



April 2000

QFET™

FQP140N03L

30V LOGIC N-Channel MOSFET

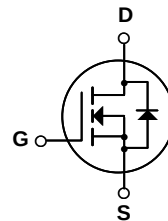
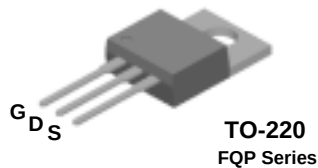
General Description

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 low voltage applications such as DC/DC converters, high efficiency switching for power management in portable and battery operated products.

Features

- 140A, 30V, $R_{DS(on)} = 0.0045\Omega$ @ $V_{GS} = 10V$
- Low gate charge (typical 73 nC)
- Low C_{rss} (typical 580 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- 175°C maximum junction temperature rating



Absolute Maximum Ratings

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

Symbol	Parameter	FQP140N03L	Units
V_{DSS}	Drain-Source Voltage	30	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) (Note 6)	140	A
	- Continuous ($T_C = 100^\circ\text{C}$) (Note 6)	99	A
I_{DM}	Drain Current - Pulsed (Note 1)	490	A
V_{GSS}	Gate-Source Voltage	± 20	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	710	mJ
I_{AR}	Avalanche Current (Note 1)	140	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	18	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	7.0	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	180	W
	- Derate above 25°C	1.2	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.84	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C}/\text{W}$

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.03	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 24\text{ V}, T_C = 150^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0	--	2.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 70\text{ A}$	--	0.0038	0.0045	Ω
		$V_{GS} = 5\text{ V}, I_D = 70\text{ A}$	--	0.005	0.006	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 70\text{ A}$ (Note 4)	--	85	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	3400	4420	pF
C_{oss}	Output Capacitance		--	2090	2720	pF
C_{rss}	Reverse Transfer Capacitance		--	580	755	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 70\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4, 5)	--	60	130	ns
t_r	Turn-On Rise Time		--	770	1500	ns
$t_{d(off)}$	Turn-Off Delay Time		--	25	60	ns
t_f	Turn-Off Fall Time		--	250	510	ns
Q_g	Total Gate Charge	$V_{DS} = 24\text{ V}, I_D = 140\text{ A},$ $V_{GS} = 5\text{ V}$ (Note 4, 5)	--	73	95	nC
Q_{gs}	Gate-Source Charge		--	29.5	--	nC
Q_{gd}	Gate-Drain Charge		--	38.5	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	140	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	490	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 140 A	--	--	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 140 A, dI _F / dt = 100 A/μs (Note 4)	--	70	--	ns
Q _{rr}	Reverse Recovery Charge		--	105	--	nC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 36\text{ }\mu\text{H}$, $I_{AS} = 140\text{ A}$, $V_{DD} = 15\text{ V}$, $R_G = 25\text{ }\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 140\text{ A}$, $di/dt \leq 300\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width $\leq 300\text{ }\mu\text{s}$, Duty cycle $\leq 2\%$
5. Essentially independent of operating temperature
6. Continuous Drain Current Calculated by Maximum Junction Temperature : Limited by Package

