

# FDD6N50/ FDU6N50

## N-Channel UniFET™ MOSFET

500 V, 6 A, 900 mΩ

### Features

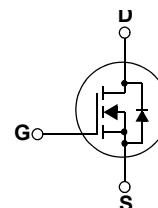
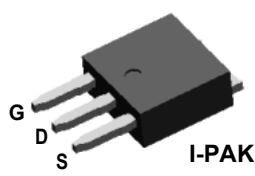
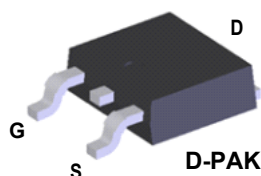
- $R_{DS(on)} = 900 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 3 \text{ A}$
- Low Gate Charge (Typ. 12.8 nC)
- Low  $C_{rss}$  (Typ. 9 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability

### Applications

- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

### Description

UniFET™ MOSFET is Fairchild Semiconductor®'s high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



### Absolute Maximum Ratings

Symbol	Parameter		FDD6N50/ FDU6N50	Unit
$V_{DSS}$	Drain-Source Voltage		500	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	6	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	3.8	A
$I_{DM}$	Drain Current	- Pulsed (Note 1)	24	A
$V_{GSS}$	Gate-Source voltage		$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	270	mJ
$I_{AR}$	Avalanche Current	(Note 1)	6	A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	8.9	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	89	W
		- Derate above $25^\circ\text{C}$	0.71	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 Purpose, 1/8" from Case for 5 Seconds		300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FDD6N50/ FDU6N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.4	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	83	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD6N50	FDD6N50TM	D-PAK	380mm	16mm	2500
FDD6N50S	FDD6N50TM_WS	D-PAK	380mm	16mm	2500
FDU6N50	FDU6N50TU	I-PAK	-	-	70

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

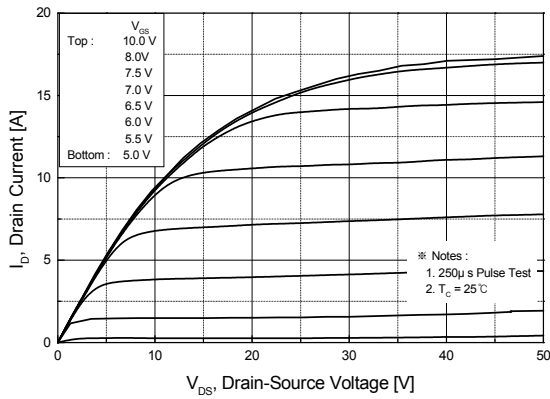
Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	500	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V V <sub>DS</sub> = 400V, T <sub>C</sub> = 125°C	-- --	-- --	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A	--	0.76	0.9	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 3A	--	2.5	--	S
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	720	940	pF
C <sub>oss</sub>	Output Capacitance		--	95	190	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	9	13.5	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250V, I <sub>D</sub> = 6A R <sub>G</sub> = 25Ω  (Note 4)	--	6	20	ns
t <sub>r</sub>	Turn-On Rise Time		--	55	120	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	25	60	ns
t <sub>f</sub>	Turn-Off Fall Time		--	35	80	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400V, I <sub>D</sub> = 6A V <sub>GS</sub> = 10V  (Note 4)	--	12.8	16.6	nC
Q <sub>gs</sub>	Gate-Source Charge		--	3.7	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	5.8	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	6	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	24	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 6A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 6A	--	275	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> /dt =100A/μs	--	1.7	--	μC

### NOTES:

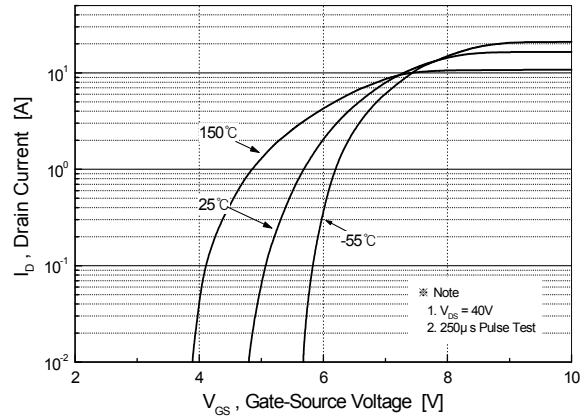
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>AS</sub> = 6A, V<sub>DD</sub> = 50V, L = 13.5mH, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 6A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

