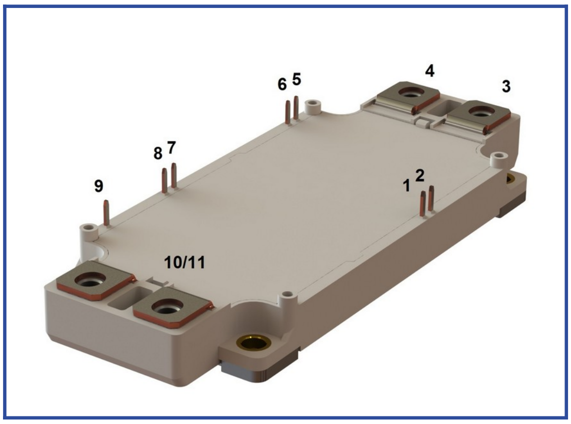
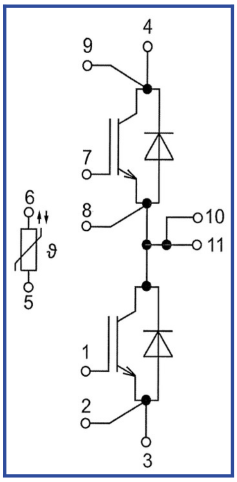
Low Inductance IGBT Module with 17 mm Height Housing 1700 V 300 A





Chip features

- IGBT chip
  - Trench FS
  - low $V_{CE(sat)}$ value
  - 10 µs short circuit duration at 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
- ultrasonic welded power terminals
- improved thermal cycling
- RoHS compliant

Typical application

- AC motor drives
- solar inverters
- air conditioning
- high power converters and UPS
- Inverters for wind energy converters

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°C; T_c = 25°C.	452	A
	$I_{C\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	300	A
Repetitive peak collector current*1	I_{CRM}	I_{CRM} = 3 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} = 1000 V; $R_{G\ on}$ = $R_{G\ off}$ = 3 Ω	10	µs
		T_{vj} = 150°C; V_{GE} =±15 V; V_{CE} = 1000 V; $R_{G\ on}$ = $R_{G\ off}$ = 3 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
Forward current (nominal)	$I_{F\ nom}$		300	A
Forward current (maximum continuous)	$I_{F\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	344	A
	$I_{F\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	260	A
Repetitive peak forward current*1	I_{FRM}	I_{FRM} = 3 x $I_{F\ nom}$; 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	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

