

# FQI27N25

## N-Channel QFET<sup>®</sup> MOSFET

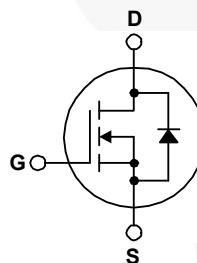
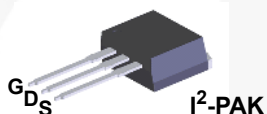
250 V, 25.5 A, 110 mΩ

### Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

### Features

- 25.5 A, 250 V,  $R_{DS(on)} = 110 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 12.75 \text{ A}$
- Low Gate Charge (Typ. 50 nC)
- Low Crss (Typ. 45 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQI27N25TU	Unit
V <sub>DSS</sub>	Drain-Source Voltage	250	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C) - Continuous (T <sub>C</sub> = 100°C)	25.5	A
		16.2	A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	102	A
V <sub>GSS</sub>	Gate-Source Voltage	± 30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	600	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	25.5	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	18	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P <sub>D</sub>	Power Dissipation (T <sub>A</sub> = 25°C) *	3.13	W
	Power Dissipation (T <sub>C</sub> = 25°C)	180	W
	- Derate above 25°C	1.43	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, 1/8" from Case for 5 Seconds.	300	°C

### Thermal Characteristics

Symbol	Parameter	FQI27N25TU	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max.	0.7	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper), Max.	62.5	
	Thermal Resistance, Junction to Ambient (*1 in <sup>2</sup> Pad of 2-oz Copper), Max.	40	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQI27N25TU	FQI27N25	I <sup>2</sup> -PAK	Tube	N/A	N/A	50 units

## Electrical Characteristics

$T_C = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	250	--	--	V
$\Delta BV_{DSS} / \Delta T$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.29	--	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 200\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	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	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 12.75\text{ A}$	--	0.083	0.11	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 12.75\text{ A}$	--	24	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1900	2450	pF
$C_{oss}$	Output Capacitance		--	360	470	pF
$C_{rss}$	Reverse Transfer Capacitance		--	45	60	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 125\text{ V}, I_D = 27\text{ A},$ $R_G = 25\ \Omega$	--	32	75	ns
$t_r$	Turn-On Rise Time		--	270	550	ns
$t_{d(off)}$	Turn-Off Delay Time		--	80	170	ns
$t_f$	Turn-Off Fall Time		(Note 4)	--	120	250
$Q_g$	Total Gate Charge	$V_{DS} = 200\text{ V}, I_D = 27\text{ A},$ $V_{GS} = 10\text{ V}$	--	50	65	nC
$Q_{gs}$	Gate-Source Charge		--	12.5	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4)	--	26	--

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	25.5	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	102	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 25.5\text{ A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 27\text{ A},$	--	220	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{s}$	--	1.8	--	$\mu\text{C}$

#### Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2.  $L = 1.5\text{ mH}, I_S = 25.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq -27\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

