FAIRCHILD
SEMICONDUCTOR®

FCD600N60Z

N-Channel SuperFET® II MOSFET

600 V, 7.4 A, 600 mΩ

Features

- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 510 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 20 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 74 pF)
- 100% Avalanche Tested
- ESD Improved Capacity
- RoHS Compliant

Applications

- LCD / LED / PDP TV and Monitor Lighting
- Solar Inverter
- AC-DC Power Supply

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 is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.

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D-PAK

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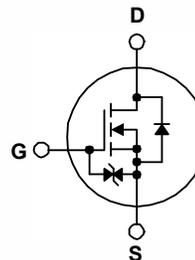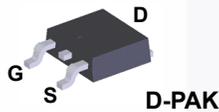
Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter			FCD600N60Z	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)		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	MOSFET dv/dt			100	V/ns
	Peak Diode Recovery dv/dt		(Note 3)	20	
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, 1/8" from Case for 5 Seconds			300	°C

Thermal Characteristics

Symbol	Parameter	FCD600N60Z	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.4	°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
FCD600N60Z	FCD600N60Z	DPAK	Tape and Reel	330 mm	16 mm	2500 units

Electrical Characteristics T_C = 25°C 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	-	-	
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25°C	-	0.67	-	V/°C
BV_{DS}	Drain to Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 7.4 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-Body Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	-	-	±10	uA
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 = 3.7 A	-	0.51	0.6	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 3.7 A	-	6.7	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	840	1120	pF
C_{oss}	Output Capacitance		-	630	840	pF
C_{rss}	Reverse Transfer Capacitance		-	30	45	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	-	16.5	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	74	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 3.7 A, V_{GS} = 10 V	-	20	26	nC
Q_{gs}	Gate to Source Gate Charge		-	3.4	-	nC
Q_{gd}	Gate to Drain "Miller" Charge	(Note 4)	-	7.5	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-	2.89	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 3.7 A, V_{GS} = 10 V, R_G = 4.7 Ω	-	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	(Note 4)	-	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} = 0 V, I_{SD} = 3.7 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 3.7 A, dI_F/dt = 100 A/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} = 1.5 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq$ 3.7 A, di/dt ≤ 200 A/μs, $V_{DD} \leq BV_{DSS}$, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

V_{GS} = 10.0V
8.0V
7.0V
6.0V
5.5V
5.0V
4.5V

I_D, Drain Current[A]

V_{DS}, Drain to Source Voltage [V]

*Notes:
1. 250μs Pulse Test
2. T_C = 25°C
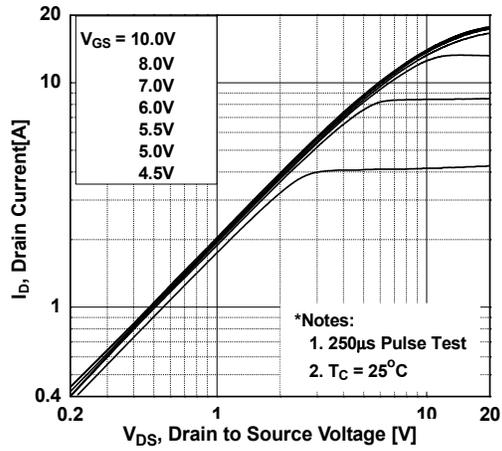
Figure 2. Transfer Characteristics

*Notes:
1. V_{DS} = 20V
2. 250μs Pulse Test

I_D, Drain Current[A]

150°C   -55°C   25°C

V_{GS}, Gate to Source Voltage [V]

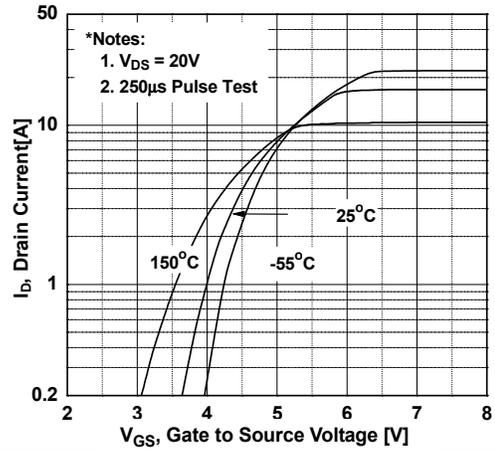### Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

