

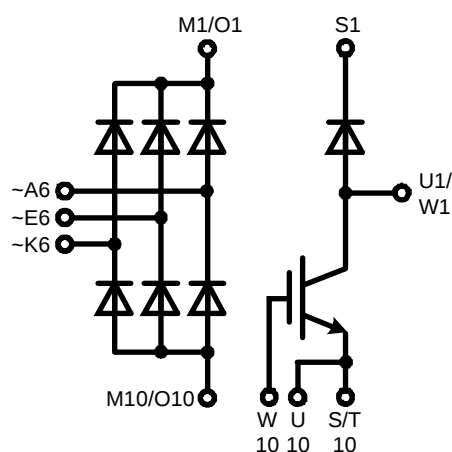
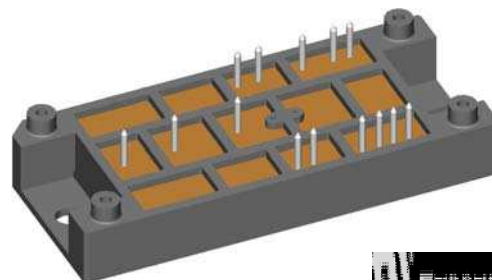
## Standard Rectifier Module

| 3 ~ Rectifier              | Brake Chopper                 |
|----------------------------|-------------------------------|
| $V_{RRM} = 1600 \text{ V}$ | $V_{CES} = 1200 \text{ V}$    |
| $I_{DAVM} = 188 \text{ A}$ | $I_{C25} = 155 \text{ A}$     |
| $I_{FSM} = 1100 \text{ A}$ | $V_{CE(sat)} = 1.9 \text{ V}$ |

### 3~ Rectifier Bridge + Brake Unit

Part name

**VUB120-16NOX**



#### Features / Advantages:

- Soldering connections for PCB mounting
- Convenient package outline

#### Applications:

- 3~ Rectifier with brake unit for drive inverters

#### Package:

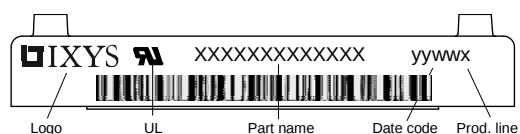
- Housing: V2-Pack
- DCB ceramic base plate
- Isolation voltage 3600 V~
- Easy to mount with two screws
- Space and weight savings
- RoHS compliant

| Rectifier    |                                              |                                                             |                                | Ratings                        |      |      |                   |
|--------------|----------------------------------------------|-------------------------------------------------------------|--------------------------------|--------------------------------|------|------|-------------------|
| Symbol       | Definition                                   | Conditions                                                  |                                | min.                           | typ. | max. | Unit              |
| $V_{RSM}$    | max. non-repetitive reverse blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$                               |                                |                                |      | 1700 | V                 |
| $V_{RRM}$    | max. repetitive reverse blocking voltage     | $T_{VJ} = 25^{\circ}\text{C}$                               |                                |                                |      | 1600 | V                 |
| $I_R$        | reverse current, drain current               | $V_{R/D} = 1600\text{ V}$                                   | $T_{VJ} = 25^{\circ}\text{C}$  |                                |      | 50   | $\mu\text{A}$     |
|              |                                              | $V_{R/D} = 1600\text{ V}$                                   | $T_{VJ} = 125^{\circ}\text{C}$ |                                |      | 2    | mA                |
| $V_F$        | forward voltage drop                         | $I_T = 60\text{ A}$                                         | $T_{VJ} = 25^{\circ}\text{C}$  |                                |      | 1.16 | V                 |
|              |                                              | $I_T = 120\text{ A}$                                        |                                |                                |      | 1.36 | V                 |
|              |                                              | $I_T = 60\text{ A}$                                         | $T_{VJ} = 125^{\circ}\text{C}$ |                                |      | 1.09 | V                 |
|              |                                              | $I_T = 120\text{ A}$                                        |                                |                                |      | 1.35 | V                 |
| $I_{D(AV)M}$ | bridge output current                        | $T_C = 80^{\circ}\text{C}$<br>rectangular $d = \frac{1}{3}$ | $T_{VJ} = 150^{\circ}\text{C}$ |                                |      | 188  | A                 |
| $V_{FO}$     | threshold voltage                            | } for power loss calculation only                           |                                | $T_{VJ} = 150^{\circ}\text{C}$ |      | 0.81 | V                 |
| $r_F$        | slope resistance                             |                                                             |                                |                                |      | 4.4  | m $\Omega$        |
| $R_{thJC}$   | thermal resistance junction to case          |                                                             |                                |                                |      | 0.60 | K/W               |
| $R_{thCH}$   | thermal resistance case to heatsink          |                                                             |                                |                                | 0.2  |      | K/W               |
| $P_{tot}$    | total power dissipation                      | $T_C = 25^{\circ}\text{C}$                                  |                                |                                |      | 200  | W                 |
| $I_{FSM}$    | max. forward surge current                   | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$            | $T_{VJ} = 45^{\circ}\text{C}$  |                                |      | 1.10 | kA                |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$           | $V_R = 0\text{ V}$             |                                |      | 1.19 | kA                |
|              |                                              | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$            | $T_{VJ} = 150^{\circ}\text{C}$ |                                |      | 935  | A                 |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$           | $V_R = 0\text{ V}$             |                                |      | 1.01 | kA                |
| $I^2t$       | value for fusing                             | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$            | $T_{VJ} = 45^{\circ}\text{C}$  |                                |      | 6.05 | kA <sup>2</sup> s |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$           | $V_R = 0\text{ V}$             |                                |      | 5.89 | kA <sup>2</sup> s |
|              |                                              | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$            | $T_{VJ} = 150^{\circ}\text{C}$ |                                |      | 4.37 | kA <sup>2</sup> s |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$           | $V_R = 0\text{ V}$             |                                |      | 4.25 | kA <sup>2</sup> s |
| $C_J$        | junction capacitance                         | $V_R = 400\text{ V}$ $f = 1\text{ MHz}$                     | $T_{VJ} = 25^{\circ}\text{C}$  |                                | 37   |      | pF                |

