

**2.0mΩ, 30V, N-Channel Power MOSFET**
**SRT03N020L**
**General Description**

The Sanrise SRT03N020L uses advanced split gate trench technology. It has extremely low on resistance, low gate charge and fast switching time. This device is ideal for Motor driver, BMS, DC-DC converter and power management.

The SRT03N020L break down voltage is 30V and it has a high rugged avalanche characteristic. The SRT03N020L is available in PDFN3.3\*3.3 and PDFN5\*6 packages.

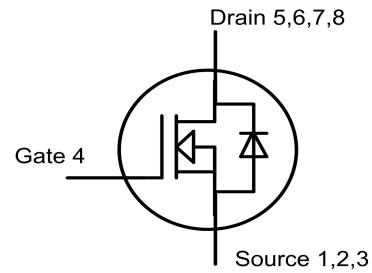
**Symbol**


Figure 1 Symbol of SRT03N020L

**Features**

- Ultra Low  
 $R_{DS(ON\_TYP)} = 2.1m\Omega$  ,PDFN3.3\*3.3@  $V_{GS} = 10V$ .  
 $R_{DS(ON\_TYP)} = 1.5m\Omega$  ,PDFN5\*6@  $V_{GS} = 10V$ .
- Ultra Low Gate Charge,  $Q_g=38.6nC$  typ.
- Fast switching capability
- Robust design with better EAS performance
- Non-automotive Qualified

**Application**

- Server / Telecom
- High Power Supply, such as DCDC converter
- Motor Driver, such as E-Tools
- BMS

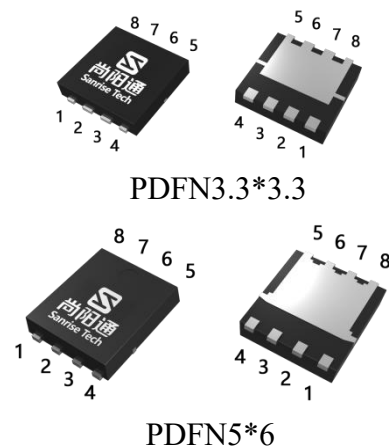
**Package Type**


Figure 2 Package Types of SRT03N020L

**Ordering Information**

|                  |  |            |   |   |   |                                                            |
|------------------|--|------------|---|---|---|------------------------------------------------------------|
| Circuit Type     |  | SRT03N020L | □ | □ | - | □                                                          |
| Package          |  |            |   |   |   | E: Lead Free<br>G: Green<br>Blank: Tube<br>TR: Tape & Reel |
| D33: PDFN3.3*3.3 |  |            |   |   |   |                                                            |
| D56: PDFN5*6     |  |            |   |   |   |                                                            |

| Package     | Part Number       | Marking ID     | Packing Type |
|-------------|-------------------|----------------|--------------|
| PDFN3.3*3.3 | SRT03N020LD33TR-G | 03N020LD33G    | Tape & Reel  |
| PDFN5*6     | SRT03N020LD56TR-G | SRT03N020LD56G | Tape & Reel  |

## Absolute Maximum Ratings

| Parameter                                           |                           | Symbol          | Rating     |     | Unit               |
|-----------------------------------------------------|---------------------------|-----------------|------------|-----|--------------------|
| Drain-Source Voltage                                |                           | $V_{DSS}$       | 30         |     | V                  |
| Gate-Source Voltage                                 |                           | $V_{GSS}$       | ±20        |     | V                  |
| Continuous Drain Current, Package Limited           | $T_C=25^{\circ}\text{C}$  | $I_D$           | PDFN3*3    | 80  | A                  |
|                                                     | $T_C=25^{\circ}\text{C}$  |                 | PDFN5*6    | 80  |                    |
|                                                     | $T_C=100^{\circ}\text{C}$ |                 | PDFN3*3    | 69  |                    |
|                                                     | $T_C=100^{\circ}\text{C}$ |                 | PDFN5*6    | 73  |                    |
| Continuous Drain Current, Silicon                   | $T_C=25^{\circ}\text{C}$  | $I_D$           | PDFN3*3    | 110 | A                  |
|                                                     | $T_C=25^{\circ}\text{C}$  |                 | PDFN5*6    | 125 |                    |
| Pulsed Drain Current (Note 2)                       |                           | $I_{DM}$        | PDFN3*3    | 240 | A                  |
|                                                     |                           |                 | PDFN5*6    | 240 |                    |
| Power Dissipation ( $T_C = 25^{\circ}\text{C}$ )    |                           | $P_D$           | 90         |     | W                  |
| Avalanche Destructive Energy, Single Pulse (Note 4) |                           | $E_{AS\_Limit}$ | 324        |     | mJ                 |
| Avalanche Energy, Single Pulse (Note 3)             |                           | $E_{AS}$        | 56         |     | mJ                 |
| Avalanche Current, Repetitive (Note 2)              |                           | $I_{AR}$        | 20.0       |     | 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:

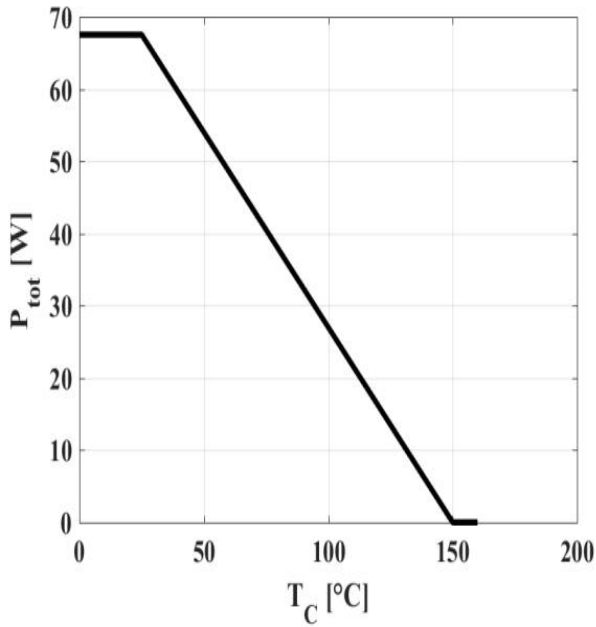
1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3.  $I_{AS} = 13.0\text{A}$ ,  $V_{DD} = 15\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$
4.  $I_{AS\_Limit} = 30.0\text{A}$ ,  $V_{DD} = 15\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$

