230mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R230B

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 $R_{DS(ON)}$ = 230mΩ @ V_{GS} = 10V.
- Ultra Low Gate Charge, Qg=25.6nC typ.
- Intrinsic Fast-Recovery Body Diode
- Fast switching capability
- Robust design with better EAS performance

Application

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

Symbol

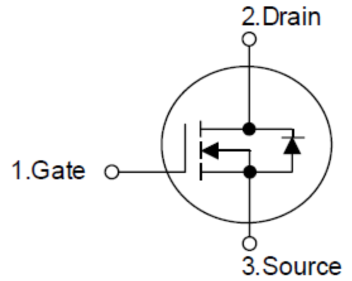


Figure 1 Symbol of SRC60R230B

Package Type

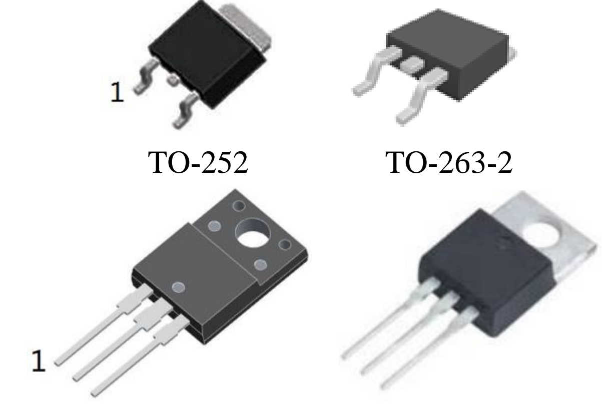
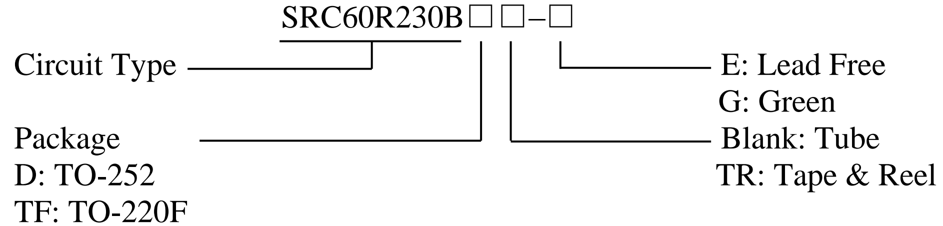


Figure 2 Package Types of SRC60R230B

Ordering Information



Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
TO-252	SRC60R230BDTR-E	SRC60R230BDTR-G	SRC60R230BDE	SRC60R230BDG	Tape & Reel
TO-263-2	SRC60R230BS2TR-E	SRC60R230BS2TR-G	SRC60R230BS2E	SRC60R230BS2G	Tape & Reel
TO-220F	SRC60R230BTF-E	SRC60R230BTF-G	SRC60R230BTFE	SRC60R230BTFG	Tube
TO-220C	SRC60R230BTC-E	SRC60R230BTC-G	SRC60R230BTCE	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℃	I_D	13.7	A
	T_C=125℃		6.5	
Pulsed Drain Current (Note 3)		I_{DM}	41.1	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	13.7	A
Diode Pulse Current		$I_{S.PULSE}$	41.1	A
MOSFET dv/dt Ruggedness, V_{DS}<=480V		dv/dt	50	V/ns
Reverse Diode dv/dt, V_{DS}<=480V, I_{SD}<=I_D		dv/dt	15	V/ns
Operating Junction Temperature		T_J	150	℃
Storage Temperature		T_{STG}	-55 to 150	℃
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	℃

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 = 25Ω, Starting T_J = 25°C

Electrical Characteristics

T_J = 25℃, 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
Gate-Body Leakage Current – Reverse	I_{GSSR}	V_{GS}=-30V, V_{DS}=0V			-100	nA
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

