FAIRCHILD
SEMICONDUCTOR®

UniFET ™

FDA59N30

300V N-Channel MOSFET

Features

- 59A, 300V, $R_{DS(on)}$ = 0.056Ω @V_{GS} = 10 V
- Low gate charge (typical 77 nC)
- Low C_{rss} (typical 80 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

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 efficient switched mode power supplies and active power factor correction.

TO-3P
FDA Series
G D S

D
G
S
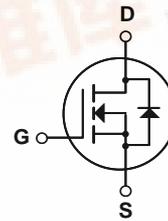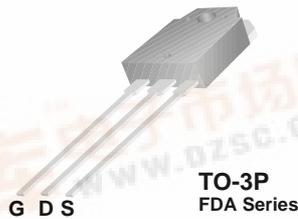
Absolute Maximum Ratings

Symbol	Parameter		FDA59N30	Unit
V_{DSS}	Drain-Source Voltage		300	V
I_D	Drain Current	- Continuous (T_C = 25°C)	59	A
		- Continuous (T_C = 100°C)	35	A
I_{DM}	Drain Current	- Pulsed (Note 1)	236	A
V_{GSS}	Gate-Source voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		1734	mJ
I_{AR}	Avalanche Current (Note 1)		59	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		50	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation (T_C = 25°C)		500	W
	- Derate above 25°C		4	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	°C

Thermal Characteristics

Symbol	Parameter	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.25	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

FDA59N30 300V N-Channel MOSFET

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDA59N30	FDA59N30	TO-3P	-	-	30

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

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	300	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$, Referenced to 25°C	--	0.3	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 300V, V_{GS} = 0V$ $V_{DS} = 240V, T_C = 125°C$	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30V, V_{DS} = 0V$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30V, V_{DS} = 0V$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 29.5A$	--	0.047	0.056	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40V, I_D = 29.5A$ (Note 4)	--	52	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$	--	3590	4670	pF
C_{oss}	Output Capacitance		--	710	920	pF
C_{rss}	Reverse Transfer Capacitance		--	80	120	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 150V, I_D = 59A$ $R_G = 25\Omega$	--	140	290	ns
t_r	Turn-On Rise Time		--	575	1160	ns
$t_{d(off)}$	Turn-Off Delay Time		--	120	250	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	200	410	ns
Q_g	Total Gate Charge	$V_{DS} = 240V, I_D = 59A$ $V_{GS} = 10V$	--	77	100	nC
Q_{gs}	Gate-Source Charge		--	22	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	40	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	59	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	236	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 59A$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V, I_S = 59A$ $dI_F/dt = 100A/\mu s$	--	246	--	ns
Q_{rr}	Reverse Recovery Charge	(Note 4)	--	6.9	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 0.83mH, I_{AS} = 59A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25°C$
3. $I_{SD} \leq 59A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25°C$
4. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

# Typical Performance Characteristics

Figure 1. On-Region Characteristics
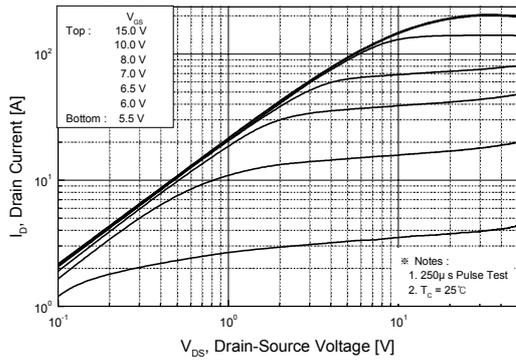

Figure 2. Transfer Characteristics
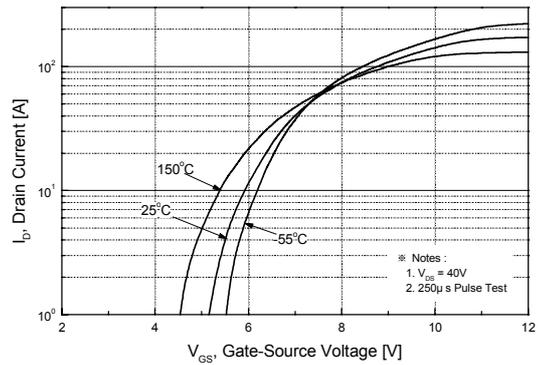
Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage
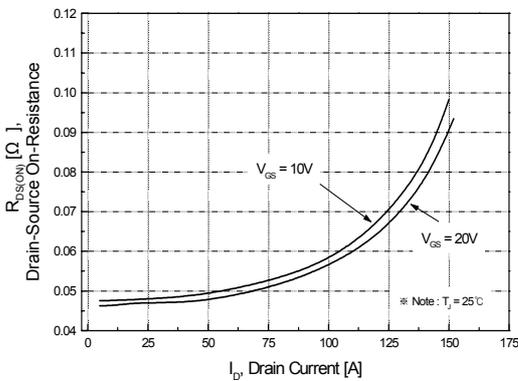

### Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue
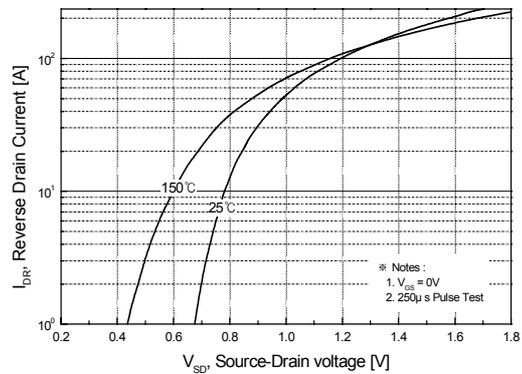
### Figure 5. Capacitance Characteristics
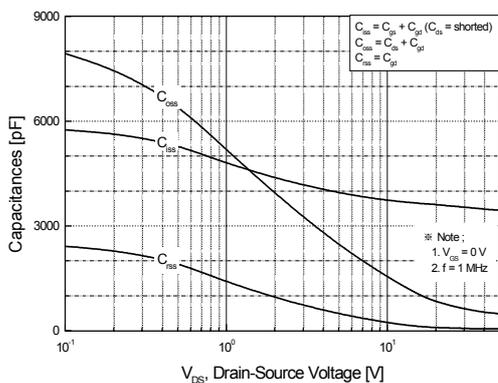
### Figure 6. Gate Charge Characteristics

