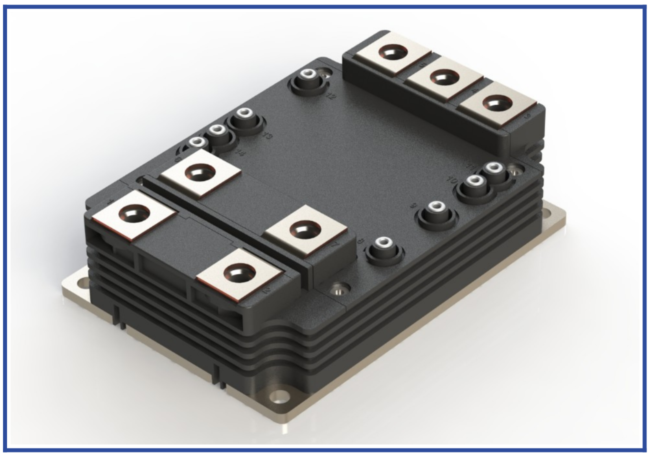
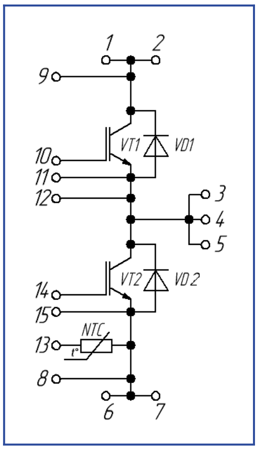
MIXM-HB17SM-1200N-A
IGBT module datasheet

PROTON-ELECTROTEX

Low inductance IGBT module in a XM package (100mm*140mm) 1700 V 1200 A





Chip features

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

Design features

- AlSiC baseplate
- AlN substrate
- improved thermal cycling
- RoHS compliant
- low inductance value

Typical application

- AC motor drives
- solar inverter
- wind-powered generator inverters
- high power converters and UPS

Maximum rated values

Definition	Symbol	Conditions	Value	Unit
IGBT				
Collector-Emitter voltage	V_{CES}	V_{GE} = 0.	1700	V
Maximum allowable collector current (continuous)	$I_{C\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	1338	A
	$I_{C\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	1020	A
Repetitive peak collector current[*1]	I_{CRM}	I_{CRM} = 3 x $I_{C\ nom}$; t_p = 1 ms.	3600	A
Short-circuit duration	t_{psc}	T_{vj} = 25°C; V_{GE} = ±15 V; V_{CE} = 920 V; $R_{G\ on}$ = $R_{G\ off}$ = 1.2 Ω	10	µs
		T_{vj} = 150°C; V_{GE} = ±15 V; V_{CE} = 920 V; $R_{G\ on}$ = $R_{G\ off}$ = 1.2 Ω	-	
Gate-Emitter voltage	V_{GES}		±20	V
Junction operating temperature	$T_{vj\ (op)}$		-40…+175	ºC
Inverse diode				
Repetitive peak reverse voltage	V_{RRM}	V_{GE} = 0 V.	1700	V
Maximum allowable forward current (continuous)	$I_{F\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	1214	A
	$I_{F\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	920	A
Repetitive peak forward current[*1]	I_{FRM}	I_{FRM} = 3 x $I_{F\ nom}$; t_p = 1 ms.	3600	A
Junction operating temperature	$T_{vj\ (op)}$		-40…+175	°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.

