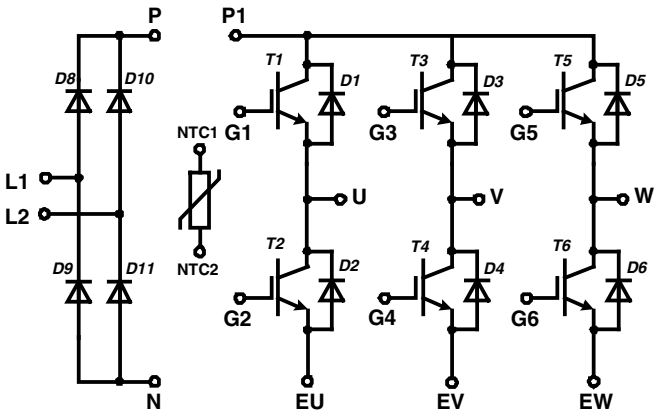
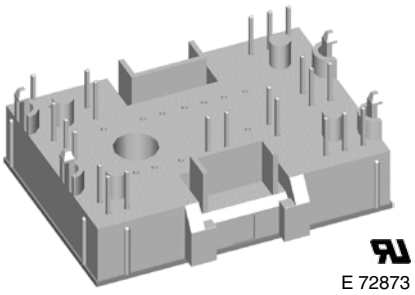
# Converter - Inverter Module
NPT IGBT

| Single Phase Rectifier | Three Phase Inverter |
|---|---|
| $V_{RRM}$ = 1600 V | $V_{CES}$ = 600 V |
| $I_{DAVM25}$ = 65 A | $I_{C25}$ = 23 A |
| $I_{FSM}$ = 550 A | $V_{CE(sat)}$ = 2.1 V |

**Part name** (Marking on product)

MIAA15WD600TMH



E 72873

Pin configuration see outlines.

**Features:**

- High level of integration - only one power semiconductor module required for the whole drive
- Inverter with NPT IGBTs
  - low saturation voltage
  - positive temperature coefficient
  - fast switching
  - short tail current
- Epitaxial free wheeling diodes with hiperfast soft reverse recovery
- Temperature sense included

**Application:**

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

**Package:**

- "Mini" package
- Assembly height is 17 mm
- Insulated base plate
- Pins suitable for wave soldering and PCB mounting
- Assembly clips available
  - IXKU 5-505 screw clamp
  - IXRB 5-506 click clamp
- UL registered E72873

