



SEMITRANS® 5

Trench IGBT Modules

SKM400GARL066T

Target Data

Features

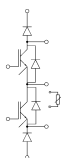
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to $6 \times I_{Cnom}$
- Fast & soft inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Isolated copper baseplate using DBC Technology (Direct Copper Bonding)
- UL recognized, file no. E63532

Typical Applications*

- UPS
- Inverter

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$



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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _J = 25 °C		600	V
I _C	T _J = 175 °C	T _c = 25 °C	504	A
		T _c = 80 °C	380	A
I _{Cnom}			400	A
I _{CRM}	I _{CRM} = 2xI _{Cnom}		800	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 300 V V _{GE} ≤ 15 V V _{CES} ≤ 600 V	T _J = 150 °C	6	μs
T _J			-40 ... 175	°C
Inverse diode				
I _F	T _J = 175 °C	T _c = 25 °C	46	A
		T _c = 80 °C	33	A
I _{Fnom}			50	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		100	A
I _{FSM}	t _p = 10 ms, sin 180°, T _J = 25 °C		345	A
T _J			-40 ... 175	°C
Freewheeling diode				
I _F	T _J = 175 °C	T _c = 25 °C	421	A
		T _c = 80 °C	301	A
I _{Fnom}			400	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		800	A
I _{FSM}	t _p = 10 ms, sin 180°, T _J = 25 °C		2880	A
T _J			-40 ... 175	°C
Module				
I _{t(RMS)}	T _{terminal} = 80 °C			A
T _{stg}			-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 = 400 A V _{GE} = 15 V chipllevel	T _j = 25 °C		1.45	1.85	V
		T _j = 150 °C		1.70	2.10	V
V _{CE0}	V _{GE} = 15 V	T _j = 25 °C		0.9	1	V
		T _j = 150 °C		0.85	0.9	V
r _{CE}		T _j = 25 °C		1.38	2.13	mΩ
		T _j = 150 °C		2.13	3.00	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 6.4 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V V _{CE} = 600 V	T _j = 25 °C		0.05	0.15	mA
		T _j = 150 °C				mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		24.67		nF
C _{oes}		f = 1 MHz		1.54		nF
C _{res}		f = 1 MHz		0.732		nF
Q _G	V _{GE} = - 8 V...+ 15 V			3800		nC
R _{Gint}	T _j = 25 °C			1.00		Ω



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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
t _{d(on)}	V _{CC} = 300 V	T _j = 150 °C		93		ns
t _r	I _C = 400 A	T _j = 150 °C		72		ns
E _{on}	V _{GE} = ±15 V	T _j = 150 °C		4.48		mJ
t _{d(off)}	R _{G on} = 0.5 Ω	T _j = 150 °C		317		ns
t _f	R _{G off} = 0.5 Ω	T _j = 150 °C		102		ns
E _{off}	di/dt _{on} = 2000 A/μs di/dt _{off} = 2000 A/μs	T _j = 150 °C		15.78		mJ
R _{th(j-c)}	per IGBT				0.12	K/W
Inverse diode						
V _F = V _{EC}	I _F = 50 A	T _j = 25 °C		1.54	1.78	V
	V _{GE} = 0 V chip	T _j = 150 °C		1.59	1.83	V
V _{F0}		T _j = 25 °C		1	1.1	V
		T _j = 150 °C		0.85	0.95	V
r _F		T _j = 25 °C		10.8	13.5	mΩ
		T _j = 150 °C		14.9	17.6	mΩ
I _{RRM}		I _F = 50 A	T _j = 150 °C			
Q _{rr}	V _{GE} = ±15 V V _{CC} = 300 V	T _j = 150 °C				μC
E _{rr}		T _j = 150 °C				mJ
R _{th(j-c)}	per diode				1.87	K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		1.40	1.6	V
	V _{GE} = 0 V chip	T _j = 150 °C		1.4	1.6	V
V _{F0}		T _j = 25 °C		1	1.1	V
		T _j = 150 °C		0.85	0.95	V
r _F		T _j = 25 °C		1.0	1.1	mΩ
		T _j = 150 °C		1.2	1.4	mΩ
I _{RRM}		I _F = 400 A	T _j = 150 °C		350	
Q _{rr}	di/dt _{off} = 2000 A/μs	T _j = 150 °C		24		μC
E _{rr}	V _{GE} = ±15 V V _{CC} = 300 V	T _j = 150 °C		8		mJ
R _{th(j-c)}	per Diode				0.23	K/W
Module						
L _{CE}						nH
R _{CC'+EE'}	terminal-chip	T _C = 25 °C				mΩ
		T _C = 125 °C				mΩ
R _{th(c-s)}	per module				0.038	K/W
M _s	to heat sink M6		3		5	Nm
M _t		to terminals M6	2.5		5	Nm
						Nm
w					310	g
Temperatur Sensor						
R ₁₀₀	T _C =100°C (R ₂₅ =5 kΩ)			493 ± 5%		Ω
B _{100/125}	R(T)=R ₁₀₀ exp[B _{100/125} (1/T-1/T ₁₀₀)]; T[K];			3550 ±2%		K



