



SKiM® 93

Trench IGBT Modules

SKiM609GAR12E4

Features

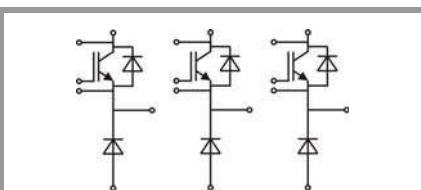
- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to $6 \times I_C$
- Integrated temperature sensor

Typical Applications*

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

Remarks

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



GAR

Absolute Maximum Ratings					
Symbol	Conditions		Values	Unit	
IGBT					
V_{CES}			1200	V	
I_C	$T_j = 175^\circ C$	$T_s = 25^\circ C$	748	A	
		$T_s = 70^\circ C$	608	A	
I_{Cnom}			600	A	
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$		1800	A	
V_{GES}			-20 ... 20	V	
t_{psc}	$V_{CC} = 800 V$ $V_{GE} \leq 15 V$ $V_{CES} \leq 1200 V$	$T_j = 150^\circ C$	10		μs
T_j			-40 ... 175	$^\circ C$	
Inverse diode					
I_F	$T_j = 175^\circ C$	$T_s = 25^\circ C$	139	A	
		$T_s = 70^\circ C$	110	A	
I_{Fnom}			600	A	
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		1800	A	
I_{FSM}	$t_p = 10 ms, \sin 180^\circ, T_j = 25^\circ C$		900	A	
T_j			-40 ... 175	$^\circ C$	
Freewheeling diode					
I_F	$T_j = 175^\circ C$	$T_s = 25^\circ C$	1397	A	
		$T_s = 70^\circ C$	1107	A	
I_{Fnom}			1350	A	
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		4050	A	
I_{FSM}	$t_p = 10 ms, \sin 180^\circ, T_j = 25^\circ C$		6480	A	
T_j			-40 ... 175	$^\circ C$	
Module					
$I_{t(RMS)}$	$T_{terminal} = 80^\circ C$		700	A	
T_{stg}			-40 ... 125	$^\circ C$	
V_{isol}	AC sinus 50 Hz, $t = 1 min$		2500	V	

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	$I_C = 600 A$ $V_{GE} = 15 V$ chipelevel	$T_j = 25^\circ C$	1.85	2.10		V
		$T_j = 150^\circ C$	2.25	2.45		V
V_{CE0}			$T_j = 25^\circ C$	0.8	0.9	V
			$T_j = 150^\circ C$	0.7	0.8	V
r_{CE}	$V_{GE} = 15 V$	$T_j = 25^\circ C$	1.8	2.0		$m\Omega$
		$T_j = 150^\circ C$	2.6	2.8		$m\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 24 mA$		5	5.8	6.5	V
I_{CES}	$V_{GE} = 0 V$ $V_{CE} = 1200 V$	$T_j = 25^\circ C$	0.1	0.3		mA
		$T_j = 150^\circ C$				mA
C_{ies}	$V_{CE} = 25 V$ $V_{GE} = 0 V$	$f = 1 MHz$	35.20			nF
C_{oes}		$f = 1 MHz$	2.32			nF
C_{res}		$f = 1 MHz$	1.88			nF
Q_G	$V_{GE} = -8 V \dots +15 V$		3400			nC
R_{Gint}	$T_j = 25^\circ C$		1.3			Ω



SKiM® 93

Trench IGBT Modules

SKiM609GAR12E4

Features

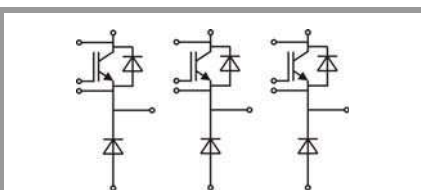
- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to $6 \times I_C$
- Integrated temperature sensor

