

## General Description

The Sanrise SRC60R200 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 SRC60R200 break down voltage is 600V and it has a high rugged avalanche characteristics, and is available in TO-252, TO-263-2, TO-220F, TO-220C, TO-262 and TO-247 packages.

## Features

- Ultra Low  $R_{DS(ON)} = 200m\Omega @ V_{GS} = 10V$ .
- Ultra Low Gate Charge,  $Q_g = 25.3nC$  typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved

## Application

- LED Lighting Power
- TV Power
- High Power AC/DC Power Supply

## Symbol

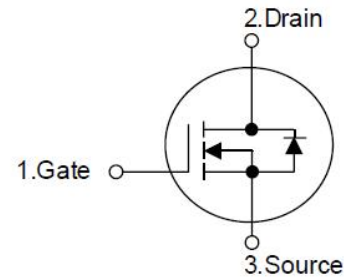


Figure 1 Symbol of SRC60R200

## Package Type

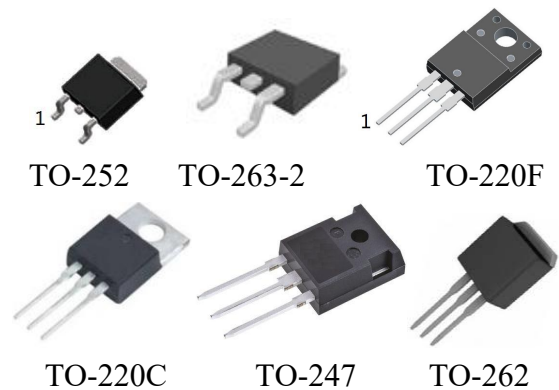
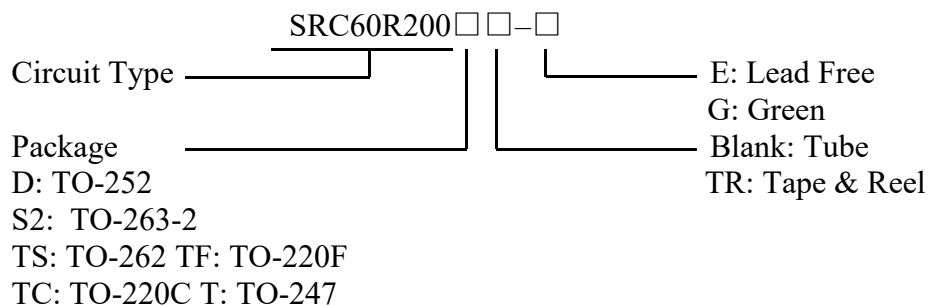


Figure 2 Package Types of SRC60R200

## Ordering Information



Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
TO-252	SRC60R200DTR-E	SRC60R200DTR-G	SRC60R200DE	SRC60R200DG	Tape & Reel
TO-263-2	SRC60R200S2TR-E	SRC60R200S2TR-G	SRC60R200S2E	SRC60R200S2G	Tape & Reel
TO-220F	SRC60R200TF-E	SRC60R200TF-G	SRC60R200TFE	SRC60R200TFG	Tube
TO-220C	SRC60R200TC-E	SRC60R200TC-G	SRC60R200TCE	SRC60R200TCG	Tube
TO-247	SRC60R200T-E	SRC60R200T-G	SRC60R200TE	SRC60R200TG	Tube
TO-262	SRC60R200TS-E	SRC60R200TS-G	SRC60R200TSE	SRC60R200TSG	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	$T_C=25^{\circ}C$	$I_D$	14.0	A
	$T_C=125^{\circ}C$		7.1	
Pulsed Drain Current (Note 3)		$I_{DM}$	43	A
Avalanche Energy, Single Pulse (Note 4)		$E_{AS}$	190	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		$I_S$	16.0	A
Diode Pulse Current		$I_{S,PULSE}$	43	A
MOSFET dv/dt Ruggedness, $V_{DS} \leq 480V$		dv/dt	50	V/ns
Reverse Diode dv/dt, $V_{DS} \leq 480V, I_{SD} \leq I_D$		dv/dt	15	V/ns
Power Dissipation(TO-220F)		$P_{tot}$	31.3	W
Power Dissipation(TO-220C,TO-247,TO-263-3,TO-252)		$P_{tot}$	86.8	W
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:

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.  $I_{AS} = 4.0A, V_{DD} = 60V, R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}C$

**Thermal characteristics**

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	$R_{thJC}$			4.0	°C /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	$R_{thJA}$			80	°C /W
	TO-247				80	
	TO-220C				80	
	TO-263-2				80	
	TO-262				80	
	TO-252				80	

