



SEMiX® 3p

Trench IGBT Modules

SEMiX453GB12M7p

Features*

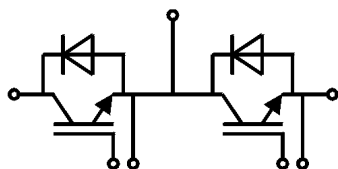
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High overload capability
- Low loss high density IGBTs
- Press-fit pins as auxiliary contacts
- UL recognized, file no. E63532

Typical Applications

- AC inverter drives
- UPS
- Renewable energy systems

Remarks

- Product reliability results are valid for $T_j = 150^\circ\text{C}$ (recommended $T_{j,op} = -40 \dots +150^\circ\text{C}$)
- V_{isol} between temperature sensor and power section is only 2500V
- For storage and case temperature with TIM see document "TP(*) SEMiX 3p"



GB

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	601	A
		T _c = 80 °C	457	A
I _{Cnom}			450	A
I _{CRM}			900	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 150 °C	8	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	554	A
		T _c = 80 °C	415	A
I _{FRM}			900	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2430	A
T _j			-40 ... 175	°C

Module

$I_{t(RMS)}$		600	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 = 450 A	T _j = 25 °C		1.55	1.88	V
	V _{GE} = 15 V chipevel	T _j = 150 °C		1.80		V
V _{CE0}	chipevel	T _j = 25 °C		0.87	0.95	V
		T _j = 150 °C		0.76		V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		1.51	2.1	mΩ
	chipevel	T _j = 150 °C		2.3		mΩ
V _{GE(th)}	V _{CE} = 10 V, I _C = 45 mA		5.4	6	6.6	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 1200 V, T _j = 25 °C				4.5	mA
C _{ies}	V _{CE} = 10 V V _{GE} = 0 V	f = 1 MHz		90.0		nF
C _{oes}		f = 1 MHz		2.74		nF
C _{res}		f = 1 MHz		0.96		nF
Q _G	V _{GE} = -8V ... + 15V			4020		nC
R _{Gint}	T _j = 25 °C			1.0		Ω
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C		280		ns
t _r	I _C = 450 A	T _j = 150 °C		75		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		39		mJ
t _{d(off)}	R _{G on} = 1.1 Ω	T _j = 150 °C		410		ns
t _f	R _{G off} = 1.1 Ω	T _j = 150 °C		100		ns
	di/dt _{on} = 6300 A/μs	T _j = 150 °C				
	di/dt _{off} = 3800 A/μs					
E _{off}	dv/dt = 5250 V/μs	T _j = 150 °C		49		mJ
	L _s = 25 nH					
R _{th(j-c)}	per IGBT				0.083	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m²K))			0.03		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.021		K/W



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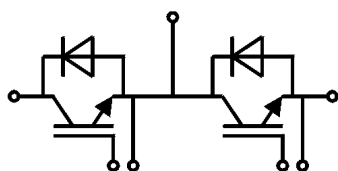
- AC inverter drives
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Remarks

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- V_{isol} between temperature sensor and power section is only 2500V
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Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverse diode					
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	2.14	2.46	V
		$T_j = 150^\circ\text{C}$	2.07	2.38	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	$T_j = 25^\circ\text{C}$	1.87	2.1	mΩ
		$T_j = 150^\circ\text{C}$	2.6	2.8	mΩ
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 150^\circ\text{C}$	430		A
Q_{rr}	$di/dt_{off} = 6400\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$	76		μC
E_{rr}	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	35		mJ
$R_{th(j-c)}$	per diode			0.107	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.045		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material		0.036		K/W
Module					
L_{CE}			20		nH
$R_{CC'+EE'}$	measured per switch	$T_C = 25^\circ\text{C}$	0.95		mΩ
		$T_C = 125^\circ\text{C}$	1.25		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling		0.009		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.014		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, pre-applied phase change material		0.010		K/W
M_s	to heat sink (M5)	3		6	Nm
M_t	to terminals (M6)	3		6	Nm
					Nm
w				350	g
Temperature Sensor					
R_{100}	$T_c=100^\circ\text{C}$ ($R_{25}=5\text{ k}\Omega$)		493 ± 5%		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; $T[\text{K}]$		3550 ± 2%		K