## Ouput Inverter T1 - T6

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CES}$ | *collector emitter voltage* | | $T_{VJ}$ = 150°C | | | 600 | 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 | | | 23 | A |
| $I_{C80}$ | | | $T_C$ = 80°C | | | 16 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 80 | W |
| $V_{CE(sat)}$ | *collector emitter saturation voltage* | $I_C$ = 15 A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25°C | | 2.1 | 2.5 | V |
| | | | $T_{VJ}$ = 125°C | | 2.3 | | V |
| $V_{GE(th)}$ | *gate emitter threshold voltage* | $I_C$ = 0.4 A; $V_{GE}$ = $V_{CE}$ | $T_{VJ}$ = 25°C | 4.5 | 5.5 | 6.5 | V |
| $I_{CES}$ | *collector emitter leakage current* | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 0.6 | mA |
| | | | $T_{VJ}$ = 125°C | | 1.0 | | mA |
| $I_{GES}$ | *gate emitter leakage current* | $V_{GE}$ = ±20 V | | | | 150 | nA |
| $C_{ies}$ | *input capacitance* | $V_{CE}$ = 25 V; $V_{GE}$ = 0 V; f = 1 MHz | | | 700 | | pF |
| $Q_{G(on)}$ | *total gate charge* | $V_{CE}$ = 300 V; $V_{GE}$ = 15 V; $I_C$ = 15 A | | | 57 | | nC |
| $t_{d(on)}$ | *turn-on delay time* | inductive load | $T_{VJ}$ = 25°C | | 40 | | ns |
| $t_r$ | *current rise time* | $V_{CE}$ = 300 V; $I_C$ = 15 A | | | 45 | | ns |
| $t_{d(off)}$ | *turn-off delay time* | $V_{GE}$ = ±15 V; $R_G$ = 68 Ω | | | 155 | | ns |
| $t_f$ | *current fall time* | | | | 95 | | ns |
| $E_{on}$ | *turn-on energy per pulse* | | | | 0.35 | | mJ |
| $E_{off}$ | *turn-off energy per pulse* | | | | 0.27 | | mJ |
| $t_{d(on)}$ | *turn-on delay time* | inductive load | $T_{VJ}$ = 125°C | | 40 | | ns |
| $t_r$ | *current rise time* | $V_{CE}$ = 300 V; $I_C$ = 15 A | | | 45 | | ns |
| $t_{d(off)}$ | *turn-off delay time* | $V_{GE}$ = ±15 V; $R_G$ = 68 Ω | | | 160 | | ns |
| $t_f$ | *current fall time* | | | | 120 | | ns |
| $E_{on}$ | *turn-on energy per pulse* | | | | 0.55 | | mJ |
| $E_{off}$ | *turn-off energy per pulse* | | | | 0.4 | | mJ |
| **RBSOA** | *reverse bias safe operating area* | $V_{GE}$ = ±15 V; $R_G$ = 68 Ω; $I_C$ = 30 A | $T_{VJ}$ = 125°C | $V_{CEK} \le V_{CES}$-$L_S$·$d_I$/dt | | | V |
| $I_{SC}$ (SCSOA) | *short circuit safe operating area* | $V_{CE}$ = 360 V; $V_{GE}$ = ±15 V; $R_G$ = 68 Ω; $t_p$ = 10 µs; non-repetitive | $T_{VJ}$ = 125°C | | 65 | | A |
| $R_{thJC}$ | *thermal resistance junction to case* | (per IGBT) | | | | 1.6 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.55 | | K/W |

## Output Inverter D1 - D6

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitve reverse voltage* | | $T_{VJ}$ = 150°C | | | 600 | V |
| $I_{F25}$ | *forward current* | | $T_C$ = 25°C | | | 37 | A |
| $I_{F80}$ | | | $T_C$ = 80°C | | | 24 | A |
| $V_F$ | *forward voltage* | $I_F$ = 15 A; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | 1.8 | 2.1 | V |
| | | | $T_{VJ}$ = 125°C | | 1.3 | | V |
| $Q_{rr}$ | *reverse recovery charge* | $V_R$ = 300 V | $T_{VJ}$ = 125°C | | 0.58 | | µC |
| $I_{RM}$ | *max. reverse recovery current* | $di_F/dt$ = -380 A/µs | | | 11.5 | | A |
| $t_{rr}$ | *reverse recovery time* | $I_F$ = 15 A; $V_{GE}$ = 0 V | | | 115 | | ns |
| $E_{rec}$ | *reverse recovery energy* | | | | 50 | | µJ |
| $R_{thJC}$ | *thermal resistance junction to case* | (per diode) | | | | 1.6 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.55 | | K/W |

$T_C$ = 25°C unless otherwise stated

## 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 | | | 39 | A |
| $I_{DAVM}$ | *max. average DC output current* | rect.; d = ½ | $T_C$ = 80°C | | | 42 | A |
| $I_{FSM}$ | *max. forward surge current* | t = 10 ms; sine 50 Hz | $T_{VJ}$ = 25°C | | | 550 | A |
| | | | $T_{VJ}$ = 125°C | | | tbd | A |
| $I^2t$ | *$I^2t$ value for fusing* | t = 10 ms; sine 50 Hz | $T_{VJ}$ = 25°C | | | 1270 | $A^2s$ |
| | | | $T_{VJ}$ = 125°C | | | tbd | $A^2s$ |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 100 | W |
| $V_F$ | *forward voltage* | $I_F$ = 30 A | $T_{VJ}$ = 25°C | | 1.2 | 1.5 | V |
| | | | $T_{VJ}$ = 125°C | | 1.3 | | V |
| $I_R$ | *reverse current* | $V_R = V_{RRM}$ | $T_{VJ}$ = 25°C | | | 0.03 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.3 | | mA |
| $R_{thJC}$ | *thermal resistance junction to case* | (per diode) | | | | 1.2 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | (per diode) | | | 0.4 | | K/W |

