

## General Description

The Sanrise SRC60R090FBS is a high voltage power MOSFET, fabricated using advanced super junction technology. The resulting device has extremely low on resistance, low gate charge and fast switching time, making it especially suitable for applications which require superior power density and outstanding efficiency.

The SRC60R090FBS break down voltage is 600V and it has a high rugged avalanche characteristics.

The SRC60R090FBS is available in TO-263-2, TO-220F, TO-220C and TO-247 packages.

## Features

- Ultra Low  $R_{DS(ON)} = 90m\Omega @ V_{GS} = 10V$ .
- Ultra Low Gate Charge,  $Q_g = 55nC$  typ.
- Fast switching capability
- Robust design with better EAS performance
- Optimized switching process
- Non-automotive Qualified
- Ultra-fast body diode

## Application

- High Performance PS

## Symbol

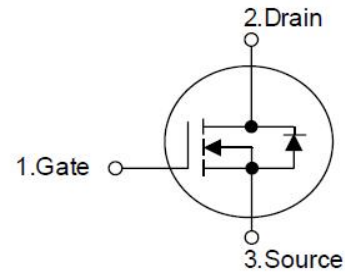


Figure 1 Symbol of SRC60R090FBS

## Package Type

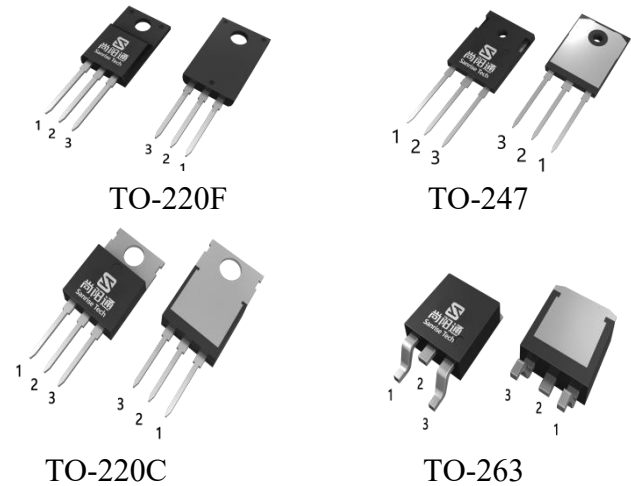
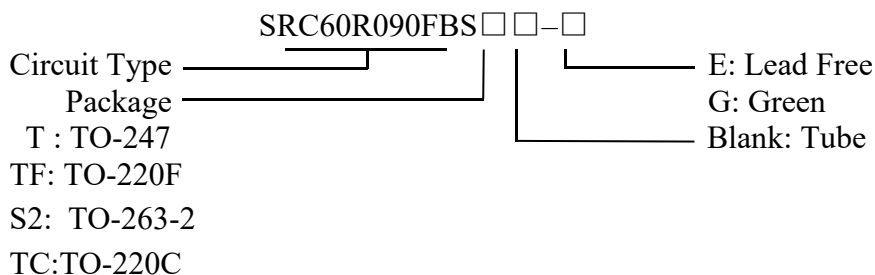


Figure 2 Package Types of SRC60R090FBS

## Ordering Information



Package	Part Number	Marking ID	Packing Type
TO-247	SRC60R090FBSTG-G	SRC60R090FBSTG	Tube
TO-220F	SRC60R090FBSTF-G	SRC60R090FBSTFG	Tube
TO-220C	SRC60R090FBSTC-G	SRC60R090FBSTCG	Tube
TO-263-2	SRC60R090FBSS2TR-G	SRC60R090FBSS2G	Tape & Reel

**Absolute Maximum Ratings**<sup>Note 1</sup>

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V <sub>DSS</sub>	600	V
Gate-Source Voltage (static)		V <sub>GSS</sub>	±20	V
Gate-Source Voltage (dynamic), AC (f>1 Hz)		V <sub>GSS</sub>	±30	V
Power Dissipation (T <sub>c</sub> =25°C, TO-220F)		P <sub>tot</sub>	32	W
Power Dissipation (T <sub>c</sub> =25°C, TO-247, TO-220C, TO-263-2)		P <sub>tot</sub>	255	W
Continuous Drain Current	T <sub>c</sub> =25°C	I <sub>D</sub>	37	A
	T <sub>c</sub> =100°C		23	
	T <sub>c</sub> =125°C		16	
Pulsed Drain Current (Note 2)		I <sub>DM</sub>	111	A
Avalanche Energy, Single Pulse (Note 3)		E <sub>AS</sub>	160	mJ
Avalanche Energy, Repetitive (Note 2)		E <sub>AR</sub>	0.2	mJ
Avalanche Current, Repetitive (Note 2)		I <sub>AR</sub>	2.2	A
Continuous Diode Forward Current		I <sub>S</sub>	37	A
Diode Pulse Current		I <sub>S,PULSE</sub>	111	A
MOSFET dv/dt Ruggedness, V <sub>DS</sub> ≤480V		dv/dt	80	V/ns
Reverse Diode dv/dt, V <sub>DS</sub> ≤480V, I <sub>SD</sub> ≤I <sub>D</sub>		dv/dt	50	V/ns
Operating Junction Temperature		T <sub>J</sub>	150	°C
Storage Temperature		T <sub>STG</sub>	-55 to 150	°C
Lead Temperature (Soldering, 10 sec)		T <sub>LEAD</sub>	260	°C

Note:

- Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
- Repetitive Rating: Pulse width limited by maximum junction temperature
- I<sub>AS</sub>=2.2A, V<sub>DD</sub>=60V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C

**Thermal characteristics**

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	R <sub>thJC</sub>			3.9	°C /W
	TO-247				0.49	
	TO-220C				0.49	
	TO-263-2				0.49	
Thermal resistance, Junction-to-Ambient	TO-220F	R <sub>thJA</sub>			78	°C /W
	TO-247				60	
	TO-220C				60	
	TO-263-2				60	

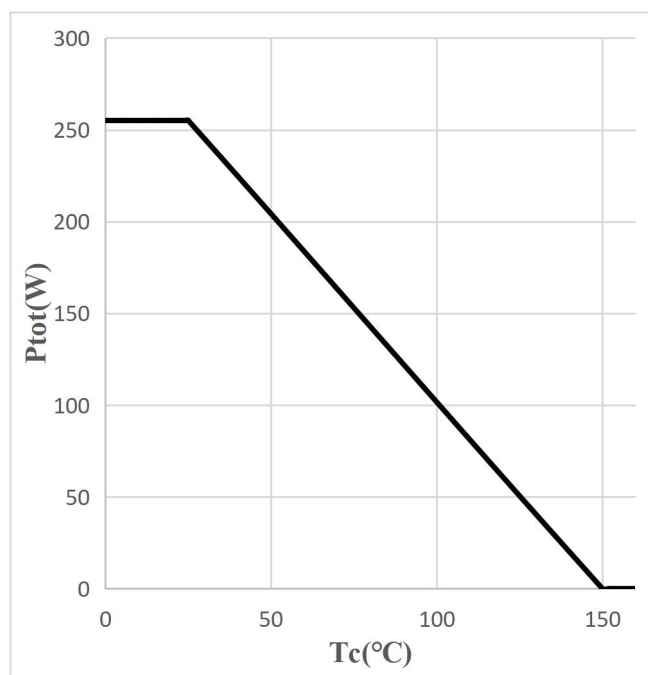
**Electrical Characteristics**

$T_j = 25^\circ\text{C}$ , unless otherwise specified.

