



SEMiX® 5

Trench IGBT Modules

SEMiX205GD12E4

Features

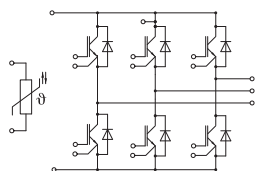
- Solderless assembly solution with PressFIT signal pins and screw power terminals
- IGBT 4 Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and robust internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Product reliability results are valid for $T_{jop}=150^{\circ}\text{C}$
- Please refer to SEMiX®5 Technical Explanations for mounting conditions
- For storage and case temperature with TIM see document "TP(HALA P8) SEMiX 5p"



GD

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	313	A
		T _c = 80 °C	239	A
I _{Cnom}			200	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		600	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	μs
T _j			-40 ... 175	°C

Inverse diode

V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 175 °C	T _c = 25 °C	224	A
		T _c = 80 °C	167	A
I _{Fnom}			200	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		400	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		990	A
T _j			-40 ... 175	°C

Module

$I_{t(RMS)}$		300	A
T_{stg}	module without TIM	-40 ... 125	$^{\circ}\text{C}$
V_{isol}	AC sinus 50Hz, $t = 1\text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 200\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^{\circ}\text{C}$	1.80	2.05	V
		$T_j = 150^{\circ}\text{C}$	2.05	2.30	V
V_{CE0}	chipelevel	$T_j = 25^{\circ}\text{C}$	0.87	1.01	V
		$T_j = 150^{\circ}\text{C}$	0.77	0.90	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^{\circ}\text{C}$	4.7	5.2	$\text{m}\Omega$
		$T_j = 150^{\circ}\text{C}$	6.4	7.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}$, $I_C = 7.4\text{ mA}$	5.3	5.8	6.3	V
I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_j = 25^{\circ}\text{C}$			2.6	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	12.5		nF
C_{oes}		$f = 1\text{ MHz}$	-		nF
C_{res}		$f = 1\text{ MHz}$	0.68		nF
Q_G	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		2087		nC
R_{Gint}	$T_j = 25^{\circ}\text{C}$		3.5		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^{\circ}\text{C}$	145		ns
t_r	$I_C = 200\text{ A}$	$T_j = 150^{\circ}\text{C}$	43		ns
E_{on}	$V_{GE} = +15/-15\text{ V}$ $R_{G on} = 1\text{ }\Omega$	$T_j = 150^{\circ}\text{C}$	14		mJ
$t_{d(off)}$	$R_{G off} = 1\text{ }\Omega$	$T_j = 150^{\circ}\text{C}$	457		ns
t_f	$di/dt_{on} = 4500\text{ A}/\mu\text{s}$ $di/dt_{off} = 1353\text{ A}/\mu\text{s}$	$T_j = 150^{\circ}\text{C}$	82		ns
E_{off}		$T_j = 150^{\circ}\text{C}$	22.8		mJ
$R_{th(j-c)}$	per IGBT			0.15	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease}=0.81\text{ W/mK}$, thickness 50-100 μm)		0.055		K/W
$R_{th(c-s)}$	per IGBT ($\lambda=3.4\text{ W/mK}$)		t.b.d.		K/W