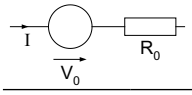
## Temperature Sensor NTC

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $R_{25}$ | *resistance* | | $T_C$ = 25°C | 4.75 | 5.0 | 5.25 | kΩ |
| $B_{25/50}$ | | | | | 3375 | | 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* | | | - | | |
| $F_C$ | *mounting force* | | 40 | | 80 | N |
| $d_S$ | *creep distance on surface* | | 12.7 | | | mm |
| $d_A$ | *strike distance through air* | | 12 | | | mm |
| **Weight** | | | | 35 | | g |

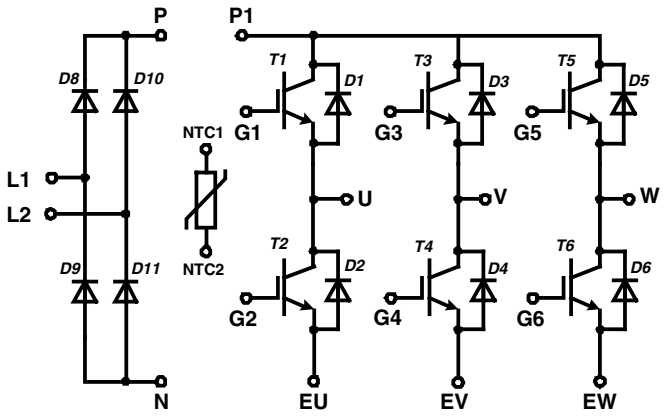
## Equivalent Circuits for Simulation




| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_0$ | *rectifier diode* | D8 - D11 | $T_{VJ}$ = 125°C | | 0.9 | | V |
| $R_0$ | | | | | 6 | | mΩ |
| $V_0$ | *IGBT* | T1 - T6 | $T_{VJ}$ = 125°C | | 1.15 | | V |
| $R_0$ | | | | | 77 | | mΩ |
| $V_0$ | *free wheeling diode* | D1 - D6 | $T_{VJ}$ = 125°C | | 1.05 | | V |
| $R_0$ | | | | | 30 | | mΩ |

