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FAIRCHILD SEMICONDUCTOR®

December 2013

FCD380N60E

N-Channel SuperFET® II Easy-Drive MOSFET

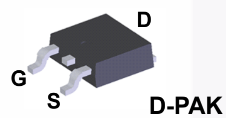
600 V, 10.2 A, 380 mΩ

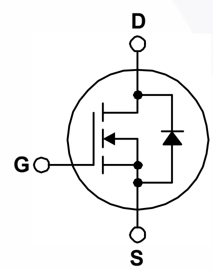
Features

- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 320 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 34 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 97 pF)
- 100% Avalanche Tested
- An Integrated Gate Resistor
- RoHS Compliant

Description

SuperFET® II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET II MOSFET easy-drive series offers slightly slower rise and fall times compared to the SuperFET II MOSFET series. Noted by the "E" part number suffix, this family helps manage EMI issues and allows for easier design implementation. For faster switching in applications where switching losses must be at an absolute minimum, please consider the SuperFET II MOSFET series.





Absolute 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	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	
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, 1/8" from Case for 5 Seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FCD380N60E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.18	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	100	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCD380N60E	FCD380N60E	DPAK	Tape and Reel	330 mm	16 mm	2500 units

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
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10$ mA, Referenced to 25^oC	-	0.67	-	$V/^oC$
BV_{DS}	Drain to 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, $T_C = 125^oC$	-	-	20	µA
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm20$ 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, $V_{GS} = 0$ V, f = 1 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	f = 1 MHz	-	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. $I_{SD} \le 5.1$ A, di/dt ≤ 200 A/µs, $V_{DD} \le BV_{DSS}$, starting $T_J = 25°C$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

