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May 2014

FCA47N60F

N-Channel SuperFET® FRFET® MOSFET

600 V, 47 A, 73 mΩ

Features

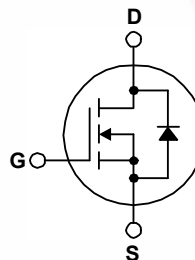
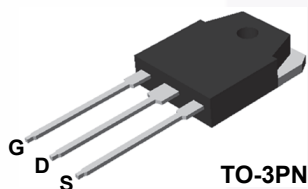
- 650 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 62\text{ m}\Omega$
- Fast Recovery Time (Typ. $T_{rr} = 240\text{ ns}$)
- Ultra Low Gate Charge (Typ. $Q_g = 210\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 420\text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Applications

- Solar Inverter
- AC-DC Power Supply

Description

SuperFET® MOSFET is Fairchild 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.



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter		FCA47N60F	Unit
V_{DSS}	Drain-Source Voltage		600	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	47	A
		- Continuous ($T_C = 100^\circ\text{C}$)	29.7	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	($T_C = 25^\circ\text{C}$)	417	W
		- Derate Above 25°C	3.33	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FCA47N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	41.7	$^\circ\text{C/W}$

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,	--	--	10	μA
		V _{DS} = 480 V, T _C = 125°C	--	--	100	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} = 40 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/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.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

