

FQP32N12V2/FQPF32N12V2

120V N-Channel MOSFET

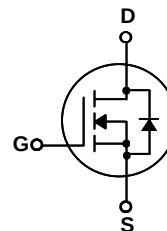
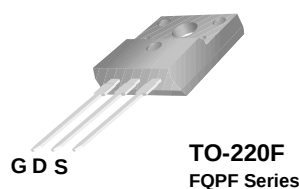
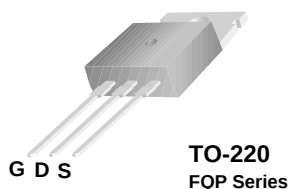
General Description

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 DC to DC converters, synchronous rectification, and other applications lowest Rds(on) is required.

Features

- 32 A, 120V, $R_{DS(on)} = 0.05\Omega$ @ $V_{GS} = 10$ V
- Low gate charge (typical 41 nC)
- Low Crss (typical 70 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



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

Symbol	Parameter	FQP32N12V2	FQPF32N12V2	Units
V_{DSS}	Drain-Source Voltage	120		V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	32	32 *	A
	- Continuous ($T_C = 100^\circ\text{C}$)	23	23 *	A
I_{DM}	Drain Current - Pulsed (Note 1)	128	128 *	A
V_{GSS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	439		mJ
I_{AR}	Avalanche Current (Note 1)	32		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	15		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	150	50	W
	- Derate above 25°C	1	0.33	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		$^\circ\text{C}$

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FQP32N12V2	FQPF32N12V2	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.0	3.0	$^\circ\text{C/W}$
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	40	--	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C/W}$

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	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	120	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.14	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 96\text{ V}, T_C = 150^\circ\text{C}$	--	--	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	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 16\text{ A}$	--	0.043	0.05	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 16\text{ A}$ (Note 4)	--	25	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1430	1860	pF
C_{oss}	Output Capacitance		--	310	405	pF
C_{rss}	Reverse Transfer Capacitance		--	70	90	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 60\text{ V}, I_D = 32\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4, 5)	--	16	42	ns
t_r	Turn-On Rise Time		--	190	390	ns
$t_{d(off)}$	Turn-Off Delay Time		--	114	238	ns
t_f	Turn-Off Fall Time		--	158	326	ns
Q_g	Total Gate Charge	$V_{DS} = 96\text{ V}, I_D = 32\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4, 5)	--	41	53	nC
Q_{gs}	Gate-Source Charge		--	8	--	nC
Q_{gd}	Gate-Drain Charge		--	18	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	32	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	128	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 32 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 32 A, dI _F / dt = 100 A/μs (Note 4)	--	123	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.54	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 0.5\text{ mH}$, $I_{AS} = 32\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 32\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
5. Essentially independent of operating temperature

