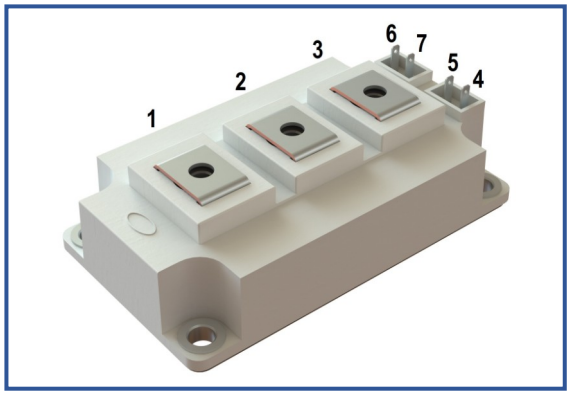
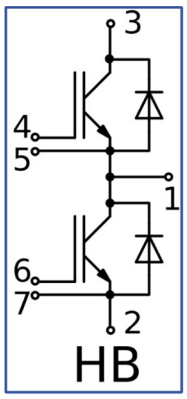
Industry standard 62mm IGBT module

1200 V 450 A





Chip features

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

Design features

- copper baseplate
- Al_2O_3 DBC substrate
- ultrasonically welded power terminals
- Improved thermal cycling
- RoHS compliant

Typical application

- AC motor drives
- solar inverter
- air conditioning
- high power converters and UPS

Maximum rated values

Definition	Symbol	Conditions	Value	Unit
IGBT				
Collector-Emitter voltage	V_{CES}	V_{GE} = 0.	1200	V
Maximum allowable collector current (continuous)	$I_{C\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	698	A
	$I_{C\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	450	A
Repetitive peak collector current*1	I_{CRM}	I_{CRM} = 2 x $I_{C\ nom}$; t_p = 1 ms.	900	A
Short-circuit duration	t_{psc}	T_{vj} = 25°C; V_{GE} = ±15 V; V_{CE} = 720 V; $R_{G\ on}$ = $R_{G\ off}$ = 2.2 Ω.	10	µs
		T_{vj} = 150°C; V_{GE} = ±15 V; V_{CE} = 720 V; $R_{G\ on}$ = $R_{G\ off}$ = 2.2 Ω.	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.	1200	V
Maximum allowable forward current (continuous)	$I_{F\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	456	A
	$I_{F\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	342	A
Repetitive peak forward current*1	I_{FRM}	I_{FRM} = 2 x $I_{F\ nom}$; t_p = 1 ms.	900	A
Junction operating temperature	$T_{vj\ (op)}$		-40…+150	°C
Module				
Storage temperature	T_{stg}		-40…+50	°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

