N-Channel Super Junction Power MOSFET Ⅳ

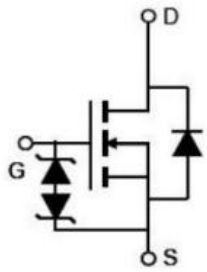
General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

$V_{DS\ min@Tjmax}$	710	V
$R_{DS(ON)TYP.}$	260	mΩ
I_D	13	A
Qg	15	nC

Features

- Optimized body diode reverse recovery performance
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant



Schematic diagram

Application

- Power factor correction（PFC）
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）
- LLC Half-bridge

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65N290F	TO-220F	NCE65N290F



TO-220F

Table 1. Absolute Maximum Ratings (T_J=25℃)

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	650	V
Gate-Source Voltage (V_{DS}=0V) ,AC (f>1 Hz)	V_{GS}	±30	V
Gate-Source Voltage (V_{DS}=0V) ,DC	V_{GS}	±20	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	13	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	9.1	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	39	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	32.9 0.22	W W/°C
Single pulse avalanche current **(Note 2)**	I_{AS}	3	A
Reverse diode dv/dt， V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	15	V/ns
Drain Source voltage slope， V_{DS} ≤480 V	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+175	°C

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	4.56	°C /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	62	°C /W

Table 3. Electrical Characteristics (T_J=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250uA	650			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=650V,V_{GS}=0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=650V,V_{GS}=0V			50	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V			±200	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250uA	3		4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=6.5A		260	290	mΩ
Dynamic Characteristics						
Gate Resistance	Rg	F=1MHZ, D-S short		16		Ω
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1MHz		847		pF
Output Capacitance	C_{oss}			37		pF
Reverse Transfer Capacitance	C_{rss}			5		pF
Total Gate Charge	Q_g	V_{DS}=450V,I_D=6.5A, V_{GS}=10V		15	18	nC
Gate-Source Charge	Q_{gs}			2		nC
Gate-Drain Charge	Q_{gd}			5		nC
Gate plateau voltage	Vgp			5.3		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=6.5A, R_G=4Ω,V_{GS}=10V		10		nS
Turn-on Rise Time	t_r			9		nS
Turn-Off Delay Time	$t_{d(off)}$			55		nS
Turn-Off Fall Time	t_f			9		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			13	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				39	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=13A,V_{GS}=0V		0.9	1.1	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=6.5A, di/dt=100A/μs		230		nS
Reverse Recovery Charge	Q_{rr}			1.84		uC
Peak reverse recovery current	I_{rrm}			16		A

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. Tj=25℃,VDD=50V,VG=10V, R_G=25Ω