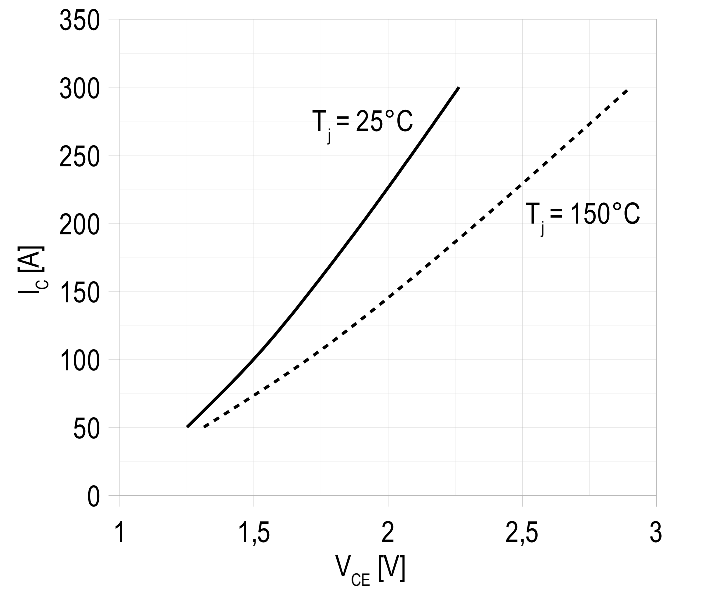
Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit
IGBT							
Collector-Emitter saturation voltage	V_{CEsat}	V_{GE} = +15 V; I_C = 300 A; t_u = 1000 µs.	T_{vj} = 25°C	2.16	2.21	2.42	V
			T_{vj} = 150°C	2.77	2.87	3.14	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C =18 mA; V_{CE} = V_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.30	5.83	6.70	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 1700 V; t_u = 50 ms; V_{GE} = 0.	T_{vj} = 25°C	1.51	1.70	300	µA
			T_{vj} = 150°C	0.84	1.02	5.00	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} = 25°C; t_u = 30 ms.		9.50	12.1	400	nA
Input capacitance	C_{ies}	V_{CE} = 10 V; V_{GE} = 0 V; f = 1 MHz; T_{vj} = 25°C.		-	29.7	-	nF
Output capacipance	C_{oes}			-	1.5	-	nF
Reverse transfer capacitance	C_{res}			-	2.4	-	nF
Total gate charge	Q_G	I_{Cmax} = 300 A; V_{CE} = 920 V; V_{GE} = - 8÷15 V.		-	3428	3550	nC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	2.5	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 920 V; V_{GE} = ±15 V; $I_{C\,max}$ = 300 A; R_G = 3 Ω; L = 100 µH.	T_{vj} = 25°C	416	432	480	ns
			T_{vj} = 150°C	536	548	610	
Rise time	t_{ri}		T_{vj} = 25°C	60	63	75	ns
			T_{vj} = 150°C	65	67	80	
Turn-on energy	E_{on}		T_{vj} = 25°C	39	42	51	mJ
			T_{vj} = 150°C	66	71	86	
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	730	780	880	ns
			T_{vj} = 150°C	900	930	1040	
Fall time	t_{fi}		T_{vj} = 25°C	452	476	560	ns
			T_{vj} = 150°C	612	648	760	
Turn-off energy	E_{off}		T_{vj} = 25°C	66	71	85	mJ
			T_{vj} = 150°C	93	99	116	
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 75 A; I_{CE2} = 300 A; t_u = 1000 µs.		1.009	1.033	1.080	V
On-State slope resistance (IGBT)	r_{CE0}			5.73	6.11	6.68	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; I_{test} = 1.5 A; V_{GE} = +15 V.		-	0.0761	0.0810	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V_F	I_F = 300 A; V_{GE} = 0; t_u = 1000 µs.	T_{vj} = 25°C	2.08	2.13	2.33	V
			T_{vj} = 150°C	2.38	2.46	2.71	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 920 V; $I_{C\,max}$ = 300 A; $R_{G\,on}$ = 3 Ω; L = 100 µH.	T_{vj} = 25°C	157	166	190	ns
			T_{vj} = 150°C	288	370	480	ns
Repetitive peak reverse current	I_{rrm}		T_{vj} = 25°C	287	307	350	A
			T_{vj} = 150°C	328	352	400	A
Reverse recovered charge	Q_{rr}		T_{vj} = 25°C	28.0	29.0	33.0	µC
			T_{vj} = 150°C	53.6	59.0	69.0	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	44.0	46.0	52.0	mJ
			T_{vj} = 150°C	82.0	86.0	96.0	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; t_u = 1000 µs		0.960	0.965	1.000	V
Forward slope resistance	r_T			4.71	4.97	5.54	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; I_{test} = 1.5 A; V_{GE} = +15 V.		-	0.14	0.15	K/W

Module							
Pin resistance	R_{Pxy}	T_{vj} = 25°C.	$R_{P10/11-3}$	-	0.92	1.00	mΩ
			$R_{P10/11-4}$	-	0.59	1.00	
Parasitic inductance between terminals	L_{Pce}			-	22	-	nH
Thermistor resistance	R_{t25}	T_{vj} = 25°C		-	5000	-	Ω
		T_{vj} = 100°C		-	495	-	
Coefficient of temperature sensitivity	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50} (1/T_2 - 1/T_1)]$, T_1 = 298.15 K		-	3375	-	K
Thermal resistance case to heatsink	R_{thCH}	per module		-	0.009	0.014	K/W
Mounting torque for screws to heatsink	M_s	to heatsink M5		3	-	6	N*m
Mounting torque for terminal screws	M_t	to terminals M6		3	-	6	N*m
Weight	W			-	360	-	g

Notes:

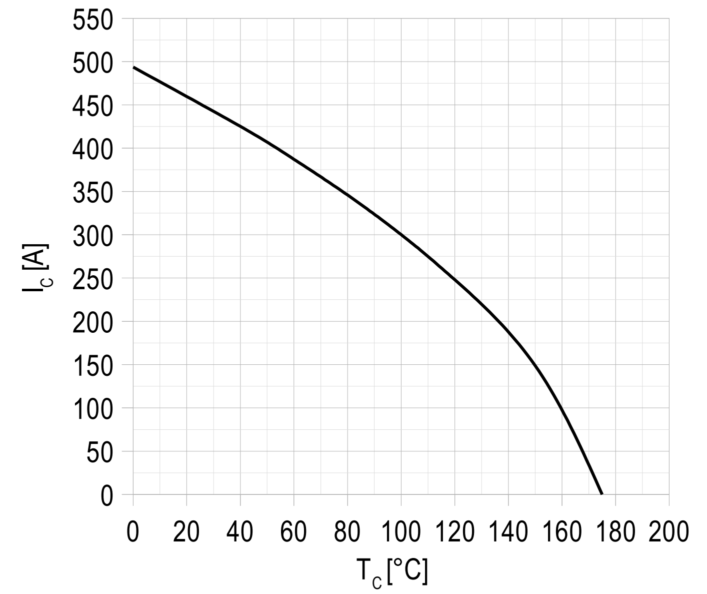
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op}$ = - 40 ÷ +150°C.

