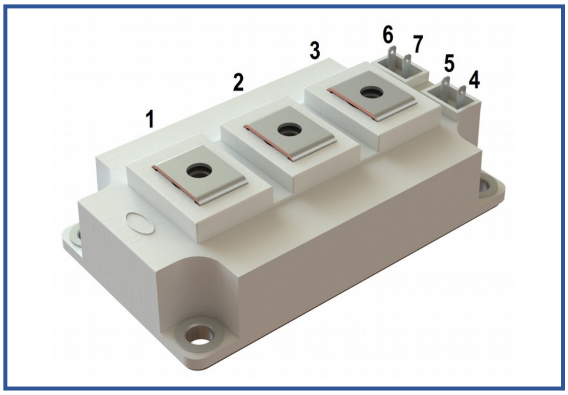
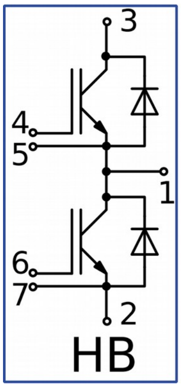
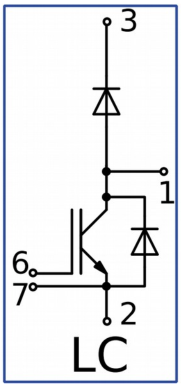
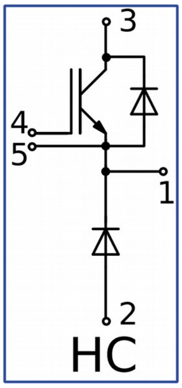
Industry standard 62mm IGBT module — 1700 V 200 A









Chip features

- IGBT chip
  - Trench FS — V-Series IGBT (Fuji 6th gen)
  - 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.	1700	V
Collector current (nominal)	$I_{C\ nom}$		200	A
Collector current (maximum continuous)	$I_{C\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	300	A
	$I_{C\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	200	A
Repetitive peak collector current*1	I_{CRM}	I_{CRM} = 3 x $I_{C\ nom}$; t_p = 1 ms.	600	A
Short-circuit duration	t_{psc}	T_{vj} = 25°C; V_{GE} = ±15 V; V_{CE} = 1000V; $R_{G\ on}$ = $R_{G\ off}$ = 2.2 Ω; I_{Cmax} < 1300 A.	10	µs
		T_{vj} = 150°C; V_{GE}=±15 V; V_{CE} = 1000V; $R_{G\ on}$ = $R_{G\ off}$ = 2.2 Ω; I_{Cmax} < 1200 A.	10	
Gate-Emitter voltage	U_{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
Forward current (nominal)	$I_{F\ nom}$		200	A
Forward current (maximum continuous)	$I_{F\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	223	A
	$I_{F\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	166	A
Repetitive peak forward current*1	I_{FRM}	I_{FRM} = 3 x $I_{F\ nom}$; t_p = 1 ms.	600	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.	4000	V

*1 Pulse width and repetition rate should be such that device junction temperature does not exceed maximum T_{vj} rating.

