



SEMiX® 3s

Trench IGBT Modules

SEMiX453GAL12E4s

Features

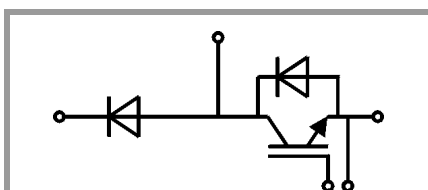
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

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:
 $R_{Gon,main} = 1,0 \Omega$
 $R_{Goff,main} = 1,0 \Omega$
 $R_{G,X} = 2,2 \Omega$
 $R_{E,X} = 0,5 \Omega$



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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	T _j = 175 °C	T _c = 25 °C	683	A
		T _c = 80 °C	526	A
I _{Cnom}			450	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		1350	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 20 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	μs
T _j			-40 ... 175	°C
Inverse diode				
I _F	T _j = 175 °C	T _c = 25 °C	544	A
		T _c = 80 °C	407	A
I _{Fnom}			450	A
I _{FRM}	I _{FRM} = 3xI _{Fnom}		1350	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2430	A
T _j			-40 ... 175	°C
Freewheeling diode				
I _F	T _j = 175 °C	T _c = 25 °C	544	A
		T _c = 80 °C	407	A
I _{Fnom}			450	A
I _{FRM}	I _{FRM} = 3xI _{Fnom}		1350	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2430	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}	T _{terminal} = 80 °C		600	A
T _{stg}			-40 ... 125	°C
V _{isol}	AC sinus 50Hz, t = 1 min		4000	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
V _{CE(sat)}	I _C = 450 A	T _j = 25 °C		1.8	2.05	V
	V _{GE} = 15 V chipllevel	T _j = 150 °C		2.2	2.4	V
V _{CE0}		T _j = 25 °C		0.8	0.9	V
		T _j = 150 °C		0.7	0.8	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		2.2	2.6	mΩ
		T _j = 150 °C		3.3	3.6	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 18 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V	T _j = 25 °C		0.1	0.3	mA
	V _{CE} = 1200 V	T _j = 150 °C				mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		27.9		nF
C _{oes}		f = 1 MHz		1.74		nF
C _{res}		f = 1 MHz		1.53		nF
Q _G	V _{GE} = - 8 V...+ 15 V			2550		nC
R _{Gint}	T _j = 25 °C			1.67		Ω



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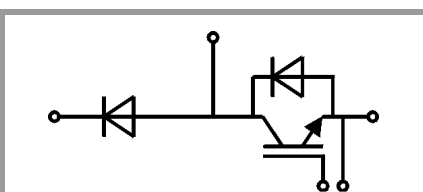
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 $R_{Gon,main} = 1,0 \Omega$
 $R_{Goff,main} = 1,0 \Omega$
 $R_{G,X} = 2,2 \Omega$
 $R_{E,X} = 0,5 \Omega$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C		336		ns
t _r	I _C = 450 A	T _j = 150 °C		80		ns
E _{on}	V _{GE} = ±15 V	T _j = 150 °C		45		mJ
t _{d(off)}	R _{G on} = 1.9 Ω	T _j = 150 °C		615		ns
t _f	R _{G off} = 1.9 Ω	T _j = 150 °C		130		ns
E _{off}	di/dt _{on} = 4000 A/μs di/dt _{off} = 5000 A/μs	T _j = 150 °C		66.5		mJ
R _{th(j-c)}	per IGBT				0.065	K/W
Inverse diode						
V _F = V _{EC}	I _F = 450 A	T _j = 25 °C		2.1	2.46	V
	V _{GE} = 0 V chip	T _j = 150 °C		2.1	2.4	V
V _{F0}		T _j = 25 °C	1.1	1.3	1.5	V
		T _j = 150 °C	0.7	0.9	1.1	V
r _F		T _j = 25 °C	1.4	1.9	2.1	mΩ
		T _j = 150 °C	2.2	2.6	2.8	mΩ
I _{RRM}	I _F = 450 A	T _j = 150 °C		350		A
Q _{rr}	di/dt _{off} = 5000 A/μs	T _j = 150 °C		70		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C		28		mJ
R _{th(j-c)}	per diode				0.11	K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 450 A	T _j = 25 °C		2.1	2.46	V
	V _{GE} = 0 V chip	T _j = 150 °C		2.1	2.4	V
V _{F0}		T _j = 25 °C	1.1	1.3	1.5	V
		T _j = 150 °C	0.7	0.9	1.1	V
r _F		T _j = 25 °C	1.4	1.9	2.1	mΩ
		T _j = 150 °C	2.2	2.6	2.8	mΩ
I _{RRM}	I _F = 450 A	T _j = 150 °C		350		A
Q _{rr}	di/dt _{off} = 5000 A/μs	T _j = 150 °C		70		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C		28		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 °C		0.7		mΩ
		T _C = 125 °C		1		mΩ
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°C (R ₂₅ =5 kΩ)			493 ± 5%		Ω
B _{100/125}	R(T)=R ₁₀₀ exp[B _{100/125} (1/T-1/T ₁₀₀)]; T[K];			3550 ±2%		K



