



SEMITRANS® 3

Fast IGBT4 Modules

SKM600GAL12T4

Features*

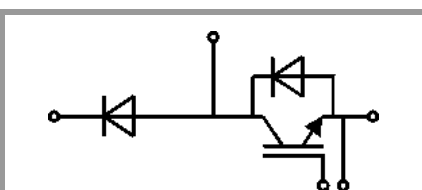
- IGBT4 = 4th generation fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 20kHz
- UL recognized, file no. E63532

Typical Applications

- Electronic welders at fsw up to 20 kHz
- DC/DC – converter
- Brake chopper
- Switched reluctance motor

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$



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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	860	A
		T _c = 80 °C	702	A
I _{Cnom}			600	A
I _{CRM}			1800	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	623	A
		T _c = 80 °C	466	A
I _{Fnom}			500	A
I _{FRM}			1200	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2736	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	707	A
		T _c = 80 °C	529	A
I _{Fnom}			600	A
I _{FRM}			1200	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		3240	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			500	A
T _{stg}	module without TIM		-40 ... 125	°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 = 600 A	T _j = 25 °C		1.80	2.05	V
	V _{GE} = 15 V	T _j = 150 °C		2.20	2.42	V
	chipelevel					
V _{CE0}		T _j = 25 °C		0.80	0.90	V
	chipelevel	T _j = 150 °C		0.70	0.80	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		1.67	1.92	mΩ
	chipelevel	T _j = 150 °C		2.5	2.7	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 24 mA		5	5.8	6.5	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		37.2		nF
C _{oes}		f = 1 MHz		2.32		nF
C _{res}		f = 1 MHz		2.04		nF
Q _G	V _{GE} = - 8 V...+ 15 V			3400		nC
R _{Gint}	T _j = 25 °C			1.3		Ω



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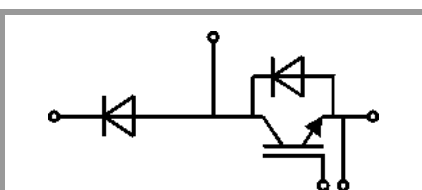
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Remarks

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- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C		178		ns
t _r	I _C = 600 A	T _j = 150 °C		68		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		33		mJ
t _{d(off)}	R _{G on} = 1.6 Ω	T _j = 150 °C		523		ns
t _f	R _{G off} = 1 Ω	T _j = 150 °C		116		ns
E _{off}	di/dt _{on} = 8900 A/μs di/dt _{off} = 4300 A/μs dv/dt = 3550 V/μs L _s = 24 nH	T _j = 150 °C		70		mJ
R _{th(j-c)}	per IGBT				0.049	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.032		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.016		K/W
Inverse diode						
V _F = V _{EC}	I _F = 600 A	T _j = 25 °C		2.28	2.63	V
	V _{GE} = 0 V chipelevel	T _j = 150 °C		2.28	2.61	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		1.64	1.88	mΩ
		T _j = 150 °C		2.3	2.5	mΩ
I _{RRM}	I _F = 600 A	T _j = 150 °C		566		A
Q _{rr}	di/dt _{off} = 8700 A/μs	T _j = 150 °C		99		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C		40		mJ
R _{th(j-c)}	per diode				0.095	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.039		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.028		K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 600 A	T _j = 25 °C		2.14	2.46	V
	V _{GE} = 0 V chipelevel	T _j = 150 °C		2.07	2.38	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		1.40	1.60	mΩ
		T _j = 150 °C		1.95	2.1	mΩ
I _{RRM}	I _F = 600 A	T _j = 150 °C		600		A
Q _{rr}	di/dt _{off} = 9000 A/μs	T _j = 150 °C		90		μC
E _{rr}	V _{GE} = ±15 V V _{CC} = 600 V	T _j = 150 °C		39		mJ
R _{th(j-c)}	per diode				0.086	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.038		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.024		K/W



