SKM1400GAR12P4

SEMITRANS® 10

IGBT4 Modules

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Features*

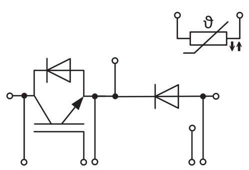
- Symmetrical current sharing
- Low-inductive module design
- High mechanical robustness
- UL recognized, file no. E63532

Typical Applications

- Brake chopper
- Windturbines

Remarks

Recommended T_{jop} = -40 ... +150°C



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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 $V_{GE} \leq$ 15 V $V_{CES} \leq$ 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 V_{GE} = 15 V chiplevel	T_j = 25 °C		1.75	2.07	V
		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 chiplevel	T_j = 25 °C		0.68	0.83	mΩ
		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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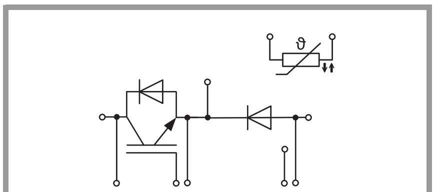

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT						
$t_{d(on)}$	V_{CC} = 600 V I_C = 1400 A V_{GE} = +15/-15 V $R_{G\ on}$ = 1 Ω $R_{G\ off}$ = 1 Ω di/dt_{on} = 11 kA/µs di/dt_{off} = 7 kA/µs dv/dt = 2950 V/µs L_s = 25 nH	T_j = 150 °C		340		ns
t_r		T_j = 150 °C		125		ns
E_{on}		T_j = 150 °C		150		mJ
$t_{d(off)}$		T_j = 150 °C		765		ns
t_f		T_j = 150 °C		180		ns
E_{off}		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 V_{GE} = 0 V chiplevel	T_j = 25 °C		2.07	2.38	V
		T_j = 150 °C		1.98	2.28	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		0.55	0.63	mΩ
		T_j = 150 °C		0.77	0.84	mΩ
I_{RRM}	I_F = 1400 A V_{GE} = -15 V di/dt_{off} = 11 kA/µs V_R = 600 V	T_j = 150 °C		1050		A
Q_{rr}		T_j = 150 °C		275		µC
E_{rr}		T_j = 150 °C		118		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 V_{GE} = 0 V level = chiplevel	T_j = 25 °C		2.07	2.38	V
		T_j = 150 °C		1.98	2.28	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		0.55	0.63	mΩ
		T_j = 150 °C		0.77	0.84	mΩ
I_{RRM}	I_F = 1400 A di/dt_{off} = 11 kA/µs V_{GE} = -15 V V_R = 600 V	T_j = 150 °C		1050		A
Q_{rr}		T_j = 150 °C		275		µC
E_{rr}		T_j = 150 °C		118		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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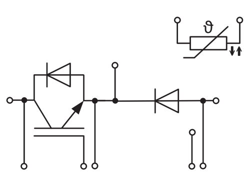

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Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Temperature 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

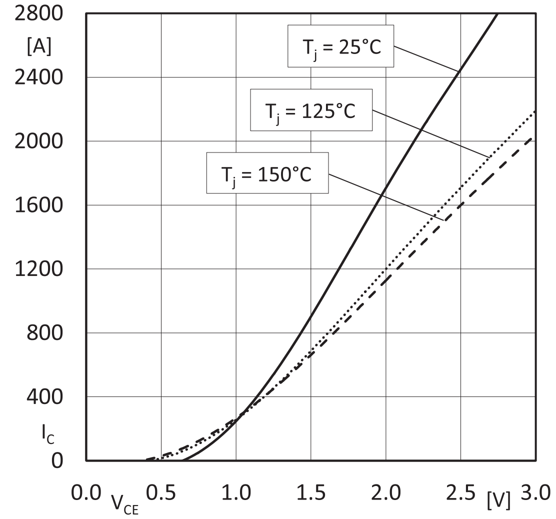


Fig. 1: Output characteristics IGBT (typical); $I_C = f(V_{CE})$; V_{GE} = 15V; (chiplevel)

