

# FDA16N50\_F109

## N-Channel UniFET™ MOSFET

500V, 16.5 A, 380 mΩ



### Features

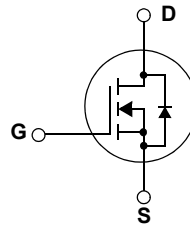
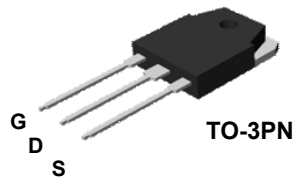
- $R_{DS(on)} = 380\text{ m}\Omega$  (Max.) @  $V_{GS} = 10$ ,  $I_D = 8.3\text{ A}$
- Low Gate Charge (Typ. 32 nC)
- Low  $C_{rSS}$  (Typ. 20 pF)
- 100% Avalanche Tested

### Applications

- PDP TV
- Uninterruptible 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

Symbol	Parameter		FDA16N50_F109	Unit
$V_{DSS}$	Drain-Source Voltage		500	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	16.5	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	9.9	A
$I_{DM}$	Drain Current	- Pulsed (Note 1)	66	A
$V_{GSS}$	Gate-Source voltage		$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		780	mJ
$I_{AR}$	Avalanche Current (Note 1)		16.5	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)		20.5	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)		4.5	V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	205	W
		- Derate above $25^\circ\text{C}$	2.1	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 Purpose, 1/8" from Case for 5 Seconds		300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FDA16N50_F109	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDA16N50	FDA16N50_F109	TO-3PN	-	-	30

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

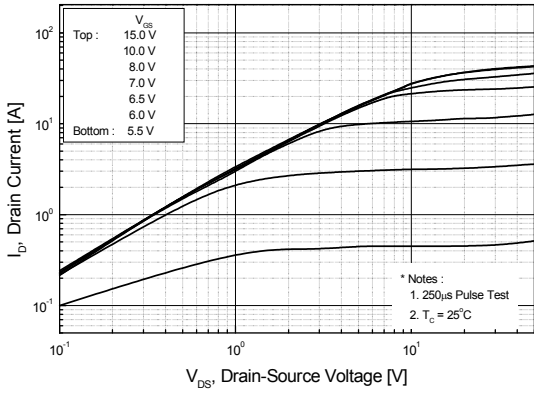
Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	500	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V V <sub>DS</sub> = 400V, T <sub>C</sub> = 125°C	--	--	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 8.3A	--	0.31	0.38	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 8.3A	--	23	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	1495	1945	pF
C <sub>oss</sub>	Output Capacitance		--	235	310	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	20	30	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250V, I <sub>D</sub> = 16A R <sub>G</sub> = 25Ω  (Note 4)	--	40	90	ns
t <sub>r</sub>	Turn-On Rise Time		--	150	310	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	65	140	ns
t <sub>f</sub>	Turn-Off Fall Time		--	80	170	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400V, I <sub>D</sub> = 16A V <sub>GS</sub> = 10V  (Note 4)	--	32	45	nC
Q <sub>gs</sub>	Gate-Source Charge		--	8.5	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	14	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	9.2	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	37	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 16.5A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 16A dI <sub>F</sub> /dt = 100A/μs	--	490	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	5.0	--	μC

### NOTES:

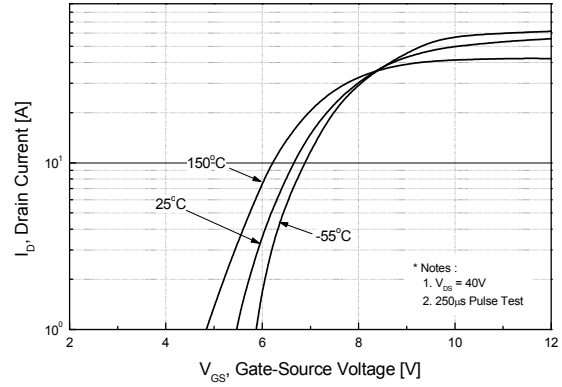
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 5.1mH, I<sub>AS</sub> = 16.5A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 16.5A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

