

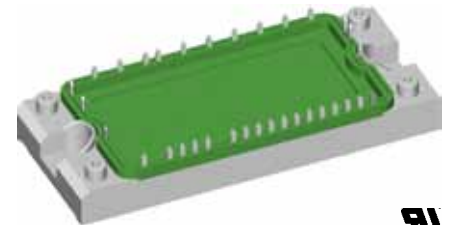
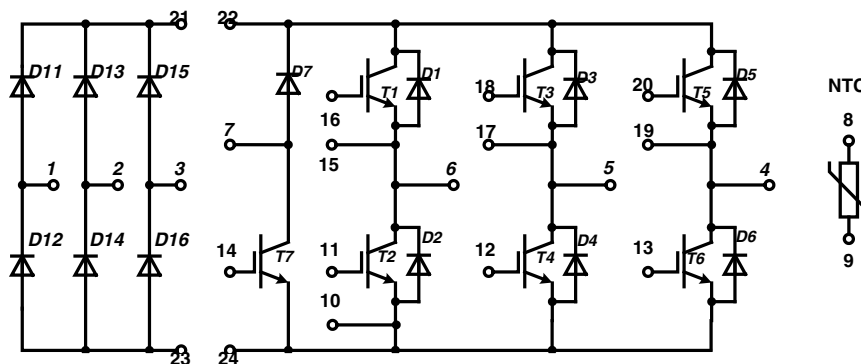
Converter - Brake - Inverter Module

XPT IGBT

| Three Phase Rectifier | Brake Chopper | Three Phase Inverter |
|---------------------------|------------------------------|------------------------------|
| $V_{RRM} = 1600\text{ V}$ | $V_{CES} = 1200\text{ V}$ | $V_{CES} = 1200\text{ V}$ |
| $I_{DAVM} = 105\text{ A}$ | $I_{C25} = 17\text{ A}$ | $I_{C25} = 28\text{ A}$ |
| $I_{FSM} = 320\text{ A}$ | $V_{CE(sat)} = 1.8\text{ V}$ | $V_{CE(sat)} = 1.8\text{ V}$ |

Part name (Marking on product)

MIXA20WB1200TED



E 72873

Pin configuration see outlines.

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 μsec .
 - very low gate charge
 - 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
- Temperature sense included

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 | | | ± 20 | V | |
| V_{GEM} | max. transient collector gate voltage | transient | | | ± 30 | V | |
| I_{C25} | collector current | | $T_C = 25^{\circ}\text{C}$ | | 28 | A | |
| I_{C80} | | | $T_C = 80^{\circ}\text{C}$ | | 20 | A | |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}\text{C}$ | | 100 | W | |
| $V_{CE(sat)}$ | collector emitter saturation voltage | $I_C = 16\text{ A}; V_{GE} = 15\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$ | 1.8 2.1 | 2.1 | V V | |
| $V_{GE(th)}$ | gate emitter threshold voltage | $I_C = 0.6\text{ mA}; V_{GE} = V_{CE}$ | $T_{VJ} = 25^{\circ}\text{C}$ | 5.4 | 6.0 | 6.5 | V |
| I_{CES} | collector emitter leakage current | $V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$ | 0.02 0.2 | 1.5 | mA mA | |
| I_{GES} | gate emitter leakage current | $V_{GE} = \pm 20\text{ V}$ | | | 500 | nA | |
| $Q_{G(on)}$ | total gate charge | $V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 15\text{ A}$ | | | 47 | nC | |
| $t_{d(on)}$ | turn-on delay time | inductive load $V_{CE} = 600\text{ V}; I_C = 15\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 56\ \Omega$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 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 | | | | 1.55 | mJ | |
| E_{off} | turn-off energy per pulse | | | | 1.7 | mJ | |
| RBSOA | reverse bias safe operating area | $V_{GE} = \pm 15\text{ V}; R_G = 56\ \Omega;$ | $T_{VJ} = 125^{\circ}\text{C}$ $V_{CEK} = 1200\text{ V}$ | | 45 | A | |
| SCSOA | short circuit safe operating area | | $T_{VJ} = 125^{\circ}\text{C}$ | | | | |
| t_{SC} | short circuit duration | $V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 56\ \Omega;$ non-repetitive | $T_{VJ} = 125^{\circ}\text{C}$ | | 10 | μs | |
| I_{SC} | short circuit current | | | | 60 | A | |
| R_{thJC} | thermal resistance junction to case | (per IGBT) | | | 1.26 | 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 | | $T_C = 25^{\circ}\text{C}$ | | 33 | A |
| I_{F80} | | | $T_C = 80^{\circ}\text{C}$ | | 22 | A |
| V_F | forward voltage | $I_F = 20\text{ A}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$ | 1.95 1.95 | 2.2 | V V |
| Q_{rr} | reverse recovery charge | $V_R = 600\text{ V}$ $di_f/dt = -400\text{ A}/\mu\text{s}$ $I_F = 20\text{ A}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 3 | μC |
| I_{RM} | max. reverse recovery current | | | | 20 | A |
| t_{rr} | reverse recovery time | | | | 350 | ns |
| E_{rec} | reverse recovery energy | | | | 0.7 | mJ |
| R_{thJC} | thermal resistance junction to case | (per diode) | | | 1.5 | K/W |

