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FCH070N60E

N-Channel SuperFET[®] II Easy-Drive MOSFET

600 V, 52 A, 70 mΩ

Features

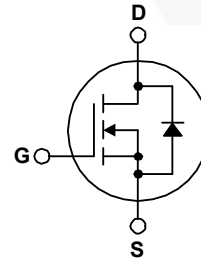
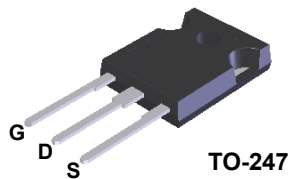
- 650 V @ T_J = 150°C
- Typ. R_{DS(on)} = 58 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 128 nC)
- Low Effective Output Capacitance (Typ. C_{oss(eff.)} = 457 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

- Telecom / Server Power Supplies
- Industrial Power Supplies

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 easy-drive series offers slightly slower rise and fall times compared to the SuperFET II MOSFET series. Noted by the "E" part number suffix, this family helps manage EMI issues and allows for easier design implementation. For faster switching in applications where switching losses must be at an absolute minimum, please consider the SuperFET II MOSFET series.



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

Symbol	Parameter	FCH070N60E	Unit
V _{DSS}	Drain to Source Voltage	600	V
V _{GSS}	Gate to Source Voltage	- DC	±20
		- AC (f > 1 Hz)	±30
I _D	Drain Current	- Continuous (T _C = 25°C)	52
		- Continuous (T _C = 100°C)	33
I _{DM}	Drain Current	- Pulsed (Note 1)	156
E _{AS}	Single Pulsed Avalanche Energy	(Note 2)	1128
I _{AR}	Avalanche Current	(Note 1)	9.5
E _{AR}	Repetitive Avalanche Energy	(Note 1)	4.8
dv/dt	MOSFET dv/dt		100
	Peak Diode Recovery dv/dt	(Note 3)	20
P _D	Power Dissipation	(T _C = 25°C)	481
		- Derate Above 25°C	3.85
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	FCH070N60E	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	0.26	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCH070N60E	FCH070N60E	TO-247	Tube	N/A	N/A	30 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	$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 25^\circ\text{C}$	600	-	-	V
		$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 150^\circ\text{C}$	650	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C	-	0.7	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	3.4	-	
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	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 26\text{ A}$	-	58	70	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 26\text{ A}$	-	44	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	3705	4925	pF
C_{oss}	Output Capacitance		-	116	155	pF
C_{riss}	Reverse Transfer Capacitance		-	12.3	20	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$	-	457	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 26\text{ A}, V_{GS} = 10\text{ V}$	-	128	166	nC
Q_{gs}	Gate to Source Gate Charge		-	18	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		(Note 4)	-	54	-
ESR	Equivalent Series Resistance	$f = 1\text{ MHz}$	-	0.6	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 26\text{ A}, V_{GS} = 10\text{ V}, R_g = 4.7\ \Omega$	-	29	68	ns
t_r	Turn-On Rise Time		-	28	66	ns
$t_{d(off)}$	Turn-Off Delay Time		-	122	254	ns
t_f	Turn-Off Fall Time		(Note 4)	-	28	66

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	52	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	156	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 26\text{ A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_{SD} = 26\text{ A}$	-	463	-	ns
Q_{rr}	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{s}$	-	10.4	-	μC

Notes:

1. Repetitive rating: pulse width limited by maximum junction temperature.
2. $I_{AS} = 9.5\text{ A}, R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 26\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

