FAIRCHILD SEMICONDUCTOR®

July 2006

SuperFET™

FCD7N60 / FCU7N60

600V N-Channel MOSFET

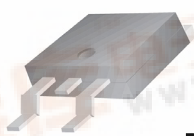
Features

- 650V @T_J = 150°C
- Typ. Rds(on)=0.53Ω
- Ultra low gate charge (typ. Qg=23nC)
- Low effective output capacitance (typ. Coss.eff=60pF)
- 100% avalanche tested

Description

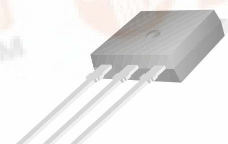
SuperFET™ is, Farichild's proprietary, new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.
This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.

D



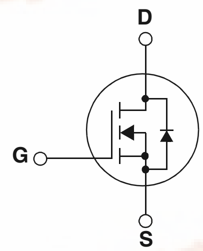
G S

D-PAK
FCD Series



G D S

I-PAK
FCU Series



Absolute Maximum Ratings

Symbol	Parameter	FCD7N60/FCU7N60	Unit
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current - Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	7 4.4	A A
I_{DM}	Drain Current - Pulsed (Note 1)	21	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	230	mJ
I_{AR}	Avalanche Current (Note 1)	7	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	8.3	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	20	V/ns
P_D	Power Dissipation (T_C = 25°C) - Derate above 25°C	83 0.67	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	°C

Thermal Characteristics

Symbol	Parameter	FCD7N60/FCU7N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	83	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCD7N60	FCD7N60TM	D-PAK	380mm	16mm	2500
FCD7N60	FCD7N60TF	D-PAK	380mm	16mm	2000
FCU7N60	FCU7N60	I-PAK	-	-	70

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA, T_J = 25°C	600	--	--	V
		V_{GS} = 0V, I_D = 250μA, T_J = 150°C	--	650	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.6	--	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0V, I_D = 7A	--	700	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0V V_{DS} = 480V, T_C = 125°C	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 3.5A	--	0.53	0.6	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 3.5A (Note 4)	--	6	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	710	920	pF
C_{oss}	Output Capacitance		--	380	500	pF
C_{rss}	Reverse Transfer Capacitance		--	34	--	pF
C_{oss}	Output Capacitance	V_{DS} = 480V, V_{GS} = 0V, f = 1.0MHz	--	22	29	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0V to 400V, V_{GS} = 0V	--	60	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300V, I_D = 7A R_G = 25Ω (Note 4, 5)	--	35	80	ns
t_r	Turn-On Rise Time		--	55	120	ns
$t_{d(off)}$	Turn-Off Delay Time		--	75	160	ns
t_f	Turn-Off Fall Time		--	32	75	ns
Q_g	Total Gate Charge	V_{DS} = 480V, I_D = 7A V_{GS} = 10V (Note 4, 5)	--	23	30	nC
Q_{gs}	Gate-Source Charge		--	4.2	5.5	nC
Q_{gd}	Gate-Drain Charge		--	11.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	7	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	21	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 7A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 7A dI_F/dt =100A/μs (Note 4)	--	360	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.5	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 3.5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 7A, di/dt $\leq$ 1200A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test: Pulse width $\leq$ 300μs, Duty Cycle $\leq$ 2%
5. Essentially Independent of Operating Temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