| Brake IGBT    |                                       |                                                                                                                                                                                                                                                                               |                                | Ratings |      |          |               |
|---------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|------|----------|---------------|
| Symbol        | Definition                            | Conditions                                                                                                                                                                                                                                                                    |                                | min.    | typ. | max.     | Unit          |
| $V_{CES}$     | collector emitter voltage             | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                                                                                                 |                                |         |      | 1200     | V             |
| $V_{GES}$     | max. DC gate voltage                  |                                                                                                                                                                                                                                                                               |                                |         |      | $\pm 20$ | V             |
| $V_{GEM}$     | max. transient collector gate voltage |                                                                                                                                                                                                                                                                               |                                |         |      | $\pm 30$ | V             |
| $I_{C25}$     | collector current                     | $T_C = 25^{\circ}\text{C}$                                                                                                                                                                                                                                                    |                                |         |      | 155      | A             |
| $I_{C80}$     |                                       | $T_C = 80^{\circ}\text{C}$                                                                                                                                                                                                                                                    |                                |         |      | 107      | A             |
| $P_{tot}$     | total power dissipation               | $T_C = 25^{\circ}\text{C}$                                                                                                                                                                                                                                                    |                                |         |      | 500      | W             |
| $V_{CE(sat)}$ | collector emitter saturation voltage  | $I_C = 100\text{ A}; V_{GE} = 15\text{ V}$                                                                                                                                                                                                                                    | $T_{VJ} = 25^{\circ}\text{C}$  |         | 1.9  | 2.2      | V             |
|               |                                       |                                                                                                                                                                                                                                                                               | $T_{VJ} = 125^{\circ}\text{C}$ |         | 2.5  |          | V             |
| $V_{GE(th)}$  | gate emitter threshold voltage        | $I_C = 4\text{ mA}; V_{GE} = V_{CE}$                                                                                                                                                                                                                                          | $T_{VJ} = 25^{\circ}\text{C}$  | 5.4     | 5.9  | 6.5      | V             |
| $I_{CES}$     | collector emitter leakage current     | $V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$                                                                                                                                                                                                                                       | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 0.1      | mA            |
|               |                                       |                                                                                                                                                                                                                                                                               | $T_{VJ} = 125^{\circ}\text{C}$ |         | 0.1  |          | mA            |
| $I_{GES}$     | gate emitter leakage current          | $V_{GE} = \pm 20\text{ V}$                                                                                                                                                                                                                                                    |                                |         |      | 500      | nA            |
| $Q_{G(on)}$   | total gate charge                     | $V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 100\text{ A}$                                                                                                                                                                                                             |                                |         | 295  |          | nC            |
| $t_{d(on)}$   | turn-on delay time                    | <div style="display: flex; align-items: center;"> <div style="font-size: 4em; margin-right: 10px;">}</div> <div> inductive load<br/> <math>V_{CE} = 600\text{ V}; I_C = 100\text{ A}</math><br/> <math>V_{GE} = \pm 15\text{ V}; R_G = 6.8\text{ }\Omega</math> </div> </div> | $T_{VJ} = 125^{\circ}\text{C}$ |         | 70   |          | ns            |
| $t_r$         | current rise time                     |                                                                                                                                                                                                                                                                               |                                |         | 40   |          | ns            |
| $t_{d(off)}$  | turn-off delay time                   |                                                                                                                                                                                                                                                                               |                                |         | 250  |          | ns            |
| $t_f$         | current fall time                     |                                                                                                                                                                                                                                                                               |                                |         | 100  |          | ns            |
| $E_{on}$      | turn-on energy per pulse              |                                                                                                                                                                                                                                                                               |                                |         | 8.5  |          | mJ            |
| $E_{off}$     | turn-off energy per pulse             |                                                                                                                                                                                                                                                                               |                                |         | 11.5 |          | mJ            |
| <b>RBSOA</b>  | reverse bias safe operating area      | $V_{GE} = \pm 15\text{ V}; R_G = 6.8\text{ }\Omega$                                                                                                                                                                                                                           | $T_{VJ} = 125^{\circ}\text{C}$ |         |      |          |               |
| $I_{CM}$      |                                       | $V_{CEK} = 1200\text{ V}$                                                                                                                                                                                                                                                     |                                |         |      | 300      | A             |
| <b>SCSOA</b>  | short circuit safe operating area     |                                                                                                                                                                                                                                                                               |                                |         |      |          |               |
| $t_{sc}$      | short circuit duration                | $V_{CE} = 720\text{ V}; V_{GE} = \pm 15\text{ V}$                                                                                                                                                                                                                             | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 10       | $\mu\text{s}$ |
| $I_{sc}$      | short circuit current                 | $R_G = 6.8\text{ }\Omega$ ; non-repetitive                                                                                                                                                                                                                                    |                                |         | 400  |          | A             |
| $R_{thJC}$    | thermal resistance junction to case   |                                                                                                                                                                                                                                                                               |                                |         |      | 0.25     | K/W           |
| $R_{thCH}$    | thermal resistance case to heatsink   |                                                                                                                                                                                                                                                                               |                                |         | 0.1  |          | K/W           |