Chart 1 – typ. output characteristic, IGBT.



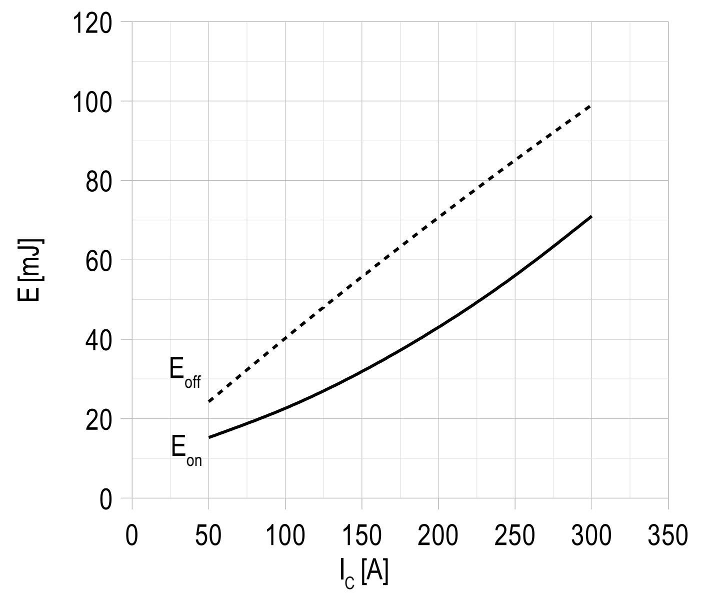
V_{GE} = +15 V.

Chart 2 – max. rated current vs temperature.



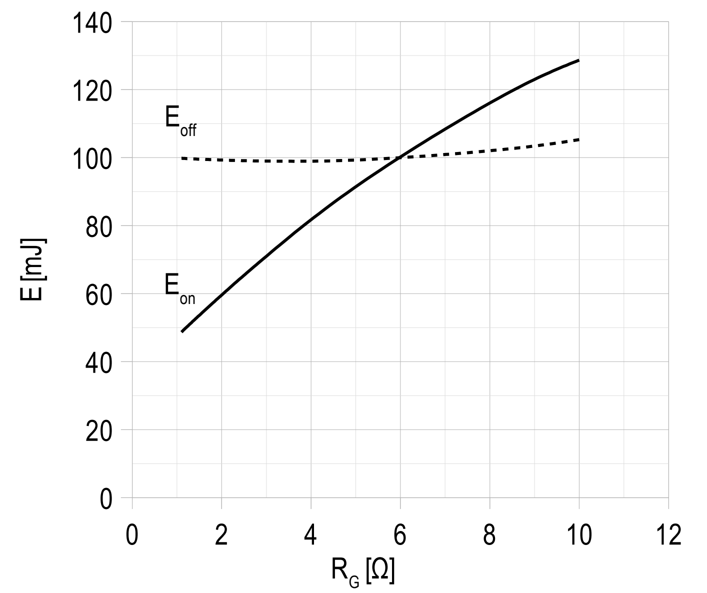
DC;
V_{GE} = +15 V;
$T_{vj\ (max)}$ = 150°C.

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



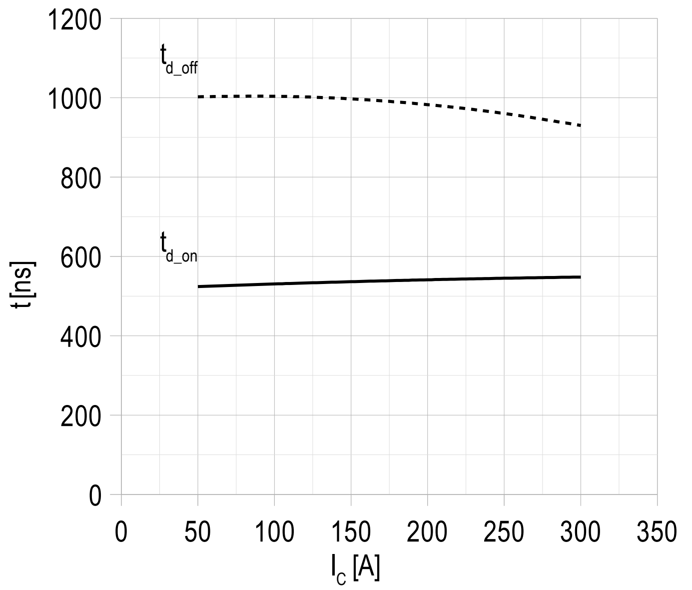
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 3 Ω;
L = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