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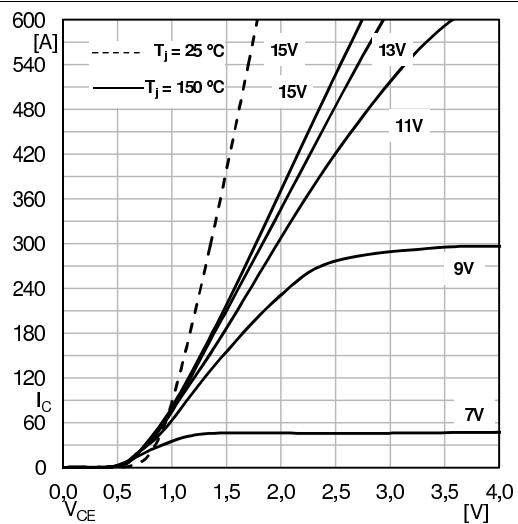


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + EE'$

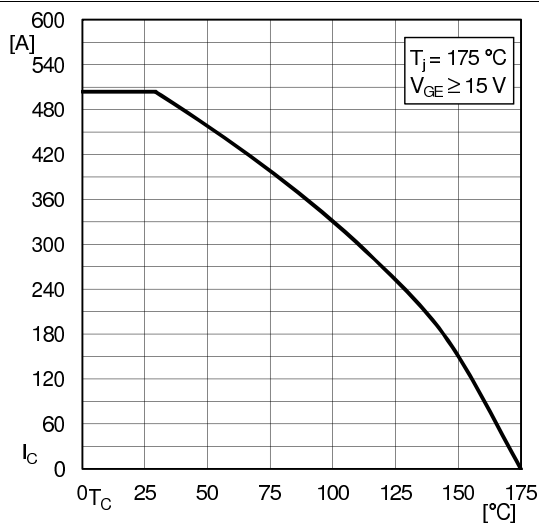


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

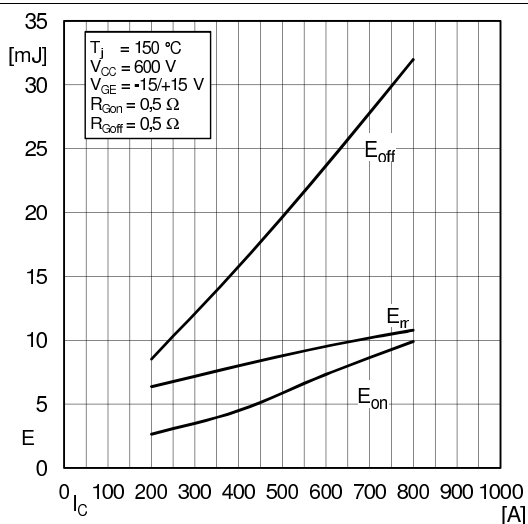


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

