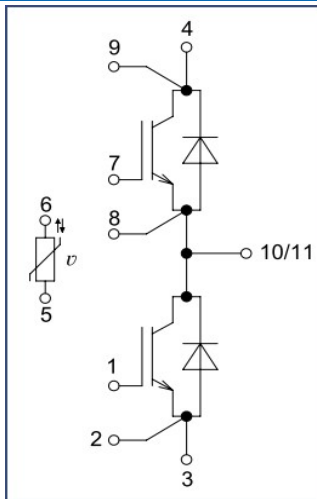
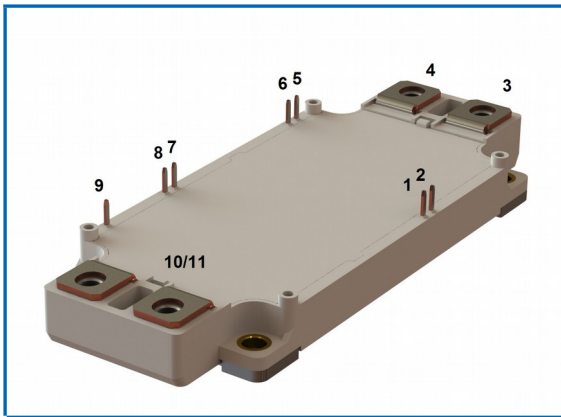


Low Inductance IGBT Module with 17 mm Height Housing
1200 V 300 A

Chip features

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

Design features

- copper baseplate
- Al₂O₃ 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}	$V_{GE} = 0.$	1200	V
Collector current (nominal)	$I_{C\ nom}$		300	A
Collector current (maximum continuous)	$I_{C\ 25}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 25^{\circ}C.$	447	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}	$T_{vj} = 25^{\circ}C; V_{GE} = \pm 15\ V; V_{CE} = 720\ V;$ $R_{G\ on} = R_{G\ off} = 1.5\ \Omega$	10	μ s
		$T_{vj} = 150^{\circ}C; V_{GE} = \pm 15\ V; V_{CE} = 720\ V;$ $R_{G\ on} = R_{G\ off} = 1.5\ \Omega$	10	
Gate-Emitter voltage	V_{GES}		± 20	V
Junction operating temperature	$T_{vj\ (op)}$		-40...+150	°C
Inverse diode				
Repetitive peak reverse voltage	V_{RRM}	$V_{GE} = 0\ V.$	1200	V
Forward current (nominal)	$I_{F\ nom}$		300	A
Forward current (maximum continuous)	$I_{F\ 25}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 25^{\circ}C.$	411	A
	$I_{F\ 80}$	$T_{vj\ (max)} = 175^{\circ}C; T_c = 80^{\circ}C.$	300	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	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}	$V_{GE} = +15\text{ V}; I_C = 300\text{ A}; t_u = 1000\ \mu\text{s}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	1.92 2.42	1.94 2.47	2.08 2.65	V V	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$I_C = 12\text{ mA}; V_{CE} = V_{GE}; T_{vj} = 25^\circ\text{C}; t_u = 2\text{ ms}.$		5.50	5.82	6.20	V	
Collector-Emitter cut-off current	I_{CES}	$V_{CE} = 1200\text{ V}; t_u = 50\text{ ms}; V_{GE} = 0.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	1.76 1.19	2.31 1.30	150 2.50	μA mA	
Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0; V_{GE} = \pm 20\text{ V}; T_{vj} = 25^\circ\text{C}; t_u = 30\text{ ms}.$		10.4	13.8	200	nA	
Input capacitance	C_{ies}	$V_{CE} = 10\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}; T_{vj} = 25^\circ\text{C}.$		-	27.3	-	nF	
Output capacitance	C_{oes}			-	2.1	-	nF	
Reverse transfer capacitance	C_{res}			-	2.4	-	nF	
Total gate charge	Q_G	$I_C = 300\text{ A}; V_{CE} = 600\text{ V}; V_{GE} = -8 \div 15\text{ V}.$		-	2880	3000	nC	
Internal gate resistance	R_{Gint}	$T_{vj} = 25^\circ\text{C}.$		-	2.5	-	Ω	
Turn-on delay time	$t_{d(on)}$	$V_{CE} = 600\text{ V}; V_{GE} = \pm 15\text{ V}; I_{Cmax} = 300\text{ A}; R_G = 1.5\ \Omega; L = 100\ \mu\text{H}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	376 416	384 420	430 460	ns	
Rise time	t_{ri}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	60 66	60 66	70 75	ns	
Turn-on energy	E_{on}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	7 15	8 16	11 19.5	mJ	
Turn-off delay time	$t_{d(off)}$		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	490 580	510 600	570 680	ns	
Fall time	t_{fi}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	224 300	232 308	260 350	ns	
Turn-off energy	E_{off}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	27 36	29 38	34 45	mJ	
Collector-emitter threshold voltage	V_{CE0}		$V_{GE} = +15\text{ V}; T_{vj} = 150^\circ\text{C}; I_{CE1} = 75\text{ A}; I_{CE2} = 300\text{ A}; t_u = 1000\ \mu\text{s}.$		0.859	0.866	0.900	V
On-State slope resistance (IGBT)	r_{CE0}				5.16	5.33	5.63	m Ω
Thermal resistance junction to case	$R_{th(j-c)}$		DC; $I_{test} = 1.5\text{ A}; V_{GE} = +15\text{ V}.$		-	0.0927	0.100	K/W
Inverse diode								
Forward voltage drop	V_F	$I_F = 300\text{ A}; V_{GE} = 0; t_u = 1000\ \mu\text{s}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	1.90 2.06	1.96 2.13	2.14 2.34	V V	
Reverse recovery time	t_{rr}	$V_{GE} = \pm 15\text{ V}; V_{CE} = 600\text{ V}; I_{Cmax} = 300\text{ A}; R_{Gon} = 1.5\ \Omega; L = 100\ \mu\text{H}.$	$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	122 179	128 188	150 220	ns ns	
Repetitive peak reverse current	I_{rrm}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	235 292	243 299	270 330	A A	
Reverse recovered charge	Q_{rr}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	17 31	18 32	21 36	μC μC	
Reverse recovery energy	E_{rec}		$T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	10 24	10 25	13 29	mJ mJ	
Threshold voltage	$V_{(TO)}$		$T_{vj} = 150^\circ\text{C}; V_{GE} = 0; t_u = 1000\ \mu\text{s}$		0.831	0.843	0.890	V
Forward slope resistance	r_T				4.09	4.30	4.67	m Ω
Thermal resistance junction to case	$R_{th(jc-D)}$	DC; $I_{test} = 1.5\text{ A}; V_{GE} = +15\text{ V}.$		-	0.128	0.135	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 M6		3	-	6	N*m
Mounting torque for terminal screws	M _t	to terminals M5		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;
- The information given in the datasheet is preliminary.

