

General Description

The Sanrise SRC60R230B 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 SRC60R230B break down voltage is 600V and it has a high rugged avalanche characteristics. The SRC60R230B is available in TO-252, TO-263-2, TO-220F and TO-220C packages.

Features

- Ultra Low $R_{DS(ON)} = 230m\Omega @ V_{GS} = 10V$.
- Ultra Low Gate Charge, $Q_g = 25.6nC$ typ.
- Fast switching capability
- Robust design with better EAS performance
- Non-automotive Qualified
- Ultra-fast body diode

Application

- AC/DC Power Supply
- PC Power
- Sever / Telecom
- Solar Inverter

Ordering Information

SRC60R230B□□-□		
Circuit Type	_____	E: Lead Free
Package	_____	G: Green
D: TO-252		Blank: Tube
TF: TO-220F		TR: Tape & Reel
TC: TO-220C		
S2: TO-263-2		

Symbol

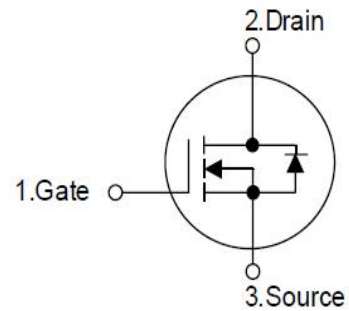


Figure 1 Symbol of SRC60R230B

Package Type

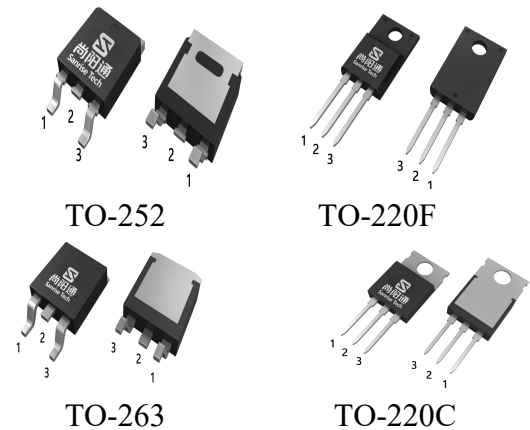


Figure 2 Package Types of SRC60R230B

Package	Part Number	Marking ID	Packing Type
TO-252	SRC60R230BDTR-G	SRC60R230BDG	Tape & Reel
TO-263-2	SRC60R230BS2TR-G	SRC60R230BS2G	Tape & Reel
TO-220F	SRC60R230BTF-E	SRC60R230BTFE	Tube
TO-220C	SRC60R230BTC-G	SRC60R230BTCG	Tube

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage (Note2)		V_{DSS}	630	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current	$T_C=25^{\circ}\text{C}$	I_D	13.7	A
	$T_C=100^{\circ}\text{C}$		9.1	
	$T_C=125^{\circ}\text{C}$		6.5	
Pulsed Drain Current (Note 3)		I_{DM}	41.1	A
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	151	mJ
Avalanche Energy, Repetitive (Note 3)		E_{AR}	0.2	mJ
Avalanche Current, Repetitive (Note 3)		I_{AR}	4.0	A
Continuous Diode Forward Current		I_S	13.7	A
Diode Pulse Current		$I_{S,PULSE}$	41.1	A
MOSFET dv/dt Ruggedness, $V_{DS}\leq 480\text{V}$		dv/dt	50	V/ns
Reverse Diode dv/dt, $V_{DS}\leq 480\text{V}$, $I_{SD}\leq I_D$		dv/dt	15	V/ns
Operating Junction Temperature		T_J	150	$^{\circ}\text{C}$
Storage Temperature		T_{STG}	-55 to 150	$^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	$^{\circ}\text{C}$

Note:

1. 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.
2. For Transient Voltage Spike.
3. Repetitive Rating: Pulse width limited by maximum junction temperature
4. $I_{AS} = 5.5\text{A}$, $V_{DD} = 60\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$

Thermal characteristics

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	RthJC			4.0	$^{\circ}\text{C} / \text{W}$
	TO-247				1.44	
	TO-220C				1.44	
	TO-263-2				1.44	
	TO-262				1.44	
	TO-252				1.44	
Thermal resistance, Junction-to-Ambient	TO-220F	RthJA			80	$^{\circ}\text{C} / \text{W}$
	TO-247				80	
	TO-220C				80	
	TO-263-2				80	
	TO-262				80	
	TO-252				80	

Electrical Characteristics

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

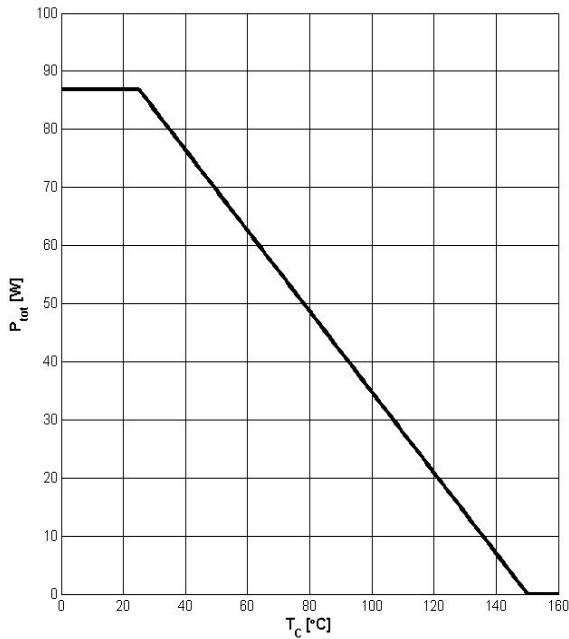
Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250uA	600			V
Zero Gate Voltage Drain Current		I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	uA
Gate-Body Leakage Current	Forward	I _{GSSF}	V _{GS} =30V, V _{DS} =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 =250uA	3.0	4.0	5.0	V
Static Drain-Source On-Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =8.0A		190	230	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		2.0		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =50V, V _{GS} =0V, f=1MHz		1130		pF
Output Capacitance		C _{OSS}			86.4		
Reverse Transfer Capacitance		C _{RSS}			10		
Effective output capacitance, energy related ^{NOTE5}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...480V		51.2		pF
Effective output capacitance, time related ^{NOTE6}		C _{O(tr)}			187.3		
Turn-on Delay Time		t _{d(on)}	V _{DD} =400V, I _D =8.0A R _G =10Ω, V _{GS} =10V		12		ns
Rise Time		t _r			20		
Turn-off Delay Time		t _{d(off)}			24		
Fall Time		t _f			50		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =480V, I _D =8.0A V _{GS} =0 to 10V		8.0		nC
Gate to Drain Charge		Q _{gd}			8.2		
Gate Charge Total		Q _g			25.6		
Gate Plateau Voltage		V _{plateau}			5.8		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =8.0A		0.89	1.1	V
Reverse Recovery Time		t _{rr}	V _R =400V, I _F =8.0A dI _F /dt=100A/us		105		ns
Reverse Recovery Charge		Q _{rr}			0.42		uC
Peak Reverse Recovery Current		I _{rrm}			8.0		A

