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FAIRCHILD SEMICONDUCTOR®

December 2014

FCP104N60F

N-Channel SuperFET® II FRFET® MOSFET

600 V, 37 A, 104 mΩ

Features

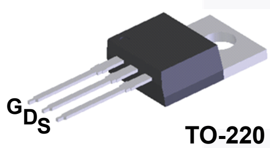
- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 91 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 110 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 313 pF)
- 100% Avalanche Tested

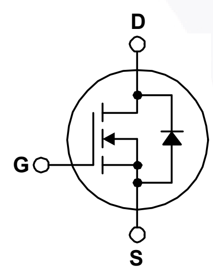
Applications

- 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. SuperFET® II FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.





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

Symbol	Parameter		FCP104N60F	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage	- DC	±20	V
		- AC (f > 1Hz)	±30	V
I_D	Drain Current	- Continuous (T_C = 25°C)	37	A
		- Continuous (T_C = 100°C)	24	
I_{DM}	Drain Current	- Pulsed (Note 1)	114	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		809	mJ
I_{AR}	Avalanche Current (Note 1)		6.8	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		3.57	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		50	V/ns
	MOSFET dv/dt		100	
P_D	Power Dissipation	(T_C = 25°C)	357	W
		- Derate Above 25°C	2.85	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	FCP104N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.35	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ,Max.	62.5	

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP104N60F	FCP104N60F	TO220	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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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	-	-	
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25°C	-	0.67	-	V/°C
BV_{DS}	Drain-Source Avlanche Breakdown Voltage	V_{GS} = 0 V, I_D = 18.5 A	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0 V	-	-	10	μA
		V_{DS} = 480 V, T_C = 125°C	-	16	-	
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 = 18.5 A	-	91	104	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 18.5 A	-	33	-	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V f = 1 MHz	-	4610	6130	pF
C_{oss}	Output Capacitance		-	3255	4330	pF
C_{rss}	Reverse Transfer Capacitance		-	155	235	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	-	74	-	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	313	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 18.5 A V_{GS} = 10 V (Note 4)	-	110	145	nC
Q_{gs}	Gate to Source Gate Charge		-	24	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	44	-	nC
ESR	Equivalent Series Resistance	Drain open		0.9		Ω

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 18.5 A V_{GS} = 10 V, R_{GEN} = 4.7 Ω (Note 4)	-	34	78	ns
t_r	Turn-On Rise Time		-	20	50	ns
$t_{d(off)}$	Turn-Off Delay Time		-	102	214	ns
t_f	Turn-Off Fall Time		-	5.7	21.4	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	37	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	114	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 18.5 A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 18.5 A dI_F/dt = 100 A/μs	-	144	-	ns
Q_{rr}	Reverse Recovery Charge		-	0.91	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 6.8 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 18.5 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