Characteristics

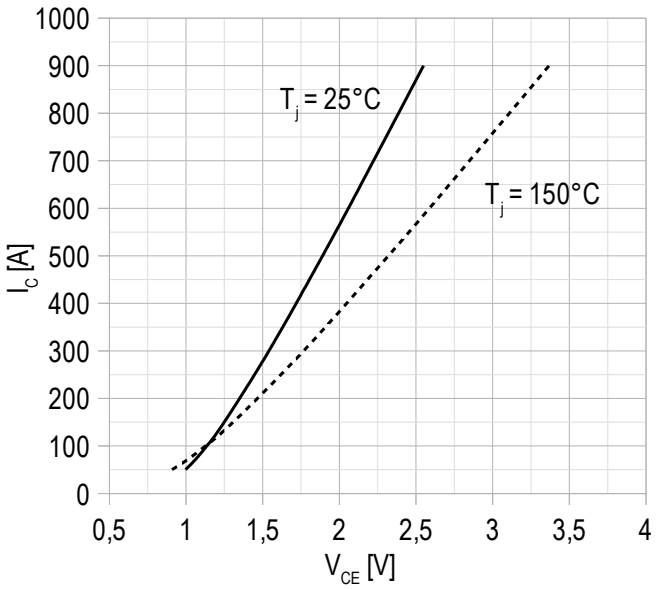
Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit
IGBT							
Collector-Emitter saturation voltage	V_{CEsat}	V_{GE} = +15 V; I_C = 450 A; t_u = 1000 µs.	T_{vj} = 25°C	1.55	1.80	2.05	V
			T_{vj} = 150°C	1.90	2.20	2.50	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C = 18 mA; V_{CE} = V_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.30	5.80	6.50	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 1200 V; t_u = 50 ms; V_{GE} = 0.	T_{vj} = 25°C	-	11.0	100	µA
			T_{vj} = 150°C	-	14.0	20.0	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} = 25°C; t_u = 30 ms.		-	11.0	100	nA
Input capacitance	C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz; T_{vj} = 25°C.		-	31.10	-	nF
Output capacitance	C_{oes}			-	2.50	-	
Reverse transfer capacitance	C_{res}			-	1.10	-	
Total gate charge	Q_G	I_G = 20 mA; V_{CE} = 600 V; V_{GE} = -8...+15 V.		-	2350	2500	nC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	-	1.90	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 600 V; V_{GE} = ±15 V; $I_{C\,max}$ = 450 A; R_G = 2.2 Ω; L_s = 56 nH.	T_{vj} = 25°C	147	196	245	ns
			T_{vj} = 150°C	191	244	297	
Rise time	t_{ri}		T_{vj} = 25°C	85	101	117	ns
			T_{vj} = 150°C	94	110	126	
Turn-on energy	E_{on}		T_{vj} = 25°C	14.0	26.0	38.0	mJ
			T_{vj} = 150°C	28.0	44.0	60.0	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	425	500	575	ns
			T_{vj} = 150°C	504	580	656	
Fall time	t_{fi}		T_{vj} = 25°C	92	116	140	ns
			T_{vj} = 150°C	163	208	253	
Turn-off energy	E_{off}		T_{vj} = 25°C	35.5	43.0	50.5	mJ
			T_{vj} = 150°C	49.5	58.0	66.5	
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 112.5 A; I_{CE2} = 450 A; t_u = 1000 µs.		0.80	0.83	0.86	V
On-State slope resistance (IGBT)	r_{CE0}			2.84	3.03	3.22	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; I_{CE} = 350±40 A; I_{test} = 0.5 A; V_{GE} = +15 V.		-	0.065	0.069	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V_F	I_F = 450 A; V_{GE} = 0; t_u = 1000 µs.	T_{vj} = 25°C	1.90	2.25	2.60	V
			T_{vj} = 150°C	2.00	2.35	2.70	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 600 V; $I_{C\,max}$ = 450 A; L_s = 56 nH; $R_{G\,on}$ = 2.2 Ω.	T_{vj} = 25°C	74	165	256	ns
			T_{vj} = 150°C	313	407	501	ns
Peak reverse current	I_{RM}		T_{vj} = 25°C	125	190	255	A
			T_{vj} = 150°C	185	270	355	A
Recovered charge	Q_r		T_{vj} = 25°C	11.5	18.0	24.5	µC
			T_{vj} = 150°C	37.5	51.0	64.5	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	4.5	10.0	15.5	mJ
			T_{vj} = 150°C	16.5	25.0	33.5	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; I_{CE1} = 112.5 A; I_{CE2} = 450 A; t_u = 1000 µs.		0.90	0.93	0.96	V
Forward slope resistance	r_T			2.93	3.16	3.39	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; I_{CE} = 350±40 A; I_{test} = 0.5 A; V_{GE} = +15 V.		-	0.124	0.131	K/W

Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	R_{P12}	-	0.28	0.50	mΩ
			R_{P13}	-	0.38	0.50	
Parasitic inductance between terminals	L_{Pce}			-	22	-	nH
Thermal resistance case to heatsink	R_{thCH}	per module			0.02	0.04	K/W
Mounting torque for screws to heatsink	M_s	to heatsink M6		3.00	-	5.00	N*m
Mounting torque for terminal screws	M_t	to terminals M6		2.25	2.50	2.75	N*m
Weight	W			-	320	340	g

Notes:

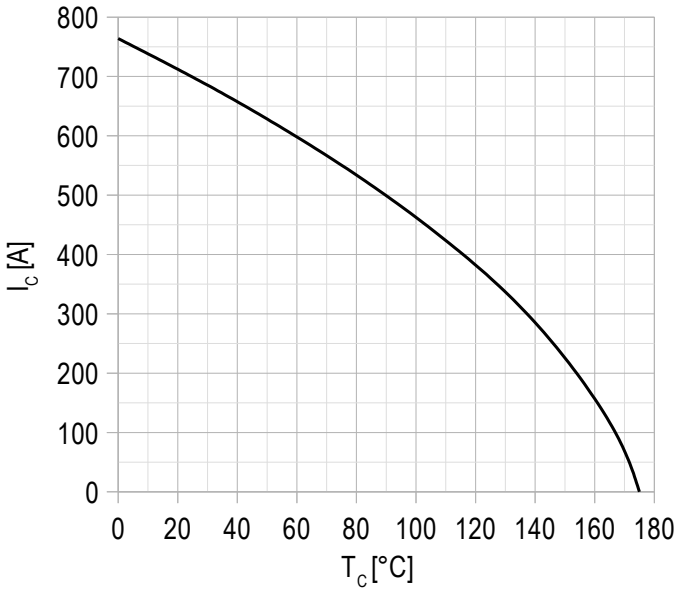
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op}$ = - 40...+150°C.