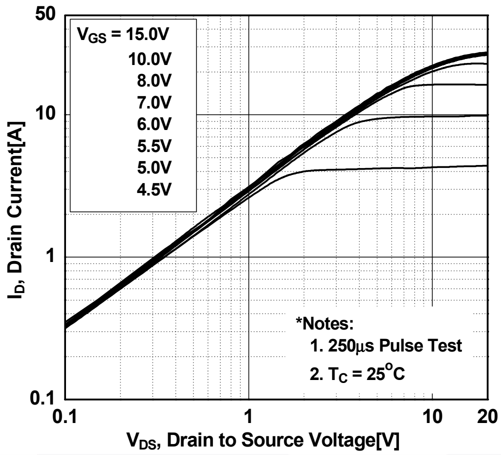


Figure 2. Transfer Characteristics

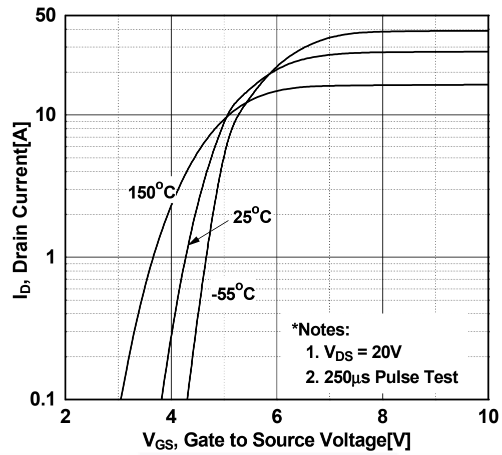


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

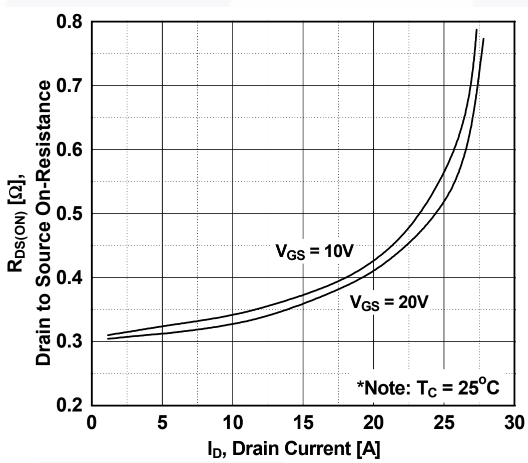


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

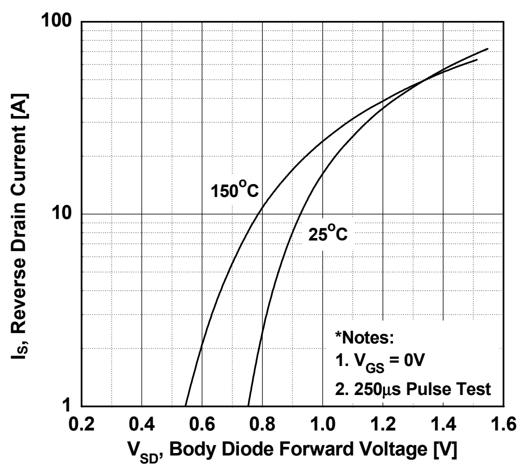


Figure 5. Capacitance Characteristics

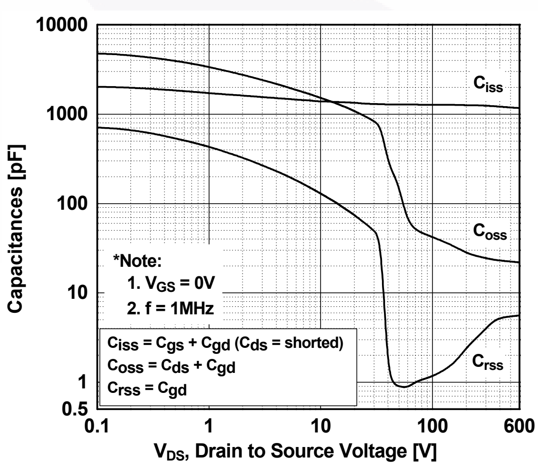
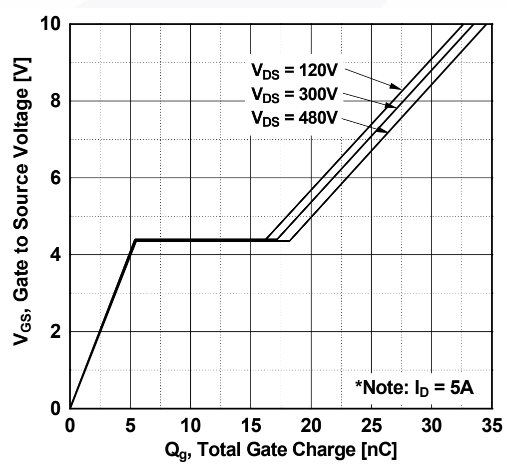


