

# IGBT XPT Module

## H Bridge

$$V_{CES} = 1200 \text{ V}$$

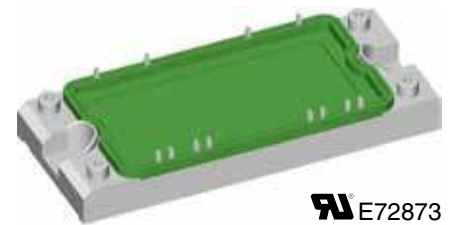
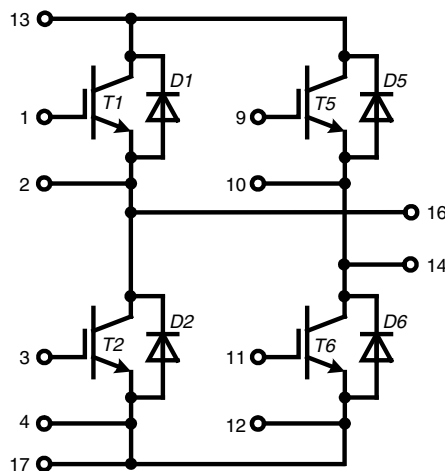
$$I_{C25} = 85 \text{ A}$$


$$V_{CE(sat)} = 1.8 \text{ V}$$

Preliminary data

**Part name** (Marking on product)

MIXA 61H1200ED



 E72873

### Features:

- Easy paralleling due to the positive temperature coefficient of the on-state voltage
- Rugged XPT design (Xtreme light Punch Through) results in:
  - short circuit rated for 10  $\mu$ sec.
  - very low gate charge
  - square RBSOA @ 3x  $I_C$
  - low EMI
- Thin wafer technology combined with the XPT design results in a competitive low  $V_{CE(sat)}$
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

### Application:

- AC motor drives
- Solar inverter
- Medical equipment
- Uninterruptible power supply
- Air-conditioning systems
- Welding equipment
- Switched-mode and resonant-mode power supplies

### Package:

- "E2-Pack" standard outline
- Insulated copper base plate
- Soldering pins for PCB mounting

**Output Inverter T1 - T6**

| Symbol        | Definitions                           | Conditions   | Ratings   |            |          | Unit          |          |
|---------------|---------------------------------------|--|---|------------|----------|---------------|----------|
|               |                                       |  | min.  | typ.       | max.     |               |          |
| $V_{CES}$     | collector emitter voltage             |  | $T_{VJ} = 25^{\circ}\text{C}$                                   |            | 1200     | V             |          |
| $V_{GES}$     | max. DC gate voltage                  | continuous   |   |            | $\pm 20$ | V             |          |
| $V_{GEM}$     | max. transient collector gate voltage | transient  |   |            | $\pm 30$ | V             |          |
| $I_{C25}$     | collector current                     |  | $T_C = 25^{\circ}\text{C}$                                      |            | 85       | A             |          |
| $I_{C80}$     |                                       |  | $T_C = 80^{\circ}\text{C}$                                      |            | 60       | A             |          |
| $P_{tot}$     | total power dissipation               |  | $T_C = 25^{\circ}\text{C}$                                      |            | 290      | W             |          |
| $V_{CE(sat)}$ | collector emitter saturation voltage  | $I_C = 55\text{ A}; V_{GE} = 15\text{ V}$  | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ | 1.8<br>2.1 | 2.1      | V<br>V        |          |
| $V_{GE(th)}$  | gate emitter threshold voltage        | $I_C = 2\text{ mA}; V_{GE} = V_{CE}$   | $T_{VJ} = 25^{\circ}\text{C}$                                   | 5.4        | 6.0      | 6.5           | V        |
| $I_{CES}$     | collector emitter leakage current     | $V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$  | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ |            | 0.5      | 0.2           | mA<br>mA |
| $I_{GES}$     | gate emitter leakage current          | $V_{GE} = \pm 20\text{ V}$   |   |            | 500      | nA            |          |
| $Q_{G(on)}$   | total gate charge                     | $V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 50\text{ A}$   |   |            | 165      | nC            |          |
| $t_{d(on)}$   | turn-on delay time                    | inductive load<br>$V_{CE} = 600\text{ V}; I_C = 50\text{ A}$<br>$V_{GE} = \pm 15\text{ V}; R_G = 15\ \Omega$ | $T_{VJ} = 125^{\circ}\text{C}$                                  |            | 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              |  |   |            | 4.5      | mJ            |          |
| $E_{off}$     | turn-off energy per pulse             |  |   |            | 5.5      | mJ            |          |
| <b>RBSOA</b>  | reverse bias safe operating area      | $V_{GE} = \pm 15\text{ V}; R_G = 15\ \Omega;$  | $T_{VJ} = 125^{\circ}\text{C}$<br>$V_{CEK} = 1200\text{ V}$     |            | 150      | A             |          |
| <b>SCSOA</b>  | short circuit safe operating area     |  | $T_{VJ} = 125^{\circ}\text{C}$                                  |            | 10       | $\mu\text{s}$ |          |
| $t_{SC}$      | short circuit duration                | $V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$<br>$R_G = 15\ \Omega;$ non-repetitive                     |   |            | 200      | A             |          |
| $I_{SC}$      | short circuit current                 |  |   |            |          |               |          |
| $R_{thJC}$    | thermal resistance junction to case   | (per IGBT)   |   |            | 0.43     | K/W           |          |

