

# FQI13N50C

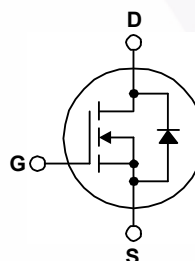
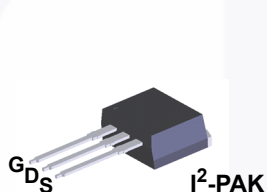
## N-Channel QFET® MOSFET 500 V, 13 A, 480 mΩ

### Features

- 13 A, 500 V,  $R_{DS(on)} = 480 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 6.5 \text{ A}$
- Low Gate Charge (Typ. 43 nC)
- Low  $C_{rss}$  (Typ. 20 pF)
- 100% Avalanche Tested
- RoHS Compliant

### 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.



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

Symbol	Parameter	FQI13N50CTU	Unit
$V_{DSS}$	Drain-Source Voltage	500	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	13	A
		8	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	52	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	860	mJ
$I_{AR}$	Avalanche Current (Note 1)	13	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	19.5	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 $25^\circ\text{C}$	195	W
		1.56	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	FQI13N50CTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.64	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ\text{C}/\text{W}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQ113N50C	FQ113N50CTU	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						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	500	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to 25°C	--	0.5	--	V/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$	--	--	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	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 6.5\text{ A}$	--	0.39	0.48	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 6.5\text{ A}$	--	15	--	S
Dynamic Characteristics						
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1580	2055	pF
$C_{oss}$	Output Capacitance		--	180	235	pF
$C_{rss}$	Reverse Transfer Capacitance		--	20	25	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{ V}, I_D = 13\text{ A},$ $R_G = 25\text{ }\Omega$  (Note 4)	--	25	60	ns
$t_r$	Turn-On Rise Time		--	100	210	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	270	ns
$t_f$	Turn-Off Fall Time		--	100	210	ns
$Q_g$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 13\text{ A},$ $V_{GS} = 10\text{ V}$  (Note 4)	--	43	56	nC
$Q_{gs}$	Gate-Source Charge		--	7.5	--	nC
$Q_{gd}$	Gate-Drain Charge		--	18.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		--	--	13	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		--	--	52	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 13\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 13\text{ A},$	--	410	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$	--	4.5	--	$\mu\text{C}$

### NOTES:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2.  $L = 6.0\text{ mH}, I_{AS} = 13\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 13\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