| Brake Diode |                                     |                                                                                                                                                                                                                                                          |                                |  |     |      |               |
|-------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--|-----|------|---------------|
| $V_{RRM}$   | max. repetitive reverse voltage     | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                                                                            |                                |  |     | 1200 | V             |
| $I_{F25}$   | forward current                     | $T_C = 25^{\circ}\text{C}$                                                                                                                                                                                                                               |                                |  |     | 62   | A             |
| $I_{F80}$   |                                     | $T_C = 80^{\circ}\text{C}$                                                                                                                                                                                                                               |                                |  |     | 40   | A             |
| $V_F$       | forward voltage                     | $I_F = 30\text{ A}$                                                                                                                                                                                                                                      | $T_{VJ} = 25^{\circ}\text{C}$  |  |     | 2.71 | V             |
|             |                                     |                                                                                                                                                                                                                                                          | $T_{VJ} = 125^{\circ}\text{C}$ |  |     | 1.94 | V             |
| $I_R$       | reverse current                     | $V_R = V_{RRM}$                                                                                                                                                                                                                                          | $T_{VJ} = 25^{\circ}\text{C}$  |  |     | 0.25 | mA            |
|             |                                     |                                                                                                                                                                                                                                                          | $T_{VJ} = 125^{\circ}\text{C}$ |  |     | 1    | mA            |
| $Q_{rr}$    | reverse recovery charge             | <div style="display: flex; align-items: center;"> <div style="font-size: 4em; margin-right: 10px;">}</div> <div> <math>V_R = 600\text{ V}</math><br/> <math>-di_F/dt = 400\text{ A}/\mu\text{s}</math><br/> <math>I_F = 30\text{ A}</math> </div> </div> | $T_{VJ} = 125^{\circ}\text{C}$ |  | 1.8 |      | $\mu\text{C}$ |
| $I_{RM}$    | max. reverse recovery current       |                                                                                                                                                                                                                                                          |                                |  | 23  |      | A             |
| $t_{rr}$    | reverse recovery time               |                                                                                                                                                                                                                                                          |                                |  | 150 |      | ns            |
| $R_{thJC}$  | thermal resistance junction to case |                                                                                                                                                                                                                                                          |                                |  |     | 0.9  | K/W           |
| $R_{thCH}$  | thermal resistance case to heatsink |                                                                                                                                                                                                                                                          |                                |  | 0.3 |      | K/W           |

