

General Description

The Sanrise SRC60R022FBSS 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 SRC60R022FBSS break down voltage is 600V and it has a high rugged avalanche characteristics.

The SRC60R022FBSS is available in TO-247 package.

Features

- Ultra Low $R_{DS(ON)} = 22m\Omega @ V_{GS} = 10V$.
- $V_{ds}@T_{jmax}=650v$.
- Ultra Low Gate Charge, $Q_g=189nC$ typ.
- Intrinsic Fast-Recovery Body Diode
- Fast switching capability
- Robust design with better EAS performance
- Non-automotive Qualified
- Ultra-fast body diode

Application

- EV Charger
- Server / Telecom

Symbol

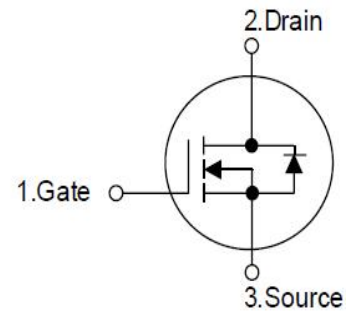
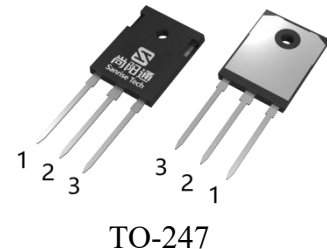


Figure 1 Symbol of SRC60R022FBSS

Package Type



TO-247

Figure 2 Package Type of SRC60R022FBSS

Ordering Information

SRC60R022FBSS□□-□	
Circuit Type	E: Lead Free
Package	G: Green
T: TO-247	Blank: Tube
	TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
TO-247	SRC60R022FBSST-G	SRC60R022FBSSTG	Tube

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	± 30	V
Gate-Source Voltage (dynamic), AC ($f > 1$ Hz)		V_{GS}	± 30	V
Power Dissipation($T_C=25^\circ\text{C}$, TO-247)		P_{tot}	595	W
Continuous Drain Current	$T_C=25^\circ\text{C}$	I_D	104	A
	$T_C=100^\circ\text{C}$		65	
	$T_C=125^\circ\text{C}$		46	
Pulsed Drain Current (Note 2)		I_{DM}	312	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	600	mJ
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	4000	mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	1.6	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	7.8	A
Continuous Diode Forward Current		I_S	104	A
Diode Pulse Current		$I_{S,PULSE}$	312	A
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. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $I_{AS} = 7.8\text{A}$, $V_{DD} = 60\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$. Finish goods test condition.
4. $I_{AS} = 20\text{A}$, $V_{DD} = 60\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$. Typical E_{AS} .

Thermal characteristics

Parameter	Symbol	Package	Value (Max.)	Unit
Thermal resistance, junction - case	R_{thJC}	TO-247	0.21	$^\circ\text{C} / \text{W}$
Thermal resistance, junction – ambient (Leaded)	R_{thJA}	TO-247	62	$^\circ\text{C} / \text{W}$

Electrical Characteristics

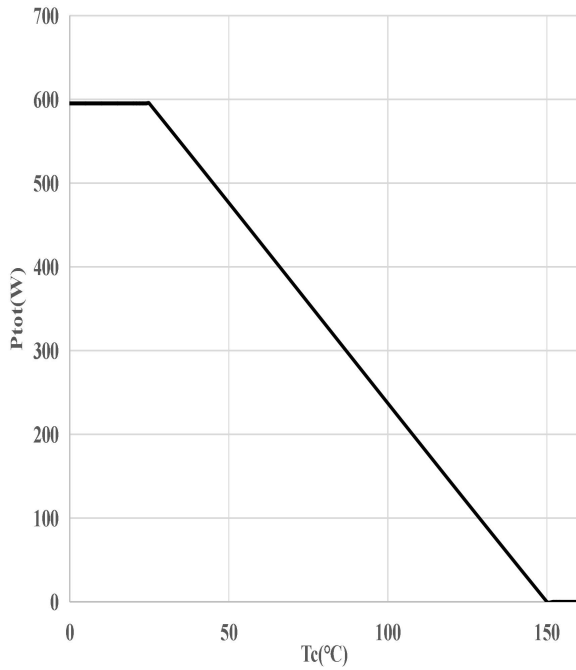
$T_J = 25^{\circ}\text{C}$, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250uA	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} =20V, V _{DS} =0V			200	nA
	Reverse	I _{GSSR}	V _{GS} =-20V, V _{DS} =0V			-200	
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250uA	3.5	4.7	5.5	V
Static Drain-Source On-Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =57A		18.6	22	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		1.6		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =400V, V _{GS} =0V, f=100KHz		8358		pF
Output Capacitance		C _{OSS}			224		pF
Effective output capacitance, energy related ^{NOTE5}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...480V		307		pF
Effective output capacitance, time related ^{NOTE6}		C _{O(tr)}			1835		
Turn-on Delay Time		t _{d(on)}	V _{DD} =400V, I _D =57A R _G =3Ω, V _{GS} =12V		62		ns
Rise Time		t _r			20		
Turn-off Delay Time		t _{d(off)}			172		
Fall Time		t _f			16		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =400V, I _D =57A V _{GS} =0 to 10V		61		nC
Gate to Drain Charge		Q _{gd}			72		
Gate Charge Total		Q _g			189		
Gate Plateau Voltage		V _{plateau}			7.5		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =57A		0.9	1.1	V
Reverse Recovery Time		t _{rr}	V _R =400V, I _F =57A dI _F /dt=90A/us		113		ns
Reverse Recovery Charge		Q _{rr}			1.24		uC
Peak Reverse Recovery Current		I _{rrm}			18		A