## Typical Characteristics

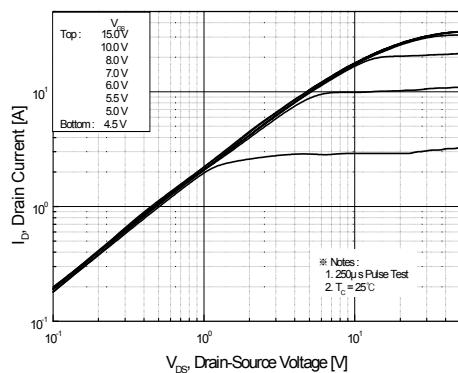


Figure 1. On-Region Characteristics

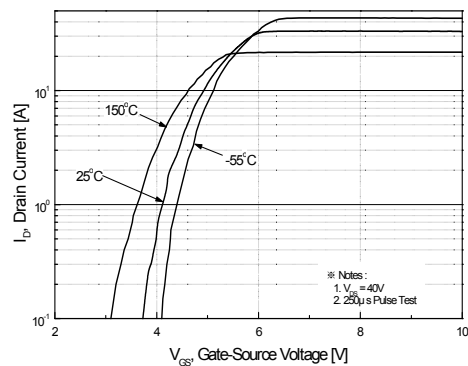


Figure 2. Transfer Characteristics

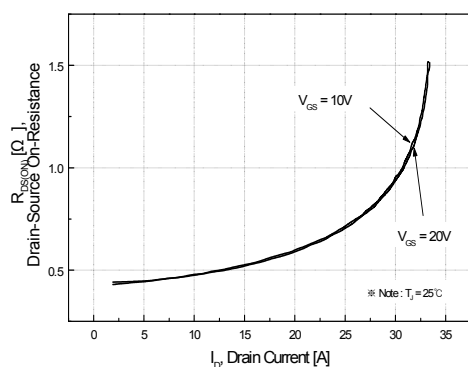


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

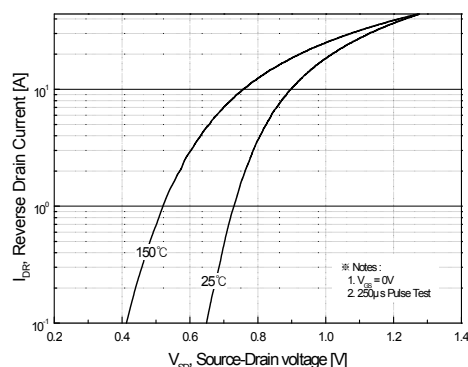


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

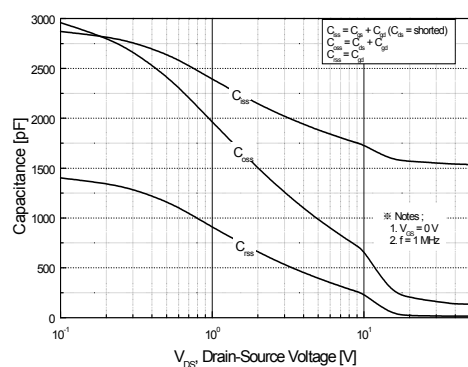


