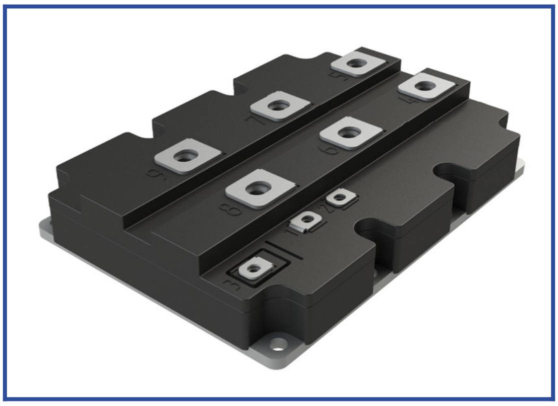
PROTON-ELECTROTEX

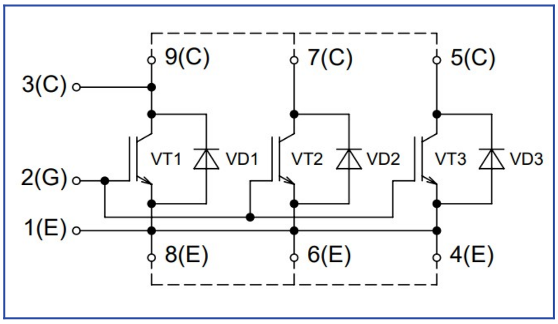
MIHM-SS17SM-2400N

IGBT module datasheet

IGBT high-power module

1700 V 2400 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.	1700	V
Maximum allowable collector current (continuous)	$I_{C\,25}$	$T_{vj\,(max)}$ = 175°C; T_c = 25°C.	3247	A
	$I_{C\,80}$	$T_{vj\,(max)}$ = 175°C; T_c = 80°C.	2400	A
Repetitive peak collector current*1	I_{CRM}	I_{CRM} = 2 x $I_{C\,nom}$; t_p = 1 ms.	4800	A
Short-circuit duration	t_{psc}	T_{vj} = 25°C; V_{GE} = ±15 V; V_{CE} = 1000 V; R_{Gon} = 1 Ω; R_{Goff} = 20 Ω.	10	µs
		T_{vj} = 150°C; V_{GE}=±15 V; V_{CE} = 1000 V; R_{Gon} = 1 Ω; R_{Goff} = 20 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)	$I_{F\,25}$	$T_{vj\,(max)}$ = 175°C; T_c = 25°C.	2830	A
	$I_{F\,80}$	$T_{vj\,(max)}$ = 175°C; T_c = 80°C.	2067	A
Repetitive peak forward current*1	I_{FRM}	I_{FRM} = 2 x $I_{F\,nom}$; t_p = 1 ms.	4800	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.

Characteristics

Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit.
IGBT							
Collector-Emitter saturation voltage	V_{CEsat}	V_{GE} =+15 V; I_C = 2400 A; t_u = 1000 µs.	T_{vj} = 25°C	1.85	2.10	2.35	V
			T_{vj} = 150°C	2.25	2.55	2.85	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C = 96 mA; U_{CE} = U_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.35	5.95	6.55	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 1700 V; t_u = 60 ms; V_{GE} = 0.	T_{vj} = 25°C	-	11.00	100	µA
			T_{vj} = 150°C	-	13.00	20.00	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} =25°C; t_u = 30 ms.		-	44.00	100	nA
Input capacitance	C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz; T_{vj} = 25°C.		-	950.40	-	nF
Output capacitance	C_{oes}			-	35.16	-	nF
Reverse transfer capacitance	C_{res}			-	4.68	-	nF
Total gate charge	Q_G	V_{GE} = -15...+15 V.		-	14.55	-	µC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	0.50	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 920 V; V_{GE} = ±15 V; $I_{C\,max}$ = 2400 A; R_G = 0.5 Ω; L_s = 100 nH.	T_{vj} = 25°C	416	482	548	ns
			T_{vj} = 150°C	416	468	520	
Rise time	t_{ri}		T_{vj} = 25°C	198	234	270	ns
			T_{vj} = 150°C	222	252	282	
Turn-on energy	E_{on}		T_{vj} = 25°C	432	615	798	mJ
			T_{vj} = 150°C	514	697	880	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	750	890	1030	ns
			T_{vj} = 150°C	805	900	995	
Fall time	t_{fi}		T_{vj} = 25°C	264	307	350	ns
			T_{vj} = 150°C	435	500	565	
Turn-off energy	E_{off}		T_{vj} = 25°C	810	1060	1310	mJ
			T_{vj} = 150°C	995	1115	1235	
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 600 A; I_{CE2} = 2400 A; t_u = 1000 µs.		1.22	1.24	1.26	V
On-State slope resistance (IGBT)	r_{CE0}			0.52	0.54	0.56	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; V_{GE} = +15 V.		-	-	0.015	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V_F	I_F = 2400 A; V_{GE} = 0; t_u = 1000 µs.	T_{vj} = 25°C	1.85	2.10	2.35	V
			T_{vj} = 150°C	1.95	2.20	2.45	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 920 V; $I_{C\,max}$ = 2400 A; R_G = 0.5 Ω; L_s = 100 nH.	T_{vj} = 25°C	410	475	540	ns
			T_{vj} = 150°C	615	705	795	ns
Peak reverse current	I_{RM}		T_{vj} = 25°C	1250	1700	2150	A
			T_{vj} = 150°C	1500	1950	2400	A
Recovered charge	Q_r		T_{vj} = 25°C	350	481	612	µC
			T_{vj} = 150°C	615	796	977	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	249	376	503	mJ
			T_{vj} = 150°C	539	708	877	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; I_{F1} = 600 A; I_{F2} = 2400 A; t_u = 1000 µs		1.18	1.20	1.22	V
Forward slope resistance	r_T			0.40	0.41	0.42	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; U_{GE} = +15 V.		-	-	0.022	K/W

