

SEMiX453GM12E4p



Trench IGBT Modules

SEMiX453GM12E4p

Features

- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- UL recognized, file no. E63532

Typical Applications*

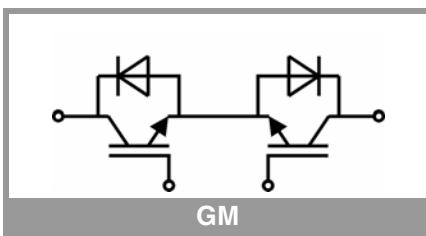
- AC inverter drives
- UPS
- Renewable energy systems

Remarks

- Product reliability results are valid for $T_j=150^\circ\text{C}$
- V_{isol} between temperature sensor and power section is only 2500V
- Pin #13 is not used in GM topology
- For storage and case temperature with TIM see document "TP(*) SEMiX 3p"

Absolute Maximum Ratings		Values	Unit
Symbol	Conditions		
IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V
I_C	$T_j = 175^\circ\text{C}$	678	A
	$T_c = 25^\circ\text{C}$	521	A
I_{Cnom}	$T_c = 80^\circ\text{C}$	450	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1350	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	10	μs
T_j		-40 ... 175	$^\circ\text{C}$
Inverse diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1200	V
I_F	$T_j = 175^\circ\text{C}$	544	A
	$T_c = 25^\circ\text{C}$	407	A
I_{Fnom}	$T_c = 80^\circ\text{C}$	450	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	1350	A
I_{FSM}	$t_p = 10\text{ ms, sin }180^\circ, T_j = 25^\circ\text{C}$	2430	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

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	1.80	2.05	2.40	V
	$T_j = 25^\circ\text{C}$	2.19	2.40		
V_{CE0}	chiplevel	0.8	0.9	0.9	V
	$T_j = 150^\circ\text{C}$	0.7	0.8	0.8	
r_{CE}	$V_{GE} = 15\text{ V}$ chiplevel	2.2	2.6	2.6	$\text{m}\Omega$
	$T_j = 25^\circ\text{C}$	3.3	3.6	3.6	
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 18\text{ mA}$	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
C_{ies}	$V_{CE} = 25\text{ V}$	27.9			nF
C_{oes}	$V_{GE} = 0\text{ V}$	1.74			nF
C_{res}	$f = 1\text{ MHz}$	1.53			nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$	2550			nC
R_{Gint}	$T_j = 25^\circ\text{C}$	1.7			Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	155			ns
t_r	$I_C = 450\text{ A}$	80			ns
E_{on}	$V_{GE} = +15/-15\text{ V}$	11			mJ
$t_{d(off)}$	$R_{G\text{ on}} = 1.1\text{ }\Omega$	510			ns
t_f	$R_{G\text{ off}} = 1.1\text{ }\Omega$	120			ns
	$di/dt_{on} = 4600\text{ A}/\mu\text{s}$				
	$di/dt_{off} = 2500\text{ A}/\mu\text{s}$				
	$du/dt = 3500\text{ V}/\mu\text{s}$				
E_{off}	$L_s = 21\text{ nH}$	66			mJ
$R_{th(j-c)}$	per IGBT		0.066		K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^*\text{K})$)	0.03			K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material	0.021			K/W