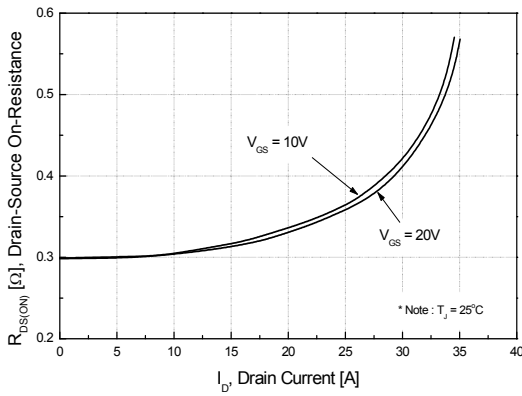
**Figure 1. On-Region Characteristics**



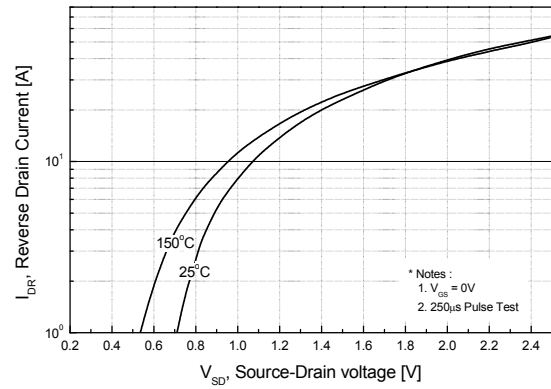
**Figure 2. Transfer Characteristics**



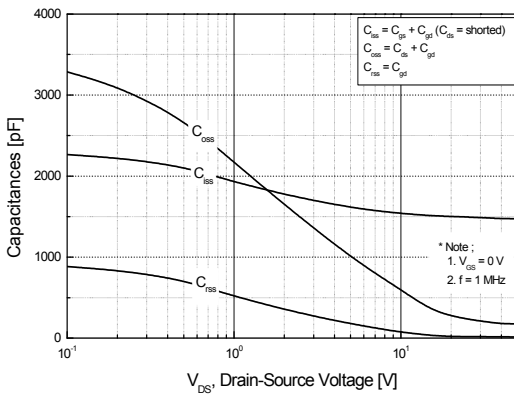
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



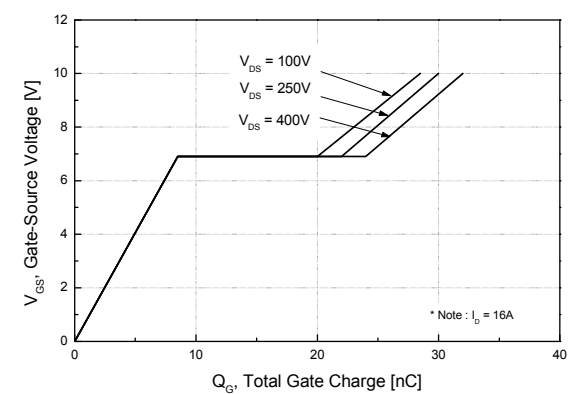
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

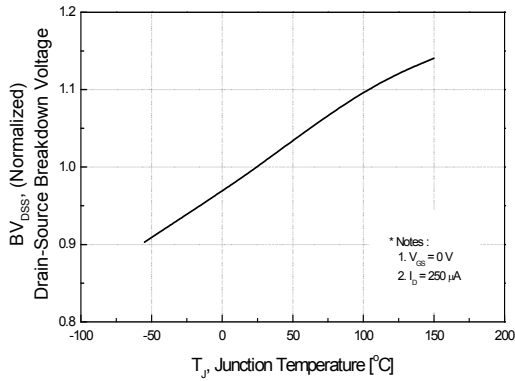


**Figure 6. Gate Charge Characteristics**

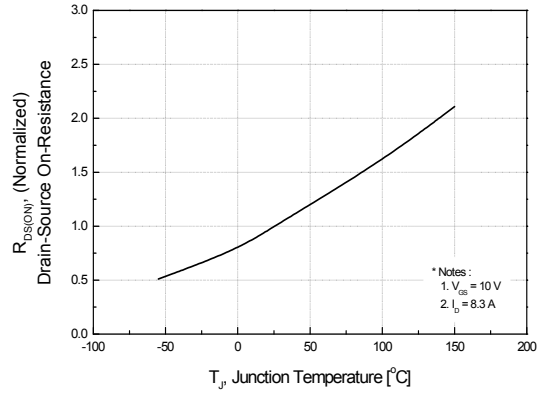


**Typical Performance Characteristics** (Continued)

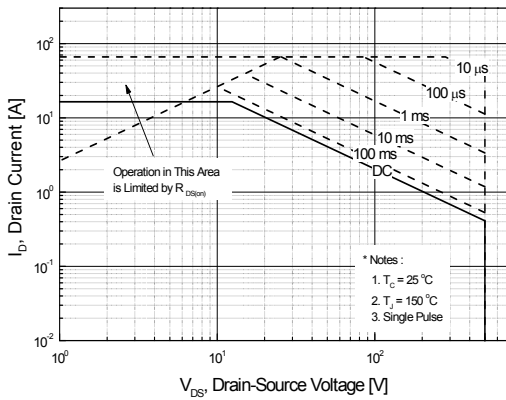
**Figure 7. Breakdown Voltage Variation vs. Temperature**



