



SEMITRANS®3

IGBT4 Modules

SKM400GAL12E4

Features

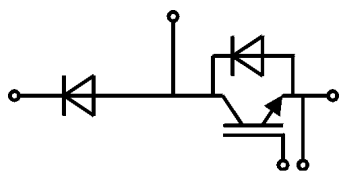
- IGBT4 = 4. Generation (Trench)IGBT
- VCEsat with positive temperature coefficient
- High short circuit capability, self limiting to 6 x I_{CNOM}
- Soft switching 4. Generation CAL diode (CAL4)

Typical Applications

- DC/DC – converter
- Brake chopper
- Switched reluctance motor
- DC – motor

Remarks

- Case temperature limited to T_c = 125°C max, recomm. T_{op} = -40 ... +150°C, product rel. results valid for T_j = 150°



GAL

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	T _j = 150 °C	10	µs	
	V _{GE} ≤ 15 V				
	V _{CES} ≤ 1200 V				
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	
Freewheeling 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	
		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
		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



SEMITRANS®3

IGBT4 Modules

SKM400GAL12E4

Features

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

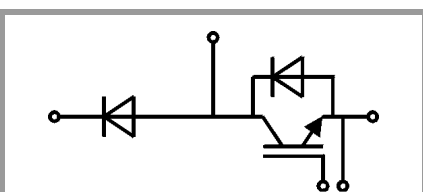
Typical Applications

- DC/DC – converter
- Brake chopper
- Switched reluctance motor
- DC – motor

Remarks

- Case temperature limited to T_c = 125°C max, recomm.
T_{op} = -40 ... +150°C, product rel. results valid for T_j = 150°

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C		242		ns
t _r	I _C = 400 A	T _j = 150 °C		47		ns
E _{on}	V _{GE} = ±15 V	T _j = 150 °C		33		mJ
t _{d(off)}	R _{G on} = 1 Ω	T _j = 150 °C		580		ns
t _f	R _{G off} = 1 Ω	T _j = 150 °C		101		ns
E _{off}	di/dt _{on} = 9700 A/μs	T _j = 150 °C		56		mJ
	di/dt _{off} = 4300 A/μs	T _j = 150 °C				
R _{th(j-c)}	per IGBT				0.072	K/W
Inverse diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		2.2	2.52	V
	V _{GE} = 0 V	T _j = 150 °C		2.15	2.47	V
	chip					
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		450		A
Q _{rr}	di/dt _{off} = 8800 A/μs	T _j = 150 °C		68		μC
E _{rr}	V _{GE} = ±15 V	T _j = 150 °C		30.5		mJ
	V _{CC} = 600 V					
R _{th(j-c)}	per diode				0.14	K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		2.2	2.52	V
	V _{GE} = 0 V	T _j = 150 °C		2.15	2.47	V
	chip					
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		450		A
Q _{rr}	di/dt _{off} = 8800 A/μs	T _j = 150 °C		68		μC
E _{rr}	V _{GE} = ±15 V	T _j = 150 °C		30.5		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		0.25		mΩ
		T _C = 125 °C		0.5		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		2.5	5	Nm
						Nm
w					325	g



