

Features

- Low $R_{DS(on)}$ & FOM
- 100% avalanche tested
- Improved dv/dt capability
- Fast switching and soft recovery

Application

- Power switch circuit of POWER
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

Product Summary

V_{DS}	$R_{DS(ON)}$ TYP	I_D
-200V	340mΩ@-10V	-11A



TO-220F



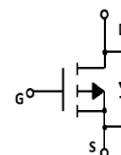
TO-220



TO-247



TO-3P



Halogen-Free

Absolute Maximum Ratings (TA=25°C unless otherwise noted)

Symbol	Parameter		Value				Unit
Common Ratings (TC=25°C Unless Otherwise Noted)			TO-220F	TO-220	TO-247	TO-3P	
V _{DS}	Drain-Source Breakdown Voltage		-200				V
V _{GS}	Gate-Source Voltage		±20				V
T _J	Maximum Junction Temperature		150				°C
T _{STG}	Storage Temperature Range		-50 to 155				°C
I _S	Diode Continuous Forward Current	Tc=25°C	-11				A

Mounted on Large Heat Sink

I _{DM}	Pulse Drain Current Tested	T _C =25°C	-44		A
E _{AS}	Single Pulse Avalanche Energy ^{Note1}		165		mJ
I _D	Continuous Drain Current	T _C =25°C	-11		A
P _D	Maximum Power Dissipation	T _C =25°C	78		W
R _{θJA}	Thermal Resistance Junction-Ambient		50	48	°C/W

Ordering Information (Example)

Type	Package	Marking	Minimum Package(pcs)	Inner Box Quantity(pcs)	Outer Carton Quantity(pcs)	Delivery Mode
MLSYF11P20	TO-220F	MLSYF11P20	50	1,000	5,000	/
MLSY11P20	TO-220	MLSY11P20	50	1,000	5,000	/
MLSA11P20	TO-247	MLSA11P20	30	270	2,160	/
MLSP11P20	TO-3P	MLSP11P20	30	270	2,160	/

Electrical Characteristics (TJ=25°C unless otherwise noted)						
Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ TJ = 25°C (unless otherwise stated)						
BV _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =-250μA	-200	--	--	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-200V, V _{GS} =0V	--	--	5.0	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±20V, V _{DS} =0V	--	--	±120	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =-250μA	-2.0	--	-4.0	V
R _{DS(on)}	Drain-Source On-State Resistance	V _{GS} =-10V, I _D =-6.6A	--	340	420	mΩ
Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated)						
C _{ISS}	Input Capacitance	V _{DS} =-25V, V _{GS} =0V, f=1MHz	--	1200	--	pF
C _{OSS}	Output Capacitance		--	370	--	pF
C _{RSS}	Reverse Transfer Capacitance		--	81	--	pF
Q _g	Total Gate Charge	V _{DD} =-100V, I _D =-13.5A, V _{GS} =-10V	--	52	68	nC
Q _{gs}	Gate Source Charge		--	9	--	nC
Q _{gd}	Gate Drain Charge		--	25	--	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DD} =-160V, I _D =-13.5A, R _G =25Ω	--	28	56	nS
t _r	Turn-on Rise Time		--	74	148	nS
t _{d(off)}	Turn-Off Delay Time		--	260	520	nS
t _f	Turn-Off Fall Time		--	120	240	nS
Source- Drain Diode Characteristics						
V _{SD}	Forward on voltage	Tj=25°C, Is=-11A	--	--	-5	V

Note :

1、EAS Test condition : V_{DD}=25V, I_{AS}=-11A, R_G=25Ω, Starting T_J=25° C.

