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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

November 2013

FCP380N60 / FCPF380N60

N-Channel SuperFET® II MOSFET

600 V, 10.2 A, 380 mΩ

Features

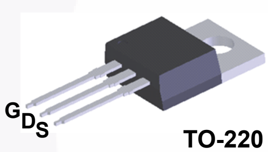
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 330 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 30 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 95 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

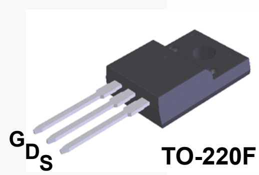
- LCD / LED / PDP TV Lighting
- Solar Inverter
- AC-DC Power Supply

Description

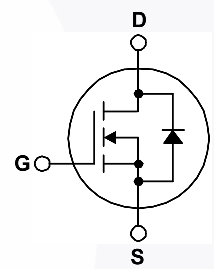
SuperFET® II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching 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.



TO-220



TO-220F



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

Symbol	Parameter		FCP380N60	FCPF380N60	Unit
V_{DSS}	Drain to Source Voltage		600		V
V_{GSS}	Gate to Source Voltage	- DC	±20		V
		- AC (f > 1 Hz)	±30		
I_D	Drain Current	- Continuous (T_C = 25°C)	10.2	10.2*	A
		- Continuous (T_C = 100°C)	6.4	6.4*	
I_{DM}	Drain Current	- Pulsed (Note 1)	30.6	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	31	W
		- Derate Above 25°C	0.85	0.25	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

*Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FCP380N60	FCPF380N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.18	4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP380N60	FCP380N60	TO-220	Tube	N/A	N/A	50 units
FCPF380N60	FCPF380N60	TO-220F	Tube	N/A	N/A	50 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	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25°C	-	0.6	-	V/°C
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	-	-	1	µA
		V_{DS} = 480 V, T_C = 125°C	-	-	10	µA
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 = 250 µA	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 5 A	-	0.33	0.38	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 5 A	-	11	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	1250	1665	pF
C_{oss}	Output Capacitance		-	905	1205	pF
C_{rss}	Reverse Transfer Capacitance		-	45	60	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	-	23	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0V	-	95	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 5 A, V_{GS} = 10 V (Note 4)	-	30	40	nC
Q_{gs}	Gate to Source Gate Charge		-	5	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	10	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-	1	-	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)	-	14	38	ns
t_r	Turn-On Rise Time		-	7	24	ns
$t_{d(off)}$	Turn-Off Delay Time		-	45	100	ns
t_f	Turn-Off Fall Time		-	6	22	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} = 0 V, I_{SD} = 5 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 5 A, dI_F/dt = 100 A/µs	-	240	-	ns
Q_{rr}	Reverse Recovery Charge		-	2.7	-	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 $\le$ 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