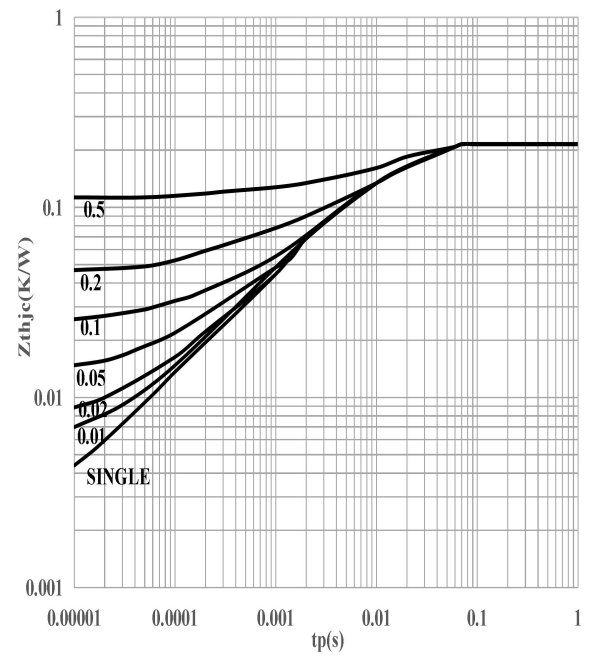
Note:

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

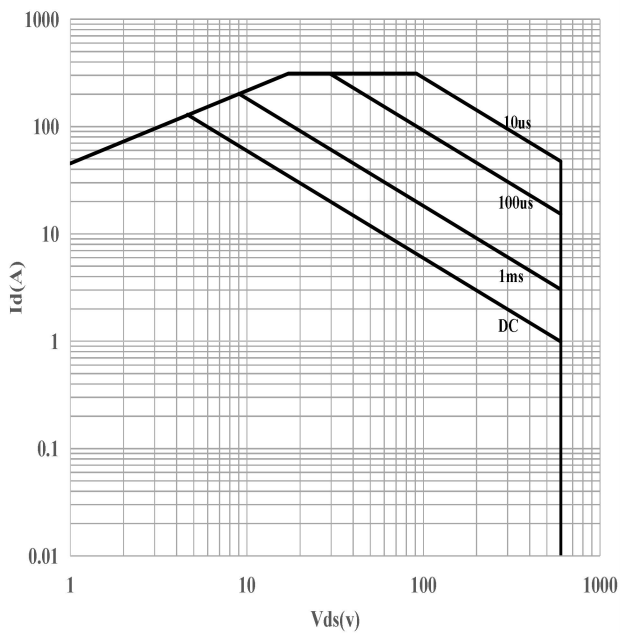
6. $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480 V

