

# XPT IGBT

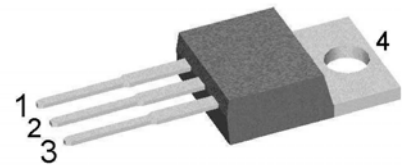
preliminary

$$V_{CES} = 1200V$$

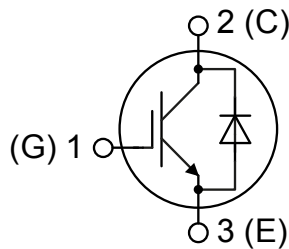
$$I_{C25} = 20A$$

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

Copack

**Part number**
**IXA12IF1200PB**


Backside: collector


**Features / Advantages:**

- 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
  - low EMI
  - square RBSOA @ 3x Ic
- Thin wafer technology combined with the XPT design results in a competitive low VCE(sat)
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

**Applications:**

- AC motor drives
- Solar inverter
- Medical equipment
- Uninterruptible power supply
- Air-conditioning systems
- Welding equipment
- Switched-mode and resonant-mode power supplies
- Inductive heating, cookers
- Pumps, Fans

**Package: TO-220**

- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0

| IGBT          |  |   |                         | Ratings |          |         |    |
|---------------|--|---|-------------------------|---------|----------|---------|----|
| Symbol        | Definition                             | Conditions  | min.                    | typ.    | max.     | Unit    |    |
| $V_{CES}$     | collector emitter voltage              | $T_{VJ} = 25^{\circ}C$  |                         |         | 1200     | V       |    |
| $V_{GES}$     | max. DC gate voltage                   |   |                         |         | $\pm 20$ | V       |    |
| $V_{GEM}$     | max. transient gate emitter voltage    |   |                         |         | $\pm 30$ | V       |    |
| $I_{C25}$     | collector current                      | $T_C = 25^{\circ}C$   |                         |         | 20       | A       |    |
| $I_{C100}$    |  | $T_C = 100^{\circ}C$  |                         |         | 13       | A       |    |
| $P_{tot}$     | total power dissipation                | $T_C = 25^{\circ}C$   |                         |         | 85       | W       |    |
| $V_{CE(sat)}$ | collector emitter saturation voltage   | $I_C = 10A; V_{GE} = 15V$   |                         | 1.8     | 2.1      | V       |    |
|               |  |   |                         | 2.1     |          | V       |    |
| $V_{GE(th)}$  | gate emitter threshold voltage         | $I_C = 0.3mA; V_{CE} = V_{CE}$  | 5.4                     | 5.9     | 6.5      | V       |    |
| $I_{CES}$     | collector emitter leakage current      | $V_{CE} = V_{CES}; V_{GE} = 0V$   |                         |         | 0.1      | mA      |    |
|               |  |   |                         | 0.1     |          | mA      |    |
| $I_{GES}$     | gate emitter leakage current           | $V_{GE} = \pm 20V$  |                         |         | 500      | nA      |    |
| $Q_{G(on)}$   | total gate charge                      | $V_{CE} = 600V; V_{GE} = 15V; I_C = 10A$  |                         | 27      |          | nC      |    |
| $t_{d(on)}$   | turn-on delay time                     | inductive load<br>$V_{CE} = 600V; I_C = 10A$<br>$V_{GE} = \pm 15V; R_G = 100\Omega$ |                         | 70      |          | ns      |    |
| $t_r$         | current rise time                      |   | $T_{VJ} = 125^{\circ}C$ |         | 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               |   |                         |         | 1.1      |         | mJ |
| $E_{off}$     | turn-off energy per pulse              |   |                         |         | 1.1      |         | mJ |
| <b>RBSOA</b>  | reverse bias safe operating area       | $V_{GE} = \pm 15V; R_G = 100\Omega$   |                         |         |          |         |    |
| $I_{CM}$      |  | $V_{CEmax} = 1200V$   |                         |         | 30       | A       |    |
| <b>SCSOA</b>  | short circuit safe operating area      | $V_{CEmax} = 900V$  |                         |         |          |         |    |
| $t_{sc}$      | short circuit duration                 | $V_{CE} = 900V; V_{GE} = \pm 15V$   |                         |         | 10       | $\mu s$ |    |
| $I_{sc}$      | short circuit current                  | $R_G = 100\Omega; \text{non-repetitive}$  |                         | 40      |          | A       |    |
| $R_{thJC}$    | thermal resistance junction to case    |   |                         |         | 1.5      | K/W     |    |
| $R_{thCH}$    | thermal resistance case to heatsink    |   |                         | 0.50    |          | K/W     |    |
| <b>Diode</b>  |  |   |                         |         |          |         |    |
| $V_{RRM}$     | max. repetitive reverse voltage        | $T_{VJ} = 25^{\circ}C$  |                         |         | 1200     | V       |    |
| $I_{F25}$     | forward current                        | $T_C = 25^{\circ}C$   |                         |         | 22       | A       |    |
| $I_{F100}$    |  | $T_C = 100^{\circ}C$  |                         |         | 14       | A       |    |
| $V_F$         | forward voltage                        | $I_F = 10A$   |                         |         | 2.20     | V       |    |
|               |  |   |                         | 1.95    |          | V       |    |
| $I_R$         | reverse current                        | $V_R = V_{RRM}$   |                         |         | *        | mA      |    |
|               | * not applicable, see Ices value above |   |                         |         | *        | mA      |    |
| $Q_{rr}$      | reverse recovery charge                | $V_R = 600V$<br>$-di_F/dt = -250A/\mu s$<br>$I_F = 10A; V_{GE} = 0V$                |                         | 1.3     |          | $\mu C$ |    |
| $I_{RM}$      | max. reverse recovery current          |   | $T_{VJ} = 125^{\circ}C$ |         | 10.5     |         | A  |
| $t_{rr}$      | reverse recovery time                  |   |                         |         | 350      |         | ns |
| $E_{rec}$     | reverse recovery energy                |   |                         |         | 0.35     |         | mJ |
| $R_{thJC}$    | thermal resistance junction to case    |   |                         |         | 1.8      | K/W     |    |
| $R_{thCH}$    | thermal resistance case to heatsink    |   |                         | 0.50    |          | K/W     |    |

