

SEMiX402GAR066HDs



SEMiX[®] 2s

Trench IGBT Modules

SEMiX402GAR066HDs

Features

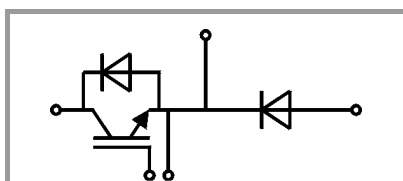
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- UL recognised file no. E63532

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



GAR

Absolute Maximum Ratings					
Symbol	Conditions		Values	Unit	
IGBT					
V_{CES}	$T_J = 25^\circ\text{C}$		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		μs
T_J			-40 ... 175	$^\circ\text{C}$	
Inverse diode					
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	$^\circ\text{C}$	
Freewheeling diode					
I_F	$T_J = 175^\circ\text{C}$	$T_C = 25^\circ\text{C}$	566	A	
		$T_C = 80^\circ\text{C}$	412	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	$^\circ\text{C}$	
Module					
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$		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						
$V_{CE(sat)}$	$I_C = 400\text{ A}$ $V_{GE} = 15\text{ V}$ 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	mA	
		$T_J = 150^\circ\text{C}$			mA	
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	24.7		nF	
C_{oes}		$f = 1\text{ MHz}$	1.54		nF	
C_{res}		$f = 1\text{ MHz}$	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		Ω	

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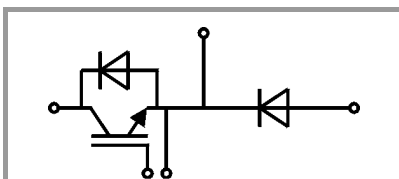
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 300\text{ V}$	$T_J = 150^\circ\text{C}$		150		ns
t_r	$I_C = 400\text{ A}$	$T_J = 150^\circ\text{C}$		125		ns
E_{on}	$V_{GE} = \pm 15\text{ V}$	$T_J = 150^\circ\text{C}$		22		mJ
$t_{d(off)}$	$R_{G\ on} = 4.5\ \Omega$	$T_J = 150^\circ\text{C}$		900		ns
t_f	$R_{G\ off} = 4.5\ \Omega$	$T_J = 150^\circ\text{C}$		65		ns
E_{off}		$T_J = 150^\circ\text{C}$		24		mJ
$R_{th(j-c)}$	per IGBT				0.12	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 400\text{ A}$	$T_J = 25^\circ\text{C}$		1.4	1.60	V
	$V_{GE} = 0\text{ V}$	$T_J = 150^\circ\text{C}$		1.4	1.6	V
	chip					
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 Ω
		$T_J = 150^\circ\text{C}$	1.1	1.4	1.6	m Ω
I_{RRM}	$I_F = 400\text{ A}$	$T_J = 150^\circ\text{C}$		250		A
Q_{rr}	$di/dt_{off} = 3700\text{ A}/\mu\text{s}$	$T_J = 150^\circ\text{C}$		47		μC
E_{rr}	$V_{GE} = -8\text{ V}$	$T_J = 150^\circ\text{C}$		10		mJ
	$V_{CC} = 300\text{ V}$					
$R_{th(j-c)}$	per diode				0.15	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 400\text{ A}$	$T_J = 25^\circ\text{C}$		1.3	1.53	V
	$V_{GE} = 0\text{ V}$	$T_J = 150^\circ\text{C}$		1.3	1.5	V
	chip					
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		$T_J = 25^\circ\text{C}$	0.7	0.9	1.1	m Ω
		$T_J = 150^\circ\text{C}$	1.0	1.2	1.4	m Ω
I_{RRM}	$I_F = 400\text{ A}$	$T_J = 150^\circ\text{C}$		250		A
Q_{rr}	$di/dt_{off} = 3700\text{ A}/\mu\text{s}$	$T_J = 150^\circ\text{C}$		47		μC
E_{rr}	$V_{GE} = -8\text{ V}$	$T_J = 150^\circ\text{C}$		10		mJ
	$V_{CC} = 300\text{ V}$					
$R_{th(j-c)}$	per diode				0.15	K/W
Module						
L_{CE}				18		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			0.045		K/W
M_s	to heat sink (M5)		3		5	Nm
M_t		to terminals (M6)	2.5		5	Nm
w					250	g
Temperatur Sensor						
R_{100}	$T_C = 100^\circ\text{C}$ ($R_{25} = 5\text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$; $T[K]$;			$3550 \pm 2\%$		K

