



SEMiX® 3p shunt

Trench IGBT Modules

SEMiX453GB17E4I50p

Features*

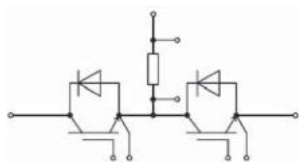
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- Current sensing shunt resistor
- UL recognized, file no. E63532

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"



GB + shunt

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _j = 25 °C		1700	V
I _c	T _j = 175 °C	T _c = 25 °C	731	A
		T _c = 80 °C	555	A
I _{Cnom}			450	A
I _{CRM}	I _{CRM} = 3 x I _{Cnom}		1350	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 1000 V V _{GE} ≤ 15 V V _{CES} ≤ 1700 V	T _j = 150 °C	10	μs
T _j			-40 ... 175	°C
Inverse diode				
V _{RRM}	T _j = 25 °C		1700	V
I _F	T _j = 175 °C	T _c = 25 °C	557	A
		T _c = 80 °C	412	A
I _{Fnom}			450	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		900	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2565	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}	T _c = 80°C		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 = 450 A	T _j = 25 °C		1.90	2.20	V
	V _{GE} = 15 V chiplevel	T _j = 150 °C		2.26	2.45	V
V _{CE0}	chiplevel	T _j = 25 °C		1.10	1.20	V
		T _j = 150 °C		1.00	1.10	V
r _{CE}	V _{GE} = 15 V chiplevel	T _j = 25 °C		1.78	2.2	mΩ
		T _j = 150 °C		2.8	3.0	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 18 mA		5.2	5.8	6.4	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 1700 V, T _j = 25 °C				5	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		36.0		nF
C _{oes}		f = 1 MHz		1.50		nF
C _{res}		f = 1 MHz		1.14		nF
Q _G	V _{GE} = - 8 V...+ 15 V			3600		nC
R _{Gint}	T _j = 25 °C			1.7		Ω
t _{d(on)}	V _{CC} = 900 V	T _j = 150 °C		270		ns
t _r	I _C = 450 A	T _j = 150 °C		90		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		153		mJ
t _{d(off)}	R _{G on} = 2.7 Ω	T _j = 150 °C		815		ns
t _f	R _{G off} = 2.7 Ω	T _j = 150 °C		200		ns
E _{off}	di/dt _{on} = 4300 A/μs di/dt _{off} = 2200 A/μs dv/dt = 3200 V/μs L _s = 21 nH	T _j = 150 °C		150		mJ
R _{th(j-c)}	per IGBT				0.06	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.029		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.02		K/W



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Typical Applications

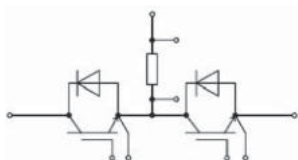
- AC inverter drives
- UPS
- Renewable energy systems

Remarks

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- V_{isol} between temperature sensor and power section is only 2500V
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 450 A	T _j = 25 °C		1.98	2.37	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.11	2.52	V
V _{F0}	chiplevel	T _j = 25 °C		1.32	1.56	V
		T _j = 150 °C		1.08	1.22	V
r _F	chiplevel	T _j = 25 °C		1.46	1.80	mΩ
		T _j = 150 °C		2.3	2.9	mΩ
I _{RRM}	I _F = 450 A	T _j = 150 °C		350		A
Q _{rr}	di/dt _{off} = 4850 A/μs	T _j = 150 °C		130		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 900 V	T _j = 150 °C		73		mJ
R _{th(j-c)}	per diode				0.1	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.048		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.038		K/W
Module						
L _{CE}				20		nH
R _{CC'+EE'}	measured per switch, shunt excluded	T _C = 25 °C		0.95		mΩ
		T _C = 125 °C		1.25		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 (λ _{grease} =0.81 W/(m*K))			0.014		K/W
R _{th(c-s)2}	including thermal coupling, Ts underneath module, pre-applied phase change material			0.010		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°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

