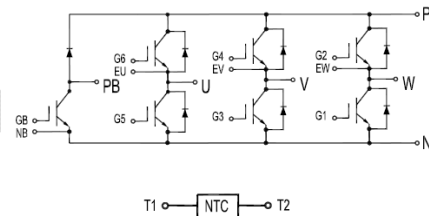


# GTS15FB120A1H

## IGBT Module

### Features:

- Trench & Field Stop IGBT
- Short Circuit Rated >10 $\mu$ s
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested (2 $\times$ I<sub>c</sub>)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement



### Applications:

- Industrial Inverters
- Servo Applications

### IGBT, Inverter

#### Maximum Rated Values of IGBT (T<sub>C</sub>=25°C unless otherwise specified)

|                  |                                    |  |      |    |
|------------------|------------------------------------|--|------|----|
| V <sub>CES</sub> | Collector-Emitter Blocking Voltage |  | 1200 | V  |
| V <sub>GES</sub> | Gate-Emitter Voltage               |  | ±20  | V  |
| I <sub>C</sub>   | Continuous Collector Current       | T <sub>C</sub> =80°C                             | 15   | A  |
|                  |                                    | T <sub>C</sub> =25°C                             | 30   | A  |
| I <sub>CM</sub>  | Repetitive Peak Collector Current  | T <sub>J</sub> =150°C                            | 30   | A  |
| t <sub>SC</sub>  | Short Circuit Withstand Time       |  | >10  | μs |
| P <sub>D</sub>   | Maximum Power Dissipation per IGBT | T <sub>C</sub> =25°C<br>T <sub>Jmax</sub> =150°C | 160  | W  |

## Electrical Characteristics of IGBT ( $T_C=25^\circ\text{C}$ unless otherwise specified)

### Static Characteristics

| Symbol        | Description                          | Conditions  | Min                     | Typ  | Max  | Unit |
|---------------|--------------------------------------|---|-------------------------|------|------|------|
| $V_{GE(th)}$  | Gate-Emitter Threshold Voltage       | $I_C=1\text{mA}, V_{CE}=V_{GE}$                                 | 5.0                     | 5.7  | 6.5  | V    |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C=15\text{A}, V_{GE}=15\text{V}$                             | $T_J=25^\circ\text{C}$  | 1.60 | 1.80 | V    |
|               |                                      |   | $T_J=125^\circ\text{C}$ | 1.90 |      | V    |
| $I_{CES}$     | Collector-Emitter Leakage Current    | $V_{GE}=0\text{V}, V_{CE}=V_{CES}, T_J=25^\circ\text{C}$        |                         |      | 1    | mA   |
| $I_{GES}$     | Gate-Emitter Leakage Current         | $V_{GE}=\pm 20\text{V}, V_{CE}=0\text{V}, T_J=25^\circ\text{C}$ |                         |      | 200  | nA   |
| $C_{ies}$     | Input Capacitance                    | $V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$            |                         | 1.67 |      | nF   |
| $C_{oes}$     | Output Capacitance                   |   | 0.26                    |      | nF   |      |
| $C_{res}$     | Reverse Transfer Capacitance         |   | 0.05                    |      | nF   |      |

### Switching Characteristics

|                 |  |   |                         |           |  |                           |
|-----------------|--|---|-------------------------|-----------|--|---------------------------|
| $t_{d(on)}$     | Turn-on Delay Time   | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Gon}=20\Omega, V_{GE}=\pm 15\text{V},$<br>Inductive Load  | $T_J=25^\circ\text{C}$  | 105       |  | ns                        |
|                 |  |   | $T_J=125^\circ\text{C}$ | 96        |  |                           |
| $t_r$           | Rise Time  | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Goff}=20\Omega, V_{GE}=\pm 15\text{V},$<br>Inductive Load   | $T_J=25^\circ\text{C}$  | 26        |  | ns                        |
|                 |  |   | $T_J=125^\circ\text{C}$ | 24        |  |                           |
| $t_{d(off)}$    | Turn-off Delay Time  | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Goff}=20\Omega, V_{GE}=\pm 15\text{V},$<br>Inductive Load   | $T_J=25^\circ\text{C}$  | 192       |  | ns                        |
|                 |  |   | $T_J=125^\circ\text{C}$ | 201       |  |                           |
| $t_f$           | Fall Time  | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Goff}=20\Omega, V_{GE}=\pm 15\text{V},$<br>Inductive Load   | $T_J=25^\circ\text{C}$  | 234       |  | ns                        |
|                 |  |   | $T_J=125^\circ\text{C}$ | 260       |  |                           |
| $E_{on}$        | Turn-on Switching Loss   | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Gon}=20\Omega, V_{GE}=\pm 15\text{V},$<br>$di/dt=498\text{A}/\mu\text{s} (T_J=125^\circ\text{C})$<br>Inductive Load   | $T_J=25^\circ\text{C}$  | 1.17      |  | mJ                        |
|                 |  |   | $T_J=125^\circ\text{C}$ | 1.31      |  |                           |
| $E_{off}$       | Turn-off Switching Loss  | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Goff}=20\Omega, V_{GE}=\pm 15\text{V},$<br>$du/dt=2314\text{V}/\mu\text{s} (T_J=125^\circ\text{C})$<br>Inductive Load | $T_J=25^\circ\text{C}$  | 0.29      |  | mJ                        |
|                 |  |   | $T_J=125^\circ\text{C}$ | 0.32      |  |                           |
| $Q_g$           | Total Gate Charge  | $V_{GE}=+15\text{V}\dots-15\text{V}$  |                         | 454       |  | nC                        |
| RBSOA           | $I_C=30\text{A}, V_{CC}=1050\text{V}, V_p=1200\text{V}, R_{Goff}=20\Omega, V_{GE}=+15\text{V to }0\text{V}, T_J=150^\circ\text{C}$ |   |                         | Trapezoid |  |                           |
| SCSOA           | $V_{CC}=600\text{V}, V_{GE}=15\text{V}, T_J=150^\circ\text{C}$   |   |                         | 10        |  | us                        |
| $R_{\theta JC}$ | IGBT Thermal Resistance: Junction-To-Case(per leg)   |   |                         | 0.68      |  | $^\circ\text{C}/\text{W}$ |

