FAIRCHILD SEMICONDUCTOR®

December 2013

FCH041N60E

N-Channel SuperFET® II Easy-Drive MOSFET

600 V, 77 A, 41 mΩ

Features

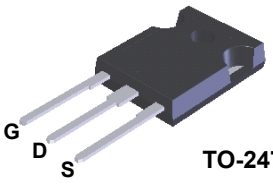
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 36 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 285 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 735 pF)
- 100% Avalanche Tested
- An Integrated Gate Resistor
- RoHS Compliant

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 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.



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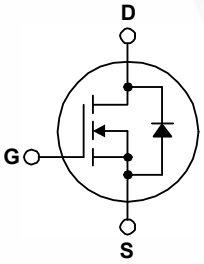


Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter		FCH041N60E	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)	77	A
		- Continuous (T_C = 100°C)	48.7	
I_{DM}	Drain Current	- Pulsed (Note 1)	231	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)	5.92	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)	592	W
		- Derate Above 25°C	4.74	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	FCH041N60E	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
FCH041N60E	FCH041N60E	TO-247	Tube	N/A	N/A	30 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	I_D = 10 mA, V_{GS} = 0 V, $T_C = 25^oC$	600	-	-	V
		I_D = 10 mA, V_{GS} = 0 V, $T_C = 150^oC$	650	-	-	
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25^oC	-	0.67	-	$V/^oC$
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 480 V, V_{GS} = 0 V	-	-	1	μA
		V_{DS} = 480 V, V_{GS} = 0 V, $T_C = 125^oC$	-	-	10	
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 = 39 A	-	36	41	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 39 A	-	71	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V, f = 1 MHz	-	10300	13700	pF
C_{oss}	Output Capacitance		-	355	475	pF
C_{rss}	Reverse Transfer Capacitance		-	4	6	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	-	187	-	pF
C_{oss}eff.	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	735	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 39 A, V_{GS} = 10 V (Note 4)	-	285	380	nC
Q_{gs}	Gate to Source Gate Charge		-	45	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	105	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-	1.2	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 39 A, V_{GS} = 10 V, R_G = 4.7 Ω (Note 4)	-	50	110	ns
t_r	Turn-On Rise Time		-	50	110	ns
$t_{d(off)}$	Turn-Off Delay Time		-	320	650	ns
t_f	Turn-Off Fall Time		-	85	180	ns
Drain-Source Diode Characteristics						
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} = 39 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 39 A, dI_F/dt = 100 A/μs	-	590	-	ns
Q_{rr}	Reverse Recovery Charge		-	18	-	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} ≤ 39 A, di/dt ≤ 200 A/μs, V_{DD} ≤ 380V, starting T_J = 25°C.
4. Essentially independent of operating temperature.

