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## FQI5N60C

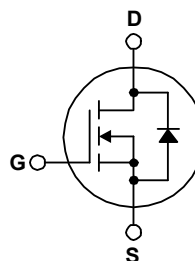
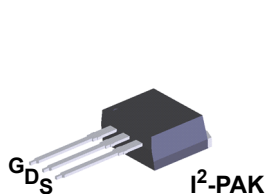
### N-Channel QFET® MOSFET 600 V, 4.5 A, 2.5 $\Omega$

#### Features

- 4.5 A, 600 V,  $R_{DS(on)} = 2.5 \Omega$  (Max.) @  $V_{GS} = 10$  V,  $I_D = 2.1$  A
- Low Gate Charge (Typ. 15 nC)
- Low  $C_{rss}$  (Typ. 6.5 pF)
- 100% Avalanche Tested

#### Description

This N-Channel enhancement mode power MOSFET is produced using ON 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.



#### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FQI5N60CTU	Unit
$V_{DSS}$	Drain-Source Voltage	600	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 100^\circ\text{C}$ )	4.5	A
		2.6	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	18	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	210	mJ
$I_{AR}$	Avalanche Current (Note 1)	4.5	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	10	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	100	W
		0.8	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

#### Thermal Characteristics

Symbol	Parameter	FQI5N60CTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.25	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQI5N60C	FQI5N60CTU	I <sup>2</sup> -PAK	Tube	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	600	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.6	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V	--	--	1	μA
		V <sub>DS</sub> = 480 V, T <sub>C</sub> = 125°C	--	--	10	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	--	--	-100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.0	--	4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.25 A	--	2.0	2.5	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 2.25 A	--	4.7	--	S
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,	--	515	670	pF
C <sub>oss</sub>	Output Capacitance	f = 1.0 MHz	--	55	72	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	6.5	8.5	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 300 V, I <sub>D</sub> = 4.5A,	--	10	30	ns
t <sub>r</sub>	Turn-On Rise Time	R <sub>G</sub> = 25 Ω	--	42	90	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	(Note 4)	--	38	85	ns
t <sub>f</sub>	Turn-Off Fall Time		--	46	100	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 480 V, I <sub>D</sub> = 4.5A,	--	15	19	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = 10 V	--	2.5	--	nC
Q <sub>gd</sub>	Gate-Drain Charge	(Note 4)	--	6.6	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	4.5	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	18	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 4.5 A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 4.5 A,	--	300	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> / dt = 100 A/μs	--	2.2	--	μC

### NOTES:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2.  $L = 18.9\text{ mH}, I_{AS} = 4.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 4.5\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

