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FQA170N06

N-Channel QFET® MOSFET

60 V, 170 A, 5.6 mΩ

June 2014

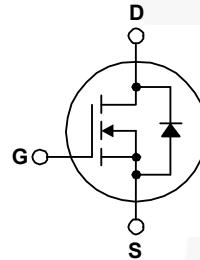
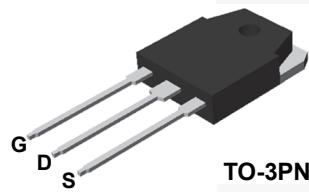
FQA170N06 — N-Channel QFET® MOSFET

Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, audio amplifier, DC motor control, and variable switching power applications.

Features

- 170 A, 60 V, $R_{DS(on)} = 5.6 \text{ mΩ}$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 85 \text{ A}$
- Low Gate Charge (Typ. 220 nC)
- Low $Crss$ (Typ. 620 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating



Absolute Maximum Ratings

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

Symbol	Parameter	FQA170N06	Unit
V_{DSS}	Drain-Source Voltage	60	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	170	A
	- Continuous ($T_C = 100^\circ\text{C}$)	120	A
I_{DM}	Drain Current - Pulsed	(Note 1)	A
V_{GSS}	Gate-Source Voltage	± 25	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 ($T_C = 25^\circ\text{C}$)	375	W
	- Derate above 25°C	2.5	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
T_L	Maximum lead temperature for soldering, 1/8" from case for 5 seconds.	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQA170N06	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.4	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQA170N06	FQA170N06	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0 \text{ V}$, $I_D = 250 \mu\text{A}$	60	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C	--	0.053	--	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 60 \text{ V}$, $V_{\text{GS}} = 0 \text{ V}$	--	--	1	μA
		$V_{\text{DS}} = 48 \text{ V}$, $T_C = 150^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 25 \text{ V}$, $V_{\text{DS}} = 0 \text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -25 \text{ V}$, $V_{\text{DS}} = 0 \text{ V}$	--	--	-100	nA

On Characteristics

$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_D = 250 \mu\text{A}$	2.0	--	4.0	V
$R_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10 \text{ V}$, $I_D = 85 \text{ A}$	--	0.0045	0.0056	Ω
g_{FS}	Forward Transconductance	$V_{\text{DS}} = 30 \text{ V}$, $I_D = 85 \text{ A}$	--	85	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{\text{DS}} = 25 \text{ V}$, $V_{\text{GS}} = 0 \text{ V}$, $f = 1.0 \text{ MHz}$	--	7200	9350	pF
C_{oss}	Output Capacitance		--	3100	4000	pF
C_{rss}	Reverse Transfer Capacitance		--	620	810	pF

Switching Characteristics

$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{\text{DD}} = 30 \text{ V}$, $I_D = 85 \text{ A}$, $R_G = 25 \Omega$	--	85	180	ns
t_r	Turn-On Rise Time		--	700	1400	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		--	260	530	ns
t_f	Turn-Off Fall Time		(Note 4)	430	870	ns
Q_g	Total Gate Charge	$V_{\text{DS}} = 48 \text{ V}$, $I_D = 170 \text{ A}$, $V_{\text{GS}} = 10 \text{ V}$	--	220	290	nC
Q_{gs}	Gate-Source Charge		--	50	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	100	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current	(Note 5)	--	--	170	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	680	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0 \text{ V}$, $I_S = 170 \text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{\text{GS}} = 0 \text{ V}$, $I_S = 170 \text{ A}$	--	100	--	ns
Q_{rr}	Reverse Recovery Charge	$dI_F / dt = 100 \text{ A}/\mu\text{s}$	--	315	--	nC

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. $L = 40 \mu\text{H}$, $I_{\text{AS}} = 170 \text{ A}$, $V_{\text{DD}} = 25 \text{ V}$, $R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{\text{SD}} \leq 170 \text{ A}$, $dI/dt \leq 300 \text{ A}/\mu\text{s}$, $V_{\text{DD}} \leq \text{BV}_{\text{DSS}}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.
5. Continuous drain current calculated by maximum junction temperature : limited by package.