## Thermal Characteristics

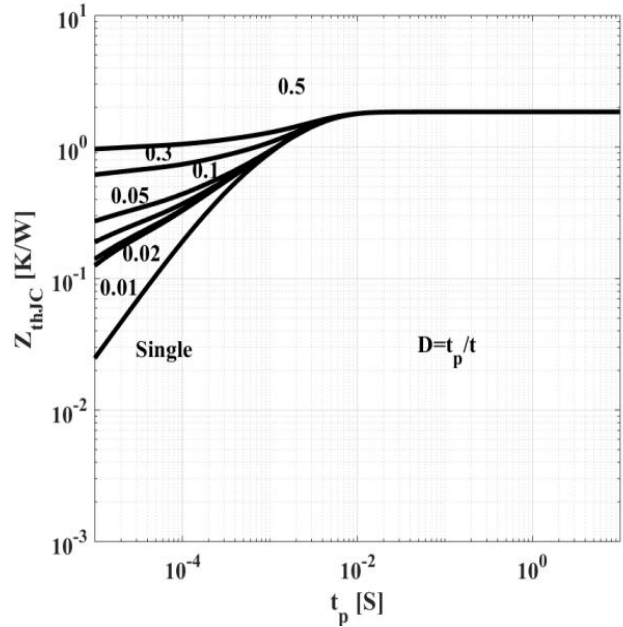
| Parameter                            |             | Symbol     | Min | Typ | Max  | Unit                        |
|--------------------------------------|-------------|------------|-----|-----|------|-----------------------------|
| Thermal Resistance, Junction-to-Case | PDFN3.3*3.3 | $R_{thJC}$ |     |     | 1.85 | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Case | PDFN5*6     | $R_{thJC}$ |     |     | 1.85 | $^{\circ}\text{C}/\text{W}$ |

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

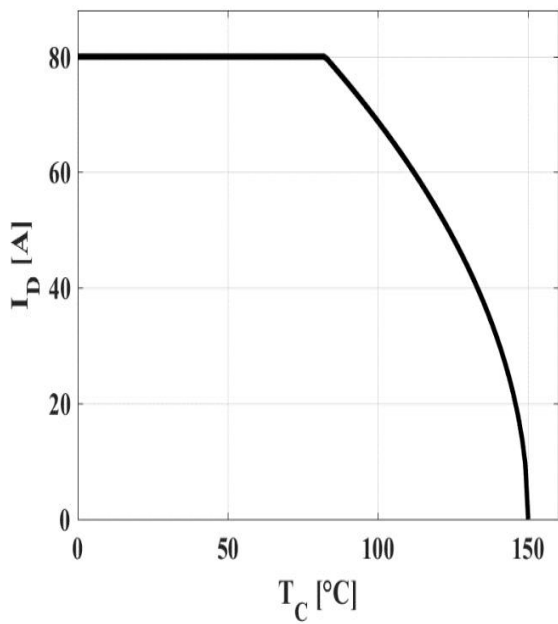
| Parameter                          |         | Symbol               | Test Conditions                                                                         | Min | Typ  | Max  | Unit |
|------------------------------------|---------|----------------------|-----------------------------------------------------------------------------------------|-----|------|------|------|
| Statistic Characteristics          |         |                      |                                                                                         |     |      |      |      |
| Drain-Source Breakdown Voltage     |         | BV <sub>DSS</sub>    | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA                                              | 30  |      |      | V    |
| Zero Gate Voltage Drain Current    |         | I <sub>DSS</sub>     | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V                                               |     |      | 1    | uA   |
|                                    |         |                      | V <sub>DS</sub> =24V,V <sub>GS</sub> =0V, Tj=55℃                                        |     |      | 10   | μ A  |
| Gate-Body Leakage Current          | Forward | I <sub>GSSF</sub>    | V <sub>GS</sub> =20V, V <sub>DS</sub> =0V                                               |     |      | 100  | nA   |
|                                    | Reverse | I <sub>GSSR</sub>    | V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V                                              |     |      | -100 |      |
| Gate Threshold Voltage             |         | V <sub>GS(TH)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =0.25mA                               | 1.2 | 1.7  | 2.1  | V    |
| Static Drain-Source On-Resistance  | PDFN3*3 | R <sub>DS(ON)</sub>  | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                              |     | 2.9  | 3.8  | mΩ   |
|                                    | PDFN5*6 |                      |                                                                                         |     | 2.3  | 3.2  |      |
| Static Drain-Source On-Resistance  | PDFN3*3 | R <sub>DS(ON)</sub>  | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                               |     | 2.1  | 2.6  | mΩ   |
|                                    | PDFN5*6 |                      |                                                                                         |     | 1.5  | 2.0  |      |
| Gate Resistance                    |         | R <sub>G</sub>       | f=1MHz, Open Drain                                                                      |     | 1.8  |      | Ω    |
| Dynamic Characteristics            |         |                      |                                                                                         |     |      |      |      |
| Input Capacitance                  |         | C <sub>ISS</sub>     | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz                                       |     | 2.9  |      | nF   |
| Output Capacitance                 |         | C <sub>OSS</sub>     |                                                                                         |     | 640  |      | pF   |
| Reverse Transfer Capacitance       |         | C <sub>RSS</sub>     |                                                                                         |     | 144  |      | pF   |
| Turn-on Delay Time                 |         | t <sub>d(on)</sub>   | V <sub>DD</sub> =15V, I <sub>D</sub> =20A<br>R <sub>G</sub> =1.6Ω, V <sub>GS</sub> =10V |     | 11   |      | ns   |
| Rise Time                          |         | t <sub>r</sub>       |                                                                                         |     | 8    |      |      |
| Turn-off Delay Time                |         | t <sub>d(off)</sub>  |                                                                                         |     | 46   |      |      |
| Fall Time                          |         | t <sub>f</sub>       |                                                                                         |     | 8    |      |      |
| Gate Charge Characteristics        |         |                      |                                                                                         |     |      |      |      |
| Gate to Source Charge              |         | Q <sub>gs</sub>      | V <sub>DD</sub> =15V, I <sub>D</sub> =20A<br>V <sub>GS</sub> =0 to 10V                  |     | 5.3  |      | nC   |
| Gate to Drain Charge               |         | Q <sub>gd</sub>      |                                                                                         |     | 5.0  |      |      |
| Gate Charge Total                  |         | Q <sub>g</sub>       |                                                                                         |     | 38.6 |      |      |
| Gate Plateau Voltage               |         | V <sub>plateau</sub> |                                                                                         |     | 2.8  |      | V    |
| Reverse Diode Characteristics      |         |                      |                                                                                         |     |      |      |      |
| Drain-Source Diode Forward Voltage |         | V <sub>SD</sub>      | V <sub>GS</sub> =0V, I <sub>SD</sub> =20A                                               |     | 0.79 | 1.1  | V    |
| Reverse Recovery Time              |         | t <sub>rr</sub>      | V <sub>R</sub> =15V, I <sub>F</sub> =20A                                                |     | 25   |      | ns   |
| Reverse Recovery Charge            |         | Q <sub>rr</sub>      | dI <sub>F</sub> /dt=100A/us                                                             |     | 50   |      | nC   |

