

# FQA13N50CF

## 500V N-Channel MOSFET

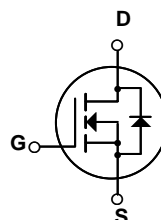
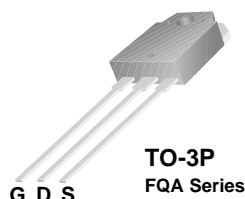
### Features

- 15A, 500V,  $R_{DS(on)} = 0.48\Omega$  @  $V_{GS} = 10\text{ V}$
- Low gate charge (typical 43 nC)
- Low  $C_{rss}$  (typical 20pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Fast recovery body diode (typical 100ns)

### Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.



### Absolute Maximum Ratings

Symbol	Parameter	FQA13N50CF	Units
$V_{DSS}$	Drain-Source Voltage	500	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	15	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	9.5	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	60	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	860	mJ
$I_{AR}$	Avalanche Current (Note 1)	15	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	21.8	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	218	W
	- Derate above $25^\circ\text{C}$	1.56	W/°C
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	°C
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	°C

### Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.58	°C/W
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQA13N50CF	FQA13N50CF	TO-3P			

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	500	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V	--	--	1	μA
		V <sub>DS</sub> = 400 V, T <sub>C</sub> = 125°C	--	--	10	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	--	--	-100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.0	--	4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.5 A	--	0.43	0.48	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 7.5 A (Note 4)	--	15	--	S
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	--	1580	2055	pF
C <sub>oss</sub>	Output Capacitance		--	180	235	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	20	25	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 15 A, R <sub>G</sub> = 25 Ω  (Note 4, 5)	--	25	60	ns
t <sub>r</sub>	Turn-On Rise Time		--	100	210	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	130	270	ns
t <sub>f</sub>	Turn-Off Fall Time		--	100	210	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400 V, I <sub>D</sub> = 15 A, V <sub>GS</sub> = 10 V  (Note 4, 5)	--	43	56	nC
Q <sub>gs</sub>	Gate-Source Charge		--	7.5	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	18.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	15	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	60	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 15 A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 15 A, dI <sub>F</sub> / dt = 100 A/μs (Note 4)	--	100	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	2.1	--	μC

### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 5.6mH, I<sub>AS</sub> = 15A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25 Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 15A, dI/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

