FAIRCHILD SEMICONDUCTOR™

April 2000

QFET™

FQD6P25 / FQU6P25

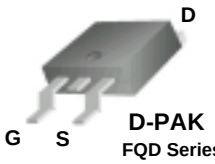
250V P-Channel MOSFET

General Description

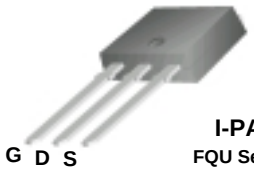
These P-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters.

Features

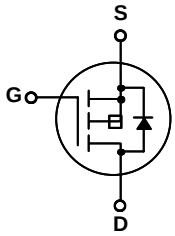
- -4.7A, -250V, $R_{DS(on)}$ = 1.1Ω @V_{GS} = -10 V
- Low gate charge (typical 21 nC)
- Low Crss (typical 20 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



D-PAK
FQD Series



I-PAK
FQU Series



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		FQD6P25 / FQU6P25	Units
V_{DSS}	Drain-Source Voltage		-250	V
I_D	Drain Current - Continuous (T_C = 25°C)		-4.7	A
	- Continuous (T_C = 100°C)		-3.0	A
I_{DM}	Drain Current - Pulsed	(Note 1)	-18.8	A
V_{GSS}	Gate-Source Voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	540	mJ
I_{AR}	Avalanche Current	(Note 1)	-4.7	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	5.5	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)		55	W
	- Derate above 25°C		0.44	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	--	2.27	°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)

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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	-250	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = -250 µA, Referenced to 25°C	--	-0.1	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -250 V, V_{GS} = 0 V	--	--	-1	µA
		V_{DS} = -200 V, T_C = 125°C	--	--	-10	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	-3.0	--	-5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = -10 V, I_D = -2.35 A	--	0.82	1.1	Ω
g_{FS}	Forward Transconductance	V_{DS} = -40 V, I_D = -2.35 A (Note 4)	--	3.0	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = -25 V, V_{GS} = 0 V, f = 1.0 MHz	--	600	780	pF
C_{oss}	Output Capacitance		--	115	150	pF
C_{rss}	Reverse Transfer Capacitance		--	20	25	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -125 V, I_D = -6.0 A, R_G = 25 Ω (Note 4, 5)	--	13	35	ns
t_r	Turn-On Rise Time		--	75	160	ns
$t_{d(off)}$	Turn-Off Delay Time		--	40	90	ns
t_f	Turn-Off Fall Time		--	50	110	ns
Q_g	Total Gate Charge	V_{DS} = -200 V, I_D = -6.0 A, V_{GS} = -10 V (Note 4, 5)	--	21	27	nC
Q_{gs}	Gate-Source Charge		--	4.7	--	nC
Q_{gd}	Gate-Drain Charge		--	10.7	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	-4.7	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	-18.8	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = -4.7 A	--	--	-5.0	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = -6.0 A, dI_F / dt = 100 A/µs (Note 4)	--	170	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.1	--	µC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 39mH, I_{AS} = -4.7A, V_{DD} = -50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ -6.0A, di/dt ≤ 300A/µs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300µs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

