



## SSC65TR20GT6

### Trench FSII Fast IGBT

#### ➤ Features

| $V_{CES}$ | $V_{GES}$ | $I_C$     |
|-----------|-----------|-----------|
| 650V      | $\pm 20V$ | 40A@25°C  |
|           |           | 20A@100°C |

#### ➤ Description

Using trench design and advanced FS (Field Stop) second generation technology, the 650V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation.

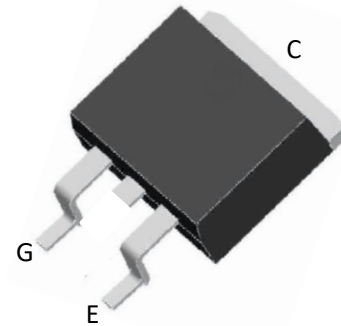
#### ➤ Applications

- Welding Machines
- PFC Circuits
- UPS
- Power Inverters

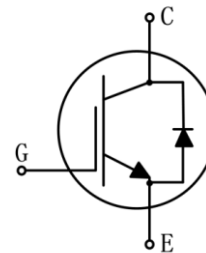
#### ➤ Ordering Information

| Device       | Package   | Shipping |
|--------------|-----------|----------|
| SSC65TR20GT6 | TO-263-3L | Reel     |

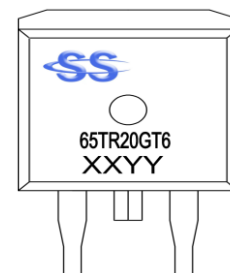
#### ➤ Pin Configuration



**TO-263-3L (Top View)**



**Pin Configuration**



**Marking**

(XXYY: Internal Traceability Code)



➤ **Absolute Maximum Ratings ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise noted)**

| Symbol      | Parameter                                              |                           | Ratings  | Unit               |
|-------------|--------------------------------------------------------|---------------------------|----------|--------------------|
| $V_{CES}$   | Collector-Emitter Voltage                              |                           | 650      | V                  |
| $V_{GES}$   | Gate-Emitter Voltage                                   |                           | $\pm 20$ | V                  |
| $I_C$       | Collector Current                                      | $T_C=25^{\circ}\text{C}$  | 40       | A                  |
|             |                                                        | $T_C=100^{\circ}\text{C}$ | 20       |                    |
| $I_{Cpuls}$ | Pulsed Collector Current, $t_p$ limited by $T_{vjmax}$ |                           | 80       | A                  |
| $P_D$       | Power Dissipation <sup>a</sup>                         | $T_C=25^{\circ}\text{C}$  | 150      | W                  |
|             |                                                        | $T_C=100^{\circ}\text{C}$ | 75       |                    |
| $T_J$       | Operating Junction and Storage Temperature Range       |                           | -40~175  | $^{\circ}\text{C}$ |
| $T_{STG}$   | Operating Junction and Storage Temperature Range       |                           | -55~150  | $^{\circ}\text{C}$ |
| $t_{sc}$    | Short circuit withstand time                           |                           | 10       | us                 |

➤ **Thermal Resistance Ratings**

| Symbol          | Parameter                                      | Typ | Max | Unit                        |
|-----------------|------------------------------------------------|-----|-----|-----------------------------|
| $R_{\theta JA}$ | Junction-to-Ambient Thermal Resistance         |     | 40  | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case for IGBT  |     | 1.0 |                             |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case for Diode |     | 1.8 |                             |



➤ **Electrical Characteristics of IGBT ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise noted)**

