



August 2007
QFET®

FQA46N15 / FQA46N15_F109

150V N-Channel MOSFET

Features

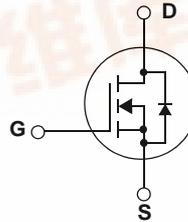
- 50A, 150V, $R_{DS(on)} = 0.042\Omega @ V_{GS} = 10V$
- Low gate charge (typical 85 nC)
- Low Crss (typical 100pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- 175°C maximum junction temperature rating



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 efficient switched mode power supplies, active power factor correction, electronic lamp ballast based on half bridge topology.



Absolute Maximum Ratings

Symbol	Parameter	FQA46N15	Units
V_{DSS}	Drain-Source Voltage	150	V
I_D	Drain Current - Continuous ($T_C = 25^\circ C$)	50	A
	- Continuous ($T_C = 100^\circ C$)	35.3	A
I_{DM}	Drain Current - Pulsed (Note 1)	200	A
V_{GSS}	Gate-Source Voltage	± 25	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	650	mJ
I_{AR}	Avalanche Current (Note 1)	50	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	25	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	6.0	V/ns
P_D	Power Dissipation ($T_C = 25^\circ C$)	250	W
	- Derate above $25^\circ C$	1.67	W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	$^\circ C$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ C$

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.6	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ C/W$

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Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQA46N15	FQA46N15	TO-3P	--	--	30
FQA46N15	FQA46N15_F109	TO-3PN	--	--	30

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	150	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.16	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 150 V, V _{GS} = 0 V	--	--	1	μA
		V _{DS} = 120 V, T _C = 150°C	--	--	10	μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 25 V, V _{DS} = 0 V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -25 V, V _{DS} = 0 V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	2.0	--	4.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 25A	--	0.033	0.042	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 25A (Note 4)	--	36	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	2500	3250	pF
C _{oss}	Output Capacitance		--	520	670	pF
C _{rss}	Reverse Transfer Capacitance		--	100	130	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 75 V, I _D = 45.6A, R _G = 25 Ω (Note 4, 5)	--	35	80	ns
t _r	Turn-On Rise Time		--	320	650	ns
t _{d(off)}	Turn-Off Delay Time		--	210	430	ns
t _f	Turn-Off Fall Time		--	200	410	ns
Q _g	Total Gate Charge	V _{DS} = 120 V, I _D = 45.6A, V _{GS} = 10 V (Note 4, 5)	--	85	110	nC
Q _{gs}	Gate-Source Charge		--	15	--	nC
Q _{gd}	Gate-Drain Charge		--	41	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	50	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	200	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 50A	--	--	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 45.6 A, dI _F / dt = 100 A/μs (Note 4)	--	130	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.55	--	μC

NOTES:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 0.43mH, I_{AS} = 50A, V_{DD} = 25V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 45.6A, di/dt ≤ 300A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 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