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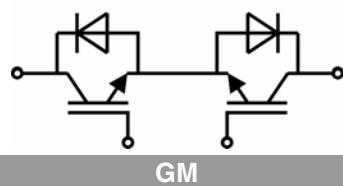
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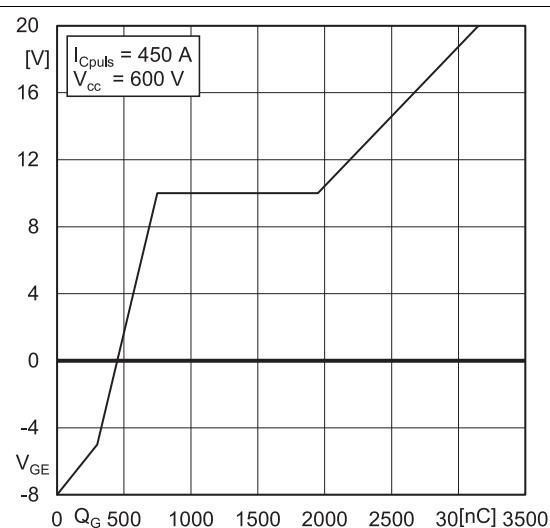
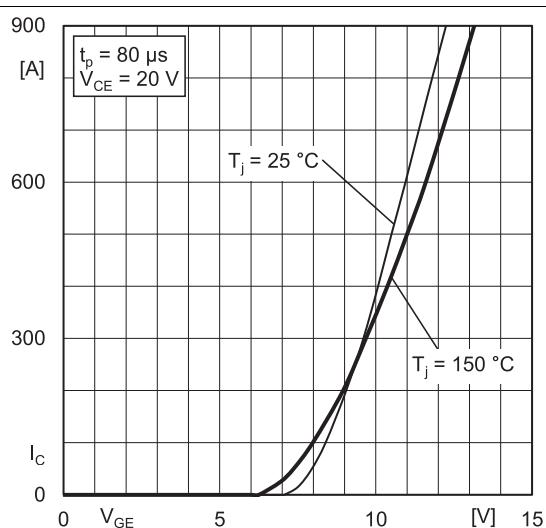
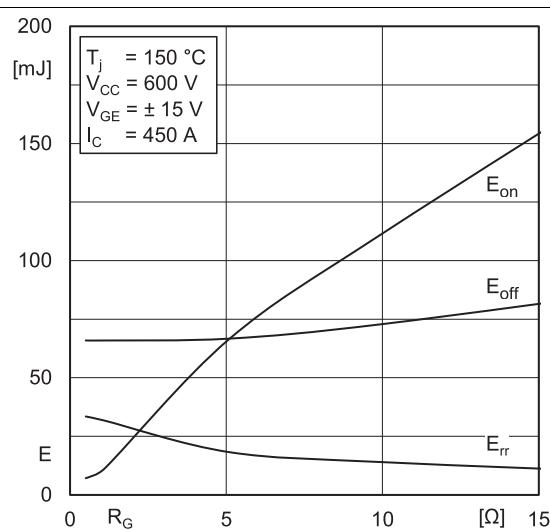
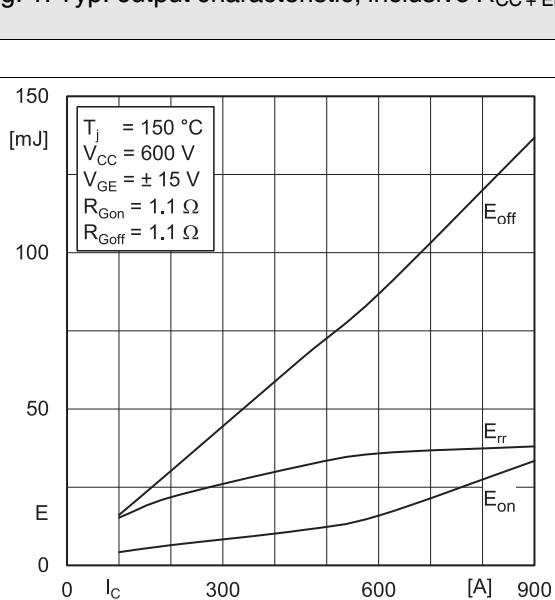
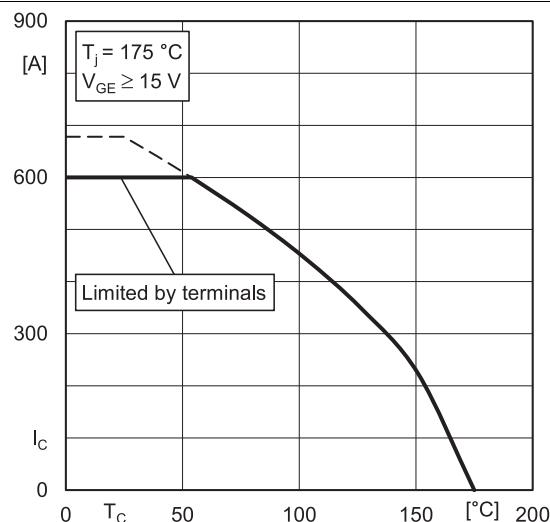
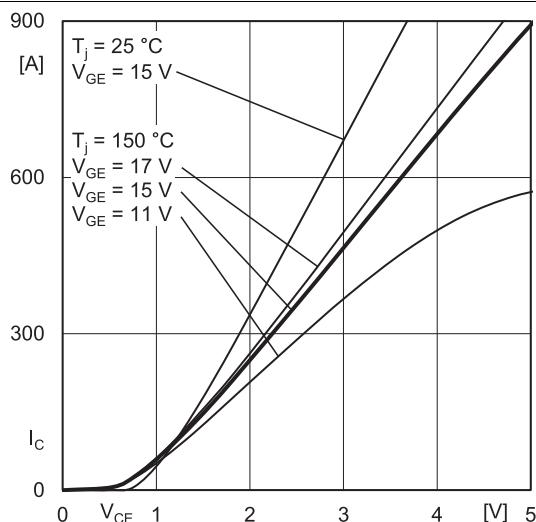
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Characteristics		Symbol	Conditions	min.	typ.	max.	Unit						
Inverse diode													
$V_F = V_{EC}$	$I_F = 450 \text{ A}$		$T_j = 25^\circ\text{C}$		2.14	2.46	V						
	$V_{GE} = 0 \text{ V}$ chiplevel		$T_j = 150^\circ\text{C}$			2.07	2.38						
V_{FO}	chiplevel		$T_j = 25^\circ\text{C}$		1.30	1.50	V						
			$T_j = 150^\circ\text{C}$			0.90	1.10						
r_F	chiplevel		$T_j = 25^\circ\text{C}$		1.87	2.1	$\text{m}\Omega$						
			$T_j = 150^\circ\text{C}$			2.6	2.8						
I_{RRM}	$I_F = 450 \text{ A}$		$T_j = 150^\circ\text{C}$		390		A						
	$dI/dt_{\text{off}} = 4900 \text{ A}/\mu\text{s}$		$T_j = 150^\circ\text{C}$			64	μC						
Q_{rr}	$V_{GE} = -15 \text{ V}$		$T_j = 150^\circ\text{C}$		32		mJ						
			$V_{CC} = 600 \text{ V}$			0.11							
$R_{th(j-c)}$	per diode				0.045		K/W						
	per diode ($\lambda_{\text{grease}}=0.81 \text{ W}/(\text{m}^\circ\text{K})$)												
$R_{th(c-s)}$	per diode, pre-applied phase change material				0.036		K/W						
Module													
L_{CE}					20		nH						
$R_{CC' + EE'}$	measured per switch		$T_C = 25^\circ\text{C}$		1.2		$\text{m}\Omega$						
			$T_C = 125^\circ\text{C}$		1.65								
$R_{th(c-s)1}$	calculated without thermal coupling				0.009		K/W						
	including thermal coupling, Ts underneath module ($\lambda_{\text{grease}}=0.81 \text{ W}/(\text{m}^\circ\text{K})$)				0.014								
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module, pre-applied phase change material				0.011		K/W						
					3	6	Nm						
M_s	to heat sink (M5)				3								
			to terminals (M6)		3	6	Nm						
M_t					3								
					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						