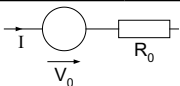
**Output Inverter D1 - D6**

| Symbol     | Definitions                         | Conditions   | Ratings   |              |      | Unit          |
|------------|-------------------------------------|--|---|--------------|------|---------------|
|            |                                     |  | min.  | typ.         | max. |               |
| $V_{RRM}$  | max. repetitive reverse voltage     |  | $T_{VJ} = 25^{\circ}\text{C}$                                   |              | 1200 | V             |
| $I_{F25}$  | forward current                     |  | $T_C = 25^{\circ}\text{C}$                                      |              | 85   | A             |
| $I_{F80}$  |                                     |  | $T_C = 80^{\circ}\text{C}$                                      |              | 57   | A             |
| $V_F$      | forward voltage                     | $I_F = 60\text{ A}; V_{GE} = 0\text{ V}$   | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ | 1.95<br>1.95 | 2.2  | V<br>V        |
| $Q_{rr}$   | reverse recovery charge             | $V_R = 600\text{ V}$<br>$di_f/dt = -1200\text{ A}/\mu\text{s}$<br>$I_F = 60\text{ A}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 125^{\circ}\text{C}$                                  |              | 8    | $\mu\text{C}$ |
| $I_{RM}$   | max. reverse recovery current       |  |   |              | 60   | A             |
| $t_{rr}$   | reverse recovery time               |  |   |              | 350  | ns            |
| $E_{rec}$  | reverse recovery energy             |  |   |              | 2.5  | mJ            |
| $R_{thJC}$ | thermal resistance junction to case | (per diode)  |   |              | 0.6  | K/W           |