Typical Performance Characteristics
Figure 3: Power Dissipation


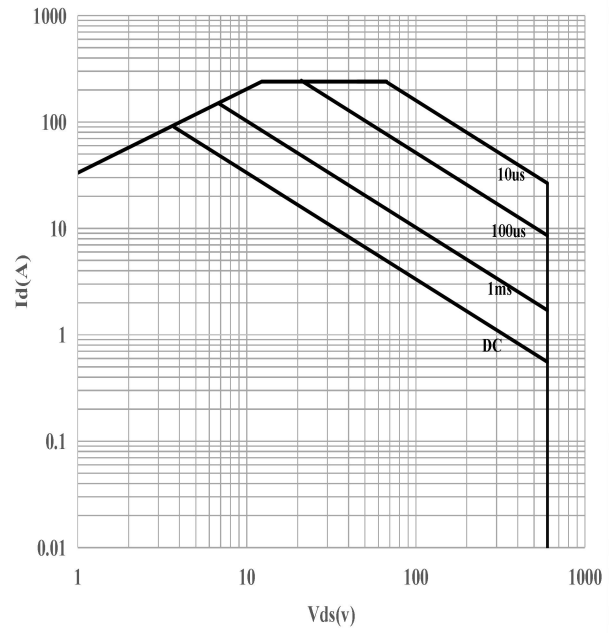
$$P_{\text{tot}} = f(T_c)$$

Figure 4: Max. Transient Thermal Impedance


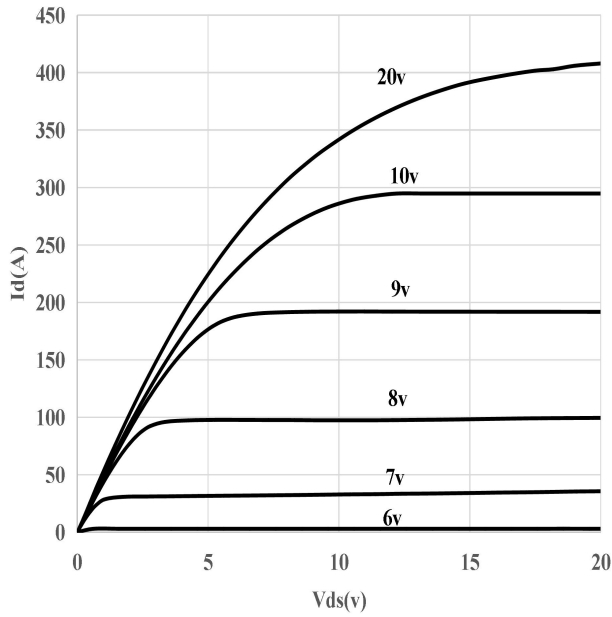
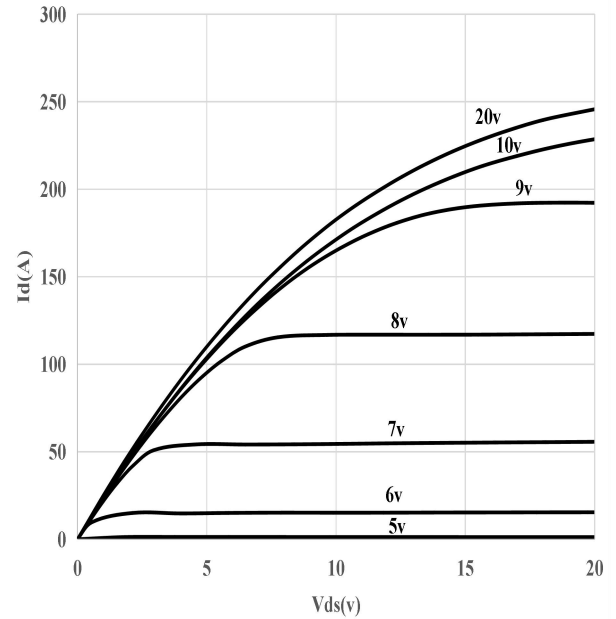
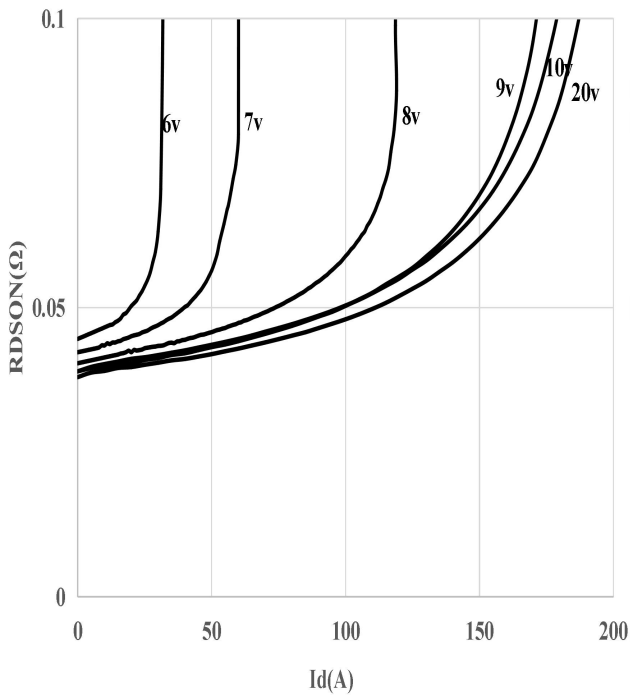
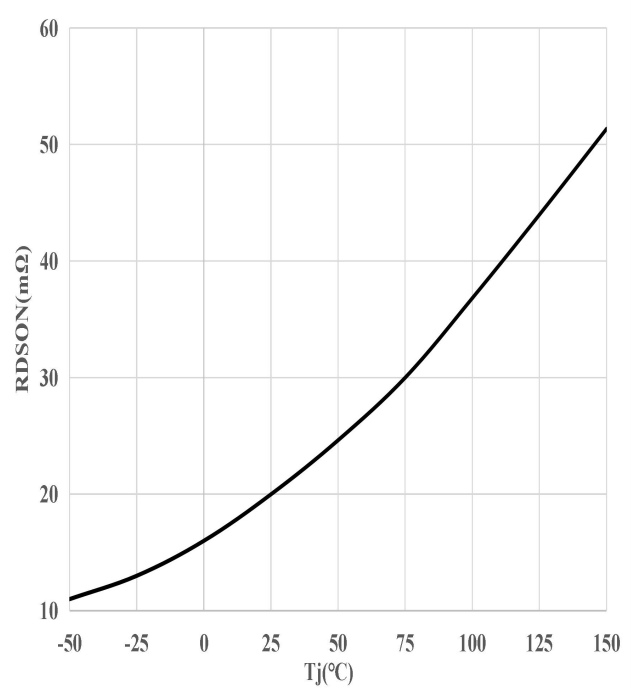
$$Z_{(\text{thJC})} = f(t_p); \text{ parameter: } D = t_p/T$$

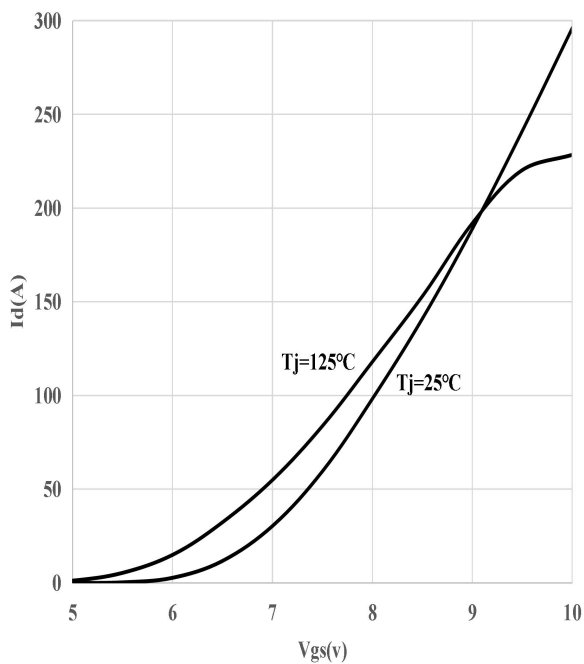
Figure 5: Safe Operating Area


$$I_{\text{D}} = f(V_{\text{DS}}); T_c = 25^{\circ}\text{C}; V_{\text{GS}} > 7\text{V}; \text{ parameter } t_p$$

