

## N-Channel Enhancement Mode MOSFET

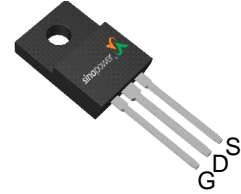
### Features

- 75V/170A\*\*,  
 $R_{DS(ON)} = 4.3m\Omega(\text{max.}) @ V_{GS} = 10V$
- Reliable and Rugged
- Lead Free and Green Devices Available  
 (RoHS Compliant)

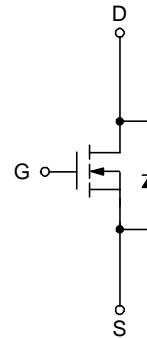
### Pin Description



Top View of TO-220



Top View of TO-220-FP

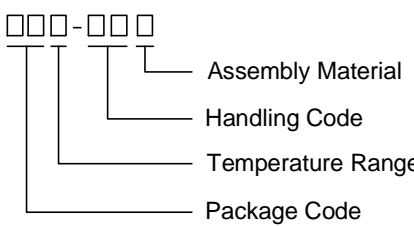



N-Channel MOSFET

### Applications

- Synchronous Rectification.
- Power Management in Inverter Systems.

### Ordering and Marking Information

SM7506N		Package Code F : TO-220      FP : TO-220-FP Operating Junction Temperature Range C : -55 to 175 °C Handling Code TU : Tube Assembly Material G : Halogen and Lead Free Device
SM7506N F/FP :		XXXXXX - Date Code

Note: SINOPOWER lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. SINOPOWER lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020D for MSL classification at lead-free peak reflow temperature. SINOPOWER defines "Green" to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

SINOPOWER reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
<b>Common Ratings</b> ( $T_A=25^\circ\text{C}$ Unless Otherwise Noted)			
$V_{DSS}$	Drain-Source Voltage	75	V
$V_{GSS}$	Gate-Source Voltage	$\pm 25$	
$T_J$	Maximum Junction Temperature	175	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 175	$^\circ\text{C}$
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$ 80	A
<b>Mounted on Large Heat Sink</b>			
$I_{DP}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_C=25^\circ\text{C}$ 480*	A
$I_D$	Continuous Drain Current(Silicon Limited)	$T_C=25^\circ\text{C}$ 170**	A
		$T_C=100^\circ\text{C}$ 130**	
$I_D$	Continuous Drain Current(Wire Bond Limited)	$T_C=25^\circ\text{C}$ 120	A
		$T_C=100^\circ\text{C}$ 120	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ\text{C}$ 300	W
		$T_C=100^\circ\text{C}$ 150	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	0.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	62.5	
$E_{AS}$	Avalanche Energy, Single Pulsed	$L=1\text{mH}$ 1.3	J

Note : \* Pulse width limited by safe operating area.

\*\* Calculated continuous current based on maximum allowable junction temperature. Bonding wire limitation current is 120A.

## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	SM7506NF/NFP			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$	75	-	-	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$	-	0.07	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=60\text{V}, V_{GS}=0\text{V}$ $T_J=85^\circ\text{C}$	-	-	1	$\mu\text{A}$
			-	-	30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	2	3	4	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 25\text{V}, V_{DS}=0\text{V}$	-	-	$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10\text{V}, I_{DS}=40\text{A}$	-	3.5	4.3	$\text{m}\Omega$