**Typical Performance Characteristics**
**Figure 3: Power Dissipation**


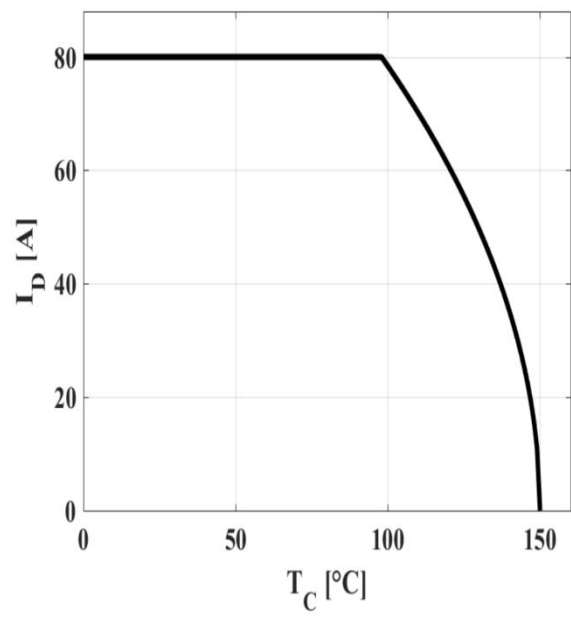
$$P_{tot} = f(T_C)$$

**Figure 4: Max. Transient Thermal Impedance**


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

**Figure 5A: Drain Current (PDFN3\*3)**


$$I_D = f(T_C); V_{GS} \geq 10V$$

**Figure 5B: Drain Current (PDFN5\*6)**


$$I_D = f(T_C); V_{GS} \geq 10V$$

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Figure 6: Typ. Output Characteristics

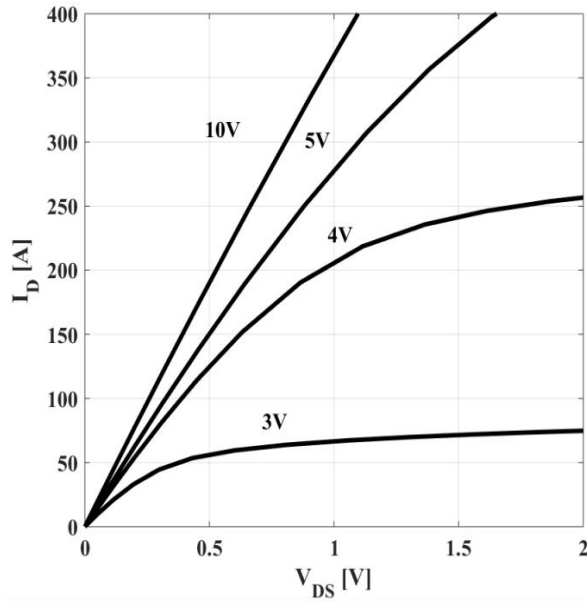

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$ 

Figure 7A: Typ. Drain-Source On-State Resistance(PDFN3\*3)

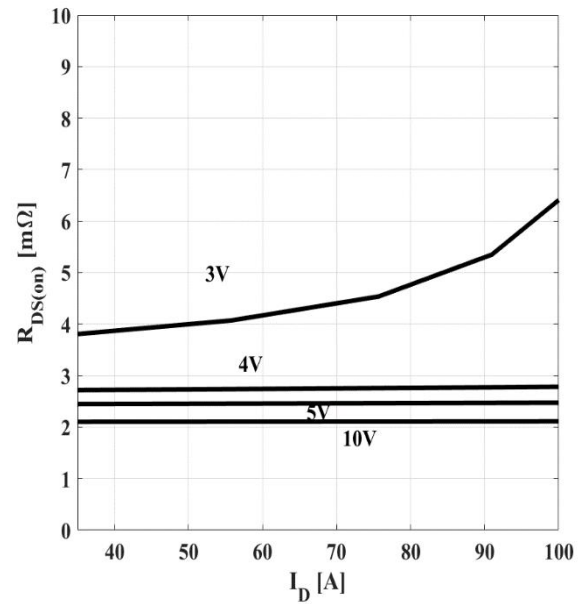

 $R_{DS(ON)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$ 

Figure7B: Typ. Drain-Source On-State Resistance(PDFN5\*6)

