



SEMITRANS® 3

SiC MOSFET Module

SKM350MB120SCH15

Features*

- Full Silicon Carbide (SiC) power module
- High reliability 2nd Generation SiC MOSFETs
- Optimized for fast switching and lowest power losses
- High humidity robustness (HV-H3TRB proof)
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Improved thermal performances with Aluminium Nitride (AlN) substrate
- UL recognized, file no. E63532

Typical Applications

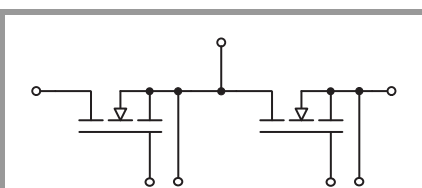
- High frequency power supplies
- AC inverters
- Traction APU
- EV Chargers
- Industrial Test Systems

Remarks

- Case temperature limited to $T_C = 125^\circ\text{C}$ max.
- Recommended $T_{jop} = -40 \dots +150^\circ\text{C}$
- Gate-Source SURGE VOLTAGE ($t_{surge} < 300\text{ns}$), $V_{GS_surge} = -10\text{V} \dots +26\text{V}$

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
MOSFET				
V _{DSS}			1200	V
I _D	T _j = 175 °C	T _c = 25 °C	478	A
		T _c = 80 °C	380	A
I _{DM}			1280	A
I _{DRM}			904	A
V _{GS}			-6 ... 22	V
T _j			-40 ... 175	°C
Integrated body diode				
I _{FM}			1280	A
I _{FRM}			904	A

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
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



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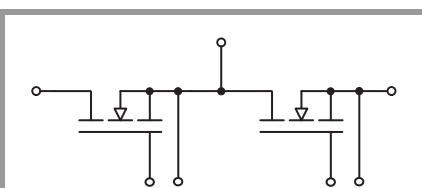
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
MOSFET					
$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_j = 25^\circ\text{C}$	1200			V
$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 71.2\text{ mA}$	1.6		4	V
I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_j = 25^\circ\text{C}$			1	mA
I_{GSS}	$V_{GS} = 22\text{ V}, V_{DS} = 0\text{ V}$			800	nA
$R_{DS(on)}$	$V_{GS} = 18\text{ V}$				
	$I_D = 176\text{ A}$				
	chiplevel				
	$T_j = 25^\circ\text{C}$		5.6	7.0	mΩ
	$T_j = 150^\circ\text{C}$		9.5		mΩ
C_{iss}	$V_{GS} = 0\text{ V}$		34.5		nF
C_{oss}	$V_{DS} = 800\text{ V}$		1.10		nF
C_{rss}	$f = 1\text{ MHz}$		0.15		nF
Q_G	$V_{DD} = 600\text{ V}, V_{GS} = -5 \dots 20\text{ V}, I_D = 350\text{ A}$		1850		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0.6		Ω
$t_{d(on)}$	$V_{DD} = 600\text{ V}$		86		ns
	$I_D = 175\text{ A}$				
t_r	$V_{GS} = -5 \dots 20\text{ V}$		11		ns
$t_{d(off)}$	$R_{Gon} = 0.5\text{ Ω}$		226		ns
t_f	$R_{Goff} = 0.5\text{ Ω}$		34		ns
E_{on}	$di/dt_{on} = 10.1\text{ kA/μs}$		2.31		mJ
E_{off}	$di/dt_{off} = 2.8\text{ kA/μs}$				
	$dv/dt_{off} = 20.1\text{ kV/μs}$		2.07		mJ
	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per MOSFET			0.055	K/W
$R_{th(c-s)}$	per MOSFET ($\lambda_{grease} = 0.81\text{ W/(m}^2\text{K)}$)		0.03		K/W
Integrated body diode					
$V_F = V_{SD}$	$-I_D = 176\text{ A}$		4.10		V
	$V_{GS} = 0\text{ V}$				
	chiplevel		3.90		V
V_{F0}	chiplevel	$T_j = 25^\circ\text{C}$	2.6		V
		$T_j = 150^\circ\text{C}$	2.1		V
r_F	chiplevel	$T_j = 25^\circ\text{C}$	8.5		mΩ
		$T_j = 150^\circ\text{C}$	10		mΩ
t_{rr}	$V_{DD} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	62		ns
	$-I_D = 175\text{ A}$	$T_j = 150^\circ\text{C}$			
Q_{rr}	$di/dt_{off} = 7.5\text{ kA/μs}$	$T_j = 150^\circ\text{C}$	7.2		μC
I_{rr}	$V_{GS} = -5\text{ V}$	$T_j = 150^\circ\text{C}$	232		A
E_{rr}	$R_{Gon} = 0.5\text{ Ω}$	$T_j = 150^\circ\text{C}$	3.3		mJ