**Electrical Characteristics (Cont.)** ( $T_A = 25^\circ\text{C}$  Unless Otherwise Noted)

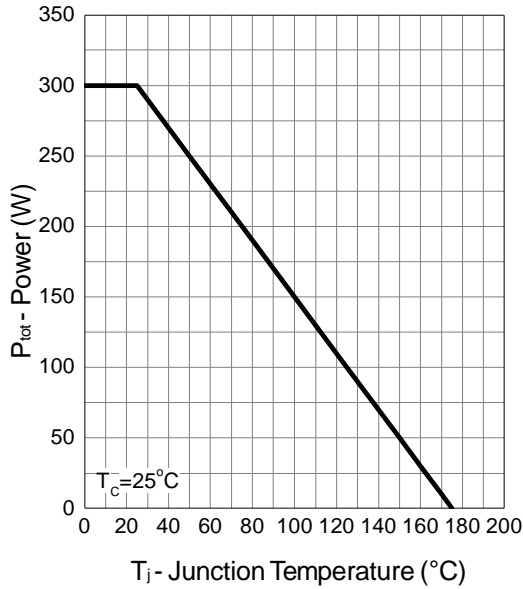
Symbol	Parameter	Test Conditions	SM7506NF/NFP			Unit
			Min.	Typ.	Max.	
<b>Diode Characteristics</b>						
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=20\text{A}, V_{GS}=0\text{V}$	-	0.8	1.1	V
$t_{rr}$	Reverse Recovery Time	$I_{DS}=40\text{A}, dI_{SD}/dt=100\text{A}/\mu\text{s}$	-	75	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	160	-	nC
<b>Dynamic Characteristics<sup>b</sup></b>						
$R_G$	Gate Resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, F=1\text{MHz}$	-	1.5	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=30\text{V},$ Frequency=1.0MHz	-	3200	4200	pF
$C_{oss}$	Output Capacitance		-	1100	-	
$C_{rss}$	Reverse Transfer Capacitance		-	450	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=30\text{V}, R_L=30\Omega,$ $I_{DS}=1\text{A}, V_{GEN}=10\text{V},$ $R_G=6\Omega$	-	20	36	ns
$T_r$	Turn-on Rise Time		-	25	45	
$t_{d(OFF)}$	Turn-off Delay Time		-	72	130	
$T_f$	Turn-off Fall Time		-	85	153	
<b>Gate Charge Characteristics<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=30\text{V}, V_{GS}=10\text{V},$ $I_{DS}=40\text{A}$	-	100	150	nC
$Q_{gs}$	Gate-Source Charge		-	19	-	
$Q_{gd}$	Gate-Drain Charge		-	30	-	

Note a : Pulse test ; pulse width $\leq 300\mu\text{s}$ , duty cycle $\leq 2\%$ .

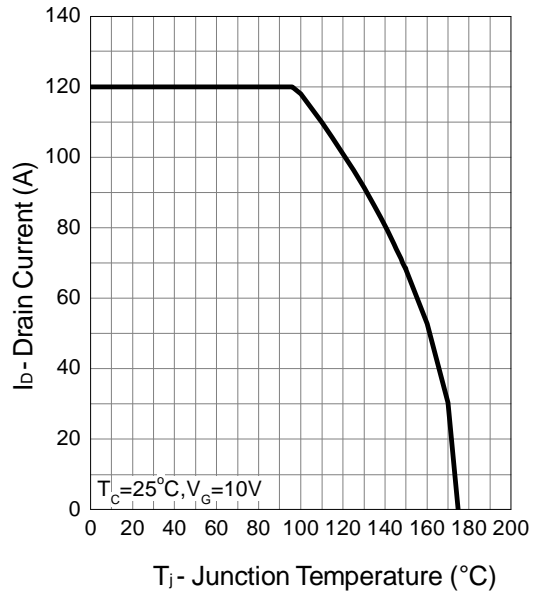
Note b : Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

