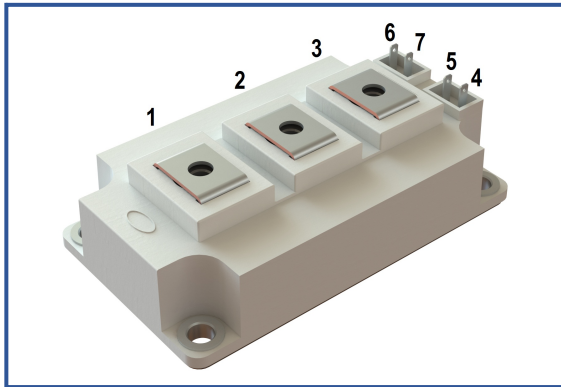


Industry standard 62mm IGBT module

1700 V 150 A


Chip features

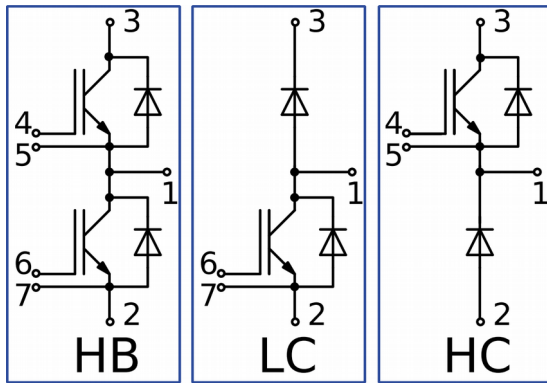
- IGBT chip
 - Trench FS — V-Series IGBT (Fuji 6th gen)
 - low $V_{CE(sat)}$ value
 - 10 μ s short circuit of 150°C
 - square RBSOA of 2xI_C
 - low EMI
- FRD chip
 - fast and soft reverse recovery
 - low voltage drop

Design features

- copper baseplate
- Al₂O₃ 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)	$I_{C\ nom}$		150	A
Collector current (maximum continuous)	$I_{C\ 25}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 25^{\circ}C$.	253	A
	$I_{C\ 80}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 80^{\circ}C$.	150	A
Repetitive peak collector current ^{*1}	I_{CRM}	$I_{CRM} = 3 \times I_{C\ nom}; t_p = 1\ ms$.	450	A
Short-circuit duration	t_{psc}	$T_{vj} = 25^{\circ}C; V_{GE} = \pm 15\ V; V_{CE} = 1000\ V;$ $R_{G\ on} = R_{G\ off} = 2.2\ \Omega; I_{Cmax} < 900\ A$.	10	μ s
		$T_{vj} = 150^{\circ}C; V_{GE} = \pm 15\ V; V_{CE} = 1000V;$ $R_{G\ on} = R_{G\ off} = 2.2\ \Omega; I_{Cmax} < 770\ A$.	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)	$I_{F\ nom}$		150	A
Forward current (maximum continuous)	$I_{F\ 25}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 25^{\circ}C$.	190	A
	$I_{F\ 80}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 80^{\circ}C$.	143	A
Repetitive peak forward current ^{*1}	I_{FRM}	$I_{FRM} = 3 \times I_{F\ nom}; t_p = 1\ ms$.	450	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}	$V_{GE} = +15\text{ V}; I_C = 150\text{ A}; t_u = 1000\ \mu\text{s}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	2.10 2.78	2.12 2.87	2.28 3.09	V V	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$I_C = 6\text{ mA}; V_{CE} = V_{GE}; T_{vj} = 25^\circ\text{C}; t_u = 2\text{ ms}.$		5.30	5.61	6.28	V	
Collector-Emitter cut-off current	I_{CES}	$V_{CE} = 1700\text{ V}; t_u = 50\text{ ms}; V_{GE} = 0.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	2.81 0.68	3.75 0.88	300 2.00	μA mA	
Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0; V_{GE} = \pm 20\text{ V}; T_{vj} = 25^\circ\text{C}; t_u = 30\text{ ms}.$		12.3	17.7	500	nA	
Input capacitance	C_{ies}	$V_{CE} = 10\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}; T_{vj} = 25^\circ\text{C}.$		-	15.0	-	nF	
Output capacitance	C_{oes}			-	0.80	-	nF	
Reverse transfer capacitance	C_{res}			-	1.00	-	nF	
Total gate charge	Q_G	$I_C = 150\text{ A}; V_{CE} = 920\text{ V}; V_{GE} = -8 \div 15\text{ V}.$		-	1620	1800	nC	
