



Trench IGBT Modules

SEMiX453GB12E4s

Features

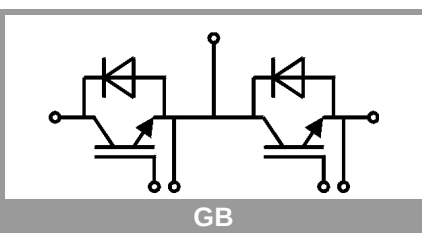
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
- Product reliability results are valid for $T_J=150^\circ\text{C}$
- Dynamic values apply to the following combination of resistors:
 $R_{Gon,main} = 1,0 \Omega$
 $R_{Goff,main} = 1,0 \Omega$
 $R_{G,X} = 2,2 \Omega$
 $R_{E,X} = 0,5 \Omega$



Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}			1200	V
I _C	T _j = 175 °C	T _c = 25 °C	683	A
		T _c = 80 °C	526	A
I _{Cnom}			450	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		1350	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 20 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	µs
T _j			-40 ... 175	°C
Inverse diode				
I _F	T _j = 175 °C	T _c = 25 °C	544	A
		T _c = 80 °C	407	A
I _{Fnom}			450	A
I _{FRM}	I _{FRM} = 3xI _{Fnom}		1350	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2430	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			600	A
T _{stg}			-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		1.8	2.05	V
	V _{GE} = 15 V chipelevel	T _J = 150 °C		2.2	2.4	V
V _{CE0}		T _J = 25 °C		0.8	0.9	V
		T _J = 150 °C		0.7	0.8	V
r _{CE}	V _{GE} = 15 V	T _J = 25 °C		2.2	2.6	mΩ
		T _J = 150 °C		3.3	3.6	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 18 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V	T _J = 25 °C		0.1	0.3	mA
	V _{CE} = 1200 V	T _J = 150 °C				mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		27.9		nF
C _{oes}		f = 1 MHz		1.74		nF
C _{res}		f = 1 MHz		1.53		nF
Q _G	V _{GE} = - 8 V...+ 15 V			2550		nC
R _{Gint}	T _J = 25 °C			1.67		Ω
t _{d(on)}	V _{CC} = 600 V	T _J = 150 °C		336		ns
t _r	I _C = 450 A	T _J = 150 °C		80		ns
E _{on}	R _{G on} = 1.9 Ω R _{G off} = 1.9 Ω di/dt _{on} = 4000 A/μs di/dt _{off} = 5000 A/μs	T _J = 150 °C		45		mJ
t _{d(off)}		T _J = 150 °C		615		ns
t _f		T _J = 150 °C		130		ns
E _{off}		T _J = 150 °C		66.5		mJ
R _{th(j-c)}	per IGBT				0.065	K/W



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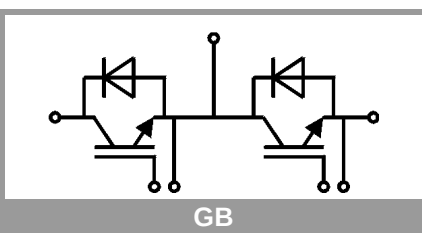
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 450 A V _{GE} = 0 V chip	T _j = 25 °C		2.1	2.46	V
		T _j = 150 °C		2.1	2.4	V
V _{F0}		T _j = 25 °C	1.1	1.3	1.5	V
		T _j = 150 °C	0.7	0.9	1.1	V
r _F		T _j = 25 °C	1.4	1.9	2.1	mΩ
		T _j = 150 °C	2.2	2.6	2.8	mΩ
I _{RRM}	I _F = 450 A di/dt _{off} = 5000 A/μs V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C	350			A
Q _{rr}		T _j = 150 °C	70			μC
E _{rr}		T _j = 150 °C	28			mJ
R _{th(j-c)}	per diode		0.11			K/W
Module						
L _{CE}			20			nH
R _{CC'+EE'}	res., terminal-chip	T _C = 25 °C	0.7			mΩ
		T _C = 125 °C	1			mΩ
R _{th(c-s)}	per module		0.04			K/W
M _s	to heat sink (M5)		3	5		Nm
M _t		to terminals (M6)	2.5	5		Nm
						Nm
w			300			g
Temperatur 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



