

# GT150FF120T6H

## IGBT Module

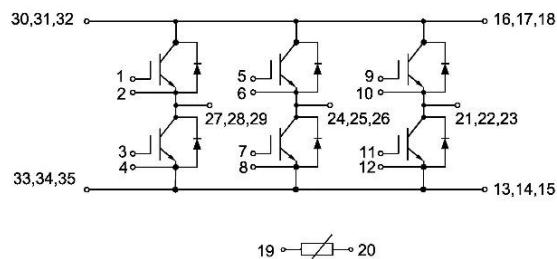
### Features:

- $V_{CES}=1200V$   $I_C=150A$  Trench & Field Stop IGBT Module
- Short Circuit Capability
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested( $2 \times I_C$ )
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

### Applications:

- Industrial Inverters
- Servo Applications

### Circuit Diagram



| Type          | Package | Marking       |
|---------------|---------|---------------|
| GT150FF120T6H | T6      | GT150FF120T6H |

### IGBT, Inverter

#### Maximum Rated Values ( $T_C=25^\circ C$ unless otherwise specified)

|           |                                                       |                                           |          |   |
|-----------|-------------------------------------------------------|-------------------------------------------|----------|---|
| $V_{CES}$ | Collector-Emitter Blocking Voltage                    |                                           | 1200     | V |
| $V_{GES}$ | Gate-Emitter Voltage                                  |                                           | $\pm 20$ | V |
| $I_C$     | Continuous Collector Current<br>Limited by $T_{Jmax}$ | $T_C=90^\circ C$                          | 150      | A |
|           |                                                       | $T_C=25^\circ C$                          | 300      | A |
| $I_{CM}$  | Peak Collector Current Repetitive                     | $T_p$ limited by $T_{Jmax}$               | 300      | A |
| $P_D$     | Maximum Power Dissipation (IGBT)                      | $T_C=25^\circ C$ , $T_{Jmax}=175^\circ C$ | 950      | W |

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

#### Static Characteristics

| Symbol               | Description                          | Conditions                                                           |                       | Min. | Typ.  | Max. | Units |
|----------------------|--------------------------------------|----------------------------------------------------------------------|-----------------------|------|-------|------|-------|
| V <sub>GE(th)</sub>  | Gate-Emitter Threshold Voltage       | I <sub>C</sub> =5.7mA, V <sub>CE</sub> =V <sub>GE</sub>              |                       | 5.0  | 5.7   | 6.5  | V     |
| V <sub>CE(sat)</sub> | Collector-Emitter Saturation Voltage | I <sub>C</sub> =150A,<br>V <sub>GE</sub> =15V                        | T <sub>J</sub> =25°C  |      | 1.71  | 2.10 | V     |
|                      |                                      |                                                                      | T <sub>J</sub> =125°C |      | 2.12  |      | V     |
|                      |                                      |                                                                      | T <sub>J</sub> =175°C |      | 2.29  |      | V     |
| I <sub>CES</sub>     | Collector-Emitter Leakage Current    | V <sub>GE</sub> =0V,<br>V <sub>CE</sub> =1200V, T <sub>J</sub> =25°C |                       |      |       | 1    | mA    |
| I <sub>GES</sub>     | Gate-Emitter Leakage Current         | V <sub>GE</sub> =20V,<br>V <sub>CE</sub> =0V, T <sub>J</sub> =25°C   |                       |      |       | 200  | nA    |
| C <sub>ies</sub>     | Input Capacitance                    | V <sub>CE</sub> =25V, V <sub>GE</sub> =0V,<br>f=100kHz               |                       |      | 17.00 |      | nF    |
| C <sub>oes</sub>     | Output Capacitance                   |                                                                      |                       |      | 2.10  |      | nF    |
| C <sub>res</sub>     | Reverse Transfer Capacitance         |                                                                      |                       |      | 0.18  |      | nF    |

#### Switching Characteristics

|              |                        |                                                                                                                             |                    |  |      |  |    |
|--------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------|--|------|--|----|
| $t_{d(ON)}$  | Turn-on Delay Time     | $V_{CC}=600V, I_C=150A,$<br>$R_{Gon}=3.3\Omega, V_{GE}=\pm 15V,$<br>Inductive Load                                          | $T_J=25^{\circ}C$  |  | 170  |  | ns |
|              |                        |                                                                                                                             | $T_J=125^{\circ}C$ |  | 184  |  |    |
|              |                        |                                                                                                                             | $T_J=175^{\circ}C$ |  | 187  |  |    |
| $t_r$        | Rise Time              |                                                                                                                             | $T_J=25^{\circ}C$  |  | 48   |  | ns |
|              |                        |                                                                                                                             | $T_J=125^{\circ}C$ |  | 54   |  |    |
|              |                        |                                                                                                                             | $T_J=175^{\circ}C$ |  | 60   |  |    |
| $t_{d(OFF)}$ | Turn-off Delay Time    | $V_{CC}=600V, I_C=150A,$<br>$R_{Goff}=3.3\Omega, V_{GE}=\pm 15V,$<br>Inductive Load                                         | $T_J=25^{\circ}C$  |  | 233  |  | ns |
|              |                        |                                                                                                                             | $T_J=125^{\circ}C$ |  | 282  |  |    |
|              |                        |                                                                                                                             | $T_J=175^{\circ}C$ |  | 295  |  |    |
| $t_f$        | Fall Time              |                                                                                                                             | $T_J=25^{\circ}C$  |  | 240  |  | ns |
|              |                        |                                                                                                                             | $T_J=125^{\circ}C$ |  | 296  |  |    |
|              |                        |                                                                                                                             | $T_J=175^{\circ}C$ |  | 323  |  |    |
| $E_{on}$     | Turn-on Switching Loss | $V_{CC}=600V, I_C=150A,$<br>$R_{Gon}=3.3\Omega, V_{GE}=\pm 15V,$<br>$di/dt=2000A/\mu s(T_J=175^{\circ}C)$<br>Inductive Load | $T_J=25^{\circ}C$  |  | 13.7 |  | mJ |
|              |                        |                                                                                                                             | $T_J=125^{\circ}C$ |  | 18.8 |  |    |
|              |                        |                                                                                                                             | $T_J=175^{\circ}C$ |  | 21.2 |  |    |

