

SKM450GM12E4D1



SEMITRANS® 3

IGBT4 Modules

SKM450GM12E4D1

Features*

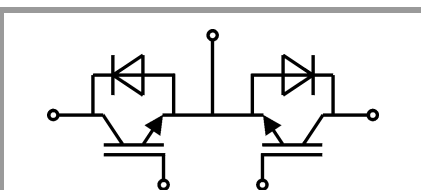
- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 12kHz
- UL recognized, file no. E63532
- SKM...D1: increased diode performance

Typical Applications

- Matrix Inverter
- Bidirectional switch

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}	$T_j = 25^\circ\text{C}$	1200	V	
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	699	A
		$T_c = 80^\circ\text{C}$	538	A
I_{Cnom}		450	A	
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1350	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	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	623	A
		$T_c = 80^\circ\text{C}$	466	A
I_{Fnom}		500	A	
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	1000	A	
I_{FSM}	$t_p = 10\text{ ms}$, $\sin 180^\circ$, $T_j = 25^\circ\text{C}$	2736	A	
T_j		-40 ... 175	$^\circ\text{C}$	
Module				
$I_{t(RMS)}$		500	A	
T_{stg}	module without TIM	-40 ... 125	$^\circ\text{C}$	
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$	4000	V	

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.84	2.07	V
		$T_j = 150^\circ\text{C}$	2.23	2.42	V
V_{CE0}	chiplevel	$T_j = 25^\circ\text{C}$	0.80	0.90	V
		$T_j = 150^\circ\text{C}$	0.70	0.80	V
r_{CE}	$V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	2.3	2.6	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	3.4	3.6	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 16.4\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_j = 25^\circ\text{C}$			5	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	27.2		nF
C_{oes}		$f = 1\text{ MHz}$	1.76		nF
C_{res}		$f = 1\text{ MHz}$	1.50		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		2500		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		1.9		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 450\text{ A}$	$T_j = 150^\circ\text{C}$	253		ns
t_r	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	59		ns
E_{on}	$R_{Gon} = 1\ \Omega$	$T_j = 150^\circ\text{C}$	28		mJ
$t_{d(off)}$	$R_{Goff} = 1\ \Omega$	$T_j = 150^\circ\text{C}$	505		ns
t_f	$di/dt_{on} = 8100\text{ A}/\mu\text{s}$ $di/dt_{off} = 3400\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	112		ns
E_{off}		$T_j = 150^\circ\text{C}$	58		mJ
$R_{th(j-c)}$	per IGBT			0.062	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)		0.028		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material		0.017		K/W

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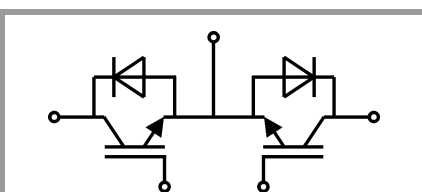
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 450 \text{ A}$ $V_{GE} = 0 \text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$		2.04	2.35	V
		$T_j = 150^\circ\text{C}$		1.94	2.23	V
V_{F0}	chipllevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
r_F	chipllevel	$T_j = 25^\circ\text{C}$		1.64	1.88	m Ω
		$T_j = 150^\circ\text{C}$		2.3	2.5	m Ω
I_{RRM}	$I_F = 450 \text{ A}$	$T_j = 150^\circ\text{C}$		504		A
Q_{rr}	$di/dt_{off} = 8000 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		75		μC
E_{rr}	$V_{GE} = -15 \text{ V}$ $V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$		31		mJ
$R_{th(j-c)}$	per diode				0.095	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81 \text{ W}/(\text{m}^2\text{K})$)			0.037		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.03		K/W
Module						
L_{CE}				15		nH
R_{CC+EE}	measured per switch	$T_c = 25^\circ\text{C}$		0.55		m Ω
		$T_c = 125^\circ\text{C}$		0.85		m Ω
$R_{th(c-s)1}$	calculated without thermal coupling			0.008		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{grease}=0.81 \text{ W}/(\text{m}^2\text{K})$)			0.013		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, pre-applied phase change material			0.009		K/W
M_s	to heat sink M6		3		5	Nm
M_t	to terminals M6					Nm
						Nm
w					325	g



