62 mm C-Series module with Trench/Fieldstop IGBT4 and emitter controlled diode

Features

- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\ nom}$ = 300 A / I_{CRM} = 600 A
  - Unbeatable robustness
  - Low $V_{CE,sat}$
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - Package with CTI > 400
  - High creepage and clearance distances
  - 4 kV AC 1 min insulation

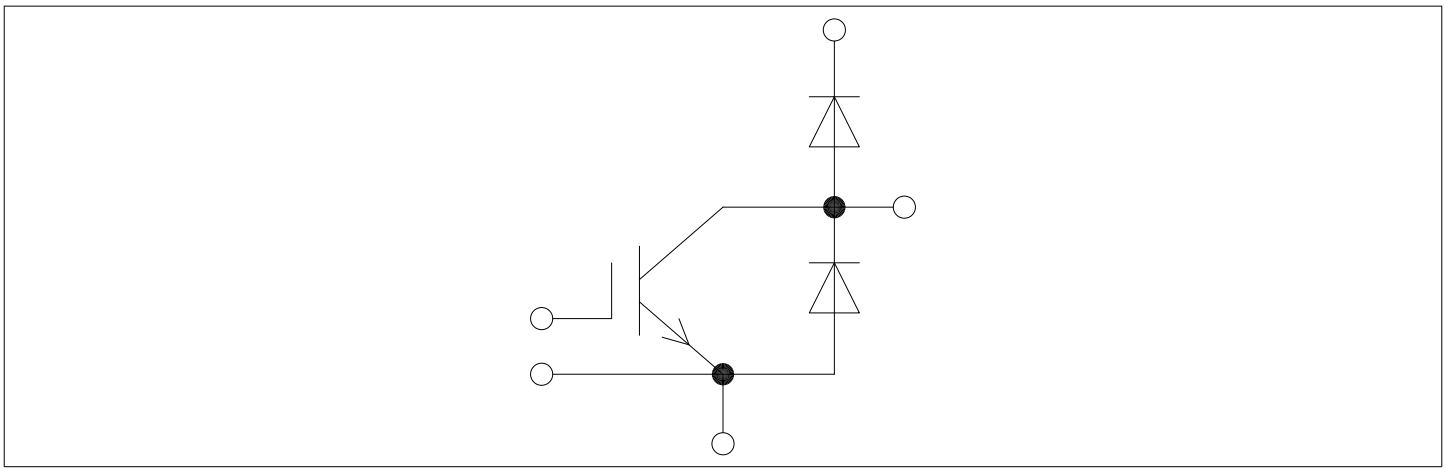
Potential applications

- Three-level applications
- Chopper applications
- Motor drives

Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

Description



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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, *t* = 1 min	4.0	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	29.0	mm
Creepage distance	d_{Creep}	terminal to terminal	23.0	mm
Clearance	d_{Clear}	terminal to heatsink	23.0	mm
Clearance	d_{Clear}	terminal to terminal	11.0	mm
Comparative tracking index	*CTI*		> 400	
Relative thermal index (electrical)	*RTI*	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray inductance module	L_{sCE}				20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C=25°C, per switch			0.7		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for module mounting	*M*	- Mounting according to valid application note	M6, Screw	3		6	Nm
Terminal connection torque	*M*	- Mounting according to valid application note	M6, Screw	2.5		5	Nm
Weight	*G*				340		g

