

General Description

The Sanrise SRC65R600EC 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 SRC65R600EC break down voltage is 650V and it has a high rugged avalanche characteristics. The SRC65R600EC is available in TO-252, TO-263-2, PDFN5*6, TO-262, TO-220F and TO-251 packages.

Features

- Ultra Low $R_{DS(ON)} = 600m\Omega @ V_{GS} = 10V$.
- Ultra Low Gate Charge, $Q_g = 18.4nC$ typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved Design (*SnowMOS™ Gen.2*)
- Non-automotive Qualified

Application

- TV Power
- High Performance Charger / Adapter
- LED Lighting Power

Ordering Information

Circuit Type		SRC65R600EC□□-□	
Package		E: Lead Free	
		G: Green	
		Blank: Tube	
		TR: Tape & Reel	
		D: TO-252, D56: PDFN5*6	
		TF: TO-220F, TS: TO-262	
		S2: TO-263-2, D1-G: TO-251	

Symbol

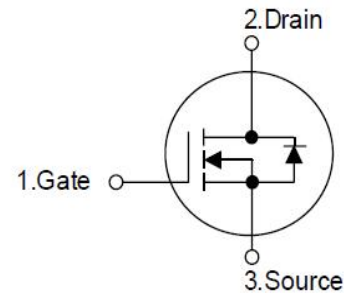


Figure 1 Symbol of SRC65R600EC

Package Type

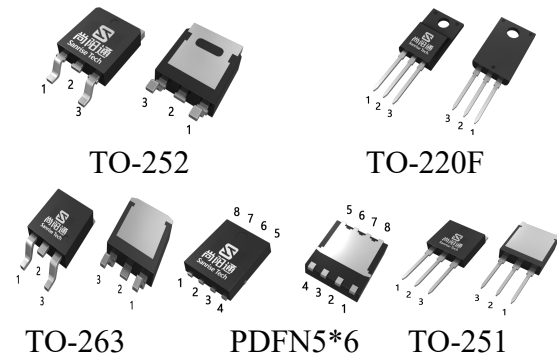


Figure 2 Package Types of SRC65R600EC

Package	Part Number	Marking ID	Packing Type
TO-252	SRC65R600ECDTR-G	SRC65R600ECDG	Tape & Reel
TO-220F	SRC65R600ECTF-G	SRC65R600ECTFG	Tube
TO-262	SRC65R600ECTS-G	SRC65R600ECTSG	Tube
TO-263-2	SRC65R600ECS2TR-G	SRC65R600ECS2G	Tape & Reel
PDFN5*6	SRC65R600ECD56TR-G	SRC65R600ECD56G	Tape & Reel
TO-251	SRC65R600ECD1-G	SRC65R600ECD1G	Tape & Reel

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage (Note2)		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	±30	V
Power Dissipation($T_C=25^{\circ}\text{C}$, TO-252, TO-262, TO-263-2, PDFN5*6, TO-251)		P_{tot}	58	W
Power Dissipation($T_C=25^{\circ}\text{C}$, TO-220F)		P_{tot}	27	W
Continuous Drain Current	$T_C=25^{\circ}\text{C}$	I_D	7.3	A
	$T_C=100^{\circ}\text{C}$		4.6	
	$T_C=125^{\circ}\text{C}$		3.3	
Pulsed Drain Current (Note 4)		I_{DM}	21.9	A
Avalanche Energy, Single Pulse (Note 5)		E_{AS}	105	mJ
Avalanche Energy, Repetitive (Note 4)		E_{AR}	0.15	mJ
Avalanche Current, Repetitive (Note 4)		I_{AR}	1.3	A
Continuous Diode Forward Current		I_S	7.3	A
Diode Pulse Current		$I_{S,PULSE}$	24.0	A
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 voltage spike during switching.
3. Repetitive Rating: Pulse width limited by maximum junction temperature
4. $I_{AS} = 1.3\text{A}$, $V_{DD} = 60\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$

Thermal characteristics

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	R_{thJC}			4.5	$^{\circ}\text{C} / \text{W}$
	TO-252				2.13	
	TO-262				2.13	
	TO-263-2				2.13	
	PDFN5*6				2.13	
	TO-251				2.13	
Thermal resistance, Junction-to-Ambient	TO-220F	R_{thJA}			60	$^{\circ}\text{C} / \text{W}$
	TO-252				60	
	TO-262				60	
	PDFN5*6				60	
	TO-263-2				60	
	TO-251				60	

Electrical Characteristics

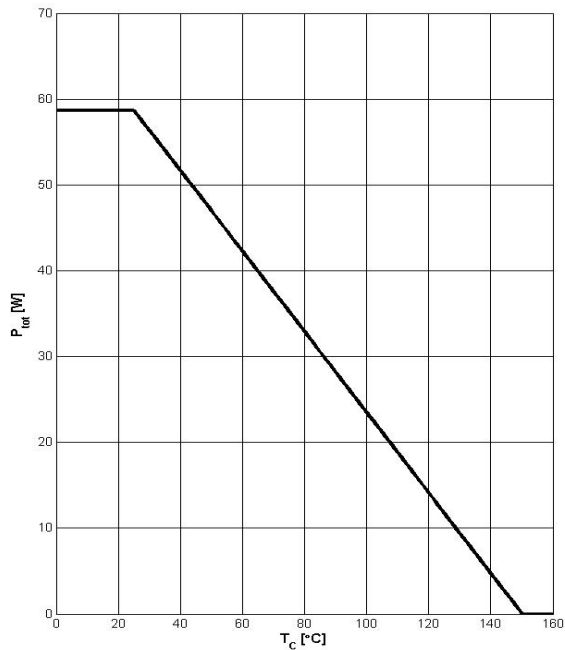
$T_J = 25^\circ\text{C}$, unless otherwise specified.

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	3.6	4.5	V
Static Drain-Source On-Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =4.0A		460	600	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		8.9		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =50V, V _{GS} =0V, f=1MHz		356		pF
Output Capacitance		C _{OSS}			31.8		
Reverse Transfer Capacitance		C _{RSS}			18.7		
Effective output capacitance, energy related ^{NOTE6}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...480V		16		pF
Effective output capacitance, time related ^{NOTE7}		C _{O(tr)}			72		
Turn-on Delay Time		t _{d(on)}	V _{DD} =400V, I _D =4.0A R _G =10Ω, V _{GS} =10V		10		ns
Rise Time		t _r			12		
Turn-off Delay Time		t _{d(off)}			36		
Fall Time		t _f			14		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =480V, I _D =4.0A V _{GS} =0 to 10V		4.2		nC
Gate to Drain Charge		Q _{gd}			9.1		
Gate Charge Total		Q _g			18.4		
Gate Plateau Voltage		V _{plateau}			5.9		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =4.0A		0.84	1.1	V
Reverse Recovery Time		t _{rr}	V _R =400V, I _F =4.0A dI _F /dt=100A/us		206		ns
Reverse Recovery Charge		Q _{rr}			1.63		uC
Peak Reverse Recovery Current		I _{rrm}			15.8		A

