



December 2000

QFET™

## FQD7N10L / FQU7N10L

### 100V LOGIC N-Channel MOSFET

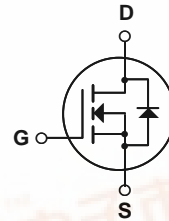
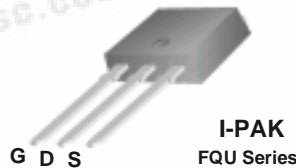
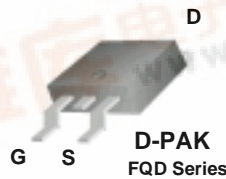
#### General Description

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

This advanced technology is especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation modes. These devices are well suited for low voltage applications such as high efficiency switching DC/DC converters, and DC motor control.

#### Features

- 5.8A, 100V,  $R_{DS(on)} = 0.35\Omega$  @  $V_{GS} = 10V$
- Low gate charge ( typical 4.6 nC)
- Low  $C_{rss}$  ( typical 12 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Low level gate drive requirements allowing direct operation from logic drives



#### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	FQD7N10L / FQU7N10L	Units
$V_{DSS}$	Drain-Source Voltage	100	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	5.8	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	3.67	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	23.2	A
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	50	mJ
$I_{AR}$	Avalanche Current (Note 1)	5.8	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	2.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	6.0	V/ns
$P_D$	Power Dissipation ( $T_A = 25^\circ\text{C}$ ) *	2.5	W
	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	25	W
	- Derate above $25^\circ\text{C}$	0.2	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

#### Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	5.0	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	50	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	110	$^\circ\text{C}/\text{W}$

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

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**Electrical Characteristics** $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
$V_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	100	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to 25°C	--	0.1	--	V/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 80\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0	--	2.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.9\text{ A}$	--	0.275	0.35	$\Omega$
		$V_{GS} = 5\text{ V}, I_D = 2.9\text{ A}$	--	0.300	0.38	
$g_{FS}$	Forward Transconductance	$V_{DS} = 30\text{ V}, I_D = 2.9\text{ A}$ (Note 4)	--	4.6	--	S
Dynamic Characteristics						
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	220	290	pF
$C_{oss}$	Output Capacitance		--	55	72	pF
$C_{rss}$	Reverse Transfer Capacitance		--	12	15	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}, I_D = 7.3\text{ A},$ $R_G = 25\text{ }\Omega$  (Note 4, 5)	--	9	30	ns
$t_r$	Turn-On Rise Time		--	100	210	ns
$t_{d(off)}$	Turn-Off Delay Time		--	17	45	ns
$t_f$	Turn-Off Fall Time		--	50	110	ns
$Q_g$	Total Gate Charge	$V_{DS} = 80\text{ V}, I_D = 7.3\text{ A},$ $V_{GS} = 5\text{ V}$  (Note 4, 5)	--	4.6	6.0	nC
$Q_{gs}$	Gate-Source Charge		--	1.0	--	nC
$Q_{gd}$	Gate-Drain Charge		--	2.6	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		--	--	5.8	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		--	--	23.2	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 5.8\text{ A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 7.3\text{ A},$ $dI_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	70	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	140	--	nC

**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 2.23\text{ mH}$ ,  $I_{AS} = 5.8\text{ A}$ ,  $V_{DD} = 25\text{ V}$ ,  $R_G = 25\text{ }\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 7.3\text{ A}$ ,  $di/dt \leq 300\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## Typical Characteristics

