



SEMITRANS® 3

IGBT4 Modules

SKM400GM17E4

Features*

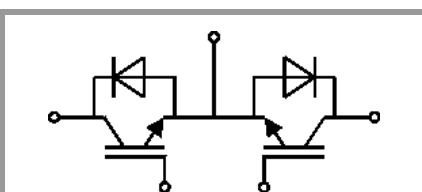
- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-Diode
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated Gate resistor
- For switching frequencies up to 8kHz
- UL recognized, file no. E63532

Typical Applications

- Matrix Inverter
- Bidirectional switch

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$



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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _J = 25 °C		1700	V
I _C	T _J = 175 °C	T _c = 25 °C	614	A
		T _c = 80 °C	474	A
I _{Cnom}			400	A
I _{CRM}			1200	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 1000 V V _{GE} ≤ 15 V V _{CES} ≤ 1700 V	T _J = 150 °C	10	μs
T _J			-40 ... 175	°C
Inverse diode				
V _{RRM}	T _J = 25 °C		1700	V
I _F	T _J = 175 °C	T _c = 25 °C	443	A
		T _c = 80 °C	327	A
I _{FRM}			800	A
I _{FSM}	t _p = 10 ms, sin 180°, T _J = 25 °C		2340	A
T _J			-40 ... 175	°C
Module				
I _{t(RMS)}			500	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 = 400 A	T _j = 25 °C		1.92	2.20	V
	V _{GE} = 15 V chipelevel	T _j = 150 °C		2.30	2.60	V
V _{CE0}	chipelevel	T _j = 25 °C		0.80	0.90	V
		T _j = 150 °C		0.70	0.80	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		2.8	3.3	mΩ
	chipelevel	T _j = 150 °C		4.0	4.5	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 16 mA		5.2	5.8	6.4	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 1700 V, T _j = 25 °C				5	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		36.0		nF
C _{oes}		f = 1 MHz		1.36		nF
C _{res}		f = 1 MHz		1.16		nF
Q _G	V _{GE} = - 8 V...+ 15 V			3200		nC
R _{Gint}	T _j = 25 °C			1.9		Ω
t _{d(on)}	V _{CC} = 1200 V	T _j = 150 °C		280		ns
t _r	I _C = 400 A	T _j = 150 °C		45		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		157		mJ
t _{d(off)}	R _{G on} = 2 Ω	T _j = 150 °C		760		ns
t _f	R _{G off} = 1 Ω	T _j = 150 °C		140		ns
	di/dt _{on} = 10000 A/ μs	T _j = 150 °C				
E _{off}	di/dt _{off} = 2300 A/μs dv/dt = 5600 V/μs	T _j = 150 °C		180		mJ
R _{th(j-c)}	per IGBT				0.066	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.028		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.017		K/W



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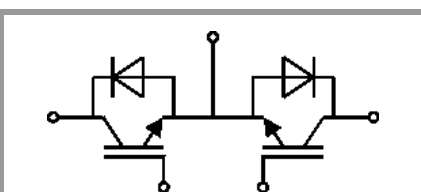
Typical Applications

- Matrix Inverter
- Bidirectional switch

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		2.00	2.40	V
	V _{GE} = 0 V chipllevel	T _j = 150 °C		2.16	2.57	V
V _{F0}	chipllevel	T _j = 25 °C		1.32	1.56	V
		T _j = 150 °C		1.08	1.22	V
r _F	chipllevel	T _j = 25 °C		1.71	2.1	mΩ
		T _j = 150 °C		2.7	3.4	mΩ
I _{RRM}	I _F = 400 A	T _j = 150 °C		615		A
Q _{rr}	di/dt _{off} = 10100 A/ μs	T _j = 150 °C		150		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 1200 V	T _j = 150 °C		130		mJ
R _{th(j-c)}	per diode				0.13	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.038		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.032		K/W
Module						
L _{CE}				15		nH
R _{CC'+EE'}	measured per switch	T _C = 25 °C		0.55		mΩ
		T _C = 125 °C		0.85		mΩ
R _{th(c-s)1}	calculated without thermal coupling			0.0081		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module (λ _{grease} =0.81 W/(m*K))			0.013		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module, pre-applied phase change material			0.009		K/W
M _s	to heat sink M6		3		5	Nm
M _t		to terminals M6	2.5		5	Nm
						Nm
w					325	g



