

# IGBT Module

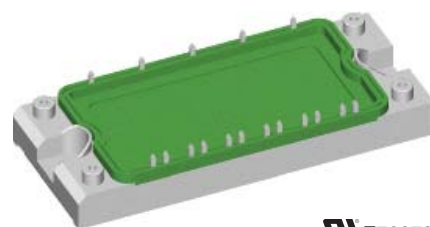
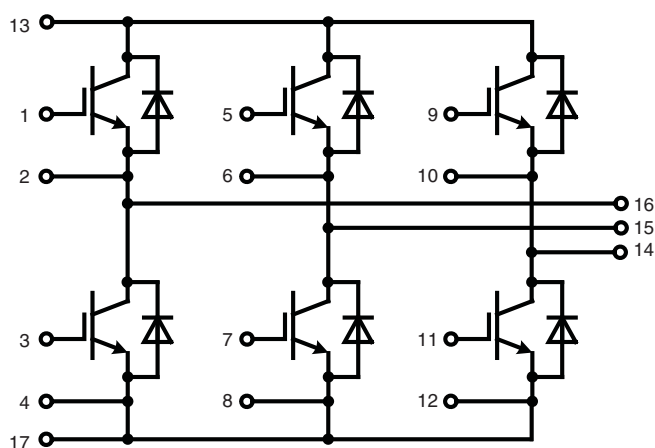
## Sixpack

Short Circuit SOA Capability  
Square RBSOA

$$\begin{aligned} I_{C25} &= 30 \text{ A} \\ V_{CES} &= 1200 \text{ V} \\ V_{CE(sat) \text{ typ.}} &= 2.0 \text{ V} \end{aligned}$$

**Part name** (Marking on product)

MWI15-12A7



 E72873

Pin configuration see outlines.

### Features:

- NPT IGBT technology
- low saturation voltage
- positive temperature coefficient for easy paralleling
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- space savings
- reduced protection circuits

### Application:

- AC motor control
- AC servo and robot drives power supplies

### Package:

- UL registered
- Industry standard E2-pack
- package with copper base plate
- package designed for wave soldering

**IGBTs**

| Symbol              | Definitions                           | Conditions                                                                                                                                      | min.                           | Ratings    |          |               |
|---------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------|----------|---------------|
|                     |                                       |                                                                                                                                                 |                                | typ.       | max.     | Unit          |
| $V_{CES}$           | collector emitter voltage             | $T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$                                                                                          |                                |            | 1200     | V             |
| $V_{GES}$           | max. DC gate voltage                  | continuous                                                                                                                                      |                                |            | $\pm 20$ | V             |
| $V_{GEM}$           | max. transient collector gate voltage | transient                                                                                                                                       |                                |            | $\pm 30$ | V             |
| $I_{C25}$           | collector current                     | $T_C = 25^{\circ}\text{C}$                                                                                                                      |                                |            | 30       | A             |
| $I_{C80}$           |                                       | $T_C = 80^{\circ}\text{C}$                                                                                                                      |                                |            | 20       | A             |
| $P_{tot}$           | total power dissipation               | $T_C = 25^{\circ}\text{C}$                                                                                                                      |                                |            | 140      | W             |
| $V_{CE(sat)}$       | collector emitter saturation voltage  | $I_C = 15\text{ A}; V_{GE} = 15\text{ V}$                                                                                                       |                                | 2.0<br>2.3 | 2.6      | V             |
| $V_{GE(th)}$        | gate emitter threshold voltage        | $I_C = 0.6\text{ mA}; V_{GE} = V_{CE}$                                                                                                          | 4.5                            |            | 6.5      | V             |
| $I_{CES}$           | collector emitter leakage current     | $V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$                                                                                                         |                                | 0.8        | 0.9      | mA<br>mA      |
| $I_{GES}$           | gate emitter leakage current          | $V_{CE} = 0\text{ V}; V_{GE} = \pm 20\text{ V}$                                                                                                 |                                |            | 200      | nA            |
| $C_{ies}$           | input capacitance                     | $V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$                                                                                   |                                | 1000       |          | pF            |
| $Q_{G(on)}$         | total gate charge                     | $V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 15\text{ A}$                                                                                |                                | 70         |          | nC            |
| $t_{d(on)}$         | turn-on delay time                    | inductive load<br>$V_{CE} = 600\text{ V}; I_C = 15\text{ A}$<br>$V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega$                                    | $T_{VJ} = 125^{\circ}\text{C}$ | 100        |          | ns            |
| $t_r$               | current rise time                     |                                                                                                                                                 |                                | 75         |          | ns            |
| $t_{d(off)}$        | turn-off delay time                   |                                                                                                                                                 |                                | 500        |          | ns            |
| $t_f$               | current fall time                     |                                                                                                                                                 |                                | 70         |          | ns            |
| $E_{on}$            | turn-on energy per pulse              |                                                                                                                                                 |                                | 2.3        |          | mJ            |
| $E_{off}$           | turn-off energy per pulse             |                                                                                                                                                 |                                | 1.8        |          | mJ            |
| $I_{CM}$            | reverse bias safe operating area      | RBSOA; $V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega$<br>$L = 100\ \mu\text{H}$ ; clamped induct. load<br>$V_{CEmax} = V_{CES} - L_S \cdot di/dt$ | $T_{VJ} = 125^{\circ}\text{C}$ | 35         |          | A             |
| $t_{SC}$<br>(SCSOA) | short circuit safe operating area     | $V_{CE} = V_{CES}; V_{GE} = \pm 15\text{ V};$<br>$R_G = 82\ \Omega$ ; non-repetitive                                                            | $T_{VJ} = 125^{\circ}\text{C}$ | 10         |          | $\mu\text{s}$ |
| $R_{thJC}$          | thermal resistance junction to case   | (per IGBT)                                                                                                                                      |                                |            | 0.88     | K/W           |