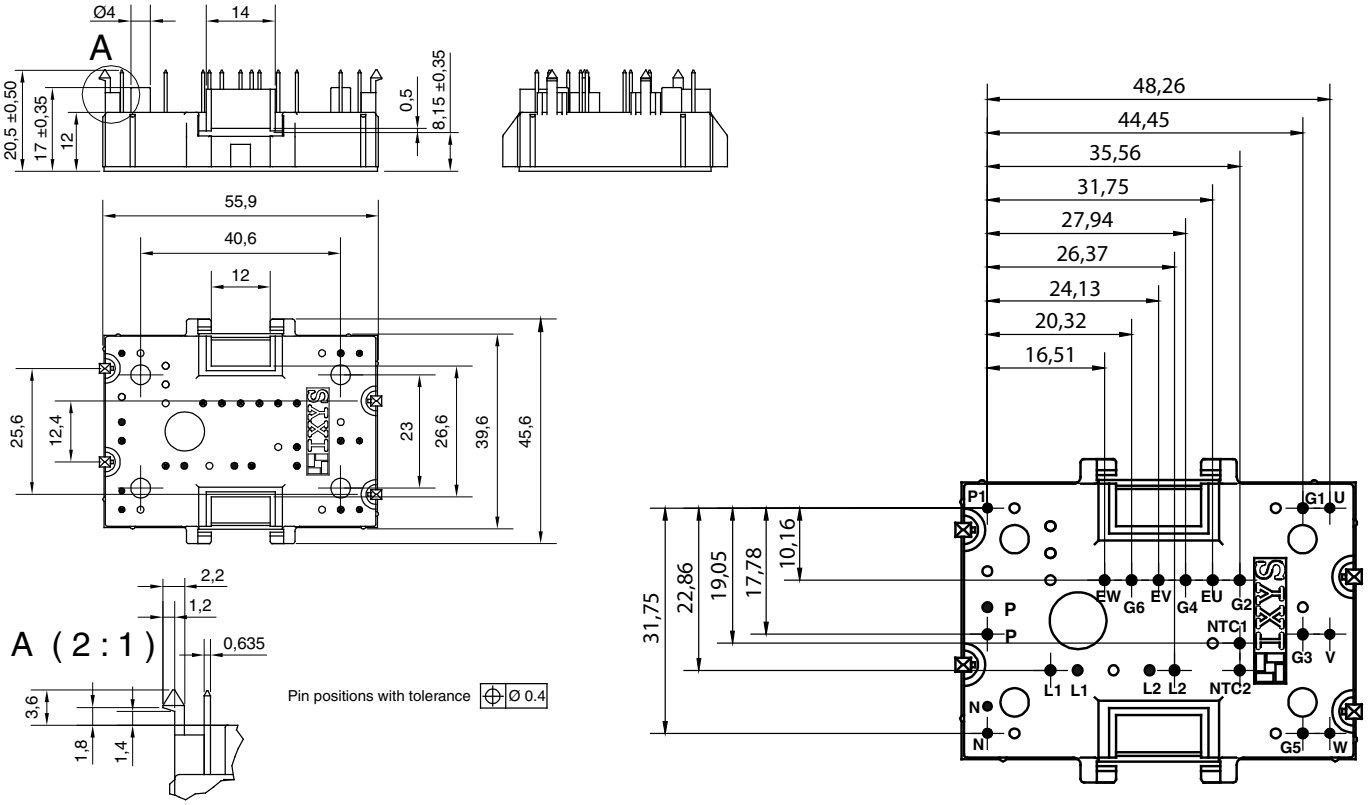
$T_C$ = 25°C unless otherwise stated

## Circuit Diagram

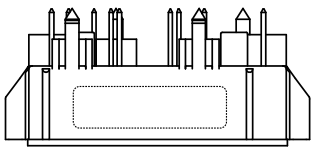



## Outline Drawing

Dimensions in mm (1 mm = 0.0394“)




## Product Marking



**Part number**

M = Module
I = IGBT
A = IGBT (NPT)
A = Gen 1 / std
15 = Current Rating [A]
WD = 6-Pack + 1~ Rectifier Bridge
600 = Reverse Voltage [V]
T = NTC
MH = MiniPack2

| Ordering | Part Name | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|---|---|---|---|---|---|
| Standard | MIAA 15 WD 600 TMH | MIAA15WD600TMH | Box | 20 | 504869 |

