**FAIRCHILD**

SEMICONDUCTOR®

SSM1N45B
450V N-Channel MOSFET

General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar, 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 electronic ballasts based on half bridge configuration.

Features

- 0.5A, 450V, $R_{DS(on)}$ = 4.25Ω @V_{GS} = 10 V
- Low gate charge (typical 6.5 nC)
- Low Crss (typical 6.5 pF)
- 100% avalanche tested
- Improved dv/dt capability
- Gate-Source Voltage $\pm$ 50V guaranteed

D

G

S

SOT-223
SSM Series
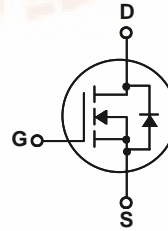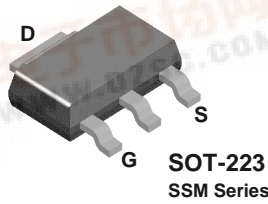
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			SSM1N45B	Units
V_{DSS}	Drain-Source Voltage			450	V
I_D	Drain Current	- Continuous (T_C = 25°C)		0.5	A
		- Continuous (T_C = 100°C)		0.32	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	4.0	A
V_{GSS}	Gate-Source Voltage			$\pm$ 50	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	108	mJ
I_{AR}	Avalanche Current		(Note 1)	0.5	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	0.25	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	5.5	V/ns
P_D	Power Dissipation (T_A = 25°C)			0.9	W
	Power Dissipation (T_L = 25°C)			2.5	W
	- Derate above 25°C			0.02	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
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 6b)	--	63	°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	450	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250$ μA, Referenced to 25°C	--	0.5	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 450$ V, $V_{GS} = 0$ V	--	--	10	μA
		$V_{DS} = 360$ V, $T_C = 125°C$	--	--	100	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 50$ V, $V_{DS} = 0$ V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -50$ V, $V_{DS} = 0$ V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250$ μA	2.3	3.0	3.7	V
		$V_{DS} = V_{GS}$, $I_D = 250$ mA	3.5	4.2	4.9	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10$ V, $I_D = 0.25$ A	--	3.4	4.25	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 50$ V, $I_D = 0.25$ A (Note 4)	--	0.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25$ V, $V_{GS} = 0$ V, f = 1.0 MHz	--	185	240	pF
C_{oss}	Output Capacitance		--	29	40	pF
C_{rss}	Reverse Transfer Capacitance		--	6.5	8.5	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 225$ V, $I_D = 0.5$ A, $R_G = 25$ Ω	--	7.5	25	ns
t_r	Turn-On Rise Time		--	21	50	ns
$t_{d(off)}$	Turn-Off Delay Time		--	23	55	ns
t_f	Turn-Off Fall Time	(Note 4,5)	--	36	80	ns
Q_g	Total Gate Charge	$V_{DS} = 360$ V, $I_D = 0.5$ A, $V_{GS} = 10$ V	--	6.5	8.5	nC
Q_{gs}	Gate-Source Charge		--	0.9	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4,5)	--	3.2	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	0.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	4.0	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0$ V, $I_S = 0.5$ A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0$ V, $I_S = 0.5$ A,	--	102	--	ns
Q_{rr}	Reverse Recovery Charge	$dI_F / dt = 100$ A/μs (Note 4)	--	0.26	--	μC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 75mH, $I_{AS} = 1.6$A, $V_{DD} = 50$V, $R_G = 25$ Ω, Starting $T_J = 25°C$
3. $I_{SD} \le 0.5$A, di/dt ≤ 300A/μs, $V_{DD} \le BV_{DSS}$, Starting $T_J = 25°C$
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle $\le 2\%$
5. Essentially independent of operating temperature
6. a) Reference point of the $R_{\theta JL}$ is the drain lead
   b) When mounted on the minimum pad size recommended (PCB Mount)
   ($R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance. $R_{\theta CA}$ is determined by the user's board design)
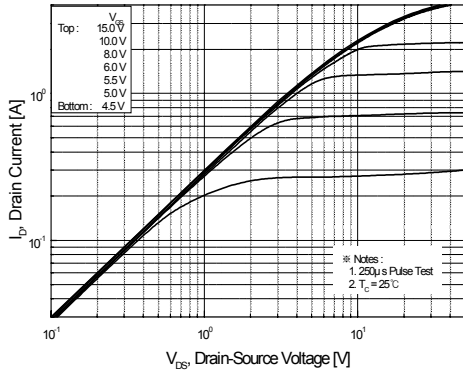
Typical Characteristics

