

SEMiX603GAL12E4p



SEMiX® 3p

Trench IGBT Modules

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Features

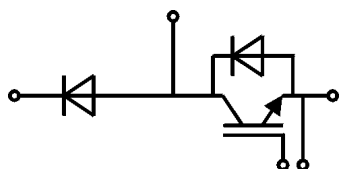
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- Thermally optimized ceramic
- UL recognized, file no. E63532

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
- For storage and case temperature with TIM see document "TP(*) SEMiX 3p"



GAL

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	T _j = 175 °C	T _c = 25 °C	1110	A
		T _c = 80 °C	853	A
I _{Cnom}			600	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		1800	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	µs
T _j			-40 ... 175	°C
Inverse diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 175 °C	T _c = 25 °C	856	A
		T _c = 80 °C	640	A
I _{Fnom}			600	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		1200	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		3456	A
T _j			-40 ... 175	°C
Freewheeling diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 175 °C	T _c = 25 °C	856	A
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T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			600	A
T _{stg}	module without TIM		-40 ... 125	°C
V _{isol}	AC sinus 50Hz, t = 1 min		4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 600\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.80	2.05	V
		$T_j = 150^\circ\text{C}$	2.03	2.30	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	0.87	1.01	V
		$T_j = 150^\circ\text{C}$	0.77	0.9	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	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



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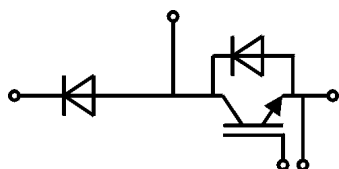
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C		160		ns
t _r	I _C = 600 A	T _j = 150 °C		80		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		59		mJ
t _{d(off)}	R _{G on} = 1.5 Ω	T _j = 150 °C		540		ns
t _f	R _{G off} = 1.5 Ω	T _j = 150 °C		130		ns
E _{off}	di/dt _{on} = 7270 A/μs du/dt = 3500 V/μs L _s = 21 nH	T _j = 150 °C		76		mJ
R _{th(j-c)}	per IGBT				0.037	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.035		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.025		K/W
Inverse diode						
V _F = V _{EC}	I _F = 600 A	T _j = 25 °C		2.08	2.44	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.08	2.34	V
V _{F0}	chiplevel	T _j = 25 °C		1.39	1.59	V
		T _j = 150 °C		1.08	1.18	V
r _F	chiplevel	T _j = 25 °C		1.16	1.42	mΩ
		T _j = 150 °C		1.67	1.93	mΩ
I _{RRM}	I _F = 600 A	T _j = 150 °C		480		A
Q _{rr}	di/dt _{off} = 6880 A/μs	T _j = 150 °C		90		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C		33		mJ
R _{th(j-c)}	per diode				0.065	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.039		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.031		K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 600 A	T _j = 25 °C		2.08	2.44	V
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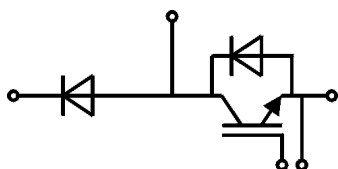
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Symbol	Conditions	min.	typ.	max.	Unit
Module					
L_{CE}			20		nH
$R_{CC'+EE'}$	measured per switch	$T_C = 25^\circ\text{C}$	1.2		mΩ
		$T_C = 125^\circ\text{C}$	1.65		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling		0.009		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module ($\lambda_{grease}=0.81\text{ W/(m}^2\text{K)}$)		0.014		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module, pre-applied phase change material		0.011		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[K];		$3550 \pm 2\%$		K



