preliminary

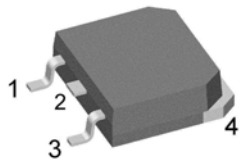
# XPT IGBT

$V_{CES}$ = 1200V
$I_{C25}$ = 20A
$V_{CE(sat)}$ = 1.8V

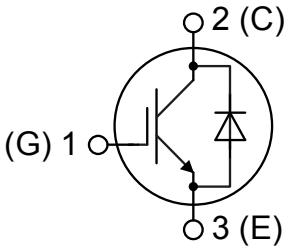
Copack

**Part number**

IXA12IF1200TC




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 µsec.
  - 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-268AA (D3Pak)

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

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| IGBT | | | | Ratings | | | |
|---|---|---|---|---|---|---|---|
| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
| $V_{CES}$ | *collector emitter voltage* | | $T_{VJ}$ = 25°C | | | 1200 | V |
| $V_{GES}$ | *max. DC gate voltage* | | | | | ±20 | V |
| $V_{GEM}$ | *max. transient gate emitter voltage* | | | | | ±30 | V |
| $I_{C25}$ | *collector current* | | $T_C$ = 25°C | | | 20 | A |
| $I_{C100}$ | | | $T_C$ = 100°C | | | 13 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 85 | W |
| $V_{CE(sat)}$ | *collector emitter saturation voltage* | $I_C$ = 10A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25°C | | 1.8 | 2.1 | V |
| | | | $T_{VJ}$ = 125°C | | 2.1 | | V |
| $V_{GE(th)}$ | *gate emitter threshold voltage* | $I_C$ = 0.3mA; $V_{GE}$ = $V_{CE}$ | $T_{VJ}$ = 25°C | 5.4 | 5.9 | 6.5 | V |
| $I_{CES}$ | *collector emitter leakage current* | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 0.1 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.1 | | mA |
| $I_{GES}$ | *gate emitter leakage current* | $V_{GE}$ = ±20 V | | | | 500 | nA |
| $Q_{G(on)}$ | *total gate charge* | $V_{CE}$ = 600 V; $V_{GE}$ = 15 V; $I_C$ = 10 A | | | 27 | | nC |
| $t_{d(on)}$ | *turn-on delay time* | | | | 70 | | ns |
| $t_r$ | *current rise time* | | | | 40 | | ns |
| $t_{d(off)}$ | *turn-off delay time* | inductive load | $T_{VJ}$ = 125°C | | 250 | | ns |
| $t_f$ | *current fall time* | $V_{CE}$ = 600 V; $I_C$ = 10 A | | | 100 | | ns |
| $E_{on}$ | *turn-on energy per pulse* | $V_{GE}$ = ±15 V; $R_G$ = 100 Ω | | | 1.1 | | mJ |
| $E_{off}$ | *turn-off energy per pulse* | | | | 1.1 | | mJ |
| RBSOA | *reverse bias safe operating area* | $V_{GE}$ = ±15 V; $R_G$ = 100 Ω | $T_{VJ}$ = 125°C | | | | |
| $I_{CM}$ | | $V_{CEmax}$ = 1200 V | | | | 30 | A |
| SCSOA | *short circuit safe operating area* | $V_{CEmax}$ = 900 V | | | | | |
| $t_{SC}$ | *short circuit duration* | $V_{CE}$ = 900 V; $V_{GE}$ = ±15 V | $T_{VJ}$ = 125°C | | | 10 | µs |
| $I_{SC}$ | *short circuit current* | $R_G$ = 100 Ω; non-repetitive | | | 40 | | A |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 1.5 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.15 | | K/W |