GB

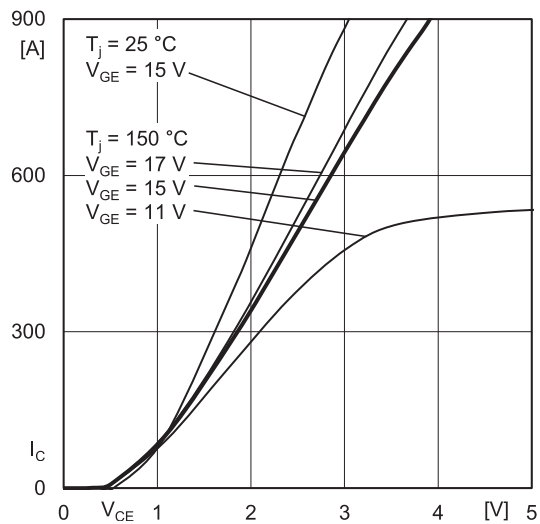


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

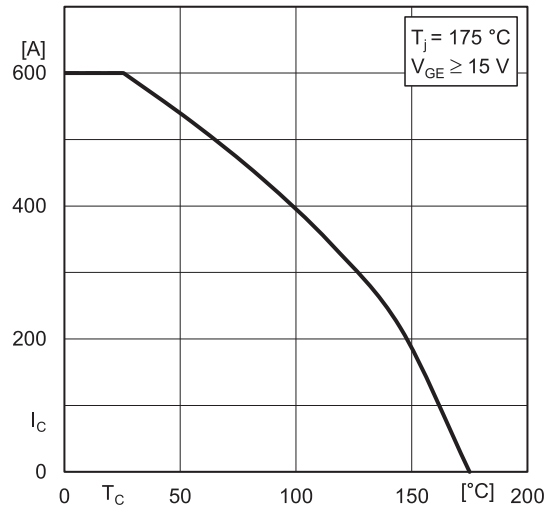


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

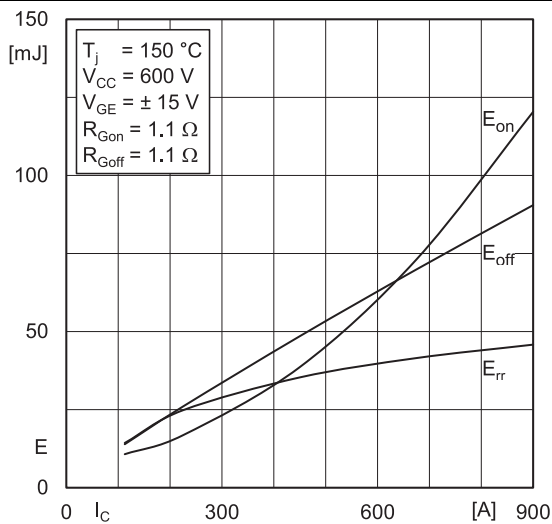


