



SEMITRANS®4

IGBT4 Modules

SKM400GA12E4

Features

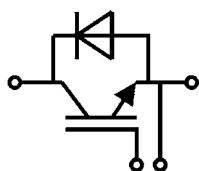
- IGBT4 = 4. Generation (Trench)IGBT
- VCEsat with positive temperature coefficient
- High short circuit capability, self limiting to $6 \times I_{C\text{NOM}}$
- Soft switching 4. Generation CAL diode (CAL4)

Typical Applications

- AC inverter drives
- UPS
- Electronic welders at fsw up to 20 kHz

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max, recomb. $T_{op} = -40 \dots +150^\circ\text{C}$, product rel. results valid for $T_j = 150^\circ$



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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}			1200	V
I _C	T _j = 175 °C	T _c = 25 °C	618	A
		T _c = 80 °C	475	A
I _{Cnom}			400	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		1200	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				
I _F	T _j = 175 °C	T _c = 25 °C	440	A
		T _c = 80 °C	329	A
I _{Fnom}			400	A
I _{FRM}	I _{FRM} = 3xI _{Fnom}		1200	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		1980	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			500	A
T _{stg}			-40 ... 125	°C
V _{isol}	AC sinus 50Hz, t = 1 min		4000	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
V _{CE(sat)}	I _C = 400 A	T _J = 25 °C		1.8	2.05	V
	V _{GE} = 15 V chipelevel	T _J = 150 °C		2.2	2.4	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		2.5	2.9	mΩ
		T _J = 150 °C		3.8	4.0	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 15.2 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V	T _J = 25 °C		0.1	0.3	mA
	V _{CE} = 1200 V	T _J = 150 °C				mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		24.6		nF
C _{oes}		f = 1 MHz		1.62		nF
C _{res}		f = 1 MHz		1.38		nF
Q _G	V _{GE} = - 8 V...+ 15 V			2260		nC
R _{Gint}	T _J = 25 °C			1.9		Ω
t _{d(on)}	V _{CC} = 600 V	T _J = 150 °C		264		ns
t _r	I _C = 400 A	T _J = 150 °C		56		ns
E _{on}	V _{GE} = ±15 V	T _J = 150 °C		28		mJ
t _{d(off)}	R _{G on} = 1 Ω	T _J = 150 °C		575		ns
t _f	R _{G off} = 1 Ω	T _J = 150 °C		117		ns
E _{off}	di/dt _{on} = 7100 A/μs	T _J = 150 °C		59		mJ
	di/dt _{off} = 3900 A/μs	T _J = 150 °C				
R _{th(j-c)}	per IGBT				0.072	K/W



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- Soft switching 4. Generation CAL diode (CAL4)

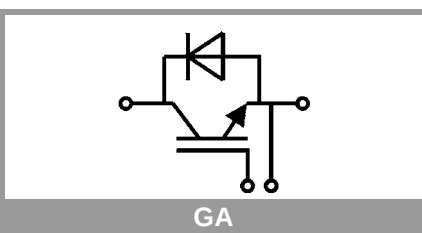
Typical Applications

- AC inverter drives
- UPS
- Electronic welders at fsw up to 20 kHz

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max, recomm.
Top = $-40 \dots +150^\circ\text{C}$, product rel. results valid for $T_j = 150^\circ$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		2.2	2.52	V
	V _{GE} = 0 V chip	T _j = 150 °C		2.15	2.47	V
V _{F0}		T _j = 25 °C		1.3	1.5	V
		T _j = 150 °C		0.9	1.1	V
r _F		T _j = 25 °C		2.3	2.5	mΩ
		T _j = 150 °C		3.1	3.4	mΩ
I _{RRM}	I _F = 400 A	T _j = 150 °C		440		A
Q _{rr}	di/dt _{off} = 7200 A/μs	T _j = 150 °C		78		μC
E _{rr}	V _{GE} = ±15 V	T _j = 150 °C		37		mJ
	V _{CC} = 600 V					
R _{th(j-c)}	per diode			0.14		K/W
Module						
L _{CE}				15	20	nH
R _{CC'+EE'}	terminal-chip	T _C = 25 °C		0.18		mΩ
		T _C = 125 °C		0.22		mΩ
R _{th(c-s)}	per module			0.02	0.038	K/W
M _s	to heat sink M6		3		5	Nm
M _t		to terminals M6, M4	2.5		5	Nm
						Nm
w				330		g



