

General Description

The Sanrise SRC65R600S 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 SRC65R600S break down voltage is 650V and it has a high rugged avalanche characteristics. The SRC65R600S is available in TO-252 ,TO-220F, TO-263-2, and TO-220C packages .

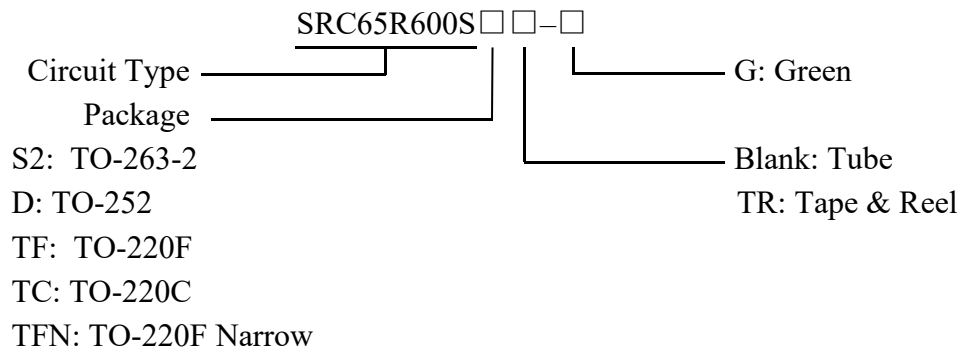
Features

- Ultra Low $R_{DS(ON)} = 600m\Omega @ V_{GS} = 10V$.
- $V_{ds}@T_{jmax}=700V$
- Ultra Low Gate Charge, $Q_g=12nC$ typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved Design
- Non-automotive Qualified

Application

- TV Power
- High Performance Charger / Adapter

Ordering Information



Symbol

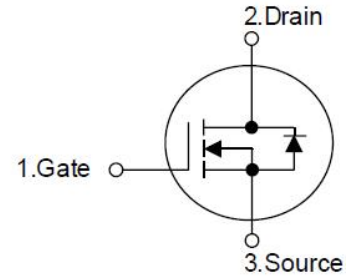


Figure 1 Symbol of SRC65R600S

Package Type

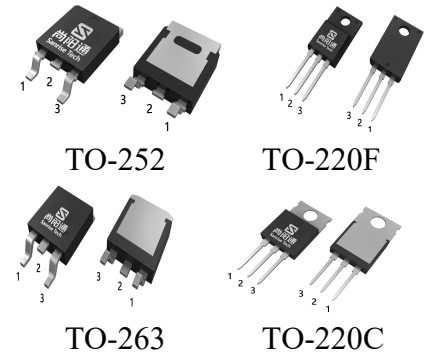


Figure 2 Package Types of SRC65R600S

Package	Part Number	Marking ID	Packing Type
TO-252	SRC65R600SDTR-G	SRC65R600SDG	Tape & Reel
TO-263-2	SRC65R600SS2TR-G	SRC65R600SS2G	Tape & Reel
TO-220F	SRC65R600STF-G	SRC65R600STFG	Tube
TO-220C	SRC65R600STC-G	SRC65R600STCG	Tube
TO-220F Narrow	SRC65R600STFN-G	SRC65R600STFNG	Tube

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DS}	650	V
Gate-Source Voltage (static)		V_{GSS}	± 20	V
Gate-Source Voltage (dynamic), AC ($f > 1$ Hz)		V_{GSS}	± 30	V
Continuous Drain Current(Note2)	$T_C = 25^\circ\text{C}$	I_D	7.5	A
	$T_C = 100^\circ\text{C}$		4.7	
	$T_C = 125^\circ\text{C}$		3.3	
Pulsed Drain Current (Note 3)		I_{DM}	22.5	A
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	48	mJ
Avalanche Energy, Single Pulse (Note 5)		E_{AS}	148	mJ
Avalanche Energy, Repetitive (Note 3)		E_{AR}	0.15	mJ
Avalanche Current, Repetitive (Note 3)		I_{AR}	1.8	A
Continuous Diode Forward Current		I_S	7.5	A
Diode Pulse Current		$I_{S,PULSE}$	22.5	A
Power Dissipation ($T_C = 25^\circ\text{C}$, TO-220F)		P_{tot}	22.7	W
Power Dissipation ($T_C = 25^\circ\text{C}$, TO-252, TO-263-2, TO-220C)		P_{tot}	43	W
MOSFET dv/dt Ruggedness, $V_{DS} \leq 480\text{V}$		dv/dt	120	V/ns
Reverse Diode dv/dt , $V_{DS} \leq 480\text{V}$, $I_{SD} \leq I_D$		dv/dt	50	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. Limited by T_{jmax} . Maximum Duty Cycle $D = 0.5$.
3. Repetitive Rating: Pulse width limited by maximum junction temperature
4. $I_{AS} = 1.2\text{A}$, $V_{DD} = 60\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$. Finish goods test condition.
4. $I_{AS} = 2.1\text{A}$, $V_{DD} = 60\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$. Typical Eas.

Thermal Resistance

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	R_{thJC}			5.5	$^\circ\text{C} / \text{W}$
	TO-220F Narrow				5.5	
	TO-252				2.7	
	TO-263-2				2.7	
	TO-220C				2.7	
Thermal resistance, Junction-to-Ambient	TO-220F	R_{thJA}			62	$^\circ\text{C} / \text{W}$
	TO-220F Narrow				62	
	TO-252				62	
	TO-263-2				62	
	TO-220C				62	

Electrical Characteristics

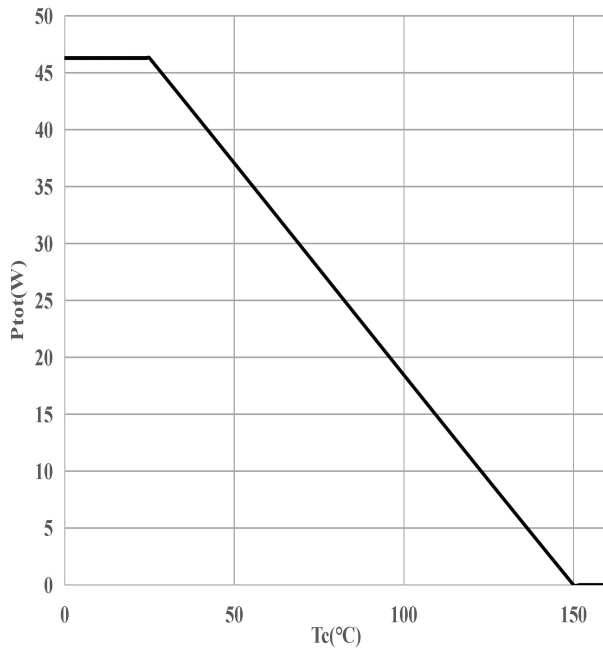
$T_J = 25^\circ\text{C}$, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250uA	650			V
Zero Gate Voltage Drain Current		I _{DSS}	V _{DS} =650V, V _{GS} =0V			1	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	2.7	3.5	4.3	V
Static Drain-Source On-Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =4.0A		415	600	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		4.9		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =400V, V _{GS} =0V, f=100KHz		409		pF
Output Capacitance		C _{OSS}			20		
Effective output capacitance, energy related ^{NOTE7}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...400V		19		pF
Effective output capacitance, time related ^{NOTE8}		C _{O(tr)}			90		
Turn-on Delay Time		t _{d(on)}	V _{DD} =400V, I _D =4.0A R _G =30Ω, V _{GS} =12V		19		ns
Rise Time		t _r			14		
Turn-off Delay Time		t _{d(off)}			48		
Fall Time		t _f			24		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =400V, I _D =4.0A V _{GS} =0 to 10V		2		nC
Gate to Drain Charge		Q _{gd}			5		
Gate Charge Total		Q _g			12		
Gate Plateau Voltage		V _{plateau}			6.0		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =4.0A		0.85	1.1	V
Reverse Recovery Time		t _{rr}	V _R =400V, I _F =4.0A dI _F /dt=100A/us		182		ns
Reverse Recovery Charge		Q _{rr}			1.3		uC
Peak Reverse Recovery Current		I _{rrm}			15		A

