ON Semiconductor®

Sept 2017

FCA47N60F

N-Channel SuperFET® FRFET® MOSFET

600 V, 47 A, 73 mΩ

Features

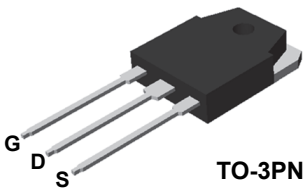
- 650 V @ T_J = 150 °C
- Typ. $R_{DS(on)}$ = 62 mΩ
- Fast Recovery Time (Typ. T_{rr} = 240 ns)
- Ultra Low Gate Charge (Typ. Q_g = 210 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 420 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

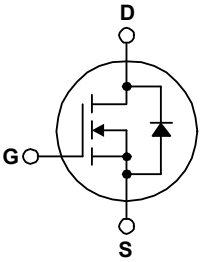
- Solar Inverter
- AC-DC Power Supply

Description

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



TO-3PN



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

Symbol	Parameter		FCA47N60F	Unit
V_{DSS}	Drain-Source Voltage		600	V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	47 29.7	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	141	A
V_{GSS}	Gate-Source voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	1800	mJ
I_{AR}	Avalanche Current	(Note 1)	47	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	41.7	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	50	V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate Above 25°C	417 3.33	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	FCA47N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	41.7	°C/W

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCA47N60F	FCA47N60F	TO-3PN	Tube	N/A	N/A	30 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
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.6	--	V/°C
BV_{DS}	Drain to Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 47 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	-- --	-- --	10 100	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 = 23.5 A	--	0.062	0.073	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 23.5 A	--	40	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	--	5900	8000	pF
C_{oss}	Output Capacitance		--	3200	4200	pF
C_{rss}	Reverse Transfer Capacitance		--	250	--	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1 MHz	--	160	--	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	--	420	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 47 A, V_{GS} = 10 V, R_G = 25 Ω	--	185	430	ns
t_r	Turn-On Rise Time		--	210	450	ns
$t_{d(off)}$	Turn-Off Delay Time		--	520	1100	ns
t_f	Turn-Off Fall Time	(Note 4)	--	75	160	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 47 A, V_{GS} = 10 V	--	210	270	nC
Q_{gs}	Gate-Source Charge		--	38	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	110	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	47	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	141	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 47 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 47 A, dI_F/dt = 100 A/μs	--	240	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.04	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I_{AS} = 18 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 47 A, di/dt ≤ 1200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

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Typical Performance Characteristics