Typical Characteristics

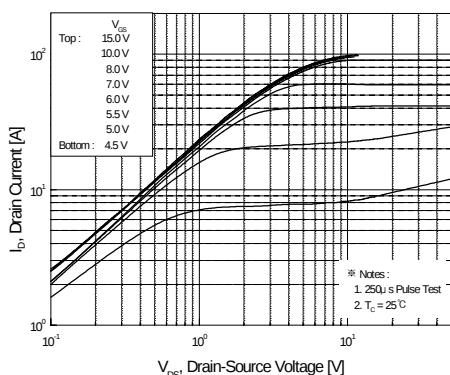


Figure 1. On-Region Characteristics

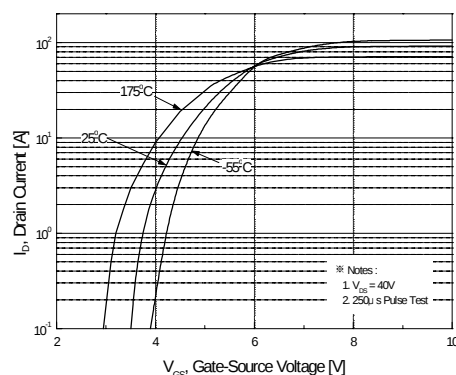


Figure 2. Transfer Characteristics

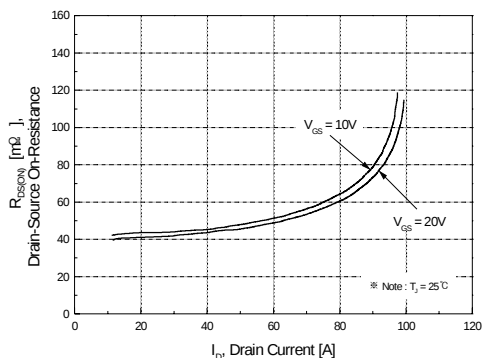


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

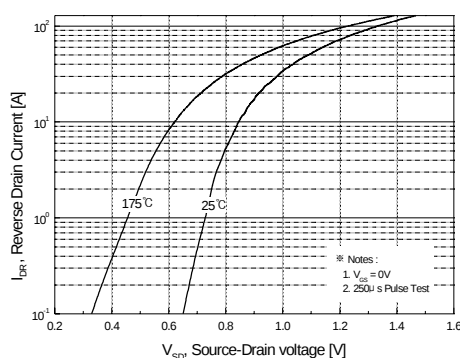


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

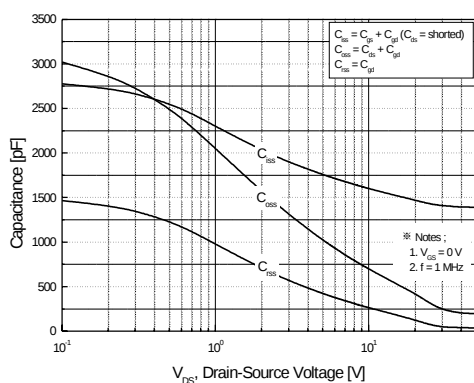


Figure 5. Capacitance Characteristics

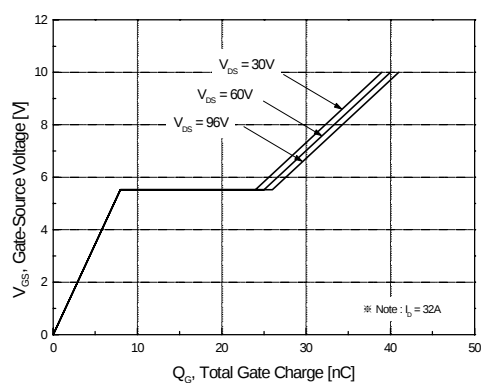


