

FQD4N50 / FQU4N50

N-Channel QFET® MOSFET

500 V, 2.6 A, 2.7 Ω

March 2013

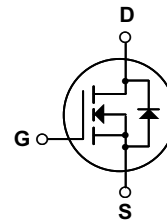
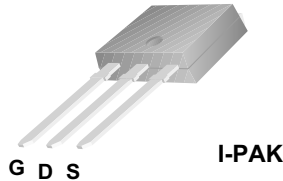
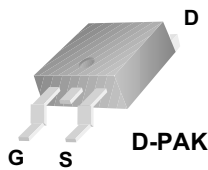


Description

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

- 2.6 A, 500 V, $R_{DS(on)}=2.7 \Omega(\text{Max.})@V_{GS}=10 \text{ V}, I_D=1.3 \text{ A}$
- Low Gate Charge (Typ. 10 nC)
- Low C_{rss} (Typ. 6.0 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQD4N50 / FQU4N50	Unit
V_{DSS}	Drain-Source Voltage	500	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	2.6	A
	- Continuous ($T_C = 100^\circ\text{C}$)	1.64	A
I_{DM}	Drain Current - Pulsed (Note 1)	10.4	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	260	mJ
I_{AR}	Avalanche Current (Note 1)	2.6	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	4.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_A = 25^\circ\text{C}$) *	2.5	W
	Power Dissipation ($T_C = 25^\circ\text{C}$)	45	W
	- Derate above 25°C	0.36	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	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	2.78	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	50	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	110	$^\circ\text{C}/\text{W}$

* When mounted on the minimum pad size recommended (PCB Mount)

Electrical Characteristics T_C = 25°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 V, I _D = 250 μA	500	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.38	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V	--	--	1	μA
		V _{DS} = 400 V, T _C = 125°C	--	--	10	μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0 V	--	--	-100	nA

On Characteristics

V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 1.3 A	--	2.0	2.7	Ω
g _{FS}	Forward Transconductance	V _{DS} = 50 V, I _D = 1.3 A (Note 4)	--	2.6	--	S

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	350	460	pF
C _{oss}	Output Capacitance		--	55	70	pF
C _{rss}	Reverse Transfer Capacitance		--	6	8	pF

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{DD} = 250 V, I _D = 3.4 A, R _G = 25 Ω (Note 4, 5)	--	12	30	ns
t _r	Turn-On Rise Time		--	45	100	ns
t _{d(off)}	Turn-Off Delay Time		--	20	50	ns
t _f	Turn-Off Fall Time		--	30	70	ns
Q _g	Total Gate Charge	V _{DS} = 400 V, I _D = 3.4 A, V _{GS} = 10 V (Note 4, 5)	--	10	13	nC
Q _{gs}	Gate-Source Charge		--	2.5	--	nC
Q _{gd}	Gate-Drain Charge		--	4.7	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current	--	--	2.6	A	
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	10.4	A	
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 2.6 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 3.4 A, di _F / dt = 100 A/μs (Note 4)	--	210	--	ns
Q _{rr}	Reverse Recovery Charge		--	1.15	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 68mH, I_{AS} = 2.6A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 3.4A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

