



April 2015

FCB110N65F

N-Channel SuperFET® II FRFET® MOSFET

650 V, 35 A, 110 mΩ

Features

- 700 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 96\text{ m}\Omega$ (Typ.)
- Ultra Low Gate Charge (Typ. $Q_g = 98\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 464\text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Applications

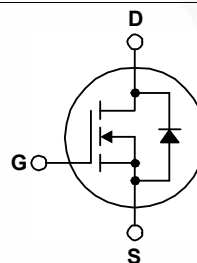
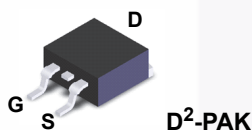
- Telecom/Server Power Supplies
- Solar Inverters
- Computing Power Supplies
- FPD TV Power/Lighting

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.

SuperFET® II FRFET® MOSFET combines a faster and more rugged intrinsic body diode performance with fast switching, aimed at achieving better reliability and efficiency especially in resonant switching applications.

SuperFET® II FRFET® is very suitable for the switching power applications such as server/telecom power, Solar inverter, FPD TV power, computing power, lighting and industrial power applications.



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

Symbol	Parameter	FCB110N65F	Unit
V_{DSS}	Drain to Source Voltage	650	V
V_{GSS}	Gate to Source Voltage	- DC	V
		- AC	
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	A
		- Continuous ($T_C = 100^\circ\text{C}$)	
I_{DM}	Drain Current	- Pulsed (Note 1)	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	mJ
I_{AR}	Avalanche Current	(Note 1)	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	mJ
dv/dt	MOSFET dv/dt	(Note 3)	V/ns
	Peak Diode Recovery dv/dt		
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	W
		- Derate Above 25°C	$W/^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FCB110N65F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.35	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz copper), Max.	62.5	
	Thermal Resistance, Junction to Ambient (1 in ² Pad of 2-oz copper), Max.	40	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Tape Width
FCB110N65F	FCB110N65F	D ² -PAK	Tape and Reel	330 mm	24 mm	800 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	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	650	-	-	V
		$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}, T_J = 150^\circ\text{C}$	700	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}, \text{Referenced to } 25^\circ\text{C}$	-	0.72	-	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	μA
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	110	-	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 3.5\text{ mA}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 17.5\text{ A}$	-	96	110	m Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 17.5\text{ A}$	-	30	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	3680	4895	pF
C_{oss}	Output Capacitance		-	110	145	pF
C_{rss}	Reverse Transfer Capacitance		-	0.65	-	pF
C_{oss}	Output Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	65	-	pF
$C_{oss\text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	464	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 17.5\text{ A}, V_{GS} = 10\text{ V}$ (Note 4)	-	98	145	nC
Q_{gs}	Gate to Source Gate Charge		-	20	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	43	-	nC
ESR	Equivalent Series Resistance	$f = 1\text{ MHz}$	-	0.7	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 17.5\text{ A}, V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$ (Note 4)	-	31	72	ns
t_r	Turn-On Rise Time		-	21	52	ns
$t_{d(off)}$	Turn-Off Delay Time		-	89	188	ns
t_f	Turn-Off Fall Time		-	5.7	21	ns

Drain-Source Diode Characteristics

I _S	Maximum Continuous Drain to Source Diode Forward Current	-	-	35	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	100	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 17.5 A		-	-
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 17.5 A,		-	133
Q _{rr}	Reverse Recovery Charge	dI _F /dt = 100 A/μs		-	0.67
				-	μC

Notes:

1. Repetitive rating: pulse width limited by maximum junction temperature.
2. $I_{AS} = 8\text{ A}, R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 17.5\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

