FAIRCHILD
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FQP4N90C / FQPF4N90C

N-Channel QFET MOSFET

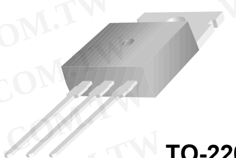
900 V, 4.0 A, 4.2 Ω

Description

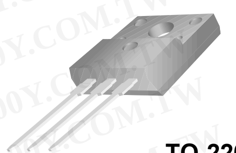
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor®'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

Features

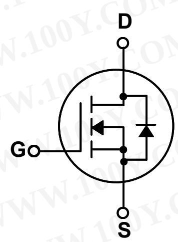
- 4.0 A, 900 V, $R_{DS(on)}$ = 4.2 Ω (Max) @V_{GS} = 10 V, I_D = 2.0 A
- Low Gate Charge (Typ. 17 nC)
- Low Crss (Typ. 5.6 pF)
- 100% Avalanche Tested



TO-220
FQP Series



TO-220F
FQPF Series



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		FQP4N90C	FQPF4N90C	Unit
V_{DSS}	Drain-Source Voltage		900		V
I_D	Drain Current - Continuous (T_C = 25°C)		4	4 *	A
	- Continuous (T_C = 100°C)		2.3	2.3 *	A
I_{DM}	Drain Current - Pulsed	(Note 1)	16	16 *	A
V_{GSS}	Gate-Source Voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	570		mJ
I_{AR}	Avalanche Current	(Note 1)	4		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	14		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation (T_C = 25°C)		140	47	W
	- Derate above 25°C		1.12	0.38	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

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FQP4N90C	FQPF4N90C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.89	2.66	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	900	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	1.05	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 900 V, V_{GS} = 0 V	--	--	10	μA
		V_{DS} = 720 V, T_C = 125°C	--	--	100	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 2 A	--	3.5	4.2	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 2 A (Note 4)	--	5	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	740	960	pF
C_{oss}	Output Capacitance		--	65	85	pF
C_{rss}	Reverse Transfer Capacitance		--	5.6	7.3	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 450 V, I_D = 4 A, R_G = 25 Ω (Note 4, 5)	--	25	60	ns
t_r	Turn-On Rise Time		--	50	110	ns
$t_{d(off)}$	Turn-Off Delay Time		--	40	90	ns
t_f	Turn-Off Fall Time		--	35	80	ns
Q_g	Total Gate Charge	V_{DS} = 720 V, I_D = 4 A, V_{GS} = 10 V (Note 4, 5)	--	17	22	nC
Q_{gs}	Gate-Source Charge		--	4.5	--	nC
Q_{gd}	Gate-Drain Charge		--	7.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	4	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	16	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 4 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 4 A, dI_F / dt = 100 A/μs (Note 4)	--	450	--	ns
Q_{rr}	Reverse Recovery Charge		--	3.5	--	μC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 67 mH, I_{AS} = 4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \le$ 4A, di/dt $\le$ 200A/μs, $V_{DD} \le BV_{DSS,}$ Starting T_J = 25°C
4. Pulse Test : Pulse width $\le$ 300μs, Duty cycle $\le$ 2%
5. Essentially independent of operating temperature