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## IGBT Module Datasheet



|                      |                                                                                                   |                                                                                                                                                            |                       |  |       |       |      |
|----------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--|-------|-------|------|
| E <sub>off</sub>     | Turn-off Switching Loss                                                                           | V <sub>CC</sub> =600V, I <sub>C</sub> =150A,<br>R <sub>Goff</sub> =3.3Ω, V <sub>GE</sub> =±15V,<br>du/dt=5300V/μs(T <sub>J</sub> =175°C)<br>Inductive Load | T <sub>J</sub> =25°C  |  | 11.6  |       | mJ   |
|                      |                                                                                                   |                                                                                                                                                            | T <sub>J</sub> =125°C |  | 15.1  |       |      |
|                      |                                                                                                   |                                                                                                                                                            | T <sub>J</sub> =175°C |  | 17.0  |       |      |
| Q <sub>g</sub>       | Total Gate Charge                                                                                 | V <sub>GE</sub> =+15V...-15V                                                                                                                               | T <sub>J</sub> =25°C  |  | 0.98  |       | uC   |
| R <sub>G (int)</sub> | Internal Gate Resistance                                                                          |                                                                                                                                                            | T <sub>J</sub> =25°C  |  | 4.0   |       | Ω    |
| T <sub>SC</sub>      | V <sub>CC</sub> =600V, V <sub>GE</sub> =±15V, T <sub>J</sub> =175°C <sup>note1</sup>              |                                                                                                                                                            |                       |  |       | 10    | us   |
| R <sub>θJC</sub>     | IGBT Thermal Resistance: Junction-to-Case (per IGBT)                                              |                                                                                                                                                            |                       |  |       | 0.157 | °C/W |
| R <sub>θCS</sub>     | IGBT Thermal Resistance: Case-to-Sink (per IGBT)<br>(per IGBT, λ <sub>grease</sub> = 1 W/(m · K)) |                                                                                                                                                            |                       |  | 0.117 |       | °C/W |

note1: Short circuit withstand time cannot exceed 10us under specified condition

### Diode, Inverter

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

|                  |                                  |                      |      |   |
|------------------|----------------------------------|----------------------|------|---|
| V <sub>RRM</sub> | Repetitive Peak Reverse Voltage  | T <sub>J</sub> =25°C | 1200 | V |
| I <sub>F</sub>   | Diode Continuous Forward Current |                      | 150  | A |
| I <sub>FM</sub>  | Diode Maximum Forward Current    | tp=1ms               | 300  | A |

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

| Symbol          | Description                   | Conditions                                                                                                          |                       | Min. | Typ. | Max. | Units |
|-----------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------|------|------|------|-------|
| V <sub>FM</sub> | Forward Voltage               | I <sub>F</sub> =150A                                                                                                | T <sub>J</sub> =25°C  |      | 1.71 | 2.20 | V     |
|                 |                               |                                                                                                                     | T <sub>J</sub> =125°C |      | 1.84 |      |       |
|                 |                               |                                                                                                                     | T <sub>J</sub> =175°C |      | 1.81 |      |       |
| t <sub>rr</sub> | Reverse Recovery Time         | I <sub>F</sub> =150A,<br>-diF/dt=2100A/μs(T <sub>J</sub> =175°C),<br>V <sub>R</sub> =600V,<br>V <sub>GE</sub> =-15V | T <sub>J</sub> =25°C  |      | 317  |      | ns    |
|                 |                               |                                                                                                                     | T <sub>J</sub> =125°C |      | 430  |      |       |
|                 |                               |                                                                                                                     | T <sub>J</sub> =175°C |      | 543  |      |       |
| I <sub>rr</sub> | Peak Reverse Recovery Current |                                                                                                                     | T <sub>J</sub> =25°C  |      | 104  |      | A     |
|                 |                               |                                                                                                                     | T <sub>J</sub> =125°C |      | 104  |      |       |
|                 |                               |                                                                                                                     | T <sub>J</sub> =175°C |      | 104  |      |       |
| Q <sub>rr</sub> | Reverse Recovery Charge       |                                                                                                                     | T <sub>J</sub> =25°C  |      | 14.5 |      | μC    |
|                 |                               |                                                                                                                     | T <sub>J</sub> =125°C |      | 22.1 |      |       |
|                 |                               |                                                                                                                     | T <sub>J</sub> =175°C |      | 28.0 |      |       |