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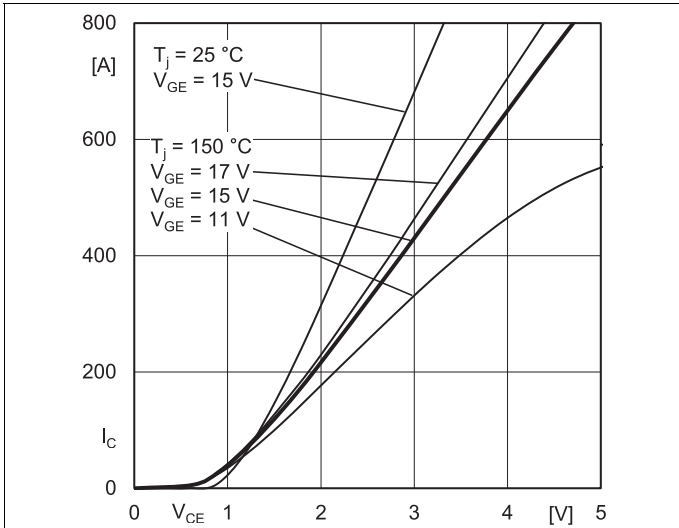


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

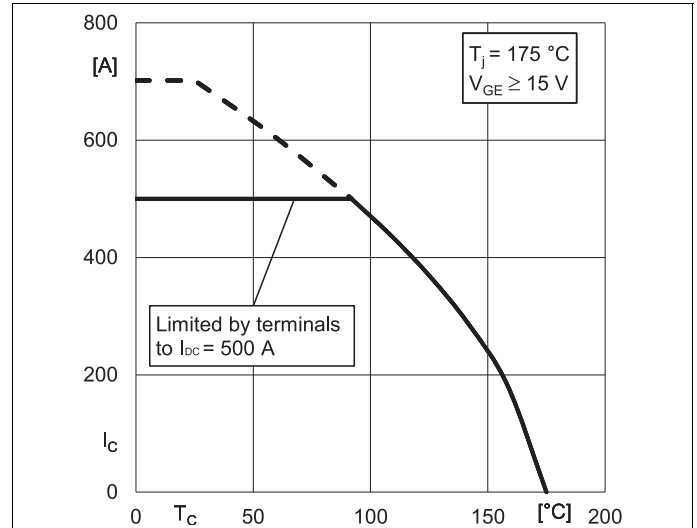


