

### General Description

The Sanrise SRC60R068BS 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 SRC60R068BS break down voltage is 600V and it has a high rugged avalanche characteristics. The SRC60R068BS is available in TO-247, TO-263-2, TO-220C and TO-220F packages.

### Features

- Ultra Low  $R_{DS(ON)} = 68m\Omega @ V_{GS} = 10V$ .
- $V_{ds@T_{jmax}} = 650v$ .
- Ultra Low Gate Charge,  $Q_g = 110nC$  typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved
- Non-automotive Qualified
- Ultra-fast body diode

### Application

- Telecom Power
- EV Charger
- High Power Application

### Ordering Information

Circuit Type Package T: TO-247 S2: TO-263-2 TF: TO-220F TC: TO-220C	SRC60R068BS □ □ - □	E: Lead Free G: Green Blank: Tube TR: Tape & Reel
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### Symbol

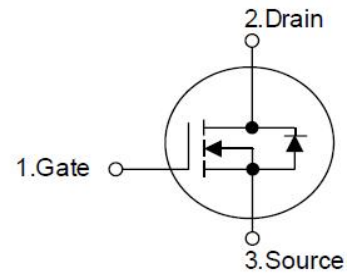


Figure 1 Symbol of SRC60R068BS

### Package Type

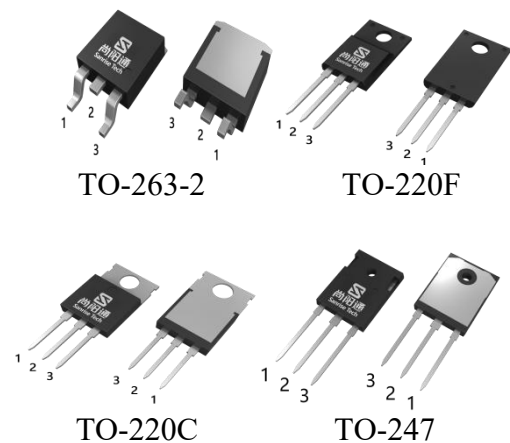


Figure 2 Package Types of SRC60R068BS

Package	Part Number	Marking ID	Packing Type
TO-247	SRC60R068BST-G	SRC60R068BSTG	Tube
TO-263-2	SRC60R068BSS2TR-G	SRC60R068BSS2G	Tape & Reel
TO-220F	SRC60R068BSTF-G	SRC60R068BSTFG	Tube
TO-220C	SRC60R068BSTC-G	SRC60R068BSTCG	Tube

**Absolute Maximum Ratings**<sup>Note1</sup>

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		$V_{DSS}$	600	V
Gate-Source Voltage		$V_{GSS}$	±30	V
Power Dissipation(TO-220C,TO-263-2,TO-247,Tc=25℃)		$P_{tot}$	357.1	W
Power Dissipation(TO-220F,Tc=25℃)		$P_{tot}$	35.7	W
Continuous Drain Current	$T_C=25^\circ C$	$I_D$	48	A
	$T_C=100^\circ C$		30.3	
	$T_C=125^\circ C$		21.5	
Pulsed Drain Current (Note 2)		$I_{DM}$	144	A
Avalanche Energy, Single Pulse (Note 3)		$E_{AS}$	125	mJ
Avalanche Energy, Single Pulse (Note 5)		$E_{AS}$	1653	mJ
Avalanche Energy, Repetitive (Note 2)		$E_{AR}$	0.6	mJ
Avalanche Current, Repetitive (Note 2)		$I_{AR}$	5.0	A
Continuous Diode Forward Current		$I_S$	48	A
Diode Pulse Current		$I_{S,PULSE}$	144	A
MOSFET dv/dt Ruggedness, $V_{DS} \leq 480V$		dv/dt	80	V/ns
Reverse Diode dv/dt, $V_{DS} \leq 480V, I_{SD} \leq I_D$		dv/dt	50	V/ns
Maximum diode commutation speed(Note 4)		diF/dt	1300	A/us
ESD		HBM	>1000	V
Operating Junction Temperature		$T_J$	150	°C
Storage Temperature		$T_{STG}$	-55 to 150	°C
Lead Temperature (Soldering, 10 sec)		$T_{LEAD}$	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
- $I_{AS} = 2.5A, V_{DD} = 60V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$ . Finish goods test condition.
- $V_{DS}=0...400V, I_{SD} \leq 30A, T_J=25^\circ C$
- $I_{AS} = 7A, V_{DD} = 60V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$ . Typical Eas.

**Thermal characteristics**

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	$R_{thJC}$			3.5	°C /W
	TO-220C				0.35	
	TO-247				0.35	
	TO-263				0.35	
Thermal resistance, Junction-to-Ambient	TO-220F	$R_{thJA}$			70	°C /W
	TO-220C				58	
	TO-247				58	
	TO-263				58	

## Electrical Characteristics

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

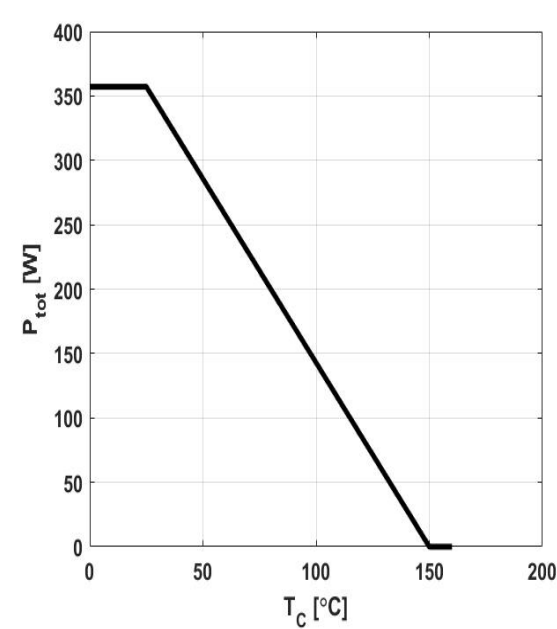
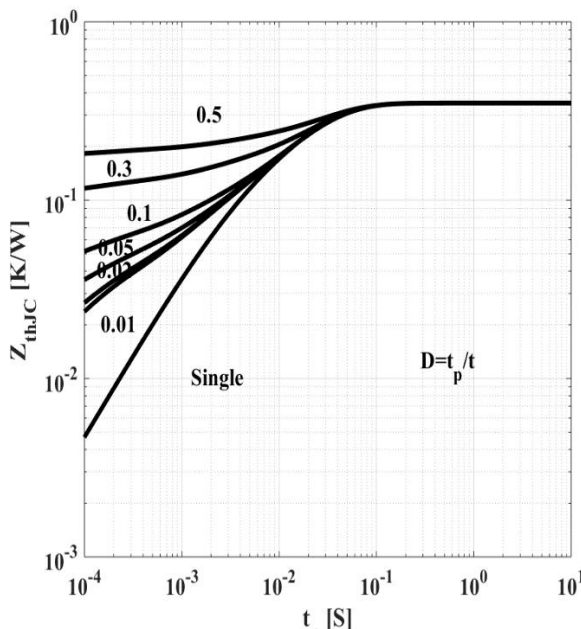
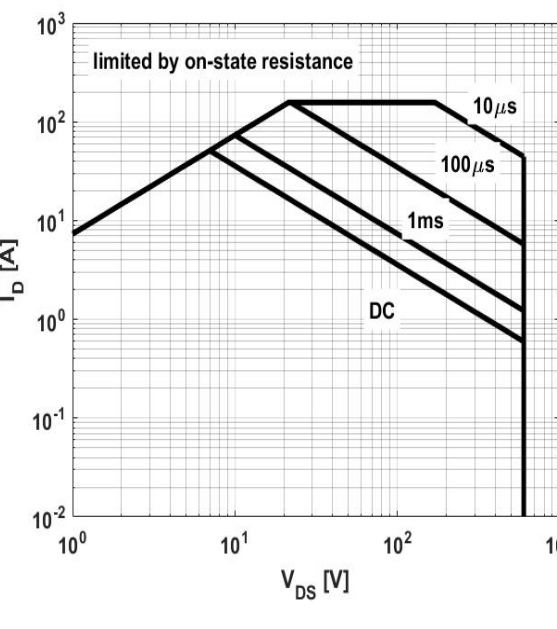
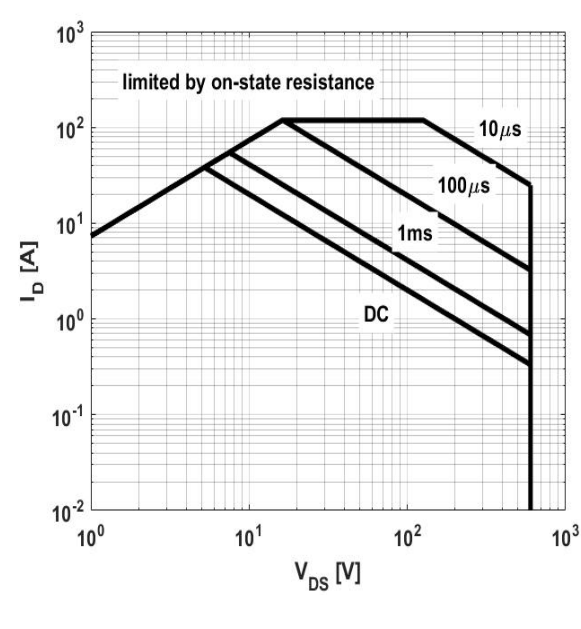
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
<b>Statistic Characteristics</b>							
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	600			V	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V$			10	$\mu A$	
Gate-Body Leakage Current	Forward	$I_{GSSF}, V_{GS}=30V, V_{DS}=0V$			100	nA	
	Reverse	$I_{GSSR}, V_{GS}=-30V, V_{DS}=0V$			-100		
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=1.0mA$	3.0	4.0	5.0	V	
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=24A$		57	68	$m\Omega$	
Gate Resistance	$R_G$	$f=1MHz, \text{Open Drain}$		1.0		$\Omega$	
<b>Dynamic Characteristics</b>							
Input Capacitance	$C_{ISS}$	$V_{DS}=50V, V_{GS}=0V, f=1MHz$		4.3		nF	
Output Capacitance	$C_{OSS}$				171		pF
Reverse Transfer Capacitance	$C_{RSS}$				2.8		pF
Effective output capacitance, energy related <sup>NOTE6</sup>	$C_{O(er)}$	$V_{GS}=0V, V_{DS}=0\dots 400V$		94		pF	
Effective output capacitance, time related <sup>NOTE7</sup>	$C_{O(tr)}$				550		
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=400V, I_D=24A, R_G=3.3\Omega, V_{GS}=10V$		16		ns	
Rise Time	$t_r$				6.0		
Turn-off Delay Time	$t_{d(off)}$				98		
Fall Time	$t_f$				4.0		
<b>Gate Charge Characteristics</b>							
Gate to Source Charge	$Q_{gs}$	$V_{DD}=480V, I_D=24A, V_{GS}=0 \text{ to } 10V$		28.1		nC	
Gate to Drain Charge	$Q_{gd}$				56.0		
Gate Charge Total	$Q_g$				110		
Gate Plateau Voltage	$V_{plateau}$				6.5		V
<b>Reverse Diode Characteristics</b>							
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_{SD}=24A$		0.9	1.1	V	
Reverse Recovery Time	$t_{rr}$	$V_R=400V, I_F=24A, dI_F/dt=100A/\mu s$		141		ns	
Reverse Recovery Charge	$Q_{rr}$				0.83		$\mu C$
Peak Reverse Recovery Current	$I_{rrm}$				11.8		A