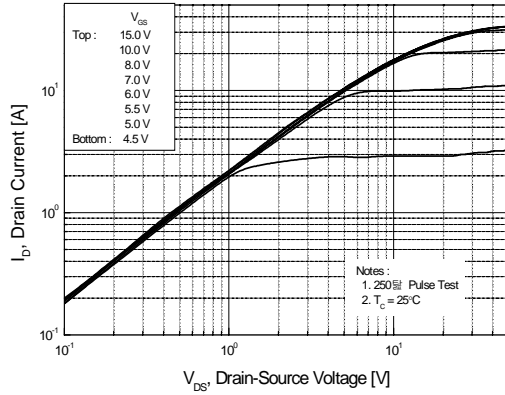


Figure 2. Transfer Characteristics

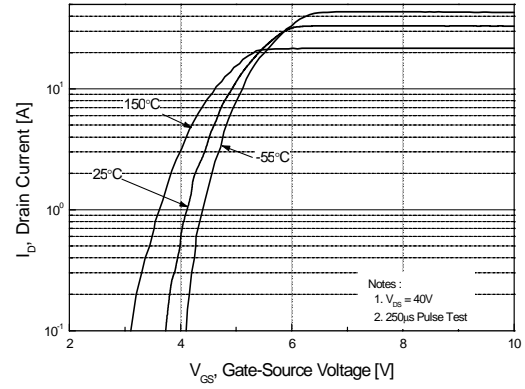


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

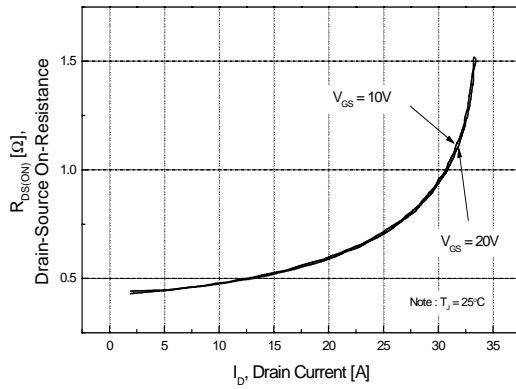


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

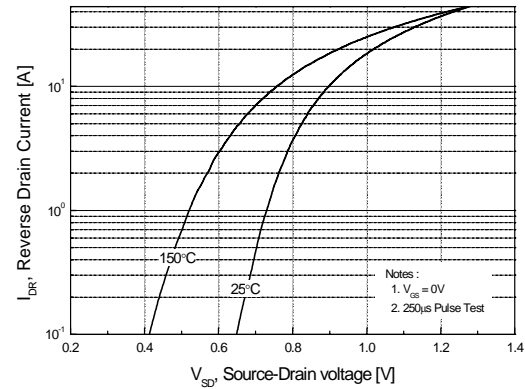


Figure 5. Capacitance Characteristics

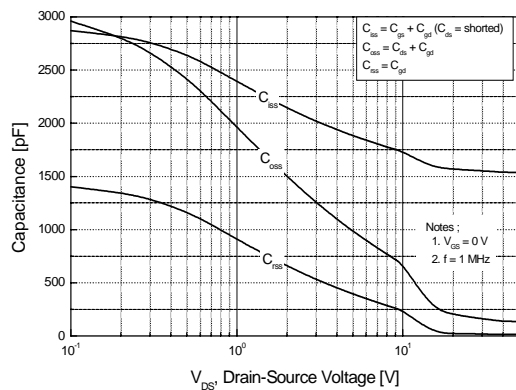
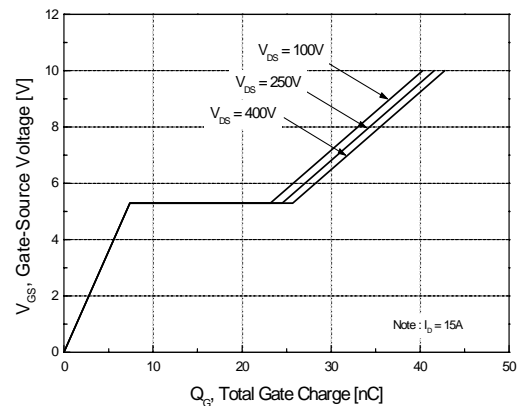