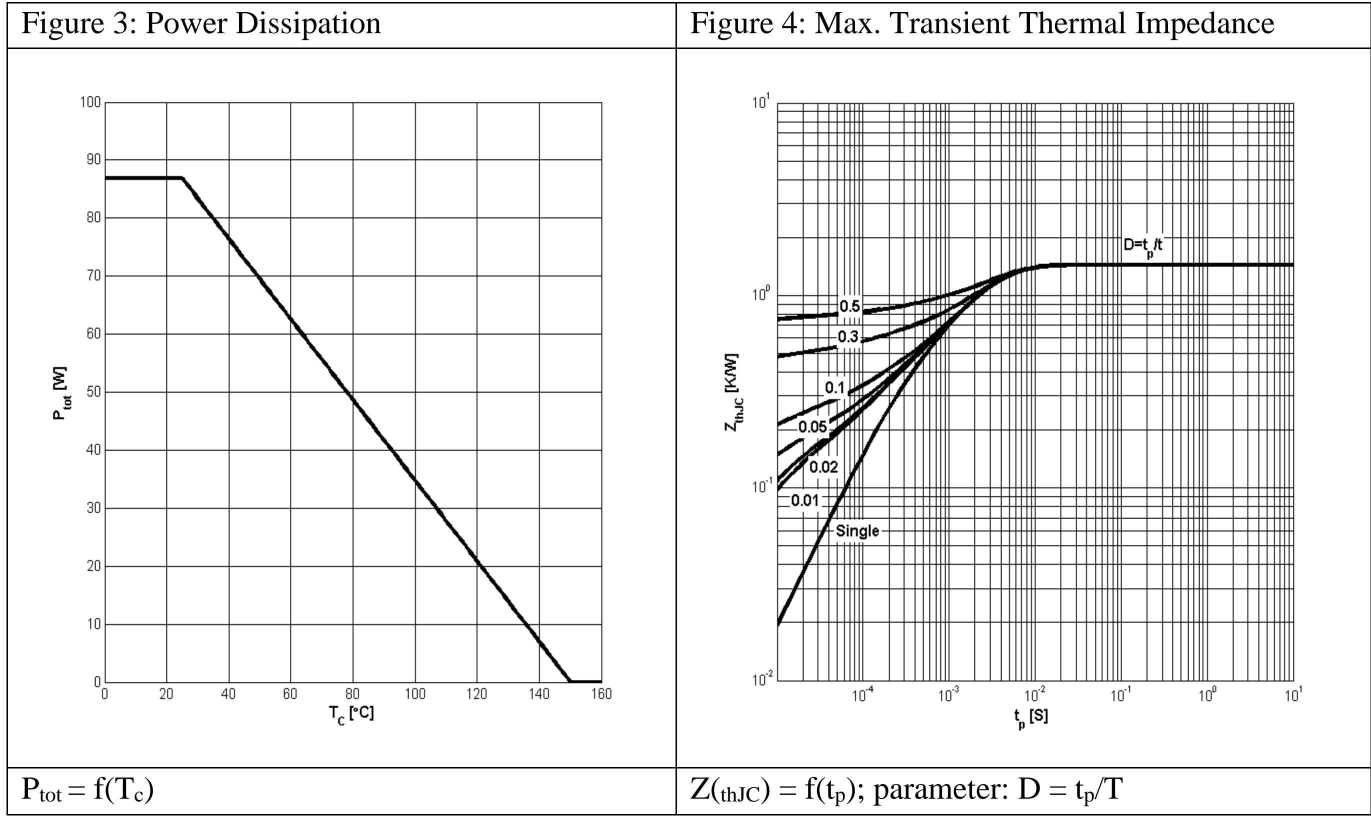


Figure 3: Power Dissipation	Figure 4: Max. Transient Thermal Impedance
$P_{tot} = f(T_c)$	$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$

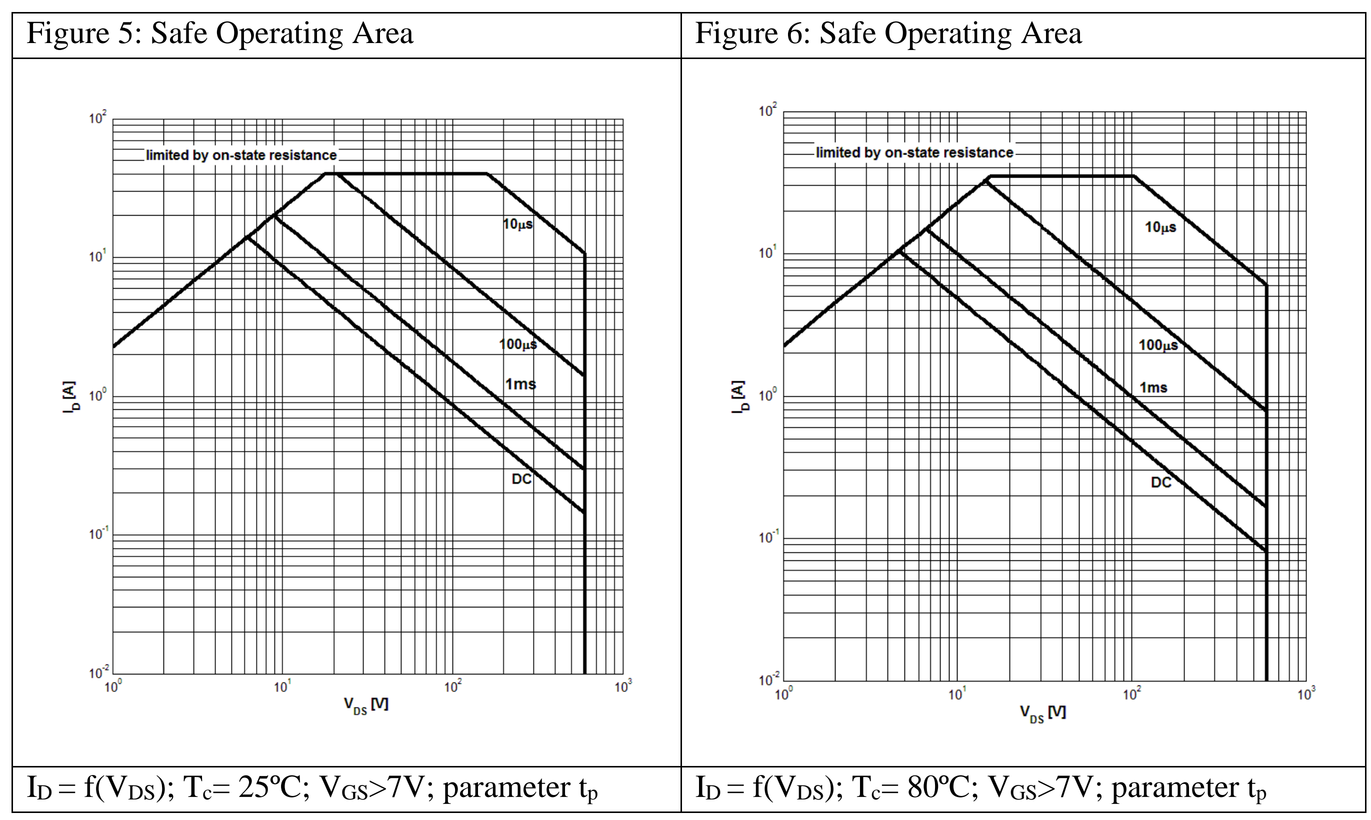


Figure 5: Safe Operating Area	Figure 6: Safe Operating Area
$I_D = f(V_{DS})$; T_c= 25℃; V_{GS}>7V; parameter t_p	$I_D = f(V_{DS})$; T_c= 80℃; V_{GS}>7V; parameter t_p