2 IGBT, Brake-Chopper

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1700	V
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 100 °C	300	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		600	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 300 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.95	2.30	V
			T_{vj} = 125 °C		2.35		
			T_{vj} = 150 °C		2.45		
Gate threshold voltage	V_{GEth}	I_C = 12 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.35	5.80	6.25	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 900 V			3.05		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			2.5		Ω
Input capacitance	C_{ies}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			24.5		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.81		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 300 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 2.4 Ω	T_{vj} = 25 °C		0.240		µs
			T_{vj} = 125 °C		0.280		
			T_{vj} = 150 °C		0.300		
Rise time (inductive load)	t_r	I_C = 300 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 2.4 Ω	T_{vj} = 25 °C		0.050		µs
			T_{vj} = 125 °C		0.055		
			T_{vj} = 150 °C		0.055		
Turn-off delay time (inductive load)	t_{doff}	I_C = 300 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 2.4 Ω	T_{vj} = 25 °C		0.700		µs
			T_{vj} = 125 °C		0.740		
			T_{vj} = 150 °C		0.780		
Fall time (inductive load)	t_f	I_C = 300 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 2.4 Ω	T_{vj} = 25 °C		0.080		µs
			T_{vj} = 125 °C		0.130		
			T_{vj} = 150 °C		0.150		
Turn-on energy loss per pulse	E_{on}	I_C = 300 A, V_{CC} = 900 V, L_σ = 60 nH, V_{GE} = ±15 V, R_{Gon} = 2.4 Ω, di/dt = 4800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		63		mJ
			T_{vj} = 125 °C		86		
			T_{vj} = 150 °C		93		
Turn-off energy loss per pulse	E_{off}	I_C = 300 A, V_{CC} = 900 V, L_σ = 60 nH, V_{GE} = ±15 V, R_{Goff} = 2.4 Ω, dv/dt = 3600 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		55		mJ
			T_{vj} = 125 °C		86		
			T_{vj} = 150 °C		96		
SC data	I_{SC}	V_{GE} ≤ 15 V, V_{CC} = 1000 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 10 µs, T_{vj}=150 °C		1400		A

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.0830	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT		0.0330		K/W
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

3 Diode, Brake-Chopper

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1700	V
Continuous DC forward current	I_F			300	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		600	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	14500	A^2s
			T_{vj} = 150 °C	14000	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 300 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.80	2.20	V
			T_{vj} = 125 °C		1.90		
			T_{vj} = 150 °C		1.95		
Peak reverse recovery current	I_{RM}	V_{CC} = 900 V, I_F = 300 A, V_{GE} = -15 V, -di$_F$/dt = 4800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		270		A
			T_{vj} = 125 °C		340		
			T_{vj} = 150 °C		360		
Recovered charge	Q_r	V_{CC} = 900 V, I_F = 300 A, V_{GE} = -15 V, -di$_F$/dt = 4800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		50		µC
			T_{vj} = 125 °C		105		
			T_{vj} = 150 °C		120		
Reverse recovery energy	E_{rec}	V_{CC} = 900 V, I_F = 300 A, V_{GE} = -15 V, -di$_F$/dt = 4800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		28		mJ
			T_{vj} = 125 °C		58		
			T_{vj} = 150 °C		68		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, junction to case	R_{thJC}	per diode			0.130	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode		0.0510		K/W
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

4 Diode, Reverse

Table 7 Maximum rated values

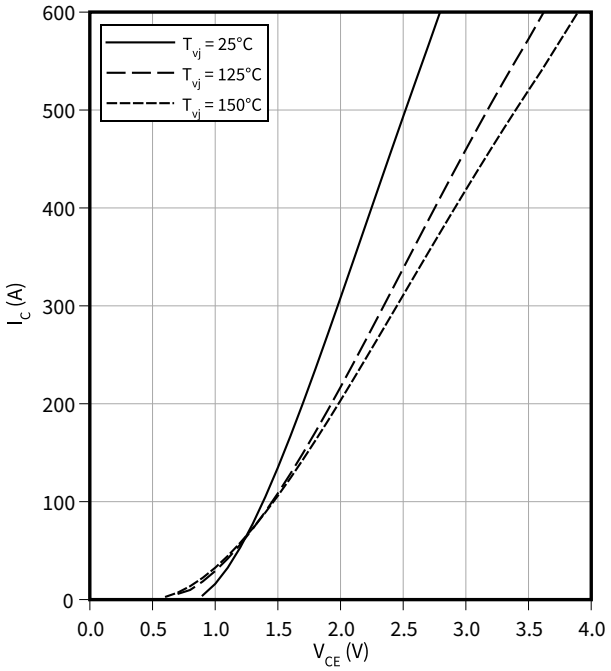
Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1700	V
Continuous DC forward current	I_F			300	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		600	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	14500	A^2s
			T_{vj} = 150 °C	14000	

