



# GT15RFF120B2H

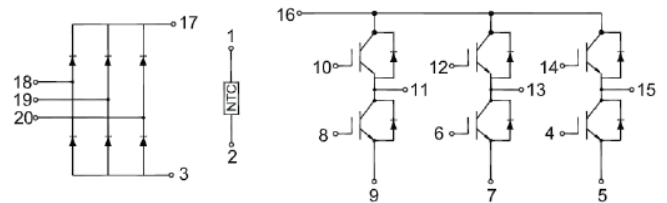
## IGBT Module

Preliminary Data

### Features:

- Field Stop Trench Gate IGBT
- Short Circuit Rated  $>10\mu\text{s}$
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested( $2\times I_c$ )
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

### Circuit Diagram



### Applications:

- Industrial Inverters

### IGBT, Inverter

**Maximum Rated Values**( $T_c=25^\circ\text{C}$  unless otherwise specified)

|           |                                    |                                                        |          |   |
|-----------|------------------------------------|--------------------------------------------------------|----------|---|
| $V_{CES}$ | Collector-Emitter Blocking Voltage | $T_J=25^\circ\text{C}$                                 | 1200     | V |
| $V_{GES}$ | Gate-Emitter Voltage               |                                                        | $\pm 20$ | V |
| $I_C$     | Continuous Collector Current       | $T_c=100^\circ\text{C}$                                | 15       | A |
|           |                                    | $T_c=25^\circ\text{C}$                                 | 30       | A |
| $I_{CM}$  | Repetitive Peak Collector Current  | $t_p=1\text{ms}$                                       | 30       | A |
| $P_D$     | Maximum Power Dissipation per IGBT | $T_c=25^\circ\text{C}$<br>$T_{Jmax}=175^\circ\text{C}$ | 199      | W |



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

### Static Characteristics

| Symbol        | Description                          | Conditions                                                                                 | Min.                      | Typ. | Max.      | Units |
|---------------|--------------------------------------|--------------------------------------------------------------------------------------------|---------------------------|------|-----------|-------|
| $V_{GE(th)}$  | Gate-Emitter Threshold Voltage       | $I_C=1\text{mA}$ , $V_{CE}=V_{GE}$ , $T_J=25^{\circ}\text{C}$                              | 5.00                      | 5.90 | 6.50      | V     |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C=15\text{A}$ , $V_{GE}=15\text{V}$                                                     | $T_J=25^{\circ}\text{C}$  | 1.85 | 2.00      | V     |
|               |                                      |                                                                                            | $T_J=125^{\circ}\text{C}$ | 2.05 |           |       |
|               |                                      |                                                                                            | $T_J=150^{\circ}\text{C}$ | 2.10 |           |       |
| $I_{CES}$     | 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         | $V_{GE}=\pm 20\text{V}$ , $V_{CE}=0\text{V}$ , $T_J=25^{\circ}\text{C}$                    |                           |      | $\pm 100$ | nA    |
| $C_{ies}$     | Input Capacitance                    | $V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$ ,<br>$f=100\text{kHz}$ , $T_J=25^{\circ}\text{C}$ |                           | 1.45 |           | nF    |
| $C_{oes}$     | Output Capacitance                   |                                                                                            |                           | 0.10 |           |       |
| $C_{res}$     | Reverse Transfer Capacitance         |                                                                                            |                           | 0.06 |           |       |

### Switching Characteristics

|              |                        |                                                                                                                                                                                 |                           |  |      |  |    |
|--------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--|------|--|----|
| $t_{d(on)}$  | Turn-on Delay Time     | $V_{CC}=600\text{V}$ , $I_C=15\text{A}$ ,<br>$R_{Gon}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load                                                                   | $T_J=25^{\circ}\text{C}$  |  | 85   |  | ns |
|              |                        |                                                                                                                                                                                 | $T_J=125^{\circ}\text{C}$ |  | 89   |  |    |
|              |                        |                                                                                                                                                                                 | $T_J=150^{\circ}\text{C}$ |  | 92   |  |    |
| $t_r$        | Rise Time              | $V_{CC}=600\text{V}$ , $I_C=15\text{A}$ ,<br>$R_{Gon}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load                                                                   | $T_J=25^{\circ}\text{C}$  |  | 50   |  | ns |
|              |                        |                                                                                                                                                                                 | $T_J=125^{\circ}\text{C}$ |  | 52   |  |    |
|              |                        |                                                                                                                                                                                 | $T_J=150^{\circ}\text{C}$ |  | 53   |  |    |
| $t_{d(off)}$ | Turn-off Delay Time    | $V_{CC}=600\text{V}$ , $I_C=15\text{A}$ ,<br>$R_{Goff}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load                                                                  | $T_J=25^{\circ}\text{C}$  |  | 137  |  | ns |
|              |                        |                                                                                                                                                                                 | $T_J=125^{\circ}\text{C}$ |  | 146  |  |    |
|              |                        |                                                                                                                                                                                 | $T_J=150^{\circ}\text{C}$ |  | 151  |  |    |
| $t_f$        | Fall Time              | $V_{CC}=600\text{V}$ , $I_C=15\text{A}$ ,<br>$R_{Goff}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>Inductive Load                                                                  | $T_J=25^{\circ}\text{C}$  |  | 222  |  | ns |
|              |                        |                                                                                                                                                                                 | $T_J=125^{\circ}\text{C}$ |  | 290  |  |    |
|              |                        |                                                                                                                                                                                 | $T_J=150^{\circ}\text{C}$ |  | 428  |  |    |
| $E_{on}$     | Turn-on Switching Loss | $V_{CC}=600\text{V}$ , $I_C=15\text{A}$ ,<br>$R_{Gon}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ ,<br>$di/dt=232\text{A}/\mu\text{s}$ ( $T_J=150^{\circ}\text{C}$ ),<br>Inductive Load | $T_J=25^{\circ}\text{C}$  |  | 2.35 |  | mJ |
|              |                        |                                                                                                                                                                                 | $T_J=125^{\circ}\text{C}$ |  | 3.03 |  |    |
|              |                        |                                                                                                                                                                                 | $T_J=150^{\circ}\text{C}$ |  | 3.29 |  |    |