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Typical Characteristics

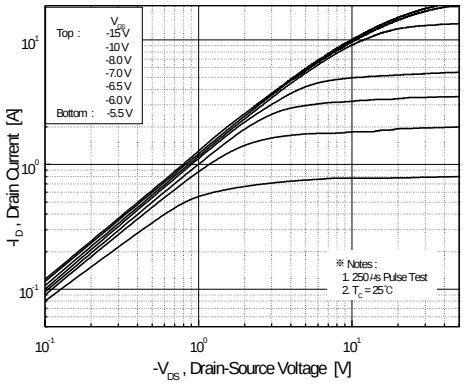


Figure 1. On-Region Characteristics

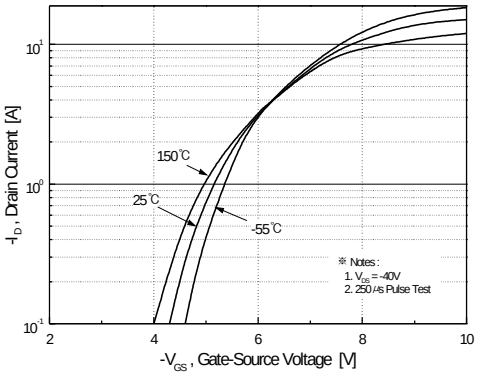


Figure 2. Transfer Characteristics

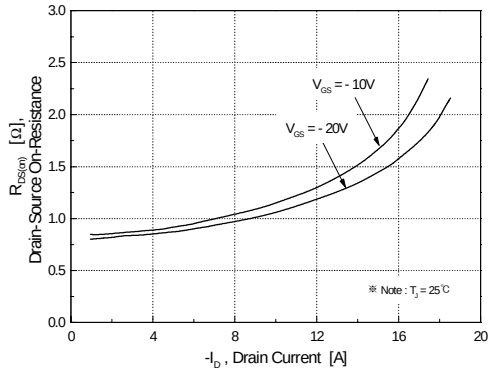


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

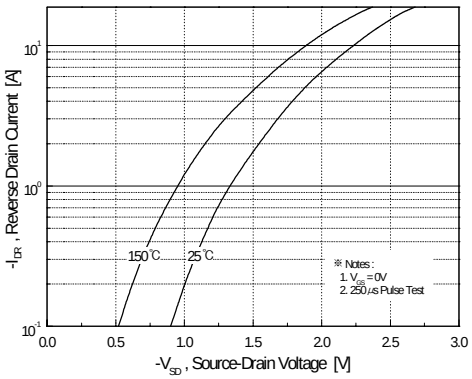


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

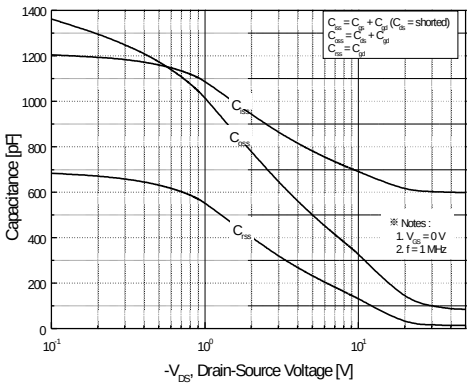


Figure 5. Capacitance Characteristics

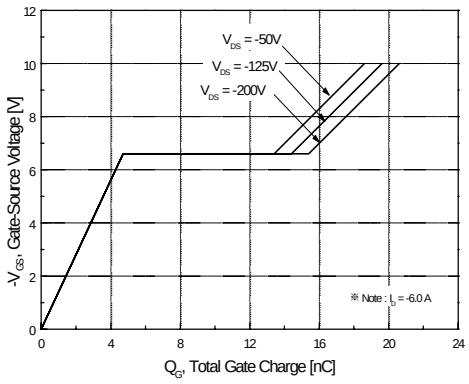


Figure 6. Gate Charge Characteristics

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Typical Characteristics (Continued)