Typical Characteristics

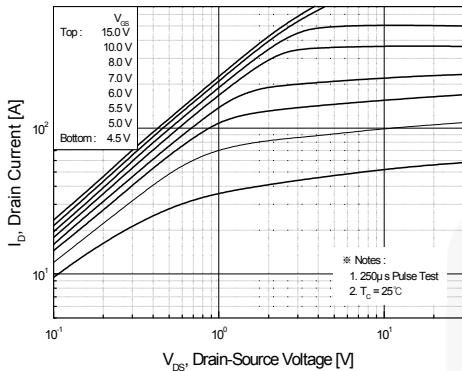


Figure 1. On-Region Characteristics.

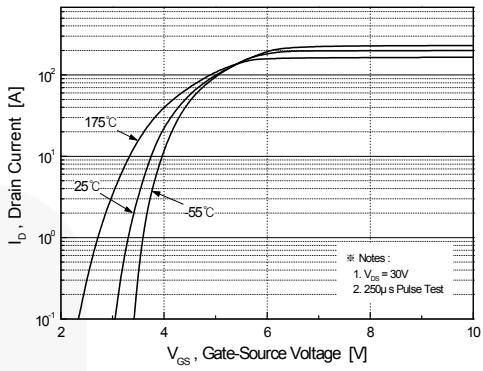


Figure 2. Transfer Characteristics.

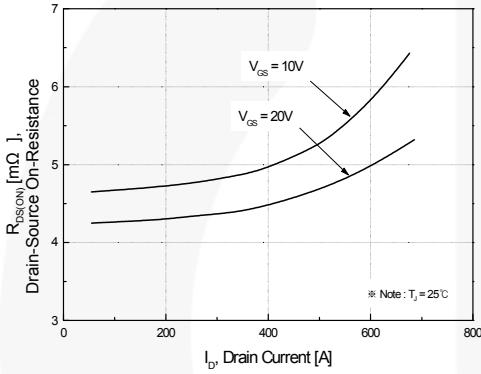


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage.

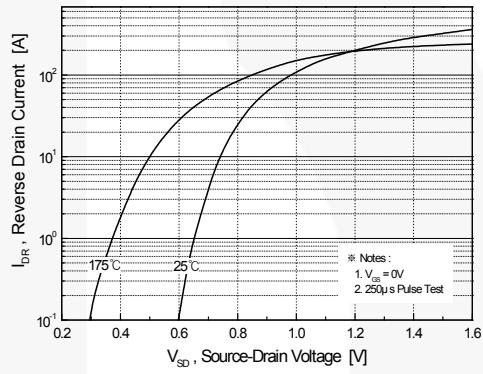


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature.

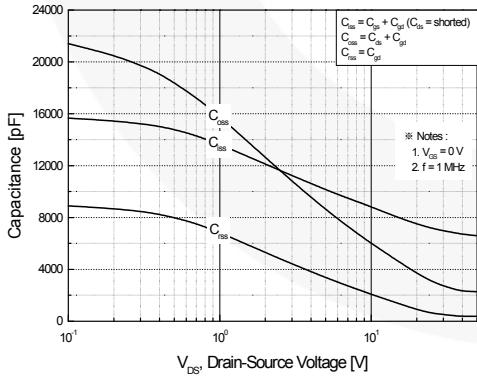


Figure 5. Capacitance Characteristics.

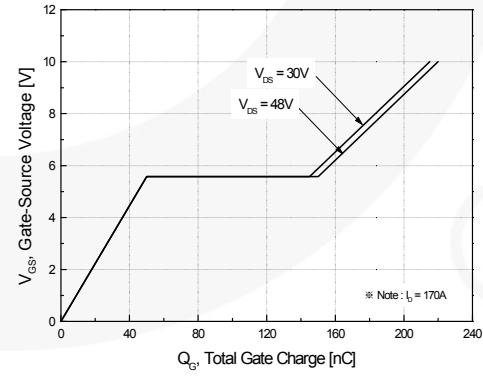


Figure 6. Gate -Charge Characteristics.

