



SKiM[®] 63

Trench IGBT Modules

SKiM306GD12E4

Features

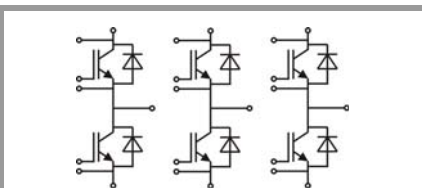
- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al₂O₃ DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to 6 x I_C
- Integrated temperature sensor

Typical Applications*

- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives

Remarks

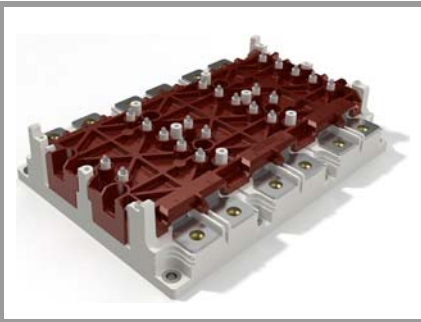
- Case temperature limited to T_s = 125°C max; T_C = T_s (for baseplateless modules)
- Recommended T_{op} = -40 ... +150°C



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Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
IGBT				
V _{CEs}		1200	V	
I _C	T _j = 175 °C	T _s = 25 °C	410	A
		T _s = 70 °C	333	A
I _{Cnom}		300	A	
I _{CRM}	I _{CRM} = 3xI _{Cnom}	900	A	
V _{GES}		-20 ... 20	V	
t _{psc}	V _{CC} = 800 V	T _j = 150 °C	10	μs
	V _{GE} ≤ 15 V			
	V _{CEs} ≤ 1200 V			
T _j		-40 ... 175		°C
Inverse diode				
I _F	T _j = 175 °C	T _s = 25 °C	302	A
		T _s = 70 °C	240	A
I _{Fnom}		300	A	
I _{FRM}	I _{FRM} = 3xI _{Fnom}	900	A	
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C	1620	A	
T _j		-40 ... 175		°C
Module				
I _{t(RMS)}	T _{terminal} = 80 °C	700		A
T _{stg}		-40 ... 125		°C
V _{isol}	AC sinus 50 Hz, t = 1 min	2500		V

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
V _{CE(sat)}	I _C = 300 A V _{GE} = 15 V chipelevel	T _j = 25 °C	1.85	2.10	V
		T _j = 150 °C	2.25	2.45	V
V _{CE0}		T _j = 25 °C	0.8	0.9	V
		T _j = 150 °C	0.7	0.8	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C	3.5	4.0	mΩ
		T _j = 150 °C	5.2	5.5	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 12 mA	5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V V _{CE} = 1200 V	T _j = 25 °C	0.1	0.3	mA
		T _j = 150 °C			mA
C _{ies}	V _{CE} = 25 V	f = 1 MHz	17.60		nF
C _{oes}	V _{GE} = 0 V	f = 1 MHz	1.16		nF
C _{res}		f = 1 MHz	0.94		nF
Q _G	V _{GE} = - 8 V...+ 15 V		1700		nC
R _{Gint}	T _j = 25 °C		2.5		Ω
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C	252		ns
t _r	I _C = 300 A	T _j = 150 °C	44		ns
E _{on}	R _{G on} = 1 Ω	T _j = 150 °C	19		mJ
t _{d(off)}	R _{G off} = 1 Ω	T _j = 150 °C	506		ns
t _f	di/dt _{on} = 6590 A/μs di/dt _{off} = 4000 A/μs	T _j = 150 °C	70		ns
		T _j = 150 °C	39		mJ
E _{off}					
R _{th(j-s)}	per IGBT		0.116		K/W



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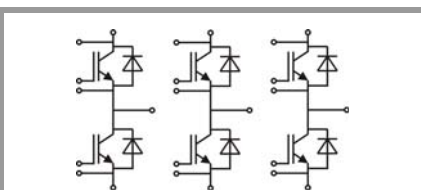
Typical Applications*

- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives

Remarks

- Case temperature limited to $T_s = 125^\circ C$ max; $T_c = T_s$ (for baseplateless modules)
- Recommended $T_{op} = -40 \dots +150^\circ C$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 300 \text{ A}$ $V_{GE} = 0 \text{ V}$ chiplevel	$T_j = 25^\circ C$		2.1	2.5	V
		$T_j = 150^\circ C$		2.1	2.4	V
V_{F0}		$T_j = 25^\circ C$		1.3	1.5	V
		$T_j = 150^\circ C$		0.9	1.1	V
r_F		$T_j = 25^\circ C$		2.8	3.2	m Ω
		$T_j = 150^\circ C$		3.9	4.3	m Ω
I_{RRM}	$I_F = 300 \text{ A}$	$T_j = 150^\circ C$		448		A
Q_{rr}	$di/dt_{off} = 8000 \text{ A}/\mu\text{s}$	$T_j = 150^\circ C$		47		μC
E_{rr}	$V_{GE} = -15 \text{ V}$ $V_{CC} = 600 \text{ V}$	$T_j = 150^\circ C$		21		mJ
$R_{th(j-s)}$	per diode				0.218	K/W
Module						
L_{CE}				9	13	nH
$R_{CC'+EE'}$	terminal-chip	$T_s = 25^\circ C$		0.3		m Ω
		$T_s = 125^\circ C$		0.5		m Ω
w				761		g
Temperature Sensor						
R_{100}	$T_{Sensor} = 100^\circ C$ ($R_{25} = 5 \text{ k}\Omega$)			339		Ω
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125}(1/T - 1/373)]$; $T[\text{K}]$;			4096		K



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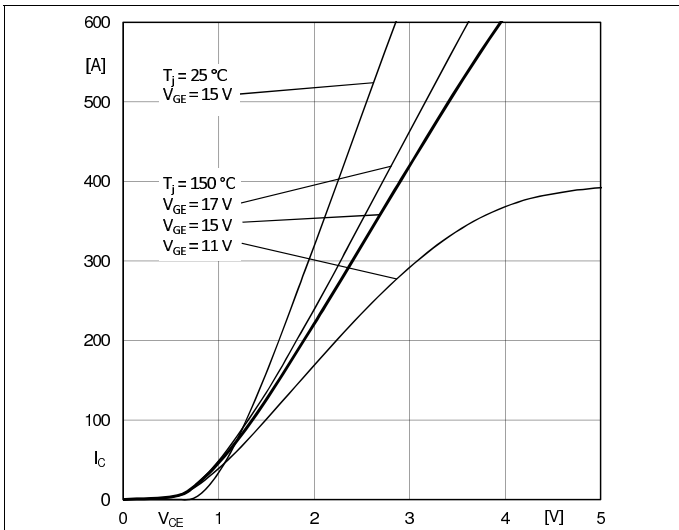