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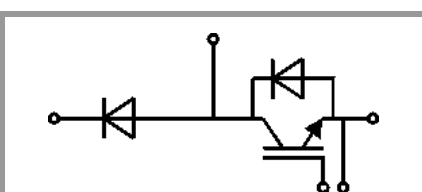
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Module						
L _{CE}			15			nH
R _{CC'+EE'}	measured per	T _C = 25 °C	0.55			mΩ
	switch	T _C = 125 °C	0.85			mΩ
R _{th(c-s)1}	calculated without thermal coupling		0.0172			K/W
R _{th(c-s)2}	including thermal coupling, Ts underneath module (λ _{grease} =0.81 W/(m*K))		0.020			K/W
R _{th(c-s)2}	including thermal coupling, Ts underneath module, pre-applied phase change material		0.011			K/W
M _s	to heat sink M6		3		5	Nm
M _t		to terminals M6	2.5		5	Nm
						Nm
w					325	g



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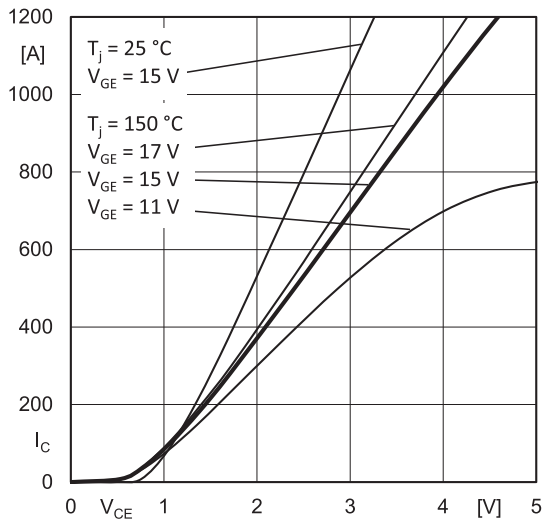