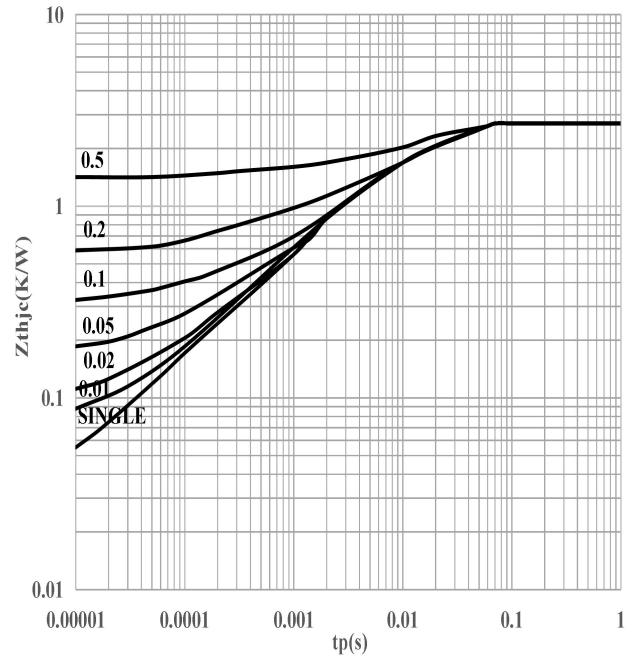
Note:

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 400V

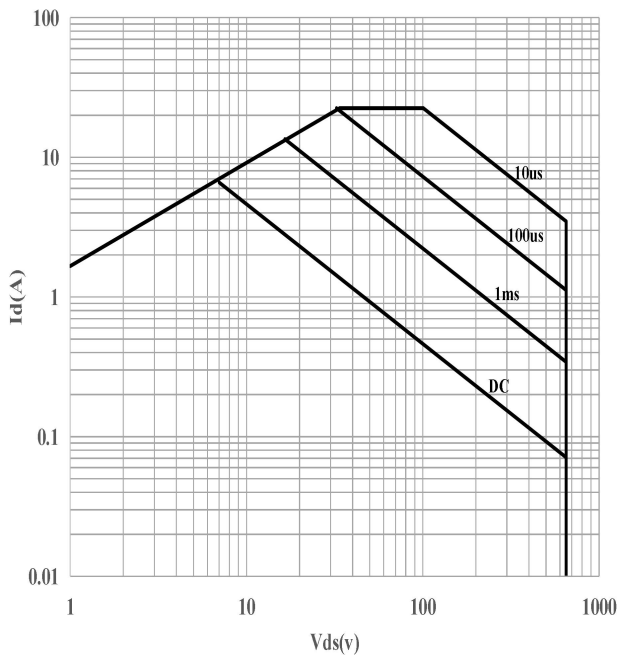
7. $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 400 V

