

FCD9N60NTM

N-Channel SupreMOS® MOSFET

600 V, 9 A, 385 mΩ

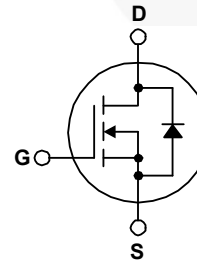
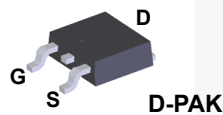


Features

- $R_{DS(on)} = 330 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 4.5 \text{ A}$
- Ultra Low Gate Charge (Typ. $Q_g = 17.8 \text{ nC}$)
- Low Effective Output Capacitance
- 100% Avalanche Tested
- RoHS Compliant

Description

The SupreMOS® MOSFET is Fairchild Semiconductor's next generation of high voltage super-junction (SJ) technology employing a deep trench filling process that differentiates it from the conventional SJ MOSFETs. This advanced technology and precise process control provides lowest R_{sp} on-resistance, superior switching performance and ruggedness. SupreMOS MOSFET is suitable for high frequency switching power converter applications such as PFC, server/telecom power, FPD TV power, ATX power, and industrial power applications.



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

Symbol	Parameter	FCD9N60NTM	Unit
V_{DSS}	Drain to Source Voltage	600	V
V_{GSS}	Gate to Source Voltage	± 30	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	9.0
		- Continuous ($T_C = 100^\circ\text{C}$)	5.7
I_{DM}	Drain Current	- Pulsed (Note 1)	27
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	135
I_{AR}	Avalanche Current	(Note 1)	9.0
E_{AR}	Repetitive Avalanche Energy	(Note 1)	9.3
dv/dt	MOSFET dv/dt Ruggedness	100	V/ns
	Peak Diode Recovery dv/dt	(Note 3)	
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	92.6
		- Derate above 25°C	0.74
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	FCD9N60NTM	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.35	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCD9N60NTM	FCD9N60NTM	D-PAK	Tape and Reel	330 mm	16 mm	2500 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 1\text{mA}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 1\text{mA}$, Referenced to 25°C	-	0.8	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$	-	-	10	μA
		$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$	-	-	100	μA
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 4.5\text{A}$	-	0.330	0.385	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{V}, I_D = 4.5\text{A}$	-	5.3	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	735	1000	pF
C_{oss}	Output Capacitance		-	40	53	pF
C_{rss}	Reverse Transfer Capacitance		-	3.5	5.5	pF
C_{oss}	Output Capacitance	$V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	23.7	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{V to } 380\text{V}, V_{GS} = 0\text{V}$	-	122	-	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{V}, I_D = 4.5\text{A}$ $R_{GEN} = 4.7\Omega$	-	13.2	-	ns	
t_r	Turn-On Rise Time		-	9.6	-	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4)	-	28.7	-	ns
t_f	Turn-Off Fall Time		(Note 4)	-	11.5	-	ns
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{V}, I_D = 4.5\text{A}$ $V_{GS} = 10\text{V}$	-	17.8	-	nC	
Q_{gs}	Gate to Source Gate Charge		(Note 4)	-	4.2	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		(Note 4)	-	7.6	-	nC
ESR	Equivalent Series Resistance(G-S)	$f = 1\text{MHz}$	-	2.65	-	Ω	

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	9.0	-	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	27	-	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 9\text{A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 9\text{A}$	-	322	-	ns
Q_{rr}	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$	-	5.04	-	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS} = 3\text{A}$, $R_G = 25\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 9\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq 380\text{V}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

