FAIRCHILD SEMICONDUCTOR®

October 2012

SuperFET® II

FCD600N60Z

600V N-Channel MOSFET

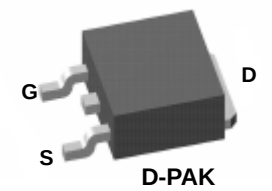
Features

- 650V @T_J = 150°C
- Max. $R_{DS(on)}$ = 600mΩ
- Ultra Low Gate Charge (Typ. Q_g = 20nC)
- Low Effective Output Capacitance (Typ. C_{oss}.eff = 74pF)
- 100% Avalanche Tested
- ESD Improved Capacity

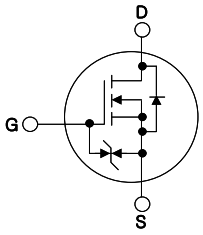
Description

SuperFET®II 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®II is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.



D-PAK



Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		FCD600N60Z	Units
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage	-DC	±20	V
		-AC (f>1Hz)	±30	V
I_D	Drain Current	-Continuous (T_C = 25°C)	7.4	A
		-Continuous (T_C = 100°C)	4.7	
I_{DM}	Drain Current	- Pulsed (Note 1)	22.2	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	135	mJ
I_{AR}	Avalanche Current	(Note 1)	1.5	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	0.89	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20	V/ns
	MOSFET dv/dt		100	V/ns
P_D	Power Dissipation	(T_C = 25°C)	89	W
		- Derate above 25°C	0.71	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	FCD600N60Z	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	100	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCD600N60Z	FCD600N60Z	D-PAK	380mm	16mm	2500

Electrical Characteristics $T_C = 25^oC$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0V, I_D = 10mA, T_J = 25°C	600	-	-	V
		V_{GS} = 0V, I_D = 10mA, T_J = 150°C	650	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 10mA, Referenced to 25°C	-	0.67	-	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0V, I_D = 7.4A	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 480V, V_{GS} = 0V	-	-	5	μA
		V_{DS} = 480V, T_C = 125°C	-	-	20	
I_{GSS}	Gate-Body Leakage Current	V_{GS} = ±20V, V_{DS} = 0V	-	-	±10	uA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 3.7A	-	0.51	0.6	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20V, I_D = 3.7A	-	6.7	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	-	840	1120	pF
C_{oss}	Output Capacitance		-	630	840	pF
C_{rss}	Reverse Transfer Capacitance		-	30	45	pF
C_{oss}	Output Capacitance	V_{DS} = 380V, V_{GS} = 0V, f = 1.0MHz	-	16.5	-	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0V to 480V, V_{GS} = 0V	-	74	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380V, I_D = 3.7A, V_{GS} = 10V (Note 4)	-	20	26	nC
Q_{gs}	Gate to Source Gate Charge		-	3.4	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	7.5	-	nC
ESR	Equivalent Series Resistance	Drain open	-	2.89	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380V, I_D = 3.7A, V_{GS} = 10V, R_{GEN} = 4.7Ω (Note 4)	-	13	36	ns
t_r	Turn-On Rise Time		-	7	24	ns
$t_{d(off)}$	Turn-Off Delay Time		-	39	88	ns
t_f	Turn-Off Fall Time		-	9	28	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	7.4	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	22.2	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_{SD} = 3.7A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 3.7A, dI_F/dt = 100A/μs	-	200	-	ns
Q_{rr}	Reverse Recovery Charge		-	2.3	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 1.5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 3.7A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