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

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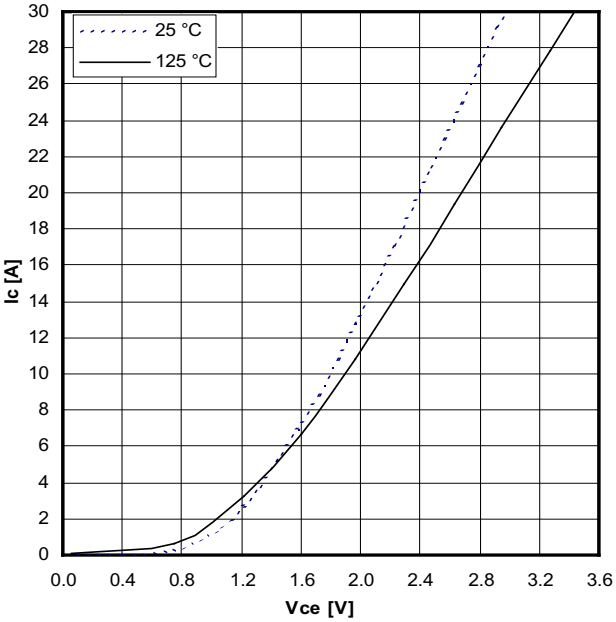
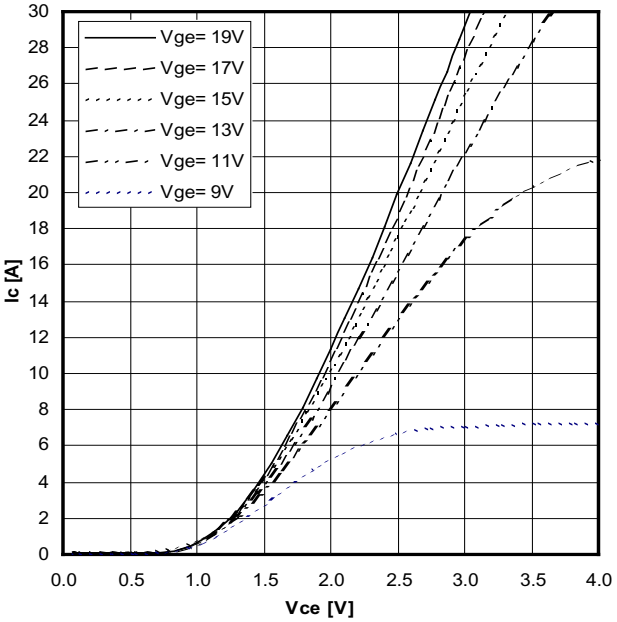
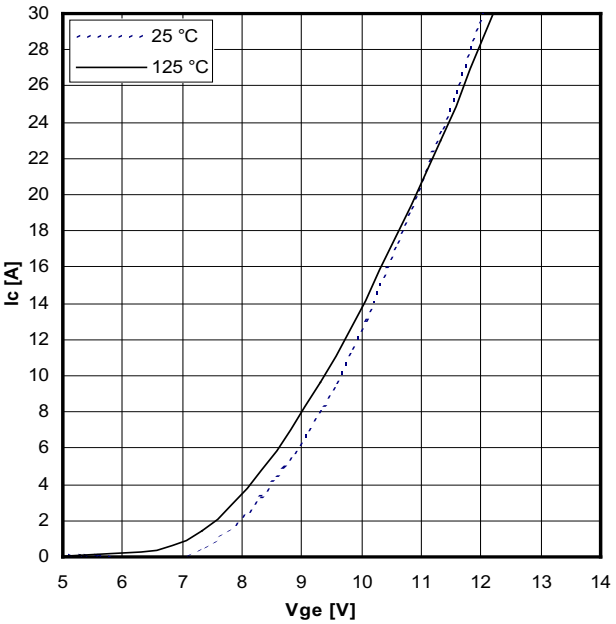