Characteristics

Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit
IGBT							
Collector-Emitter saturation voltage (at terminals)	V_{CEsat}	V_{GE} = +15 V; I_C = 1200 A; t_u = 1000 µs.	T_{vj} = 25°C	1.80	2.10	2.40	V
			T_{vj} = 150°C	2.40	2.75	3.10	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C = 56 mA; V_{CE} = V_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.35	6.05	6.75	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 1700 V; t_u = 50ms; V_{GE} = 0;	T_{vj} = 25°C	-	11.00	100	µA
			T_{vj} = 150°C	-	5.00	13.00	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} = 25°C; t_u = 100 ms.		-	5.00	100	nA
Input capacitance	C_{ies}	V_{CE} = 10 V; V_{GE} = 0 V; f = 1 MHz; T_{vj} = 25°C.		-	-	-	nF
Output capacitance	C_{oes}			-	-	-	
Reverse transfer capacitance	C_{res}			-	-	-	nF
Total gate charge	Q_G	I_C = 1200 A; V_{CE} = 920 V; V_{GE} = -8...+15 V.		-	7400	7800	nC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	-	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 920 V; V_{GE} = ±15 V; $I_{C\,max}$ = 1200 A; $R_{G\,on}$ = 0.5 Ω; $L_s \leq$ 80 nH.	T_{vj} = 25°C	244	272	300	ns
			T_{vj} = 150°C	262	292	322	
Rise time	t_{ri}		T_{vj} = 25°C	85	100	115	ns
			T_{vj} = 150°C	100	116	132	
Turn-on energy	E_{on}		T_{vj} = 25°C	339	487	635	mJ
			T_{vj} = 150°C	490	641	792	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	595	665	735	ns
			T_{vj} = 150°C	650	730	810	
Fall time	t_{fi}		T_{vj} = 25°C	390	465	540	ns
			T_{vj} = 150°C	590	665	740	
Turn-off energy	E_{off}		T_{vj} = 25°C	235	299	363	mJ
			T_{vj} = 150°C	307	389	471	
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 300 A; I_{CE2} = 1200 A; t_u = 1000 µs.		0.81	0.85	0.89	V
On-State slope resistance (IGBT)	r_{CE0}			1.45	1.59	1.66	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; I_{CE} = 300±50 A; I_{test} = 1.0 A; V_{GE} = +15 V.		-	0.033	0.036	K/W
Inverse diode							
Forward voltage drop (at terminals)	V_F	I_F = 1200 A; V_{GE} = 0; t_u = 1000 µs.	T_{vj} = 25°C	2.10	2.35	2.60	V
			T_{vj} = 150°C	2.30	2.65	3.00	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 920 V; $I_{C\,max}$ = 1200 A; $L_s \leq$ 80 nH; $R_{G\,on}$ = 0.5 Ω.	T_{vj} = 25°C	275	307	339	ns
			T_{vj} = 150°C	346	445	544	ns
Peak reverse current	I_{RM}		T_{vj} = 25°C	1000	1450	1900	A
			T_{vj} = 150°C	1050	1500	1950	A
Recovered charge	Q_r		T_{vj} = 25°C	173	256	339	µC
			T_{vj} = 150°C	288	361	434	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	132	194	256	mJ
			T_{vj} = 150°C	258	330	402	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; I_{F1} = 300 A; I_{F2} = 1200 A; t_u = 1000 µs.		0.83	0.86	0.89	V
Forward slope resistance	r_T			1.43	1.51	1.58	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; I_{CE} = 300±50 A; I_{test} = 1.0 A; V_{GE} = +15 V.		-	0.040	0.044	K/W

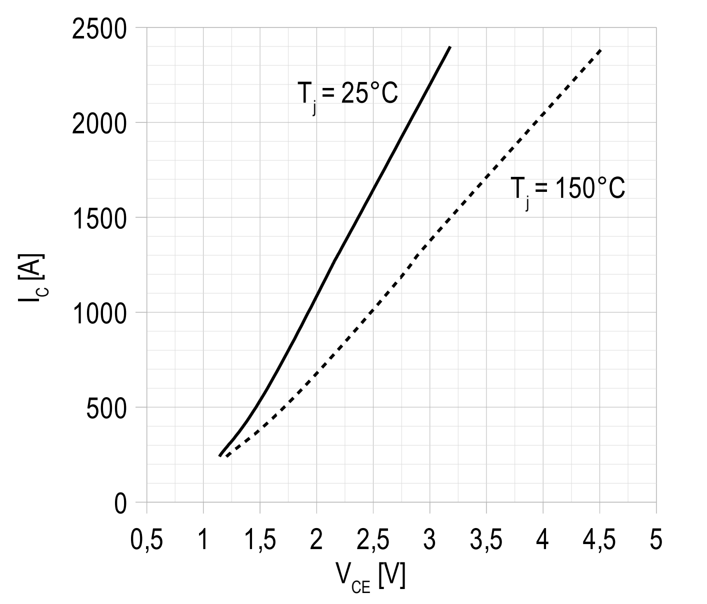
Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	$R_{P1/2-3/4/5}$	-	0.269	-	mΩ
			$R_{P6/7-3/4/5}$	-	0.366	-	
			$R_{P1/2-6/7}$	-	0.516	-	
Parasitic inductance between terminals	L_{Pce}		$L_{P1/2-3/4/5}$	-	16.3	-	nH
			$L_{P6/7-3/4/5}$	-	18.9	-	
			$L_{P1/2-6/7}$	-	8.8	-	
Thermistor resistance	R_t	T_{vj} = 25°C		4850	-	6225	Ω
		T_{vj} = 150°C		160	-	195	
Coefficient of temperature sensitivity	$B_{25/50}$	$R_2 = R_{25}$ exp $[B_{25/50}$ $(1/T_2 - 1/T_1)]$, T_1 = 298,15 K		-	3375	-	K
Thermal resistance case to heatsink	R_{thCH}	per module		-	0.02	-	K/W
Mounting torque for screws to heatsink	M_s	to heatsink M6		4.00	-	6.00	N*m
Mounting torque for terminal screws	M_t	to terminals M8		8.00	-	10.00	N*m
Mounting torque for gate terminal	M_a	to gate terminal M3		0.90	-	1.10	
Weight	W			-	820	-	g

“ - ” — data will be refined as additional tests are conducted and statistics are collected.