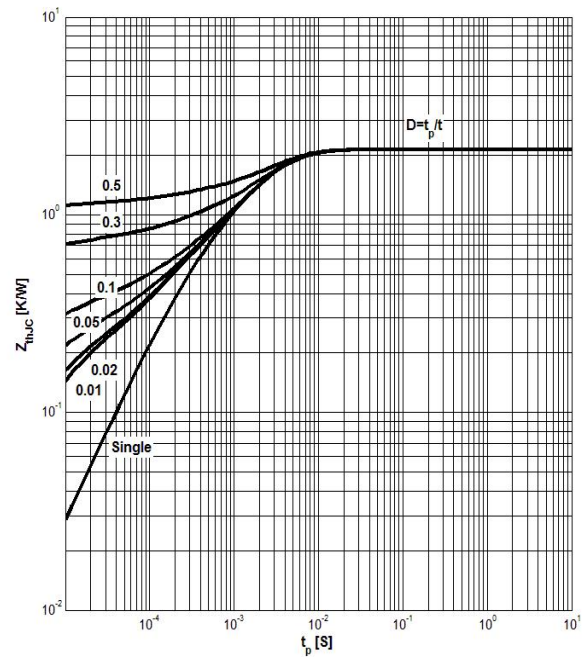
Note:

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 480V

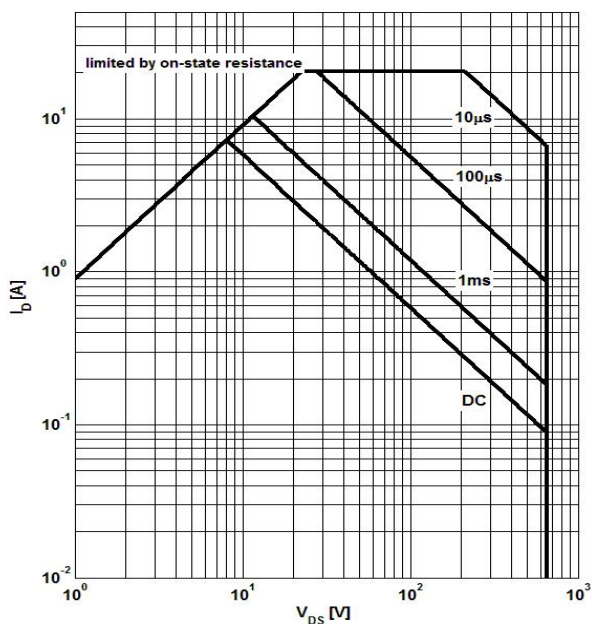
7. $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480 V

