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April 2014

FDA59N25

N-Channel UniFET™ MOSFET

250 V, 59 A, 49 mΩ



FDA59N25 — N-Channel UniFET™ MOSFET

Features

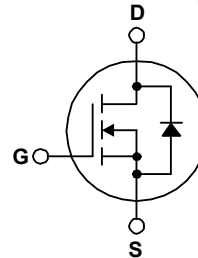
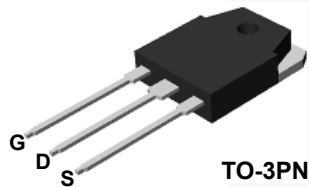
- $R_{DS(on)} = 49 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 29.5 \text{ A}$
- Low Gate Charge (Typ. 63 nC)
- Low C_{rss} (Typ. 70 pF)
- 100% Avalanche Tested
- RoHS Compliant

Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

Applications

- PDP TV
- Uninterruptible Power Supply
- AC-DC Power Supply



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

Symbol	Parameter	FDA59N25	Unit
V_{DSS}	Drain to Source Voltage	250	V
$V_{DS(Avalanche)}$	Repetitive Avalanche Voltage (Note 1,2)	300	V
V_{GSS}	Gate to Source Voltage	±30	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	59
		- Continuous ($T_C = 100^\circ\text{C}$)	35
I_{DM}	Drain Current - Pulsed (Note 1)	236	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1458	mJ
I_{AR}	Avalanche Current (Note 1)	59	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	39.2	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	392	W
		- Derate Above 25°C	3.2
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	FDA59N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.32	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case to Sink, Typ.	0.24	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDA59N25	FDA59N25	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	250	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.25	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 250 V, V _{GS} = 0 V V _{DS} = 200 V, T _C = 125°C	--	--	1 10	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 = 29.5 A	--	0.041	0.049	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 29.5 A	--	45	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	--	3090	4020	pF
C _{oss}	Output Capacitance		--	630	820	pF
C _{rss}	Reverse Transfer Capacitance		--	70	110	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 125 V, I _D = 59 A V _{GS} = 10 V, R _G = 25 Ω	--	70	150	ns
t _r	Turn-On Rise Time		--	480	970	ns
t _{d(off)}	Turn-Off Delay Time		--	90	190	ns
t _f	Turn-Off Fall Time		(Note 4)	--	170	350
Q _g	Total Gate Charge	V _{DS} = 200 V, I _D = 59 A V _{GS} = 10 V	--	63	82	nC
Q _{gs}	Gate-Source Charge		--	18.5	--	nC
Q _{gd}	Gate-Drain Charge		(Note 4)	--	30	--
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	59	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	236	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 59 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 59 A, di _F /dt = 100 A/μs	--	190	--	ns
Q _{rr}	Reverse Recovery Charge		--	4.4	--	μC

Notes:

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2. L = 0.67 mH, I_{AS} = 59 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 59 A, di/dt ≤ 200 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

