Is Now Part of

ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at www.onsemi.com

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®

December 2013

FCP4N60

N-Channel SuperFET® MOSFET

600 V, 3.9 A, 1.2 Ω

Features

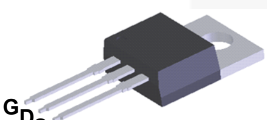
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 1.0 Ω
- Ultra Low Gate Charge (Typ. Q_g = 12.8 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 32 pF)
- 100% Avalanche Tested
- RoHS Compliant

Application

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

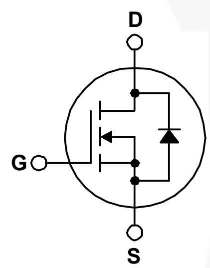
Description

SuperFET® MOSFET is Fairchild Semiconductor's first generation of 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 MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.



G D S

TO-220



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

Symbol	Parameter	FCP4N60	Unit
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current - Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	3.9 2.5	A A
I_{DM}	Drain Current - Pulsed (Note 1)	11.7	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	128	mJ
I_{AR}	Avalanche Current (Note 1)	3.9	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25°C) - Derate Above 25°C	50 0.4	W 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	FCP4N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.5	°C/W
	Thermal Resistance, Junction to Ambient, Max.	83	

$R_{\theta JA}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP4N60	FCP4N60	TO-220	Tube	N/A	N/A	50 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA, T_J = 25°C	600	--	--	V
		V_{GS} = 0 V, I_D = 250 µA, T_J = 150°C	--	650	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	--	0.6	--	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 3.9 A	--	700	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V V_{DS} = 480 V, T_C = 125°C	-- --	-- --	1 10	µA µA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 2.0 A	--	1.0	1.2	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 2.0 A	--	3.2	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	415	540	pF
C_{oss}	Output Capacitance		--	210	275	pF
C_{rss}	Reverse Transfer Capacitance		--	19.5	--	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1.0 MHz	--	12	16	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	--	32	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 3.9 A R_G = 25 Ω (Note 4)	--	16	45	ns
t_r	Turn-On Rise Time		--	45	100	ns
$t_{d(off)}$	Turn-Off Delay Time		--	36	85	ns
t_f	Turn-Off Fall Time		--	30	70	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 3.9 A V_{GS} = 10 V (Note 4)	--	12.8	16.6	nC
Q_{gs}	Gate-Source Charge		--	2.4	--	nC
Q_{gd}	Gate-Drain Charge		--	7.1	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	3.9	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	11.7	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 3.9 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 3.9 A dI_F/dt =100 A/µs	--	277	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.07	--	µC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I_{AS} = 1.9 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq$ 3.9 A, di/dt $\leq$ 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