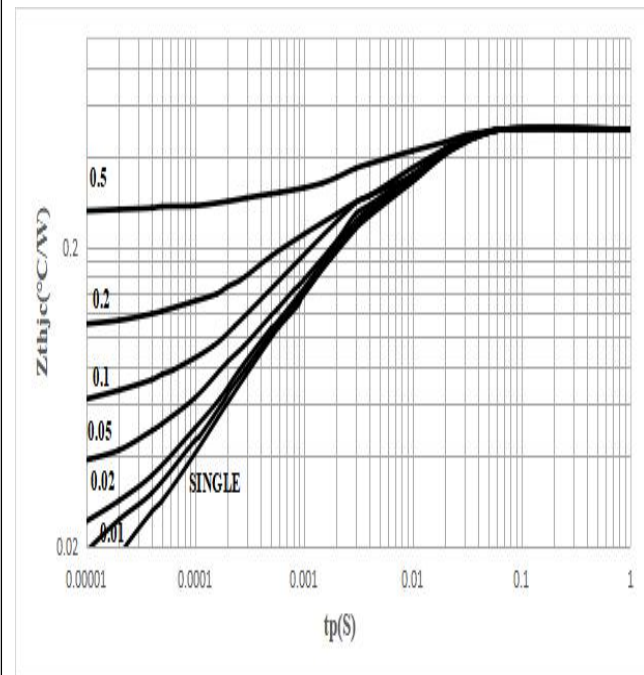
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Statistic Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	600			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V$			20	$\mu A$
Gate-Body Leakage Current	Forward	$I_{GSSF}, V_{GS}=20V, V_{DS}=0V$			100	nA
	Reverse	$I_{GSSR}, V_{GS}=-20V, V_{DS}=0V$			-100	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=0.25mA$	4.0	5.0	6.0	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=20A$		70	90	mΩ
Gate Resistance	$R_G$	f=1MHz, Open Drain		2.2		Ω
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=400V, V_{GS}=0V,$		2.3		nF
Output Capacitance	$C_{OSS}$	f=100kHz		68		pF
Effective output capacitance, energy related <sup>NOTE5</sup>	$C_{O(er)}$	$V_{GS}=0V, V_{DS}=0\dots 480V$		98		pF
Effective output capacitance, time related <sup>NOTE6</sup>	$C_{O(tr)}$			600		
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=400V, I_D=20A, R_G=3.3\Omega, V_{GS}=10V$		25		ns
Rise Time	$t_r$			6		
Turn-off Delay Time	$t_{d(off)}$			80		
Fall Time	$t_f$			5		
<b>Gate Charge Characteristics</b>						
Gate to Source Charge	$Q_{gs}$	$V_{DD}=480V, I_D=20A, V_{GS}=0 \text{ to } 10V$		15.6		nC
Gate to Drain Charge	$Q_{gd}$			25		
Gate Charge Total	$Q_g$			55		
Gate Plateau Voltage	$V_{plateau}$				6.5	V
<b>Reverse Diode Characteristics</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_{SD}=20A$		0.9	1.1	V
Reverse Recovery Time	$t_{rr}$	$V_R=400V, I_F=20A, dI_F/dt=100A/\mu s$		149		ns
Reverse Recovery Charge	$Q_{rr}$				1.2	$\mu C$
Peak Reverse Recovery Current	$I_{rrm}$				15	A

Note:

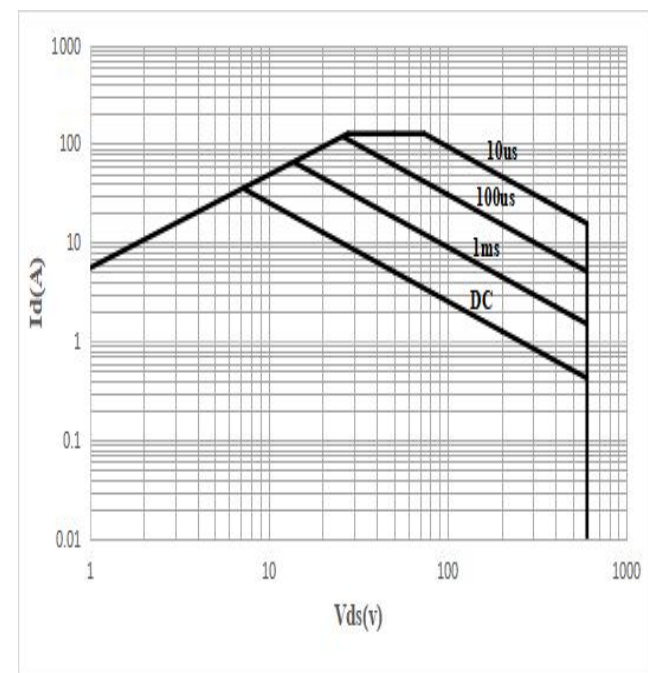
- $C_{O(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 480V
- $C_{O(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 480V

