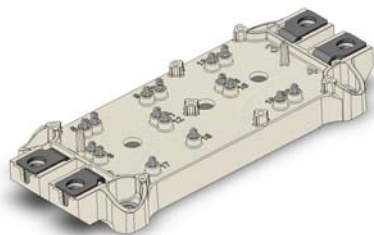


SEMiX653GAL176HDs



SEMiX® 3s

Trench IGBT Modules

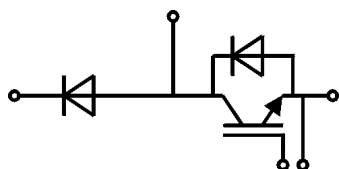
SEMiX653GAL176HDs

Features

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

Typical Applications*

- AC inverter drives
- UPS
- Electronic welders

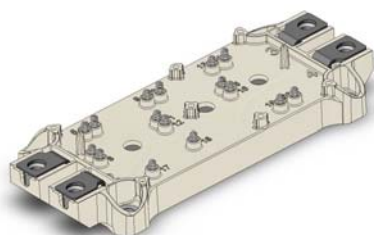


GAL

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V_{CES}			1700	V
I_C	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	619	A
		$T_c = 80\text{ °C}$	438	A
I_{Cnom}			450	A
I_{CRM}	$I_{CRM} = 2 \times I_{Cnom}$		900	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 1000\text{ V}$ $V_{GE} \leq 20\text{ V}$ $V_{CES} \leq 1700\text{ V}$	$T_j = 125\text{ °C}$	10	μs
T_j			-55 ... 150	$^{\circ}\text{C}$
Inverse diode				
I_F	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	545	A
		$T_c = 80\text{ °C}$	365	A
I_{Fnom}			450	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$		900	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ °C}$		2900	A
T_j			-40 ... 150	$^{\circ}\text{C}$
Freewheeling diode				
I_F	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	545	A
		$T_c = 80\text{ °C}$	365	A
I_{Fnom}			450	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$		900	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ °C}$		2900	A
T_j			-40 ... 150	$^{\circ}\text{C}$
Module				
$I_{t(RMS)}$			600	A
T_{stg}			-40 ... 125	$^{\circ}\text{C}$
V_{isol}	AC sinus 50Hz, $t = 1\text{ min}$		4000	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25\text{ °C}$	2	2.45		V
		$T_j = 125\text{ °C}$	2.45	2.9		V
V_{CE0}		$T_j = 25\text{ °C}$	1	1.2		V
		$T_j = 125\text{ °C}$	0.9	1.1		V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25\text{ °C}$	2.2	2.8		$\text{m}\Omega$
		$T_j = 125\text{ °C}$	3.4	4.0		$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 18\text{ mA}$		5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1700\text{ V}$	$T_j = 25\text{ °C}$	0.1	0.3		mA
		$T_j = 125\text{ °C}$				mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		39.6		nF
C_{oes}		$f = 1\text{ MHz}$		1.65		nF
C_{res}		$f = 1\text{ MHz}$		1.31		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$			4200		nC
R_{Gint}	$T_j = 25\text{ °C}$			1.67		Ω

