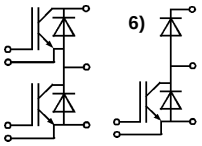
| Absolute Maximum Ratings | | Values | Units |
|---|---|---|---|
| **Symbol** | **Conditions** [1] | | |
| $V_{CES}$ | | 600 | V |
| $V_{CGR}$ | $R_{GE}$ = 20 kΩ | 600 | V |
| $I_C$ | $T_{case}$ = 25/80 °C | 200 / 140 | A |
| $I_{CM}$ | $T_{case}$ = 25/80 °C; $t_p$ = 1 ms | 400 / 280 | A |
| $V_{GES}$ | | ± 20 | V |
| $P_{tot}$ | per IGBT, $T_{case}$ = 25 °C | 700 | W |
| $T_j$, ($T_{stg}$) | | –40 ... +150 (125) | °C |
| $V_{isol}$ | AC, 1 min. | 2500 | V |
| humidity | IEC 60721-3-3 | class 3K7/IE32 | |
| climate | IEC 68 T.1 | 40/125/56 | |
| Inverse Diode and FWD of type „GAL“[6)8)] | | | |
| $I_F = -I_C$ | $T_{case}$ = 25/80 °C | 130 / 90 | A |
| $I_{FM} = -I_{CM}$ | $T_{case}$ = 25/80 °C; $t_p$ = 1 ms | 400 / 280 | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin.; $T_j$ = 150 °C | 880 | A |
| $I^2t$ | $t_p$ = 10 ms; $T_j$ = 150 °C | 3800 | $A^2s$ |

| Characteristics | | | | | |
|---|---|---|---|---|---|
| **Symbol** | **Conditions** [1] | **min.** | **typ.** | **max.** | **Units** |
| $V_{(BR)CES}$ | $V_{GE}$ = 0, $I_C$ = 4 mA | ≥ $V_{CES}$ | – | – | V |
| $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 3mA | 4,5 | 5,5 | 6,5 | V |
| $I_{CES}$ | $V_{GE}$ = 0, $T_j$ = 25 °C | – | 0,2 | 0,4 | mA |
| | $V_{CE}$ = $V_{CES}$, $T_j$ = 125 °C | – | 5 | – | mA |
| $I_{GES}$ | $V_{GE}$ = 20 V, $V_{CE}$ = 0 | – | – | 0,3 | µA |
| $V_{CEsat}$ | $I_C$ = 100 A; $V_{GE}$ = 15 V; $T_j$ = 25 (125) °C | – | 1,8(2,0) | – | V |
| $V_{CEsat}$ | $I_C$ = 150 A; $V_{GE}$ = 15 V; $T_j$ = 25 (125) °C | – | 2,1(2,4) | 2,5(2,8) | V |
| $g_{fs}$ | $V_{CE}$ = 20 V, $I_C$ = 150 A | 50 | – | – | S |
| $C_{CHC}$ | per IGBT | – | – | 350 | pF |
| $C_{ies}$ | $V_{GE}$ = 0, $V_{CE}$ = 25 V, f = 1 MHz | – | 8400 | – | pF |
| $C_{oes}$ | | – | 1000 | – | pF |
| $C_{res}$ | | – | 600 | – | pF |
| $L_{CE}$ | | – | – | 25 | nH |
| $t_{d(on)}$ | $V_{CC}$ = 300 V | – | 130 | – | ns |
| $t_r$ | $V_{GE}$ = –15 V / +15 V[3)] | – | 65 | – | ns |
| $t_{d(off)}$ | $I_C$ = 150 A, ind. load | – | 450 | – | ns |
| $t_f$ | $R_{Gon}$ = $R_{Goff}$ = 10 Ω | – | 40 | – | ns |
| $E_{on}$ | $T_j$ = 125 °C | – | 8,5 | – | mWs |
| $E_{off}$ | | – | 5,5 | – | mWs |
| Inverse Diode and FWD of type „GAL“[6)8)] | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 100 A; $V_{GE}$ = 0 V; $T_j$ = 25 (125) °C | – | 1,45(1,35) | 1,7 | V |
| | $I_F$ = 150 A; $V_{GE}$ = 0 V; $T_j$ = 25 (125) °C | – | 1,55(1,55) | 1,9 | V |
| $V_{TO}$ | $T_j$ = 125 °C | – | – | 0,9 | V |
| $r_t$ | $T_j$ = 125 °C | – | 6 | 8 | mΩ |
| $I_{RRM}$ | $I_F$ = 150 A; $T_j$ = 125 °C[2)] | – | 53 | – | A |
| $Q_{rr}$ | $I_F$ = 150 A; $T_j$ = 125 °C[2)] | – | 8,1 | – | µC |
| Thermal characteristics | | | | | |
| $R_{thjc}$ | per IGBT | – | – | 0,18 | °C/W |
| $R_{thjc}$ | per diode | – | – | 0,5 | °C/W |
| $R_{thch}$ | per module | – | – | 0,05 | °C/W |