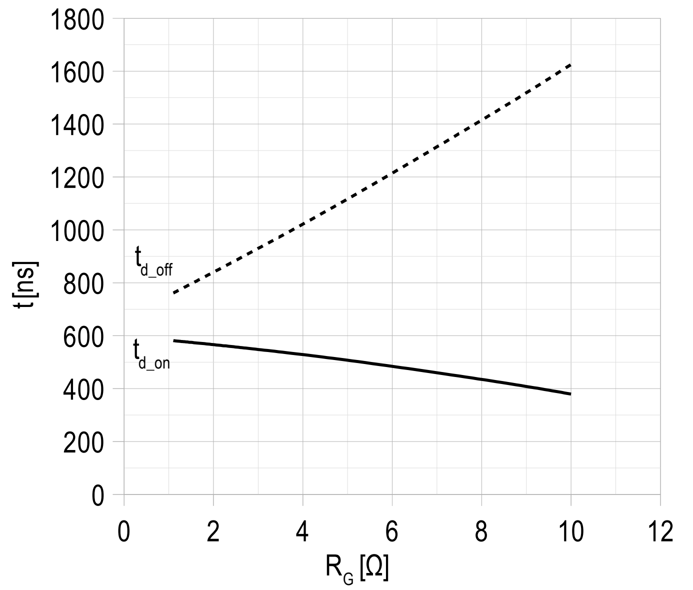
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 300 A;
L = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



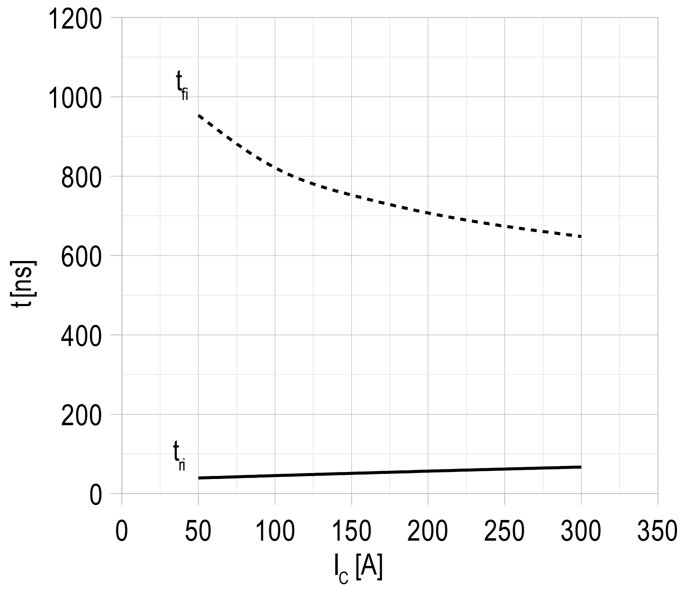
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 3 Ω;
L = 56 nH;
$T_{vj\,(max)}$ = 150°C.

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



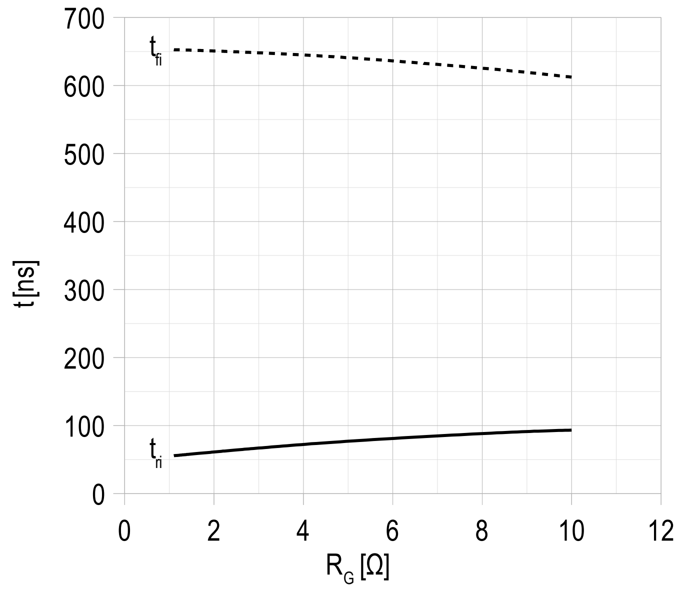
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 300 A;
L = 56 nH;
$T_{vj\,(max)}$ = 150°C.

