

Features

- Integrate fast recovery diode
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Application

- Switch Mode Power Supply (SMPS)
- Motor Controls
- Power Factor Correction (PFC)

Product Summary

V_{DS}	$R_{DS(ON)}$ TYP	I_D
200V	250mΩ@10V	9A



TO-220F



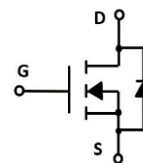
TO-220



TO-251



TO-252



Pb-Free



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
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	9

Mounted on Large Heat Sink

I _{DM}	Pulse Drain Current Tested	Tc=25°C	36		A
I _D	Continuous Drain Current@GS=10V	Tc=25°C	9		A
P _D	Maximum Power Dissipation	Tc=25°C	34	74	W
R _{thJA}	Thermal Resistance, Junction-to-Ambient		62.5	60	°C/W
E _{AS}	Single pulse avalanche energy ^(Notes1)		115		mJ

Ordering Information (Example)

Type	Package	Marking	Minimum Package(pcs)	Inner Box Quantity(pcs)	Outer Carton Quantity(pcs)	Delivery Mode
MLSYF9N20	TO-220F	MLSYF9N20	50	1,000	5,000	/
MLSY9N20	TO-220	MLSY9N20	50	1,000	5,000	/
MLSD9N20	TO-251	MLSD9N20	80	4,000	20,000	/
MLSU9N20	TO-252	MLSU9N20	2,500	5,000	35,000	13" reel

Electrical Characteristics (TJ=25℃ unless otherwise noted)						
Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ TJ = 25℃ (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	--	--	1	uA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±20V, V _{DS} =0V	--	--	±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.0	--	2.0	V
R _{DS(on)}	Drain-Source On-State Resistance	V _{GS} =10V, I _D =4.5A	--	250	300	mΩ
Dynamic Electrical Characteristics @ TJ = 25℃ (unless otherwise stated)						
C _{ISS}	Input Capacitance	V _{DS} =25V, V _{GS} =0V, f=1MHz	--	605	--	pF
C _{OSS}	Output Capacitance		--	87	--	pF
C _{RSS}	Reverse Transfer Capacitance		--	37	--	pF
Switching Characteristics						
Q _g	Total Gate Charge	V _{DD} =160V, I _D =9A, V _{GS} =10V	--	19	--	nC
Q _{gs}	Gate Source Charge		--	3	--	nC
Q _{gd}	Gate Drain Charge		--	8	--	nC
t _{d(on)}	Turn-on Delay Time	V _{DD} =100V, I _D =9A, R _G =25Ω	--	35	--	nS
t _r	Turn-on Rise Time		--	7	--	nS
t _{d(off)}	Turn-Off Delay Time		--	98	--	nS
t _f	Turn-Off Fall Time		--	32	--	nS
Source- Drain Diode Characteristics						
V _{SD}	Forward on voltage	Tj=25℃, Is=4.5A,	--	--	1.4	V

Note:

