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FDA59N30

N-Channel UniFET™ MOSFET

300 V, 59 A, 56 mΩ

May 2014

Features

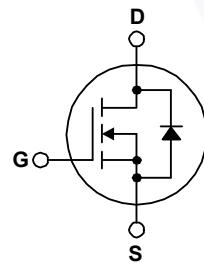
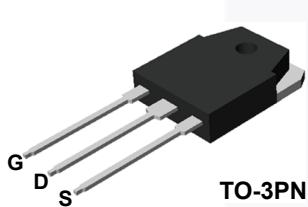
- $R_{DS(on)} = 47 \text{ mΩ}$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 29.5 \text{ A}$
- Low Gate Charge (Typ. 77 nC)
- Low C_{rss} (Typ. 80 pF)
- 100% Avalanche Tested

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)	A
V_{GSS}	Gate-Source voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	mJ
I_{AR}	Avalanche Current		(Note 1)	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	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	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	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	$\text{V}_{\text{GS}} = 0 \text{ V}$, $\text{I}_D = 250 \mu\text{A}$	300	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$\text{I}_D = 250 \mu\text{A}$, Referenced to 25°C	--	0.3	--	$^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$\text{V}_{\text{DS}} = 300 \text{ V}$, $\text{V}_{\text{GS}} = 0 \text{ V}$ $\text{V}_{\text{DS}} = 240 \text{ V}$, $T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$\text{V}_{\text{GS}} = 30 \text{ V}$, $\text{V}_{\text{DS}} = 0 \text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$\text{V}_{\text{GS}} = -30 \text{ V}$, $\text{V}_{\text{DS}} = 0 \text{ V}$	--	--	-100	nA
On Characteristics						
$\text{V}_{\text{GS(th)}}$	Gate Threshold Voltage	$\text{V}_{\text{DS}} = \text{V}_{\text{GS}}$, $\text{I}_D = 250 \mu\text{A}$	3.0	--	5.0	V
$\text{R}_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$\text{V}_{\text{GS}} = 10 \text{ V}$, $\text{I}_D = 29.5 \text{ A}$	--	0.047	0.056	Ω
g_{FS}	Forward Transconductance	$\text{V}_{\text{DS}} = 40 \text{ V}$, $\text{I}_D = 29.5 \text{ A}$	--	52	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$\text{V}_{\text{DS}} = 25 \text{ V}$, $\text{V}_{\text{GS}} = 0 \text{ V}$, $f = 1 \text{ MHz}$	--	3590	4670	pF
C_{oss}	Output Capacitance		--	710	920	pF
C_{rss}	Reverse Transfer Capacitance		--	80	120	pF
Switching Characteristics						
$t_{\text{d(on)}}$	Turn-On Delay Time	$\text{V}_{\text{DD}} = 150 \text{ V}$, $\text{I}_D = 59 \text{ A}$, $\text{V}_{\text{GS}} = 10 \text{ V}$, $\text{R}_G = 25 \Omega$	--	140	290	ns
t_r	Turn-On Rise Time		--	575	1160	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		--	120	250	ns
t_f	Turn-Off Fall Time		--	200	410	ns
Q_g	Total Gate Charge	$\text{V}_{\text{DS}} = 240 \text{ V}$, $\text{I}_D = 59 \text{ A}$, $\text{V}_{\text{GS}} = 10 \text{ V}$	--	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	$\text{V}_{\text{GS}} = 0 \text{ V}$, $\text{I}_S = 59 \text{ A}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$\text{V}_{\text{GS}} = 0 \text{ V}$, $\text{I}_S = 59 \text{ A}$, $\text{dI}_F/\text{dt} = 100 \text{ A}/\mu\text{s}$	--	246	--	ns
Q_{rr}	Reverse Recovery Charge		--	6.9	--	μC

Notes:

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

Typical Performance Characteristics

Figure 1. On-Region Characteristics

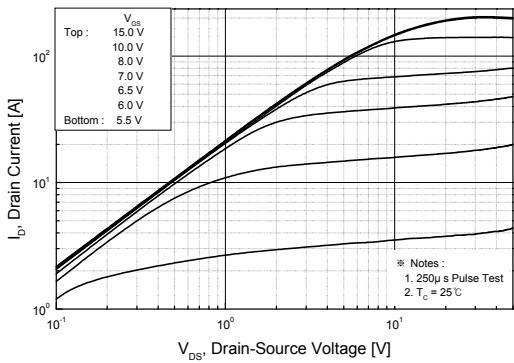


Figure 2. Transfer Characteristics

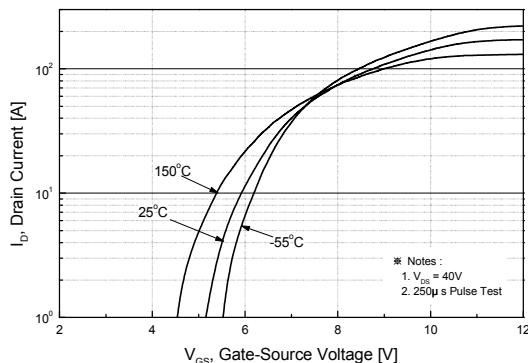


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

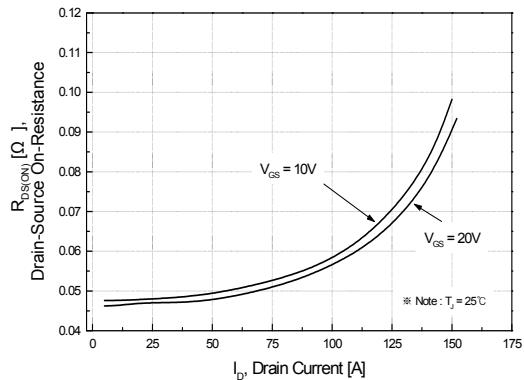


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

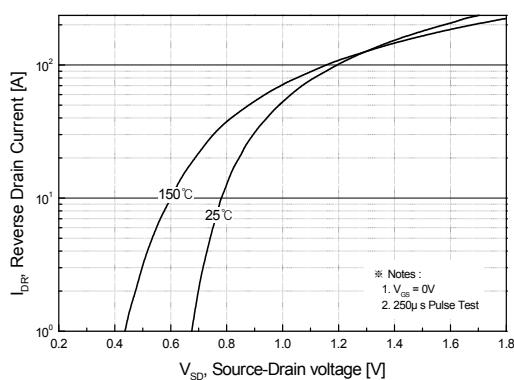


Figure 5. Capacitance Characteristics

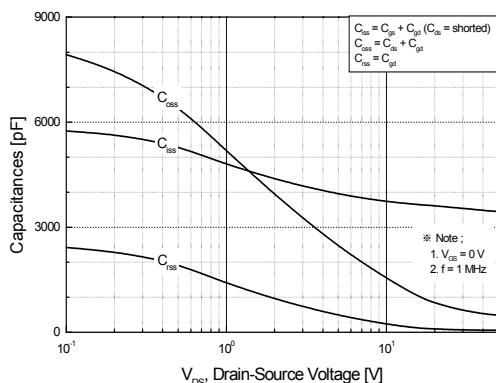
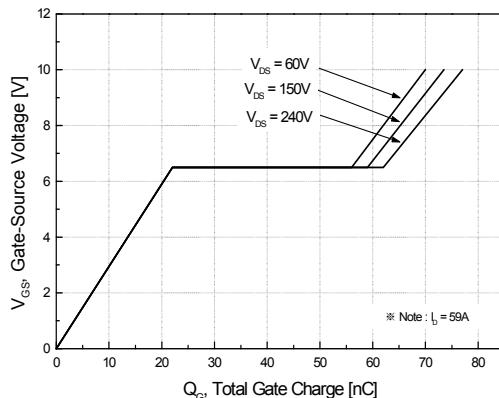