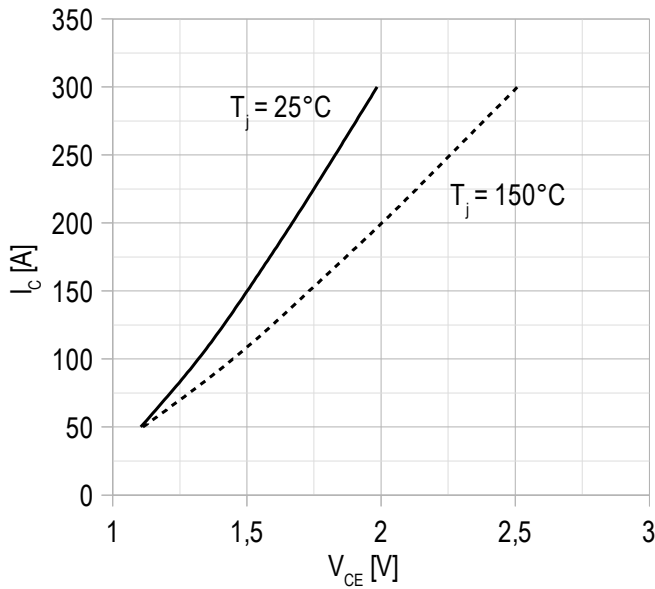
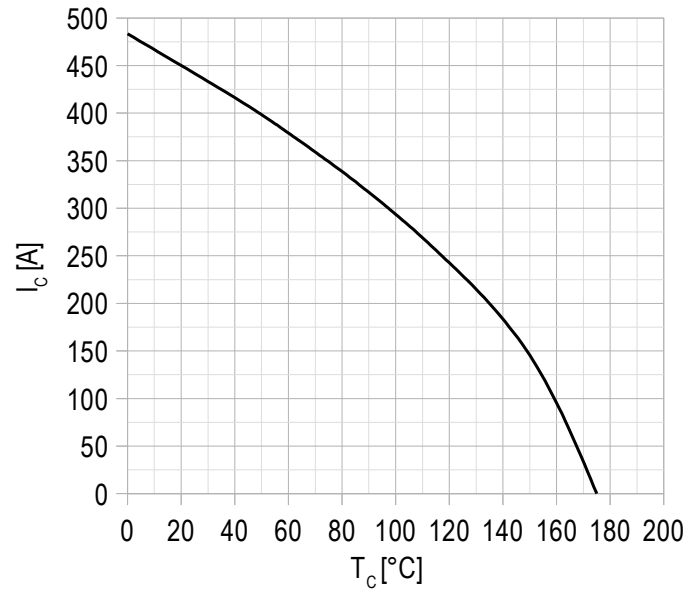
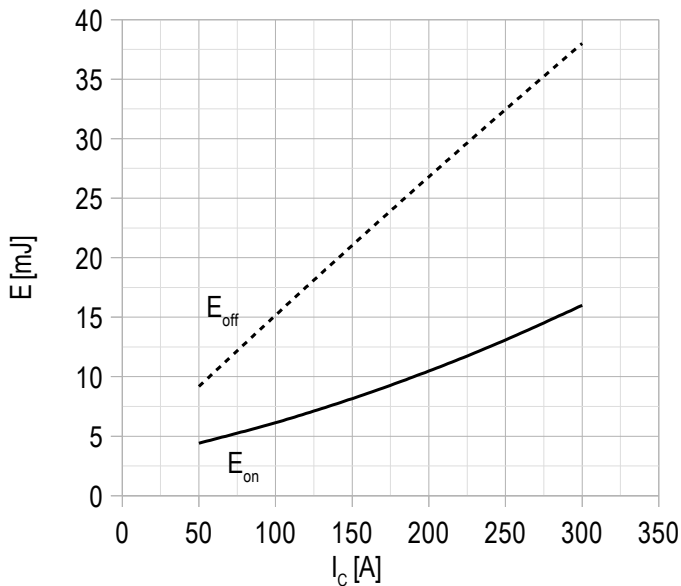
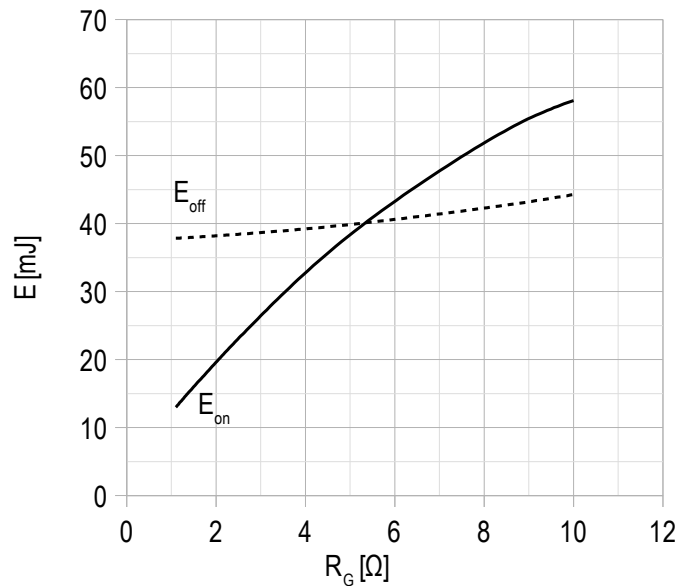
Chart 1 – typ. output characteristic, IGBT.