|                  |                                                                                                                                             |                                                                                                                                                           |                       |           |      |       |      |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------|------|-------|------|
| E <sub>off</sub> | Turn-off Switching Loss                                                                                                                     | V <sub>CC</sub> =600V, I <sub>C</sub> =15A,<br>R <sub>Goff</sub> =36Ω, V <sub>GE</sub> =±15V,<br>du/dt=1984V/μs(T <sub>J</sub> =150°C),<br>Inductive Load | T <sub>J</sub> =25°C  |           | 0.70 |       | mJ   |
|                  |                                                                                                                                             |                                                                                                                                                           | T <sub>J</sub> =125°C |           | 1.23 |       |      |
|                  |                                                                                                                                             |                                                                                                                                                           | T <sub>J</sub> =150°C |           | 1.28 |       |      |
| Q <sub>g</sub>   | Total Gate Charge                                                                                                                           | V <sub>GE</sub> =+15V...-15V                                                                                                                              | T <sub>J</sub> =25°C  |           | 354  |       | nC   |
| RBSOA            | I <sub>C</sub> =30A, V <sub>CC</sub> =1050V, V <sub>p</sub> =1200V, R <sub>G</sub> =36Ω, 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, R <sub>Gon</sub> =36Ω, R <sub>Goff</sub> =36Ω, T <sub>J</sub> =125°C                          |                                                                                                                                                           |                       | 10        |      |       | μs   |
| R <sub>θJC</sub> | Thermal Resistance: Junction-to-Case (per IGBT)                                                                                             |                                                                                                                                                           |                       |           |      | 0.753 | °C/W |

## Diode, Inverter

### Maximum Rated Values(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 |                      | 15   | A |
| I <sub>FM</sub>  | Diode Maximum Forward Current    | tp=1ms               | 30   | 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> =15A                                                                                               | T <sub>J</sub> =25℃  |      | 1.90 |      | V     |
|                 |                               |                                                                                                                   | T <sub>J</sub> =125℃ |      | 2.05 |      |       |
|                 |                               |                                                                                                                   | T <sub>J</sub> =150℃ |      | 2.00 |      |       |
| t <sub>rr</sub> | Reverse Recovery Time         | I <sub>F</sub> =15A,<br>-diF/dt=344A/μs(T <sub>J</sub> =150℃),<br>V <sub>rr</sub> =600V,<br>V <sub>GE</sub> =-15V | T <sub>J</sub> =25℃  |      | 154  |      | ns    |
|                 |                               |                                                                                                                   | T <sub>J</sub> =125℃ |      | 159  |      |       |
|                 |                               |                                                                                                                   | T <sub>J</sub> =150℃ |      | 206  |      |       |
| I <sub>rr</sub> | Peak Reverse Recovery Current |                                                                                                                   | T <sub>J</sub> =25℃  |      | 7.8  |      | A     |
|                 |                               |                                                                                                                   | T <sub>J</sub> =125℃ |      | 12.2 |      |       |
|                 |                               |                                                                                                                   | T <sub>J</sub> =150℃ |      | 12.8 |      |       |
| Q <sub>rr</sub> | Reverse Recovery Charge       |                                                                                                                   | T <sub>J</sub> =25℃  |      | 0.83 |      | μC    |
|                 |                               |                                                                                                                   | T <sub>J</sub> =125℃ |      | 1.22 |      |       |
|                 |                               |                                                                                                                   | T <sub>J</sub> =150℃ |      | 1.47 |      |       |



|                  |                                                       |                                                                                                                    |                       |  |      |       |      |
|------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------|--|------|-------|------|
| E <sub>rec</sub> | Reverse Recovery Energy                               | I <sub>F</sub> =15A,<br>-diF/dt=344A/μs(T <sub>J</sub> =150°C),<br>V <sub>rr</sub> =600V,<br>V <sub>GE</sub> =-15V | T <sub>J</sub> =25°C  |  | 0.10 |       | mJ   |
|                  |                                                       |                                                                                                                    | T <sub>J</sub> =125°C |  | 0.15 |       |      |
|                  |                                                       |                                                                                                                    | T <sub>J</sub> =150°C |  | 0.17 |       |      |
| R <sub>θJC</sub> | Diode Thermal Resistance: Junction-to-Case(per Diode) |                                                                                                                    |                       |  |      | 1.127 | °C/W |

