FAIRCHILD SEMICONDUCTOR

November 2002

QFET™

FQU4N60

600V N-Channel MOSFET

Features

- 2.6A, 600V @T_J = 25°C
- Typ. $R_{DS(on)}$ = 1.0Ω
- Low gate charge (typical 12.8nC)
- Low effective output capacitance (typical 32pF)
- 100% avalanche tested
- Improved dv/dt capability

Description

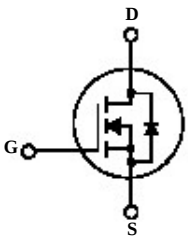
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

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 efficiency switch mode power supply,power Factor correction, electronic lamp ballast on half bridge.

G D S

I-PAK

FQU Series



Absolute Maximum Ratings

Symbol	Parameter		FQU4N60	Unit
V_{DSS}	Drain-Source Voltage		600	V
I_D	Drain Current - Continuous (T_C = 25°C) - Continuous (T_C = 100°C)		2.6 1.64	A A
I_{DM}	Drain Current - Pulsed	(Note 1)	11	A
V_{GSS}	Gate-Source voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	180	mJ
I_{AR}	Avalanche Current	(Note 1)	2.6	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	4.5	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25°C) - Derate above 25°C		50 0.4	W 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	FQU4N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	110	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Tape Size	Tape Width	Quantity
FQU4N60	FQU4N60TU	IPAK			5040
FQU4N60C	FQU4N60CTU	IPAK			5040

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 = 250μA, T_J = 25°C	600	--	--	V
		V_{GS} = 0V, I_D = 250μA, T_J = 150°C	--	650	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.38	--	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0V, I_D =2.6A	--	650	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0V V_{DS} = 480V, 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 = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 1.3A	--	1.0	1.2	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 1.3A (Note 4)	--	2.6	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	415	540	pF
C_{oss}	Output Capacitance		--	210	275	pF
C_{rss}	Reverse Transfer Capacitance		--	19.5	--	pF
C_{oss}	Output Capacitance	V_{DS} = 480V, V_{GS} = 0V, f = 1.0MHz	--	12	16	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0V to 400V, V_{GS} = 0V	--	32	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300V, I_D = 3.4A, R_G = 25Ω	--	16	45	ns
t_r	Turn-On Rise Time		--	45	100	ns
$t_{d(off)}$	Turn-Off Delay Time		--	36	85	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	30	70	ns
Q_g	Total Gate Charge	V_{DS} = 480V, I_D = 3.4A, V_{GS} = 10V	--	12.8	16.6	nC
Q_{gs}	Gate-Source Charge		--	2.4	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	7.1	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	2.6	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	11	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 2.6A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 3.4A, dI_F/dt =100A/μs (Note 4)	--	277	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.07	--	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperatur
2. I_{AS} = 1.3, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 3.4, di/dt ≤ 200A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