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

**Module**

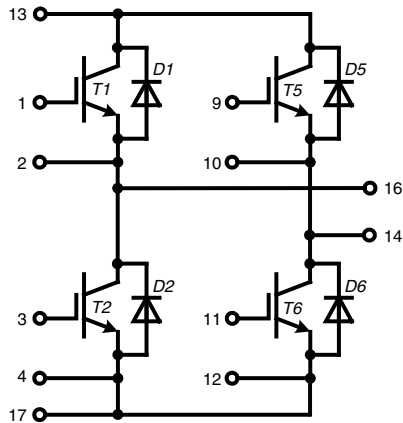
| Symbol         | Definitions                         | Conditions                                     | Ratings |      |      | Unit |
|----------------|-------------------------------------|--|---------|------|------|------|
|                |                                     |  | min.    | typ. | max. |      |
| $T_{VJ}$       | operating temperature               |  | -40     |      | 125  | °C   |
| $T_{VJM}$      | max. virtual junction temperature   |  |         |      | 150  | °C   |
| $T_{stg}$      | storage temperature                 |  | -40     |      | 125  | °C   |
| $V_{ISOL}$     | isolation voltage                   | $I_{ISOL} \leq 1 \text{ mA}; 50/60 \text{ Hz}$ |         |      | 3000 | V~   |
| <b>CTI</b>     | comparative tracking index          |  |         |      | -    |      |
| $M_d$          | mounting torque (M5)                |  | 3       |      | 6    | Nm   |
| $d_s$          | creep distance on surface           |  | 6       |      |      | mm   |
| $d_A$          | strike distance through air         |  | 6       |      |      | mm   |
| $R_{pin-chip}$ | resistance pin to chip              |  |         | 5    |      | mΩ   |
| $R_{thCH}$     | thermal resistance case to heatsink | with heatsink compound                         |         | 0.02 |      | K/W  |
| <b>Weight</b>  |                                     |  |         | 180  |      | g    |

**Equivalent Circuits for Simulation**


| Symbol         | Definitions         | Conditions | min.                         | Ratings |      | Unit |
|----------------|---------------------|------------|------------------------------|---------|------|------|
|                |                     |            |                              | typ.    | max. |      |
| $V_0$<br>$R_0$ | IGBT                | T1 - T6    | $T_{VJ} = 150^\circ\text{C}$ | 1.1     |      | V    |
| $V_0$<br>$R_0$ | free wheeling diode | D1 - D6    | $T_{VJ} = 150^\circ\text{C}$ | 1.22    |      | V    |
|                |                     |            |                              | 12.99   |      | mΩ   |

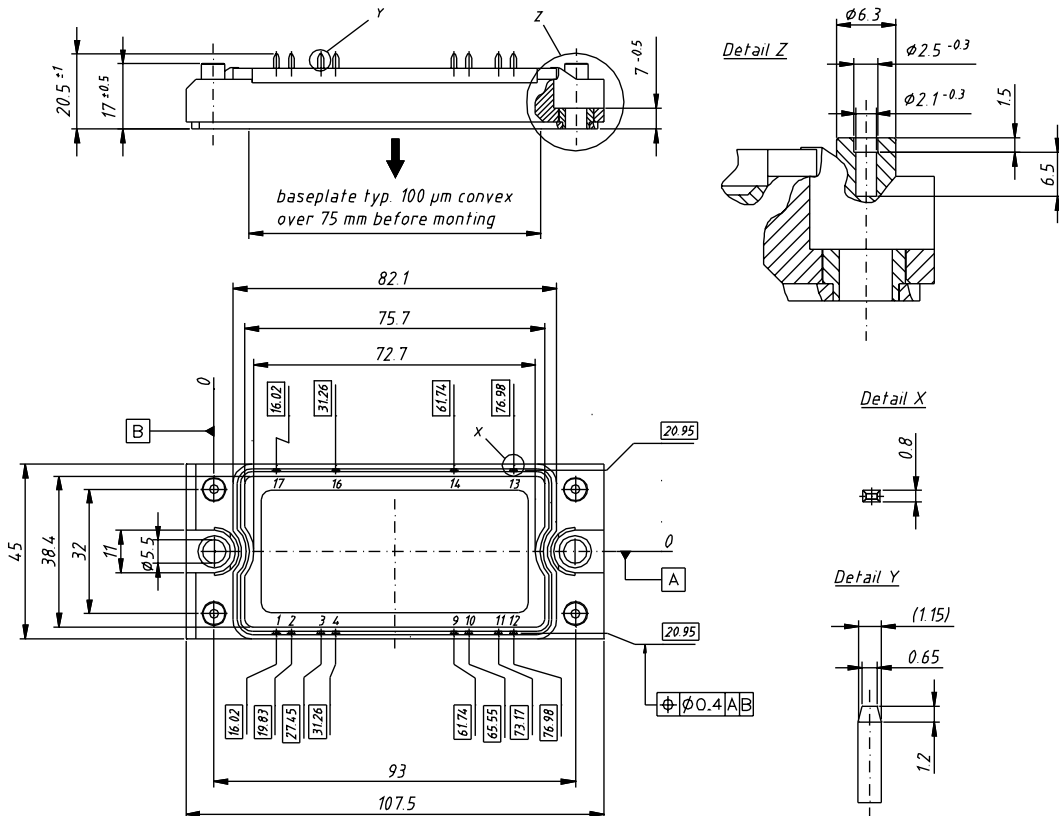
 $T_C = 25^\circ\text{C}$  unless otherwise stated

