

## Three Phase Rectifier Bridge

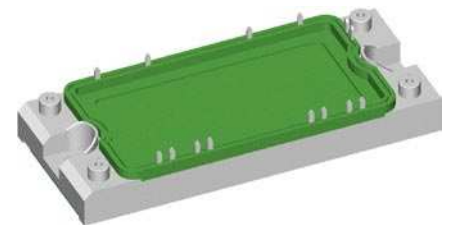
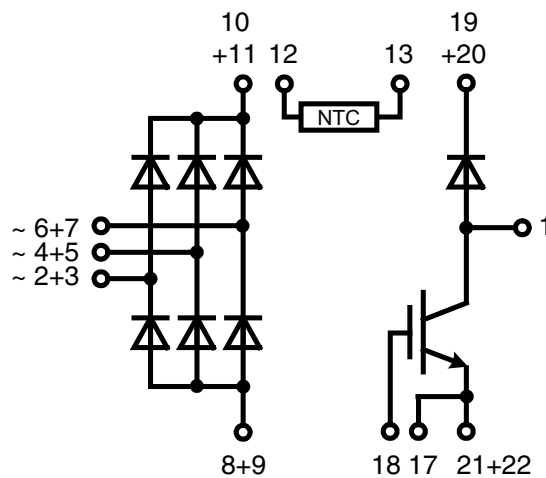
with IGBT and Fast Recovery Diode  
for Braking System

| Rectifier Diode               | Fast Recovery Diode         | IGBT                        |
|-------------------------------|-----------------------------|-----------------------------|
| $V_{RRM} = 2200 \text{ V}$    | $V_{CES} = 1800 \text{ V}$  | $V_{CES} = 1700 \text{ V}$  |
| $I_{DAVM100} = 150 \text{ A}$ | $I_{C80} = 33 \text{ A}$    | $I_{C80} = 80 \text{ A}$    |
| $I_{FSM45} = 1000 \text{ A}$  | $V_{F125} = 3.11 \text{ V}$ | $V_{CE125} = 3.0 \text{ V}$ |

Preliminary data

**Part name** (Marking on product)

VUB135-22NO1



**E72873**

Pin configuration see outlines.

### Features:

- Soldering connections for PCB mounting
- Convenient package outline
- Thermistor

### Application:

- Drive Inverters with brake system

### Package:

- 2 functions in one package
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability
- UL registered, E72873

