

IGBT module high-power & increased rated insulation voltage 10.5 kV

3300 V 1500 A


Chip features

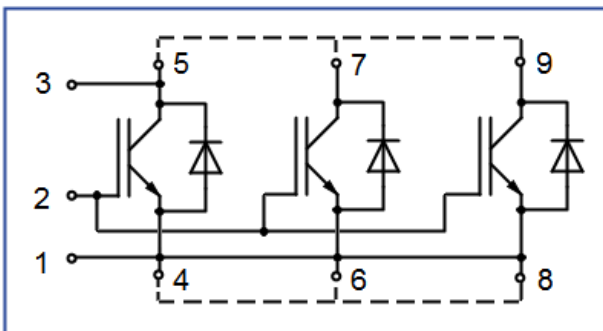
- IGBT chip
 - SPT+
 - low $V_{CE(sat)}$ value
 - low EMI
 - fast and soft reverse recovery

Design features

- AlSiC baseplate
- AlN AMB substrate
- ultrasonically welded power terminals
- high rated insulation voltage – 10500 V
- RoHS compliant

Typical application

- transport (auxiliary power systems for rail and public transport)
- 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)	$I_{C 100}$	$T_{vj(max)} = 175^{\circ}C$; $T_c = 100^{\circ}C$.	1500	A
Repetitive peak collector current ^{*1}	I_{CRM}	$I_{CRM} = 2 \times I_{C nom}$; $t_p = 1$ ms.	3000	A
Short-circuit duration	t_{psc}	$T_{vj} = 150^{\circ}C$; $V_{GE} = \pm 15$ V; $V_{CE} = 2500$ V.	10	μs
Gate-Emitter voltage	V_{GES}		± 20	V
Junction operating temperature	$T_{vj(op)}$		-40...+150	$^{\circ}C$
Inverse diode \ Freewheeling diode				
Repetitive peak reverse voltage	V_{RRM}	$V_{GE} = 0$ V.	3300	V
Maximum allowable forward current (continuous)	$I_{F 100}$	$T_{vj(max)} = 175^{\circ}C$; $T_c = 100^{\circ}C$.	1267	A
Repetitive peak forward current ^{*1}	I_{FRM}	$I_{FRM} = 2 \times I_{F nom}$; $t_p = 1$ ms.	3000	A
Junction operating temperature	$T_{vj(op)}$		-40...+150	$^{\circ}C$
Module				
Storage temperature	T_{stg}		-50...+50	$^{\circ}C$
Isolation voltage	V_{isol}	AC sin 50 Hz; $t = 1$ min.	10500	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			Unit
				min.	typ.	max.	
IGBT							
Collector-Emitter saturation voltage	V _{CEsat}	V _{GE} = +15 V; I _C =1500 A; t _u = 1 ms.	T _{vj} = 25°C	-	3.05	3.50	V
			T _{vj} = 150°C	-	3.80	4.40	V
Gate-Emitter threshold voltage	V _{GE(th)}	I _C = 60 mA; V _{CE} = V _{GE} ; T _{vj} = 25°C; t _u = 2 ms.		5.70	6.30	7.00	V
Collector-Emitter cut-off current	I _{CES}	V _{CE} = 3300 V; t _u = 10 ms; V _{GE} = 0.	T _{vj} = 25°C	-	0.13	5.00	mA
			T _{vj} = 150°C	-	39.60	50.00	mA
Gate-Emitter leakage current	I _{GES}	V _{CE} = 0; V _{GE} = ±20 V; T _{vj} = 25°C; t _u = 30 ms		-	70.00	300	nA
Input capacitance	C _{ies}	f = 100 kHz; T _{vj} = 25°C.		-	153	-	nF
Output capacitance	C _{oes}			-	12	-	
Reverse transfer capacitance	C _{res}			-	3	-	
Total gate charge	Q _G	I _C = 1500 A; V _{CE} = 1800 V; V _{GE} = -8...+15 V.		-	25.00	-	µC