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

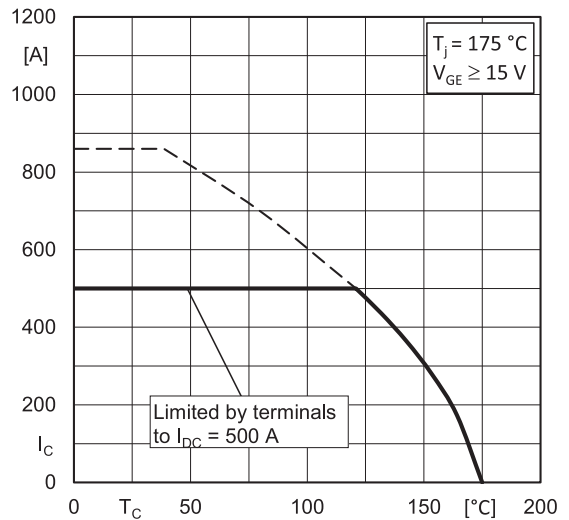


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

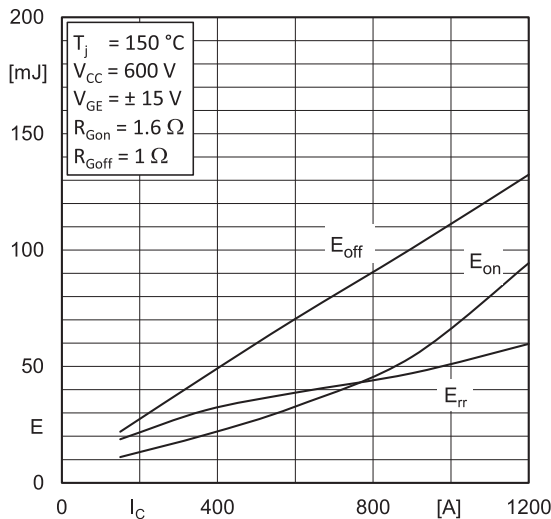


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

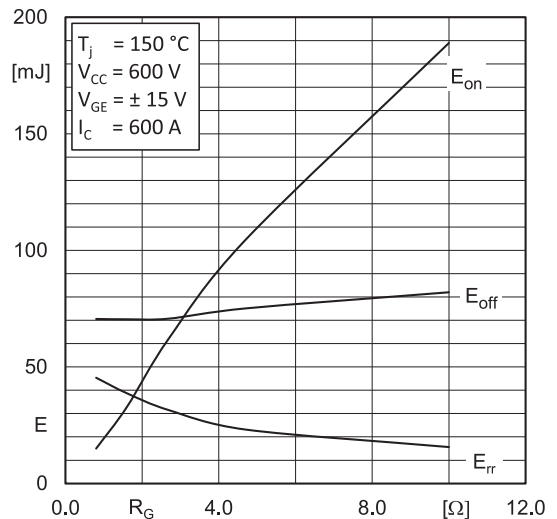


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