| Symbol        | Parameter                            | Test Conditions                                                                                        | Min. | Typ. | Max. | Unit    |
|---------------|--------------------------------------|--------------------------------------------------------------------------------------------------------|------|------|------|---------|
| $V_{(BR)CES}$ | Collector-Emitter Breakdown Voltage  | $V_{GE} = 0V, I_C = 0.25mA$                                                                            | 650  |      |      | V       |
| $I_{CES}$     | Collector-Emitter Leakage Current    | $V_{GE}=0V, V_{CE}=650V, T_{vj}=25^{\circ}\text{C}$                                                    |      |      | 50   | $\mu A$ |
| $I_{GES(F)}$  | Gate to Emitter Forward Leakage      | $V_{GE} = +20V, V_{CE} = 0V$                                                                           |      |      | 100  | nA      |
| $I_{GES(R)}$  | Gate to Emitter Reverse Leakage      | $V_{GE} = -20V, V_{CE} = 0V$                                                                           |      |      | -100 | nA      |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C=20A, V_{GE}=15V, T_{vj}=25^{\circ}\text{C}$                                                       |      | 1.6  |      | V       |
|               |                                      | $I_C=20A, V_{GE}=15V, T_{vj}=175^{\circ}\text{C}$                                                      |      | 1.9  |      | V       |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $I_C = 1mA, V_{CE} = V_{GE}$                                                                           | 5.2  | 5.7  | 6.2  | V       |
| $C_{ies}$     | Input Capacitance                    | $V_{CE} = 30V, V_{GE} = 0V, f = 1MHz$                                                                  |      | 1700 |      | pF      |
| $C_{oes}$     | Output Capacitance                   |                                                                                                        |      | 72   |      |         |
| $C_{res}$     | Reverse Transfer Capacitance         |                                                                                                        |      | 13   |      |         |
| $T_{D(ON)}$   | Turn-on delay time                   | $T_{vj}=25^{\circ}\text{C}, V_{CC}=400V, I_C=20A, V_{GE}=0/15V, R_g=10\Omega, \text{ Inductive Load}$  |      | 21   |      | ns      |
| $T_r$         | Rise time                            |                                                                                                        |      | 23   |      |         |
| $T_{D(OFF)}$  | Turn-off delay time                  |                                                                                                        |      | 120  |      |         |
| $T_f$         | Fall time                            |                                                                                                        |      | 63   |      |         |
| $E_{on}$      | Turn-On Switching Loss               |                                                                                                        |      | 0.37 |      | mJ      |
| $E_{off}$     | Turn-Off Switching Loss              |                                                                                                        |      | 0.46 |      |         |
| $E_{ts}$      | Total Switching Loss                 |                                                                                                        |      | 0.83 |      |         |
| $T_{D(ON)}$   | Turn-on delay time                   | $T_{vj}=175^{\circ}\text{C}, V_{CC}=400V, I_C=20A, V_{GE}=0/15V, R_g=10\Omega, \text{ Inductive Load}$ |      | 21   |      | ns      |
| $T_r$         | Rise time                            |                                                                                                        |      | 23   |      |         |
| $T_{D(OFF)}$  | Turn-off delay time                  |                                                                                                        |      | 141  |      |         |
| $T_f$         | Fall time                            |                                                                                                        |      | 108  |      |         |
| $E_{on}$      | Turn-On Switching Loss               |                                                                                                        |      | 0.59 |      | mJ      |
| $E_{off}$     | Turn-Off Switching Loss              |                                                                                                        |      | 0.67 |      |         |
| $E_{ts}$      | Total Switching Loss                 |                                                                                                        |      | 1.26 |      |         |
| $Q_G$         | Total Gate Charge                    | $V_{CC} = 520V, I_C = 20A, V_{GE} = 0/15V$                                                             |      | 71   |      | nC      |



➤ **Electrical Characteristics of Diode ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise noted)**

| Symbol | Parameter                           | Test Conditions                                                                 | Min. | Typ. | Max. | Unit |
|--------|-------------------------------------|---------------------------------------------------------------------------------|------|------|------|------|
| VF     | Diode forward voltage               | IF=20A, $T_{vj}=25^{\circ}\text{C}$                                             |      | 1.5  |      | V    |
|        |                                     | IF=20A, $T_{vj}=175^{\circ}\text{C}$                                            |      | 1.2  |      | V    |
| Trr    | Diode reverse recovery time         | VR=400V<br>IF=20A<br>diF/dt=500A/ $\mu\text{s}$<br>$T_{vj}=25^{\circ}\text{C}$  |      | 62   |      | ns   |
| Irrm   | Diode peak reverse recovery current |                                                                                 |      | 12   |      | A    |
| Qrr    | Diode reverse recovery charge       |                                                                                 |      | 472  |      | nC   |
| Trr    | Diode reverse recovery time         | VR=400V<br>IF=20A<br>diF/dt=500A/ $\mu\text{s}$<br>$T_{vj}=175^{\circ}\text{C}$ |      | 90   |      | ns   |
| Irrm   | Diode peak reverse recovery current |                                                                                 |      | 19   |      | A    |
| Qrr    | Diode reverse recovery charge       |                                                                                 |      | 1130 |      | nC   |

➤ Typical Performance Characteristics ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise noted)

