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.
- 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

Symbol

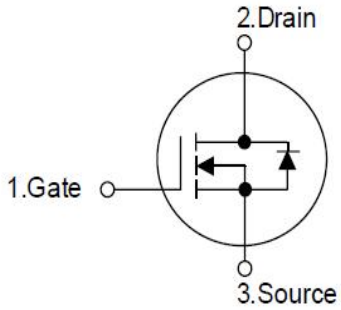


Figure 1 Symbol of SRC60R230B

Package Type

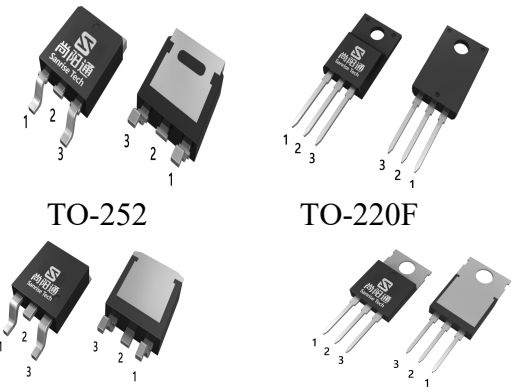


Figure 2 Package Types of SRC60R230B

Ordering Information

SRC60R230B□□–□

Circuit Type

Package
D: TO-252
TF: TO-220F
TC: TO-220C
S2: TO-263-2

E: Lead Free
G: Green
Blank: Tube
TR: Tape & Reel

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

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

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=25ºC	I_D	13.7	A
	T_C=100ºC		9.1	
	T_C=125ºC		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}<=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	ºC
Storage Temperature		T_{STG}	-55 to 150	ºC
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	ºC

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} = 5.5A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C

Thermal characteristics

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	RthJC			4.0	ºC /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	ºC /W
	TO-247				80	
	TO-220C				80	
	TO-263-2				80	
	TO-262				80	
	TO-252				80	

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
	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

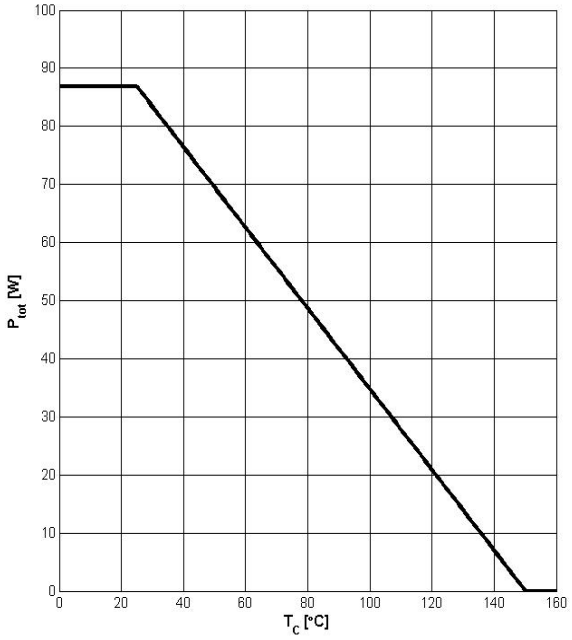
Note:

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

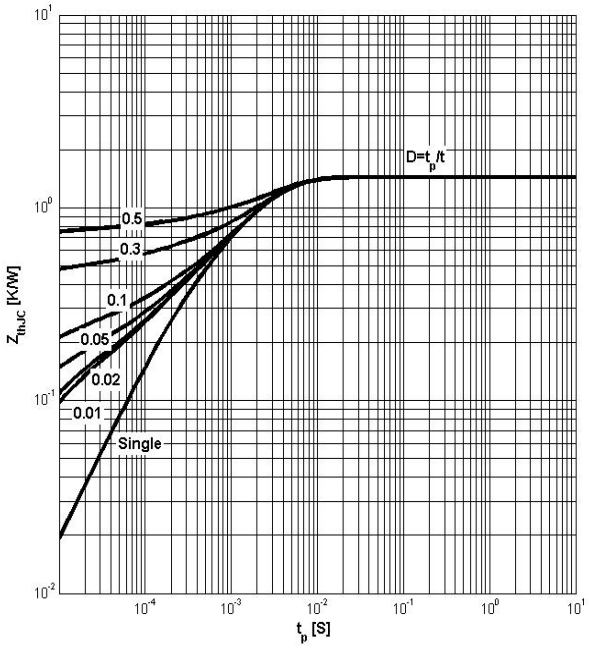
Typical Performance Characteristics

Figure 3: Power Dissipation



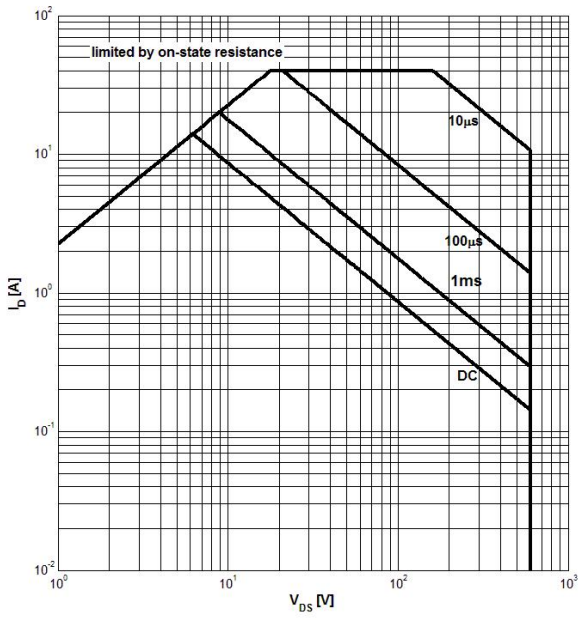
$P_{tot} = f(T_c)$

Figure 4: Max. Transient Thermal Impedance



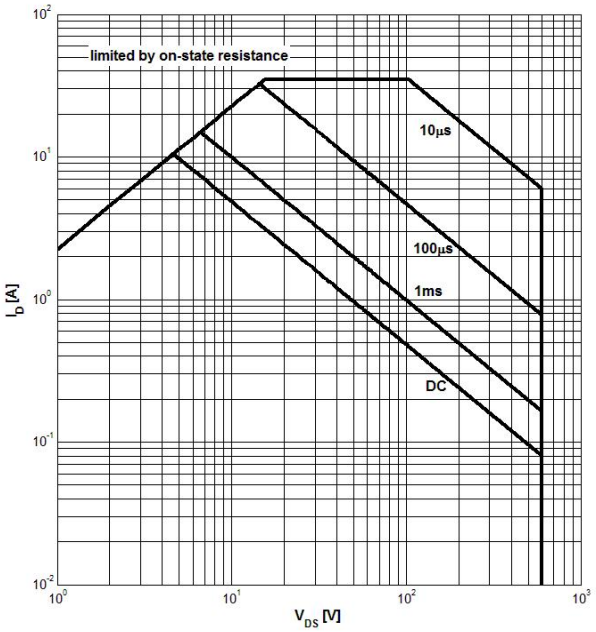
$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$