Typical Characteristics

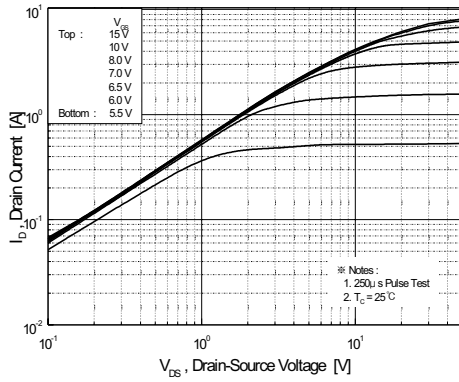


Figure 1. On-Region Characteristics

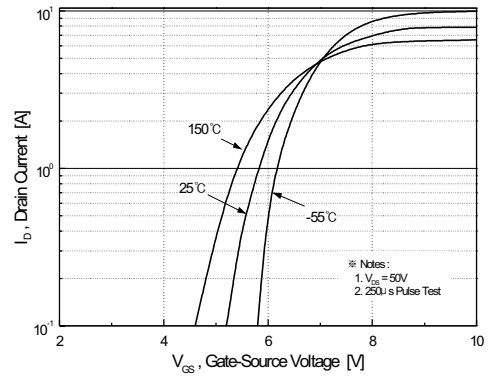


Figure 2. Transfer Characteristics

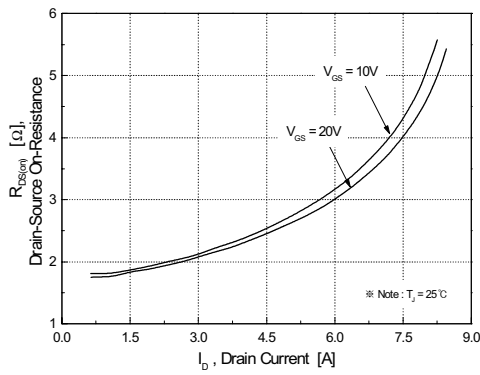


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

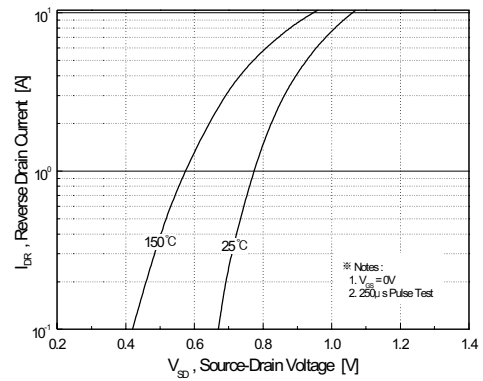


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

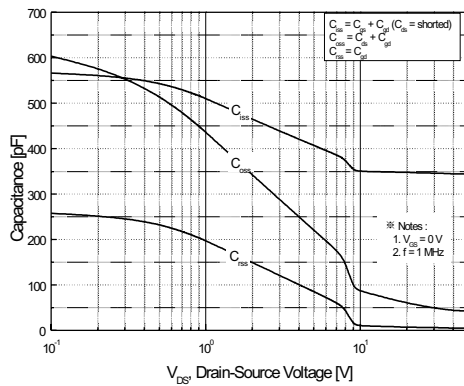


Figure 5. Capacitance Characteristics

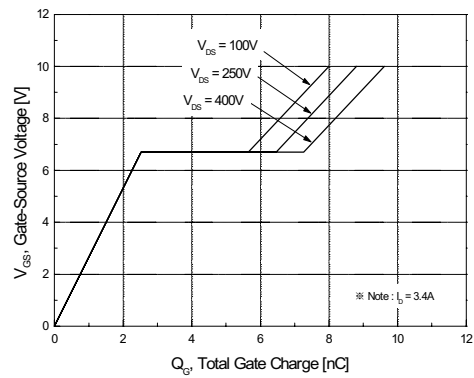


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