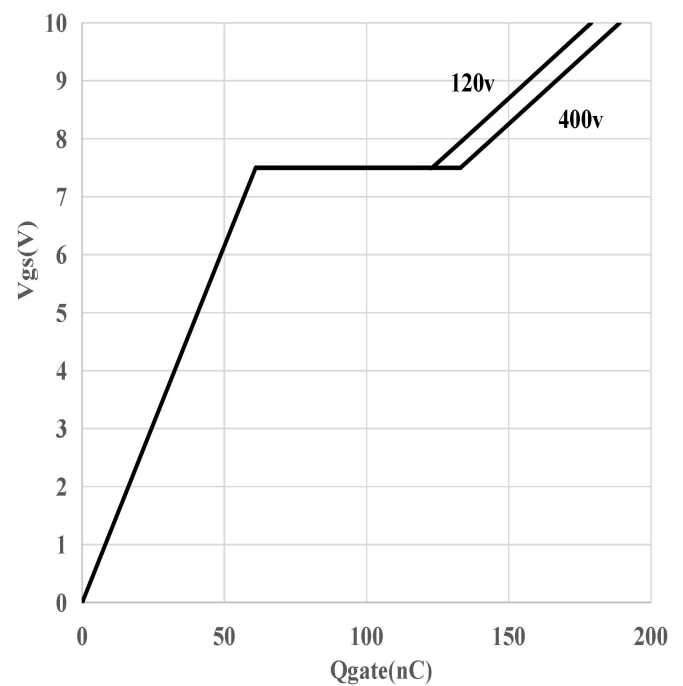
Figure 6: Safe Operating Area


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

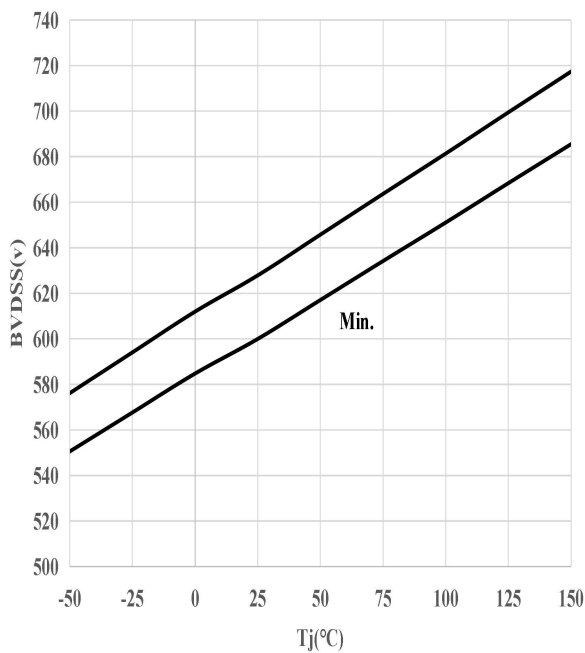
Figure 7: Typ. Output Characteristics

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

 $R_{DS(ON)} = f(T_j); I_D = 57\text{A}; V_{GS} = 10\text{V}$

22mΩ, 600V, Super Junction N-Channel Power MOSFET
SRC60R022FBSS
Figure 11: Typ. Transfer Characteristics


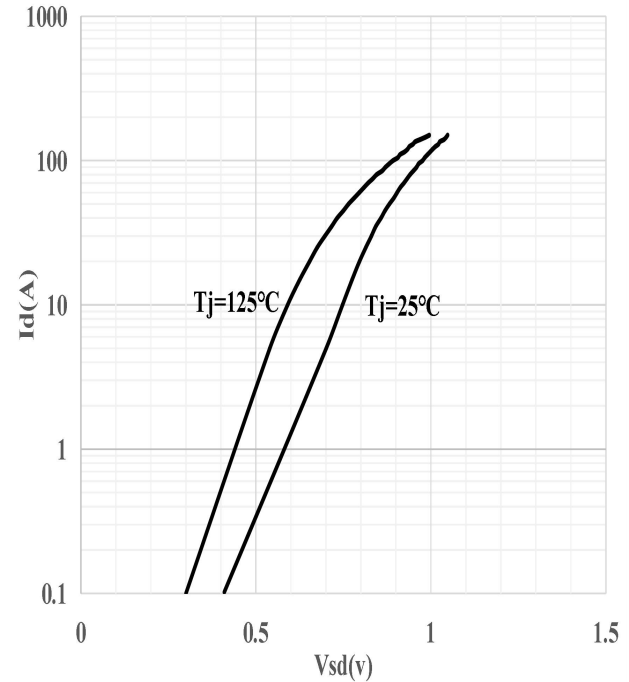
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Figure 12: Typ. Gate Charge


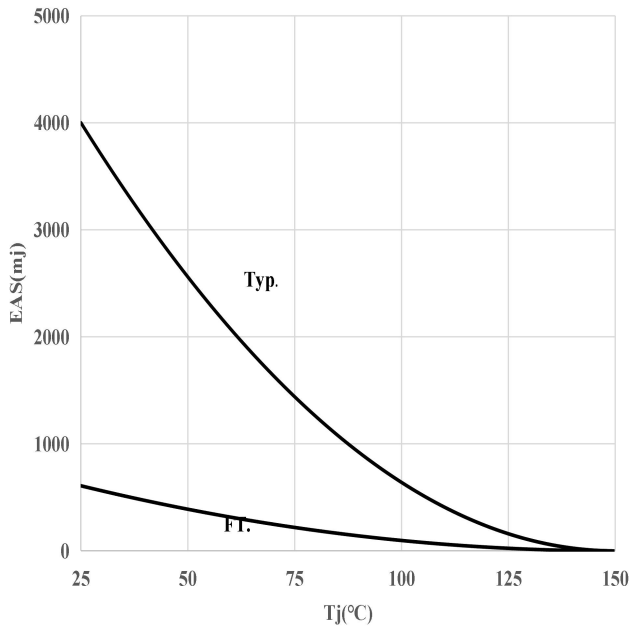
$$V_{GS} = f(Q_{gate}), I_D = 57A \text{ pulsed}$$