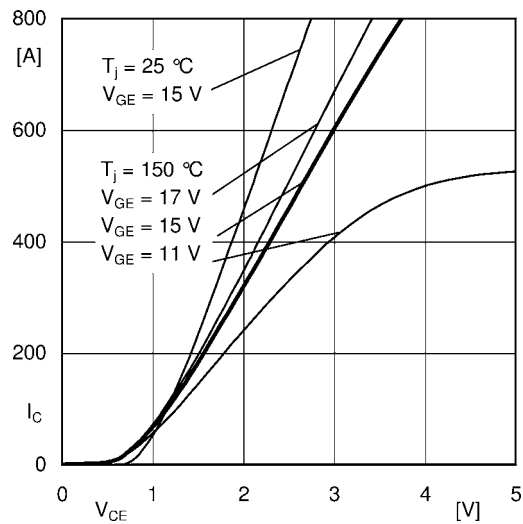


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

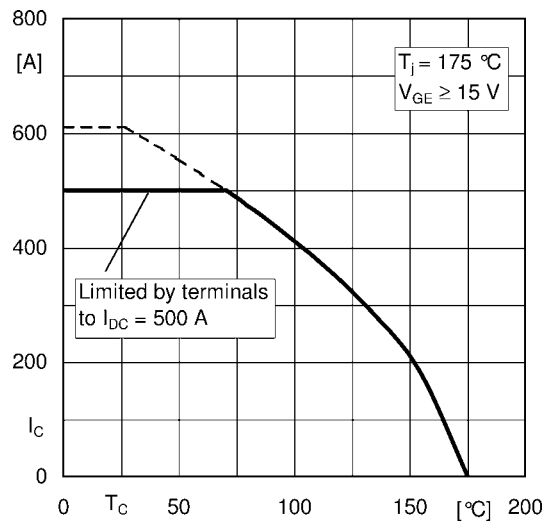


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

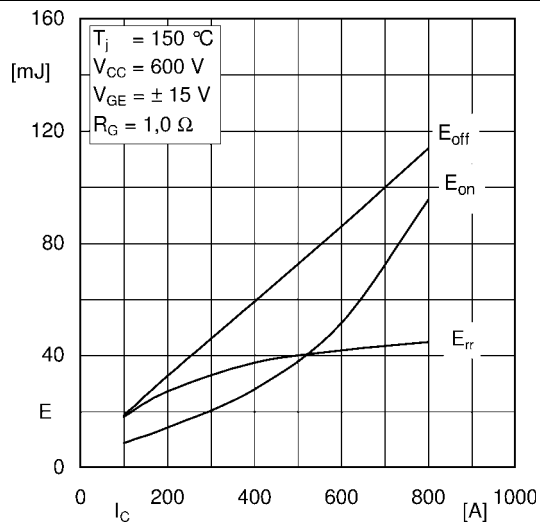


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

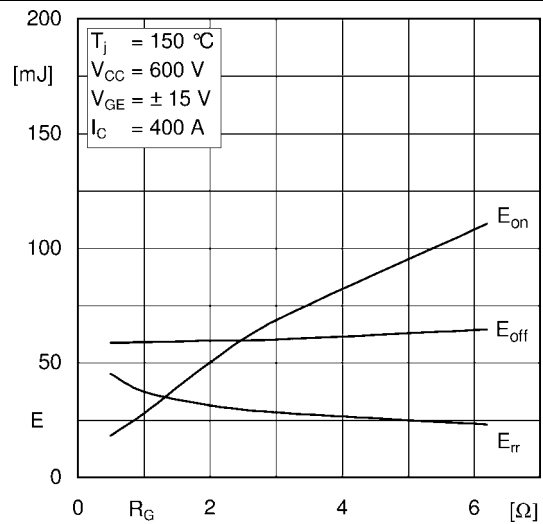