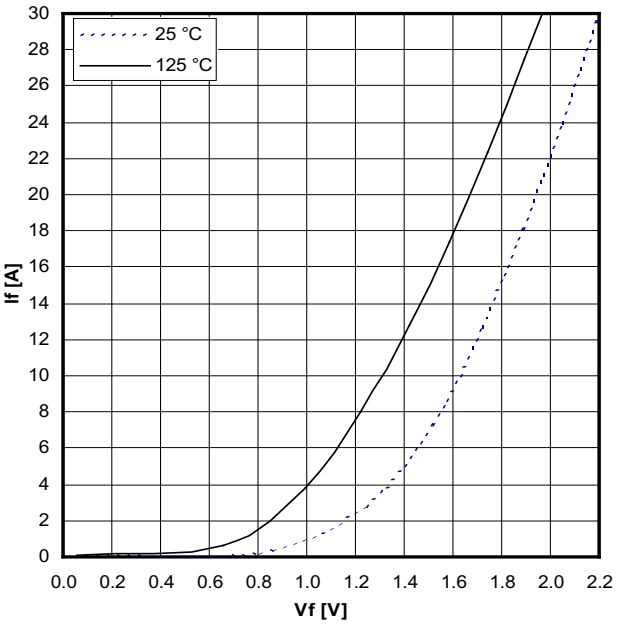

Typical output characteristics, $V_{GE}$ = 15 V



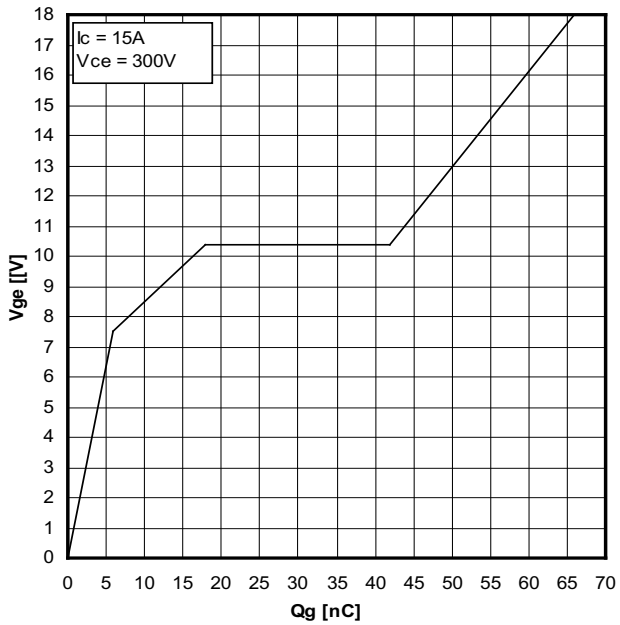

Typical output characteristics (125°C)



