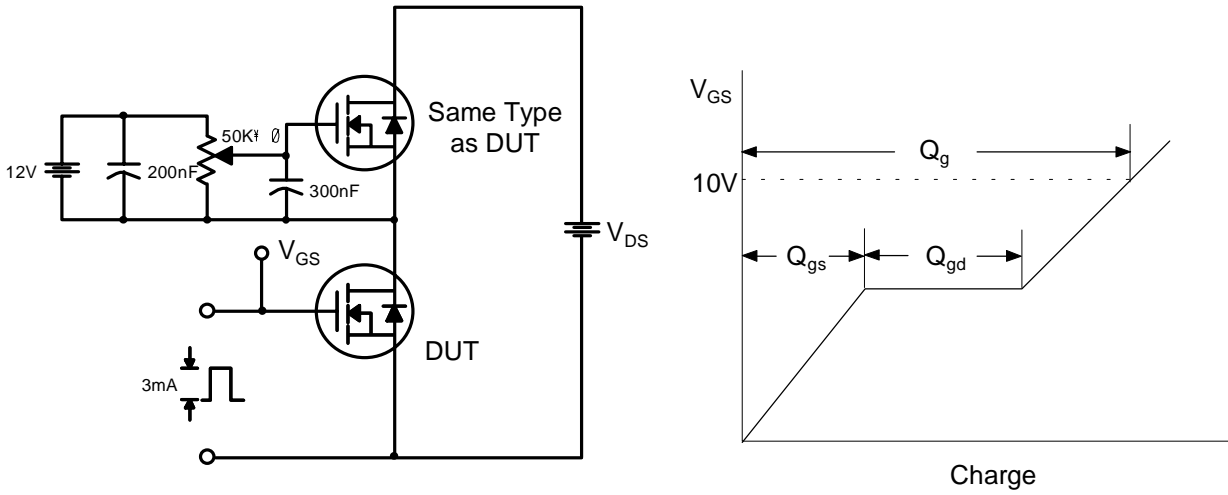


Fig 13. Resistive Switching Test Circuit & Waveforms

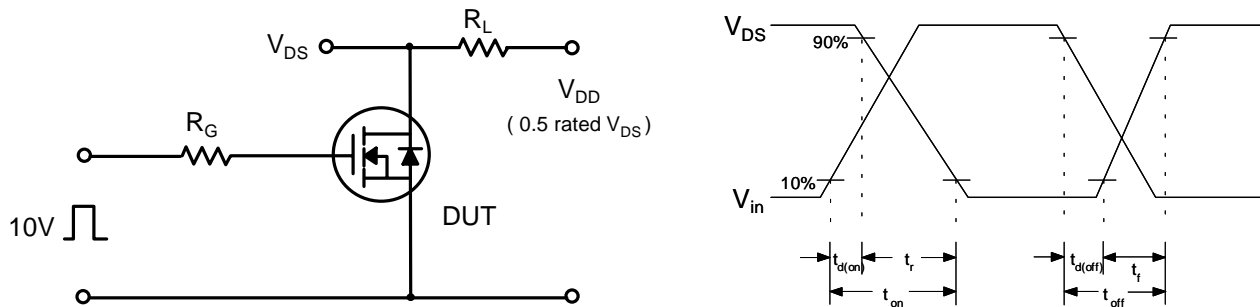


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