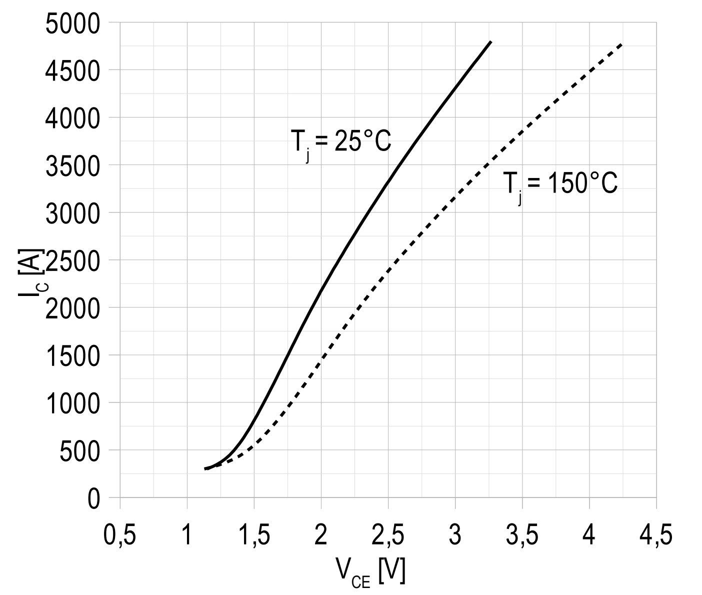
Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	$R_{P5-7-9/4-6-8}$	-	0.10	-	mΩ
Parasitic inductance between terminals	L_{Pxy}		$L_{P5-7-9/4-6-8}$	-	11.00	-	nH
Thermal resistance case to heatsink	R_{thCH}	per module		-	6.00	-	K/kW
Mounting torque for screws to heatsink	M_s	to heatsink M6		-	5.00	-	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			32.20	-	-	mm
Clearance	d_a			19.10	-	-	mm
Comparative Tracking Index	CTI			600	-	-	
Weight	W			-	-	1400	g

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

Notes:

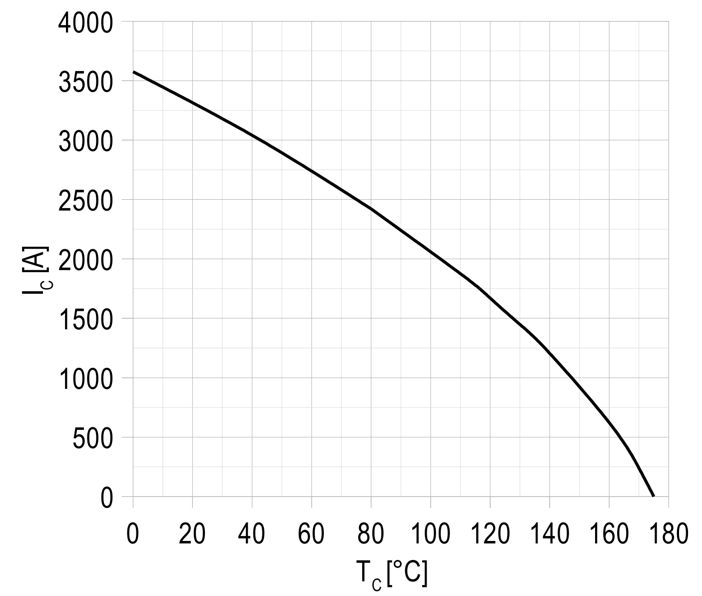
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op}$ = - 40...+150°C.