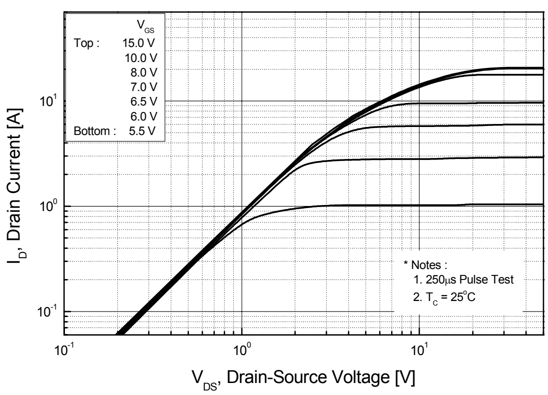


Figure 2. Transfer Characteristics

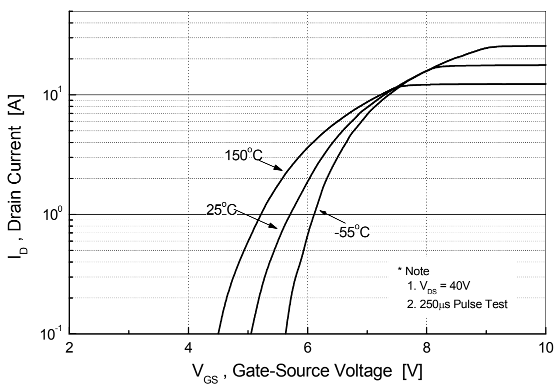


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

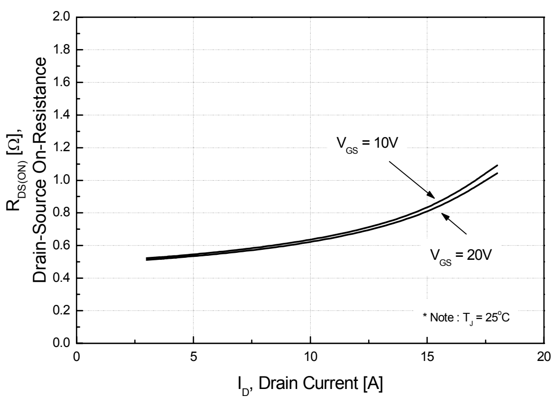


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

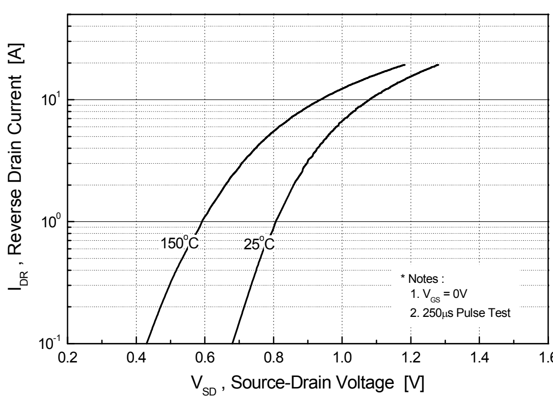


Figure 5. Capacitance Characteristics

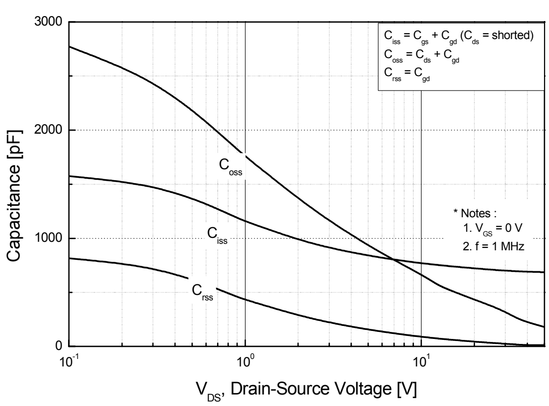
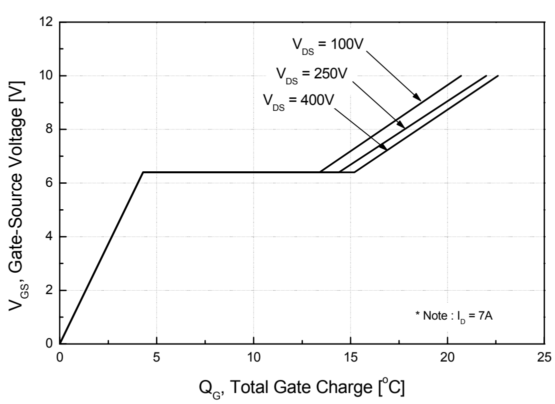


