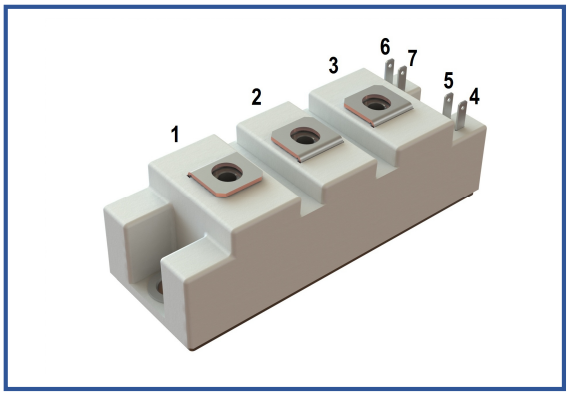
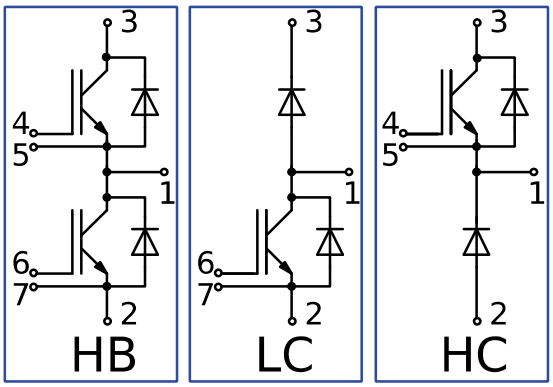
Industry standart 34mm IGBT module

1200 V 150 A





Chip features

- IGBT chip
  - Trench FS — V-Series IGBT (6 th 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 termal cycling
- RoHS compliant

Typical application

- AC motor drivers
- 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.	1200	V
Collector current (nominal)	$I_{C\ nom}$		150	A
Collector current (maximum continuous)	$I_{C\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	232	A
	$I_{C\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	179	A
Repetitive peak collector current*1	I_{CRM}	I_{CRM} = 3 x $I_{C\ nom}$; t_p = 1 ms.	450	A
Short-circuit duration	t_{psc}	T_{vj} = 25°C; V_{GE} = ±15 V; V_{CE} = 700 V; $R_{G\ on}$ = $R_{G\ off}$ = 1.5 Ω; $I_{C\ max}$ < 1100 A.	10	µs
		T_{vj} = 150°C; V_{GE} = ±15 V; V_{CE} = 700 V; $R_{G\ on}$ = $R_{G\ off}$ = 1.5 Ω; $I_{C\ max}$ < 1100 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.	1200	V
Forward current (nominal)	$I_{F\ nom}$		150	A
Forward current (maximum continuous)	$I_{F\ 25}$	$T_{vj\ (max)}$ = 175°C; T_c = 25°C.	220	A
	$I_{F\ 80}$	$T_{vj\ (max)}$ = 175°C; T_c = 80°C.	146	A
Repetitive peak forward current*1	I_{FRM}	I_{FRM} = 3 x $I_{F\ nom}$; t_p = 1 ms.	450	A
Junction operating temperature	$T_{vj\ (op)}$		-40…+150	°C
Module				
Storage temperature	T_{stg}		-40…+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