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

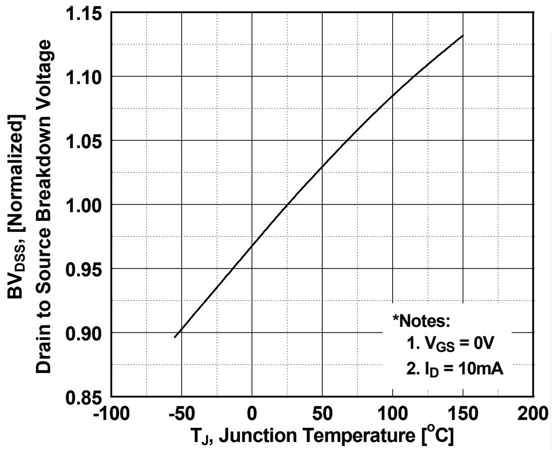


Figure 8. On-Resistance Variation vs. Temperature

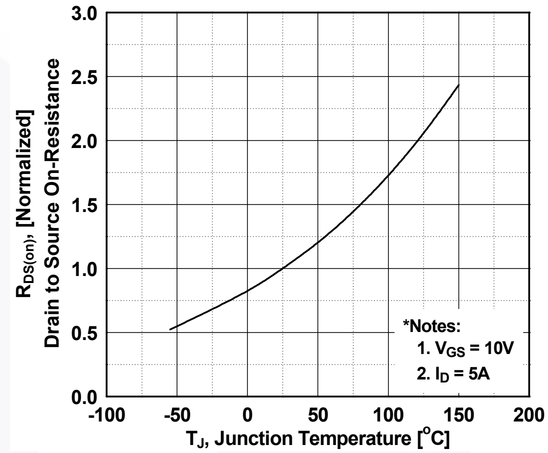


Figure 9. Maximum Safe Operating Area

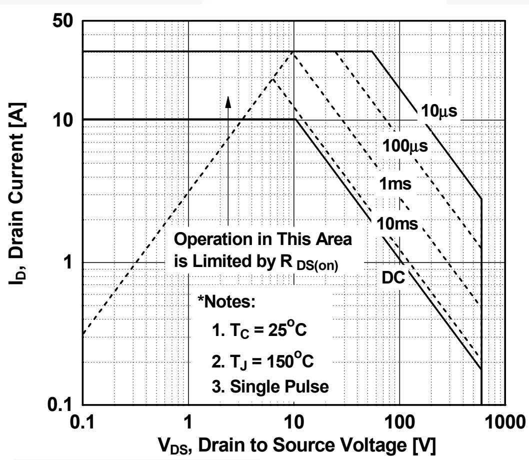


Figure 10. Maximum Drain Current vs. Case Temperature

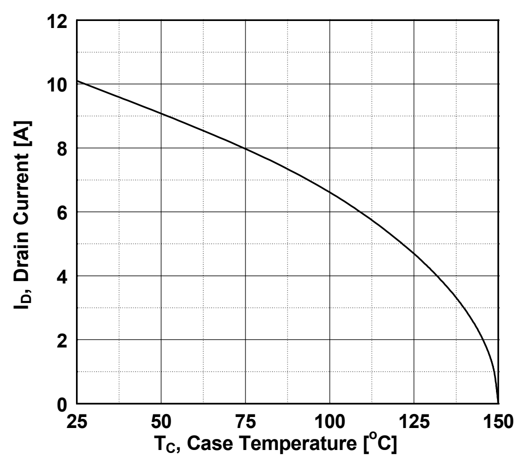
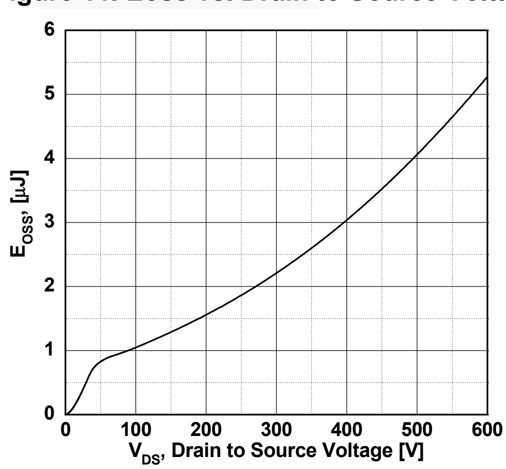
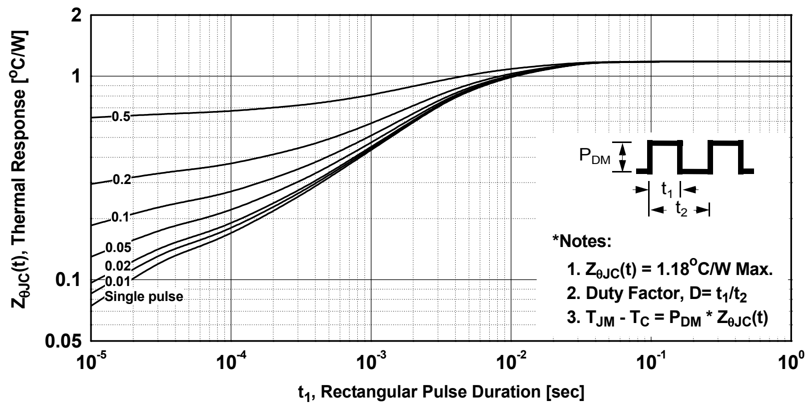