Typical Performance Characteristics
Figure 3: Power Dissipation


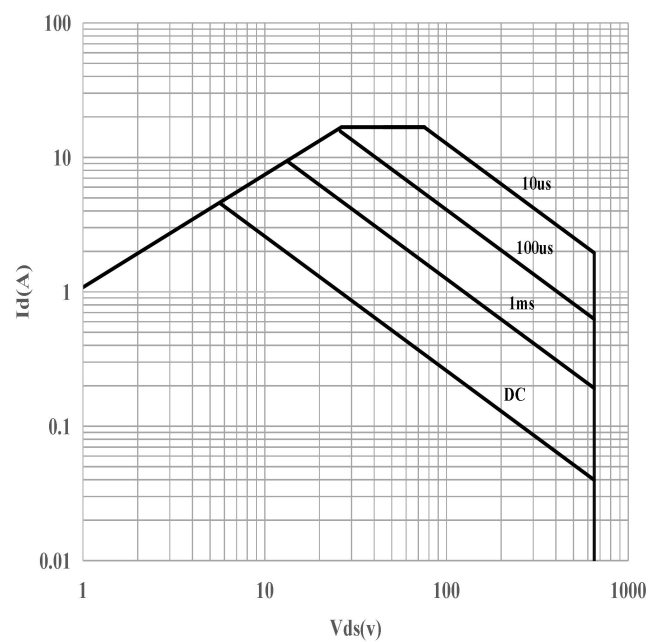
$$P_{tot} = f(T_c)$$

Figure 4: Max. Transient Thermal Impedance


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

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


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

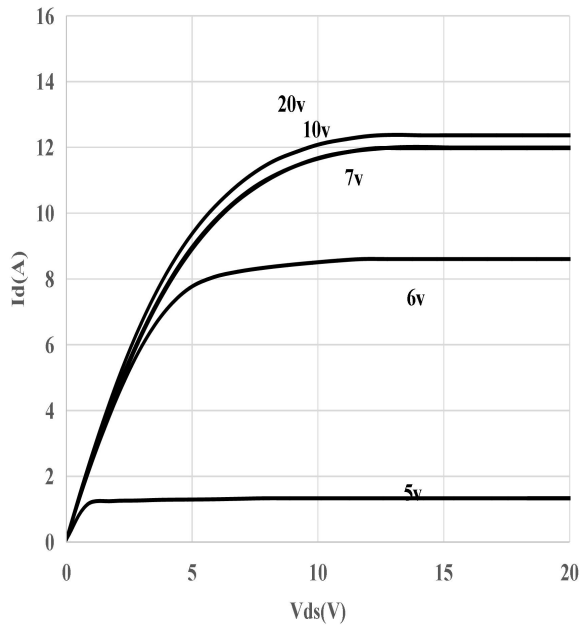
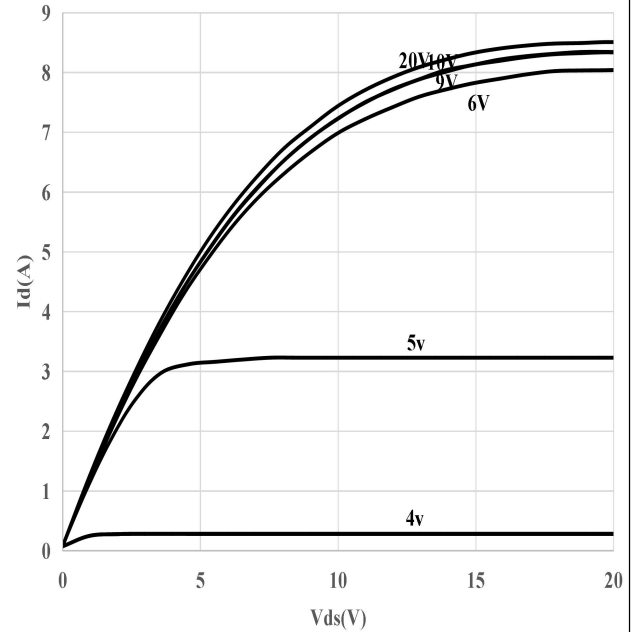
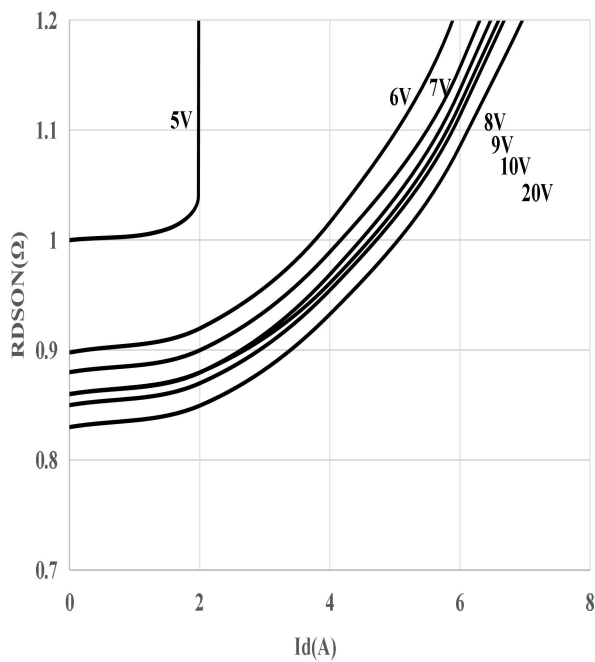
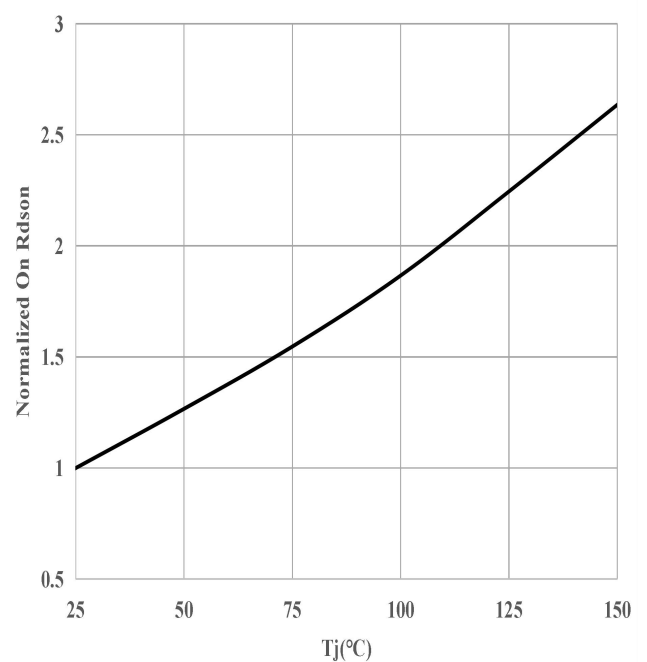
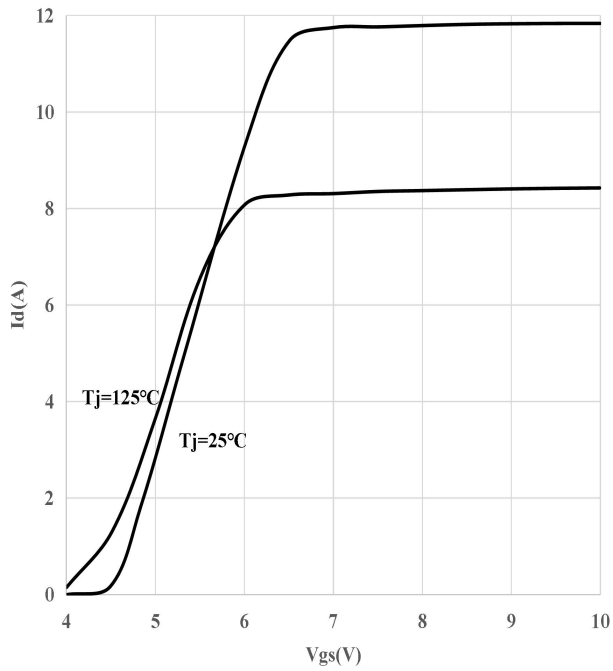
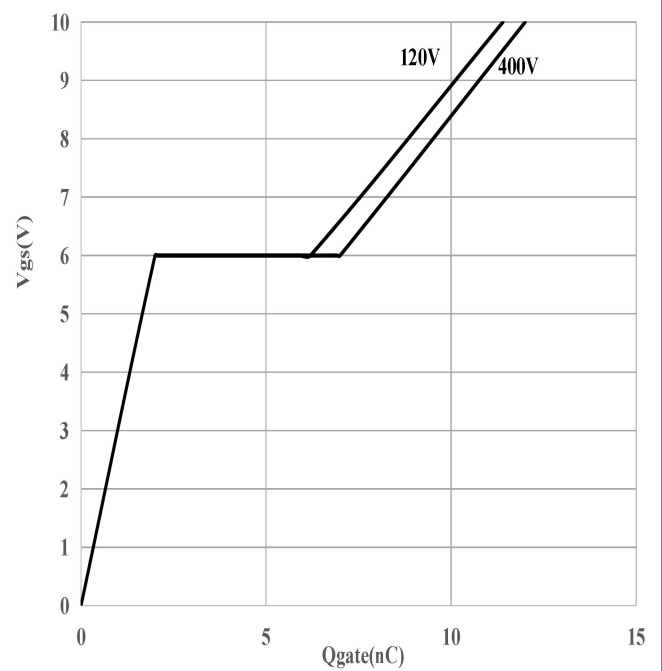
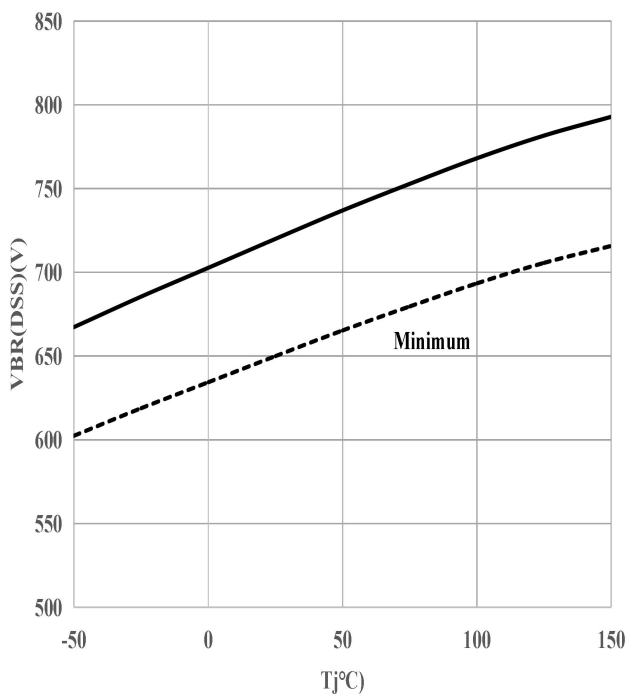
Figure 7: Typ. Output Characteristics