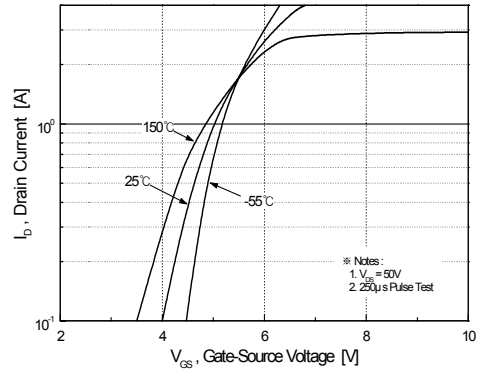**Figure 1. On-Region Characteristics**
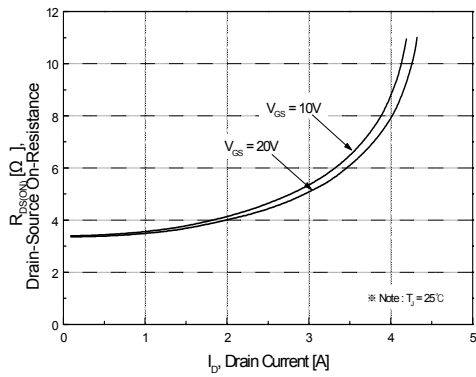

Figure 2. Transfer Characteristics

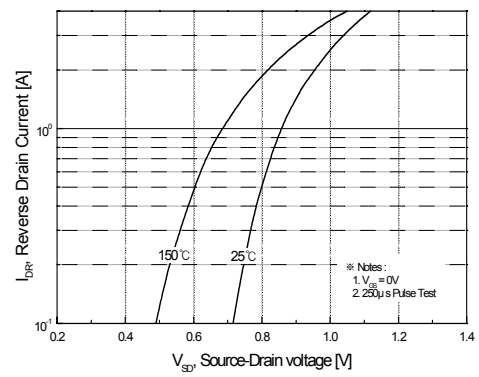**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

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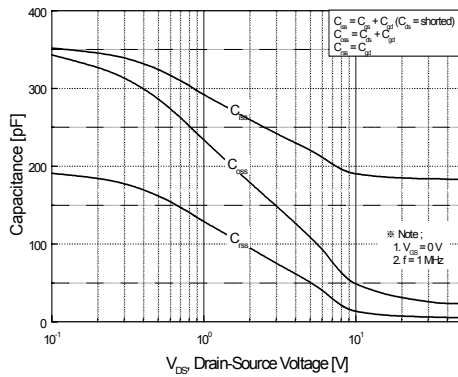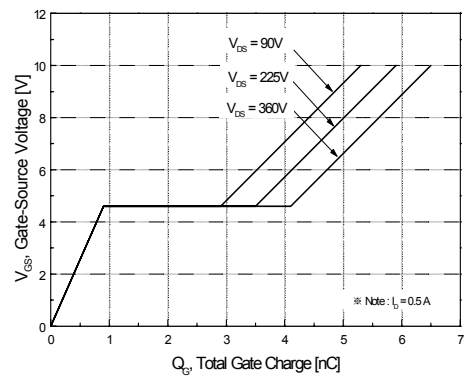