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

Chart 2 – max. rated current vs temperature.


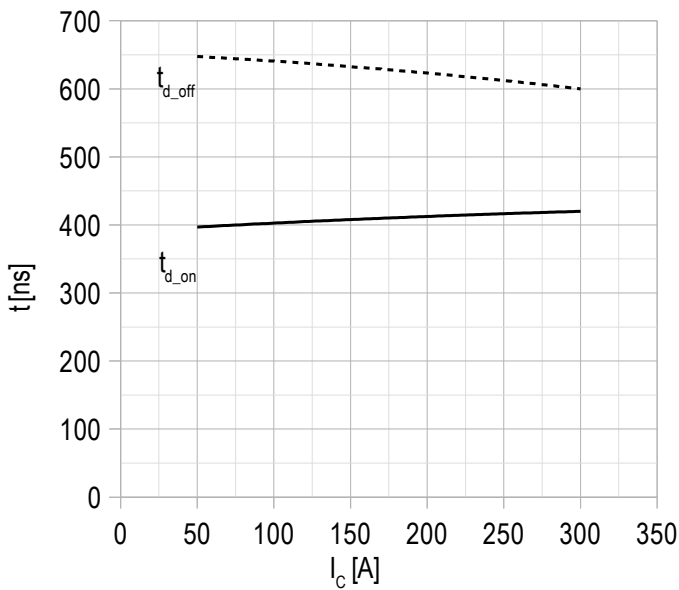
DC;
 $V_{GE} = +15\text{ V}$;
 $T_{vj(max)} = 150^\circ\text{C}$.

