

# GT200FF120T6H-M

## IGBT Module

Preliminary Data

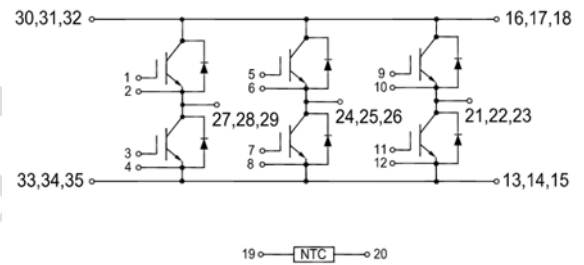
### Features:

- 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:

- Industrial Inverters
- Servo Applications



### IGBT, Inverter

Maximum Rated Values (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    | 200  | A  |
|                  |                                    | T <sub>C</sub> = 25°C     | 385  | A  |
| I <sub>CM</sub>  | Peak Collector Current Repetitive  | T <sub>J</sub> = 175°C    | 400  | 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     | 1305 | W  |
|                  |                                    | T <sub>Jmax</sub> = 175°C |      |    |

## 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       | $I_C = 3\text{mA}$ , $V_{CE} = V_{GE}$                                       | 5.0                     | 5.6  | 6.5 | V    |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C = 200\text{A}$ ,<br>$V_{GE} = 15\text{V}$                               | $T_J=25^\circ\text{C}$  | 1.70 |     | V    |
|               |                                      |  | $T_J=125^\circ\text{C}$ | 1.90 |     | V    |
|               |                                      |  | $T_J=150^\circ\text{C}$ | 2.00 |     | V    |
| $I_{CES}$     | 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>$V_{CE} = V_{CES}$ , $T_J = 25^\circ\text{C}$ |                         |      | 200 | nA   |
| $C_{ies}$     | Input Capacitance                    | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ ,<br>$f = 1\text{MHz}$          |                         | 17   |     | nF   |
| $C_{res}$     | Reveres Transfer Capacitance         |  |                         | 0.57 |     | nF   |

### Switching Characteristics

|              |                        |   |   |  |                         |      |    |    |
|--------------|------------------------|---|---|--|-------------------------|------|----|----|
| $t_{d(on)}$  | Turn-on Delay Time     | $V_{CC} = 600\text{V}$ , $I_C = 200\text{A}$ ,<br>$R_{Gon} = 1\Omega$ , $V_{GE} = \pm 15\text{V}$ ,<br>Inductive Load   | $T_J=25^\circ\text{C}$  | 254  |                         | ns   |    |    |
|              |                        |   | $T_J=125^\circ\text{C}$   | 260  |                         |      |    |    |
|              |                        |   | $T_J=150^\circ\text{C}$   | 266  |                         |      |    |    |
| $t_r$        | Rise Time              |   | $V_{CC} = 600\text{V}$ , $I_C = 200\text{A}$ ,<br>$R_{Goff} = 1\Omega$ , $V_{GE} = \pm 15\text{V}$ ,<br>Inductive Load  | $T_J=25^\circ\text{C}$   | 87                      |      | ns |    |
|              |                        |   |   | $T_J=125^\circ\text{C}$  | 92                      |      |    |    |
|              |                        |   |   | $T_J=150^\circ\text{C}$  | 95                      |      |    |    |
| $t_{d(off)}$ | Turn-off Delay Time    |   |   | $V_{CC} = 600\text{V}$ , $I_C = 200\text{A}$ ,<br>$R_{Goff} = 1\Omega$ , $V_{GE} = \pm 15\text{V}$ ,<br>Inductive Load | $T_J=25^\circ\text{C}$  | 252  |    | ns |
|              |                        |   |   |  | $T_J=125^\circ\text{C}$ | 281  |    |    |
|              |                        |   |   |  | $T_J=150^\circ\text{C}$ | 289  |    |    |
| $t_f$        | Fall Time              | $V_{CC} = 600\text{V}$ , $I_C = 200\text{A}$ ,<br>$R_{Gon} = 1\Omega$ , $V_{GE} = \pm 15\text{V}$ ,<br>$di/dt = 1851\text{A}/\mu\text{s}$ ( $T_J=150^\circ\text{C}$ )<br>Inductive Load |   |  | $T_J=25^\circ\text{C}$  | 155  |    | ns |
|              |                        |   |   |  | $T_J=125^\circ\text{C}$ | 199  |    |    |
|              |                        |   |   |  | $T_J=150^\circ\text{C}$ | 226  |    |    |
| $E_{on}$     | Turn-on Switching Loss |   | $V_{CC} = 600\text{V}$ , $I_C = 200\text{A}$ ,<br>$R_{Gon} = 1\Omega$ , $V_{GE} = \pm 15\text{V}$ ,<br>$di/dt = 1851\text{A}/\mu\text{s}$ ( $T_J=150^\circ\text{C}$ )<br>Inductive Load |  | $T_J=25^\circ\text{C}$  | 8.4  |    | mJ |
|              |                        |   |   |  | $T_J=125^\circ\text{C}$ | 12.9 |    |    |
|              |                        |   |   |  | $T_J=150^\circ\text{C}$ | 14.2 |    |    |