**Diodes**

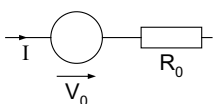
| Symbol         | Definitions                         | Conditions                                                                                                | min.                           | Ratings    |      |        |
|----------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------|------------|------|--------|
|                |                                     |                                                                                                           |                                | typ.       | max. | Unit   |
| $V_{RRM}$      | max. repetitive reverse voltage     | $T_{VJ} = 150^{\circ}\text{C}$                                                                            |                                |            | 1200 | V      |
| $I_{F25}$      | forward current                     | $T_C = 25^{\circ}\text{C}$                                                                                |                                |            | 25   | A      |
| $I_{F80}$      |                                     | $T_C = 80^{\circ}\text{C}$                                                                                |                                |            | 17   | A      |
| $V_F$          | forward voltage                     | $I_F = 15\text{ A}; V_{GE} = 0\text{ V}$                                                                  |                                | 2.4<br>1.7 | 2.7  | V<br>V |
| $I_{RM}$       | max. reverse recovery current       | $V_R = 600\text{ V}$<br>$di_F/dt = -400\text{ A}/\mu\text{s}$<br>$I_F = 15\text{ A}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 125^{\circ}\text{C}$ | 16         |      | A      |
| $t_{rr}$       | reverse recovery time               |                                                                                                           |                                | 130        |      | ns     |
| $E_{rec(off)}$ | reverse recovery energy             |                                                                                                           |                                | 0.49       |      | mJ     |
| $R_{thJC}$     | thermal resistance junction to case | (per diode)                                                                                               |                                |            | 2.1  | K/W    |

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

## 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                   | $I_{ISOL} \leq 1 \text{ mA}; 50/60 \text{ Hz}$ |         |      | 2500 | V~   |
| $M_d$      | mounting torque                     | (M4)                                           | 2.7     |      | 3.3  | Nm   |
| $d_S$      | creep distance on surface           |                                                | 6       |      |      | mm   |
| $d_A$      | strike distance through air         |                                                | 6       |      |      | mm   |
| Weight     |                                     |                                                |         | 180  |      | g    |
| $R_{thCH}$ | thermal resistance case to heatsink | with heatsink compound                         |         | 0.02 |      | K/W  |