Internal gate resistance	R_{Gint}	$T_{vj} = 25^\circ\text{C}.$		-	5.00	-	Ω	
Turn-on delay time	$t_{d(on)}$	$V_{CE} = 920\text{ V}; V_{GE} = \pm 15\text{ V}; I_{Cmax} = 150\text{ A}; R_G = 2.2\ \Omega; L = 300\ \mu\text{H}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	388 440	396 448	470 530	ns	
Rise time	t_{ri}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	39.0 45.0	40.0 46.0	60.0 60.0	ns	
Turn-on energy	E_{on}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	20.0 35.0	21.0 37.0	28.0 44.0	mJ	
Turn-off delay time	$t_{d(off)}$		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	450 550	460 590	530 690	ns	
Fall time	t_{fi}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	572 772	600 816	670 940	ns	
Turn-off energy	E_{off}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	31.0 44.0	33.0 48.0	41.0 57.0	mJ	
Collector-emitter threshold voltage	V_{CE0}		$V_{GE} = +15\text{ V}; T_{vj} = 150^\circ\text{C}; I_{CE1} = 38\text{ A}; I_{CE2} = 150\text{ A}; t_u = 1000\ \mu\text{s}.$		1.02	1.04	1.10	V
On-State slope resistance (IGBT)	r_{CE0}				11.7	12.1	13.0	m Ω
Thermal resistance junction to case	$R_{th(j-c)}$		DC; $I_{CE} = 150 \pm 10\text{ A}; I_{test} = 1.0\text{ A}; V_{GE} = +15\text{ V}.$		-	0.122	0.135	K/W
Inverse diode \ Freewheeling diode								
Forward voltage drop	V_F	$I_F = 150\text{ A}; V_{GE} = 0; t_u = 1000\ \mu\text{s}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	1.84 2.14	1.86 2.21	2.01 2.45	V V	
Reverse recovery time	t_{rr}	$V_{GE} = \pm 15\text{ V}; V_{CE} = 920\text{ V}; I_{Cmax} = 150\text{ A}; R_{Gon} = 2.2\ \Omega; L = 300\ \mu\text{H}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	138 195	150 300	200 460	ns ns	
Peak reverse recovery current	I_{rrM}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	197 211	201 219	230 250	A A	
Reverse recovered charge	Q_{rr}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	16.0 24.0	17.0 31.0	21.0 42.0	μC μC	
Reverse recovery energy	E_{rec}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	20.0 37.0	24.0 42.0	32.0 55.0	mJ mJ	
Threshold voltage	$V_{(T0)}$		$T_{vj} = 150^\circ\text{C}; V_{GE} = 0; I_{CE1} = 38\text{ A}; I_{CE2} = 150\text{ A}; t_u = 1000\ \mu\text{s}.$		0.93	0.95	0.99	V
Forward slope resistance	r_T				8.04	8.48	9.56	m Ω
Thermal resistance junction to case	$R_{th(jc-D)}$	DC; $I_{CE} = 120 \pm 10\text{ A}; I_{test} = 1.0\text{ A}; V_{GE} = +15\text{ V}.$		-	0.261	0.280	K/W	