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SEMiX® 3s

Trench IGBT Modules

SEMiX653GAL176HDs

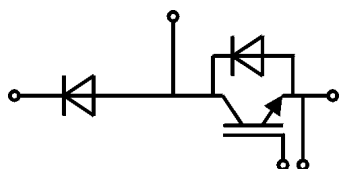
Features

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

Typical Applications*

- AC inverter drives
- UPS
- Electronic welders

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 1200\text{ V}$	$T_j = 125\text{ °C}$		290		ns
t_r	$I_c = 450\text{ A}$	$T_j = 125\text{ °C}$		90		ns
E_{on}	$R_{G\ on} = 3.6\ \Omega$	$T_j = 125\text{ °C}$		300		mJ
$t_{d(off)}$	$R_{G\ off} = 3.6\ \Omega$	$T_j = 125\text{ °C}$		975		ns
t_f		$T_j = 125\text{ °C}$		190		ns
E_{off}		$T_j = 125\text{ °C}$		180		mJ
$R_{th(j-c)}$	per IGBT				0.054	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$	$T_j = 25\text{ °C}$		1.7	1.90	V
	$V_{GE} = 0\text{ V}$ chip	$T_j = 125\text{ °C}$		1.7	1.9	V
V_{F0}		$T_j = 25\text{ °C}$	0.9	1.1	1.3	V
		$T_j = 125\text{ °C}$	0.7	0.9	1.1	V
r_F		$T_j = 25\text{ °C}$	1.3	1.3	1.3	m Ω
		$T_j = 125\text{ °C}$	1.8	1.8	1.8	m Ω
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 125\text{ °C}$		380		A
Q_{rr}	$di/dt_{off} = 4200\text{ A}/\mu\text{s}$	$T_j = 125\text{ °C}$		130		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 1200\text{ V}$	$T_j = 125\text{ °C}$		73		mJ
$R_{th(j-c)}$	per diode				0.11	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$	$T_j = 25\text{ °C}$		1.7	1.9	V
	$V_{GE} = 0\text{ V}$ chip	$T_j = 125\text{ °C}$		1.7	1.9	V
V_{F0}		$T_j = 25\text{ °C}$	0.9	1.1	1.3	V
		$T_j = 125\text{ °C}$	0.7	0.9	1.1	V
r_F		$T_j = 25\text{ °C}$	1.3	1.3	1.3	m Ω
		$T_j = 125\text{ °C}$	1.8	1.8	1.8	m Ω
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 125\text{ °C}$		380		A
Q_{rr}	$di/dt_{off} = 4200\text{ A}/\mu\text{s}$	$T_j = 125\text{ °C}$		130		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 1200\text{ V}$	$T_j = 125\text{ °C}$		73		mJ
$R_{th(j-c)}$	per diode				0.11	K/W
Module						
L_{CE}				20		nH
$R_{CC+EE'}$	res., terminal-chip	$T_C = 25\text{ °C}$		0.7		m Ω
		$T_C = 125\text{ °C}$		1		m Ω
$R_{th(c-s)}$	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}	$T_C = 100\text{ °C}$ ($R_{25} = 5\text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$; $T[\text{K}]$;			3550 $\pm 2\%$		K