FDA59N30 Rev. A
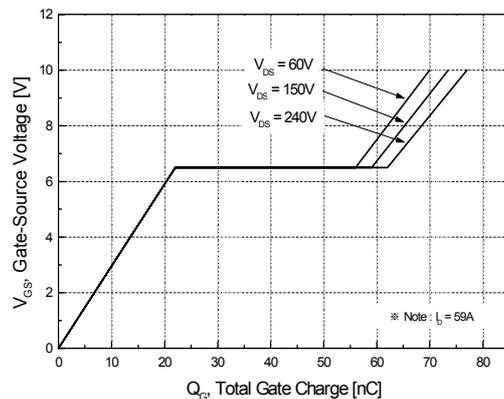
Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature
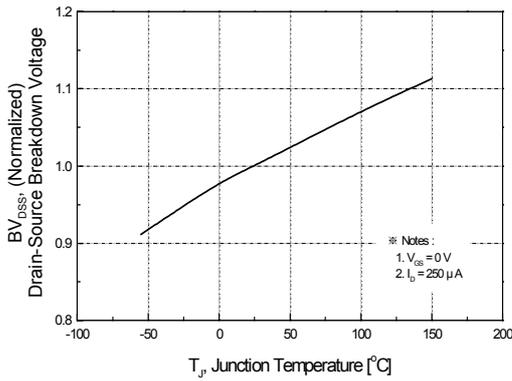
### Figure 8. On-Resistance Variation vs. Temperature
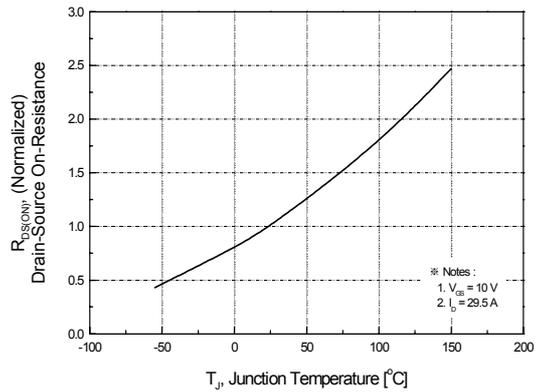
Figure 9. Maximum Safe Operating Area
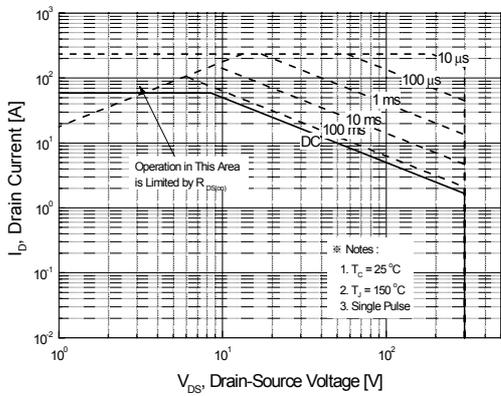
### Figure 10. Maximum Drain Current vs. Case Temperature
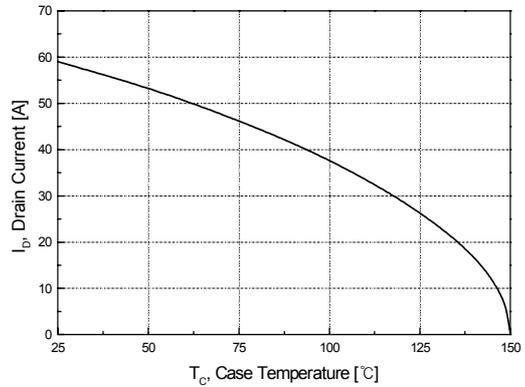
Figure 11. Transient Thermal Response Curve
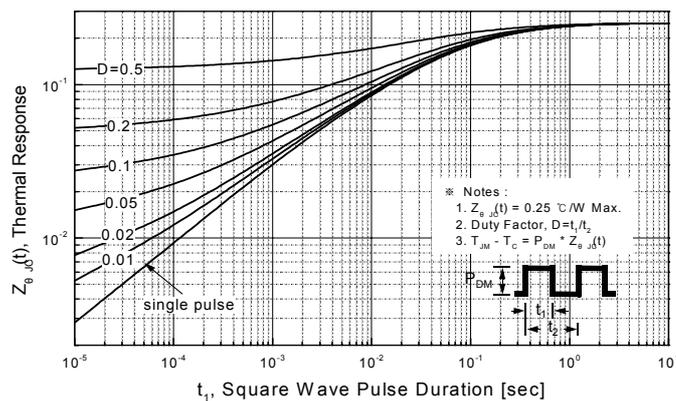
Gate Charge Test Circuit & Waveform
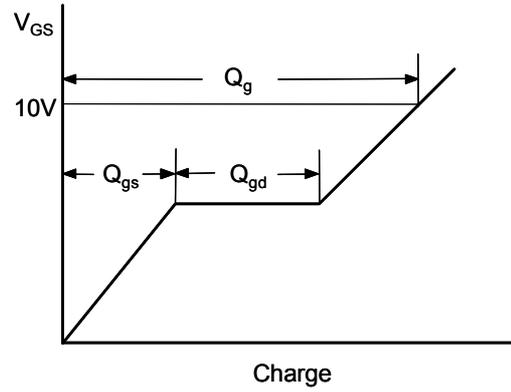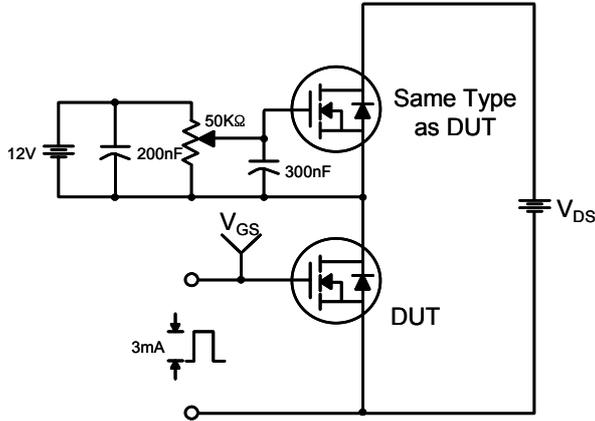
Resistive Switching Test Circuit & Waveforms
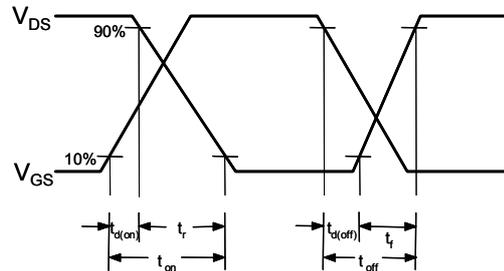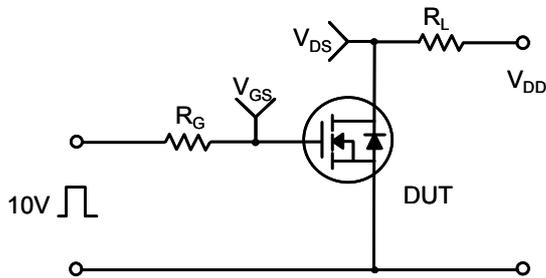
Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} \, L \, I_{AS}^2 \; \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
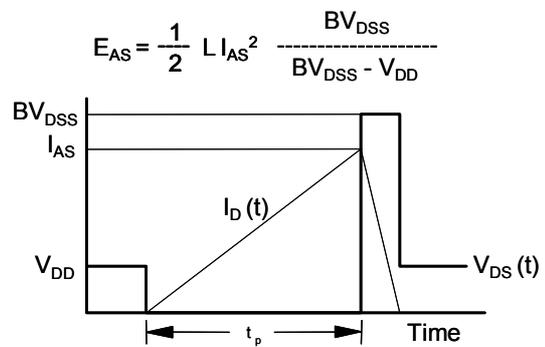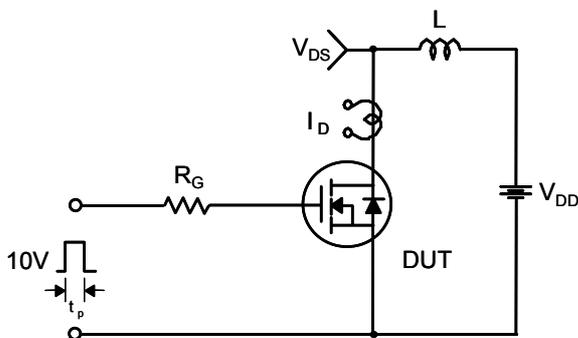
Peak Diode Recovery dv/dt Test Circuit & Waveforms

