FAIRCHILD

SEMICONDUCTOR®

November 2001

SSR4N60B / SSU4N60B

600V 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 high efficiency switch mode power supplies.

Features

- 2.8A, 600V, $R_{DS(on)}$ = 2.5Ω @V_{GS} = 10 V
- Low gate charge (typical 22 nC)
- Low Crss (typical 14 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

D-PAK
SSR Series
G S

I-PAK
SSU Series
G D S
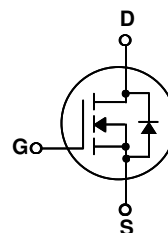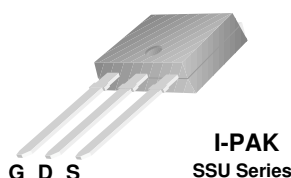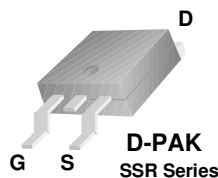
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			SSR4N60B / SSU4N60B	Units
V_{DSS}	Drain-Source Voltage			600	V
I_D	Drain Current	- Continuous (T_C = 25°C)		2.8	A
		- Continuous (T_C = 100°C)		1.8	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	11.2	A
V_{GSS}	Gate-Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	240	mJ
I_{AR}	Avalanche Current		(Note 1)	2.8	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	4.9	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	5.5	V/ns
P_D	Power Dissipation (T_A = 25°C) *			2.5	W
	Power Dissipation (T_C = 25°C)			49	W
	- Derate above 25°C			0.39	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	--	2.56	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	50	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	110	°C/W

* When mounted on the minimum pad size recommended (PCB Mount)

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	600	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	--	0.65	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	--	--	10	µA
		V_{DS} = 480 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 = 1.4 A	--	2.0	2.5	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 1.4 A (Note 4)	--	3.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	710	920	pF
C_{oss}	Output Capacitance		--	65	85	pF
C_{rss}	Reverse Transfer Capacitance		--	14	19	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 4.0 A, R_G = 25 Ω	--	20	50	ns
t_r	Turn-On Rise Time		--	55	120	ns
$t_{d(off)}$	Turn-Off Delay Time		--	70	150	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	55	120	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 4.0 A, V_{GS} = 10 V	--	22	29	nC
Q_{gs}	Gate-Source Charge		--	4.8	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	8.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	2.8	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	11.2	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.8 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 4.0 A, dI_F / dt = 100 A/µs (Note 4)	--	330	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.67	--	µC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 56mH, I_{AS} = 2.8A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 4.0A, 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
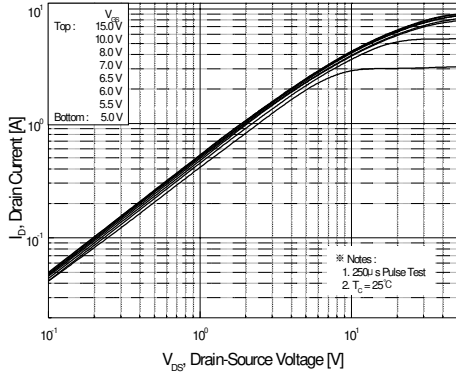
Typical Characteristics
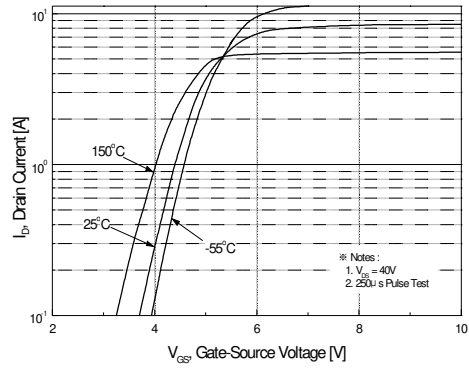
Figure 1. On-Region Characteristics