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

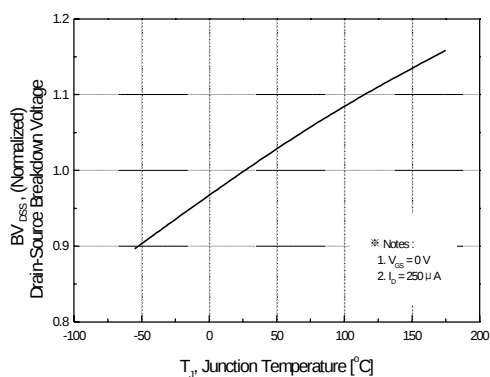


Figure 7. Breakdown Voltage Variation vs Temperature

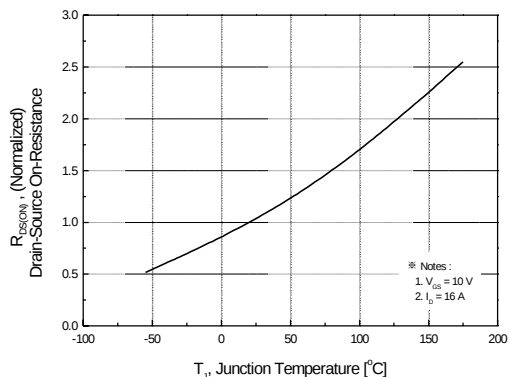


Figure 8. On-Resistance Variation vs Temperature

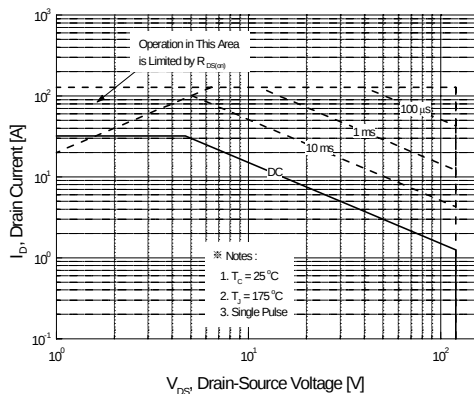


Figure 9-1. Maximum Safe Operating Area for FQP32N12V2

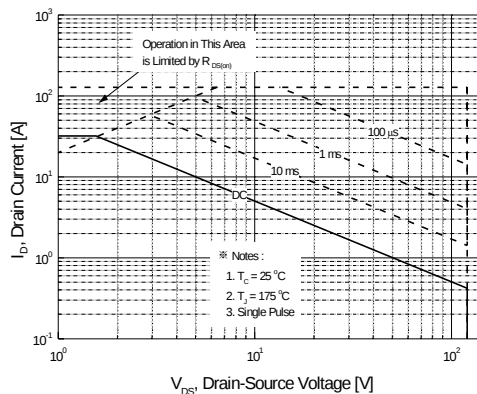


Figure 9-2. Maximum Safe Operating Area for FQPF32N12V2

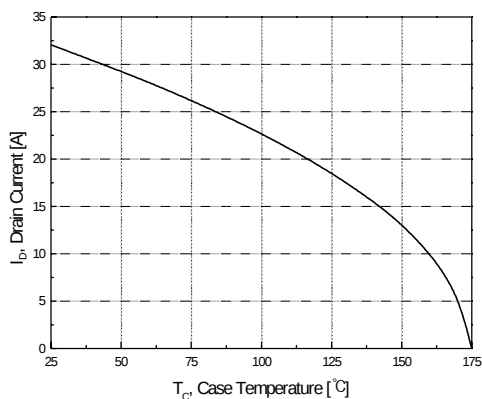


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (Continued)

