



SEMiX®1s

Trench IGBT Modules

SEMiX151GB12E4s

Features

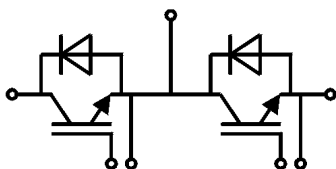
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognised file no. E63532

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 $T_J = 150^\circ\text{C}$



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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}			1200	V
I _C	T _j = 175 °C	T _c = 25 °C	232	A
		T _c = 80 °C	179	A
I _{Cnom}			150	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		450	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	189	A
		T _c = 80 °C	141	A
I _{Fnom}			150	A
I _{FRM}	I _{FRM} = 3xI _{Fnom}		450	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		900	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 = 150 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		6.7	7.7	mΩ
		T _J = 150 °C		10.0	10.7	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 6 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		9.3		nF
C _{oes}		f = 1 MHz		0.58		nF
C _{res}		f = 1 MHz		0.51		nF
Q _G	V _{GE} = - 8 V...+ 15 V			850		nC
R _{Gint}	T _J = 25 °C			5.00		Ω
t _{d(on)}	V _{CC} = 600 V	T _J = 150 °C		204		ns
t _r	I _C = 150 A	T _J = 150 °C		42		ns
E _{on}	R _{G on} = 1 Ω	T _J = 150 °C		16.6		mJ
t _{d(off)}	R _{G off} = 1 Ω	T _J = 150 °C		468		ns
t _f	di/dt _{on} = 3900 A/μs	T _J = 150 °C		91		ns
E _{off}	di/dt _{off} = 2000 A/μs	T _J = 150 °C		18.4		mJ
R _{th(j-c)}	per IGBT				0.19	K/W



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Typical Applications

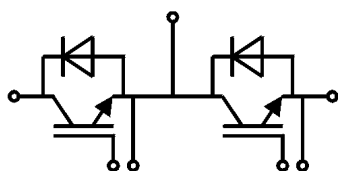
- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
- Product reliability results are valid for $T_J=150^\circ\text{C}$

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 150\text{ A}$ $V_{GE} = 0\text{ V}$ chip	$T_J = 25^\circ\text{C}$		2.1	2.46	V
		$T_J = 150^\circ\text{C}$		2.1	2.4	V
V_{F0}		$T_J = 25^\circ\text{C}$	1.1	1.3	1.5	V
		$T_J = 150^\circ\text{C}$	0.7	0.9	1.1	V
r_F		$T_J = 25^\circ\text{C}$	4.3	5.6	6.4	m Ω
		$T_J = 150^\circ\text{C}$	6.7	7.8	8.5	m Ω
I_{RRM}	$I_F = 150\text{ A}$	$T_J = 150^\circ\text{C}$		115		A
Q_{rr}	$di/dt_{off} = 3400\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_J = 150^\circ\text{C}$		23		μC
E_{rr}	$V_{CC} = 600\text{ V}$	$T_J = 150^\circ\text{C}$		8.9		mJ
$R_{th(j-c)}$	per diode				0.31	K/W
Module						
L_{CE}				16		nH
$R_{CC'+EE'}$	res., terminal-chip	$T_C = 25^\circ\text{C}$		0.7		m Ω
		$T_C = 125^\circ\text{C}$		1		m Ω
$R_{th(c-s)}$	per module			0.075		K/W
M_s	to heat sink (M5)		3		5	Nm
M_t		to terminals (M6)	2.5		5	Nm
						Nm
w					145	g
Temperatur Sensor						
R_{100}	$T_C=100^\circ\text{C}$ ($R_{25}=5\text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; $T[\text{K}]$;			$3550 \pm 2\%$		K