Figure 13: Drain-Source Breakdown Voltage


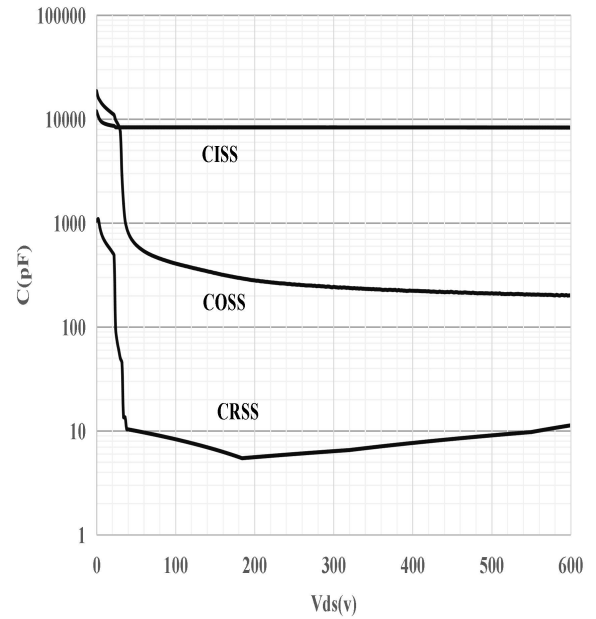
$$V_{BR(DSS)} = f(T_j); I_D = 10mA$$

Figure 14: Forward Characteristics of Reverse Diode


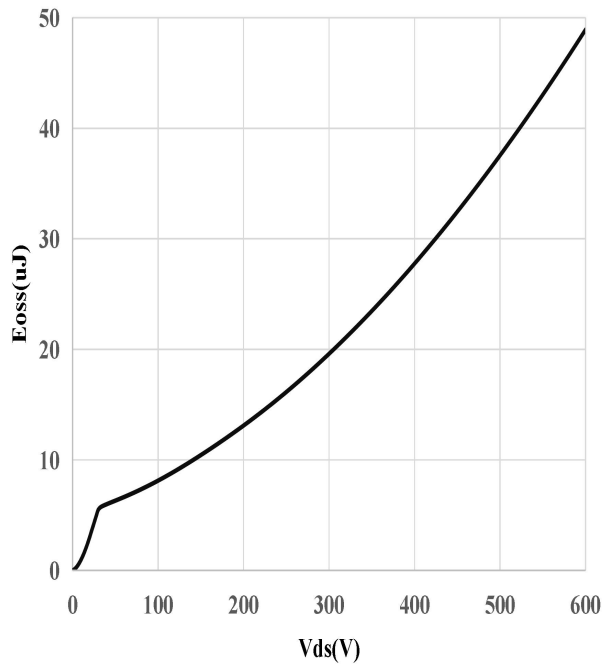
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

22mΩ, 600V, Super Junction N-Channel Power MOSFET
SRC60R022FBSS
Figure 15: Avalanche Energy


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

Figure 16: Typ. Capacitances


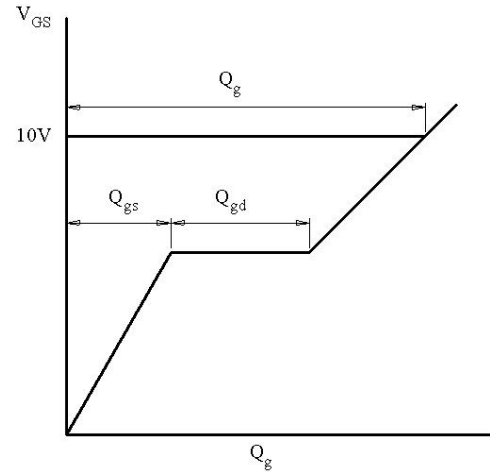
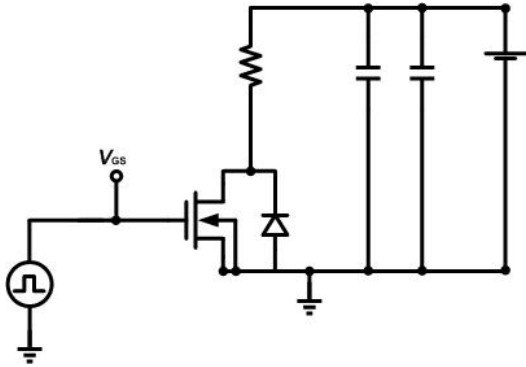
$$C=f(V_{DS}); V_{GS}=0; f=100KHz$$

Figure 17: Coss Stored Energy


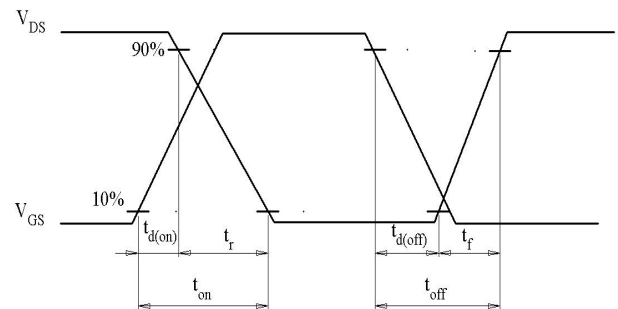
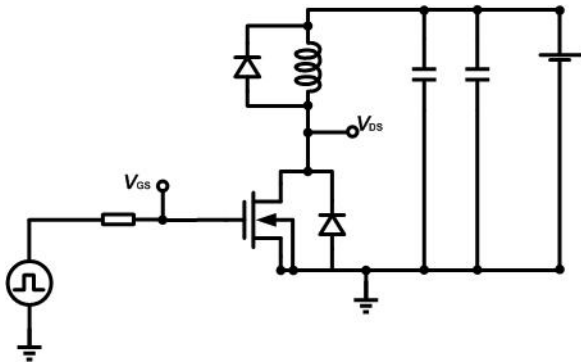
$$E_{OSS}=f(V_{DS})$$

Test Circuits

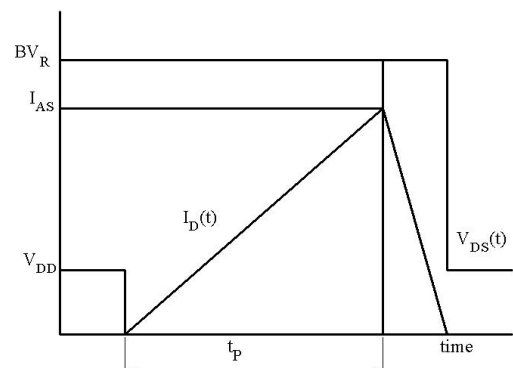
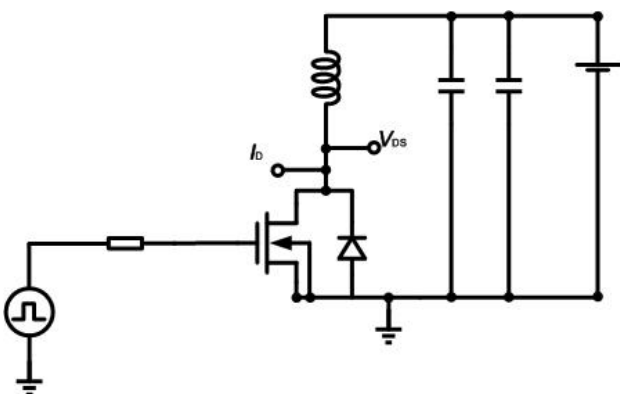
1. Gate Charge Test Circuit & Waveform