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
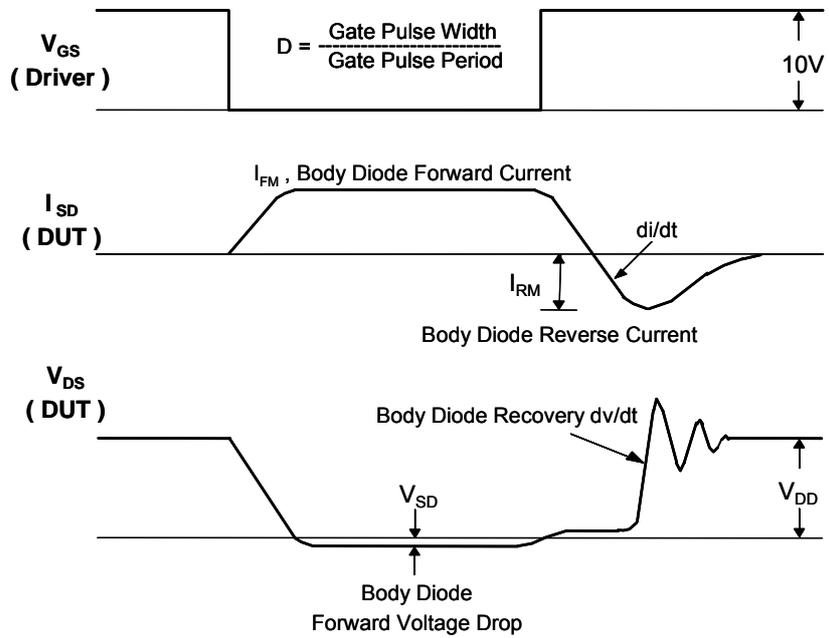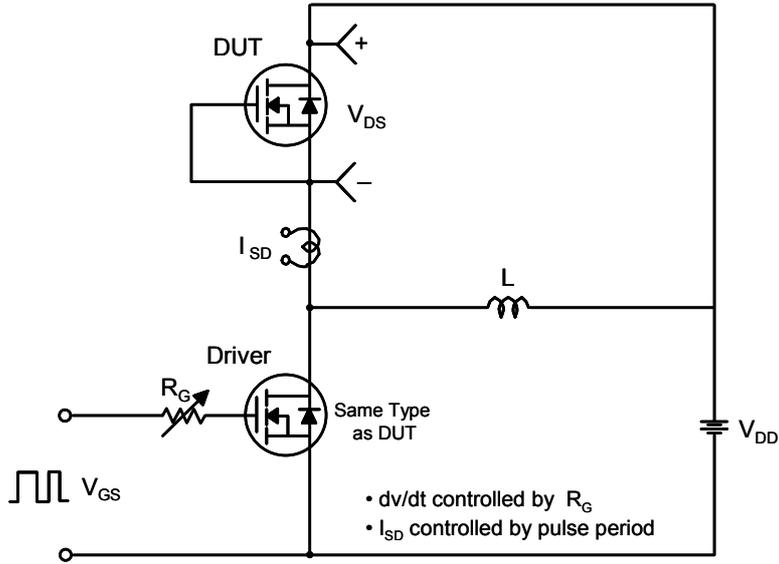
Mechanical Dimensions (Continued)