Notes:

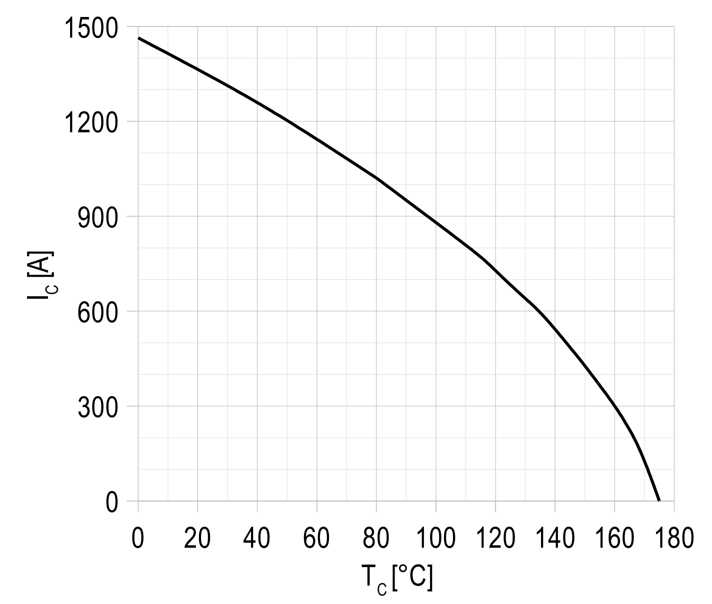
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op}$ = -40...+150°C.

Chart 1 – typ. output characteristic, IGBT.



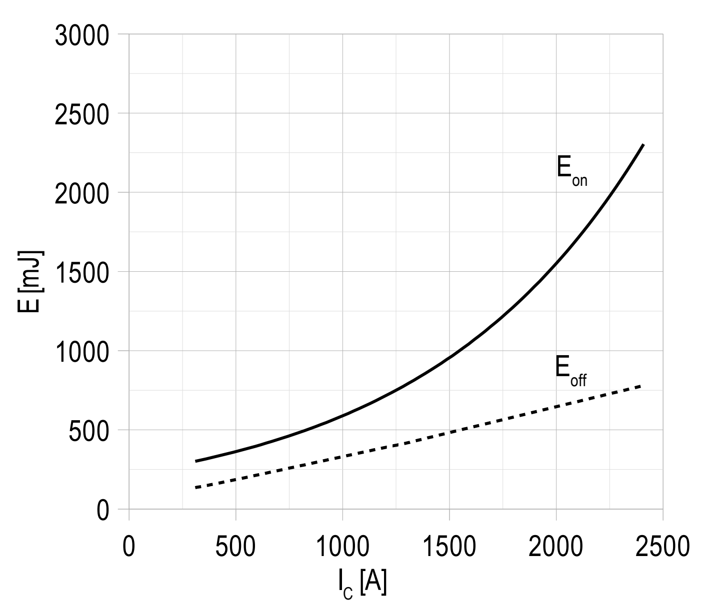
V_{GE} = +15 V.

Chart 2 – max. rated current vs temperature.



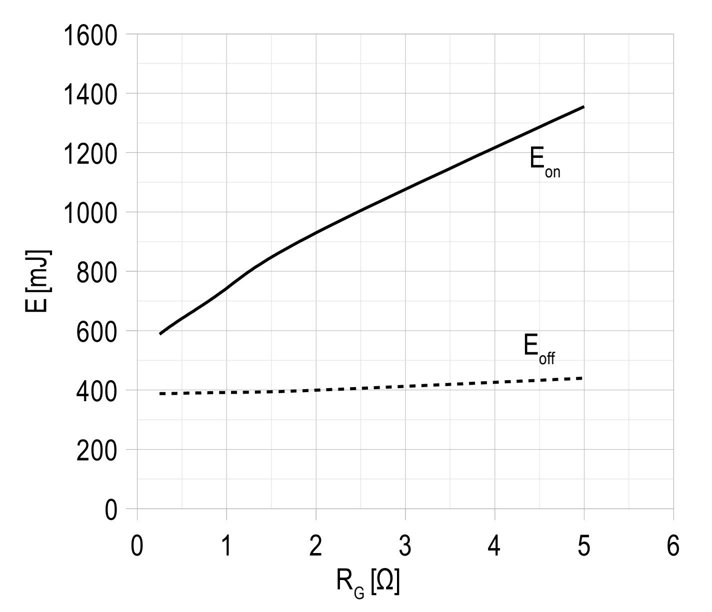
DC;
V_{GE} = +15 V;
$T_{vj\,(max)}$ = 150°C.

Chart 3 – typ. turn-on/-off energy vs rated current, IGBT.