Typical Characteristics

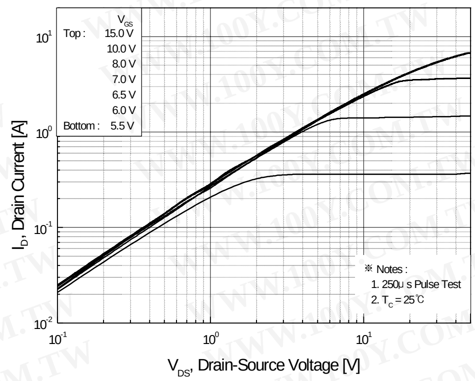


Figure 1. On-Region Characteristics

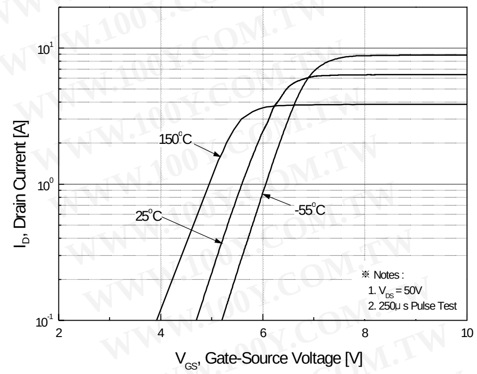


Figure 2. Transfer Characteristics

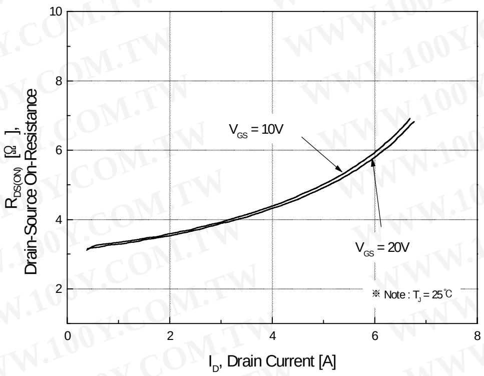


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

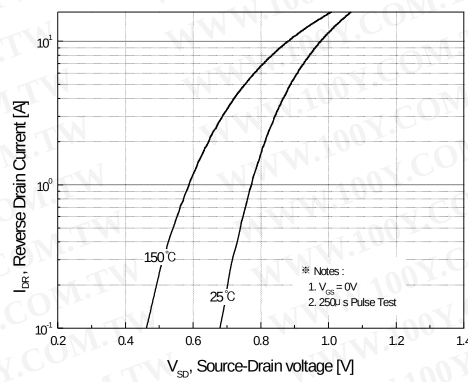


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

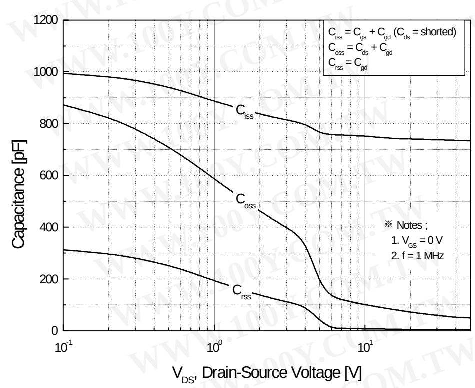


Figure 5. Capacitance Characteristics

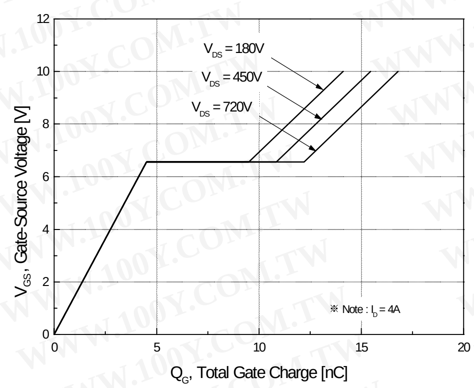


