

MDP5N50F / MDF5N50F

N-Channel MOSFET 500V, 4.5 A, 1.55Ω

General Description

The MDP5N50F/MDF5N50F use advanced Magnachip's MOSFET Technology, which provides low on-state resistance, high switching performance and excellent quality.

MDP5N50F/MDF5N50F are suitable device for SMPS, HID and general purpose applications.

Features

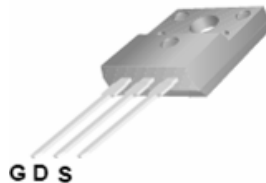
- $V_{DS} = 500V$
- $I_D = 4.5A$ @ $V_{GS} = 10V$
- $R_{DS(ON)} \leq 1.55\Omega$ @ $V_{GS} = 10V$

Applications

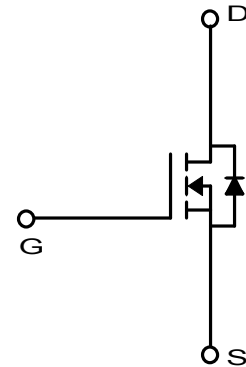
- Power Supply
- PFC
- Ballast



TO-220
MDP Series



TO-220F
MDF Series



Absolute Maximum Ratings ($T_a = 25^\circ C$)

Characteristics		Symbol	MDP5N50F	MDF5N50F	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	4.5	4.5*	A
	$T_C = 100^\circ C$		2.8	2.8*	A
Pulsed Drain Current ⁽¹⁾		I_{DM}	18	18*	A
Power Dissipation	$T_C = 25^\circ C$	P_D	93	27	W
	Derate above $25^\circ C$		0.74	0.22	W/°C
Repetitive Avalanche Energy ⁽¹⁾		E_{AR}	93		mJ
Peak Diode Recovery dv/dt ⁽³⁾		dv/dt	4.5		V/ns
Single Pulse Avalanche Energy ⁽⁴⁾		E_{AS}	230		mJ
Junction and Storage Temperature Range		T_J, T_{stg}	-55~150		°C

* I_D limited by maximum junction temperature

Thermal Characteristics

Characteristics	Symbol	MDP5N50F	MDF5N50F	Unit
Thermal Resistance, Junction-to-Ambient ⁽¹⁾	$R_{\theta JA}$	62.5	62.5	°C/W
Thermal Resistance, Junction-to-Case ⁽¹⁾	$R_{\theta JC}$	1.35	4.6	

Ordering Information

Part Number	Temp. Range	Package	Packing	RoHS Status
MDP5N50FTH	-55~150°C	TO-220	Tube	Halogen Free
MDF5N50FTH	-55~150°C	TO-220F	Tube	Halogen Free

Electrical Characteristics (Ta =25°C)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D = 250\mu A, V_{GS} = 0V$	500	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5	-	4.5	
Drain Cut-Off Current	I_{DSS}	$V_{DS} = 500V, V_{GS} = 0V$	-	-	10	μA
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	100	μA
Drain-Source ON Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 2.5A$		1.25	1.55	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 30V, I_D = 2.5A$	-	3.3	-	S
Dynamic Characteristics						
Total Gate Charge	Q_g	$V_{DS} = 500V, I_D = 5.0A, V_{GS} = 10V^{(3)}$	-	12.1	15.73	nC
Gate-Source Charge	Q_{gs}		-	3.6	-	
Gate-Drain Charge	Q_{gd}		-	4.3	-	
Input Capacitance	C_{iss}	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz$	-	500	650	pF
Reverse Transfer Capacitance	C_{rss}		-	1.5	2.25	
Output Capacitance	C_{oss}		-	65	84.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10V, V_{DS} = 250V, I_D = 5.0A, R_G = 25\Omega^{(3)}$	-	23	48.3	ns
Rise Time	t_r		-	30	60	
Turn-Off Delay Time	$t_{d(off)}$		-	37	77.7	
Fall Time	t_f		-	29	60.9	
Drain-Source Body Diode Characteristics						
Maximum Continuous Drain to Source Diode Forward Current	I_S		-	4.5	-	A
Source-Drain Diode Forward Voltage	V_{SD}	$I_S = 5.0A, V_{GS} = 0V$	-		1.4	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 5.0A, di/dt = 100A/\mu s^{(3)}$	-	80		ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	1.6		μC

