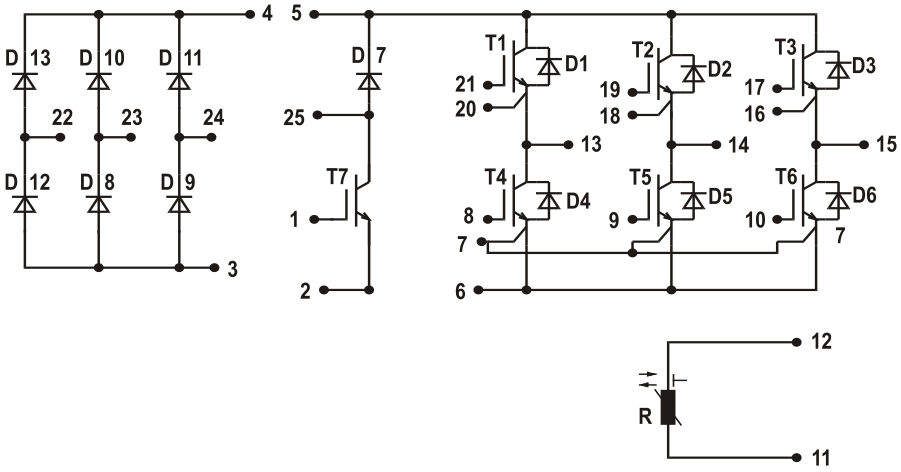
# Converter - Brake - Inverter Module
## XPT IGBT

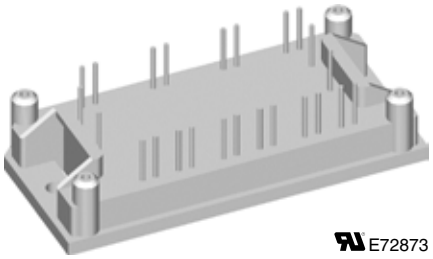
| Three Phase Rectifier | Brake Chopper | Three Phase Inverter |
|---|---|---|
| $V_{RRM}$ = 1600 V | $V_{CES}$ = 1200 V | $V_{CES}$ = 1200 V |
| $I_{DAVM25}$ = 100 A | $I_{C25}$ = 17 A | $I_{C25}$ = 17 A |
| $I_{FSM}$ = 320 A | $V_{CE(sat)}$ = 1.8 V | $V_{CE(sat)}$ = 1.8 V |

Preliminary data

**Part name** (Marking on product)

MIXA10WB1200TML



E72873

Pin configuration see outlines.

**Features:**

- High level of integration - only one power semiconductor module required for the whole drive
- Rugged XPT design (Xtreme light Punch Through) results in:
  - short circuit rated for 10 µsec.
  - very low gate charge
  - square RBSOA @ 3x $I_C$
  - low EMI
- Thin wafer technology combined with the XPT design results in a competitive low $V_{CE(sat)}$
- Temperature sense included
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

**Application:**

- AC motor drives
- Pumps, Fans
- Washing machines
- Air-conditioning system
- Inverter and power supplies

**Package:**

- DCB based "E1-Pack"
- Assembly height is 17 mm
- Insulated base plate
- UL registered E72873