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
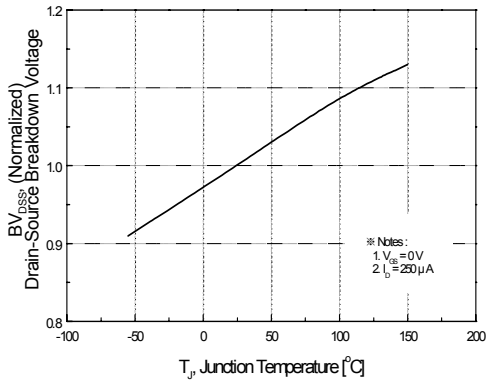
Typical Characteristics (Continued)
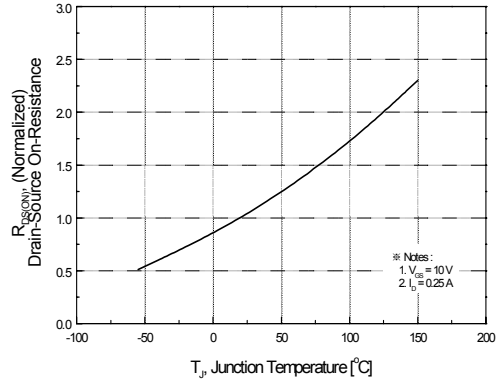

**Figure 7. Breakdown Voltage Variation
vs. Temperature**

**Figure 8. On-Resistance Variation
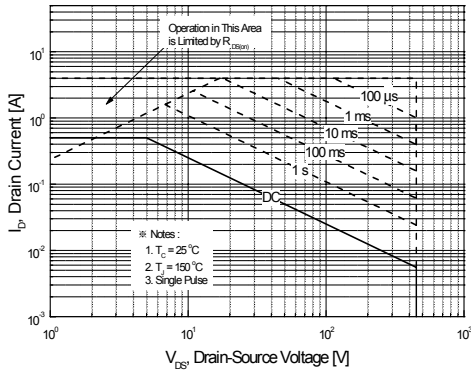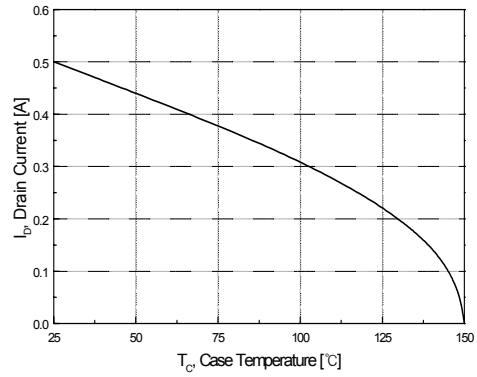vs. Temperature**

Figure 9. Maximum Safe Operating Area
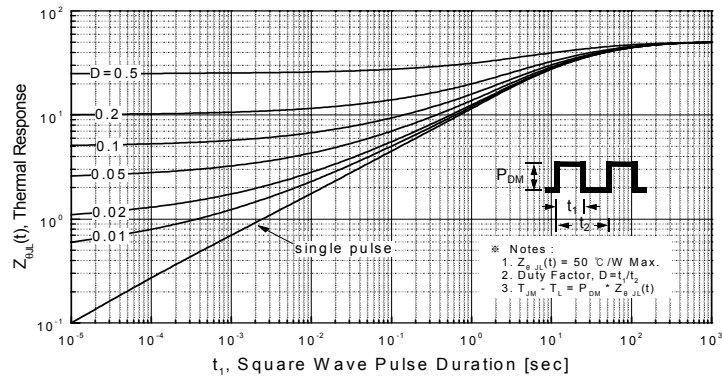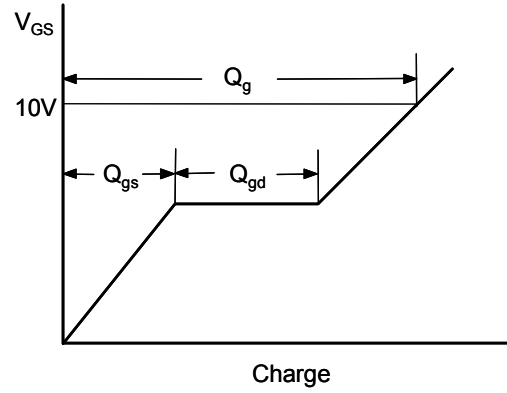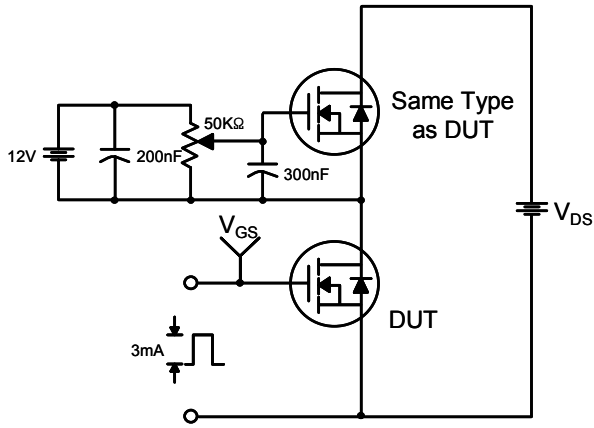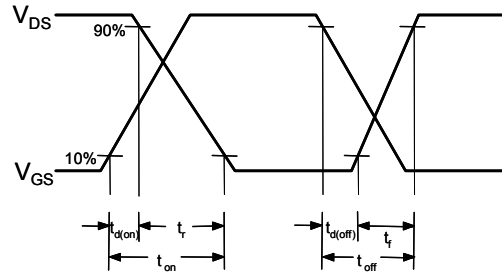