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

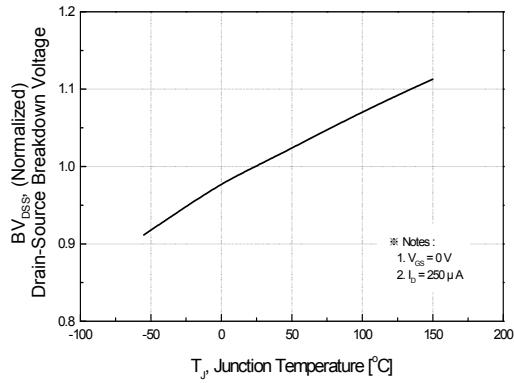


Figure 8. On-Resistance Variation vs. Temperature

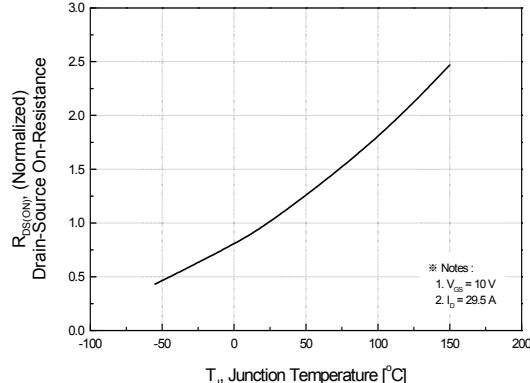


Figure 9. Maximum Safe Operating Area

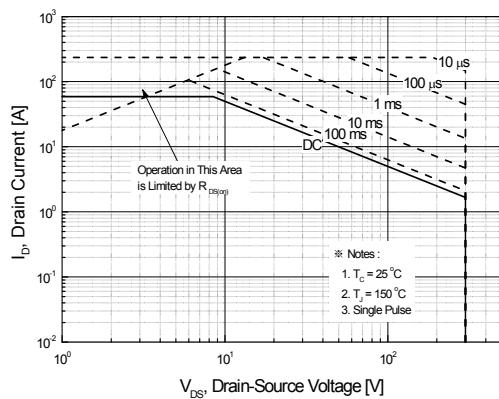


Figure 10. Maximum Drain Current vs. Case Temperature

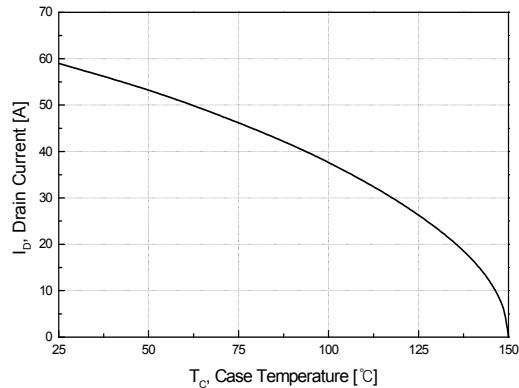
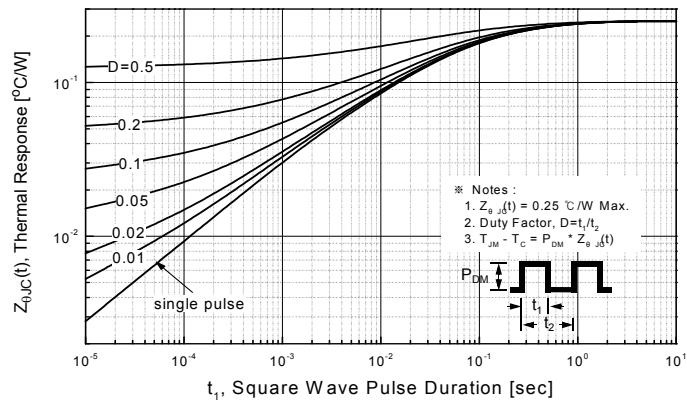