Characteristics

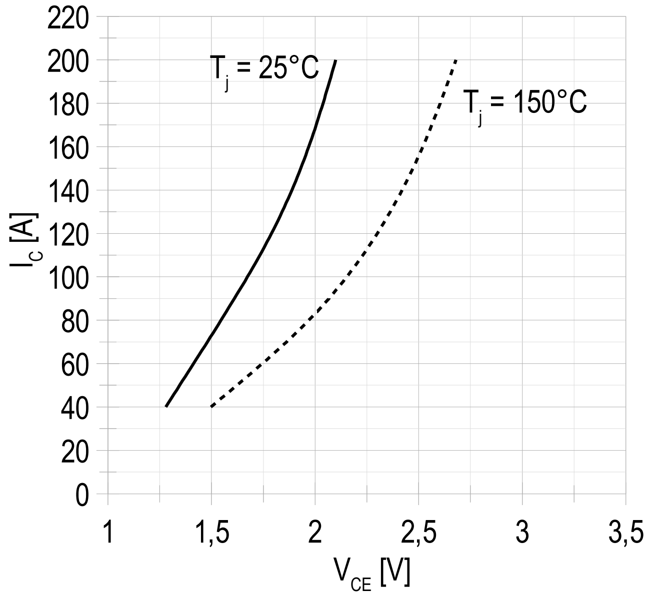
Definition	Symbol	Conditions		Value			Unit.
				min.	typ.	max.	
IGBT							
Collector-Emitter saturation voltage	V_{CEsat}	V_{GE} = +15 V; I_C = 200 A; t_u = 1000 µs.	T_{vj} = 25°C	2.08	2.10	2.28	V
			T_{vj} = 150°C	2.62	2.68	2.92	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C = 8 mA; V_{CE} = V_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.20	5.73	6.40	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 1700 V; t_u = 50 ms; V_{GE} = 0.	T_{vj} = 25°C	3.90	4.81	300	µA
			T_{vj} = 150°C	0.97	1.20	3.0	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} = 25°C; t_u = 30 ms.		15.5	20.4	500	nA
Input capacitance	C_{ies}	V_{CE} = 10 V; V_{GE} = 0 V; f = 1 MHz; T_{vj} = 25°C.		-	19.8	-	nF
Output capacitatce	C_{oes}			-	1.00	-	nF
Reverse transfer capacitance	C_{res}			-	1.60	-	nF
Total gate charge	Q_G	I_C = 200 A; V_{CE} = 920 V; V_{GE} = - 8÷15 V.		-	2336	2520	nC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	3.75	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 920 V; V_{GE} = ±15 V; $I_{C\,max}$ = 200 A; R_G = 2.2 Ω; L = 100 µH.	T_{vj} = 25°C	412	440	520	ns
			T_{vj} = 150°C	496	508	580	
Rise time	t_{ri}		T_{vj} = 25°C	42.0	43.0	60.0	ns
			T_{vj} = 150°C	48.0	49.0	70.0	
Turn-on energy	E_{on}		T_{vj} = 25°C	20.0	21.0	33.0	mJ
			T_{vj} = 150°C	39.0	41.0	55.0	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	510	520	610	ns
			T_{vj} = 150°C	630	660	810	
Fall time	t_{fi}		T_{vj} = 25°C	544	564	660	ns
			T_{vj} = 150°C	640	684	840	
Turn-off energy	E_{off}		T_{vj} = 25°C	37.0	39.0	53.0	mJ
			T_{vj} = 150°C	54.0	56.0	73.0	
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 50 A; I_{CE2} = 200 A; t_u = 1000 µs.		0.98	1.00	1.07	V
On-State slope resistance (IGBT)	r_{CE0}			8.13	8.39	9.03	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; I_{CE} = 150±10 A; I_{test} = 0.5 A; V_{GE} = +15 V.		-	0.126	0.132	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V_F	I_F = 200 A; V_{GE} = 0; t_u = 1000 µs.	T_{vj} = 25°C	1.83	1.87	2.00	V
			T_{vj} = 150°C	2.04	2.10	2.37	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 920 V; $I_{C\,max}$ = 200 A; $R_{G\,on}$ = 2.2 Ω; L = 100 µH.	T_{vj} = 25°C	132	145	180	ns
			T_{vj} = 150°C	186	256	350	ns
Peak reverse recovery current	I_{rrM}		T_{vj} = 25°C	256	266	300	A
			T_{vj} = 150°C	279	293	330	A
Reverse recovered charge	Q_{rr}		T_{vj} = 25°C	20.0	22.0	28.0	µC
			T_{vj} = 150°C	31.0	38.0	49.0	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	13.0	26.0	41.0	mJ
			T_{vj} = 150°C	43.0	53.0	67.0	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; I_{CE1} = 50 A; I_{CE2} = 200 A; t_u = 1000 µs		0.91	0.93	0.98	V
Forward slope resistance	r_T			5.60	5.85	6.37	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; I_{CE} = 80±10 A; I_{test} = 0.5 A; V_{GE} = +15 V.		-	0.254	0.280	K/W

Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	R_{P12}	-	0.47	0.50	mΩ
			R_{P13}	-	0.66	0.66	
Parasitic inductance between terminals	L_{Pxy}	T_{vj} = 25°C; f = 1 MHz.	L_{P12}	-	33.4	35.0	nH
			L_{P13}	-	56.0	60.0	
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	-	5	N*m
Mounting torque for terminal screws	M_t	to terminals M6		2.25	2.50	2.75	N*m
Weight	W			-	318	340	g

Notes:

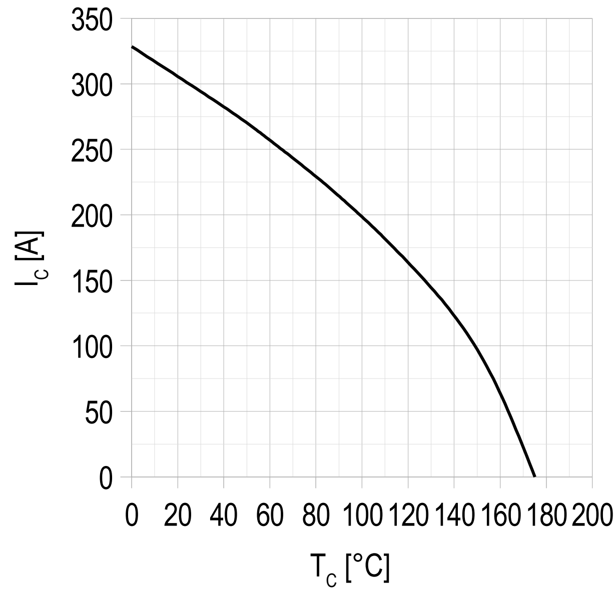
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op}$ = - 40 ÷ +150°C.