| Diode | | | | | | | |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitive reverse voltage* | | $T_{VJ}$ = 25°C | | | 1200 | V |
| $I_{F25}$ | *forward current* | | $T_C$ = 25°C | | | 22 | A |
| $I_{F100}$ | | | $T_C$ = 100°C | | | 14 | A |
| $V_F$ | *forward voltage* | $I_F$ = 10A | $T_{VJ}$ = 25°C | | | 2.20 | V |
| | | | $T_{VJ}$ = 125°C | | 1.95 | | V |
| $I_R$ | *reverse current* | $V_R$ = $V_{RRM}$ | $T_{VJ}$ = 25°C | | | * | mA |
| | * not applicable, see Ices value above | | $T_{VJ}$ = 125°C | | * | | mA |
| $Q_{rr}$ | *reverse recovery charge* | $V_R$ = 600 V | | | 1.3 | | µC |
| $I_{RM}$ | *max. reverse recovery current* | -$di_F$/dt = -250 A/µs | $T_{VJ}$ = 125°C | | 10.5 | | A |
| $t_{rr}$ | *reverse recovery time* | $I_F$ = 10A; $V_{GE}$ = 0 V | | | 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* | | | | 0.15 | | K/W |

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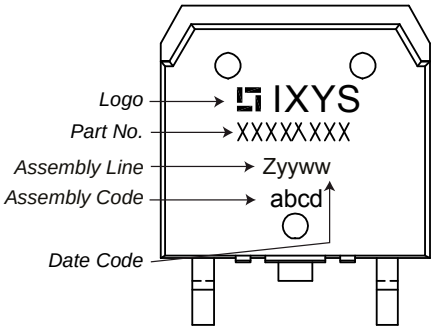
| Package TO-268AA (D3Pak) | | | Ratings | | | |
|---|---|---|---|---|---|---|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $I_{RMS}$ | *RMS current* | per terminal | | | 70 | A |
| $T_{VJ}$ | *virtual junction temperature* | | -40 | | 150 | °C |
| $T_{op}$ | *operation temperature* | | -40 | | 125 | °C |
| $T_{stg}$ | *storage temperature* | | -40 | | 150 | °C |
| Weight | | | | 5 | | g |
| $F_C$ | *mounting force with clip* | | 20 | | 120 | N |

## Product Marking




### Part number

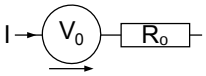
I = IGBT
X = XPT IGBT
A = Gen 1 / std
12 = Current Rating [A]
IF = Copack
1200 = Reverse Voltage [V]
TC = TO-268AA (D3Pak) (2)

| Ordering | Part Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | IXA12IF1200TC | IXA12IF1200TC | Tube | 30 | 508475 |

| Similar Part | Package | Voltage class |
|---|---|---|
| IXA12IF1200HB | TO-247AD (3) | 1200 |
| IXA12IF1200PB | TO-220AB (3) | 1200 |

