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.

FCH041N60F

N-Channel SuperFET® II FRFET® MOSFET

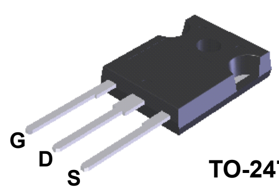
600 V, 76 A, 41 mΩ

Features

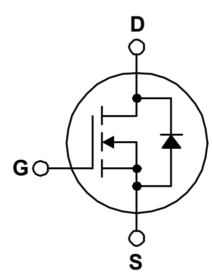
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 36 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 277 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 748 pF)
- 100% Avalanche Tested
- RoHS Compliant

Description

SuperFET® II MOSFET is ON 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-247



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

Symbol	Parameter		FCH041N60F	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)	76	A
		- Continuous (T_C = 100°C)	48.1	
I_{DM}	Drain Current	- Pulsed (Note 1)	228	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		2025	mJ
I_{AR}	Avalanche Current (Note 1)		15	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		5.95	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)	595	W
		- Derate Above 25°C	4.76	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	FCH041N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.21	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCH041N60F	FCH041N60F	TO-247	Tube	N/A	N/A	30 units

Electrical Characteristics T_C = 25^{o}C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 10 mA, V_{GS} = 0 V, T_J = 25^{o}C	600	-	-	V
		I_D = 10 mA, V_{GS} = 0 V, T_J = 150^{o}C	650	-	-	
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25^{o}C	-	0.67	-	V/^{o}C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	-	-	10	μA
		V_{DS} = 480 V, T_C = 125^{o}C	-	267	-	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 38 A	-	36	41	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 38 A	-	64.5	-	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V, f = 1 MHz	-	10800	14365	pF
C_{oss}	Output Capacitance		-	324	430	pF
C_{rss}	Reverse Transfer Capacitance		-	4.5	-	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	-	185	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	748	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 38 A, V_{GS} = 10 V (Note 4)	-	277	360	nC
Q_{gs}	Gate to Source Gate Charge		-	65.3	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	116	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-	1.0	-	Ω

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 38 A, V_{GS} = 10 V, R_G = 4.7 Ω (Note 4)	-	63	136	ns
t_r	Turn-On Rise Time		-	66	142	ns
$t_{d(off)}$	Turn-Off Delay Time		-	244	498	ns
t_f	Turn-Off Fall Time		-	53	116	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	77	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	231	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 38 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 38 A, dI_F/dt = 100 A/μs	-	214	-	ns
Q_{rr}	Reverse Recovery Charge		-	1.79	-	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I_{AS} = 15 A, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq$ 38 A, di/dt $\leq$ 200 A/μs, $V_{DD} \leq$ 380 V, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