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

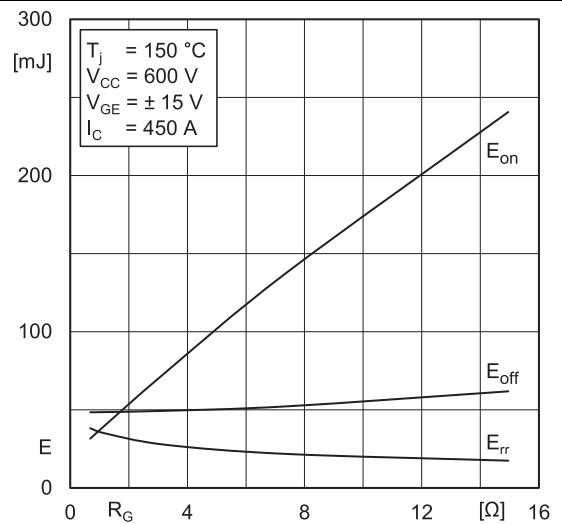


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

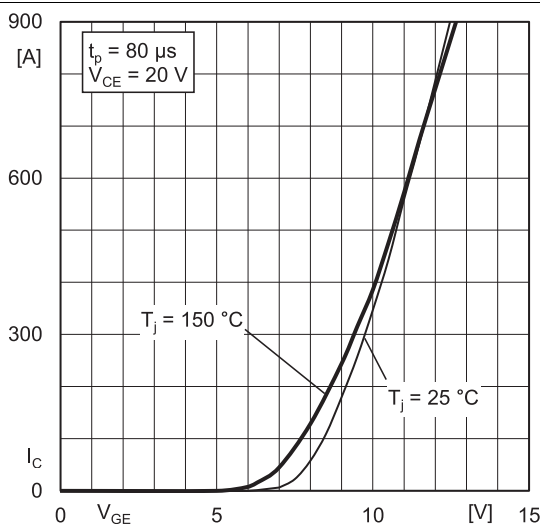


Fig. 5: Typ. transfer characteristic

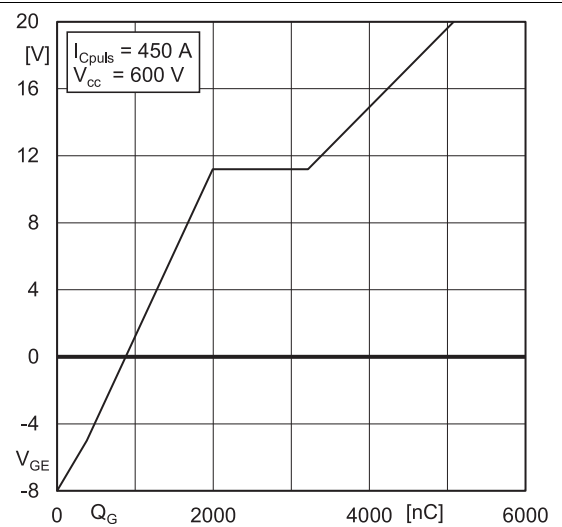
