## General Description

The SRE100N120FSUDA is a Field Stop Trench IGBT with anti-parallel diode, which offers low switching losses, high energy efficiency and high avalanche ruggedness for soft switching applications such as UPS, solar inverters, etc.

The SRE100N120FSUDA is TO-247Plus package.

## Features

- High Breakdown Voltage to 1200V
- Advanced Trench Fieldstop technology
  - Low $V_{CE(sat)}$
  - High Ruggedness, Temperature Stability
  - Easy Parallel Switching Capability due to Positive Temperature Coefficient in $V_{CE(sat)}$
- High Speed Switching
- Enhanced Avalanche Capability
- Non-Automotive Qualified

## Application

- Solar Inverters
- Uninterrupted Power Supply
- Industrial Power Supplies
- Grid Inverter

## Symbol

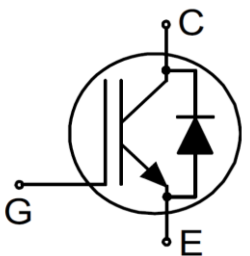
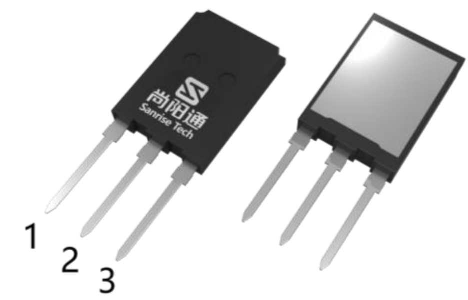



Figure 1 Symbol of SRE100N120FSUDA

## Package Type




TO-247Plus

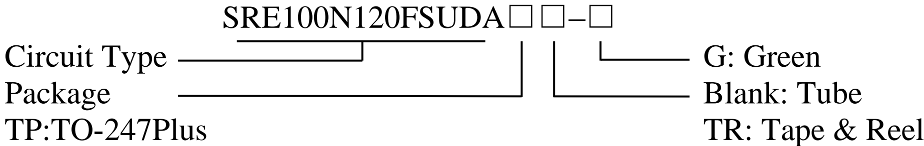
Pin 1- Gate

Pin 2&backside- Collector

Pin 3-Emitter

Fgure 2 Package Type of SRE100N120FSUDA

## Ordering Information




| Package | Part Number | Marking ID | Packing Type |
|---|---|---|---|
| | Green | Green | |
| TO-247Plus | SRE100N120FSUDATP-G7 | SRE100N120FSUDATPG7 | Tube |

## Absolute Maximum Ratings

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | | $V_{CES}$ | 1200 | V |
| Gate-emitter Voltage | | $V_{GES}$ | ±20 | V |
| Transient Gate-emitter Voltage | | | ±30 | V |
| Continuous Collector Current | $T_C$=25℃ | $I_C$ | 160(1) | A |
| | $T_C$=100℃ | | 100 | |
| Pulsed Collector Current, Limited by $T_{Jmax}$ | | $I_{CM}$ | 400 | A |
| Diode Continuous Collector Current | $T_C$=25℃ | $I_F$ | 120 | A |
| | $T_C$=100℃ | | 100(2) | |
| Diode Pulsed Current, Limited by $T_{Jmax}$ | | $I_{FM}$ | 320 | A |
| Power dissipation | $T_C$=25℃ | $P_{tot}$ | 880 | W |
| | $T_C$=100℃ | | 440 | W |
| Operating Junction Temperature | | $T_J$ | -40~175(3) | ℃ |
| Storage Temperature | | $T_{STG}$ | -55 ~ 150 | ℃ |
| Lead Temperature (Soldering, 10 sec) | | $T_{LEAD}$ | 260 | ℃ |

Note:

1. Limited to bond wire.
2. Current level is limited by Tj_max.
3. Reliability testing conducted at Tj=175℃.

## Thermal Resistance

| Parameter | Package | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| IGBT thermal Resistance，Junction-to-Case | TO-247Plus | $R_{thJC}$ | - | - | 0.17 | ℃/W |
| Diode thermal Resistance，Junction-to-Case | TO-247Plus | $R_{thJC}$ | - | - | 0.4 | |
| Thermal Resistance，Junction-to-Ambient | TO-247Plus | $R_{thJA}$ | - | - | 40 | |

## Electrical Characteristics

$T_J$ = 25℃, unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Statistic Characteristics** | | | | | | |
| Collector-emitter Breakdown Voltage | $BV_{CES}$ | $V_{GE}$=0V, $I_C$=500uA | 1200 | | | V |
| Gate Threshold Voltage | $V_{GE(th)}$ | VCE=VGE, IC=1.6mA | 4.6 | 5.6 | 6.6 | V |
| Collector-emitter saturation voltage | $V_{CEsat}$ | $V_{GE}$=15V, $I_C$=100A, $T_J$=25℃ | | 1.8 | 2.2 | V |
| | | $T_J$=125℃ | | 2.46 | | V |
| | | $T_J$=175℃ | | 2.86 | | V |
| Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V $T_J$=25℃ | | | 100 | uA |
| | | $T_J$=175℃ | | | 1.3 | mA |
| Gate-emitter Leakage Current Forward | $I_{GESF}$ | $V_{GE}$=20V, $V_{CE}$=0V | | | 100 | nA |
| Gate-emitter Leakage Current Reverse | $I_{GESR}$ | $V_{GE}$=-20V, $V_{CE}$=0V | | | -100 | nA |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{IES}$ | $V_{CE}$=25V, $V_{GE}$=0V, f=100KHz | | 6965 | | pF |
| Output Capacitance | $C_{OES}$ | | | 399 | | pF |
| Reverse Transfer Capacitance | $C_{RES}$ | | | 70 | | pF |
| Gate Resistance | $R_G$ | f=1MHz, Open Drain | | 0.83 | | Ω |
| Turn-on Delay Time | $t_{d(on)}$ | Tj=25℃, $V_{CC}$=600V, $I_C$=100A $R_G$=10Ω, $V_{GE}$=0/15V (Ets includes tail current and FRD reverse recovery energy.) | | 55 | | ns |
| Rise Time | $t_r$ | | | 66 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 276 | | ns |
| Fall Time | $t_f$ | | | 100 | | ns |
| Turn-on energy | $E_{on}$ | | | 7 | | mJ |
| Turn-off energy | $E_{off}$ | | | 2.6 | | mJ |
| Total switching energy | $E_{ts}$ | | | 9.6 | | mJ |
| Turn-on Delay Time | $t_{d(on)}$ | Tj=150℃ $V_{CC}$=600V, $I_C$=100A; $R_G$=10Ω, $V_{GE}$=0/15V (Ets includes tail current and FRD reverse recovery energy.) | | 47 | | ns |
| Rise Time | $t_r$ | | | 66 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 288 | | ns |
| Fall Time | $t_f$ | | | 111 | | ns |
| Turn-on energy | $E_{on}$ | | | 8.2 | | mJ |
| Turn-off energy | $E_{off}$ | | | 3.4 | | mJ |
| Total switching energy | $E_{ts}$ | | | 11.6 | | mJ |
| Gate to Emitter Charge | $Q_{GE}$ | $V_{CC}$=600V, $I_C$=100A $V_{GE}$=0 to 15V | | 46 | | nC |
| Gate to Collector Charge | $Q_{GC}$ | | | 97 | | nC |
| Gate Charge Total | $Q_G$ | | | 168 | | nC |