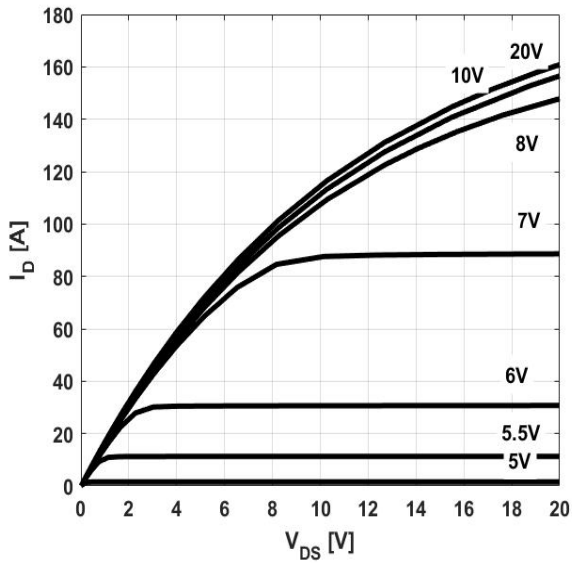
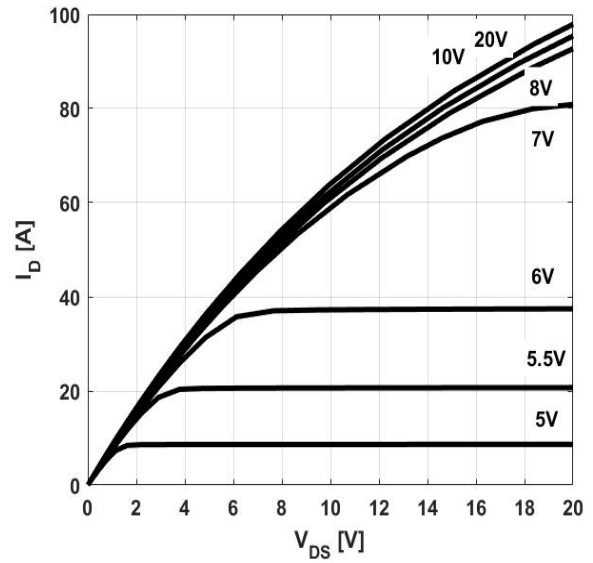
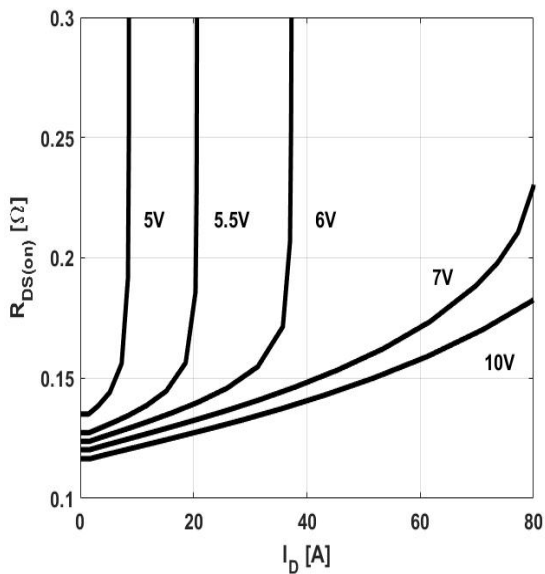
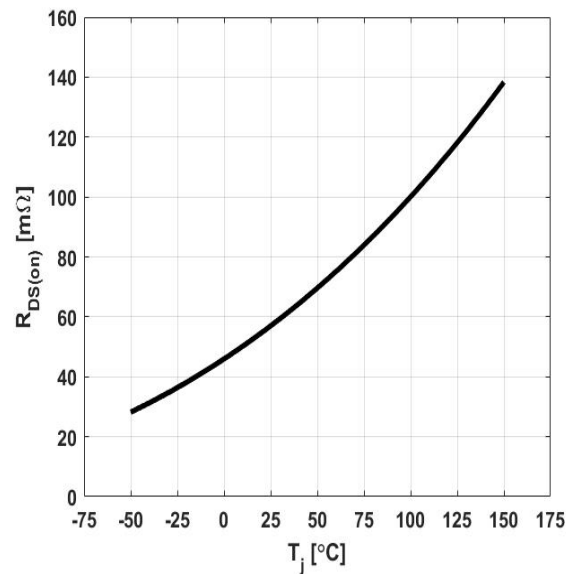