Table 8 Characteristic values

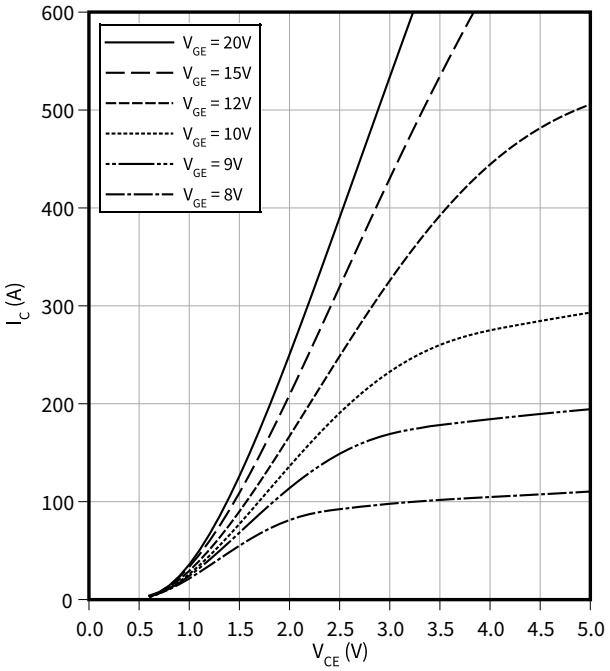
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 300 A	T_{vj} = 25 °C		1.80	2.20	V
			T_{vj} = 125 °C		1.90		
			T_{vj} = 150 °C		1.95		
Thermal resistance, junction to case	R_{thJC}	per diode				0.130	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode			0.0510		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

5 Characteristics diagrams

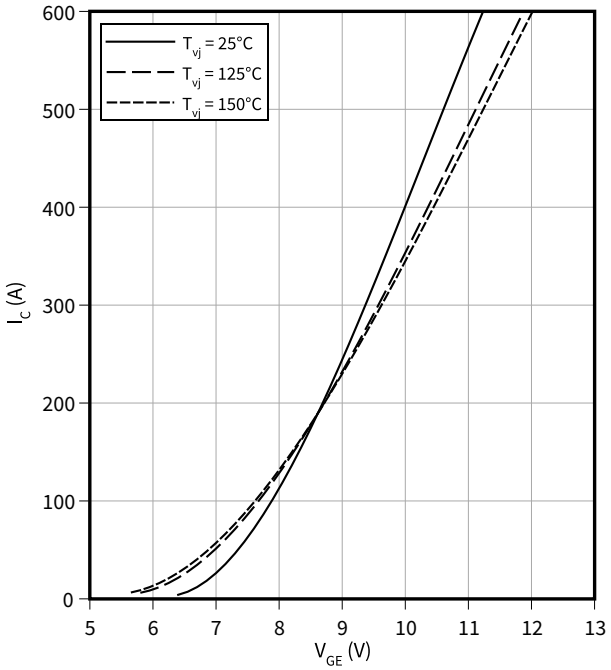
Output characteristic (typical), IGBT, Brake-Chopper
$I_C = f(V_{CE})$
V_{GE} = 15 V



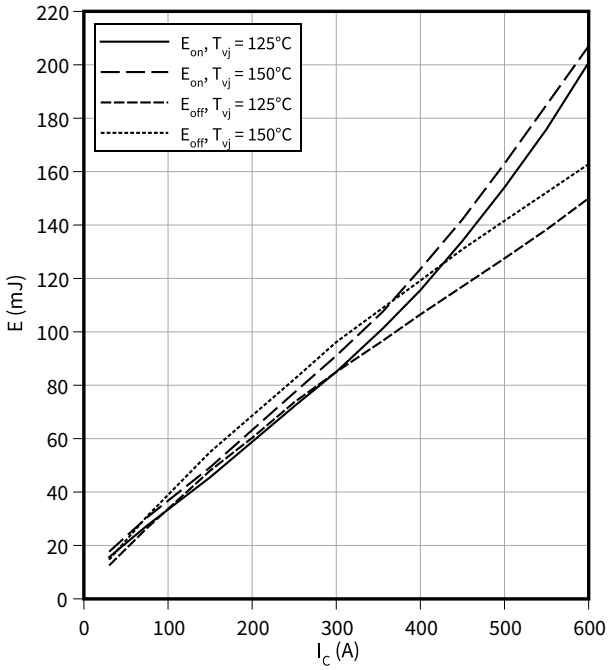
Output characteristic field (typical), IGBT, Brake-Chopper
$I_C = f(V_{CE})$
T_{vj} = 150 °C



