FAIRCHILD

### SEMICONDUCTOR®

QFET®

FQAF16N25C

250V 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 high efficiency switching DC/DC converters, switch mode power supplies, DC-AC converters for uninterrupted power supplies and motor controls.

Features

- 11.4A, 250V, $R_{DS(on)}$ = 0.27Ω @V_{GS} = 10 V
- Low gate charge (typical 41 nC)
- Low Crss (typical 68 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

TO-3PF
FQAF Series

G   D   S

D

G
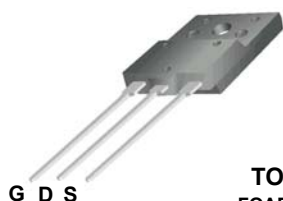
S
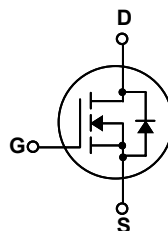
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			FQAF16N25C	Units
V_{DSS}	Drain-Source Voltage			250	V
I_D	Drain Current	- Continuous (T_C = 25°C)		11.4	A
		- Continuous (T_C = 100°C)		7.2	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	45.6	A
V_{GSS}	Gate-Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	410	mJ
I_{AR}	Avalanche Current		(Note 1)	11.4	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	7.3	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	5.5	V/ns
P_D	Power Dissipation (T_C = 25°C)			73	W
		- Derate above 25°C		0.59	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

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	1.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Electrical Characteristics $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	250	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	--	0.31	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 250 V, V_{GS} = 0 V	--	--	10	µA
		V_{DS} = 200 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	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5.7 A	--	0.22	0.27	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 5.7 A (Note 4)	--	9.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	830	1080	pF
C_{oss}	Output Capacitance		--	170	220	pF
C_{rss}	Reverse Transfer Capacitance		--	68	89	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 125 V, I_D = 15.6 A, R_G = 25 Ω	--	15	40	ns
t_r	Turn-On Rise Time		--	130	270	ns
$t_{d(off)}$	Turn-Off Delay Time		--	135	280	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	105	220	ns
Q_g	Total Gate Charge	V_{DS} = 200 V, I_D = 15.6 A, V_{GS} = 10 V	--	41	53.5	nC
Q_{gs}	Gate-Source Charge		--	5.6	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	22.7	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	11.4	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	45.6	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 11.4 A	--	--	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 15.6 A,	--	260	--	ns
Q_{rr}	Reverse Recovery Charge	dI_F / dt = 100 A/µs (Note 4)	--	2.47	--	µC

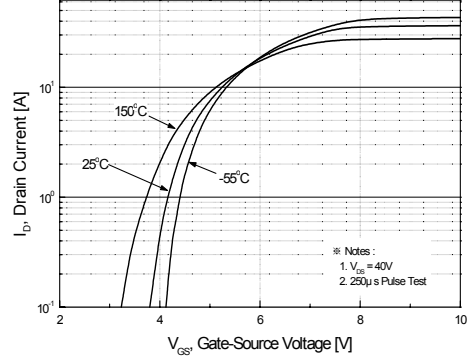**Notes:**
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 2.7mH, I_{AS} = 15.6A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 11.4A, di/dt $\leq$ 300A/µs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test : Pulse width $\leq$ 300µs, Duty cycle $\leq$ 2%
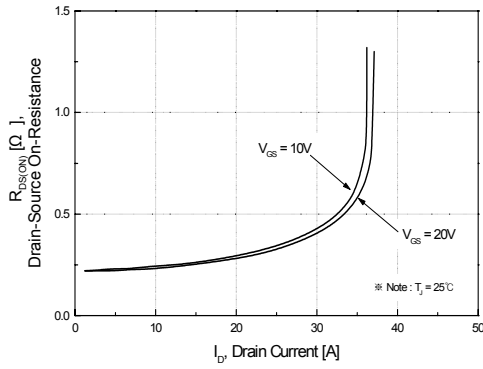5. Essentially independent of operating temperature