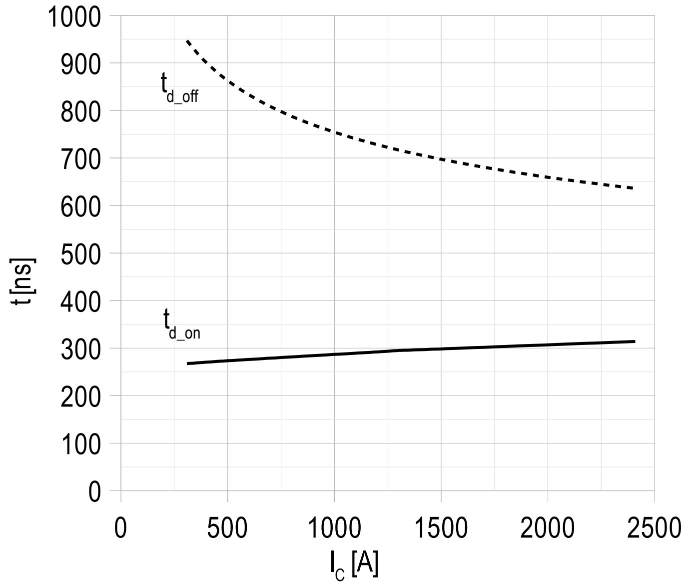
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 0.5 Ω;
$L_s \leq$ 80 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 4 – typ. turn-on/-off energy vs gate resistance, IGBT.



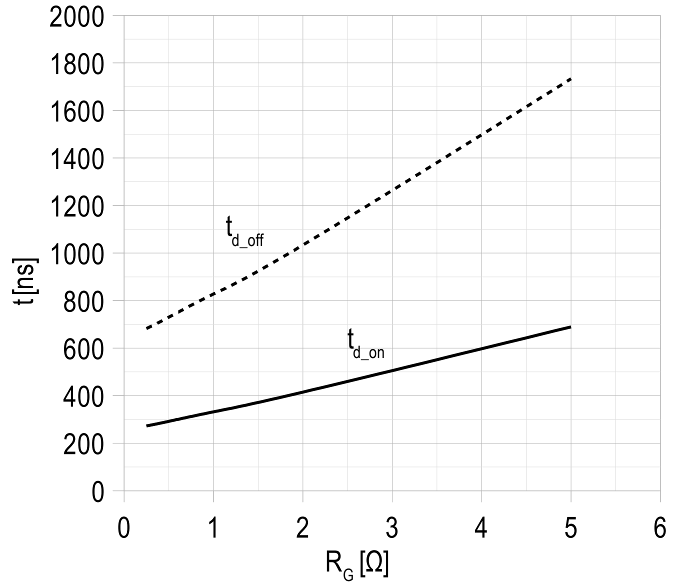
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 1200 A;
$L_s \leq$ 80 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 5 – typ. switching times vs rated current, IGBT.



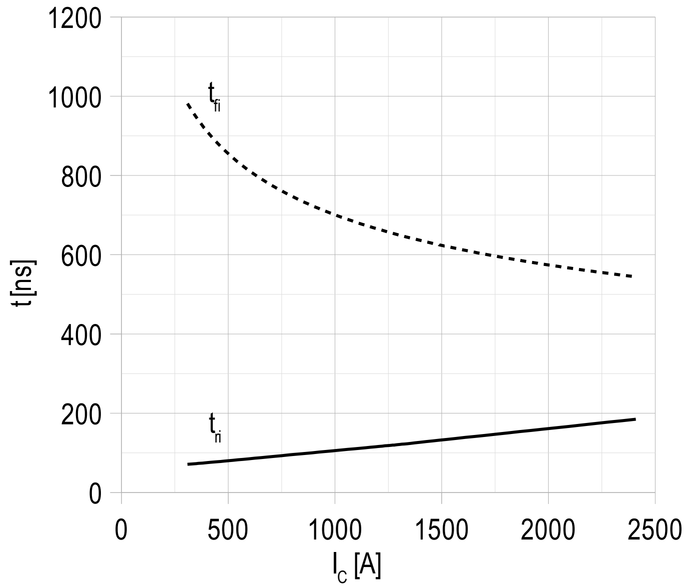
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 0.5 Ω;
$L_s \le$ 80 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 6 – typ. switching times vs gate resistance, IGBT.



