



SEMITRANS® 3

Fast IGBT4 Modules

SKM400GAL12T4

Features

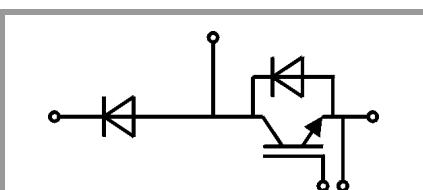
- IGBT4 = 4. generation fast trench IGBT (Infineon)
- CAL4 = Soft switching 4. generation CAL-diode
- Isolated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 20kHz
- UL recognized, file no. E63532

Typical Applications*

- Electronic welders at fsw up to 20 kHz
- DC/DC – converter
- Brake chopper
- Switched reluctance motor

Remarks

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



GAL

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$		1200	V
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	616	A
		$T_c = 80^\circ\text{C}$	474	A
I_{Cnom}			400	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$		1200	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
T_j			-40 ... 175	$^\circ\text{C}$
Inverse diode				
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	440	A
		$T_c = 80^\circ\text{C}$	329	A
I_{Fnom}			400	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		1200	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		1980	A
T_j			-40 ... 175	$^\circ\text{C}$
Freewheeling diode				
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	440	A
		$T_c = 80^\circ\text{C}$	329	A
I_{Fnom}			400	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		1200	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		1980	A
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Characteristics					
Symbol	Conditions		min.	typ.	max. Unit
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		220	ns
t_r	$I_C = 400\text{ A}$	$T_j = 150^\circ\text{C}$		47	ns
E_{on}	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		33	mJ
$t_{d(off)}$	$R_{G\ on} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		505	ns
t_f	$R_{G\ off} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		78	ns
E_{off}	$di/dt_{on} = 9700\text{ A}/\mu\text{s}$ $di/dt_{off} = 4300\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		42	mJ
$R_{th(j-c)}$	per IGBT			0.072	K/W
Inverse diode					
$V_F = V_{EC}$	$I_F = 400\text{ A}$	$T_j = 25^\circ\text{C}$		2.20	2.52 V
	$V_{GE} = 0\text{ V}$ chipelevel	$T_j = 150^\circ\text{C}$		2.15	2.47 V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		1.3	1.5 V
		$T_j = 150^\circ\text{C}$		0.9	1.1 V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		2.3	2.5 m Ω
		$T_j = 150^\circ\text{C}$		3.1	3.4 m Ω
I_{RRM}	$I_F = 400\text{ A}$	$T_j = 150^\circ\text{C}$		450	A
Q_{rr}	$di/dt_{off} = 8800\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		68	μC
E_{rr}	$V_{GE} = \pm 15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		30.5	mJ
$R_{th(j-c)}$	per diode			0.14	K/W
Freewheeling diode					
$V_F = V_{EC}$	$I_F = 400\text{ A}$	$T_j = 25^\circ\text{C}$		2.20	2.52 V
	$V_{GE} = 0\text{ V}$ chipelevel	$T_j = 150^\circ\text{C}$		2.15	2.47 V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		1.3	1.5 V
		$T_j =$			