Typical Applications*

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

Remarks

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



GAR

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600 V$	$T_j = 150^\circ C$		150		ns
t_r	$I_C = 600 A$	$T_j = 150^\circ C$		121		ns
E_{on}	$V_{GE} = \pm 15 V$	$T_j = 150^\circ C$		136		mJ
$t_{d(off)}$	$R_{G on} = 4.1 \Omega$	$T_j = 150^\circ C$		808		ns
t_f	$R_{G off} = 4.1 \Omega$	$T_j = 150^\circ C$		100		ns
E_{off}	$di/dt_{on} = 5000 A/\mu s$	$T_j = 150^\circ C$		83		mJ
E_{off}	$di/dt_{off} = 4400 A/\mu s$	$T_j = 150^\circ C$		83		mJ
$R_{th(j-s)}$	per IGBT				0.068	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 150 A$	$T_j = 25^\circ C$		2.1	2.5	V
	$V_{GE} = 0 V$ chipllevel	$T_j = 150^\circ C$		2.1	2.4	V
V_{F0}		$T_j = 25^\circ C$	1.1	1.3	1.5	V
		$T_j = 150^\circ C$	0.7	0.9	1.1	V
r_F		$T_j = 25^\circ C$	4.3	5.6	6.4	m Ω
		$T_j = 150^\circ C$	6.7	7.8	8.5	m Ω
I_{RRM}	$I_F = 150 A$	$T_j = 150^\circ C$		153		A
Q_{rr}	$di/dt_{off} = 3300 A/\mu s$	$T_j = 150^\circ C$		15		μC
E_{rr}	$V_{GE} = -15 V$ $V_{CC} = 600 V$	$T_j = 150^\circ C$		9		mJ
$R_{th(j-s)}$	per diode				0.501	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 600 A$	$T_j = 25^\circ C$		1.7	1.9	V
	$V_{GE} = 0 V$ chipllevel	$T_j = 150^\circ C$		1.4	1.7	V
V_{F0}		$T_j = 25^\circ C$	1.1	1.3	1.5	V
		$T_j = 150^\circ C$	0.7	0.9	1.1	V
r_F		$T_j = 25^\circ C$	0.5	0.6	0.7	m Ω
		$T_j = 150^\circ C$	0.7	0.9	0.9	m Ω
I_{RRM}	$I_F = 600 A$	$T_j = 150^\circ C$		510		A
Q_{rr}	$di/dt_{off} = 5300 A/\mu s$	$T_j = 150^\circ C$		123		μC
E_{rr}	$V_{GE} = -15 V$ $V_{CC} = 600 V$	$T_j = 150^\circ C$		39		mJ
$R_{th(j-s)}$	per diode				0.048	K/W
Module						
L_{CE}				10	15	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				1042		g
Temperature Sensor						
R_{100}	$T_{Sensor} = 100^\circ C$ ($R_{25} = 5 k\Omega$)			339		Ω
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125} (1/T - 1/373)]$; $T[K]$;			4096		K

