SEMITRANS® 2

High Speed IGBT4 Modules

SKM150GB12F4

Features*

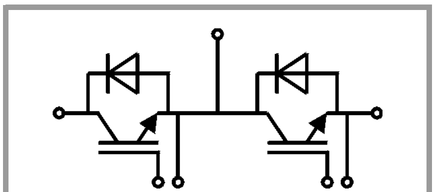
- High speed trench and field-stop IGBT
- CAL4 ultra-fast = soft switching 4. generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- For higher switching frequencies above 15kHz
- UL recognized, file no. E63532

Typical Applications

- UPS
- Electronic welders
- Inductive heating
- Switched mode power supplies

Remarks

- Case temperature limited to T_c = 125°C max.
- Recommended T_{op} = -40 ... +150°C
- Product reliability results valid for T_j = 150°C



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	201	A
		T_c = 80 °C	153	A
I_{Cnom}			150	A
I_{CRM}			300	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V $R_{G\ on/off}$ ≥ 2.7 Ω	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Inverse diode				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_c = 25 °C	174	A
		T_c = 80 °C	128	A
I_{FRM}			300	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		774	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			200	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min		4000	V

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	I_C = 150 A V_{GE} = 15 V chiplevel	T_j = 25 °C		2.05	2.42	V
		T_j = 150 °C		2.60	2.93	V
V_{CE0}	chiplevel	T_j = 25 °C		1.10	1.28	V
		T_j = 150 °C		0.95	1.13	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		6.3	7.6	mΩ
		T_j = 150 °C		11	12	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 5.2 mA		5.2	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				2.0	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		8.8		nF
C_{oes}		f = 1 MHz		0.58		nF
C_{res}		f = 1 MHz		0.47		nF
Q_G	V_{GE} = - 8 V...+ 15 V			850		nC
R_{Gint}	T_j = 25 °C			2.4		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 150 A V_{GE} = +15/-15 V $R_{G\ on}$ = 2 Ω $R_{G\ off}$ = 1 Ω di/dt_{on} = 4200 A/µs di/dt_{off} = 1880 A/µs dv/dt = 4800 V/µs L_s = 25 nH	T_j = 150 °C		93		ns
t_r		T_j = 150 °C		34		ns
E_{on}		T_j = 150 °C		14.5		mJ
$t_{d(off)}$		T_j = 150 °C		300		ns
t_f		T_j = 150 °C		65		ns
E_{off}		T_j = 150 °C		12		mJ
$R_{th(j-c)}$	per IGBT				0.2	K/W
$R_{th(c-s)}$	per IGBT (λ_{grease}=0.81 W/(m*K))			0.072		K/W

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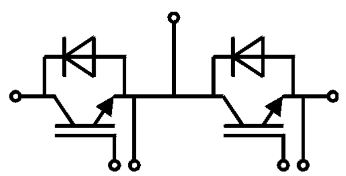

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse diode						
$V_F = V_{EC}$	I_F = 150 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.43	2.80	V
		T_j = 150 °C		2.30	2.65	V
V_{F0}	chiplevel	T_j = 25 °C		1.51	1.75	V
		T_j = 150 °C		1.16	1.40	V
r_F	chiplevel	T_j = 25 °C		6.1	7.0	mΩ
		T_j = 150 °C		7.6	8.3	mΩ
I_{RRM}	I_F = 150 A	T_j = 150 °C		140		A
Q_{rr}	di/dt_{off} = 4400 A/µs	T_j = 150 °C		20		µC
E_{rr}	V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		6		mJ
$R_{th(j-c)}$	per diode				0.32	K/W
$R_{th(c-s)}$	per diode (λ_{grease}=0.81 W/(m*K))			0.072		K/W
Module						
L_{CE}				30		nH
$R_{CC'+EE'}$	measured per switch	T_C = 25 °C		0.65		mΩ
		T_C = 125 °C		1.09		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling			0.018		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module (λ_{grease}=0.81 W/(m*K))			0.027		K/W
M_s	to heat sink M6		3		5	Nm
M_t		to terminals M5	2.5		5	Nm
				-		Nm
w					160	g

