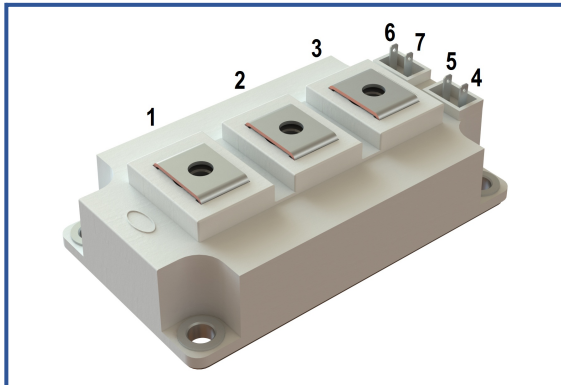


Industry standard 62mm IGBT module

1700 V 300 A


Chip features

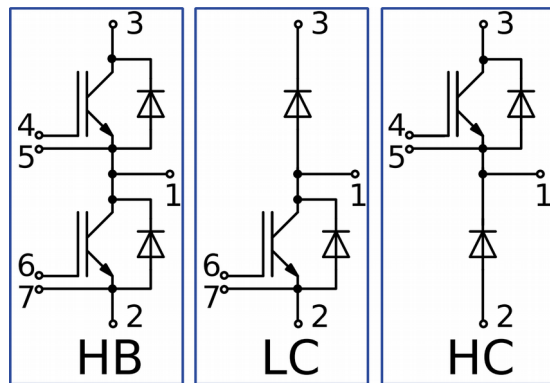
- IGBT chip
 - Trench FS — V-Series IGBT (Fuji 6th gen)
 - low $V_{CE(sat)}$ value
 - 10 μ s short circuit of 150°C
 - square RBSOA of $2xI_C$
 - low EMI
- FRD chip
 - fast and soft reverse recovery
 - low voltage drop

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)	$I_{C\ nom}$		300	A
Collector current (maximum continuous)	$I_{C\ 25}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 25^{\circ}C.$	390	A
	$I_{C\ 80}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 80^{\circ}C.$	300	A
Repetitive peak collector current ^{*1}	I_{CRM}	$I_{CRM} = 3 \times I_{C\ nom}; t_p = 1\ ms.$	900	A
Short-circuit duration	t_{psc}	$T_{vj} = 25^{\circ}C; V_{GE} = \pm 15\ V; V_{CE} = 1000\ V;$ $R_{G\ on} = R_{G\ off} = 2.2\ \Omega; I_{Cmax} < 1900\ A.$	10	μ s
		$T_{vj} = 150^{\circ}C; V_{GE} = \pm 15\ V; V_{CE} = 1000\ V;$ $R_{G\ on} = R_{G\ off} = 2.2\ \Omega; I_{Cmax} < 1550\ A.$	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}	$V_{GE} = 0\ V.$	1700	V
Forward current (nominal)	$I_{F\ nom}$		300	A
Forward current (maximum continuous)	$I_{F\ 25}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 25^{\circ}C.$	291	A
	$I_{F\ 80}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 80^{\circ}C.$	219	A
Repetitive peak forward current ^{*1}	I_{FRM}	$I_{FRM} = 3 \times I_{F\ nom}; t_p = 1\ ms.$	900	A
Junction operating temperature	$T_{vj\ (op)}$		-40...+150	°C
Module				
Storage temperature	T_{stg}		-55...+50	°C
Isolation voltage	U_{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.

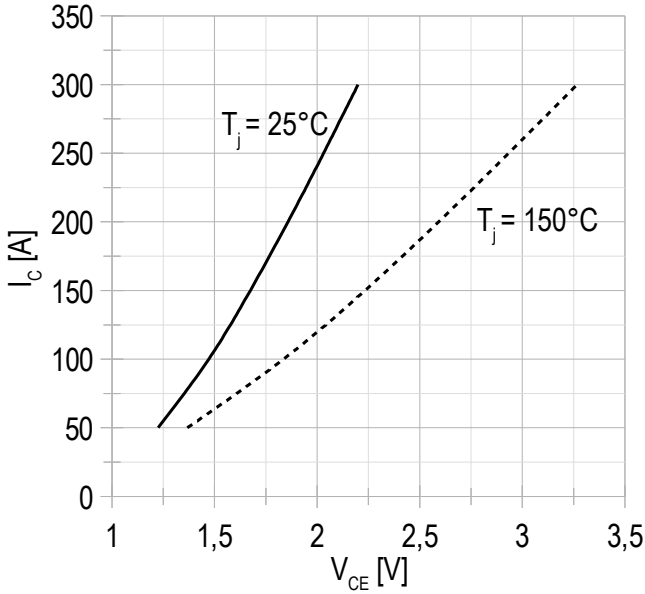
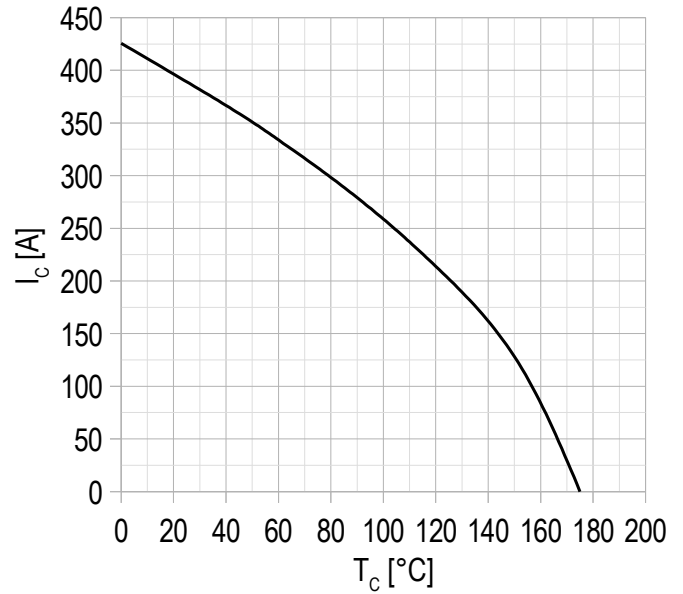
Characteristics