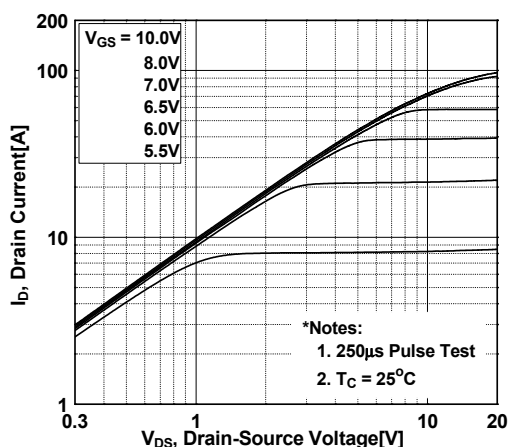


Figure 2. Transfer Characteristics

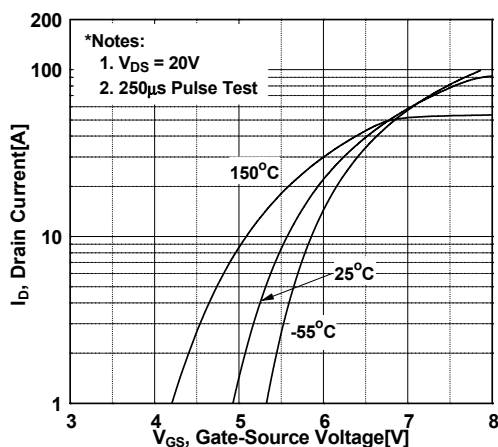


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

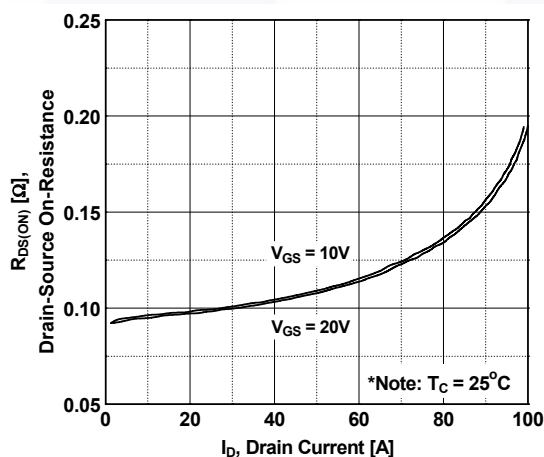


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

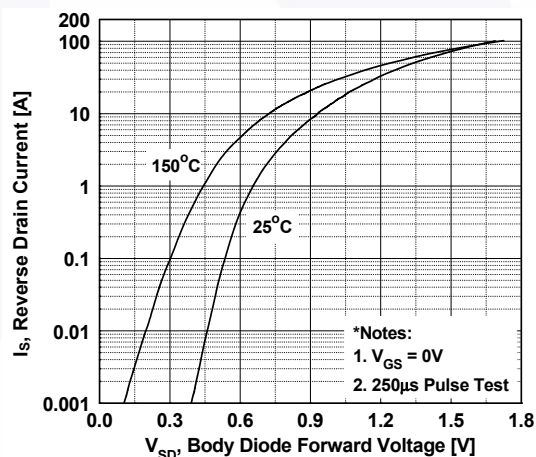


Figure 5. Capacitance Characteristics

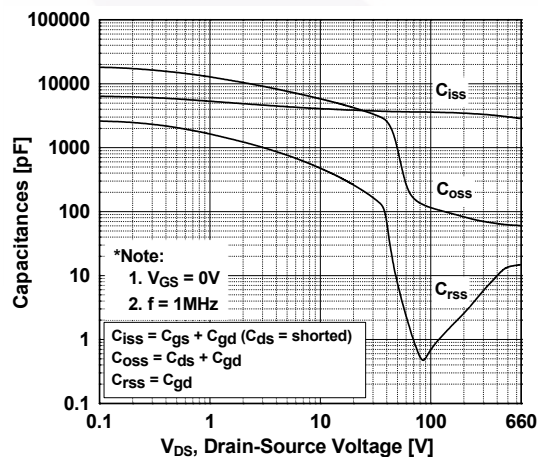
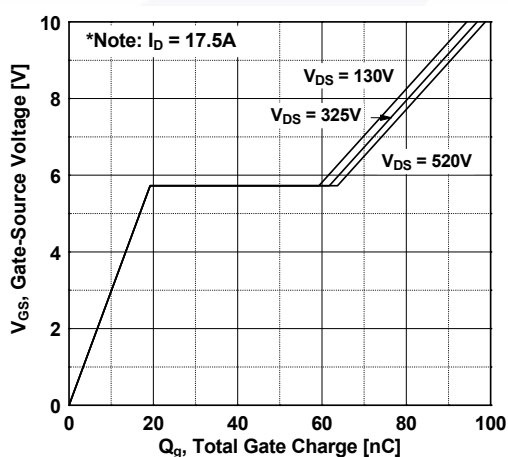