**Diode, Inverter**  
**Maximum Rated Values** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

|           |                                  |      |   |
|-----------|----------------------------------|------|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage  | 1200 | V |
| $I_F$     | Diode Continuous Forward Current | 15   | A |
| $I_{FM}$  | Diode Maximum Forward Current    | 30   | A |

**Electrical Characteristics of FWD** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

| Symbol          | Description  | Conditions  | Min                     | Typ  | Max  | Unit               |
|-----------------|--|---|-------------------------|------|------|--------------------|
| $V_{FM}$        | Forward Voltage                                      | $I_F=15\text{A}$  | $T_J=25^\circ\text{C}$  | 1.60 |      | V                  |
|                 |  |   | $T_J=125^\circ\text{C}$ |      | 1.70 |                    |
| $t_{rr}$        | Reverse Recovery Time                                |   | $T_J=25^\circ\text{C}$  | 241  |      | ns                 |
|                 |  |   | $T_J=125^\circ\text{C}$ |      | 261  |                    |
| $I_{rr}$        | Peak Reverse Recovery Current                        | $I_F=15\text{A}$ ,<br>-diF/dt=488A/ $\mu\text{s}$ ( $T_J=125^\circ\text{C}$ )<br>$V_{rr} = 600\text{V}$ ,<br>$V_{GE} = -15\text{V}$ | $T_J=25^\circ\text{C}$  | 21.9 |      | A                  |
|                 |  |   | $T_J=125^\circ\text{C}$ |      | 24.7 |                    |
| $Q_{rr}$        | Reverse Recovery Charge                              |   | $T_J=25^\circ\text{C}$  | 1.82 |      | $\mu\text{C}$      |
|                 |  |   | $T_J=125^\circ\text{C}$ |      | 2.37 |                    |
| $E_{rec}$       | Reverse Recovery Energy                              |   | $T_J=25^\circ\text{C}$  | 0.74 |      | mJ                 |
|                 |  |   | $T_J=125^\circ\text{C}$ |      | 1.28 |                    |
| $R_{\theta JC}$ | Diode Thermal Resistance: Junction-To-Case (per leg) |   |                         | 1.13 |      | $^\circ\text{C/W}$ |

**IGBT, Brake-Chopper**  
**Maximum Rated Values** ( $T_C=25^\circ\text{C}$  Unless otherwise specified)

|           |                                    |  |          |               |
|-----------|------------------------------------|--|----------|---------------|
| $V_{CES}$ | Collector-Emitter Blocking Voltage |  | 1200     | V             |
| $V_{GES}$ | Gate-Emitter Voltage               |  | $\pm 20$ | V             |
| $I_C$     | Continuous Collector Current       | $T_C=80^\circ\text{C}$                                 | 15       | A             |
|           |                                    | $T_C=25^\circ\text{C}$                                 | 30       | A             |
| $I_{CM}$  | Repetitive Peak Collector Current  | $T_J=150^\circ\text{C}$                                | 30       | A             |
| $t_{SC}$  | Short Circuit Withstand Time       |  | >10      | $\mu\text{s}$ |
| $P_D$     | Maximum Power Dissipation per IGBT | $T_C=25^\circ\text{C}$<br>$T_{Jmax}=150^\circ\text{C}$ | 160      | W             |