TO-3P

15.60 ±0.20
13.60 ±0.20
9.60 ±0.20
ø3.20 ±0.10
3.80 ±0.20
13.90 ±0.20
12.76 ±0.20
19.90 ±0.20
23.40 ±0.20
2.00 ±0.20
3.00 ±0.20
1.00 ±0.20
3.50 ±0.20
16.50 ±0.30

5.45 TYP
[5.45 ±0.30]

5.45 TYP
[5.45 ±0.30]

4.80 ±0.20
1.50 +0.15 −0.05
18.70 ±0.20
1.40 ±0.20
0.60 +0.15 −0.05
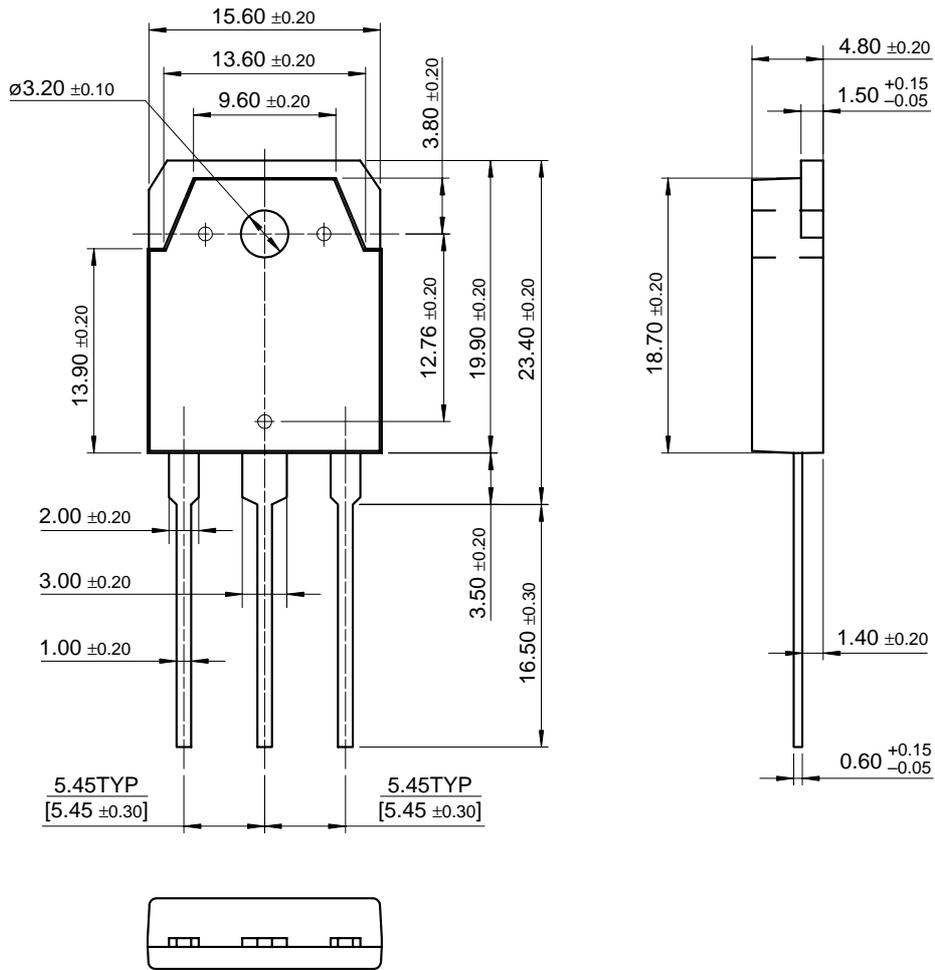
Dimensions in Millimeters

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CROSSVOLT™	GlobalOptoisolator™	MicroFET™	PowerTrench®	SuperSOT™-6
DOME™	GTO™	MicroPak™	QFET®	SuperSOT™-8
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EnSigna™	i-Lo™	MSXPro™	Quiet Series™	TINYOPTO™
FACT™	ImpliedDisconnect™	OCX™	RapidConfigure™	TruTranslation™
FACT Quiet Series™		OCXPro™	RapidConnect™	UHC™
		OPTOLOGIC®	µSerDes™	UltraFET®
Across the board. Around the world.™		OPTOPLANAR™	SILENT SWITCHER®	UniFET™
The Power Franchise®		PACMAN™	SMART START™	VCX™
Programmable Active Droop™				

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