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Module					
L_{CE}			15		nH
$R_{CC'+EE'}$	measured per switch	$T_C = 25^\circ\text{C}$	0.55		mΩ
		$T_C = 125^\circ\text{C}$	0.85		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling ($\lambda_{grease} = 0.81\text{ W/(m}^2\text{K)}$)		0.015		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{grease} = 0.81\text{ W/(m}^2\text{K)}$)		0.016		K/W
M_s	to heat sink M6	3		5	Nm
M_t	to terminals M6	2.5		5	Nm
					Nm
w				325	g

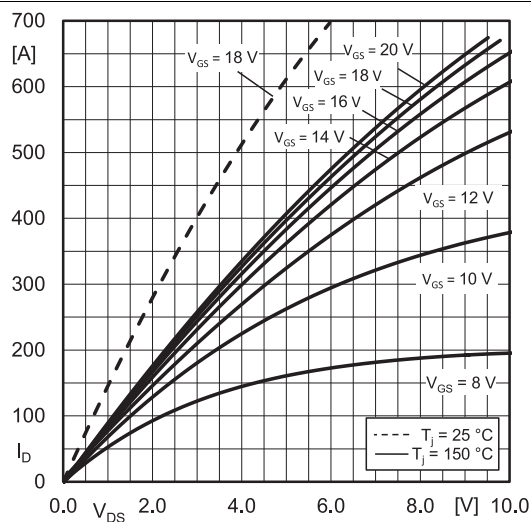


Fig. 1: Typ. MOSFET forward output characteristic, incl. $R_{DS(on)}$

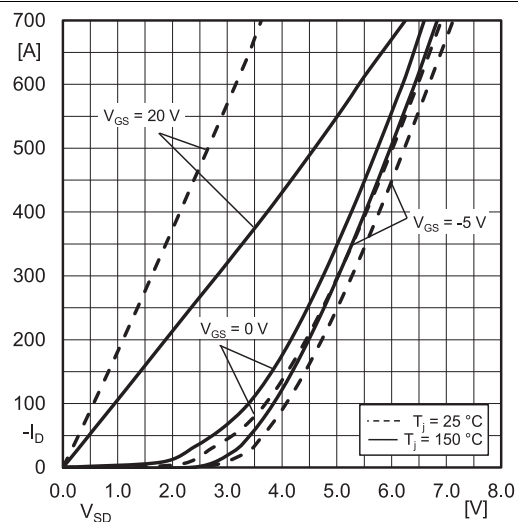


Fig. 2: Typ. reverse output characteristic, incl. $R_{DS(on)}$

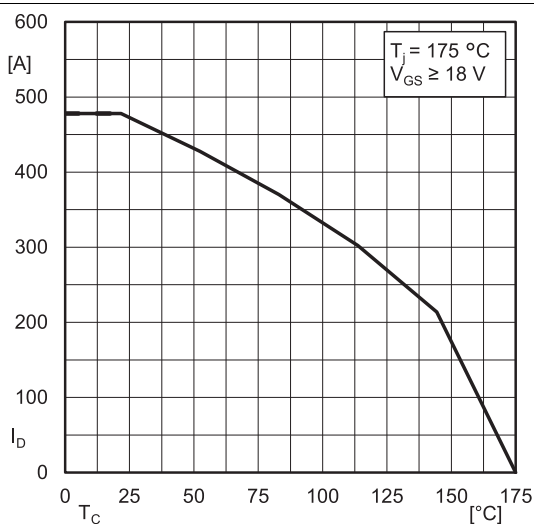