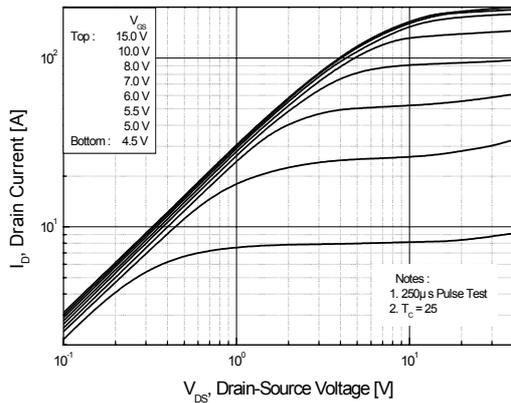


Figure 2. Transfer Characteristics

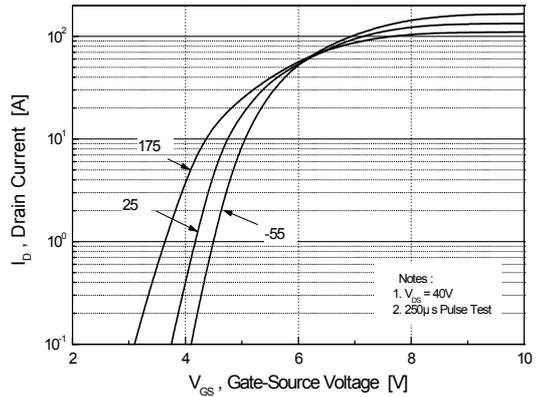


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

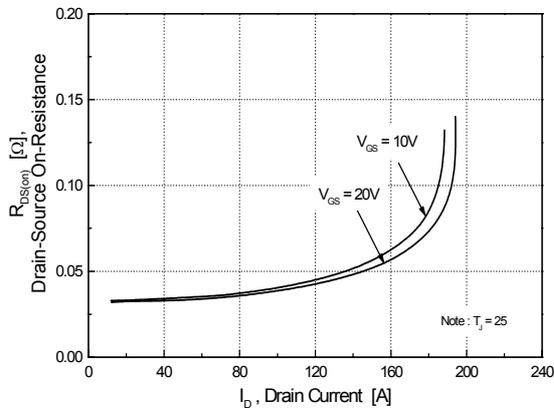


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

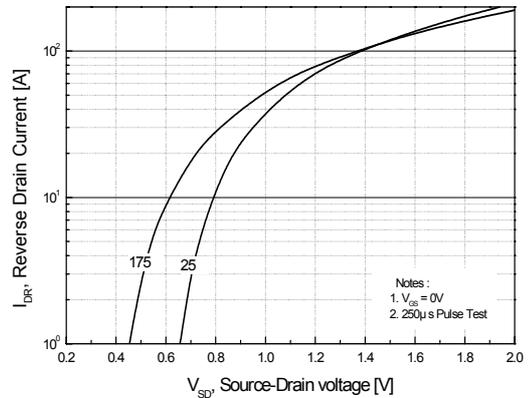


Figure 5. Capacitance Characteristics

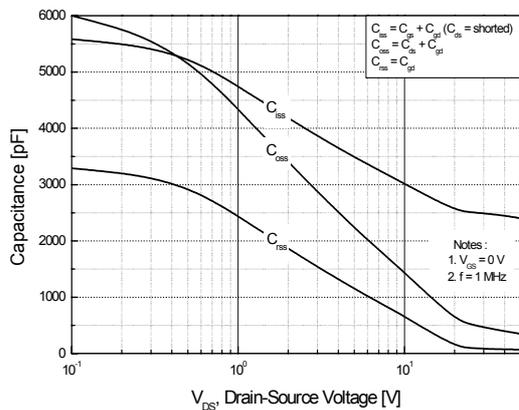
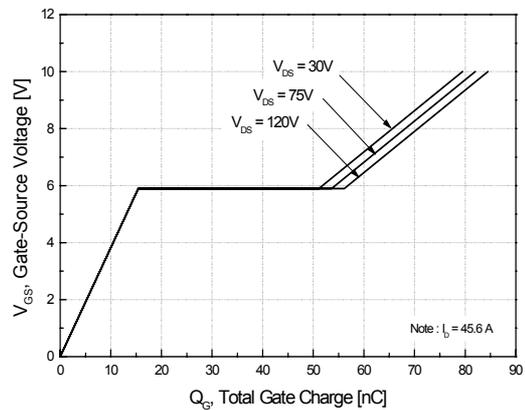