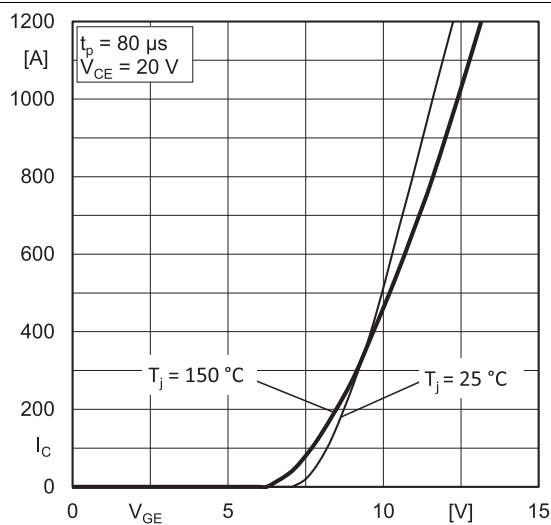


Fig. 5: Typ. transfer characteristic

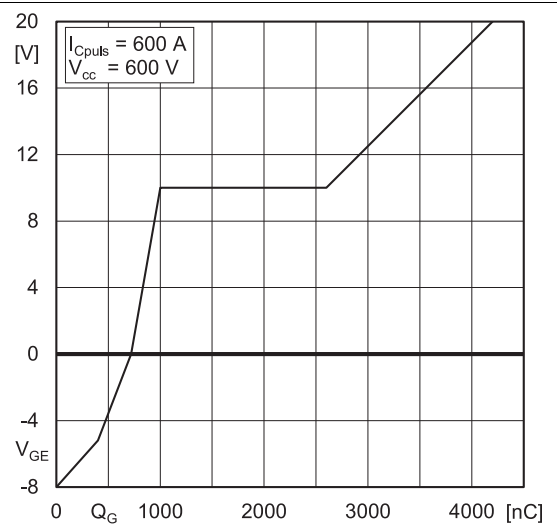
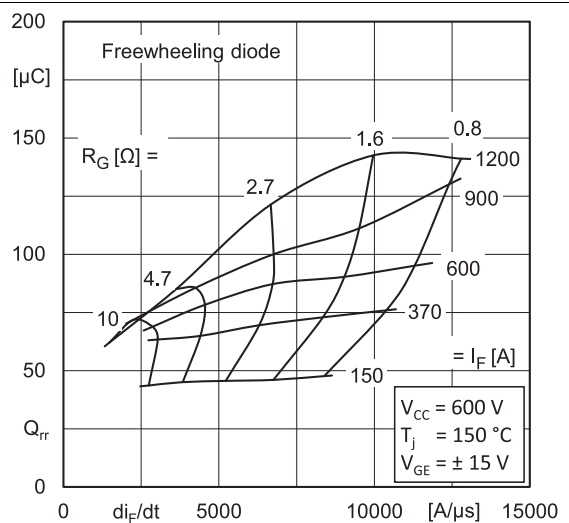
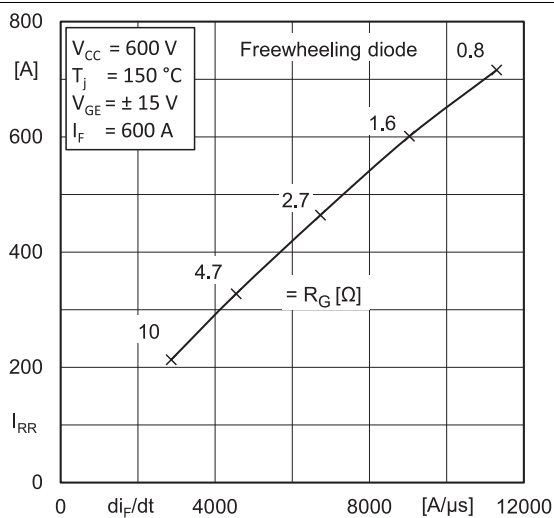
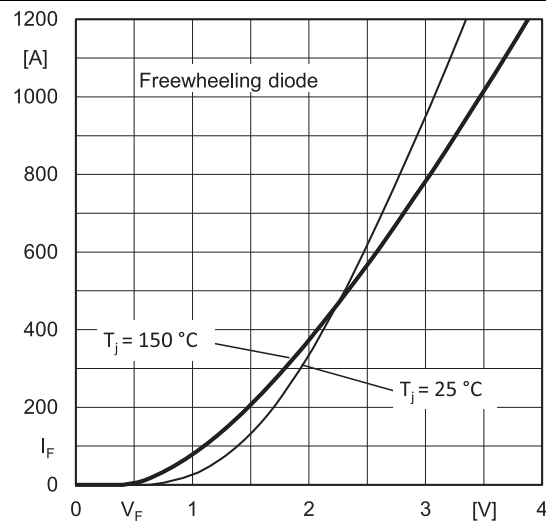
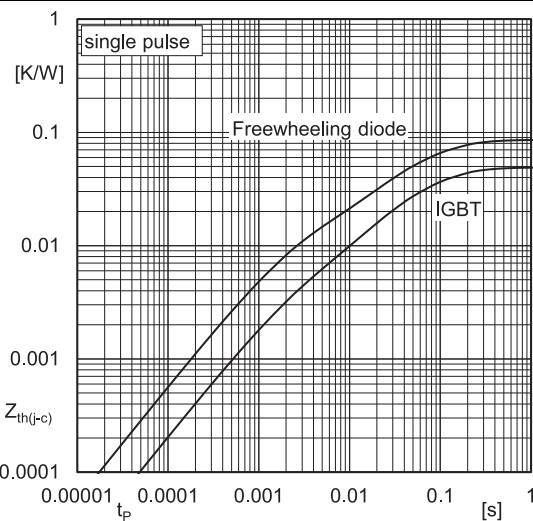
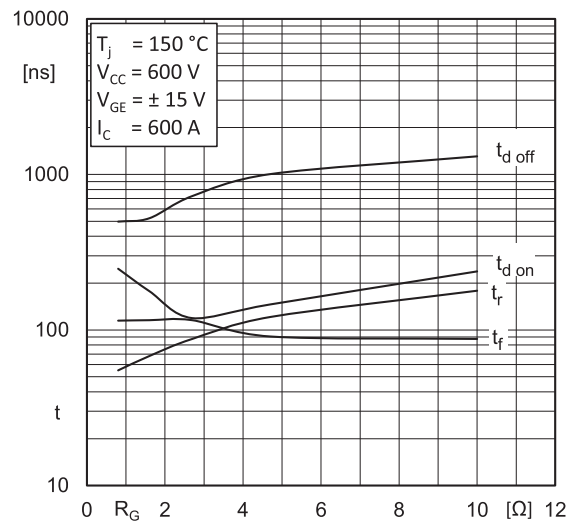
