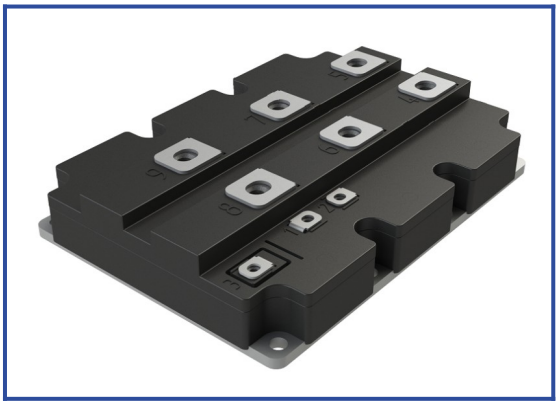
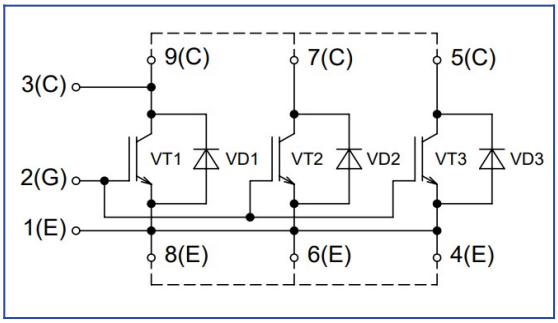
IGBT high-power module

3300 V 1500 A





Chip features

- IGBT chip
  - low $V_{CE(sat)}$ value
  - 10 µs short circuit of 150°C
  - square RBSOA of 2xIC
  - low EMI
- FRD chip
  - fast and soft reverse recovery
  - low voltage drop

Design features

- AlSiC baseplate
- AlN DBC substrate

Typical application

- AC and DC motor drives
- high-power converters
- wind-powered generator inverters
- industrial equipment

Maximum rated values

Definition	Symbol	Conditions	Value	Unit
IGBT				
Collector-Emitter voltage	V_{CES}	V_{GE} = 0.	3300	V
Maximum allowable collector current (continuous)	$I_{C\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	2870	A
	$I_{C\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	1500	A
Repetitive peak collector current*1	I_{CRM}	I_{CRM} = 2 x $I_{C\ nom}$; t_p = 1 ms.	3000	A
Short-circuit duration	t_{psc}	T_{vj} = 25°C; V_{GE} = ±15 V; V_{CE} = 2500 V; $I_{C\ max}$ < 5800 A.	10	µs
		T_{vj} = 150°C; V_{GE}=±15 V; V_{CE} = 2500 V; $I_{C\ max}$ < 5800 A.	10	
Gate-Emitter voltage	V_{GES}		±20	V
Junction operating temperature	$T_{vj\ (op)}$		-40…+150	°C
Inverse diode \ Freewheeling diode				
Repetitive peak reverse voltage	V_{RRM}	V_{GE} = 0 V.	3300	V
Maximum allowable forward current (continuous)	$I_{F\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	2625	A
	$I_{F\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	1500	A
Repetitive peak forward current*1	I_{FRM}	I_{FRM} = 2 x $I_{F\ nom}$; t_p = 1 ms.	3000	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.	6000	V

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

Advance Data

Characteristics

Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit.
IGBT							
Collector-Emitter saturation voltage	V_{CEsat}	V_{GE} =+15 V; I_C = 1500 A; t_u = 1000 µs.	T_{vj} = 25°C	-	3.00	-	V
			T_{vj} = 150°C	-	3.60	-	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C = 240 mA; U_{CE} = U_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.80	6.60	7.80	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 3300 V; t_u = 50 ms; V_{GE} = 0.	T_{vj} = 25°C	-	-	1.00	mA
			T_{vj} = 150°C	-	-	30.00	
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} =25°C; t_u = 30 ms.		-	-	500	nA
Input capacitance	C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz; T_{vj} = 25°C.		-	153.12	-	nF
Output capacitance	C_{oes}			-	12.00	-	nF
Reverse transfer capacitance	C_{res}			-	3.12	-	nF
Total gate charge	Q_G	V_{CE} = 1800 V; V_{GE} = -8...+15 V.		-	9.60	-	µC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	0.52	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 1800 V; V_{GE} = ±15 V; $I_{C\,max}$ = 1500 A; R_G = 1.5 Ω; L_s = 72.5 µH.	T_{vj} = 25°C	-	590	-	ns
			T_{vj} = 150°C	-	590	-	
Rise time	t_{ri}		T_{vj} = 25°C	-	230	-	ns
			T_{vj} = 150°C	-	240	-	
Turn-on energy	E_{on}		T_{vj} = 25°C	-	2000	-	mJ
			T_{vj} = 150°C	-	2700	-	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	-	1150	-	ns
			T_{vj} = 150°C	-	1220	-	
Fall time	t_{fi}		T_{vj} = 25°C	-	1500	-	ns
			T_{vj} = 150°C	-	2220	-	
Turn-off energy	E_{off}		T_{vj} = 25°C	-	2140	-	mJ
			T_{vj} = 150°C	-	2800	-	
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 375 A; I_{CE2} = 1500 A; t_u = 1000 µs.		-	-	1.25	V
On-State slope resistance (IGBT)	r_{CE0}			-	-	1.62	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; V_{GE} = +15 V.		-	-	0.0089	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V_F	I_F = 1500 A; V_{GE} = 0; t_u = 1000 µs.	T_{vj} = 25°C	-	2.60	-	V
			T_{vj} = 150°C	-	2.70	-	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 1800 V; $I_{C\,max}$ = 1500 A; R_G = 1.5 Ω; L_s = 72.5 µH.	T_{vj} = 25°C	-	620	-	ns
			T_{vj} = 150°C	-	710	-	ns
Peak reverse current	I_{RM}		T_{vj} = 25°C	-	2400	-	A
			T_{vj} = 150°C	-	2630	-	A
Recovered charge	Q_r		T_{vj} = 25°C	-	870	-	µC
			T_{vj} = 150°C	-	1080	-	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	-	1020	-	mJ
			T_{vj} = 150°C	-	1420	-	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; I_{F1} = 375 A; I_{F2} = 1500 A; t_u = 1000 µs		-	-	1.04	V
Forward slope resistance	r_T			-	-	1.13	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; U_{GE} = +15 V.		-	-	0.0142	K/W

