380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

General Description

The Sanrise SRC65R380S 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 SRC65R380S break down voltage is 650V and it has a high rugged avalanche characteristics.

The SRC65R380S is available in TO-252 ,TO-220F, and TO-263-2 packages .

Features

- Ultra Low $R_{DS(ON)}$ = 380mΩ @ V_{GS} = 10V.
- Vds@Tjmax=700v
- Ultra Low Gate Charge, Qg=17nC typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved Design
- Non-automotive Qualified

Application

- TV Power
- High Performance Charger / Adapter

Symbol

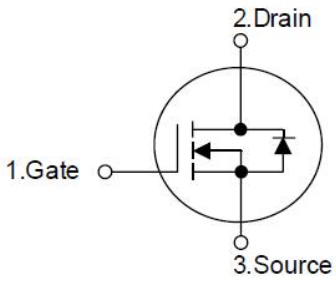
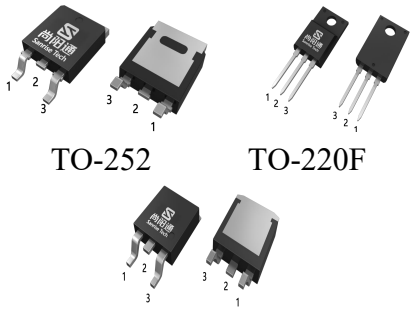


Figure 1 Symbol of SRC65R380S

Package Type



TO-252 TO-220F

TO-263

Figure 2 Package Types of SRC65R380S

Ordering Information

SRC65R380S□□–□

Circuit Type

Package

S2: TO-263-2

D: TO-252

TF: TO-220F

E: Lead Free

G: Green

Blank: Tube

TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
TO-252	SRC65R380SDTR-G	SRC65R380SDG	Tape & Reel
TO-263-2	SRC65R380SS2TR-G	SRC65R380SS2G	Tape & Reel
TO-220F	SRC65R380STF-G	SRC65R380STFG	Tube

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	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	T_C=25ºC (Note2)	I_D	12.6	A
	T_C=100ºC		8.0	
	T_C=125ºC		5.6	
Pulsed Drain Current (Note 3)		I_{DM}	37.8	A
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	109	mJ
Avalanche Energy, Single Pulse (Note 5)		E_{AS}	356	mJ
Avalanche Energy, Repetitive (Note 3)		E_{AR}	0.1	mJ
Avalanche Current, Repetitive (Note 3)		I_{AR}	1.8	A
Continuous Diode Forward Current		I_S	12.6	A
Diode Pulse Current		$I_{S.PULSE}$	37.8	A
Power Dissipation（Tc=25℃,TO-220F）		P_{tot}	32	W
Power Dissipation（Tc=25℃,TO-252, TO-263-2）		P_{tot}	73	W
MOSFET dv/dt Ruggedness, V_{DS}<=480V		dv/dt	120	V/ns
Reverse Diode dv/dt, V_{DS}<=480V, I_{SD}<=I_D		dv/dt	50	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. Duty=0.70.
3. Repetitive Rating: Pulse width limited by maximum junction temperature
4. I_{AS} = 1.8A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C. Finish goods test condition.

4.I_{AS} =3.25A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C. Typical Eas.

Thermal Resistance

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	R_{thJC}			3.8	ºC /W
	TO-252				1.7	
	TO-263-2				1.7	
Thermal resistance, Junction-to-Ambient	TO-220F	R_{thJA}			70	ºC /W
	TO-252				62	
	TO-263-2				62	

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	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=5.0A		240	380	mΩ
Gate Resistance		R_G	f=1MHz, Open Drain		4.3		Ω
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS}=400V, V_{GS}=0V, f=100KHz		759		pF
Output Capacitance		C_{OSS}			25		
Effective output capacitance, energy related NOTE7		$C_{O(er)}$	V_{GS}=0V, V_{DS}=0…400V		38		pF
Effective output capacitance, time related NOTE8		$C_{O(tr)}$			186		
Turn-on Delay Time		$t_{d(on)}$	V_{DD}=400V, I_D=5.0A R_G=30Ω, V_{GS}=10V		41		ns
Rise Time		t_r			14		
Turn-off Delay Time		$t_{d(off)}$			74		
Fall Time		t_f			14		
Gate Charge Characteristics							
Gate to Source Charge		Q_{gs}	V_{DD}=400V, I_D=5.0A V_{GS}=0 to 10V		4.2		nC
Gate to Drain Charge		Q_{gd}			6.5		
Gate Charge Total		Q_g			17		
Gate Plateau Voltage		$V_{plateau}$			6.0		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_{SD}=5.0A		0.83	1.1	V
Reverse Recovery Time		t_{rr}	V_R=400V, I_F=5.0A dI$_F$/dt=100A/us		218		ns
Reverse Recovery Charge		Q_{rr}			2.3		uC
Peak Reverse Recovery Current		I_{rrm}			21		A

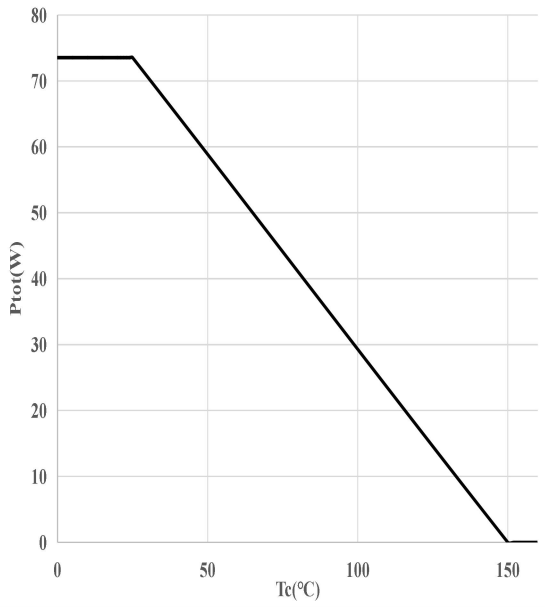
Note:

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

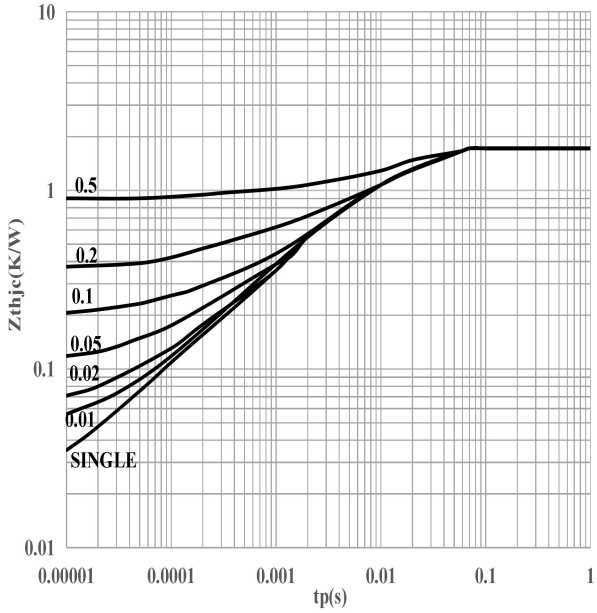
Typical Performance Characteristics

Figure 3: Power Dissipation



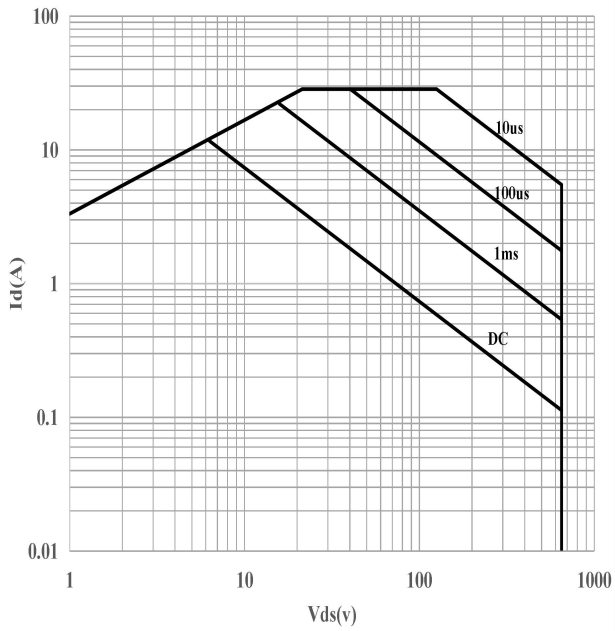
$P_{tot} = f(T_c)$

Figure 4: Max. Transient Thermal Impedance



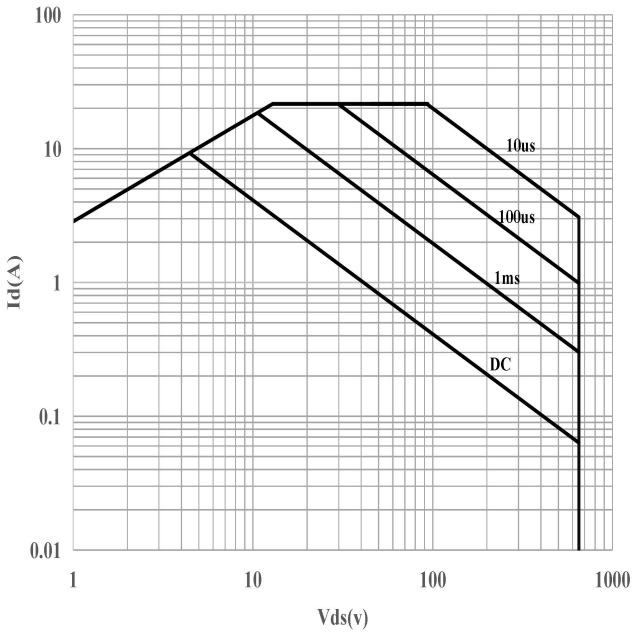
$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$

Figure 5: Safe Operating Area



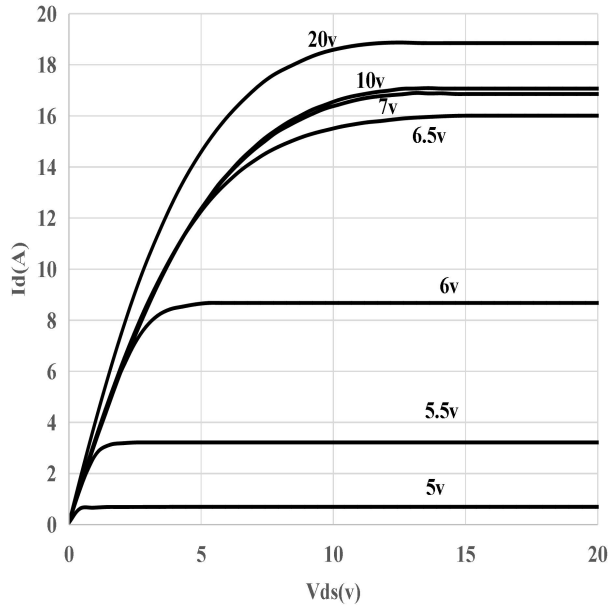
$I_D = f(V_{DS})$; T_c= 25ºC; V_{GS}>7V; parameter t_p

Figure 6: Safe Operating Area



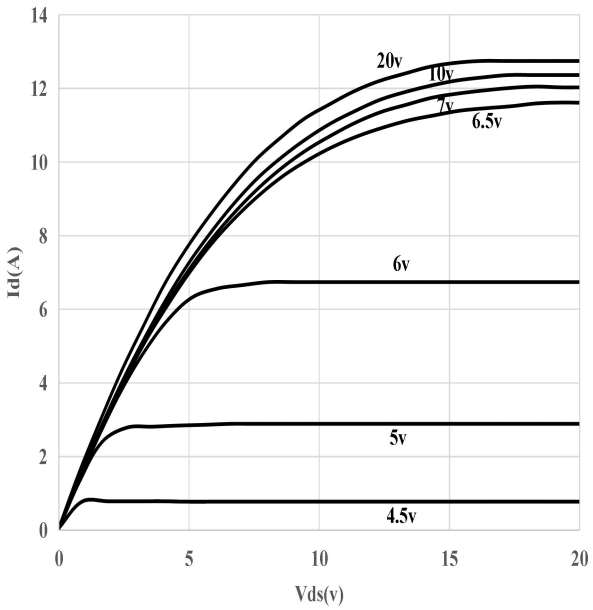
$I_D = f(V_{DS})$; T_c= 80ºC; V_{GS}>7V; parameter t_p