Typical Characteristics

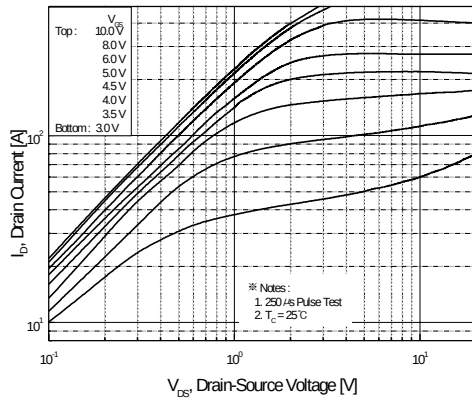


Figure 1. On-Region Characteristics

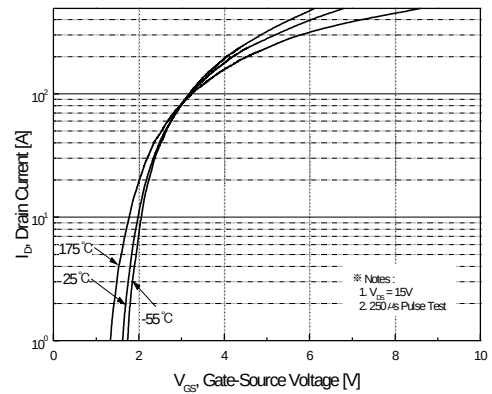


Figure 2. Transfer Characteristics

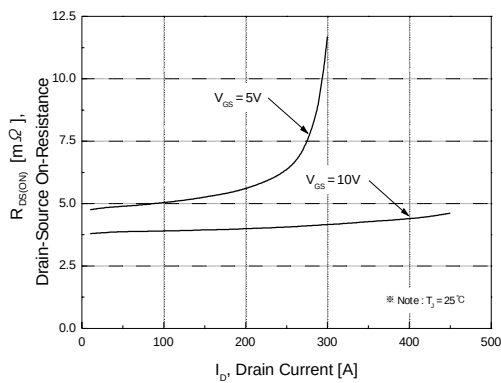


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

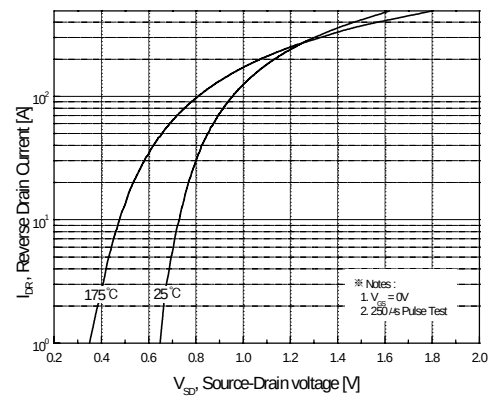


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

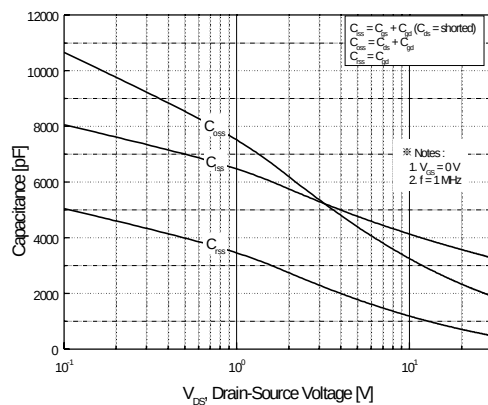


Figure 5. Capacitance Characteristics

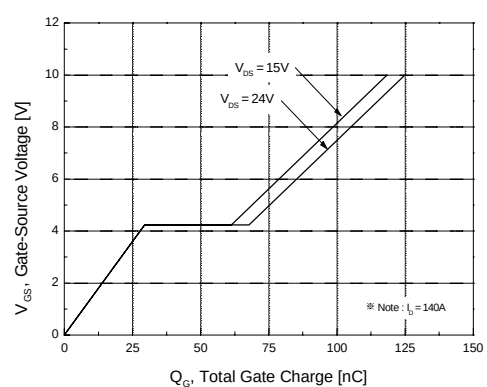


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