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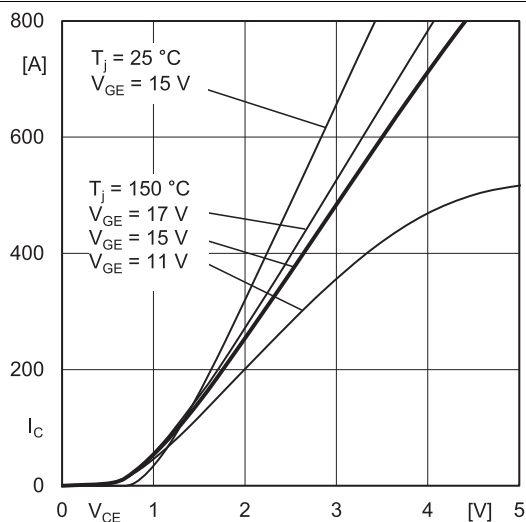


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

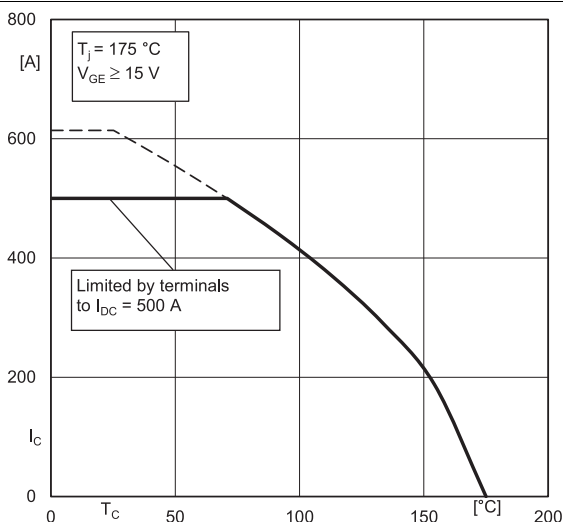


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

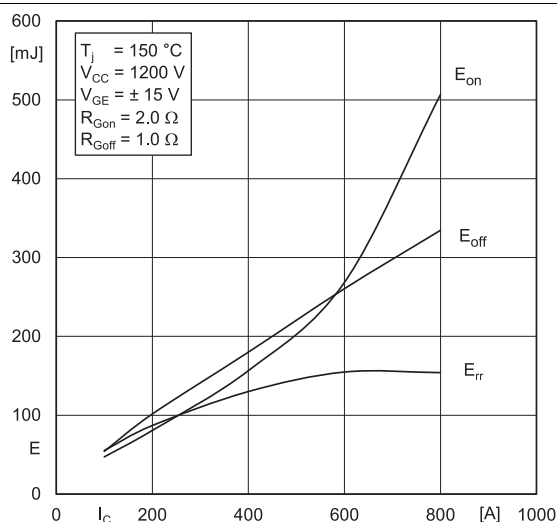


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