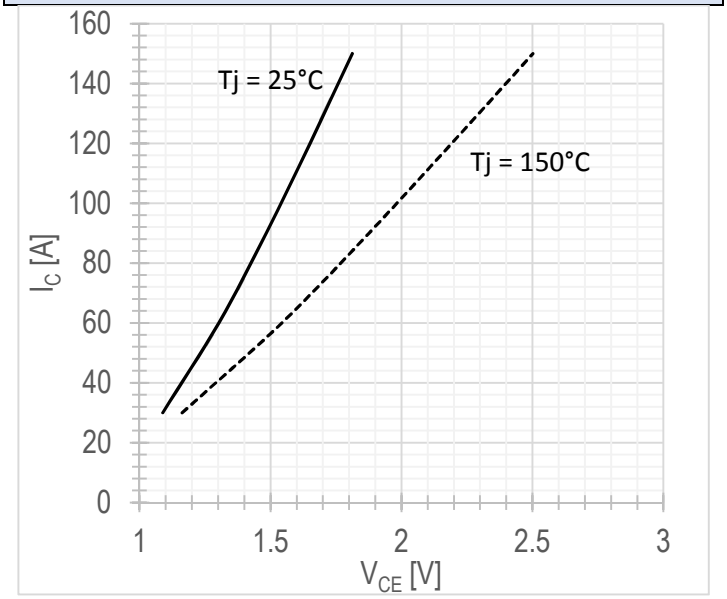
Definition	Symbol	Conditions		Value min.	Value typ.	Value max.	Unit
IGBT							
Collector-Emitter saturation voltage	V_{CEsat}	V_{GE} = +15 V; I_C = 150 A; t_u = 1000 µs.	T_{vj} = 25°C	1.77	1.81	1.90	V
			T_{vj} = 150°C	2.26	2.31	2.50	V
Gate-Emitter threshold voltage	$V_{GE(th)}$	I_C = 1.6 mA; V_{CE} = V_{GE}; T_{vj} = 25°C; t_u = 2 ms.		5.50	6.04	6.50	V
Collector-Emitter cut-off current	I_{CES}	V_{CE} = 1200 V; t_u = 10 ms; V_{GE} = 0.	T_{vj} = 25°C	2.32	2.71	150	µA
			T_{vj} = 150°C	0.77	0.98	1.50	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0; V_{GE} = ±20 V; T_{vj} = 25°C; t_u = 30 ms.		10.0	13.9	125	nA
Input capacitance	C_{ies}	V_{CE} = 10 V; V_{GE} = 0 V; f = 1 MHz; T_{vj} = 25°C.		-	13.8	-	nF
Output capacipance	C_{oes}			-	1.00	-	nF
Reverse transfer capacitance	C_{res}			-	1.20	-	nF
Total gate charge	Q_G	I_C = 150 A; V_{CE} = 600 V; V_{GE} = - 8÷15 V.		-	1565	1676	нC
Internal gate resistance	R_{Gint}	T_{vj} = 25°C.		-	5.00	-	Ω
Turn-on delay time	$t_{d(on)}$	V_{CE} = 600 V; V_{GE} = ±15 V; $I_{C\,max}$ = 150 A; R_G = 1.5 Ω; L = 300 µH.	T_{vj} = 25°C	331	350	400	ns
			T_{vj} = 150°C	375	390	440	ns
Rise time	t_{ri}		T_{vj} = 25°C	46.0	49.0	56.0	ns
			T_{vj} = 150°C	51.0	53.5	60.0	ns
Turn-on energy	E_{on}		T_{vj} = 25°C	4.26	6.30	8.50	mJ
			T_{vj} = 150°C	10.1	11.5	14.0	mJ
Turn-off delay time	$t_{d(off)}$		T_{vj} = 25°C	407	419	460	ns
			T_{vj} = 150°C	470	483	540	ns
Fall time	t_{fi}		T_{vj} = 25°C	183	232	310	ns
			T_{vj} = 150°C	322	354	440	ns
Turn-off energy	E_{off}		T_{vj} = 25°C	11.5	12.5	16.0	mJ
			T_{vj} = 150°C	15.6	16.6	20.0	mJ
Collector-emitter threshold voltage	V_{CE0}	V_{GE} = +15 V; T_{vj} = 150°C; I_{CE1} = 38 A; I_{CE2} = 150 A; t_u = 1000 µs.		0.84	0.86	0.90	V
On-State slope resistance (IGBT)	r_{CE0}			9.46	9.76	10.7	mΩ
Thermal resistance junction to case	$R_{th(j-c)}$	DC; I_{CE} = 150 A; I_{test} = 0.5 A; V_{GE} = +15 V.		-	0.146	0.190	K/W
Inverse diode \ Freewheeling diode							
Forward voltage drop	V_F	I_F = 150 A; V_{GE} = 0; t_u = 1000 µs.	T_{vj} = 25°C	1.78	1.83	1.96	V
			T_{vj} = 150°C	1.91	1.95	2.10	V
Reverse recovery time	t_{rr}	V_{GE} = ±15 V; V_{CE} = 600 V; $I_{C\,max}$ = 150 A; L = 300 µH; $R_{G\,on}$ = 1.5 Ω.	T_{vj} = 25°C	110	122	145	ns
			T_{vj} = 150°C	359	410	500	ns
Repetitive peak reverse current	I_{rrm}		T_{vj} = 25°C	127	134	152	A
			T_{vj} = 150°C	158	167	177	A
Reverse recovered charge	Q_{rr}		T_{vj} = 25°C	9.00	9.80	11.0	µC
			T_{vj} = 150°C	22.2	23.1	26.0	µC
Reverse recovery energy	E_{rec}		T_{vj} = 25°C	4.19	4.55	6.00	mJ
			T_{vj} = 150°C	9.61	10.3	12.0	mJ
Threshold voltage	$V_{(T0)}$	T_{vj} = 150°C; V_{GE} = 0; I_{CE1} = 38 A; I_{CE2} = 150 A; t_u = 1000 µs		0.82	0.83	0.84	V
Forward slope resistance	r_T			7.23	7.53	8.15	mΩ
Thermal resistance junction to case	$R_{th(JC-D)}$	DC; I_{CE} = 120 A; I_{test} = 0.5 A; V_{GE} = +15 V.		-	0.260	0.320	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}	-	34.5	35.0	nH
			L_{P13}	-	52.3	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		3.00	-	5.00	Nm
Mounting torque for terminal screws	M_t	to terminals M5		2.25	2.50	2.75	Nm
Weight	W			-	150	170	g

