

**Key Parameters**

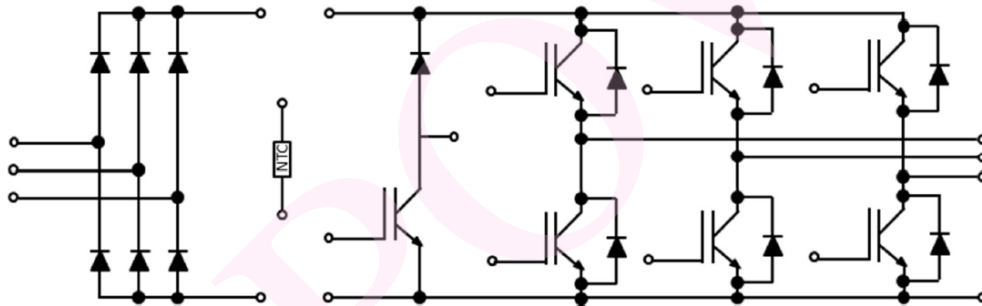
$V_{CES}$  = 1200V  
 $I_c$  = 35A

**Features**

- Low  $V_{ce(sat)}$
- Fast switching
- High ruggedness
- High short circuit capability

**Applications**

- Inverter for motor drive
- Frequency converters
- UPS
- General purpose Inverters



Equivalent Circuit Schematic

|                   |                               |
|-------------------|-------------------------------|
| Prepared by : ABA | Date of Publication : 10.2022 |
| Approved by :     | Revision : 0                  |