Figure 5. Capacitance Characteristics

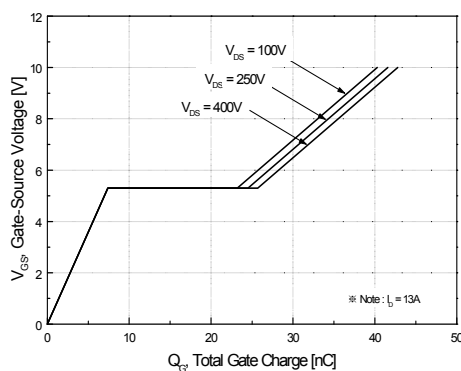


Figure 6. Gate Charge Characteristics

## Package Dimensions (Continued)

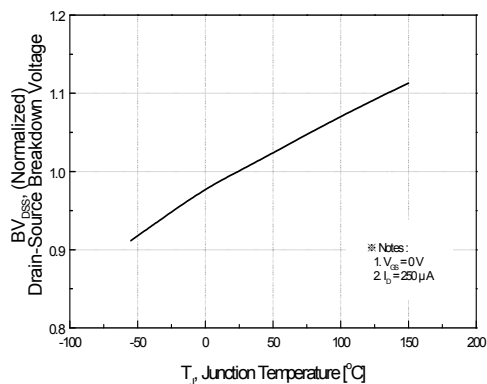


Figure 7. Breakdown Voltage Variation vs Temperature

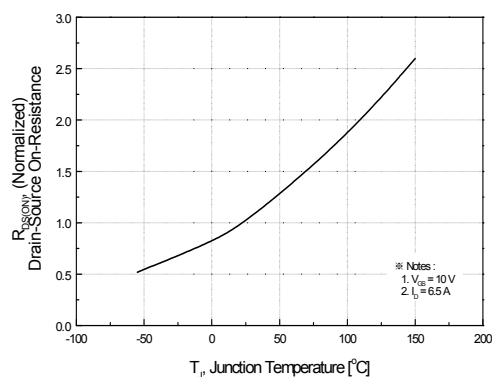


Figure 8. On-Resistance Variation vs Temperature

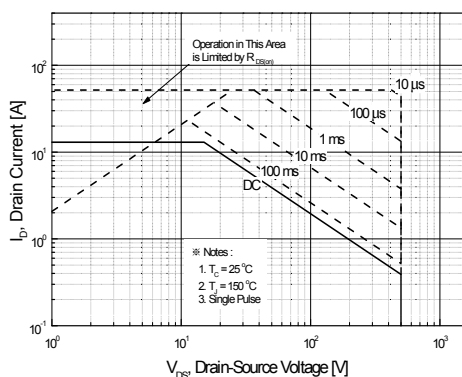


Figure 9. Maximum Safe Operating Area

