

SEMiX302GAL12E4s



SEMiX® 2s

Trench IGBT Modules

SEMiX302GAL12E4s

Features

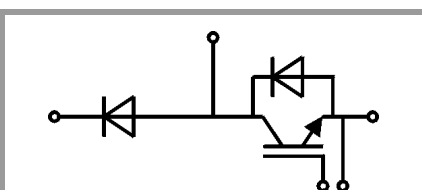
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

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 $T_j = 150^\circ\text{C}$
- Dynamic values apply to the following combination of resistors:
 $R_{Gon,main} = 0,5 \Omega$
 $R_{Goff,main} = 0,5 \Omega$
 $R_{G,X} = 2,2 \Omega$
 $R_{E,X} = 0,5 \Omega$



GAL

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$		1200	V
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	463	A
		$T_c = 80^\circ\text{C}$	356	A
I_{Cnom}			300	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$		900	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
	$V_{GE} \leq 20\text{ V}$			
	$V_{CES} \leq 1200\text{ V}$			
T_j			-40 ... 175	$^\circ\text{C}$
Inverse diode				
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	356	A
		$T_c = 80^\circ\text{C}$	266	A
I_{Fnom}			300	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		900	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		1620	A
T_j			-40 ... 175	$^\circ\text{C}$
Freewheeling diode				
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	356	A
		$T_c = 80^\circ\text{C}$	266	A
I_{Fnom}			300	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		900	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		1620	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						
$V_{CE(sat)}$	$I_C = 300\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.8	2.05		V
		$T_j = 150^\circ\text{C}$	2.2	2.4		V
V_{CE0}		$T_j = 25^\circ\text{C}$	0.8	0.9		V
		$T_j = 150^\circ\text{C}$	0.7	0.8		V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	3.3	3.8		$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	5.0	5.3		$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 12\text{ mA}$		5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3		mA
		$T_j = 150^\circ\text{C}$				mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		18.6		nF
C_{oes}		$f = 1\text{ MHz}$		1.16		nF
C_{res}		$f = 1\text{ MHz}$		1.02		nF
Q_G	$V_{GE} = -8\text{ V...} + 15\text{ V}$			1700		nC
R_{Gint}	$T_j = 25^\circ\text{C}$			2.50		Ω

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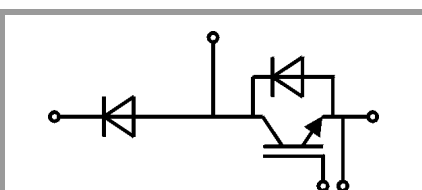
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 $R_{E,X} = 0,5 \Omega$



GAL

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$		282		ns
t_r	$I_C = 300 \text{ A}$	$T_j = 150^\circ\text{C}$		60		ns
E_{on}	$V_{GE} = \pm 15 \text{ V}$	$T_j = 150^\circ\text{C}$		30		mJ
$t_{d(off)}$	$R_{G on} = 1.9 \Omega$	$T_j = 150^\circ\text{C}$		564		ns
t_f	$R_{G off} = 1.9 \Omega$	$T_j = 150^\circ\text{C}$		117		ns
E_{off}	$di/dt_{on} = 5000 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		44		mJ
	$di/dt_{off} = 2800 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per IGBT				0.096	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 300 \text{ A}$	$T_j = 25^\circ\text{C}$		2.1	2.46	V
	$V_{GE} = 0 \text{ V}$	$T_j = 150^\circ\text{C}$		2.1	2.4	V
	chip					
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		$T_j = 25^\circ\text{C}$	2.2	2.8	3.2	m Ω
		$T_j = 150^\circ\text{C}$	3.3	3.9	4.3	m Ω
I_{RRM}	$I_F = 300 \text{ A}$	$T_j = 150^\circ\text{C}$		230		A
Q_{rr}	$di/dt_{off} = 4300 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		50		μC
E_{rr}	$V_{GE} = -15 \text{ V}$	$T_j = 150^\circ\text{C}$		19		mJ
	$V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per diode				0.17	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 300 \text{ A}$	$T_j = 25^\circ\text{C}$		2.1	2.46	V
	$V_{GE} = 0 \text{ V}$	$T_j = 150^\circ\text{C}$		2.1	2.4	V
	chip					
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		$T_j = 25^\circ\text{C}$	2.2	2.8	3.2	m Ω
		$T_j = 150^\circ\text{C}$	3.3	3.9	4.3	m Ω
I_{RRM}	$I_F = 300 \text{ A}$	$T_j = 150^\circ\text{C}$		230		A
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E_{rr}	$V_{GE} = -15 \text{ V}$	$T_j = 150^\circ\text{C}$		19		mJ
	$V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per diode				0.17	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
						Nm
w					250	g
Temperatur Sensor						
R_{100}	$T_C=100^\circ\text{C}$ ($R_{25}=5 \text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R(T)=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; $T[\text{K}]$;			$3550 \pm 2\%$		K

