



ON Semiconductor®

# FQA11N90C-F109

## N-Channel QFET<sup>®</sup> MOSFET

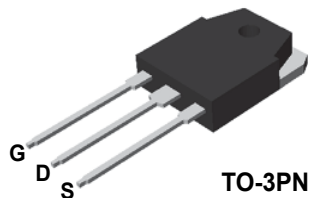
900 V, 11.0 A, 1.1 Ω

### Features

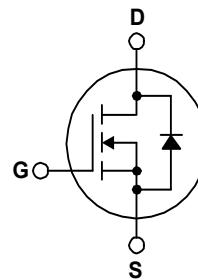
- 11 A, 900 V,  $R_{DS(on)} = 1.1 \Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 5.5 \text{ A}$
- Low Gate Charge (Typ. 60 nC)
- Low Crss (Typ. 23 pF)
- 100% Avalanche Tested
- RoHS compliant

### Description

This N-Channel enhancement mode power MOSFET is produced using ON 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, active power factor correction (PFC), and elec-tronic lamp ballasts.



TO-3PN



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

Symbol	Parameter	FQA11N90C_F109	Unit
$V_{DSS}$	Drain to Source Voltage	900	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	11.0
		- Continuous ( $T_C = 100^\circ\text{C}$ )	6.9
$I_{DM}$	Drain Current - Pulsed (Note 1)	44.0	A
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	960	mJ
$I_{AR}$	Avalanche Current (Note 1)	11.0	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	30	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate Above $25^\circ\text{C}$	300	W
		2.38	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	FQA11N90C_F109	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	0.42	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	40	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQA11N90C-F109	FQA11N90C	TO-3PN	Tube	N/A	N/A	30 units

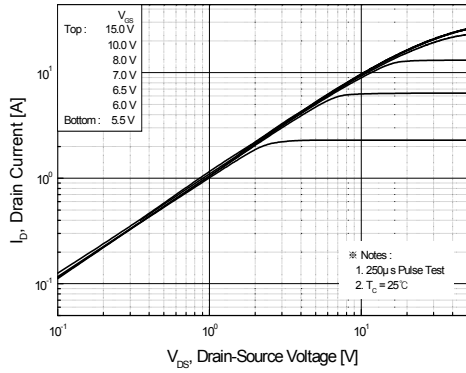
## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	900	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	1.02	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 900\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 720\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 5.5\text{ A}$	--	0.91	1.1	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 5.5\text{ A}$	--	9.0	--	S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	2530	3290	pF
$C_{oss}$	Output Capacitance		--	215	280	pF
$C_{rss}$	Reverse Transfer Capacitance		--	23	30	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 450\text{ V}, I_D = 11.0\text{ A},$ $R_G = 25\ \Omega$	--	60	130	ns
$t_r$	Turn-On Rise Time		--	130	270	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	270	ns
$t_f$	Turn-Off Fall Time		(Note 4)	--	85	180
$Q_g$	Total Gate Charge	$V_{DS} = 720\text{ V}, I_D = 11.0\text{ A},$ $V_{GS} = 10\text{ V}$	--	60	80	nC
$Q_{gs}$	Gate-Source Charge		--	13	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4)	--	25	--
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		--	--	11.0	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		--	--	44.0	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 11.0\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 11.0\text{ A},$	--	1000	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$	--	17.0	--	$\mu\text{C}$

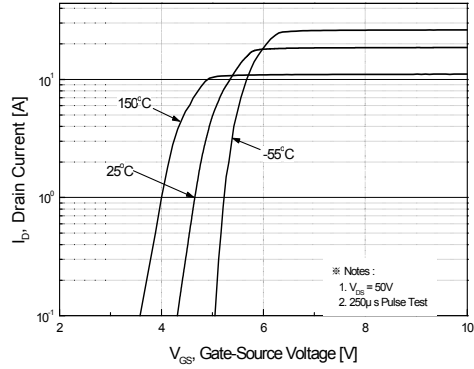
### Notes :

1. Repetitive rating : pulse width limited by maximum junction temperature.
2.  $L = 15\text{ mH}, I_{AS} = 11.0\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 11.0\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