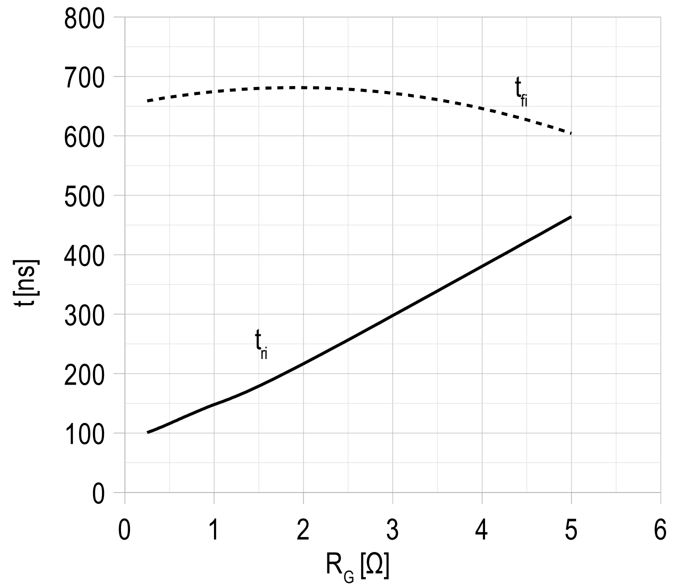
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 1200 A;
$L_s \le$ 80 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 7 – typ. switching times vs rated current, IGBT.



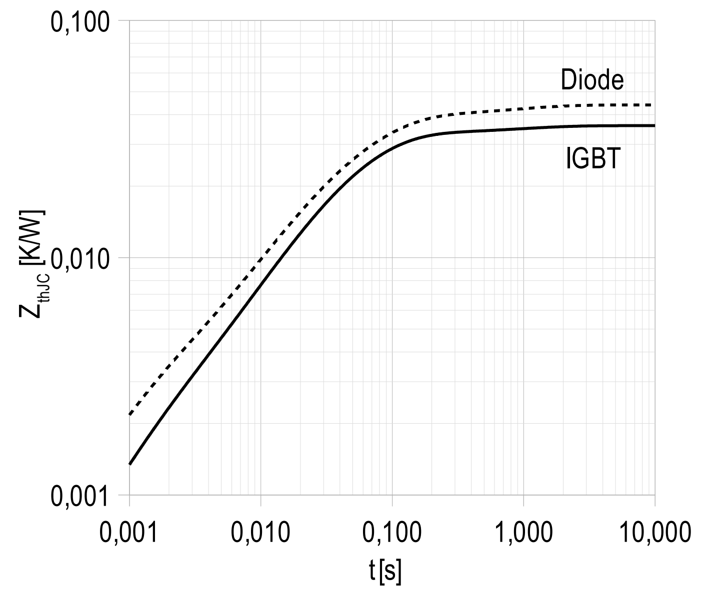
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 0.5 Ω;
$L_s \le$ 80 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 8 – typ. switching times vs gate resistance, IGBT.



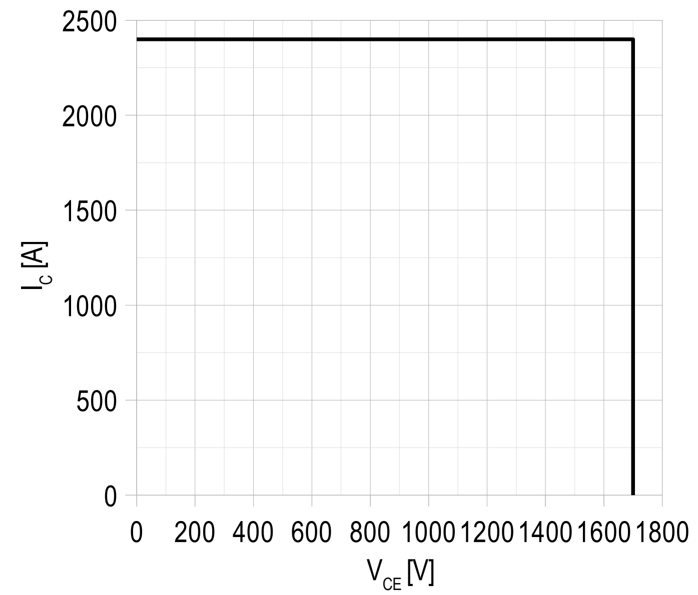
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 1200 A;
$L_s \le$ 80 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 9 – max. transient thermal impedance.



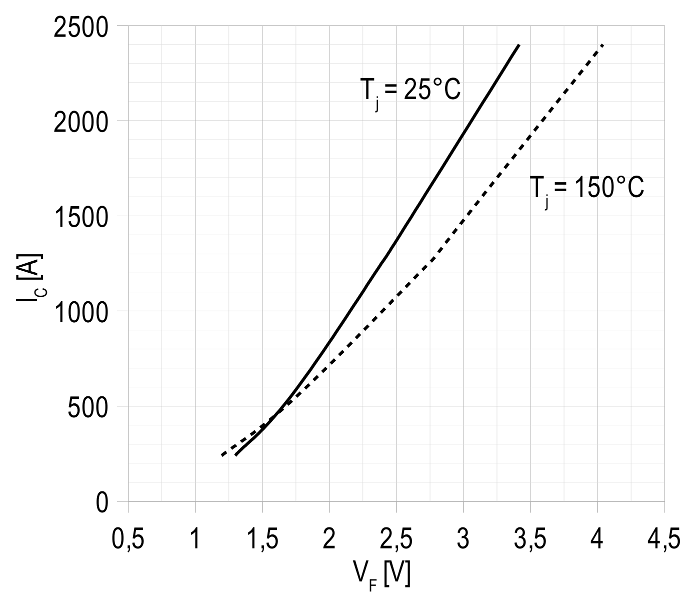
Single pulse;
V_{GE} = +15 V.