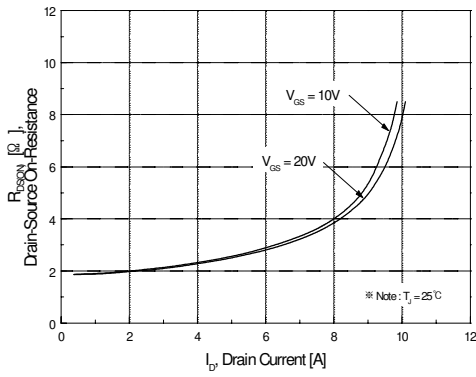**Figure 2. Transfer Characteristics**

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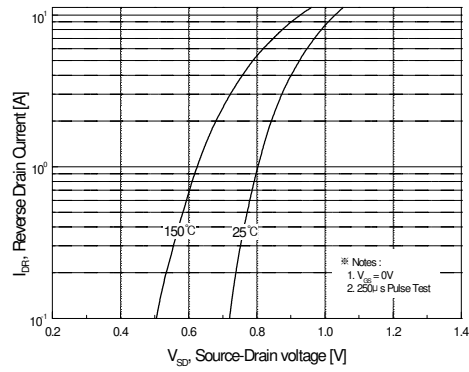Drain Current and Gate Voltage**

**Figure 4. Body Diode Forward Voltage
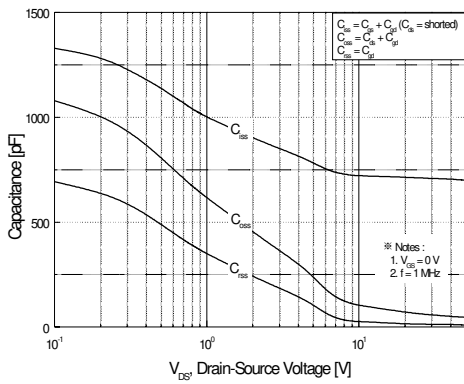Variation with Source Current
and Temperature**
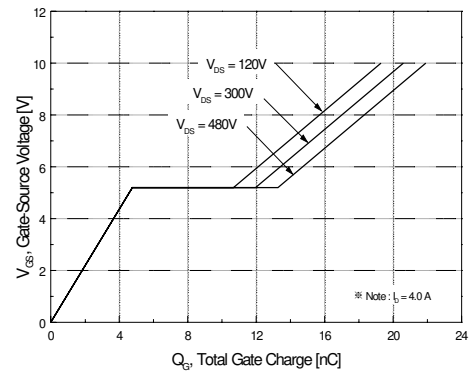
Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
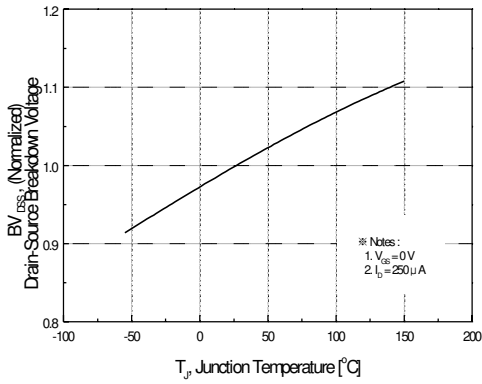
Typical Characteristics (Continued)

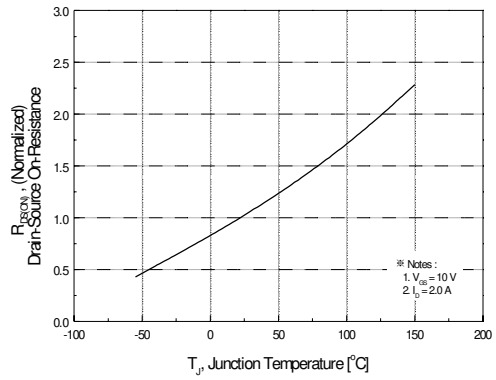**Figure 7. Breakdown Voltage Variation
vs Temperature**