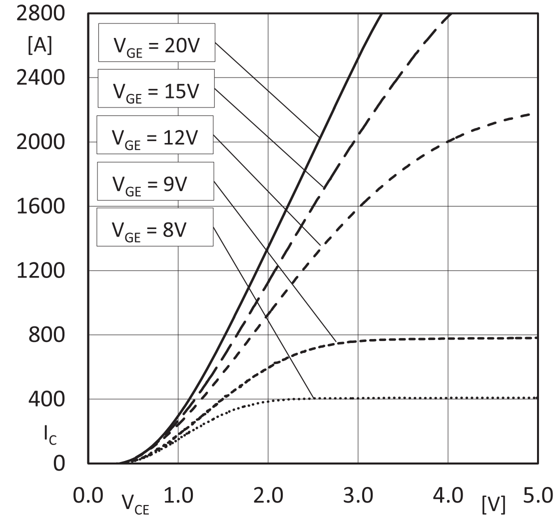


Fig. 2: Output characteristics IGBT (typical); $I_C = f(V_{CE})$; T_j = 150 °C; (chiplevel)

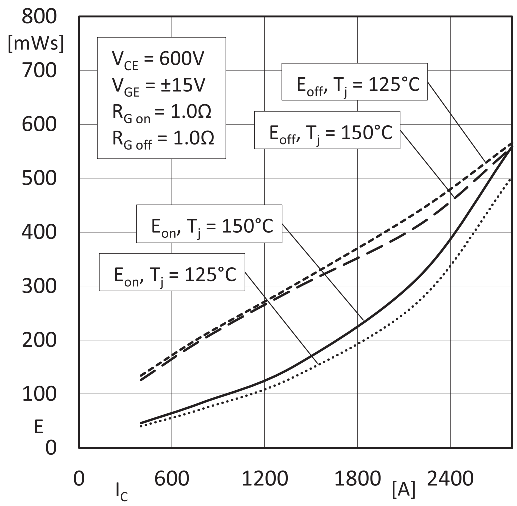


Fig. 3: Switching losses IGBT (typical); $E=f(I_C)$

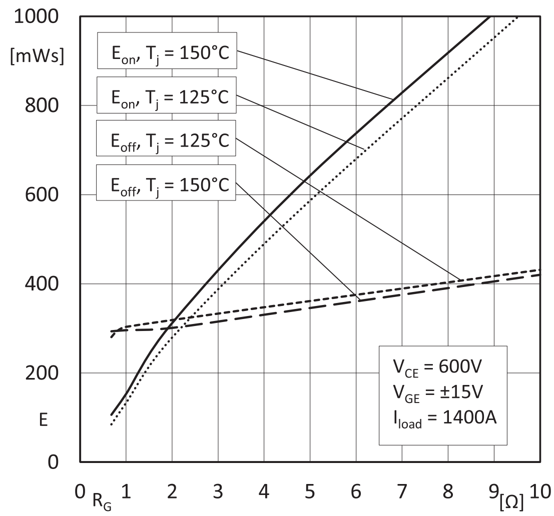


Fig. 4: Switching losses IGBT (typical); $E=f(R_G)$

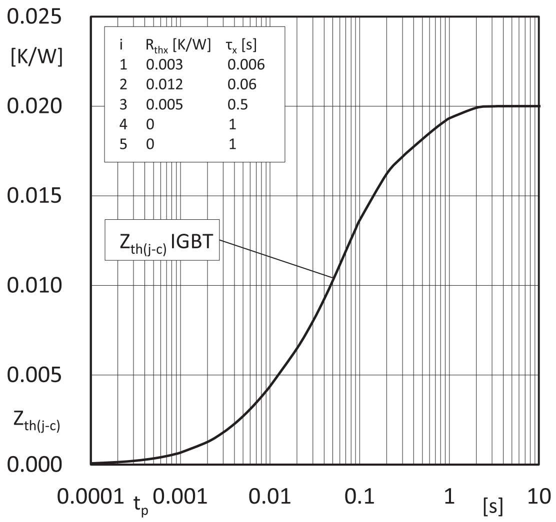


