FAIRCHILD SEMICONDUCTOR®

March 2013

FCD380N60E

N-Channel SuperFET® II MOSFET

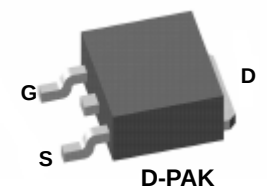
600 V, 10.2 A, 380 mΩ

Features

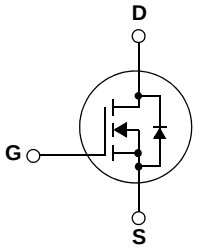
- 650 V @T_J = 150°C
- Max. $R_{DS(on)}$ = 380 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 34 nC)
- Low Effective Output Capacitance (Typ. C_{oss}.eff = 97 pF)
- 100% Avalanche Tested

Description

SuperFET®II MOSFET is Fairchild Semiconductor®'s first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance.This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFETII MOSFET is suitable for various AC/DC power conversion for system miniaturization and higher efficiency.



D-PAK



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		FCD380N60E	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage	- DC	±20	V
		- AC (f > 1 Hz)	±30	V
I_D	Drain Current	-Continuous (T_C = 25°C)	10.2	A
		-Continuous (T_C = 100°C)	6.4	
I_{DM}	Drain Current	- Pulsed (Note 1)	30.6	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	211.6	mJ
I_{AR}	Avalanche Current	(Note 1)	2.3	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	1.06	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20	V/ns
	MOSFET dv/dt		100	
P_D	Power Dissipation	(T_C = 25°C)	106	W
		- Derate above 25°C	0.85	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

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FCD380N60E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.18	°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
FCD380N60E	FCD380N60E	D-PAK	380 mm	16 mm	2500

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 10 mA, T_J = 25°C	600	-	-	V
		V_{GS} = 0 V, I_D = 10 mA, T_J = 150°C	650	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25°C	-	0.67	-	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 10 A	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 480 V, V_{GS} = 0 V	-	-	5	μA
		V_{DS} = 480 V, T_C = 125°C	-	-	20	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 5 A	-	0.32	0.38	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 5 A	-	10	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	1330	1770	pF
C_{oss}	Output Capacitance		-	945	1260	pF
C_{rss}	Reverse Transfer Capacitance		-	60	90	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0V, f = 1.0 MHz	-	25	-	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	97	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 5 A, V_{GS} = 10 V (Note 4)	-	34	45	nC
Q_{gs}	Gate to Source Gate Charge		-	5.3	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	13	-	nC
ESR	Equivalent Series Resistance	Drain open	-	6	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 5 A, V_{GS} = 10 V, R_G = 4.7 Ω (Note 4)	-	17	44	ns
t_r	Turn-On Rise Time		-	9	28	ns
$t_{d(off)}$	Turn-Off Delay Time		-	64	138	ns
t_f	Turn-Off Fall Time		-	10	30	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	10.2	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	30.6	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_{SD} = 5 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 5 A, dI_F/dt = 100 A/μs	-	240	-	ns
Q_{rr}	Reverse Recovery Charge		-	3	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 2.3 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 5.1 A, di/dt ≤ 200 A/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