Typical Characteristics
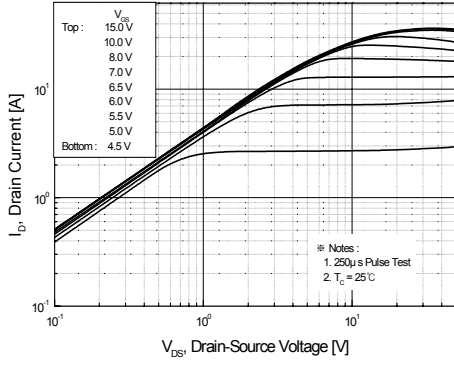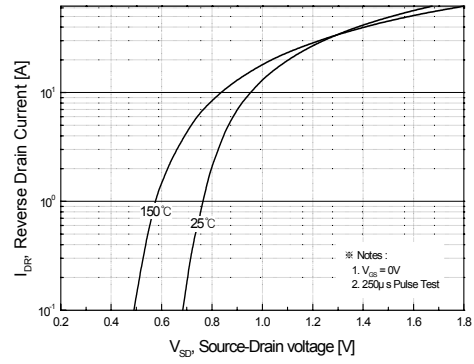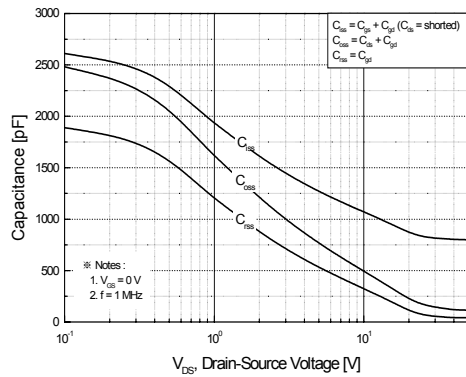

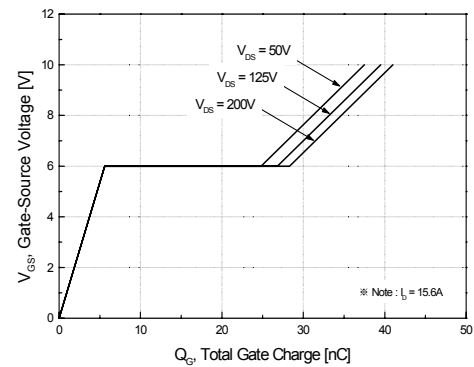Figure 1. On-Region Characteristics

Figure 2. Transfer Characteristics

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

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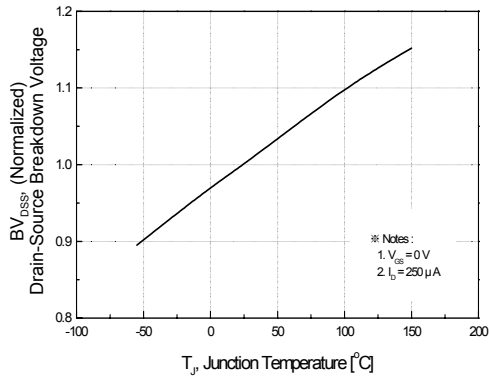Variation with Source Current
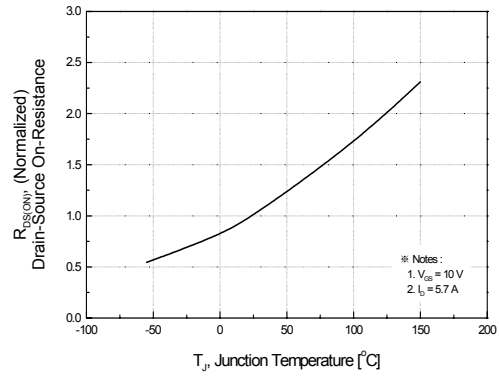and Temperature