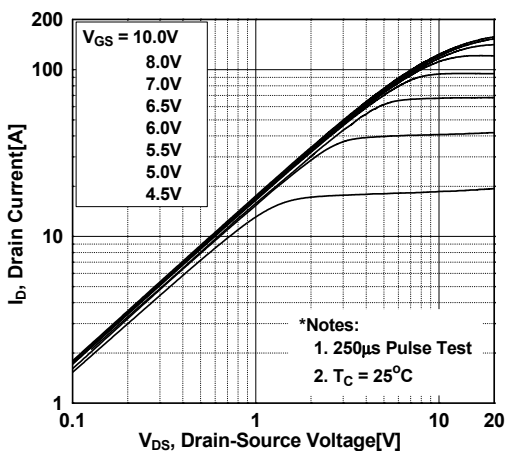


Figure 2. Transfer Characteristics

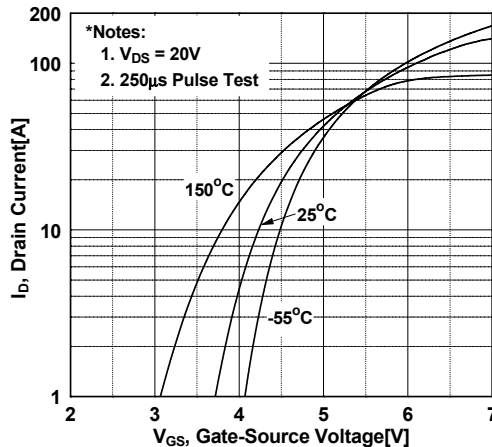


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

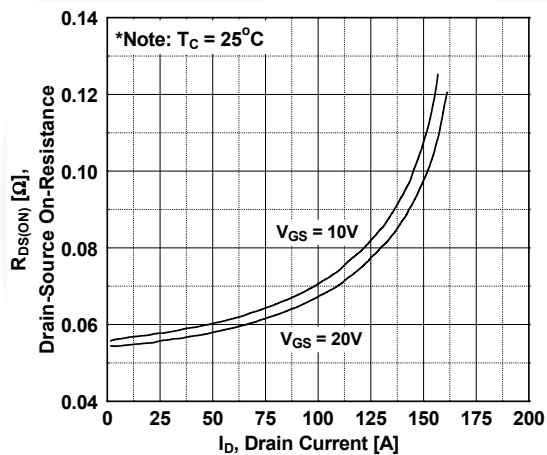


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

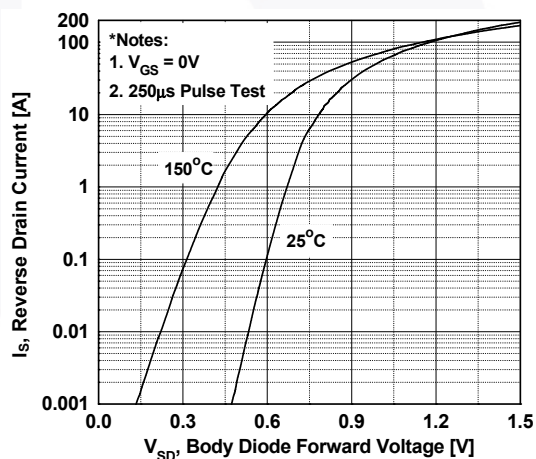


Figure 5. Capacitance Characteristics

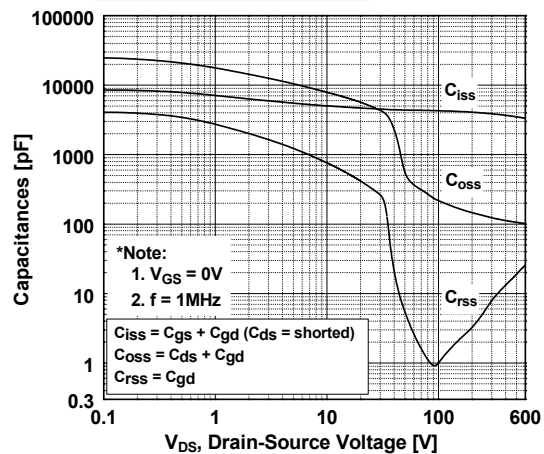
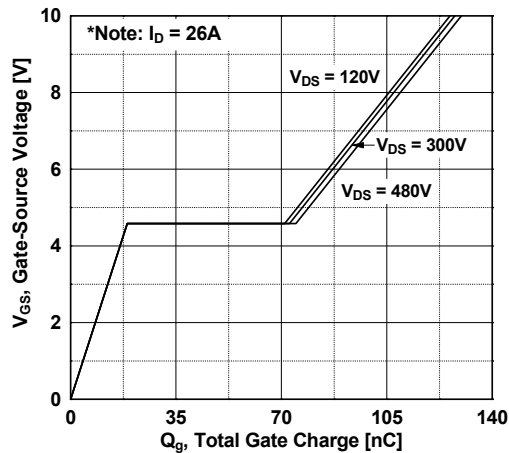