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Typical Characteristics

Figure 1. On-Region Characteristics

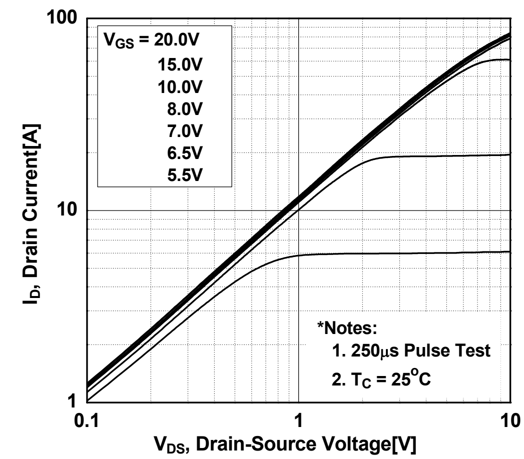


Figure 2. Transfer Characteristics

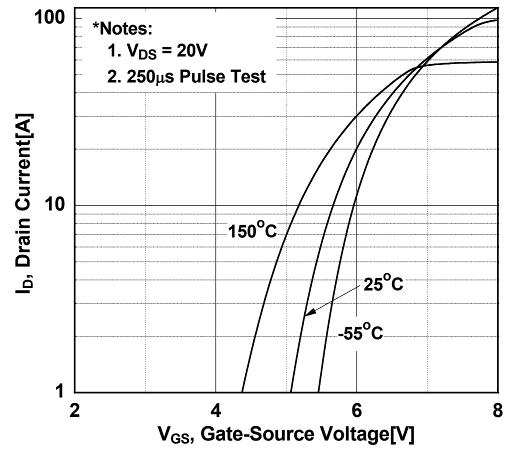


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

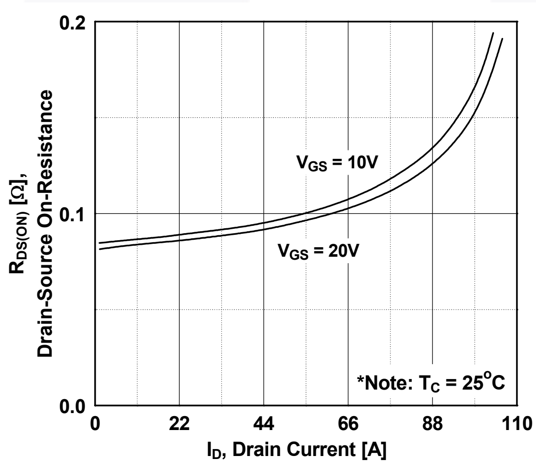


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

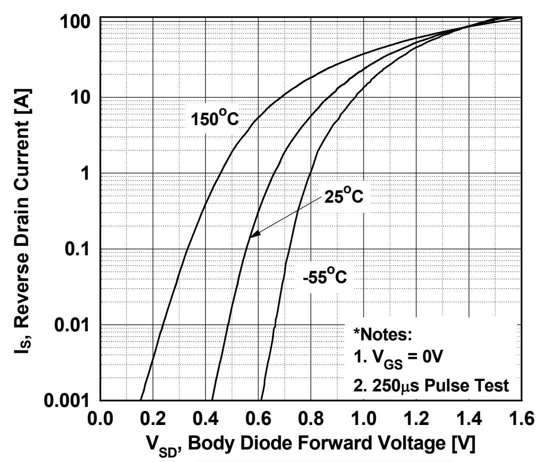


Figure 5. Capacitance Characteristics

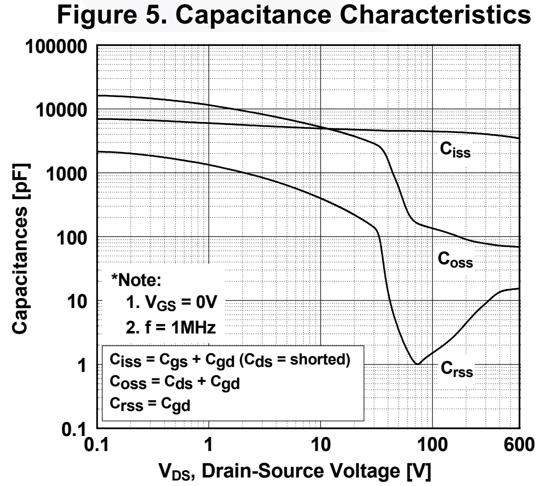
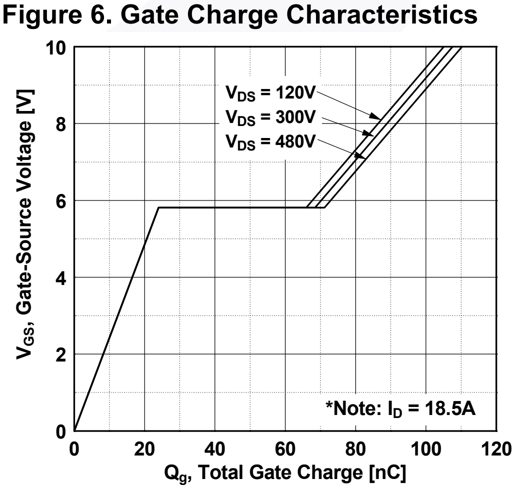


Figure 6. Gate Charge Characteristics



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Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