**Typical Performance Characteristics**
**Figure 3: Power Dissipation**


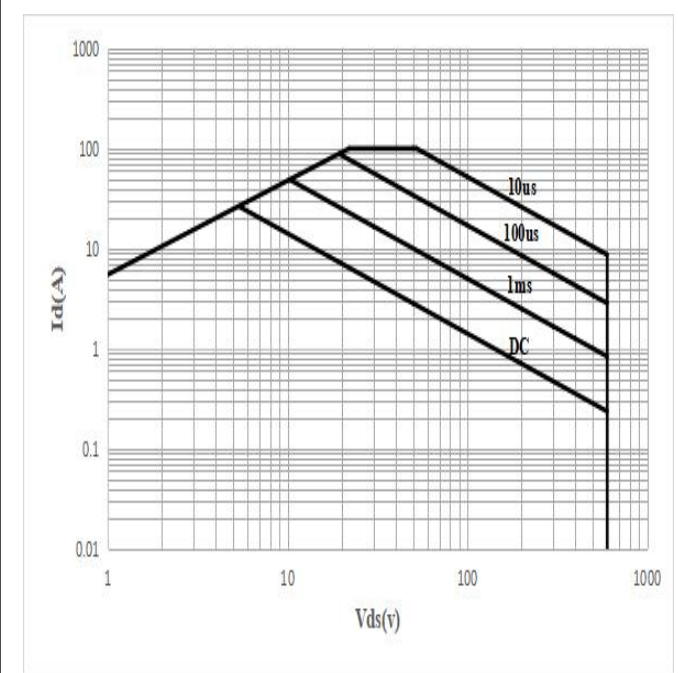
$$P_{tot} = f(T_c)$$

**Figure 4: Max. Transient Thermal Impedance**


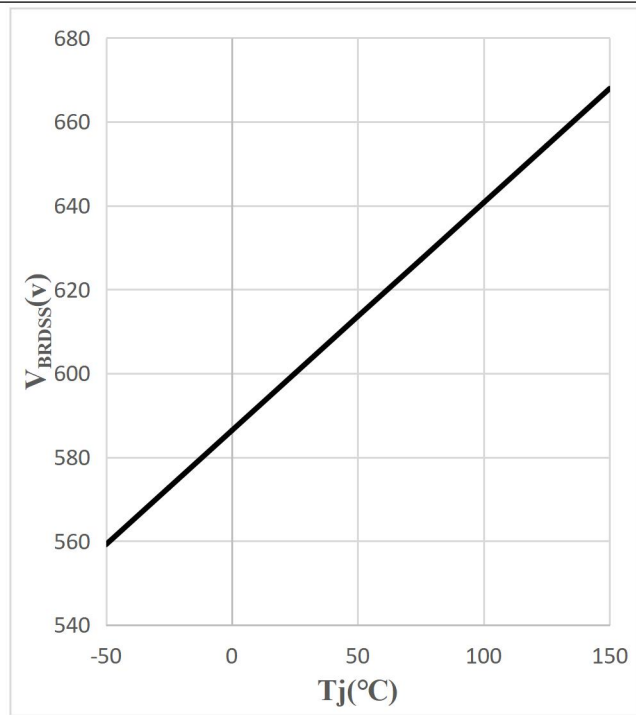
$$Z_{(th)C} = f(t_p); \text{ parameter: } D = t_p/T$$

**Figure 5: Safe Operating Area**


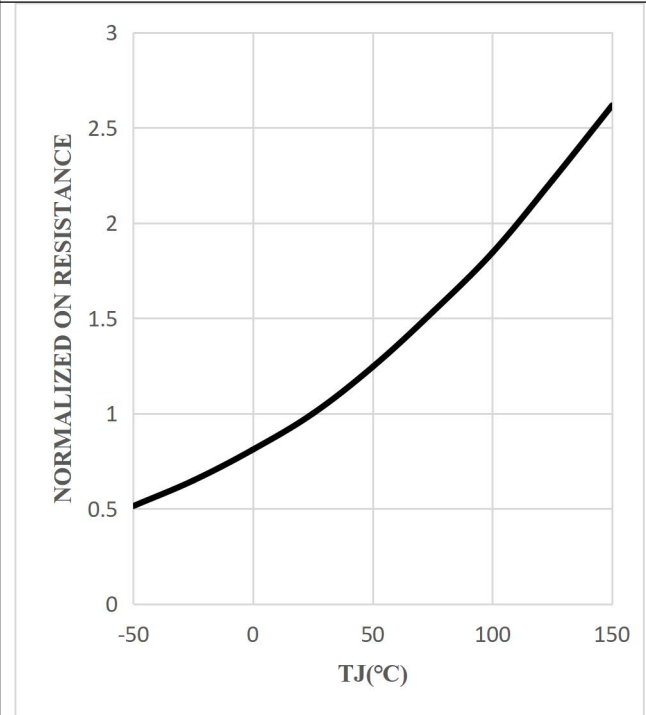
$$I_D = f(V_{DS}); T_c = 25^\circ\text{C}; V_{GS} > 7\text{V}; \text{ parameter } t_p$$

**Figure 6: Safe Operating Area**


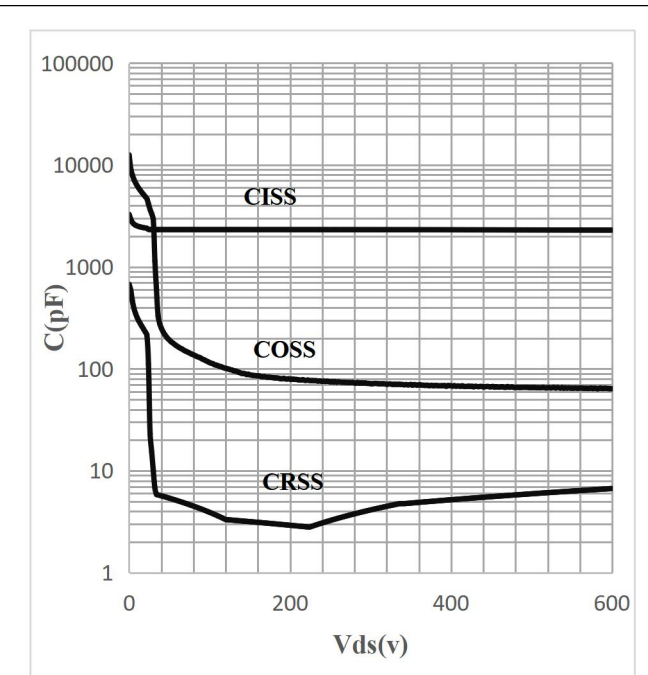
$$I_D = f(V_{DS}); T_c = 80^\circ\text{C}; V_{GS} > 7\text{V}; \text{ parameter } t_p$$