Chart 1 – typ. output characteristic, IGBT.



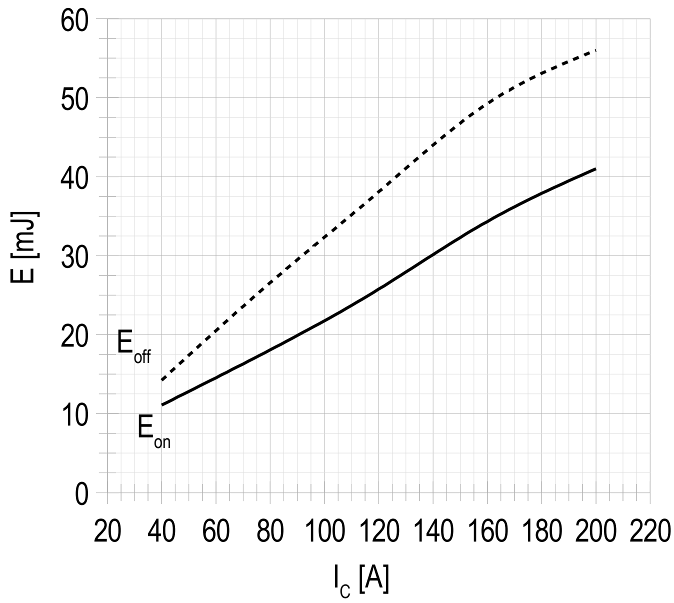
V_{GE} = +15 V.

Chart 2 – max. rated current vs temperature.



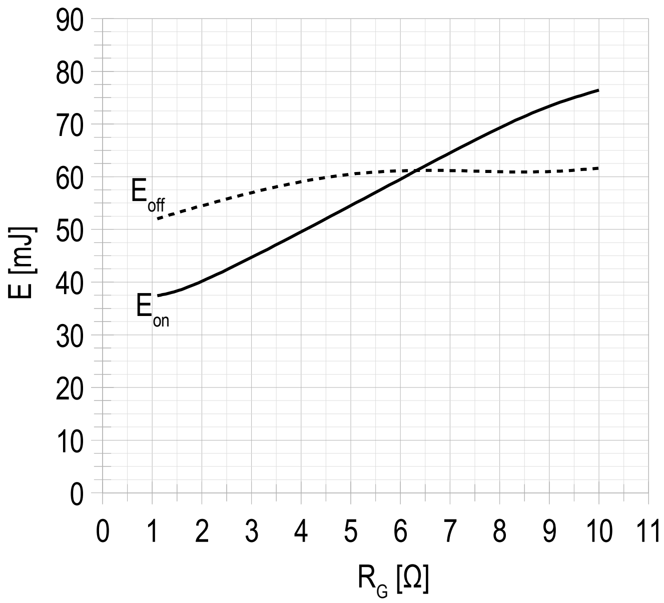
DC;
V_{GE} = +15 V;
$T_{vj\,(max)}$ = 175°C.

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



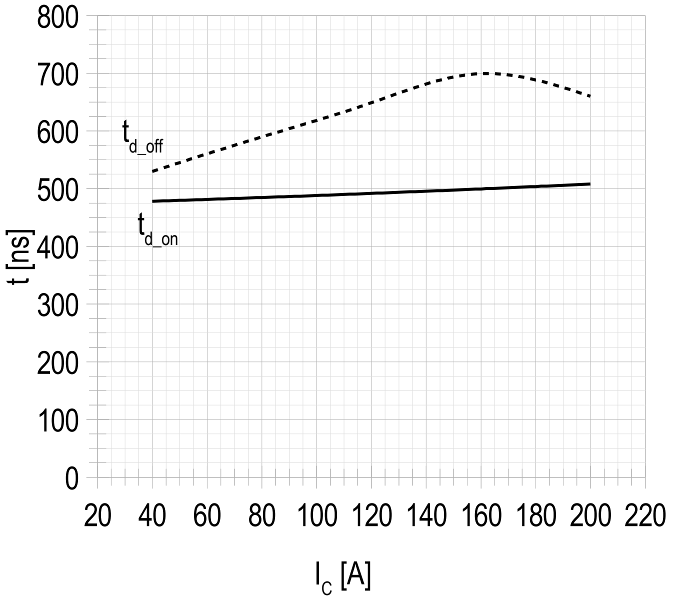
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 2.2 Ω;
L = 100 μH;
$T_{vj\,(max)}$ = 150°C.