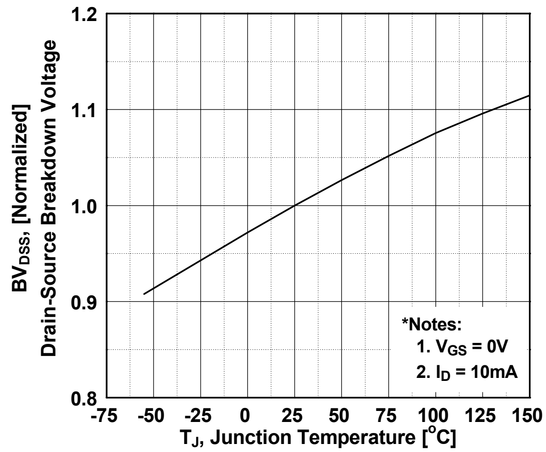

Figure 8. On-Resistance Variation vs. Temperature

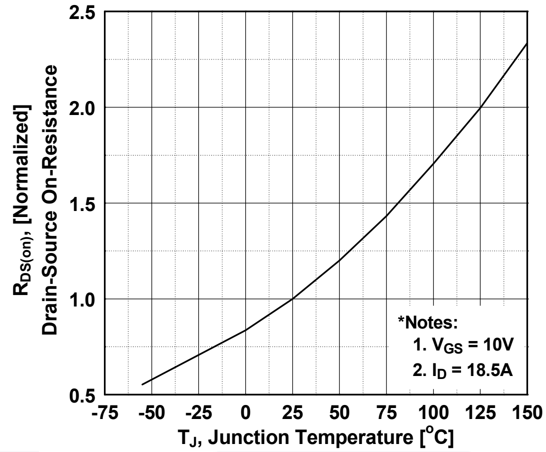

Figure 9. Maximum Safe Operating Area

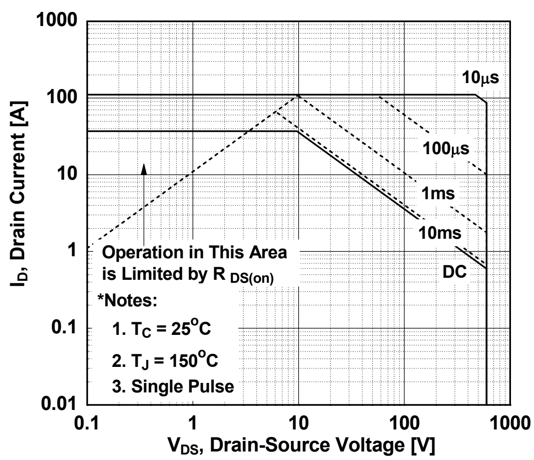

Figure 10. Maximum Drain Current vs. Case Temperature

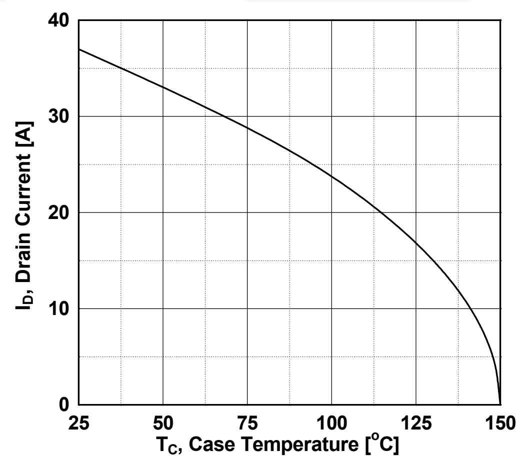

Figure 11. Transient Thermal Response Curve

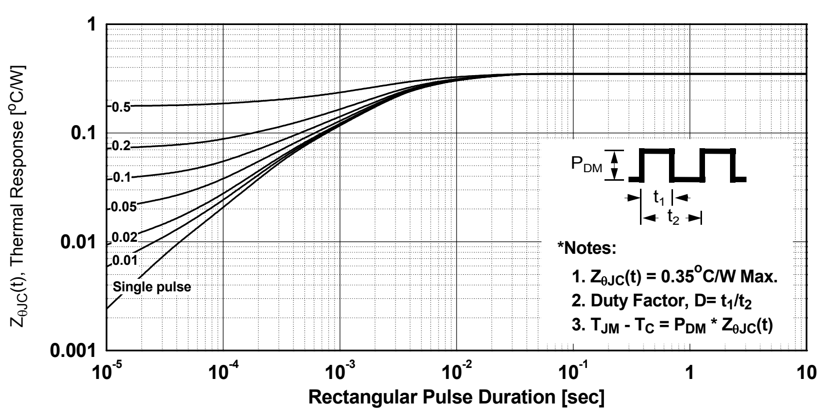

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Figure 12. Gate Charge Test Circuit & Waveform