**Figure 7: Drain-Source Breakdown Voltage**


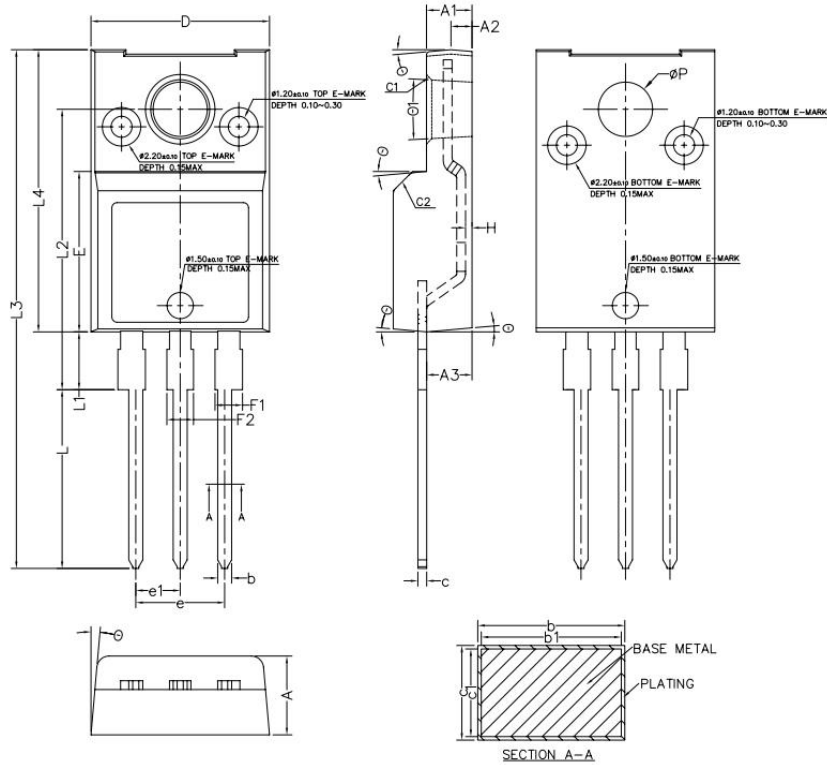
$$V_{BR(DSS)}=f(T_j); I_D=10mA$$

**Figure 8: Typ. Drain-Source On-State Resistance**


$$R_{DS(ON)}=f(T_j); I_D=19A; V_{GS}=10V$$

**Figure 9: Typ. Capacitances**


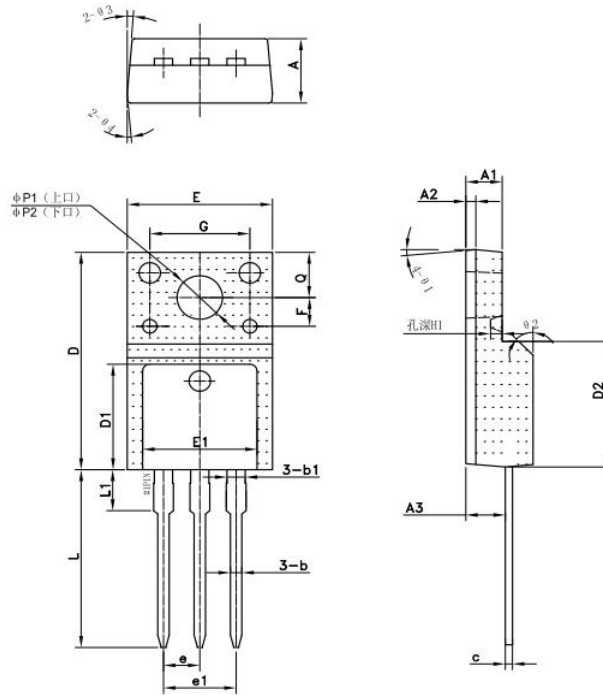
$$C=f(V_{DS}); V_{GS}=0; f=100kHz$$

**Mechanical Dimensions**
**TO-220F (Package 1)**
**Unit: mm**


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.50	4.60
A1	2.50	2.60	2.70
A2	1.10	1.20	1.30
A3	2.49	2.59	2.69
b	0.76	-	0.89
b1	0.75	0.80	0.85
c	0.46	-	0.59
c1	0.45	0.50	0.55
C1	0.20	0.30	0.40
C2	1.00	1.10	1.20
D	10.10	10.20	10.30
E	9.05	9.15	9.25
e	4.98	5.08	5.18
e1	2.44	2.54	2.64
F1	1.22	-	1.60
F2	1.17	-	1.55
H	0.32	0.37	0.42
L	10.00	10.20	10.40
L1	3.15	3.30	3.45
L2	15.85	16.00	16.15
L3	29.30	29.60	29.90
L4	16.00	16.10	16.20
P	3.00	3.10	3.20
θ	3°	5°	7°
θ1	4°	6°	8°

**Mechanical Dimensions**
**TO-220F (Package 2)**

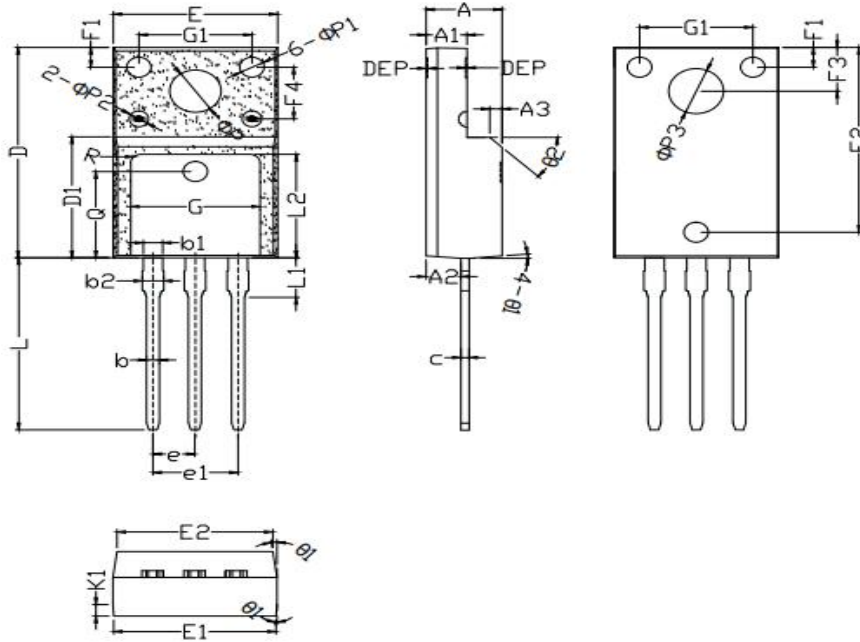
Unit: mm



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.70
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
D2	-	9.12	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54		
e1		5.08	
F		2.1	
G		7	
H1	-	0.81	-
L	12.48	12.98	13.20
L1	-	2.93	-
ΦP1 (上口)	2.98	3.18	3.38
ΦP2 (下口)	3.20	3.40	3.60
Q	3.10	3.30	3.50
θ1		5°	
θ2		45°	
θ2		5°	
θ3		5°	

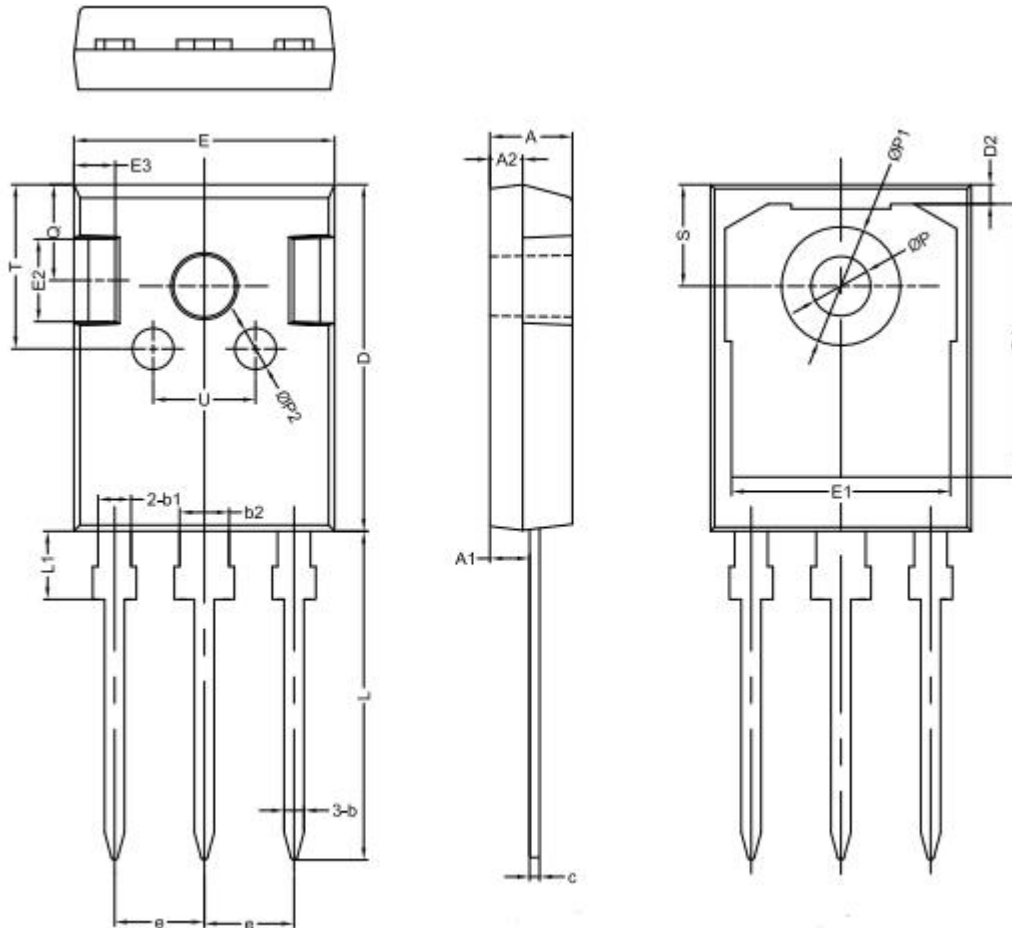
**Mechanical Dimensions**
**TO-220F (Package 3)**

