SKiM® 93

Trench IGBT Modules

SKiM429GD17E4HD

Features

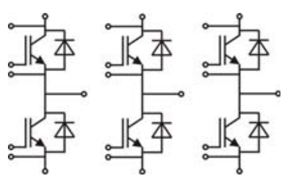
- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to 6 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 … +125°C for Inverse Diode, T_{op} = -40 … +150°C for IGBT



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V_{CES}			1700	V
I_C	T_j = 175 °C	T_s = 25 °C	595	A
		T_s = 70 °C	479	A
I_{Cnom}			420	A
I_{CRM}	$I_{CRM} = 3xI_{Cnom}$		1260	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 1200 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 1700 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Inverse diode				
I_F	T_j = 150 °C	T_s = 25 °C	413	A
		T_s = 70 °C	298	A
I_{Fnom}			420	A
I_{FRM}	$I_{FRM} = 2xI_{Fnom}$		840	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		3699	A
T_j			-40 ... 150	°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		3300	V

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	I_C = 420 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.90	2.25	V
		T_j = 125 °C		2.1	2.3	V
V_{CE0}		T_j = 25 °C		1.1	1.2	V
		T_j = 125 °C		1	1.1	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		1.9	2.5	mΩ
		T_j = 125 °C		2.6	2.9	mΩ
$V_{GE(th)}$	$V_{GE}=V_{CE}$, I_C = 16.8 mA		5.2	5.8	6.4	V
I_{CES}	V_{GE} = 0 V V_{CE} = 1700 V	T_j = 25 °C		0.15	0.45	mA
						mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		33.00		nF
C_{oes}		f = 1 MHz		1.38		nF
C_{res}		f = 1 MHz		1.08		nF
Q_G	V_{GE} = - 8 V...+ 15 V			6660		nC
R_{Gint}	T_j = 25 °C			2.7		Ω
$t_{d(on)}$	V_{CC} = 1200 V I_C = 420 A $R_{G\,on}$ = 3.6 Ω $R_{G\,off}$ = 3.6 Ω di/dt_{on} = 5200 A/µs di/dt_{off} = 2200 A/µs	T_j = 125 °C		390		ns
t_r		T_j = 125 °C		80		ns
E_{on}		T_j = 125 °C		245		mJ
$t_{d(off)}$		T_j = 125 °C		1005		ns
t_f		T_j = 125 °C		170		ns
E_{off}		T_j = 125 °C		180		mJ
$R_{th(j-s)}$	per IGBT				0.079	K/W

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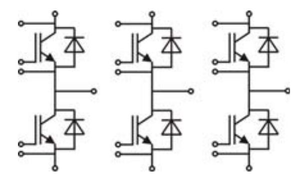

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse diode						
$V_F = V_{EC}$	I_F = 420 A V_{GE} = 0 V chiplevel	T_j = 25 °C		1.7	1.9	V
		T_j = 125 °C		1.6	1.8	V
V_{F0}		T_j = 25 °C		1.1	1.3	V
		T_j = 125 °C		0.9	1.1	V
r_F		T_j = 25 °C		1.3	1.3	mΩ
		T_j = 125 °C		1.8	1.8	mΩ
I_{RRM}	I_F = 420 A di/dt_{off} = 5990 A/µs V_{GE} = -15 V V_{CC} = 1200 V	T_j = 125 °C		500		A
Q_{rr}		T_j = 125 °C		140		µC
E_{rr}		T_j = 125 °C		99		mJ
$R_{th(j-s)}$	per diode				0.169	K/W
Module						
L_{CE}				10	15	nH
$R_{CC'+EE'}$	terminal-chip	T_s = 25 °C		0.3		mΩ
		T_s = 125 °C		0.5		mΩ
w				1042		g
Temperature Sensor						
R_{100}	T_{Sensor} = 100 °C (R_{25} = 5 kΩ)			339		Ω
$B_{100/125}$	$R_{(T)} = R_{100}exp[B_{100/125}(1/T-1/373)]$; T[K];			4096		K