Typical Operating Characteristics

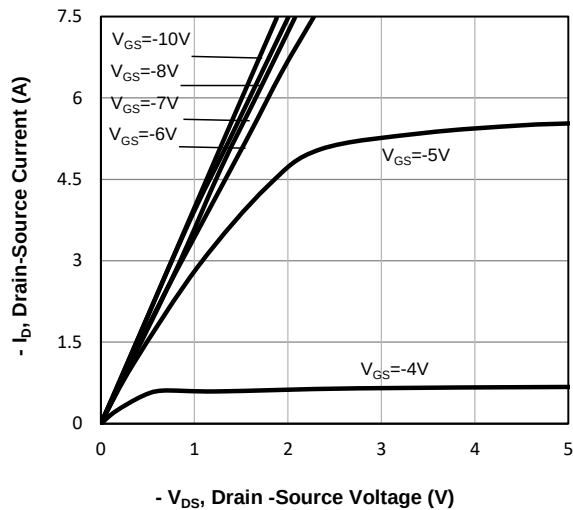


Fig1. Typical Output Characteristics

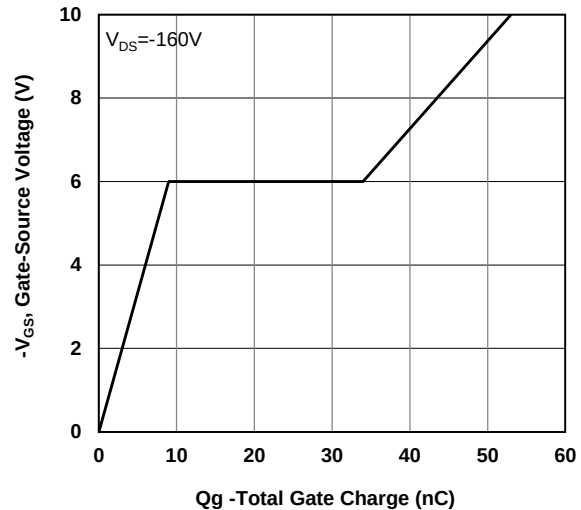


Fig2. Typical Gate Charge Vs. Gate-Source Voltage

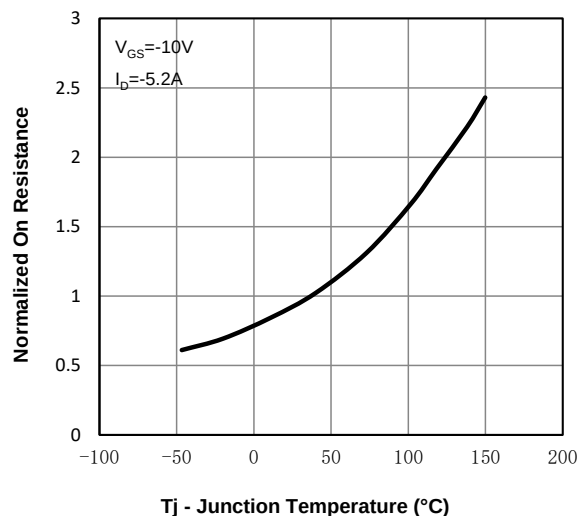