preliminary

| Package TO-220 |                              |              | Ratings |      |      |      |
|----------------|------------------------------|--------------|---------|------|------|------|
| Symbol         | Definition                   | Conditions   | min.    | typ. | max. | Unit |
| $I_{RMS}$      | RMS current                  | per terminal |         |      | 35   | A    |
| $T_{VJ}$       | virtual junction temperature |              | -40     |      | 150  | °C   |
| $T_{op}$       | operation temperature        |              | -40     |      | 125  | °C   |
| $T_{stg}$      | storage temperature          |              | -40     |      | 150  | °C   |
| <b>Weight</b>  |                              |              |         | 2    |      | g    |
| $M_D$          | mounting torque              |              | 0.4     |      | 0.6  | Nm   |
| $F_C$          | mounting force with clip     |              | 20      |      | 60   | N    |

### Product Marking



### Part number

- I = IGBT
- X = XPT IGBT
- A = Gen 1 / std
- 12 = Current Rating [A]
- IF = Copack
- 1200 = Reverse Voltage [V]
- PB = TO-220AB (3)

| Ordering | Part Number   | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|---------------|--------------------|---------------|----------|----------|
| Standard | IXA12IF1200PB | IXA12IF1200PB      | Tube          | 50       | 507428   |

| Similar Part  | Package              | Voltage class |
|---------------|----------------------|---------------|
| IXA12IF1200HB | TO-247AD (3)         | 1200          |
| IXA12IF1200TC | TO-268AA (D3Pak) (2) | 1200          |

### Equivalent Circuits for Simulation

\* on die level

$T_{VJ} = 150\text{ °C}$

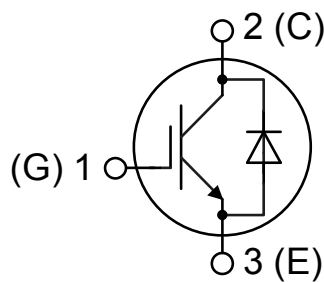


|              | IGBT | Diode |    |
|--------------|------|-------|----|
| $V_{0\ max}$ | 1.1  | 1.25  | V  |
| $R_{0\ max}$ | 153  | 85    | mΩ |