Chart 1 – typ. output characteristic, IGBT.



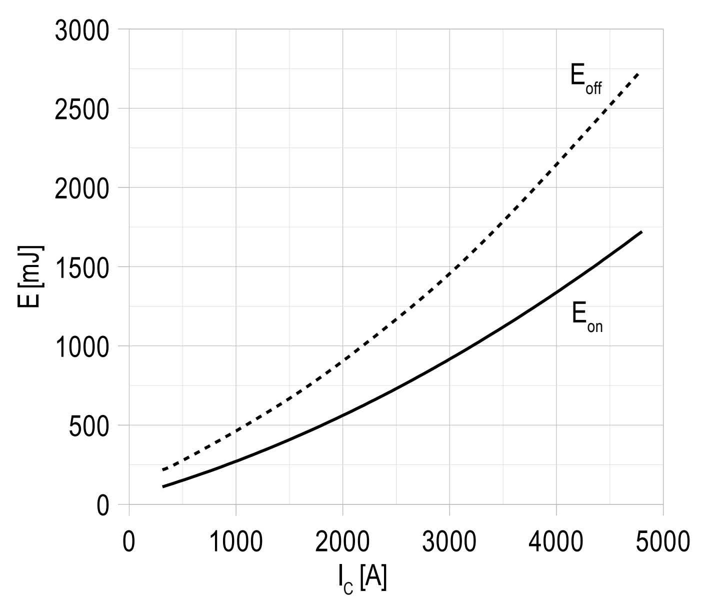
V_{GE} = +15 V.

Chart 2 – max. rated current vs temperature.



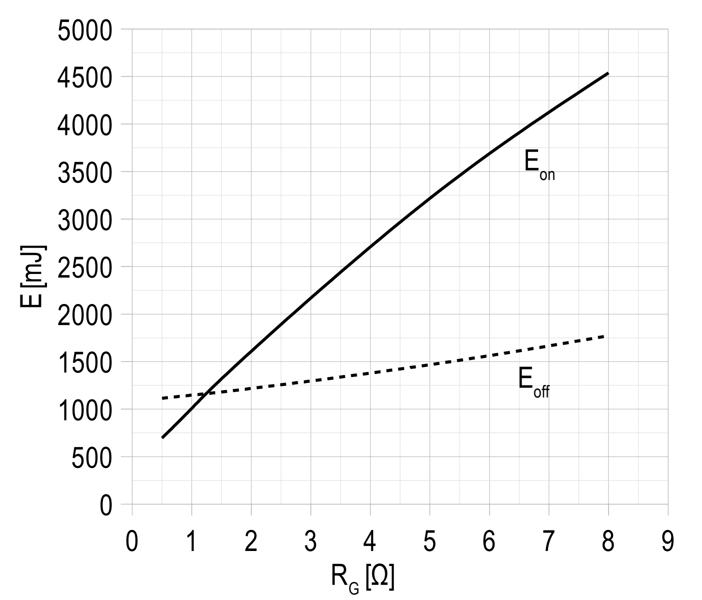
DC;
V_{GE} = +15 V;
$T_{vj\,(max)}$ = 150°C.

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



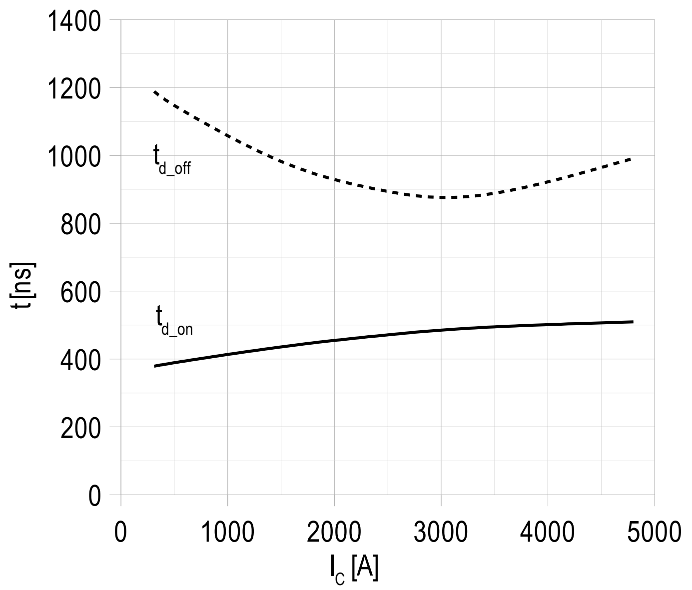
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 0.5 Ω;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