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Shunt					
R _{Shunt}	Tolerance = ±1 %, T _c = 20°C		0.50		mΩ
α				50	ppm/K
T _{Shunt}				170	°C
R _{th(r-c)}				3	K/W
P _{Shunt}	T _c = 80 °C			30	W



GB + shunt

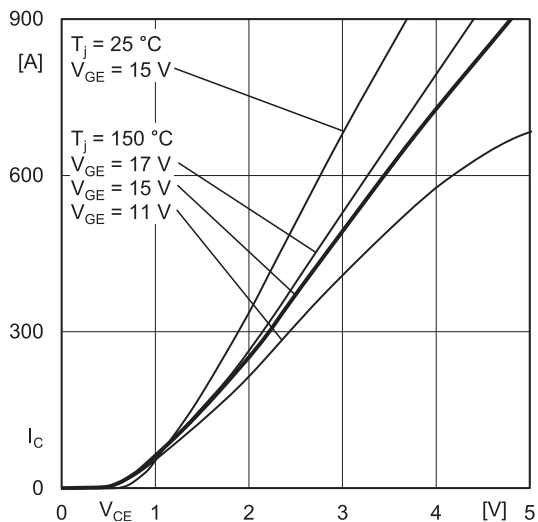
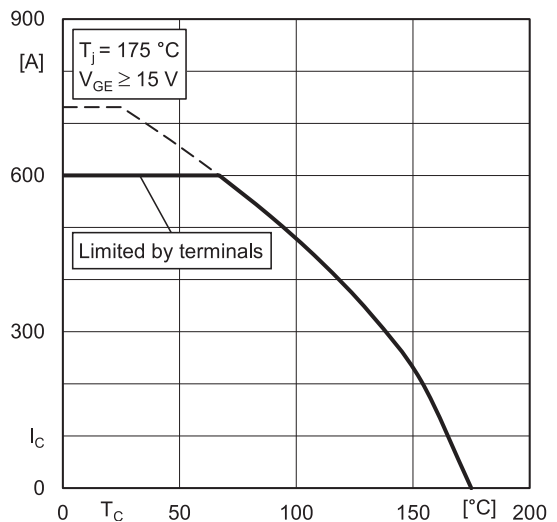
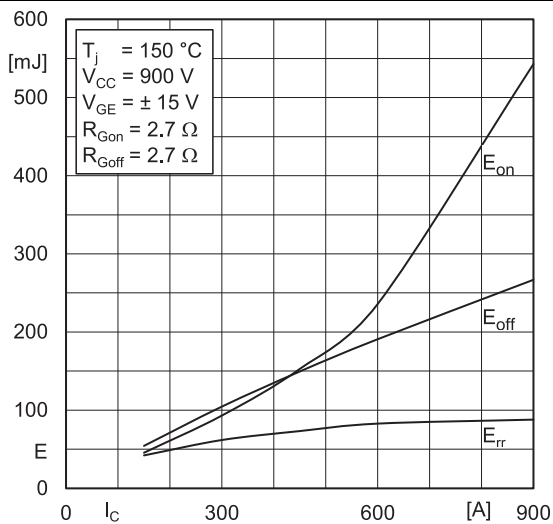
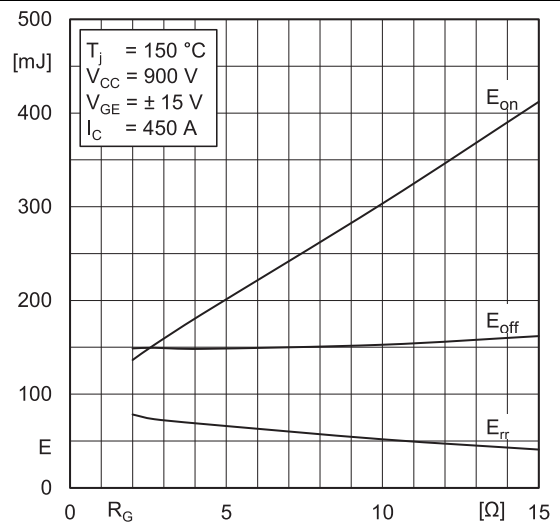
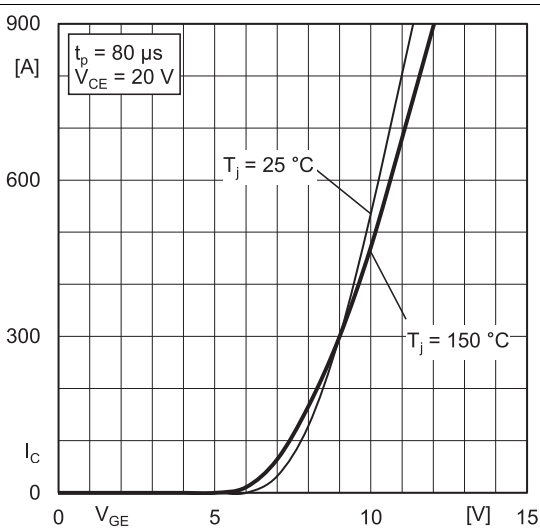
Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_{E'}$ Fig. 2: Rated current vs. temperature $I_C = f(T_C)$ Fig. 3: Typ. turn-on /-off energy = $f(I_C)$ Fig. 4: Typ. turn-on /-off energy = $f(R_G)$ 