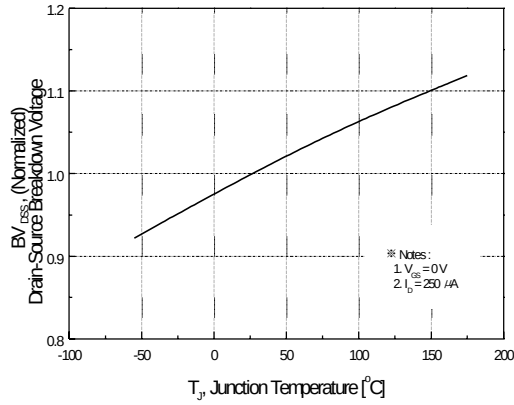


Figure 7. Breakdown Voltage Variation vs. Temperature

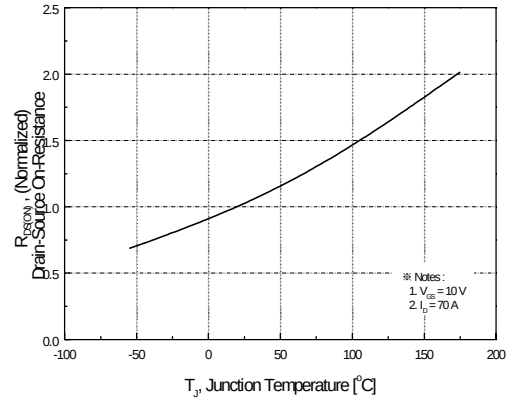


Figure 8. On-Resistance Variation vs. Temperature

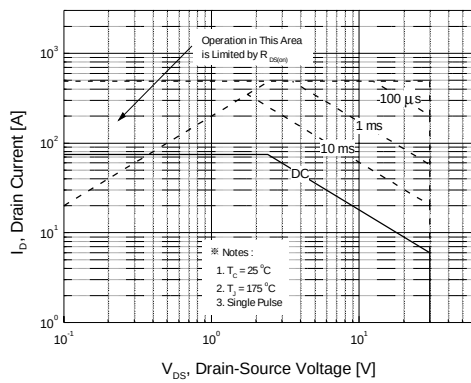


Figure 9. Maximum Safe Operating Area

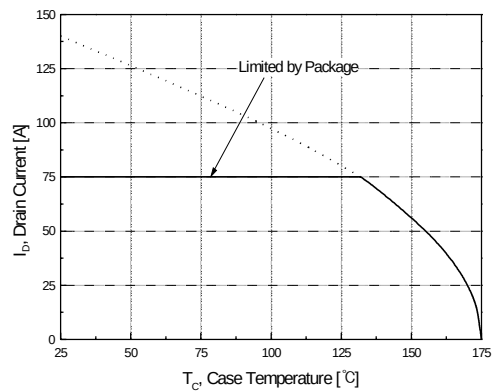


Figure 10. Maximum Drain Current vs. Case Temperature

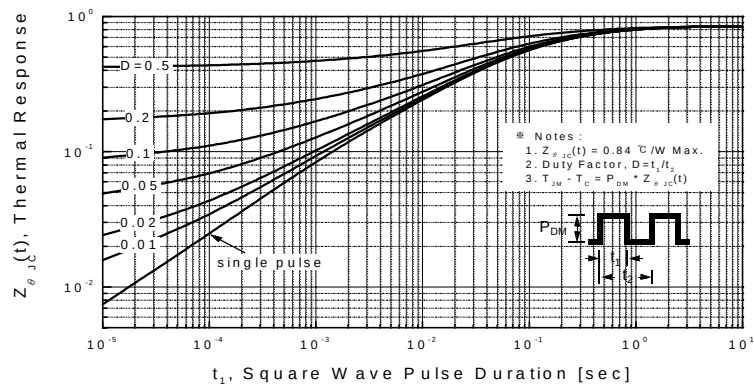
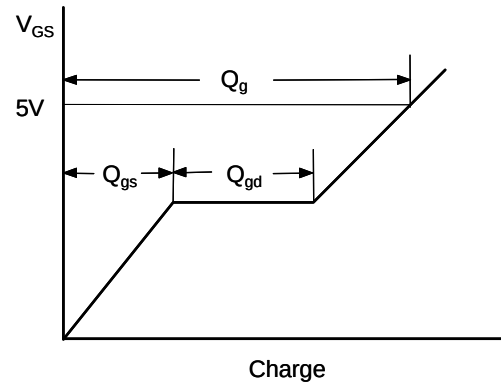
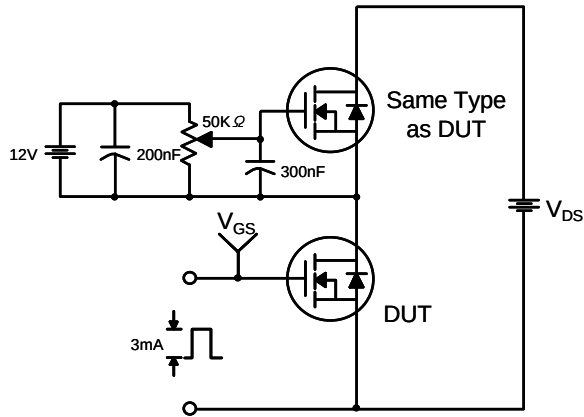
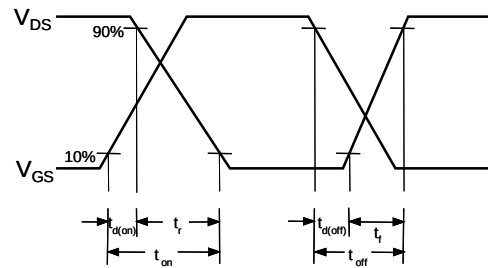
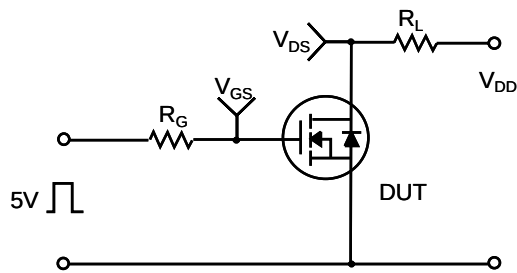