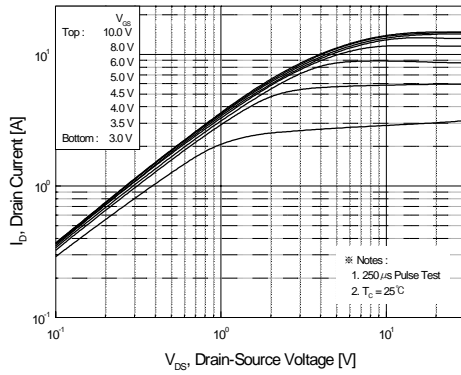


Figure 1. On-Region Characteristics

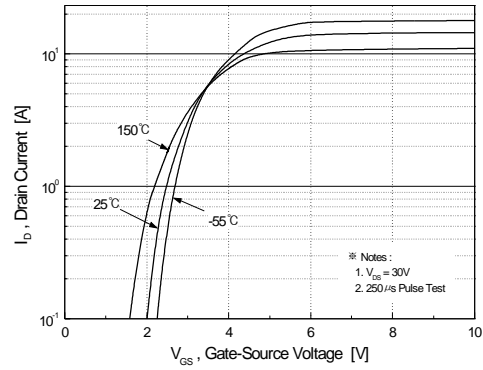


Figure 2. Transfer Characteristics

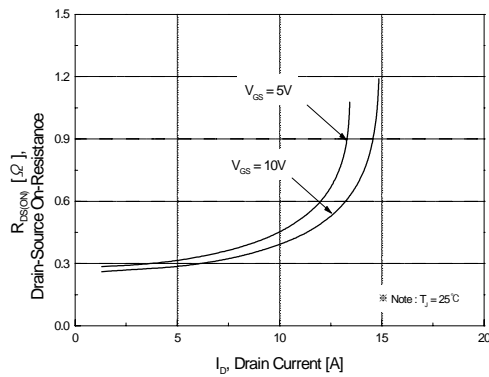


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

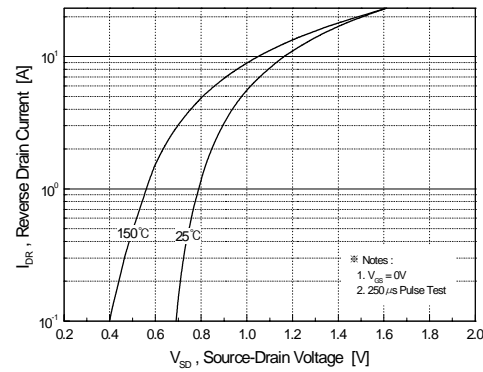


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

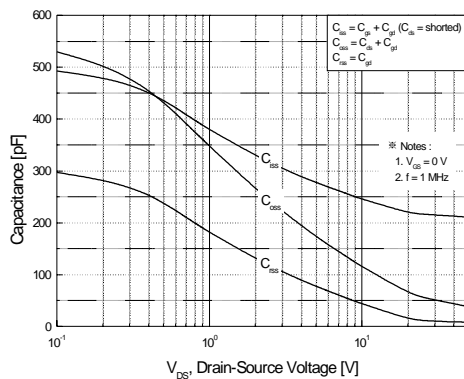


Figure 5. Capacitance Characteristics

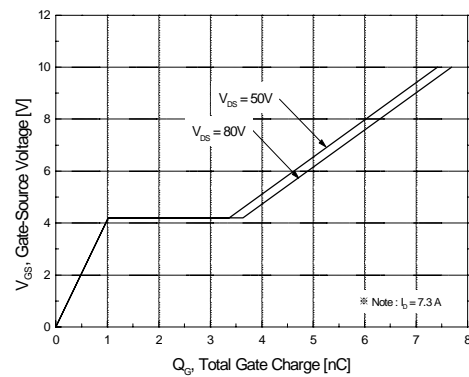


Figure 6. Gate Charge Characteristics