$R_{DS(ON)}$ [Ω], Drain to Source On-Resistance

V_{GS} = 10V

V_{GS} = 20V

*Note: T_C = 25°C

I_D, Drain Current [A]
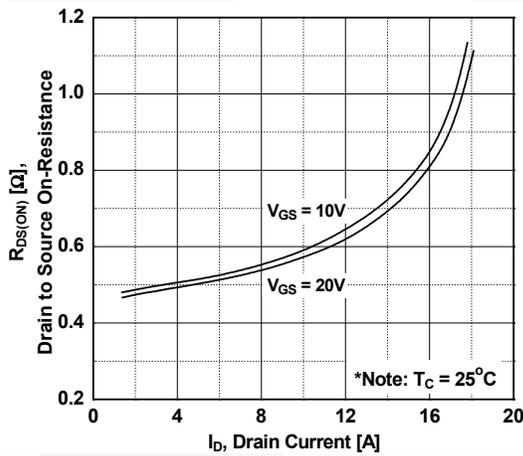
Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

I_S, Reverse Drain Current [A]

150°C   25°C

*Notes:
1. V_{GS} = 0V
2. 250μs Pulse Test

V_{SD}, Body Diode Forward Voltage [V]
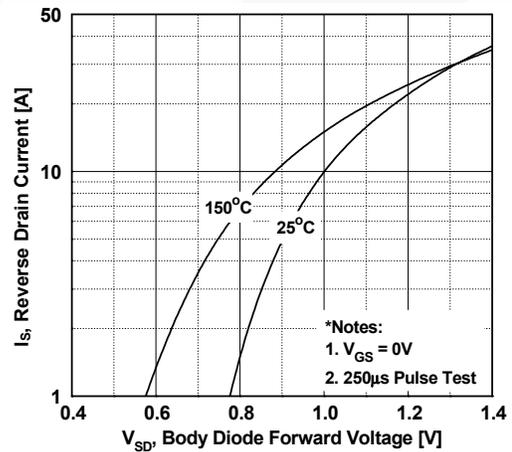
Figure 5. Capacitance Characteristics

Capacitances [pF]

C_{iss}

C_{oss}

C_{rss}

*Note:
1. V_{GS} = 0V
2. f = 1MHz

$C_{iss} = C_{gs} + C_{gd}$ (C_{ds} = shorted)
$C_{oss} = C_{ds} + C_{gd}$
$C_{rss} = C_{gd}$

V_{DS}, Drain to Source Voltage [V]
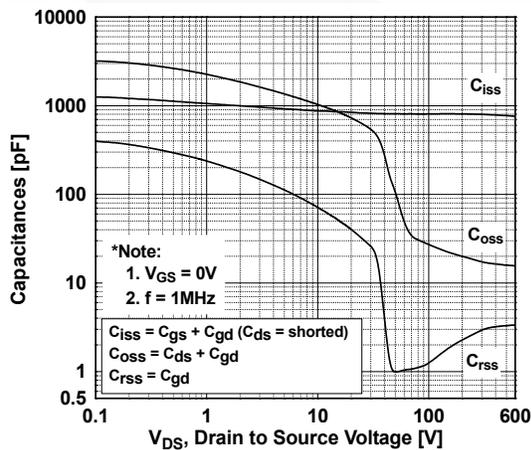
Figure 6. Gate Charge Characteristics

V_{GS}, Gate to Source Voltage [V]