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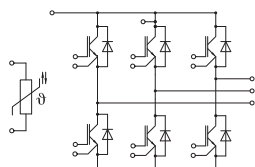
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Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverse diode					
$V_F = V_{EC}$	$I_F = 200\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^{\circ}\text{C}$	2.20	2.52	V
		$T_j = 150^{\circ}\text{C}$	2.15	2.47	V
V_{F0}	chipelevel	$T_j = 25^{\circ}\text{C}$	1.30	1.50	V
		$T_j = 150^{\circ}\text{C}$	0.90	1.10	V
r_F	chipelevel	$T_j = 25^{\circ}\text{C}$	4.5	5.1	mΩ
		$T_j = 150^{\circ}\text{C}$	6.3	6.9	mΩ
I_{RRM}	$I_F = 200\text{ A}$	$T_j = 150^{\circ}\text{C}$	250		A
Q_{rr}	$di/dt_{off} = 4500\text{ A/}\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 150^{\circ}\text{C}$	37		μC
E_{rr}	$V_{CC} = 600\text{ V}$	$T_j = 150^{\circ}\text{C}$	16		mJ
$R_{th(j-c)}$	per diode			0.27	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W/mK}$, thickness 50-100μm)		0.065		K/W
$R_{th(c-s)}$	per diode ($\lambda=3.4\text{ W/mK}$)		t.b.d.		K/W
Module					
L_{CE}			20		nH
$R_{CC'+EE'}$	measured per switch	$T_C = 25^{\circ}\text{C}$	1.2		mΩ
		$T_C = 125^{\circ}\text{C}$	1.65		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling		0.005		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module ($\lambda_{grease}=0.81\text{ W/}$ (m*K))		0.0081		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module, pre-applied phase change material		t.b.d.		K/W
M_s	to heat sink (M5)	3		6	Nm
M_t	to terminals (M6)	3		6	Nm
					Nm
w			398		g
Temperature Sensor					
R_{100}	$T_c=100^{\circ}\text{C}$ ($R_{25}=5\text{ k}\Omega$)		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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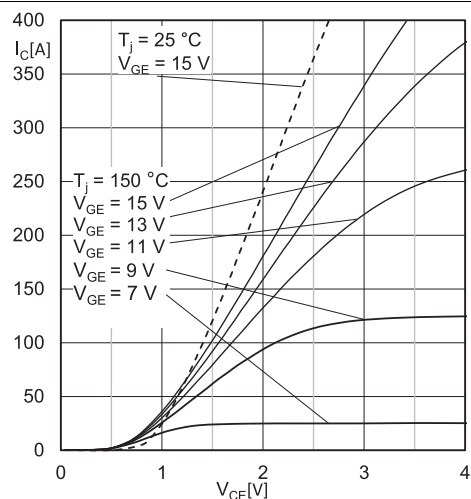