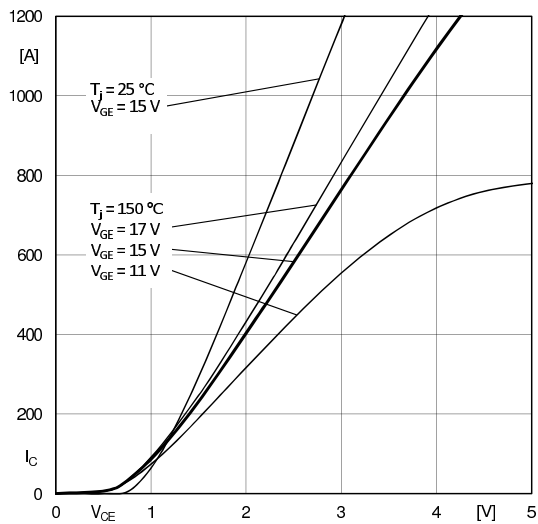


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

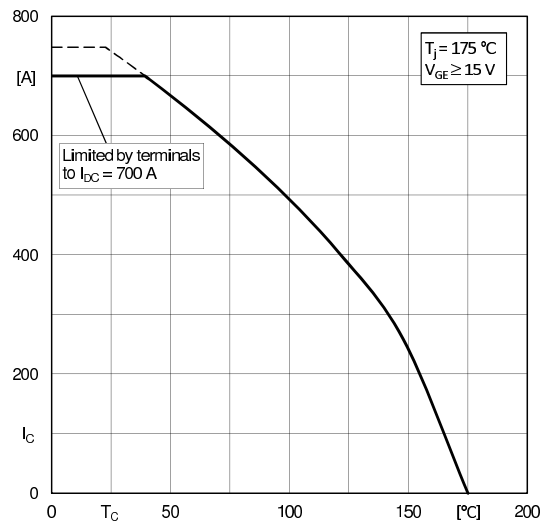


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

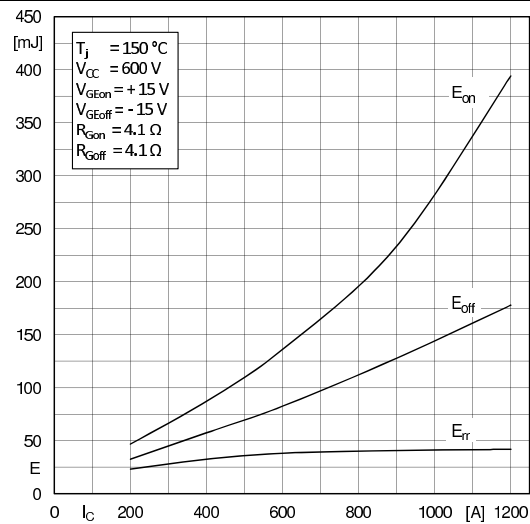


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

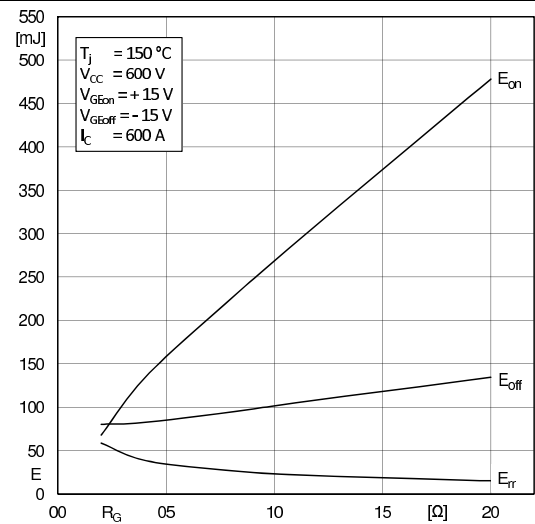


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

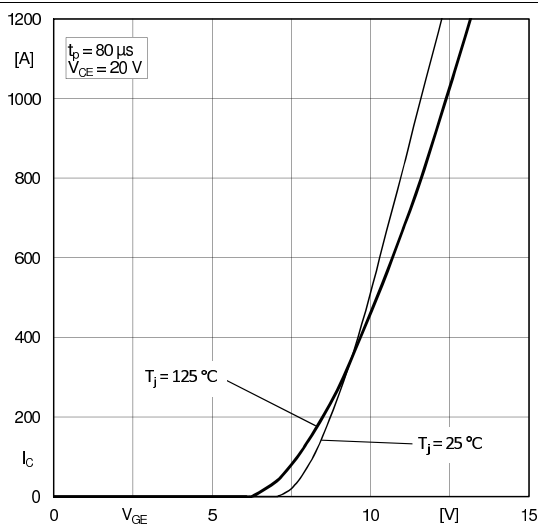