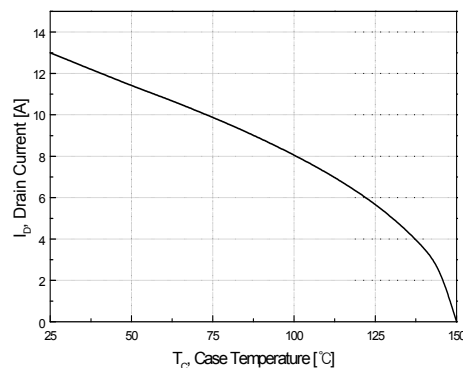


Figure 10. Maximum Drain Current vs Case Temperature

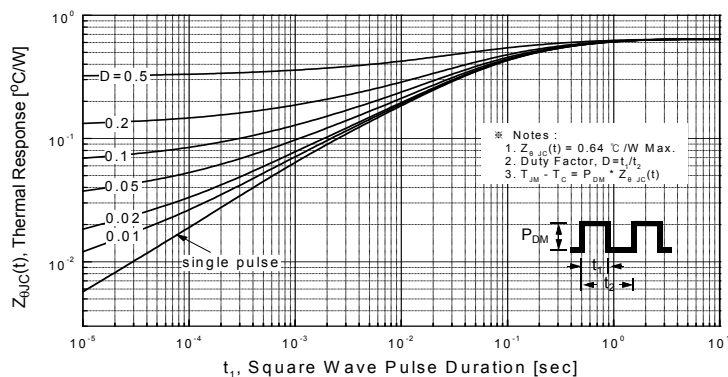


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform

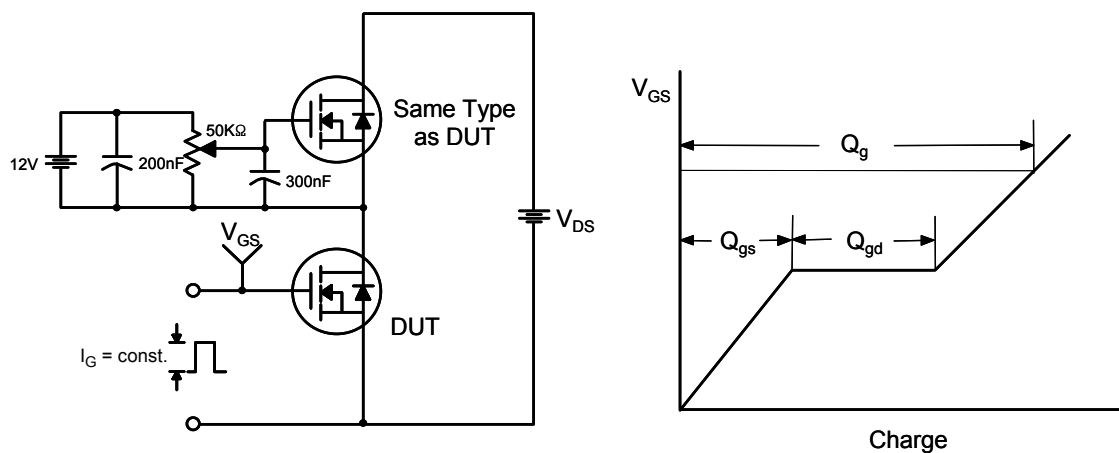


Figure 13. Resistive Switching Test Circuit & Waveforms

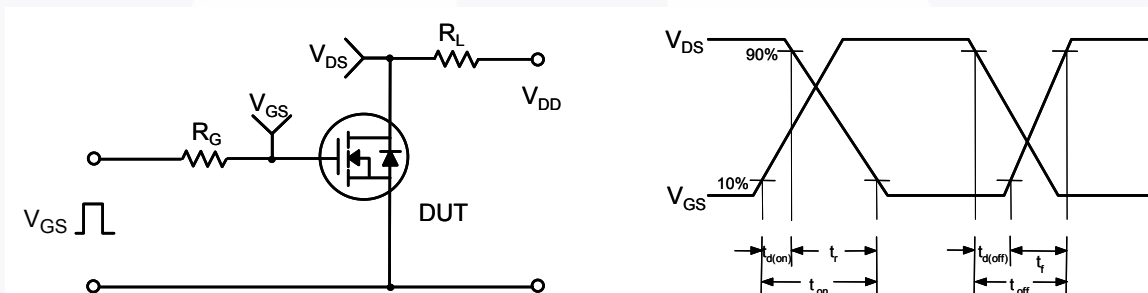


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

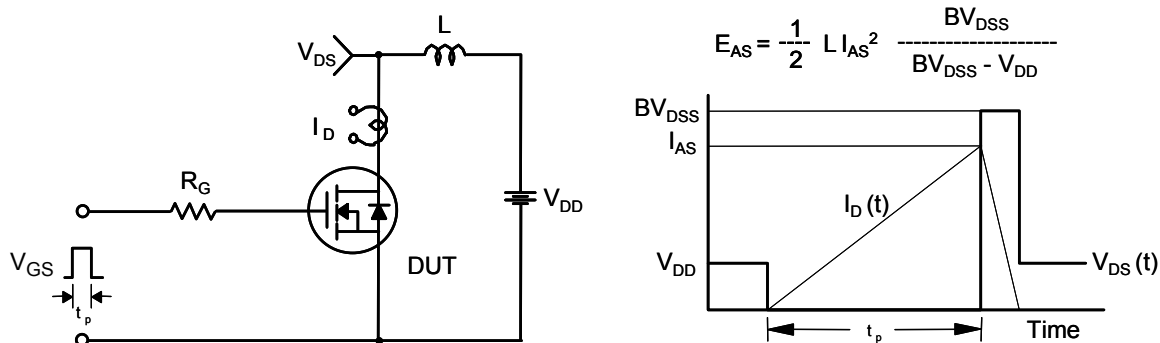