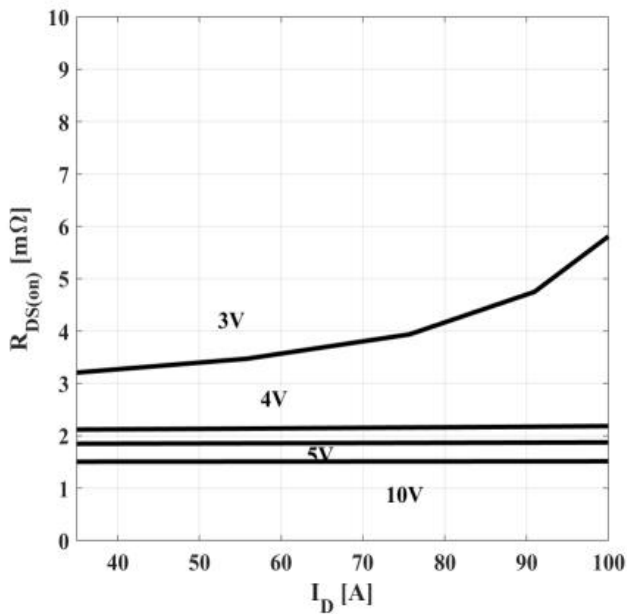
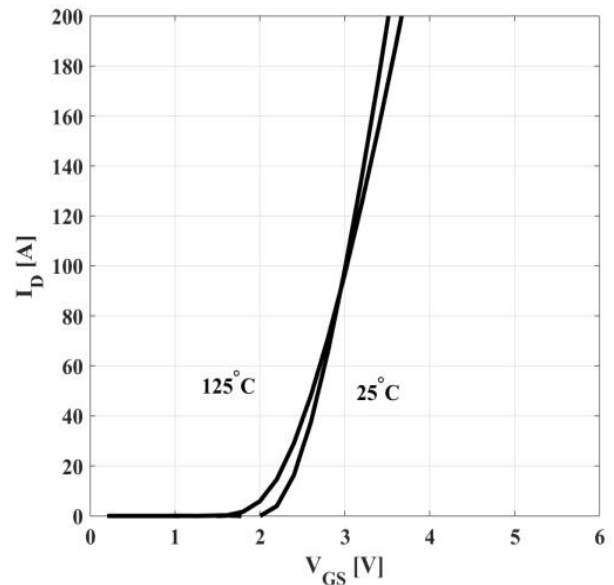

 $R_{DS(ON)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$ 

Figure 8: Typ. Transfer Characteristics


 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{parameter: } T_j$

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Figure 9: Typ. Forward Transconductance

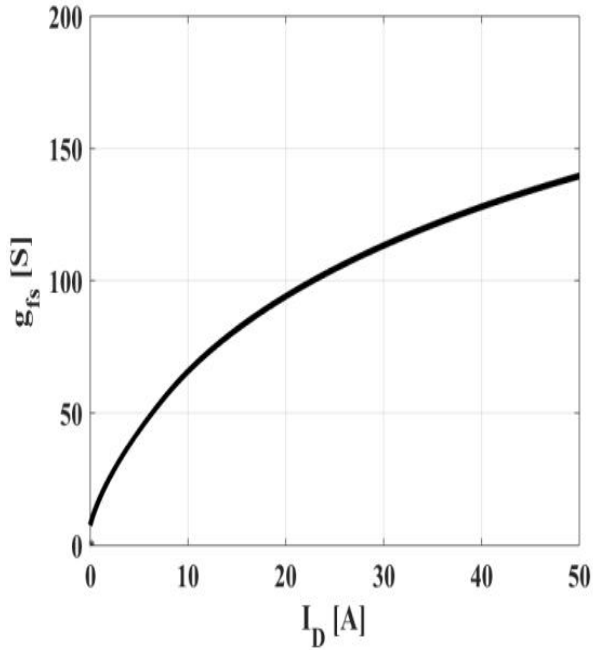

 $g_{fs}=f(I_D)$ ;  $T_j=25^{\circ}\text{C}$ 

Figure 10A: Typ. Drain-Source On-State Resistance (PDFN3\*3)

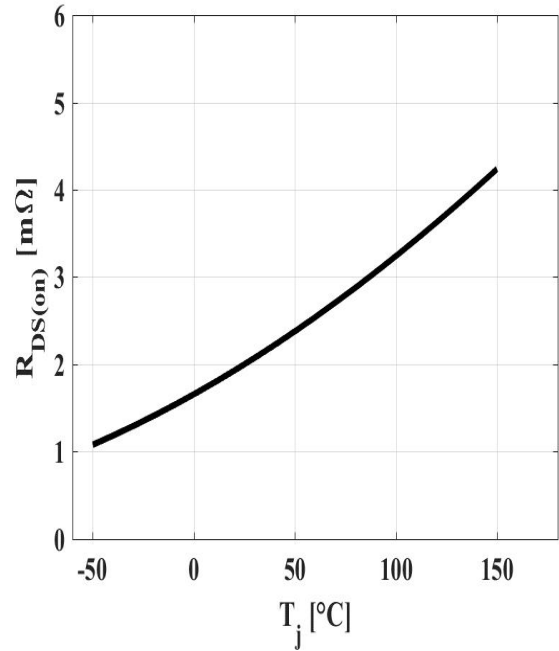

 $R_{DS(ON)}=f(T_j)$ ;  $I_D=20\text{A}$ ;  $V_{GS}=10\text{V}$ 

Figure 10B: Typ. Drain-Source On-State Resistance (PDFN5\*6)