Note :

1. Pulse width is based on R θ_{JC} & R θ_{JA} and the maximum allowed junction temperature of 150°C.
2. Pulse test: pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$, pulse width limited by junction temperature $T_J(MAX)=150^\circ C$.
3. $I_{SD} \leq 4.5A$, $di/dt \leq 200A/\mu s$, $V_{DD}=50V$, $R_G=25\Omega$, Starting $T_J=25^\circ C$
4. $L=20.5mH$, $I_{AS}=4.5A$, $V_{DD}=50V$, $R_G=25\Omega$, Starting $T_J=25^\circ C$

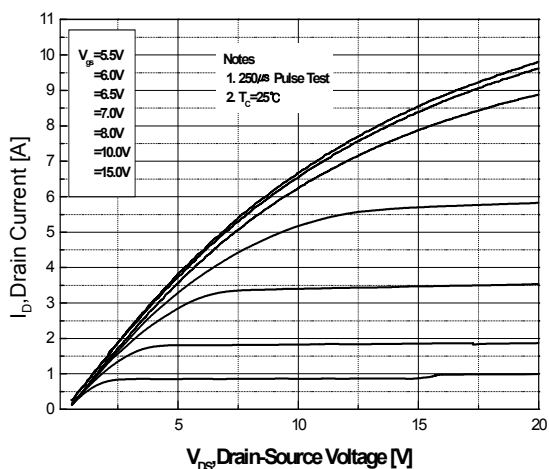


Fig.1 On-Region Characteristics

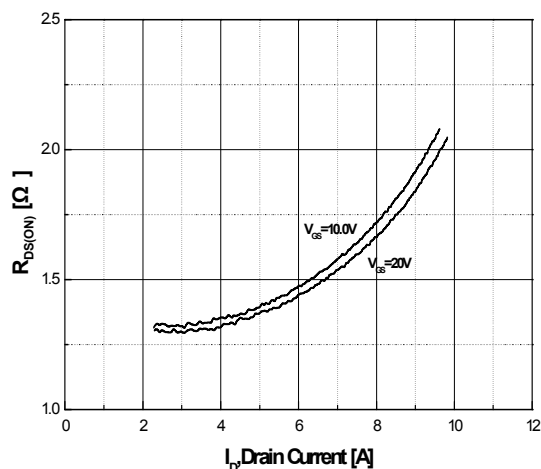


Fig.2 On-Resistance Variation with Drain Current and Gate Voltage

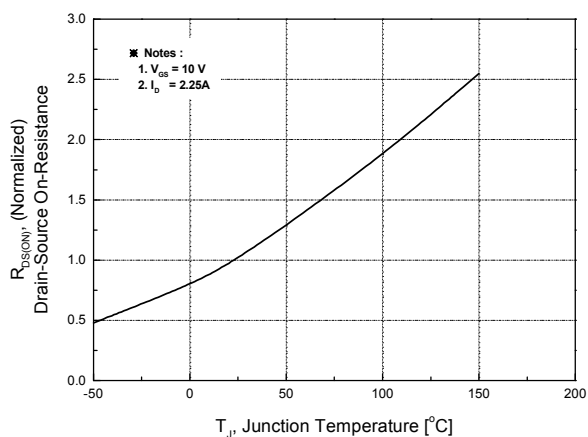


Fig.3 On-Resistance Variation with Temperature

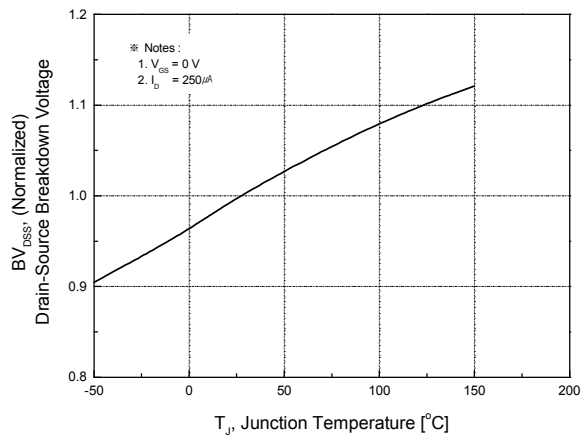


Fig.4 Breakdown Voltage Variation vs. Temperature

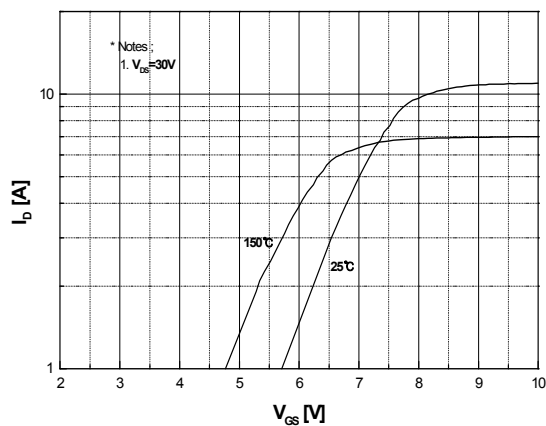


Fig.5 Transfer Characteristics

