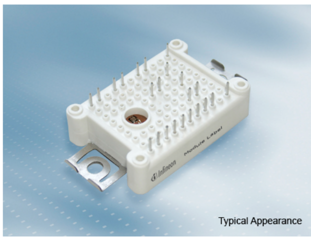
Final datasheet

EasyPIM™ module with Trench/Fieldstop IGBT4 and emitter controlled 4 diode and NTC / pre-applied thermal interface material

Features



- Electrical features
  - $V_{CES} = 1200$ V
  - $I_{C\ nom} = 15$ A / $I_{CRM} = 30$ A
  - Low switching losses
  - Trench IGBT 4
  - $V_{CE,sat}$ with positive temperature coefficient
  - Low $V_{CE,sat}$
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - Al_2O_3 substrate with low thermal resistance
  - Compact design
  - Solder contact technology
  - Rugged mounting due to integrated mounting clamps

Potential applications

- Auxiliary inverters
- Air conditioning
- Motor drives

Product validation

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

Description

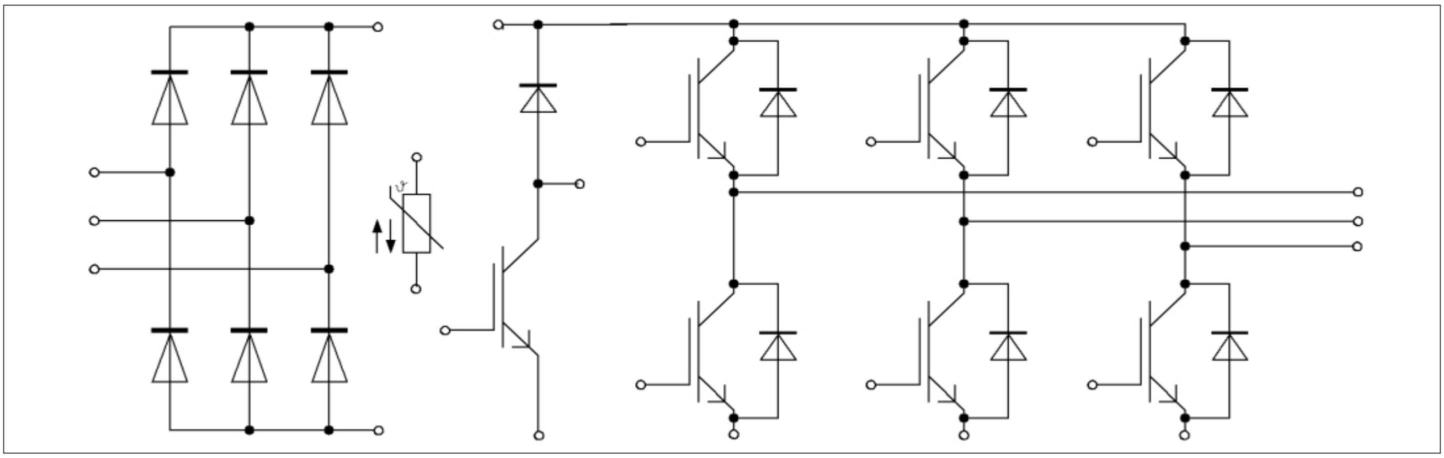


Table of contents

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	2.5	kV
Isolation test voltage NTC	$V_{\mathrm{ISOL(NTC)}}$	RMS, f = 50 Hz, t = 1 min	2.5	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Comparative tracking index	CTI		> 200	
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}			30		nH
Module lead resistance, terminals - chip	$R_{\mathrm{AA'+CC'}}$	T_H = 25 °C, per switch		6		mΩ
Module lead resistance, terminals - chip	$R_{\mathrm{CC'+EE'}}$	T_H = 25 °C, per switch		8		mΩ
Storage temperature	T_{stg}		-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}				150	°C
Mounting force per clamp	F		20		50	N
Weight	G			24		g

Note: *The current under continuous operation is limited to 30A rms per connector pin.*
Storage and shipment of modules with TIM => see AN 2012-07

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Continuous DC collector current	I_{CDC}	$T_{\mathrm{vj\,max}}$ = 175 °C	T_H = 115 °C	15	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{\mathrm{vj\,op}}$		30	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	$V_{CE\ sat}$	$I_C = 15$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.85	2.25	V
			$T_{vj} = 125$ °C		2.15		
			$T_{vj} = 150$ °C		2.25		
Gate threshold voltage	V_{GEth}	$I_C = 0.48$ mA, $V_{CE} = V_{GE}$, $T_{vj} = 25$ °C		5.2	5.8	6.4	V
Gate charge	Q_G	$V_{GE} = \pm15$ V, $T_{vj} = 25$ °C			0.12		µC
Internal gate resistor	R_{Gint}	$T_{vj} = 25$ °C			0.0		Ω
Input capacitance	C_{ies}	$f = 1000$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			0.89		nF
Reverse transfer capacitance	C_{res}	$f = 1000$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			0.03		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200$ 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}	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Gon} = 39$ Ω	$T_{vj} = 25$ °C		0.055		µs
			$T_{vj} = 125$ °C		0.055		
			$T_{vj} = 150$ °C		0.055		
Rise time (inductive load)	t_r	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Gon} = 39$ Ω	$T_{vj} = 25$ °C		0.059		µs
			$T_{vj} = 125$ °C		0.065		
			$T_{vj} = 150$ °C		0.065		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Goff} = 39$ Ω	$T_{vj} = 25$ °C		0.195		µs
			$T_{vj} = 125$ °C		0.275		
			$T_{vj} = 150$ °C		0.280		
Fall time (inductive load)	t_f	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Goff} = 39$ Ω	$T_{vj} = 25$ °C		0.145		µs
			$T_{vj} = 125$ °C		0.190		
			$T_{vj} = 150$ °C		0.215		
Turn-on energy loss per pulse	E_{on}	$I_C = 15$ A, $V_{CC} = 600$ V, $L_\sigma = 50$ nH, $V_{GE} = \pm15$ V, $R_{Gon} = 39$ Ω, di/dt = 550 A/µs ($T_{vj} = 150$ °C)	$T_{vj} = 25$ °C		1.3		mJ
			$T_{vj} = 125$ °C		1.75		
			$T_{vj} = 150$ °C		1.95		
Turn-off energy loss per pulse	E_{off}	$I_C = 15$ A, $V_{CC} = 600$ V, $L_\sigma = 50$ nH, $V_{GE} = \pm15$ V, $R_{Goff} = 39$ Ω, dv/dt = 3500 V/µs ($T_{vj} = 150$ °C)	$T_{vj} = 25$ °C		0.83		mJ
			$T_{vj} = 125$ °C		1.2		
			$T_{vj} = 150$ °C		1.35		
SC data	I_{SC}	$V_{GE} \leq 15$ V, $V_{CC} = 800$ V, $V_{CEmax}=V_{CES}-L_{sCE}*di/dt$	$t_P \leq 10$ µs, $T_{vj}=150$ °C		55		A

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material		1.32		K/W
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} = 25 °C	1200	V
Continuous DC forward current	I_F			15	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		30	A
I²t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	16	A^2s
			T_{vj} = 150 °C	14	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 15 A, V_{GE} = 0 V	T_{vj} = 25 °C		2.00	2.65	V
			T_{vj} = 125 °C		2.10		
			T_{vj} = 150 °C		2.10		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 15 A, V_{GE} = -15 V, -di_F/dt = 550 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		13		A
			T_{vj} = 125 °C		12		
			T_{vj} = 150 °C		12		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 15 A, V_{GE} = -15 V, -di_F/dt = 550 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1.2		µC
			T_{vj} = 125 °C		2.05		
			T_{vj} = 150 °C		2.4		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 15 A, V_{GE} = -15 V, -di_F/dt = 550 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.37		mJ
			T_{vj} = 125 °C		0.68		
			T_{vj} = 150 °C		0.8		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material			2.25		K/W

(table continues...)