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

 $R_{DS(on)} = f(T_j); I_D = 4.0\text{A}; V_{GS} = 10\text{V}$

Figure 11: Typ. Transfer Characteristics


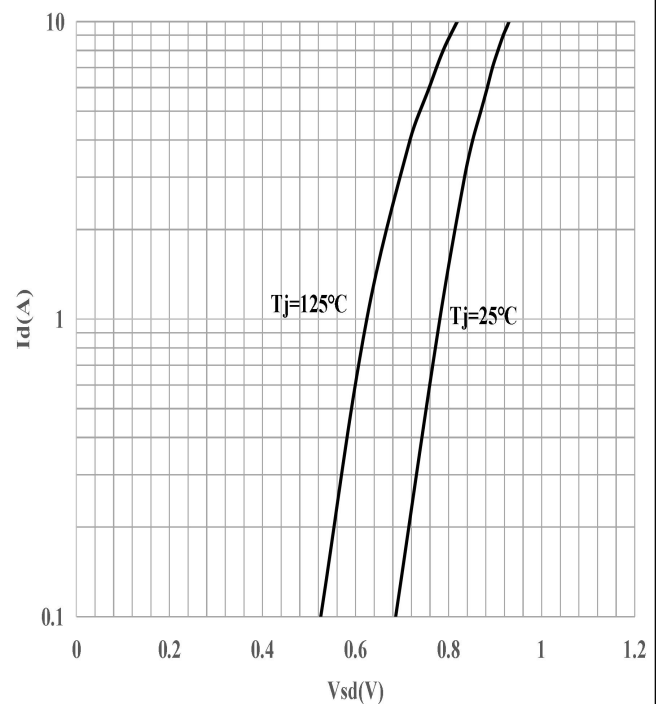
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Figure 12: Typ. Gate Charge


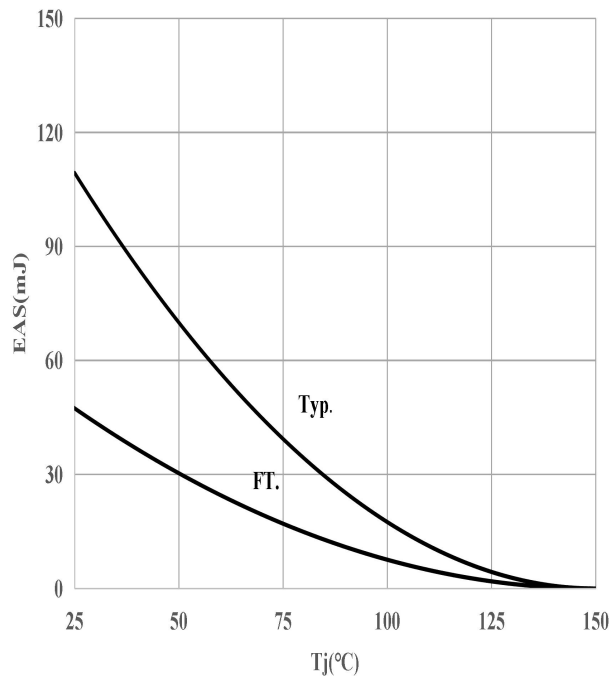
$$V_{GS} = f(Q_{gate}), I_D = 4.0A \text{ pulsed}$$

Figure 13: Drain-Source Breakdown Voltage


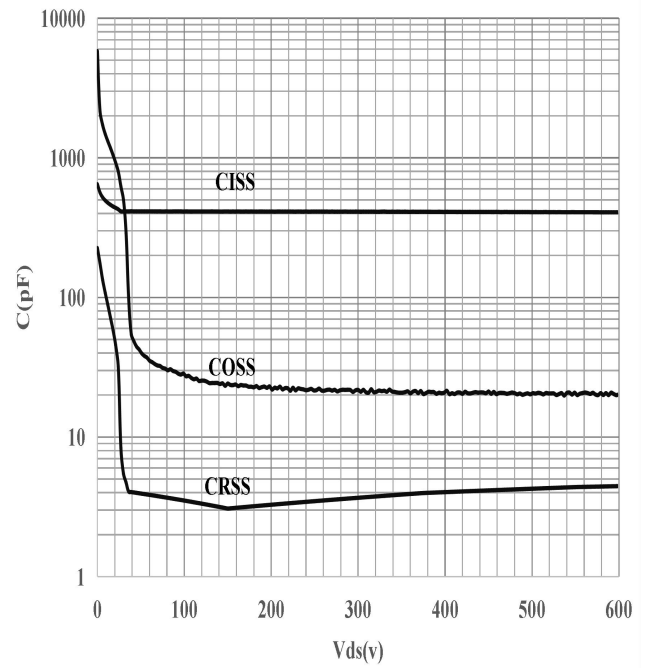
$$\text{Minimum } V_{BR(DSS)} = f(T_j); I_D = 1mA$$

Figure 14: Forward Characteristics of Reverse Diode


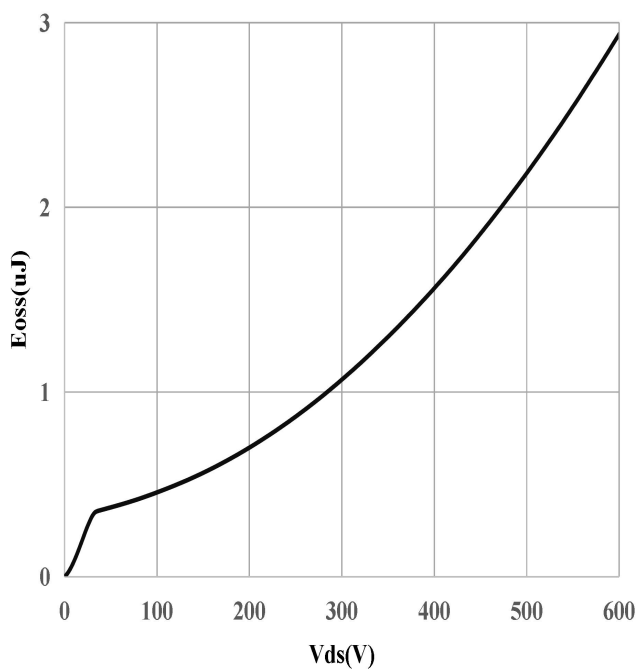
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

Figure 15: Avalanche Energy


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

Figure 16: Typ. Capacitances


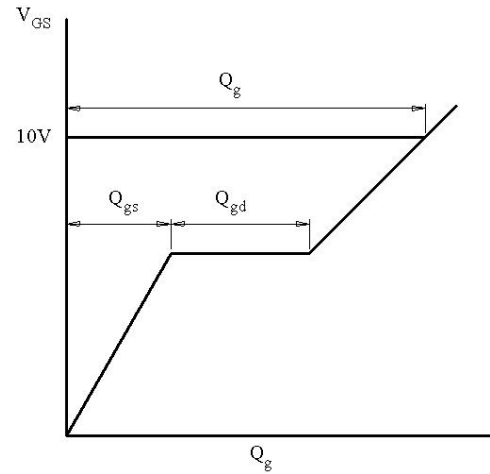
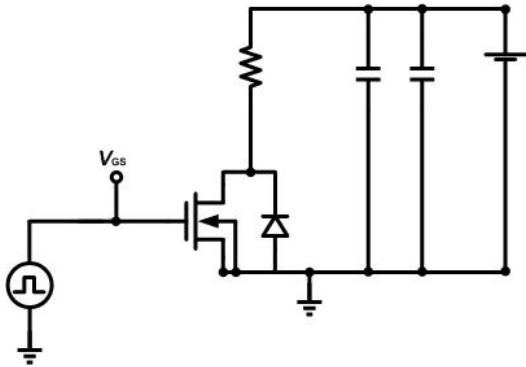
$$C=f(V_{DS}); V_{GS}=0; f=100kHz$$

