



PFU1N70/PFD1N70 700V N-Channel MOSFET

FEATURES

- ❑ Originative New Design
- ❑ 100% EAS Test
- ❑ Rugged Gate Oxide Technology
- ❑ Extremely Low Intrinsic Capacitances
- ❑ Remarkable Switching Characteristics
- ❑ Unequalled Gate Charge : 4.8 nC (Typ.)
- ❑ Extended Safe Operating Area
- ❑ Lower $R_{DS(ON)}$: 12.0 Ω (Typ.) @ $V_{GS}=10V$

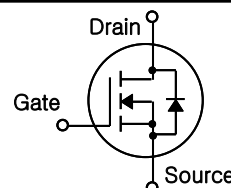
APPLICATION

- ❑ Low power battery chargers
- ❑ Switch mode power supply (SMPS)
- ❑ DC-AC converters.

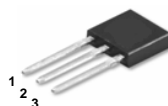
$$BV_{DSS} = 700 \text{ V}$$

$$R_{DS(on)typ} = 12.0 \ \Omega$$

$$I_D = 0.8 \text{ A}$$

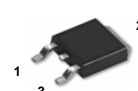


I-PAK(TO-251)



1.Gate 2. Drain 3. Source

D-PAK(TO-252)



1.Gate 2. Drain 3. Source

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

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	700	V
I_D	Drain Current – Continuous ($T_C = 25^\circ\text{C}$)	0.8	A
	Drain Current – Continuous ($T_C = 100^\circ\text{C}$)	0.5	A
I_{DM}	Drain Current – Pulsed (Note 1)	3.0	A
V_{GS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	65	mJ
I_{AR}	Avalanche Current (Note 1)	0.8	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	2.8	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Total Power Dissipation ($T_A=25^\circ\text{C}$) *	2.5	W
	Power Dissipation ($T_C = 25^\circ\text{C}$)	28	W
	– Derate above 25°C	0.22	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 Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	4.0	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient*	--	50	
$R_{\theta JA}$	Junction-to-Ambient	--	110	

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

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
V_{GS}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2.0	--	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 0.4 \text{ A}$	--	12.0	15.0	Ω

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	700	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C	--	0.72	--	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 700 \text{ V}, V_{GS} = 0 \text{ V}$	--	--	1	μA
		$V_{DS} = 650 \text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30 \text{ V}, V_{DS} = 0 \text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30 \text{ V}, V_{DS} = 0 \text{ V}$	--	--	-100	nA

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$	--	165	215	pF
C_{oss}	Output Capacitance		--	22	28	pF
C_{rss}	Reverse Transfer Capacitance		--	3.5	4.5	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Time	$V_{DS} = 350 \text{ V}, I_D = 0.8 \text{ A},$ $R_G = 25 \Omega$ (Note 4,5)	--	12	34	ns
t_r	Turn-On Rise Time		--	25	60	ns
$t_{d(off)}$	Turn-Off Delay Time		--	20	50	ns
t_f	Turn-Off Fall Time		--	28	65	ns
Q_g	Total Gate Charge	$V_{DS} = 560 \text{ V}, I_D = 0.8 \text{ A},$ $V_{GS} = 10 \text{ V}$ (Note 4,5)	--	4.8	6.3	nC
Q_{gs}	Gate-Source Charge		--	1.5	--	nC
Q_{gd}	Gate-Drain Charge		--	2.7	--	nC

Source-Drain Diode Maximum Ratings and Characteristics

I_S	Continuous Source-Drain Diode Forward Current	--	--	0.8*	A	
I_{SM}	Pulsed Source-Drain Diode Forward Current	--	--	3.0*		
V_{SD}	Source-Drain Diode Forward Voltage	$I_S = 0.8 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$I_S = 0.8 \text{ A}, V_{GS} = 0 \text{ V}$	--	205	--	ns
Q_{rr}	Reverse Recovery Charge	$di_F/dt = 100 \text{ A}/\mu\text{s}$ (Note 4)	--	0.6	--	μC

Notes ;