Note:

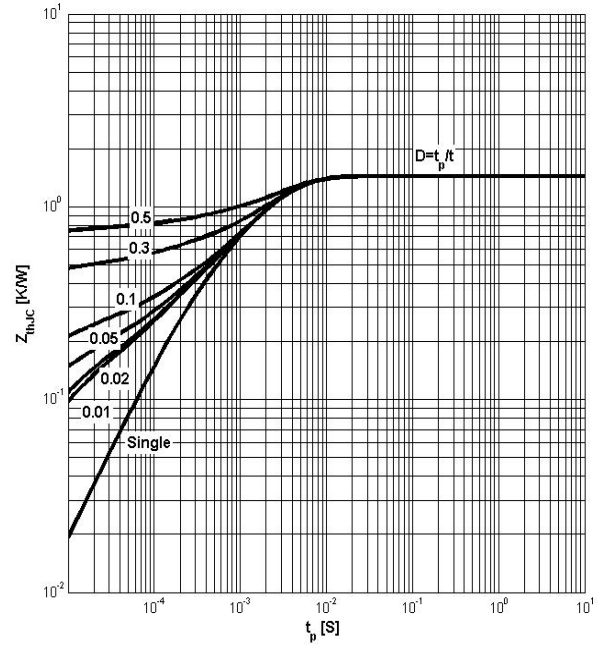
5. $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 480V