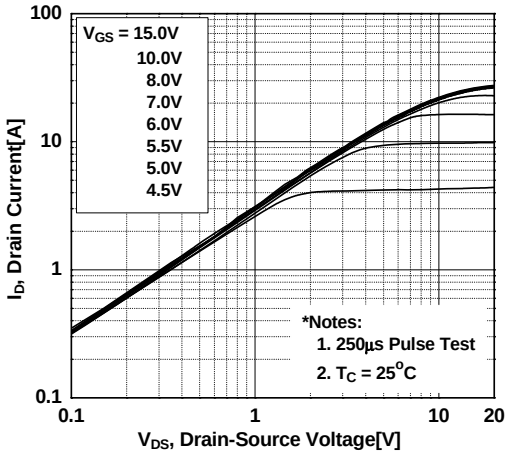


Figure 2. Transfer Characteristics

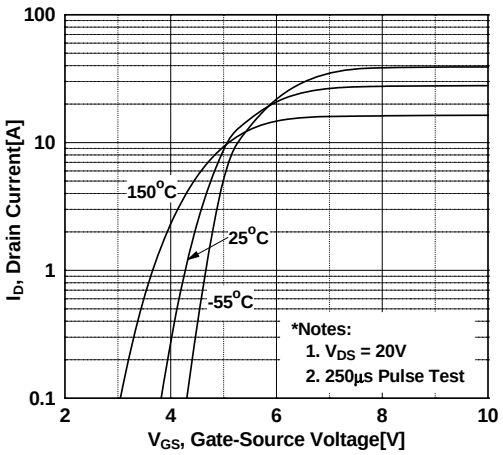


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

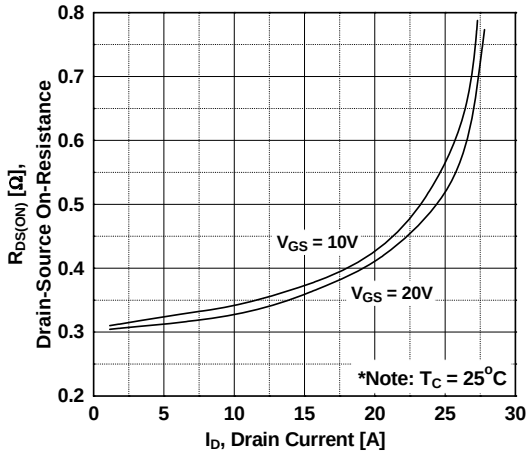


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

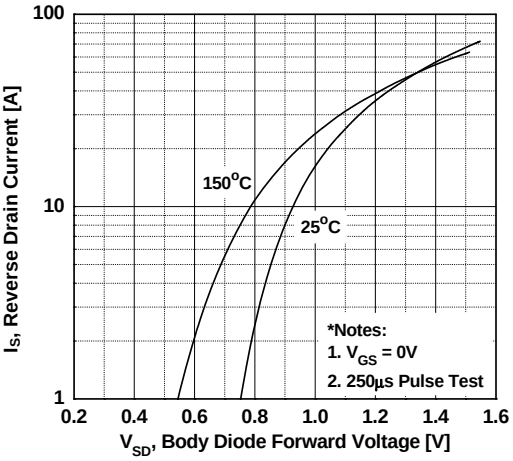


Figure 5. Capacitance Characteristics

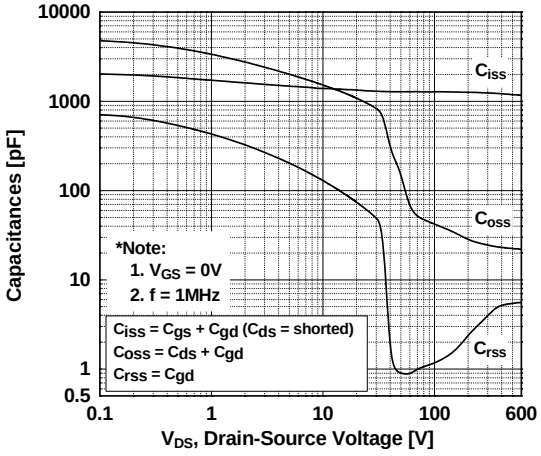
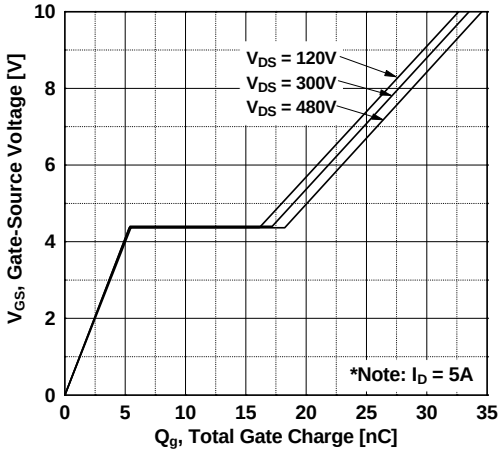


