

# MDP12N50B / MDF12N50B

## N-Channel MOSFET 500V, 11.5A, 0.65Ω

### General Description

The MDP/F12N50B uses advanced Magnachip's MOSFET Technology, which provides low on-state resistance, high switching performance and excellent quality.

MDP/F12N50B is suitable device for SMPS, high Speed switching and general purpose applications.

### Features

- $V_{DS} = 500V$
- $I_D = 11.5A$  @  $V_{GS} = 10V$
- $R_{DS(ON)} \leq 0.65\Omega$  @  $V_{GS} = 10V$

### Applications

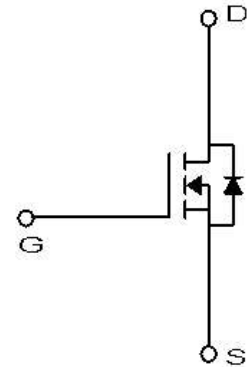
- Power Supply
- PFC
- Ballast



TO-220  
MDP Series



TO-220F  
MDF Series



### Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	MDP12N50B	MDF12N50B	Unit
Drain-Source Voltage		$V_{DSS}$	500		V
Gate-Source Voltage		$V_{GSS}$	±30		V
Continuous Drain Current	$T_C=25^\circ C$	$I_D$	11.5	11.5*	A
	$T_C=100^\circ C$		7.0	7.0*	A
Pulsed Drain Current <sup>(1)</sup>		$I_{DM}$	46	46*	A
Power Dissipation	$T_C=25^\circ C$	$P_D$	165	42	W
	Derate above 25 °C		1.33	0.32	W/°C
Repetitive Avalanche Energy <sup>(1)</sup>		$E_{AR}$	16.5		mJ
Peak Diode Recovery $dv/dt$ <sup>(3)</sup>		$dv/dt$	4.5		V/ns
Single Pulse Avalanche Energy <sup>(4)</sup>		$E_{AS}$	460		mJ
Junction and Storage Temperature Range		$T_J, T_{stg}$	-55~150		°C

\* Id limited by maximum junction temperature

### Thermal Characteristics

Characteristics	Symbol	MDP12N50B	MDF12N50B	Unit
Thermal Resistance, Junction-to-Ambient <sup>(1)</sup>	$R_{\theta JA}$	62.5	62.5	°C/W
Thermal Resistance, Junction-to-Case <sup>(1)</sup>	$R_{\theta JC}$	0.75	3.0	

## Ordering Information

Part Number	Temp. Range	Package	Packing	RoHS Status
MDP12N50BTH	-55~150°C	TO-220	Tube	Halogen Free
MDF12N50BTH	-55~150°C	TO-220F	Tube	Halogen Free

## Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D = 250\mu A, V_{GS} = 0V$	500	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	-	4.0	
Drain Cut-Off Current	$I_{DSS}$	$V_{DS} = 500V, V_{GS} = 0V$	-	-	1	$\mu A$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	100	nA
Drain-Source ON Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 5.75A$	-	0.55	0.65	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 30V, I_D = 5.75A$	-	15	-	S
<b>Dynamic Characteristics</b>						
Total Gate Charge	$Q_g$	$V_{DS} = 400V, I_D = 11.5A, V_{GS} = 10V^{(3)}$	-	19.3	-	nC
Gate-Source Charge	$Q_{gs}$		-	4.6	-	
Gate-Drain Charge	$Q_{gd}$		-	6.1	-	
Input Capacitance	$C_{iss}$	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz$	-	1034	-	pF
Reverse Transfer Capacitance	$C_{rss}$		-	5.1	-	
Output Capacitance	$C_{oss}$		-	126	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10V, V_{DS} = 250V, I_D = 11.5A, R_G = 25\Omega^{(3)}$	-	16	-	ns
Rise Time	$t_r$		-	35	-	
Turn-Off Delay Time	$t_{d(off)}$		-	31	-	
Fall Time	$t_f$		-	40	-	
<b>Drain-Source Body Diode Characteristics</b>						
Maximum Continuous Drain to Source Diode Forward Current	$I_S$		-	11.5	-	A
Source-Drain Diode Forward Voltage	$V_{SD}$	$I_S = 11.5A, V_{GS} = 0V$	-	-	1.4	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 11.5A, di/dt = 100A/\mu s$	-	310	-	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	2.6	-	$\mu C$

