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May 2014

FDA59N30

N-Channel UniFET™ MOSFET

300 V, 59 A, 56 mΩ

Features

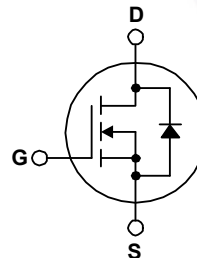
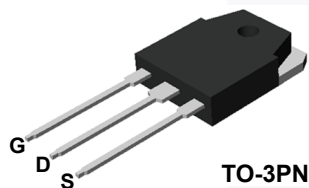
- $R_{DS(on)} = 47 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 29.5 \text{ A}$
- Low Gate Charge (Typ. 77 nC)
- Low C_{rss} (Typ. 80 pF)
- 100% Avalanche Tested

Applications

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

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.



Absolute Maximum Ratings

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

Symbol	Parameter		FDA59N30	Unit
V_{DSS}	Drain-Source Voltage		300	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	59	A
		- Continuous ($T_C = 100^\circ\text{C}$)	35	A
I_{DM}	Drain Current	- Pulsed (Note 1)	236	A
V_{GSS}	Gate-Source voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		1734	mJ
I_{AR}	Avalanche Current (Note 1)		59	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		50	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	500	W
		- Derate Above 25°C	4	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	FDA59N30	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.25	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDA59N30	FDA59N30	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ 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	300	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.3	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 300 V, V _{GS} = 0 V V _{DS} = 240 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	--	0.047	0.056	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 29.5 A	--	52	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	--	3590	4670	pF
C _{oss}	Output Capacitance		--	710	920	pF
C _{rss}	Reverse Transfer Capacitance		--	80	120	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 150 V, I _D = 59 A, V _{GS} = 10 V, R _G = 25 Ω	--	140	290	ns
t _r	Turn-On Rise Time		--	575	1160	ns
t _{d(off)}	Turn-Off Delay Time		--	120	250	ns
t _f	Turn-Off Fall Time		--	200	410	ns
Q _g	Total Gate Charge	V _{DS} = 240 V, I _D = 59 A, V _{GS} = 10 V	--	77	100	nC
Q _{gs}	Gate-Source Charge		--	22	--	nC
Q _{gd}	Gate-Drain Charge		--	40	--	nC
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} = 0 V, I _S = 59 A,	--	246	--	ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt =100 A/μs	--	6.9	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $L = 0.83\text{ mH}$, $I_{AS} = 59\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 59\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