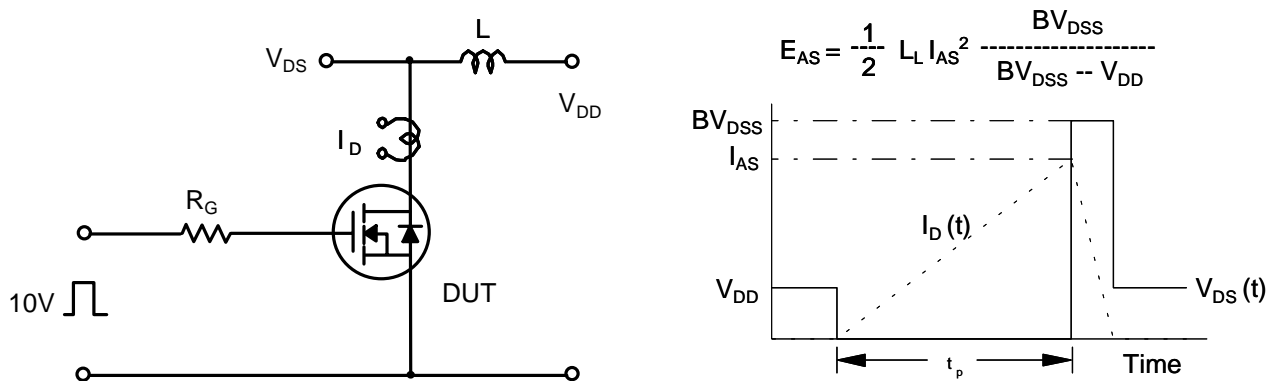
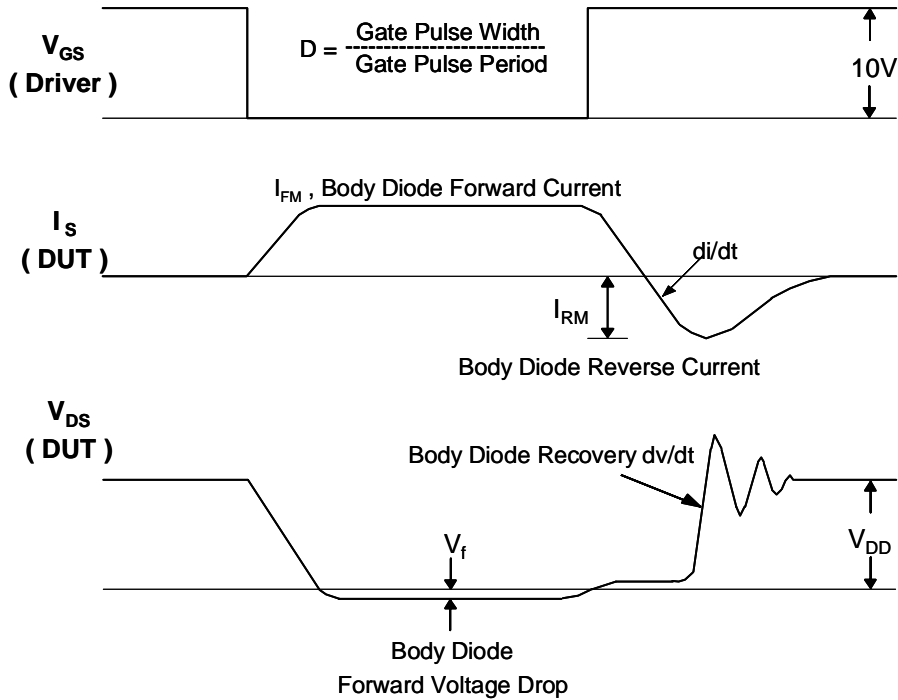
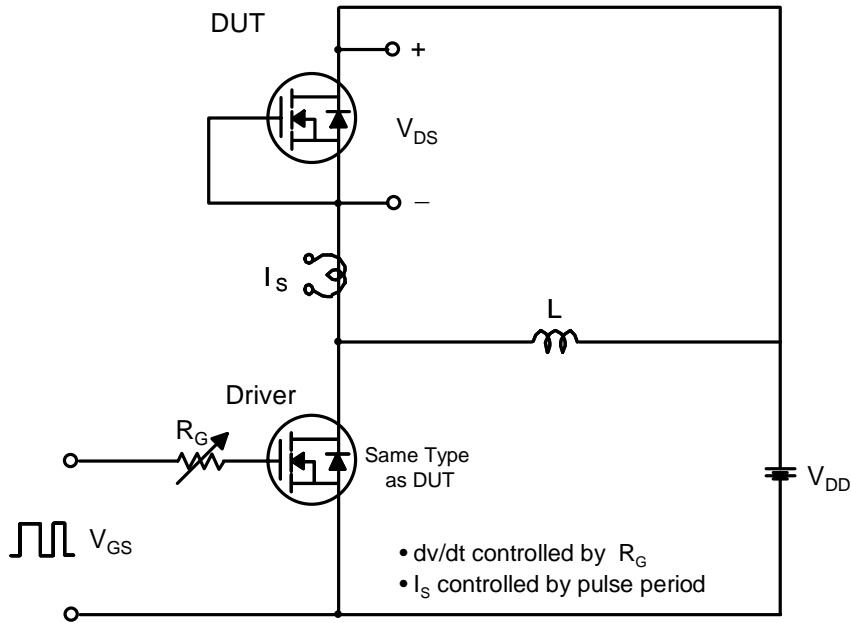
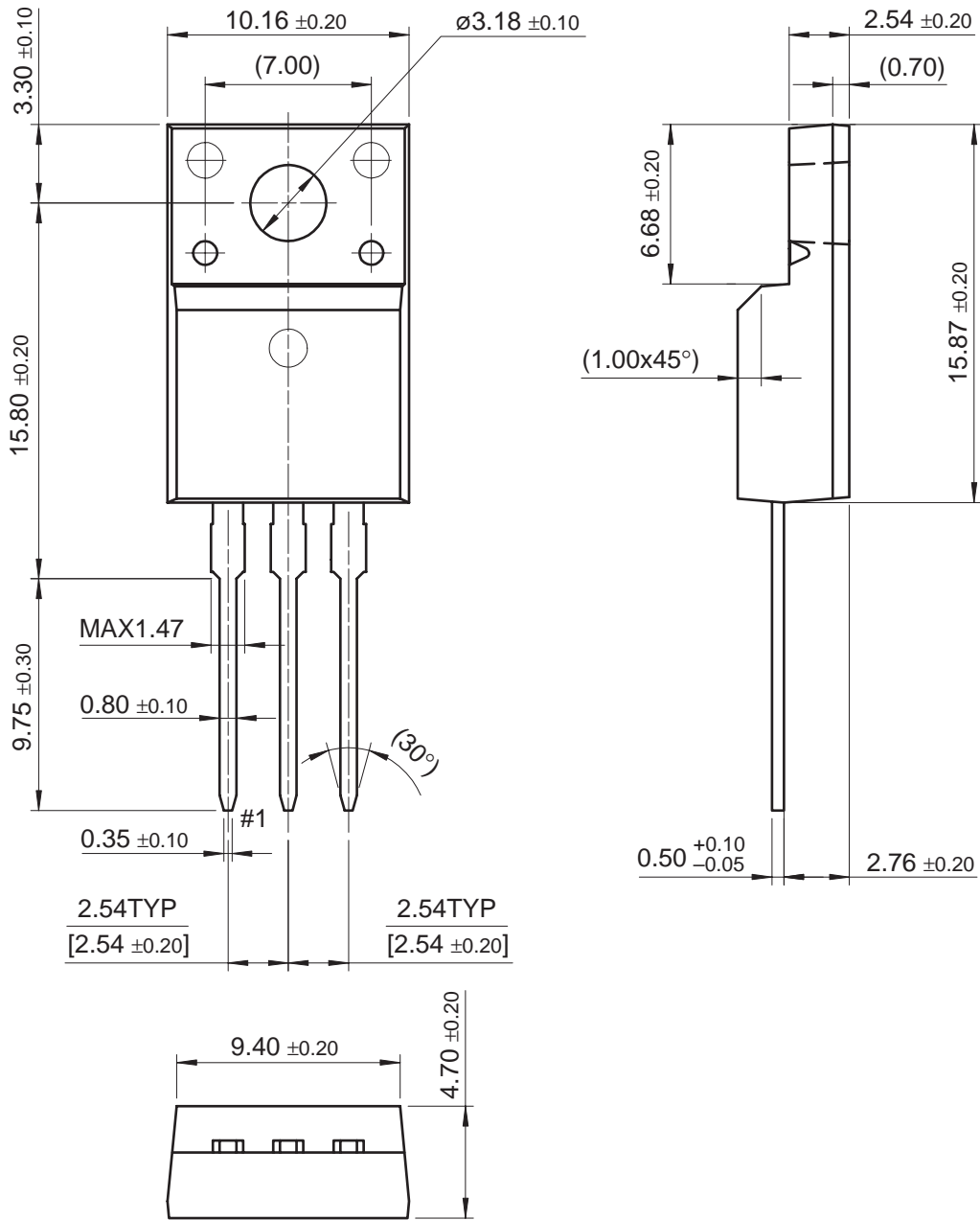


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



TO-220F Package Dimensions

TO-220F (FS PKG CODE AQ)



Dimensions in Millimeters

September 1999, Rev B

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