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|                  |                                                                                       |                                                                                                                     |                       |  |       |       |      |
|------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------|--|-------|-------|------|
| E <sub>rec</sub> | Reverse Recovery Energy                                                               | I <sub>F</sub> =150A,<br>-diF/dt=2100A/μs(T <sub>J</sub> =175°C),<br>V <sub>R</sub> =600V,<br>V <sub>GE</sub> =-15V | T <sub>J</sub> =25°C  |  | 5.0   |       | mJ   |
|                  |                                                                                       |                                                                                                                     | T <sub>J</sub> =125°C |  | 8.2   |       |      |
|                  |                                                                                       |                                                                                                                     | T <sub>J</sub> =175°C |  | 10.5  |       |      |
| R <sub>θJC</sub> | Diode Thermal Resistance: Junction-to-Case (per Diode)                                |                                                                                                                     |                       |  |       | 0.326 | °C/W |
| R <sub>θCS</sub> | Diode Thermal Resistance: Case-to-Sink (per Diode, λ <sub>grease</sub> = 1 W/(m • K)) |                                                                                                                     |                       |  | 0.244 |       | °C/W |

### Internal NTC-Thermistor Characteristics

| Symbol       | Conditions                                       | Min. | Typ. | Max. | Units.     |
|--------------|--------------------------------------------------|------|------|------|------------|
| $R_{25}$     | $T_C=25^\circ C$                                 |      | 5    |      | k $\Omega$ |
| $\Delta R/R$ | $T_C=100^\circ C$ , $R_{100}=465\Omega$          | -5   |      | +5   | %          |
| $P_{25}$     | $T_C=25^\circ C$                                 |      |      | 10   | mW         |
| $B_{25/50}$  | $R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$  |      | 3380 |      | K          |
| $B_{25/80}$  | $R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$  |      | 3440 |      | K          |
| $B_{25/100}$ | $R_2=R_{25} \exp[B_{25/100}(1/T_2-1/(298.15K))]$ |      | 3545 |      | K          |

### Module

| Symbol    | Description                                                   |                  | Min. | Typ. | Max. | Units      |
|-----------|---------------------------------------------------------------|------------------|------|------|------|------------|
| $V_{iso}$ | Isolation Voltage (All Terminals Shorted)                     | RMS, f=50Hz, 60s | 2500 |      |      | V          |
| $T_J$     | Maximum Junction Temperature                                  |                  | -40  |      | 175  | $^\circ C$ |
| $T_{JOP}$ | Maximum Operating Junction Temperature Range <sup>note2</sup> |                  | -40  |      | 150  | $^\circ C$ |
| $T_{stg}$ | Storage Temperature                                           |                  | -40  |      | 125  | $^\circ C$ |
| CTI       | Comparative Tracking Index                                    |                  | 200  |      |      |            |
| M         | Mounting Screw:M5                                             |                  | 3.0  |      | 6.0  | N·m        |
| G         | Weight                                                        |                  |      | 300  |      | g          |

note2:  $T_{JOP} > 150^\circ C$  is only allowed for operation at overload conditions.