## Typical Characteristics

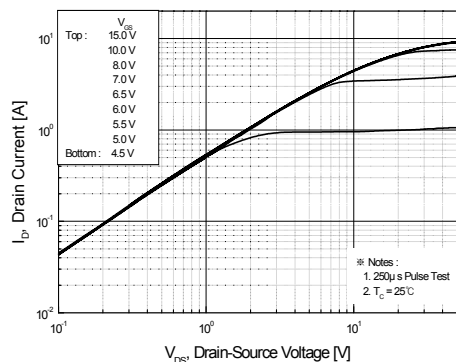


Figure 1. On-Region Characteristics

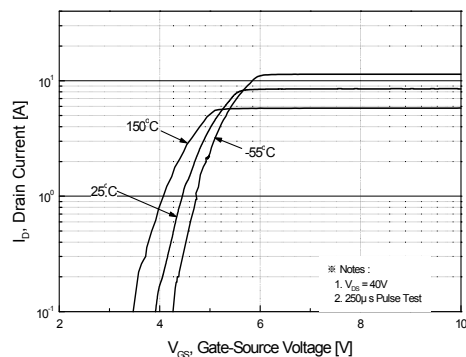


Figure 2. Transfer Characteristics

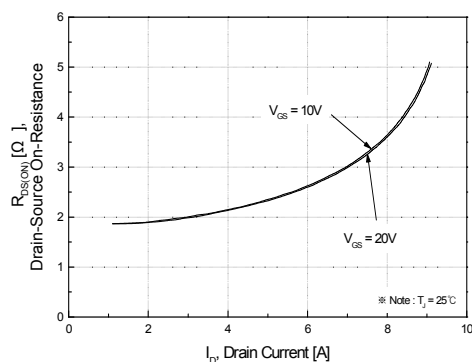


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

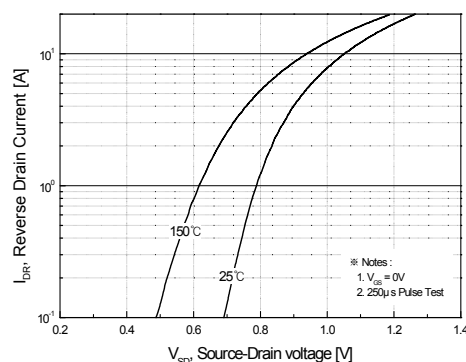


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

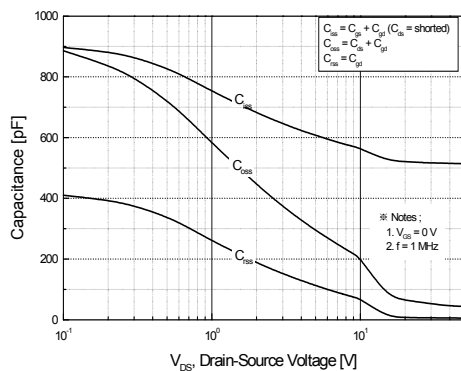