## Equivalent Circuits for Simulation

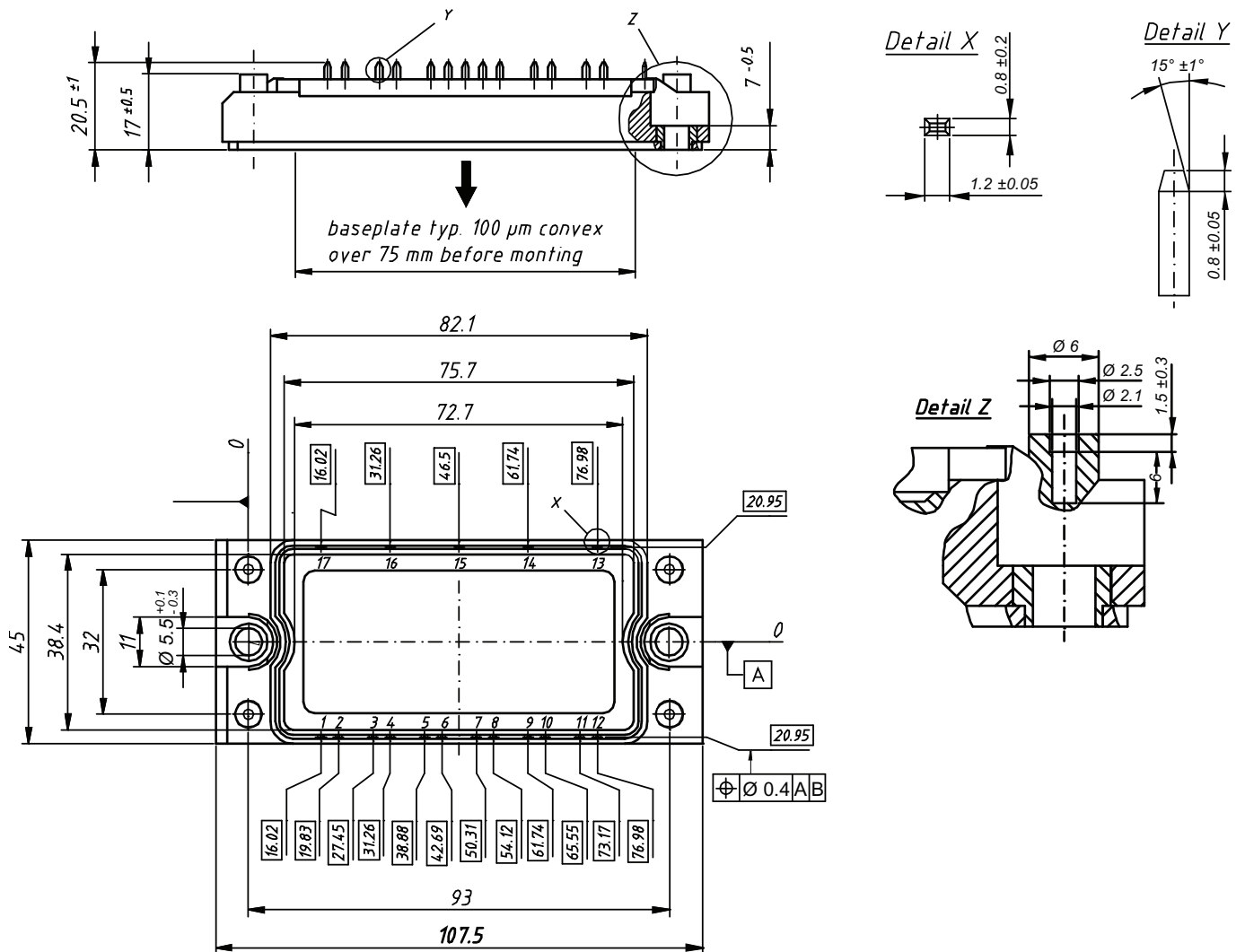


## Ratings

| Symbol                                                                                                                             | Definitions | Conditions                              | min. | typ.        | max.  | Unit    |
|------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------|------|-------------|-------|---------|
| $V_0$<br>$R_0$                                                                                                                     | IGBT        | T1 - T6<br>$T_{VJ} = 125^\circ\text{C}$ |      | 1.37<br>62  |       | V<br>mΩ |
| $V_0$<br>$R_0$                                                                                                                     | Diode       | D1 - D6<br>$T_{VJ} = 125^\circ\text{C}$ |      | 1.327<br>30 |       | V<br>mΩ |
| $Z_{th}(t) = \sum_{i=1}^n \left[ R_i \cdot \left( 1 - \exp\left(-\frac{t}{\tau_i}\right) \right) \right]$ $\tau_i = R_i \cdot C_i$ |             |                                         | IGBT |             | Diode |         |
| $R_1$<br>$R_2$                                                                                                                     |             |                                         | -    | -           | -     | -       |
| $C_1$<br>$C_2$                                                                                                                     |             |                                         | -    | -           | -     | -       |