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

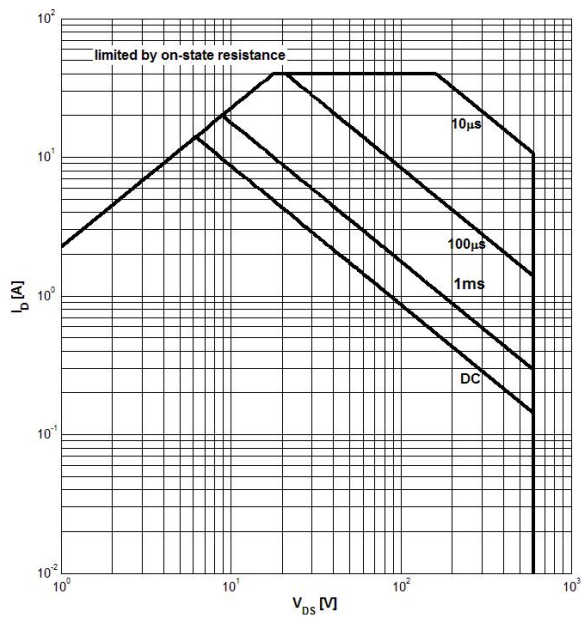
Typical Performance Characteristics

Figure 3: Power Dissipation


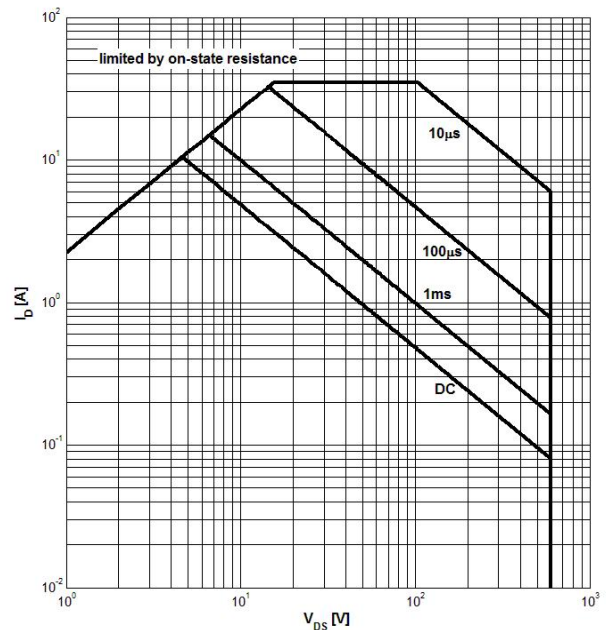
$$P_{tot} = f(T_c)$$

Figure 4: Max. Transient Thermal Impedance


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

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


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

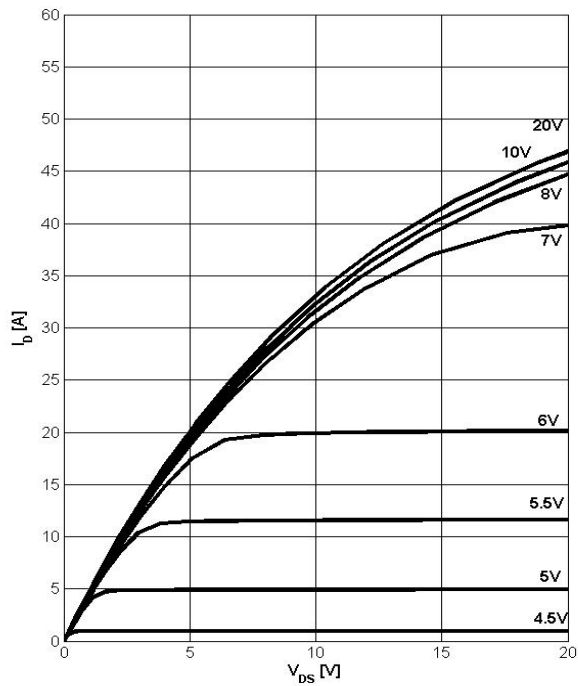
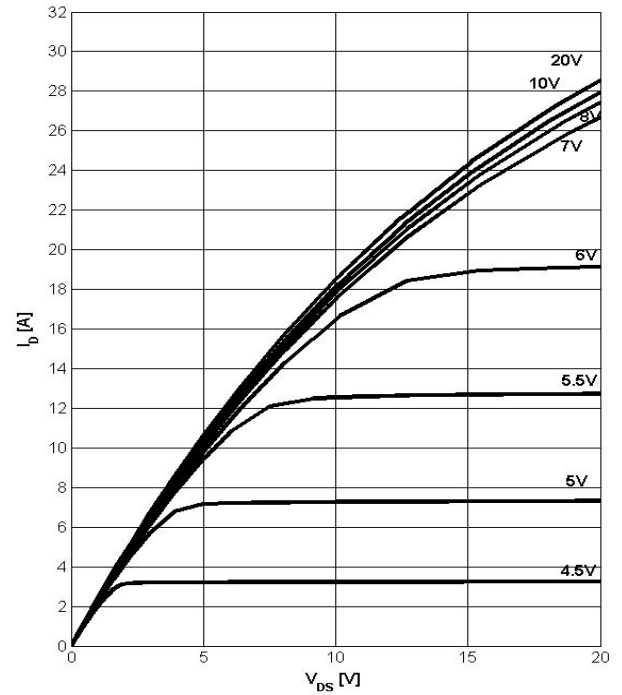
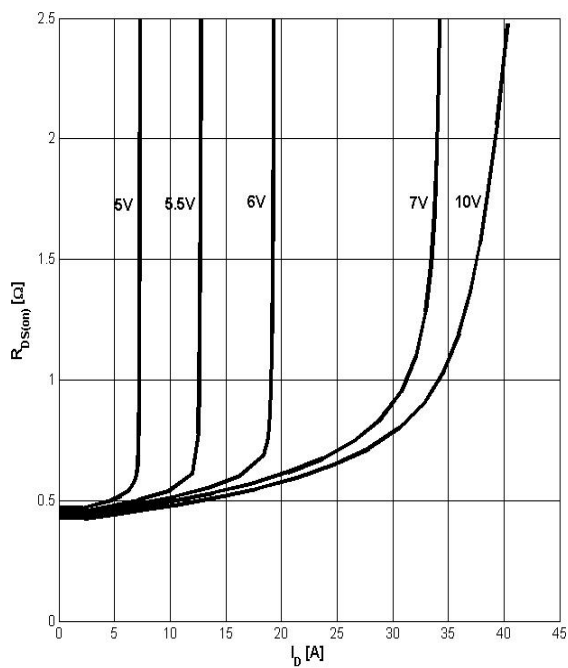
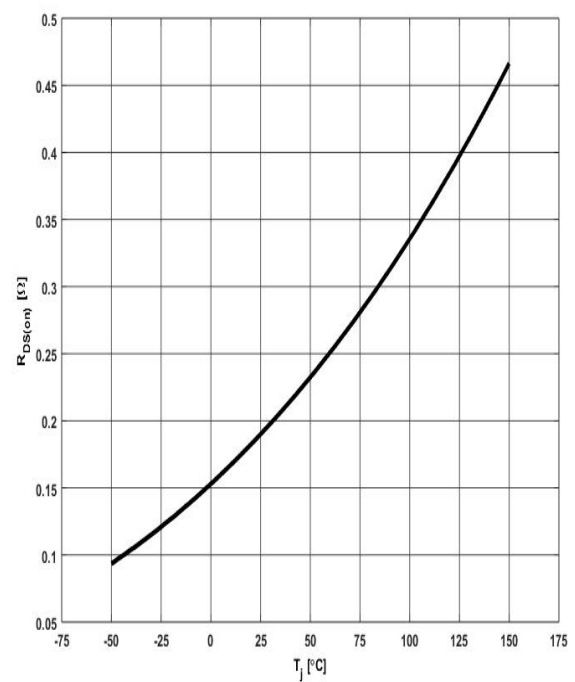
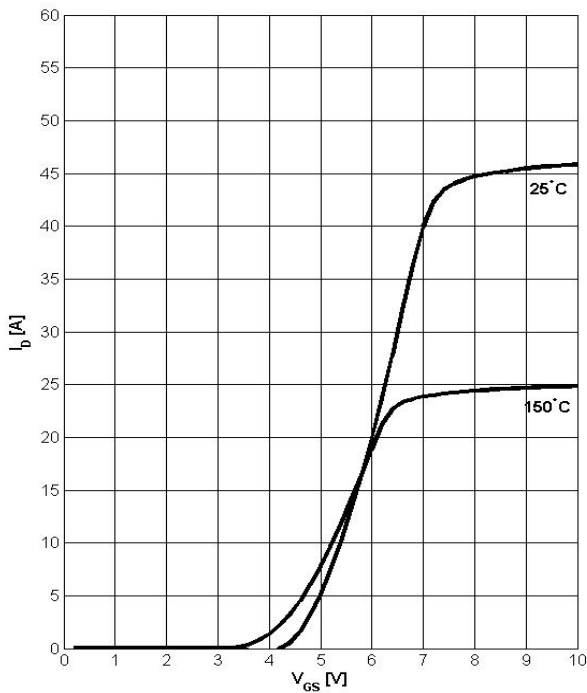
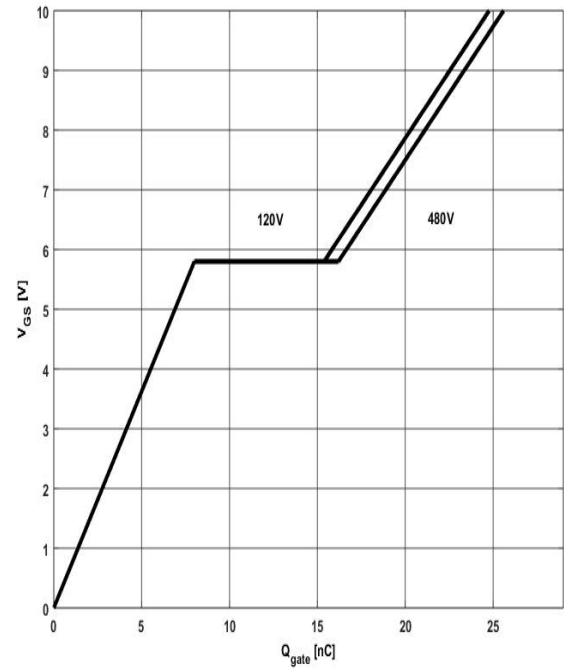
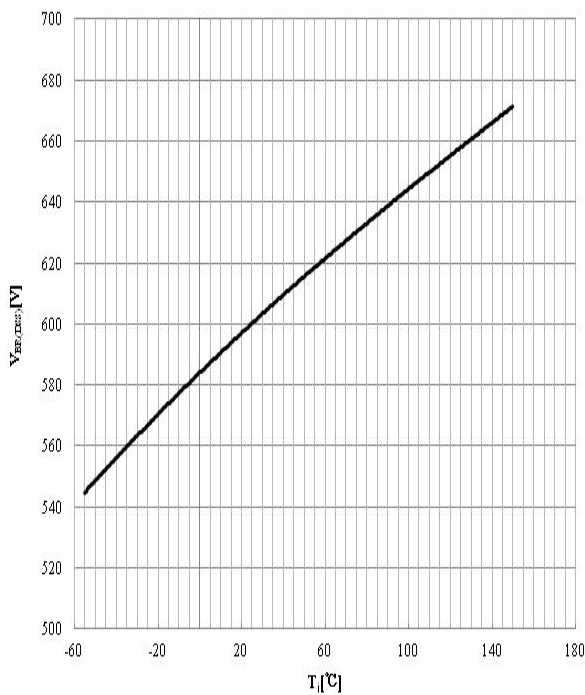
Figure 7: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$
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