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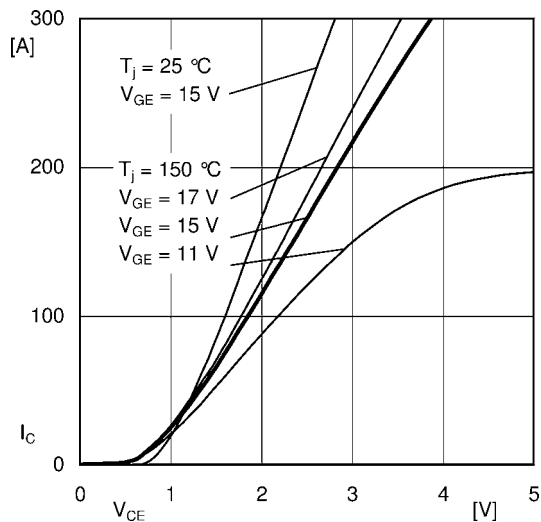


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_E$

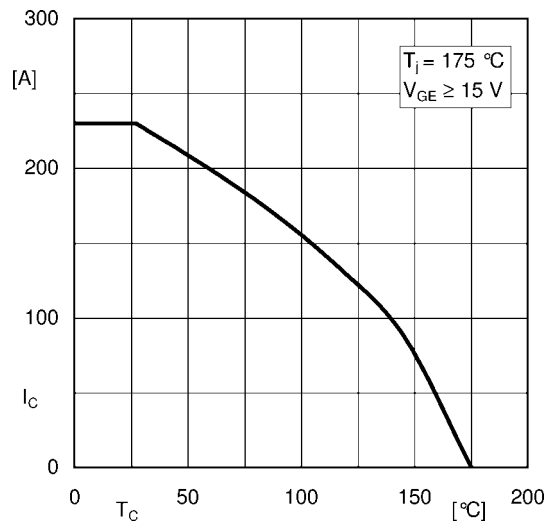


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

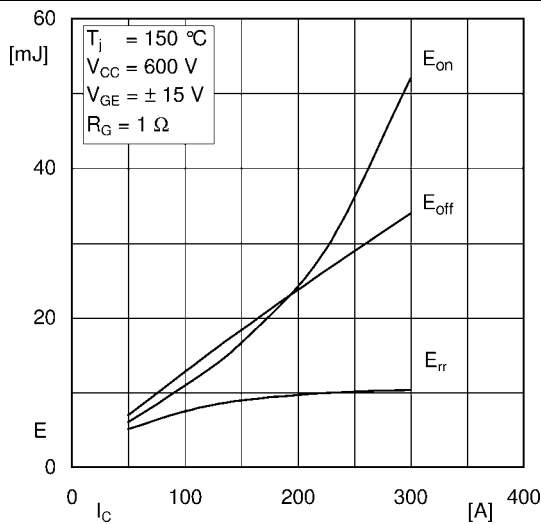


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

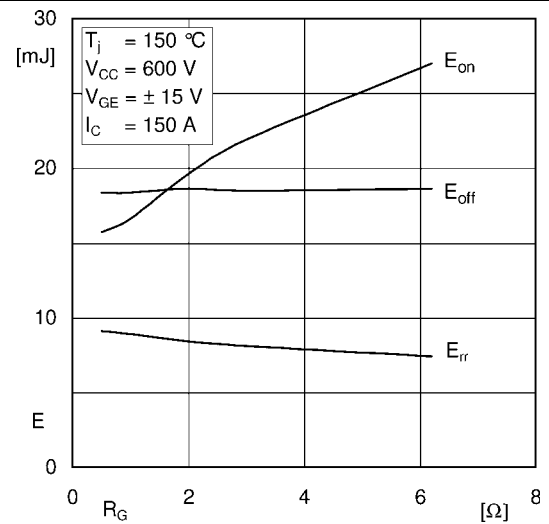


