

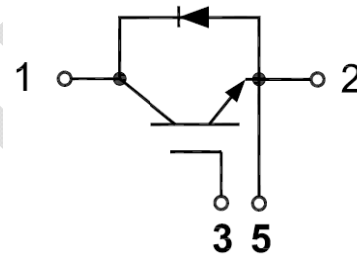
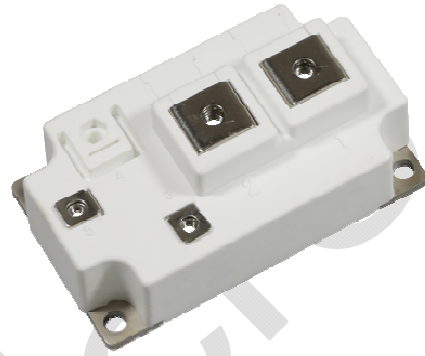
# GT600SD120T2ZH-M

## IGBT Module

Preliminary Data

### Features:

- Field Stop Trench Gate 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:

- Induction Heating
- UPS Systems
- High Power converters

### 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> =100°C                            | 600  | A  |
|                  |                                    | T <sub>C</sub> =25°C                             | 1160 | A  |
| I <sub>CM</sub>  | Peak Collector Current Repetitive  | T <sub>J</sub> =175°C                            | 1200 | A  |
| t <sub>sc</sub>  | Short Circuit Withstand Time       |  | >10  | μs |
| P <sub>D</sub>   | Maximum Power Dissipation (IGBT)   | T <sub>C</sub> =25°C<br>T <sub>Jmax</sub> =175°C | 3950 | 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       | $I_C=10\text{mA}$ , $V_{CE}=V_{GE}$                                      | 5.00                    | 5.5   | 6.80 | V    |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C=600\text{A}$ ,<br>$V_{GE}=15\text{V}$                               | $T_J=25^\circ\text{C}$  | 1.70  | 1.95 | V    |
|               |                                      |  | $T_J=125^\circ\text{C}$ | 1.90  |      | V    |
|               |                                      |  | $T_J=150^\circ\text{C}$ | 2.00  |      |      |
| $I_{CES}$     | Collector-Emitter Leakage Current    | $V_{GE}=0\text{V}$ ,<br>$V_{CE}=V_{CES}$ , $T_J=25^\circ\text{C}$        |                         |       | 1    | mA   |
| $I_{GES}$     | Gate-Emitter Leakage Current         | $V_{GE}=\pm 20\text{V}$ ,<br>$V_{CE}=0\text{V}$ , $T_J=25^\circ\text{C}$ |                         |       | 800  | nA   |
| $C_{ies}$     | Input Capacitance                    |  |                         | 49.26 |      | nF   |
| $C_{oes}$     | Output Capacitance                   | $V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$ ,<br>$f=1\text{MHz}$            |                         | 3.67  |      | nF   |
| $C_{res}$     | Reveres Transfer Capacitance         |  |                         | 1.85  |      | nF   |