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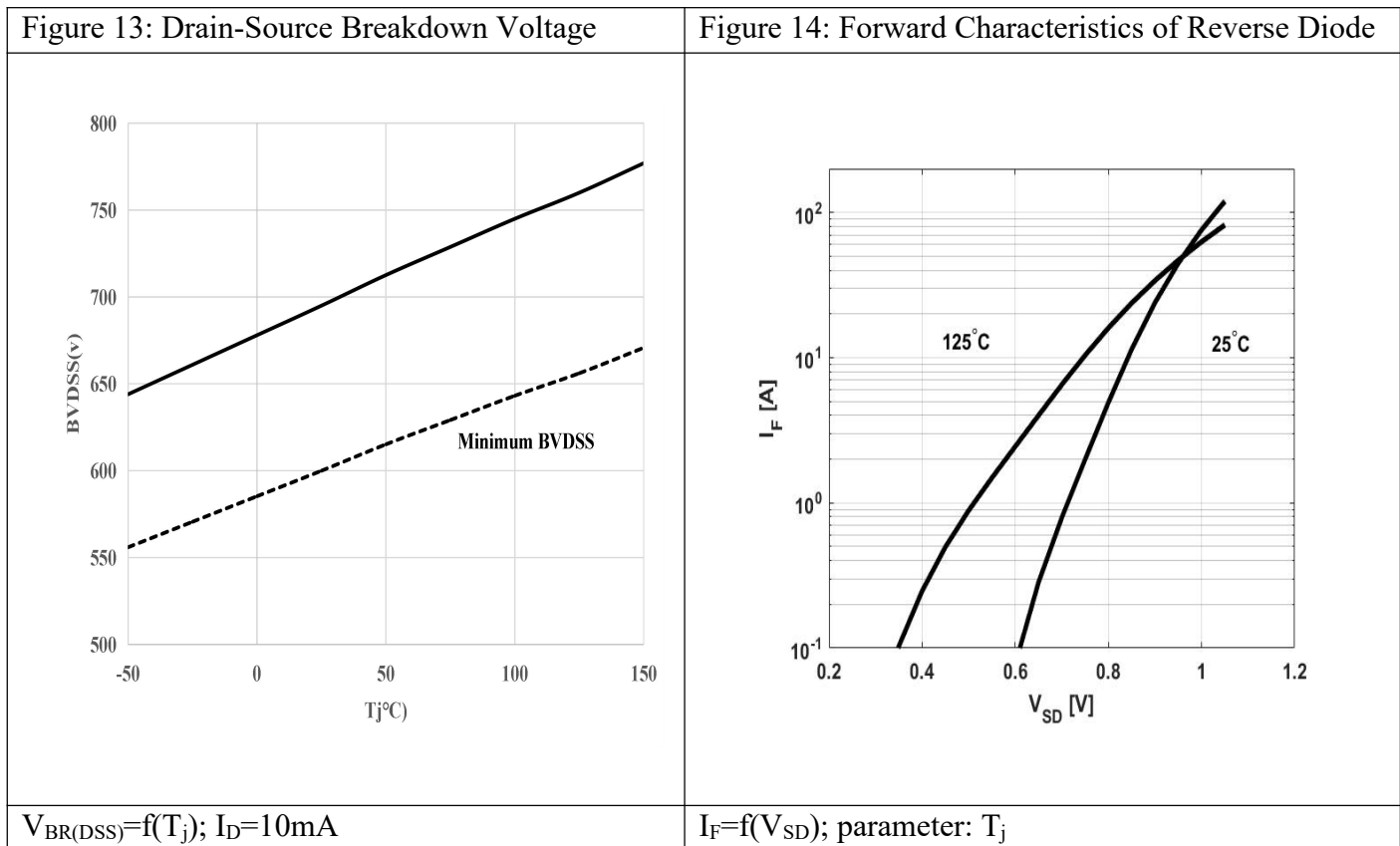
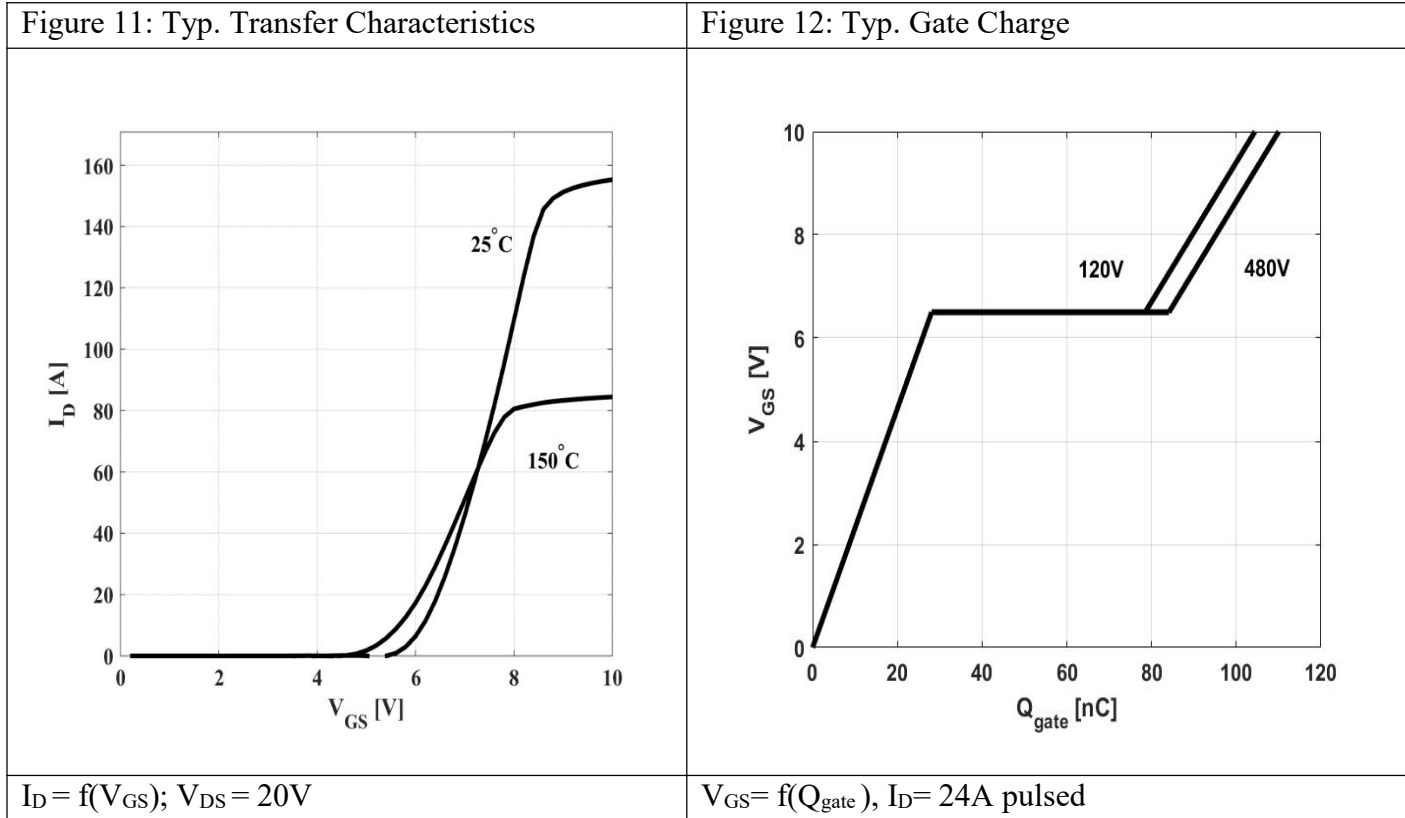
6.  $C_{O(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 480V