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


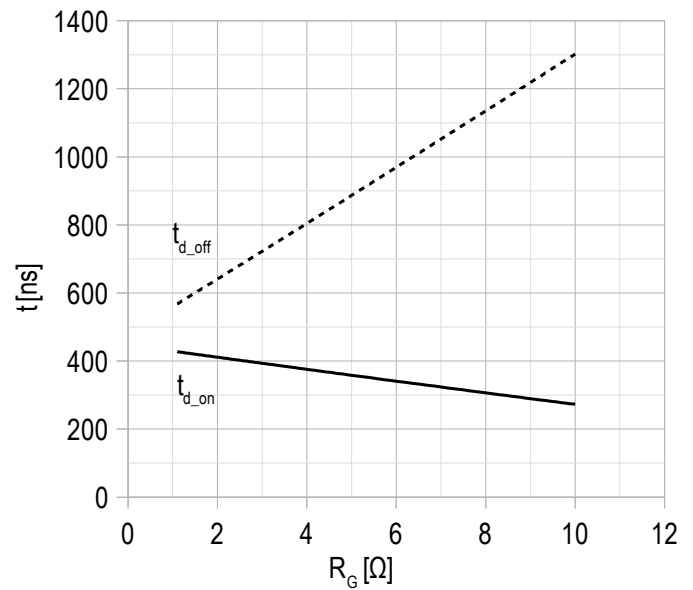
$V_{CE} = 600\text{ V}$;
 $V_{GE} = \pm 15\text{ V}$;
 $R_G = 1.5\ \Omega$;
 $L = 100\ \mu\text{H}$;
 $T_{vj(max)} = 150^\circ\text{C}$.

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


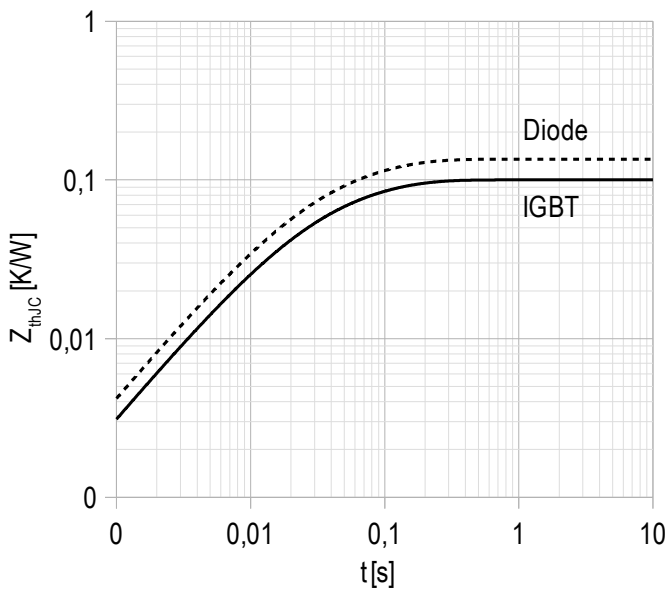
$V_{CE} = 600\text{ V}$;
 $V_{GE} = \pm 15\text{ V}$;
 $I_{Cmax} = 300\text{ A}$;
 $L = 100\ \mu\text{H}$;
 $T_{vj(max)} = 150^\circ\text{C}$.

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


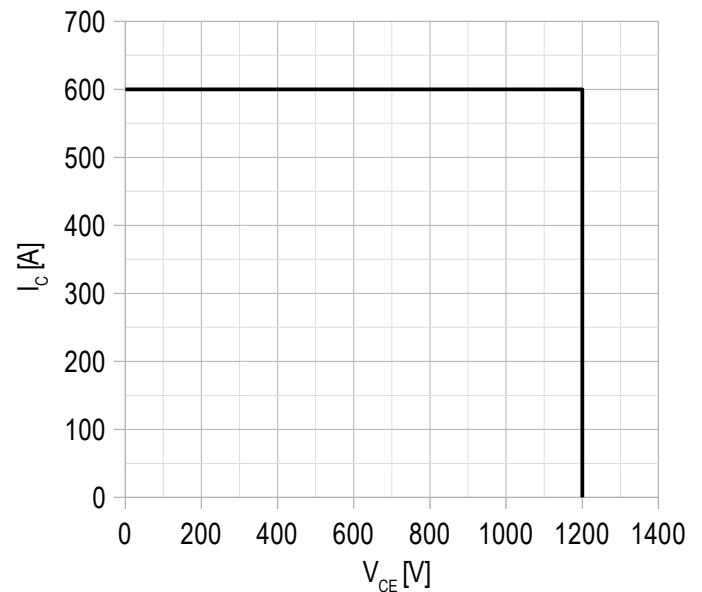
$V_{CE} = 600$ V;
 $V_{GE} = \pm 15$ V;
 $R_G = 1.5$ Ω ;
 $L = 100$ μ H;
 $T_{vj(max)} = 150^\circ$ C.