### Switching Characteristics

|              |                        |   |                         |      |  |               |
|--------------|------------------------|---|-------------------------|------|--|---------------|
| $t_{d(on)}$  | Turn-on Delay Time     | $V_{CC}=600\text{V}$ , $I_C=600\text{A}$ ,<br>$R_{Gon}=1\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load   | $T_J=25^\circ\text{C}$  | 0.55 |  | $\mu\text{s}$ |
|              |                        |   | $T_J=125^\circ\text{C}$ | 0.56 |  |               |
|              |                        |   | $T_J=150^\circ\text{C}$ | 0.56 |  |               |
| $t_r$        | Rise Time              | $V_{CC}=600\text{V}$ , $I_C=600\text{A}$ ,<br>$R_{Goff}=1\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load  | $T_J=25^\circ\text{C}$  | 0.22 |  | $\mu\text{s}$ |
|              |                        |   | $T_J=125^\circ\text{C}$ | 0.22 |  |               |
|              |                        |   | $T_J=150^\circ\text{C}$ | 0.23 |  |               |
| $t_{d(off)}$ | Turn-off Delay Time    | $V_{CC}=600\text{V}$ , $I_C=600\text{A}$ ,<br>$R_{Goff}=1\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load  | $T_J=25^\circ\text{C}$  | 0.54 |  | $\mu\text{s}$ |
|              |                        |   | $T_J=125^\circ\text{C}$ | 0.57 |  |               |
|              |                        |   | $T_J=150^\circ\text{C}$ | 0.57 |  |               |
| $t_f$        | Fall Time              | $V_{CC}=600\text{V}$ , $I_C=600\text{A}$ ,<br>$R_{Goff}=1\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load  | $T_J=25^\circ\text{C}$  | 0.14 |  | $\mu\text{s}$ |
|              |                        |   | $T_J=125^\circ\text{C}$ | 0.18 |  |               |
|              |                        |   | $T_J=150^\circ\text{C}$ | 0.19 |  |               |
| $E_{on}$     | Turn-on Switching Loss | $V_{CC}=600\text{V}$ , $I_C=600\text{A}$ ,<br>$R_{Gon}=1\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>$di/dt=2120\text{A}/\mu\text{s}$ ( $T_J=150^\circ\text{C}$ )<br>Inductive Load | $T_J=25^\circ\text{C}$  | 49.0 |  | mJ            |
|              |                        |   | $T_J=125^\circ\text{C}$ | 75.8 |  |               |
|              |                        |   | $T_J=150^\circ\text{C}$ | 81.2 |  |               |

|                         |  |   |                       |           |      |
|-------------------------|--|---|-----------------------|-----------|------|
| E <sub>off</sub>        | Turn-off Switching Loss  | V <sub>CC</sub> =600V, I <sub>C</sub> =600A,<br>R <sub>Goff</sub> =1Ω, V <sub>GE</sub> = ±15V,<br>du/dt=2600V/μs ( T <sub>J</sub> =150°C)<br>Inductive Load | T <sub>J</sub> =25°C  | 81.5      | mJ   |
|                         |  |   | T <sub>J</sub> =125°C | 96.1      |      |
|                         |  |   | T <sub>J</sub> =150°C | 100.1     |      |
| Q <sub>g</sub>          | Total Gate Charge  | V <sub>GE</sub> =+15V...-15V  | T <sub>J</sub> =25°C  | 3.36      | μC   |
| R <sub>g internal</sub> | Internal gate resistance   |   | T <sub>J</sub> =25°C  | 2.49      | Ω    |
| RBSOA                   | I <sub>C</sub> =1200A, V <sub>CC</sub> =1050V, V <sub>p</sub> =1200V, R <sub>Goff</sub> = 1Ω, V <sub>GE</sub> =+15V to 0V, T <sub>J</sub> =150°C |   |                       | Trapezoid |      |
| SCSOA                   | V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V, T <sub>J</sub> = 150°C  |   |                       | 10        | μs   |
| R <sub>θJC</sub>        | IGBT Thermal Resistance: Junction-To-Case(per leg)   |   |                       | 0.038     | °C/W |

### Diode, Inverter

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

|                  |                                  |      |   |
|------------------|----------------------------------|------|---|
| V <sub>RRM</sub> | Repetitive Peak Reverse Voltage  | 1200 | V |
| I <sub>F</sub>   | Diode Continuous Forward Current | 600  | A |
| I <sub>FM</sub>  | Peak FWD Current Repetitive      | 1200 | A |