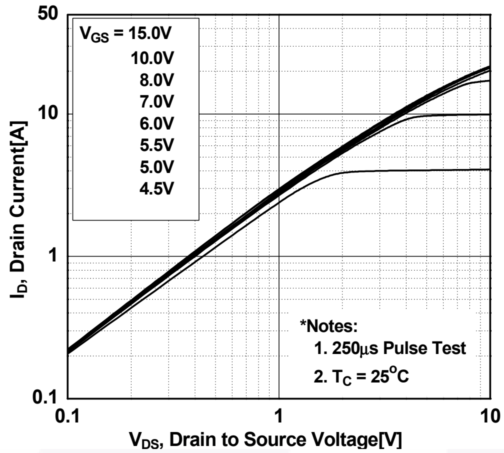


Figure 2. Transfer Characteristics

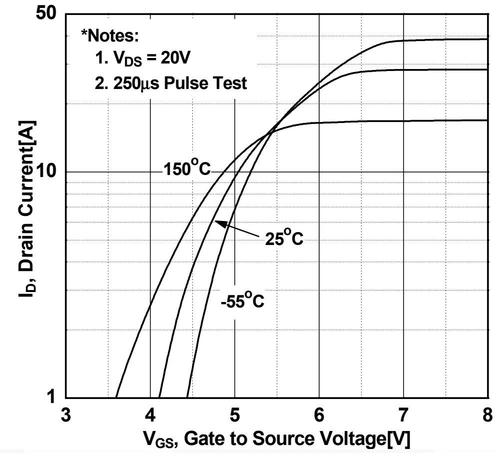


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

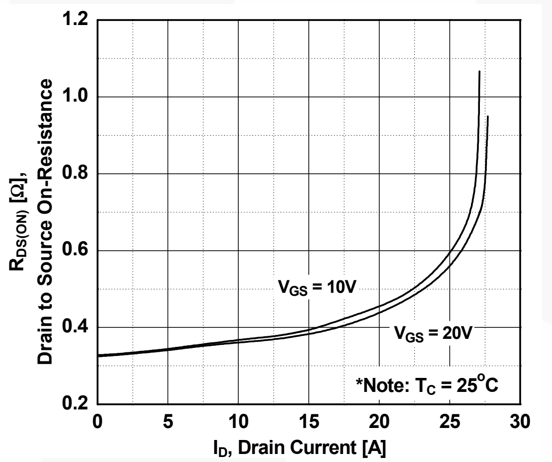


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

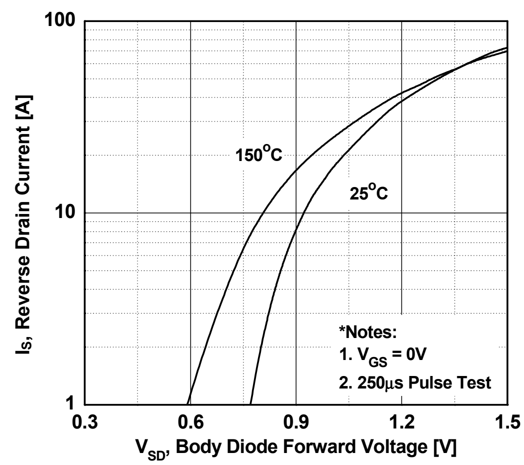


Figure 5. Capacitance Characteristics

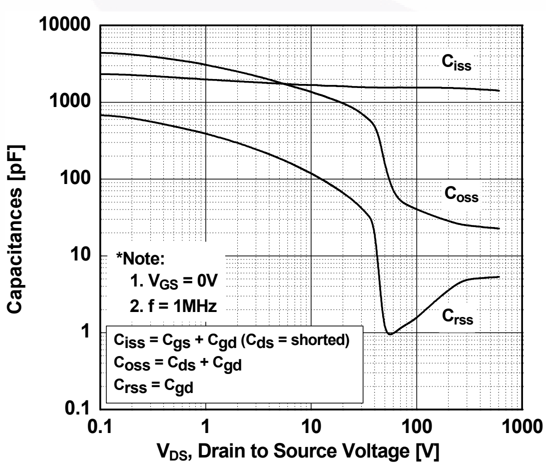
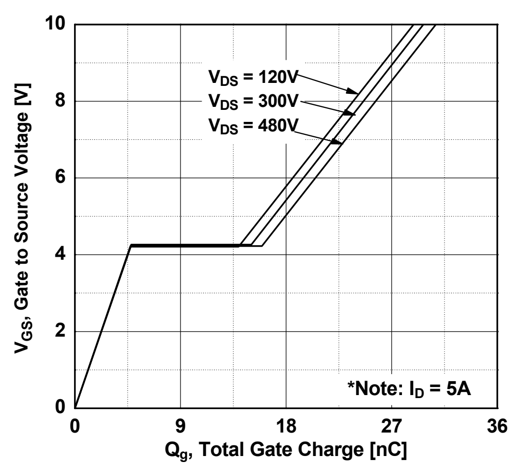