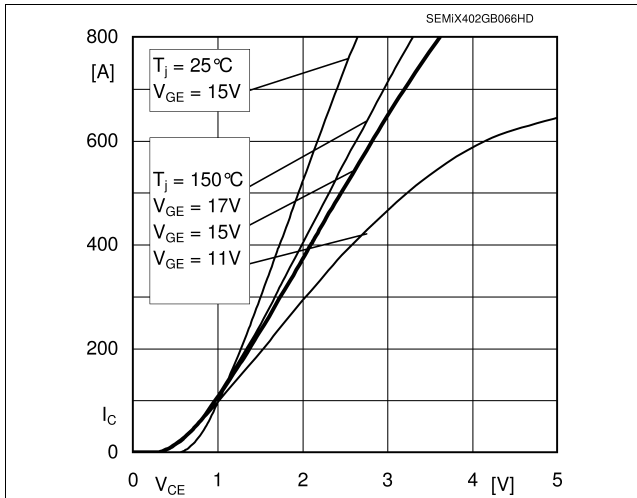


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

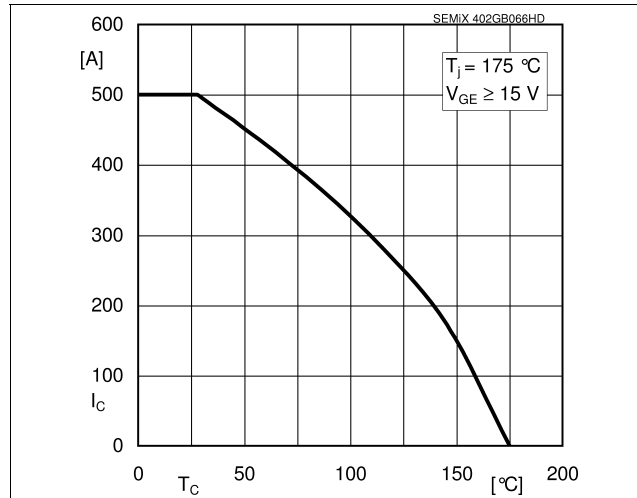


Fig. 2: Rated current vs. temperature $I_c = f(T_c)$

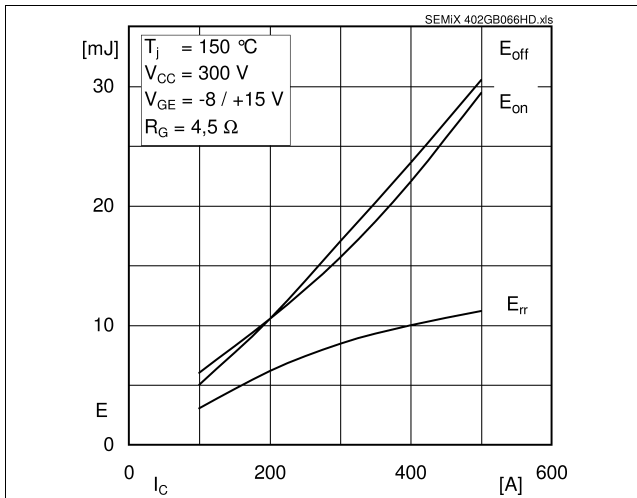


Fig. 3: Typ. turn-on /-off energy = $f(I_c)$

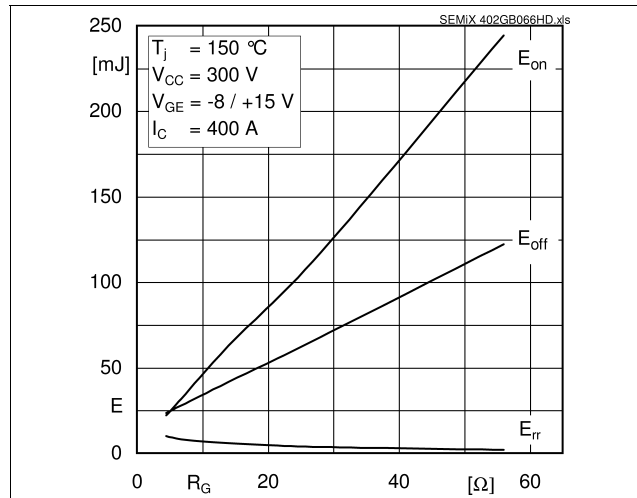


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