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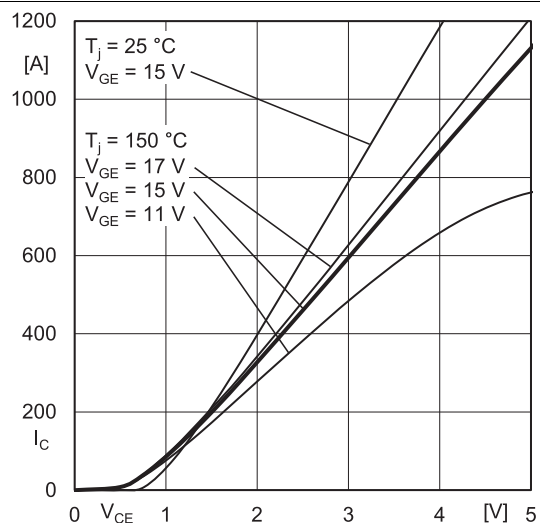


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_E'$

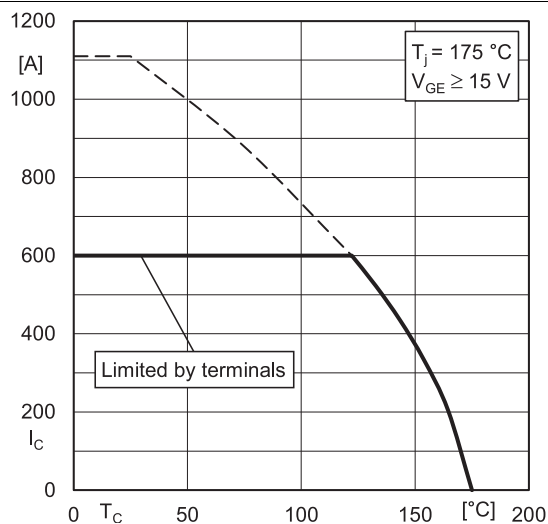


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

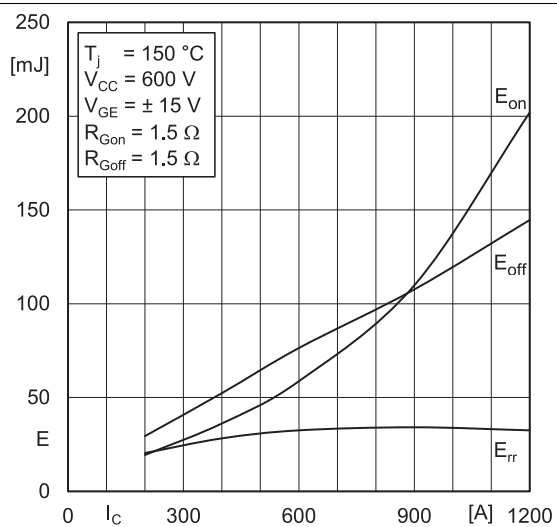


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