Definition	Symbol	Conditions	Value			Unit.		
			min.	typ.	max.			
IGBT								
Collector-Emitter saturation voltage	V_{CEsat}	$V_{GE} = +15\text{ V}; I_C = 300\text{ A}; t_u = 1000\text{ }\mu\text{s}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	2.16 2.95	2.19 3.23	2.33 3.57	V V	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$I_C = 6\text{ mA}; V_{CE} = V_{GE}; T_{vj} = 25^\circ\text{C}; t_u = 2\text{ ms}.$		5.29	5.64	6.36	V	
Collector-Emitter cut-off current	I_{CES}	$V_{CE} = 1700\text{ V}; t_u = 50\text{ ms}; V_{GE} = 0.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	3.71 0.98	4.57 1.41	300 5.00	μA mA	
Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0; V_{GE} = \pm 20\text{ V}; T_{vj} = 25^\circ\text{C}; t_u = 30\text{ ms}.$		12.2	20.4	500	nA	
Input capacitance	C_{ies}	$V_{CE} = 10\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}; T_{vj} = 25^\circ\text{C}.$		-	27.2	-	nF	
Output capacitance	C_{oes}			-	1.40	-	nF	
Reverse transfer capacitance	C_{res}			-	2.80	-	nF	
Total gate charge	Q_G	$I_C = 300\text{ A}; V_{CE} = 920\text{ V}; V_{GE} = -8 \div 15\text{ V}.$		-	3483	3738	nC	
Internal gate resistance	R_{Gint}	$T_{vj} = 25^\circ\text{C}.$		-	2.50	-	Ω	
Turn-on delay time	$t_{d(on)}$	$V_{CE} = 920\text{ V}; V_{GE} = \pm 15\text{ V}; I_{Cmax} = 300\text{ A}; R_G = 2.2\text{ }\Omega; L = 100\text{ }\mu\text{H}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	452 556	488 568	570 650	ns	
Rise time	t_{ri}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	58.0 63.0	59.0 64.0	70.0 80.0	ns	
Turn-on energy	E_{on}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	39.0 68.0	41.0 72.0	51.0 85.0	mJ	
Turn-off delay time	$t_{d(off)}$		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	640 820	650 840	760 940	ns	
Fall time	t_{fi}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	468 596	480 616	540 740	ns	
Turn-off energy	E_{off}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	63.0 89.0	66.0 93.0	74.0 105	mJ	
Collector-emitter threshold voltage	V_{CE0}		$V_{GE} = +15\text{ V}; T_{vj} = 150^\circ\text{C}; I_{CE1} = 75\text{ A}; I_{CE2} = 300\text{ A}; t_u = 1000\text{ }\mu\text{s}.$		0.98	1.02	1.07	V
On-State slope resistance (IGBT)	r_{CE0}				6.36	7.26	8.25	m Ω
Thermal resistance junction to case	$R_{th(j-c)}$		DC; $I_{CE} = 220 \pm 10\text{ A}; I_{test} = 1.0\text{ A}; V_{GE} = +15\text{ V}.$		-	0.096	0.100	K/W
Inverse diode \ Freewheeling diode								
Forward voltage drop	V_F	$I_F = 300\text{ A}; V_{GE} = 0; t_u = 1000\text{ }\mu\text{s}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	1.89 2.24	1.94 2.51	2.10 2.78	V V	
Reverse recovery time	t_{rr}	$V_{CE} = 920\text{ V}; V_{GE} = \pm 15\text{ V}; I_{Cmax} = 300\text{ A}; R_{Gon} = 2.2\text{ }\Omega; L = 100\text{ }\mu\text{H}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	157 259	168 330	200 470	ns ns	
Peak reverse recovery current	I_{rrM}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	324 355	339 376	390 430	A A	
Reverse recovered charge	Q_{rr}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	31.0 53.0	33.0 60.0	39.0 74.0	μC μC	
Reverse recovery energy	E_{rec}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	47.0 83.0	50.0 87.0	58.0 97.0	mJ mJ	
Threshold voltage	$V_{(T0)}$		$T_{vj} = 150^\circ\text{C}; V_{GE} = 0; I_{CE1} = 75\text{ A}; I_{CE2} = 300\text{ A}; t_u = 1000\text{ }\mu\text{s}.$		0.87	0.90	0.96	V
Forward slope resistance	r_T				4.40	5.19	6.10	m Ω
Thermal resistance junction to case	$R_{th(jc-D)}$	DC; $I_{CE} = 200 \pm 10\text{ A}; I_{test} = 1.0\text{ A}; V_{GE} = +15\text{ V}.$		-	0.176	0.190	K/W	