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



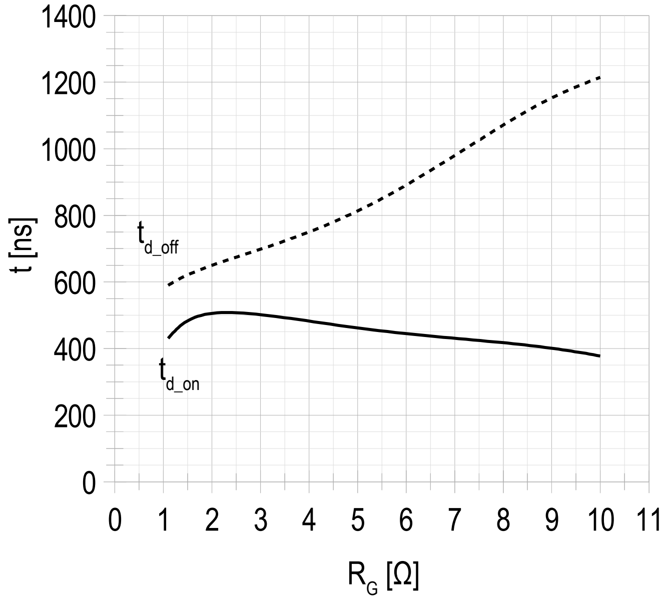
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 200 A;
L = 100 μH;
$T_{vj\,(max)}$ = 150°C.

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



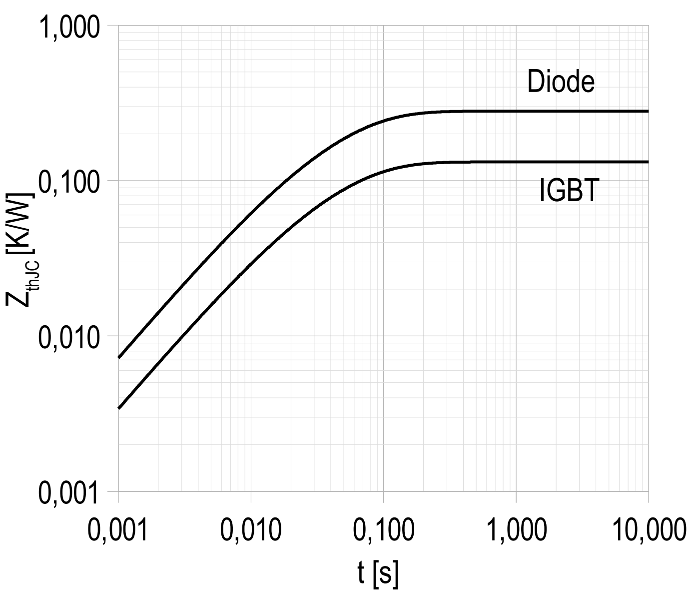
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 2.2 Ω;
L = 100 μH;
$T_{vj\,(max)}$ = 150°C.

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



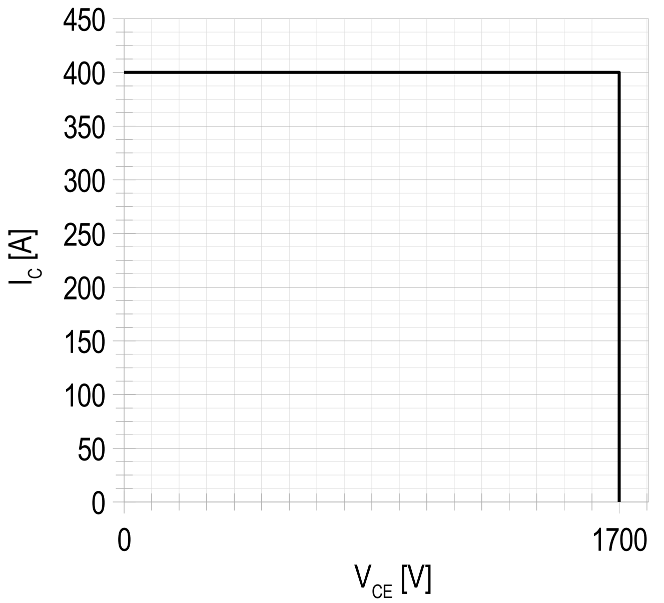
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 200 A;
L = 100 μH;
$T_{vj\,(max)}$ = 150°C.