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

Brake T7

| 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 | | | ± 20 | V | |
| V_{GEM} | max. transient collector gate voltage | transient | | | ± 30 | V | |
| I_{C25} | collector current | | $T_C = 25^{\circ}\text{C}$ | | 17 | A | |
| I_{C80} | | | $T_C = 80^{\circ}\text{C}$ | | 12 | A | |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}\text{C}$ | | 60 | W | |
| $V_{CE(sat)}$ | collector emitter saturation voltage | $I_C = 9\text{ A}; V_{GE} = 15\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$ | 1.8 2.1 | 2.1 | V V | |
| $V_{GE(th)}$ | gate emitter threshold voltage | $I_C = 0.3\text{ mA}; V_{GE} = V_{CE}$ | $T_{VJ} = 25^{\circ}\text{C}$ | 5.4 | 6.0 | 6.5 | V |
| I_{CES} | collector emitter leakage current | $V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$ | | 0.1 | 0.1 | mA mA |
| I_{GES} | gate emitter leakage current | $V_{GE} = \pm 20\text{ V}$ | | | 500 | nA | |
| $Q_{G(on)}$ | total gate charge | $V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 10\text{ A}$ | | | 28 | | nC |
| $t_{d(on)}$ | turn-on delay time | inductive load $V_{CE} = 600\text{ V}; I_C = 10\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 100\ \Omega$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 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 | | | | 1.1 | | mJ |
| E_{off} | turn-off energy per pulse | | | | 1.1 | | mJ |
| RBSOA | reverse bias safe operating area | $V_{GE} = \pm 15\text{ V}; R_G = 100\ \Omega;$ | $T_{VJ} = 125^{\circ}\text{C}$ $V_{CEK} = 1200\text{ V}$ | | | 30 | A |
| SCSOA | short circuit safe operating area | | $T_{VJ} = 125^{\circ}\text{C}$ | | | | |
| t_{SC} | short circuit duration | $V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$ | | | | 10 | μs |
| I_{SC} | short circuit current | $R_G = 100\ \Omega;$ non-repetitive | | | 40 | | A |
| R_{thJC} | thermal resistance junction to case | (per IGBT) | | | | 2.0 | K/W |

Brake Chopper D7

| 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 | | $T_C = 25^{\circ}\text{C}$ | | 12 | A | |
| I_{F80} | | | $T_C = 80^{\circ}\text{C}$ | | 8 | A | |
| V_F | forward voltage | $I_F = 5\text{ A}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$ | 1.95 1.95 | 2.2 | V V | |
| I_R | reverse current | $V_R = V_{RRM}$ | $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$ | | 0.5 | 0.5 | mA mA |
| Q_{rr} | reverse recovery charge | $V_R = 600\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $I_F = 5\text{ A}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 0.6 | | μC |
| I_{RM} | max. reverse recovery current | | | | 6 | | A |
| t_{rr} | reverse recovery time | | | | 350 | | ns |
| E_{rec} | reverse recovery energy | | | | 0.2 | | mJ |
| R_{thJC} | thermal resistance junction to case | (per diode) | | | | 3.4 | K/W |

