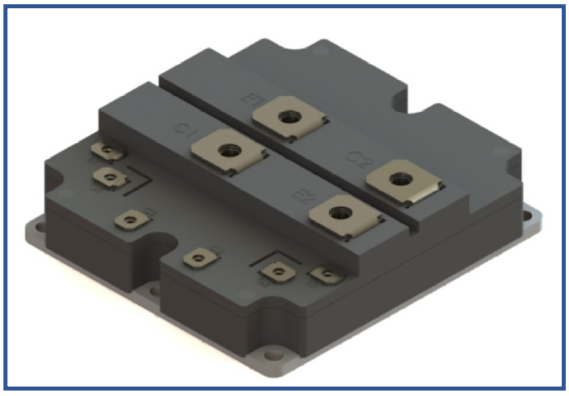
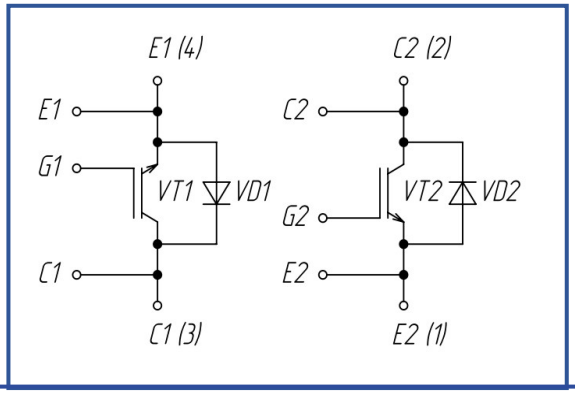
IGBT high-power module

1200 V 1200 A





Chip features

- IGBT chip
  - Trench FS
  - 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
- ultrasonically welded power terminals

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.	1700	V
Maximum allowable collector current (continuous)*2	$I_{C\ 25}$	$T_{vj\ (max)}$ = 150°C; T_c = 25°C.	1899	A
	$I_{C\ 80}$	$T_{vj\ (max)}$ = 150°C; T_c = 80°C.	1333	A
Repetitive peak collector current*1	I_{CRM}	I_{CRM} = 2 x $I_{C\ nom}$; t_p = 1 ms.	2400	A
Short-circuit duration	t_{psc}	T_{vj} = 25°C; V_{GE} = ±15 V; V_{CE} = 1000 V; $R_{G\ on}$ = $R_{G\ off}$ = 0.5 Ω.	10	µs
		T_{vj} = 150°C; V_{GE} = ±15 V; V_{CE} = 1000 V; $R_{G\ on}$ = $R_{G\ off}$ = 0.5 Ω.	10	
Gate-Emitter voltage	V_{GES}		±20	V
Junction operating temperature	$T_{vj\ (op)}$		-40…+150	ºC
Inverse diode \ Freewheeling diode				
Repetitive peak reverse voltage	V_{RRM}	V_{GE} = 0 V.	1700	V
Maximum allowable forward current (continuous)*2	$I_{F\ 25}$	$T_{vj\ (max)}$ = 150°C; T_c = 25°C.	1295	A
	$I_{F\ 80}$	$T_{vj\ (max)}$ = 150°C; T_c = 80°C.	899	A
Repetitive peak forward current*1	I_{FRM}	I_{FRM} = 2 x $I_{F\ nom}$; t_p = 1 ms.	2400	A
Junction operating temperature	$T_{vj\ (op)}$		-40…+150	°C
Module				
Storage temperature	T_{stg}		-40…+60	°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.
*2 $I_{C\ 25}$ and $I_{C\ 80}$ ($I_{F\ 25}$ и $I_{F\ 80}$) values were calculated in accordance with typical U_{CE0}, r_{CE0} and $R_{th(j-c)}$ ($U_{(T0)}$, r_T and $R_{th(JC-D)}$).