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

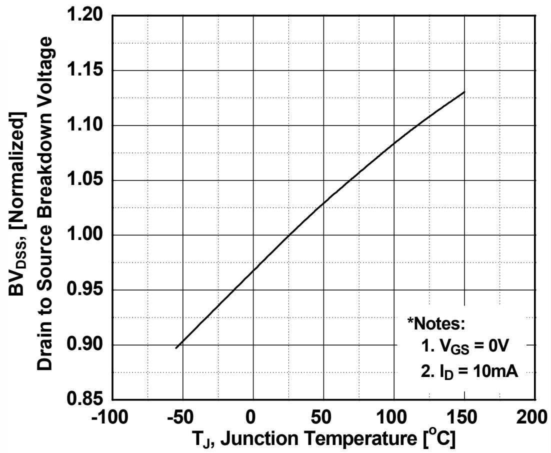


Figure 8. On-Resistance Variation vs. Temperature

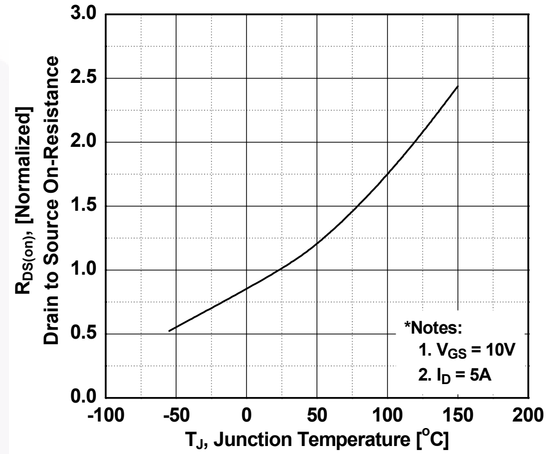


Figure 9. Maximum Safe Operating Area for FCP380N60

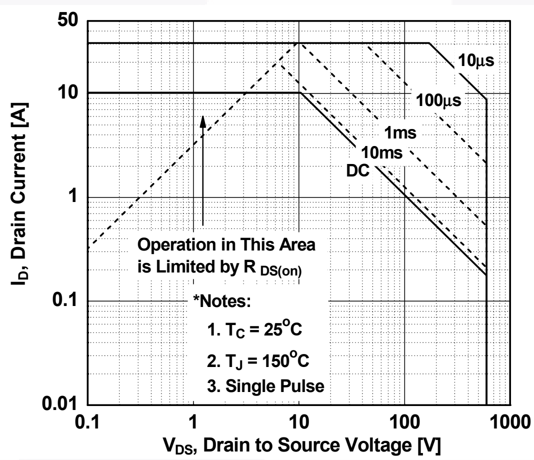


Figure 10. Maximum Safe Operating Area for FCPF380N60

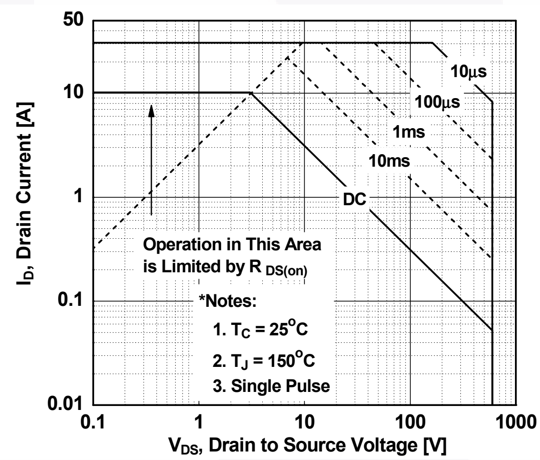


Figure 11. Maximum Drain Current vs. Case Temperature

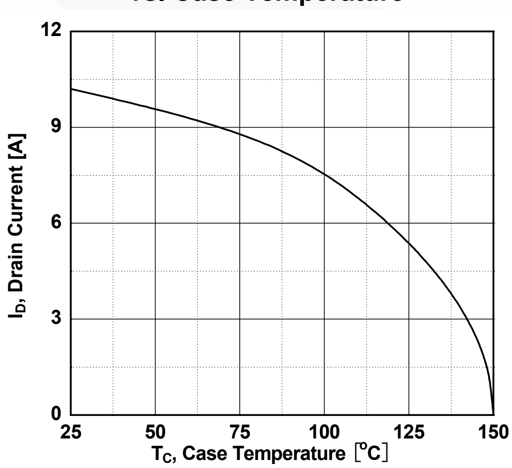
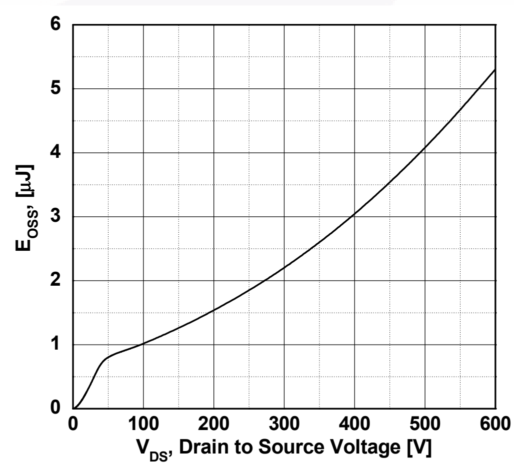