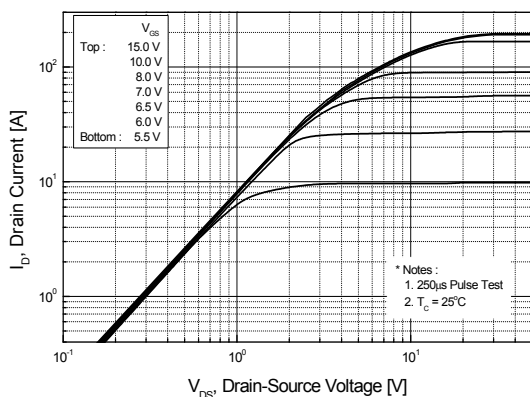


Figure 2. Transfer Characteristics

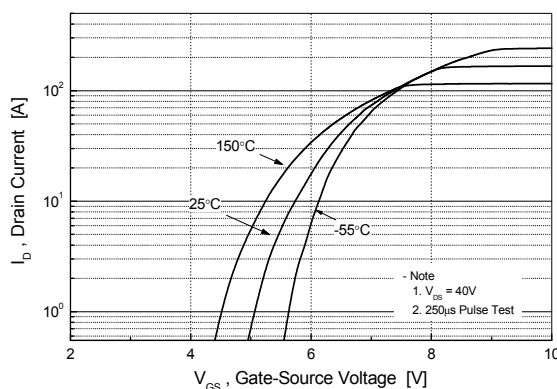


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

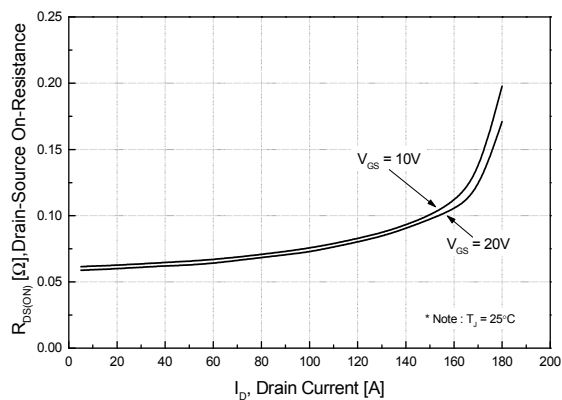


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

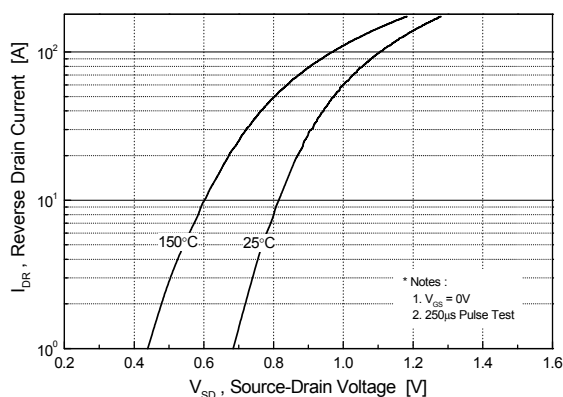


Figure 5. Capacitance Characteristics

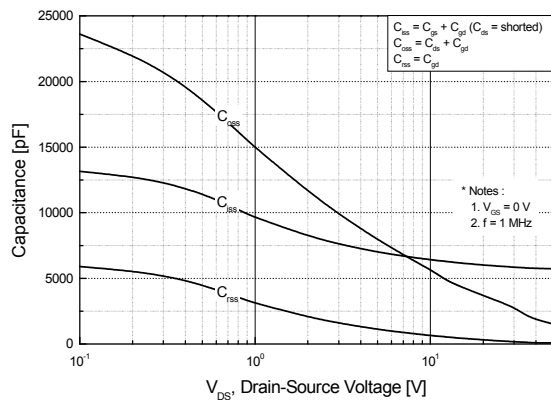
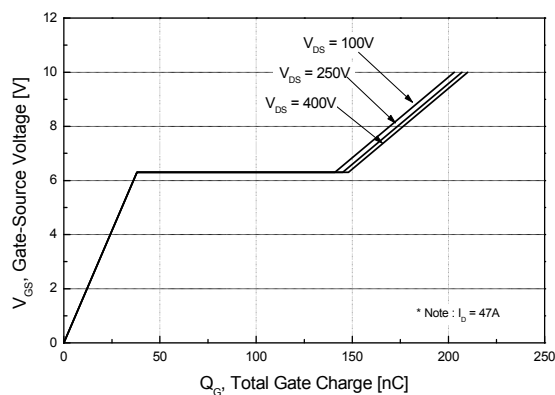