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

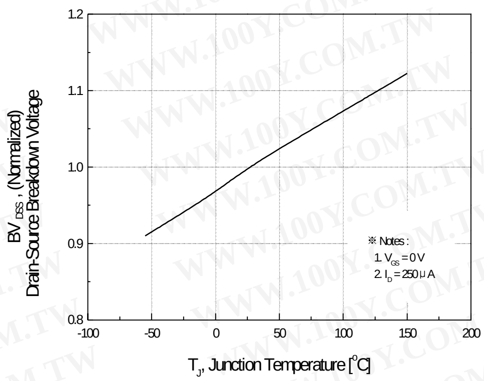


Figure 7. Breakdown Voltage Variation vs Temperature

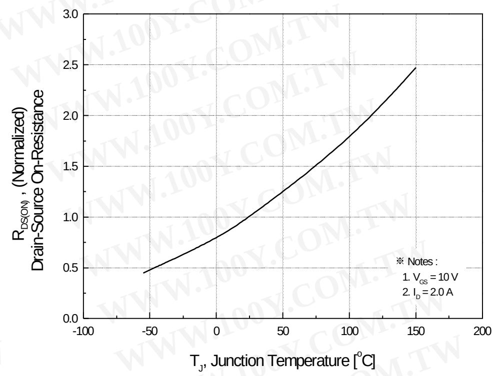


Figure 8. On-Resistance Variation vs Temperature

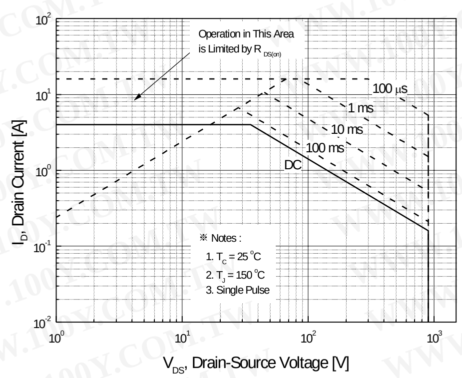


Figure 9-1. Maximum Safe Operating Area for FQP4N90C

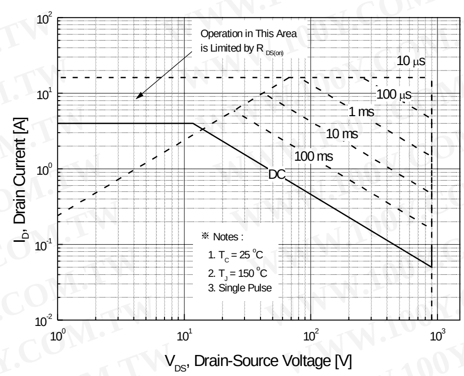


Figure 9-2. Maximum Safe Operating Area for FQPF4N90C

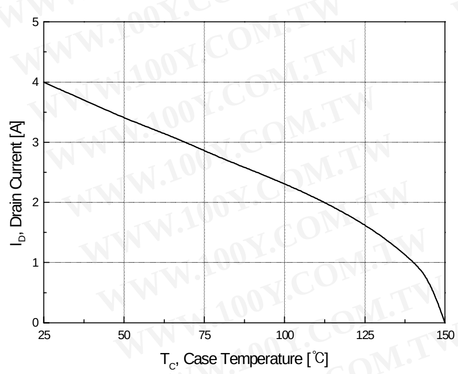


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (Continued)