Chart 1 – typ. output characteristic, IGBT.



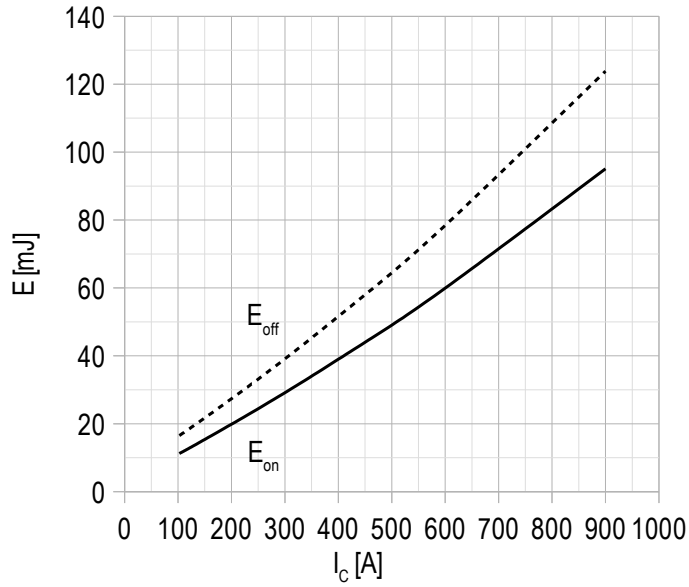
V_{GE} = +15 V.

Chart 2 – max. rated current vs temperature.



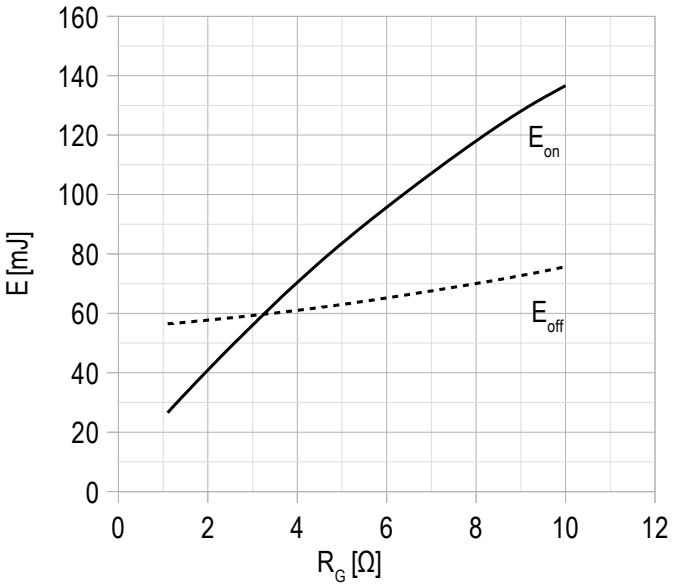
DC;
V_{GE} = +15 V;
$T_{vj\ (max)}$ = 175°C.

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



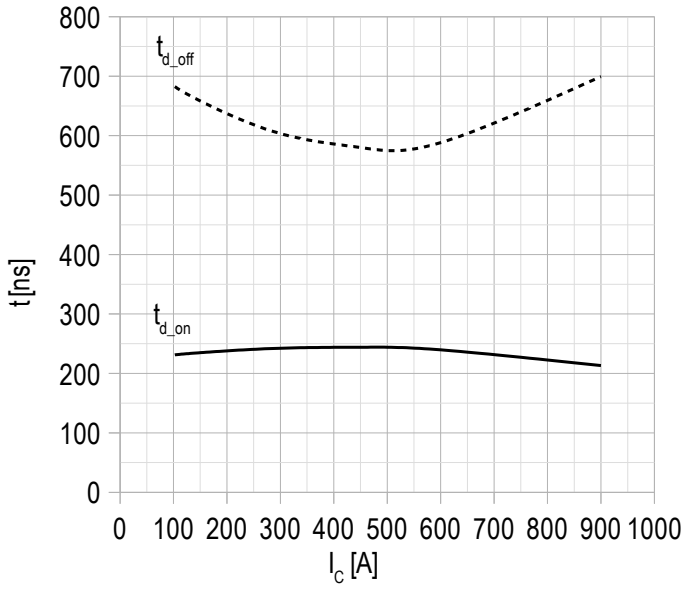
V_{CE} = 600 V;
V_{GE} = ±15 V;
R_G = 2.2 Ω;
L_s = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