Outlines TO-220



| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | Min.       | Max.  | Min.   | Max.  |
| A    | 4.32       | 4.82  | 0.170  | 0.190 |
| A1   | 1.14       | 1.39  | 0.045  | 0.055 |
| A2   | 2.29       | 2.79  | 0.090  | 0.110 |
| b    | 0.64       | 1.01  | 0.025  | 0.040 |
| b2   | 1.15       | 1.65  | 0.045  | 0.065 |
| C    | 0.35       | 0.56  | 0.014  | 0.022 |
| D    | 14.73      | 16.00 | 0.580  | 0.630 |
| E    | 9.91       | 10.66 | 0.390  | 0.420 |
| e    | 2.54       | BSC   | 0.100  | BSC   |
| H1   | 5.85       | 6.85  | 0.230  | 0.270 |
| L    | 12.70      | 13.97 | 0.500  | 0.550 |
| L1   | 2.79       | 5.84  | 0.110  | 0.230 |
| ØP   | 3.54       | 4.08  | 0.139  | 0.161 |
| Q    | 2.54       | 3.18  | 0.100  | 0.125 |



## IGBT

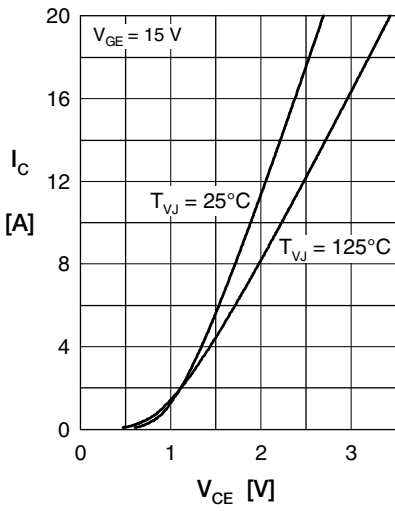


Fig. 1 Typ. output characteristics

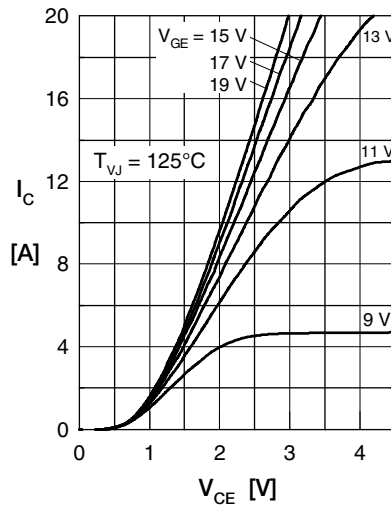


Fig. 2 Typ. output characteristics

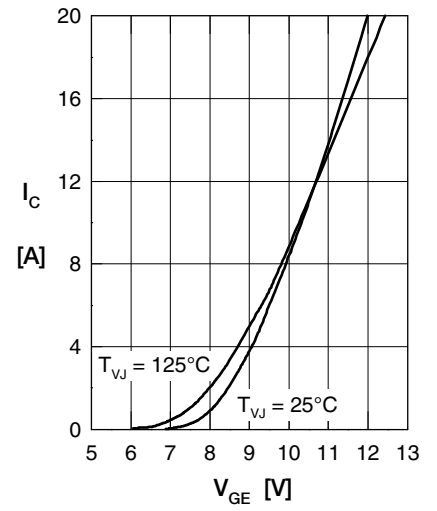