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## IGBT Module Datasheet



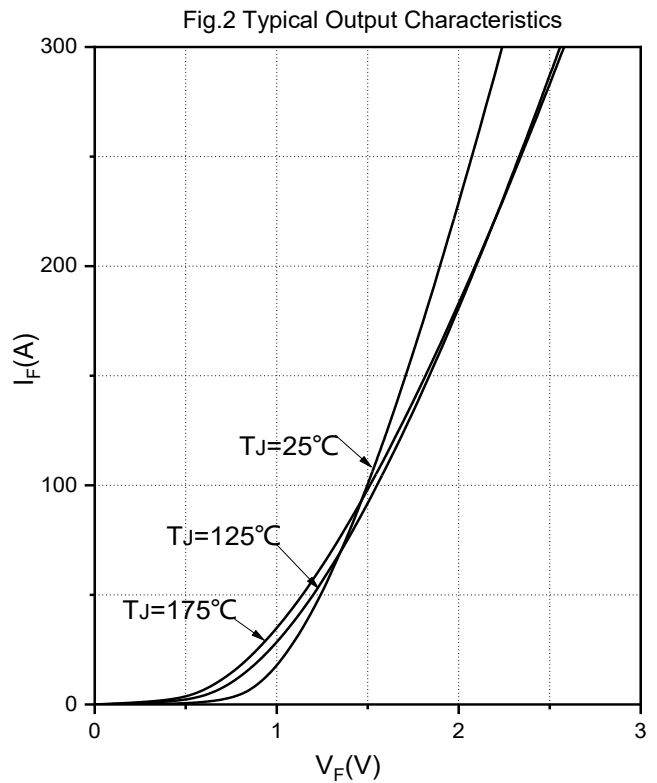
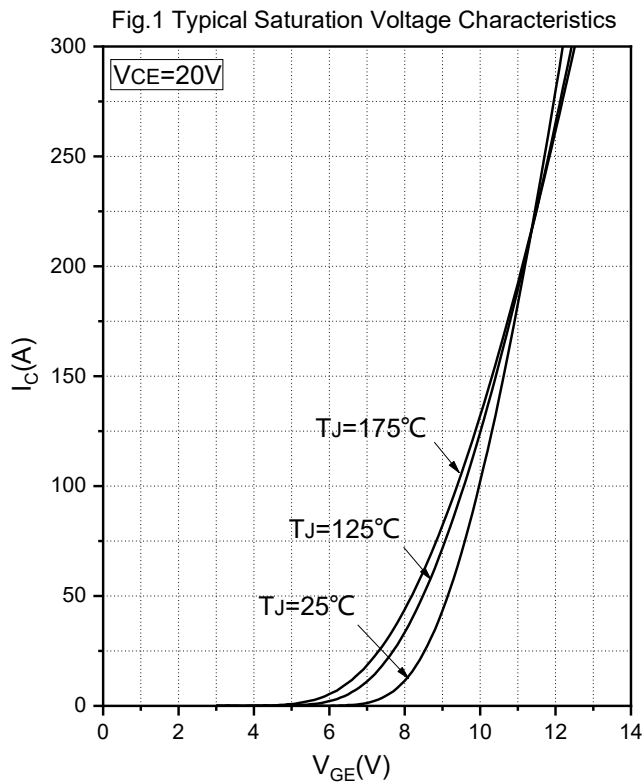
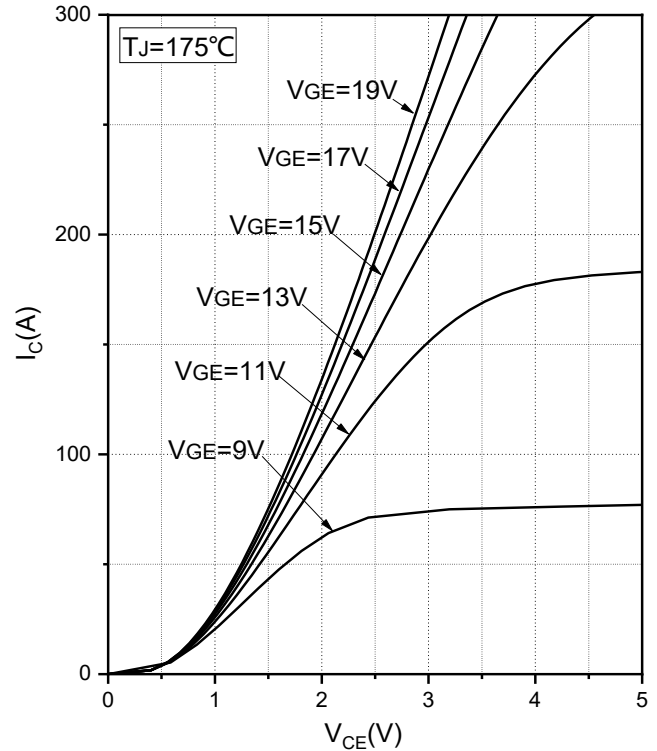
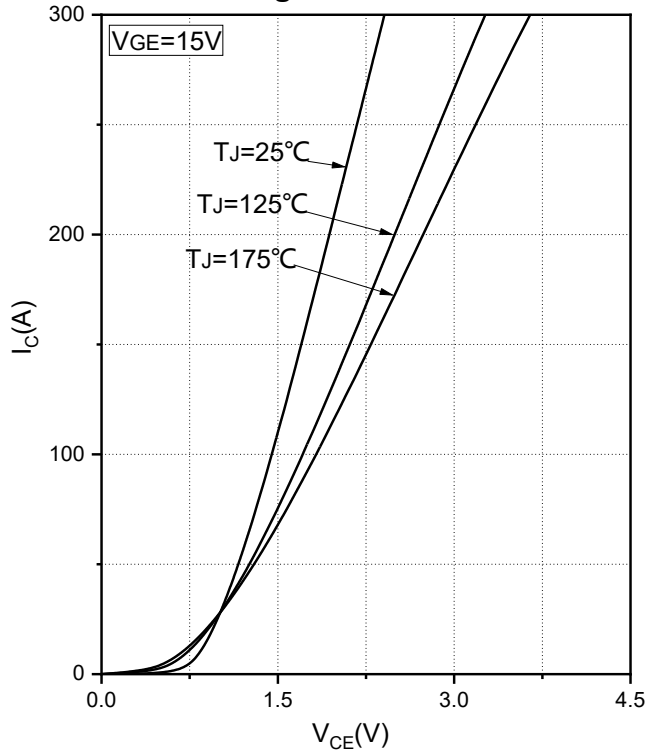
### Ordering Information Table

|             |   |   |     |    |     |    |   |
|-------------|---|---|-----|----|-----|----|---|
| Device code | G | T | 150 | FF | 120 | T6 | H |
|             | ① | ② | ③   | ④  | ⑤   | ⑥  | ⑦ |

- ① - IGBT Module
- ② - Field Stop Trench Gate IGBT
- ③ - Rated Current (150=150A)
- ④ - Circuit Configuration:FF (Full Bridge)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)