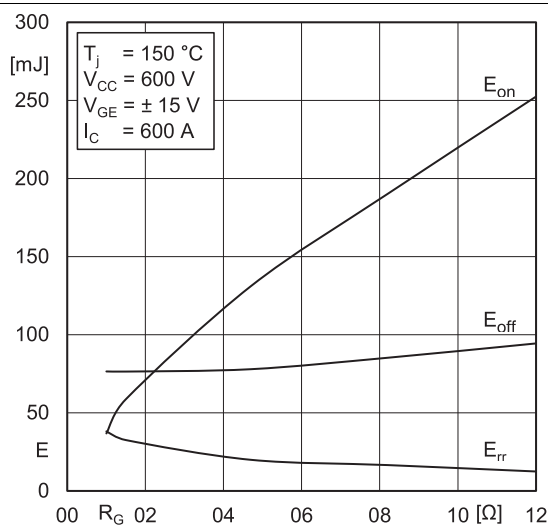


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

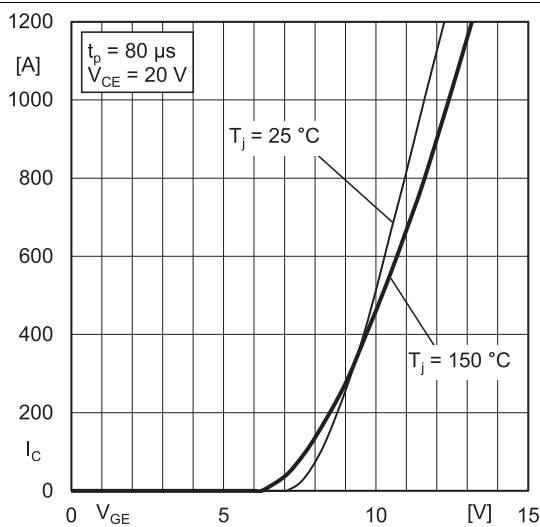


Fig. 5: Typ. transfer characteristic

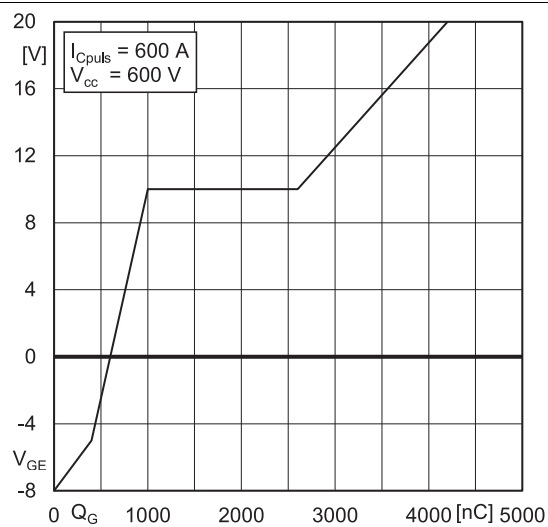


Fig. 6: Typ. gate charge characteristic

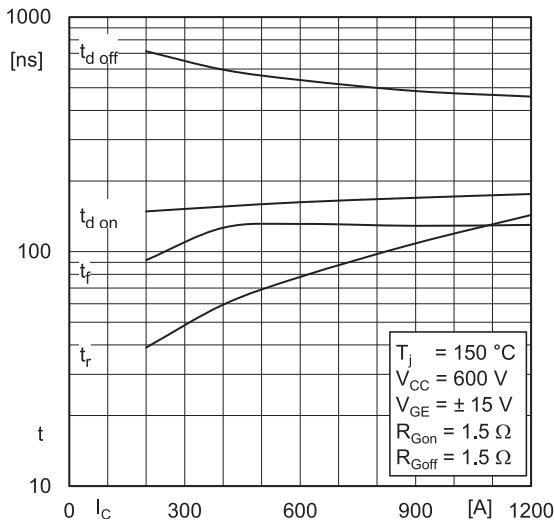


Fig. 7: Typ. switching times vs. I_C

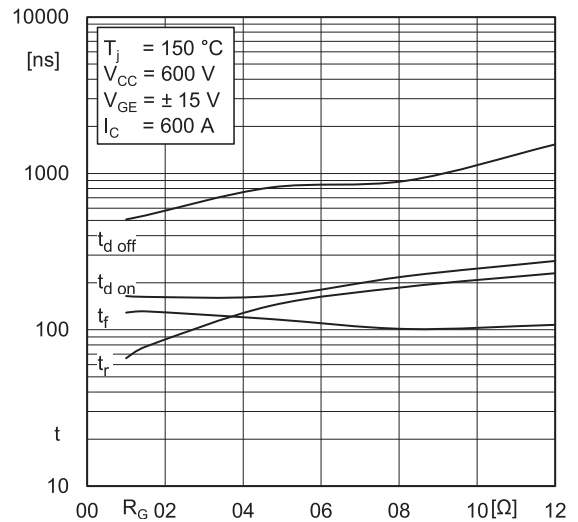