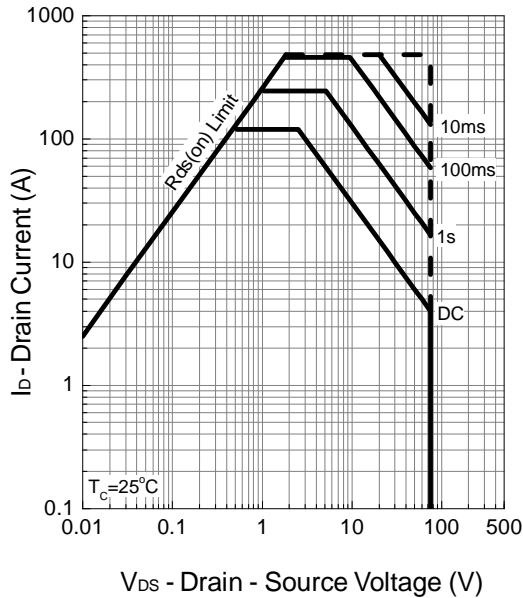
Power Dissipation



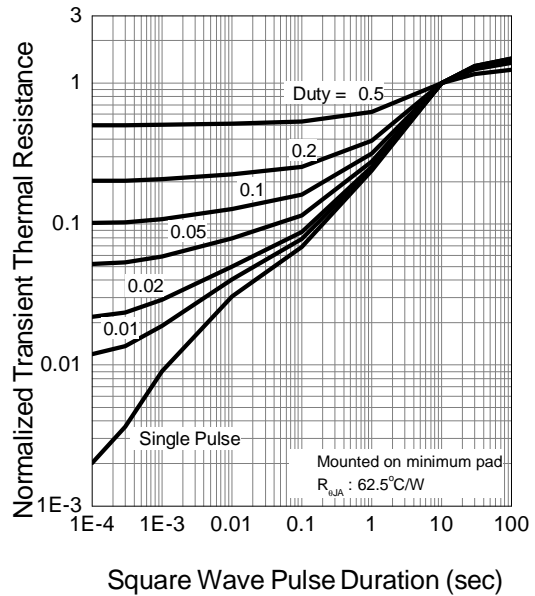
Drain Current



Safe Operation Area

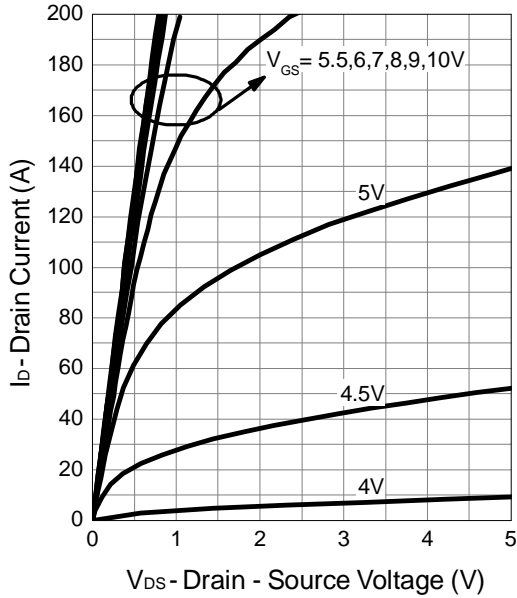


Thermal Transient Impedance

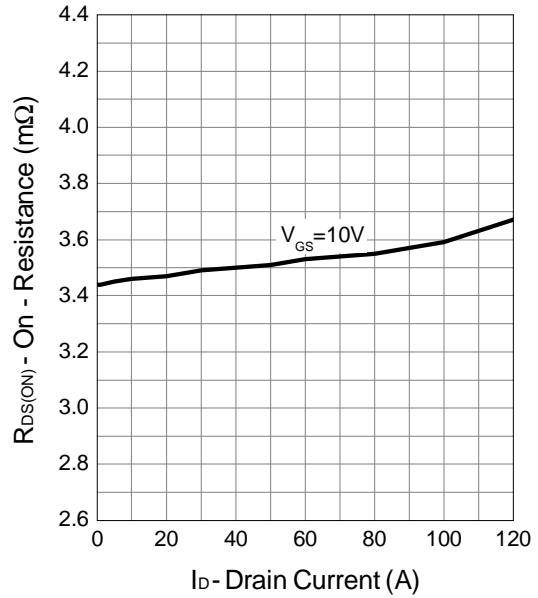


Typical Operating Characteristics (Cont.)

