

SEMiX653GAL176HDs



SEMiX® 3s

Trench IGBT Modules

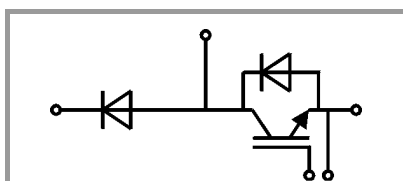
SEMiX653GAL176HDs

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



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Absolute Maximum Ratings					
Symbol	Conditions		Values	Unit	
IGBT					
V_{CES}	$T_j = 25\text{ °C}$		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					
$I_{t(RMS)}$	$T_{terminal} = 80\text{ °C}$		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						
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25\text{ °C}$		2	2.45	V
		$T_j = 125\text{ °C}$		2.5	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}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1700\text{ V}$	$T_j = 25\text{ °C}$			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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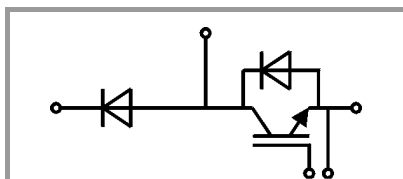
Features

- 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
$t_{d(on)}$	$V_{CC} = 1200\text{ V}$ $I_C = 450\text{ A}$	$T_j = 125\text{ °C}$		290		ns
t_r	$V_{GE} = \pm 15\text{ V}$	$T_j = 125\text{ °C}$		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						
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chip	$T_j = 25\text{ °C}$		1.7	1.90	V
		$T_j = 125\text{ °C}$		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}	$di/dt_{off} = 4200\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 125\text{ °C}$		130		μC
E_{rr}	$V_{CC} = 1200\text{ V}$	$T_j = 125\text{ °C}$		73		mJ
$R_{th(j-c)}$	per diode				0.11	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chip	$T_j = 25\text{ °C}$		1.7	1.90	V
		$T_j = 125\text{ °C}$		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}	$di/dt_{off} = 4200\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 125\text{ °C}$		130		μC
E_{rr}	$V_{CC} = 1200\text{ V}$	$T_j = 125\text{ °C}$		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
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$; $T[K]$;			$3550 \pm 2\%$		K



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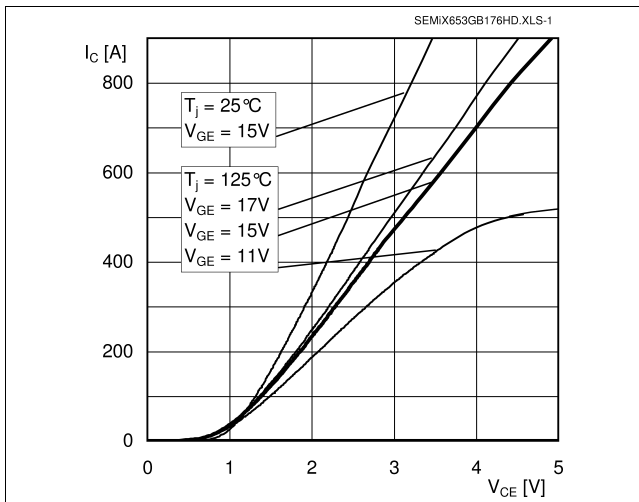