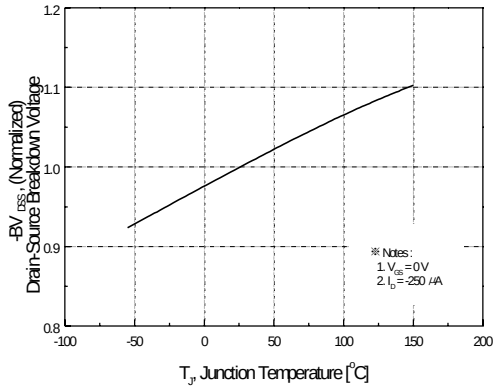


Figure 7. Breakdown Voltage Variation vs. Temperature

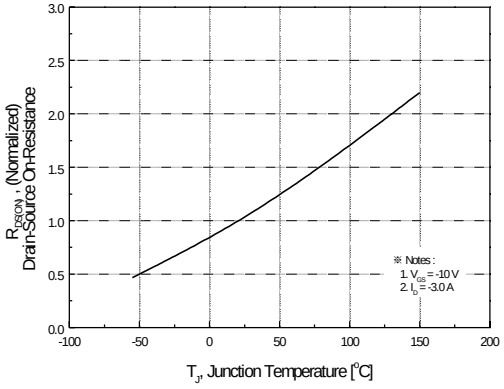


Figure 8. On-Resistance Variation vs. Temperature

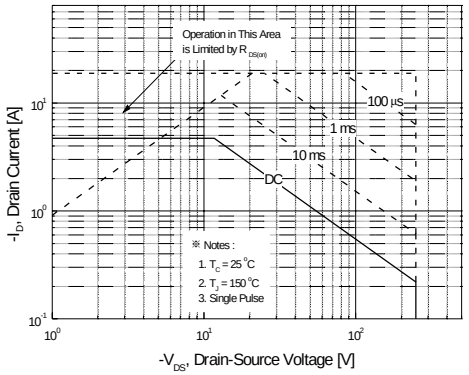


Figure 9. Maximum Safe Operating Area

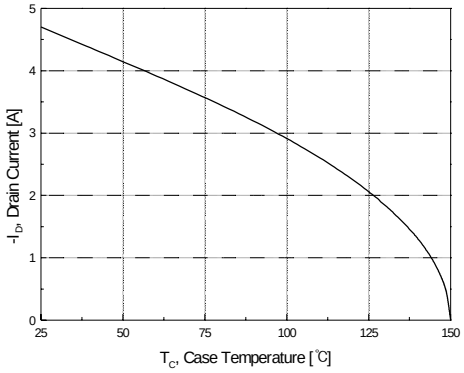


Figure 10. Maximum Drain Current vs. Case Temperature

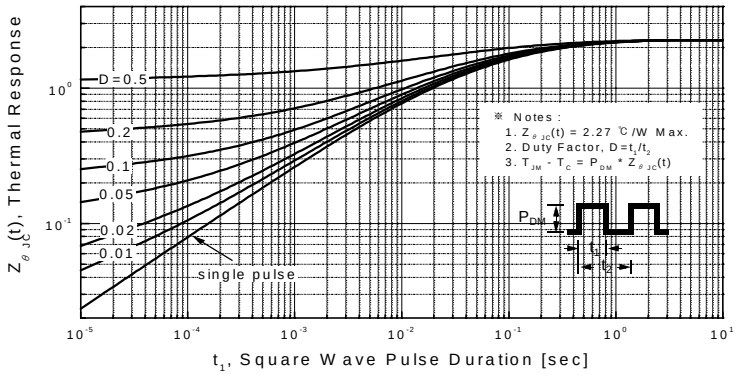
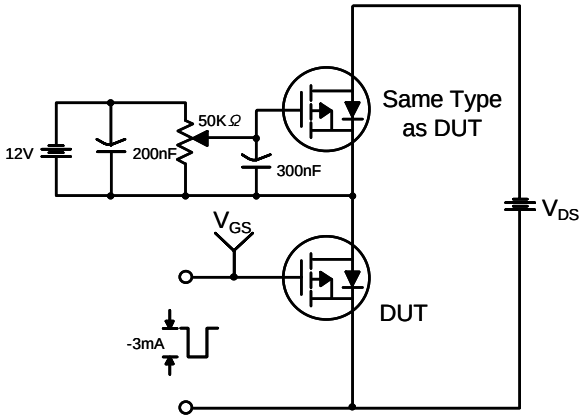
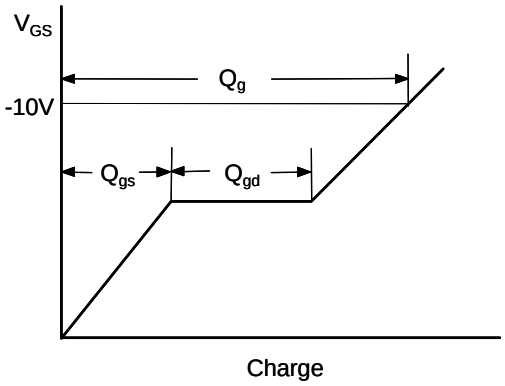


Figure 11. Transient Thermal Response Curve

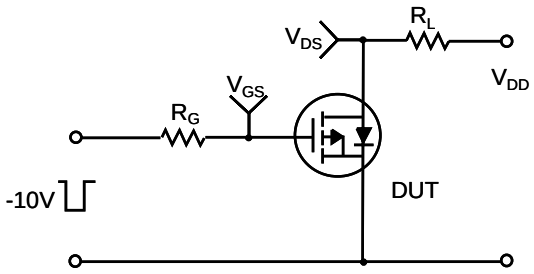
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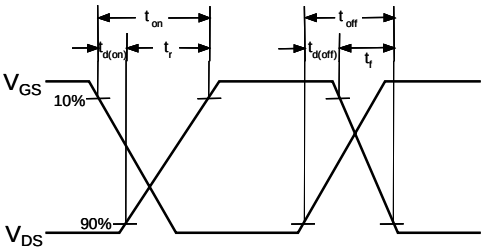
Gate Charge Test Circuit & Waveform