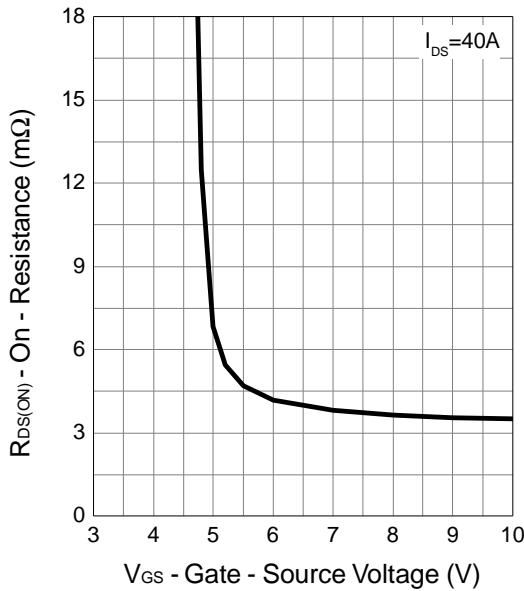
Output Characteristics



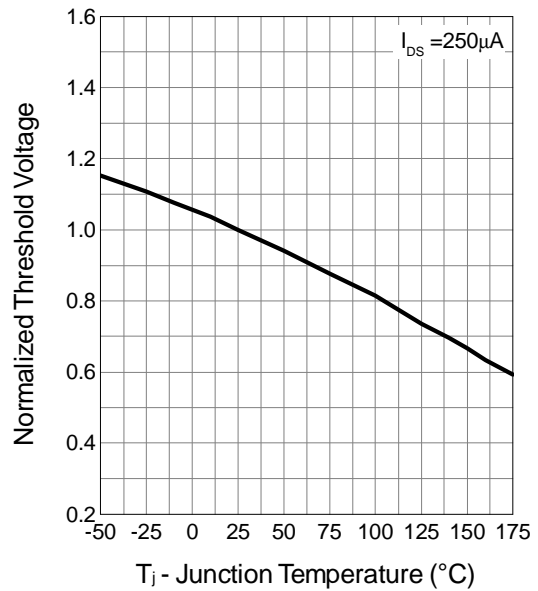
Drain-Source On Resistance



Gate-Source On Resistance

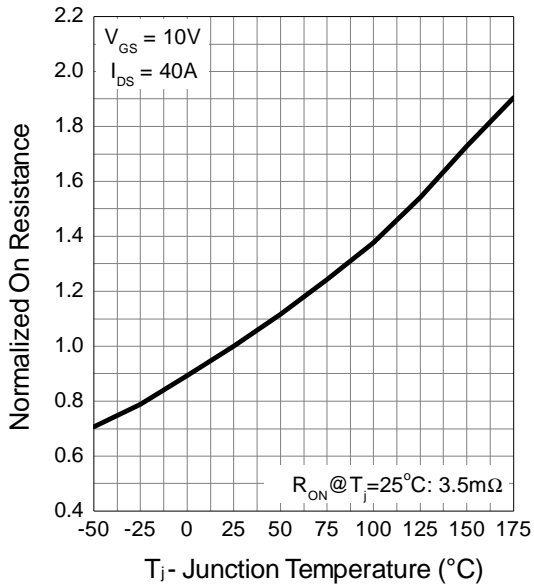


Gate Threshold Voltage

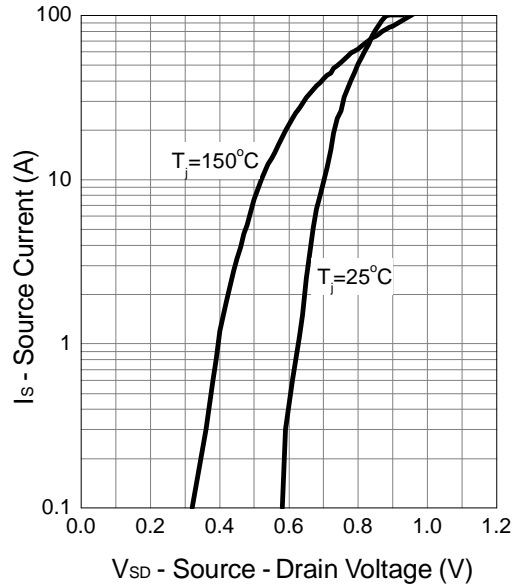


Typical Operating Characteristics (Cont.)