Figure 7: Typ. Output Characteristics



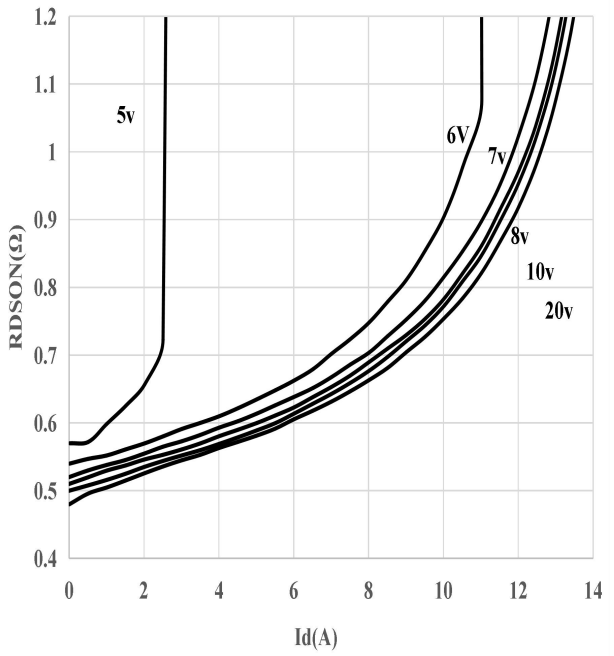
$I_D = f(V_{DS})$; Tj= 25ºC; parameter: V_{GS}

Figure 8: Typ. Output Characteristics



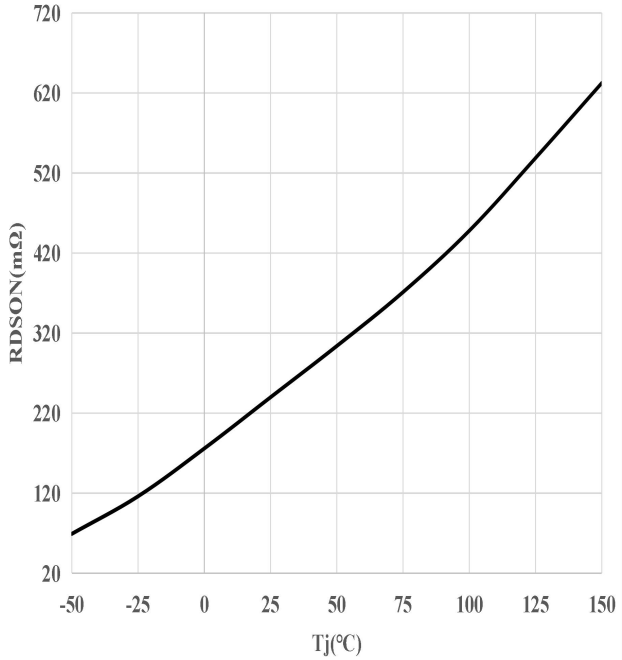
$I_D = f(V_{DS})$; T_j= 125ºC; parameter: V_{GS}

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=5.0A; V_{GS}=10V

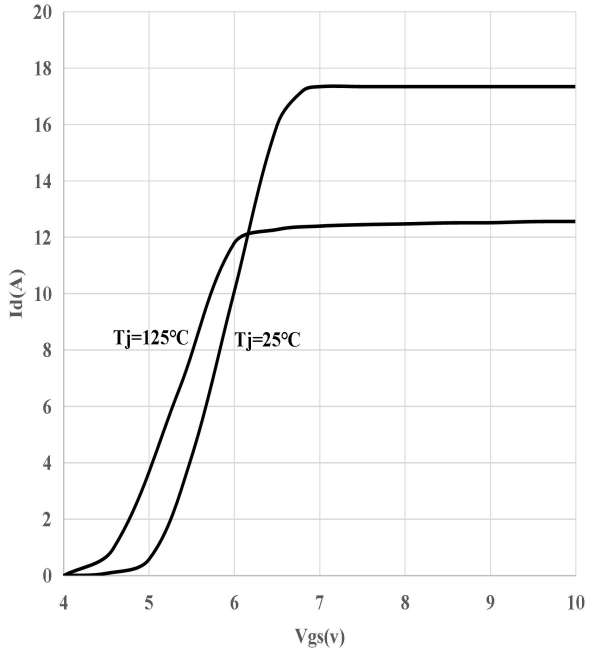
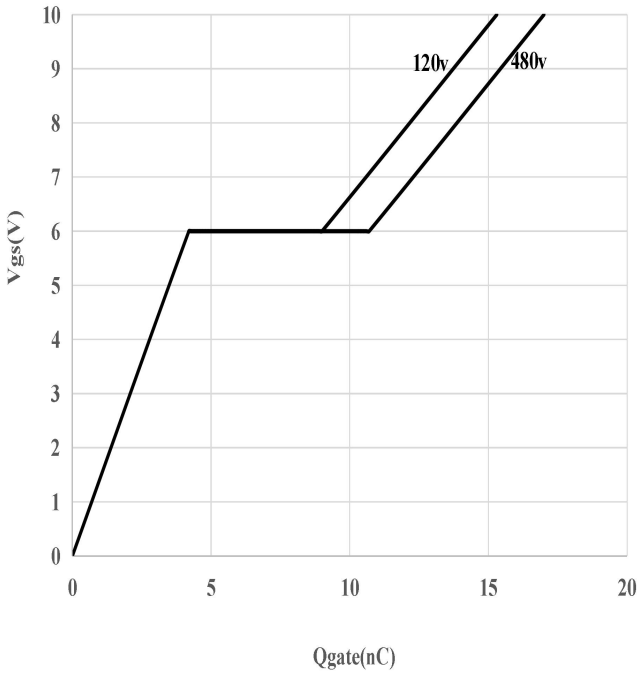
Figure 11: Typ. Transfer Characteristics	Figure 12: Typ. Gate Charge
	