| Absolute Maximum Ratings: IGBT, Inverter  |   |  |   |      |      |      |
|---|---|--|---|------|------|------|
| Symbol                                    | Characteristic  | Value  | Unit  |      |      |      |
| V <sub>CES</sub>                          | Collector-Emitter Voltage   | 1200   | V   |      |      |      |
| I <sub>CDC</sub>                          | Continuous DC Collector Current ( T <sub>C</sub> =100°C, T <sub>J</sub> =175°C) | 35   | A   |      |      |      |
| I <sub>CRM</sub>                          | Peak Collector Current ( tp=1ms)  | 70   | A   |      |      |      |
| V <sub>GES</sub>                          | Gate-Emitter Voltage  | ±20  | V   |      |      |      |
| IGBT Characteristics                      |   |  |   |      |      |      |
| Symbol                                    | Characteristic  | Conditions   | Value   |      |      | Unit |
|   |   |  | Min.  | Typ. | Max. |      |
| BV <sub>CES</sub>                         | Collector-Emitter breakdown Voltage   | V <sub>GE</sub> =0V, I <sub>C</sub> =250μA, T <sub>vj</sub> =25°C  | 1200  |      |      | V    |
| I <sub>CES</sub>                          | Collector-Emitter leakage Current   | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C   |   |      | 1.0  | mA   |
| I <sub>GES</sub>                          | Gate-Emitter leakage Current  | V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V, T <sub>vj</sub> =25°C  |   |      | 100  | ηA   |
| V <sub>GE(th)</sub>                       | Gate-emitter Threshold Voltage  | V <sub>GE</sub> =V <sub>CE</sub> , I <sub>C</sub> =1.5mA, T <sub>vj</sub> =25°C  | 5.5   | 6.5  | 7.5  | V    |
| V <sub>CE(sat)</sub>                      | Collector-Emitter Saturation Voltage  | I <sub>C</sub> =35A, V <sub>GE</sub> =15V, T <sub>vj</sub> =25°C   |   | 1.65 | 2.0  | V    |
|   |   | I <sub>C</sub> =35A, V <sub>GE</sub> =15V, T <sub>vj</sub> =125°C  |   | 2.0  |      | V    |
|   |   | I <sub>C</sub> =35A, V <sub>GE</sub> =15V, T <sub>vj</sub> =150°C  |   | 2.1  |      | V    |
| Q <sub>G</sub>                            | Gate Charge   | V <sub>CC</sub> =600V, V <sub>GE</sub> =15V, I <sub>C</sub> =35A T <sub>vj</sub> =25°C   |   | 148  |      | ηC   |
| C <sub>iss</sub>                          | Input Capacitance   | V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=1MHz, T <sub>vj</sub> =25°C   |   | 3460 |      | pF   |
| C <sub>oss</sub>                          | Output Capacitance  |  |   | 154  |      | pF   |
| C <sub>rss</sub>                          | Reverse Transfer Capacitance  |  |   | 41   |      | pF   |
| t <sub>d(on)</sub>                        | Turn-on Delay Time  | I <sub>C</sub> =35A<br>V <sub>CE</sub> = 600 V<br>V <sub>GE</sub> =0/15V<br>R <sub>G</sub> = 10Ω<br>T <sub>vj</sub> =25°C , L <sub>load</sub> =0.82mH<br>Energy loss include tail and diode reverse recovery |   | 55   |      | ηs   |
| t <sub>r</sub>                            | Rise Time   |  |   | 58   |      | ηs   |
| t <sub>d(off)</sub>                       | Turn-off Delay Time   |  |   | 300  |      | ηs   |
| t <sub>f</sub>                            | Fall Time   |  |   | 110  |      | ηs   |
| E <sub>on</sub>                           | Energy Dissipation During Turn-on Time  |  |   | 2.8  |      | mJ   |
| E <sub>off</sub>                          | Energy Dissipation During Turn-off Time   |  |   | 1.6  |      | mJ   |
| t <sub>d(on)</sub>                        | Turn-on Delay Time  |  | I <sub>C</sub> =35A<br>V <sub>CE</sub> = 600 V<br>V <sub>GE</sub> =0/15V<br>R <sub>G</sub> = 10Ω<br>T <sub>vj</sub> =150°C , L <sub>load</sub> =0.82mH<br>Energy loss include tail and diode reverse recovery |      | 57   |      |
| t <sub>r</sub>                            | Rise Time   |  |   | 60   |      | ηs   |
| t <sub>d(off)</sub>                       | Turn-off Delay Time   |  |   | 320  |      | ηs   |
| t <sub>f</sub>                            | Fall Time   |  |   | 136  |      | ηs   |
| E <sub>on</sub>                           | Energy Dissipation During Turn-on Time  |  |   | 4.95 |      | mJ   |
| E <sub>off</sub>                          | Energy Dissipation During Turn-off Time   |  |   | 2.15 |      | mJ   |
| I <sub>C(SC)</sub>                        | SC Data   | t <sub>sc</sub> ≤10μs, V <sub>GE</sub> =15V, T <sub>vj</sub> =25°C, V <sub>CC</sub> ≤600V,   |   |      | 160  |      |
| Absolute Maximum Ratings: Diode, Inverter |   |  |   |      |      |      |
| Symbol                                    | Characteristic  | Value  | Unit  |      |      |      |
| V <sub>RRM</sub>                          | Repetitive peak reverse voltage   | 1200   | V   |      |      |      |
| I <sub>F</sub>                            | Continuous DC forward current ( T <sub>C</sub> =100°C, T <sub>J</sub> =150°C)   | 35   | A   |      |      |      |
| I <sub>FRM</sub>                          | Repetitive peak forward current (tp=1ms)  | 75   | A   |      |      |      |
| Diode Characteristics                     |   |  |   |      |      |      |
| Symbol                                    | Characteristic  | Conditions   | Value   |      |      | Unit |
|   |   |  | Min.  | Typ. | Max. |      |
| V <sub>F</sub>                            | Forward Voltage   | I <sub>F</sub> =35A, T <sub>vj</sub> =25°C   |   | 2.05 | 2.45 | V    |
|   |   | I <sub>F</sub> =35A, T <sub>vj</sub> =125°C  |   | 1.75 |      | V    |
|   |   | I <sub>F</sub> =35A, T <sub>vj</sub> =150°C  |   | 1.68 |      | V    |
| Q <sub>rr</sub>                           | Recovered Charge  | I <sub>F</sub> =35A  |   | 2.15 |      | μC   |
| I <sub>rrm</sub>                          | Peak Reverse Recovery Current   | V <sub>R</sub> =600V   |   | 18   |      | A    |
| E <sub>rr</sub>                           | Reverse Recovery Energy   | -di <sub>F</sub> /dt =500A/μs<br>T <sub>vj</sub> =25°C   |   | 0.75 |      | mJ   |
|   |   | Prepared by : ABA  | Date of Publication : 10.2022   |      |      |      |
|   |   | Approved by :  | Revision : 0  |      |      |      |