 $R_{DS(ON)} = f(T_j); I_D = 8.0\text{A}; V_{GS} = 10\text{V}$

Figure 11: Typ. Transfer Characteristics


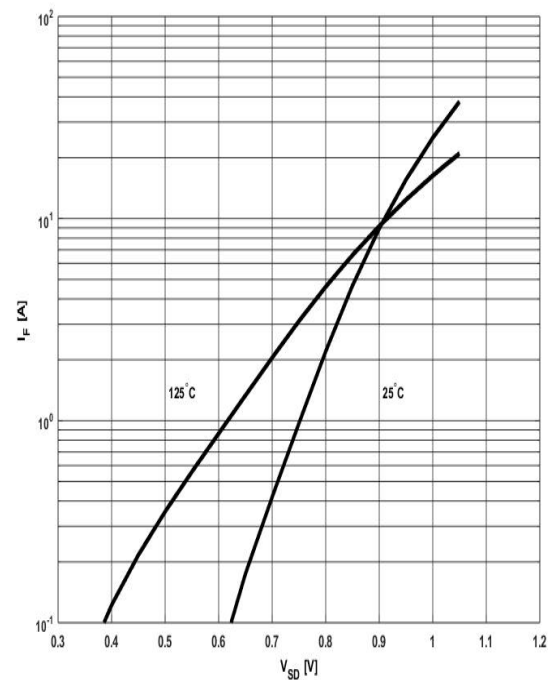
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Figure 12: Typ. Gate Charge


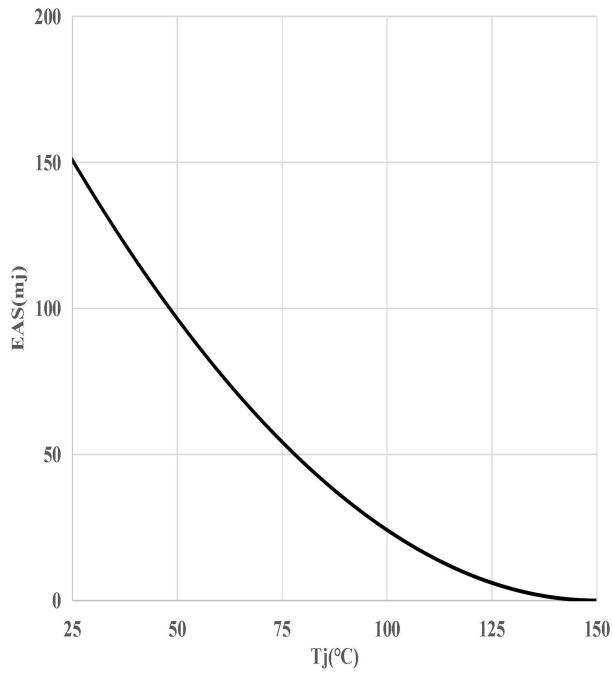
$$V_{GS} = f(Q_{gate}), I_D = 8A \text{ pulsed}$$

Figure 13: Drain-Source Breakdown Voltage


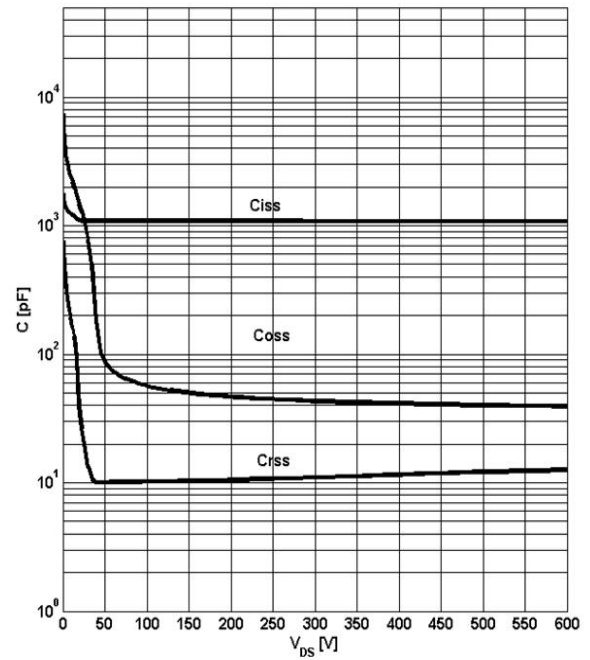
$$V_{BR(DSS)} = f(T_J); I_D = 10mA$$

Figure 14: Forward Characteristics of Reverse Diode


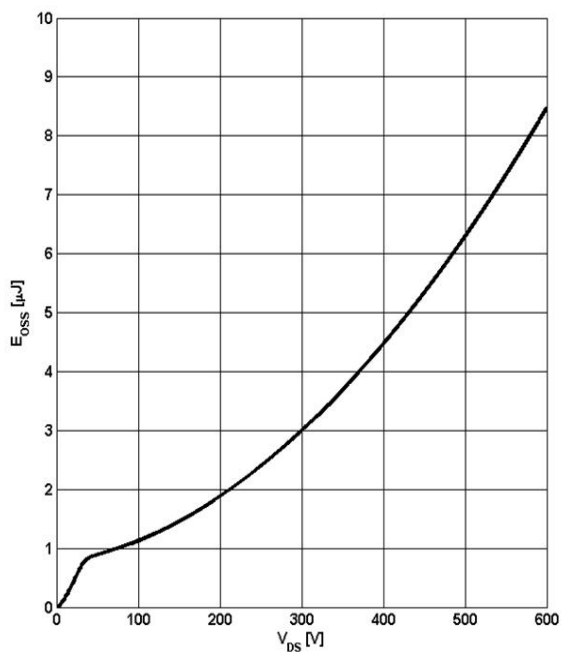
$$I_F = f(V_{SD}); \text{parameter: } T_J$$

Figure 15: Avalanche Energy


$$E_{AS}=f(T_j); I_D=5.5A; V_{DD}=60V$$

Figure 16: Typ. Capacitances


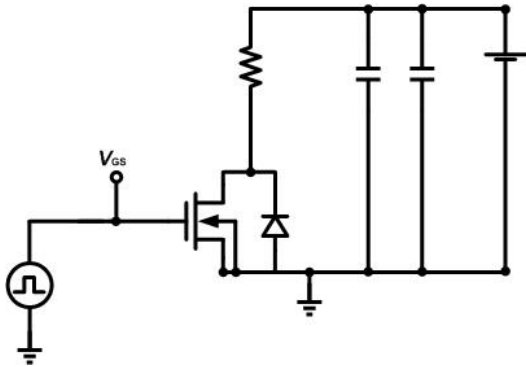
$$C=f(V_{DS}); V_{GS}=0; f=1MHz$$

Figure 17: Coss Stored Energy


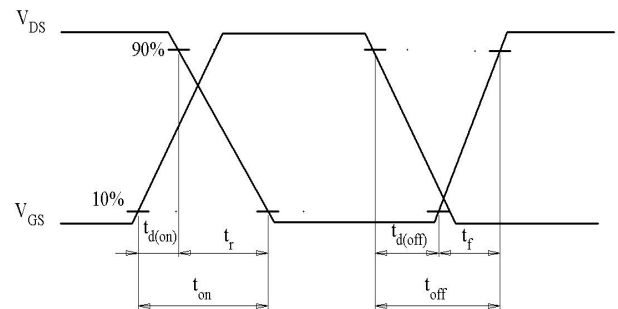
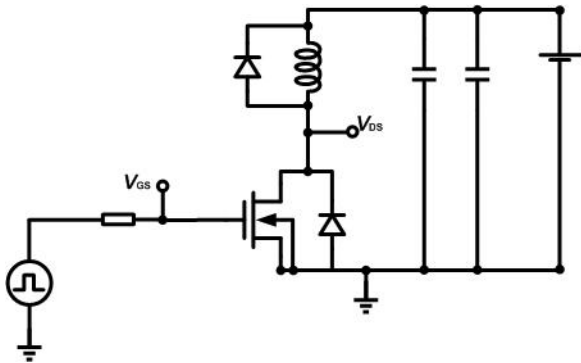
$$E_{OSS}=f(V_{DS})$$