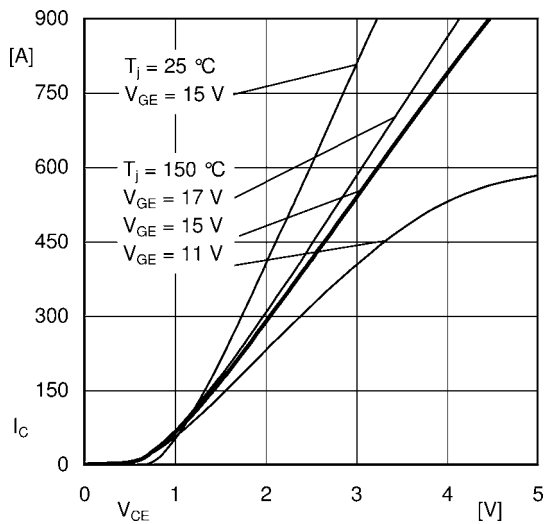
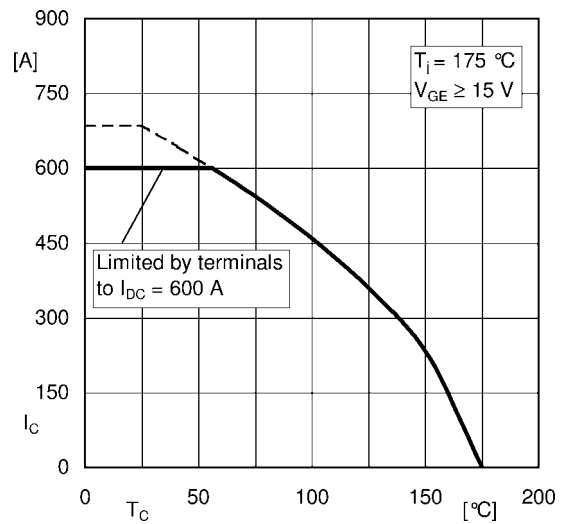
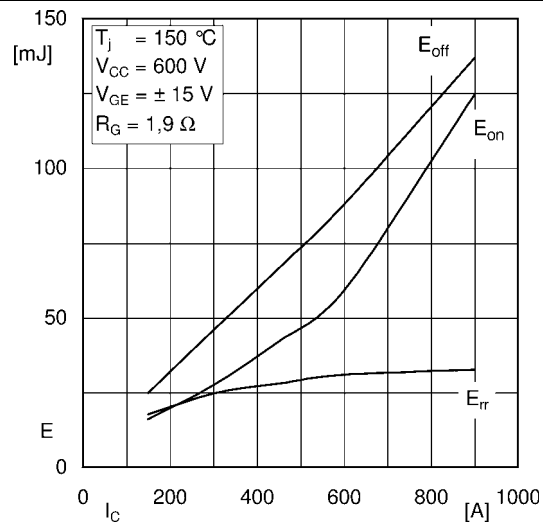
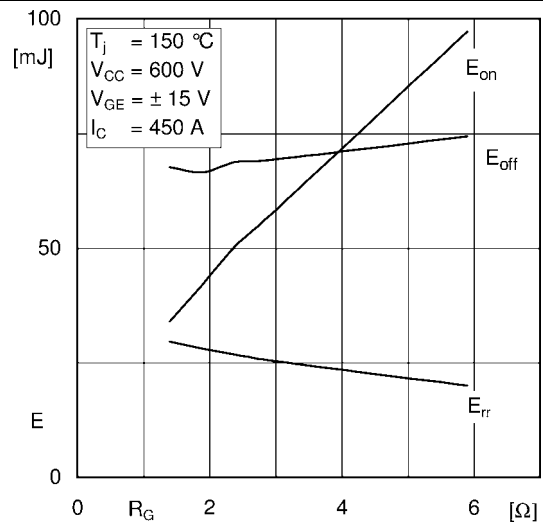
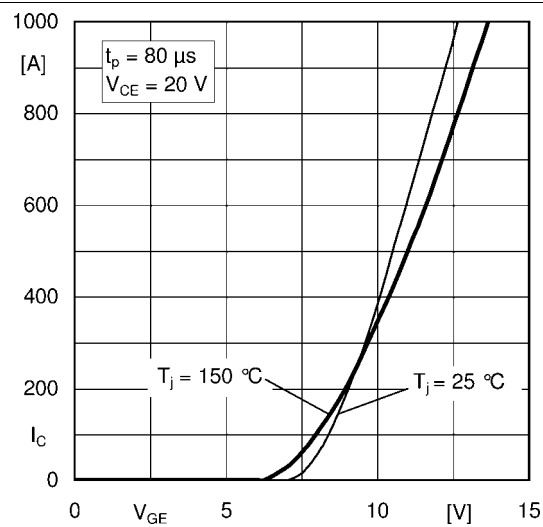
Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$ Fig. 2: Rated current vs. temperature $I_C = f(T_C)$ Fig. 3: Typ. turn-on /-off energy = $f(I_C)$ Fig. 4: Typ. turn-on /-off energy = $f(R_G)$ 