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



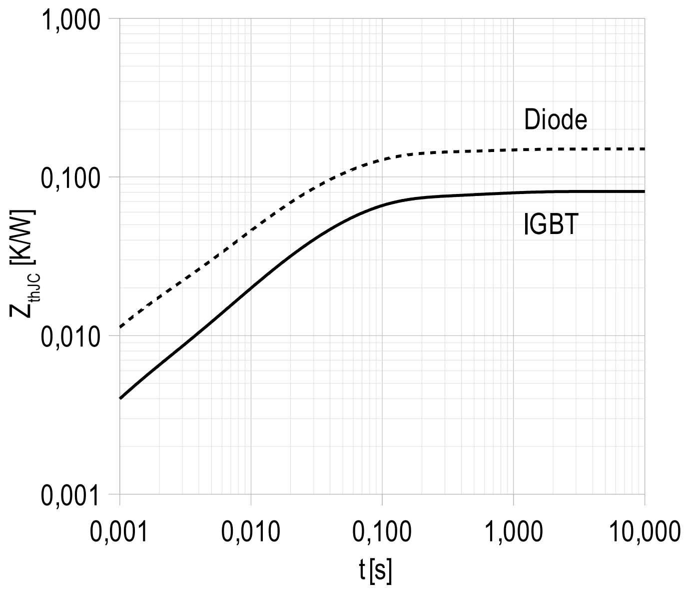
V_{CE} = 920 V;
V_{GE} = ±15 V;
R_G = 3 Ω;
L = 56 nH;
$T_{vj\,(max)}$ = 150°C.

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



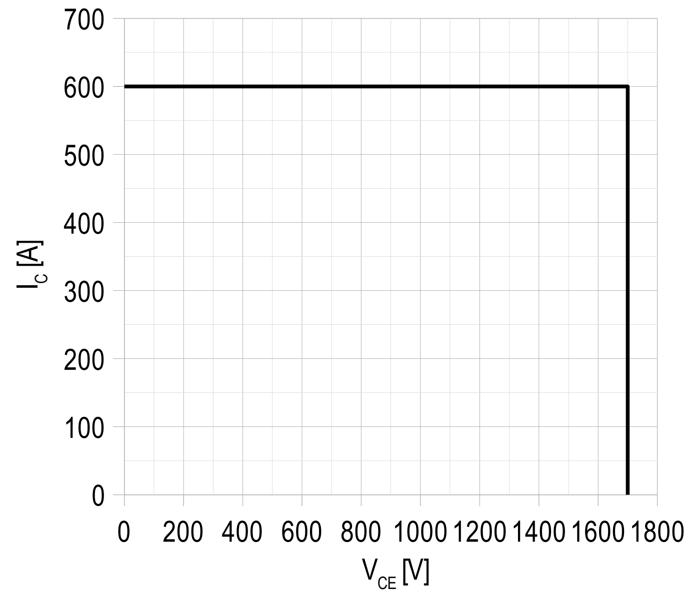
V_{CE} = 920 V;
V_{GE} = ±15 V;
$I_{C\,max}$ = 300 A;
L = 56 nH;
$T_{vj\,(max)}$ = 150°C.

Chart 9 – max. transient thermal impedance.



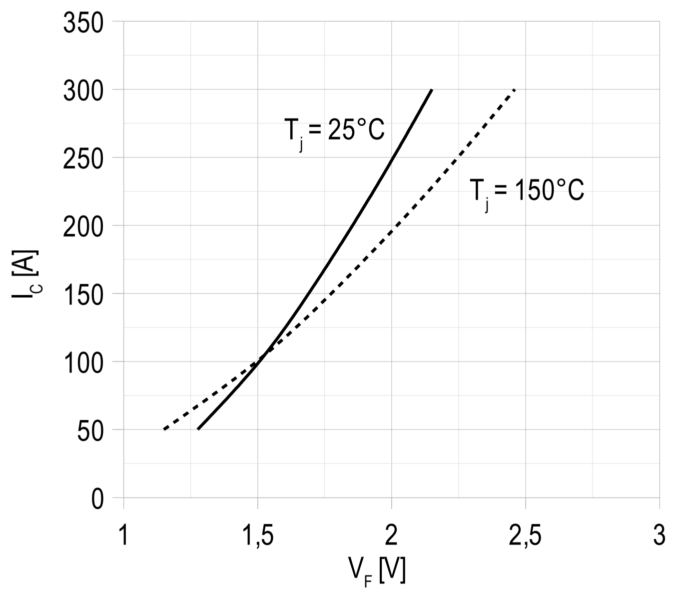
Single pulse;
V_{GE} = +15 V.