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

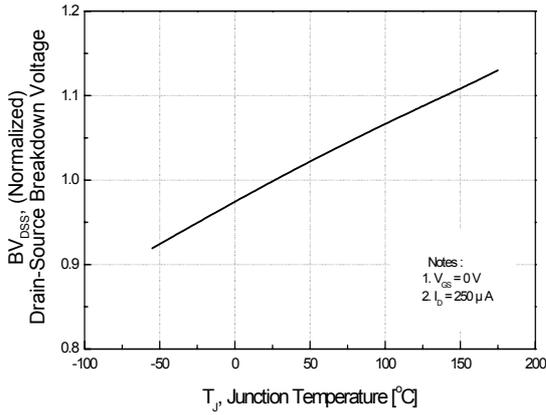


Figure 8. On-Resistance Variation vs. Temperature

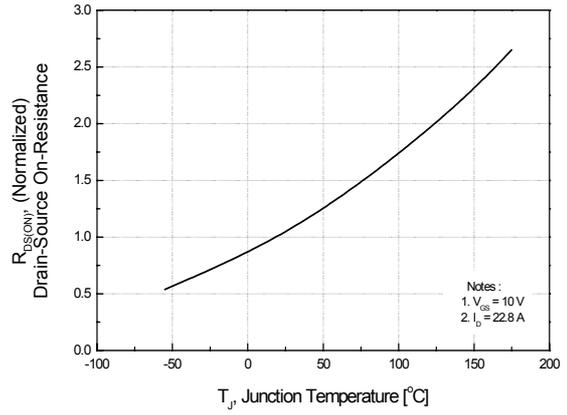


Figure 9. Maximum Safe Operating Area

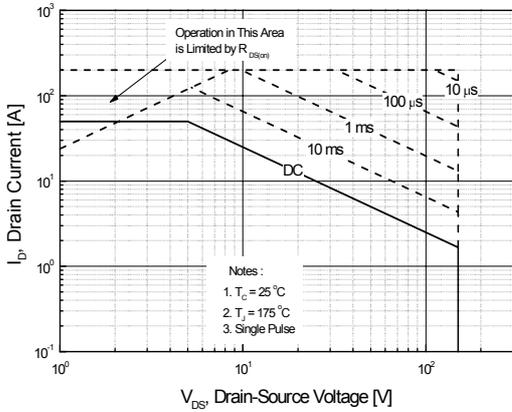


Figure 10. Maximum Drain Current vs. Case Temperature

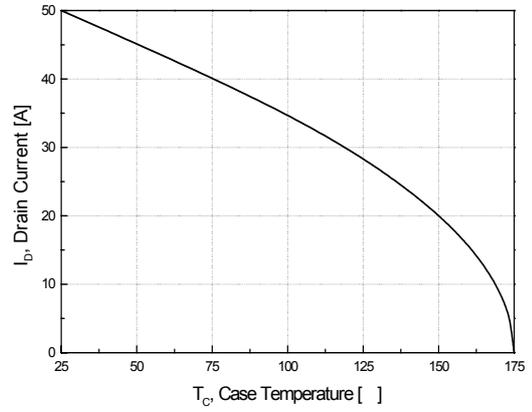
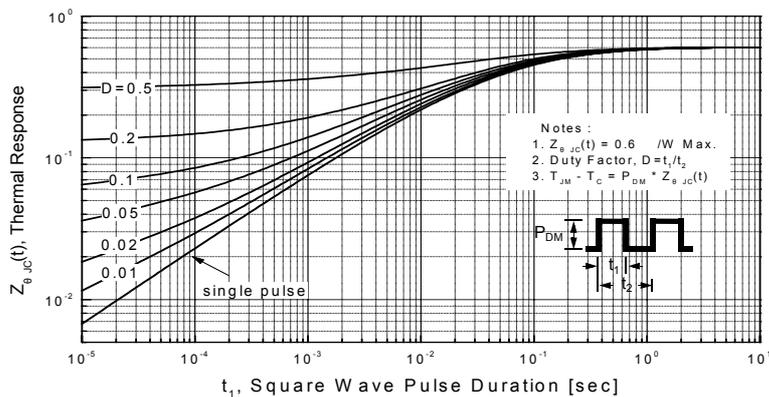
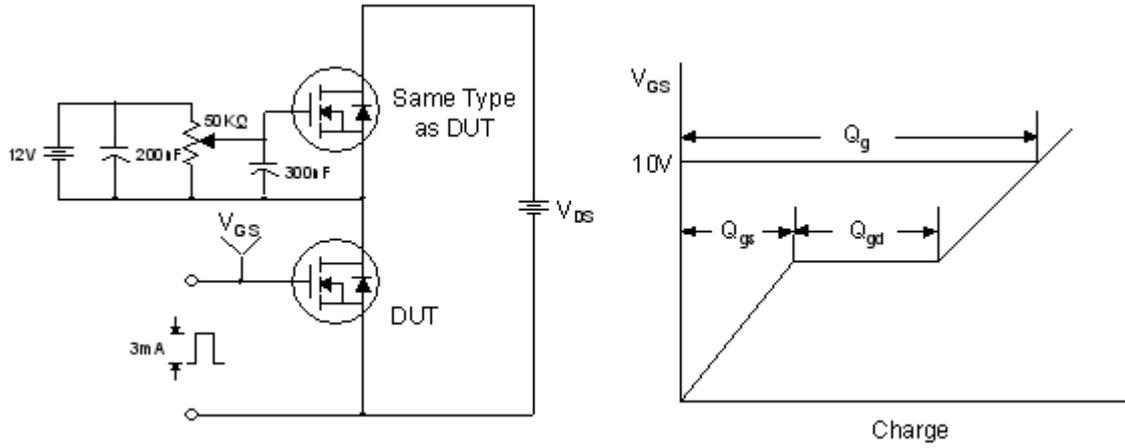