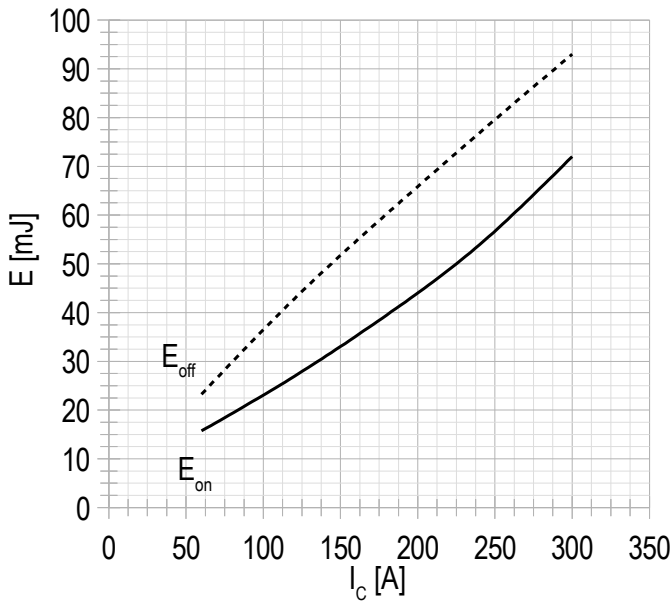
Module							
Pin resistance	R_{Pxy}	$T_{vj} = 25^{\circ}\text{C}.$	R_{P12}	-	0.28	0.50	mΩ
			R_{P13}	-	0.38	0.50	
Parasitic inductance between terminals	L_{Pxy}	$T_{vj} = 25^{\circ}\text{C};$ $f = 1 \text{ MHz}.$	L_{P12}	-	33.4	35.0	nH
			L_{P13}	-	56.0	60.0	
Thermal resistance case to heatsink	R_{thCH}	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 M5		2.25	2.50	2.75	N*m
Weight	W			-	318	340	g

Notes:

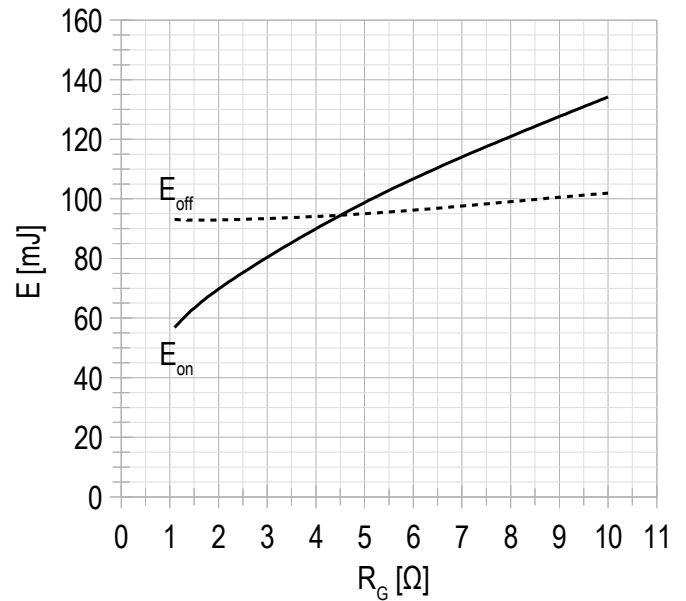
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op} = -40 \div +150^{\circ}\text{C}.$

Chart 1 – typ. output characteristic, IGBT.

 $V_{GE} = +15 \text{ V.}$
Chart 2 – max. rated current vs temperature.