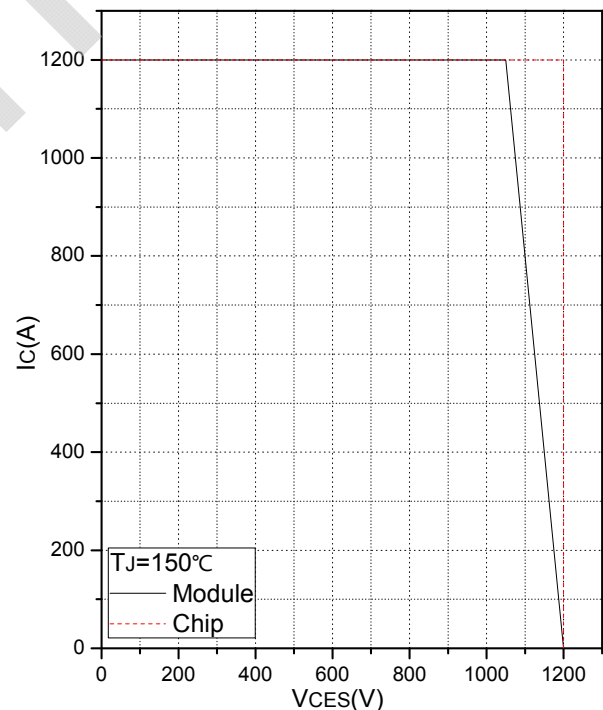
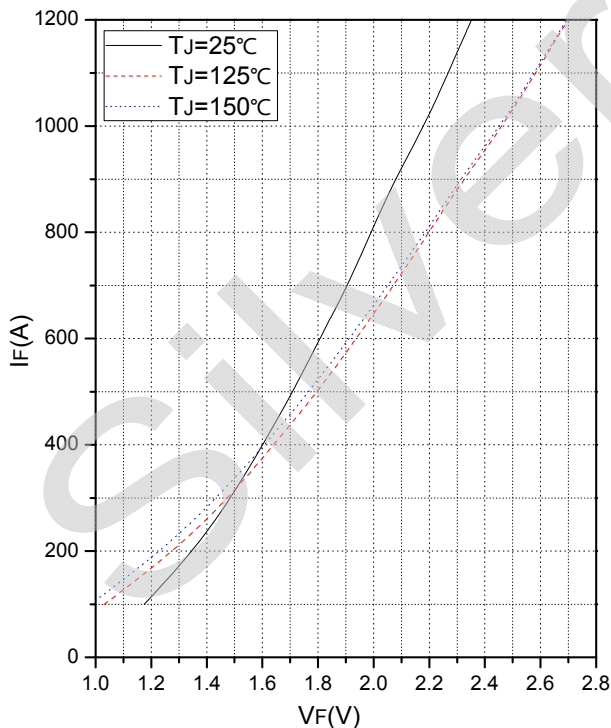
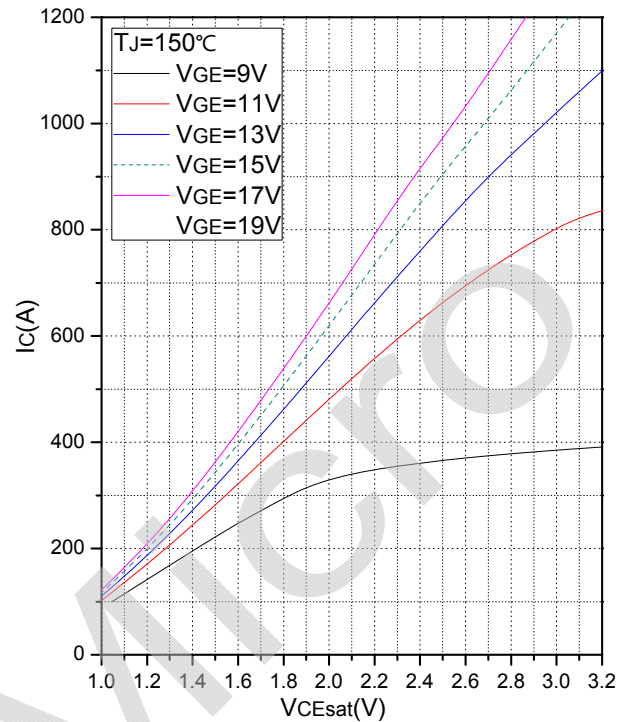
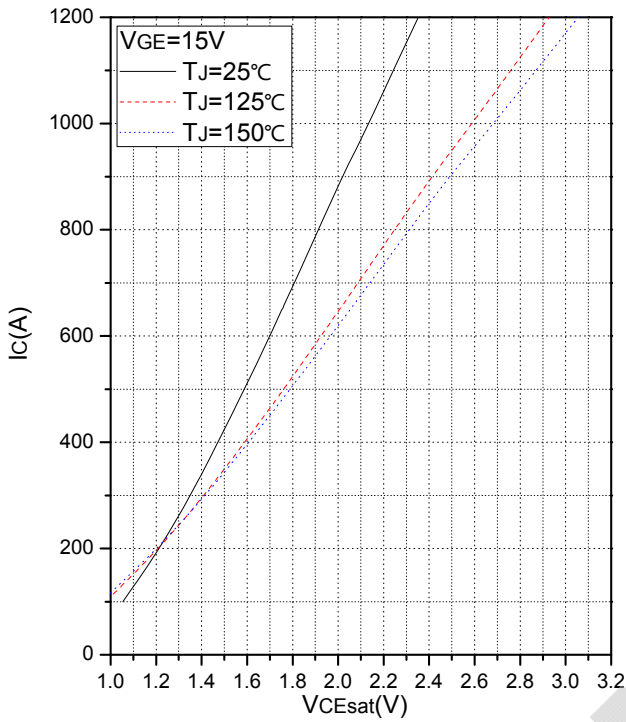
#### Electrical Characteristics of Diode (T<sub>C</sub>=25°C unless otherwise specified)