Figure 11. Eoss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



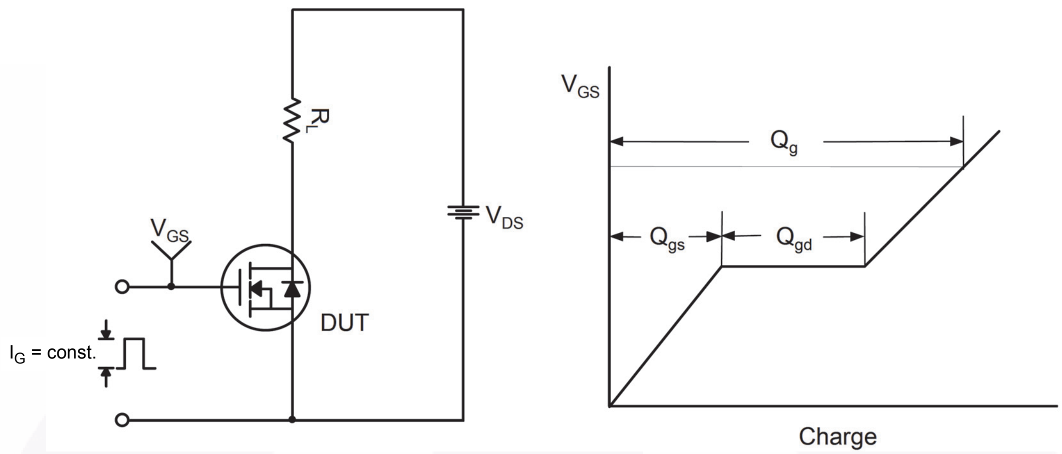


Figure 13. Gate Charge Test Circuit & Waveform

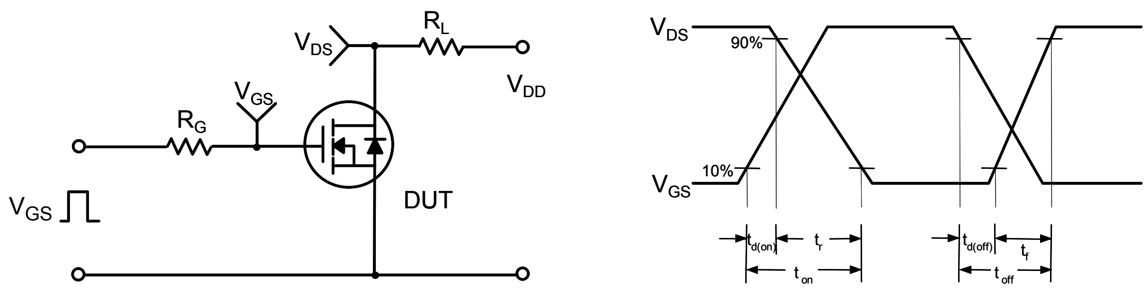


Figure 14. Resistive Switching Test Circuit & Waveforms