Module							
Pin resistance	R_{Pxy}	$T_{vj} = 25^{\circ}\text{C}.$	R_{P12}	-	0.28	0.50	m Ω
			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 $T_{vj\ op} = -40 \div +150^{\circ}\text{C}.$

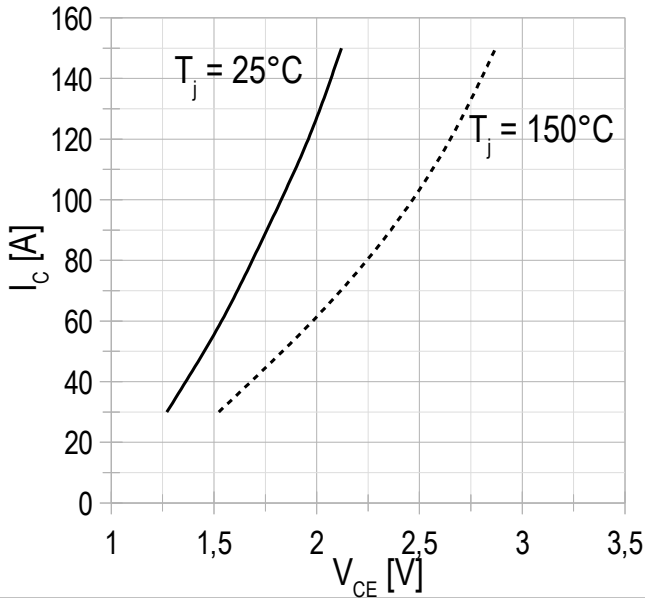
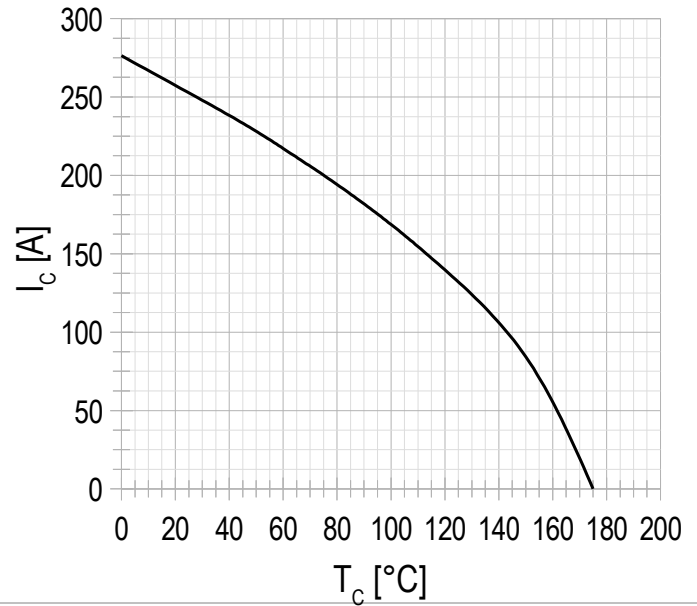
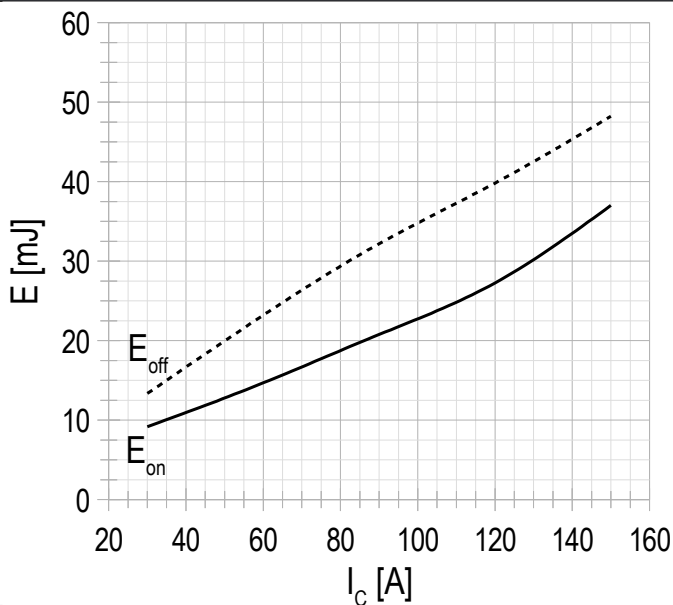
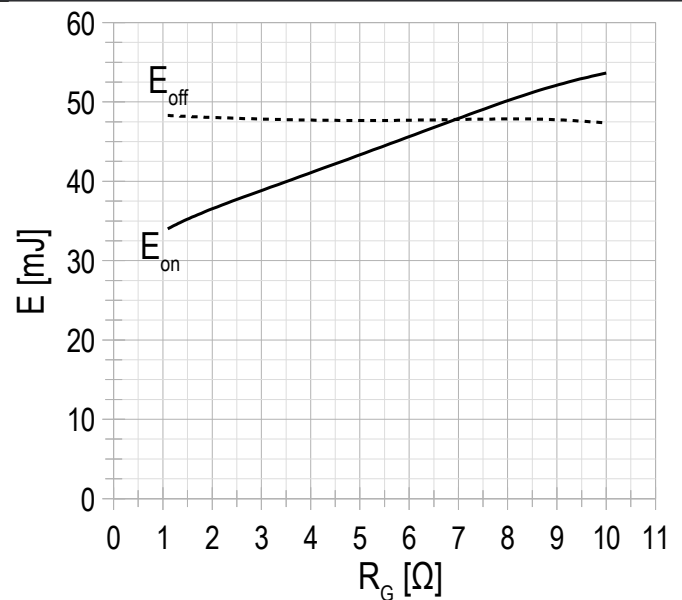
Chart 1 – typ. output characteristic, IGBT.

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

Chart 2 – max. rated current vs temperature.


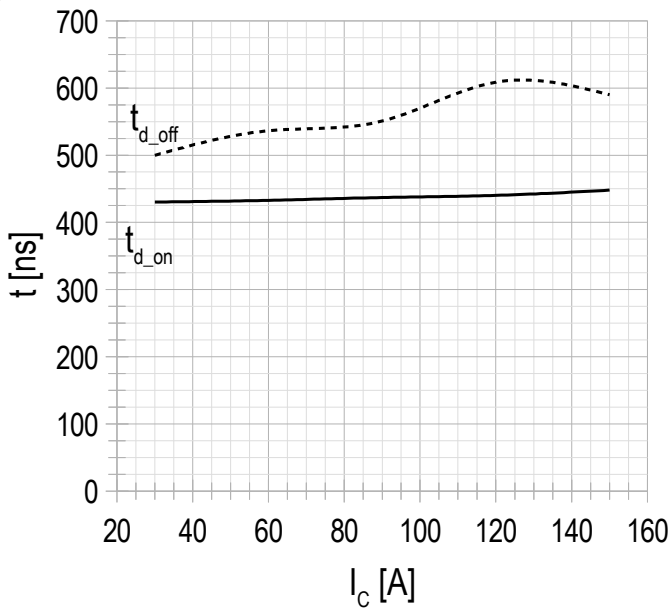
DC;
 $V_{GE} = +15 \text{ V}$;
 $T_{vj(max)} = 150^\circ\text{C}$.

