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December 2014

FCP190N65F

N-Channel SuperFET® II FRFET® MOSFET

650 V, 20.6 A, 190 mΩ

Features

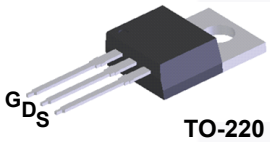
- 700 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 168 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 60 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 304 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

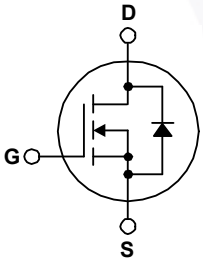
- LCD / LED / PDP TV
- Solar Inverter
- AC - DC Power Supply

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. SuperFET II FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.



TO-220



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

Symbol	Parameter		FCP190N65F	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GSS}	Gate to Source Voltage	- DC	±20	V
		- AC (f > 1 Hz)	±30	
I_D	Drain Current	- Continuous (T_C = 25°C)	20.6	A
		- Continuous (T_C = 100°C)	13.1	
I_{DM}	Drain Current	- Pulsed (Note 1)	61.8	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	400	mJ
I_{AR}	Avalanche Current	(Note 1)	4.0	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	2.1	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt	(Note 3)	50	
P_D	Power Dissipation	(T_C = 25°C)	208	W
		- Derate Above 25°C	1.67	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	FCP190N65F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.6	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP190N65F	FCP190N65F	TO-220	Tube	N/A	N/A	50 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	650	-	-	V
		V_{GS} = 0 V, I_D = 10 mA, T_J = 150°C	700	-	-	
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25°C	-	0.72	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V	-	-	10	μA
		V_{DS} = 520 V, T_C = 125°C	-	60	-	
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 = 2 mA	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 10 A	-	168	190	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 10 A	-	18	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	2425	3225	pF
C_{oss}	Output Capacitance		-	2110	2805	pF
C_{rss}	Reverse Transfer Capacitance		-	105	155	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	-	44	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	-	304	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 10 A, V_{GS} = 10 V (Note 4)	-	60	78	nC
Q_{gs}	Gate to Source Gate Charge		-	12	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	25	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-	0.6	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 10 A, V_{GS} = 10 V, R_g = 4.7 Ω (Note 4)	-	25	60	ns
t_r	Turn-On Rise Time		-	11	32	ns
$t_{d(off)}$	Turn-Off Delay Time		-	62	134	ns
t_f	Turn-Off Fall Time		-	4.2	18	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	20.6	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	61.8	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 10 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 10 A, dI_F/dt = 100 A/μs	-	105	-	ns
Q_{rr}	Reverse Recovery Charge		-	515	-	nC

Notes:

1. Repetitive rating: pulse width limited by maximum junction temperature.
2. I_{AS} = 4 A, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 10 A, di/dt ≤ 200 A/μs, V_{DD} ≤ 380 V, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

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Typical Performance Characteristics

