



SEMiX® 5

Trench IGBT Modules

SEMiX205GD12E4

Features*

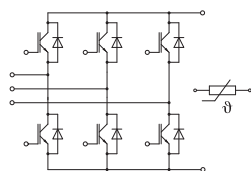
- Solderless assembly solution with PressFIT signal pins and screw power terminals
- IGBT 4 Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and robust internal connections
- UL recognized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

Typical Applications

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
- Product reliability results are valid for $T_{jop}=150^\circ\text{C}$
- Please refer to Semix5p Technical Explanations for mounting conditions
- For storage and case temperature with TIM see document TP(HALA P8) SEMiX5p



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Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V	
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	313	A
		$T_c = 80^\circ\text{C}$	239	A
I_{Cnom}		200	A	
I_{CRM}		600	A	
V_{GES}		-20 ... 20	V	
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
T_j		-40 ... 175	$^\circ\text{C}$	
Inverse diode				
V_{RRM}	$T_j = 25^\circ\text{C}$	1200	V	
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	224	A
		$T_c = 80^\circ\text{C}$	167	A
I_{FRM}		400	A	
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	990	A	
T_j		-40 ... 175	$^\circ\text{C}$	
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
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 200\text{ A}$	$T_j = 150^\circ\text{C}$	145		ns
t_r	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	43		ns
E_{on}	$R_{Gon} = 1\ \Omega$	$T_j = 150^\circ\text{C}$	14		mJ
$t_{d(off)}$	$R_{Goff} = 1\ \Omega$	$T_j = 150^\circ\text{C}$	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
		$T_j = 150^\circ\text{C}$			
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 ($\lambda=3.4\text{ W/mK}$)		-		K/W



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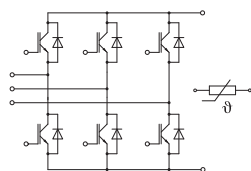
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 200\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.20	2.52	V
		$T_j = 150^\circ\text{C}$		2.15	2.47	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		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}	$di/dt_{off} = 4500\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		37		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		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 ($\lambda=3.4\text{ W/mK}$)			-		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, T_s underneath module ($\lambda_{grease}=0.81\text{ W}/$ (m^*K))			0.0081		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, pre-applied phase change material			-		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}	$T_c=100^\circ\text{C}$ ($R_{25}=5\text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; $T[\text{K}]$;			3550 $\pm 2\%$		K



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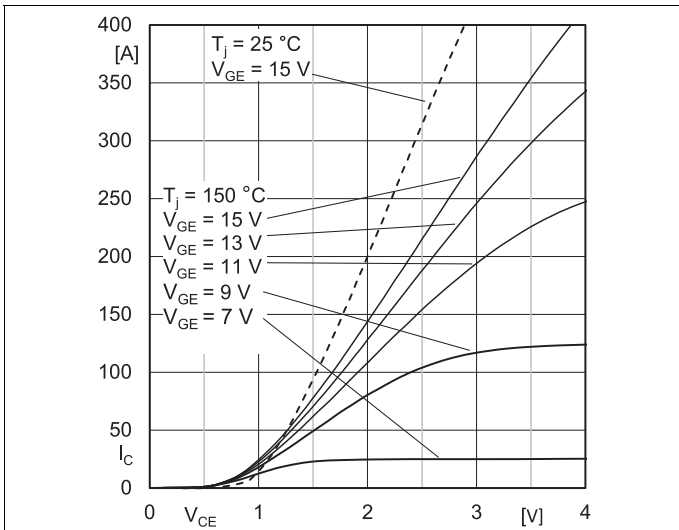