Figure 12. Eoss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve for FCP380N60

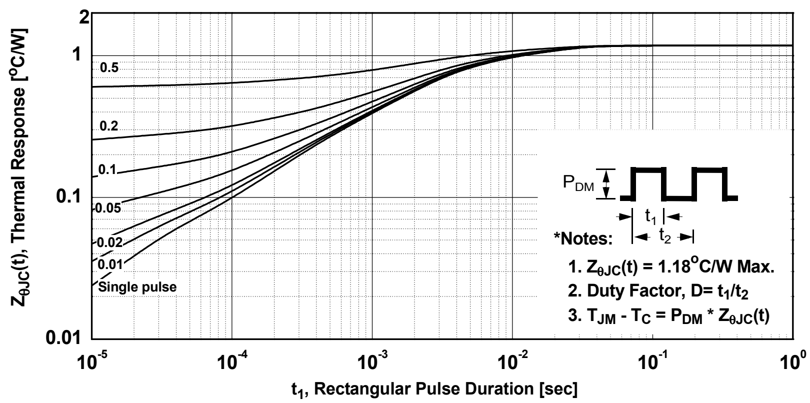
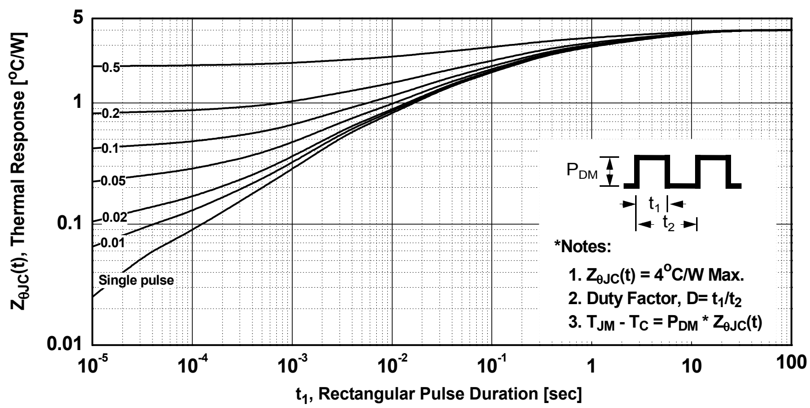