Figure 1. On-Region Characteristics

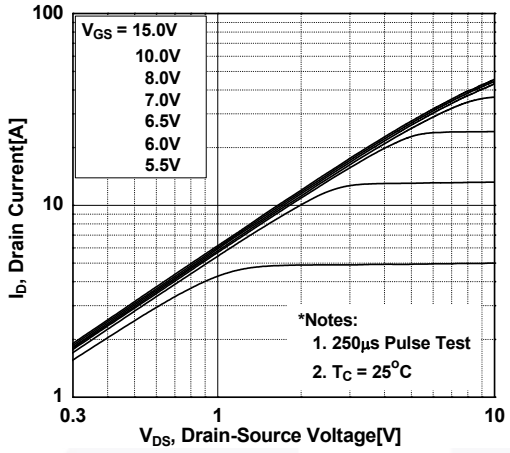


Figure 2. Transfer Characteristics

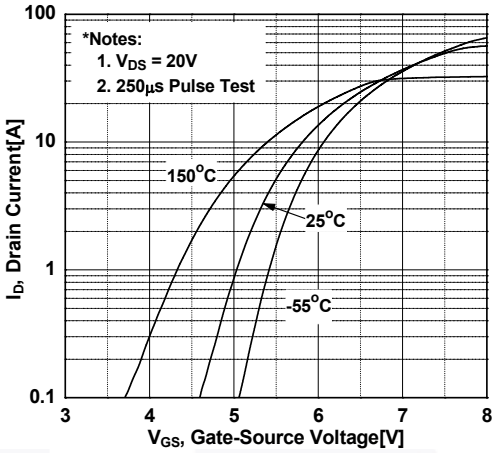


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

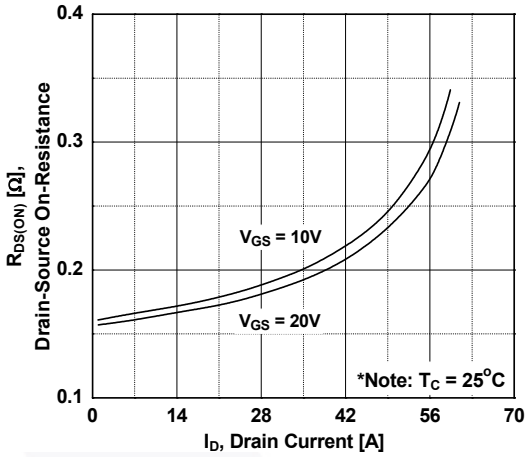


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

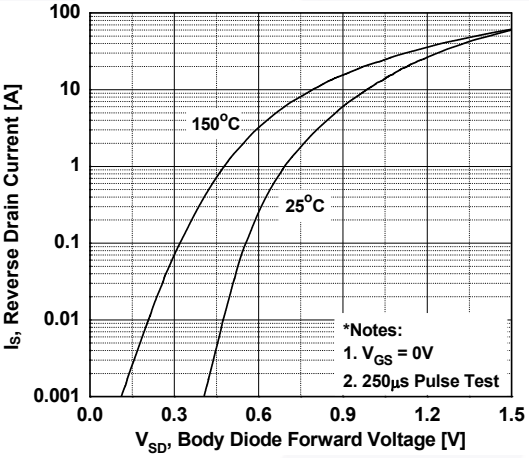


Figure 5. Capacitance Characteristics

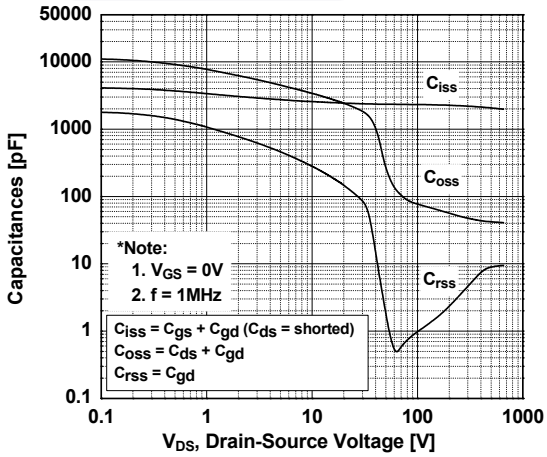
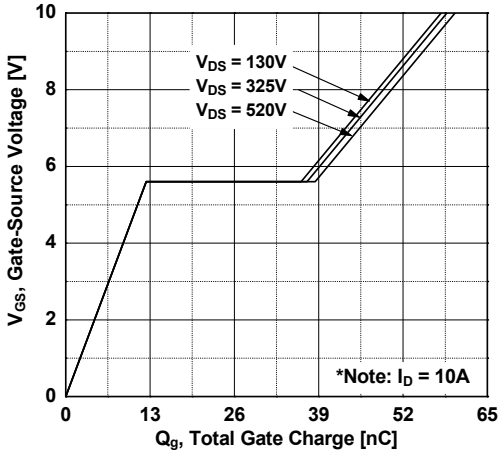


Figure 6. Gate Charge Characteristics



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Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