Note :

- Pulse width is based on  $R_{\theta JC}$  &  $R_{\theta JA}$  and the maximum allowed junction temperature of 150°C.
- Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ , pulse width limited by junction temperature  $T_{J(MAX)} = 150^\circ C$ .
- $I_{SD} \leq 11.5A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}, R_g = 25\Omega$ , Starting  $T_J = 25^\circ C$
- $L = 6.3mH, I_{AS} = 11.5A, V_{DD} = 50V, R_g = 25\Omega$ , Starting  $T_J = 25^\circ C$

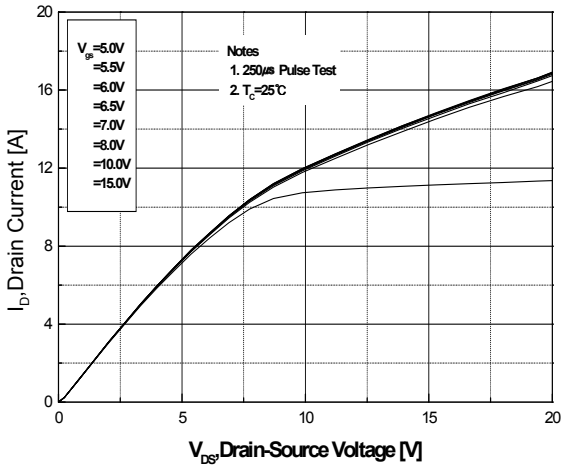