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

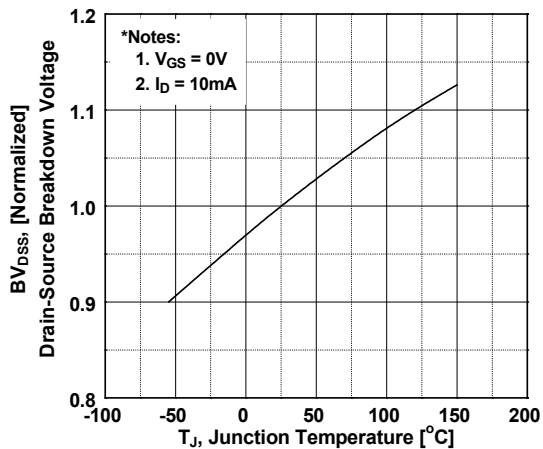


Figure 8. On-Resistance Variation vs. Temperature

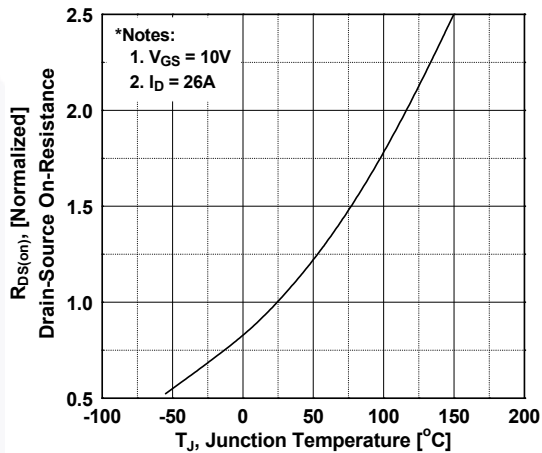


Figure 9. Maximum Safe Operating Area

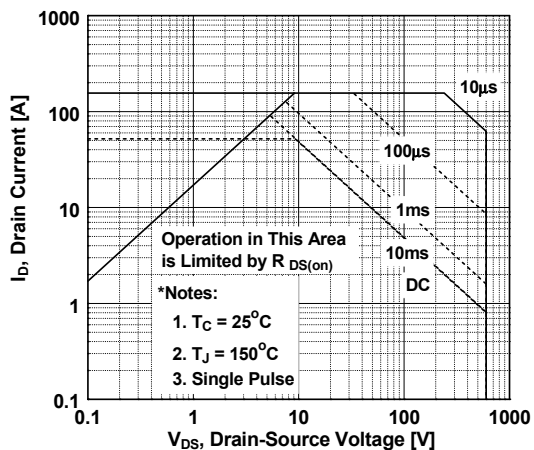


Figure 10. Maximum Drain Current vs. Case Temperature

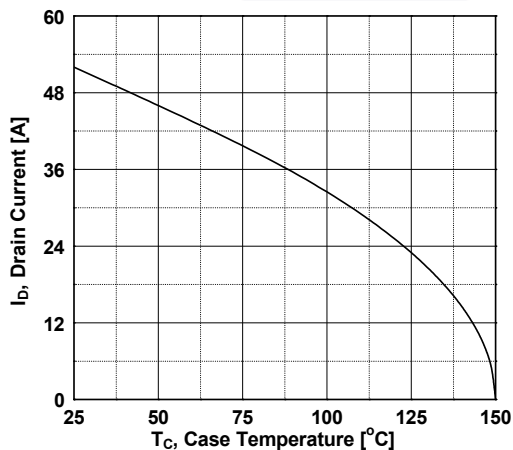
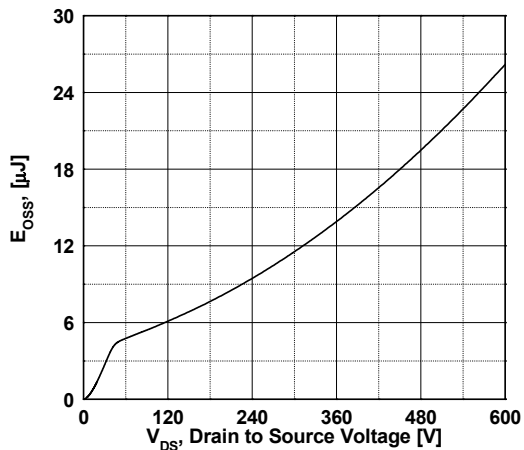