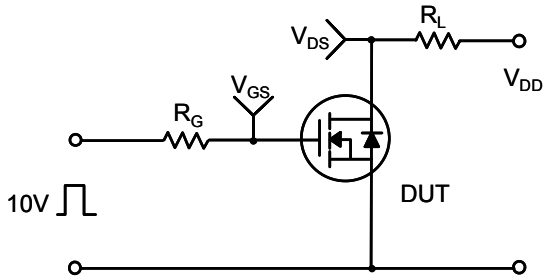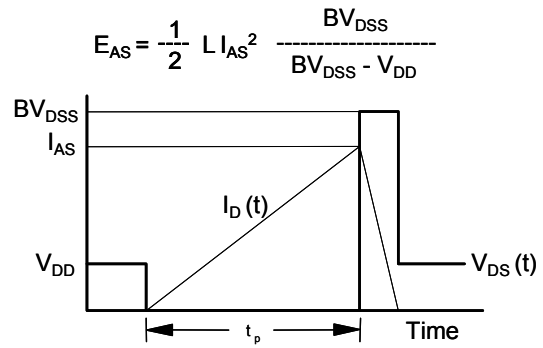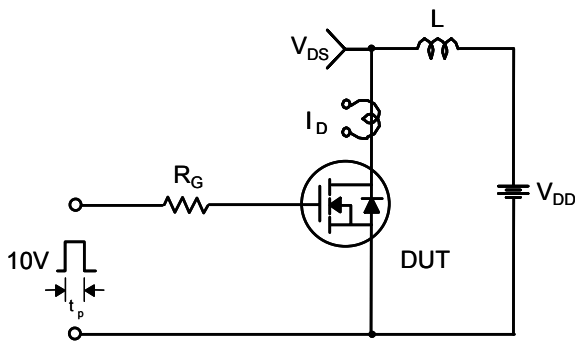**Figure 10. Maximum Drain Current
vs. Case Temperature**

Figure 11. Transient Thermal Response Curve

Gate Charge Test Circuit & Waveform

Charge

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching Test Circuit & Waveforms