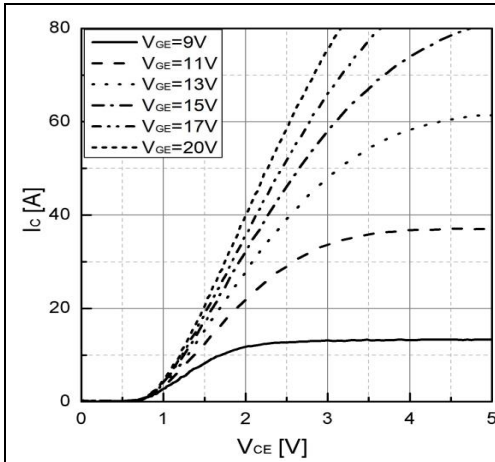


Fig 1. Typical output characteristic ( $T_{vj}=25^{\circ}\text{C}$ )

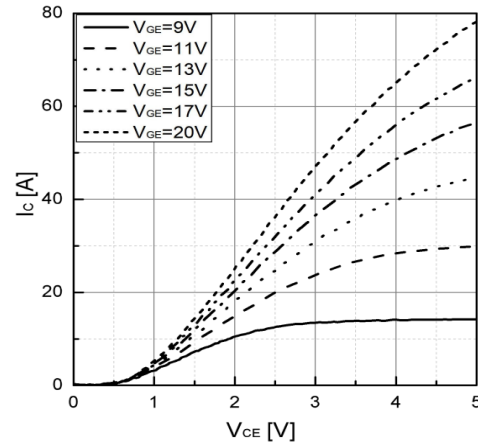


Fig 2. Typical output characteristic ( $T_{vj}=175^{\circ}\text{C}$ )

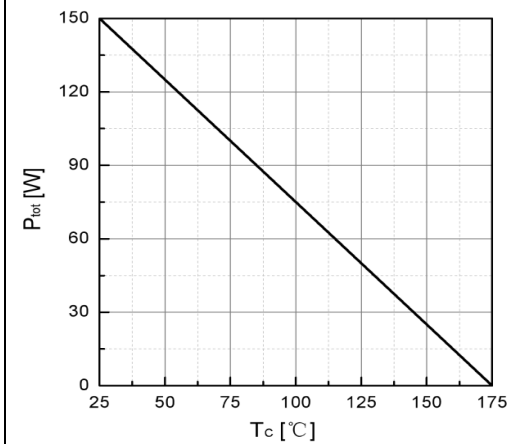


Fig 3. Power dissipation as a function of TC

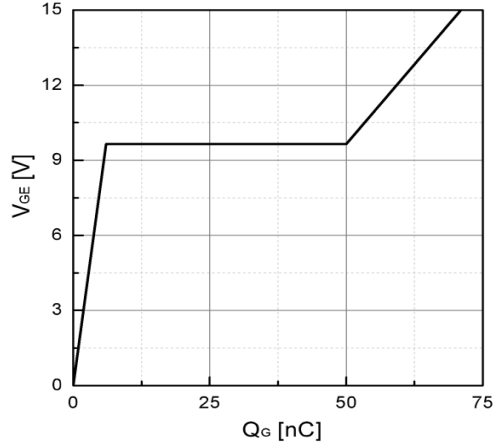


Fig 4. Typical Gate charge

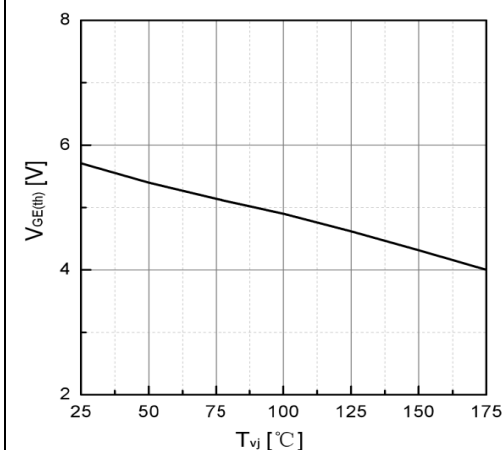


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_c=1\text{mA}$ )

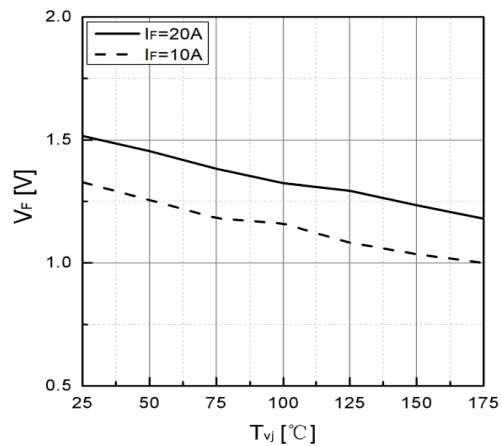


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

➤ **Typical Performance Characteristics ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise noted)**