Fig3. Normalized On-Resistance Vs. Temperature

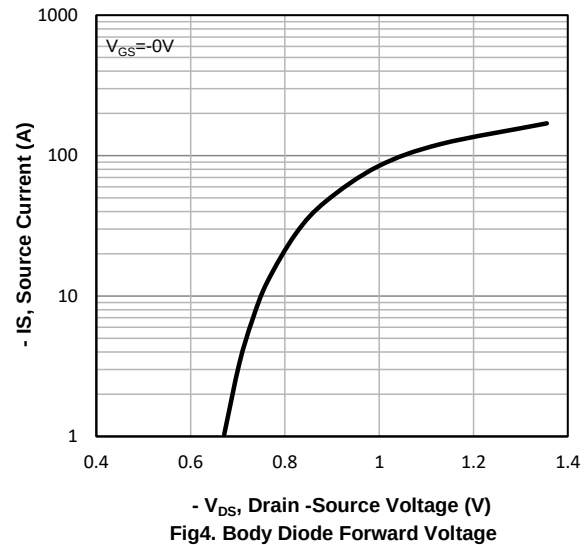


Fig4. Body Diode Forward Voltage

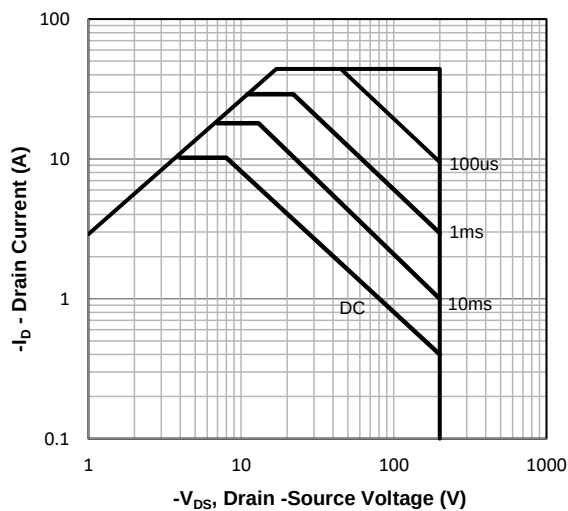


Fig5. Maximum Safe Operating Area

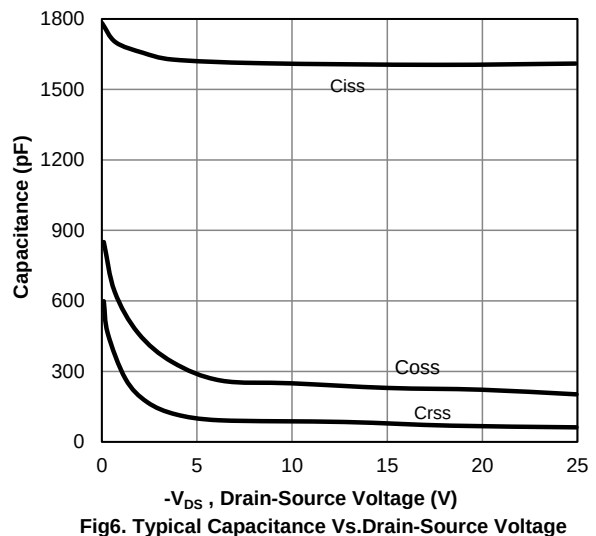
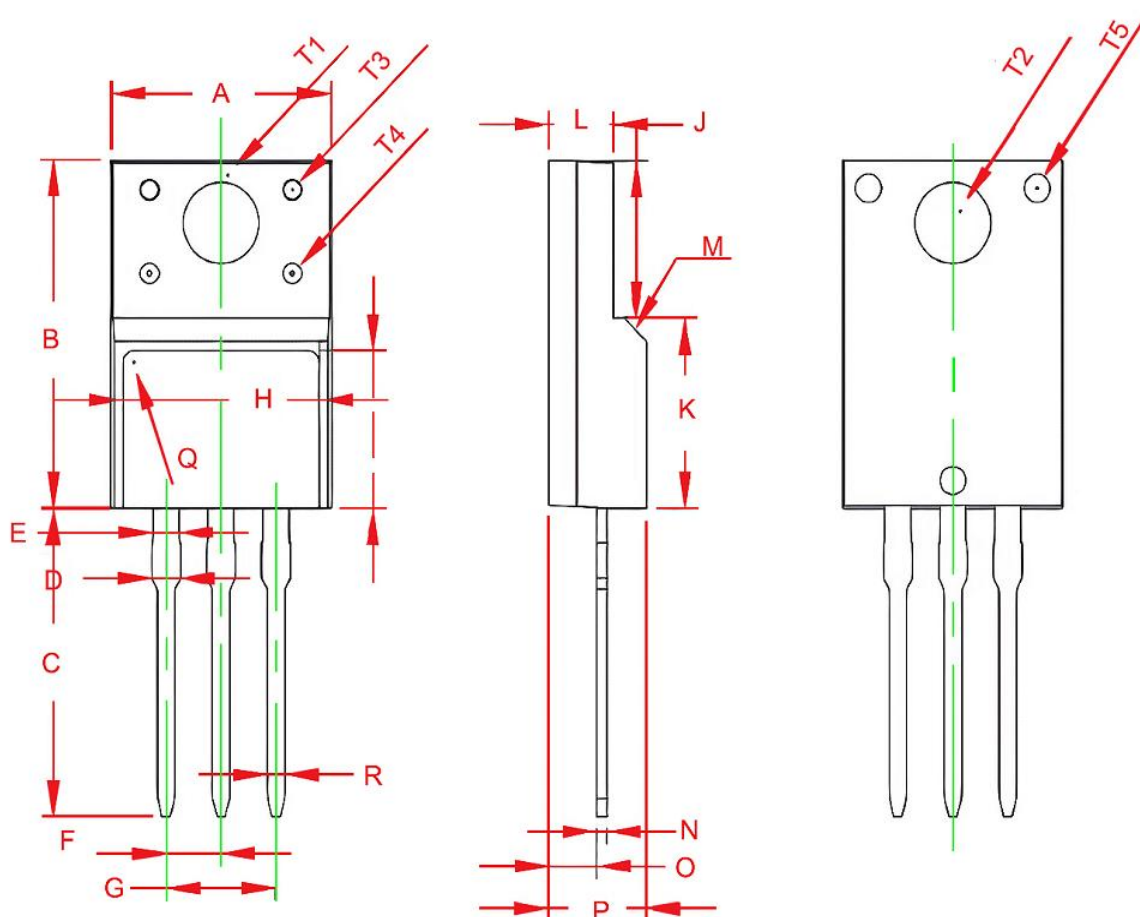


