SEMiX® 5

Trench IGBT Modules

Engineering Sample

SEMiX305GARL07E3

Target Data

Features

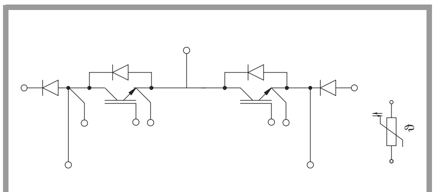
- Solderless assembling solution with PressFIT signal pins and screw power terminals
- IGBT Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Typical Applications*

- UPS
- 3 Level Inverters

Remarks

- Case temperature limited to T_C=125°C max.
- Product reliability results are valid for T_{jop}=150°C
- Dynamic data are estimated
- For storage and case temperature with TIM see document “TP(HALA P8) SEMiX 5p”



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	T_j = 25 °C		650	V
I_C	T_j = 175 °C	T_c = 25 °C	353	A
		T_c = 80 °C	265	A
I_{Cnom}			300	A
I_{CRM}	I_{CRM} = 3xI_{Cnom}		900	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V V_{GE} ≤ 15 V V_{CES} ≤ 650 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Inverse diode				
V_{RRM}	T_j = 25 °C		650	V
I_F	T_j = 175 °C	T_c = 25 °C	86	A
		T_c = 80 °C	64	A
I_{Fnom}			50	A
I_{FRM}	I_{FRM} = 2xI_{Fnom}		100	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		550	A
T_j			-40 ... 175	°C
Freewheeling diode				
V_{RRM}	T_j = 25 °C		650	V
I_F	T_j = 175 °C	T_c = 25 °C	355	A
		T_c = 80 °C	259	A
I_{Fnom}			300	A
I_{FRM}	I_{FRM} = 2xI_{Fnom}		600	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		2160	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			400	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 = 300 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.45	1.90	V
		T_j = 150 °C		1.69	2.10	V
V_{CE0}	chiplevel	T_j = 25 °C		0.90	1.00	V
		T_j = 150 °C		0.82	0.90	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.83	3.0	mΩ
		T_j = 150 °C		2.9	4.0	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 4.8 mA		5.1	5.8	6.4	V
I_{CES}	V_{GE} = 0 V V_{CE} = 650 V	T_j = 25 °C		0.10	0.3	mA
		T_j = 150 °C		-		mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		18.5		nF
C_{oes}		f = 1 MHz		1.16		nF
C_{res}		f = 1 MHz		0.55		nF
Q_G	V_{GE} = - 15 V...+ 15 V			3940		nC
R_{Gint}	T_j = 25 °C			1.0		Ω

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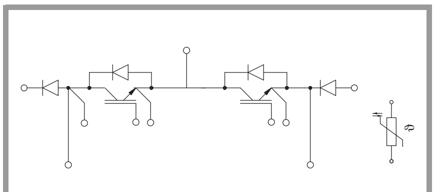

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$t_{d(on)}$	V_{CC} = 300 V	T_j = 150 °C		220		ns
t_r	I_C = 300 A	T_j = 150 °C		220		ns
E_{on}	V_{GE} = +15/-15 V $R_{G\ on}$ = 13 Ω	T_j = 150 °C		21.3		mJ
$t_{d(off)}$	$R_{G\ off}$ = 13 Ω	T_j = 150 °C		1120		ns
t_f	di/dt$_{on}$ = 2038 A/µs	T_j = 150 °C		103		ns
E_{off}	di/dt$_{off}$ = 3960 A/µs du/dt = 3052 V/µs	T_j = 150 °C		21.3		mJ
$R_{th(j-c)}$	per IGBT				0.18	K/W
$R_{th(c-s)}$	per IGBT (λgrease=0.81 W/mK, thickness 50-100µm)			0.066		K/W
$R_{th(c-s)}$	per IGBT (λ=3.4 W/mK)			t.b.d.		K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 50 A	T_j = 25 °C		1.37	1.73	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		1.35	1.72	V
V_{F0}	chiplevel	T_j = 25 °C		1.04	1.24	V
		T_j = 150 °C		0.85	0.99	V
r_F	chiplevel	T_j = 25 °C		6.7	9.8	mΩ
		T_j = 150 °C		10	15	mΩ
I_{RRM}	I_F = 50 A	T_j = 150 °C		-		A
Q_{rr}		T_j = 150 °C		-		µC
E_{rr}	V_{CC} = 300 V	T_j = 150 °C				mJ
$R_{th(j-c)}$	per diode				0.81	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/mK, thickness 50-100µm)			0.082		K/W
$R_{th(c-s)}$	per diode (λ=3.4 W/mK)			t.b.d.		K/W
Freewheeling diode						
$V_F = V_{EC}$	I_F = 300 A	T_j = 25 °C		1.40	1.76	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		1.39	1.77	V
V_{F0}	chiplevel	T_j = 25 °C		1.04	1.236	V
		T_j = 150 °C		0.85	0.99	V
r_F	chiplevel	T_j = 25 °C		1.19	1.76	mΩ
		T_j = 150 °C		1.79	2.6	mΩ
I_{RRM}	I_F = 300 A	T_j = 150 °C		141.4		A
Q_{rr}	di/dt$_{off}$ = 2038 A/µs	T_j = 150 °C		28		µC
E_{rr}	V_{CC} = 300 V	T_j = 150 °C		4.7		mJ
$R_{th(j-c)}$	per diode				0.23	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/mK, thickness 50-100µm)			0.076		K/W
$R_{th(c-s)}$	per diode (λ=3.4 W/mK)			t.b.d.		K/W

