SEMITRANS 3

IGBT4 Modules

SKM600GM12E4D1

Features*

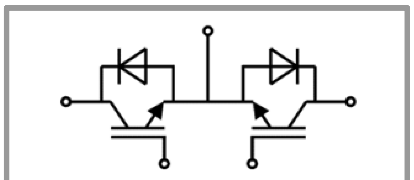
- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4HD = 4th generation high density (HD) CAL-diode optimized for low static losses
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 8kHz
- UL recognized, file no. E63532

Typical Applications

- Matrix inverter
- Bidirectional switch

Remarks

- Case temperature limited to T_c = 125°C max, recomm. T_{op} = -40... +150°C, product rel. results valid for T_j = 150°C
- Max. operating DC link voltage limited to 800V



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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	860	A
		T_c = 80 °C	702	A
I_{Cnom}			600	A
I_{CRM}			1800	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	Continuous DC forward current		600	A
I_{FRM}			1200	A
I_{FSM}	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 = 600 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.80	2.05	V
		T_j = 150 °C		2.05	2.42	V
V_{CE0}	chiplevel	T_j = 25 °C		0.80	0.90	V
		T_j = 150 °C		0.75	0.80	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.67	1.92	mΩ
		T_j = 150 °C		2.2	2.7	mΩ
$V_{GE(th)}$	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 °C				5	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		37.2		nF
C_{oes}		f = 1 MHz		2.32		nF
C_{res}		f = 1 MHz		2.04		nF
Q_G	V_{GE} = - 8V ... + 15 V			3400		nC
R_{Gint}	T_j = 25 °C			1.3		Ω
$t_{d(on)}$	V_{CC}= 600 V I_C= 600 A V_{GE} =+15/-15V R_{Gon}= 1.8 Ω R_{Goff}= 1.2 Ω di/dt_{on}= 8050 A/µs di/dt_{off}= 4100 A/µs dv/dt = 3500 V/µs L_s = 25 nH	T_j = 150 °C		175		ns
t_r		T_j = 150 °C		75		ns
E_{on}		T_j = 150 °C		55		mJ
$t_{d(off)}$		T_j = 150 °C		530		ns
t_f		T_j = 150 °C		120		ns
E_{off}		T_j = 150 °C		80		mJ
$R_{th(j-c)}$	per IGBT				0.049	K/W
$R_{th(c-s)}$	per IGBT, (λ_{grease} = 0.81 W/(m*K))			0.032		K/W

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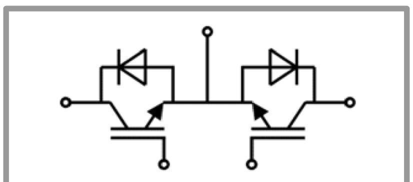

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse diode						
$V_F = V_{EC}$	I_F = 600 A V_{GE} = 0 V chiplevel	T_j = 25 °C		1.80	2.13	V
		T_j = 150 °C		1.83	2.17	V
V_{F0}	chiplevel	T_j = 25 °C		1.19	1.40	V
		T_j = 150 °C		0.97	1.10	V
r_F	chiplevel	T_j = 25 °C		1.02	1.21	mΩ
		T_j = 150 °C		1.44	1.79	mΩ
I_{RRM}	V_{CC} = 600 V I_F = 600 A V_{GE} = -15 V di/dt_{off} = 9200 A/µs	T_j = 150 °C		680		A
Q_{rr}		T_j = 150 °C		130		µC
E_{rr}		T_j = 150 °C		60		mJ
$R_{th(j-c)}$	per diode				0.095	K/W
$R_{th(c-s)}$	per diode, (λ_{grease} = 0.81 W/(m*K))			0.039		K/W
Module						
L_{CE}				15		nH
$R_{CC'+EE'}$	measured per switch	T_j = 25 °C		0.55		mΩ
		T_j = 150 °C		0.85		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling (λ_{grease}=0.81 W/(m*K))			0.0088		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module (λ_{grease}=0.81 W/(m*K))			0.014		K/W
M_s	to heat sink M6		3		5	Nm
M_t		to terminal M6	2.5		5	Nm
				-		Nm
w					325	g