V_{DS} = 120V
V_{DS} = 300V
V_{DS} = 480V

*Note: I_D = 3.7A

Q_g, Total Gate Charge [nC]
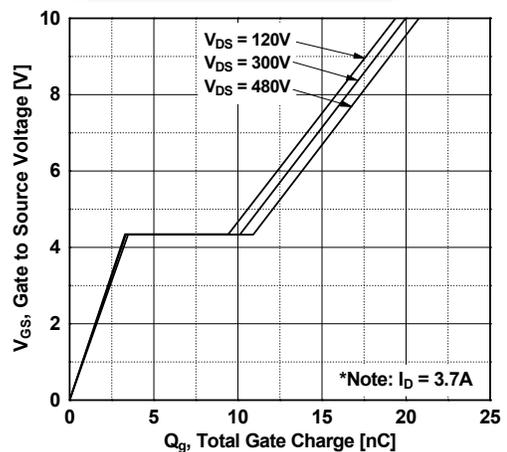
Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

*Notes:
1. $V_{GS} = 0V$
2. $I_D = 250\mu A$
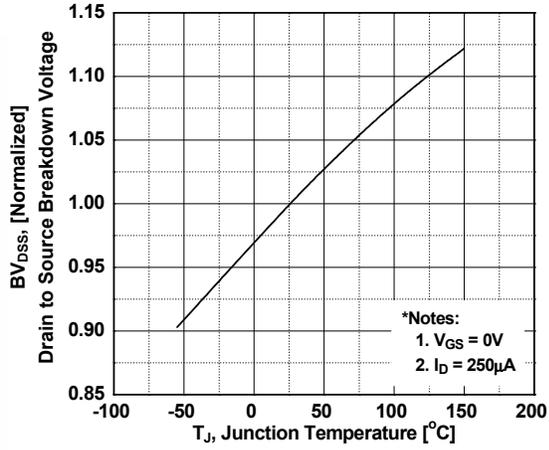
Figure 8. On-Resistance Variation vs. Temperature

*Notes:
1. $V_{GS} = 10V$
2. $I_D = 3.7A$
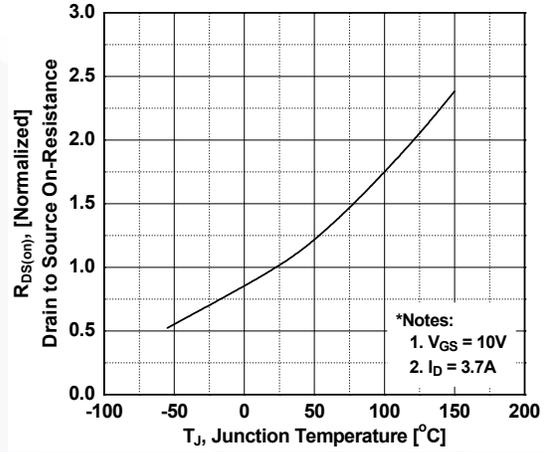
Figure 9. Maximum Safe Operating Area

10µs
100µs
1ms
10ms
DC

Operation in This Area is Limited by $R_{DS(on)}$
*Notes:
1. $T_C = 25^{o}C$
2. $T_J = 150^{o}C$
3. Single Pulse
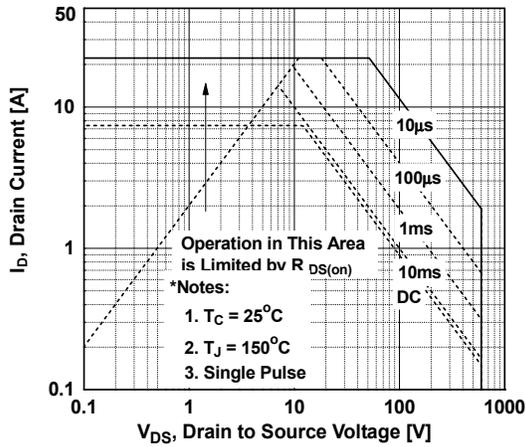
Figure 10. Maximum Drain Current vs. Case Temperature
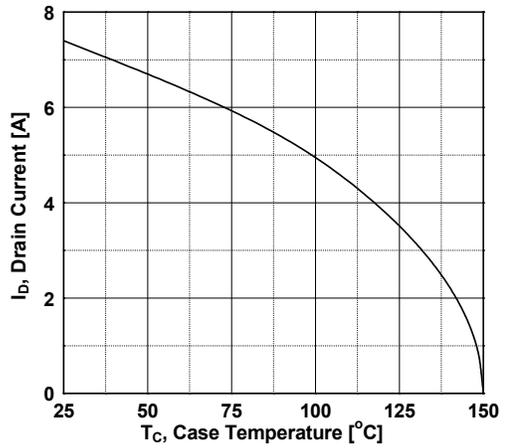
Figure 11. Eoss vs. Drain to Source Voltage
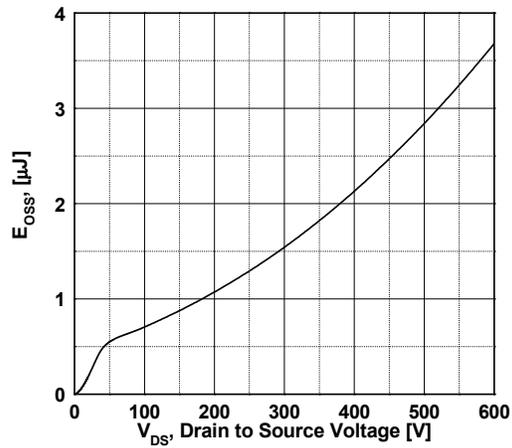
Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