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

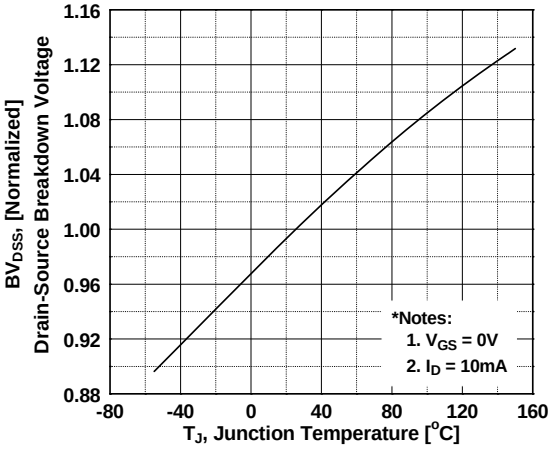


Figure 8. On-Resistance Variation vs. Temperature

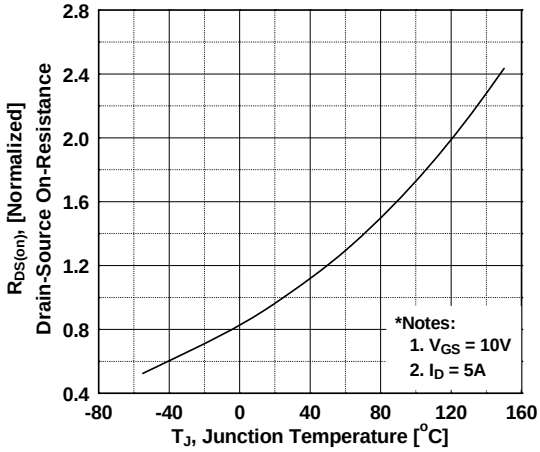


Figure 9. Maximum Safe Operating Area vs. Case Temperature

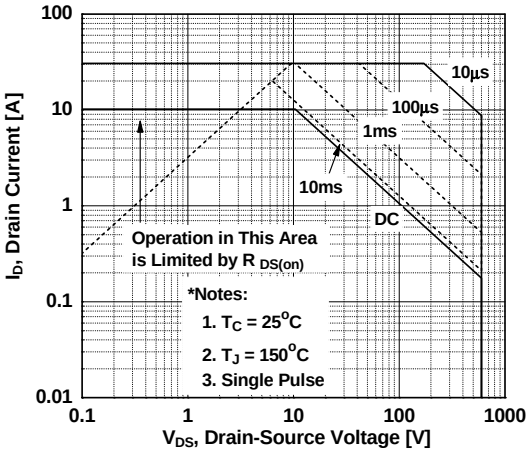


Figure 10. Maximum Drain Current

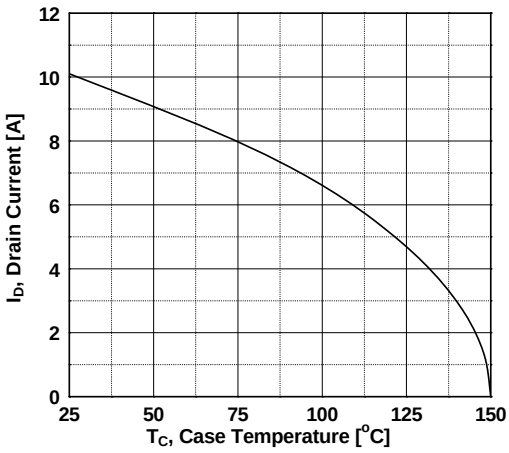
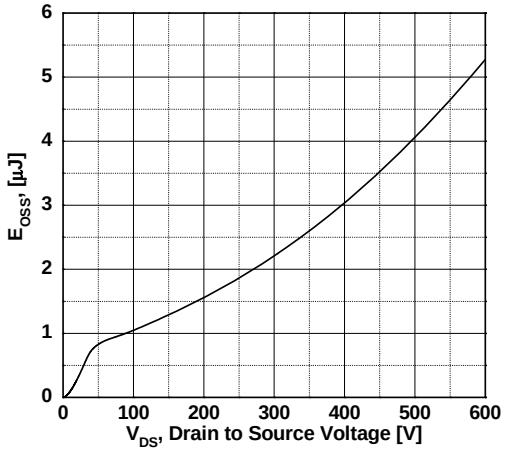
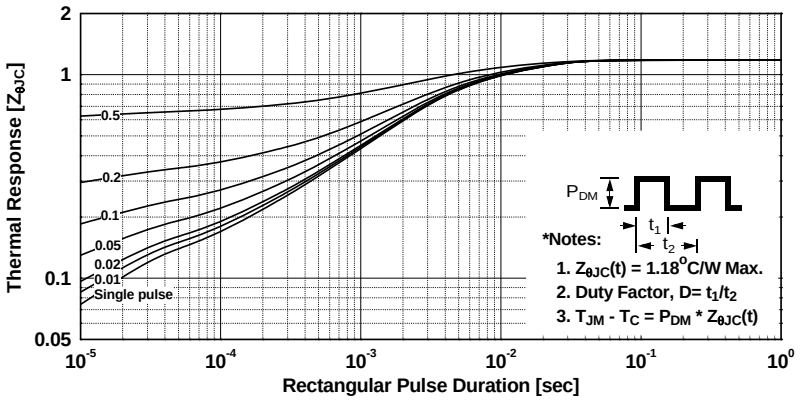