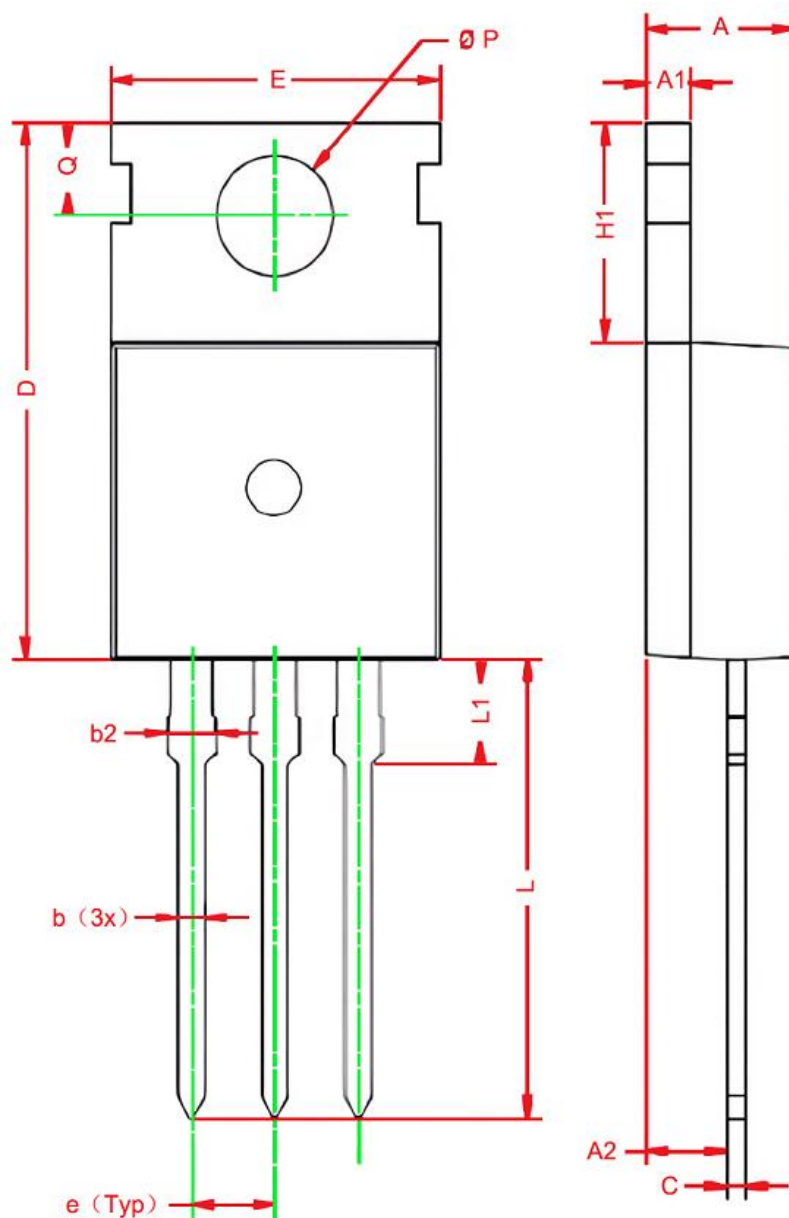
Fig6. Typical Capacitance Vs. Drain-Source Voltage