1、L=1mH, $V_{DD}=50V$, $R_G=25\Omega$, Starting $T_J=25^\circ C$

Typical Operating Characteristics

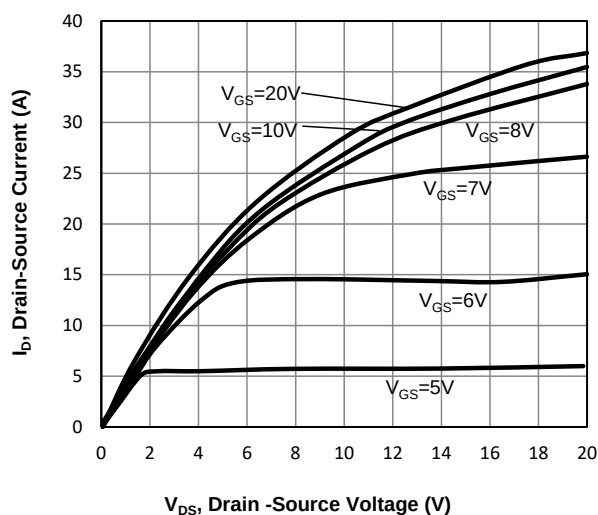


Fig1. Typical Output Characteristics

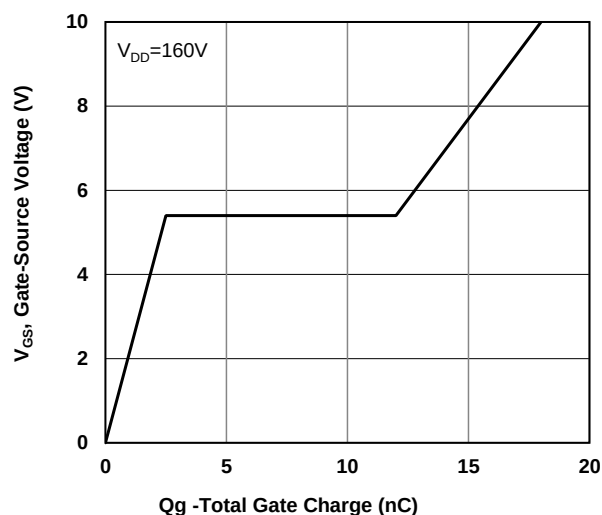


Fig2. Typical Gate Charge Vs. Gate-Source Voltage

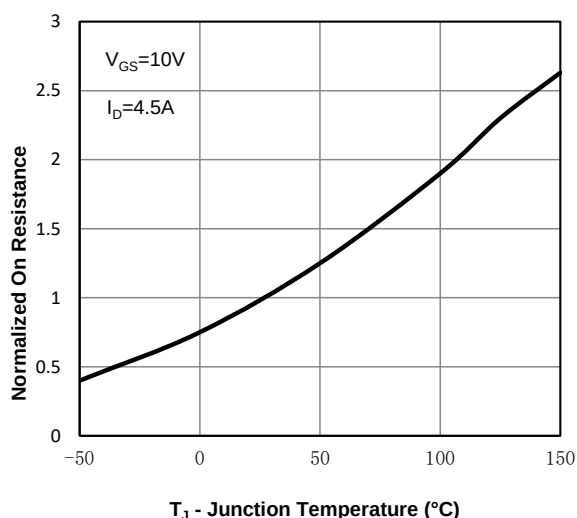


