



SEMITRANS® 4

IGBT4 Modules

SKM600GA12E4

Features

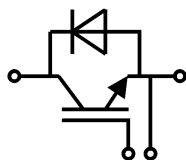
- IGBT4 = 4. generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4. generation CAL-diode
- Isolated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 12kHz
- UL recognized, file no. E63532

Typical Applications*

- AC inverter drives
- UPS
- Switched reluctance motor

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max, recomm. $T_{op} = -40 \dots +150^\circ\text{C}$, product rel. results valid for $T_j = 150^\circ$
- Short circuit: Soft Turn-off recommended $R_{Goff} > 20 \Omega$
- With $R_G = 2 \Omega$ the RBSOA is limited to $1 \times I_{Cnom} = 600 \text{ A}$



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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	913
		$T_c = 80^\circ\text{C}$	702
I_{Cnom}		600	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1800	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
T_j		-40 ... 175	$^\circ\text{C}$
Inverse diode			
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	707
		$T_c = 80^\circ\text{C}$	529
I_{Fnom}		600	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	1800	A
I_{FSM}	$t_p = 10 \text{ ms}$, sin 180° , $T_j = 25^\circ\text{C}$	3240	A
T_j		-40 ... 175	$^\circ\text{C}$
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$	500	A
T_{stg}		-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50 Hz, $t = 1 \text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 600 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.80	2.05	V
		$T_j = 150^\circ\text{C}$	2.20	2.40	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
r_{CE}	$V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.67	1.92	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	2.50	2.67	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 24 \text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0 \text{ V}$ $V_{CE} = 1200 \text{ V}$	$T_j = 25^\circ\text{C}$		5	mA
		$T_j = 150^\circ\text{C}$			mA
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	37.2		nF
C_{oes}		$f = 1 \text{ MHz}$	2.32		nF
C_{res}		$f = 1 \text{ MHz}$	2.04		nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		3400		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		1.3		Ω
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$	195		ns
t_r	$I_C = 600 \text{ A}$ $V_{GE} = \pm 15 \text{ V}$	$T_j = 150^\circ\text{C}$	90		ns
		$T_j = 150^\circ\text{C}$	74		mJ
E_{on}	$R_{Gon} = 2 \Omega$	$T_j = 150^\circ\text{C}$	690		ns
$t_{d(off)}$	$R_{Goff} = 2 \Omega$	$T_j = 150^\circ\text{C}$	130		ns
t_f	$di/dt_{on} = 6000 \text{ A}/\mu\text{s}$ $di/dt_{off} = 5200 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	84		mJ
E_{off}		$T_j = 150^\circ\text{C}$			
$R_{th(j-c)}$	per IGBT			0.049	K/W



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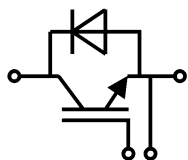
Typical Applications*

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Remarks

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- Short circuit: Soft Turn-off recommended $R_{Goff} > 20 \Omega$
- With $R_G = 2 \Omega$ the RBSOA is limited to $1 \times I_{Cnom} = 600 \text{ A}$

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		2.14	2.46	V
		T _j = 150 °C		2.07	2.38	V
V _{F0}	chiplevel	T _j = 25 °C		1.3	1.5	V
		T _j = 150 °C		0.9	1.1	V
r _F	chiplevel	T _j = 25 °C		1.4	1.6	mΩ
		T _j = 150 °C		1.9	2.1	mΩ
I _{RRM}	I _F = 600 A	T _j = 150 °C		420		A
Q _{rr}	di/dt _{off} = 5500 A/μs	T _j = 150 °C		92		μC
E _{rr}	V _{GE} = ±15 V V _{CC} = 600 V	T _j = 150 °C		38		mJ
R _{th(j-c)}	per diode				0.086	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	2.5		5	Nm
		M4	1.1		2	Nm
w					330	g