| Package V2-Pack |                                                              |                      | Ratings |      |      |      |
|-----------------|--------------------------------------------------------------|----------------------|---------|------|------|------|
| Symbol          | Definition                                                   | Conditions           | min.    | typ. | max. | Unit |
| $I_{RMS}$       | $I_{RM}$ current                                             | per terminal         |         |      | 100  | A    |
| $T_{stg}$       | storage temperature                                          |                      | -40     |      | 125  | °C   |
| $T_{vj}$        | virtual junction temperature                                 |                      | -40     |      | 150  | °C   |
| Weight          |                                                              |                      |         | 76   |      | g    |
| $M_D$           | mounting torque                                              |                      | 2       |      | 2.5  | Nm   |
| $V_{ISOL}$      | isolation voltage                                            | t = 1 second         | 3600    |      |      | V    |
|                 |                                                              | t = 1 minute         | 3000    |      |      | V    |
| $d_{Spp/App}$   | creepage distance on surface   striking distance through air | terminal to terminal | 6.0     |      |      | mm   |
| $d_{Spb/Appb}$  |                                                              | terminal to backside | 12.0    |      |      | mm   |



| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | VUB120-16NOX    | VUB120-16NOX       | Box           | 6        | 510468   |

| Similar Part  | Package | Voltage class |
|---------------|---------|---------------|
| VUB120-16NOXT | V2-Pack | 1600          |

Technical drawing of a mechanical part, likely a bracket or support, showing dimensions and features. The part has a total length of 93 and a width of 17. It features a central section with a diameter of 1.5 and a length of 65 x 38. The drawing includes various dimension lines, a scale bar, and a title block.

Technical drawing of a conical pin. The drawing shows a cross-section of the pin with a central hole. The dimensions are as follows:

- Diameter:  $\varnothing 1.5$  (DIN 46 431)
- Height of the conical part:  $0.5 \pm 0.2$
- Total height:  $1.5 +0.6 / -0.3$

Technical drawing of a rectangular plate with dimensions and markings. The drawing shows a top view of the plate with various dimensions and a marking area.

**Dimensions:**

- Overall width:  $80 \pm 0.3$
- Overall height:  $40.4$
- Top edge dimensions (from left to right):
  - $10.45 \pm 0.3$
  - $22.85 \pm 0.3$
  - $42.65 \pm 0.3$
  - $12.4 \pm 0.3$
  - $4 \pm 0.3$
  - $9.4 \pm 0.3$
  - $0.6 \pm 0.3$
- Left edge dimensions (from top to bottom):
  - $4.04$
  - $32$
  - $23.8$
  - $\phi 5.5$
- Right edge dimensions (from top to bottom):
  - $5.5$
  - $30.8 \pm 0.3$
- Bottom edge dimensions (from left to right):
  - $0.5$
  - $42.65 \pm 0.3$
  - $4 \pm 0.3$
  - $56.05 \pm 0.3$
  - $4 \pm 0.3$
  - $64.05 \pm 0.3$
  - $4 \pm 0.3$
  - $78.5 \pm 0.3$

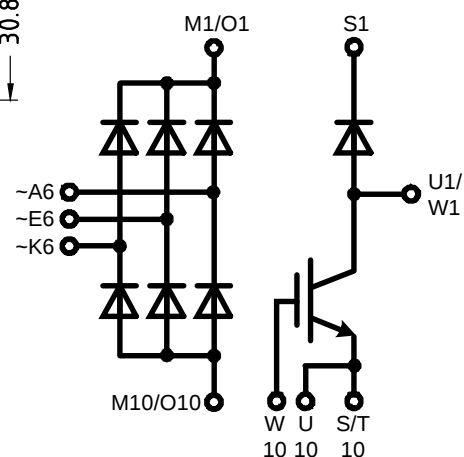
**Markings:**

- The plate is marked with letters A through W in a grid pattern.
- There are four circular holes, one in each corner, with a diameter of  $\phi 5.5$ .
- There are four rectangular holes, one in each corner, with dimensions  $4 \pm 0.3$  by  $4 \pm 0.3$ .
- There are four rectangular holes, one in each corner, with dimensions  $42.65 \pm 0.3$  by  $4 \pm 0.3$ .
- There are four rectangular holes, one in each corner, with dimensions  $56.05 \pm 0.3$  by  $4 \pm 0.3$ .
- There are four rectangular holes, one in each corner, with dimensions  $64.05 \pm 0.3$  by  $4 \pm 0.3$ .
- There are four rectangular holes, one in each corner, with dimensions  $78.5 \pm 0.3$  by  $4 \pm 0.3$ .