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

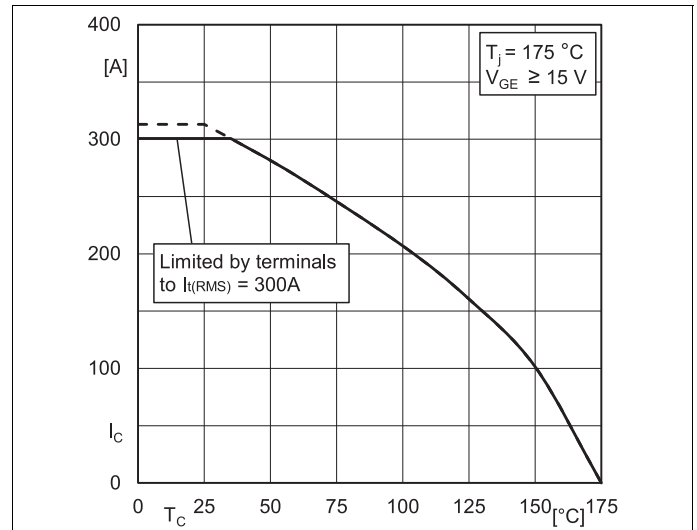


Fig. 2: Rated current vs. temperature $I_c = f(T_c)$

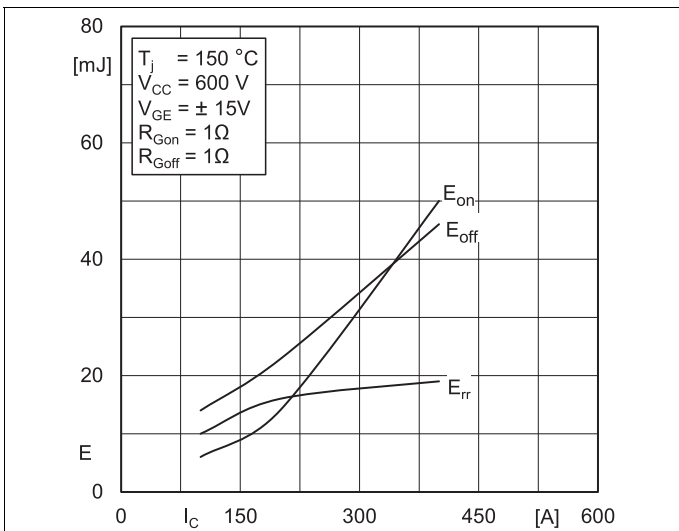


Fig. 3: Typ. turn-on /-off energy = $f(I_c)$

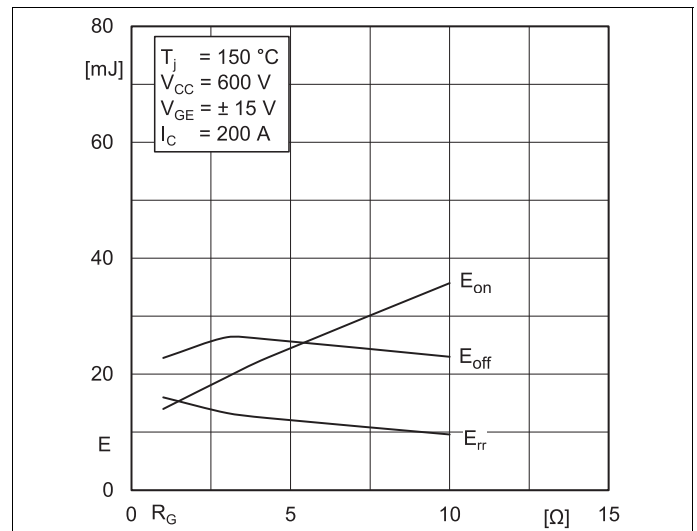


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