| Absolute Maximum Ratings: IGBT, Break-Chopper  |   |  |   |      |      |      |    |
|--|---|--|---|------|------|------|----|
| Symbol   | Characteristic  | Value  | Unit  |      |      |      |    |
| V <sub>CEs</sub>                               | Collector-Emitter Voltage   | 1200   | V   |      |      |      |    |
| I <sub>CDc</sub>                               | Continuous DC Collector Current ( T <sub>C</sub> =100°C, T <sub>J</sub> =175°C) | 25   | A   |      |      |      |    |
| I <sub>CRM</sub>                               | Peak Collector Current ( tp=1ms)  | 50   | A   |      |      |      |    |
| V <sub>GES</sub>                               | Gate-Emitter Voltage  | ±20  | V   |      |      |      |    |
| IGBT Characteristics                           |   |  |   |      |      |      |    |
| Symbol   | Characteristic  | Conditions   | Value   |      |      | Unit |    |
|  |   |  | Min.  | Typ. | Max. |      |    |
| BV <sub>CEs</sub>                              | Collector-Emitter breakdown Voltage   | V <sub>GE</sub> =0V, I <sub>C</sub> =250μA, T <sub>vj</sub> =25°C  | 1200  |      |      | V    |    |
| I <sub>CEs</sub>                               | Collector-Emitter leakage Current   | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C   |   |      | 1.0  | mA   |    |
| I <sub>GES</sub>                               | Gate-Emitter leakage Current  | V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V, T <sub>vj</sub> =25°C  |   |      | 100  | ηA   |    |
| V <sub>GE(th)</sub>                            | Gate-emitter Threshold Voltage  | V <sub>GE</sub> =V <sub>CE</sub> , I <sub>C</sub> =600μA, T <sub>vj</sub> =25°C  | 5.5   | 6.5  | 7.5  | V    |    |
| V <sub>CE(sat)</sub>                           | Collector-Emitter Saturation Voltage  | I <sub>C</sub> =25A, V <sub>GE</sub> =15V, T <sub>vj</sub> =25°C   |   | 1.85 | 2.2  | V    |    |
|  |   | I <sub>C</sub> =25A, V <sub>GE</sub> =15V, T <sub>vj</sub> =125°C  |   | 2.3  |      | V    |    |
|  |   | I <sub>C</sub> =25A, V <sub>GE</sub> =15V, T <sub>vj</sub> =150°C  |   | 2.4  |      | V    |    |
| Q <sub>G</sub>                                 | Gate Charge   | V <sub>CC</sub> =600V, V <sub>GE</sub> =15V, I <sub>C</sub> =25A T <sub>vj</sub> =25°C   |   | 105  |      | ηC   |    |
| C <sub>iss</sub>                               | Input Capacitance   | V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=1MHz, T <sub>vj</sub> =25°C   |   | 1980 |      | pF   |    |
| C <sub>oss</sub>                               | Output Capacitance  |  |   | 110  |      | pF   |    |
| C <sub>rss</sub>                               | Reverse Transfer Capacitance  |  |   | 20   |      | pF   |    |
| t <sub>d(on)</sub>                             | Turn-on Delay Time  | I <sub>C</sub> =25A<br>V <sub>CE</sub> = 600 V<br>V <sub>GE</sub> =0/15V<br>R <sub>G</sub> = 15Ω<br>T <sub>vj</sub> =25°C , L <sub>load</sub> =0.82mH<br>Energy loss include tail and diode reverse recovery |   | 53   |      | ηs   |    |
| t <sub>r</sub>                                 | Rise Time   |  |   | 52   |      | ηs   |    |
