FAIRCHILD
SEMICONDUCTOR ™

December 2000

QFET™

FQAF44N10

100V 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 is especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation modes These devices are well suited for low voltage applications such as audio amplifiers, high efficiency switching DC/DC converters, and DC motor control.

Features

- 33A, 100V, $R_{DS(on)}$ = 0.039Ω @V_{GS} = 10 V
- Low gate charge (typical 48 nC)
- Low Crss (typical 85 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- 175°C maximum junction temperature rating

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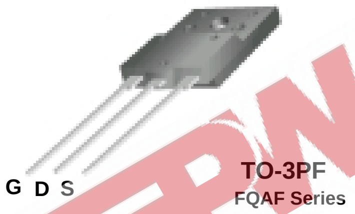

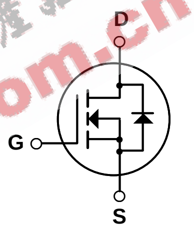

Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		FQAF44N10	Units
V_{DSS}	Drain-Source Voltage		100	V
I_D	Drain Current - Continuous (T_C = 25°C)		33	A
	- Continuous (T_C = 100°C)		23.3	A
I_{DM}	Drain Current - Pulsed	(Note 1)	132	A
V_{GSS}	Gate-Source Voltage		± 25	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	530	mJ
I_{AR}	Avalanche Current	(Note 1)	33	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	8.5	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	6.0	V/ns
P_D	Power Dissipation (T_C = 25°C)		85	W
	- Derate above 25°C		0.57	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	°C

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	1.76	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

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Electrical Characteristics

T_C = 25°C unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	100	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	--	0.1	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 100 V, V_{GS} = 0 V	--	--	1	µA
		V_{DS} = 80 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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	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 = 16.5 A	--	0.03	0.039	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 16.5 A (Note 4)	--	29	--	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	1400	1800	pF
C_{oss}	Output Capacitance		--	425	550	pF
C_{rss}	Reverse Transfer Capacitance		--	85	110	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 50 V, I_D = 43.5 A, R_G = 25 Ω (Note 4, 5)	--	19	45	ns
t_r	Turn-On Rise Time		--	190	390	ns
$t_{d(off)}$	Turn-Off Delay Time		--	90	190	ns
t_f	Turn-Off Fall Time		--	100	210	ns
Q_g	Total Gate Charge	V_{DS} = 80 V, I_D = 43.5 A, V_{GS} = 10 V (Note 4, 5)	--	48	62	nC
Q_{gs}	Gate-Source Charge		--	9.0	--	nC
Q_{gd}	Gate-Drain Charge		--	24	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	33	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	132	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 33 A	--	--	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 43.5 A, dI_F / dt = 100 A/µs (Note 4)	--	98	--	ns
Q_{rr}	Reverse Recovery Charge		--	360	--	nC

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Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 0.73mH, I_{AS} = 33A, V_{DD} = 25V, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 43.5A, di/dt $\leq$ 300A/µs, $V_{DD} \leq BV_{DSS,}$ Starting T_J = 25°C
4. Pulse Test : Pulse width $\leq$ 300µs, Duty cycle $\leq$ 2%
5. Essentially independent of operating temperature