|                  |  |   |                        |           |      |
|------------------|--|---|------------------------|-----------|------|
| E <sub>off</sub> | Turn-off Loss  | Switching<br>V <sub>CC</sub> = 600V, I <sub>C</sub> = 200A,<br>R <sub>Goff</sub> = 1Ω, V <sub>GE</sub> = ±15V,<br>du/dt = 4407V/μs (T <sub>J</sub> = 150°C)<br>Inductive Load | T <sub>J</sub> = 25°C  | 11.7      | mJ   |
|                  |  |   | T <sub>J</sub> = 125°C | 19.3      |      |
|                  |  |   | T <sub>J</sub> = 150°C | 21.5      |      |
| Q <sub>g</sub>   | Total Gate Charge  | V <sub>GE</sub> = -15...+15V  | T <sub>J</sub> = 25°C  | 960       | nC   |
| RBSOA            | I <sub>C</sub> = 400A, 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 |      |
| I <sub>SC</sub>  | SC Data  | V <sub>CC</sub> = 600V, t <sub>p</sub> = 10μs, V <sub>GE</sub> = ±15V,<br>R <sub>Gon</sub> = 4.7ohm, R <sub>Goff</sub> = 4.7ohm, T <sub>J</sub> = 150°C                       |                        | 1044      | A    |
| R <sub>θJC</sub> | IGBT Thermal Resistance: Junction-To-Case  |   |                        | 0.115     | °C/W |

## Diode, Inverter

### Maximum Rated Values (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 | 200  | A |
| I <sub>FM</sub>  | Peak FWD Current Repetitive      | 400  | A |

### Electrical Characteristics of FWD (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> = 200A   | T <sub>J</sub> = 25°C  | 1.80 |     | V    |
|                 |                               |   | T <sub>J</sub> = 150°C | 1.95 |     |      |
| t <sub>rr</sub> | Reverse Recovery Time         | I <sub>F</sub> = 200A,<br>-di <sub>F</sub> /dt = 1300A/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  | 286  |     | ns   |
|                 |                               |   | T <sub>J</sub> = 125°C | 456  |     |      |
|                 |                               |   | T <sub>J</sub> = 150°C | 522  |     |      |
| I <sub>rr</sub> | Peak Reverse Recovery Current | I <sub>F</sub> = 200A,<br>-di <sub>F</sub> /dt = 1300A/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  | 145  |     | A    |
|                 |                               |   | T <sub>J</sub> = 125°C | 172  |     |      |
|                 |                               |   | T <sub>J</sub> = 150°C | 178  |     |      |
| Q <sub>rr</sub> | Reverse Recovery Charge       | I <sub>F</sub> = 200A,<br>-di <sub>F</sub> /dt = 1300A/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  | 21.4 |     | μC   |
|                 |                               |   | T <sub>J</sub> = 125°C | 35.8 |     |      |
|                 |                               |   | T <sub>J</sub> = 150°C | 41.3 |     |      |

|                  |  |   |                       |       |      |
|------------------|--|---|-----------------------|-------|------|
| E <sub>rec</sub> | Reverse Recovery Energy                    | I <sub>F</sub> = 200A,<br>-di <sub>F</sub> /dt = 1300A/μs(T <sub>J</sub> =125°C),<br>V <sub>R</sub> = 600V,<br>V <sub>GE</sub> = -15V | T <sub>J</sub> =25°C  | 10.2  | mJ   |
|                  |  |   | T <sub>J</sub> =125°C | 17.2  |      |
|                  |  |   | T <sub>J</sub> =150°C | 19.7  |      |
| R <sub>θJC</sub> | Diode Thermal Resistance: Junction-To-Case |   |                       | 0.199 | °C/W |