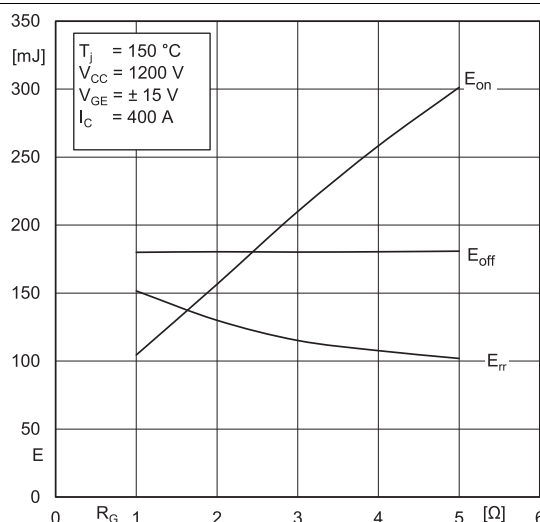


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

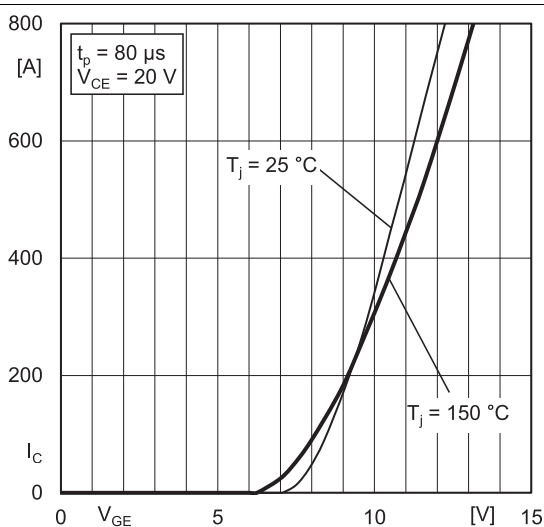


Fig. 5: Typ. transfer characteristic

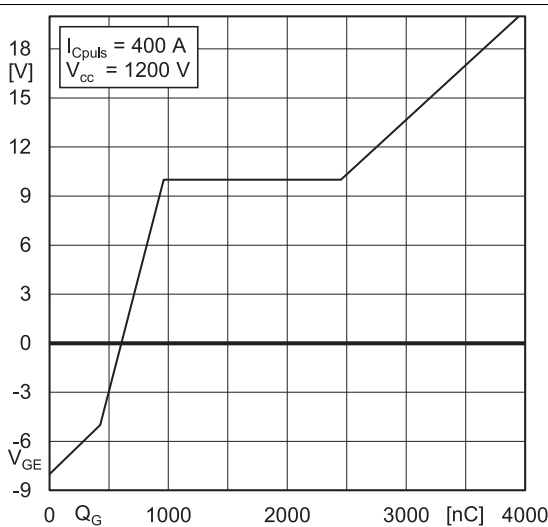


Fig. 6: Typ. gate charge characteristic

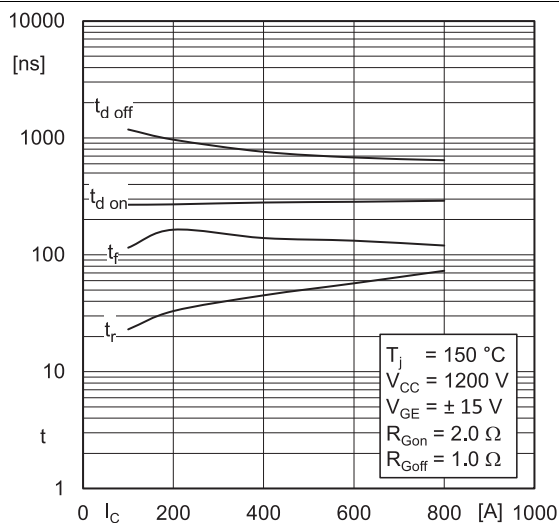


Fig. 7: Typ. switching times vs. I_C