Notes:

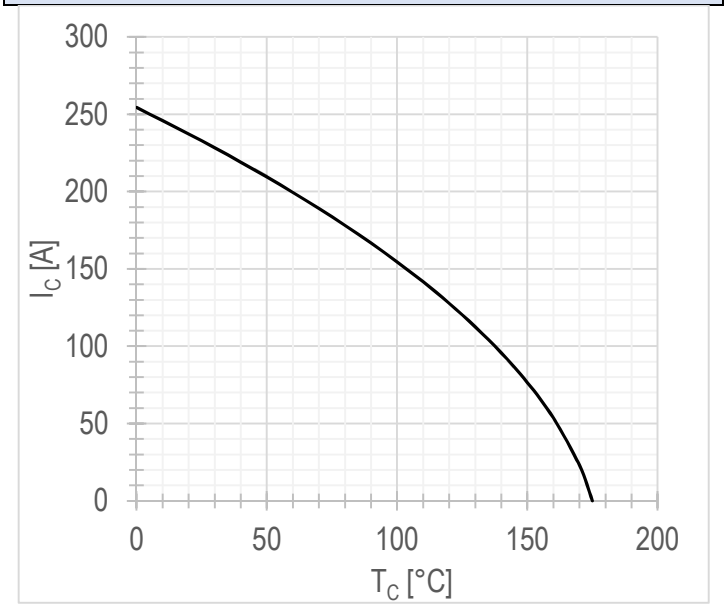
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op}$ = - 40 ÷ +150°C.

Chart 1 – typ. output characteristic, IGBT.



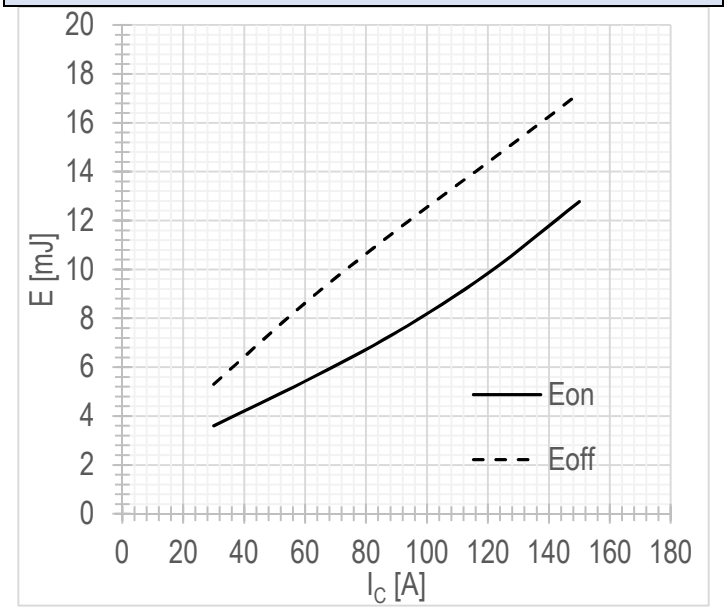
V_{GE} = +15 V.

Chart 2 – typ. rated current vs temperature.



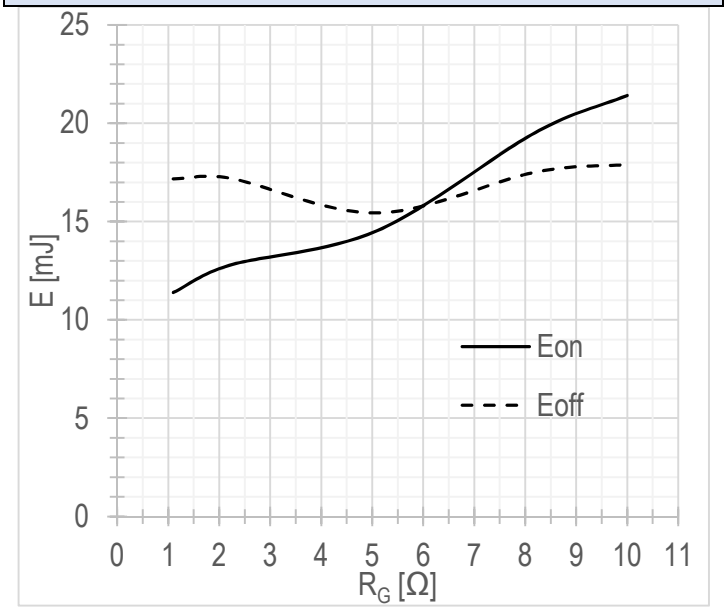
DC;
V_{GE} = +15 V;
$T_{vj\ (max)}$ = 150°C.