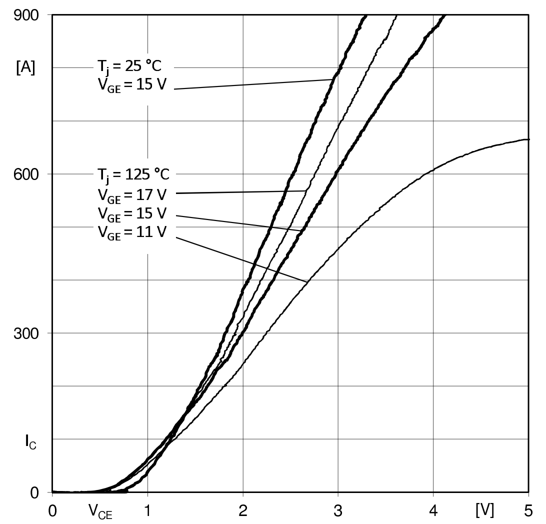


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+ EE'}$

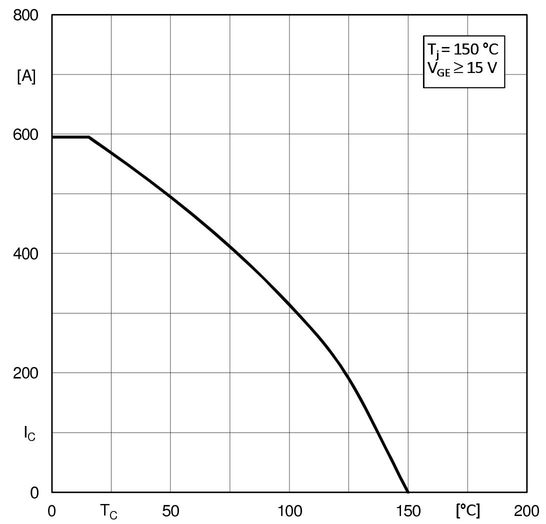


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

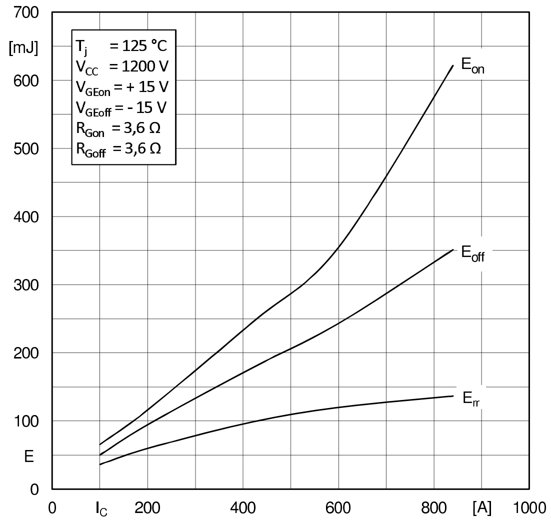


Fig. 3: Typ. turn-on /-off energy = f (I_C)

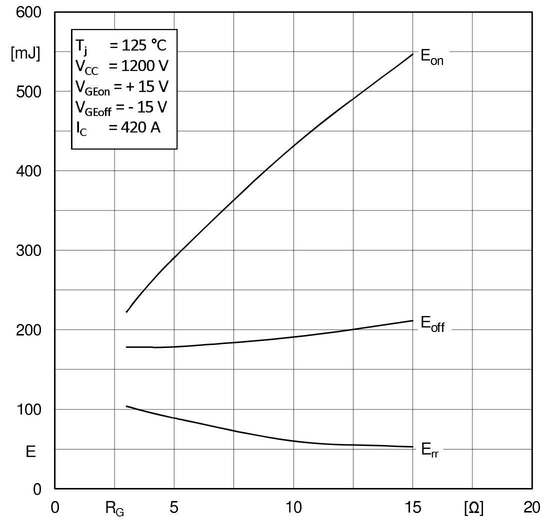


Fig. 4: Typ. turn-on /-off energy = f (R_G)