Figure 5: Safe Operating Area



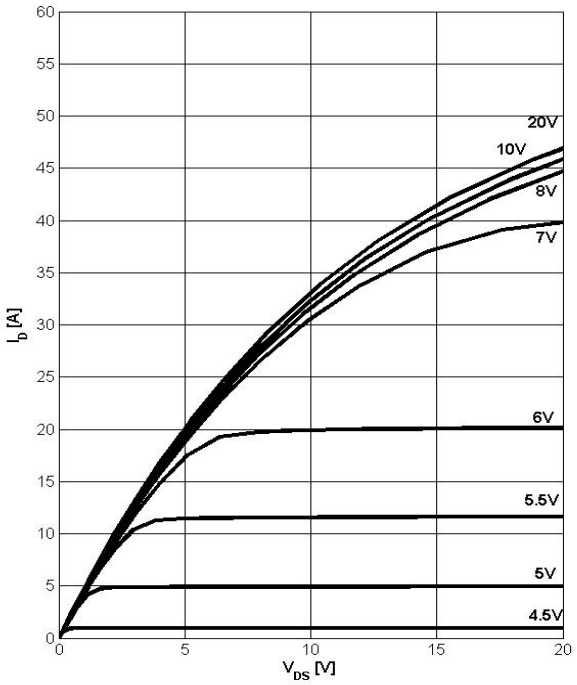
$I_D = f(V_{DS})$; T_c= 25ºC; V_{GS}>7V; parameter t_p

Figure 6: Safe Operating Area



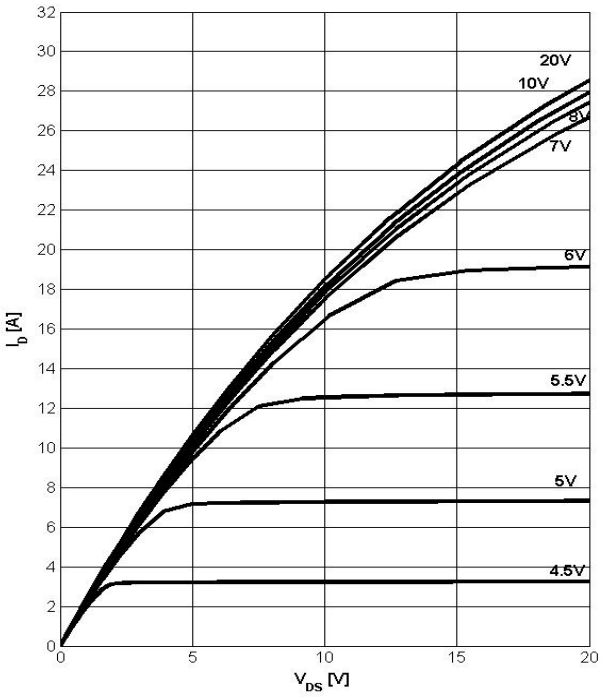
$I_D = f(V_{DS})$; T_c= 80ºC; V_{GS}>7V; parameter t_p

Figure 7: Typ. Output Characteristics



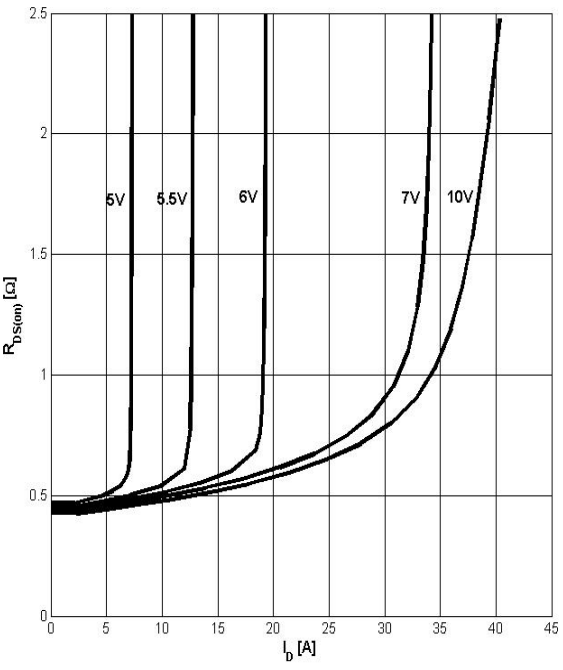
$I_D = f(V_{DS})$; Tj= 25ºC; parameter: V_{GS}

Figure 8: Typ. Output Characteristics



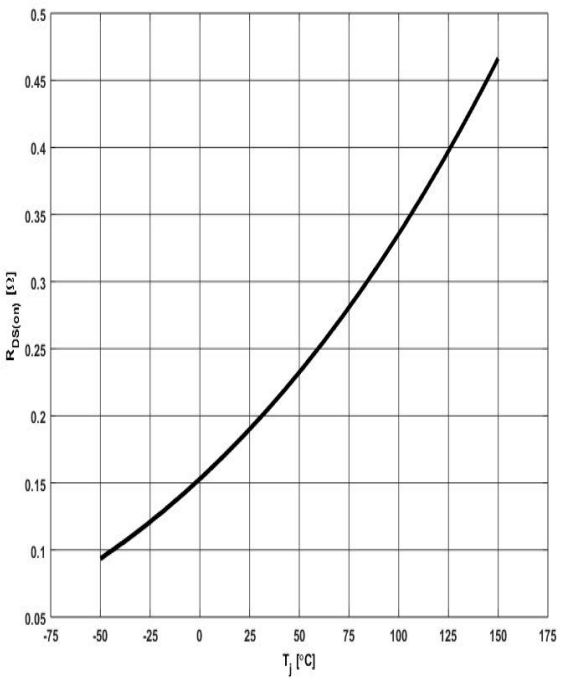
$I_D = f(V_{DS})$; T_j= 125ºC; parameter: V_{GS}