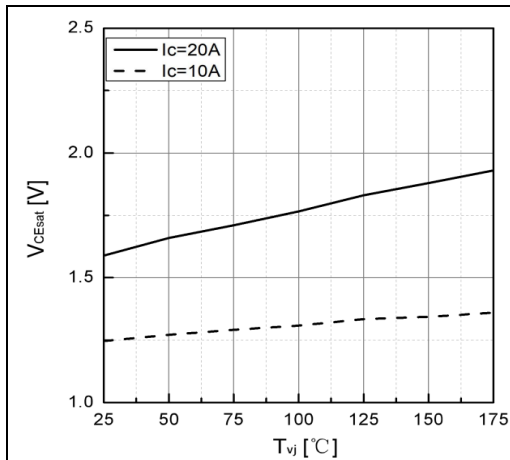


**Fig 7. Typical VCEsat as a function of  $T_{vj}$**

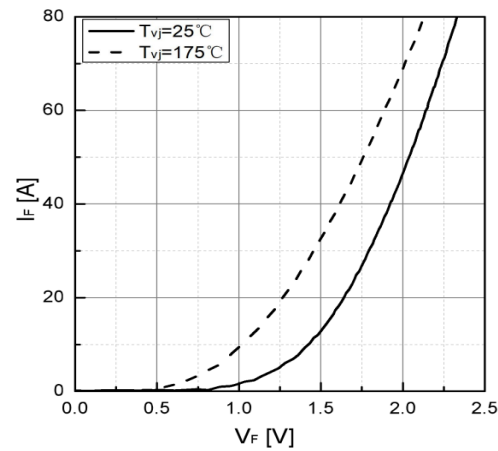


**Fig 8. Typical IF as a function of  $V_F$**

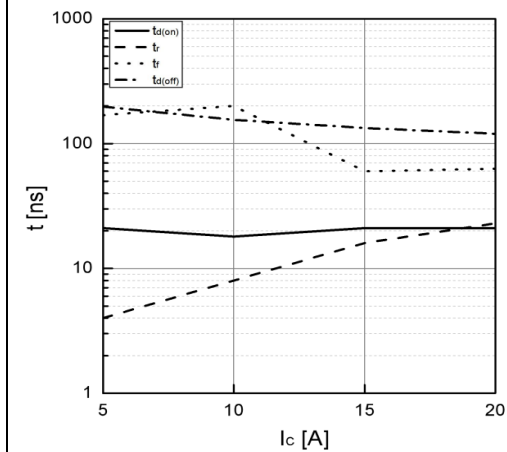


**Fig 9. Typical switching time as a function of  $I_C$**

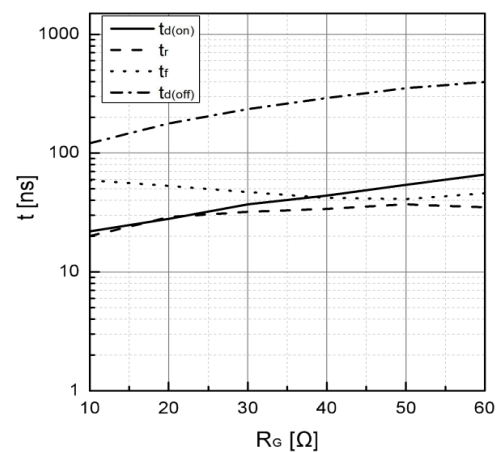


**Fig 10. Typical switching times as a function of  $R_G$**

➤ Typical Performance Characteristics ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise noted)