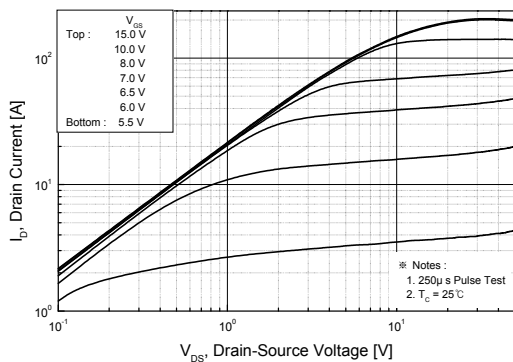


Figure 2. Transfer Characteristics

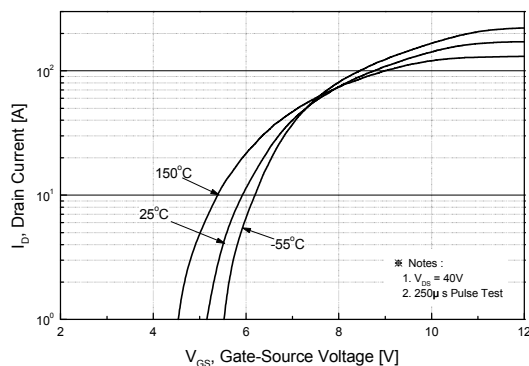


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

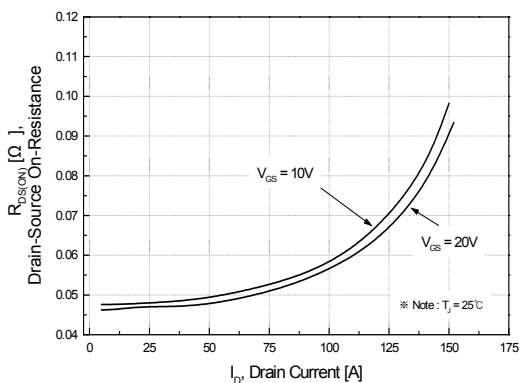


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

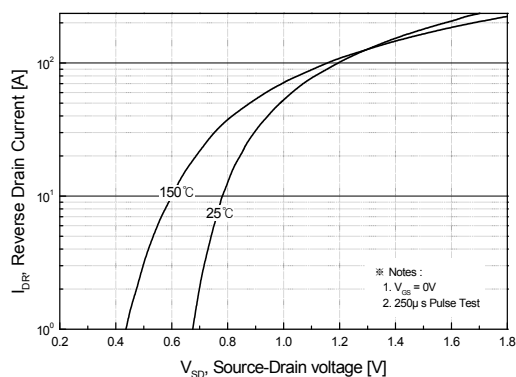


Figure 5. Capacitance Characteristics

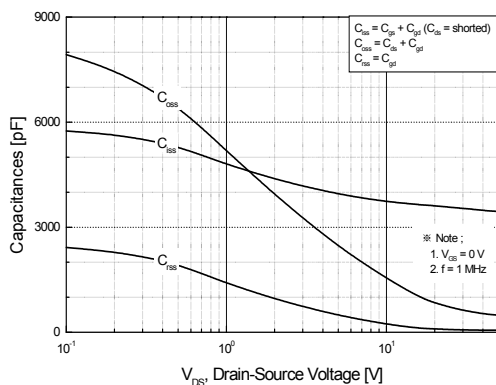
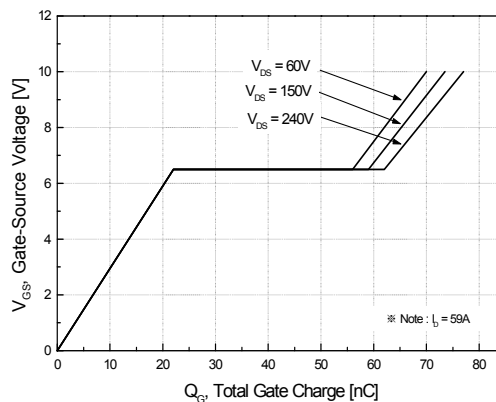