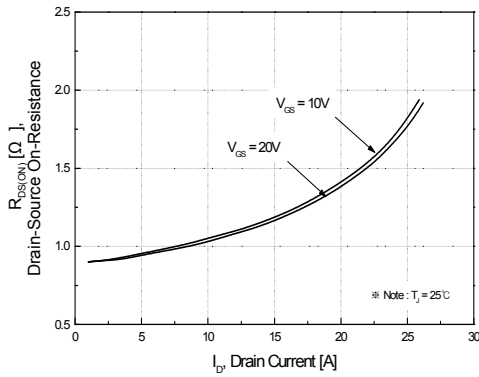
## Typical Characteristics



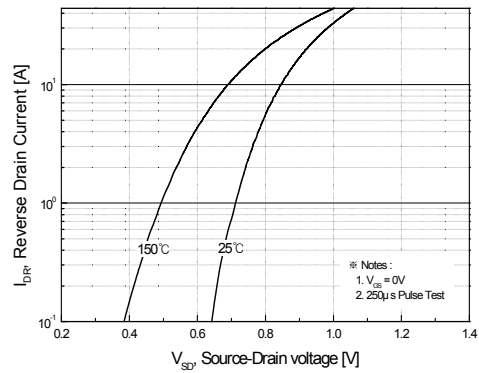
**Figure 1. On-Region Characteristics**



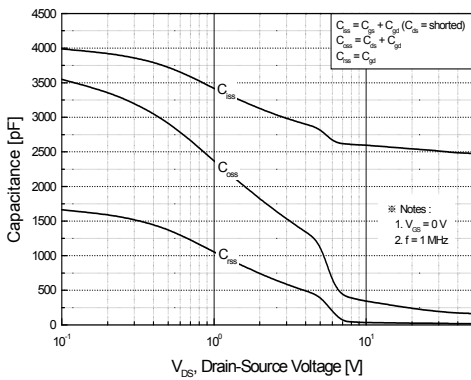
**Figure 2. Transfer Characteristics**



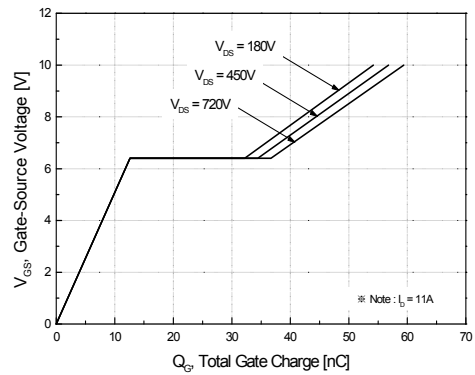
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



**Figure 4. Body Diode Forward Voltage Variation with Source Current**

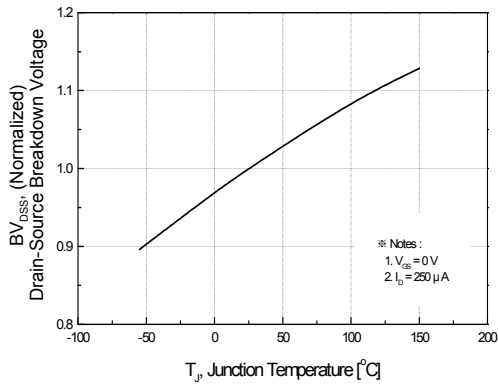


**Figure 5. Capacitance Characteristics**

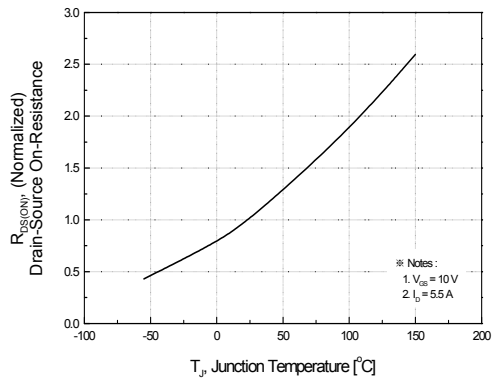


**Figure 6. Gate Charge Characteristics**

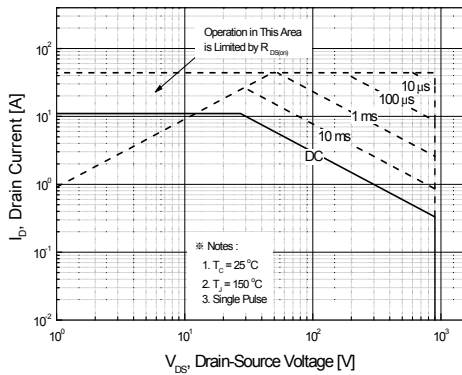
**Typical Characteristics** (Continued)



