

SEMiX603GB12E4SiCp



SEMiX® 3p

Trench IGBT Modules

SEMiX603GB12E4SiCp

Features

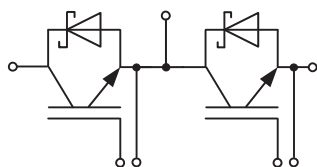
- With Silicon Carbide (SiC) Schottky diodes
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Press-fit pins as auxiliary contacts
- Thermally optimized ceramic
- UL recognized, file no. E63532

Typical Applications*

- AC inverter drives
- UPS
- Renewable energy systems

Remarks

- Product reliability results are valid for $T_j=150^\circ\text{C}$
- V_{isol} between temperature sensor and power section is only 2500V
- $R_{G\ off}$ must be at least 16Ω in case $V_{CC} \geq 900\text{V}$
- For storage and case temperature with TIM see document "TP(*) SEMiX 3p"



GB

Absolute Maximum Ratings

Symbol	Conditions	Values	Unit	
IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V	
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	1110	A
		$T_c = 80^\circ\text{C}$	853	A
I_{Cnom}		600	A	
I_{CRM}	$I_{CRM} = 2 \times I_{Cnom}$	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				
V_{RRM}	$T_j = 25^\circ\text{C}$	1200	V	
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	404	A
		$T_c = 80^\circ\text{C}$	306	A
I_{Fnom}		300	A	
I_{FRM}		900	A	
I_{FSM}	$t_p = 8.3\text{ms}$, $\sin 180^\circ$, $T_j = 25^\circ\text{C}$	994	A	
T_j		-40 ... 175	$^\circ\text{C}$	
Module				
$I_{t(RMS)}$		600	A	
T_{stg}	module without TIM	-40 ... 125	$^\circ\text{C}$	
V_{isol}	AC sinus 50Hz, $t = 1\text{min}$	4000	V	

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 600\text{A}$ $V_{GE} = 15\text{V}$ chipllevel	$T_j = 25^\circ\text{C}$	1.80	2.05	V
		$T_j = 150^\circ\text{C}$	2.03	2.30	V
V_{CE0}	chipllevel	$T_j = 25^\circ\text{C}$	0.87	1.01	V
		$T_j = 150^\circ\text{C}$	0.77	0.9	V
r_{CE}	$V_{GE} = 15\text{V}$ chipllevel	$T_j = 25^\circ\text{C}$	1.55	1.73	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	2.1	2.3	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}$, $I_C = 22.2\text{mA}$	5.3	5.8	6.3	V
I_{CES}	$V_{GE} = 0\text{V}$, $V_{CE} = 1200\text{V}$, $T_j = 25^\circ\text{C}$			5	mA
C_{ies}	$V_{CE} = 25\text{V}$ $V_{GE} = 0\text{V}$	$f = 1\text{MHz}$	37.5		nF
C_{oes}		$f = 1\text{MHz}$	2.31		nF
C_{res}		$f = 1\text{MHz}$	2.04		nF
Q_G	$V_{GE} = -8\text{V} \dots +15\text{V}$		3450		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		1.2		Ω
$t_{d(on)}$	$V_{CC} = 600\text{V}$ $I_C = 600\text{A}$	$T_j = 150^\circ\text{C}$	145		ns
t_r	$V_{GE} = +15/-15\text{V}$	$T_j = 150^\circ\text{C}$	68		ns
E_{on}	$R_{G\ on} = 1.1\Omega$	$T_j = 150^\circ\text{C}$	17		mJ
$t_{d(off)}$	$R_{G\ off} = 1.1\Omega$	$T_j = 150^\circ\text{C}$	520		ns
t_f	$di/dt_{on} = 7550\text{A}/\mu\text{s}$ $di/dt_{off} = 4220\text{A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	130		ns
E_{off}	$du/dt = 3450\text{V}/\mu\text{s}$ $L_s = 21\text{nH}$	$T_j = 150^\circ\text{C}$	72		mJ
$R_{th(j-c)}$	per IGBT			0.037	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease}=0.81\text{W}/(\text{m}^2\text{K})$)		0.035		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material		0.025		K/W