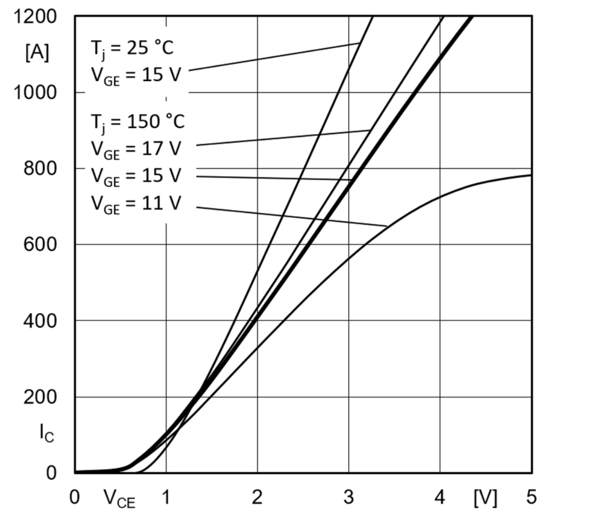


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

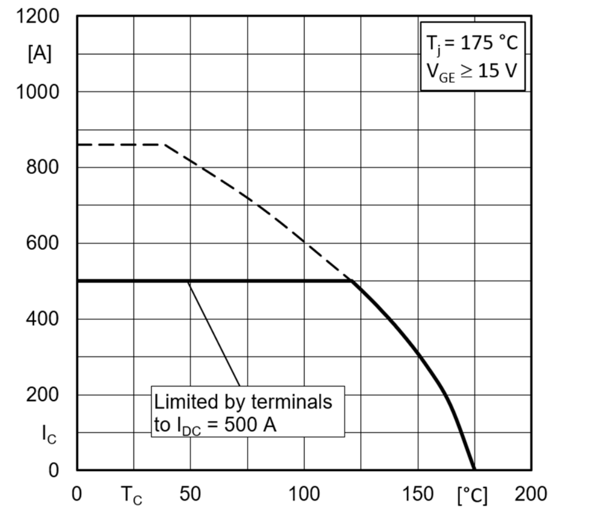


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

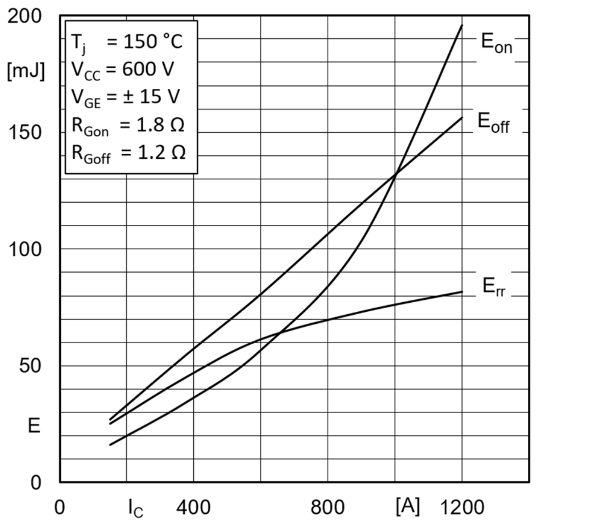


Fig. 3: Typ. turn-on /-off energy = f (I_C)

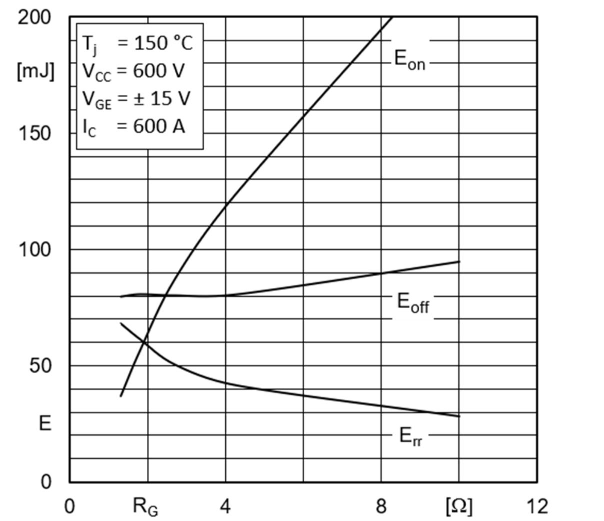


Fig. 4: Typ. turn-on /-off energy = f (R_G)