## Electrical Characteristics

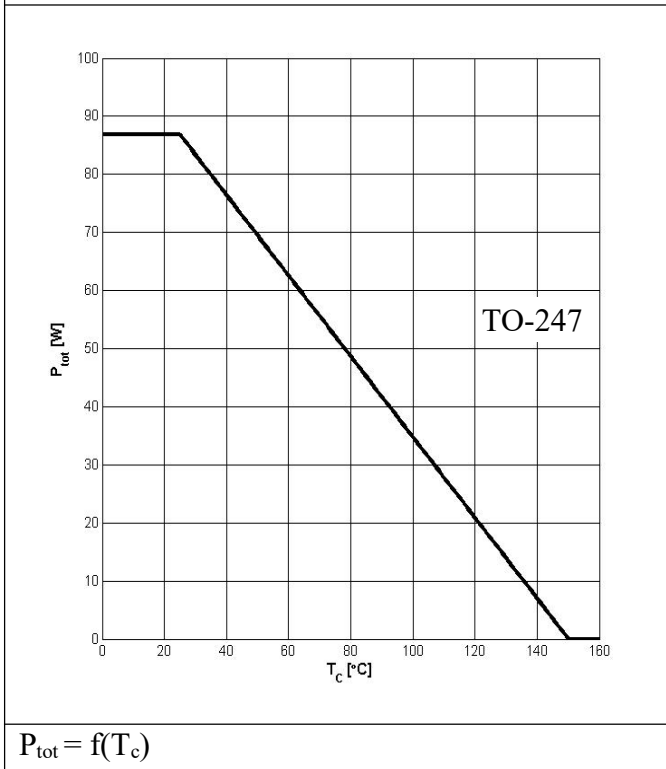
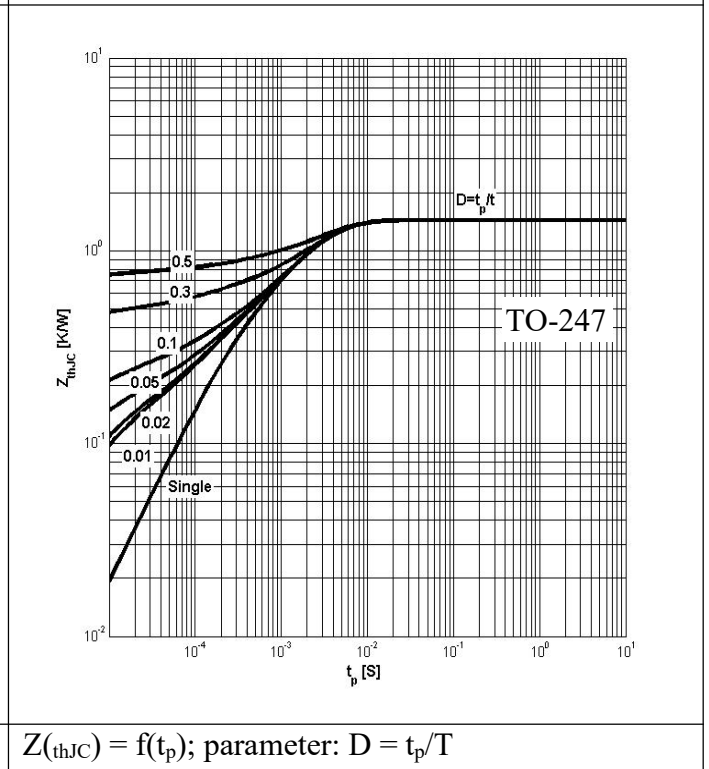
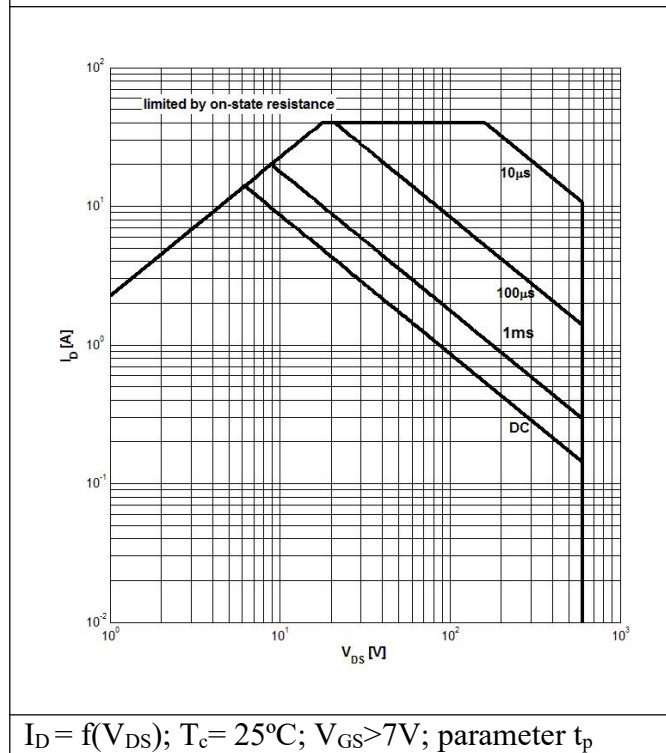
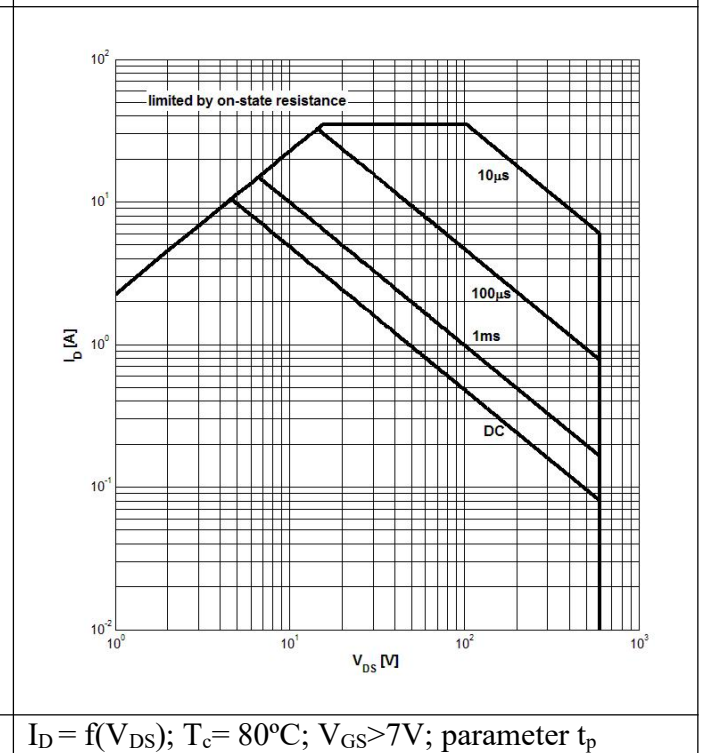
$T_J = 25^\circ\text{C}$ , unless otherwise specified.