Typical Performance Characteristics
Figure 3: Power Dissipation


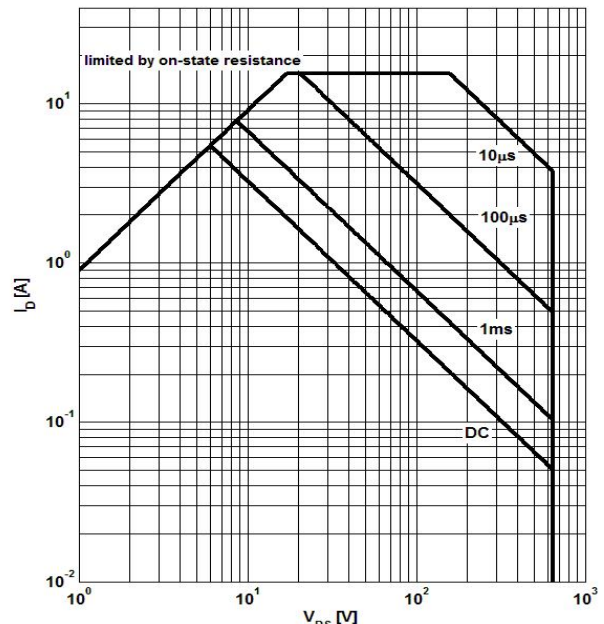
$$P_{tot} = f(T_c)$$

Figure 4: Max. Transient Thermal Impedance


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

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


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

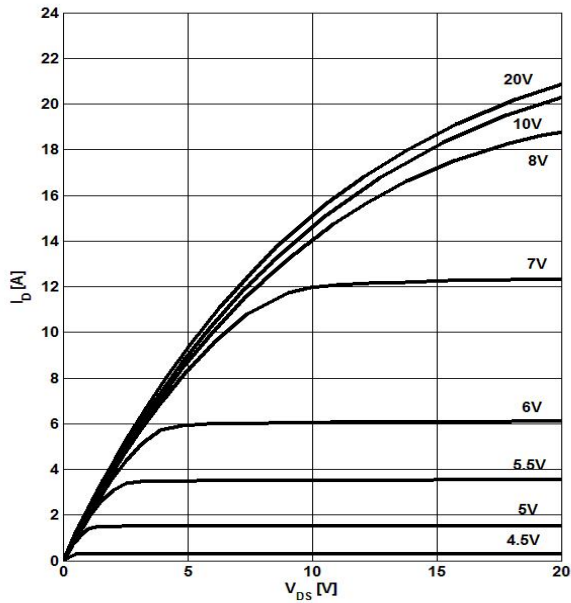
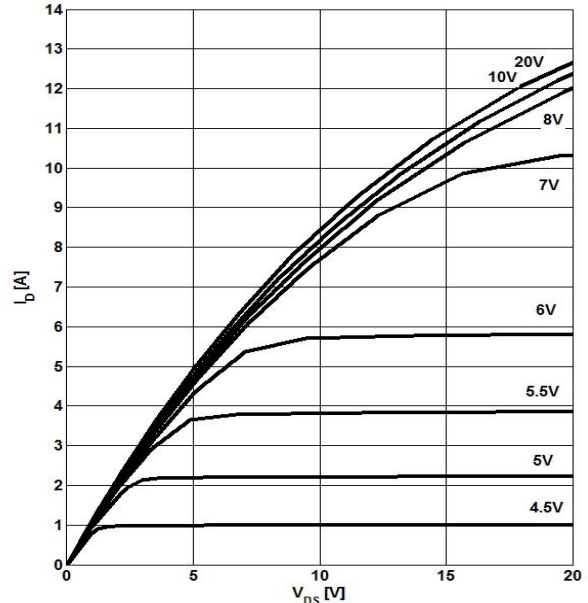
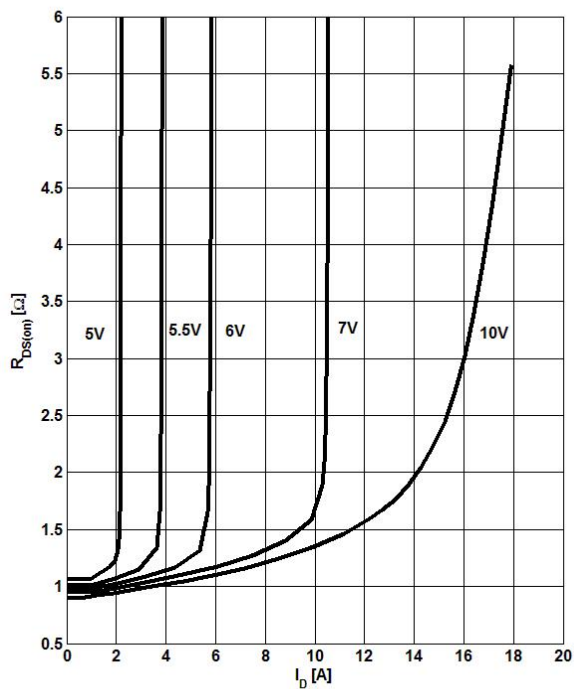
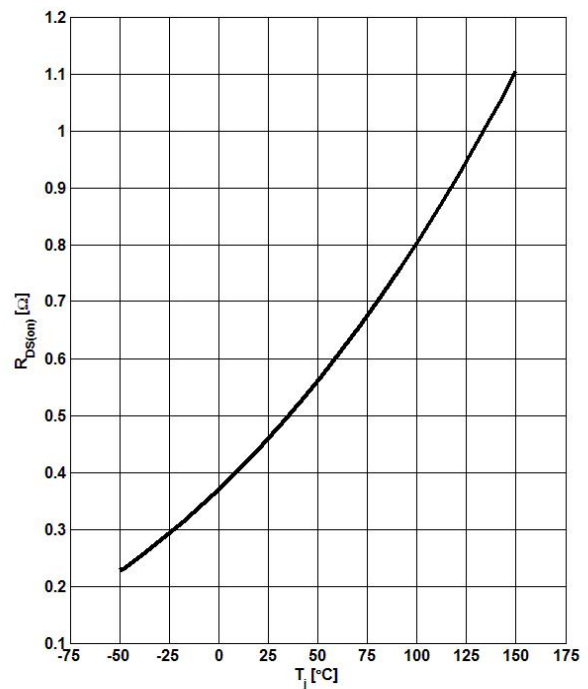
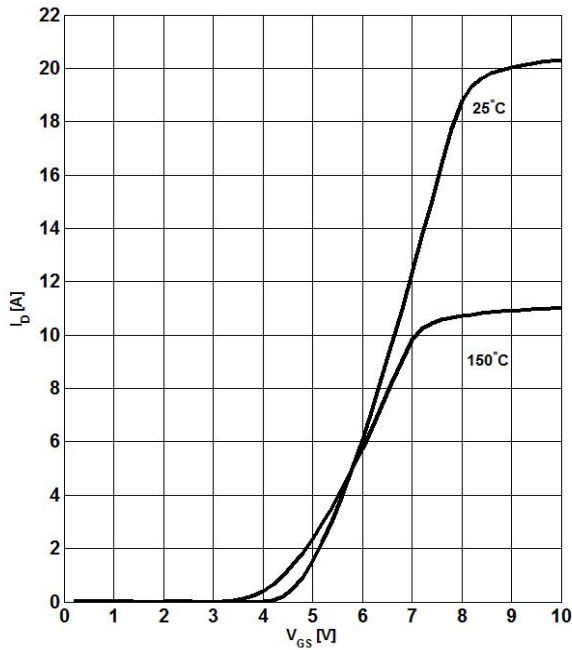
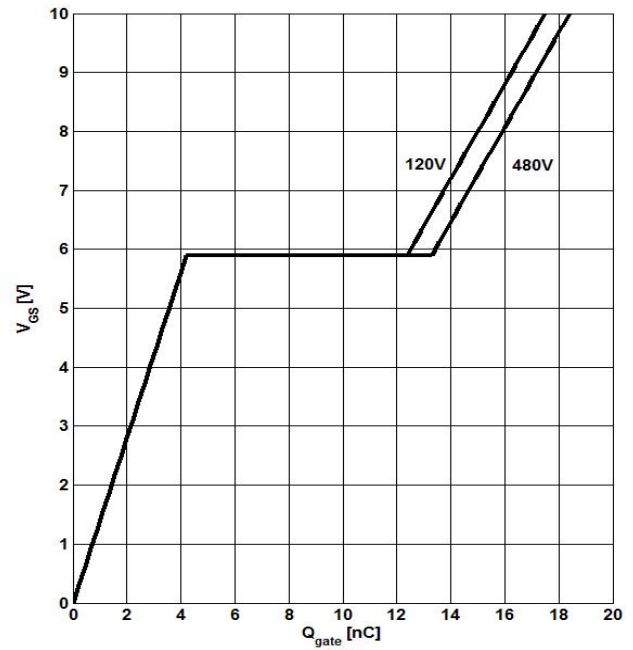
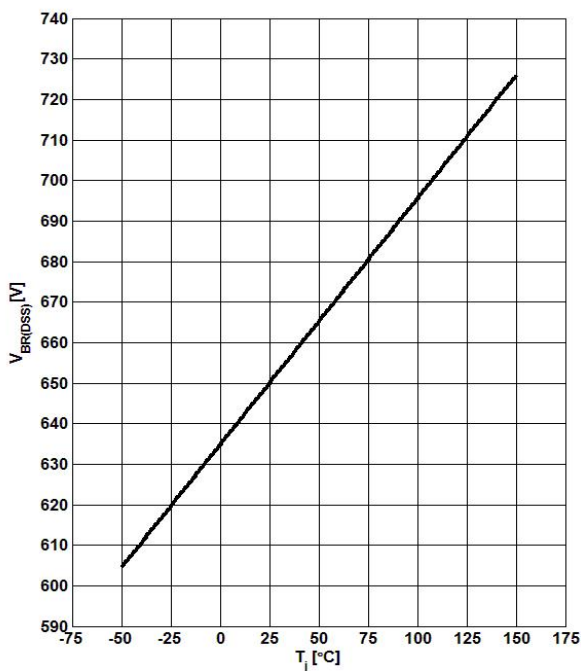
Figure 7: Typ. Output Characteristics

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


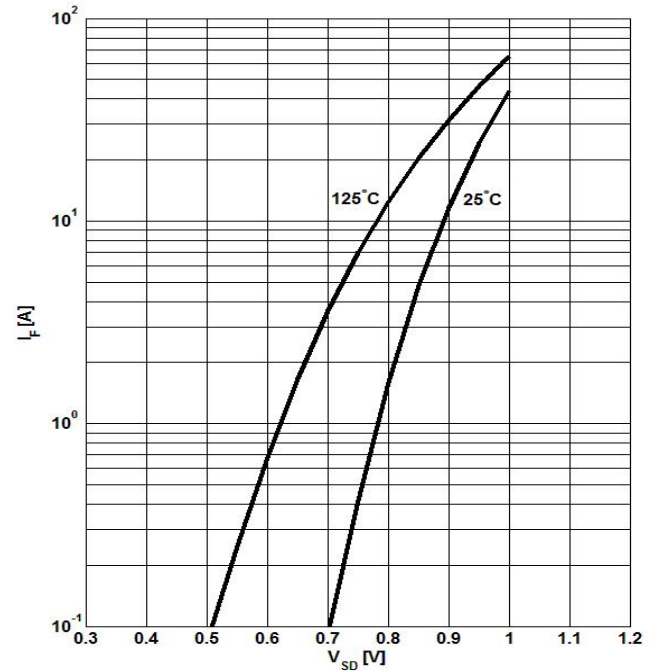
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Figure 12: Typ. Gate Charge


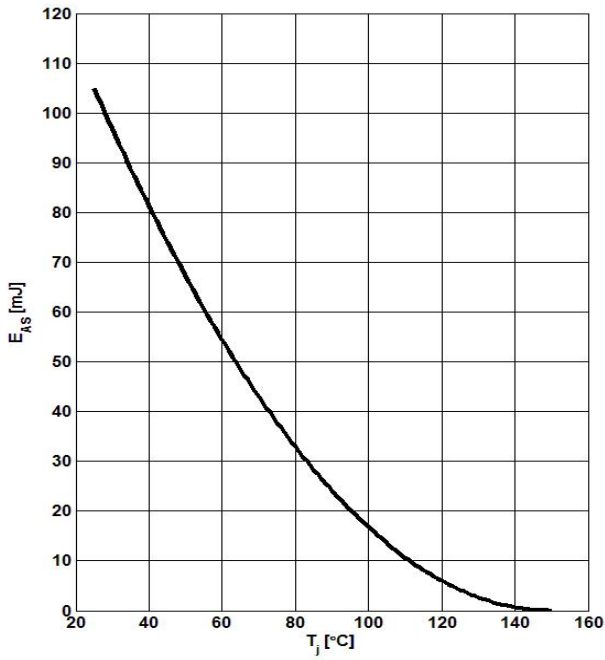
$$V_{GS} = f(Q_{gate}), I_D = 4.0A \text{ pulsed}$$