Chart 10 – RBSOA.



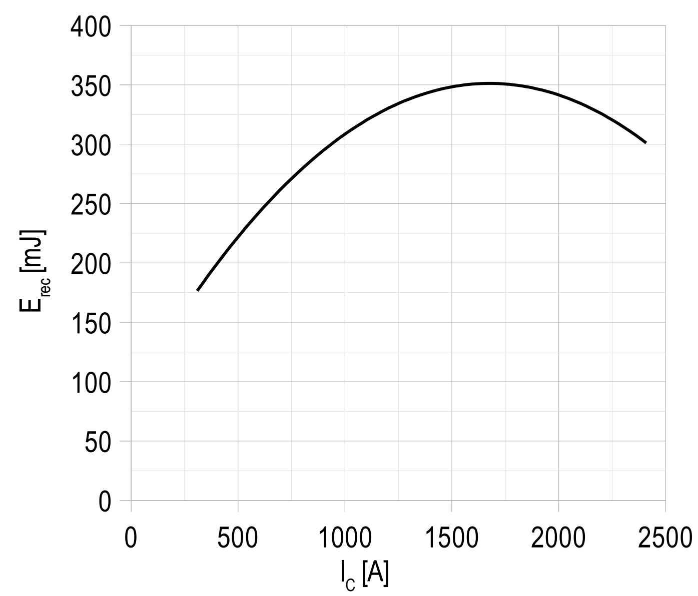
$V_{CE\ max}$ = 1700 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 2*$I_{C\ nom}$;
R_G = 0.5 Ω;
L_s ≤ 80 nH.

Chart 11 – typ. output characteristic, FRD.



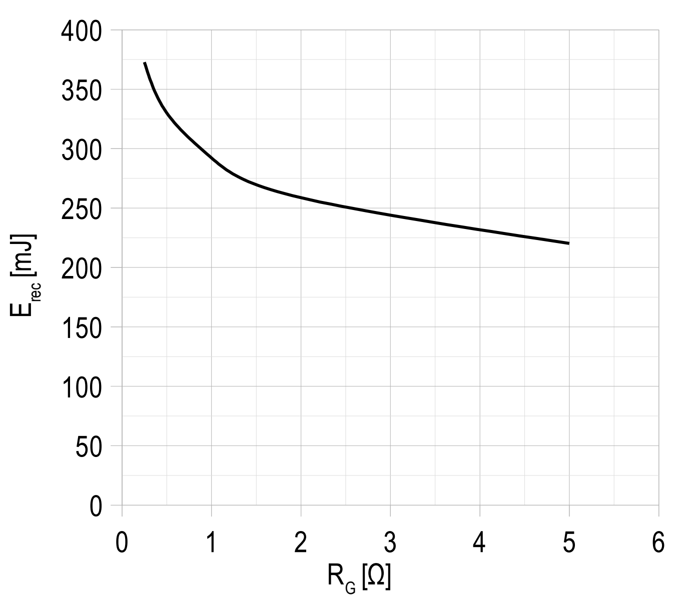
V_{GE} = 0 V.

Chart 12 – typ. switching losses vs rated current, FRD.



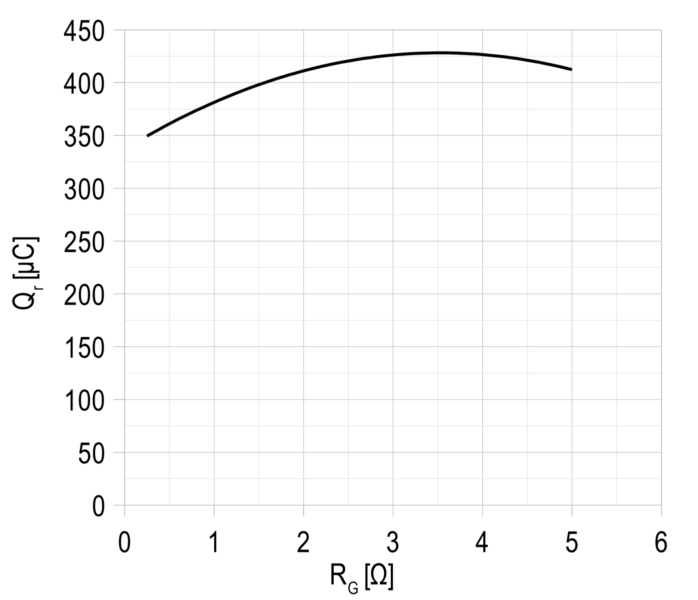
V_{GE} = ±15 V;
V_{CE} = 920 V;
R_G = 0.5 Ω;
L_s ≤ 80 nH;
$T_{vj\ (max)}$ = 150°C.

