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August 2014

FQA38N30

N-Channel QFET[®] MOSFET

300 V, 38.4 A, 85 mΩ

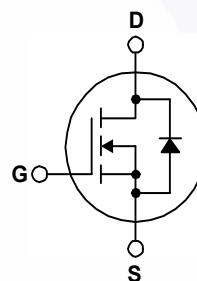
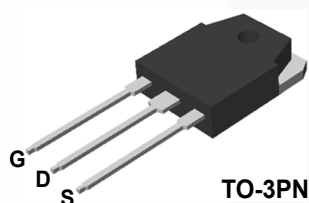
Features

- 38.4 A, 300 V, $R_{DS(on)} = 85 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 19.2 \text{ A}$
- Low Gate Charge (Typ. 90 nC)
- Low C_{rss} (Typ. 70 pF)
- 100% Avalanche Tested
- RoHS compliant

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 switch mode power supply, power factor correction, electronic lamp ballast based on half bridge.



Absolute Maximum Ratings

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

Symbol	Parameter	FQA38N30	Unit
V_{DSS}	Drain-Source Voltage	300	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	38.4	A
	- Continuous ($T_C = 100^\circ\text{C}$)	24.3	A
I_{DM}	Drain Current - Pulsed (Note 1)	153.6	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1500	mJ
I_{AR}	Avalanche Current (Note 1)	38.4	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	29	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	290	W
	- Derate above 25°C	2.33	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	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.43	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ\text{C/W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQA38N30	FQA38N30	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	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	300	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.35	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 300\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 240\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
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

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 19.2\text{ A}$	--	0.065	0.085	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 19.2\text{ A}$	--	24	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	3380	4400	pF
C_{oss}	Output Capacitance		--	670	870	pF
C_{rss}	Reverse Transfer Capacitance		--	70	90	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 150\text{ V}, I_D = 38.4\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4)	--	80	170	ns
t_r	Turn-On Rise Time		--	430	870	ns
$t_{d(off)}$	Turn-Off Delay Time		--	170	350	ns
t_f	Turn-Off Fall Time		--	190	390	ns
Q_g	Total Gate Charge	$V_{DS} = 240\text{ V}, I_D = 38.4\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4)	--	90	120	nC
Q_{gs}	Gate-Source Charge		--	23	--	nC
Q_{gd}	Gate-Drain Charge		--	44	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	38.4	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	153.6	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 38.4 A	--	--	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 38.4 A, dI _F / dt = 100 A/μs	--	300	--	ns
Q _{rr}	Reverse Recovery Charge		--	2.85	--	μC

Notes :

1. Repetitive rating : pulse width limited by maximum junction temperature.
2. $L = 1.7\text{ mH}$, $I_{AS} = 38.4\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 38.4\text{ A}$, $dI/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Characteristics