### Circuit Diagram

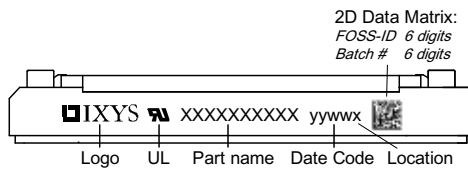


### Outline Drawing

Dimensions in mm (1 mm = 0.0394")



### Product Marking



#### Part number

- M = Module
- I = IGBT
- X = XPT
- A = standard
- 61 = Current Rating [A]
- H = H~ Bridge
- 1200 = Reverse Voltage [V]
- ED = E2-Pack

| Ordering | Part Name     | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|---------------|--------------------|-----------------|----------|---------------|
| Standard | MIXA61H1200ED | MIXA61H1200ED      | Box             | 6        | 511060        |

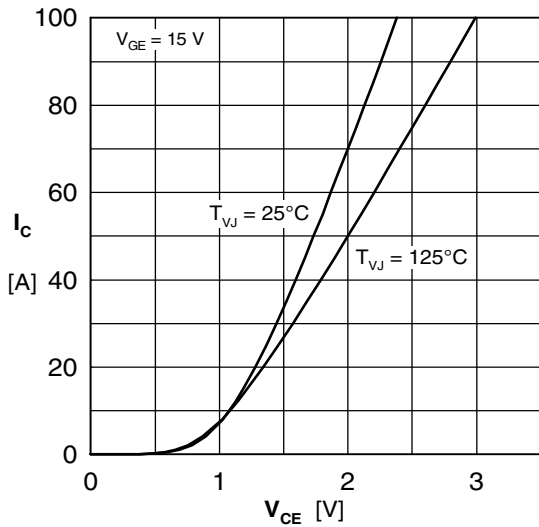
**Inverter T1 - T6**


Fig. 1 Typ. output characteristics

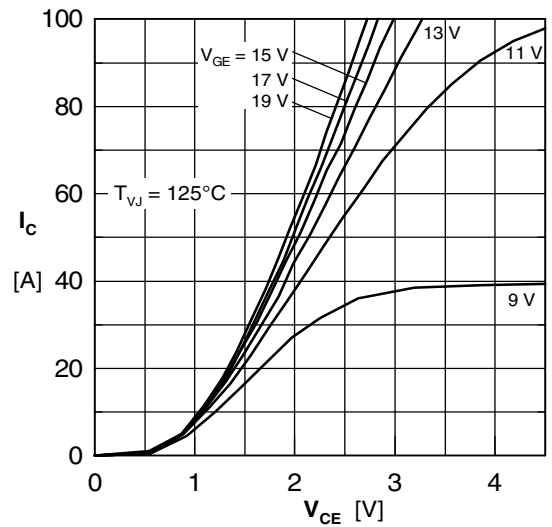


Fig. 2 Typ. output characteristics

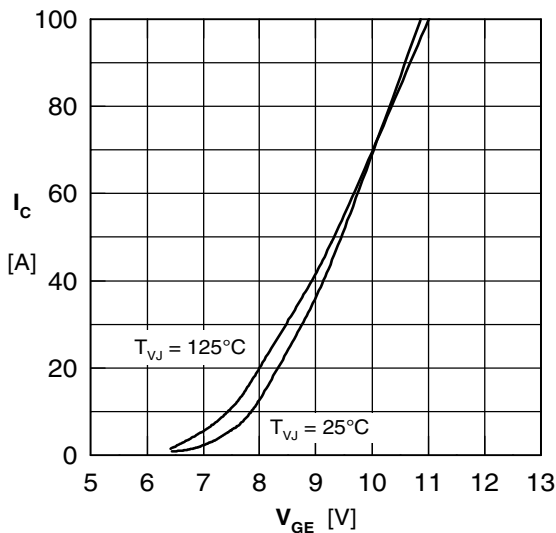


Fig. 3 Typ. transfer characteristics

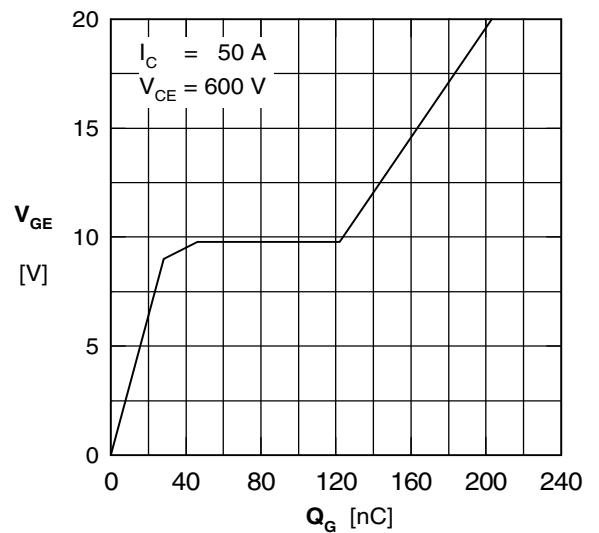


Fig. 4 Typ. turn-on gate charge

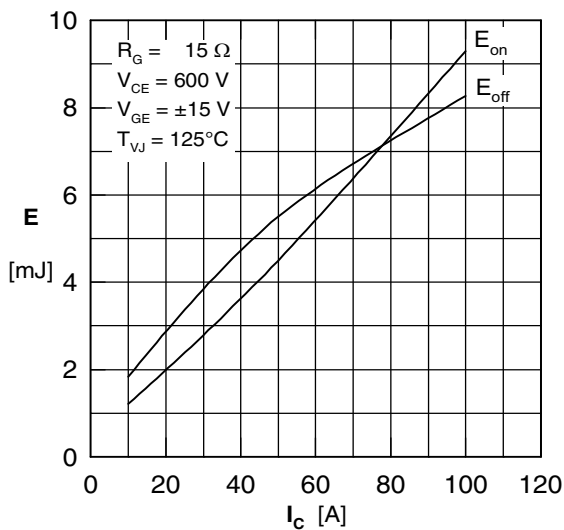


Fig. 5 Typ. switching energy vs. collector current

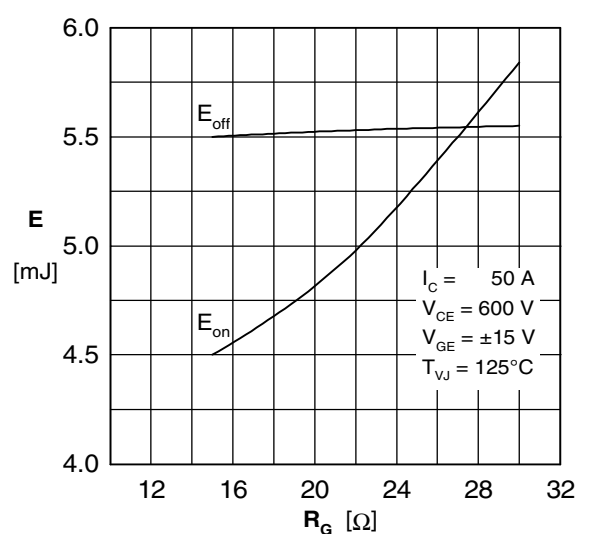


Fig. 6 Typ. switching energy vs. gate resistance

## Inverter D1 - D6

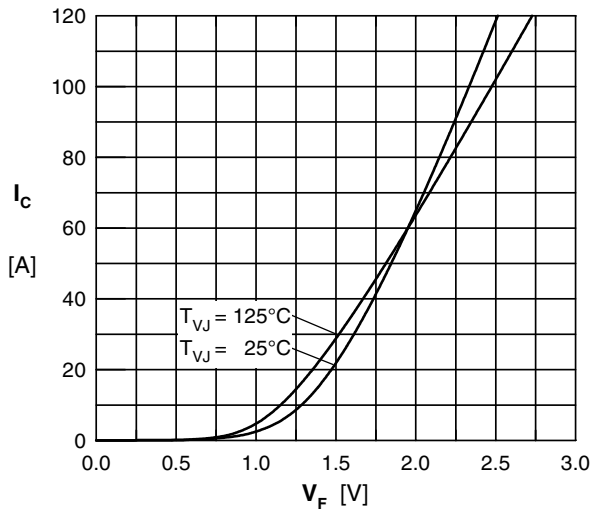