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Reverse Diode Characteristics** | | | | | | |
| Drain-Source Diode Forward Voltage | $V_F$ | $V_{GE}$=0V, $I_F$=100A Tj=25℃ | | 2.5 | 2.9 | V |
| | | $V_{GE}$=0V, $I_F$=100A Tj=125℃ | | 2.45 | | |
| | | $V_{GE}$=0V, $I_F$=100A Tj=175℃ | | 2.26 | | |
| Reverse Recovery Time | $t_{rr}$ | Tj=25℃ $V_R$=600V, $I_F$=100A $dI_F/dt$=1200A/us | | 316 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | 2.0 | | uC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 31 | | A |
| Diode peak rate of fall of reverse Recovery current during tb | dirr/dt | | | -485 | | A/us |
| Reverse Recovery Time | $t_{rr}$ | Tj=150℃ $V_R$=600V, $I_F$=100A $dI_F/dt$=1200A/us | | 468 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | 6.7 | | uC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 59 | | A |
| Diode peak rate of fall of reverse Recovery current during tb | dirr/dt | | | -435 | | A/us |

## Typical Performance Characteristics

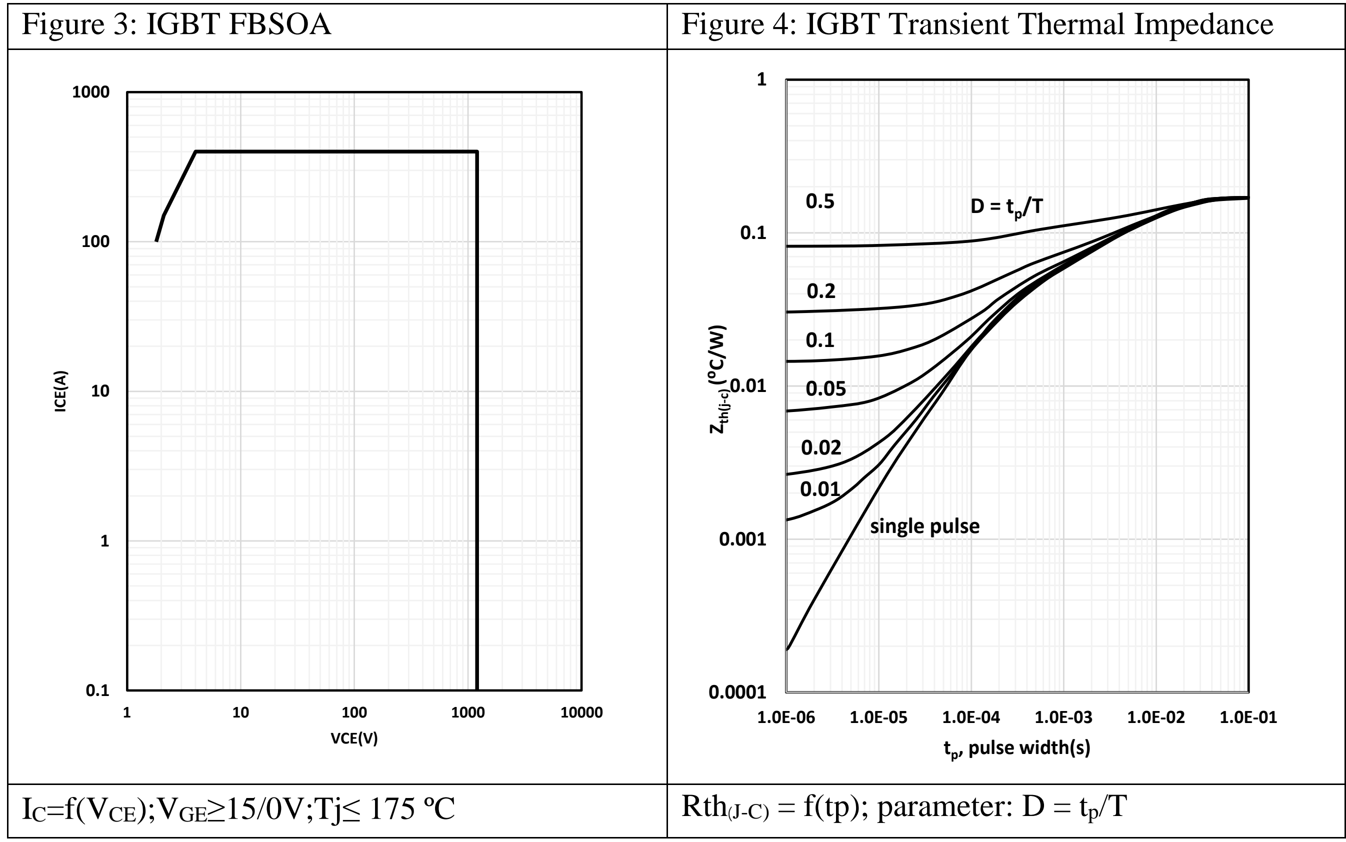



Figure 3: IGBT FBSOA

$I_C=f(V_{CE});V_{GE}\geq15/0V;T_j\leq 175\ ^\circ C$