Figure 14. Transient Thermal Response Curve for FCPF380N60



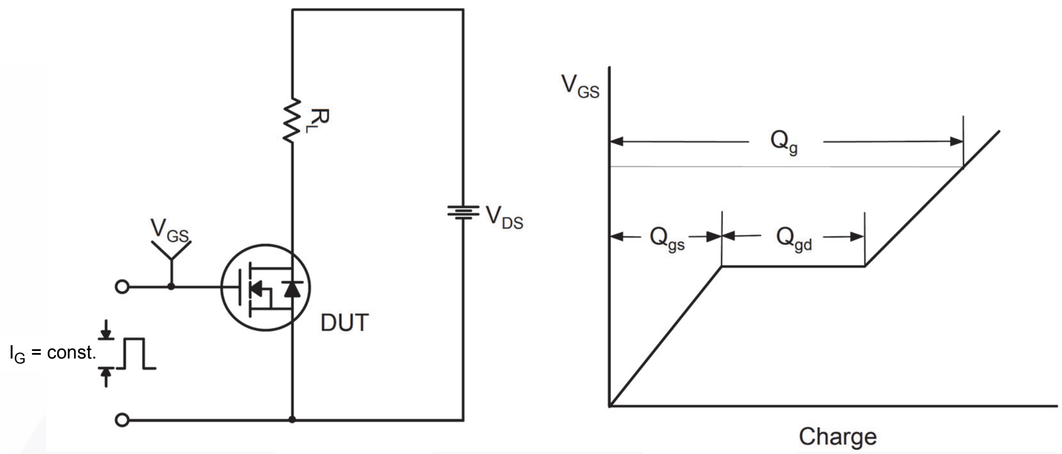


Figure 15. Gate Charge Test Circuit & Waveform

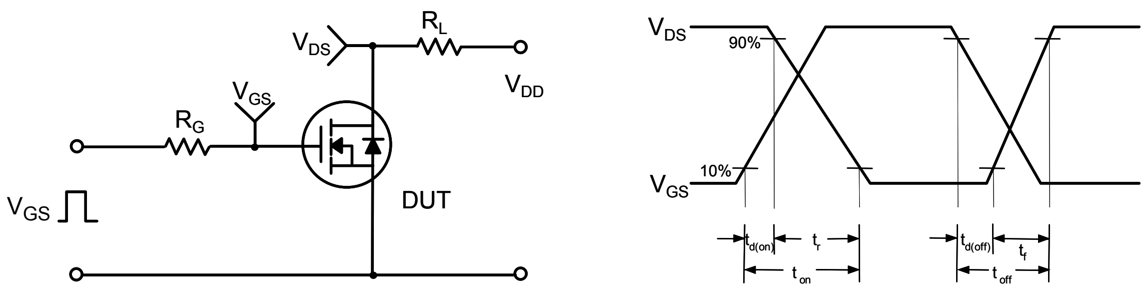