## Outline Drawing

Dimensions in mm (1 mm = 0.0394")



## Product Marking

| Ordering | Part Name   | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|-------------|--------------------|-----------------|----------|---------------|
| Standard | MWI 15-12A7 | MWI15-12A7         | Box             | 10       | 485063        |

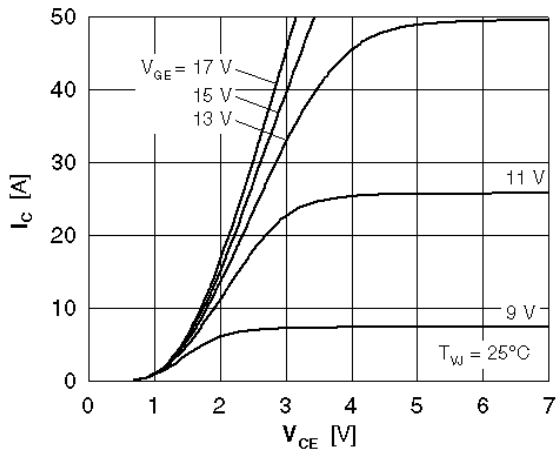


Fig. 1 Typ. output characteristics

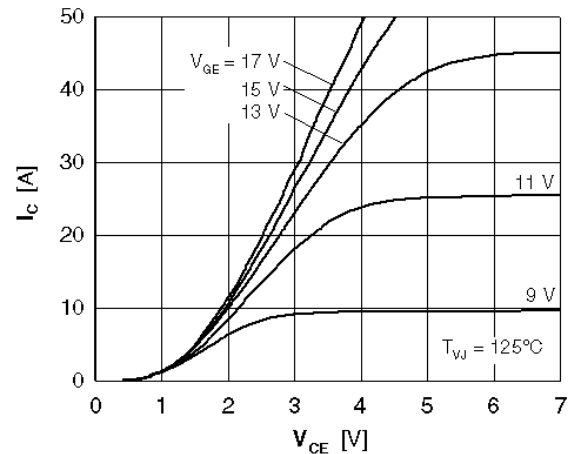


Fig. 2 Typ. output characteristics

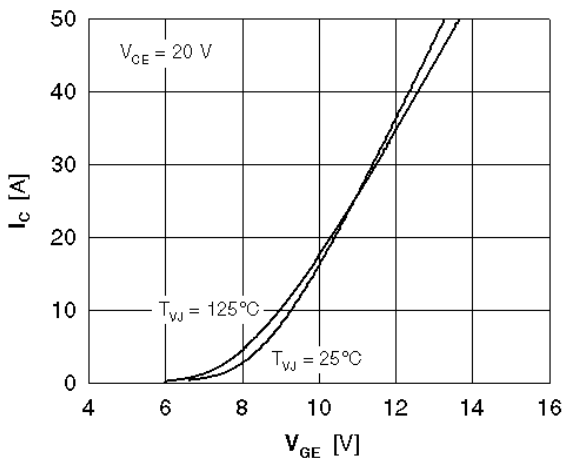