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

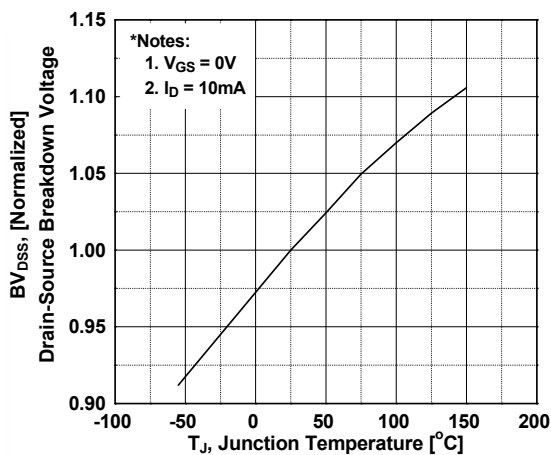


Figure 8. On-Resistance Variation vs. Temperature

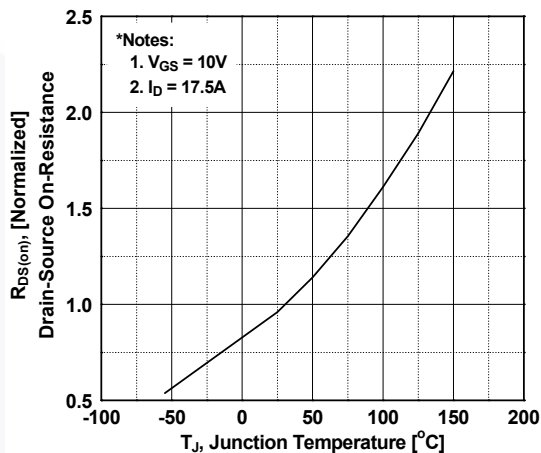


Figure 9. Maximum Safe Operating Area

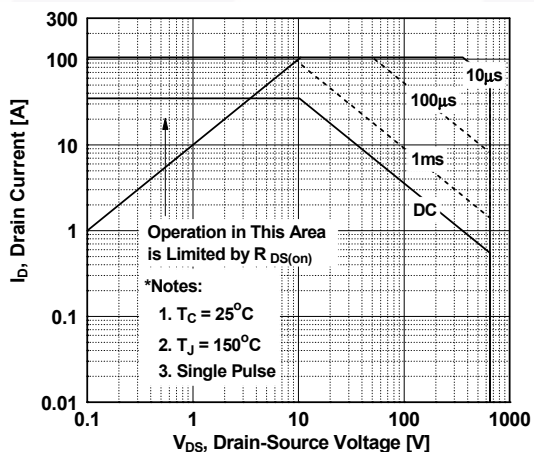


Figure 10. Maximum Drain Current vs. Case Temperature

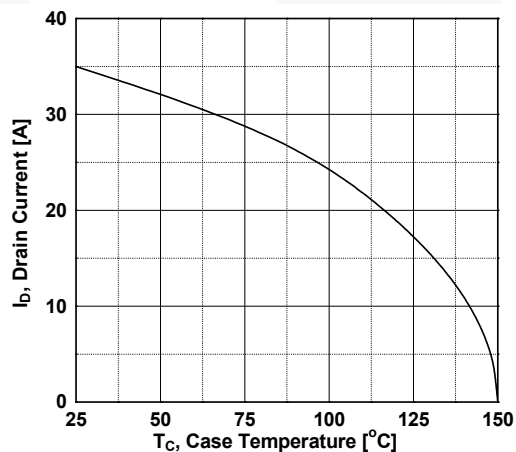
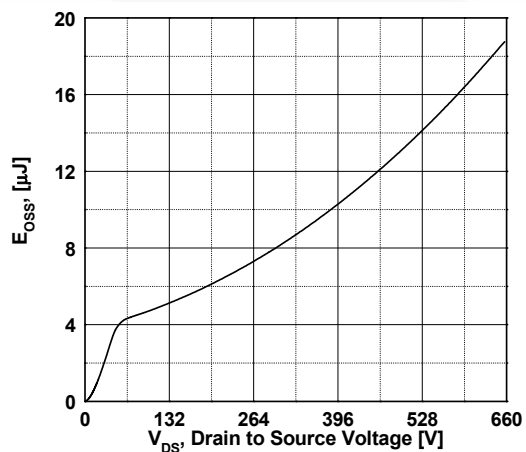
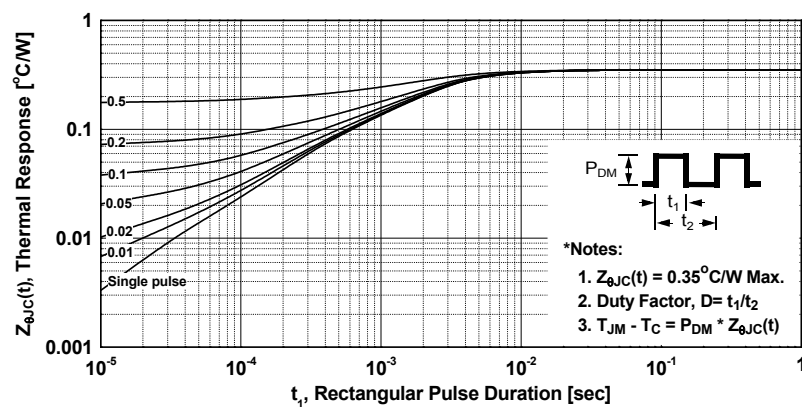