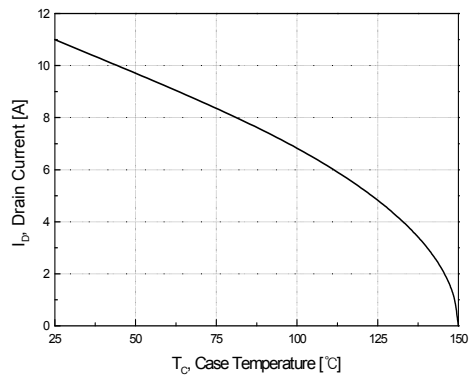
**Figure 7. Breakdown Voltage Variation**



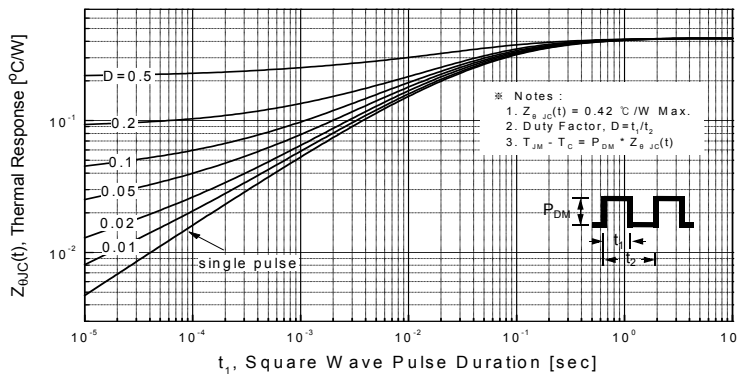
**Figure 8. On-Resistance Variation**



**Figure 9. Maximum Safe Operating Area**

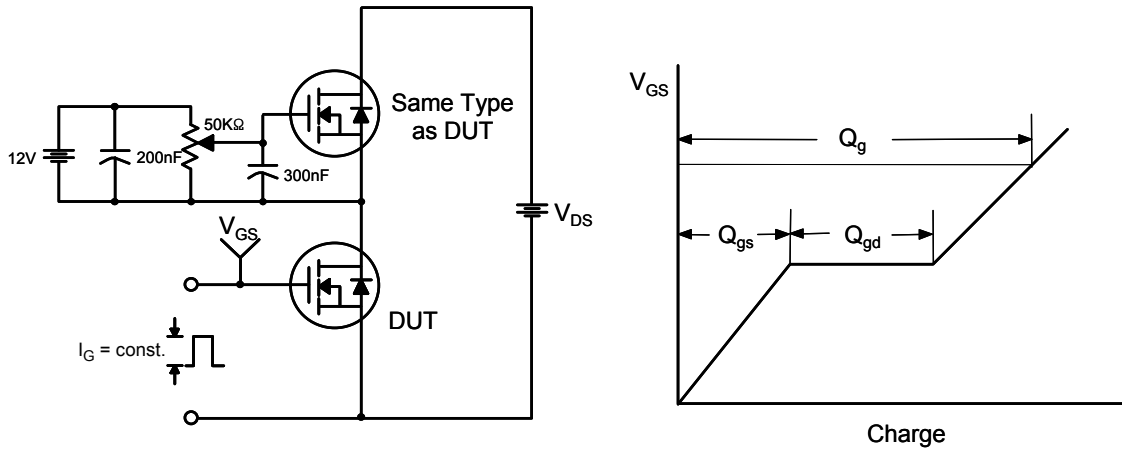


**Figure 10. Maximum Drain Current vs Case