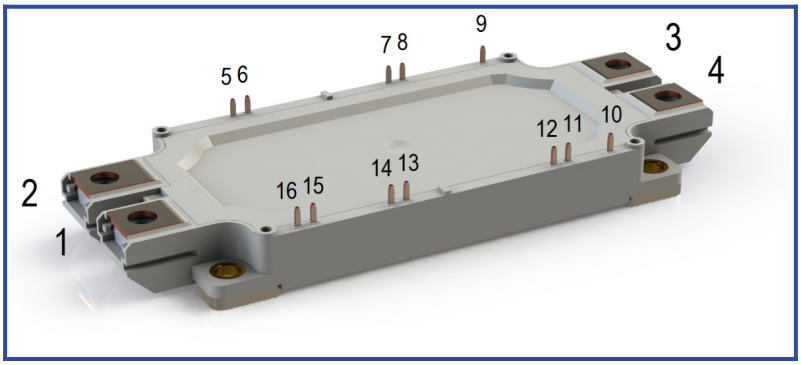
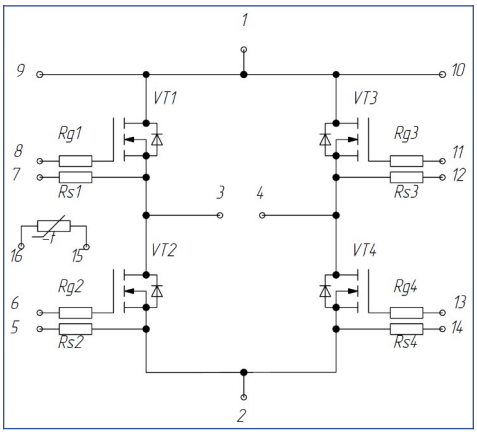
MCDA-HBI12-I1000N-C

SiC MOSFET module datasheet

SiC MOSFET module in industry standard package

1200V 1000A Half-Bridge





Features

- SiC MOSFET
- Low inductance (<10 nH)
- Scheme — Half-Bridge
- Switching cell topology
- Low $R_{DS(on)}$ value
- Optimized control circuits
- AIN Substrates
- Copper baseplate

Advantages

- Industry standard package
- Low static and dynamic losses
- Fast and clean switching
- Low $R_{th(j-c)}$ value
- High thermal cycling performance

Typical application

- Inverters for RES
- DC/DC converters, inverters
- Motor drives
- Electric transport

Advance Data

Maximum rated values

Definition	Symbol	Conditions		Value	Unit
MOSFET (VT1;VT2;VT3;VT4)					
Drain-source voltage	V_{DSmax}	V_{GE} = 0		1200	V
Maximum allowable drain current (continuous)	$I_{D\ 25}$	$T_{vj\ (max)}$ = 175°C; V_{GS}= +20 V	T_c = 25°C	1070	A
	$I_{D\ 80}$		T_c = 80°C	852	
Repetitive peak drain current*1	$I_{D(pulse)}$	t_p > 10 µs; D = 1%		-	A
Gate-source voltage (maximum)	V_{GSmax}			-5/+22	V
Gate-source voltage (operating)	V_{GSop}			-3.5/+20	V
Junction operating temperature	$T_{vj\ (op)}$			-40…+150	ºC
Body Diode (VD1;VD2)					
Repetitive peak reverse voltage	V_{RRM}	V_{GS} = 0 V		1200	V
Maximum allowable forward current (continuous)	$I_{SD\ BD\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C		678	A
	$I_{SD\ BD\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C		466	A
Repetitive peak forward current*1	$I_{SD\ (pulse)}$	t_p > 10 µs; D = 1%; T_{vj} = 25°C		1500	A
Junction operating temperature	$T_{vj\ (op)}$			-40…+150	°C
Module					
Storage temperature	T_{stg}			-55…+50	°C
Isolation voltage	V_{isol}	AC sin 50 Hz; t = 1 min		4000	V

*1 Pulse width and repetition rate should be such that device junction temperature does not exceed maximum T_{vj} rating.