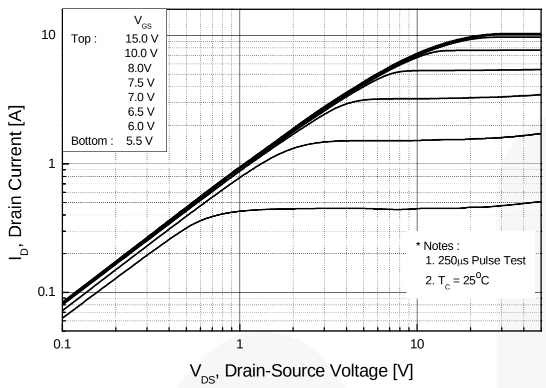


Figure 2. Transfer Characteristics

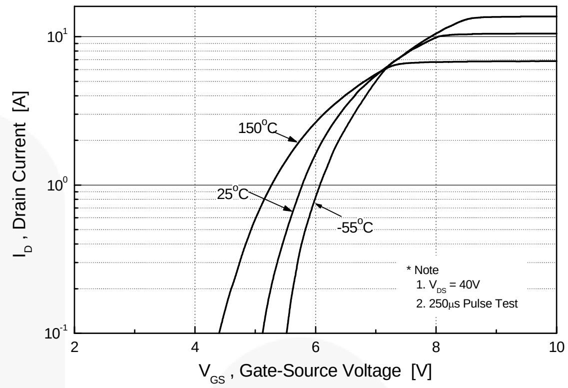


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

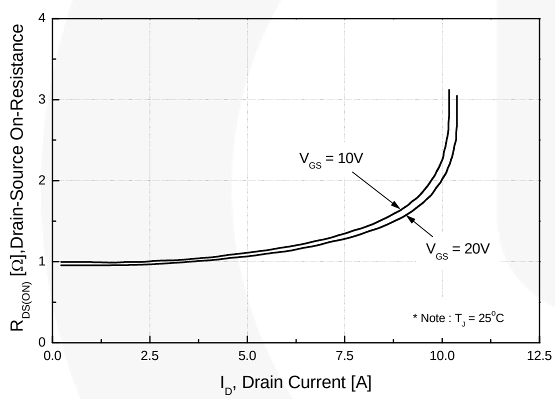


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

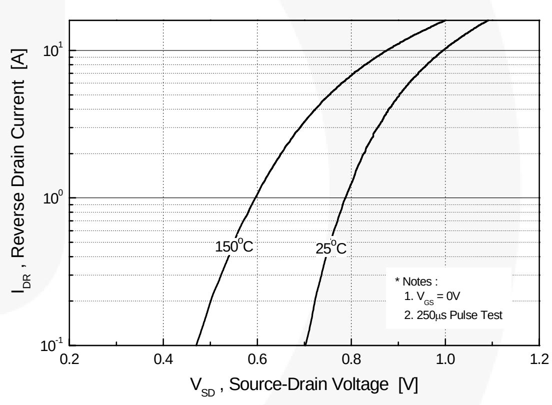


Figure 5. Capacitance Characteristics

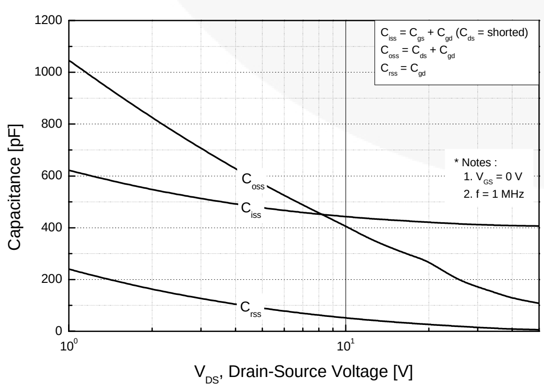
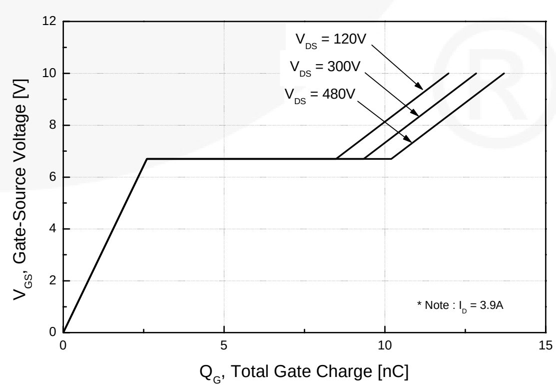


