

# SEMiX402GB066HDs



SEMiX® 2s

## Trench IGBT Modules

### SEMiX402GB066HDs

#### Features

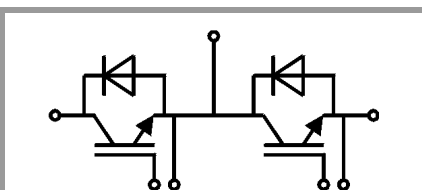
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- UL recognised file no. E63532

#### Typical Applications\*

- Matrix Converter
- Resonant Inverter
- Current Source Inverter

#### Remarks

- Case temperature limited to  $T_C=125^\circ\text{C}$  max.
- Product reliability results are valid for  $T_j=150^\circ\text{C}$
- For short circuit: Soft  $R_{Goff}$  recommended
- Take care of over-voltage caused by stray inductance



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Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$		600	V	
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	502	A
		$T_c = 80^\circ\text{C}$	379	A
$I_{Cnom}$		400	A	
$I_{CRM}$	$I_{CRM} = 2 \times I_{Cnom}$	800	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 360\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 600\text{ V}$	$T_j = 150^\circ\text{C}$	6	$\mu\text{s}$
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Inverse diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	543	A
		$T_c = 80^\circ\text{C}$	397	A
$I_{Fnom}$		400	A	
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	800	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	1800	A	
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$		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
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 400\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.45	1.85	V
		$T_j = 150^\circ\text{C}$	1.7	2.1	V
$V_{CE0}$		$T_j = 25^\circ\text{C}$	0.9	1	V
		$T_j = 150^\circ\text{C}$	0.85	0.9	V
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	1.4	2.1	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	2.1	3.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C = 6.4\text{ mA}$	5	5.8	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 600\text{ V}$	$T_j = 25^\circ\text{C}$	0.15	0.45	$\text{mA}$
		$T_j = 150^\circ\text{C}$			$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$		24.7		nF
$C_{oes}$	$V_{GE} = 0\text{ V}$		1.54		nF
$C_{res}$			0.73		nF
$Q_G$	$V_{GE} = -8\text{ V...}+15\text{ V}$		3200		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$		1.00		$\Omega$
$t_{d(on)}$	$V_{CC} = 300\text{ V}$	$T_j = 150^\circ\text{C}$	150		ns
$t_r$	$I_C = 400\text{ A}$	$T_j = 150^\circ\text{C}$	125		ns
		$T_j = 150^\circ\text{C}$	22		mJ
$E_{on}$	$R_{Gon} = 4.5\ \Omega$	$T_j = 150^\circ\text{C}$			mJ
$t_{d(off)}$	$R_{Goff} = 4.5\ \Omega$	$T_j = 150^\circ\text{C}$	900		ns
$t_f$		$T_j = 150^\circ\text{C}$	65		ns
		$T_j = 150^\circ\text{C}$	24		mJ
$E_{off}$		$T_j = 150^\circ\text{C}$			mJ
$R_{th(j-c)}$	per IGBT			0.12	K/W

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 400\text{ A}$ $V_{GE} = 0\text{ V}$ chip	$T_j = 25^\circ\text{C}$		1.4	1.60	V
		$T_j = 150^\circ\text{C}$		1.4	1.6	V
$V_{F0}$		$T_j = 25^\circ\text{C}$	0.9	1	1.1	V
		$T_j = 150^\circ\text{C}$	0.75	0.85	0.95	V
$r_F$		$T_j = 25^\circ\text{C}$	0.8	1.0	1.3	m $\Omega$
		$T_j = 150^\circ\text{C}$	1.1	1.4	1.6	m $\Omega$
$I_{RRM}$	$I_F = 400\text{ A}$ $di/dt_{off} = 3700\text{ A}/\mu\text{s}$ $V_{GE} = -8\text{ V}$ $V_{CC} = 300\text{ V}$	$T_j = 150^\circ\text{C}$		250		A
$Q_{rr}$		$T_j = 150^\circ\text{C}$		47		$\mu\text{C}$
$E_{rr}$		$T_j = 150^\circ\text{C}$			10	
$R_{th(j-c)}$	per diode				0.15	K/W
<b>Module</b>						
$L_{CE}$				18		nH
$R_{CC'+EE'}$	res., terminal-chip	$T_C = 25^\circ\text{C}$		0.7		m $\Omega$
		$T_C = 125^\circ\text{C}$		1		m $\Omega$
$R_{th(c-s)}$	per module			0.045		K/W
$M_s$	to heat sink (M5)		3		5	Nm
$M_t$		to terminals (M6)	2.5		5	Nm
						Nm
w					250	g
<b>Temperatur Sensor</b>						
$R_{100}$	$T_C=100^\circ\text{C}$ ( $R_{25}=5\text{ k}\Omega$ )			$493 \pm 5\%$		$\Omega$
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$ ; $T[\text{K}]$ ;			$3550 \pm 2\%$		K