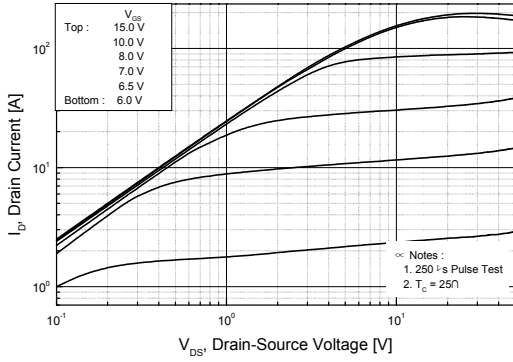


Figure 2. Transfer Characteristics

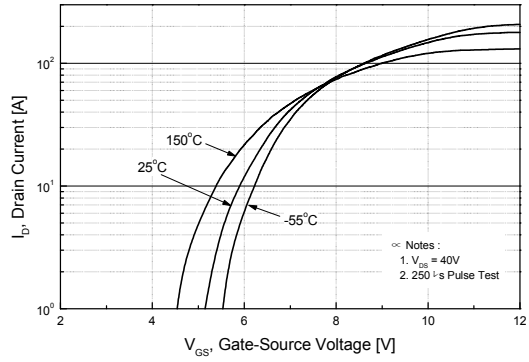


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

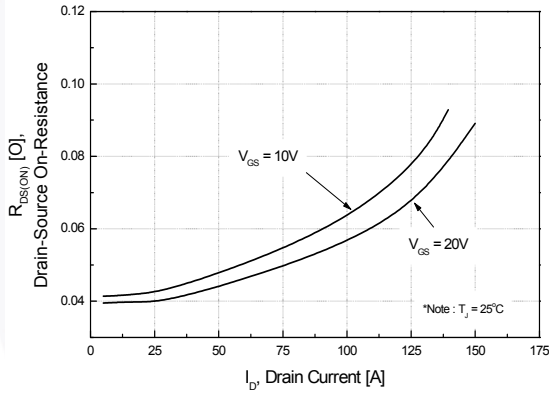


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

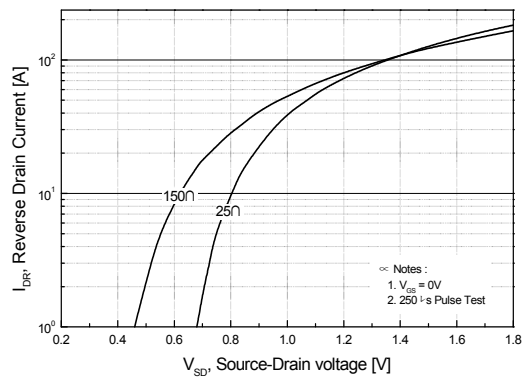


Figure 5. Capacitance Characteristics

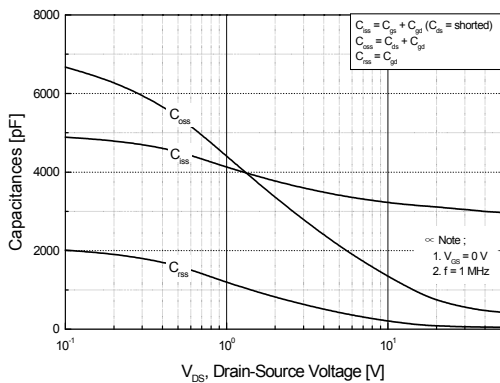
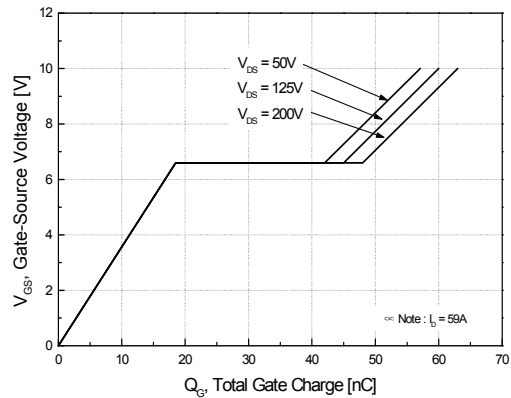