Fig. 5: Typ. transfer characteristic

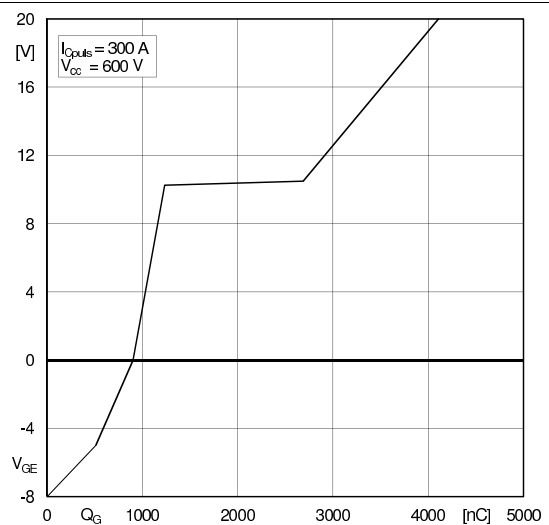


Fig. 6: Typ. gate charge characteristic

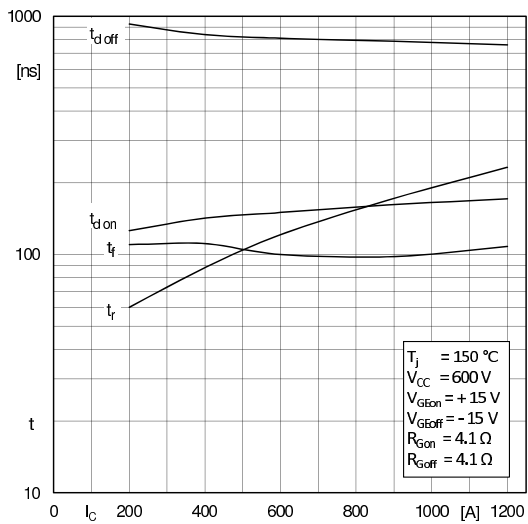


Fig. 7: Typ. switching times vs. I_C

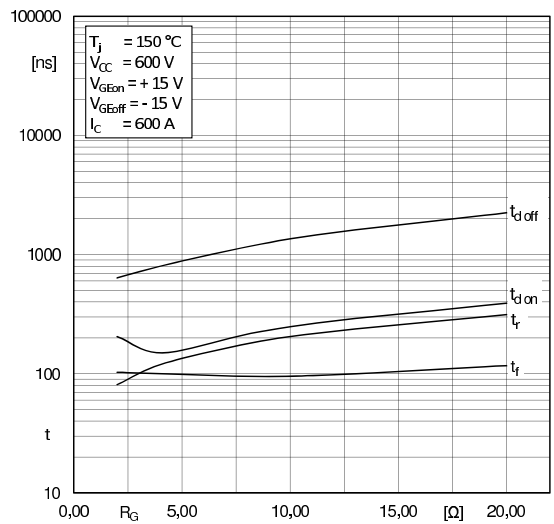


Fig. 8: Typ. switching times vs. gate resistor R_G

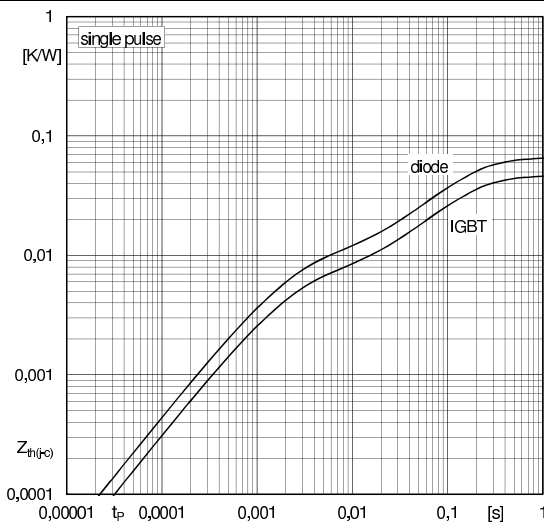


Fig. 9: Typ. transient thermal impedance

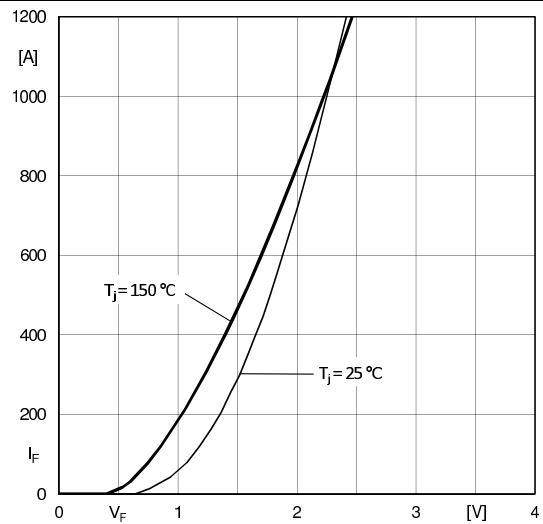