**Detail X** M 2:1

Technical drawing of Detail X, showing a cross-section of a mechanical part. The drawing includes the following dimensions:

- Top flange outer diameter:  $\phi 6.1$
- Top flange thickness: 1.5
- Central hole diameter (top):  $\phi 2.5$
- Bottom flange outer diameter:  $\phi 6.0$
- Bottom flange thickness: 1.4
- Central hole diameter (bottom):  $\phi 2.1$



## Rectifier

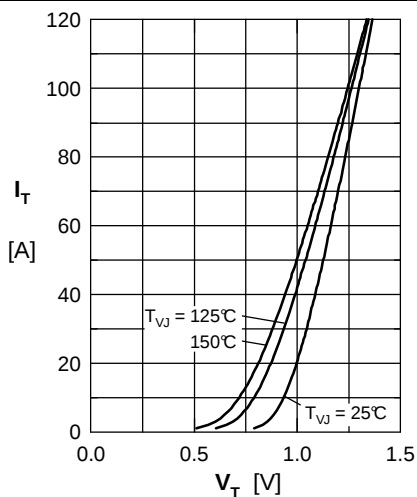


Fig.1 Forward current versus voltage drop per diode

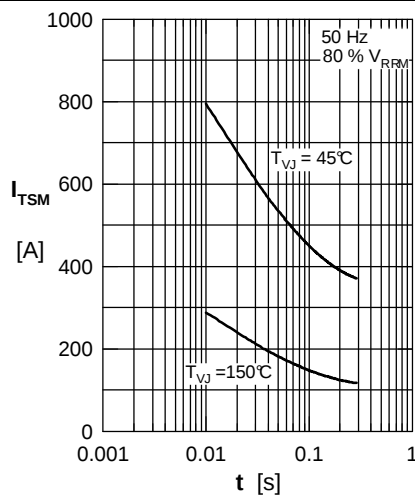


Fig.2 Surge overload current

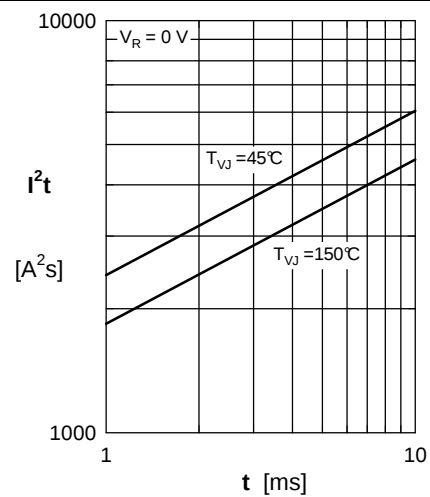


Fig.3  $I^2t$  versus time per diode

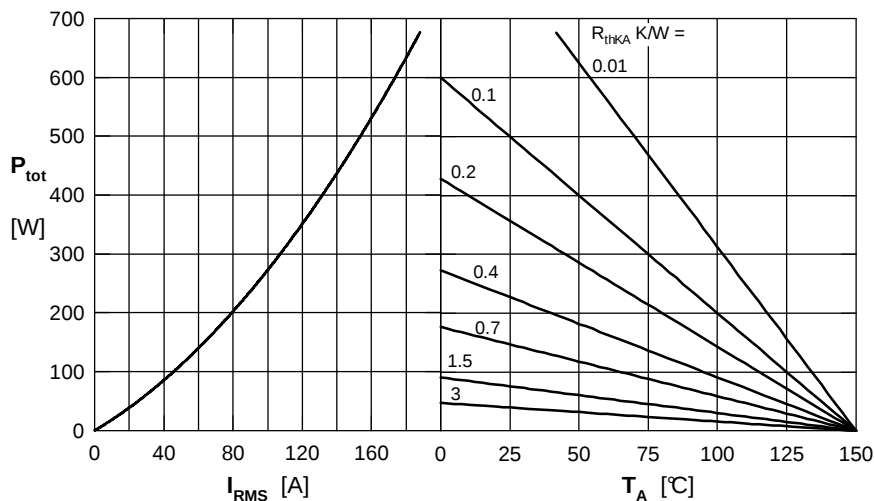


Fig.4 Power dissipation versus direct output current and ambient temperature, sine 180°