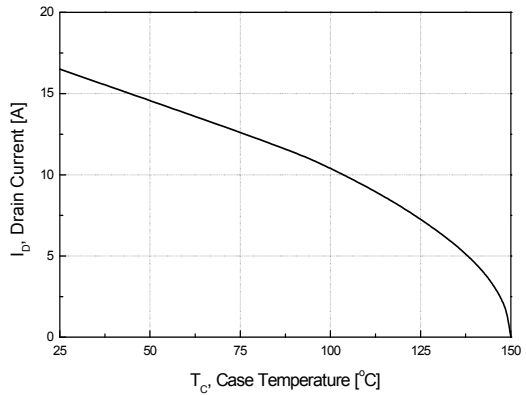
**Figure 8. On-Resistance Variation vs. Temperature**



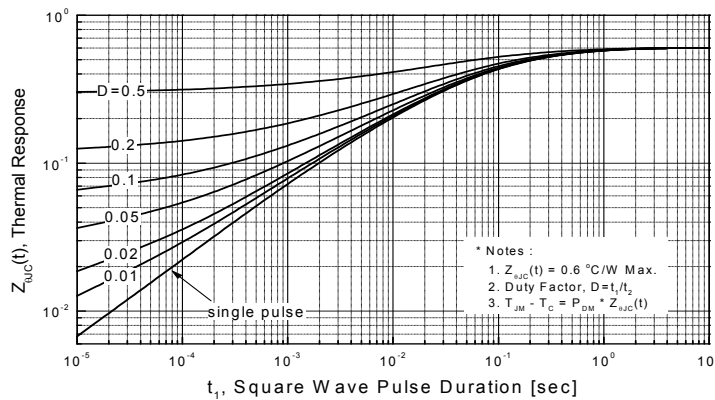
**Figure 9. Maximum Safe Operating Area**



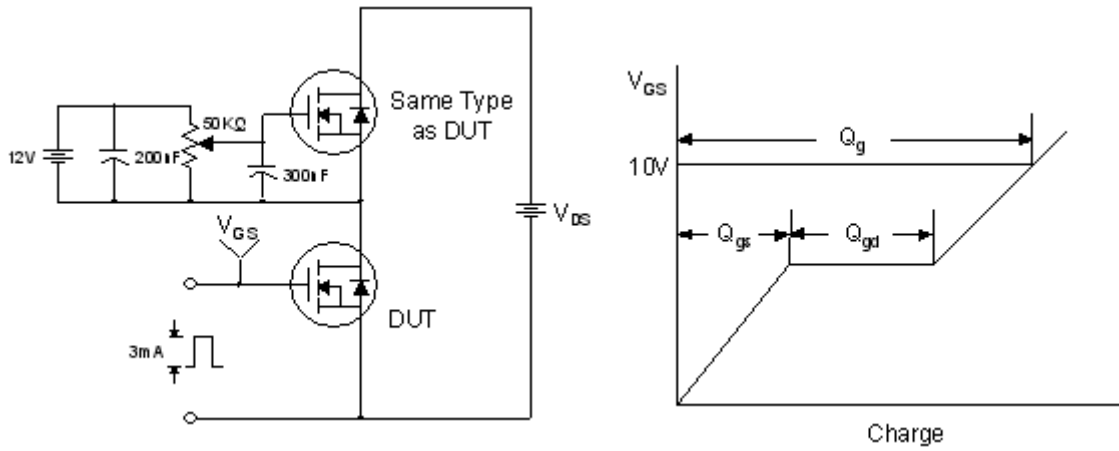
**Figure 10. Maximum Drain Current vs. Case Temperature**



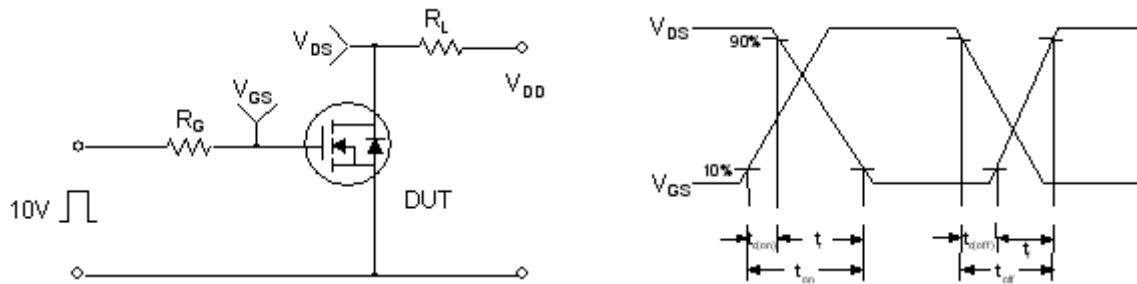
**Figure 11. Transient Thermal Response Curve**