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

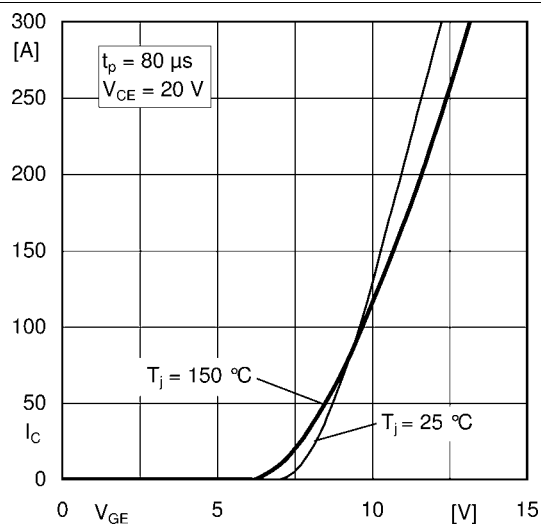


Fig. 5: Typ. transfer characteristic

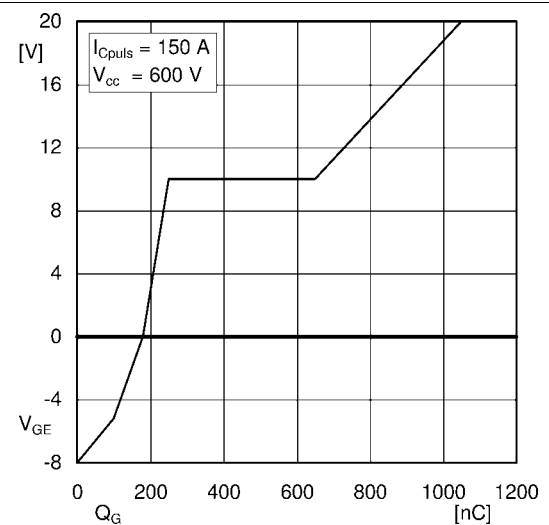


Fig. 6: Typ. gate charge characteristic

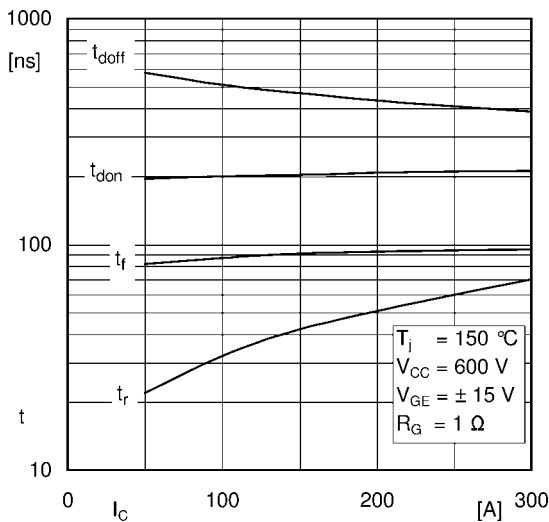


Fig. 7: Typ. switching times vs. I_C

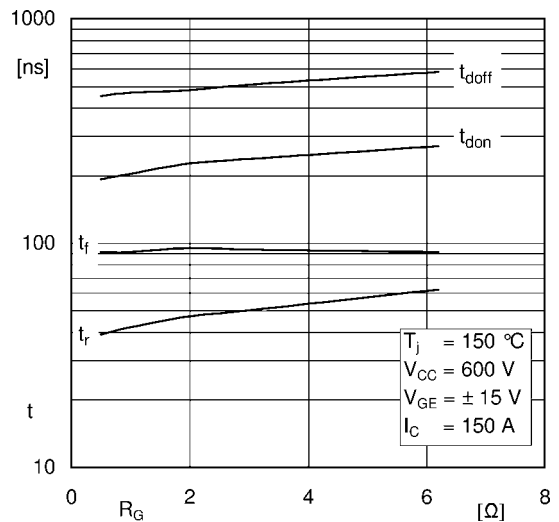


Fig. 8: Typ. switching times vs. gate resistor R_G