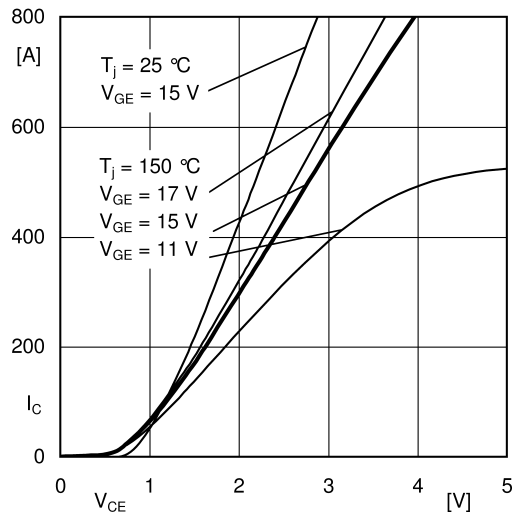


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

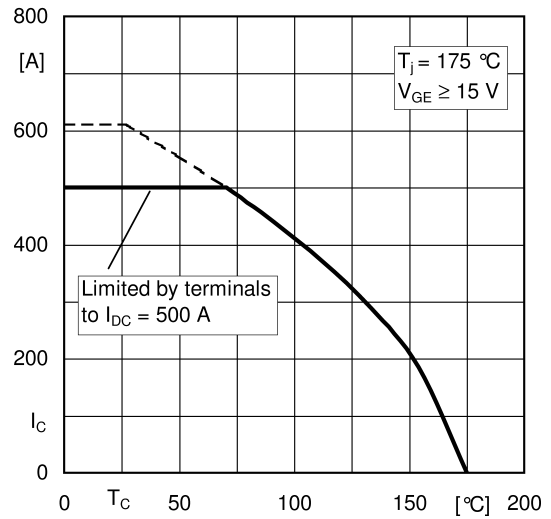


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

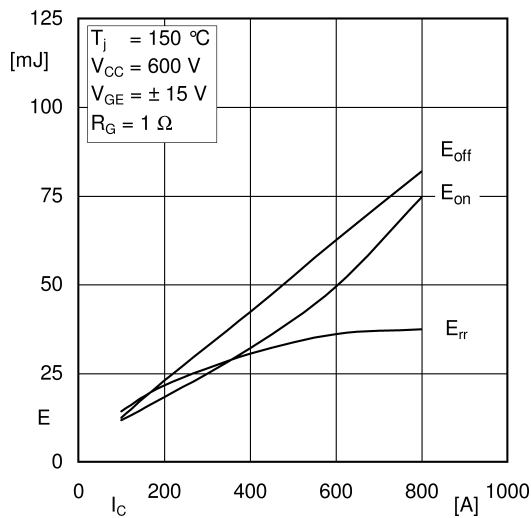


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

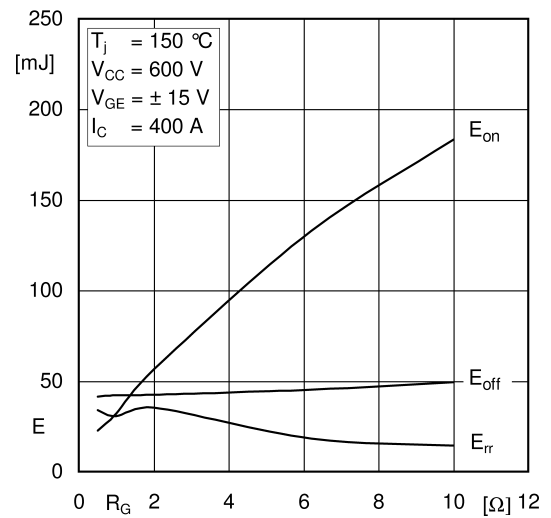


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

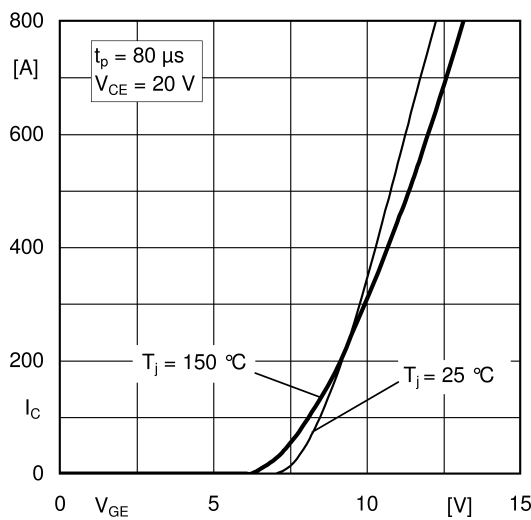


Fig. 5: Typ. transfer characteristic

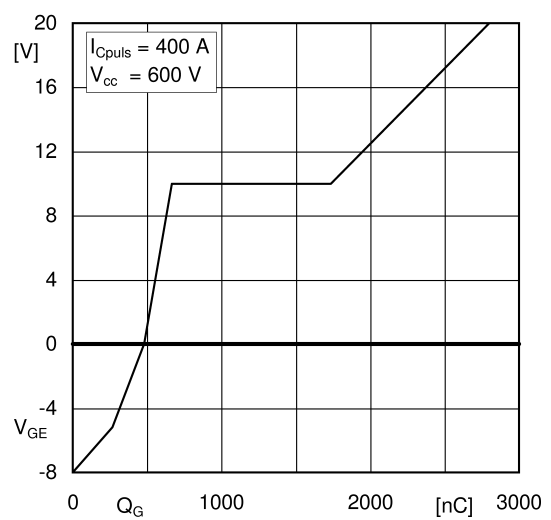


Fig. 6: Typ. gate charge characteristic

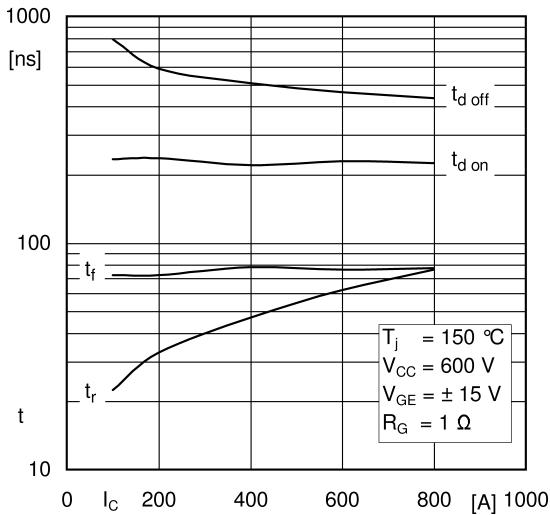


Fig. 7: Typ. switching times vs. I_C