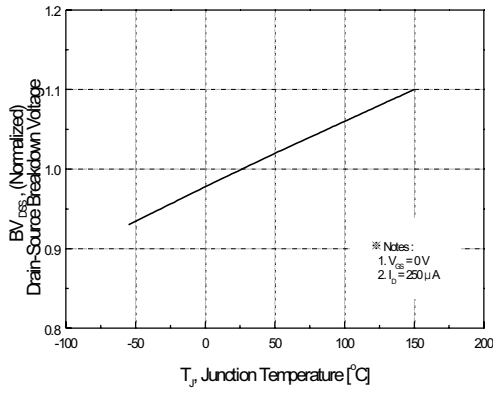


Figure 7. Breakdown Voltage Variation vs. Temperature

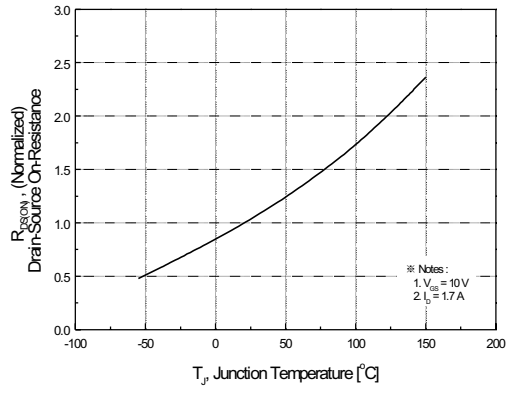


Figure 8. On-Resistance Variation vs. Temperature

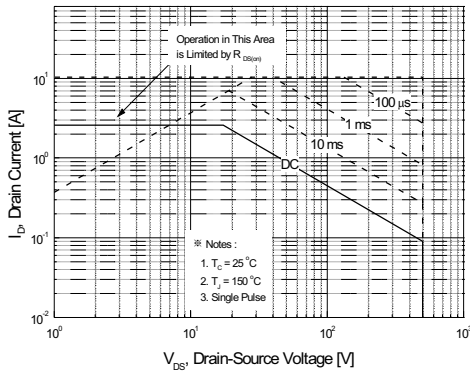


Figure 9. Maximum Safe Operating Area

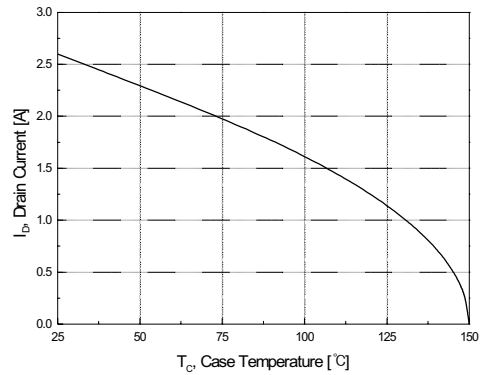


Figure 10. Maximum Drain Current vs. Case Temperature

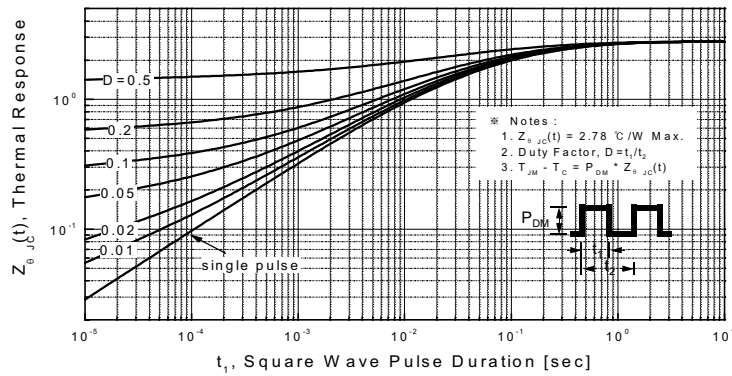
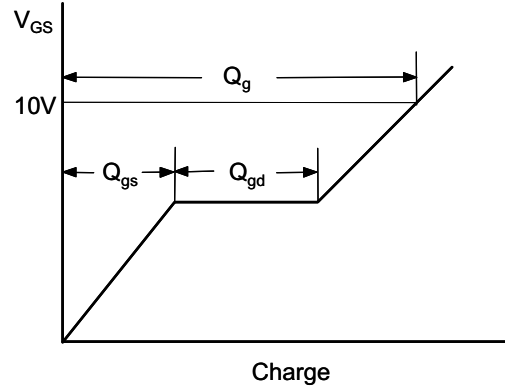
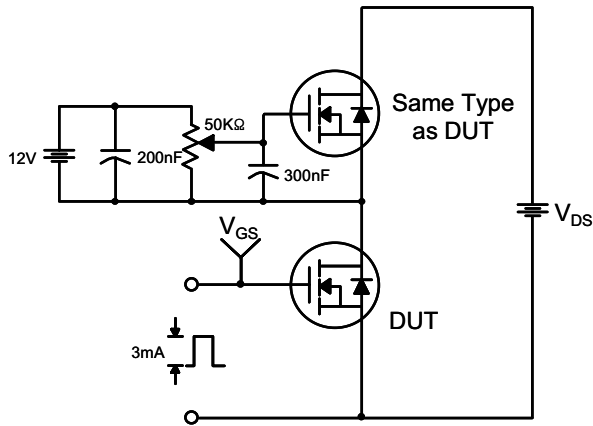
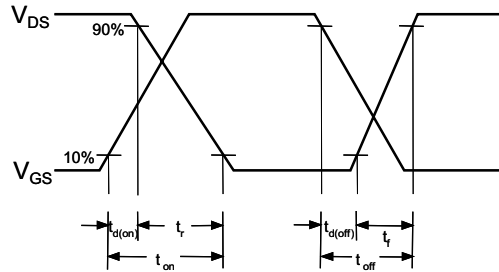
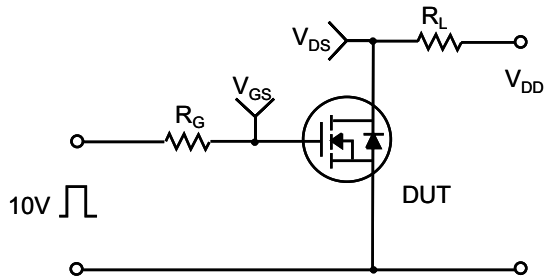