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

Input Rectifier Bridge D11 - D16

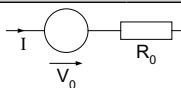
| Symbol | Definitions | Conditions | Ratings | | | Unit |
|------------|-------------------------------------|-------------------------|---------|------|------|------------------|
| | | | min. | typ. | max. | |
| V_{RRM} | max. repetitive reverse voltage | | | | 1600 | V |
| I_{FAV} | average forward current | sine 180° | | | 37 | A |
| I_{DAVM} | max. average DC output current | rect.; $d = 1/3$ | | | 105 | A |
| I_{FSM} | max. forward surge current | $t = 10$ ms; sine 50 Hz | | | 320 | A |
| | | | | | 280 | A |
| I^2t | I^2t value for fusing | $t = 10$ ms; sine 50 Hz | | | 510 | A ² s |
| | | | | | 390 | A ² s |
| P_{tot} | total power dissipation | | | | 110 | W |
| V_F | forward voltage | $I_F = 50$ A | | 1.34 | 1.7 | V |
| | | | | 1.34 | | V |
| I_R | reverse current | $V_R = V_{RRM}$ | | | 0.02 | mA |
| | | | | 0.2 | | mA |
| R_{thJC} | thermal resistance junction to case | (per diode) | | | 1.1 | K/W |

Temperature Sensor NTC

| Symbol | Definitions | Conditions | Ratings | | | Unit |
|-------------|-------------|------------|---------|------|------|------------|
| | | | min. | typ. | max. | |
| R_{25} | resistance | | 4.75 | 5.0 | 5.25 | k Ω |
| $B_{25/50}$ | | | | 3375 | | K |

Module

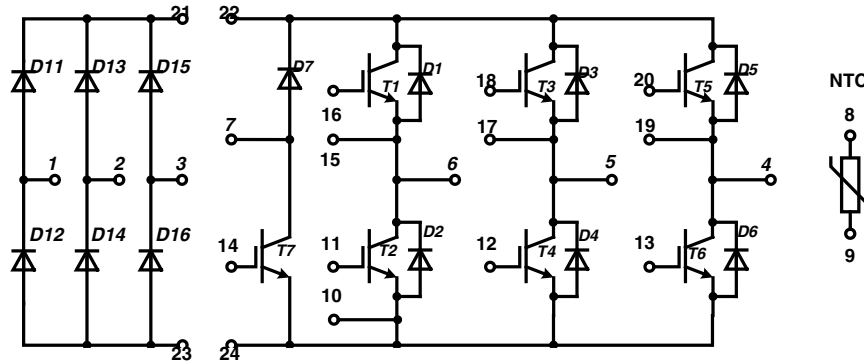
| Symbol | Definitions | Conditions | Ratings | | | Unit |
|----------------|-------------------------------------|--------------------------------|---------|------|------|------------|
| | | | min. | typ. | max. | |
| T_{VJ} | operating temperature | | -40 | | 125 | °C |
| T_{VJM} | max. virtual junction temperature | | | | 150 | °C |
| T_{stg} | storage temperature | | -40 | | 125 | °C |
| V_{ISOL} | isolation voltage | $I_{ISOL} \leq 1$ mA; 50/60 Hz | | | 2500 | V~ |
| CTI | 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 | | m Ω |
| R_{thCH} | thermal resistance case to heatsink | with heatsink compound | | 0.02 | | K/W |
| Weight | | | | 180 | | g |

Equivalent Circuits for Simulation


| Symbol | Definitions | Conditions | Ratings | | | Unit |
|--------|---------------------|------------|---------|------|------|------------|
| | | | min. | typ. | max. | |
| V_0 | rectifier diode | D8 - D13 | | | 0.88 | V |
| R_0 | | | | | 9 | m Ω |
| V_0 | IGBT | T1 - T6 | | | 1.1 | V |
| R_0 | | | | | 86 | m Ω |
| V_0 | free wheeling diode | D1 - D6 | | | 1.2 | V |
| R_0 | | | | | 40 | m Ω |
| V_0 | IGBT | T7 | | | 1.1 | V |
| R_0 | | | | | 153 | m Ω |
| V_0 | free wheeling diode | D7 | | | 1.15 | V |
| R_0 | | | | | 170 | m Ω |