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


$V_{CE} = 600$ V;
 $V_{GE} = \pm 15$ V;
 $I_{Cmax} = 300$ A;
 $L = 100$ μ H;
 $T_{vj(max)} = 150^\circ$ C.

Chart 7 – max. transient thermal impedance.


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

Chart 8 – RBSOA.


$V_{CEmax} = 1200$ V;
 $V_{GE} = \pm 15$ V;
 $I_{Cmax} = 2 \cdot I_{Cnom}$;
 $R_G = 1.5$ Ω ;
 $L = 30$ μ H.

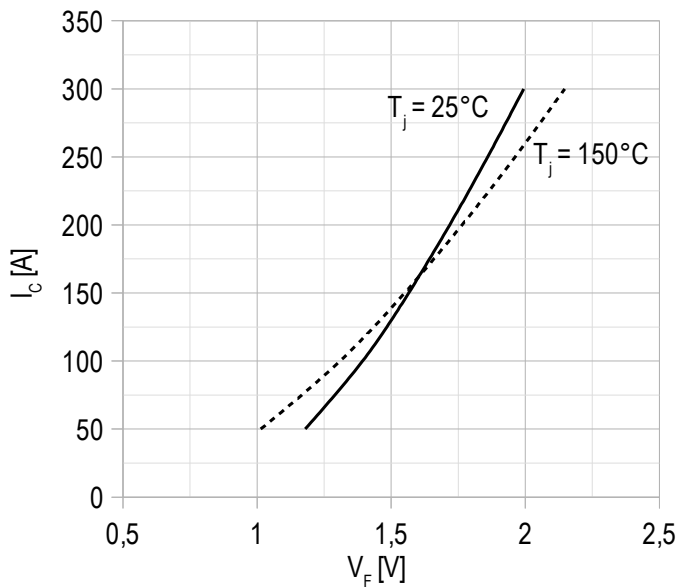
Chart 9 – typ. output characteristic, FRD.

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

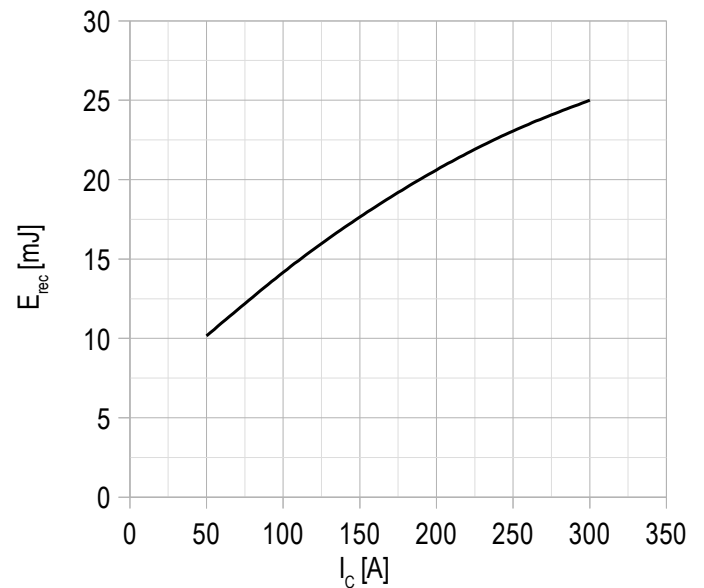
Chart 10 – typ. switching losses vs rated current, FRD.

 $V_{GE} = \pm 15\text{ V}$;
 $V_{CE} = 600\text{ V}$;
 $L = 100\ \mu\text{H}$;
 $R_{G\ on} = 1.5\ \Omega$;
 $T_{vj\ (max)} = 150^\circ\text{C}$.

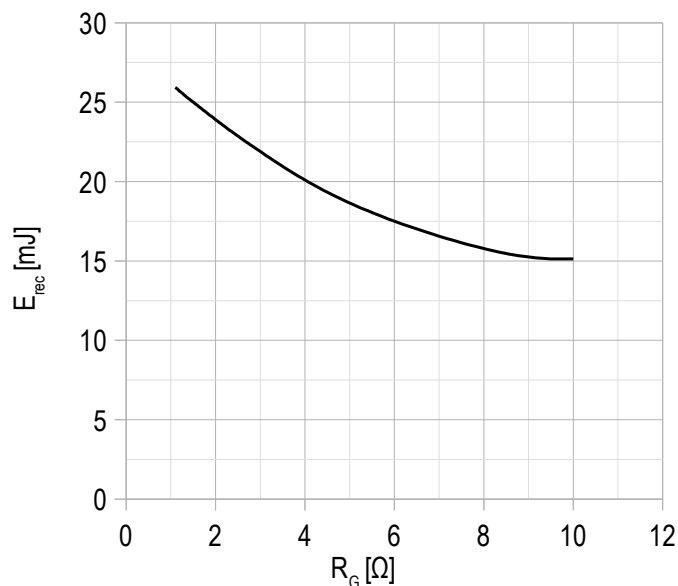
Chart 11 – typ. switching losses vs gate resistance, FRD.

