

# IGBT (NPT) Module

$$V_{CES} = 1200V$$

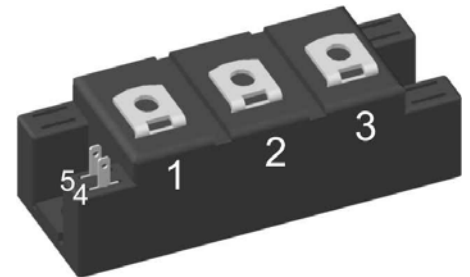
$$I_{C25} = 90A$$

$$V_{CE(sat)} = 2.2V$$

Boost Chopper + free wheeling Diode

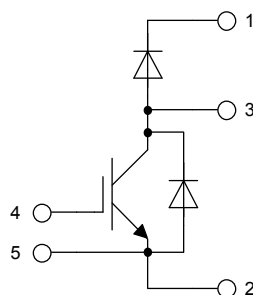
Part number

**MID75-12A3**



Backside: isolated

 E72873



## Features / Advantages:

- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes

## 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

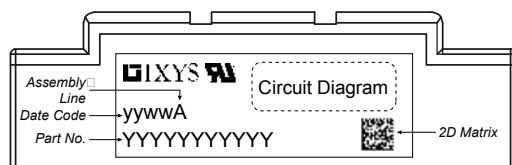
## Package: Y4

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

| Free Wheeling Diode FWD |                                              |                                                                    |                                | Ratings                        |      |      |               |
|-------------------------|----------------------------------------------|--------------------------------------------------------------------|--------------------------------|--------------------------------|------|------|---------------|
| Symbol                  | Definition                                   | Conditions                                                         |                                | min.                           | typ. | max. | Unit          |
| $V_{RSM}$               | max. non-repetitive reverse blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$                                      |                                |                                |      | 1200 | V             |
| $V_{RRM}$               | max. repetitive reverse blocking voltage     | $T_{VJ} = 25^{\circ}\text{C}$                                      |                                |                                |      | 1200 | V             |
| $I_R$                   | reverse current, drain current               | $V_R = 1200\text{ V}$                                              | $T_{VJ} = 25^{\circ}\text{C}$  |                                |      | 650  | $\mu\text{A}$ |
|                         |                                              | $V_R = 1200\text{ V}$                                              | $T_{VJ} = 125^{\circ}\text{C}$ |                                |      | 2    | mA            |
| $V_F$                   | forward voltage drop                         | $I_F = 50\text{ A}$                                                | $T_{VJ} = 25^{\circ}\text{C}$  |                                |      | 2.50 | V             |
|                         |                                              | $I_F = 100\text{ A}$                                               |                                |                                |      | 3.00 | V             |
|                         |                                              | $I_F = 50\text{ A}$                                                | $T_{VJ} = 125^{\circ}\text{C}$ |                                |      | 1.90 | V             |
|                         |                                              | $I_F = 100\text{ A}$                                               |                                |                                |      | 2.30 | V             |
| $I_{FAV}$               | average forward current                      | $T_C = 80^{\circ}\text{C}$                                         | $T_{VJ} = 150^{\circ}\text{C}$ |                                |      | 60   | A             |
|                         |                                              | DC current $d = 1$                                                 |                                |                                |      |      |               |
| $V_{F0}$                | threshold voltage                            | } for power loss calculation only                                  |                                | $T_{VJ} = 150^{\circ}\text{C}$ |      | 1.30 | V             |
| $r_F$                   | slope resistance                             |                                                                    |                                |                                |      | 12   | m $\Omega$    |
| $R_{thJC}$              | thermal resistance junction to case          |                                                                    |                                |                                |      | 0.66 | K/W           |
| $R_{thCH}$              | thermal resistance case to heatsink          |                                                                    |                                |                                | 0.66 |      | K/W           |
| $P_{tot}$               | total power dissipation                      | $T_C = 25^{\circ}\text{C}$                                         |                                |                                |      | 190  | W             |
| $I_{FSM}$               | max. forward surge current                   | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}; V_R = 0\text{ V}$ | $T_{VJ} = 45^{\circ}\text{C}$  |                                |      | 400  | A             |
| $C_J$                   | junction capacitance                         | $V_R = 600\text{ V}$ $f = 1\text{ MHz}$                            | $T_{VJ} = 25^{\circ}\text{C}$  |                                | 30   |      | pF            |