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

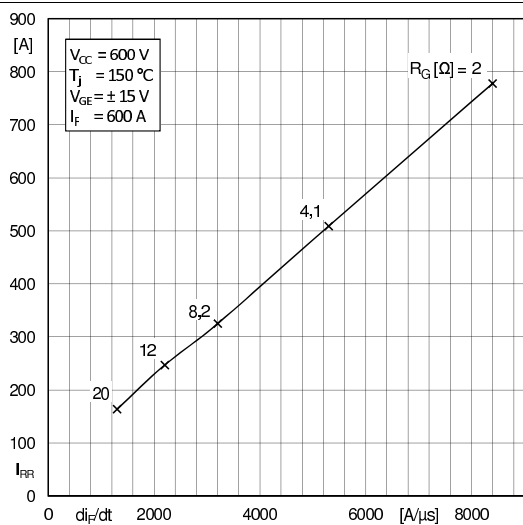


Fig. 11: Typ. CAL diode peak reverse recovery current

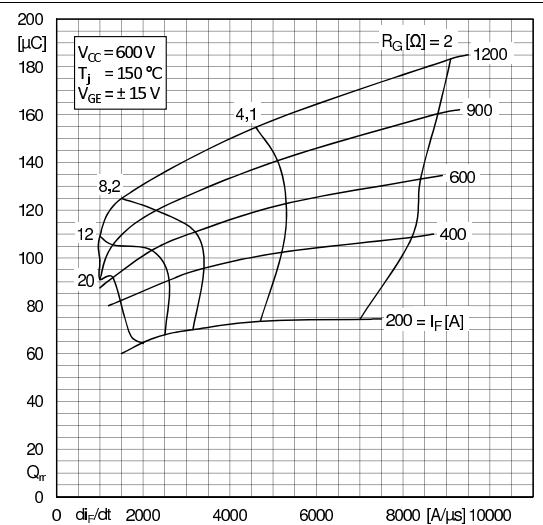
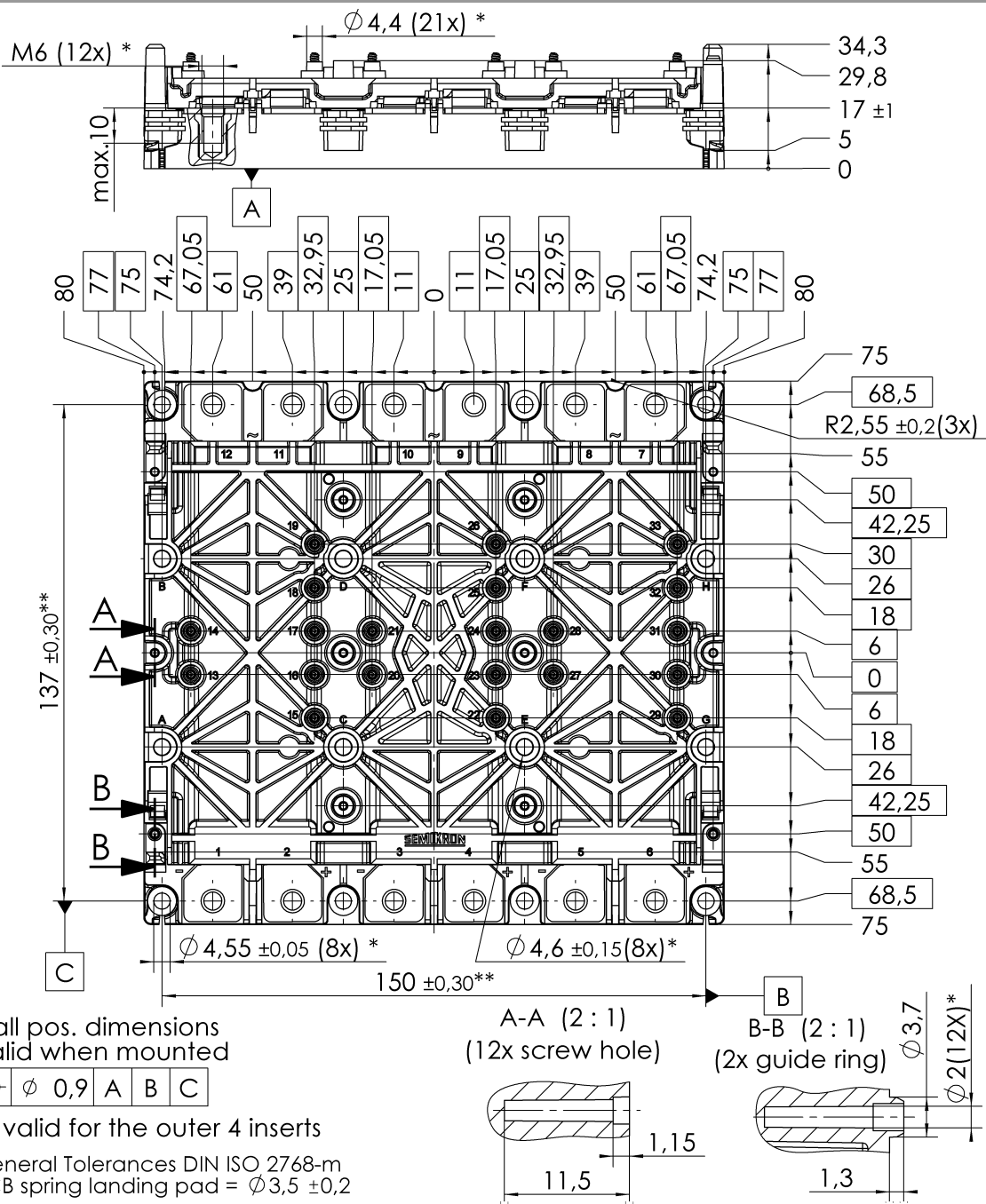
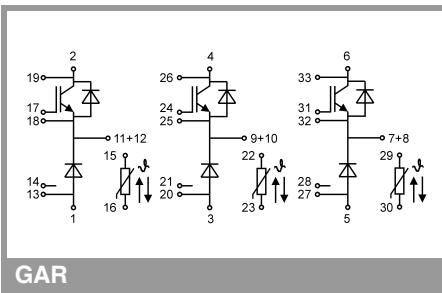


Fig. 12: Typ. CAL diode recovery charge

SKiM609GAR12E4



SKIM 93



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.