SEMITRANS® 3

IGBT4 Modules

SKM450GB12E4D1

Features*

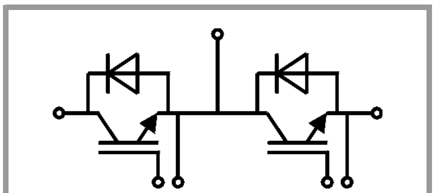
- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 12kHz
- UL recognized, file no. E63532
- SKM…**D1**: increased diode performance

Typical Applications

- AC inverter drives
- UPS

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



GB

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	699	A
		T_c = 80 °C	538	A
I_{Cnom}			450	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		1350	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V	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	623	A
		T_c = 80 °C	466	A
I_{Fnom}			500	A
I_{FRM}	I_{FRM} = 2xI_{Fnom}		1000	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		2736	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 = 450 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.84	2.07	V
		T_j = 150 °C		2.23	2.42	V
V_{CE0}	chiplevel	T_j = 25 °C		0.80	0.90	V
		T_j = 150 °C		0.70	0.80	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		2.3	2.6	mΩ
		T_j = 150 °C		3.4	3.6	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 16.4 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				5	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		27.2		nF
C_{oes}		f = 1 MHz		1.76		nF
C_{res}		f = 1 MHz		1.50		nF
Q_G	V_{GE} = - 8 V...+ 15 V			2500		nC
R_{Gint}	T_j = 25 °C			1.9		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 450 A V_{GE} = +15/-15 V $R_{G\ on}$ = 1 Ω $R_{G\ off}$ = 1 Ω di/dt_{on} = 8100 A/µs di/dt_{off} = 3400 A/µs	T_j = 150 °C		253		ns
t_r		T_j = 150 °C		59		ns
E_{on}		T_j = 150 °C		28		mJ
$t_{d(off)}$		T_j = 150 °C		505		ns
t_f		T_j = 150 °C		112		ns
E_{off}		T_j = 150 °C		58		mJ
$R_{th(j-c)}$	per IGBT				0.062	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

SEMITRANS® 3

IGBT4 Modules

SKM450GB12E4D1

Features*

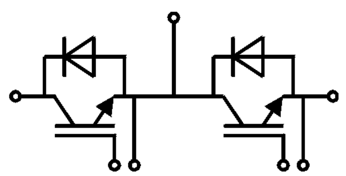
- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 12kHz
- UL recognized, file no. E63532
- SKM…**D1**: increased diode performance

Typical Applications

- AC inverter drives
- UPS

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



GB

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	I_F = 450 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.04	2.35	V
		T_j = 150 °C		1.94	2.23	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		1.64	1.88	mΩ
		T_j = 150 °C		2.3	2.5	mΩ
I_{RRM}	I_F = 450 A di/dt_{off} = 8000 A/µs V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		504		A
Q_{rr}		T_j = 150 °C		75		µC
E_{rr}		T_j = 150 °C		31		mJ
$R_{th(j-c)}$	per diode				0.095	K/W
$R_{th(c-s)}$	per diode (λ_{grease}=0.81 W/(m*K))			0.037		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.03		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			0.008		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module (λ_{grease}=0.81 W/(m*K))			0.013		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts 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