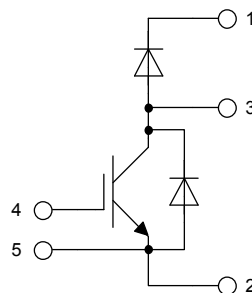
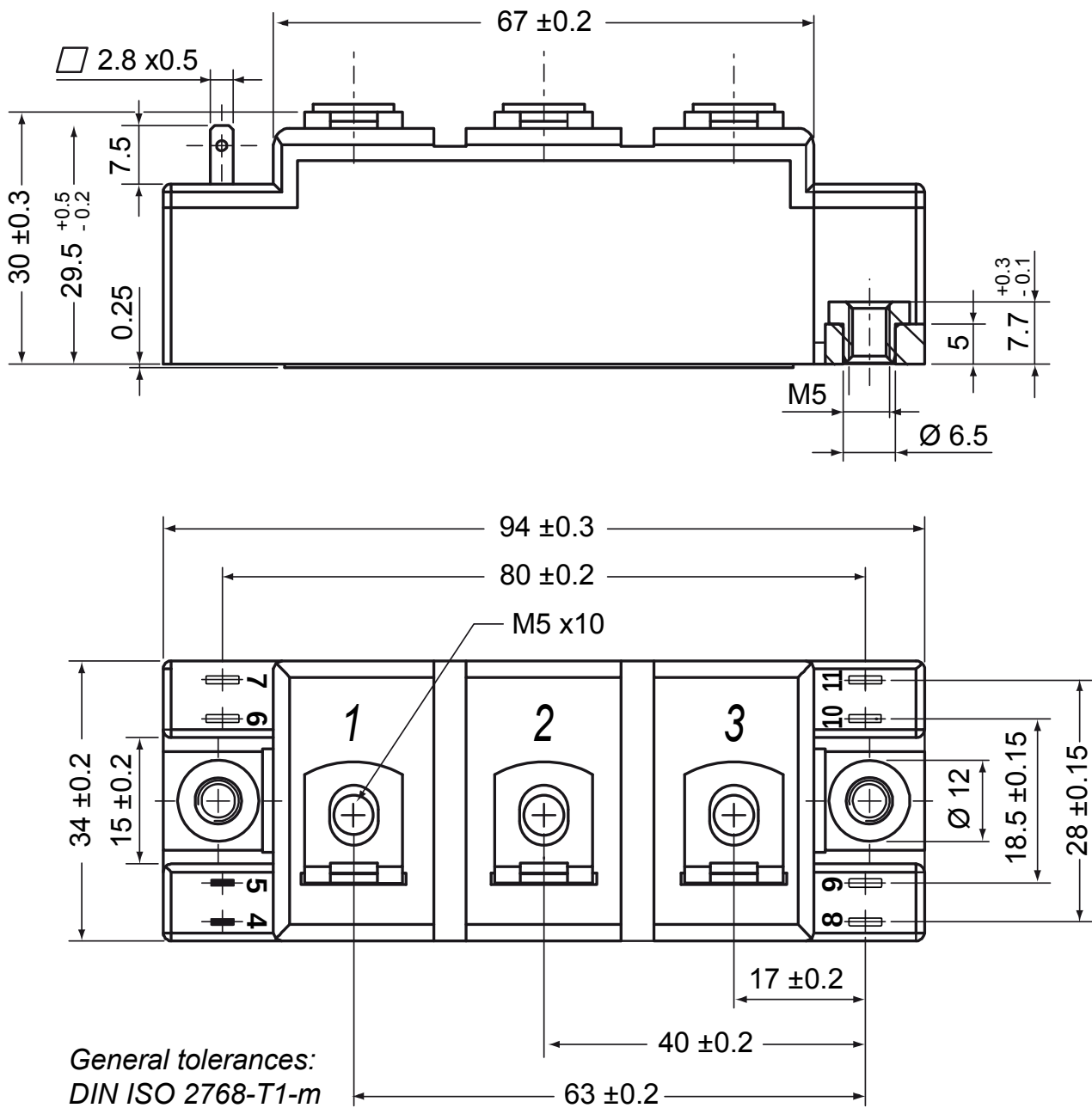
| Boost IGBT            |                                      |                                                                                                                                                                                   |                                | Ratings |      |          |               |
|-----------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|------|----------|---------------|
| Symbol                | Definition                           | Conditions                                                                                                                                                                        |                                | min.    | typ. | max.     | Unit          |
| $V_{CES}$             | collector emitter voltage            | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                     |                                |         |      | 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                    | $T_C = 25^{\circ}\text{C}$                                                                                                                                                        |                                |         |      | 90       | A             |
| $I_{C80}$             |                                      | $T_C = 80^{\circ}\text{C}$                                                                                                                                                        |                                |         |      | 60       | A             |
| $P_{tot}$             | total power dissipation              | $T_C = 25^{\circ}\text{C}$                                                                                                                                                        |                                |         |      | 370      | W             |
| $V_{CE(sat)}$         | collector emitter saturation voltage | $I_C = 50\text{A}; V_{GE} = 15\text{V}$                                                                                                                                           | $T_{VJ} = 25^{\circ}\text{C}$  |         | 2.2  | 2.7      | V             |
|                       |                                      |                                                                                                                                                                                   | $T_{VJ} = 125^{\circ}\text{C}$ |         | 2.7  |          | V             |
| $V_{GE(th)}$          | gate emitter threshold voltage       | $I_C = 2\text{mA}; V_{GE} = V_{CE}$                                                                                                                                               | $T_{VJ} = 25^{\circ}\text{C}$  | 4.5     | 5.5  | 6.5      | V             |
| $I_{CES}$             | collector emitter leakage current    | $V_{CE} = V_{CES}; V_{GE} = 0\text{V}$                                                                                                                                            | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 4        | mA            |
|                       |                                      |                                                                                                                                                                                   | $T_{VJ} = 125^{\circ}\text{C}$ |         | 6    |          | mA            |
| $I_{GES}$             | gate emitter leakage current         | $V_{GE} = \pm 20\text{V}$                                                                                                                                                         |                                |         |      | 200      | nA            |
| $Q_{G(on)}$           | total gate charge                    | $V_{CE} = 600\text{V}; V_{GE} = 15\text{V}; I_C = 50\text{A}$                                                                                                                     |                                |         | 240  |          | nC            |
| $t_{d(on)}$           | turn-on delay time                   | <div> <div></div> <div>inductive load</div> <div><math>V_{CE} = 600\text{V}; I_C = 50\text{A}</math></div> <div><math>V_{GE} = \pm 15\text{V}; R_G = 22\Omega</math></div> </div> | $T_{VJ} = 125^{\circ}\text{C}$ |         | 100  |          | ns            |
| $t_r$                 | current rise time                    |                                                                                                                                                                                   |                                |         | 70   |          | ns            |
| $t_{d(off)}$          | turn-off delay time                  |                                                                                                                                                                                   |                                |         | 500  |          | ns            |
| $t_f$                 | current fall time                    |                                                                                                                                                                                   |                                |         | 70   |          | ns            |
| $E_{on}$              | turn-on energy per pulse             |                                                                                                                                                                                   |                                |         | 7.6  |          | mJ            |
| $E_{off}$             | turn-off energy per pulse            |                                                                                                                                                                                   |                                |         | 5.6  |          | mJ            |
| <b>RBSOA</b>          | reverse bias safe operating area     | $V_{GE} = \pm 15\text{V}; R_G = 22\Omega$                                                                                                                                         | $T_{VJ} = 125^{\circ}\text{C}$ |         |      |          |               |