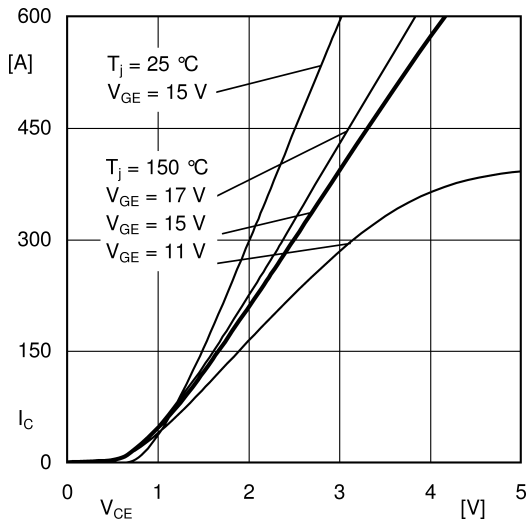


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

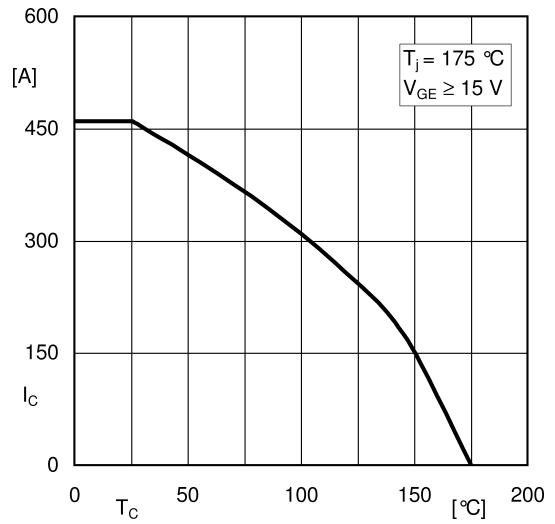


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

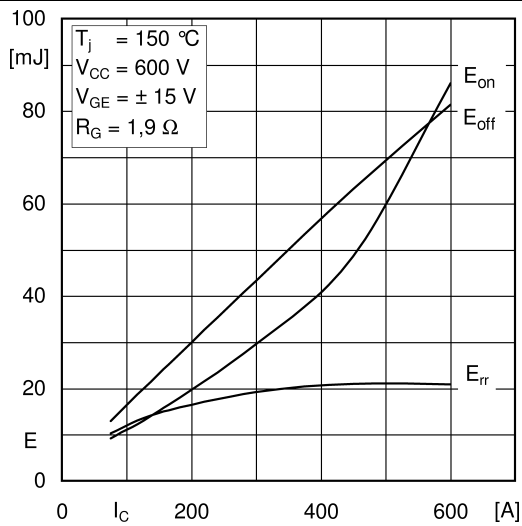


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

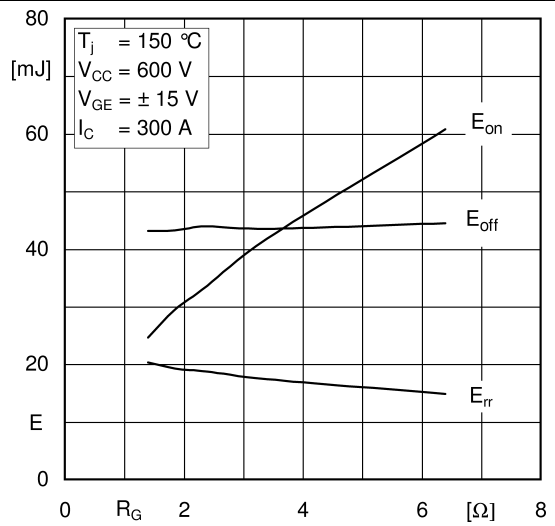


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