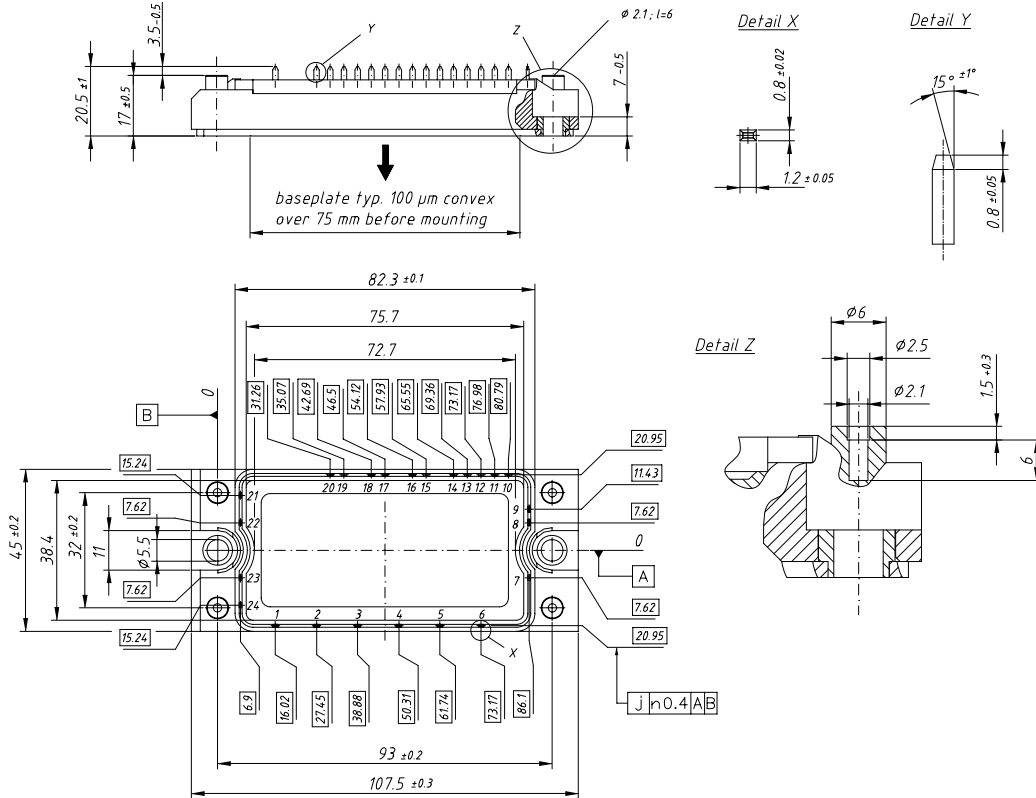
 $T_C = 25^\circ\text{C}$ unless otherwise stated

Circuit Diagram

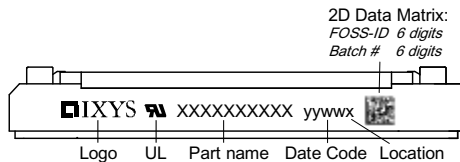


Outline Drawing

Dimensions in mm (1 mm = 0.0394")



Product Marking



Part number

- M = Module
- I = IGBT
- A = MPT
- X = Parallel Legs
- 20 = Current Rating [A]
- WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
- 1200 = Reverse Voltage [V]
- T = NTC
- ED = E2-Pack

| Ordering | Part Name | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|------------------|--------------------|-----------------|----------|---------------|
| Standard | MIXA20WB1200 TED | MIXA20WB1200TED | Box | 6 | 507 490 |