## SEMITRANS® M
## Superfast NPT-IGBT Modules

## SKM 145 GB 063 DN
## SKM 145 GAL 063 DN

**SEMITRANS 2N (low inductance)**




**GB** **GAL**

### Features

- N channel, homogeneous Silicon structure (NPT- Non punch-through IGBT)
- Low tail current with low temperature dependence
- High short circuit capability, self limiting if term. G is clamped to E
- Pos. temp.-coeff. of $V_{CEsat}$
- Very low $C_{ies}$, $C_{oes}$, $C_{res}$
- Fast & soft inverse CAL diodes [8)]
- Without hard mould
- Large clearance (10 mm) and creepage distances (20 mm)

### Typical Applications

- Switching (not for linear use)
- Switched mode power supplies
- UPS
- AC inverter servo drives
- Pulse frequencies also above 10 kHz
- Welding inverters

[1)] $T_{case}$ = 25 °C, unless otherwise specified
[2)] $I_F$ = – $I_C$, $V_R$ = 300 V, $-di_F/dt$ = 1500 A/µs, $V_{GE}$ = 0 V
[3)] Use $V_{GEoff}$ = –5... –15 V
[6)] The free-wheeling diode of the GAL type has the data of the inverse diode
[8)] CAL = Controlled Axial Lifetime Technology

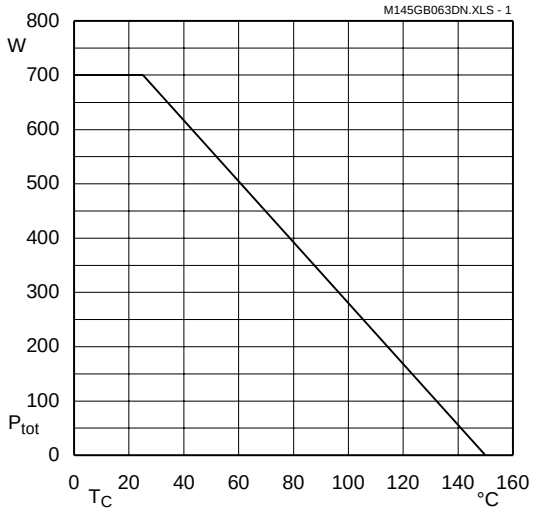



Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

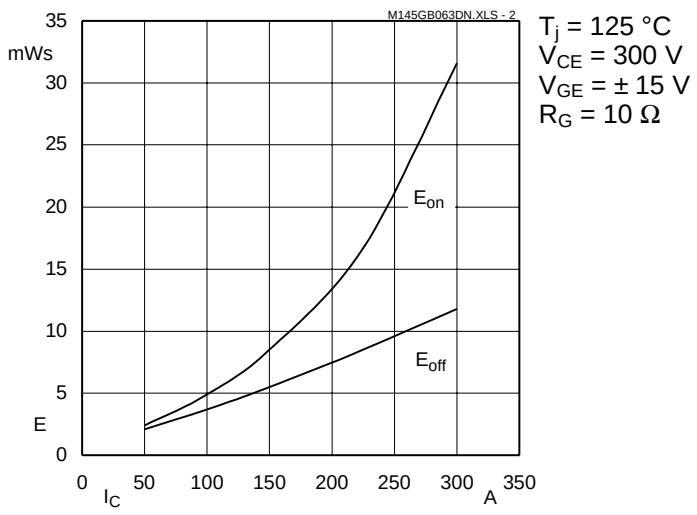



Fig. 2 Turn-on /-off energy = f ($I_C$)