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


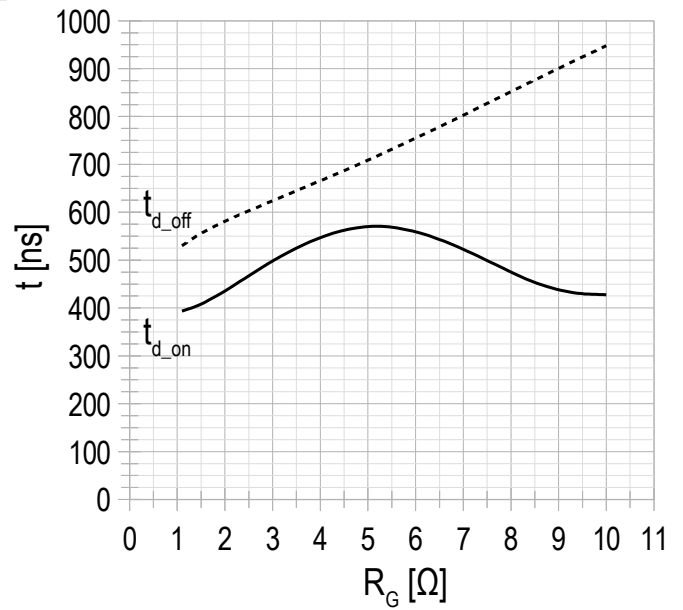
$V_{CE} = 920 \text{ V}$;
 $V_{GE} = \pm 15 \text{ V}$;
 $R_G = 2.2 \Omega$;
 $L = 300 \mu\text{H}$;
 $T_{vj(max)} = 150^\circ\text{C}$.

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


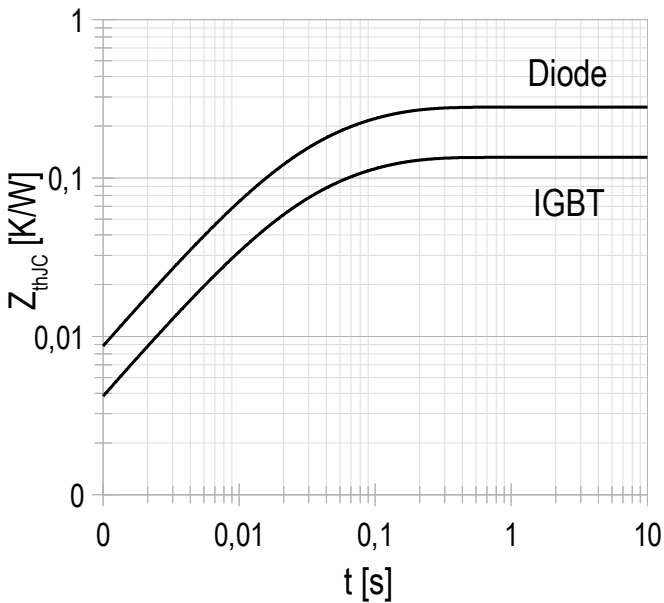
$V_{CE} = 920 \text{ V}$;
 $V_{GE} = \pm 15 \text{ V}$;
 $I_{Cmax} = 150 \text{ A}$;
 $L = 300 \mu\text{H}$;
 $T_{vj(max)} = 150^\circ\text{C}$.

