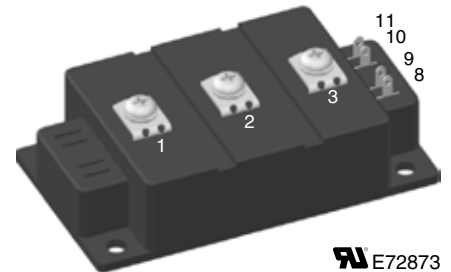
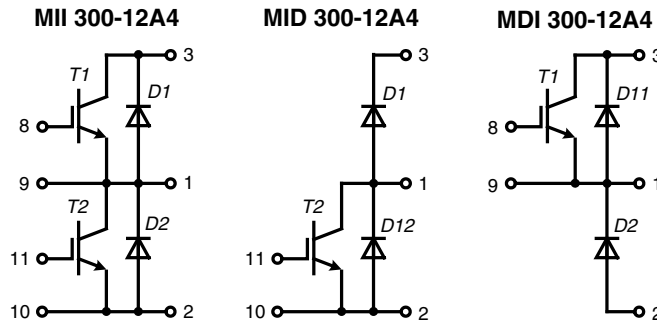


# IGBT Modules

Short Circuit SOA Capability  
 Square RBSOA

$I_{C25} = 330 \text{ A}$   
 $V_{CES} = 1200 \text{ V}$   
 $V_{CE(sat) \text{ typ.}} = 2.2 \text{ V}$



| IGBTs T1 - T2       |  | Maximum Ratings |               |
|---------------------|--|-----------------|---------------|
| Symbol              | Conditions   |                 |               |
| $V_{CES}$           | $T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$  | 1200            | V             |
| $V_{GES}$           |  | $\pm 20$        | V             |
| $I_{C25}$           | $T_C = 25^{\circ}\text{C}$   | 330             | A             |
| $I_{C80}$           | $T_C = 80^{\circ}\text{C}$   | 220             | A             |
| $I_{CM}$            | $V_{GE} = \pm 15 \text{ V}; R_G = 3.3 \Omega; T_{VJ} = 125^{\circ}\text{C}$  | 400             | A             |
| $V_{CEK}$           | <b>RBSOA</b> Clamped inductive load; $L = 100 \mu\text{H}$   | $V_{CES}$       |               |
| $t_{SC}$<br>(SCSOA) | $V_{CE} = V_{CES}; V_{GE} = \pm 15 \text{ V}; R_G = 3.3 \Omega$<br>$T_{VJ} = 125^{\circ}\text{C}; \text{non-repetitive}$ | 10              | $\mu\text{s}$ |
| $P_{tot}$           | $T_C = 25^{\circ}\text{C}$   | 1380            | W             |

### Features

- NPT IGBT technology
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy paralleling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

### Advantages

- space and weight savings
- reduced protection circuits

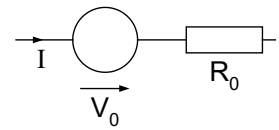
### Applications

- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

| Symbol   | Conditions  | Characteristic Values   |      |           |            |    |
|--|---|---|------|-----------|------------|----|
|  |   | $(T_{VJ} = 25^{\circ}\text{C}, \text{ unless otherwise specified})$ |      |           |            |    |
|  |   | min.  | typ. | max.      |            |    |
| $V_{CE(sat)}$  | $I_C = 200 \text{ A}; V_{GE} = 15 \text{ V}$  |   | 2.2  | 2.7       | V          |    |
| $V_{GE(th)}$   | $I_C = 8 \text{ mA}; V_{GE} = V_{CE}$   | 4.5   |      | 6.5       | V          |    |
| $I_{CES}$  | $V_{CE} = V_{CES}; V_{GE} = 0 \text{ V}$<br>$T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$                                     |   |      | 13        | mA<br>mA   |    |
| $I_{GES}$  | $V_{CE} = 0 \text{ V}; V_{GE} = \pm 20 \text{ V}$   |   |      | $\pm 800$ | nA         |    |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$<br>$E_{on}$<br>$E_{off}$ | Inductive load $T_{VJ} = 125^{\circ}\text{C}$<br>$V_{CE} = 600 \text{ V}; I_C = 200 \text{ A}$<br>$V_{GE} = \pm 15 \text{ V}; R_G = 3.3 \Omega$ |   | 100  |           | ns         |    |
|  |   |   |      | 60        |            | ns |
|  |   |   |      | 600       |            | ns |
|  |   |   |      | 90        |            | ns |
|  |   |   |      | 32        |            | mJ |
|  |   |   |      | 29        |            | mJ |
|  |   |   |      |           |            |    |
| $C_{ies}$  | $V_{CE} = 25 \text{ V}; V_{GE} = 0 \text{ V}; f = 1 \text{ MHz}$  |   | 13   |           | nF         |    |
| $C_{oes}$  |   |   | 2    |           | nF         |    |
| $C_{res}$  |   |   | 1    |           | nF         |    |
| $R_{thJC}$<br>$R_{thJH}$   | (per IGBT)<br>with heatsink compound  |   | 0.18 | 0.09      | K/W<br>K/W |    |