## Ouput Inverter T1 - T6

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CES}$ | *collector emitter voltage* | | $T_{VJ}$ = 25°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°C | | | 17 | A |
| $I_{C80}$ | | | $T_C$ = 80°C | | | 12 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 63 | W |
| $V_{CE(sat)}$ | *collector emitter saturation voltage* | $I_C$ = 9 A; $V_{GE}$ = 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* | $I_C$ = 0.3 mA; $V_{GE}$ = $V_{CE}$ | $T_{VJ}$ = 25°C | 5.5 | 6.0 | 6.5 | V |
| $I_{CES}$ | *collector emitter leakage current* | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | 0.02 | 0.1 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.2 | | 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* | inductive load<br>$V_{CE}$ = 600 V; $I_C$ = 10 A<br>$V_{GE}$ = ±15 V; $R_G$ = 100 Ω | $T_{VJ}$ = 125°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* | $V_{GE}$ = ±15 V; $R_G$ = 100 Ω; $V_{CEK}$ = 1200 V | $T_{VJ}$ = 125°C | | | 30 | A |
| $I_{SC}$ **(SCSOA)** | *short circuit safe operating area* | $V_{CE}$ = 900 V; $V_{GE}$ = ±15 V;<br>$R_G$ = 100 Ω; $t_p$ = 10 µs; non-repetitive | $T_{VJ}$ = 125°C | | 40 | | A |
| $R_{thJC}$ | *thermal resistance junction to case* | (per IGBT) | | | | 2.0 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.7 | | K/W |

## Output Inverter D1 - D6

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitve reverse voltage* | | $T_{VJ}$ = 25°C | | | 1200 | V |
| $I_{F25}$ | *forward current* | | $T_C$ = 25°C | | | 19 | A |
| $I_{F80}$ | | | $T_C$ = 80°C | | | 13 | A |
| $V_F$ | *forward voltage* | $I_F$ = 10 A; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | 1.95 | 2.2 | V |
| | | | $T_{VJ}$ = 125°C | | 1.85 | | V |
| $Q_{rr}$ | *reverse recovery charge* | $V_R$ = 600 V<br>$di_F/dt$ = -250 A/µs<br>$I_F$ = 10 A; $V_{GE}$ = 0 V | $T_{VJ}$ = 125°C | | tbd | | µC |
| $I_{RM}$ | *max. reverse recovery current* | | | | tbd | | A |
| $t_{rr}$ | *reverse recovery time* | | | | tbd | | ns |
| $E_{rec}$ | *reverse recovery energy* | | | | tbd | | mJ |
| $R_{thJC}$ | *thermal resistance junction to case* | (per diode) | | | | 2.4 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.8 | | K/W |

## Brake T7

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CES}$ | *collector emitter voltage* | | $T_{VJ}$ = 25°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°C | | | 17 | A |
| $I_{C80}$ | | | $T_C$ = 80°C | | | 12 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 63 | W |
| $V_{CE(sat)}$ | *collector emitter saturation voltage* | $I_C$ = 9 A; $V_{GE}$ = 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* | $I_C$ = 0.3 mA; $V_{GE}$ = $V_{CE}$ | $T_{VJ}$ = 25°C | 5.5 | 6.0 | 6.5 | V |
| $I_{CES}$ | *collector emitter leakage current* | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | 0.01 | 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* | inductive load<br>$V_{CE}$ = 600 V; $I_C$ = 10 A<br>$V_{GE}$ = ±15 V; $R_G$ = 100 Ω | $T_{VJ}$ = 125°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* | $V_{GE}$ = ±15 V; $R_G$ = 100 Ω; $V_{CEK}$ = 1200 V | $T_{VJ}$ = 125°C | | | 30 | A |
| $I_{SC}$ **(SCSOA)** | *short circuit safe operating area* | $V_{CE}$ = 900 V; $V_{GE}$ = ±15 V;<br>$R_G$ = 100 Ω; $t_p$ = 10 µs; non-repetitive | $T_{VJ}$ = 125°C | | 40 | | A |
| $R_{thJC}$ | *thermal resistance junction to case* | (per IGBT) | | | | 2.0 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.7 | | K/W |