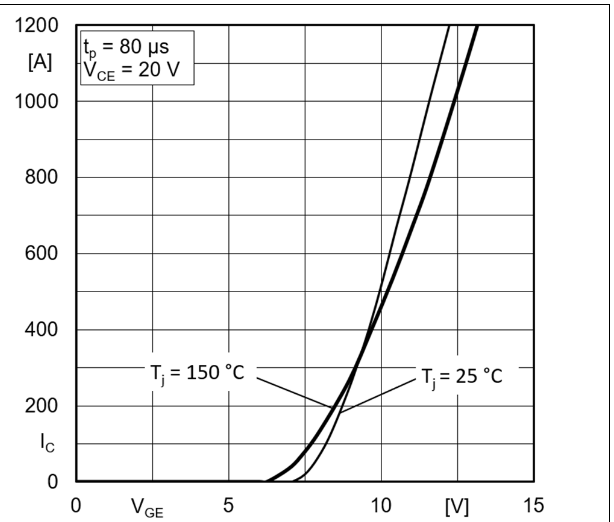


Fig. 5: Typ. transfer characteristic

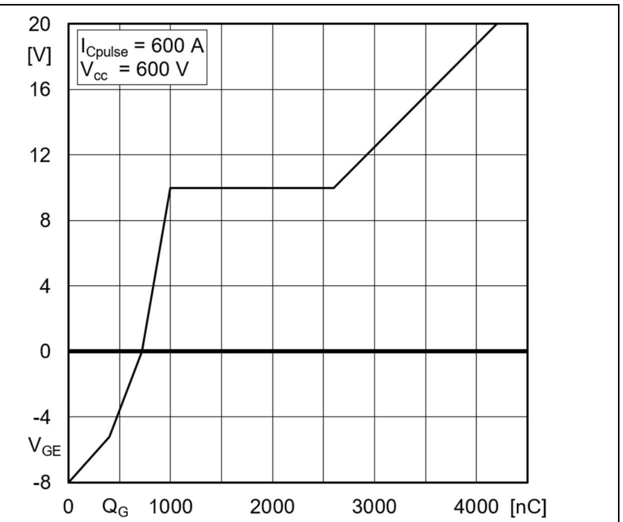


Fig. 6: Typ. gate charge characteristic

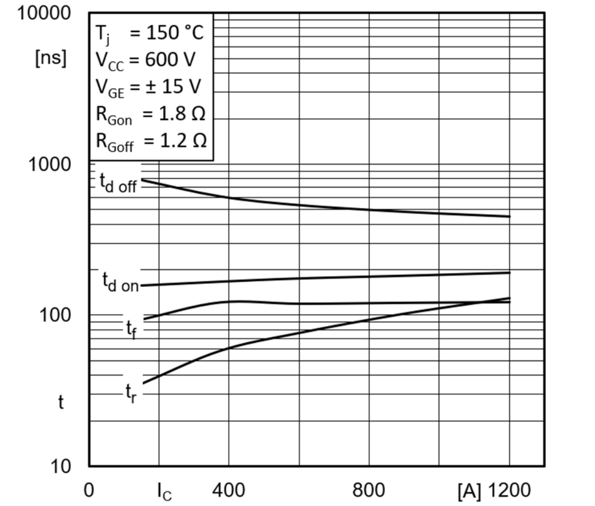


Fig. 7: Typ. switching times vs. I_C

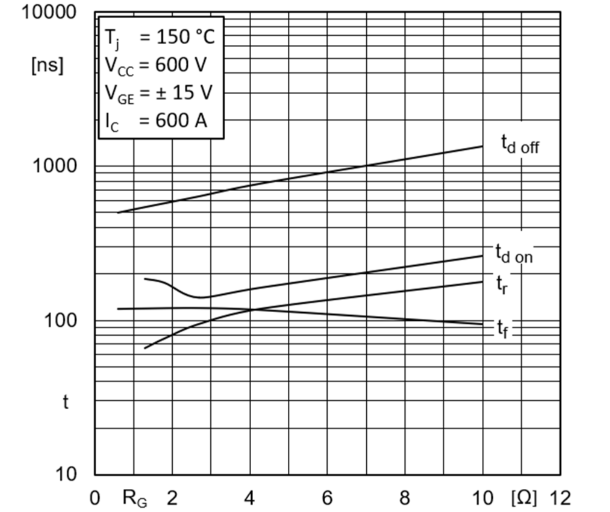