### Internal NTC-Thermistor Characteristics

|                    |   |      |    |    |
|--------------------|---|------|----|----|
| R <sub>25</sub>    | T <sub>C</sub> =25°C  | 5    |    | kΩ |
| ΔR/R               | T <sub>C</sub> =100°C, R <sub>100</sub> =481Ω   |      | ±5 | %  |
| P <sub>25</sub>    | T <sub>C</sub> =25°C  | 50   |    | mW |
| B <sub>25/50</sub> | R <sub>2</sub> =R <sub>25</sub> exp[B <sub>25/50</sub> (1/T <sub>2</sub> -1/(298.15K))] | 3380 |    | K  |
| B <sub>25/80</sub> | R <sub>2</sub> =R <sub>25</sub> exp[B <sub>25/80</sub> (1/T <sub>2</sub> -1/(298.15K))] | 3440 |    | K  |

### Module

| Symbol           | Description  | Conditions        | 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                       |                   |      |     | 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>θCS</sub> | Case-To-Sink Thermally (Conductive Grease Applied) |                   |      | 0.1 |      | °C/W |
| M                | Power Terminals Screw:M5                           |                   | 3.0  |     | 5.0  | N·m  |
| G                | Weight   |                   |      | 300 |      | g    |

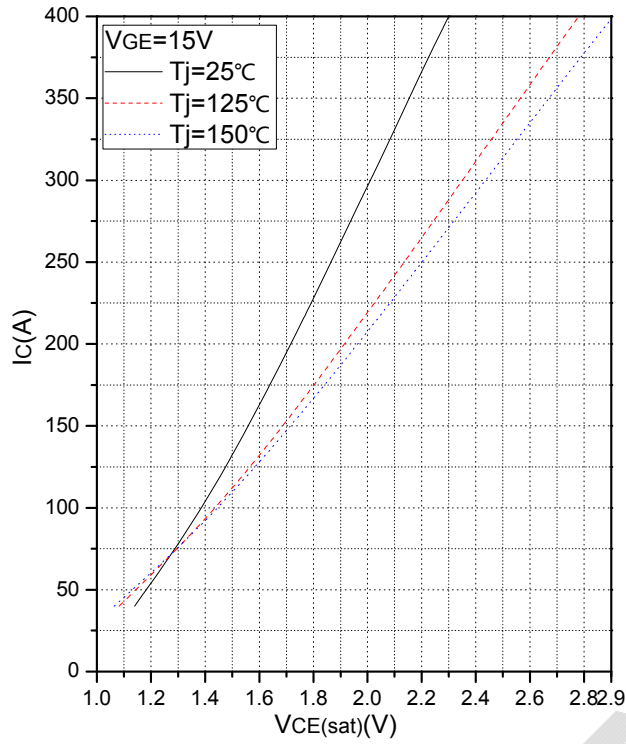


Fig.1 Typical Saturation Voltage Characteristics

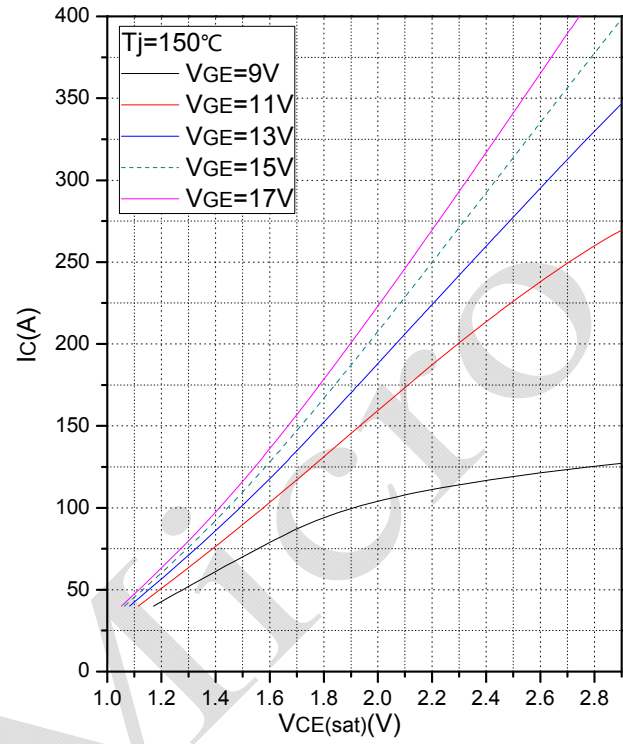


Fig.2 Typical Output Characteristics

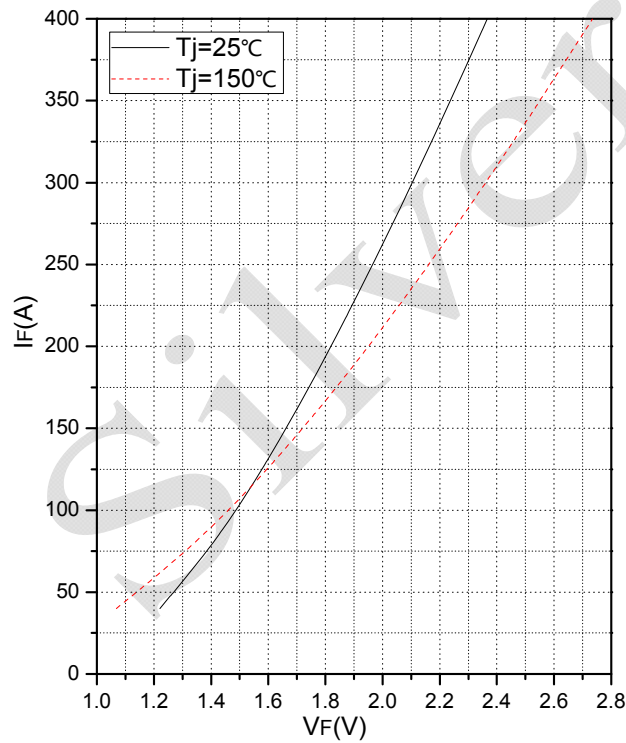


Fig.3 Forward Characteristics of FWD

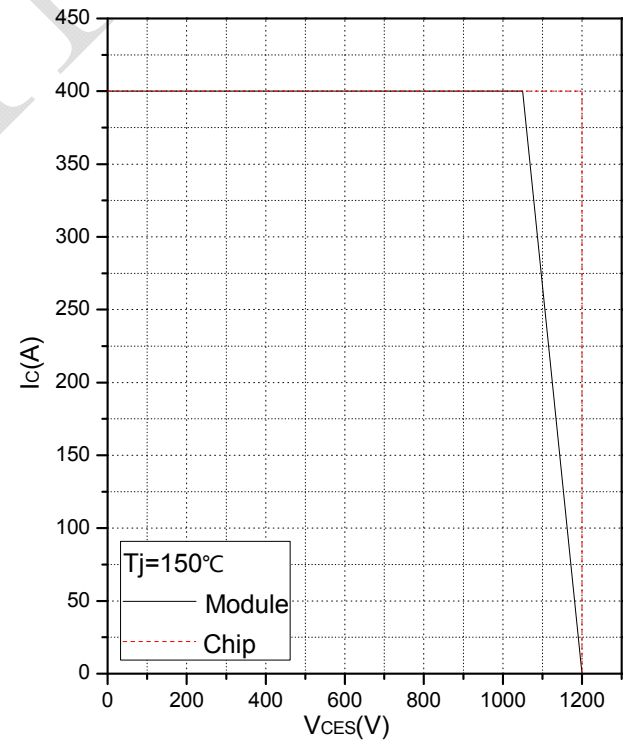


Fig.4 Reverse Bias Safe Operation Area (RBSOA)