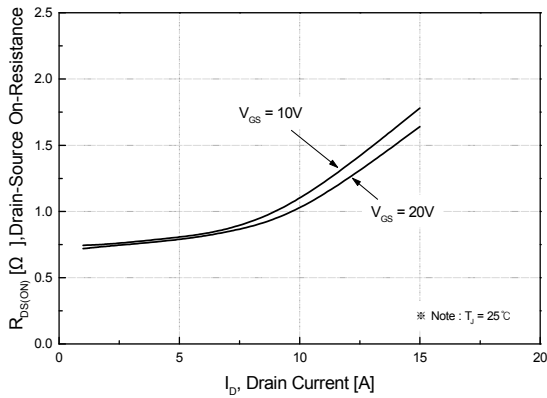
**Figure 1. On-Region Characteristics**



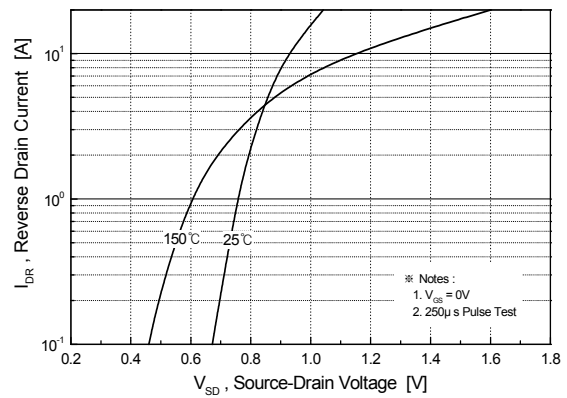
**Figure 2. Transfer Characteristics**



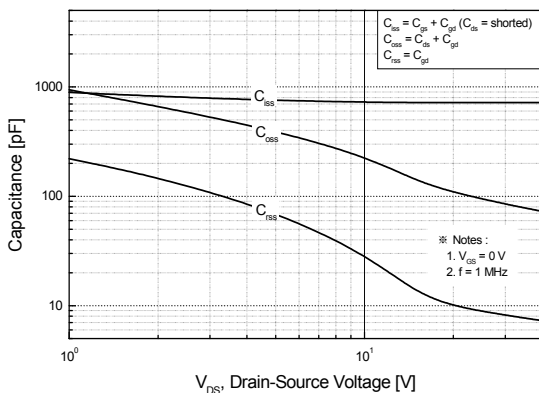
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



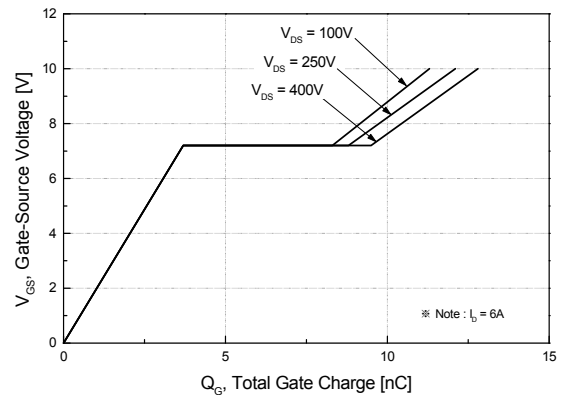
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