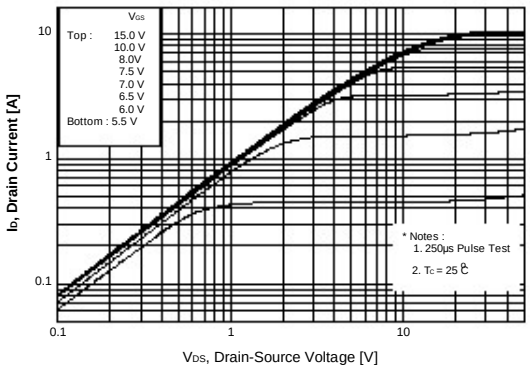


Figure 2. Transfer Characteristics

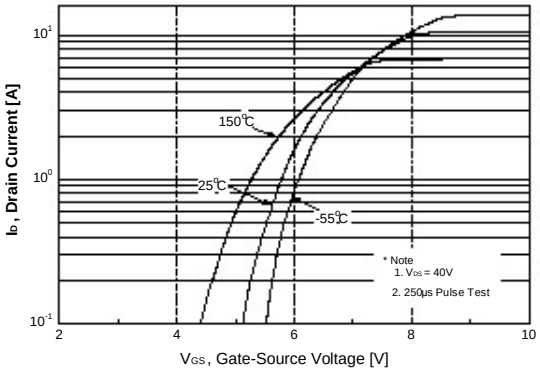


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

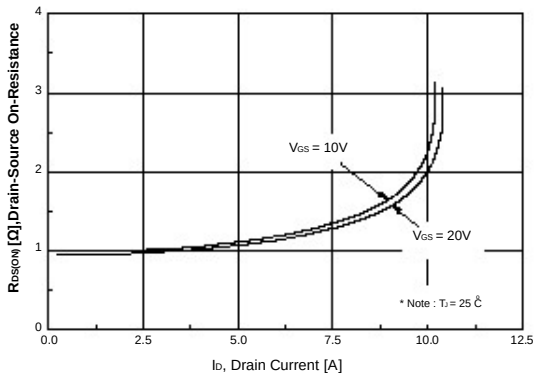


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

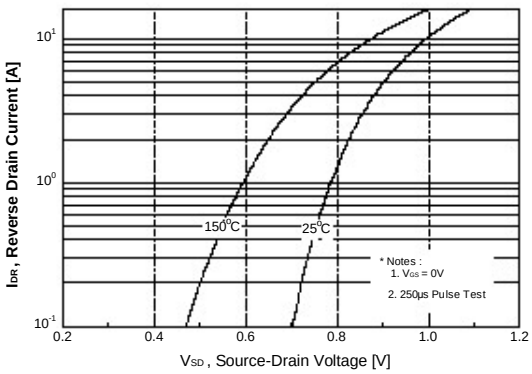


Figure 5. Capacitance Characteristics

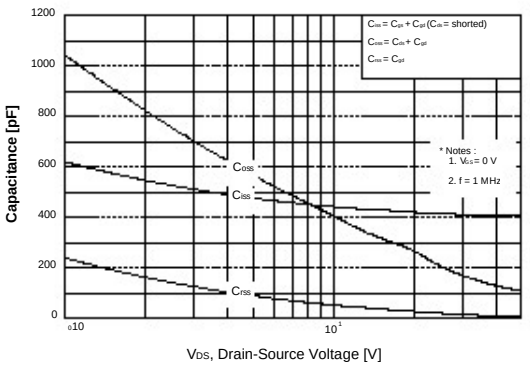
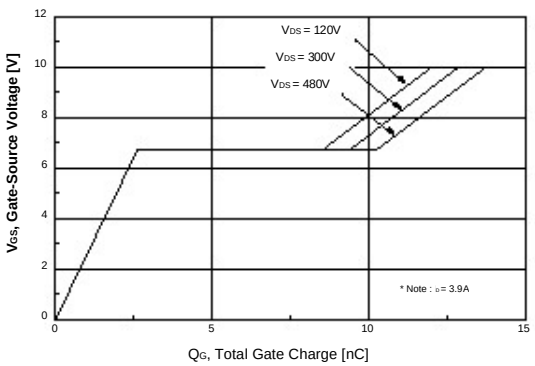


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics(Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