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

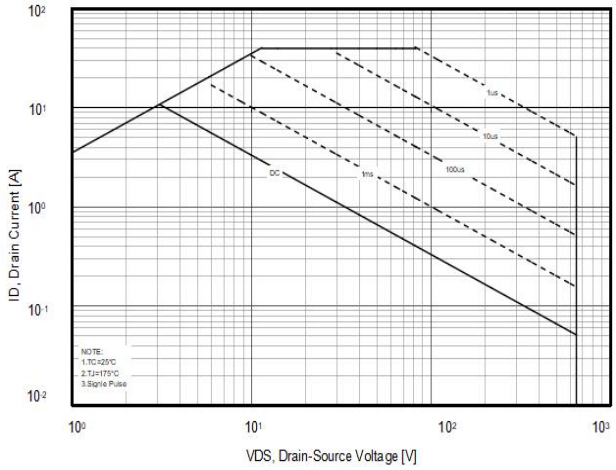


Figure2. Source-Drain Diode Forward Voltage

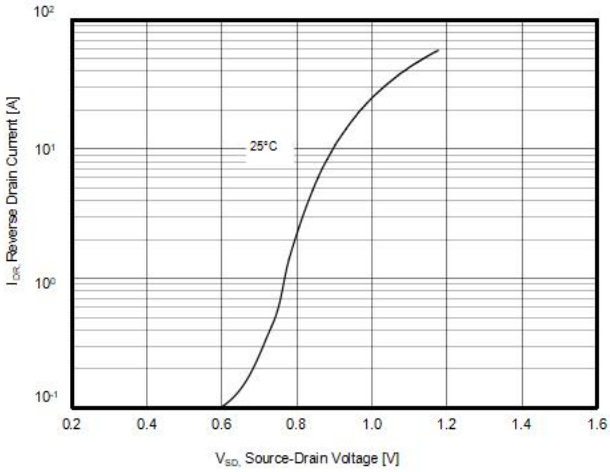


Figure3. Transfer characteristics

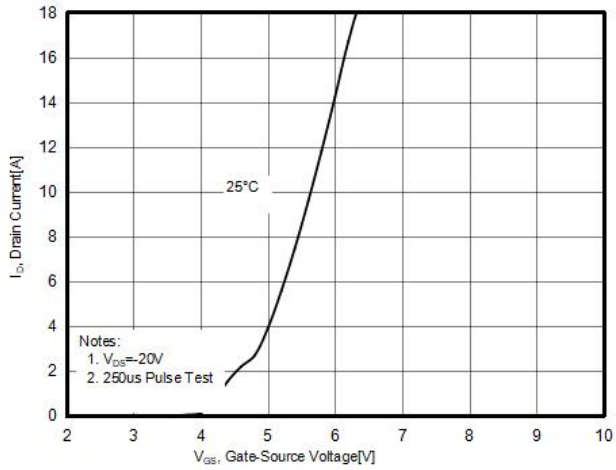


Figure4. Output characteristics

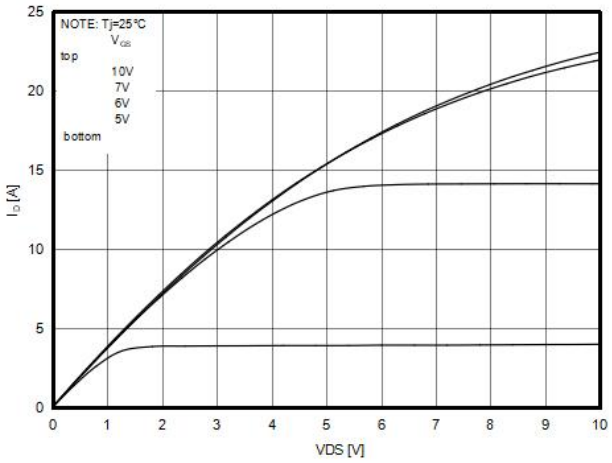


Figure5. Static drain-source on resistance

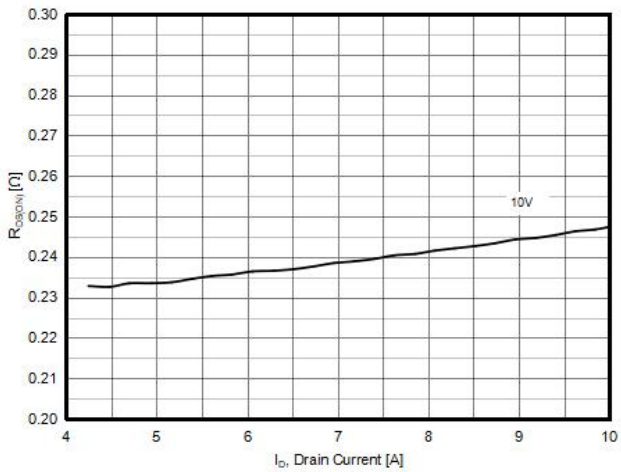