Figure 11. Eoss vs. Drain to Source Voltage Switching Capability

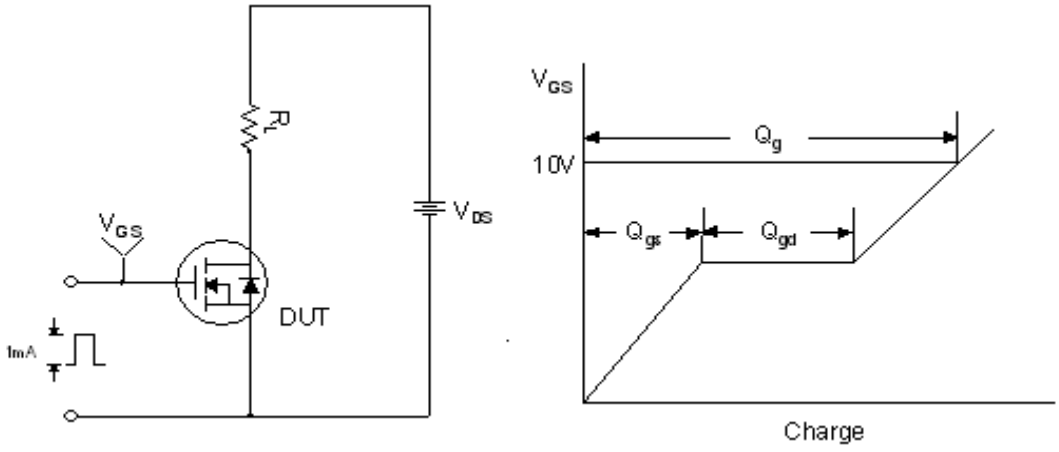


Typical Performance Characteristics (Continued)

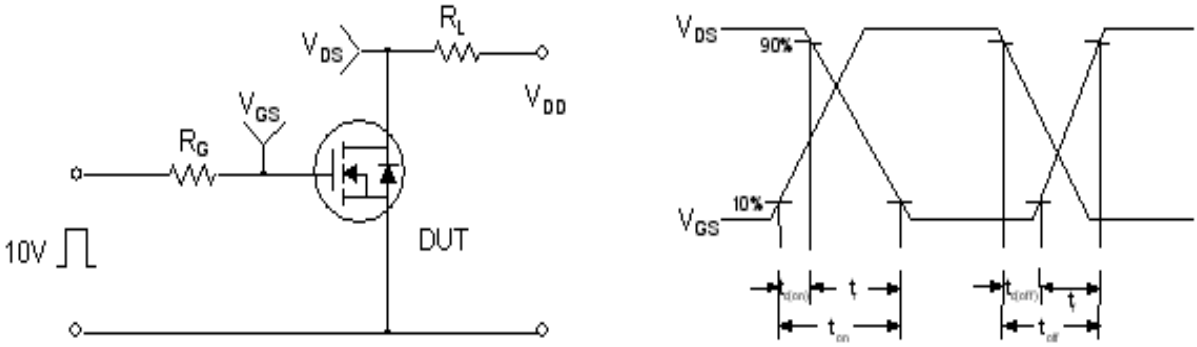
Figure 12. Transient Thermal Response Curve