Figure 1. On-Region Characteristics

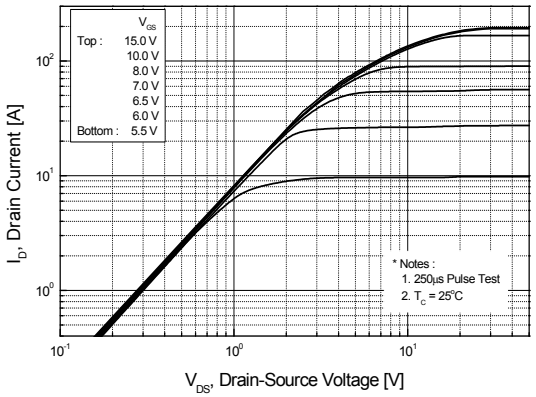


Figure 2. Transfer Characteristics

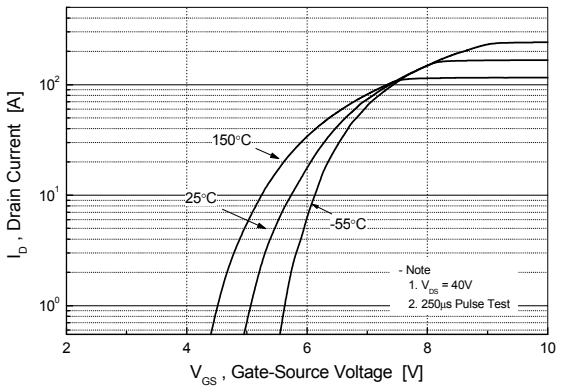


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

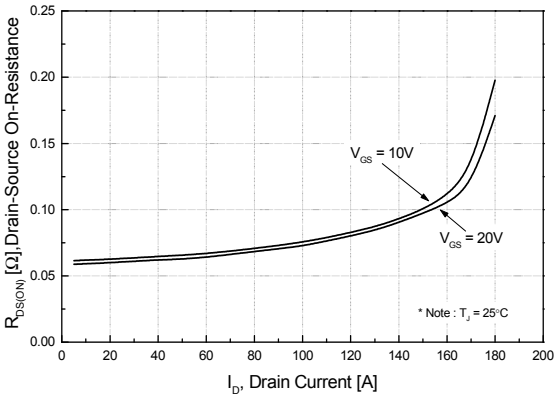


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

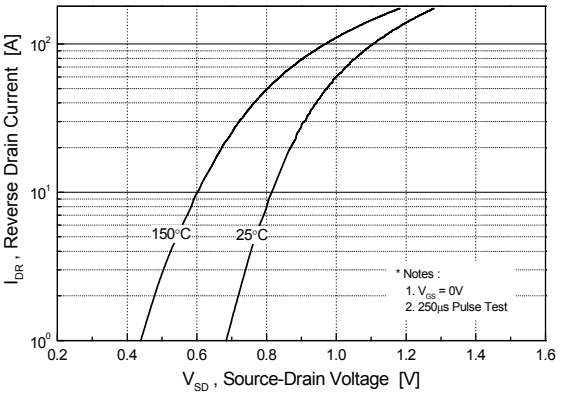


Figure 5. Capacitance Characteristics

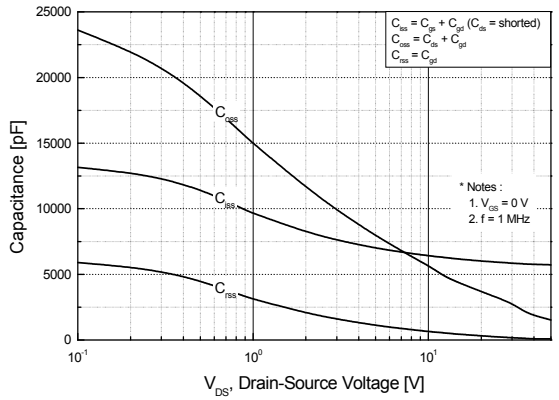
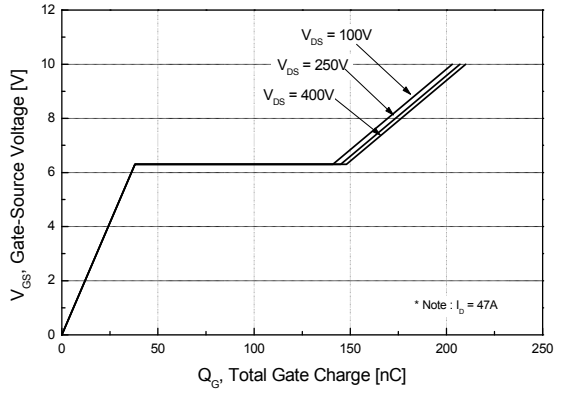


Figure 6. Gate Charge Characteristics



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Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