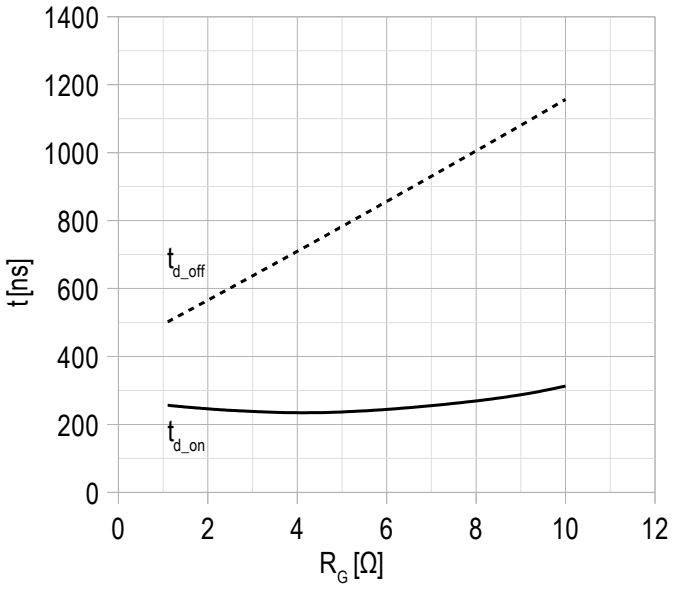
V_{CE} = 600 V;
V_{GE} = ±15 V;
I_{Cmax} = 450 A;
L_s = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



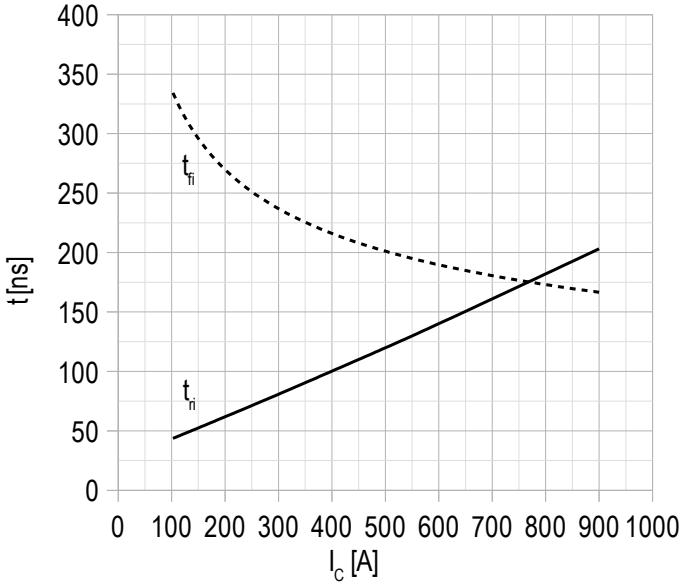
V_{CE} = 600 V;
V_{GE} = ±15 V;
R_G = 2.2 Ω;
L_s = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



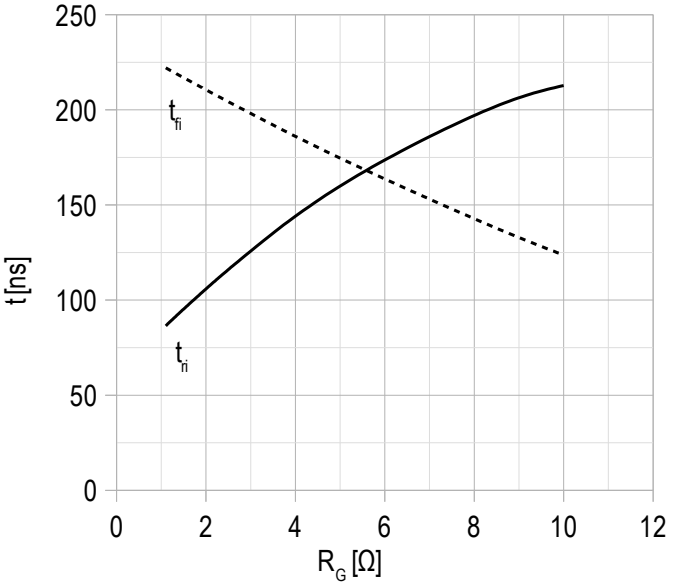
V_{CE} = 600 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 450 A;
L_s = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