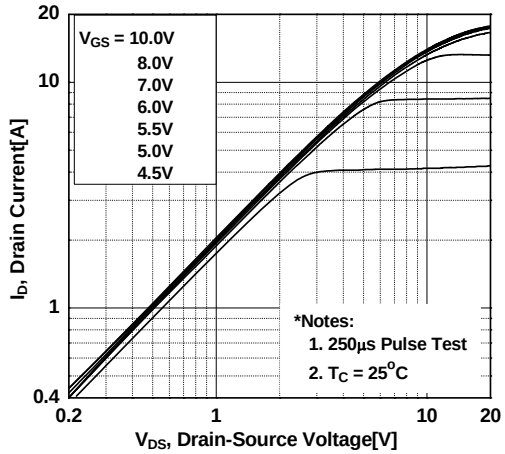


Figure 2. Transfer Characteristics

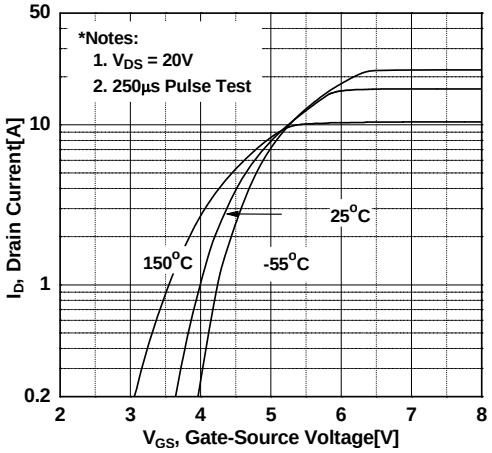


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

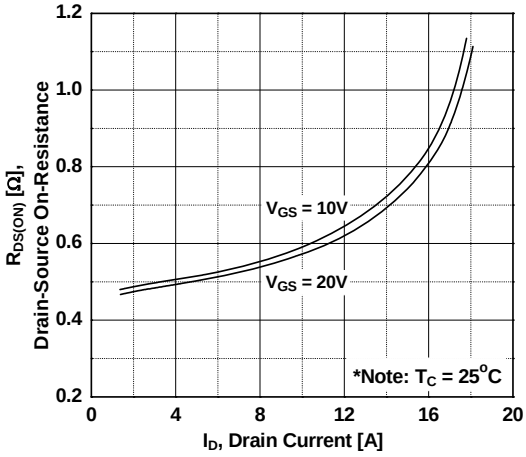


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

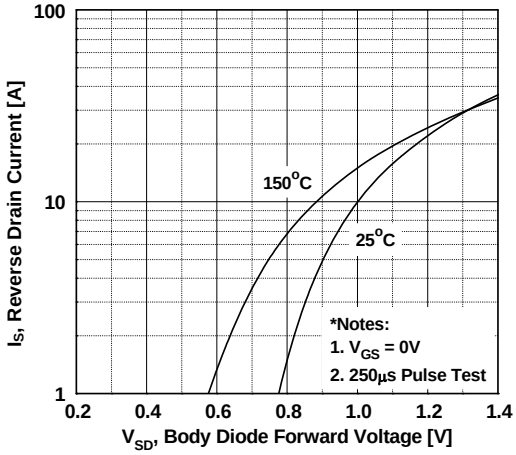


Figure 5. Capacitance Characteristics

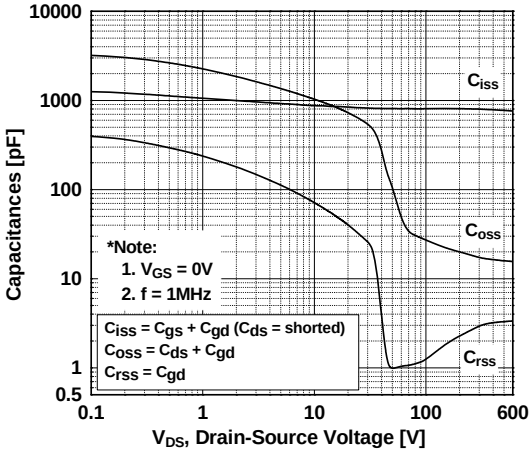
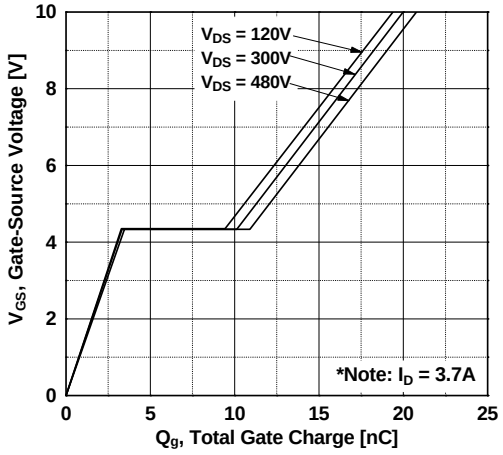