Figure 17: Coss Stored Energy


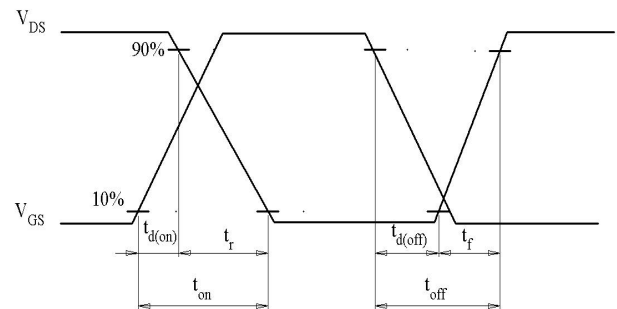
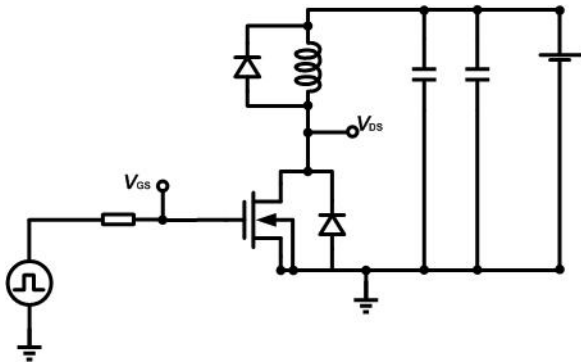
$$E_{OSS}=f(V_{DS})$$

Test Circuits

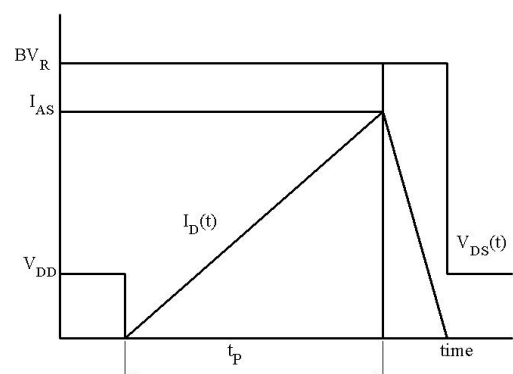
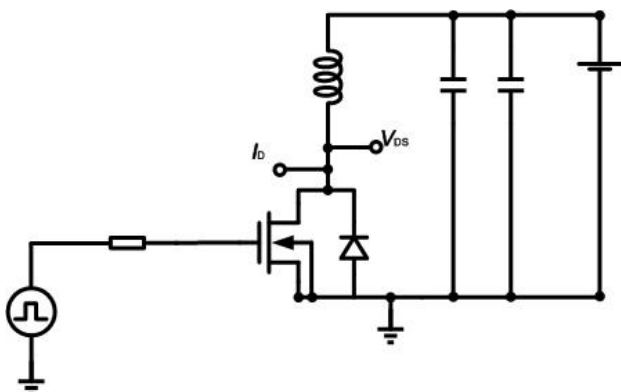
1. Gate Charge Test Circuit & Waveform



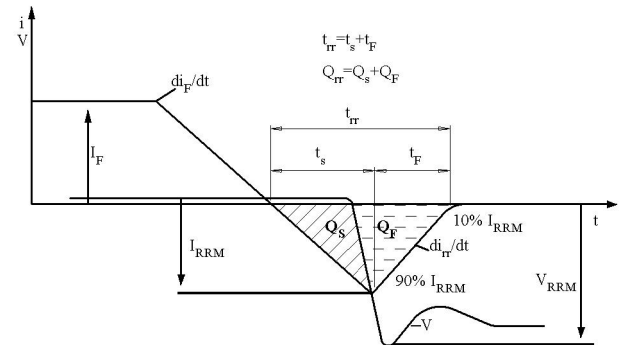
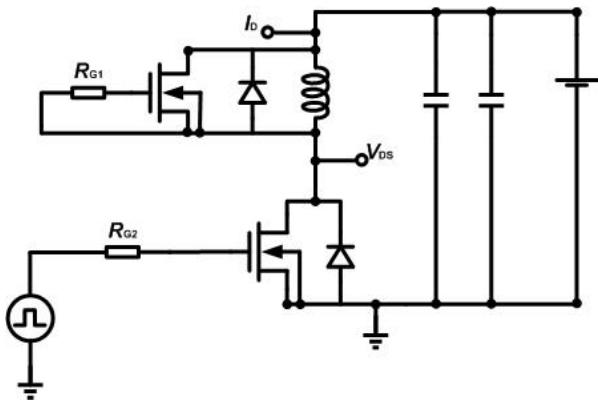
2. Switch Time Test Circuit