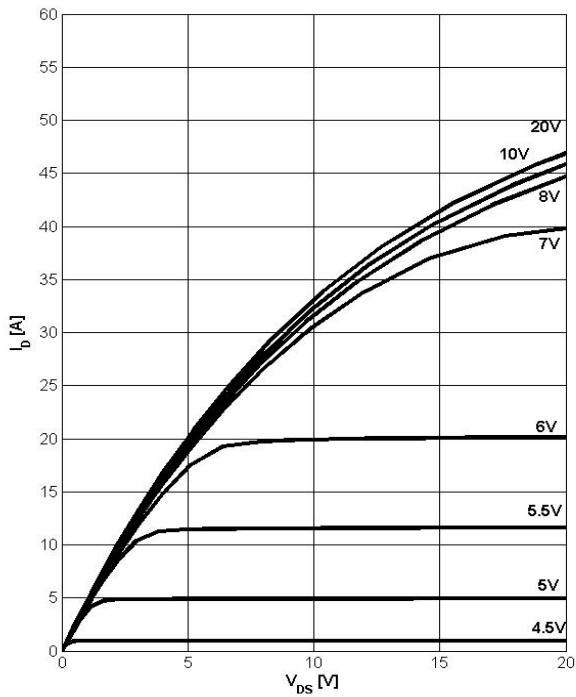
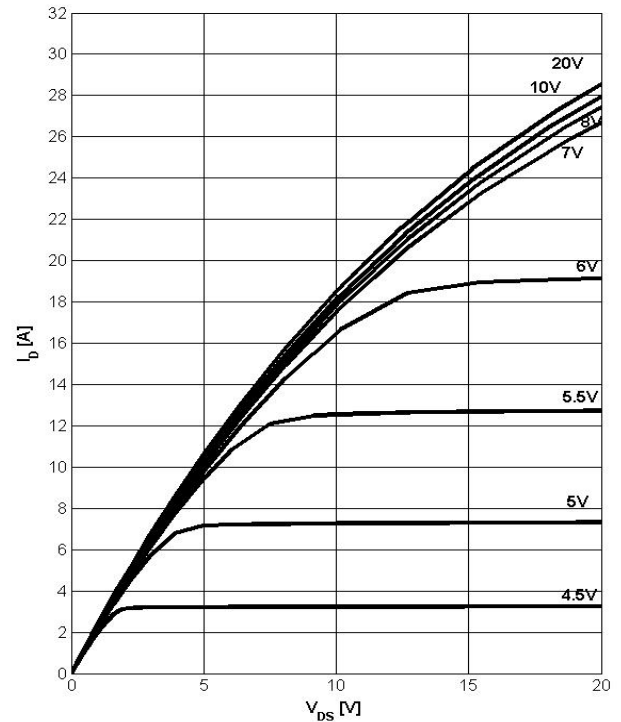
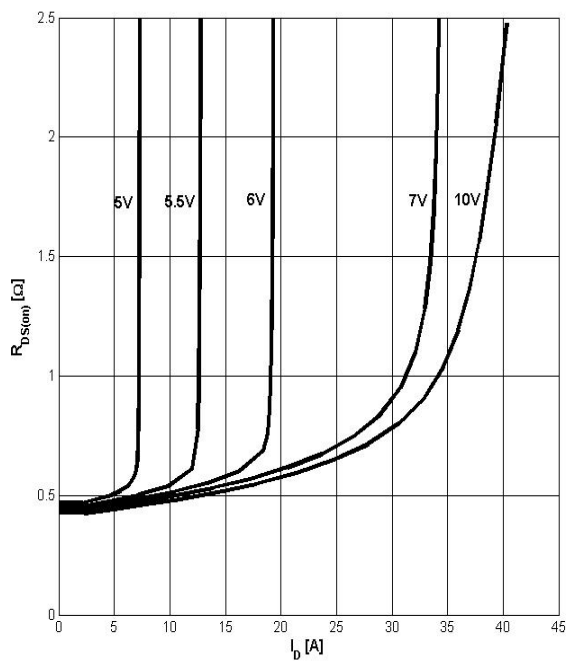
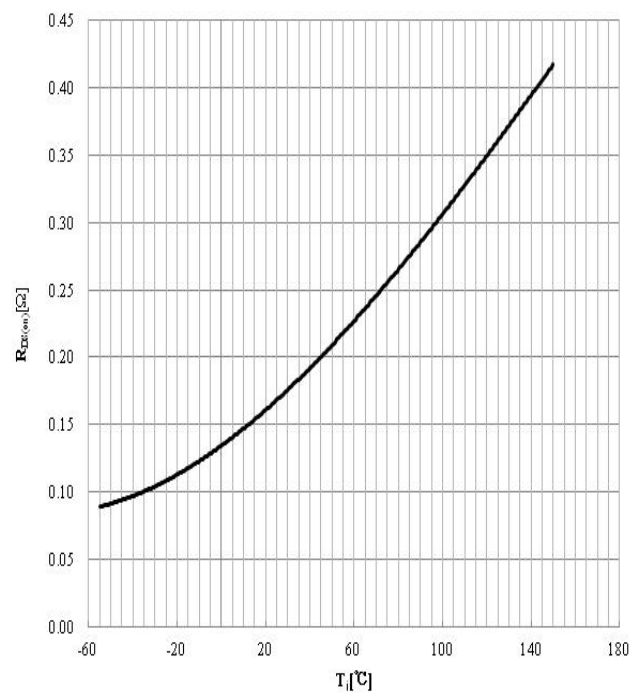
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Statistic Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	600			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V$			1	$\mu A$
Gate-Body Leakage Current	Forward	$I_{GSSF}, V_{GS}=30V, V_{DS}=0V$			100	nA
	Reverse	$I_{GSSR}, V_{GS}=-30V, V_{DS}=0V$			-100	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5	3.4	4.3	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=9.0A$		170	200	mΩ
Gate Resistance	$R_G$	f=1MHz, Open Drain		2.0		Ω
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=50V, V_{GS}=0V, f=1MHz$		1093		pF
Output Capacitance	$C_{OSS}$			86.4		
Reverse Transfer Capacitance	$C_{RSS}$			10		
Effective output capacitance, energy related <sup>NOTE5</sup>	$C_{O(er)}$	$V_{GS}=0V, V_{DS}=0\dots 480V$		51.2		pF
Effective output capacitance, time related <sup>NOTE6</sup>	$C_{O(tr)}$			187.3		
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=400V, I_D=7.0A, R_G=10\Omega, V_{GS}=10V$		12		ns
Rise Time	$t_r$			20		
Turn-off Delay Time	$t_{d(off)}$			24		
Fall Time	$t_f$			50		
<b>Gate Charge Characteristics</b>						
Gate to Source Charge	$Q_{gs}$	$V_{DD}=480V, I_D=7.0A, V_{GS}=0 \text{ to } 10V$		7.2		nC
Gate to Drain Charge	$Q_{gd}$			8.1		
Gate Charge Total	$Q_g$			25.3		
Gate Plateau Voltage	$V_{plateau}$			5.4		V
<b>Reverse Diode Characteristics</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_{SD}=7.0A$		0.81	1.1	V
Reverse Recovery Time	$t_{rr}$	$V_R=400V, I_F=7.0A, dI_F/dt=100A/\mu s$		216.9		ns
Reverse Recovery Charge	$Q_{rr}$			1.7		$\mu C$
Peak Reverse Recovery Current	$I_{rrm}$			16.1		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**