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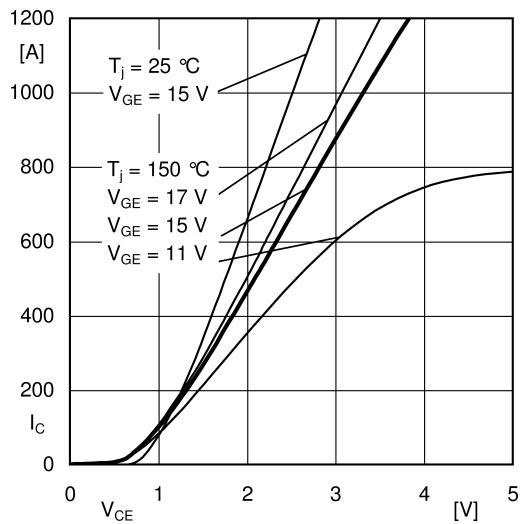


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

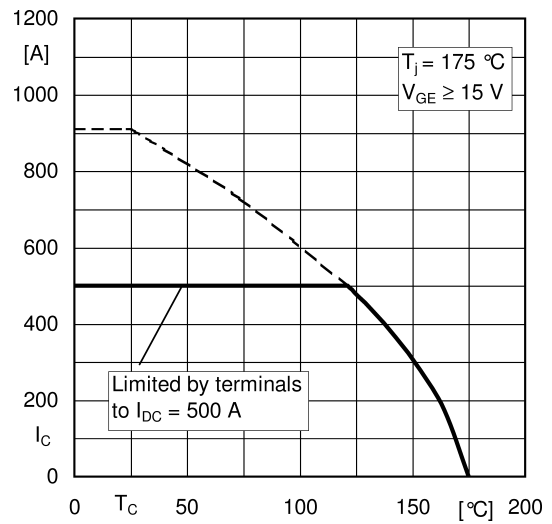


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