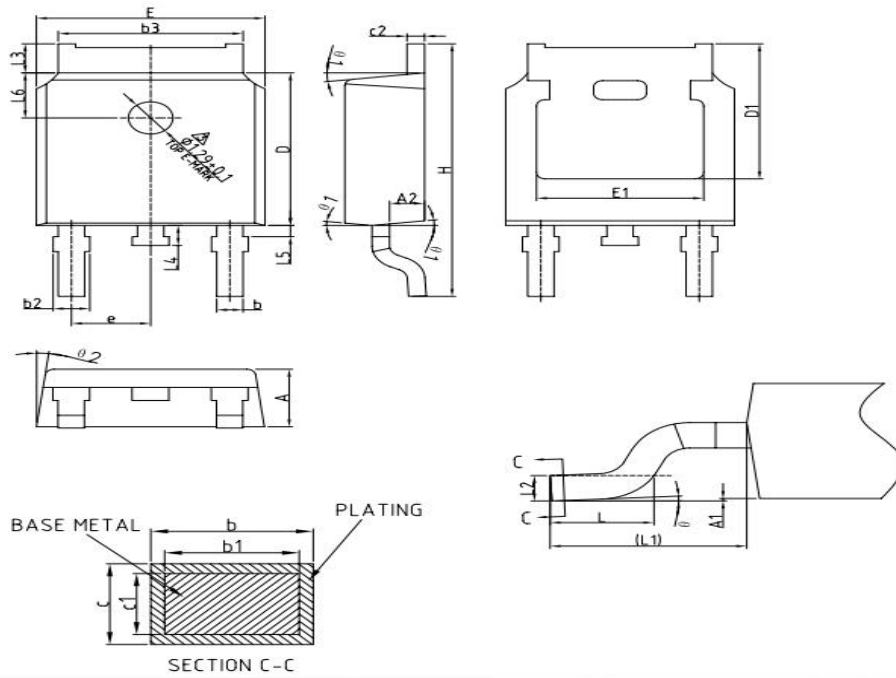


3. Unclaimed Inductive Switching Test Circuit & Waveforms

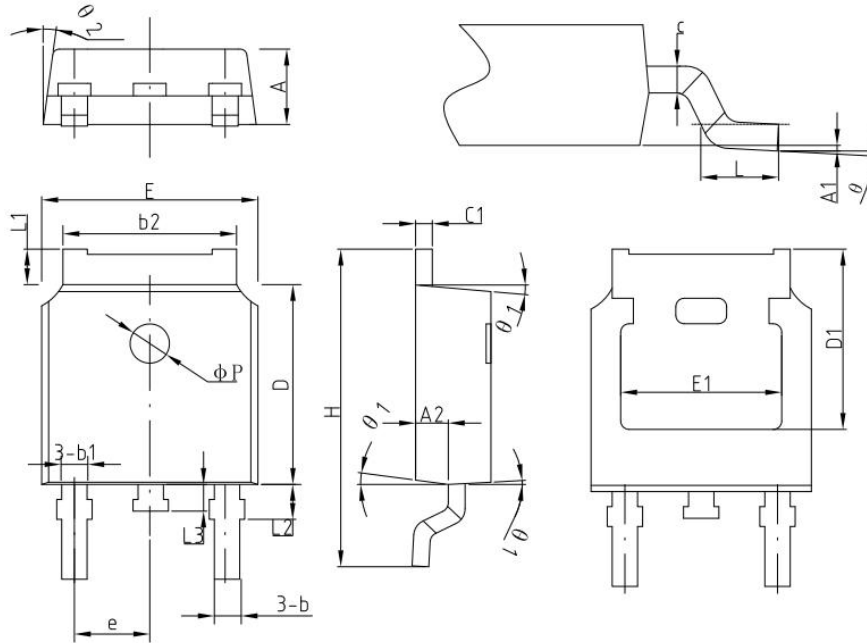


4. Test Circuit and Waveform for Diode Characteristics

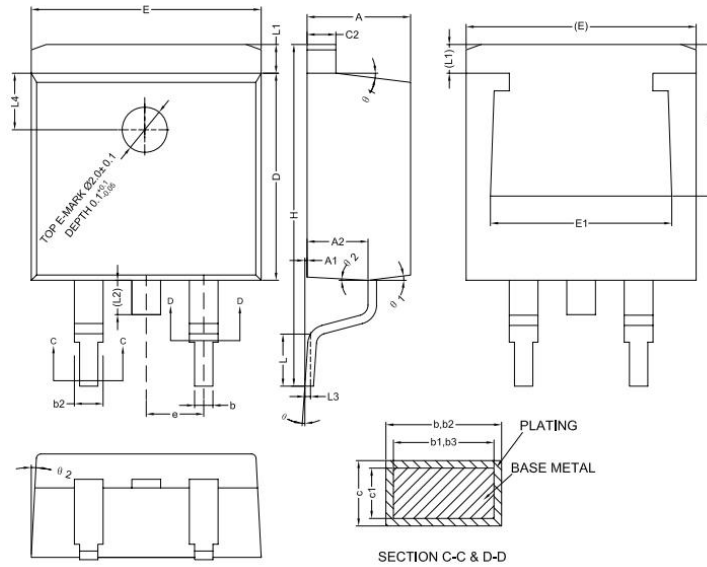


Mechanical Dimensions
TO-252 (Package 1)
Unit: mm


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°
Θ1	5°	7°	9°
Θ2	5°	7°	9°

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


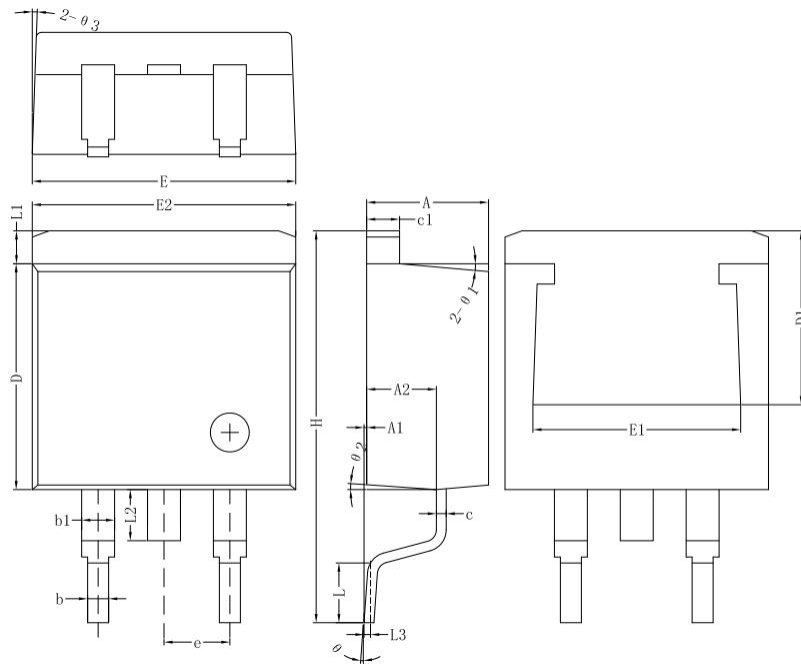
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.127
A2	0.90	1.01	1.10
b	0.635	0.76	0.86
b1	-	0.76	-
b2	5.2	5.33	5.46
c	0.47	0.50	0.60
c1	0.47	0.50	0.60
D	6.0	6.10	6.20
D1	-	5.30	-
E	6.50	6.60	6.70
E1	-	4.83	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.40	1.50	1.70
L1	0.90	-	1.25
L2	-	1.0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