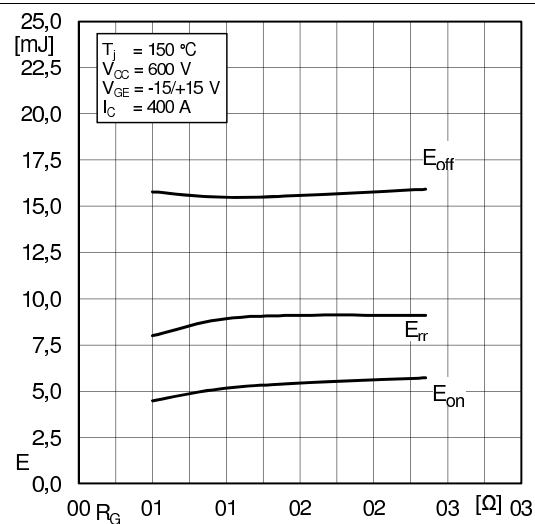


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

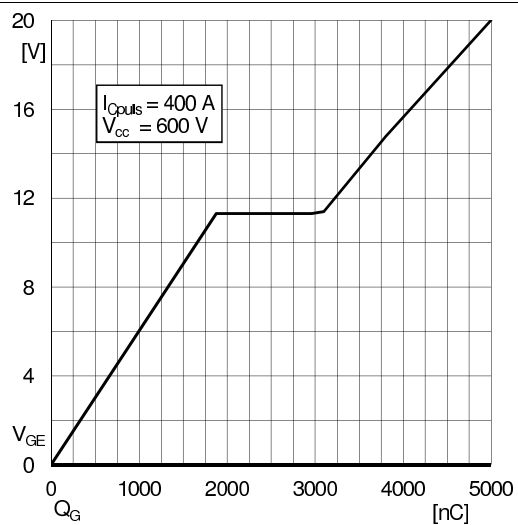


Fig. 6: Typ. gate charge characteristic

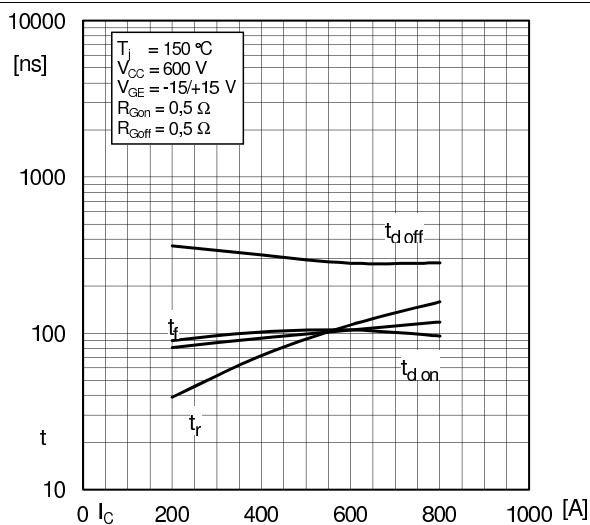


Fig. 7: Typ. switching times vs. I_C

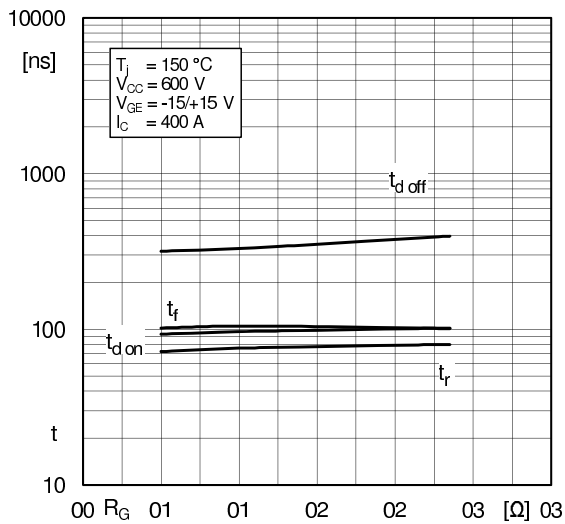