## Brake Chopper D7

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitive reverse voltage* | | $T_{VJ}$ = 150°C | | | 1200 | V |
| $I_{F25}$ | *forward current* | | $T_C$ = 25°C | | | 19 | A |
| $I_{F80}$ | | | $T_C$ = 80°C | | | 13 | A |
| $V_F$ | *forward voltage* | $I_F$ = 10 A; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | 1.95 | 2.2 | V |
| | | | $T_{VJ}$ = 125°C | | 1.85 | | V |
| $I_R$ | *reverse current* | $V_R$ = $V_{RRM}$ | $T_{VJ}$ = 25°C | | 0.01 | 0.1 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.1 | | mA |
| $Q_{rr}$ | *reverse recovery charge* | $V_R$ = 600 V<br>$di_F/dt$ = tbd A/µs<br>$I_F$ = 10 A; $V_{GE}$ = 0 V | $T_{VJ}$ = 125°C | | tbd | | µC |
| $I_{RM}$ | *max. reverse recovery current* | | | | tbd | | A |
| $t_{rr}$ | *reverse recovery time* | | | | tbd | | ns |
| $E_{rec}$ | *reverse recovery energy* | | | | tbd | | mJ |
| $R_{thJC}$ | *thermal resistance junction to case* | (per diode) | | | | 2.4 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.8 | | K/W |

## Input Rectifier Bridge D8 - D11

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitive reverse voltage* | | $T_{VJ}$ = 25°C | | | 1600 | V |
| $I_{FAV}$ | *average forward current* | sine 180° | $T_C$ = 80°C | | | 24 | A |
| $I_{DAVM}$ | *max. average DC output current* | rect.; d = $^1/_3$ | $T_C$ = 80°C | | | 69 | A |
| $I_{FSM}$ | *max. forward surge current* | t = 10 ms; sine 50 Hz | $T_{VJ}$ = 25°C | | | 270 | A |
| | | | $T_{VJ}$ = 125°C | | | 240 | A |
| $I^2t$ | *$I^2t$ value for fusing* | t = 10 ms; sine 50 Hz | $T_{VJ}$ = 25°C | | | 360 | $A^2s$ |
| | | | $T_{VJ}$ = 125°C | | | 290 | $A^2s$ |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 70 | W |
| $V_F$ | *forward voltage* | $I_F$ = 30 A | $T_{VJ}$ = 25°C | | 1.27 | 1.7 | V |
| | | | $T_{VJ}$ = 125°C | | 1.24 | | V |
| $I_R$ | *reverse current* | $V_R = V_{RRM}$ | $T_{VJ}$ = 25°C | | | 0.02 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.2 | | mA |
| $R_{thJC}$ | *thermal resistance junction to case* | (per diode) | | | | 1.8 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | (per diode) | | | 0.6 | | K/W |

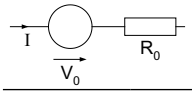
## Temperature Sensor NTC

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $R_{25}$ | *resistance* | | $T_C$ = 25°C | 4.45 | 4.7 | 5.0 | kΩ |
| $B_{25/50}$ | | | | | 3510 | | K |

## Module

| Symbol | Definitions | Conditions | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| $T_{VJ}$ | *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* | (M4) | 2.0 | | 2.2 | Nm |
| $d_S$ | *creep distance on surface* | | 12.7 | | | mm |
| $d_A$ | *strike distance through air* | | 7.6 | | | mm |
| **Weight** | | | | 40 | | g |

## Equivalent Circuits for Simulation




| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_0$ | *rectifier diode* | D8 - D13 | $T_{VJ}$ = 150°C | | | 0.86 | V |
| $R_0$ | | | | | | 12.3 | mΩ |
| $V_0$ | *IGBT* | T1 - T6 | $T_{VJ}$ = 150°C | | | 1.1 | V |
| $R_0$ | | | | | | 153 | mΩ |
| $V_0$ | *free wheeling diode* | D1 - D6 | $T_{VJ}$ = 150°C | | | 1.09 | V |
| $R_0$ | | | | | | 91 | mΩ |
| $V_0$ | *IGBT* | T7 | $T_{VJ}$ = 150°C | | | 1.1 | V |
| $R_0$ | | | | | | 153 | mΩ |
| $V_0$ | *free wheeling diode* | D7 | $T_{VJ}$ = 150°C | | | 1.09 | V |
| $R_0$ | | | | | | 91 | mΩ |

IXYS reserves the right to change limits, test conditions and dimensions.