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



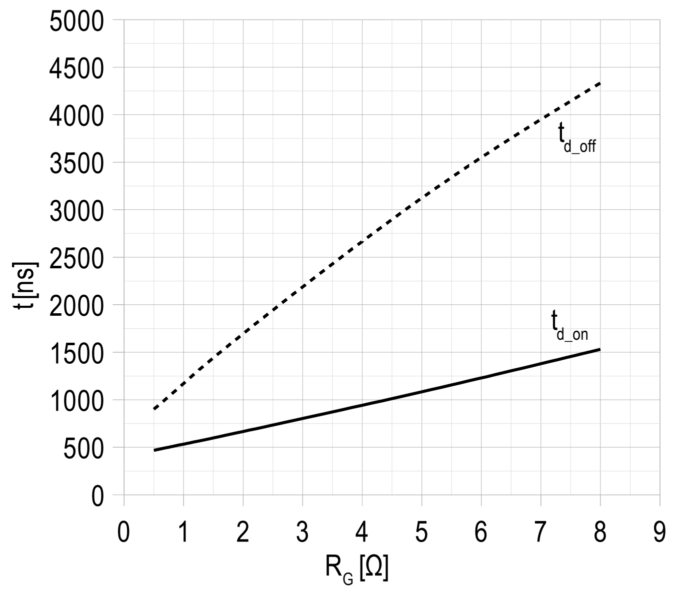
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 2400 A;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

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



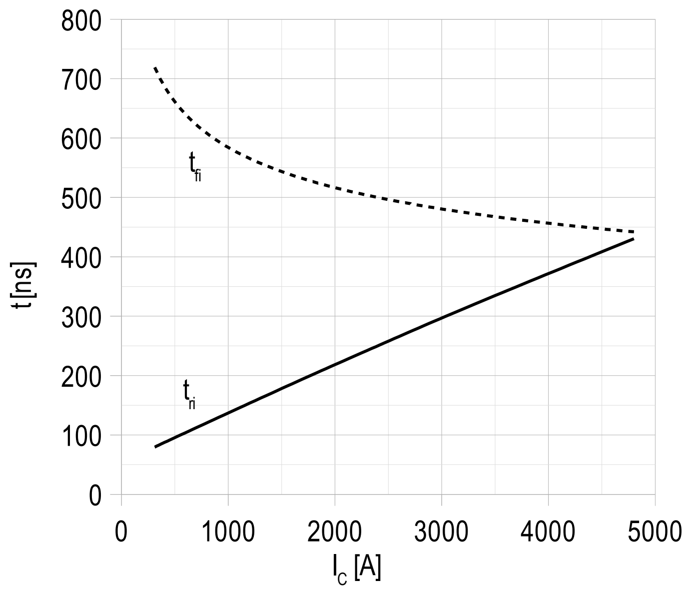
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 0.5 Ω;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

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



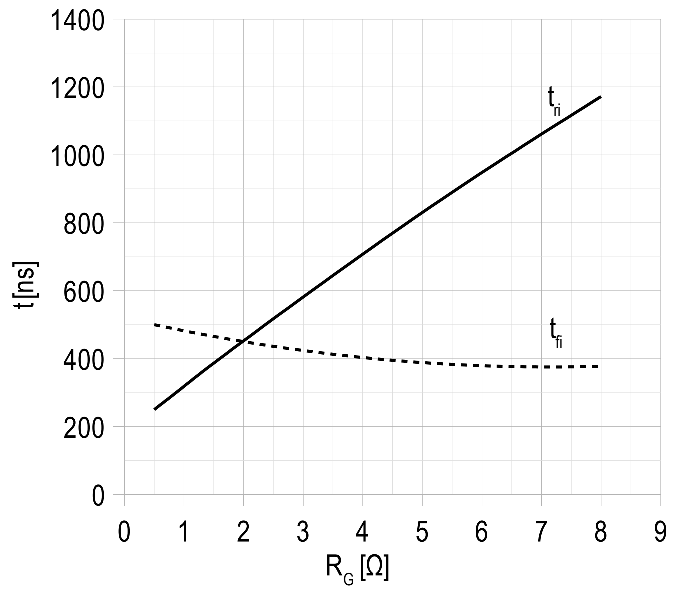
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 2400 A;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