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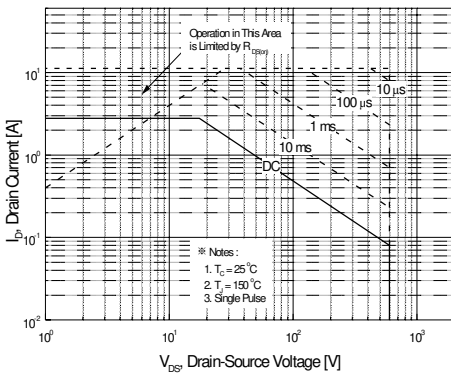vs Temperature**
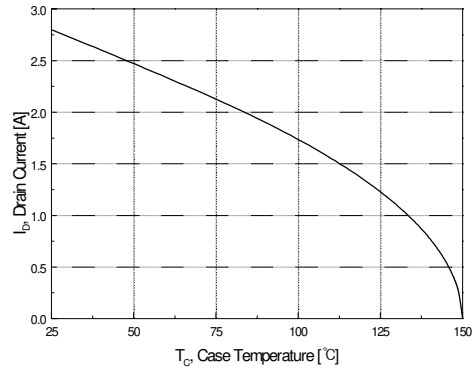

Figure 9. Maximum Safe Operating Area

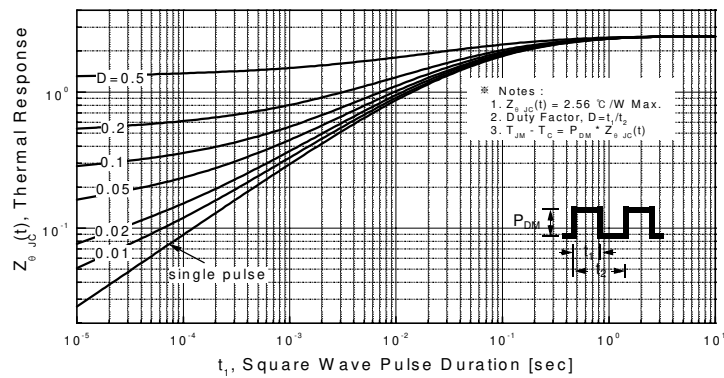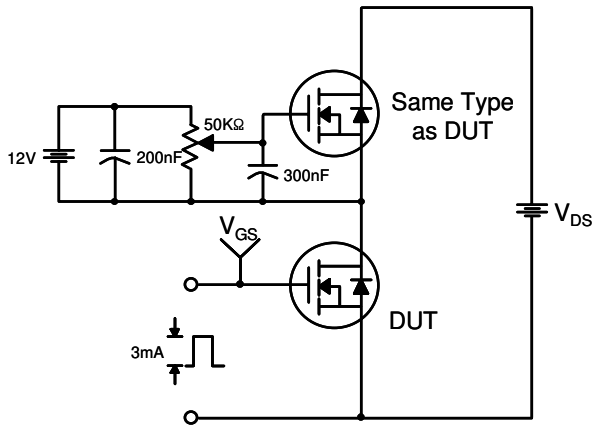**Figure 10. Maximum Drain Current
vs Case Temperature**

Figure 11. Transient Thermal Response Curve

Gate Charge Test Circuit & Waveform

12V · 200nF · 50KΩ · 300nF · Same Type as DUT · V_{GS} · V_{DS} · DUT · 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

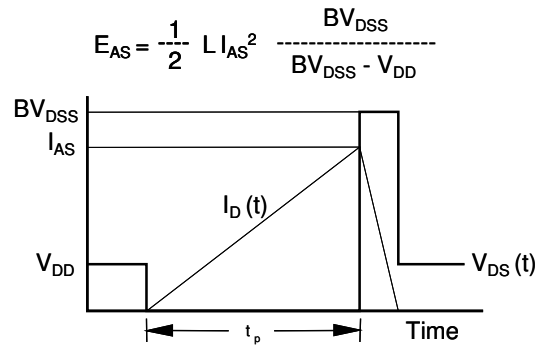V_{DS} · 90% · V_{GS} · 10% · $t_{d(on)}$ · t_r · $t_{d(off)}$ · t_f · t_{on} · t_{off}