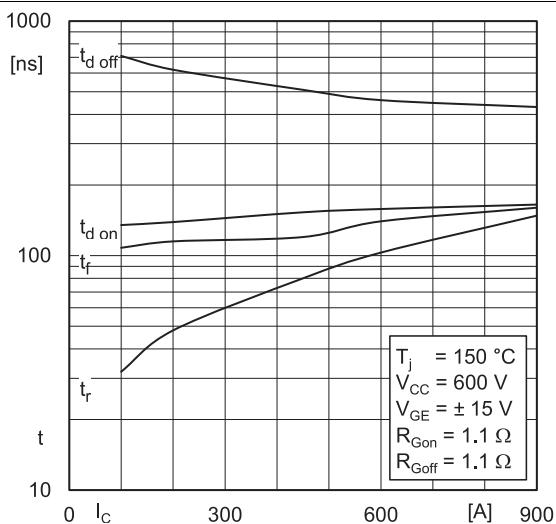


Fig. 7: Typ. switching times vs. I_C

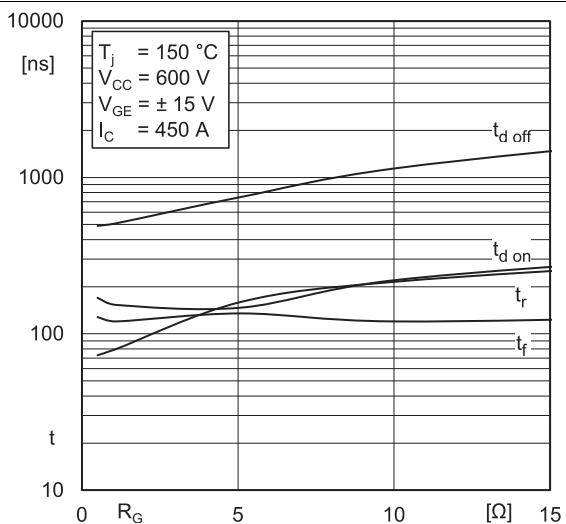


Fig. 8: Typ. switching times vs. gate resistor R_G

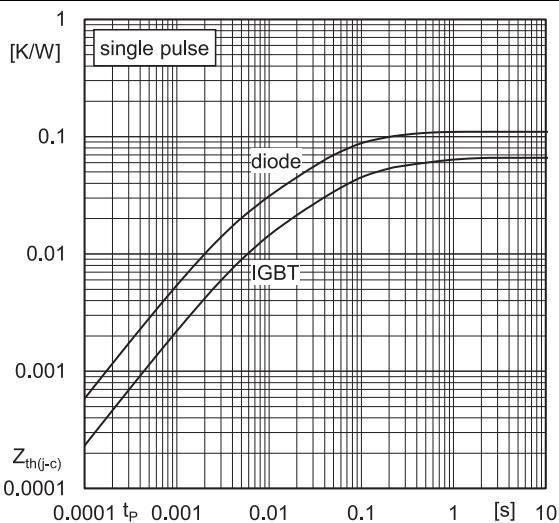


Fig. 9: Transient thermal impedance

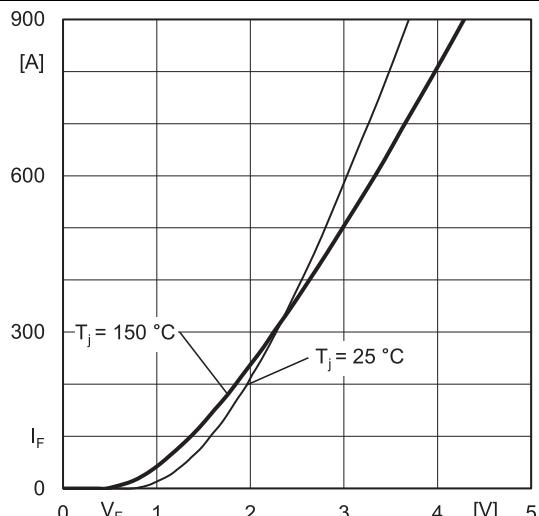


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC' + EE'}$

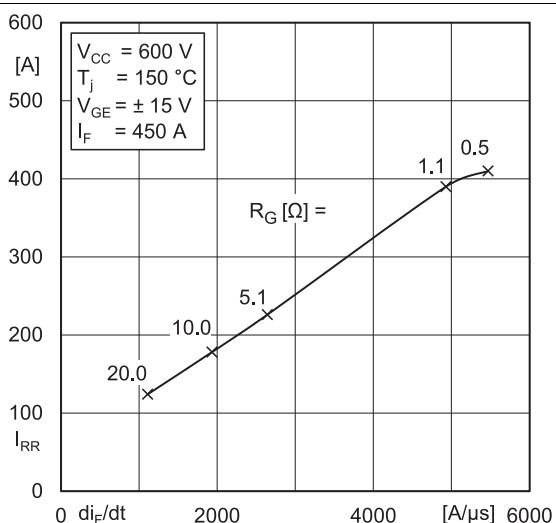


Fig. 11: Typ. CAL diode peak reverse recovery current

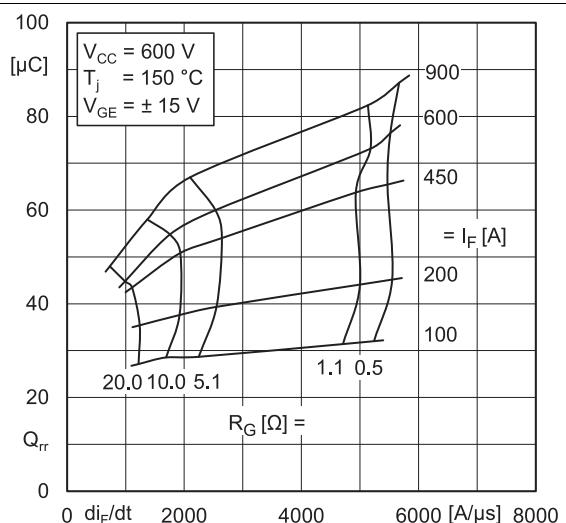