Figure 11. E_{oss} vs. Drain to Source Voltage Switching Capability



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



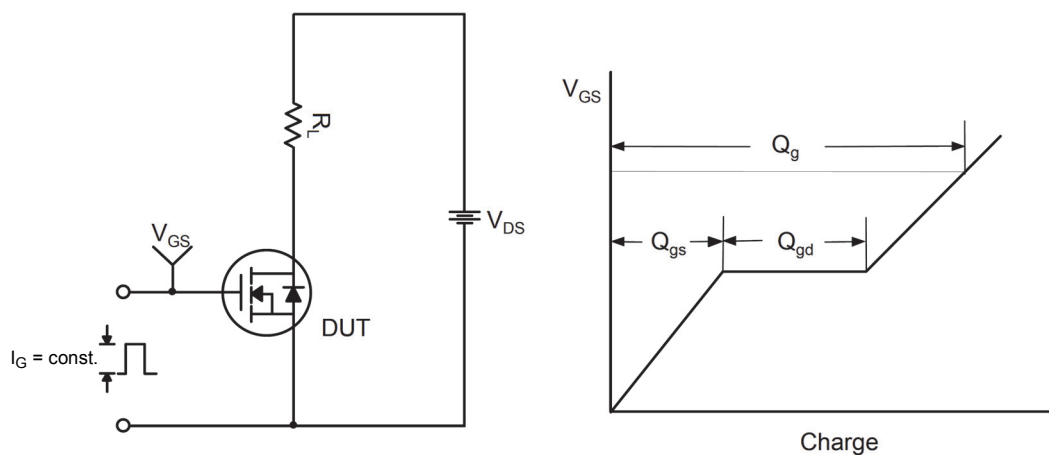


Figure 13. Gate Charge Test Circuit & Waveform

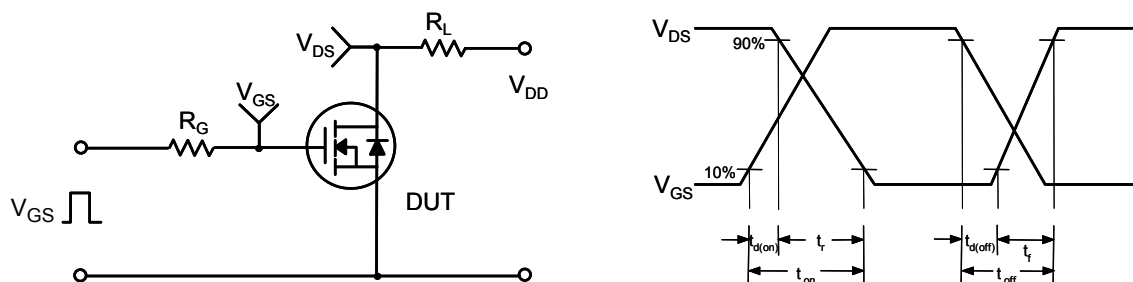