Fig. 3: Rated current vs. temperature $I_D = f(T_C)$

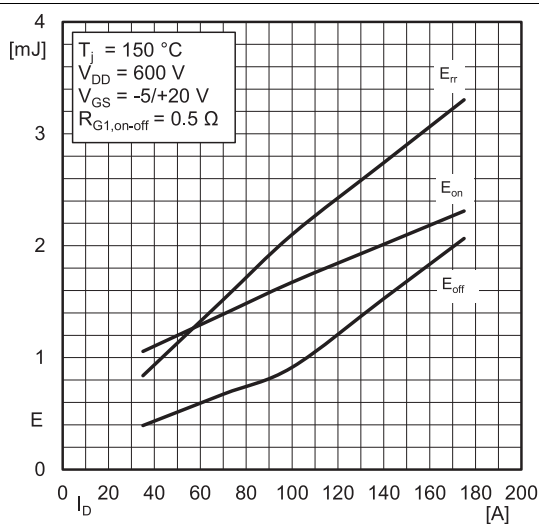


Fig. 4: Typ. switching energy $E = f(I_D)$ at R_{G1}

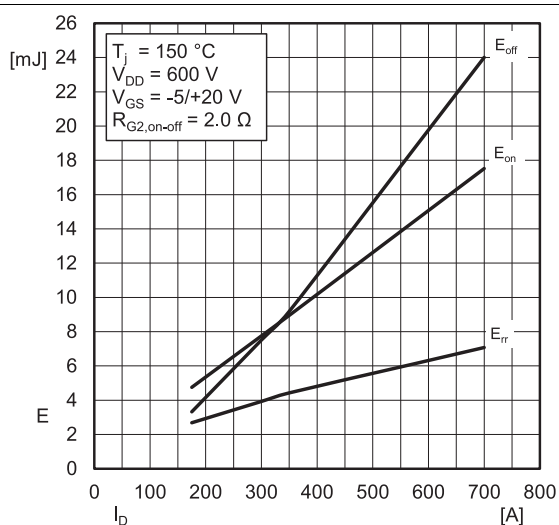


Fig. 5: Typ. switching energy $E = f(I_D)$ at R_{G2}

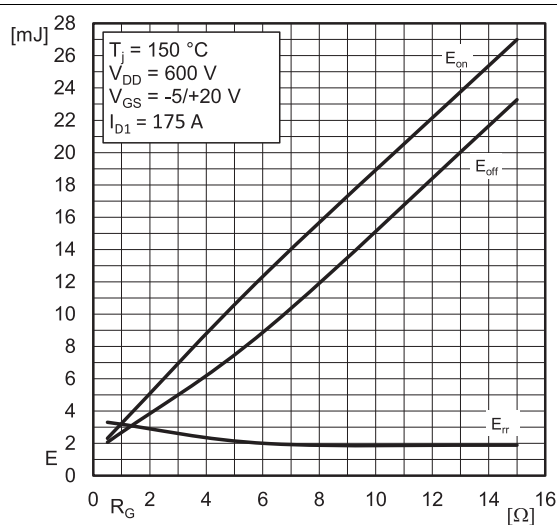


Fig. 6: Typ. switching energy $E = f(R_G)$ at I_{D1}