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

**Figure 5: Safe Operating Area**

**Figure 6: Safe Operating Area**


**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**

 $R_{DS(ON)} = f(T_j); I_D = 9.0\text{A}; V_{GS} = 10\text{V}$

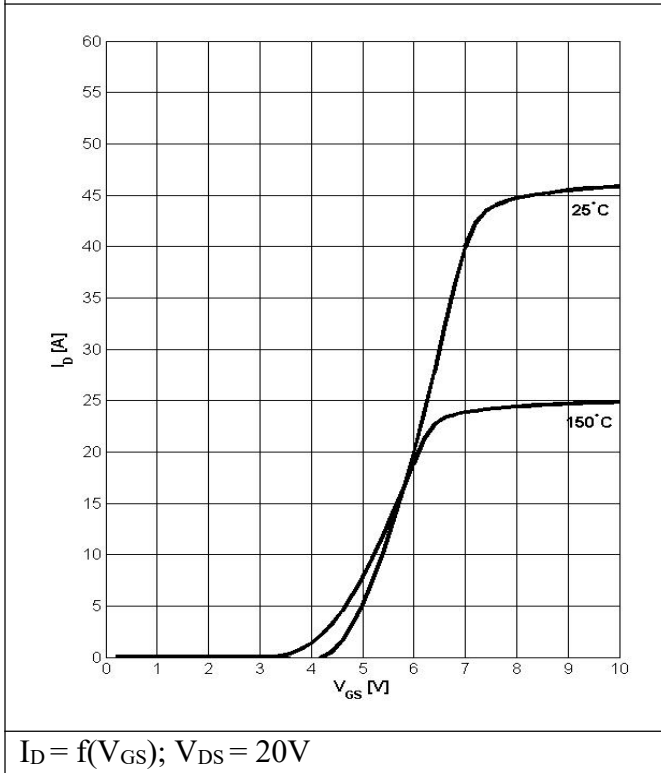
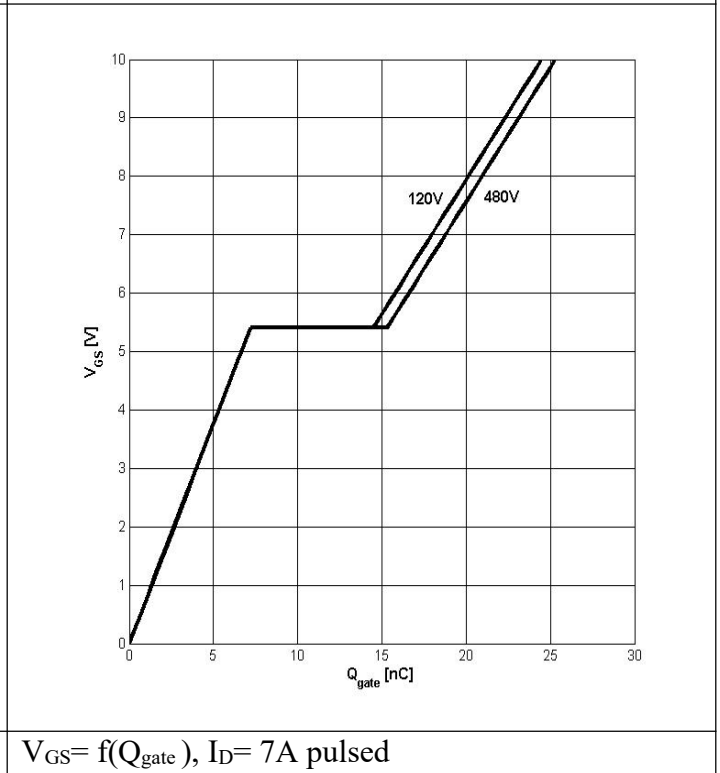
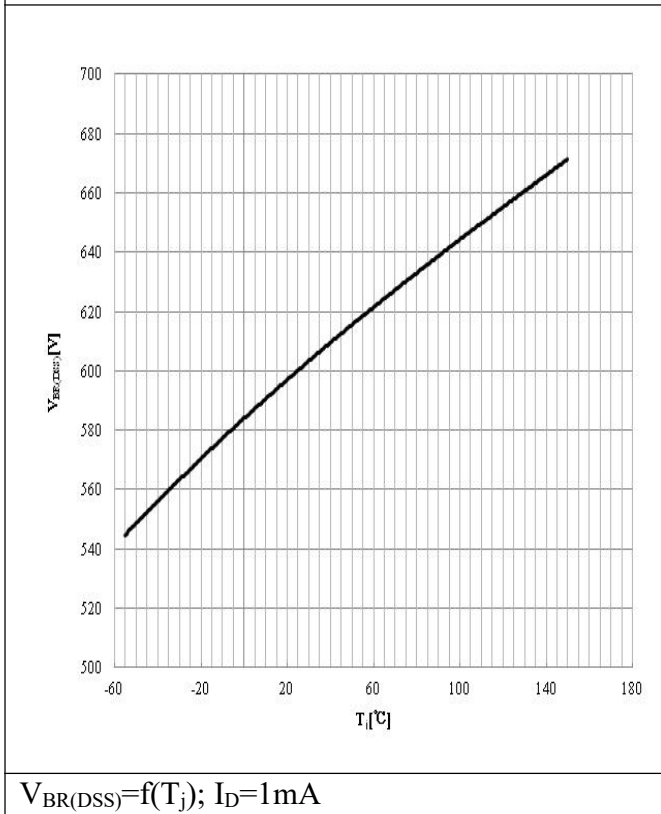
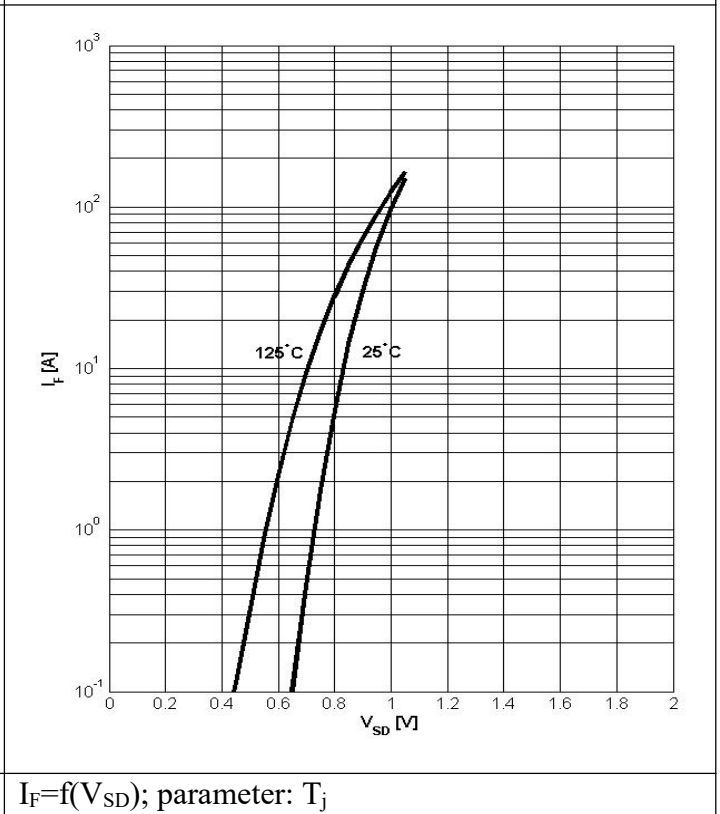
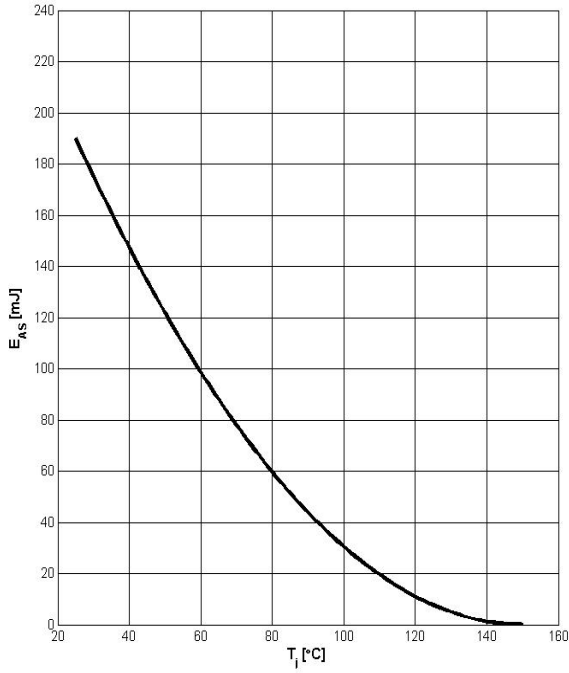
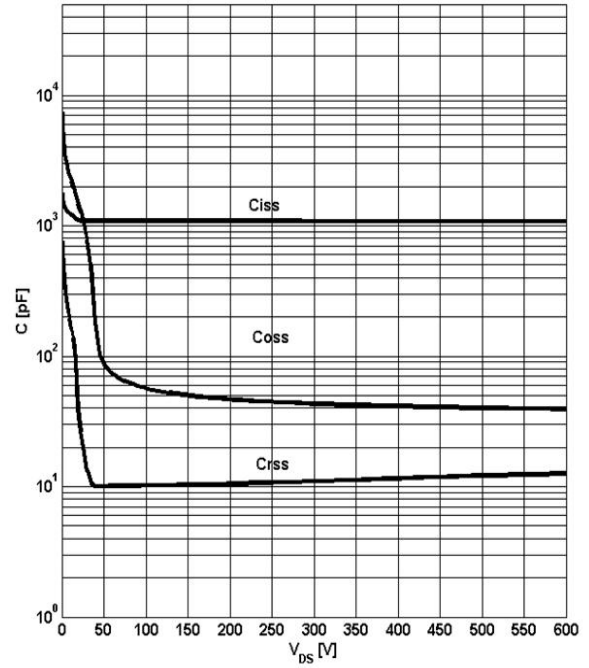
**Figure 11: Typ. Transfer Characteristics**