Unclamped Inductive Switching Test Circuit & Waveforms

L · V_{DS} · I_D · R_G · V_{DD} · 10V · t_p · DUT

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

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)

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

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
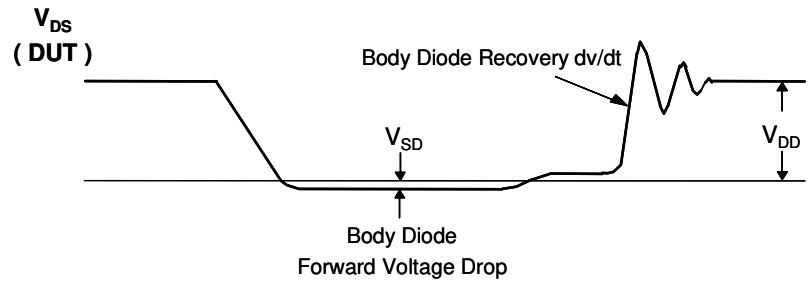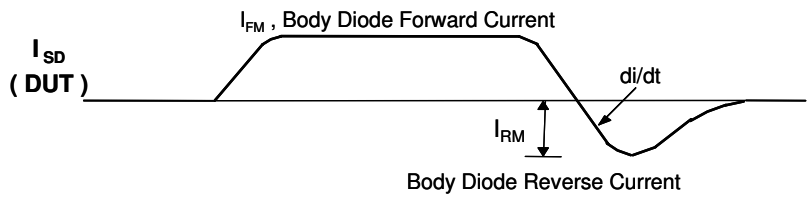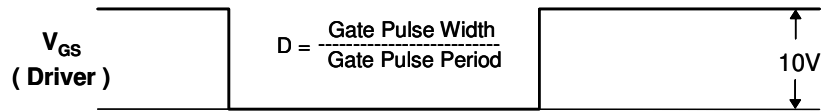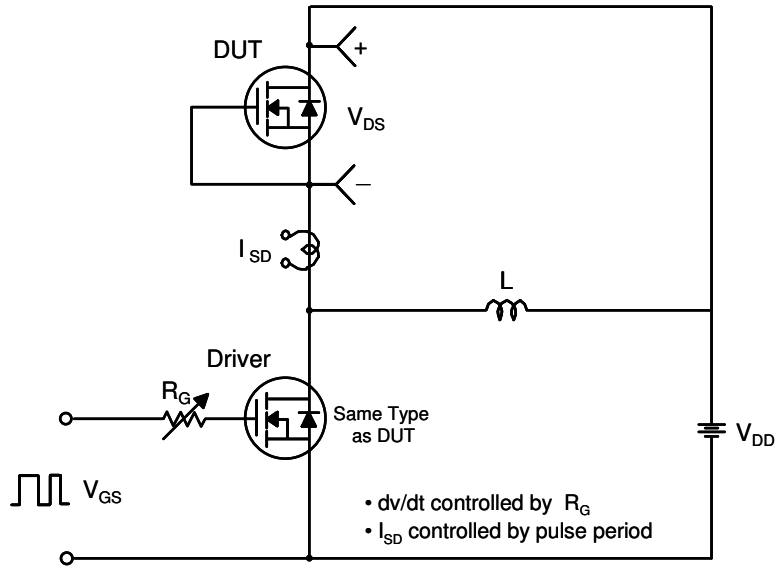
Package Dimensions