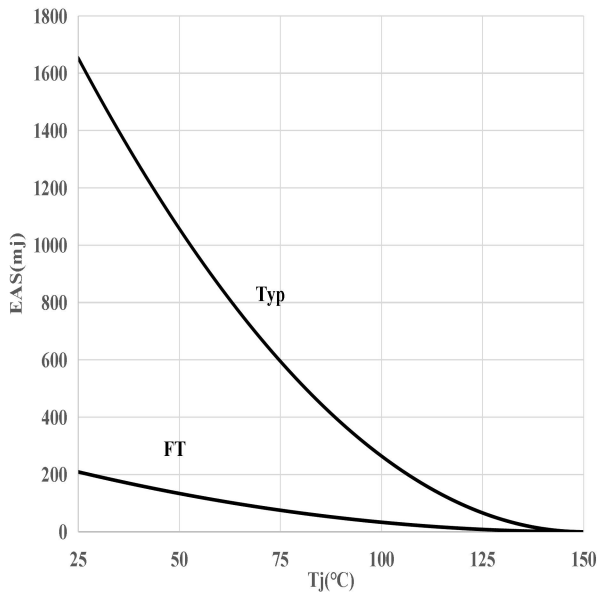
7.  $C_{O(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 480 V

**Typical Performance Characteristics**

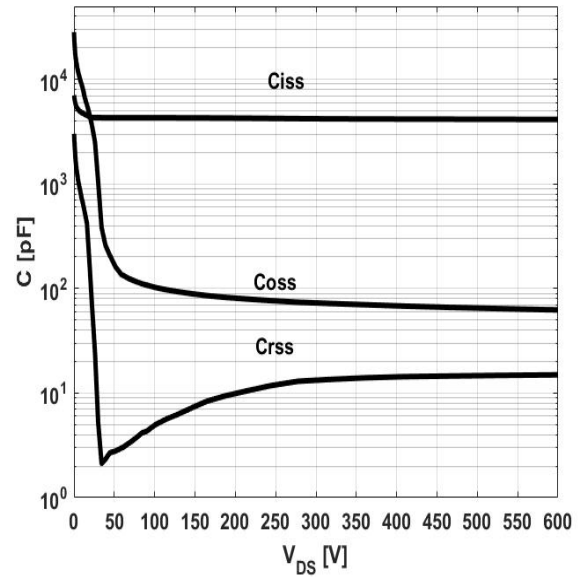
<p>Figure 3: Power Dissipation</p>  <p><math>P_{tot} = f(T_c)</math>; TO-247</p>	<p>Figure 4: Max. Transient Thermal Impedance</p>  <p><math>Z_{th(jc)} = f(t_p)</math>; parameter: <math>D = t_p/t</math>; TO-247</p>
<p>Figure 5: Safe Operating Area</p>  <p><math>I_D = f(V_{DS})</math>; <math>T_c = 25^\circ\text{C}</math>; <math>V_{GS} &gt; 7\text{V}</math>; parameter <math>t_p</math></p>	<p>Figure 6: Safe Operating Area</p>  <p><math>I_D = f(V_{DS})</math>; <math>T_c = 80^\circ\text{C}</math>; <math>V_{GS} &gt; 7\text{V}</math>; parameter <math>t_p</math></p>

**Figure 7: Typ. Output Characteristics**

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$ 
**Figure 8: Typ. Output Characteristics**

 $I_D = f(V_{DS}); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$ 
**Figure 9: Typ. Drain-Source On-State Resistance**

 $R_{DS(ON)} = f(I_D); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$ 
**Figure 10: Typ. Drain-Source On-State Resistance**

 $R_{DS(ON)} = f(T_j); I_D = 24\text{A}; V_{GS} = 10\text{V}$

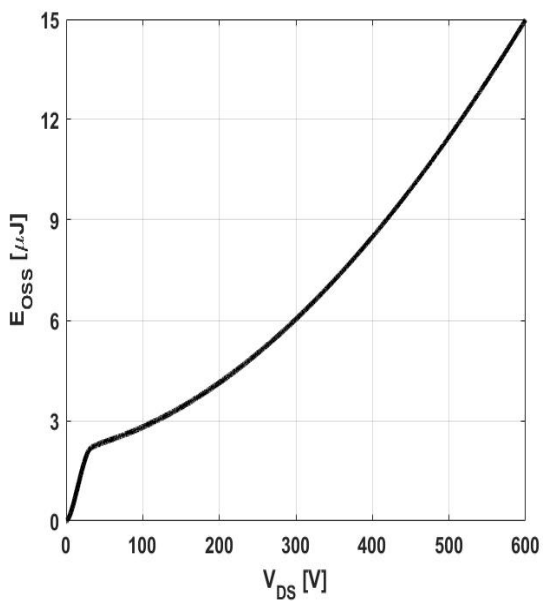


**Figure 15: Avalanche Energy**


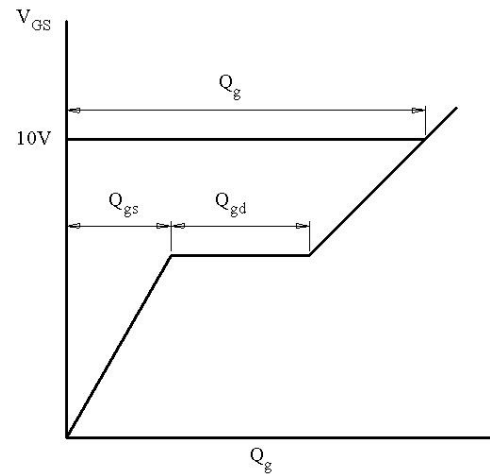
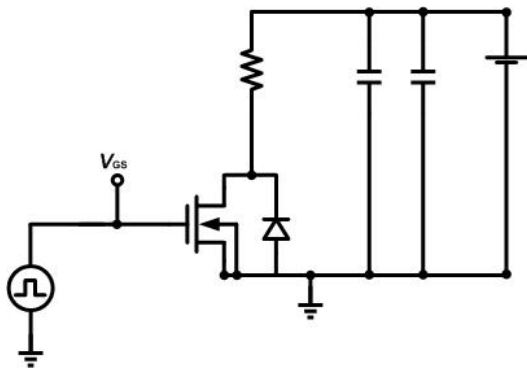
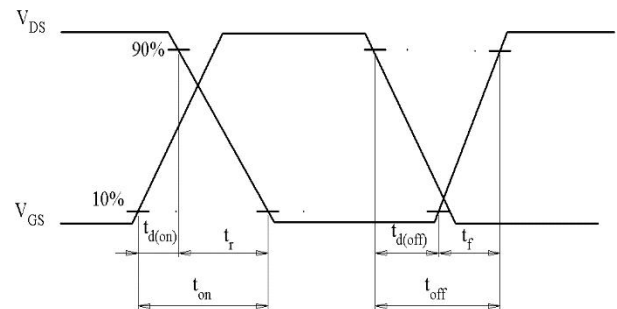
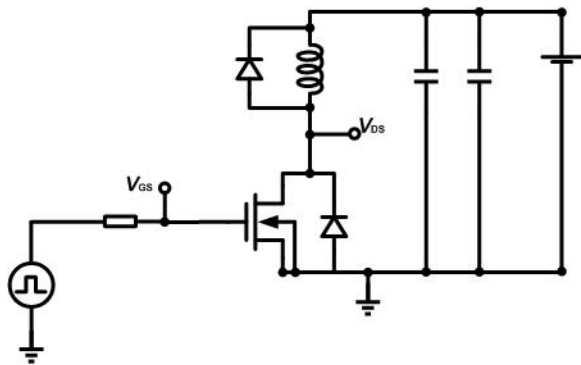
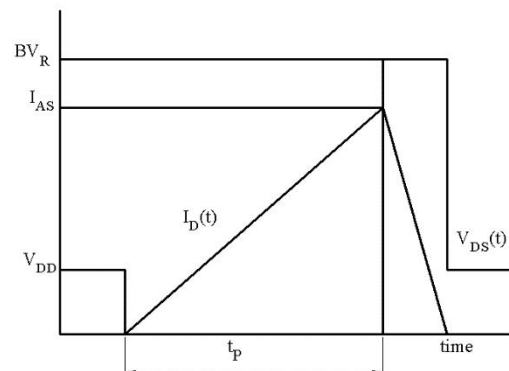
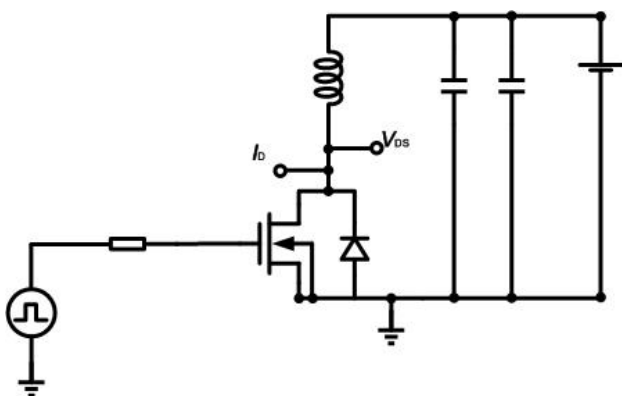
$$E_{AS}=f(T_j); V_{DD}=60V$$