$T_C$ = 25°C unless otherwise stated

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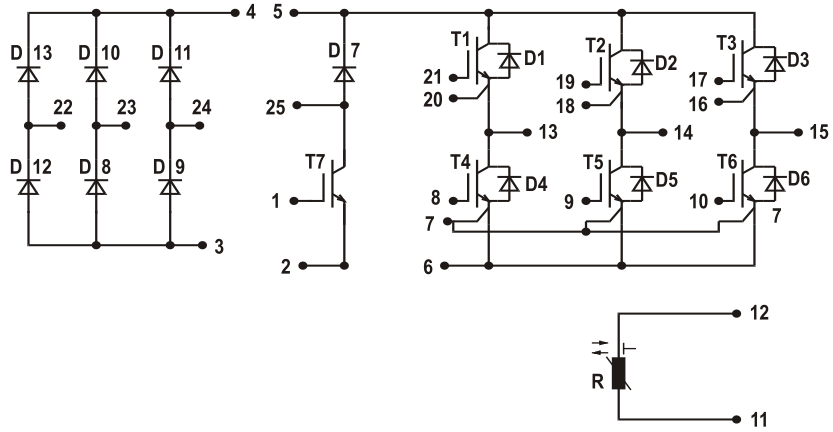
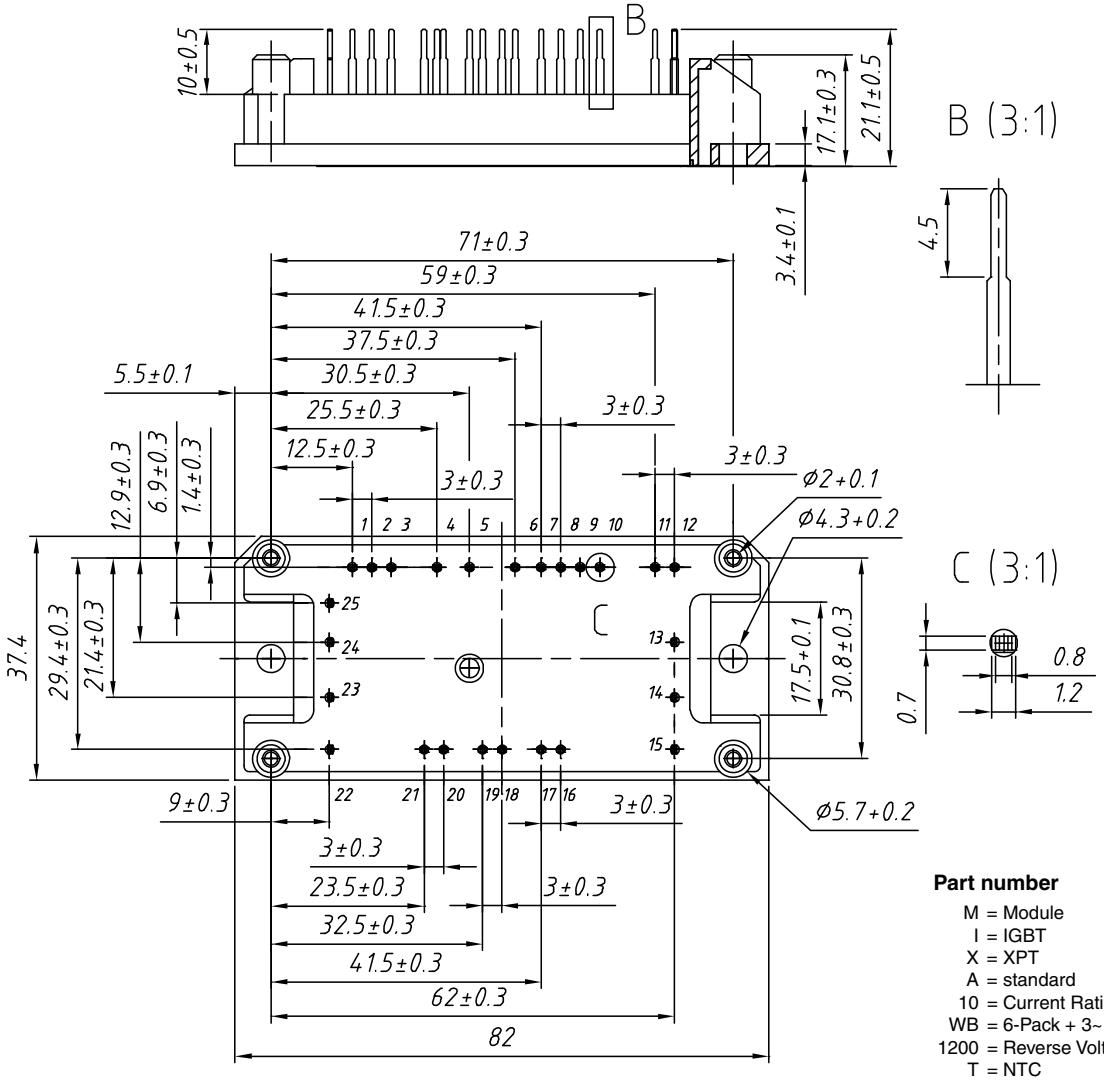
## Circuit Diagram