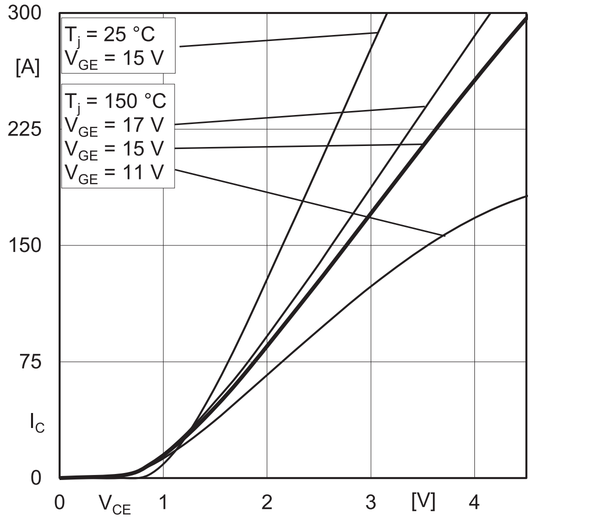


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

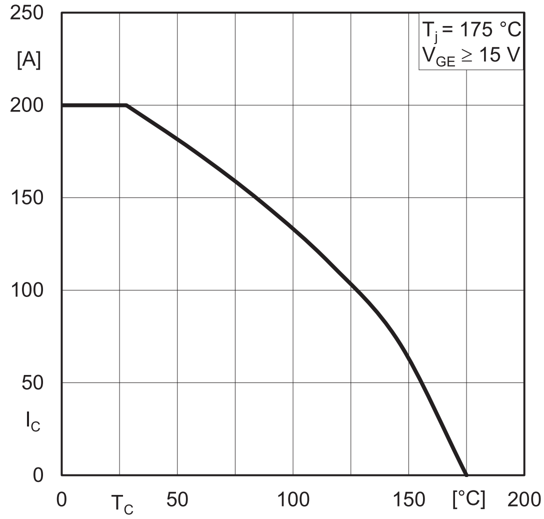


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

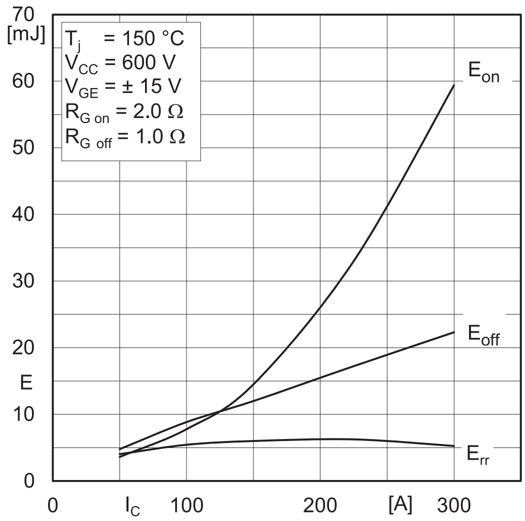


Fig. 3: Typ. turn-on /-off energy = f (I_C)

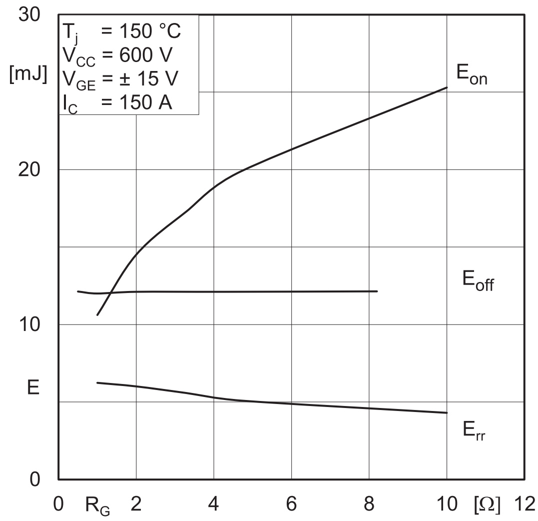


Fig. 4: Typ. turn-on /-off energy = f (R_G)

