# 60A 1200V Trench Fieldstop IGBT with anti-parallel diode SRE60N120FSSDA

## General Description

TheSRE60N120FSSDA 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 SRE60N120FSSDA is available in TO-247 packages.

## Features

- High Breakdown Voltage to 1200V
- Advanced Trench Fieldstop technology
  - Low $V_{CE(sat)}$
  - Short circuit withstand time 6 us
  - Easy Parallel Switching Capability due to Positive Temperature Coefficient in $V_{CE(SAT)}$
- Soft Current Turn-off Waveforms
- Enhanced Avalanche Capability
- Non-Automotive Qualified

## Application

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

## Symbol

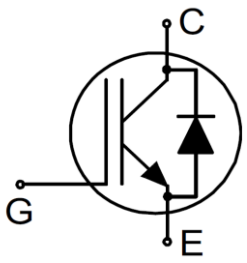
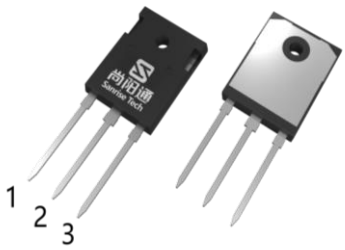



Figure 1 Symbol of SRE60N120FSSDA

## Package Type




TO-247

Pin 1- gate
Pin 2&backside-collector
Pin 3-emitter

Figure 2 Package Type of SRE60N120FSSDA

## Ordering Information

SRE60N120FSSDA□□–□

Circuit Type
Package
T: TO-247

G: Green
Blank: Tube
TR: Tape & Reel

| Package | Part Number | Marking ID | Packing Type |
|---|---|---|---|
| TO-247 | SRE60N120FSSDAT-G | SRE60N120FSSDATG | Tube |

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## 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 | $T_C$=25ºC | $I_C$ | 100 | A |
| | $T_C$=100ºC | | 60 | |
| Pulsed Collector Current, Limited by $T_{Jmax}$ | | $I_{CM}$ | 240 | A |
| Diode Continuous Collector Current ($T_C$=100ºC) | | $I_F$ | 60 | A |
| Diode Pulsed Current, Limited by $T_{Jmax}$ | | $I_{FM}$ | 240 | A |
| Power dissipation (TO-247) | $T_C$=25ºC | $P_{tot}$ | 500 | W |
| | $T_C$=100ºC | | 250 | W |
| Power dissipation (TO-247Plus) | $T_C$=25ºC | $P_{tot}$ | 650 | W |
| | $T_C$=100ºC | | 325 | W |
| Short Circuit withstand time:<br>$V_{GE}$≤15V,Vcc≤600V,Tj_start=25℃;<br>Allow number of short circuits<1000;<br>Time between short circuits:1.0s; | | tsc | 6 | us |
| Operating Junction Temperature | | $T_J$ | -40 ~ 175(1) | ºC |
| Storage Temperature | | $T_{STG}$ | -55 ~ 150 | ºC |
| Lead Temperature (Soldering, 10 sec) | | $T_{LEAD}$ | 260 | ºC |

Note:
1. Reliability testing conducted at Tj=175℃.

## Thermal Resistance

| Parameter | Package | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| IGBT thermal Resistance，Junction-to-Case | TO-247 | $R_{thJC}$ | - | - | 0.3 | ºC/W |
| Diode thermal Resistance，Junction-to-Case | TO-247 | $R_{thJC}$ | - | - | 0.6 | |
| Thermal Resistance，Junction-to-Ambient | TO-247 | $R_{thJA}$ | - | - | 40 | |