## Outline Drawing

Dimensions in mm (1 mm = 0.0394“)




**Part number**

M = Module
I = IGBT
X = XPT
A = standard
10 = Current Rating [A]
WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
1200 = Reverse Voltage [V]
T = NTC
ML = E1-Pack

| Ordering | Part Name | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|---|---|---|---|---|---|
| Standard | MIXA 10 WB 1200 TML | MIXA10WB1200TML | Box | 10 | 509367 |

IXYS reserves the right to change limits, test conditions and dimensions.

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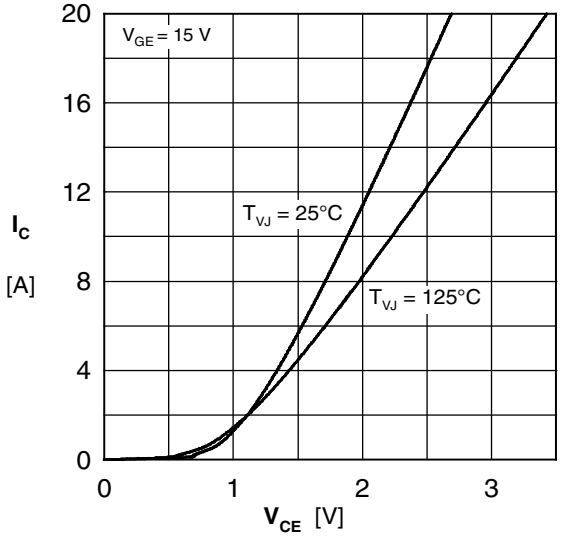