Figure 6. Gate Charge Characteristics



## Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

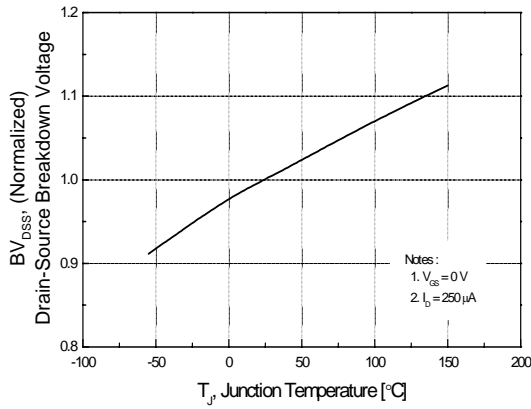


Figure 8. On-Resistance Variation vs. Temperature

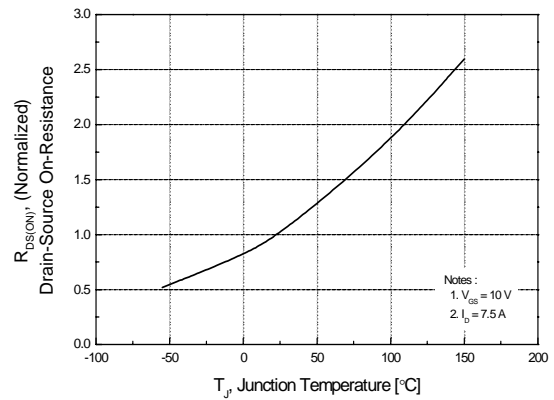


Figure 9-1. Maximum Safe Operating Area

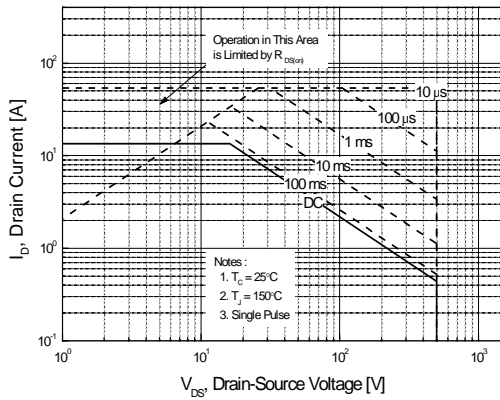


Figure 10. Maximum Drain Current vs. Case Temperature

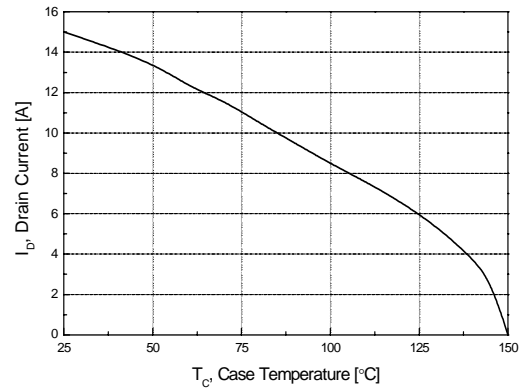
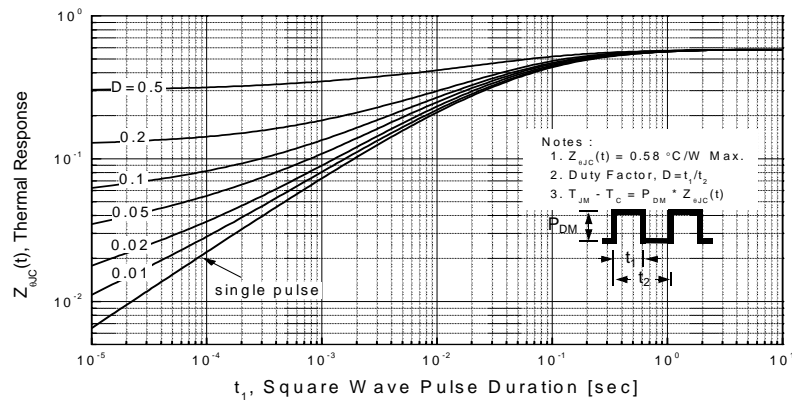
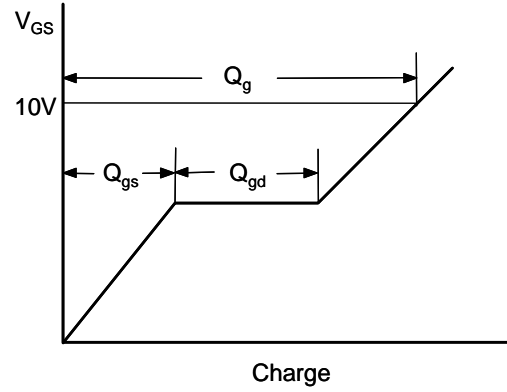
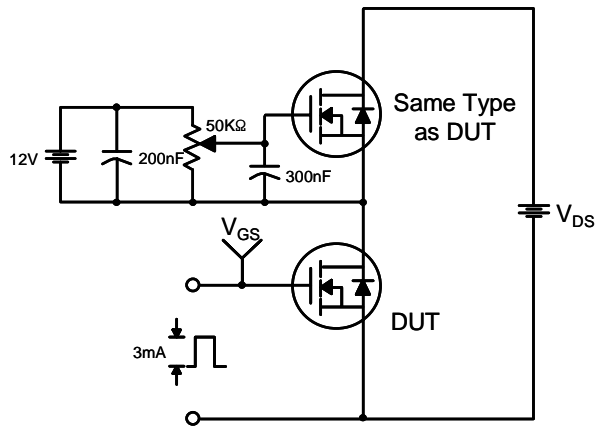


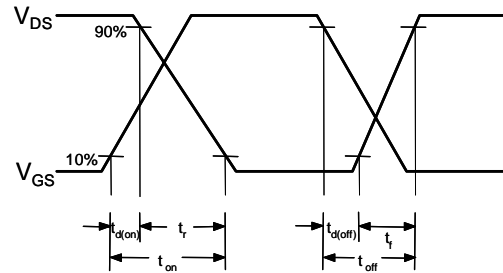
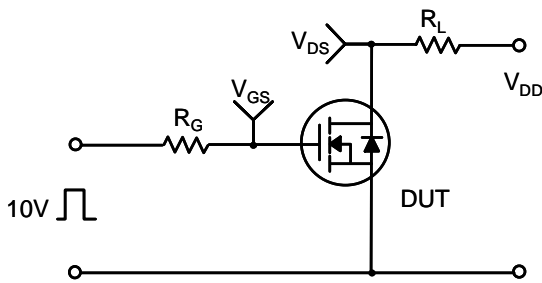
Figure 11. Transient Thermal Response Curve