Figure 11. Transient Thermal Response Curve

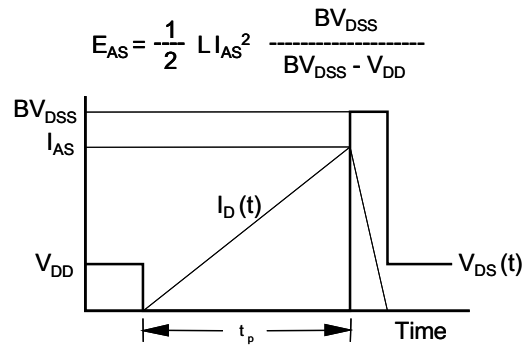
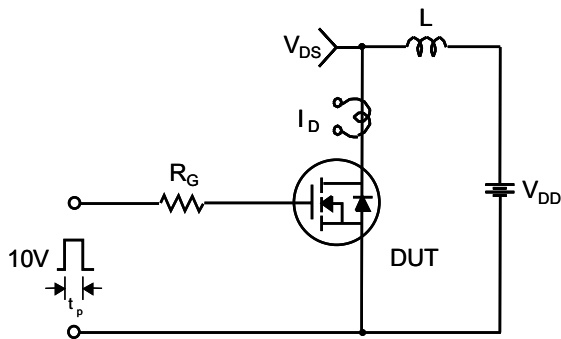
Gate Charge Test Circuit & Waveform