Typical Characteristics

Figure 1. On-Region Characteristics

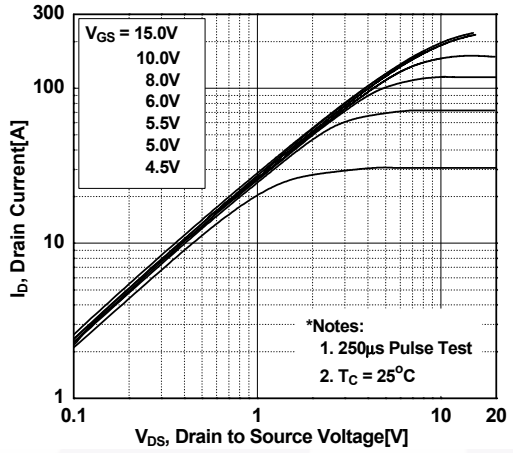


Figure 2. Transfer Characteristics

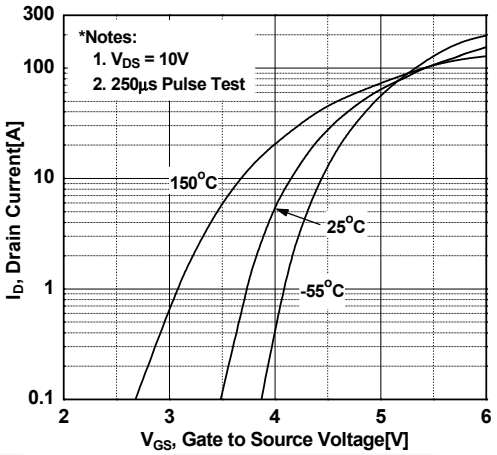


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

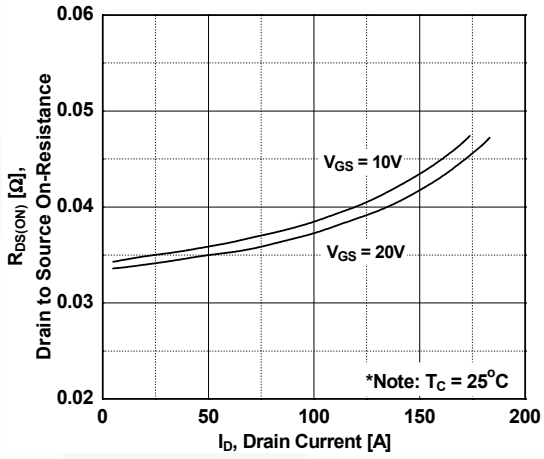


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

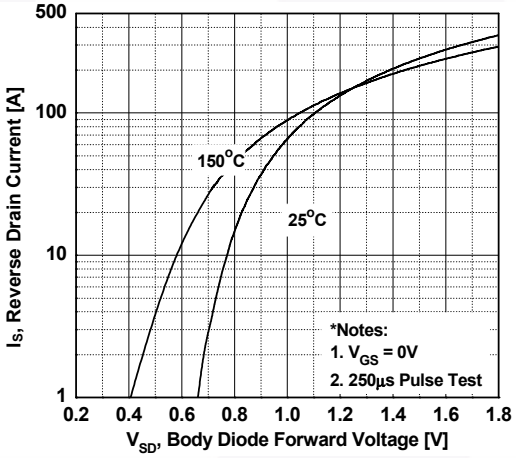


Figure 5. Capacitance Characteristics

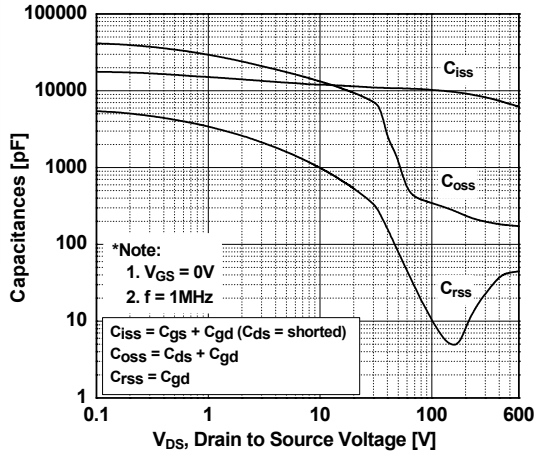
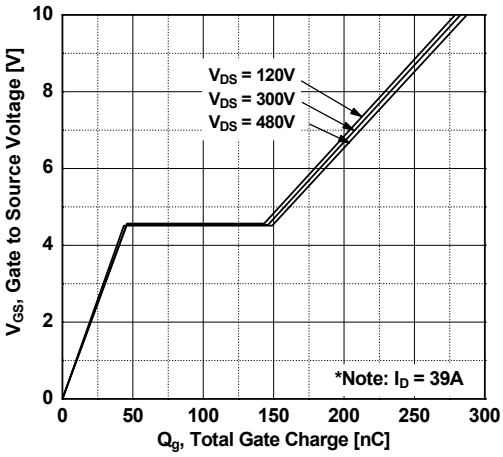