Characteristics

Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit.
MOSFET (VT1;VT2;VT3;VT4)							
On-state drain-source resistance (at chip)	$R_{DS(on)}$	V_{GS} = +20 V; I_D = 720 A	T_{vj} = 25°C	-	1.42	-	mΩ
			T_{vj} = 150°C	-	2.62	-	mΩ
Drain-source voltage (at terminals)	$V_{DS(on)}$	V_{GS} = +20 V; I_D = 1000 A; t_u = 1000 µs	T_{vj} = 25°C	-	2800	-	mV
			T_{vj} = 150°C	-	3850	-	mV
Gate-source threshold voltage	$V_{GS(th)}$	V_{GS}=V_{DS}; I_D = 216 mA; t_u = 2 ms		1800	3200	5000	mV
Drain-Source cut-off current	I_{DSS}	V_{DS} = 1200 V; t_u = 50 ms; V_{GS} = 0	T_{vj} = 25°C	-	60	1200	µA
			T_{vj} = 175°C	-	-	-	
Gate-Source leakage current	I_{GSS}	V_{DS}= 0; V_{GS}=-5...+20 V; t_u = 30 ms	T_{vj} = 25°C	-	-	1200	nA
			T_{vj} = 150°C	-	-	-	
Transconductance	g_{fs}	V_{DS} = 20 V; I_D = 100 A		-	-	-	S
Short-circuit duration	t_{psc}	-		-	-	-	µs
Input capacitance	C_{iss}	V_{DS} = 800 V; V_{GS} = 0 V; f = 100 kHz		-	73560	-	pF
Output capacitance	C_{oss}			-	3024	-	
Reverse transfer capacitance	C_{rss}			-	187.2	-	
Effective output capacitance	$C_{o(er)}$	-		-	-	-	
Gate-source charge	Q_{gs}	I_D = 720 A; V_{DD} = 800 V; V_{GS} = -5...+20 V		-	1152	-	nC
Gate-drain charge	Q_{gd}			-	912	-	
Total gate charge	Q_g			-	3360	-	
Internal gate resistance	R_{GInt}	T_{vj} = 25°C.; R_{GInt}=R_G1=R_G2=R_G3=R_G4		-	0.111	-	Ω
Internal source resistance	R_{SInt}	T_{vj} = 25°C.; R_{GInt}=R_s1=R_s2=R_s3=R_s4		-	0.10	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{DS} = 800 V; V_{GS} = -2...+20 V; I_D = 720 A; $R_{Gon/off}$ = 2.7 Ω	T_{vj} = 25°C	-	36	-	ns
			T_{vj} = 150°C	-	-	-	
Rise time	t_{ri}		T_{vj} = 25°C	-	31	-	ns
			T_{vj} = 150°C	-	-	-	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	-	64	-	ns
			T_{vj} = 150°C	-	-	-	
Fall time	t_{fi}		T_{vj} = 25°C	-	24	-	ns
			T_{vj} = 150°C	-	-	-	
Turn-off energy	E_{off}		T_{vj} = 25°C	-	7.7	-	mJ
			T_{vj} = 150°C	-	-	-	
Turn-on energy	E_{on}		T_{vj} = 25°C	-	15.7	-	
			T_{vj} = 150°C	-	-	-	
Thermal resistance junction to case	$R_{th(j-c)}$	DC; I_D = 170 A; I_{test} = 1.5 A; V_{GS} = +20 V		-	-	0.05	K/W
Body Diode (VD1;VD2)							
Forward voltage drop	V_F	I_{SD} = 1000 A; V_{GS} = -5 V; t_u = 1000 µs	T_{vj} = 25°C	-	5200	-	mV
			T_{vj} = 150°C	-	5900	-	mV
Reverse recovery time	t_{rr}	V_R = 800 V; V_{GS} = -2...+20 V; I_{SD} = 720 A; $R_{Gon/off}$ = 15 Ω	T_{vj} = 25°C	-	-	-	ns
			T_{vj} = 150°C	-	25	-	ns
Peak reverse current	I_{RM}		T_{vj} = 25°C	-	-	-	A
			T_{vj} = 150°C	-	341	-	A
Recovered charge	Q_r		T_{vj} = 25°C	-	-	-	µC
			T_{vj} = 150°C	-	4758	-	
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	-	-	-	mJ
			T_{vj} = 150°C	-	-	-	
Threshold voltage	$U_{(T0)}$	T_{vj} = 150°C; V_{GE} = -5 V; I_{SD1} = 250 A; I_{SD2} = 1000 A; t_u = 1000 µs		-	3.32	-	V
Forward slope resistance	r_T			-	1.63	-	mΩ
Thermal resistance junction to case	$R_{th(JH-D)}$	DC; I_D = 170 A; I_{test} = 1.5 A; V_{GS} = +20 V		-	0.05	-	K/W

Advance Data

Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	$R_{P1-3/4}$	-	1.00	-	mΩ
			$R_{P2-3/4}$	-	1.00	-	
Parasitic inductance between terminals	L_{Pxy}	T_{vj} = 25°C; f = 1 MHz.	$L_{P12\ (DC+:DC-)}$	-	10	-	nH
Thermal resistance case to heatsink	R_{thCH}	per module		-	0.010	0.015	K/W
Mounting torque for screws to heatsink	M_s	to heatsink M5		3.00	-	6.00	N*m
Mounting torque for terminal screws	M_t	to terminals M6		3.00	-	6.00	N*m
Weight	W			-	360	-	g

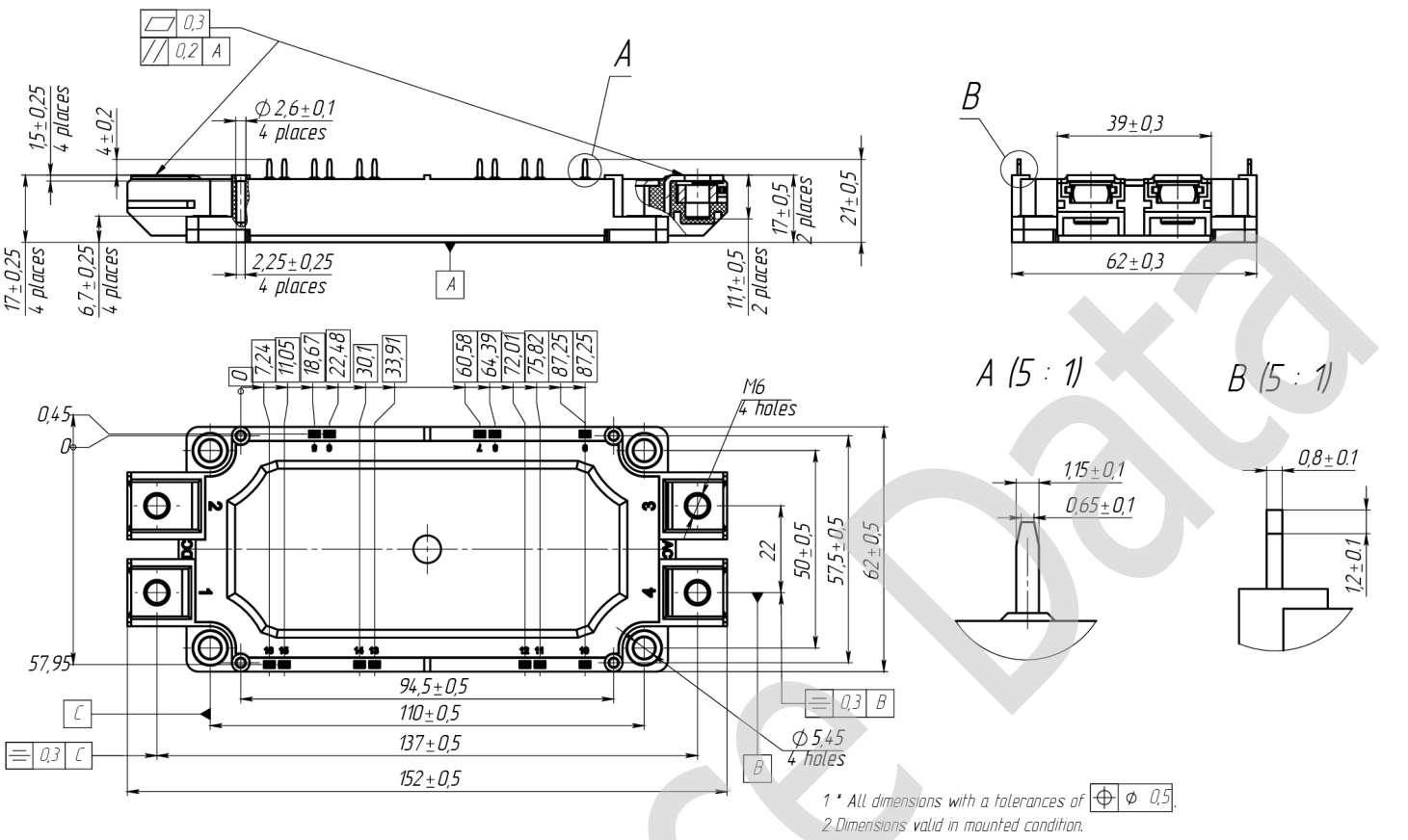
" - " Data will be refined as additional tests are conducted and statistics are collected.

Notes:

- To configure the module to the "Half-bridge" scheme, please, connect pins 3+4, 5+14, 6+13, 7+12, 8+11 in parallel.
- This document contains data for the "Half-bridge" scheme.
- The operating temperature of the package and insulation materials must not exceed T_c = 125°C max;
- The recommended operating temperature of the chip $T_{vj\ op}$ = - 40 ÷ +150°C.

Advance Data

Overall dimensions: Package type – MCDA



Part numbering guide

MCDA	-	HBI	12	-	I	1000	N	-	C	
MCDA										Module based on SiC MOSFET in the package type MCDA
		HBI								Half-bridge without Schottky barrier diode (SBD)
			12							Nominal voltage ($U_{DS(max)}$/100)
					I					Chip SiC MOSFET: I – Chip manufacturer code
						1000				1000A nominal current
							N			Climatic version: normal climate
									C	Copper baseplate

Advance Data

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