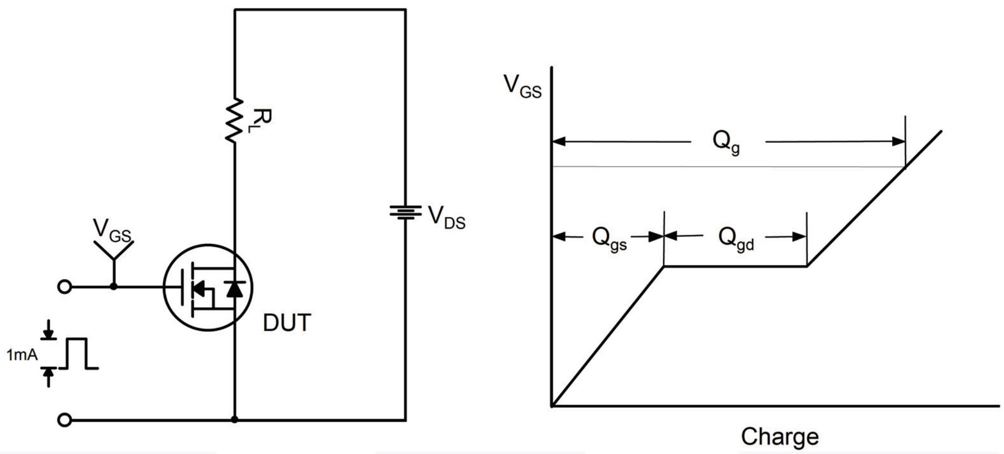

Figure 13. Resistive Switching Test Circuit & Waveforms

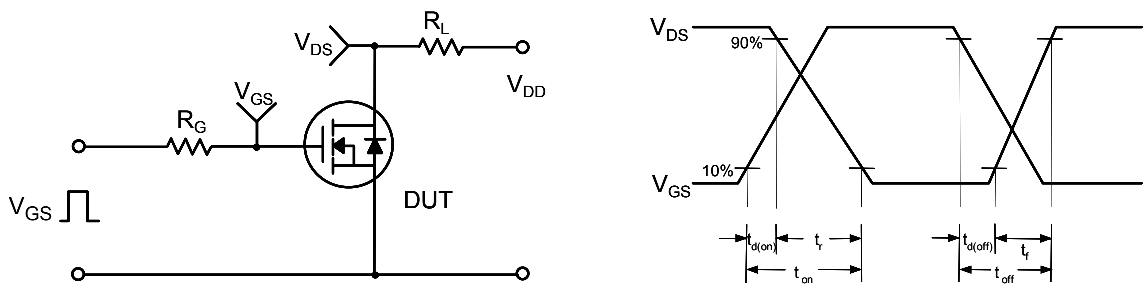

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