Fig. 8: Typ. switching times vs. gate resistor R_G

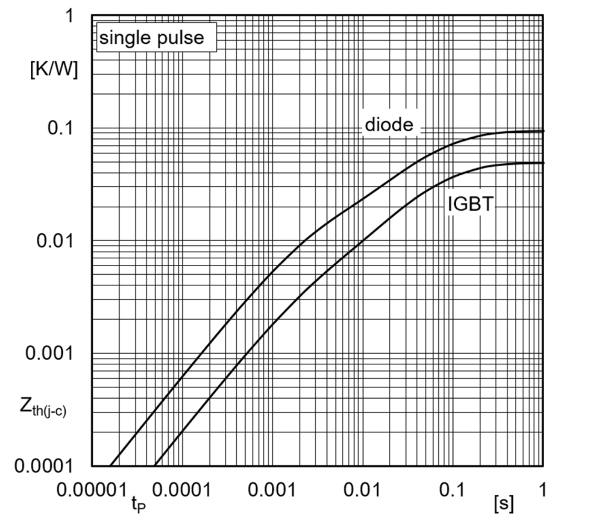


Fig. 9: Transient thermal impedance

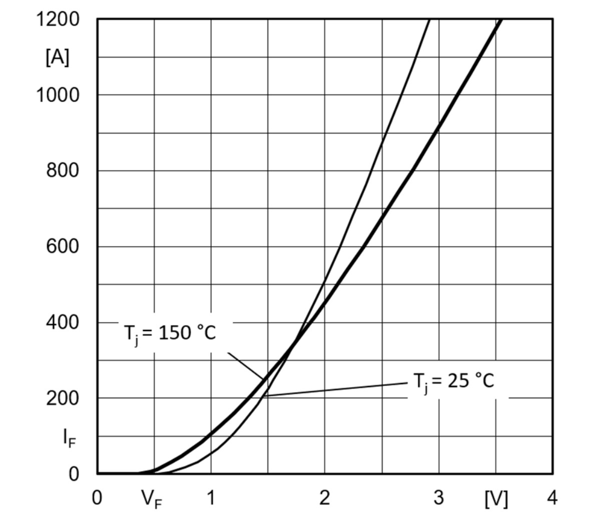


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

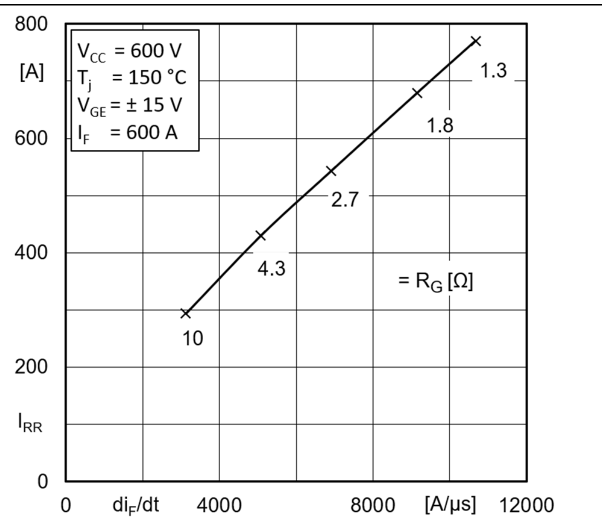