| Symbol          | Description                   | Conditions  | Min                   | Typ  | Max  | Unit |
|-----------------|-------------------------------|---|-----------------------|------|------|------|
| V <sub>FM</sub> | Forward Voltage               | I <sub>F</sub> =600A  | T <sub>J</sub> =25°C  | 1.80 | 2.00 | V    |
|                 |                               |   | T <sub>J</sub> =125°C | 1.90 |      |      |
|                 |                               |   | T <sub>J</sub> =150°C | 1.90 |      |      |
| t <sub>rr</sub> | Reverse Recovery Time         | I <sub>F</sub> =600A,<br>-diF/dt=2270A/μs(T <sub>J</sub> =150°C),<br>V <sub>R</sub> =600V,<br>V <sub>GE</sub> =-15V | T <sub>J</sub> =25°C  | 0.37 |      | μs   |
|                 |                               |   | T <sub>J</sub> =125°C | 0.58 |      |      |
|                 |                               |   | T <sub>J</sub> =150°C | 0.65 |      |      |
| I <sub>rr</sub> | Peak Reverse Recovery Current | I <sub>F</sub> =600A,<br>-diF/dt=2270A/μs(T <sub>J</sub> =150°C),<br>V <sub>R</sub> =600V,<br>V <sub>GE</sub> =-15V | T <sub>J</sub> =25°C  | 238  |      | A    |
|                 |                               |   | T <sub>J</sub> =125°C | 294  |      |      |
|                 |                               |   | T <sub>J</sub> =150°C | 306  |      |      |

|                  |  |   |                       |       |    |
|------------------|--|---|-----------------------|-------|----|
| Q <sub>rr</sub>  | Reverse Recovery Charge                              | I <sub>F</sub> =600A,<br>-diF/dt=2270A/μs(T <sub>J</sub> =150°C),<br>V <sub>R</sub> =600V,<br>V <sub>GE</sub> =-15V | T <sub>J</sub> =25°C  | 52.3  | μC |
|                  |  |   | T <sub>J</sub> =125°C | 96.1  |    |
|                  |  |   | T <sub>J</sub> =150°C | 110.6 |    |
| E <sub>rec</sub> | Reverse Recovery Energy                              |   | T <sub>J</sub> =25°C  | 22.0  | mJ |
|                  |  |   | T <sub>J</sub> =125°C | 38.3  |    |
|                  |  |   | T <sub>J</sub> =150°C | 44.6  |    |
| R <sub>θJC</sub> | Diode Thermal Resistance: Junction-To-Case (per leg) |   | 0.064                 | °C/W  |    |

## Module

| Symbol           | Description  | Min                    | Typ  | Max  | Unit |
|------------------|--|------------------------|------|------|------|
| V <sub>iso</sub> | Isolation Voltage (All Terminals Shorted)          | RMS, f = 50Hz, 1minute | 2.5  |      | kV   |
| L <sub>sCE</sub> | Stray Inductance Module                            |                        | 16   |      | nH   |
| T <sub>J</sub>   | Maximum Junction Temperature                       |                        |      | 175  | °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>ecs</sub> | Case-To-Sink Thermally (Conductive Grease Applied) |                        | 0.03 |      | °C/W |
| T                | Signal Terminals Screw:M4                          | 1.0                    |      | 2.0  | N·m  |
|                  | Power Terminals Screw:M6                           | 3.0                    |      | 5.0  | N·m  |
| T                | Mounting Screw:M6                                  | 4.0                    |      | 6.0  | N·m  |
| G                | Weight   |                        | 320  |      | g    |