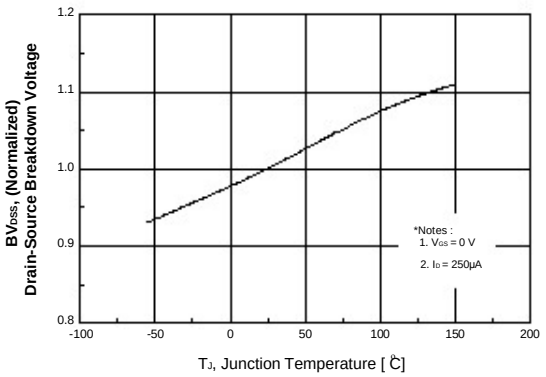


Figure 8. On-Resistance Variation vs. Temperature

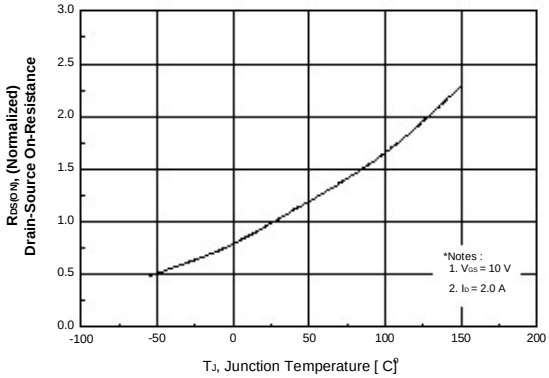


Figure 9. Maximum Safe Operating Area

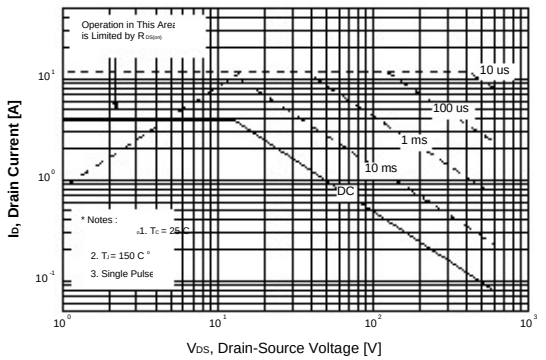


Figure 10. Maximum Drain Current vs. Case Temperature

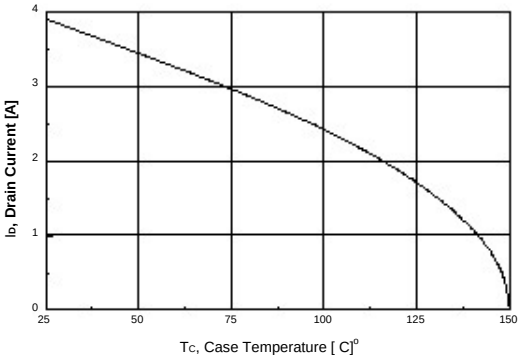
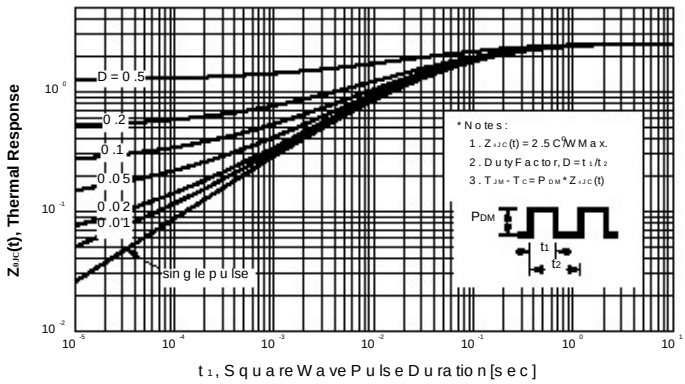
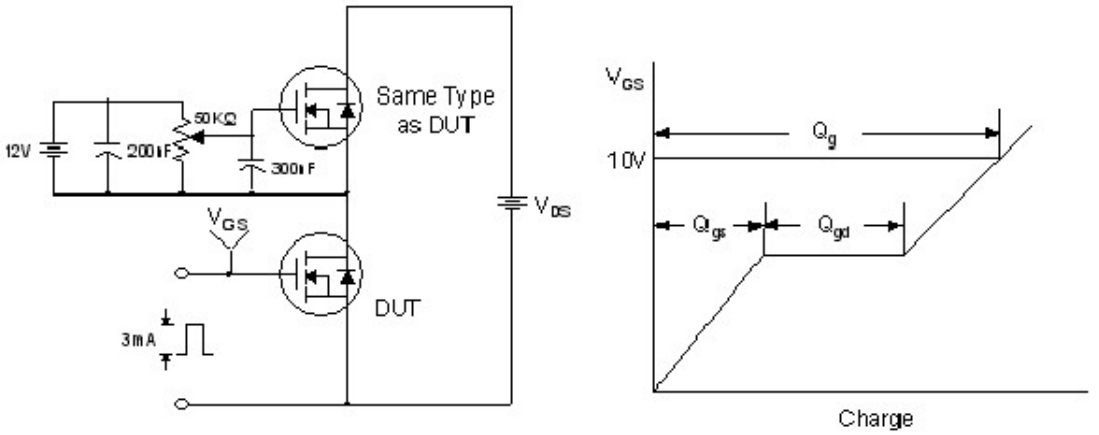


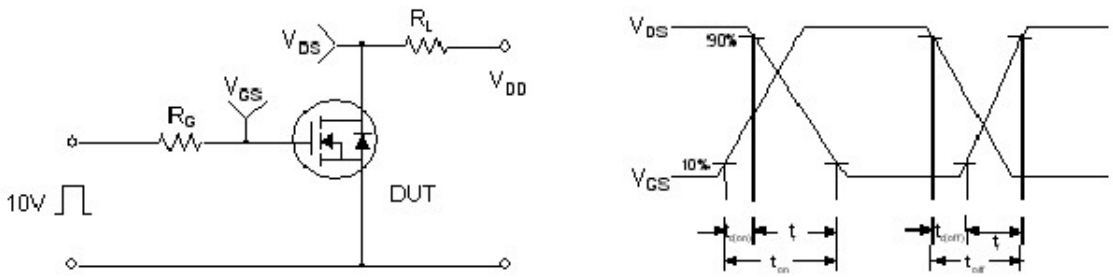
Figure 11-1. Transient Thermal Response Curve