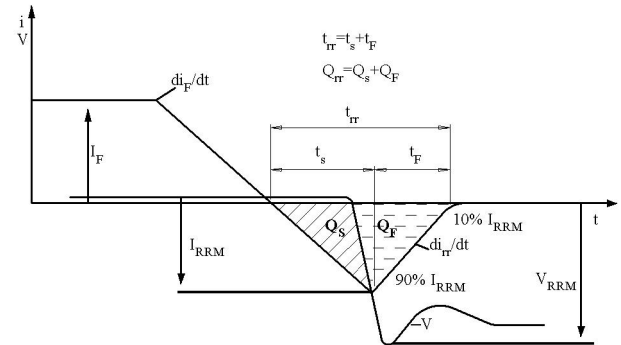
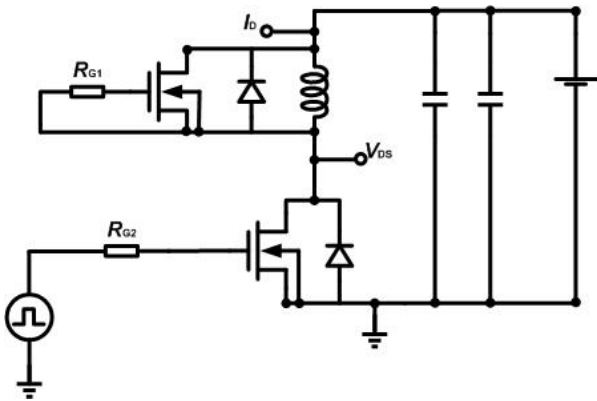