## Typical Characteristics

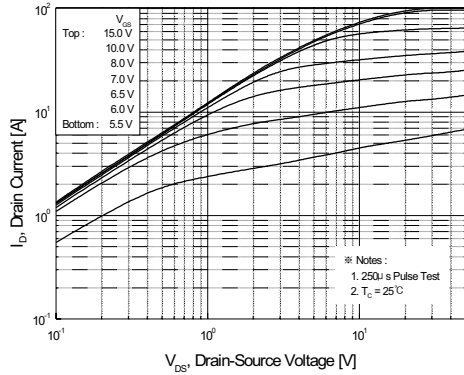


Figure 1. On-Region Characteristics

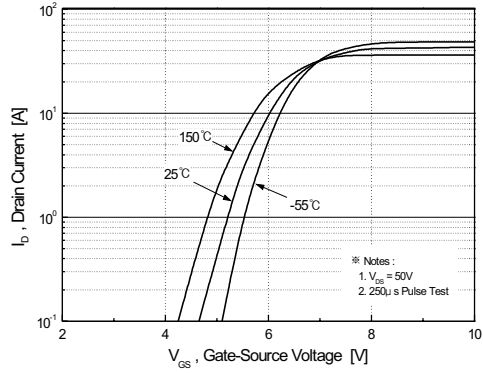


Figure 2. Transfer Characteristics

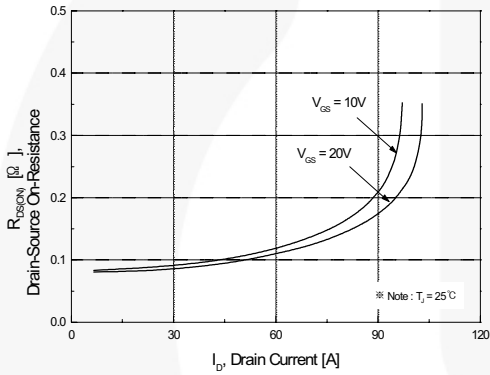


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

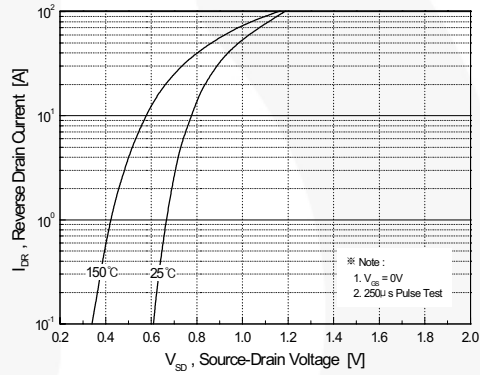


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

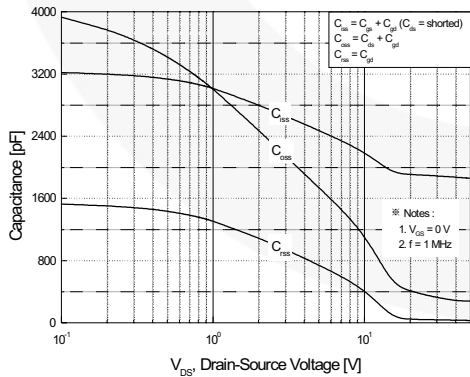


Figure 5. Capacitance Characteristics

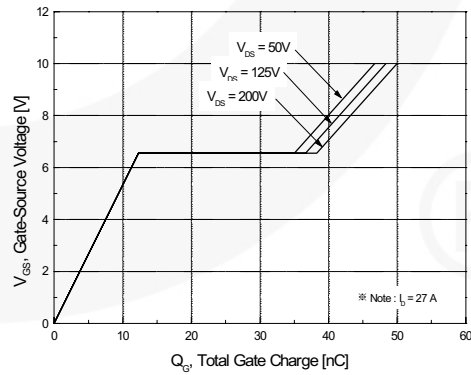
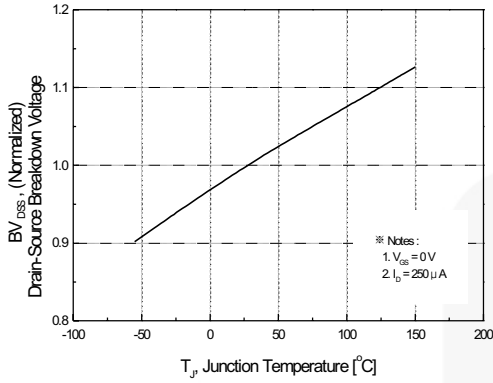
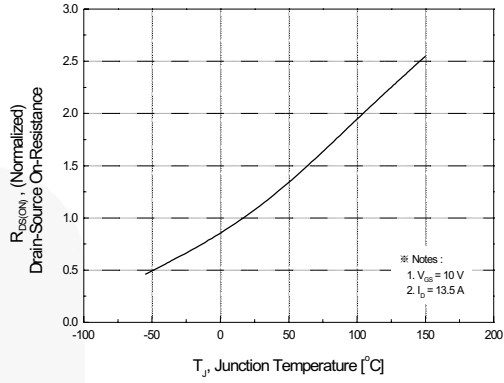