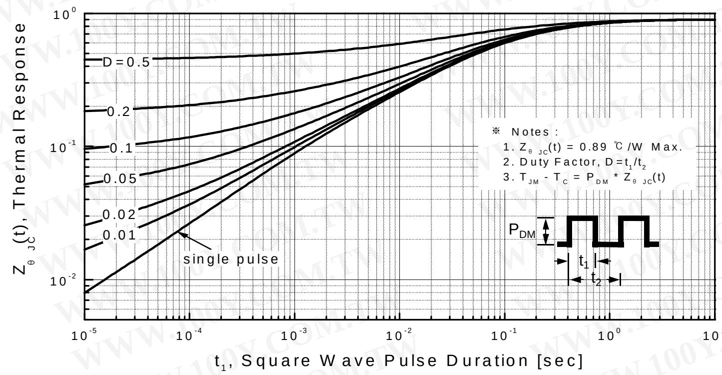


Figure 11-1. Transient Thermal Response Curve for FQP4N90C

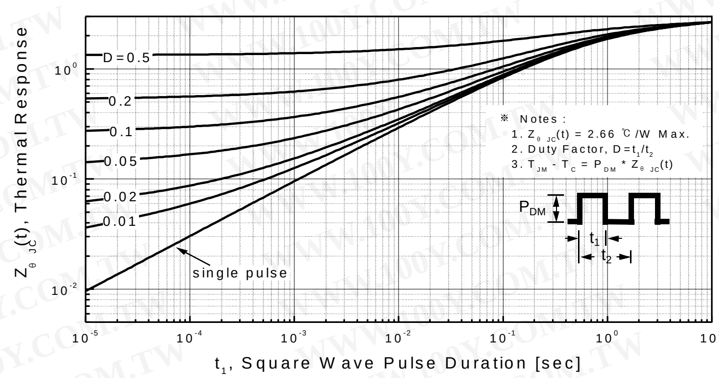
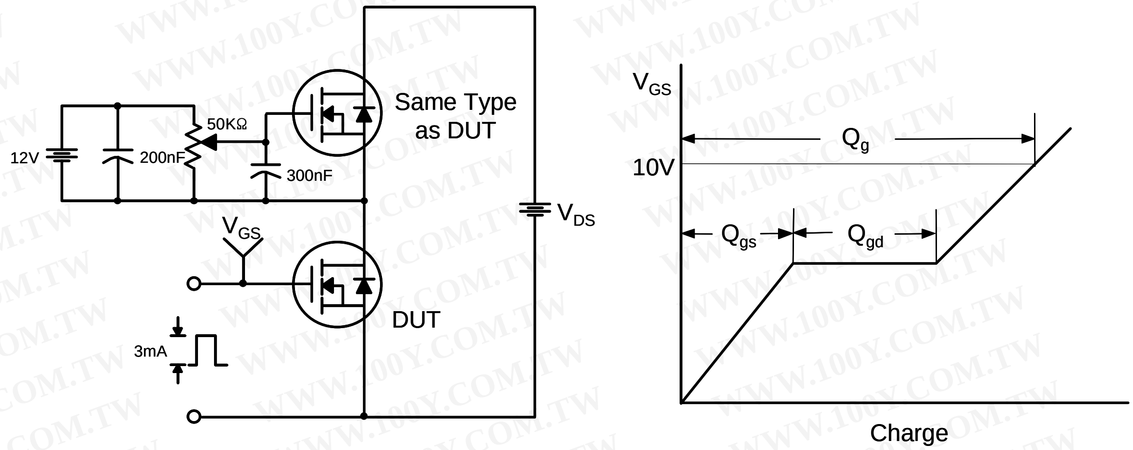
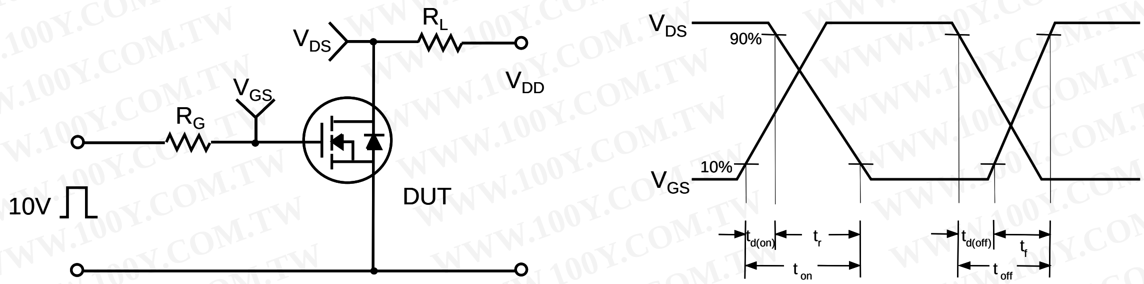


