Final datasheet

IHM-B module with Trench/Fieldstop IGBT4 and emitter controlled 4 diode

Features

Typical appearance

- Electrical features
  - V_{CES} = 4500 V
  - $I_{C\ nom}$ = 1200 A / I_{CRM} = 2400 A
  - High DC stability
  - High short-circuit capability
  - High dynamic robustness
  - Low $V_{CE,sat}$
  - Trench IGBT 4
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - AlSiC base plate for increased thermal cycling capability
  - Package with CTI > 600
  - IHM B housing
  - Isolated base plate
  - Standard housing

Potential applications

- High-power converters
- Medium-voltage converters
- Power transmission and distribution

Product validation

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

Description

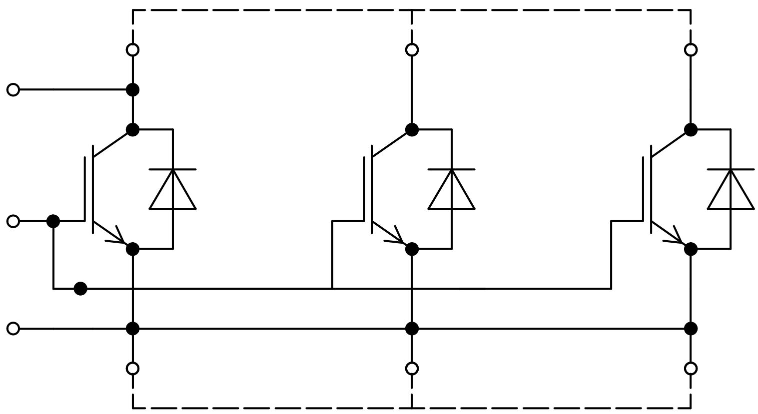


Table of contents

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	6.0	kV
Partial discharge extinction voltage	V_{isol}	RMS, f = 50 Hz, $Q_{PD} \leq 10$ pC	3.5	kV
DC stability	$V_{CE(D)}$	T_{vj} = 25 °C, 100 Fit	2900	V
Material of module baseplate			AlSiC	
Creepage distance	d_{Creep}	terminal to heatsink	32.2	mm
Clearance	d_{Clear}	terminal to heatsink	19.1	mm
Comparative tracking index	CTI		> 600	

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray inductance module	L_{sCE}				6		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_C = 25 °C, per switch			0.08		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C = 25 °C, per switch			0.095		mΩ
Storage temperature	T_{stg}			-40		150	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M6, Screw	4.25		5.75	Nm
Terminal connection torque	M	- Mounting according to valid application note	M4, Screw	1.8		2.1	Nm
			M8, Screw	8		10	
Weight	G				1200		g

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = -40 °C	4300	V
			T_{vj} = 150 °C	4500	
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 150 °C	T_C = 110 °C	1200	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		2400	A
Gate-emitter peak voltage	V_{GES}			-20/26.25	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 = 1200 A, V_{GE} = 25 V	T_{vj} = 25 °C		2.10	2.55	V
			T_{vj} = 125 °C		2.40	2.95	
			T_{vj} = 150 °C		2.50	3.05	
Gate threshold voltage	V_{GEth}	I_C = 112 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.5	6	6.5	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC}=2800 V			35		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.39		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			223		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			4.1		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 4500 V, V_{GE} = 0 V	T_{vj} = 25 °C			5	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				400	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 1200 A, V_{CC} = 2800 V, V_{GE} = ±15 V, R_{Gon} = 1.3 Ω	T_{vj} = 25 °C		0.330		µs
			T_{vj} = 125 °C		0.360		
			T_{vj} = 150 °C		0.370		
Rise time (inductive load)	t_r	I_C = 1200 A, V_{CC} = 2800 V, V_{GE} = ±15 V, R_{Gon} = 1.3 Ω	T_{vj} = 25 °C		0.260		µs
			T_{vj} = 125 °C		0.270		
			T_{vj} = 150 °C		0.280		
Turn-off delay time (inductive load)	t_{doff}	I_C = 1200 A, V_{CC} = 2800 V, V_{GE} = ±15 V, R_{Goff} = 9.1 Ω	T_{vj} = 25 °C		9.300		µs
			T_{vj} = 125 °C		9.800		
			T_{vj} = 150 °C		9.900		
Fall time (inductive load)	t_f	I_C = 1200 A, V_{CC} = 2800 V, V_{GE} = ±15 V, R_{Goff} = 9.1 Ω	T_{vj} = 25 °C		0.740		µs
			T_{vj} = 125 °C		1.730		
			T_{vj} = 150 °C		2.040		
Turn-on time (resistive load)	t_{on_R}	I_C = 500 A, V_{CC} = 2000 V, V_{GE} = ±15 V, R_{Gon} = 1.3 Ω	T_{vj} = 25 °C	1.24			µs
Turn-on energy loss per pulse	E_{on}	I_C = 1200 A, V_{CC} = 2800 V, $L_σ$ = 150 nH, V_{GE} = ±15 V, R_{Gon} = 1.3 Ω, di/dt = 3700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		4100		mJ
			T_{vj} = 125 °C		5800		
			T_{vj} = 150 °C		6350		
Turn-off energy loss per pulse	E_{off}	I_C = 1200 A, V_{CC} = 2800 V, $L_σ$ = 150 nH, V_{GE} = ±15 V, R_{Goff} = 9.1 Ω, dv/dt = 1000 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		5500		mJ
			T_{vj} = 125 °C		6900		
			T_{vj} = 150 °C		7300		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
SC data	I_{SC}	$V_{GE} \leq 15$ V, V_{CC} = 3000 V, $V_{CEmax}=V_{CES}-L_{sCE}*di/dt$	$t_P \leq 10$ µs, T_{vj}=150 °C		6400		A
Thermal resistance, junction to case	R_{thJC}	per IGBT				9.40	K/kW
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, λ_{grease} = 1 W/(m·K)			4.10		K/kW
Temperature under switching conditions	$T_{vj\ op}$			-40		150	°C