Fig.1 On-Region Characteristics

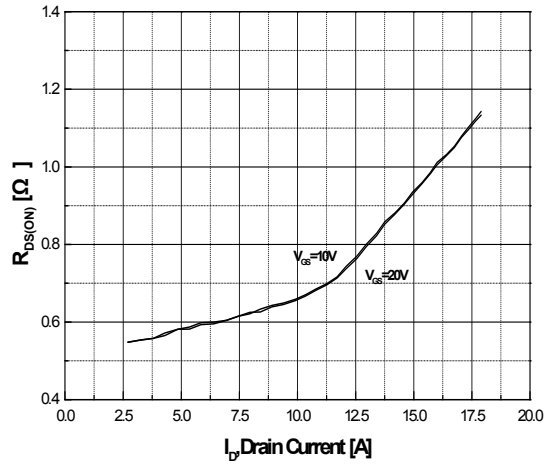


Fig.2 On-Resistance Variation with Drain Current and Gate Voltage

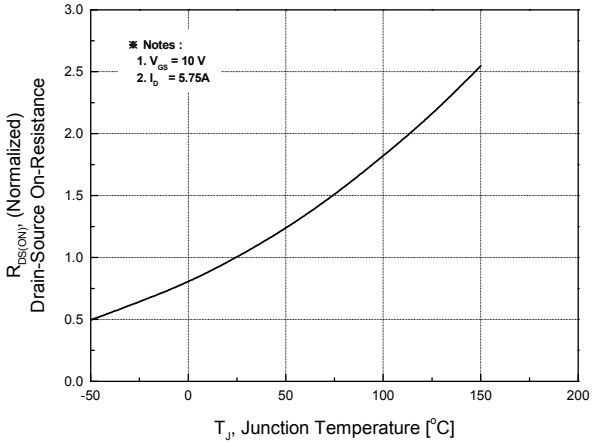


Fig.3 On-Resistance Variation with Temperature

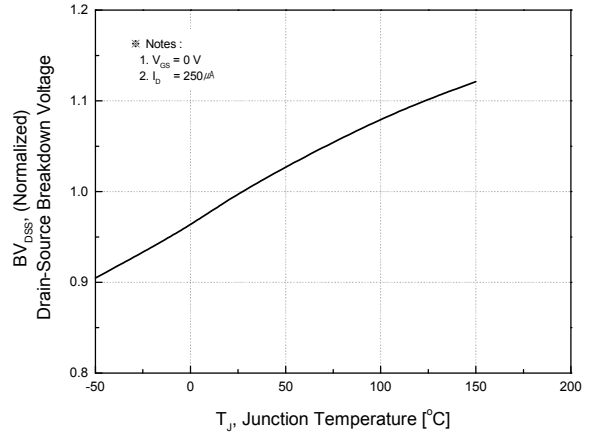


Fig.4 Breakdown Voltage Variation vs. Temperature

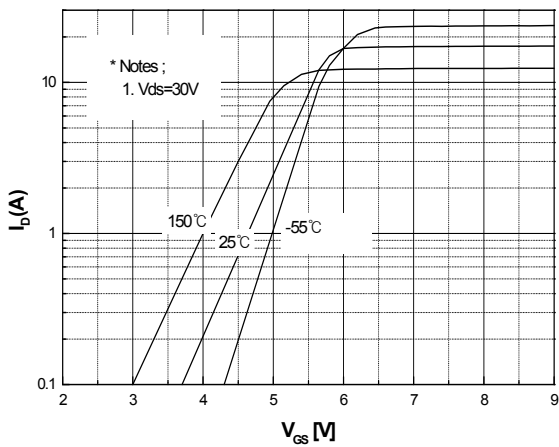


Fig.5 Transfer Characteristics

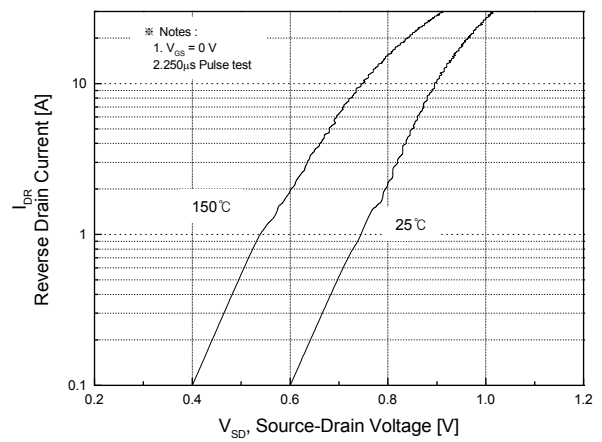
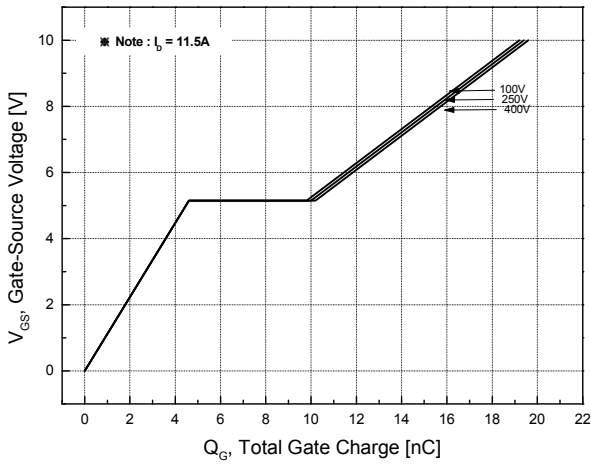
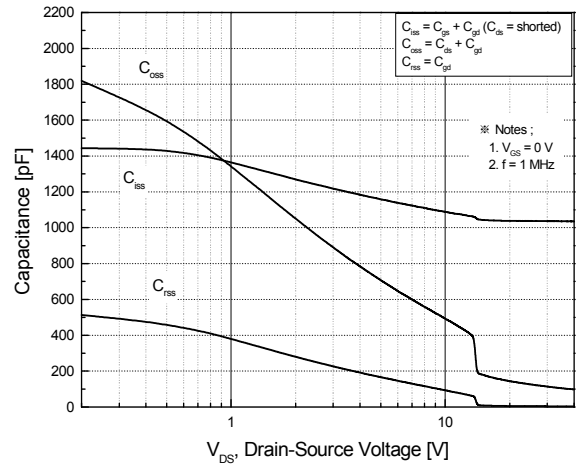