$I_D = f(V_{GS})$; $V_{DS} = 20V$	$V_{GS} = f(Q_{gate})$, $I_D = 5.0A$ pulsed

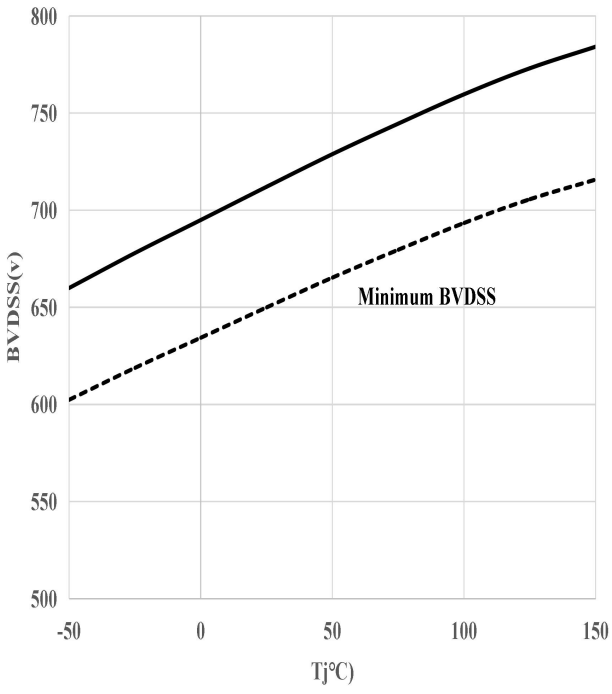
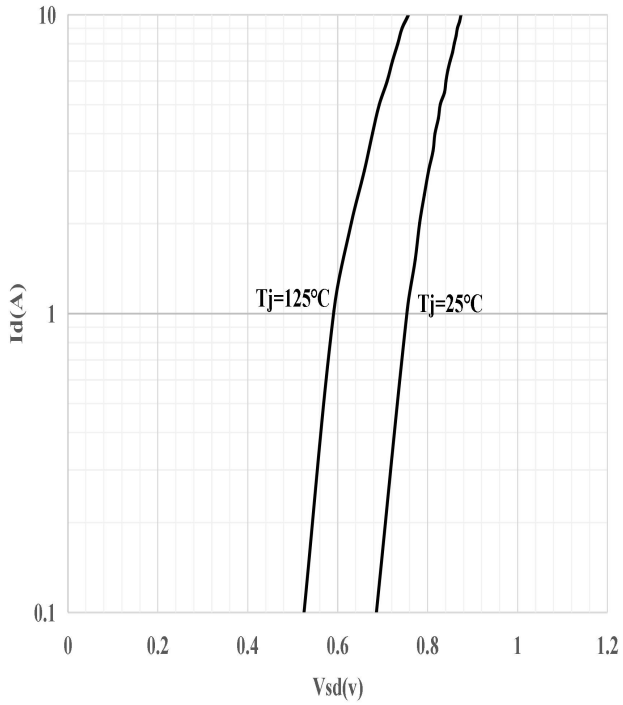
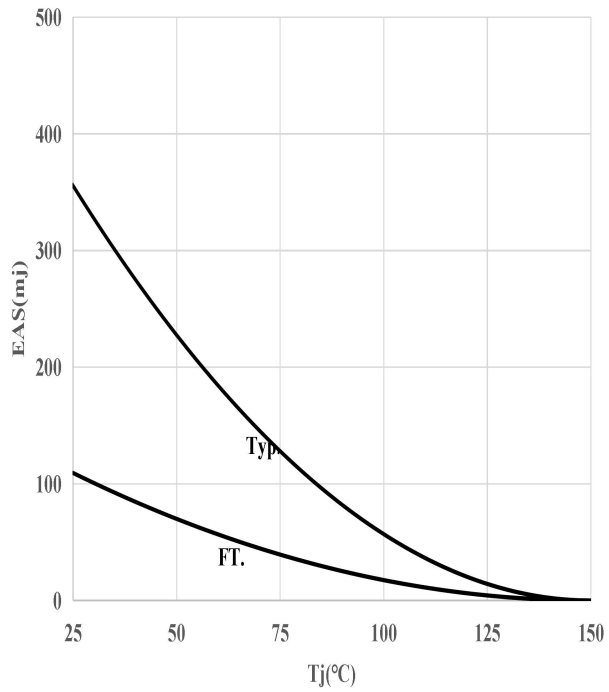
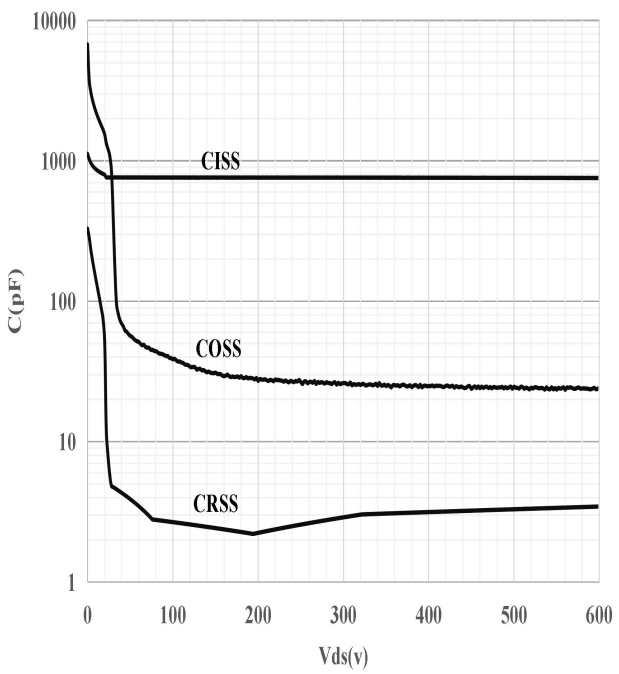
Figure 13: Drain-Source Breakdown Voltage	Figure 14: Forward Characteristics of Reverse Diode
	