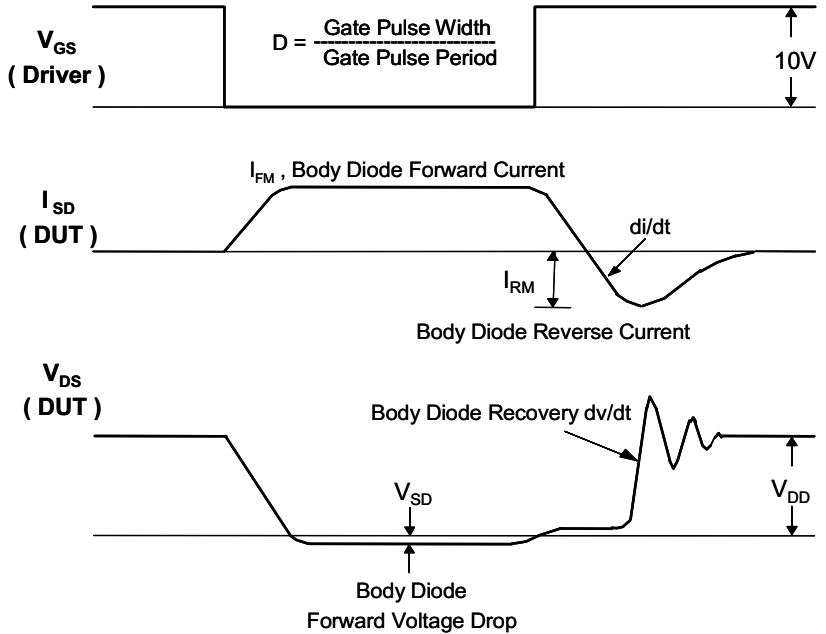
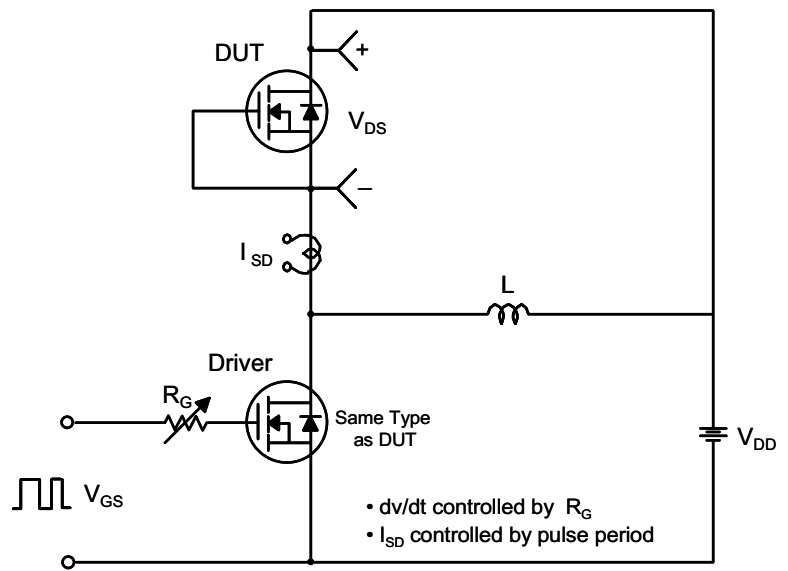
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

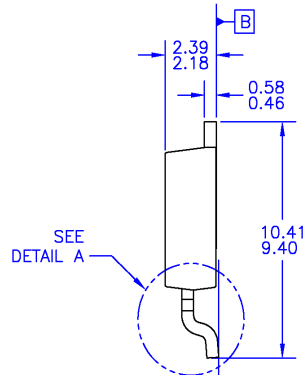
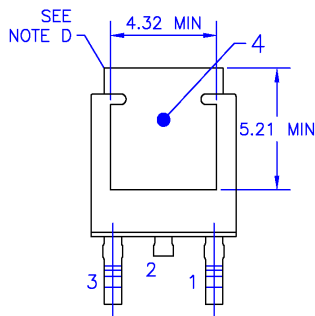
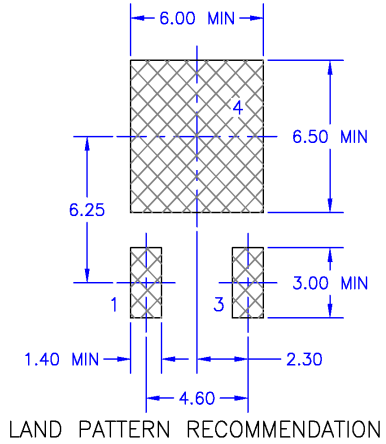
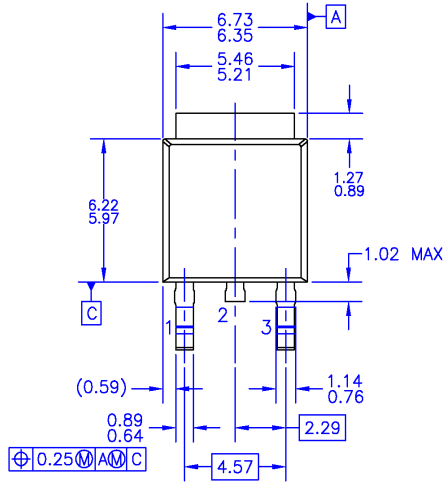