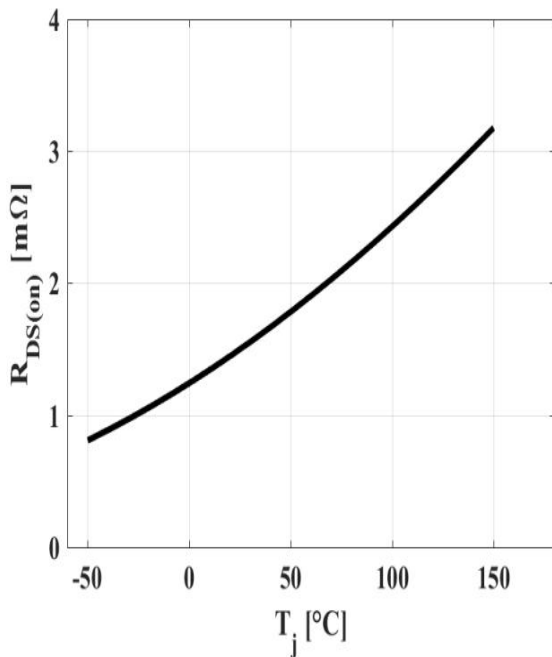
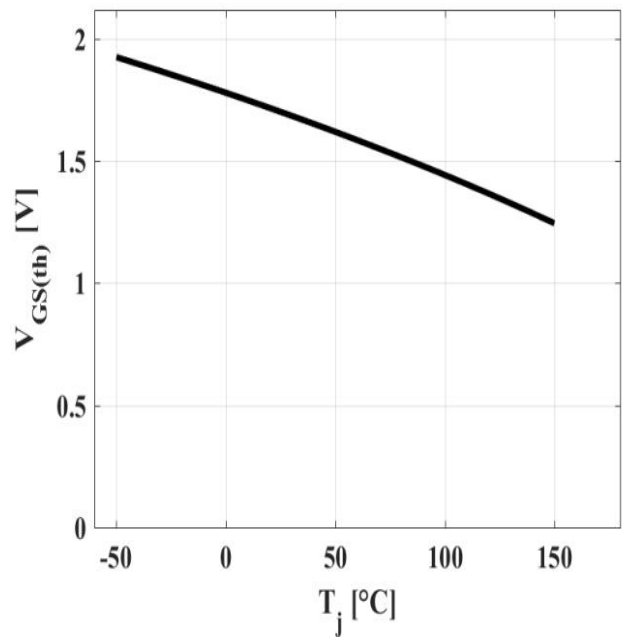
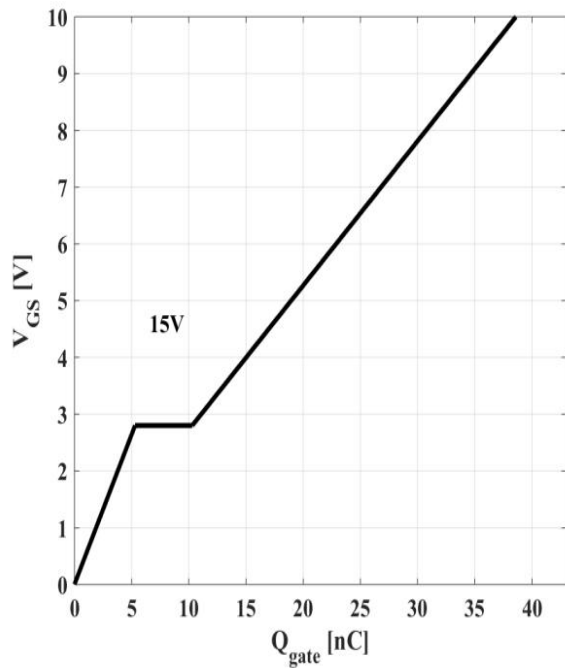
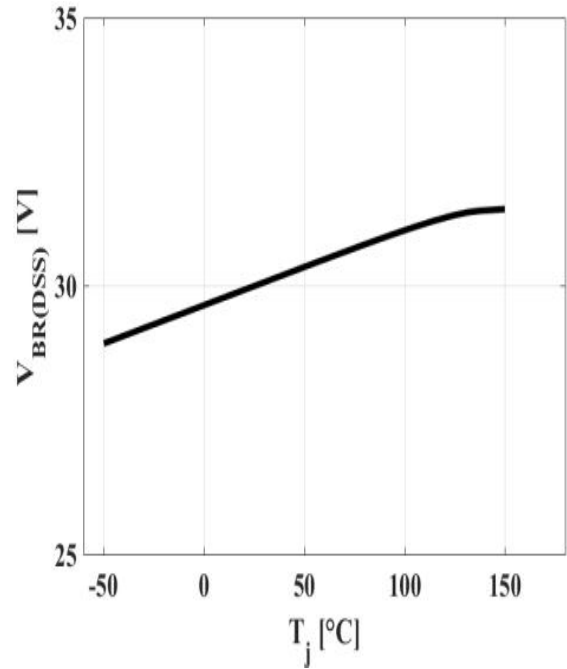

 $R_{DS(ON)}=f(T_j)$ ;  $I_D=20\text{A}$ ;  $V_{GS}=10\text{V}$ 

Figure 11: Typ. Gate Threshold Voltage

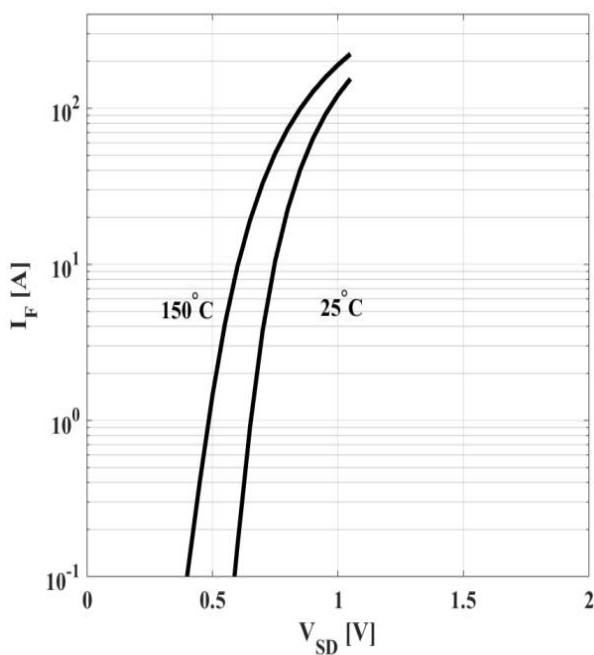

 $V_{GS(th)}=f(T_j)$ ;  $V_{GS}=V_{DS}$ ;  $I_{DS}=250\mu\text{A}$

**Figure 12: Typ. Gate Charge**


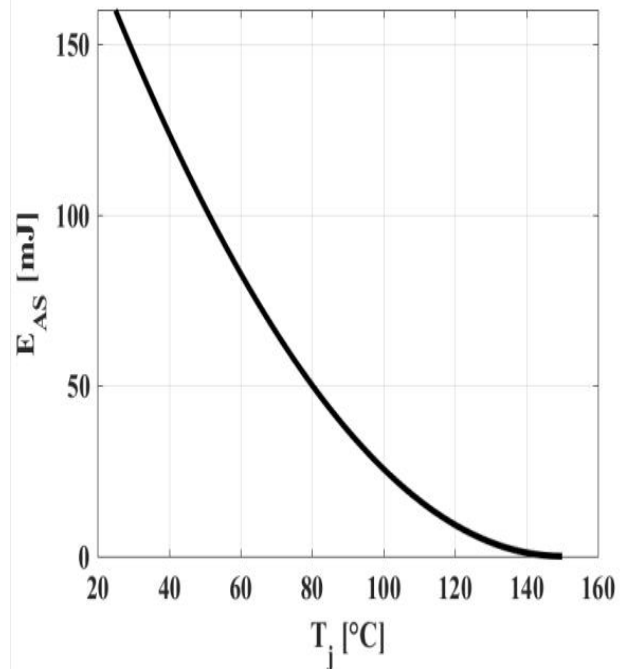
$$V_{GS} = f(Q_{gate}), I_D = 20A \text{ pulsed}$$