Figure 13: Drain-Source Breakdown Voltage


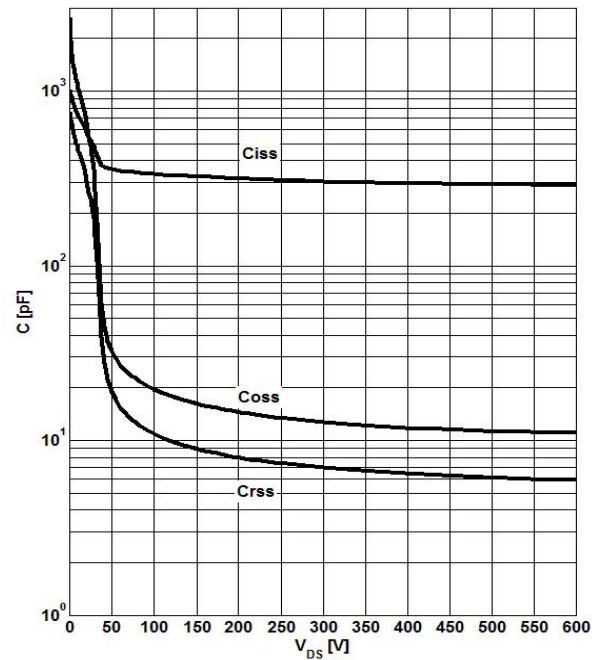
$$\text{Minimum } V_{BR(DSS)} = f(T_j); I_D = 1mA$$

Figure 14: Forward Characteristics of Reverse Diode


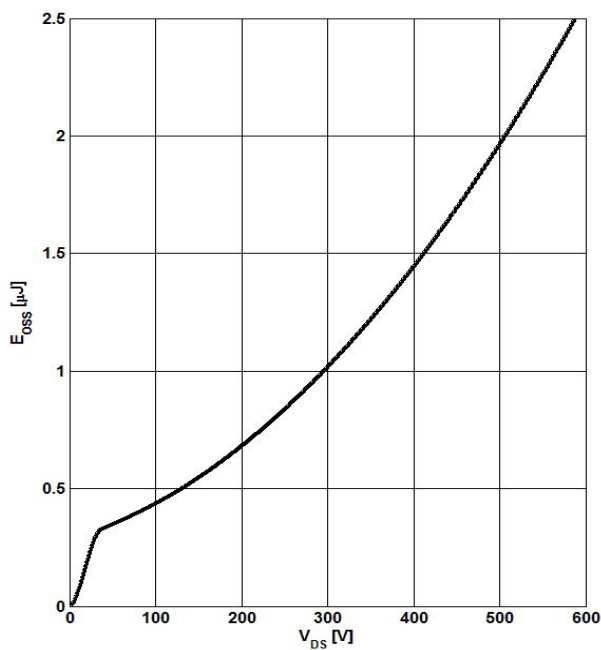
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

Figure 15: Avalanche Energy


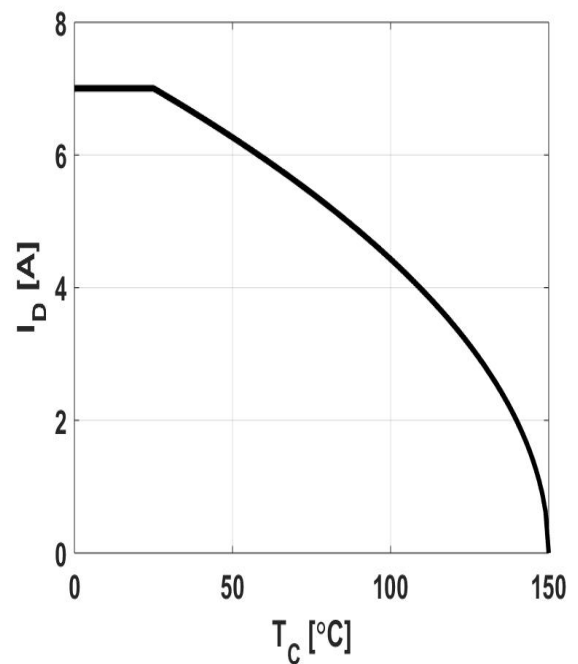
$$E_{AS}=f(T_J); I_D=1.3A; V_{DD}=60V$$

Figure 16: Typ. Capacitances


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

Figure 17: Coss Stored Energy


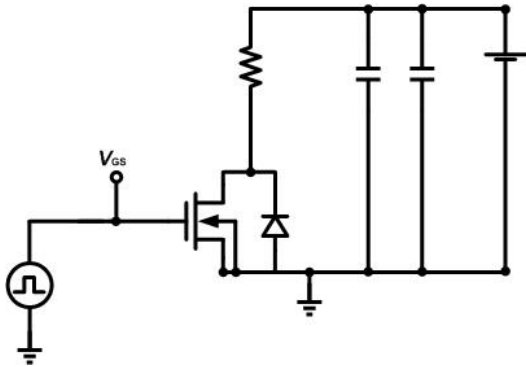
$$E_{OSS}=f(V_{DS})$$

Figure 18: Drain current


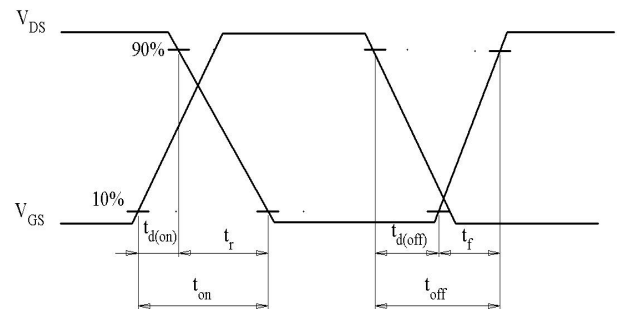
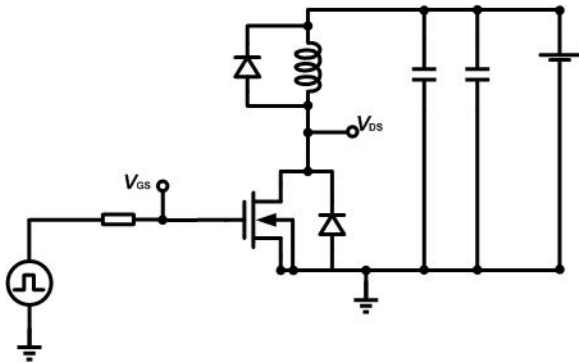
$$I_D=f(T_C)$$