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

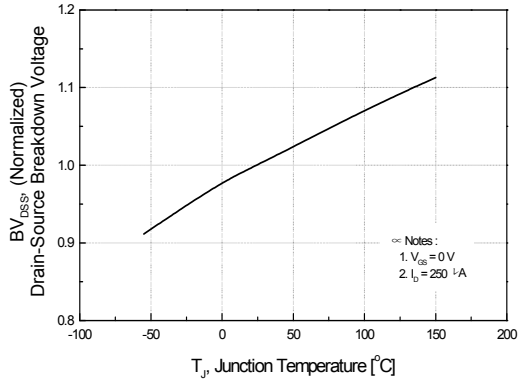


Figure 8. On-Resistance Variation vs. Temperature

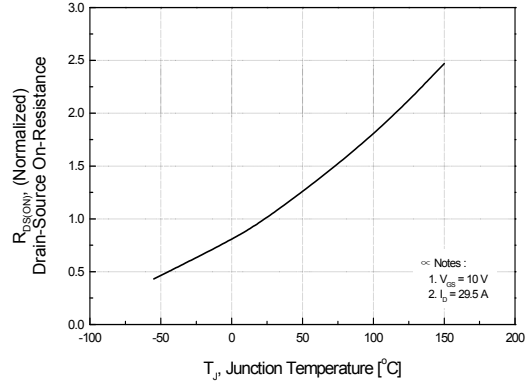


Figure 9. Maximum Safe Operating Area

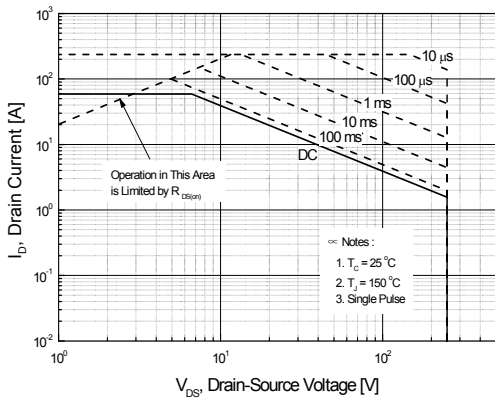


Figure 10. Maximum Drain Current vs. Case Temperature

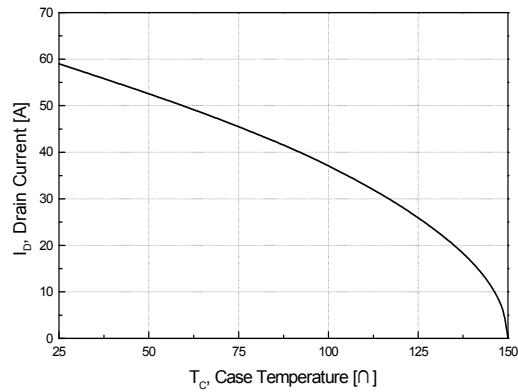
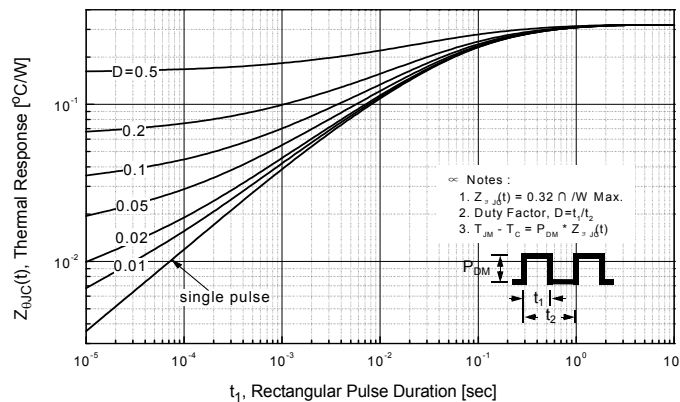