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Typical Characteristics

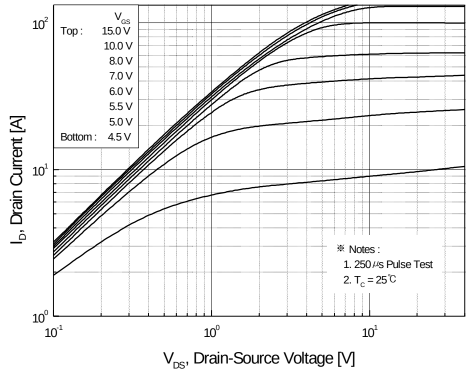

Figure 1. On-Region Characteristics

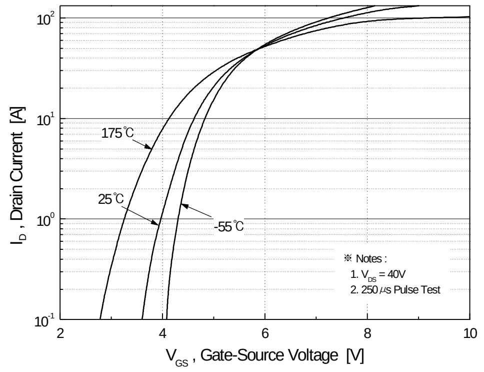

Figure 2. Transfer Characteristics

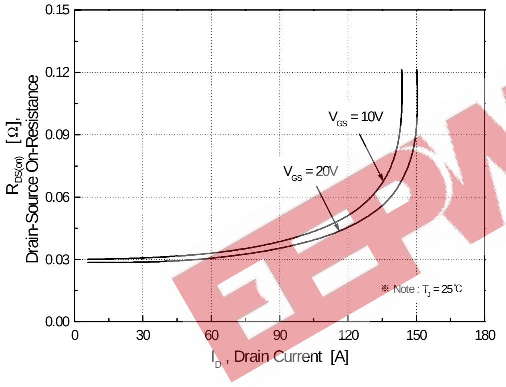

Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

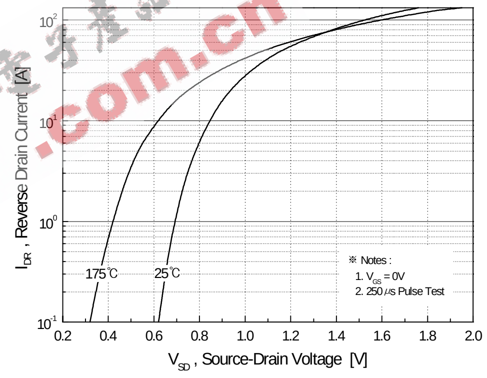

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Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

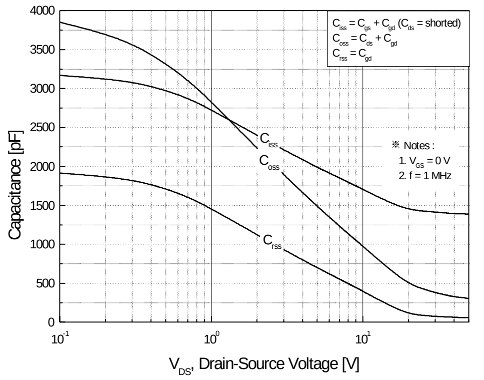

Figure 5. Capacitance Characteristics

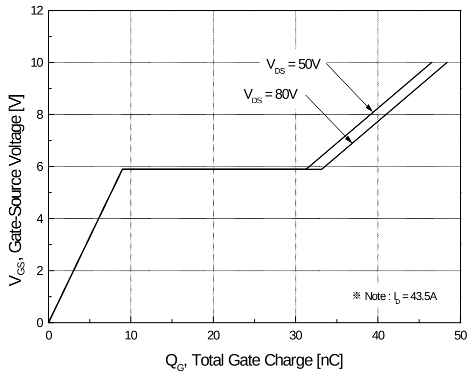

Figure 6. Gate Charge Characteristics

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Typical Characteristics (Continued)