Test Circuits

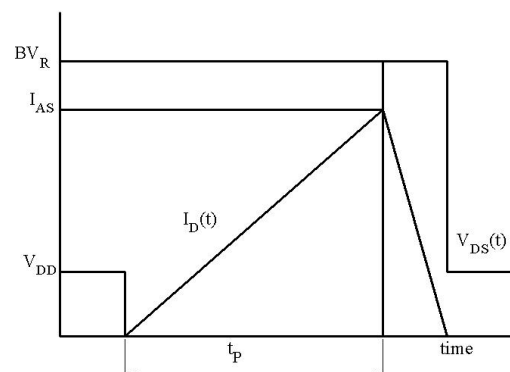
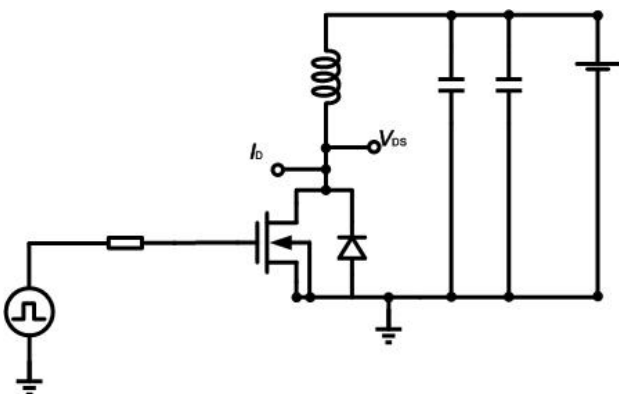
1. Gate Charge Test Circuit & Waveform



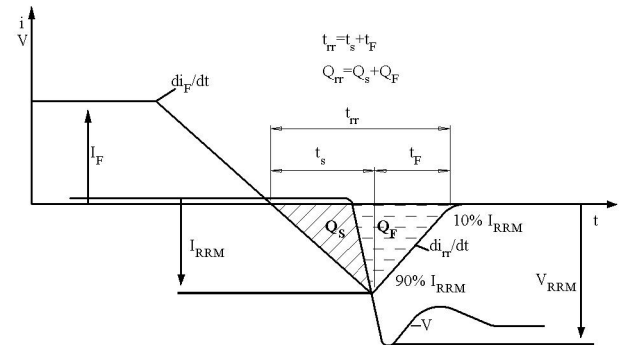
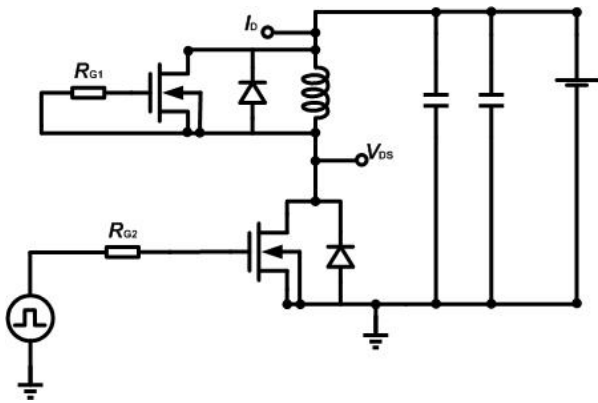
2. Switch Time Test Circuit