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

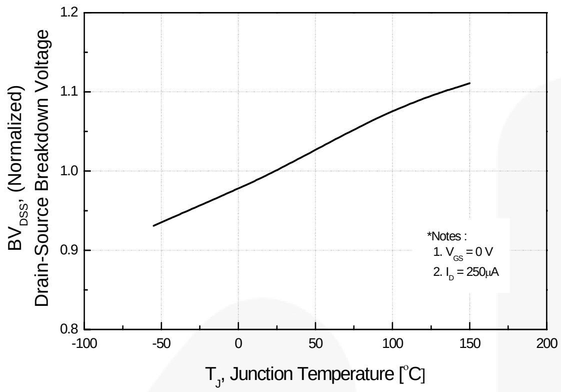


Figure 8. On-Resistance Variation vs. Temperature

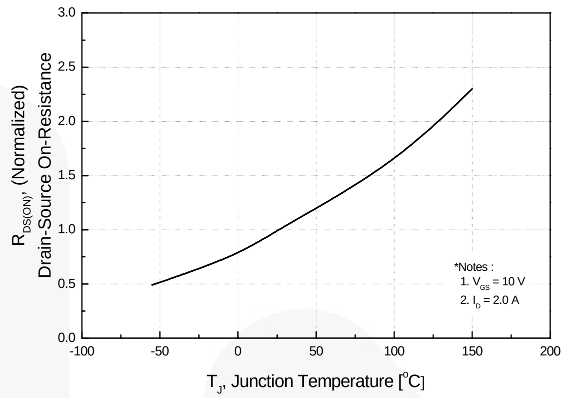


Figure 9. Maximum Safe Operating Area

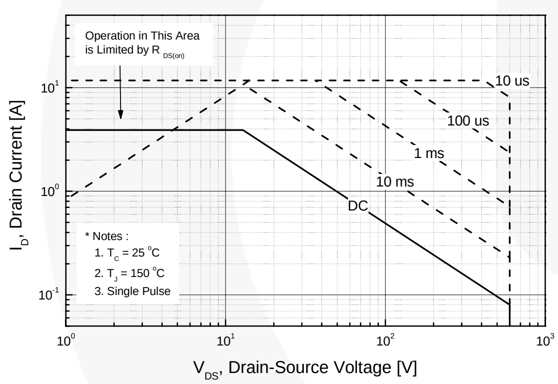


Figure 10. Maximum Drain Current vs. Case Temperature

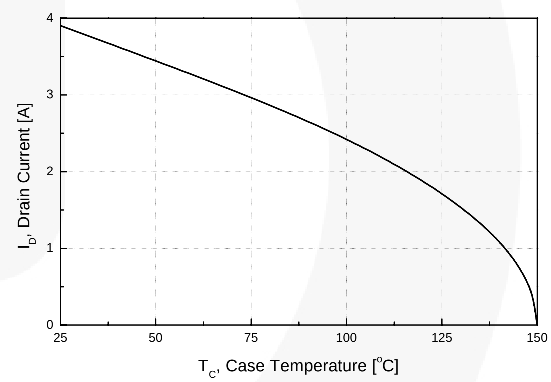
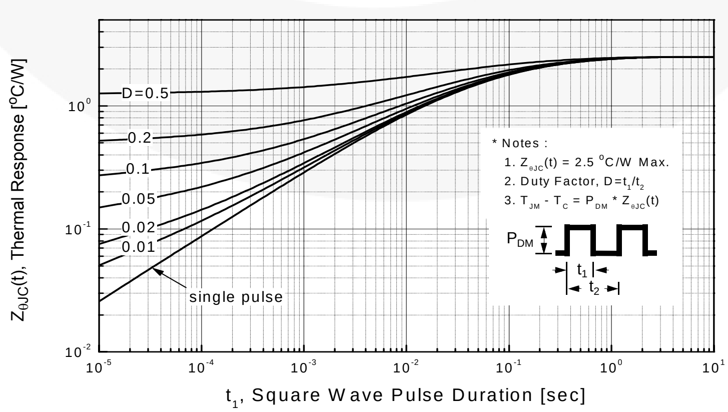