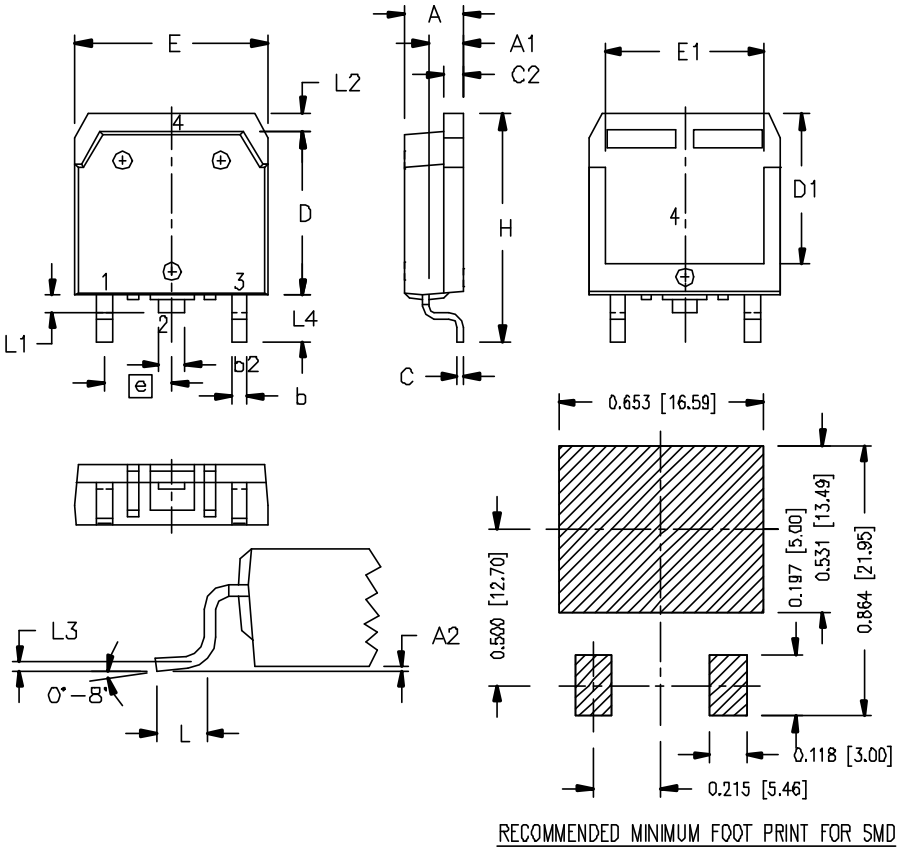
## Equivalent Circuits for Simulation

** on die level* $T_{VJ}$ = 150 °C

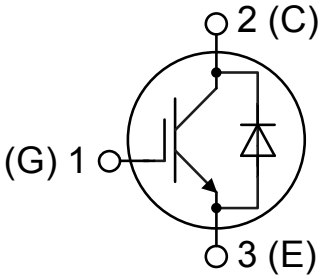



| | | IGBT | Diode | |
|---|---|---|---|---|
| $V_{0\,max}$ | *threshold voltage* | 1.1 | 1.25 | V |
| $R_{0\,max}$ | *slope resistance ** | 153 | 85 | mΩ |

## Outlines TO-268AA (D3Pak)




| Dim. | Millimeter | | Inches | |
|---|---|---|---|---|
| | min | max | min | max |
| A | 4.90 | 5.10 | 0.193 | 0.201 |
| A1 | 2.70 | 2.90 | 0.106 | 0.114 |
| A2 | 0.02 | 0.25 | 0.001 | 0.100 |
| b | 1.15 | 1.45 | 0.045 | 0.057 |
| b2 | 1.90 | 2.10 | 0.075 | 0.083 |
| C | 0.40 | 0.65 | 0.016 | 0.026 |
| C2 | 1.45 | 1.60 | 0.057 | 0.063 |
| D | 13.80 | 14.00 | 0.543 | 0.551 |
| D1 | 12.40 | 12.70 | 0.488 | 0.500 |
| E | 15.85 | 16.05 | 0.624 | 0.632 |
| E1 | 13.30 | 13.60 | 0.524 | 0.535 |
| e | 5.45 BSC | | 0.215 BSC | |
| H | 18.70 | 19.10 | 0.736 | 0.752 |
| L | 2.40 | 2.70 | 0.094 | 0.106 |
| L1 | 1.20 | 1.40 | 0.047 | 0.055 |
| L2 | 1.00 | 1.15 | 0.039 | 0.045 |
| L3 | 0.25 BSC | | 0.100 BSC | |
| L4 | 3.80 | 4.10 | 0.150 | 0.161 |