Unit: mm

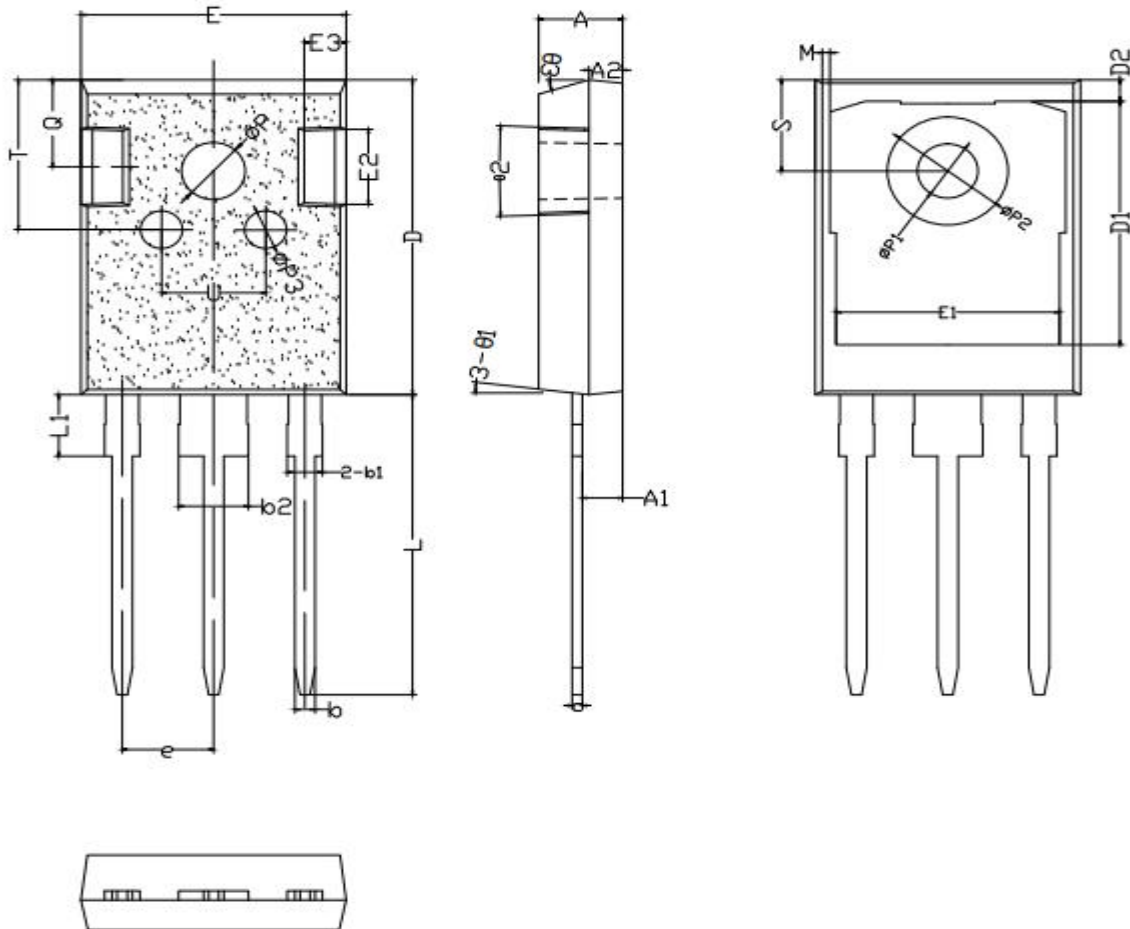


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.60	2.80	2.95
A3	1.0REF		
b	0.75	0.80	0.85
b1	1.18	1.20	1.24
b2	1.18	1.24	1.30
c	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
E	10.00	10.16	10.30
E1	9.94	10.06	10.30
E2	9.40	9.50	9.60
e	2.50	2.54	2.58
e1	5.08REF		
L	12.78	12.98	13.18
L1	2.70	2.92	3.20
L2	7.70	7.80	7.90
Q	6.50REF		
ΦP	3.08	3.18	3.28
ΦP1	1.45	1.55	1.65
ΦP2	0.95	1.15	1.35
ΦP3	3.30	3.40	3.50
θ1	3°	5°	7°
θ2	42°	45°	48°
F1	1.40	1.50	1.60
F2	13.80	13.90	14.00
F3	3.20	3.30	3.40
F4	3.70	3.90	4.10
G	7.80	8.00	8.20
G1	6.90	7.00	7.10
K1	0.65	0.70	0.75