Figure 11. Transient Thermal Response Curve

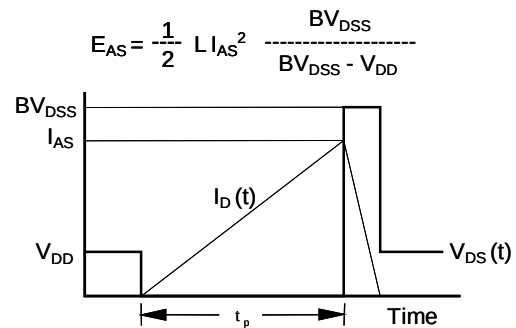
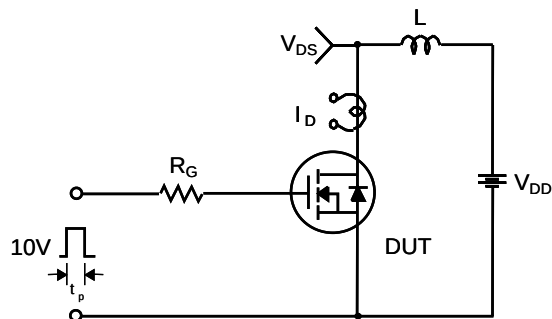
Gate Charge Test Circuit & Waveform



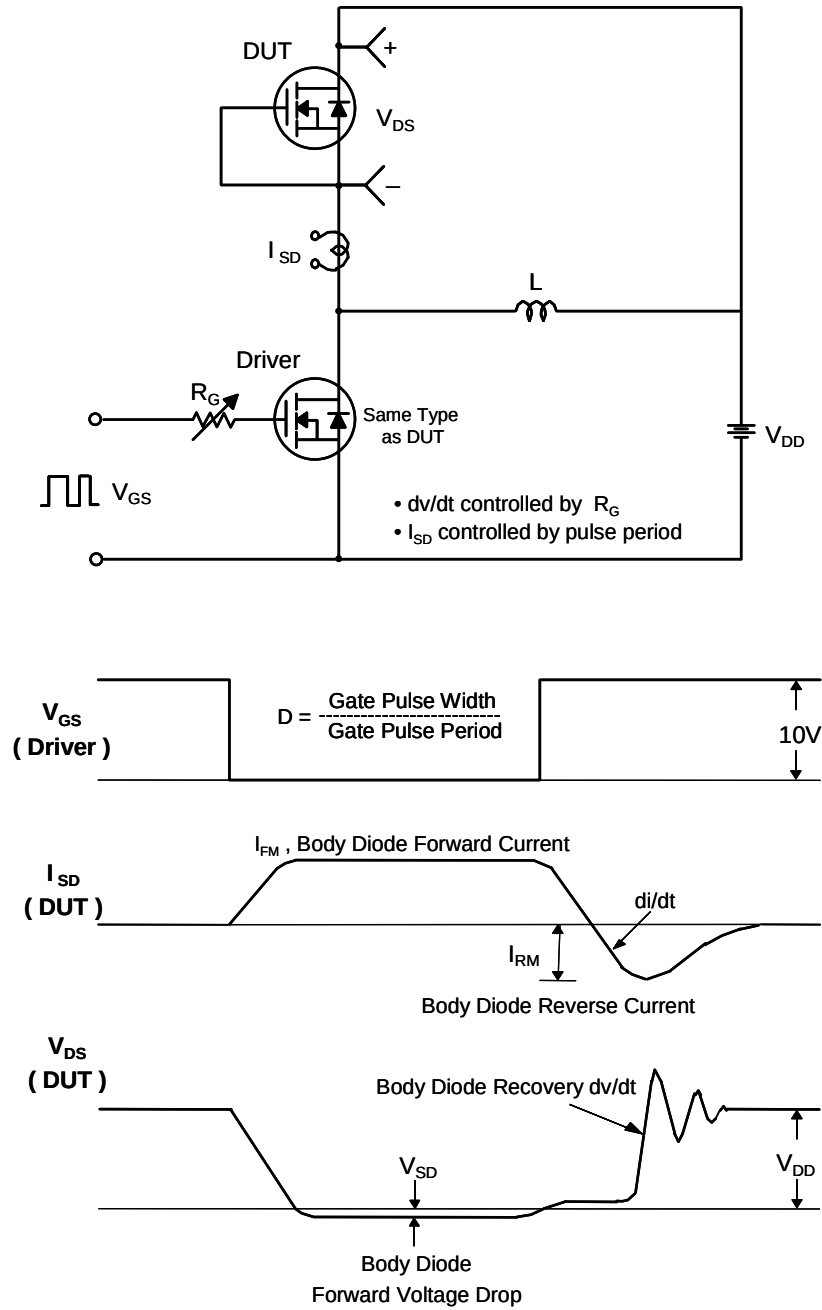
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