**Free wheeling diodes D1 - D2 / D11 - D12**

| Symbol                   | Conditions  | Maximum Ratings       |            |      |            |
|--------------------------|---|-----------------------|------------|------|------------|
| $I_{F25}$                | $T_C = 25^\circ\text{C}$  | 450                   | A          |      |            |
| $I_{F80}$                | $T_C = 80^\circ\text{C}$  | 280                   | A          |      |            |
| Symbol                   | Conditions  | Characteristic Values |            |      |            |
|                          |   | min.                  | typ.       | max. |            |
| $V_F$                    | $I_F = 300\text{ A}; V_{GE} = 0\text{ V};$<br>$T_{VJ} = 25^\circ\text{C}$<br>$T_{VJ} = 125^\circ\text{C}$                                 |                       | 2.2<br>1.7 | 2.5  | V<br>V     |
| $I_{RM}$<br>$t_{rr}$     | $I_F = 200\text{ A}; di_F/dt = -1800\text{ A}/\mu\text{s};$<br>$V_R = 600\text{ V}; V_{GE} = 0\text{ V};$<br>$T_{VJ} = 125^\circ\text{C}$ |                       | 180<br>200 |      | A<br>ns    |
| $R_{thJC}$<br>$R_{thJH}$ | (per IGBT)<br>with heatsink compound  |                       | 0.3        | 0.15 | K/W<br>K/W |

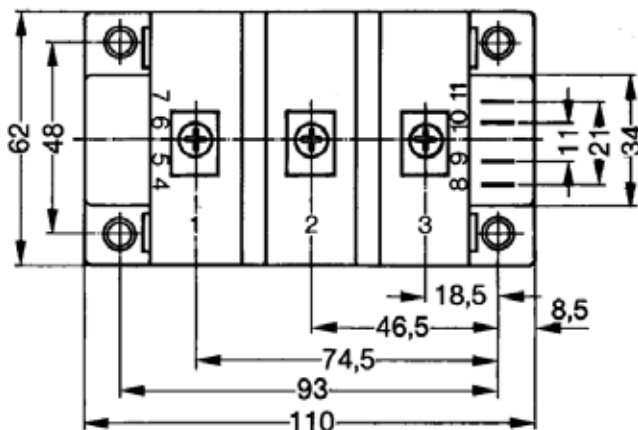
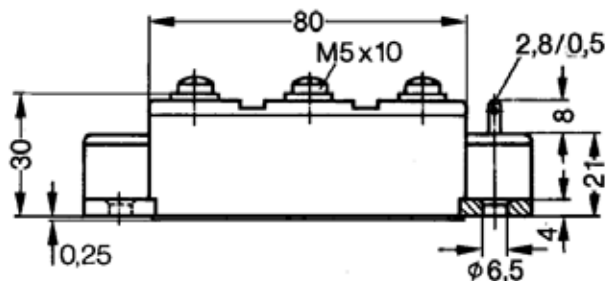
**Equivalent Circuits for Simulation**
**Conduction**


IGBT (typ. at  $V_{GE} = 15\text{ V}; T_J = 125^\circ\text{C}$ )  
 $V_0 = 1.3\text{ V}; R_0 = 6.2\text{ m}\Omega$

Free wheeling diode (typ. at  $T_J = 125^\circ\text{C}$ )  
 $V_0 = 1.3\text{ V}; R_0 = 2.4\text{ m}\Omega$