Fig. 5: Typ. transfer characteristic

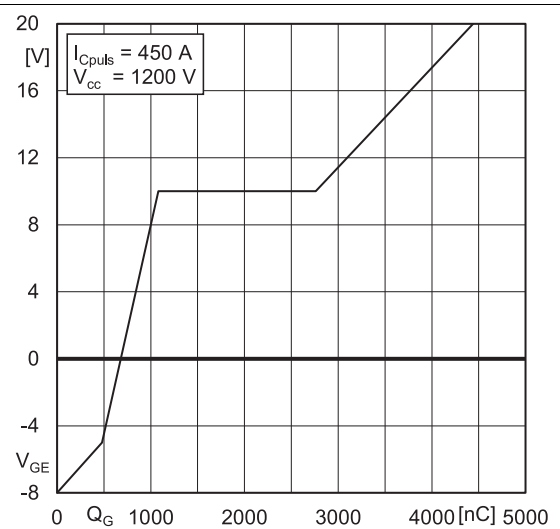


Fig. 6: Typ. gate charge characteristic

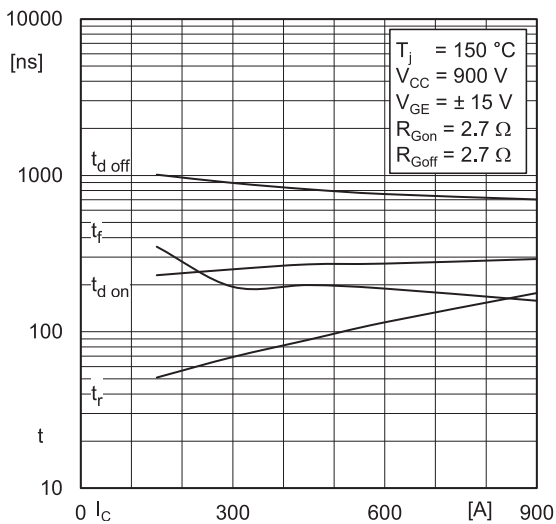


Fig. 7: Typ. switching times vs. I_C

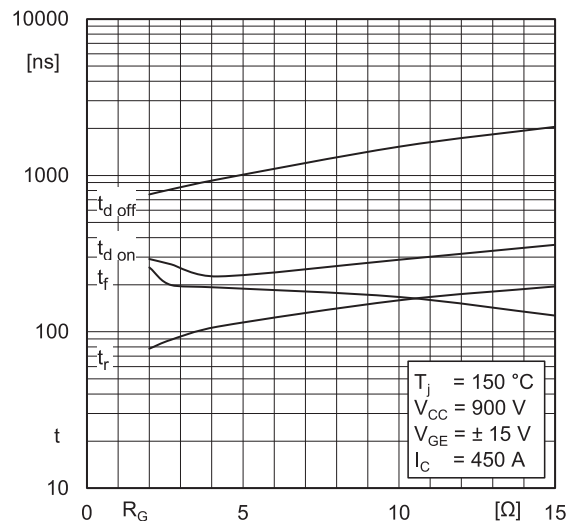


Fig. 8: Typ. switching times vs. gate resistor R_G

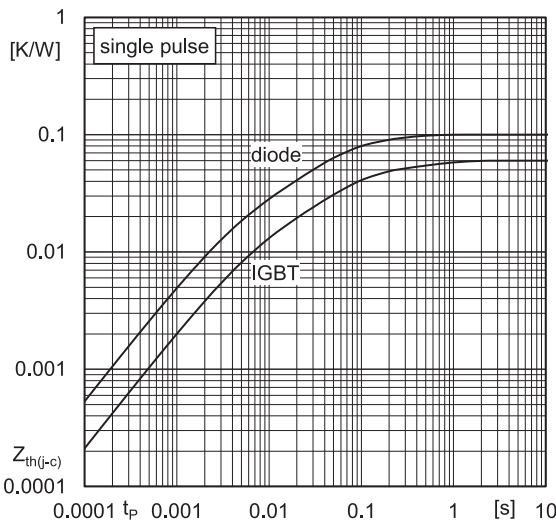


Fig. 9: Transient thermal impedance