3 Diode, Inverter

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = -40 °C	4500	V
			T_{vj} = 150 °C	4500	
Continuous DC forward current	I_F			1200	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		2400	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	760	kA^2s
			T_{vj} = 150 °C	710	
Maximum power dissipation	P_{RQM}		T_{vj} = 150 °C	2400	kW
Minimum turn-on time	t_{onmin}			10	µs

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 1200 A, V_{GE} = 0 V	T_{vj} = 25 °C		2.50	2.95	V
			T_{vj} = 125 °C		2.40	2.85	
			T_{vj} = 150 °C		2.30	2.75	
Peak reverse recovery current	I_{RM}	V_{CC} = 2800 V, I_F = 1200 A, V_{GE} = -15 V, $-di_F/dt$ = 3700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1400		A
			T_{vj} = 125 °C		1640		
			T_{vj} = 150 °C		1750		

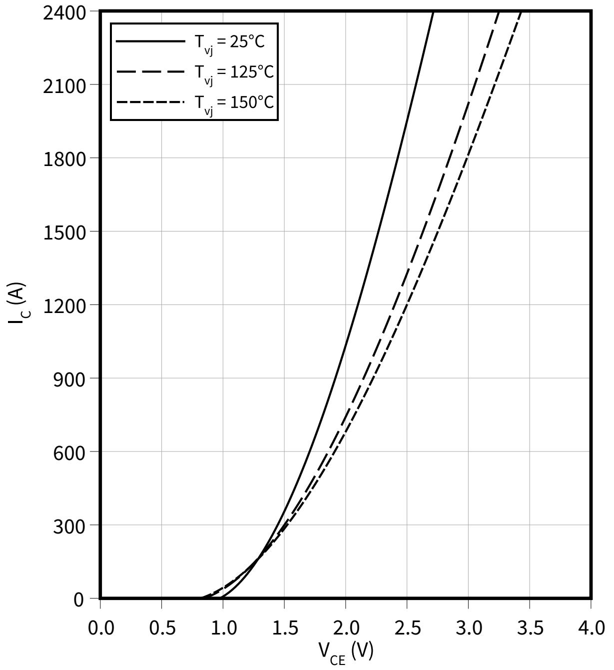
(table continues...)