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

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)

$$D = \frac{Gate\ Pulse\ Width}{Gate\ Pulse\ Period}$$

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
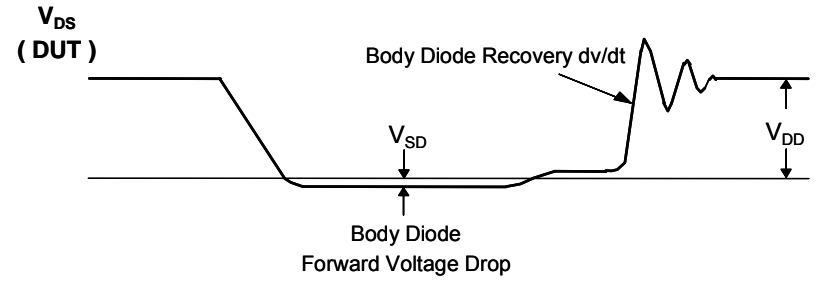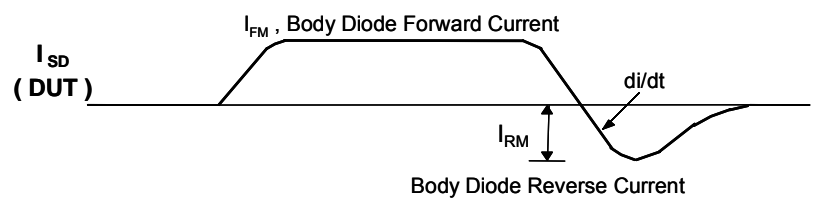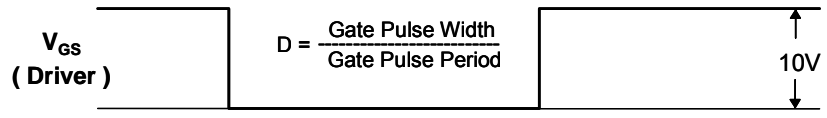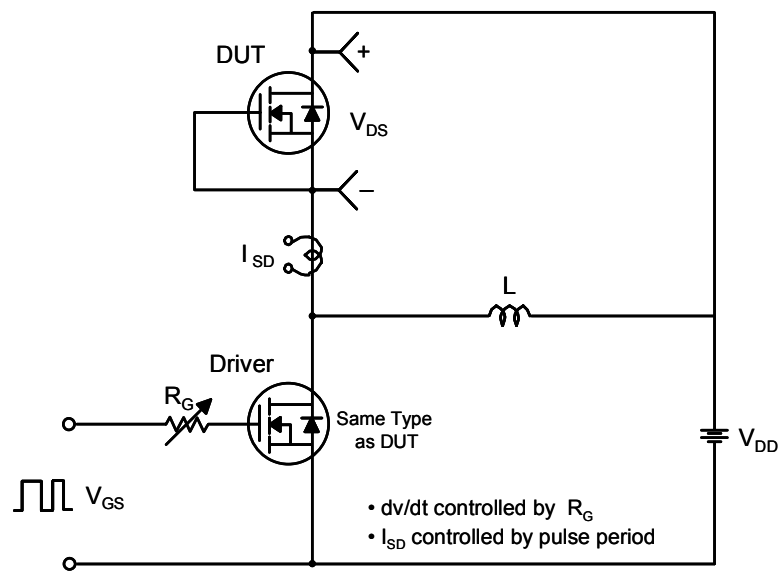
Package Dimensions

SOT-223

3.00 ±0.10

MAX1.80

0.65 ±0.20

◎ 0.08MAX

1.75 ±0.20

3.50 ±0.20

(0.60)

(0.60)

0.06 +0.04 −0.02

7.00 ±0.30

0° ~10°

0.25 +0.10 −0.05

2.30 TYP

0.70 ±0.10

(0.95)

4.60 ±0.25

(0.95)

1.60 ±0.20

(0.46)

(0.89)