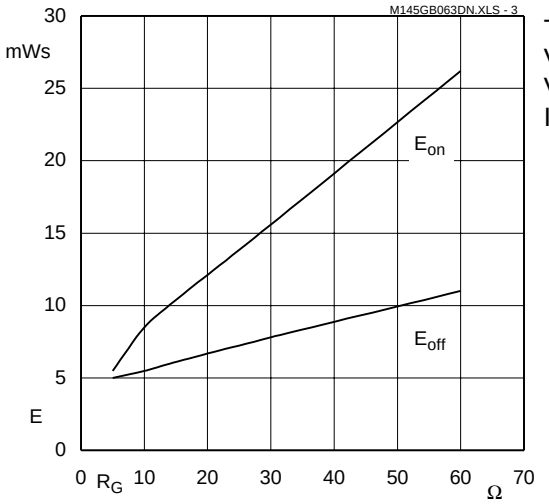



Fig. 3 Turn-on /-off energy = f ($R_G$)

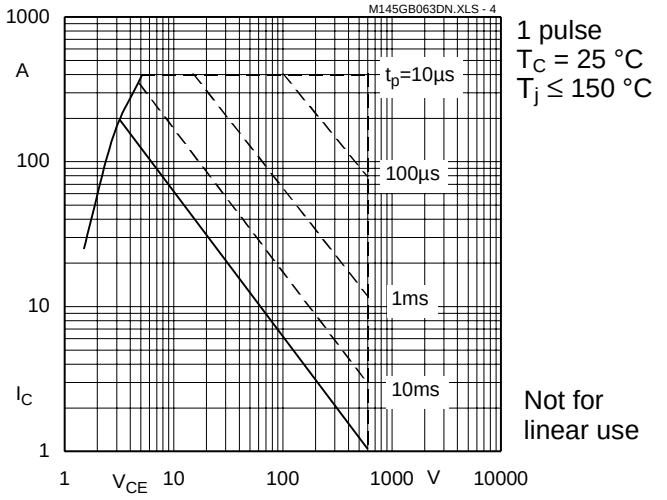



Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

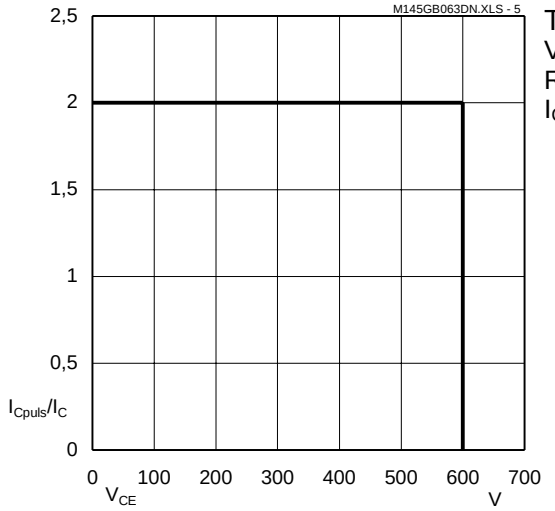



Fig. 5 Turn-off safe operating area (RBSOA)