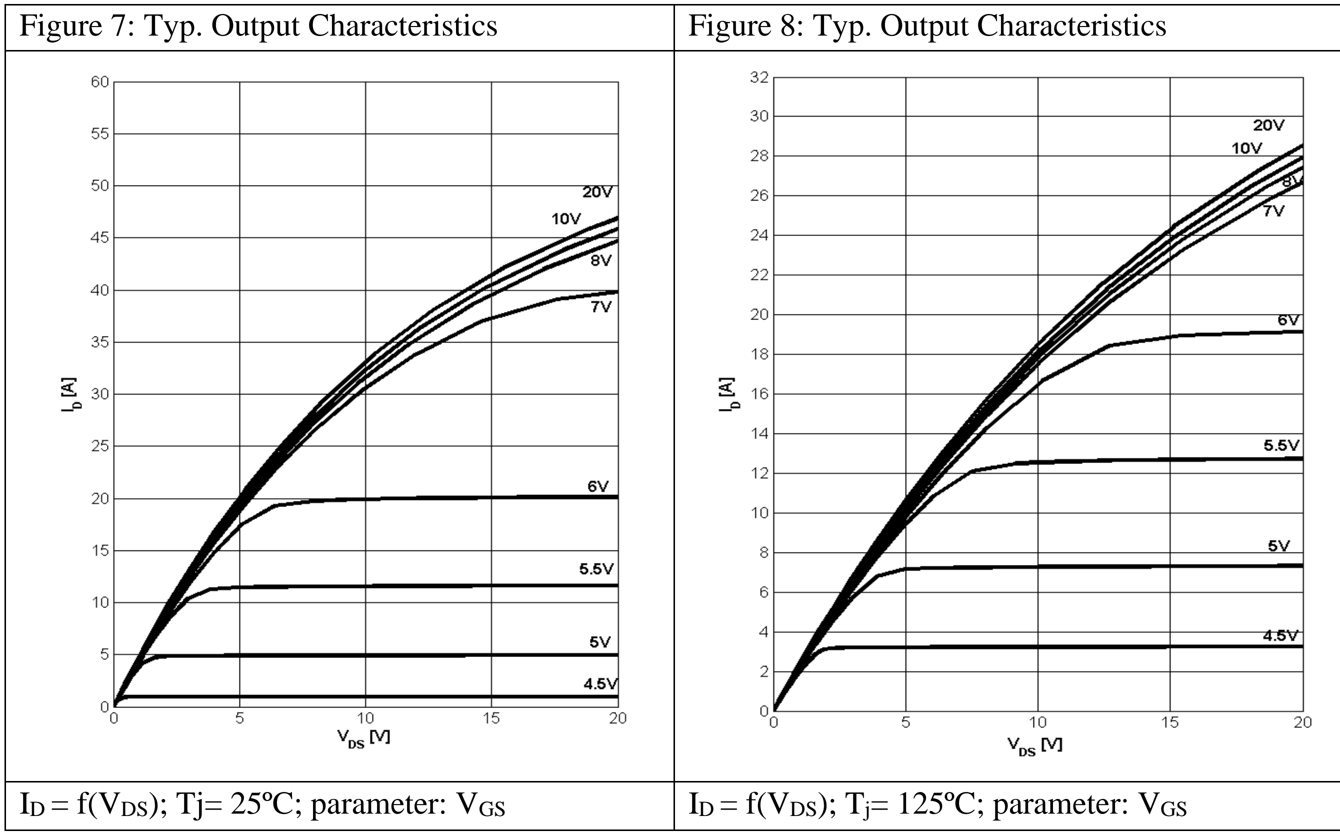


Figure 7: Typ. Output Characteristics	Figure 8: Typ. Output Characteristics
$I_D = f(V_{DS})$; Tj= 25°C; parameter: V_{GS}	$I_D = f(V_{DS})$; T_j= 125°C; parameter: V_{GS}