Fig. 5: Transient thermal impedance IGBT

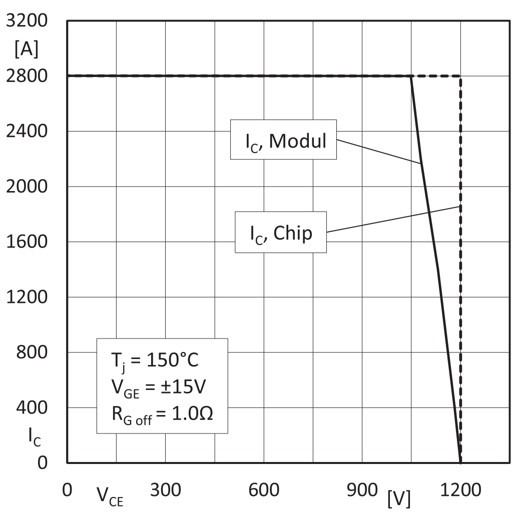


Fig. 6: RBSOA IGBT

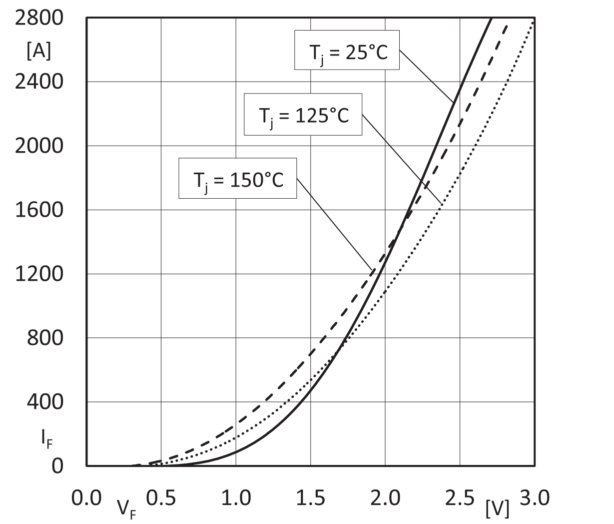


Fig. 7: Forward charact. Diode (typical); I_F=f(V_F); (chiplevel)

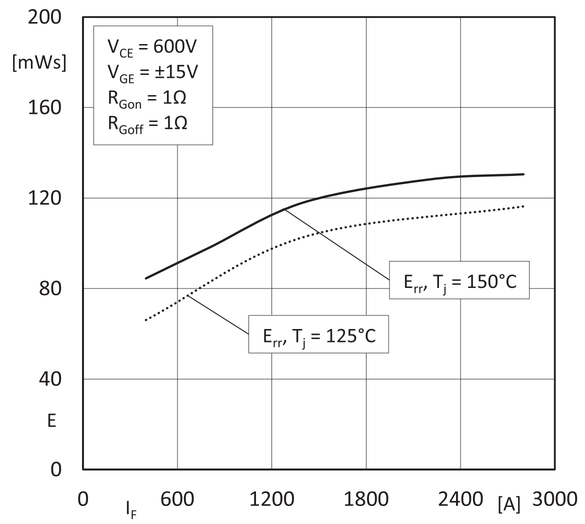


Fig. 8: Switching losses Diode (typical); E=f(I_F)

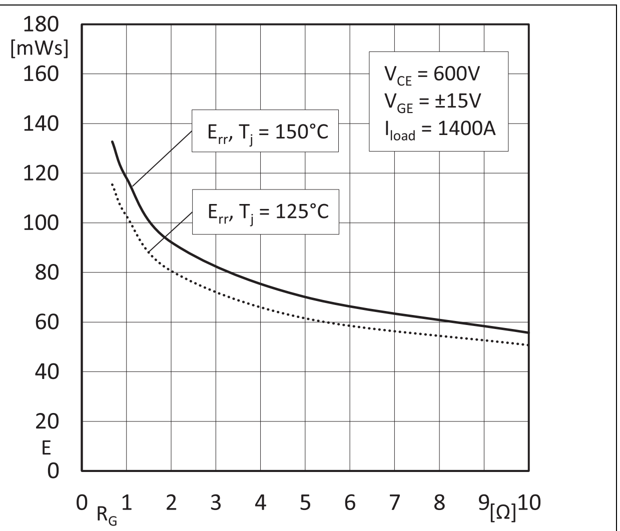


Fig. 9: Switching losses Diode (typical); E=f(R_G)