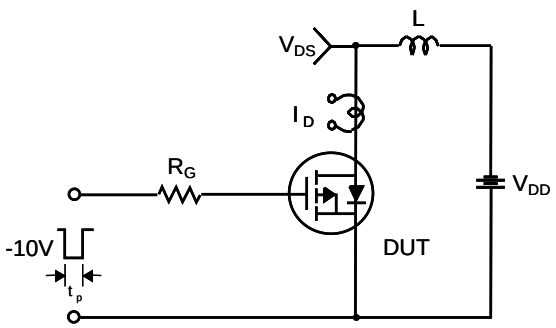


Resistive Switching Test Circuit & Waveforms

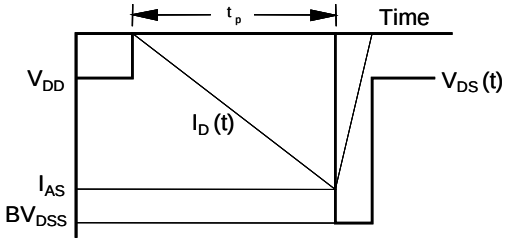




Unclamped Inductive Switching Test Circuit & Waveforms

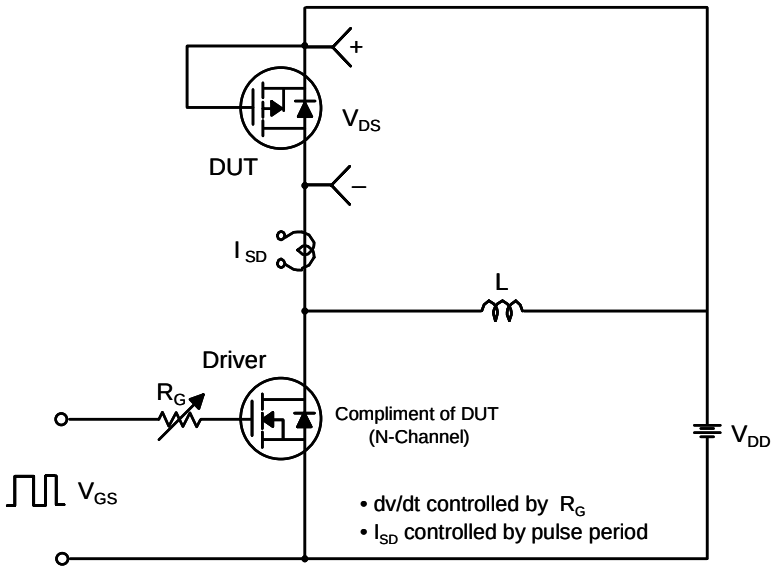


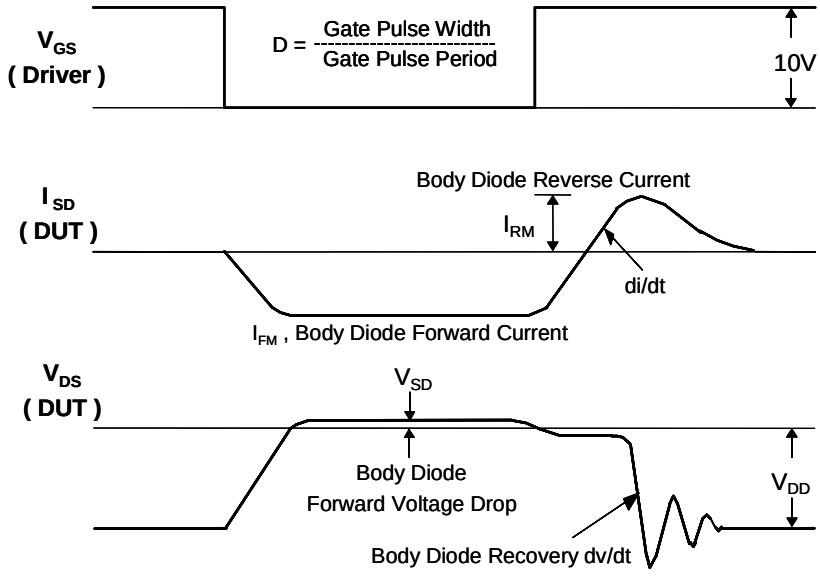
$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