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

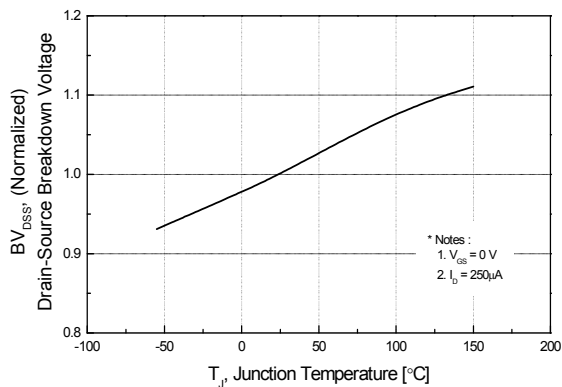


Figure 8. On-Resistance Variation vs. Temperature

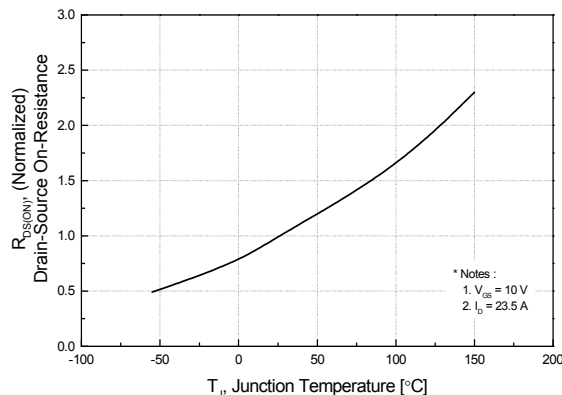


Figure 9. Safe Operating Area

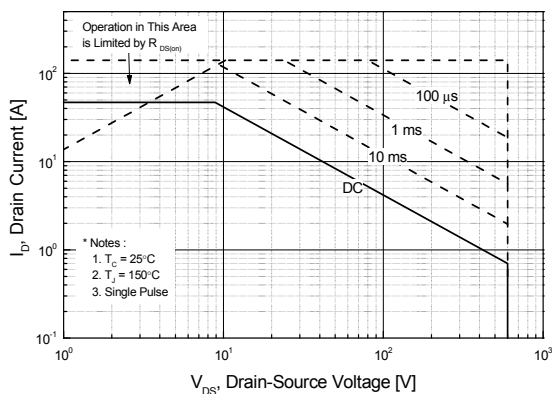


Figure 10. Maximum Drain Current vs. Case Temperature

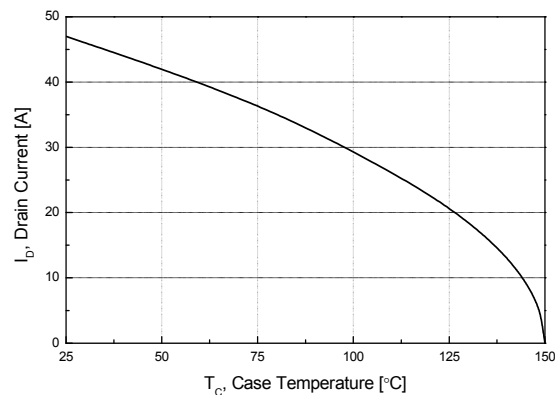