Fig3. Normalized On-Resistance Vs. Temperature

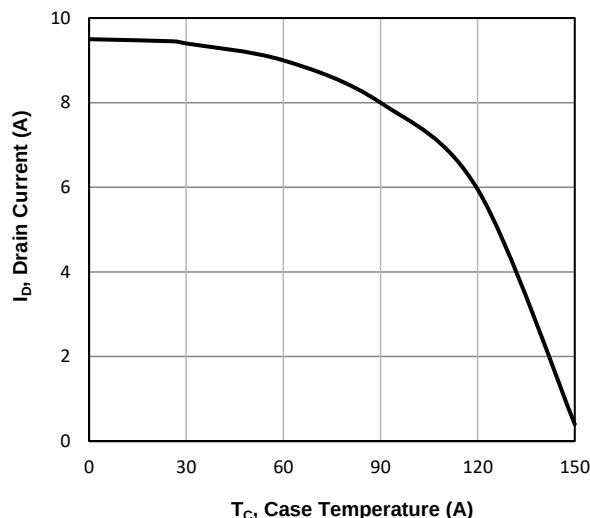


Fig4. Drain Current vs. Temperature

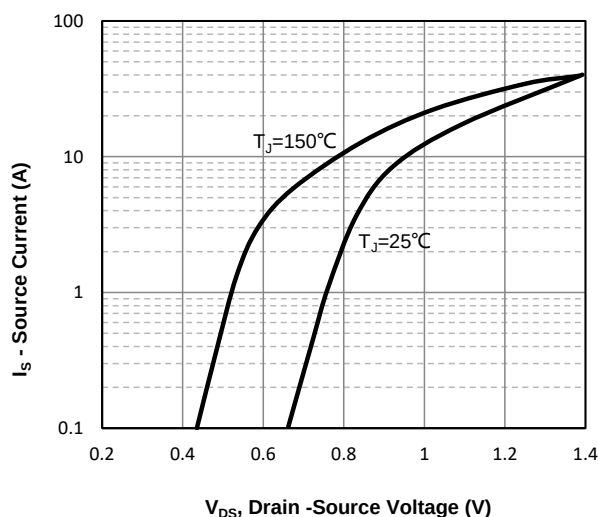


Fig5. Body Diode Forward Voltage

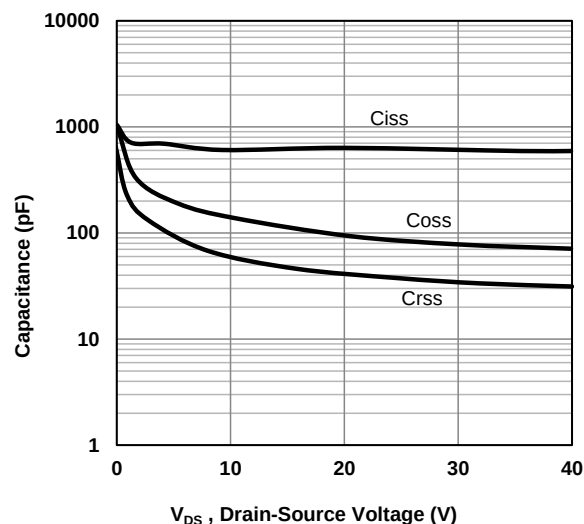
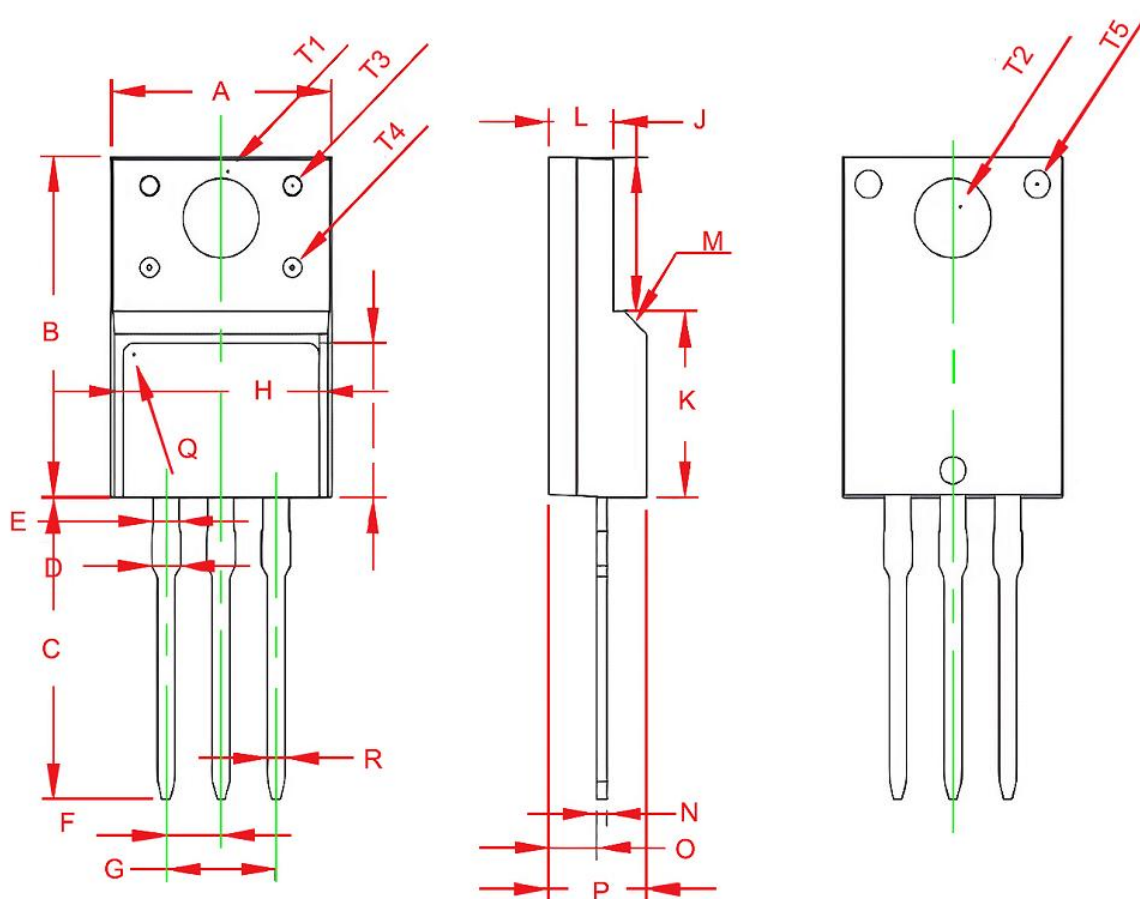