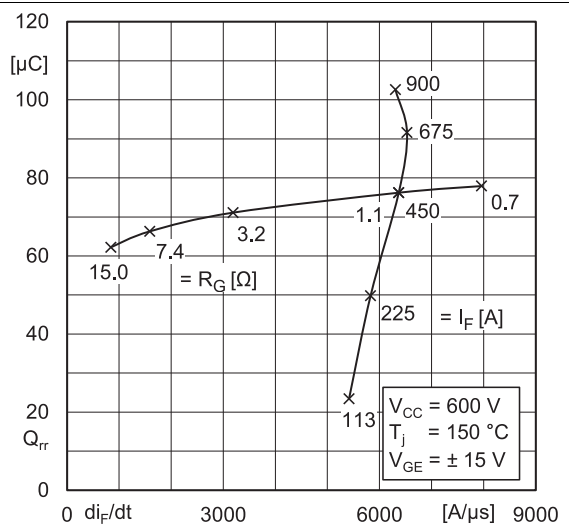
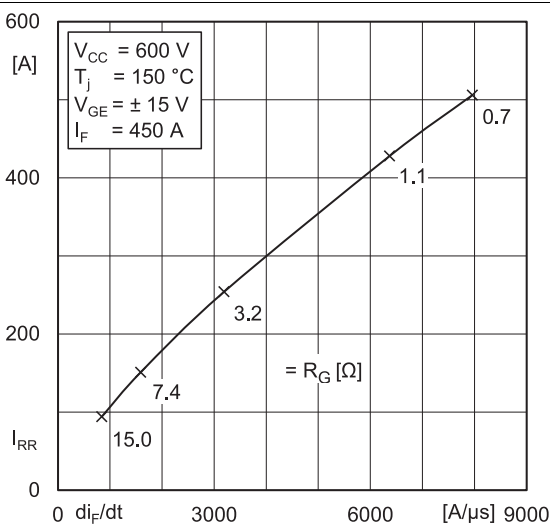
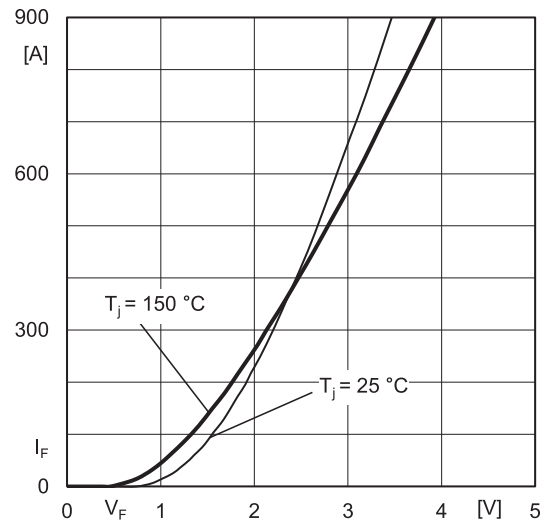
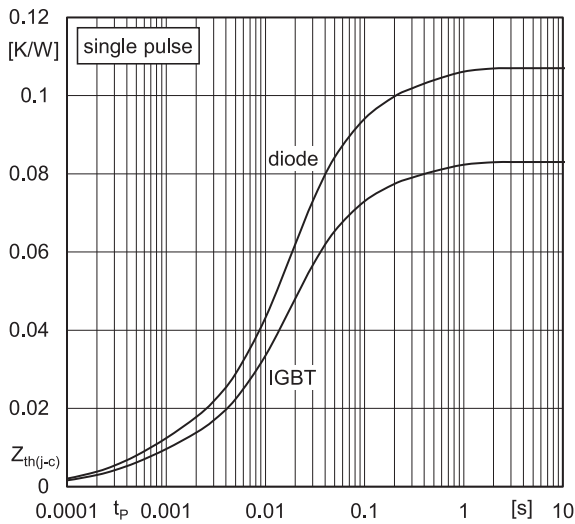
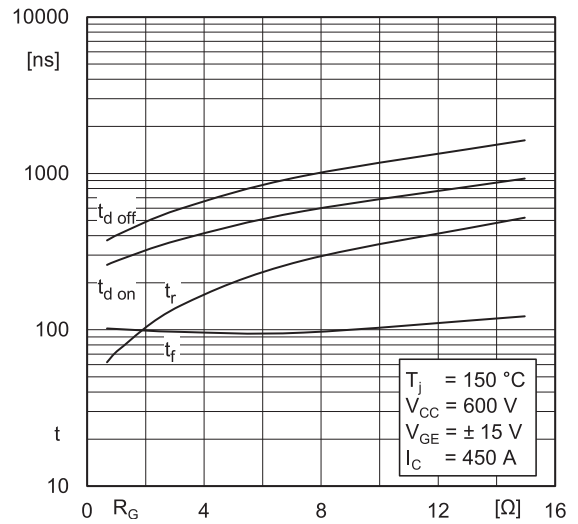
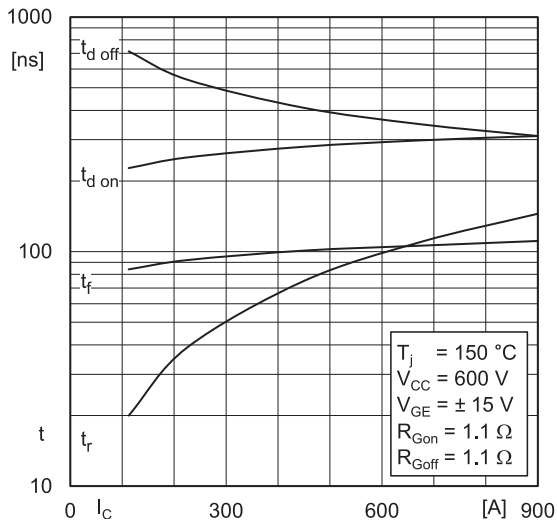
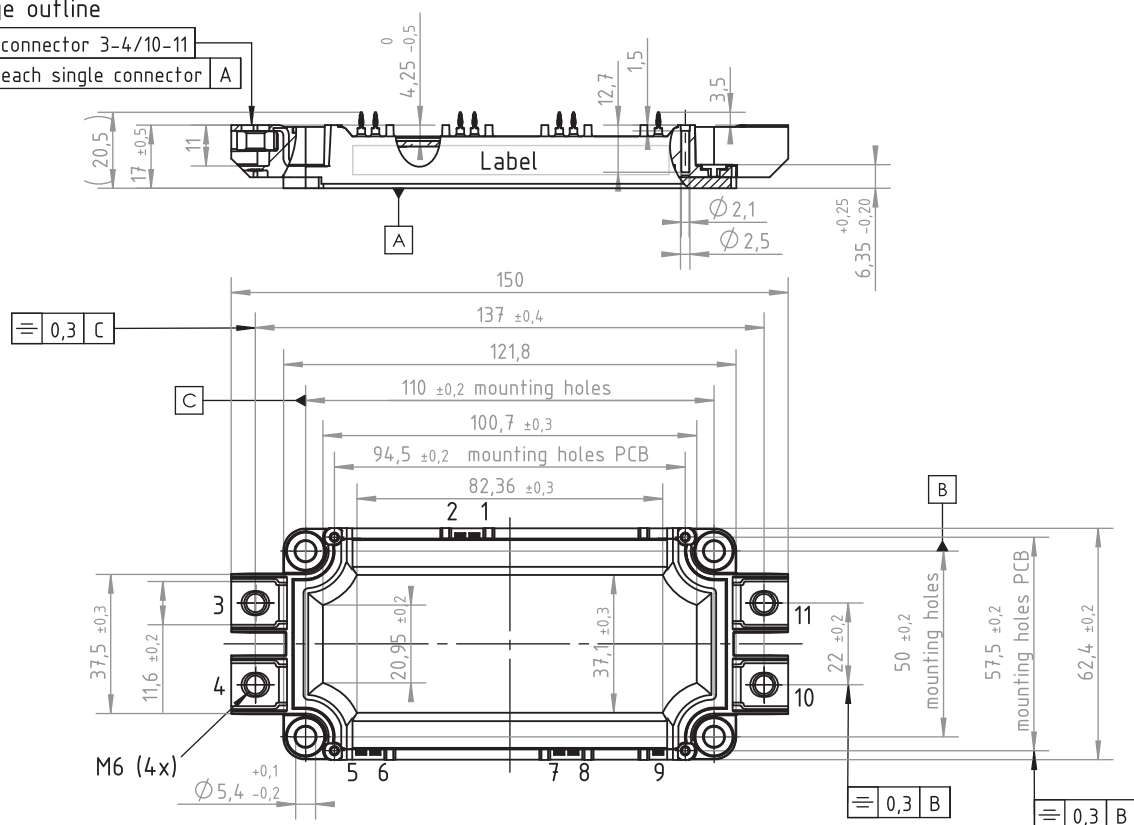