| t <sub>d(off)</sub>                            | Turn-off Delay Time   |  |   | 210  |      | ηs   |    |
| t <sub>f</sub>                                 | Fall Time   |  |   | 126  |      | ηs   |    |
| E <sub>on</sub>                                | Energy Dissipation During Turn-on Time  |  |   | 2.0  |      | mJ   |    |
| E <sub>off</sub>                               | Energy Dissipation During Turn-off Time   |  |   | 1.25 |      | mJ   |    |
| t <sub>d(on)</sub>                             | Turn-on Delay Time  |  | I <sub>C</sub> =25A<br>V <sub>CE</sub> = 600 V<br>V <sub>GE</sub> =0/15V<br>R <sub>G</sub> = 15Ω<br>T <sub>vj</sub> =150°C , L <sub>load</sub> =0.82mH<br>Energy loss include tail and diode reverse recovery |      | 58   |      | ηs |
| t <sub>r</sub>                                 | Rise Time   |  |   |      | 55   |      | ηs |
| t <sub>d(off)</sub>                            | Turn-off Delay Time   |  |   | 260  |      | ηs   |    |
| t <sub>f</sub>                                 | Fall Time   |  |   | 176  |      | ηs   |    |
| E <sub>on</sub>                                | Energy Dissipation During Turn-on Time  |  |   | 3.3  |      | mJ   |    |
| E <sub>off</sub>                               | Energy Dissipation During Turn-off Time   |  |   | 1.6  |      | mJ   |    |
| Absolute Maximum Ratings: Diode, Break-Chopper |   |  |   |      |      |      |    |
| Symbol   | Characteristic  | Value  |   | Unit |      |      |    |
| V <sub>RRM</sub>                               | Repetitive peak reverse voltage   | 1200   | V   |      |      |      |    |
| I <sub>F</sub>                                 | Continuous DC forward current ( T <sub>C</sub> =100°C, T <sub>J</sub> =150°C)   | 15   | A   |      |      |      |    |
| I <sub>FRM</sub>                               | Repetitive peak forward current (tp=1ms)  | 30   | A   |      |      |      |    |
| Diode Characteristics                          |   |  |   |      |      |      |    |
| Symbol   | Characteristic  | Conditions   | Value   |      |      | Unit |    |
|  |   |  | Min.  | Typ. | Max. |      |    |
| V <sub>F</sub>                                 | Forward Voltage   | I <sub>F</sub> =15A, T <sub>vj</sub> =25°C   |   | 2.1  | 2.40 | V    |    |
|  |   | I <sub>F</sub> =15A, T <sub>vj</sub> =125°C  |   | 1.75 |      | V    |    |
|  |   | I <sub>F</sub> =15A, T <sub>vj</sub> =150°C  |   | 1.65 |      | V    |    |
| Q <sub>rr</sub>                                | Recovered Charge  | I <sub>F</sub> =15A  |   | 1.45 |      | μC   |    |
| I <sub>rrm</sub>                               | Peak Reverse Recovery Current   | V <sub>R</sub> =600V   |   | 16   |      | A    |    |
| E <sub>rr</sub>                                | Reverse Recovery Energy   | -di <sub>F</sub> /dt =600A/μs<br>T <sub>vj</sub> =25°C   |   | 0.5  |      | mJ   |    |
|  |   | Prepared by : ABA  | Date of Publication : 10.2022   |      |      |      |    |
|  |   | Approved by :  | Revision : 0  |      |      |      |    |