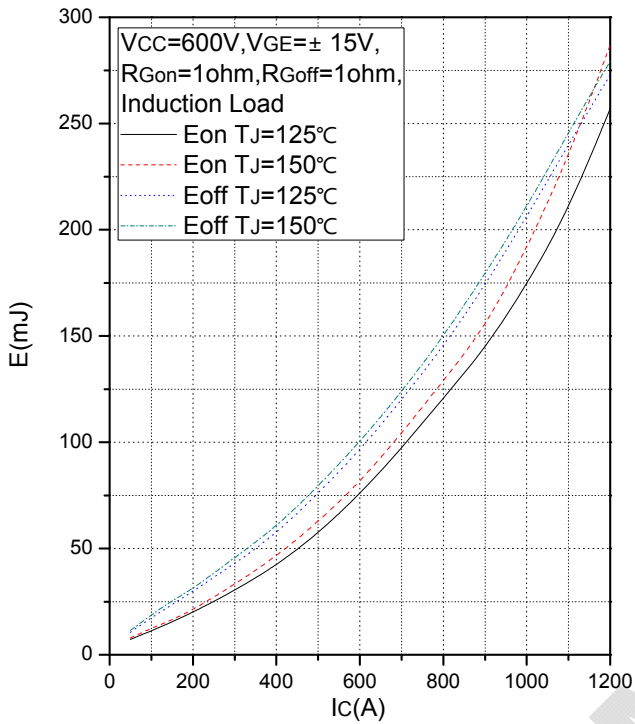


Fig.5 Typical Switching Loss vs. Collector Current

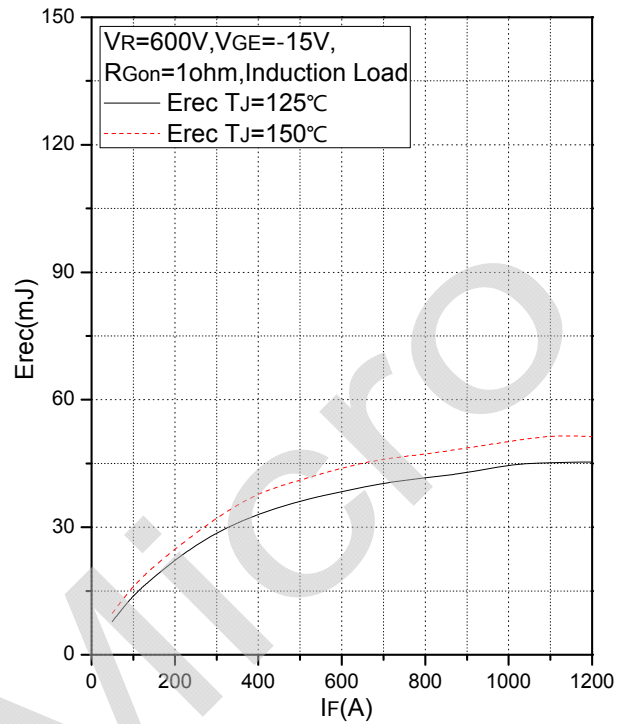


Fig.6 Typical Switching Loss vs. Forward Current

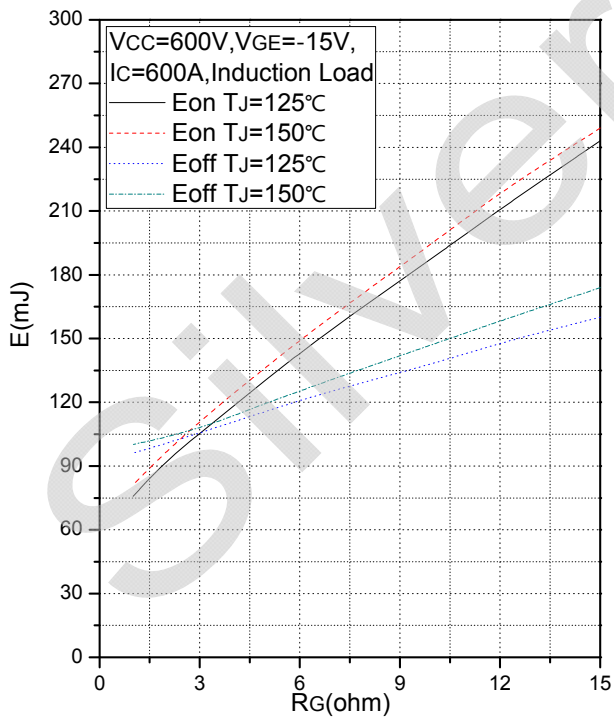