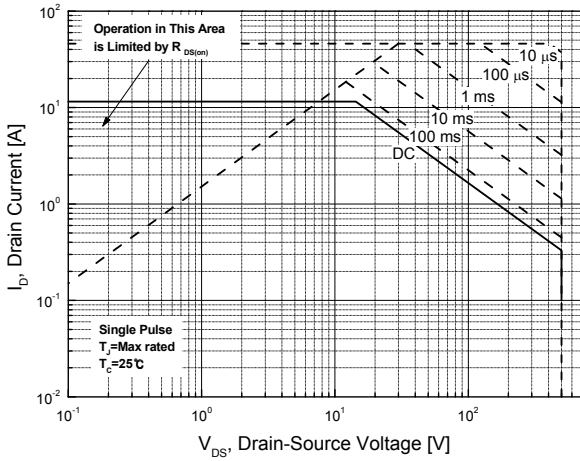
Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature



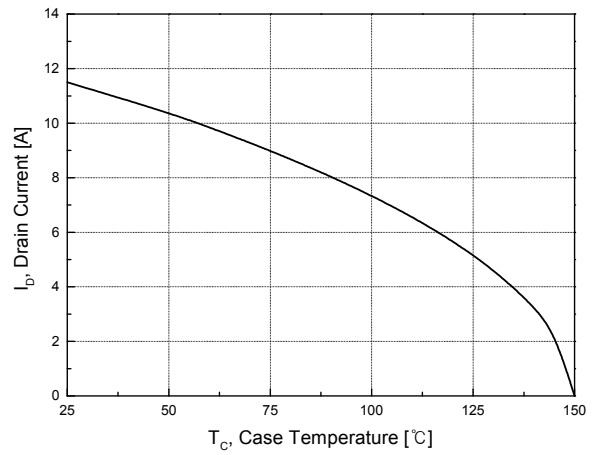
**Fig.7 Gate Charge Characteristics**



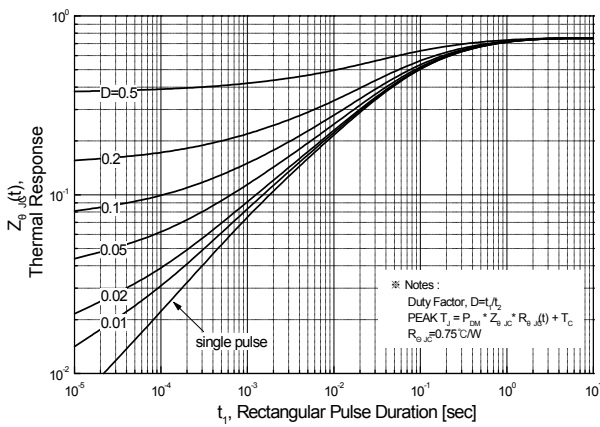
**Fig.8 Capacitance Characteristics**



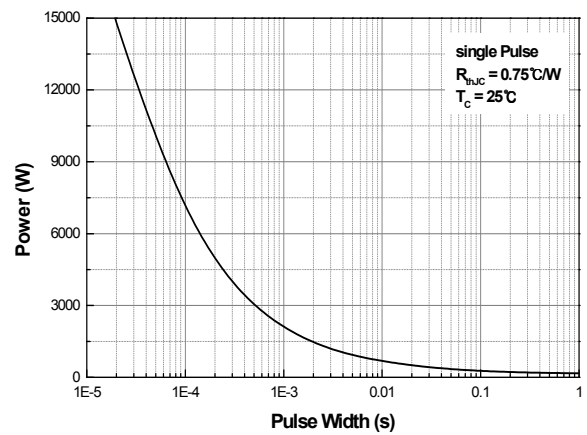
**Fig.9 Maximum Safe Operating Area  
MDP12N50B (TO-220)**



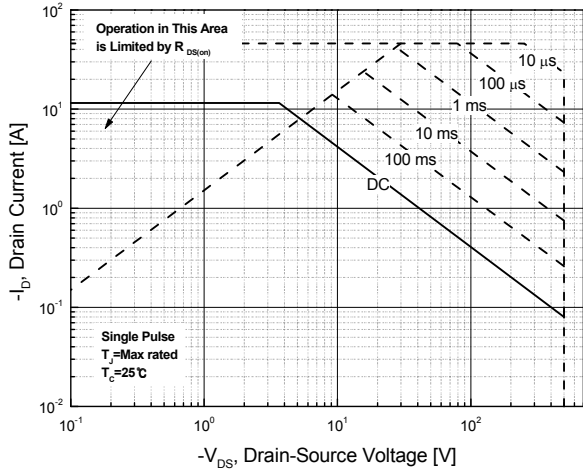
**Fig.10 Maximum Drain Current vs. Case Temperature**