| Absolute Maximum Ratings: Diode, Rectifier |  |  |                   |      |                               |                  |
|--|--|--|-------------------|------|-------------------------------|------------------|
| Symbol                                     | Characteristic   | Value  |                   |      |                               | Unit             |
| $V_{RRM}$                                  | Repetitive peak reverse voltage                                  | 1600   |                   |      |                               | V                |
| $I_{F(AV)}$                                | Average output current 50/60Hz, sine wave ( $T_C=100^{\circ}C$ ) | 35   |                   |      |                               | A                |
| $I_{RMSM}$                                 | Maximum RMS current at rectifier output ( $T_C=100^{\circ}C$ )   | 70   |                   |      |                               | A                |
| $I_{FSM}$                                  | Surge forward current ( $V_R=0V, t_p=10msec$ )                   | 400  |                   |      |                               | A                |
| $I^2t$                                     | $I^2t$ value ( $V_R=0V, t_p=10msec$ )                            | 800  |                   |      |                               | A <sup>2</sup> s |
| Diode Characteristics                      |  |  |                   |      |                               |                  |
| Symbol                                     | Characteristic   | Conditions                                     | Value             |      |                               | Unit             |
|  |  |  | Min.              | Typ. | Max.                          |                  |
| $V_F$                                      | Forward Voltage  | $I_F=35A, T_{vj}=150^{\circ}C$                 |                   | 1.1  |                               | V                |
| $I_R$                                      | Diode reverse current  | $V_R=1600V, T_j=150^{\circ}C$                  |                   |      | 2.0                           | mA               |
| Module Characteristics                     |  |  |                   |      |                               |                  |
| Symbol                                     | Characteristic   | Conditions                                     | Value             |      |                               | Unit             |
|  |  |  | Min.              | Typ. | Max.                          |                  |
| $V_{isol}$                                 | Isolation voltage  | $t=1min, f=50Hz$                               | 2500              |      |                               | V                |
| $T_{jmax}$                                 | Maximum Junction Temperature                                     |  |                   |      | 175                           | $^{\circ}C$      |
| $T_{vjop}$                                 | Operating Junction Temperature                                   |  | -40               |      | 150                           | $^{\circ}C$      |
| $T_{stg}$                                  | Storage Temperature  |  | -40               |      | 150                           | $^{\circ}C$      |
| $R_{CC'+EE'}$                              | Module lead resistance terminal to chip                          |  |                   | 4.0  |                               | m $\Omega$       |
| $R_{AA'+CC'}$                              | Module lead resistance terminal to chip                          |  |                   | 3.0  |                               | m $\Omega$       |
| $L_{SCE}$                                  | Stray Inductance, Module   |  |                   | 35   |                               | nH               |
| $R_{\theta jc}$                            | Junction-to Case   | per IGBT-inverter                              |                   | 0.60 |                               | $^{\circ}C/W$    |
|  |  | per Diode-inverter                             |                   | 0.80 |                               | $^{\circ}C/W$    |
|  |  | per IGBT-Break Chopper                         |                   | 0.64 |                               | $^{\circ}C/W$    |
|  |  | per Diode- Break Chopper                       |                   | 1.30 |                               | $^{\circ}C/W$    |
|  |  | per Diode- Rectifier                           |                   | 0.90 |                               | $^{\circ}C/W$    |
| $R_{\theta cs}$                            | Case to Sink   | per IGBT-inverter                              |                   | 0.34 |                               | $^{\circ}C/W$    |
|  |  | per Diode-inverter                             |                   | 0.46 |                               | $^{\circ}C/W$    |
|  |  | per IGBT-Break Chopper                         |                   | 0.47 |                               | $^{\circ}C/W$    |
|  |  | per Diode- Break Chopper                       |                   | 0.70 |                               | $^{\circ}C/W$    |
|  |  | per Diode- Rectifier                           |                   | 0.40 |                               | $^{\circ}C/W$    |
|  |  | per Module                                     |                   | 0.02 |                               | $^{\circ}C/W$    |
| $M_t$                                      | Module to sink torque  |  | 3.0               |      | 6.0                           | NM               |
| $G$  | Weight of Module   |  |                   | 180  |                               | g                |
| NTC thermistors Characteristics            |  |  |                   |      |                               |                  |
| Symbol                                     | Characteristic   | Conditions                                     | Min.              | Typ. | Max.                          | Unit             |
| $R_{25}$                                   | Rated resistance   |  |                   | 5.0  |                               | k $\Omega$       |
| $\Delta R/R$                               | Deviation of R100  | $T_C=100^{\circ}C, R_{100}=493.3\Omega$        | -5                |      | 5                             | %                |
| $P_{25}$                                   | Power Dissipation  |  |                   |      | 20.0                          | mW               |
| $B_{25/50}$                                | B-value  | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$ |                   | 3375 |                               | K                |
|  |  |  | Prepared by : ABA |      | Date of Publication : 10.2022 |                  |
|  |  |  | Approved by :     |      | Revision : 0                  |                  |