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + E_{E'}$

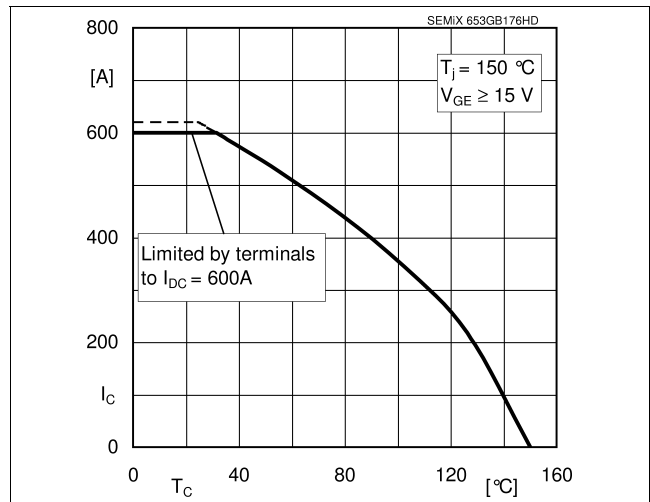


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

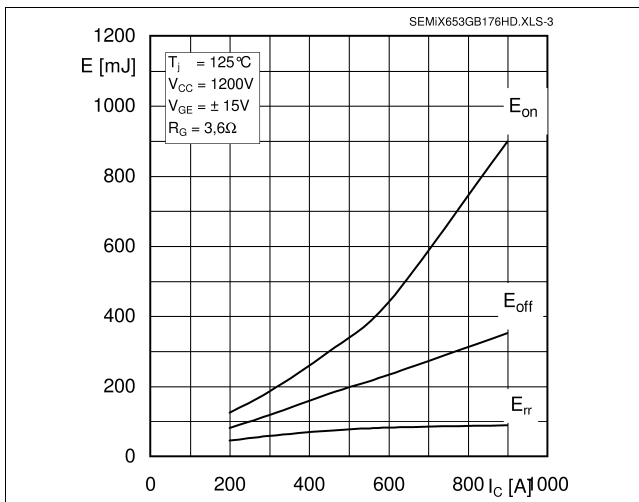


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

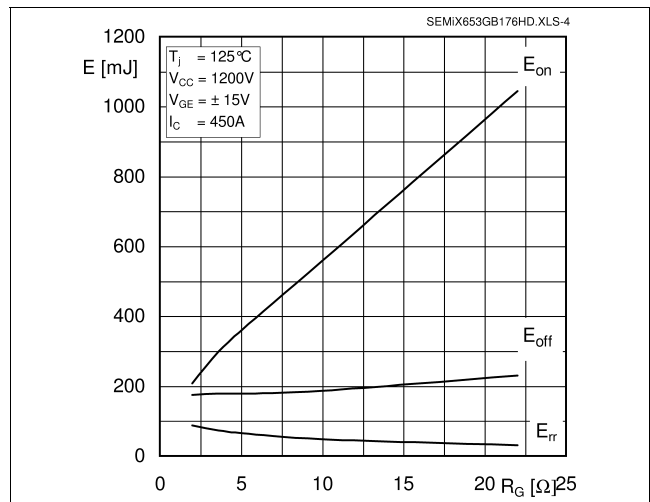


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

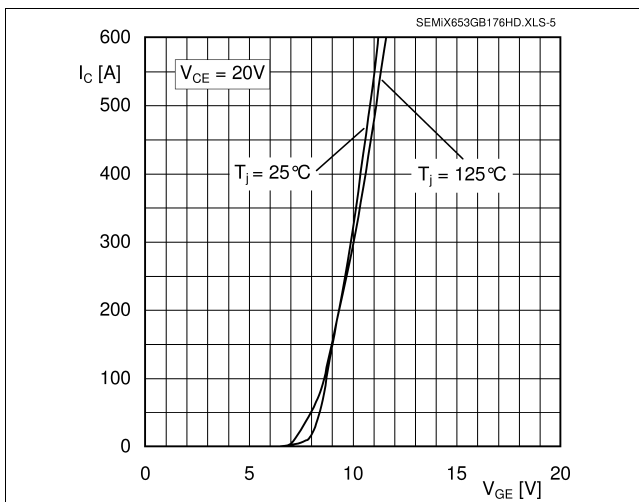


Fig. 5: Typ. transfer characteristic

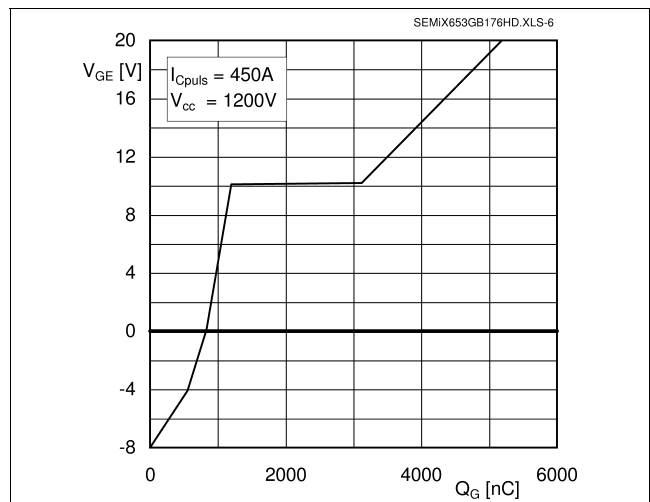


Fig. 6: Typ. gate charge characteristic