**Figure 16: Typ. Capacitances**


$$C=f(V_{DS}); V_{GS}=0; f=1MHz$$

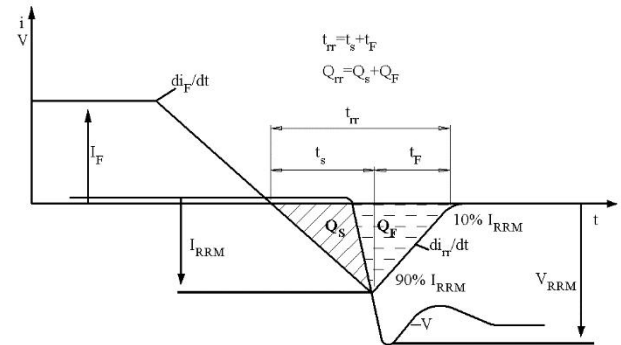
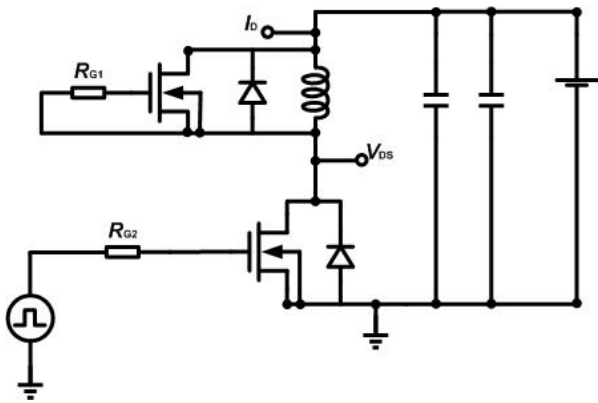
**Figure 17: Coss Stored Energy**


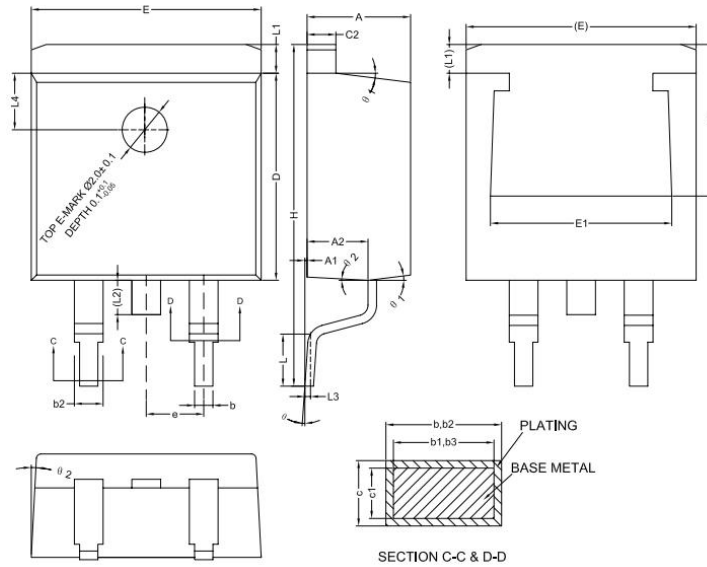
$$E_{OSS}=f(V_{DS})$$

**Test Circuits**
**1. Gate Charge Test Circuit & Waveform**

**2. Switch Time Test Circuit**

**3. Unclaimed Inductive Switching Test Circuit & Waveforms**




**4. Test Circuit and Waveform for Diode Characteristics**

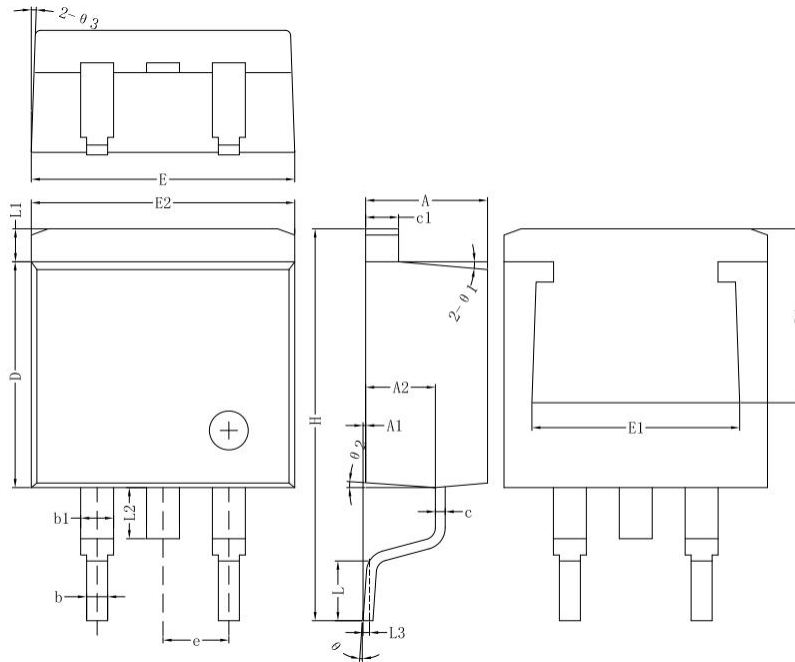


**Mechanical Dimensions**
**TO-263-2 (Package 1)**
**Unit: mm**


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)**

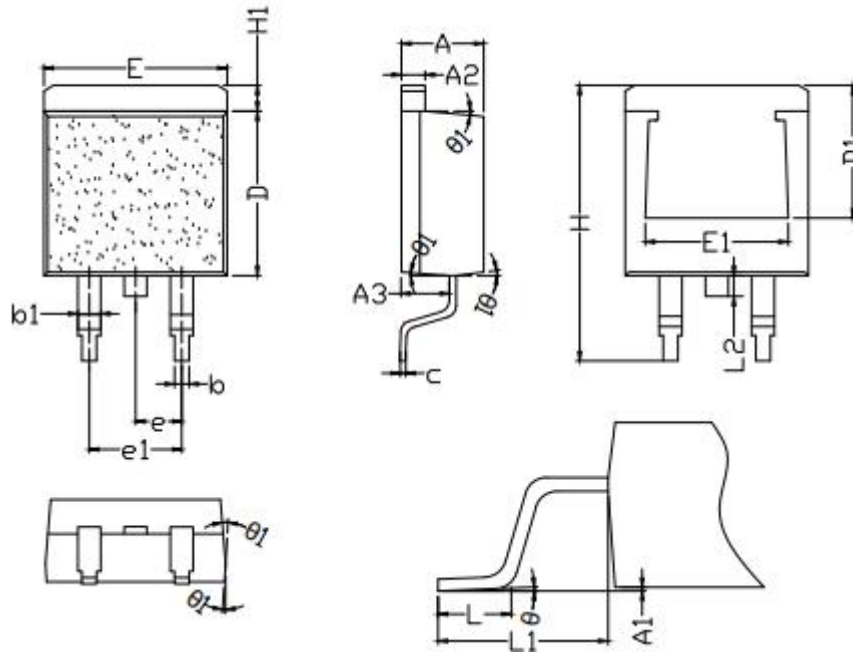
Unit: mm



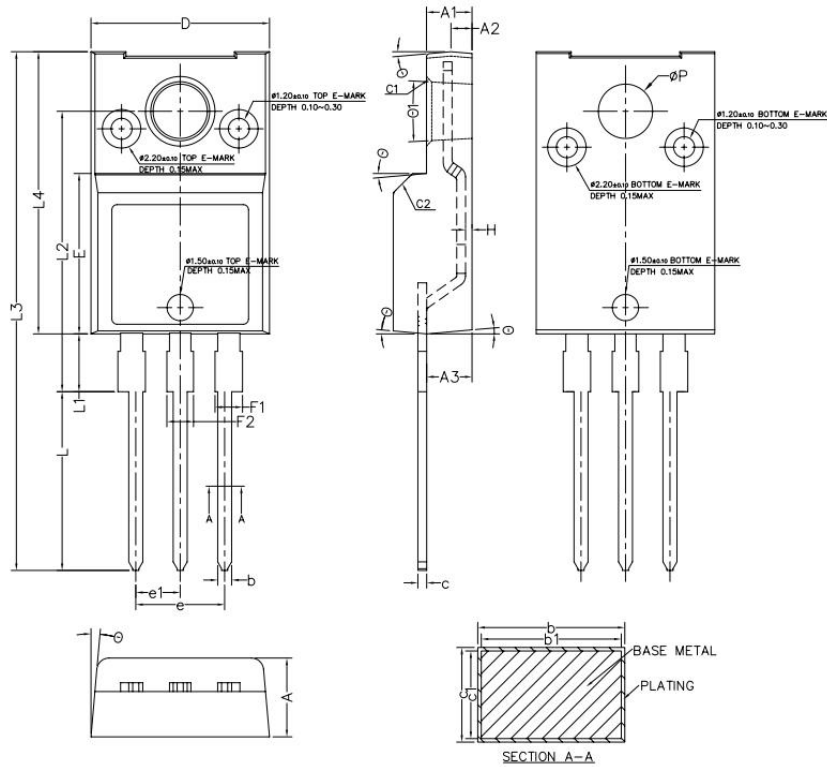
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40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