Fig.7 Typical Switching Loss vs. Gate Resistance

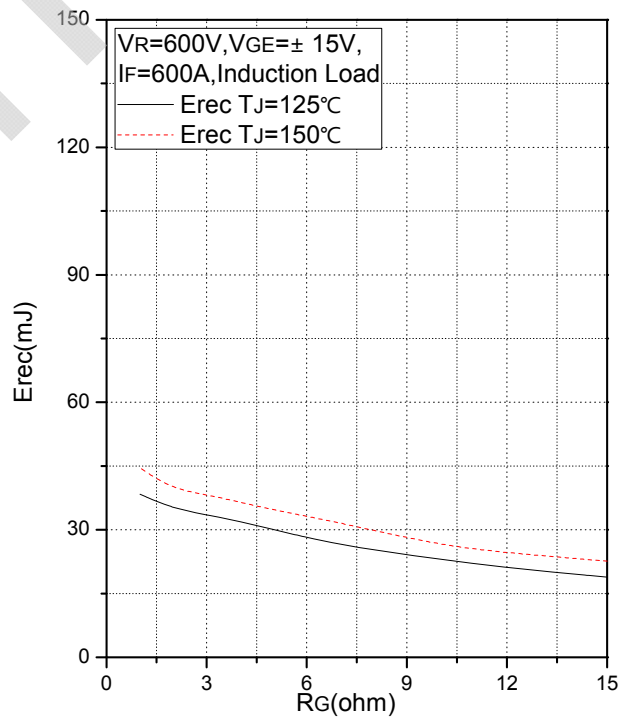


Fig.8 Typical Switching Loss vs. Gate Resistance

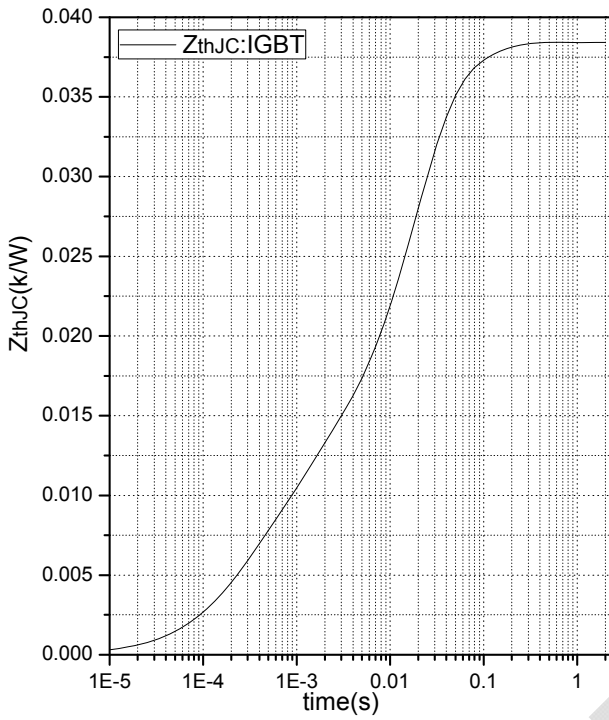


Fig.9 Transient Thermal Impedance (IGBT)