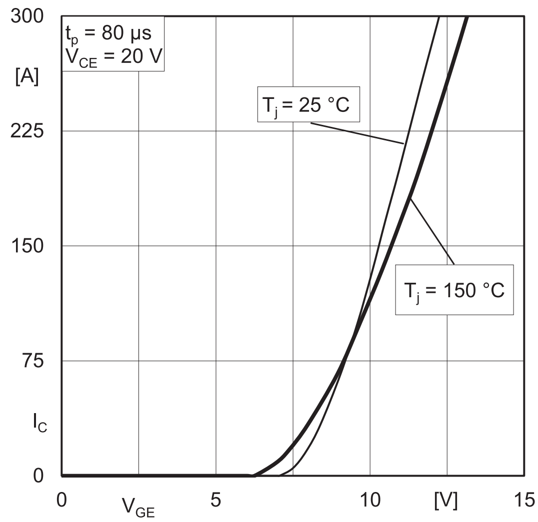


Fig. 5: Typ. transfer characteristic

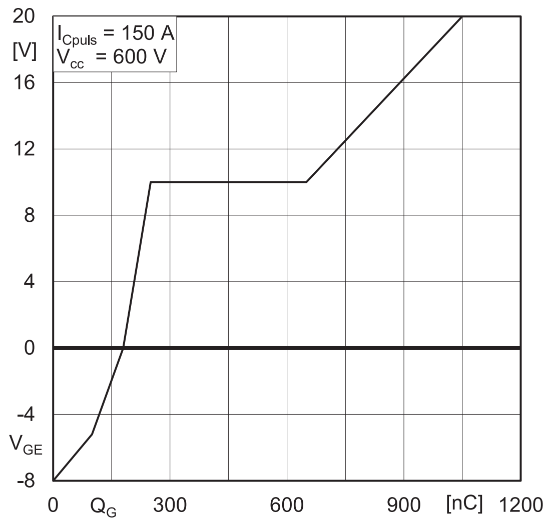


Fig. 6: Typ. gate charge characteristic

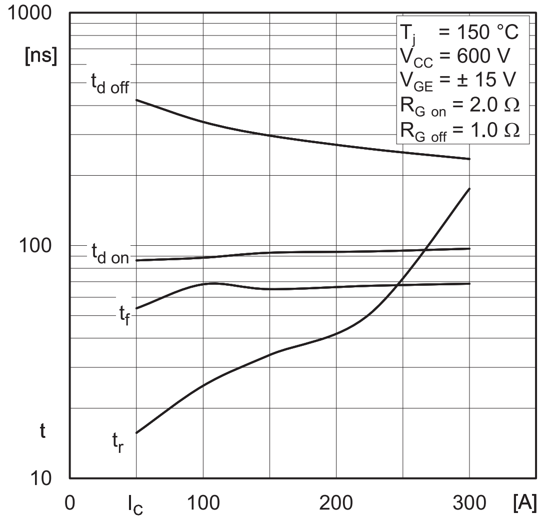


Fig. 7: Typ. switching times vs. I_C

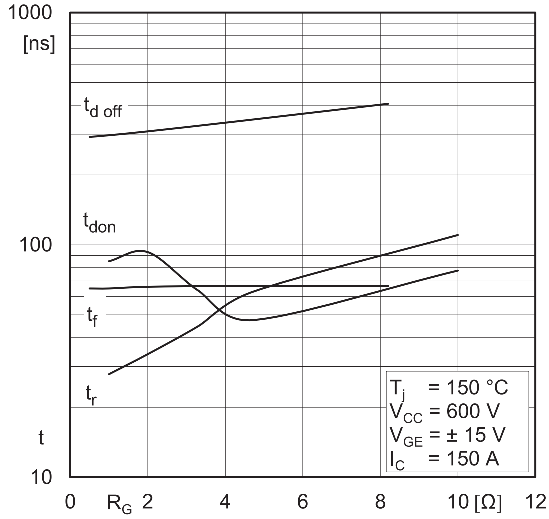


Fig. 8: Typ. switching times vs. gate resistor R_G

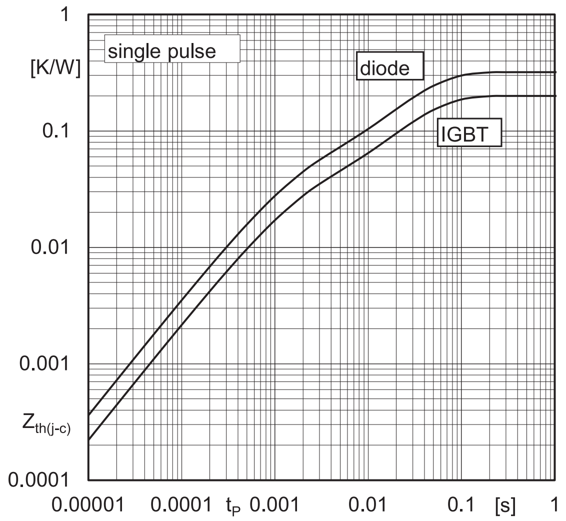