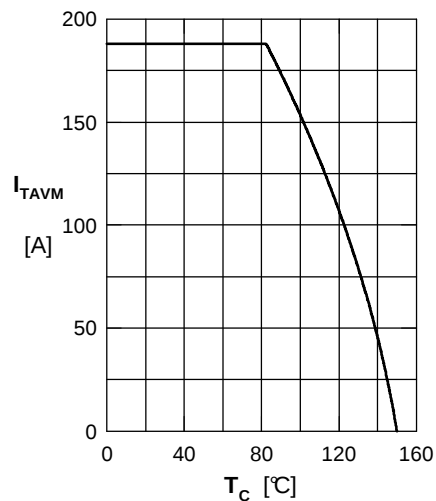


Fig.5 Max. forward current vs. case temperature

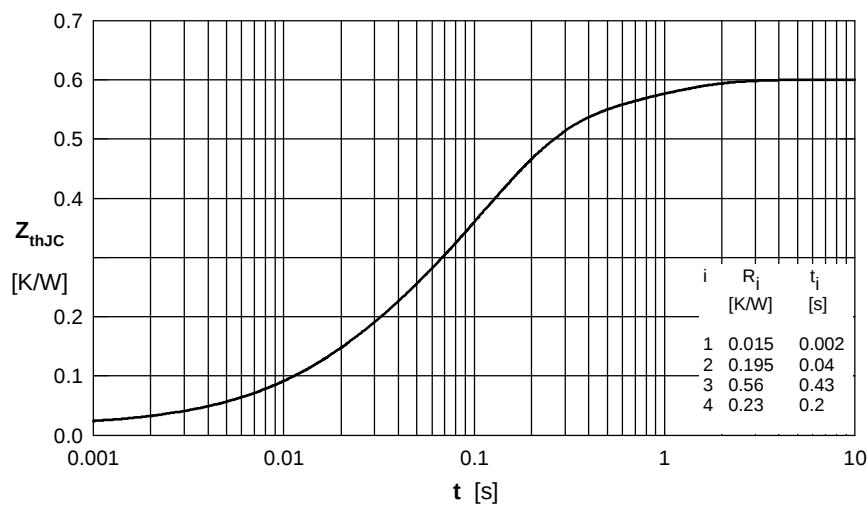


Fig.6 Transient thermal impedance junction to case

## Brake IGBT

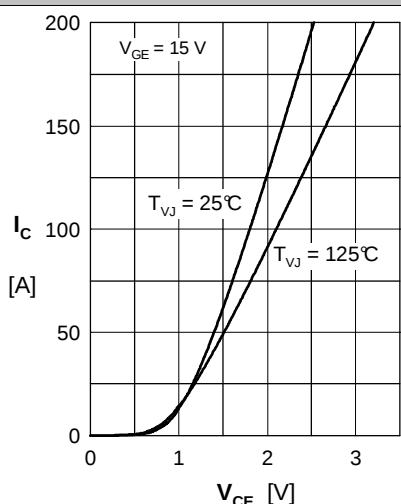


Fig. 1 Typ. output characteristics

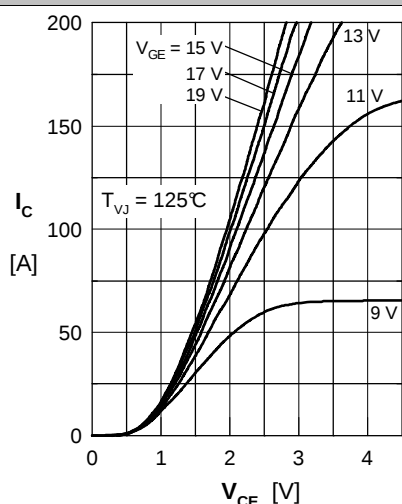


Fig. 2 Typ. output characteristics

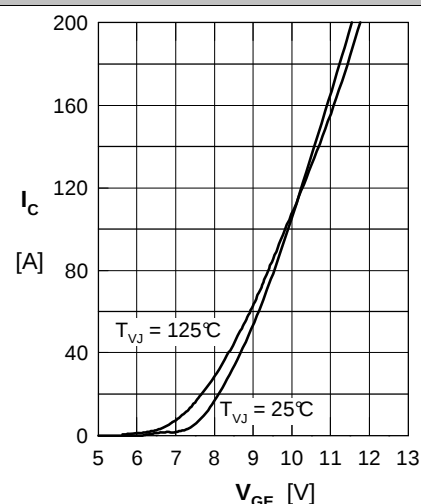


Fig. 3 Typ. transfer characteristics

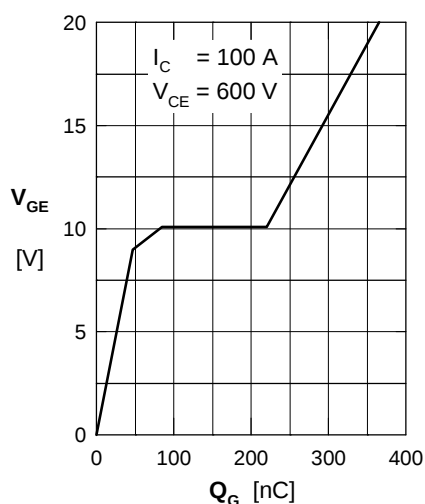


Fig. 4 Typ. turn-on gate charge

