



SEMiX® 13

Trench IGBT Modules

SEMiX151GD12E4s

Features

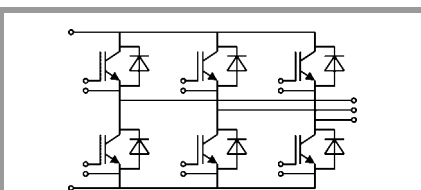
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

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 $T_J=150^\circ\text{C}$



GD

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}			1200	V
I _C	T _j = 175 °C	T _c = 25 °C	232	A
		T _c = 80 °C	179	A
I _{Cnom}			150	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		450	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	189	A
		T _c = 80 °C	141	A
I _{Fnom}			150	A
I _{FRM}	I _{FRM} = 3xI _{Fnom}		450	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		900	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			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 = 150 A	T _J = 25 °C		1.8	2.05	V
	V _{GE} = 15 V chipelevel	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		6.7	7.7	mΩ
		T _J = 150 °C		10.0	10.7	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 6 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	f = 1 MHz		9.3		nF
C _{oes}	V _{GE} = 0 V	f = 1 MHz		0.58		nF
C _{res}		f = 1 MHz		0.51		nF
Q _G	V _{GE} = - 8 V...+ 15 V			850		nC
R _{Gint}	T _J = 25 °C			5.00		Ω
t _{d(on)}	V _{CC} = 600 V	T _J = 150 °C		209		ns
t _r	I _C = 150 A	T _J = 150 °C		39		ns
E _{on}	R _{G on} = 1 Ω	T _J = 150 °C		14.1		mJ
t _{d(off)}	R _{G off} = 1 Ω	T _J = 150 °C		483		ns
t _f	di/dt _{on} = 3900 A/μs	T _J = 150 °C		82		ns
E _{off}	di/dt _{off} = 2000 A/μs	T _J = 150 °C		19.2		mJ
R _{th(j-c)}	per IGBT				0.19	K/W



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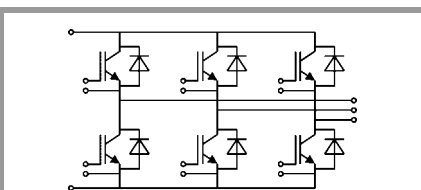
Typical Applications*

- AC inverter drives
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Remarks