Table 6 (continued) Characteristic values

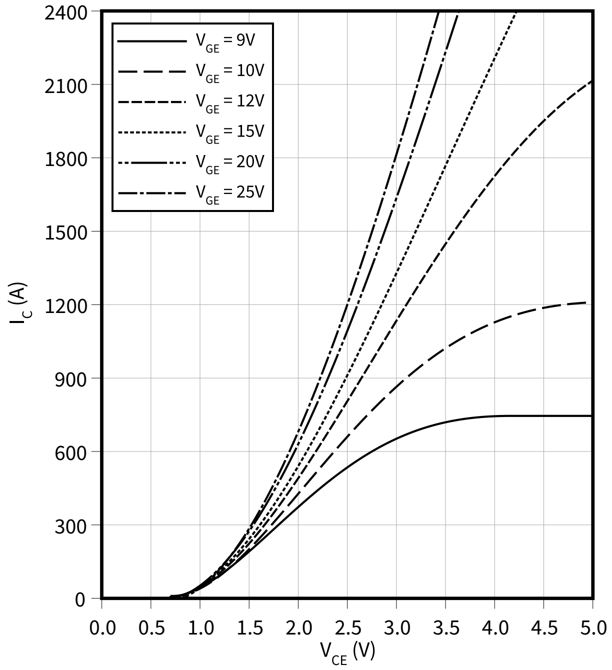
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Recovered charge	Q_r	V_{CC} = 2800 V, I_F = 1200 A, V_{GE} = -15 V, -di_F/dt = 3700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1000		µC
			T_{vj} = 125 °C		2000		
			T_{vj} = 150 °C		2380		
Reverse recovery energy	E_{rec}	V_{CC} = 2800 V, I_F = 1200 A, V_{GE} = -15 V, -di_F/dt = 3700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1500		mJ
			T_{vj} = 125 °C		3300		
			T_{vj} = 150 °C		4000		
Thermal resistance, junction to case	R_{thJC}	per diode				15.6	K/kW
Thermal resistance, case to heat sink	R_{thCH}	per diode, λ_{grease} = 1 W/(m·K)			6.20		K/kW
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

4 Characteristics diagrams

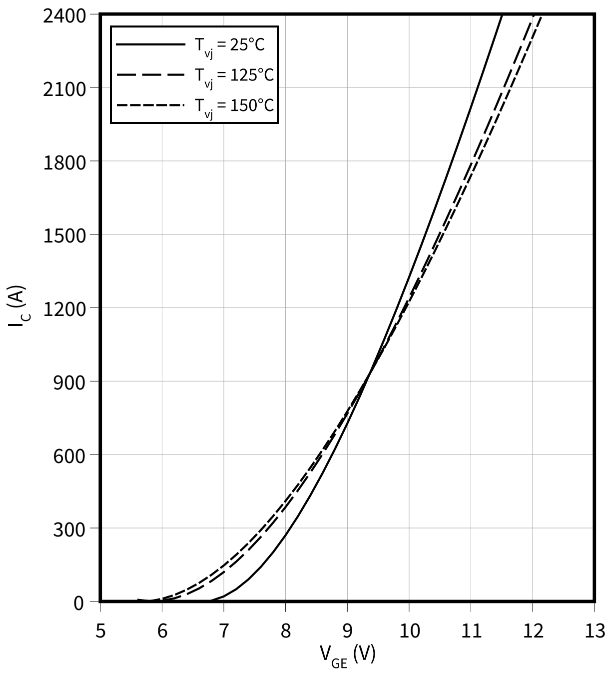
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 25\ V$



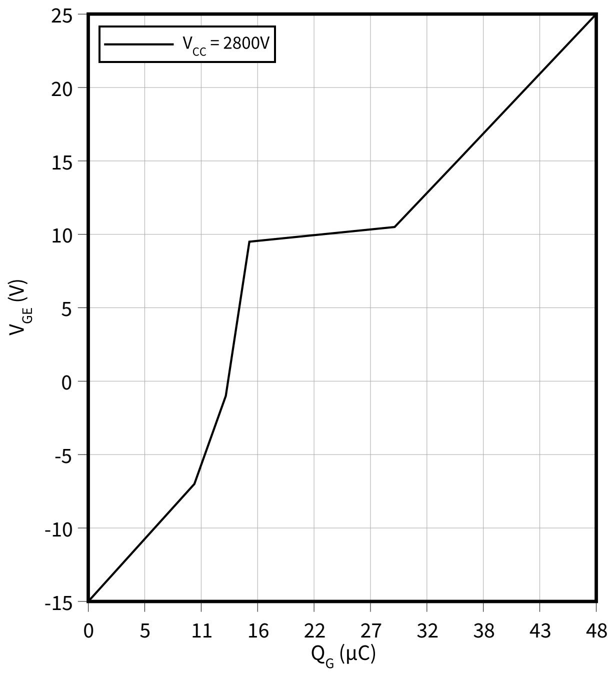
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



Transfer characteristic (typical), IGBT, Inverter
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