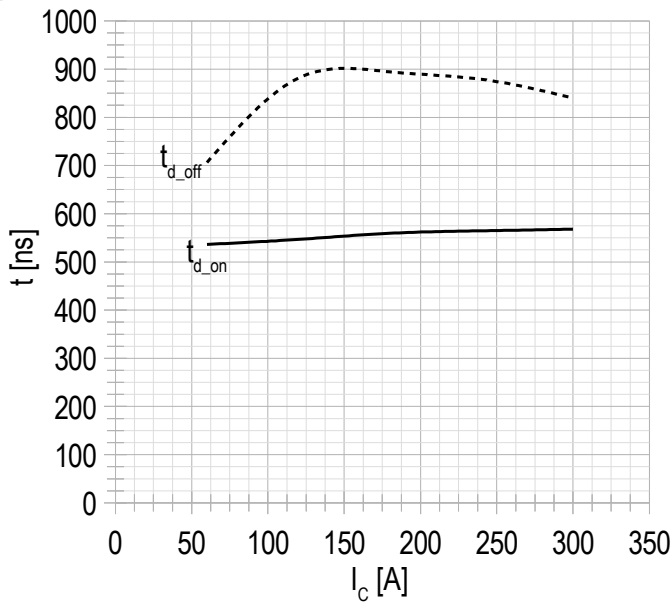
DC;
 $V_{GE} = +15 \text{ V;}$
 $T_{vj}(\text{max}) = 175^\circ\text{C.}$

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


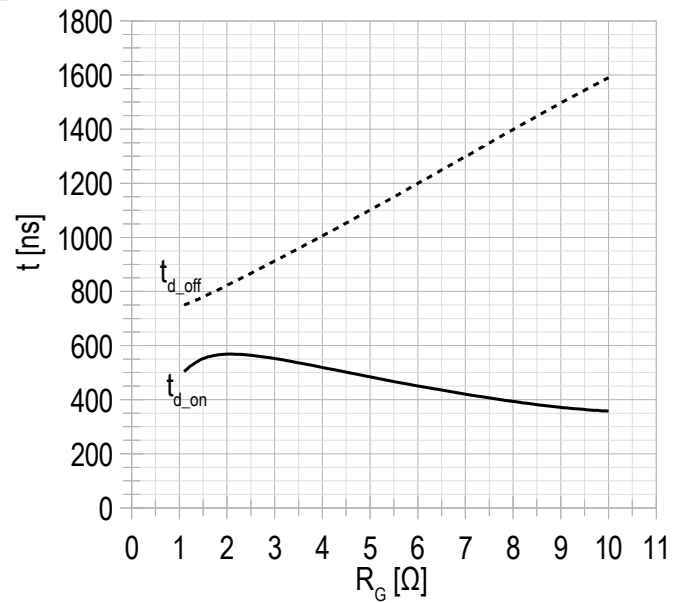
$V_{CE} = 920 \text{ V;}$
 $V_{GE} = \pm 15 \text{ V;}$
 $R_G = 2.2 \ \Omega;$
 $L = 100 \ \mu\text{H;}$
 $T_{vj}(\text{max}) = 150^\circ\text{C.}$

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


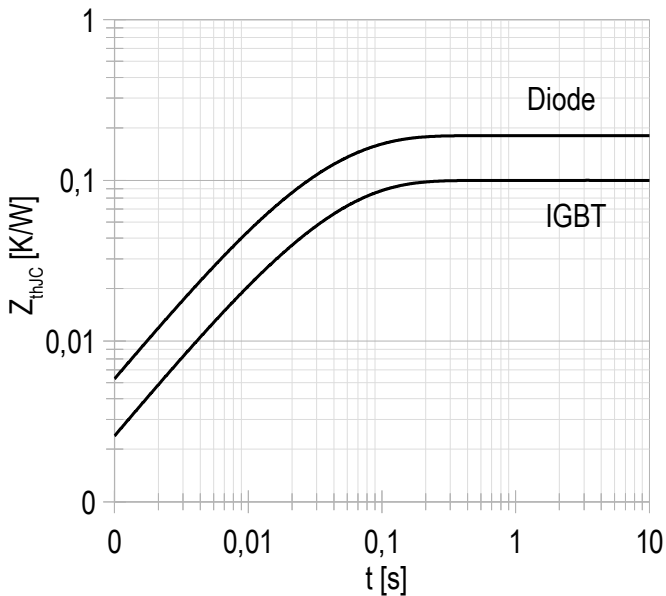
$V_{CE} = 920 \text{ V;}$
 $V_{GE} = \pm 15 \text{ V;}$
 $I_{c \text{ max}} = 300 \text{ A;}$
 $L = 100 \ \mu\text{H;}$
 $T_{vj}(\text{max}) = 150^\circ\text{C.}$