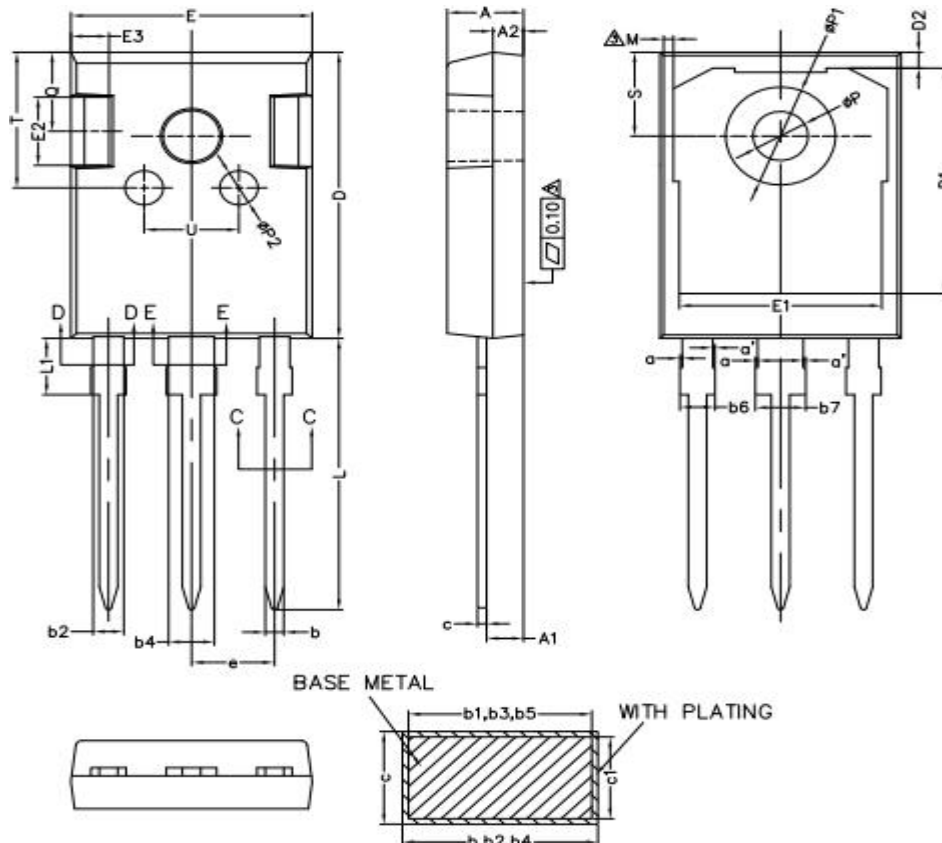


**Mechanical Dimensions**
**TO-247(Package 1)**
**Unit: mm**


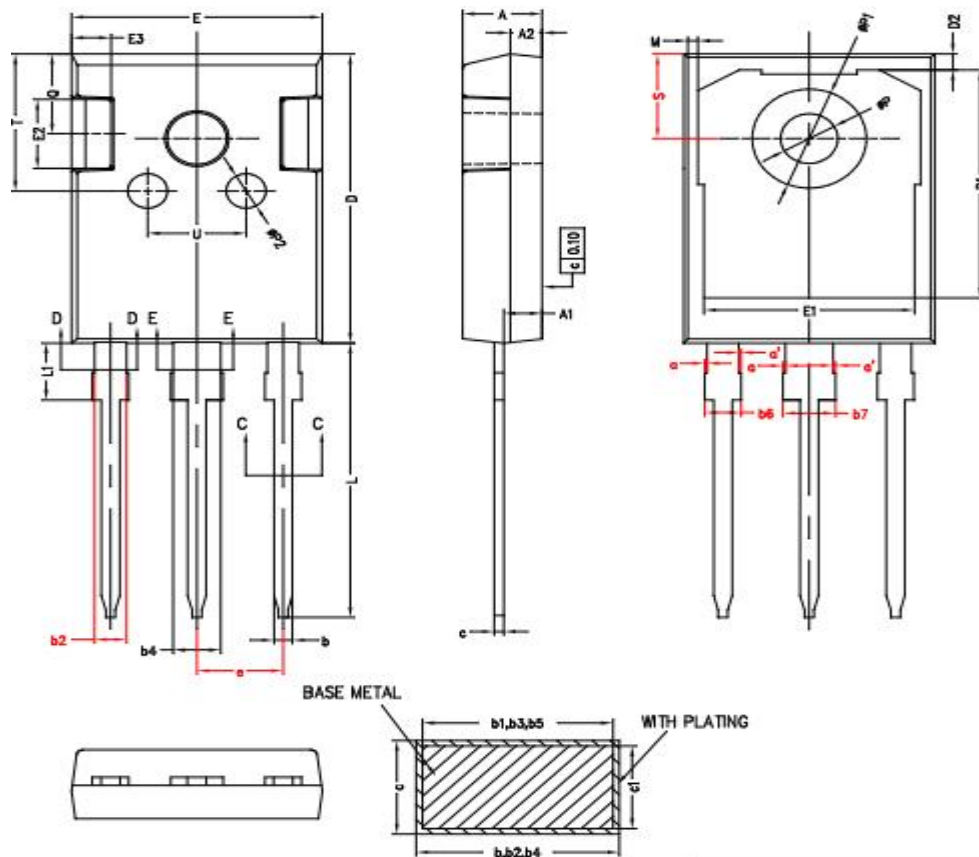
Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.80	5.00	5.20	E1	-	13.30	-
A1	2.21	2.41	2.61	E2	-	5.00	-
A2	1.90	2.00	2.10	E3	-	2.50	-
b	1.10	1.20	1.35	L	19.42	19.92	20.42
b1	-	2.00	-	L1	-	4.13	-
b2	-	3.00	-	P	3.50	3.60	3.70
c	0.55	0.60	0.75	P1	-	7.19	-
D	20.80	21.00	21.20	P2	-	2.50	-
D1	-	16.55	-	Q	-	5.80	-
D2	-	1.20	-	S	6.05	6.15	6.25
E	15.60	15.80	16.0	T	-	10.00	-
U	-	6.20	-				

**Mechanical Dimensions**
**TO-247(Package 2)**
**Unit: mm**


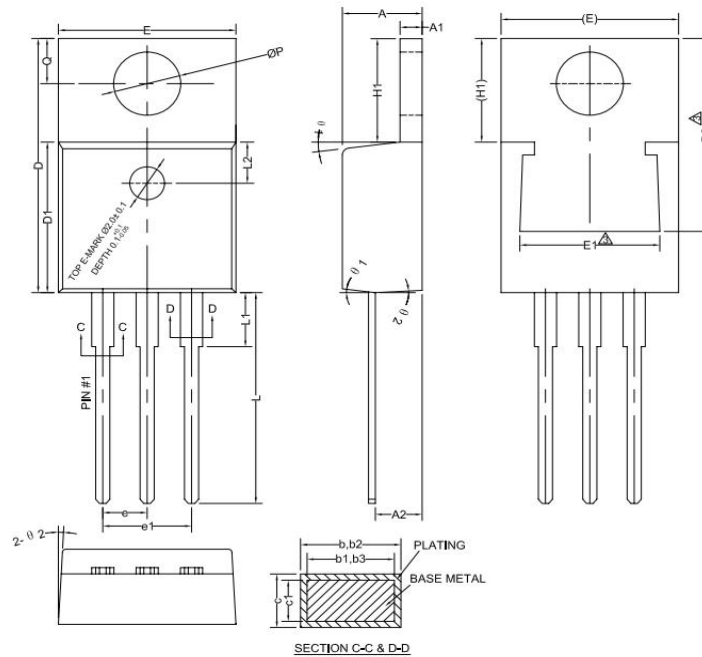
Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	E1	13.10	13.25	13.40
A1	2.31	2.41	2.51	E2	4.85	4.95	5.10
A2	1.90	2.00	2.10	E3	2.40	2.50	2.60
b	1.15	1.20	1.25	L	19.80	19.98	20.15
b1	1.95	2.10	2.25	L1	-	-	4.30
b2	2.95	3.10	3.25	ΦP	3.60	3.70	3.80
c	0.55	0.60	0.65	ΦP1	3.40	3.50	3.60
D	20.90	21.00	21.10	ΦP2	6.90	7.10	7.30
D1	16.35	16.55	16.75	Q	5.60	5.80	6.00
D2	1.05	1.20	1.35	S	6.05	6.15	6.25
E	15.70	15.80	15.90	T	9.80	10.00	10.20
U	6.00	6.20	6.40	e	5.40	5.44	5.48
Θ1	5°	7°	9°	ΦP3	2.40	2.50	2.60
Θ2	1°	3°	5°	Θ3	13°	15°	17°