Fig. 1 Typ. output characteristics

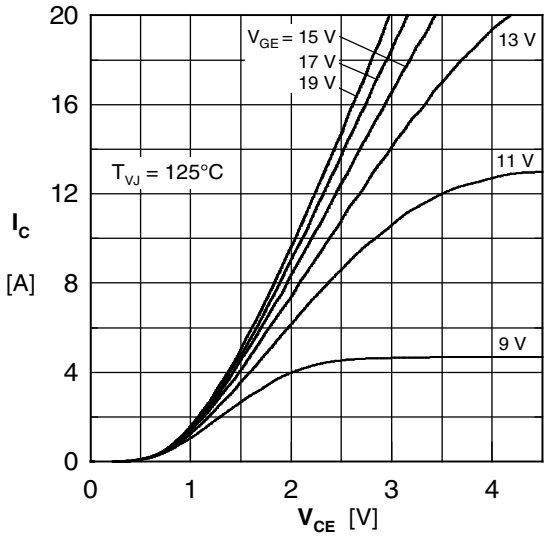


Fig. 2 Typ. output characteristics

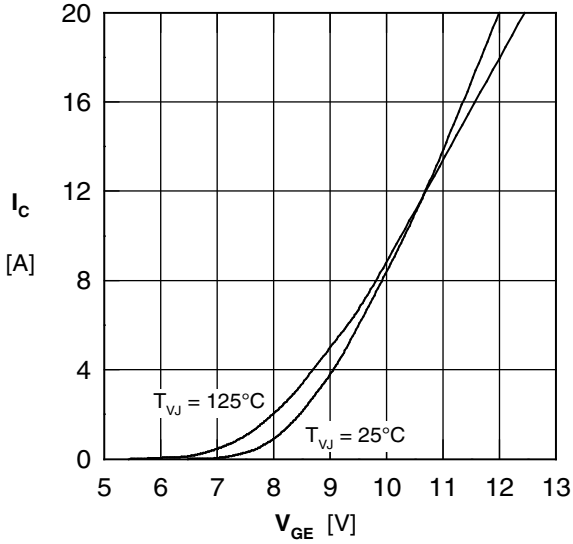


Fig. 3 Typ. tranfer characteristics

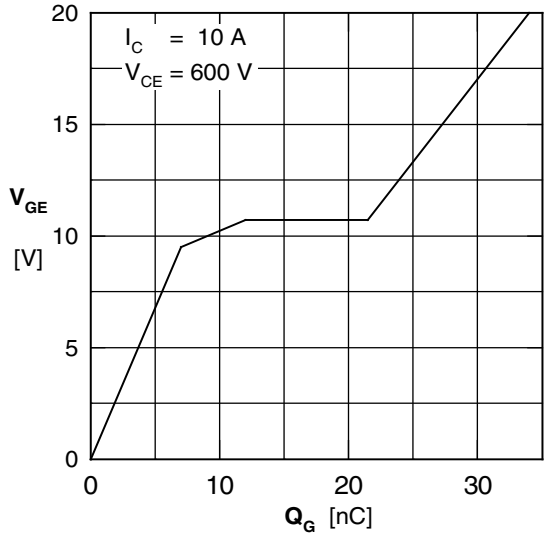


Fig. 4 Typ. turn-on gate charge

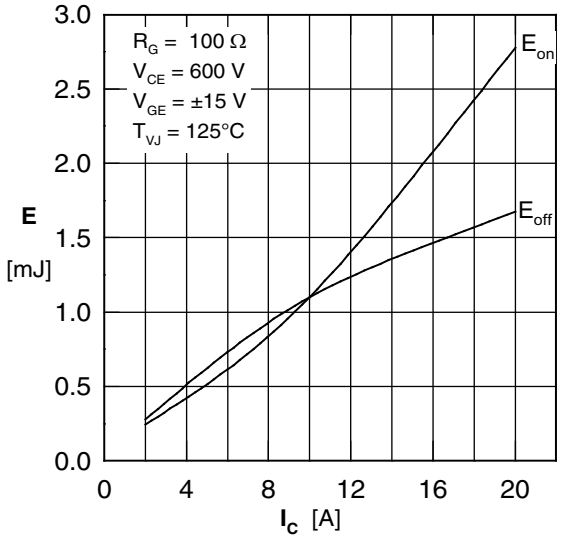


Fig. 5 Typ. switching energy vs. collector current

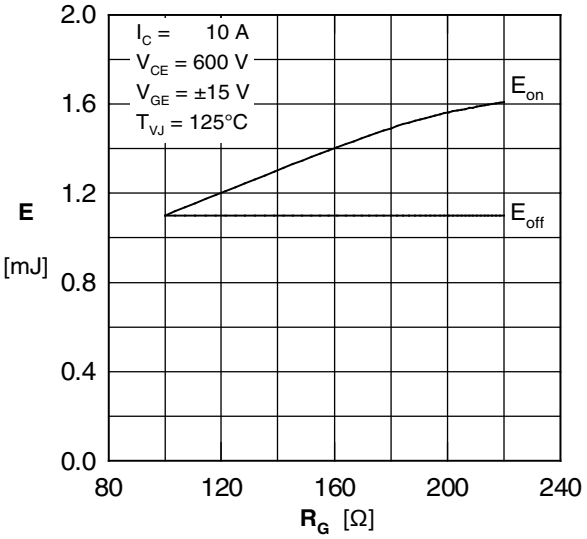


Fig. 6 Typ. switching energy vs. gate resistance

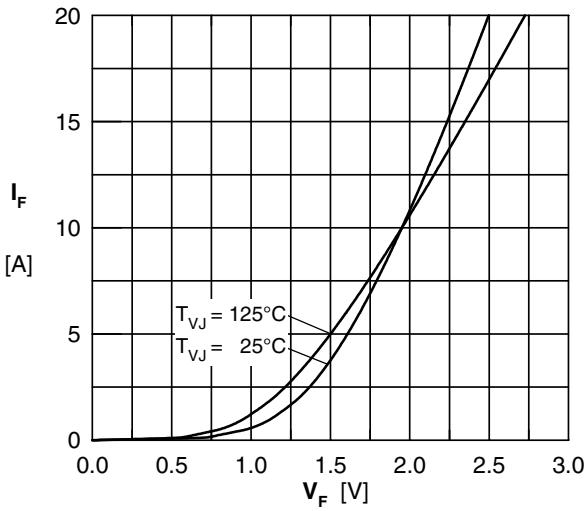


Fig. 7 Typ. forward characteristics

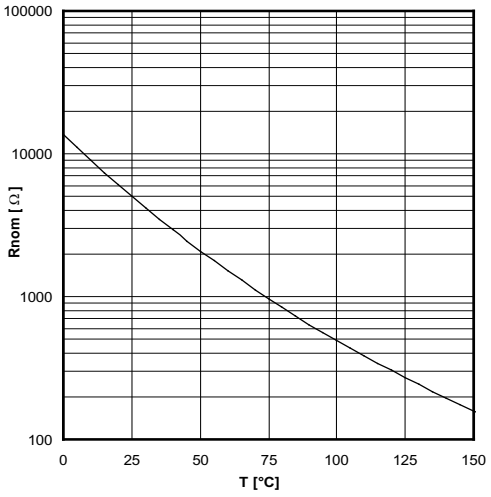


Fig. 8 Typ. thermistor resistance vs. temperature