 $V_{GE} = \pm 15\text{ V}$;
 $V_{CE} = 600\text{ V}$;
 $I_{C\ max} = 300\text{ A}$;
 $L = 100\ \mu\text{H}$;
 $T_{vj\ (max)} = 150^\circ\text{C}$.

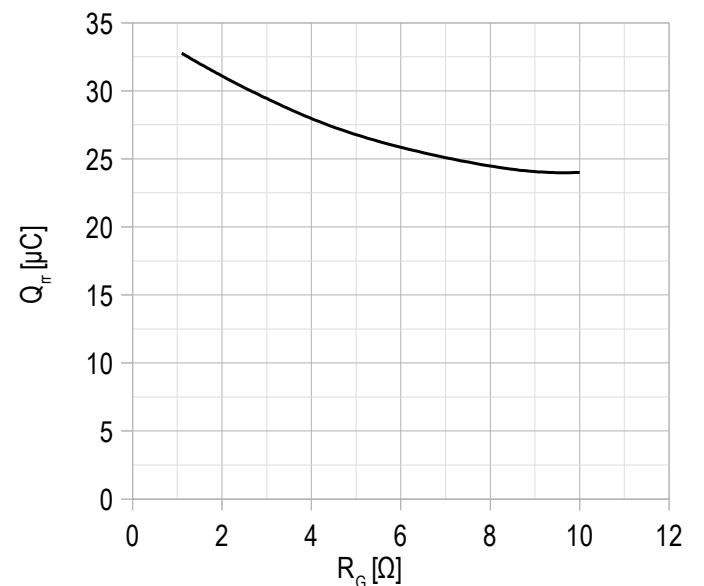
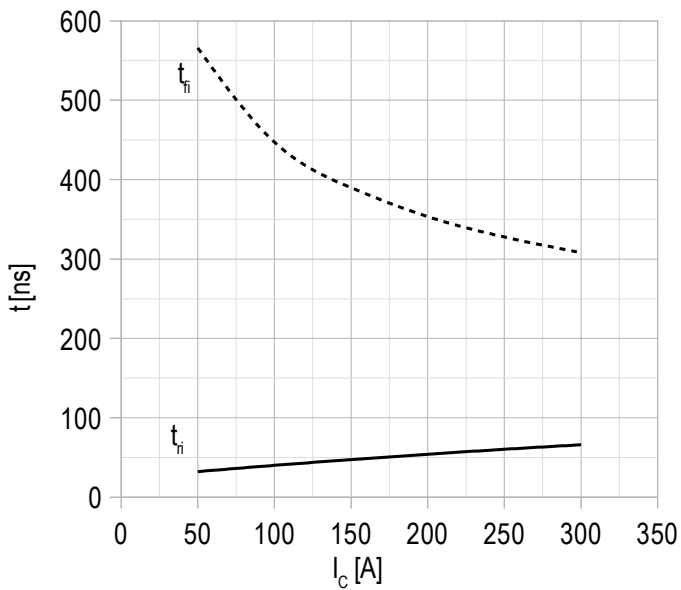
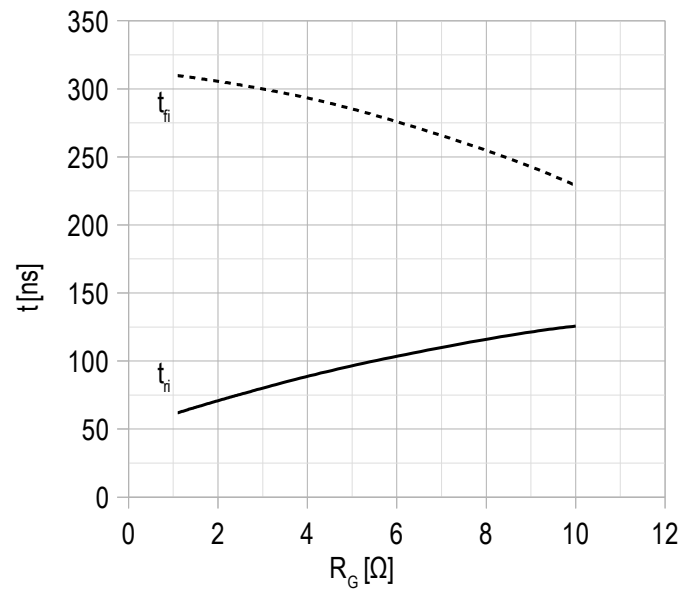
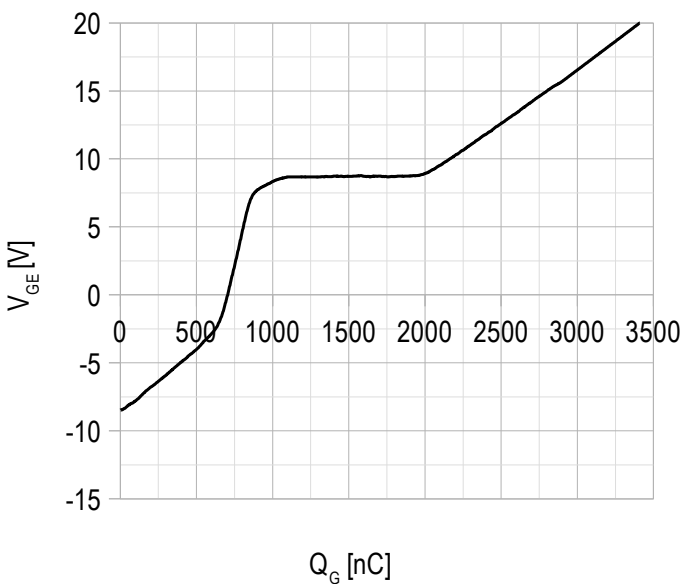
Chart 12 – typ. reverse recovered charge vs gate resistance, FRD.