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

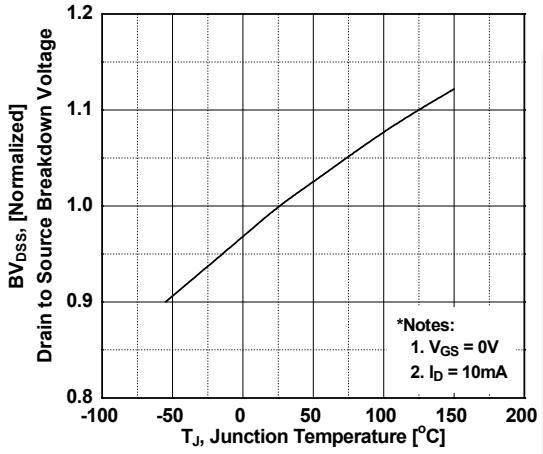


Figure 8. On-Resistance Variation vs. Temperature

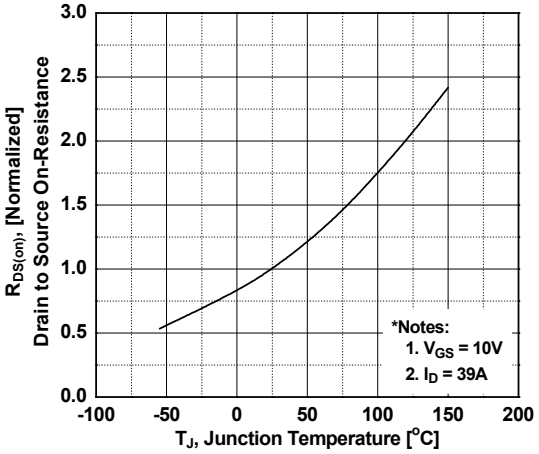


Figure 9. Maximum Safe Operating Area

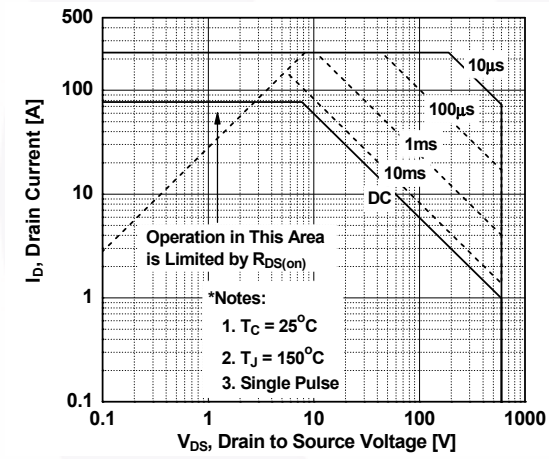


Figure 10. Maximum Drain Current vs. Case Temperature

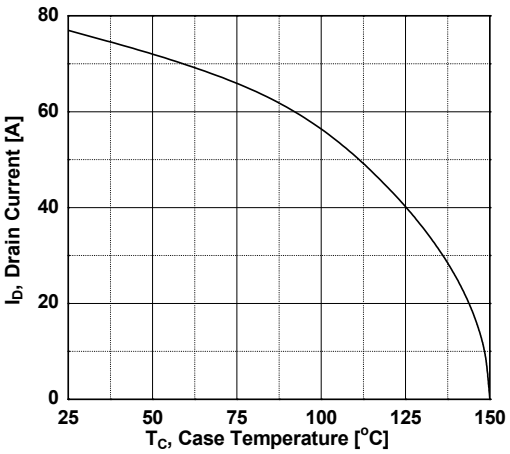
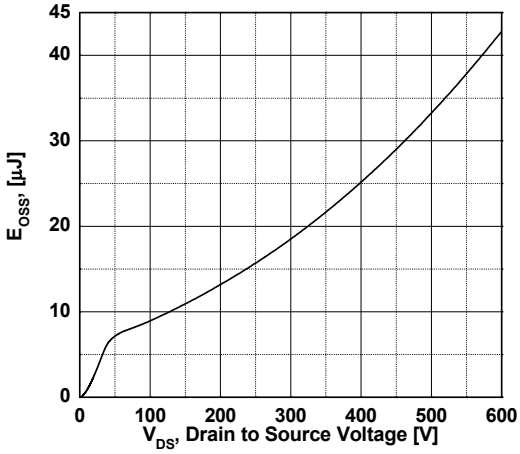
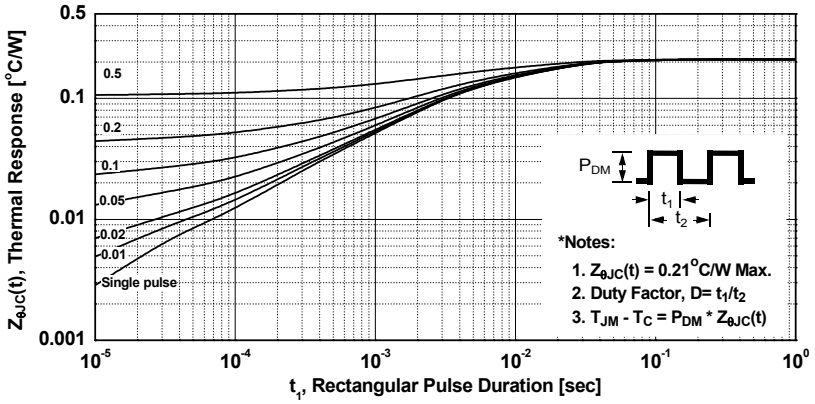