Chart 7 – max. transient thermal impedance .



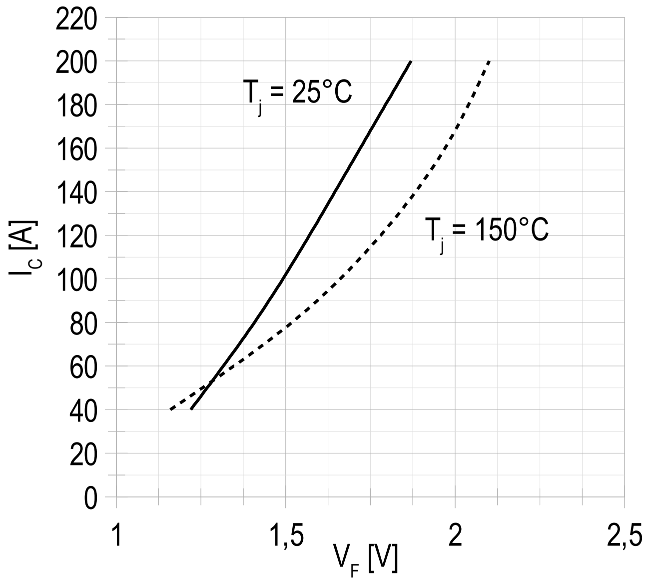
Single pulse;
V_{GE} = +15 V.

Chart 8 – RBSOA.



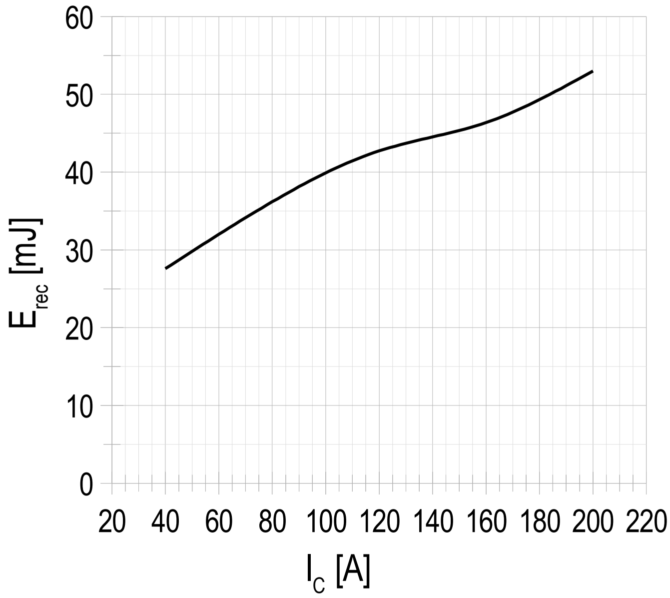
$V_{CE\,max}$ = 1700 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 2*$I_{C\,nom}$;
R_G = 2.2 Ω;
L = 100 μH.

Chart 9 – typ. output characteristic, FRD.



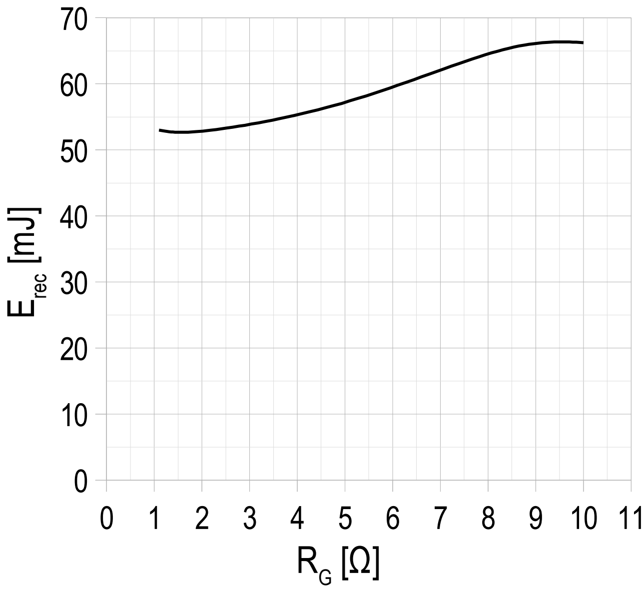
V_{GE} = +15 V.

Chart 10 – typ. switching losses vs rated current, FRD.