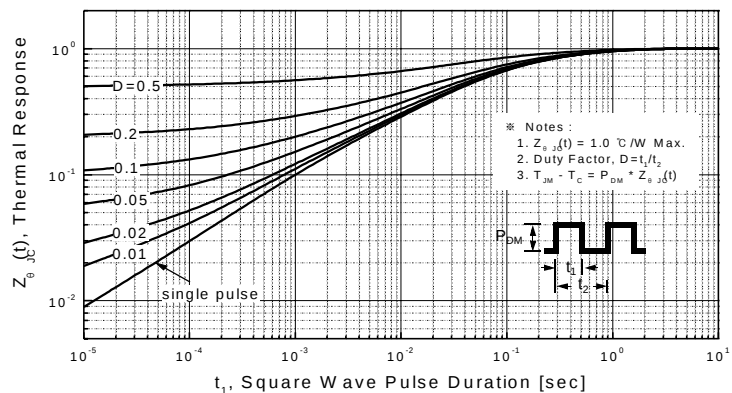


Figure 11-1. Transient Thermal Response Curve for FQP32N12V2

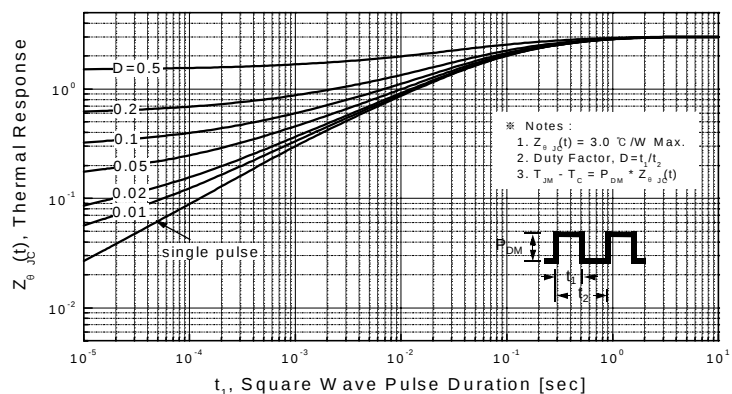


Figure 11-2. Transient Thermal Response Curve for FQPF32N12V2

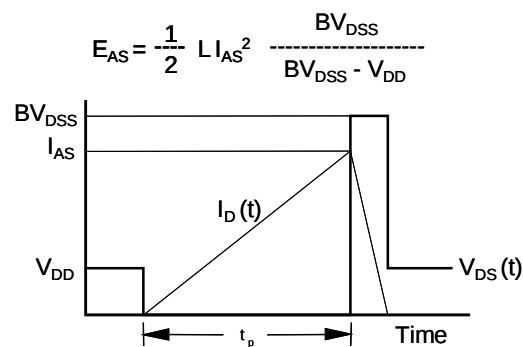
Gate Charge Test Circuit & Waveform

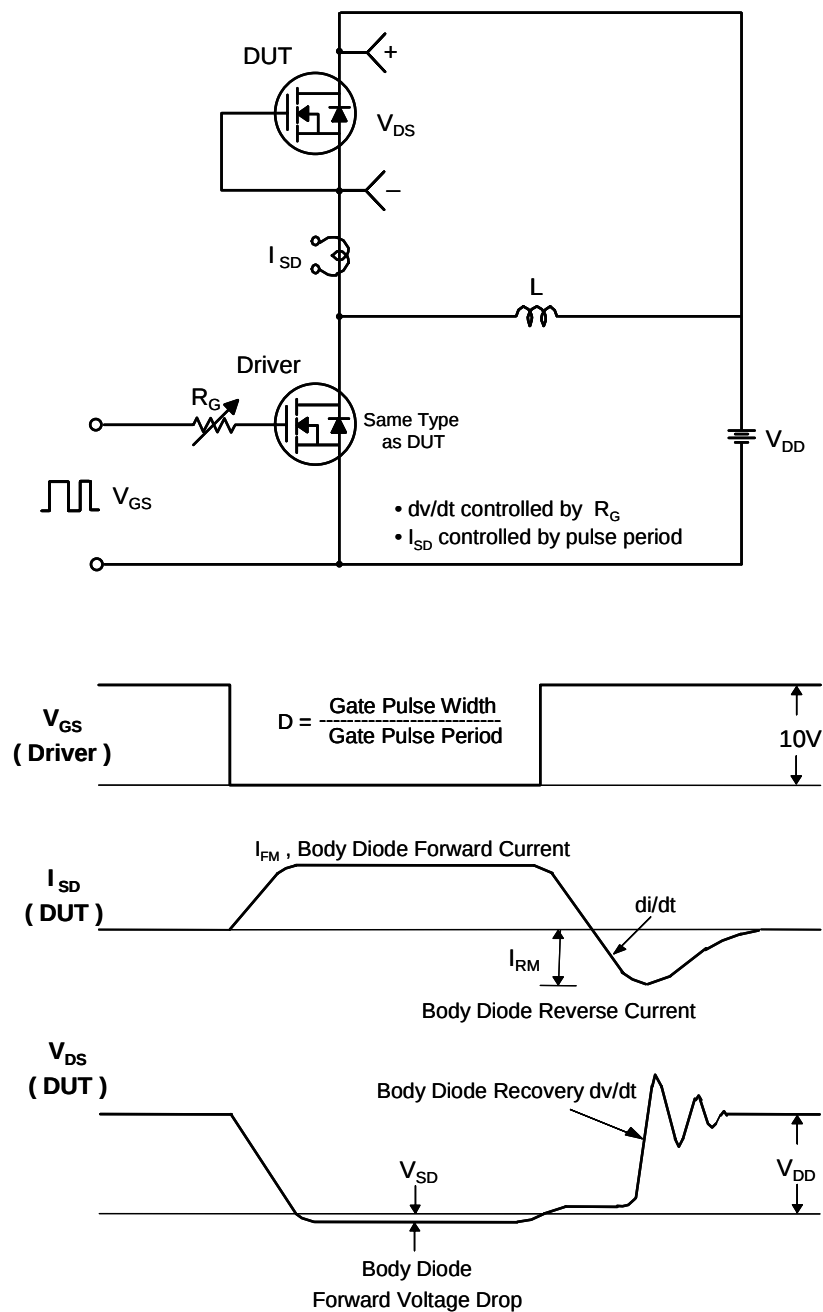


Resistive Switching Test Circuit & Waveforms