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


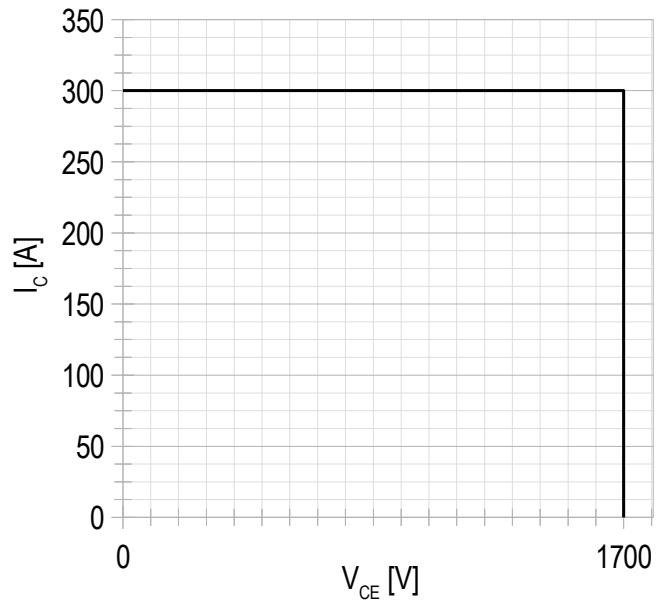
$V_{CE} = 920 \text{ V};$
 $V_{GE} = \pm 15 \text{ V};$
 $R_G = 2.2 \text{ } \Omega;$
 $L = 300 \text{ } \mu\text{H};$
 $T_{vj(max)} = 150^\circ\text{C}.$

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


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

Chart 7 – max. transient thermal impedance.


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

Chart 8 – RBSOA.


$V_{CE\ max} = 1700 \text{ V};$
 $V_{GE} = \pm 15 \text{ V};$
 $I_{C\ max} = 2 * I_{C\ nom};$
 $R_G = 2.2 \text{ } \Omega;$
 $L = 300 \text{ } \mu\text{H}.$

Chart 9 – typ. output characteristic, FRD.

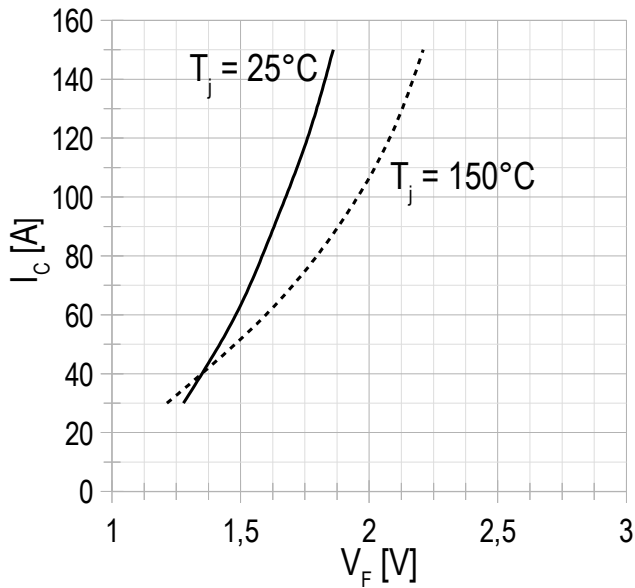

 $V_{GE} = +15\text{ V}$.

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

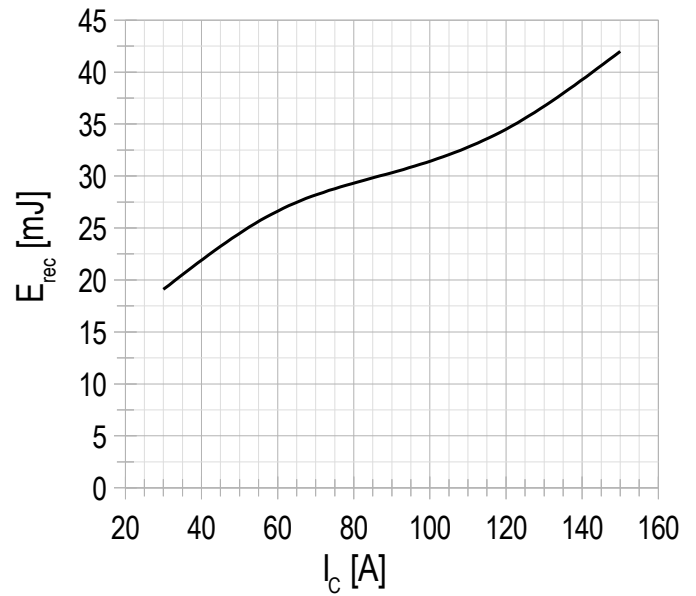

 $V_{CE} = 920\text{ V};$
 $V_{GE} = \pm 15\text{ V};$
 $L = 300\ \mu\text{H};$
 $R_{G\text{ on}} = 2.2\ \Omega;$
 $T_{vj(\text{max})} = 150^\circ\text{C}.$