**Figure 13: Drain-Source Breakdown Voltage**


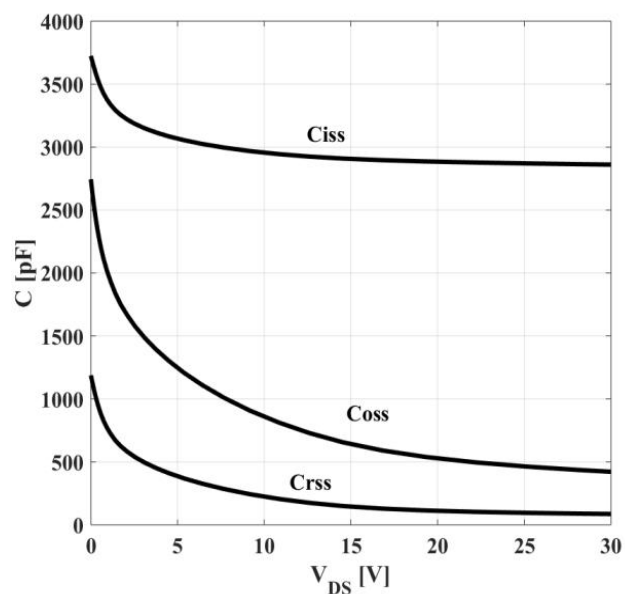
$$V_{BR(DSS)} = f(T_j); I_D = 1mA$$

**Figure 14: Forward Characteristics of Reverse Diode**


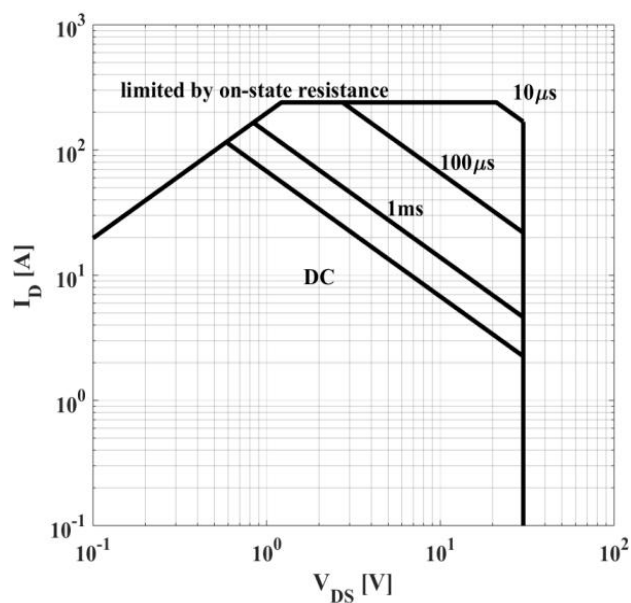
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

**Figure 15: Avalanche Energy**


$$E_{AS} = f(T_j); I_D = 20.0A; V_{DD} = 15V$$

**Figure 16: Typ. Capacitances**


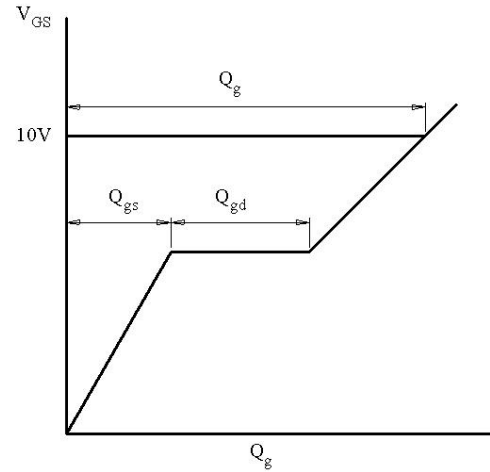
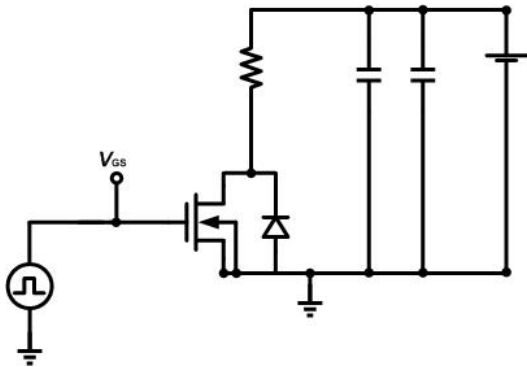
$C=f(V_{DS}); V_{GS}=0; f=1\text{MHz}$

**Figure 17: Safe Operating Area**


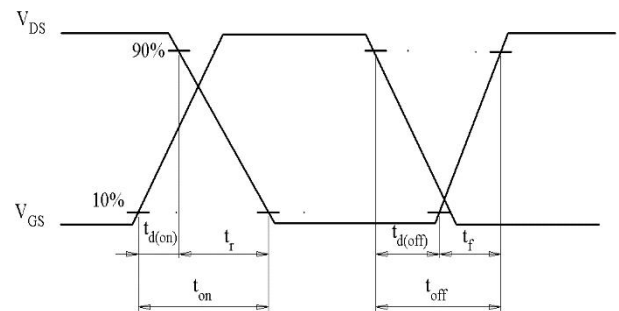
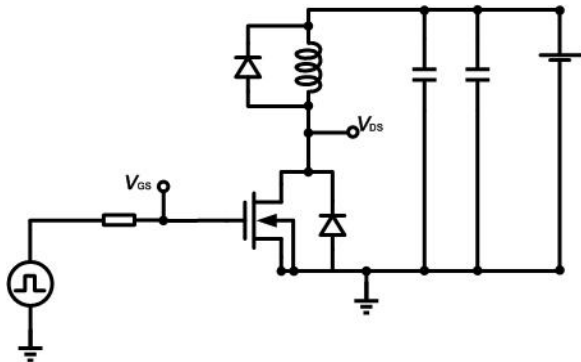
$I_D=f(V_{DS}); T_C=25^\circ\text{C}; V_{GS}>7\text{V}; \text{parameter: } t_p$