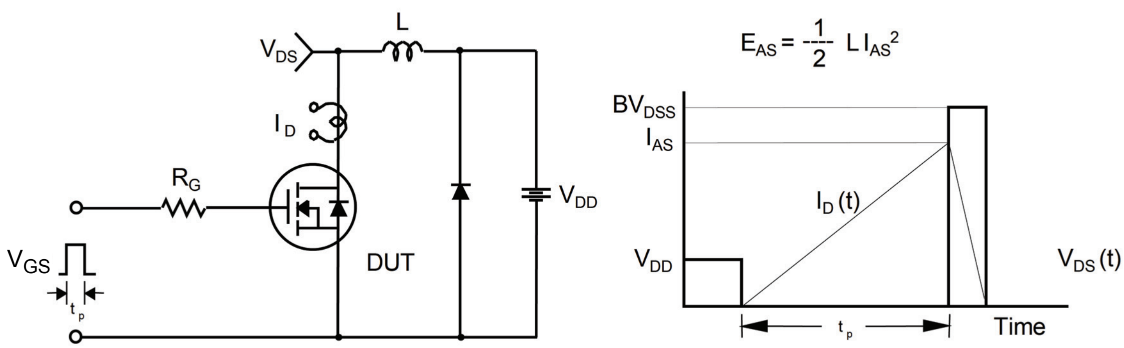

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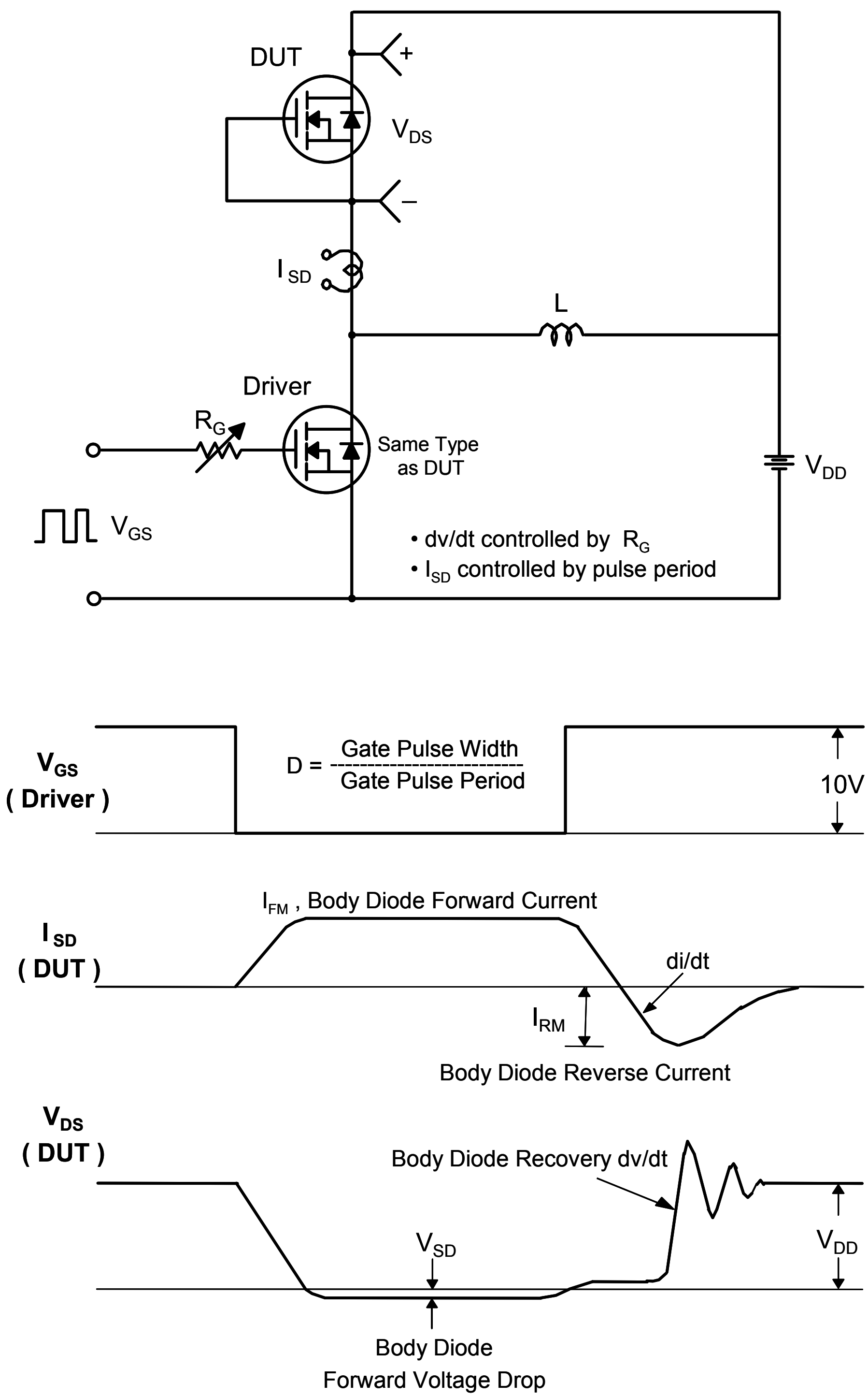
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