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



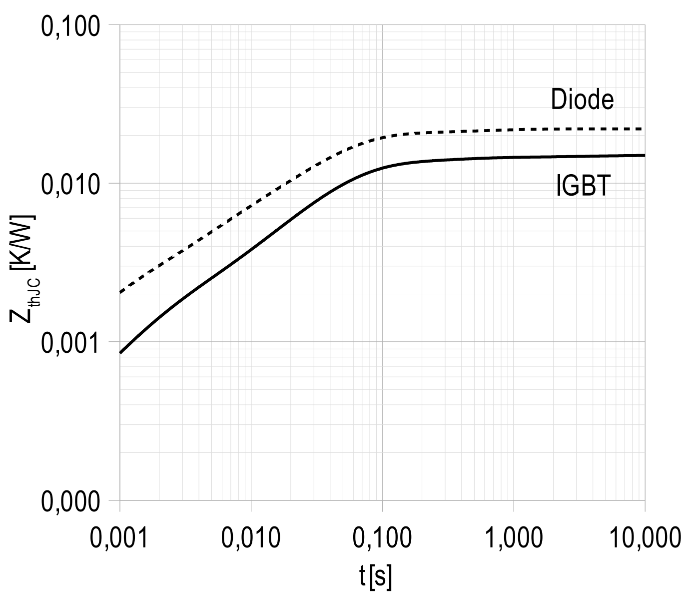
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 0.5 Ω;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

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



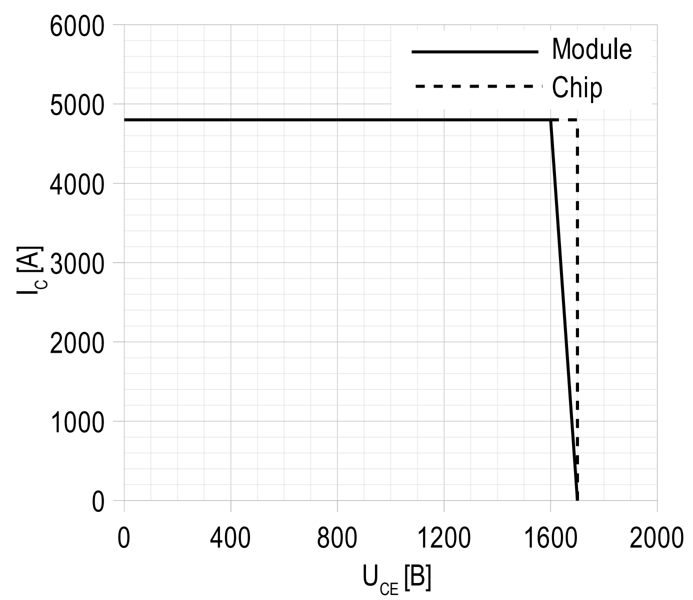
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 2400 A;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 9 – max. transient thermal impedance.



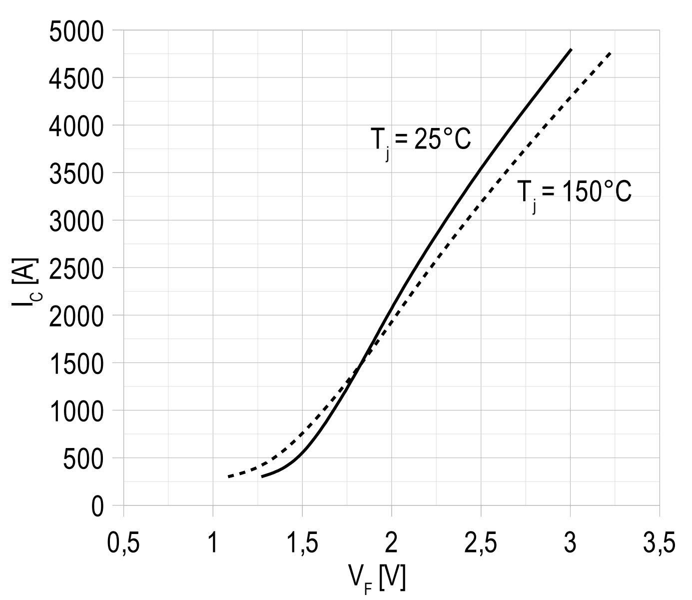
Single pulse;
V_{GE} = +15 V.

Chart 10 – RBSOA.