Minimum $V_{BR(DSS)}=f(T_j)$; $I_D=1mA$	$I_F=f(V_{SD})$; parameter: T_j

Figure 15: Avalanche Energy



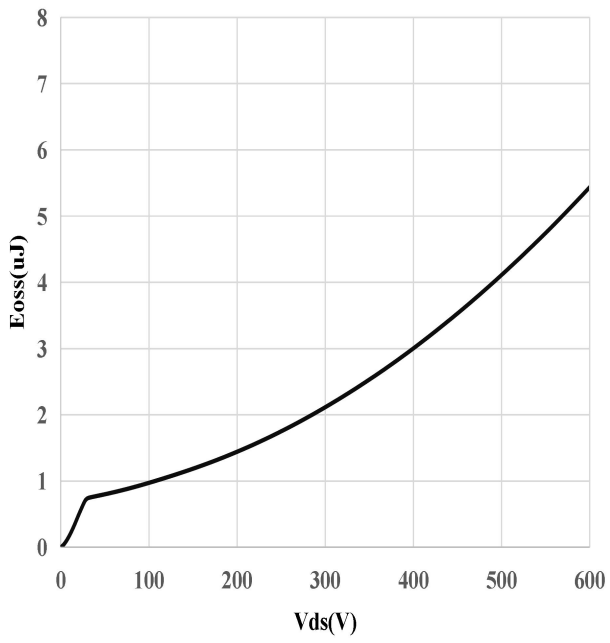
$E_{AS}=f(T_j)$; $V_{DD}=60V$

Figure 16: Typ. Capacitances



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

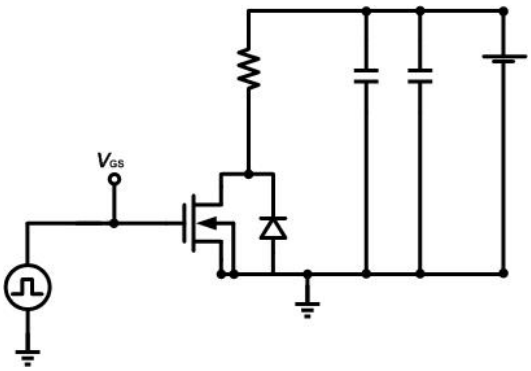
Figure 17: C_{OSS} Stored Energy

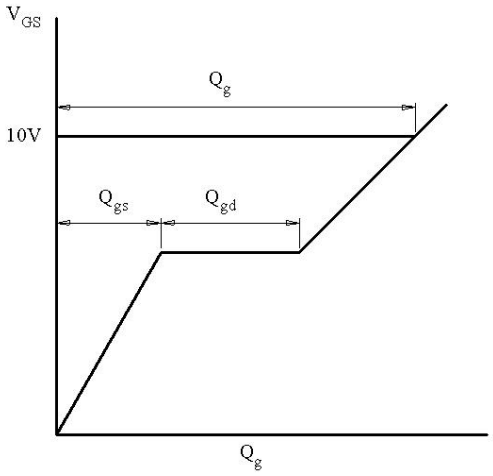


$E_{OSS}=f(V_{DS})$

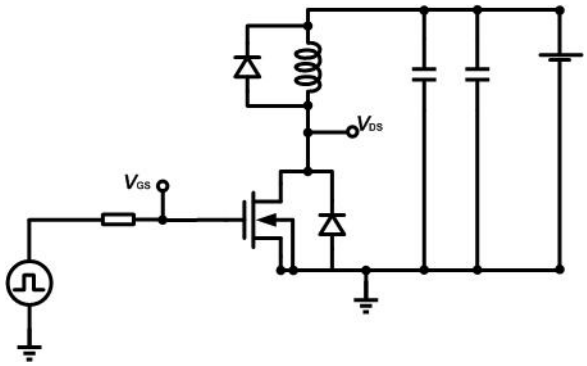
Test Circuits

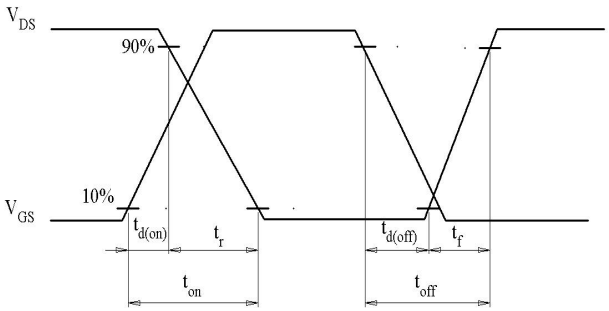
1. Gate Charge Test Circuit & Waveform



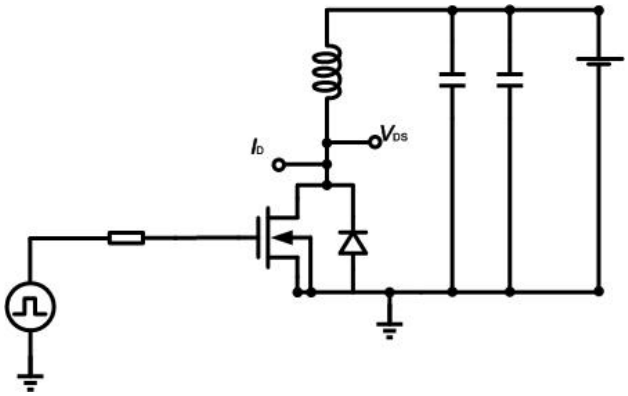


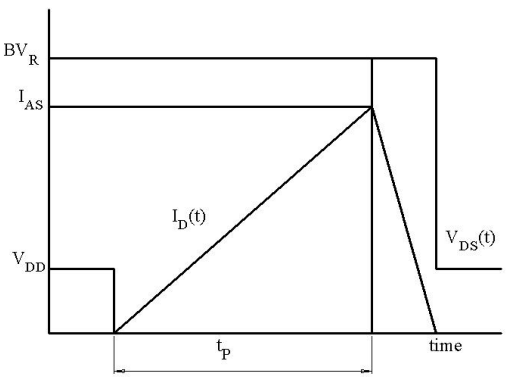
2. Switch Time Test Circuit



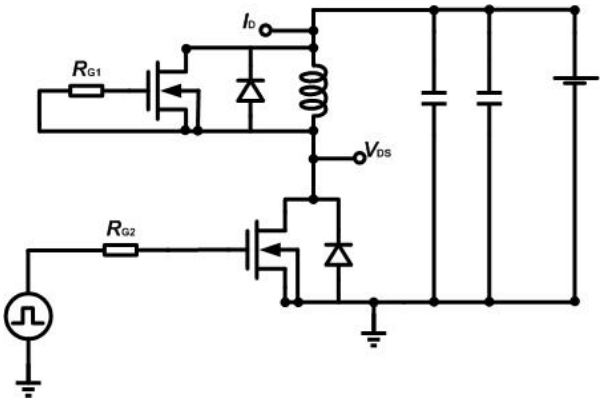