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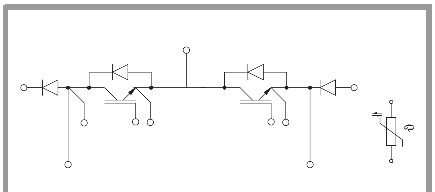

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Module						
L_{CE}				30		nH
$R_{CC'+EE'}$	measured per switch	T_C = 25 °C		0.8		mΩ
		T_C = 125 °C		1.1		mΩ
$Rth_{(c-s)1}$	calculated without thermal coupling			0.018		K/W
$Rth_{(c-s)2}$	including thermal coupling, Ts underneath module (λ_{grease}=0.81 W/(m*K))			t.b.d.		K/W
$Rth_{(c-s)2}$	including thermal coupling, Ts underneath module, pre-applied phase change material			t.b.d.		K/W
M_s	to heat sink (M5)		3		6	Nm
M_t		to terminals (M6)	3		6	Nm
						Nm
w				398		g
Temperature Sensor						
R_{100}	T_c=100°C (R_{25}=5 kΩ)			493 ± 5%		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; T[K];			3550 ±2%		K

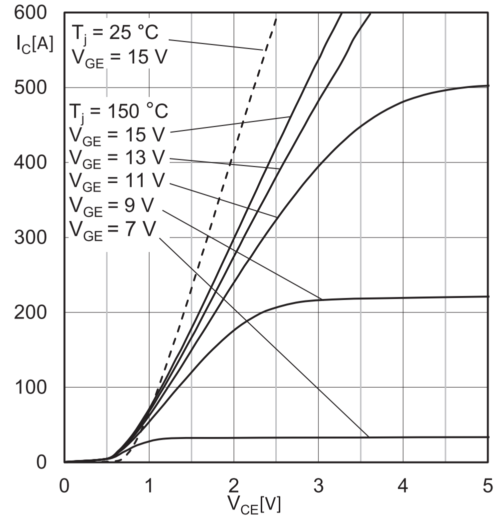


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

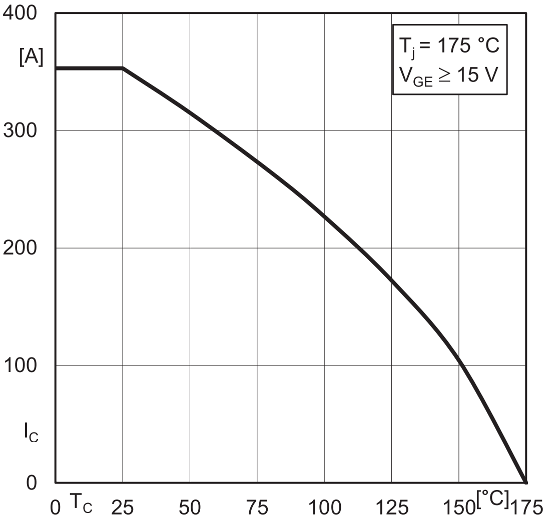


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

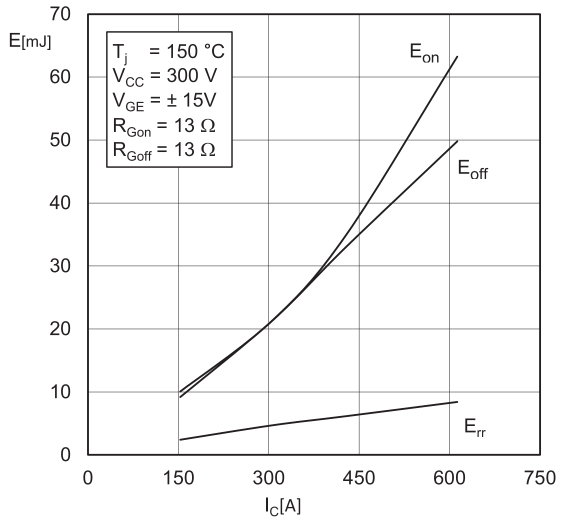


Fig. 3: Typ. turn-on /-off energy = f (I_C)

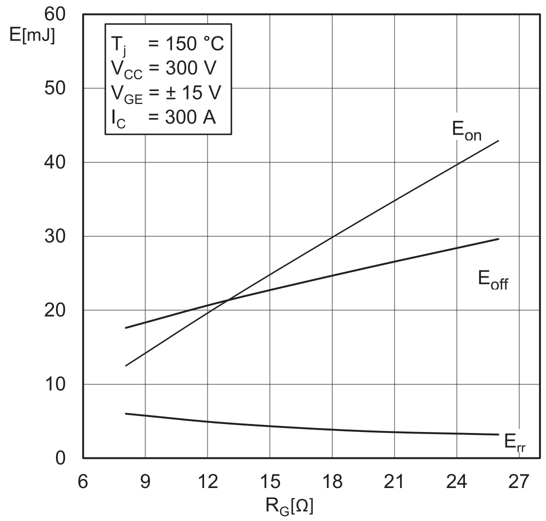


Fig. 4: Typ. turn-on /-off energy = f (R_G)