Figure 4: IGBT Transient Thermal Impedance

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

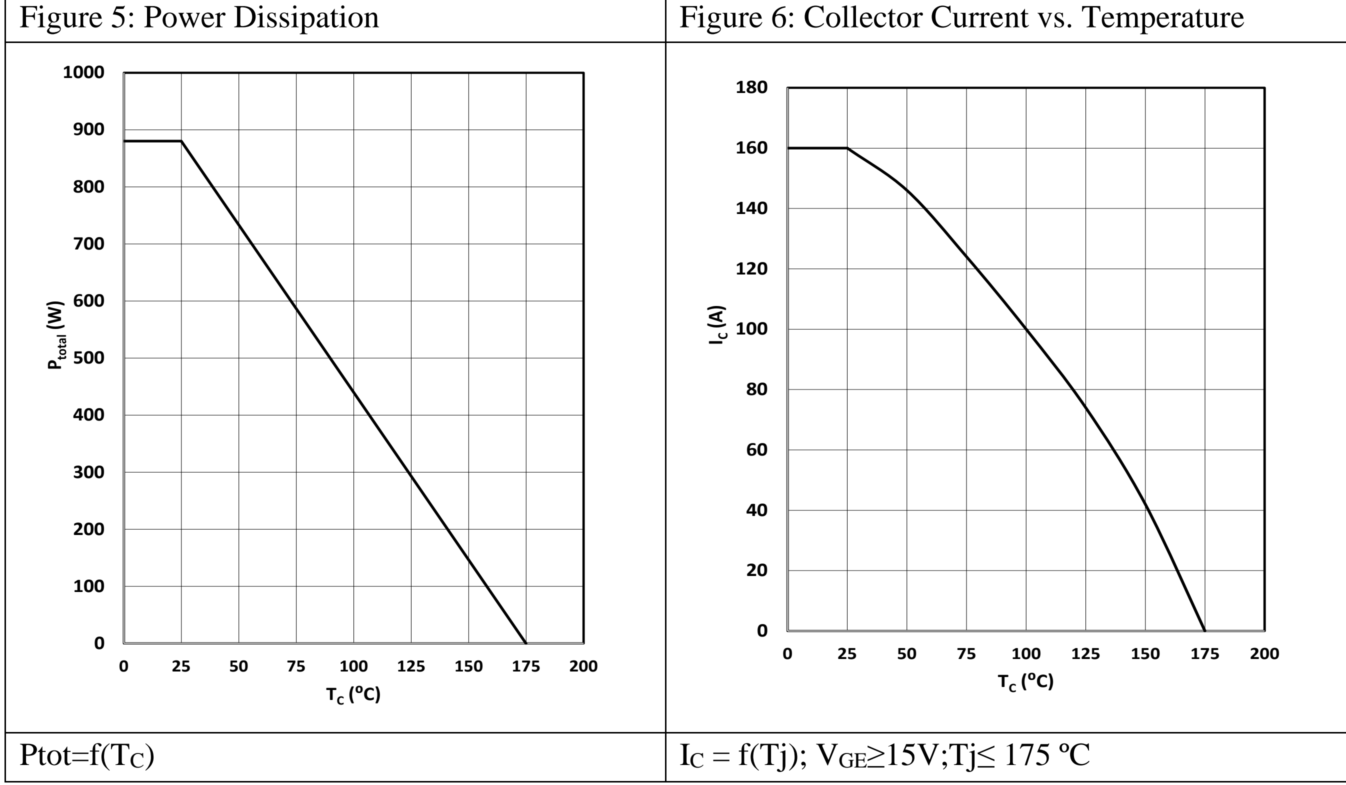



Figure 5: Power Dissipation

$P_{tot}=f(T_C)$

Figure 6: Collector Current vs. Temperature

$I_C = f(T_j)$; $V_{GE}\geq15V;T_j\leq 175\ ^\circ C$

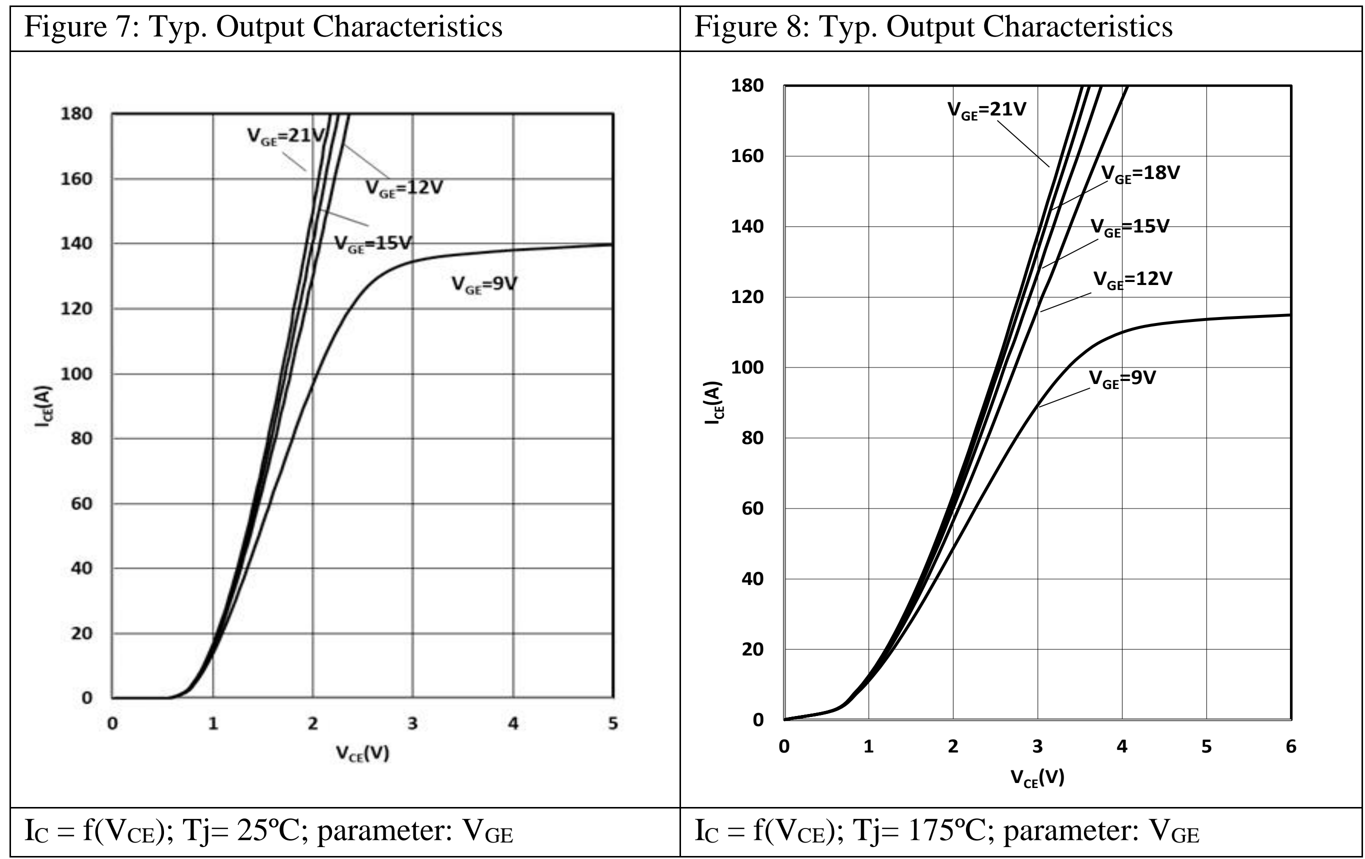



Figure 7: Typ. Output Characteristics

$I_C = f(V_{CE})$; Tj= 25℃; parameter: $V_{GE}$

Figure 8: Typ. Output Characteristics

$I_C = f(V_{CE})$; Tj= 175℃; parameter: $V_{GE}$

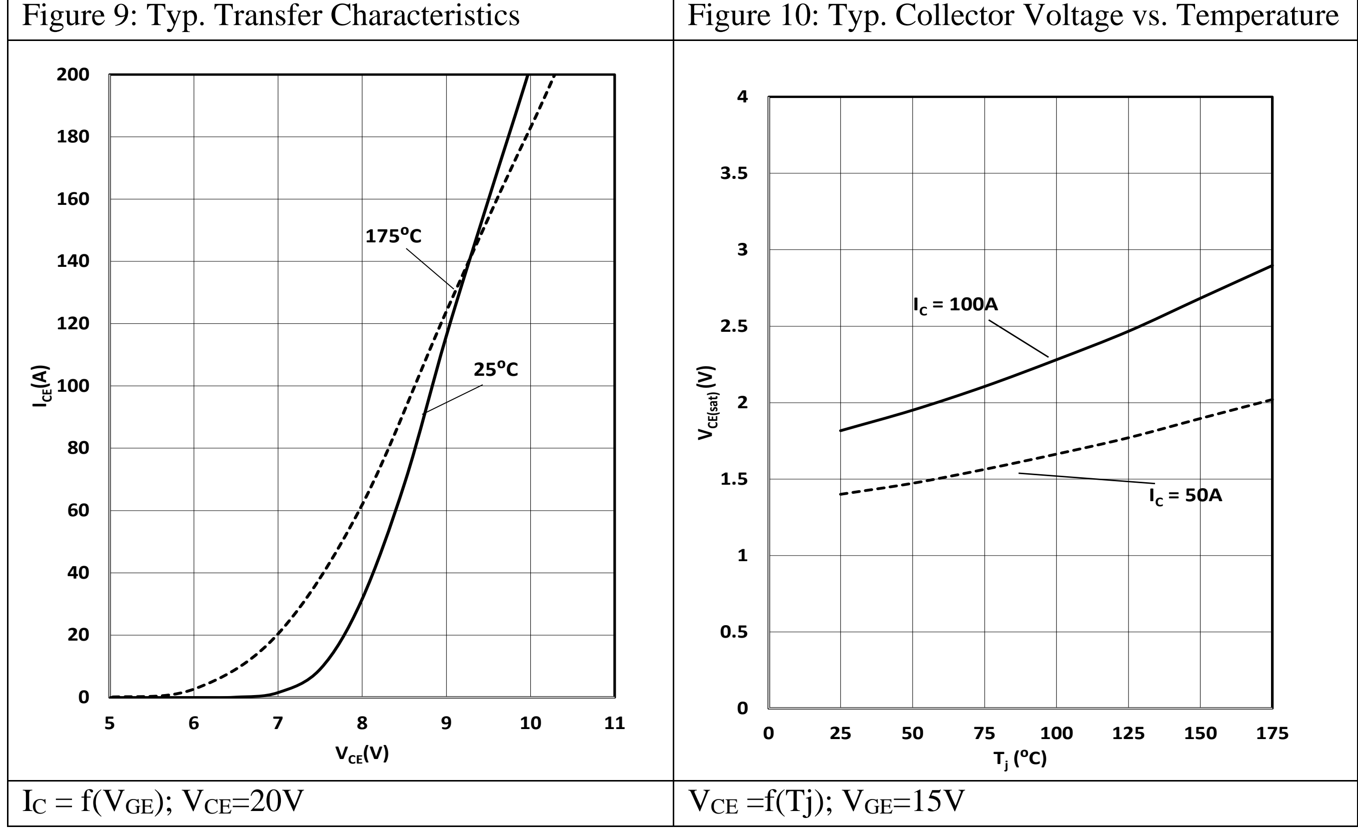