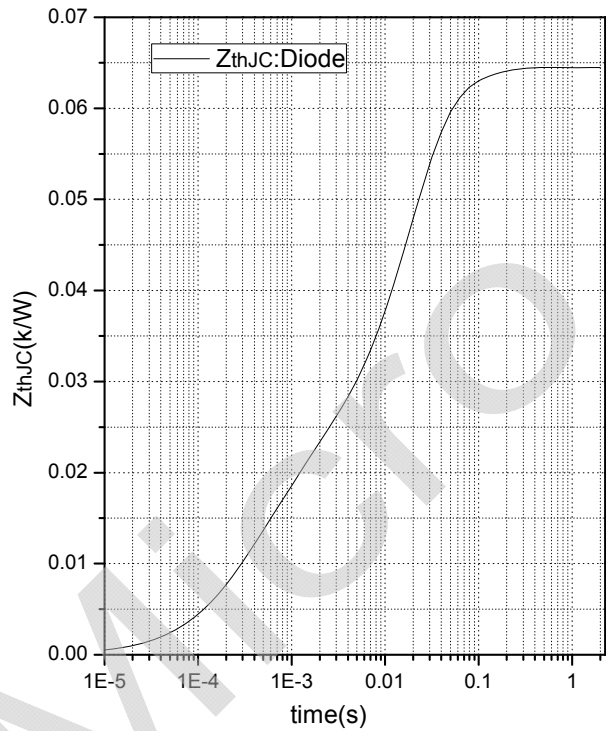


Fig.10 Transient Thermal Impedance (Diode)