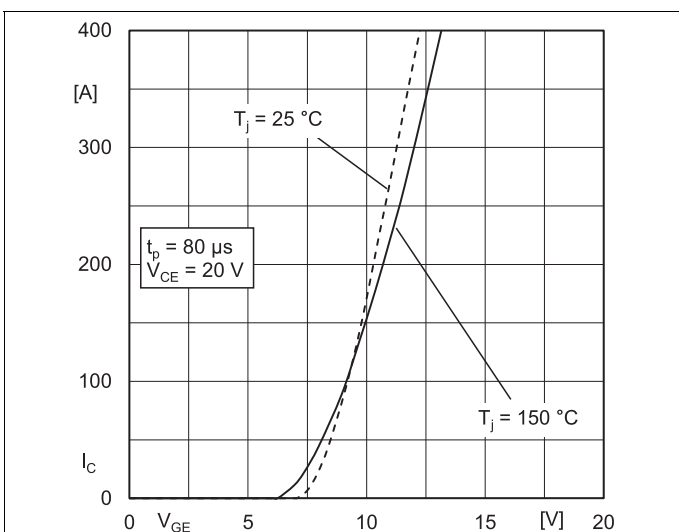


Fig. 5: Typ. transfer characteristic

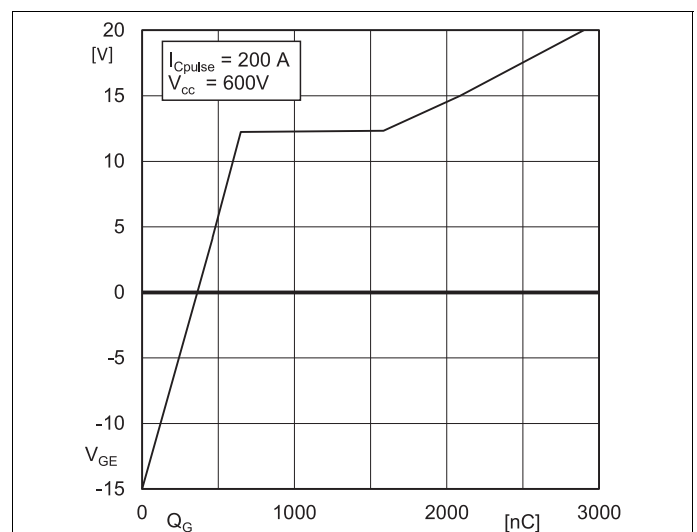


Fig. 6: Typ. gate charge characteristic

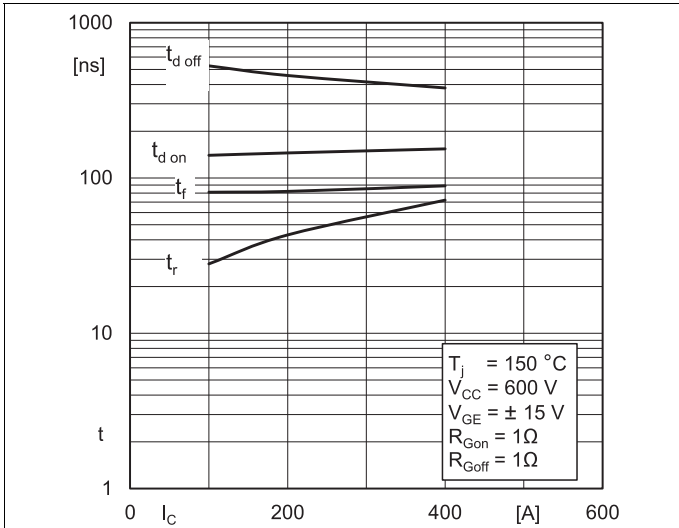


Fig. 7: Typ. switching times vs. I_C

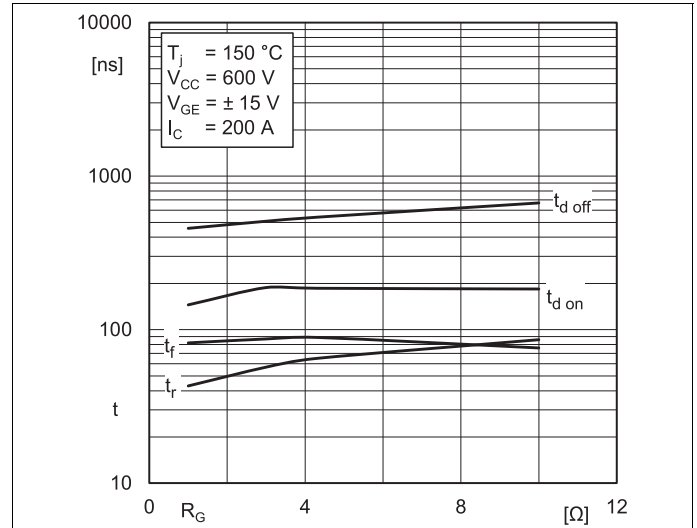


Fig. 8: Typ. switching times vs. gate resistor R_G