Figure 9: Typ. Transfer Characteristics

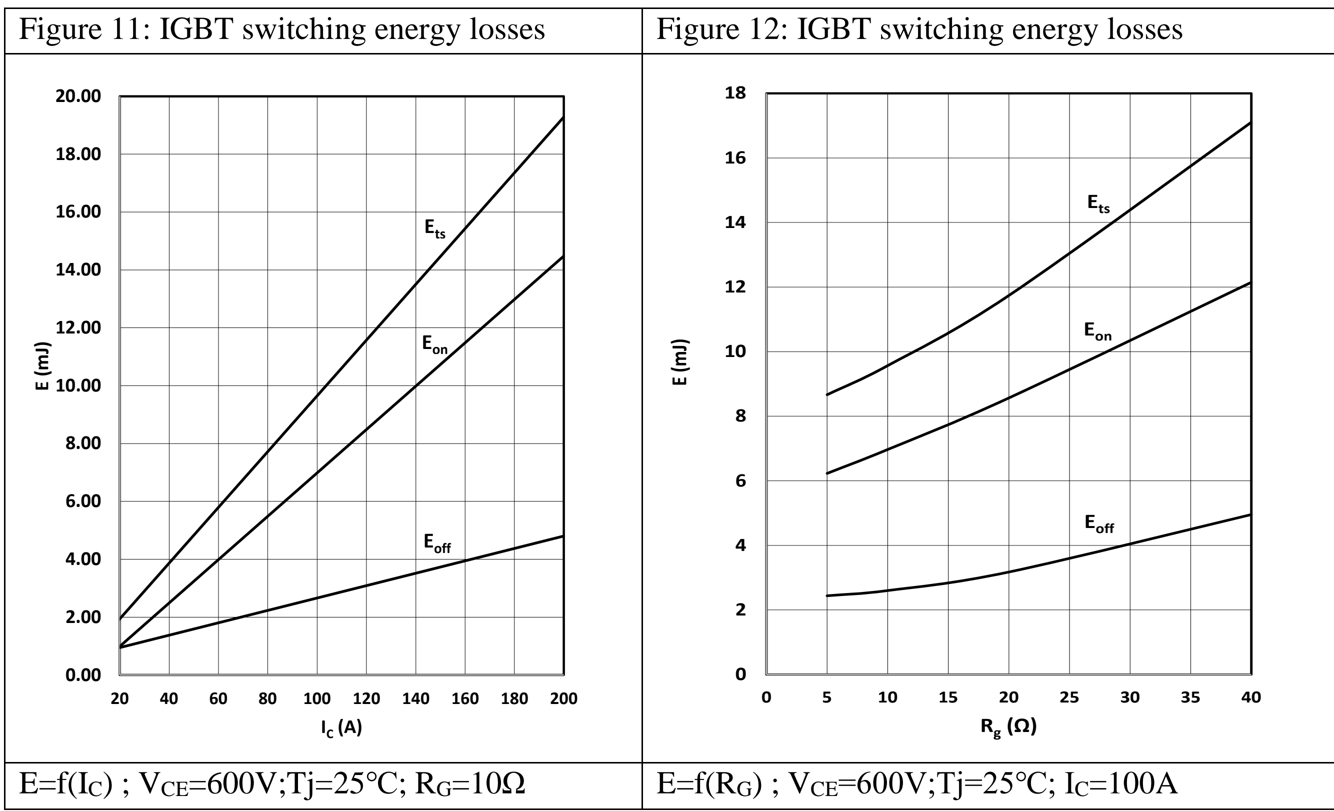
$I_C = f(V_{GE})$; $V_{CE}$=20V

Figure 10: Typ. Collector Voltage vs. Temperature

$V_{CE} = f(T_j)$; $V_{GE}$=15V

Figure 11: IGBT switching energy losses

Figure 12: IGBT switching energy losses

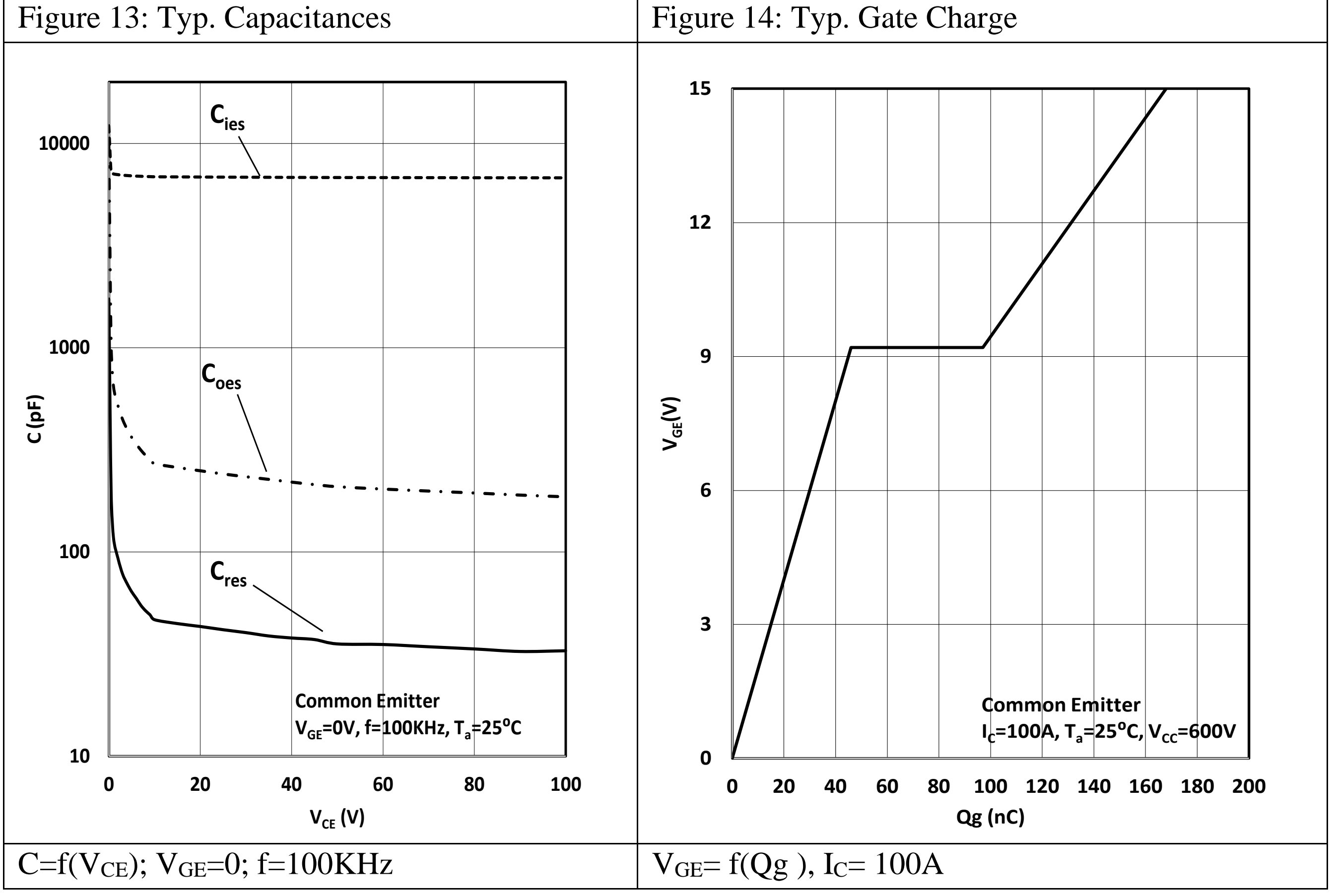



$E=f(I_C)$ ; $V_{CE}$=600V;Tj=25°C; $R_G$=10Ω

$E=f(R_G)$ ; $V_{CE}$=600V;Tj=25°C; $I_C$=100A

Figure 13: Typ. Capacitances

Figure 14: Typ. Gate Charge



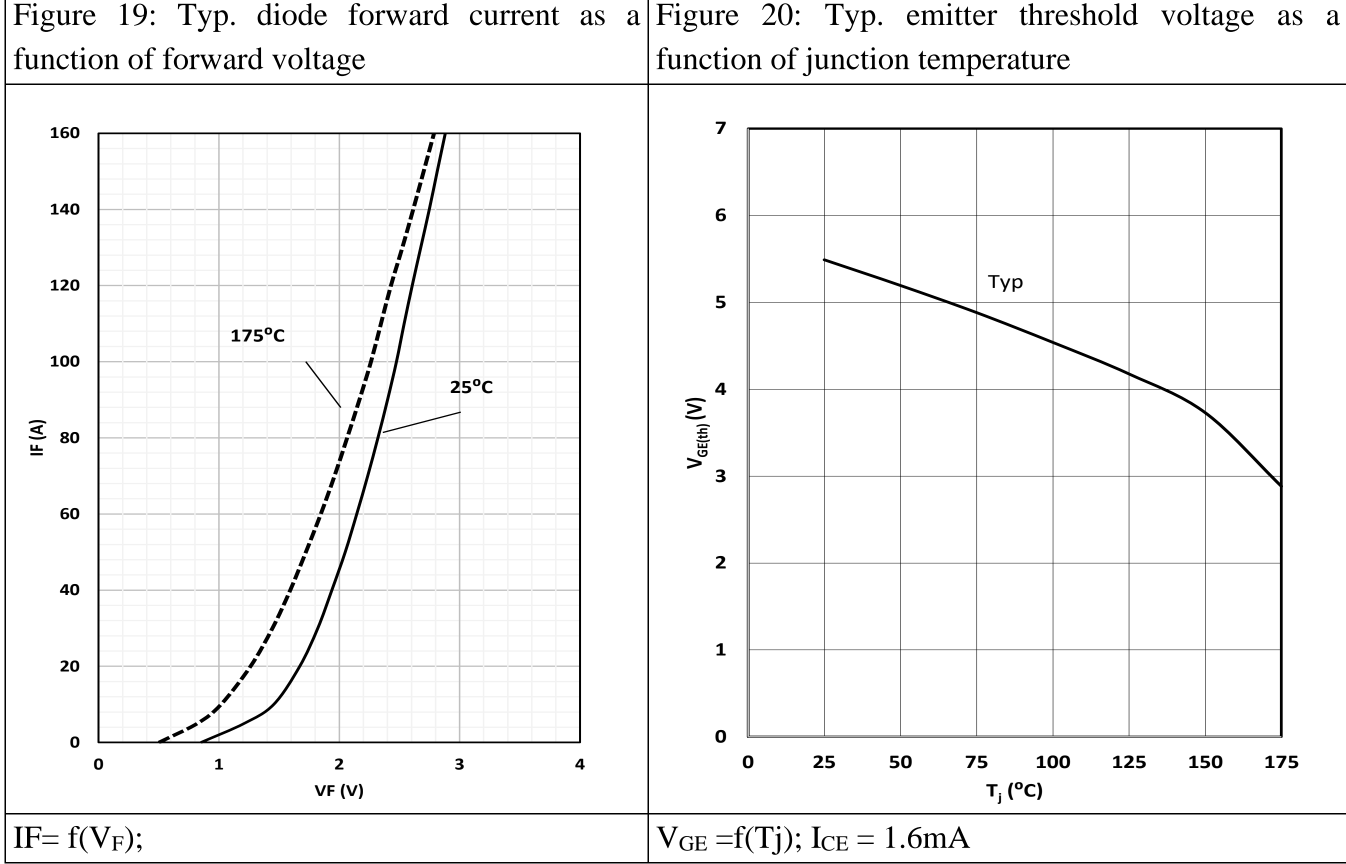

$C=f(V_{CE})$; $V_{GE}$=0; f=100KHz

$V_{GE}$= f(Qg ), $I_C$= 100A