Figure 9: Typ. Drain-Source On-State Resistance



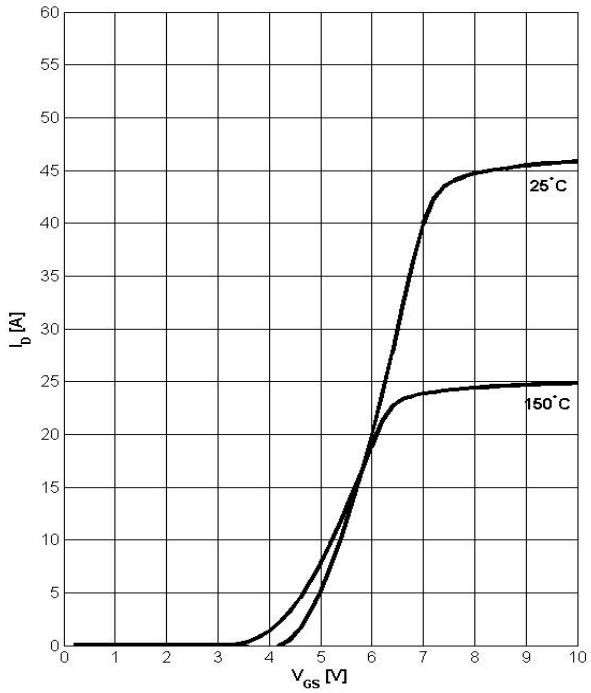
$R_{DS(ON)} = f(I_D)$; T_j=125ºC; parameter: V_{GS}

Figure 10: Typ. Drain-Source On-State Resistance



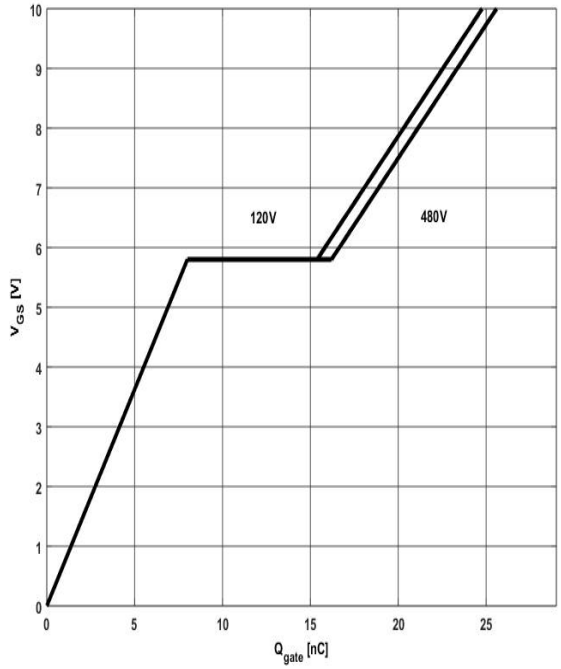
$R_{DS(ON)} = f(T_j)$; I_D=8.0A; V_{GS}=10V

Figure 11: Typ. Transfer Characteristics



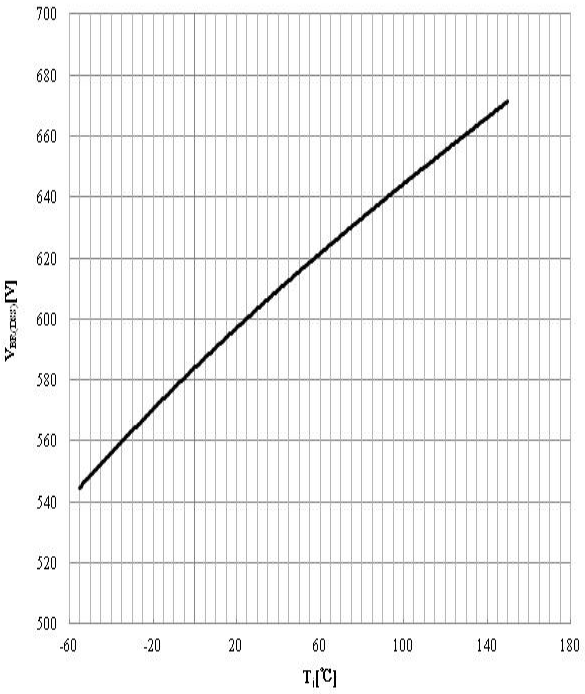
$I_D = f(V_{GS})$; $V_{DS} = 20V$

Figure 12: Typ. Gate Charge



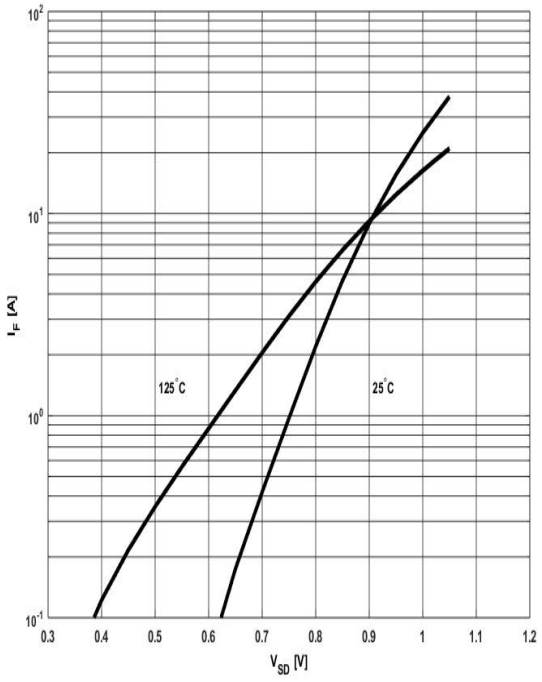
$V_{GS} = f(Q_{gate})$, $I_D = 8A$ pulsed