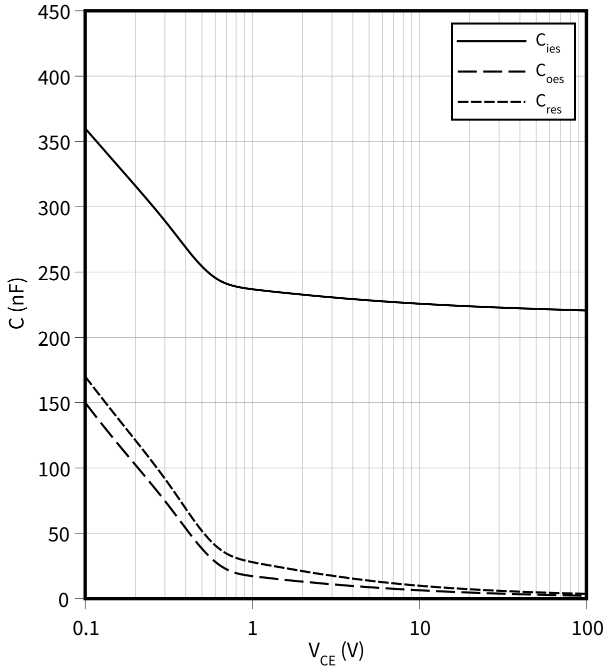
Gate charge characteristic (typical), IGBT, Inverter
$V_{GE} = f(Q_G)$
$I_C = 1200\ A$, $T_{vj} = 25\ °C$



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

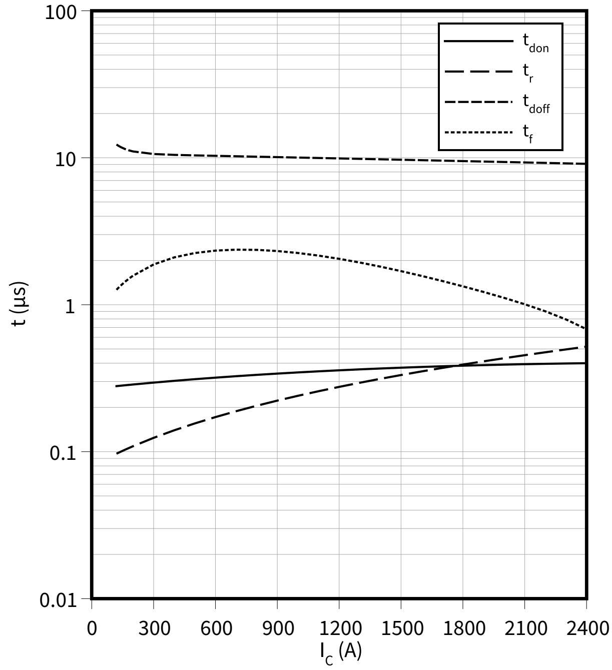
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

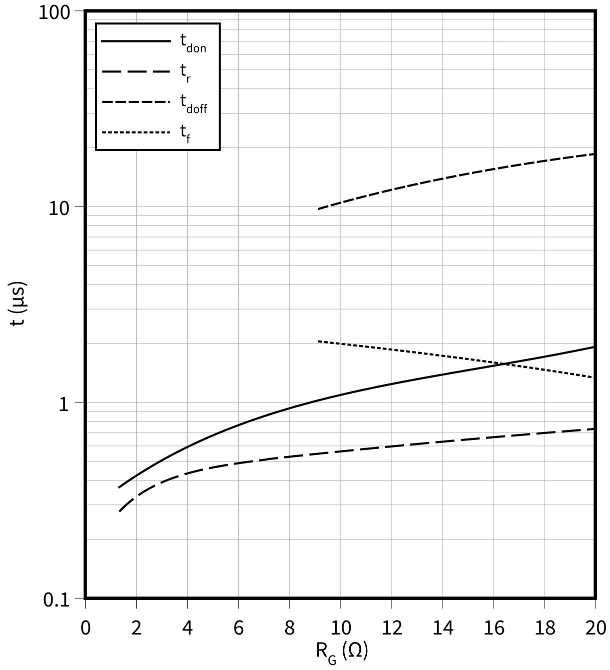
$R_{Goff} = 9.1\ \Omega$, $R_{Gon} = 1.3\ \Omega$, $V_{CC} = 2800$ V, $V_{GE} = -15$ V/ 15 V, $T_{vj} = 150$ °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