Figure 5. Capacitance Characteristics
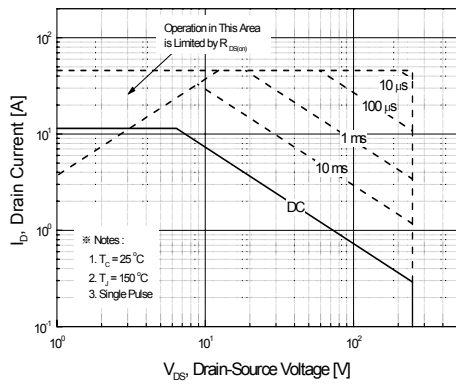

Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

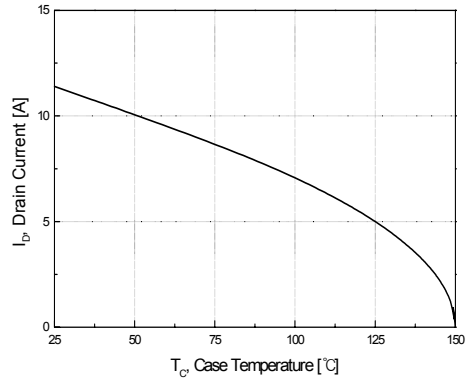Figure 7. Breakdown Voltage Variation
vs Temperature
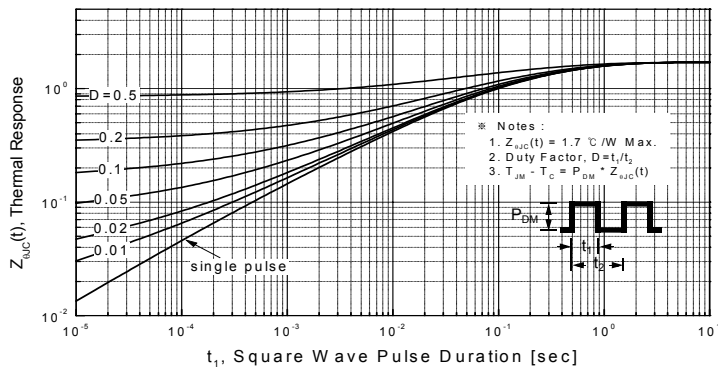

Figure 8. On-Resistance Variation
vs Temperature

Figure 9. Maximum Safe Operating Area
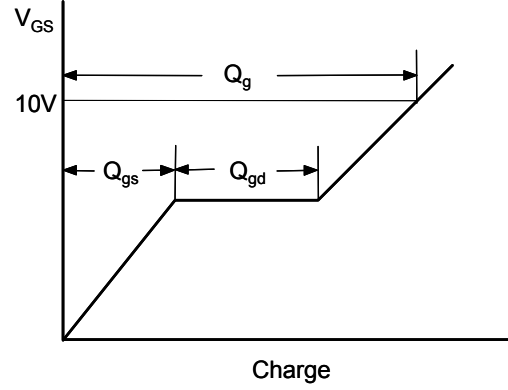

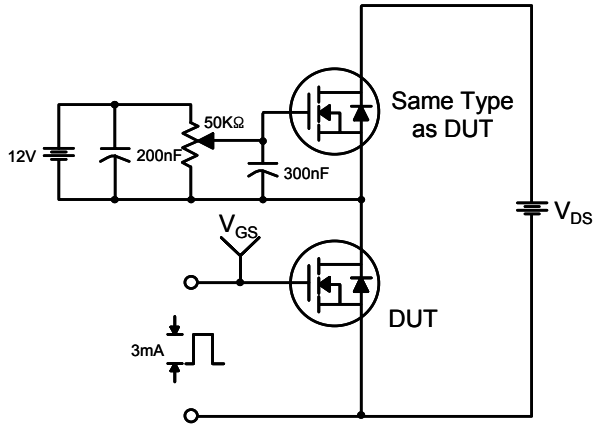Figure 10. Maximum Drain Current
vs Case Temperature