## Diode, Rectifier

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

|             |                                         |                   |      |        |
|-------------|-----------------------------------------|-------------------|------|--------|
| $V_{RRM}$   | Repetitive Peak Reverse Voltage         | $T_J=25^\circ C$  | 1600 | V      |
| $I_F$       | Diode Continuous Forward Current        | $T_J=25^\circ C$  | 10   | A      |
| $I_{FRMSM}$ | Maximum RMS Forward Current per Chip    | $T_J=80^\circ C$  | 20   | A      |
| $I_{RMSM}$  | Maximum RMS Current at Rectifier Output | $T_J=80^\circ C$  | 30   | A      |
| $I_{FSM}$   | Surge Current @ $t_p=10$ ms             | $T_J=25^\circ C$  | 300  | A      |
|             |                                         | $T_J=150^\circ C$ | 250  |        |
| $I^2t$      | $I^2t$ - value                          | $T_J=25^\circ C$  | 450  | $A^2s$ |
|             |                                         | $T_J=150^\circ C$ | 312  |        |

### Electrical Characteristics of Diode( $T_C=25^\circ C$ unless otherwise specified)

| Symbol          | Description                                            | Conditions  |                   | Min. | Typ. | Max.  | Units        |
|-----------------|--------------------------------------------------------|-------------|-------------------|------|------|-------|--------------|
| $V_F$           | Forward Voltage                                        | $I_F=10A$   | $T_J=25^\circ C$  |      | 1.05 |       | V            |
|                 |                                                        |             | $T_J=150^\circ C$ |      | 1.00 |       |              |
| $I_R$           | Reverse Current                                        | $V_R=1600V$ | $T_J=25^\circ C$  |      |      | 1     | mA           |
| $R_{\theta JC}$ | Diode Thermal Resistance: Junction-to-Case (per Diode) |             |                   |      |      | 0.944 | $^\circ C/W$ |



## Internal NTC-Thermistor Characteristics

| Symbol             | Conditions                                      | Min. | Typ. | Max. | Units |
|--------------------|-------------------------------------------------|------|------|------|-------|
| R <sub>25</sub>    | T <sub>C</sub> =25°C                            |      | 22.7 |      | kΩ    |
| ΔR/R               | T <sub>C</sub> =100°C, R <sub>100</sub> =481Ω   |      |      | ±3   | %     |
| P <sub>25</sub>    | T <sub>C</sub> =25°C                            | 5    |      |      | mW    |
| B <sub>25/50</sub> | $R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$ | 3950 |      |      | K     |
| B <sub>25/80</sub> | $R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$ | 4000 |      |      | K     |

## Module

| Symbol             | Description                                        |                    | Min.                           | Typ. | Max. | Units |
|--------------------|----------------------------------------------------|--------------------|--------------------------------|------|------|-------|
| V <sub>iso</sub>   | Isolation Voltage (All Terminals Shorted)          | RMS, f=50Hz, t=30s | 4500                           |      |      | V     |
| Internal Isolation |                                                    |                    | Al <sub>2</sub> O <sub>3</sub> |      |      |       |
| 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) |                    |                                |      | 0.09 | °C/W  |
| T                  | Mounting Screw:M4                                  |                    | 1.0                            |      | 1.2  | N·m   |
| G                  | Weight                                             |                    |                                | 25   |      | g     |