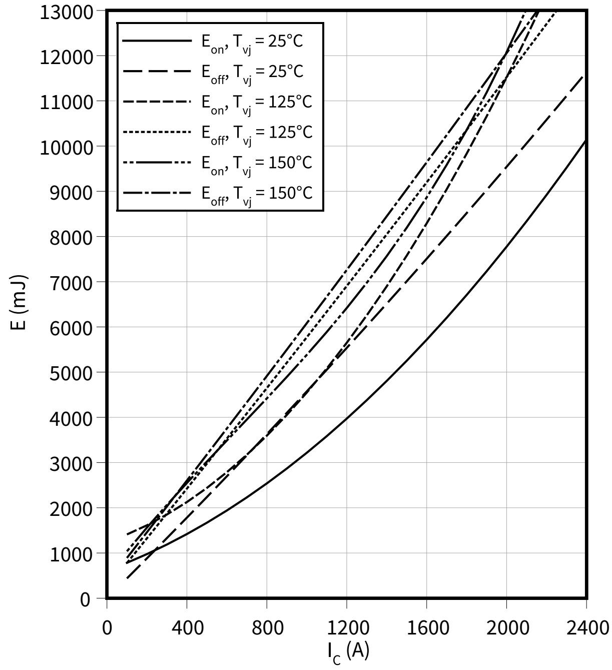
$I_C = 1200$ A, $V_{CC} = 2800$ V, $V_{GE} = -15$ V/ 15 V, $T_{vj} = 150$ °C



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

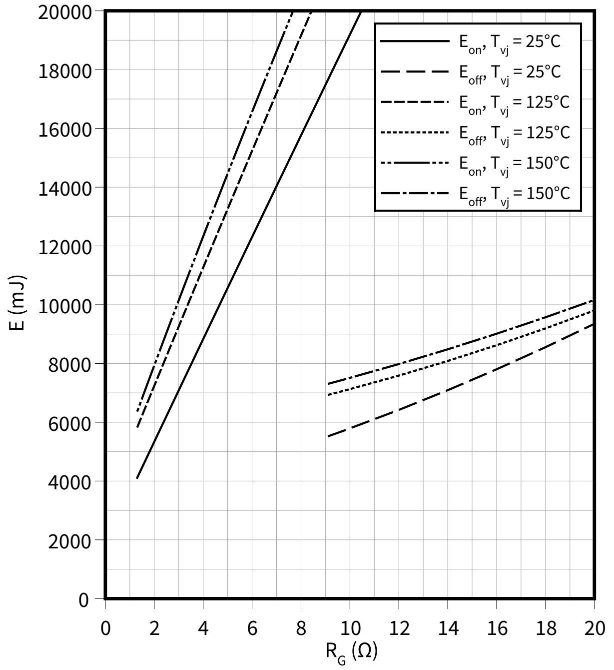
$R_{Goff} = 9.1\ \Omega$, $R_{Gon} = 1.3\ \Omega$, $V_{CC} = 2800$ V, $V_{GE} = -15$ / 15 V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

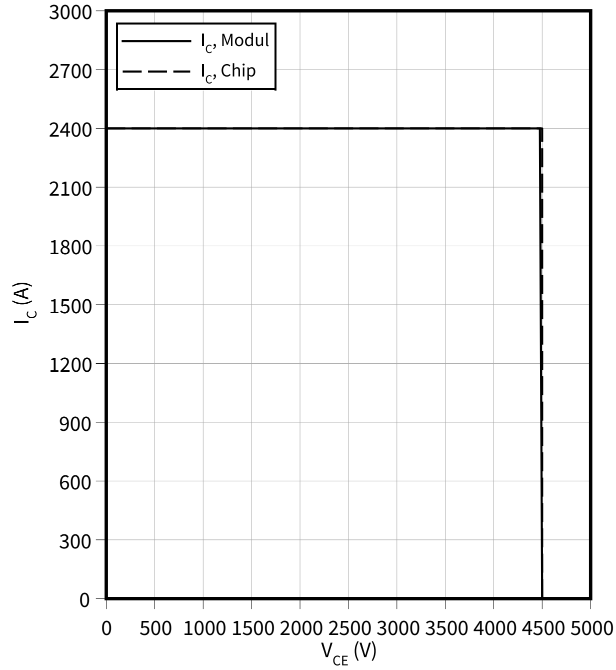
$I_C = 1200$ A, $V_{CC} = 2800$ V, $V_{GE} = -15$ / 15 V