Figure6. $R_{DS(ON)}$ vs Junction Temperature

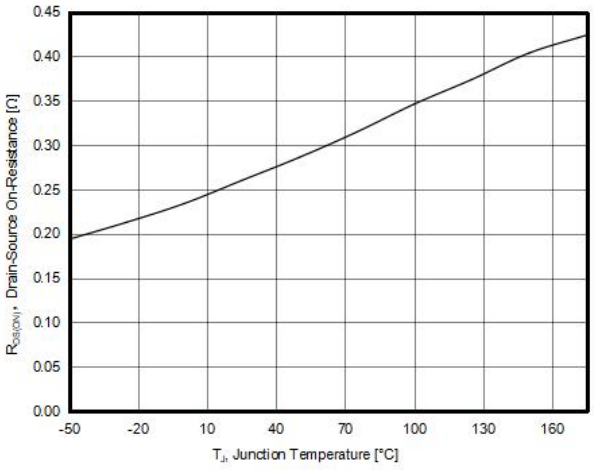


Figure7. BV_{DSS} vs Junction Temperature

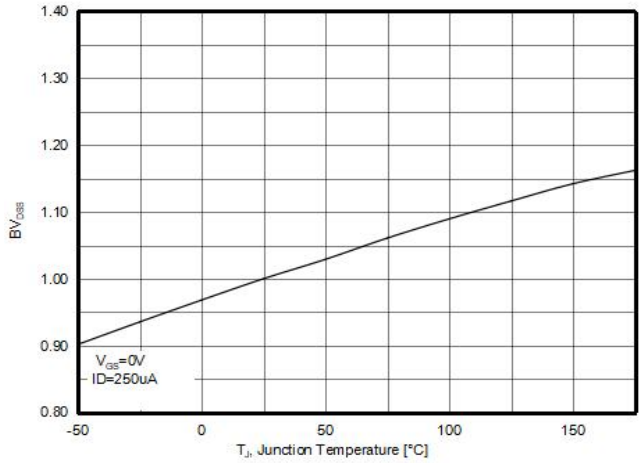


Figure8. Maximum I_D vs Junction Temperature

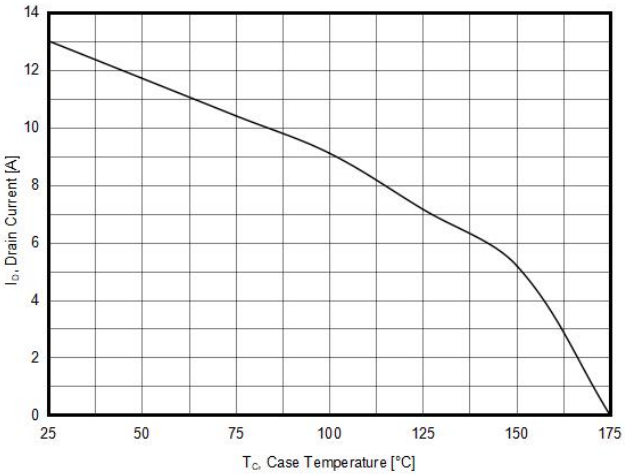


Figure9. Gate charge waveforms

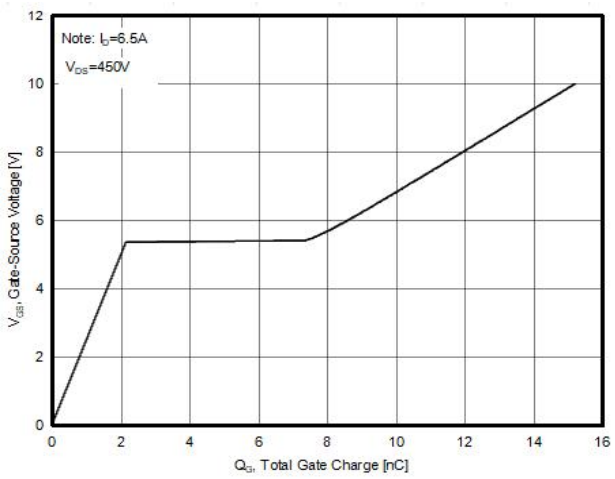
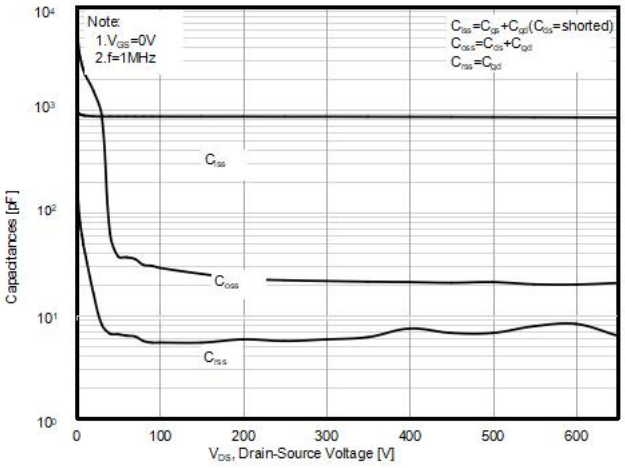
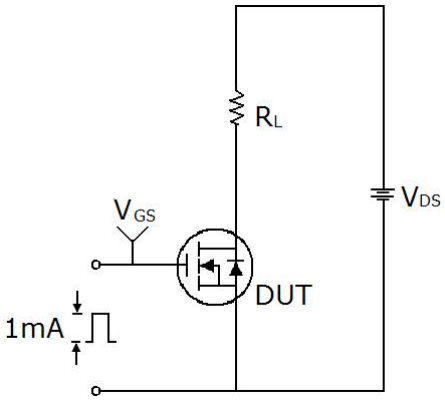