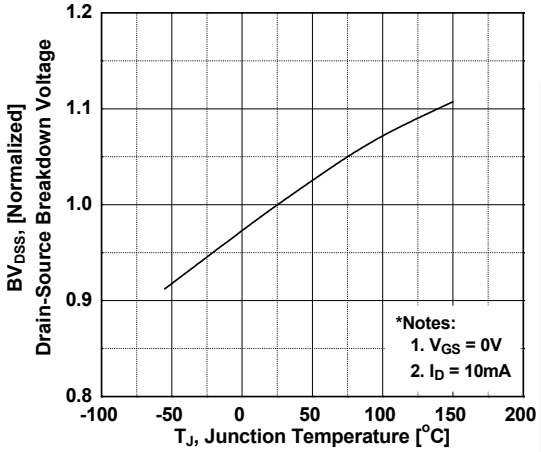


Figure 8. On-Resistance Variation vs. Temperature

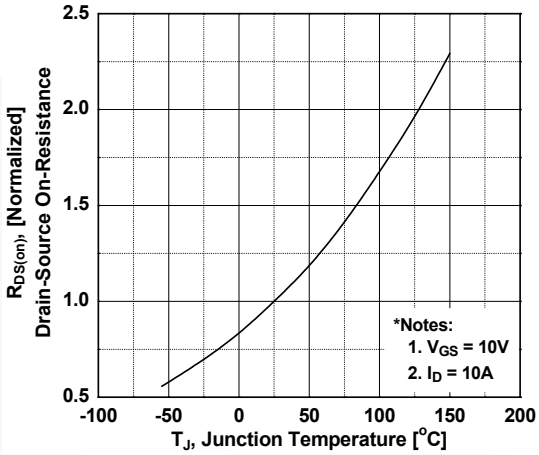


Figure 9. Maximum Safe Operating Area

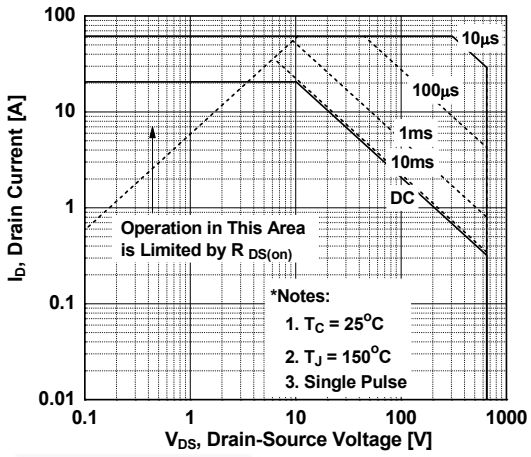


Figure 10. Maximum Drain Current vs. Case Temperature

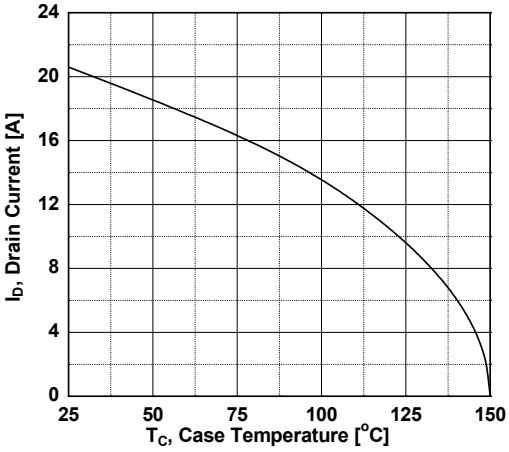
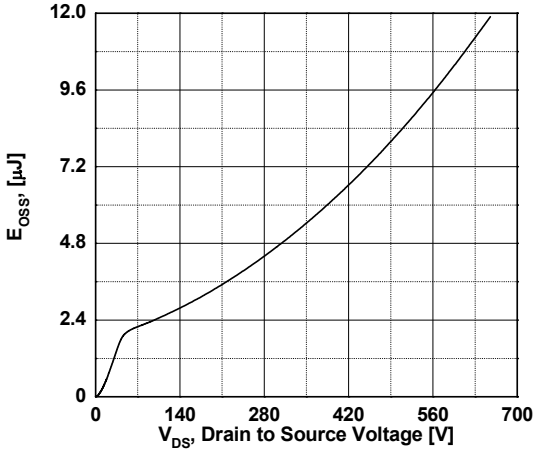


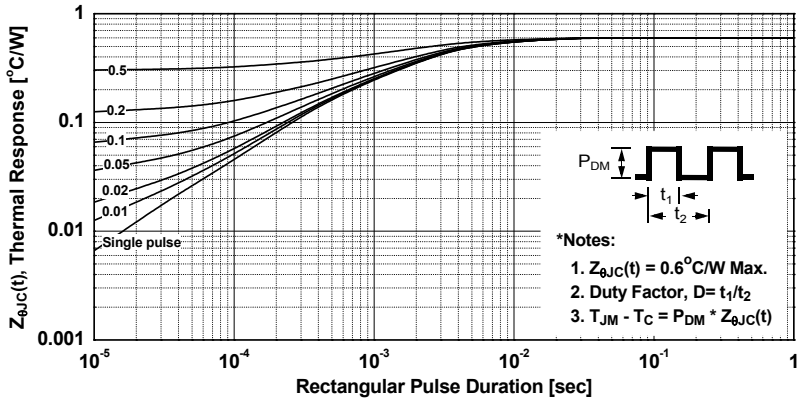
Figure 11. Eoss vs. Drain to Source Voltage