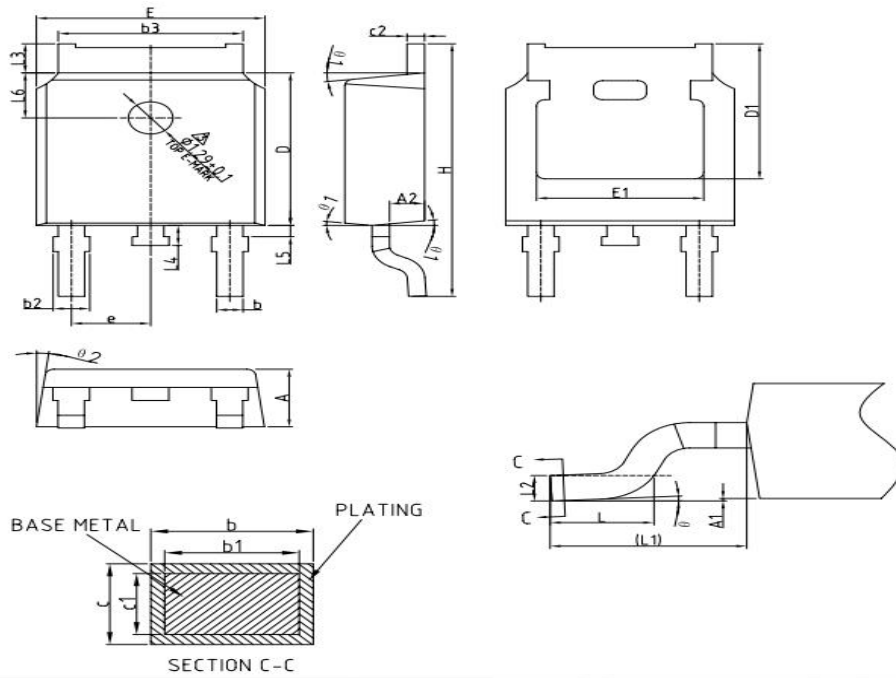


3. Unclaimed Inductive Switching Test Circuit & Waveforms

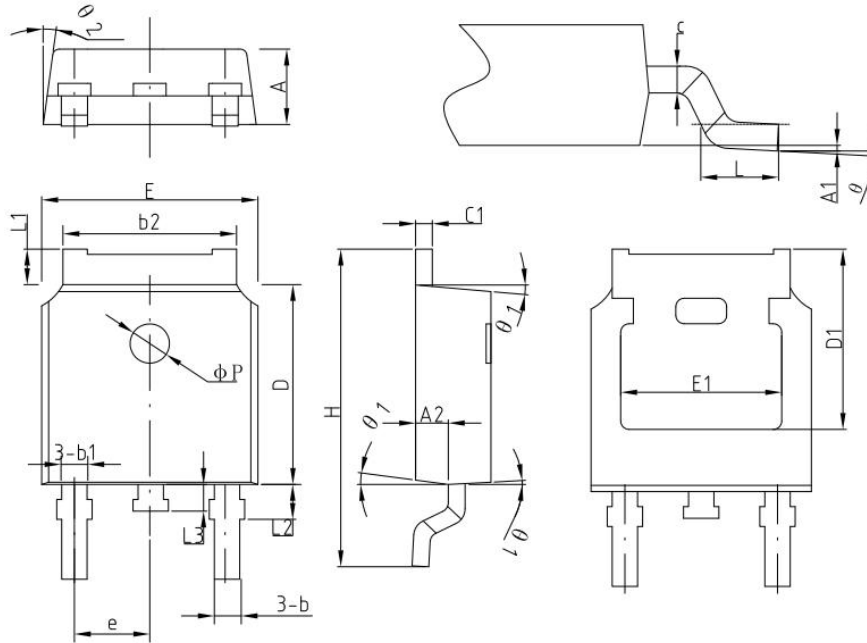


4. Test Circuit and Waveform for Diode Characteristics

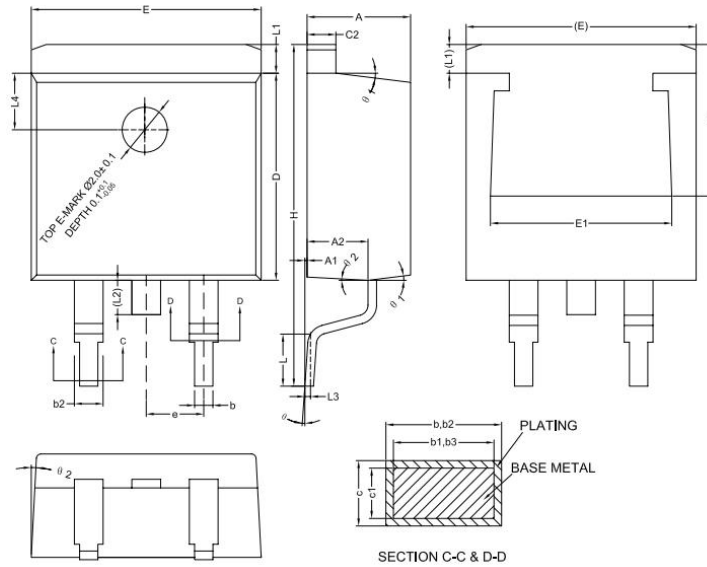


Mechanical Dimensions
TO-252 (Package 1)
Unit: mm


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


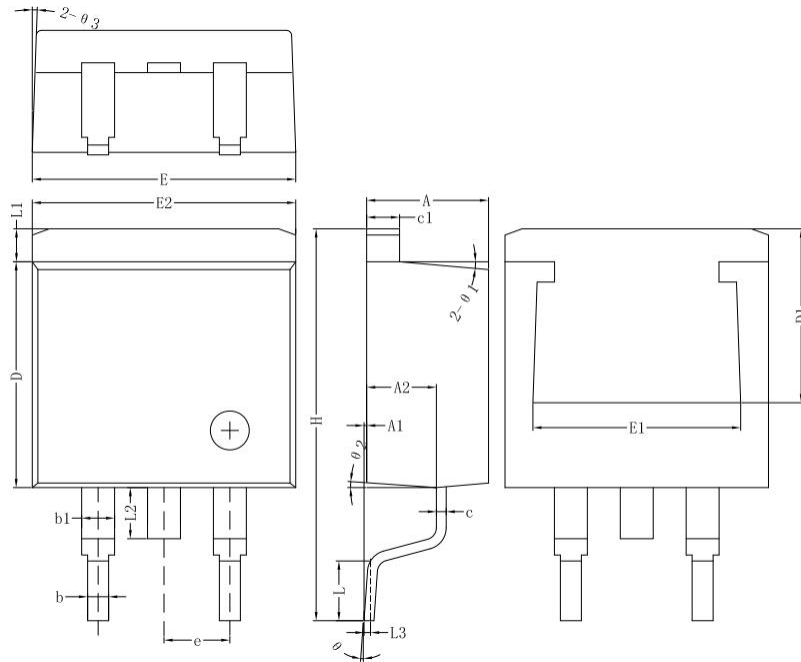
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.127
A2	0.90	1.01	1.10
b	0.635	0.76	0.86
b1	-	0.76	-
b2	5.2	5.33	5.46
c	0.47	0.50	0.60
c1	0.47	0.50	0.60
D	6.0	6.10	6.20
D1	-	5.30	-
E	6.50	6.60	6.70
E1	-	4.83	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.40	1.50	1.70
L1	0.90	-	1.25
L2	-	1.0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

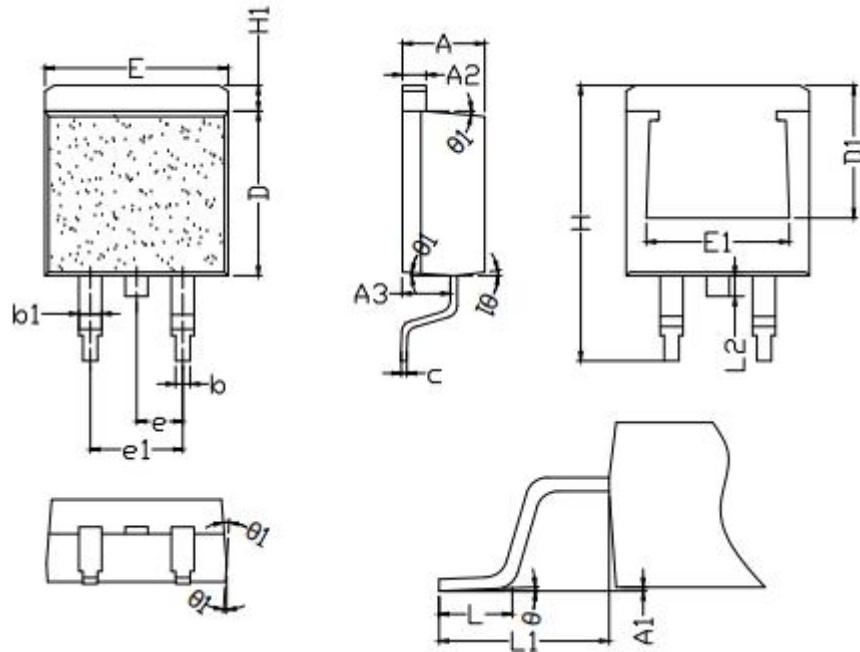
Unit: mm



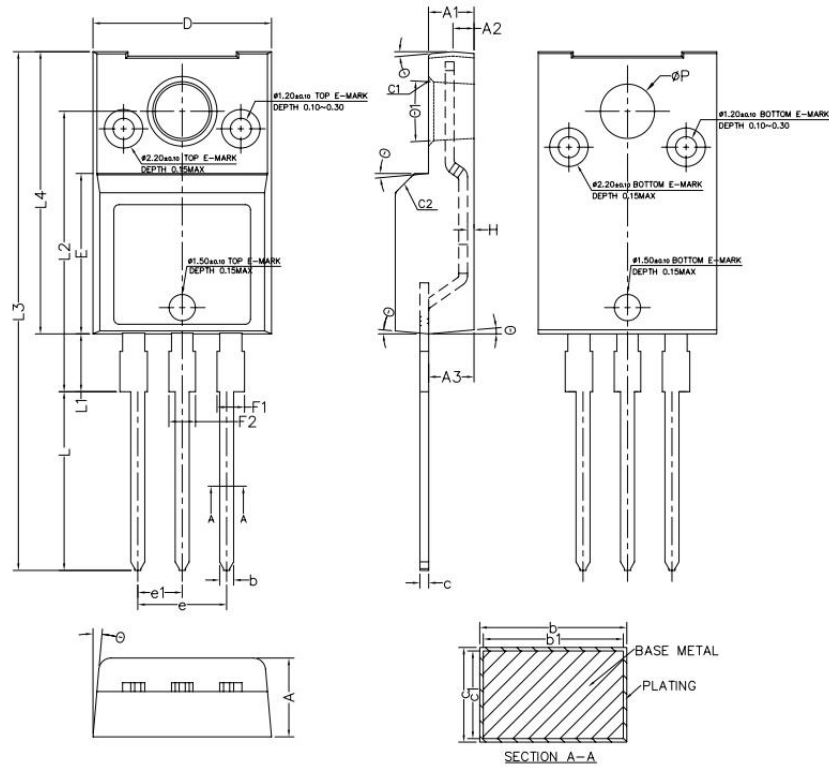
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40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

Mechanical Dimensions
TO-263-2 (Package 3)