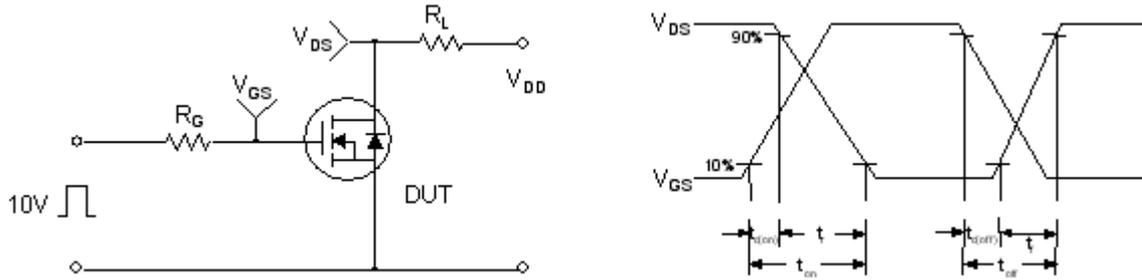
Figure 11. Transient Thermal Response Curve



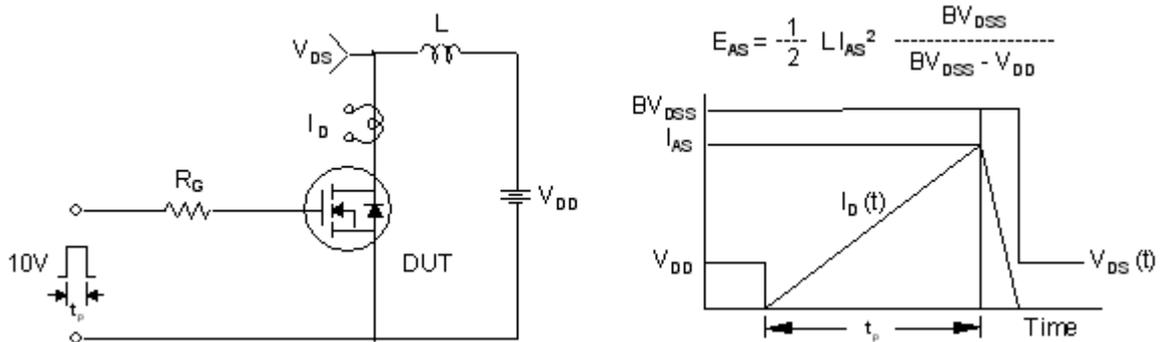
Gate Charge Test Circuit & Waveform



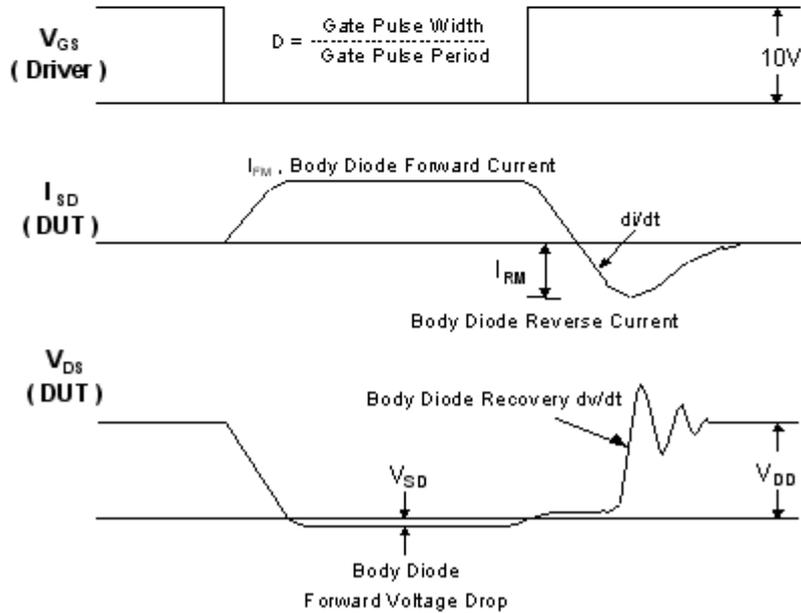
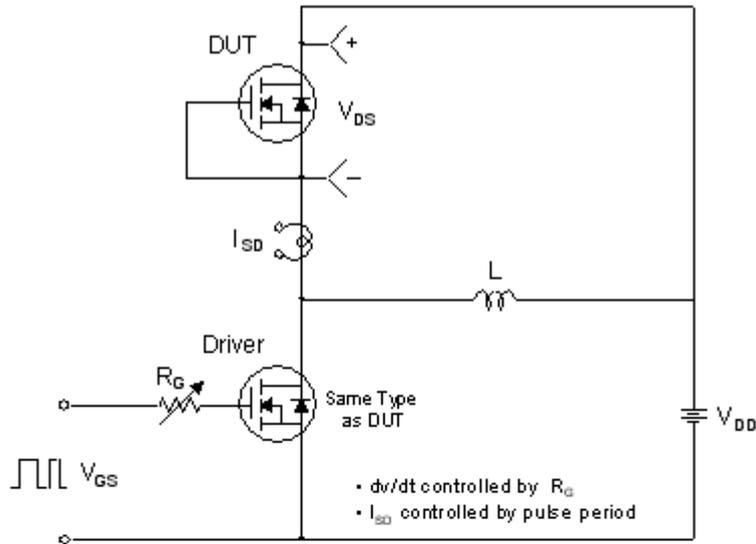
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