## Typical Characteristics (Continued)

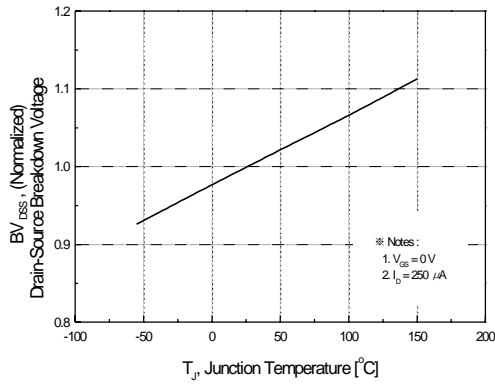


Figure 7. Breakdown Voltage Variation vs. Temperature

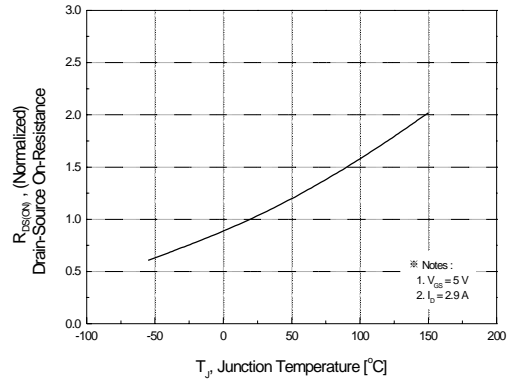


Figure 8. On-Resistance Variation vs. Temperature

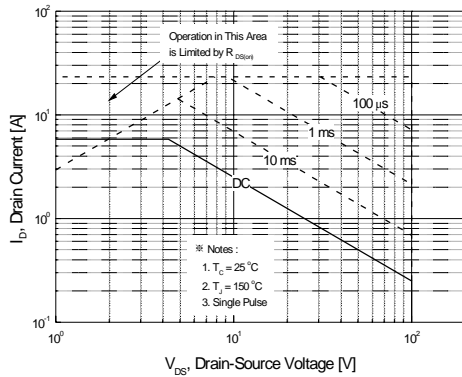


Figure 9. Maximum Safe Operating Area

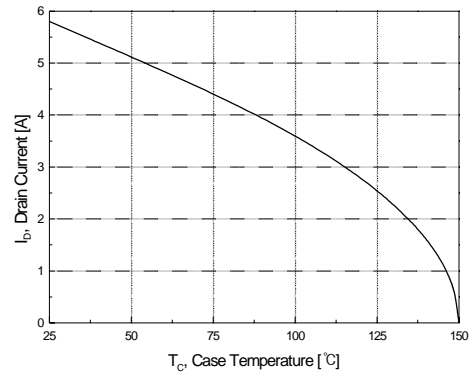


Figure 10. Maximum Drain Current vs. Case Temperature

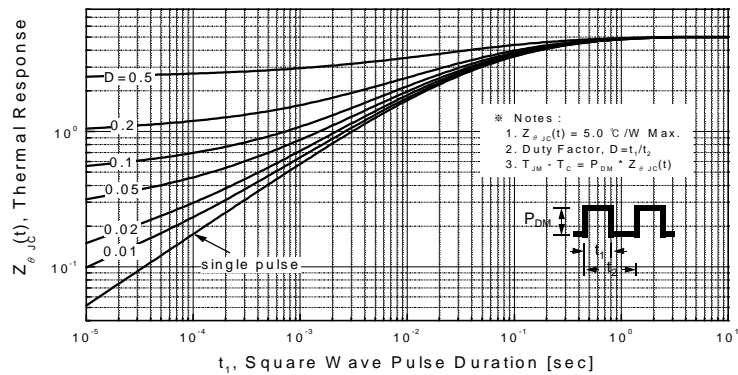
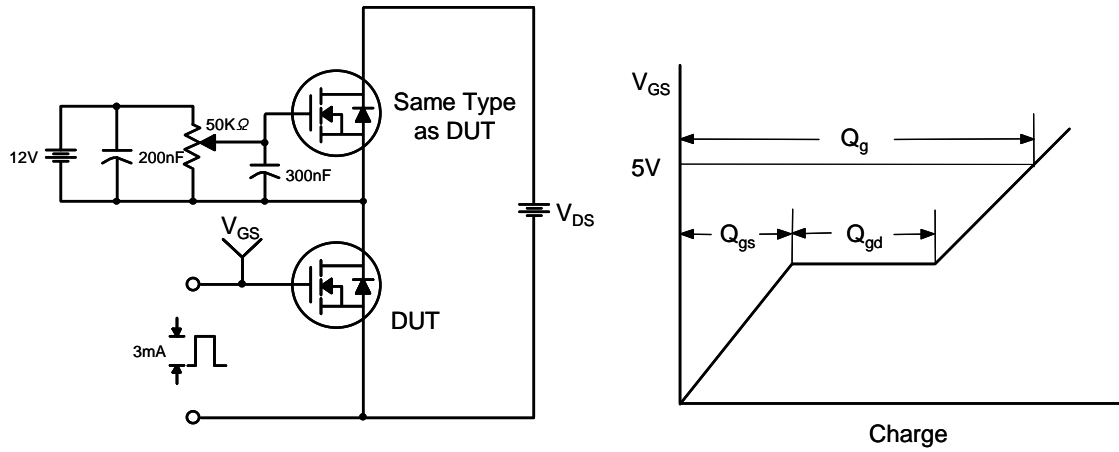
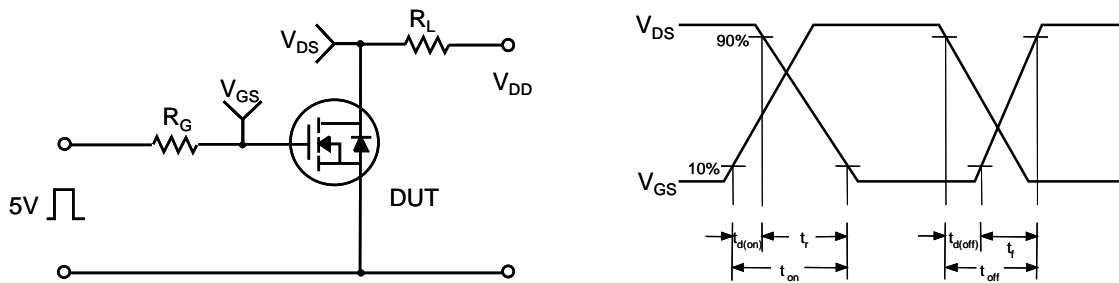