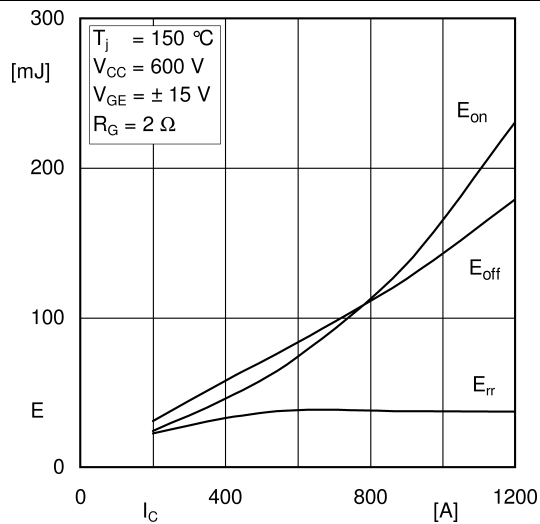


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

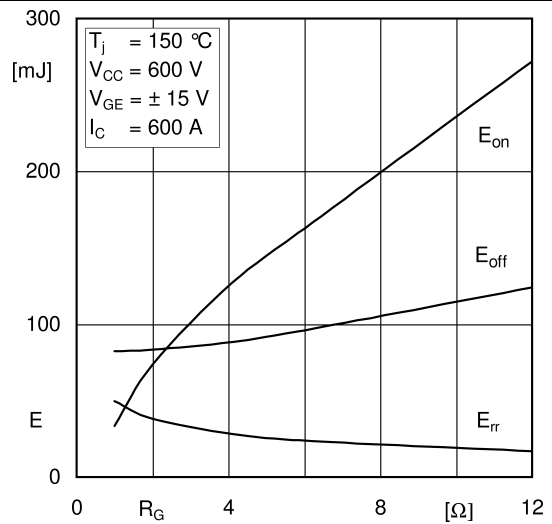


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

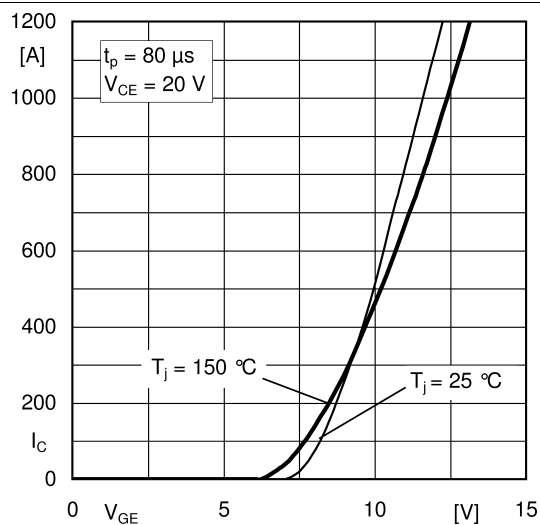


Fig. 5: Typ. transfer characteristic