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 150 A V _{GE} = 0 V chip	T _j = 25 °C		2.1	2.46	V
		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	4.3	5.6	6.4	mΩ
		T _j = 150 °C	6.7	7.8	8.5	mΩ
I _{RRM}	I _F = 150 A di/dt _{off} = 3400 A/μs V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C	185			A
Q _{rr}		T _j = 150 °C	23			μC
E _{rr}		T _j = 150 °C	8.9			mJ
R _{th(j-c)}	per diode		0.31			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			350			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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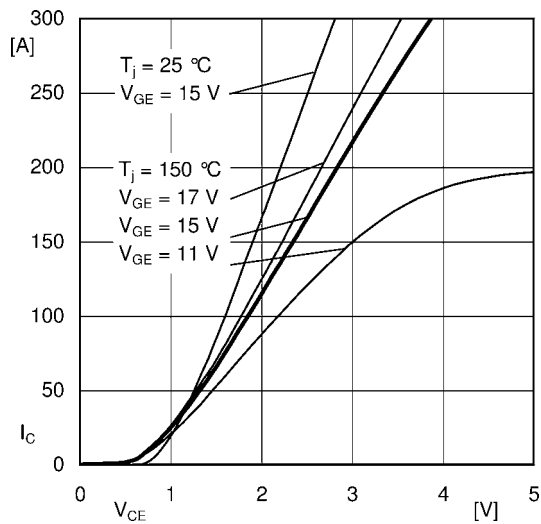
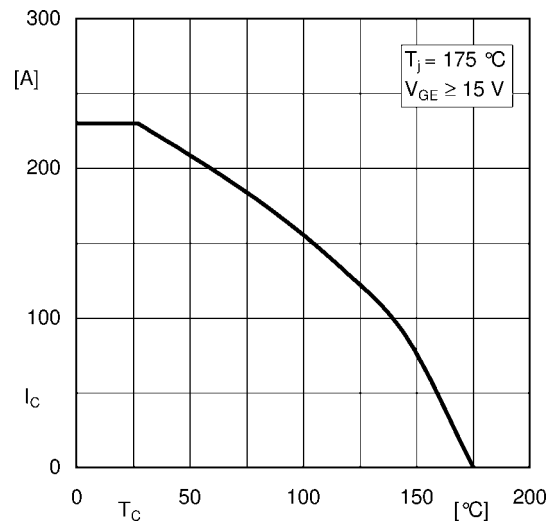
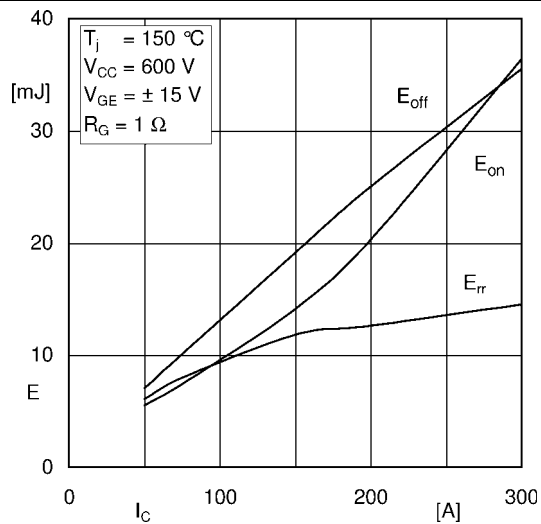
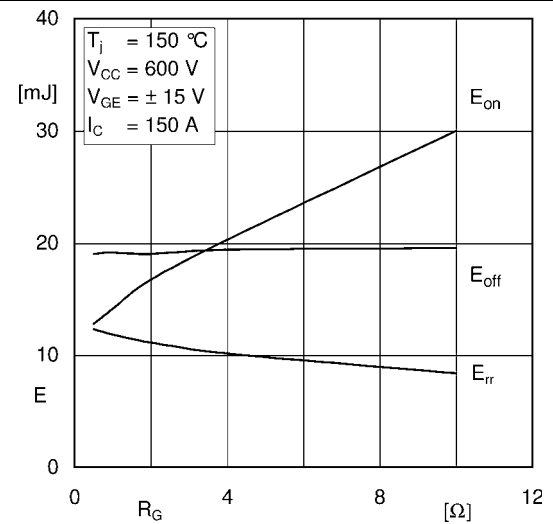
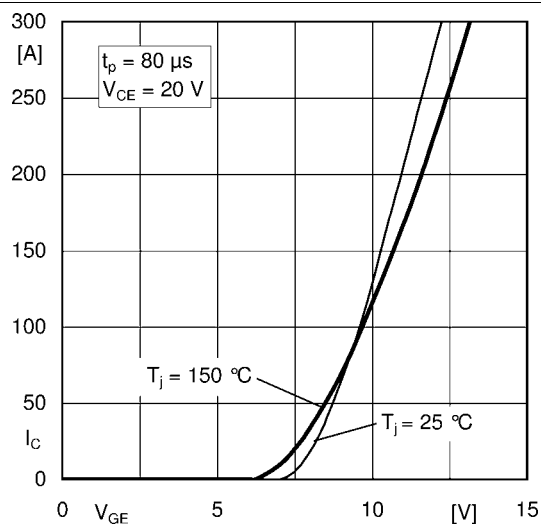
Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + EE'$ Fig. 2: Rated current vs. temperature $I_C = f(T_C)$ Fig. 3: Typ. turn-on /-off energy = $f(I_C)$ Fig. 4: Typ. turn-on /-off energy = $f(R_G)$ 