Figure 11. Transient Thermal Response Curve

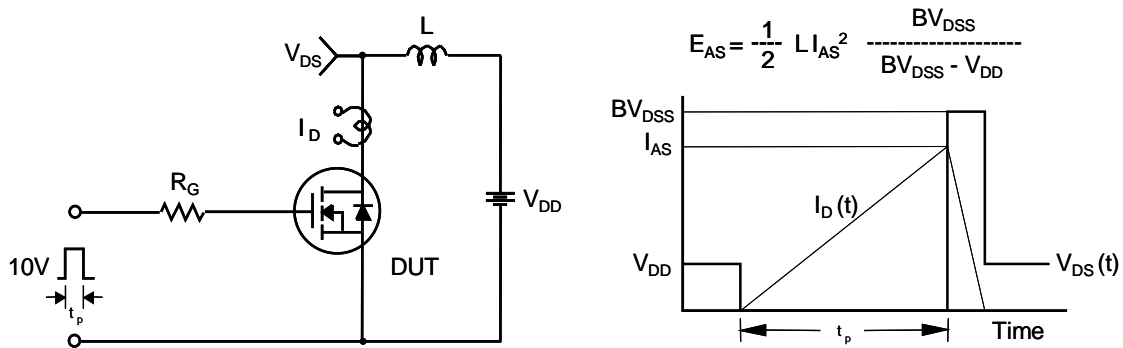
### Gate Charge Test Circuit & Waveform



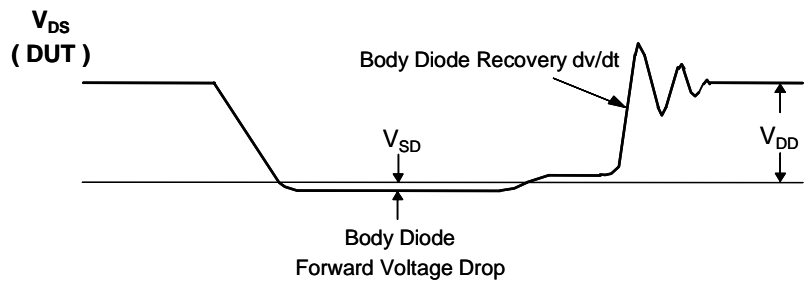
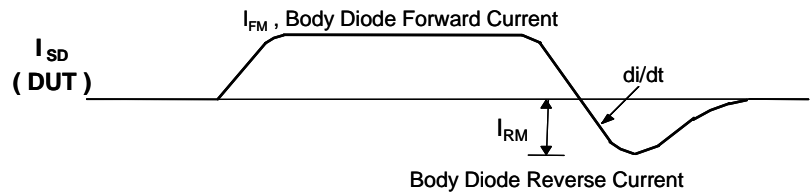
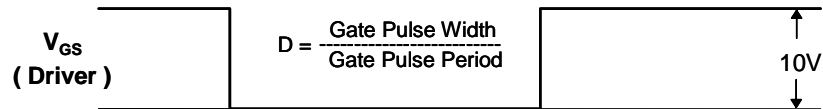
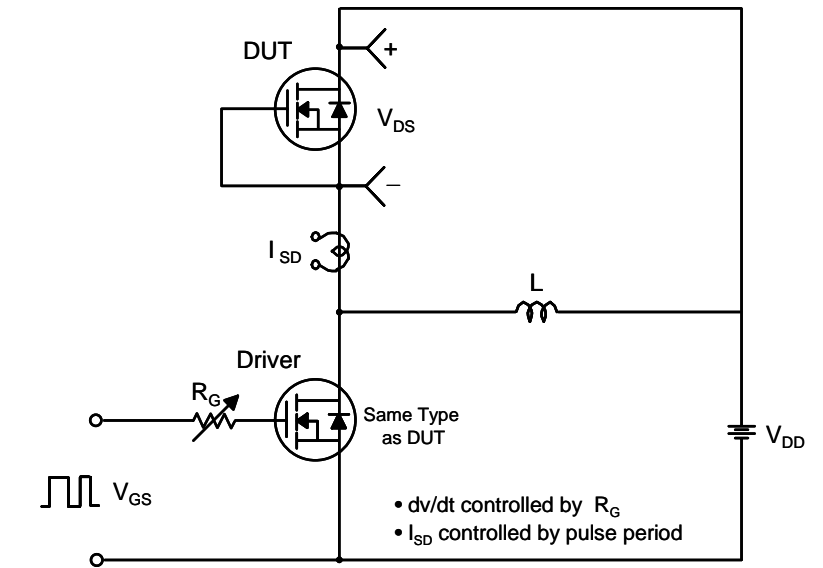
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