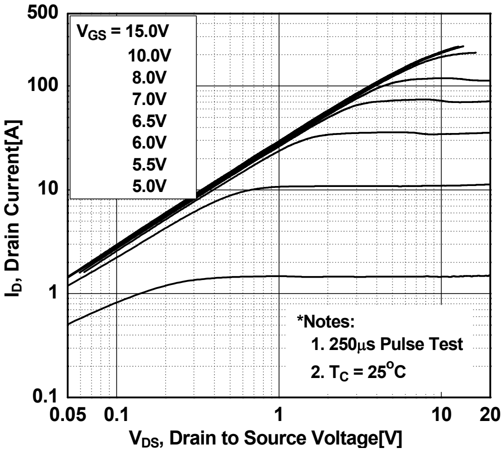


Figure 2. Transfer Characteristics

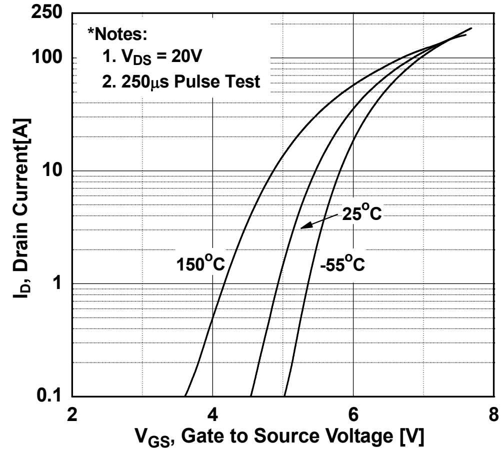


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

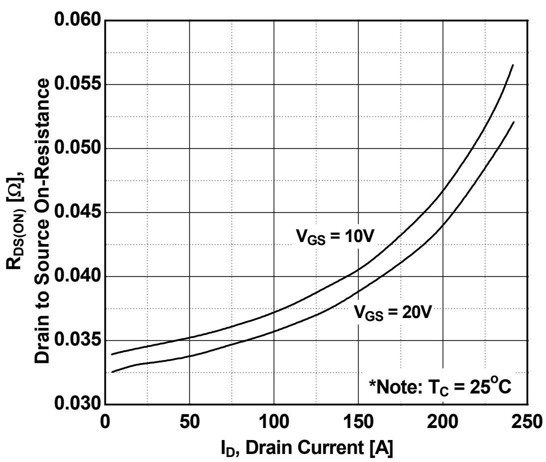


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

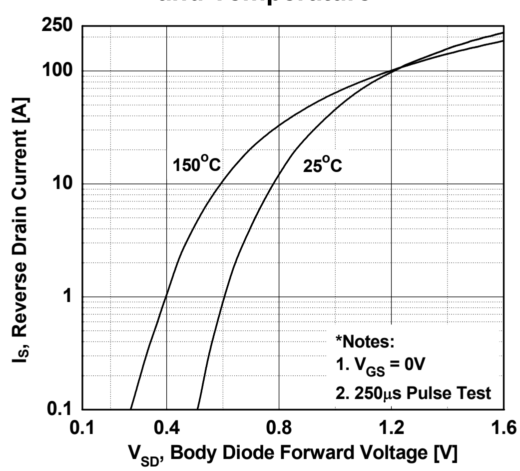


Figure 5. Capacitance Characteristics

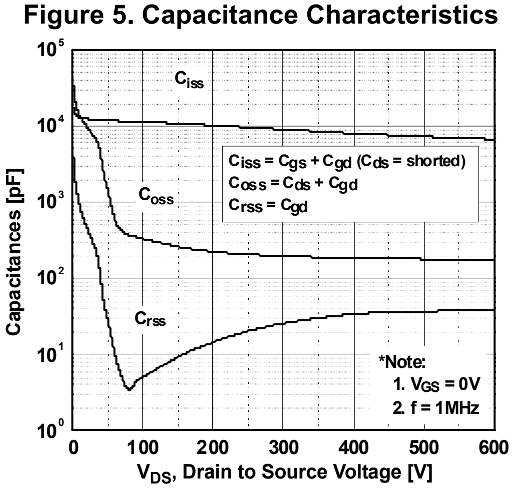
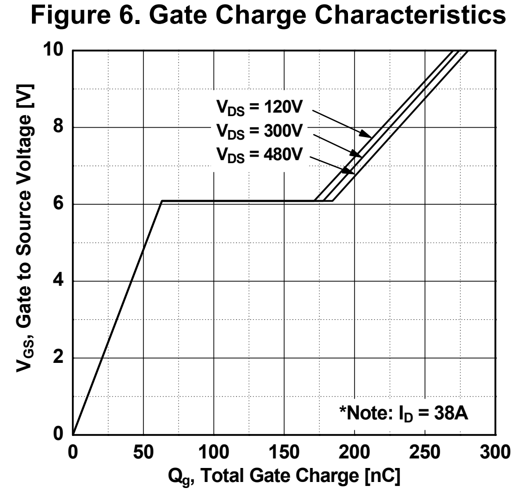