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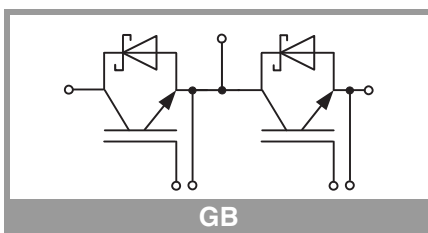
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 300\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		1.40	1.60	V
		$T_j = 150^\circ\text{C}$		1.80	2.10	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		0.95	1.05	V
		$T_j = 150^\circ\text{C}$		0.80	0.90	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		1.50	1.83	m Ω
		$T_j = 150^\circ\text{C}$		3.3	4.0	m Ω
C_j	parallel to C_{oss} , $f = 1\text{ MHz}$, $V_R = 800\text{ V}$, $T_j = 25^\circ\text{C}$			1.26		nF
Q_c	$V_R = 600\text{ V}$, $di/dt_{off} = 500\text{ A}/\mu\text{s}$, $T_j = 25^\circ\text{C}$			1.0		μC
$R_{th(j-c)}$	per diode				0.14	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)			0.08		K/W
$R_{th(c-s)}$	per Diode, pre-applied phase change material			0.065		K/W
Module						
L_{CE}				20		nH
R_{CC+EE}	measured per switch	$T_C = 25^\circ\text{C}$		1.2		m Ω
		$T_C = 125^\circ\text{C}$		1.65		m Ω
$R_{th(c-s)1}$	calculated without thermal coupling, ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)			0.012		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)			0.019		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module, pre-applied phase change material			0.015		K/W
M_s	to heat sink (M5)		3		6	Nm
M_t		to terminals (M6)	3		6	Nm
						Nm
w					350	g
Temperature Sensor						
R_{100}	$T_c=100^\circ\text{C}$ ($R_{25}=5\text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; $T[\text{K}]$;			$3550 \pm 2\%$		K