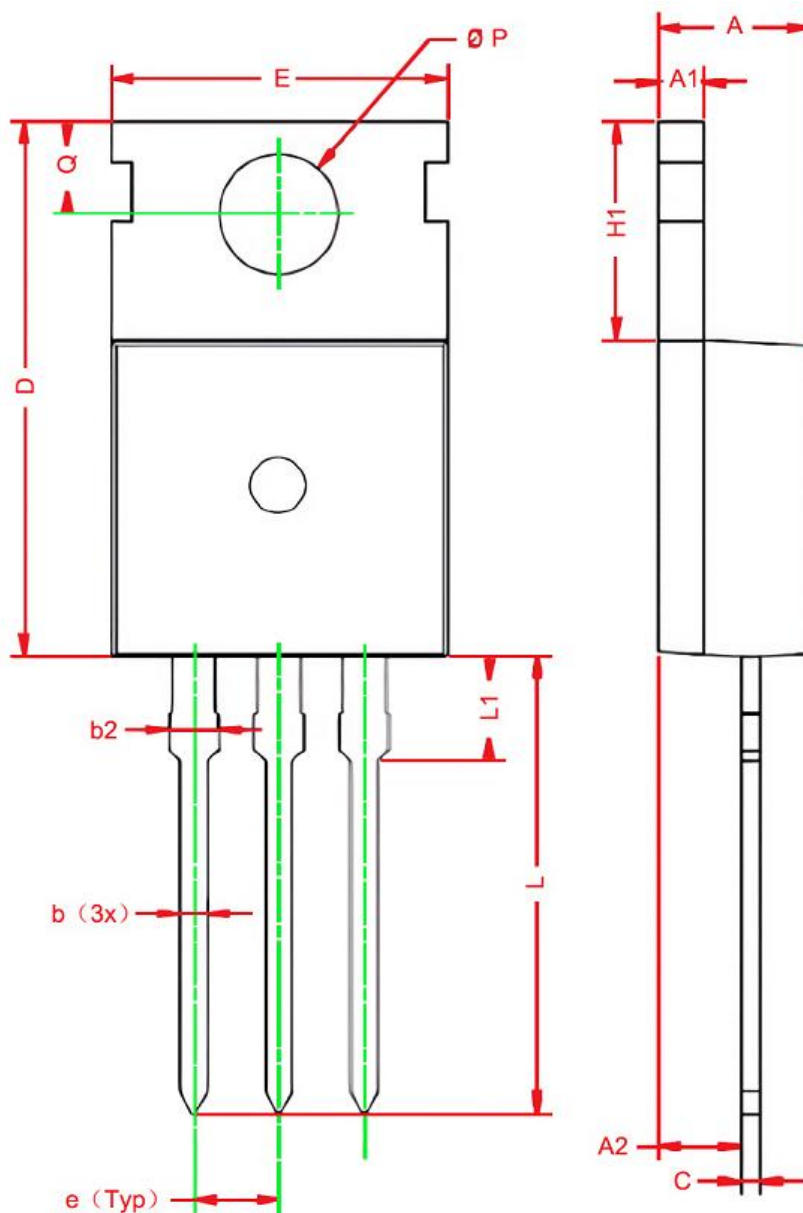
Fig6 Typical Capacitance Vs. Drain-Source Voltage