Unit: mm



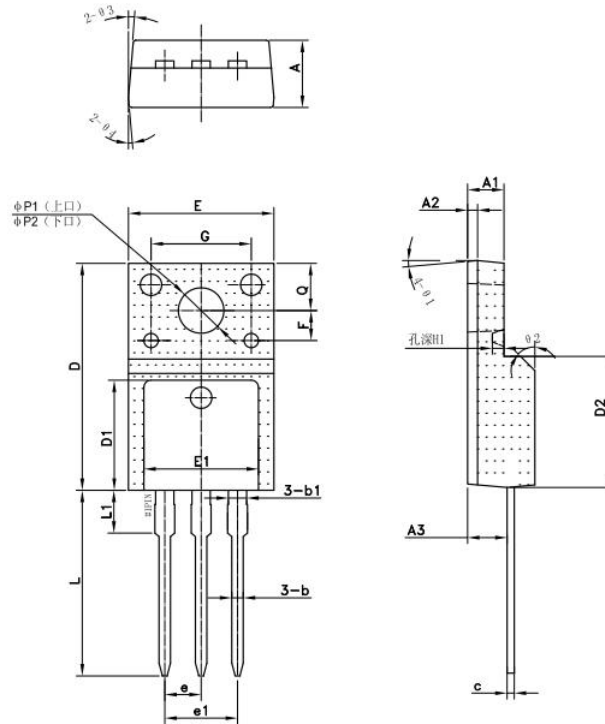
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.42	4.52	4.62
A1	0.00	0.10	0.25
A2	1.24	1.27	1.32
A3	2.50	2.60	2.70
b	0.77	0.81	0.84
b1	1.23	1.28	1.41
c	0.33	0.38	0.43
D	8.80	8.95	9.10
D1	7.2REF		
E	9.92	10.07	10.22
E1	7.85REF		
e	2.50	2.54	2.58
e1	5.08REF		
H	14.80	15.10	15.30
H1	1.12	1.28	1.42
L	2.10	2.23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

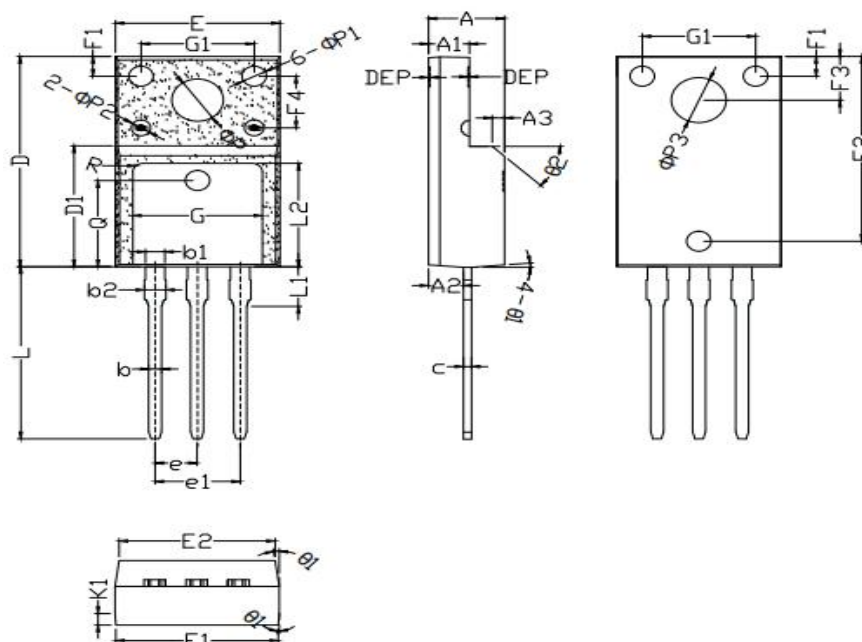


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.70
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
D2	-	9.12	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54		
e1		5.08	
F		2.1	
G		7	
H1	-	0.81	-
L	12.48	12.98	13.20
L1	-	2.93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

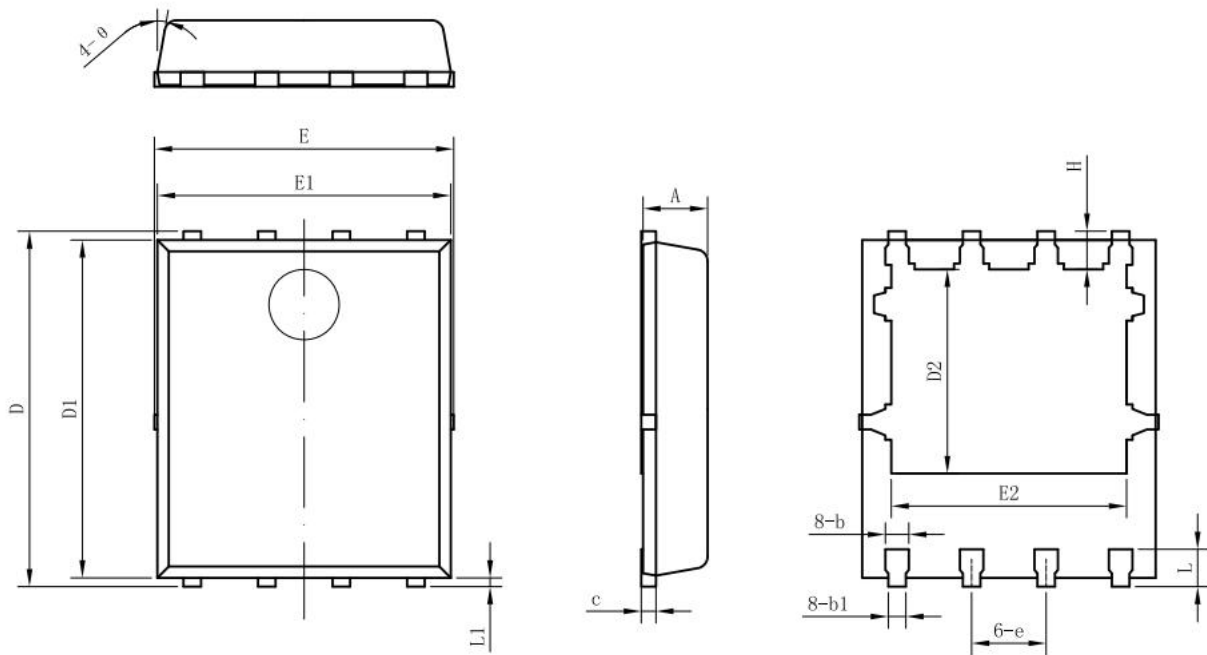
Mechanical Dimensions

TO-220F (Package 3)