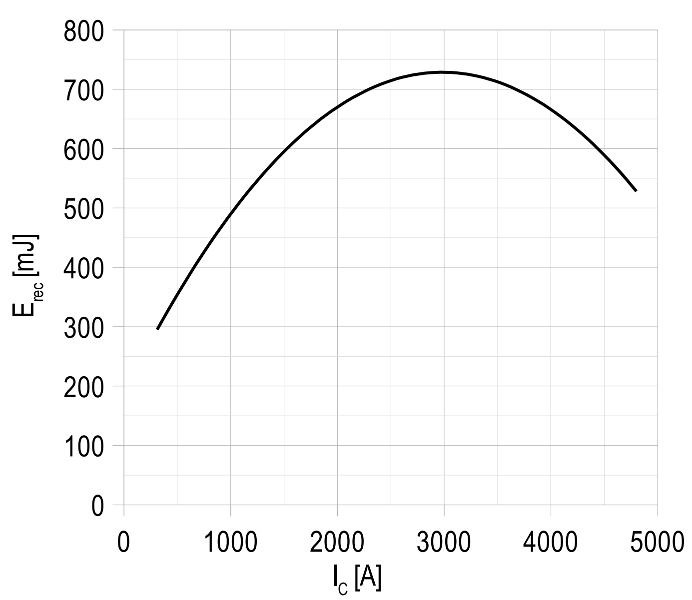
$V_{CE\ max}$ = 1700 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 2*$I_{C\ nom}$;
$R_{G\ on}$ = 1 Ω;
$R_{G\ off}$ = 20 Ω;
L_s = 100 nH.

Chart 11 – typ. output characteristic, FRD.



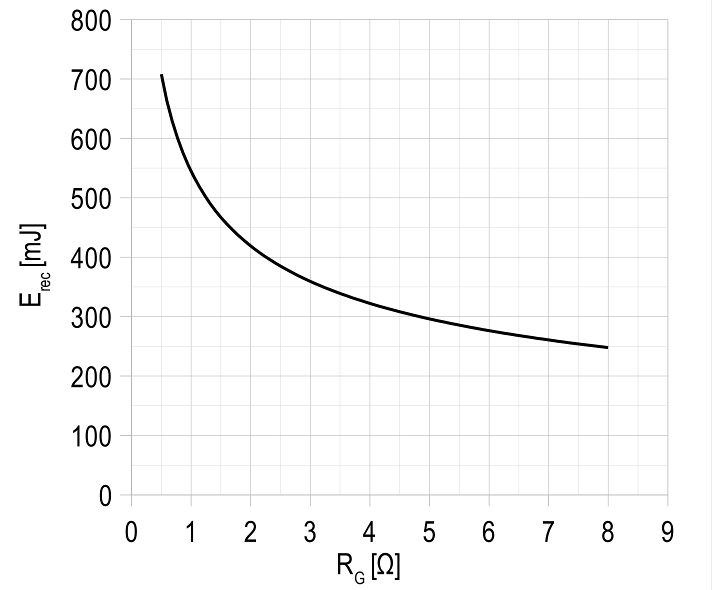
V_{GE} = 0 V.

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



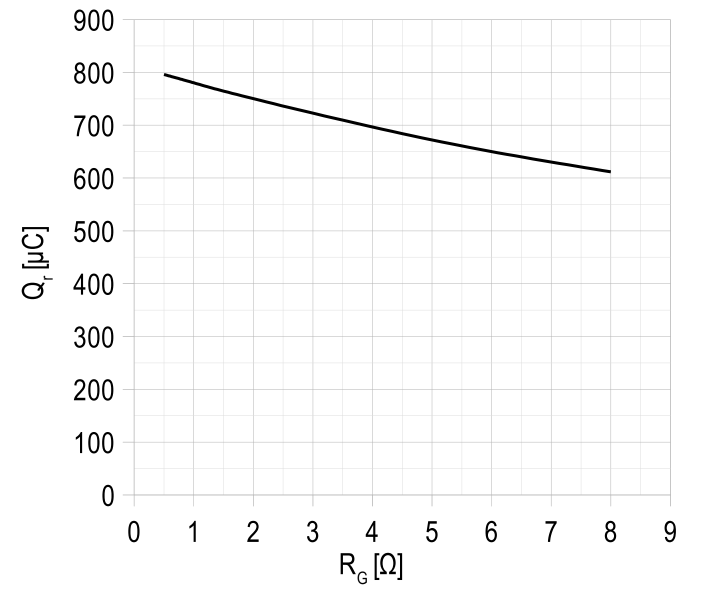
V_{GE} = ±15 V;
V_{CE} = 920 V;
$R_{G\ on}$ = 0.5 Ω;
L_s = 100 nH;
$T_{vj\ (max)}$ = 150°C.