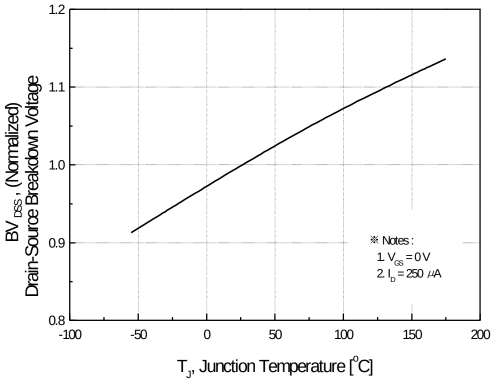

Figure 7. Breakdown Voltage Variation vs. Temperature

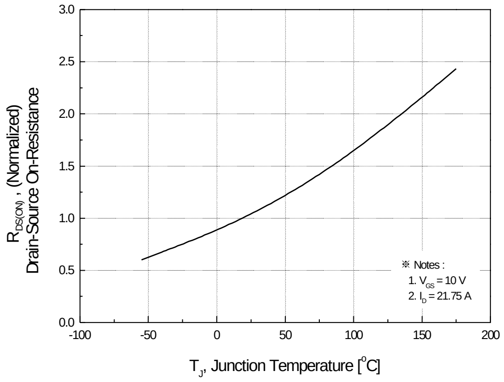

Figure 8. On-Resistance Variation vs. Temperature

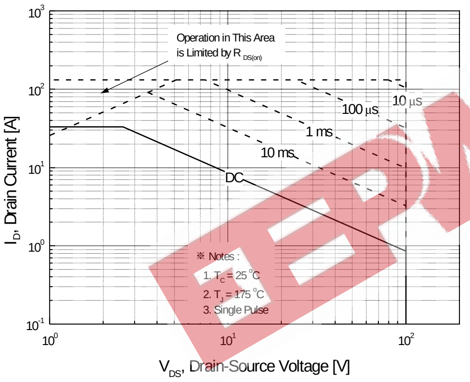

Figure 9. Maximum Safe Operating Area

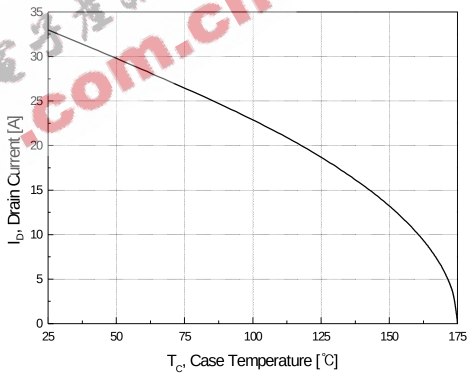

Figure 10. Maximum Drain Current vs. Case Temperature

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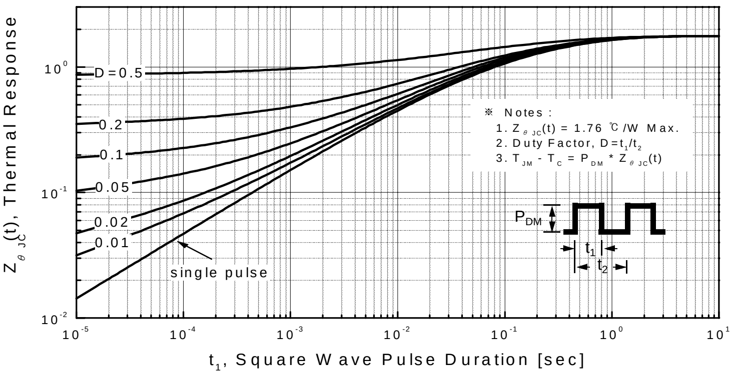

Figure 11. Transient Thermal Response Curve

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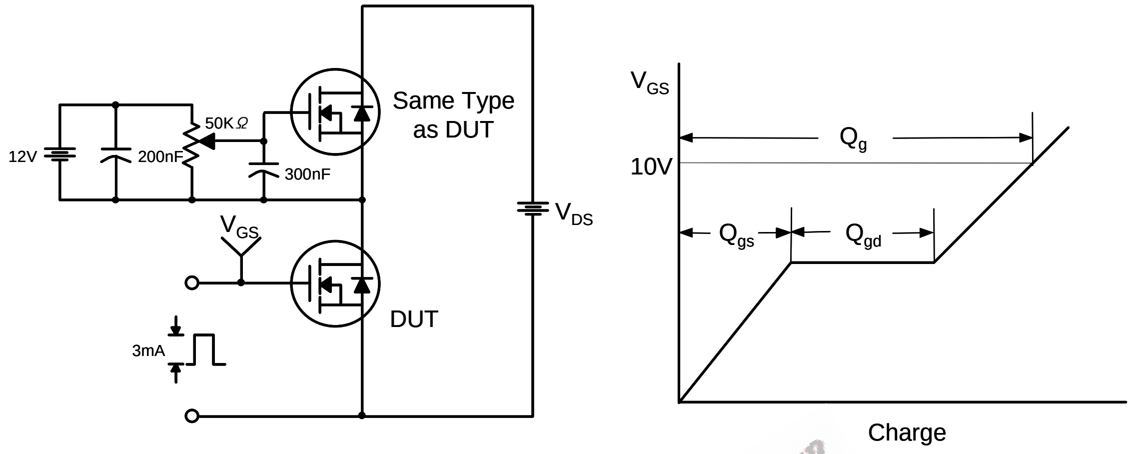
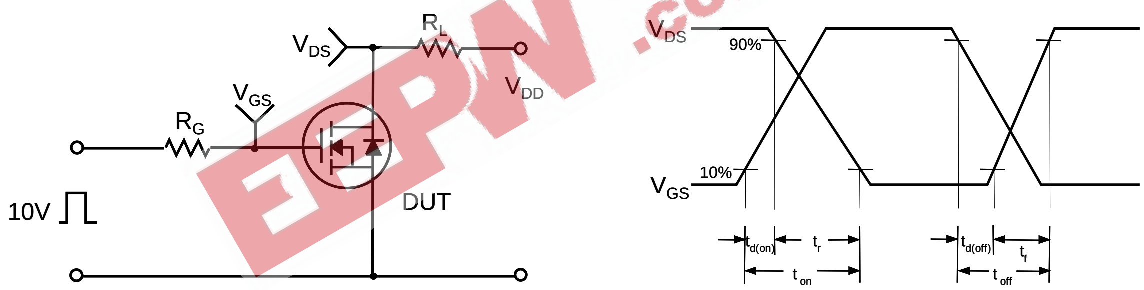
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