Fig. 7 Typ. Forward current versus  $V_F$

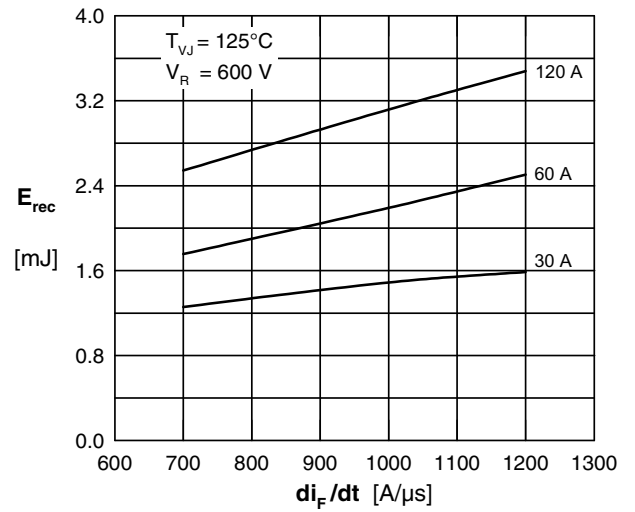


Fig. 8 Typ. recovery energy  $E_{rec}$  versus  $di/dt$

|   | IGBT  |          | FRD   |          |
|---|-------|----------|-------|----------|
|   | $R_i$ | $\tau_i$ | $R_i$ | $\tau_i$ |
| 1 | 0.1   | 0.0025   | 0.137 | 0.0025   |
| 2 | 0.05  | 0.03     | 0.1   | 0.03     |
| 3 | 0.21  | 0.03     | 0.233 | 0.03     |
| 4 | 0.07  | 0.08     | 0.13  | 0.08     |

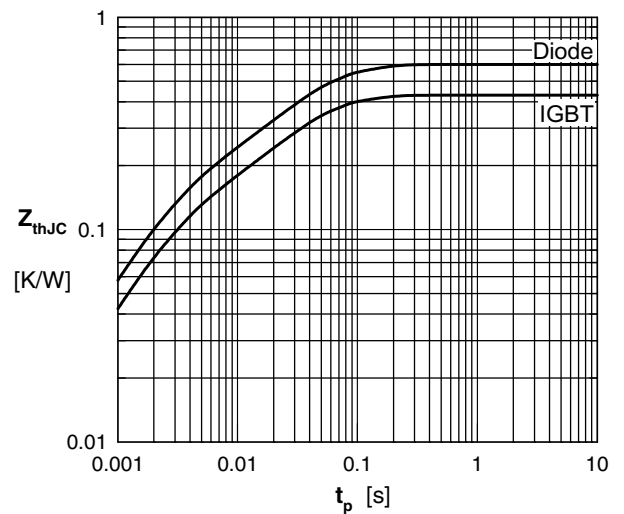


Fig. 9 Typ. transient thermal impedance