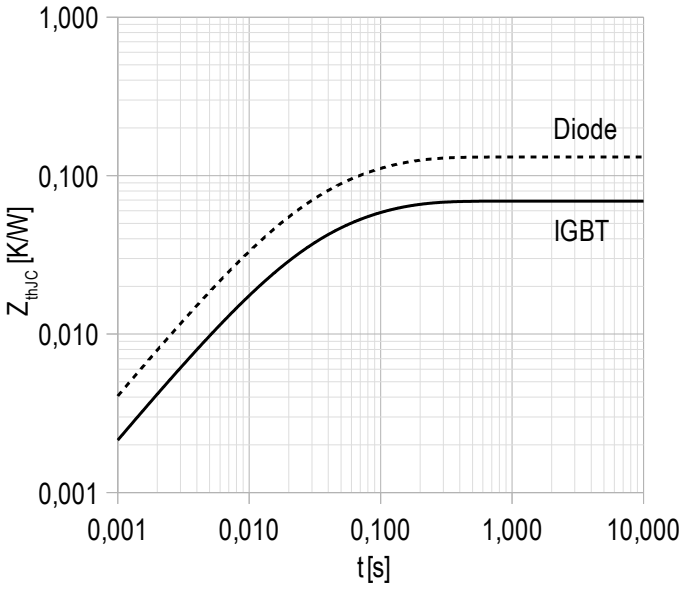
V_{CE} = 600 V;
V_{GE} = ±15 V;
R_G = 2.2 Ω;
L_s = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



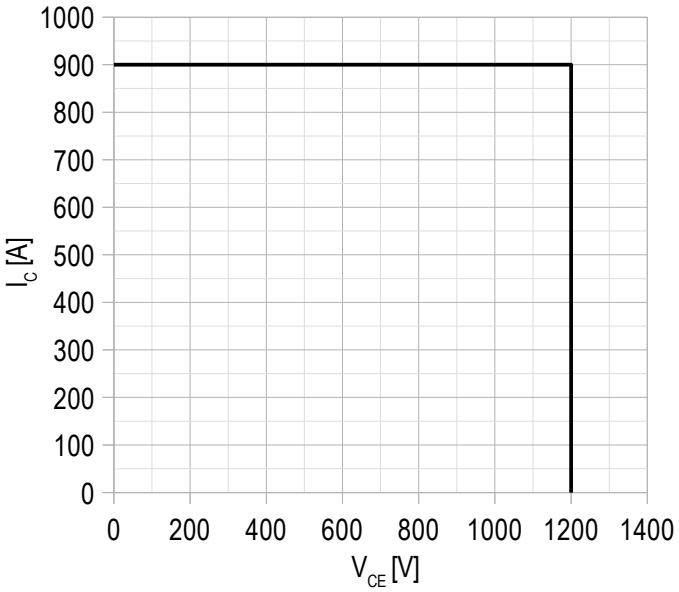
V_{CE} = 600 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 450 A;
L_s = 56 nH.
$T_{vj\ (max)}$ = 150°C.

Chart 9 – max. transient thermal impedance .



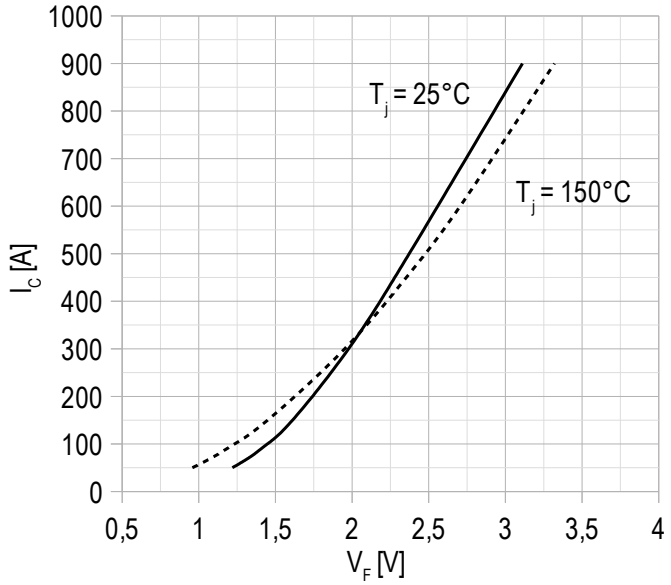
Single pulse;
V_{GE} = +15 V.

Chart 10 – RBSOA.