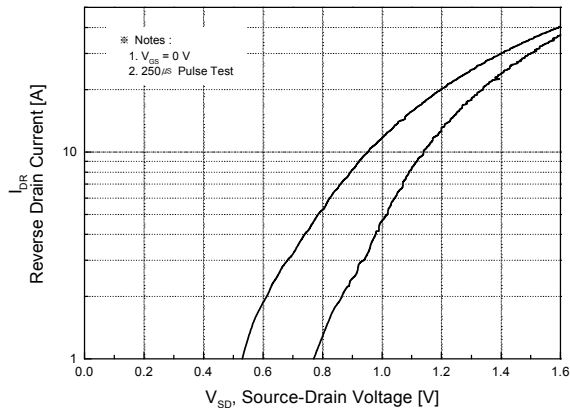


Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature

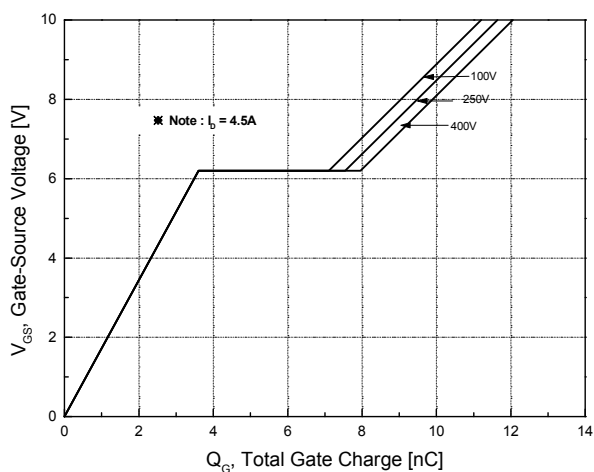


Fig.7 Gate Charge Characteristics

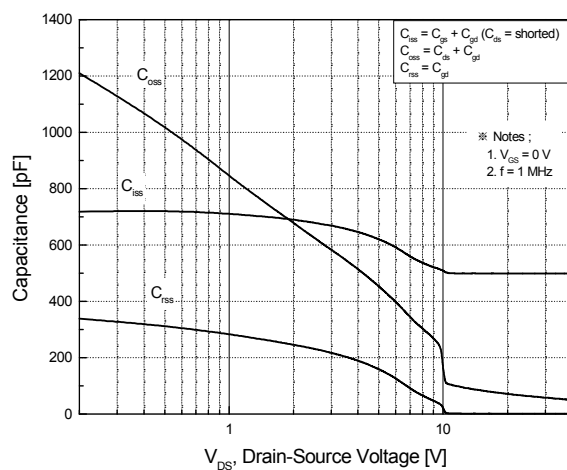
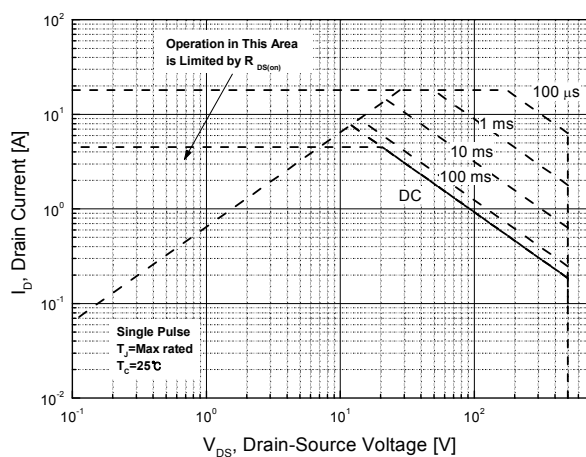
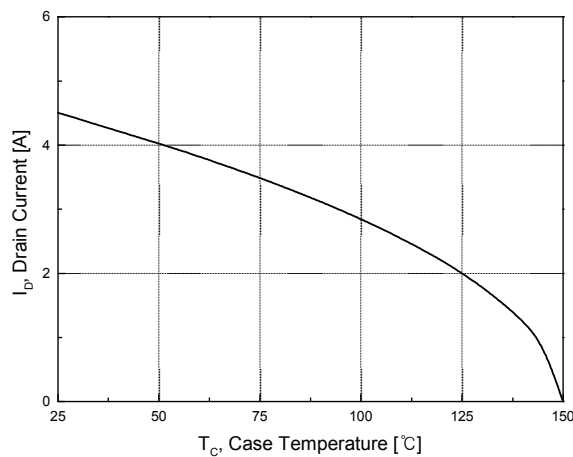
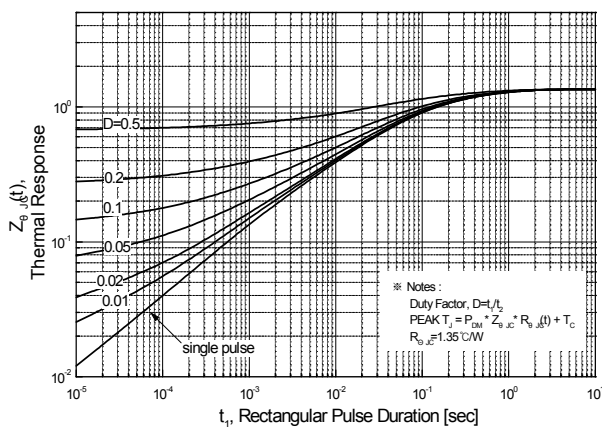
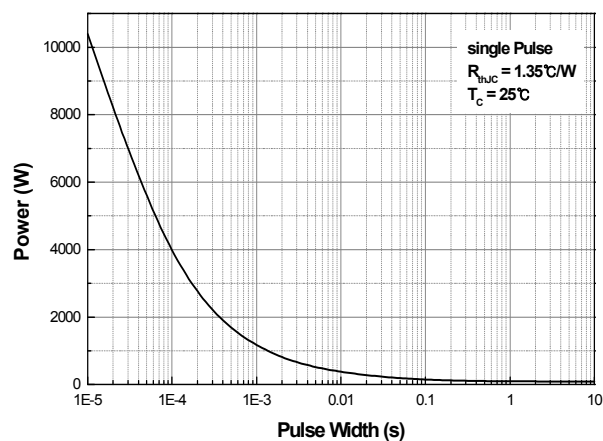
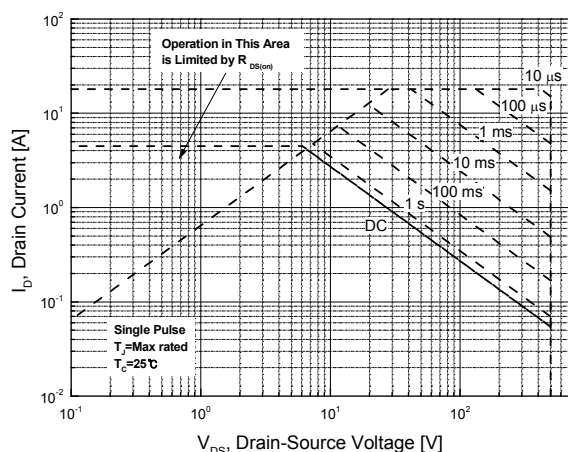
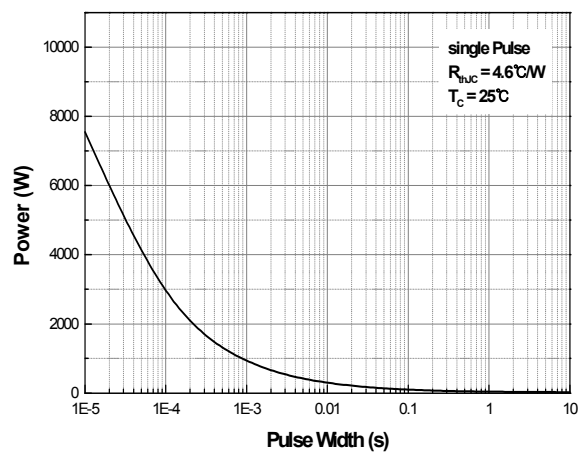