Figure 14. Resistive Switching Test Circuit & Waveforms



Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

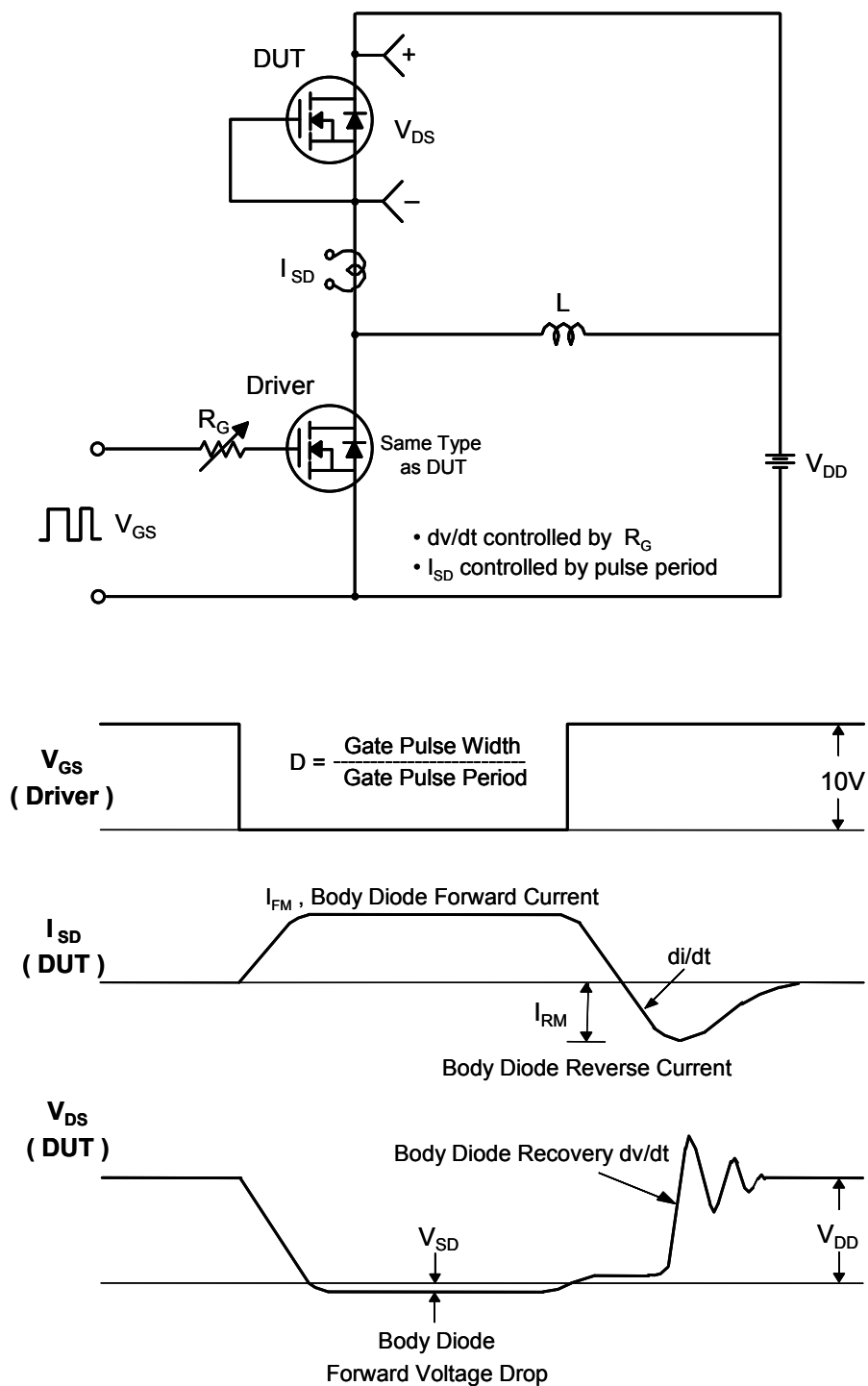
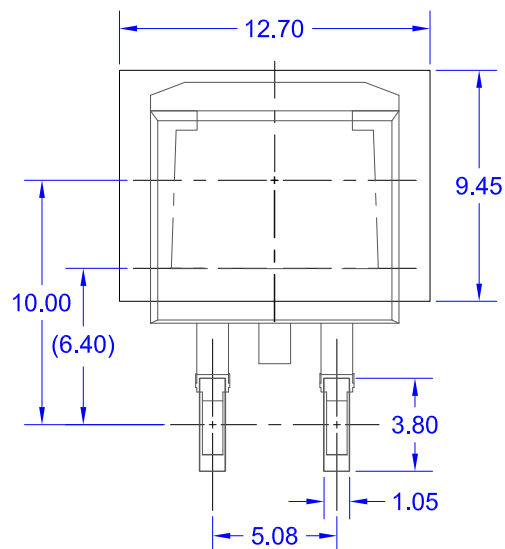
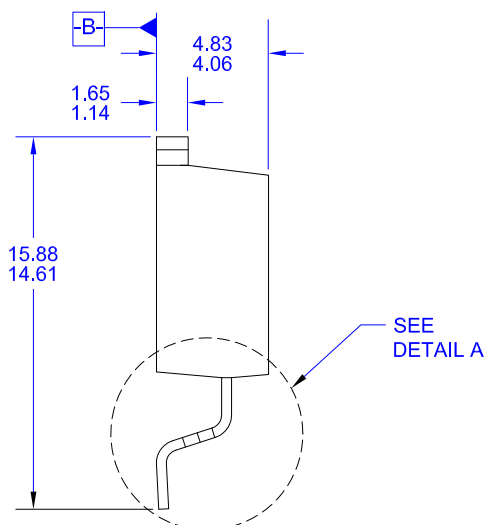
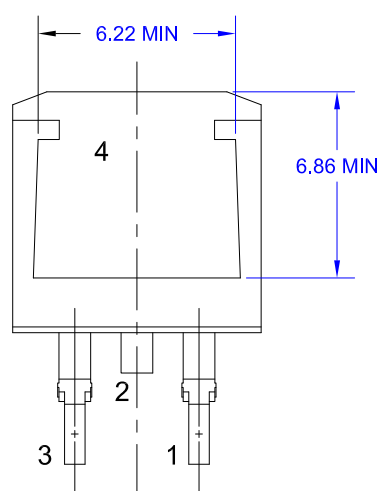