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS}=0.8\text{A}, V_{DD}=50\text{V}, R_G=25\Omega, \text{Starting } T_J=25^\circ\text{C}$
3. $I_{SD}\leq 0.8\text{A}, di/dt\leq 300\text{A}/\mu\text{s}, V_{DD}\leq BV_{DSS}, \text{Starting } T_J=25^\circ\text{C}$
4. Pulse Test : Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature

Typical Characteristics

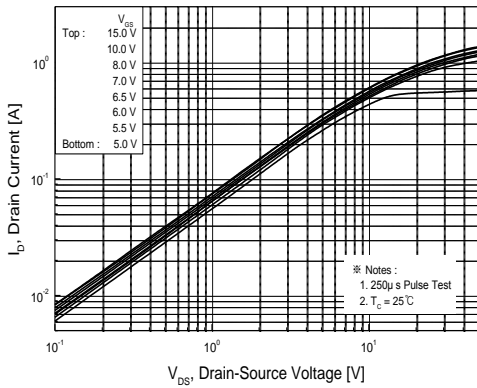


Figure 1. On Region Characteristics

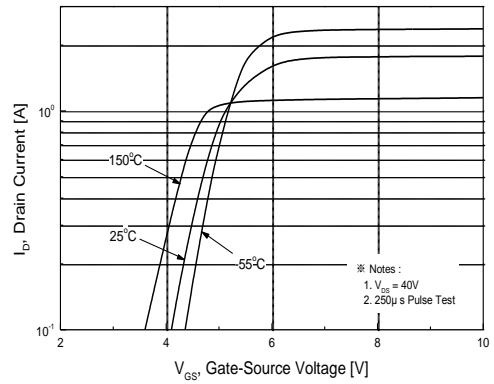


Figure 2. Transfer Characteristics

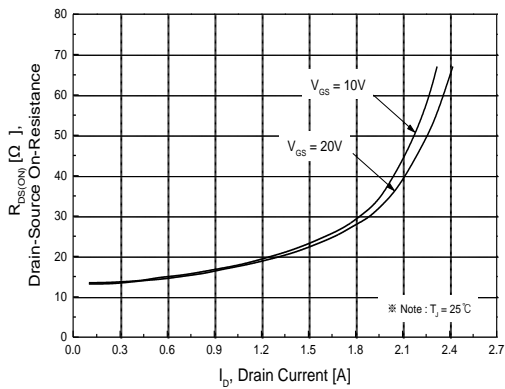