Transfer characteristic (typical), IGBT, Brake-Chopper
$I_C = f(V_{GE})$
V_{CE} = 20 V



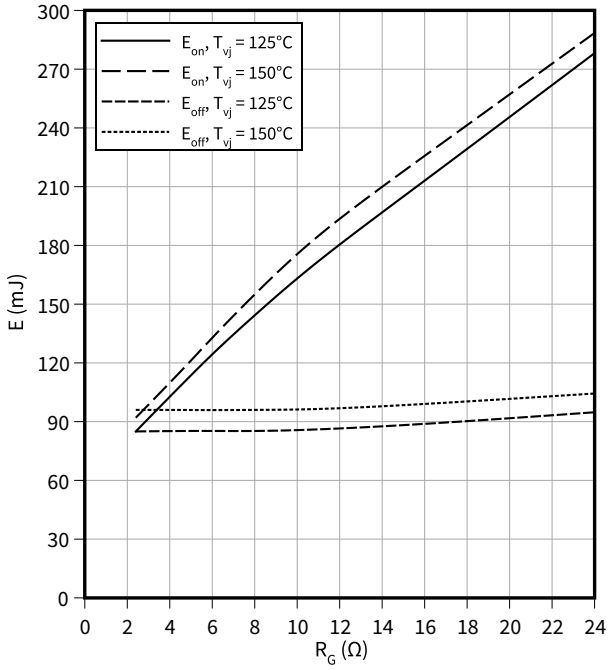
Switching losses (typical), IGBT, Brake-Chopper
$E = f(I_C)$
R_{Goff} = 2.4 Ω, R_{Gon} = 2.4 Ω, V_{GE} = ±15 V, V_{CC} = 900 V



Switching losses (typical), IGBT, Brake-Chopper

$E = f(R_G)$

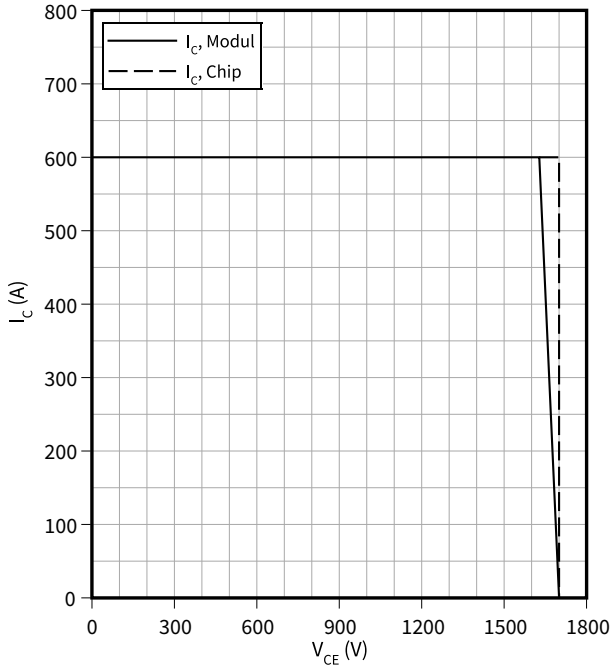
$V_{GE} = \pm 15$ V, $I_C = 300$ A, $V_{CC} = 900$ V



