

SKM500MB120SC



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

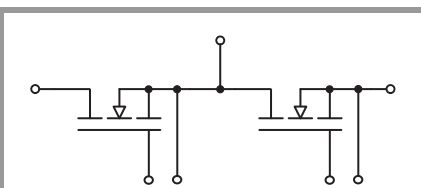
- High frequency power supplies
- AC inverters
- Traction APU
- EV Chargers
- Industrial Test Systems

Remarks

- Case temperature limited to $T_C = 125^\circ\text{C}$ 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	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	485	A
		$T_c = 80^\circ\text{C}$	386	A
I_{DM}		1920	A	
I_{DRM}		1356	A	
V_{GS}		-6 ... 22	V	
T_j		-40 ... 175	$^\circ\text{C}$	
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	$^\circ\text{C}$
V_{isol}	AC sinus 50 Hz, $t = 1 \text{ min}$	4000	V



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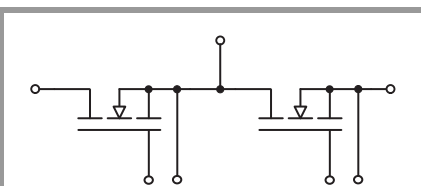
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
MOSFET					
$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_j = 25^\circ\text{C}$	1200			V
$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 106.8\text{ mA}$	1.6		4	V
I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_j = 25^\circ\text{C}$			1	mA
I_{GSS}	$V_{GS} = 22\text{ V}, V_{DS} = 0\text{ V}$			1200	nA
$R_{DS(on)}$	$V_{GS} = 18\text{ V}$ $I_D = 264\text{ A}$ chipelevel	$T_j = 25^\circ\text{C}$	3.8	4.7	m Ω
		$T_j = 150^\circ\text{C}$	6.3		m Ω
C_{iss}	$V_{GS} = 0\text{ V}$		51.7		nF
C_{oss}	$V_{DS} = 800\text{ V}$		1.64		nF
C_{riss}	$f = 1\text{ MHz}$		0.23		nF
Q_G	$V_{DD} = 600\text{ V}, V_{GS} = -5 \dots 20\text{ V}, I_D = 500\text{ A}$		2775		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0.4		Ω
$t_{d(on)}$	$V_{DD} = 600\text{ V}$ $I_D = 150\text{ A}$	$T_j = 150^\circ\text{C}$	83		ns
t_r	$V_{GS} = -5 \dots 20\text{ V}$	$T_j = 150^\circ\text{C}$	8		ns
$t_{d(off)}$	$R_{Gon} = 0.7\ \Omega$	$T_j = 150^\circ\text{C}$	225		ns
t_f	$R_{Goff} = 0.7\ \Omega$	$T_j = 150^\circ\text{C}$	40		ns
E_{on}	$di/dt_{on} = 9.8\text{ kA}/\mu\text{s}$ $di/dt_{off} = 2.7\text{ kA}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	2.51		mJ
E_{off}	$dv/dt_{off} = 19.4\text{ kV}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	1.37		mJ
$R_{th(j-c)}$	per MOSFET			0.08	K/W
$R_{th(c-s)}$	per MOSFET ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)		0.025		K/W
Integrated body diode					
$V_F = V_{SD}$	$-I_D = 264\text{ A}$ $V_{GS} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	4.10		V
		$T_j = 150^\circ\text{C}$	3.90		V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$	2.6		V
		$T_j = 150^\circ\text{C}$	2.1		V
r_F	chipelevel	$T_j = 25^\circ\text{C}$	5.7		m Ω
		$T_j = 150^\circ\text{C}$	6.8		m Ω
t_{rr}	$V_{DD} = 600\text{ V}$ $-I_D = 150\text{ A}$	$T_j = 150^\circ\text{C}$	56		ns
Q_{rr}	$di/dt_{off} = 8.4\text{ kA}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	7.2		μC
I_{rr}	$V_{GS} = -5\text{ V}$	$T_j = 150^\circ\text{C}$	255		A
E_{rr}	$R_{Gon} = 0.7\ \Omega$	$T_j = 150^\circ\text{C}$	3.2		mJ

Characteristics						
Symbol	Conditions	min.	typ.	max.	Unit	
Module						
L_{CE}			15		nH	
R_{CC+EE}	measured per switch	$T_C = 25^\circ\text{C}$	0.55		m Ω	
		$T_C = 125^\circ\text{C}$	0.85		m Ω	
$R_{th(c-s)1}$	calculated without thermal coupling ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)		0.013		K/W	
	including thermal coupling, T_s underneath module ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)		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	

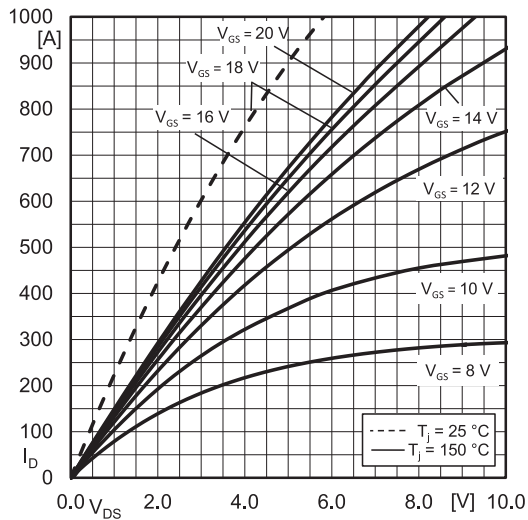


Fig. 1: Typ. MOSFET forward output characteristic, incl. $R_{DD'+SS}$

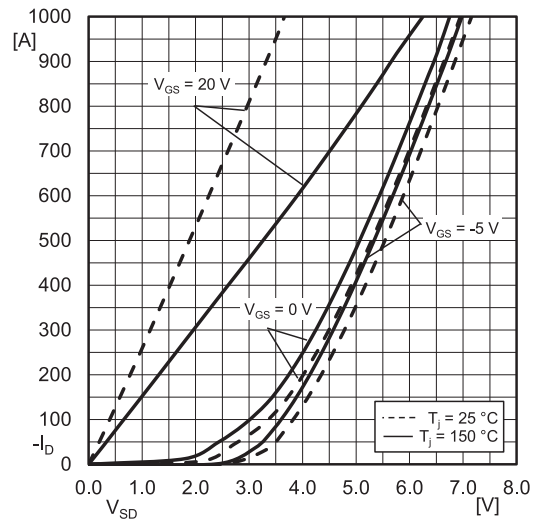


Fig. 2: Typ. reverse output characteristic, incl. $R_{DD'+SS}$

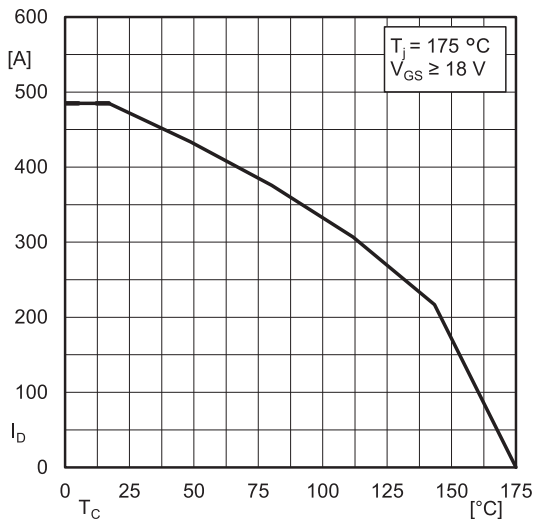


Fig. 3: Rated current vs. temperature $I_D = f(T_C)$

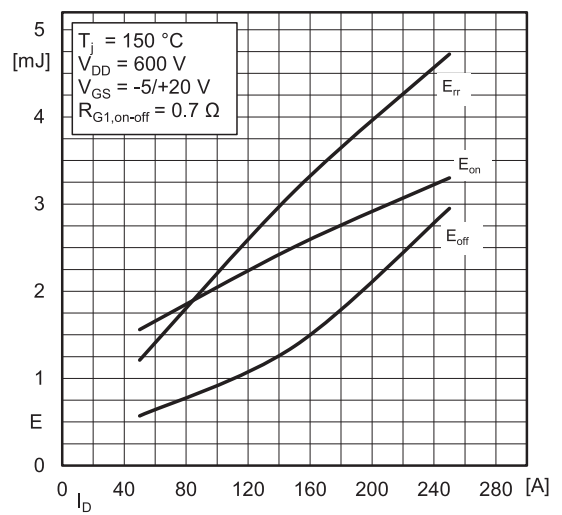


Fig. 4: Typ. switching energy $E = f(I_D)$ at R_{G1}

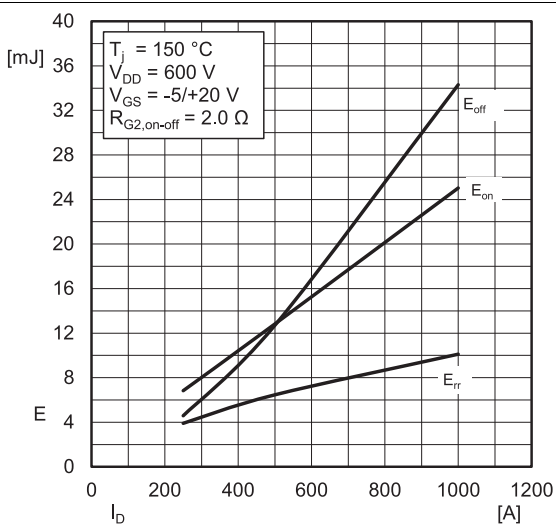


Fig. 5: Typ. switching energy $E = f(I_D)$ at R_{G2}

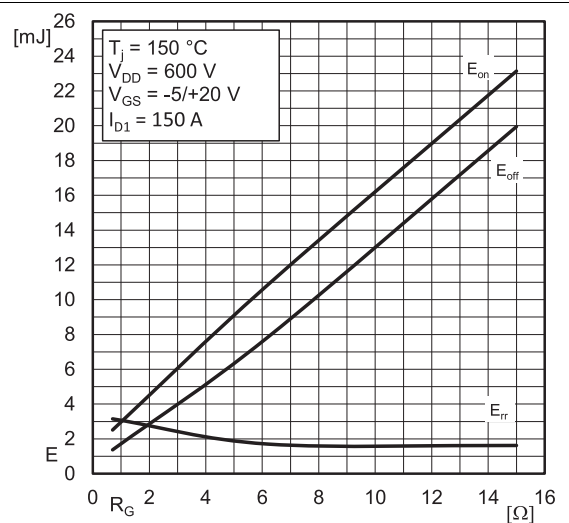


Fig. 6: Typ. switching energy $E = f(R_G)$ at I_{D1}

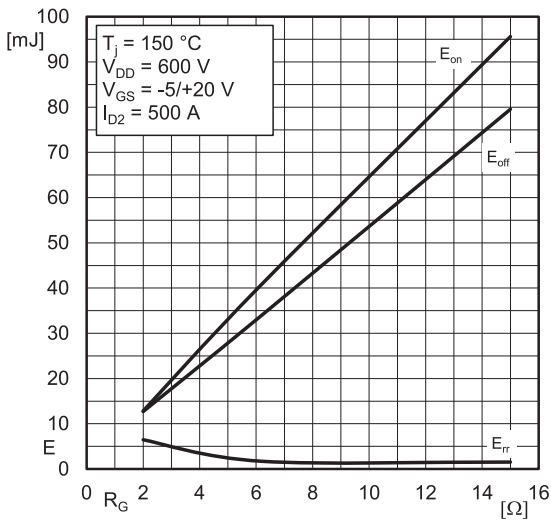


Fig. 7: Typ. switching energy $E = f (R_G)$ at I_{D2}

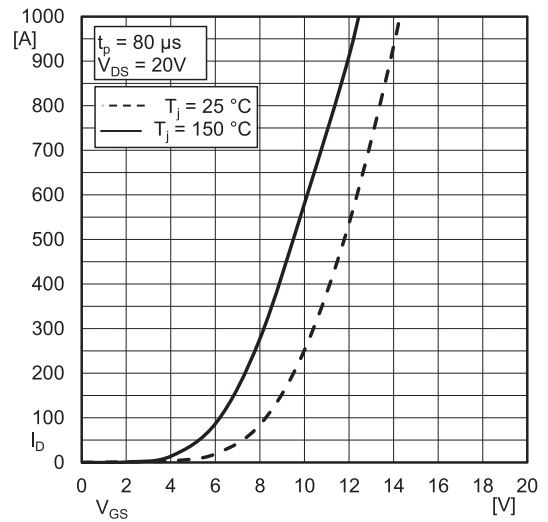


Fig. 8: Typ. MOSFET transfer characteristic

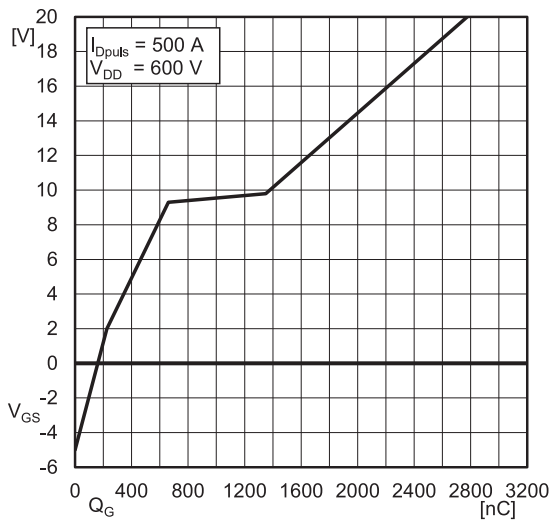


Fig. 9: Typ. gate charge characteristic

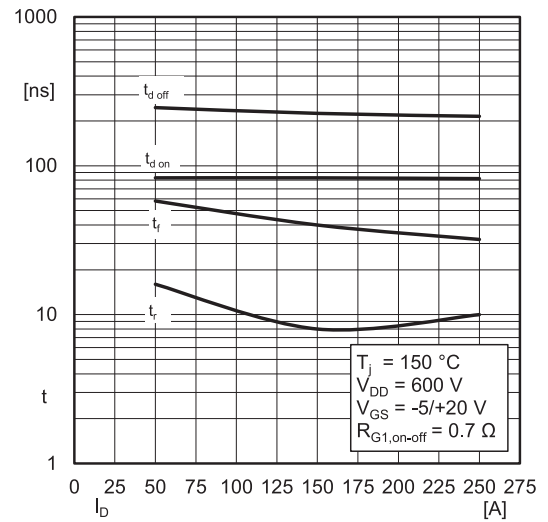


Fig. 10: Typ. switching times $t = f (I_D)$ at R_{G1}

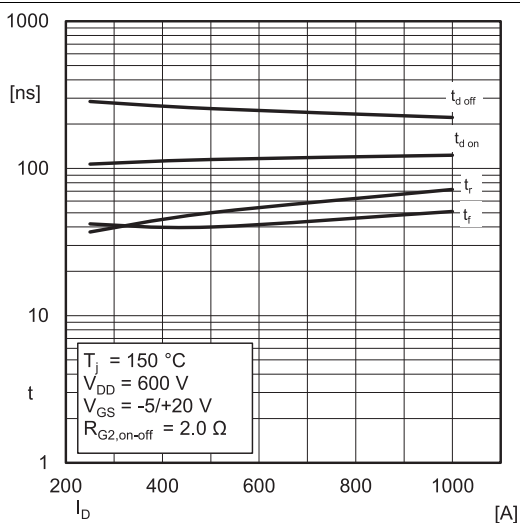


Fig. 11: Typ. switching times $t = f (I_D)$ at R_{G2}

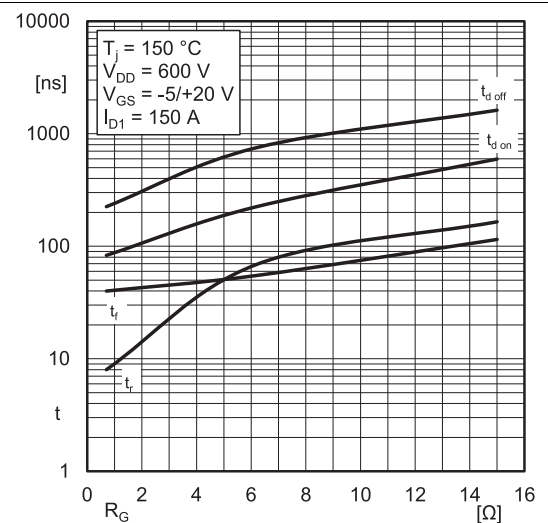


Fig. 12: Typ. switching times $t = f (R_G)$ at I_{D1}

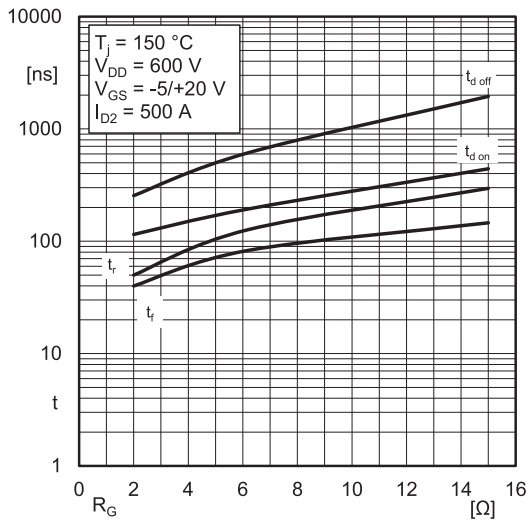


Fig. 13: Typ. switching times $t = f (R_G)$ at I_{D2}

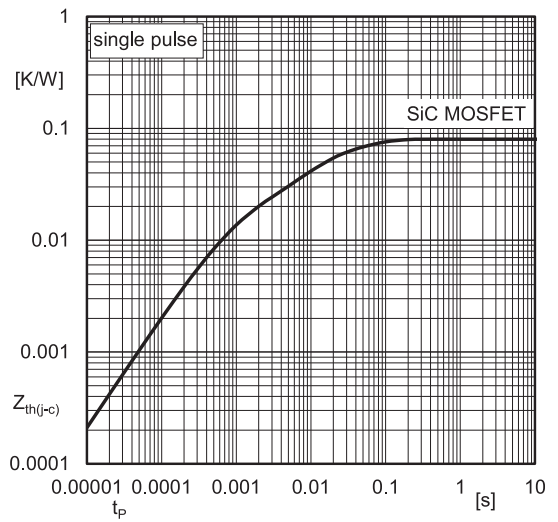


Fig. 14: Transient thermal impedance

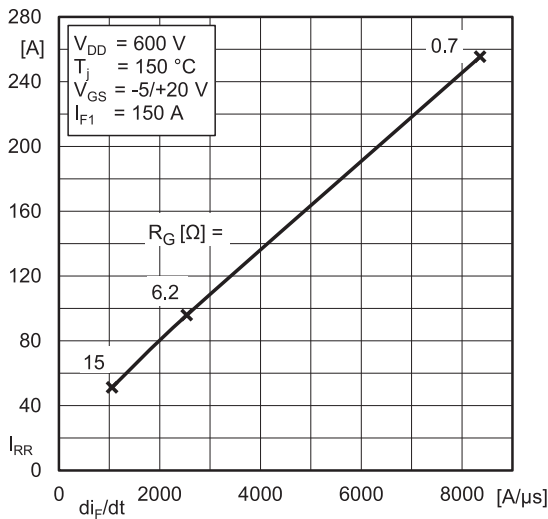


Fig. 15: Typ. diode peak reverse recovery current $I_{RR} = f (di_F/dt)$ at I_{F1} , R_G

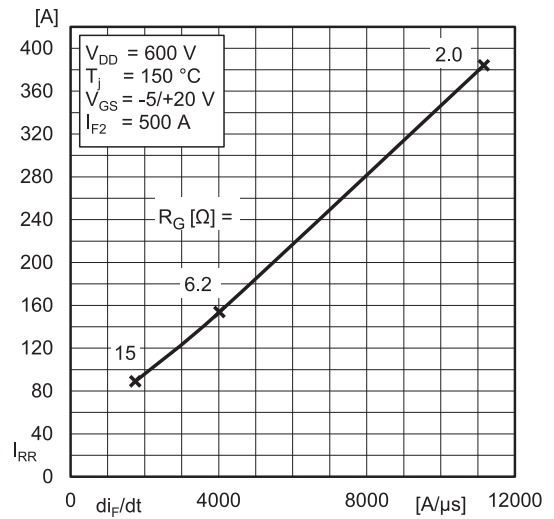


Fig. 16: Typ. diode peak reverse recovery current $I_{RR} = f (di_F/dt)$ at I_{F2} , R_G

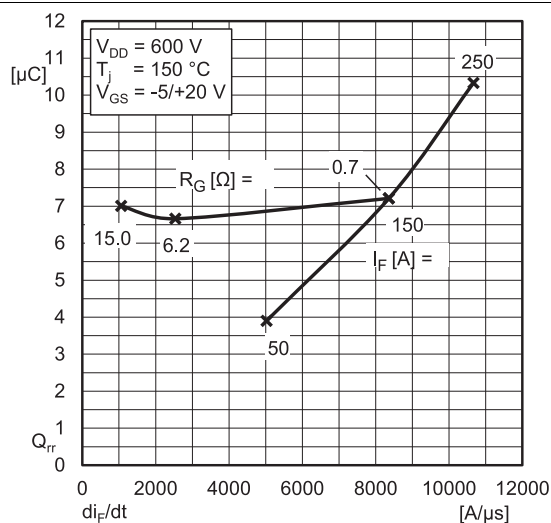


Fig. 17: Typ. diode peak reverse recovery charge $Q_{RR} = f (di_F/dt)$ at I_F , R_G

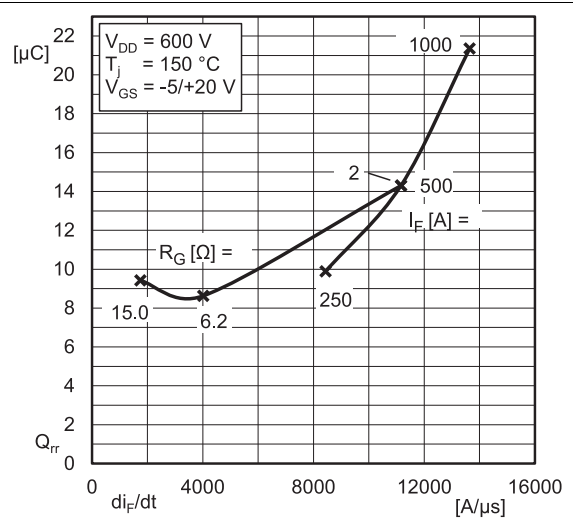


Fig. 18: Typ. diode peak reverse recovery charge $Q_{RR} = f (di_F/dt)$ at I_F , R_G

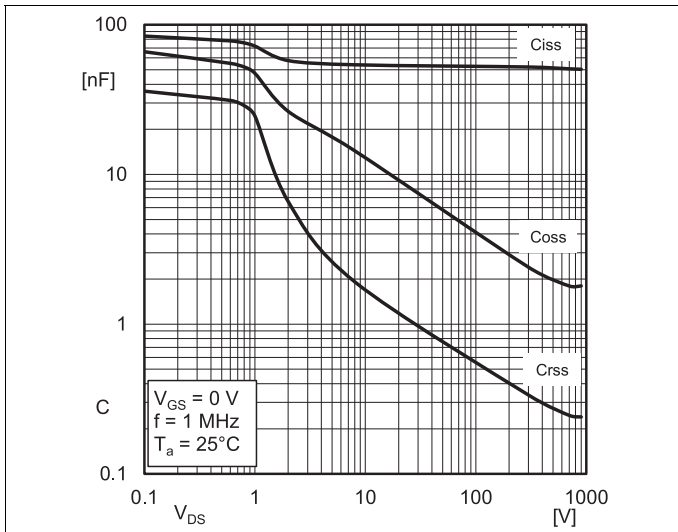
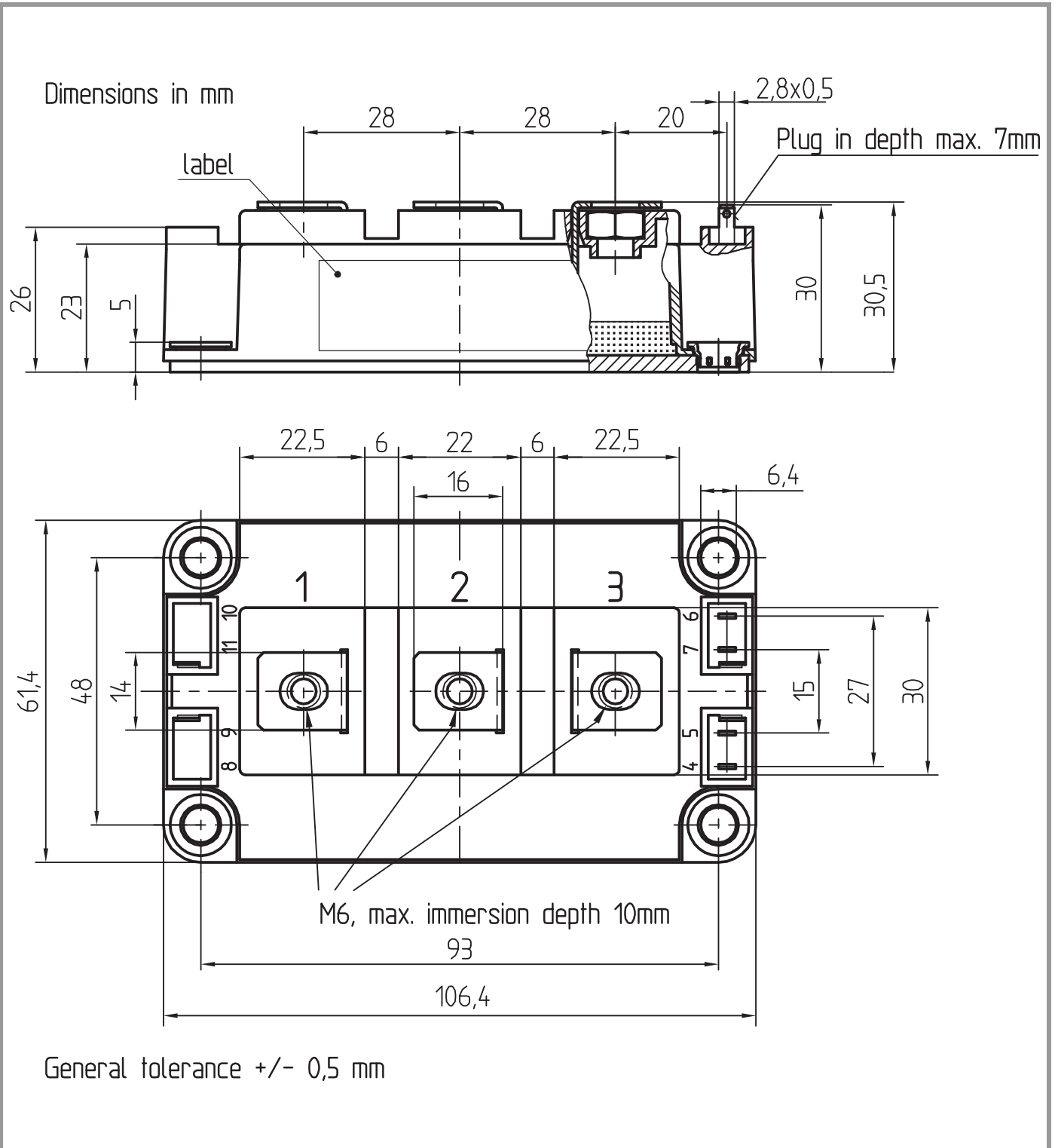
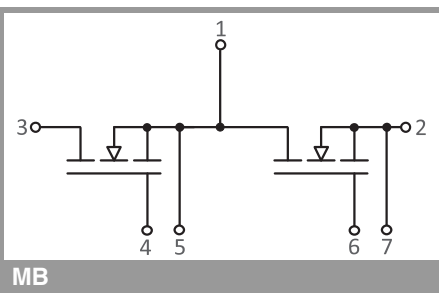


Fig. 19: Capacitances vs. drain-source voltage

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

***IMPORTANT INFORMATION AND WARNINGS**

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