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



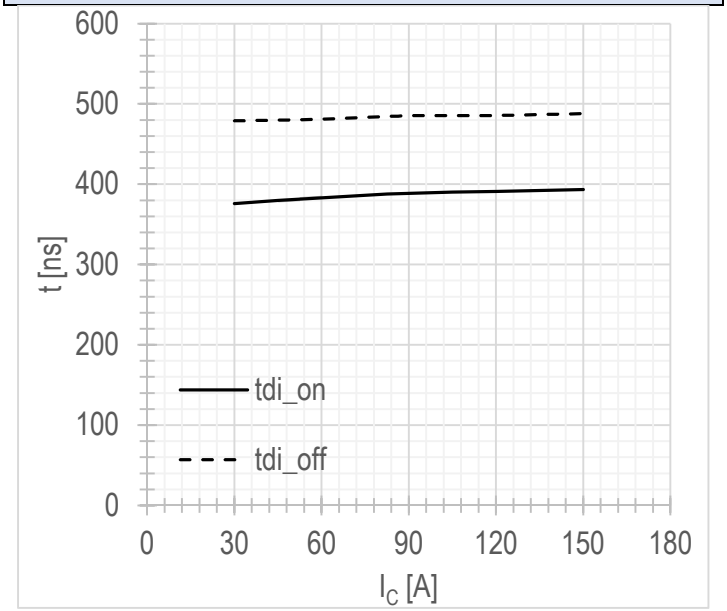
V_{CE} = 600 V;
V_{GE} = ±15 V;
R_G = 1.5 Ω;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

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



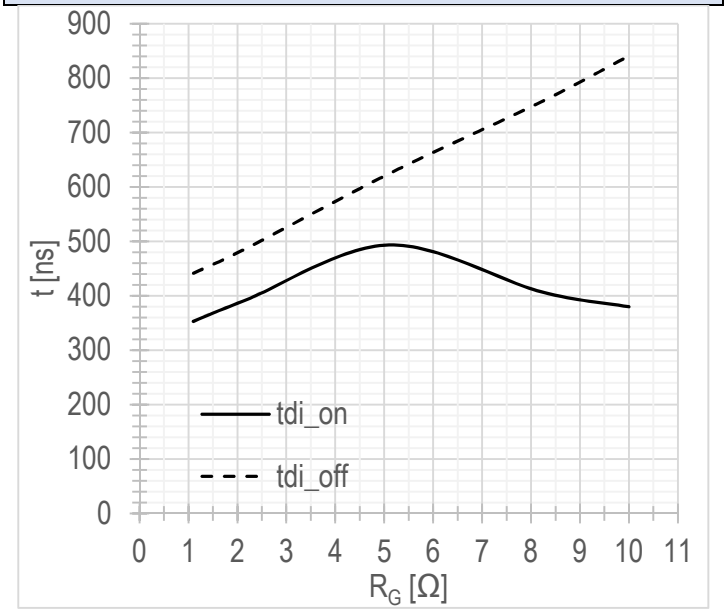
V_{CE} = 600 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 150 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

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



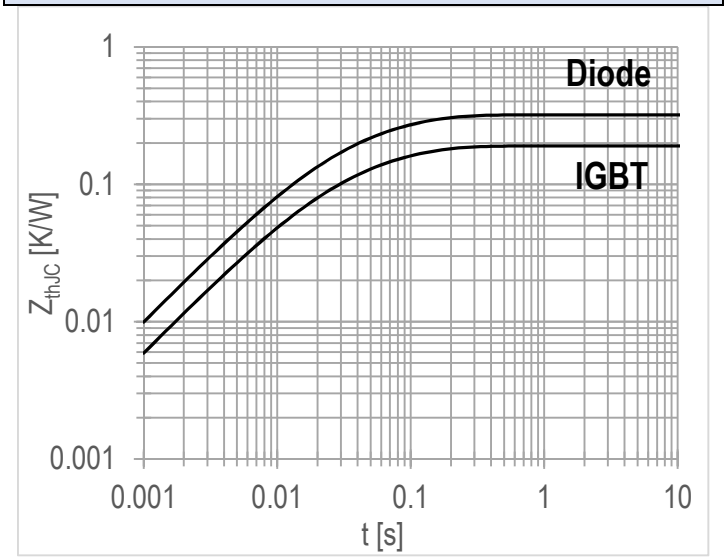
V_{CE} = 600 V;
V_{GE} = ±15 V;
R_G = 1.5 Ω;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

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



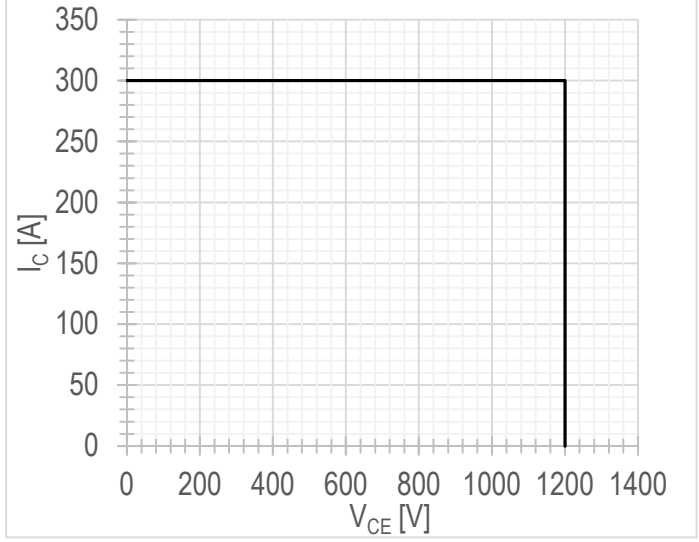
V_{CE} = 600 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 150 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

Chart 7 – max. transient thermal impedance .