Figure 13: Drain-Source Breakdown Voltage



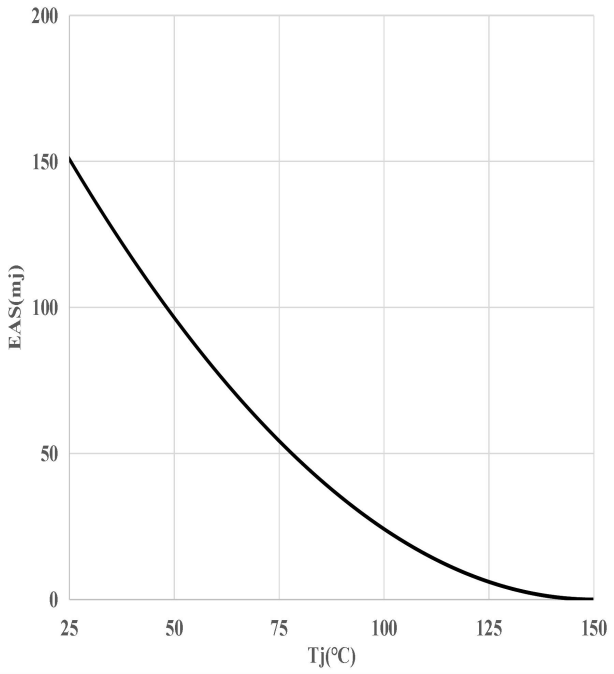
$V_{BR(DSS)} = f(T_j)$; $I_D = 10mA$

Figure 14: Forward Characteristics of Reverse Diode



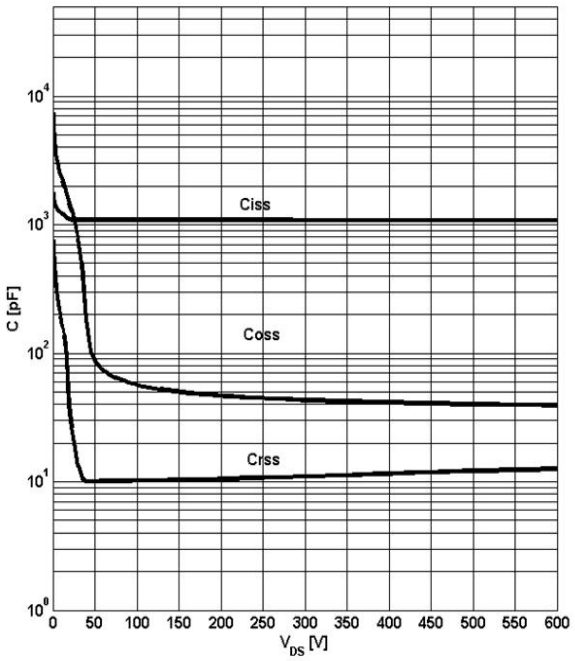
$I_F = f(V_{SD})$; parameter: T_j

Figure 15: Avalanche Energy



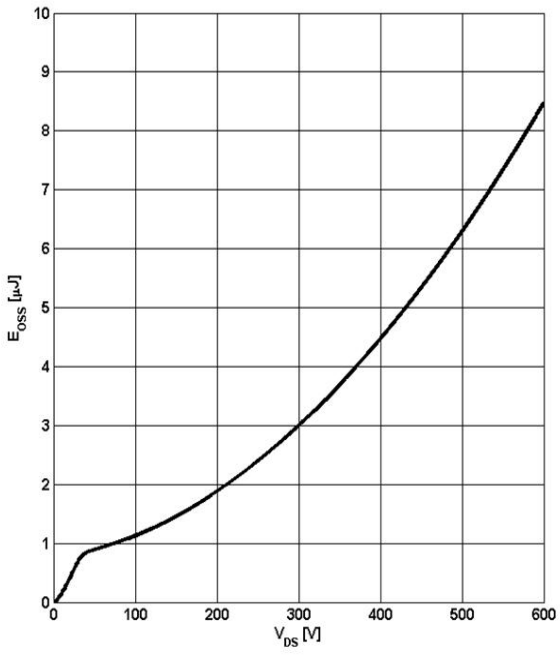
$E_{AS}=f(T_j)$; I_D=5.5A; V_{DD}=60V

Figure 16: Typ. Capacitances



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

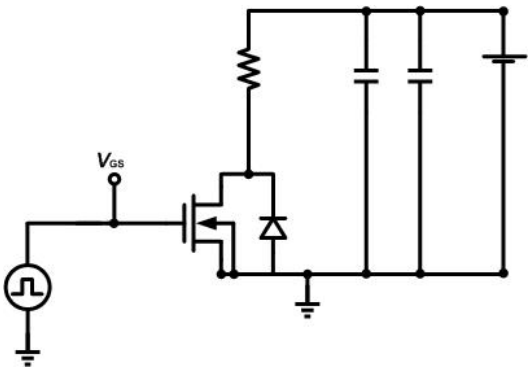
Figure 17: C_{OSS} Stored Energy

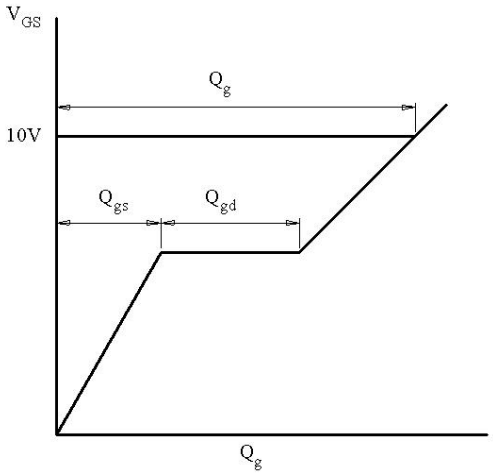


$E_{OSS}=f(V_{DS})$

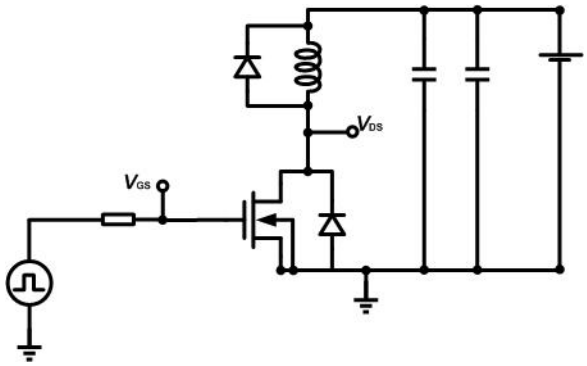
Test Circuits

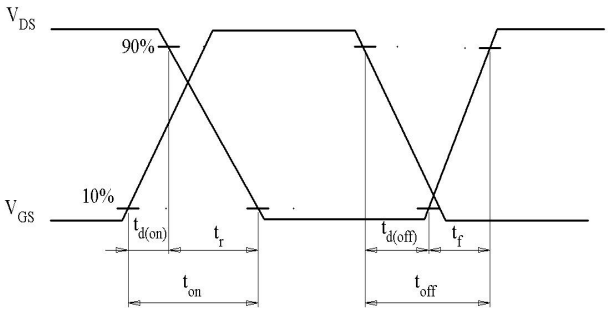
1. Gate Charge Test Circuit & Waveform



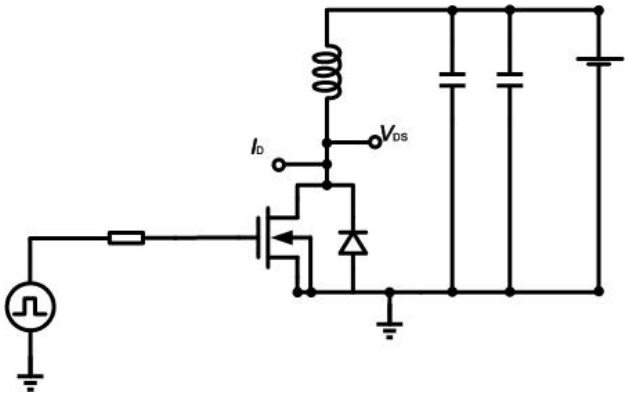


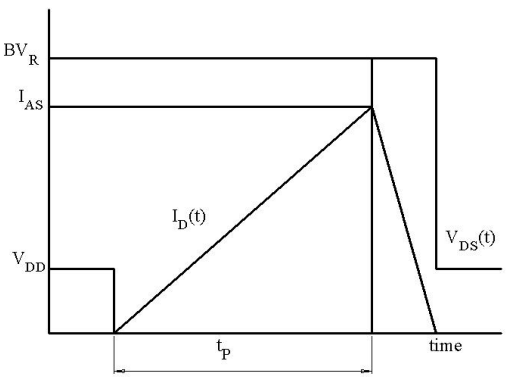