Peak Diode Recovery dv/dt Test Circuit & Waveforms

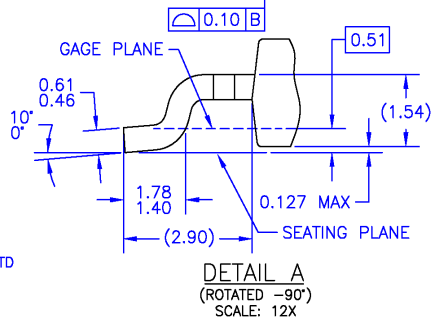


Mechanical Dimensions

D-PAK



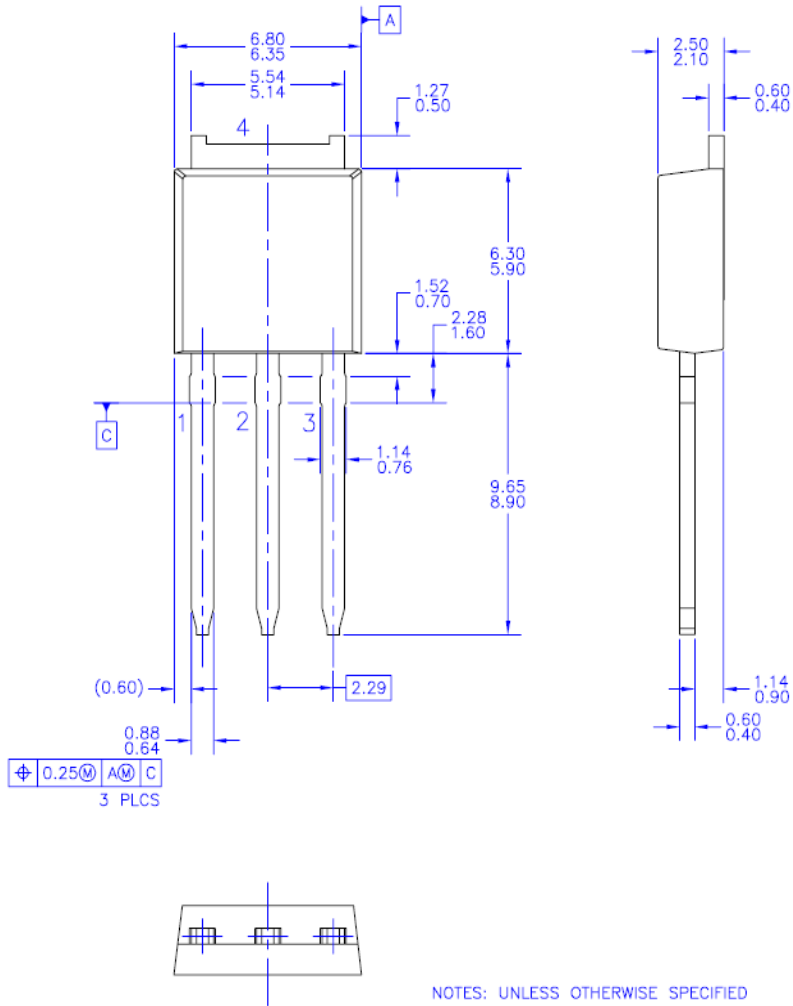
- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.
 - C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
 - D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.
 - E) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.
 - F) DIMENSIONS ARE EXCLUSIVE OF BURSS, 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

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-251, ISSUE C, VARIATION AA, DATED SEP 1988.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

Dimensions in Millimeters



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