Figure 11. Transient Thermal Response Curve

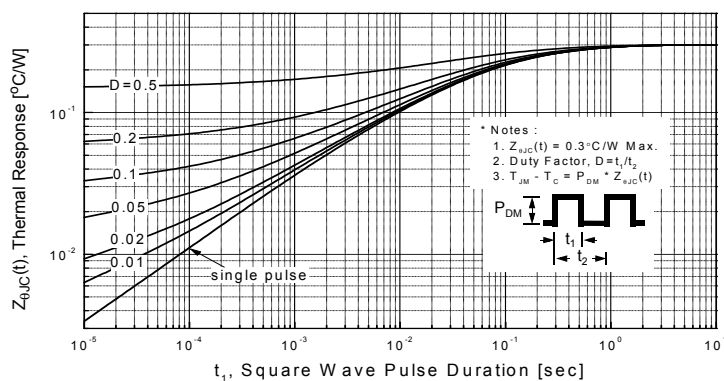


Figure 12. Gate Charge Test Circuit & Waveform

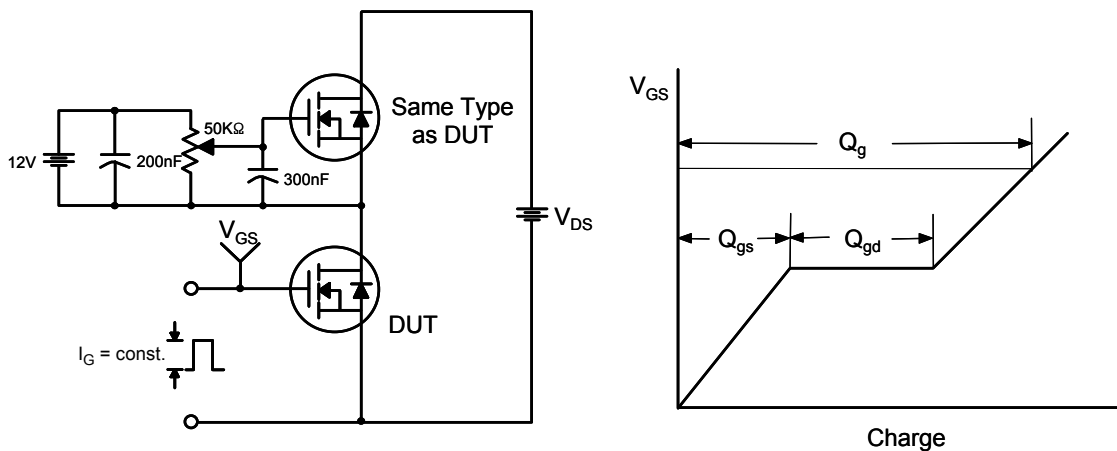


Figure 13. Resistive Switching Test Circuit & Waveforms

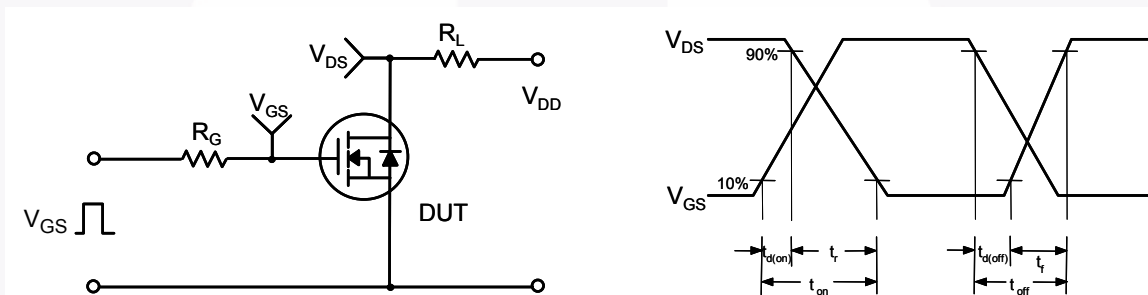


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