## Test Circuits

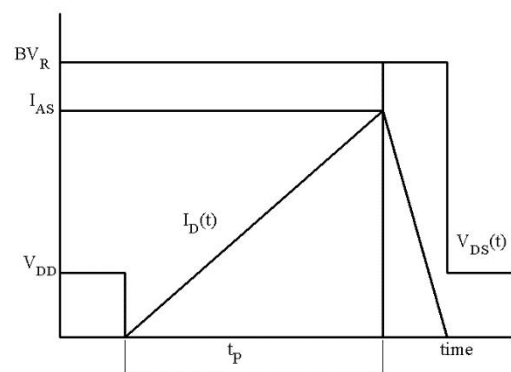
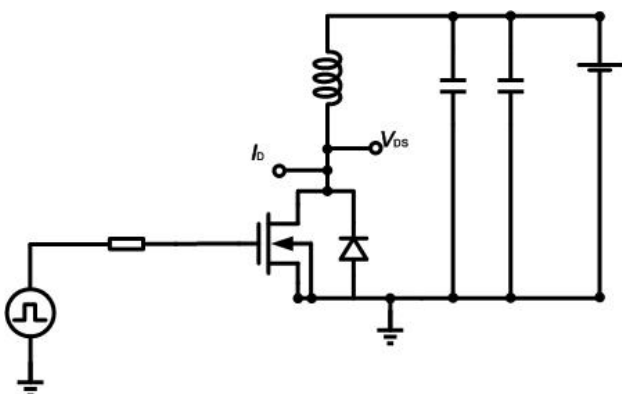
### 1. Gate Charge Test Circuit & Waveform



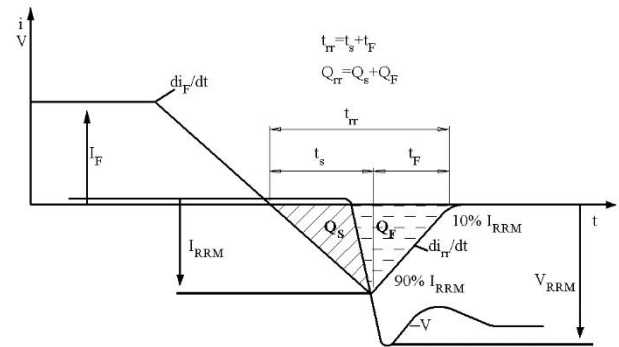
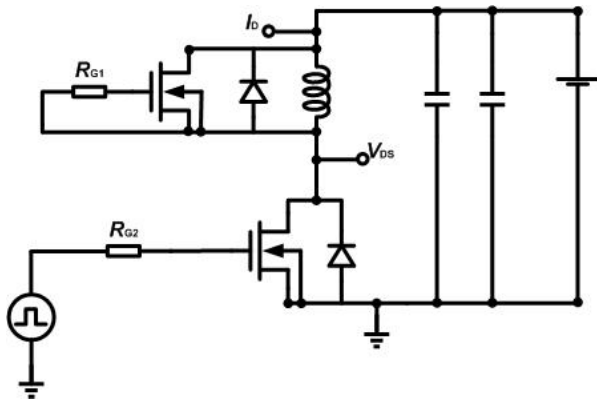
### 2. Switch Time Test Circuit