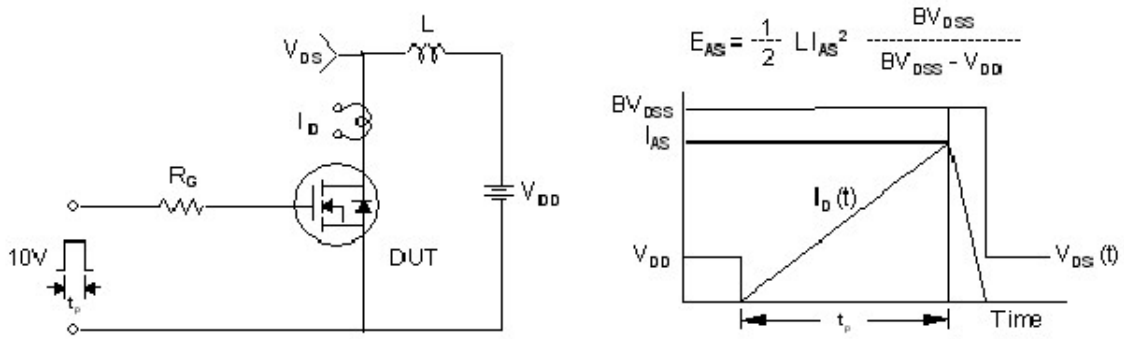
Gate Charge Test Circuit & Waveform



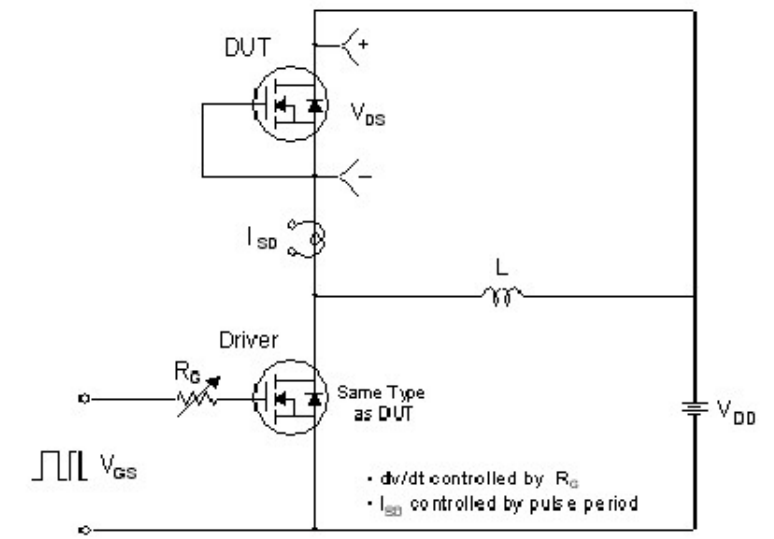
Resistive Switching Test Circuit & Waveforms