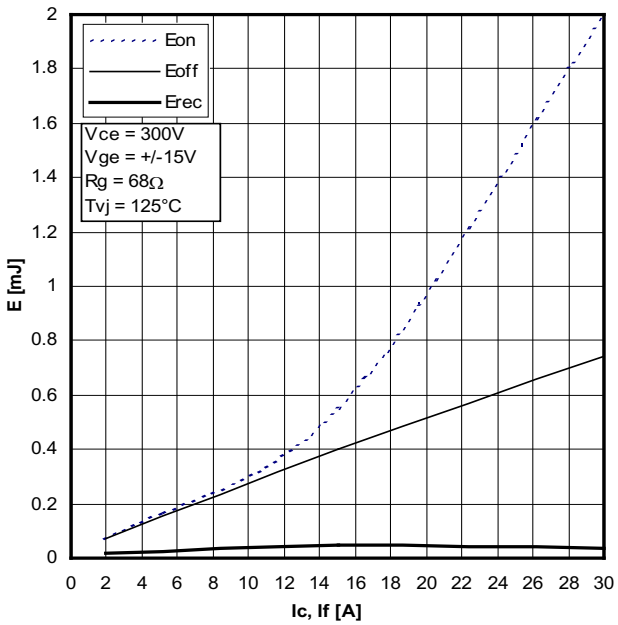

Typical transfer characteristics



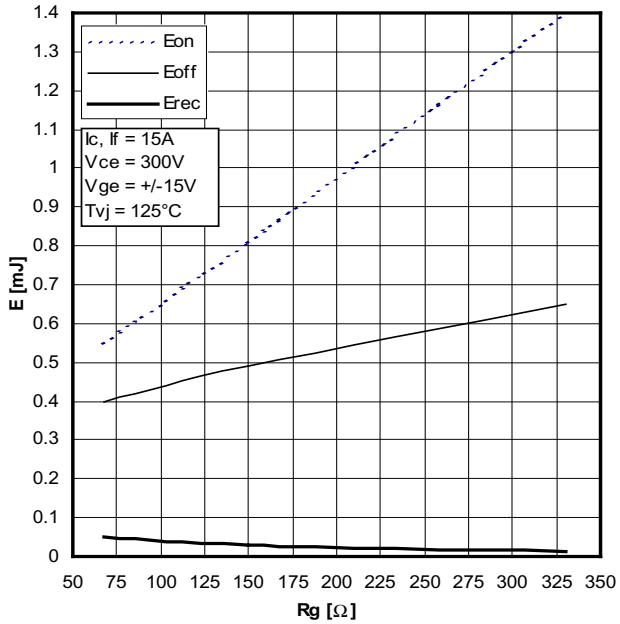

Typical forward characteristics of freewheeling diode



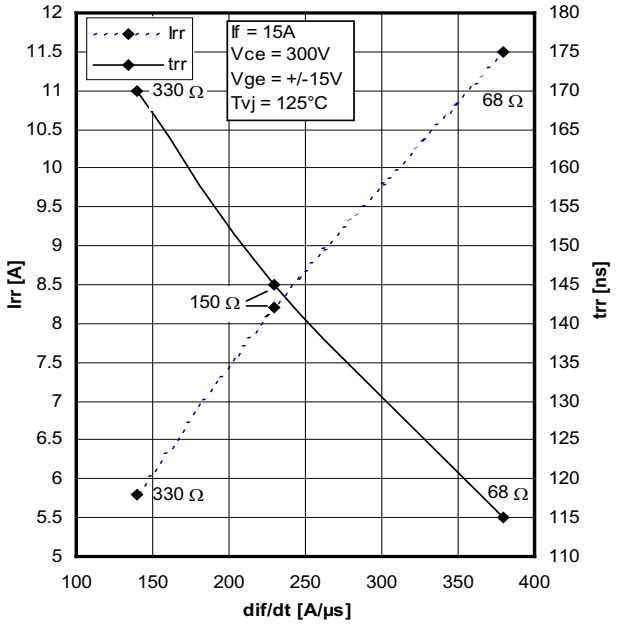

Typical turn on gate charge



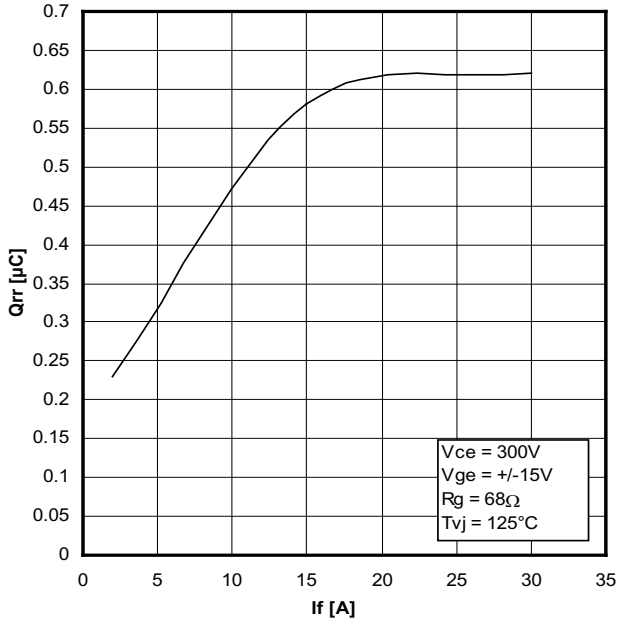

Typical switching energy versus collector current



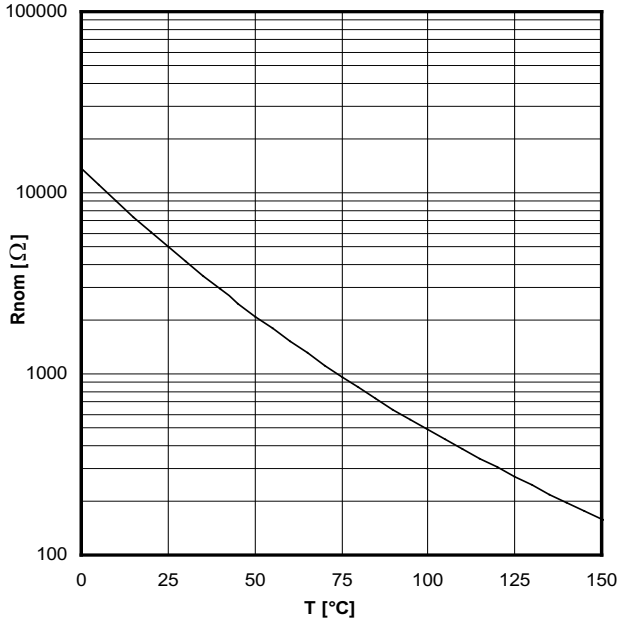

Typical switching energy versus gate resistance




Typical turn-off characteristics of free wheeling diode




Typical turn-off characteristics of free wheeling diode




Typical thermistor resistance versus temperature

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