Figure 16. Resistive Switching Test Circuit & Waveforms

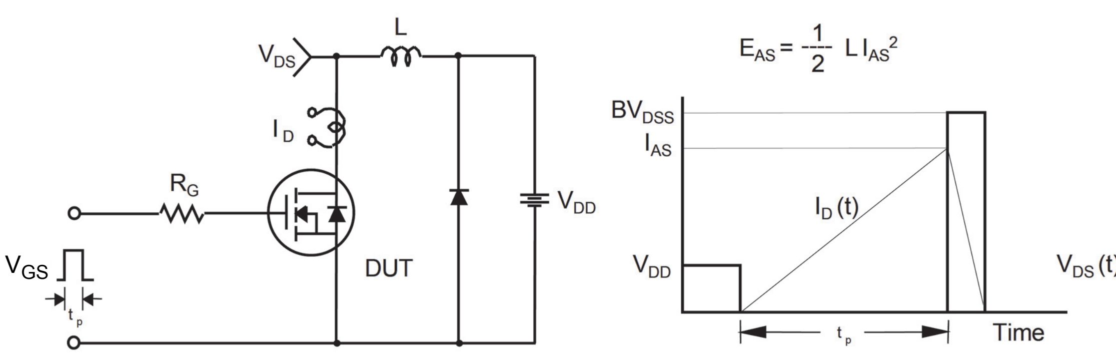


Figure 17. Unclamped Inductive Switching Test Circuit & Waveforms