 $V_{GE} = \pm 15\text{ V}$;
 $V_{CE} = 600\text{ V}$;
 $I_{C\ max} = 300\text{ A}$;
 $L = 100\ \mu\text{H}$;
 $T_{vj\ (max)} = 150^\circ\text{C}$.

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


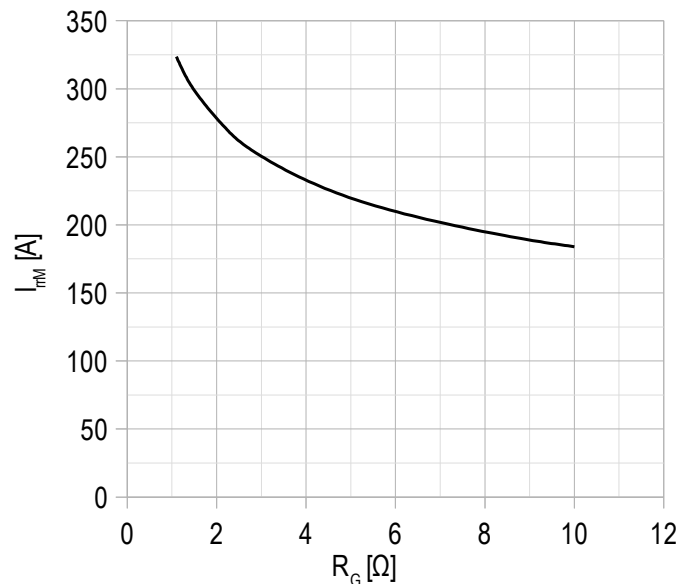
$V_{CE} = 600$ V;
 $V_{GE} = \pm 15$ V;
 $R_G = 1.5$ Ω ;
 $L = 100$ μ H.
 $T_{vj(max)} = 150^\circ$ C.

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


$V_{CE} = 600$ V;
 $V_{GE} = \pm 15$ V;
 $I_{Cmax} = 300$ A;
 $L = 100$ μ H.
 $T_{vj(max)} = 150^\circ$ C.

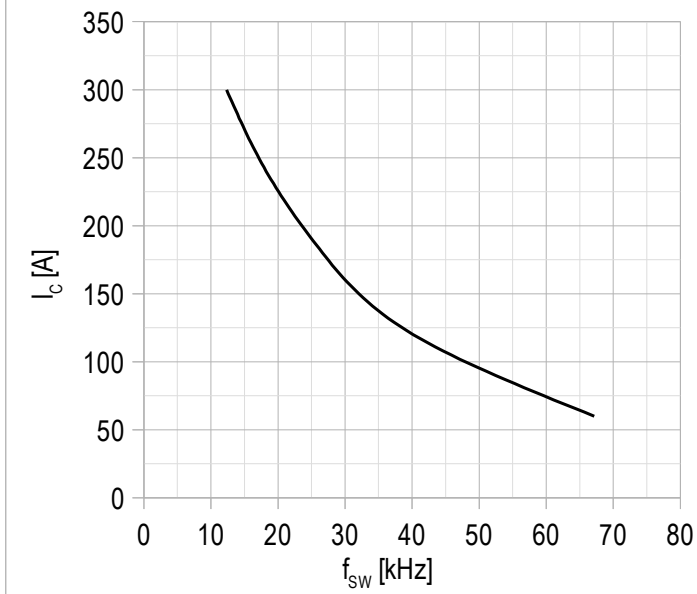
Chart 15 – typ. gate charge characteristic.


