SEMiX® 5

Trench IGBT Modules

SEMiX205GD12E4

Features

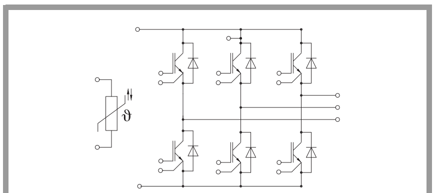
- Solderless assembly solution with PressFIT signal pins and screw power terminals
- IGBT 4 Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and robust internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Product reliability results are valid for T_{jop}=150°C
- Please refere to SEMiX®5 Technical Explanations for mounting conditions
- 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		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	313	A
		T_c = 80 °C	239	A
I_{Cnom}			200	A
I_{CRM}	$I_{CRM} = 3xI_{Cnom}$		600	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 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	224	A
		T_c = 80 °C	167	A
I_{Fnom}			200	A
I_{FRM}	$I_{FRM} = 2xI_{Fnom}$		400	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		990	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			300	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 = 200 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.80	2.05	V
		T_j = 150 °C		2.05	2.30	V
V_{CE0}	chiplevel	T_j = 25 °C		0.87	1.01	V
		T_j = 150 °C		0.77	0.90	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		4.7	5.2	mΩ
		T_j = 150 °C		6.4	7.0	mΩ
$V_{GE(th)}$	$V_{GE}=V_{CE}$, I_C = 7.4 mA		5.3	5.8	6.3	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				2.6	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		12.5		nF
C_{oes}		f = 1 MHz		-		nF
C_{res}		f = 1 MHz		0.68		nF
Q_G	V_{GE} = - 15 V...+ 15 V			2087		nC
R_{Gint}	T_j = 25 °C			3.5		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 200 A V_{GE} = +15/-15 V $R_{G\,on}$ = 1 Ω $R_{G\,off}$ = 1 Ω di/dt_{on} = 4500 A/µs di/dt_{off} = 1353 A/µs	T_j = 150 °C		145		ns
t_r		T_j = 150 °C		43		ns
E_{on}		T_j = 150 °C		14		mJ
$t_{d(off)}$		T_j = 150 °C		457		ns
t_f		T_j = 150 °C		82		ns
E_{off}		T_j = 150 °C		22.8		mJ
$R_{th(j-c)}$	per IGBT				0.15	K/W
$R_{th(c-s)}$	per IGBT (λgrease=0.81 W/mK, thickness 50-100µm)			0.055		K/W
$R_{th(c-s)}$	per IGBT (λ=3.4 W/mK)			t.b.d.		K/W

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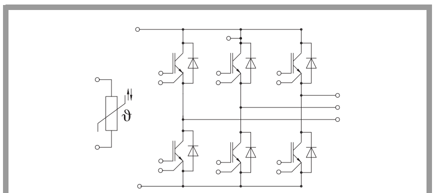
Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse diode						
$V_F = V_{EC}$	I_F = 200 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.20	2.52	V
		T_j = 150 °C		2.15	2.47	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		4.5	5.1	mΩ
		T_j = 150 °C		6.3	6.9	mΩ
I_{RRM}	I_F = 200 A di/dt_{off} = 4500 A/µs V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		250		A
Q_{rr}		T_j = 150 °C		37		µC
E_{rr}		T_j = 150 °C		16		mJ
$R_{th(j-c)}$	per diode				0.27	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/mK, thickness 50-100µm)			0.065		K/W
$R_{th(c-s)}$	per diode (λ=3.4 W/mK)			t.b.d.		K/W
Module						
L_{CE}				20		nH
$R_{CC'+EE'}$	measured per switch	T_C = 25 °C		1.2		mΩ
		T_C = 125 °C		1.65		mΩ
$Rth_{(c-s)1}$	calculated without thermal coupling			0.005		K/W
$Rth_{(c-s)2}$	including thermal coupling, Ts underneath module (λ_{grease}=0.81 W/(m*K))			0.0081		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