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


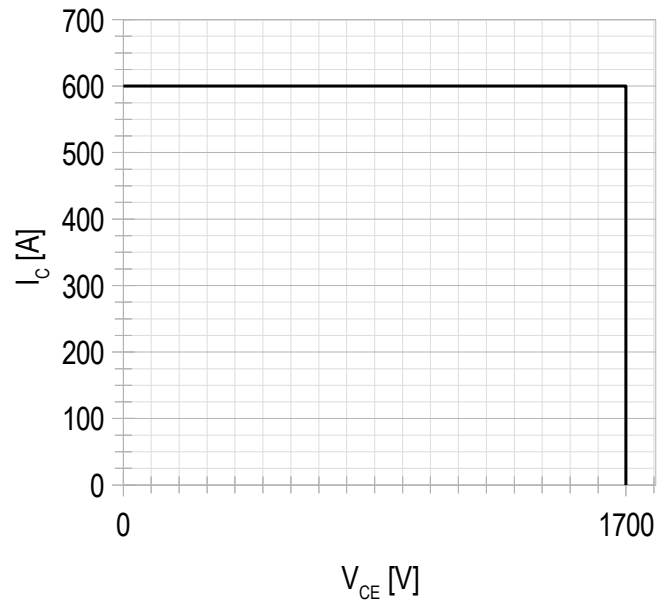
$V_{CE} = 920 \text{ V};$
 $V_{GE} = \pm 15 \text{ V};$
 $R_G = 2.2 \ \Omega;$
 $L = 100 \ \mu\text{H};$
 $T_{vj(max)} = 150^\circ\text{C}.$

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


$V_{CE} = 920 \text{ V};$
 $V_{GE} = \pm 15 \text{ V};$
 $I_{Cmax} = 300 \text{ A};$
 $L = 100 \ \mu\text{H};$
 $T_{vj(max)} = 150^\circ\text{C}.$

Chart 7 – max. transient thermal impedance .


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

Chart 8 – RBSOA.


$V_{CEmax} = 1700 \text{ V};$
 $V_{GE} = \pm 15 \text{ V};$
 $I_{Cmax} = 2 \cdot I_{Cnom};$
 $R_G = 2.2 \ \Omega;$
 $L = 300 \text{ мкГн}.$