Chart 13 – typ. switching losses vs gate resistance, FRD.



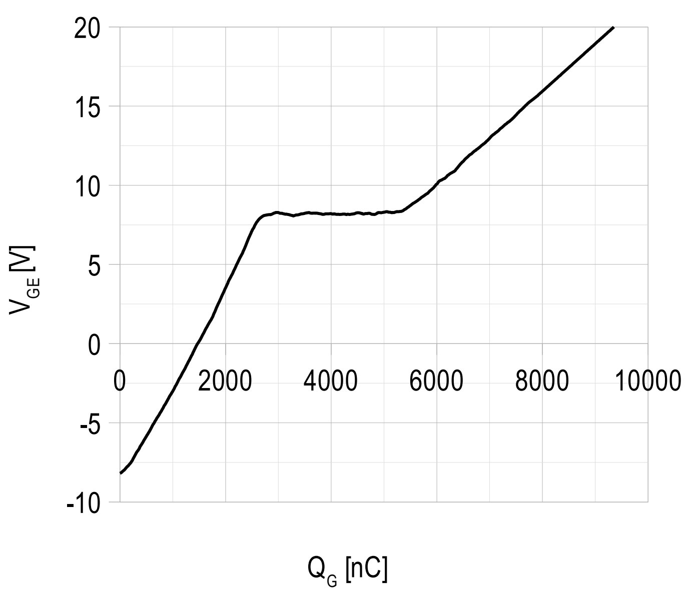
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\ max}$ = 1200 A;
$L_s \leq$ 80 nH;
$T_{vj\ (max)}$ = 150°C.

Chart 14 – typ. reverse recovered charge vs gate resistance, FRD.



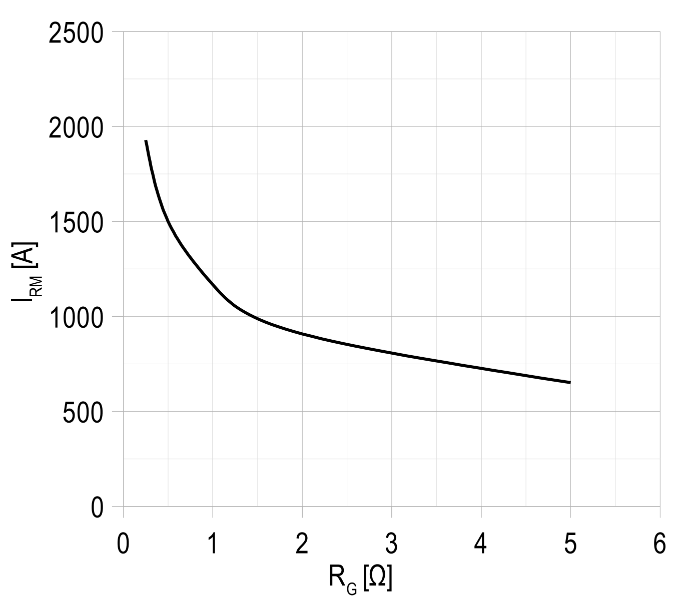
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\ max}$ = 1200 A;
$L_s \leq$ 80 nH;
$T_{vj\ (max)}$ = 150°C.

Chart 15 – typ. gate charge characteristic.



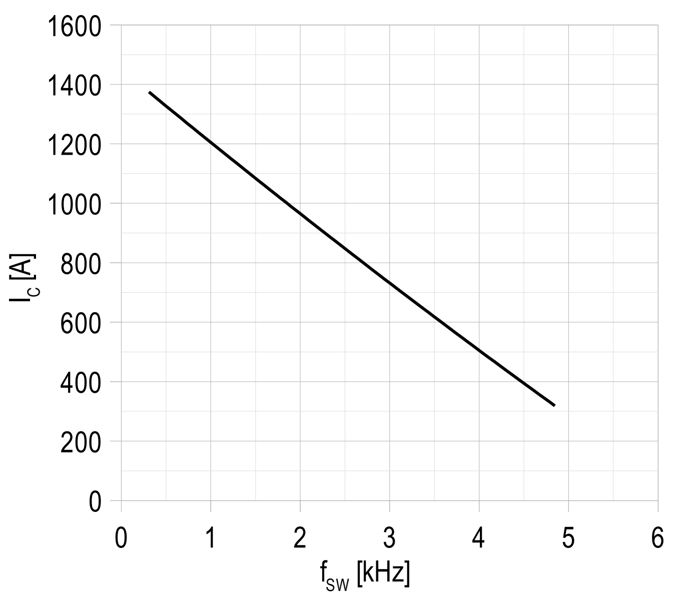
I_C = 1200 A;
V_{CE} = 850 V;
V_{GE} = -8...+15 V.