Internal gate resistance	R _{Gint}	T _{vj} = 25°C.		-	1.08	-	Ω
Turn-on delay time	t _{d(on)}	V _{CE} = 1800 V; V _{GE} = ±15 V; I _{C max} = 1500 A; R _{G on} = 5 Ω; R _{G off} = 1.5 Ω; L = 150 nH.	T _{vj} = 25°C	-	910	1200	µs
Rise time	t _{ri}		T _{vj} = 150°C	-	880	1090	
			T _{vj} = 25°C	-	400	520	µs
Turn-on energy	E _{on}		T _{vj} = 150°C	-	390	490	
			T _{vj} = 25°C	-	3555	4790	mJ
Turn-off delay time	t _{d(off)}		T _{vj} = 150°C	-	4700	6160	
			T _{vj} = 25°C	-	1190	1560	µs
Fall time	t _{fi}		T _{vj} = 150°C	-	1310	1730	
			T _{vj} = 25°C	-	1570	2320	µs
Turn-off energy	E _{off}		T _{vj} = 150°C	-	2210	3090	
			T _{vj} = 25°C	-	2265	2905	mJ
Collector-emitter threshold voltage	V _{CE0}		T _{vj} = 150°C	-	2755	3465	
		I _{CE1} = 375 A; I _{CE2} = 1500 A; t _u = 1 ms.	-	1.70	1.93	V	
On-State slope resistance (IGBT)	r _{CE0}			-	1.40	1.45	mΩ
Thermal resistance junction to case	R _{th(j-c)}	DC; I _{CE} = 1000 A; I _{test} = 1 A; V _{GE} = +15 V.		-	-	0.01	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V _F	I _F = 1500 A; V _{GE} = 0; t _u = 1 ms.	T _{vj} = 25°C	-	2.75	3.25	V
			T _{vj} = 150°C	-	2.90	3.40	V
Reverse recovery time	t _{rr}	V _{CE} = 1800 V; V _{GE} = ±15 V; I _{C max} = 1500 A; R _{G on} = 5 Ω; R _{G off} = 1.5 Ω; L = 150 nH.	T _{vj} = 25°C	-	790	1090	
			T _{vj} = 150°C	-	930	1280	
Peak reverse current	I _{RM}		T _{vj} = 25°C	-	1450	2500	A
			T _{vj} = 150°C	-	1550	2600	A
Recovered charge	Q _r		T _{vj} = 25°C	-	685	1025	µC
			T _{vj} = 150°C	-	835	1310	µC
Reverse recovery energy	E _{rec}		T _{vj} = 25°C	-	620	1365	J
			T _{vj} = 150°C	-	785	1650	J
Threshold voltage	V _(T0)	T _{vj} = 150°C; V _{GE} = 0; I _{F1} = 375 A;		-	1.38	1.54	V
Forward slope resistance	r _T	I _{F2} = 1500 A; t _u = 1 ms		-	1.02	1.06	mΩ
Thermal resistance junction to case	R _{th(JC-D)}	DC; I _{CE} = 1000 A; I _{test} = 1 A; V _{GE} = +15 V.		-	-	0.026	K/W



Module						
Parasitic inductance between terminals	L_{Pxy}	$T_{vj} = 25^{\circ}\text{C}; f = 1 \text{ MHz}$	-	11.00	-	nH
Thermal resistance case to heatsink	R_{thCH}	per module	-	0.006	-	K/W
Mounting torque for screws to heatsink	M_s	to heatsink M6	4.25	-	5.75	N*m
Mounting torque for terminal screws	M_t	to terminals M8	8.00	-	10.00	N*m
Mounting torque for gate terminal	M_t	to terminals M4	1.88	-	2.20	N*m
Weight	W		-	1700	-	g