Reverse bias safe operating area (RBSOA), IGBT, Brake-Chopper

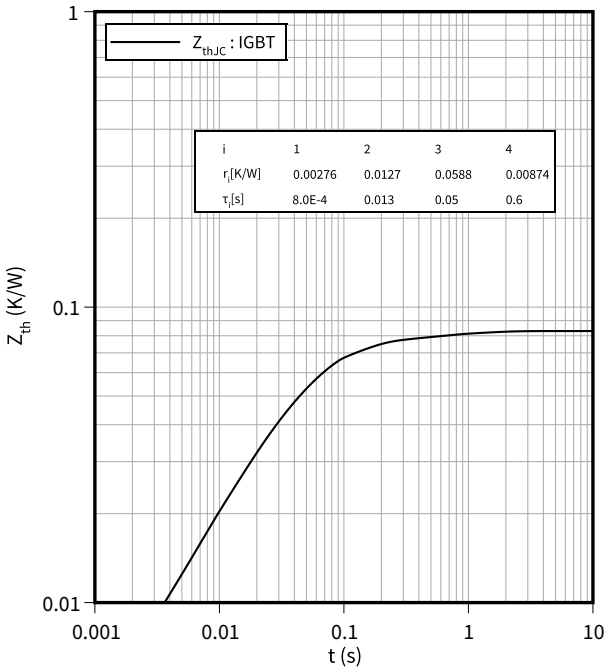
$I_C = f(V_{CE})$

$R_{Goff} = 2.4\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



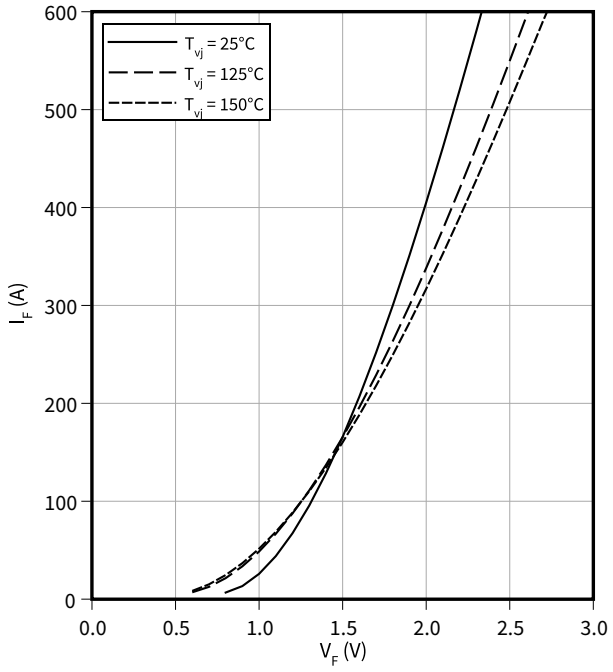
Transient thermal impedance , IGBT, Brake-Chopper

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Brake-Chopper

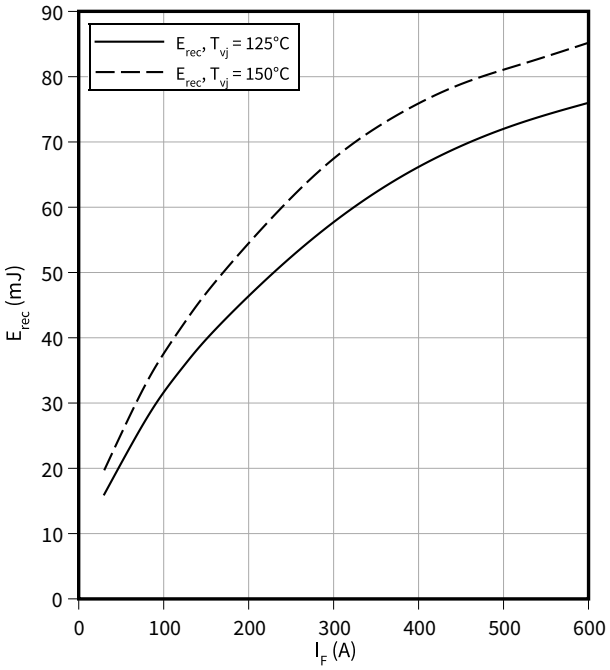
$I_F = f(V_F)$



Switching losses (typical), Diode, Brake-Chopper

$E_{rec} = f(I_F)$

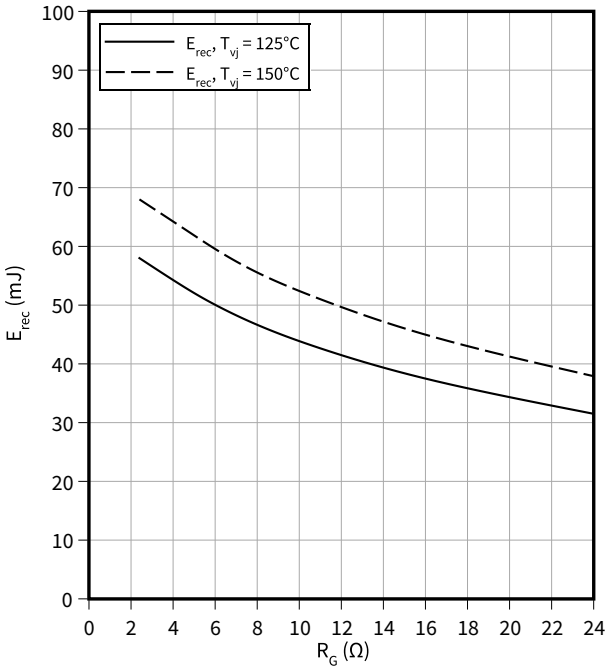
$R_{Gon} = 2.4\ \Omega$, $V_{CC} = 900$ V