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

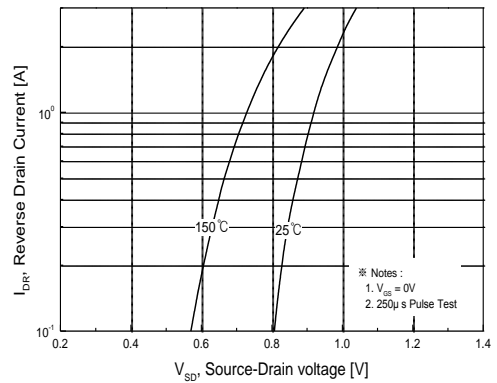


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

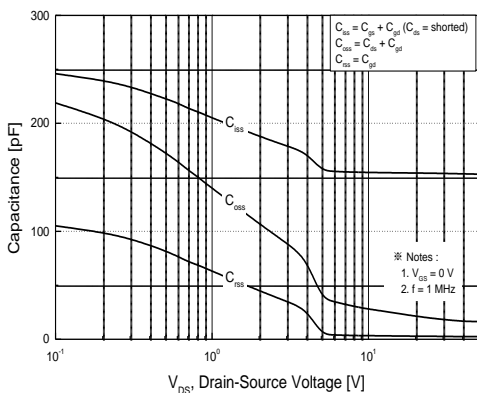


Figure 5. Capacitance Characteristics

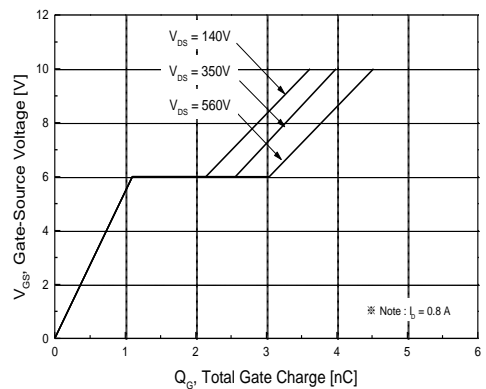


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

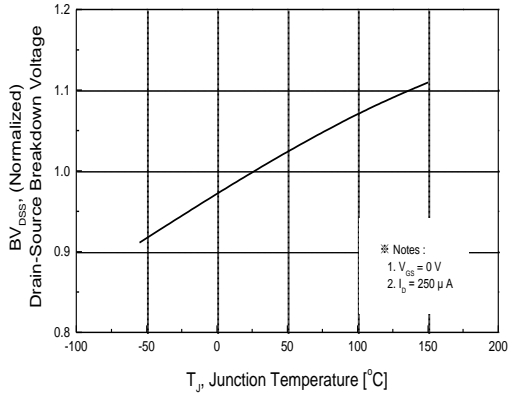


Figure 7. Breakdown Voltage Variation vs Temperature

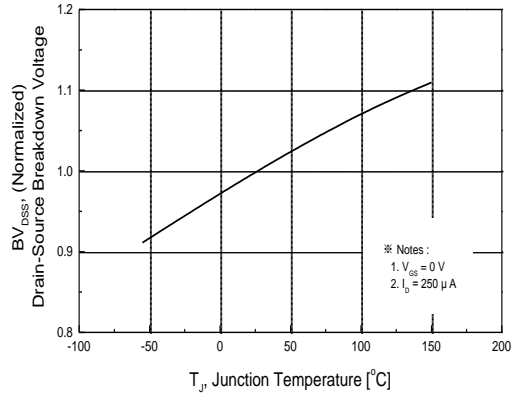


Figure 8. On-Resistance Variation vs Temperature

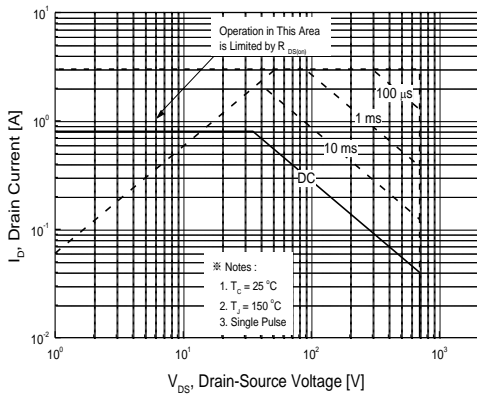


Figure 9. Maximum Safe Operating Area