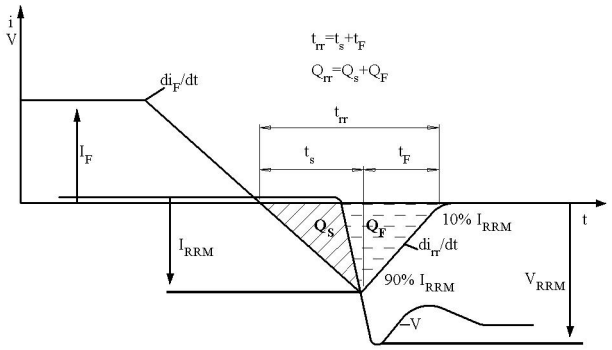
3. Unclaimed Inductive Switching Test Circuit & Waveforms





4. Test Circuit and Waveform for Diode Characteristics



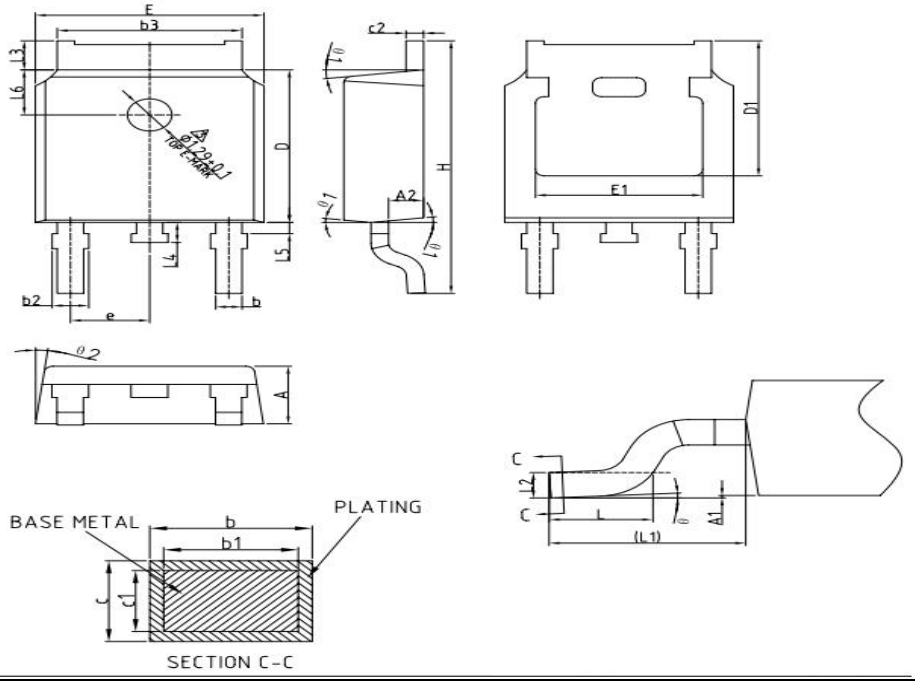


380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Mechanical Dimensions

TO-252（Package 1）

Unit: mm



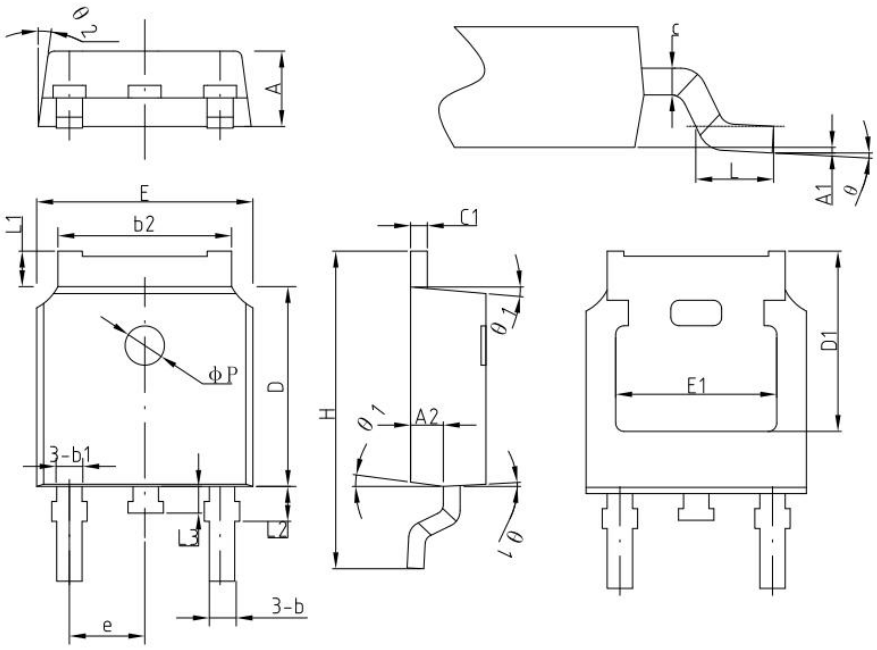
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.10
A2	0.90	1.01	1.10
b	0.72	-	0.85
b1	0.71	0.76	0.81
b2	0.72	-	0.90
b3	5.13	5.33	5.46
c	0.47	-	0.60
c1	0.46	0.51	0.56
C2	0.47	-	0.60
D	6.0	6.10	6.20
D1	5.25	-	-
E	6.50	6.60	6.70
E1	4.70	-	-
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40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