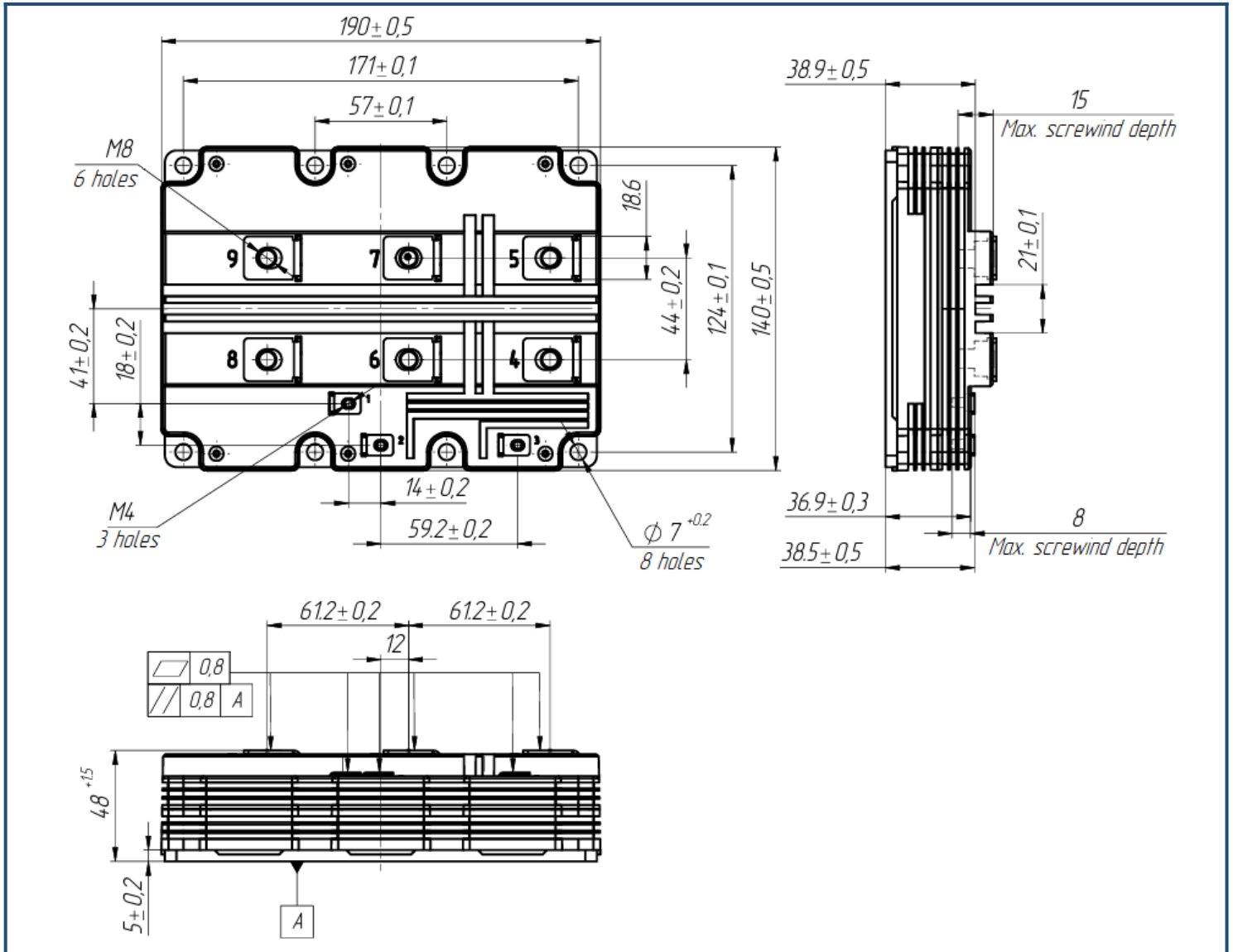
" - " Data will be refined as additional tests are conducted and statistics are collected.

Notes:

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



Overall dimensions: Package type – HV



Part numbering guide

MIHV	-	SS	33	SG	-	1500	N	
MIHV								IGBT module package type: HV
		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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