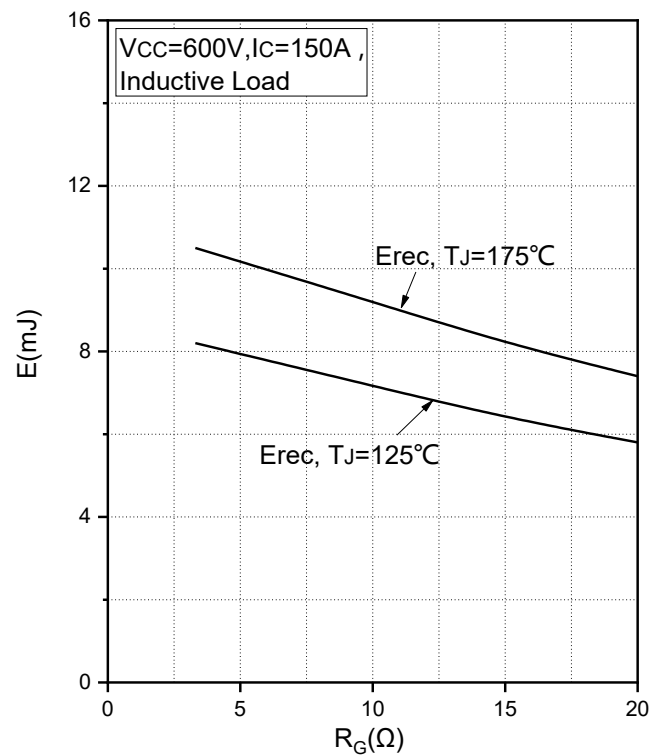
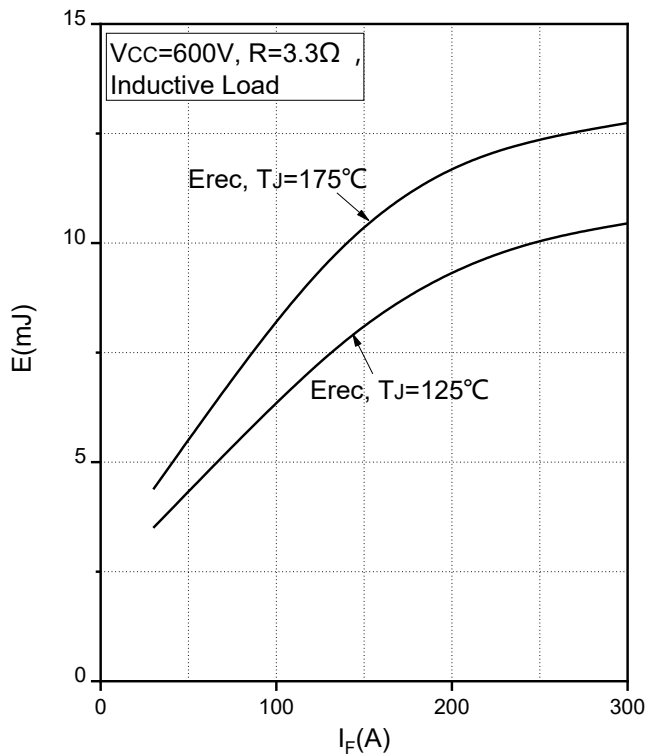
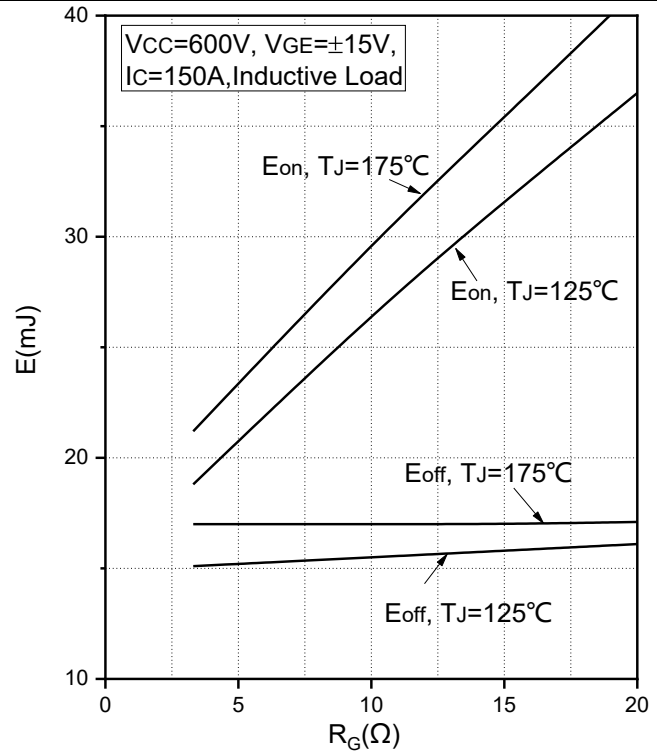
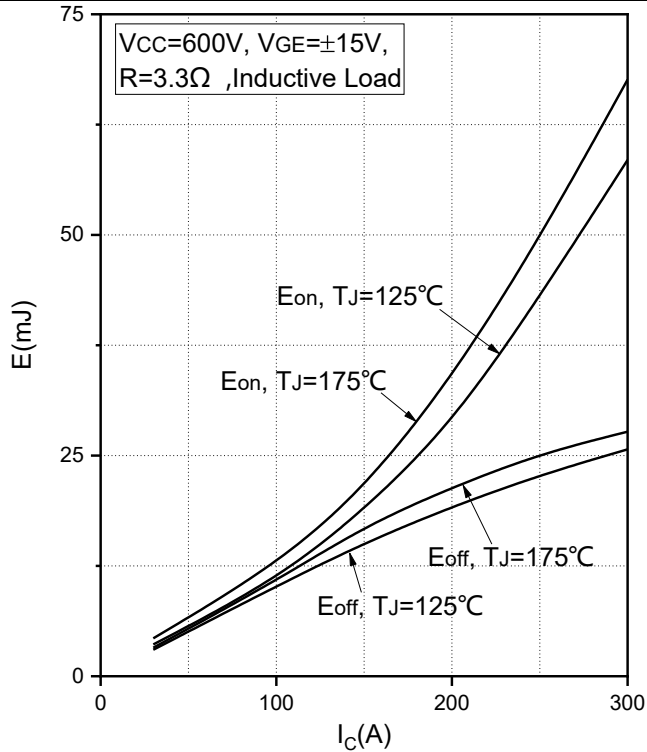