| Figure 15：Typ. Switching time as a function of gate resistance | Figure 16: Typ. Switching time as a function of junction temperature |
|---|---|
| $V_{CE}$=600V;$I_C$= 100A; Tj=25°C | $V_{CE}$ =600V; $I_C$ = 100A;$R_G$=10Ω |

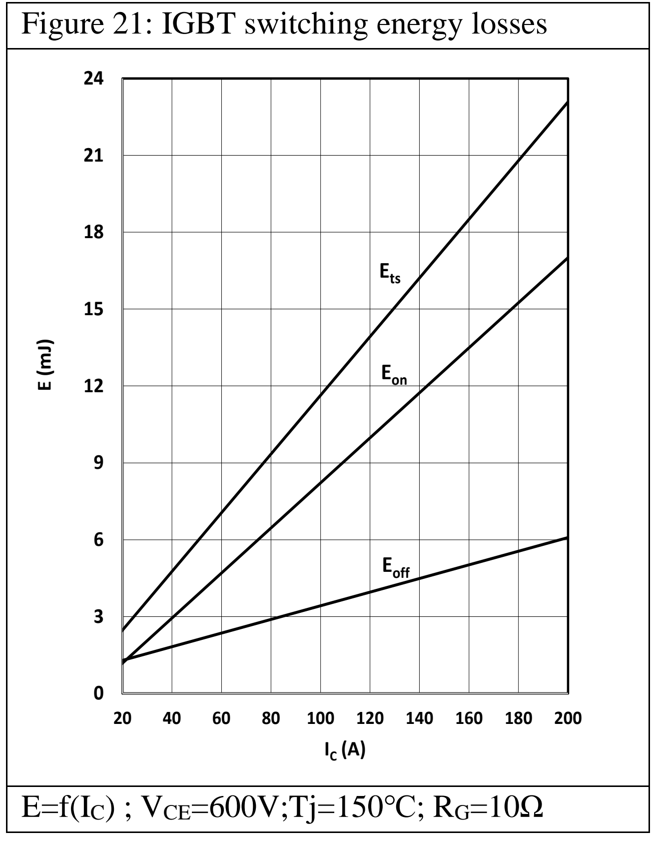
| Figure 17: Typical switching energy losses as a function of junction temperature | Figure 18: Typical switching energy losses as a function of junction temperature |
|---|---|
| E= f(Tj); $V_{CE}$=600V;$I_C$=50A;$R_G$=10Ω | E= f(Tj); $V_{CE}$=600V;$I_C$= 100A;$R_G$=10Ω |