TO-220F Package information



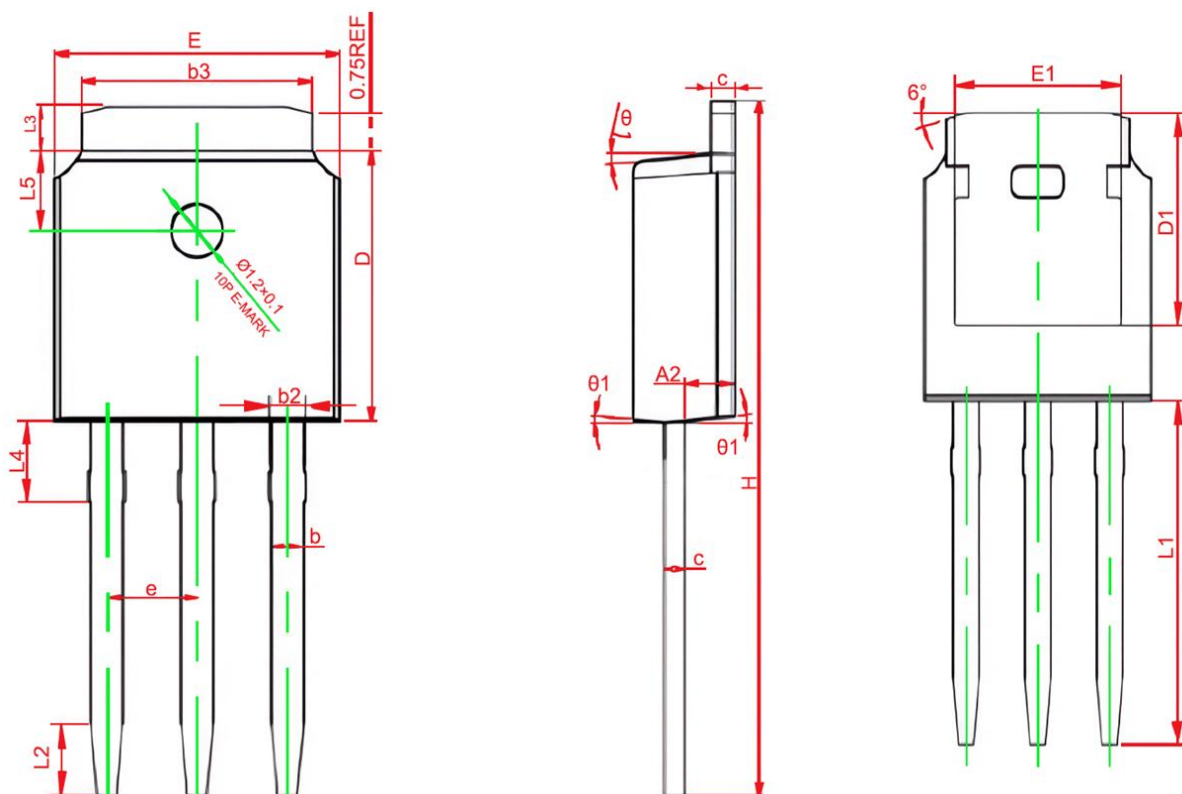
Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	9.960	10.360	0.392	0.407
B	15.670	16.070	0.616	0.632
C	13.140	13.540	0.517	0.533
D	1.200	1.400	0.047	0.055
E	1.200TYP		0.047TYP	
F	2.540TYP		0.100TYP	
G	5.080TYP		0.200TYP	
H	7.600	8.000	0.299	0.314
I	7.100	7.500	0.279	0.295
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