Figure 11. Eoss vs. Drain to Source Voltage



Typical Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



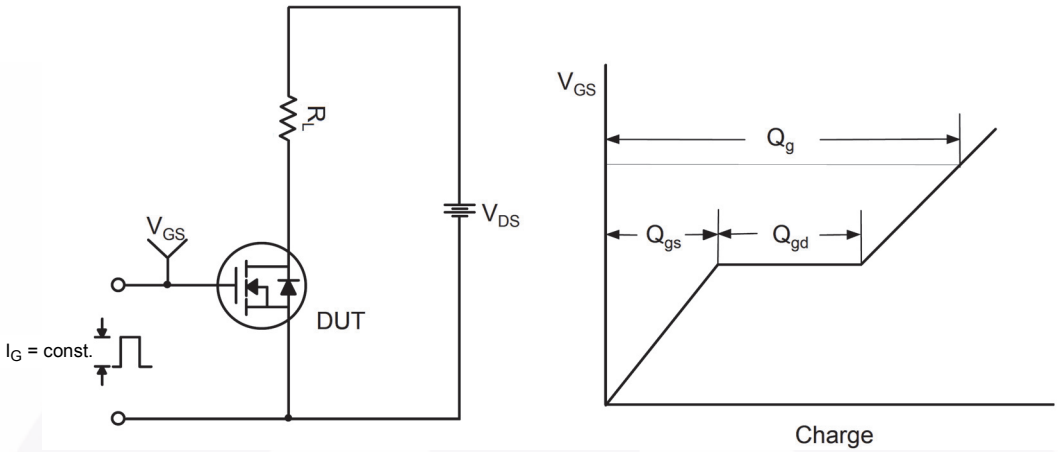


Figure 13. Gate Charge Test Circuit & Waveform

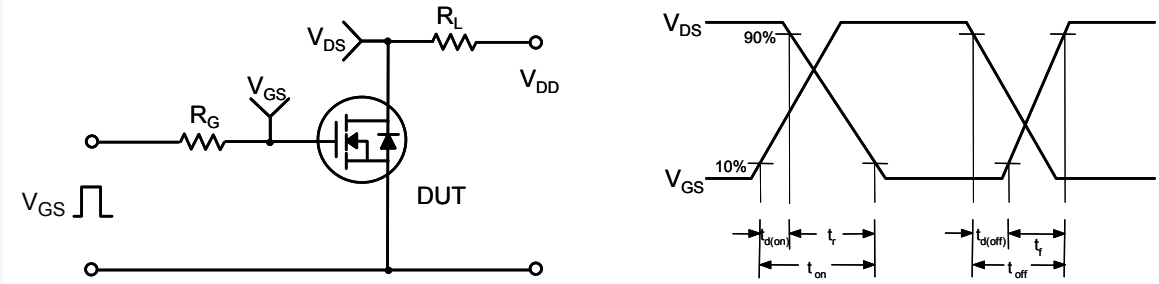