Figure 11. Transient Thermal Response Curve



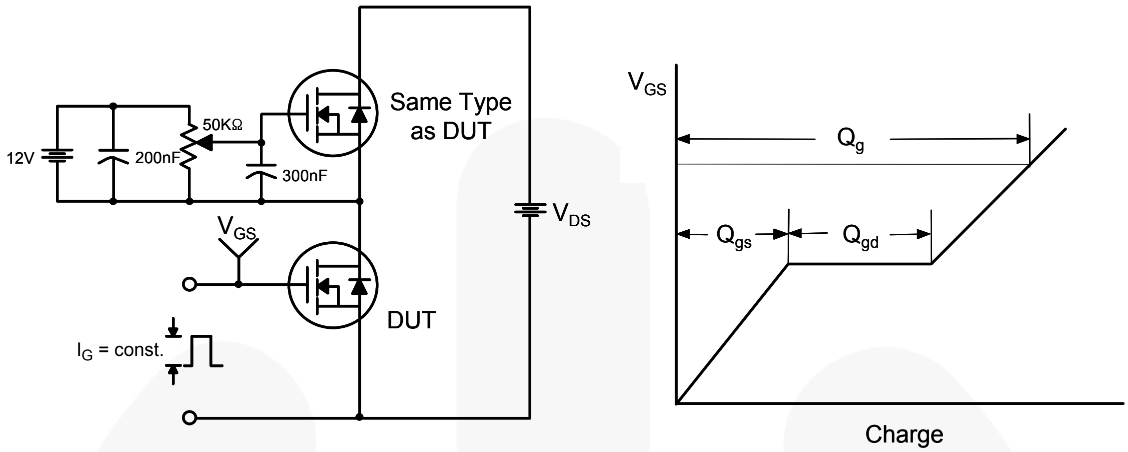


Figure 12. Gate Charge Test Circuit & Waveform

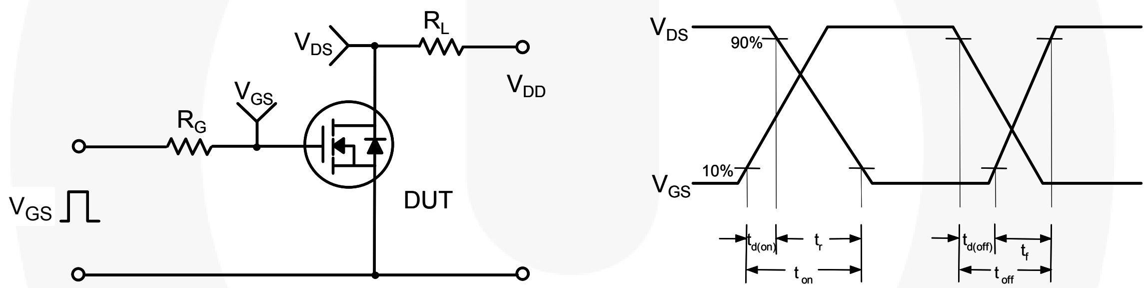


Figure 13. Resistive Switching Test Circuit & Waveforms