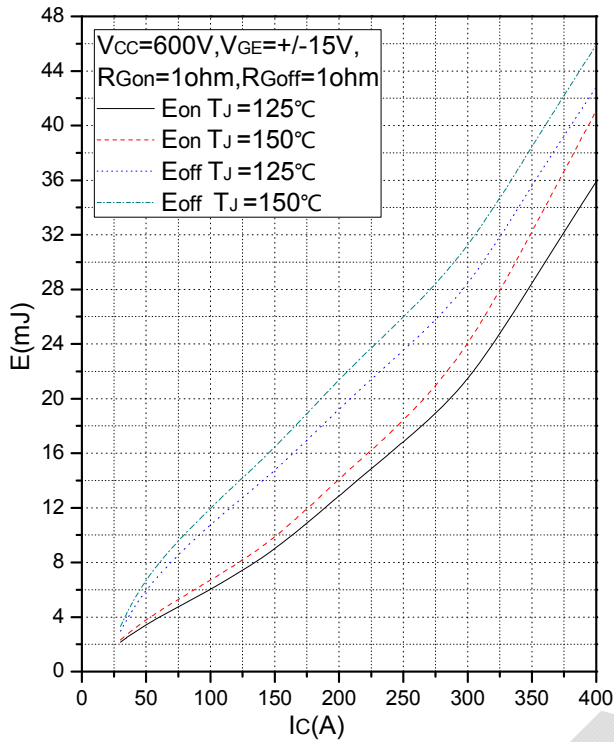


Fig.5 Typical Switching Loss vs. Collector Current

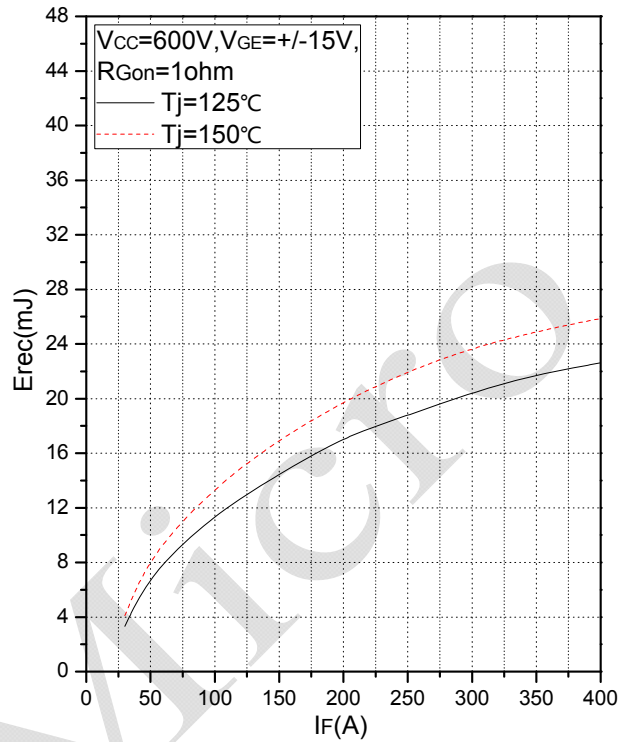


Fig.6 Typical Switching Loss vs. Forward Current

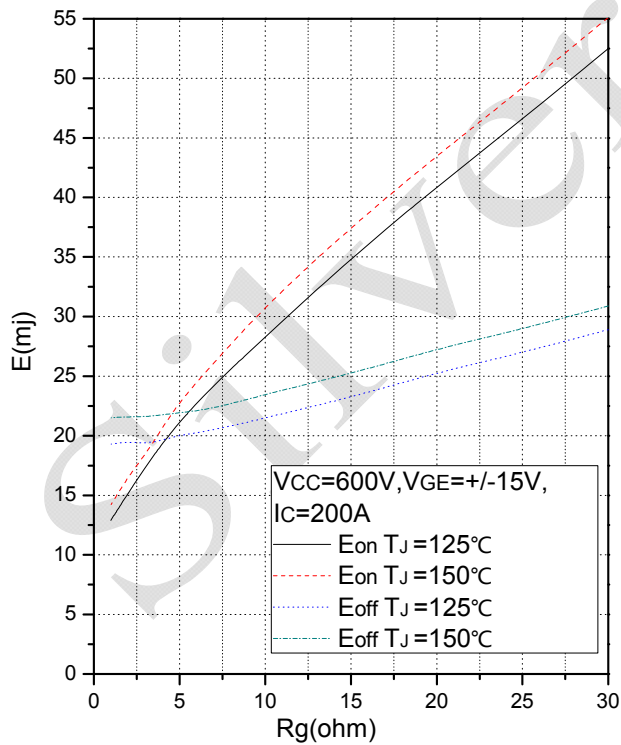


Fig.7 Typical Switching Loss vs. Gate Resistance