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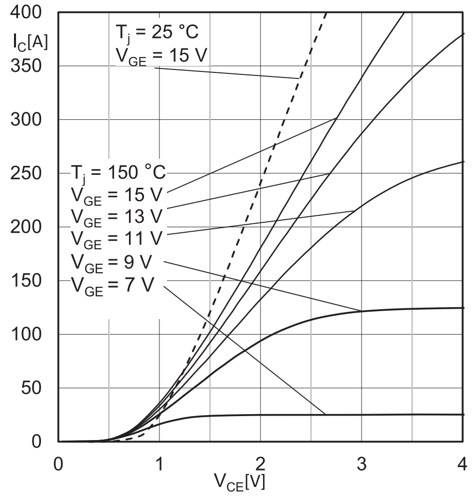


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

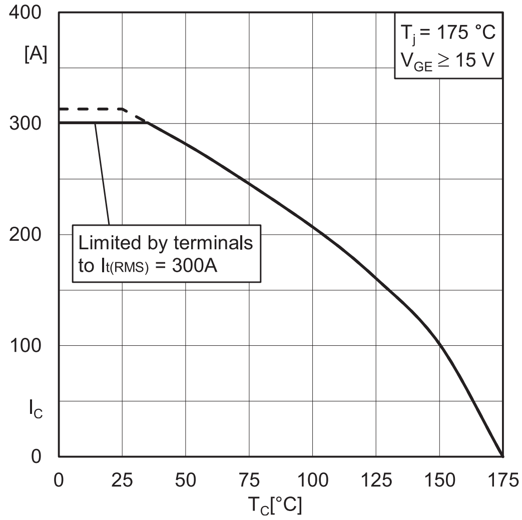


Fig. 2: Rated current vs. Temperature I_c=f(Tc)

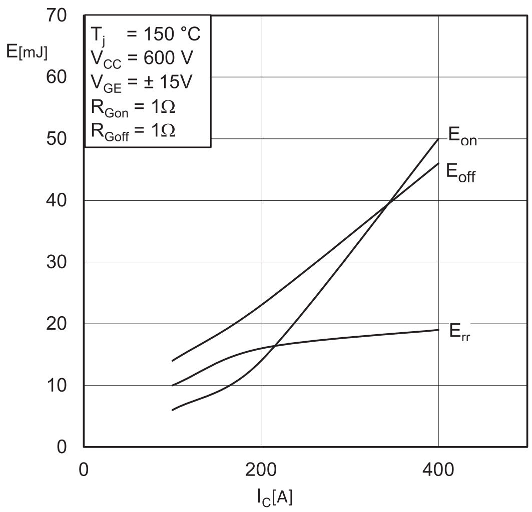


Fig. 3: Typ. turn-on /-off energy = f (I_C)

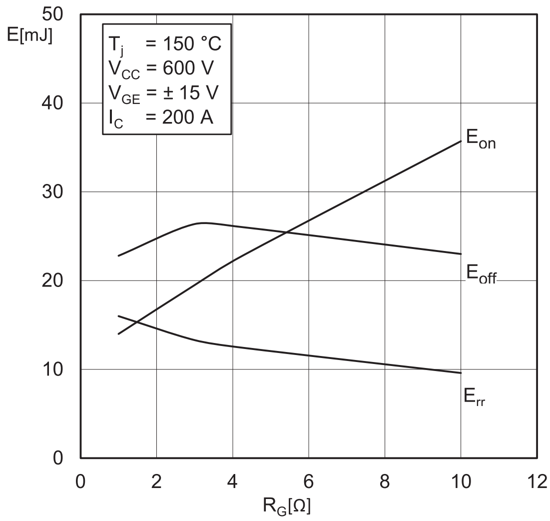


Fig. 4: Typ. turn-on /-off energy = f (R_G)