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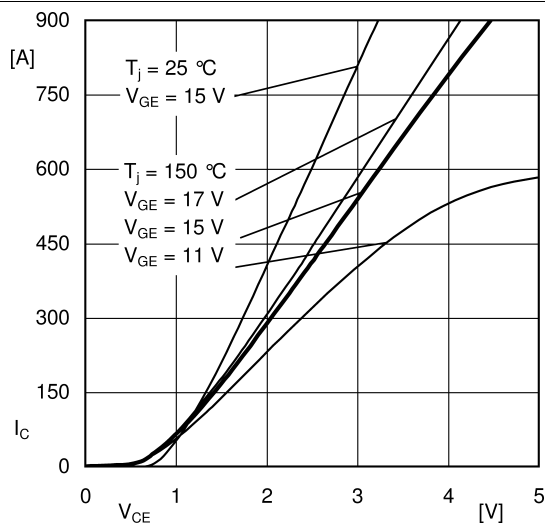


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

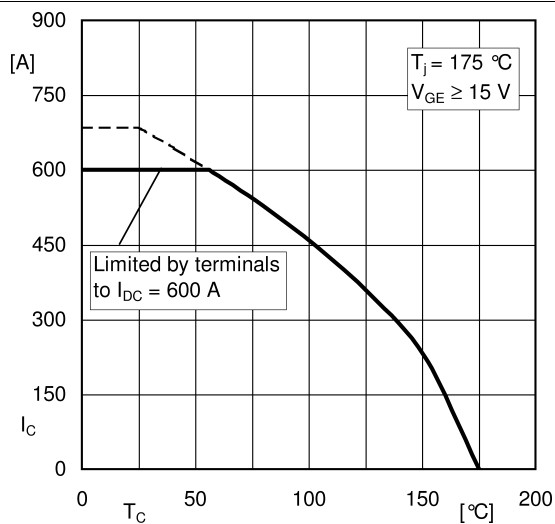


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

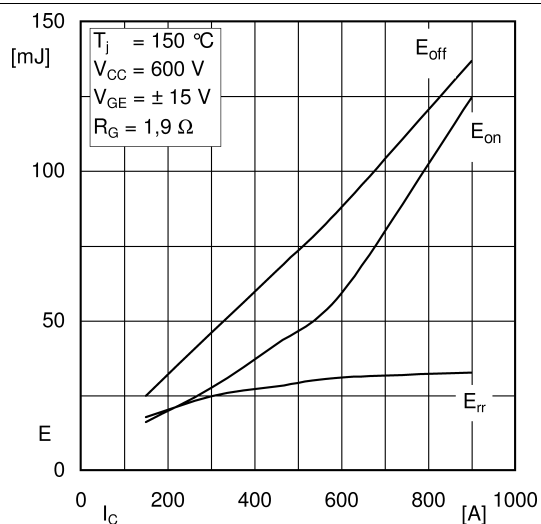