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

Unit: mm



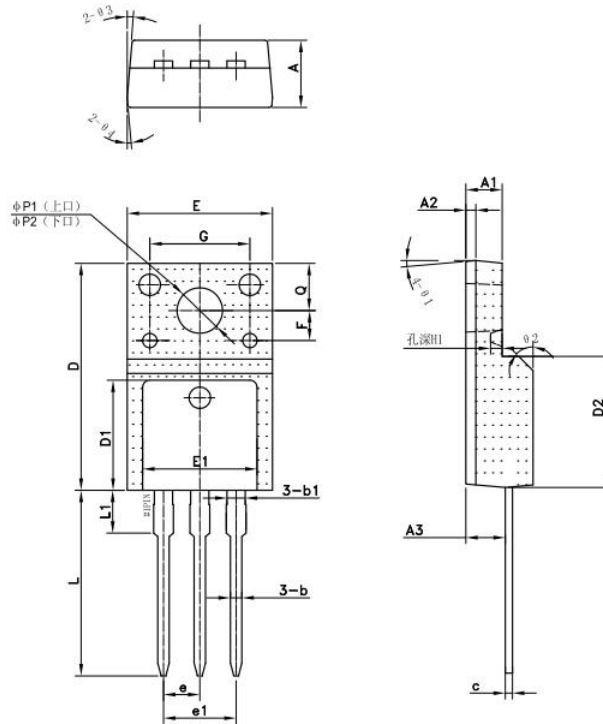
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.42	4.52	4.62
A1	0.00	0.10	0.25
A2	1.24	1.27	1.32
A3	2.50	2.60	2.70
b	0.77	0.81	0.84
b1	1.23	1.28	1.41
c	0.33	0.38	0.43
D	8.80	8.95	9.10
D1	7.2REF		
E	9.92	10.07	10.22
E1	7.85REF		
e	2.50	2.54	2.58
e1	5.08REF		
H	14.80	15.10	15.30
H1	1.12	1.28	1.42
L	2.10	2.23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

**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)**

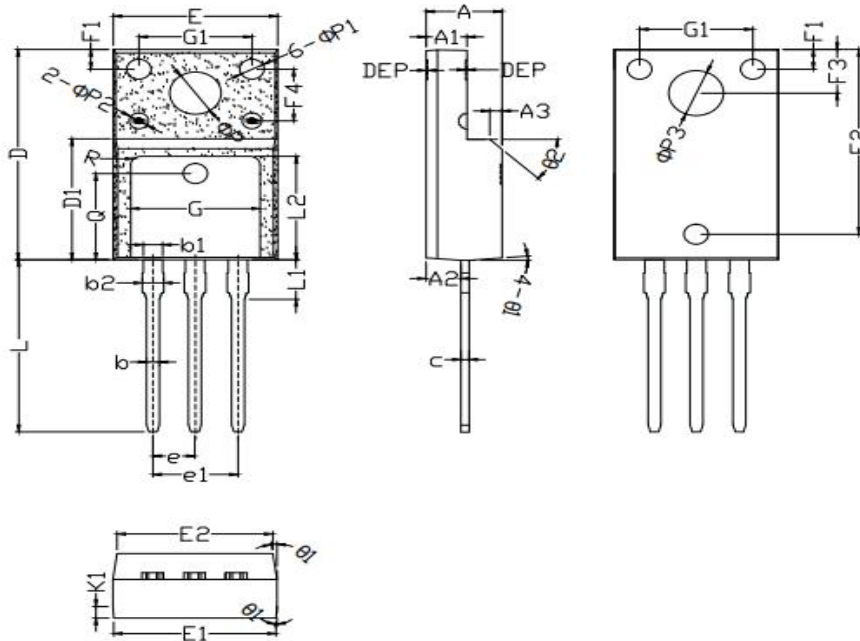
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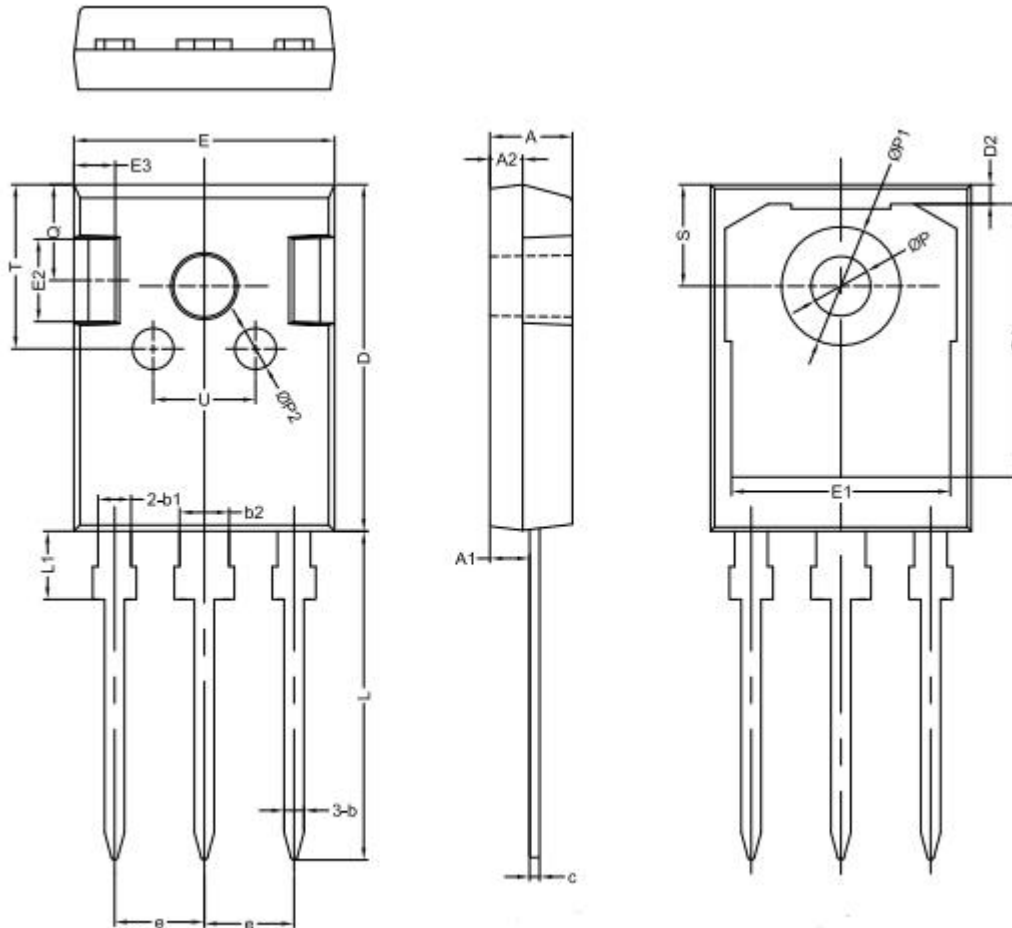
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.70
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
D2	-	9.12	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54		
e1	5.08		
F	2.1		
G	7		
H1	-	0.81	-
L	12.48	12.98	13.20
L1	-	2.93	-
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