Fig. 5: Typ. transfer characteristic

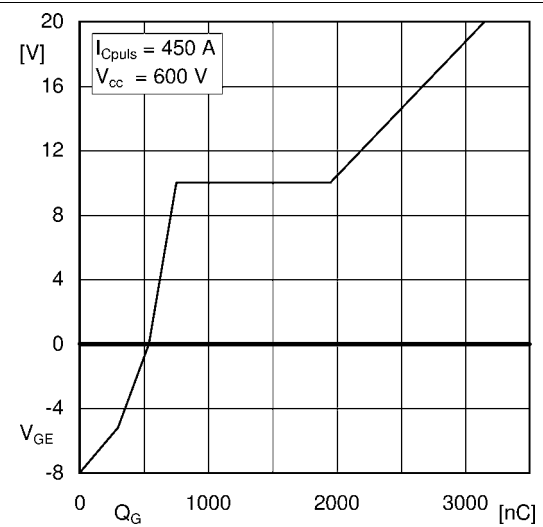


Fig. 6: Typ. gate charge characteristic

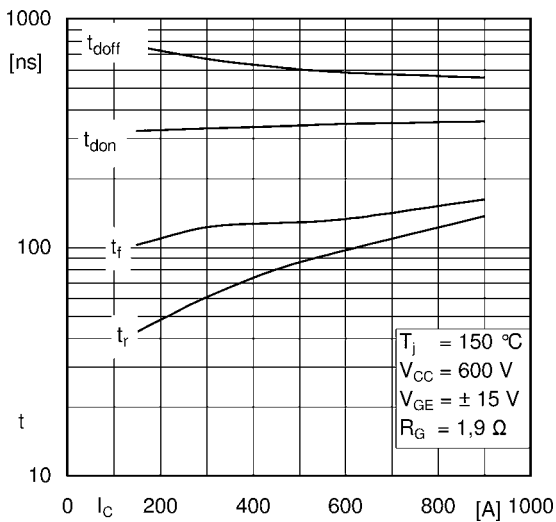
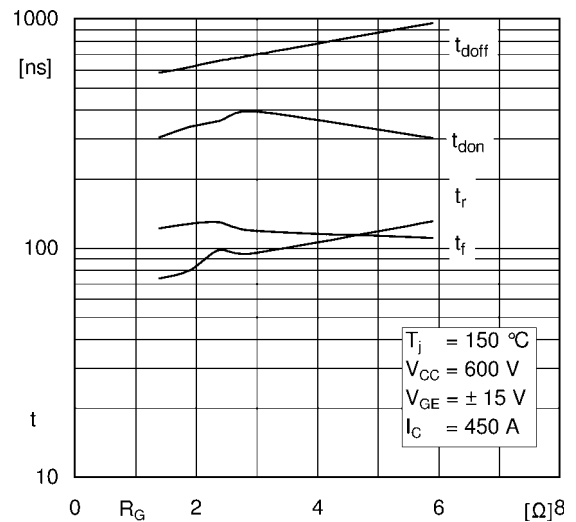
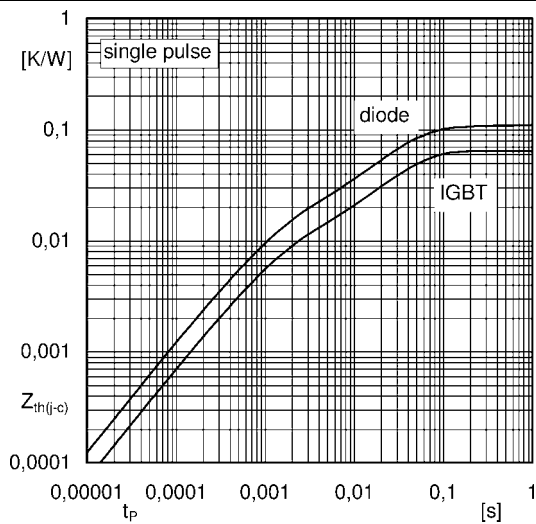
Fig. 7: Typ. switching times vs. I_C Fig. 8: Typ. switching times vs. gate resistor R_G 