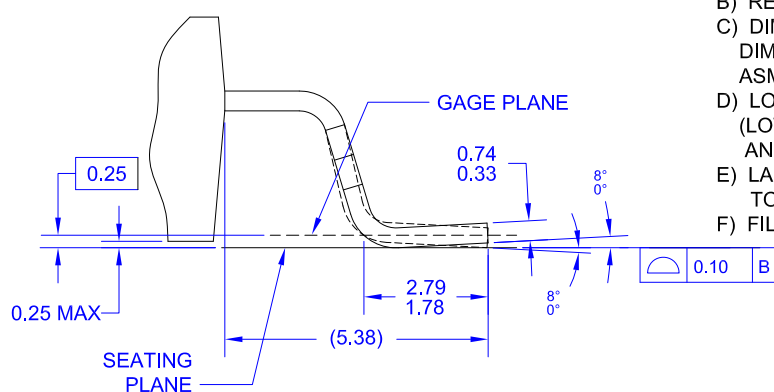
Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms



LAND PATTERN RECOMMENDATION
UNLESS NOTED, ALL DIMS TYPICAL



- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) REFERENCE JEDEC, TO-263, VARIATION AB.
- C) DIMENSIONING AND TOLERANCING PER DIMENSIONING AND TOLERANCING PER ASME Y14.5 - 2009.
- D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE).
- E) LANDPATTERN RECOMMENDATION PER IPC TO254P1524X482-3N
- F) FILENAME: TO263A02REV7



DETAIL A, ROTATED 90°
SCALE: 2X



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Definition of Terms

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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