Chart 10 – RBSOA.



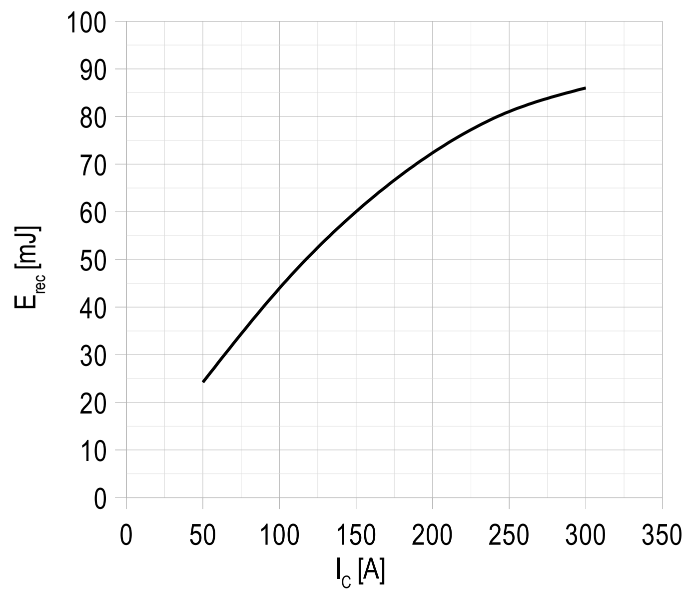
$V_{CE\ max}$ = 1700 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 2*$I_{C\ nom}$;
R_G = 3 Ω;
L = 56 nH.

Chart 11 – typ. output characteristic, FRD.



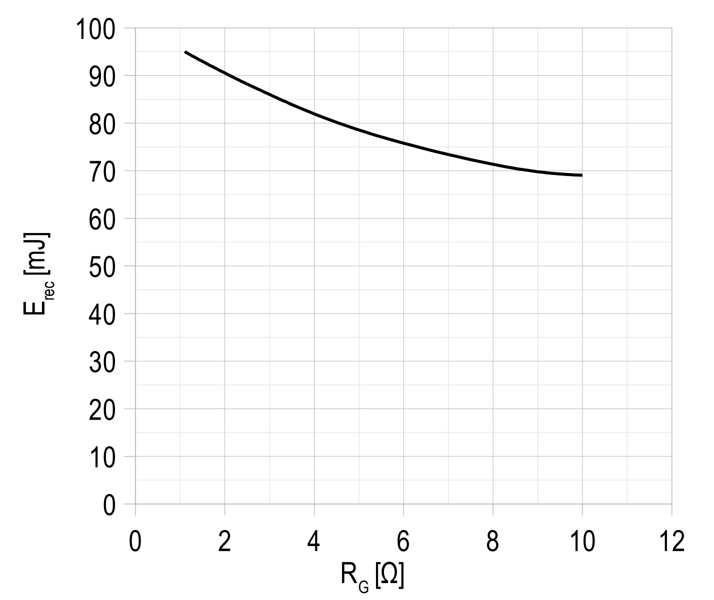
V_{GE} = 0 V.

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



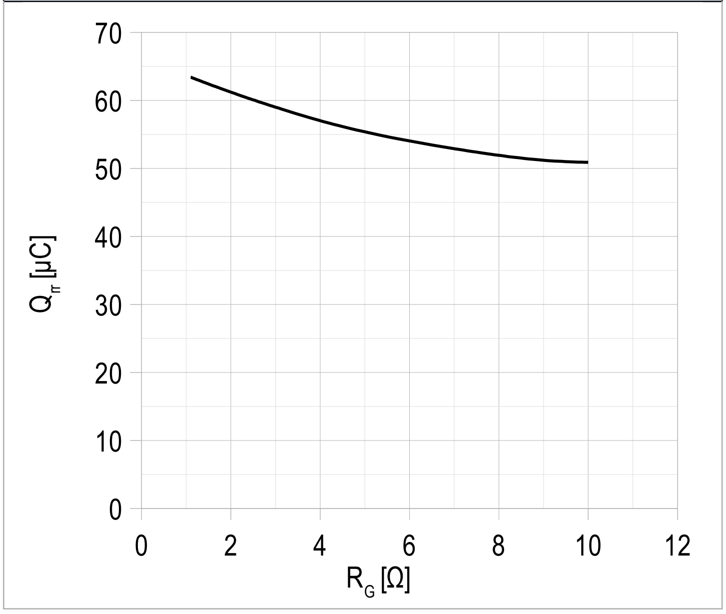
V_{GE} = ±15 V;
V_{CE} = 920 V;
L = 56 nH;
$R_{G\ on}$ = 3 Ω;
$T_{vj\ (max)}$ = 150°C.

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



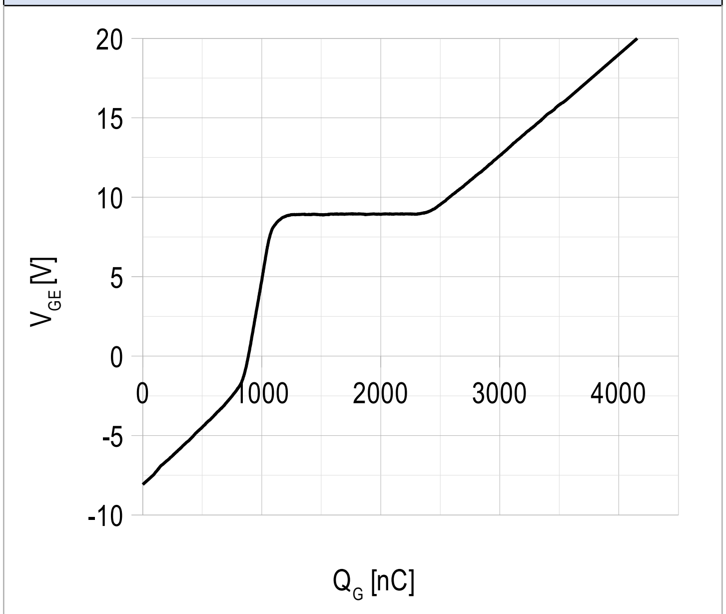
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\ max}$ = 300 A;
L = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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



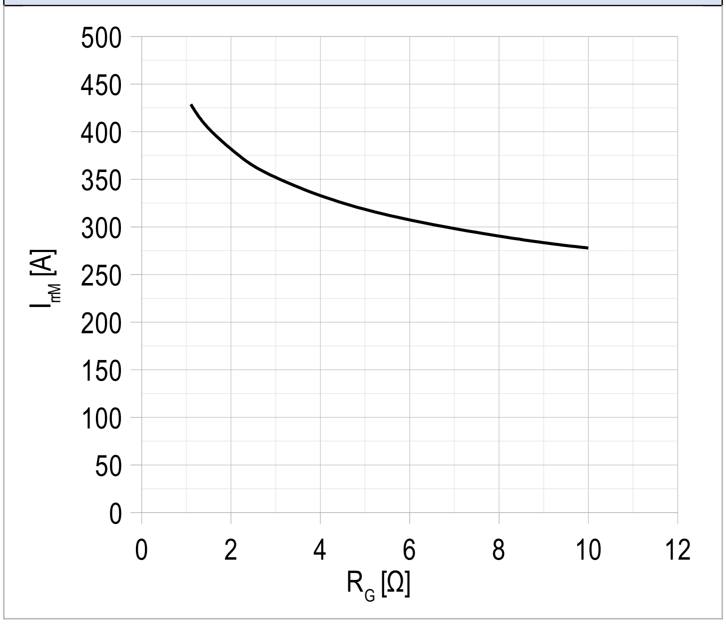
V_{GE} = ±15 V;
V_{CE} = 920 V;
$I_{C\ max}$ = 300 A;
L = 56 nH;
$T_{vj\ (max)}$ = 150°C.

Chart 15 – typ. gate charge characteristic.



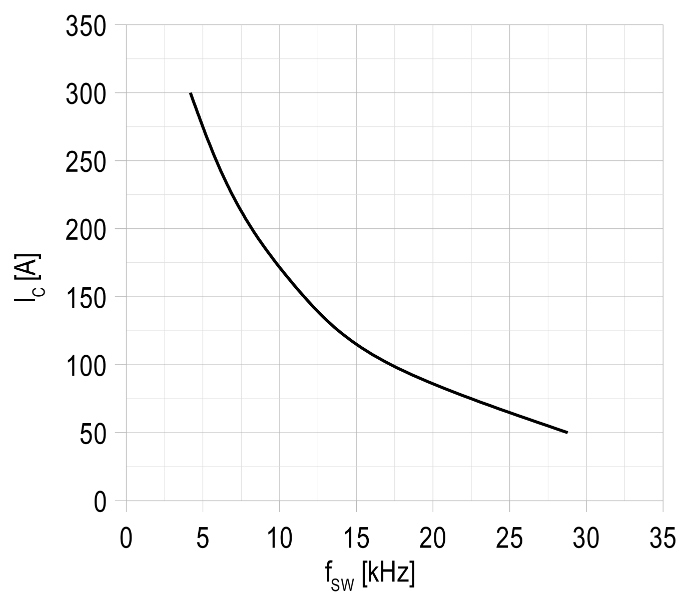
I_C = 300 A;
V_{CE} = 920 V;
V_{GE} = - 8÷15 V.