GAL

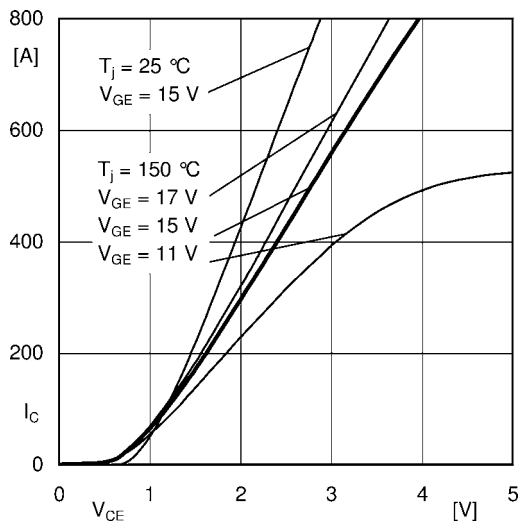


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

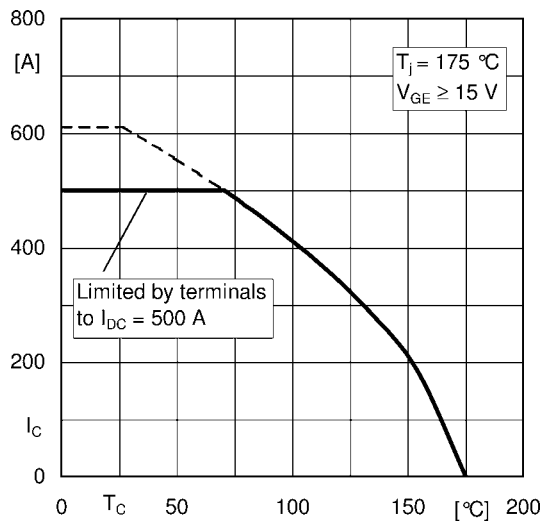


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

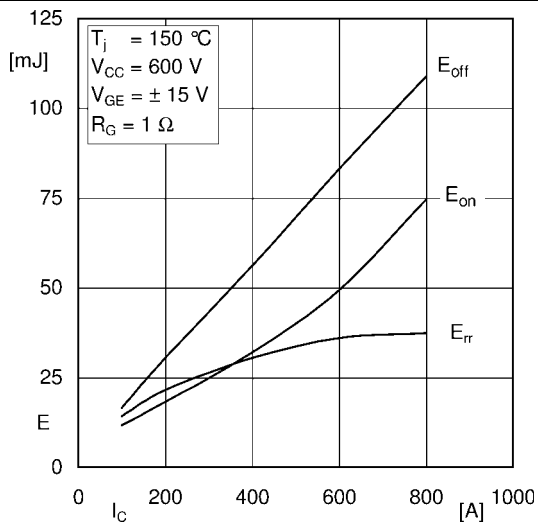


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

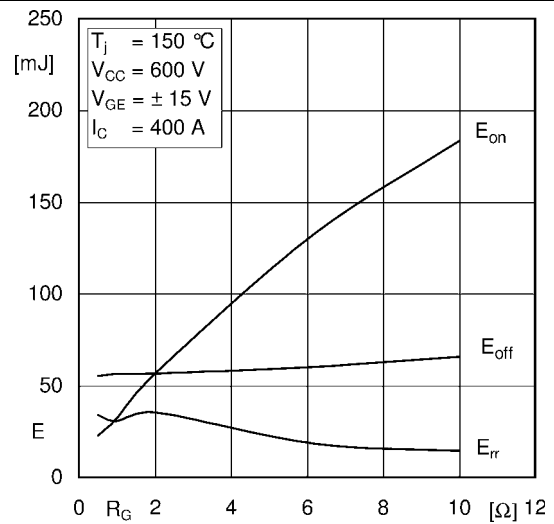


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

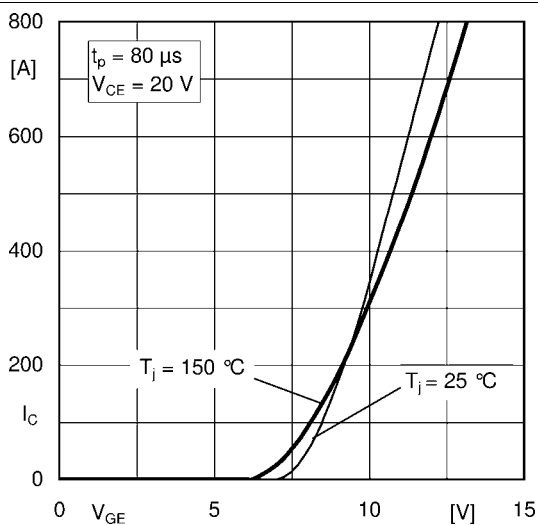


Fig. 5: Typ. transfer characteristic

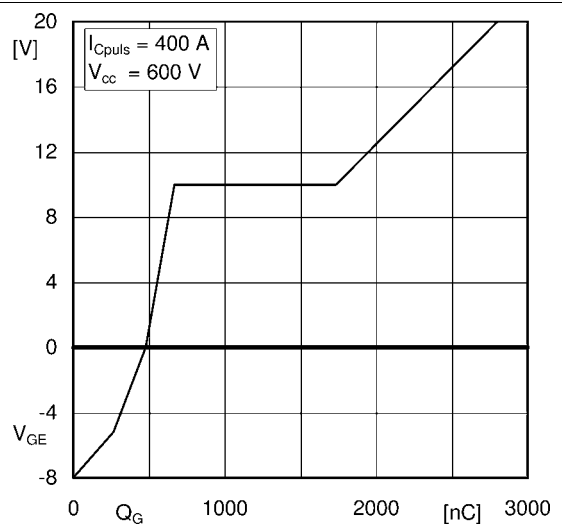


Fig. 6: Typ. gate charge characteristic