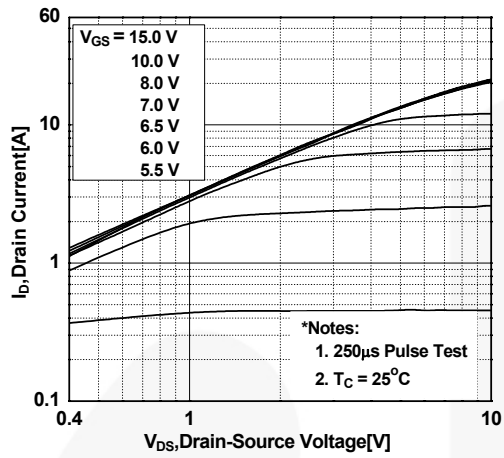


Figure 2. Transfer Characteristics

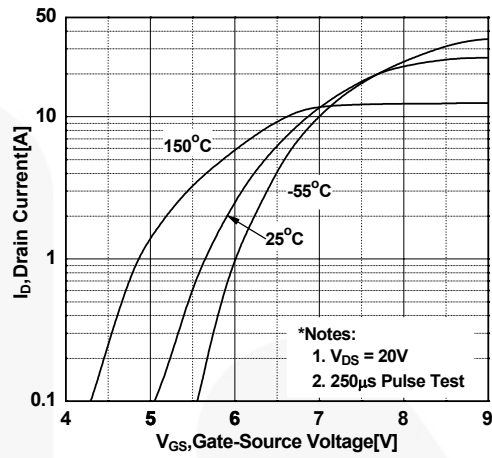


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

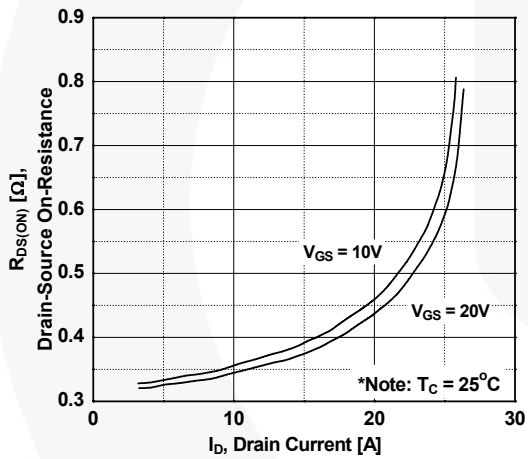


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

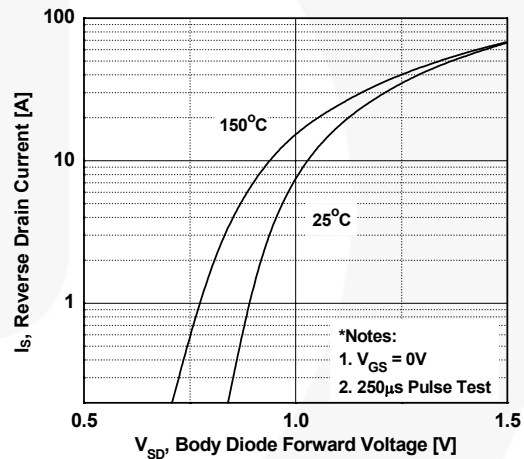


Figure 5. Capacitance Characteristics

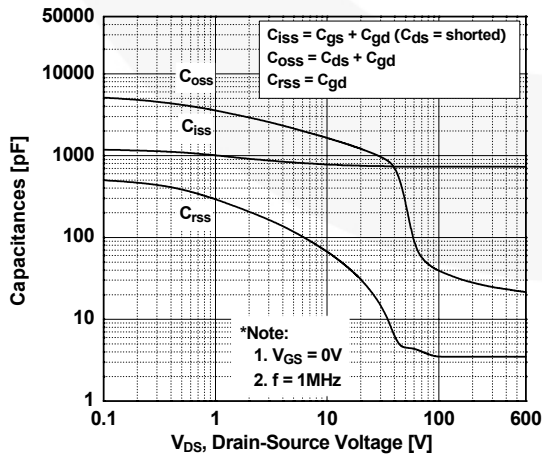
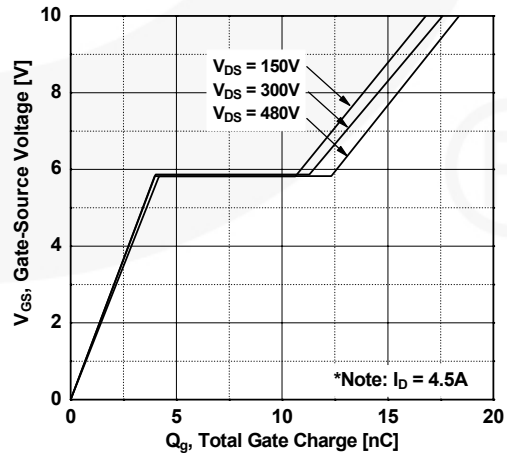