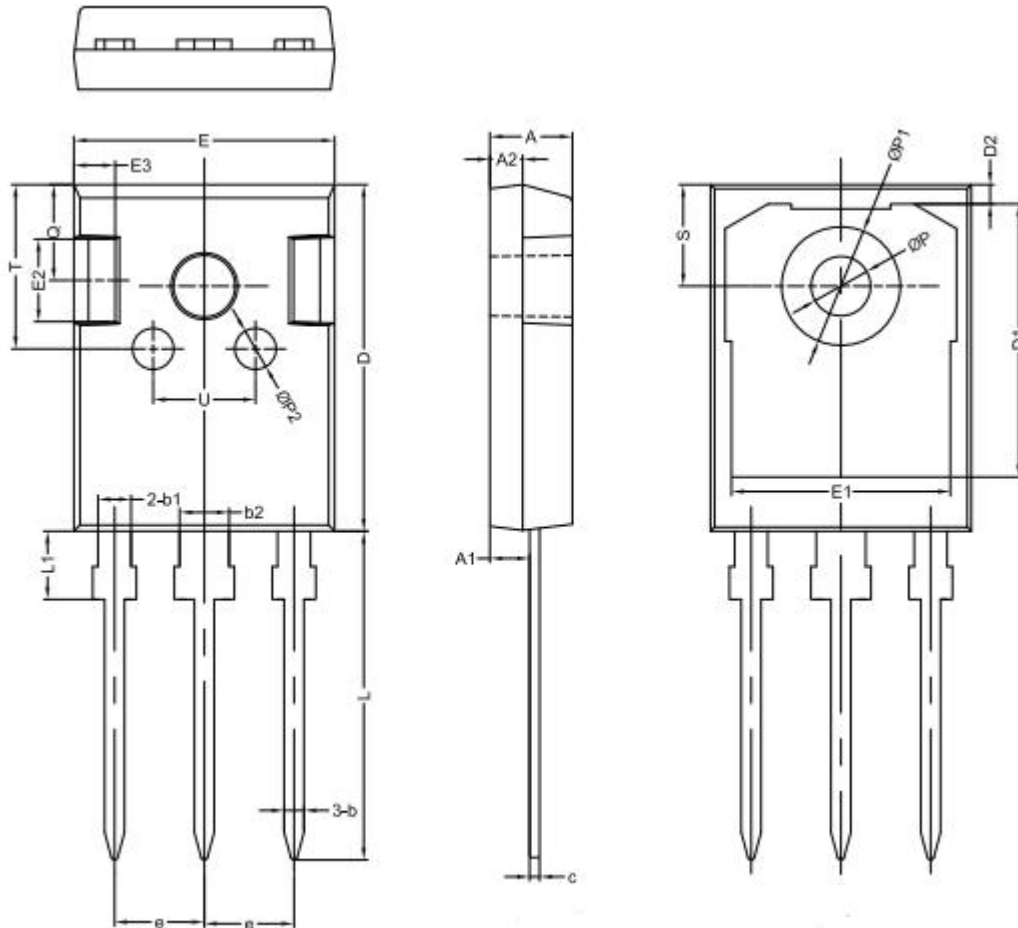
2. Switch Time Test Circuit



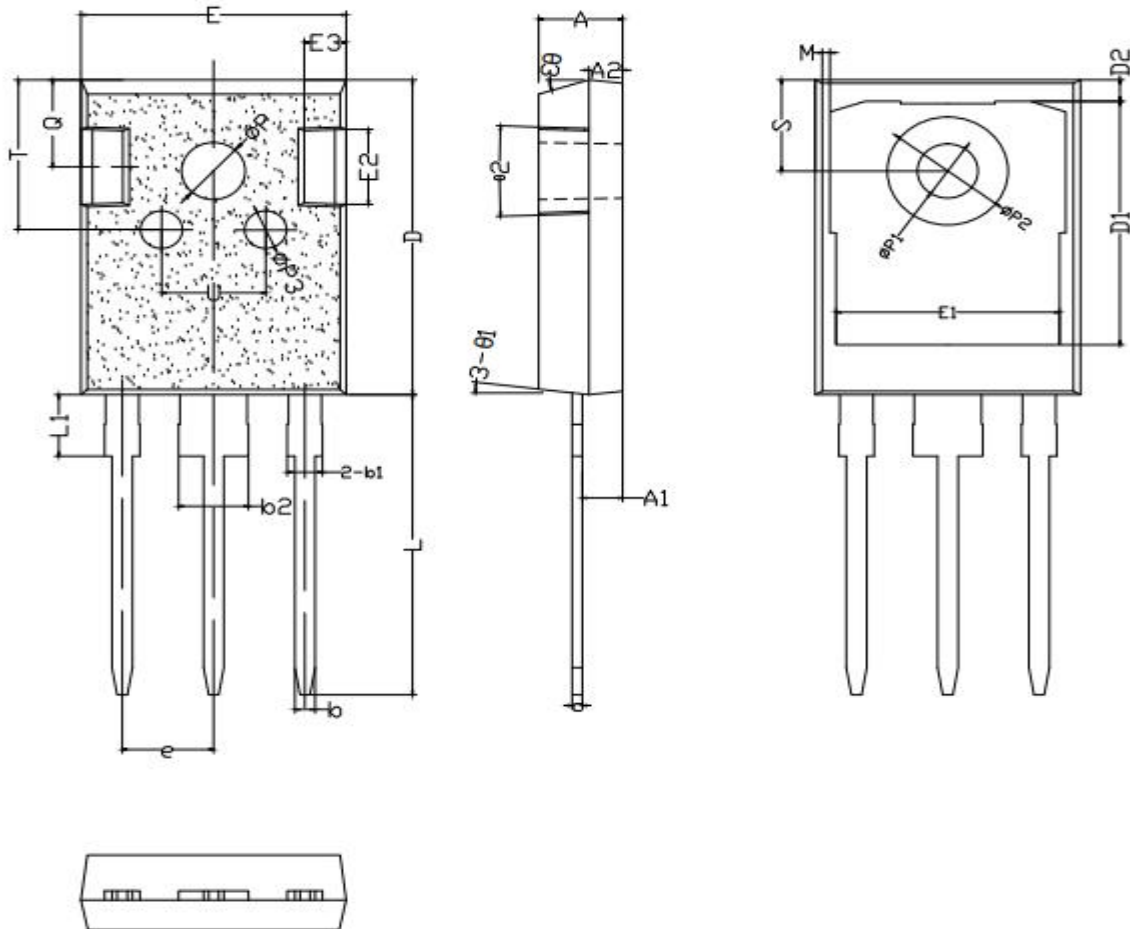
3. Unclaimed Inductive Switching Test Circuit & Waveforms



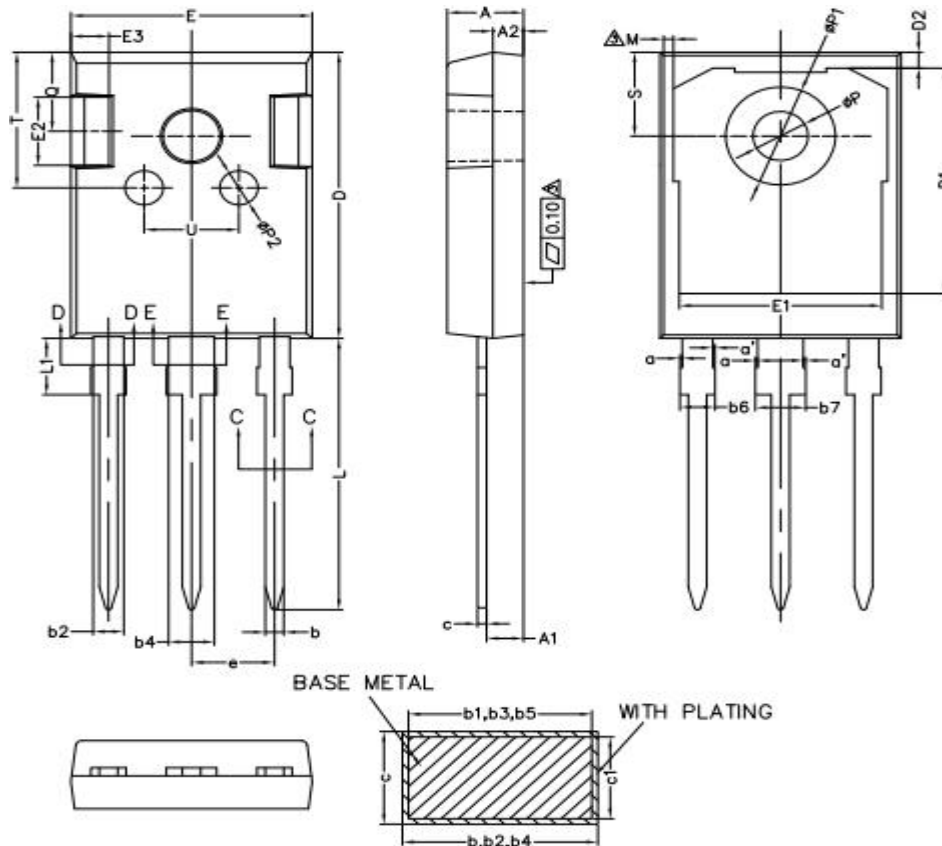
4. Test Circuit and Waveform for Diode Characteristics