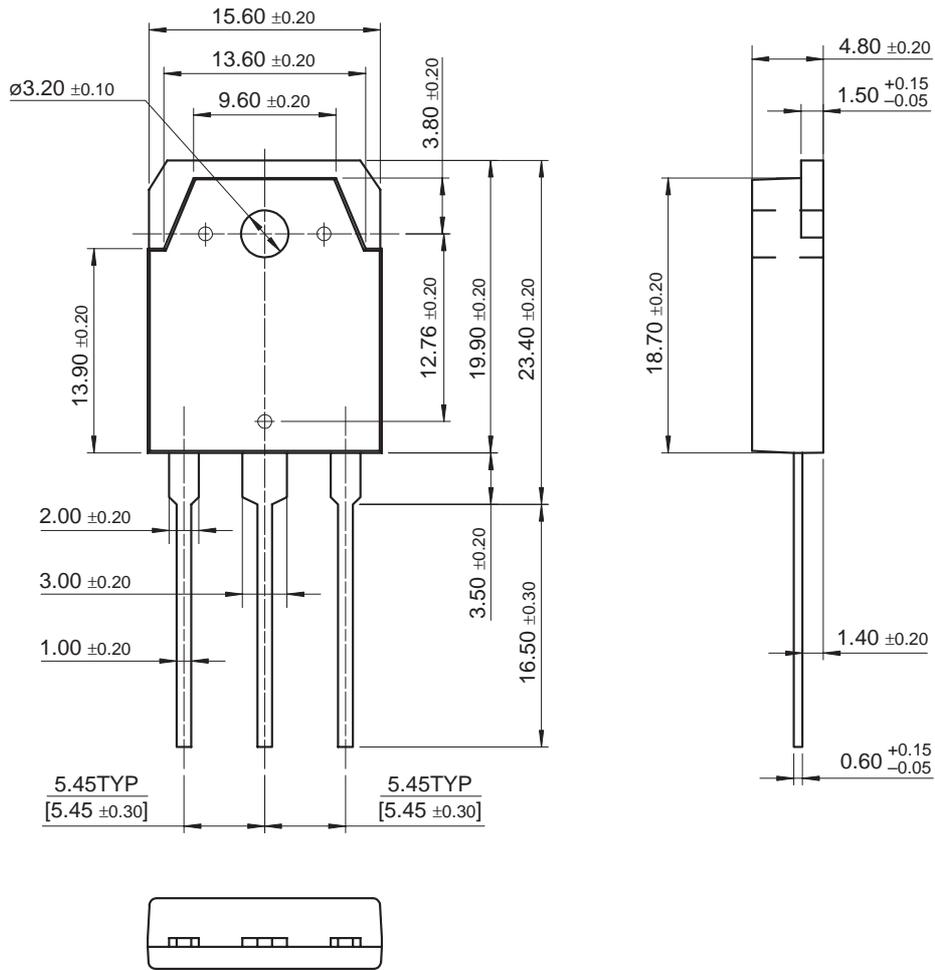


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

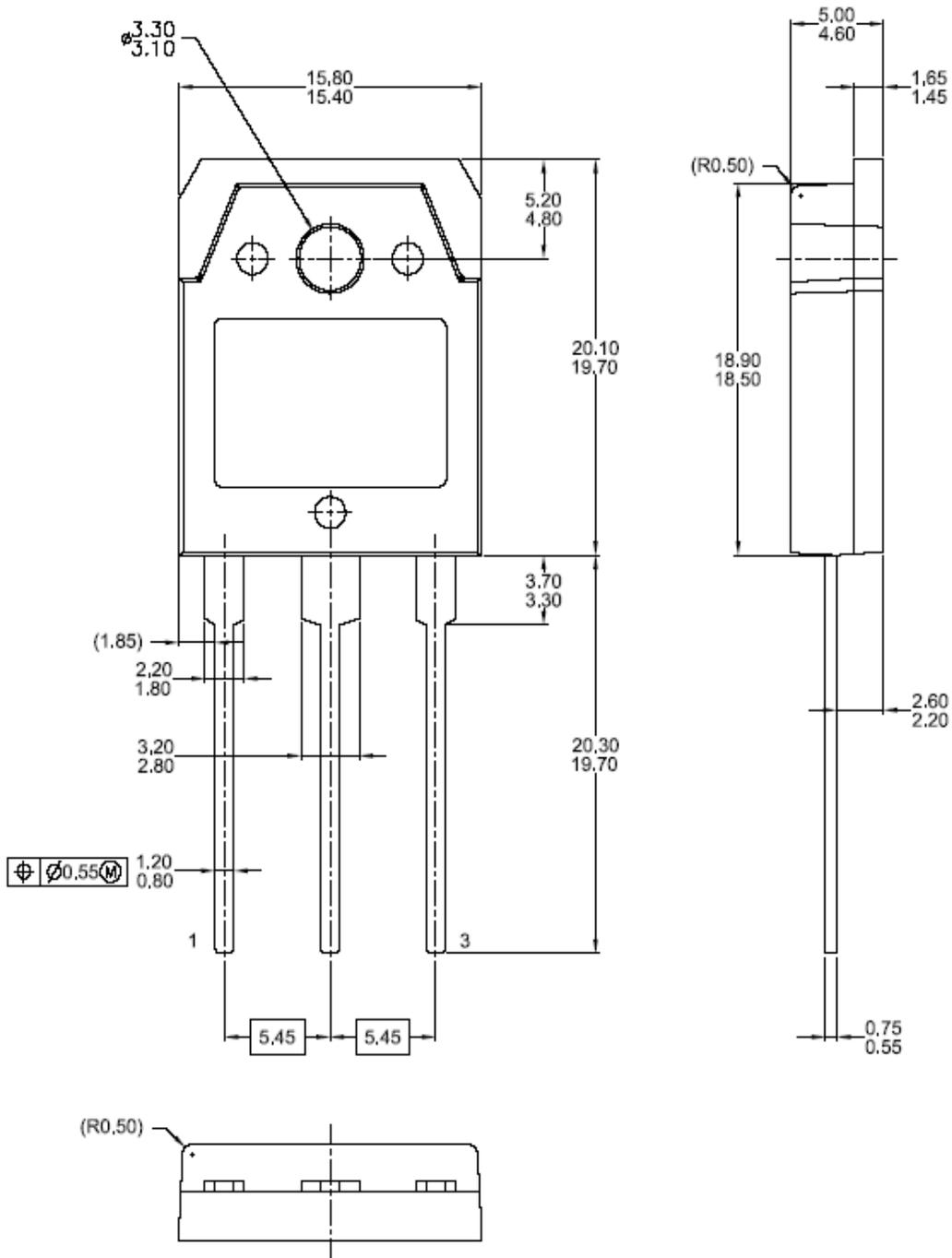
TO-3P



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-3PN



Dimensions in Millimeters



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Rev. 130