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Peak Diode Recovery dv/dt Test Circuit & Waveforms

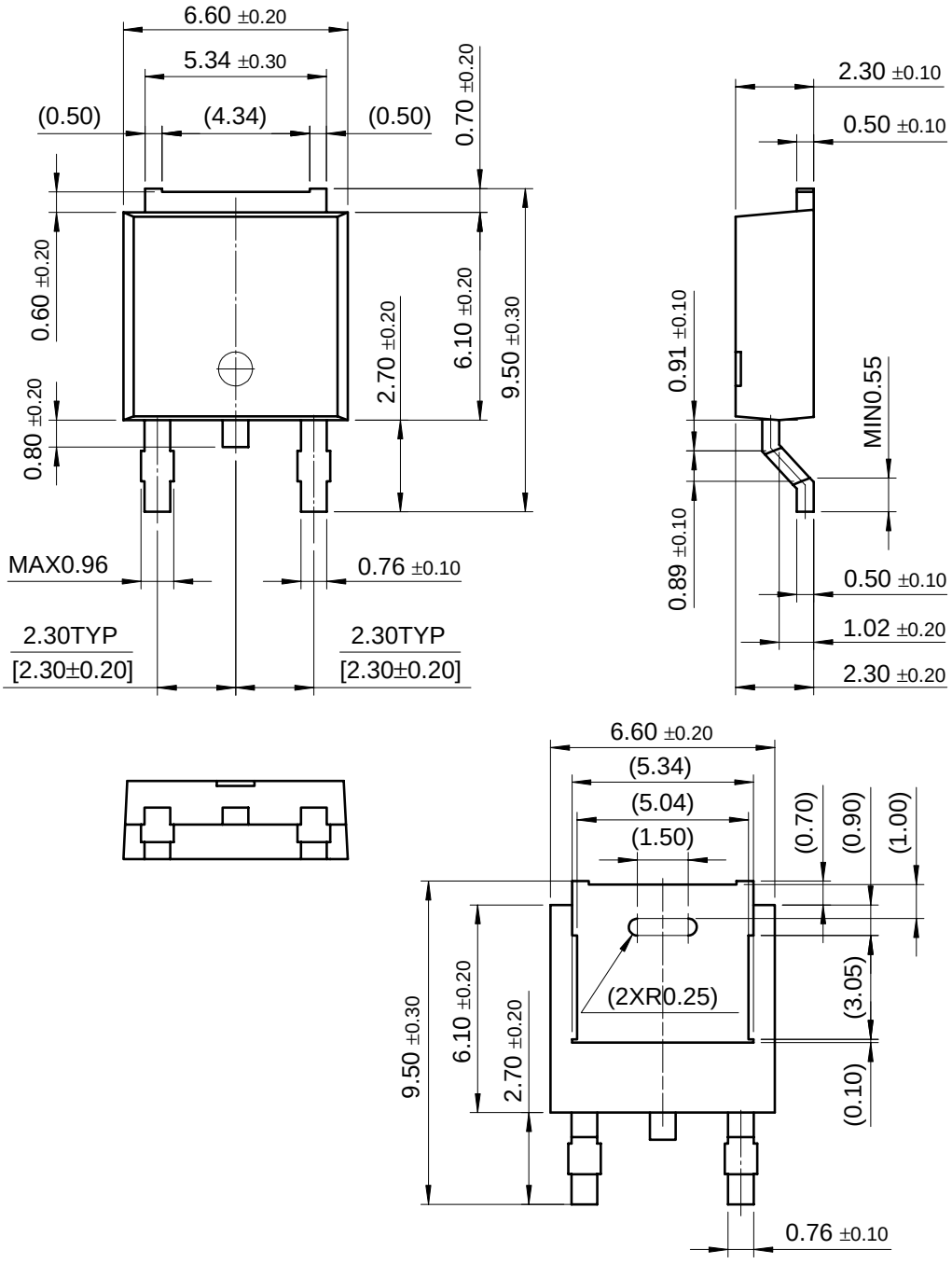




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Package Dimensions