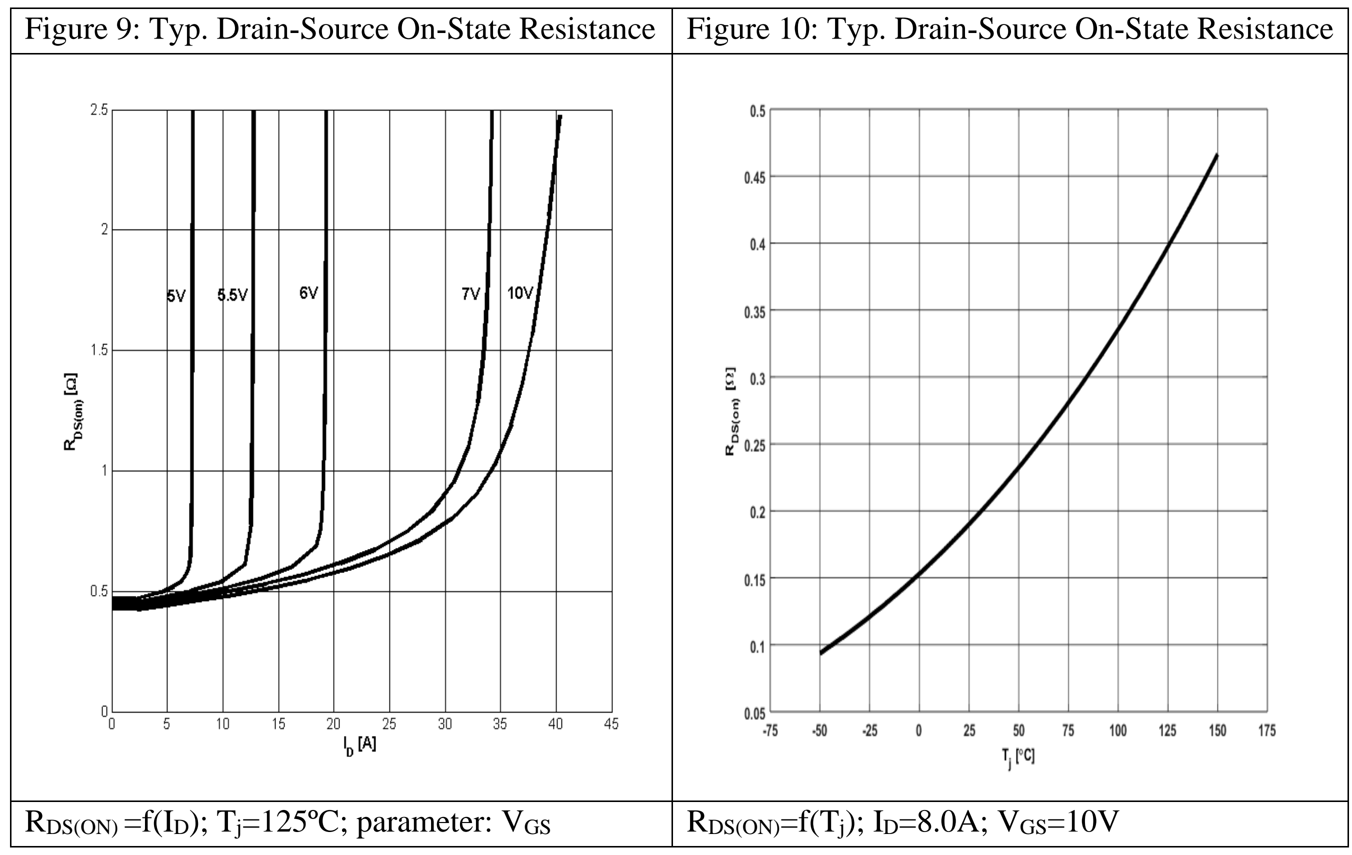
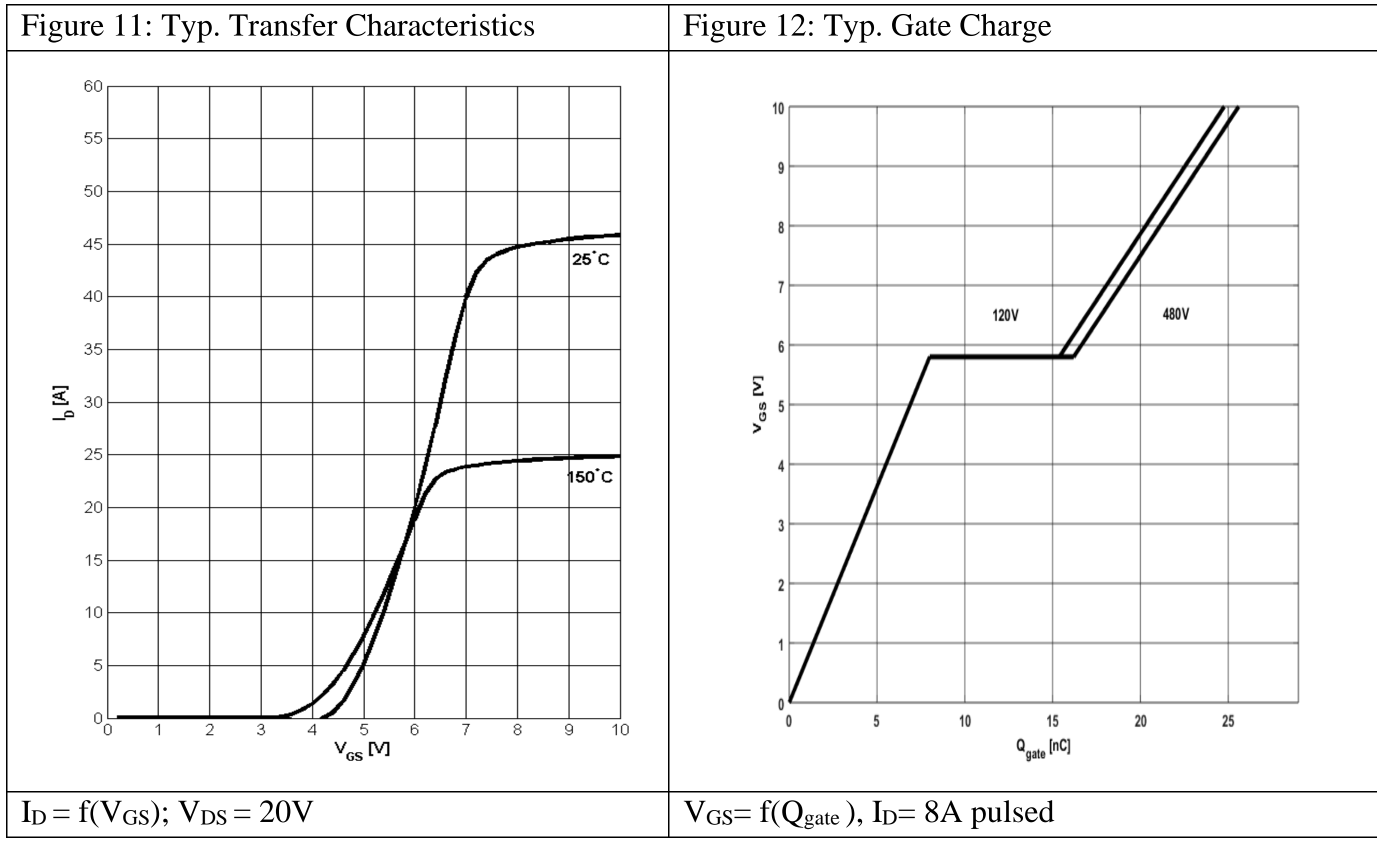