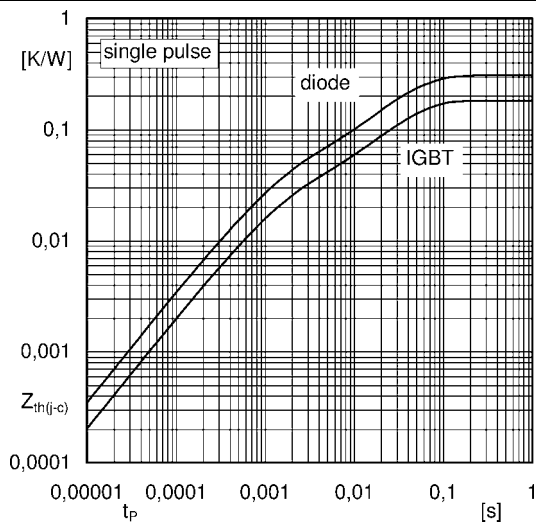


Fig. 9: Typ. transient thermal impedance

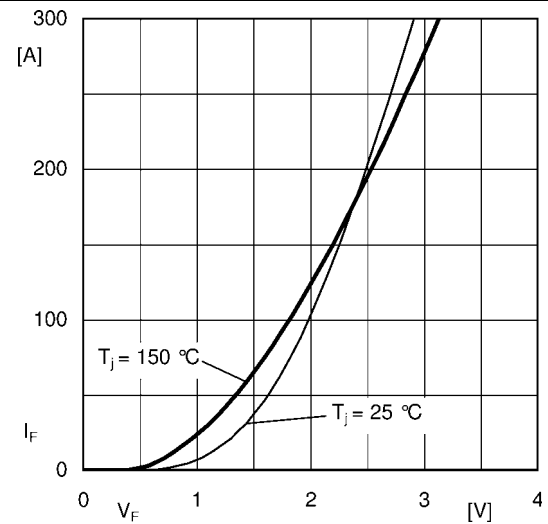


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

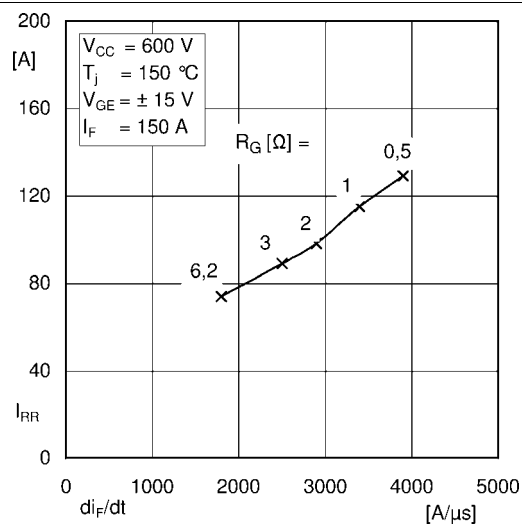


Fig. 11: Typ. CAL diode peak reverse recovery current

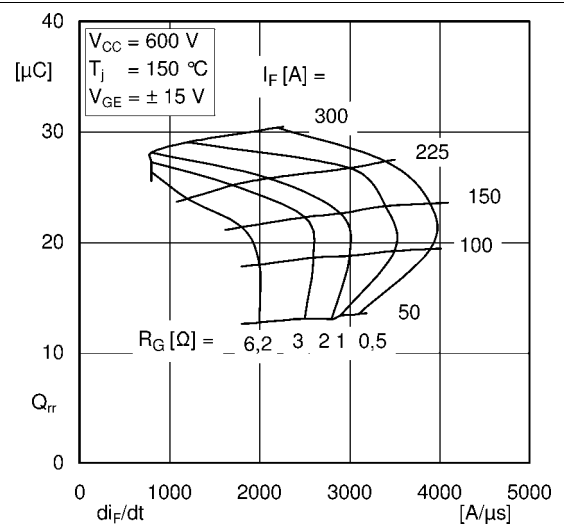
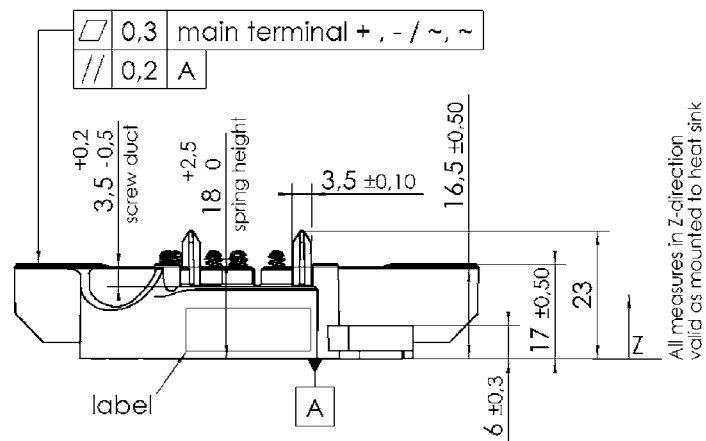
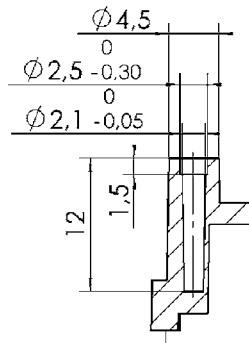