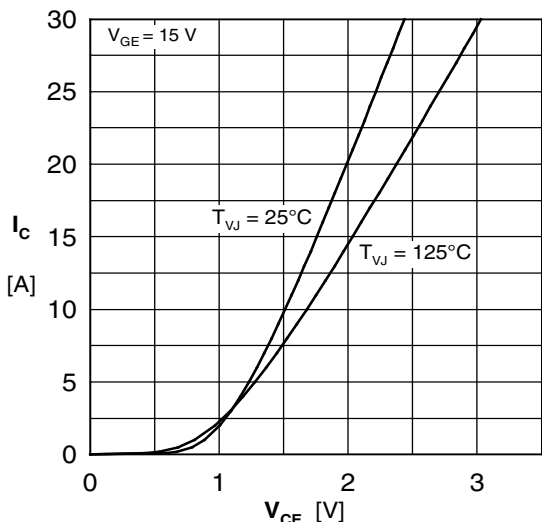
Inverter T1 - T6


Fig. 1 Typ. output characteristics

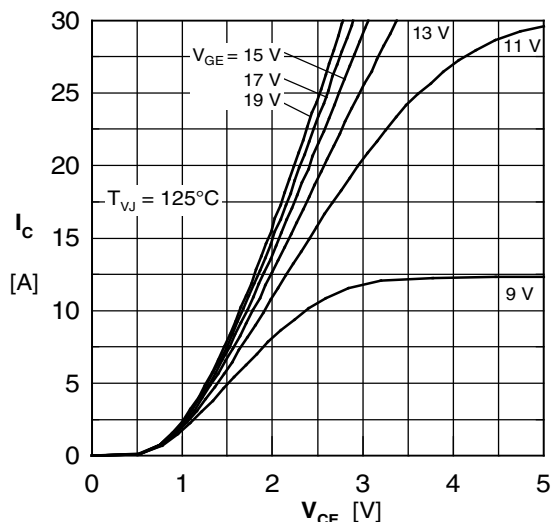


Fig. 2 Typ. output characteristics

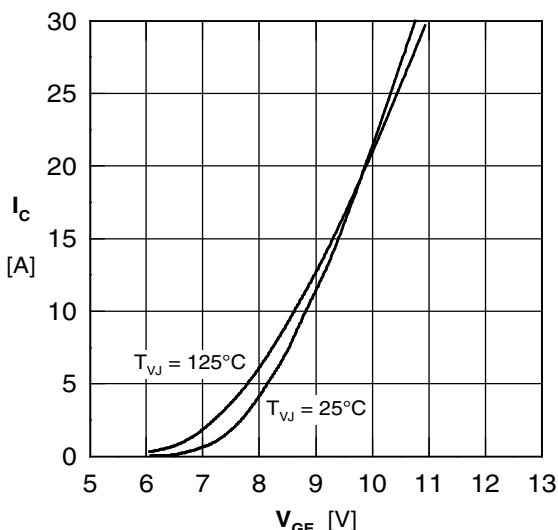


Fig. 3 Typ. transfer characteristics

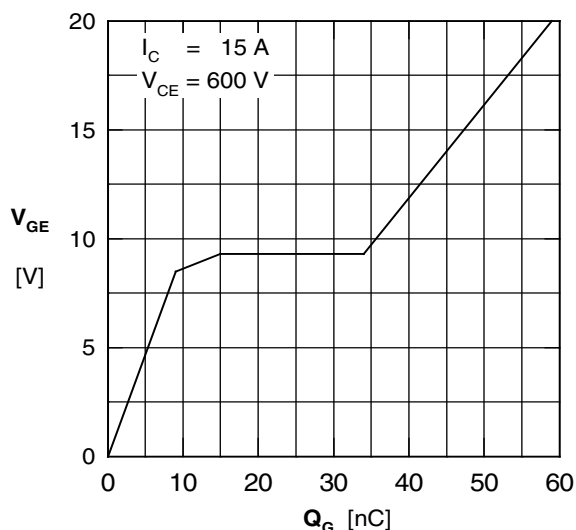


Fig. 4 Typ. turn-on gate charge

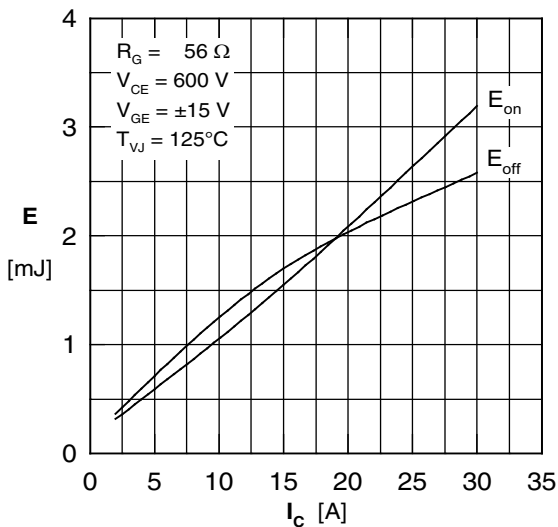