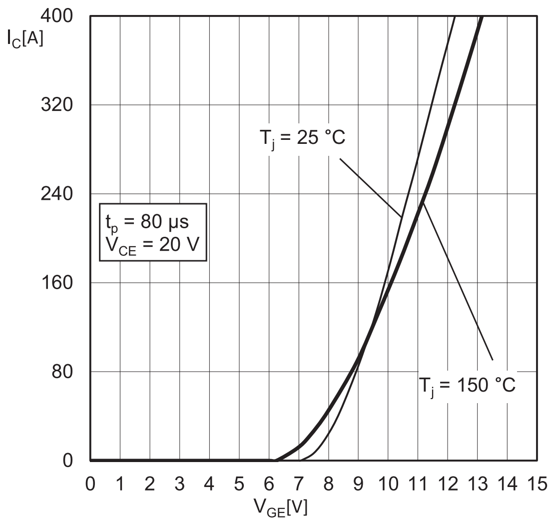


Fig. 5: Typ. transfer characteristic

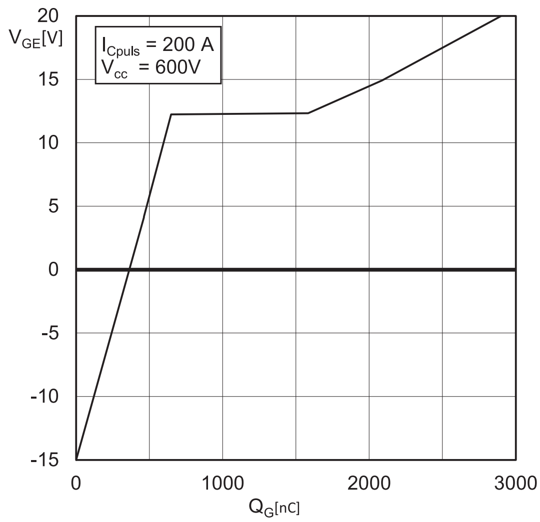


Fig. 6: Typ. gate charge characteristic

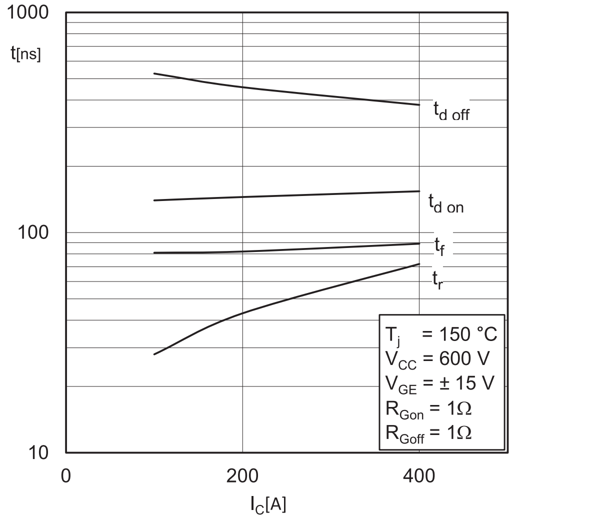


Fig. 7: Typ. switching times vs. I_C

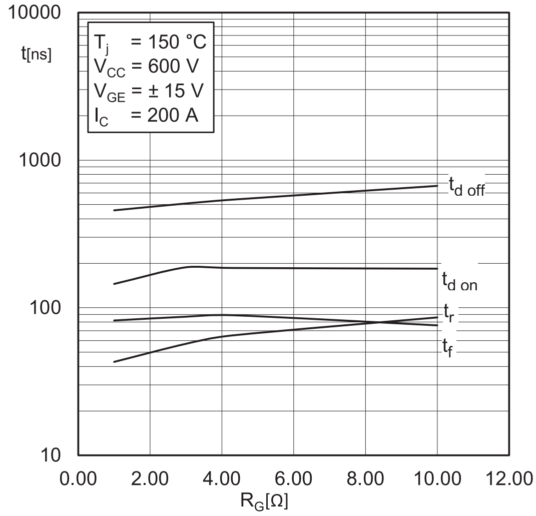