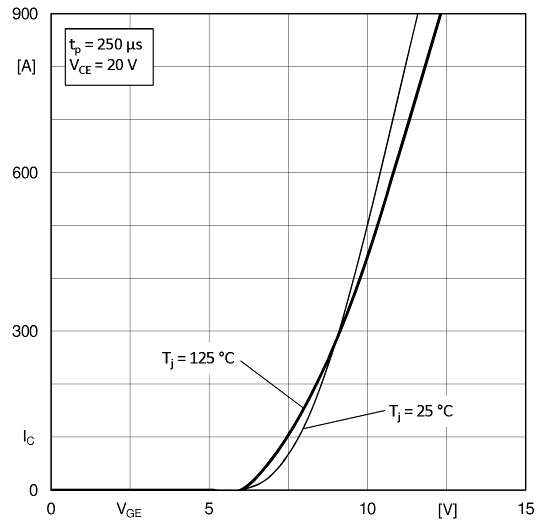


Fig. 5: Typ. transfer characteristic

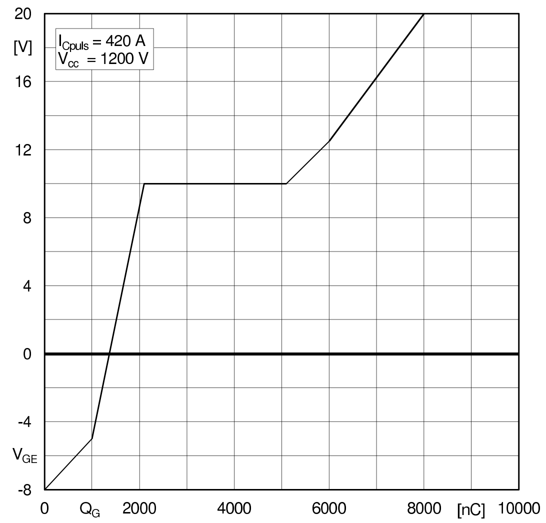


Fig. 6: Typ. gate charge characteristic

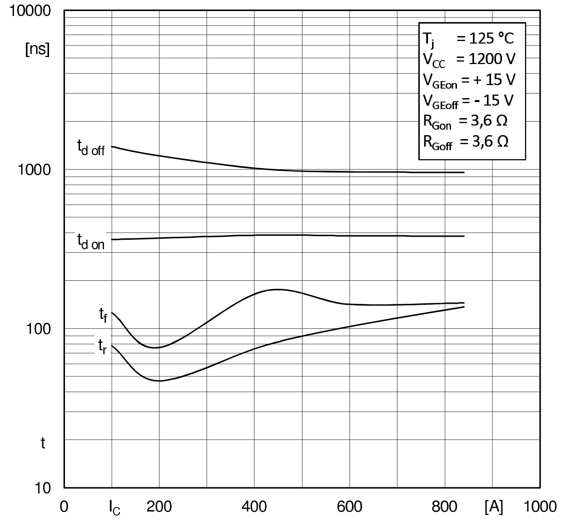


Fig. 7: Typ. switching times vs. I_C

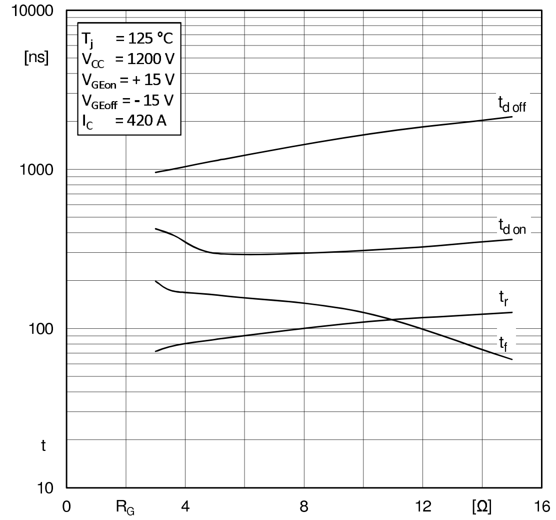


Fig. 8: Typ. switching times vs. gate resistor R_G