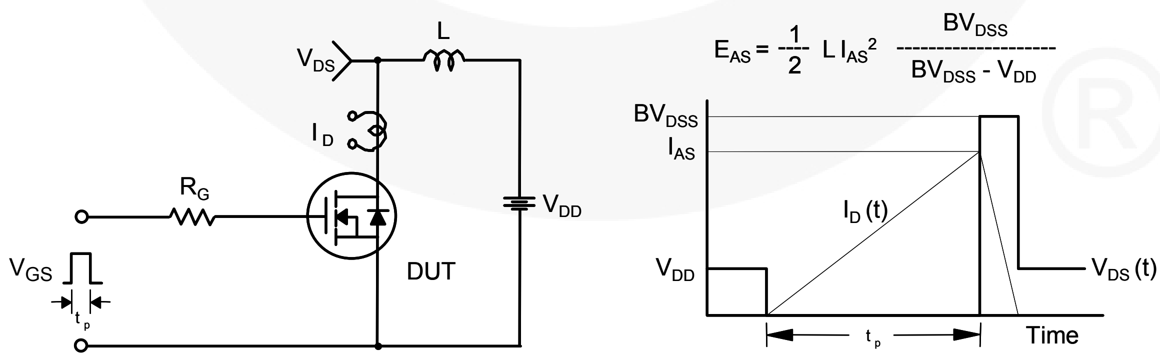


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

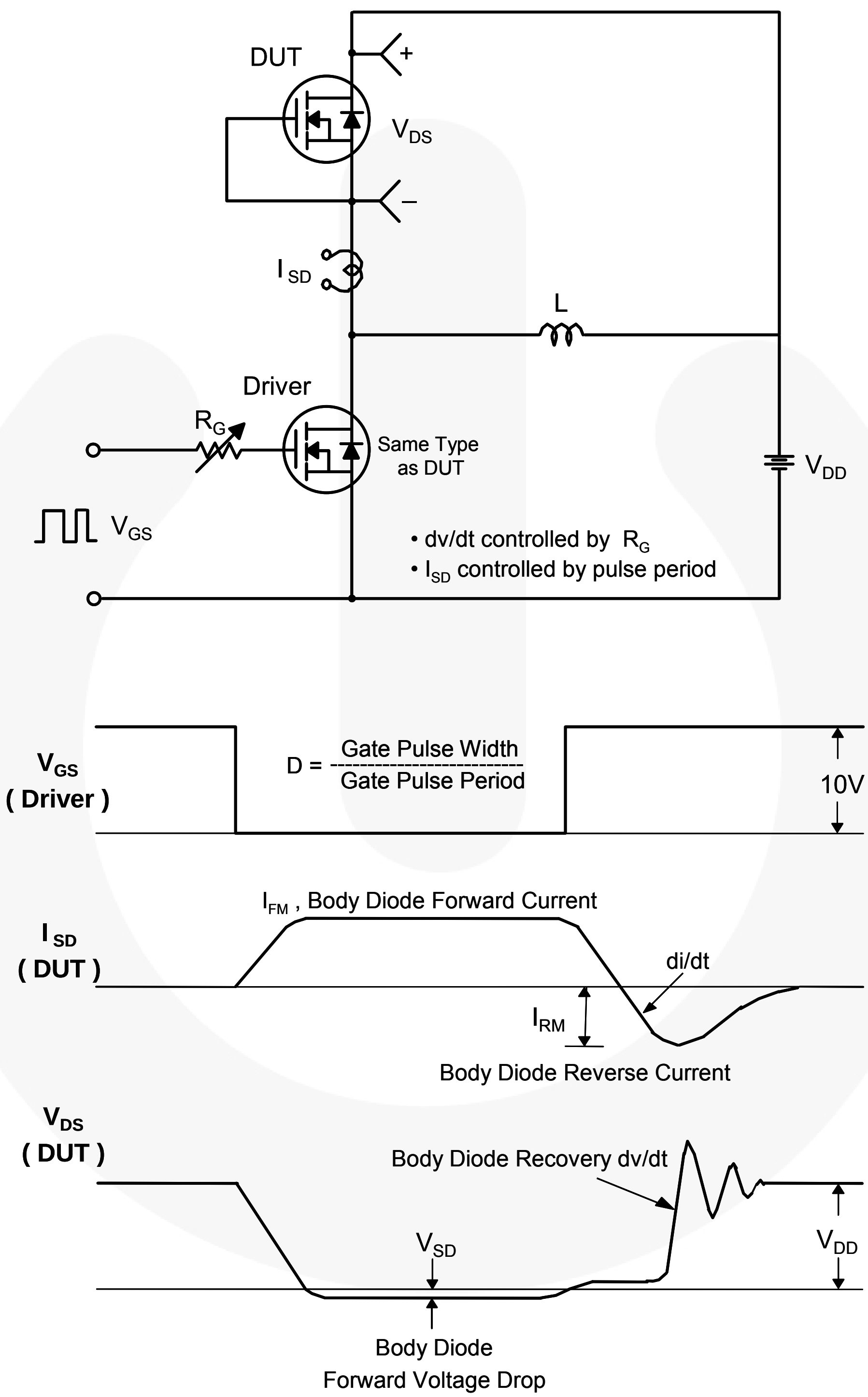
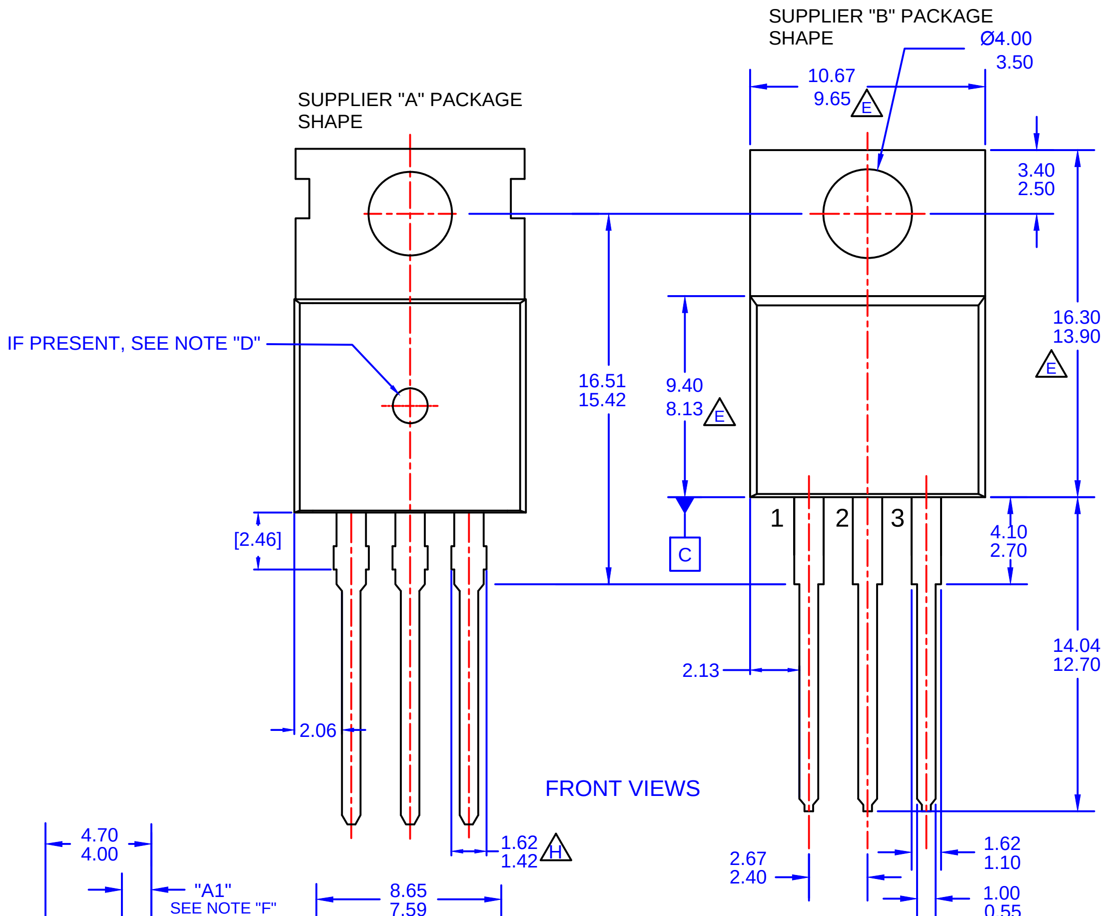
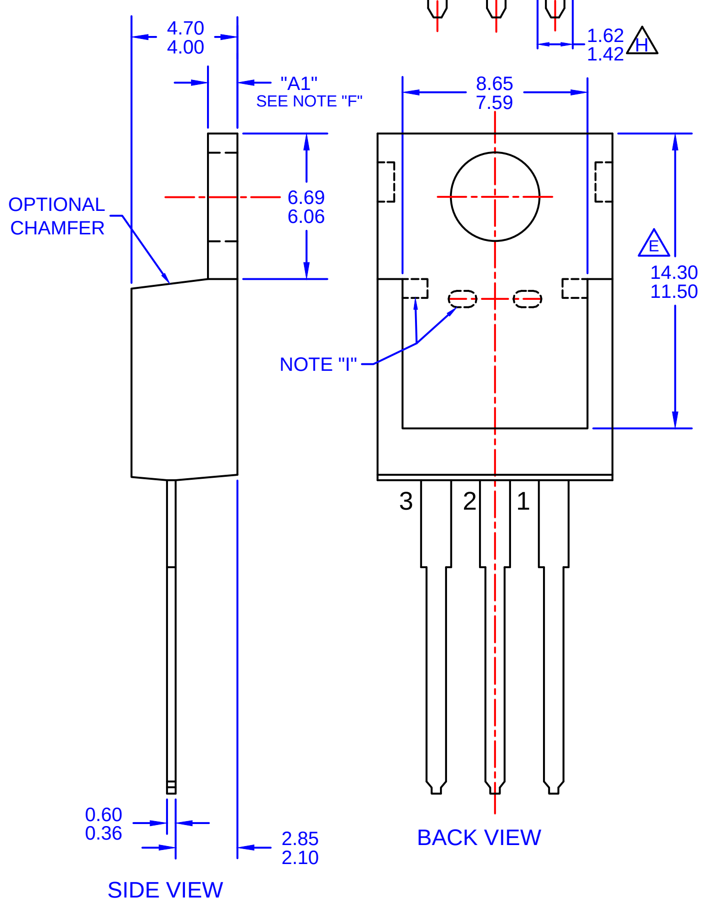
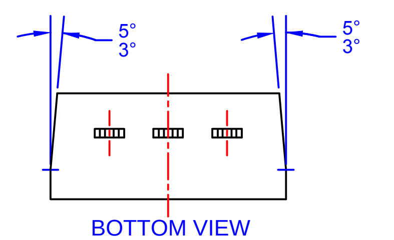


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms







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.

FAIRCHILD™

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative