SEMITRANS® 3

SiC MOSFET Module

SKM500MB120SC

Features*

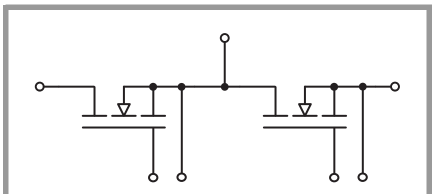
- Full Silicon Carbide (SiC) power module
- High reliability 2nd Generation SiC MOSFETs
- Optimized for fast switching and lowest power losses
- High humidity robustness (HV-H3TRB proof)
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- UL recognized, file no. E63532

Typical Applications

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

Remarks

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



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
MOSFET				
V_{DSS}			1200	V
I_D	T_j = 175 °C	T_c = 25 °C	485	A
		T_c = 80 °C	386	A
I_{DM}			1920	A
I_{DRM}			1356	A
V_{GS}			-6 ... 22	V
T_j			-40 ... 175	°C
Integrated body diode				
I_{FM}			1920	A
I_{FRM}			1356	A

Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
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

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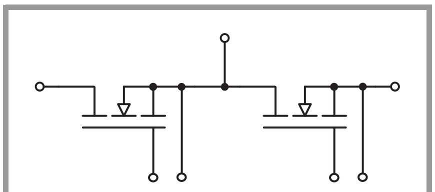

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
MOSFET						
$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 1 mA, T_j = 25 °C		1200			V
$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 106.8 mA		1.6		4	V
I_{DSS}	V_{GS} = 0 V, V_{DS} = 1200 V, T_j = 25 °C				1	mA
I_{GSS}	V_{GS} = 22 V, V_{DS} = 0 V				1200	nA
$R_{DS(on)}$	V_{GS} = 18 V I_D = 264 A chiplevel	T_j = 25 °C		3.8	4.7	mΩ
		T_j = 150 °C		6.3		mΩ
C_{iss}	V_{GS} = 0 V V_{DS} = 800 V f = 1 MHz	T_j = 25 °C		51.7		nF
C_{oss}		T_j = 25 °C		1.64		nF
C_{rss}		T_j = 25 °C		0.23		nF
Q_G	V_{DD}=600V, V_{GS}=-5 ... 20V, I_D = 500 A			2775		nC
R_{Gint}	T_j = 25 °C			0.4		Ω
$t_{d(on)}$	V_{DD} = 600 V I_D = 150 A V_{GS} = -5 ... 20 V R_{Gon} = 0.7 Ω R_{Goff} = 0.7 Ω di/dt_{on} = 9.8 kA/µs di/dt_{off} = 2.7 kA/µs dv/dt_{off} = 19.4 kV/µs	T_j = 150 °C		83		ns
t_r		T_j = 150 °C		8		ns
$t_{d(off)}$		T_j = 150 °C		225		ns
t_f		T_j = 150 °C		40		ns
E_{on}		T_j = 150 °C		2.51		mJ
E_{off}		T_j = 150 °C		1.37		mJ
$R_{th(j-c)}$	per MOSFET				0.08	K/W
$R_{th(c-s)}$	per MOSFET (λ_{grease}=0.81 W/(m*K))			0.025		K/W
Integrated body diode						
$V_F = V_{SD}$	$-I_D$ = 264 A V_{GS} = 0 V chiplevel	T_j = 25 °C		4.10		V
		T_j = 150 °C		3.90		V
V_{F0}	chiplevel	T_j = 25 °C		2.6		V
		T_j = 150 °C		2.1		V
r_F	chiplevel	T_j = 25 °C		5.7		mΩ
		T_j = 150 °C		6.8		mΩ
t_{rr}	V_{DD} = 600 V $-I_D$ = 150 A di/dt_{off} = 8.4 kA/µs V_{GS} = -5 V R_{Gon} = 0.7 Ω	T_j = 150 °C		56		ns
Q_{rr}		T_j = 150 °C		7.2		µC
I_{rr}		T_j = 150 °C		255		A
E_{rr}		T_j = 150 °C		3.2		mJ

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Module						
L_{CE}				15		nH
$R_{CC'+EE'}$	measured per switch	T_C = 25 °C		0.55		mΩ
		T_C = 125 °C		0.85		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling (λ_{grease}=0.81 W/(m*K))			0.013		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module (λ_{grease}=0.81 W/(m*K))			0.014		K/W
M_s	to heat sink M6		3		5	Nm
M_t		to terminals M6	2.5		5	Nm
						Nm
w					325	g

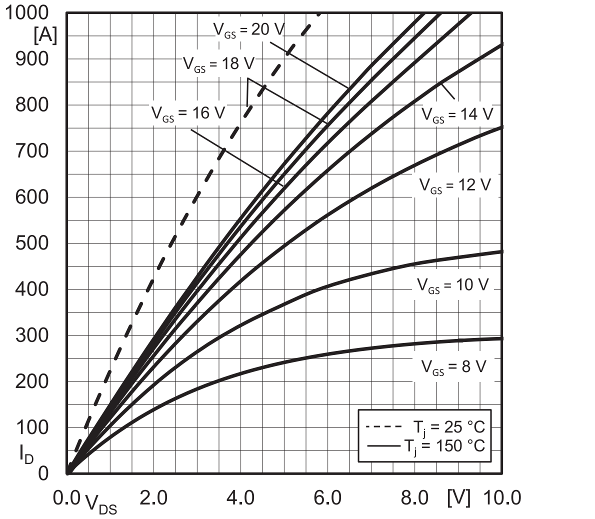


Fig.1: Typ. MOSFET forward output characteristic, incl. $R_{DD'+SS'}$

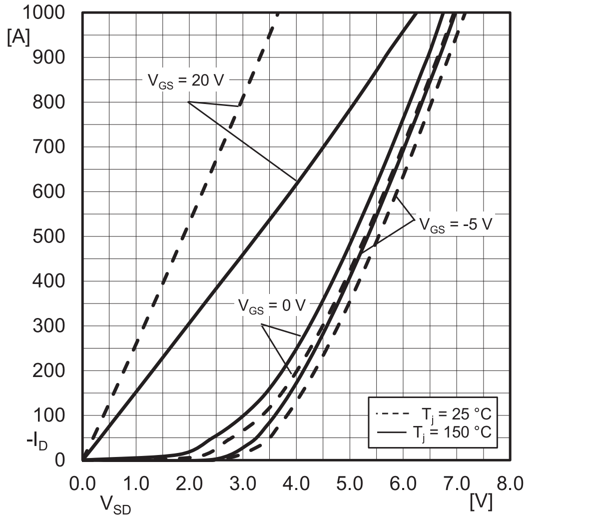


Fig. 2: Typ. reverse output characteristic, incl. $R_{DD'+SS'}$

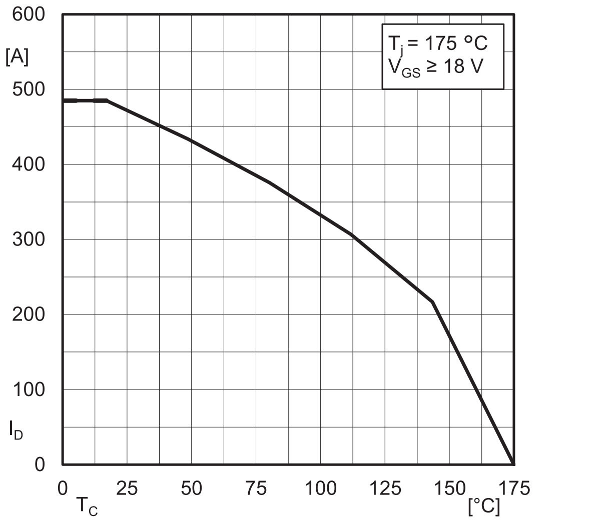


Fig. 3: Rated current vs. temperature $I_D = f(T_C)$

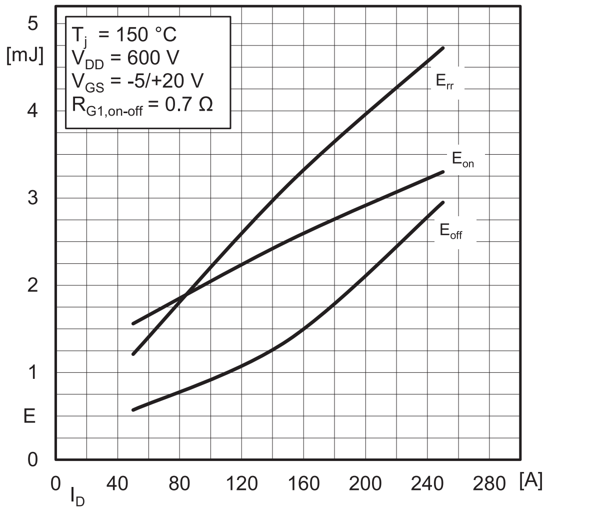


Fig. 4: Typ. switching energy $E = f(I_D)$ at R_{G1}

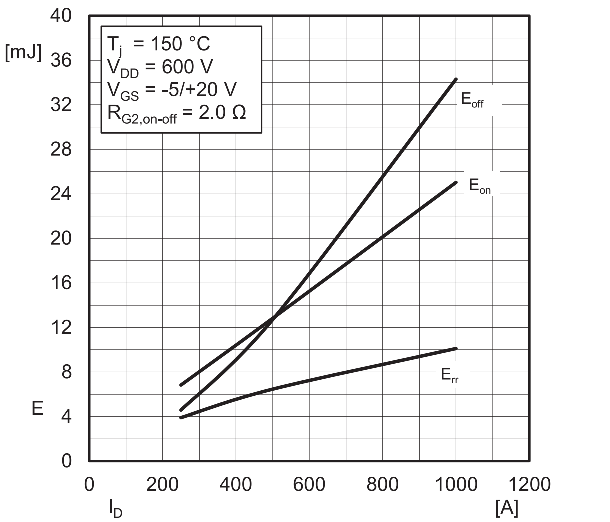


Fig. 5: Typ. switching energy $E = f(I_D)$ at R_{G2}

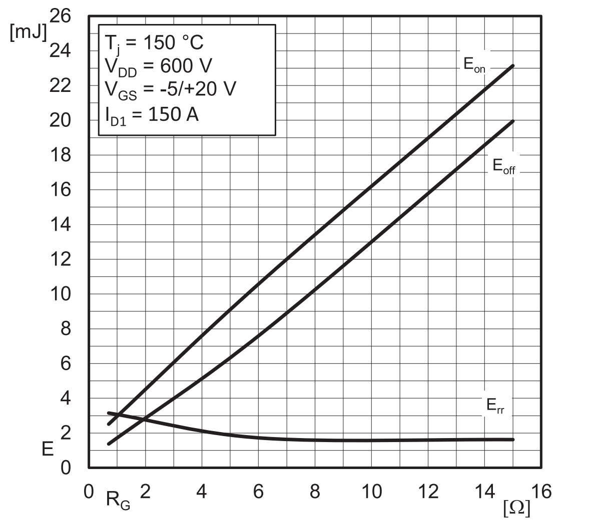


Fig. 6: Typ. switching energy $E = f(R_G)$ at I_{D1}

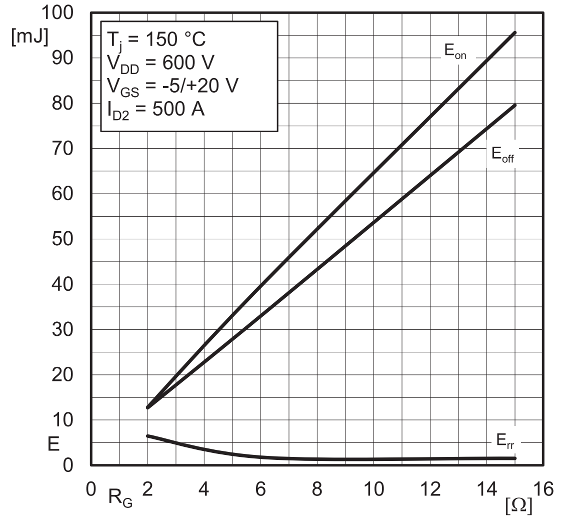


Fig. 7: Typ. switching energy E = f (R_G) at I_{D2}

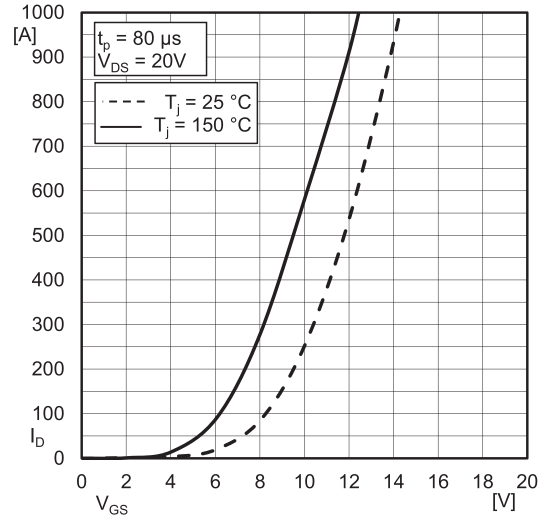


Fig. 8: Typ. MOSFET transfer characteristic

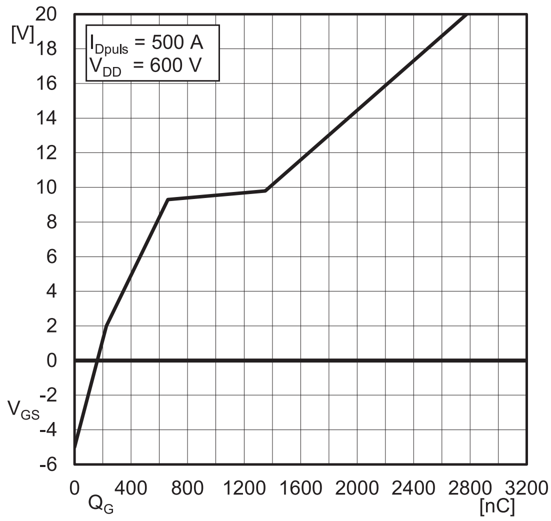


Fig. 9: Typ. gate charge characteristic

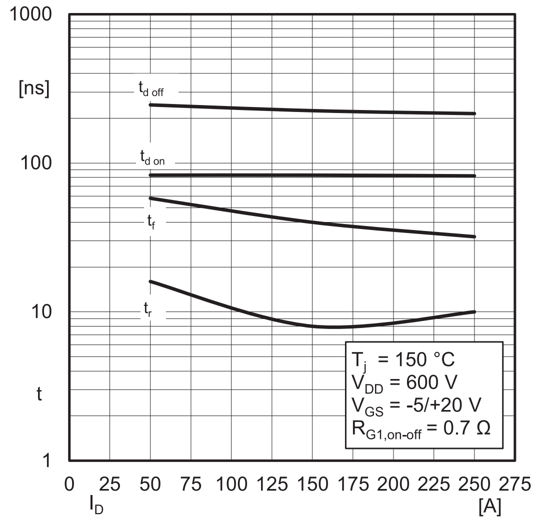


Fig. 10:Typ. switching times t = f (I_D) at R_{G1}

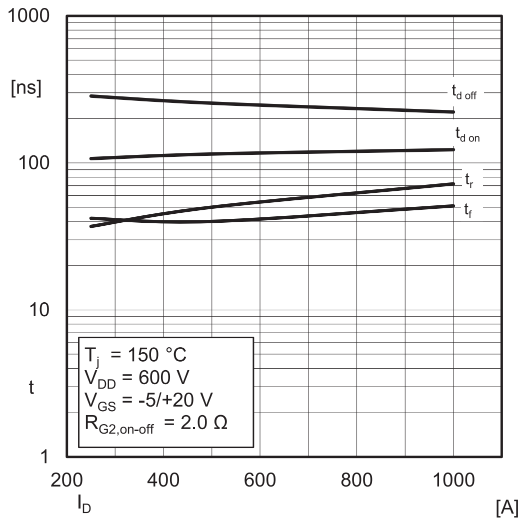


Fig. 11: Typ. switching times t = f (I_D) at R_{G2}

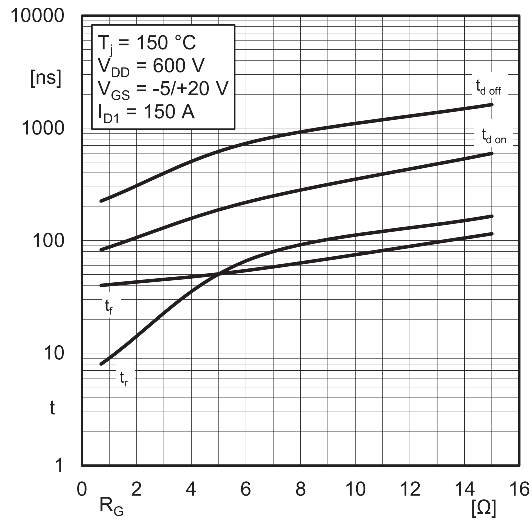


Fig. 12: Typ. switching times t = f (R_G) at I_{D1}

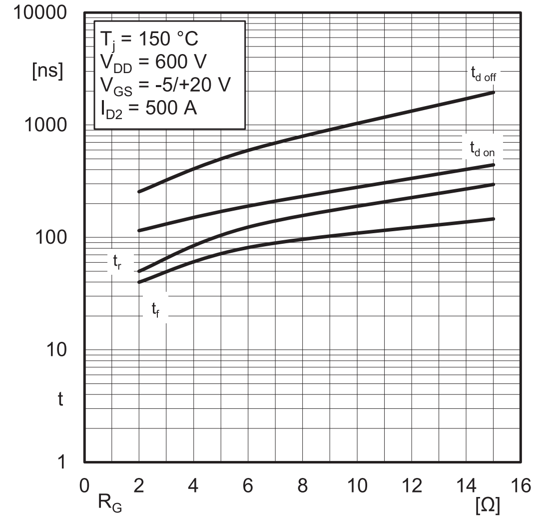


Fig. 13: Typ. switching times t = f (R_G) at I_{D2}

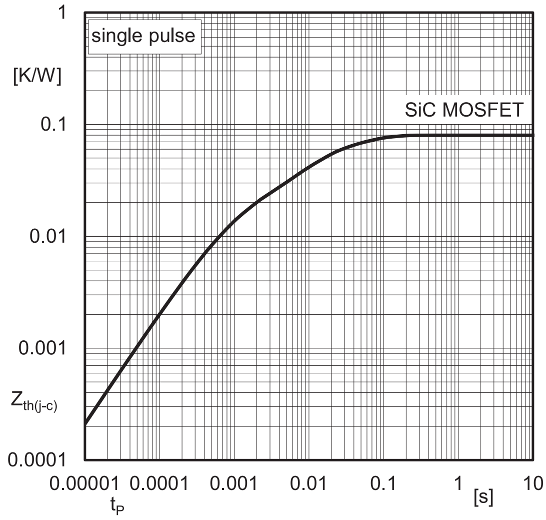


Fig. 14: Transient thermal impedance

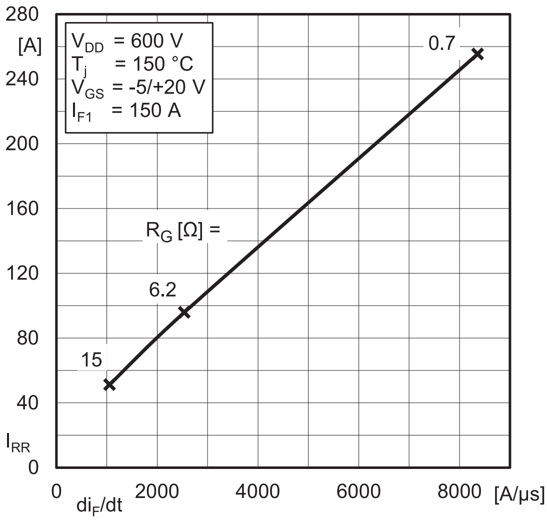


Fig. 15: Typ. diode peak reverse recovery current I_{RR} = f (di_F/dt) at I_{F1}, R_G