Fig. 9: Typ. transient thermal impedance

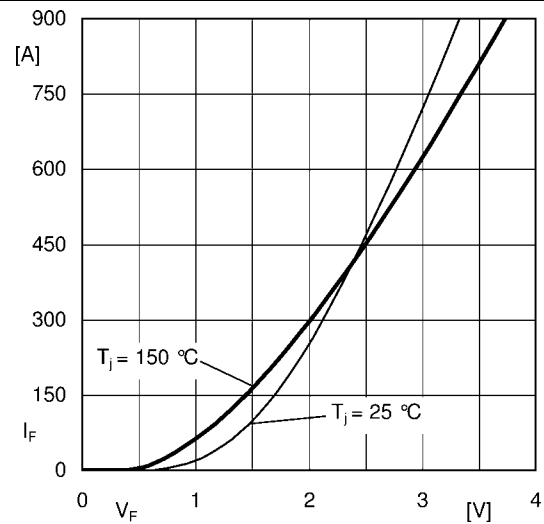
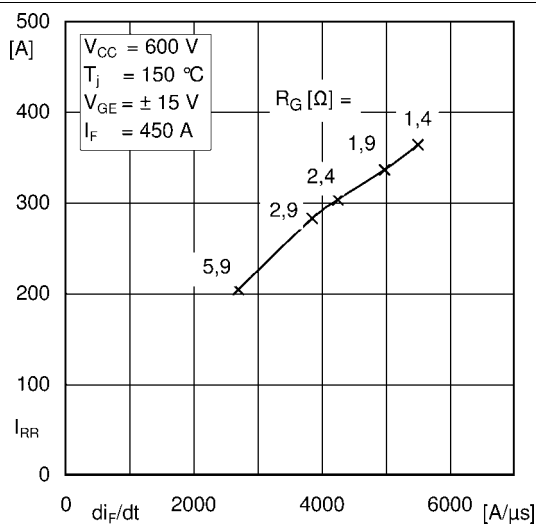
Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$ 