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

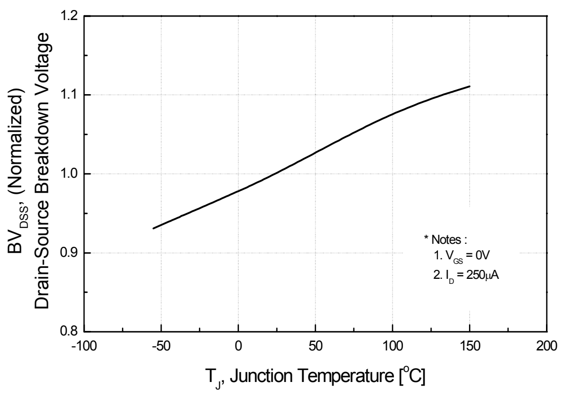


Figure 8. On-Resistance Variation vs. Temperature

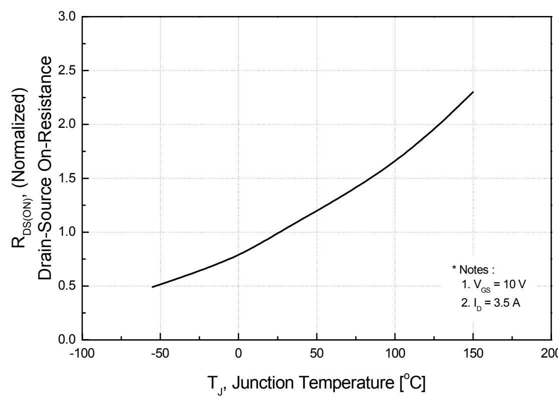


Figure 9. Maximum Safe Operating Area

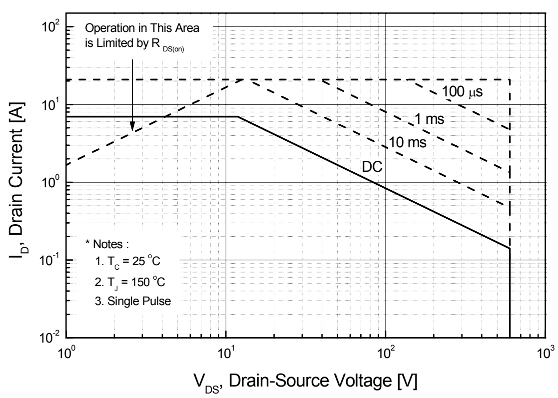


Figure 10. Maximum Drain Current vs. Case Temperature

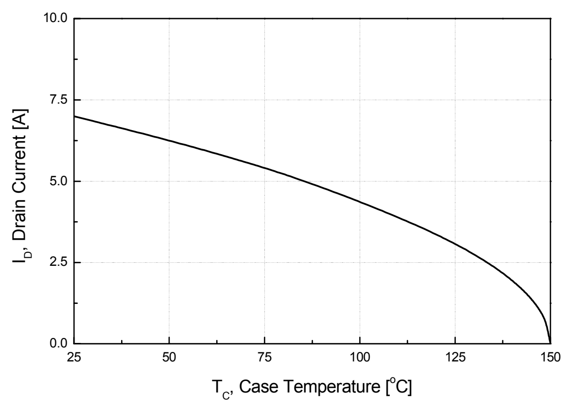
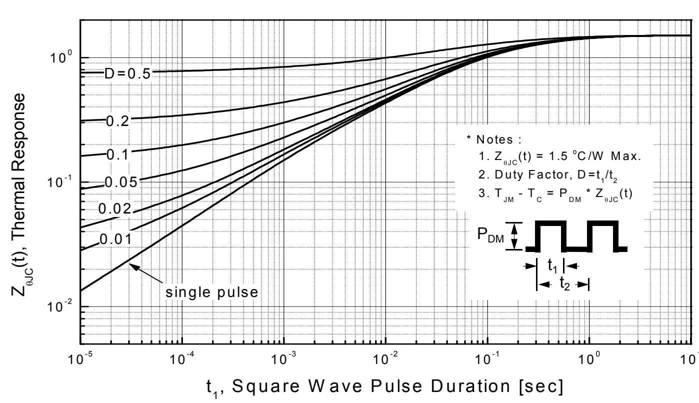
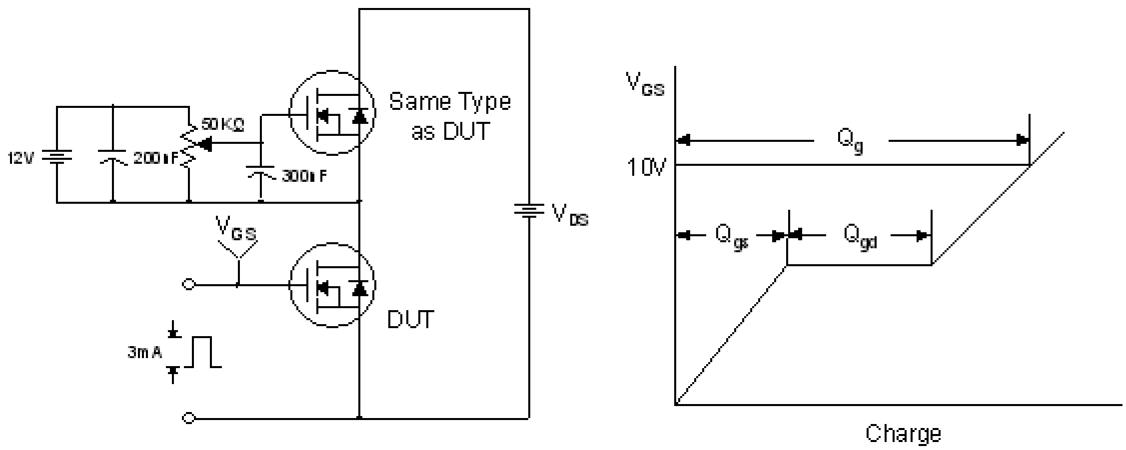