Switching losses (typical), Diode, Brake-Chopper

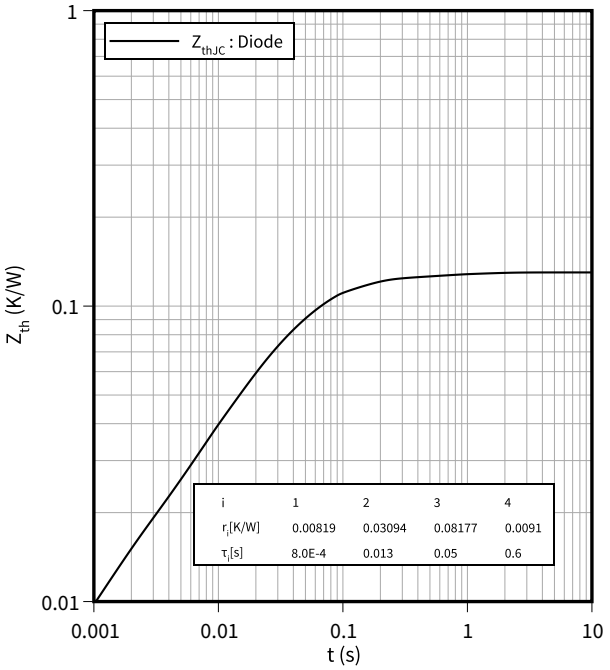
$E_{rec} = f(R_G)$

$I_F = 300$ A, $V_{CC} = 900$ V



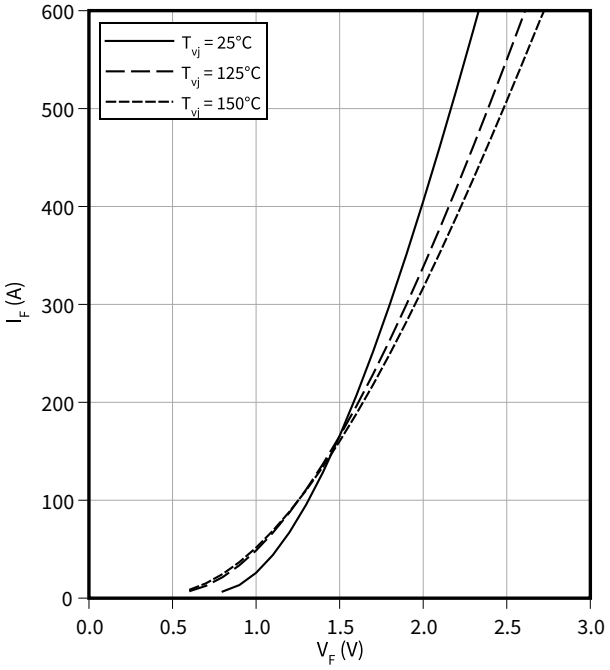
Transient thermal impedance, Diode, Brake-Chopper

$Z_{th} = f(t)$



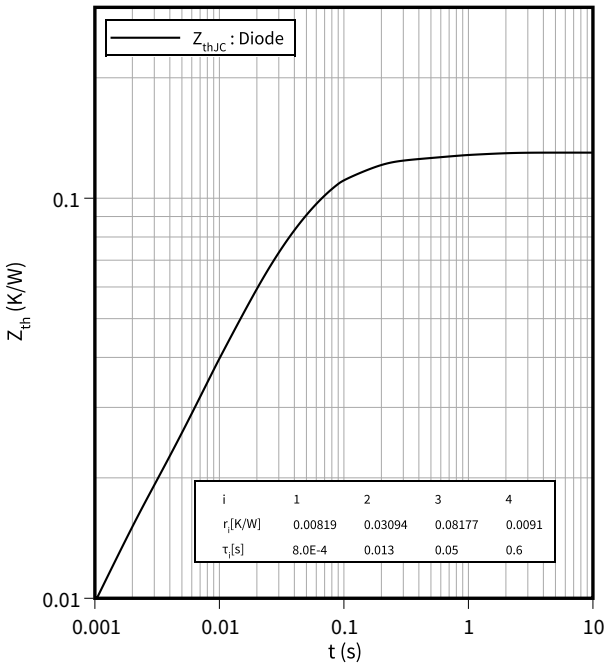
Forward characteristic (typical), Diode, Reverse