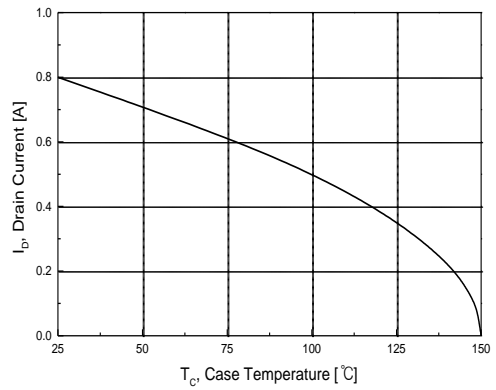


Figure 10. Maximum Drain Current vs Case Temperature

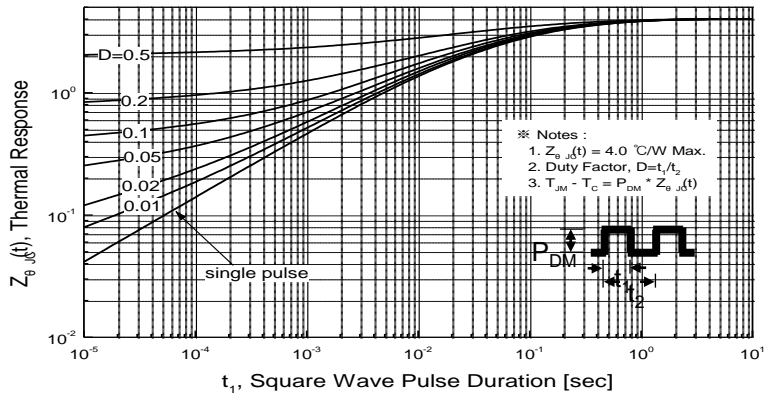


Figure 11. Transient Thermal Response Curve

Characteristics Test Circuit & Waveform

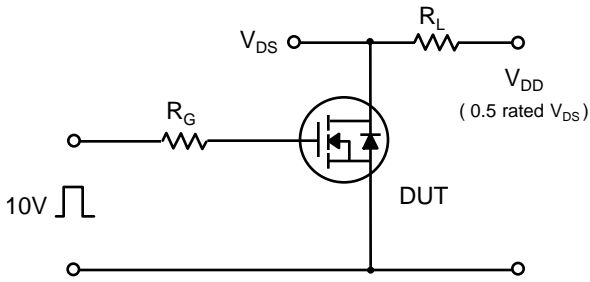


Fig 14. Resistive Switching Test Circuit & Waveforms

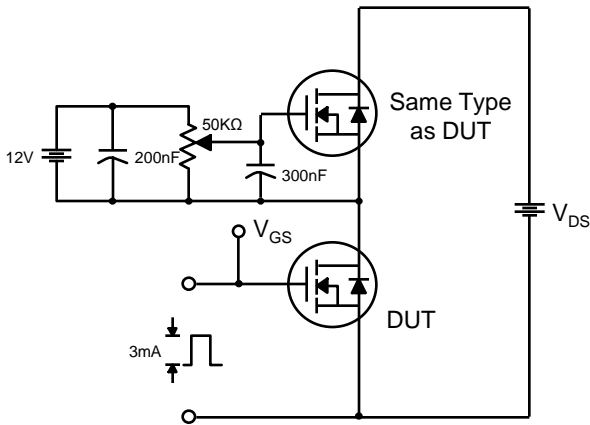


Fig 15. Gate Charge Test Circuit & Waveform

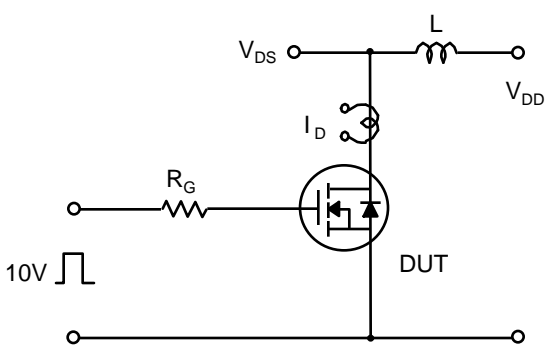
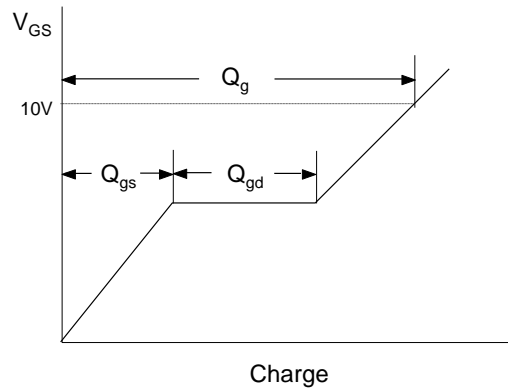
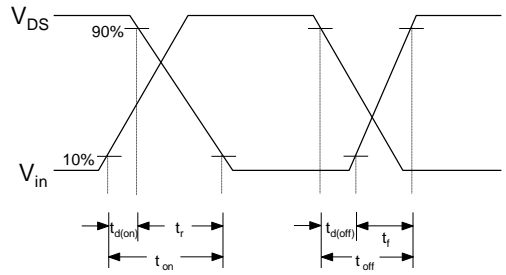
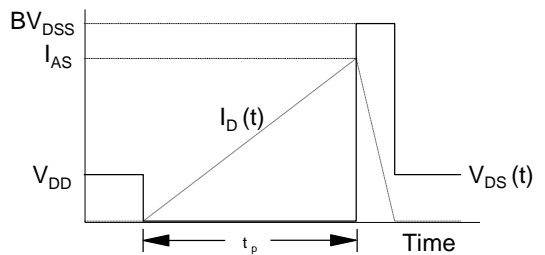


Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms



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



Characteristics Test Circuit & Waveform (continued)

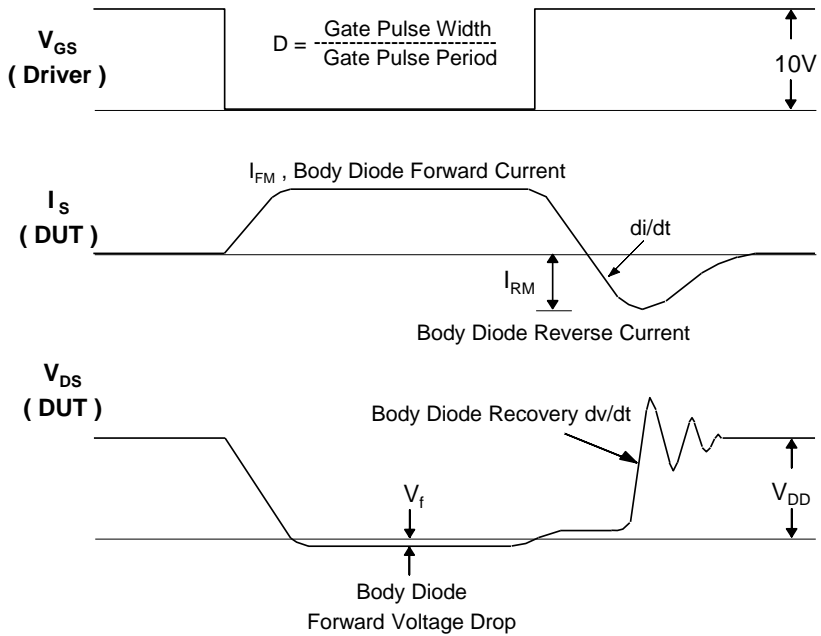
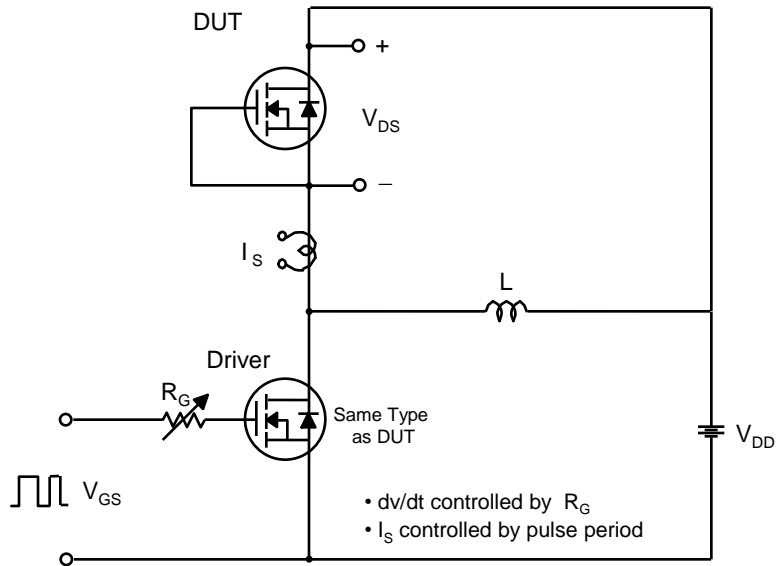
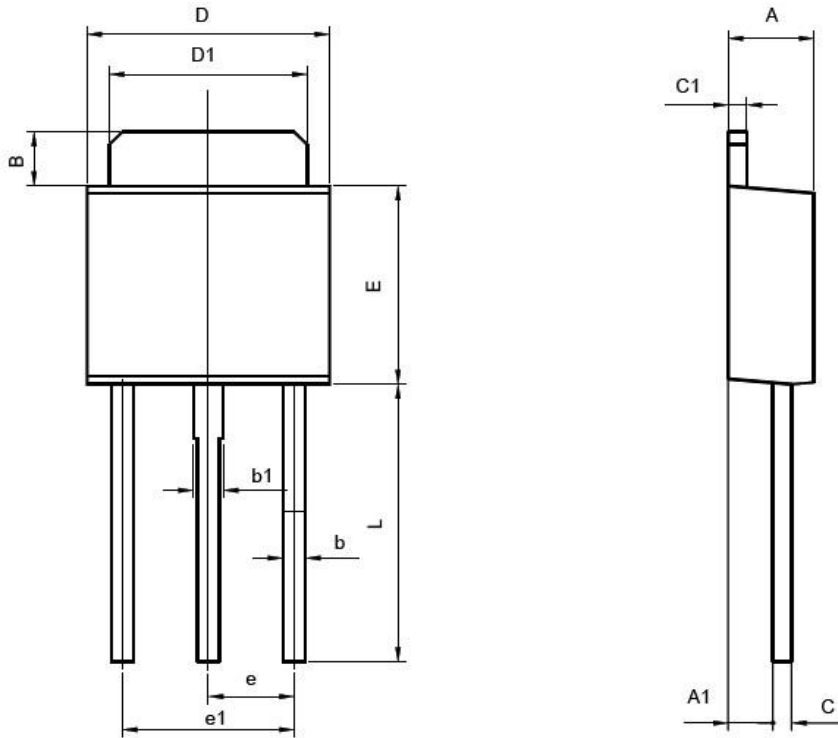