Fig. 3 Typ. transfer characteristics

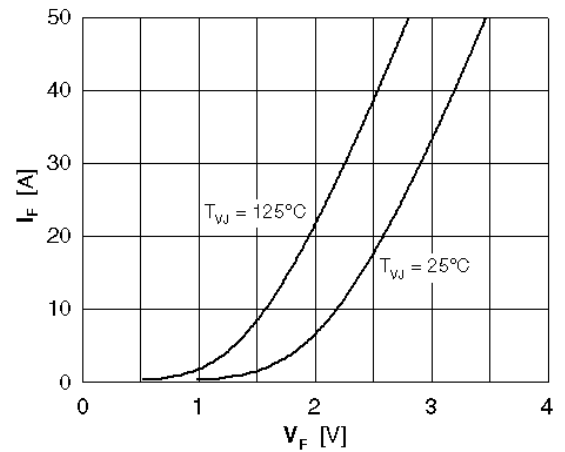


Fig. 4 Typ. forward characteristics of free wheeling diode

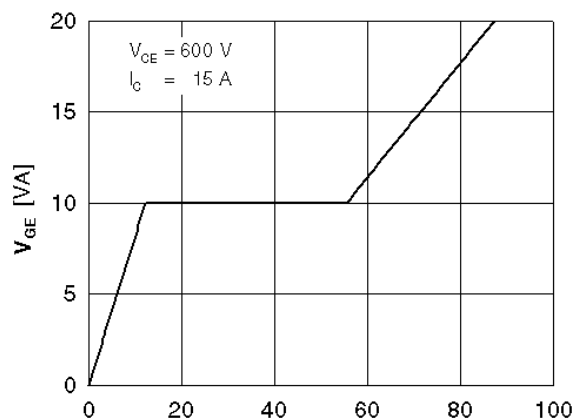


Fig. 5 Typ. turn on gate charge

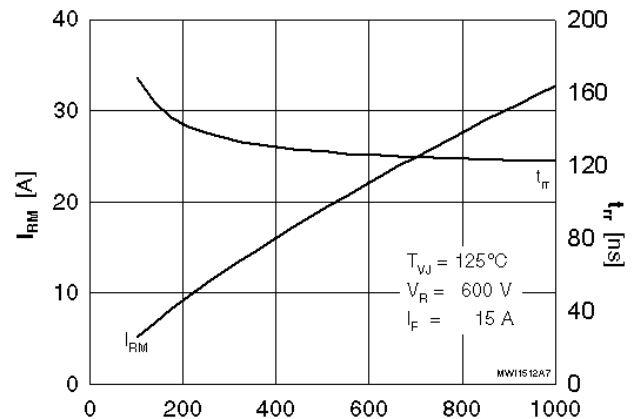


Fig. 6 Typ. turn off characteristics of free wheeling diode

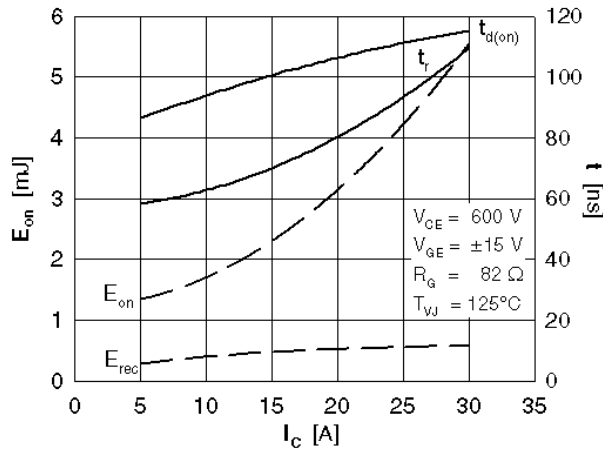


Fig. 7 Typ. turn on energy and switching times versus collector current

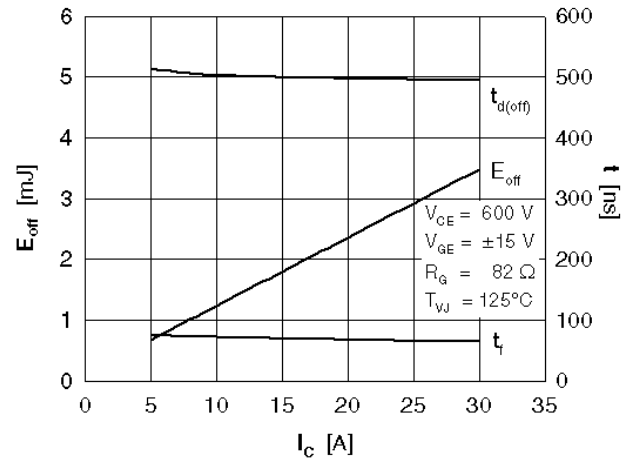