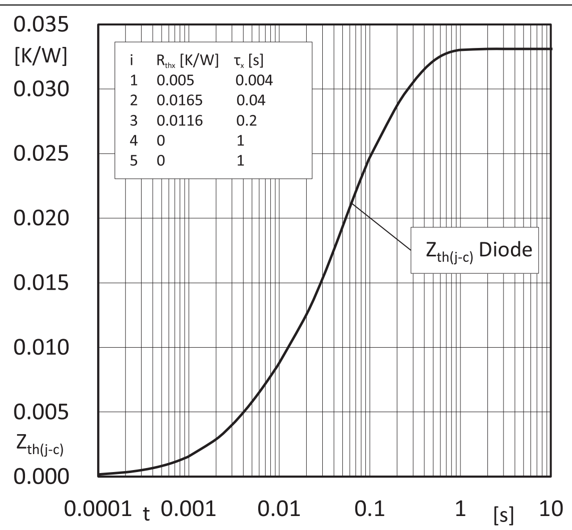


Fig. 10: Transient thermal impedance Diode

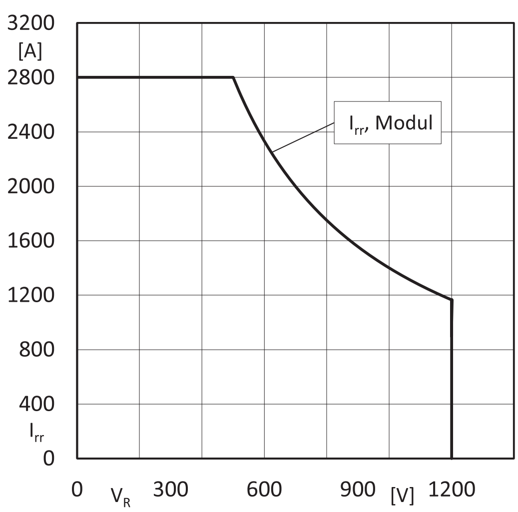


Fig. 11: RBSOA Diode

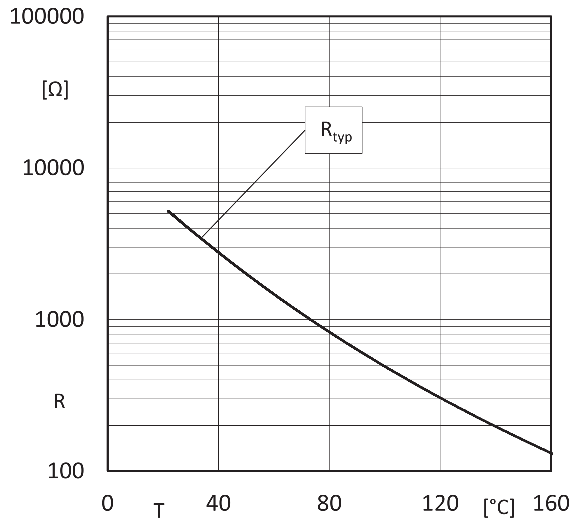


Fig. 12: NTC characteristics (typical)