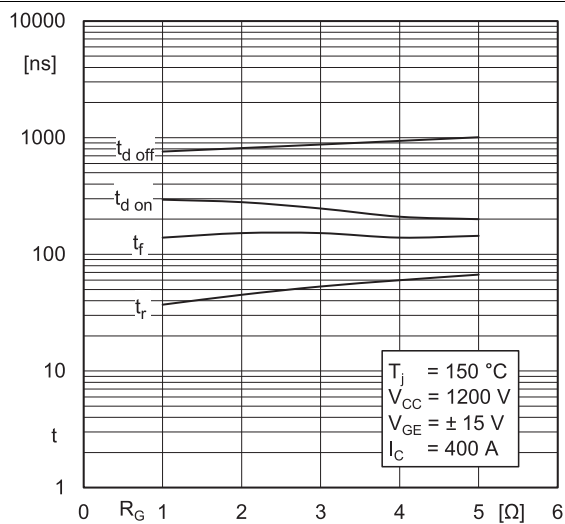


Fig. 8: Typ. switching times vs. gate resistor R_G

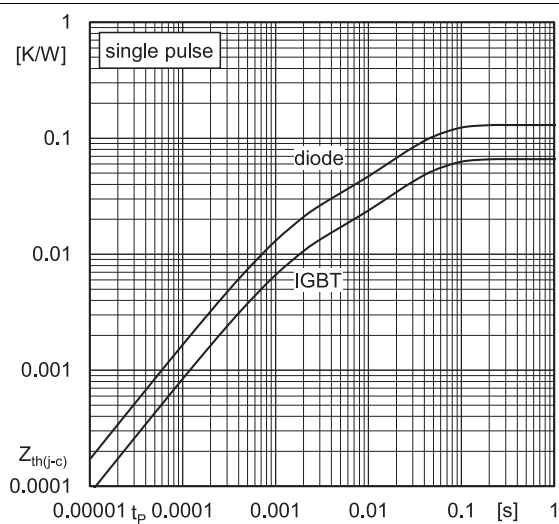


Fig. 9: Transient thermal impedance

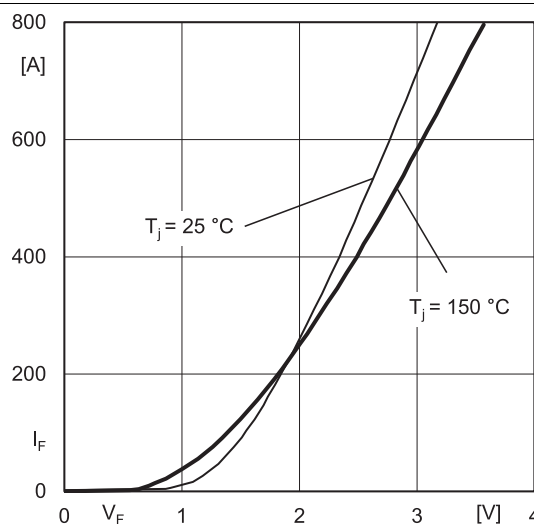


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

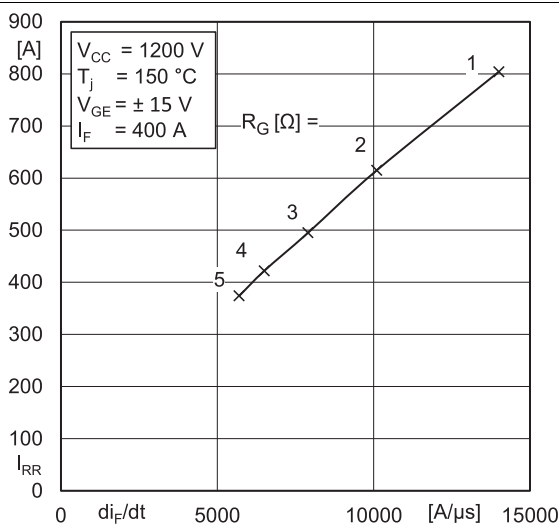


Fig. 11: Typ. CAL diode peak reverse recovery current