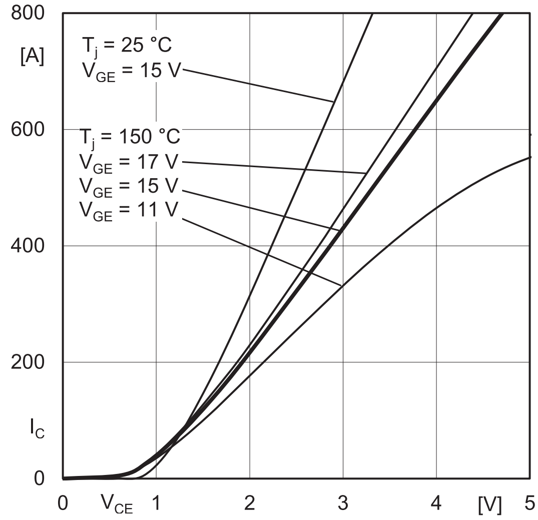


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

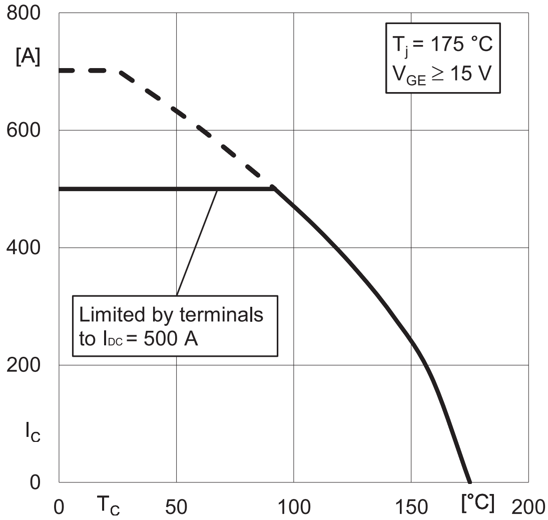


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

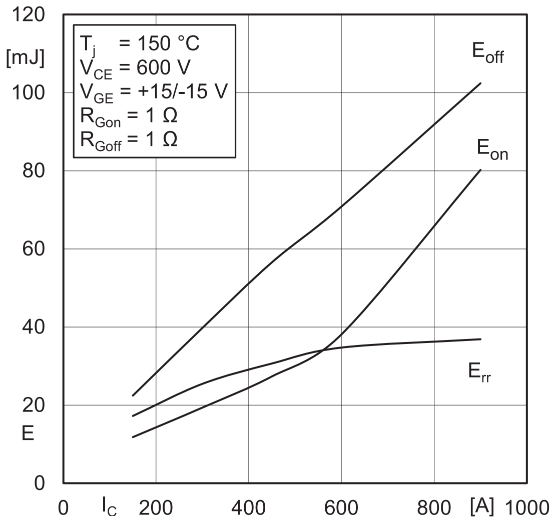


Fig. 3: Typ. turn-on /-off energy = f (I_C)

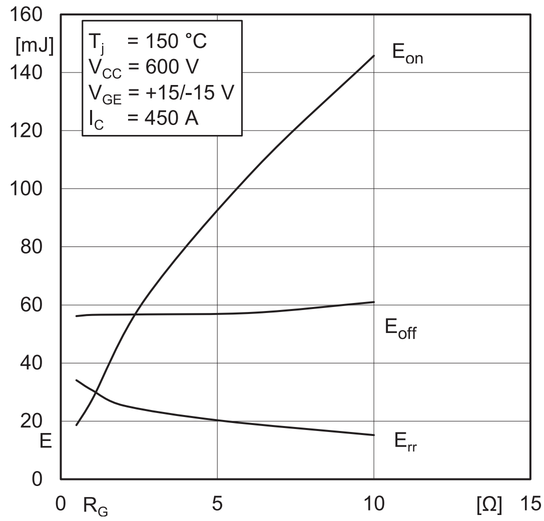


Fig. 4: Typ. turn-on /-off energy = f (R_G)