Chart 16 – typ. reverse recovery current vs gate resistance FRD.



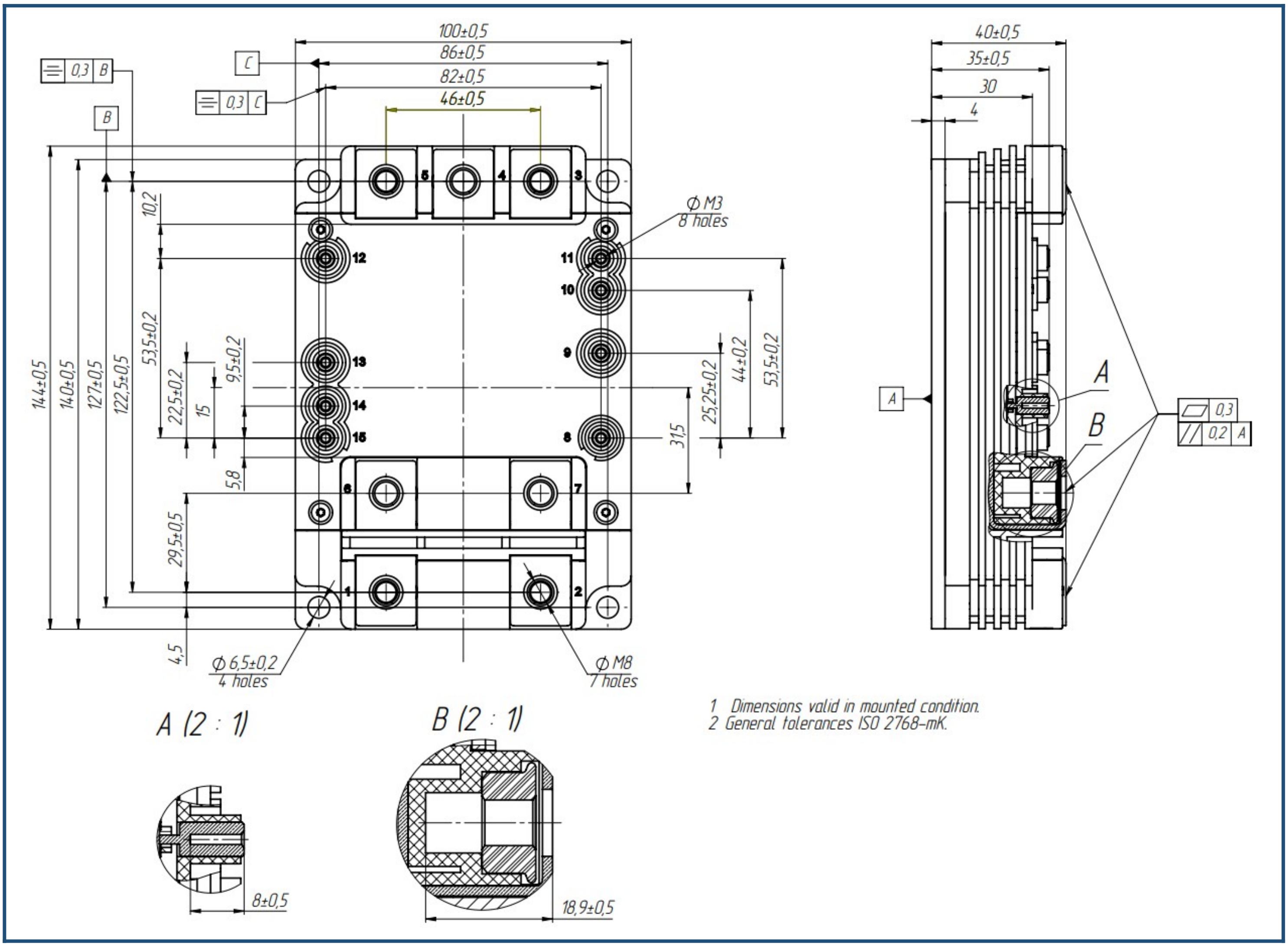
V_{CE} = 920 V;
V_{GE} = ±15 V;
$L_s \leq$ 80 nH;
$T_{vj\ (max)}$ = 150°C.

Chart 17 – max. rated current vs frequency.



Duty cycle 50%;
V_{CE} = 920 V;
T_c = 80 °C;
$T_{vj\,(max)}$ = 175 °C.

Overall dimensions: Package type – XM



Part numbering guide

MIXM	-	HB	17	SM	-	1200	N	-	A	
MIXM										IGBT module package type: XM
		HB								2 switches as Half-Bridge
			17							Voltage rating (V_{CES}/100)
				SM						IGBT+FRD chipset modification
						1200				Current Rating
							N			Climatic version: normal climate
									A	AlSiC baseplate