Fig.8 Capacitance Characteristics

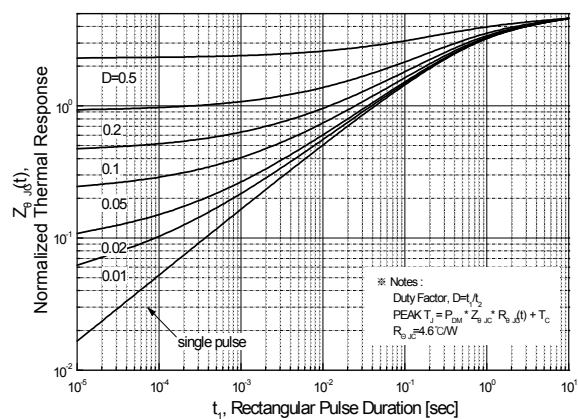
Fig.9 Maximum Safe Operating Area
MDP5N50F (TO-220)Fig.10 Maximum Drain Current vs. Case
TemperatureFig.11 Transient Thermal Response Curve
MDP5N50F (TO-220)Fig.12 Single Pulse Maximum Power
Dissipation – MDP5N50F (TO-220)



**Fig.13 Maximum Safe Operating Area
MDF5N50F (TO-220F)**



**Fig.12 Single Pulse Maximum Power
Dissipation- MDF5N50F (TO-220F)**



**Fig.11 Transient Thermal Response Curve
MDF5N50F (TO-220F)**

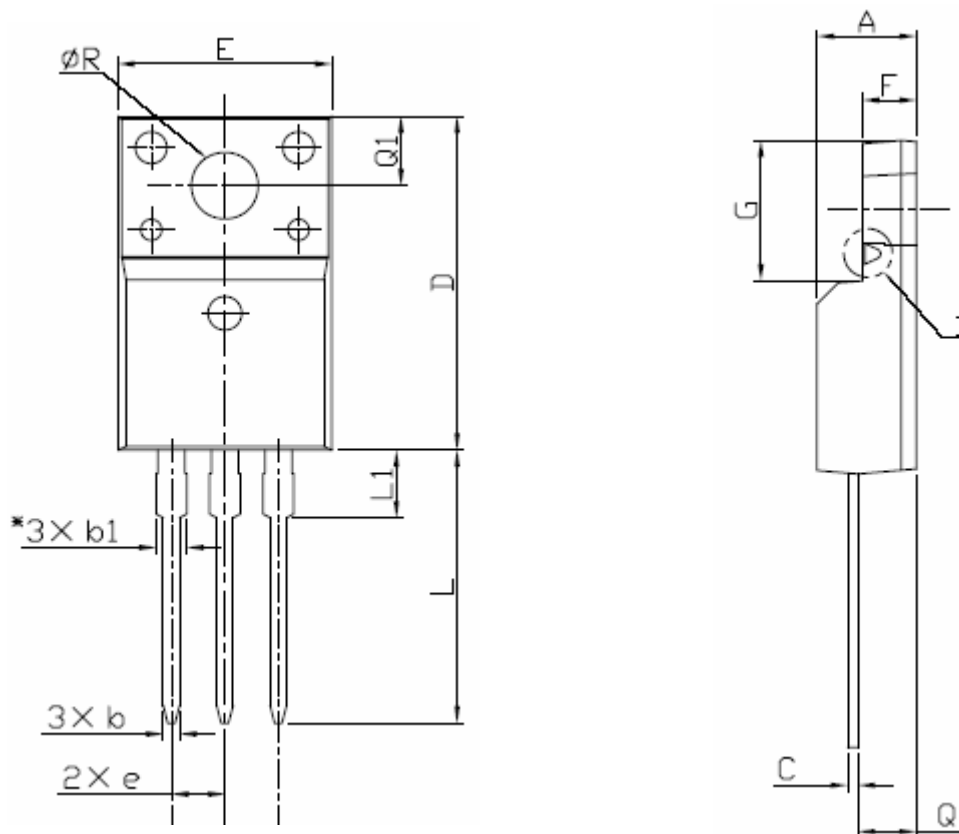
Technical drawing of a 3-pin connector. The drawing includes three views: a front view (left), a side view (middle), and a top view (right). Dimensions are provided in inches (top) and millimeters (bottom) for each feature.