Fig. 2: Rated current vs. temperature $I_c = f(T_c)$

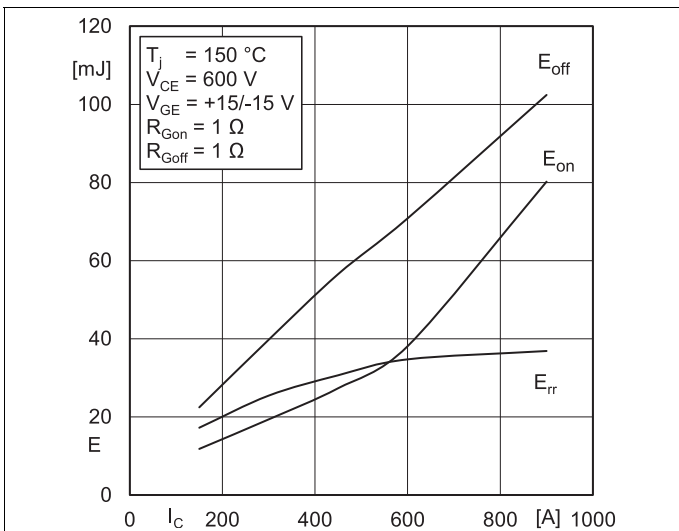


Fig. 3: Typ. turn-on /-off energy = $f(I_c)$

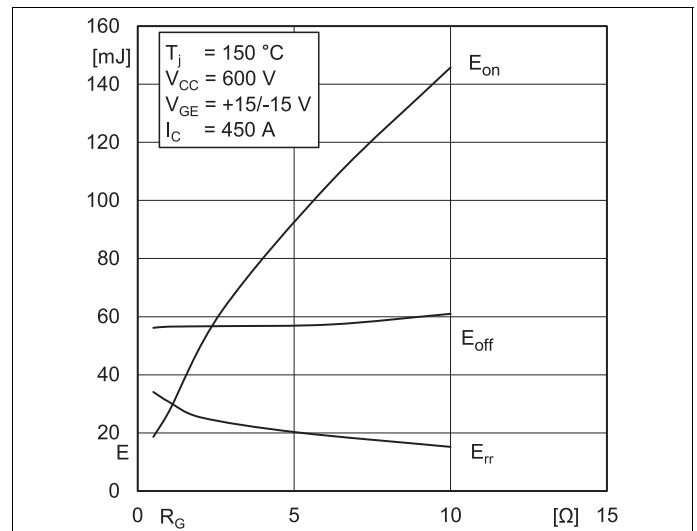


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