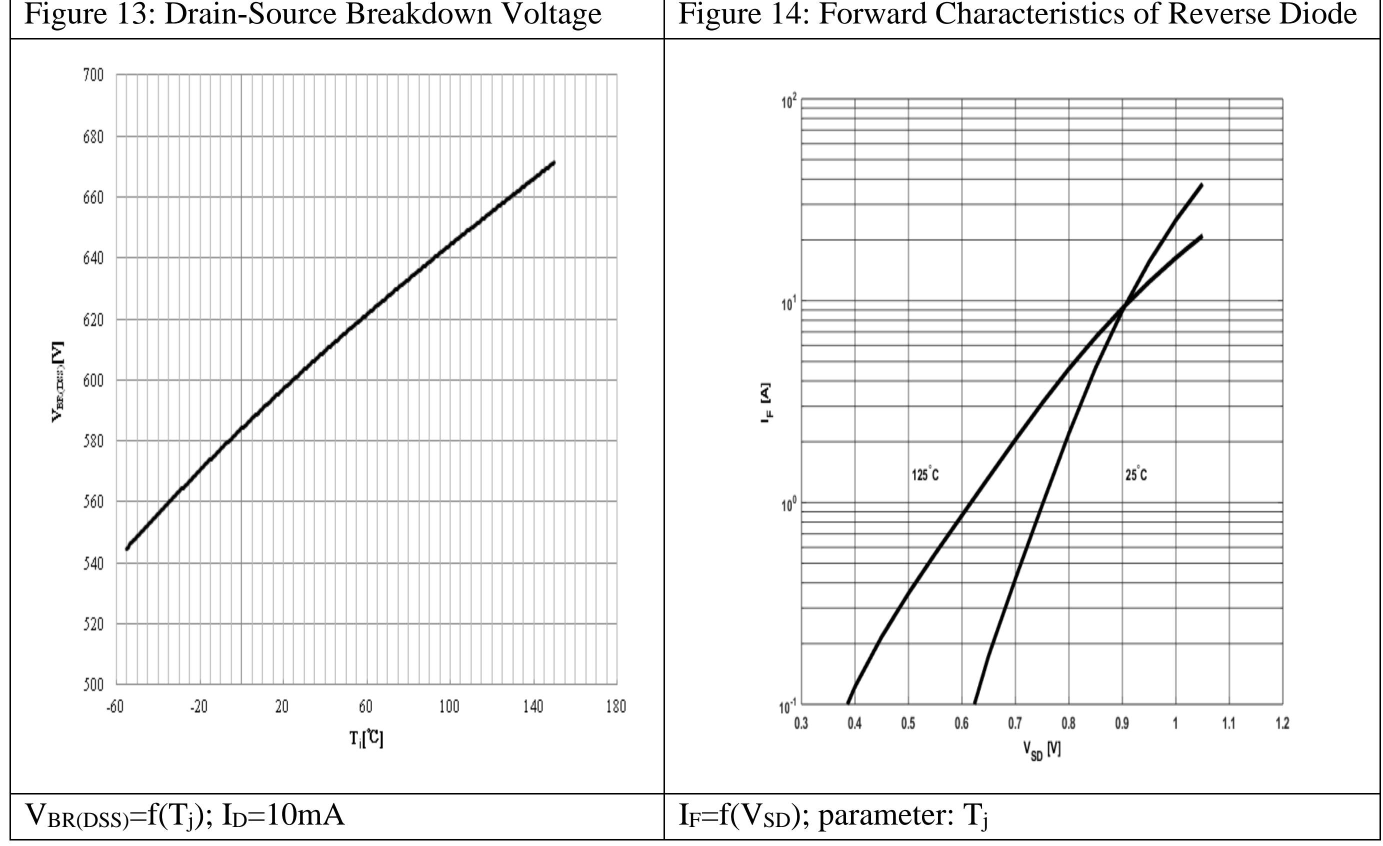