GAL

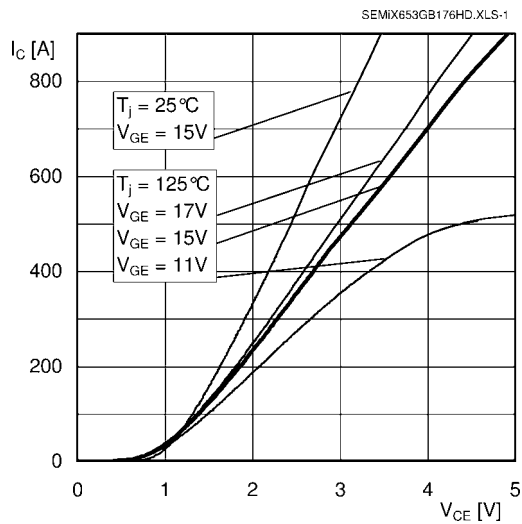


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

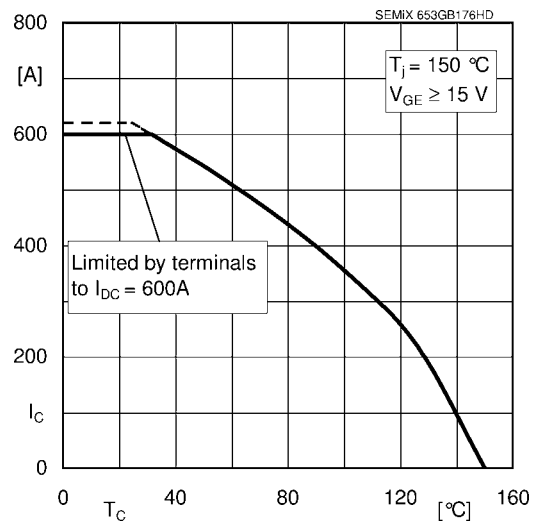


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

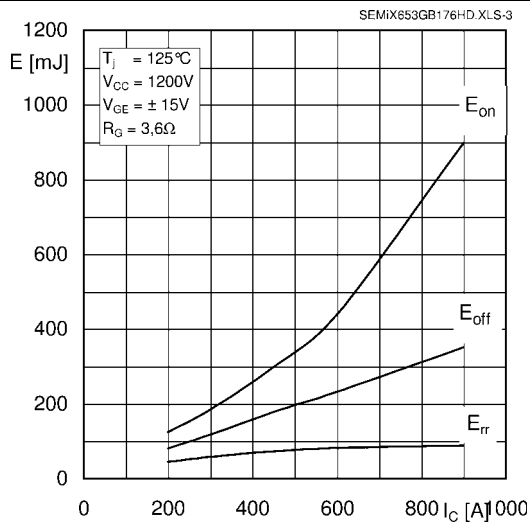


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

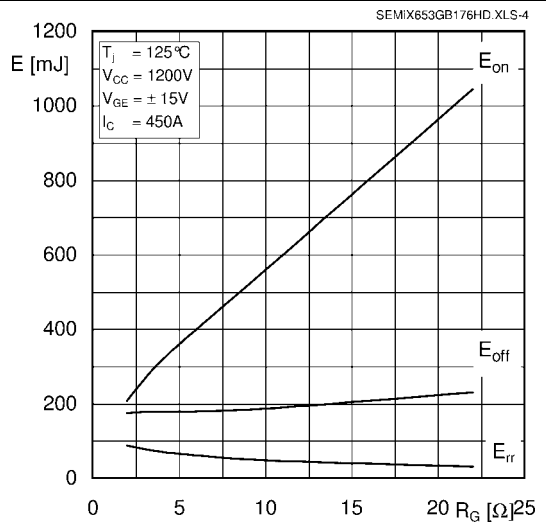


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

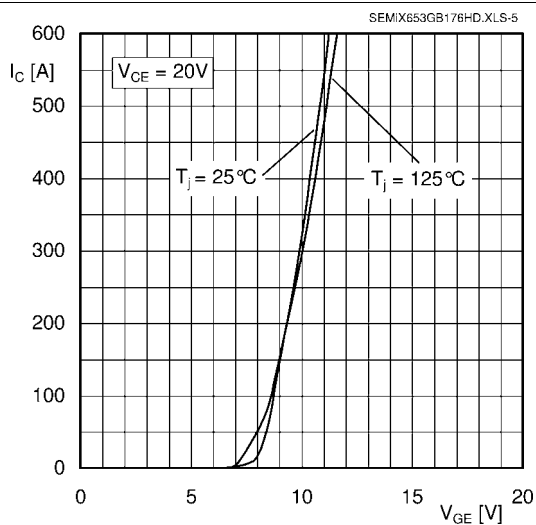


Fig. 5: Typ. transfer characteristic

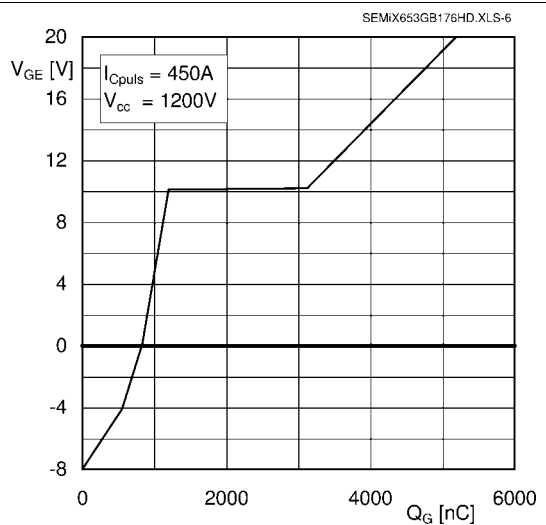


Fig. 6: Typ. gate charge characteristic

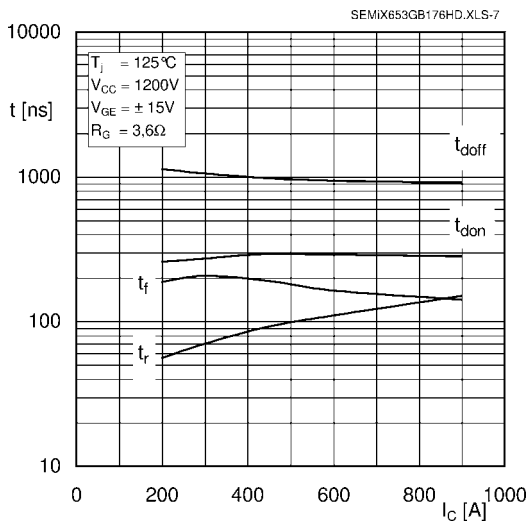


Fig. 7: Typ. switching times vs. I_C