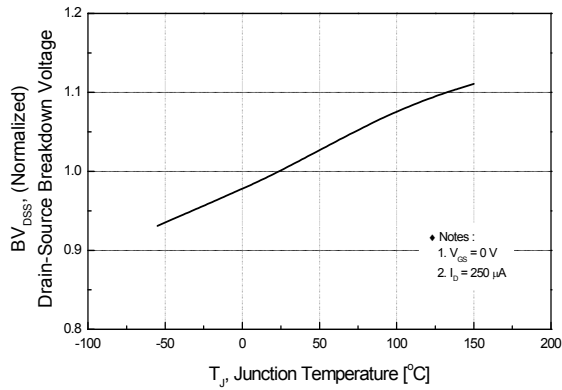


**Figure 6. Gate Charge Characteristics**

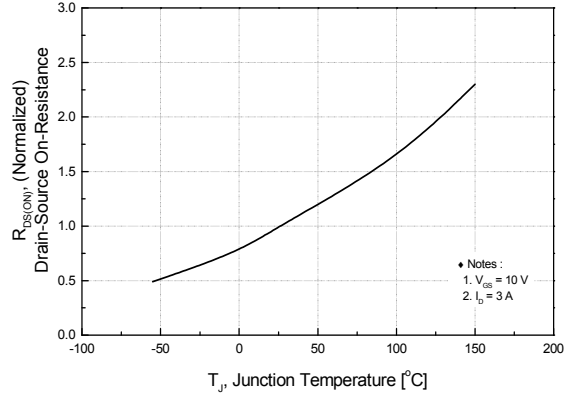


## Typical Performance Characteristics (Continued)

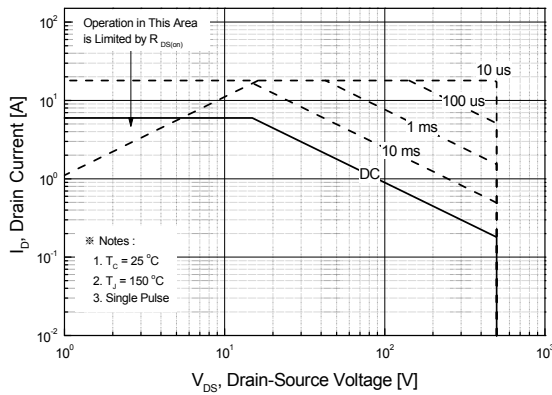
**Figure 7. Breakdown Voltage Variation vs. Temperature**



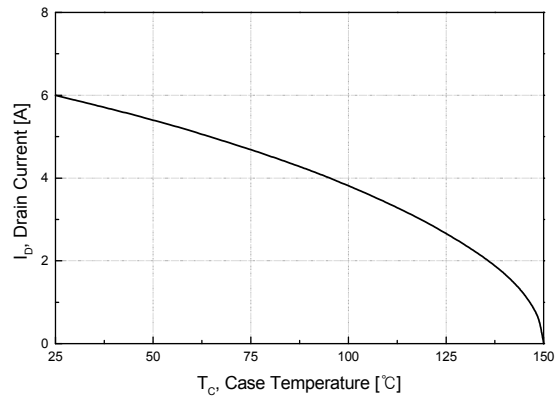
**Figure 8. On-Resistance Variation vs. Temperature**



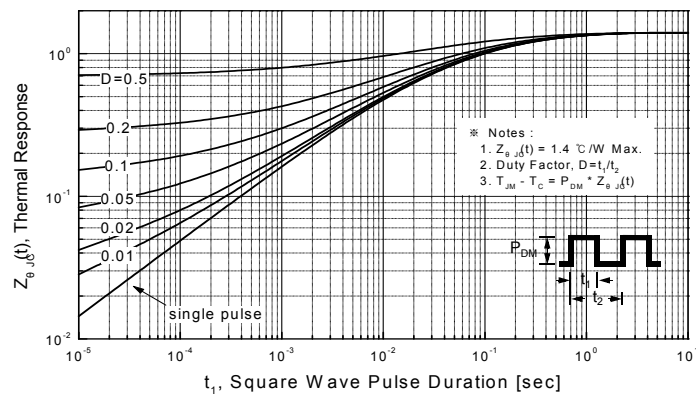
**Figure 9. Maximum Safe Operating Area**



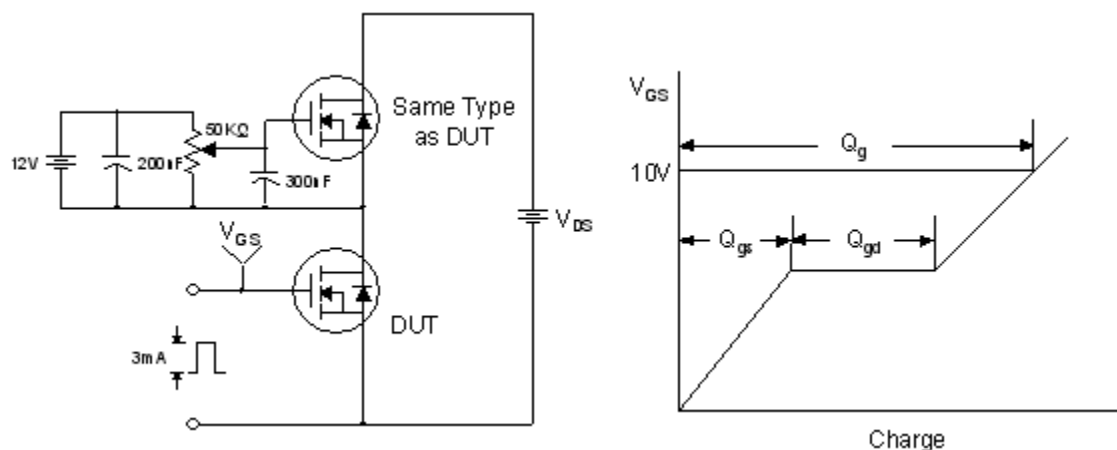
**Figure 10. Maximum Drain Current vs. Case Temperature**