Fig. 5 Typ. switching energy vs. collector current

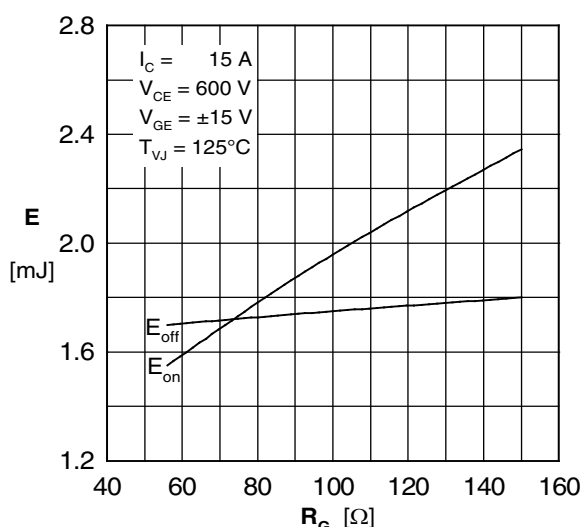


Fig. 6 Typ. switching energy vs. gate resistance

Inverter D1 - D6

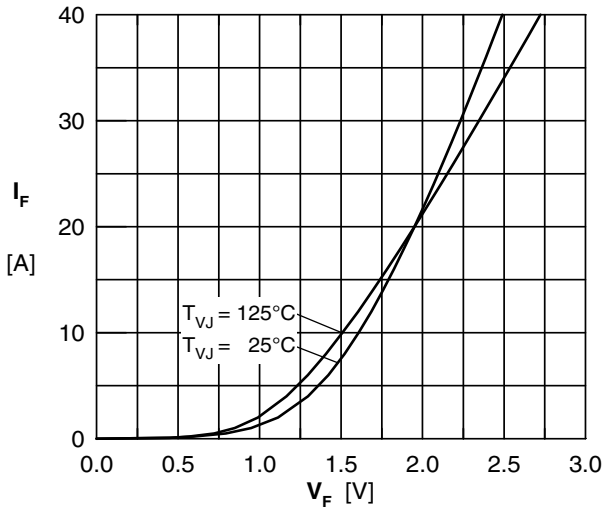


Fig. 7 Typ. Forward current versus V_F

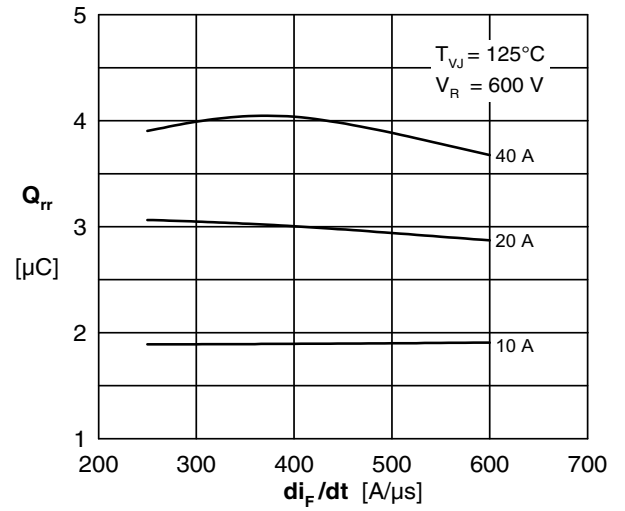


Fig. 8 Typ. reverse recov.charge Q_{rr} vs. di/dt