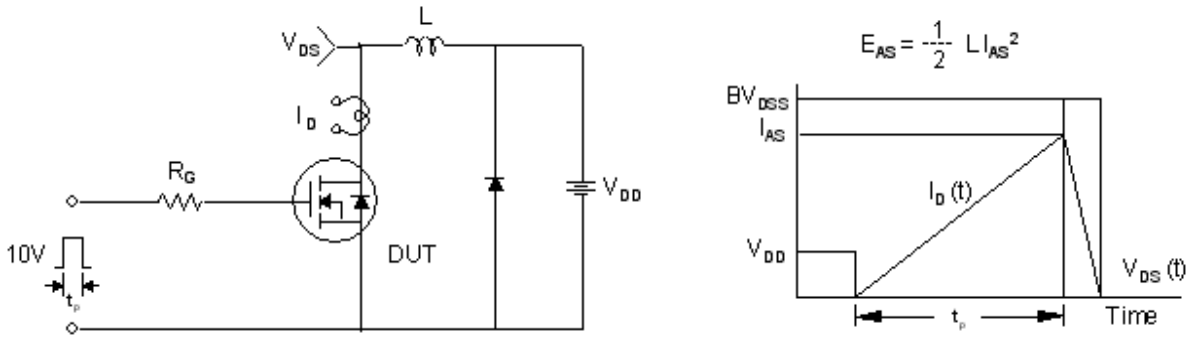
Gate Charge Test Circuit & Waveform



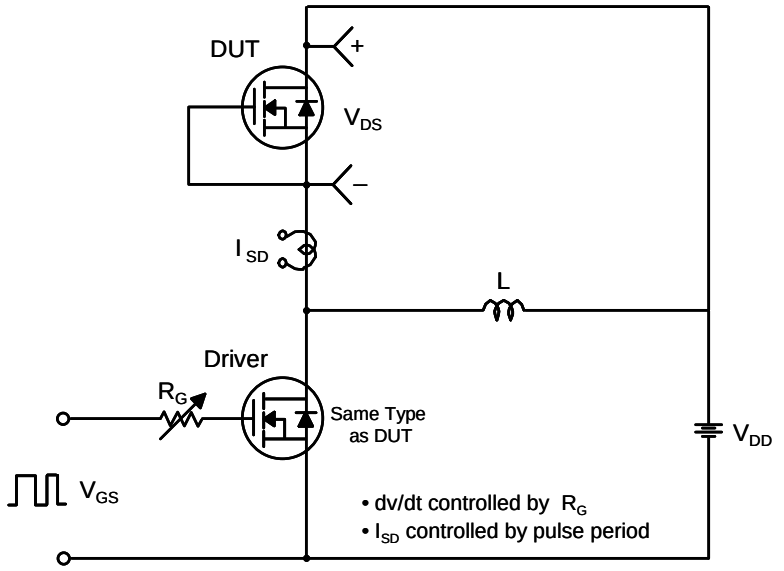
Resistive Switching Test Circuit & Waveforms