Figure 6. Gate Charge Characteristics

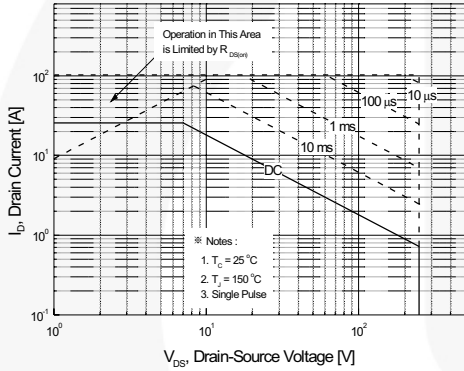
**Typical Characteristics** (Continued)



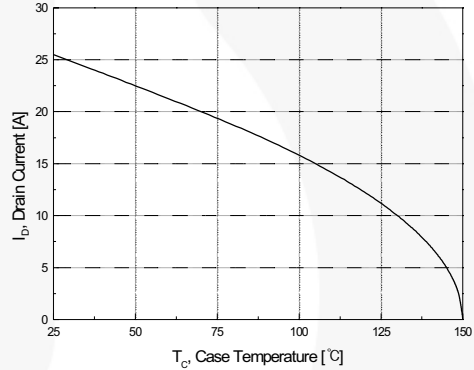
**Figure 7. Breakdown Voltage Variation vs. Temperature**



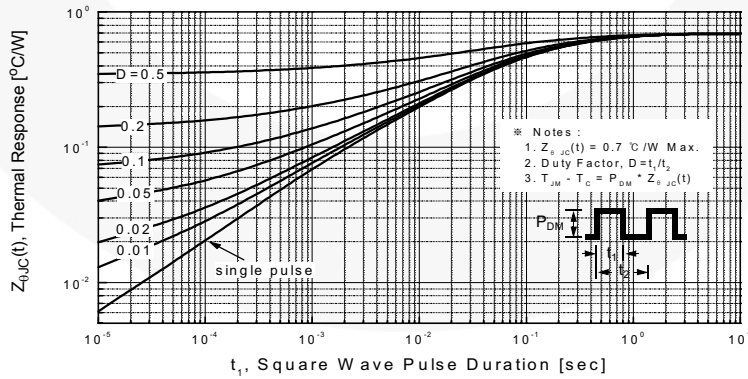
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**