Figure 11. Transient Thermal Response Curve

Gate Charge Test Circuit & Waveform

Same Type as DUT

DUT

V_{GS}

V_{DS}

12V   200nF   50KΩ   300nF   3mA

V_{GS}

10V

Q_g

Q_{gs} Q_{gd}

Charge

Resistive Switching Test Circuit & Waveforms

R_L

V_{DS} V_{GS} V_{DD}

R_G

10V   DUT

V_{DS} 90%

V_{GS} 10%

$t_{d(on)}$ t_r $t_{d(off)}$ t_f

t_{on} t_{off}
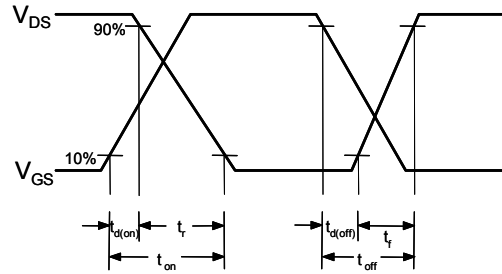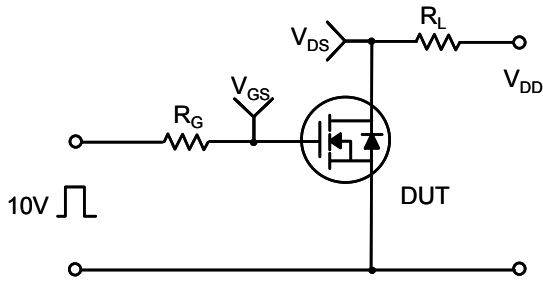
Unclamped Inductive Switching Test Circuit & Waveforms

L

V_{DS}

I_D

R_G V_{DD}

10V   DUT

t_p

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

BV_{DSS}
I_{AS}

$I_D(t)$

V_{DD} $V_{DS}(t)$

t_p Time
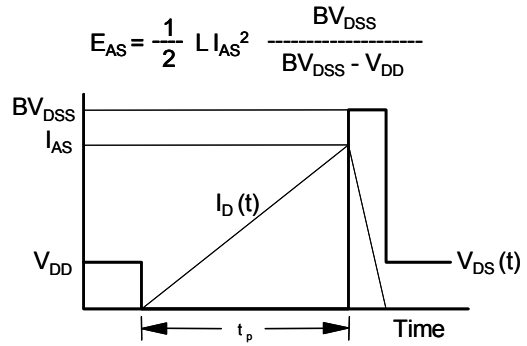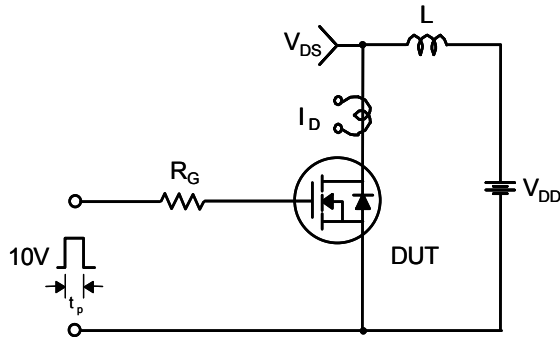
Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

+

−

I_{SD}

L

Driver

R_G

Same Type
as DUT

V_{DD}

V_{GS}

• dv/dt controlled by R_G
• I_{SD} controlled by pulse period

V_{GS}
(Driver)

$D = \dfrac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$

10V

I_{SD}
(DUT)