Fig. 8 Typ. turn off energy and switching times versus collector current

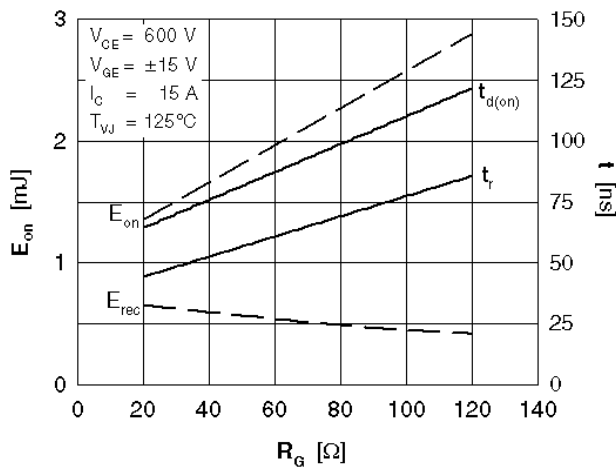


Fig. 9 Typ. turn on energy and switching times versus gate resistor

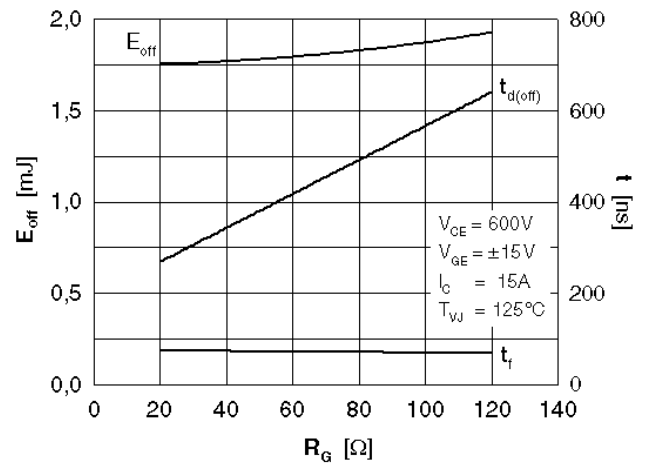


Fig. 10 Typ. turn off energy and switching times versus gate resistor

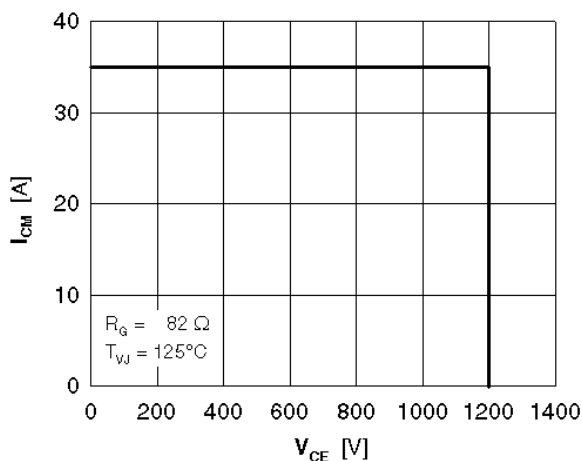


Fig. 11 Reverse biased safe operating area

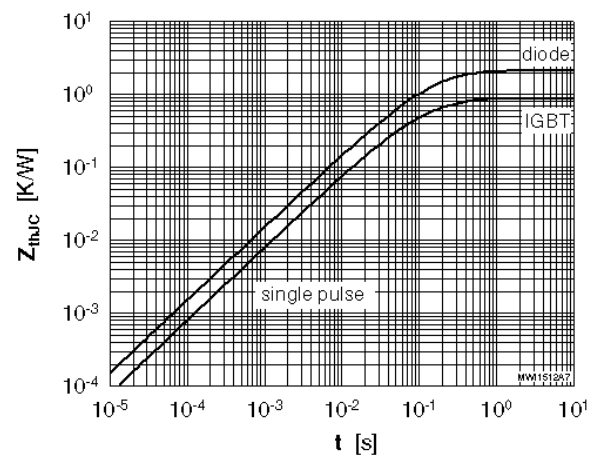


Fig. 12 Typ. transient thermal impedance

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