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

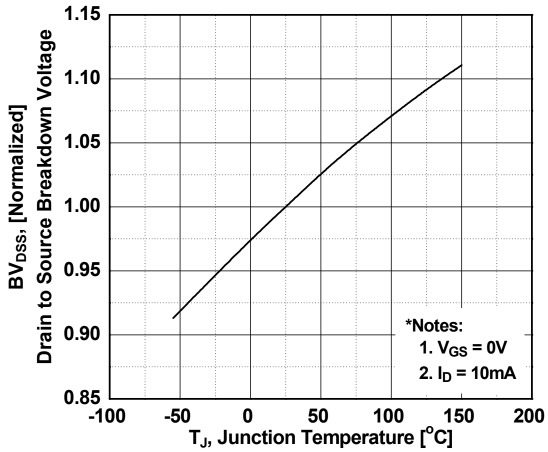


Figure 8. On-Resistance Variation vs. Temperature

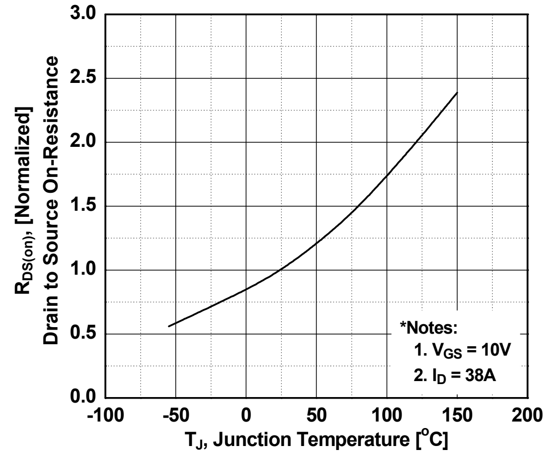


Figure 9. Maximum Safe Operating Area

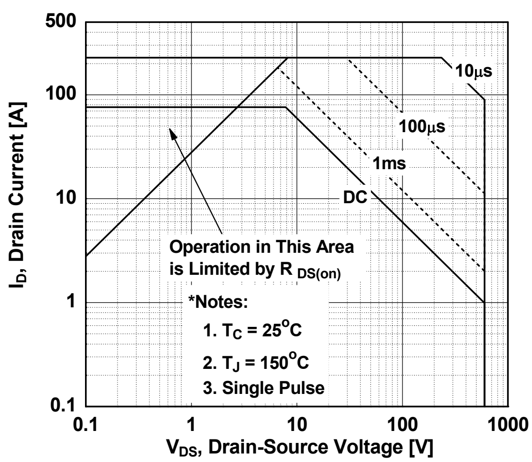


Figure 10. Maximum Drain Current vs. Case Temperature

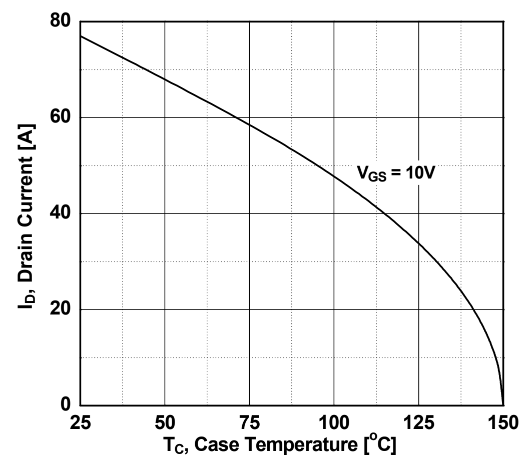
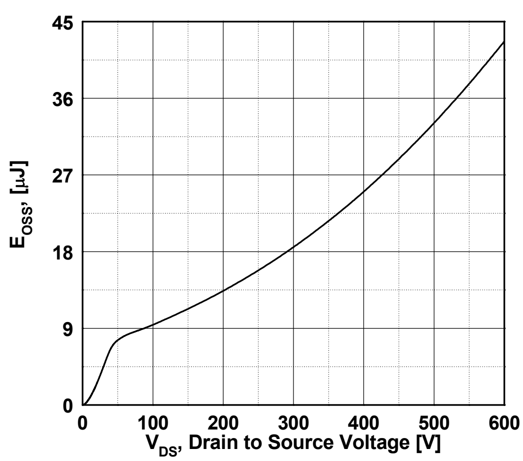
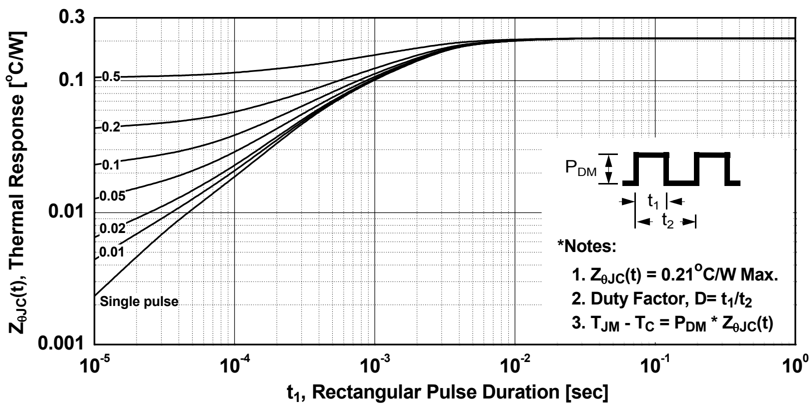