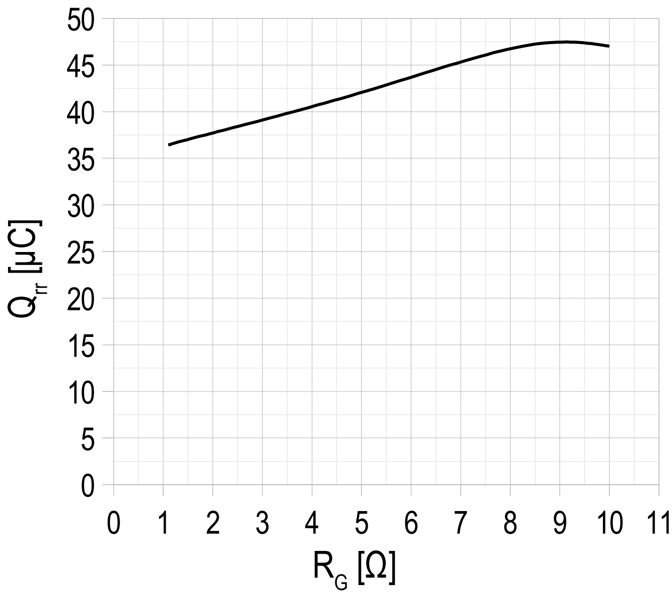
V_{GE} = ±15 V;
V_{CE} = 920 V;
L = 100 μH;
$R_{G\,on}$ = 2.2 Ω;
$T_{vj\,(max)}$ = 150°C.

Chart 11 – typ. switching losses vs gate resistance, FRD.



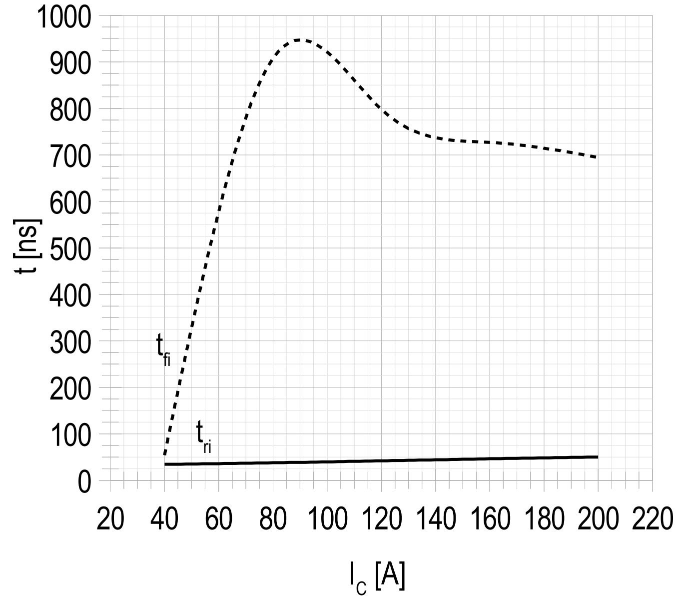
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\,max}$ = 200 A;
L = 100 μH;
$T_{vj\,(max)}$ = 150°C.

Chart 12 – typ. reverse recovered charge vs gate resistance, FRD.



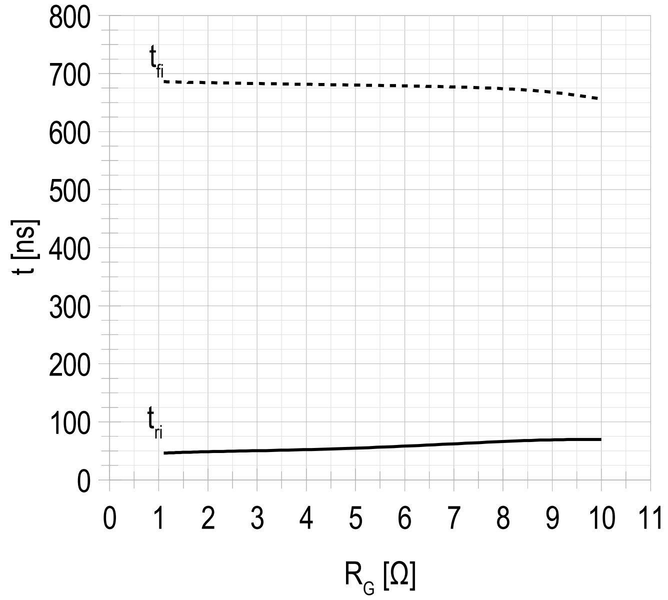
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\,max}$ = 200 A;
L = 100 μH;
$T_{vj\,(max)}$ = 150°C.