Figure 9: Typ. Drain-Source On-State Resistance	Figure 10: Typ. Drain-Source On-State Resistance
$R_{DS(ON)} = f(I_D)$; T_j=125°C; parameter: V_{GS}	$R_{DS(ON)} = f(T_j)$; I_D=8.0A; V_{GS}=10V



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

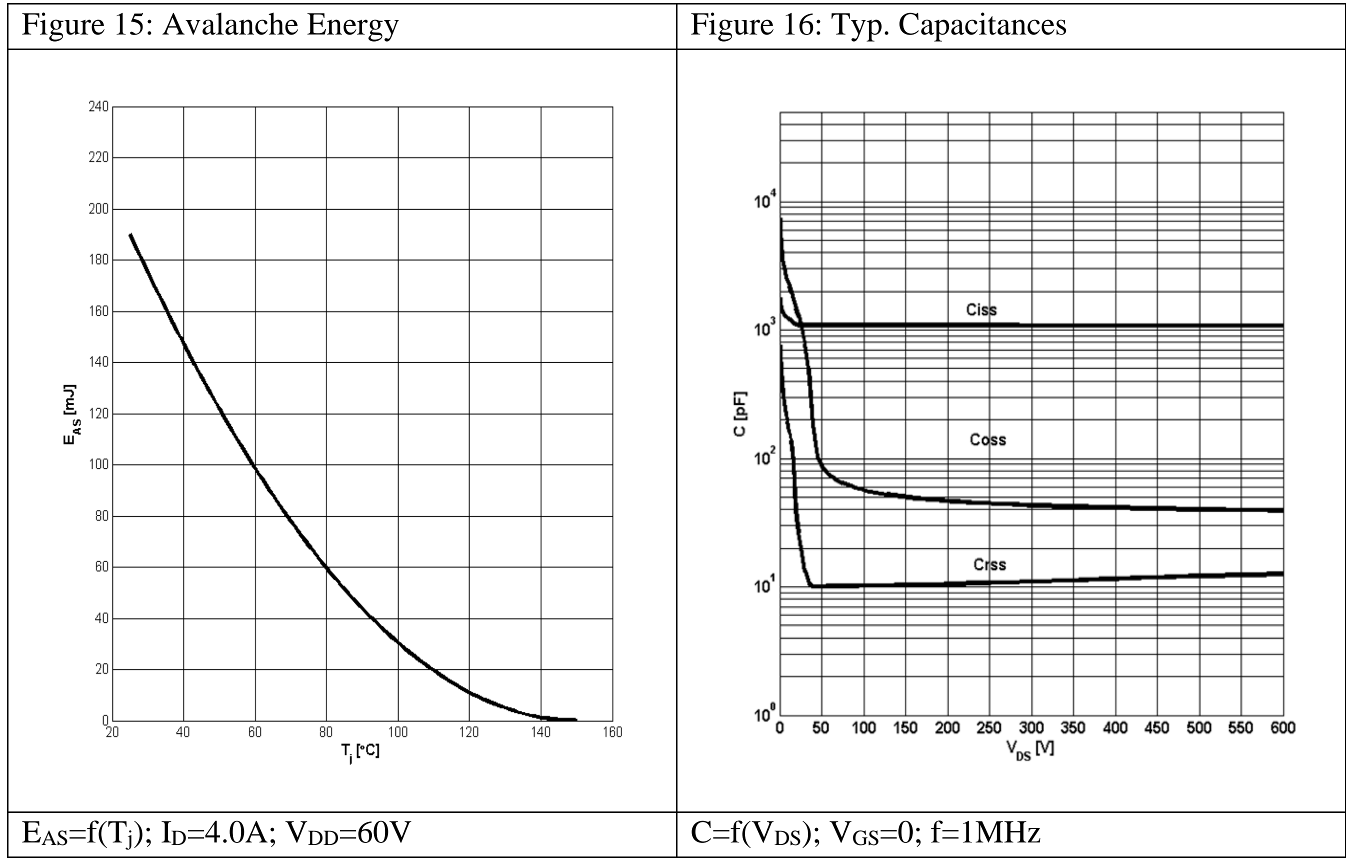
$V_{GS}= f(Q_{gate})$, $I_D= 8A$ pulsed



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

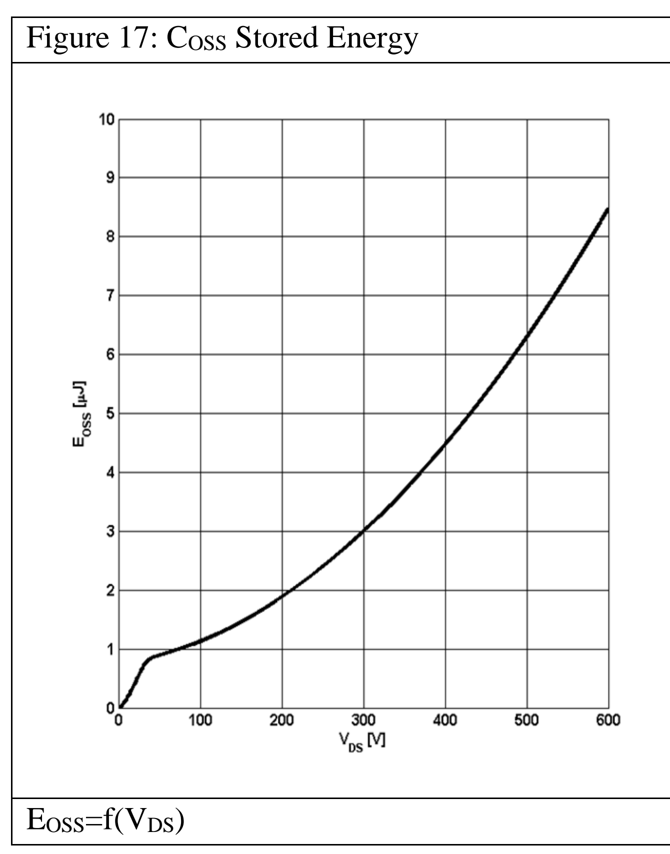
$I_F=f(V_{SD})$; parameter: T_j

Figure 15: Avalanche Energy	Figure 16: Typ. Capacitances



$E_{AS}=f(T_j)$; $I_D=4.0A$; $V_{DD}=60V$	$C=f(V_{DS})$; $V_{GS}=0$; $f=1MHz$

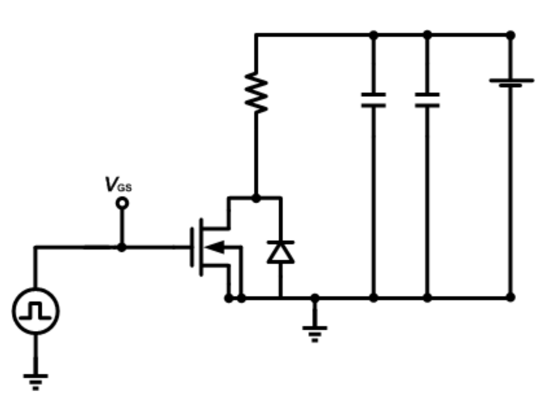
Figure 17: C_{OSS} Stored Energy

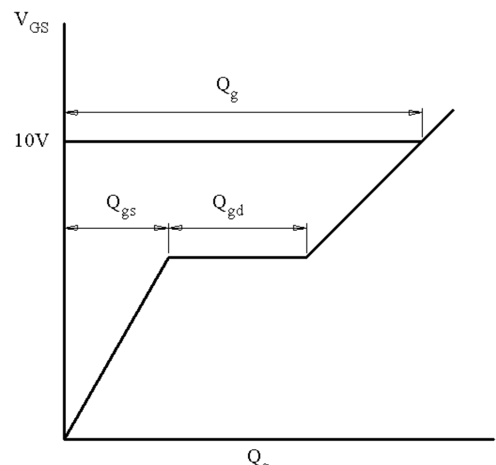