| Figure 19: Typ. diode forward current as a function of forward voltage | Figure 20: Typ. emitter threshold voltage as a function of junction temperature |
|---|---|




| IF= f($V_F$); | $V_{GE}$ =f(Tj); $I_{CE}$ = 1.6mA |
|---|---|

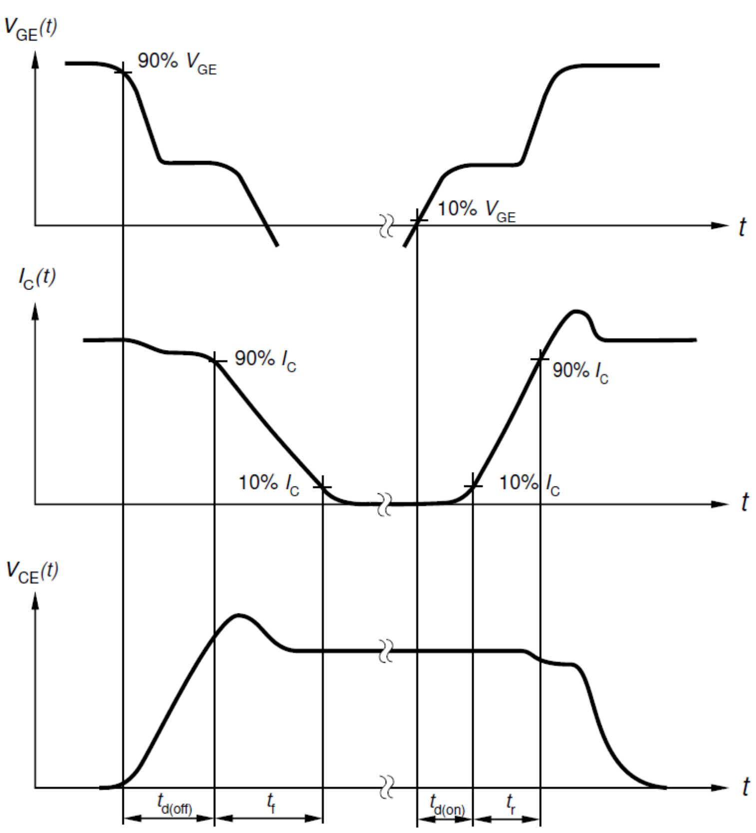
Figure 21: IGBT switching energy losses



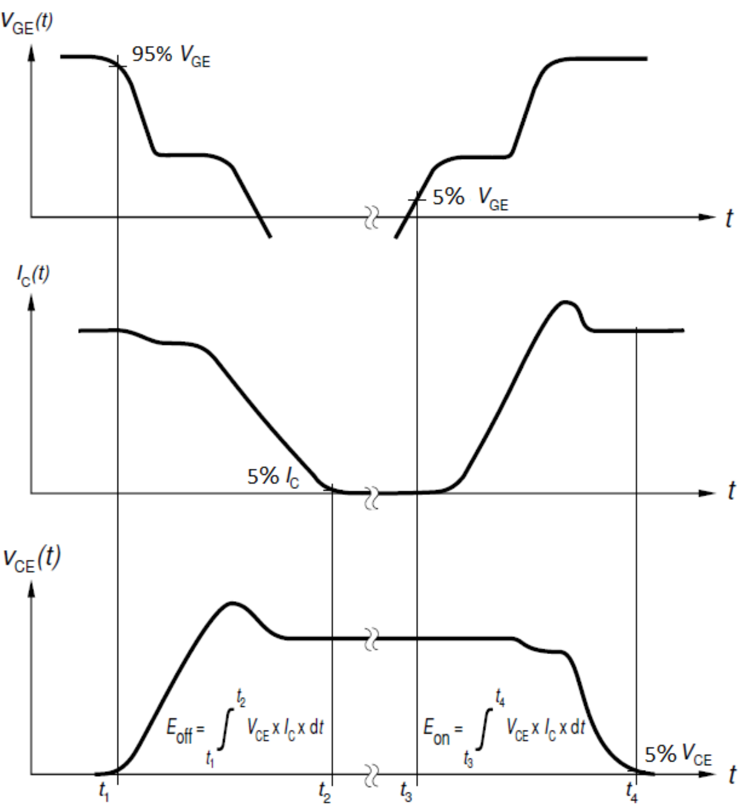

E=f($I_C$) ; $V_{CE}$=600V;Tj=150°C; $R_G$=10Ω

## Test Circuits

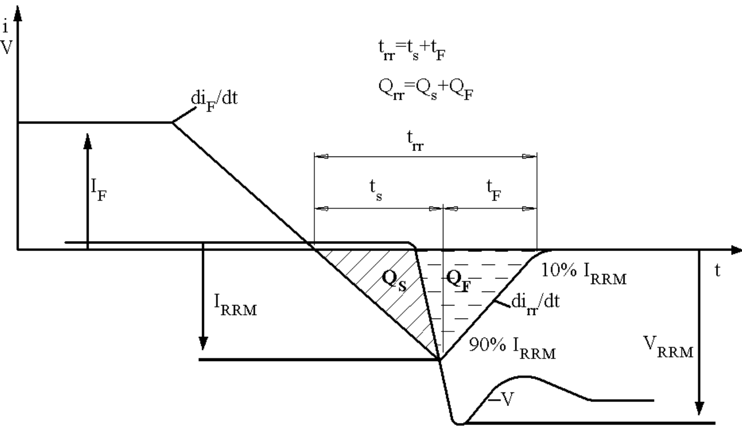
### 1. Definition Switching times



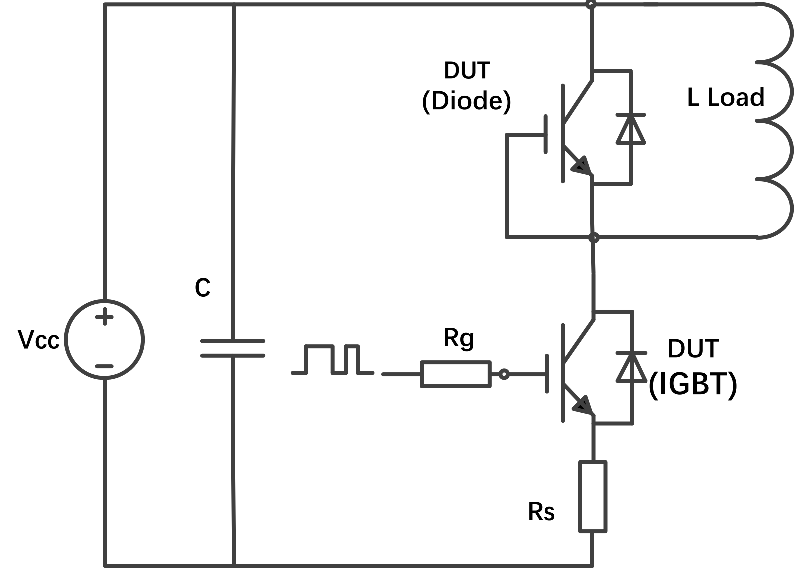

### 2. Definition Switching losses



### 3. Definition Diode Switching Characteristics



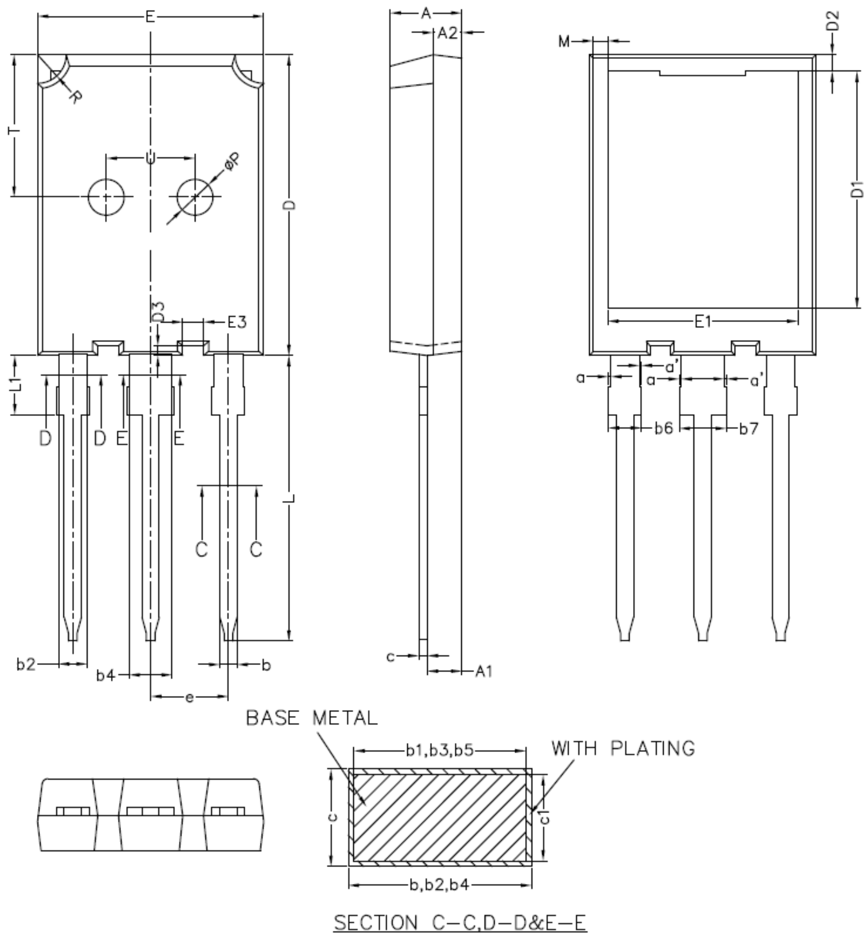

### 4. Dynamic test circuit



## Mechanical Dimensions

**TO-247Plus**

**Unit: mm**



| Symbol | Dimensions(mm) | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.90 | 5.00 | 5.10 |
| A1 | 2.31 | 2.41 | 2.51 |
| A2 | 1.90 | 2.00 | 2.10 |
| α | 0 | - | 0.15 |
| α’ | 0 | - | 0.15 |
| b | 1.16 | - | 1.26 |
| b1 | 1.15 | 1.2 | 1.22 |
| b2 | 1.96 | - | 2.06 |
| b3 | 1.95 | 2.00 | 2.02 |
| b4 | 2.96 | - | 3.06 |
| b5 | 2.95 | 3.00 | 3.02 |
| b6 | - | - | 2.25 |
| b7 | - | - | 3.25 |
| c | 0.59 | - | 0.66 |
| c1 | 0.58 | 0.60 | 0.62 |