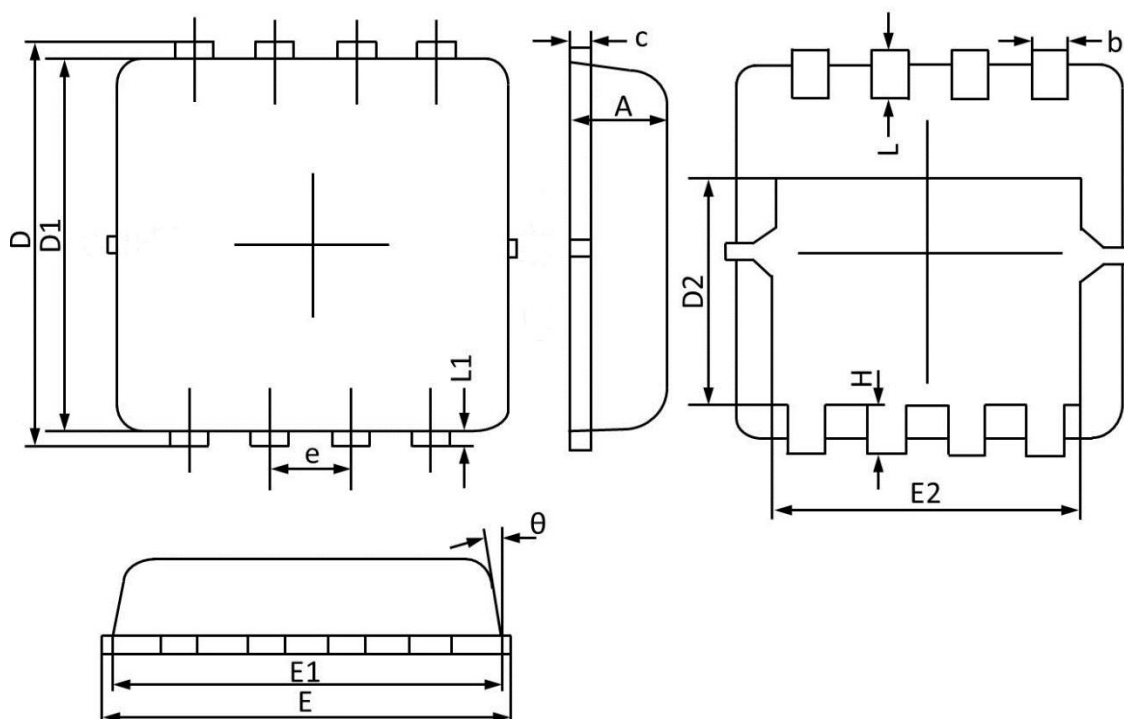


### 3. Unclaimed Inductive Switching Test Circuit & Waveforms

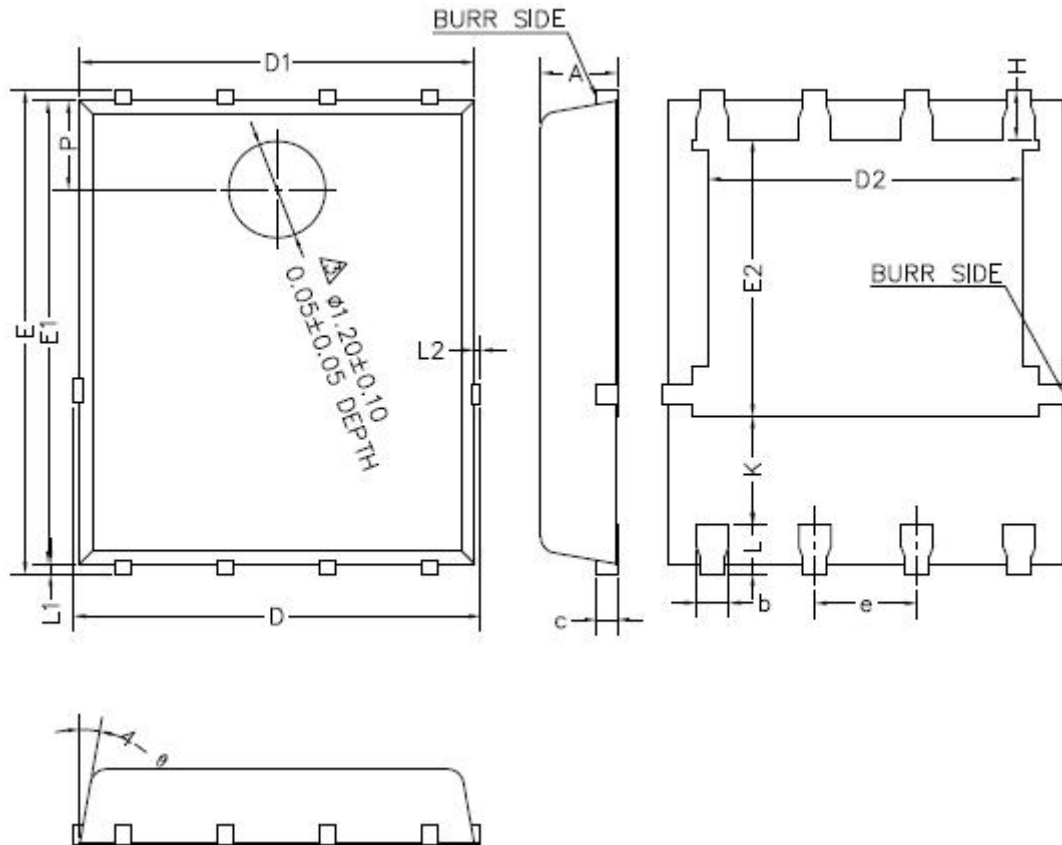


#### 4. Test Circuit and Waveform for Diode Characteristics



**Mechanical Dimensions**
**PDFN3.3\*3.3-8**
**Unit: mm**


| Symbol    | Dimensions In Millimeters |       | Dimensions In Inches |       |
|-----------|---------------------------|-------|----------------------|-------|
|           | MAX                       | MIN   | MAX                  | MIN   |
| <b>A</b>  | 0.900                     | 0.700 | 0.035                | 0.028 |
| <b>b</b>  | 0.350                     | 0.240 | 0.014                | 0.009 |
| <b>c</b>  | 0.250                     | 0.100 | 0.010                | 0.004 |
| <b>D</b>  | 3.450                     | 3.050 | 0.136                | 0.120 |
| <b>D1</b> | 3.200                     | 2.900 | 0.126                | 0.114 |
| <b>D2</b> | 1.850                     | 1.350 | 0.073                | 0.053 |
| <b>E</b>  | 3.400                     | 3.000 | 0.134                | 0.118 |
| <b>E1</b> | 3.250                     | 2.900 | 0.128                | 0.114 |
| <b>E2</b> | 2.600                     | 2.350 | 0.102                | 0.093 |
| <b>e</b>  | 0.65BSC                   |       | 0.026BSC             |       |
| <b>H</b>  | 0.500                     | 0.300 | 0.020                | 0.012 |
| <b>L</b>  | 0.500                     | 0.300 | 0.020                | 0.012 |
| <b>L1</b> | 0.200                     | 0.070 | 0.008                | 0.003 |
| <b>θ</b>  | 12°                       | 0°    | 12°                  | 0°    |

**Mechanical Dimensions**
**PDFN5\*6-8**
**Unit: mm**


| Symbol | Dimensions(mm) |      |      |
|--------|----------------|------|------|
|        | Min.           | Typ. | Max. |
| A      | 0.90           | 1.10 | 1.20 |
| b      | 0.35           | 0.40 | 0.45 |
| c      | 0.21           | 0.25 | 0.34 |
| D      |                |      | 5.10 |
| D1     | 4.80           | 4.90 | 5.00 |
| D2     | 3.91           | 4.01 | 4.11 |
| e      | 1.17           | 1.27 | 1.37 |
| E      | 5.90           | 6.00 | 6.10 |
| E1     | 5.70           | 5.75 | 5.80 |
| E2     | 3.34           | 3.44 | 3.54 |
| H      | 0.51           | 0.61 | 0.71 |
| K      | 1.10           |      |      |
| L      | 0.51           | 0.61 | 0.71 |
| L1     | 0.06           | 0.13 | 0.20 |
| L2     |                |      | 0.10 |
| P      | 1.00           | 1.10 | 1.20 |
| θ      | 8°             | 10°  | 12°  |



Sanrise Technology Limited Company

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

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#### Main Site:

##### - Headquarter

Shenzhen Sanrise Technology Co., LTD.

A1206, Skyworth building, No. 008, gaoxinnan 1st Road,  
Gaoxin District, Yuehai street,, Nanshan District, ShenZhen,  
P.R.China

Tel: +86-755-22953335

Fax: +86-755-22916878

##### - Shanghai Office

Sanrise Technology Limited Company

Rm.401, Building B, No. 666, Zhangheng Road,  
Zhangjiang Hi-Tech Park, Shanghai, P.R.China

Tel: +86-21-68825918