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

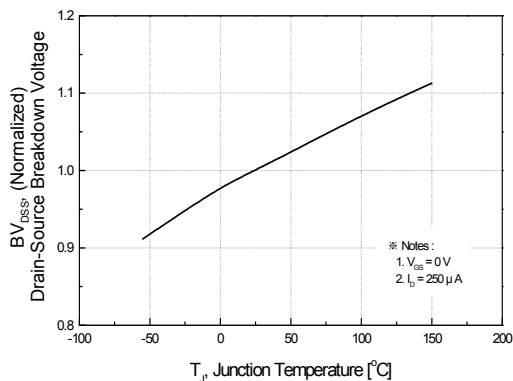


Figure 8. On-Resistance Variation vs. Temperature

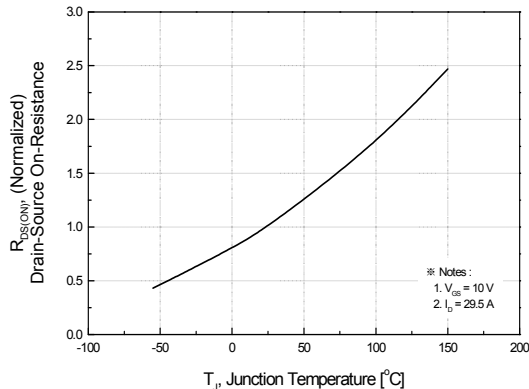


Figure 9. Maximum Safe Operating Area

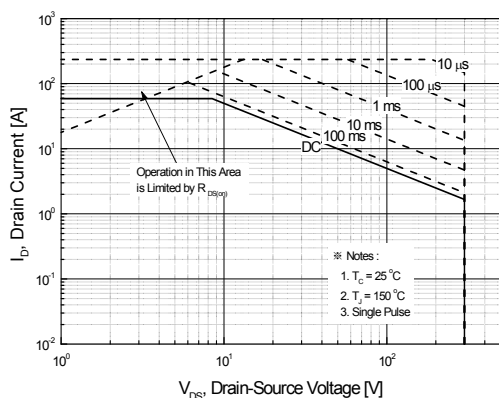


Figure 10. Maximum Drain Current vs. Case Temperature

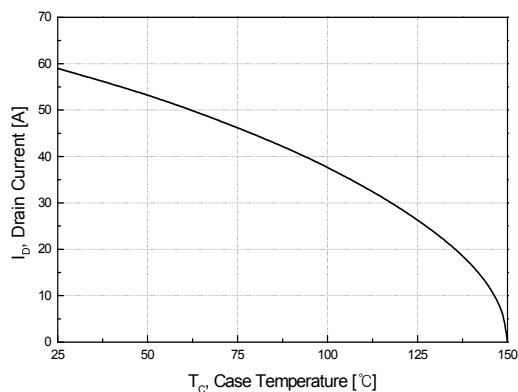
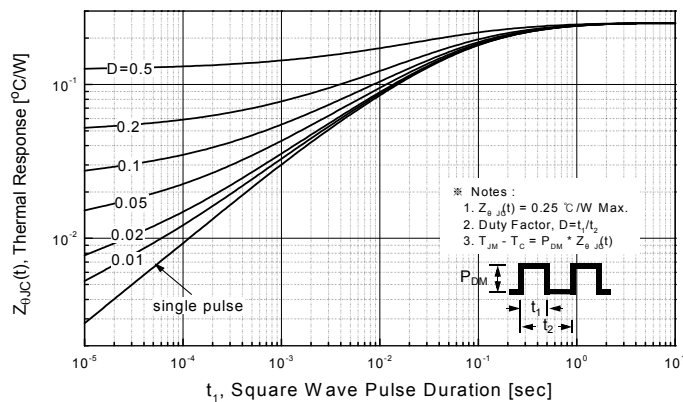