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

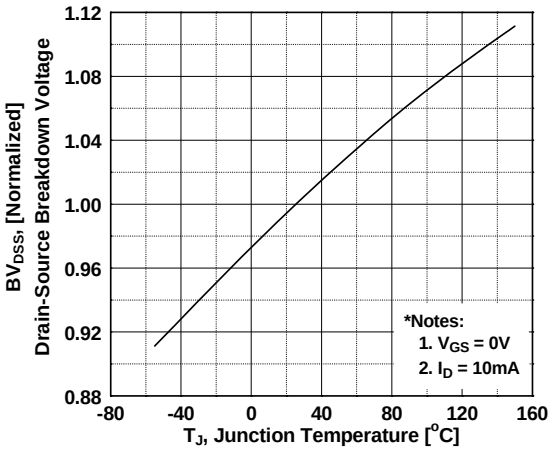


Figure 8. On-Resistance Variation vs. Temperature

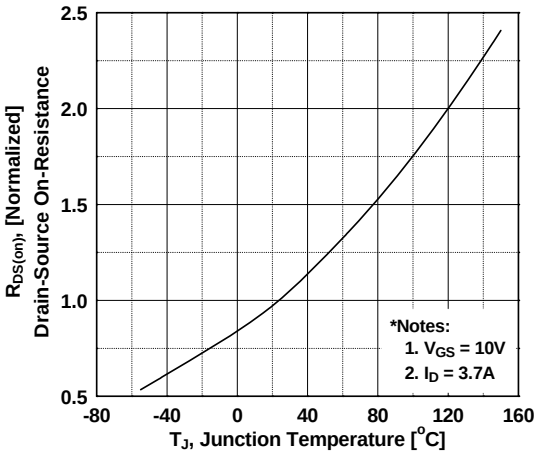


Figure 9. Maximum Safe Operating Area vs. Case Temperature

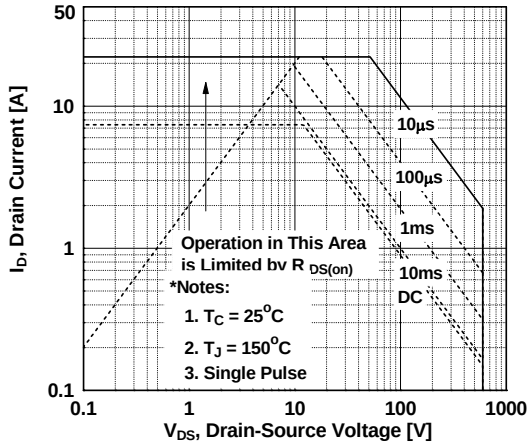


Figure 10. Maximum Drain Current

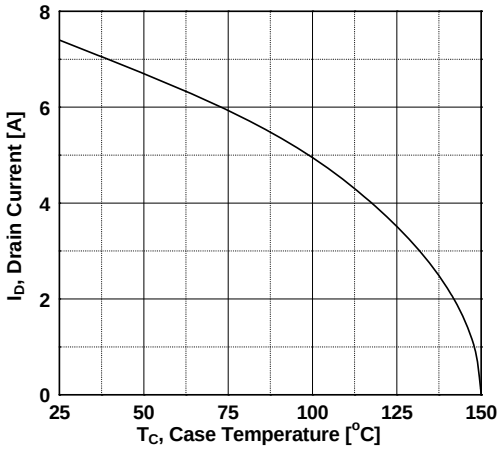
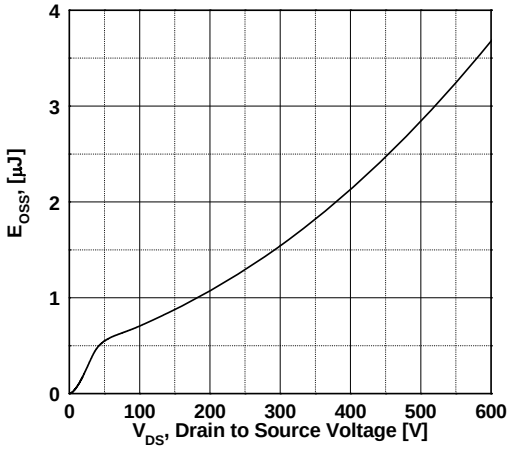
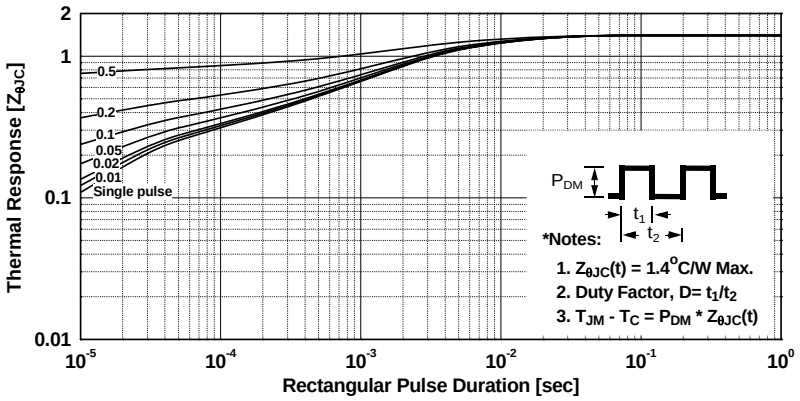