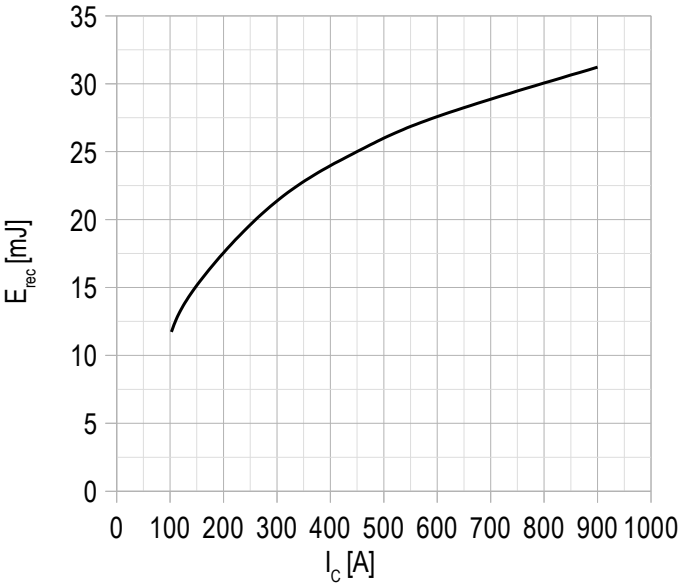
$V_{CE\ max}$ = 1200 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 2*$I_{C\ nom}$;
R_G = 2.2 Ω;
L_s = 56 nH.

Chart 11 – typ. output characteristic, FRD.



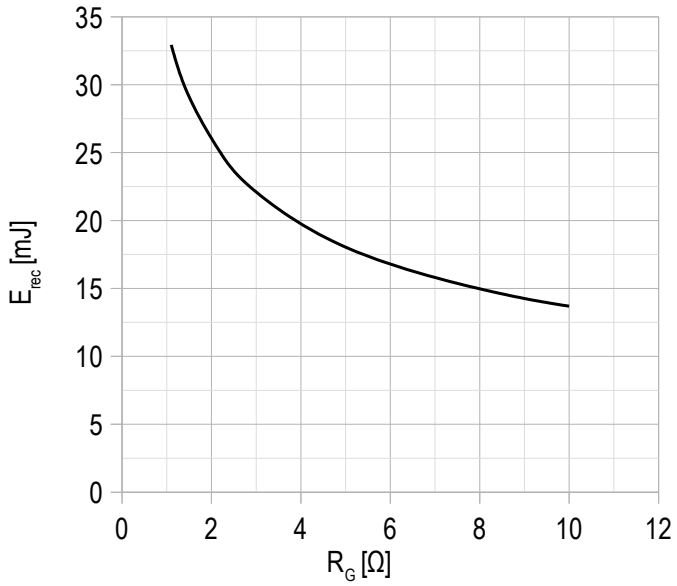
V_{GE} = 0 V.

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



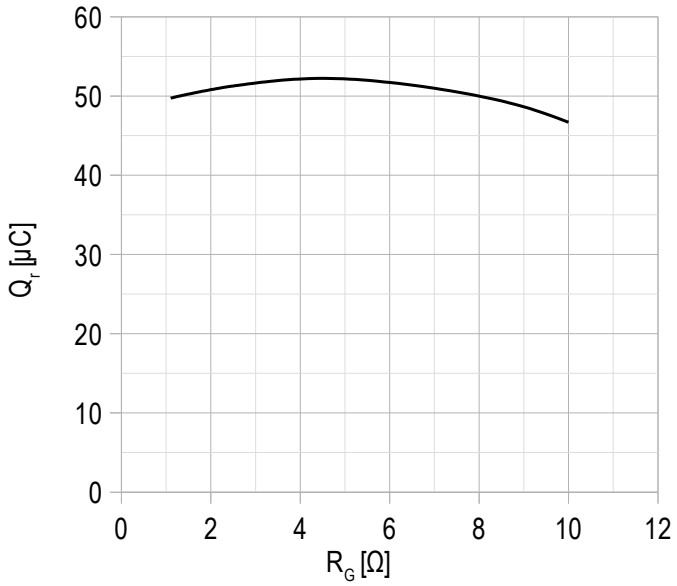
V_{GE} = ±15 V;
V_{CE} = 600 V;
L_s = 56 nH;
$R_{G\ on}$ = 2.2 Ω;
$T_{vj\ (max)}$ = 150°C.