**Module**

| Symbol        | Conditions                                     | Maximum Ratings          |                  |      |    |
|---------------|--|--------------------------|------------------|------|----|
| $T_{VJ}$      | operating                                      | -40...+150               | $^\circ\text{C}$ |      |    |
| $T_{stg}$     |  | -40...+150               | $^\circ\text{C}$ |      |    |
| $V_{ISO}$     | $I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz}$   | 4000                     | V~               |      |    |
| $M_d$         | Mounting torque (module, M6)<br>(terminal, M5) | 2.25 - 2.75<br>2.5 - 3.7 | Nm<br>Nm         |      |    |
| Symbol        | Conditions                                     | Characteristic Values    |                  |      |    |
|               |  | min.                     | typ.             | max. |    |
| $d_S$         | Creepage distance on surface                   | 10                       |                  |      | mm |
| $d_A$         | Strike distance in air                         | 9.6                      |                  |      | mm |
| <b>Weight</b> |  |                          | 250              |      | g  |



Dimensions in mm (1 mm = 0.0394")

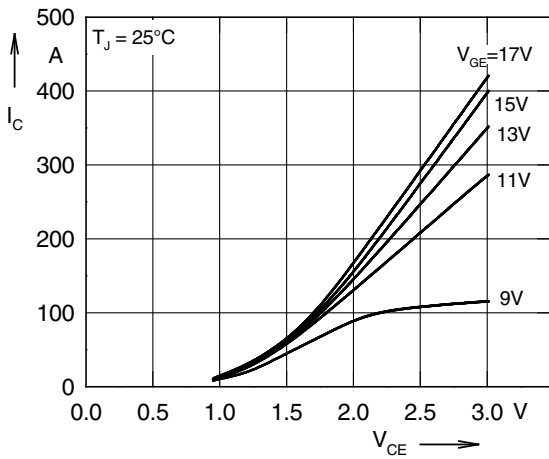


Fig. 1 Typ. output characteristics

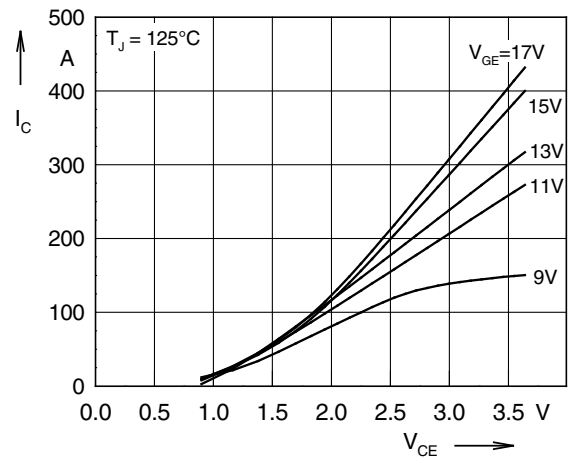


Fig. 2 Typ. output characteristics

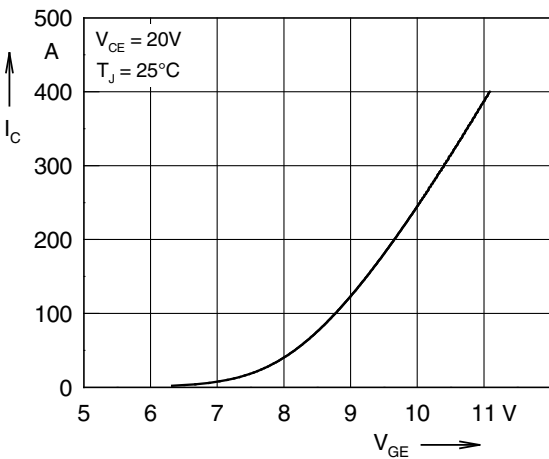


Fig. 3 Typ. transfer characteristics

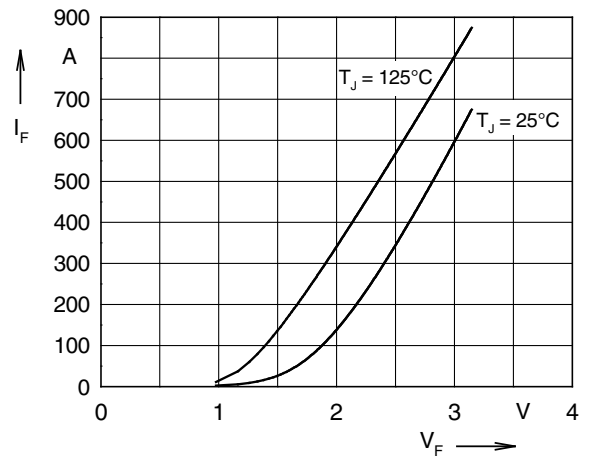


Fig. 4 Typ. forward characteristics of free wheeling diode