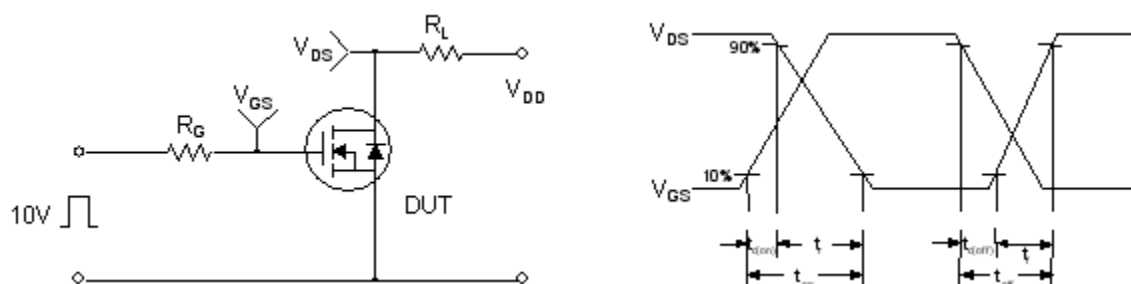
**Figure 11. Transient Thermal Response Curve**



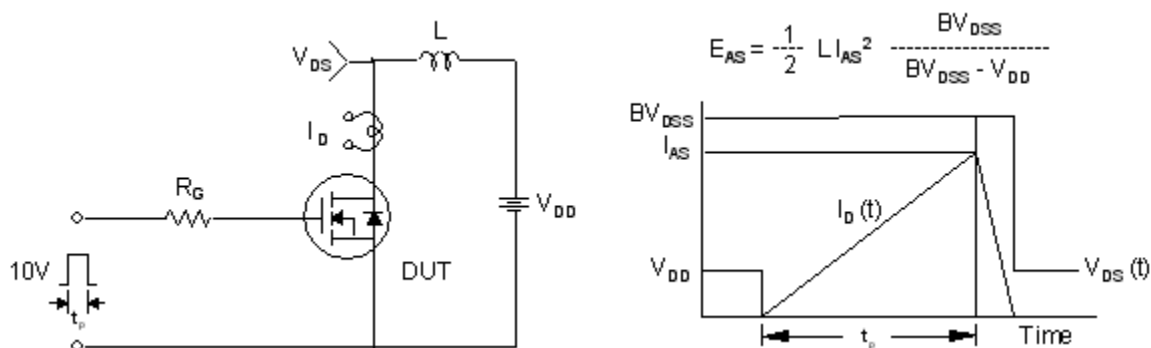
**Gate Charge Test Circuit & Waveform**



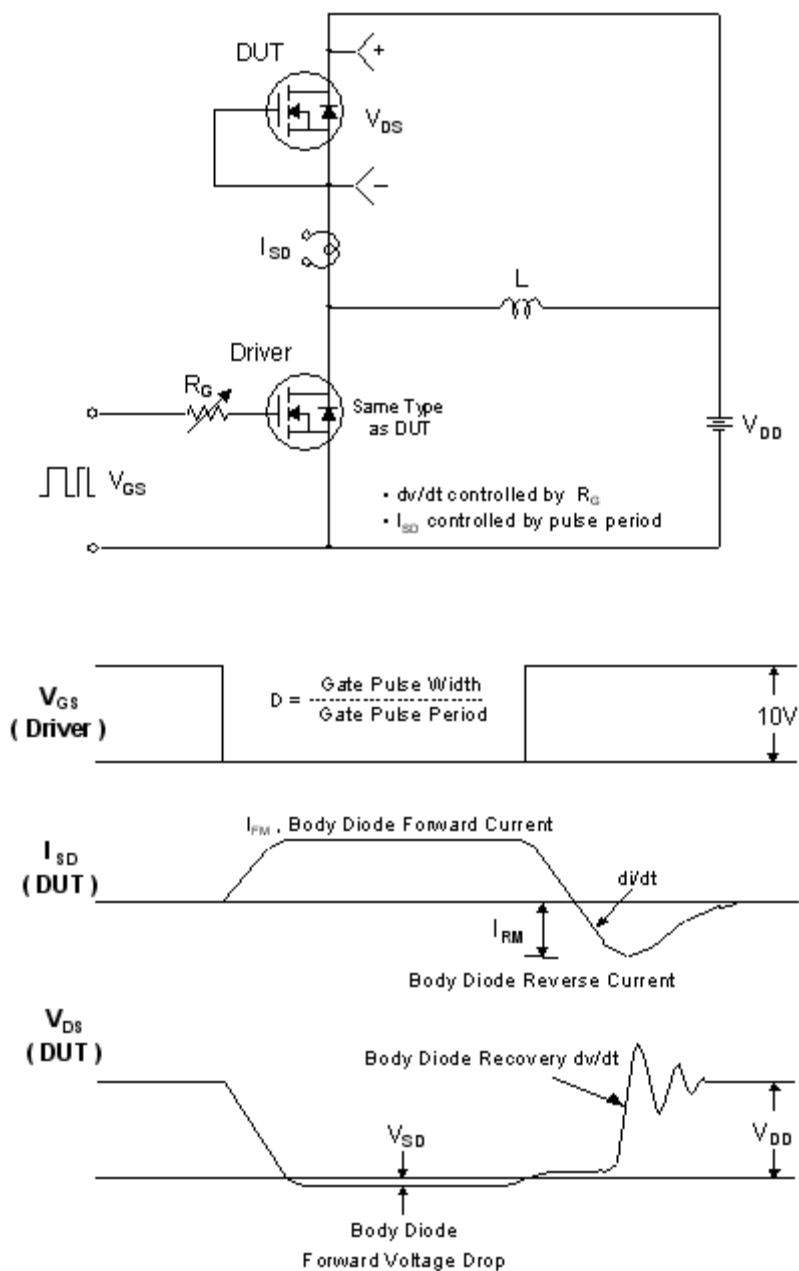