Fig. 5: Typ. transfer characteristic

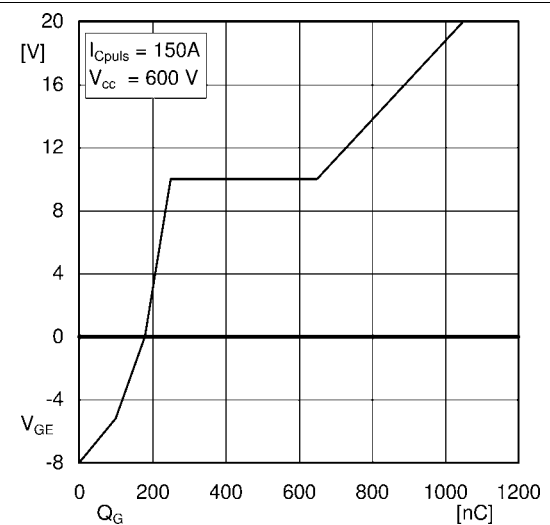


Fig. 6: Typ. gate charge characteristic

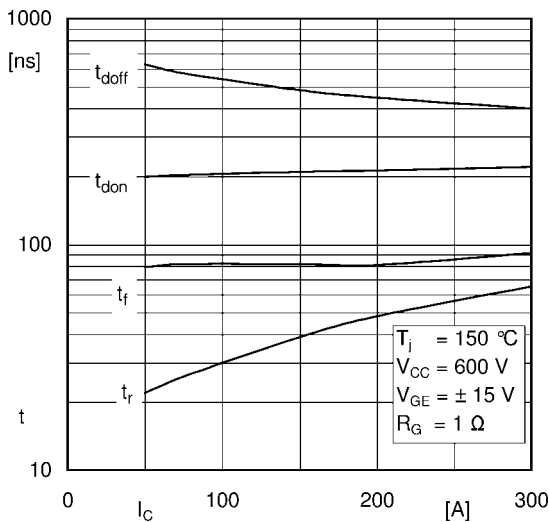
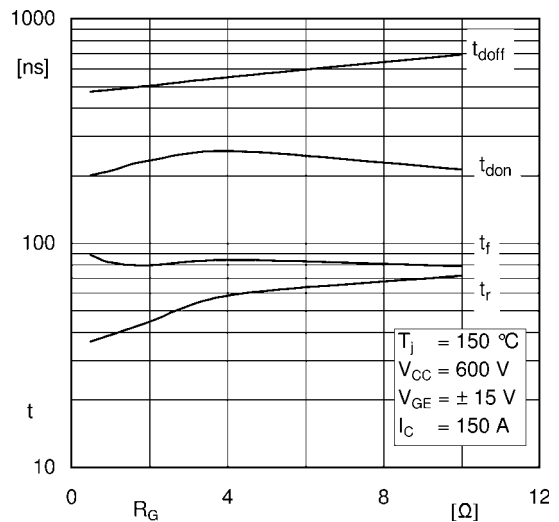
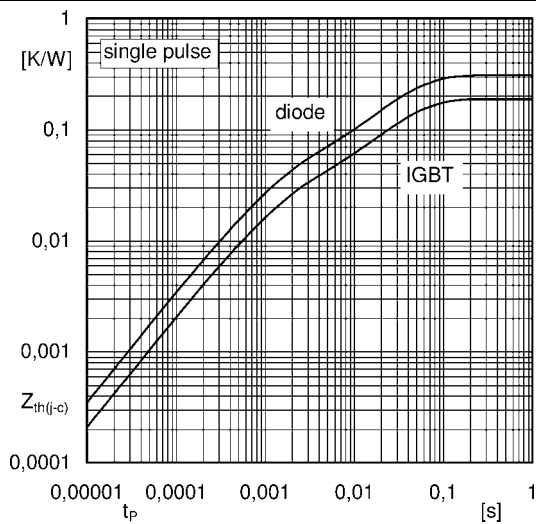
Fig. 7: Typ. switching times vs. I_C Fig. 8: Typ. switching times vs. gate resistor R_G 

Fig. 9: Typ. transient thermal impedance

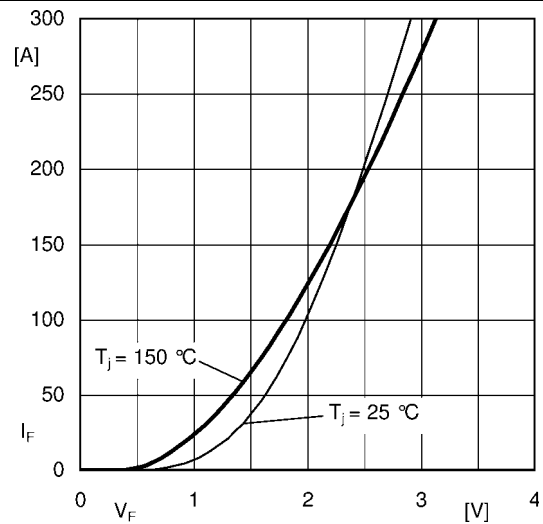
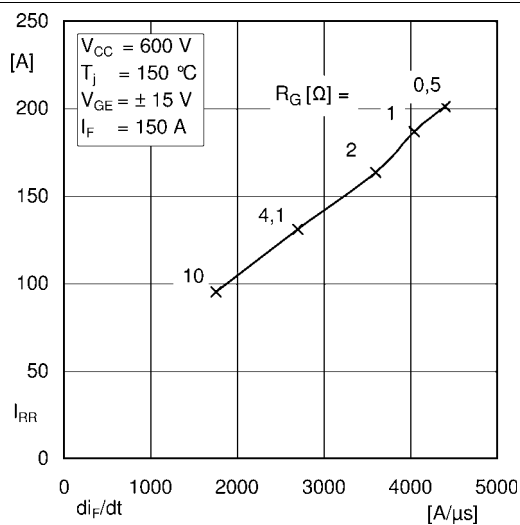
Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$ 

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

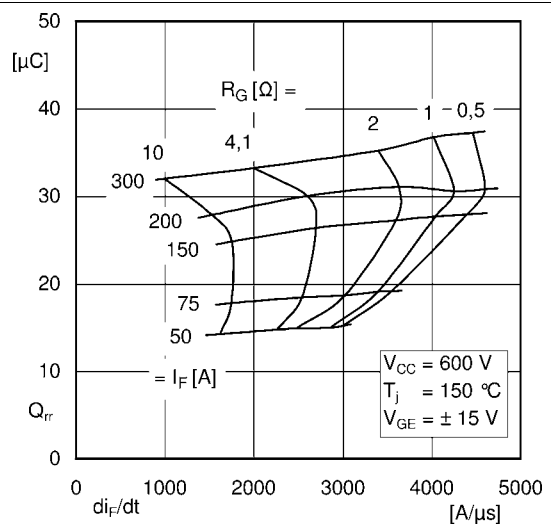


Fig. 12: Typ. CAL diode recovery charge



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