## Electrical Characteristics of IGBT ( $T_C=25^\circ\text{C}$ unless otherwise specified)

### Static Characteristics

| Symbol        | Description                          | Conditions  | Min                     | Typ  | Max  | Unit |
|---------------|--------------------------------------|---|-------------------------|------|------|------|
| $V_{GE(th)}$  | Gate-Emitter Threshold Voltage       | $I_C=1\text{mA}, V_{CE}=V_{GE}$                                 | 5.0                     | 5.7  | 6.5  | V    |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C=15\text{A}, V_{GE}=15\text{V}$                             | $T_J=25^\circ\text{C}$  | 1.60 | 1.80 | V    |
|               |                                      |   | $T_J=125^\circ\text{C}$ | 1.90 |      | V    |
| $I_{CES}$     | Collector-Emitter Leakage Current    | $V_{GE}=0\text{V}, V_{CE}=V_{CES}, T_J=25^\circ\text{C}$        |                         |      | 1    | mA   |
| $I_{GES}$     | Gate-Emitter Leakage Current         | $V_{GE}=\pm 20\text{V}, V_{CE}=0\text{V}, T_J=25^\circ\text{C}$ |                         |      | 200  | nA   |
| $C_{ies}$     | Input Capacitance                    | $V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$            |                         | 1.67 |      | nF   |
| $C_{oes}$     | Output Capacitance                   |   | 0.26                    |      | nF   |      |
| $C_{res}$     | Reverse Transfer Capacitance         |   | 0.05                    |      | nF   |      |

### Switching Characteristics

|                 |  |   |   |                         |      |                           |    |
|-----------------|--|---|---|-------------------------|------|---------------------------|----|
| $t_{d(on)}$     | Turn-on Delay Time   | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Gon}=20\Omega, V_{GE}=\pm 15\text{V},$<br>Inductive Load  | $T_J=25^\circ\text{C}$  | 105                     |      | ns                        |    |
|                 |  |   | $T_J=125^\circ\text{C}$   | 96                      |      |                           |    |
| $t_r$           | Rise Time  |   | $T_J=25^\circ\text{C}$  | 26                      |      | ns                        |    |
|                 |  |   | $T_J=125^\circ\text{C}$   | 24                      |      |                           |    |
| $t_{d(off)}$    | Turn-off Delay Time  | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Goff}=20\Omega, V_{GE}=\pm 15\text{V},$<br>Inductive Load   | $T_J=25^\circ\text{C}$  | 192                     |      | ns                        |    |
|                 |  |   | $T_J=125^\circ\text{C}$   | 201                     |      |                           |    |
| $t_f$           | Fall Time  |   | $T_J=25^\circ\text{C}$  | 234                     |      | ns                        |    |
|                 |  |   | $T_J=125^\circ\text{C}$   | 260                     |      |                           |    |
| $E_{on}$        | Turn-on Switching Loss   | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Gon}=20\Omega, V_{GE}=\pm 15\text{V},$<br>$di/dt=498\text{A}/\mu\text{s} (T_J=125^\circ\text{C})$<br>Inductive Load | $T_J=25^\circ\text{C}$  | 1.17                    |      | mJ                        |    |
|                 |  |   | $T_J=125^\circ\text{C}$   | 1.31                    |      |                           |    |
| $E_{off}$       | Turn-off Switching Loss  |   | $V_{CC}=600\text{V}, I_C=15\text{A}, R_{Goff}=20\Omega, V_{GE}=\pm 15\text{V},$<br>$du/dt=2314\text{V}/\mu\text{s} (T_J=125^\circ\text{C})$<br>Inductive Load | $T_J=25^\circ\text{C}$  | 0.29 |                           | mJ |
|                 |  |   |   | $T_J=125^\circ\text{C}$ | 0.32 |                           |    |
| $Q_g$           | Total Gate Charge  | $V_{GE}=\pm 15\text{V} \dots -15\text{V}$   |   |                         | 454  |                           | nC |
| RBSOA           | $I_C=30\text{A}, V_{CC}=1050\text{V}, V_p=1200\text{V}, R_{Goff}=20\Omega, V_{GE}=\pm 15\text{V to } 0\text{V}, T_J=150^\circ\text{C}$ |   |   | Trapezoid               |      |                           |    |
| SCSOA           | $V_{CC}=600\text{V}, V_{GE}=15\text{V}, T_J=150^\circ\text{C}$   |   |   | 10                      |      | us                        |    |
| $R_{\theta JC}$ | IGBT Thermal Resistance: Junction-To-Case(per leg)   |   |   | 0.68                    |      | $^\circ\text{C}/\text{W}$ |    |