Test Circuits

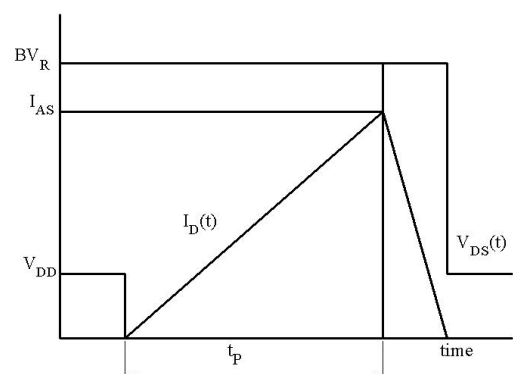
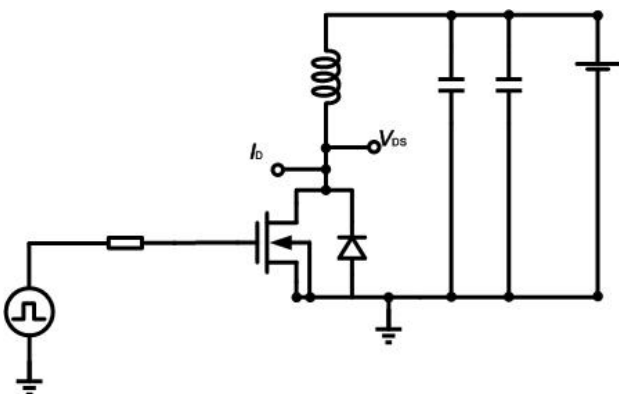
1. Gate Charge Test Circuit & Waveform



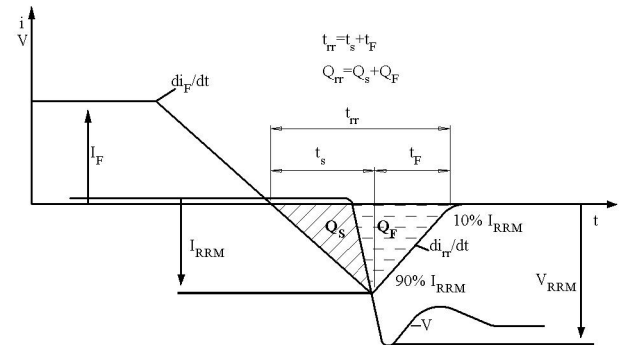
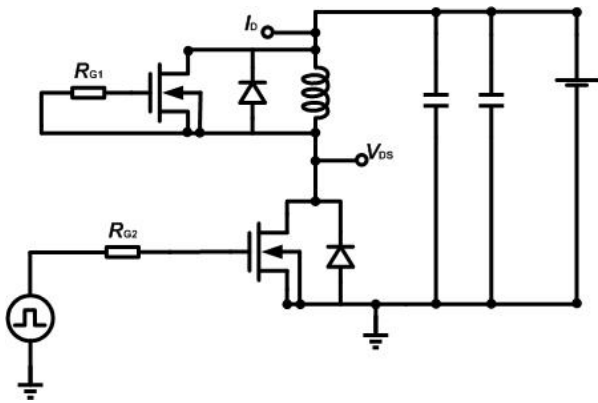
2. Switch Time Test Circuit