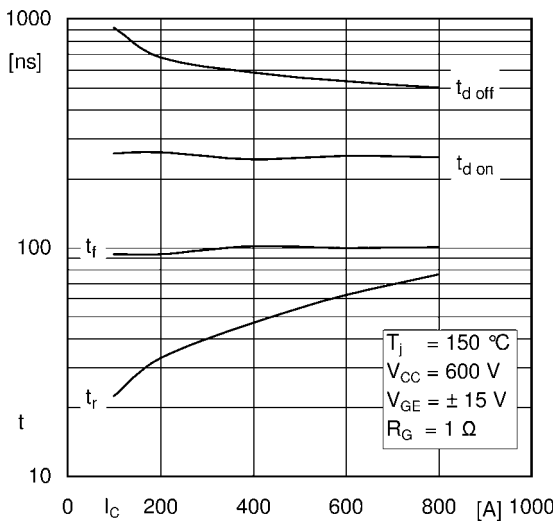


Fig. 7: Typ. switching times vs. I_C

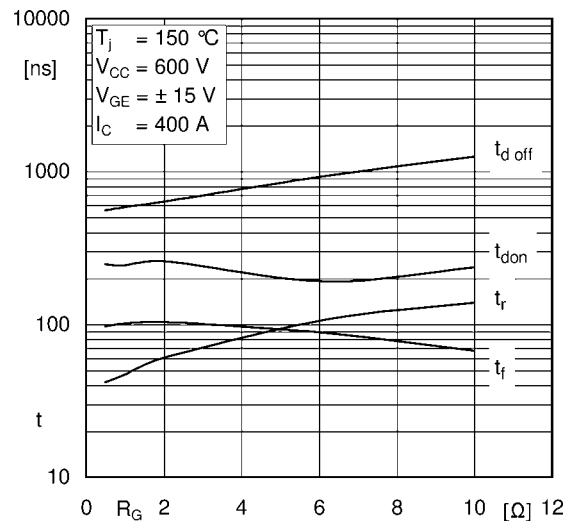


Fig. 8: Typ. switching times vs. gate resistor R_G

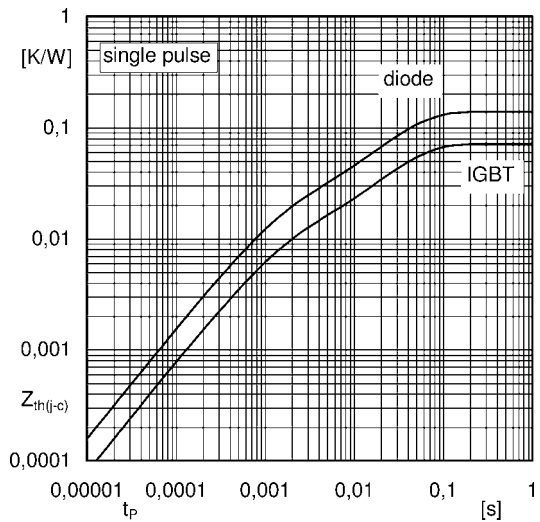


Fig. 9: Transient thermal impedance

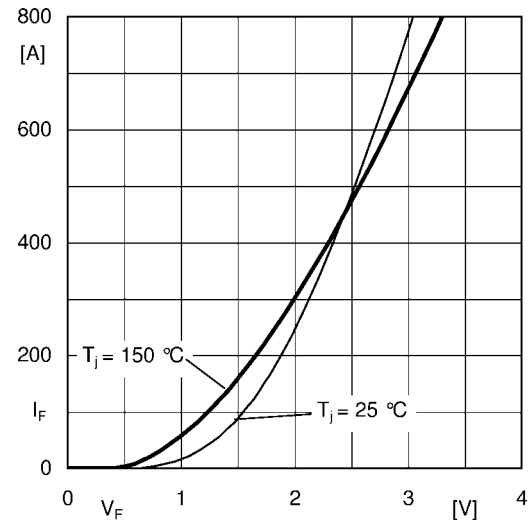


Fig. 10: CAL diode forward characteristic

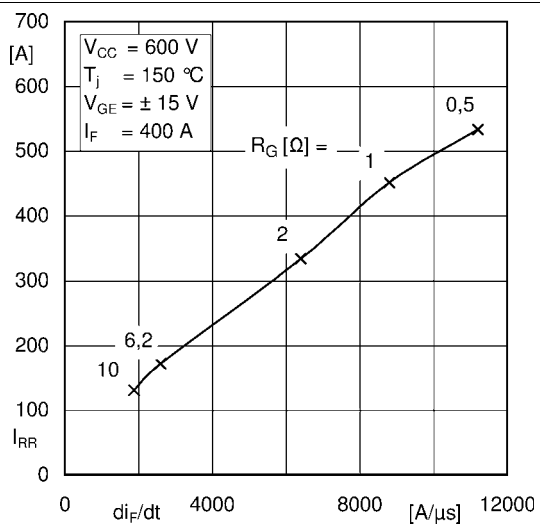


Fig. 11: CAL diode peak reverse recovery current

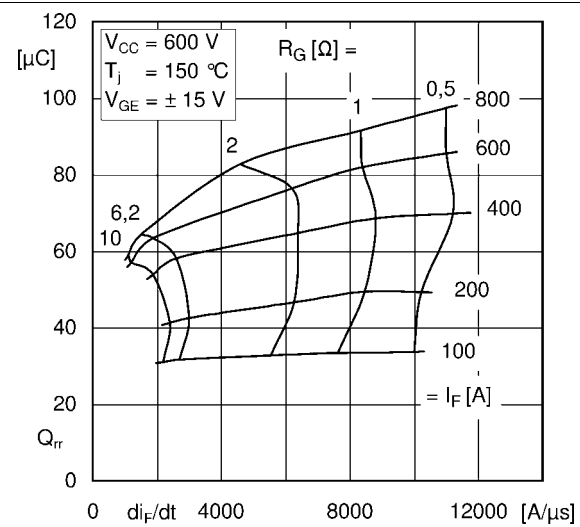


Fig. 12: Typ. CAL diode peak reverse recovery charge