Figure 5. Capacitance Characteristics

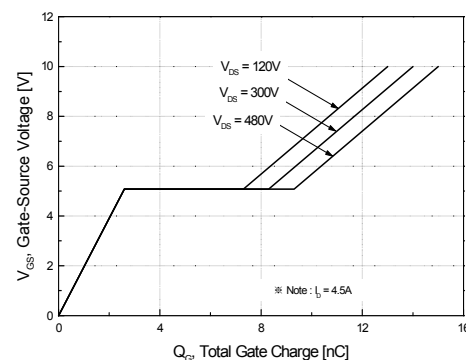


Figure 6. Gate Charge Characteristics

## Typical Characteristics (Continued)

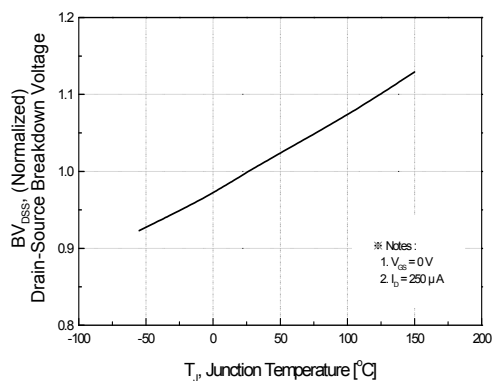


Figure 7. Breakdown Voltage Variation vs Temperature

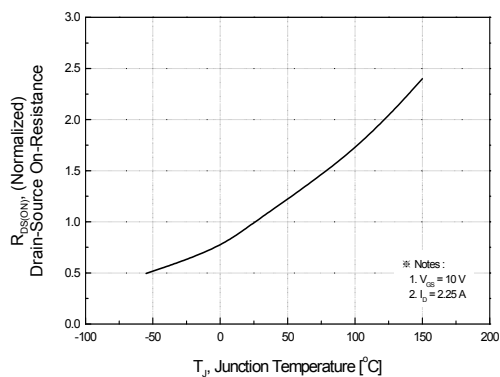


Figure 8. On-Resistance Variation vs Temperature

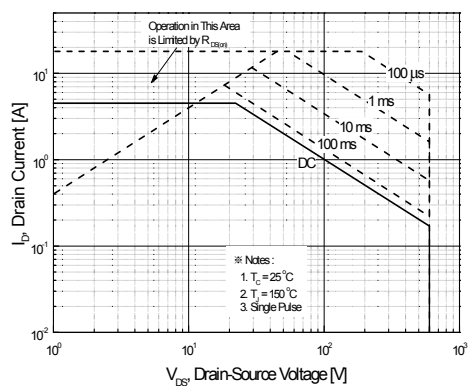


Figure 9. Maximum Safe Operating Area