**Figure 12: Typ. Gate Charge**

**Figure 13: Drain-Source Breakdown Voltage**

**Figure 14: Forward Characteristics of Reverse Diode**


Figure 15: Avalanche Energy



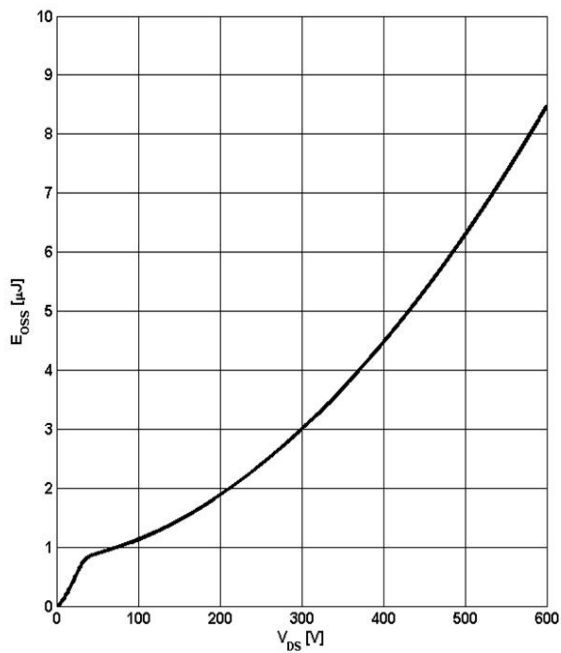
$E_{AS}=f(T_j)$ ;  $I_D=4.0A$ ;  $V_{DD}=60V$

Figure 16: Typ. Capacitances

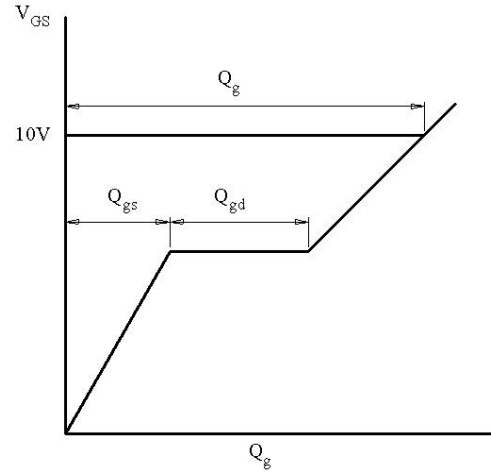
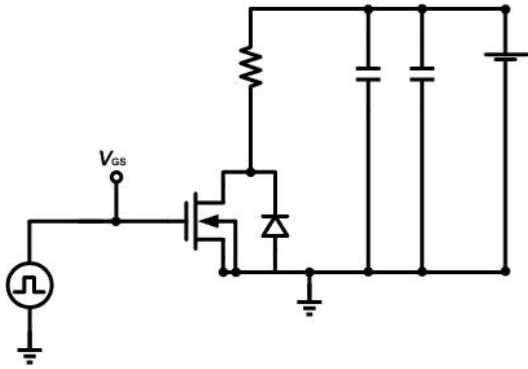
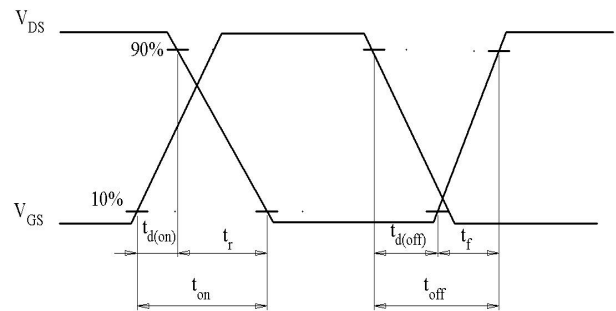
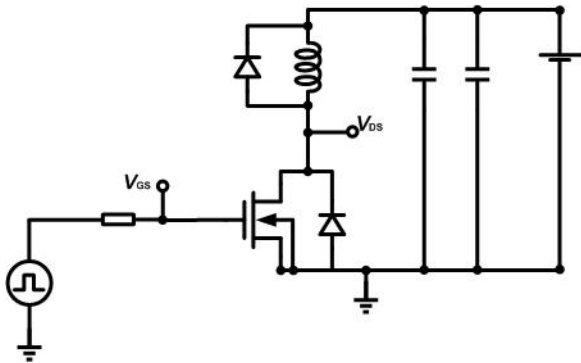
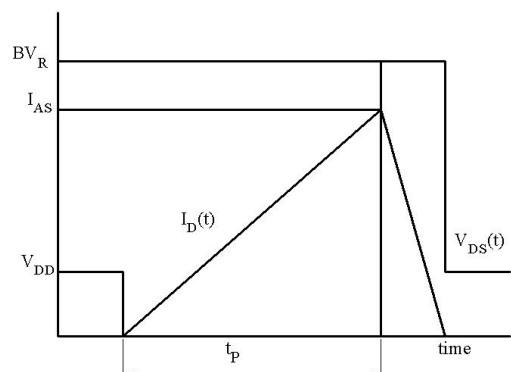
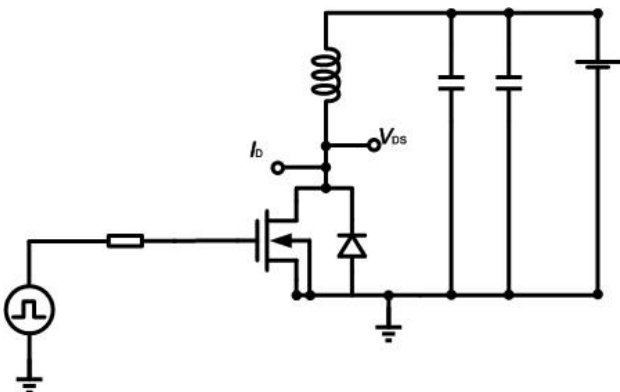