Characteristics

Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit.
IGBT							
Collector-Emitter saturation voltage	V_{CEsat}	V_{GE} =+15 V; I_C = 1200 A; t_u = 10 µs.	T_{vj} = 25°C	-	1.80	2.20	V
			T_{vj} = 150°C	-	2.20	2.60	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C = 40 mA; U_{CE} = U_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.00	6.00	7.00	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 1200 V; t_u = 10 ms; V_{GE} = 0.	T_{vj} = 25°C	-	-	1.00	µA
			T_{vj} = 150°C	-	-	30.00	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} =25°C; t_u = const.		-	-	500	nA
Input capacitance	C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 100 kHz; T_{vj} = 25°C.		-	109.00	-	nF
Output capacitance	C_{oes}			-	-	-	nF
Reverse transfer capacitance	C_{res}			-	3.00	-	nF
Total gate charge	Q_G	I_C = 1200 A; V_{CE} = 920 V; V_{GE} = -8÷15 V.		-	11.60	-	nC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	0.27	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 900 V; V_{GE} = ±15 V; $I_{C\,max}$ = 1200 A; R_G = 0.5 Ω; L_s = 150 nH.	T_{vj} = 25°C	-	480	-	ns
			T_{vj} = 150°C	-	480	-	
Rise time	t_{ri}		T_{vj} = 25°C	-	230	-	ns
			T_{vj} = 150°C	-	240	-	
Turn-on energy	E_{on}		T_{vj} = 25°C	-	83	-	mJ
			T_{vj} = 150°C	-	128	-	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	-	1200	-	ns
			T_{vj} = 150°C	-	1280	-	
Fall time	t_{fi}		T_{vj} = 25°C	-	400	-	ns
			T_{vj} = 150°C	-	490	-	
Turn-off energy	E_{off}		T_{vj} = 25°C	-	570	-	mJ
			T_{vj} = 150°C	-	660	-	
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 900 A; I_{CE2} = 1200 A; t_u = 10 µs.		-	0.96	-	V
On-State slope resistance (IGBT)	r_{CE0}			-	1.07	-	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; I_{CE} = 2000±500 A; I_{test} = 3 A; V_{GE} = +15 V.		-	0.0220	-	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V_F	I_F = 1200 A; V_{GE} = 0; t_u = 10 µs.	T_{vj} = 25°C	-	1.93	-	V
			T_{vj} = 150°C	-	2.10	-	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 900 V; $I_{C\,max}$ = 1200 A; $R_{G\,on}$ = 0.5 Ω; L_s = 150 nH.	T_{vj} = 25°C	-	-	-	ns
			T_{vj} = 150°C	-	-	-	ns
Peak reverse current	I_{RM}		T_{vj} = 25°C	-	710	-	A
			T_{vj} = 150°C	-	870	-	A
Recovered charge	Q_r		T_{vj} = 25°C	-	240	-	µC
			T_{vj} = 150°C	-	415	-	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	-	155	-	mJ
			T_{vj} = 150°C	-	295	-	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; I_{CE1} = 900 A; I_{CE2} = 1200 A; t_u = 10 µs		-	0.9	-	V
Forward slope resistance	r_T			-	1.00	-	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; I_{CE} = 2000±500 A; I_{test} = 3 A; U_{GE} = +15 V.		-	0.0440	-	K/W