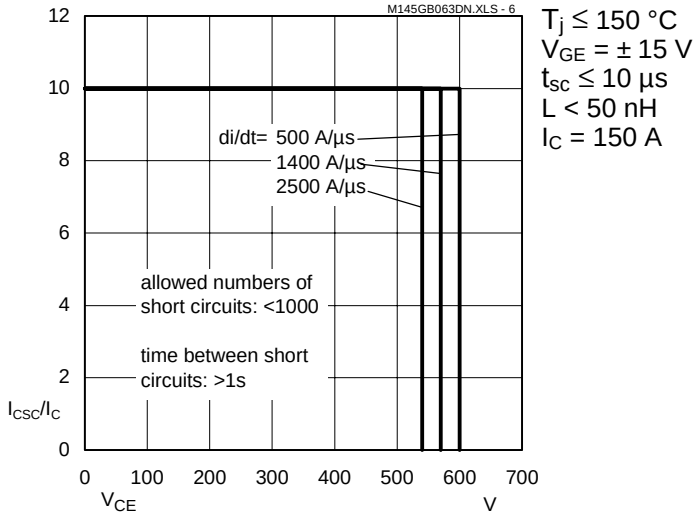
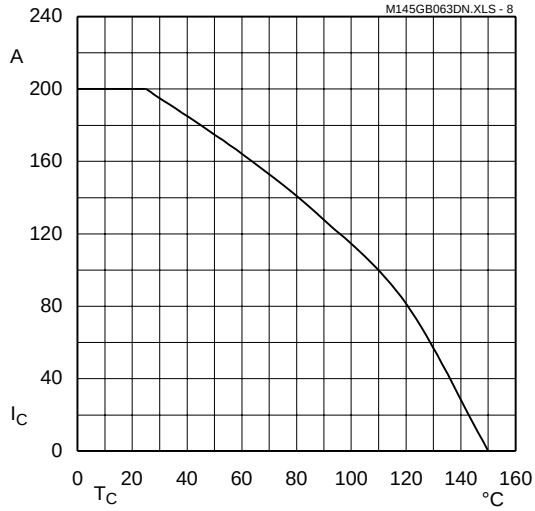



Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$




$T_j$ = 150 °C
$V_{GE} \geq$ 15V

Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

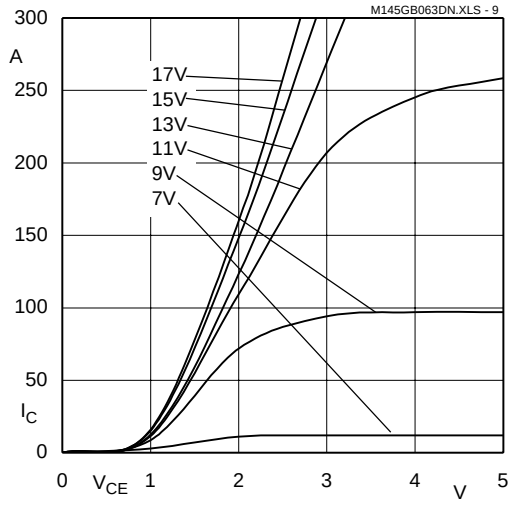



Fig. 9 Typ. output characteristic, $t_p$ = 250 µs; $T_j$ = 25 °C

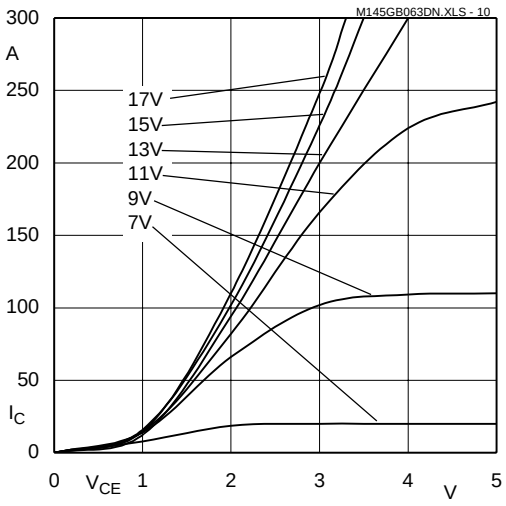



Fig. 10 Typ. output characteristic, $t_p$ = 250 µs; $T_j$ = 125 °C

$P_{cond(t)} = V_{CEsat(t)} \cdot I_{C(t)}$

$V_{CEsat(t)} = V_{CE(TO)(Tj)} + r_{CE(Tj)} \cdot I_{C(t)}$

$V_{CE(TO)(Tj)} \leq 1{,}2 - 0{,}001\ (T_j - 25)$ [V]

typ.: $r_{CE(Tj)} = 0{,}006 + 0{,}000027\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}0090 + 0{,}000028\ (T_j - 25)$ [Ω]