Advance Data

Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	$R_{P5-7-9/4-6-8}$	-	0.10	-	mΩ
Parasitic inductance between terminals	L_{Pxy}		$L_{P5-7-9/4-6-8}$	-	11.00	-	nH
Thermal resistance case to heatsink	R_{thCH}	per module		-	-	6.00	K/kW
Mounting torque for screws to heatsink	M_s	to heatsink M6		-	5.00	-	N*m
Mounting torque for screws to control terminal	M_t	to terminals M4		-	2.00	-	N*m
Mounting torque for screws to power terminal	M_t	to terminals M8		-	9.00	-	N*m
Creepage distance	d_s			-	-	33.00	mm
Clearance	d_a			-	-	20.00	mm
Comparative Tracking Index	CTI			600	-	-	
Weight	W			-	-	1400	g

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

Notes:

- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\,op}$ = - 40 ÷ +150°C.

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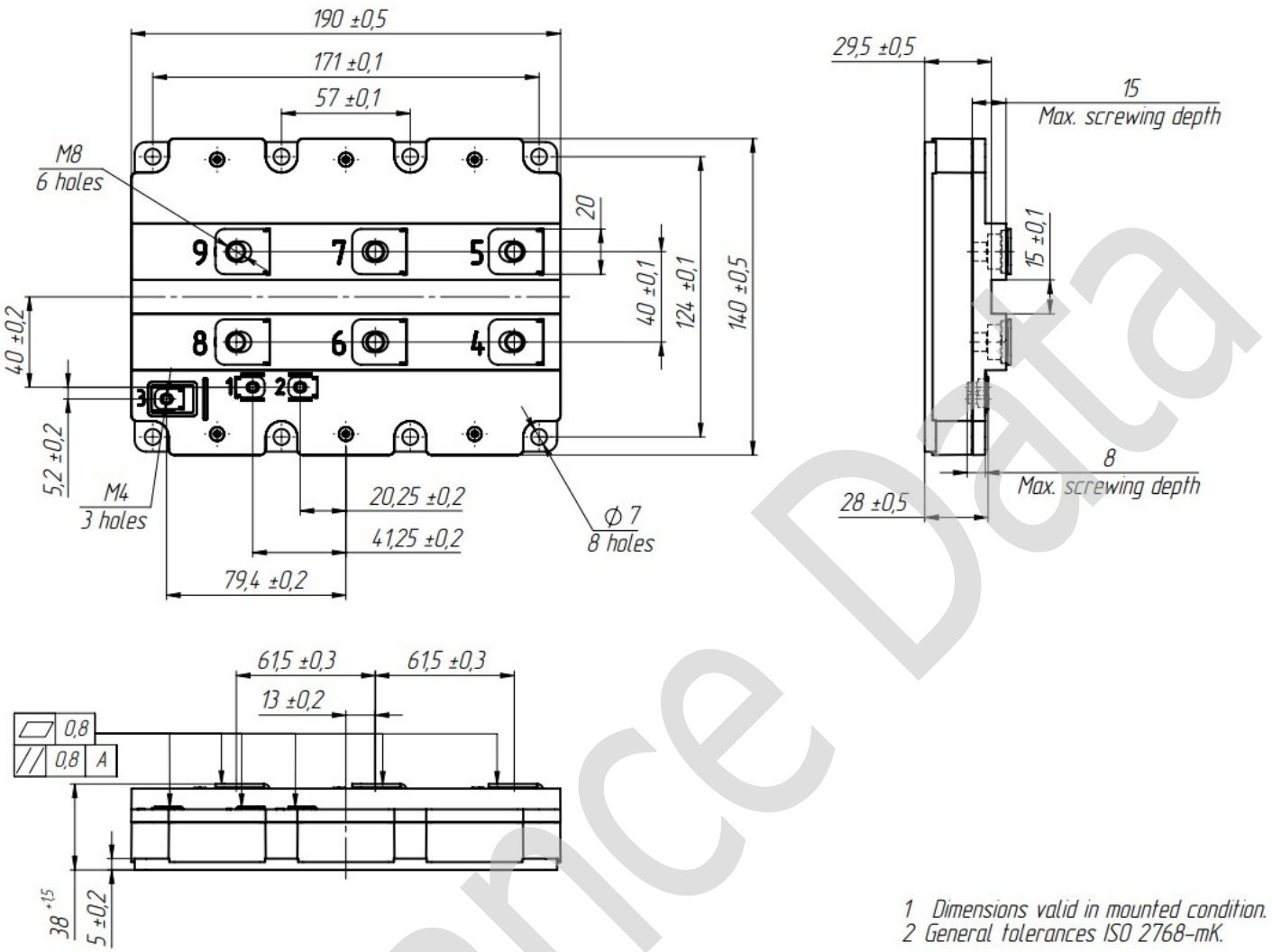
Overall dimensions: Package type – HM



Part numbering guide

MIHM	-	SS	33	SG	-	1500	N	
MIHM								IGBT module package type: HM
		SS						Single switch
			33					Voltage rating (V_{CES}/100)
				SG				IGBT+FRD chipset modification
						1500		Current Rating
							N	Climatic version: normal climate

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