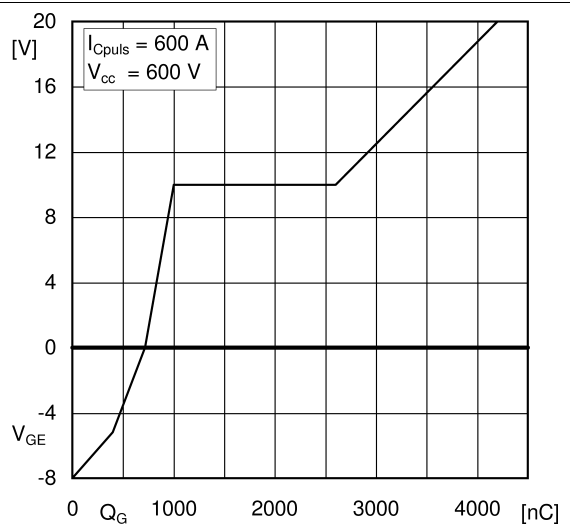
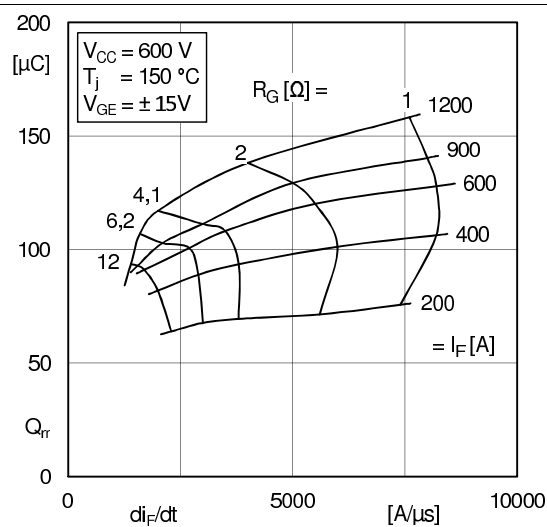
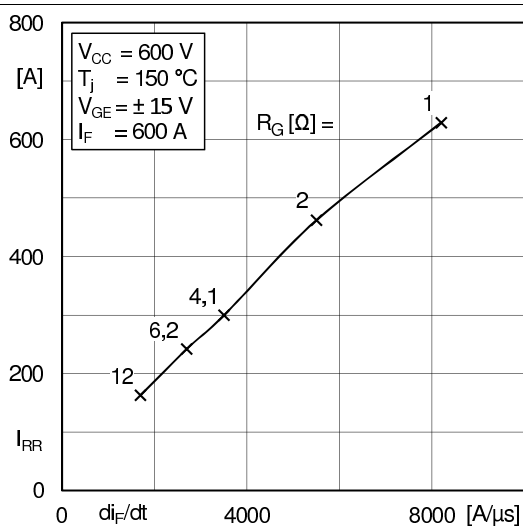
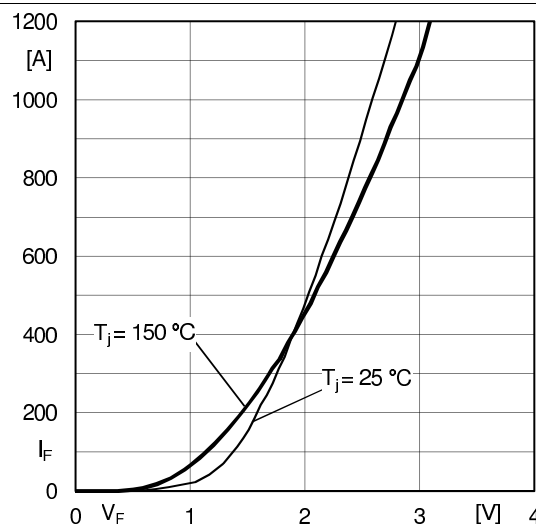
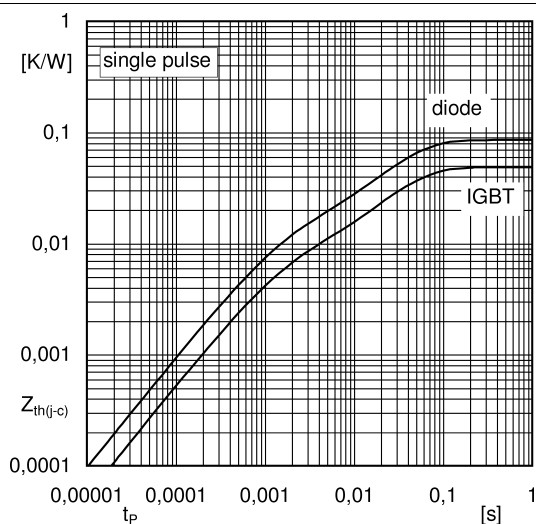
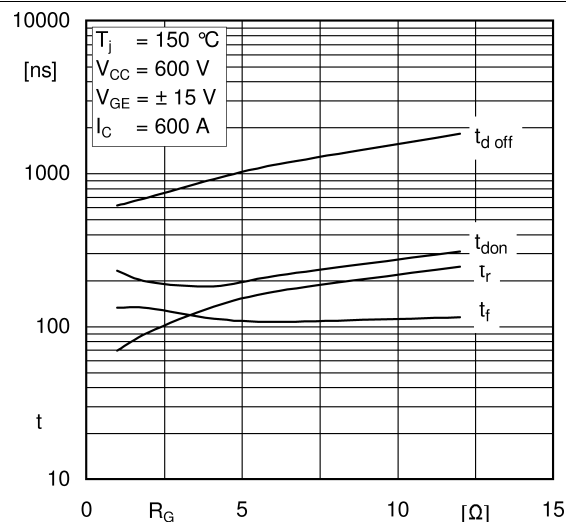