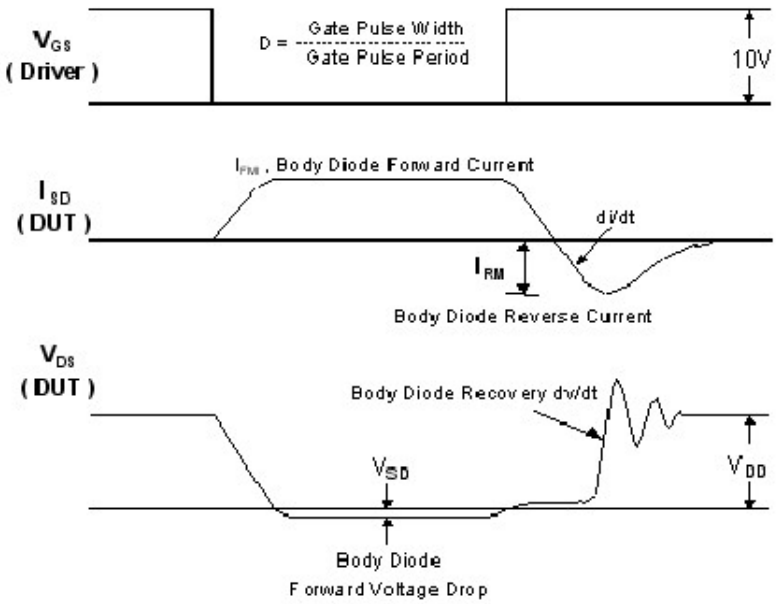


Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms





Package Dimensions

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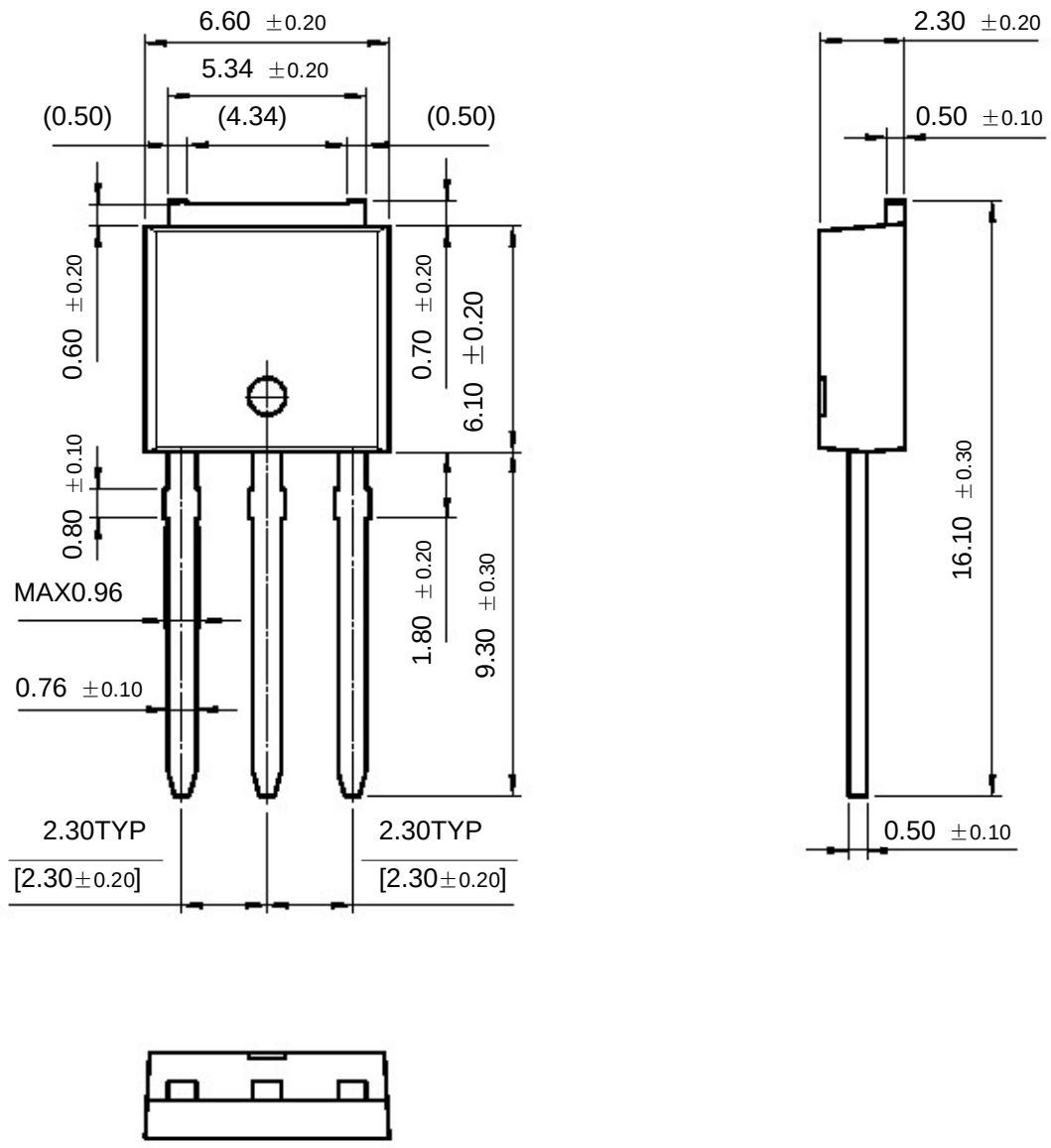

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