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

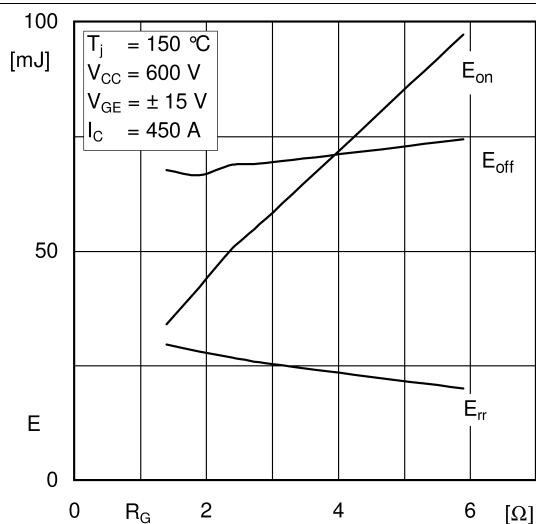


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

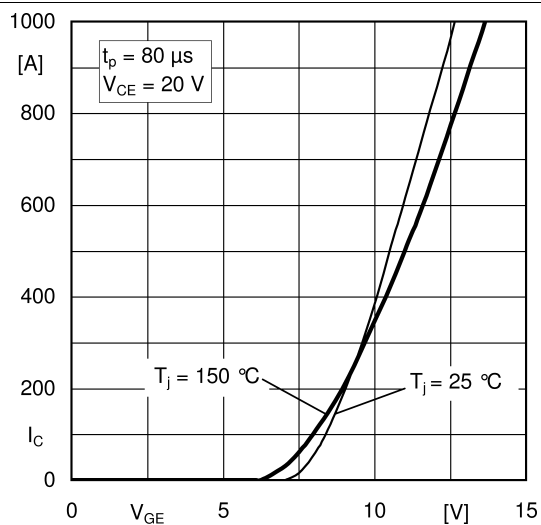


Fig. 5: Typ. transfer characteristic

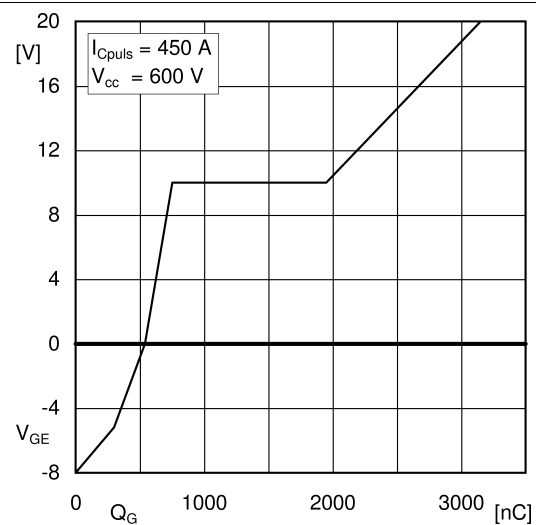
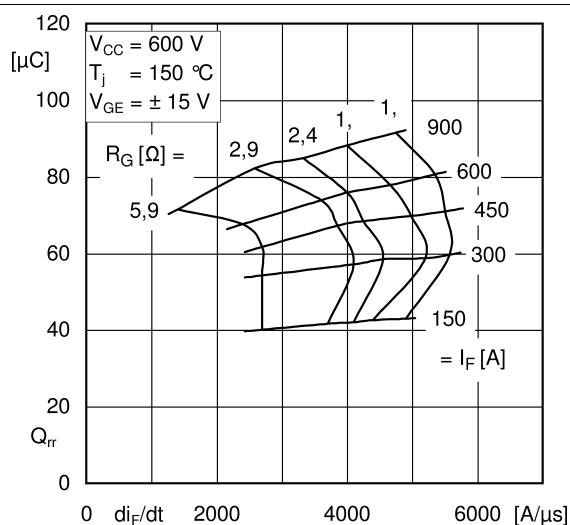
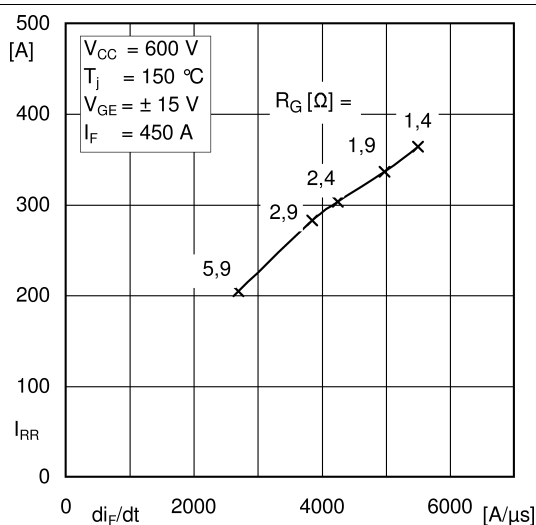