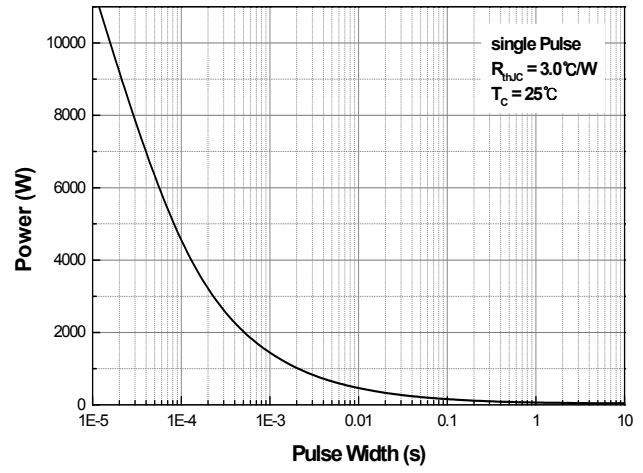
**Fig.11 Transient Thermal Response Curve  
MDP12N50B (TO-220)**



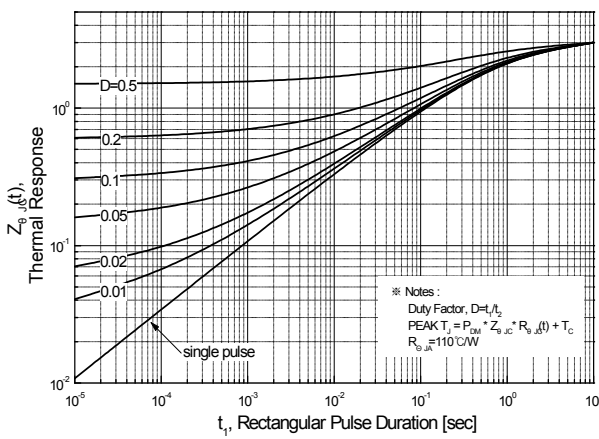
**Fig.12 Single Pulse Maximum Power  
Dissipation – MDP12N50B (TO-220)**