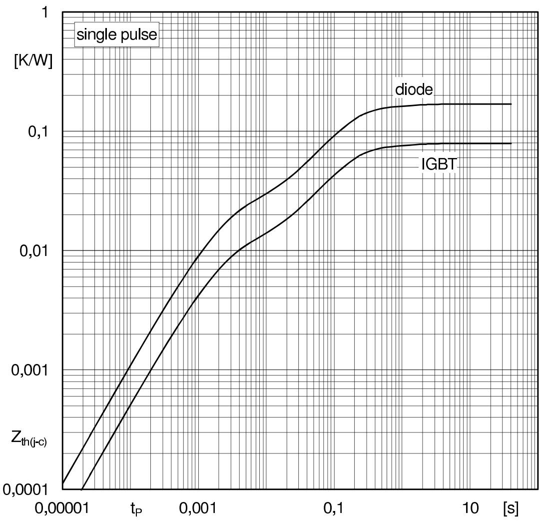


Fig. 9: Typ. transient thermal impedance

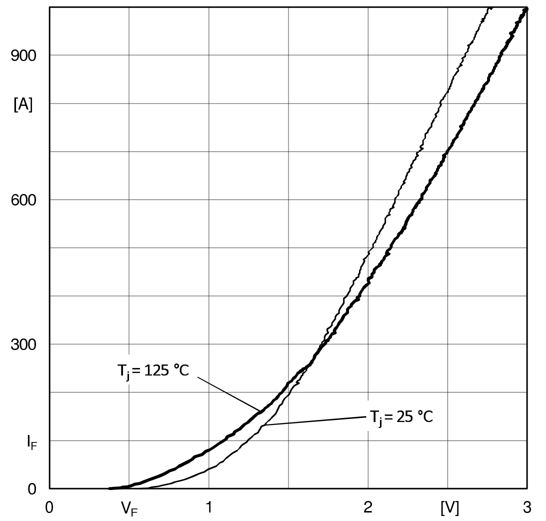


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

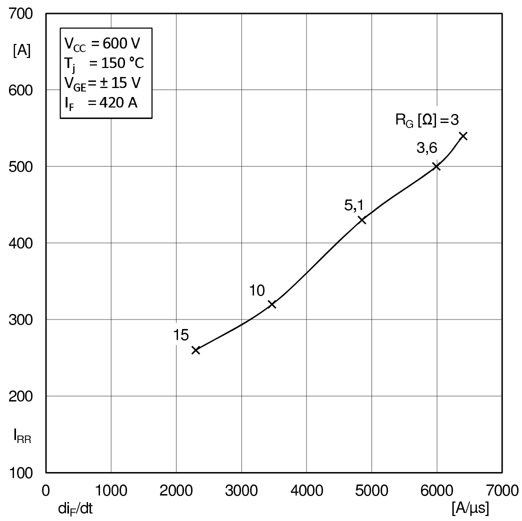


Fig. 11: Typ. CAL diode peak reverse recovery current

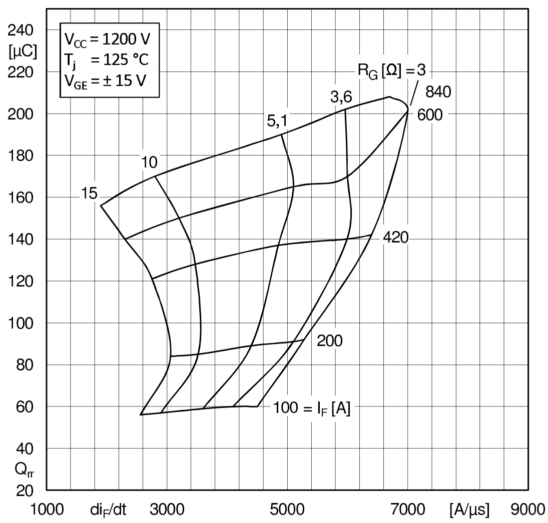