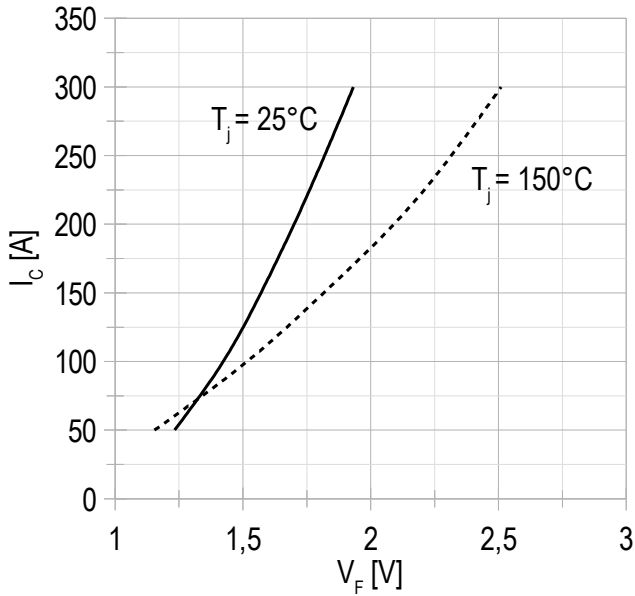
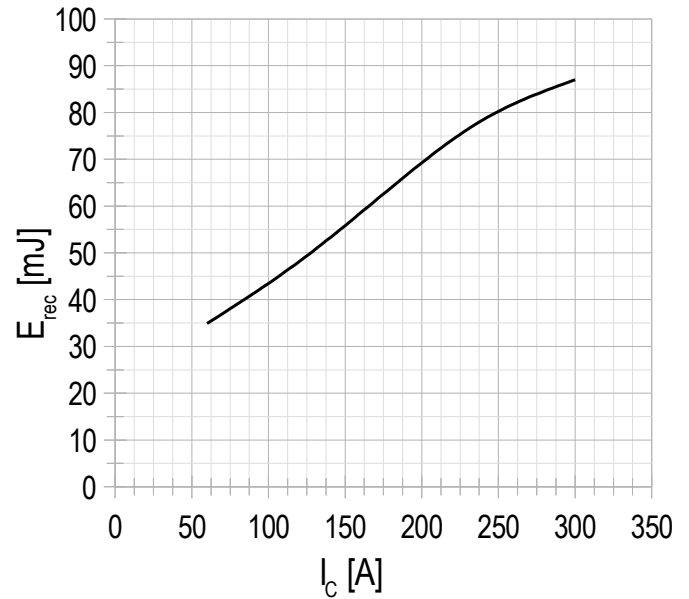
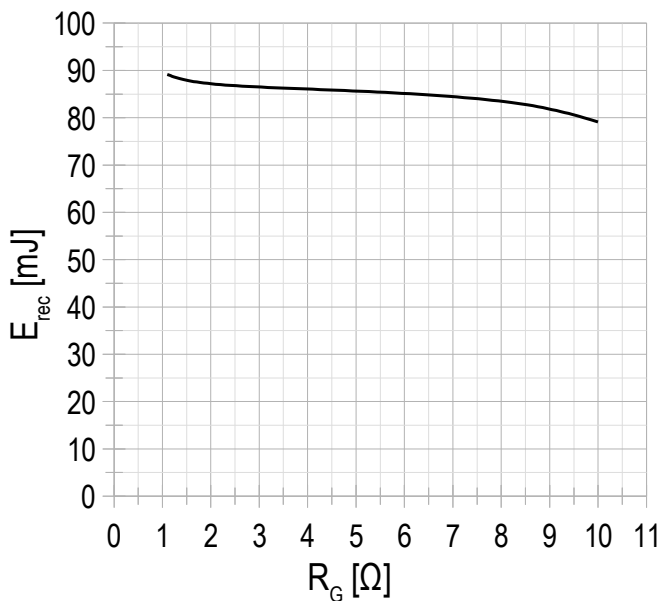
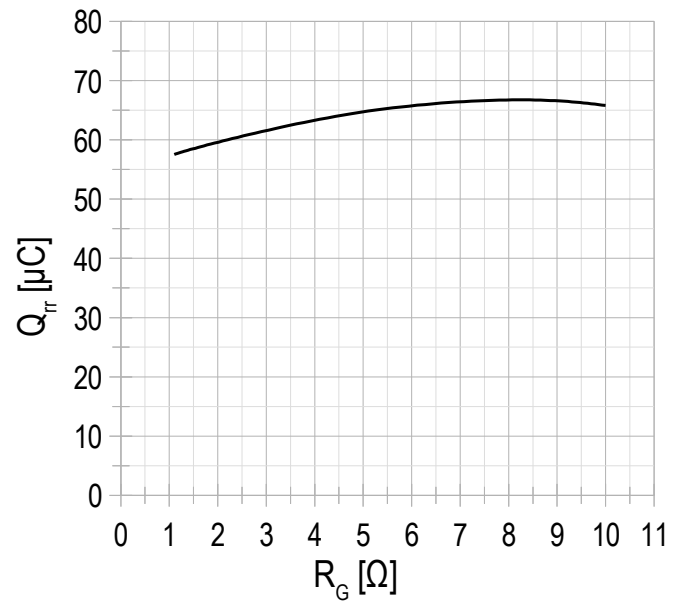
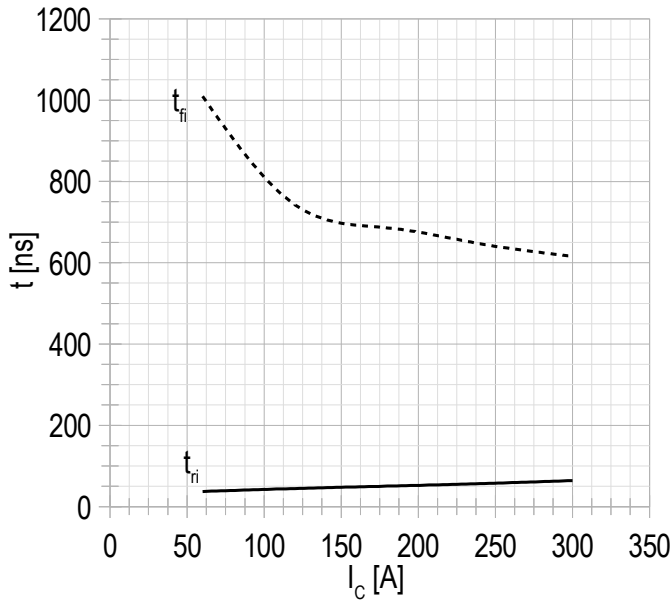
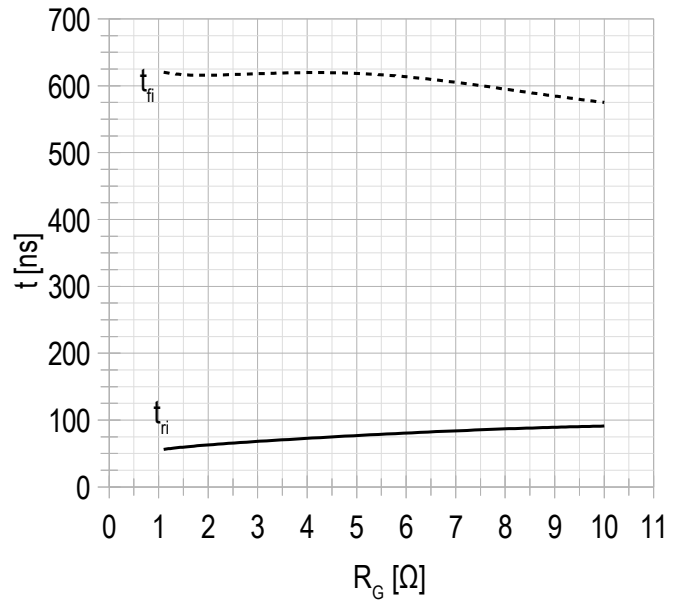
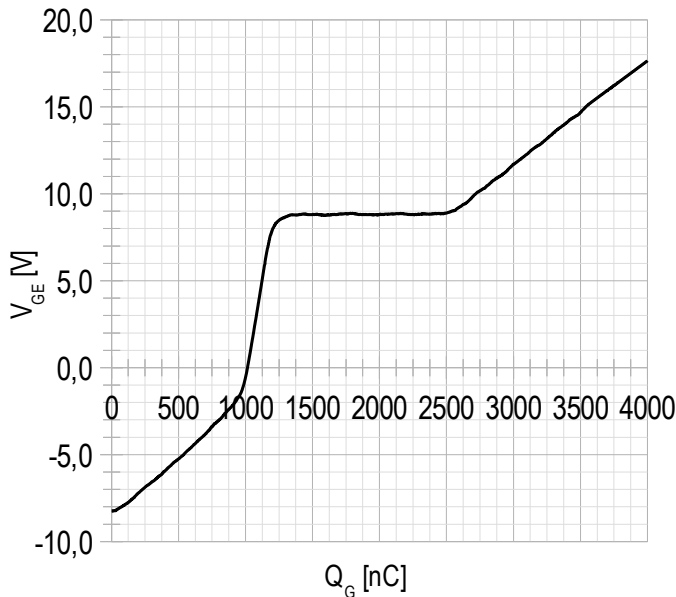
Chart 9 – typ. output characteristic, FRD.