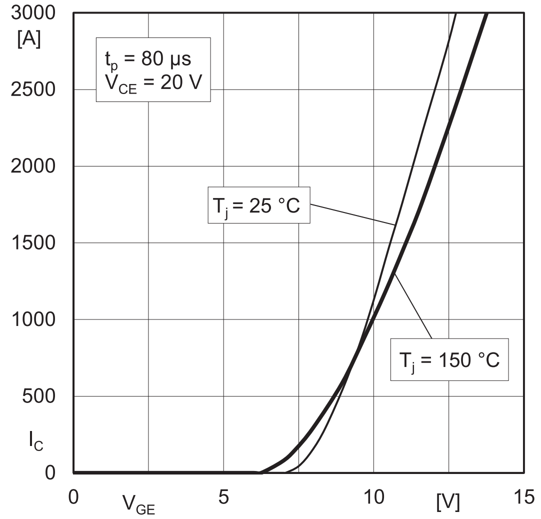


Fig. 13: Typ. transfer characteristic

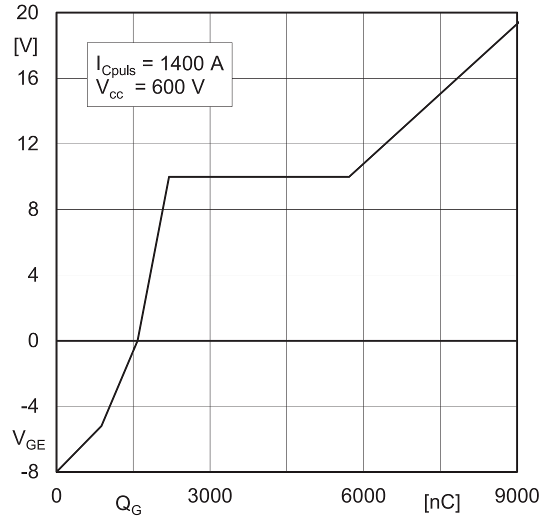
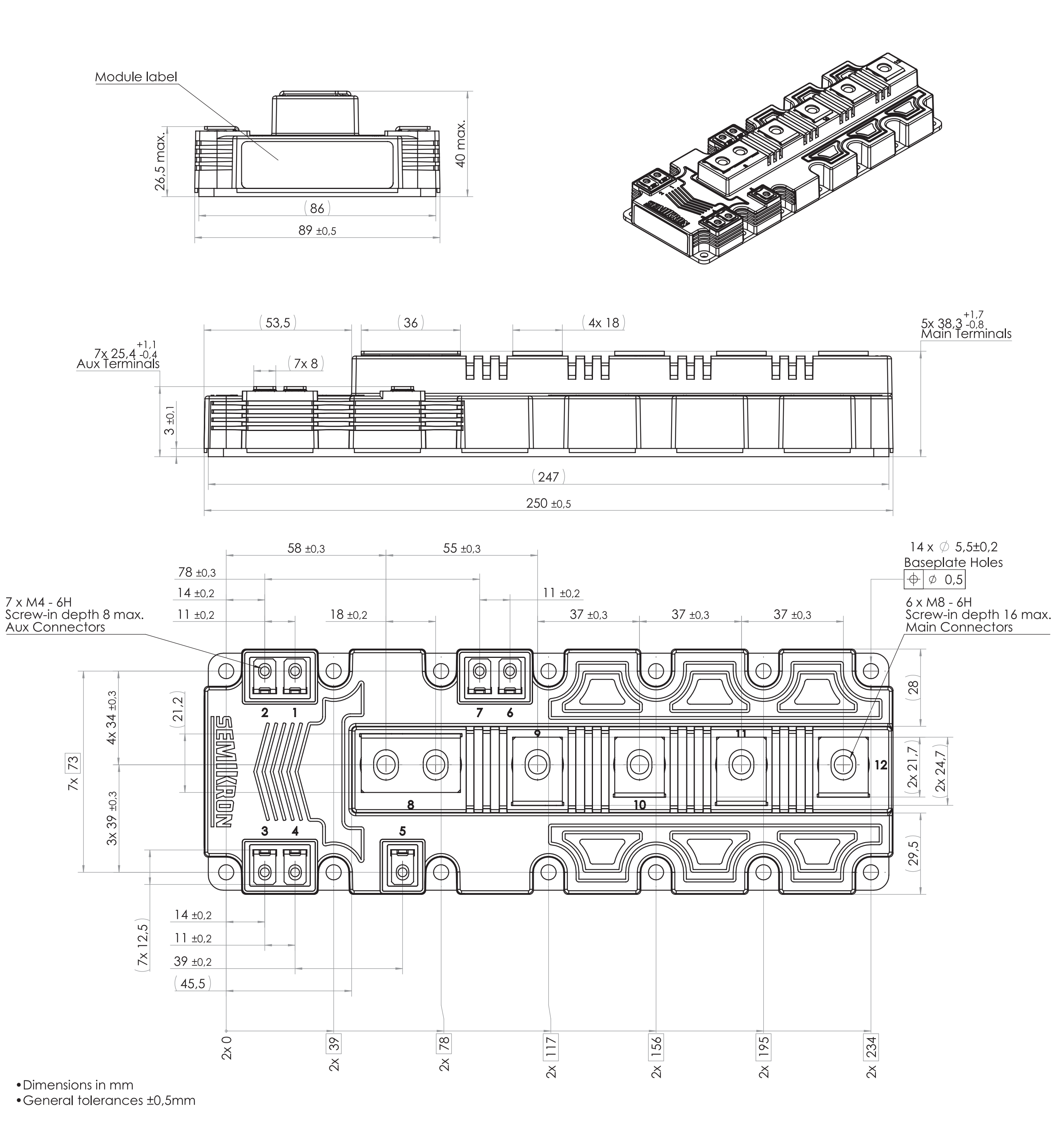


Fig. 14: Typ. gate charge characteristic



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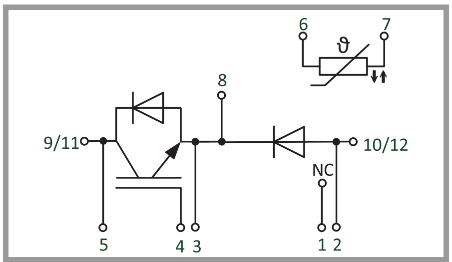

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This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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