Fig. 8: Typ. switching times vs. gate resistor R_G

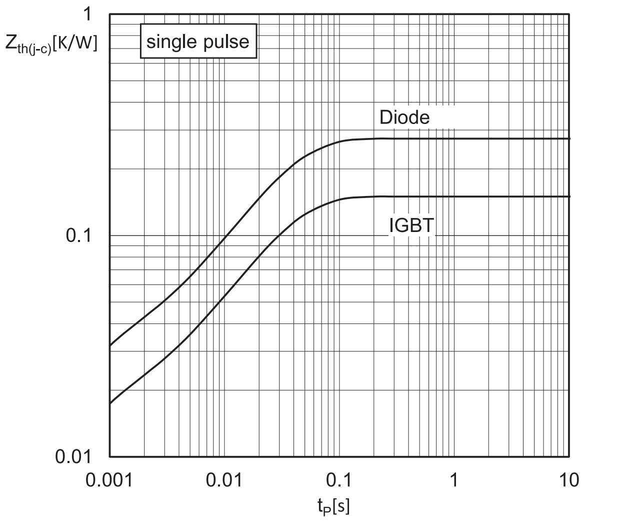


Fig. 9: Typ. transient thermal impedance

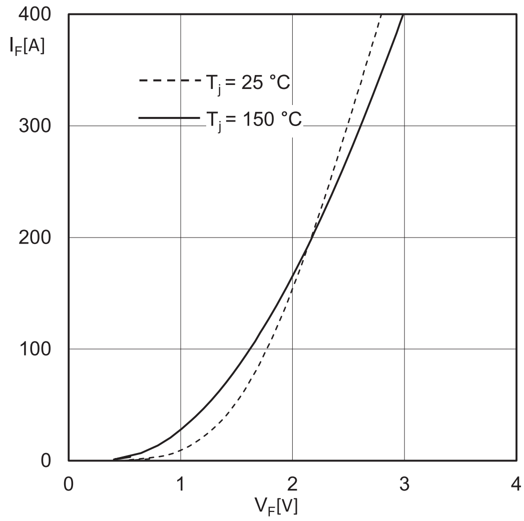


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