2. Switch Time Test Circuit



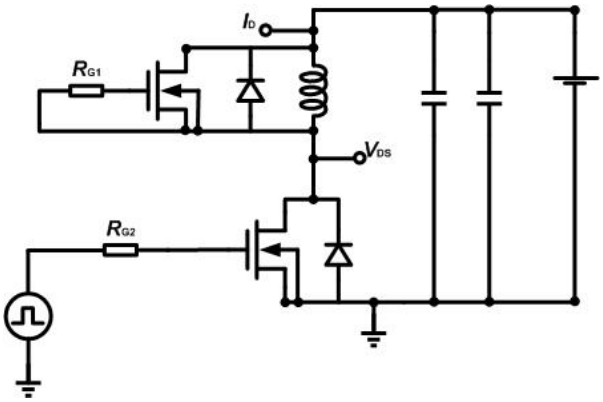


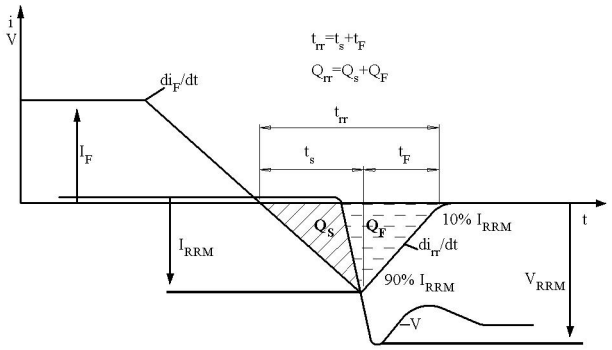
3. Unclaimed Inductive Switching Test Circuit & Waveforms





4. Test Circuit and Waveform for Diode Characteristics



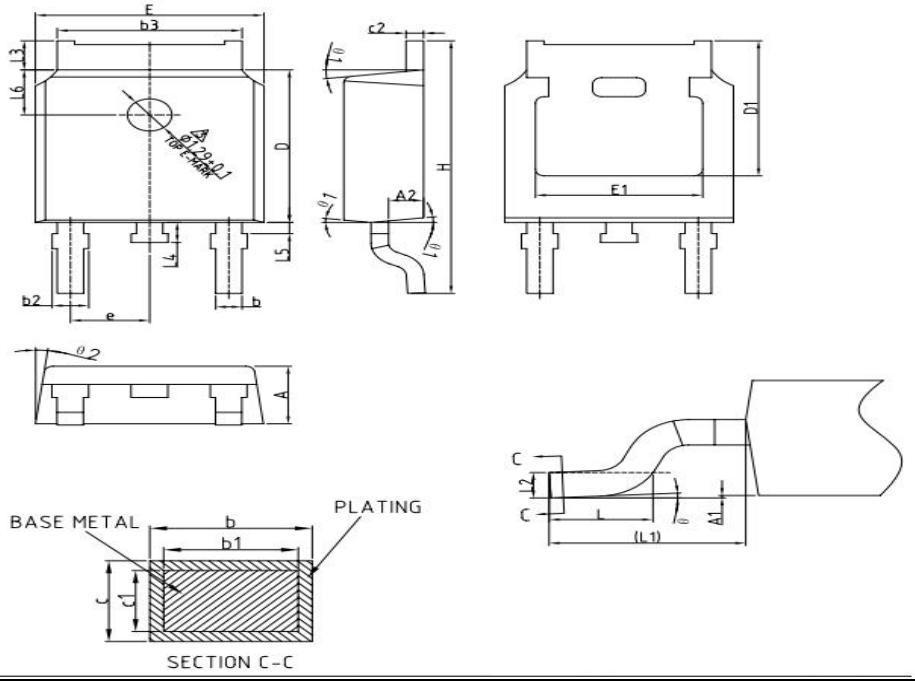


230mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R230B

Mechanical Dimensions

TO-252（Package 1）

Unit: mm



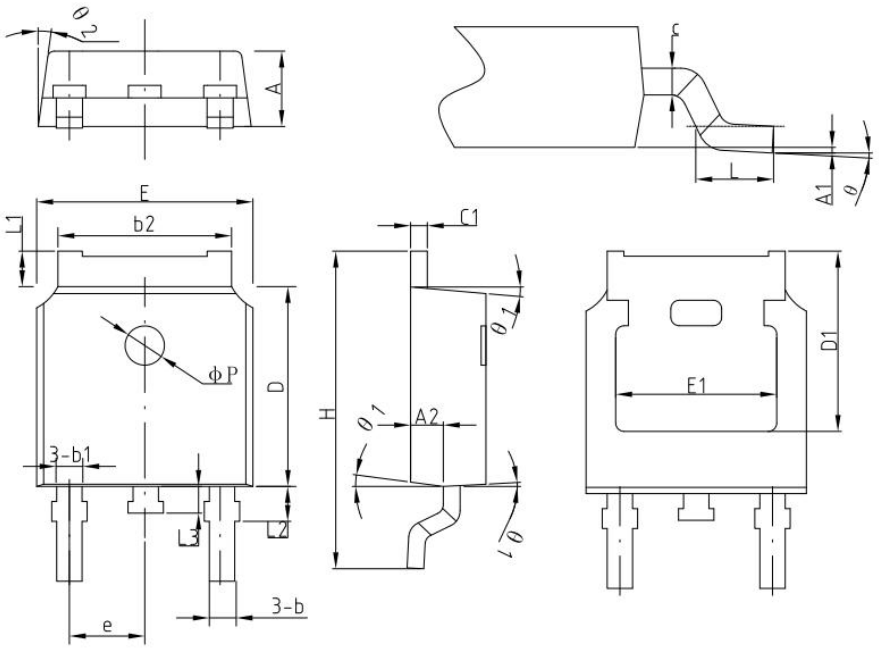
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.10
A2	0.90	1.01	1.10
b	0.72	-	0.85
b1	0.71	0.76	0.81
b2	0.72	-	0.90
b3	5.13	5.33	5.46
c	0.47	-	0.60
c1	0.46	0.51	0.56
C2	0.47	-	0.60
D	6.0	6.10	6.20
D1	5.25	-	-
E	6.50	6.60	6.70
E1	4.70	-	-
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	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°
Θ1	5°	7°	9°
Θ2	5°	7°	9°