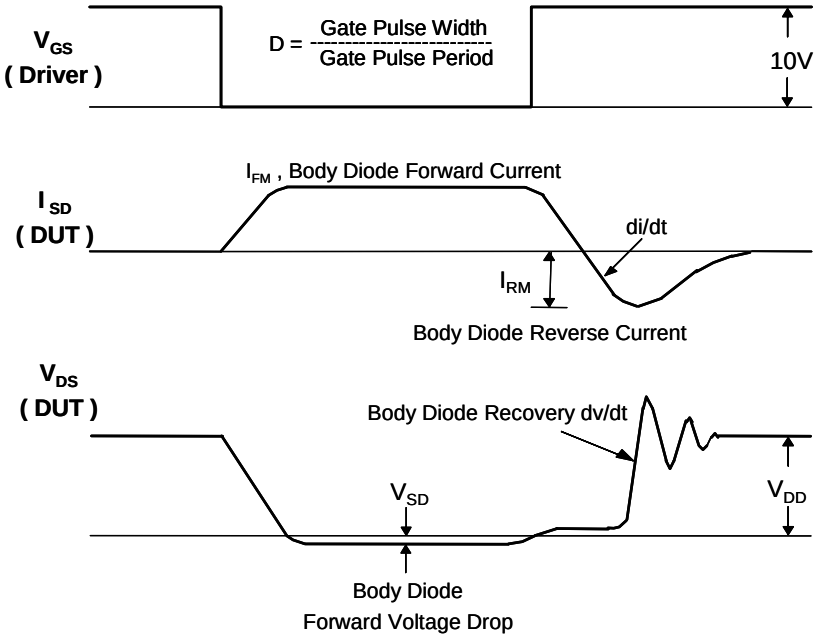


Unclamped Inductive Switching Test Circuit & Waveforms



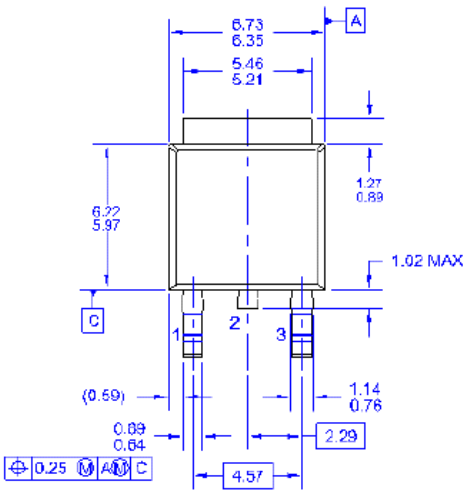
Peak Diode Recovery dv/dt Test Circuit & Waveforms

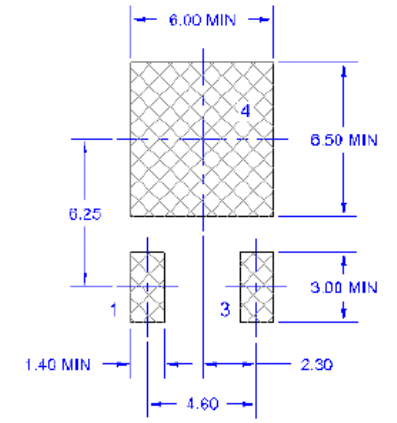




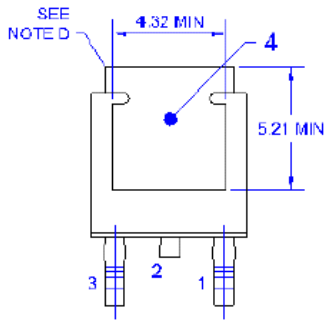
Mechanical Dimensions

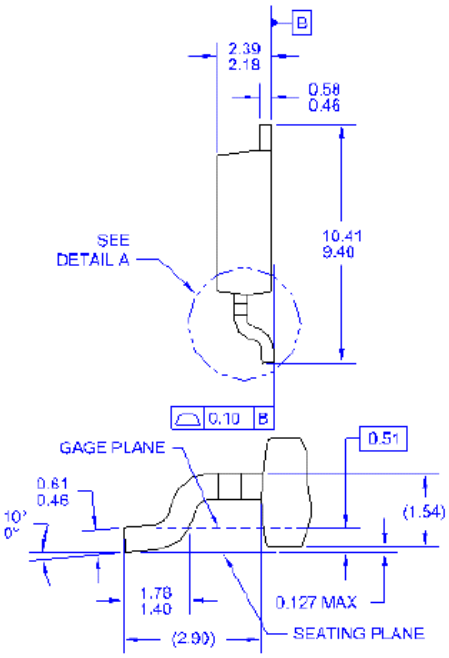
D-PAK





LAND PATTERN RECOMMENDATION





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 TO220P1003X238-3N.
H) DRAWING NUMBER AND REVISION: MKT-TO252A03REVB

Dimensions in Millimeters

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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