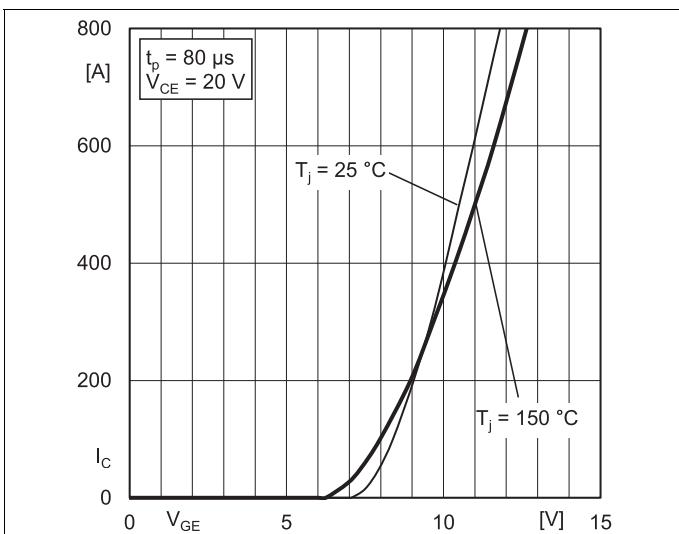


Fig. 5: Typ. transfer characteristic

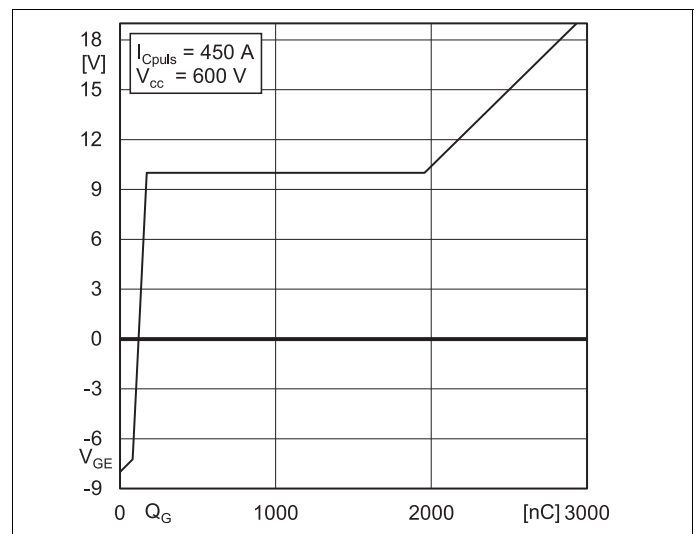
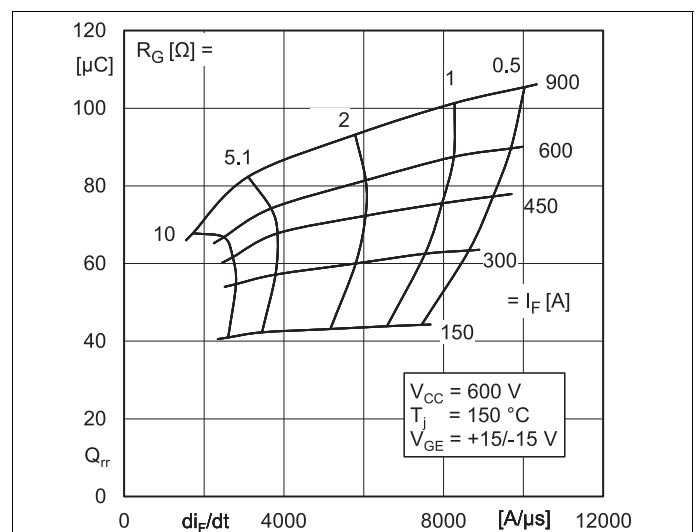
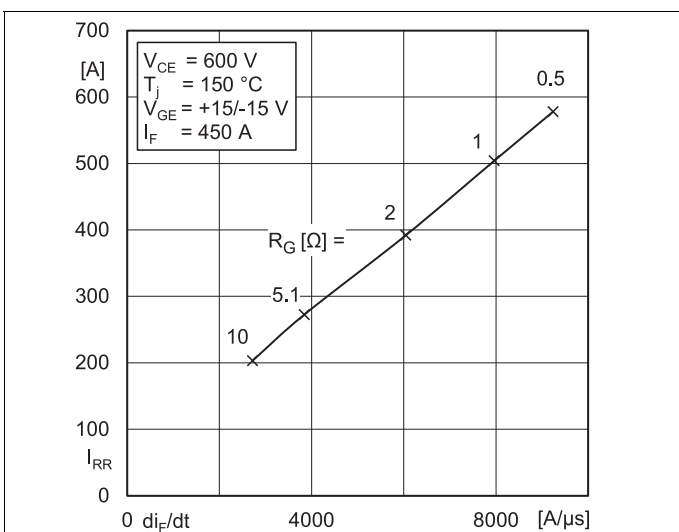