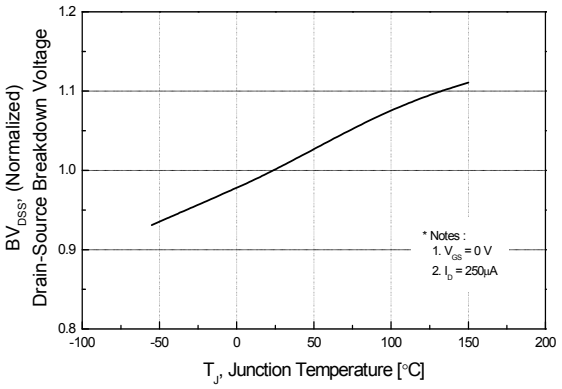

Figure 8. On-Resistance Variation vs. Temperature

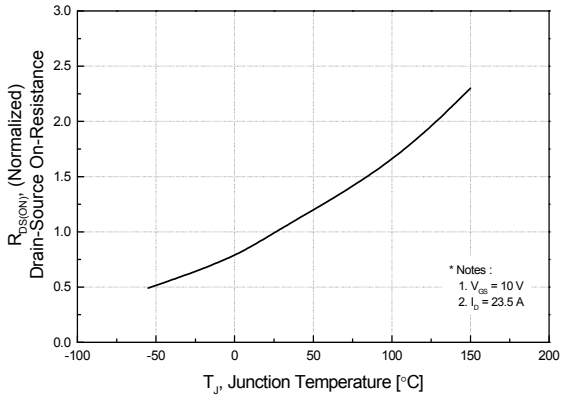

Figure 9. Safe Operating Area

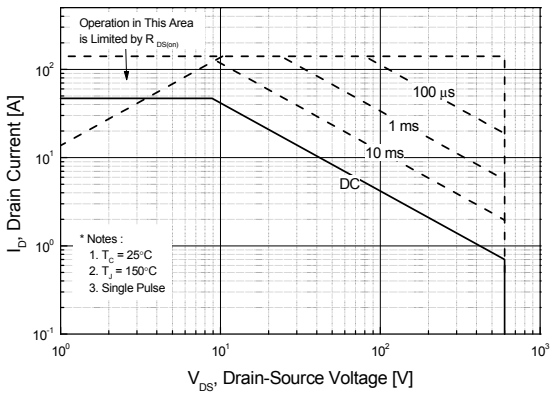

Figure 10. Maximum Drain Current vs. Case Temperature

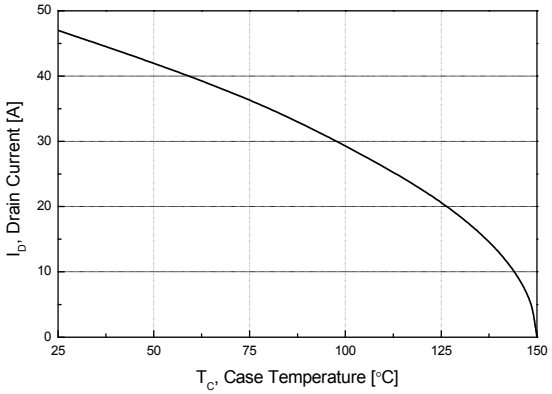

Figure 11. Transient Thermal Response Curve

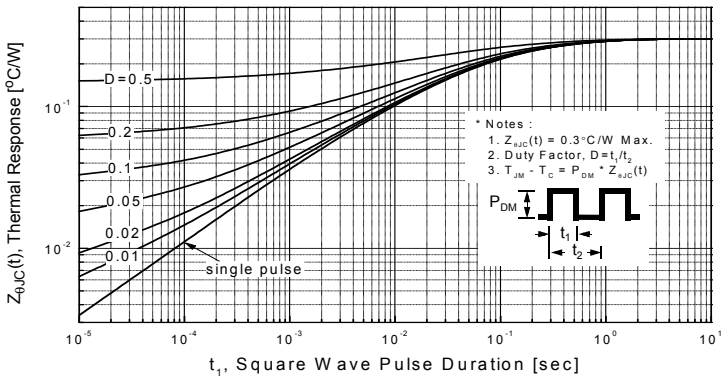

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Figure 12. Gate Charge Test Circuit & Waveform