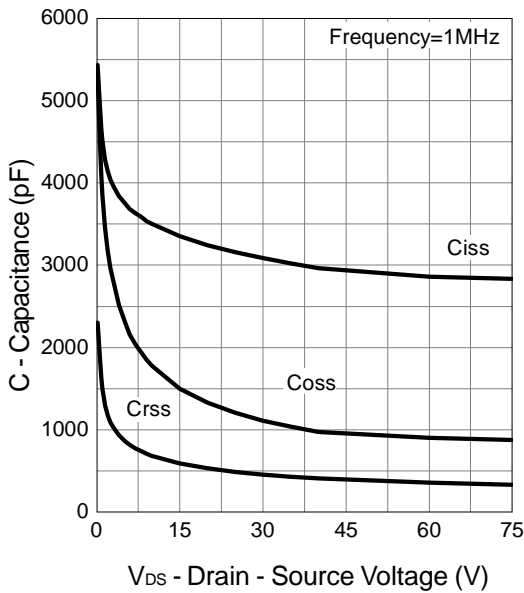
Drain-Source On Resistance



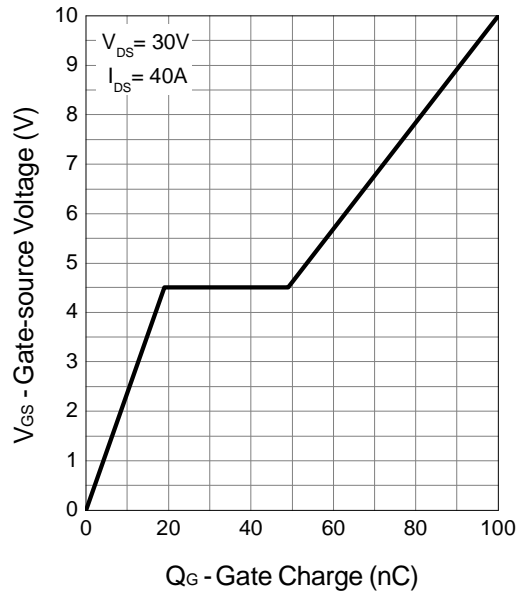
Source-Drain Diode Forward



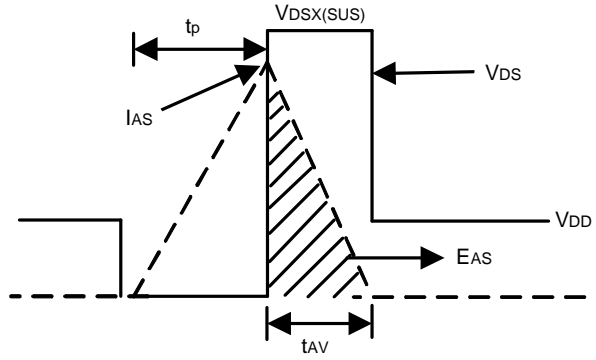
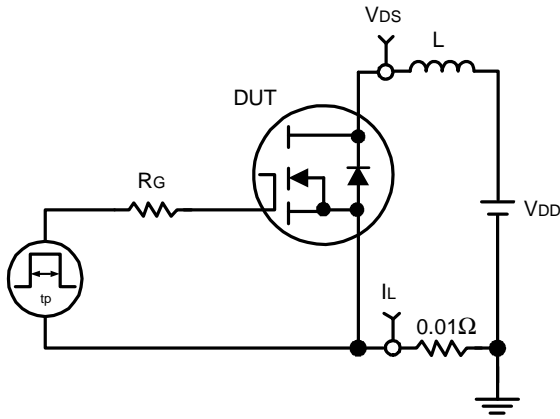
Capacitance