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Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



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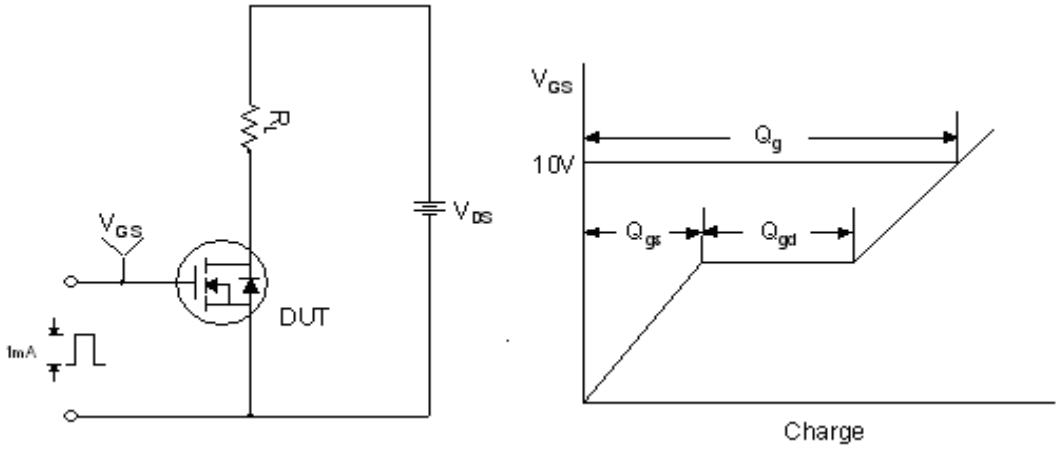