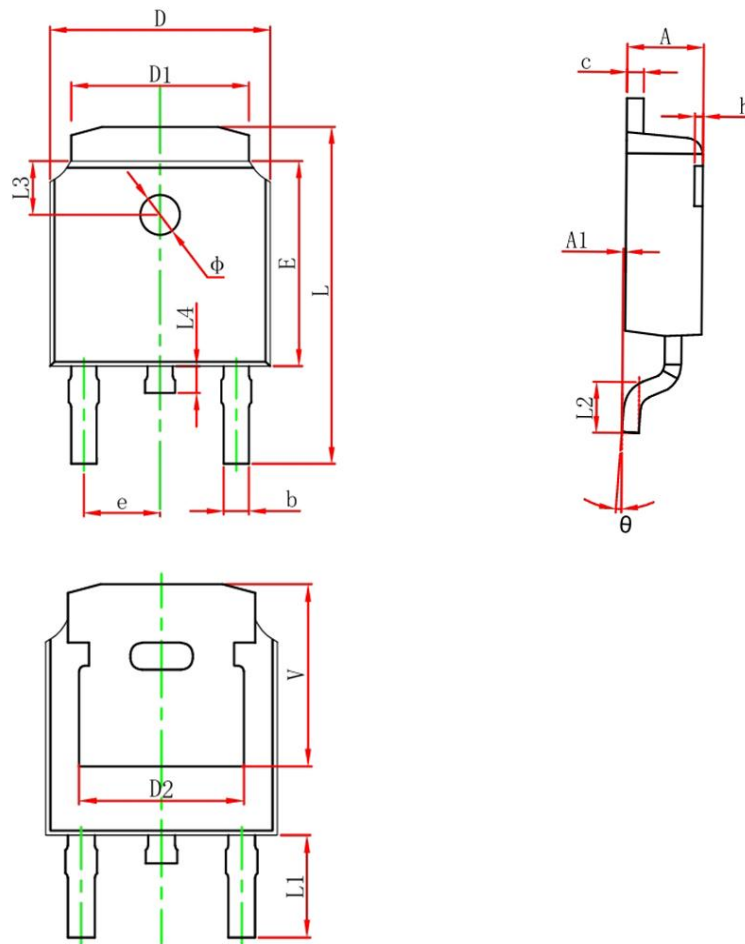
Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	3.600	4.800	0.142	0.189
A1	1.200	1.400	0.047	0.055
A2	2.030	2.900	0.080	0.114
b	0.400	1.000	0.016	0.039
b2	1.200	1.780	0.047	0.070
c	0.360	0.600	0.014	0.024
D	14.220	16.500	0.561	0.651
e	2.340	2.740	0.092	0.108
E	9.700	10.600	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-251 Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.380	0.087	0.094
A2	0.970	1.170	0.038	0.046
b	0.720	0.850	0.028	0.034
b2	0.720	0.950	0.028	0.038
b3	5.230	5.460	0.207	0.216
c	0.470	0.580	0.019	0.023
D	6.000	6.200	0.237	0.245
D1	5.300 REF		0.210 REF	
E	6.500	6.700	0.257	0.265
E1	4.700	4.920	0.186	0.195
e	2.286 REF.		0.114 REF.	
H	16.100	16.600	0.637	0.656
L1	9.200	9.600	0.364	0.380
L2	1.250	1.460	0.049	0.058
L3	0.900	1.220	0.036	0.048
L4	0.950	1.150	0.038	0.045
L5	1.700	1.900	0.067	0.075
θ 1	5°	7°	5°	7°

TO-252 Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.635	0.770	0.025	0.030
c	0.450	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.712	10.312	0.386	0.406
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
ϕ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.250 REF.		0.207 REF.	