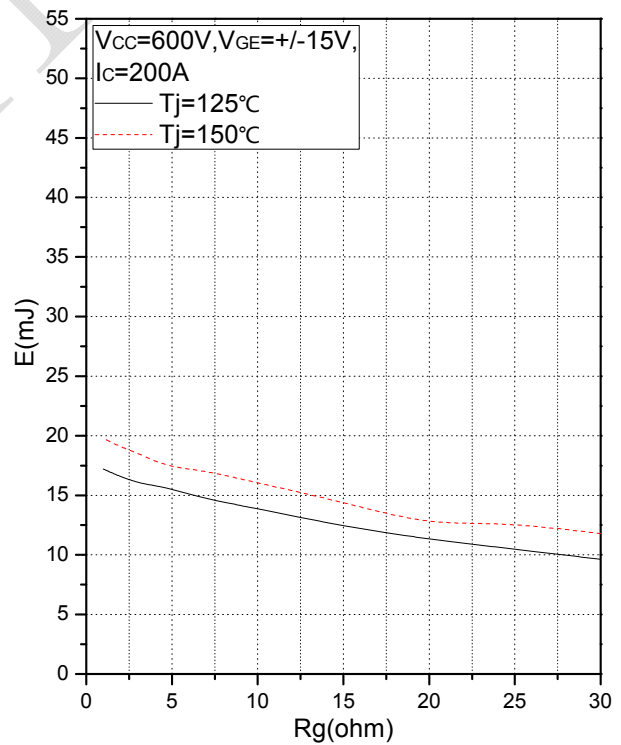


Fig.8 Typical Switching Loss vs. Gate Resistance

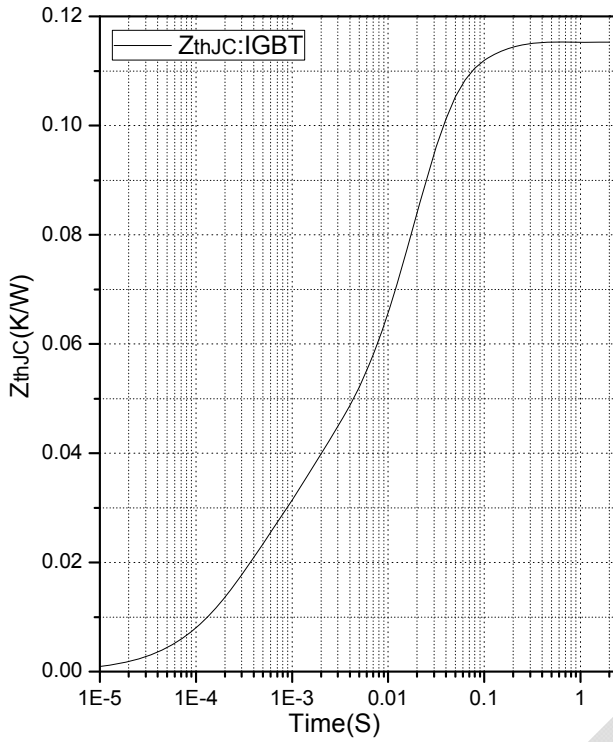


Fig.9 Transient Thermal Impedance (IGBT)

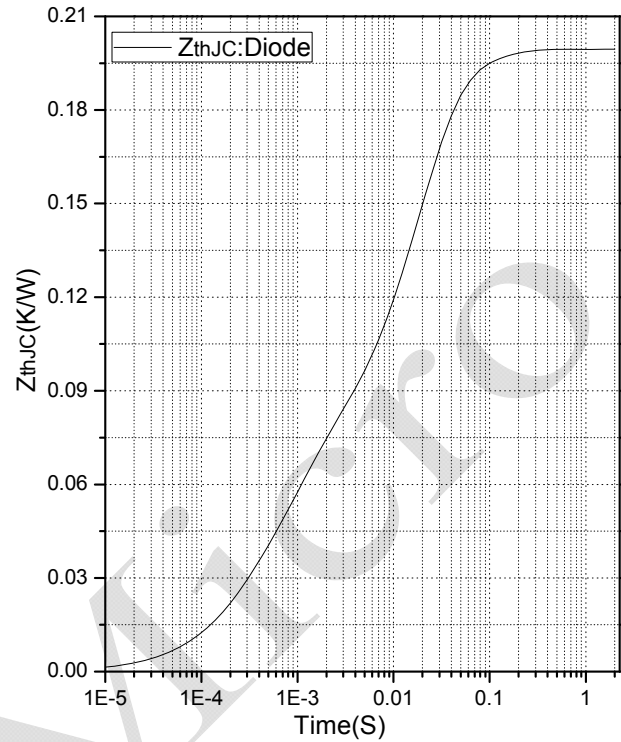


Fig.10 Transient Thermal Impedance (Diode)