### Diode, Brake-Chopper Maximum Rated Values ( $T_C=25^\circ\text{C}$ Unless otherwise specified)

|           |                                  |      |   |
|-----------|----------------------------------|------|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage  | 1200 | V |
| $I_F$     | Diode Continuous Forward Current | 10   | A |
| $I_{FM}$  | Repetitive Peak Forward Current  | 20   | A |

### Electrical Characteristics of FWD ( $T_C=25^\circ\text{C}$ Unless otherwise specified)

| Symbol          | Description                                | Conditions  |                           | Min | Typ   | Max | Unit                      |  |
|-----------------|--|---|---------------------------|-----|-------|-----|---------------------------|--|
| $V_{FM}$        | Forward Voltage                            | $I_F = 10\text{ A}$   | $T_J = 25^\circ\text{C}$  |     | 1.80  |     | V                         |  |
|                 |  |   | $T_J = 125^\circ\text{C}$ |     | 1.90  |     |                           |  |
| $t_{rr}$        | Reverse Recovery Time                      | $I_F = 10\text{ A},$<br>$-di_F/dt = 252\text{ A}/\mu\text{s},$<br>$V_{rr} = 600\text{ V},$<br>$V_{GE} = -15\text{ V}$ | $T_J = 25^\circ\text{C}$  |     | 381   |     | ns                        |  |
|                 |  |   | $T_J = 125^\circ\text{C}$ |     | 490   |     |                           |  |
| $I_{rr}$        | Peak Reverse Recovery Current              |   | $T_J = 25^\circ\text{C}$  |     | 9.02  |     | A                         |  |
|                 |  |   | $T_J = 125^\circ\text{C}$ |     | 11.52 |     |                           |  |
| $Q_{rr}$        | Reverse Recovery Charge                    |   | $T_J = 25^\circ\text{C}$  |     | 1.34  |     | $\mu\text{C}$             |  |
|                 |  |   | $T_J = 125^\circ\text{C}$ |     | 2.12  |     |                           |  |
| $E_{rec}$       | Reverse Recovery Energy                    |   | $T_J = 25^\circ\text{C}$  |     | 0.47  |     | mJ                        |  |
|                 |  |   | $T_J = 125^\circ\text{C}$ |     | 0.85  |     |                           |  |
| $R_{\theta JC}$ | Diode Thermal Resistance: Junction-To-Case |   |                           |     | 1.13  |     | $^\circ\text{C}/\text{W}$ |  |

### Internal NTC-Thermistor Characteristics

|              |  |      |         |            |
|--------------|--|------|---------|------------|
| $R_{25}$     | $T_C = 25^\circ\text{C}$                                   | 5    |         | k $\Omega$ |
| $\Delta R/R$ | $T_C = 100^\circ\text{C}, R_{100} = 481\Omega$             |      | $\pm 5$ | %          |
| $P_{25}$     | $T_C = 25^\circ\text{C}$                                   | 50   |         | mW         |
| $B_{25/50}$  | $R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15\text{K}))]$ | 3380 |         | K          |
| $B_{25/80}$  | $R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15\text{K}))]$ | 3440 |         | K          |

## Module

| Symbol           | Description   | Min  | Typ | Max  | Unit |
|------------------|---|------|-----|------|------|
| V <sub>iso</sub> | Isolation Voltage (All Terminals Shorted) f = 50Hz, 1minute | 2500 |     |      | V    |
| T <sub>J</sub>   | Maximum Junction Temperature                                |      |     | 150  | °C   |
| T <sub>JOP</sub> | Maximum Operating Junction Temperature Range                | -40  |     | +150 | °C   |
| T <sub>stg</sub> | Storage Temperature   | -40  |     | +125 | °C   |
| CTI              | Comparative Tracking Index                                  | 200  |     |      |      |
| R <sub>θCS</sub> | Case-To-Sink Thermally (Conductive Grease Applied)          |      | 0.1 |      | °C/W |
| M                | Mounting Screw:M3   | 1.5  |     | 2.0  | N·m  |
| G                | Weight  |      | 30  |      | g    |