Figure 11-2. Transient Thermal Response Curve for FQPF4N90C

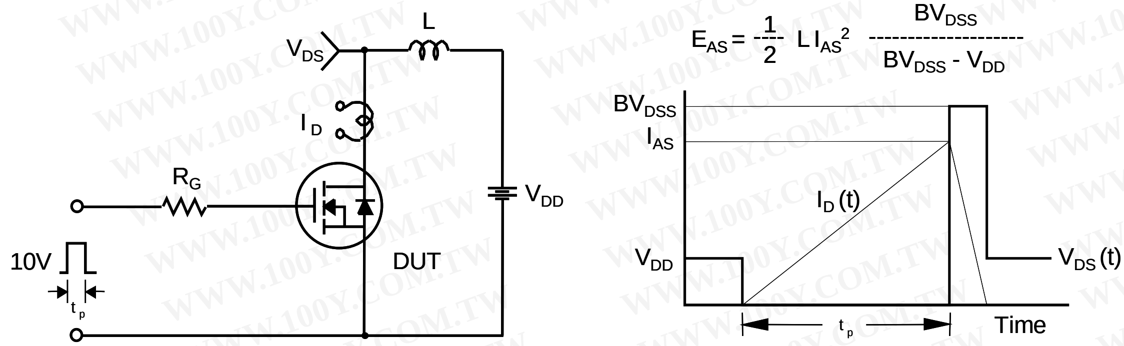
Gate Charge Test Circuit & Waveform



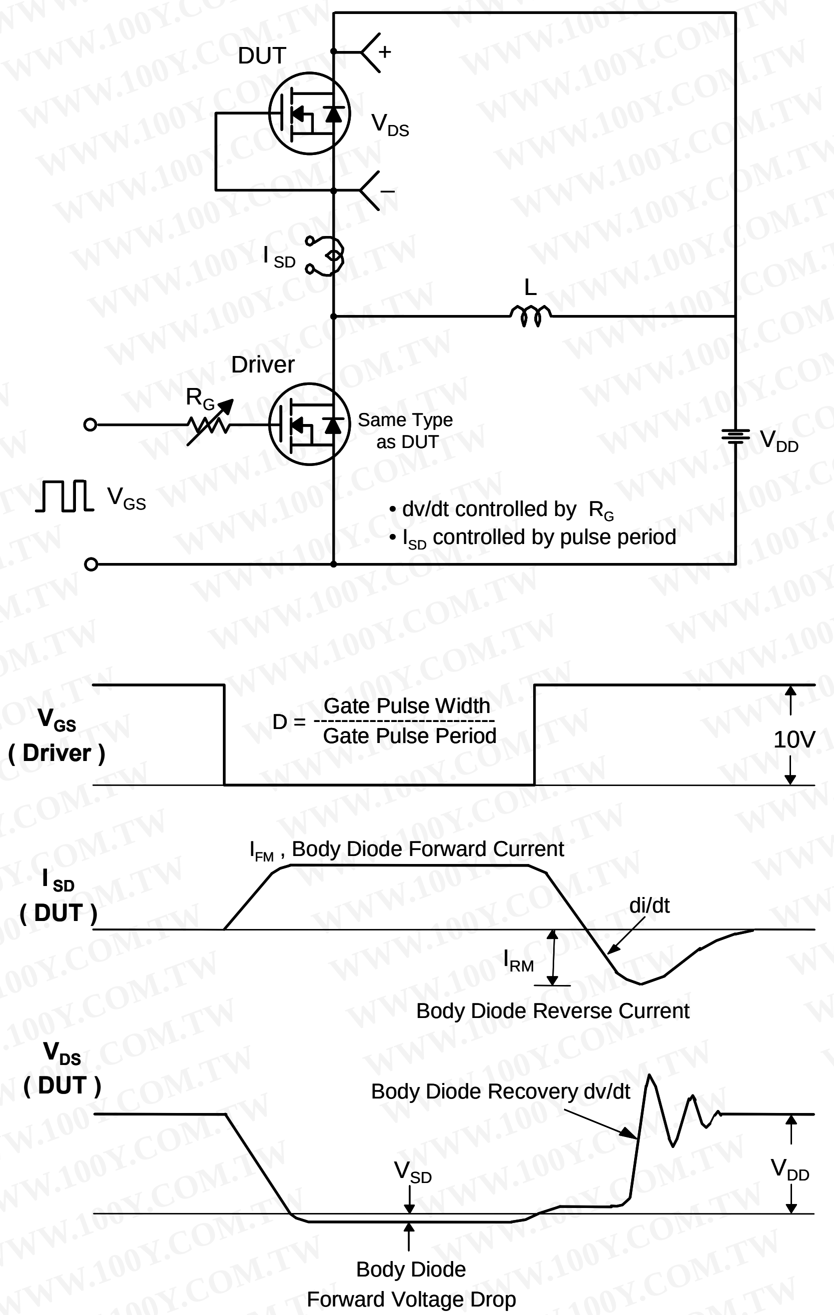
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