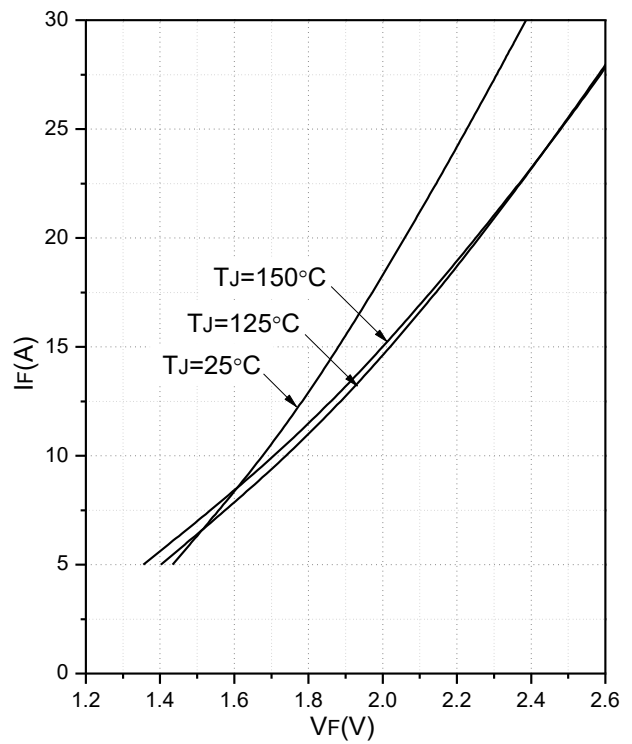
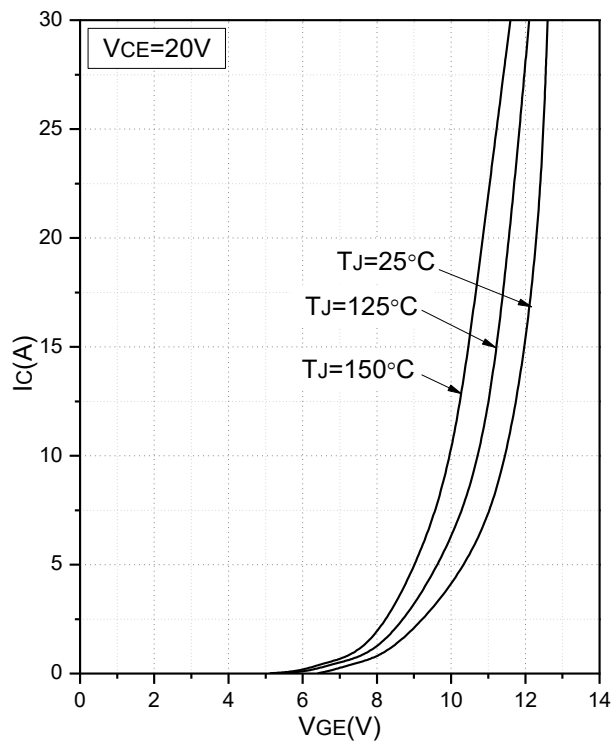
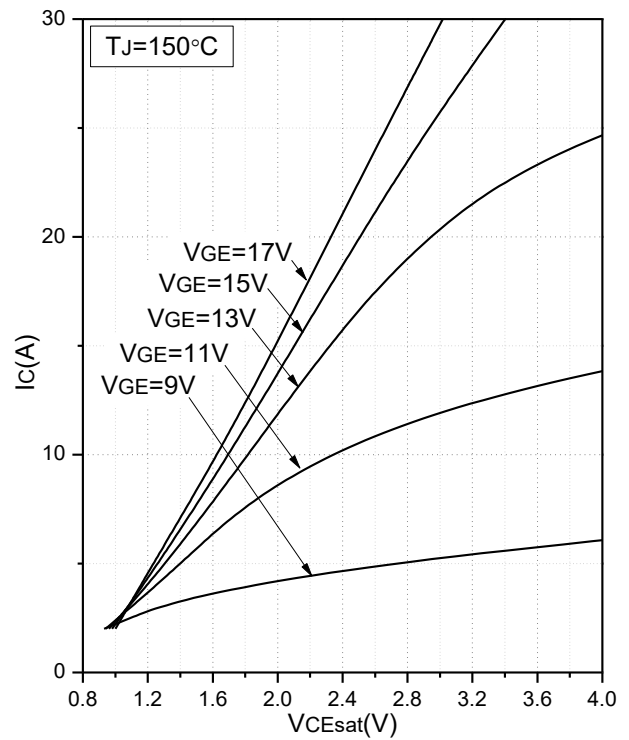
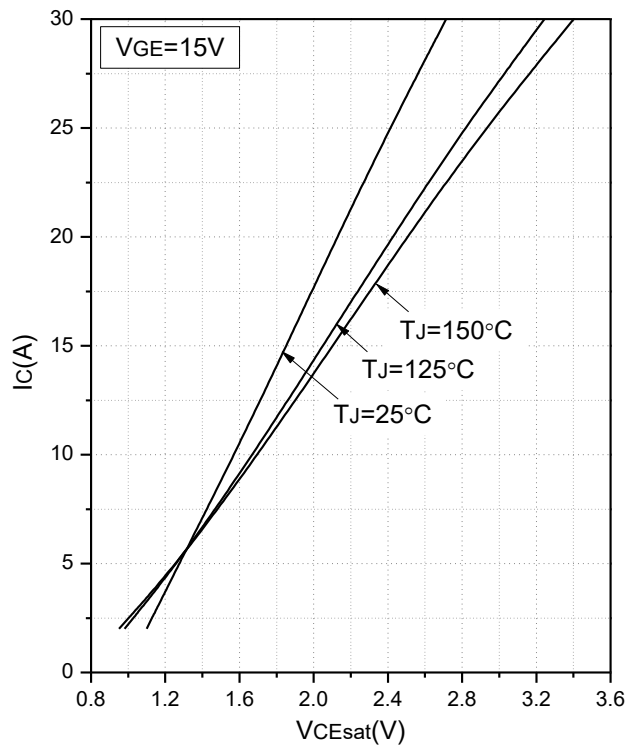