• Typical Electrical Characteristics

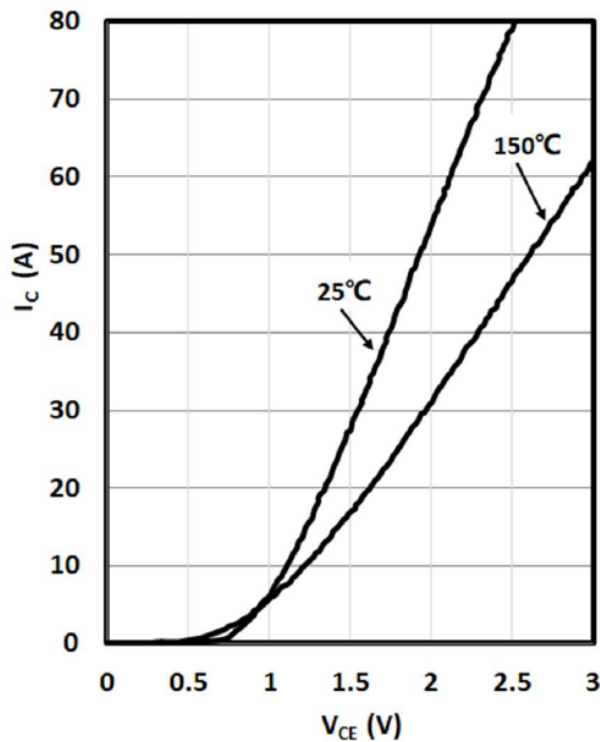


Fig. 1 IGBT (Inverter) Output Characteristics

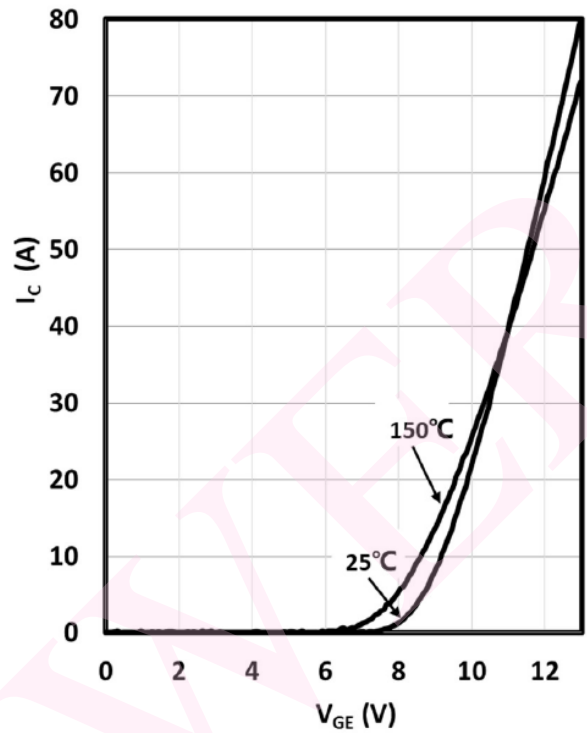


Fig. 2 IGBT (Inverter) Transfer Characteristics

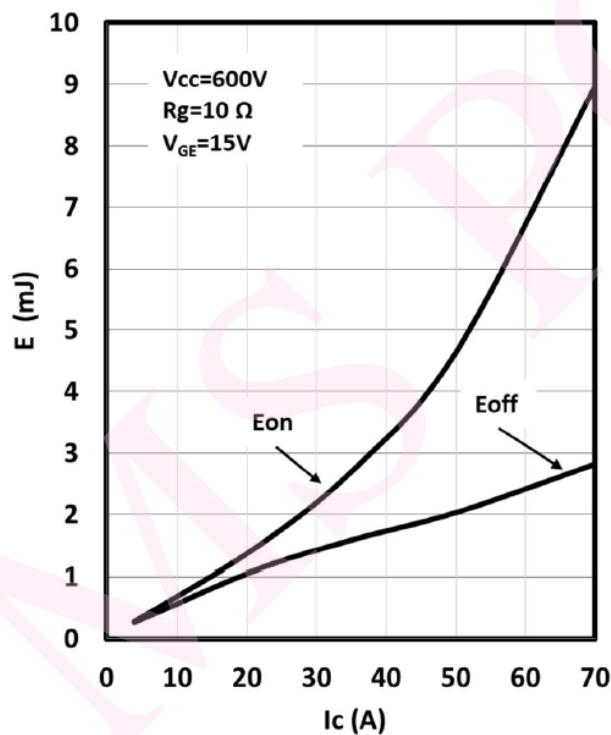


Fig. 3 IGBT (Inverter) Switching Loss vs. Ic

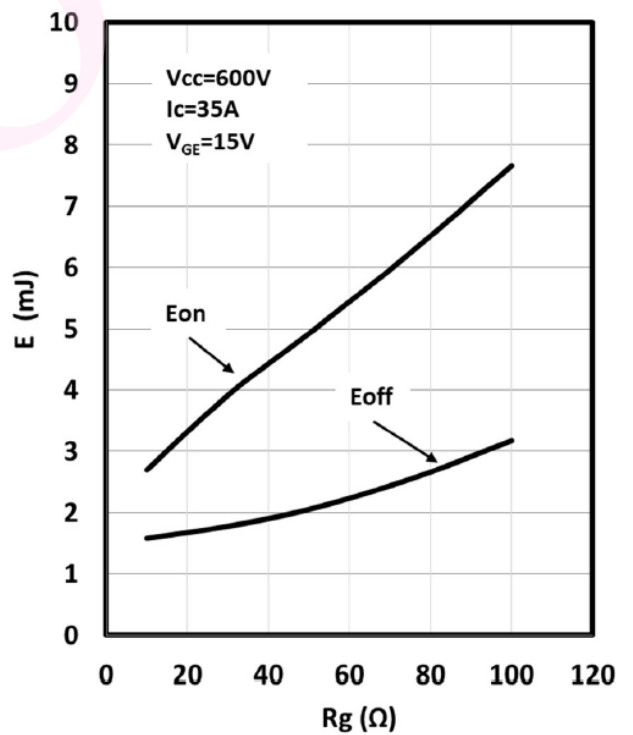


Fig. 4 IGBT (Inverter) Switching Loss vs. Rg

|                   |                               |
|-------------------|-------------------------------|
| Prepared by : ABA | Date of Publication : 10.2022 |
| Approved by :     | Revision : 0                  |