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



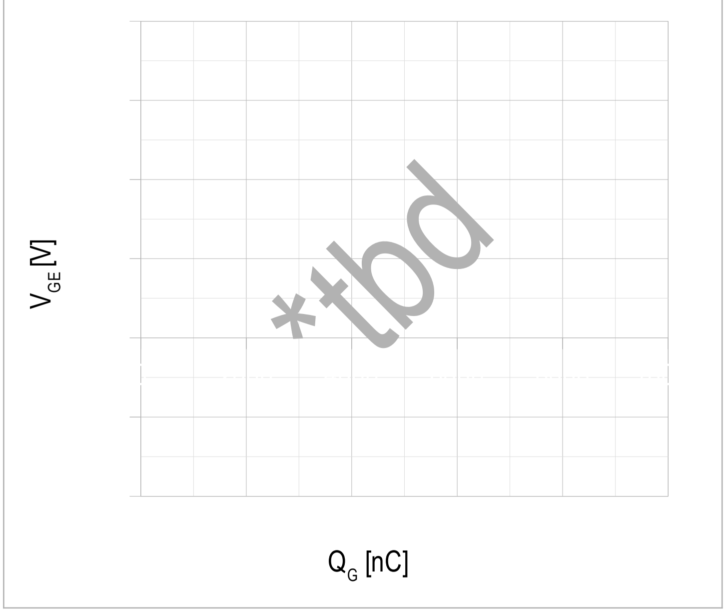
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\,max}$ = 2400 A;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

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



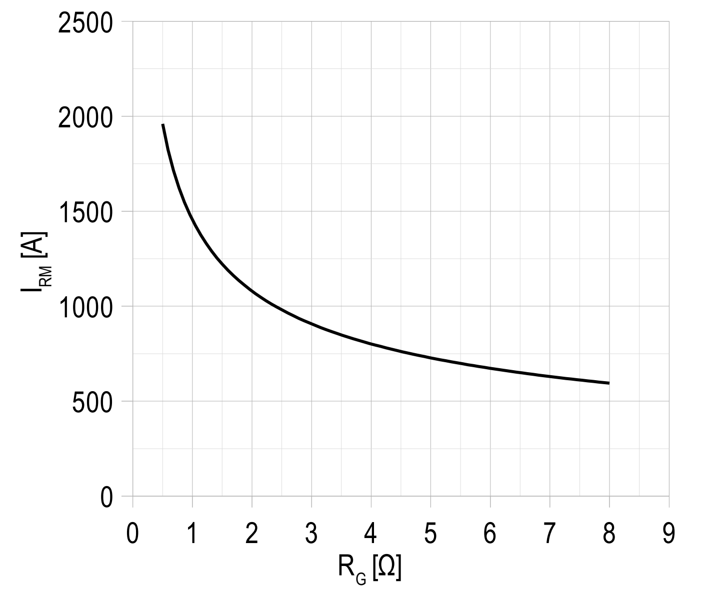
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\,max}$ = 2400 A;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 15 – typ. gate charge characteristic.



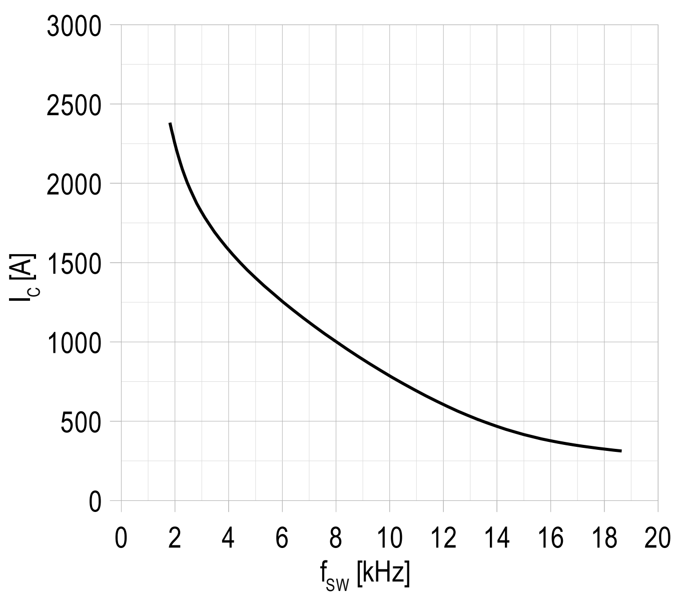
* tbd - data will be refined as additional tests are conducted and statistics are collected.