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

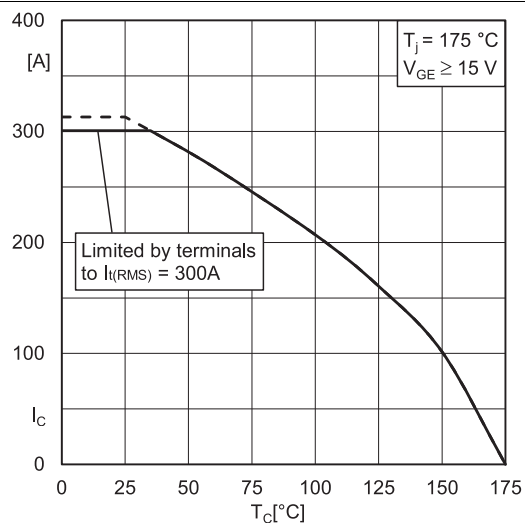


Fig. 2: Rated current vs. Temperature $I_C = f(T_c)$

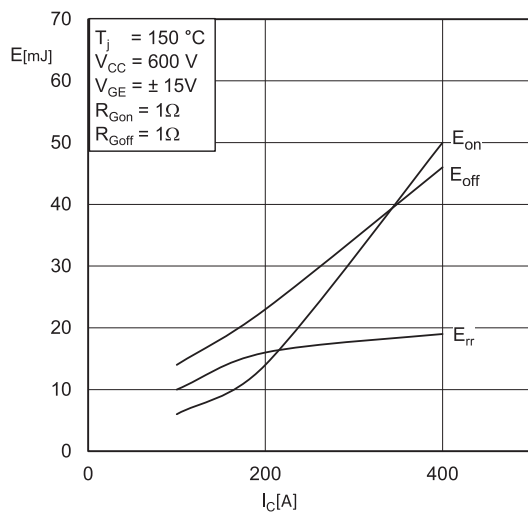


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

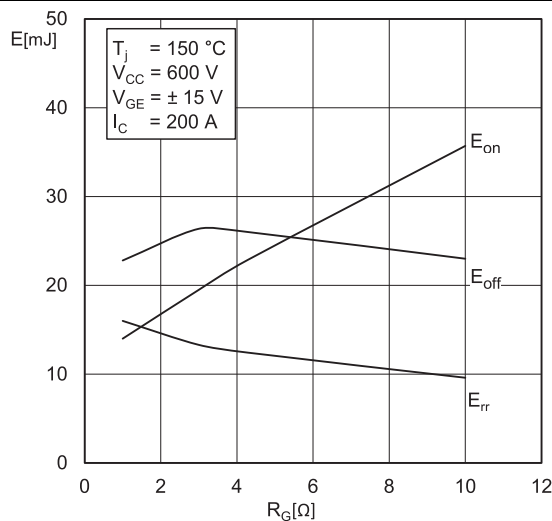


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

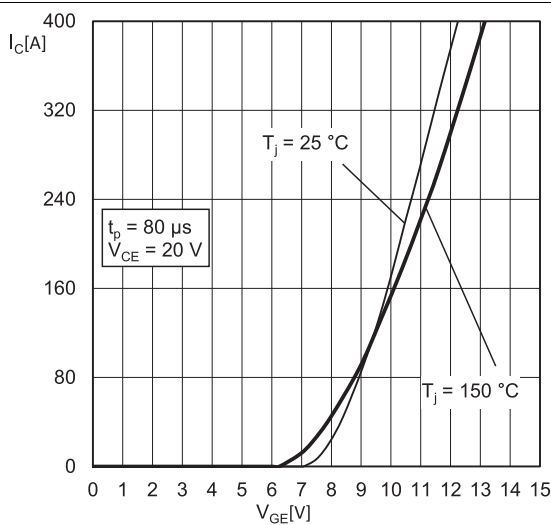


Fig. 5: Typ. transfer characteristic