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

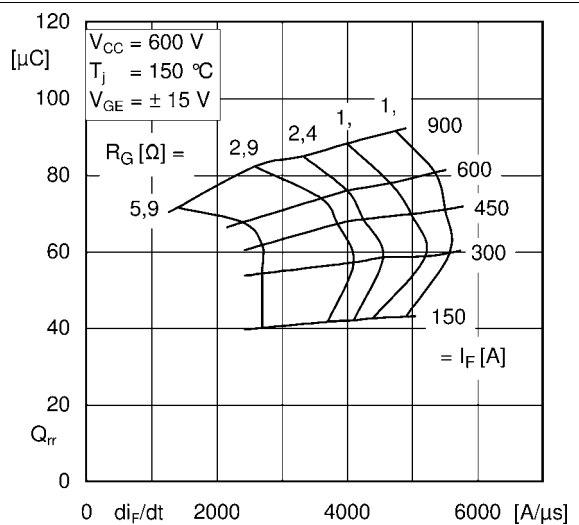
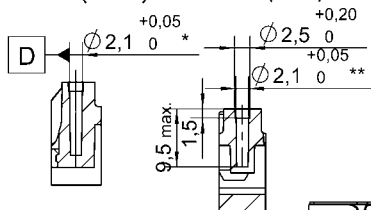
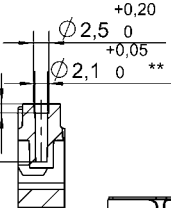
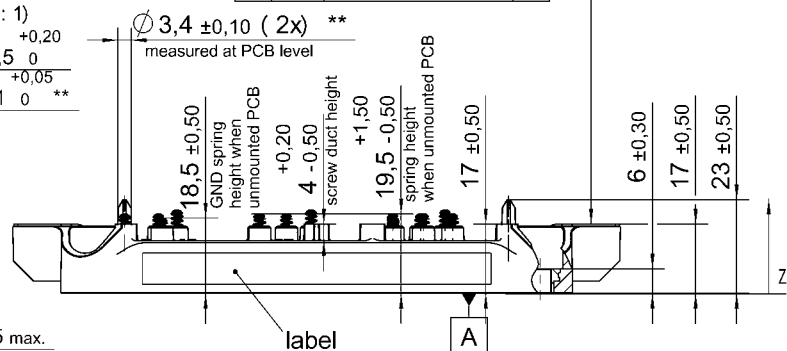
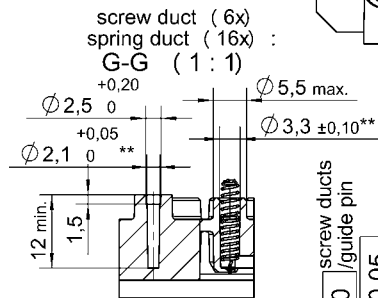
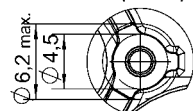
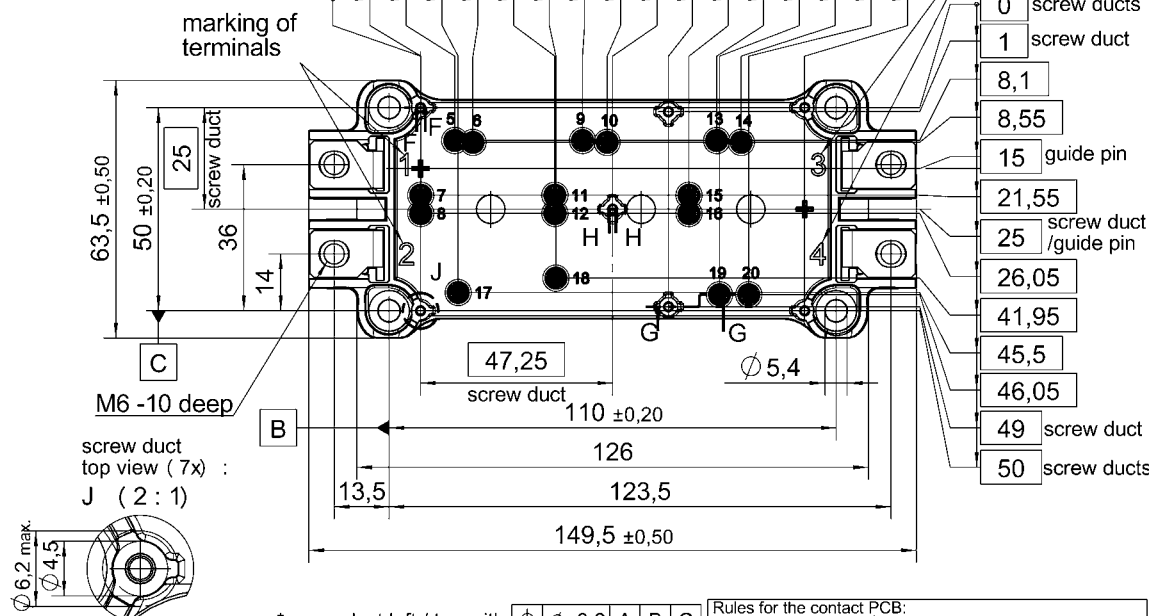


Fig. 12: Typ. CAL diode recovery charge

Case: SEMiX 3s

screw duct
(left top) :
F-F (1:1)screw duct
(1x centre) :
H-H (1:1)

$\square$ 0,3	connector 1-2 / 3-4
$\parallel$ 0,2	each connector A

general tolerance:
ISO 2768-mK
ISO 8015All measures in Z-direction
valid when mounted to heat sink

*screw duct left / top with

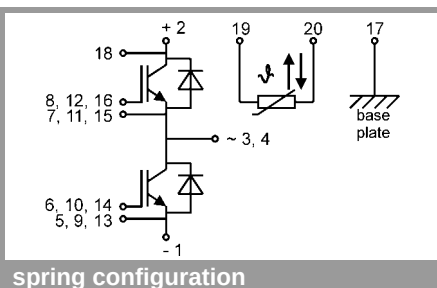
ϕ	ϕ 0,2	A	B	C
ϕ	ϕ 0,2	A	D	C

**screw ducts / guide pins / spring ducts with

Rules for the contact PCB:

- holes guidepins = $\phi 4 \pm 0,1$ / position tolerance $\pm 0,1$
- holes for screws = $\phi 2,9 \pm 0,1$ / position tolerance $\pm 0,1$
- spring contact pad = $\phi 3,6 \pm 0,1$ / position tolerance $\pm 0,1$

SEMiX 3s



spring configuration

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

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our personal.