## Ordering Information Table

Device code

|   |   |    |     |     |    |   |
|---|---|----|-----|-----|----|---|
| G | T | 15 | RFF | 120 | B2 | H |
| ① | ② | ③  | ④   | ⑤   | ⑥  | ⑦ |

- ① - IGBT Module
- ② - Trench, Low Switching Losses IGBT
- ③ - Rated Current (15=15A)
- ④ - Circuit Configuration: RFF (Rectifier +Full Bridge)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)



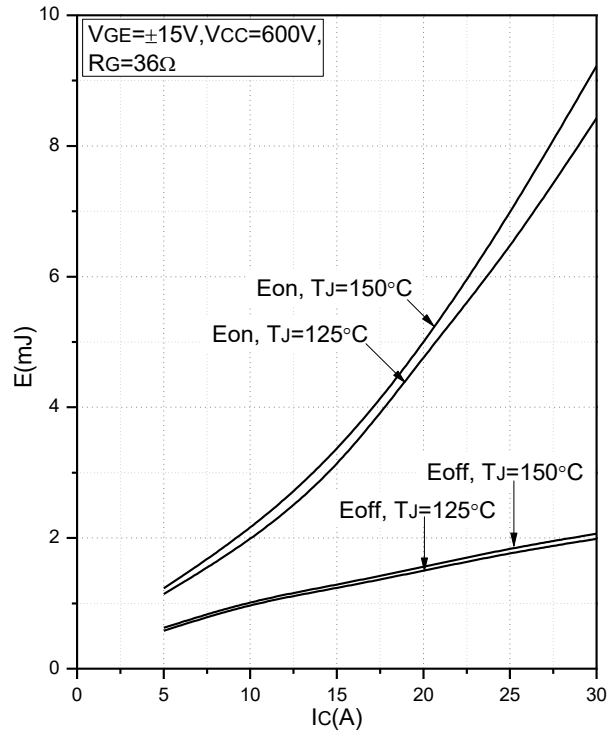


Fig.5 Typical Switching Loss vs. Collector Current