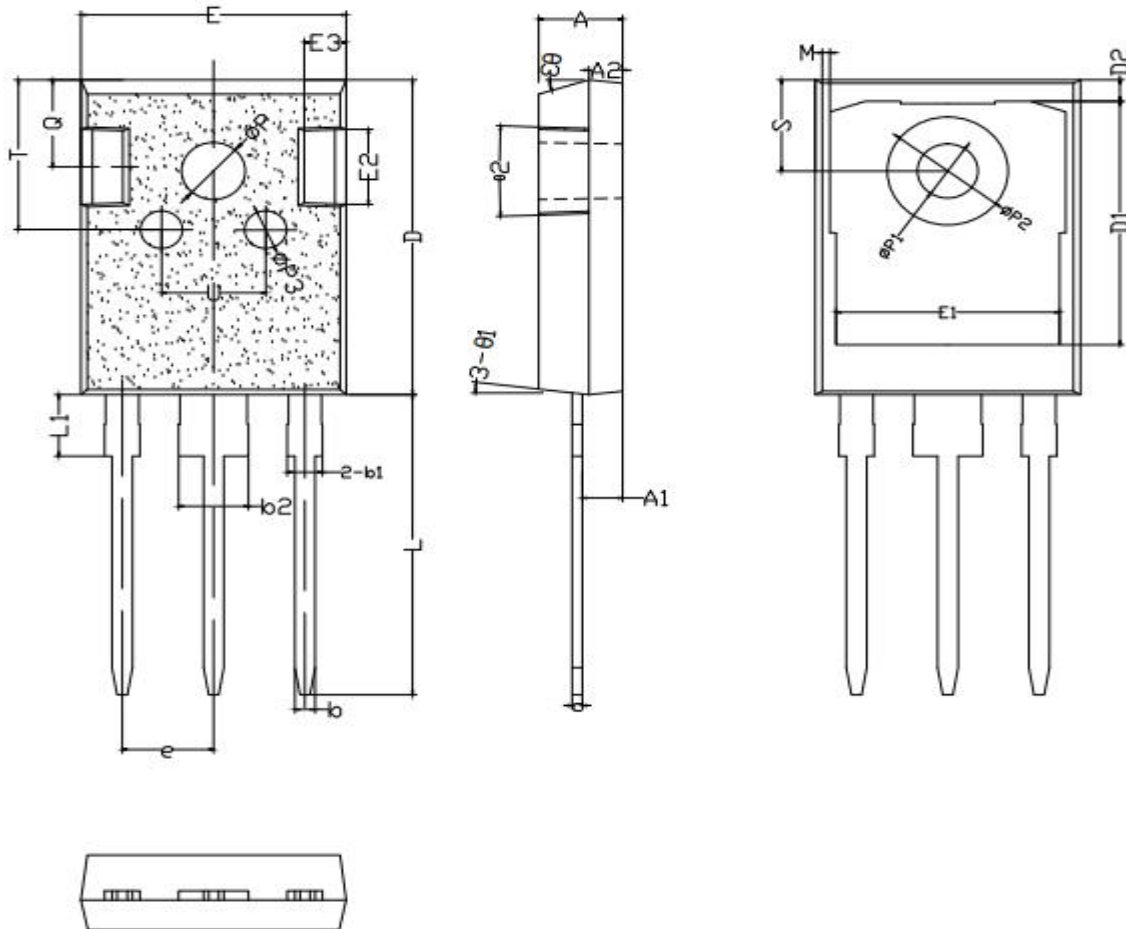


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.60	2.80	2.95
A3	1.0REF		
b	0.75	0.80	0.85
b1	1.18	1.20	1.24
b2	1.18	1.24	1.30
c	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
E	10.00	10.16	10.30
E1	9.94	10.06	10.30
E2	9.40	9.50	9.60
e	2.50	2.54	2.58
e1	5.08REF		
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

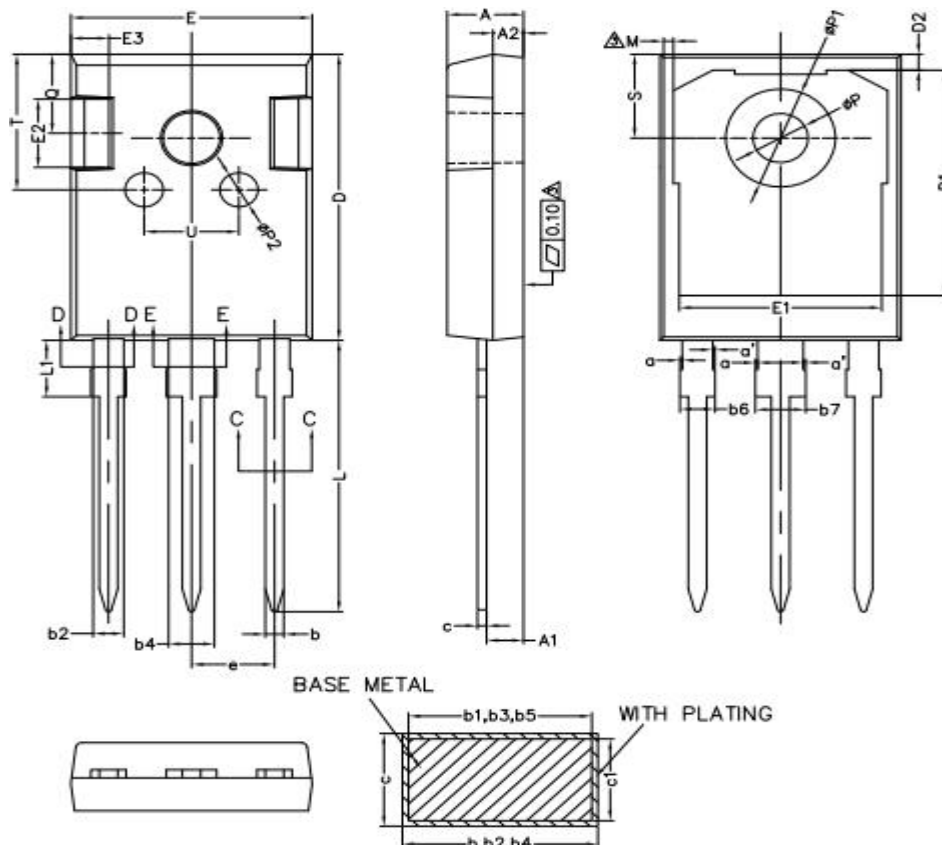
**Mechanical Dimensions**
**TO-247(Package 1)**
**Unit: mm**