Figure 11. Transient Thermal Response Curve



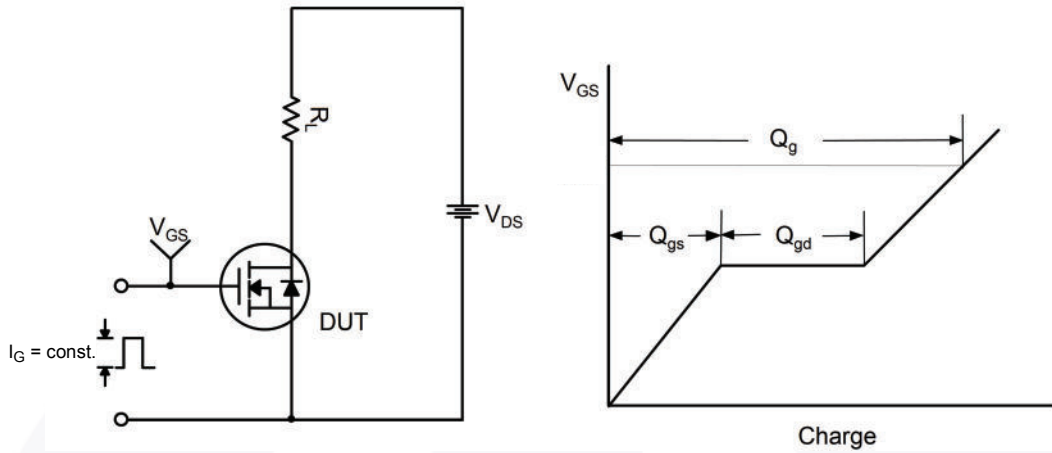


Figure 12. Gate Charge Test Circuit & Waveform

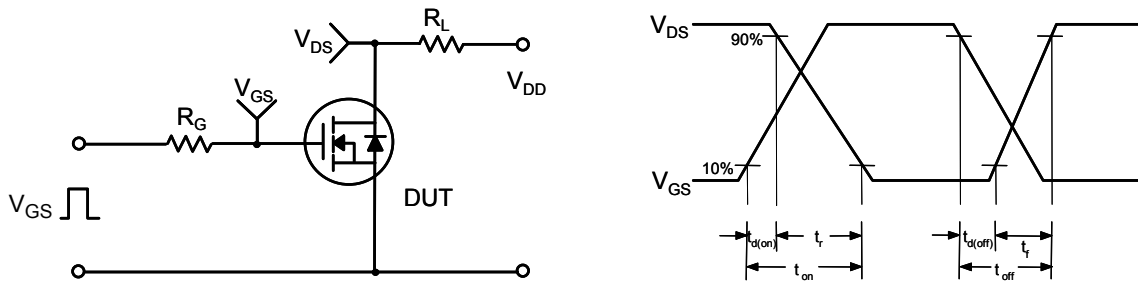


Figure 13. Resistive Switching Test Circuit & Waveforms

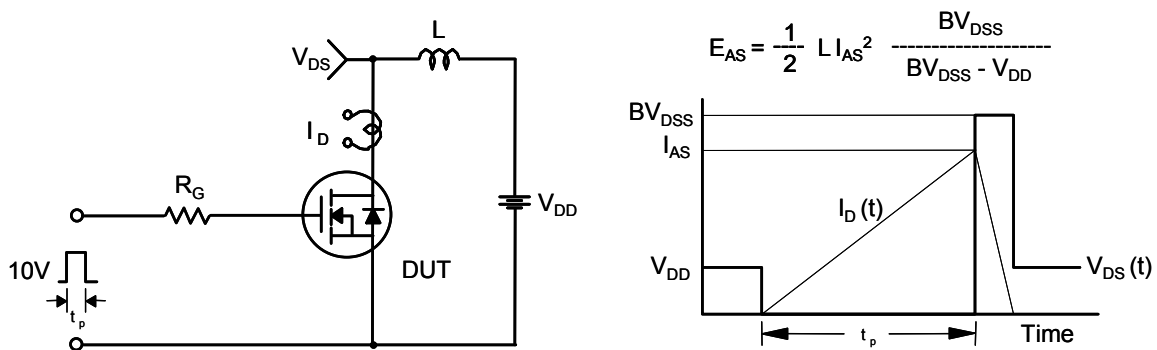