### Characteristic diagram



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## IGBT Module Datasheet



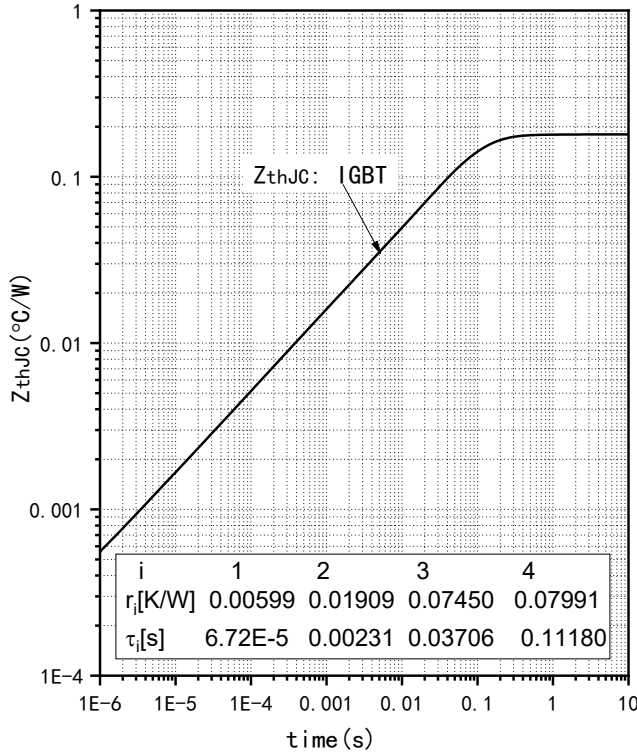


Fig.9 Transient Thermal Impedance (IGBT)

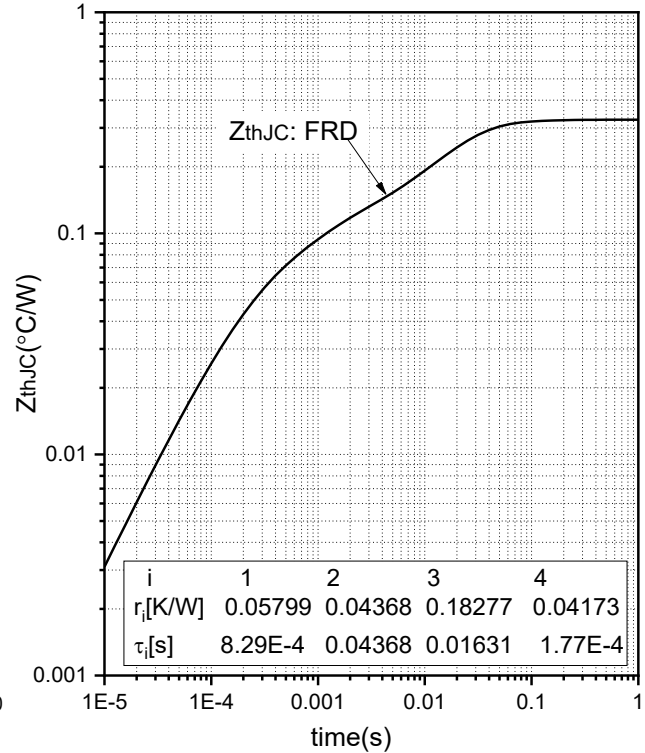


Fig.10 Transient Thermal Impedance (Diode)