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

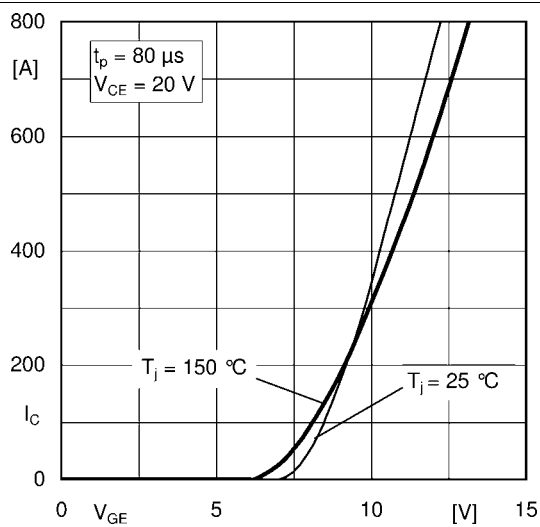


Fig. 5: Typ. transfer characteristic

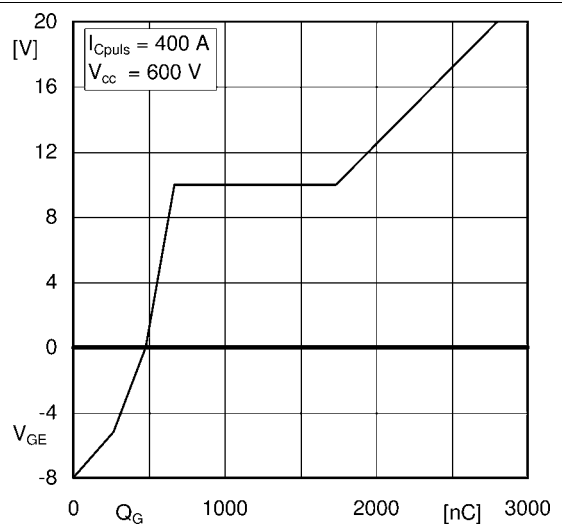


Fig. 6: Typ. gate charge characteristic

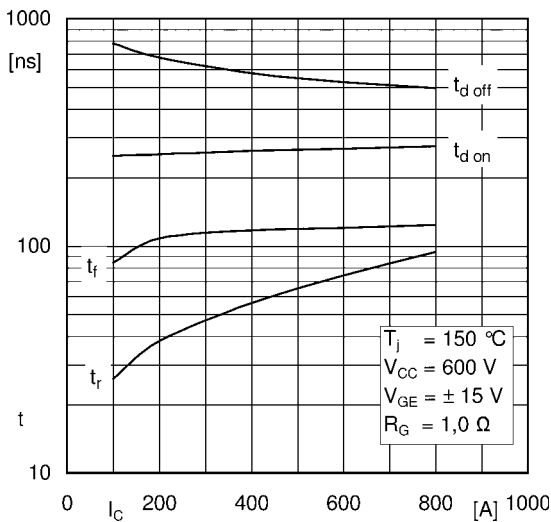


Fig. 7: Typ. switching times vs. I_C