$C=f(V_{DS})$ ;  $V_{GS}=0$ ;  $f=1MHz$

Figure 17:  $C_{OSS}$  Stored Energy

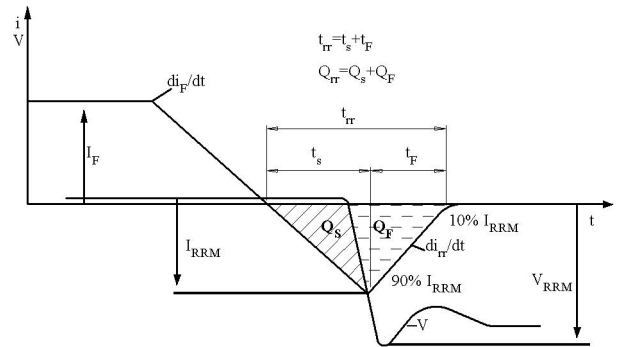
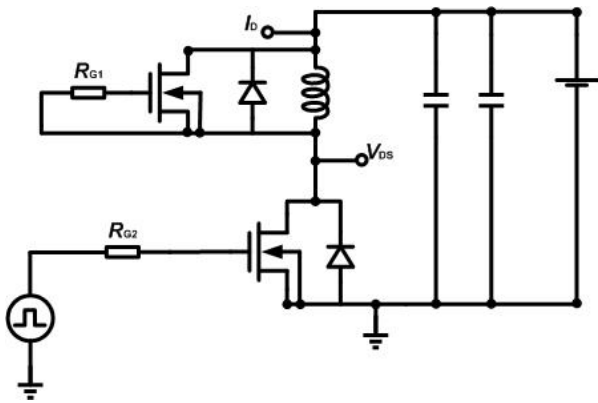