Temperature**

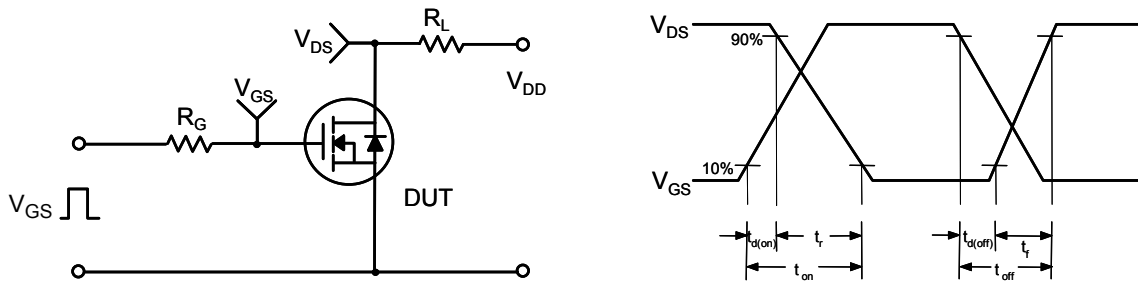


**Figure 11. Transient Thermal Response Curve**

**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

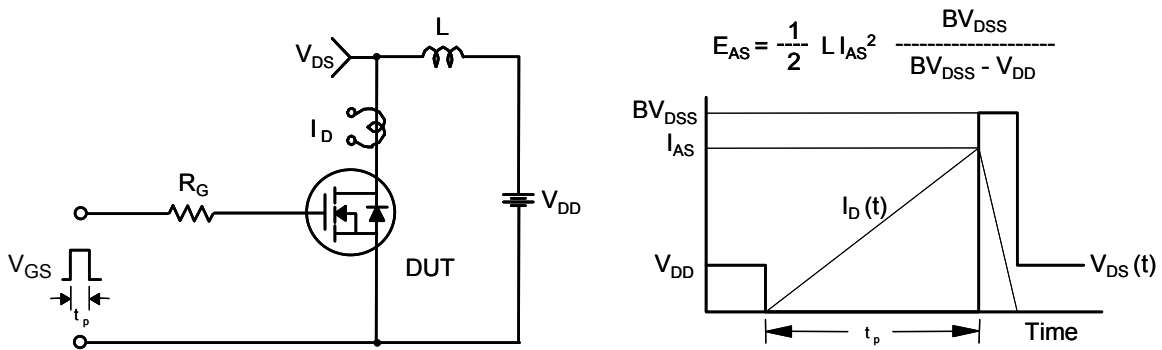
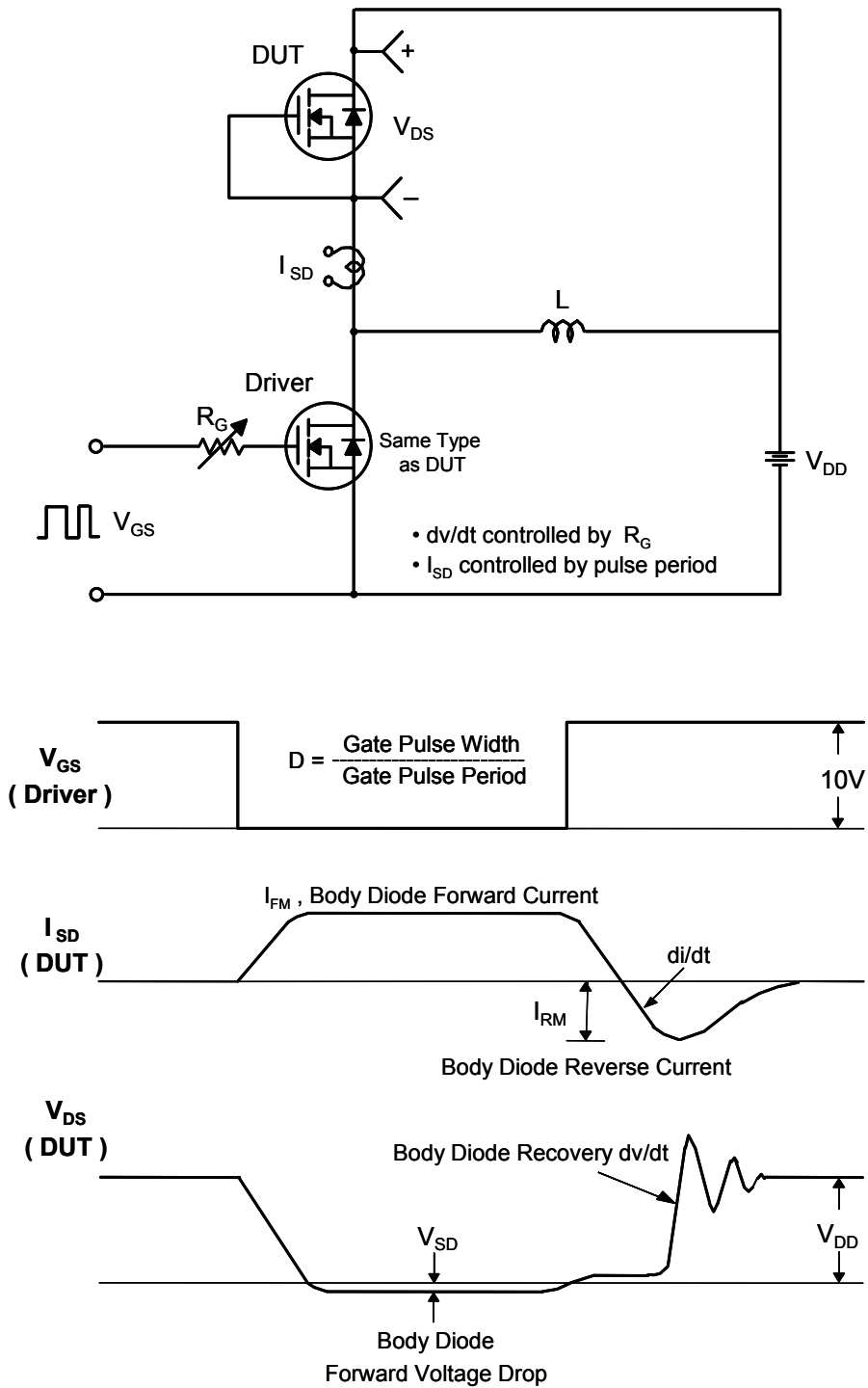
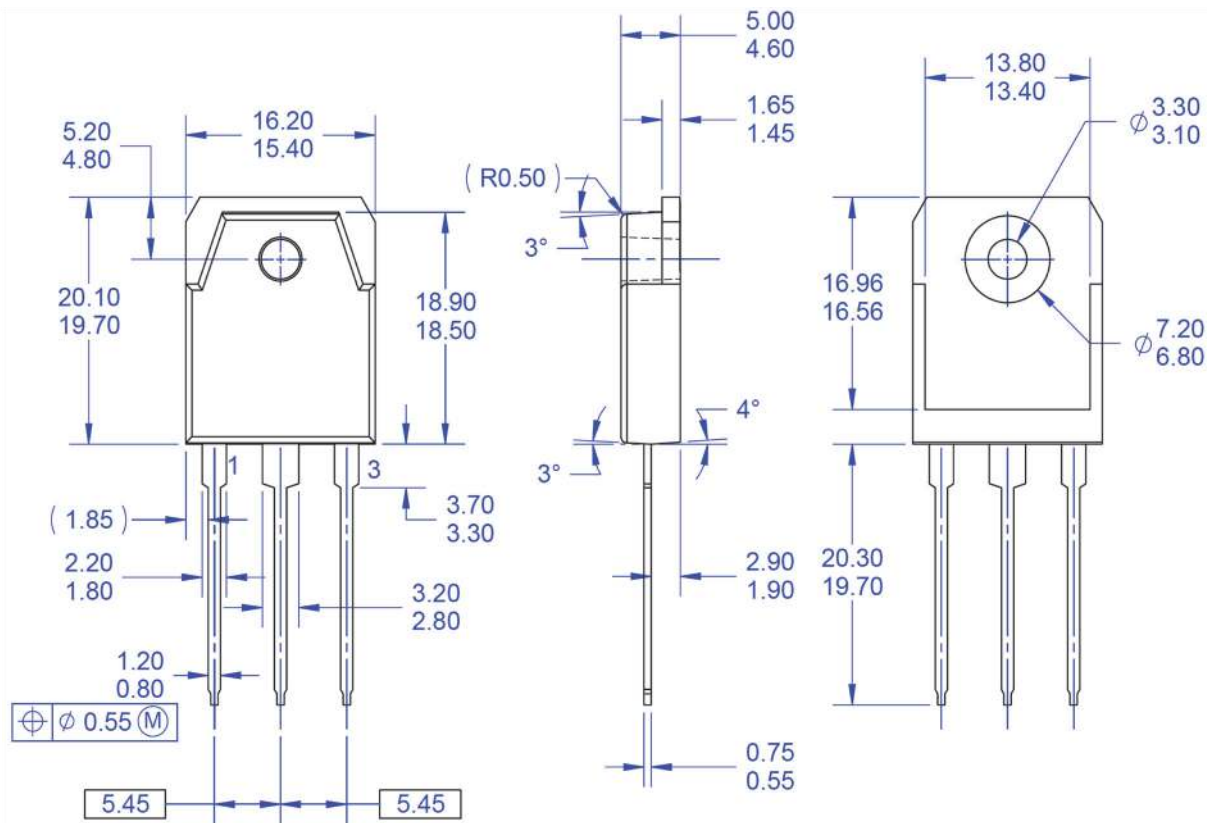


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms




## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
- D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- E) DRAWING FILE NAME: TO3PN03AREV1.

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

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