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



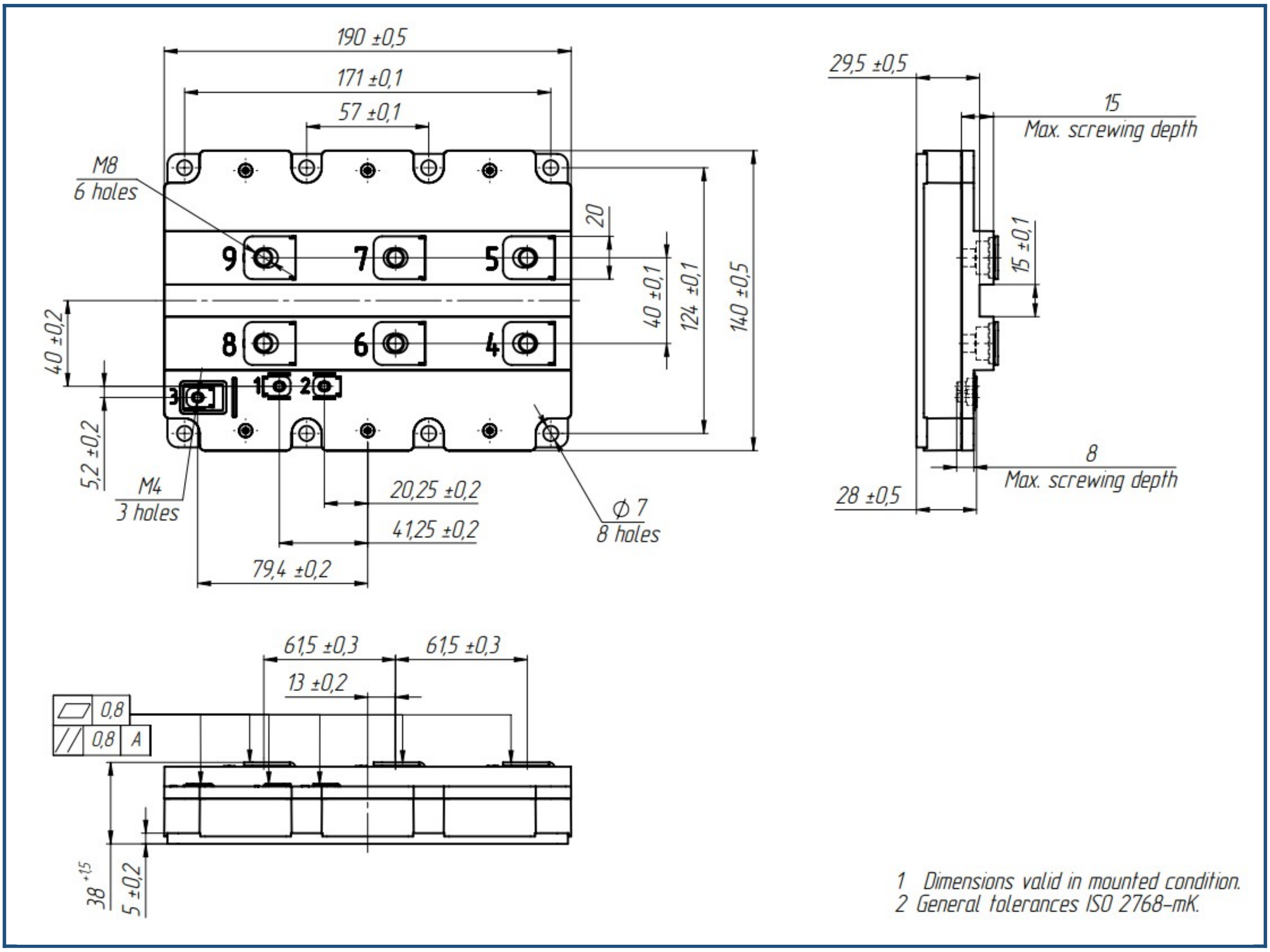
V_{CE} = 920 V;
V_{GE} = ±15 V;
L_s = 100 nH;
$T_{vj\,(max)}$ = 150°C.

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 – HM



Part numbering guide

MIHM	-	SS	17	SM	-	2400	N	
MIHM								IGBT module package type: HM
		SS						Single switch
			17					Voltage rating (V_{CES}/100)
				SM				IGBT+FRD chipset modification
						2400		Current Rating
							N	Climatic version: normal climate