Figure 11. Transient Thermal Response Curve



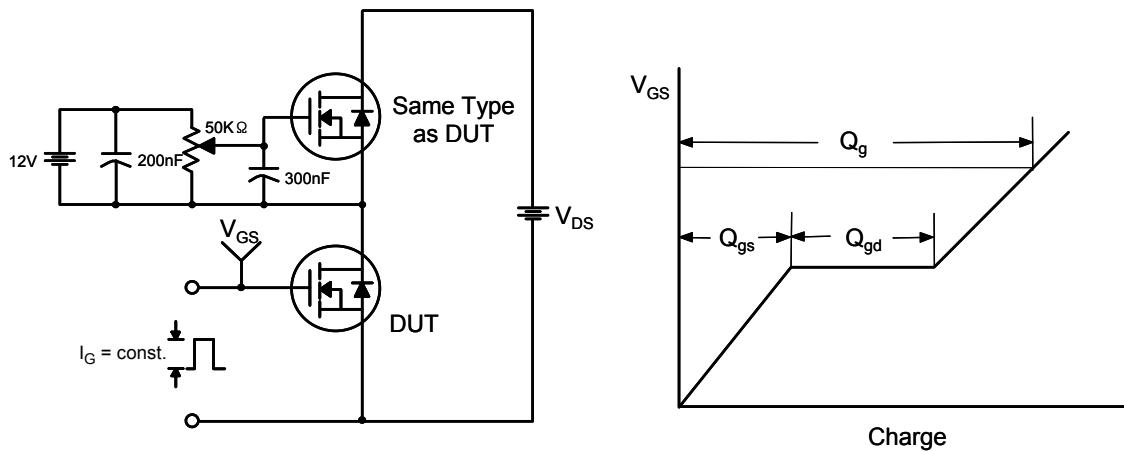


Figure 12. Gate Charge Test Circuit & Waveform

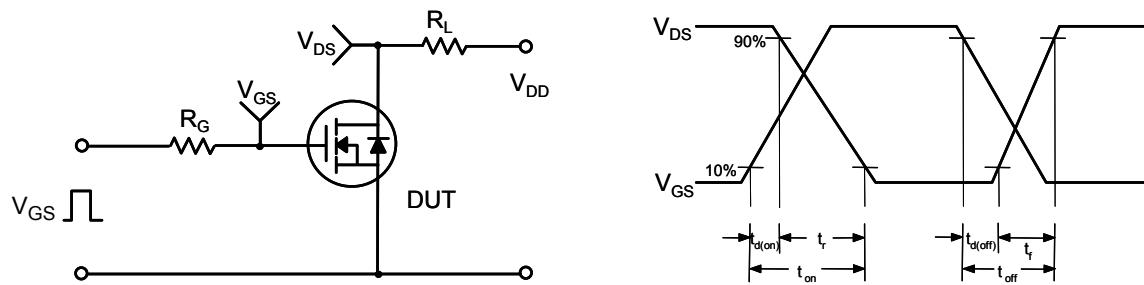


Figure 13. Resistive Switching Test Circuit & Waveforms

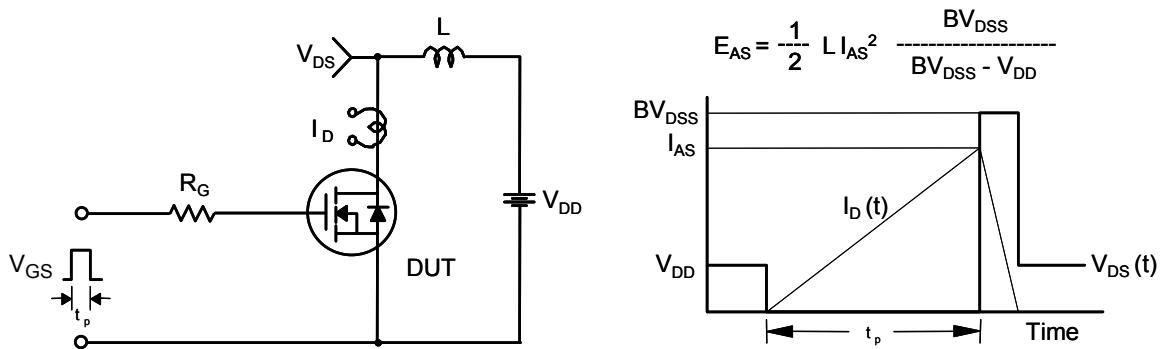