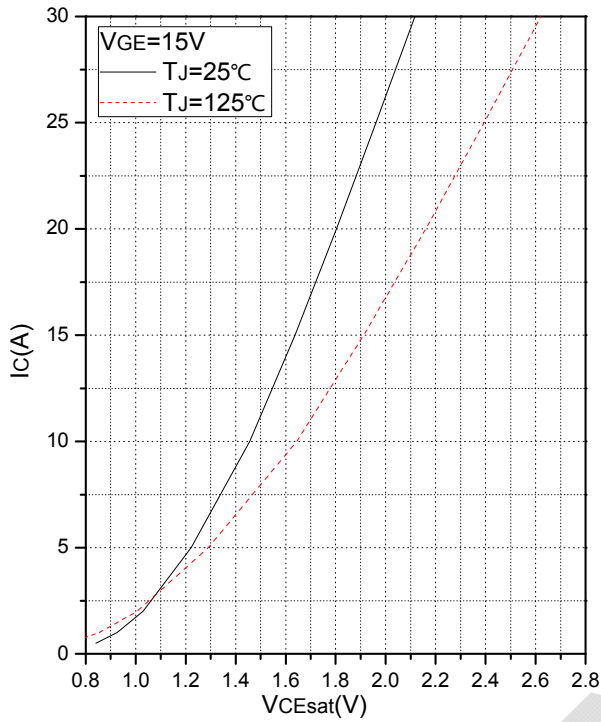


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

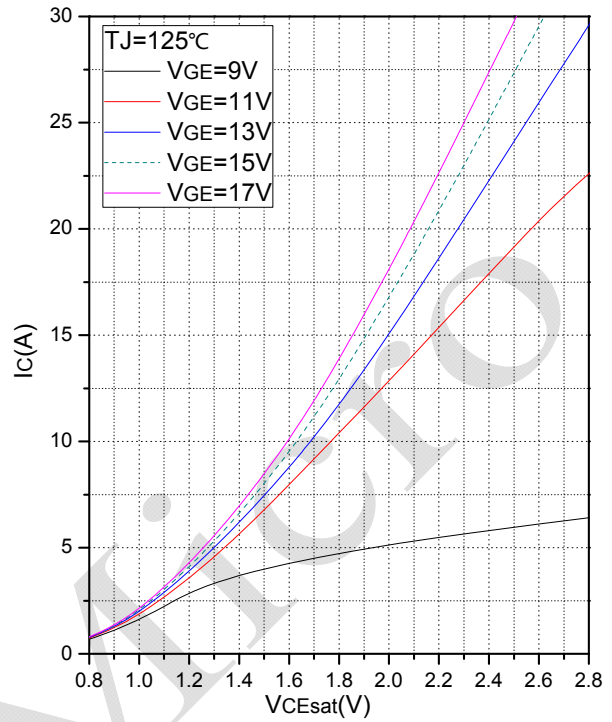


Fig.2 Typical Output Characteristics (Inverter)

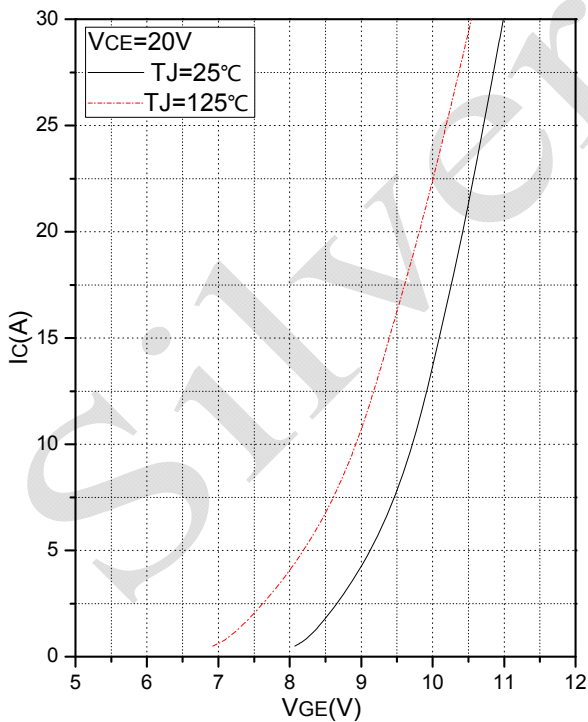


Fig.3 Transfer Characteristic (Inverter)

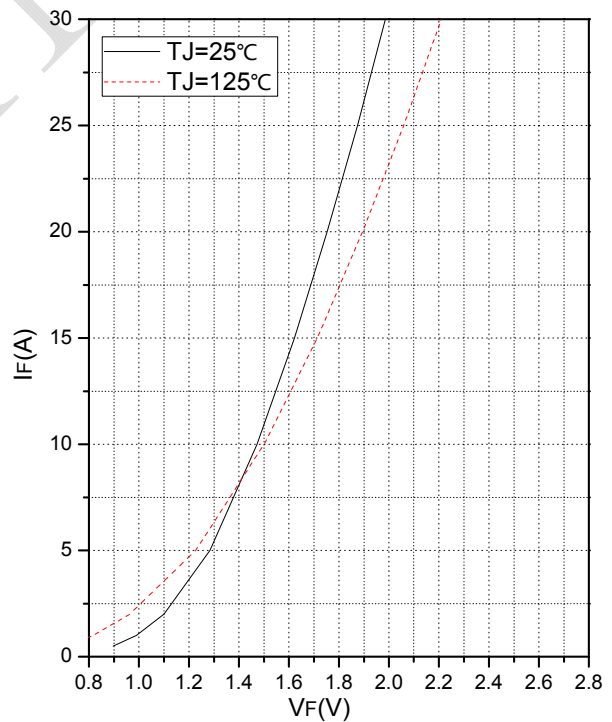


Fig.4 Forward Characteristics of FWD (Inverter)