Chart 13 – typ. switching times vs rated current, FRD.



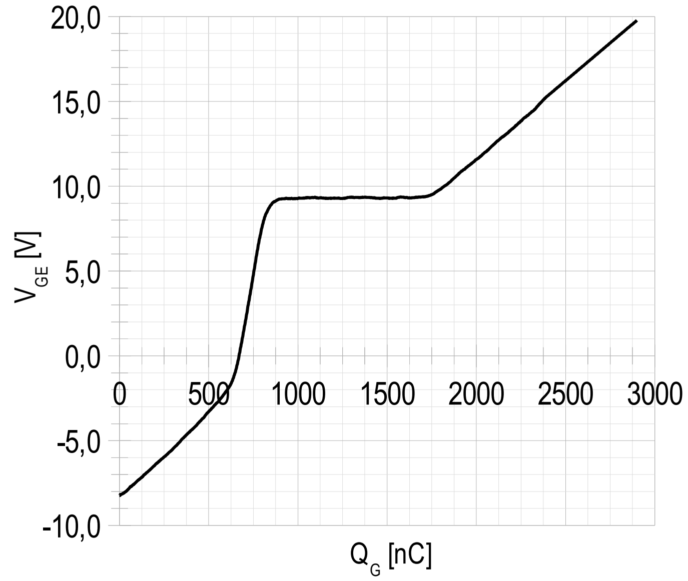
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 2.2 Ω;
L = 100 µH;
$T_{vj\,(max)}$ = 150°C.

Chart 14 – typ. switching times vs gate resistance, FRD.



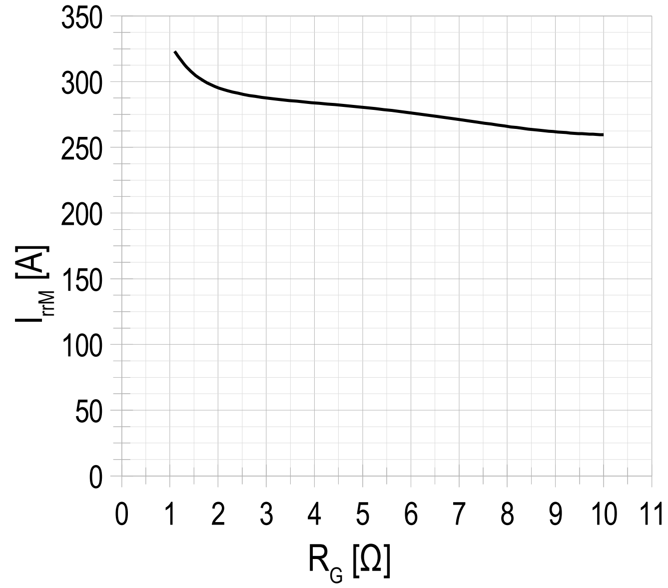
V_{CE} = 920 V;
U_{GE} = ±15 V;
$I_{C\,max}$ = 200 A;
L = 100 µH;
$T_{vj\,(max)}$ = 150°C.

Chart 15 – typ. gate charge characteristic.



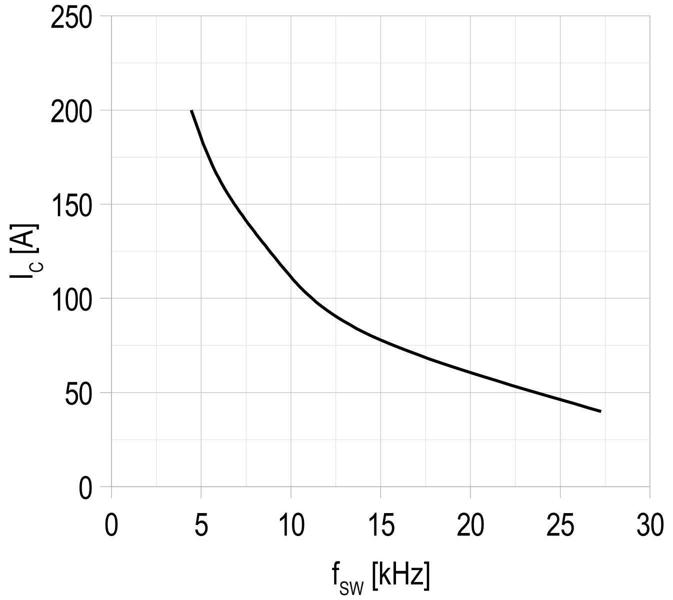
I_C = 200 A;
V_{CE} = 920 V;
V_{GE} = - 8÷15 V.