Figure 11. E_oss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

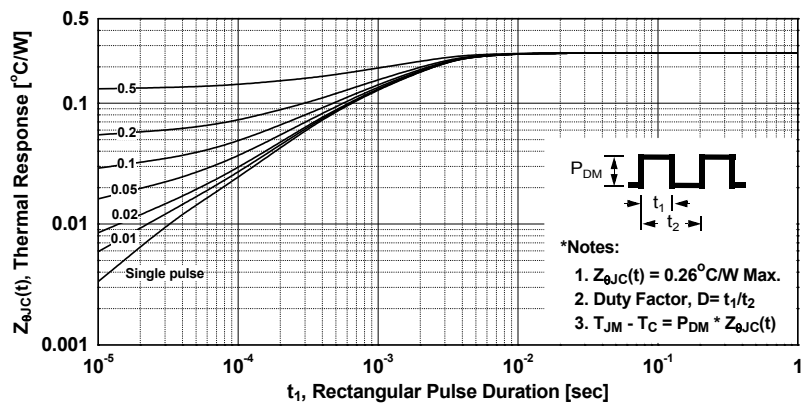


Figure 13. Gate Charge Test Circuit & Waveform

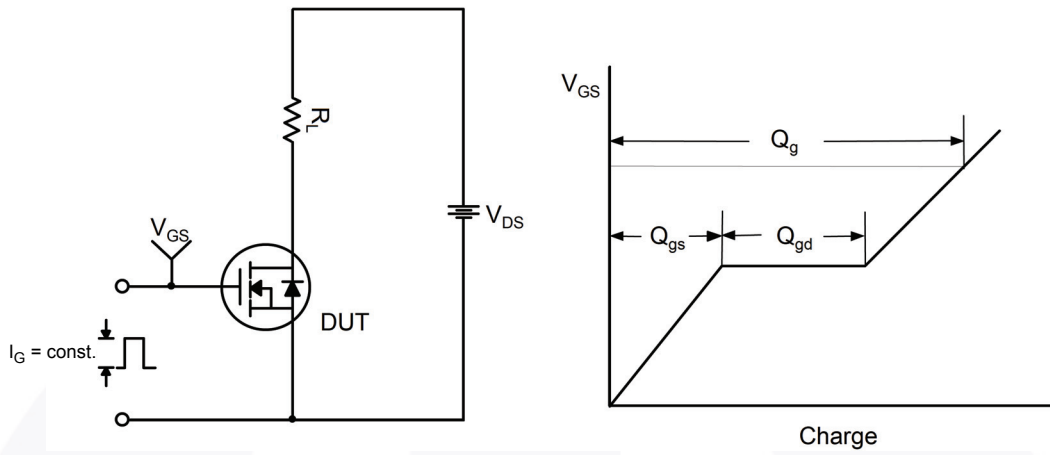


Figure 14. Resistive Switching Test Circuit & Waveforms