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

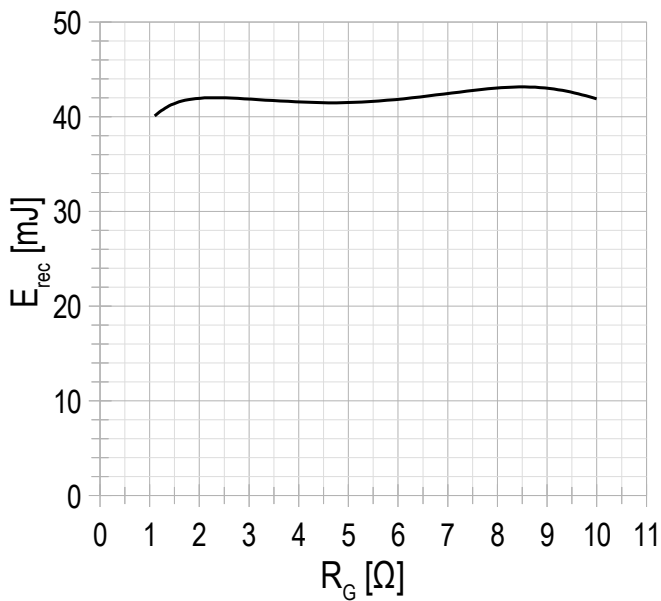

 $V_{CE} = 920\text{ V};$
 $V_{GE} = \pm 15\text{ V};$
 $I_{C\text{ max}} = 150\text{ A};$
 $L = 300\ \mu\text{H};$
 $T_{vj(\text{max})} = 150^\circ\text{C}.$

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

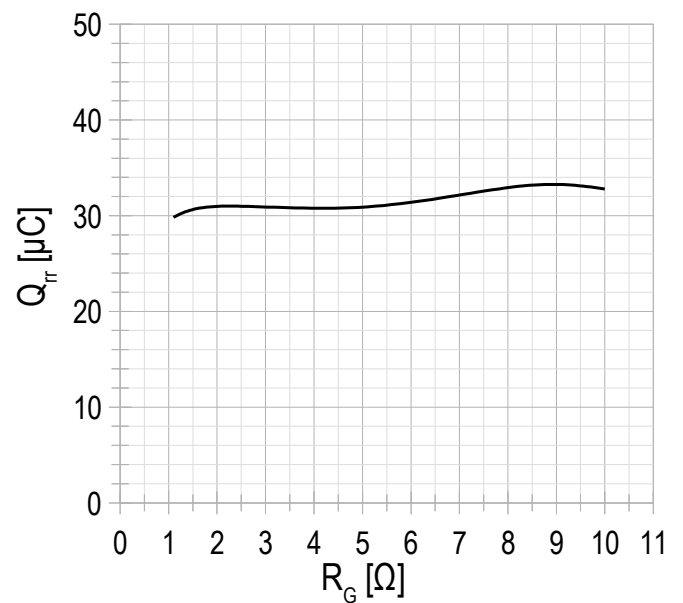
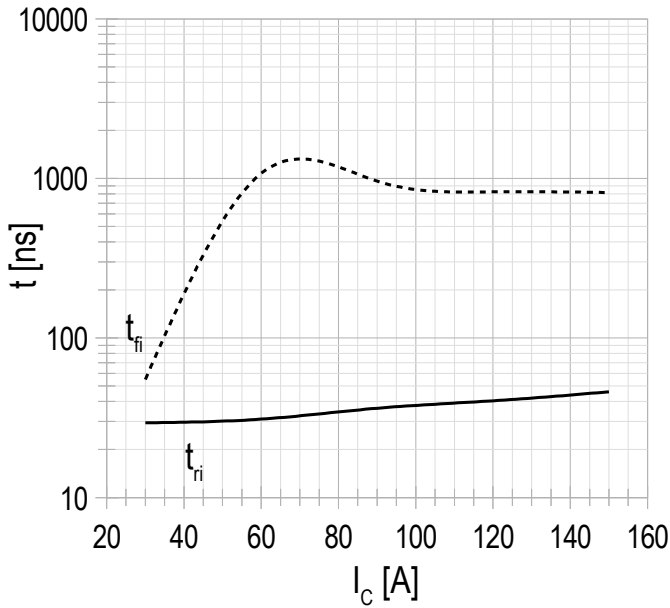
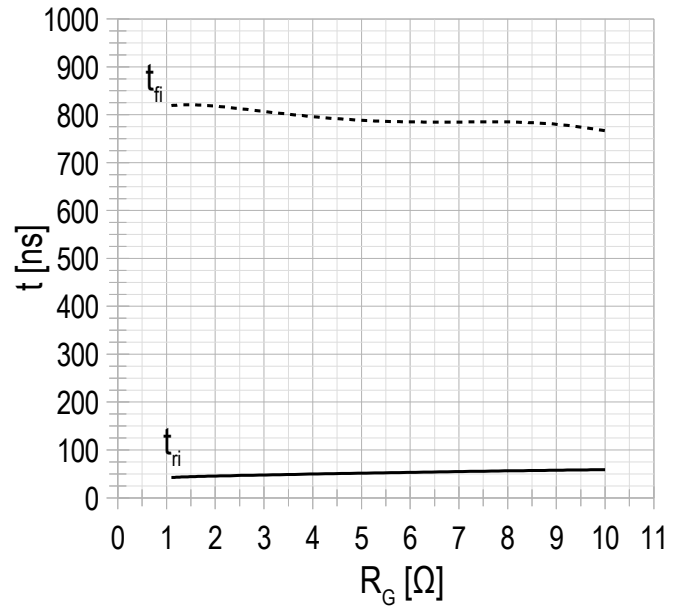
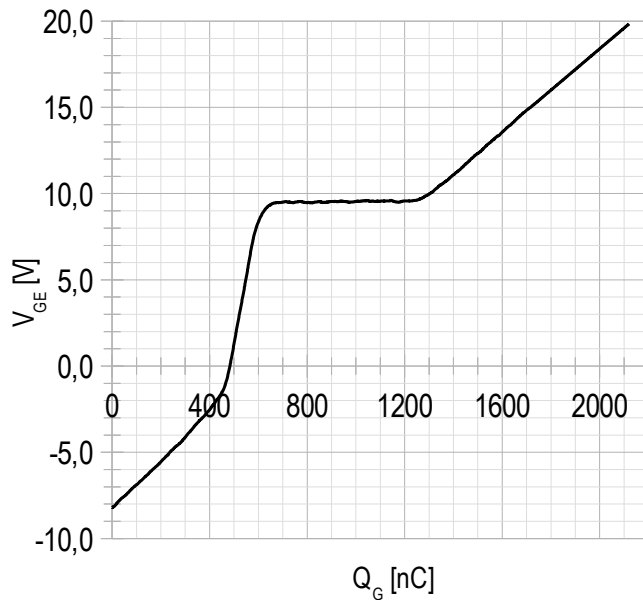