Fig. 8: Typ. switching times vs. gate resistor R_G

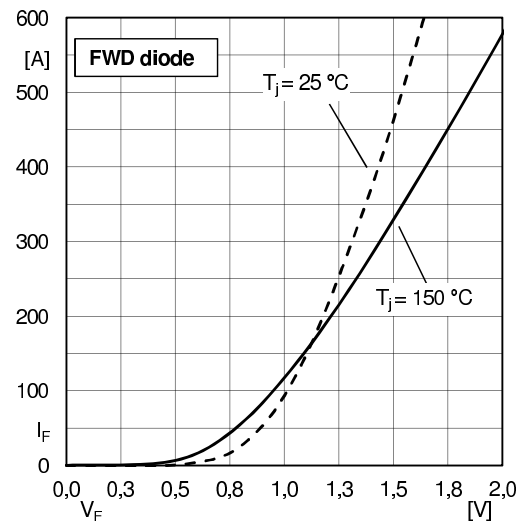
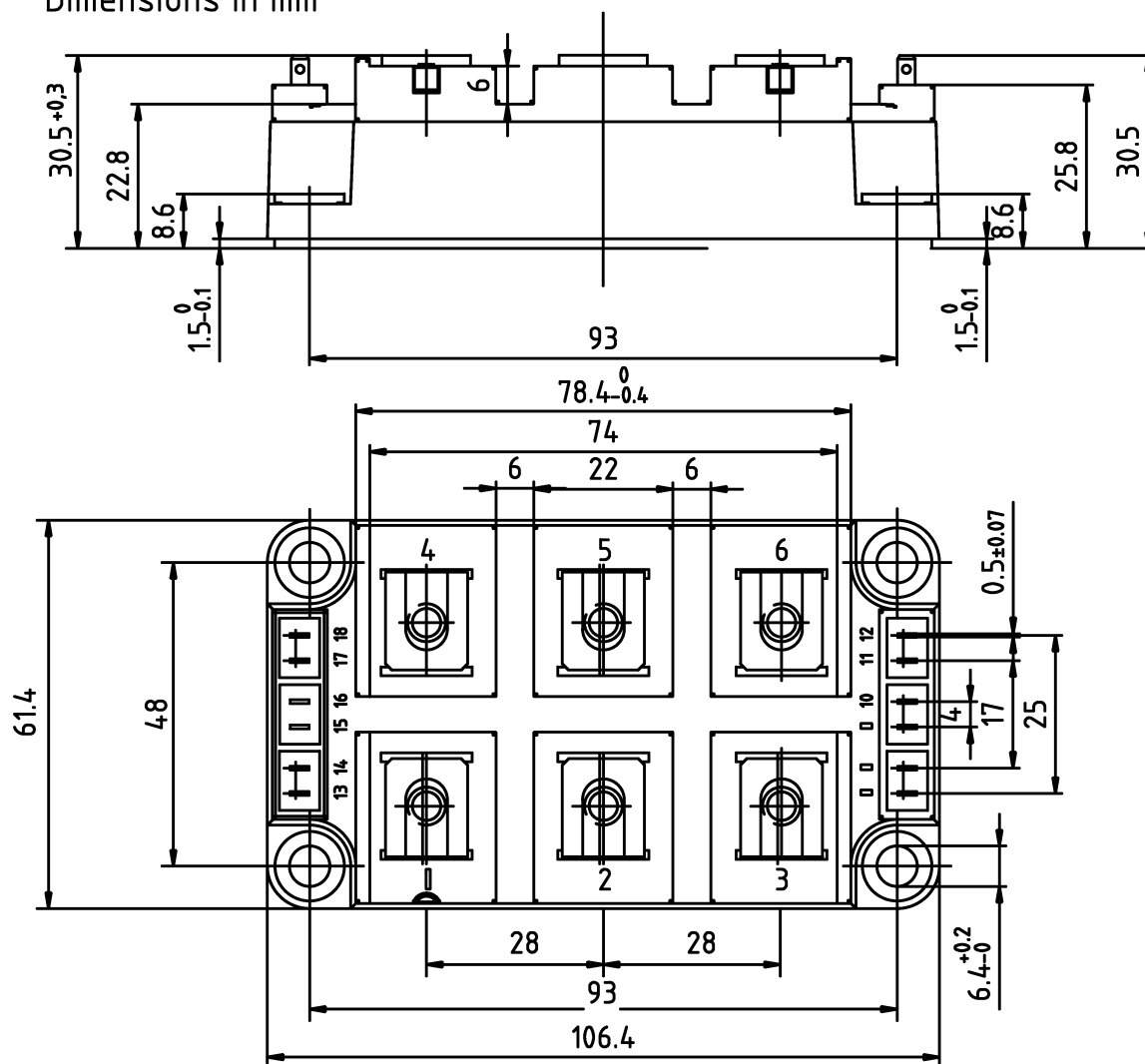
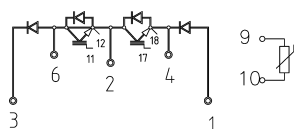


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC'+EE'}

Dimensions in mm



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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.