Mechanical Dimensions
TO-247(Package 1)
Unit: mm


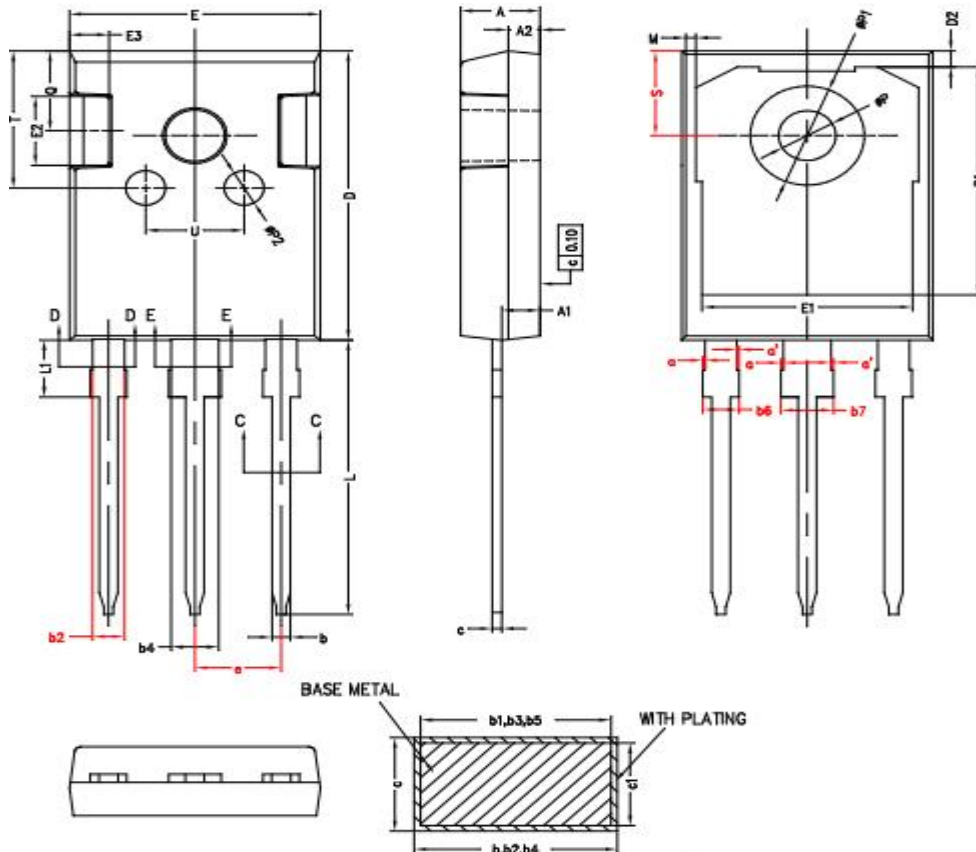
Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.80	5.00	5.20	E1	-	13.30	-
A1	2.21	2.41	2.61	E2	-	5.00	-
A2	1.90	2.00	2.10	E3	-	2.50	-
b	1.10	1.20	1.35	L	19.42	19.92	20.42
b1	-	2.00	-	L1	-	4.13	-
b2	-	3.00	-	P	3.50	3.60	3.70
c	0.55	0.60	0.75	P1	-	7.19	-
D	20.80	21.00	21.20	P2	-	2.50	-
D1	-	16.55	-	Q	-	5.80	-
D2	-	1.20	-	S	6.05	6.15	6.25
E	15.60	15.80	16.0	T	-	10.00	-
U	-	6.20	-				

Mechanical Dimensions
TO-247(Package 2)
Unit: mm


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	E1	13.10	13.25	13.40
A1	2.31	2.41	2.51	E2	4.85	4.95	5.10
A2	1.90	2.00	2.10	E3	2.40	2.50	2.60
b	1.15	1.20	1.25	L	19.80	19.98	20.15
b1	1.95	2.10	2.25	L1	-	-	4.30
b2	2.95	3.10	3.25	ΦP	3.60	3.70	3.80
c	0.55	0.60	0.65	ΦP1	3.40	3.50	3.60
D	20.90	21.00	21.10	ΦP2	6.90	7.10	7.30
D1	16.35	16.55	16.75	Q	5.60	5.80	6.00
D2	1.05	1.20	1.35	S	6.05	6.15	6.25
E	15.70	15.80	15.90	T	9.80	10.00	10.20
U	6.00	6.20	6.40	e	5.40	5.44	5.48
Θ1	5°	7°	9°	ΦP3	2.40	2.50	2.60
Θ2	1°	3°	5°	Θ3	13°	15°	17°

Mechanical Dimensions
TO-247(Package 3)
Unit: mm


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	c1	0.58	0.60	0.62
A1	2.31	2.41	2.51	D	20.90	21.00	21.10
A2	1.90	2.00	2.10	D1	16.25	16.55	16.85
b	1.16	-	1.26	D2	1.05	1.20	1.35
b1	1.15	1.20	1.22	E	15.70	15.80	15.90
b2	1.96	-	2.06	E1	13.10	13.30	13.50
b3	1.95	2.00	2.02	E2	4.90	5.00	5.10
b4	2.96	-	3.06	E3	2.40	2.50	2.60
b5	2.95	3.00	3.02	e	5.34	5.44	5.54
b6	-	-	2.25	L	19.80	19.92	20.10
b7	-	-	3.25	L1	3.95	4.13	4.30
c	0.59	-	0.66	M	0.35	-	0.95
P	3.50	3.60	3.70	P1	7.00	-	7.40
P2	2.40	2.50	2.60	Q	5.60	-	6.00
S	6.05	6.15	6.25	T	9.80	-	10.20
U	6.00	-	6.40	a	0	-	0.15
a'	0	-	0.15				

Mechanical Dimensions
TO-247(Package 4)
Unit: mm


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	E2	4.90	5.00	5.10
A1	2.31	2.41	2.51	E3	2.40	2.50	2.60
A2	1.90	2.00	2.10	e	5.34	5.44	5.54
b	1.12	-	1.22	L	19.80	19.92	20.10
b1	1.11	1.16	1.18	L1	3.95	4.13	4.30
b2	1.96	-	2.06	P	3.50	3.60	3.70
c	0.59	-	0.66	P1	7.00	-	7.40
D	20.90	21.00	21.10	P2	2.40	2.50	2.60
D1	16.25	16.55	16.85	Q	5.60	-	6.00
D2	1.05	1.20	1.35	S	6.05	6.15	6.25
E	15.70	15.80	15.90	T	9.80	-	10.20
E1	13.10	13.30	13.50	U	6.00	-	6.40
b3	1.95	2.00	2.02	b6	-	-	2.25
b4	2.96	-	3.06	b7	-	-	3.25
b5	2.95	3.00	3.02	c1	0.58	0.60	0.62
M	0.35	-	0.95	a	0	-	0.15
a'	0	-	0.15				



Shenzhen Sanrise Technology Co., LTD

<http://www.sanrise-tech.com>

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