Figure 11. Transient Thermal Response Curve



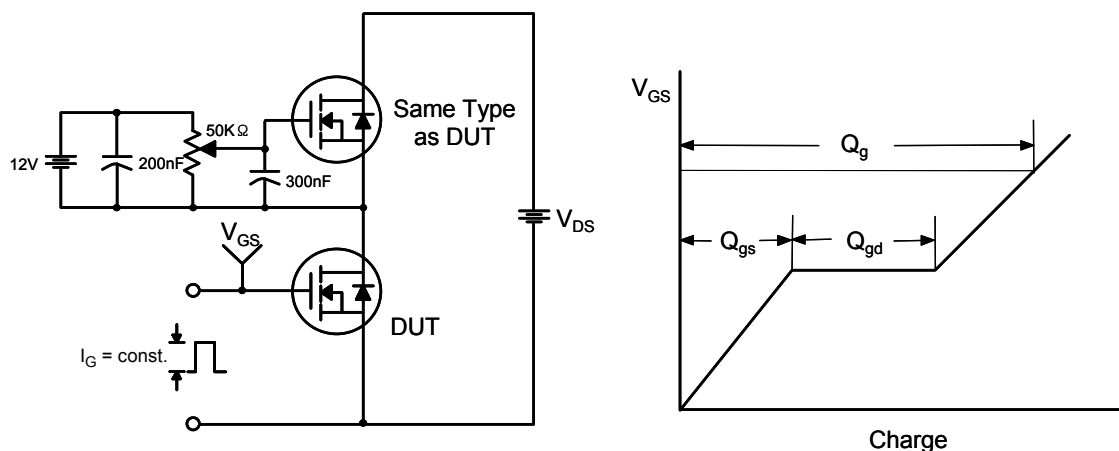


Figure 12. Gate Charge Test Circuit & Waveform

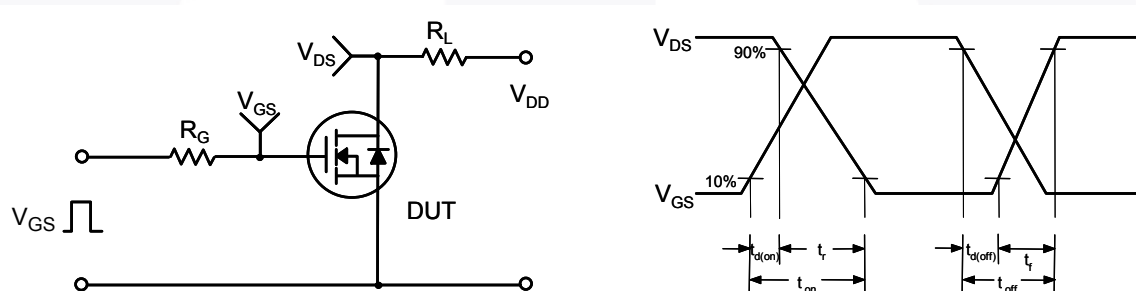


Figure 13. Resistive Switching Test Circuit & Waveforms

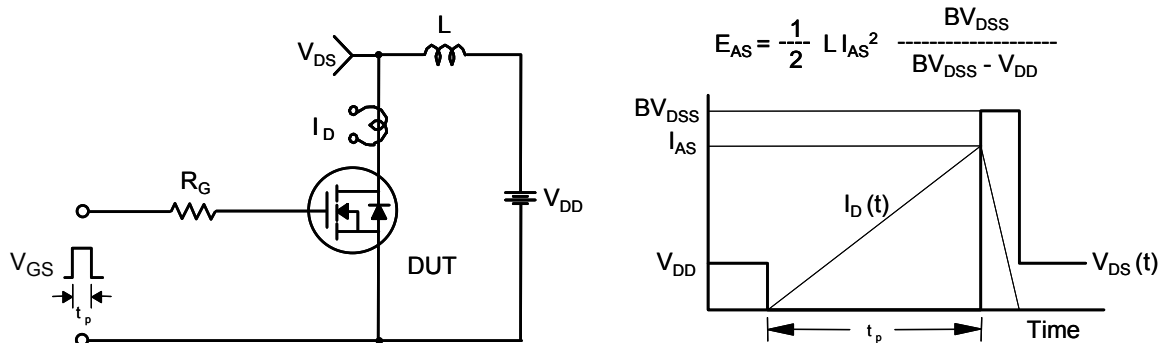