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



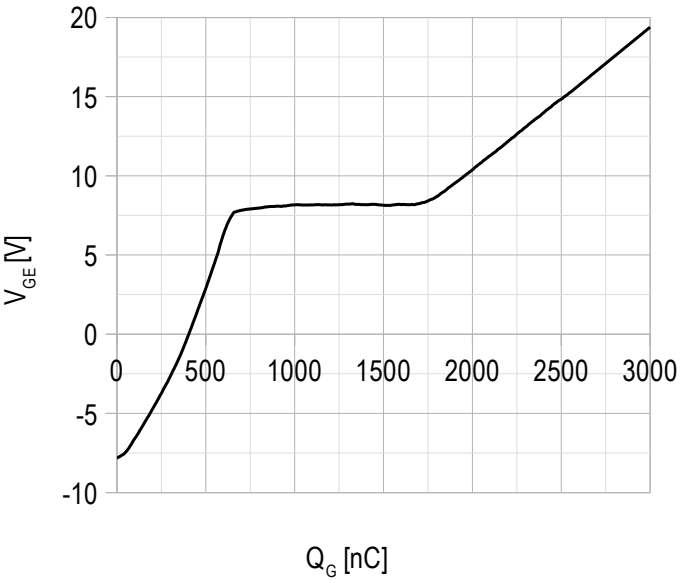
V_{GE} = ±15 V;
V_{CE} = 600 V;
$I_{C\ max}$ = 450 A;
L_s = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



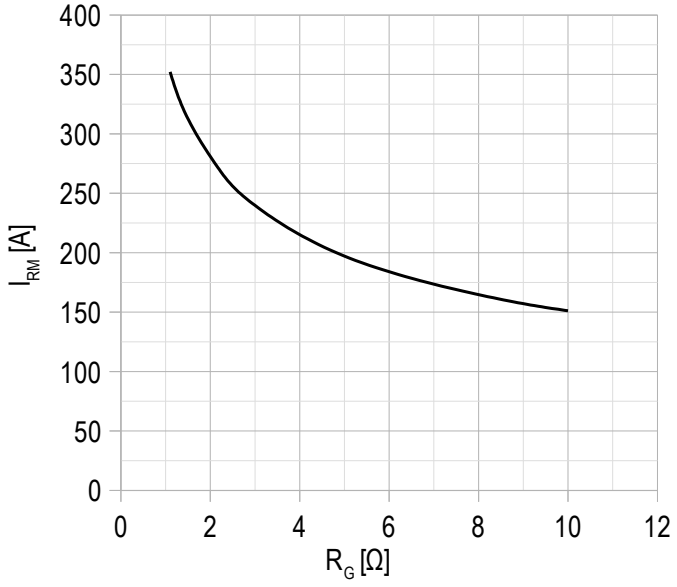
V_{GE} = ±15 V;
V_{CE} = 600 V;
$I_{C\ max}$ = 450 A;
L_s = 56 nH;
$T_{vj\ (max)}$ = 150°C.

Chart 15 – typ. gate charge characteristic.



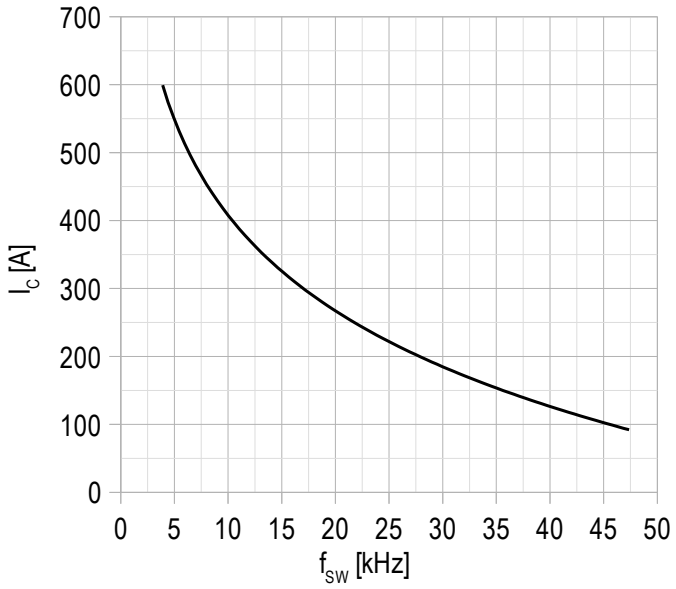
I_C = 450 A;
V_{CE} = 600 V;
V_{GE} = - 8÷15 V.