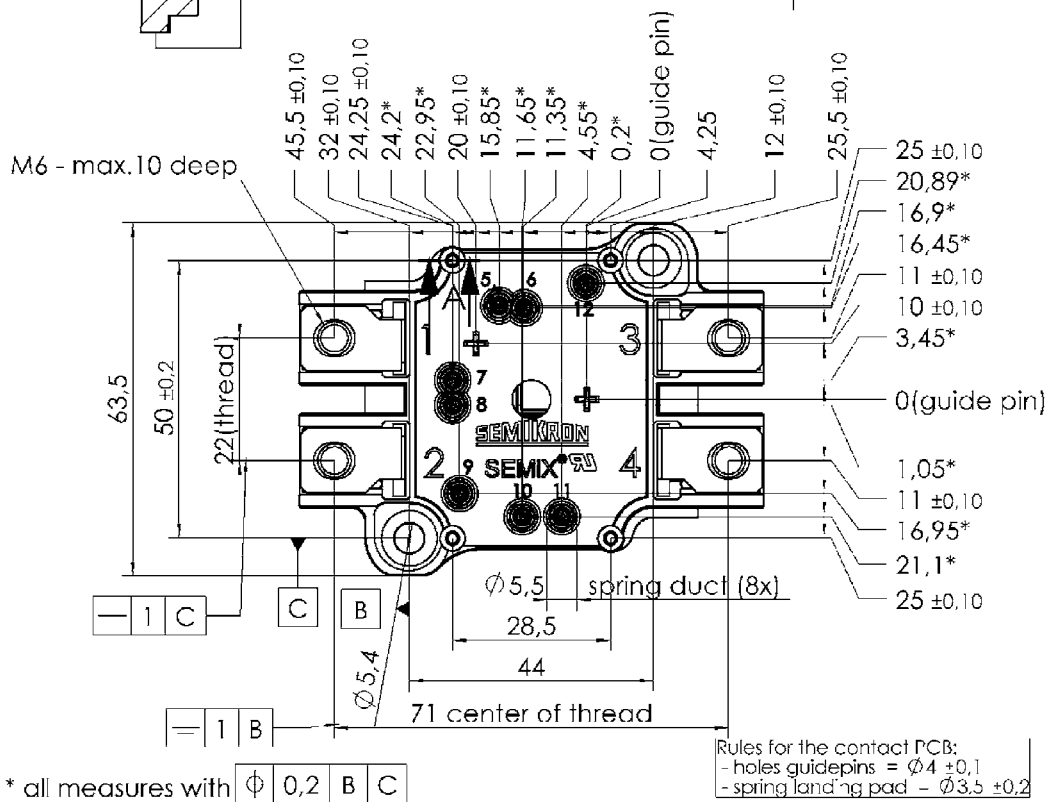
Fig. 12: Typ. CAL diode recovery charge

case: SEMiX 1s

screw duct (4x):
A-A (2:1)

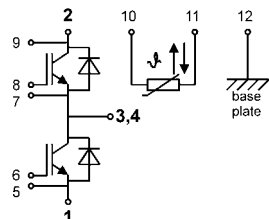


All measures in Z-direction
valid as mounted to heat sink



Rules for the contact PCB:
- holes guidepins = $\phi 4 \pm 0,1$
- spring landing pad = $\phi 3,5 \pm 0,2$

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

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