valid for $V_{GE} = +15\ ^{+2}_{-1}$ [V]; $I_C \geq 0{,}3\ I_{Cn}$

Fig. 11 Saturation characteristic (IGBT)
Calculation elements and equations

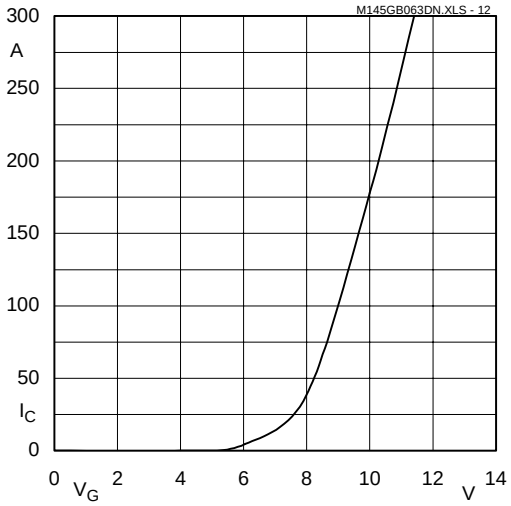



Fig. 12 Typ. transfer characteristic, $t_p$ = 250 µs; $V_{CE}$ = 20 V

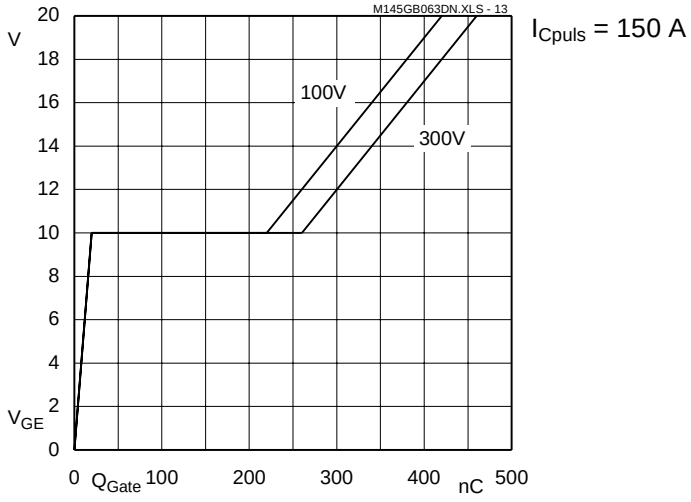



Fig. 13 Typ. gate charge characteristic

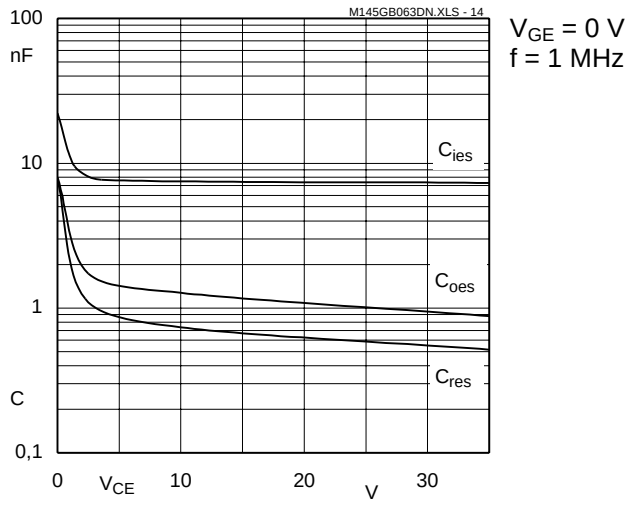



Fig. 14 Typ. capacitances vs.$V_{CE}$

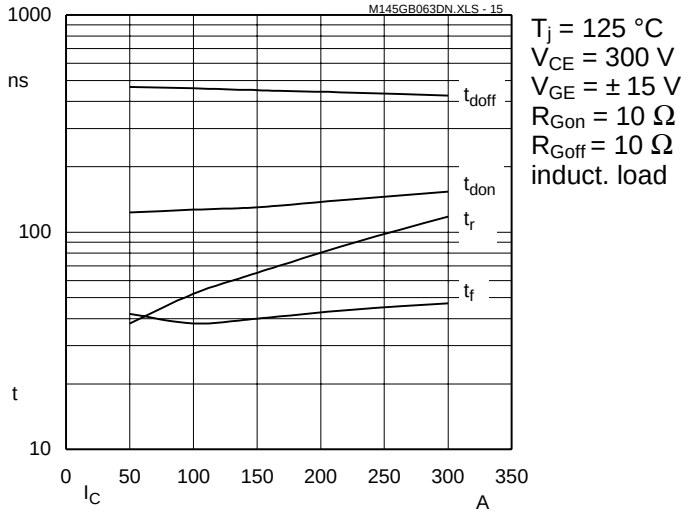



