



SEMITRANS® 10

IGBT4 Modules

SKM1400GAL12P4

Features*

- Symmetrical current sharing
- Low-inductive module design
- High mechanical robustness
- UL recognized, file no. E63532

Typical Applications

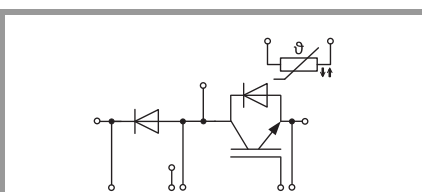
- Brake chopper
- Wind turbines

Remarks

Recommended $T_{jop} = -40 \dots +150^{\circ}\text{C}$

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	2165	A
		T _c = 100 °C	1453	A
I _{Cnom}			1400	A
I _{CRM}			2800	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	1849	A
		T _c = 100 °C	1181	A
I _{FRM}			2800	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		7296	A
T _j			-40 ... 175	°C
Freewheeling diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 175 °C	T _c = 25 °C	1849	A
		T _c = 100 °C	1181	A
I _{FRM}			2800	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		7296	A
T _j			-40 ... 175	°C
Module				
T _{stg}			-40 ... 150	°C
V _{isol}	AC sinus 50 Hz, t = 1 min		4000	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
V _{CE(sat)}	I _C = 1400 A	T _j = 25 °C		1.75	2.07	V
	V _{GE} = 15 V chiplevel	T _j = 150 °C		2.18	2.44	V
V _{CE0}	chiplevel	T _j = 25 °C		0.80	0.90	V
		T _j = 150 °C		0.70	0.80	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		0.68	0.83	mΩ
	chiplevel	T _j = 150 °C		1.06	1.17	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 49.2 mA		5.1	5.8	6.4	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 1200 V, T _j = 25 °C				5	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		81.6		nF
C _{oes}		f = 1 MHz		5.28		nF
C _{res}		f = 1 MHz		4.50		nF
Q _G	V _{GE} = - 8 V...+ 15 V			7500		nC
R _{Gint}	T _j = 25 °C			0.6		Ω



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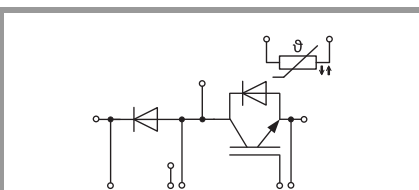
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C		355		ns
t _r	I _C = 1400 A	T _j = 150 °C		120		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		150		mJ
t _{d(off)}	R _{G on} = 1 Ω	T _j = 150 °C		800		ns
t _f	R _{G off} = 1 Ω	T _j = 150 °C		155		ns
E _{off}	di/dt _{on} = 11 kA/μs di/dt _{off} = 7.4 kA/μs dv/dt = 3100 V/μs L _s = 25 nH	T _j = 150 °C		290		mJ
R _{th(j-c)}	per IGBT				0.02	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.008		K/W
Inverse diode						
V _F = V _{EC}	I _F = 1400 A	T _j = 25 °C		2.07	2.38	V
	V _{GE} = 0 V chipelevel	T _j = 150 °C		1.98	2.28	V
V _{F0}	chipelevel	T _j = 25 °C		1.30	1.50	V
		T _j = 150 °C		0.90	1.10	V
r _F	chipelevel	T _j = 25 °C		0.55	0.63	mΩ
		T _j = 150 °C		0.77	0.84	mΩ
I _{RRM}	I _F = 1400 A	T _j = 150 °C		1020		A
Q _{rr}	V _{GE} = -15 V	T _j = 150 °C		260		μC
E _{rr}	di/dt _{off} = 11 kA/μs V _R = 600 V	T _j = 150 °C		110		mJ
R _{th(j-c)}	per diode				0.033	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.01		K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 1400 A	T _j = 25 °C		2.07	2.38	V
	V _{GE} = 0 V level = chipelevel	T _j = 150 °C		1.98	2.28	V
V _{F0}	chipelevel	T _j = 25 °C		1.30	1.50	V
		T _j = 150 °C		0.90	1.10	V
r _F	chipelevel	T _j = 25 °C		0.55	0.63	mΩ
		T _j = 150 °C		0.77	0.84	mΩ
I _{RRM}	I _F = 1400 A	T _j = 150 °C		1020		A
Q _{rr}	di/dt _{off} = 11 kA/μs	T _j = 150 °C		260		μC
E _{rr}	V _{GE} = -15 V V _R = 600 V	T _j = 150 °C		110		mJ
R _{th(j-c)}	per diode				0.033	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.010		K/W
Module						
L _{CE}				10		nH
R _{CC'+EE'}	measured per switch, T _C = 25 °C			0.2		mΩ
R _{th(c-s)1}	calculated without thermal coupling (λ _{grease} =0.81 W/(m*K))			0.004		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module (λ _{grease} =0.81 W/(m*K))			0.004		K/W
M _s	to heat sink M5		4		6	Nm
M _t		to terminals M8	8		10	Nm
		to terminals M4	1.8		2.1	Nm
w					1250	g