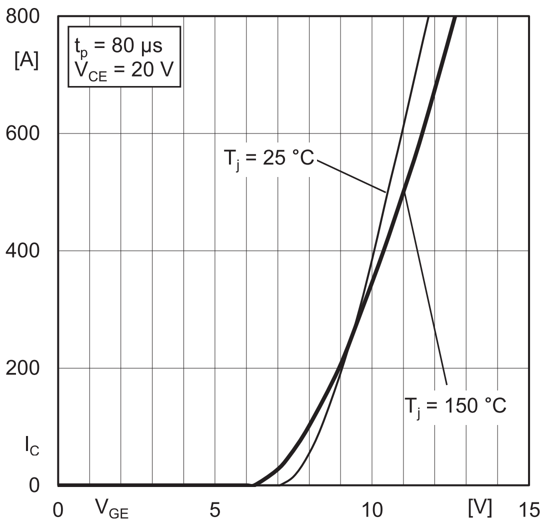


Fig. 5: Typ. transfer characteristic

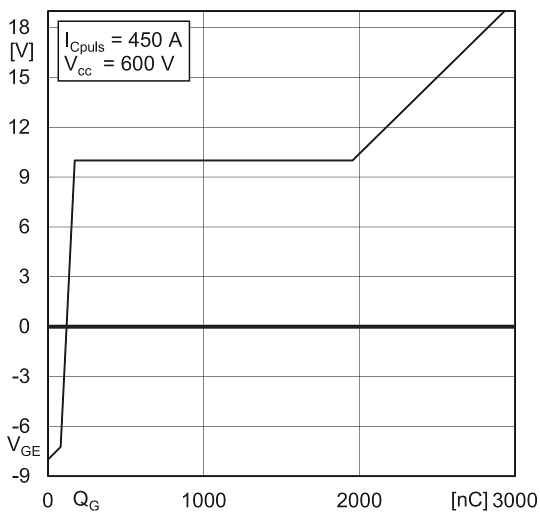


Fig. 6: Typ. gate charge characteristic

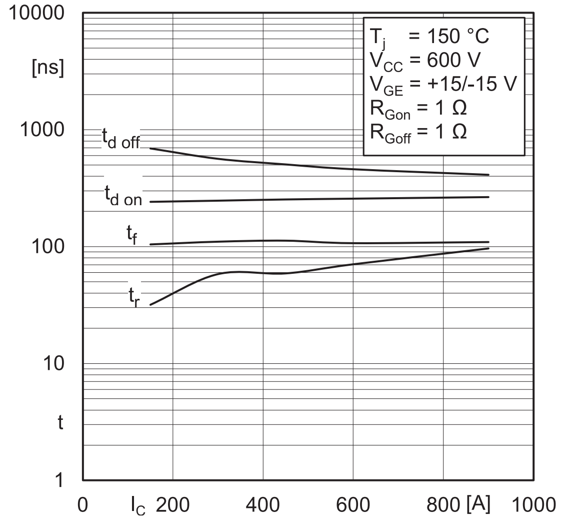


Fig. 7: Typ. switching times vs. I_C

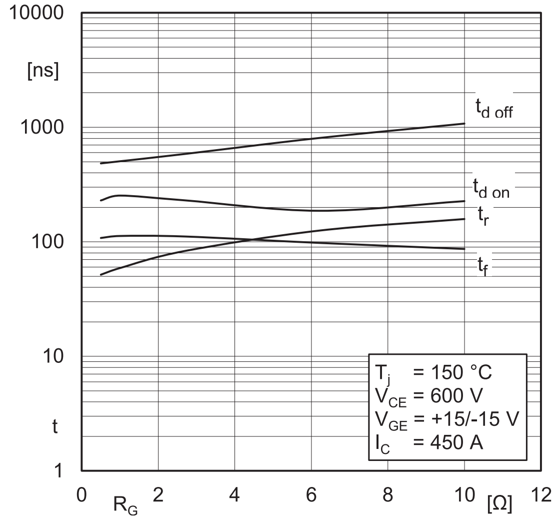


Fig. 8: Typ. switching times vs. gate resistor R_G

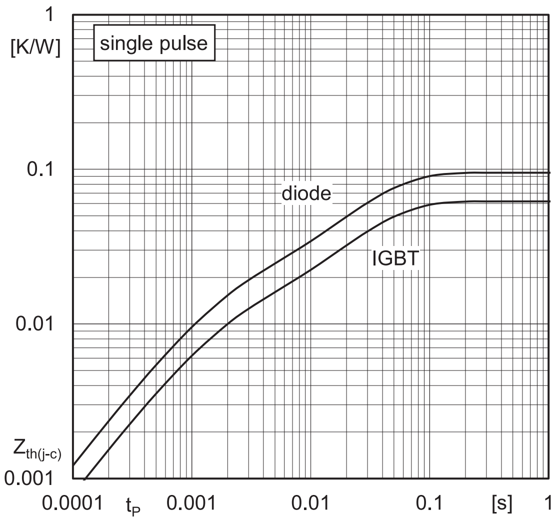