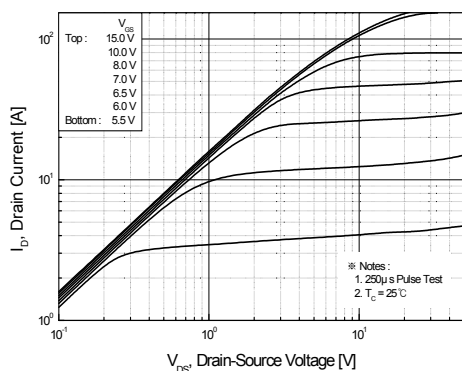


Figure 1. On-Region Characteristics

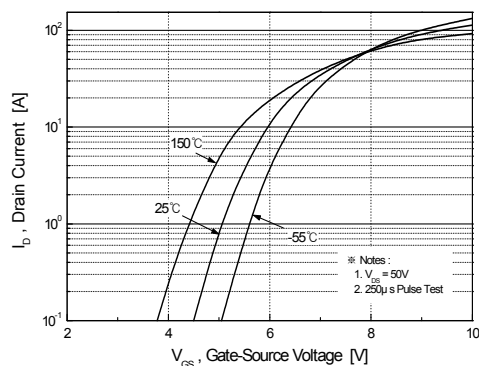


Figure 2. Transfer Characteristics

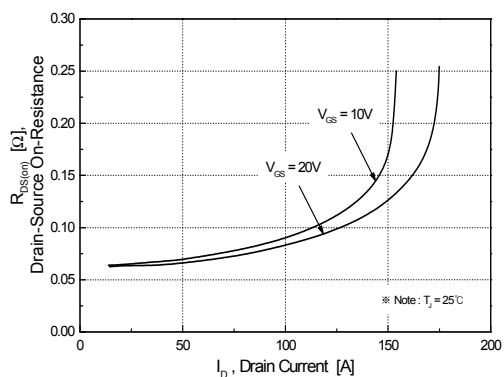


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

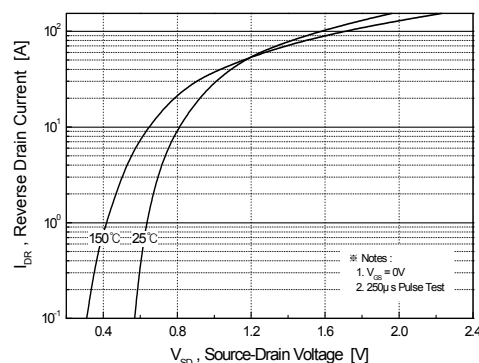


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