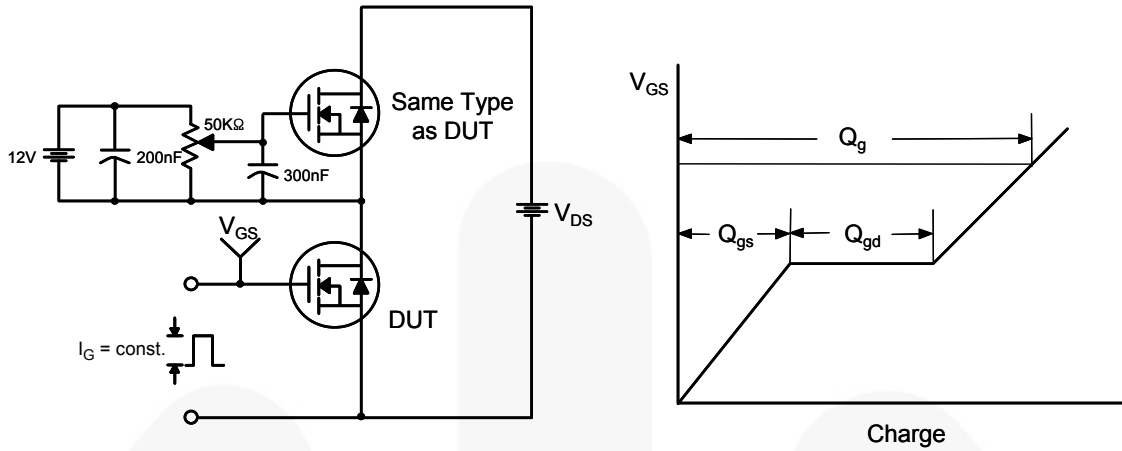


Figure 12. Gate Charge Test Circuit & Waveform

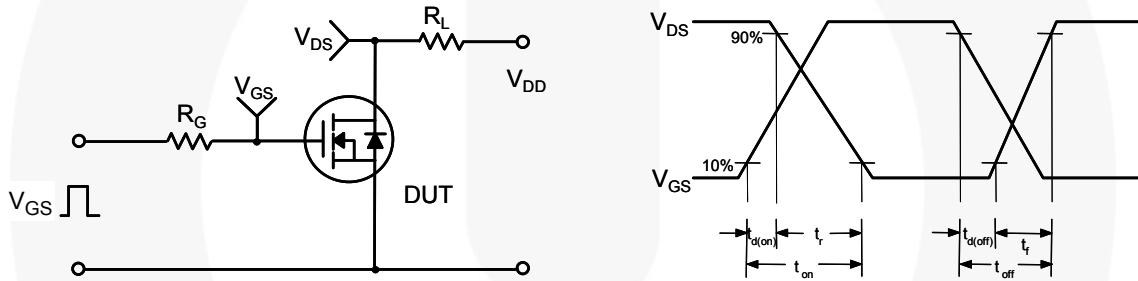


Figure 13. Resistive Switching Test Circuit & Waveforms