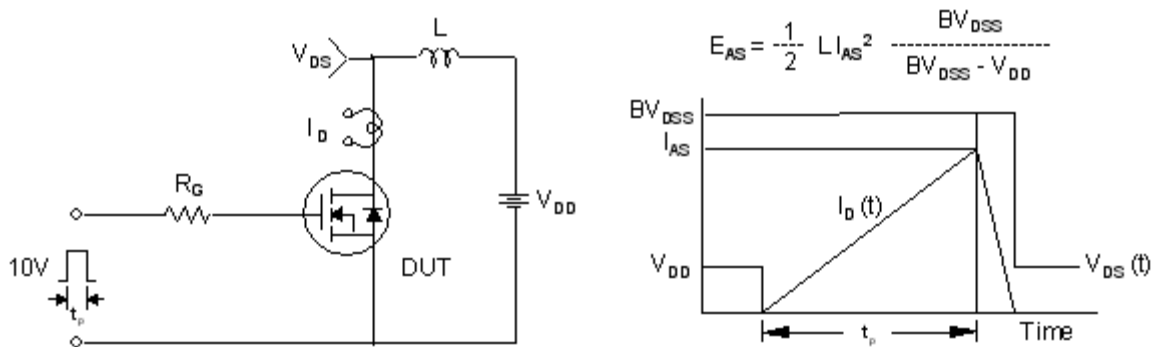
**Gate Charge Test Circuit & Waveform**



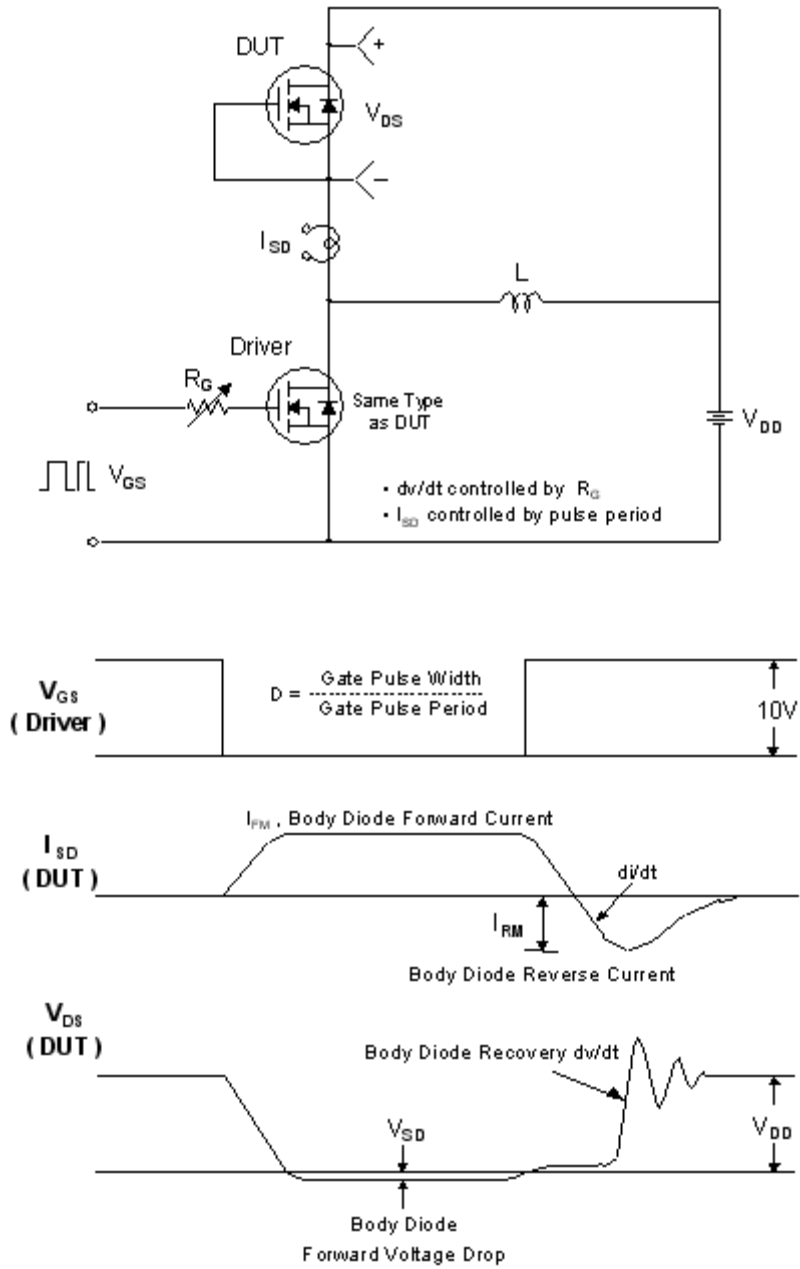
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