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



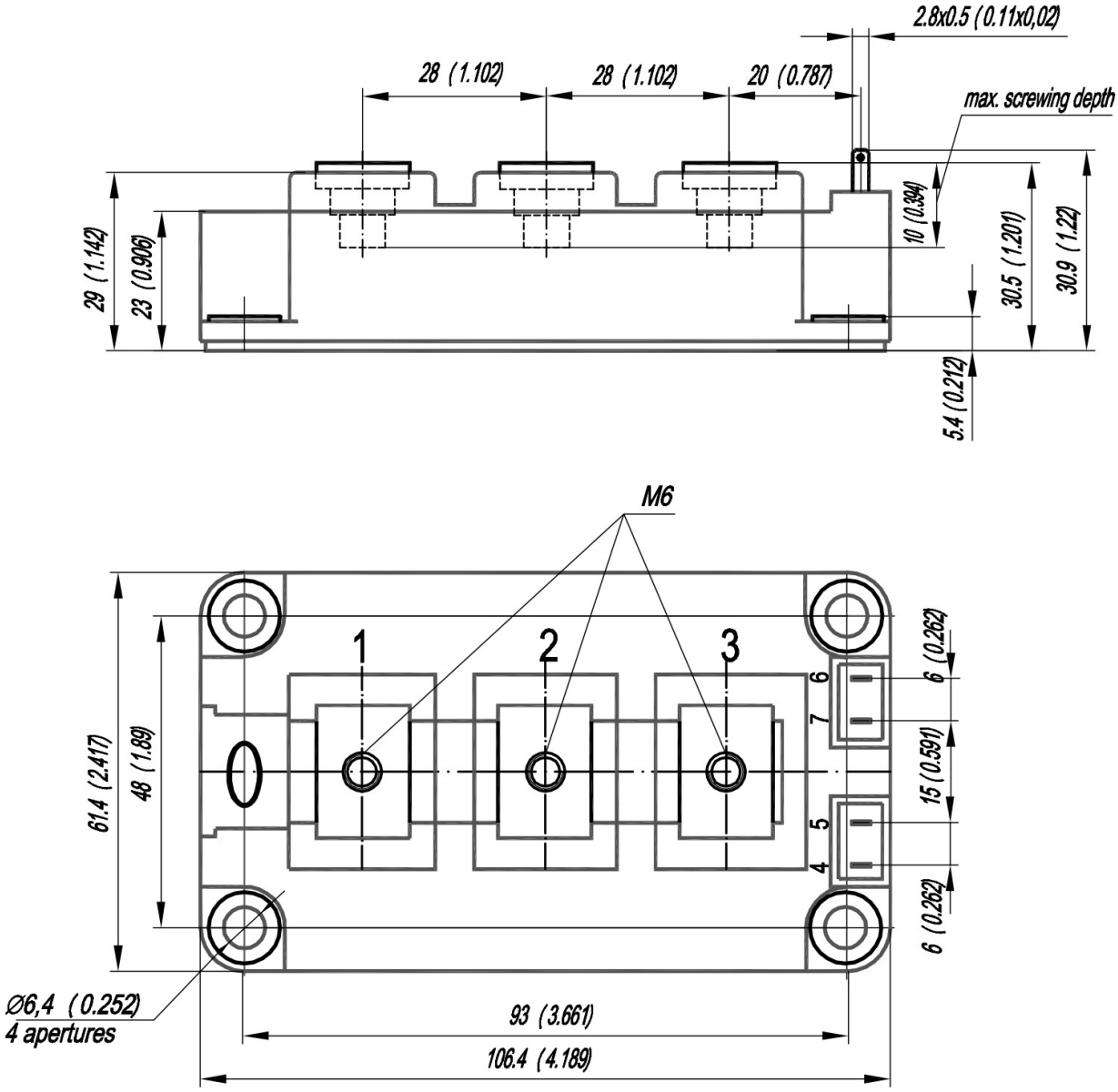
V_{CE} = 600 V;
V_{GE} = ±15 V;
L_s = 56 nH.
$T_{vj\ (max)}$ = 150°C.

Chart 17 – max. rated current vs frequency.



Duty cycle 50%;
V_{CE} = 600 V;
T_c = 80 °C;
$T_{vj\ (max)}$ = 175 °C.

Overall dimensions: Package type – AA



Part numbering guide

MIAA	-	HB	12	SA	-	450	N	
MIAA								IGBT module package type: AA
		HB						2 switches as Half-Bridge
			12					Voltage rating (V_{CES}/100)
				SA				IGBT+FRD chipset modification
						450		Current Rating
							N	Climatic version: normal climate