D-PAK
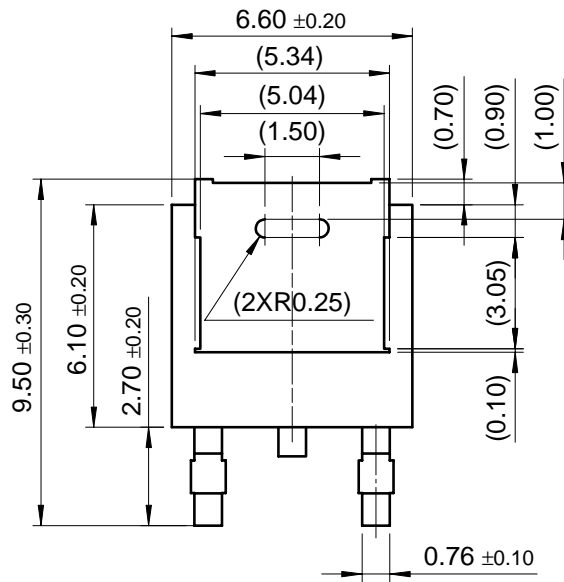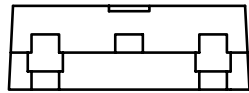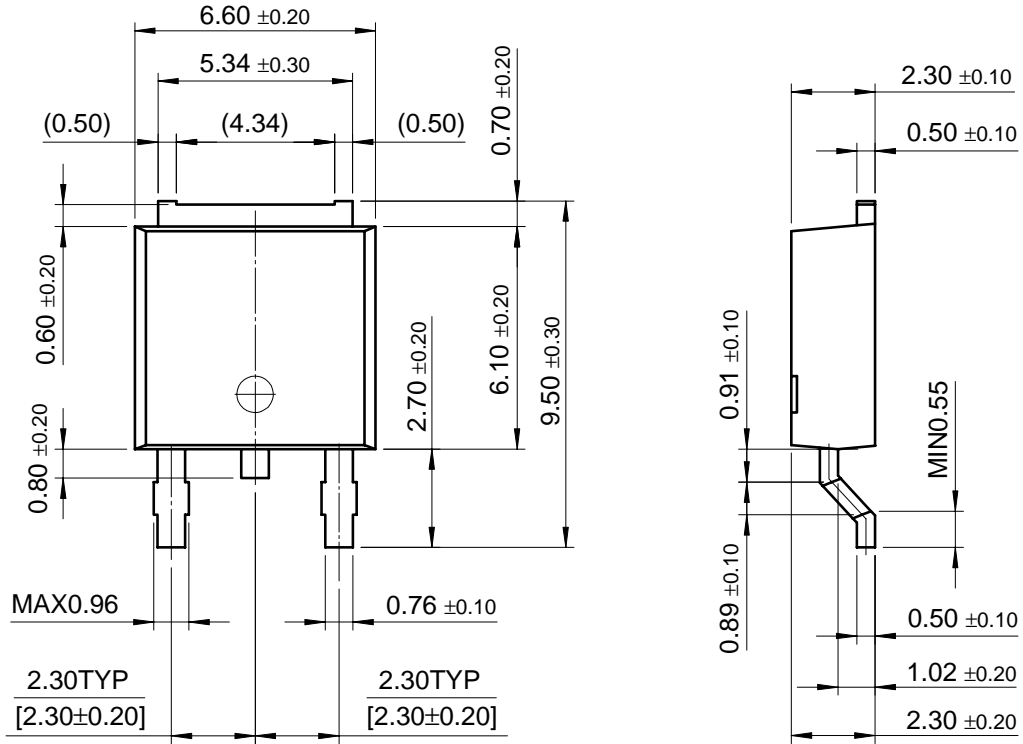
Dimensions in Millimeters

Package Dimensions (Continued)

I-PAK

6.60 ±0.20

5.34 ±0.20

(0.50)   (4.34)   (0.50)

0.60 ±0.20

0.70 ±0.20

6.10 ±0.20

0.80 ±0.10

MAX0.96

1.80 ±0.20

0.76 ±0.10

9.30 ±0.30

2.30TYP
[2.30±0.20]

2.30TYP
[2.30±0.20]