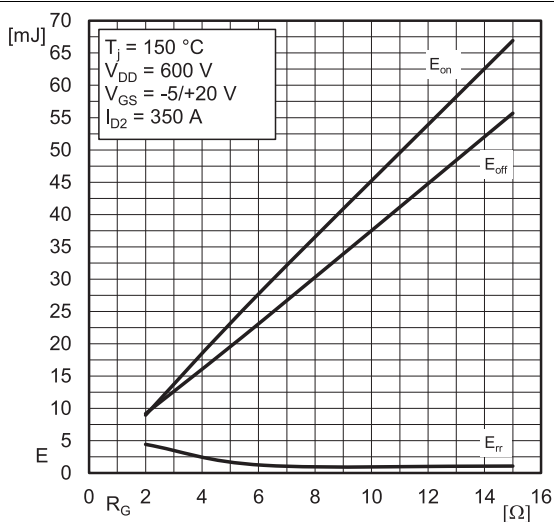


Fig. 7: Typ. switching energy $E = f(R_G)$ at I_{D2}

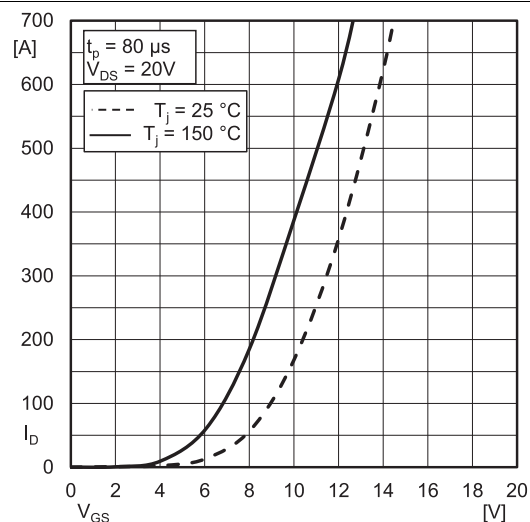


Fig. 8: Typ. MOSFET transfer characteristic

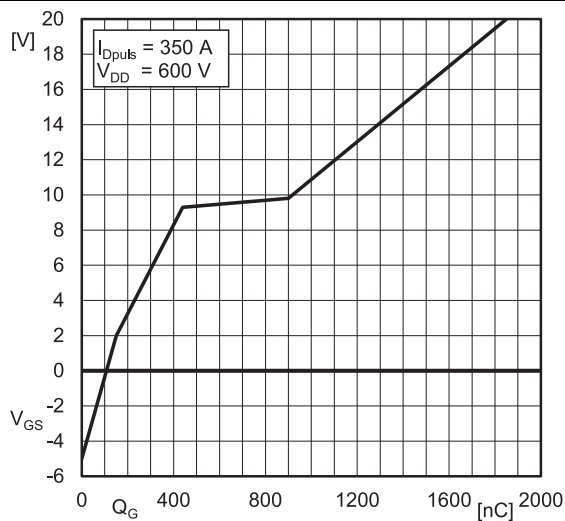


Fig. 9: Typ. gate charge characteristic

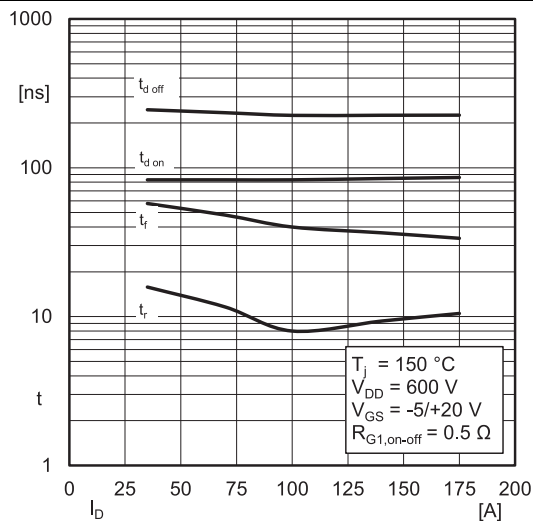


Fig. 10: Typ. switching times $t = f(I_D)$ at R_{G1}