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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
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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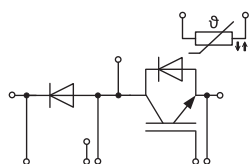
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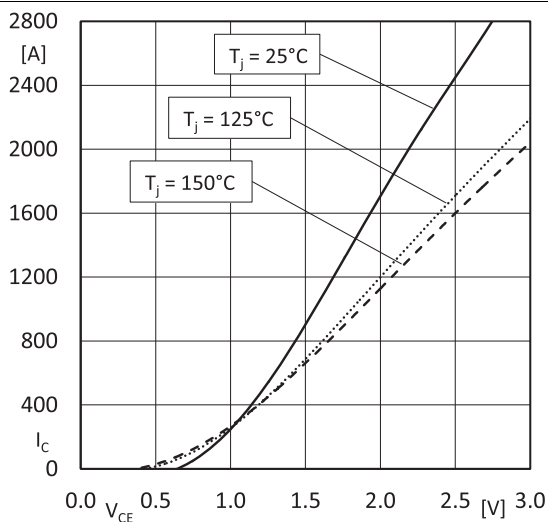


Fig. 1: Output characteristics IGBT (typical); $I_C = f(V_{CE})$; $V_{GE} = 15V$; (chiplevel)

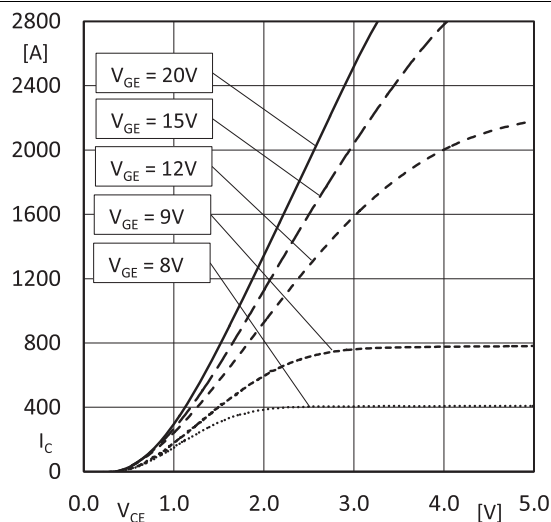


Fig. 2: Output characteristics IGBT (typical); $I_C = f(V_{CE})$; $T_j = 150^\circ C$; (chiplevel)