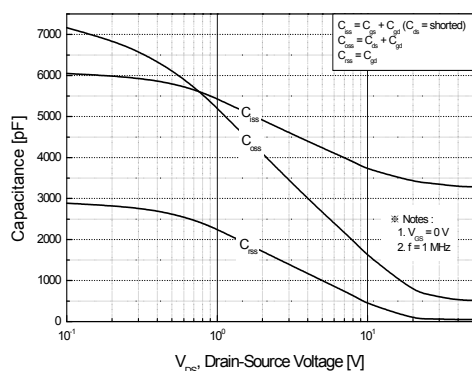


Figure 5. Capacitance Characteristics

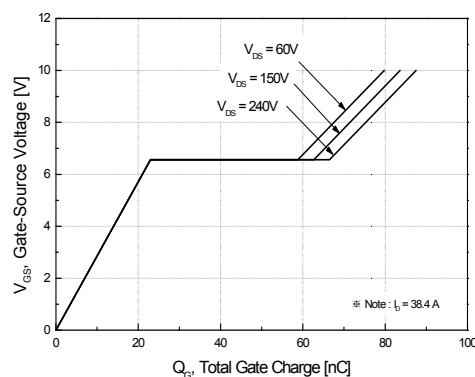


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

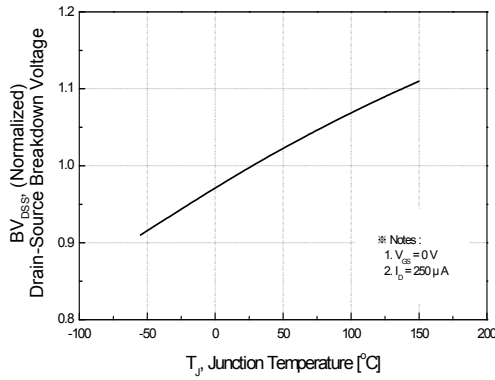


Figure 7. Breakdown Voltage Variation vs. Temperature

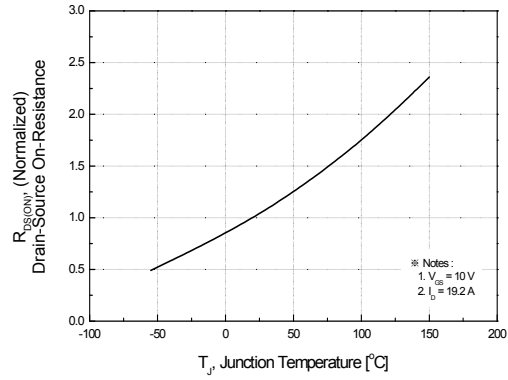


Figure 8. On-Resistance Variation vs. Temperature