**Mechanical Dimensions**
**TO-247(Package 3)**
**Unit: mm**


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	c1	0.58	0.60	0.62
A1	2.31	2.41	2.51	D	20.90	21.00	21.10
A2	1.90	2.00	2.10	D1	16.25	16.55	16.85
b	1.16	-	1.26	D2	1.05	1.20	1.35
b1	1.15	1.20	1.22	E	15.70	15.80	15.90
b2	1.96	-	2.06	E1	13.10	13.30	13.50
b3	1.95	2.00	2.02	E2	4.90	5.00	5.10
b4	2.96	-	3.06	E3	2.40	2.50	2.60
b5	2.95	3.00	3.02	e	5.34	5.44	5.54
b6	-	-	2.25	L	19.80	19.92	20.10
b7	-	-	3.25	L1	3.95	4.13	4.30
c	0.59	-	0.66	M	0.35	-	0.95
P	3.50	3.60	3.70	P1	7.00	-	7.40
P2	2.40	2.50	2.60	Q	5.60	-	6.00
S	6.05	6.15	6.25	T	9.80	-	10.20
U	6.00	-	6.40	a	0	-	0.15
a'	0	-	0.15				

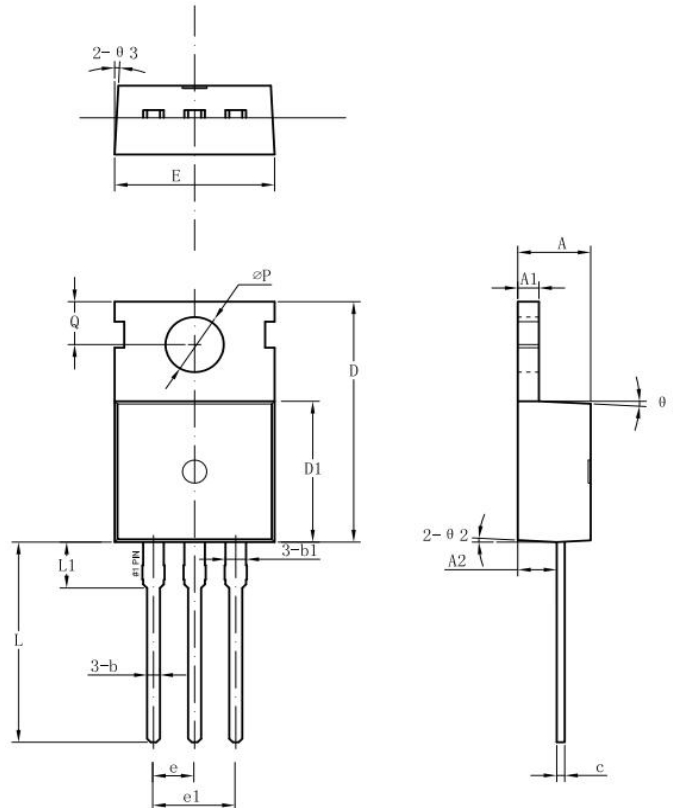
**Mechanical Dimensions**
**TO-247(Package 4)**
**Unit: mm**


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	E2	4.90	5.00	5.10
A1	2.31	2.41	2.51	E3	2.40	2.50	2.60
A2	1.90	2.00	2.10	e	5.34	5.44	5.54
b	1.12	-	1.22	L	19.80	19.92	20.10
b1	1.11	1.16	1.18	L1	3.95	4.13	4.30
b2	1.96	-	2.06	P	3.50	3.60	3.70
c	0.59	-	0.66	P1	7.00	-	7.40
D	20.90	21.00	21.10	P2	2.40	2.50	2.60
D1	16.25	16.55	16.85	Q	5.60	-	6.00
D2	1.05	1.20	1.35	S	6.05	6.15	6.25
E	15.70	15.80	15.90	T	9.80	-	10.20
E1	13.10	13.30	13.50	U	6.00	-	6.40
b3	1.95	2.00	2.02	b6	-	-	2.25
b4	2.96	-	3.06	b7	-	-	3.25
b5	2.95	3.00	3.02	c1	0.58	0.60	0.62
M	0.35	-	0.95	a	0	-	0.15
a'	0	-	0.15				

**Mechanical Dimensions**
**TO-220C (Package 1)**
**Unit: mm**


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	1.22	-	1.32
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
D	15.15	15.45	15.75
D1	9.05	9.15	9.25
D2	11.40	-	12.88
E	9.96	10.16	10.36
E1	6.86	-	8.89
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
H1	6.10	6.30	6.50
L	12.70	-	13.12
L1	-	-	3.90
ΦP	3.80	3.84	3.88
Q	2.60	-	2.90
θ1	5°	7°	9°
θ2	1°	2°	5°

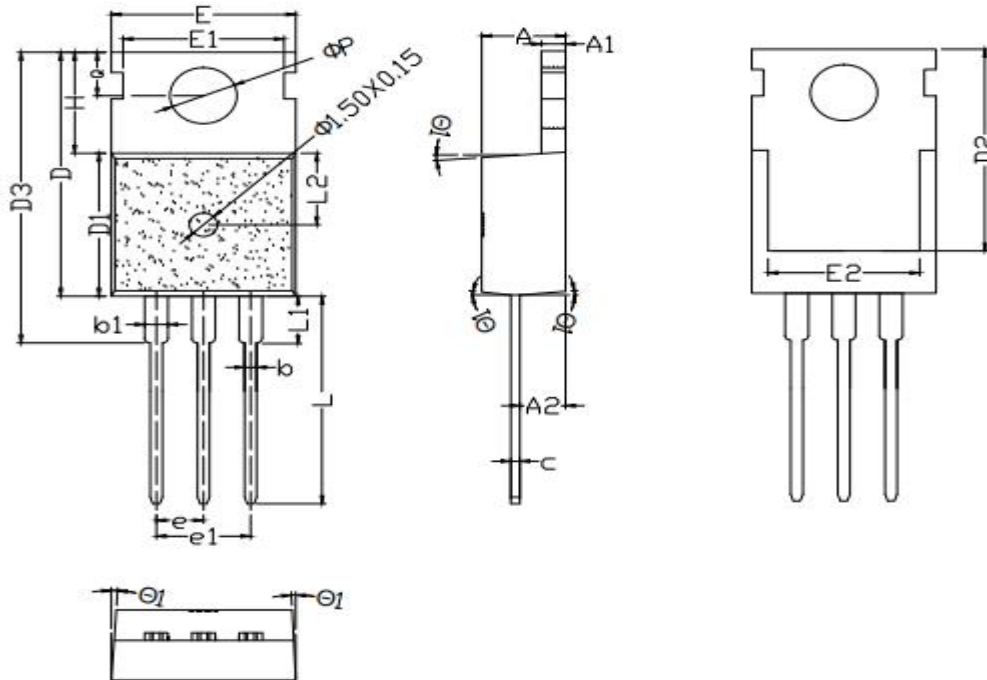
**Mec**

**Mechanical Dimensions**
**TO-220C (Package 2)**
**Unit: mm**


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.50	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b1	-	1.27	-
c	0.40	0.50	0.65
D	15.20	15.70	16.20
D1	9.00	9.20	9.40
E	9.70	10.00	10.20
e		2.54	
e1		5.08	
L	12.60	13.08	13.60
L1	-	3.00	-
$\phi P$	3.50	3.60	3.80
Q	2.60	2.80	3.00
$\theta 1$		3°	
$\theta 2$		3°	
$\theta 2$		3°	