Fig. 8: Typ. switching times vs. gate resistor R_G

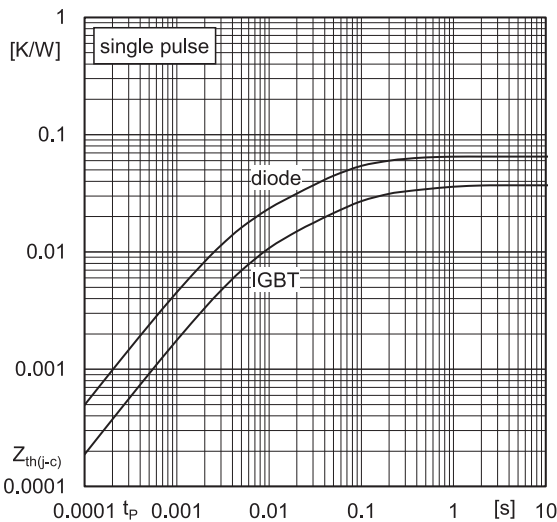


Fig. 9: Transient thermal impedance

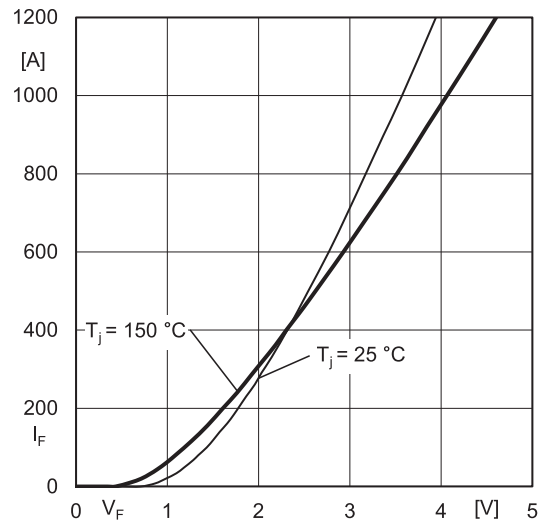


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

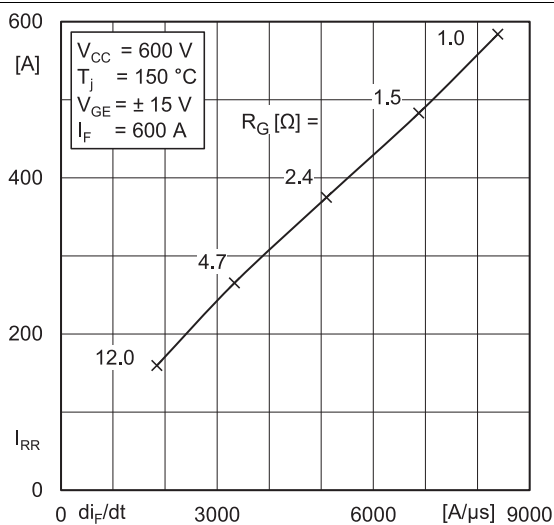


Fig. 11: Typ. CAL diode peak reverse recovery current

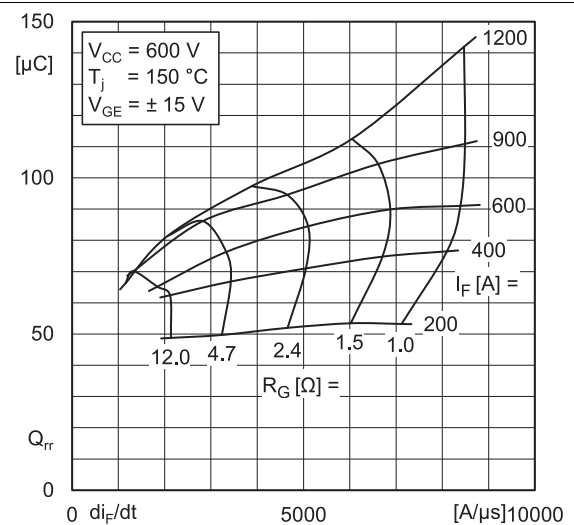