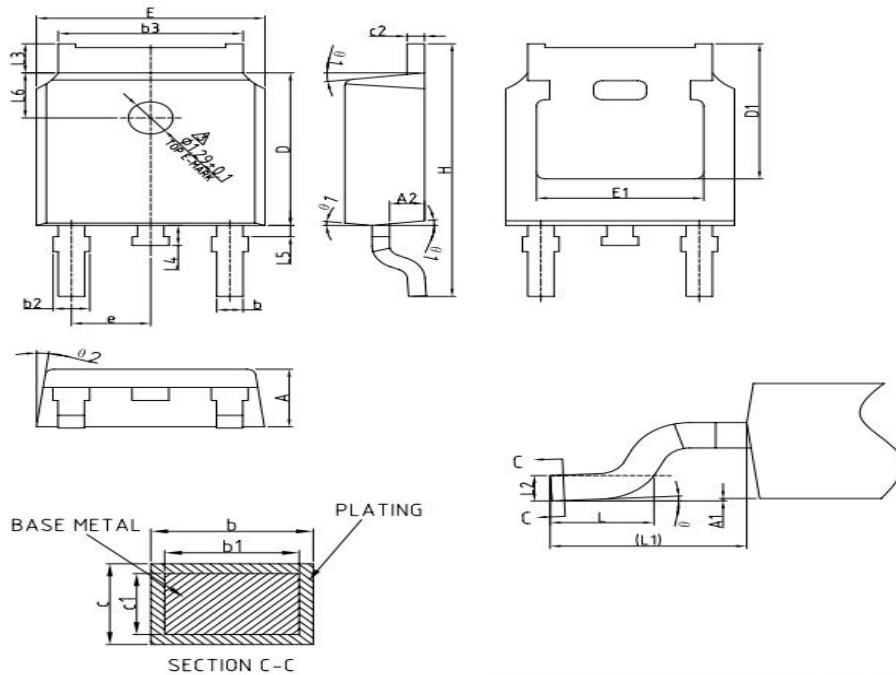


3. Unclaimed Inductive Switching Test Circuit & Waveforms

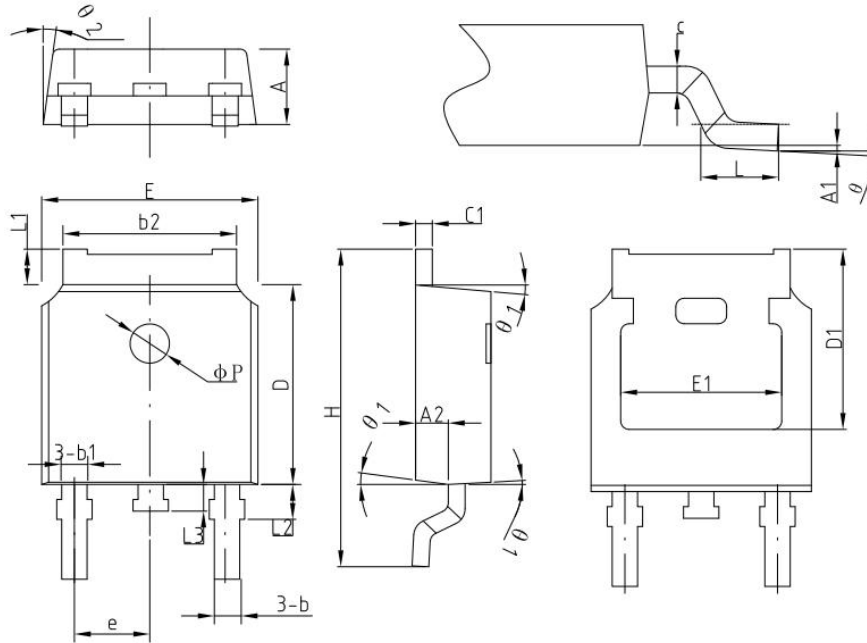


4. Test Circuit and Waveform for Diode Characteristics

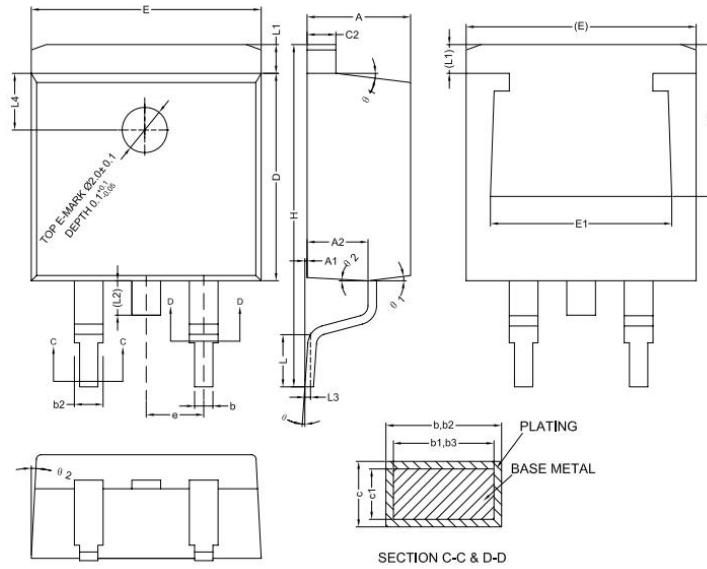


Mechanical Dimensions
TO-252 (Package 1)
Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.10
A2	0.90	1.01	1.10
b	0.72	-	0.85
b1	0.71	0.76	0.81
b2	0.72	-	0.90
b3	5.13	5.33	5.46
c	0.47	-	0.60
c1	0.46	0.51	0.56
C2	0.47	-	0.60
D	6.0	6.10	6.20
D1	5.25	-	-
E	6.50	6.60	6.70
E1	4.70	-	-
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90REF		
L2	0.51BSC		
L3	0.90	-	1.25
L4	0.60	0.80	1.00
L5	0.15	-	0.75
L6	1.80REF		
θ	0°	-	8°
$\theta 1$	5°	7°	9°
$\theta 2$	5°	7°	9°

Mechanical Dimensions
TO-252 (Package 2)
Unit: mm


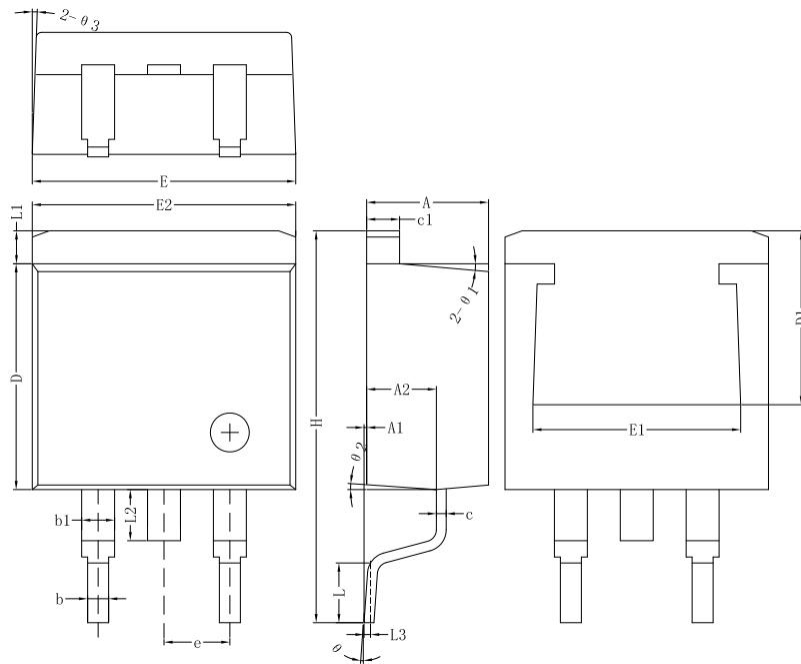
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.127
A2	0.90	1.01	1.10
b	0.635	0.76	0.86
b1	-	0.76	-
b2	5.2	5.33	5.46
c	0.47	0.50	0.60
c1	0.47	0.50	0.60
D	6.0	6.10	6.20
D1	-	5.30	-
E	6.50	6.60	6.70
E1	-	4.83	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.40	1.50	1.70
L1	0.90	-	1.25
L2	-	1.0	-
L3	-	0.8	-
φP	-	1.2	-
Θ	0°	-	8°
Θ1	5°	7°	9°
Θ2	5°	7°	9°

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)