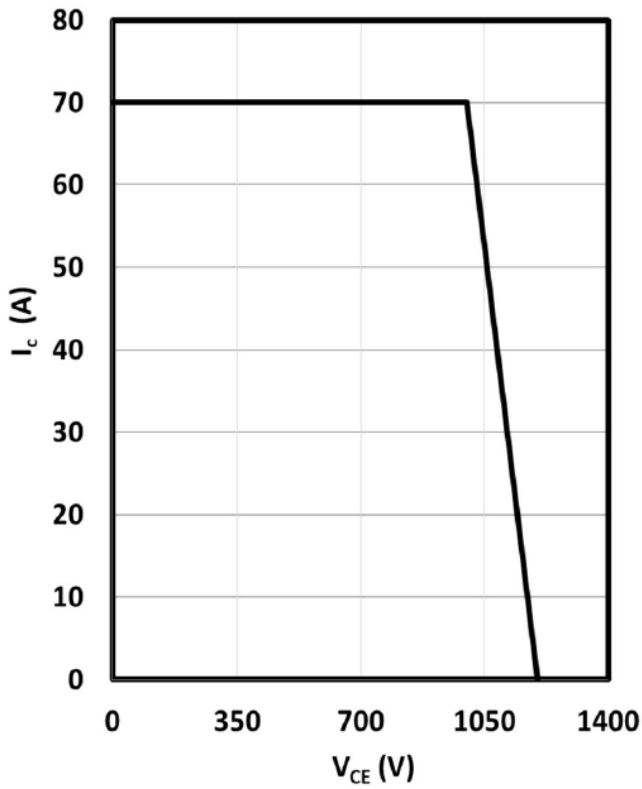


Fig. 5 RBSOA

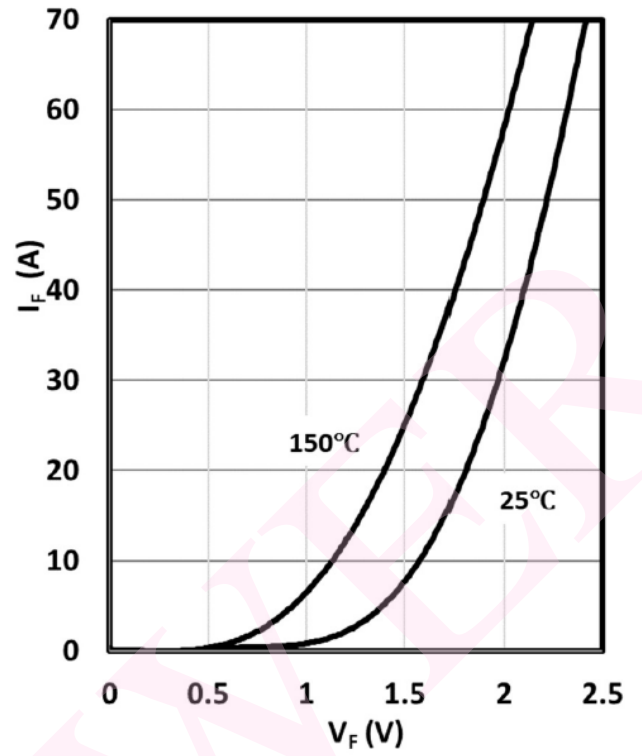


Fig. 6 Diode (Inverter) Forward Characteristics

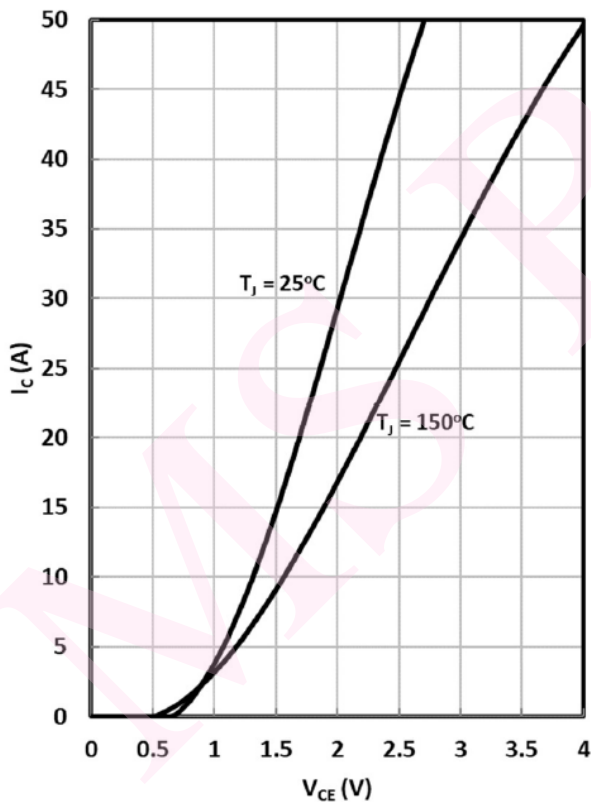


Fig. 7 IGBT (Brake-Chopper) Output Characteristics

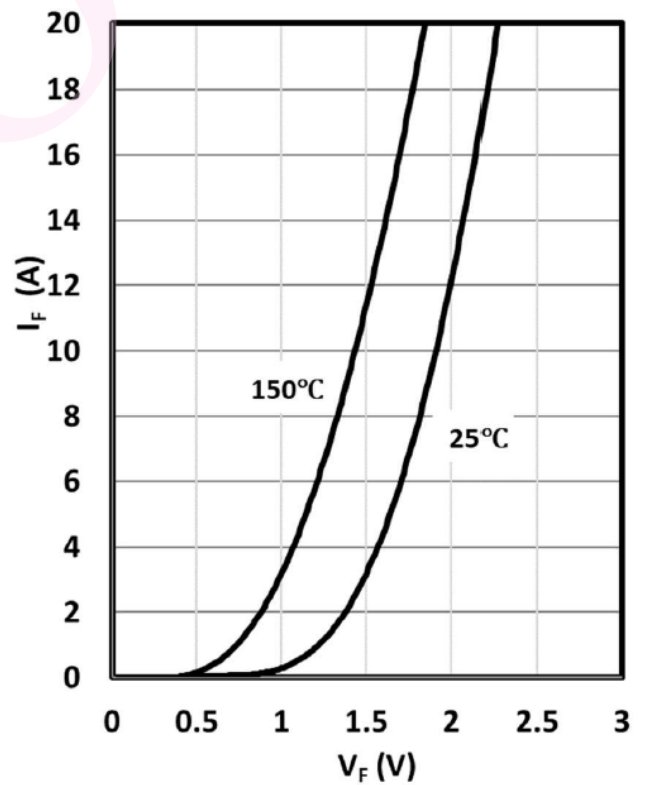


Fig. 8 Diode (Brake-Chopper) Output Characteristics

|                   |                               |
|-------------------|-------------------------------|
| Prepared by : ABA | Date of Publication : 10.2022 |
| Approved by :     | Revision : 0                  |