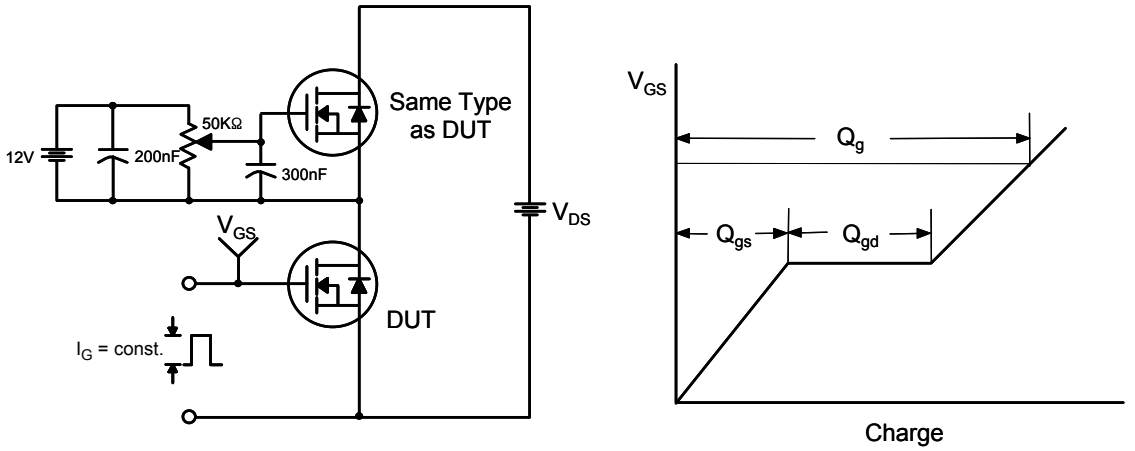

Figure 13. Resistive Switching Test Circuit & Waveforms

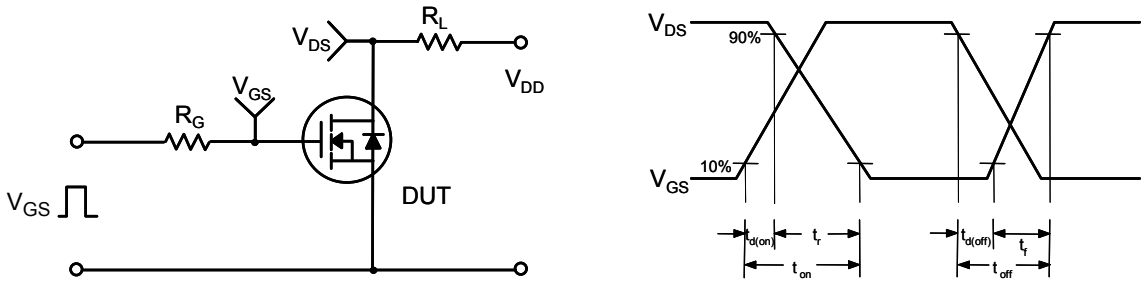

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

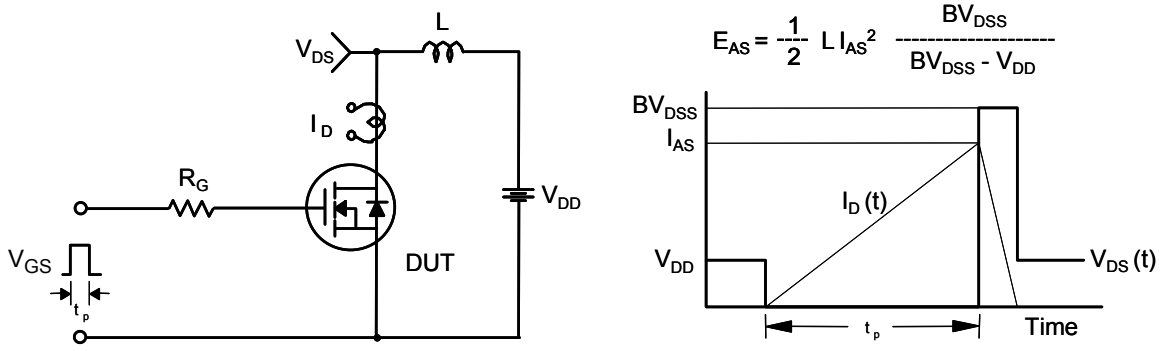