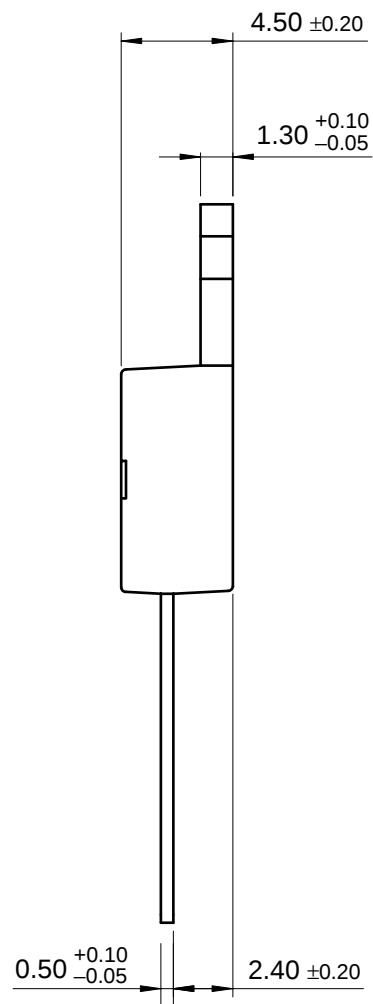
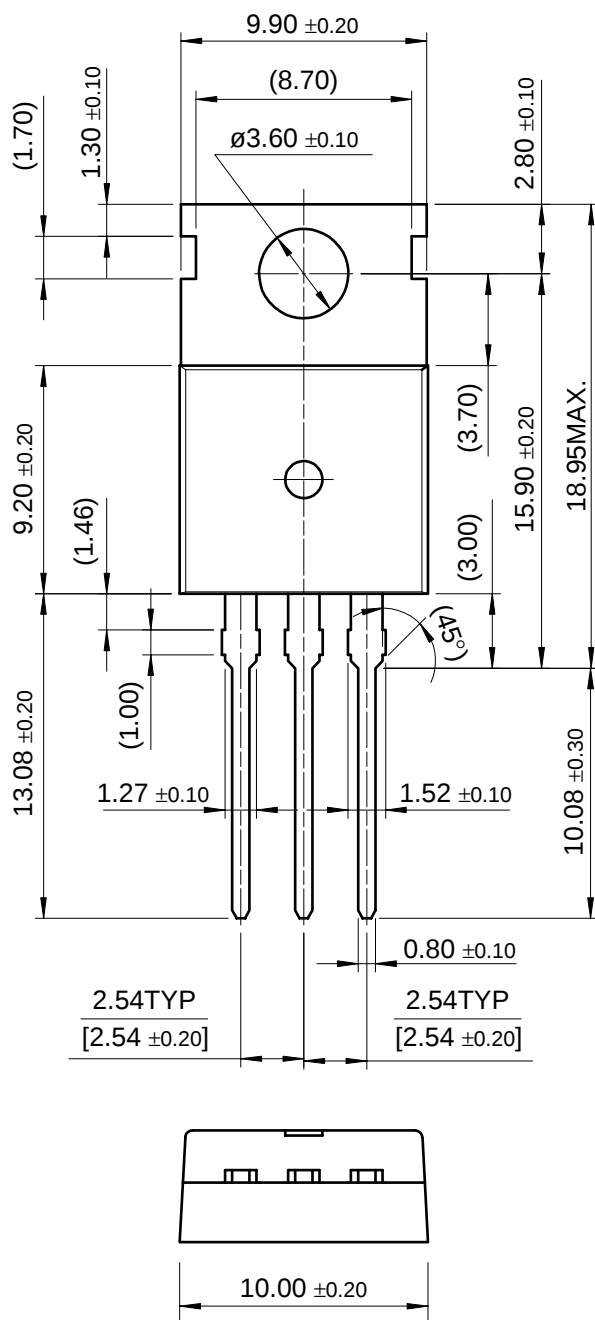
Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms

Package Dimensions

TO-220



Dimensions in Millimeters

Package Dimensions (Continued)

TO-220F



Dimensions in Millimeters

FQP32N12V2/FQPF32N12V2

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