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

Mechanical Dimensions

TO-252（Package 2）

Unit: mm

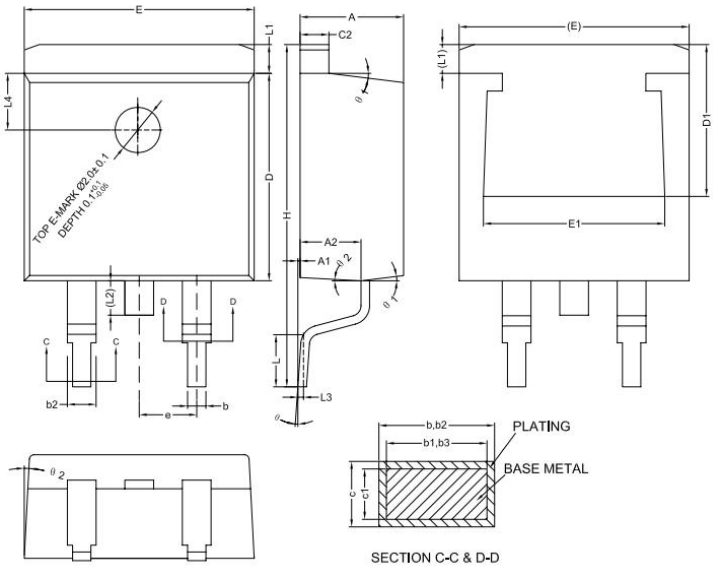


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.127
A2	0.90	1.01	1.10
b	0.635	0.76	0.86
b1	-	0.76	-
b2	5.2	5.33	5.46
c	0.47	0.50	0.60
c1	0.47	0.50	0.60
D	6.0	6.10	6.20
D1	-	5.30	-
E	6.50	6.60	6.70
E1	-	4.83	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.40	1.50	1.70
L1	0.90	-	1.25
L2	-	1.0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

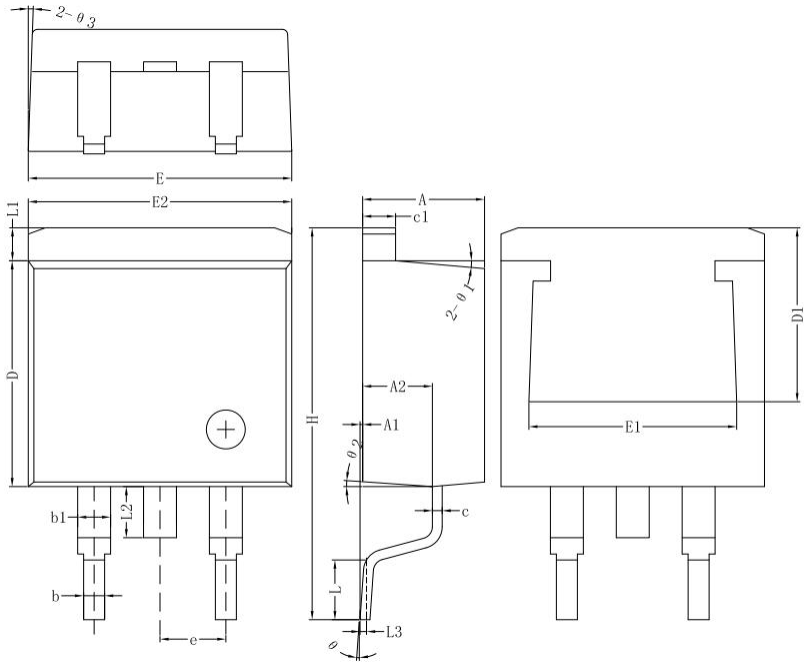


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	0.00	0.10	0.25
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
c2	1.22	-	1.32
D	9.05	9.15	9.25
D1	6.60	-	-
E	10.06	10.16	10.26
E1	7.80	-	8.20
e	2.54(BSC)		
H	14.70	15.10	15.50
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°

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

Mechanical Dimensions

TO-263-2 （Package 2） **Unit: mm**



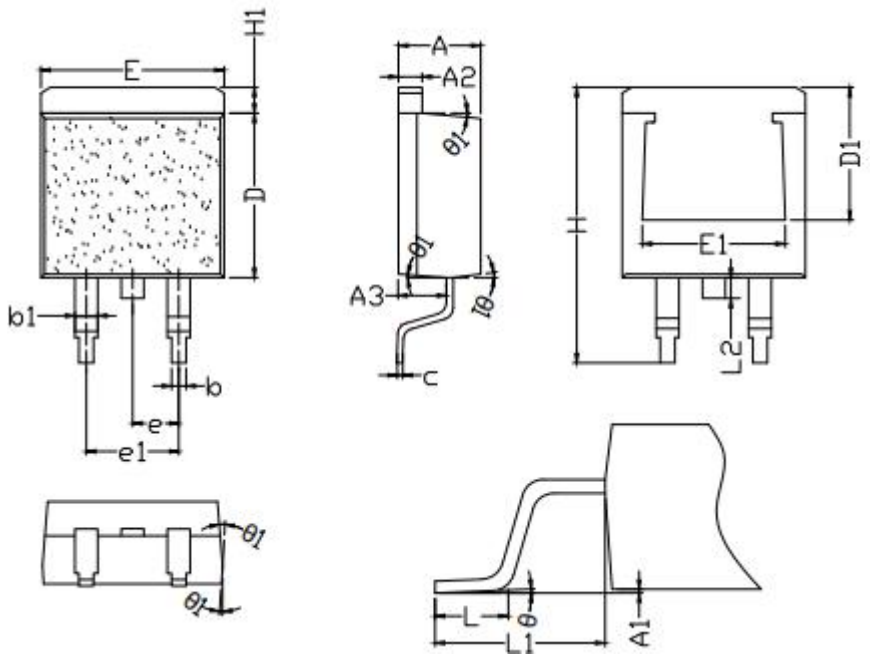
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40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