| $I_{CM}$              |                                      | $V_{CEmax} = 1200\text{V}$                                                                                                                                                        |                                |         |      | 100      | A             |
| <b>SCSOA</b>          | short circuit safe operating area    | $V_{CEmax} = 1200\text{V}$                                                                                                                                                        | $T_{VJ} = 125^{\circ}\text{C}$ |         |      |          |               |
| $t_{SC}$              | short circuit duration               | $V_{CE} = 1200\text{V}; V_{GE} = \pm 15\text{V}$                                                                                                                                  |                                |         |      | 10       | $\mu\text{s}$ |
| $I_{SC}$              | short circuit current                | $R_G = 22\Omega$ ; non-repetitive                                                                                                                                                 |                                |         | 180  |          | A             |
| $R_{thJC}$            | thermal resistance junction to case  |                                                                                                                                                                                   |                                |         |      | 0.33     | K/W           |
| $R_{thCH}$            | thermal resistance case to heatsink  |                                                                                                                                                                                   |                                |         | 0.33 |          | K/W           |
| <b>Boost Diode BD</b> |                                      |                                                                                                                                                                                   |                                |         |      |          |               |
| $V_{RRM}$             | max. repetitive reverse voltage      |                                                                                                                                                                                   | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1200     | V             |
| $I_{F25}$             | forward current                      |                                                                                                                                                                                   | $T_C = 25^{\circ}\text{C}$     |         |      | 100      | A             |
| $I_{F80}$             |                                      |                                                                                                                                                                                   | $T_C = 80^{\circ}\text{C}$     |         |      | 60       | A             |
| $V_F$                 | forward voltage                      | $I_F = 50\text{A}$                                                                                                                                                                | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 2.50     | V             |
|                       |                                      |                                                                                                                                                                                   | $T_{VJ} = 125^{\circ}\text{C}$ |         | 1.80 |          | V             |
| $I_R$                 | reverse current                      | $V_R = V_{RRM}$                                                                                                                                                                   | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 0.65     | mA            |
|                       |                                      |                                                                                                                                                                                   | $T_{VJ} = 125^{\circ}\text{C}$ |         | 1    |          | mA            |
| $Q_{rr}$              | reverse recovery charge              | <div> <div><math>V_R = 600\text{V}</math></div> <div><math>-di_F/dt = 400\text{A}/\mu\text{s}</math></div> <div><math>I_F = 50\text{A}; V_{GE} = 0\text{V}</math></div> </div>    | $T_{VJ} = 125^{\circ}\text{C}$ |         | 3.5  |          | $\mu\text{C}$ |
| $I_{RM}$              | max. reverse recovery current        |                                                                                                                                                                                   |                                |         | 40   |          | A             |
| $t_{rr}$              | reverse recovery time                |                                                                                                                                                                                   |                                |         | 200  |          | ns            |
| $E_{rec}$             | reverse recovery energy              |                                                                                                                                                                                   |                                |         | 1    |          | mJ            |
| $R_{thJC}$            | thermal resistance junction to case  |                                                                                                                                                                                   |                                |         |      | 0.66     | K/W           |
| $R_{thCH}$            | thermal resistance case to heatsink  |                                                                                                                                                                                   |                                |         | 0.66 |          | K/W           |