Fig. 9: Transient thermal impedance

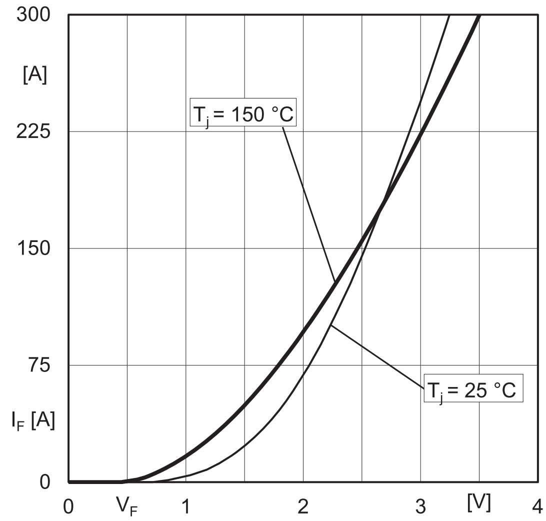


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

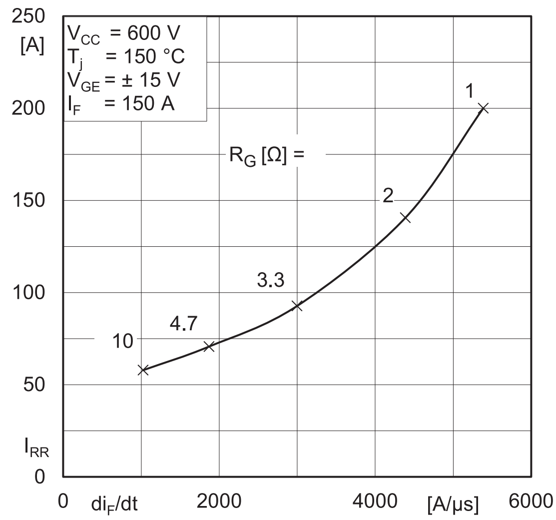


Fig. 11: Typ. CAL diode peak reverse recovery current

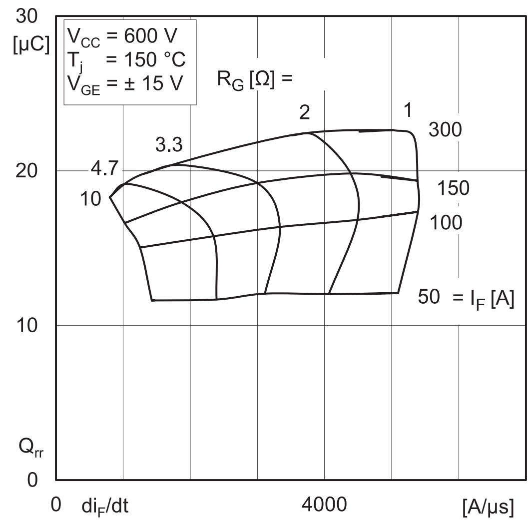


Fig. 12: Typ. CAL diode peak reverse recovery charge

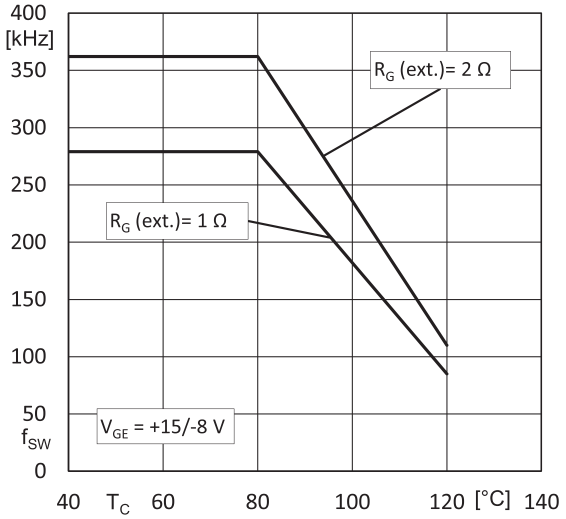