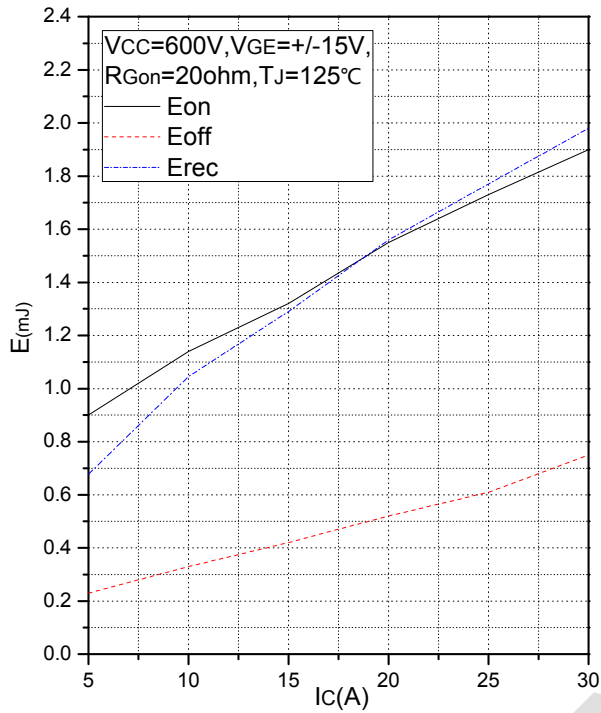


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

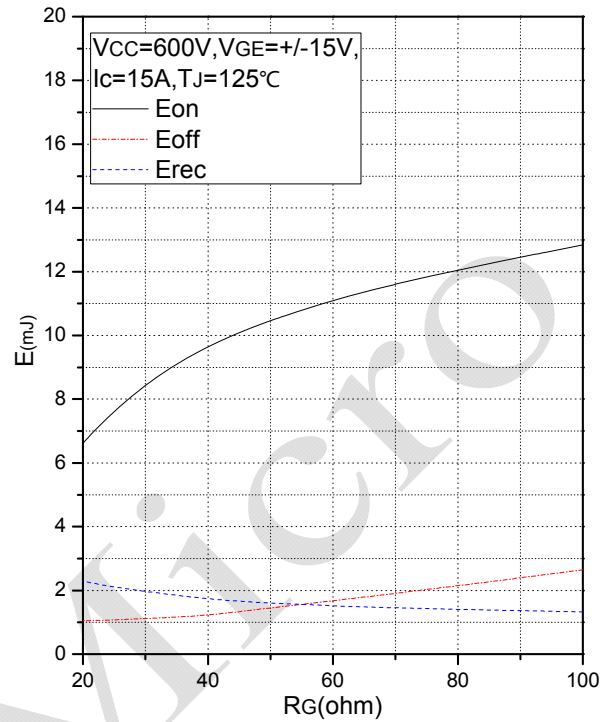


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

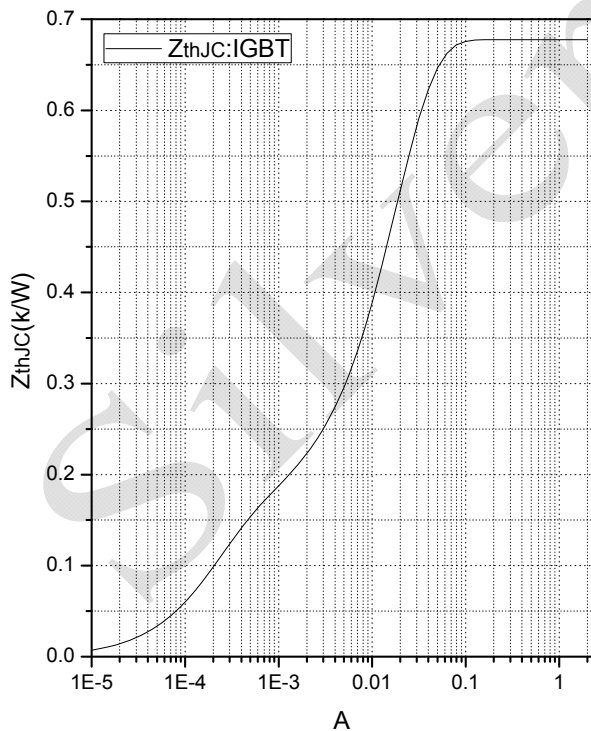


Fig.7 Transient Thermal Impedance (Inverter-IGBT)