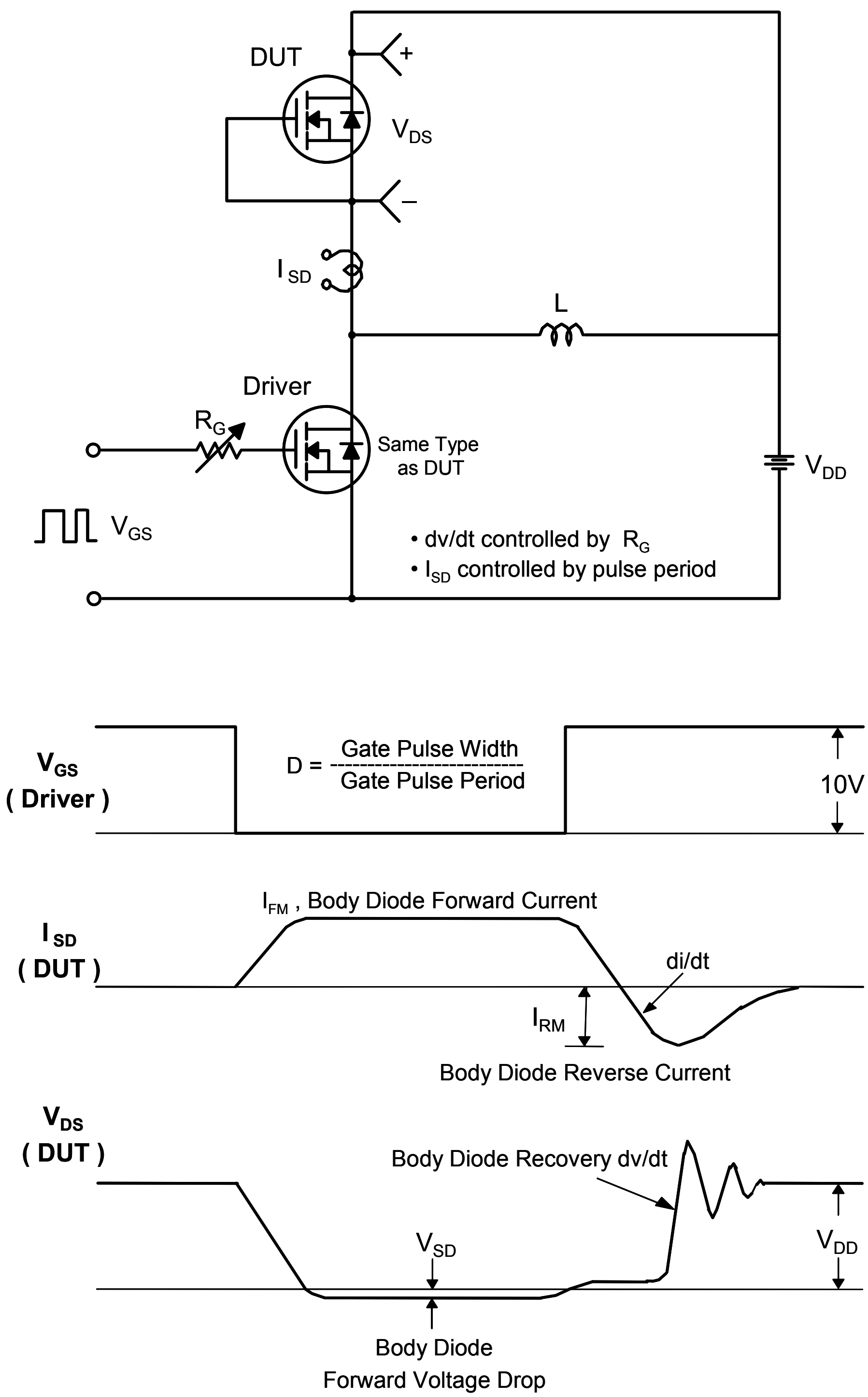
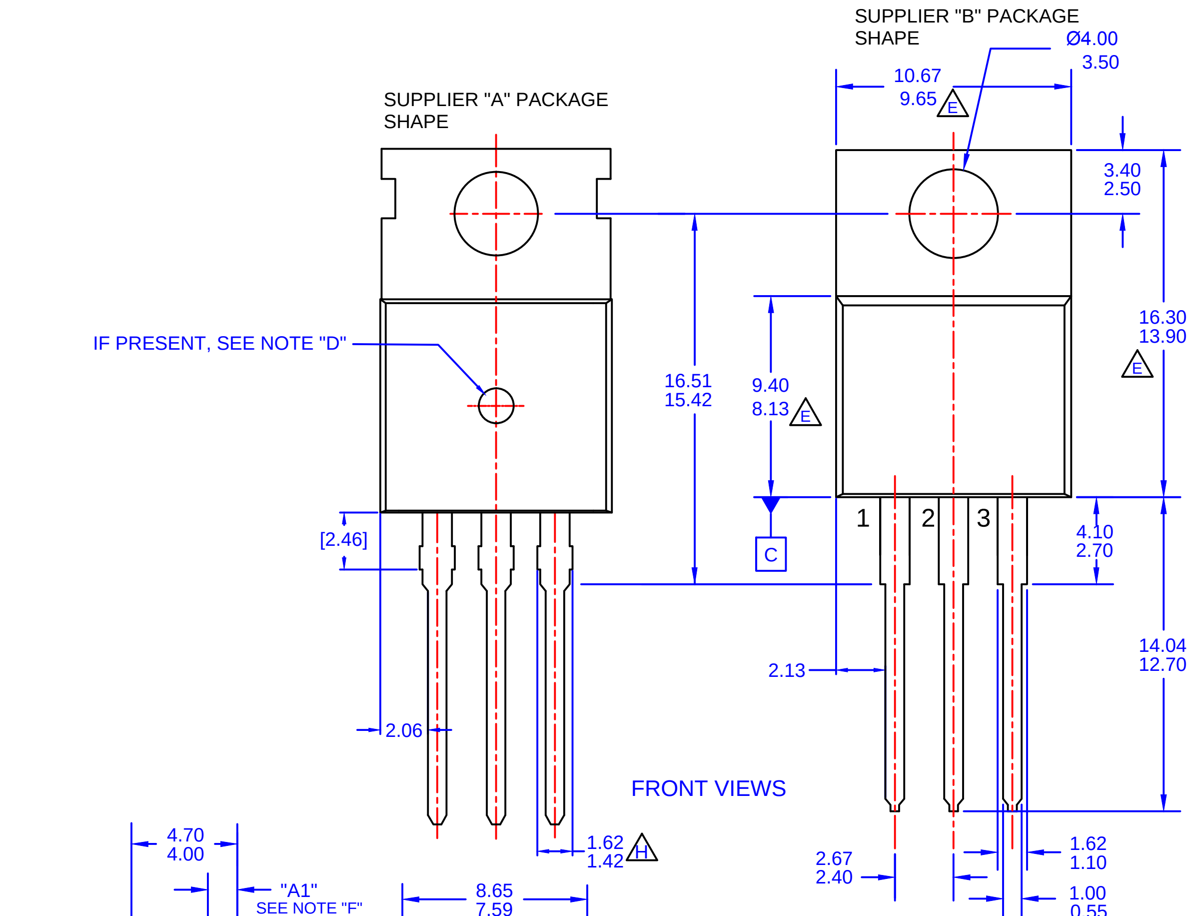
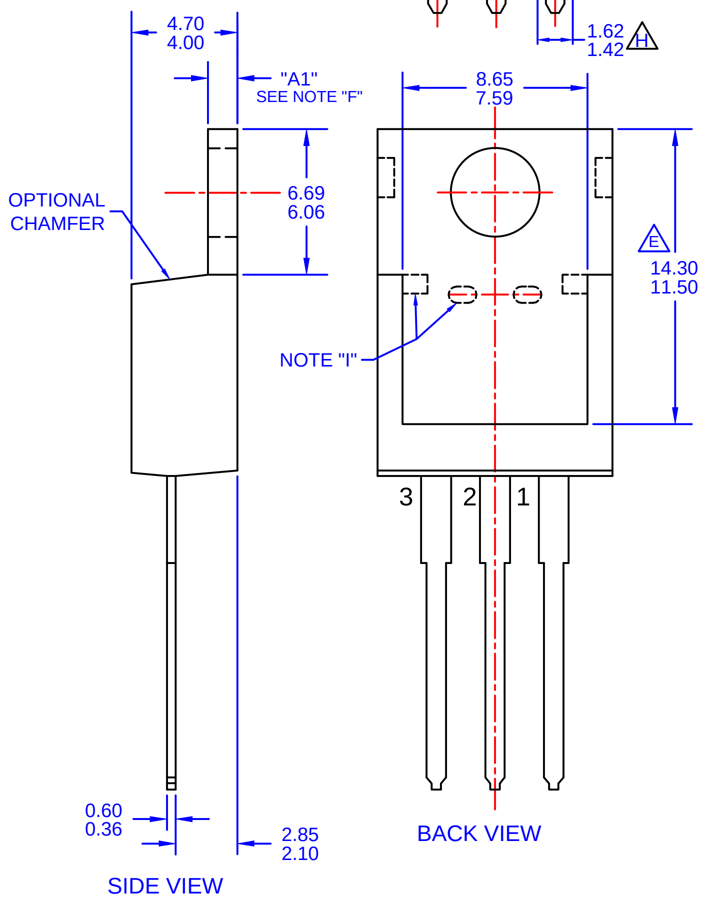
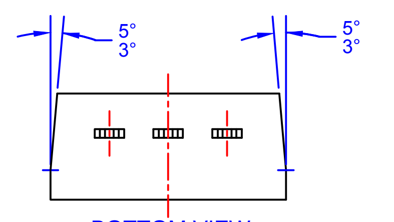