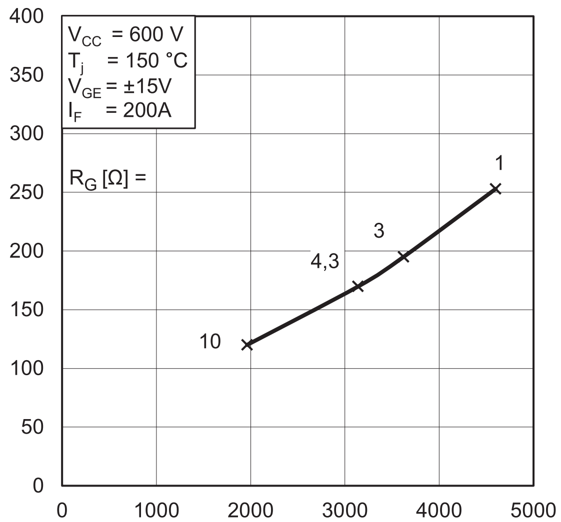
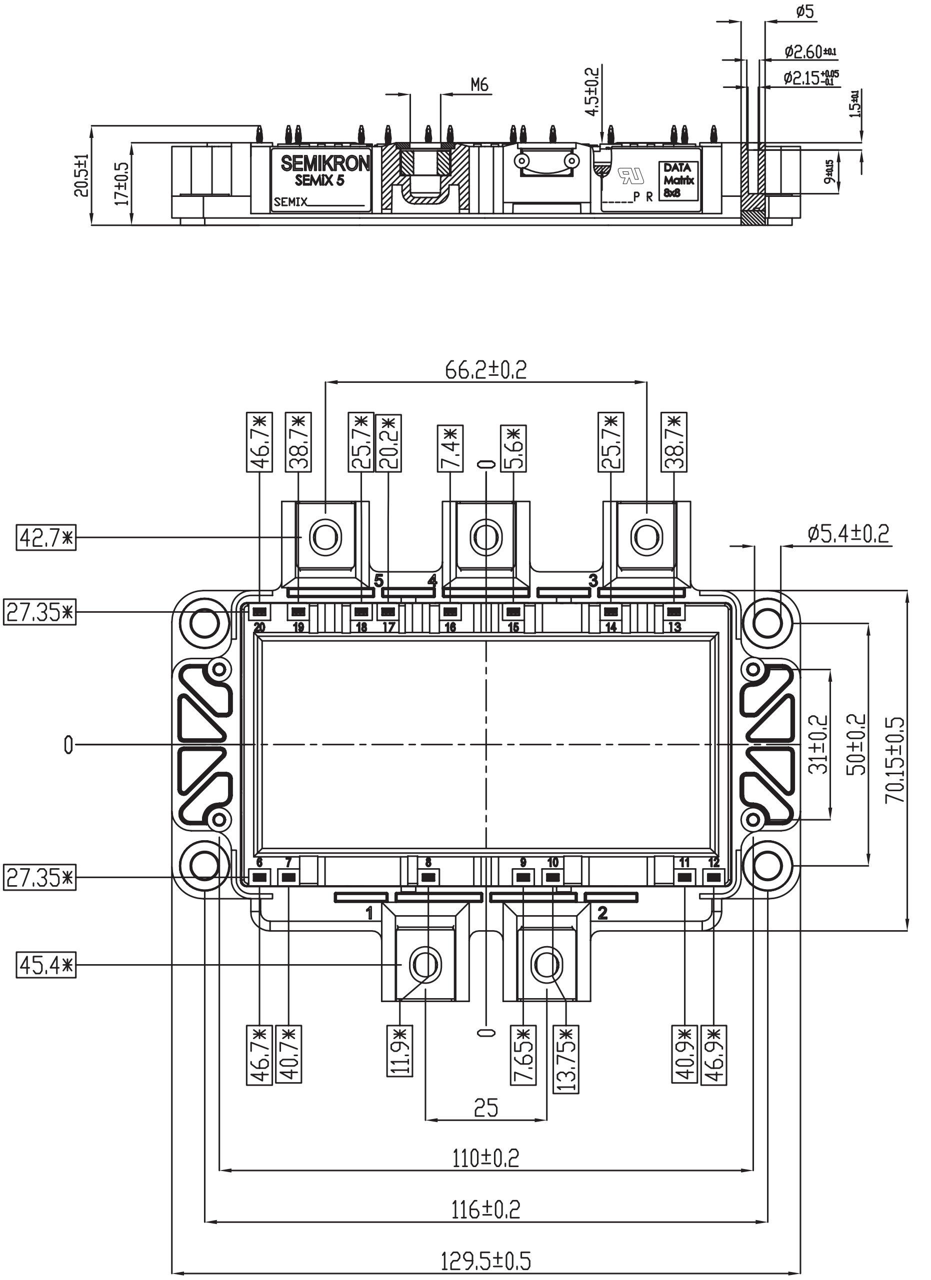


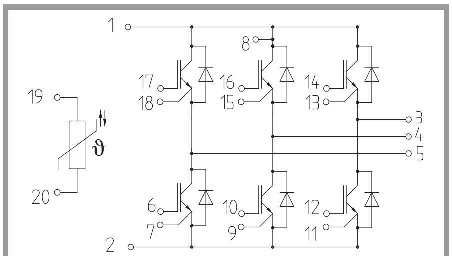
Fig. 11: Typ. CAL diode peak reverse recovery current



* = 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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