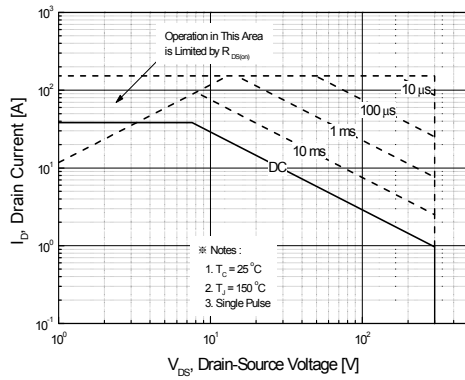


Figure 9. Maximum Safe Operating Area

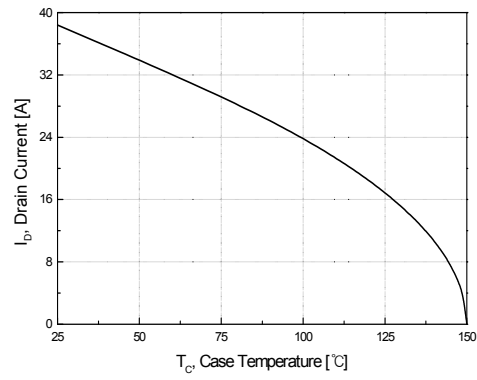


Figure 10. Maximum Drain Current vs. Case Temperature

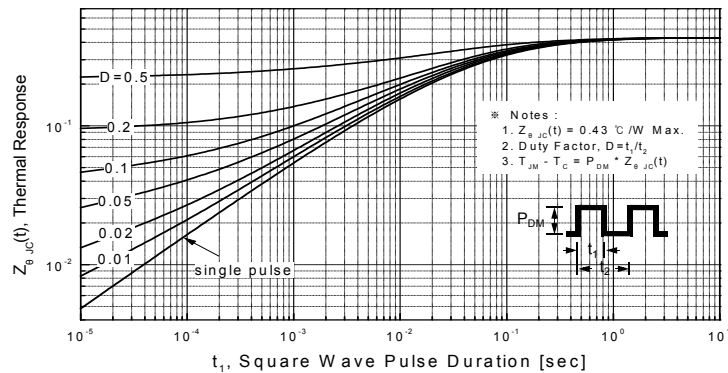


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform

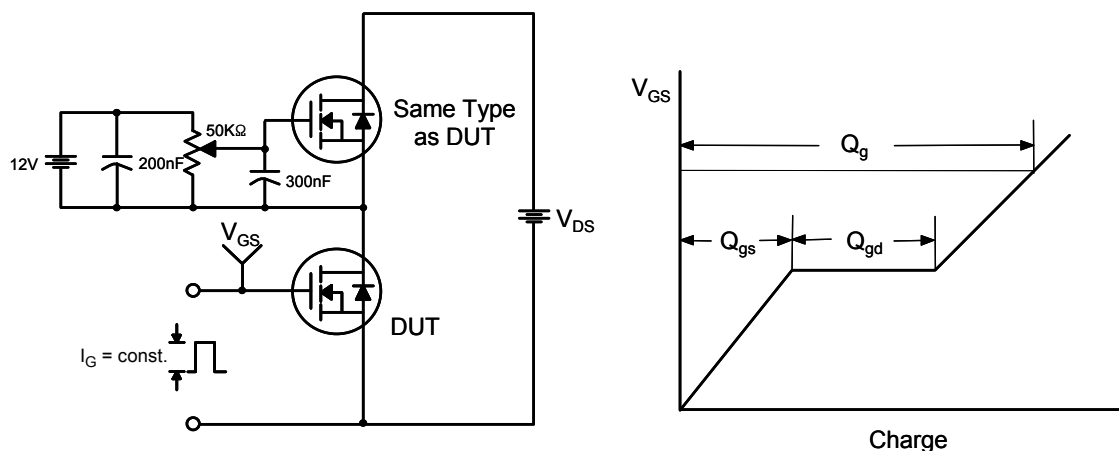


Figure 13. Resistive Switching Test Circuit & Waveforms