Typical Characteristics (Continued)

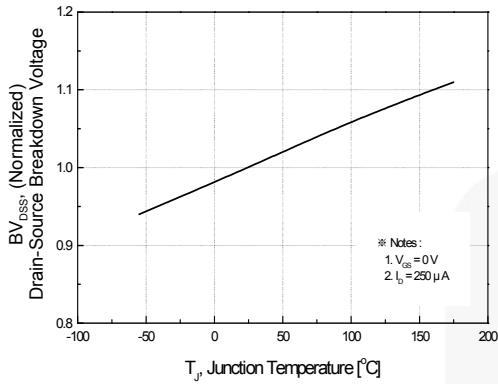


Figure 7. Breakdown Voltage Variation vs Temperature.

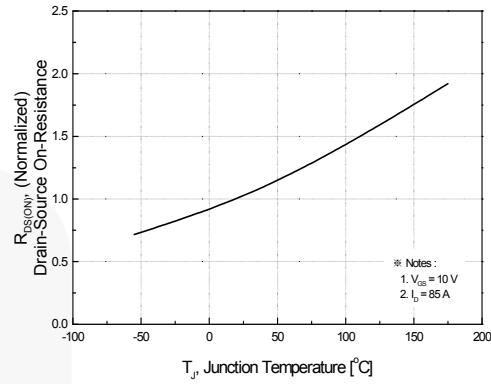


Figure 8. On-Resistance Variation vs Temperature.

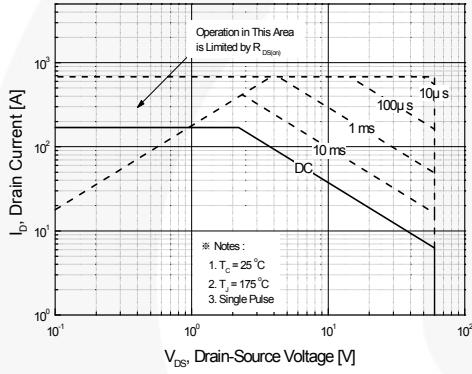


Figure 9. Maximum Safe Operating Area.

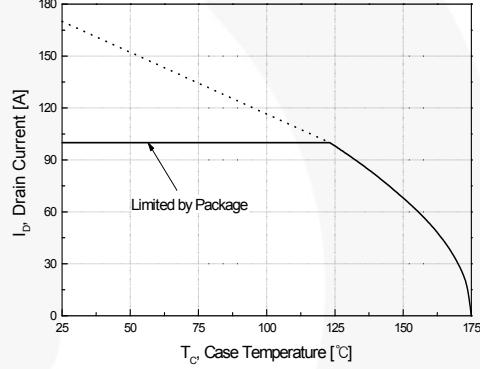


Figure 10. Maximum Drain Current vs Case Temperature.

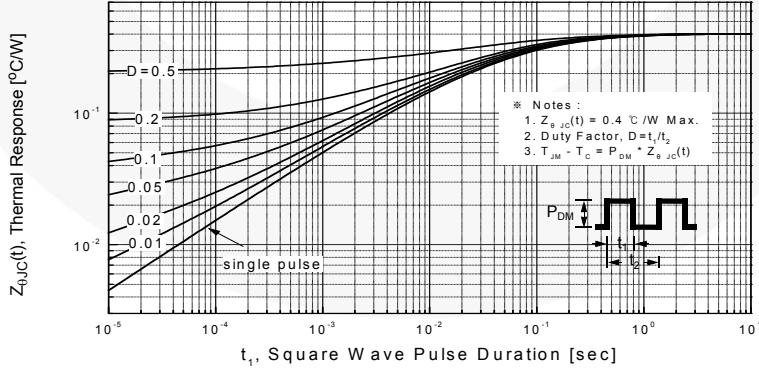


Figure 11. Transient Thermal Response Curve.