2.30 ±0.20

0.50 ±0.10

16.10 ±0.30

0.50 ±0.10
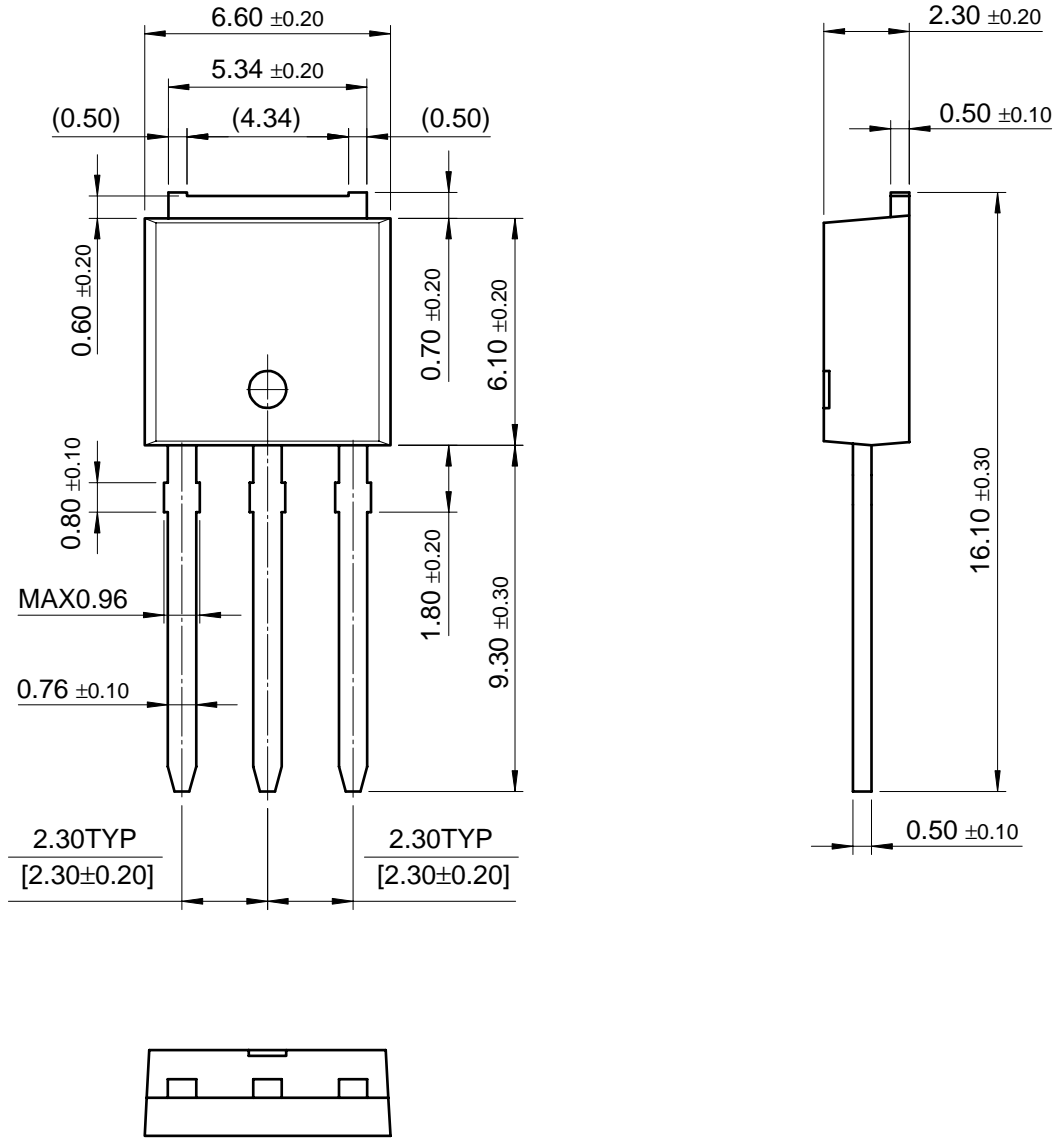
Dimensions in Millimeters

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General description | Features | Product status/pricing/packaging

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