$I_F = f(V_F)$



Transient thermal impedance, Diode, Reverse

$Z_{th} = f(t)$



6 Circuit diagram

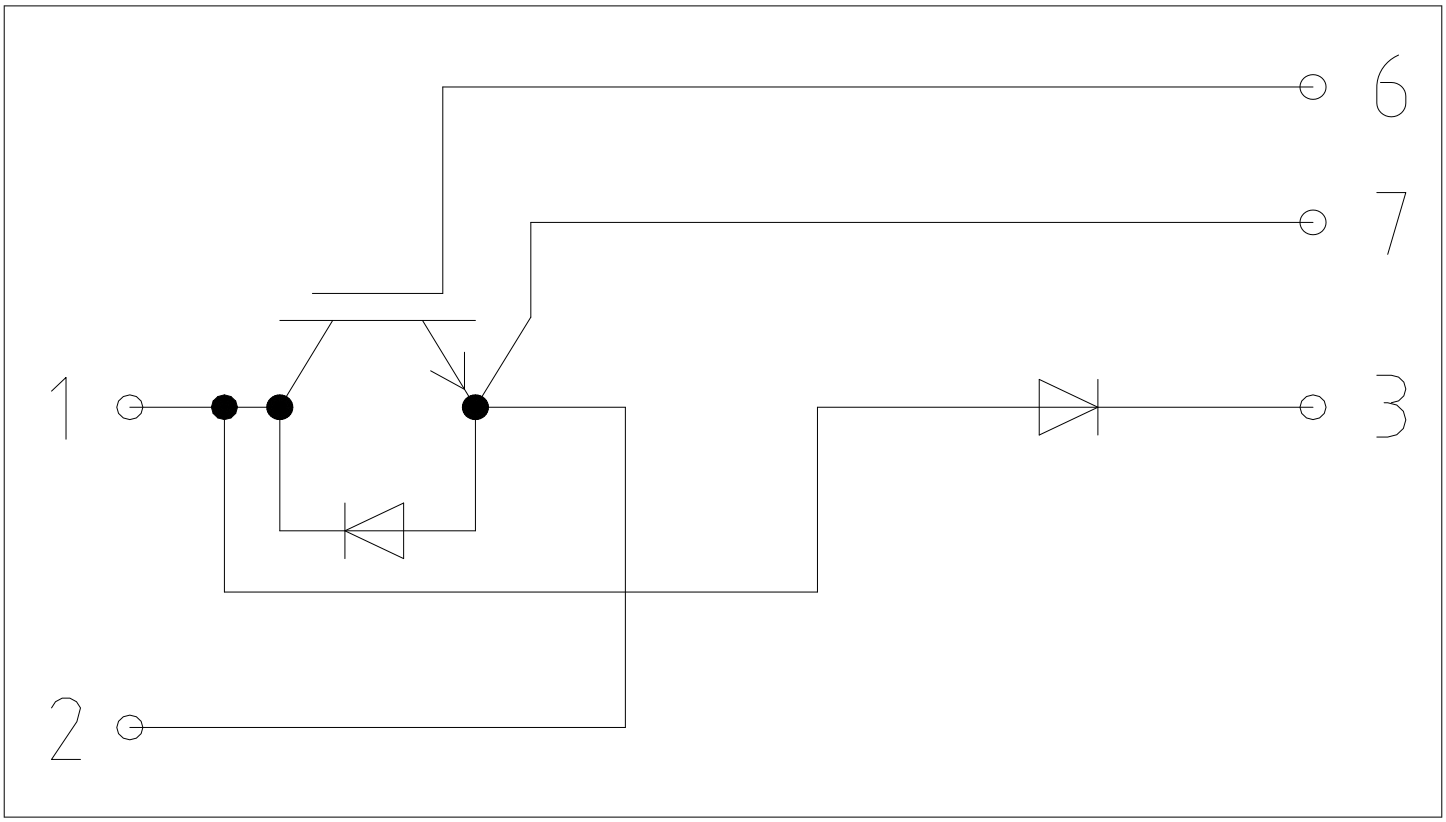


Figure 1

7 Package outlines

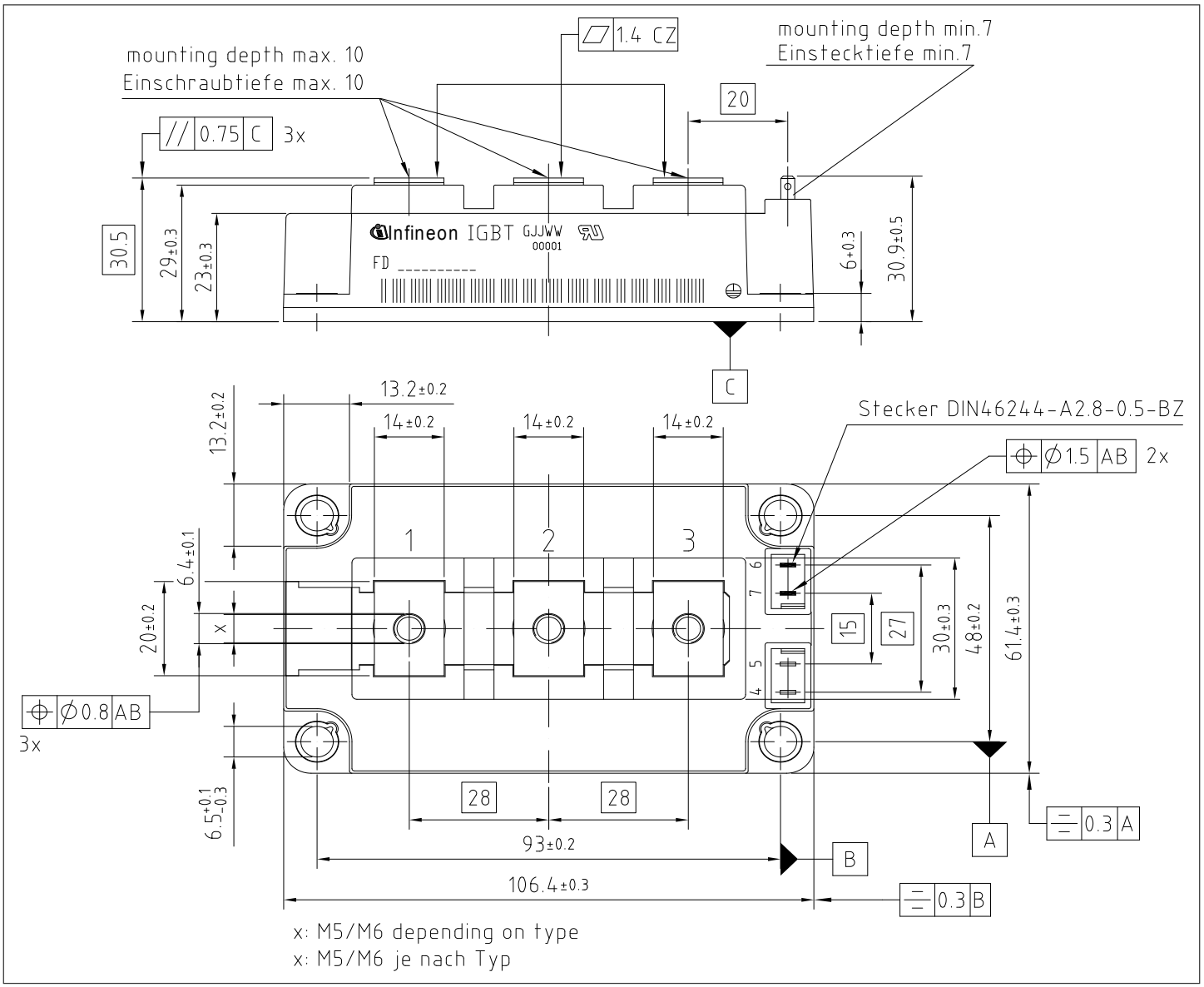


Figure 2

8 Module label code

Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	71549142846550549911530		71549142846550549911530

Figure 3

Revision history

Document revision	Date of release	Description of changes
1.00	2022-05-24	Initial version

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