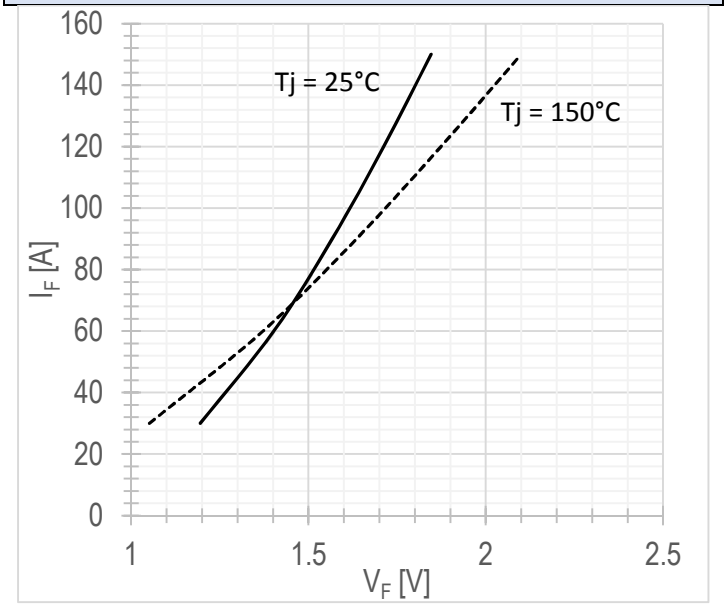
Single pulse;
V_{GE} = +15 V.

Chart 8 – RBSOA.



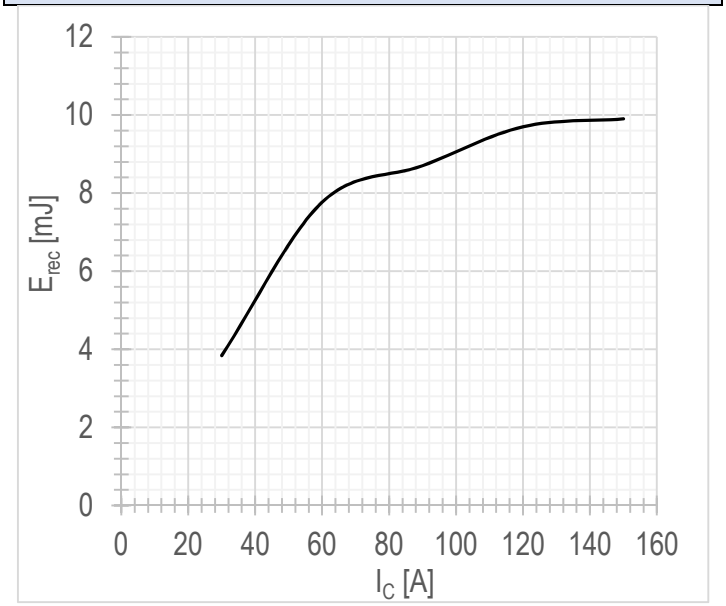
$V_{CE\ max}$ = 1200 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 2*$I_{C\ nom}$;
L = 300 µH.

Chart 9 – typ. output characteristic, FRD.



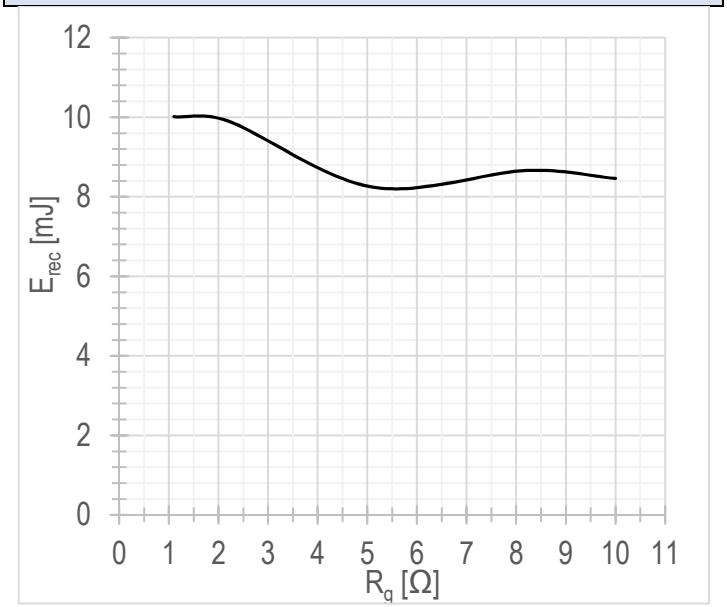
V_{GE} = +15 V.

