

SEMITOP®E2

Half-Bridge (Full SiC)

SK200MB120CR03TE2

Features*

- Optimized design for superior thermal performance
- Extremely low inductance design
- Press-Fit contact technology
- 1200V Planar Gen3 SiC MOSFET
- Simple to drive with +15V gate voltage
- Optimized switching stability thanks to module integrated gate resistors
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

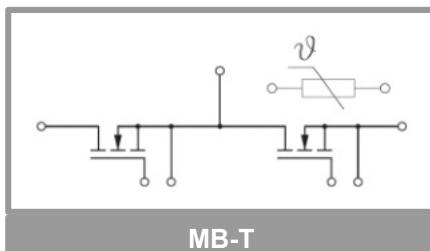
- Switched Mode Power Supplies
- Energy Storage Systems
- Electric Vehicle charging
- UPS
- Solar

Remarks

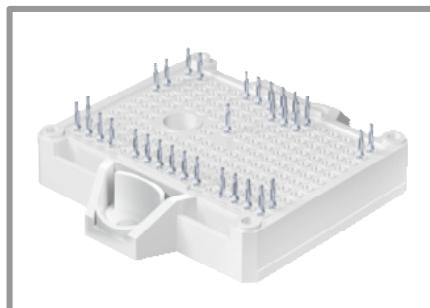
- Recommended $T_{jop} = -40^{\circ}\text{C}...+150^{\circ}\text{C}$
- Recommended turn-off / turn-on gate voltage $V_{GS} = -4...0/+15\text{V}$

Absolute Maximum Ratings		Values	Unit
Symbol	Conditions		
MOSFET			
V_{DSS}	$T_j = 25^{\circ}\text{C}$	1200	V
I_D	HPTP / HP-PCM	223	A
	$T_j = 175^{\circ}\text{C}$	186	A
I_{DM}	Pulse width t_p limited by T_{vjmax}	600	A
V_{GS}	Transient Gate - Source voltage ($t < 100\text{ns}$)	-8 ... 19	V
T_j		-40 ... 175	$^{\circ}\text{C}$
Integrated body diode			
I_{FM}	Pulse width t_p limited by T_{vjmax}	600	A
I_{FSM}	$t_p = 10\text{ ms}$, $\sin 180^{\circ}$, $T_j = 150^{\circ}\text{C}$	896	A

Absolute Maximum Ratings		Values	Unit
Symbol	Conditions		
Module			
$I_{tr(RMS)}$	$\Delta T_{\text{terminal}}$ at PCB joint = 30 K, per pin	30	A
T_{stg}	module without TIM	-40 ... 125	$^{\circ}\text{C}$
V_{isol}	AC, sinusoidal, $t = 1\text{ min}$	2500	V



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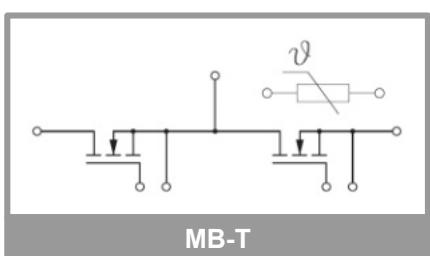
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- Recommended $T_{jop} = -40^\circ\text{C}...+150^\circ\text{C}$
- Recommended turn-off / turn-on gate voltage $V_{GS} = -4...0/+15\text{V}$

Characteristics		Symbol	Conditions	min.	typ.	max.	Unit
MOSFET							
$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 0.5\text{ mA}, T_j = 25^\circ\text{C}$			1200			V
$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 58\text{ mA}, T_j = 25^\circ\text{C}$			1.8	2.5	3.6	V
I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_j = 25^\circ\text{C}$					0.5	mA
I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = 15\text{ V}, T_j = 25^\circ\text{C}$					400	nA
$R_{DS(on)}$	$V_{GS} = 15\text{ V}, I_D = 207\text{ A}, \text{chiplevel}$		$T_j = 25^\circ\text{C}$		6.4	8.6	$\text{m}\Omega$
			$T_j = 150^\circ\text{C}$		10		$\text{m}\Omega$
C_{iss}	$V_{GS} = 0\text{ V}, f = 0.1\text{ MHz}$			17000			pF
C_{oss}	$V_{DS} = 1000\text{ V}, f = 0.1\text{ MHz}$			650			pF
C_{rss}	$T_j = 25^\circ\text{C}, f = 0.1\text{ MHz}$			50			pF
Q_G	$V_{GS} = -4...15\text{V}, V_{DD} = 800\text{V}, I_D = 207\text{ A}$			590			nC
R_{Gint}	$T_j = 25^\circ\text{C}$			2.7			Ω
$t_{d(on)}$	$V_{DD} = 600\text{ V}, T_j = 150^\circ\text{C}$			49			ns
$t_{d(off)}$	$I_D = 200\text{ A}, T_j = 150^\circ\text{C}$			120			ns
t_r	$V_{GS} = -4/+15\text{ V}$			17			ns
t_f	$R_{G\text{ on/off}} = 0.6\text{ }\Omega$			29			ns
E_{on}	$\text{di/dt}_{off} = 13\text{ kA}/\mu\text{s}$			2.47			mJ
E_{off}	$\text{di/dt}_{on} = 18\text{ kA}/\mu\text{s}$			2.14			mJ
L_s	$\text{dv/dt} = 32\text{ kV}/\mu\text{s}$						
$R_{th(j-s)}$	per MOSFET, HPTP / HP-PCM			0.23			K/W
Integrated body diode							
$V_F = V_{SD}$	$-I_D = 104\text{ A}$ $V_{GS} = -4\text{ V}$ chiplevel		$T_j = 25^\circ\text{C}$		4.6		V
			$T_j = 150^\circ\text{C}$		4.3		V
$V_{F0} = V_{SD0}$	chiplevel		$T_j = 25^\circ\text{C}$		3.8		V
			$T_j = 150^\circ\text{C}$		3.6		V
$r_F = r_{SD}$	chiplevel		$T_j = 25^\circ\text{C}$		7.7		$\text{m}\Omega$
			$T_j = 150^\circ\text{C}$		6.8		$\text{m}\Omega$
t_{rr}	$V_{DD} = 600\text{ V}$			40			μs
Q_{rr}	$-I_D = 200\text{ A}$			5.6			μC
I_{rr}	$V_{GS} = -4\text{ V}$			281			A
E_{rr}	$R_{Gon} = 0.6\text{ }\Omega$			1.84			mJ

Characteristics		Symbol	Conditions	min.	typ.	max.	Unit
Module							
L_{CE}				6			nH
M_s	to heatsink			1.6		2.3	Nm
w	weight			35			g

Characteristics		Symbol	Conditions	min.	typ.	max.	Unit
Temperature Sensor							
R_{100}	$T_r = 100^\circ\text{C}$			493 \pm 5%			Ω
$B_{100/125}$	$R_{(T)} = R_{100} \cdot \exp[B_{100/125} \cdot (1/T - 1/T_{100})], T[\text{K}]$			3550 (\pm 2%)			K



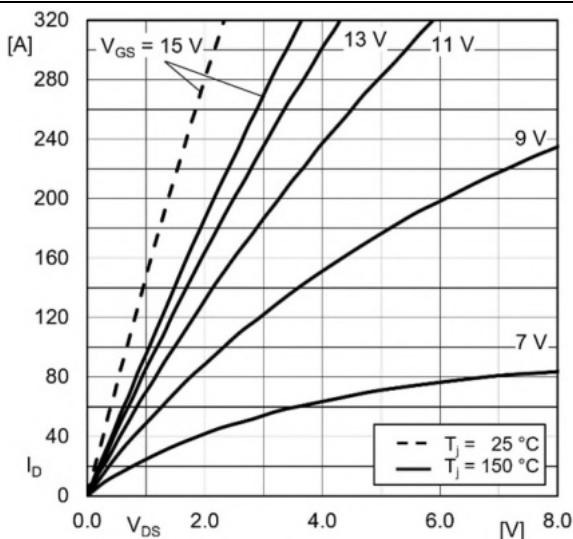


Fig. 1: Typ. MOSFET forward output characteristic, incl. $R_{DD} + ss'$

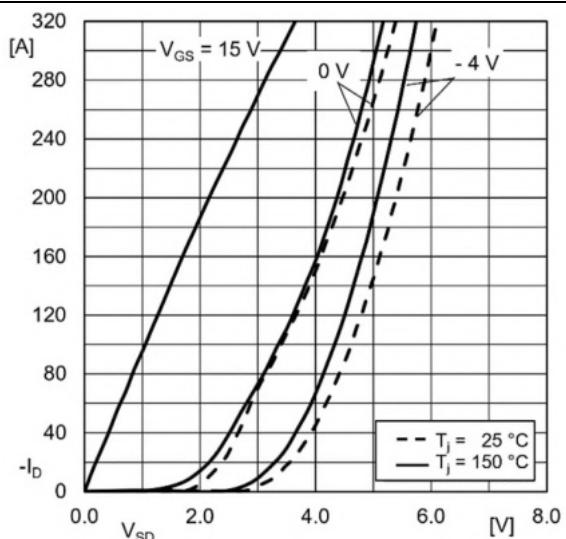


Fig. 1a: Typ. MOSFET reverse output characteristic, incl. $R_{DD} + ss'$

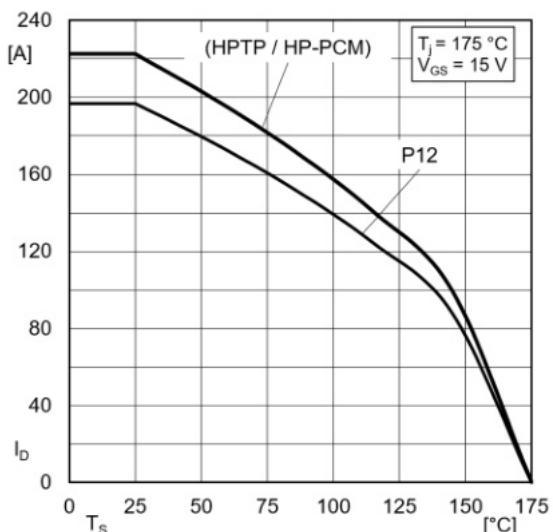


Fig. 2: MOSFET Rated current vs. temperature $I_D = f(T_s)$

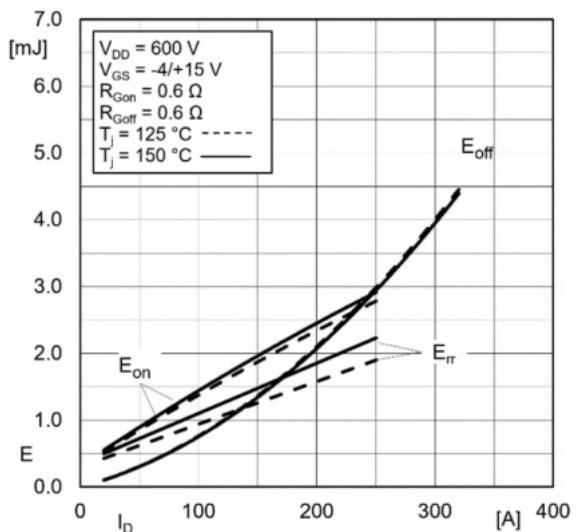


Fig. 3: Typ. MOSFET switching energy $E = f(I_D)$ at R_{G1}

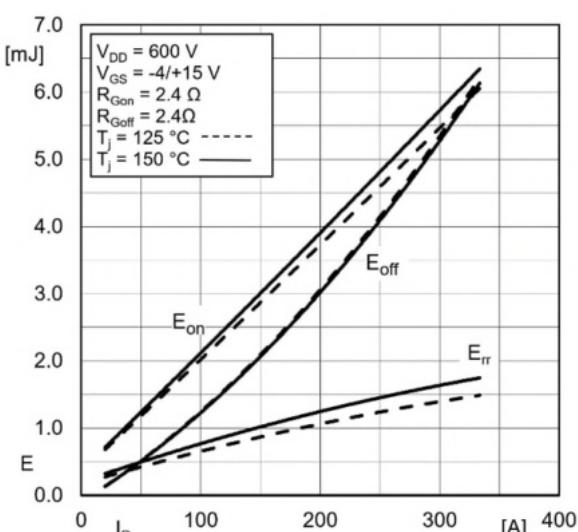


Fig. 3a: Typ. MOSFET switching energy $E = f(I_D)$ at R_{G2}

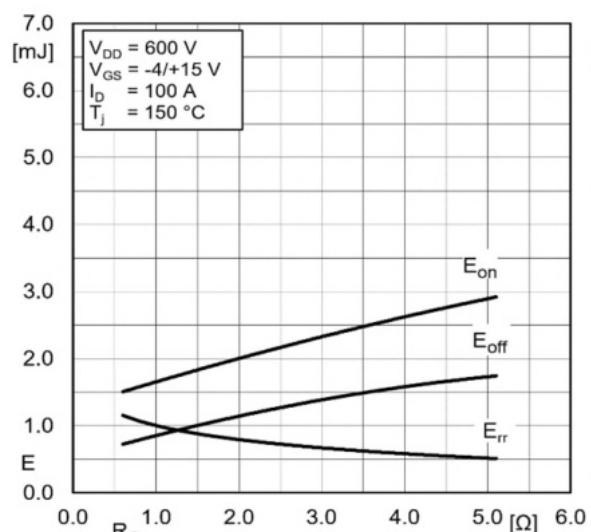


Fig. 4: Typ. MOSFET switching energy $E = f(R_G)$ at $I_D = 150\text{ A}$

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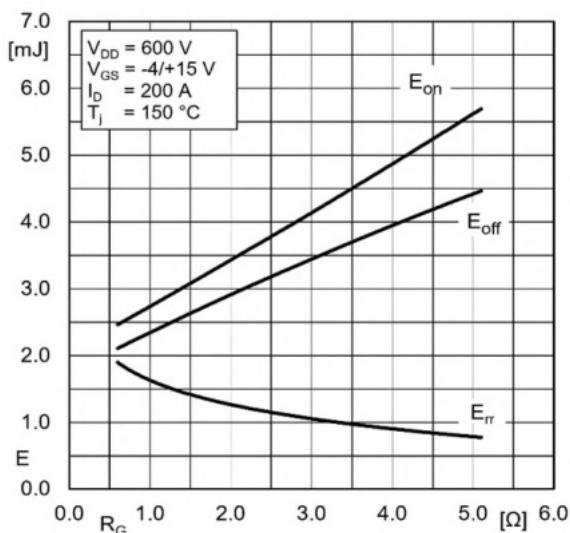


Fig. 4a: Typ. MOSFET switching energy E = $f(R_G)$ at I_D2

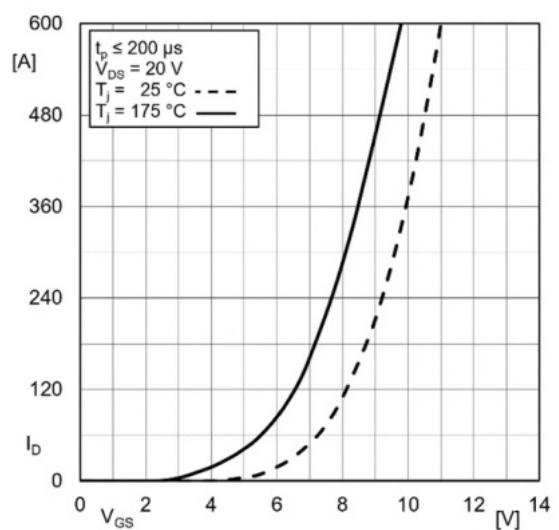


Fig. 5: Typ. MOSFET transfer characteristic

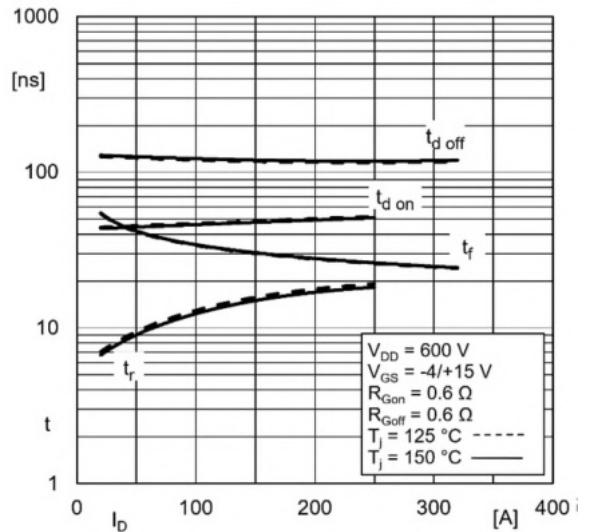
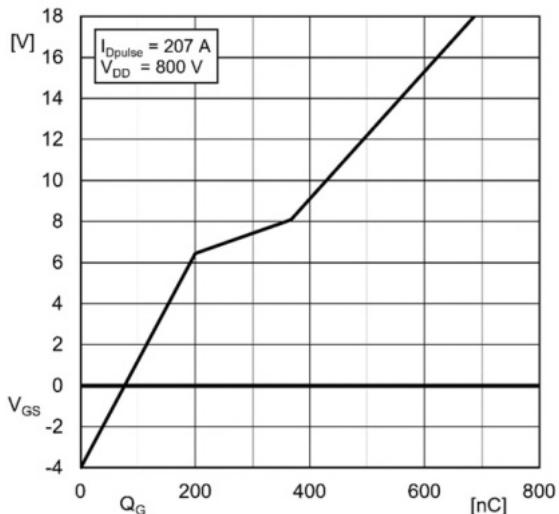


Fig. 7: Typ. MOSFET switching times t = $f(I_D)$ at R_{G1}

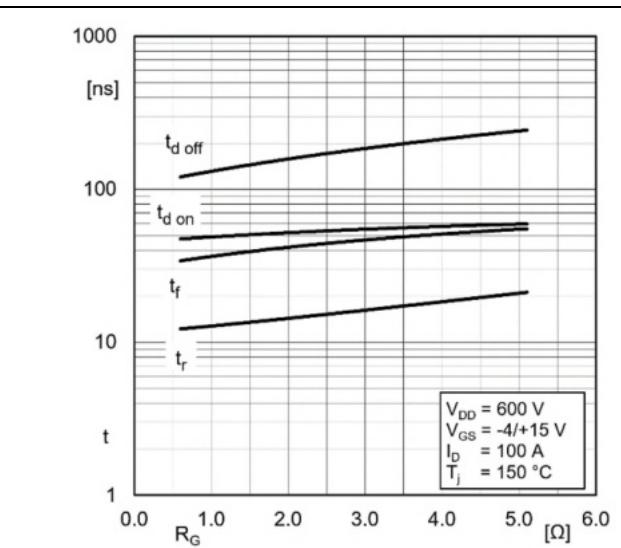
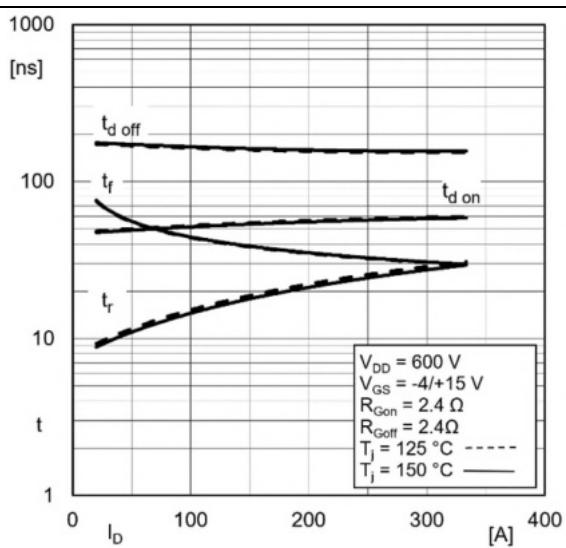


Fig. 7a: Typ. MOSFET switching times t = $f(I_D)$ at R_{G2}

Fig. 8: Typ. MOSFET switching times t = $f(R_G)$ at I_D1

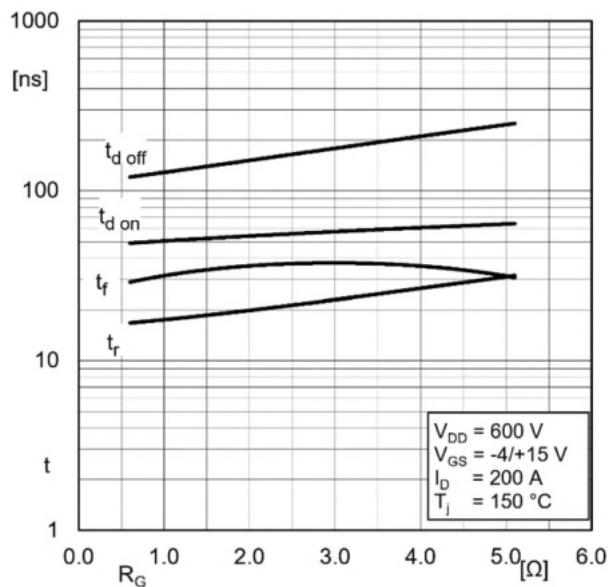


Fig. 8a: Typ. MOSFET switching times $t = f(R_G)$ at $I_D = 200$ A

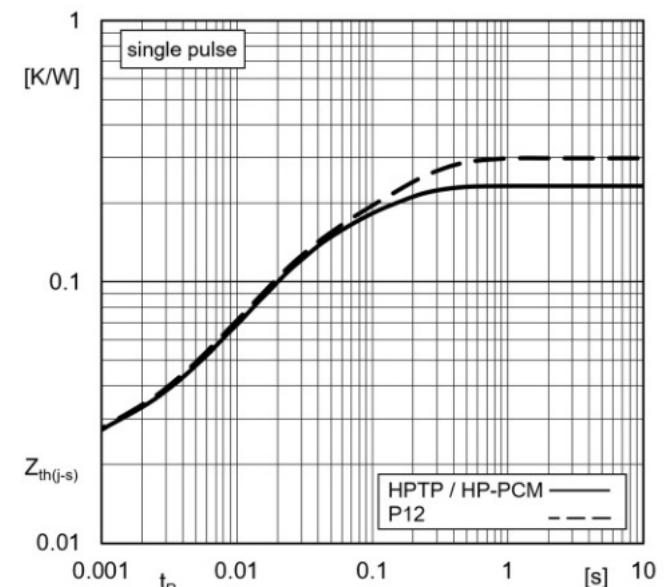


Fig. 9: Typ. transient thermal impedance

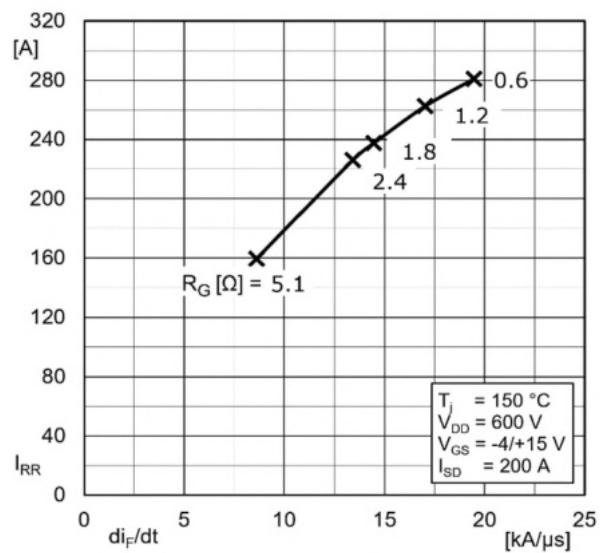


Fig. 10: Typ. body diode peak reverse recovery current $I_{RR} = f(\frac{di_F}{dt})$

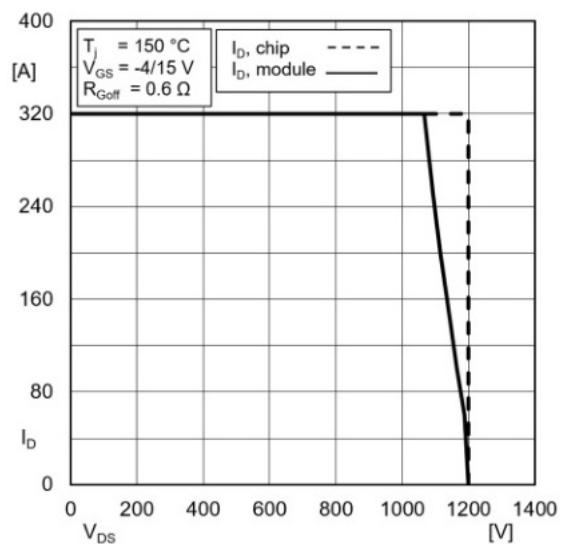
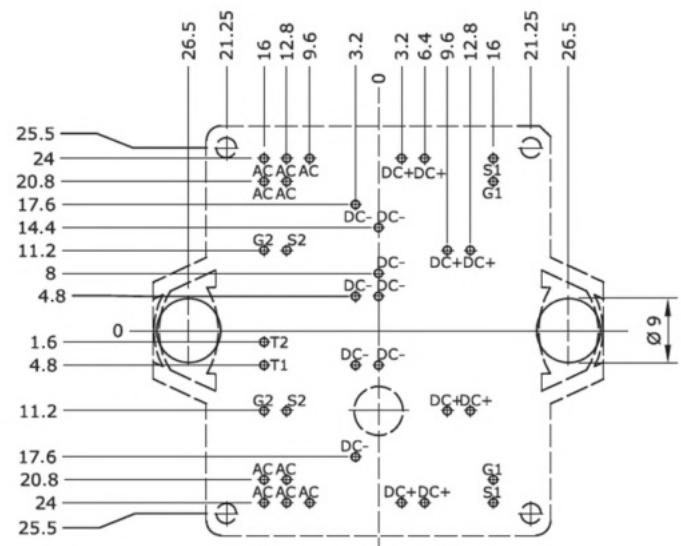
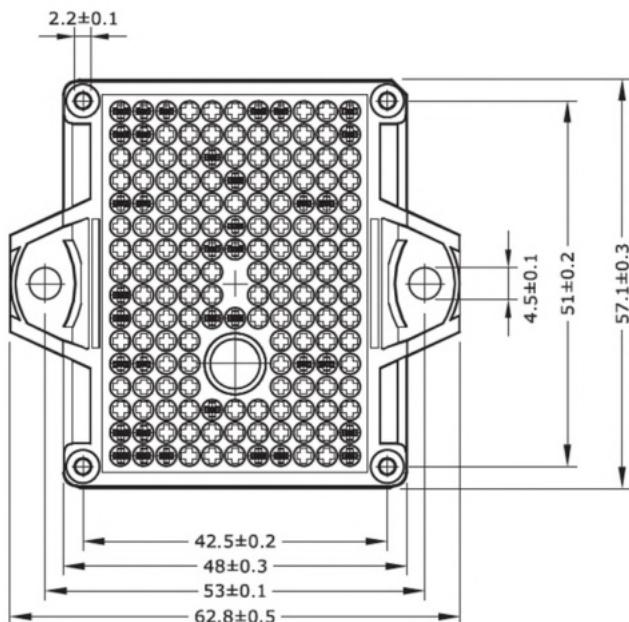
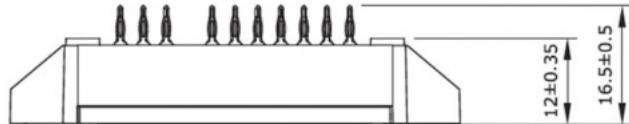
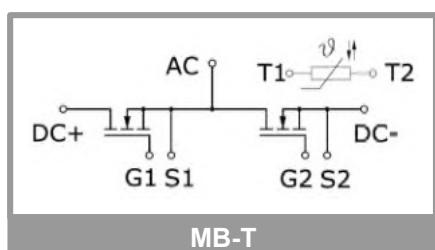


Fig. 11: MOSFET Reverse Bias Safe Operating Area (RBSOA)



- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern ± 0.1
- Diameters of drill $\varnothing 1.15\text{mm}$
- Copper thickness in hole 25 - 50 μm
- Hole specification for contacts:
refer to SEMITOP E1/E2 Mounting Instruction

Pinout and Dimensions



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

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