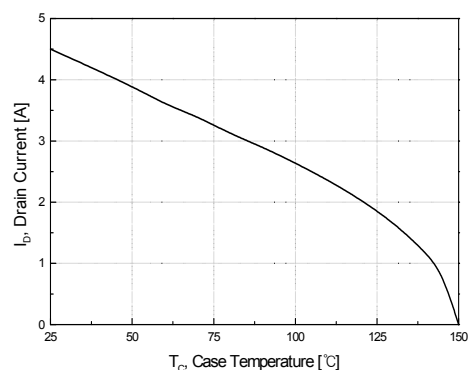


Figure 10. Maximum Drain Current vs Case Temperature

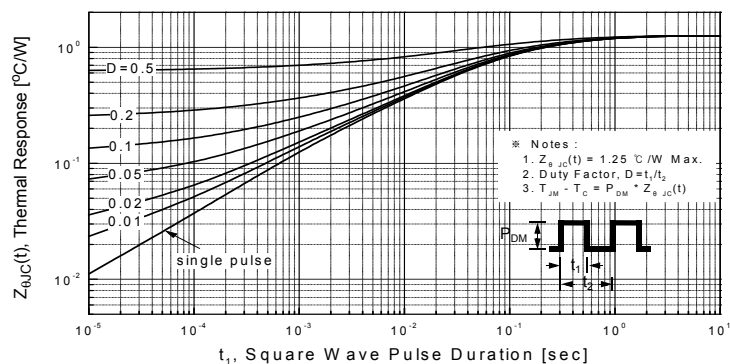


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform

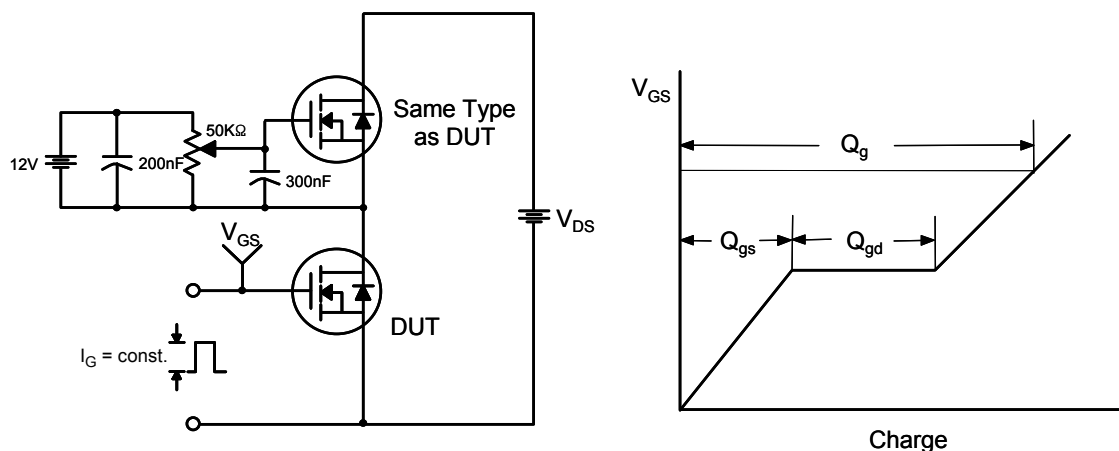


Figure 13. Resistive Switching Test Circuit & Waveforms

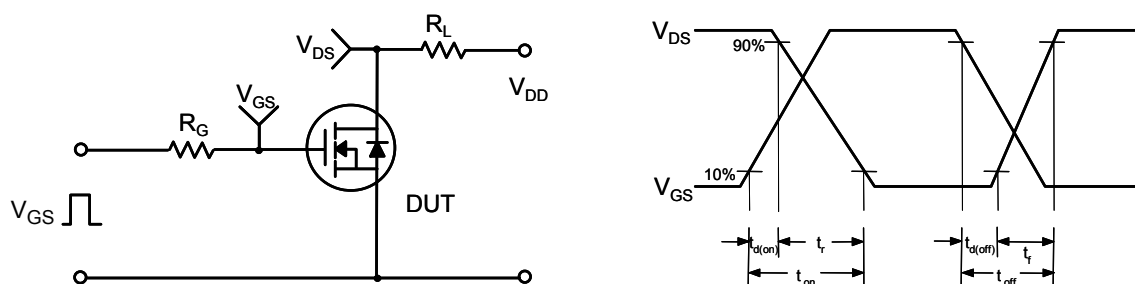


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