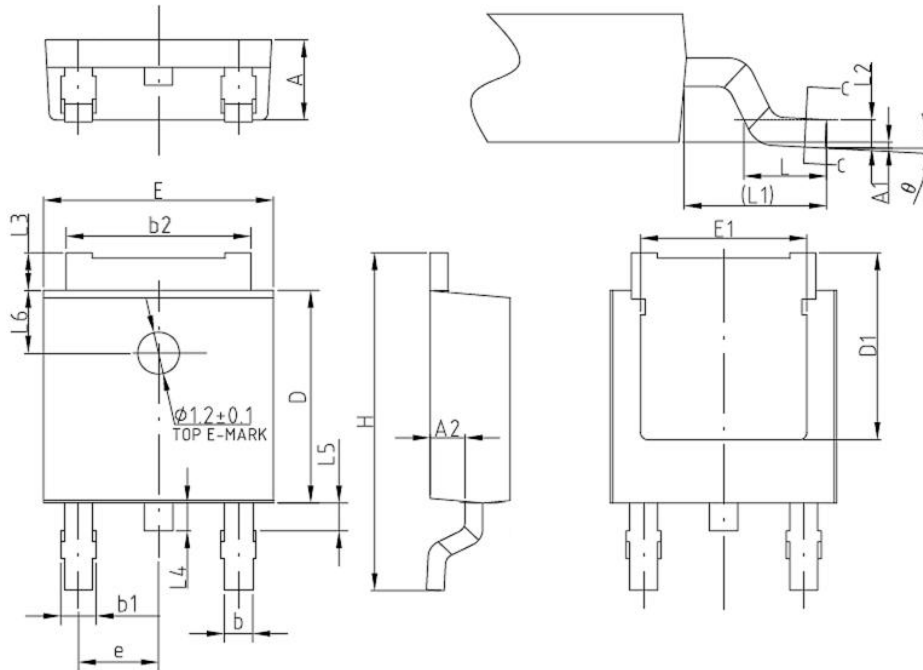
$E_{OSS}=f(V_{DS})$

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

**2. Switch Time Test Circuit**

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


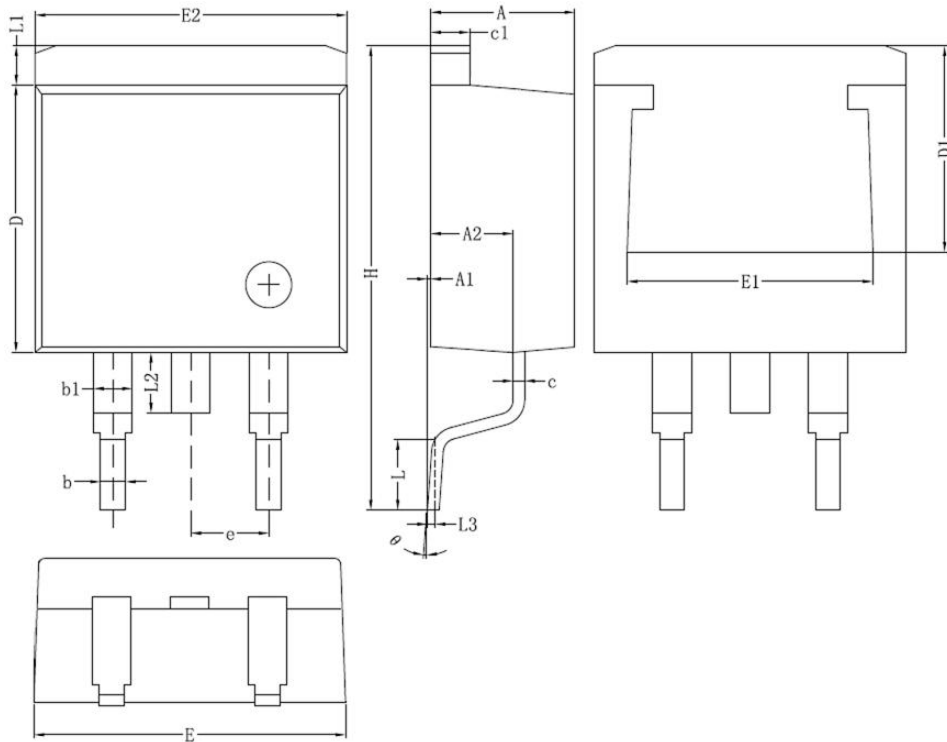


**4. Test Circuit and Waveform for Diode Characteristics**

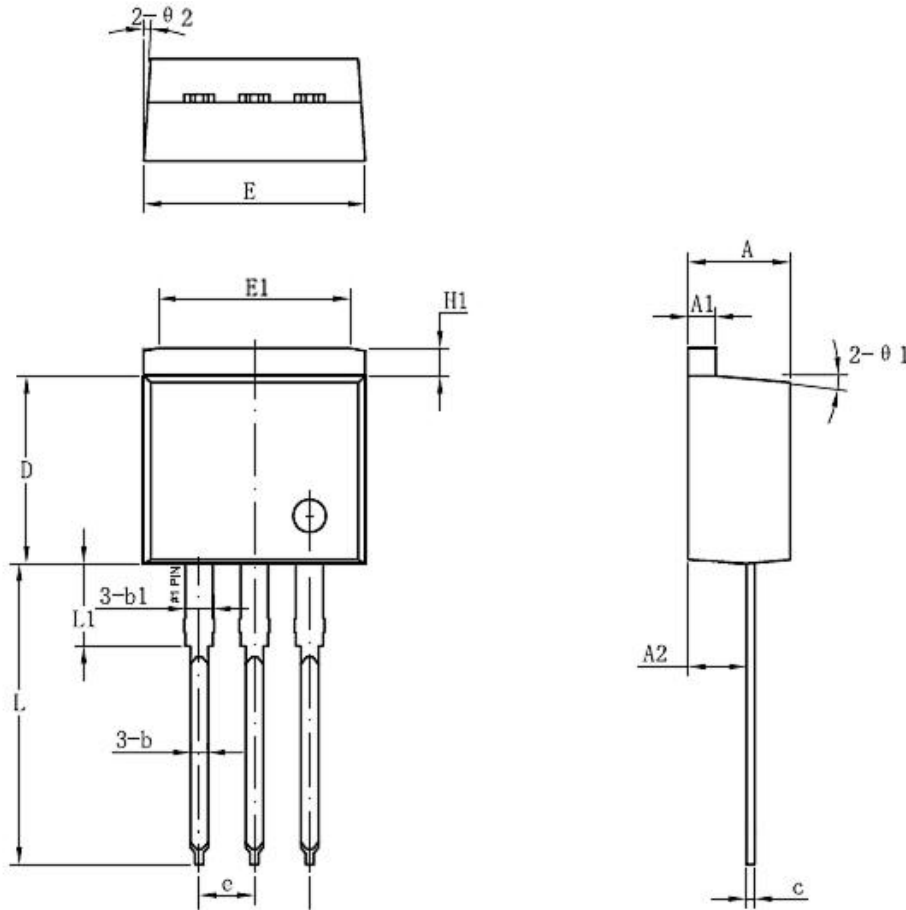


**Mechanical Dimensions**
**TO-252**
**Unit: mm**


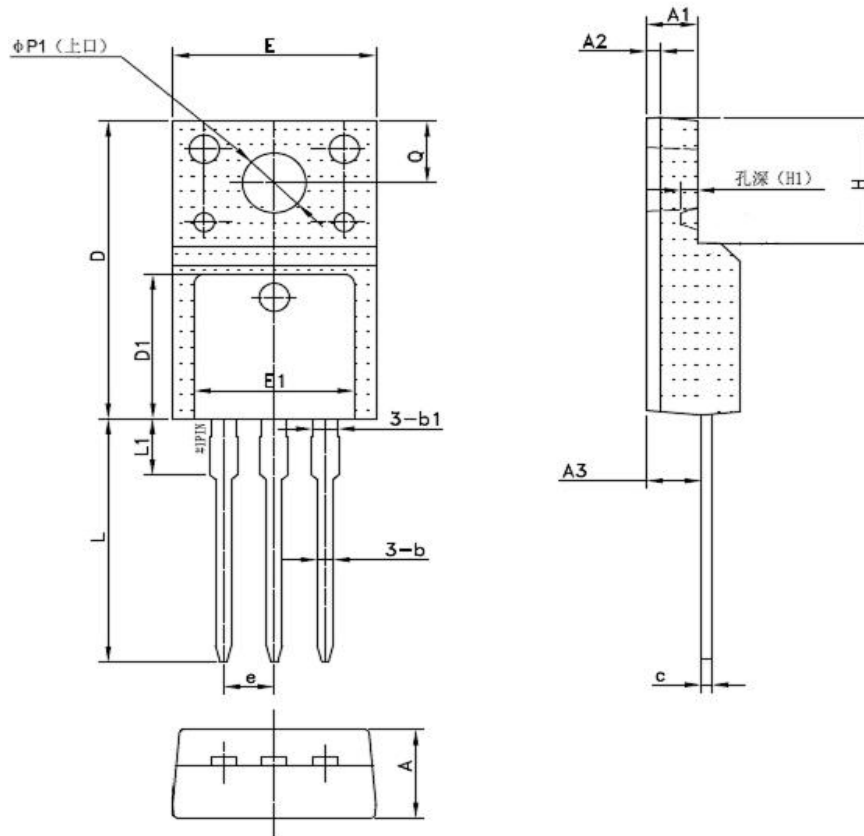
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.40
A1	0	-	0.10
A2	0.90	1.00	1.17
b	0.70	0.76	0.90
b1	0.77	-	1.10
b2	5.13	5.33	5.46
c	0.45	-	0.60
D	5.95	6.10	6.25
D1	-	5.30	-
E	6.45	6.60	6.75
E1	-	4.80	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.25	1.50	1.75
L1	-	2.90	-
L2	-	0.51	-
L3	0.90	-	1.25
L4	-	0.80	-
L5	-	1.00	-
L6	-	1.80	-
$\theta$	0°	-	8°