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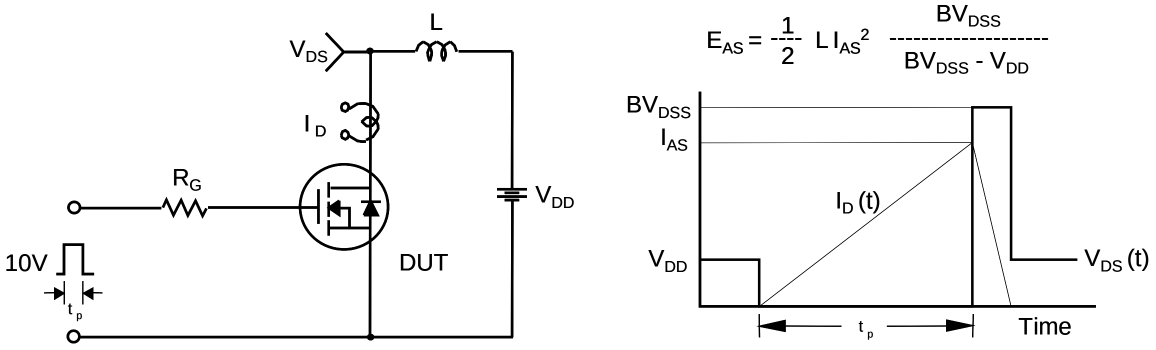
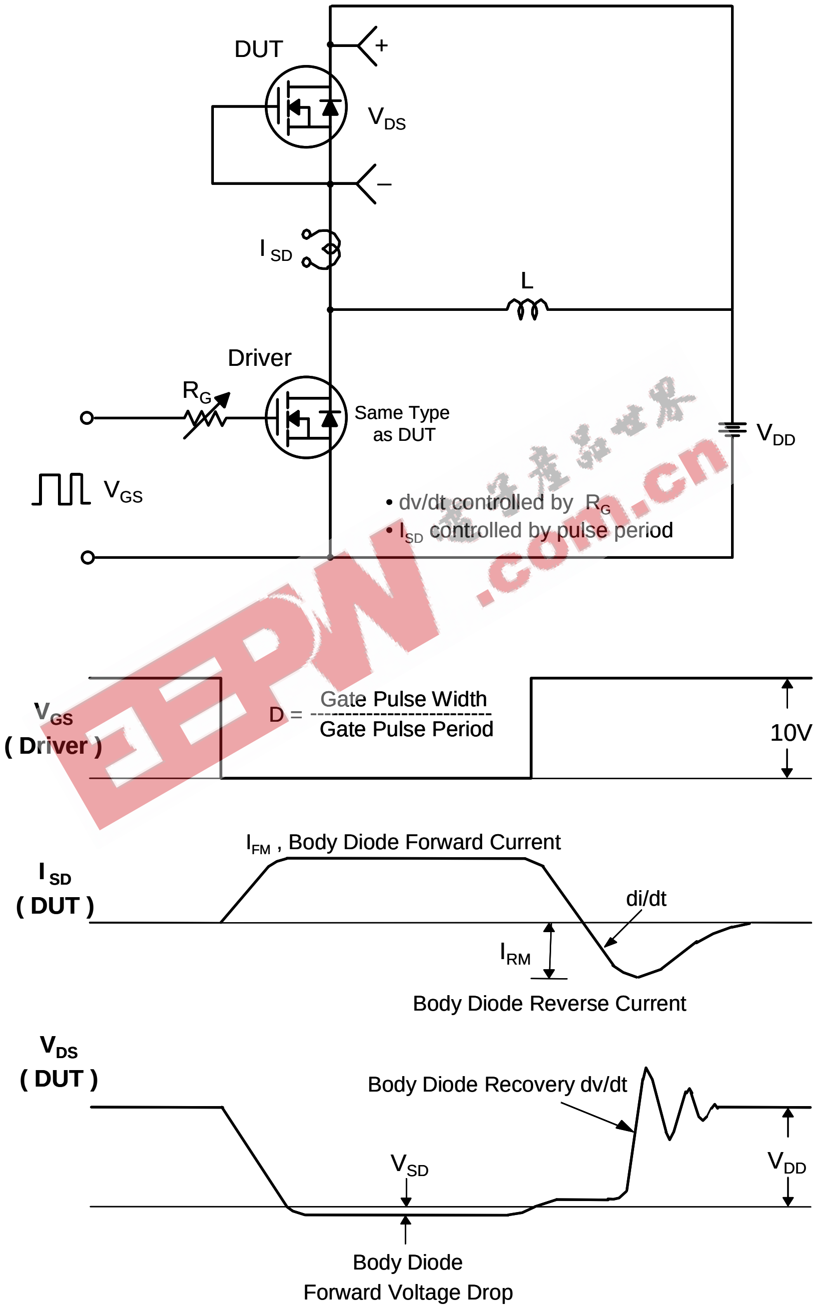
Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms



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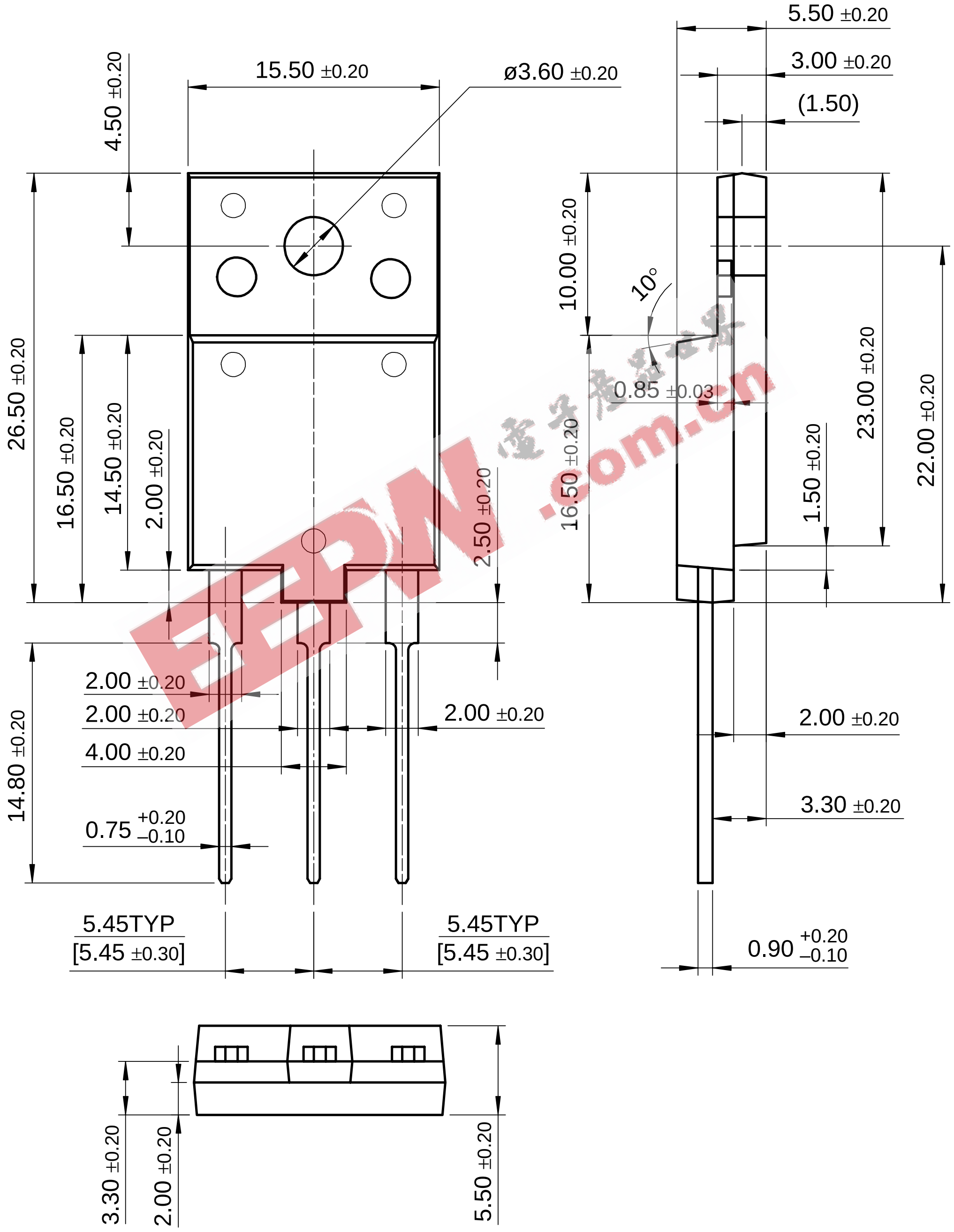
Package Dimensions

TO-3PF



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