Figure 11. Eoss vs. Drain to Source Voltage

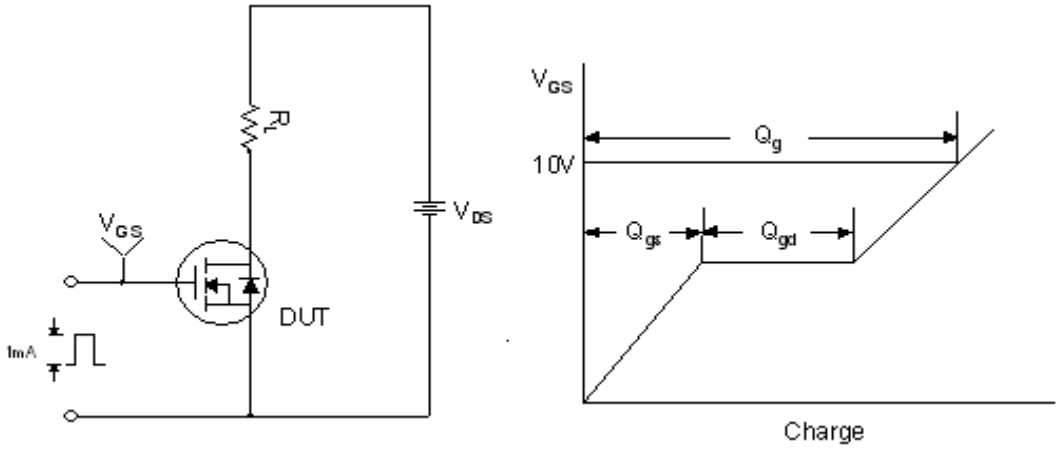


Typical Performance Characteristics (Continued)

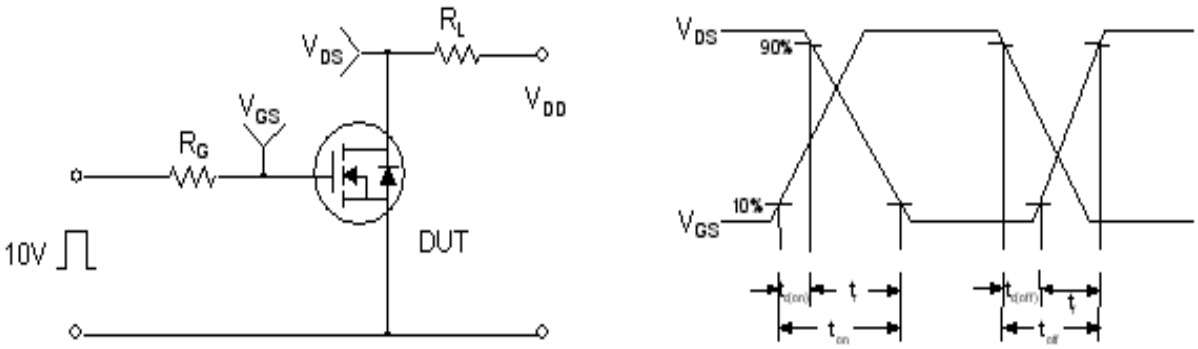
Figure 12. Transient Thermal Response Curve