$I_C = 300$ A;
 $V_{CE} = 600$ V;
 $V_{GE} = -8 \div 15$ V.

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


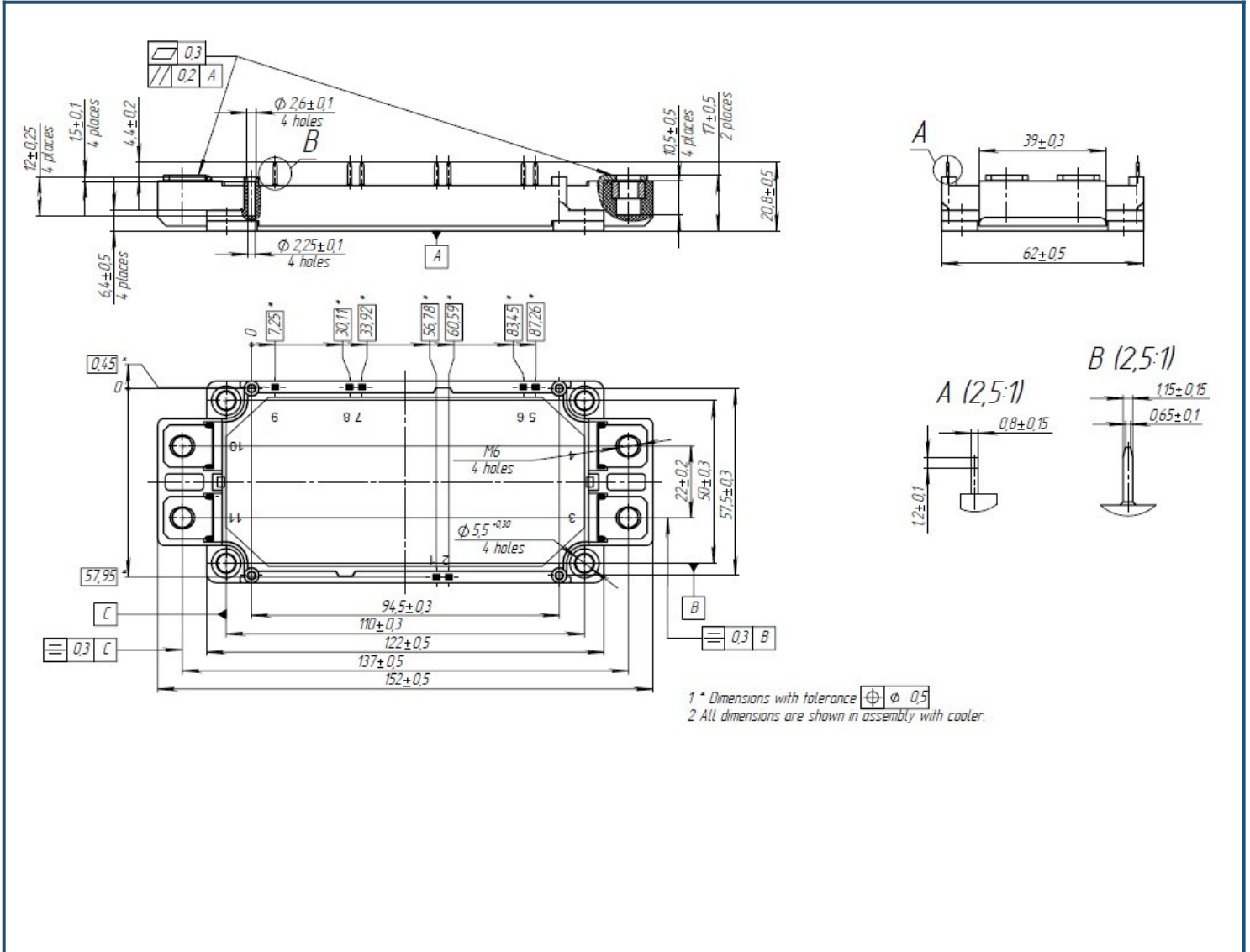
$V_{CE} = 600$ V;
 $V_{GE} = \pm 15$ V;
 $L = 100$ μ H.
 $T_{vj(max)} = 150^\circ$ C.

Chart 17 – typ. rated current vs frequency.



Duty cycle 50%

Overall dimensions: Package type – DA



Part numbering guide

MIDA	-	HB	12	FA	-	300	N	
MIDA								IGBT module package type: DA
		HB						Half-Bridge
			12					Voltage rating (V _{CES} /100)
				FA				IGBT+FRD chipset modification
						300		Current Rating
							N	Climatic version: normal climate

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