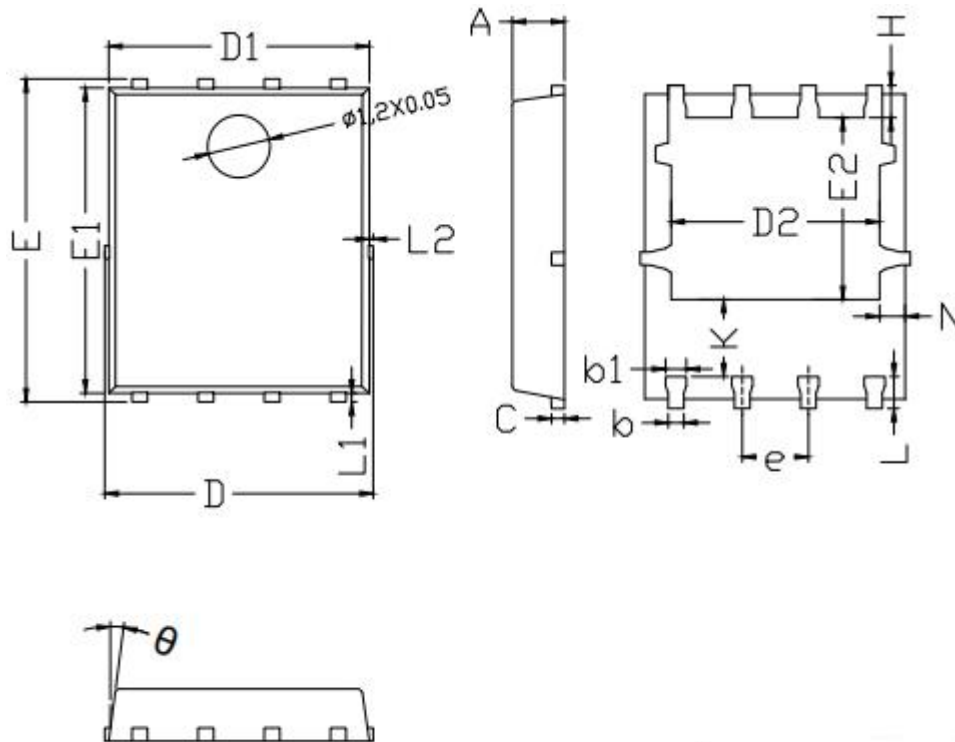
Unit: mm



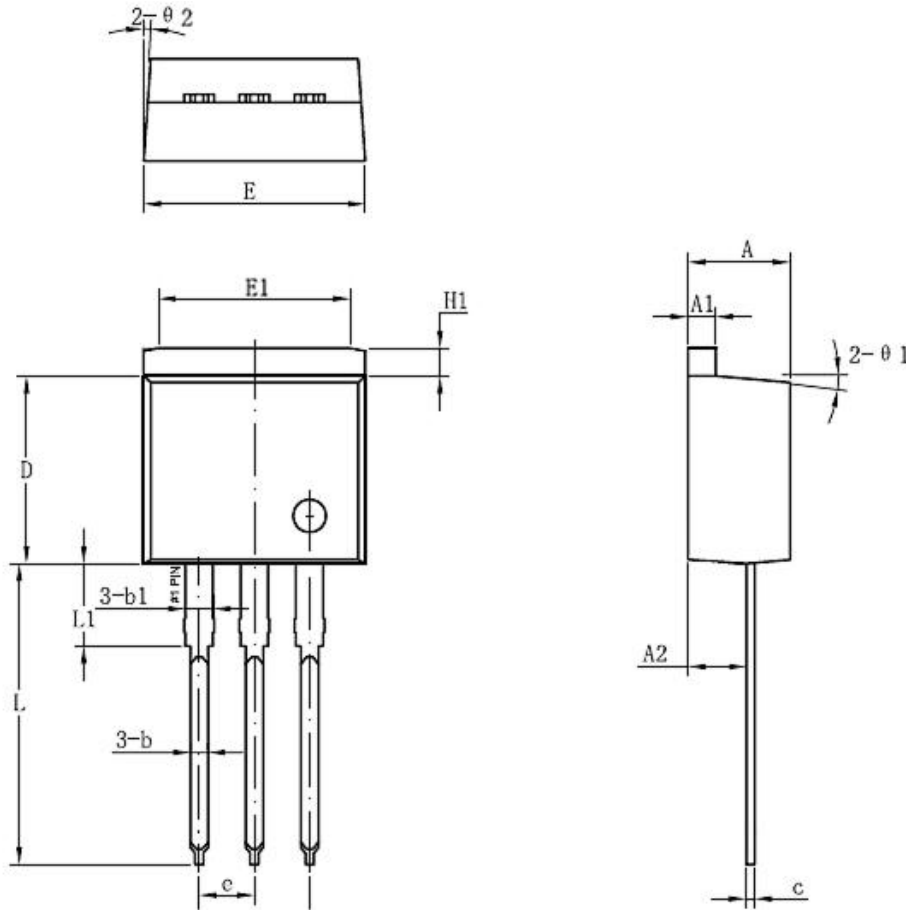
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.60	2.80	2.95
A3	1.0REF		
b	0.75	0.80	0.85
b1	1.18	1.20	1.24
b2	1.18	1.24	1.30
c	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
E	10.00	10.16	10.30
E1	9.94	10.06	10.30
E2	9.40	9.50	9.60
e	2.50	2.54	2.58
e1	5.08REF		
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
PDFN5*6-8 (Package 1)
Unit: mm


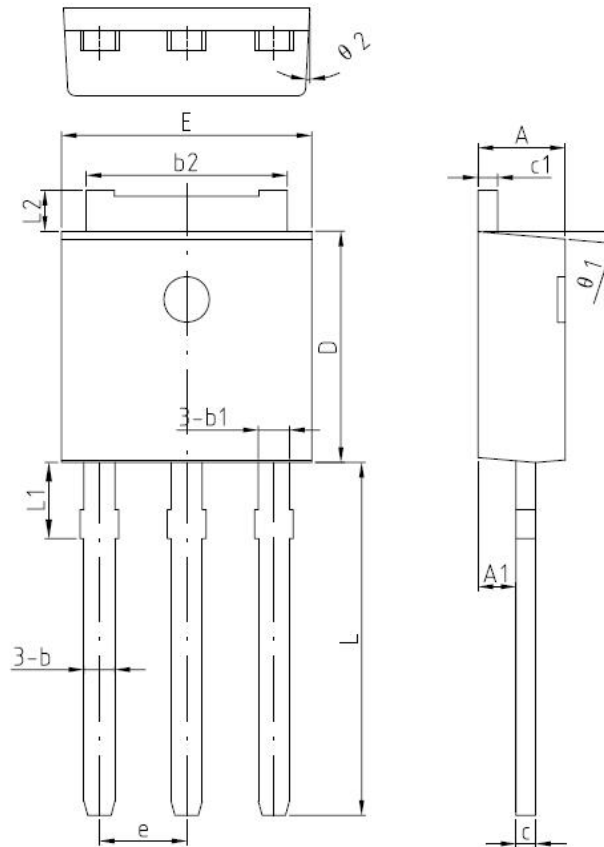
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	1.0	1.10	1.20
b	0.3	0.40	0.5
c	0.2	0.25	0.35
D	5.9	6.05	6.2
D1	5.65	5.75	5.85
D2		3.475	
e		1.27BSC	
E			5.2
E1	4.9	5	5.1
E2		4.01	
H	0.5	0.65	0.75
L	0.51	0.635	0.75
L1		0.15	
θ		10°	

Mechanical Dimensions
PDFN5*6-8 (Package 2)
Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	0.95	1.00	1.05
b	0.25	0.30	0.35
c	0.20	0.25	0.30
D	5.15BSC		
D1	4.90	5.00	5.10
D2	3.90	4.01	4.20
e	1.17	1.27	1.37
E	6.15BSC		
E1	5.75	5.85	5.95
E2	3.35	3.50	3.65
H	0.51	0.61	0.71
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
L2	-	-	0.12
N	0.40	0.50	0.60
P	0.95	1.10	1.25
θ	9°	11°	13°

Mechanical Dimensions
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
TO-251
Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.40
A1	0.90	1.01	1.17
b	0.50	-	0.91
b1	-	0.81	-
b2	5.13	5.33	5.46
c	0.46	0.50	0.60
c1	0.46	0.50	0.60
D	5.95	6.10	6.25
E	6.45	6.60	6.75
e	2.286(BSC)		
L	9.00	9.30	9.60
L1	-	2.00	-
L2	0.90	-	1.25
θ1	-	5°	-
θ2	-	3°	-



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