Figure 11. Eoss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



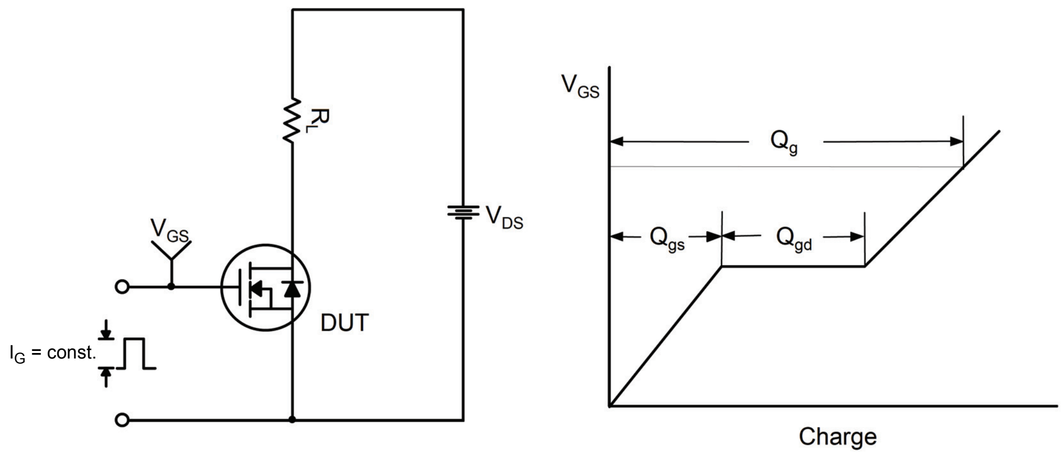


Figure 13. Gate Charge Test Circuit & Waveform

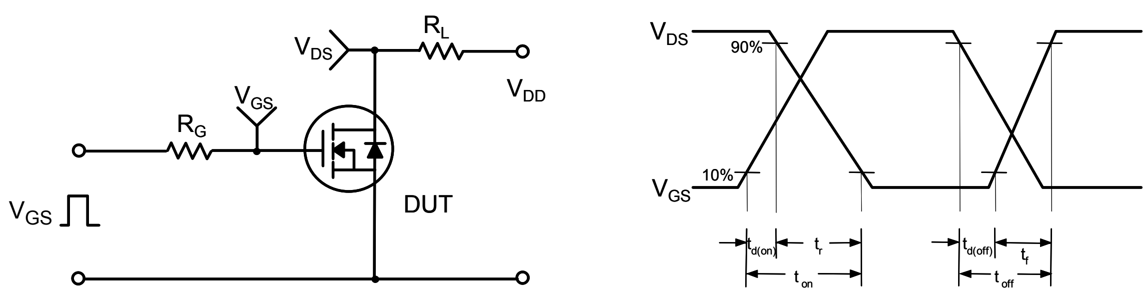