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



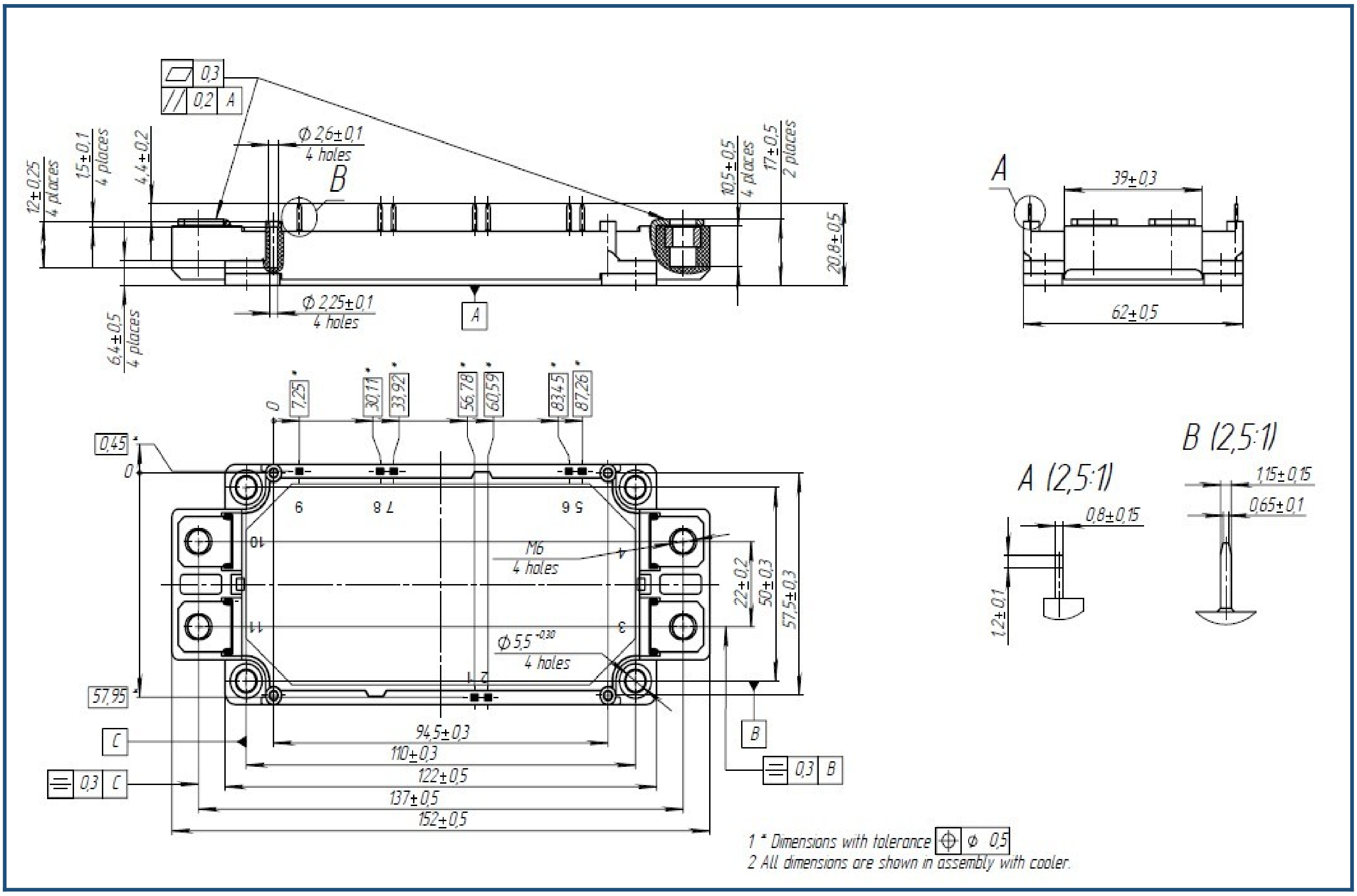
V_{CE} = 920 V;
V_{GE} = ±15 V;
L = 56 nH;
$T_{vj\ (max)}$ = 150°C.

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 – DA



Part numbering guide

MIDA	-	HB	17	FA	-	300	N	
MIDA								IGBT module package type: DA
		HB						Half-Bridge
			17					Voltage rating (V_{CES}/100)
				FA				IGBT+FRD chipset modification
						300		Current Rating
							N	Climatic version: normal climate