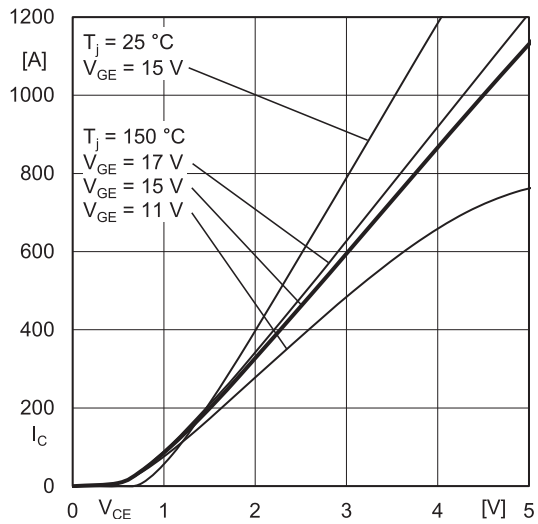


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

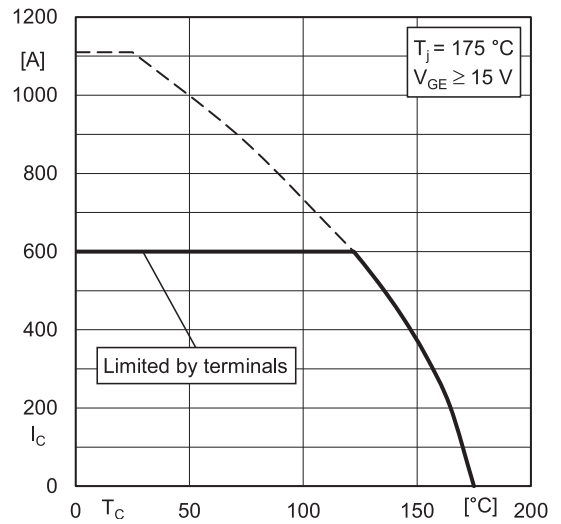


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

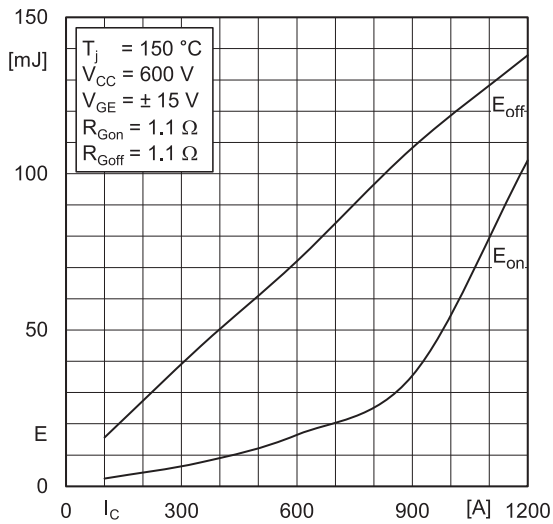


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

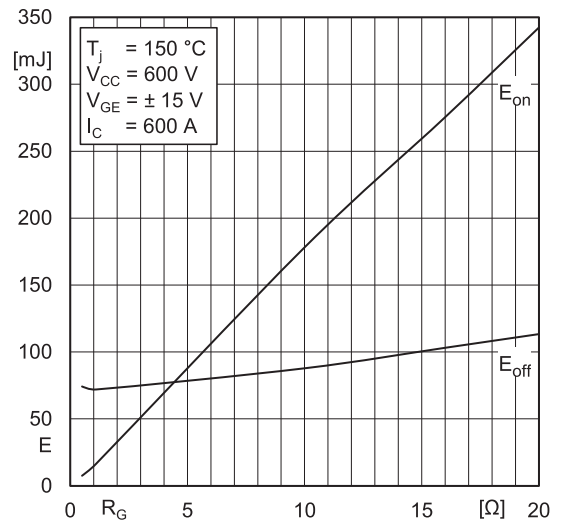


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

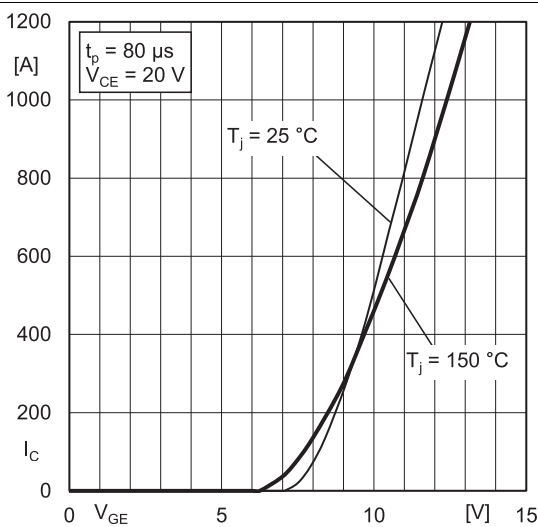


Fig. 5: Typ. transfer characteristic