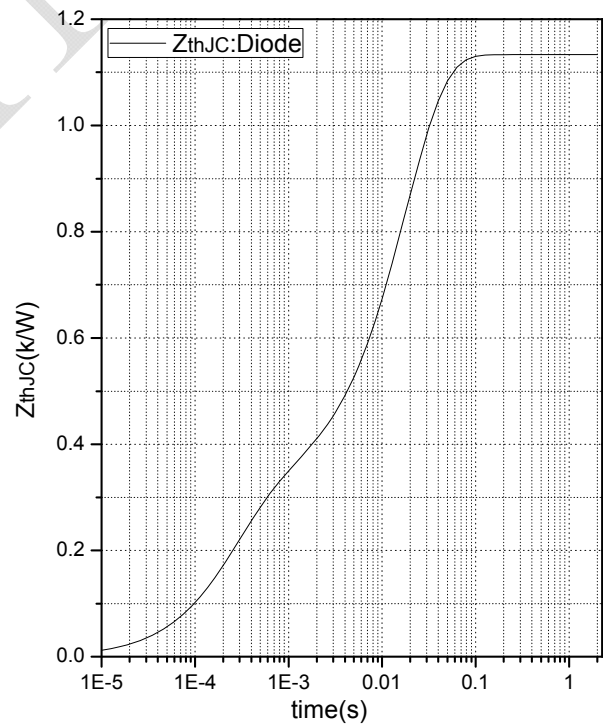


Fig.8 Transient Thermal Impedance (Inverter-Diode)



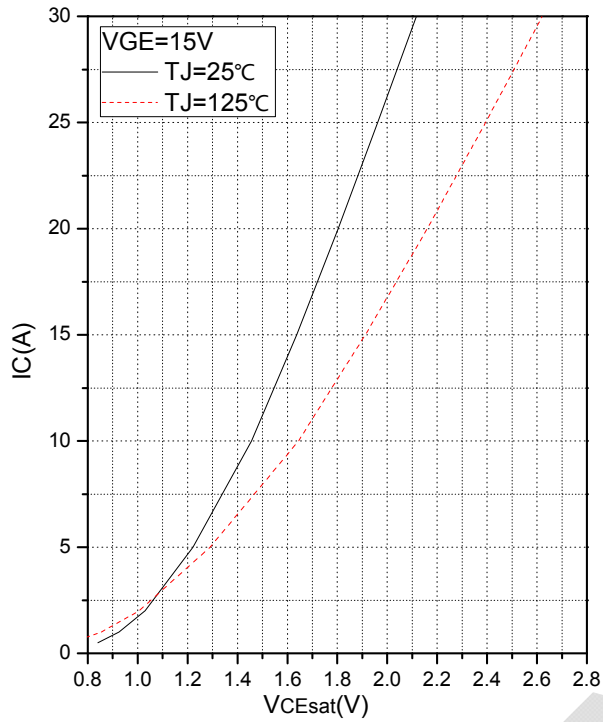


Fig.9 Typical Saturation Voltage Characteristics (Brake-Chopper)

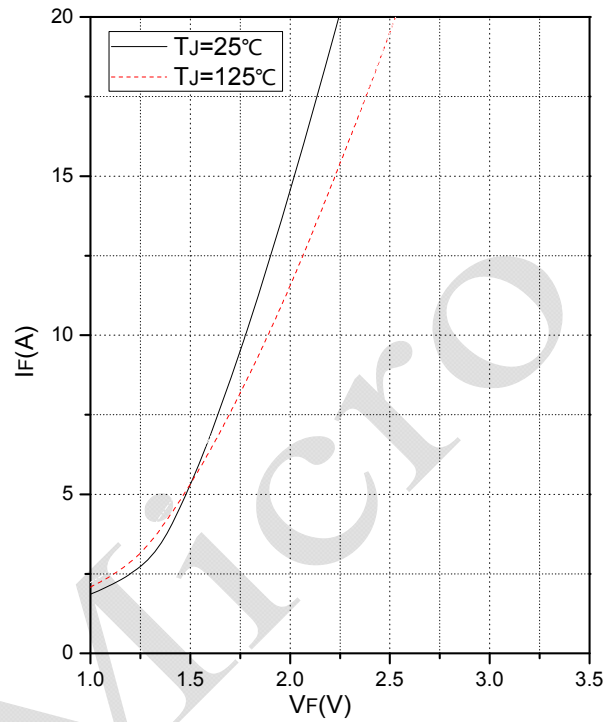


Fig.10 Forward Characteristics of Diode (Brake-Chopper)