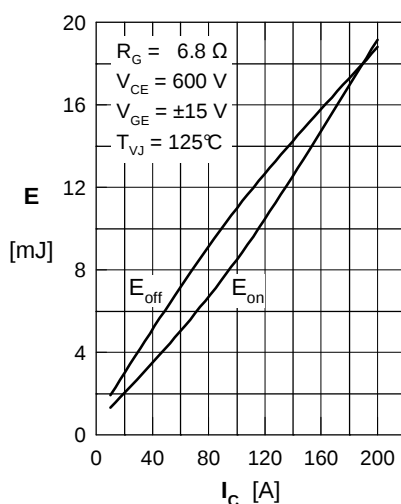


Fig. 5 Typ. switching energy versus collector current

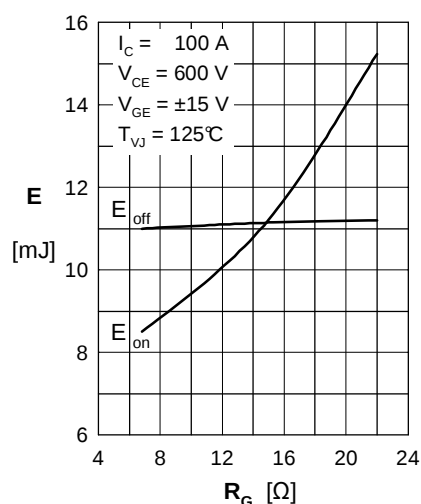


Fig. 6 Typ. switching energy versus gate resistance

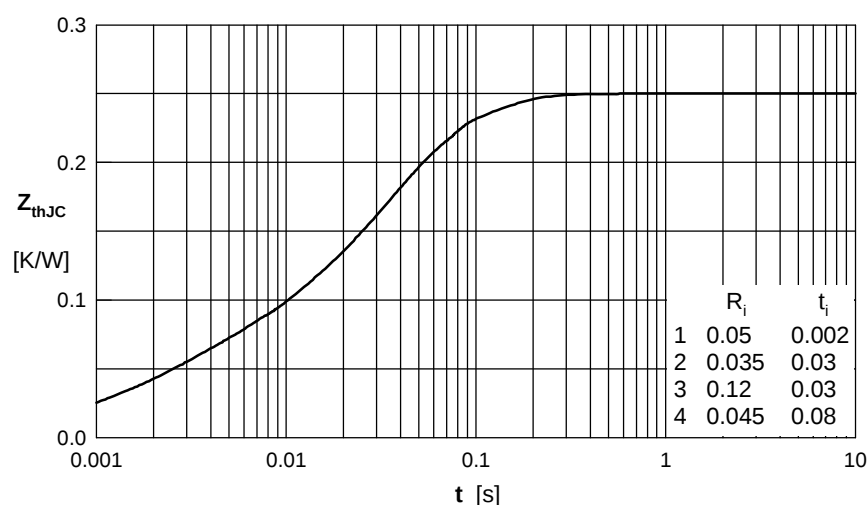


Fig. 7 Transient thermal impedance junction to case

## Brake Diode

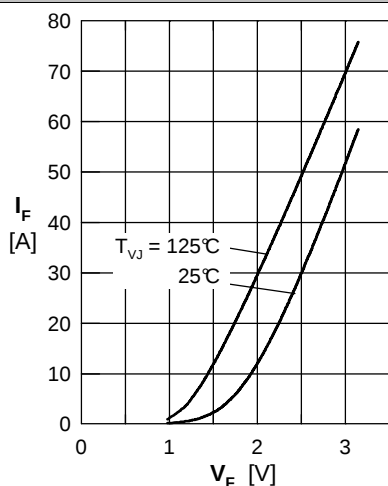


Fig. 1 Typ. forward current  $I_F$  vs.  $V_F$

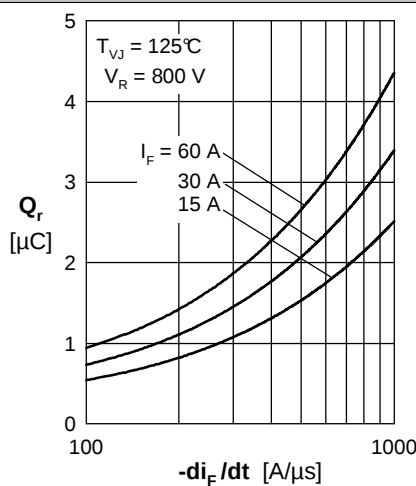


Fig. 2 Typ. reverse recovery charge  $Q_r$  versus  $-di_F/dt$