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

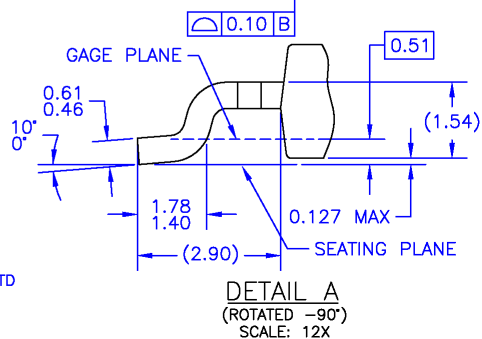
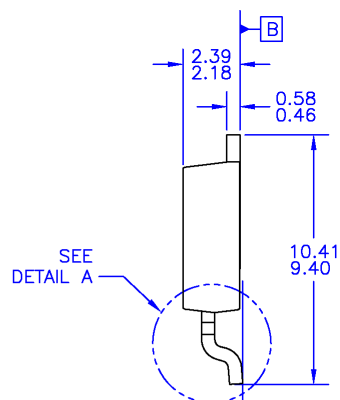
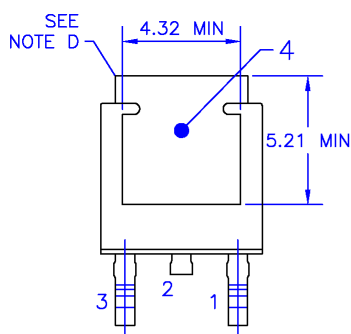
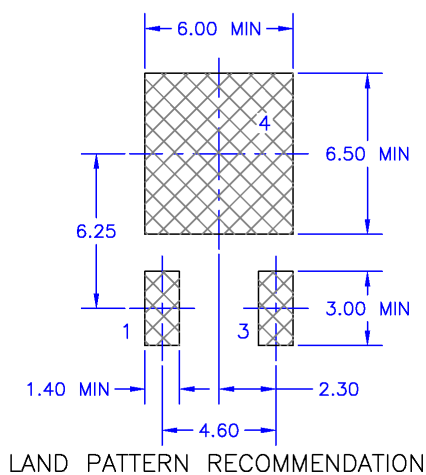
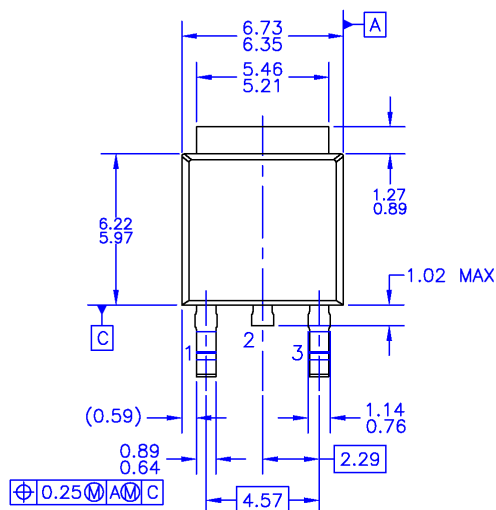


# Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Mechanical Dimensions

## D-PAK

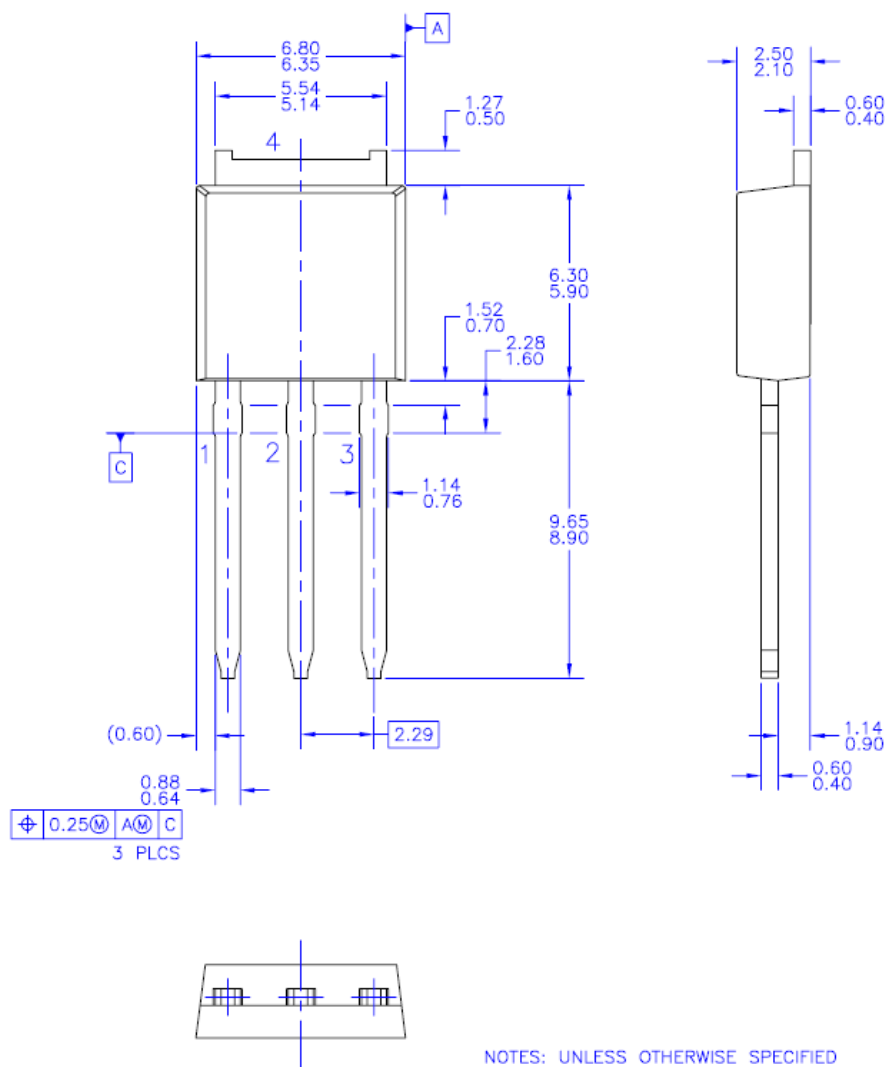


- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
  - D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.
  - E) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.
  - F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
  - G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO220P1003X238-3N.
  - H) DRAWING NUMBER AND REVISION: MKT-T0252A03REV8

Dimensions in Millimeters

# Mechanical Dimensions

## I-PAK



NOTES: UNLESS OTHERWISE SPECIFIED

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- B) THIS PACKAGE CONFORMS TO JEDEC, TO-251, ISSUE C, VARIATION AA, DATED SEP 1988.
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Dimensions in Millimeters





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