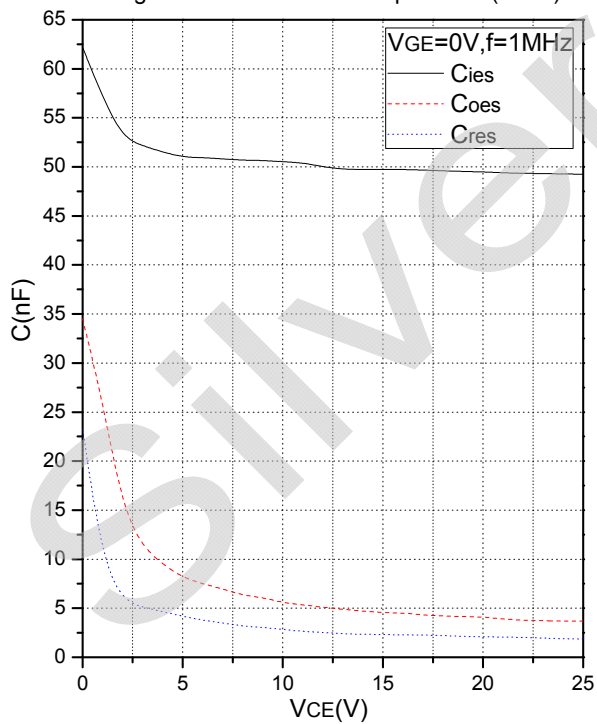


Fig.11 Capacitance Characteristics

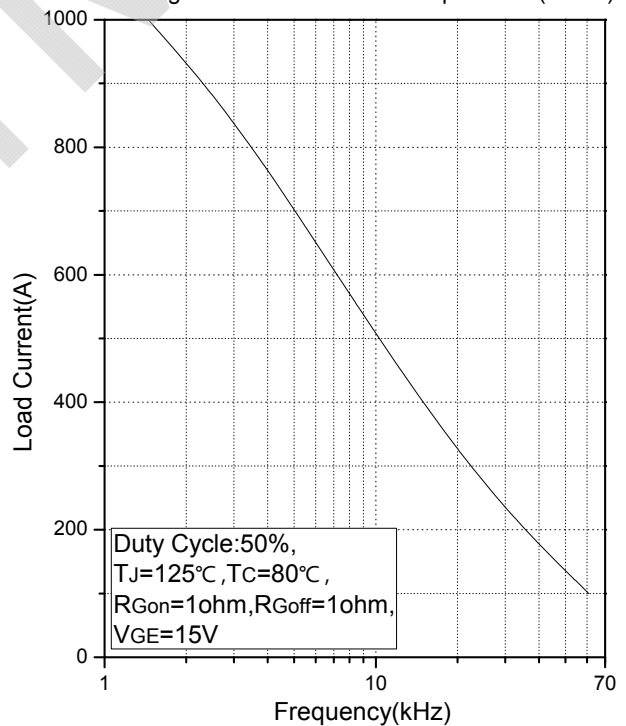


Fig.12 Typical Load Current vs. Frequency

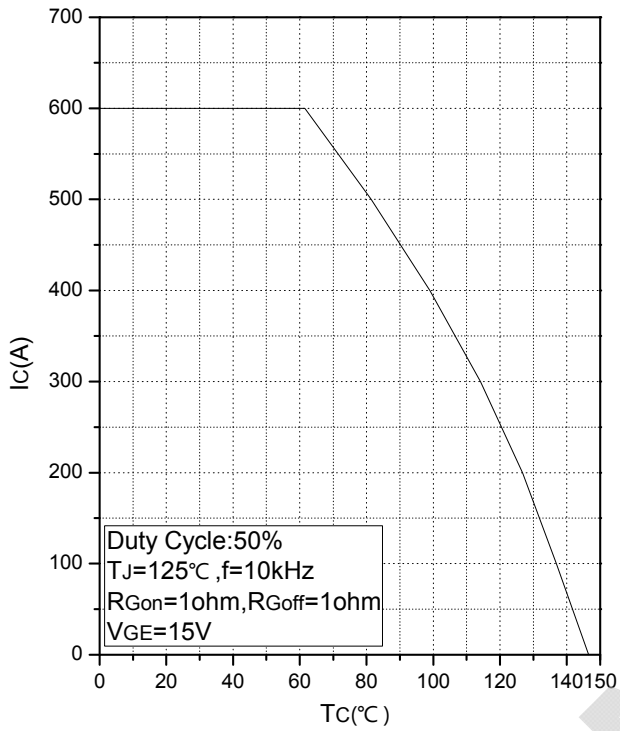
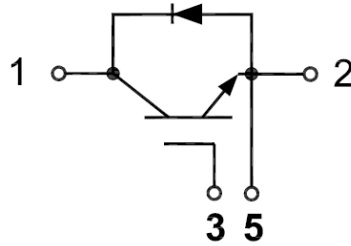


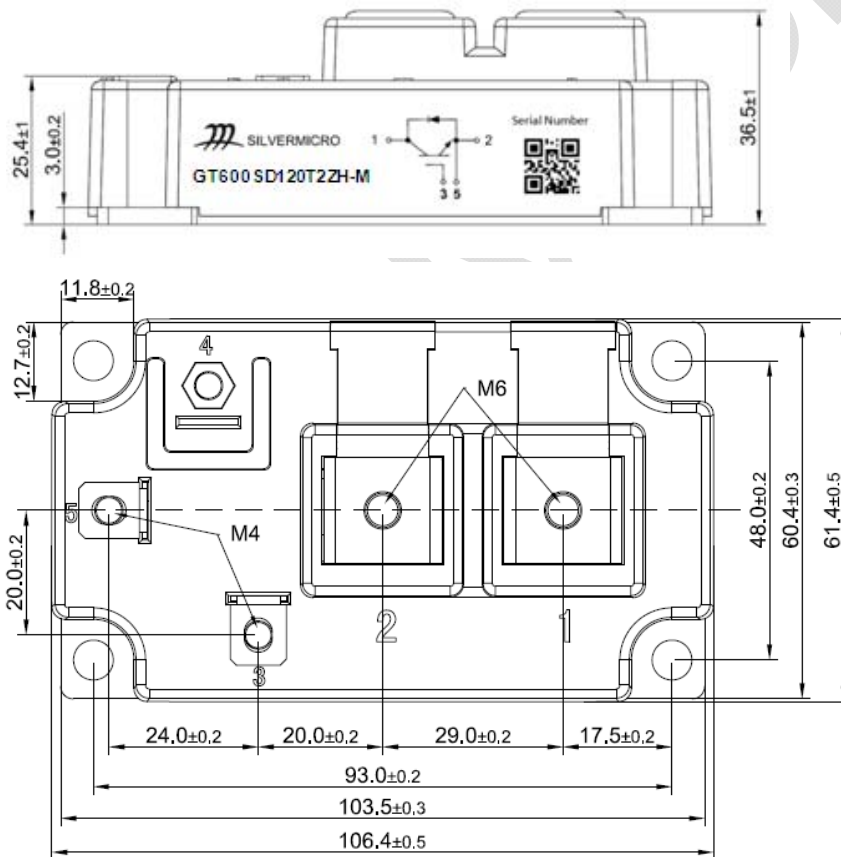
Fig.13 Rated Current vs. Temperature



### Internal Circuit



### Package Outline (Unit: mm):





### Revision History

| Date       | Revision | Notes           |
|------------|----------|-----------------|
| 08/06/2019 | 01       | Initial Release |
|            |          |                 |

### Announcement

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