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Mechanical Dimensions

TO-252（Package 2）

Unit: mm



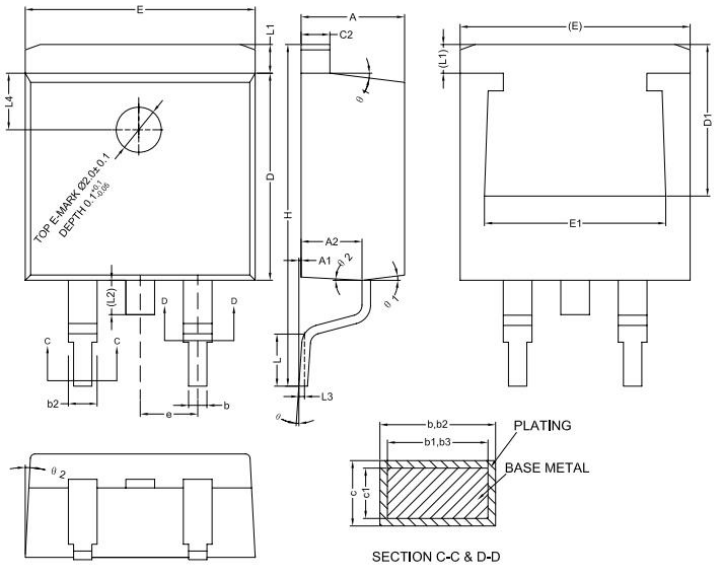
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.127
A2	0.90	1.01	1.10
b	0.635	0.76	0.86
b1	-	0.76	-
b2	5.2	5.33	5.46
c	0.47	0.50	0.60
c1	0.47	0.50	0.60
D	6.0	6.10	6.20
D1	-	5.30	-
E	6.50	6.60	6.70
E1	-	4.83	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.40	1.50	1.70
L1	0.90	-	1.25
L2	-	1.0	-
L3	-	0.8	-
ΦP	-	1.2	-
Θ	0°	-	8°
Θ1	5°	7°	9°
Θ2	5°	7°	9°

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Mechanical Dimensions

TO-263-2（Package 1）

Unit: mm

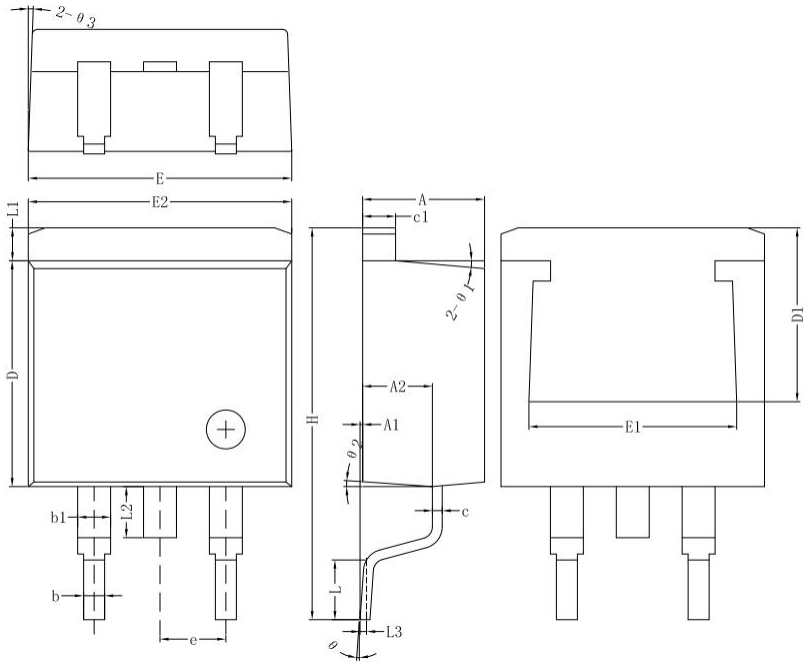


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	0.00	0.10	0.25
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
c2	1.22	-	1.32
D	9.05	9.15	9.25
D1	6.60	-	-
E	10.06	10.16	10.26
E1	7.80	-	8.20
e	2.54(BSC)		
H	14.70	15.10	15.50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

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Mechanical Dimensions

TO-263-2 （Package 2） **Unit: mm**

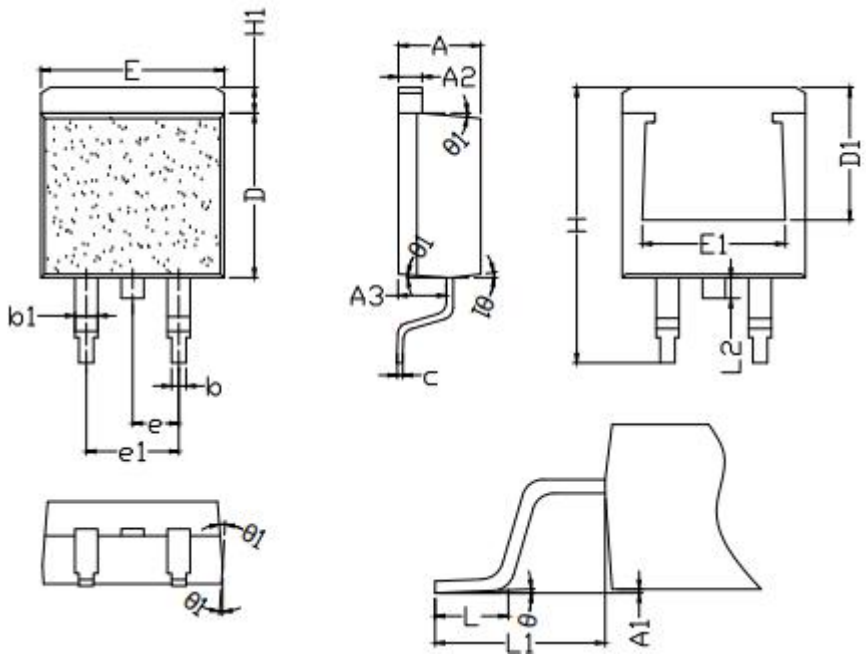


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40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