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


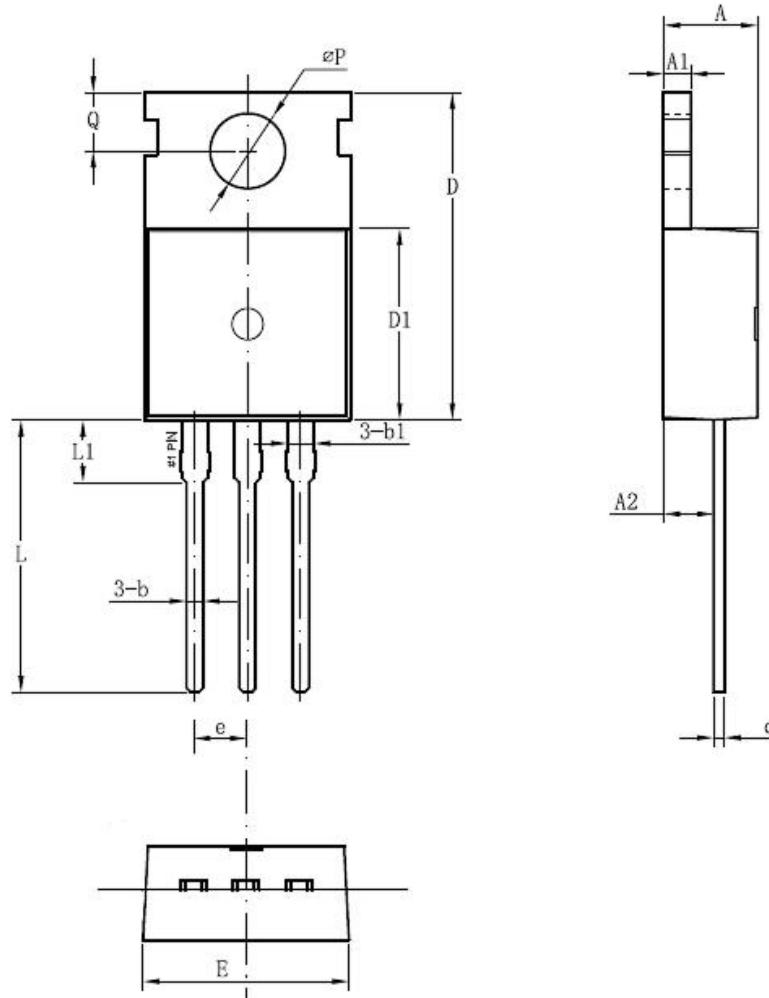
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.60	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.70	0.81	0.96
b1	-	1.27	-
c	0.36	0.40	0.61
c1	1.15	1.27	1.40
D	8.55	-	9.40
D1	6.40	-	-
E	9.80	10.10	10.31
E1	7.60	-	-
E2	9.80	10.00	10.20
e	2.54(BSC)		
H	14.70	15.20	16.00
L	2.00	2.30	2.84
L1	1.00	1.27	1.40
L2	-	-	2.20
L3	-	0.25	-
θ	0°	-	8°

**Mechanical Dimensions (Continued)**
**TO-262**
**Unit: mm**


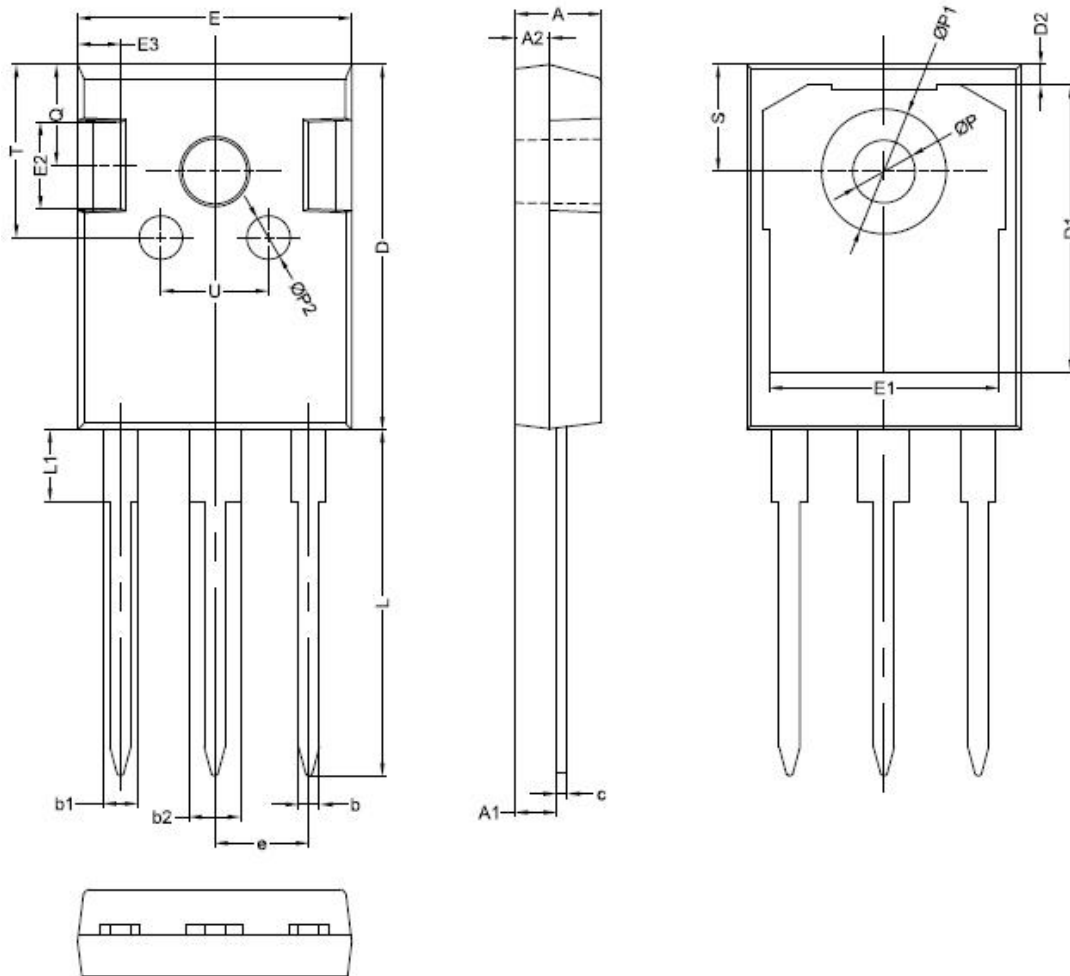
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.65	4.85
A1	1.17	1.27	1.40
A2	2.20	-	2.89
b	0.70	0.81	0.96
b1	-	1.27	-
c	0.36	0.40	0.61
D	8.55	-	9.4
E	9.80	10.10	10.31
E1	-	8.80	-
e	2.54(BSC)		
H1	1.00	1.25	1.40
L	12.60	-	14.08
L1	-	3.8	-
θ1		5°	
θ2		4°	

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


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.70	4.90
A1	2.34	2.54	2.90
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.55	-	0.95
b1	-	1.28	-
c	0.42	0.50	0.70
D	14.70	-	16.07
D1	-	7.70	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54(BSC)		
H	-	6.70	-
(H1)	-	(0.81)	-
L	12.48	12.98	13.50
L1	-	2.93	-
ΦP1	-	3.18	-
Q	2.90	3.30	3.50

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


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.50	4.70
A1	1.20	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(BSC)		
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

**Mechanical Dimensions (Continued)**
**TO-247**
**Unit: mm**


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.80	5.00	5.20	E2	-	5.00	-
A1	2.21	2.41	2.61	E3	-	2.50	-
A2	1.90	2.00	2.10	e	5.44(BSC)		
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	-	-	7.40
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	16.00	T	-	10.00	-
E1	-	13.30	-	U	-	6.20	-



Shenzhen Sanrise Technology Co., LTD

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