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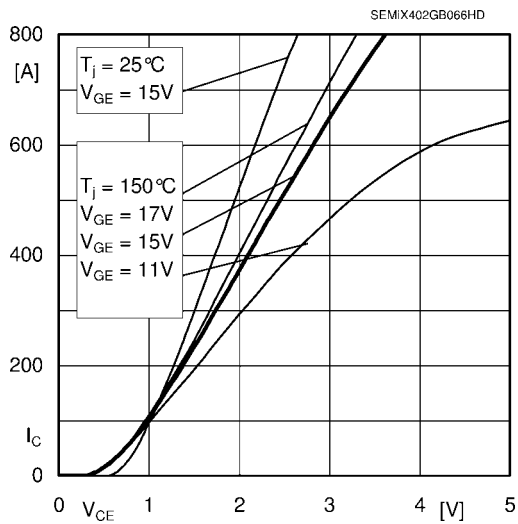


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

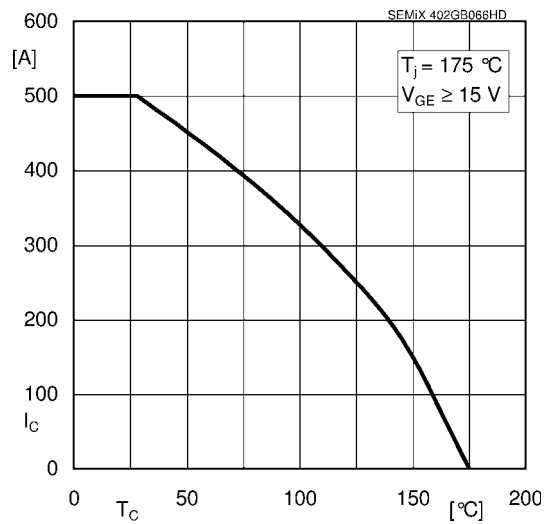


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

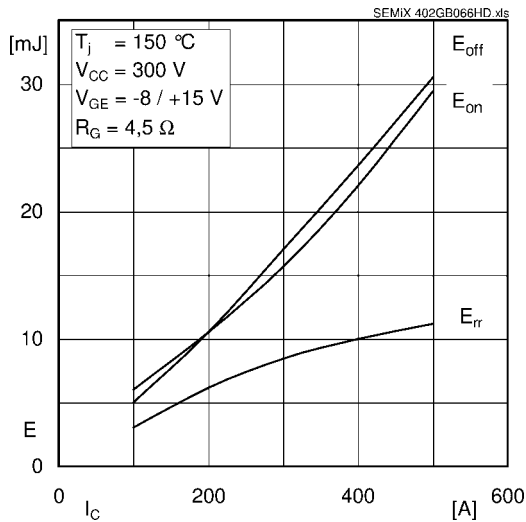


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

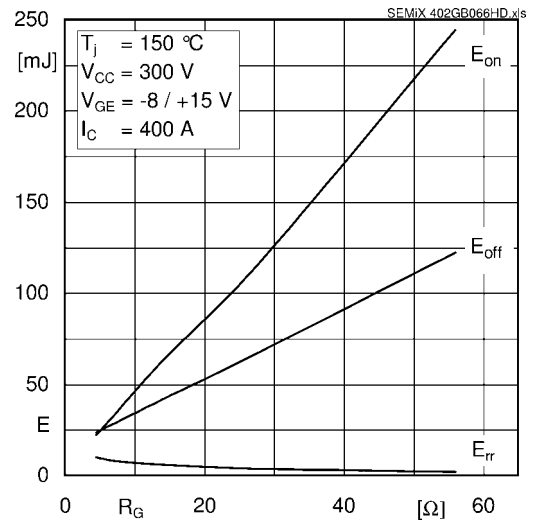


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

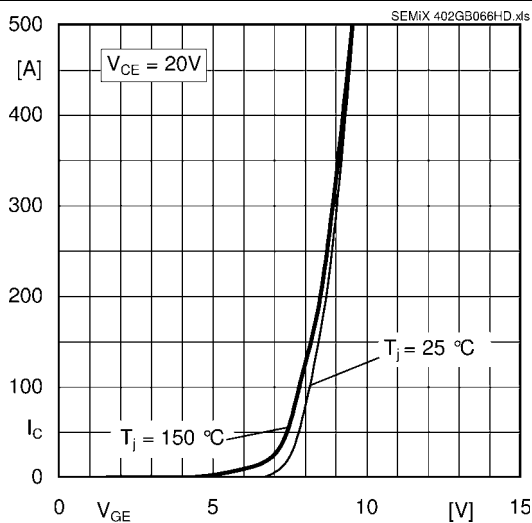


Fig. 5: Typ. transfer characteristic

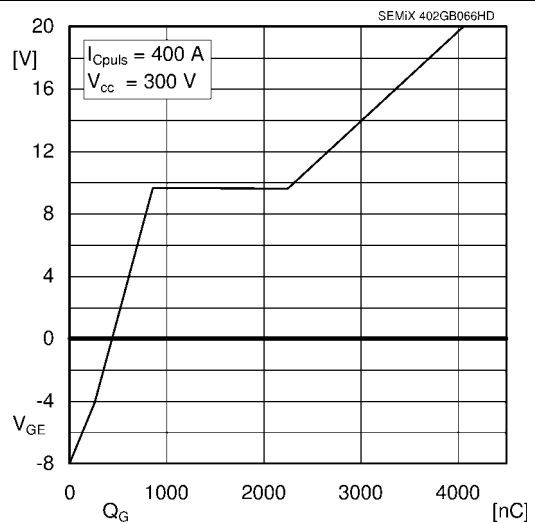


Fig. 6: Typ. gate charge characteristic