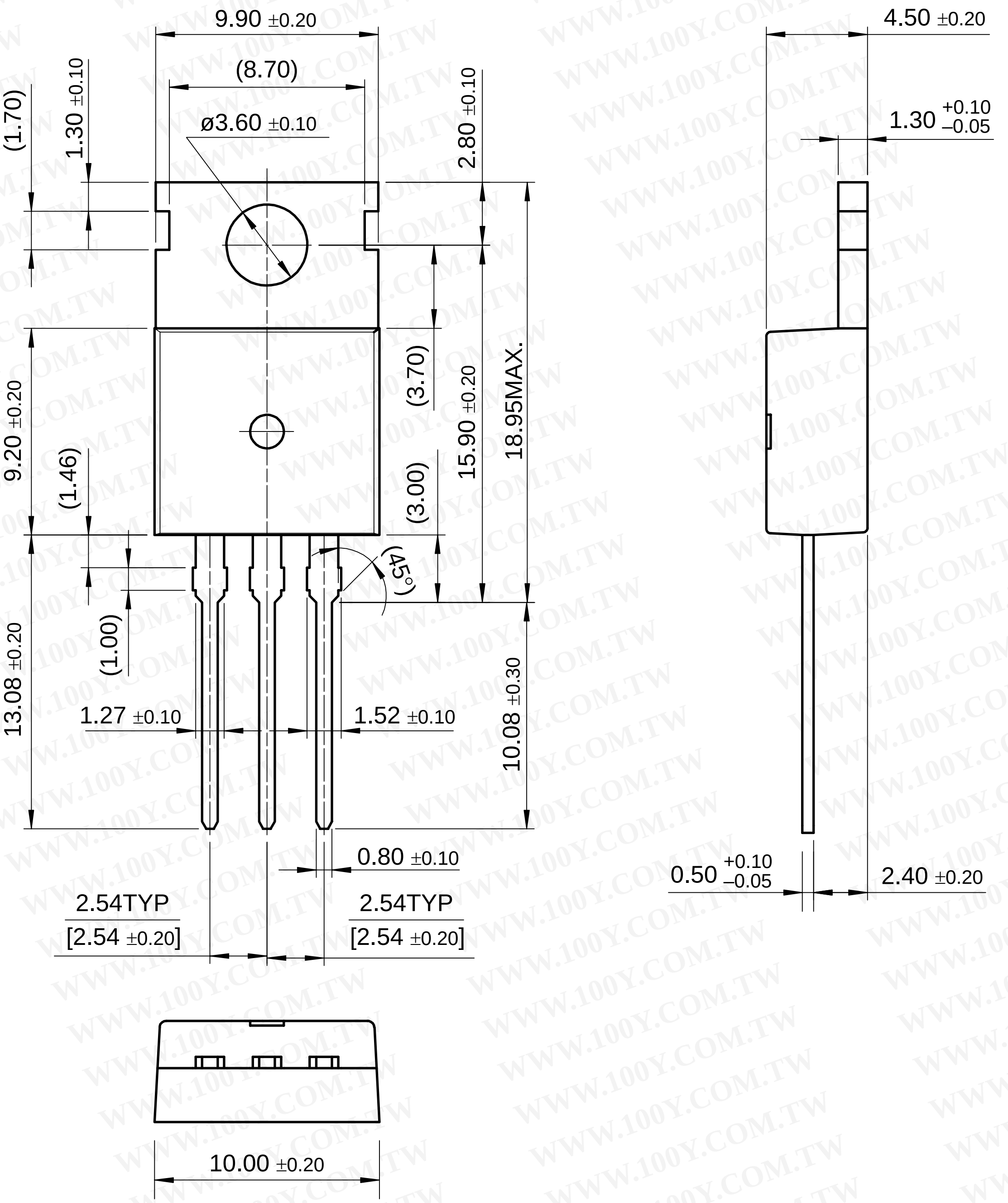


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

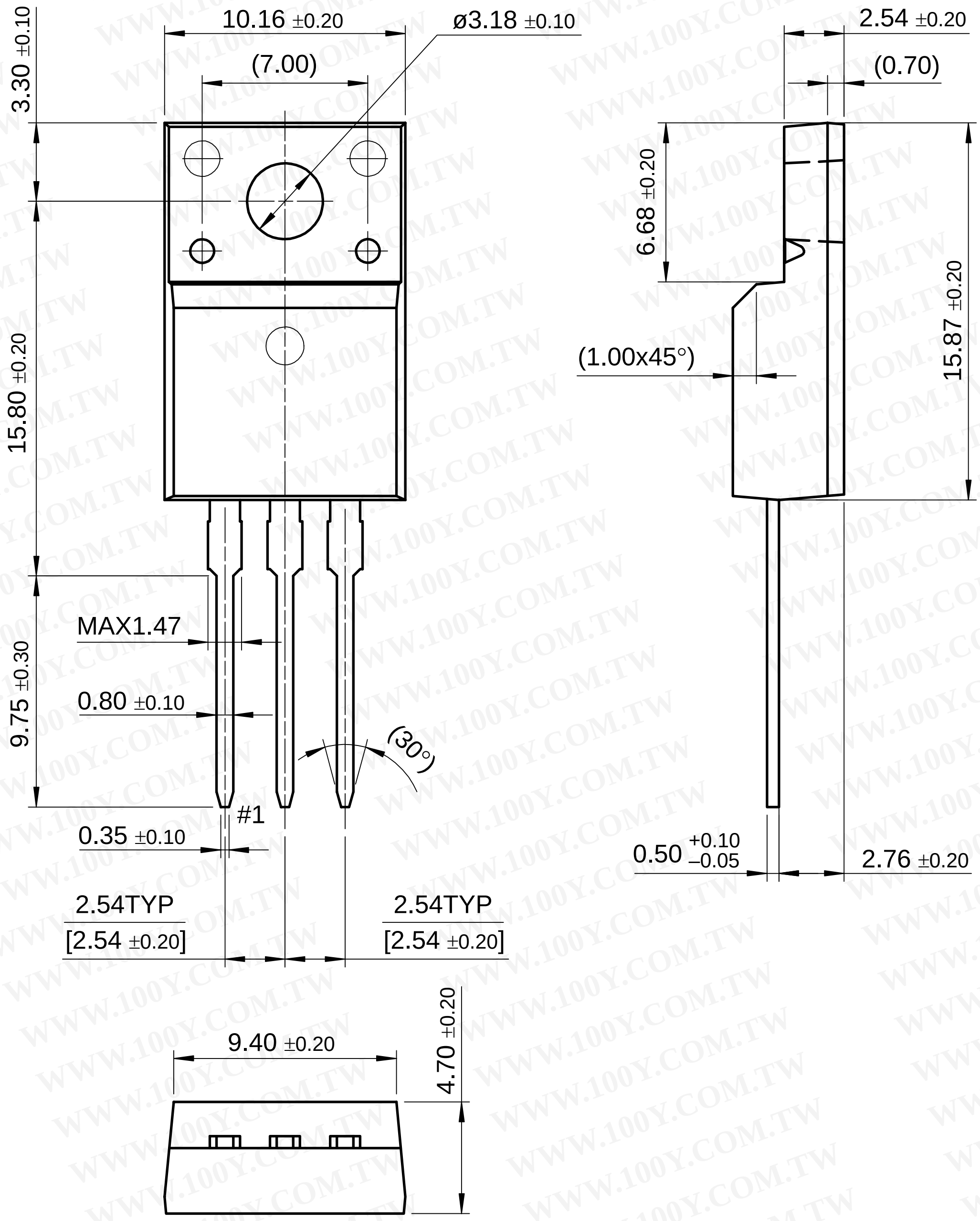
TO-220



Dimensions in Millimeters

Package Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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