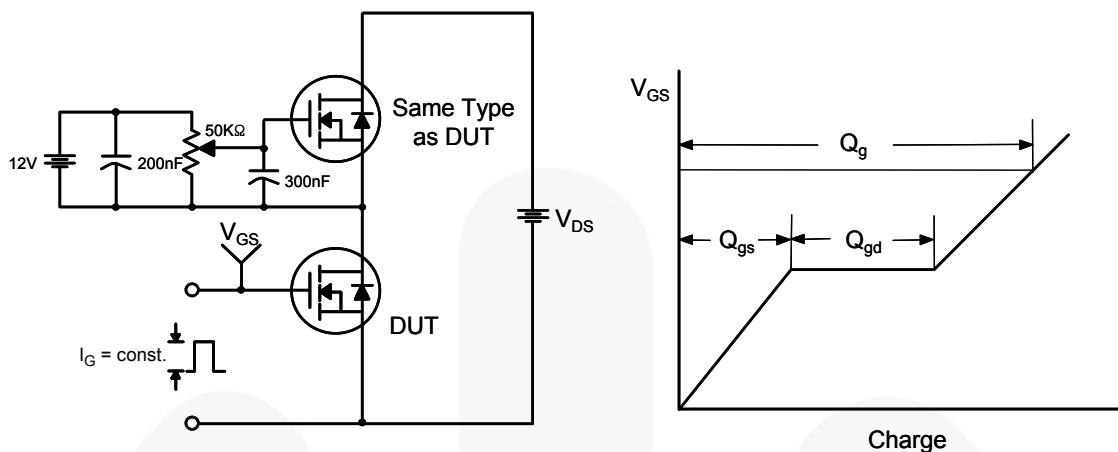


Figure 12. Gate Charge Test Circuit & Waveform

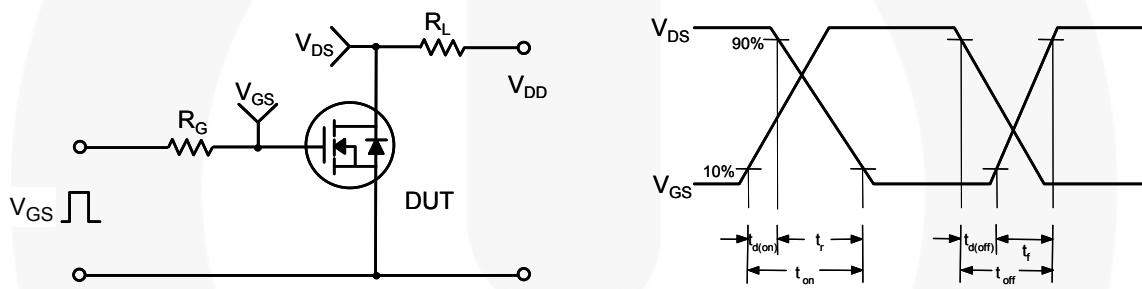


Figure 13. Resistive Switching Test Circuit & Waveforms