$E_{OSS}=f(V_{DS})$

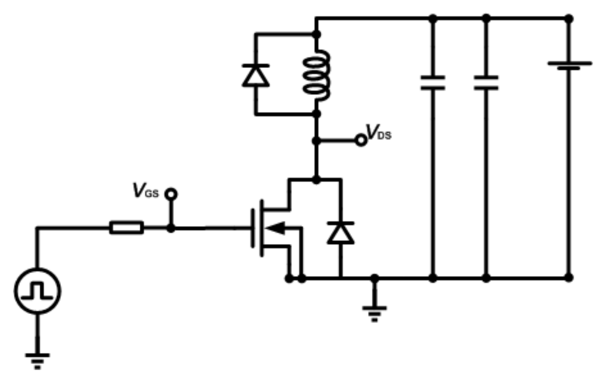
Test Circuits

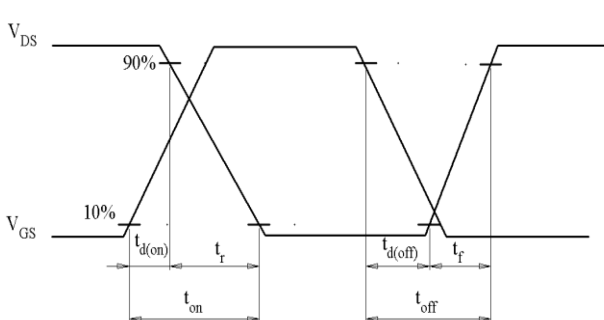
1. Gate Charge Test Circuit & Waveform



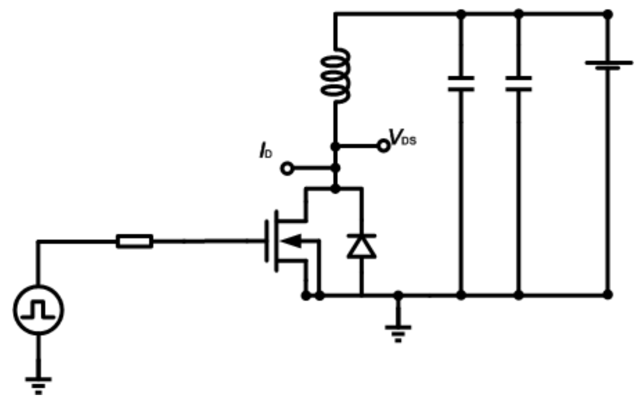


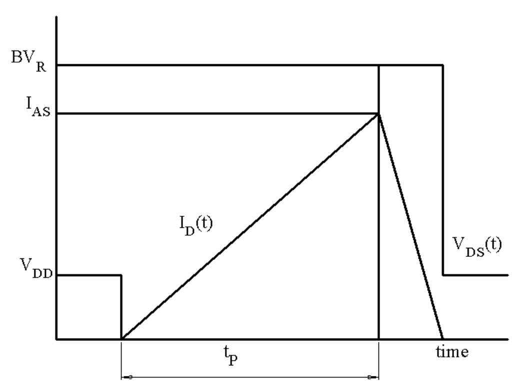
2. Switch Time Test Circuit



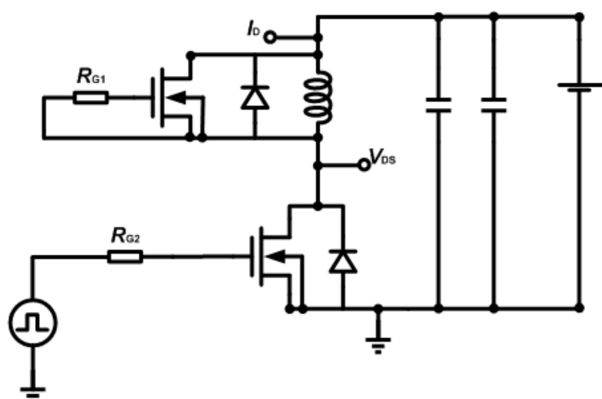


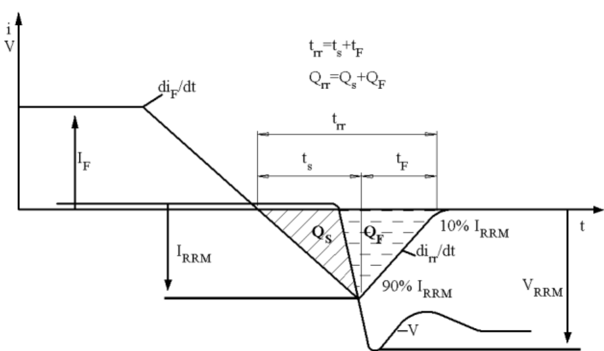
3. Unclaimed Inductive Switching Test Circuit & Waveforms





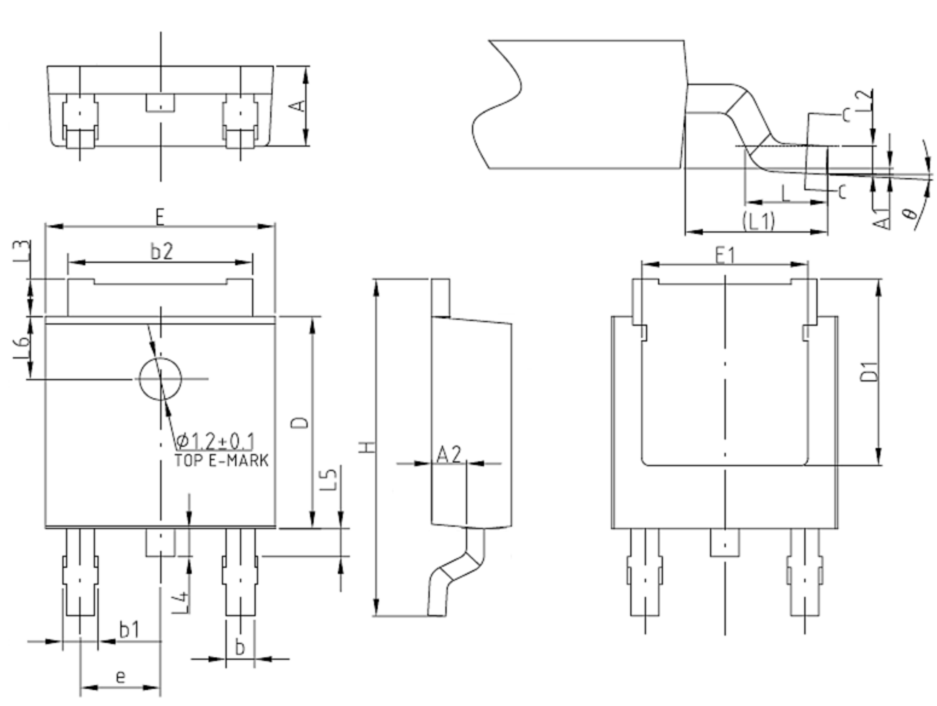
4. Test Circuit and Waveform for Diode Characteristics





Mechanical Dimensions

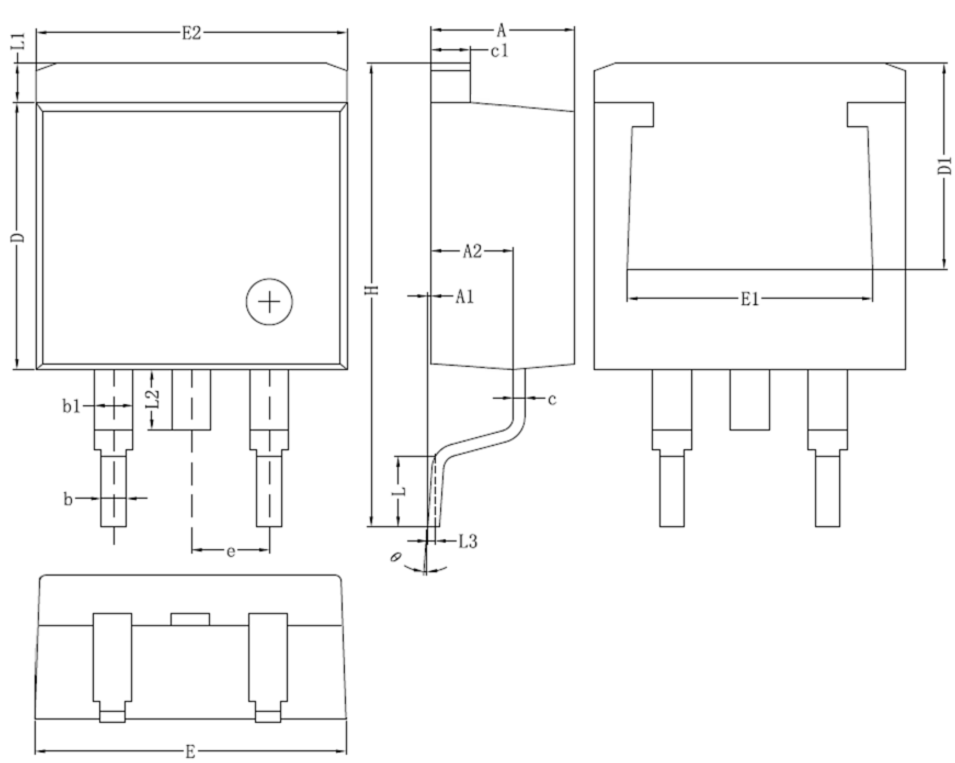
TO-252 **Unit: mm**



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	-
θ	0°	-	8°

Mechanical Dimensions (Continued)