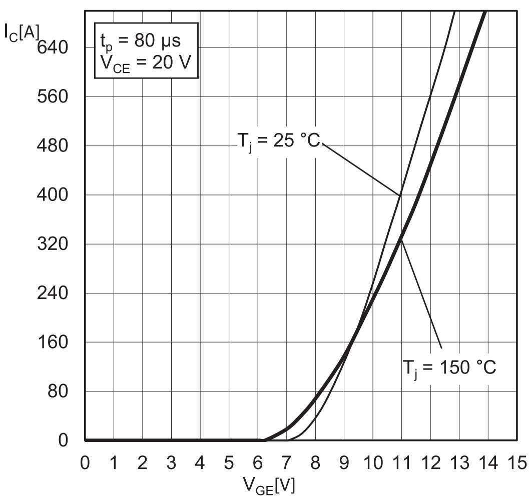


Fig. 5: Typ. transfer characteristic

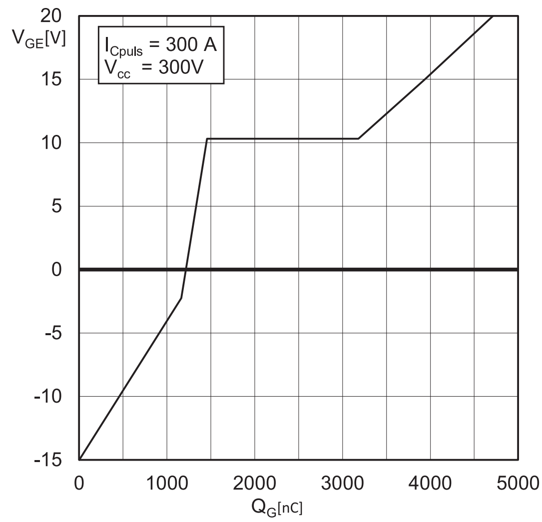


Fig. 6: Typ. gate charge characteristic

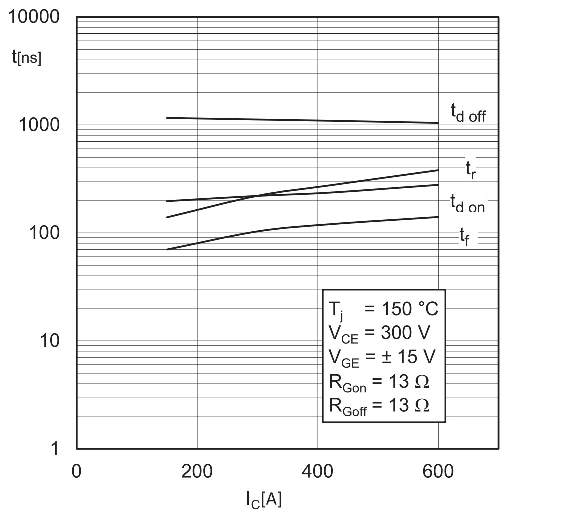


Fig. 7: Typ. switching times vs. I_C

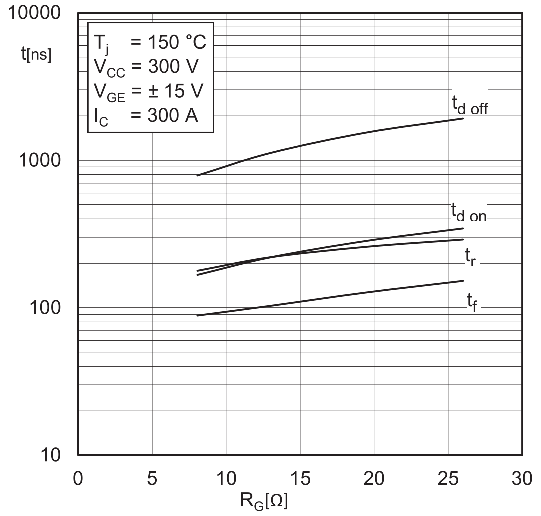


Fig. 8: Typ. switching times vs. gate resistor R_G