# Peak Diode Recovery dv/dt Test Circuit & Waveforms

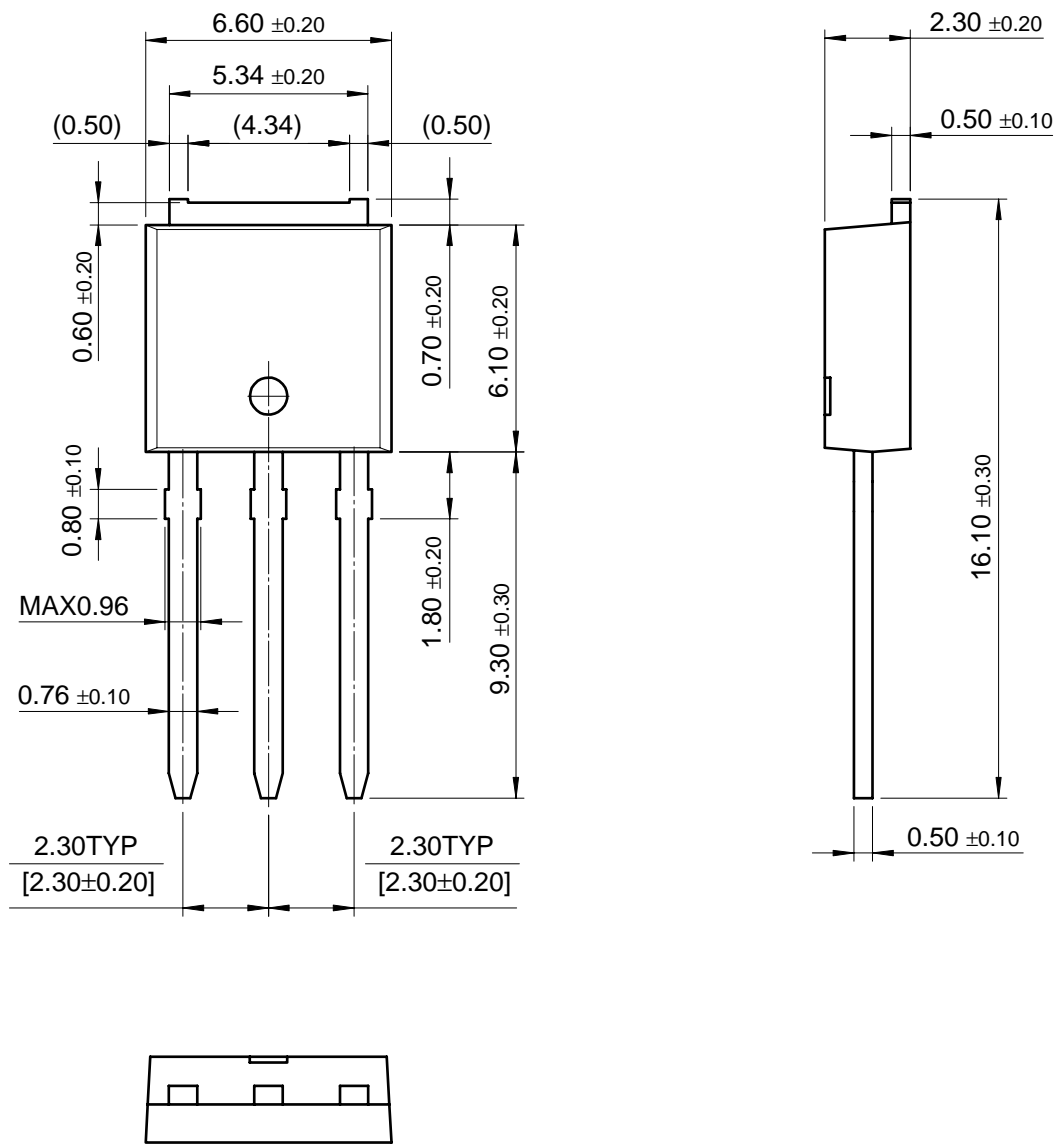


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Package Dimensions (Continued)

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