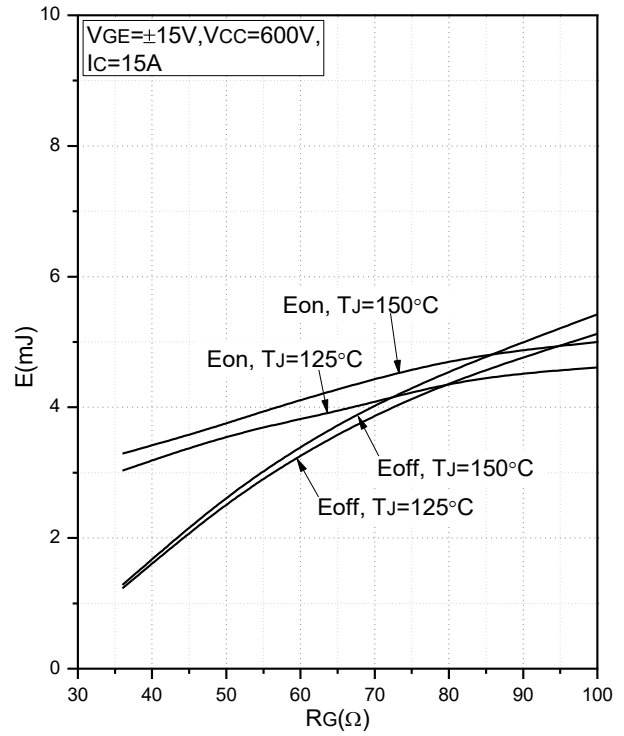


Fig.6 Typical Switching Loss vs. Forward Current

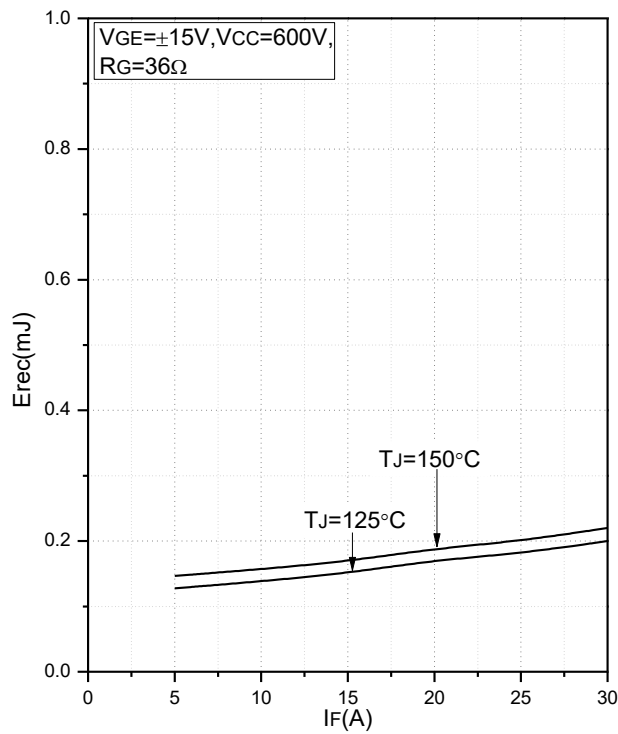


Fig.7 Typical Switching Loss vs. Gate Resistance

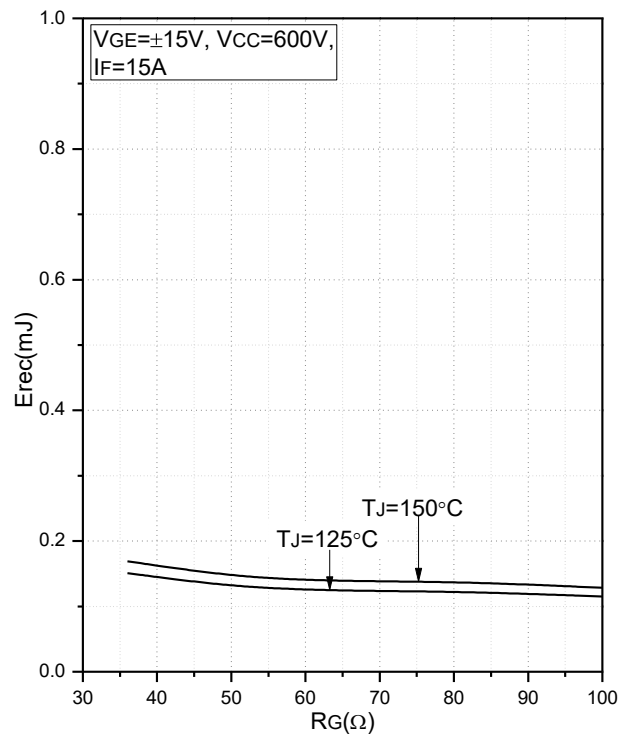


Fig.8 Typical Switching Loss vs. Gate Resistance

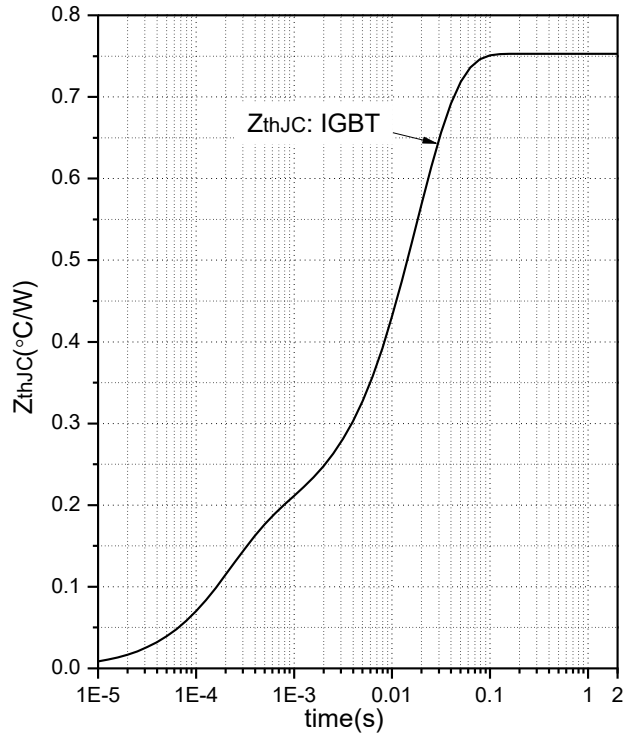


Fig.9 Transient Thermal Impedance IGBT(Inverter)

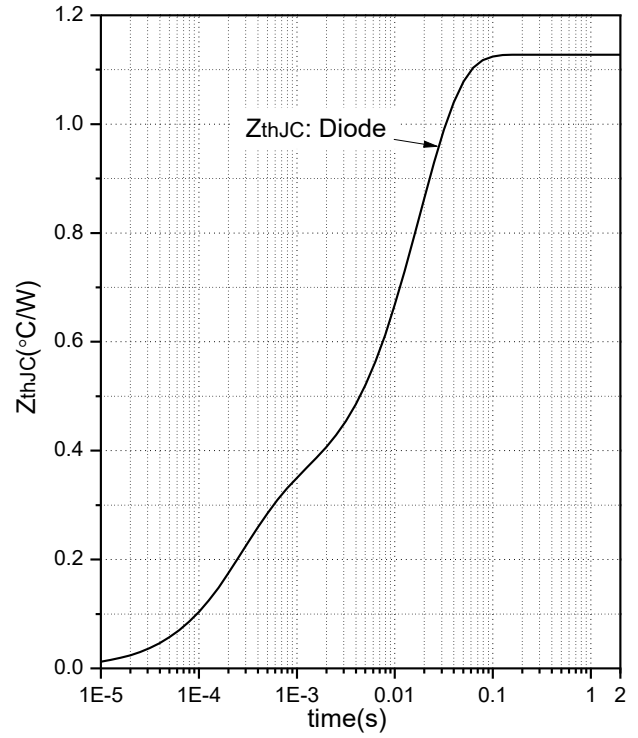


Fig.10 Transient Thermal Impedance Diode(Inverter)