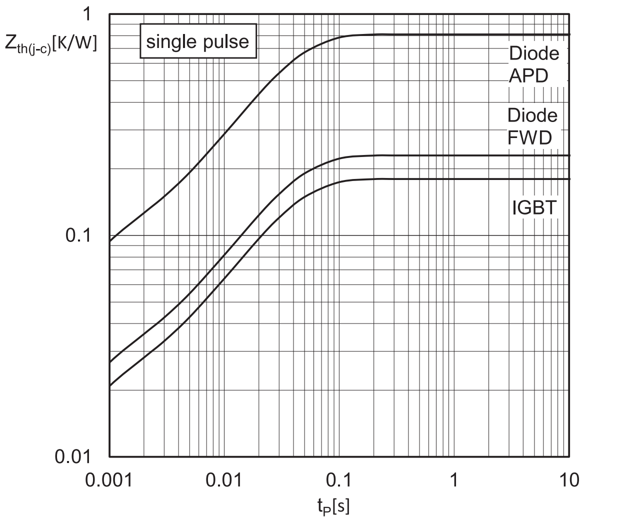


Fig. 9: Transient thermal impedance

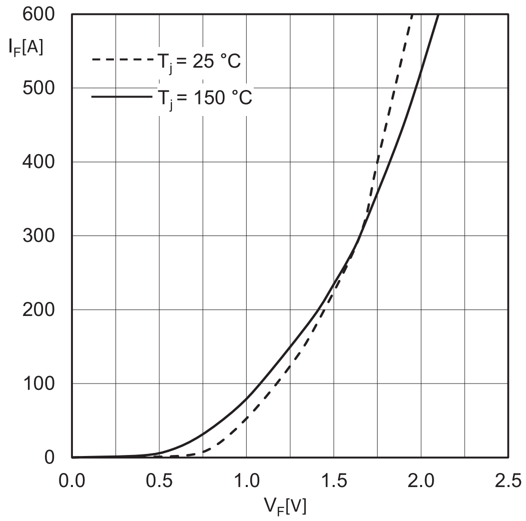


Fig.10: Typ. FWD diode forward characteristic, incl. $R_{CC' + EE'}$

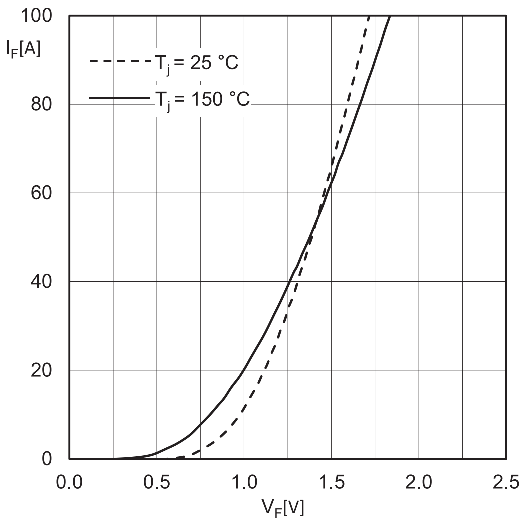
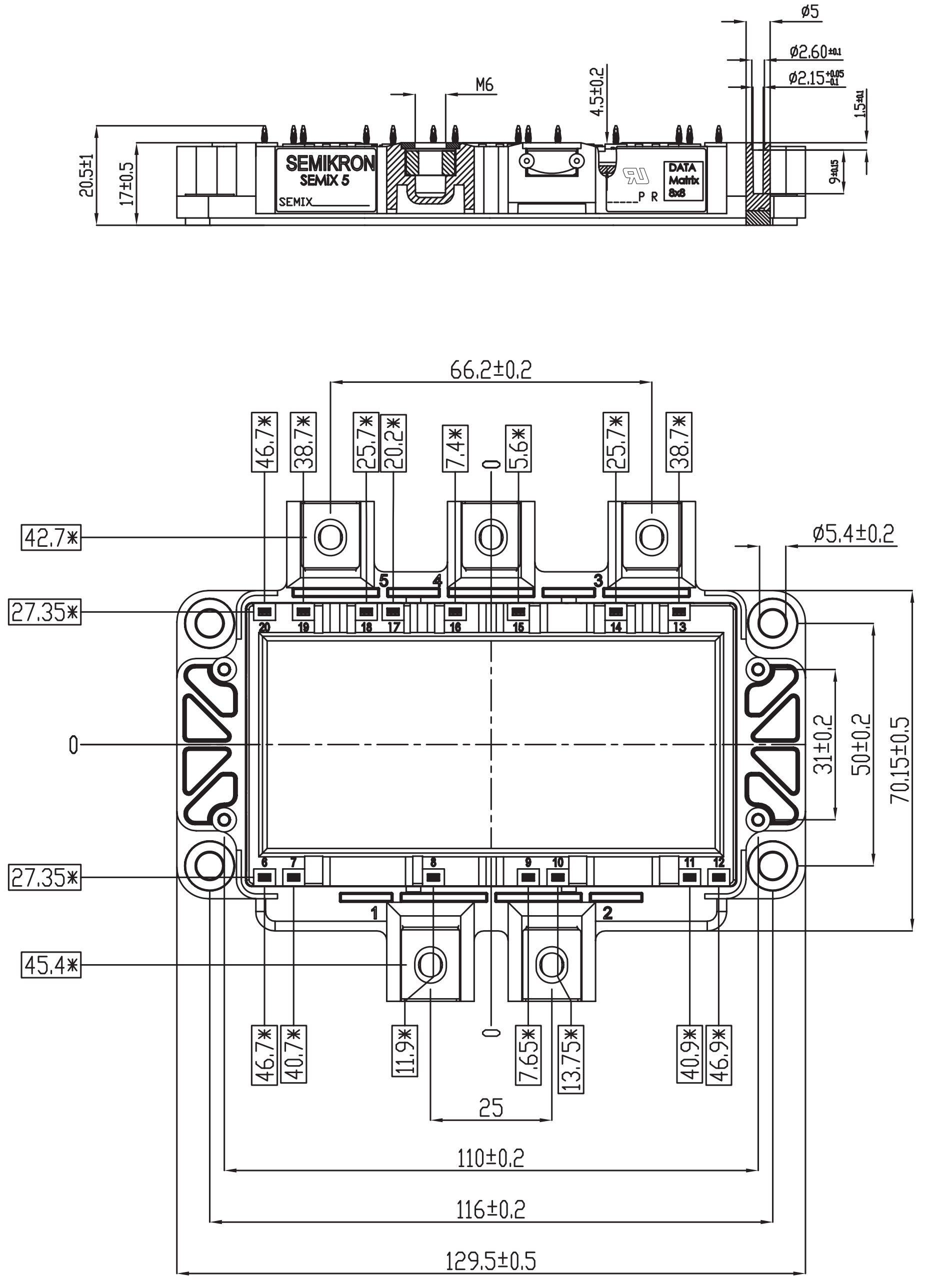


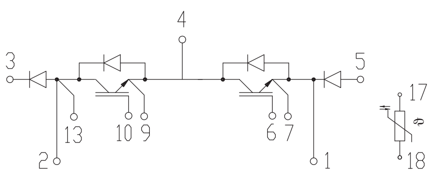
Fig. 11: Typ. inv. diode forward charact., incl. $R_{CC'+ EE'}$



* = All dimension with tolerance of ⌖ Ø 0.4

For technical details please refer to SEMiX(R)5 Mounting Instruction

SEMiX5p



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

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