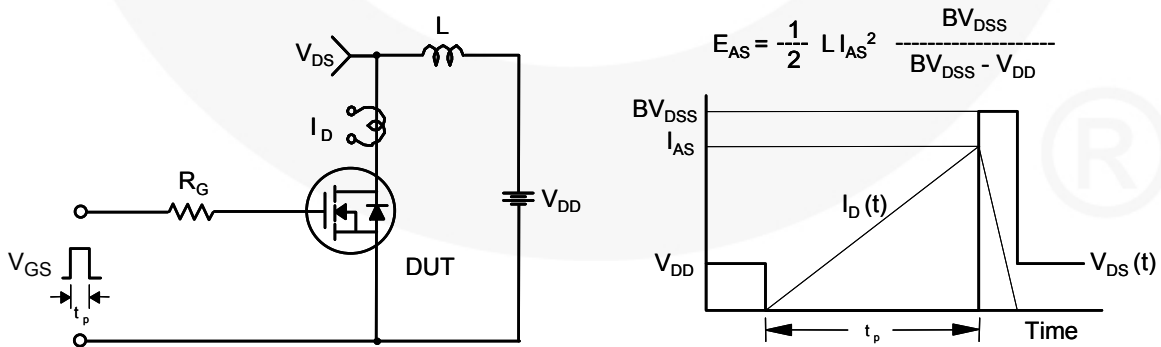


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

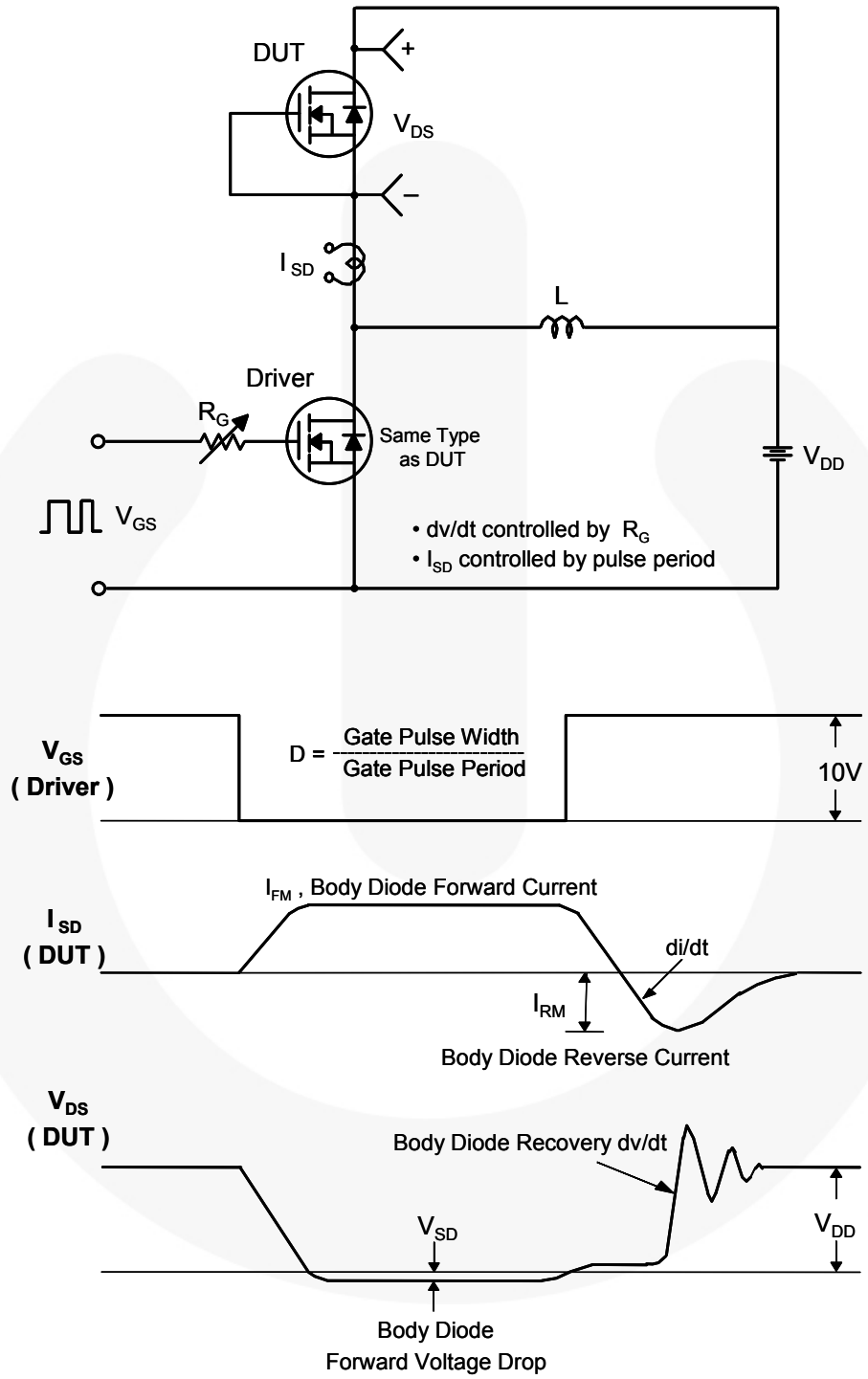
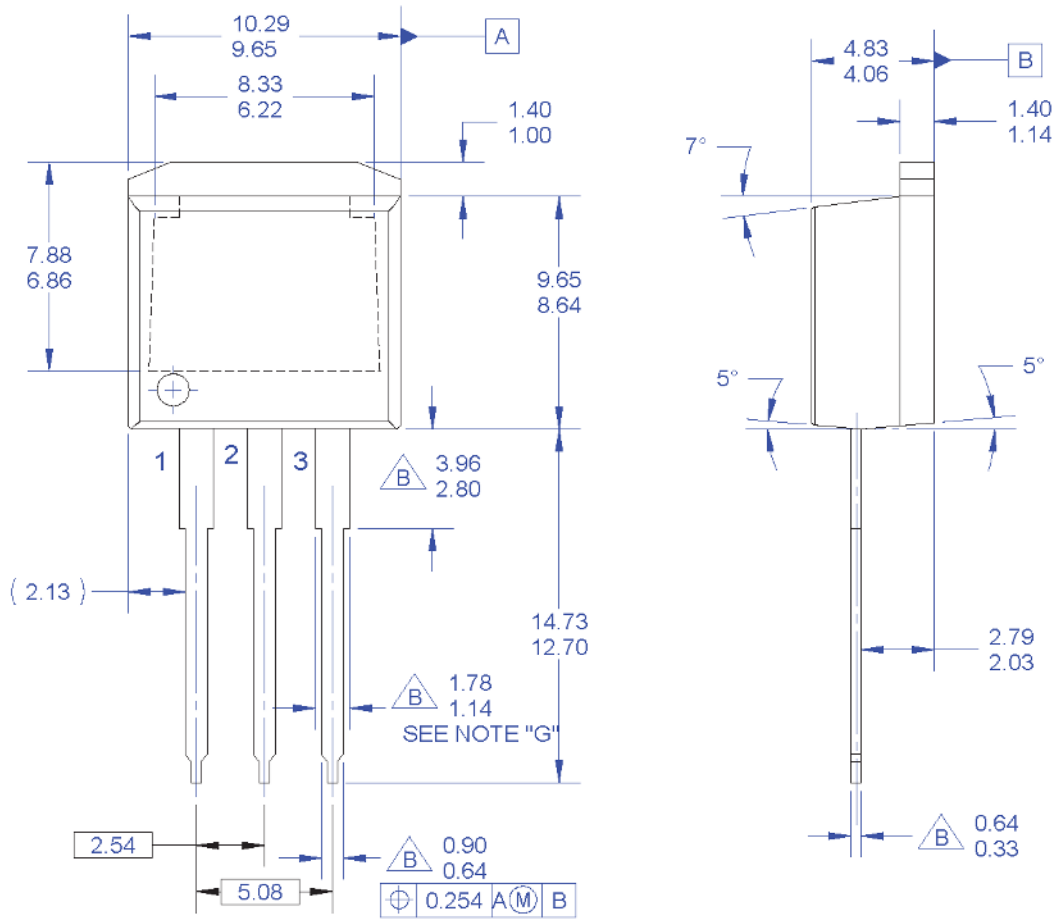