## IGBT

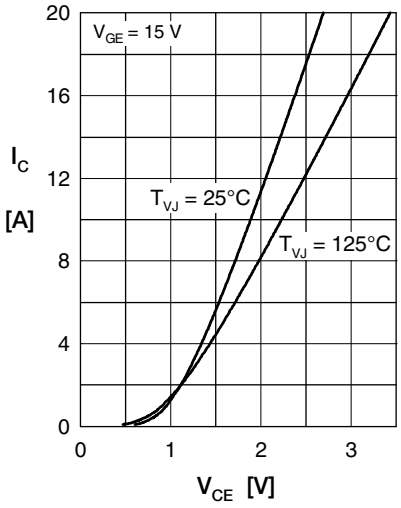



Fig. 1 Typ. output characteristics

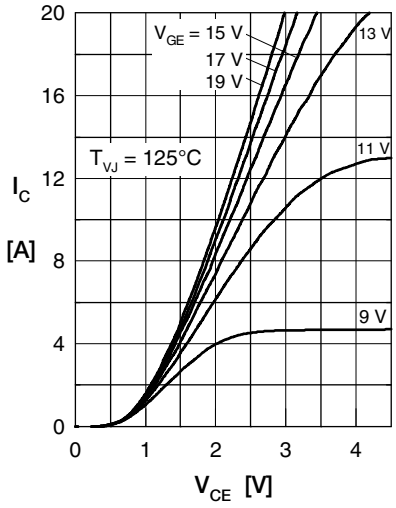



Fig. 2 Typ. output characteristics

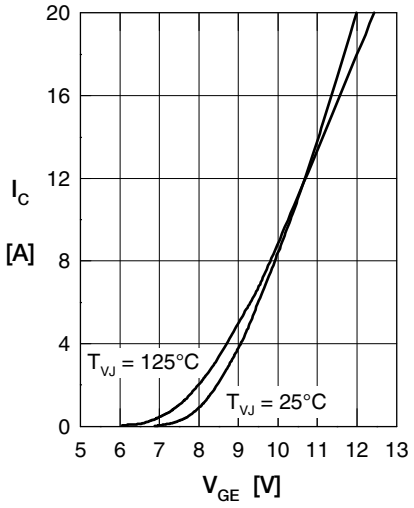



Fig. 3 Typ. tranfer characteristics

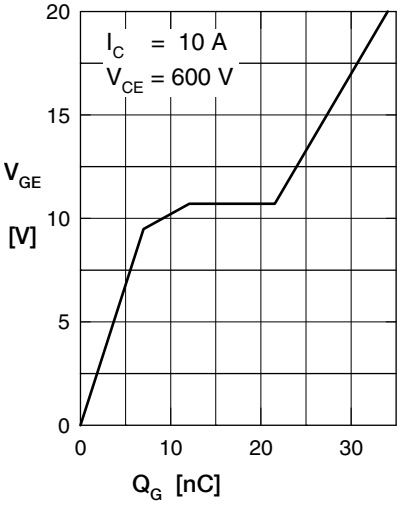



Fig. 4 Typ. turn-on gate charge

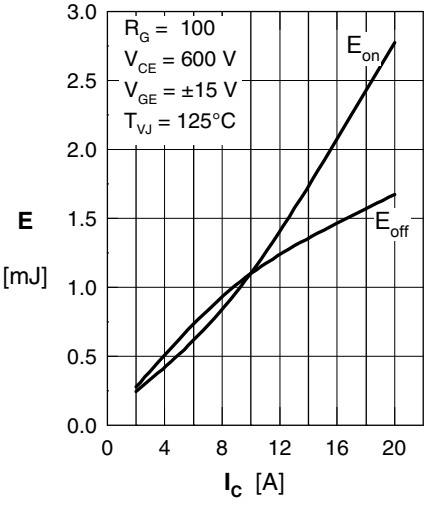



Fig. 5 Typ. switching energy vs. collector current

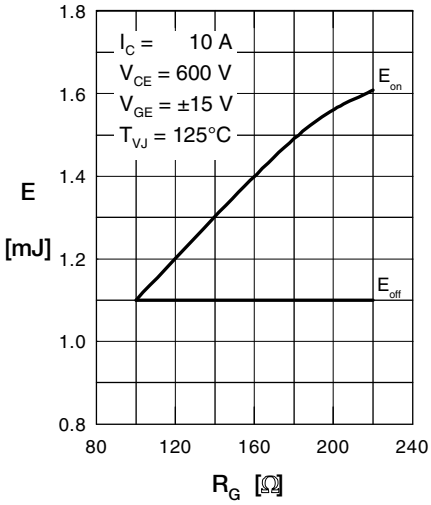



Fig. 6 Typ. switching energy vs. gate resistance

Fig. 7 Typ. transient thermal impedance junction to case