 $V_{GE} = +15\text{ V.}$
Chart 10 – typ. switching losses vs rated current, FRD.

 $V_{GE} = \pm 15\text{ V;}$
 $V_{CE} = 920\text{ V;}$
 $L = 100\ \mu\text{H;}$
 $R_{G\text{ on}} = 2.2\ \Omega;$
 $T_{vj(\text{max})} = 150^\circ\text{C.}$
Chart 11 – typ. switching losses vs gate resistance, FRD.

 $V_{GE} = \pm 15\text{ V;}$
 $V_{CE} = 920\text{ V;}$
 $I_{C\text{ max}} = 300\text{ A;}$
 $L = 100\ \mu\text{H;}$
 $T_{vj(\text{max})} = 150^\circ\text{C.}$
Chart 12 – typ. reverse recovered charge vs gate resistance, FRD.

 $V_{GE} = \pm 15\text{ V;}$
 $V_{CE} = 920\text{ V;}$
 $I_{C\text{ max}} = 300\text{ A;}$
 $L = 100\ \mu\text{H;}$
 $T_{vj(\text{max})} = 150^\circ\text{C.}$

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


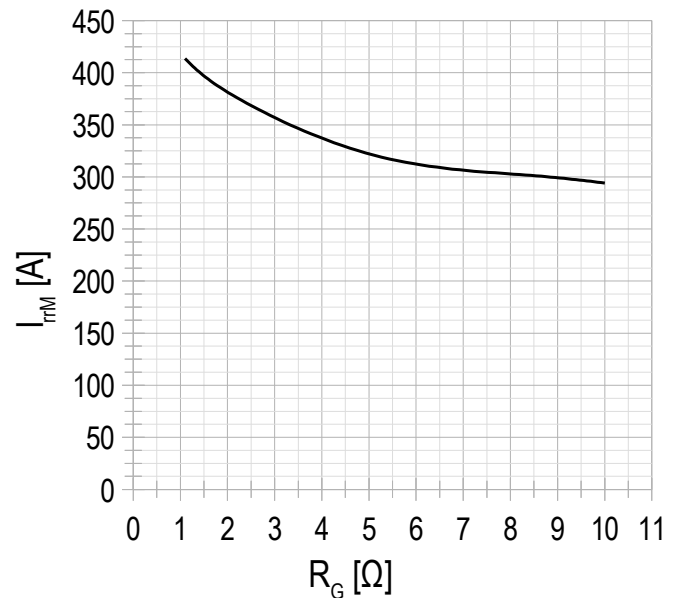
$V_{CE} = 920$ V;
 $V_{GE} = \pm 15$ V;
 $R_G = 2.2$ Ω ;
 $L = 100$ μ H.
 $T_{vj(max)} = 150^\circ$ C.

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


$V_{CE} = 920$ V;
 $V_{GE} = \pm 15$ V;
 $I_{Cmax} = 300$ A;
 $L = 100$ μ H.
 $T_{vj(max)} = 150^\circ$ C.

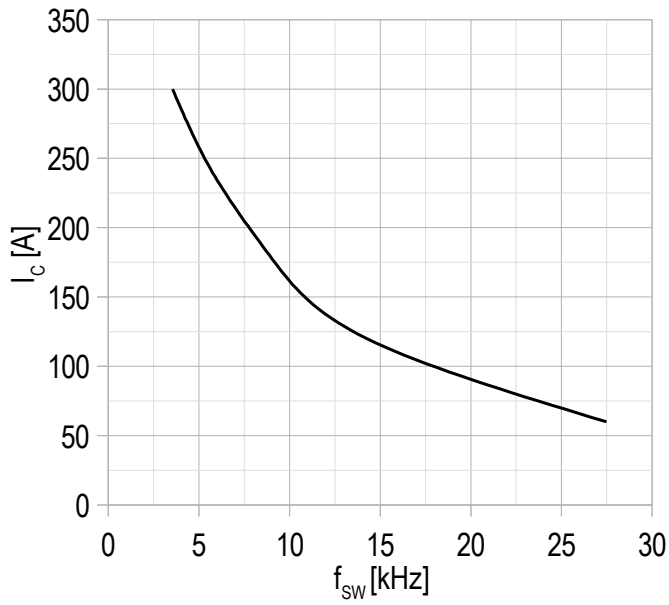
Chart 15 – typ. gate charge characteristic.