**IGBT**

|                     |                                       |                                                                                                                                                                                        |                                                                 | <b>Ratings</b>                   |             |               |
|---------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------|-------------|---------------|
| <b>Symbol</b>       | <b>Definitions</b>                    | <b>Conditions</b>                                                                                                                                                                      | <b>min.</b>                                                     | <b>typ.</b>                      | <b>max.</b> | <b>Unit</b>   |
| $V_{CES}$           | collector emitter voltage             | $T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$                                                                                                                                  |                                                                 |                                  | 1700        | V             |
| $V_{GES}$           | max. DC gate voltage                  | continuous                                                                                                                                                                             | -20                                                             |                                  | +20         | V             |
| $V_{GEM}$           | max. transient collector gate voltage | transient                                                                                                                                                                              | -30                                                             |                                  | +30         | V             |
| $I_{C25}$           | collector current                     | $T_C = 25^{\circ}\text{C}$                                                                                                                                                             |                                                                 |                                  | 113         | A             |
| $I_{C80}$           |                                       | $T_C = 80^{\circ}\text{C}$                                                                                                                                                             |                                                                 |                                  | 80          | A             |
| $P_{tot}$           | total power dissipation               | $T_C = 25^{\circ}\text{C}$                                                                                                                                                             |                                                                 |                                  | 445         | W             |
| $V_{CE(sat)}$       | collector emitter saturation voltage  | $I_C = 75\text{ A}; V_{GE} = 15\text{ V}$                                                                                                                                              | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ |                                  | 2.13<br>3   | V<br>V        |
| $V_{GE(th)}$        | gate emitter threshold voltage        | $I_C = 3\text{ mA}; V_{GE} = V_{CE}$                                                                                                                                                   | $T_{VJ} = 25^{\circ}\text{C}$                                   | 5.2                              | 6.4         | V             |
| $I_{CES}$           | collector emitter leakage current     | $V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$                                                                                                                                                | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ |                                  | 0.6<br>tbd  | mA<br>mA      |
| $I_{GES}$           | gate emitter leakage current          | $V_{CE} = 0\text{ V}; V_{GE} = \pm 20\text{ V}$                                                                                                                                        |                                                                 |                                  | 400         | nA            |
| $C_{ies}$           | input capacitance                     | $V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$                                                                                                                          |                                                                 | 6640                             |             | pF            |
| $Q_{G(on)}$         | total gate charge                     | $V_{CE} = 900\text{ V}; V_{GE} = 15\text{ V}; I_C = 75\text{ A}$                                                                                                                       |                                                                 | tbd                              |             | nC            |
| $t_{d(on)}$         | turn-on delay time                    | <div> <div></div> <div>inductive load</div> <div><math>V_{CE} = 900\text{ V}; I_C = 75\text{ A}</math></div> <div><math>V_{GE} = \pm 15\text{ V}; R_G = 18\ \Omega</math></div> </div> | $T_{VJ} = 125^{\circ}\text{C}$                                  | 220                              |             | ns            |
| $t_r$               | current rise time                     |                                                                                                                                                                                        |                                                                 | 100                              |             | ns            |
| $t_{d(off)}$        | turn-off delay time                   |                                                                                                                                                                                        |                                                                 | 880                              |             | ns            |
| $t_f$               | current fall time                     |                                                                                                                                                                                        |                                                                 | 200                              |             | ns            |
| $E_{on}$            | turn-on energy per pulse              |                                                                                                                                                                                        |                                                                 | 30                               |             | mJ            |
| $E_{off}$           | turn-off energy per pulse             |                                                                                                                                                                                        |                                                                 | 25                               |             | mJ            |
| $I_{CM}$            | reverse bias safe operating area      | RBSOA; $V_{GE} = \pm 15\text{ V}; R_G = 18\ \Omega; L = 100\ \mu\text{H}$                                                                                                              |                                                                 | 150                              |             | A             |
| $V_{CEK}$           |                                       | clamped inductive load; $T_{VJ} = 125^{\circ}\text{C}$                                                                                                                                 |                                                                 | $\leq V_{CES} - L_S \cdot di/dt$ |             | V             |
| $t_{SC}$<br>(SCSOA) | short circuit safe operating area     | $V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V}; R_G = 18\ \Omega; \text{non-repetitive}$                                                                                             | $T_{VJ} = 125^{\circ}\text{C}$                                  |                                  | 10          | $\mu\text{s}$ |
| $R_{thJC}$          | thermal resistance junction to case   | (per IGBT)                                                                                                                                                                             |                                                                 |                                  | 0.28        | K/W           |
| $R_{thCH}$          | thermal resistance case to heatsink   |                                                                                                                                                                                        |                                                                 | 0.1                              |             | K/W           |

**Fast Recovery Diode**

|               |                                     |                                                                                                                                                                |                                                                 | <b>Ratings</b> |              |             |
|---------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------|--------------|-------------|
| <b>Symbol</b> | <b>Definitions</b>                  | <b>Conditions</b>                                                                                                                                              | <b>min.</b>                                                     | <b>typ.</b>    | <b>max.</b>  | <b>Unit</b> |
| $V_{RRM}$     | max. repetitive reverse voltage     | $T_{VJ} = 150^{\circ}\text{C}$                                                                                                                                 |                                                                 |                | 1800         | V           |
| $I_{FAV}$     | average forward current             | $T_C = 80^{\circ}\text{C}$                                                                                                                                     |                                                                 |                | 33           | A           |
| $V_{F0}$      | threshold voltage                   | $T_{VJ} = 150^{\circ}\text{C}$                                                                                                                                 |                                                                 |                | 2.09         | V           |
| $r_F$         | slope resistance                    | for power loss calculation only                                                                                                                                |                                                                 |                | 17           | m $\Omega$  |
| $V_F$         | forward voltage                     | $I_F = 60\text{ A}$                                                                                                                                            | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ |                | 3.05<br>3.11 | V<br>V      |
| $I_R$         | reverse current                     | $V_R = V_{RRM}$                                                                                                                                                | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ |                | 0.1<br>6     | mA<br>mA    |
| $I_{RM}$      | max. reverse recovery current       | <div> <div><math>V_R = 1200\text{ V}</math></div> <div><math>di_f/dt = -400\text{ A}/\mu\text{s}</math></div> <div><math>I_F = 60\text{ A}</math></div> </div> | $T_{VJ} = 100^{\circ}\text{C}$                                  | 40             |              | A           |
| $t_{rr}$      | reverse recovery time               |                                                                                                                                                                |                                                                 | tbd            |              | ns          |
| $R_{thJC}$    | thermal resistance junction to case | (per diode)                                                                                                                                                    |                                                                 |                | 0.65         | K/W         |
| $R_{thCH}$    | thermal resistance case to heatsink |                                                                                                                                                                |                                                                 | 0.25           |              | K/W         |