 $V_{CE} = 920\text{ V};$
 $V_{GE} = \pm 15\text{ V};$
 $I_{C\text{ max}} = 150\text{ A};$
 $L = 300\ \mu\text{H};$
 $T_{vj(\text{max})} = 150^\circ\text{C}.$

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


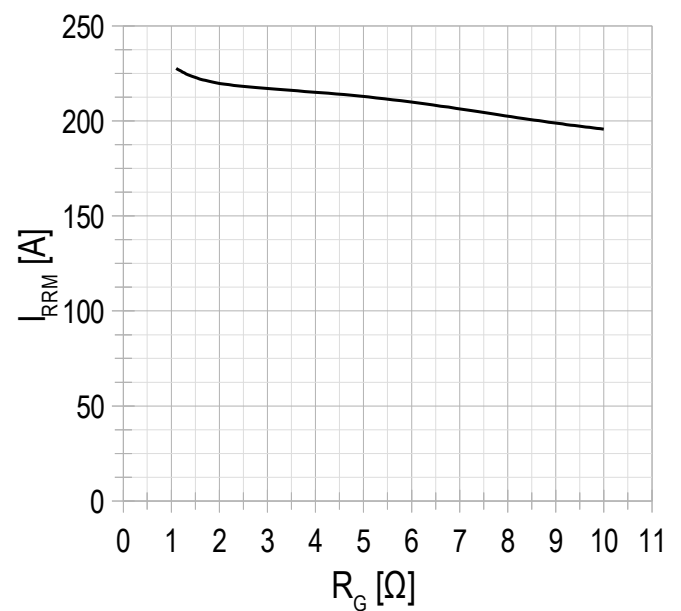
$V_{CE} = 920 \text{ V};$
 $V_{GE} = \pm 15 \text{ V};$
 $R_G = 2.2 \text{ } \Omega;$
 $L = 300 \text{ } \mu\text{H};$
 $T_{vj(\text{max})} = 150^\circ\text{C}.$

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


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

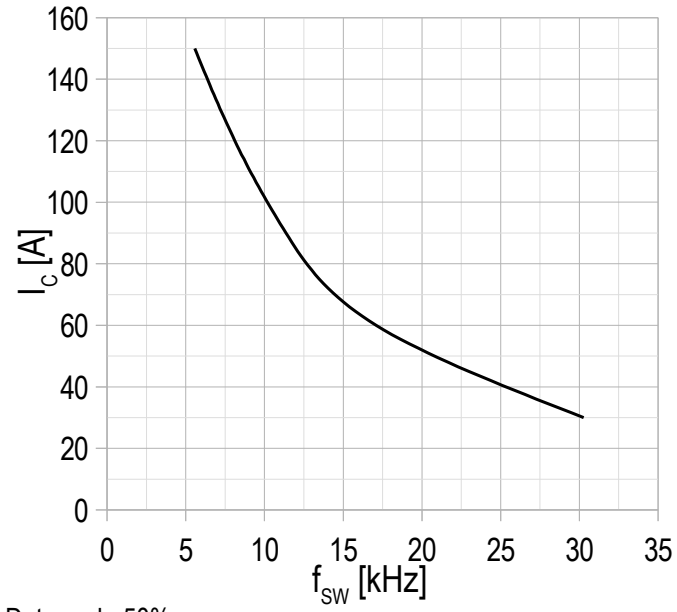
Chart 15 – typ. gate charge characteristic.