**Mechanical Dimensions**
**TO-220C (Package 3)**

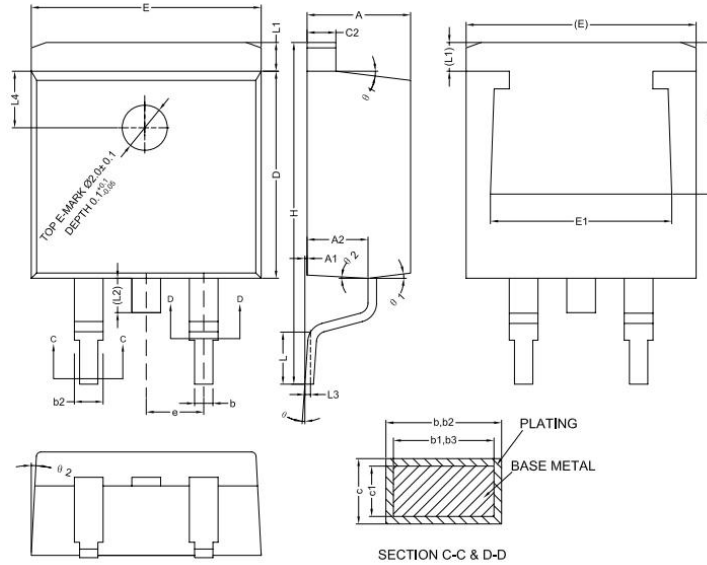
Unit: mm



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.50	4.60
A1	1.25	1.30	1.35
A2	2.30	2.40	2.50
b	0.70	0.80	0.90
b1	1.25	1.33	1.42
c	0.45	0.50	0.55
D	15.50	15.75	16.00
D1	9.10	9.20	9.30
D2	12.90	13.10	13.30
D3	15.45	15.80	16.15
E	9.80	10.02	10.15
e	2.54BSC		
e1	5.08BSC		
L	13.00	13.28	13.45
L1	-	-	3.40
ΦP	3.55	3.65	3.75
Q	2.65	2.75	2.85
θ1	2°	-	7°
E1	8.55	8.70	8.85
E2	7.40	7.60	7.80
H	6.40	6.50	6.60
L2	4.50	4.65	4.80

**Mechanical Dimensions**
**TO-263-2 (Package 1)**

Unit: mm

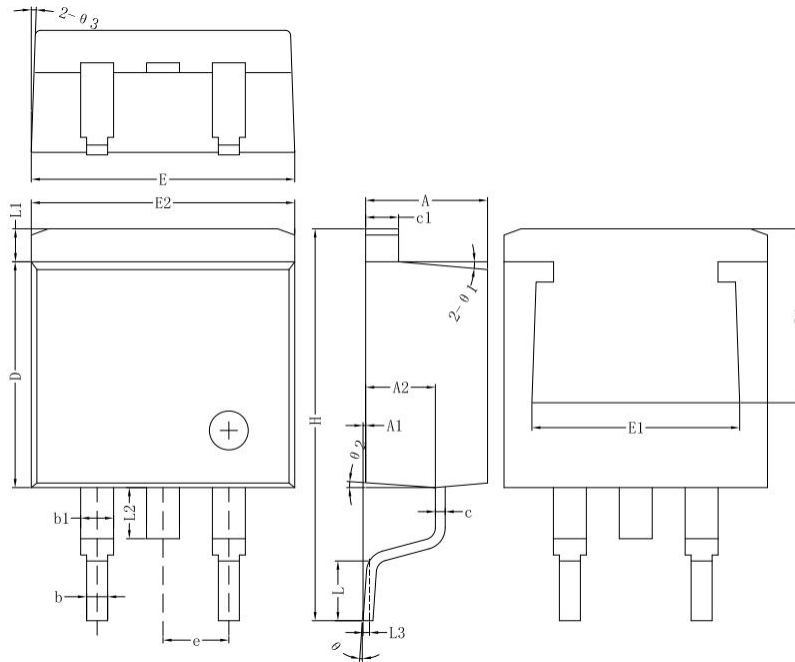


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	0.00	0.10	0.25
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
c2	1.22	-	1.32
D	9.05	9.15	9.25
D1	6.60	-	-
E	10.06	10.16	10.26
E1	7.80	-	8.20
e	2.54(BSC)		
H	14.70	15.10	15.50
L	2.00	2.30	2.60
L1	1.17	1.27	1.40
L2	-	-	1.75
L3	0.25BSC		
L4	2.00REF		
θ	0°	-	8°
θ1	5°	7°	9°
θ2	1°	3°	5°



**Mechanical Dimensions**
**TO-263-2 (Package 2)**

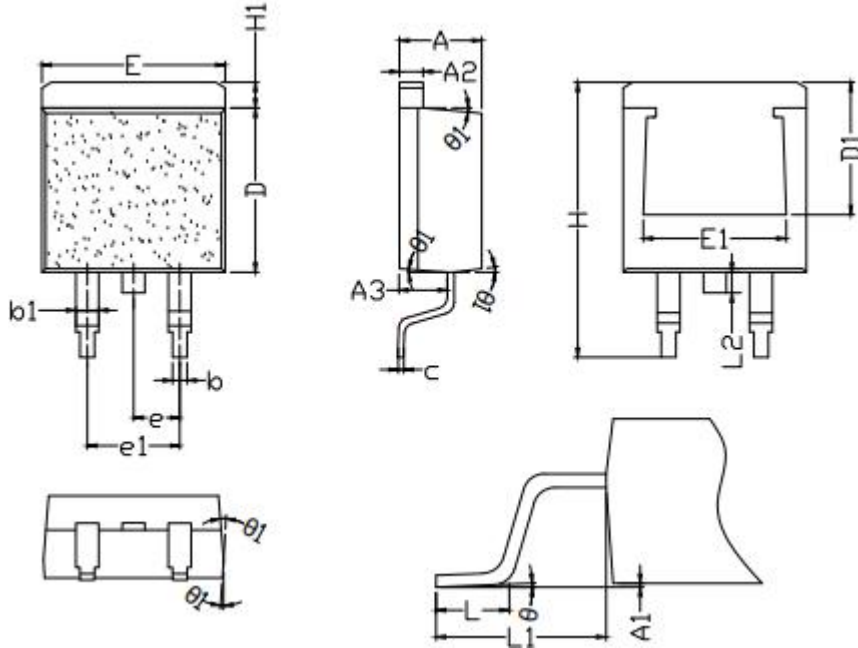
Unit: mm



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40
L2	-	-	2.20
L3	-	0.25BSC	-
θ	0°	-	8°
θ1	-	5°	-
θ2	-	4°	-
θ3	-	4°	-

**Mechanical Dimensions**
**TO-263-2 (Package 3)**

Unit: mm



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.42	4.52	4.62
A1	0.00	0.10	0.25
A2	1.24	1.27	1.32
A3	2.50	2.60	2.70
b	0.77	0.81	0.84
b1	1.23	1.28	1.41
c	0.33	0.38	0.43
D	8.80	8.95	9.10
D1	7.2REF		
E	9.92	10.07	10.22
E1	7.85REF		
e	2.50	2.54	2.58
e1	5.08REF		
H	14.80	15.10	15.30
H1	1.12	1.28	1.42
L	2.10	2.23	2.36
L1	4.55	4.75	4.95
L2	1.10	1.30	1.50
θ	0°	2°	5°
θ1	3°	-	5°



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