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

Mechanical Dimensions

TO-263-2 （Package 3）

Unit: mm



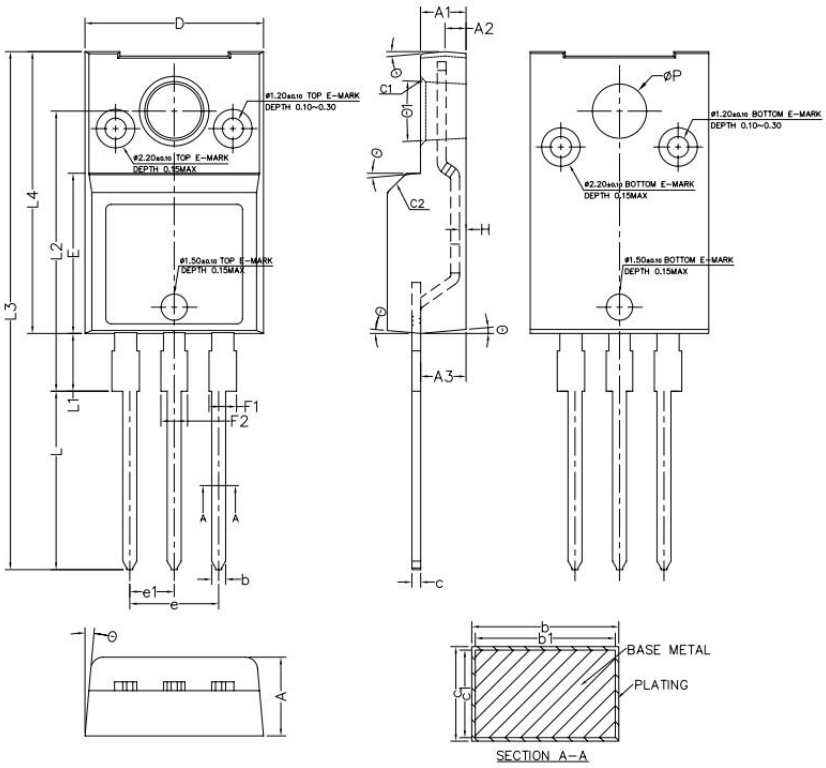
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.42	4.52	4.62
A1	0.00	0.10	0.25
A2	1.24	1.27	1.32
A3	2.50	2.60	2.70
b	0.77	0.81	0.84
b1	1.23	1.28	1.41
c	0.33	0.38	0.43
D	8.80	8.95	9.10
D1		7.2REF	
E	9.92	10.07	10.22
E1		7.85REF	
e	2.50	2.54	2.58
e1		5.08REF	
H	14.80	15.10	15.30
H1	1.12	1.28	1.42
L	2.10	2.23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

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

Mechanical Dimensions

TO-220F（Package 1）

Unit: mm



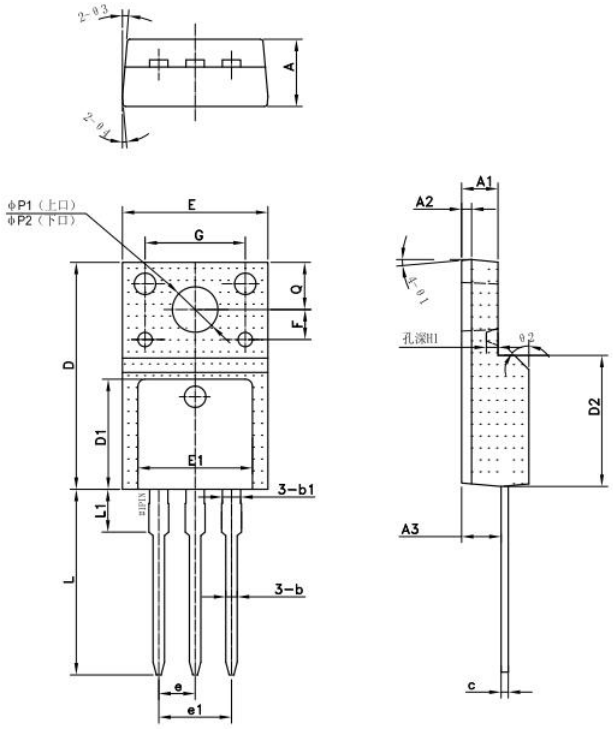
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.50	4.60
A1	2.50	2.60	2.70
A2	1.10	1.20	1.30
A3	2.49	2.59	2.69
b	0.76	-	0.89
b1	0.75	0.80	0.85
c	0.46	-	0.59
c1	0.45	0.50	0.55
C1	0.20	0.30	0.40
C2	1.00	1.10	1.20
D	10.10	10.20	10.30
E	9.05	9.15	9.25
e	4.98	5.08	5.18
e1	2.44	2.54	2.64
F1	1.22	-	1.60
F2	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°

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

Mechanical Dimensions

TO-220F（Package 2）

Unit: mm



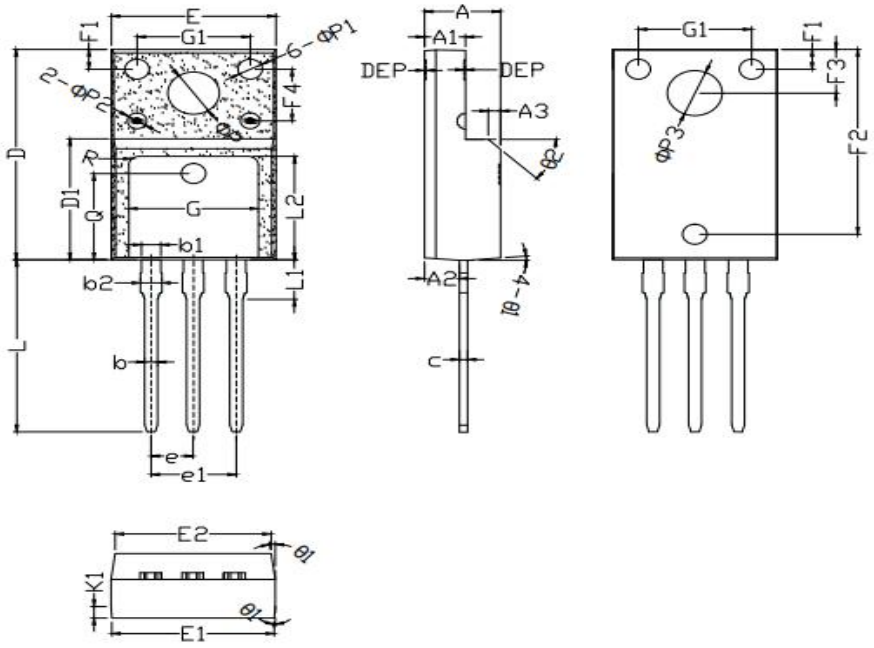
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.70
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
D2		9.12	
E	9.96	10.16	10.36
E1	-	8.00	-
e		2.54	
e1		5.08	
F		2.1	
G		7	
H1	-	0.81	-
L	12.48	12.98	13.20
L1	-	2.93	-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