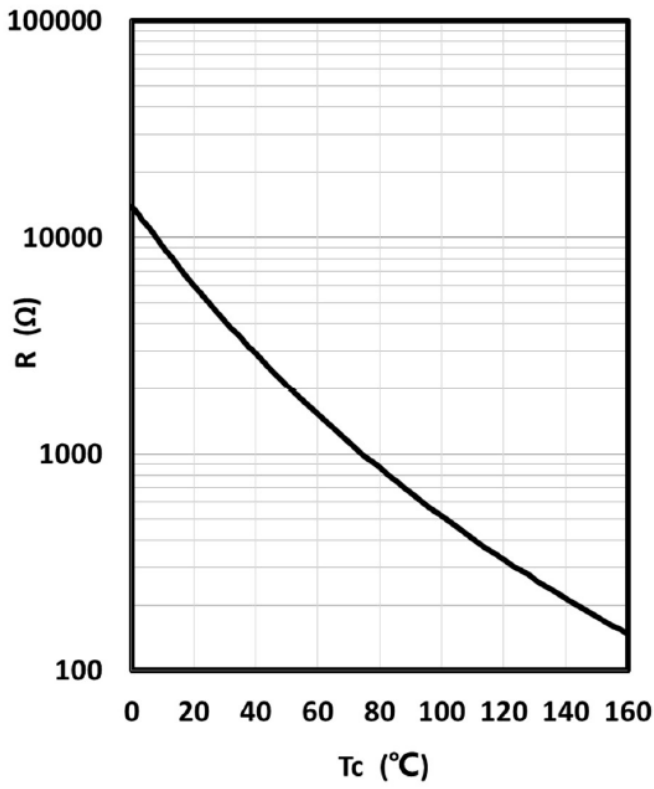
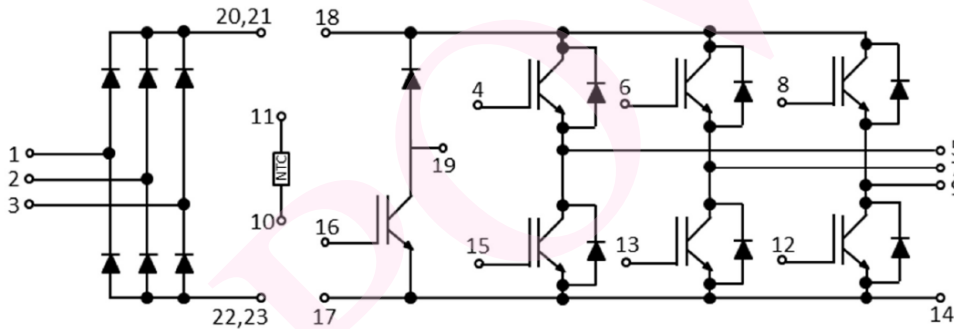
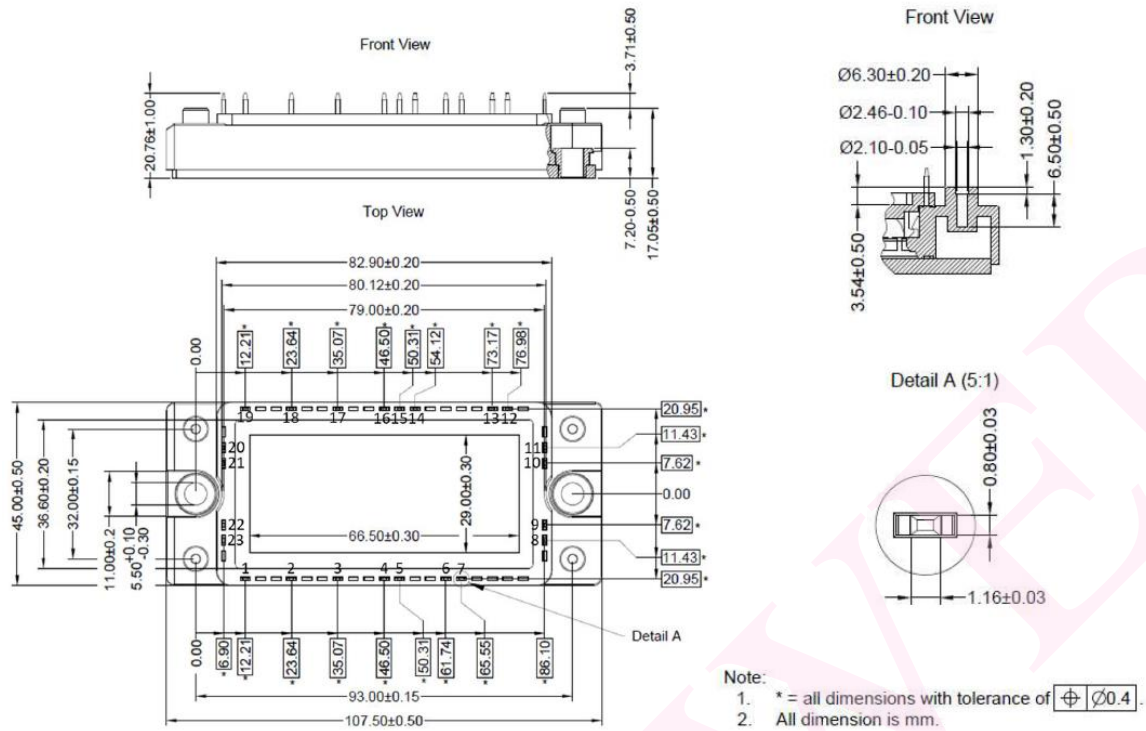


Fig. 9 NTC Temperature Characteristics

|                   |                               |
|-------------------|-------------------------------|
| Prepared by : ABA | Date of Publication : 10.2022 |
| Approved by :     | Revision : 0                  |

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