Figure 18. Peak Diode Recovery dv/dt Test Circuit & Waveforms







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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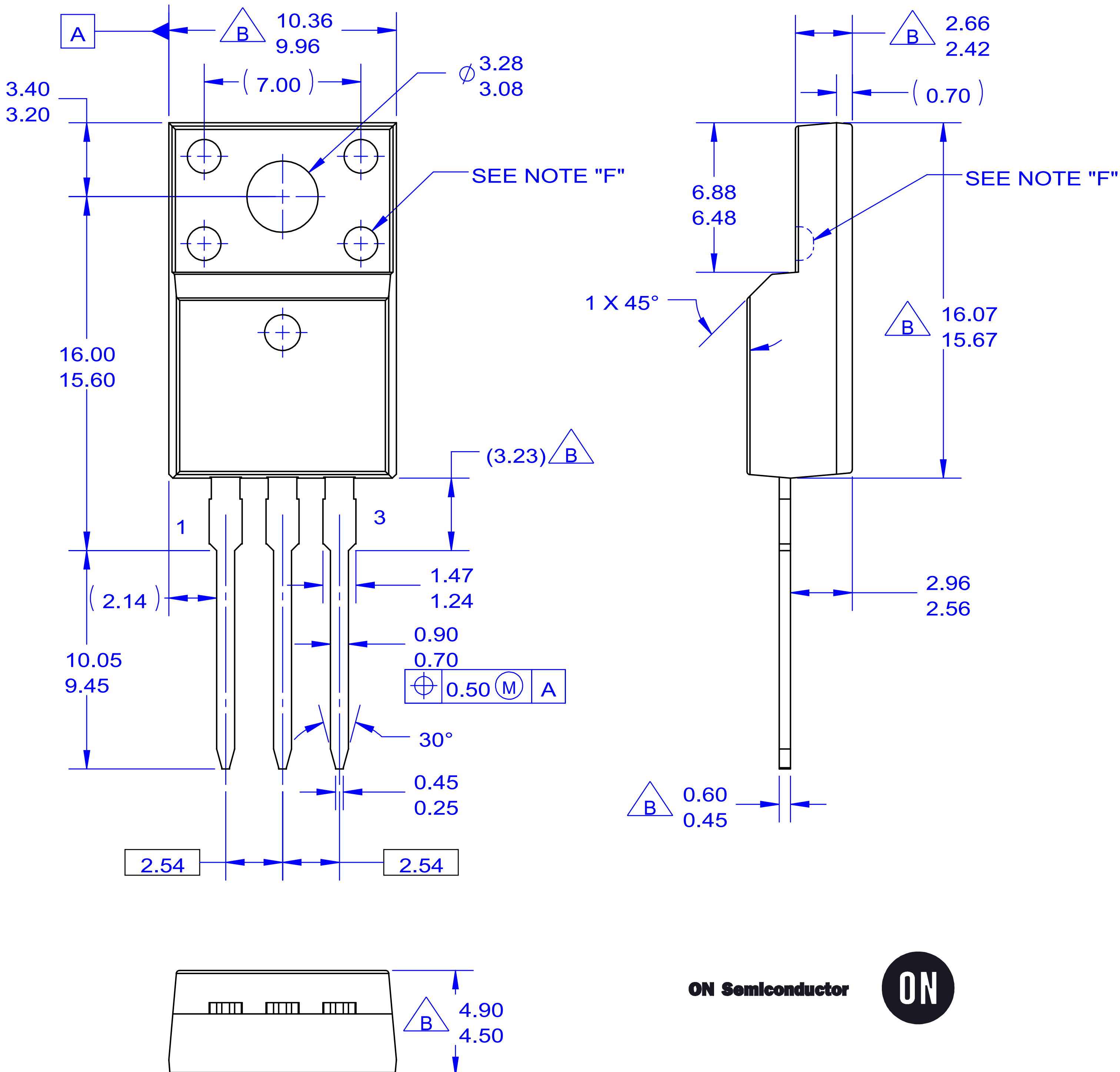

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NOTES:

A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
B DOES NOT COMPLY EIAJ STD. VALUE.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
F. OPTION 1 - WITH SUPPORT PIN HOLE.
   OPTION 2 - NO SUPPORT PIN HOLE.
G. DRAWING FILE NAME: TO220M03REV5

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