## Diode

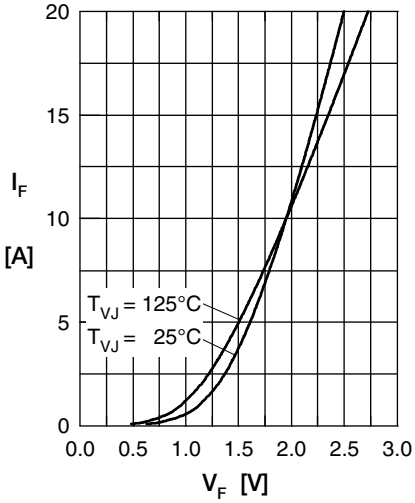



Fig. 1 Typ. forward current versus $V_F$

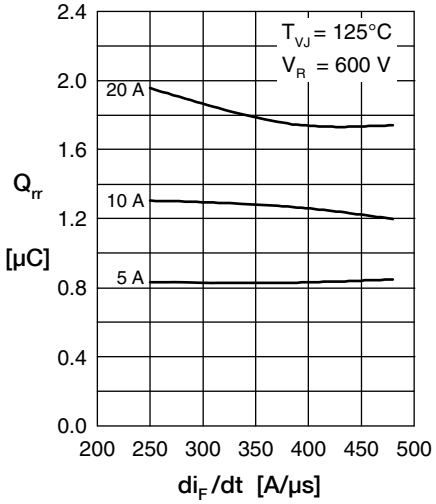



Fig. 2 Typical reverse recov. charge $Q_{rr}$ versus. $di_F/dt$

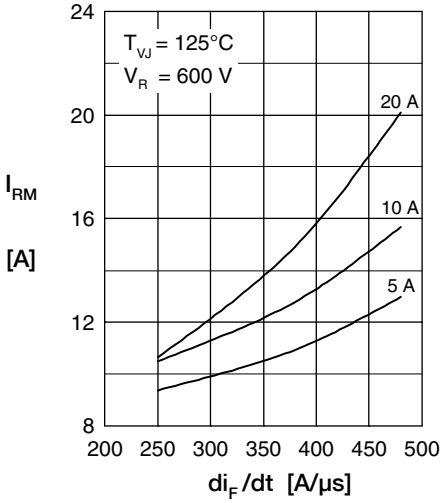



Fig.3 Typ: peak reverse current $I_{RR}$ versus $di_F/dt$




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

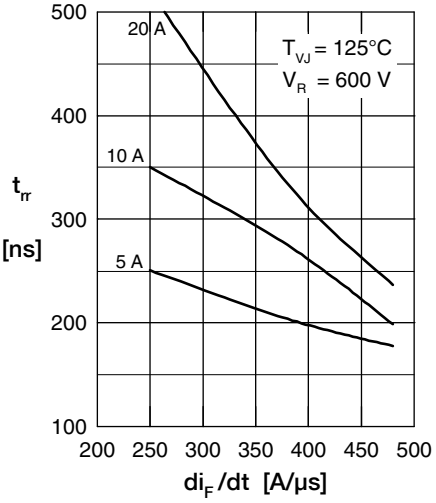



Fig. 5 Typ. recovery time $t_{rr}$ versus $di_F/dt$

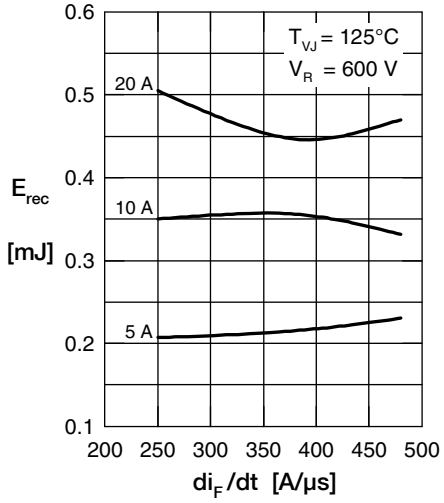



Fig. 6 Typ. recovery energy $E_{rec}$ vs. $di_F/dt$

Fig. 7 Typ. transient thermal impedance junction to case