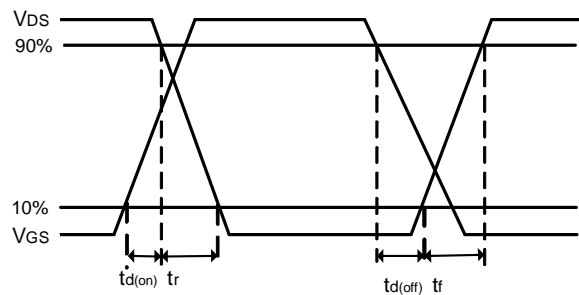
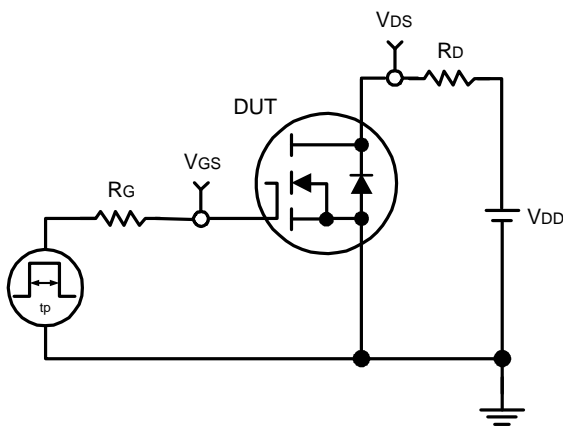
Gate Charge



### Avalanche Test Circuit and Waveforms

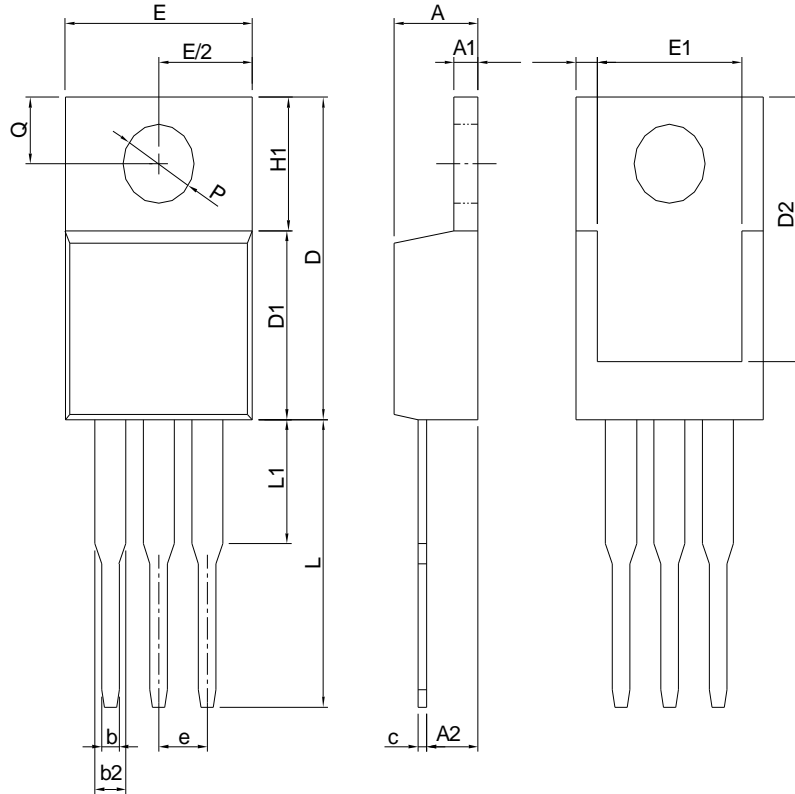


### Switching Time Test Circuit and Waveforms



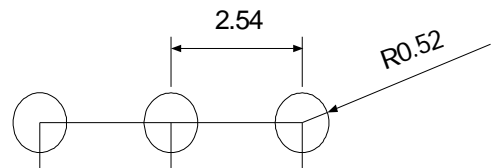
## Package Information

TO-220



DIMENSIONS	TO-220			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	3.56	4.83	0.140	0.190
A1	0.51	1.40	0.020	0.055
A2	2.03	2.92	0.080	0.115
b	0.38	1.02	0.015	0.040
b2	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.22	16.51	0.560	0.650
D1	8.38	9.02	0.330	0.355
D2	12.19	13.65	0.480	0.537
E	9.65	10.67	0.380	0.420
E1	6.86	8.89	0.270	0.350
e	2.54 BSC		0.100 BSC	
H1	5.84	6.86	0.230	0.270
L	12.70	14.73	0.500	0.580
L1		6.35		0.250
P	3.53	4.09	0.139	0.161
Q	2.54	3.43	0.100	0.135