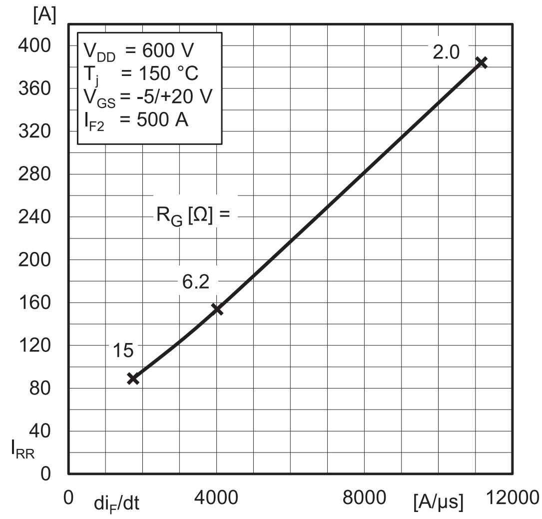


Fig. 16: Typ. diode peak reverse recovery current I_{RR} = f (di_F/dt) at I_{F2}, R_G

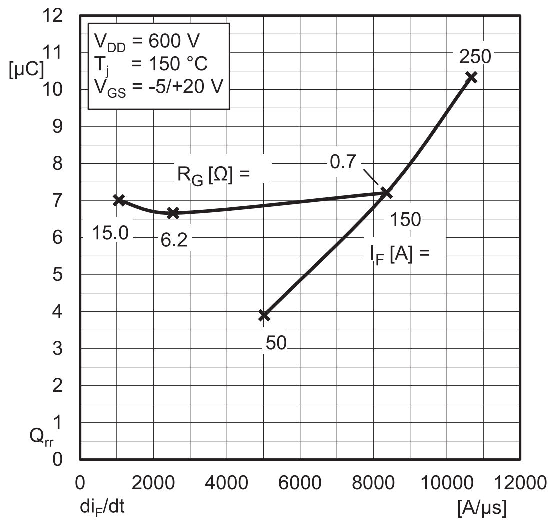


Fig. 17: Typ. diode peak reverse recovery charge Q_{RR} = f (di_F/dt) at I_F, R_G

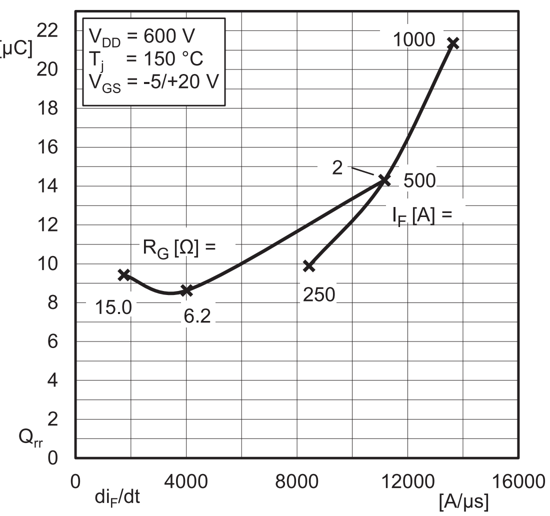


Fig. 18: Typ. diode peak reverse recovery charge Q_{RR} = f (di_F/dt) at I_F, R_G