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



**NOTES:**

- A. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.
- $\triangle B$ . DOES NOT COMPLY JEDEC 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 ANSI Y14.5-1994.
- F. LOCATION OF PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF PACKAGE)
- G. MAXIMUM WIDTH FOR F102 DEVICE = 1.35 MAX.
- H. DRAWING FILE NAME: TO262A03REV5

**Figure 16. TO262 (I<sup>2</sup>PAK), Molded, 3-Lead, Jedec Variation AA**

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| AX-CAP®*                 | FRFET®  | <b>S</b> SYSTEM GENERAL®* |
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| Build it Now™            | GreenBridge™                                    | TinyBuck®                 |
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| CorePOWER™               | Green FPS™ e-Series™                            | TinyLogic®                |
| CROSSVOLT™               | Gmax™   | TINYOPTO™                 |
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| Current Transfer Logic™  | IntelliMAX™                                     | TinyPWM™                  |
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|                          | PowerTrench®                                    |                           |
|                          | PowerXS™  |                           |
|                          | Programmable Active Droop™                      |                           |
|                          | QFET®   |                           |
|                          | QS™   |                           |
|                          | Quiet Series™                                   |                           |
|                          | RapidConfigure™                                 |                           |
|                          | <b>TM</b>                                       |                           |
|                          | Saving our world, 1mW/W/kW at a time™           |                           |
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|                          | SuperFET®                                       |                           |
|                          | SuperSOT™-3                                     |                           |
|                          | SuperSOT™-6                                     |                           |
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Rev. I66