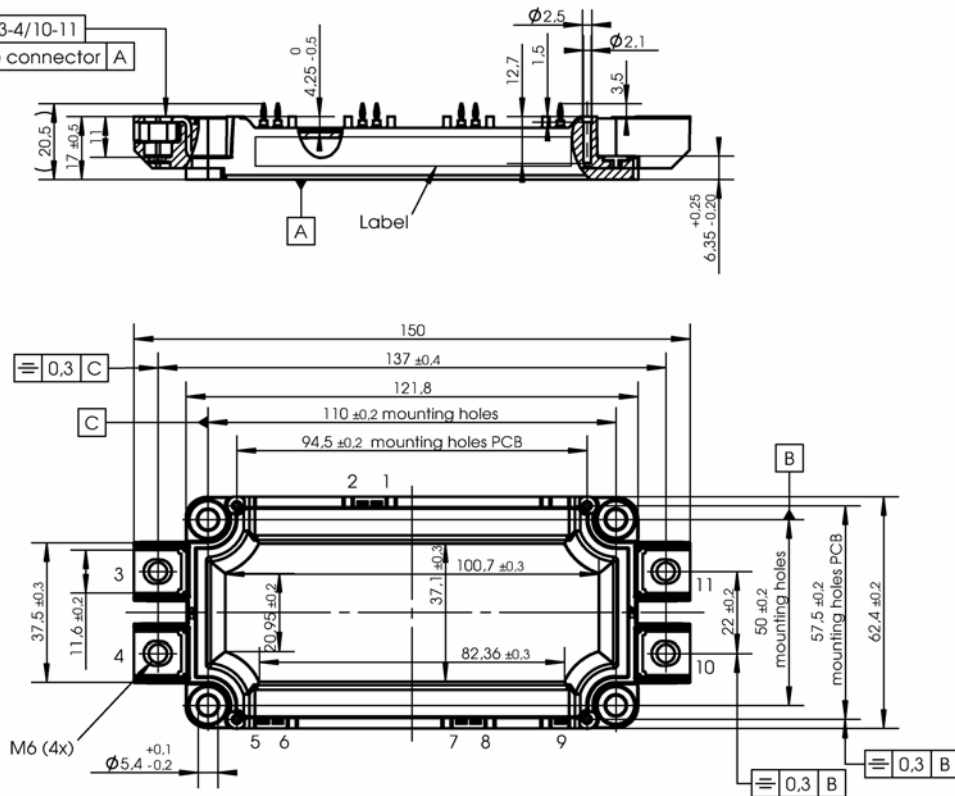


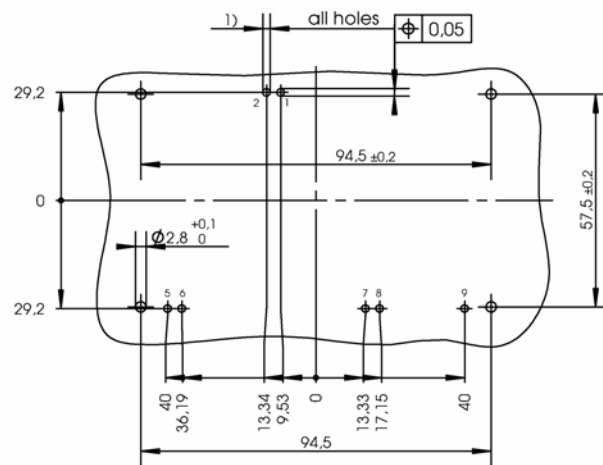
Fig. 12: Typ. CAL diode recovery charge

Package outline

	0.3 connector 3-4/10-11
	0.2 each single connector A



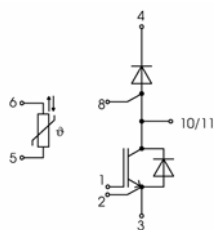
PCB drillhole pattern



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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