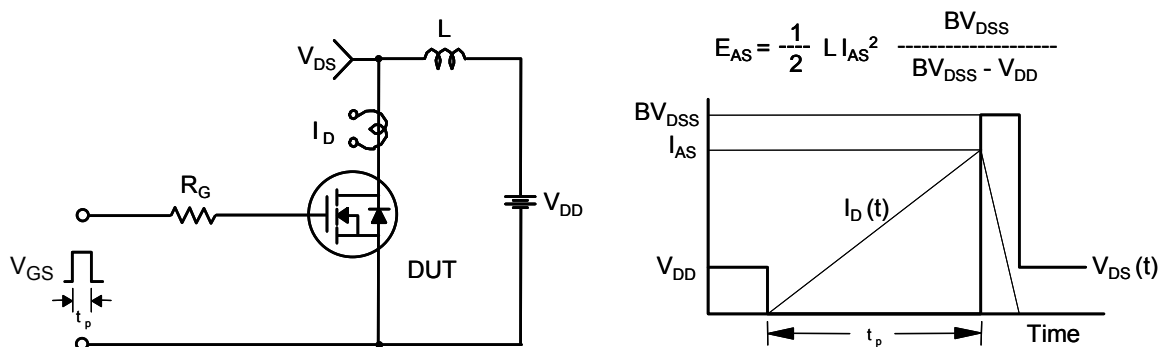
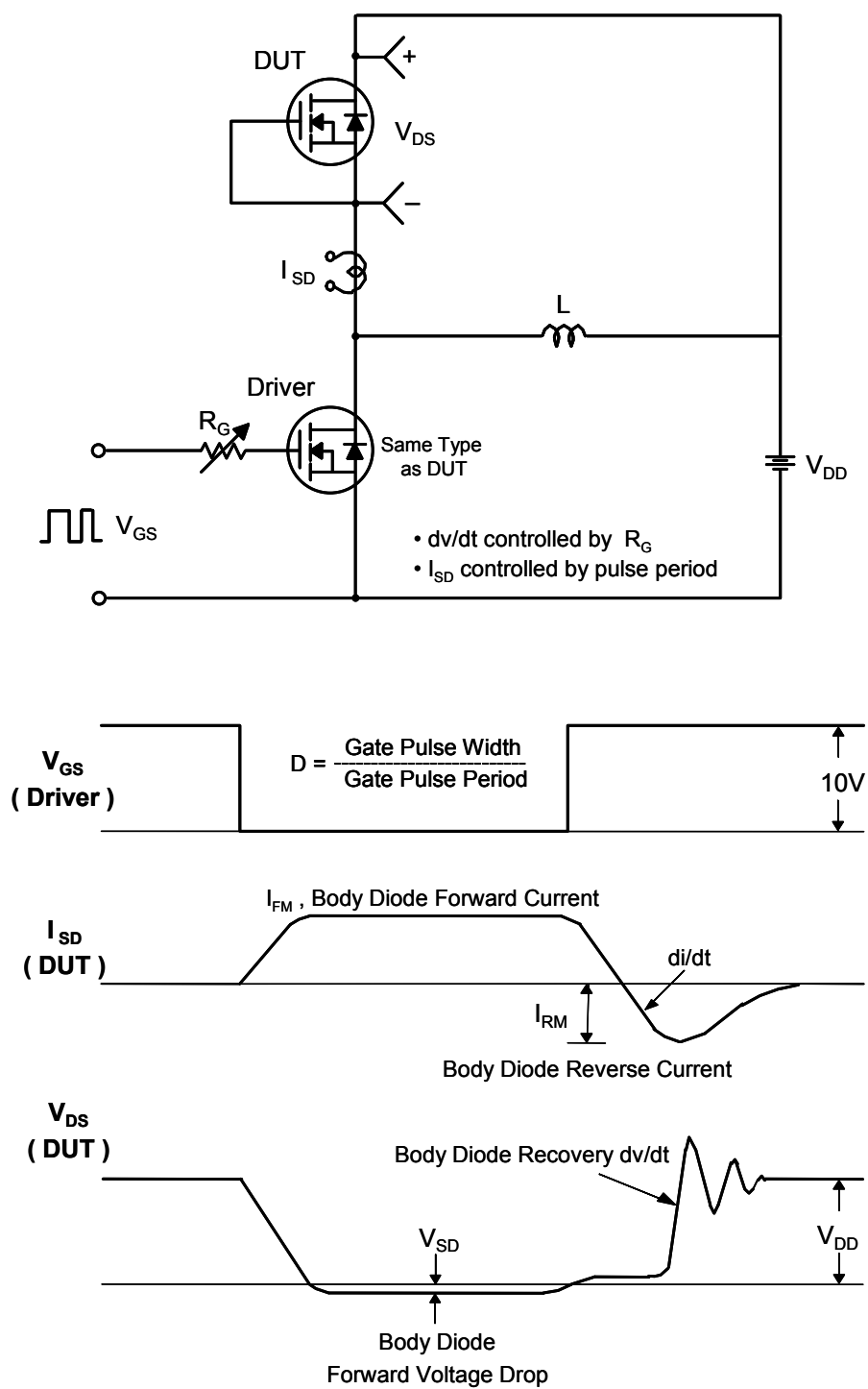
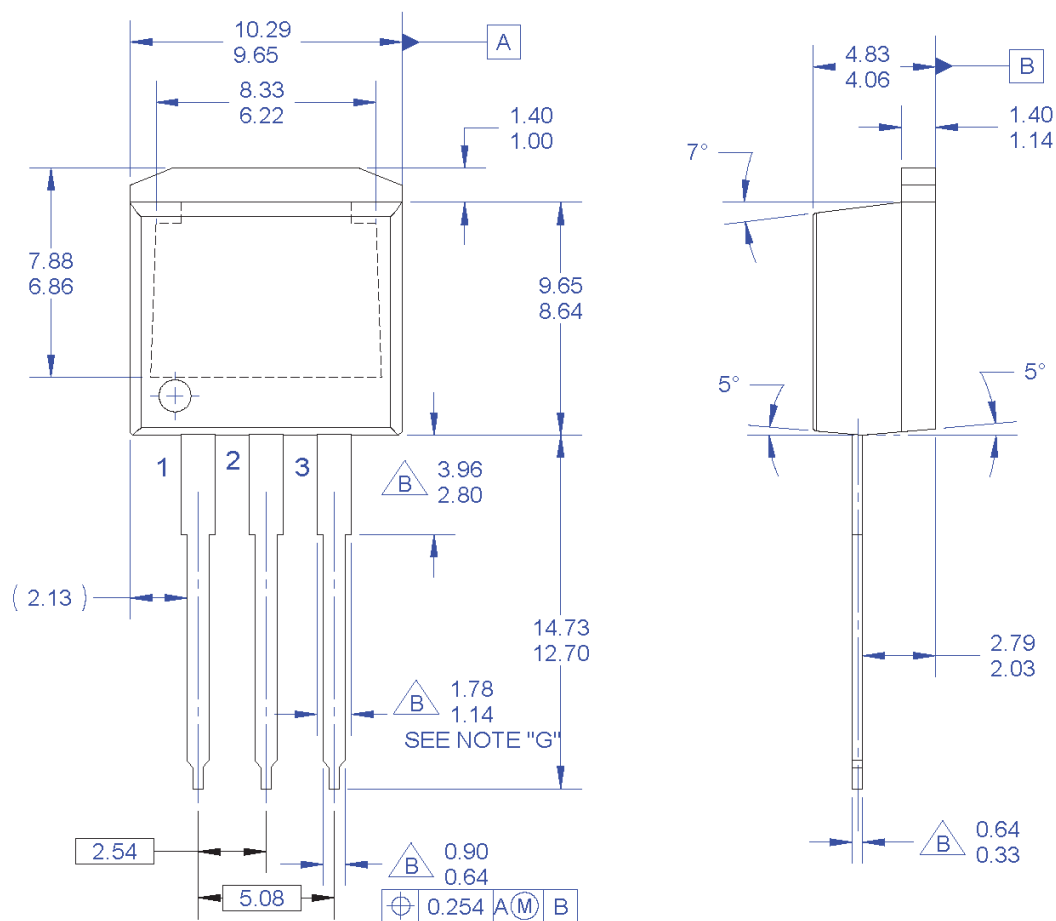


Figure 15. Peak Diode Recovery dv/dt Test Circuit &amp; Waveforms



## Mechanical Dimensions



## NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.
- 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 (I²PAK), Molded, 3-Lead, Jedec Variation AA

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