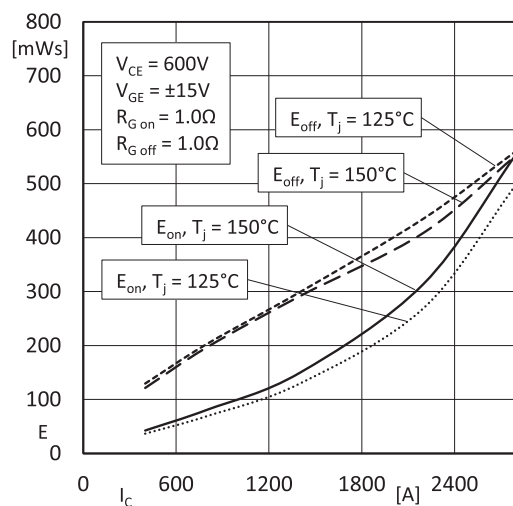


Fig. 3: Switching losses IGBT (typical); $E=f(I_C)$

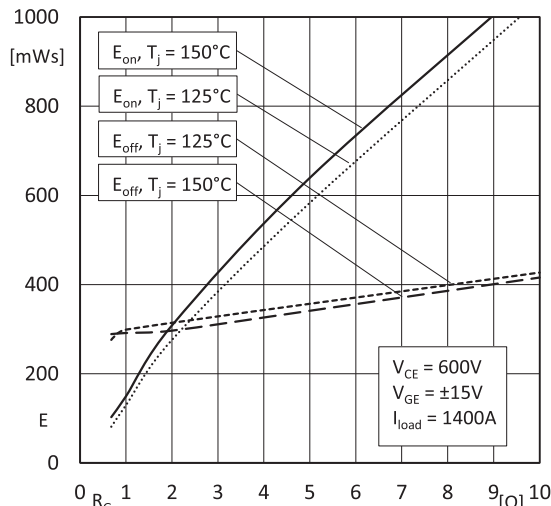


Fig. 4: Switching losses IGBT (typical); $E=f(R_G)$

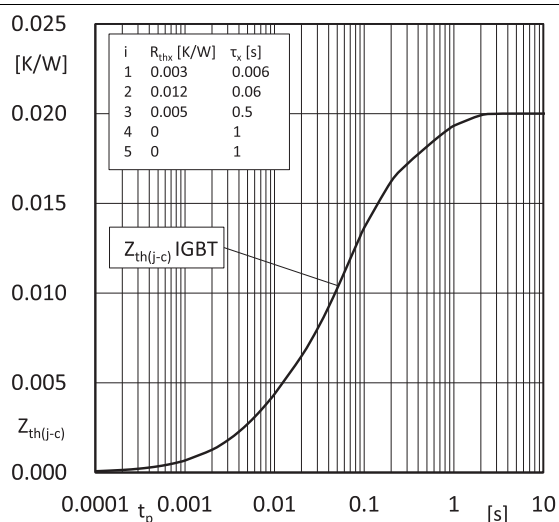


Fig. 5: Transient thermal impedance IGBT

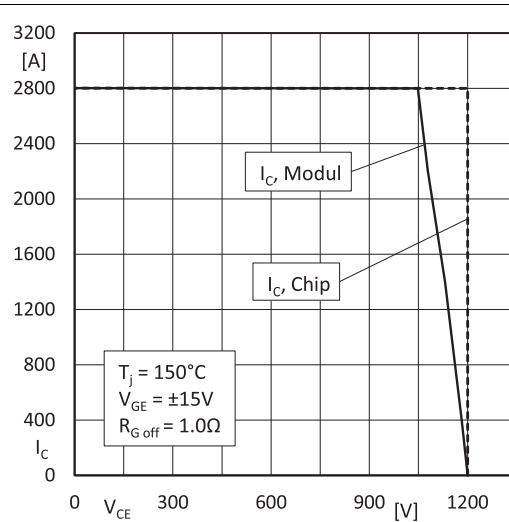


Fig. 6: RBSOA IGBT

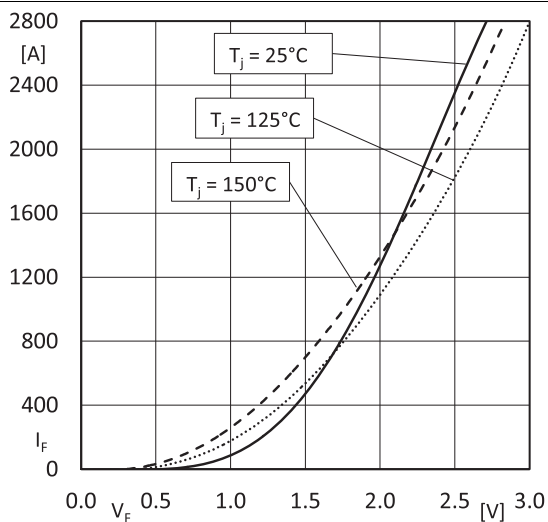


Fig. 7: Forward charact. Diode (typical); $I_F = f(V_F)$; (chipllevel)