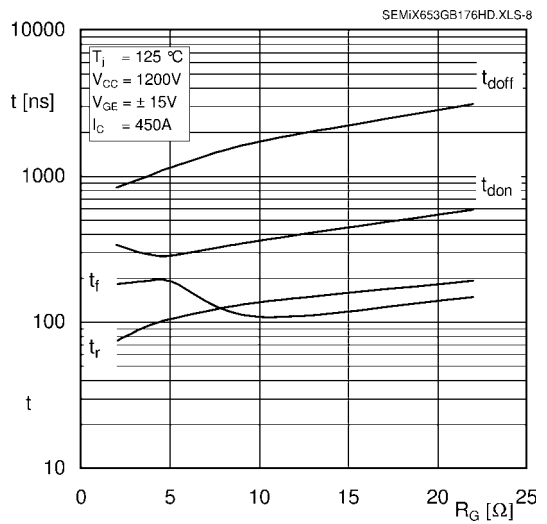


Fig. 8: Typ. switching times vs. gate resistor R_G

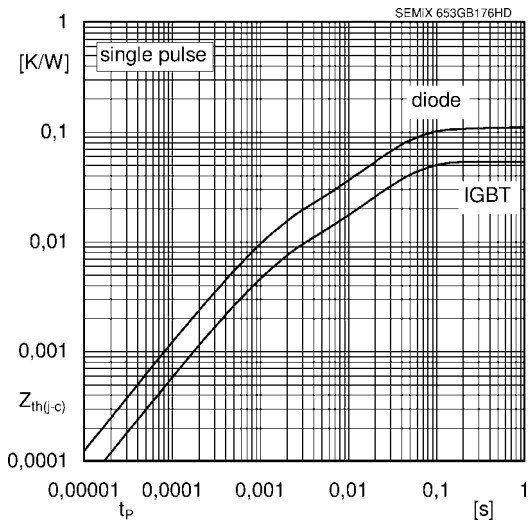


Fig. 9: Typ. transient thermal impedance

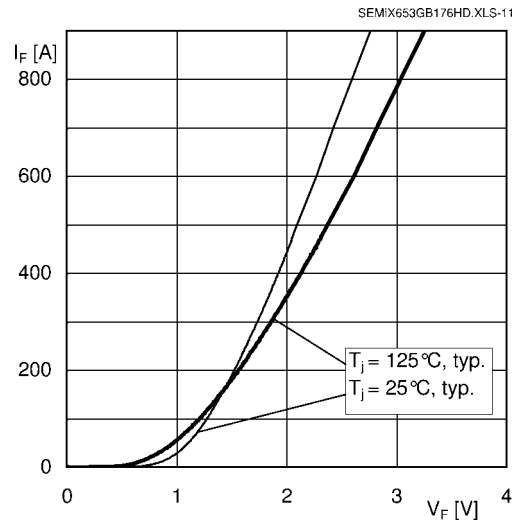


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

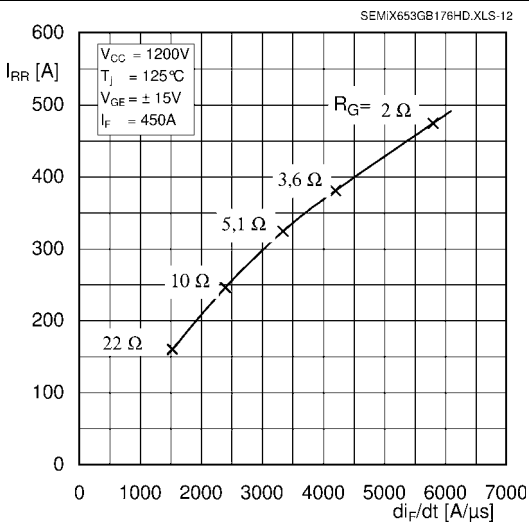


Fig. 11: Typ. CAL diode peak reverse recovery current

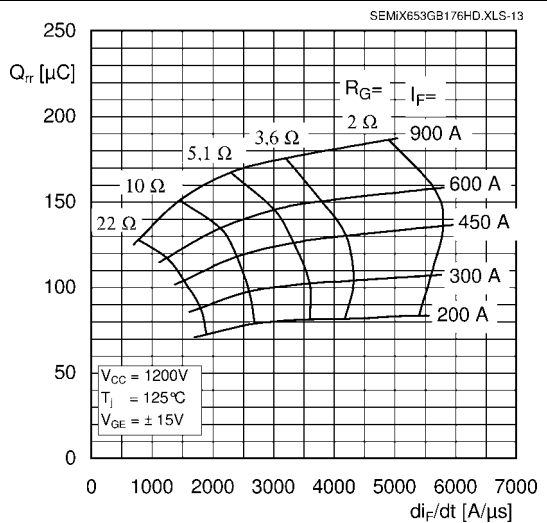


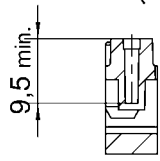
Fig. 12: Typ. CAL diode recovery charge

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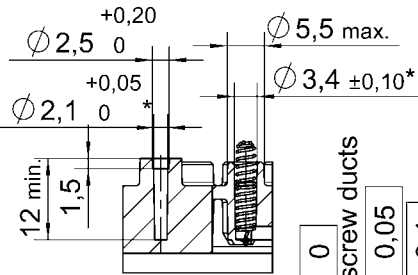
Case: SEMiX 3s

general tolerance ISO 2768-mK