Fig 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Package Dimension

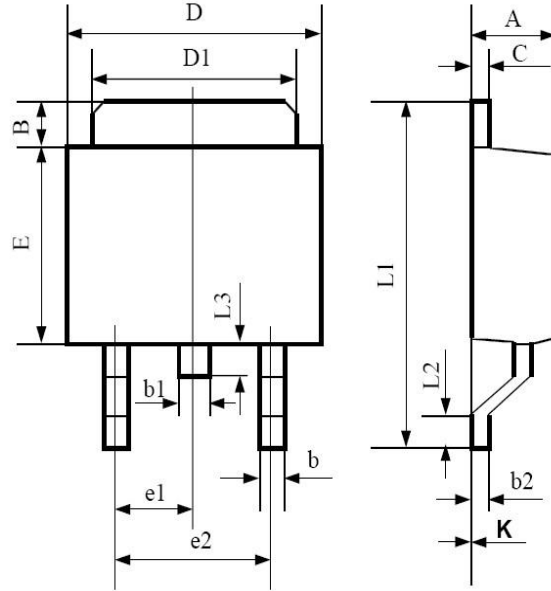
I-PAK(TO-251)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	1.100	1.300	0.043	0.051
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.460	0.560	0.018	0.022
c1	0.460	0.560	0.018	0.022
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.600	0.213	0.224
e	2.300TYP		0.091TYP	
e1	4.500	4.700	0.177	0.185
L	7.500	7.900	0.295	0.311

Package Dimension

I-PAK(TO-252)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	2.20	2.40	0.087	0.094
B	1.35	1.65	0.053	0.065
b	0.50	0.70	0.020	0.028
b1	0.70	0.90	0.028	0.035
b2	0.46	0.56	0.018	0.022
C	0.46	0.56	0.018	0.022
D	6.35	6.65	0.250	0.262
D1	5.20	5.40	0.205	0.212
E	5.40	5.60	0.212	0.220
e1	2.25	2.35	0.089	0.093
e2	4.50	4.70	0.177	0.185
L1	9.25	9.75	0.346	0.384
L2	0.95	1.45	0.037	0.057
L3	0.90	1.10	0.035	0.043
K	-0.1	0.00	-0.004	0.000