TO-220F Package information

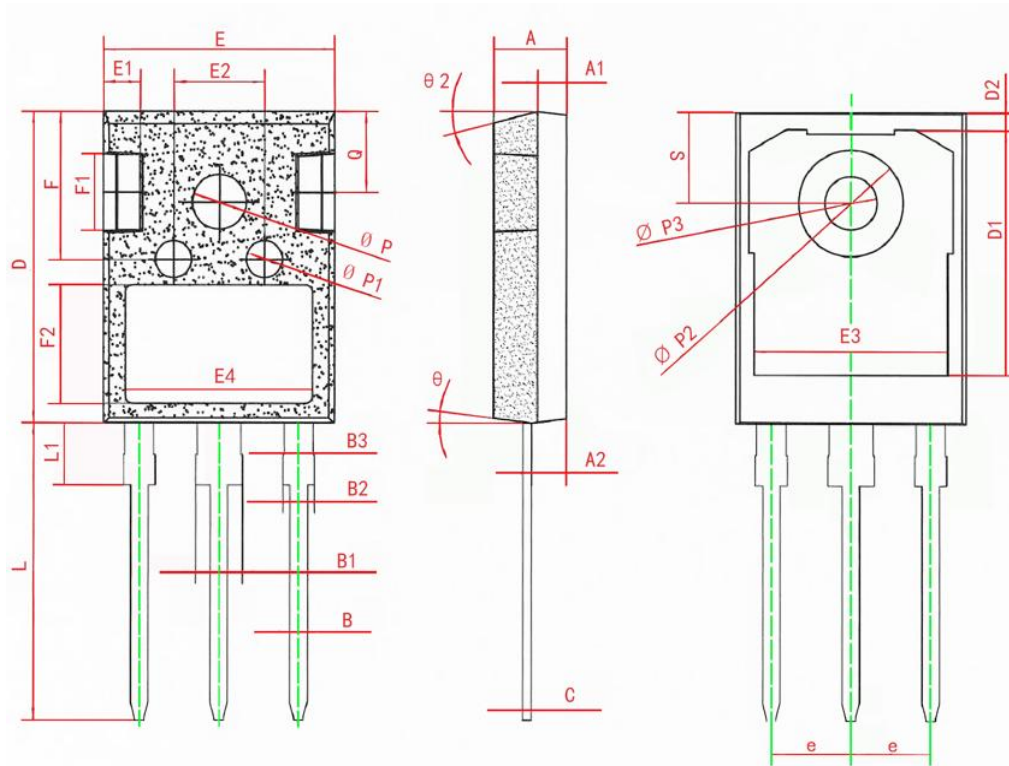


Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	9.960	10.360	0.392	0.407
B	15.670	16.070	0.616	0.632
C	13.140	13.540	0.517	0.533
D	1.200	1.400	0.047	0.055
E	1.200TYP		0.047TYP	
F	2.540TYP		0.100TYP	
G	5.080TYP		0.200TYP	
H	7.600	8.000	0.299	0.314
I	7.100	7.500	0.279	0.295
J	6.480	6.880	0.255	0.270
K	8.990	9.390	0.353	0.369
L	2.340	2.740	0.092	0.107
M	45°TYP		45°TYP	
N	0.490	0.520	0.019	0.020
O	2.150	2.550	0.084	0.100
P	4.500	4.900	0.177	0.192
Q	0.500TYP		0.019TYP	
S	4.5°TYP		4.5°TYP	
T1	3.450TYP		0.135TYP	
T2	3.180TYP		0.125TYP	
T3	1.500TYP		0.059TYP	
T4	1.200TYP		0.047TYP	
T5	1.500TYP		0.059TYP	
R	0.770	0.830	0.030	0.032