$I_C = 150 \text{ A};$
 $V_{CE} = 920 \text{ V};$
 $V_{GE} = -8 \div 15 \text{ V}.$

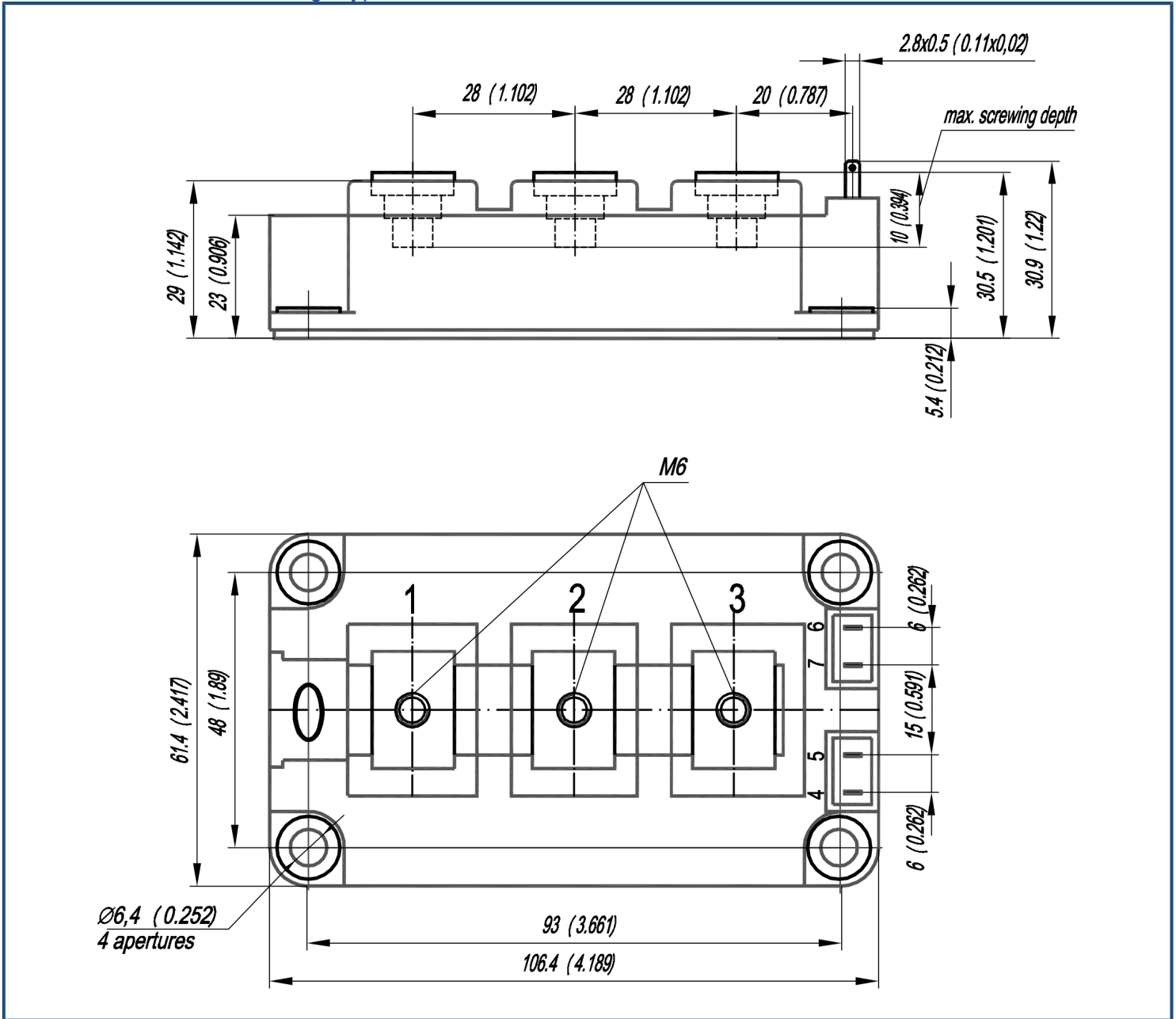
Chart 16 – typ. reverse recovery current vs gate resistance FRD.


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

Chart 17 – typ. rated current vs frequency.



Duty cycle 50%

Overall dimensions: Package type – AA

Part numbering guide

MIAA	-	HB	17	AA	-	150	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
						150		Current Rating
							N	Climatic version: normal climate

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