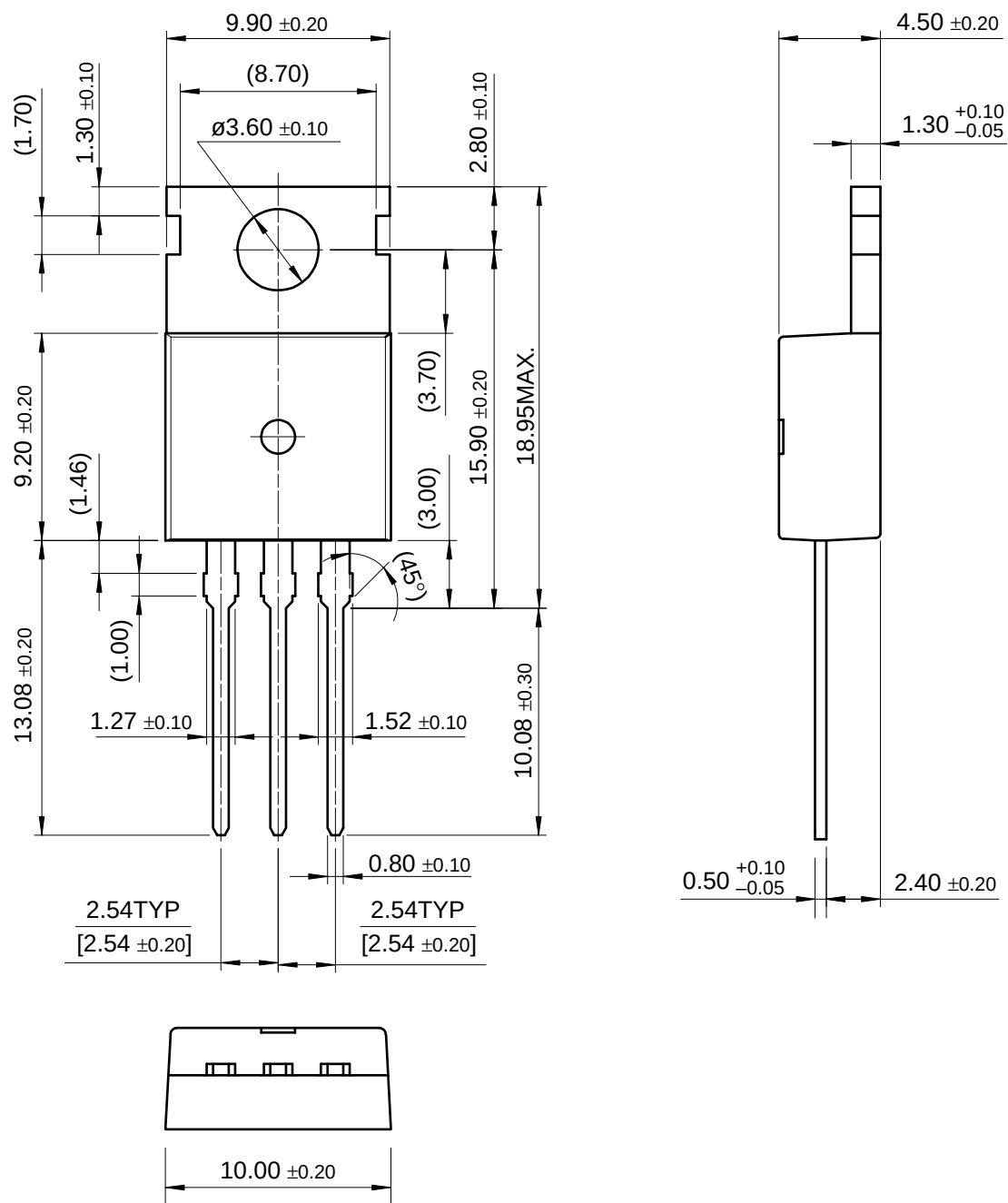


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

TO-220



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