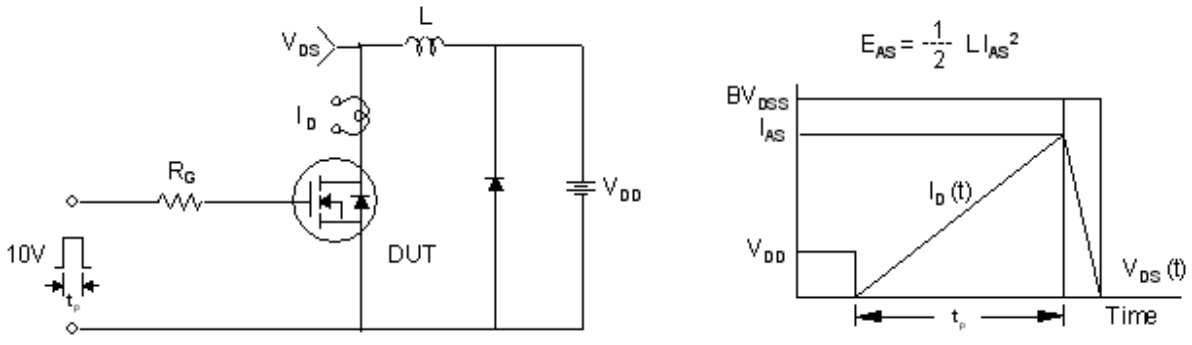
Gate Charge Test Circuit & Waveform



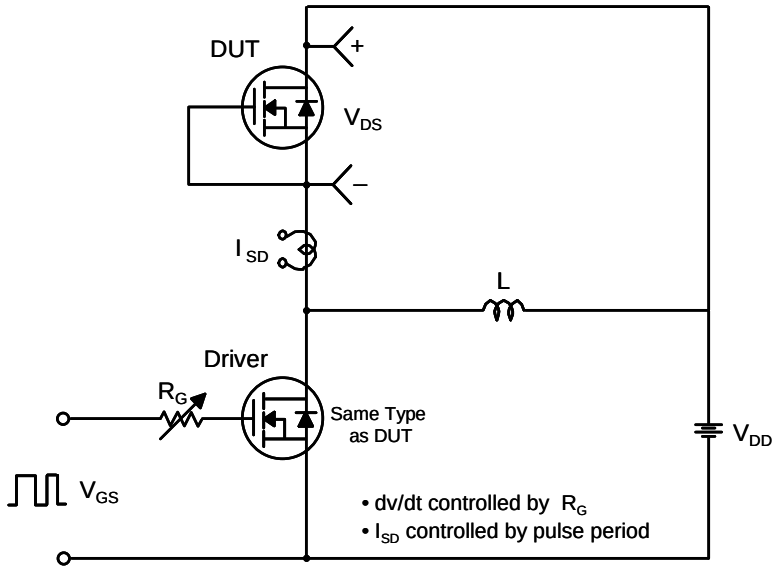
Resistive Switching Test Circuit & Waveforms