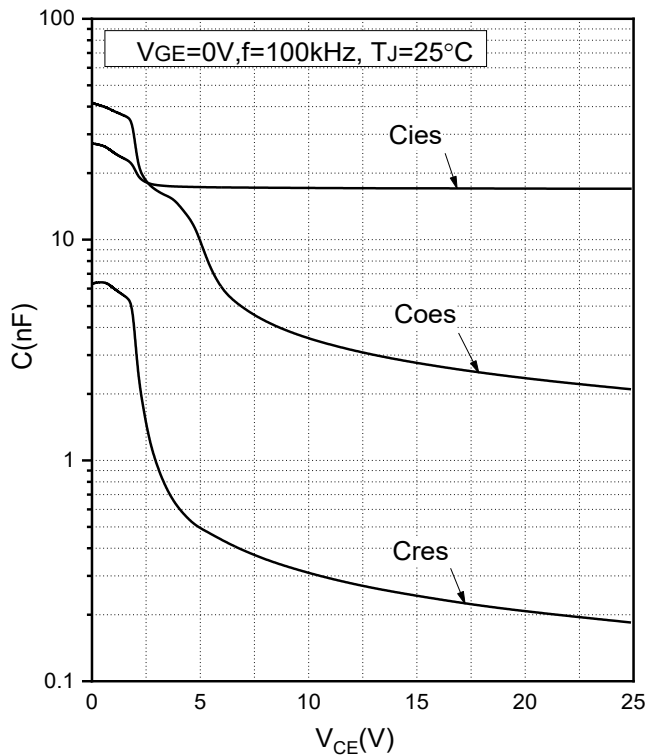


Fig.11 Capacitance Characteristics

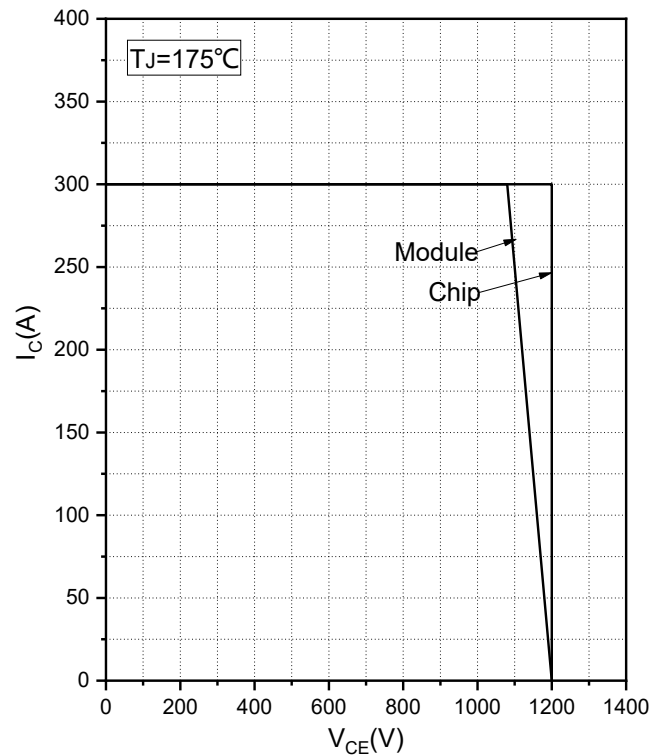


Fig.12 Reverse Bias Safe Operation Area (RBSOA)

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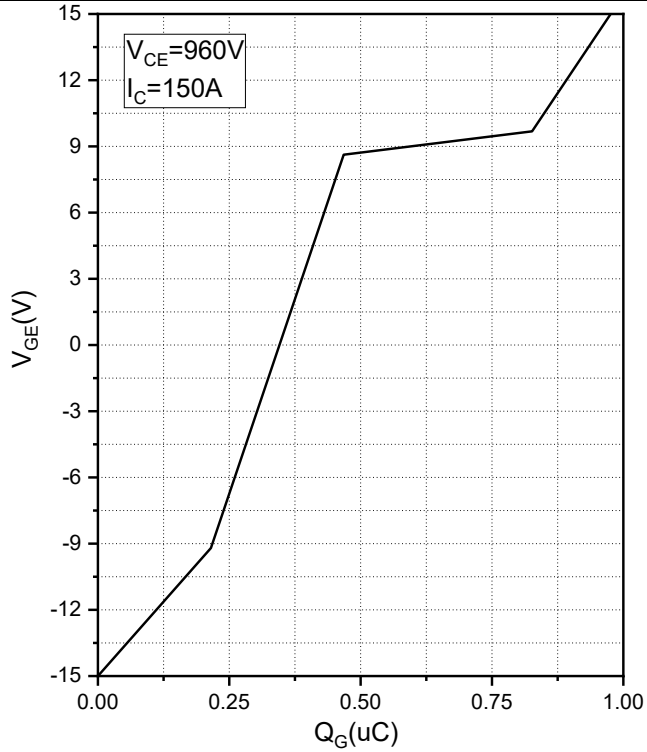