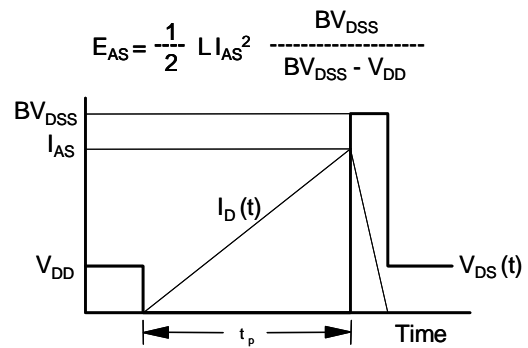
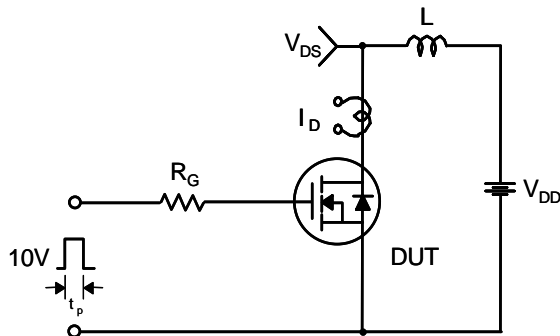
### Gate Charge Test Circuit & Waveform



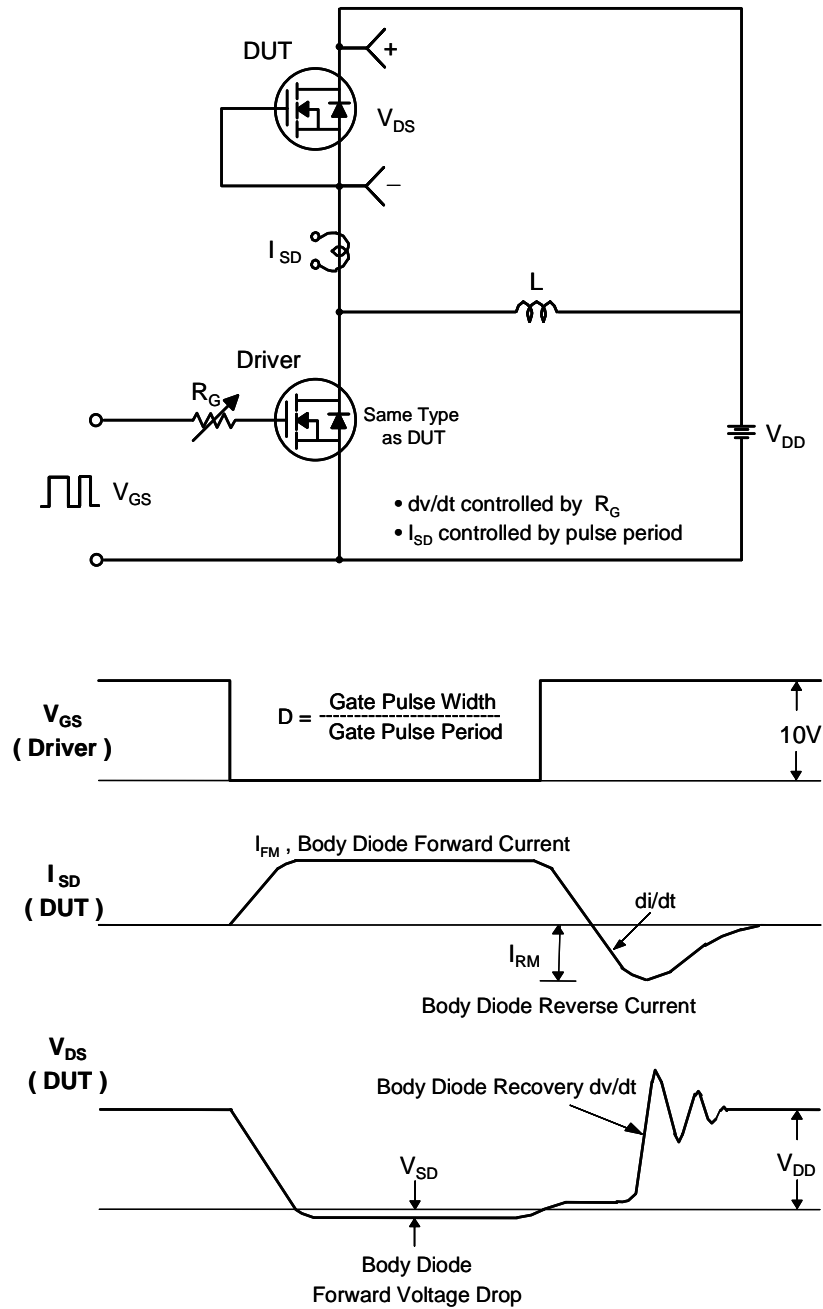
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms

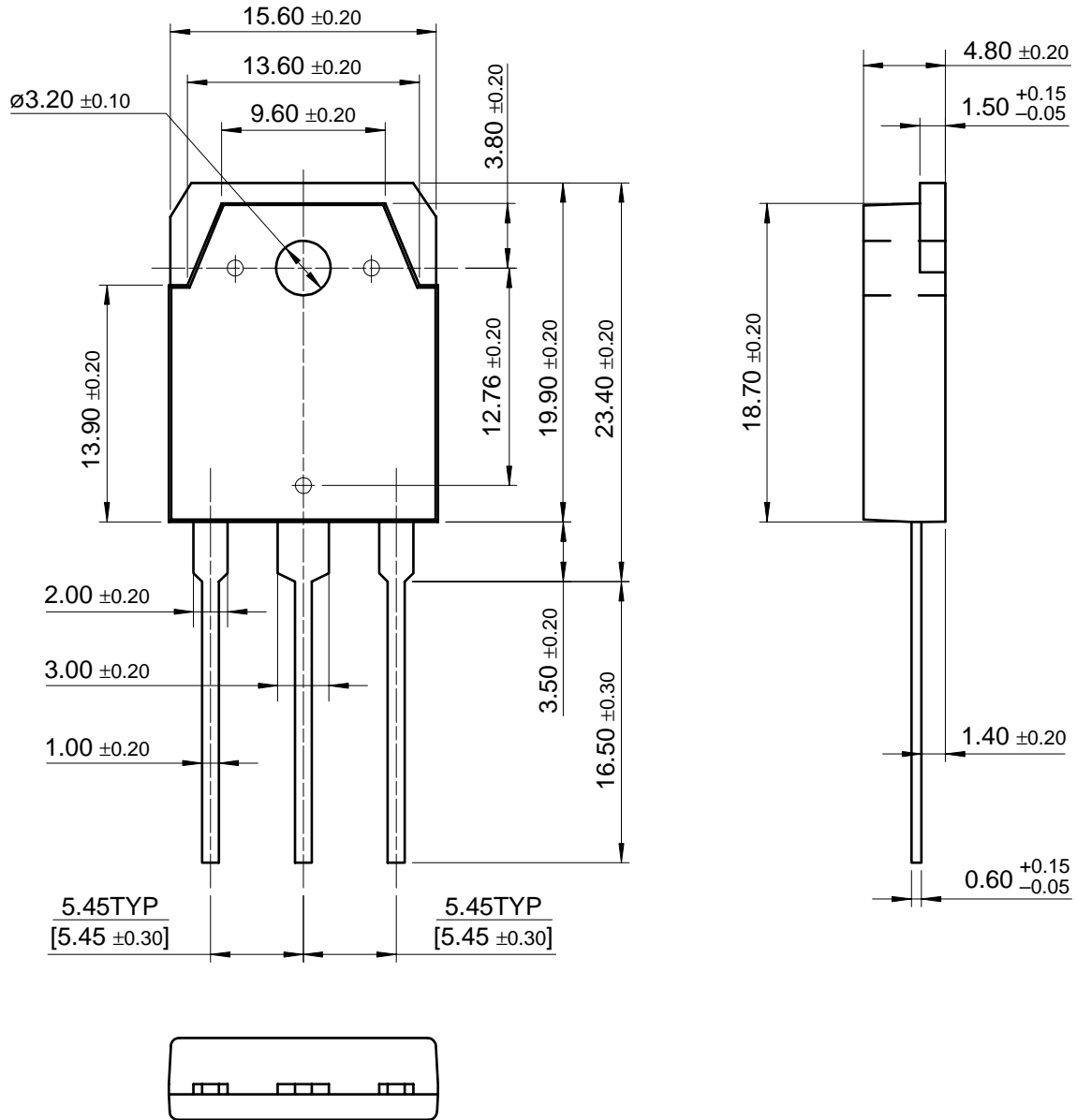


## Peak Diode Recovery dv/dt Test Circuit &amp; Waveforms



# Mechanical Dimensions

TO-3P



Dimensions in Millimeters

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