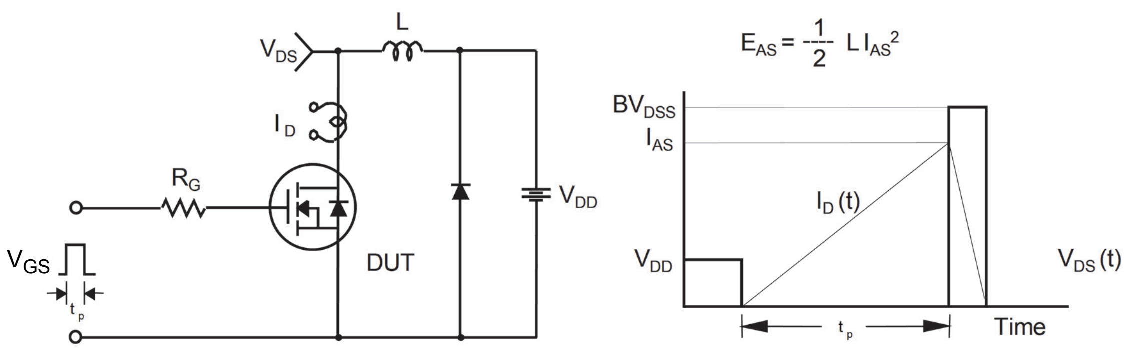


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

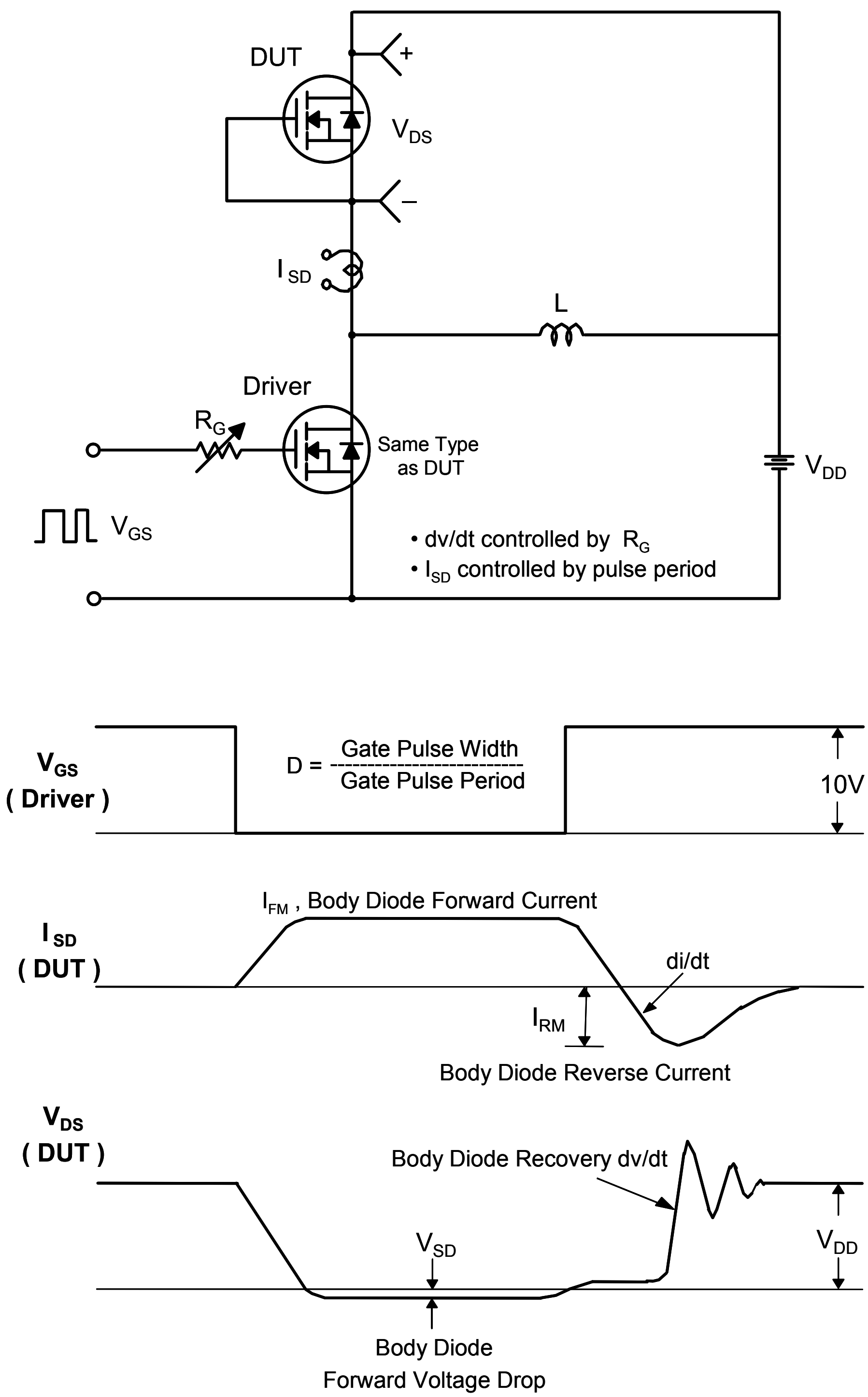


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

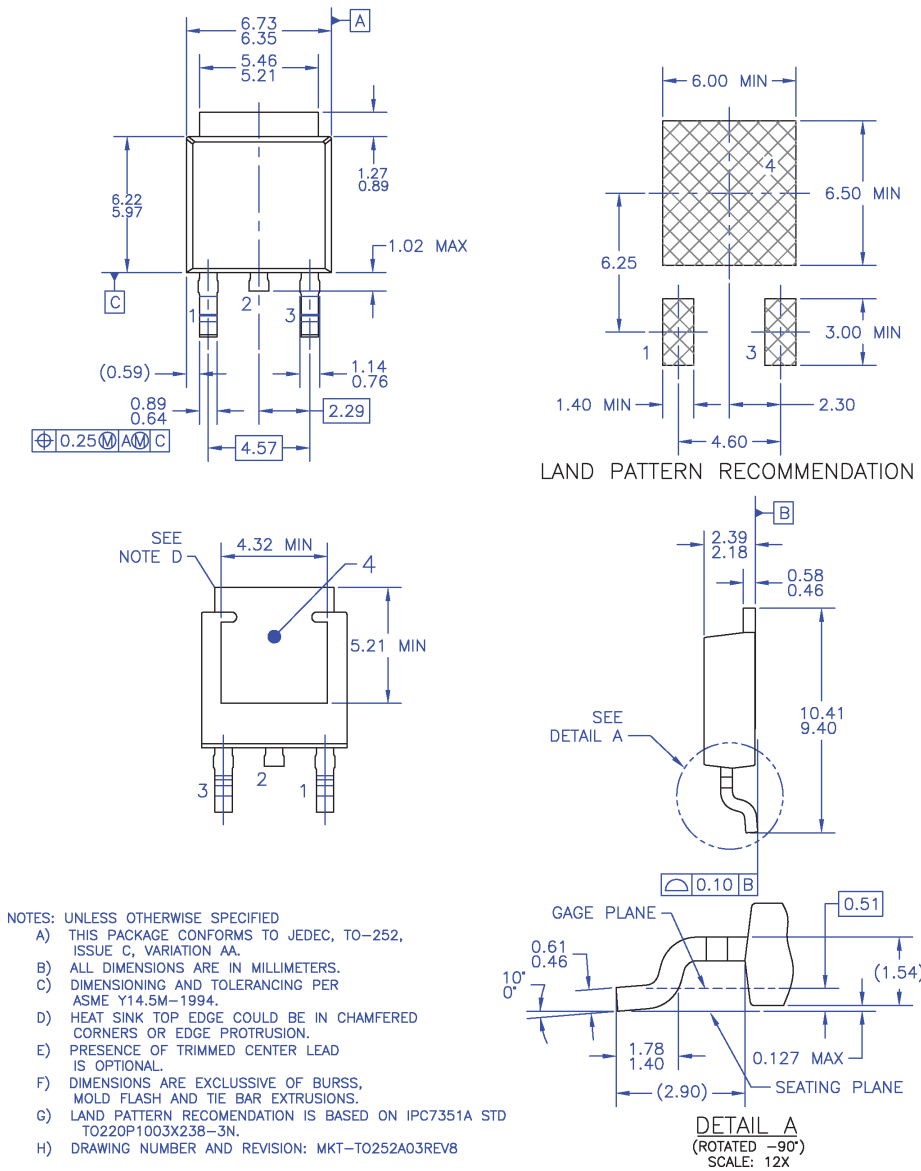


Figure 17. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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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.
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