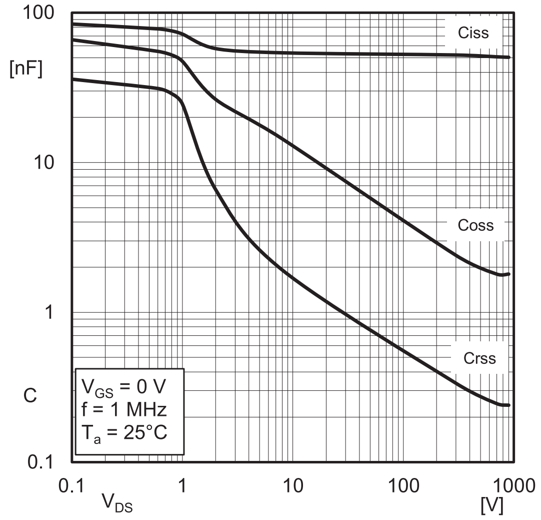
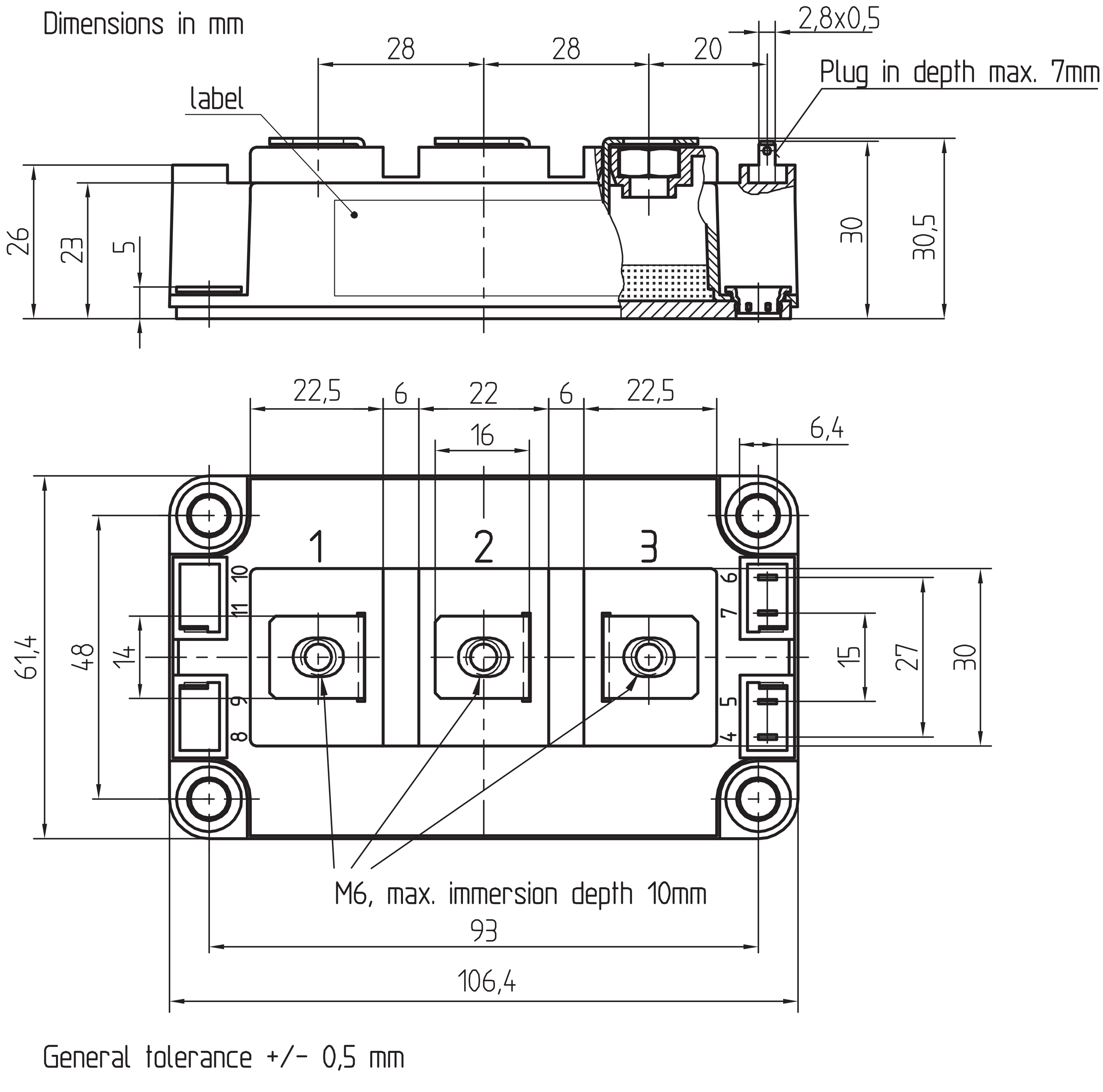


Fig. 19: Capacitances vs. drain-source voltage



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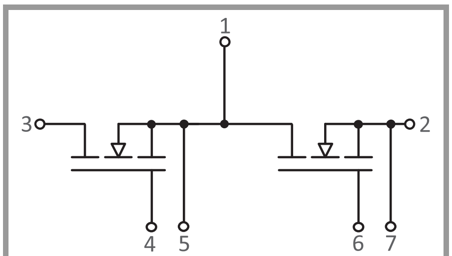

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This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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