I_{FM} , Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

Body Diode
Forward Voltage Drop
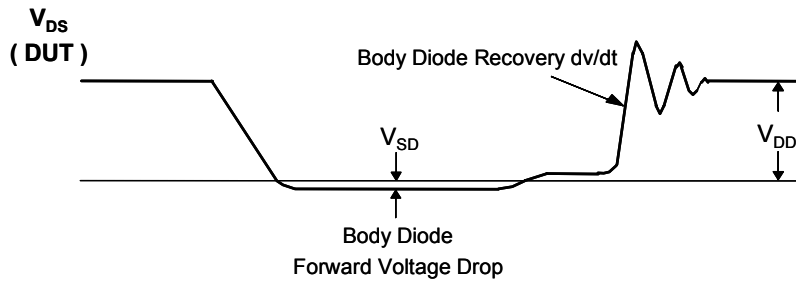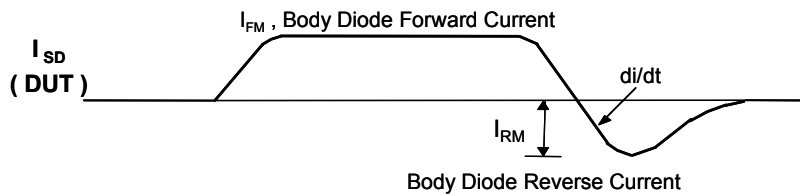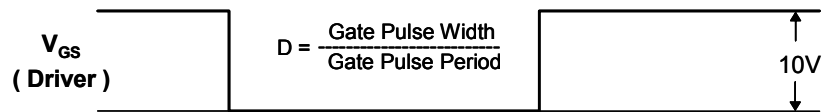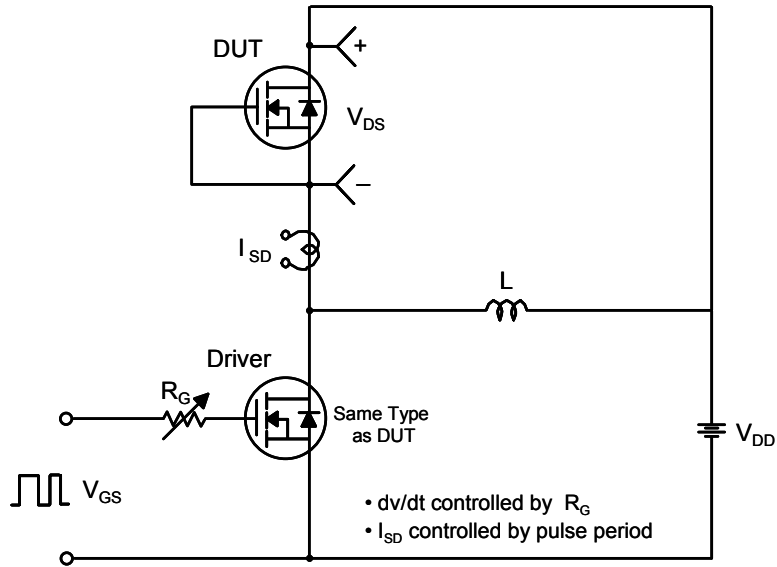
Package Dimensions

TO-3PF

15.50 ±0.20

⌀3.60 ±0.20

4.50 ±0.20

26.50 ±0.20

16.50 ±0.20

14.50 ±0.20

2.00 ±0.20

2.50 ±0.20

14.80 ±0.20

2.00 ±0.20

2.00 ±0.20

2.00 ±0.20

4.00 ±0.20

0.75 +0.20 −0.10

5.45TYP
[5.45 ±0.30]

5.45TYP
[5.45 ±0.30]

5.50 ±0.20

3.00 ±0.20

(1.50)