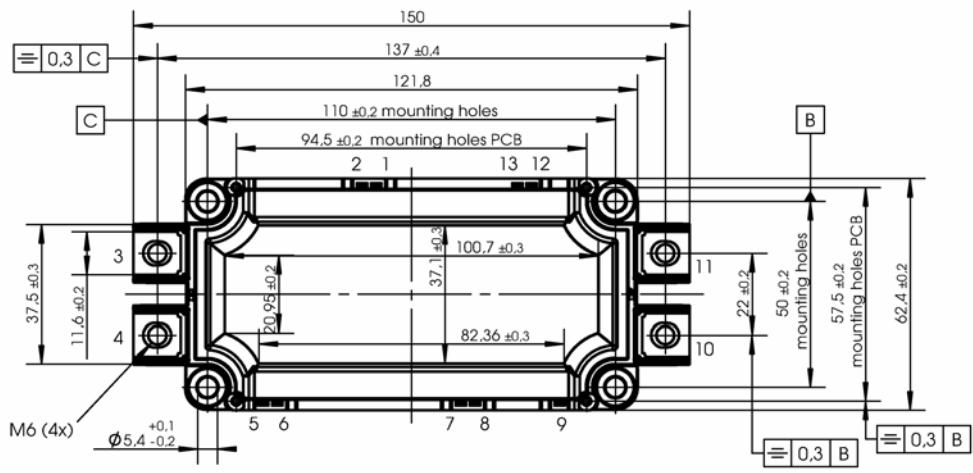
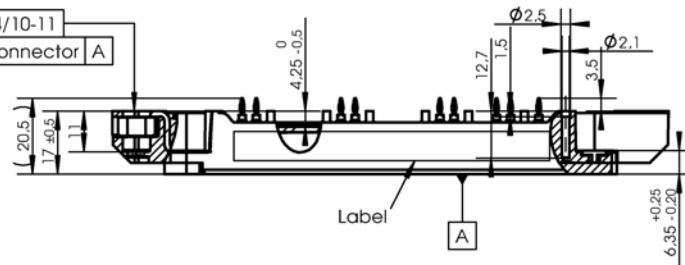


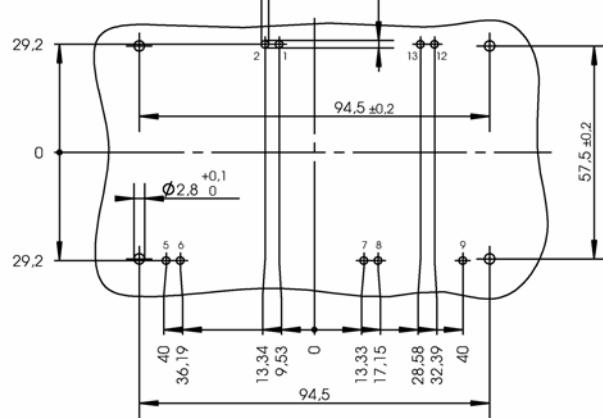
Fig. 12: Typ. CAL diode recovery charge

Package outline

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



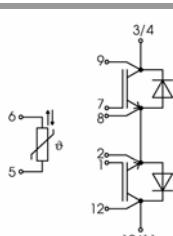
PCB drillhole pattern



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

Dimensions valid in mounted status

SEMiX 3p



pinout

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

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