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	-				

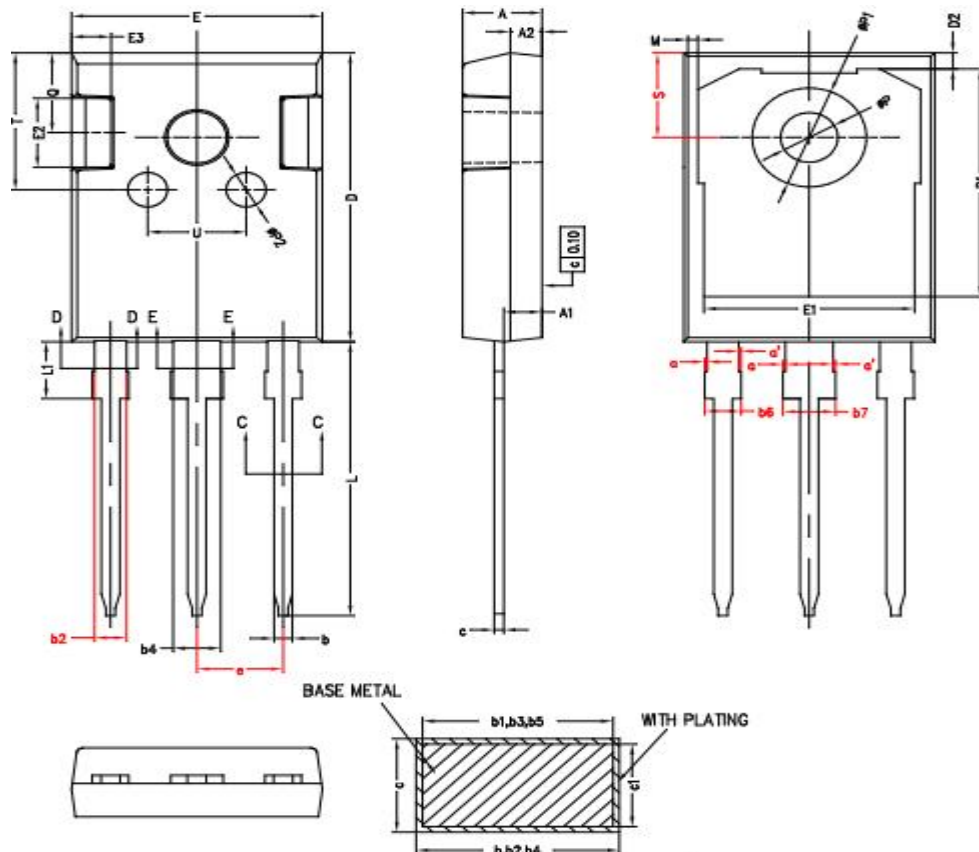


**Mechanical Dimensions**
**TO-247(Package 2)**
**Unit: mm**


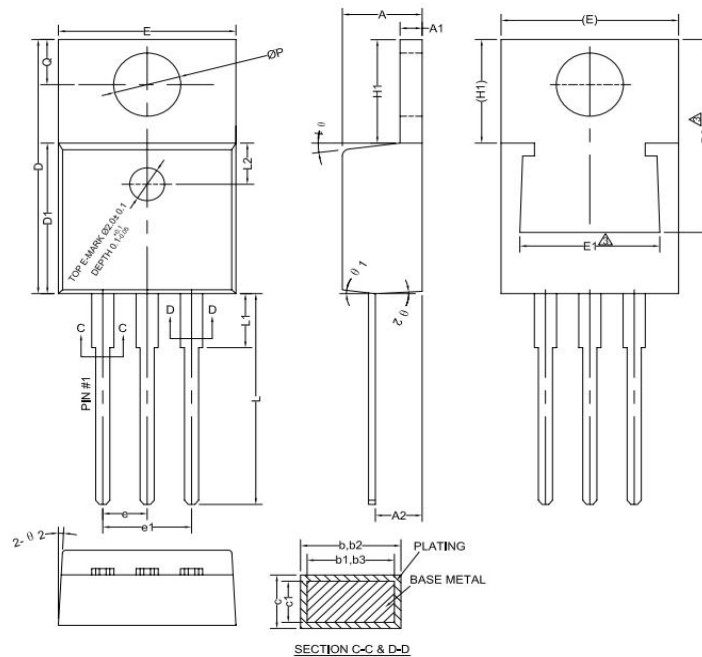
Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	E1	13.10	13.25	13.40
A1	2.31	2.41	2.51	E2	4.85	4.95	5.10
A2	1.90	2.00	2.10	E3	2.40	2.50	2.60
b	1.15	1.20	1.25	L	19.80	19.98	20.15
b1	1.95	2.10	2.25	L1	-	-	4.30
b2	2.95	3.10	3.25	ΦP	3.60	3.70	3.80
c	0.55	0.60	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**


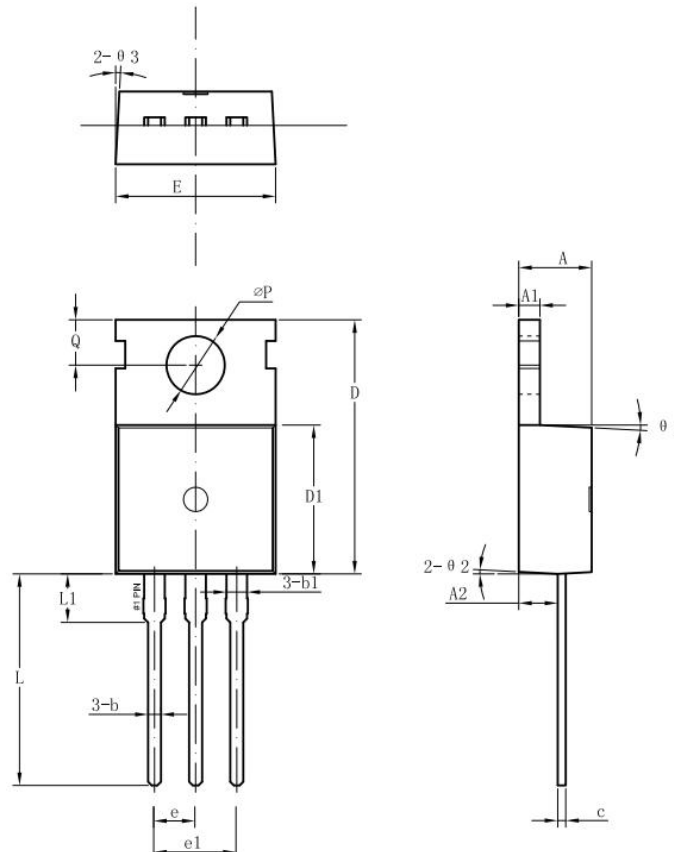
Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	c1	0.58	0.60	0.62
A1	2.31	2.41	2.51	D	20.90	21.00	21.10
A2	1.90	2.00	2.10	D1	16.25	16.55	16.85
b	1.16	-	1.26	D2	1.05	1.20	1.35
b1	1.15	1.20	1.22	E	15.70	15.80	15.90
b2	1.96	-	2.06	E1	13.10	13.30	13.50
b3	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**


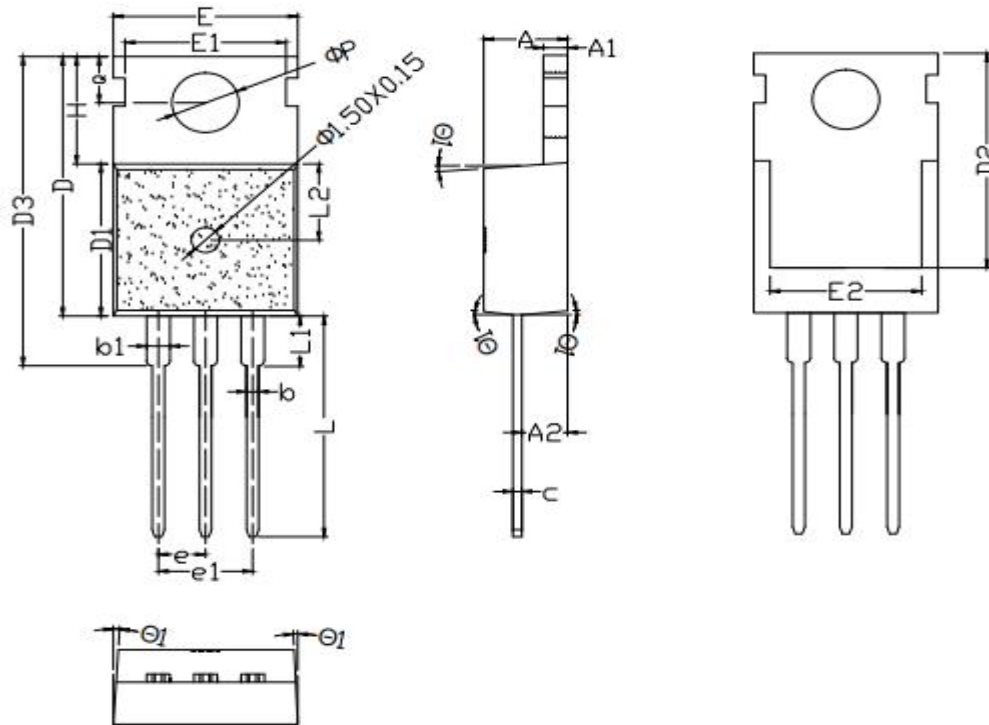
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	1.22	-	1.32
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
D	15.15	15.45	15.75
D1	9.05	9.15	9.25
D2	11.40	-	12.88
E	9.96	10.16	10.36
E1	6.86	-	8.89
e	2.44	2.54	2.64
e1	4.98	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°

**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	-
ΦP	3.50	3.60	3.80
Q	2.60	2.80	3.00
θ1		3°	
θ2		3°	
θ2		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



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#### **Main Site:**

##### **- Headquarter**

Shenzhen Sanrise Technology Co., LTD  
A1206, Skyworth building, No. 008, gaoxinnan 1st Road,  
Gaoxin District, Yuehai street,, Nanshan District, ShenZhen,  
P.R.China  
Tel: +86-755-22953335  
Fax: +86-755-22916878

##### **- Shanghai Office**

Shenzhen Sanrise Technology Co., LTD  
Rm.401, Building B, No. 666, Zhangheng Road,  
Zhangjiang Hi-Tech Park, Shanghai, P.R.China  
Tel: +86-21-68825918