- Front View (Left):**
 - Overall width: 10.67 (271.1)
 - Pin spacing (1-2): 2.54 (64.5)
 - Pin spacing (2-3): 2.54 (64.5)
 - Pin spacing (1-3): 5.08 (128.0)
 - Pin diameter: $\phi 1.09$ (27.7)
 - Pin length: 6.35 MAX (161.3)
 - Pin 1 width: 1.78 (45.2)
 - Pin 2 width: 1.02 (25.9)
 - Pin 3 width: 1.14 (29.0)
 - Pin 1 offset: 1.73 (43.9)
 - Pin 2 offset: 1.73 (43.9)
 - Pin 3 offset: 1.73 (43.9)
 - Pin 1 offset (mm): 1.73 (43.9)
 - Pin 2 offset (mm): 1.73 (43.9)
 - Pin 3 offset (mm): 1.73 (43.9)
 - Pin 1 offset (mm): 1.73 (43.9)
 - Pin 2 offset (mm): 1.73 (43.9)
 - Pin 3 offset (mm): 1.73 (43.9)
 - Pin 1 offset (mm): 1.73 (43.9)
 - Pin 2 offset (mm): 1.73 (43.9)
 - Pin 3 offset (mm): 1.73 (43.9)
- Side View (Middle):**
 - Overall height: 13.40 (340.4)
 - Pin 1 height: 1.40 (35.4)
 - Pin 2 height: 1.40 (35.4)
 - Pin 3 height: 1.40 (35.4)
 - Pin 1 offset: 1.40 (35.4)
 - Pin 2 offset: 1.40 (35.4)
 - Pin 3 offset: 1.40 (35.4)
 - Pin 1 offset (mm): 1.40 (35.4)
 - Pin 2 offset (mm): 1.40 (35.4)
 - Pin 3 offset (mm): 1.40 (35.4)
 - Pin 1 offset (mm): 1.40 (35.4)
 - Pin 2 offset (mm): 1.40 (35.4)
 - Pin 3 offset (mm): 1.40 (35.4)
 - Pin 1 offset (mm): 1.40 (35.4)
 - Pin 2 offset (mm): 1.40 (35.4)
 - Pin 3 offset (mm): 1.40 (35.4)
- Top View (Right):**
 - Overall width: 8.89 (225.8)
 - Pin 1 width: 1.78 (45.2)
 - Pin 2 width: 1.02 (25.9)
 - Pin 3 width: 1.14 (29.0)
 - Pin 1 offset: 1.73 (43.9)
 - Pin 2 offset: 1.73 (43.9)
 - Pin 3 offset: 1.73 (43.9)
 - Pin 1 offset (mm): 1.73 (43.9)
 - Pin 2 offset (mm): 1.73 (43.9)
 - Pin 3 offset (mm): 1.73 (43.9)
 - Pin 1 offset (mm): 1.73 (43.9)
 - Pin 2 offset (mm): 1.73 (43.9)
 - Pin 3 offset (mm): 1.73 (43.9)
 - Pin 1 offset (mm): 1.73 (43.9)
 - Pin 2 offset (mm): 1.73 (43.9)
 - Pin 3 offset (mm): 1.73 (43.9)

Physical Dimensions

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
ØR	3.00		3.55