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

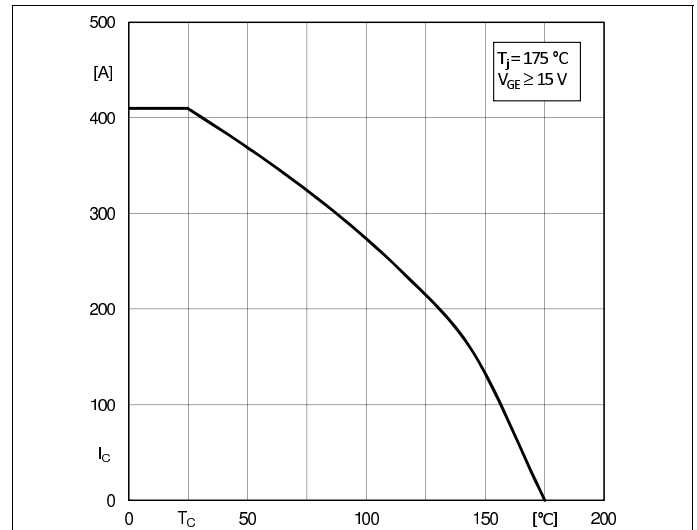


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

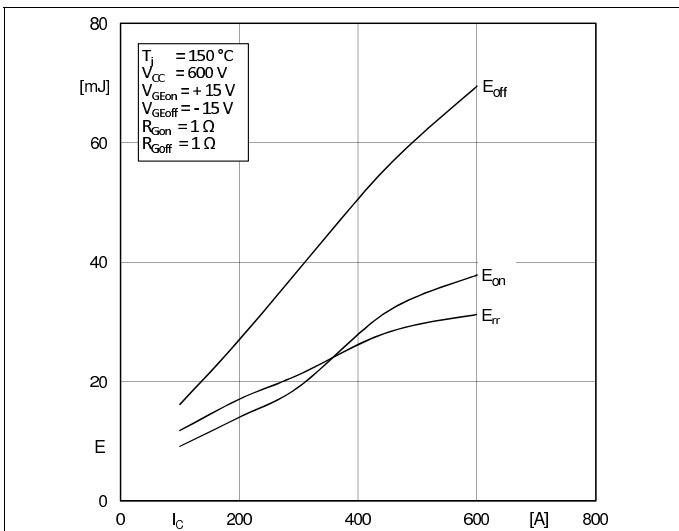


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

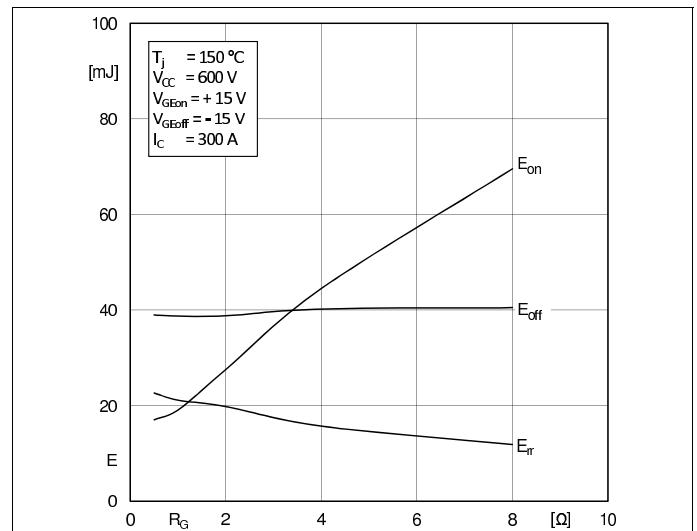