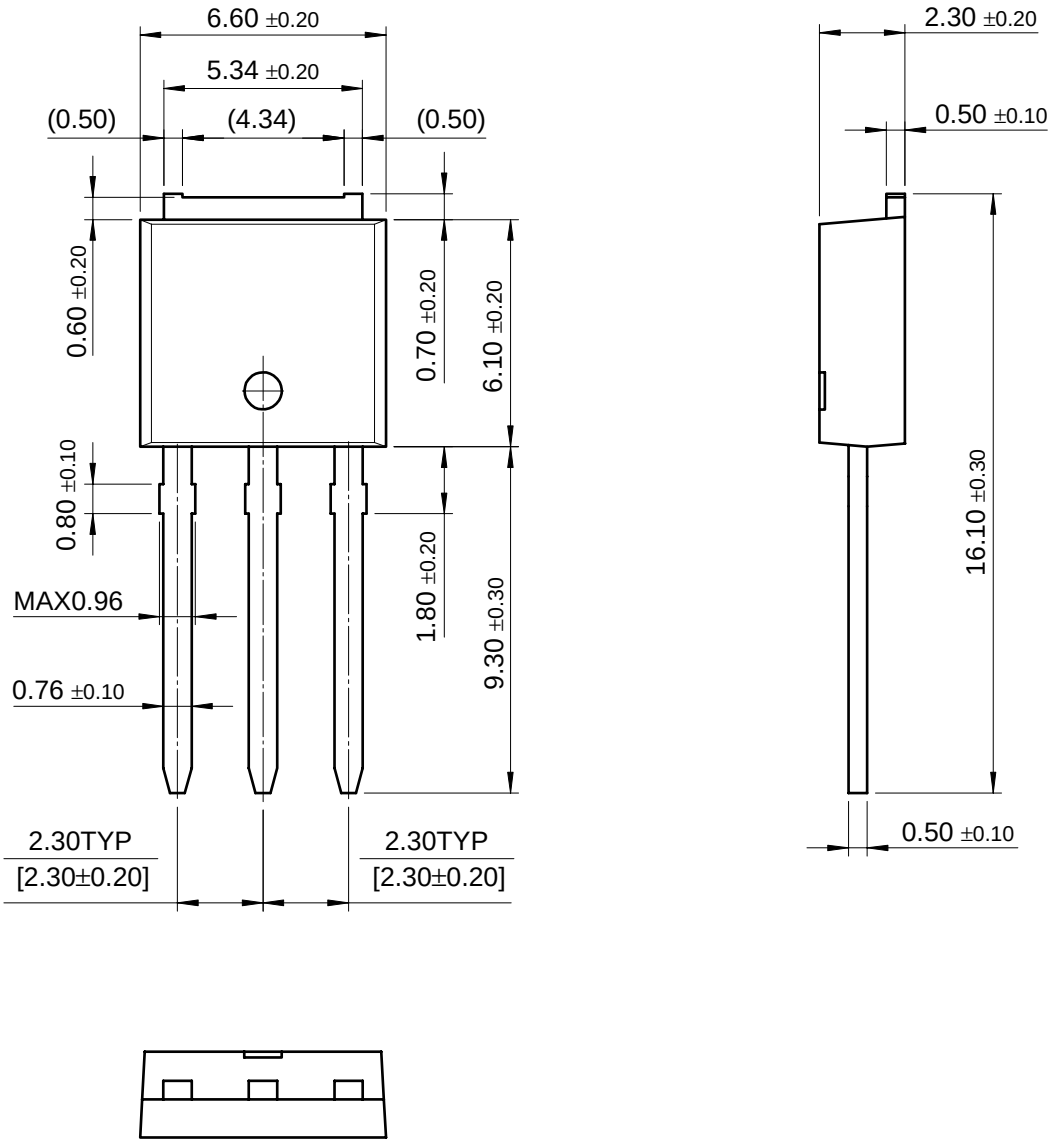
DPAK



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Package Dimensions (Continued)

IPAK



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