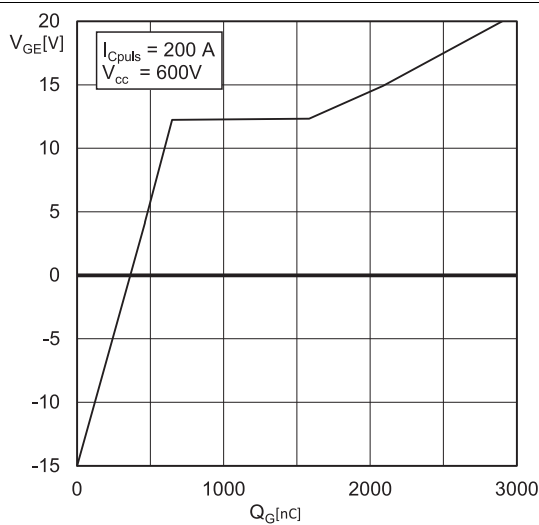
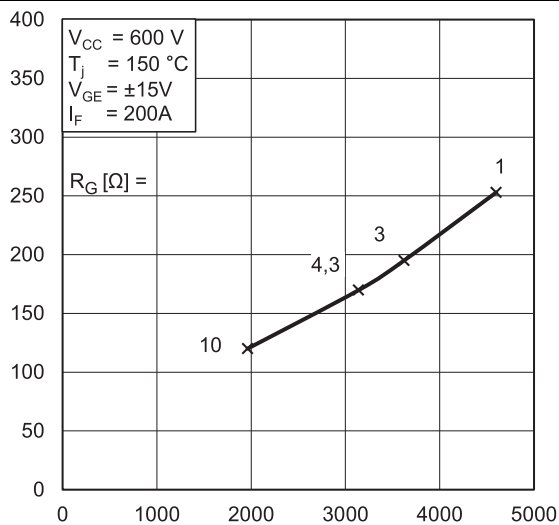
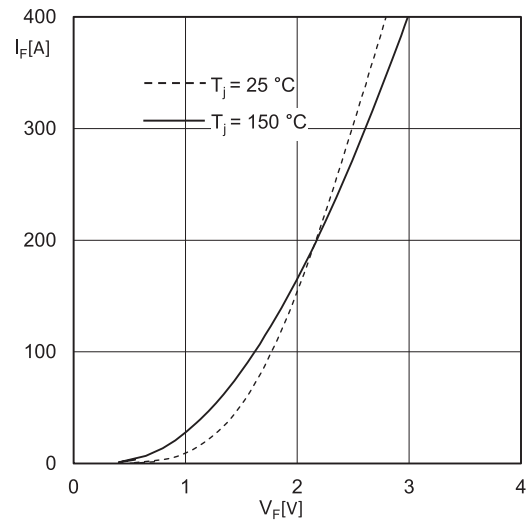
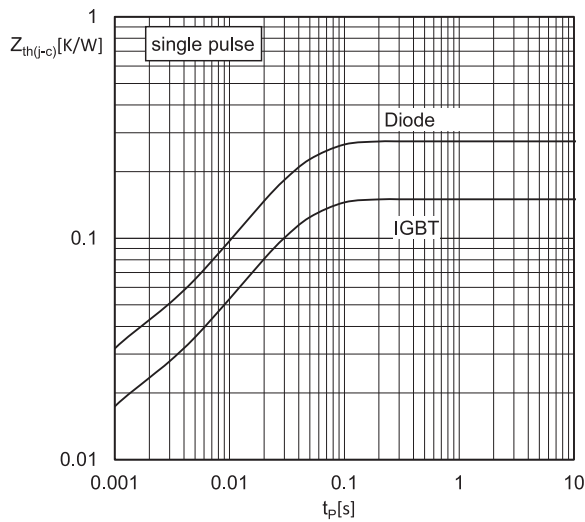
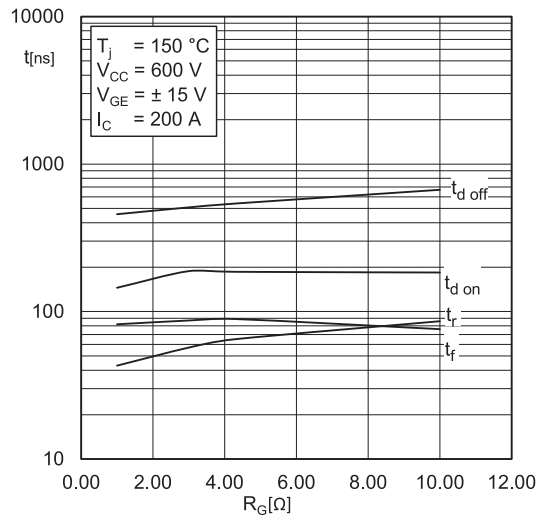
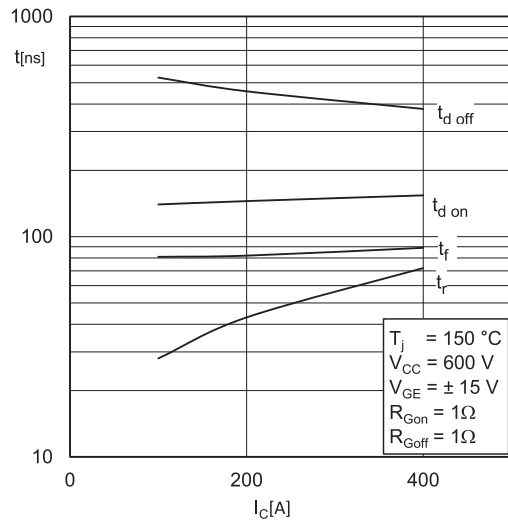


Fig. 6: Typ. gate charge characteristic





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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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