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

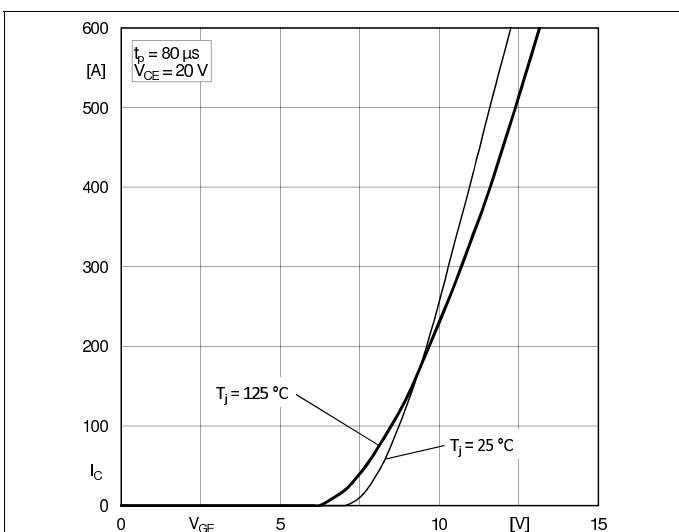


Fig. 5: Typ. transfer characteristic

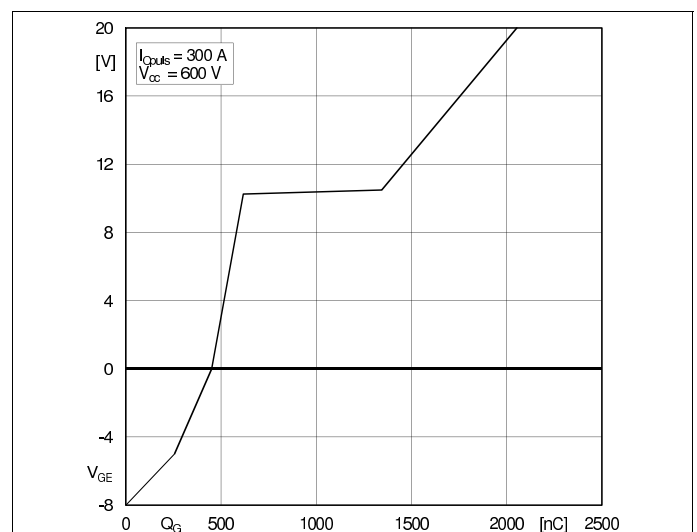


Fig. 6: Typ. gate charge characteristic

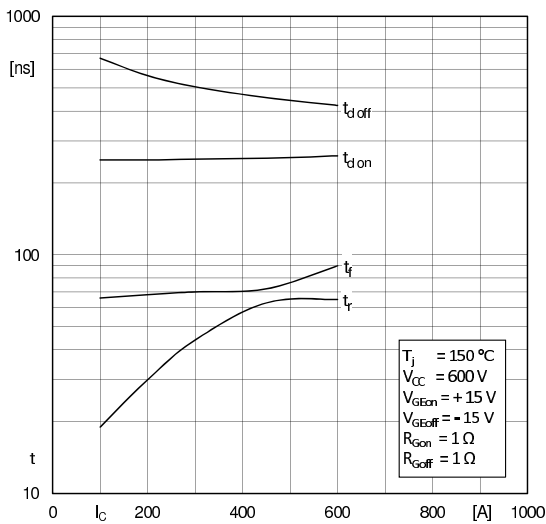


Fig. 7: Typ. switching times vs. I_C

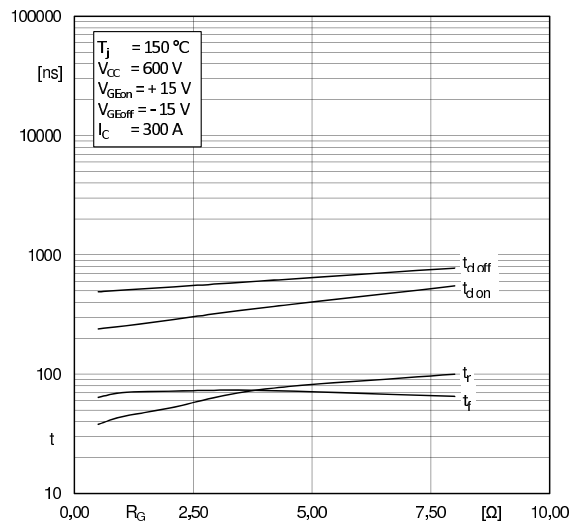