*Notes:
1. $Z_{\theta JC}(t) = 1.4^{\circ}C/W$ Max.
2. Duty Factor, $D = t_1/t_2$
3. $T_{JM} - T_C = P_{DM} * Z_{\theta JC}(t)$
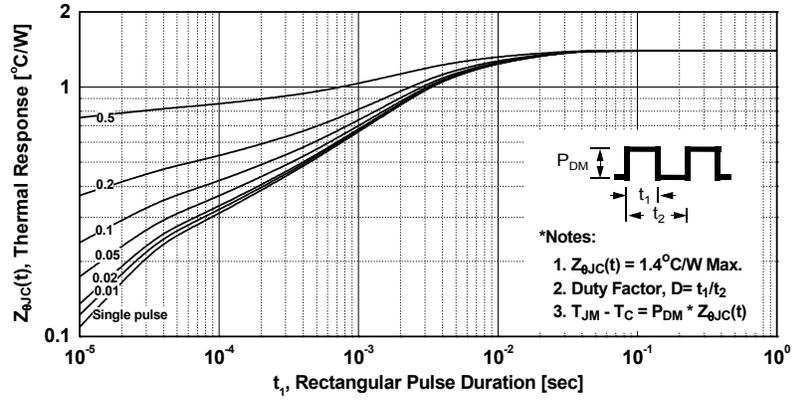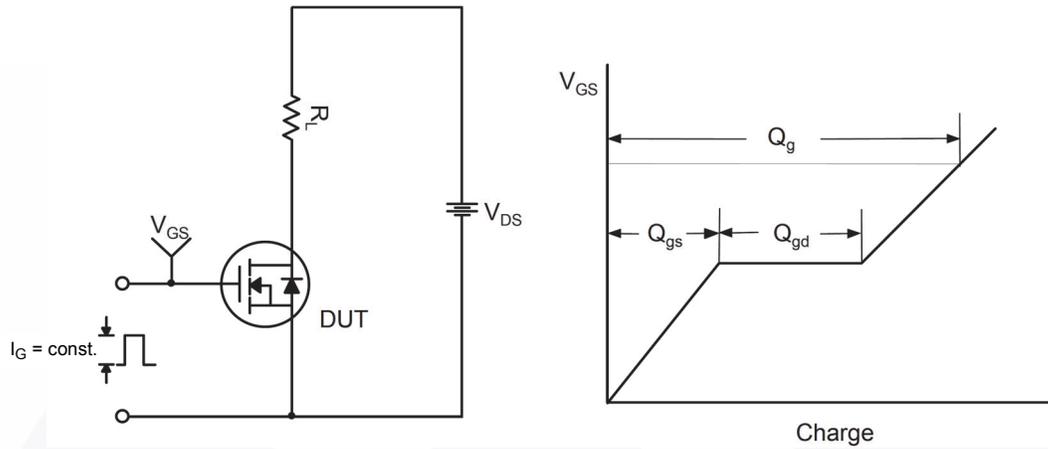
Figure 13. Gate Charge Test Circuit & Waveform