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Mechanical Dimensions

TO-263-2 （Package 3） **Unit: mm**



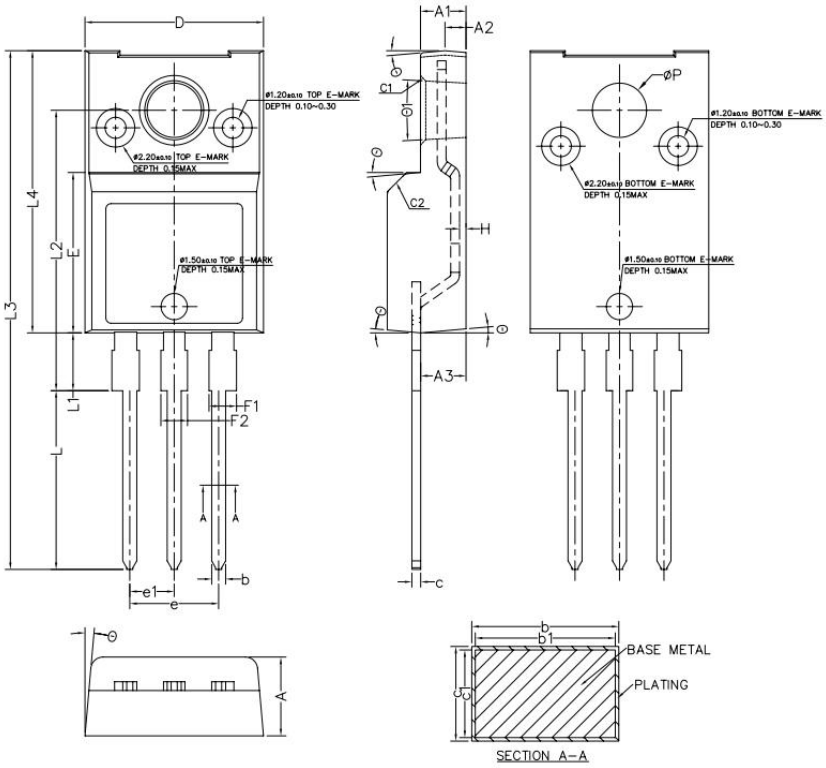
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.42	4.52	4.62
A1	0.00	0.10	0.25
A2	1.24	1.27	1.32
A3	2.50	2.60	2.70
b	0.77	0.81	0.84
b1	1.23	1.28	1.41
c	0.33	0.38	0.43
D	8.80	8.95	9.10
D1		7.2REF	
E	9.92	10.07	10.22
E1		7.85REF	
e	2.50	2.54	2.58
e1		5.08REF	
H	14.80	15.10	15.30
H1	1.12	1.28	1.42
L	2.10	2.23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

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Mechanical Dimensions

TO-220F（Package 1）

Unit: mm



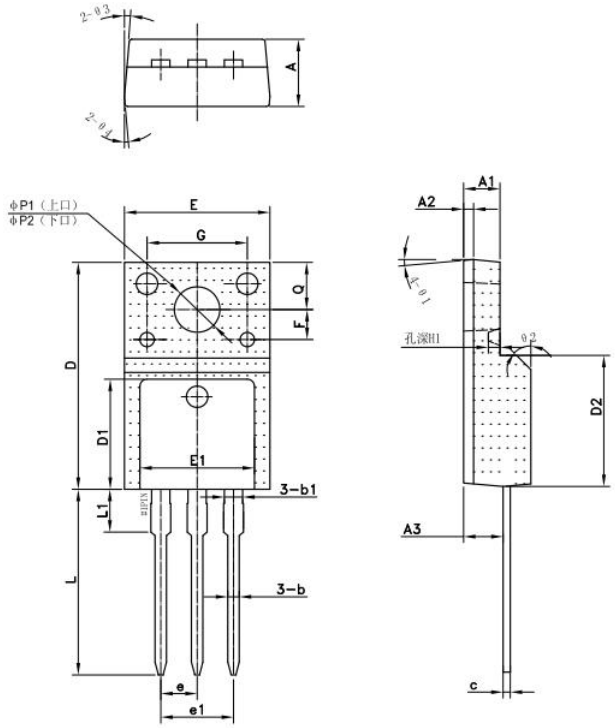
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.50	4.60
A1	2.50	2.60	2.70
A2	1.10	1.20	1.30
A3	2.49	2.59	2.69
b	0.76	-	0.89
b1	0.75	0.80	0.85
c	0.46	-	0.59
c1	0.45	0.50	0.55
C1	0.20	0.30	0.40
C2	1.00	1.10	1.20
D	10.10	10.20	10.30
E	9.05	9.15	9.25
e	4.98	5.08	5.18
e1	2.44	2.54	2.64
F1	1.22	-	1.60
F2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

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

Mechanical Dimensions

TO-220F（Package 2）

Unit: mm



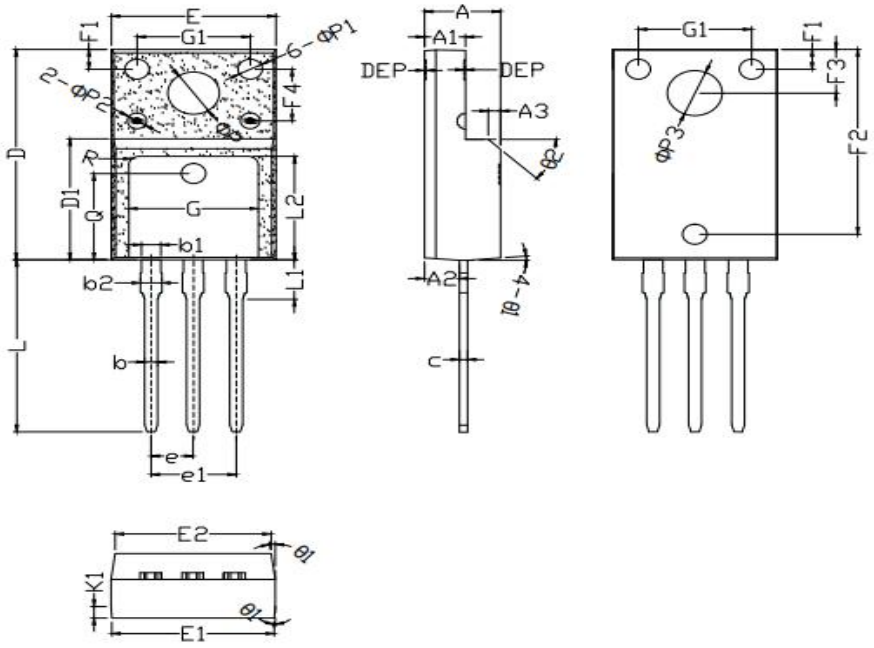
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.70
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
D2		9.12	
E	9.96	10.16	10.36
E1	-	8.00	-
e		2.54	
e1		5.08	
F		2.1	
G		7	
H1	-	0.81	-
L	12.48	12.98	13.20
L1	-	2.93	-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

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

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

380mΩ, 650V, Super Junction N-Channel Power MOSFET SRC65R380S

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