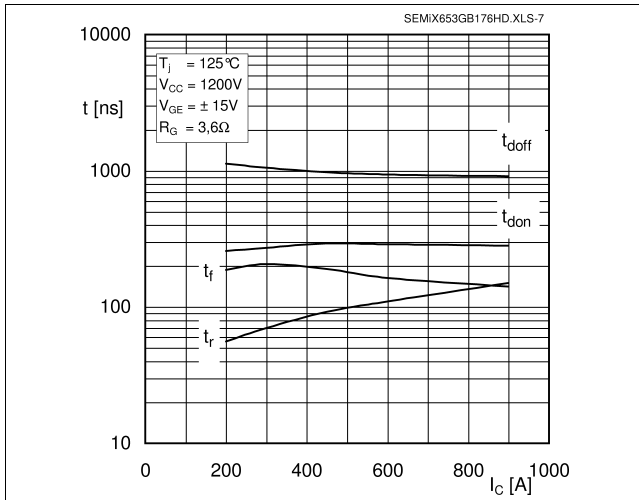


Fig. 7: Typ. switching times vs. I_C

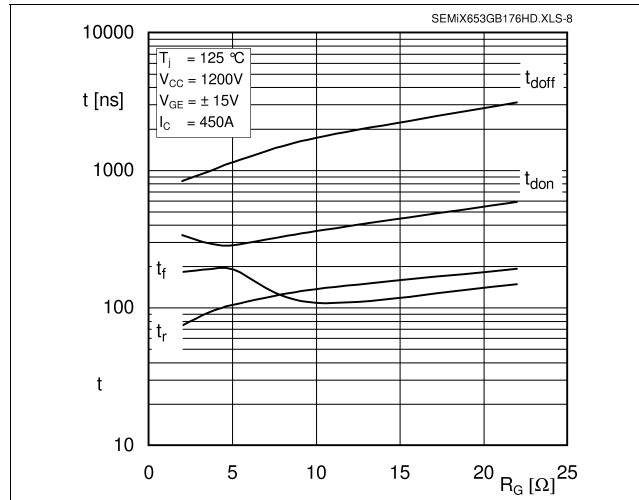


Fig. 8: Typ. switching times vs. gate resistor R_G

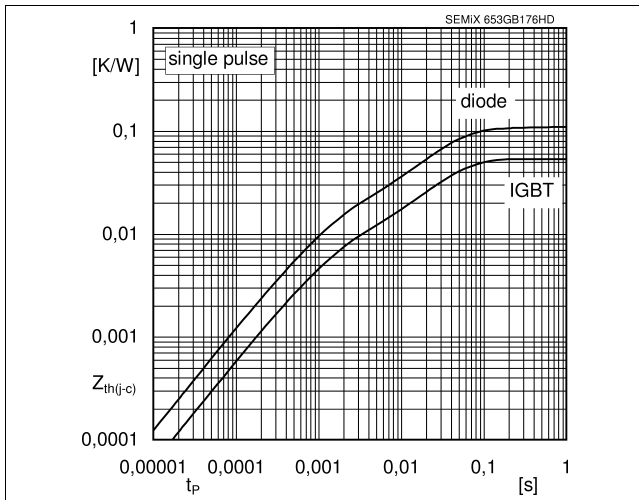


Fig. 9: Typ. transient thermal impedance

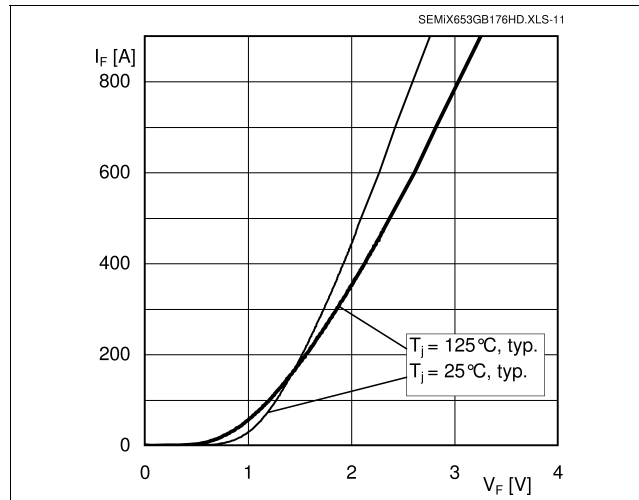


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

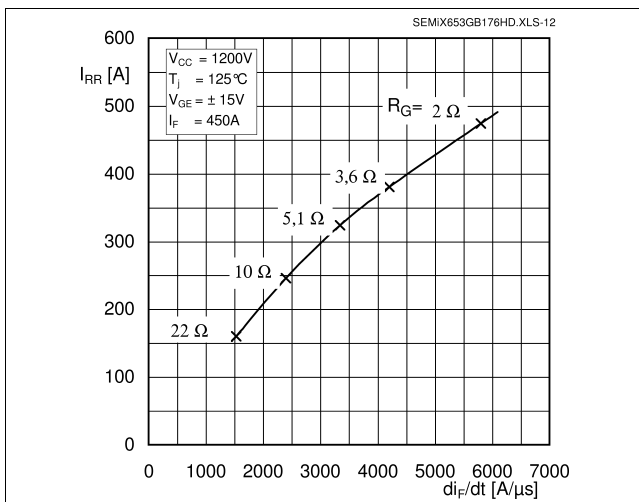


Fig. 11: Typ. CAL diode peak reverse recovery current

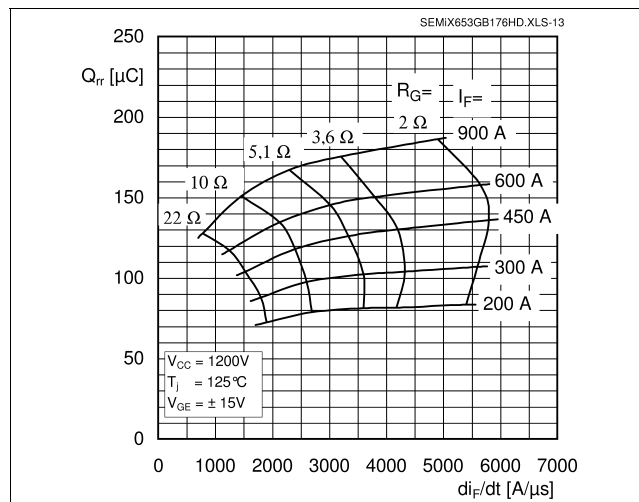


Fig. 12: Typ. CAL diode recovery charge