Fig. 11: Typ. CAL diode peak reverse recovery current

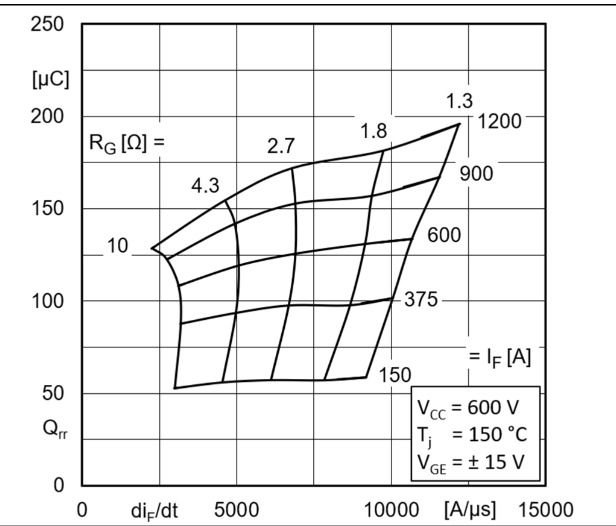
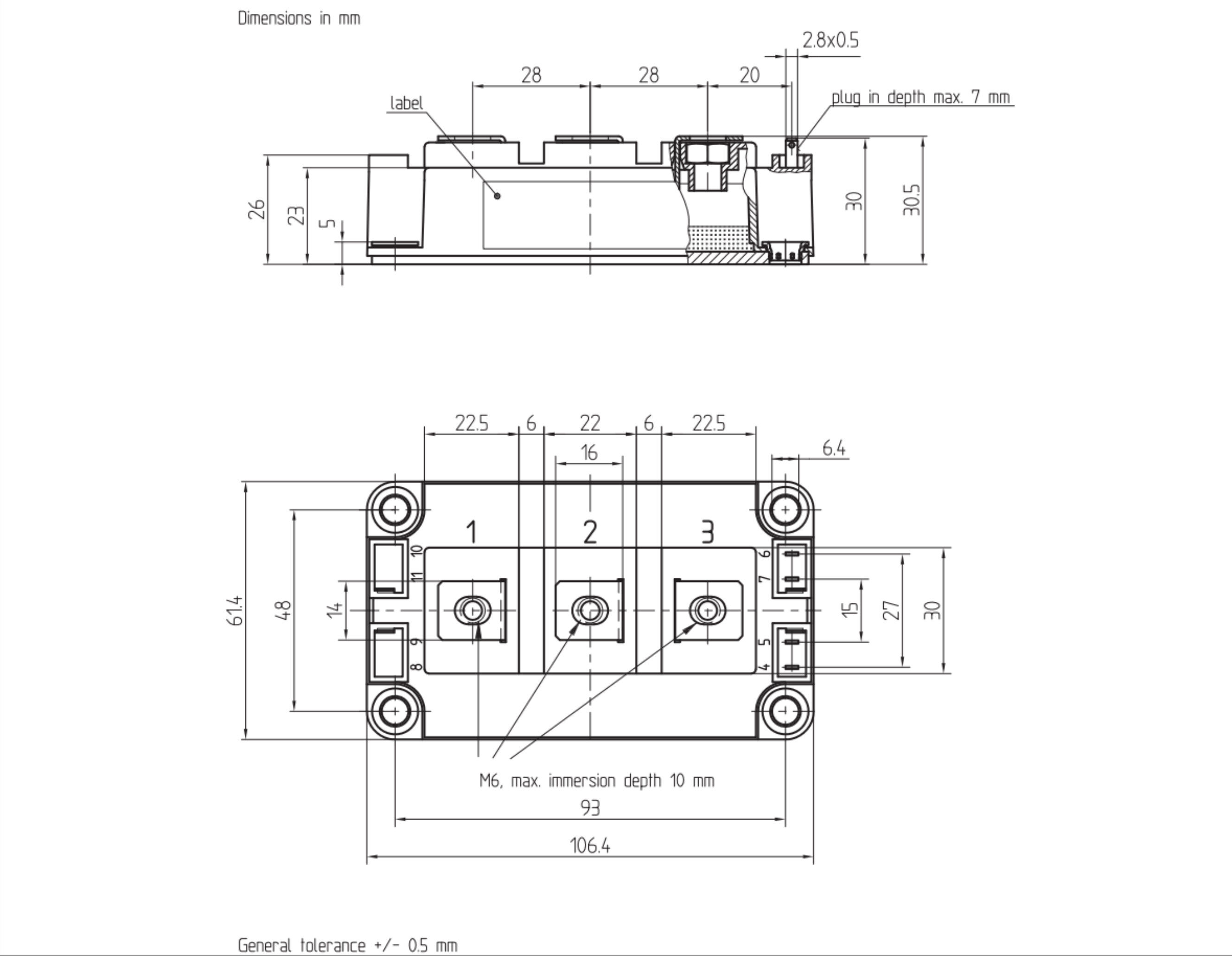
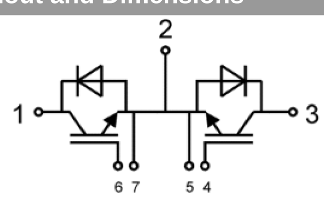


Fig. 12: Typ. CAL diode peak reverse recovery charge



Pinout and Dimensions



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