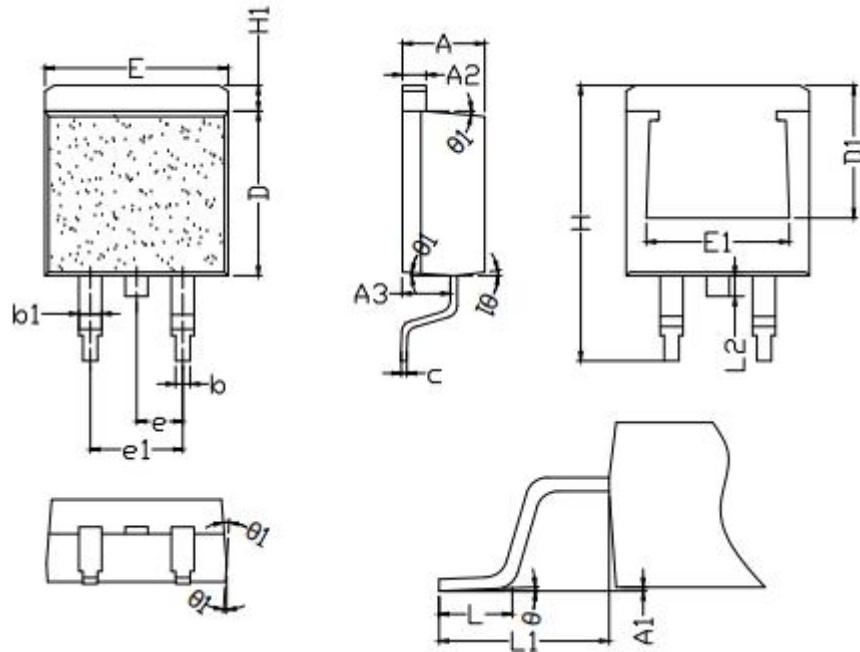
Unit: mm



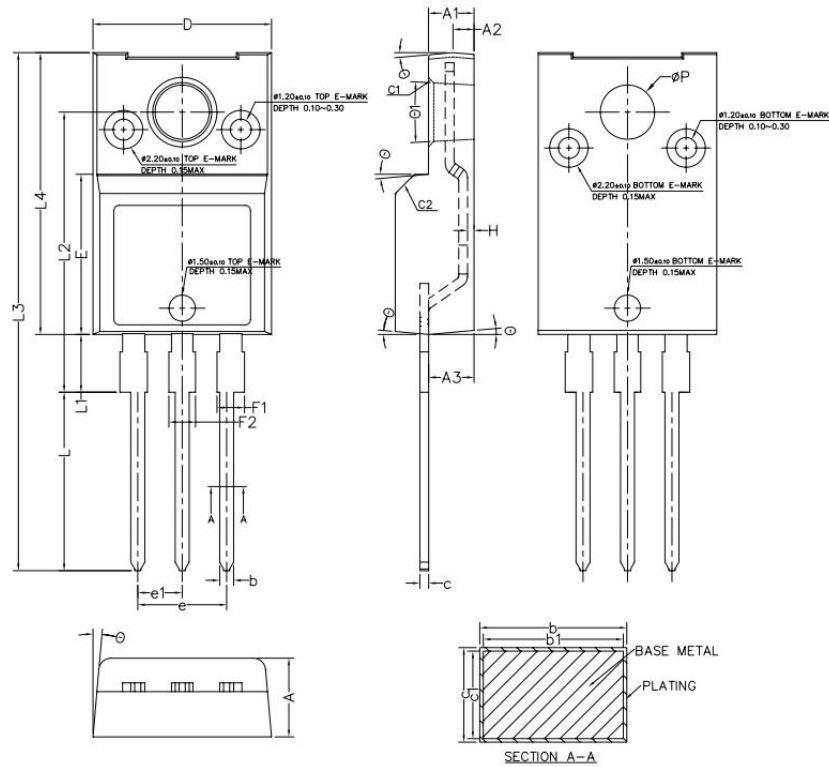
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40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

Mechanical Dimensions
TO-263-2 (Package 3)

Unit: mm



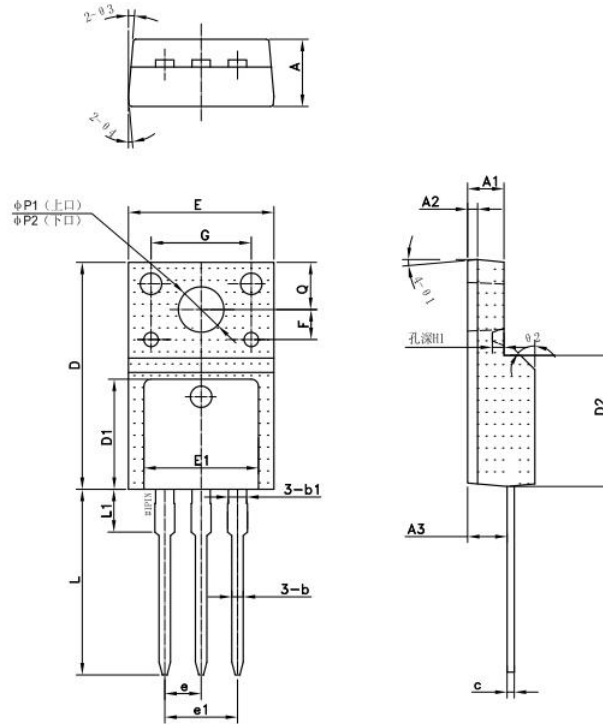
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.42	4.52	4.62
A1	0.00	0.10	0.25
A2	1.24	1.27	1.32
A3	2.50	2.60	2.70
b	0.77	0.81	0.84
b1	1.23	1.28	1.41
c	0.33	0.38	0.43
D	8.80	8.95	9.10
D1	7.2REF		
E	9.92	10.07	10.22
E1	7.85REF		
e	2.50	2.54	2.58
e1	5.08REF		
H	14.80	15.10	15.30
H1	1.12	1.28	1.42
L	2.10	2.23	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)

Unit: mm

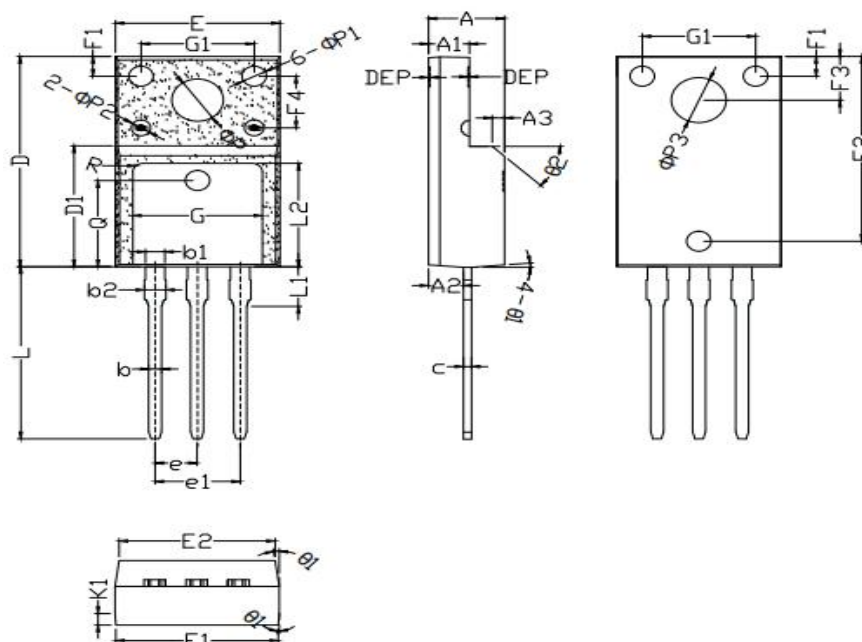


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.70
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
D2	-	9.12	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54		
e1		5.08	
F		2.1	
G		7	
H1	-	0.81	-
L	12.48	12.98	13.20
L1	-	2.93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