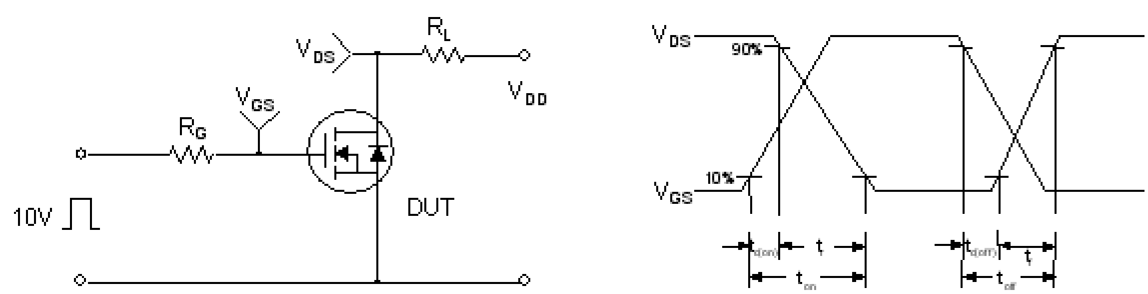
Figure 11. Transient Thermal Response Curve



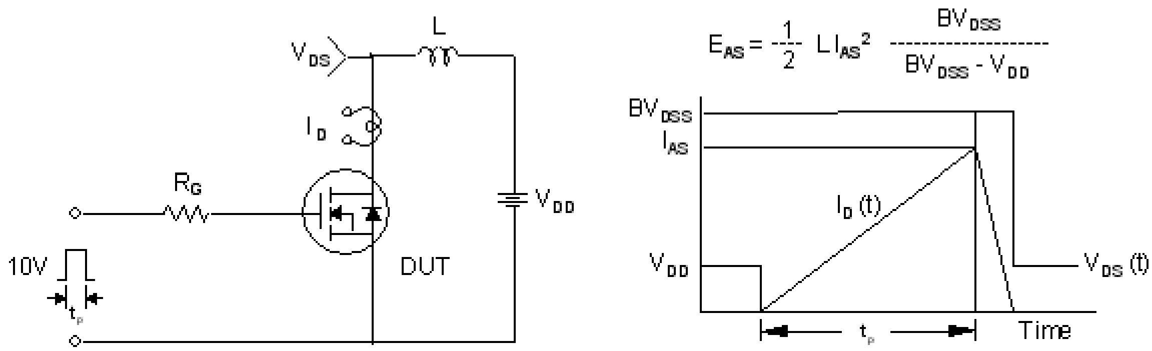
Gate Charge Test Circuit & Waveform



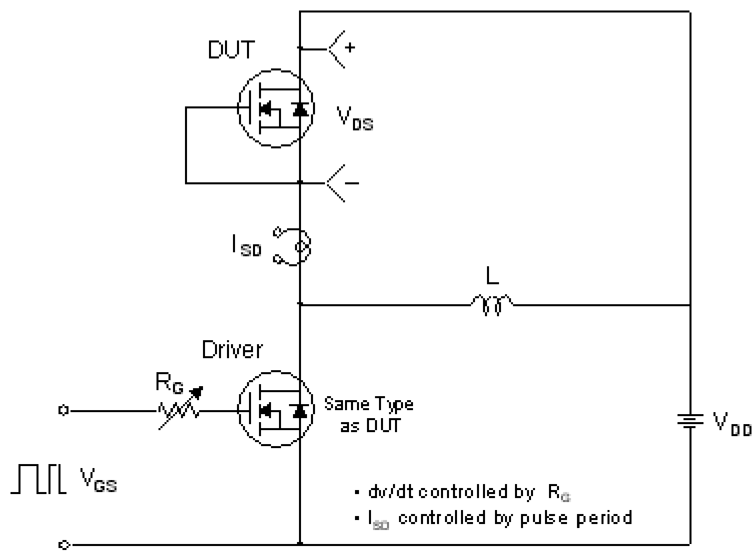