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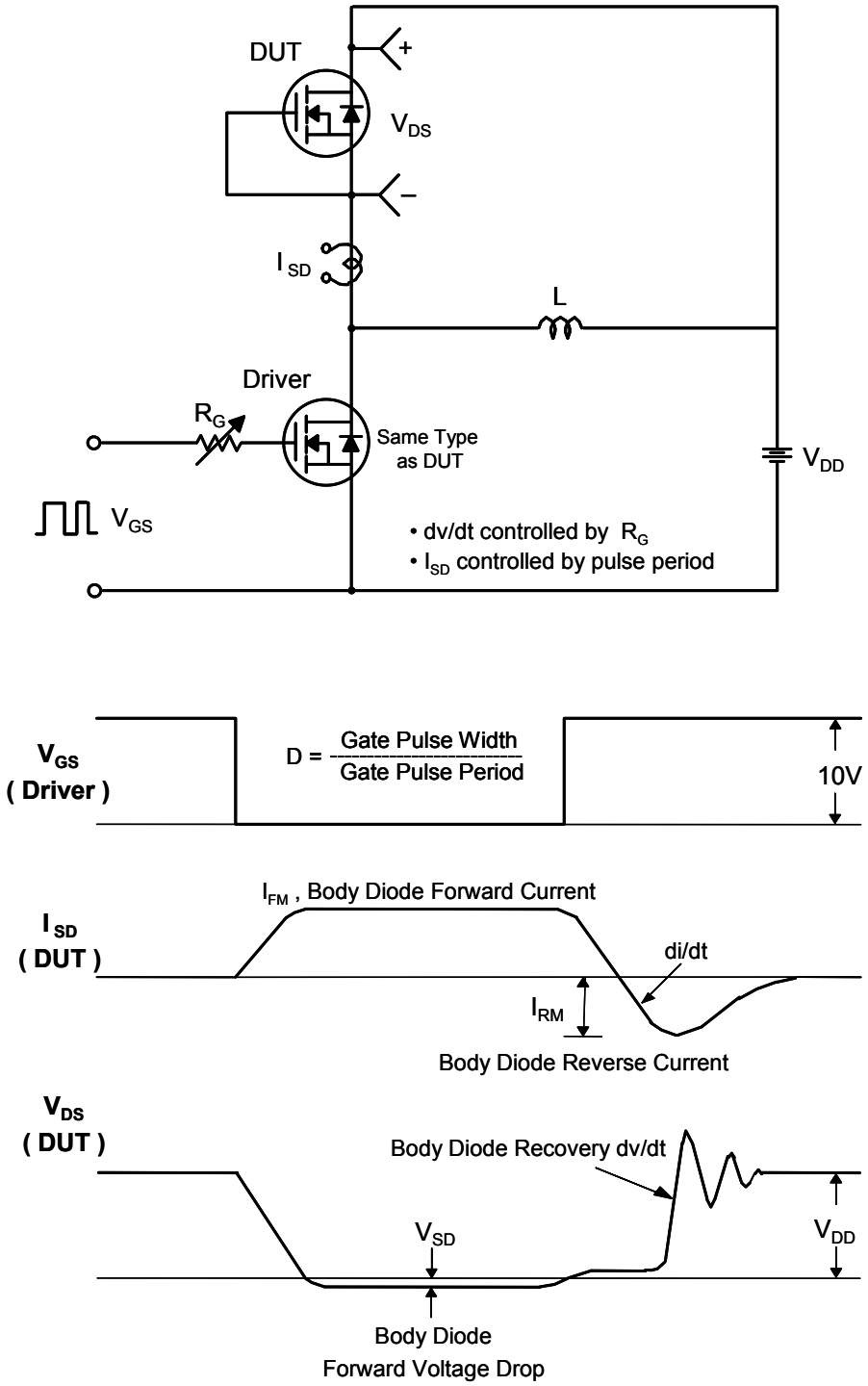
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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Mechanical Dimensions