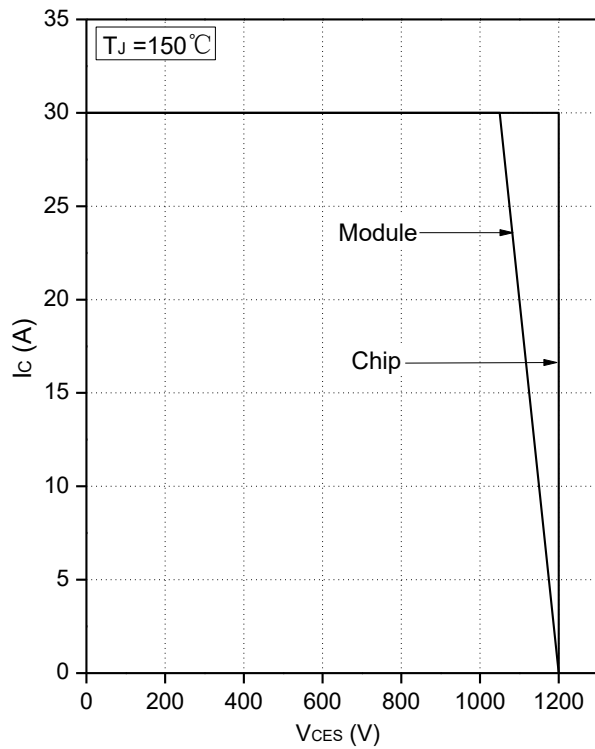


Fig.11 Reverse Bias Safe Operation Area (RBSOA)