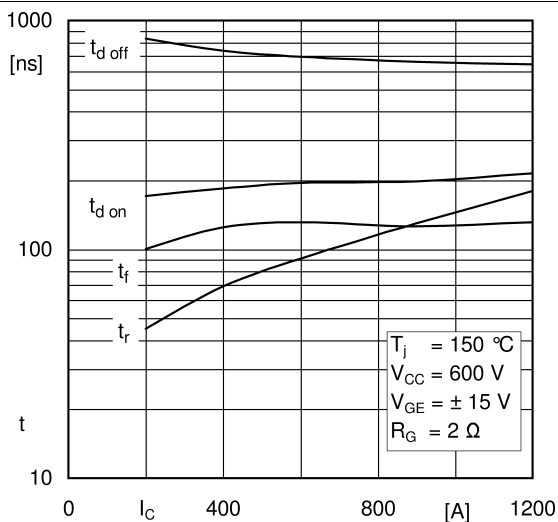
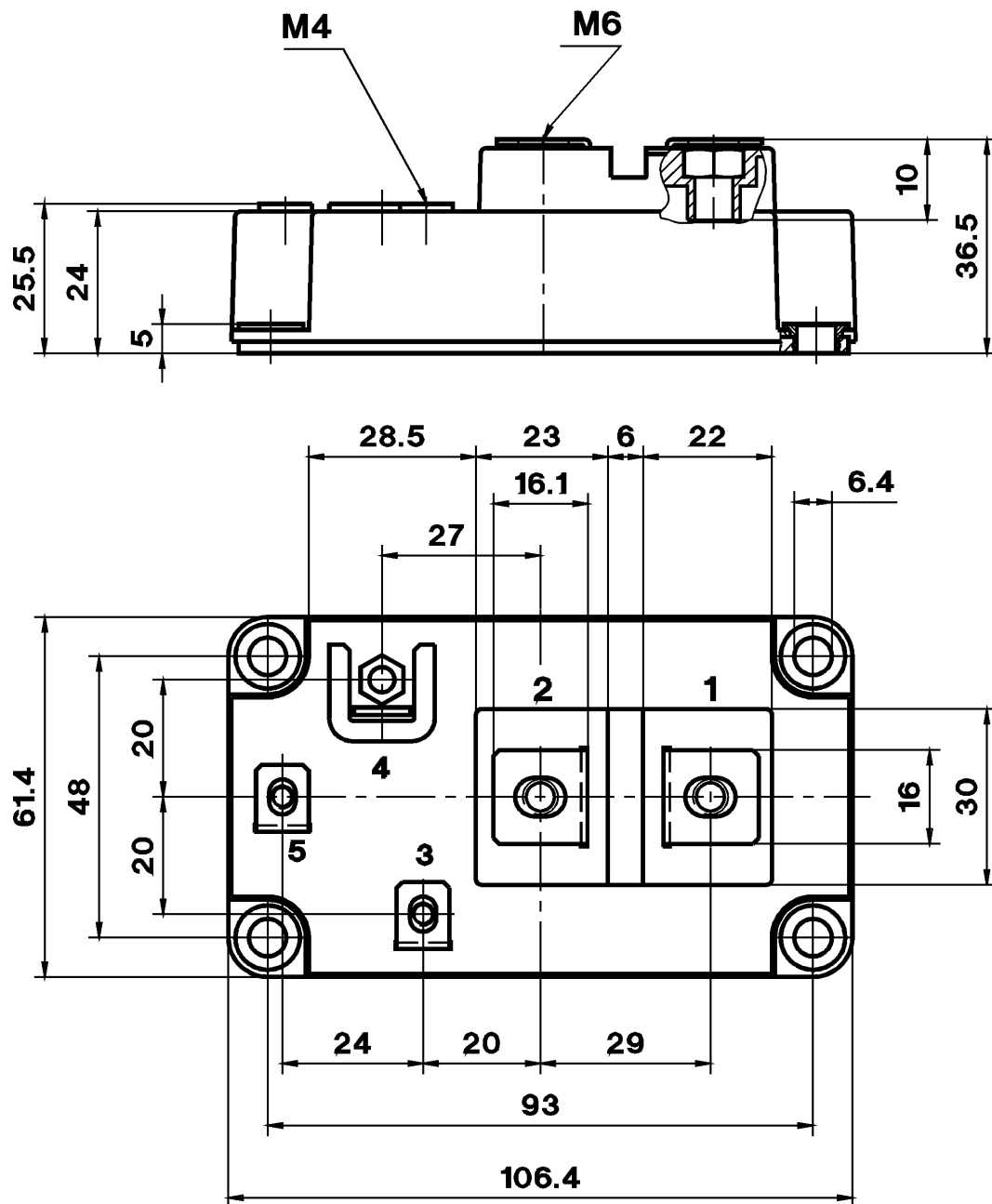
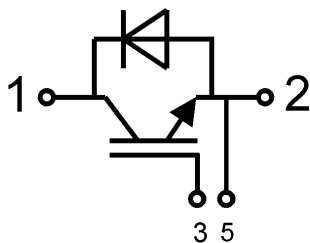


Fig. 6: Typ. gate charge characteristic





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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.