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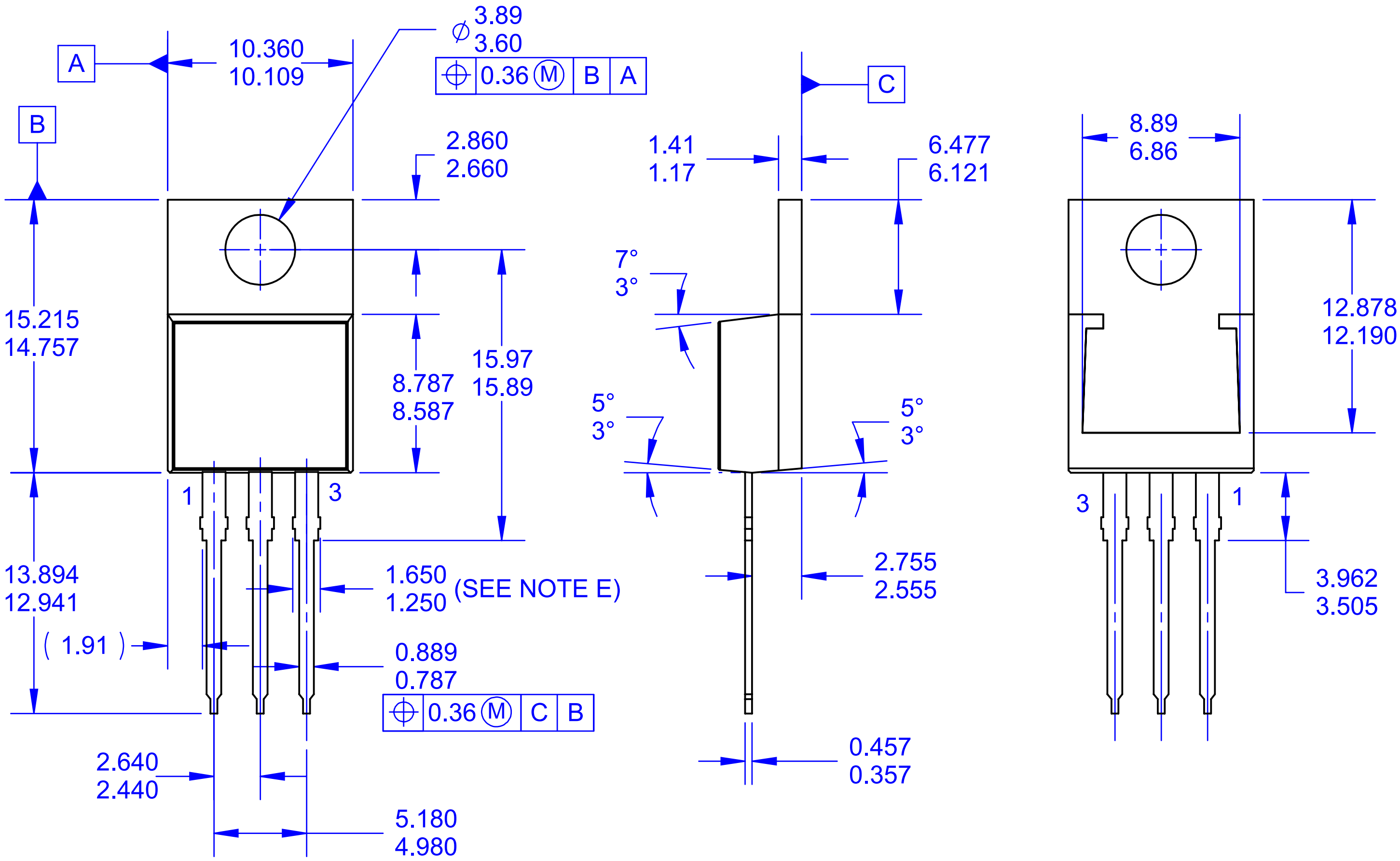

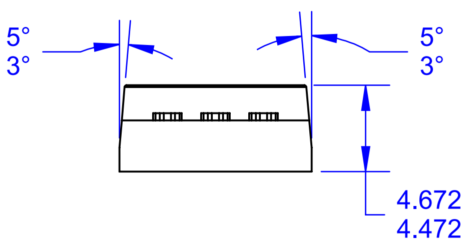

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