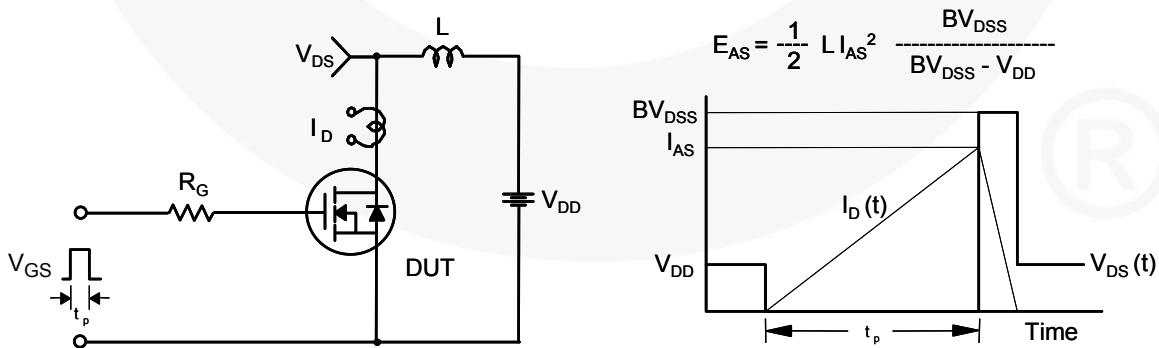


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

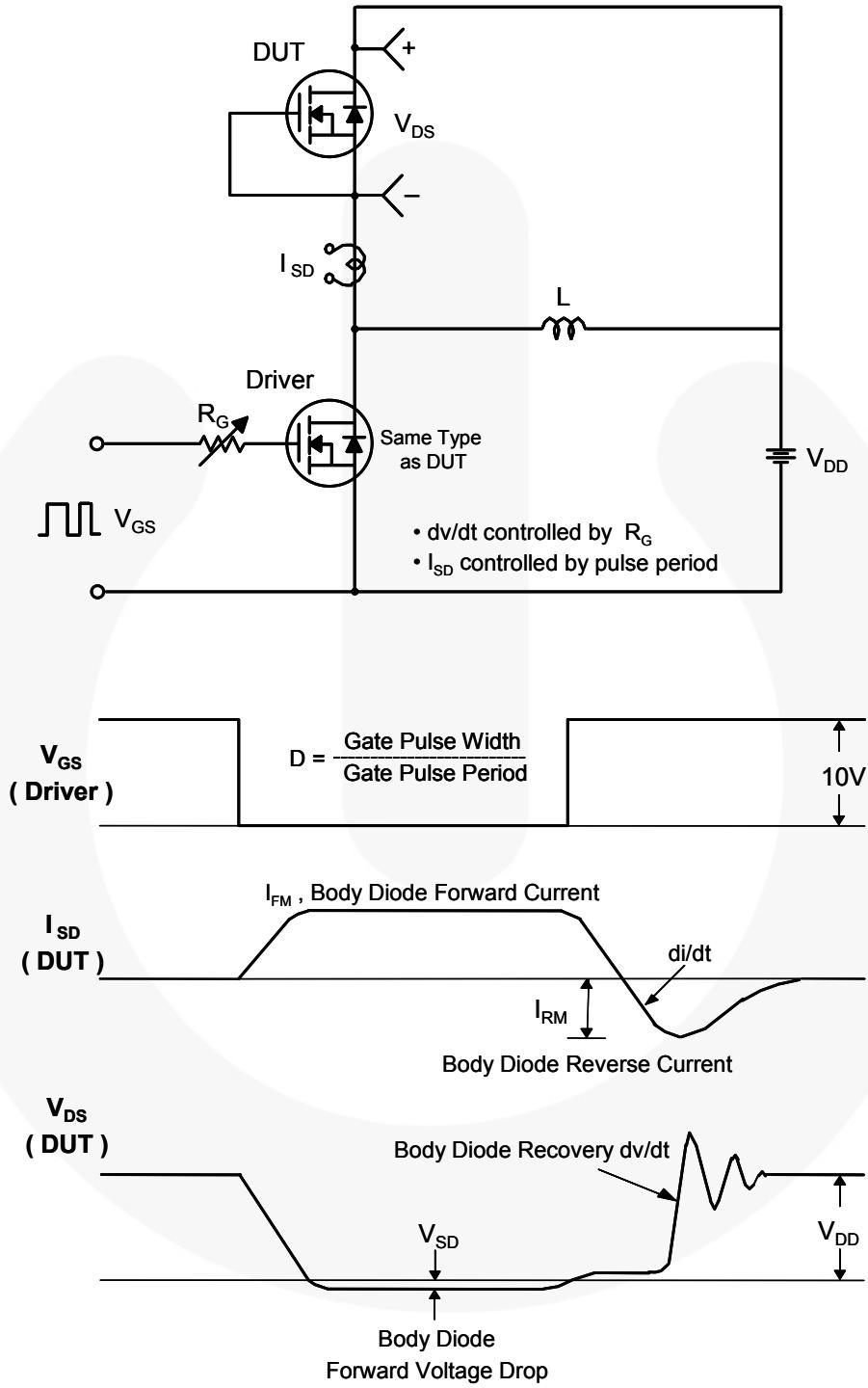
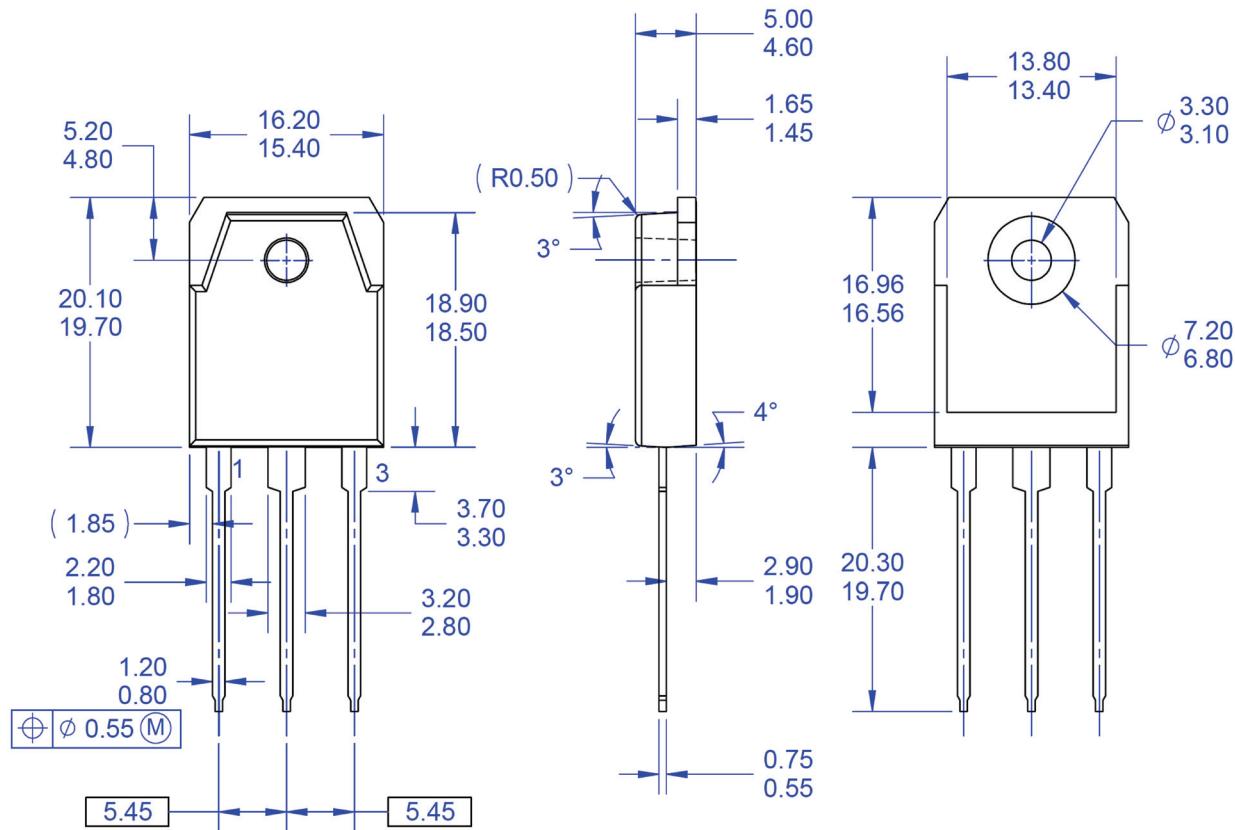


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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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