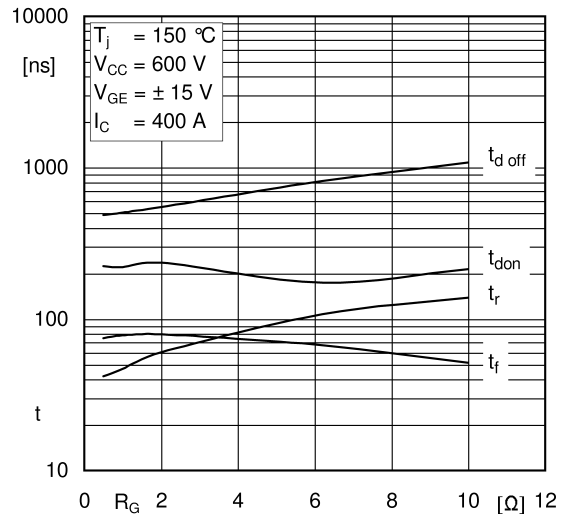


Fig. 8: Typ. switching times vs. gate resistor R_G

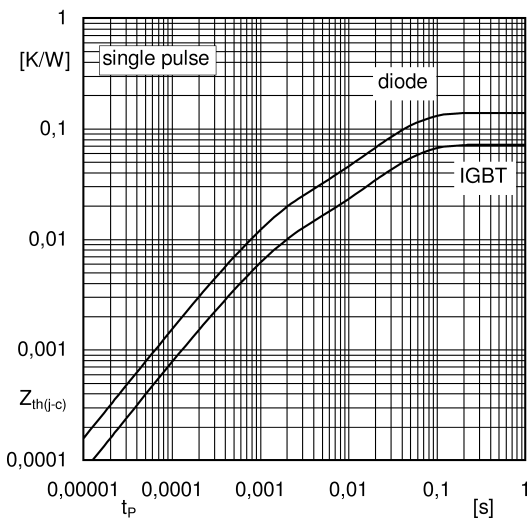


Fig. 9: Transient thermal impedance

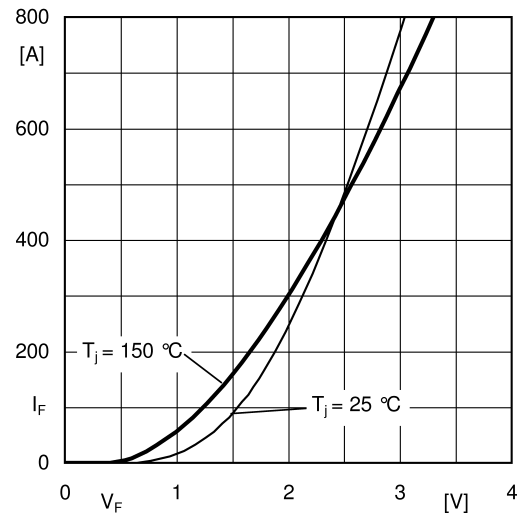


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'}+EE'$

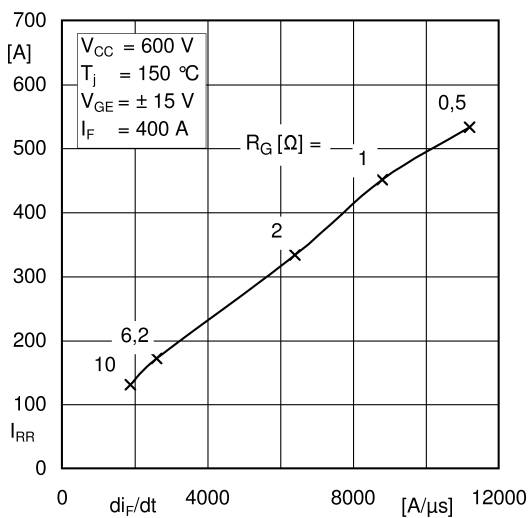


Fig. 11: CAL diode peak reverse recovery current

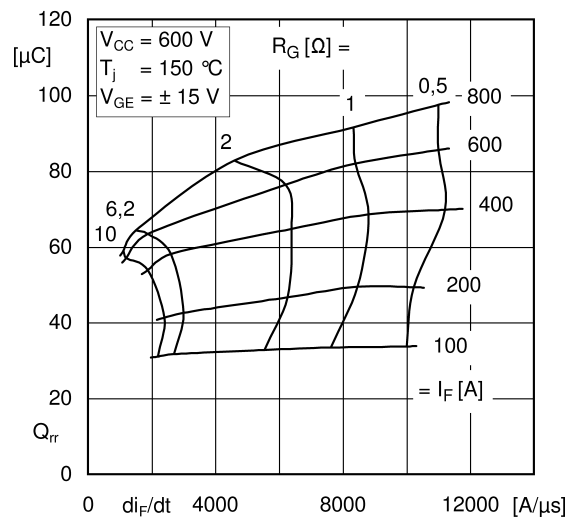
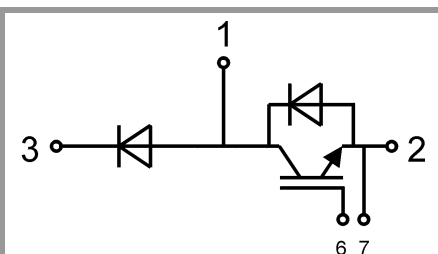


Fig. 12: Typ. CAL diode peak reverse recovery charge



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

* 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.