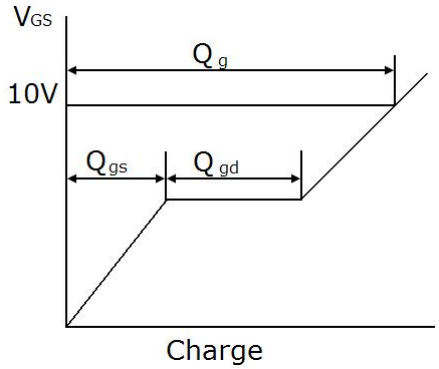
Figure10. Capacitance



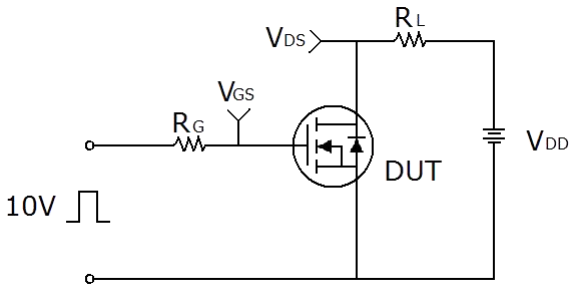
Test circuit

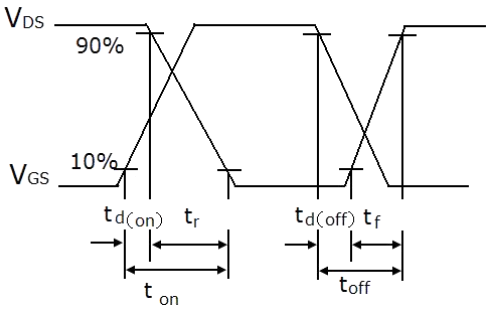
1）Gate charge test circuit & Waveform



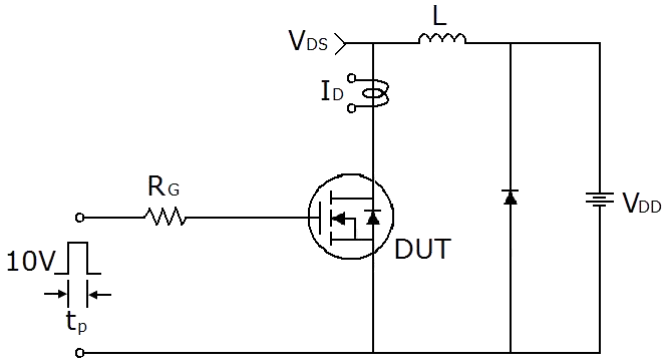


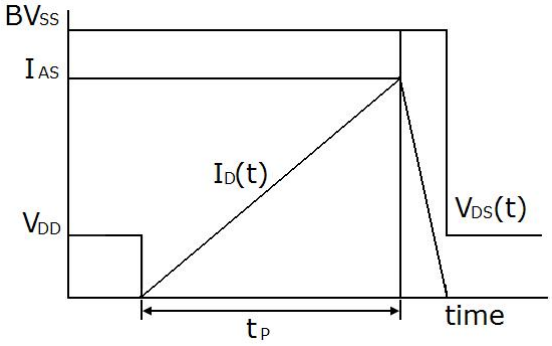
2）Switch Time Test Circuit：



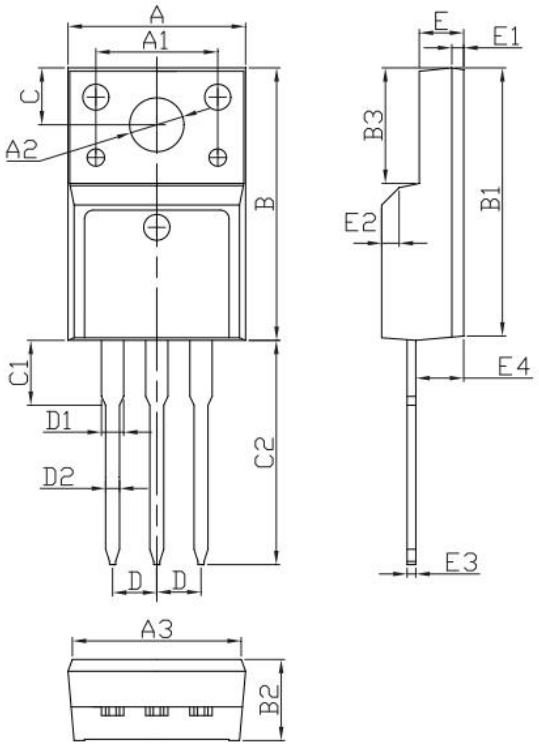


3）Unclamped Inductive Switching Test Circuit & Waveforms



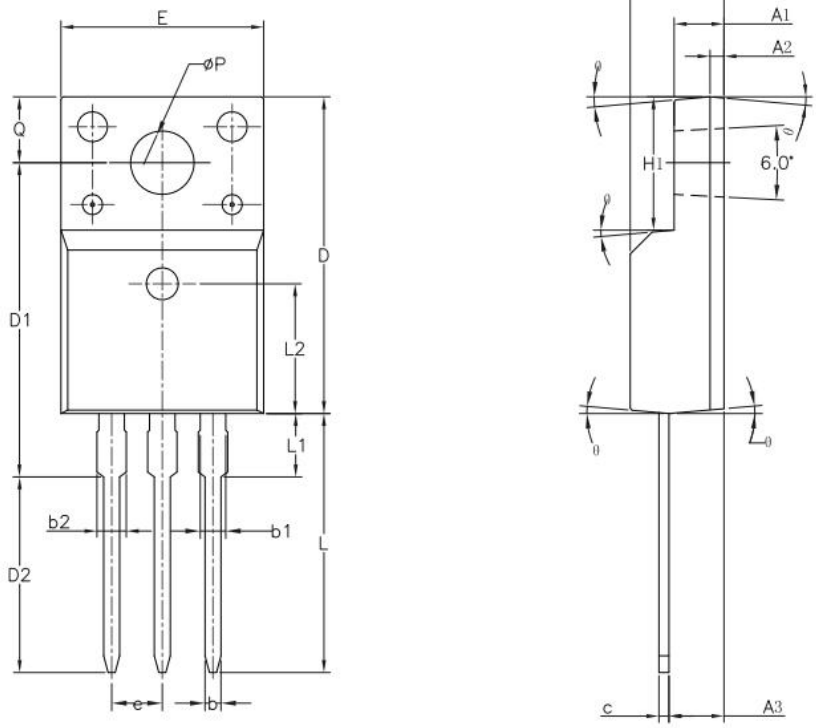


TO-220F-3L-L Package Information



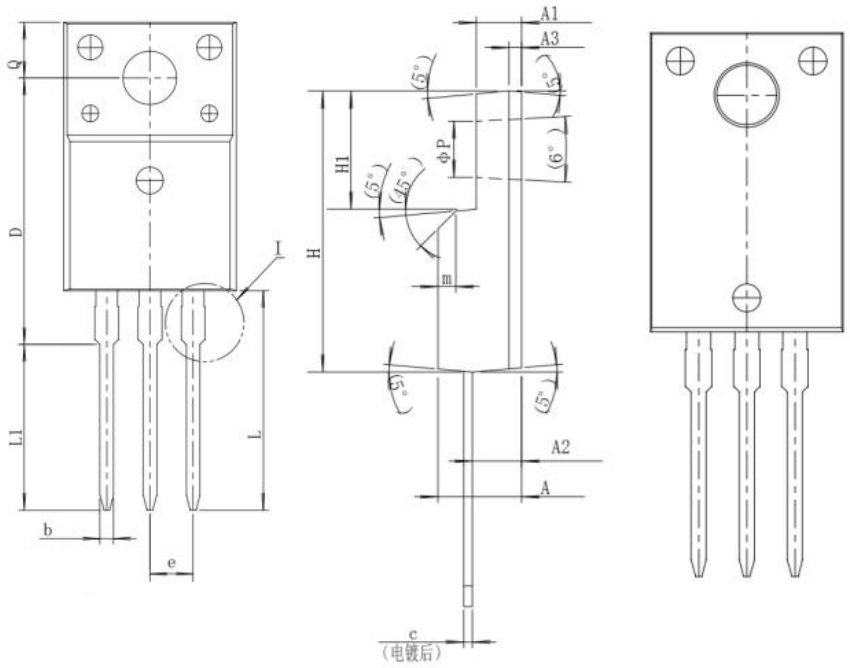
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	9.96	10.36	0.391	0.407
A1	6.85	7.15	0.269	0.281
A2	2.97	3.27	0.117	0.128
A3	9.50	9.90	0.373	0.389
B	15.70	16.10	0.617	0.633
B1	15.40	15.80	0.605	0.621
B2	4.50	4.90	0.177	0.193
B3	6.50	6.90	0.255	0.271
C	3.10	3.50	0.122	0.138
C1	3.05	3.45	0.120	0.136
C2	12.80	13.20	0.503	0.519
D	2.54 BSC		0.100 BSC	
D1	1.13	1.43	0.044	0.056
D2	0.65	0.95	0.026	0.037
E	2.35	2.75	0.092	0.108
E1	0.55	0.85	0.022	0.033
E2	45.0°		45.00°	
E3	0.35	0.65	0.014	0.026
E4	2.55	2.95	0.100	0.116