Figure 14. Resistive Switching Test Circuit & Waveforms

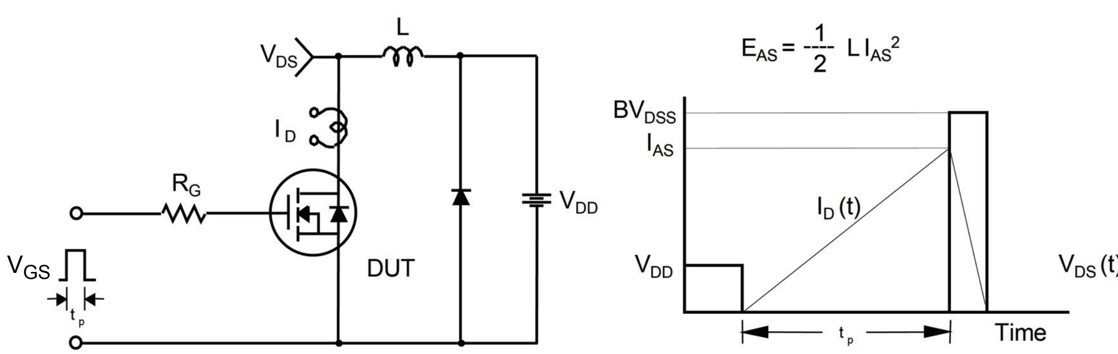


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

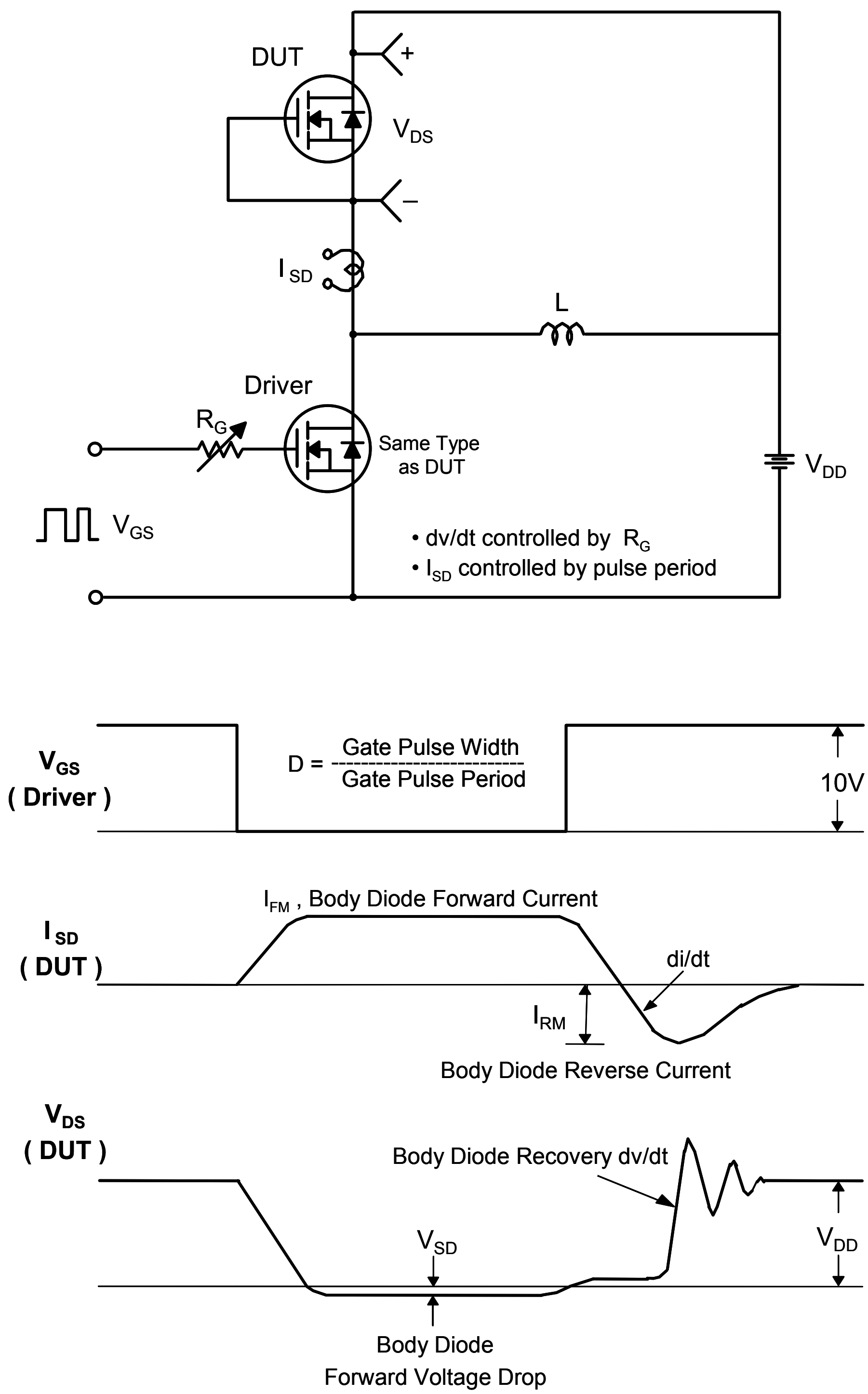
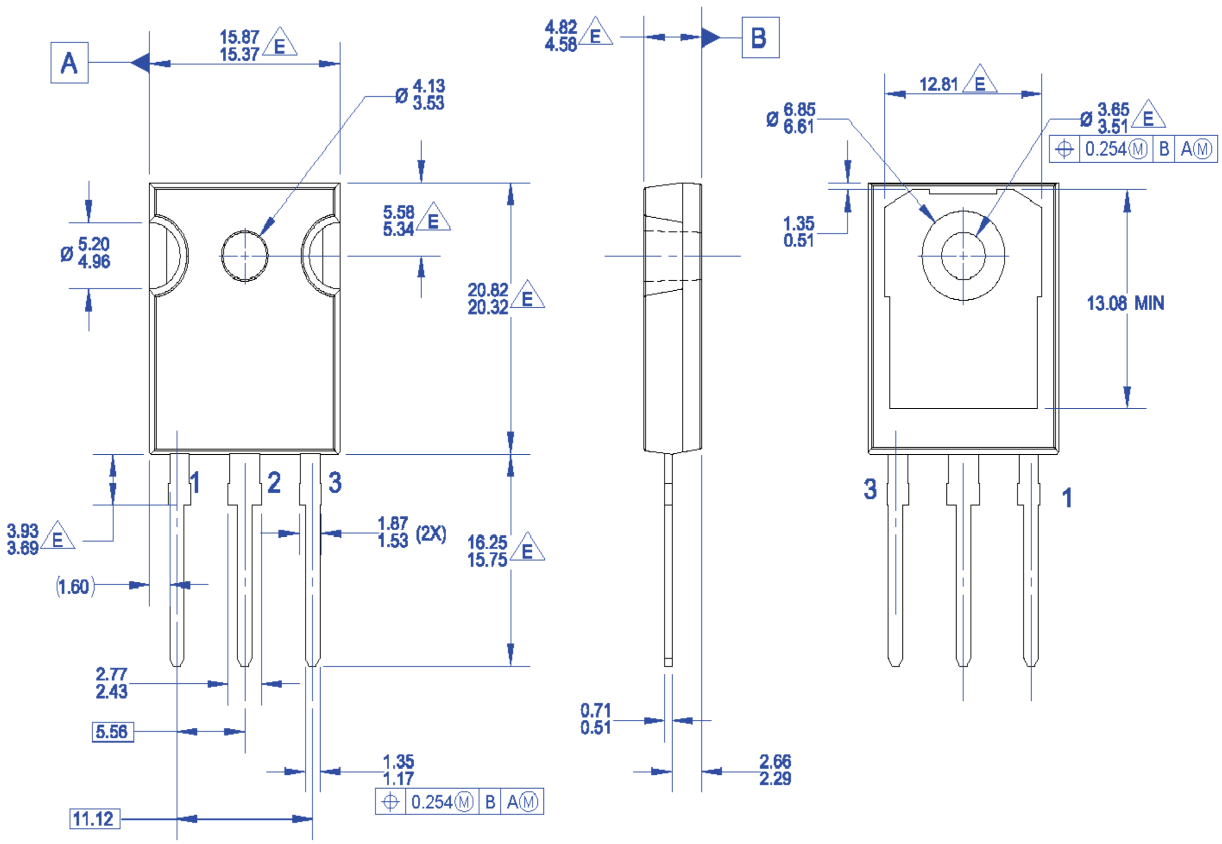


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5 - 1994

E DOES NOT COMPLY JEDEC STANDARD VALUE
F. DRAWING FILENAME: MKT-TO247A03_REV04

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