Fig. 3 Typ. transfer characteristics



Fig. 4 Typ. turn-on gate charge



Fig. 5 Typ. switching energy vs. collector current

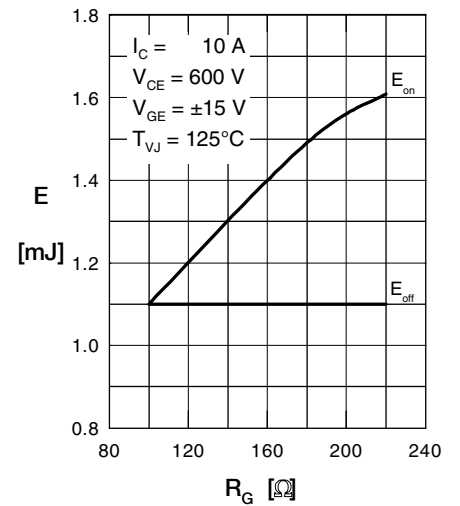


Fig. 6 Typ. switching energy vs. gate resistance

Fig. 7 Typ. transient thermal impedance junction to case

## Diode

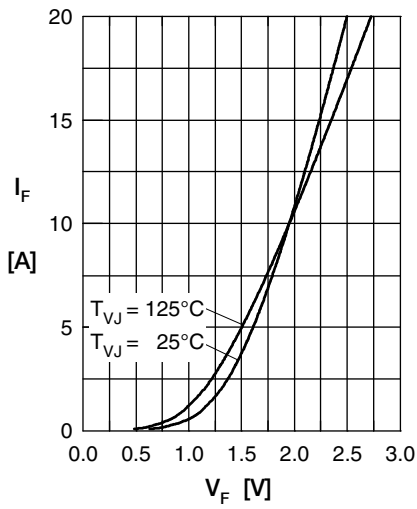


Fig. 1 Typ. forward current versus  $V_F$

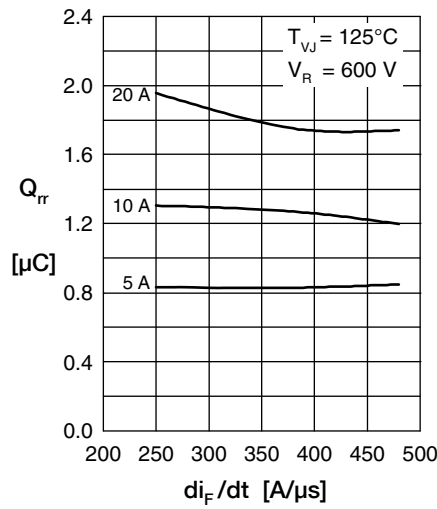


Fig. 2 Typical reverse recov. charge  $Q_{rr}$  versus  $di_F/dt$

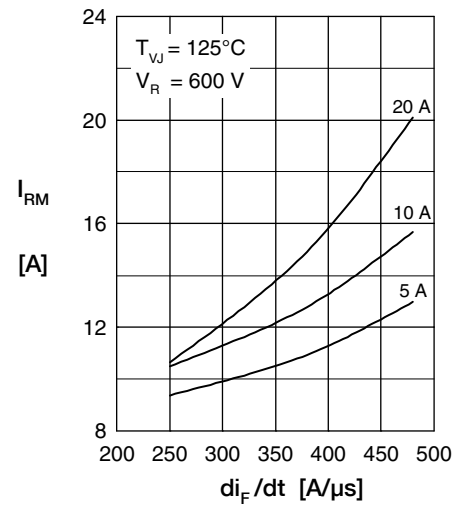


Fig. 3 Typ. peak reverse current  $I_{RM}$  versus  $di_F/dt$

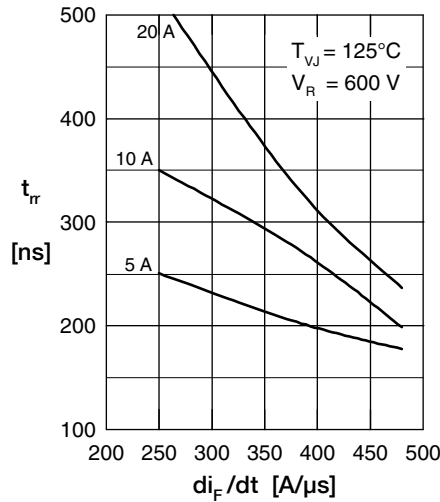


Fig. 4 Dynamic parameters  $Q_{rr}$ ,  $I_{RM}$  versus  $T_{VJ}$

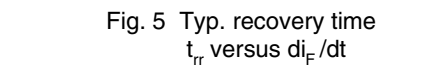


Fig. 5 Typ. recovery time  $t_{rr}$  versus  $di_F/dt$

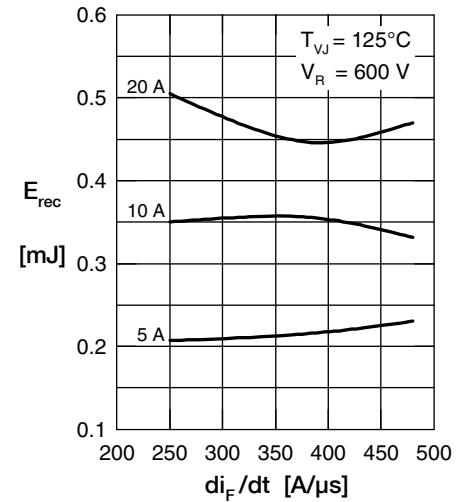


Fig. 6 Typ. recovery energy  $E_{rec}$  vs.  $di_F/dt$

Fig. 7 Typ. transient thermal impedance junction to case