**Fig.13 Maximum Safe Operating Area  
MDF12N50B (TO-220F)**



**Fig.14 Single Pulse Maximum Power  
Dissipation – MDF12N50B (TO-220F)**

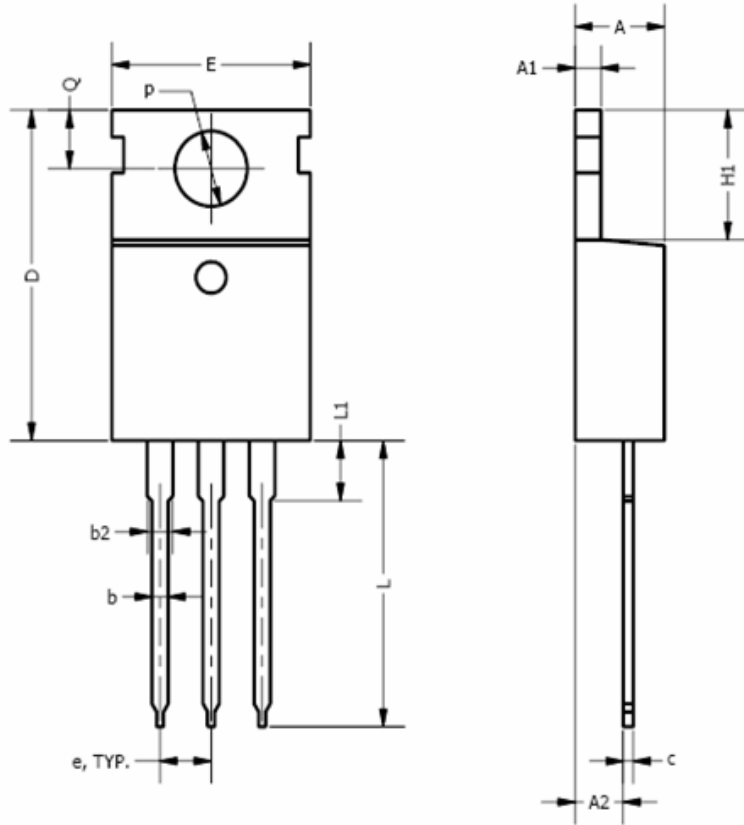


**Fig.15 Transient Thermal Response Curve  
MDF12N50B (TO-220F)**

**Physical Dimensions**

**3 Leads, TO-220**

Dimensions are in millimeters unless otherwise specified

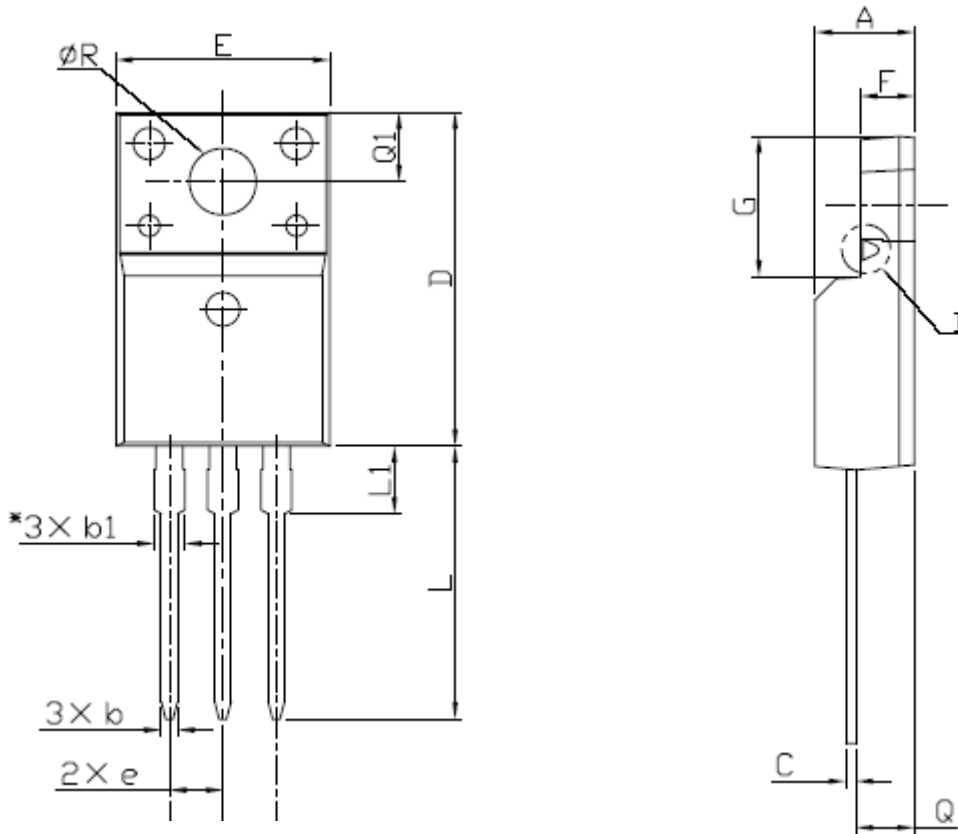


Symbol	Min	Nom	Max
A	3.56		4.83
A1	0.50		1.40
A2	2.03		2.92
b	0.38	0.69	1.02
b2	1.14	1.45	1.78
c	0.36		0.61
D	14.22		16.51
e	2.54 TYP		
E	9.65		10.67
H1	5.84		6.86
L	12.70		14.73
L1			6.35
$\phi P$	3.53		4.09
Q	2.54		3.43

**Physical Dimension**

**3 Leads, TO-220F**

Dimensions are in millimeters unless otherwise specified



Symbol	Min	Nom	Max
A	4.50		4.93
b	0.63		0.91
b1	1.15		1.47
C	0.33		0.63
D	15.47		16.13
E	9.60		10.71
e		2.54	
F	2.34		2.84
G	6.48		6.90
L	12.24		13.72
L1	2.79		3.67
Q	2.52		2.96
Q1	3.10		3.50
∅R	3.00		3.55

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