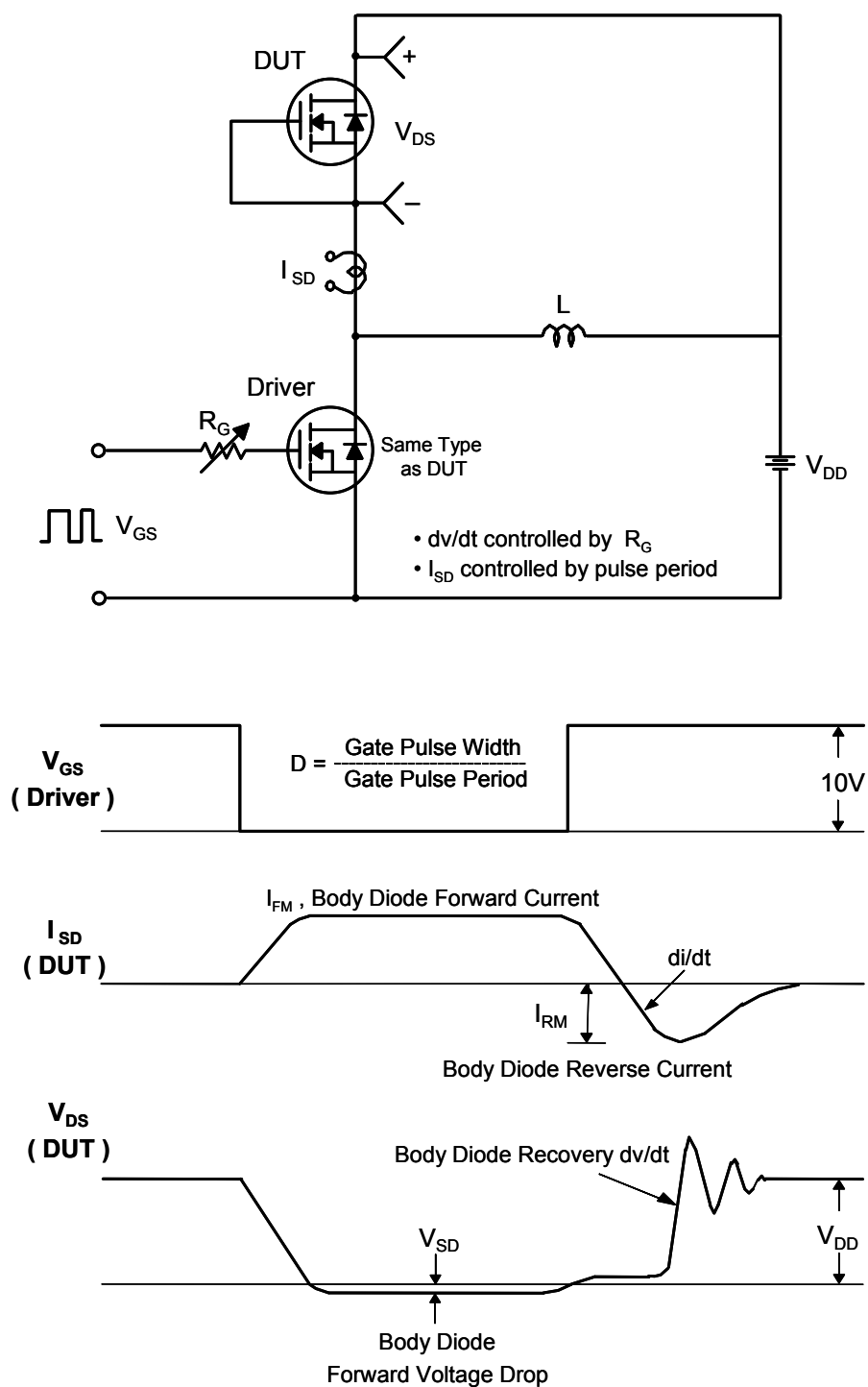
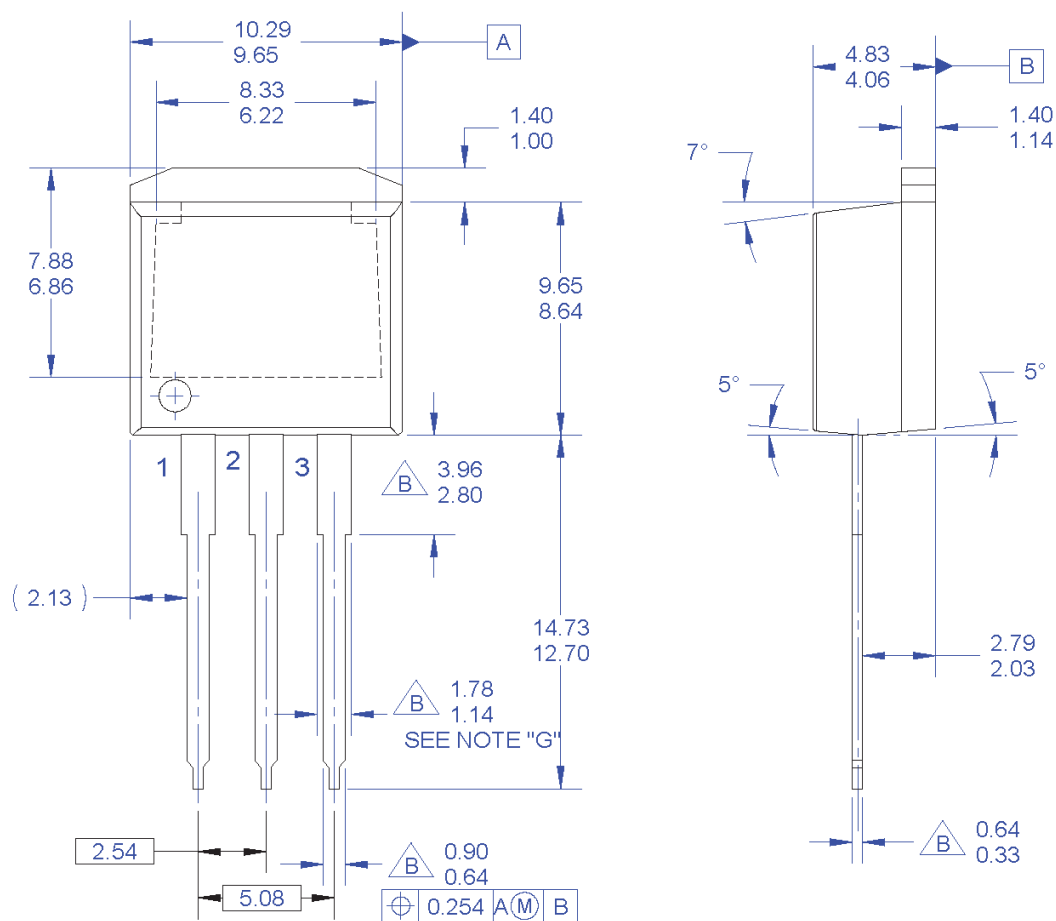


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



## Mechanical Dimensions



### NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.
- 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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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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Rev. I66