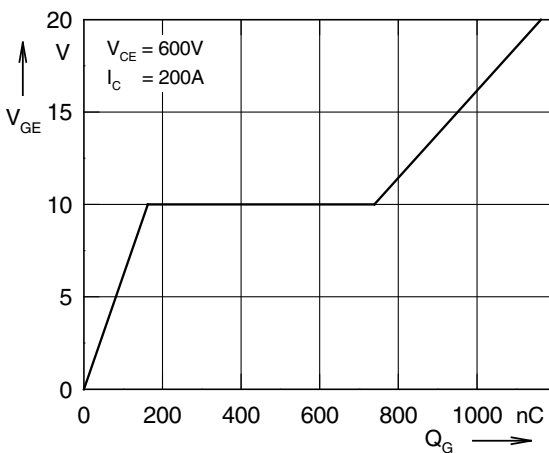


Fig. 5 Typ. turn on gate charge

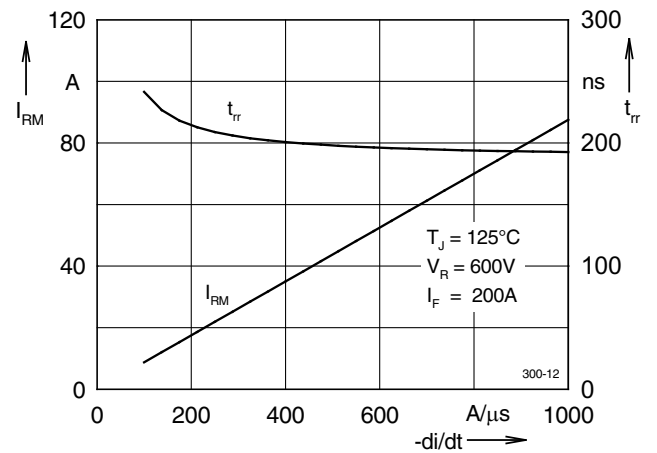


Fig. 6 Typ. turn off characteristics of free wheeling diode

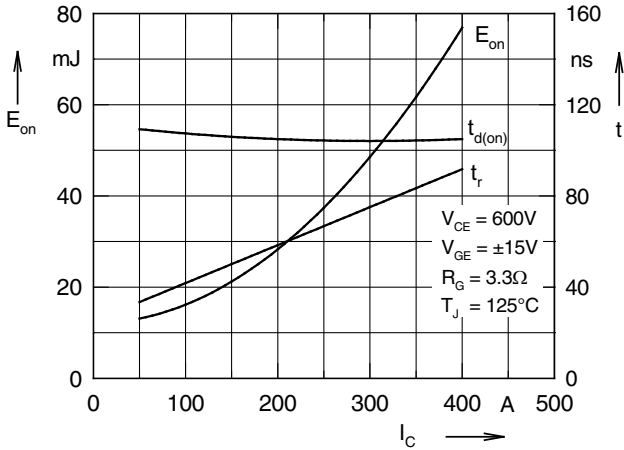


Fig. 7 Typ. turn on energy and switching

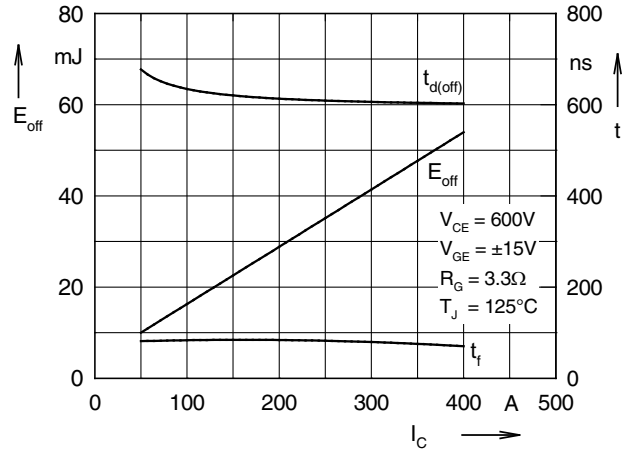


Fig. 8 Typ. turn off energy and switching times versus collector current

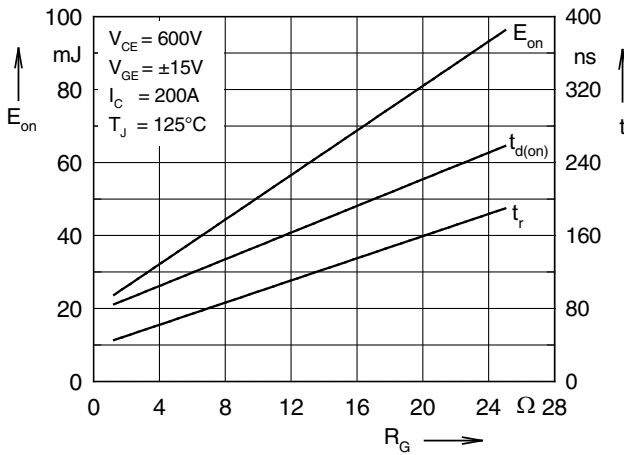


Fig. 9 Typ. turn on energy and switching times versus gate resistor

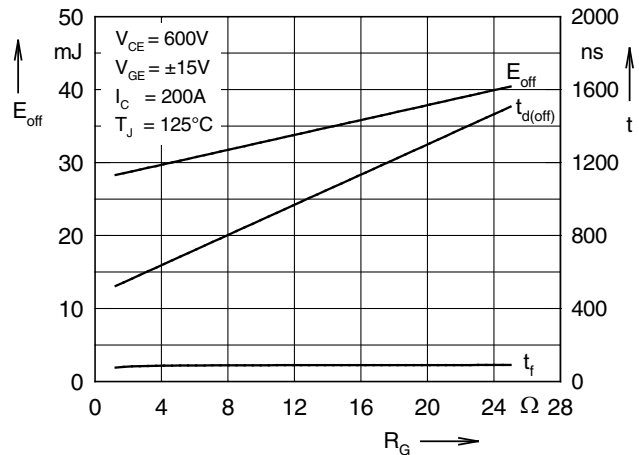


Fig.10 Typ. turn off energy and switching times versus gate resistor

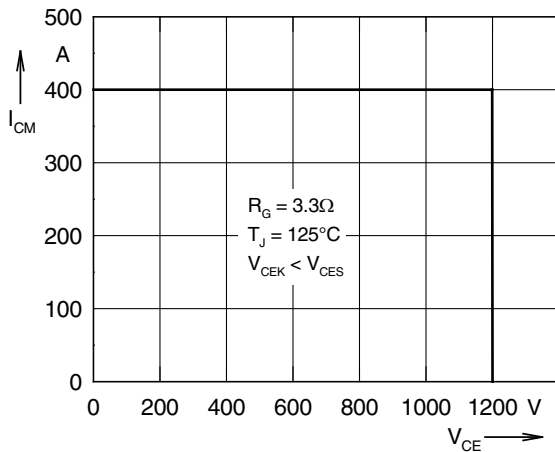


Fig. 11 Reverse biased safe operating area RBSOA

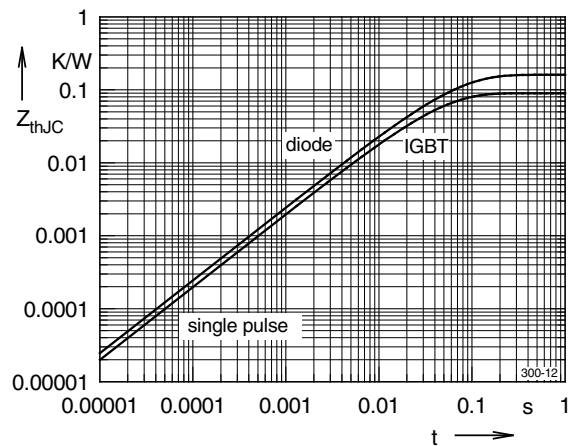


Fig. 12 Typ. transient thermal impedance