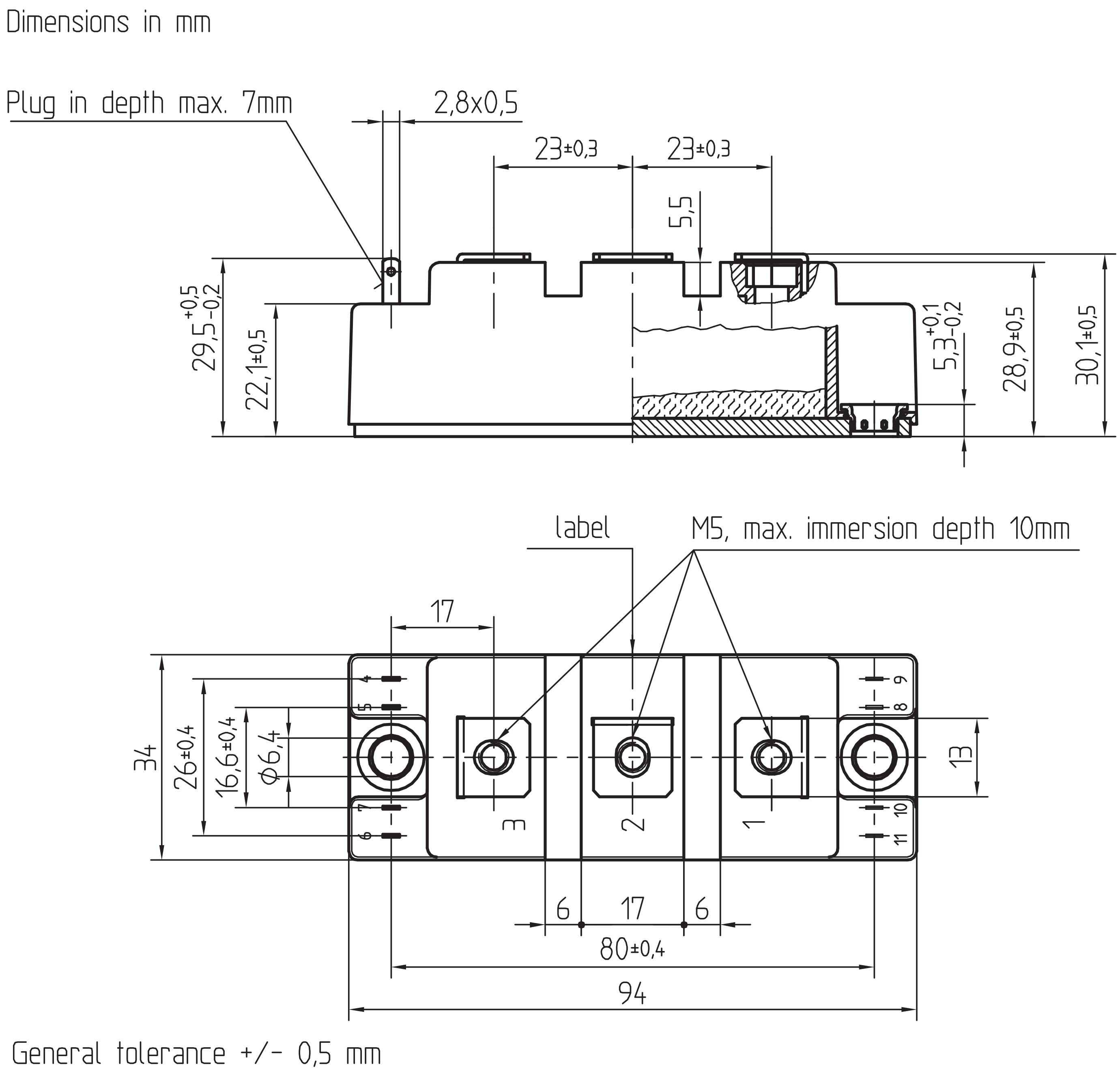


Fig. 13: Max. switching frequency vs. case temperature $f_{sw} = f(T_c)$



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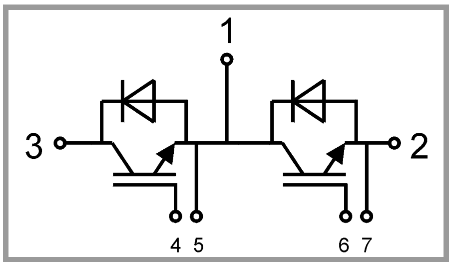

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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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