6.50 ±0.20
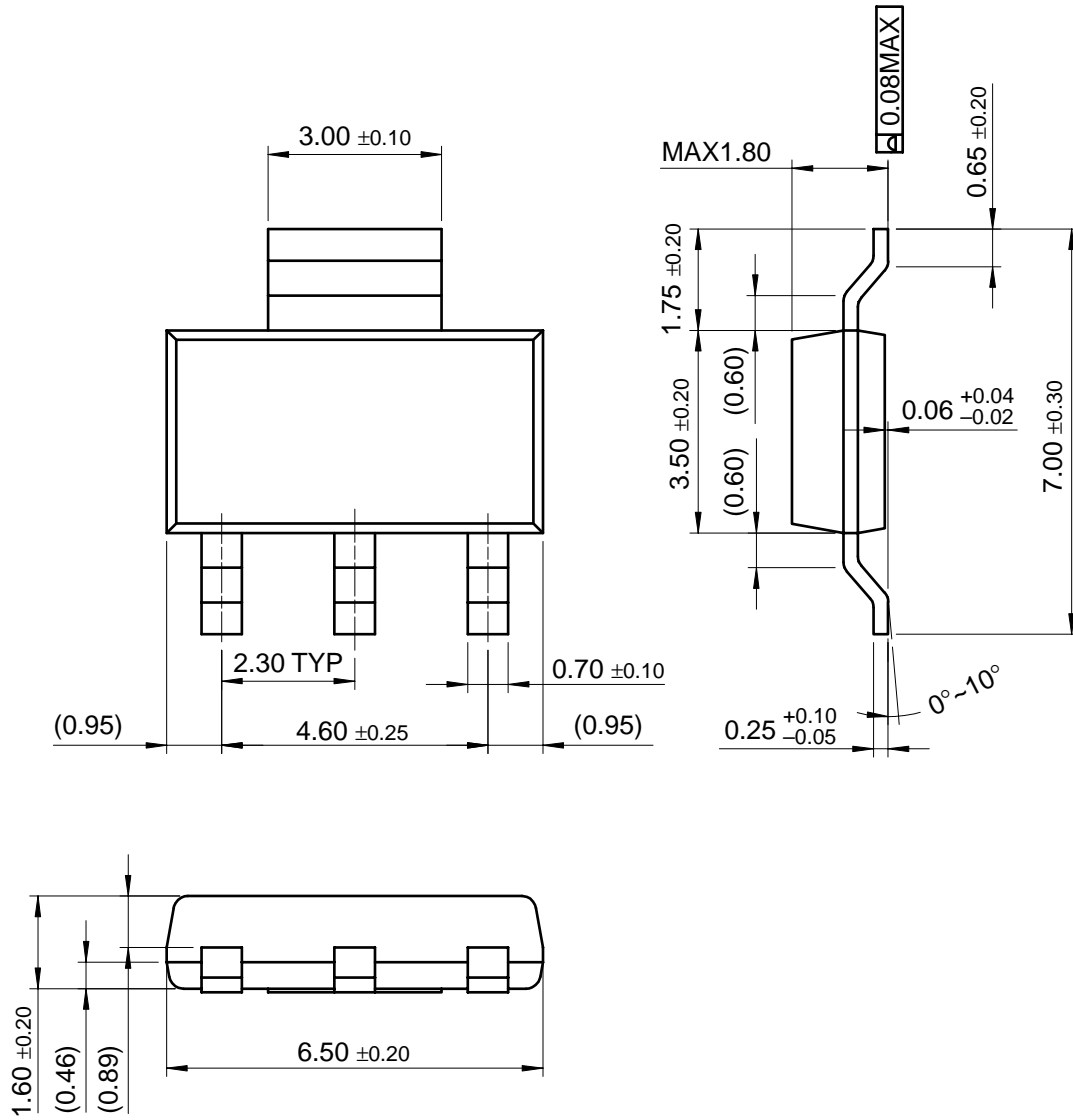
Dimensions in Millimeters

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CROSSVOLT™	GlobalOptoisolator™	MicroPak™	QS™	SyncFET™
DOME™	GTO™	MICROWIRE™	QT Optoelectronics™	TinyLogic®
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E²CMOS™	I²C™	MSXPro™	RapidConfigure™	TruTranslation™
EnSigna™	i-Lo™	OCX™	RapidConnect™	UHC™
FACT™	ImpliedDisconnect™	OCXPro™	μSerDes™	UltraFET®
FACT Quiet Series™		OPTOLOGIC®	SILENT SWITCHER®	VCX™
Across the board. Around the world.™		OPTOPLANAR™	SMART START™	
The Power Franchise®		PACMAN™	SPM™	
Programmable Active Droop™		POP™	Stealth™	

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