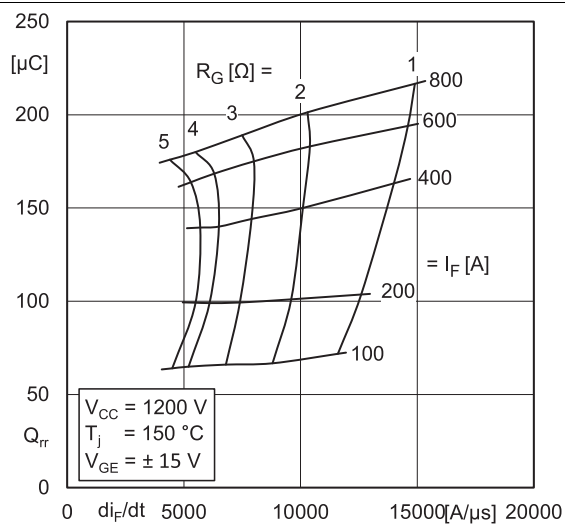
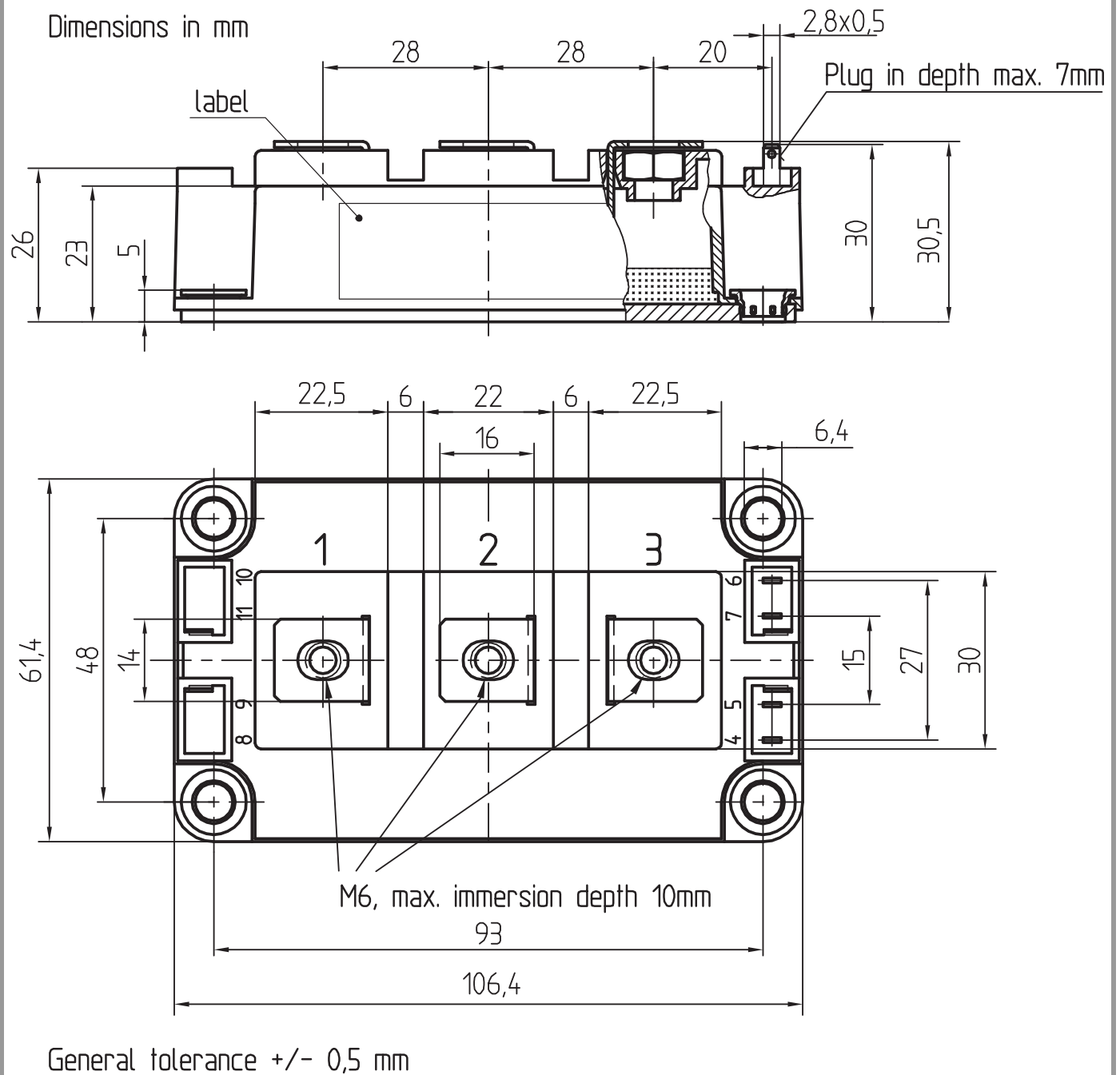
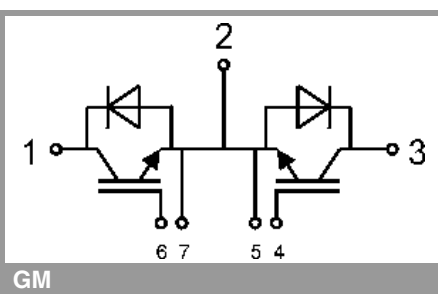


Fig. 12: Typ. CAL diode peak reverse recovery charge



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This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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