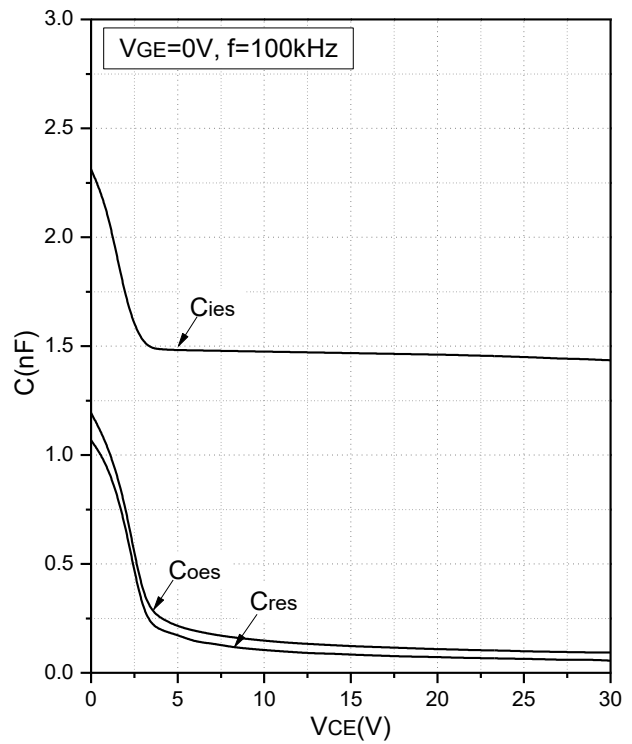


Fig.12 Capacitance Characteristics

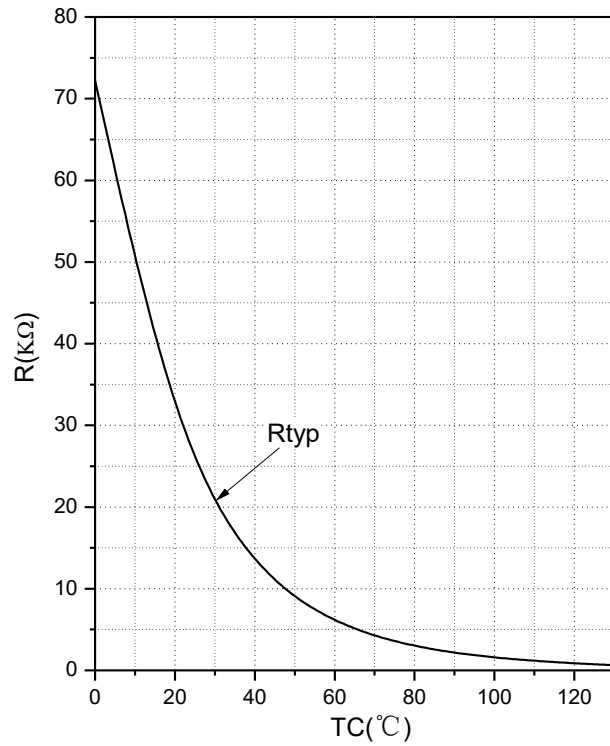
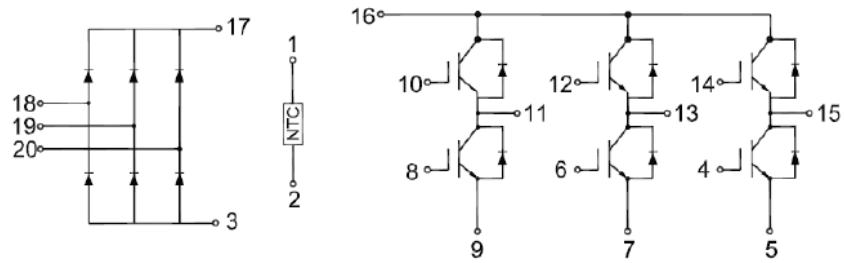


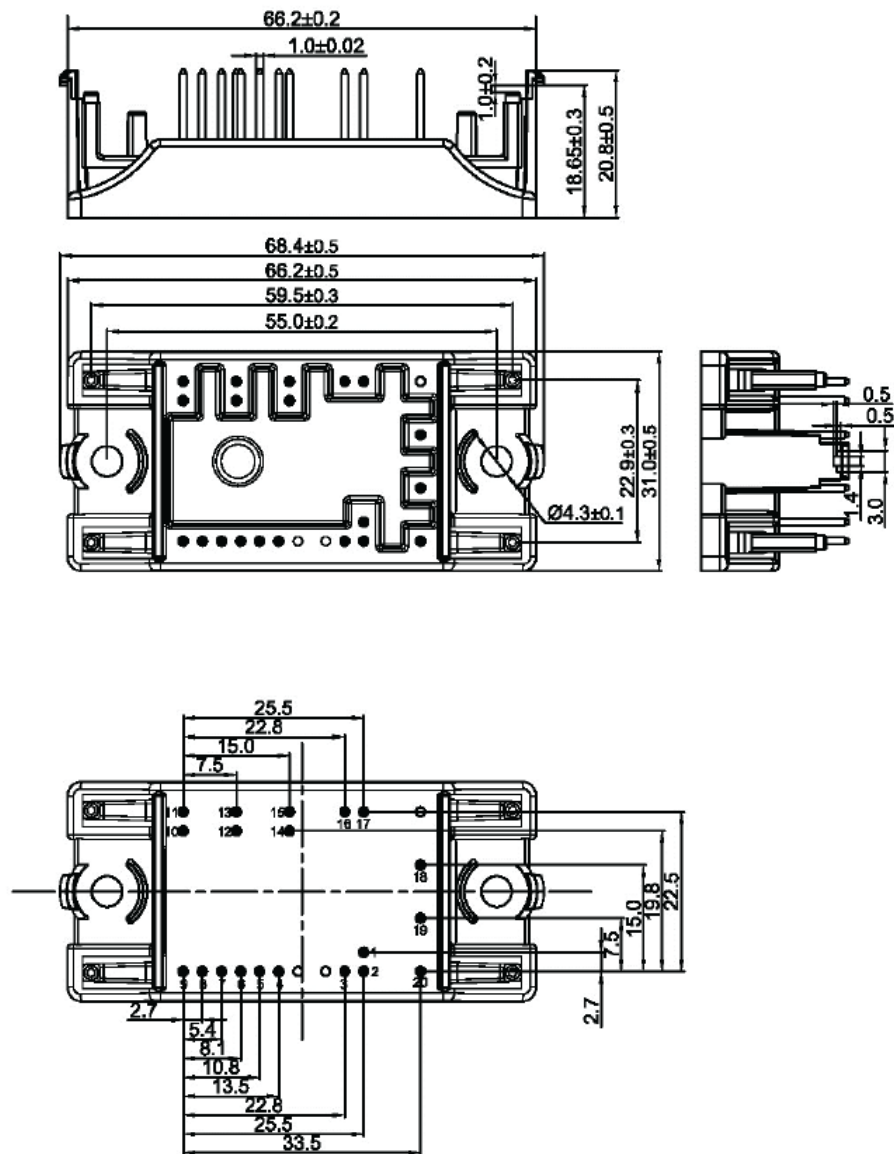
Fig.13 NTC Temperature Characteristics



## Internal Circuit



## Package Outlines (Unit: mm):





| Date       | Revision | Notes           |
|------------|----------|-----------------|
| 11/09/2023 | 01       | Initial Release |
|            |          |                 |

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