Reverse bias safe operating area (RBSOA), IGBT, Inverter

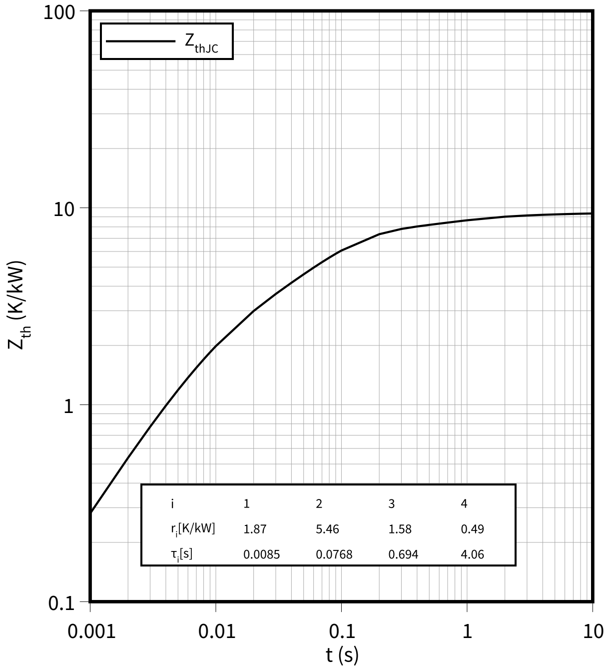
$I_C = f(V_{CE})$

$R_{Goff} = 9.1$ Ω, $V_{GE} = \pm15$ V, $V_{CC} \le 3200$ V, $T_{vj} = 150$ °C



Transient thermal impedance, IGBT, Inverter

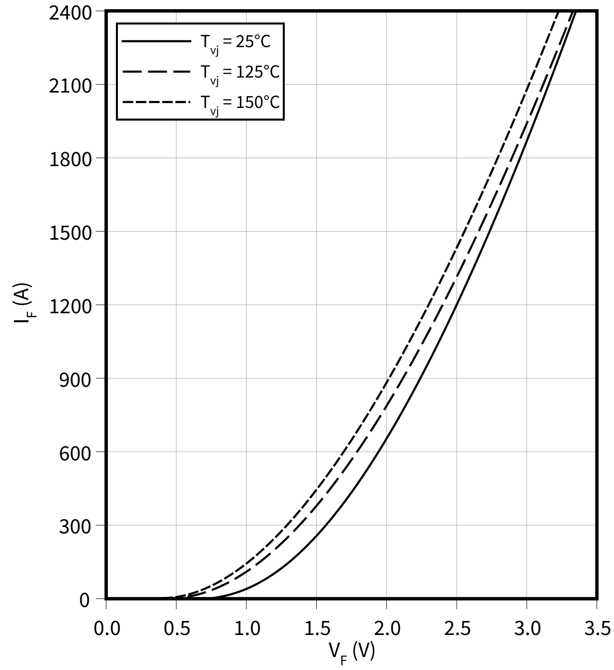
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/kW]	1.87	5.46	1.58	0.49
τ_i[s]	0.0085	0.0768	0.694	4.06

Forward characteristic (typical), Diode, Inverter

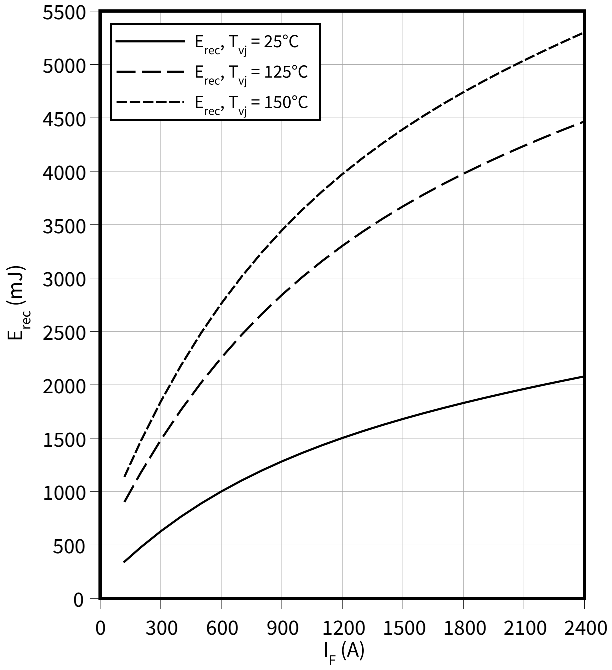
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

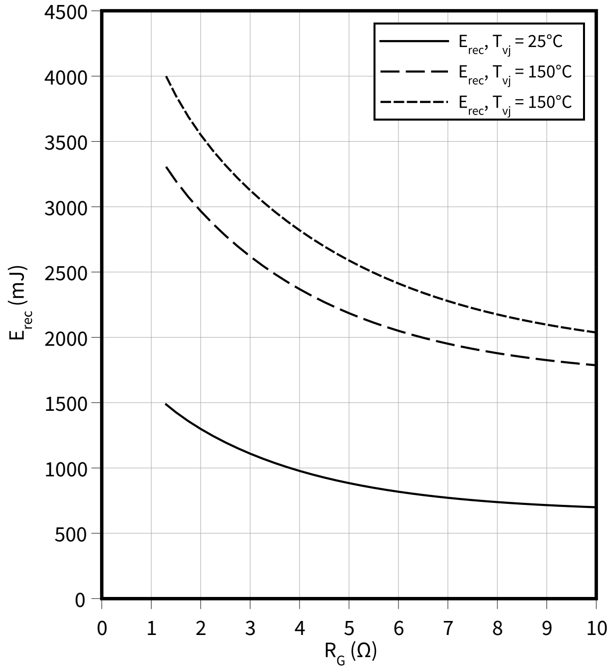
$R_{Gon} = R_{Gon}(IGBT)$, $V_{CC} = 2800$ V



Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$

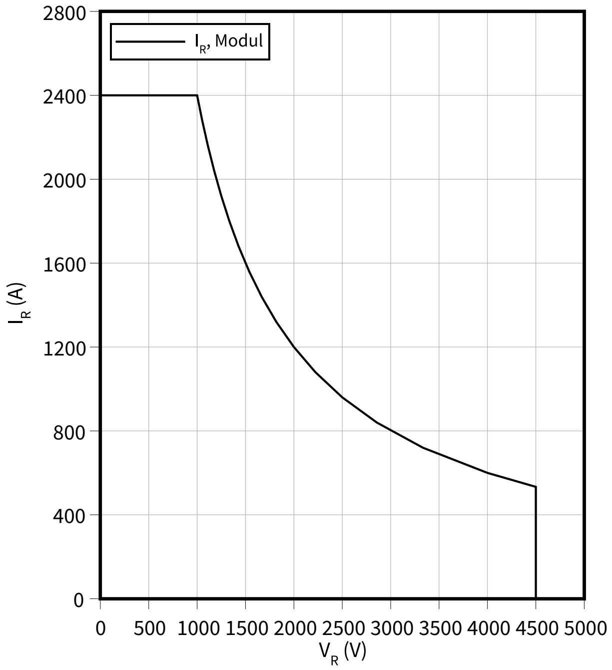
$I_F = 1200$ A, $V_{CC} = 2800$ V



Safe operating area (SOA), Diode, Inverter

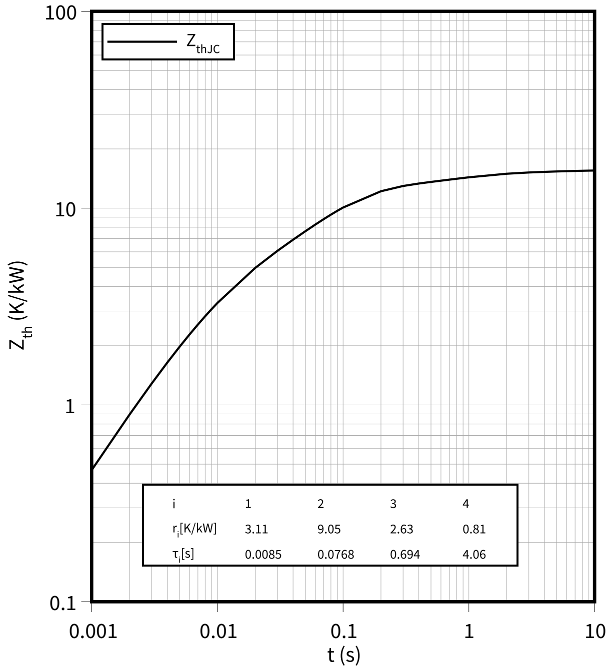
$I_R = f(V_R)$

$T_{vj} = 150$ °C



Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/kW]	3.11	9.05	2.63	0.81
τ_i[s]	0.0085	0.0768	0.694	4.06