Fig. 6: Typ. gate charge characteristic

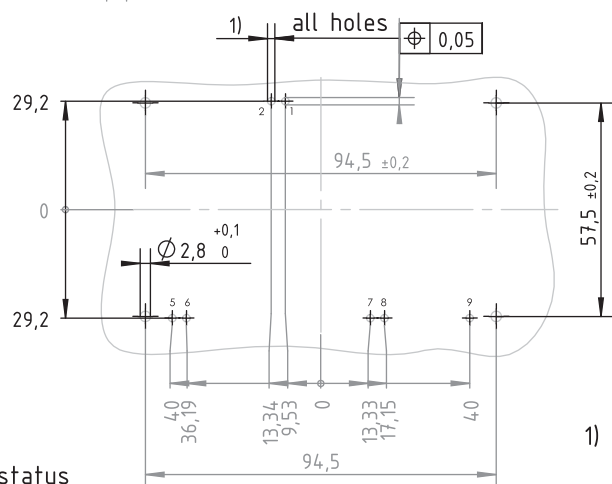


Package outline

	0,3 connector 3-4/10-11	
	0,2 each single connector	A



PCB drillhole pattern

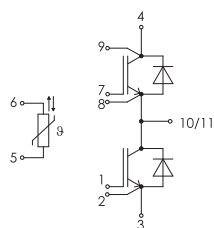


Dimensions in mm

Dimensions valid in mounted status

1) PCB hole specification see
Mounting Instructions SEMiX press-fit

SEMIX 3p



pinout

This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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