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



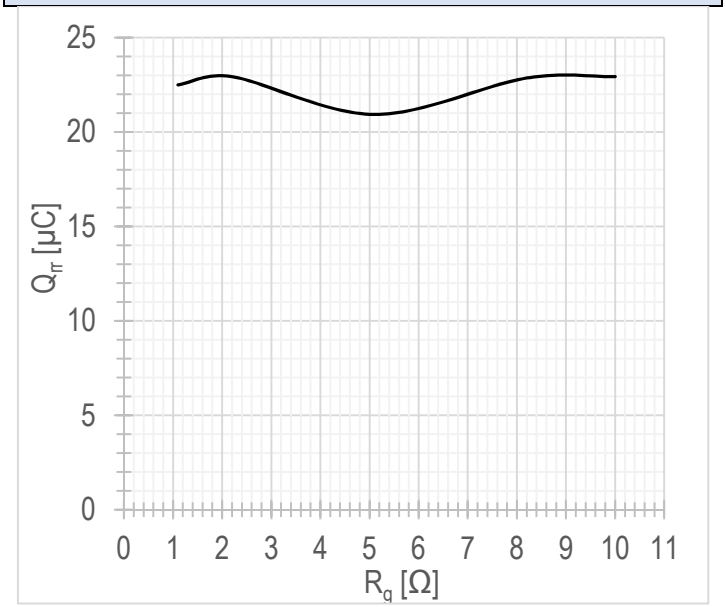
V_{GE} = ±15 V;
V_{CE} = 600 V;
L = 300 µH;
R_G = 1.5 Ω;
$T_{vj\ (max)}$ = 150°C.

Chart 11 – typ. swithing losses vs gate resistanse, FRD.



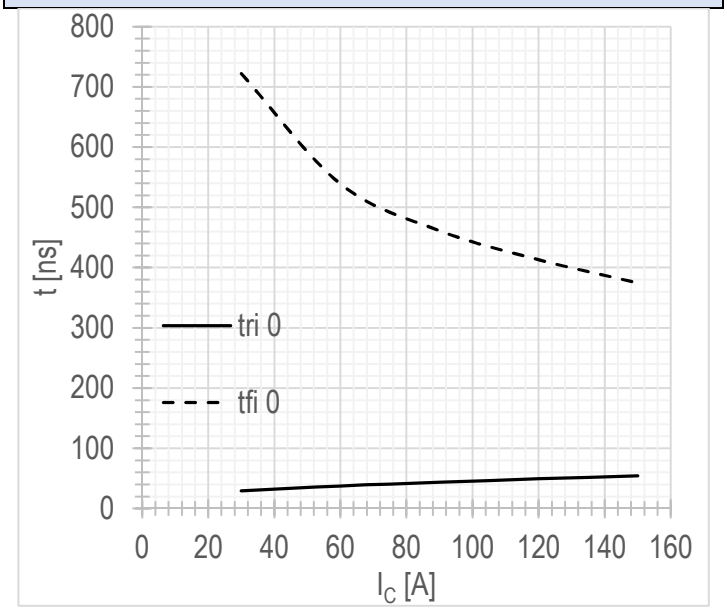
V_{GE} = ±15 V;
V_{CE} = 600 V;
$I_{C\ max}$ = 150 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

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



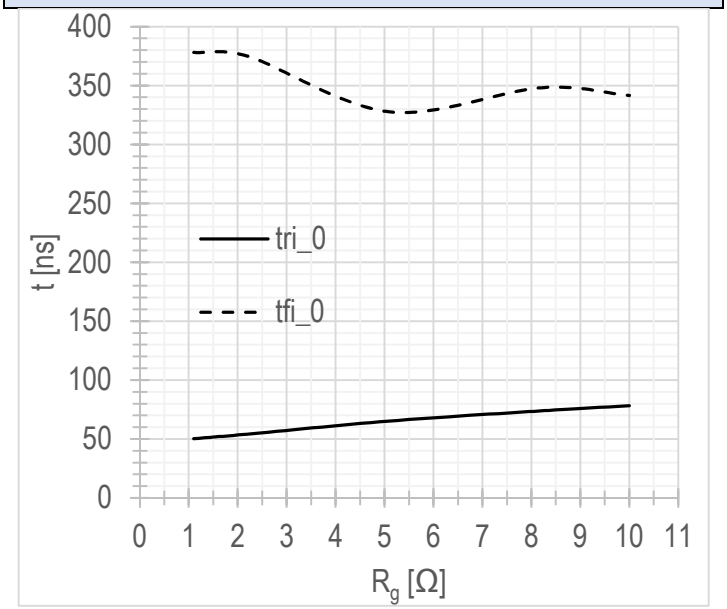
V_{GE} = ±15 V;
V_{CE} = 600 V;
$I_{C\ max}$ = 150 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