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

Mechanical Dimensions

TO-220F（Package 3）

Unit: mm



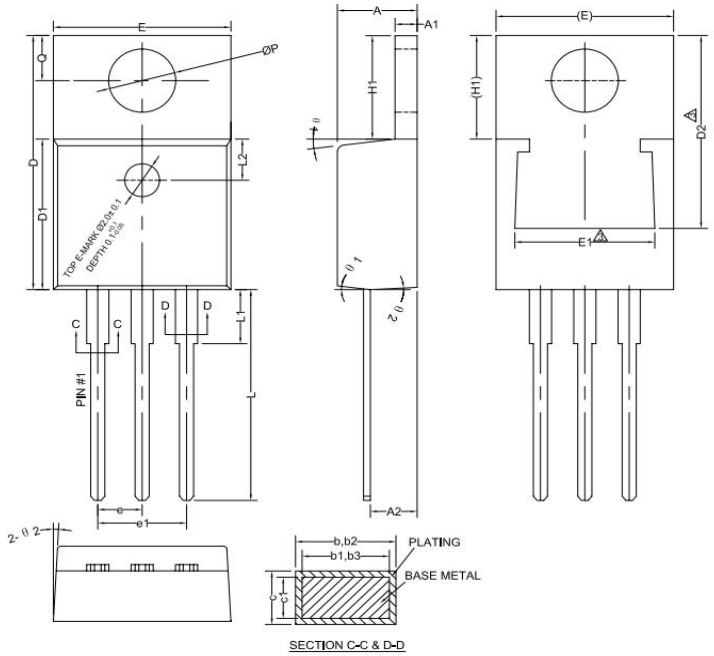
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.60	2.80	2.95
A3		1.0REF	
b	0.75	0.80	0.85
b1	1.18	1.20	1.24
b2	1.18	1.24	1.30
c	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
E	10.00	10.16	10.30
E1	9.94	10.06	10.30
E2	9.40	9.50	9.60
e	2.50	2.54	2.58
e1		5.08REF	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

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

Mechanical Dimensions

TO-220C（Package 1）

Unit: mm

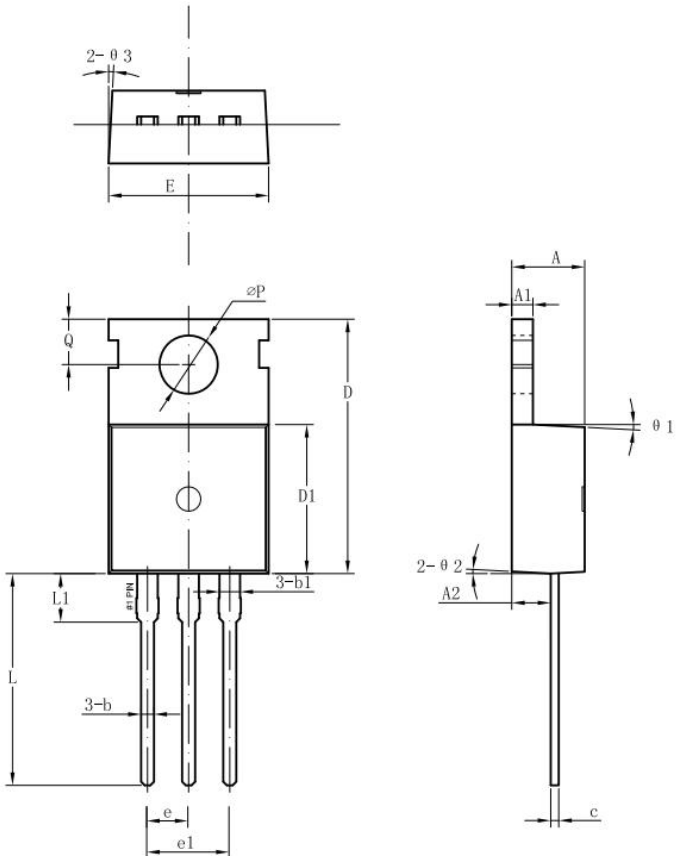


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	1.22	-	1.32
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
D	15.15	15.45	15.75
D1	9.05	9.15	9.25
D2	11.40	-	12.88
E	9.96	10.16	10.36
E1	6.86	-	8.89
e	2.44	2.54	2.64
e1	4.98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

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

Mechanical Dimensions

TO-220C（Package 2） **Unit: mm**



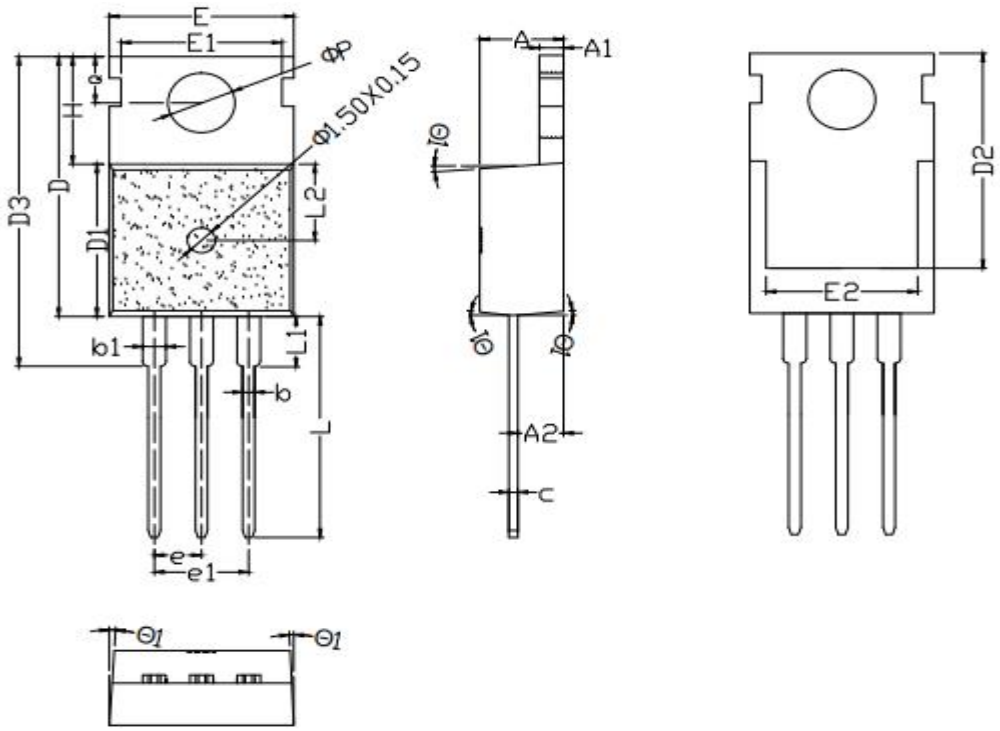
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.50	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b1	-	1.27	-
c	0.40	0.50	0.65
D	15.20	15.70	16.20
D1	9.00	9.20	9.40
E	9.70	10.00	10.20
e		2.54	
e1		5.08	
L	12.60	13.08	13.60
L1	-	3.00	-
ΦP	3.50	3.60	3.80
Q	2.60	2.80	3.00
θ1		3°	
θ2		3°	
θ2		3°	

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

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

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

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