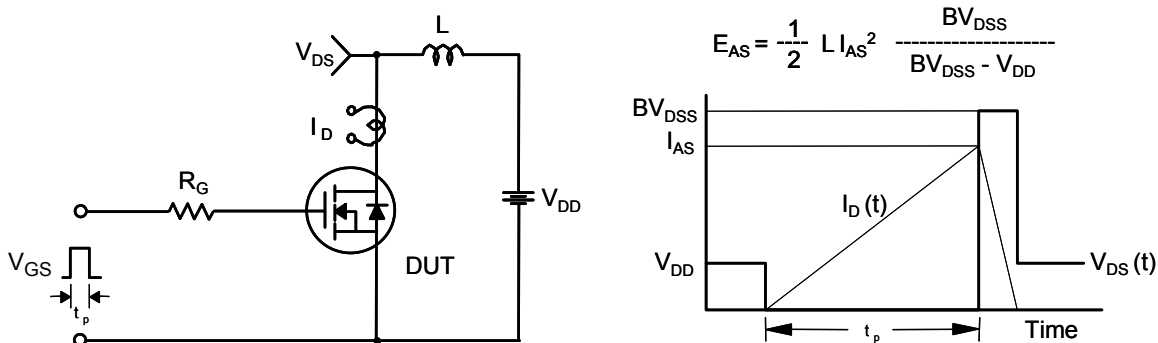
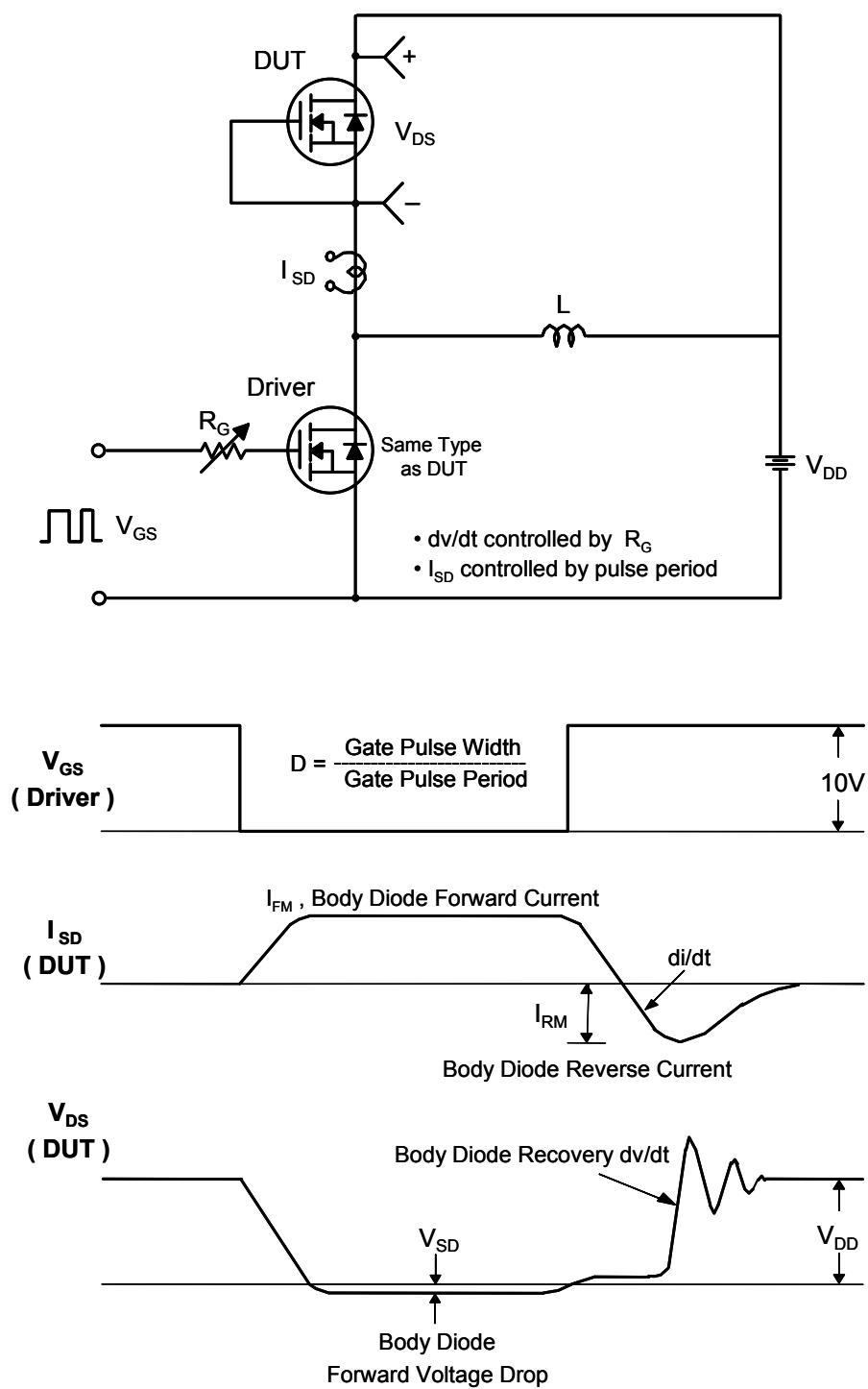
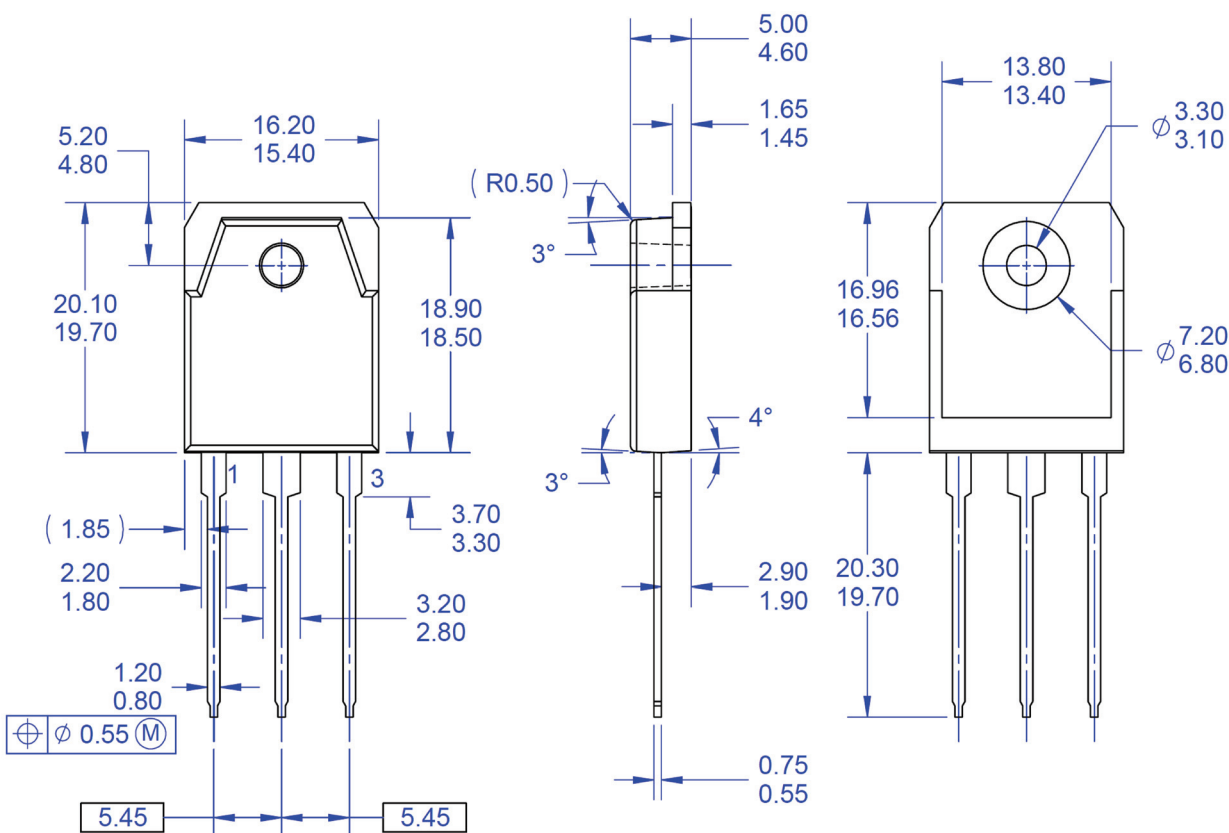


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
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Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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