Fig. 9: Transient thermal impedance

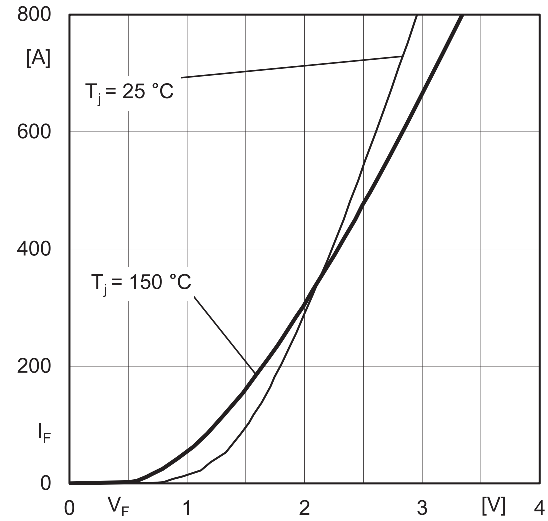


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

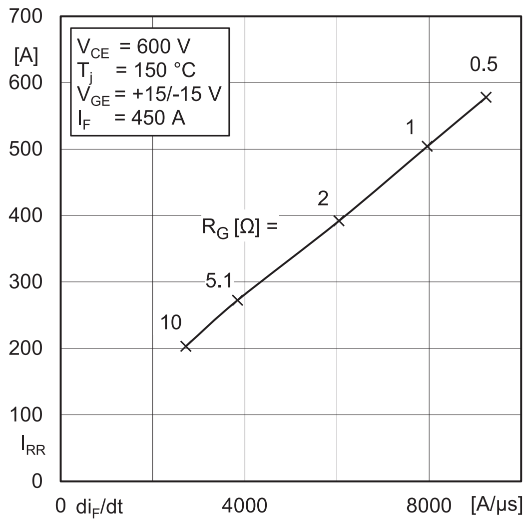


Fig. 11: Typ. CAL diode peak reverse recovery current

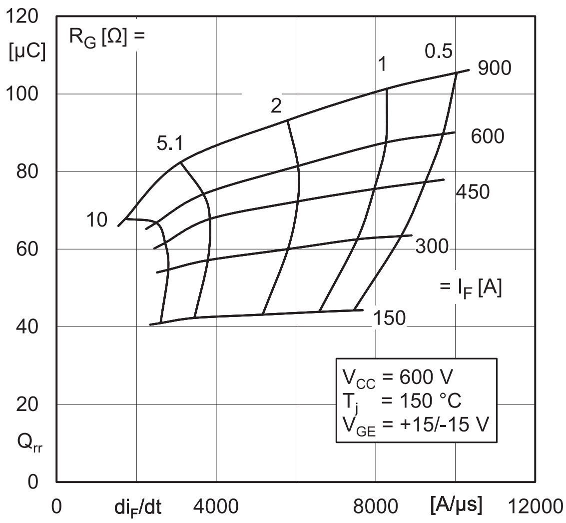
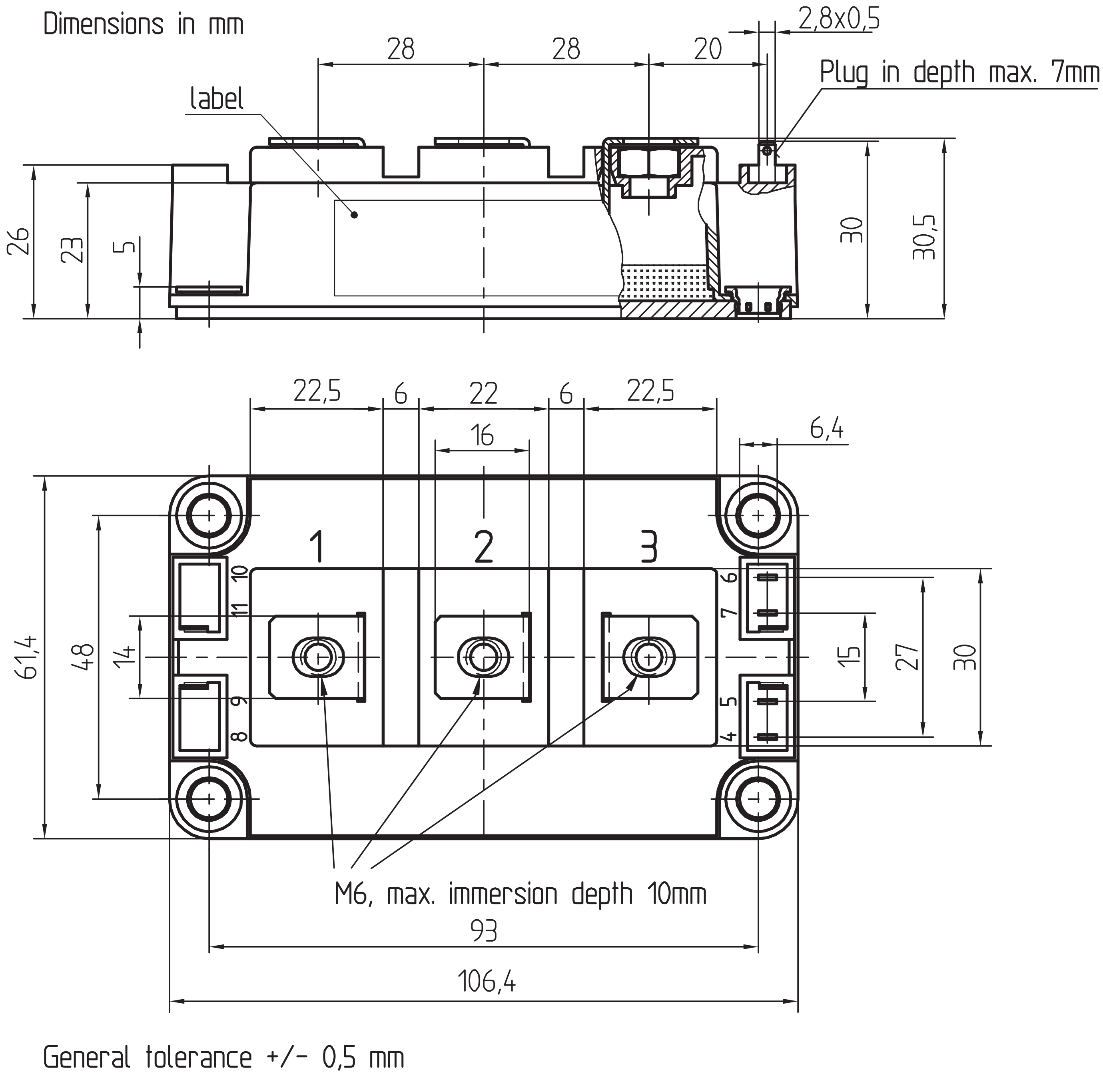
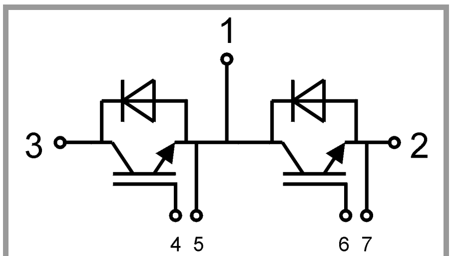