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

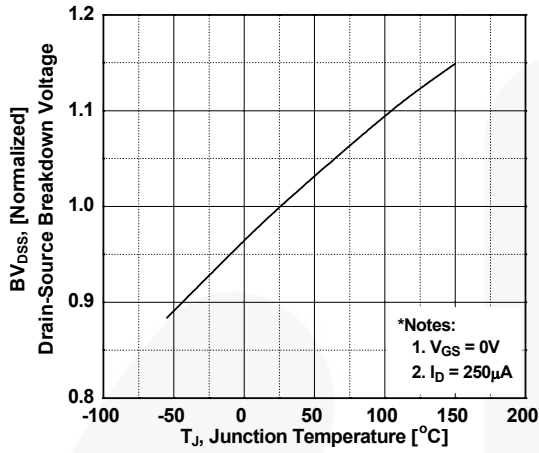


Figure 8. On-Resistance Variation vs. Temperature

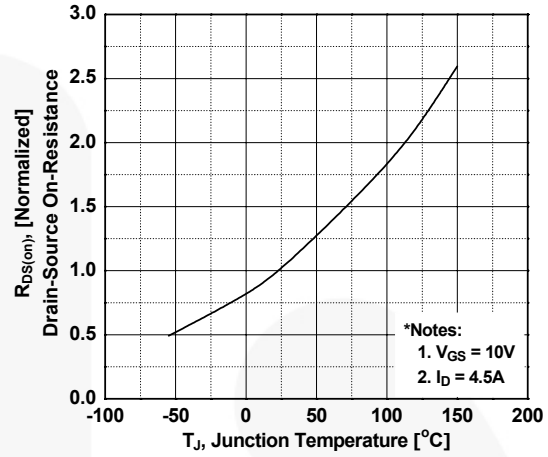


Figure 9. Maximum Safe Operating Area

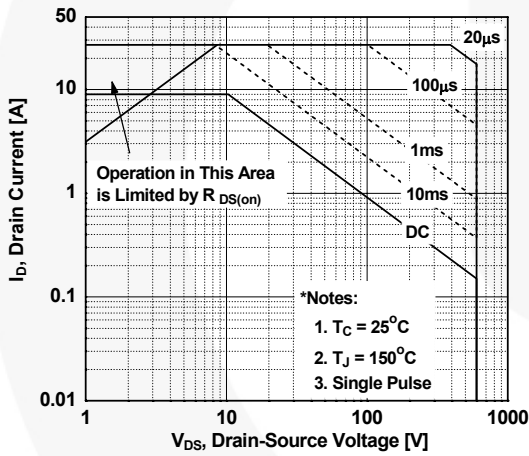


Figure 10. Maximum Drain Current vs. Case Temperature

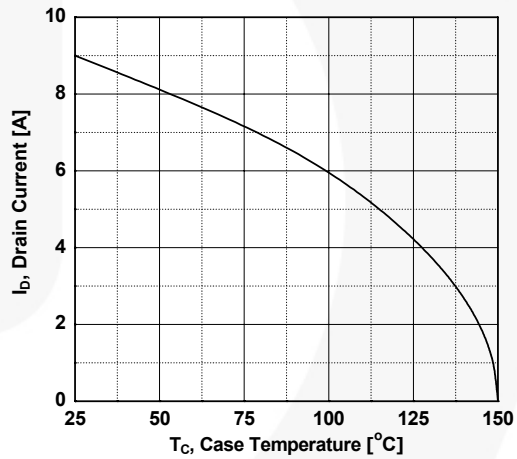


Figure 11. Transient Thermal Response Curve

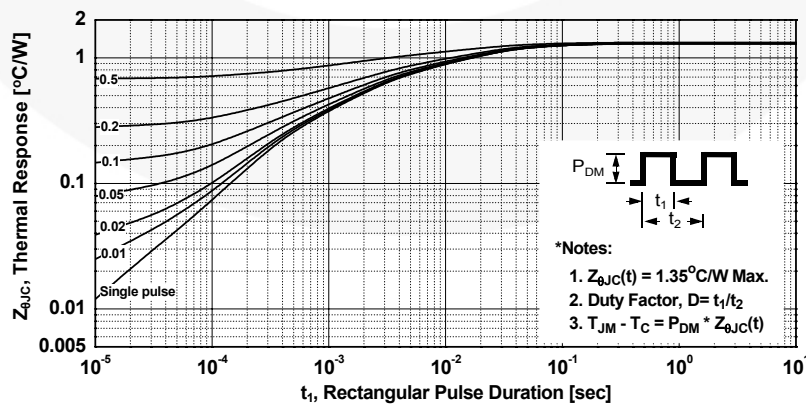