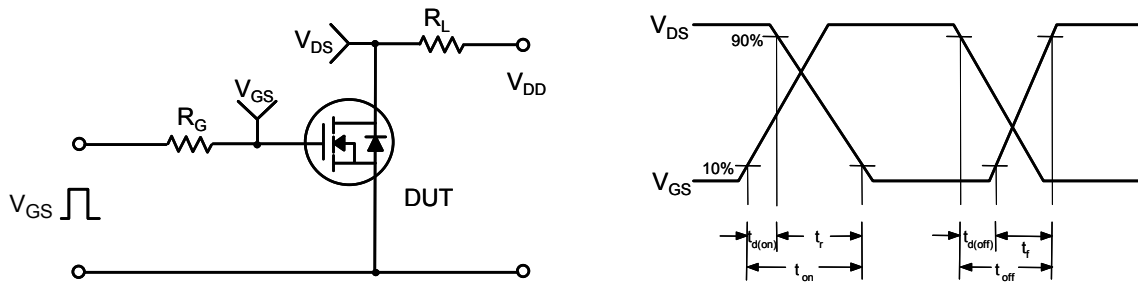


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

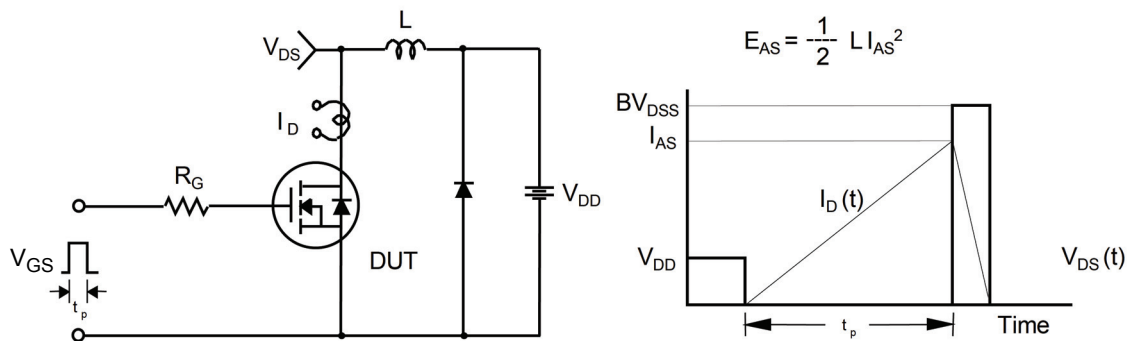
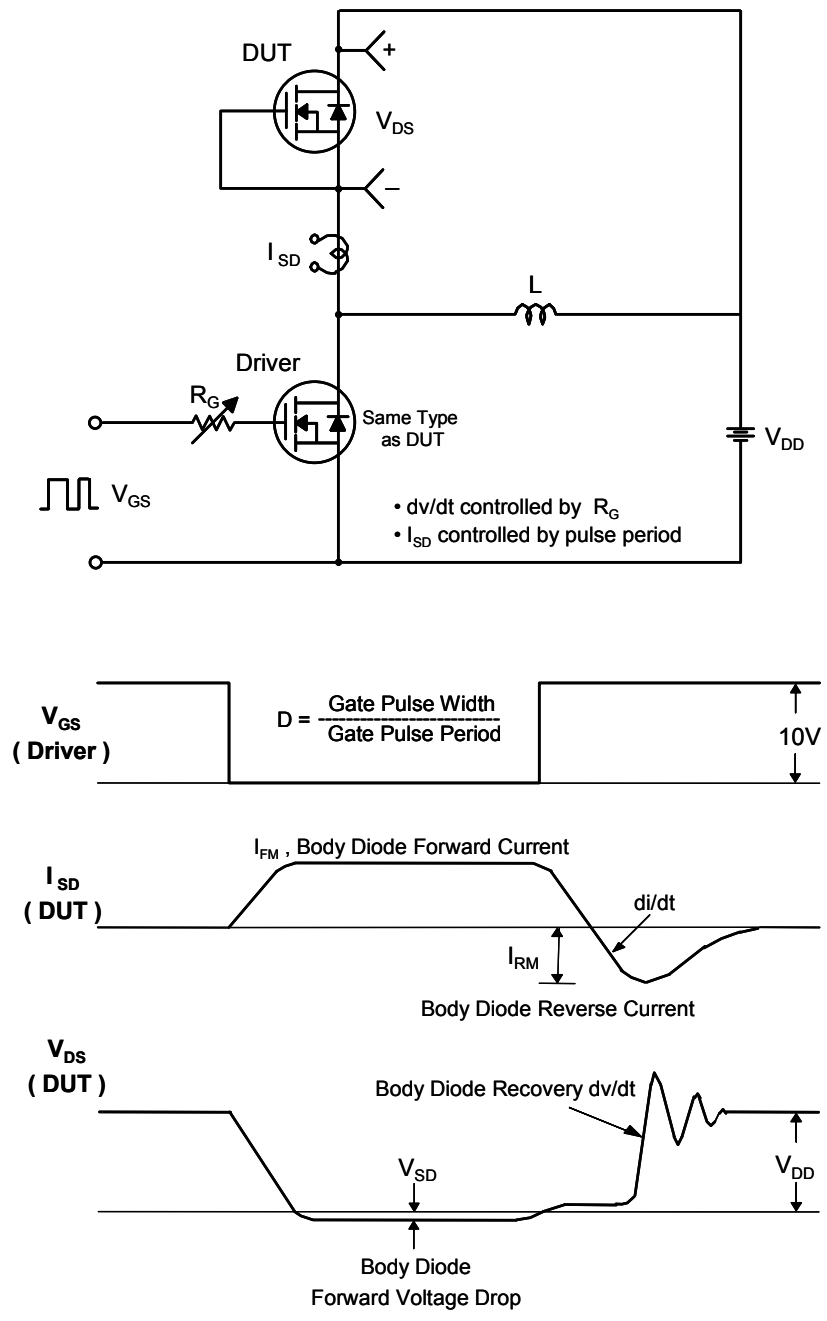
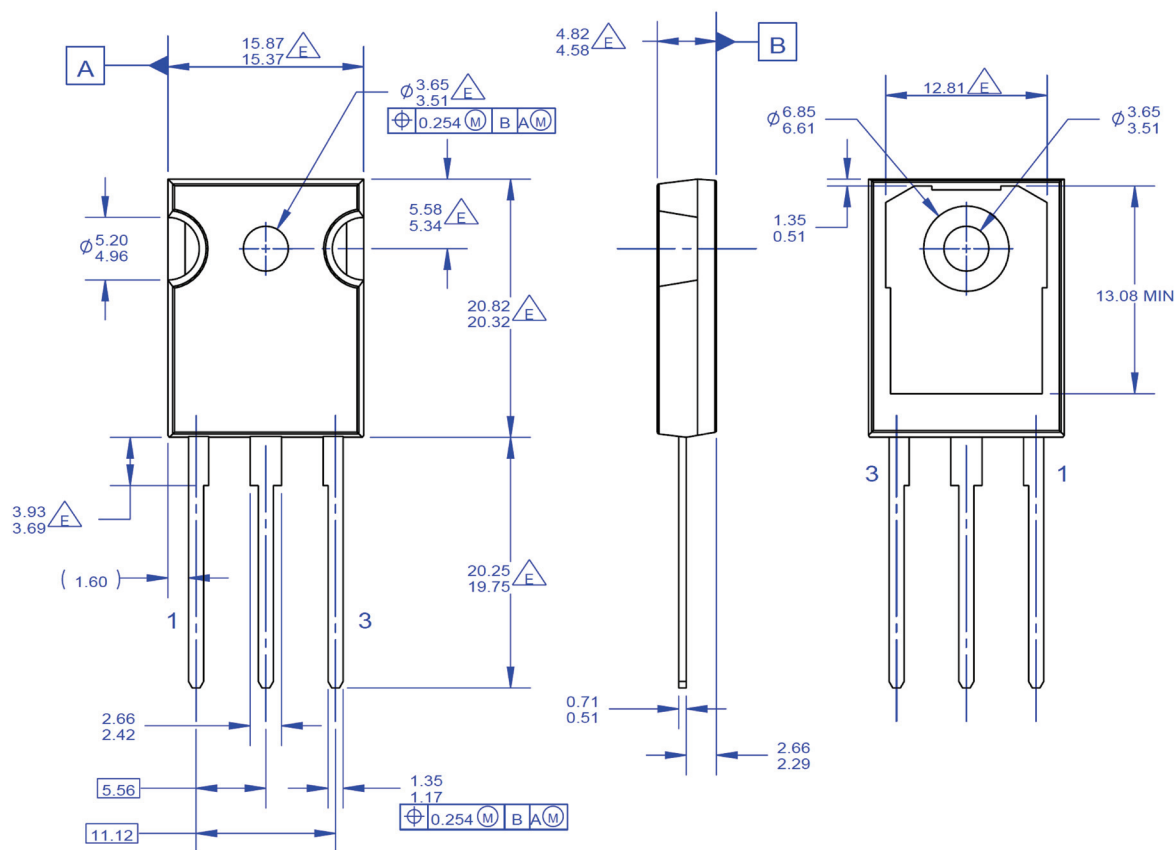


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
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- D. DRAWING CONFORMS TO ASME Y14.5 - 1994

- DOES NOT COMPLY JEDEC STANDARD VALUE
- F. DRAWING FILENAME: MKT-TO247G03_REV01

Figure 16. TO-247, Molded, 3-Lead, Jedec AB Long Leads

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