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F3L400R07ME4_B22 F4-50R07W2H3_B51 FB15R06W1E3 FB20R06W1E3_B11 FD1000R33HE3-K FD400R33KF2C-K FD401R17KF6C_B2 FD-DF80R12W1H3_B52 FF200R06YE3 FF300R12KE4_E FF450R12ME4P FF600R12IP4V FP10R06W1E3_B11 FP20R06W1E3 FP50R12KT3 FP75R07N2E4_B11 FS10R12YE3 FS150R07PE4 FS150R12PT4 FS200R12KT4R FS50R07N2E4_B11 FZ1000R33HE3 FZ1800R17KF4 DD250S65K3 DF1000R17IE4 DF1000R17IE4D_B2 DF1400R12IP4D DF200R12PT4_B6 DF400R07PE4R_B6 BSM75GB120DN2_E3223c-Se F3L300R12ME4_B22 F3L75R07W2E3_B11 F4-50R12KS4_B11 F475R07W1H3B11ABOMA1 FD1400R12IP4D FD200R12PT4_B6 FD800R33KF2C-K FF1200R17KP4_B2 FF300R17KE3_S4 FF300R17ME4_B11 FF401R17KF6C_B2 FF650R17IE4D_B2 FF900R12IP4D FF900R12IP4DV STGIF7CH60TS-L FP50R07N2E4_B11 FS100R07PE4 FS150R07N3E4_B11 FS150R17N3E4 FS150R17PE4