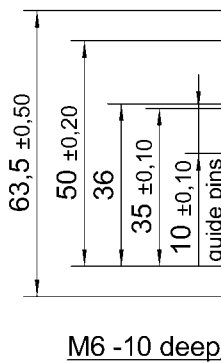
screw duct
(1x centre) :
H-H (1:1)



screw duct (6x)
spring duct (16x) :
A-A (1:1)

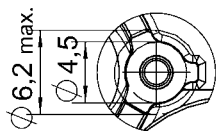


marking of terminals

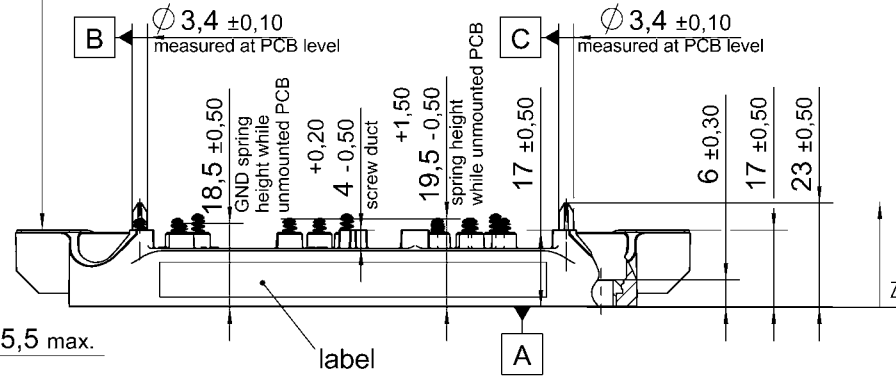


M6 -10 deep

screw duct
top view (7x) :
J (2:1)



	0,3	connector 1-2 / 3-4
	0,2	each connector A

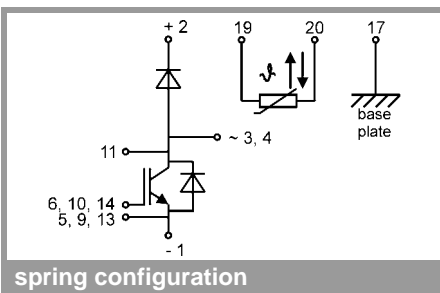


All measures in Z-direction
valid as mounted to heat sink

*screw ducts / spring ducts with $\phi \pm 0,2$ A B C

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

SEMiX 3s



spring configuration

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