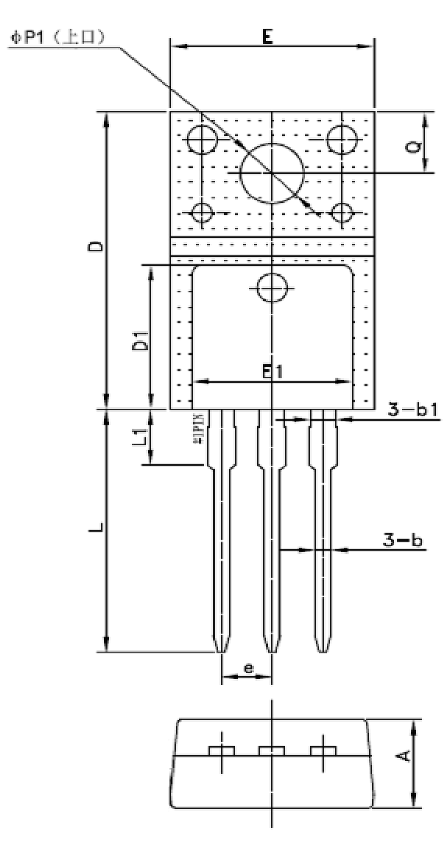
TO-263-2 Unit: mm

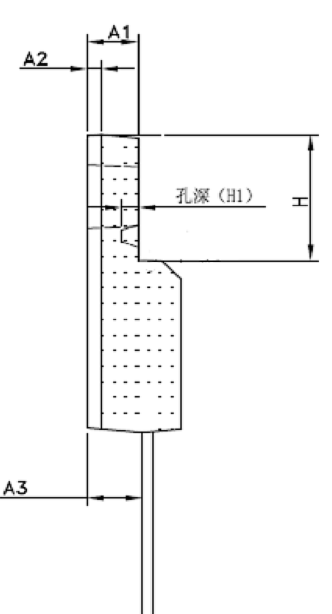


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.60	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.70	0.81	0.96
b1	-	1.27	-
c	0.36	0.40	0.61
c1	1.15	1.27	1.40
D	8.55	-	9.40
D1	6.40	-	-
E	9.80	10.10	10.31
E1	7.60	-	-
E2	9.80	10.00	10.20
e	2.54(BSC)		
H	14.70	15.20	16.00
L	2.00	2.30	2.84
L1	1.00	1.27	1.40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

Mechanical Dimensions (Continued)

TO-220F **Unit: mm**

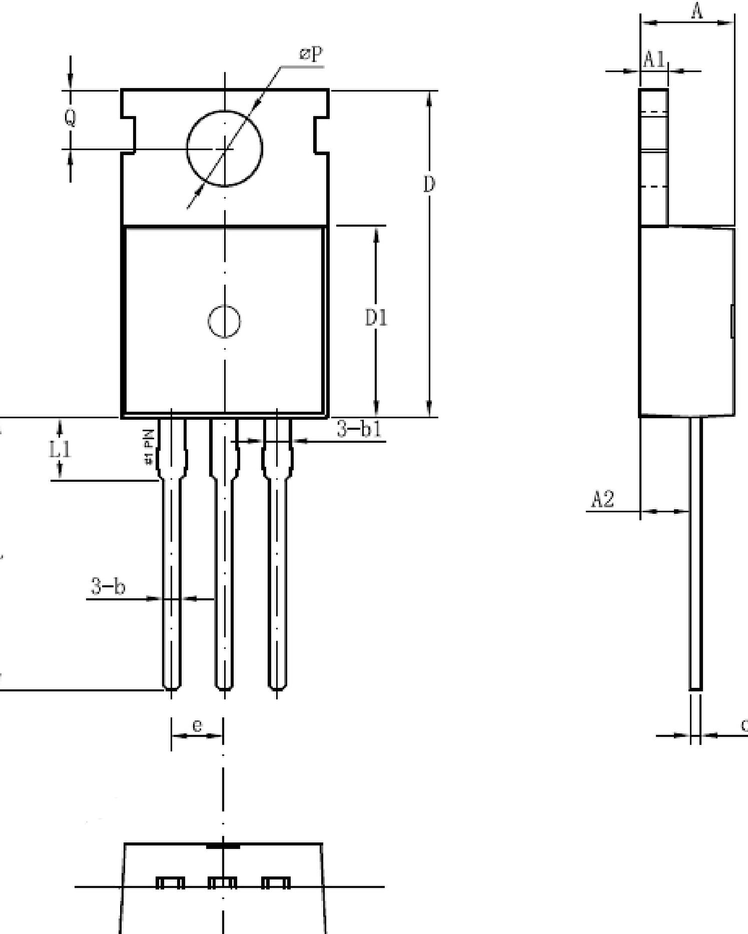




Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.70	4.90
A1	2.34	2.54	2.90
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.55	-	0.95
b1	-	1.28	-
c	0.42	0.50	0.70
D	14.70	-	16.07
D1	-	7.70	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54(BSC)		
H	-	6.70	-
(H1)	-	(0.81)	-
L	12.48	12.98	13.50
L1	-	2.93	-
ΦP1	-	3.18	-
Q	2.90	3.30	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	-
ΦP	3.50	3.60	3.80
Q	2.60	2.80	3.00

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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

S Shenzhen Sanrise Technology Co., LTD.
Rm.702, Building A, No. 666, Zhangheng Road, Zhangjiang Hi-Tech Park, Shanghai, P.R.China

Tel: +86-21-68825918