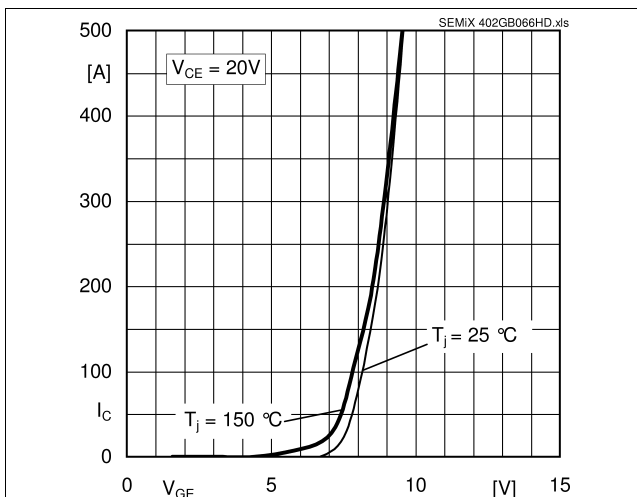


Fig. 5: Typ. transfer characteristic

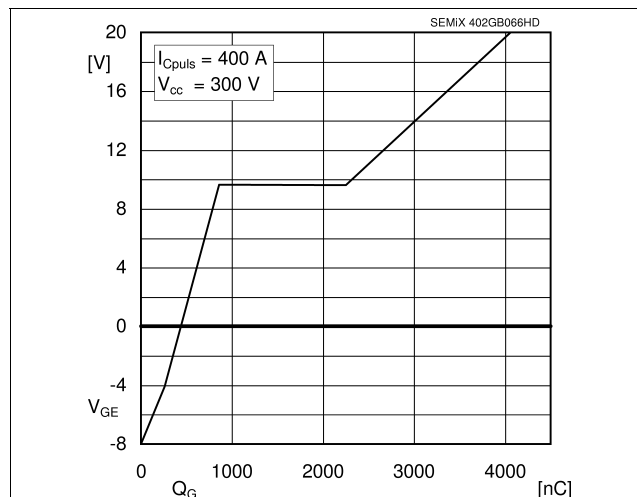


Fig. 6: Typ. gate charge characteristic

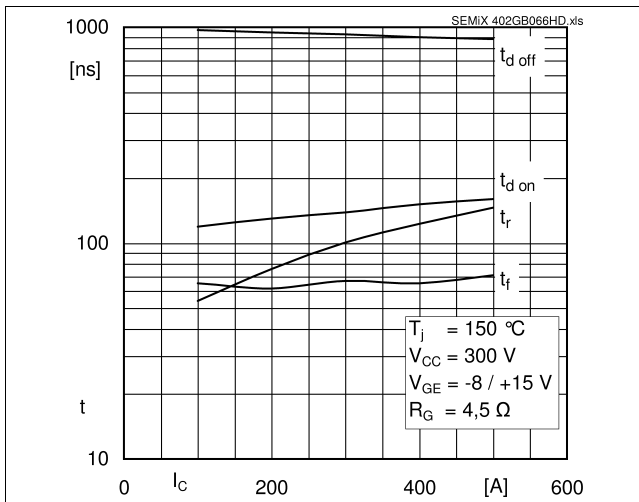


Fig. 7: Typ. switching times vs. I_C

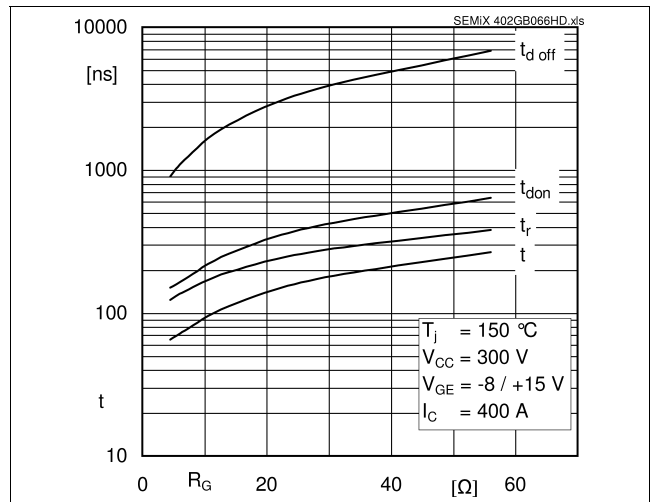


Fig. 8: Typ. switching times vs. gate resistor R_G