Figure 14. Resistive Switching Test Circuit & Waveforms

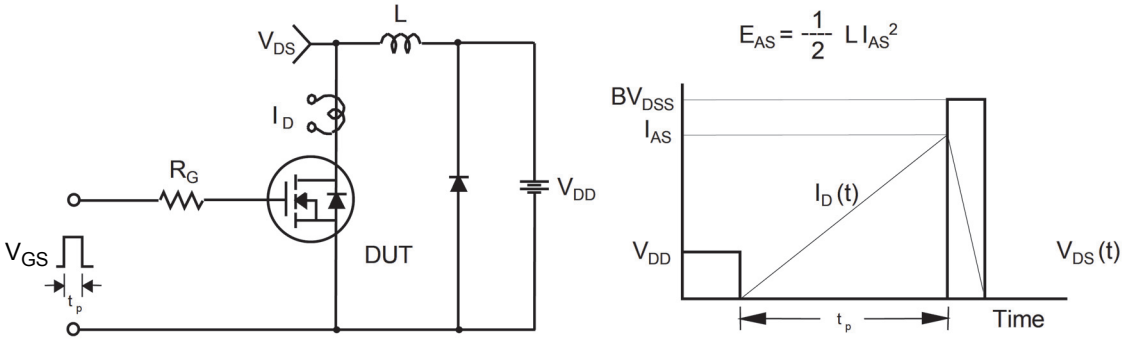


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

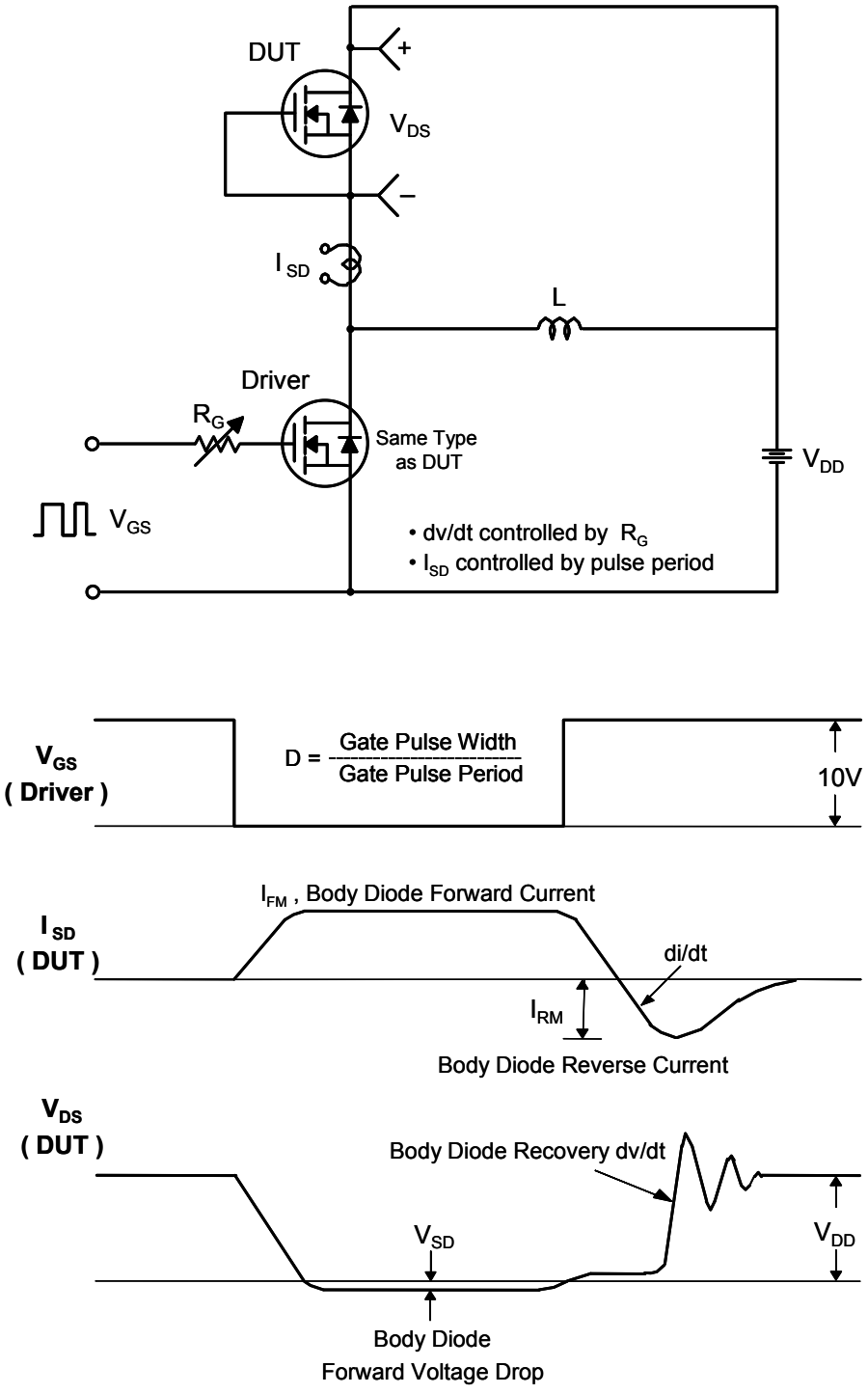
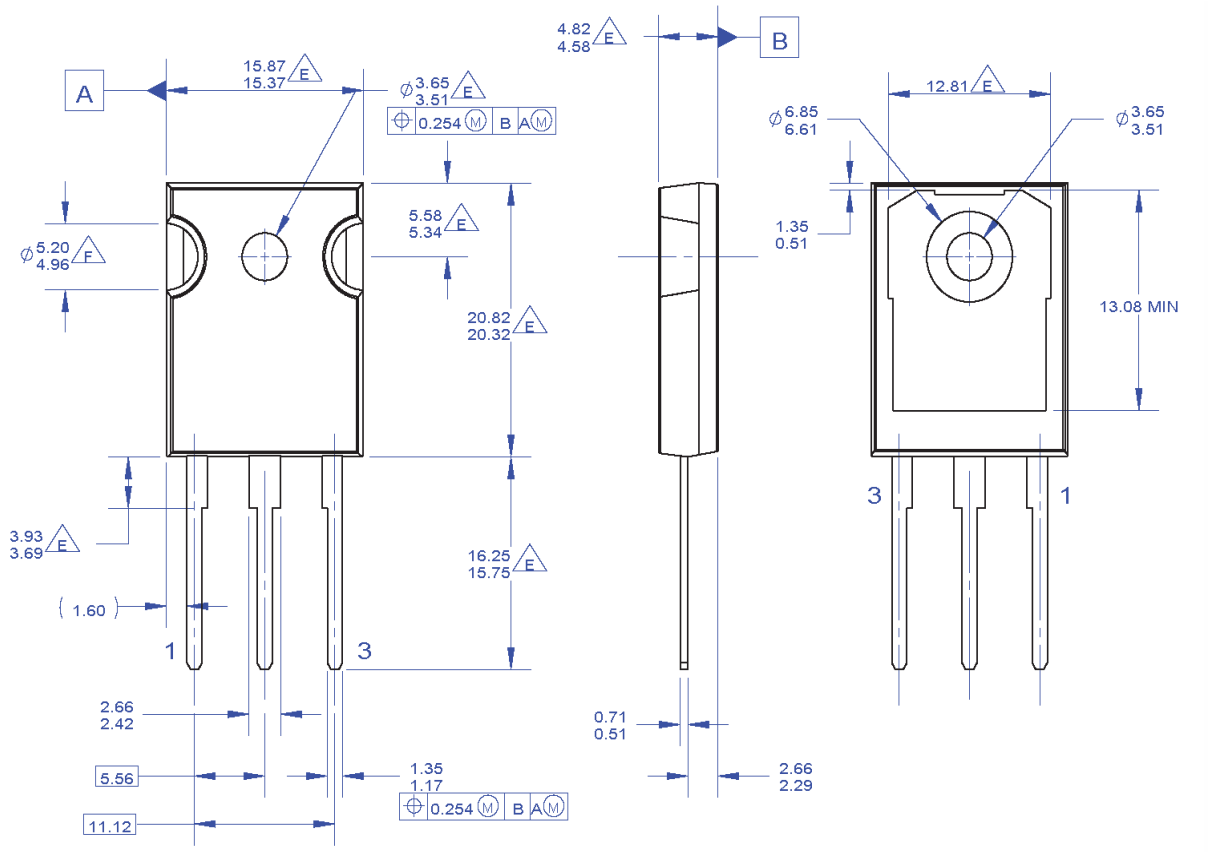


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



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G. DRAWING FILENAME: MKT-TO247A03_REV03

Figure 17. TO-247, Molded, 3-Lead, Jedec Variation AB

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