| Package Y4    |                                                              |                      |                                     | Ratings |      |      |      |
|---------------|--------------------------------------------------------------|----------------------|-------------------------------------|---------|------|------|------|
| Symbol        | Definition                                                   | Conditions           |                                     | min.    | typ. | max. | Unit |
| $I_{RMS}$     | RMS current                                                  | per terminal         |                                     |         |      | 300  | A    |
| $T_{VJ}$      | virtual junction temperature                                 |                      |                                     | -40     |      | 150  | °C   |
| $T_{op}$      | operation temperature                                        |                      |                                     | -40     |      | 125  | °C   |
| $T_{stg}$     | storage temperature                                          |                      |                                     | -40     |      | 125  | °C   |
| Weight        |                                                              |                      |                                     |         | 108  |      | g    |
| $M_D$         | mounting torque                                              |                      |                                     | 2.25    |      | 2.75 | Nm   |
| $M_T$         | terminal torque                                              |                      |                                     | 4.5     |      | 5.5  | Nm   |
| $d_{Spp/App}$ | creepage distance on surface   striking distance through air | terminal to terminal | 14.0                                | 10.0    |      |      | mm   |
| $d_{Spb/Apb}$ |                                                              | terminal to backside | 16.0                                | 16.0    |      |      | mm   |
| $V_{ISOL}$    | isolation voltage                                            | t = 1 second         | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | 3600    |      |      | V    |
|               |                                                              | t = 1 minute         |                                     | 3000    |      |      | V    |