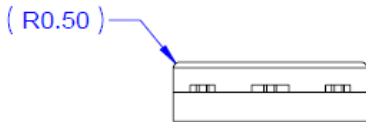
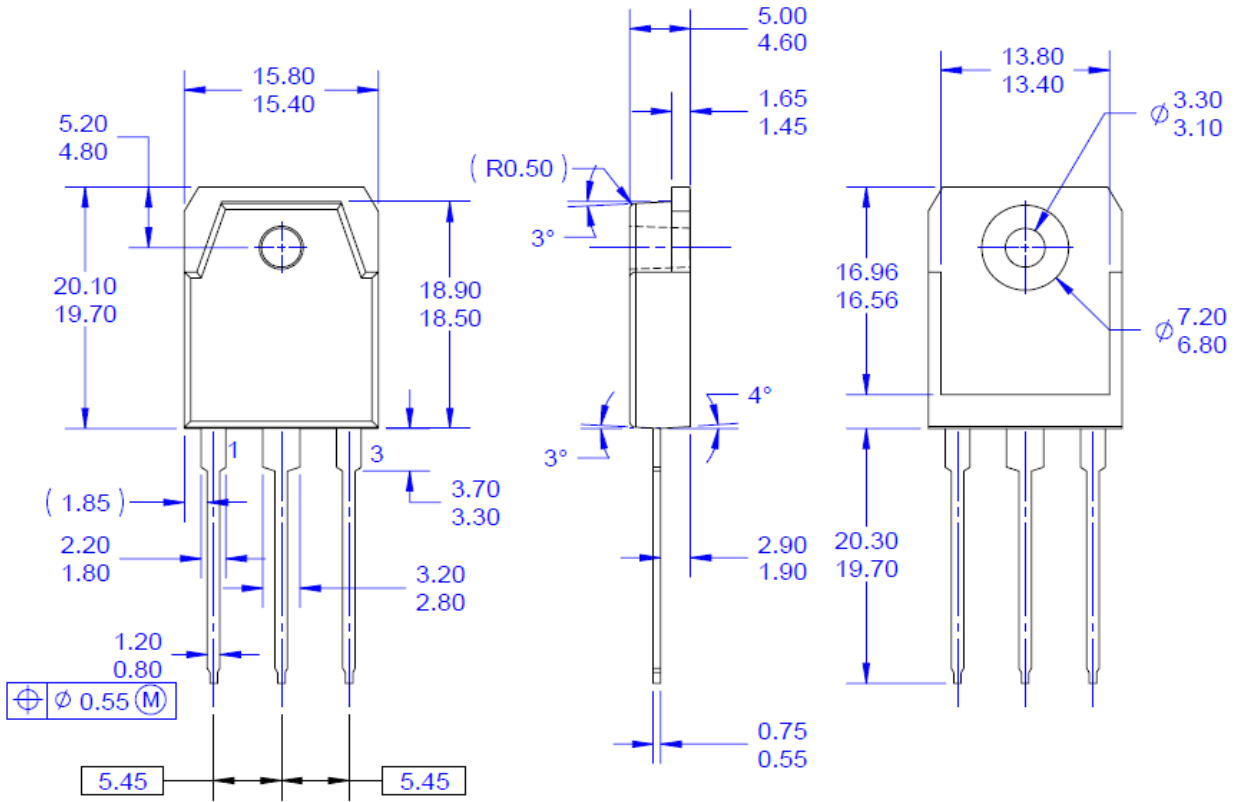


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-3PN**



**NOTES: UNLESS OTHERWISE SPECIFIED**

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5
- D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- E) THIS PACKAGE IS INTENDED ONLY FOR TO3PN.
- F) DRAWING FILE NAME: TO3P03AREV4.

Dimensions in Millimeters



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