Resistive Switching Test Circuit & Waveforms

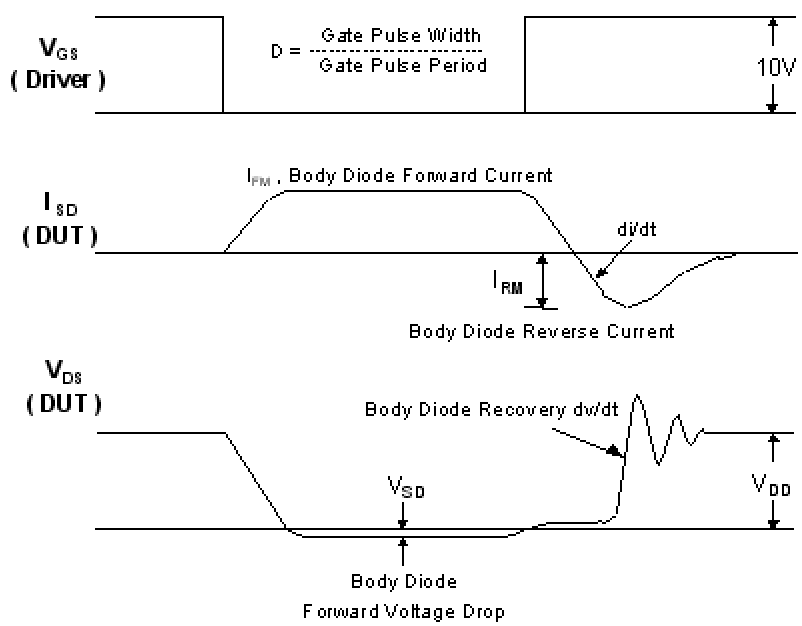


Unclamped Inductive Switching Test Circuit & Waveforms



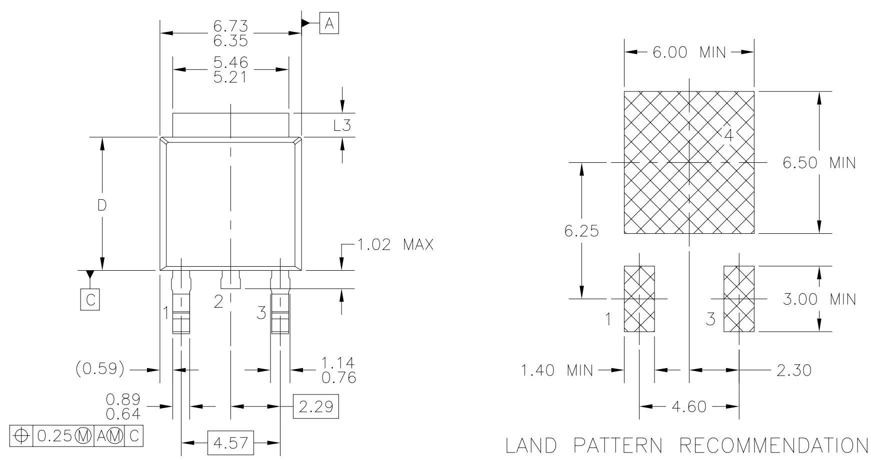
Peak Diode Recovery dv/dt Test Circuit & Waveforms