| Ordering | Part Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-------------|--------------------|---------------|----------|----------|
| Standard | MID75-12A3  | MID75-12A3         | Box           | 6        | 474193   |

## Outlines Y4



## Boost IGBT

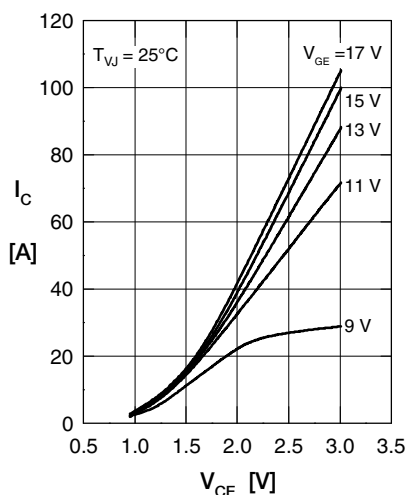


Fig. 1 Typ. output characteristics

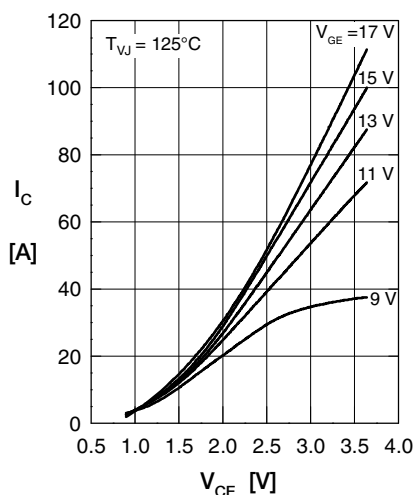


Fig. 2 Typ. output characteristics

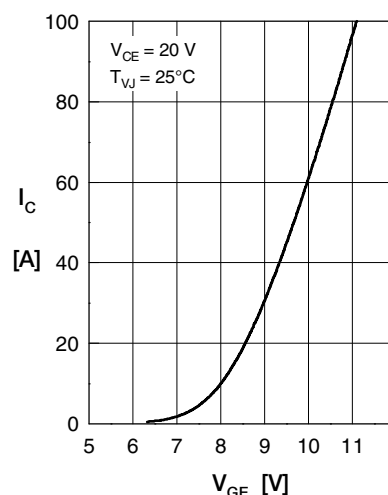


Fig. 3 Typ. transfer characteristics

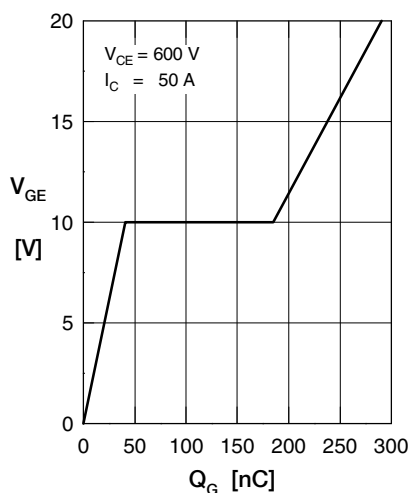


Fig. 4 Typ. turn-on gate charge

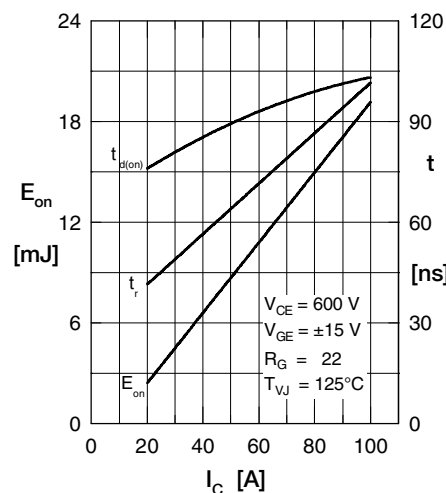