 $T_C = 25^{\circ}\text{C}$  unless otherwise stated

**Rectifier Diode**

| Symbol       | Conditions                          |                                                                                                                    | Ratings |      |              |                    |
|--------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------|------|--------------|--------------------|
|              |                                     |                                                                                                                    | min.    | typ. | max.         |                    |
| $V_{RRM}$    | max. repetitive reverse voltage     | $T_{VJ} = 25^{\circ}\text{C}$                                                                                      |         |      | 2200         | V                  |
| $I_R$        | reverse current                     | $V_R = V_{RRM}$<br>$T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$                                 |         |      | 0.1<br>2     | mA<br>mA           |
| $V_F$        | forward voltage                     | $I_F = 150\text{ A}$<br>$T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$                            |         |      | 1.85<br>1.96 | V<br>V             |
| $I_{D(AV)M}$ | max. average DC output current      | rectangular; $d = 1/3$ ; bridge<br>$T_C = 100^{\circ}\text{C}$                                                     |         |      | 150          | A                  |
| $V_{F0}$     | threshold voltage                   | $T_{VJ} = 150^{\circ}\text{C}$                                                                                     |         |      | 0.87         | V                  |
| $r_F$        | slope resistance                    | for power loss calculation only                                                                                    |         |      | 6.5          | m $\Omega$         |
| $R_{thJC}$   | thermal resistance junction to case | $T_{VJ} = 25^{\circ}\text{C}$                                                                                      |         |      | 0.5          | K/W                |
| $R_{thCH}$   | thermal resistance case to heatsink | $T_{VJ} = 25^{\circ}\text{C}$                                                                                      |         |      | 0.1          | K/W                |
| $T_{VJ}$     | virtual junction temperature        |                                                                                                                    | -40     |      | 125          | $^{\circ}\text{C}$ |
| $P_{tot}$    | total power dissipation             | $T_{VJ} = 25^{\circ}\text{C}$                                                                                      |         |      | 250          | W                  |
| $I_{FSM}$    | max. forward surge current          | $t = 10\text{ ms (50Hz)}$<br>$V_R = 0\text{ V}$<br>$T_{VJ} = 45^{\circ}\text{C}$<br>$T_{VJ} = 150^{\circ}\text{C}$ |         |      | 1000<br>870  | A<br>A             |
| $I^2t$       | value for fusing                    | $t = 10\text{ ms (50Hz)}$<br>$V_R = 0\text{ V}$<br>$T_{VJ} = 45^{\circ}\text{C}$<br>$T_{VJ} = 150^{\circ}\text{C}$ |         |      | 5000<br>3780 | A<br>A             |

**Temperature Sensor NTC**

| Symbol      | Definitions | Conditions                 | Ratings |      |      | Unit       |
|-------------|-------------|----------------------------|---------|------|------|------------|
|             |             |                            | min.    | typ. | max. |            |
| $R_{25}$    | resistance  | $T_C = 25^{\circ}\text{C}$ | 4.75    | 5.0  | 5.25 | k $\Omega$ |
| $B_{25/85}$ |             |                            |         | 3375 |      | K          |