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



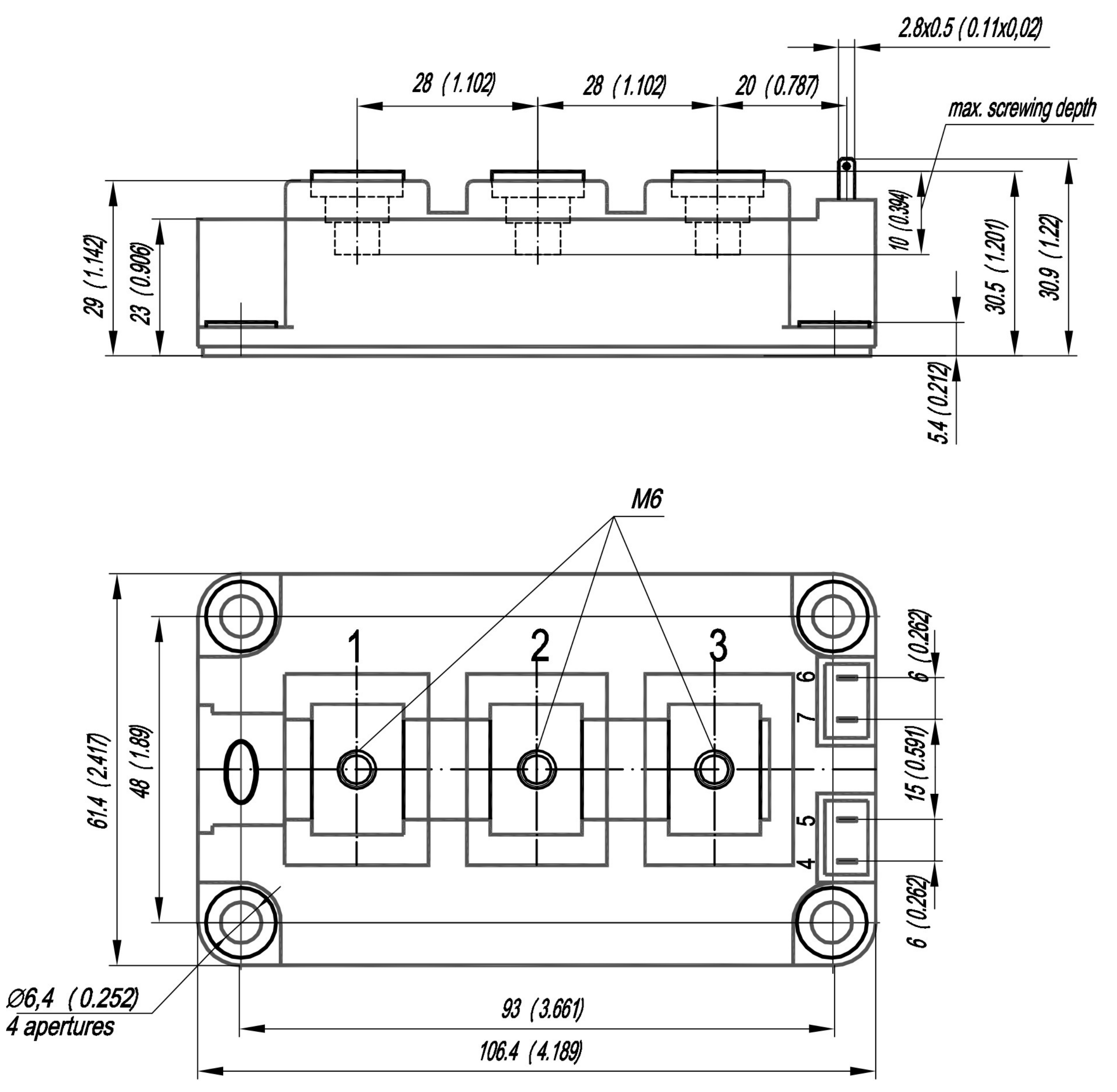
V_{CE} = 920 V;
V_{GE} = ±15 V;
L = 100 µH.
$T_{vj\,(max)}$ = 150°C.

Chart 17 – typ. rated current vs frequency.



Duty cycle 50%

Overall dimensions: Package type – AA



Part numbering guide

MIAA	-	HB	17	AA	-	200	N	
MIAA								IGBT module package type: AA
		HB						2 switches as Half-Bridge
		HC						1 switch as High-Side chopper
		LC						1 switch as Low-Side chopper
			17					Voltage rating (V_{CE}/100)
				AA				IGBT+FRD chipset modification
						200		Current Rating
							N	Climatic version: normal climate