Fig. 12: Typ. CAL diode peak reverse recovery charge



SEMITRANS 3



GB

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

***IMPORTANT INFORMATION AND WARNINGS**

The specifications of SEMIKRON products may not be considered as guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). The specifications of SEMIKRON products describe only the usual characteristics of products to be expected in typical applications, which may still vary depending on the specific application. Therefore, products must be tested for the respective application in advance. Application adjustments may be necessary. The user of SEMIKRON products is responsible for the safety of their applications embedding SEMIKRON products and must take adequate safety measures to prevent the applications from causing a physical injury, fire or other problem if any of SEMIKRON products become faulty. The user is responsible to make sure that the application design is compliant with all applicable laws, regulations, norms and standards. Except as otherwise explicitly approved by SEMIKRON in a written document signed by authorized representatives of SEMIKRON, SEMIKRON products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury. No representation or warranty is given and no liability is assumed with respect to the accuracy, completeness and/or use of any information herein, including without limitation, warranties of non-infringement of intellectual property rights of any third party. SEMIKRON does not assume any liability arising out of the applications or use of any product; neither does it convey any license under its patent rights, copyrights, trade secrets or other intellectual property rights, nor the rights of others. SEMIKRON makes no representation or warranty of non-infringement or alleged non-infringement of intellectual property rights of any third party which may arise from applications. Due to technical requirements our products may contain dangerous substances. For information on the types in question please contact the nearest SEMIKRON sales office. This document supersedes and replaces all information previously supplied and may be superseded by updates. SEMIKRON reserves the right to make changes.