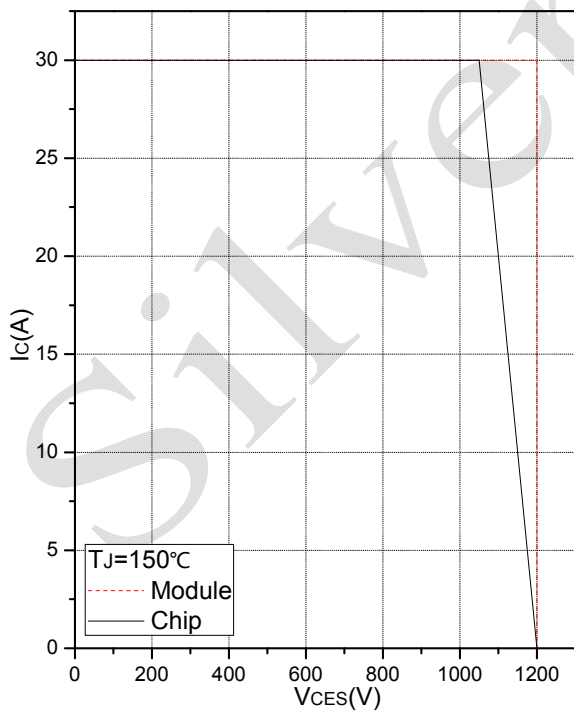


Fig.11 Reverse Bias Safe Operation Area (RBSOA)

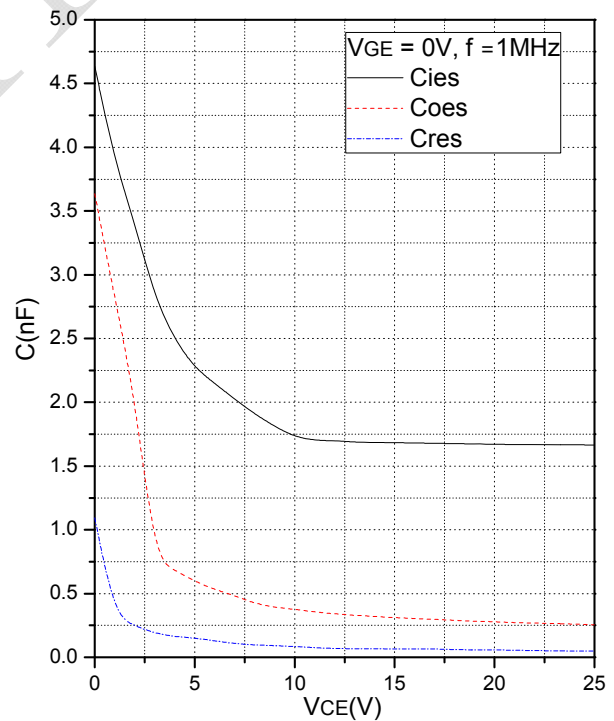


Fig.12 Capacitance Characteristics (Inverter)

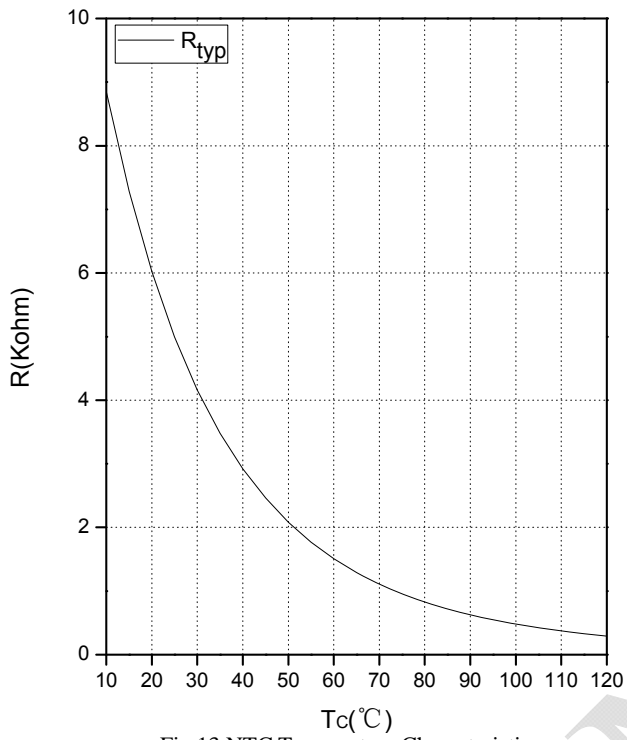


Fig.13 NTC Temperature Characteristics

SilverMicro





| Date       | Revision | Notes         |
|------------|----------|---------------|
| 07/08/2019 | A        | Final Version |
|            |          |               |

## Announcement

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