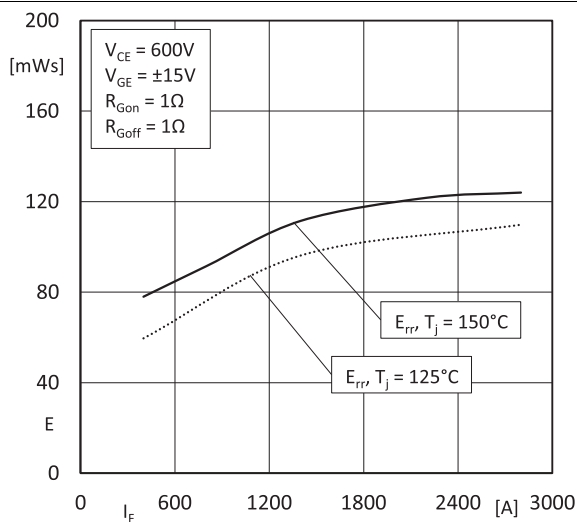


Fig. 8: Switching losses Diode (typical); $E = f(I_F)$

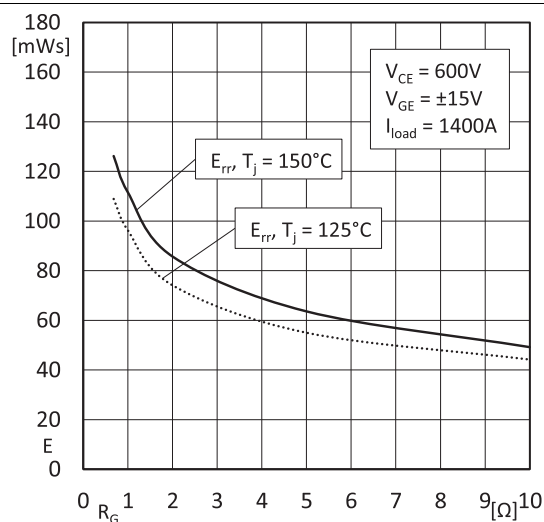


Fig. 9: Switching losses Diode (typical); $E = f(R_G)$

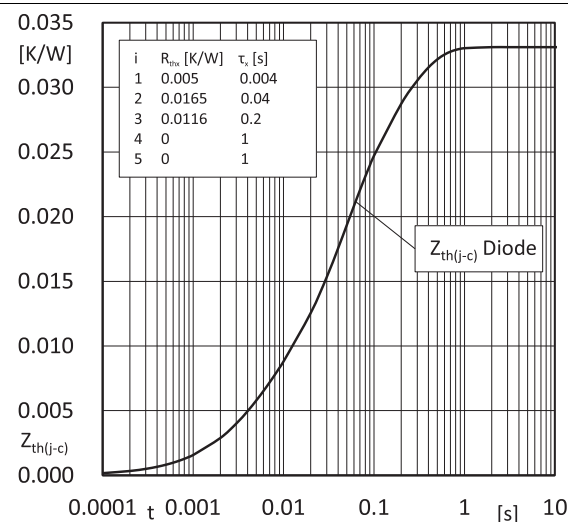


Fig. 10: Transient thermal impedance Diode

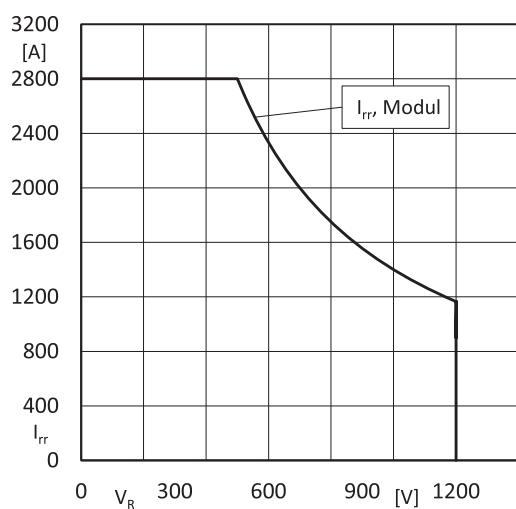


Fig. 11: RBSOA Diode

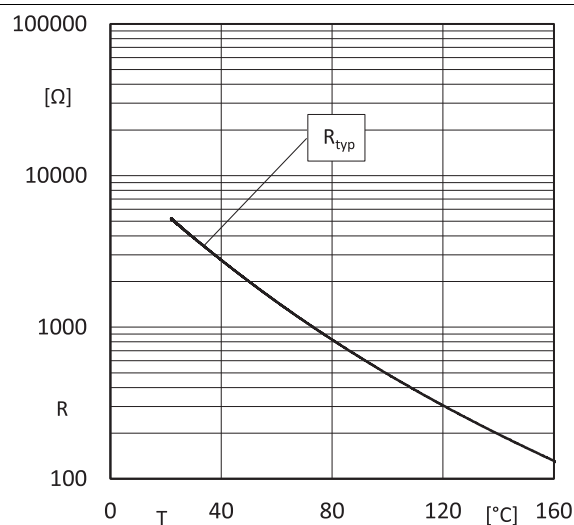


Fig. 12: NTC characteristics (typical)