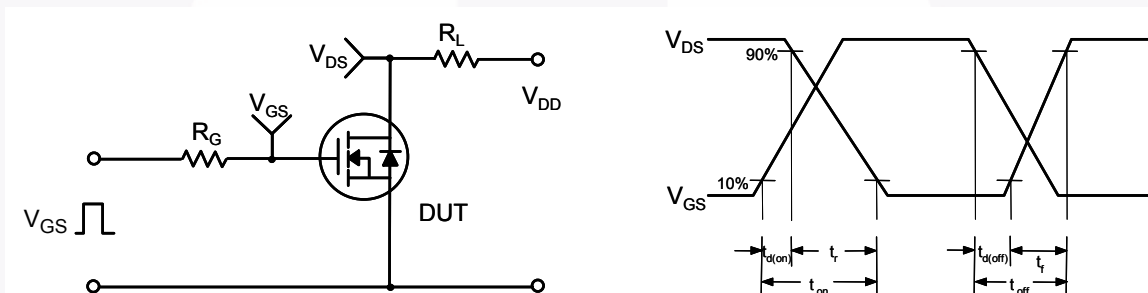


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

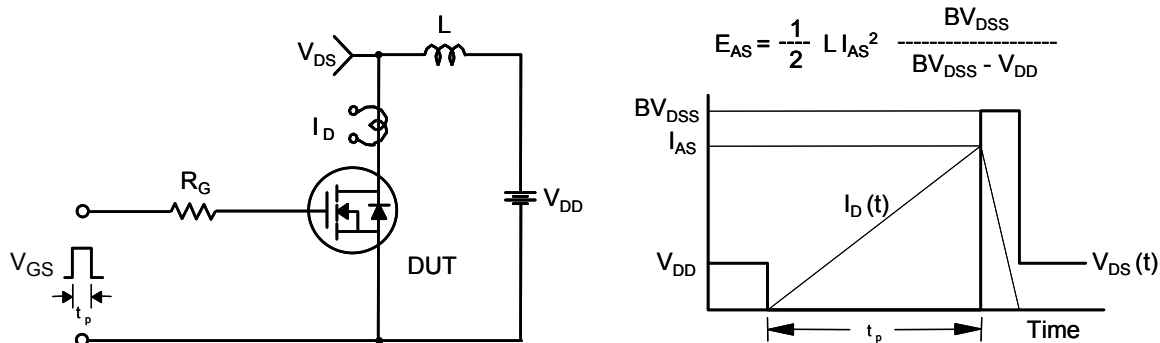
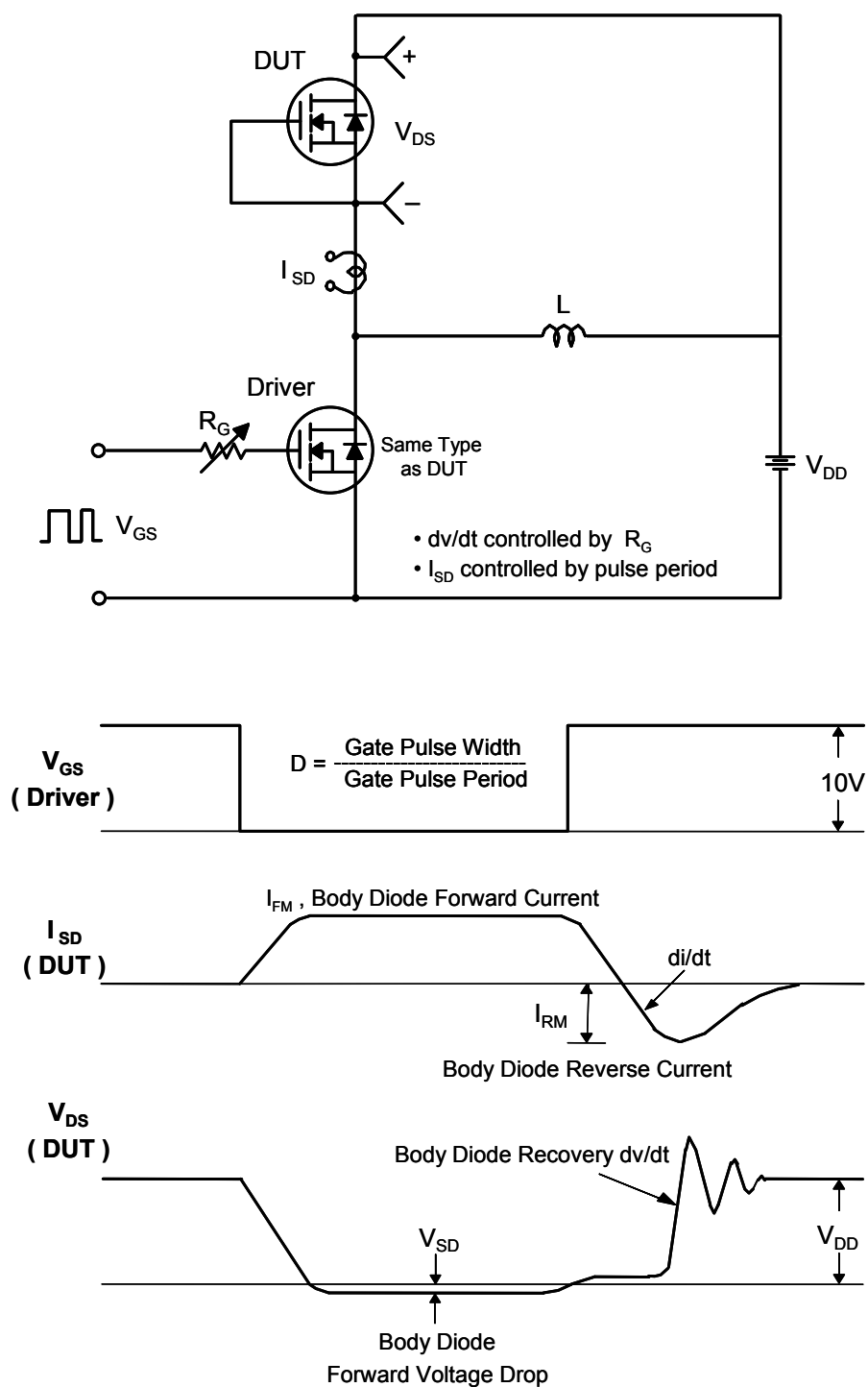
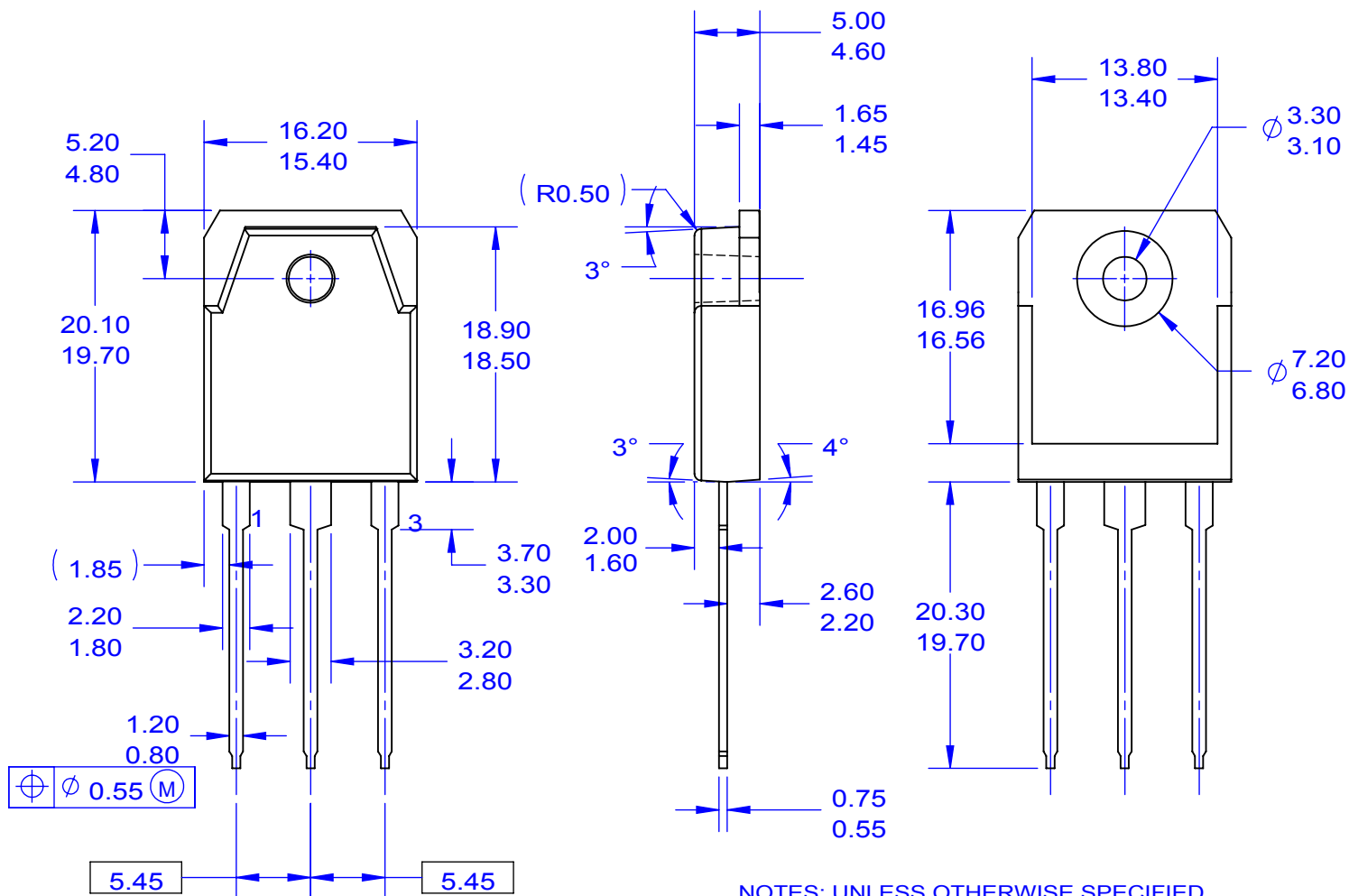


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms





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