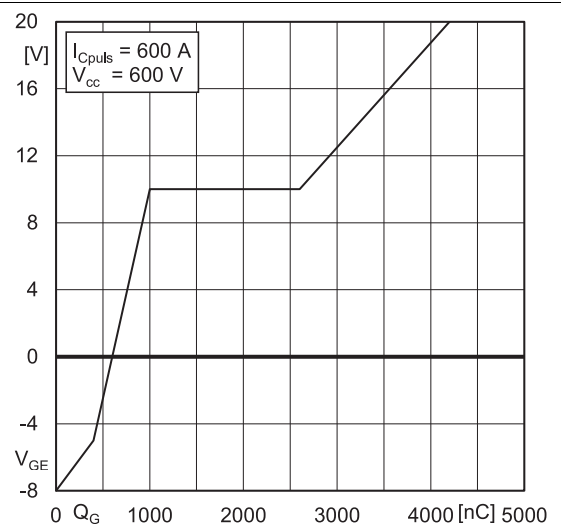


Fig. 6: Typ. gate charge characteristic

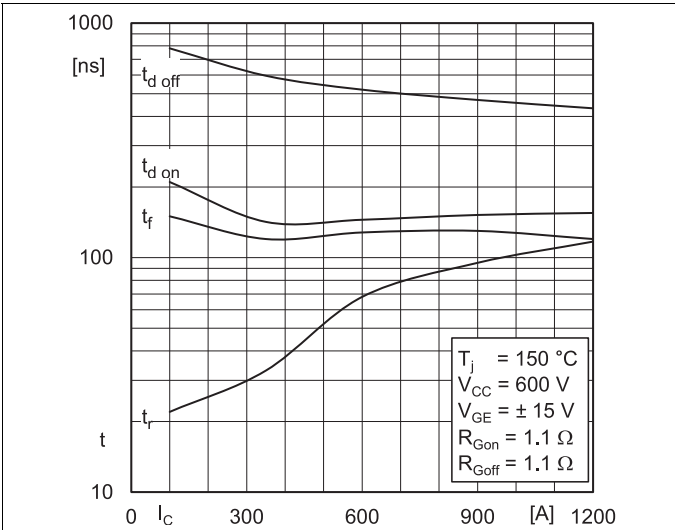


Fig. 7: Typ. switching times vs. I_C

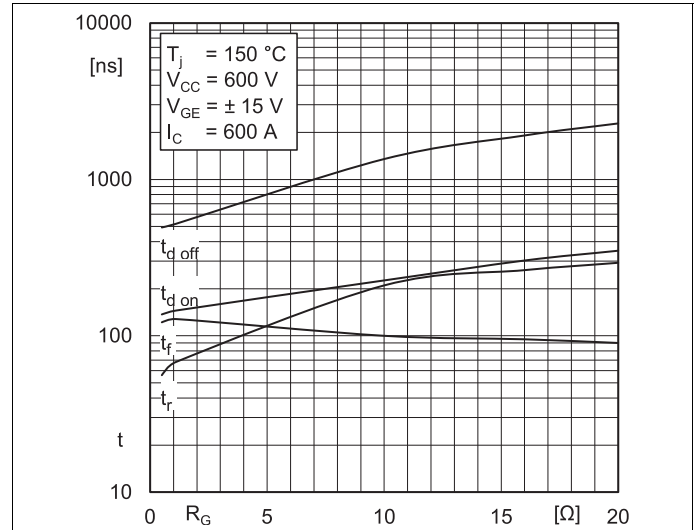


Fig. 8: Typ. switching times vs. gate resistor R_G

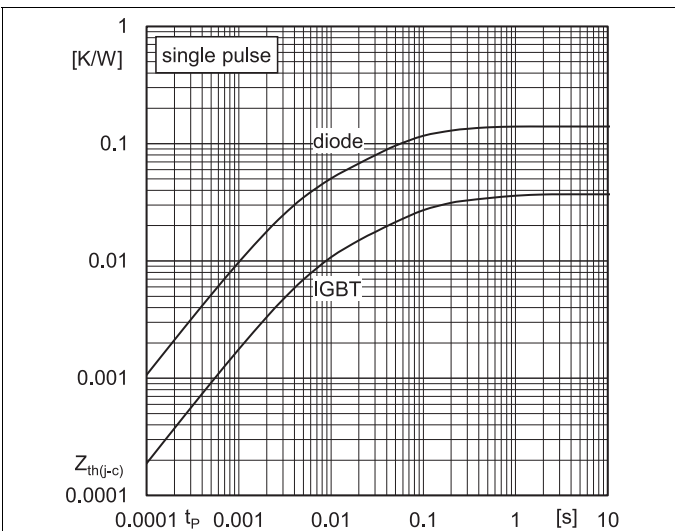


Fig. 9: Transient thermal impedance

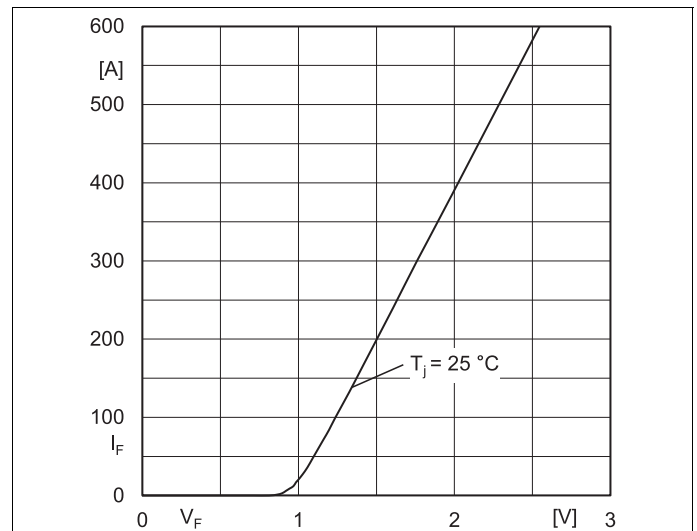


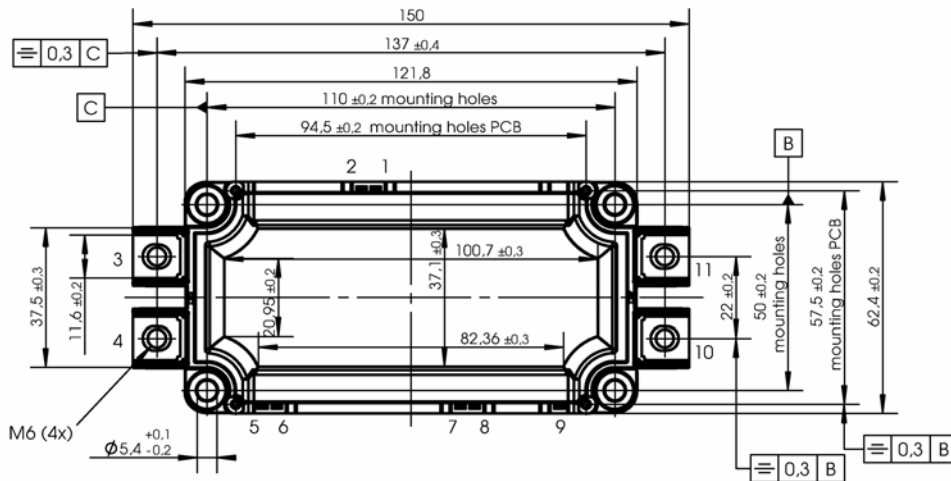
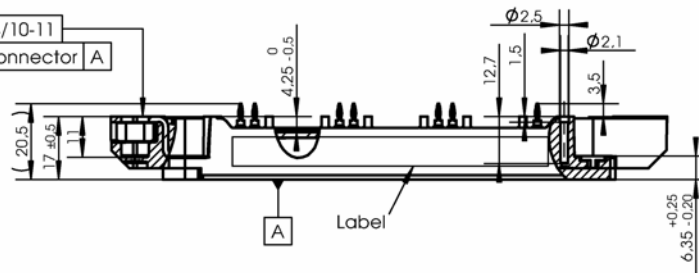


Fig. 10: Typ. diode forward charact., incl. R_{CC+EE}