Fig.13 Gate Charge Characteristics

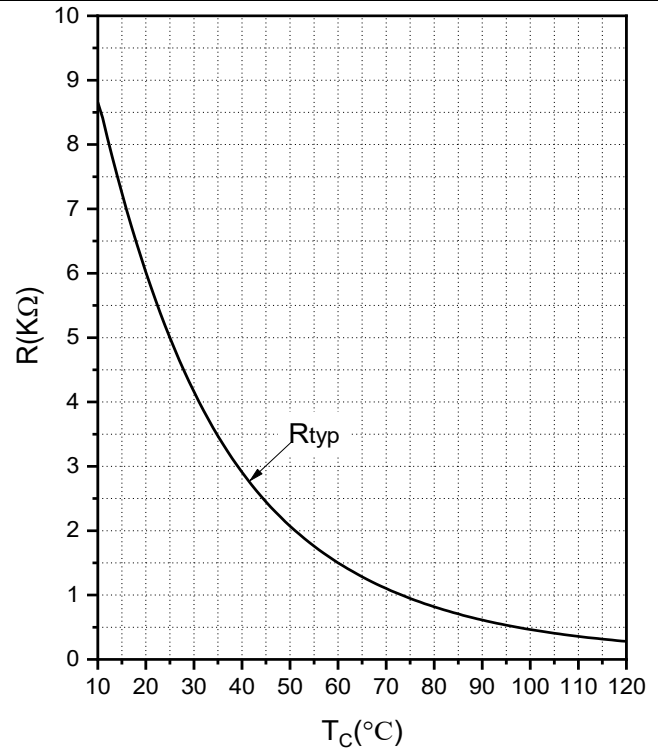


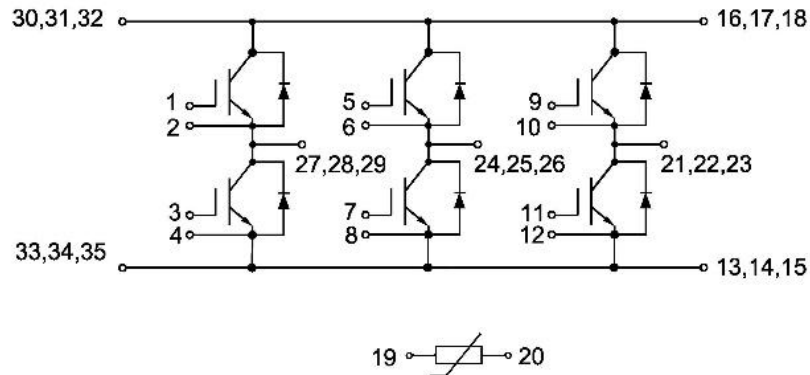
Fig.14 NTC Temperature Characteristics

# GT150FF120T6H

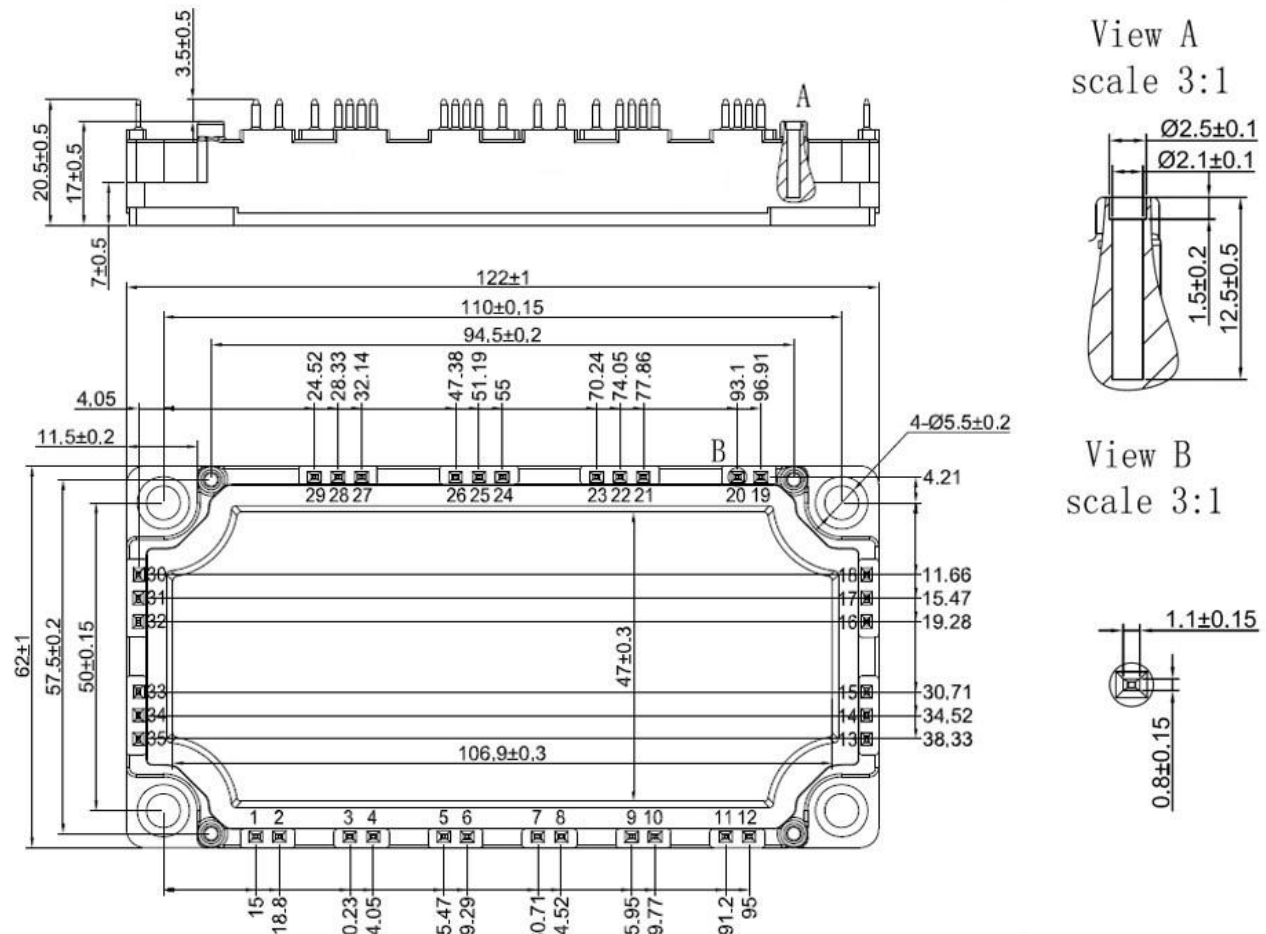
## IGBT Module Datasheet



### Internal Circuit:



### Package Outline (Unit: mm):



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## IGBT Module Datasheet



| Revision | Notes                          |
|----------|--------------------------------|
| A        | Fina Datasheet Initial Release |
|          |                                |

### Announcement

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The released datasheet would be issued with “REV.” + “alphabet characters”.