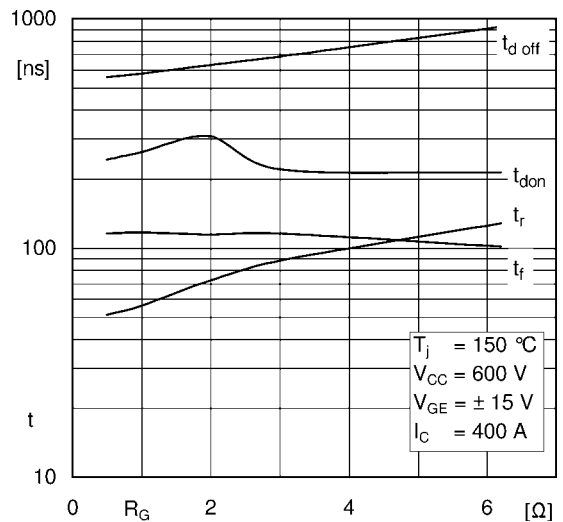


Fig. 8: Typ. switching times vs. gate resistor R_G

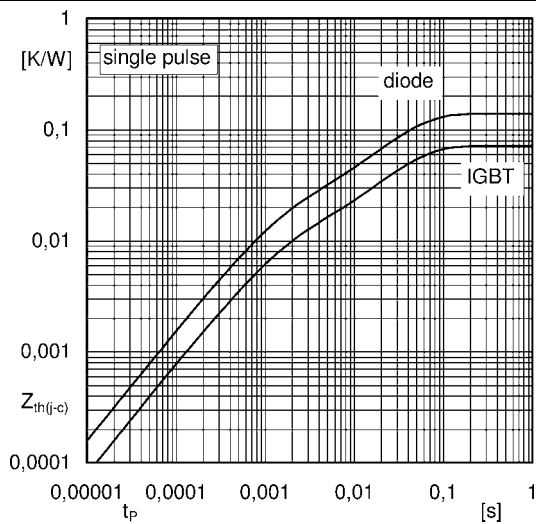


Fig. 9: Transient thermal impedance

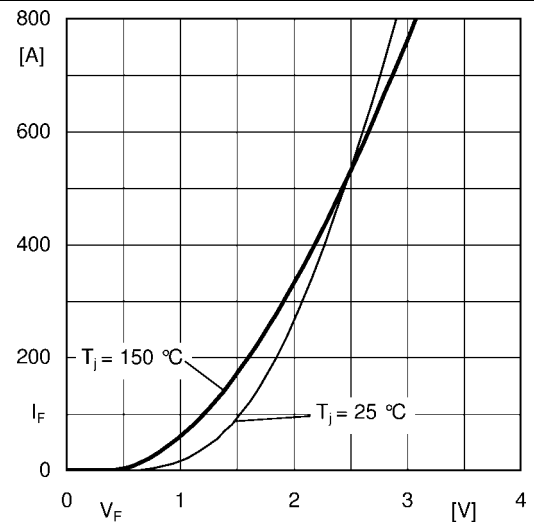


Fig. 10: CAL diode forward characteristic

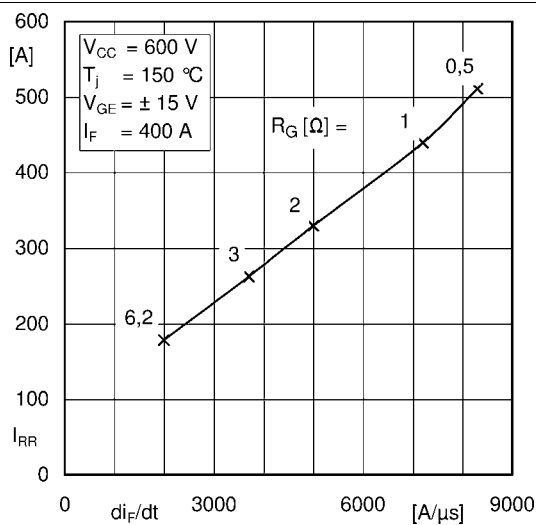