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



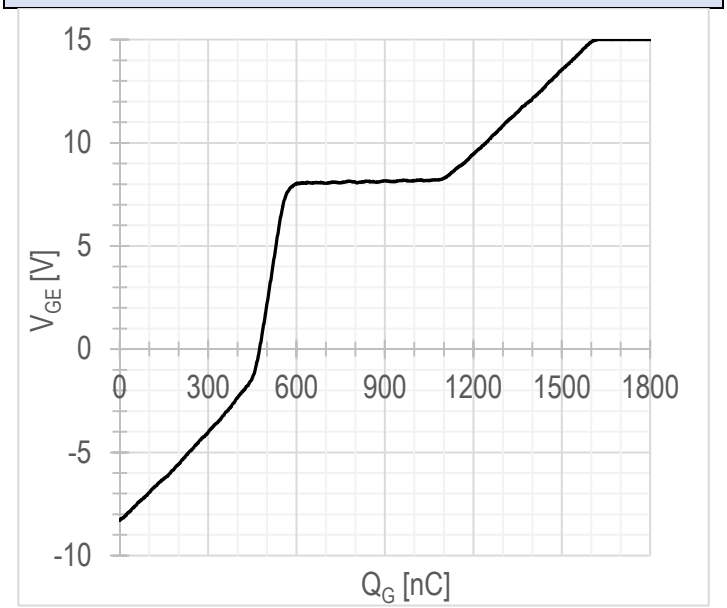
V_{CE} = 600 V;
V_{GE} = ±15 V;
R_G = 1.5 Ω;
L = 300 µH.
$T_{vj\ (max)}$ = 150°C.

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



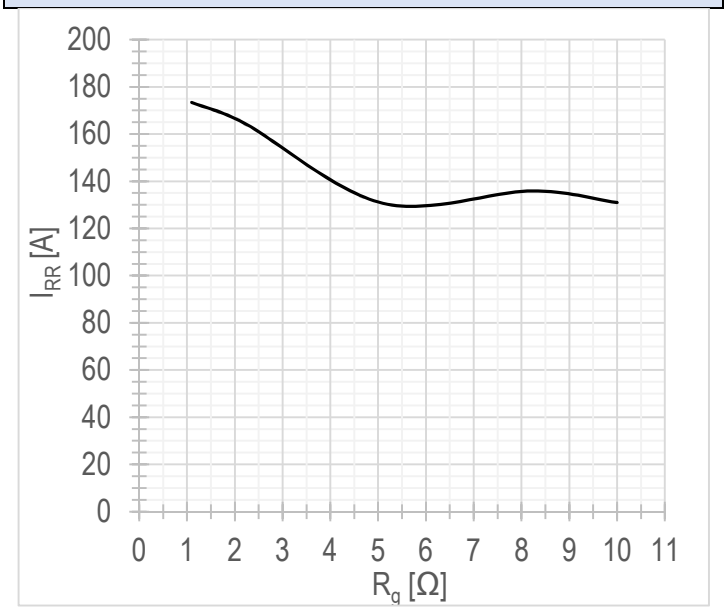
V_{CE} = 600 V;
V_{GE} = ±15 V;
$I_{C\ max}$ = 150 A;
L = 300 µH.
$T_{vj\ (max)}$ = 150°C.

Chart 15 – typ. gate charge characteristic.



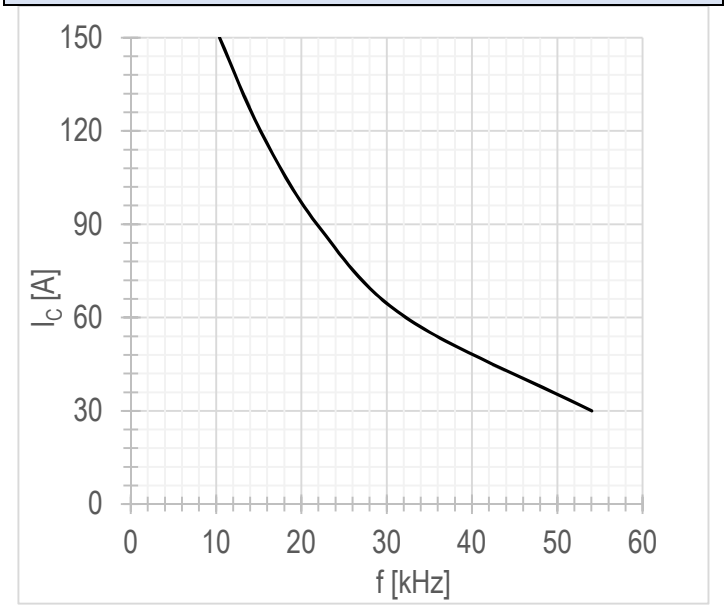
I_C = 150 A;
V_{CE} = 600 V;
V_{GE} = - 8÷15 V.