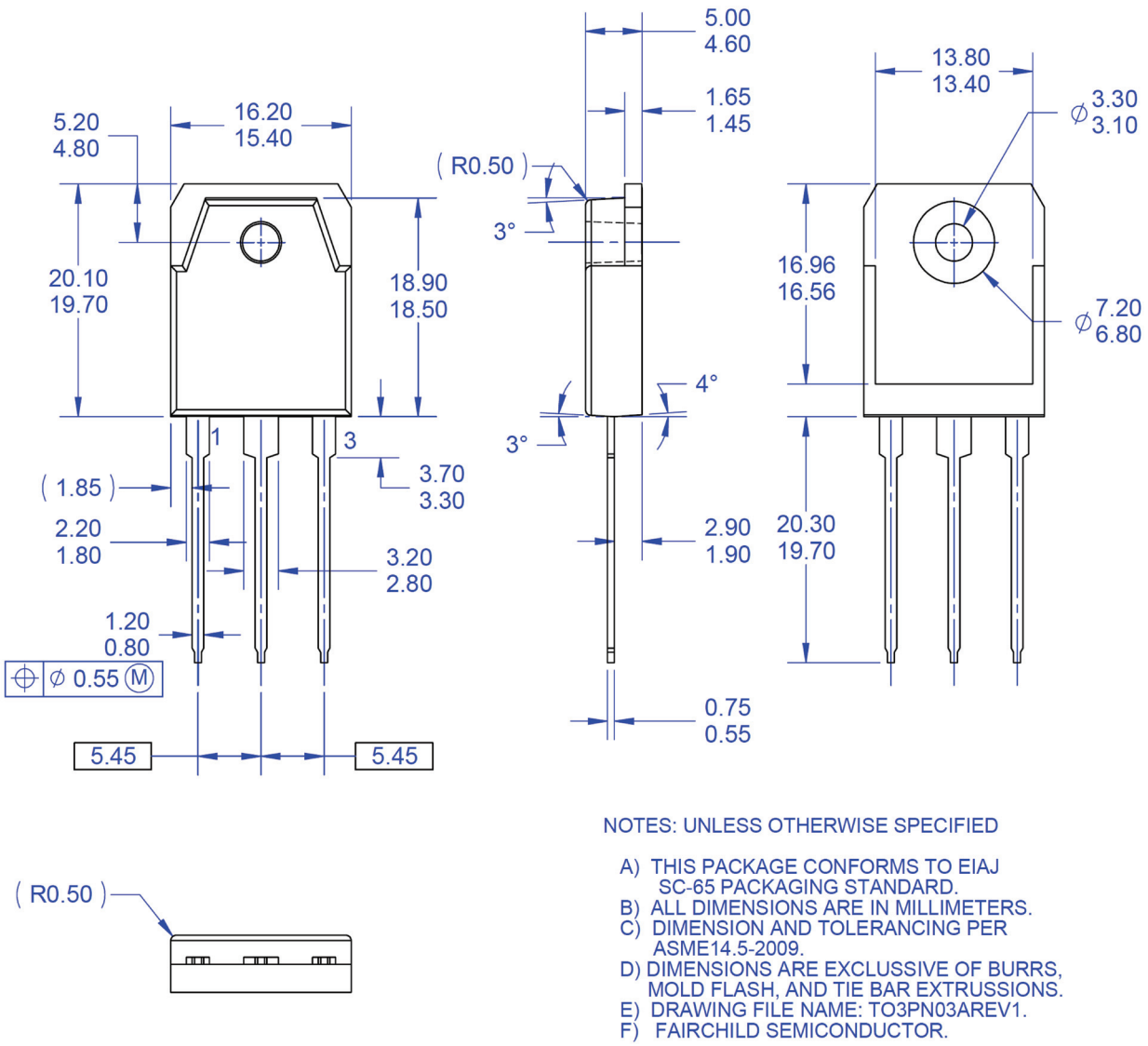

Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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