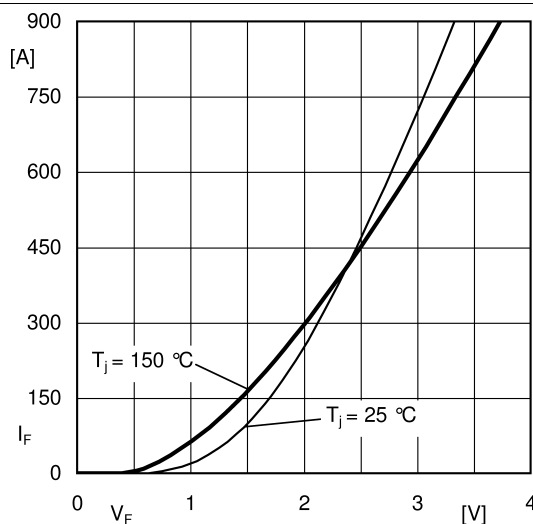
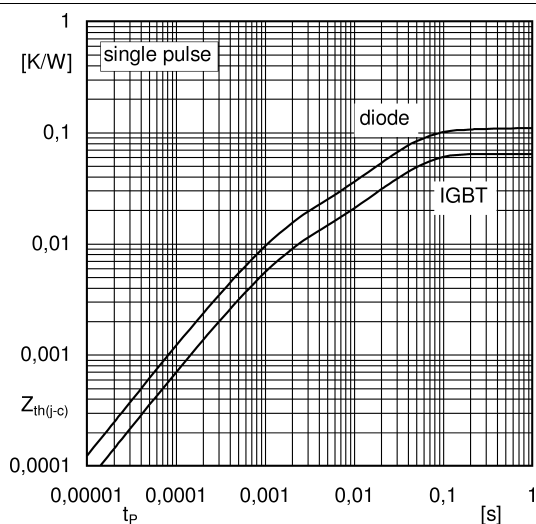
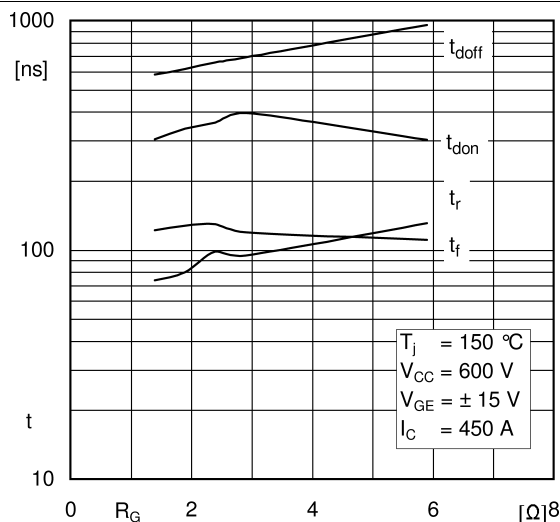
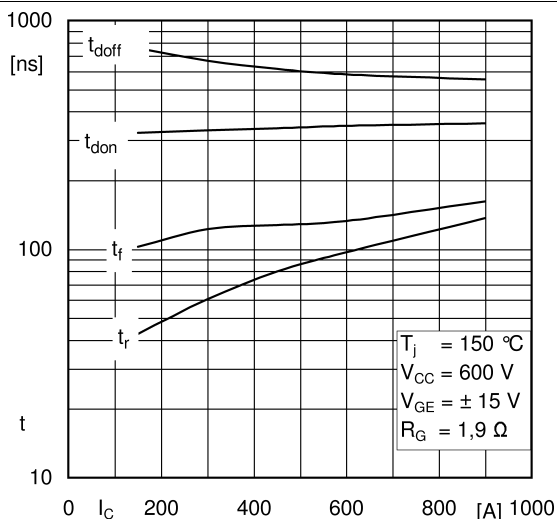
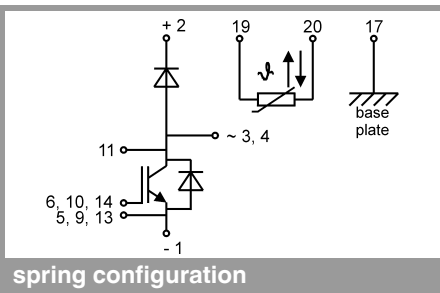


Fig. 6: Typ. gate charge characteristic





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