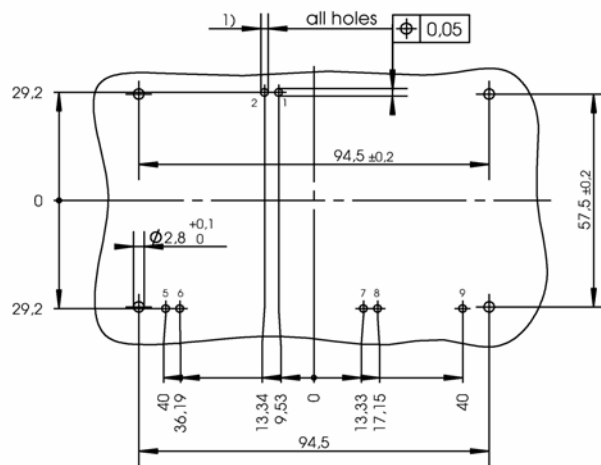
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Package outline

-  0,3 connector 3-4/10-11
-  0,2 each single connector A



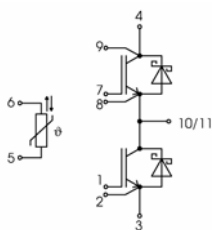
PCB drillhole pattern



Dimensions valid in mounted status

1) PCB hole specification see Mounting Instructions SEMiX press-fit

SEMiX 3p



pinout

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

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