Fig. 11: CAL diode peak reverse recovery current

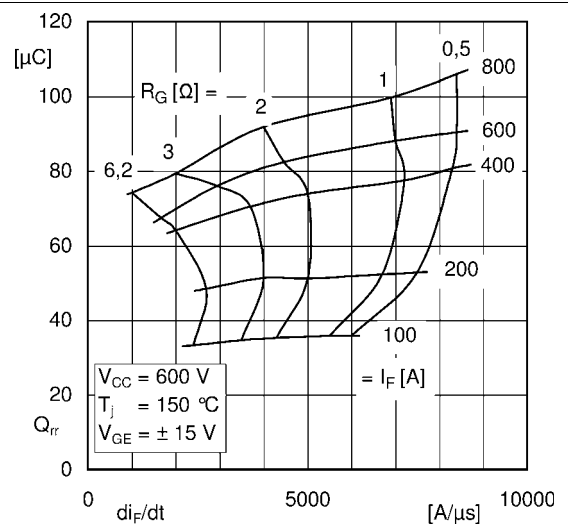
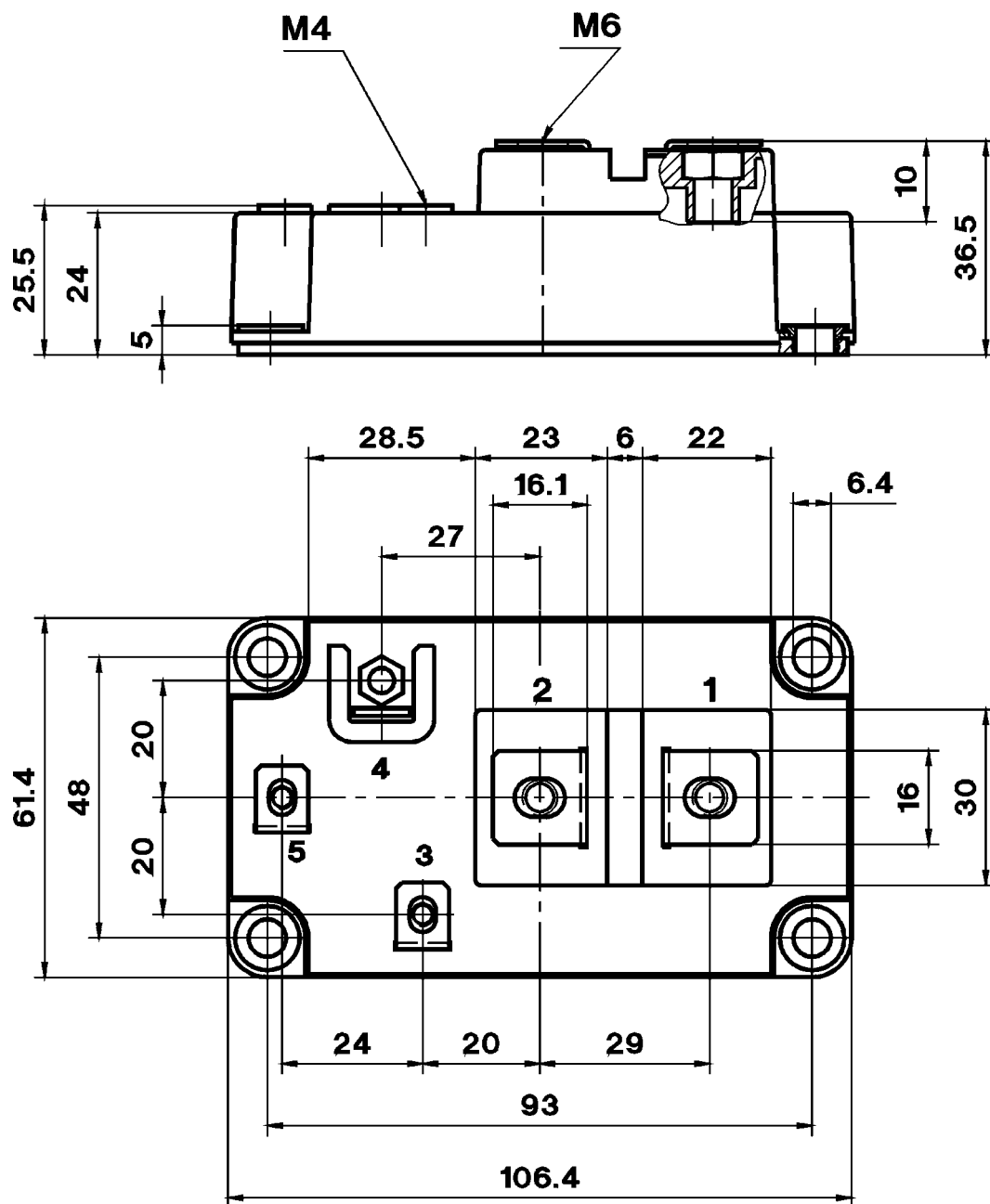
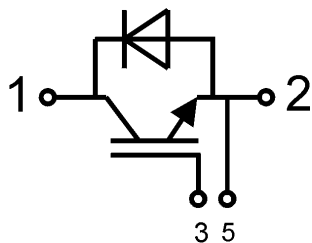


Fig. 12: Typ. CAL diode peak reverse recovery charge



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

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