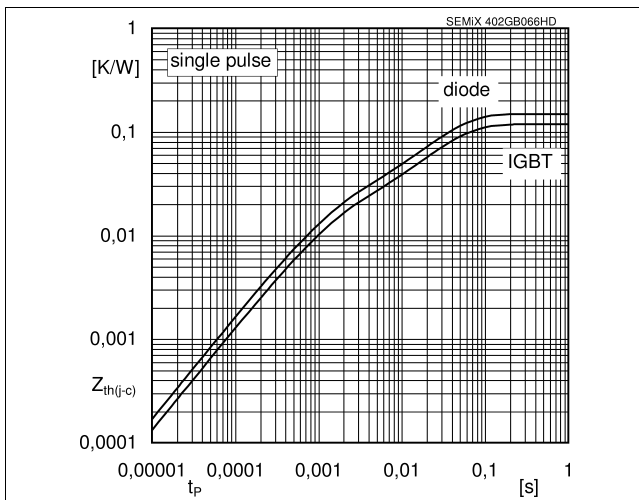


Fig. 9: Typ. transient thermal impedance

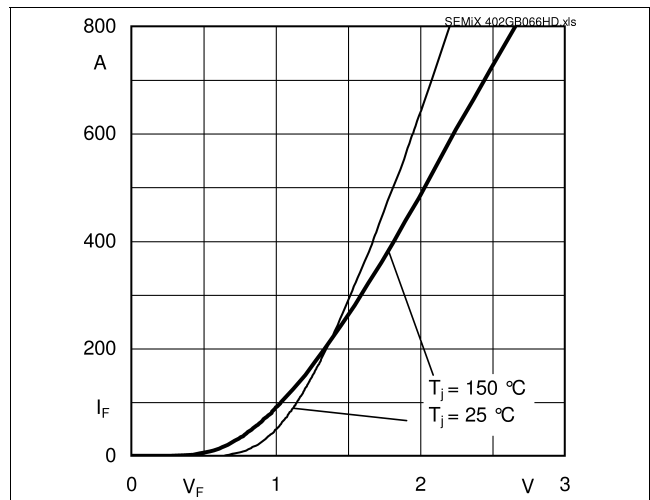


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC+EE'}$

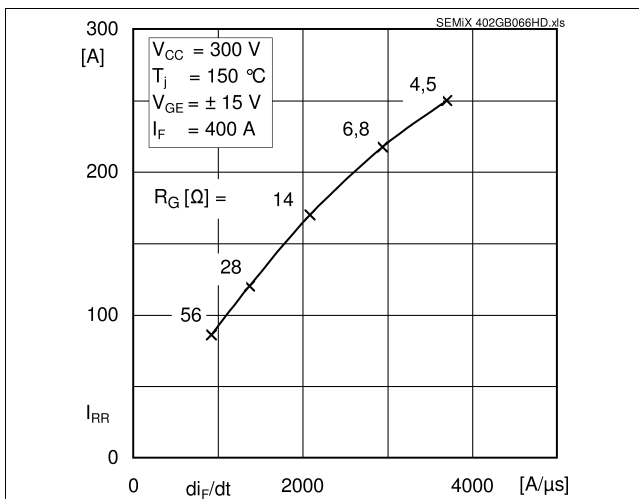


Fig. 11: Typ. CAL diode peak reverse recovery current

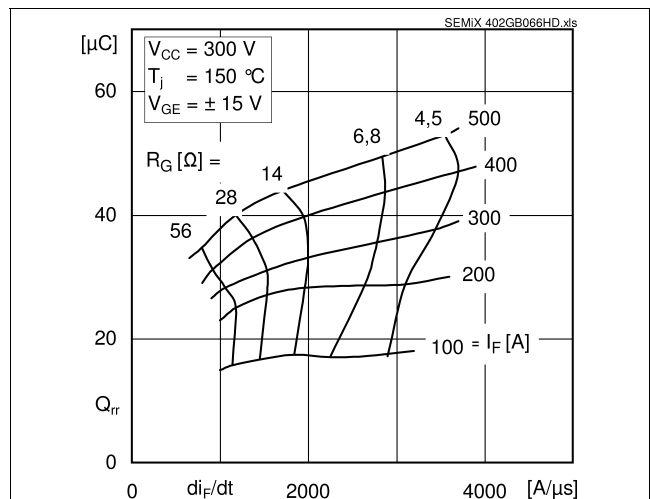


Fig. 12: Typ. CAL diode recovery charge