Fig. 8: Typ. switching times vs. gate resistor R_G

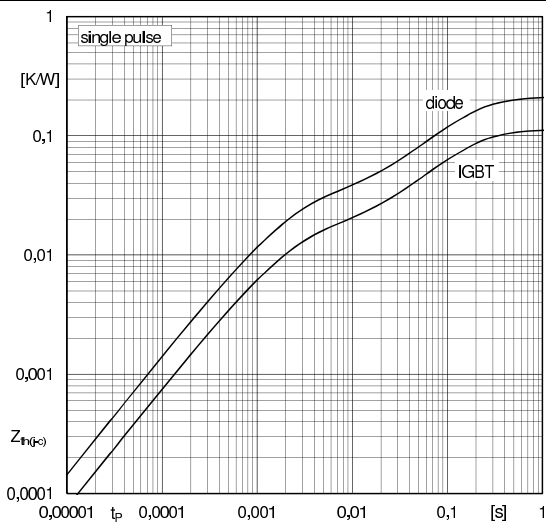


Fig. 9: Typ. transient thermal impedance

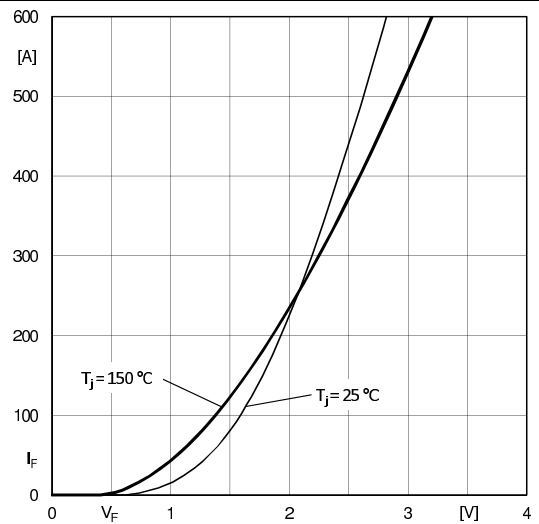


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC+EE'}$

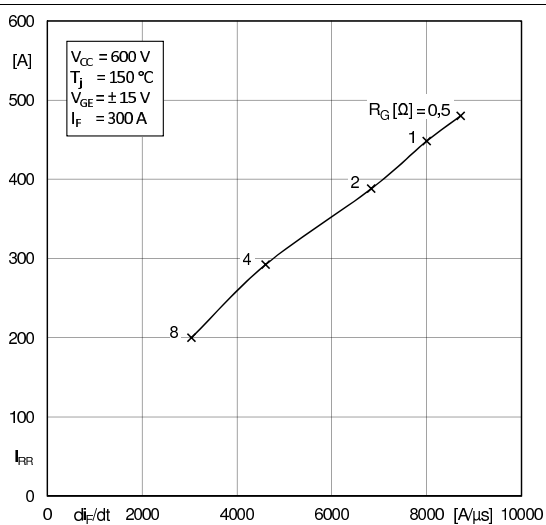


Fig. 11: Typ. CAL diode peak reverse recovery current