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

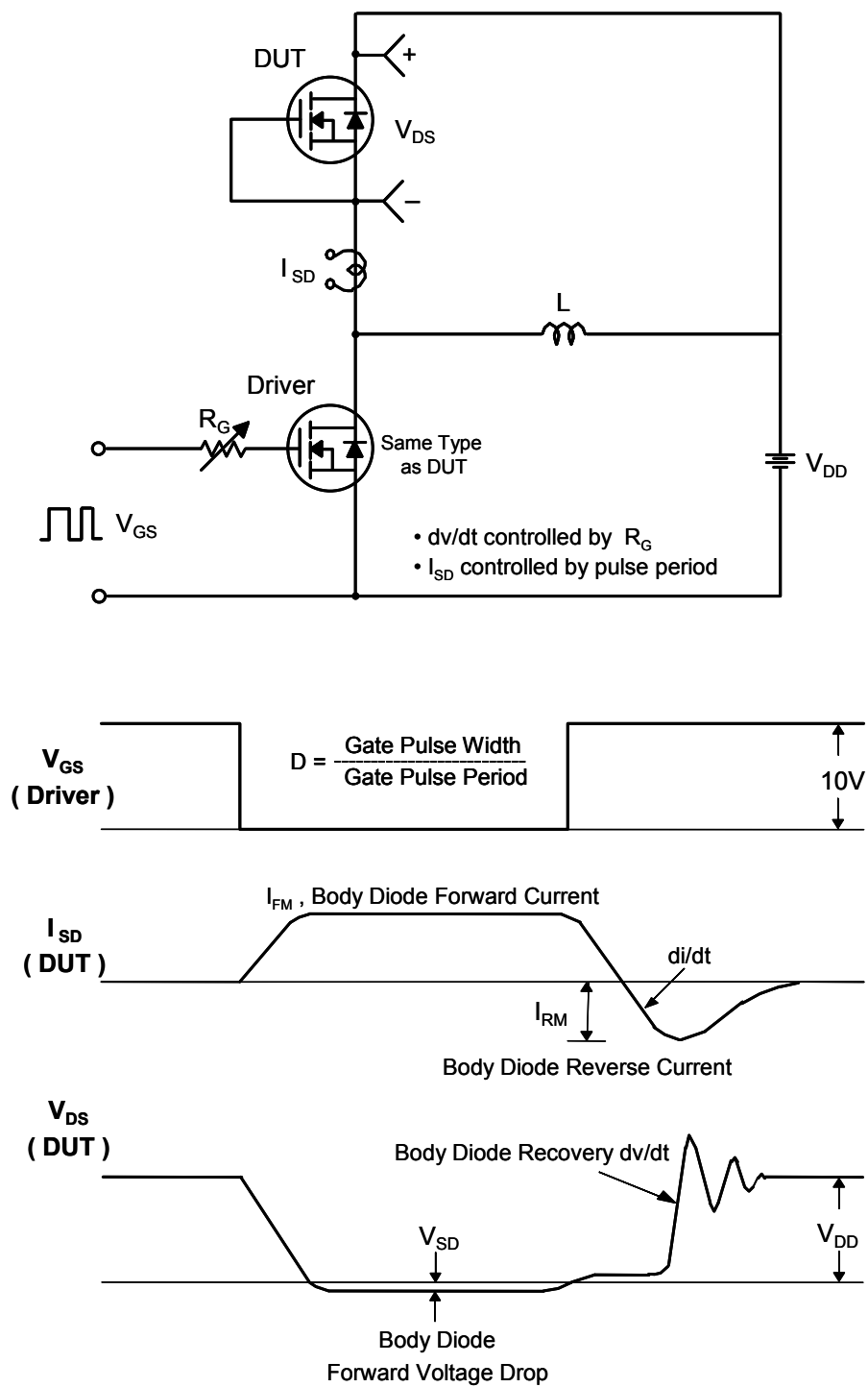
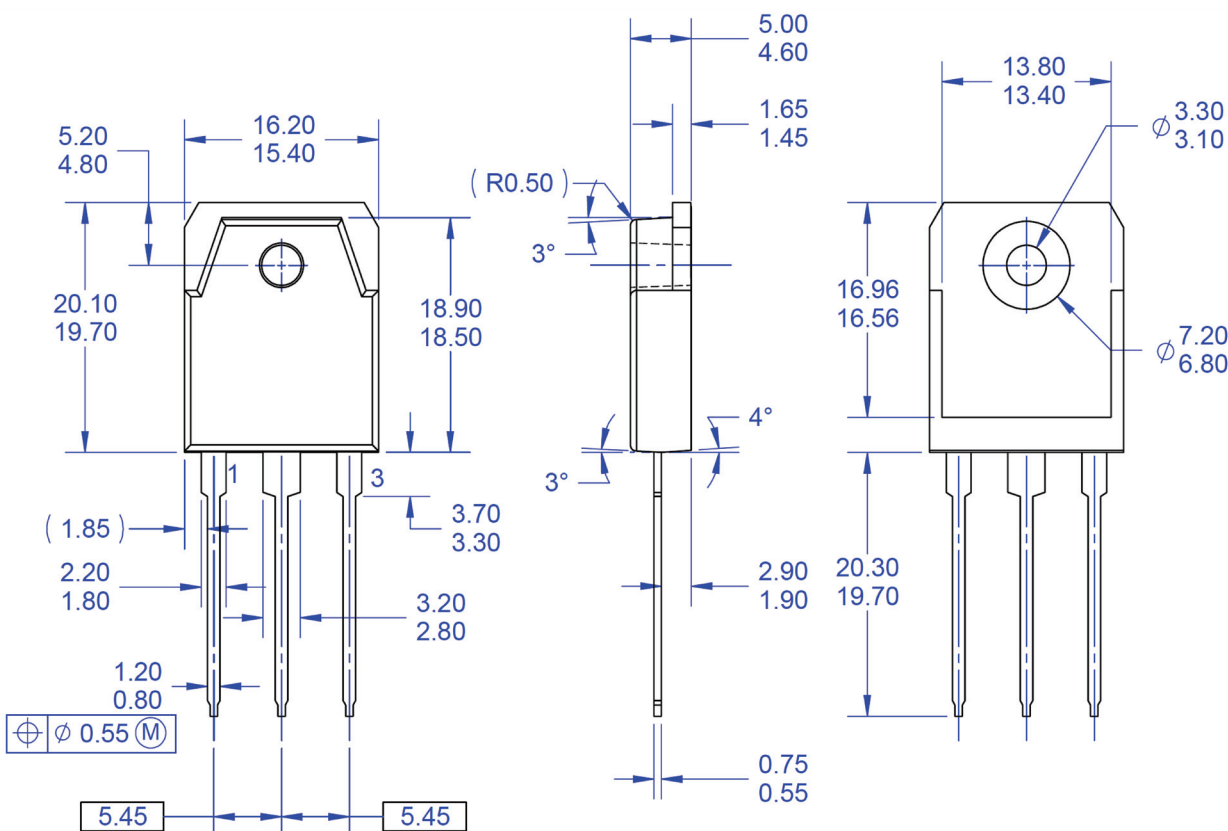


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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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