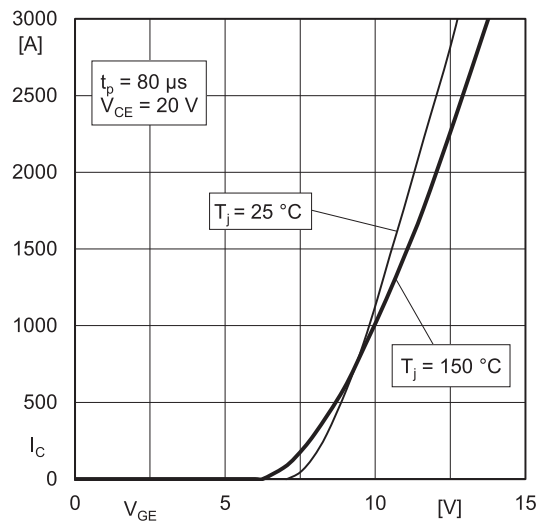


Fig. 13: Typ. transfer characteristic

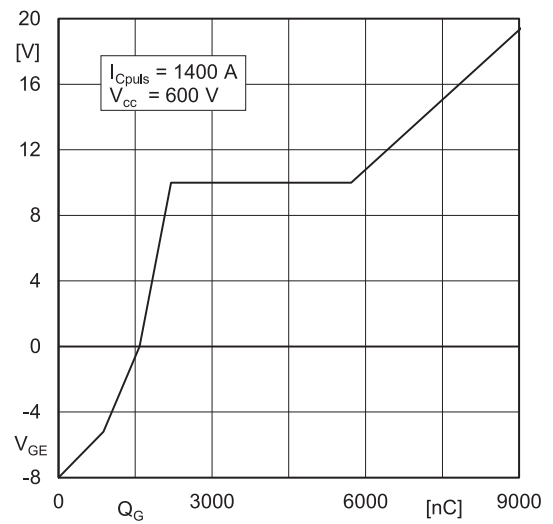
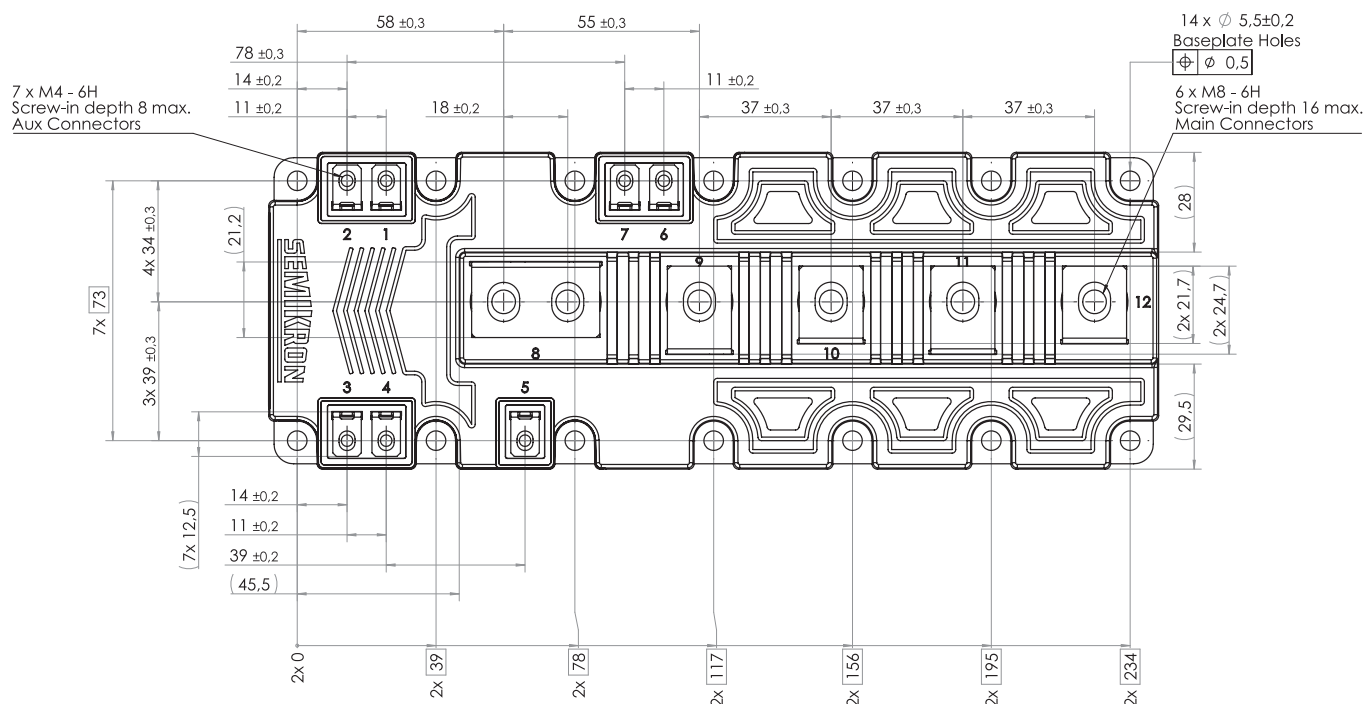
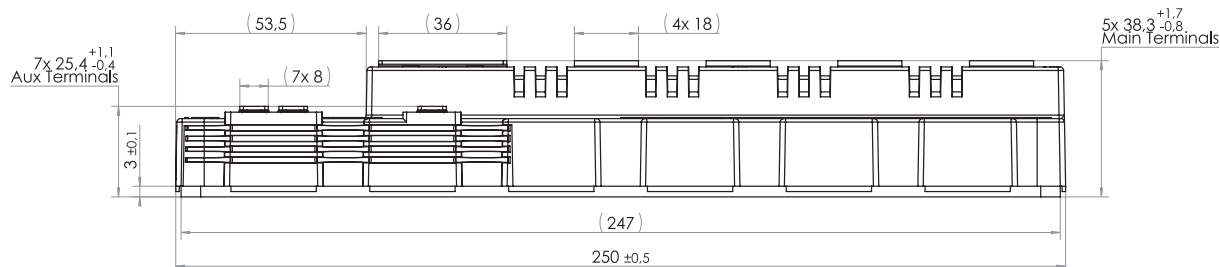
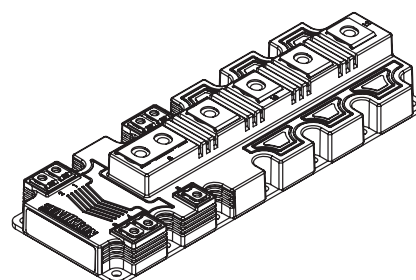
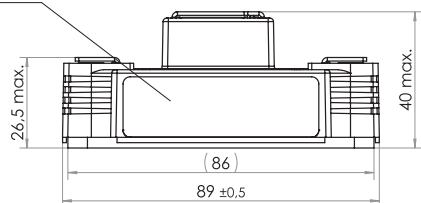


Fig. 14: Typ. gate charge characteristic

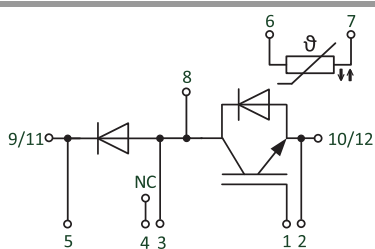
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Module label



- Dimensions in mm
- General tolerances ± 0.5 mm

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

***IMPORTANT INFORMATION AND WARNINGS**

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