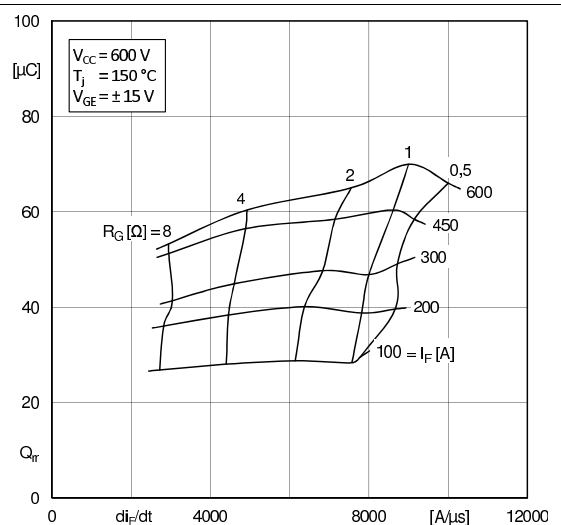
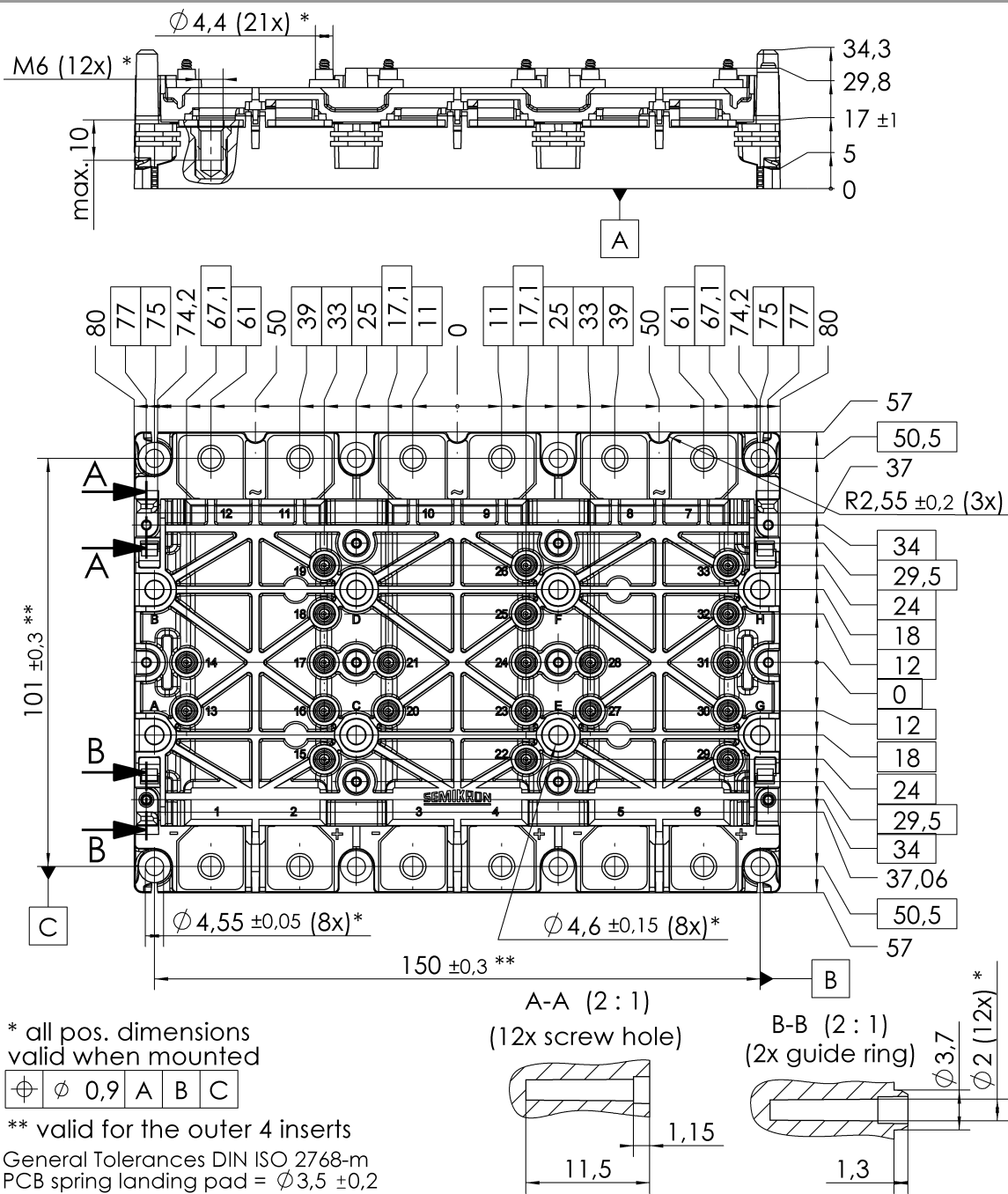
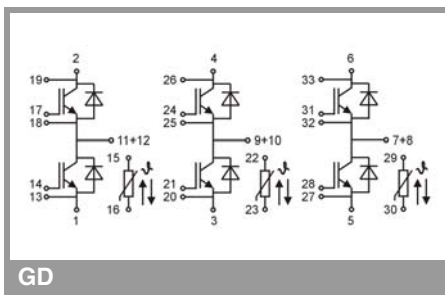


Fig. 12: Typ. CAL diode recovery charge

SKiM306GD12E4



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

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.