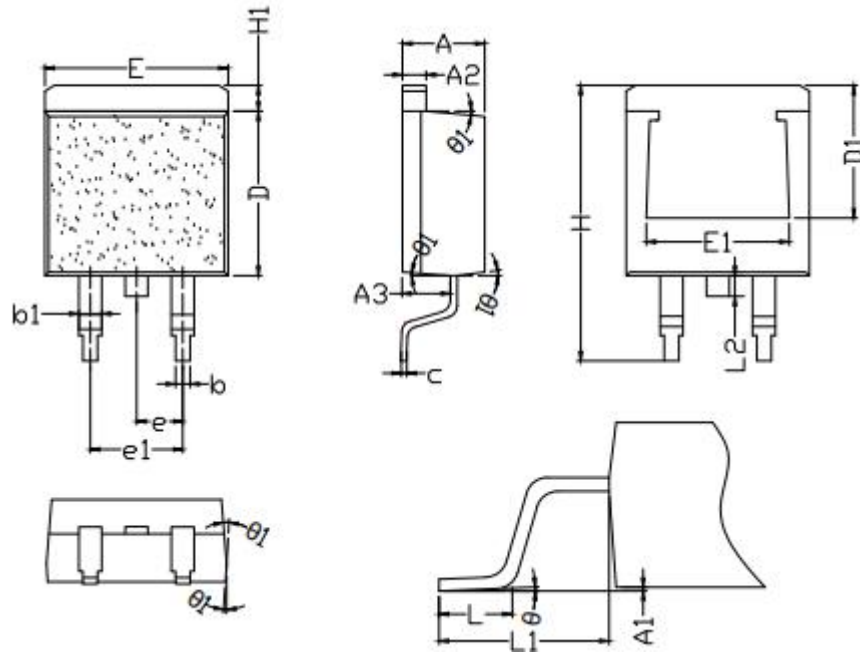
Unit: mm



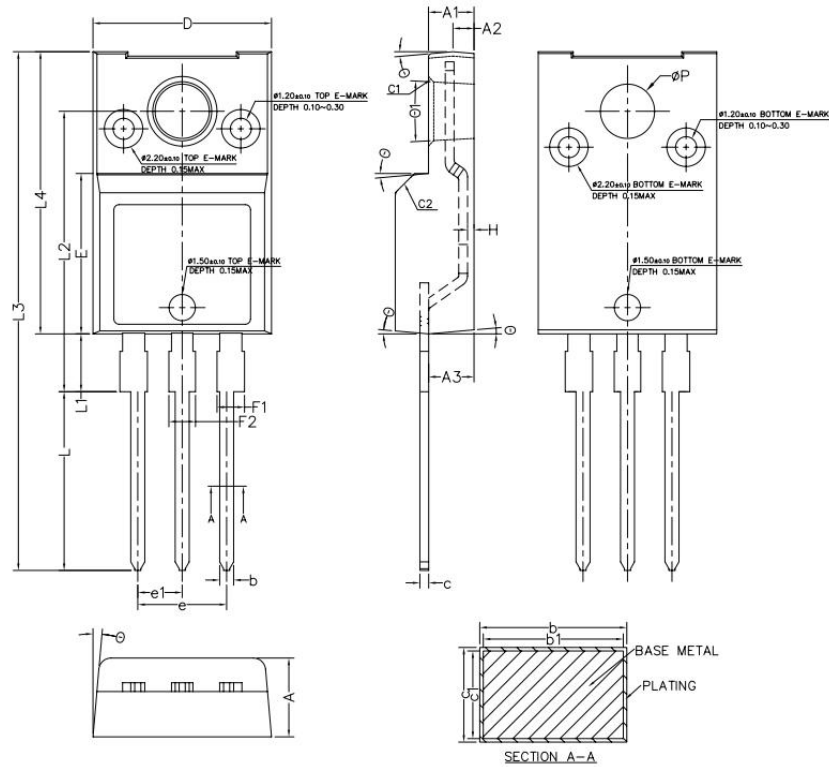
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40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

Mechanical Dimensions
TO-263-2 (Package 3)

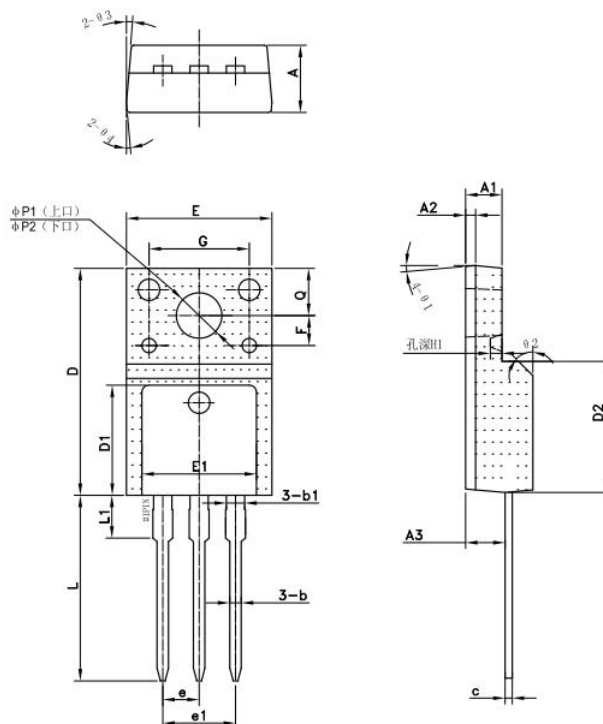
Unit: mm



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°

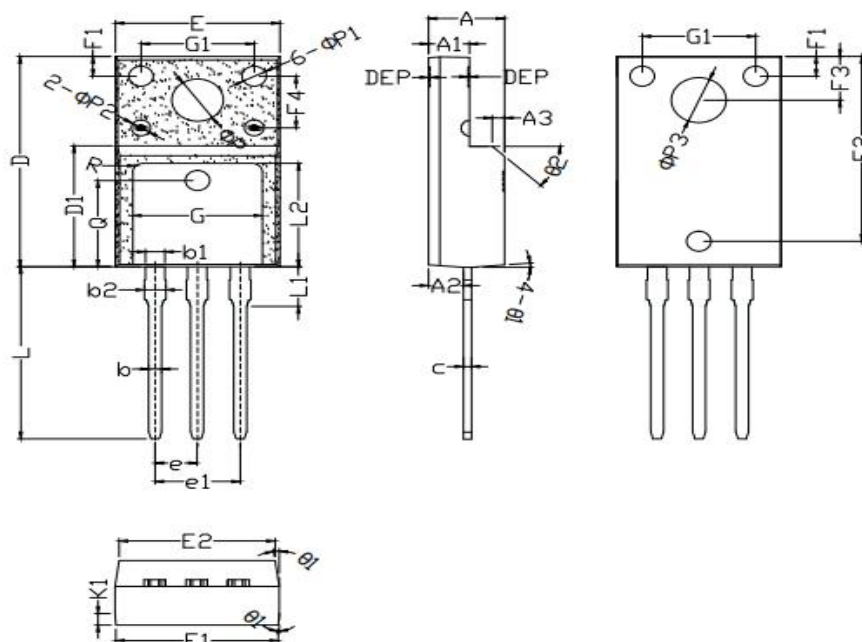
Mechanical Dimensions
TO-220F (Package 2)
Unit: mm


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°	

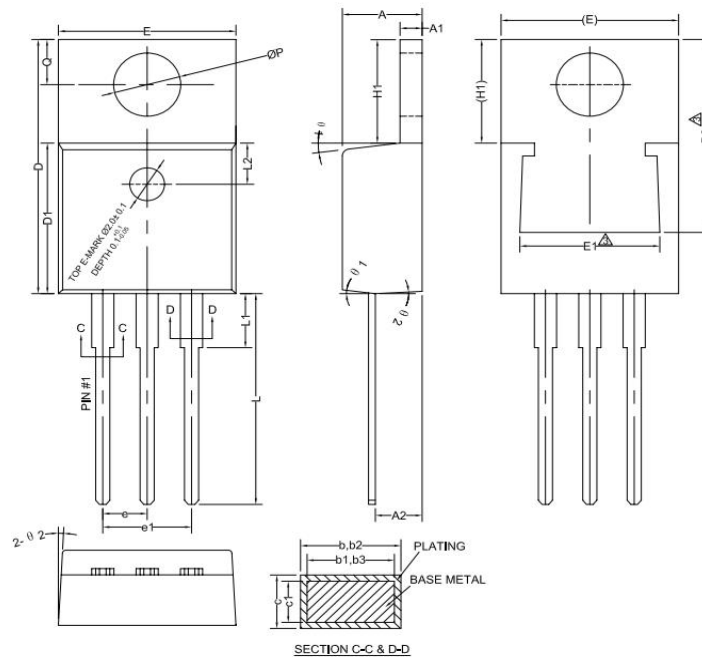
Mechanical Dimensions

TO-220F (Package 3)