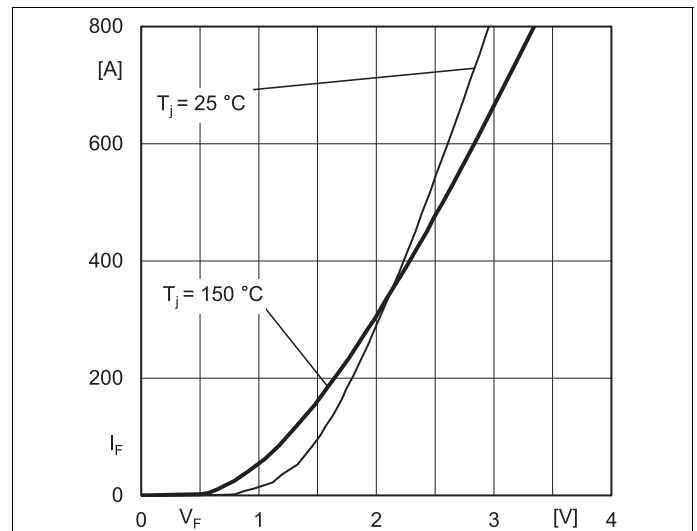
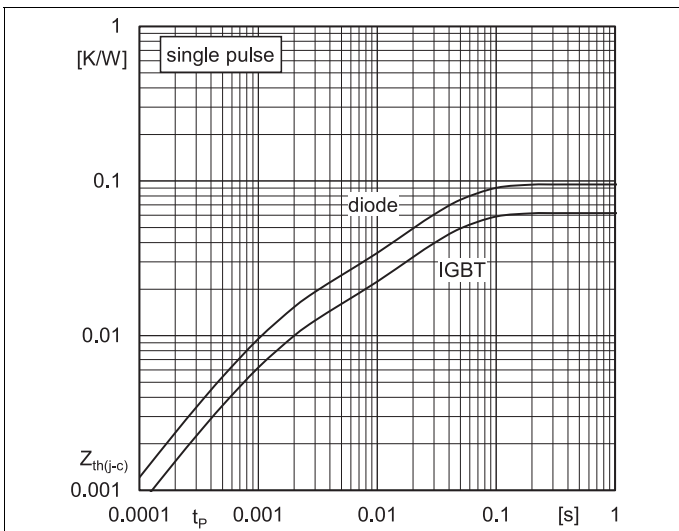
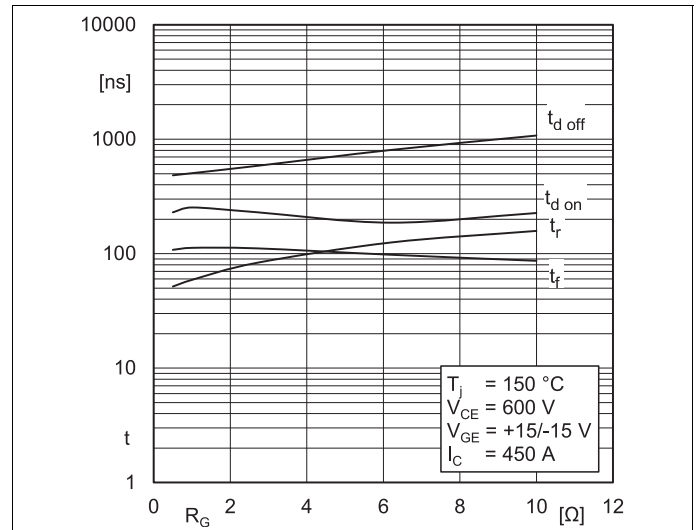
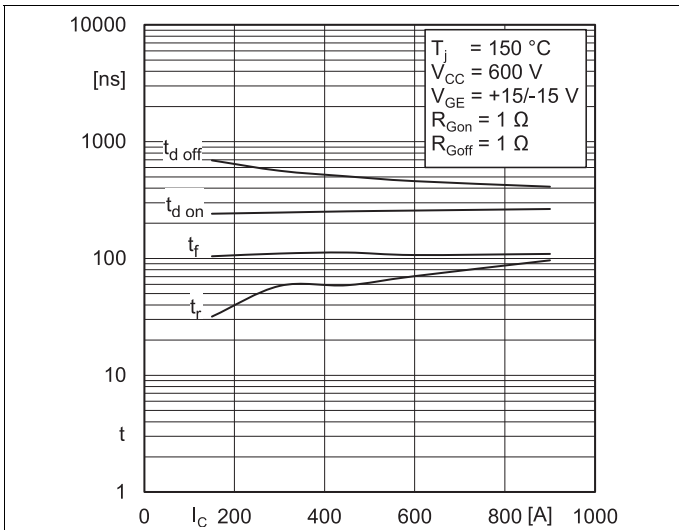
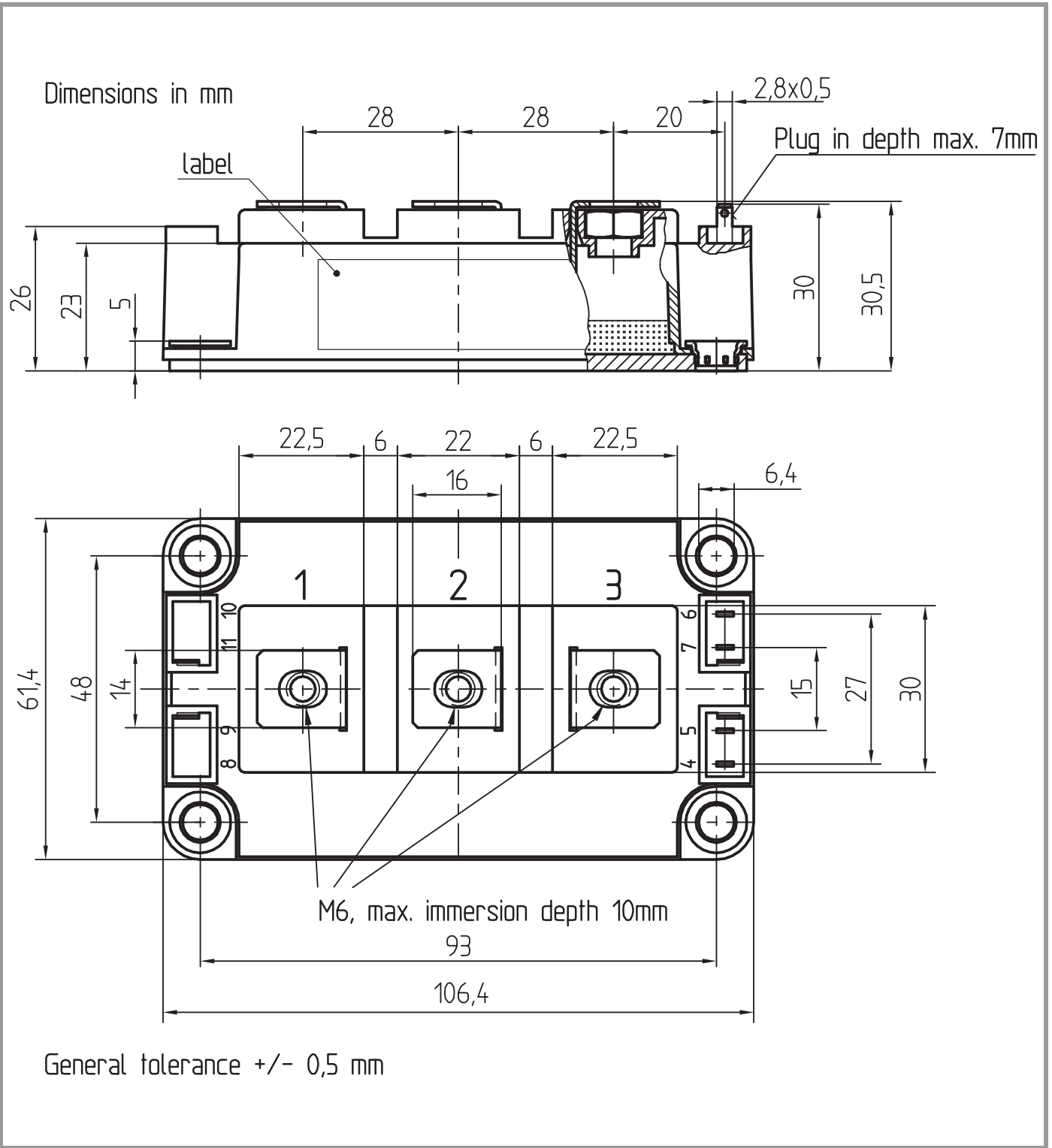


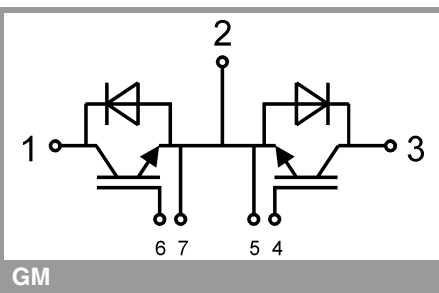
Fig. 6: Typ. gate charge characteristic



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

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