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



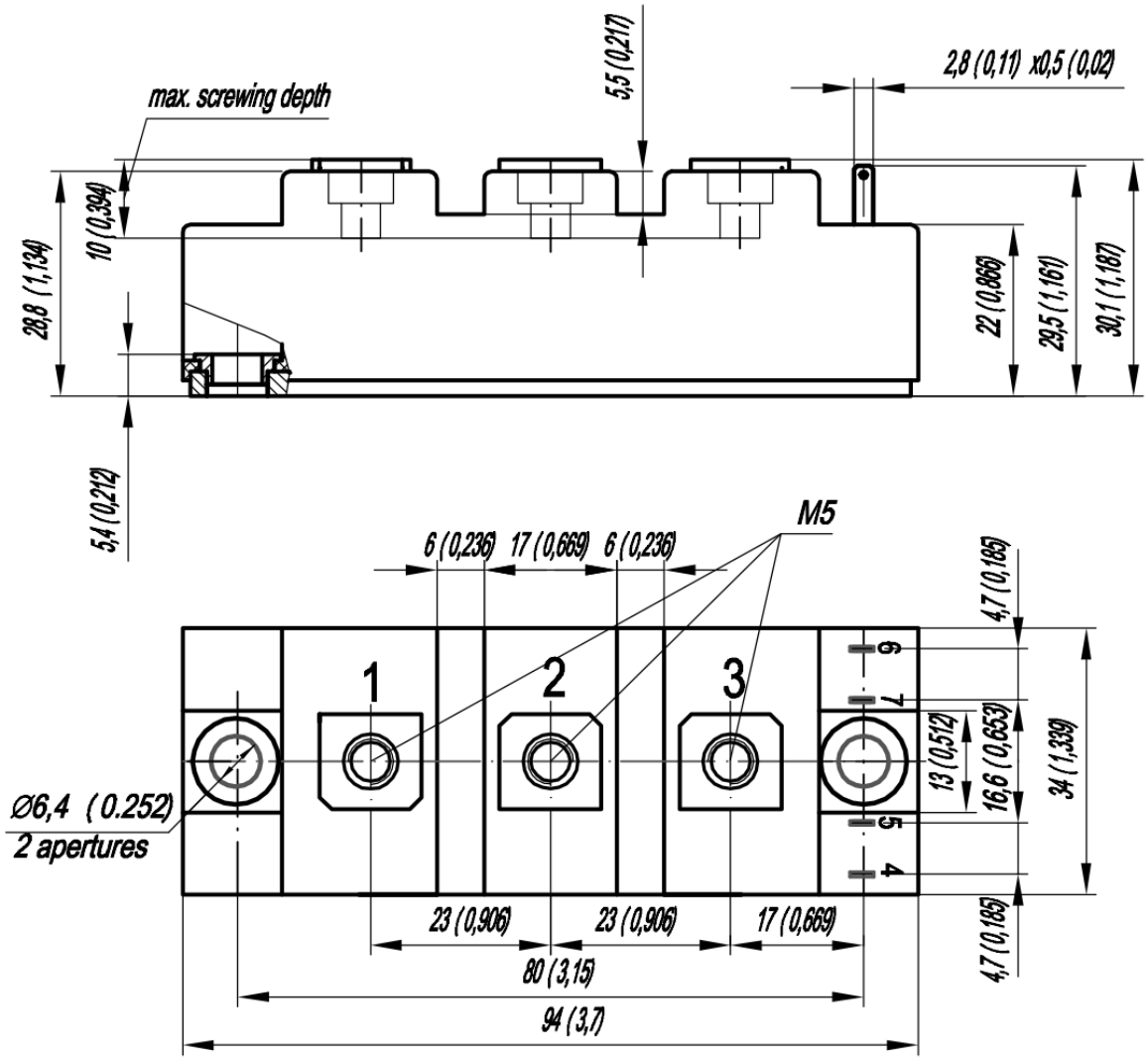
V_{CE} = 600 V;
V_{GE} = ±15 V;
L = 300 µH.
$T_{vj\ (max)}$ = 150°C.

Chart 17 – typ. rated current vs frequency.



Duty cycle 50%

Overall dimensions: Package type – FA



Part numbering guide

MIFA	-	HB	12	FA	-	150	N	
MIFA								IGBT module package type: FA
		HB						2 switches as Half-Bridge
		HC						1 switch as High-Side chopper
		LC						1 switch as Low-Side chopper
			12					Voltage rating (V_{CES}/100)
				FA				IGBT+FRD chipset modification
						150		Current Rating
							N	Climatic version: normal climate