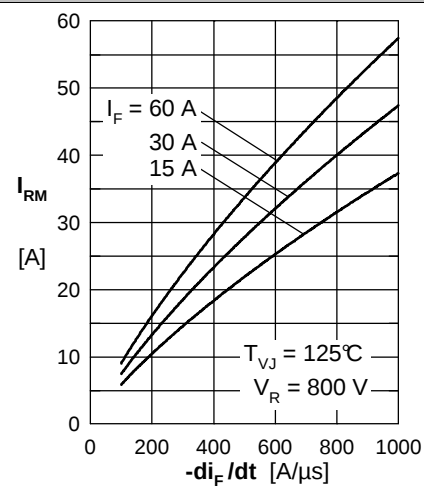


Fig. 3 Typ. peak reverse current  $I_{RM}$  versus  $-di_F/dt$

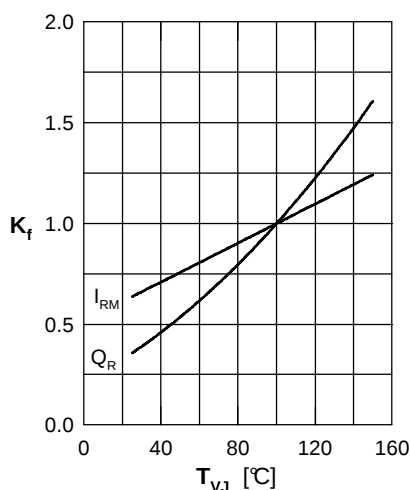


Fig. 4 Typ. dynamic parameters  $Q_r$ ,  $I_{RM}$ , versus  $T_{VJ}$

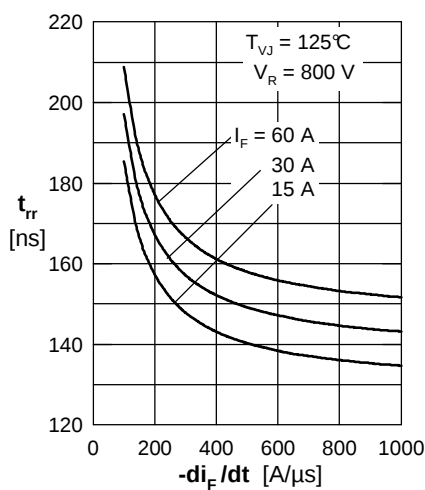


Fig. 5 Typ. recovery time  $t_{rr}$  vs.  $-di_F/dt$

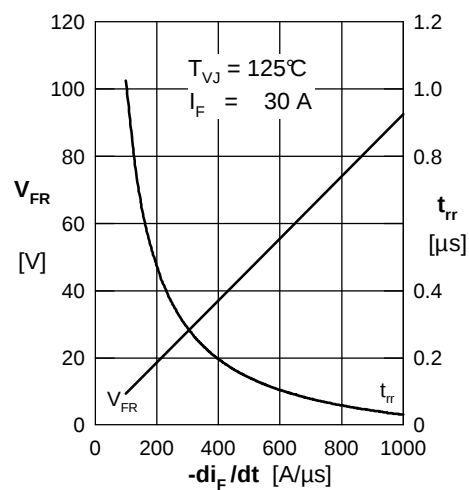


Fig. 6 Typ. peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

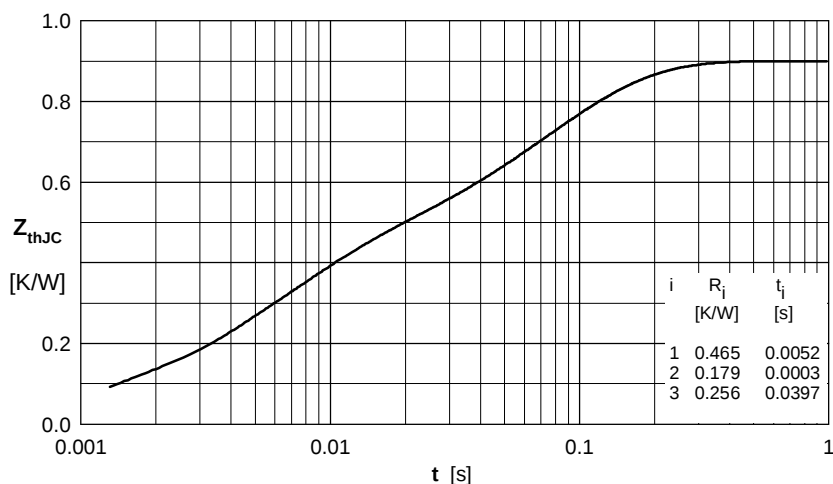


Fig. 7 Typ. transient thermal impedance junction to case