Figure 13. Gate Charge Test Circuit & Waveform

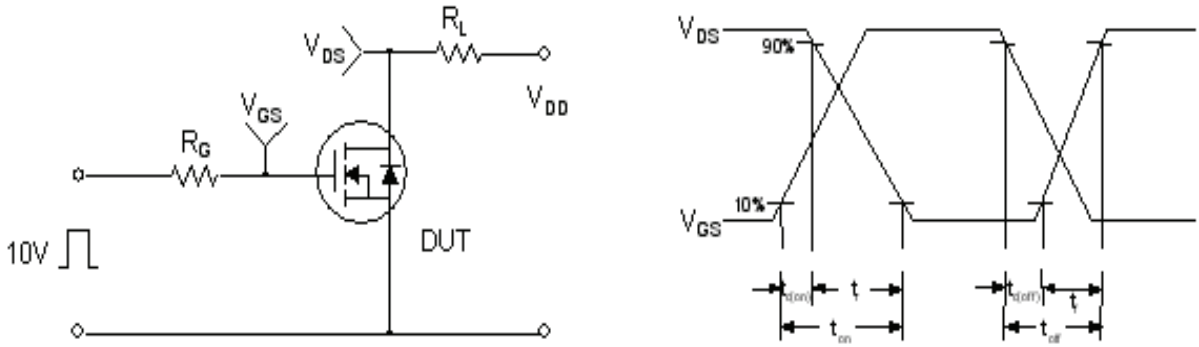


Figure 14. Resistive Switching Test Circuit & Waveforms

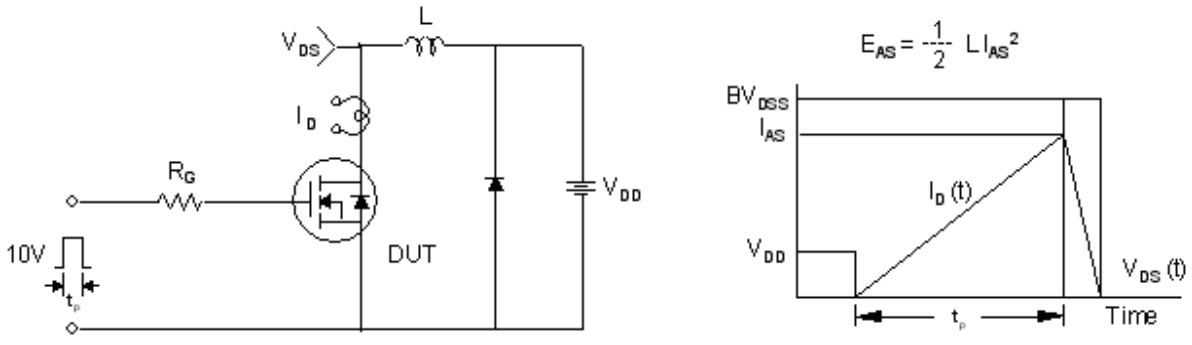


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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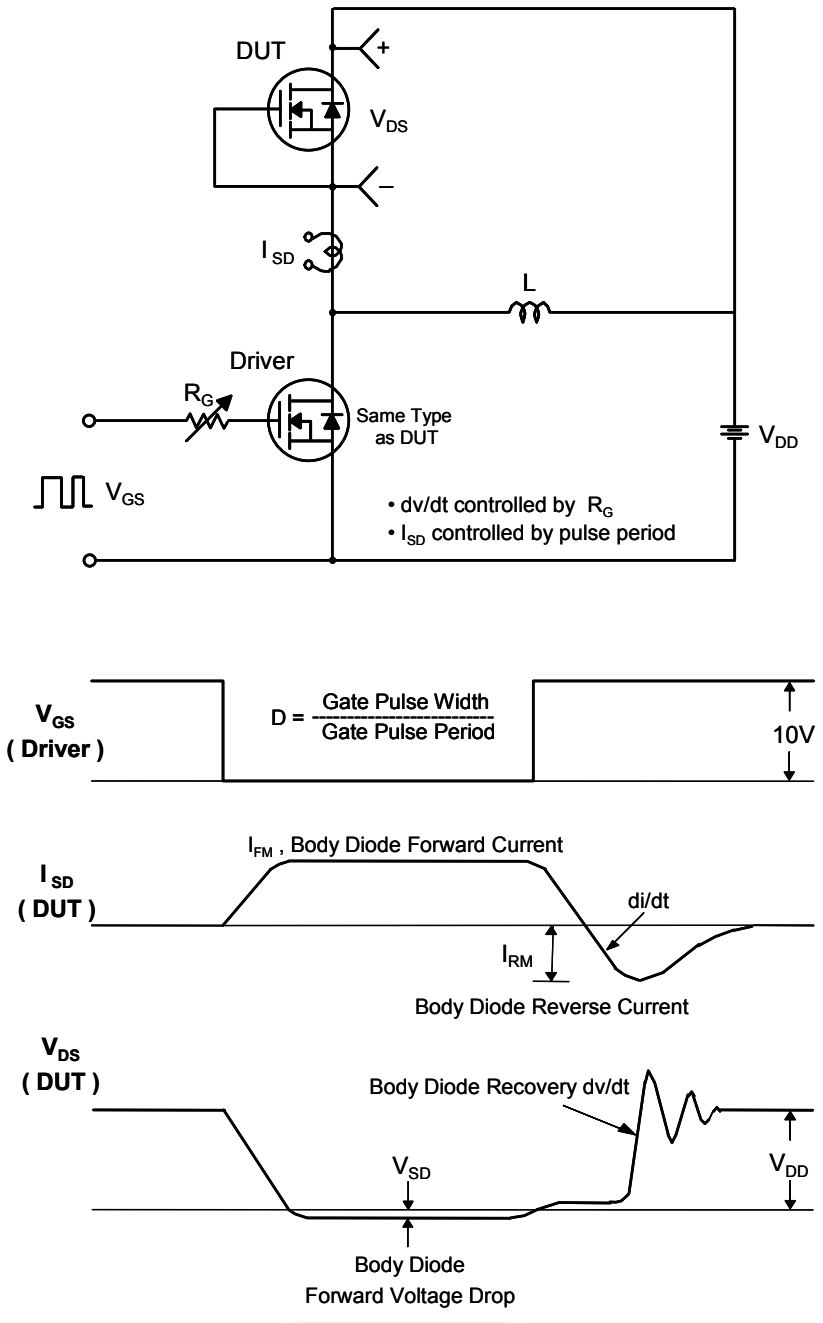
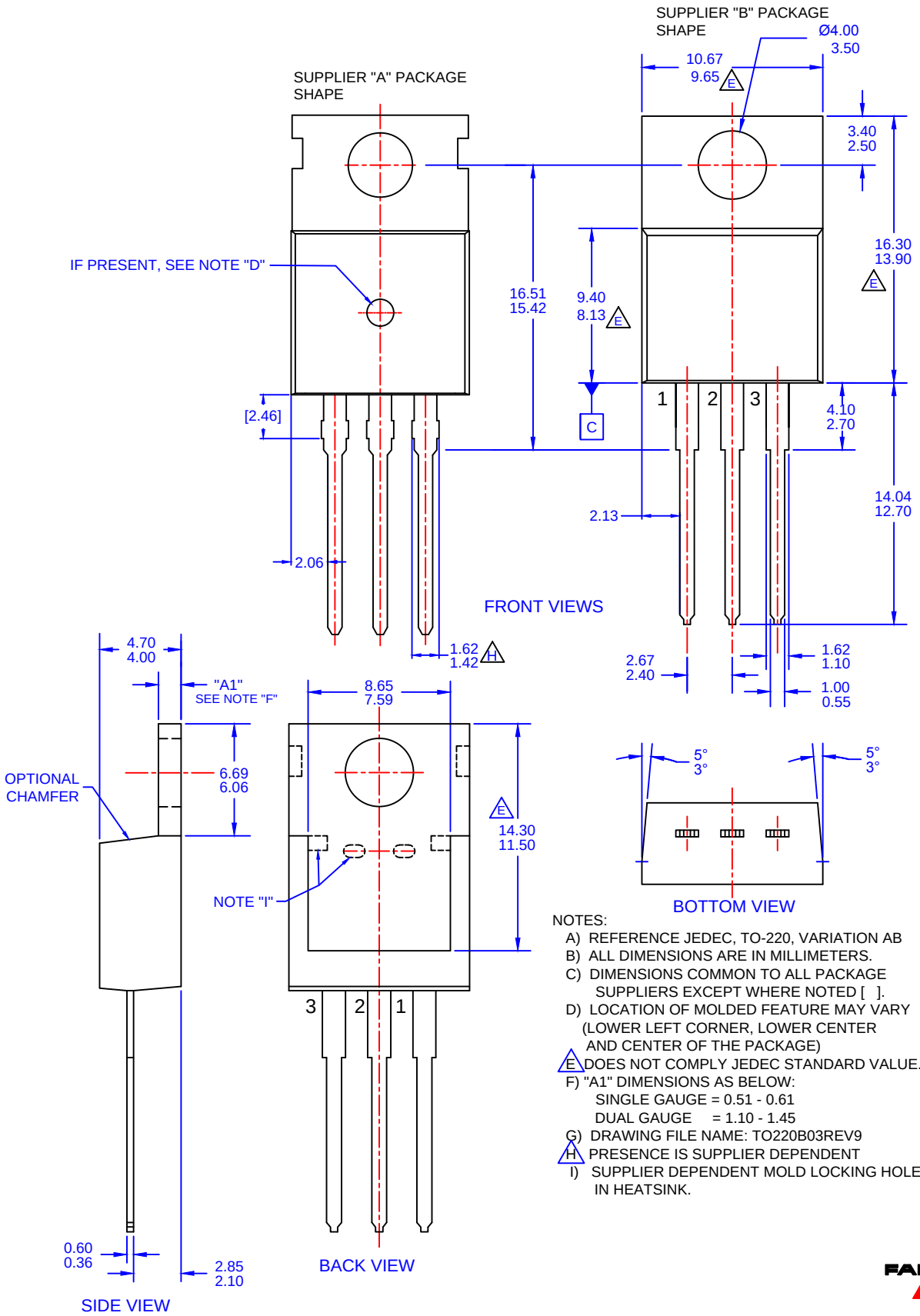


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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NOTES:

A) REFERENCE JEDEC, TO-220, VARIATION AB
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
E DOES NOT COMPLY JEDEC STANDARD VALUE.
F) "A1" DIMENSIONS AS BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1.10 - 1.45
G) DRAWING FILE NAME: TO220B03REV9
H PRESENCE IS SUPPLIER DEPENDENT
I) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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