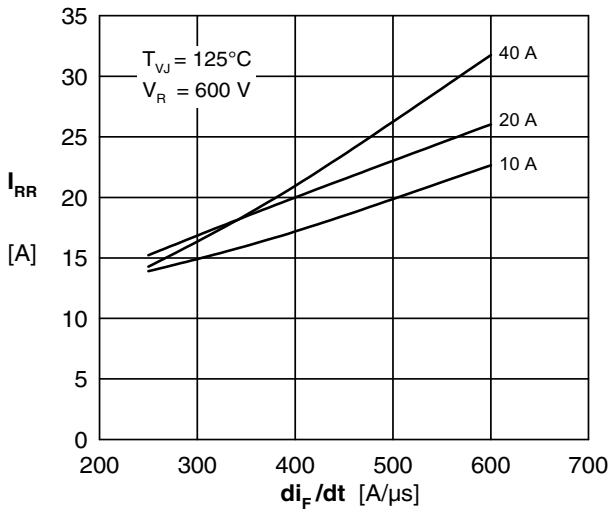


Fig. 9 Typ. peak reverse current I_{RM} vs. di/dt

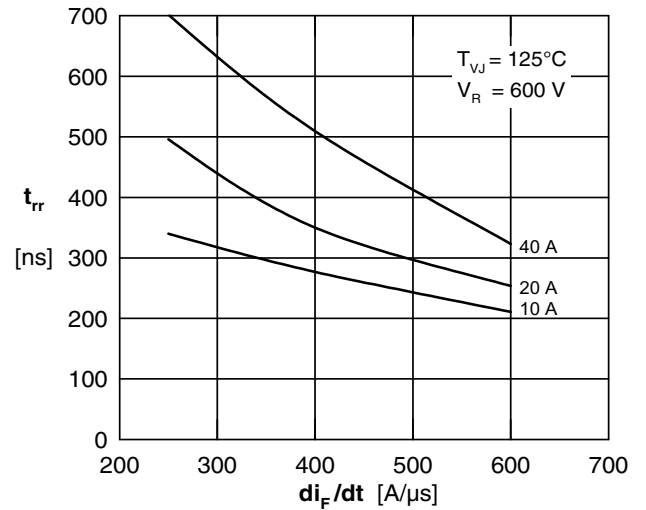


Fig. 10 Typ. recovery time t_{rr} versus di/dt

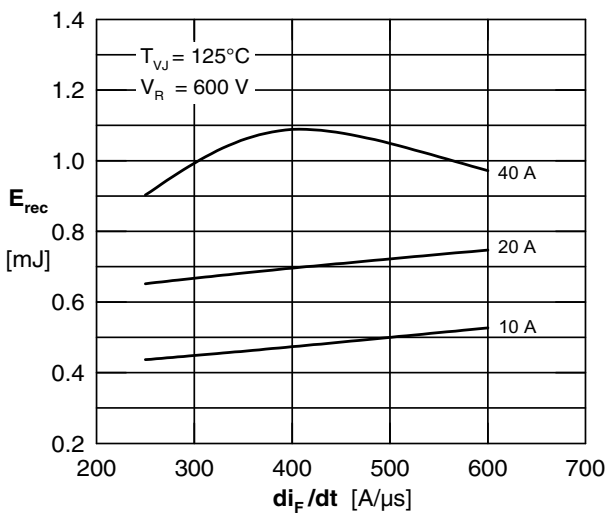


Fig. 11 Typ. recovery energy E_{rec} versus di/dt

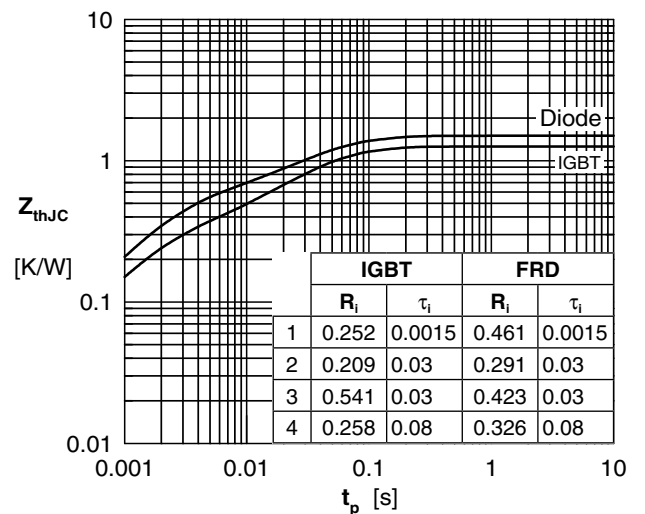


Fig. 12 Typ. transient thermal impedance