Fig. 15 Typ. switching times vs. $I_C$

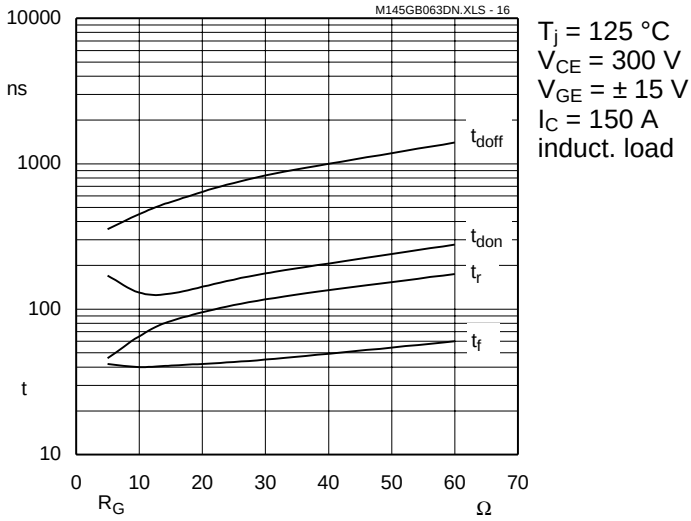



Fig. 16 Typ. switching times vs. gate resistor $R_G$

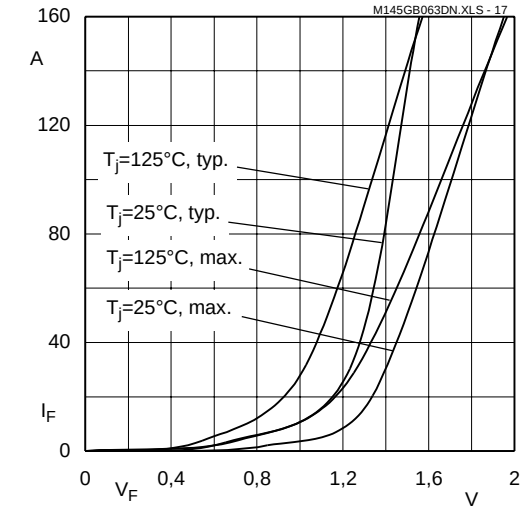



Fig. 17 Typ. CAL diode forward characteristic

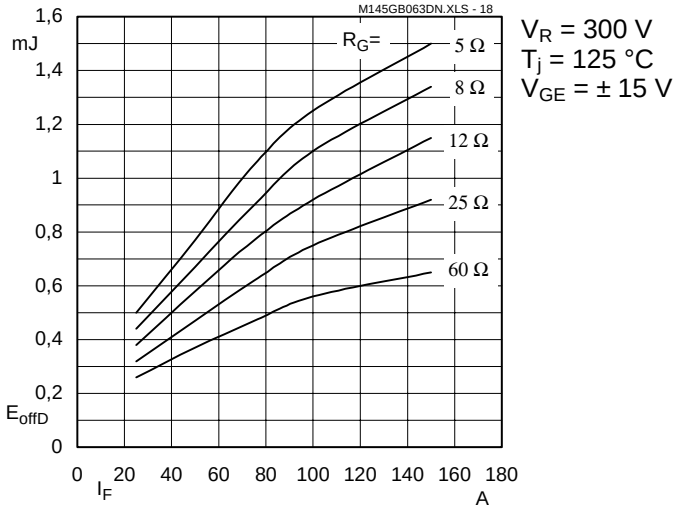



Fig. 18 Diode turn-off energy dissipation per pulse

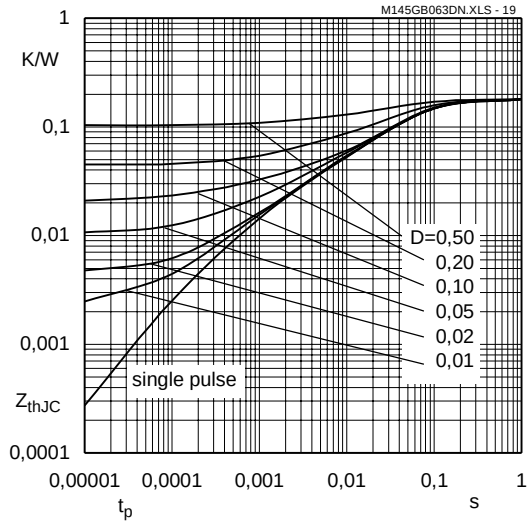



Fig. 19 Transient thermal impedance of IGBT
$Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