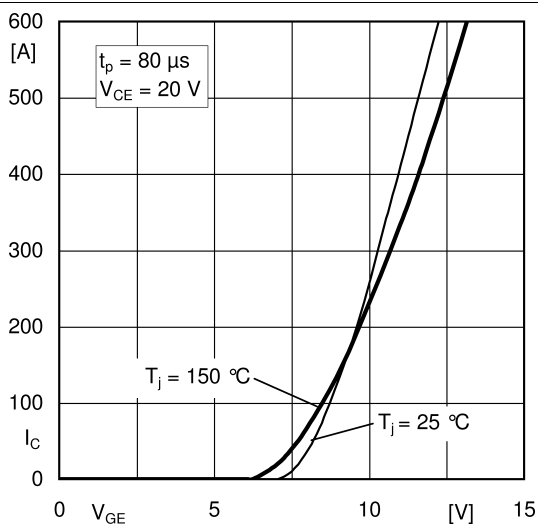


Fig. 5: Typ. transfer characteristic

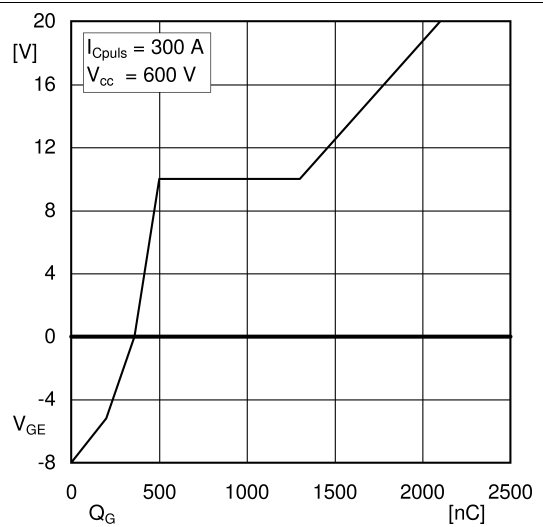


Fig. 6: Typ. gate charge characteristic

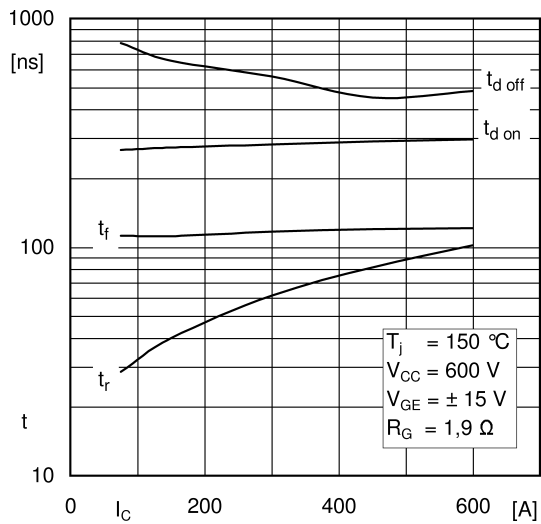


Fig. 7: Typ. switching times vs. I_C

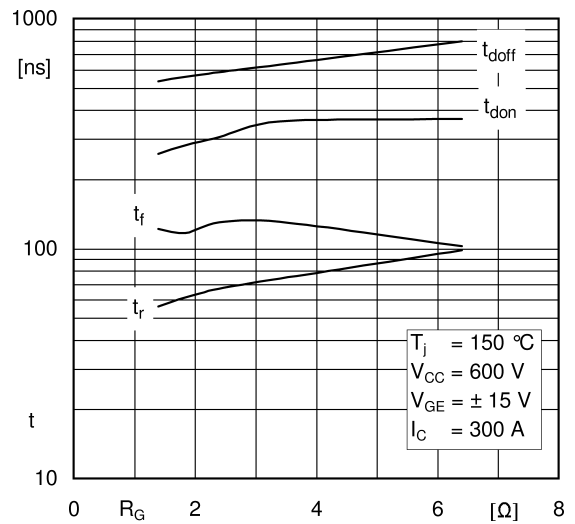


Fig. 8: Typ. switching times vs. gate resistor R_G