10.00 ±0.20

10°

0.85 ±0.03

16.50 ±0.20

23.00 ±0.20

1.50 ±0.20

22.00 ±0.20

2.00 ±0.20

3.30 ±0.20

0.90 +0.20 −0.10

3.30 ±0.20

2.00 ±0.20

5.50 ±0.20
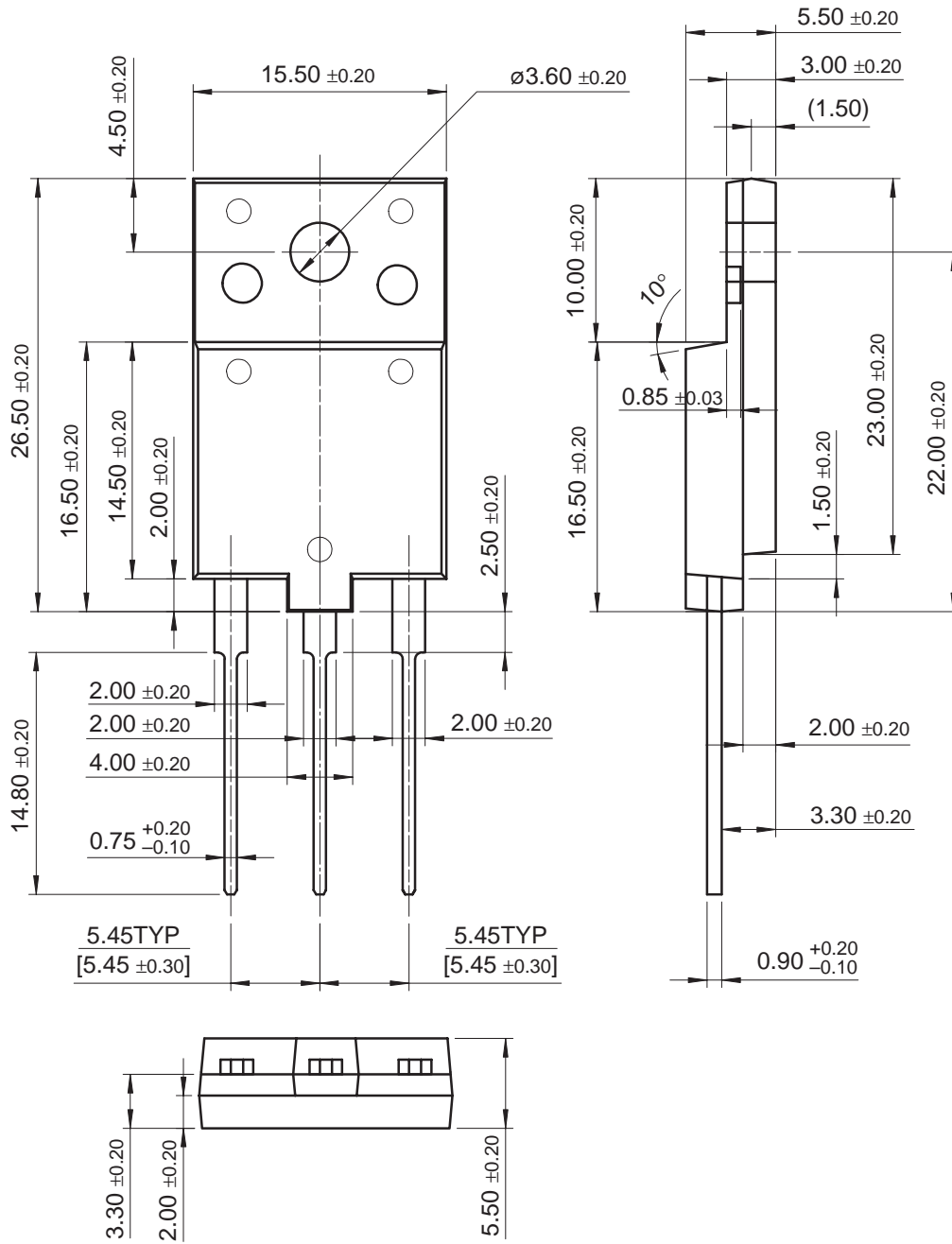
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EcoSPARK™	GTO™	MSX™	QT Optoelectronics™	TinyLogic®
E²CMOS™	HiSeC™	MSXPro™	Quiet Series™	TINYOPTO™
EnSigna™	I²C™	OCX™	RapidConfigure™	TruTranslation™
FACT™	ImpliedDisconnect™	OCXPro™	RapidConnect™	UHC™
Across the board. Around the world.™		OPTOLOGIC®	SILENT SWITCHER®	UltraFET®
The Power Franchise™		OPTOPLANAR™	SMART START™	VCX™
Programmable Active Droop™		PACMAN™	SPM™	

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