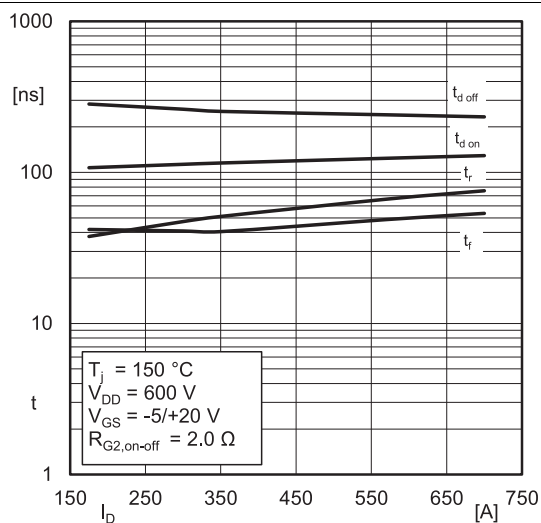


Fig. 11: Typ. switching times $t = f(I_D)$ at R_{G2}

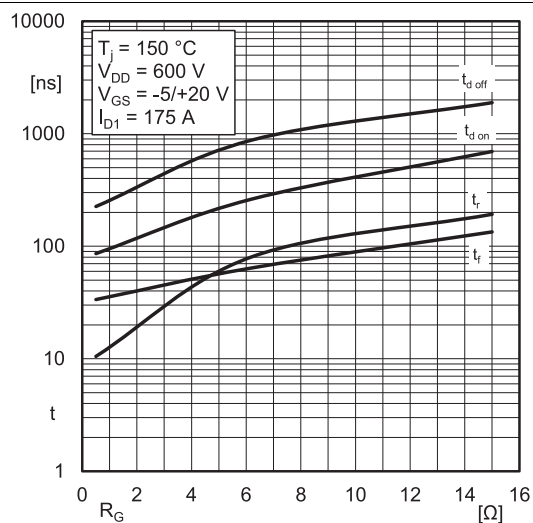
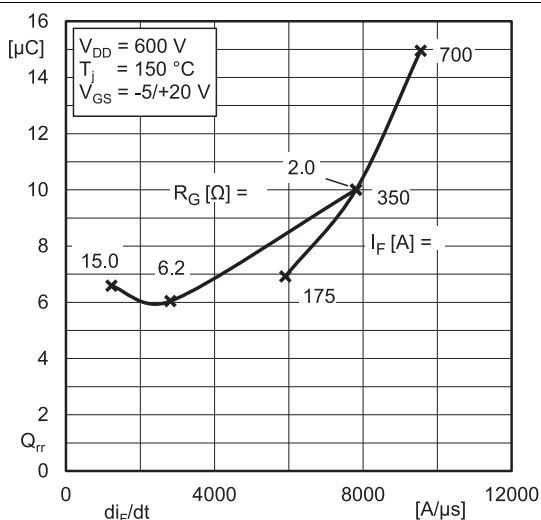
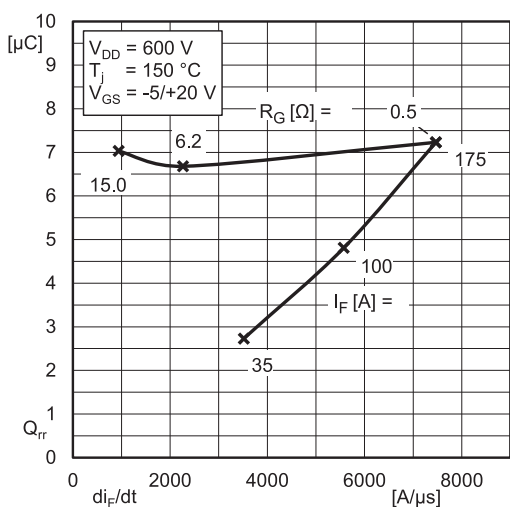
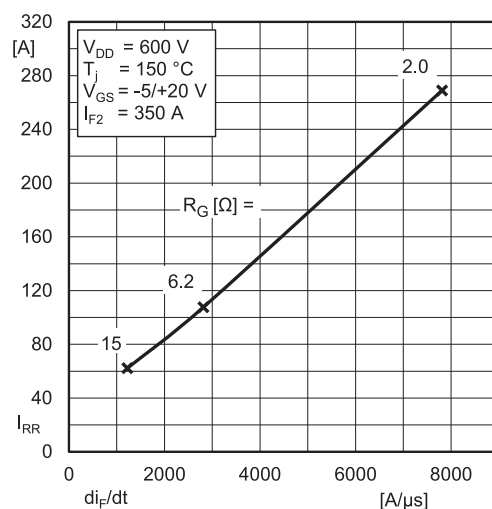
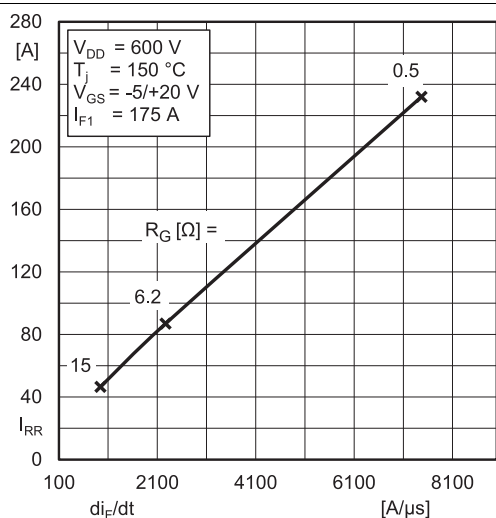
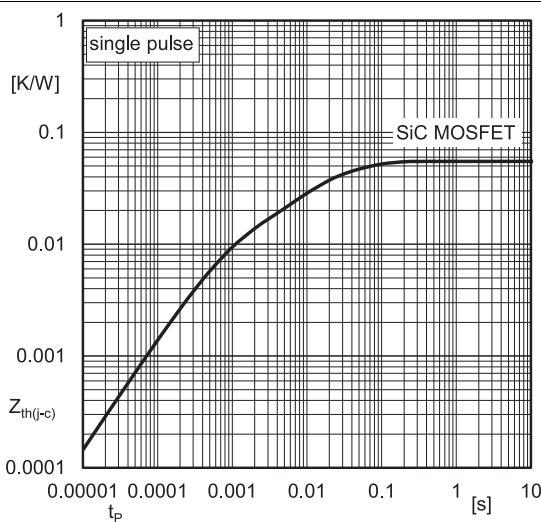
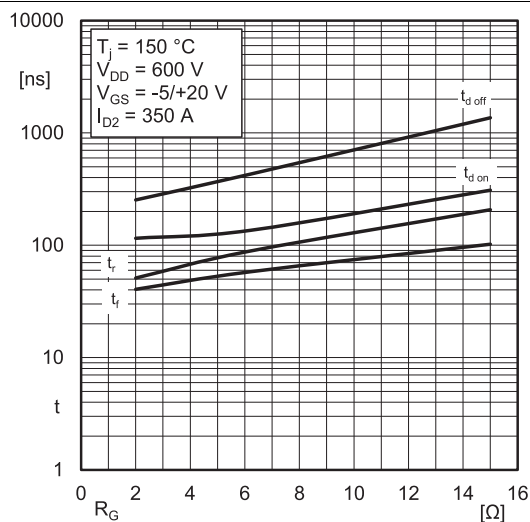