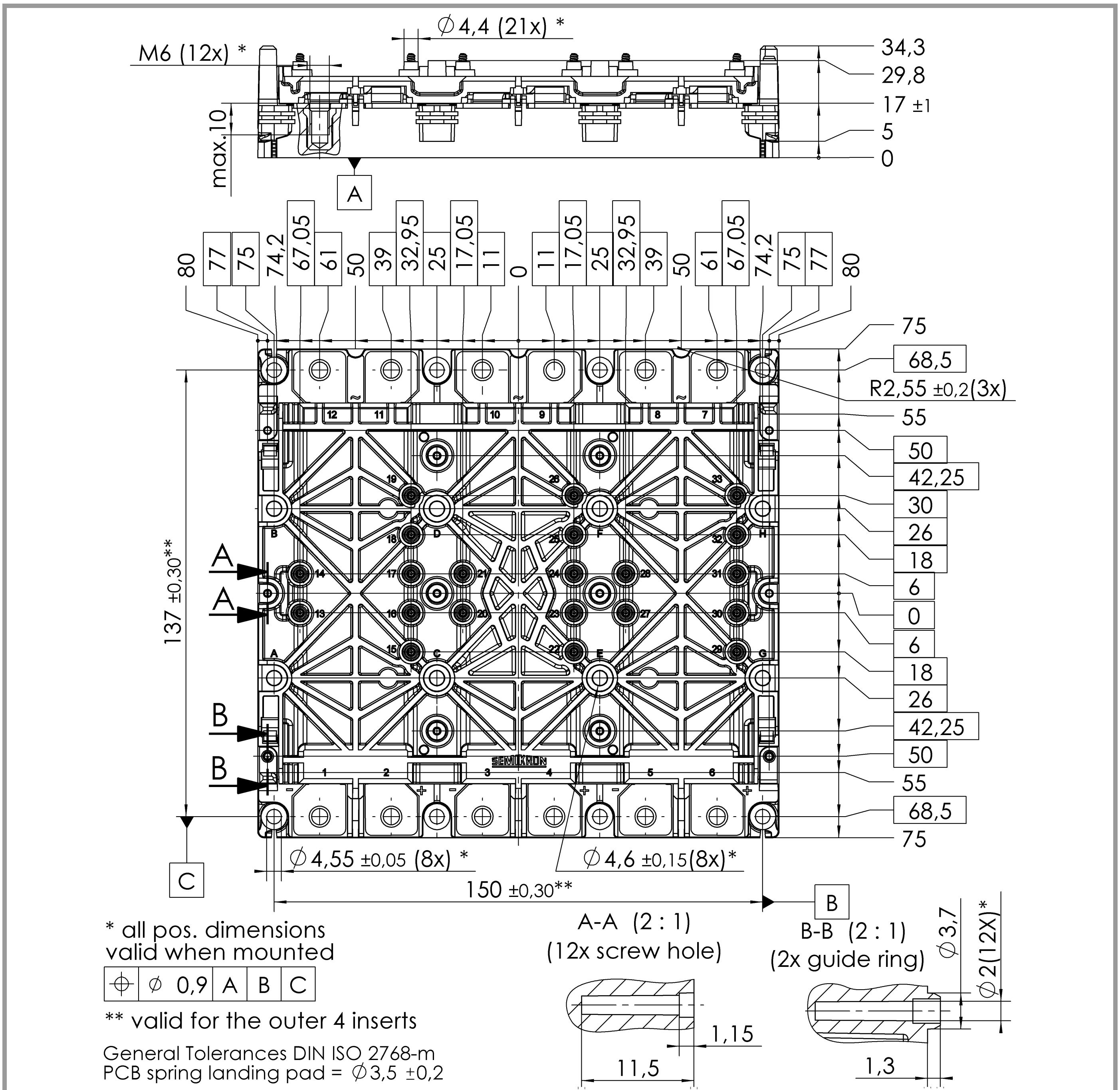


Fig. 12: Typ. CAL diode recovery charge



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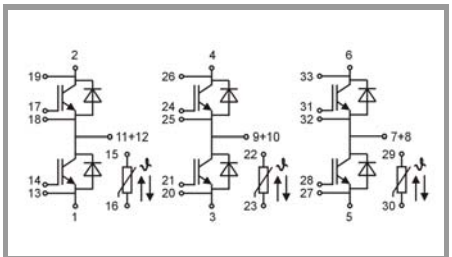

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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX

* 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.