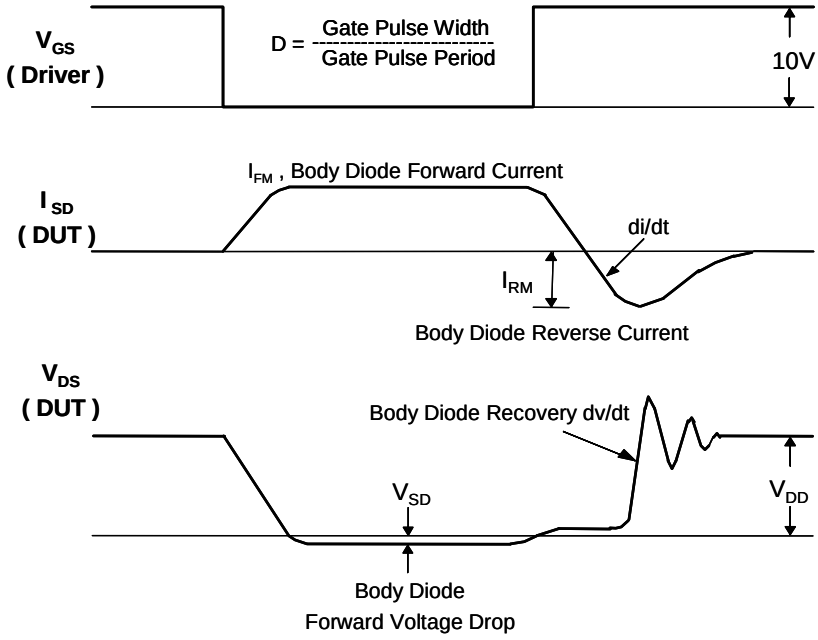


Unclamped Inductive Switching Test Circuit & Waveforms



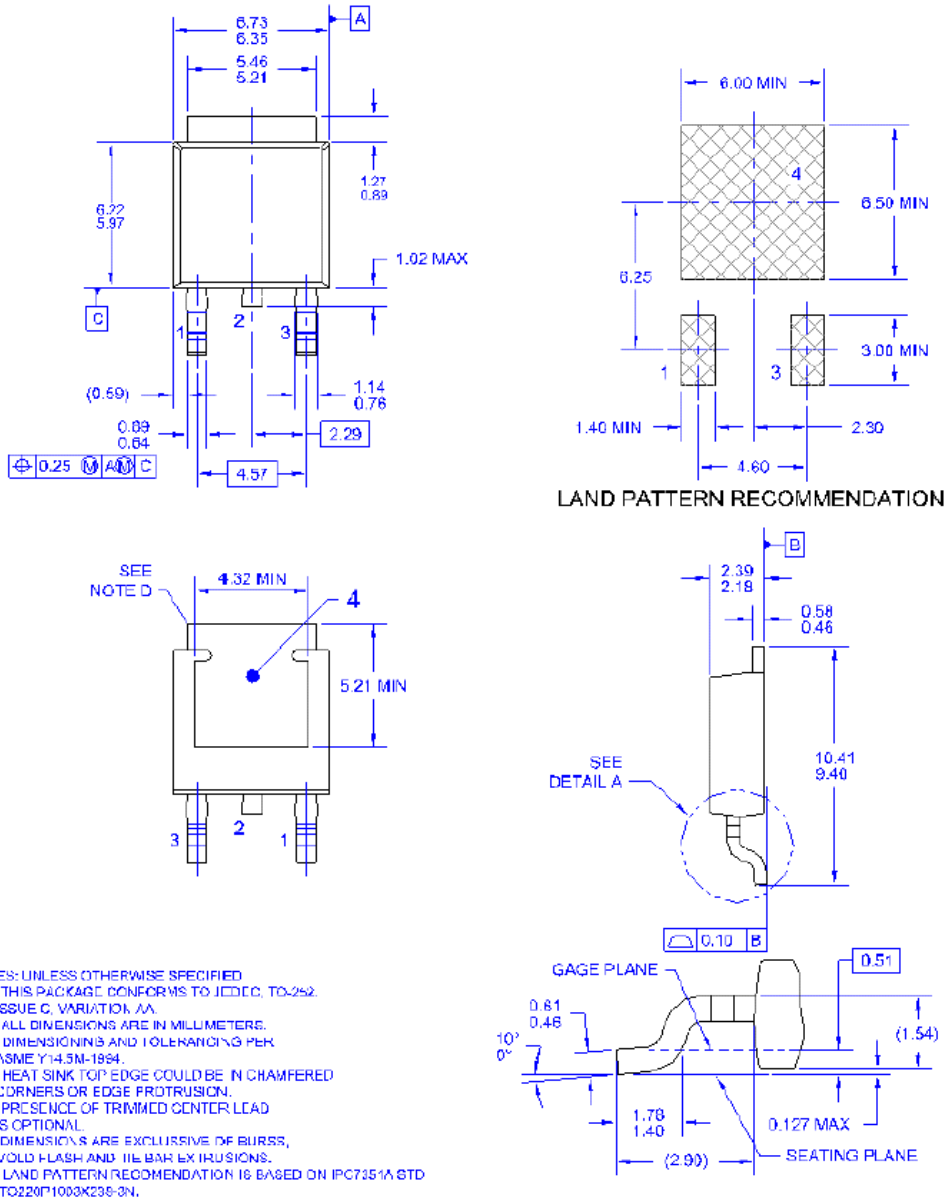
Peak Diode Recovery dv/dt Test Circuit & Waveforms





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 EXCLUSSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO220P1003X239-3N.
H) DRAWING NUMBER AND REVISION: MKT-TO252A03REVB

Dimensions in Millimeters

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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.
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