5 Circuit diagram

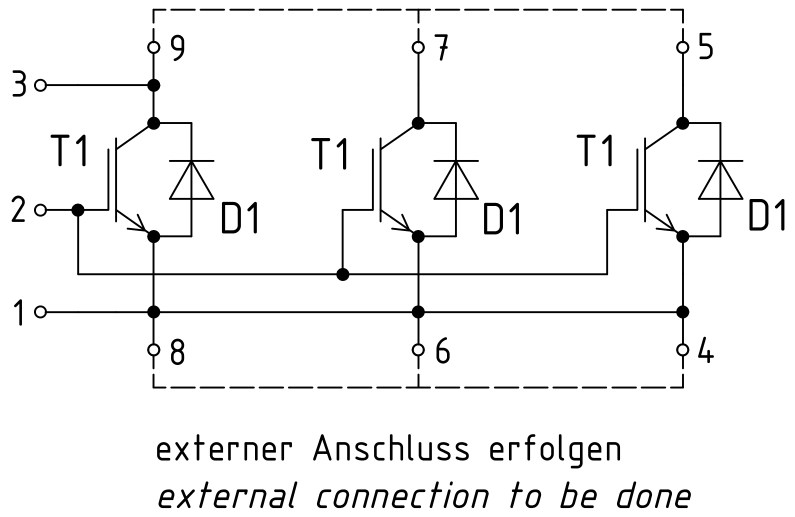


Figure 1

6 Package outlines

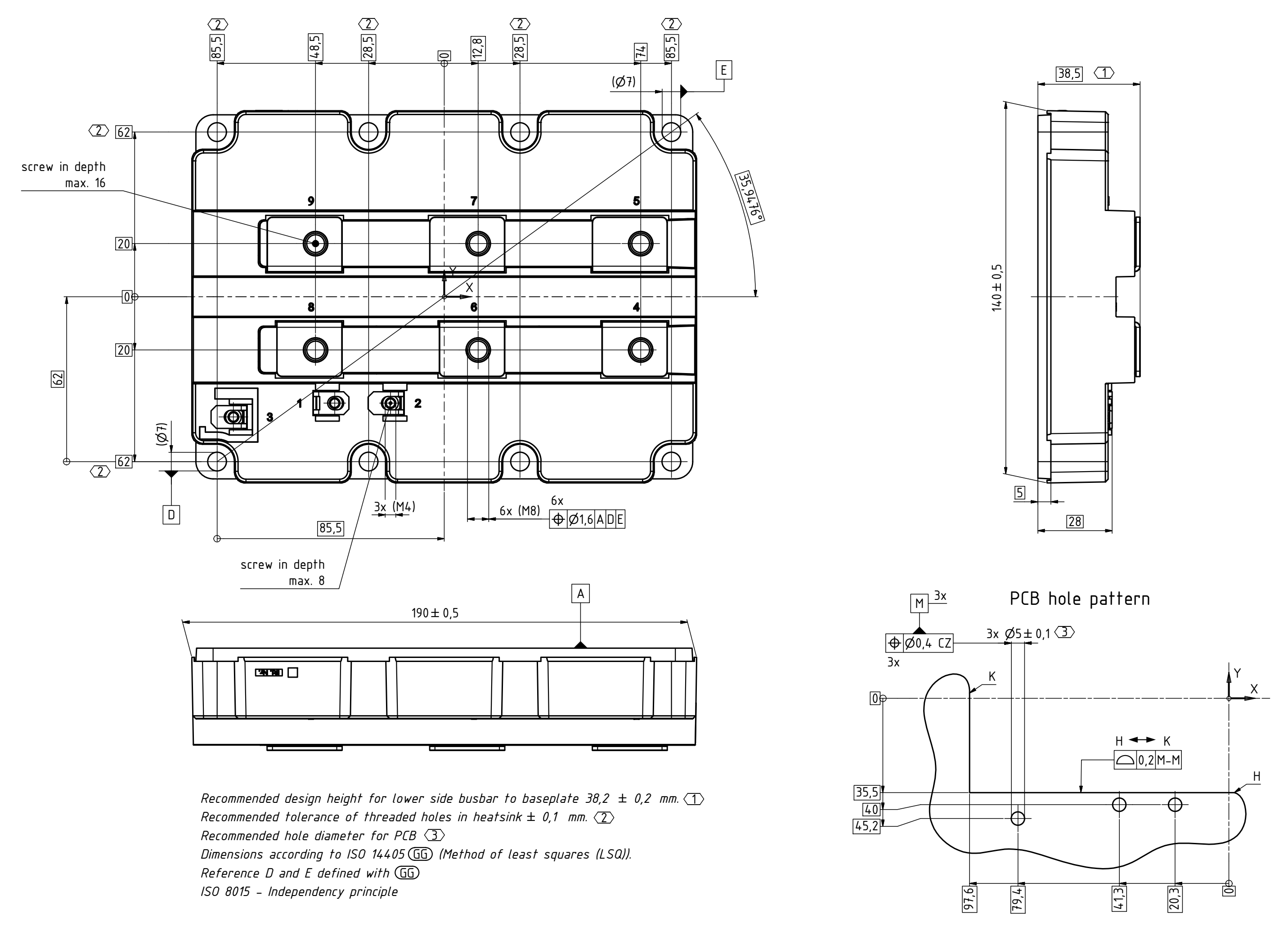


Figure 2

7 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	2023-12-12	Initial version
1.01	2023-12-15	Final datasheet Update package outlines drawing

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