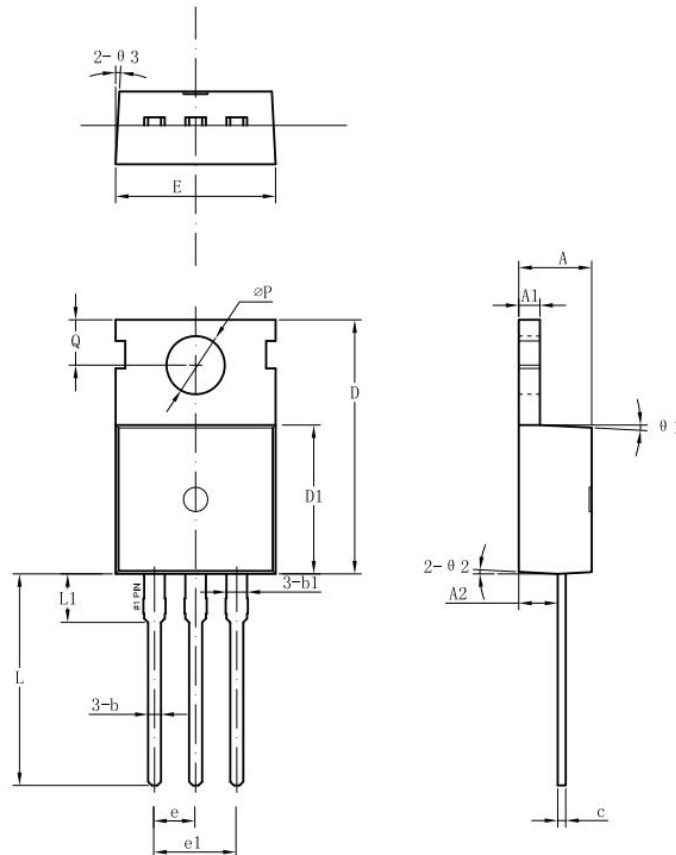
Unit: mm



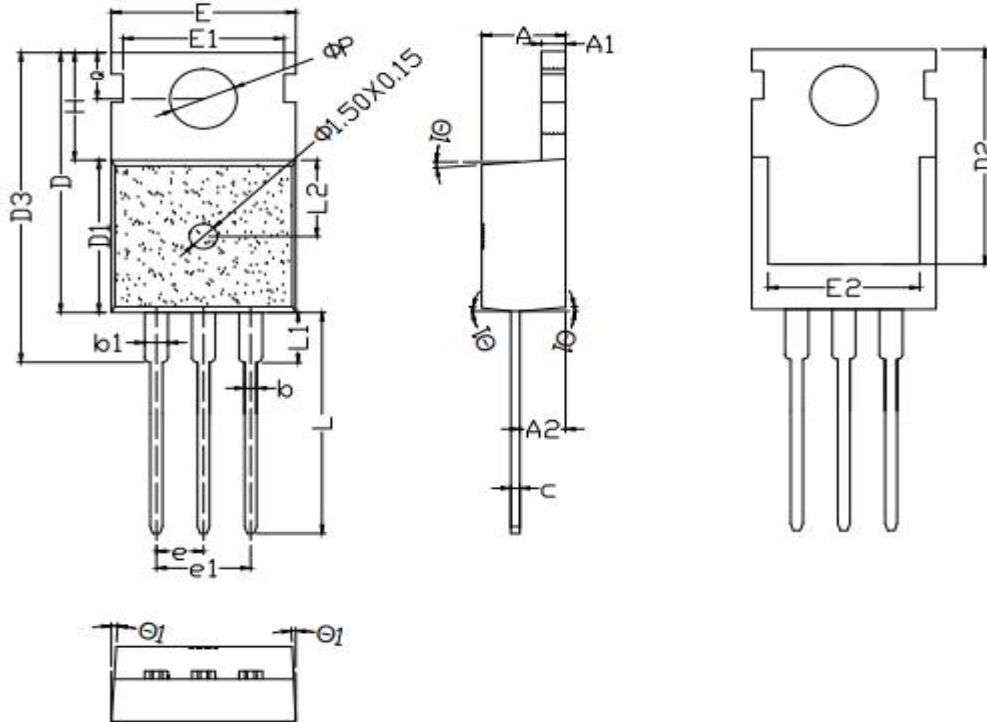
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.60	2.80	2.95
A3	1.0REF		
b	0.75	0.80	0.85
b1	1.18	1.20	1.24
b2	1.18	1.24	1.30
c	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
E	10.00	10.16	10.30
E1	9.94	10.06	10.30
E2	9.40	9.50	9.60
e	2.50	2.54	2.58
e1	5.08REF		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


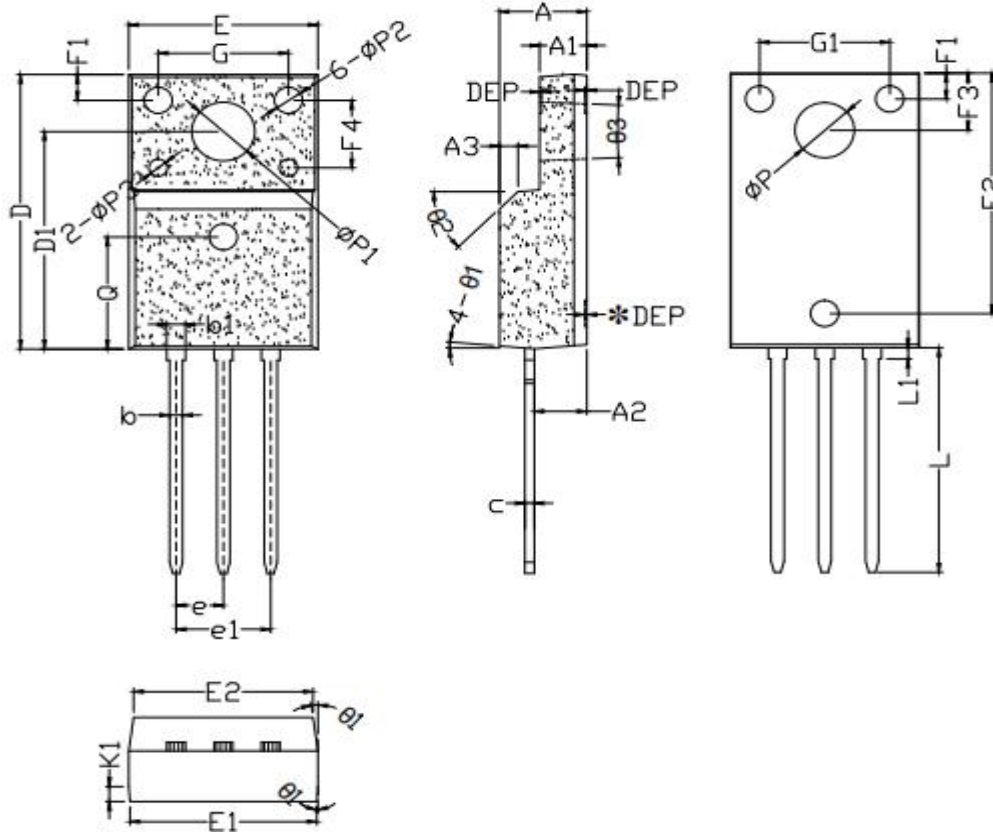
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	1.22	-	1.32
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
D	15.15	15.45	15.75
D1	9.05	9.15	9.25
D2	11.40	-	12.88
E	9.96	10.16	10.36
E1	6.86	-	8.89
e	2.44	2.54	2.64
e1	4.98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

Mechanical Dimensions
TO-220F Narrow
Unit: mm


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.60	4.70	4.80	E1	9.94	10.06	10.20
A1	2.34	2.54	2.74	E2	9.30	9.40	9.50
A2	2.56	2.76	2.93	F1	1.40	1.50	1.60
A3	1.0REF			F2	13.80	13.90	14.00
b	0.60	0.70	0.80	F3	3.20	3.30	3.40
b1	0.90	1.00	1.10	F4	3.70	3.90	4.10
c	0.45	0.50	0.55	G1	6.90	7.00	7.10
D	15.67	15.87	16.07	K1	0.65	0.70	0.75
D1	12.37	12.57	12.77	L	12.78	12.98	13.18
E	10.06	10.16	10.26	L1	-	-	0.85
e	2.50	2.54	2.58	Q	6.50REF		
e1	5.08REF			ΦP	3.08	3.18	3.28
ΦP1	3.30	3.40	3.50	ΦP3	0.90	1.00	1.10
ΦP2	1.40	1.50	1.60	θ1	3°	5°	7°
θ2	42°	45°	48°	θ3	3°	5°	7°
DEF	0.05	0.10	0.15				



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