TO-220 Package information

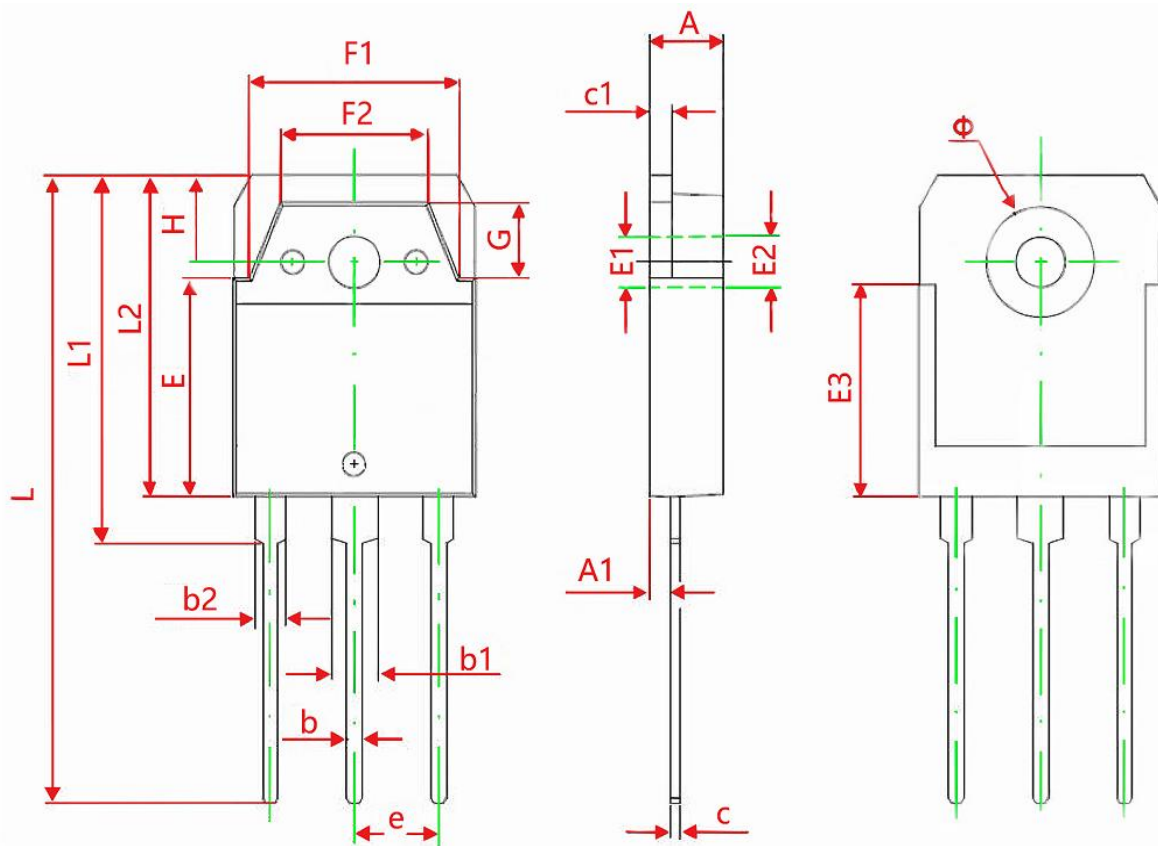


Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	3.600	4.800	0.142	0.189
A1	1.200	1.400	0.047	0.055
A2	2.030	2.900	0.080	0.114
b	0.400	1.000	0.016	0.039
b2	1.200	1.780	0.047	0.070
c	0.360	0.600	0.014	0.024
D	14.220	16.500	0.561	0.651
e	2.340	2.740	0.092	0.108
E	9.700	10.600	0.383	0.418
H1	5.840	6.850	0.230	0.270
L	12.700	14.700	0.501	0.580
L1	2.700	3.300	0.106	0.130
$\varnothing P$	3.500	4.000	0.138	0.158
Q	2.540	3.400	0.100	0.134

TO-247 Package information


Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	4.900	5.100	0.192	0.200
A1	1.900	2.100	0.074	0.082
A2	2.300	2.500	0.090	0.098
B	1.140	1.240	0.044	0.048
B1	3.050	3.250	0.120	0.127
B2	2.000	2.200	0.078	0.086
B3	1.900	2.100	0.074	0.082
C	0.550	0.650	0.021	0.025
D	20.800	21.200	0.818	0.834
D1	16.350	16.750	0.643	0.659
D2	1.020	1.320	0.040	0.051
E	15.600	16.000	0.614	0.629
E1	2.400	2.600	0.094	0.102
E2	6.100	6.300	0.240	0.248
E3	13.060	13.460	0.514	0.529
E4	12.700	12.900	0.500	0.507
F	9.800	10.200	0.385	0.401
F1	4.800	5.400	0.188	0.212
F2	7.900	8.100	0.311	0.318
e	5.436BSC		0.214BSC	
L	19.720	20.120	0.776	0.792
L1	3.900	4.300	0.153	0.169
ΦP	3.550	3.950	0.139	0.155
ΦP1	2.400	2.600	0.094	0.102
ΦP2	7.090	7.290	0.279	0.287
ΦP3	3.500	3.700	0.137	0.145
S	6.050	6.250	0.238	0.246
Q	5.400	5.600	0.212	0.220
θ	5°	9°	5°	9°
θ1	5°	9°	5°	9°
θ2	13°	17°	13°	17°

TO-3P Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	4.600	5.000	0.181	0.196
A1	2.300	2.500	0.090	0.098
b	0.800	1.200	0.031	0.047
b1	2.800	3.200	0.110	0.125
b2	1.800	2.200	0.070	0.086
c	0.500	0.700	0.019	0.027
c1	1.450	1.650	0.057	0.064
D	15.450	15.850	0.608	0.624
E	13.700	14.100	0.539	0.555
E1	3.200REF		0.126REF	
E2	3.300REF		0.130REF	
E3	13.450REF		0.530REF	
F1	13.200	13.400	0.519	0.527
F2	9.400	9.800	0.370	0.385
L	39.780	39.980	1.566	1.574
L1	23.200	23.600	0.913	0.929
L2	19.780	19.980	0.778	0.786
Φ	6.900	7.100	0.271	0.279
G	5.150	5.550	0.203	0.219
e	5.450TYP		0.215TYP	
H	5.000REF		0.197REF	
h	0.000	0.300	0.000	0.011