| D | 20.90 | 21.00 | 21.10 |
| D1 | 16.25 | 16.55 | 16.85 |
| D2 | 1.05 | 1.17 | 1.35 |
| D3 | 0.58 | 0.68 | 0.78 |
| E | 15.70 | 15.80 | 15.90 |
| E1 | 13.10 | 13.26 | 13.50 |
| E3 | 1.35 | 1.45 | 1.55 |
| e | 5.34 | 5.44 | 5.54 |
| L | 19.80 | 19.92 | 20.10 |
| L1 | 3.90 | - | 4.30 |
| M | 0.70 | - | 1.30 |
| P | 2.40 | 2.50 | 2.60 |
| R | 1.90 | 2.00 | 2.10 |
| T | 9.80 | - | 10.20 |
| U | 6.00 | - | 6.40 |

Shenzhen Sanrise Technology Co., LTD

http://www.sanrise-tech.com

**IMPORTANT NOTICE**

Shenzhen Sanrise Technology Co., LTD. reserves the right to make changes without further notice to any products or specifications herein. Shenzhen Sanrise Technology Co., LTD. does not assume any responsibility for use of any its products for any particular purpose, nor does Shenzhen Sanrise Technology Co., LTD. assume any liability arising out of the application or use of any its products or circuits. Shenzhen Sanrise Technology Co., LTD. does not convey any license under its patent rights or other rights nor the rights of others.

**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**

Shenzhen Sanrise Technology Co., LTD.
Rm.401, Building B, No. 666, Zhangheng Road, Zhangjiang Hi-Tech Park, Shanghai, P.R.China

Tel: +86-21-68825918