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

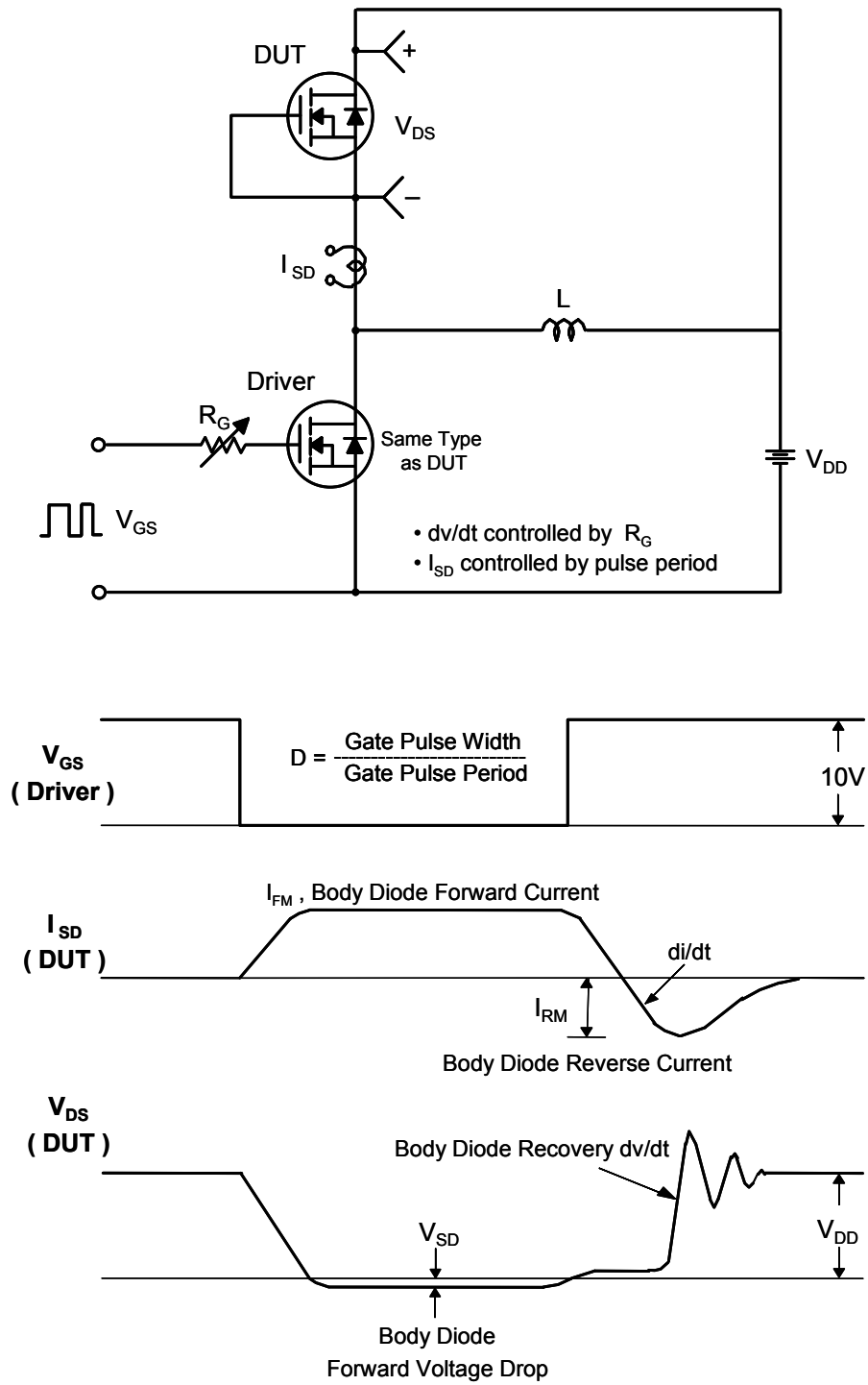
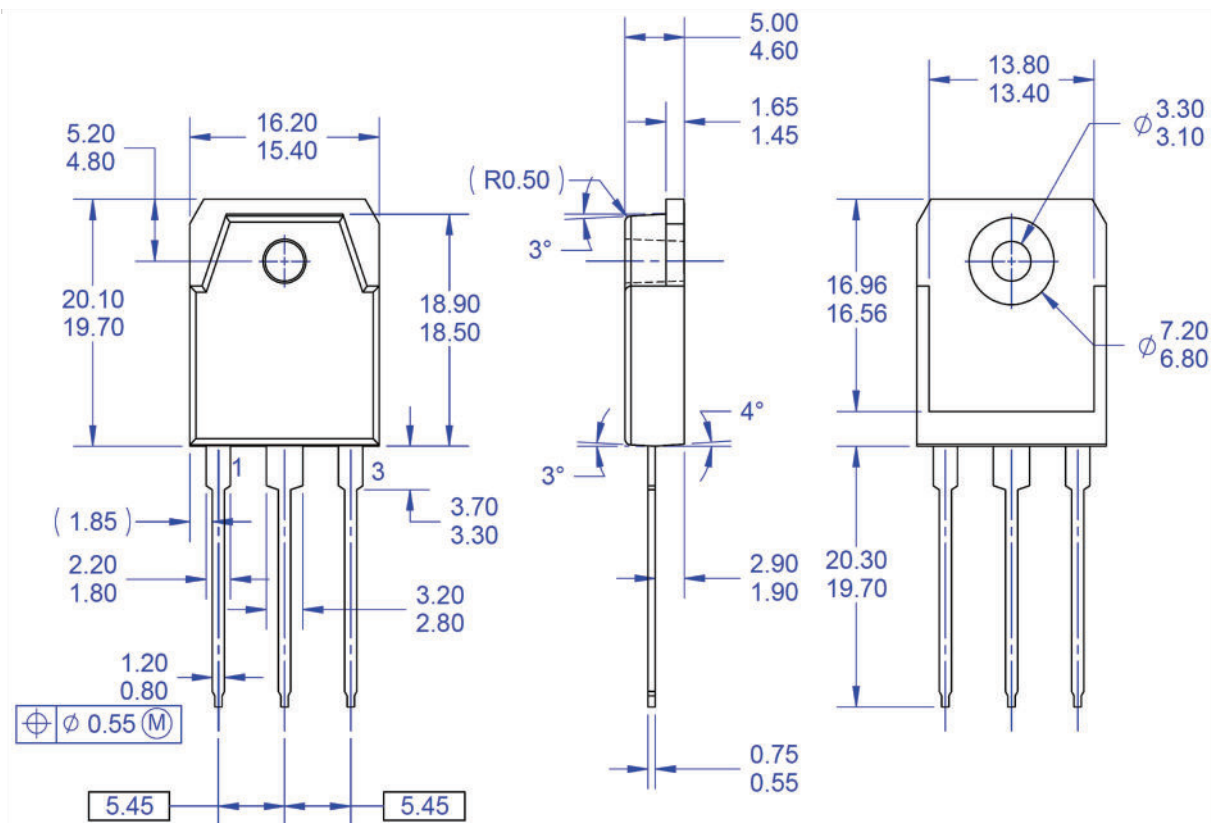


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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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