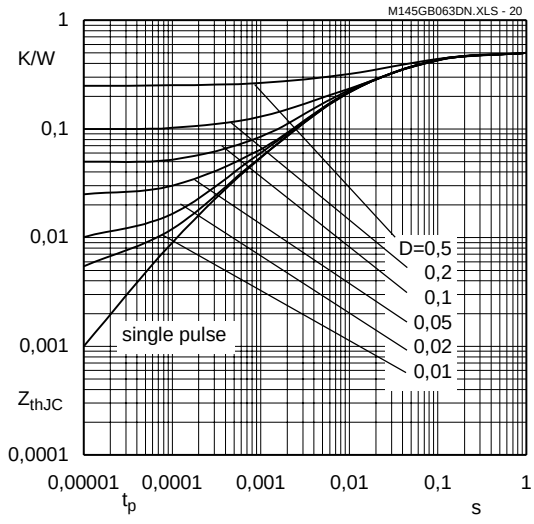



Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

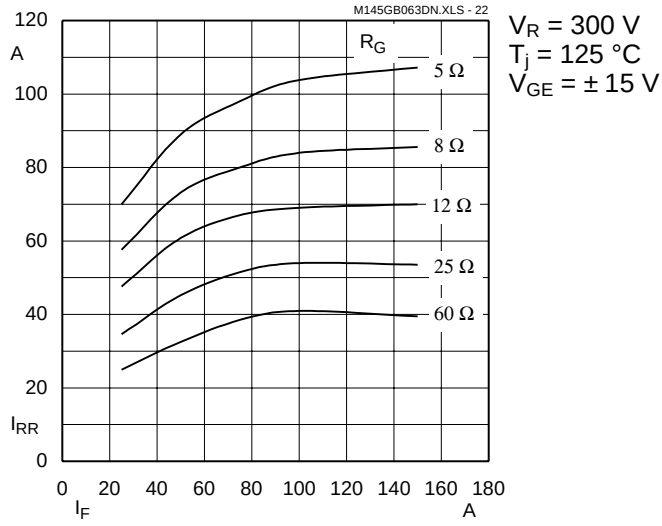



Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

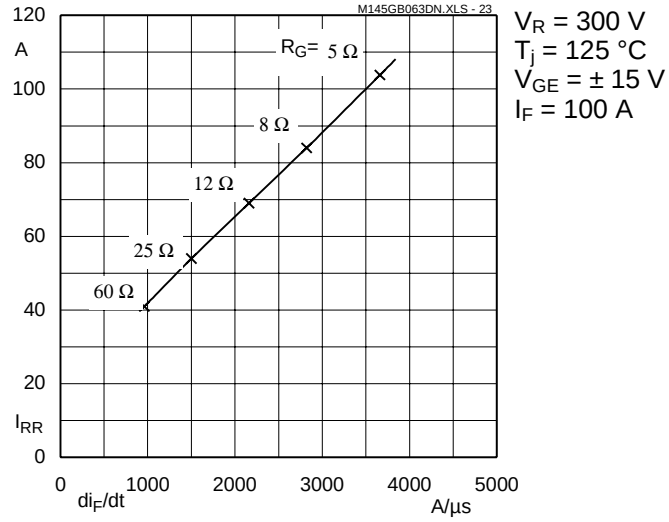



Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

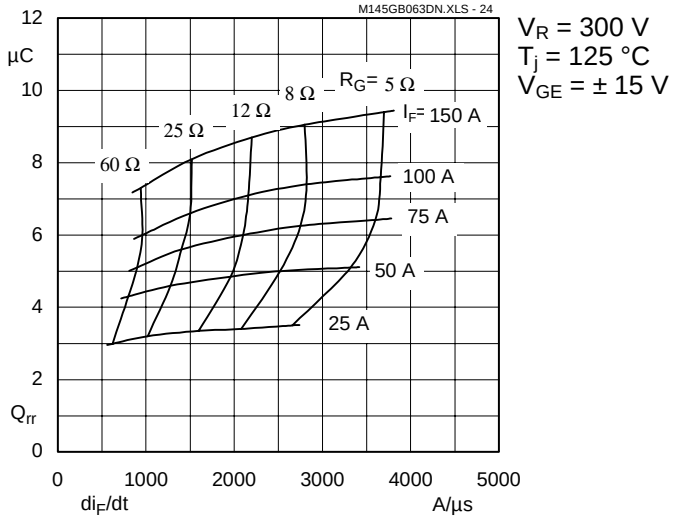
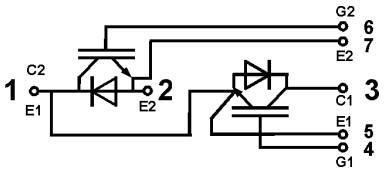


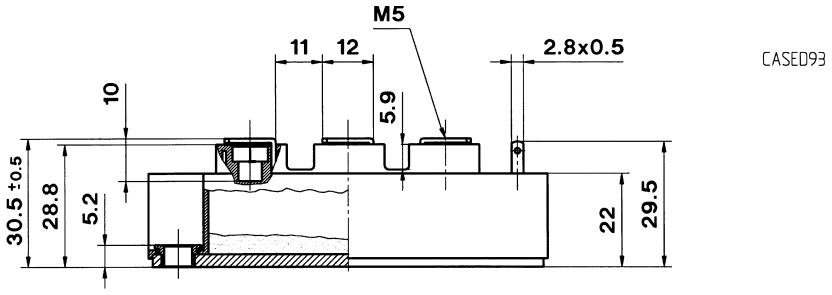

Fig. 24 Typ. CAL diode recovered charge

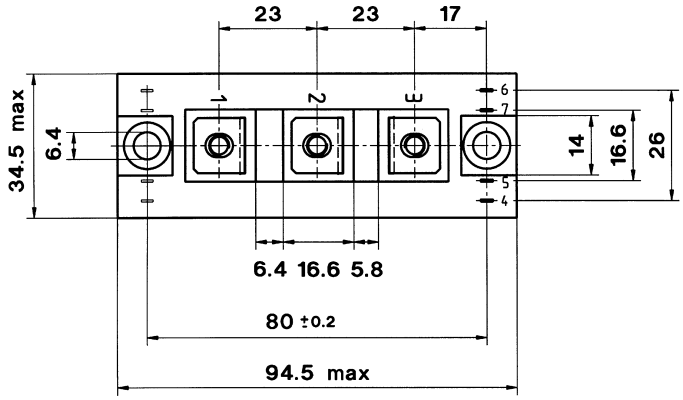
**SEMITRANS 2N (low inductance)**

Case D 93
UL Recognized
File no. E 63 532

**SKM 145 GB 063 DN**



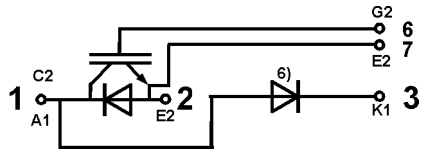




Dimensions in mm

**SKM 145 GAL 063 DN**

Case D 94 ( → D 93)




Case outline and circuit diagrams

| Mechanical Data | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Conditions | | Values | | | Units |
| | | | min. | typ. | max. | |
| $M_1$ | to heatsink, SI Units | (M6) | 3 | – | 5 | Nm |
| | to heatsink, US Units | | 27 | – | 44 | lb.in. |
| $M_2$ | for terminals, SI Units | (M5) | 2,5 | – | 5 | Nm |
| | for terminals, US Units | | 22 | – | 44 | lb.in. |
| a | | | – | – | 5x9,81 | $m/s^2$ |
| w | | | – | – | 160 | g |

**This is an electrostatic discharge sensitive device (ESDS). Please observe the international standard IEC 747-1, Chapter IX.**

Eight devices are supplied in one SEMIBOX A without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 2)

Larger packing units of 20 pieces are used if suitable