Figure 12. Gate Charge Test Circuit & Waveform

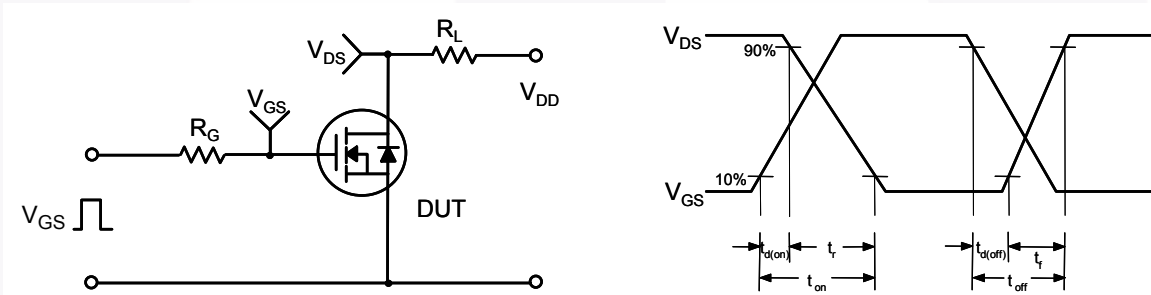


Figure 13. Resistive Switching Test Circuit & Waveforms

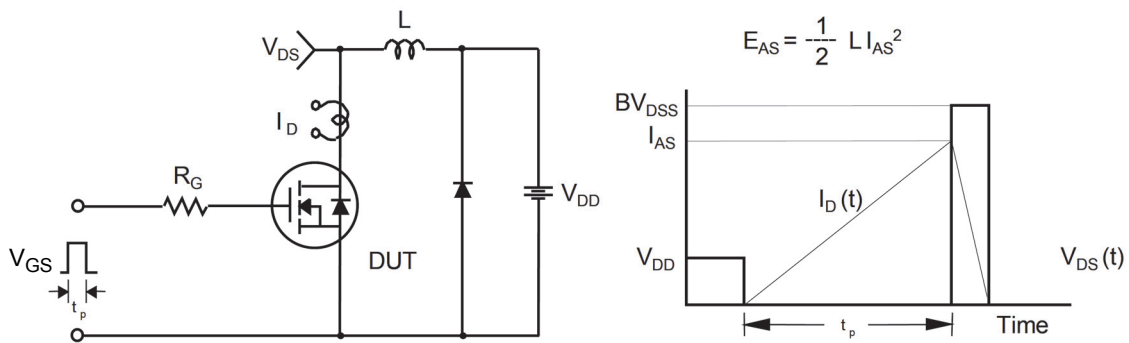


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

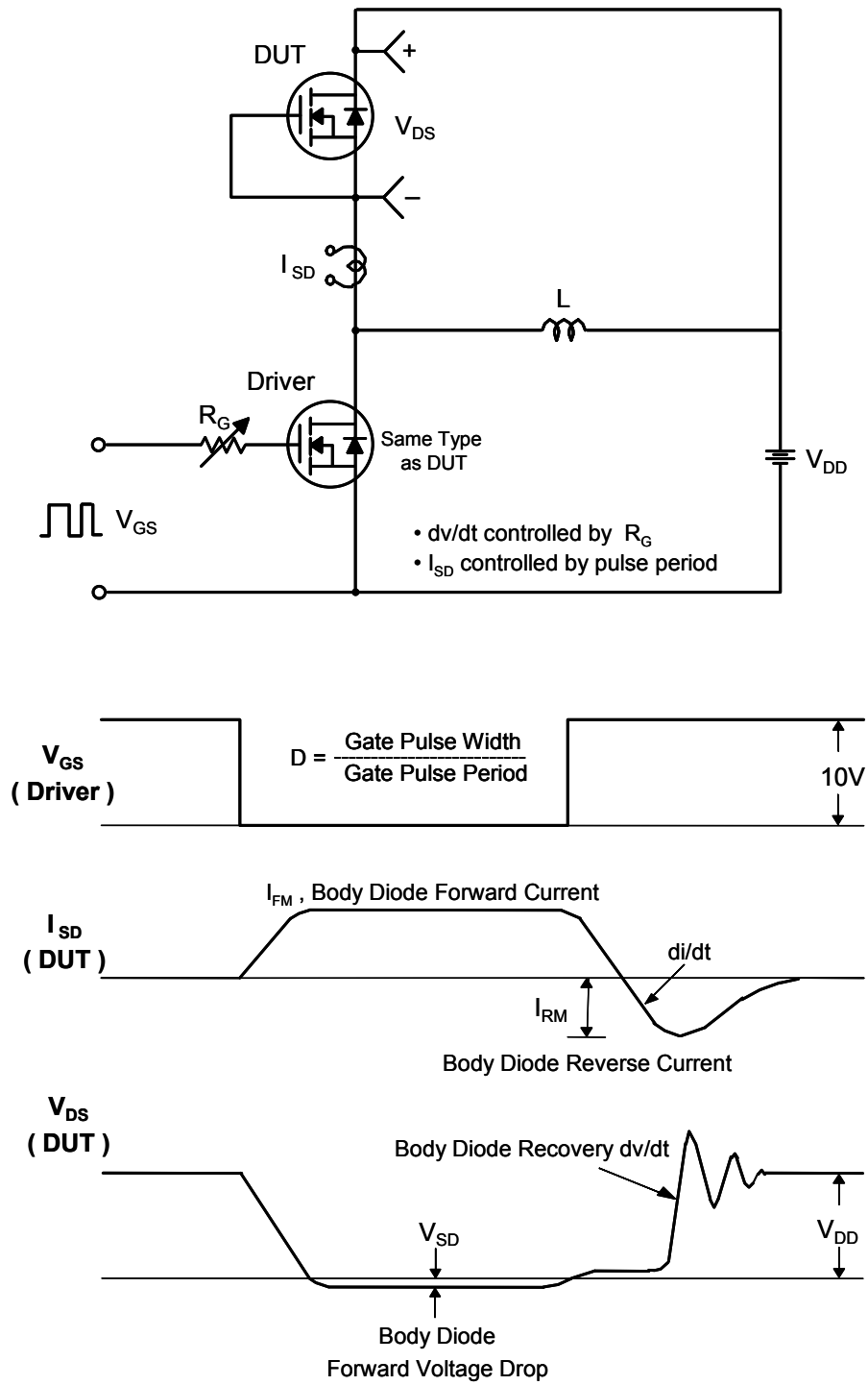
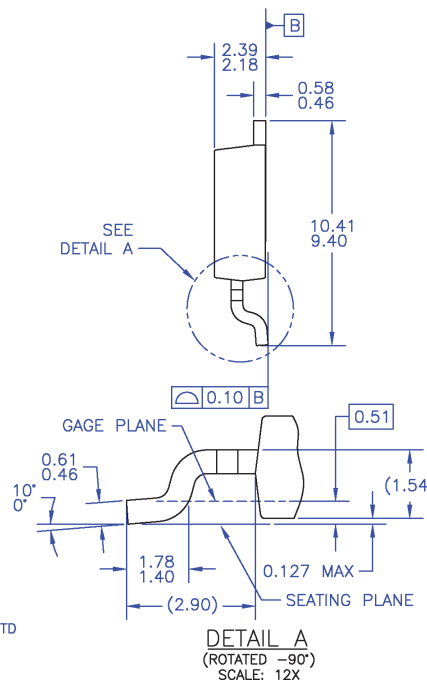
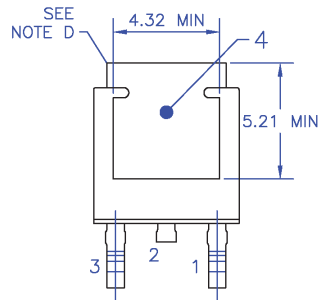
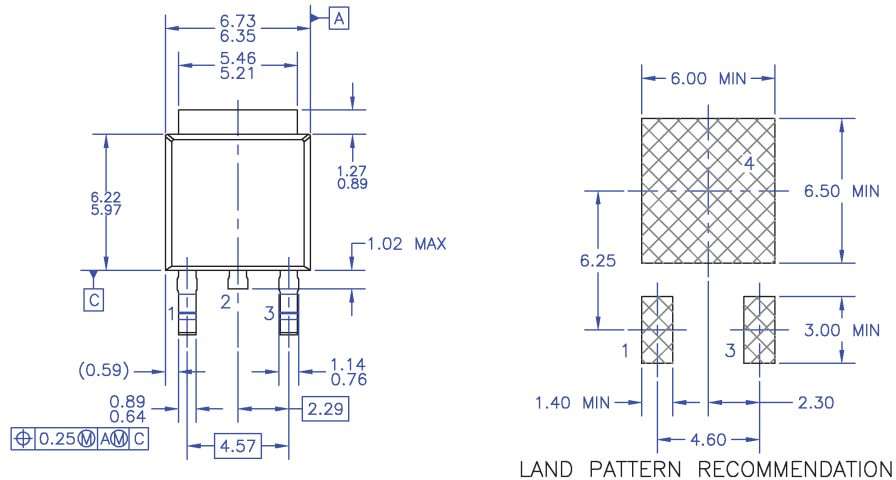


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



- 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

Figure 16. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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		SyncFET™	

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2. A critical component in 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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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.
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