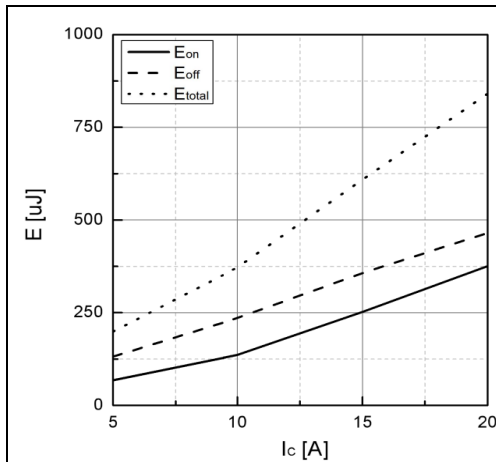


**Fig 11. Typical switching energy losses as a function of  $I_C$**

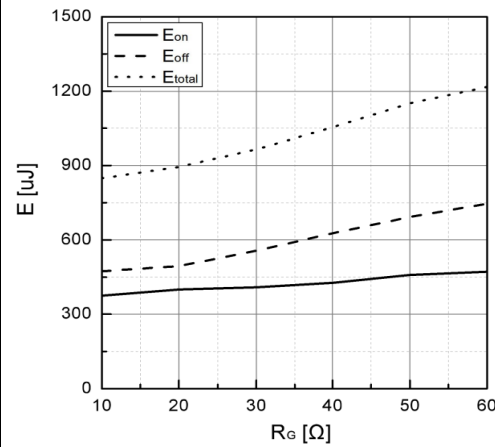


**Fig 12. Typical switching times as a function of  $R_G$**

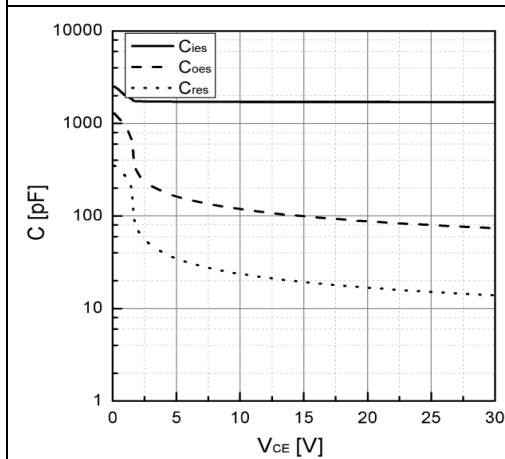
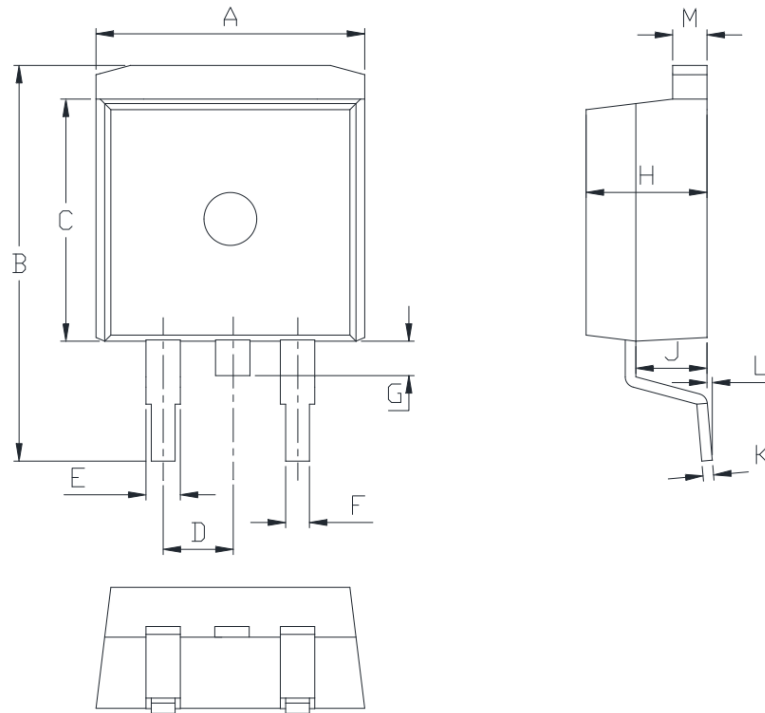


**Fig 13. Typical capacitance as a function of  $V_{CE}$  ( $f=1\text{Mhz}$ ,  $V_{GE}=0\text{V}$ )**

## Package Information

TO-263



| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    | 9.90        | -    | 10.20 | 0.390  | -     | 0.402 |
| B    | 14.70       | -    | 15.80 | 0.579  | -     | 0.622 |
| C    | 9.4         | -    | 9.6   | 0.37   | -     | 0.378 |
| D    | -           | 2.54 | -     | -      | 0.100 | -     |
| E    | 1.20        | -    | 1.40  | 0.047  | -     | 0.055 |
| F    | 0.75        | -    | 0.85  | 0.029  | -     | 0.033 |
| G    | -           | -    | 1.75  | -      | -     | 0.069 |
| H    | 4.40        | -    | 4.70  | 0.173  | -     | 0.185 |
| J    | 2.30        | -    | 2.70  | 0.091  | -     | 0.106 |
| K    | 0.38        | -    | 0.55  | 0.015  | -     | 0.022 |
| L    | 0           | 0.10 | 0.25  | 0      | 0.004 | 0.010 |
| M    | 1.25        | -    | 1.35  | 0.049  | -     | 0.053 |



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