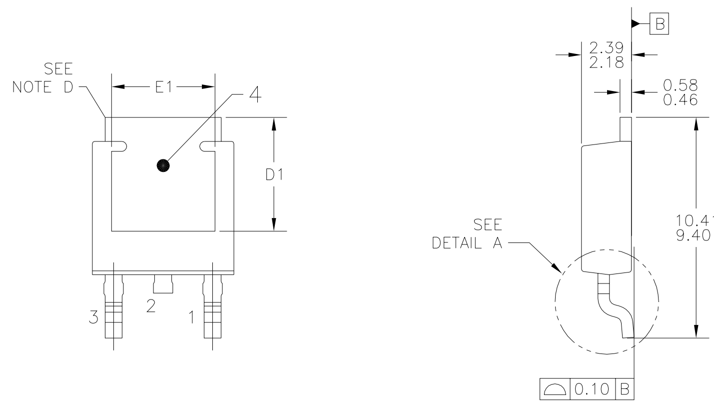


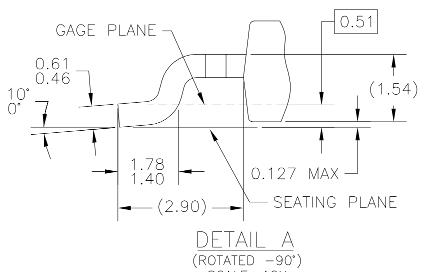


Mechanical Dimensions

D-PAK







NOTES: UNLESS OTHERWISE SPECIFIED

A) ALL DIMENSIONS ARE IN MILLIMETERS.

B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA & AB, DATED NOV. 1999.

C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.

E) DIMENSIONS L3,D,E1&D1 TABLE:

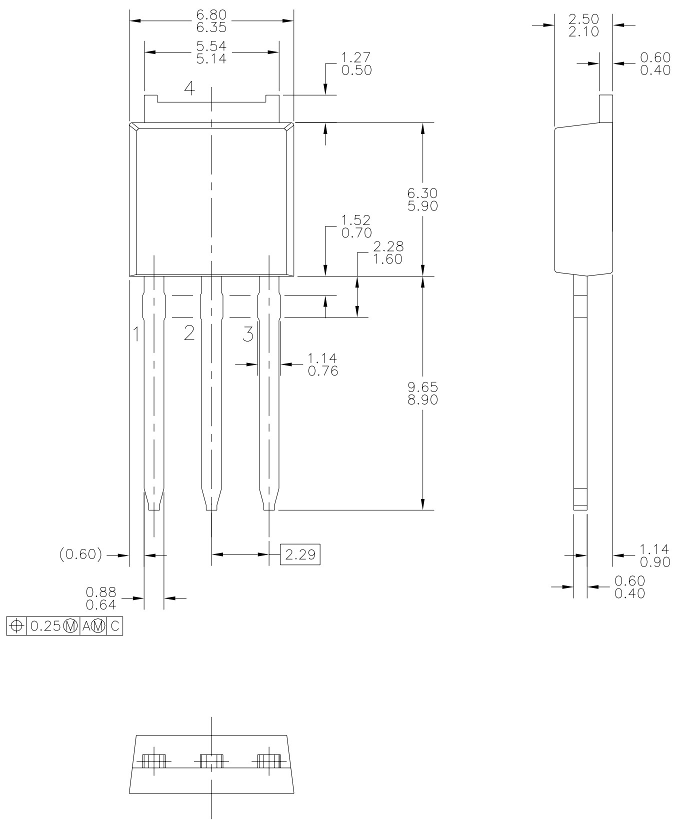
	OPTION AA	OPTION AB
L3	0.89-1.27	1.52-2.03
D	5.97-6.22	5.33-5.59
E1	4.32 MIN	3.81 MIN
D1	5.21 MIN	4.57 MIN

F) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.

Dimensions in Millimeters

Package Dimensions (Continued)

I-PAK



Dimensions in Millimeters

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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