# 60A 1200V Trench Fieldstop IGBT with anti-parallel diode SRE60N120FSSDA

## Electrical Characteristics

$T_J$ = 25ºC, 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=1.0mA | 4.5 | 5.3 | 6.1 | V |
| Collector-emitter saturation voltage | | $V_{CEsat}$ | $V_{GE}$=15V, $I_C$=60A, $T_J$=25ºC | | 1.5 | 2.0 | V |
| | | | $T_J$=125ºC | | 1.8 | | V |
| | | | $T_J$=175ºC | | 2.03 | | V |
| Zero Gate Voltage Collector Current | | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V $T_J$=25ºC | | | 10 | uA |
| | | | $T_J$=175ºC | | | 1 | mA |
| Gate-emitter Leakage Current | Forward | $I_{GESF}$ | $V_{GE}$=20V, $V_{CE}$=0V | | | 100 | nA |
| | Reverse | $I_{GESR}$ | $V_{GE}$=-20V, $V_{CE}$=0V | | | -100 | nA |
| **Dynamic Characteristics** | | | | | | | |
| Input Capacitance | | $C_{IES}$ | $V_{CE}$=25V, $V_{GE}$=0V, f=1MHz | | 4433 | | pF |
| Output Capacitance | | $C_{OES}$ | | | 257 | | |
| Reverse Transfer Capacitance | | $C_{RES}$ | | | 44 | | |
| Gate Resistance | | $R_G$ | f=1MHz, Open Drain | | 1.53 | | Ω |
| Turn-on Delay Time | | $t_{d(on)}$ | Tj=25℃ $V_{CC}$=600V, $I_C$=60A $R_G$=10Ω, $V_{GE}$=0/15V Energy losses include "tail" and diode reverse recovery | | 51 | | ns |
| Rise Time | | $t_r$ | | | 61 | | ns |
| Turn-off Delay Time | | $t_{d(off)}$ | | | 236 | | ns |
| Fall Time | | $t_f$ | | | 176 | | ns |
| Turn-on energy | | $E_{on}$ | | | 4.1 | | mJ |
| Turn-off energy | | $E_{off}$ | | | 2.7 | | mJ |
| Total switching energy | | $E_{ts}$ | | | 6.8 | | mJ |
| Turn-on Delay Time | | $t_{d(on)}$ | Tj=150℃ $V_{CC}$=600V, $I_C$=60A $R_G$=10Ω,$V_{GE}$=0/15V Energy losses include "tail" and diode reverse recovery | | 46 | | ns |
| Rise Time | | $t_r$ | | | 58 | | ns |
| Turn-off Delay Time | | $t_{d(off)}$ | | | 284 | | ns |
| Fall Time | | $t_f$ | | | 231 | | ns |
| Turn-on energy | | $E_{on}$ | | | 4.8 | | mJ |
| Turn-off energy | | $E_{off}$ | | | 3.8 | | mJ |
| Total switching energy | | $E_{ts}$ | | | 8.6 | | mJ |
| Gate to Emitter Charge | | $Q_{GE}$ | $V_{CC}$=600V, $I_C$=60A $V_{GE}$=0 to 15V | | 44 | | nC |
| Gate to Collector Charge | | $Q_{GC}$ | | | 80 | | |
| Gate Charge Total | | $Q_G$ | | | 131 | | |

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| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Reverse Diode Characteristics** | | | | | | |
| Diode Forward Voltage | $V_F$ | $I_F$=30A<br>$T_J$=25ºC | | 1.82 | 2.2 | V |
| | | $I_F$=30A<br>$T_J$=125ºC | | 1.67 | | |
| | | $I_F$=30A<br>$T_J$=175ºC | | 1.5 | | |
| | | $I_F$=60A<br>$T_J$=25ºC | | 2.18 | 2.5 | |
| | | $I_F$=60A<br>$T_J$=125ºC | | 1.91 | | |
| | | $I_F$=60A<br>$T_J$=175ºC | | 1.82 | | |
| Reverse Recovery Time | $t_{rr}$ | Tj=25℃<br>$V_R$=600V, $I_F$=60A<br>$dI_F/dt$=960A/us | | 447 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | 3.3 | | uC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 30 | | A |
| Diode peak rate of fall of reverse Recovery current during tb | dirr/dt | | | -800 | | A/us |
| Reverse Recovery Time | $t_{rr}$ | Tj=150℃<br>$V_R$=600V, $I_F$=60A<br>$dI_F/dt$=960A/us | | 718 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | 7.9 | | uC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 53 | | A |
| Diode peak rate of fall of reverse Recovery current during tb | dirr/dt | | | -125 | | A/us |

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Shenzhen Sanrise Technology Co., LTD

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