Fig. 5 Typ. turn on energy & switching times versus collector current

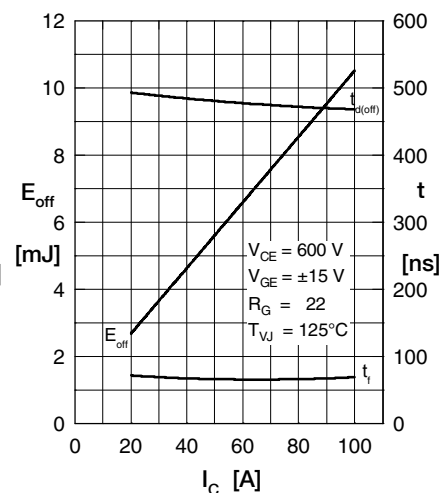


Fig. 6 Typ. turn off energy & switching times versus collector current

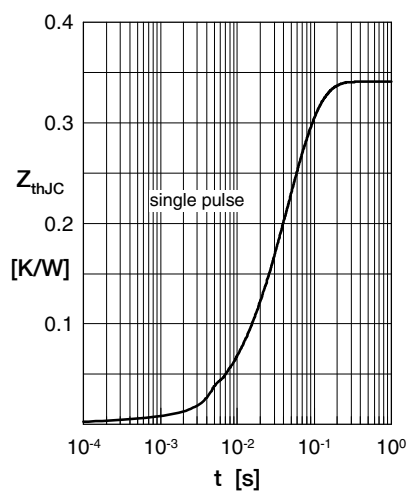


Fig. 12 Typical transient thermal impedance

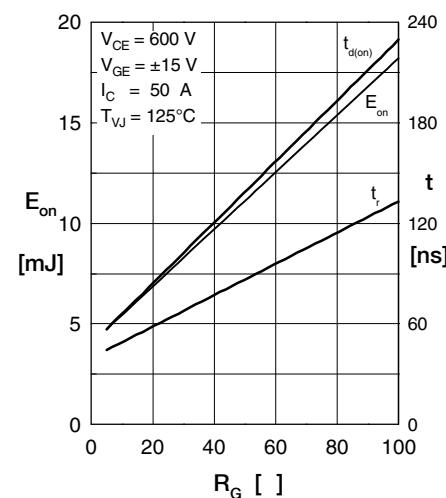


Fig. 9 Typ. turn on energy & switching times versus gate resistor

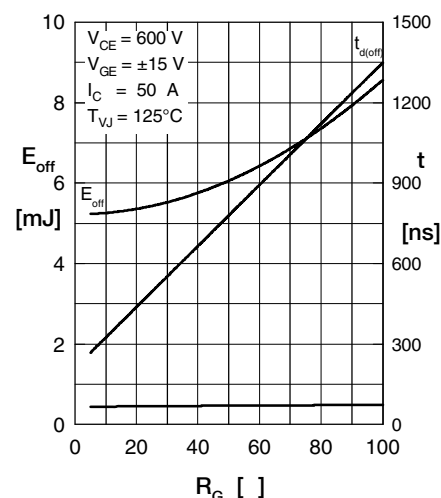


Fig. 9 Typ. turn off energy & switching times versus gate resistor

## Boost Diode BD

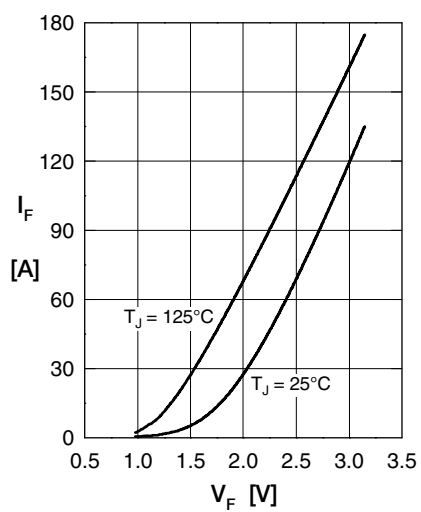
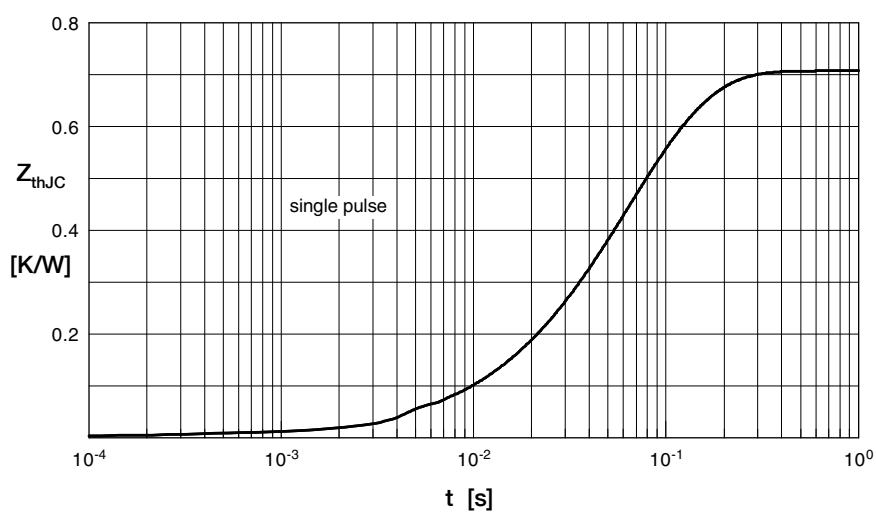
Fig. 1 Typ. Forward current vs.  $V_F$ 

Fig. 2 Typ. transient thermal impedance junction to case