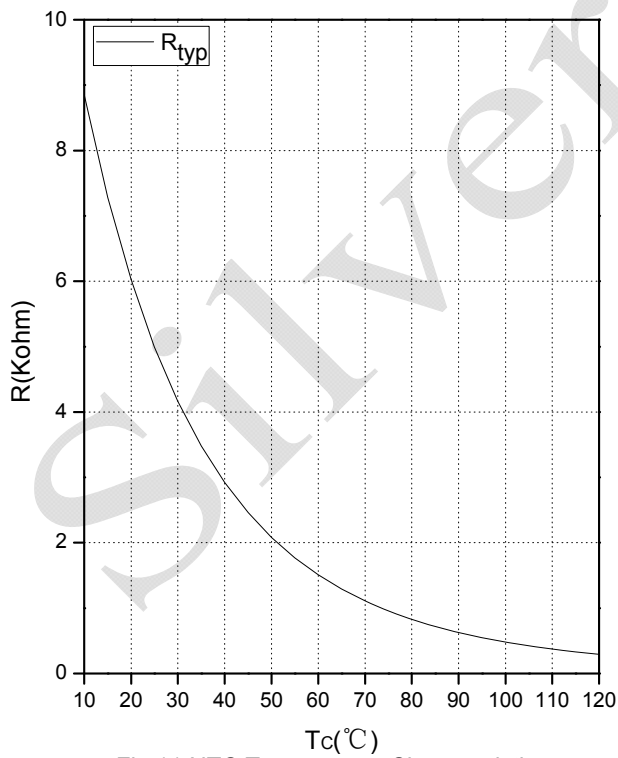
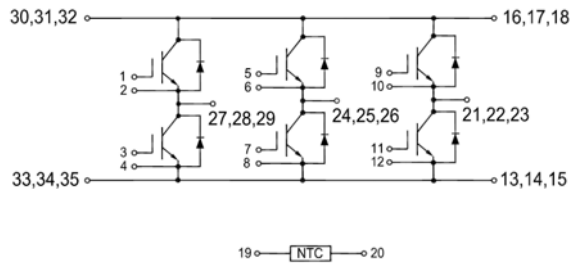
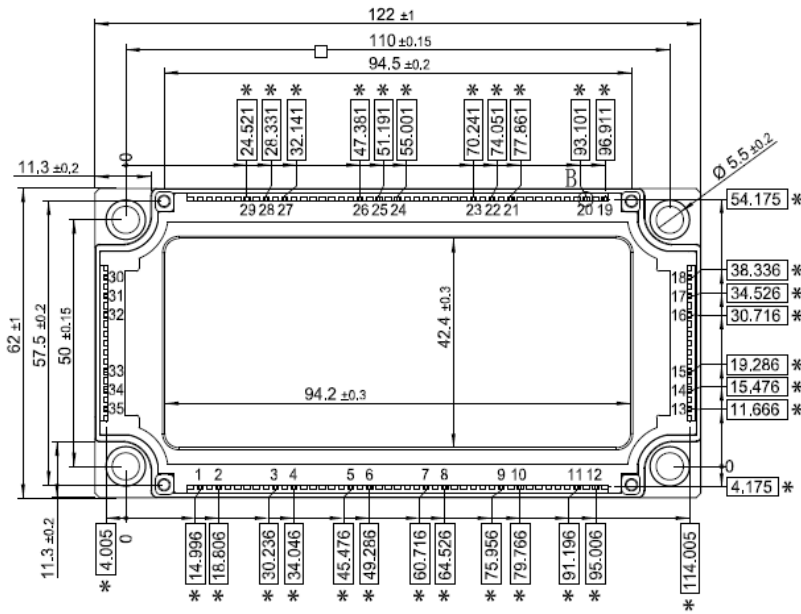


Fig.11 NTC Temperature Characteristics

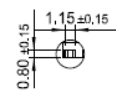
**Internal Circuit:**



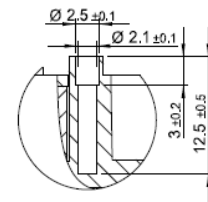
**Package Outline (Unit: mm):**



View B  
scale 3:1



View A  
scale 3:1



\*=all dimensions with tolerance of  $\pm 0.05$





| Date       | Revision | Notes           |
|------------|----------|-----------------|
| 01/16/2019 | 01       | Initial release |
|            |          |                 |
|            |          |                 |

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