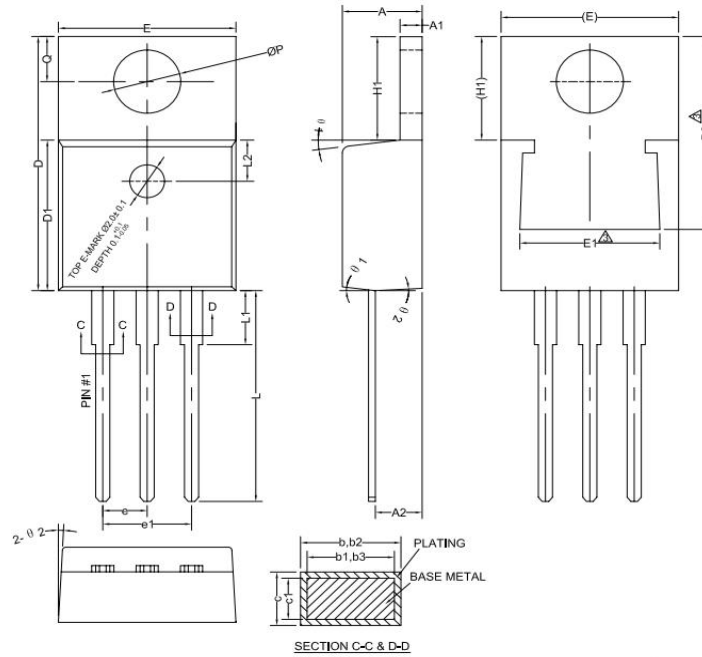
Mechanical Dimensions

TO-220F (Package 3)

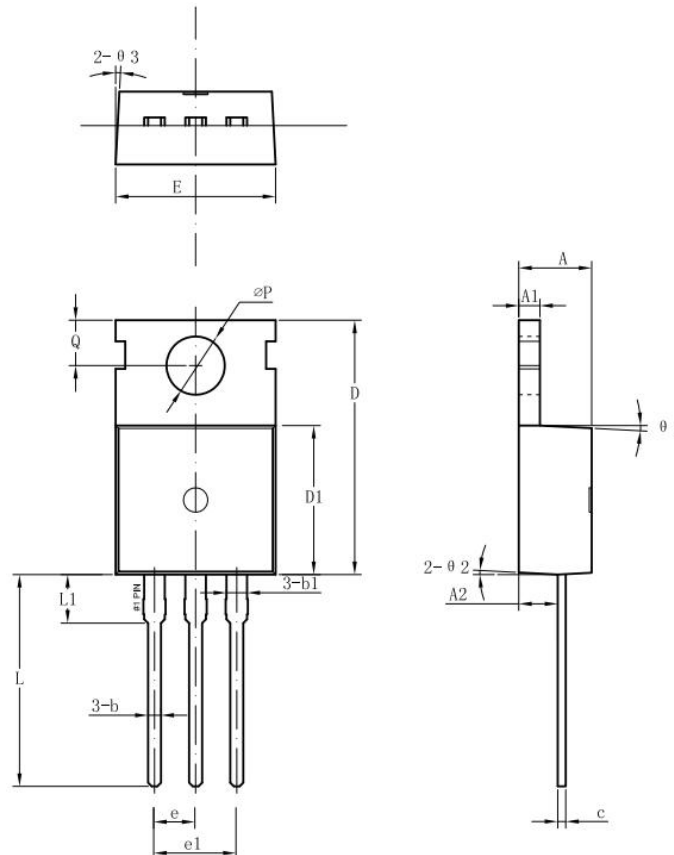
Unit: mm



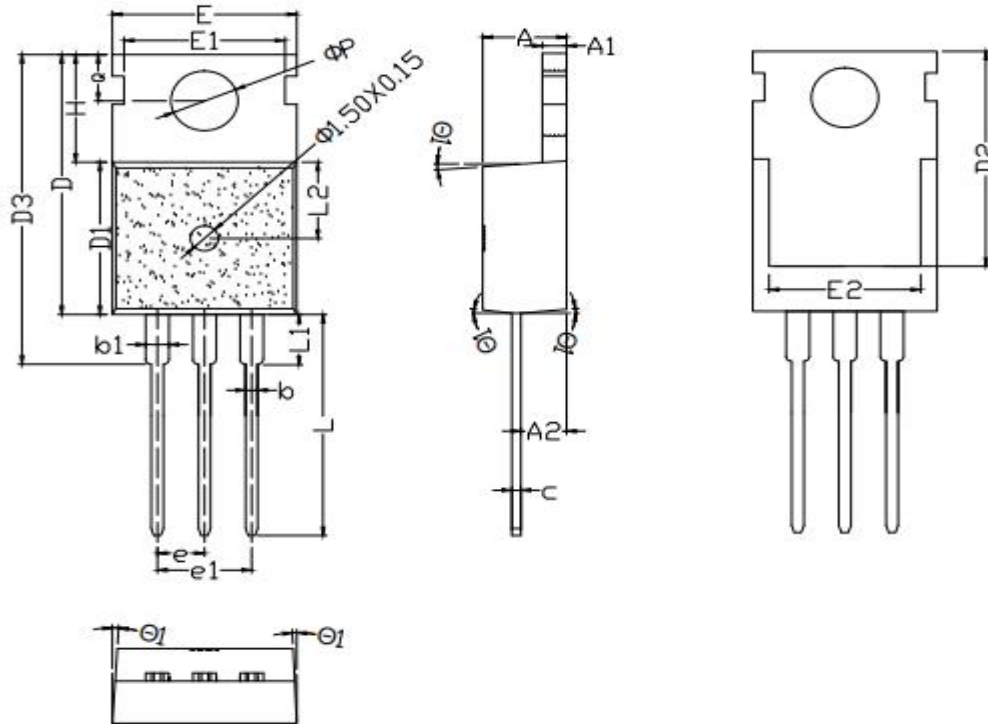
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.60	2.80	2.95
A3	1.0REF		
b	0.75	0.80	0.85
b1	1.18	1.20	1.24
b2	1.18	1.24	1.30
c	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
E	10.00	10.16	10.30
E1	9.94	10.06	10.30
E2	9.40	9.50	9.60
e	2.50	2.54	2.58
e1	5.08REF		
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-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
ØP	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
$\theta 1$		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



Shenzhen Sanrise Technology Co., LTD.

<http://www.sanrise-tech.com>

IMPORTANT NOTICE

Shenzhen Sanrise Technology Co., LTD. reserves the right to make changes without further notice to any products or specifications herein. Shenzhen Sanrise Technology Co., LTD. does not assume any responsibility for use of any its products for any particular purpose, nor does Shenzhen Sanrise Technology Co., LTD. assume any liability arising out of the application or use of any its products or circuits. Shenzhen Sanrise Technology Co., LTD. does not convey any license under its patent rights or other rights nor the rights of others.

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