Fig. 12: Typ. switching times $t = f(R_G)$ at I_{D1}



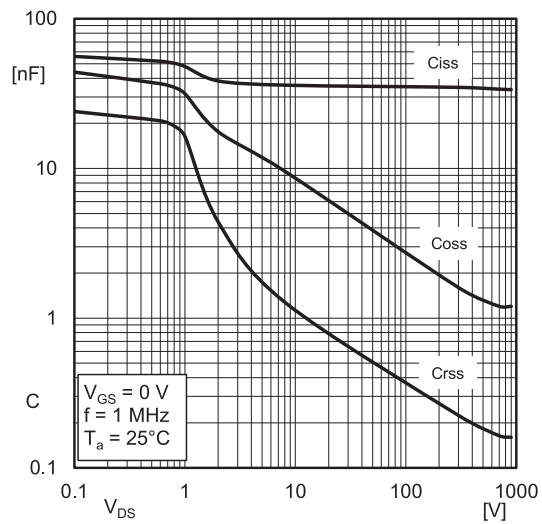
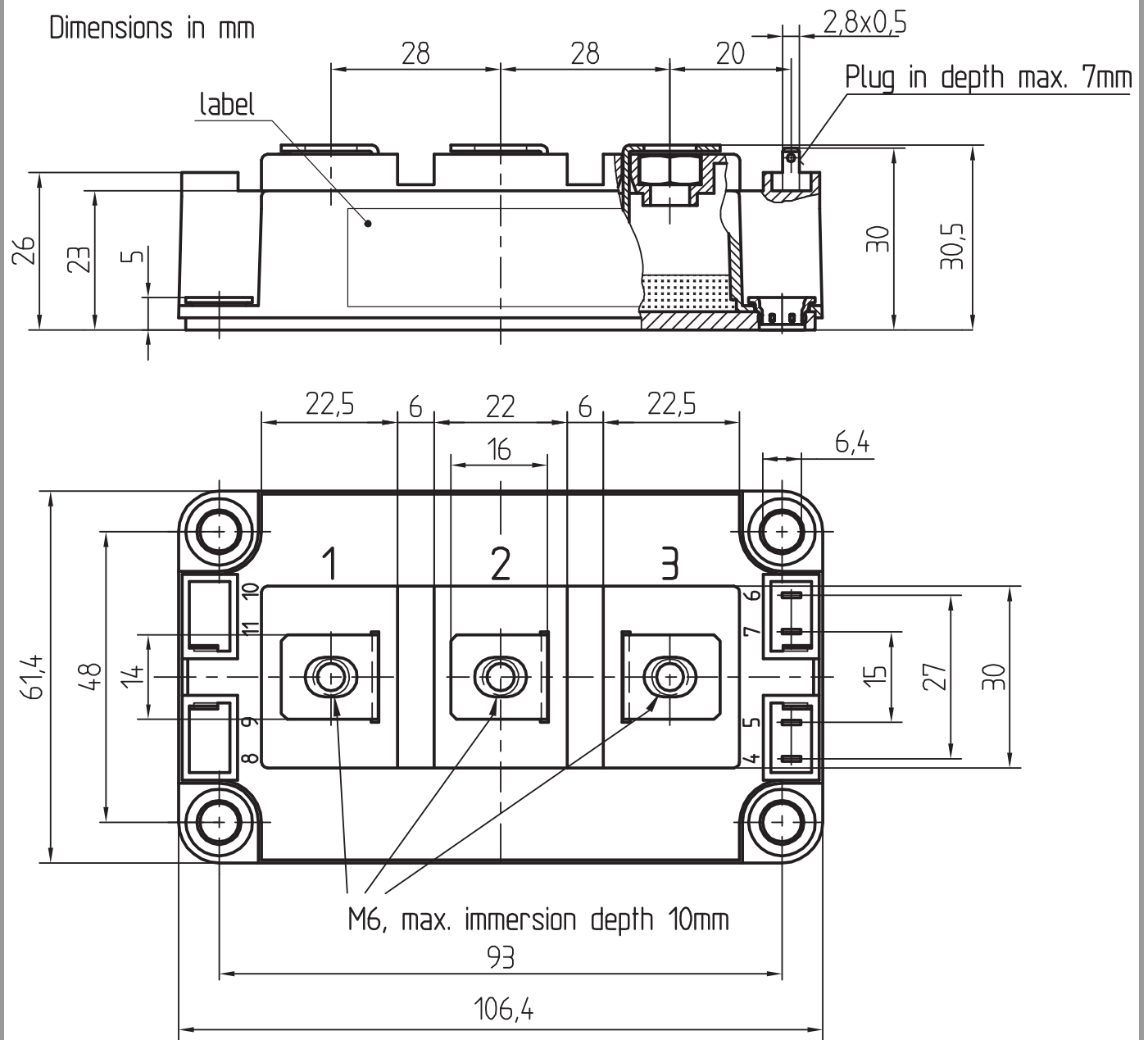
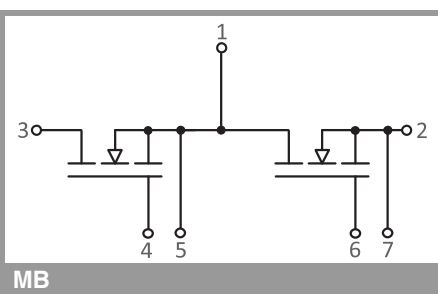


Fig. 19: Capacitances vs. drain-source voltage



General tolerance ± 0.5 mm

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

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