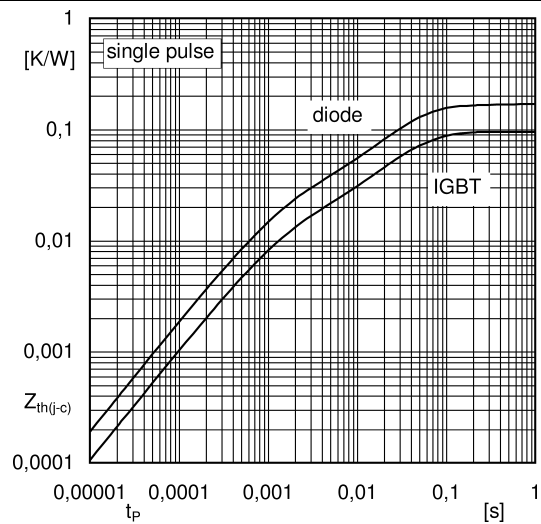


Fig. 9: Typ. transient thermal impedance

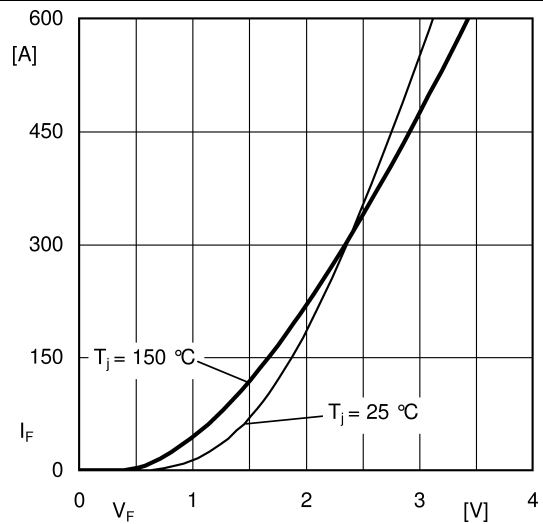


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

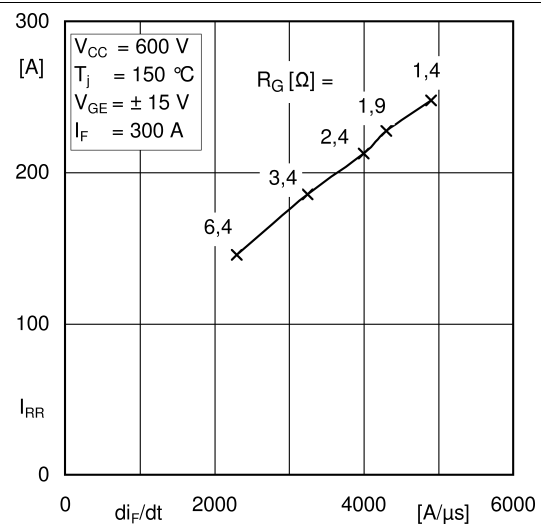


Fig. 11: Typ. CAL diode peak reverse recovery current

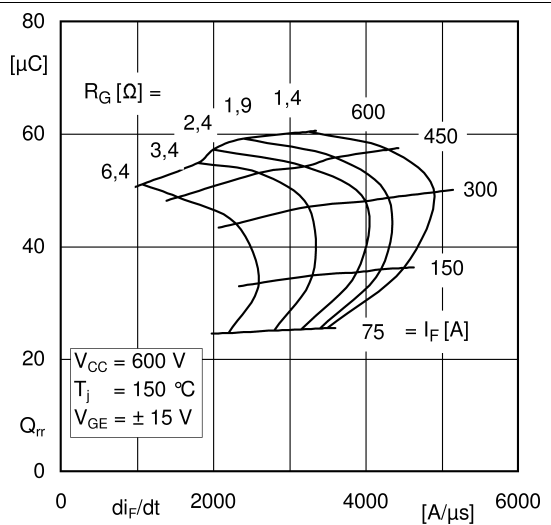


Fig. 12: Typ. CAL diode recovery charge