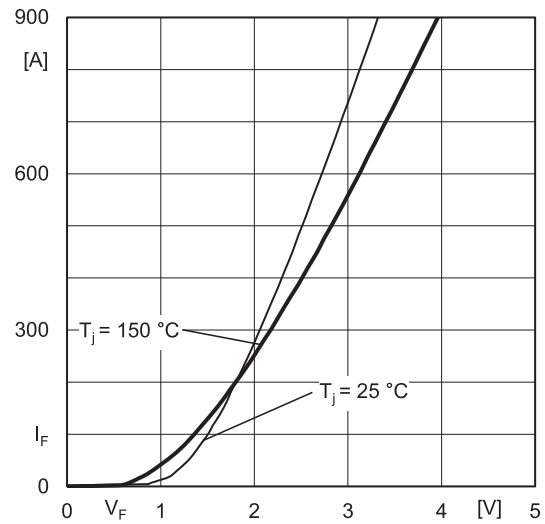


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

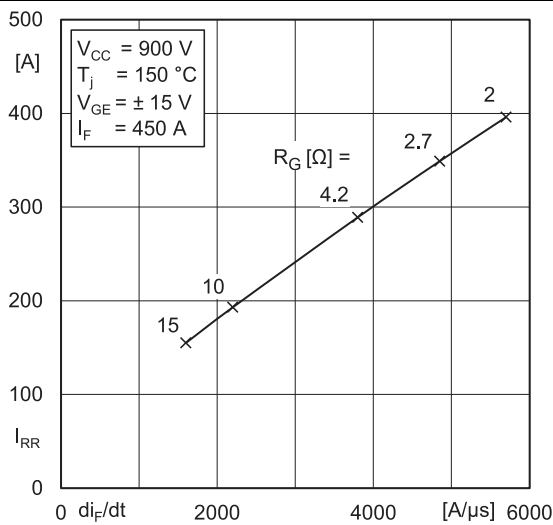


Fig. 11: Typ. CAL diode peak reverse recovery current

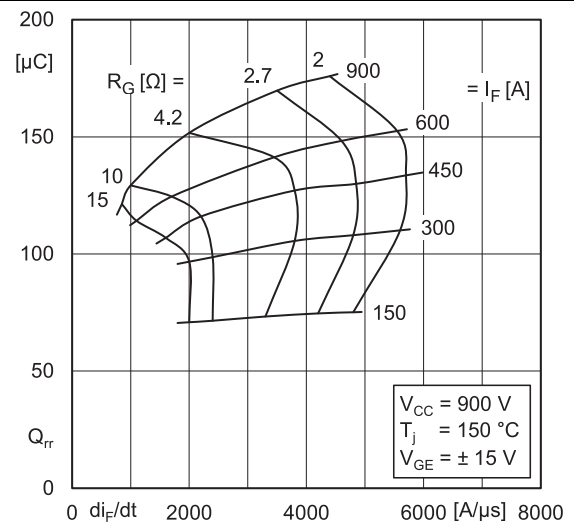
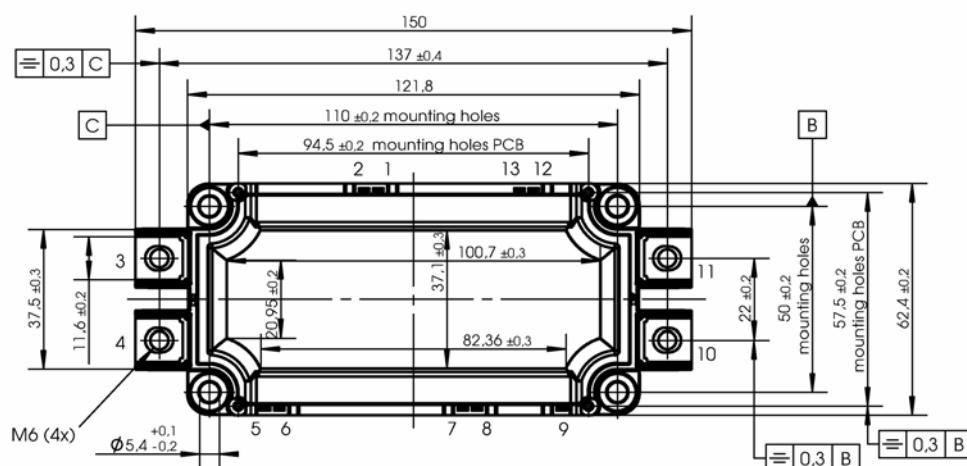
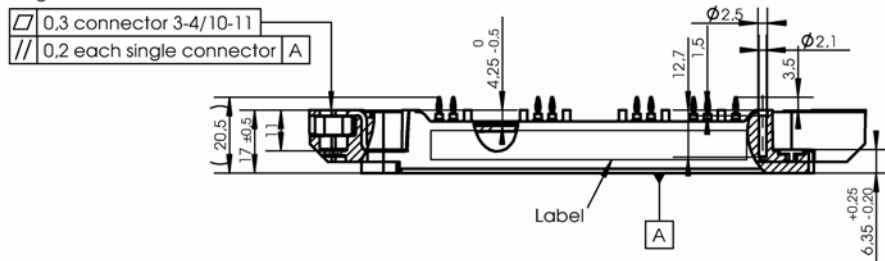


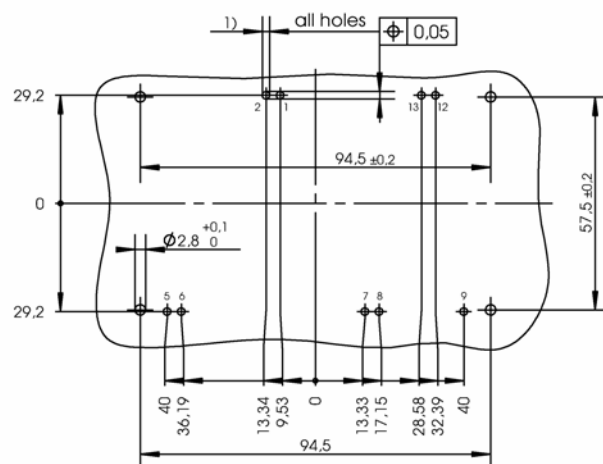
Fig. 12: Typ. CAL diode recovery charge

SEMiX453GB17E4I50p

Package outline



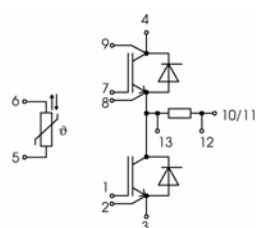
PCB drillhole pattern



Dimensions valid in mounted status

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

SEMiX 3p shunt



pinout

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

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