$I_c = 300$ A;
 $V_{CE} = 920$ V;
 $V_{GE} = -8 \div 15$ V.

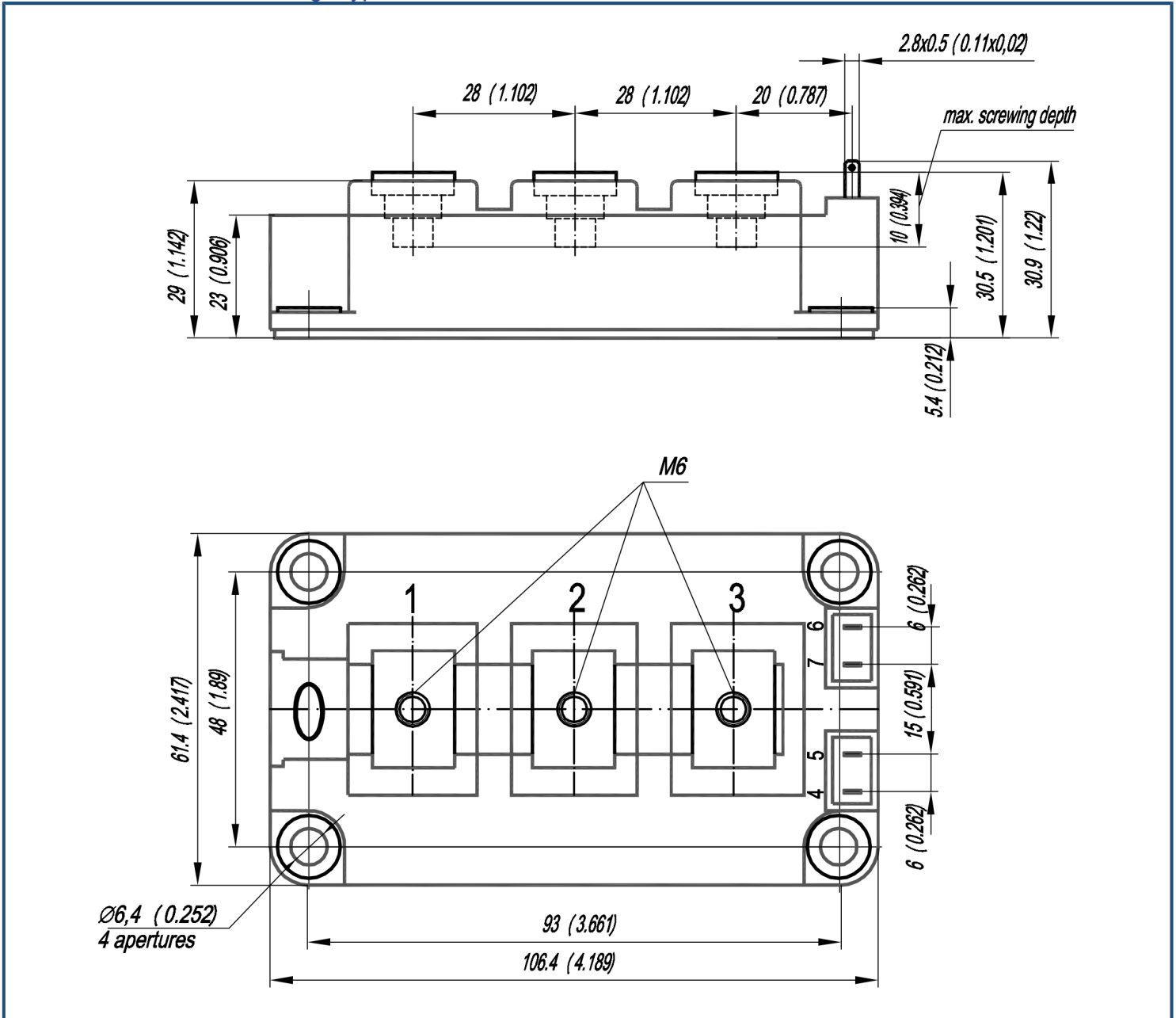
Chart 16 – typ. reverse recovery current vs gate resistance FRD.


$V_{CE} = 920$ V;
 $V_{GE} = \pm 15$ V;
 $L = 100$ μ H;
 $T_{vj(max)} = 150^\circ$ C.

Chart 17 – typ. rated current vs frequency.



Duty cycle 50%

Overall dimensions: Package type – AA

Part numbering guide

MIAA	-	HB	17	AA	-	300	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 ($V_{CES}/100$)
				AA				IGBT+FRD chipset modification
					300			Current Rating
							N	Climatic version: normal climate

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