TO-220F-3L-P Package Information



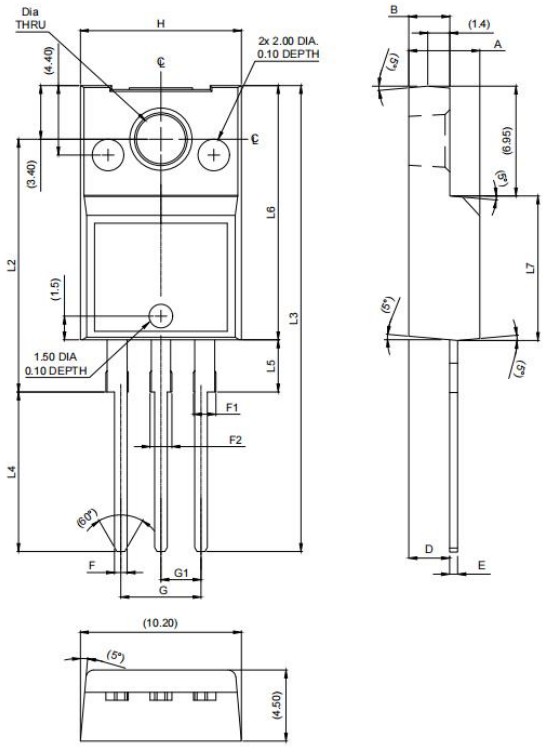
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.50	4.83	0.177	0.190
A1	2.34	2.74	0.092	0.108
A2	0.70 REF		0.028 REF	
A3	2.56	2.93	0.101	0.115
b	0.70	0.90	0.028	0.035
b1	1.18	1.38	0.046	0.054
b2	--	1.47	--	0.058
c	0.45	0.60	0.018	0.024
D	15.67	16.07	0.616	0.631
D1	15.55	15.95	0.611	0.627
D2	9.60	10.00	0.377	0.393
E	9.96	10.36	0.391	0.407
e	2.54 BSC		0.100 BSC	
H1	6.48	6.88	0.255	0.270
L	12.68	13.28	0.498	0.522
L1	--	3.50	--	0.138
L2	6.50 REF		0.255 REF	
⌀ P	3.08	3.28	0.121	0.129
Q	3.20	3.40	0.126	0.134

TO-220F-3L-M Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.60	4.80	0.181	0.189
A1	2.44	2.64	0.096	0.104
A2	2.65	2.85	0.104	0.112
A3	0.70 REF		0.028 REF	
b	0.70	0.90	0.028	0.035
b2	1.18	1.39	0.046	0.055
b1	1.28	1.47	--	0.058
c	0.45	0.60	0.018	0.024
D	15.64	15.85	0.614	0.623
E	10.06	10.26	0.395	0.403
e	2.54 BSC		0.100 BSC	
H	15.77	15.97	0.620	0.627
H1	6.58	6.78	0.259	0.266
L	12.68	13.28	0.498	0.522
L1	9.60	10.00	0.377	0.393
⌀ P	3.08	3.28	0.121	0.129
Q	3.20	3.40	0.126	0.134

TO-220F-3L-B Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
B	2.50	2.70	0.098	0.106
D	2.50	2.75	0.098	0.108
E	0.45	0.70	0.018	0.028
F	0.75	1.00	0.029	0.039
F1	1.15	1.50	0.045	0.059
F2	1.15	1.50	0.045	0.059
G	4.95	5.20	0.19	0.20
G1	2.40	2.70	0.09	0.11
H	10.00	10.40	0.39	0.41
L2	16.00		0.63	
L3	28.60	30.60	1.12	1.20
L4	9.80	10.60	0.39	0.42
L5	2.90	3.60	0.11	0.14
L6	15.90	16.40	0.62	0.64
L7	9.00	9.30	0.35	0.37
Dia	3.00	3.20	0.12	0.13

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