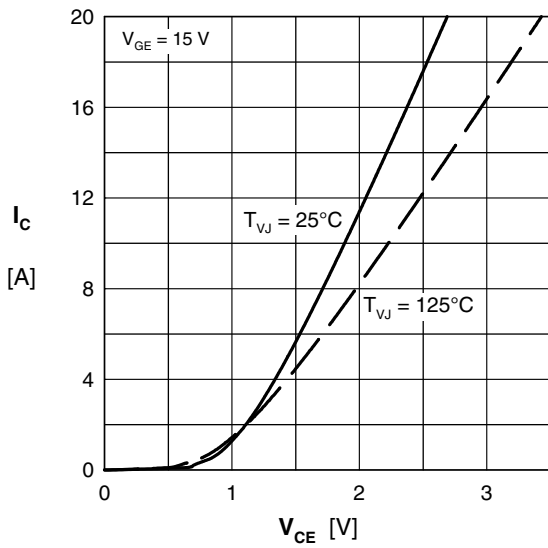
Brake T7 & D7


Fig. 13 Typ. output characteristics

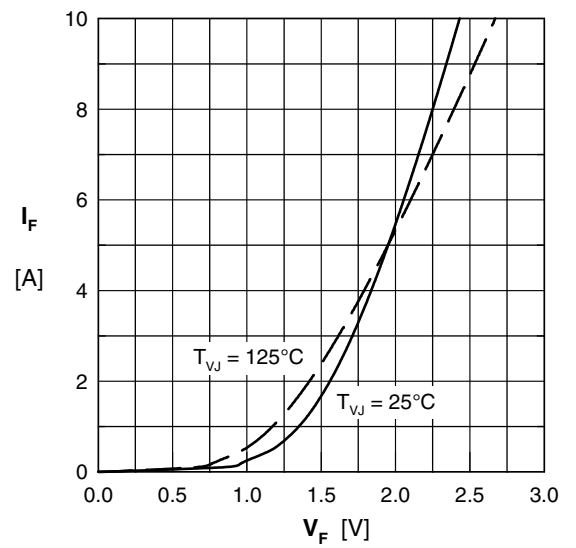


Fig. 14 Typ. forward characteristics

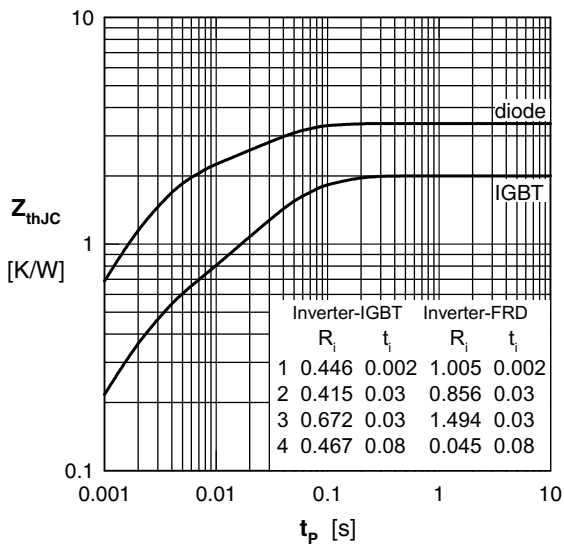


Fig. 15 Typ. transient thermal impedance

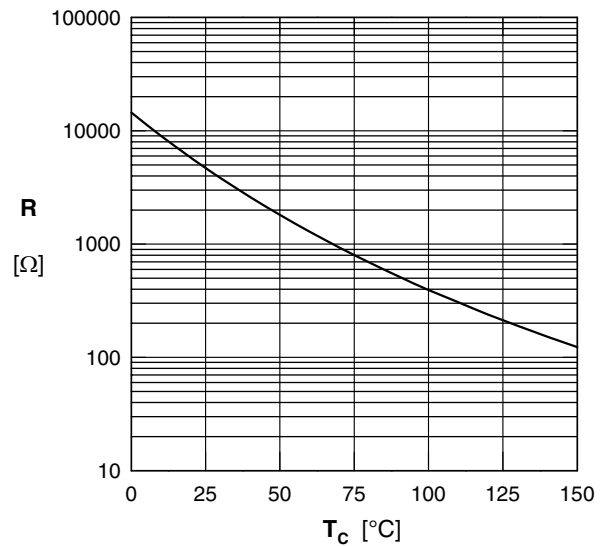


Fig. 16 Typ. NTC resistance vs. temperature