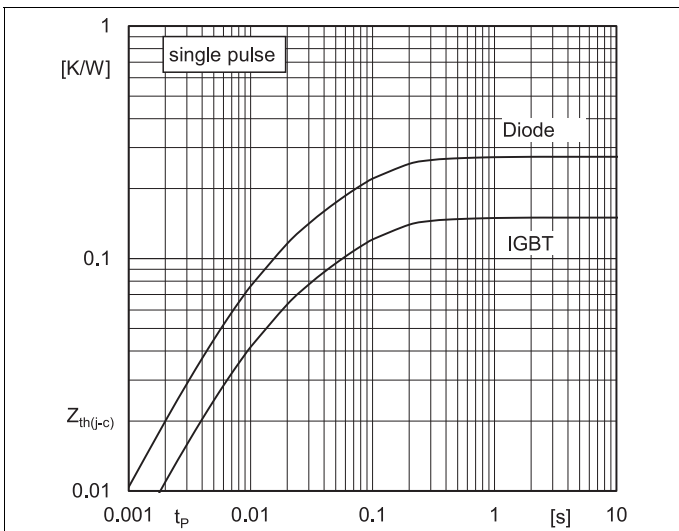


Fig. 9: Transient thermal impedance

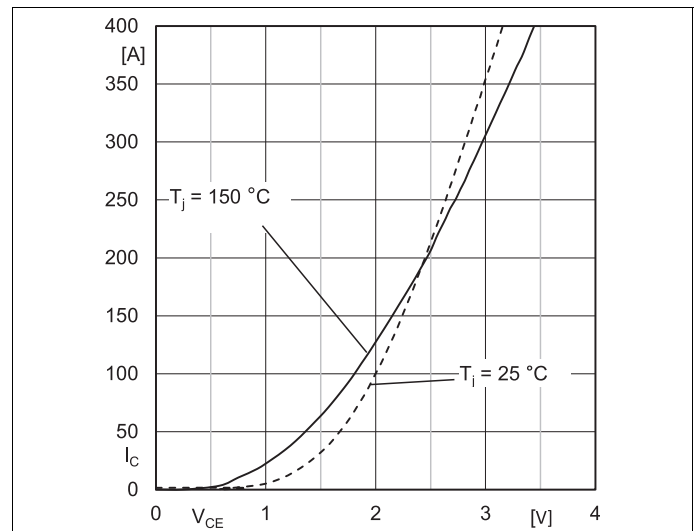


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

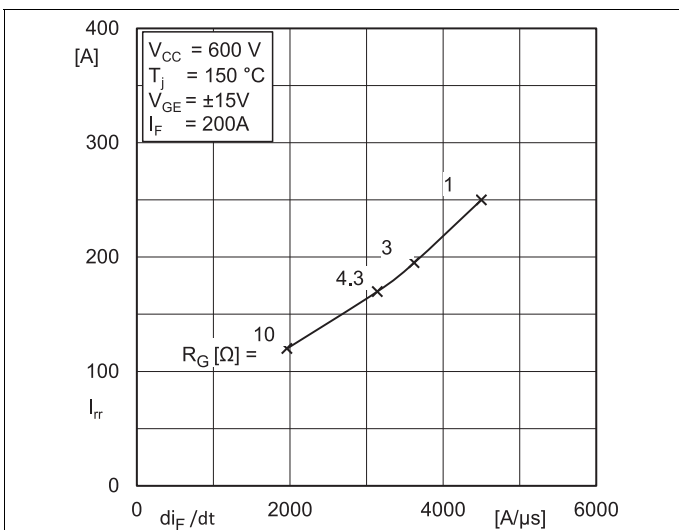
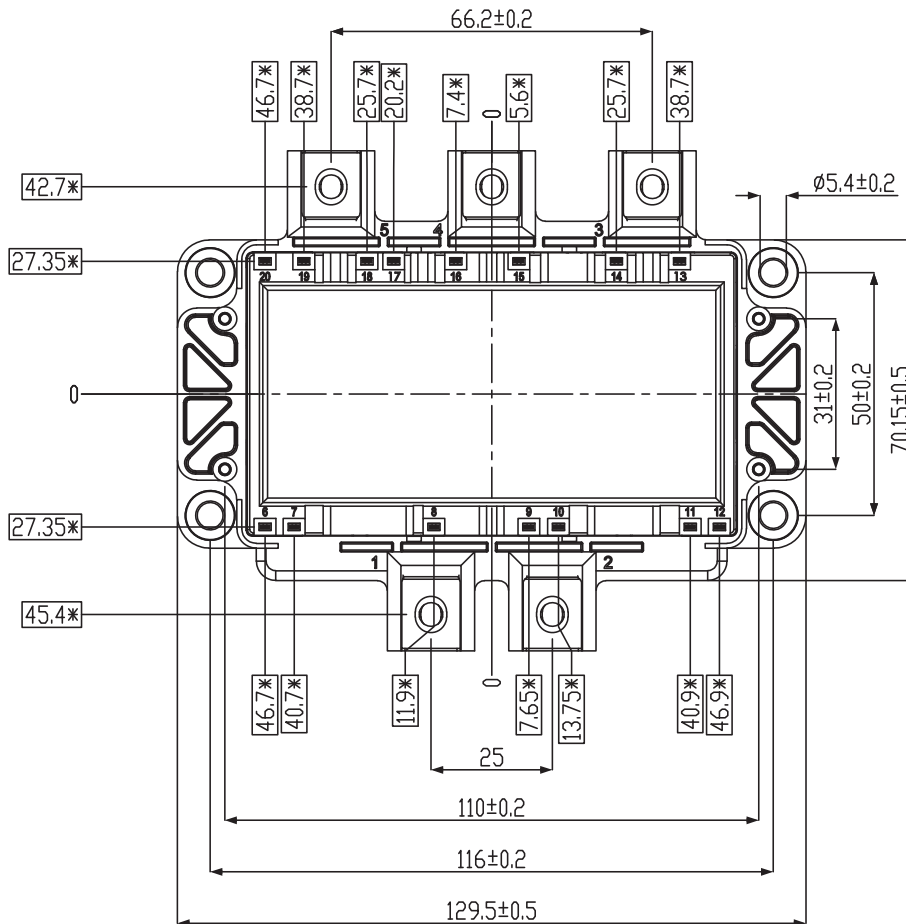
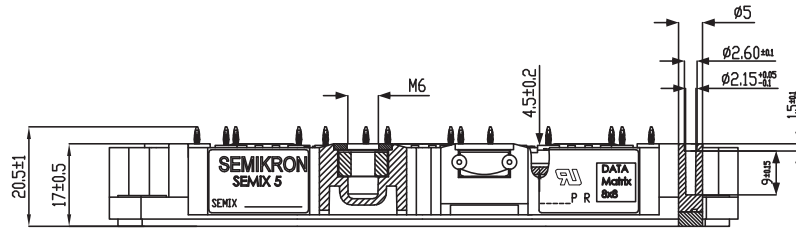


Fig. 11: Typ. CAL diode peak reverse recovery current

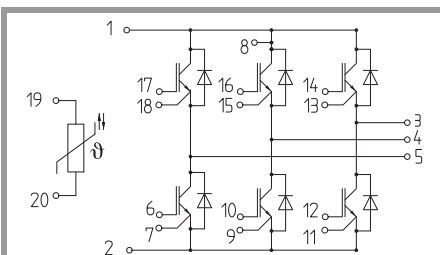
SEMiX205GD12E4



* = Dimensions in mm with tolerance of $\boxed{\oplus \ominus} \varnothing 0.4$

For technical details please refer
to SEMiX(R)5 Mounting Instruction

SEMiX5p



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

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