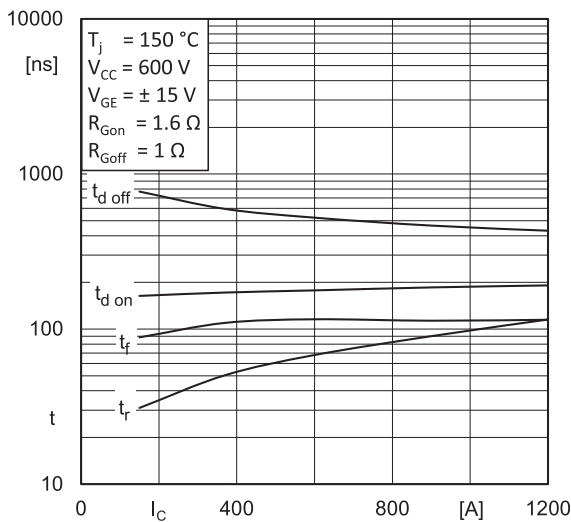
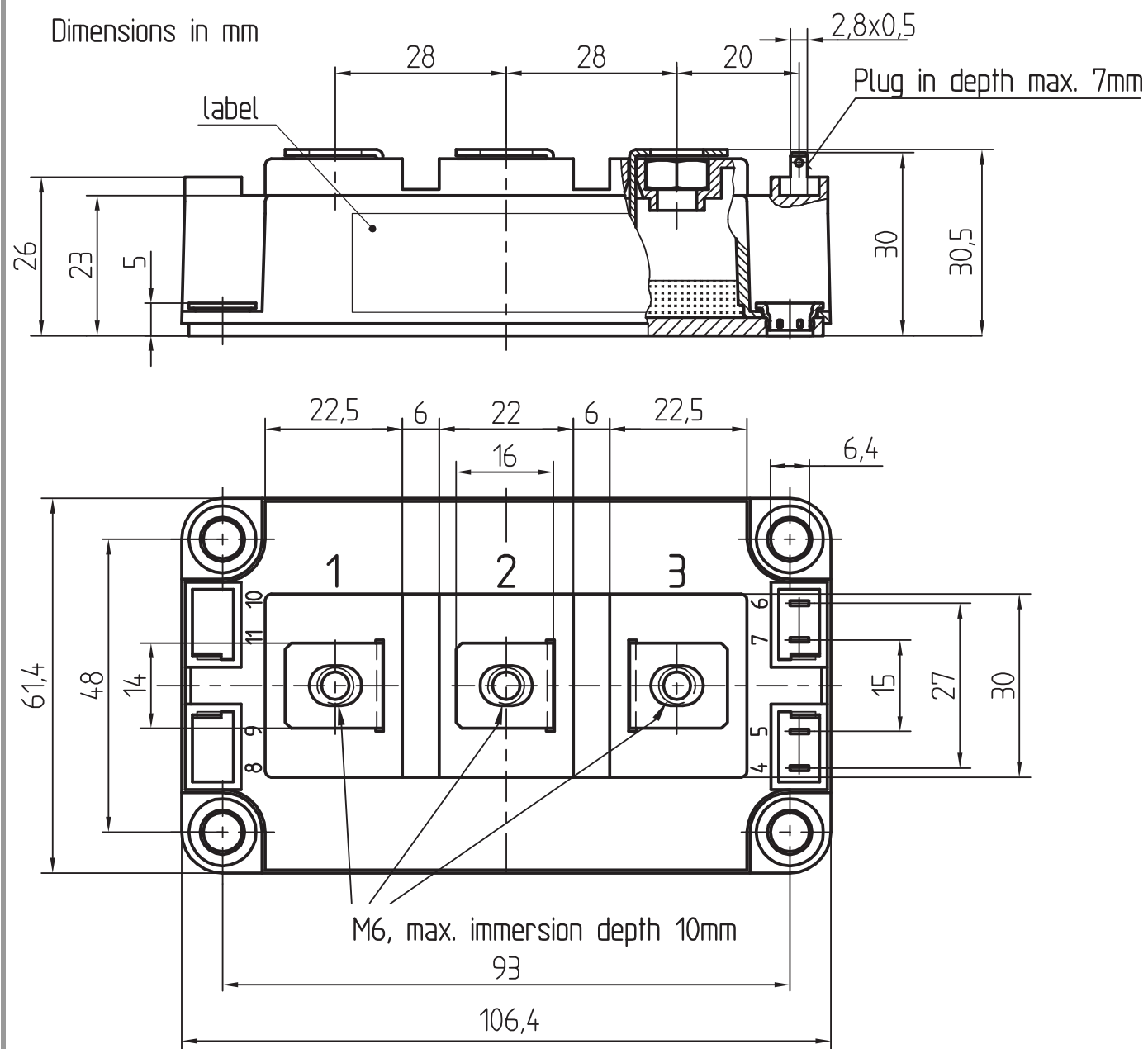


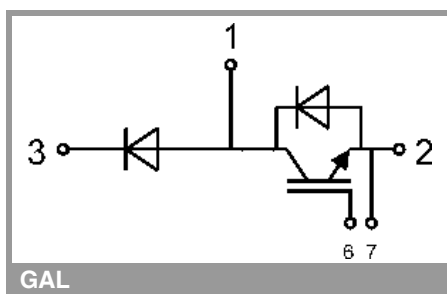
Fig. 6: Typ. gate charge characteristic





General tolerance $\pm 0,5$ mm

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

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