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

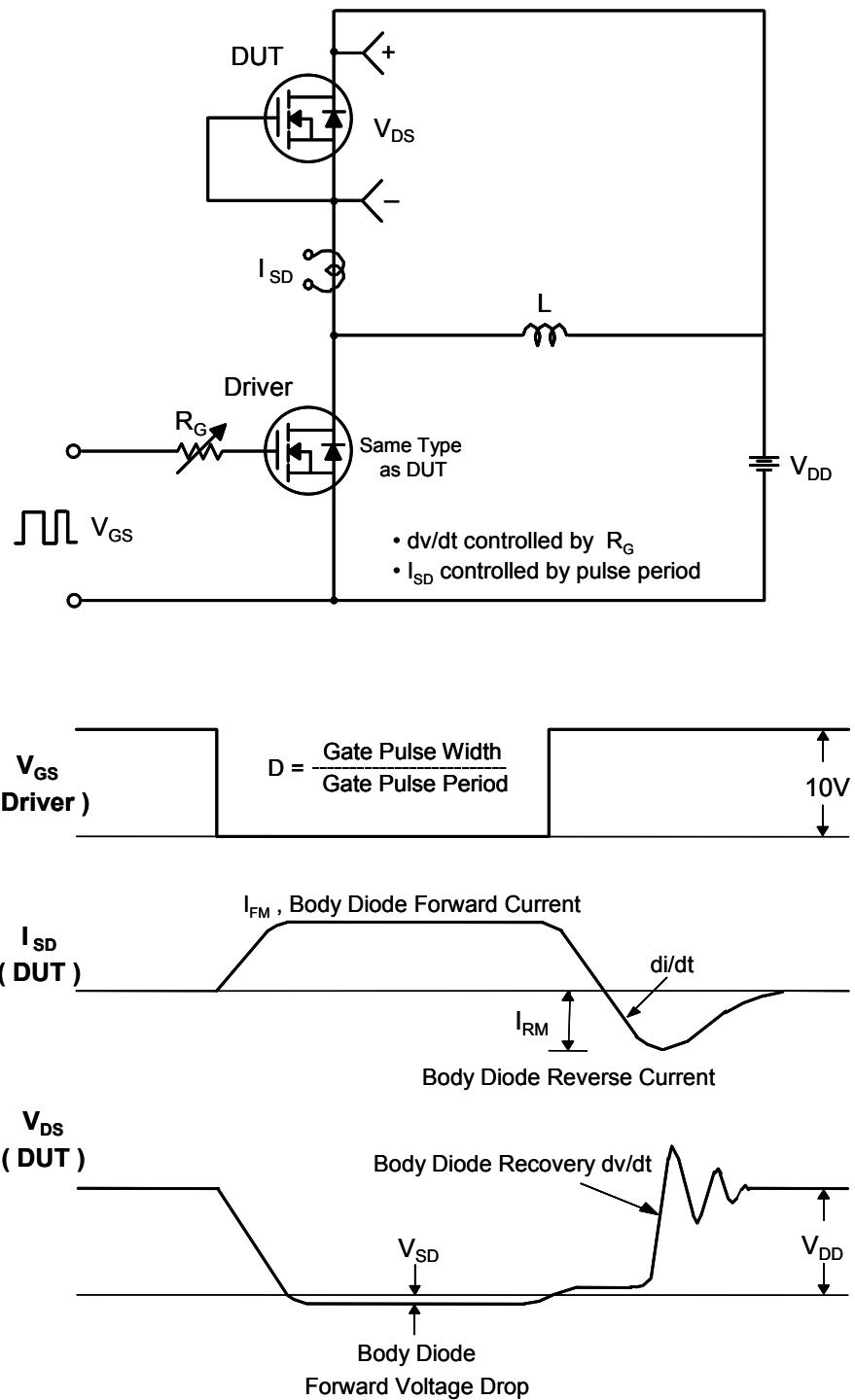
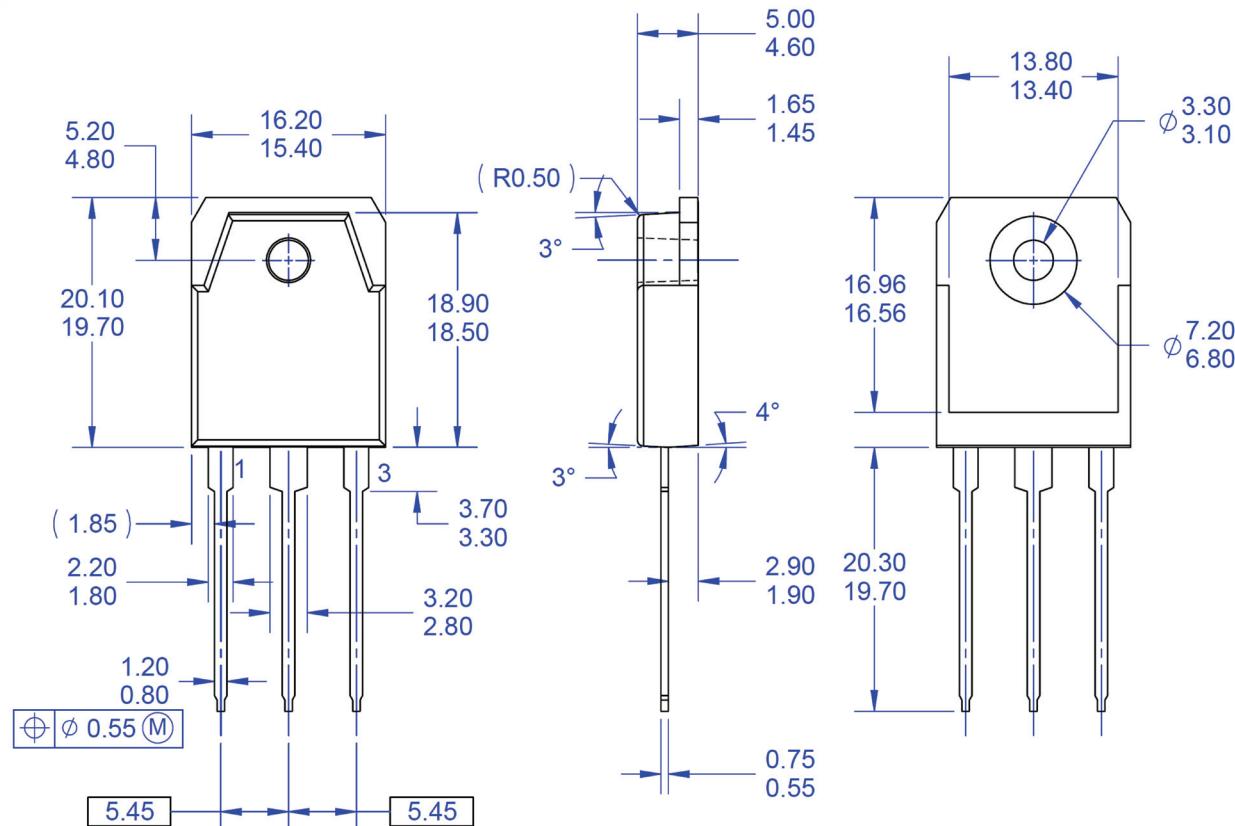


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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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- E) DRAWING FILE NAME: TO3PN03AREV1.
- F) FAIRCHILD SEMICONDUCTOR.

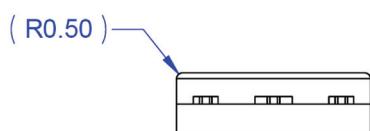


Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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