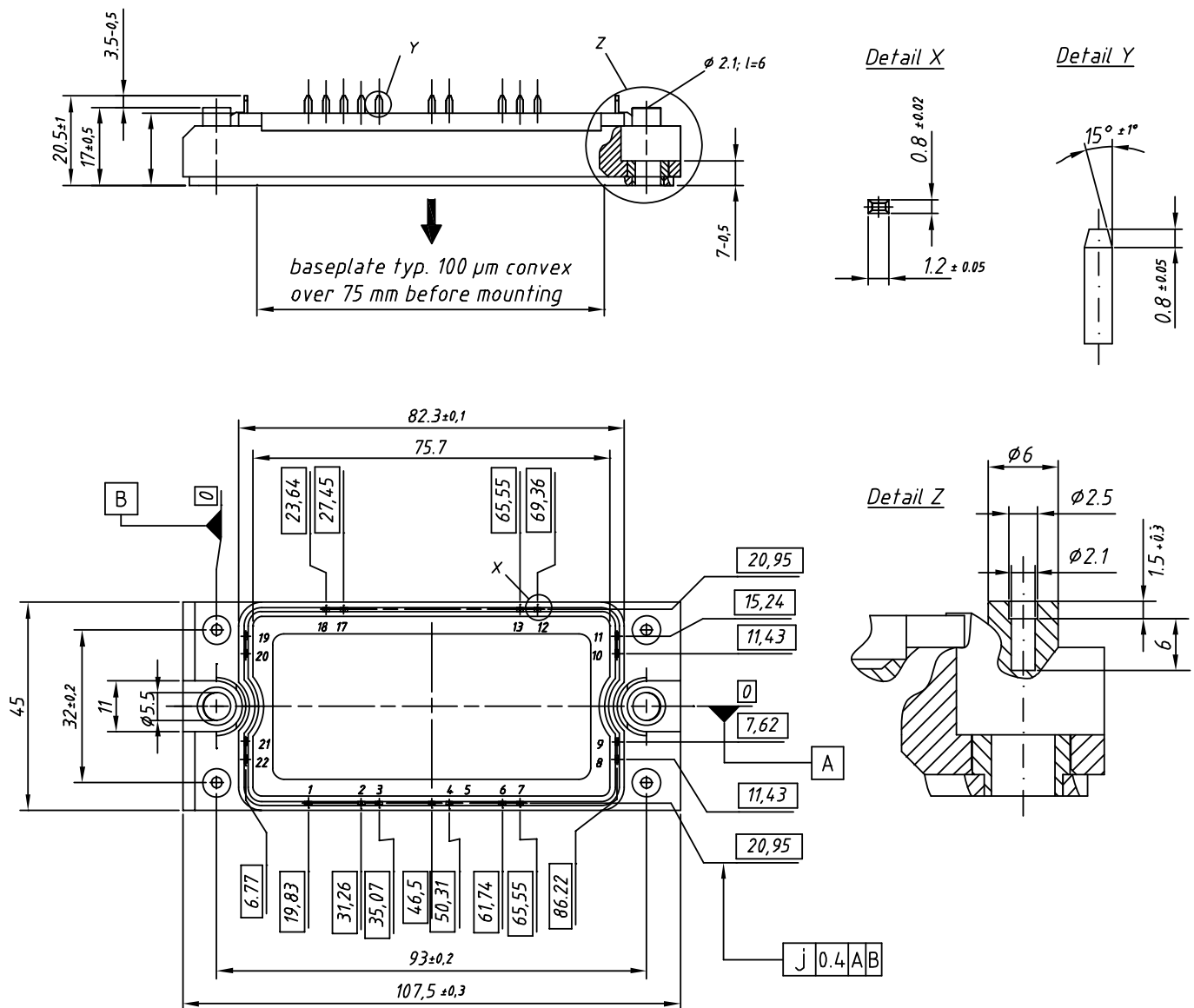
**Module**

| Symbol        | Definitions                       | Conditions                                                                               | Ratings |      |              | Unit               |
|---------------|-----------------------------------|------------------------------------------------------------------------------------------|---------|------|--------------|--------------------|
|               |                                   |                                                                                          | min.    | typ. | max.         |                    |
| $T_{VJ}$      | operating temperature             |                                                                                          | -40     |      | 125          | $^{\circ}\text{C}$ |
| $T_{VJM}$     | max. virtual junction temperature |                                                                                          |         |      | 150          | $^{\circ}\text{C}$ |
| $T_{stg}$     | storage temperature               |                                                                                          | -40     |      | 125          | $^{\circ}\text{C}$ |
| $V_{ISOL}$    | isolation voltage                 | $I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz};$<br>$t = 1\text{ min.}$<br>$t = 1\text{ s}$ |         |      | 3000<br>3600 | V~<br>V~           |
| $M_d$         | mounting torque                   | (M5)                                                                                     | 2.7     |      | 3.3          | Nm                 |
| $d_s$         | creep distance on surface         |                                                                                          | 12.7    |      |              | mm                 |
| $d_A$         | strike distance through air       |                                                                                          | 9.6     |      |              | mm                 |
| $a$           | maximum allowable acceleration    |                                                                                          | 50      |      |              | m/s $^2$           |
| <b>Weight</b> |                                   |                                                                                          |         | 180  |              | g                  |

$T_C = 25^{\circ}\text{C}$  unless otherwise stated

## Outline Drawing

Dimensions in mm (1 mm = 0.0394")



## Product Marking

| Ordering | Part Name     | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|---------------|--------------------|-----------------|----------|---------------|
| Standard | VUB 135-22NO1 | VUB135-22NO1       | Box             | 6        | 503948        |