### RECOMMENDED LAND PATTERN



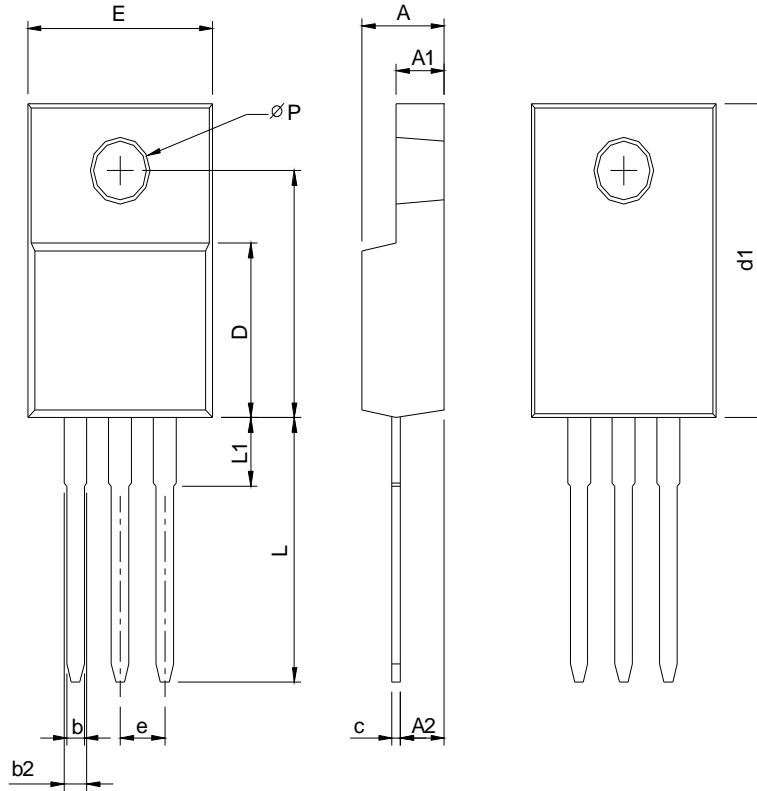
UNIT: mm

Note: Follow JEDEC TO-220 AB.



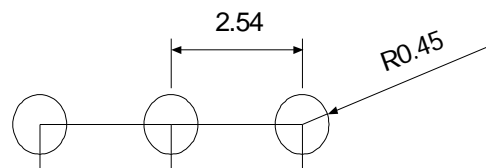
## Package Information

TO-220-FP



SYMBOL	TO-220FP			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.20	4.80	0.165	0.189
A1	2.60	3.20	0.102	0.126
A2	2.10	2.90	0.083	0.114
b	0.50	1.00	0.020	0.039
b2	0.90	1.90	0.035	0.075
c	0.30	0.80	0.012	0.031
D	8.10	9.10	0.319	0.358
d1	14.50	16.50	0.571	0.650
d2	12.10	12.90	0.476	0.508
E	9.70	10.70	0.382	0.421
e	2.54 BSC		0.100 BSC	
L	13.00	14.50	0.512	0.570
L1	1.60	4.00	0.063	0.157
P	3.00	3.60	0.118	0.142