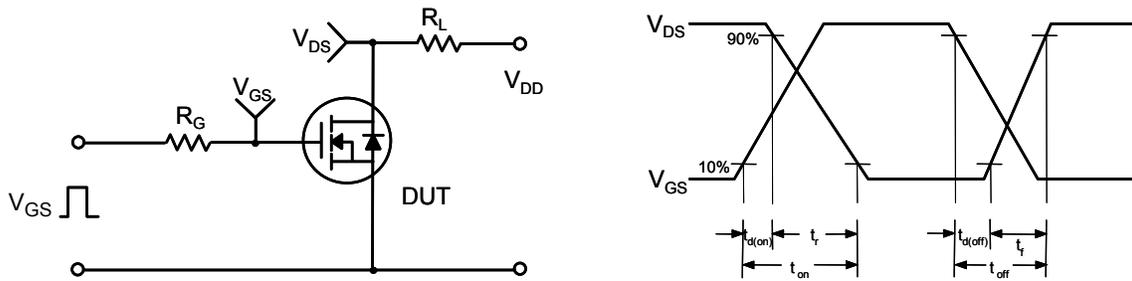
Figure 14. Resistive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2$$
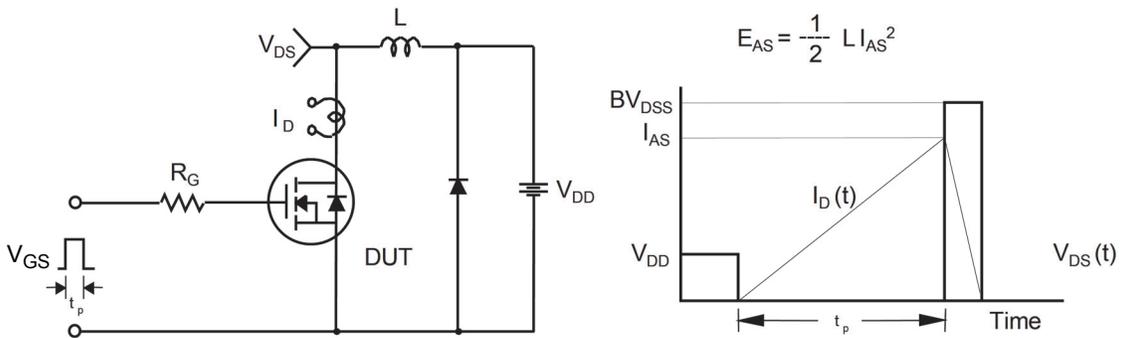
Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$
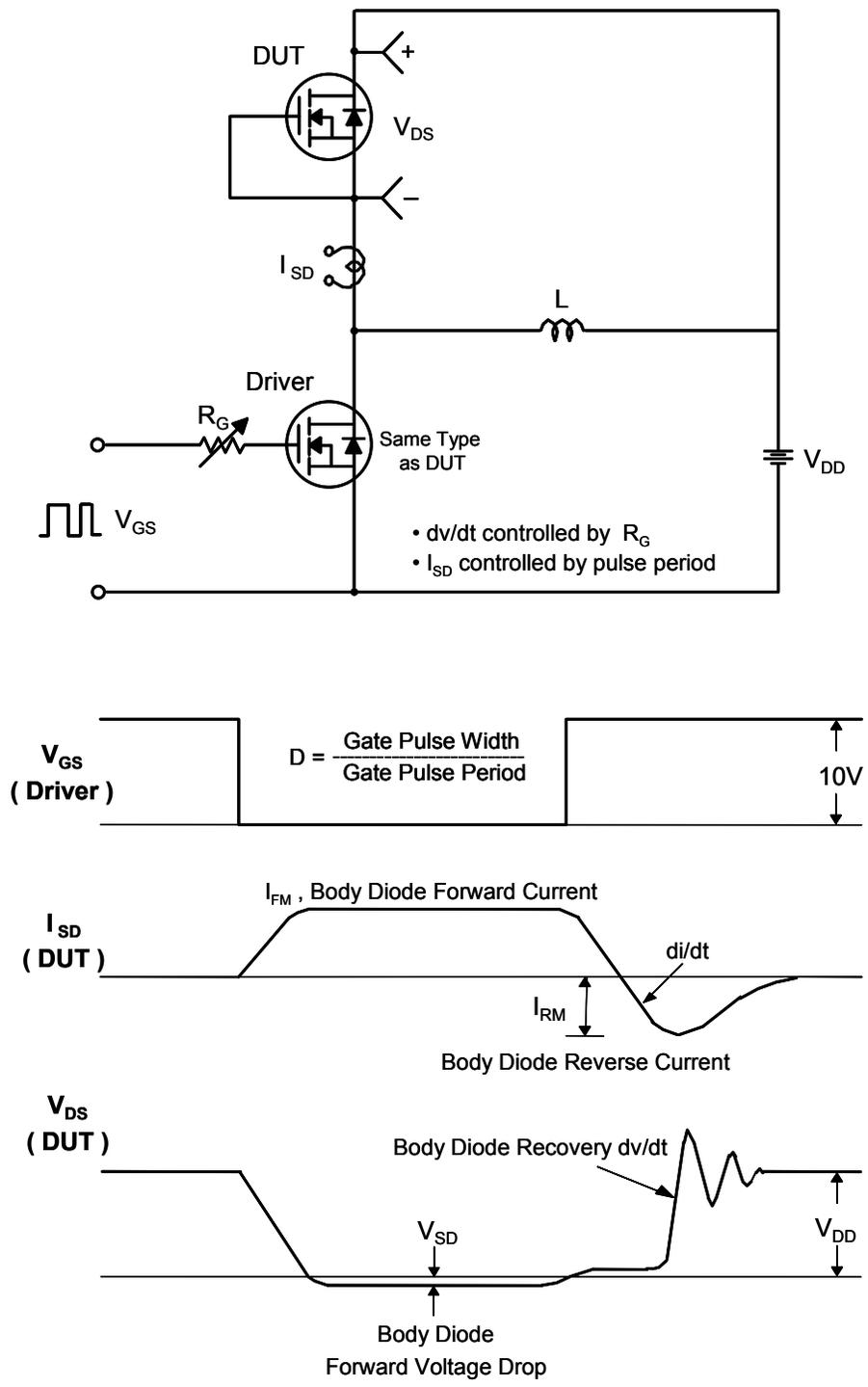
Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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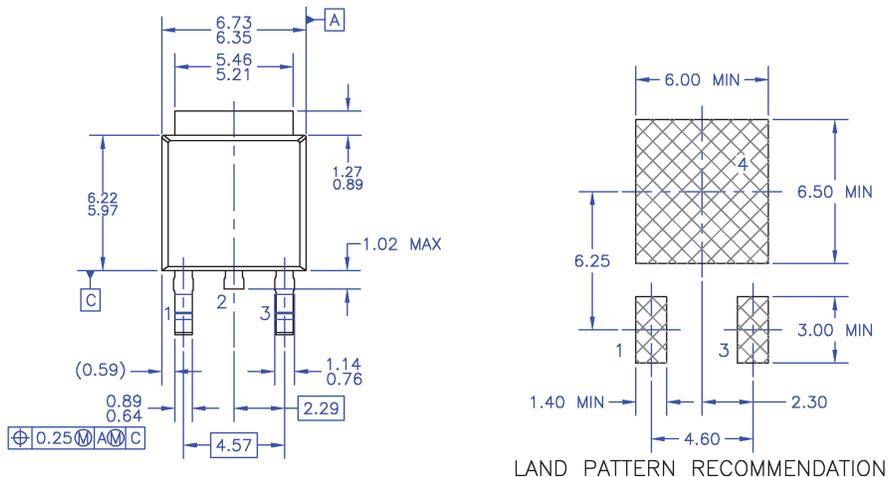
Figure 17. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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Rev. I66