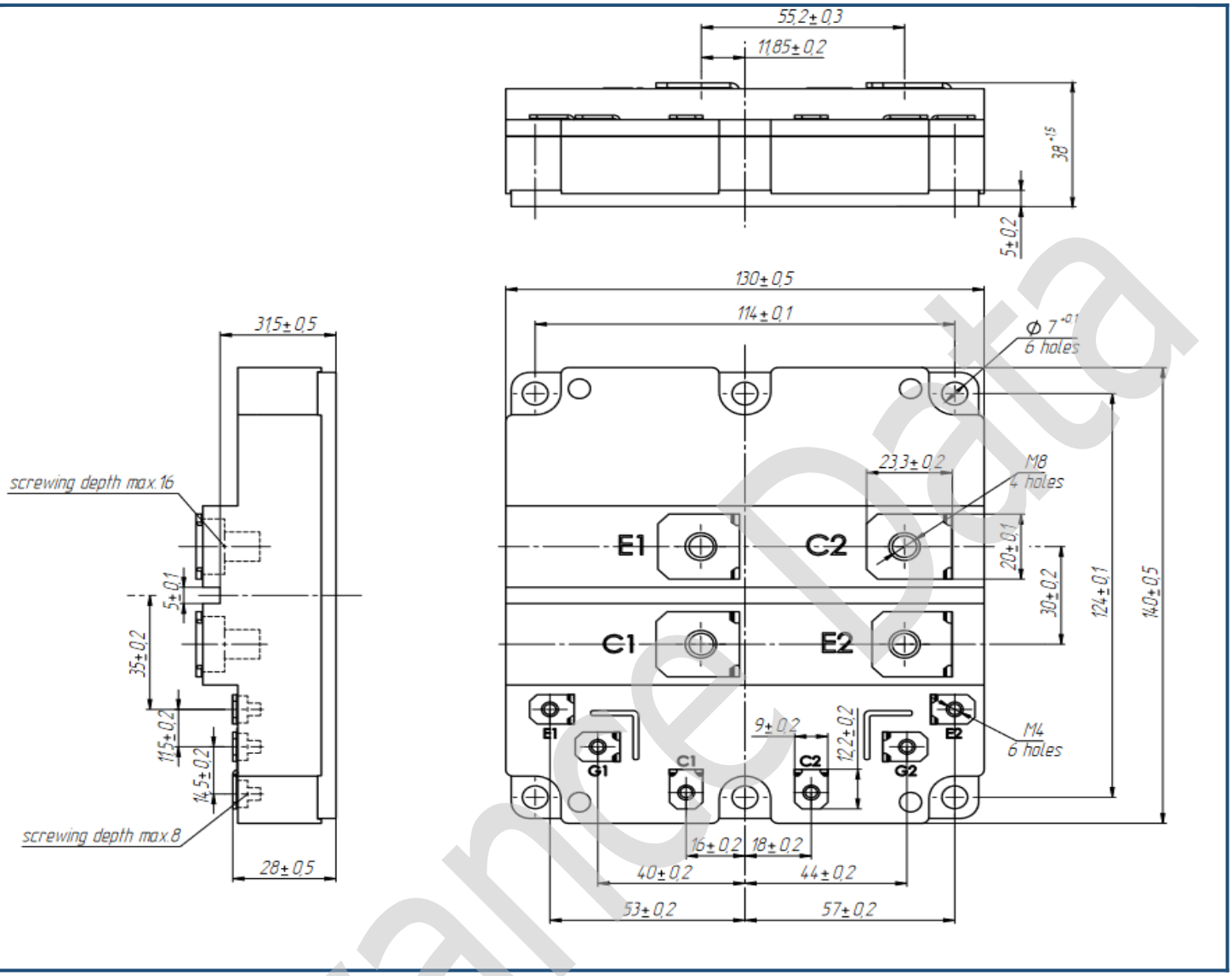
Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	$R_{P4-3/1-2}$	-	0.24	-	mΩ
Parasitic inductance between terminals	L_{Pxy}		$L_{P4-3/1-2}$	-	18.00	-	nH
Thermal resistance case to heatsink	R_{thCH}	per module		-	12.00	-	K/W
Mounting torque for screws to heatsink	M_s	to heatsink M6		-	-	5.00	N*m
Mounting torque for screws to control terminal	M_{ct}	to terminals M4		-	-	2.00	N*m
Mounting torque for screws to power terminal	M_{pt}	to terminals M8		-	-	10.00	N*m
Creepage distance	d_s			-	-	15.00	mm
Clearance	d_a			-	-	10.00	mm
Comparative Tracking Index	CTI			-	-	600	
Weight	W			-	-	900	g

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

Notes:

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

Overall dimensions: Package type – SM



Part numbering guide

MISM	-	DS	12	CA	-	1200	N	
MISM								IGBT module package type: SM
		DS						Double switch
			12					Voltage rating (V_{CES}/100)
				CA				IGBT+FRD chipset modification
						1200		Current Rating
							N	Climatic version: normal climate