### RECOMMENDED LAND PATTERN

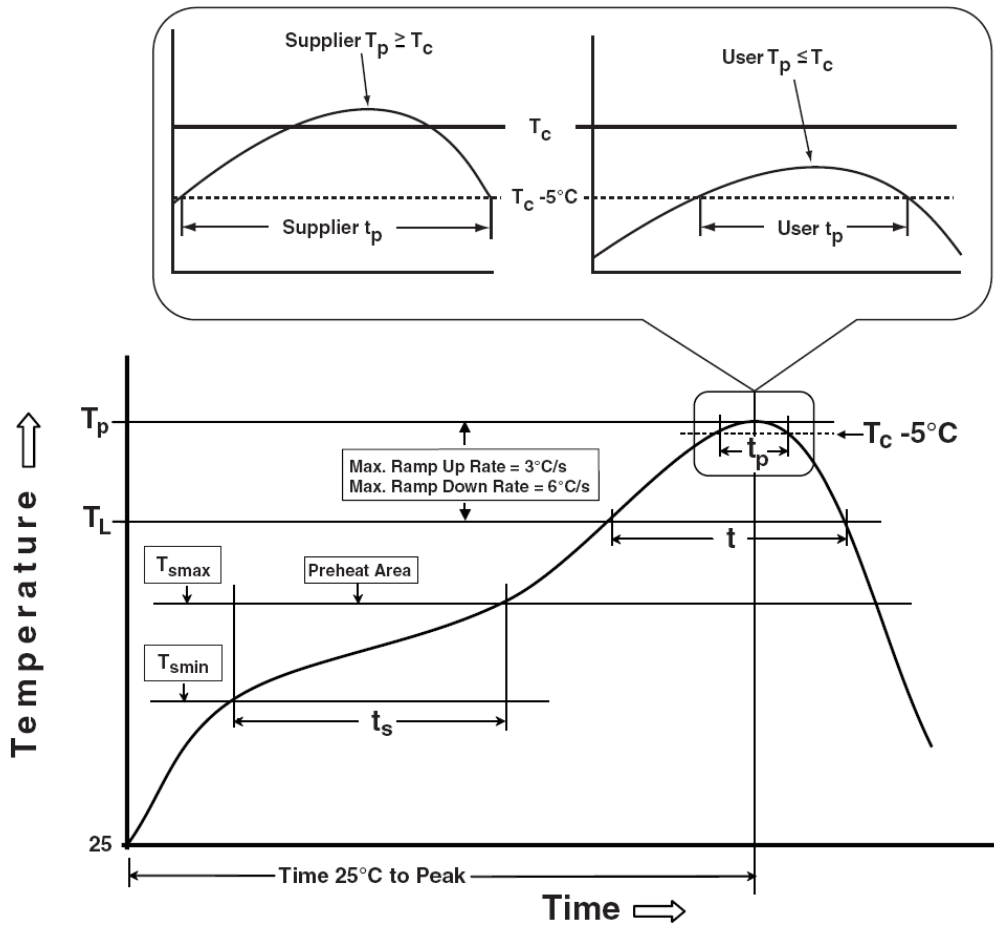


UNIT: mm

Devices Per Unit

Package Type	Unit	Quantity
TO-220	Tube	50
TO-220-FP	Tube	50

Classification Profile



## Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b>		
Temperature min ( $T_{smin}$ )	100 °C	150 °C
Temperature max ( $T_{smax}$ )	150 °C	200 °C
Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	60-120 seconds	60-120 seconds
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3 °C/second max.	3°C/second max.
Liquidous temperature ( $T_L$ )	183 °C	217 °C
Time at liquidous ( $t_L$ )	60-150 seconds	60-150 seconds
Peak package body Temperature ( $T_p$ )*	See Classification Temp in table 1	See Classification Temp in table 2
Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ )	20** seconds	30** seconds
Average ramp-down rate ( $T_p$ to $T_{smax}$ )	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.		
** Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.		

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

## Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245°C
HOLT	JESD-22, A108	1000 Hrs, Bias @ 125°C
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C

## Customer Service

### Sinopower Semiconductor, Inc.

5F, No. 6, Dusing 1St Rd., Hsinchu Science Park,

Hsinchu, 30078, Taiwan

TEL: 886-3-5635818 Fax: 886-3-5642050