Table 6 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

4 Diode, Rectifier

Table 7 **Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1600	V
Maximum RMS forward current per chip	I_{FRMSM}	T_H = 100 °C		30	A
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 100 °C		30	A
Surge forward current	I_{FSM}	t_p = 10 ms	T_{vj} = 25 °C	300	A
			T_{vj} = 150 °C	245	
I^2t - value	I^2t	t_p = 10 ms	T_{vj} = 25 °C	450	A^2s
			T_{vj} = 150 °C	300	

Table 8 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 15 A	T_{vj} = 150 °C		0.85		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1600 V			1		mA
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material			1.43		K/W
Temperature under switching conditions	$T_{vj,\ op}$			-40		150	°C

5 IGBT, Brake-Chopper

Table 9 **Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj\ max}$ = 175 °C	T_H = 115 °C	15	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$		30	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 10 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 15$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.85	2.25	V
			$T_{vj} = 125$ °C		2.15		
			$T_{vj} = 150$ °C		2.25		
Gate threshold voltage	V_{GEth}	$I_C = 0.48$ mA, $V_{CE} = V_{GE}$, $T_{vj} = 25$ °C		5.2	5.8	6.4	V
Gate charge	Q_G	$V_{GE} = \pm15$ V, $T_{vj} = 25$ °C			0.12		µC
Internal gate resistor	R_{Gint}	$T_{vj} = 25$ °C			0.0		Ω
Input capacitance	C_{ies}	$f = 1000$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			0.89		nF
Reverse transfer capacitance	C_{res}	$f = 1000$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			0.03		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200$ 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}	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Gon} = 43$ Ω	$T_{vj} = 25$ °C		0.065		µs
			$T_{vj} = 125$ °C		0.065		
			$T_{vj} = 150$ °C		0.065		
Rise time (inductive load)	t_r	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Gon} = 43$ Ω	$T_{vj} = 25$ °C		0.060		µs
			$T_{vj} = 125$ °C		0.065		
			$T_{vj} = 150$ °C		0.065		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Goff} = 43$ Ω	$T_{vj} = 25$ °C		0.210		µs
			$T_{vj} = 125$ °C		0.280		
			$T_{vj} = 150$ °C		0.285		
Fall time (inductive load)	t_f	$I_C = 15$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Goff} = 43$ Ω	$T_{vj} = 25$ °C		0.170		µs
			$T_{vj} = 125$ °C		0.200		
			$T_{vj} = 150$ °C		0.225		
Turn-on energy loss per pulse	E_{on}	$I_C = 15$ A, $V_{CC} = 600$ V, $L_\sigma = 50$ nH, $V_{GE} = \pm15$ V, $R_{Gon} = 43$ Ω, di/dt = 550 A/µs ($T_{vj} = 150$ °C)	$T_{vj} = 25$ °C		1.35		mJ
			$T_{vj} = 125$ °C		1.8		
			$T_{vj} = 150$ °C		2		
Turn-off energy loss per pulse	E_{off}	$I_C = 15$ A, $V_{CC} = 600$ V, $L_\sigma = 50$ nH, $V_{GE} = \pm15$ V, $R_{Goff} = 43$ Ω, dv/dt = 3500 V/µs ($T_{vj} = 150$ °C)	$T_{vj} = 25$ °C		0.85		mJ
			$T_{vj} = 125$ °C		1.2		
			$T_{vj} = 150$ °C		1.35		
SC data	I_{SC}	$V_{GE} \leq 15$ V, $V_{CC} = 800$ V, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_P \leq 10$ µs, $T_{vj} = 150$ °C		55		A

(table continues...)

Table 10 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material		1.32		K/W
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

6 Diode, Brake-Chopper

Table 11 **Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Continuous DC forward current	I_F			10	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		20	A
I²t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	16	A^2s

Table 12 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 10 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.75	2.25	V
			T_{vj} = 125 °C		1.75		
			T_{vj} = 150 °C		1.75		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 10 A, -di_F/dt = 550 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		12		A
			T_{vj} = 125 °C		10		
			T_{vj} = 150 °C		8		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 10 A, -di_F/dt = 550 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.9		µC
			T_{vj} = 125 °C		1.7		
			T_{vj} = 150 °C		1.9		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 10 A, -di_F/dt = 550 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.24		mJ
			T_{vj} = 125 °C		0.52		
			T_{vj} = 150 °C		0.59		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material			2.25		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

7 NTC-Thermistor

Table 13 Characteristic values

Parameter	**Symbol**	**Note or test condition**	**Values**			**Unit**
			Min.	**Typ.**	**Max.**	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25}\ \exp[B_{25/50}(1/T_2 - 1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25}\ \exp[B_{25/80}(1/T_2 - 1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25}\ \exp[B_{25/100}(1/T_2 - 1/(298{,}15\ K))]$		3433		K

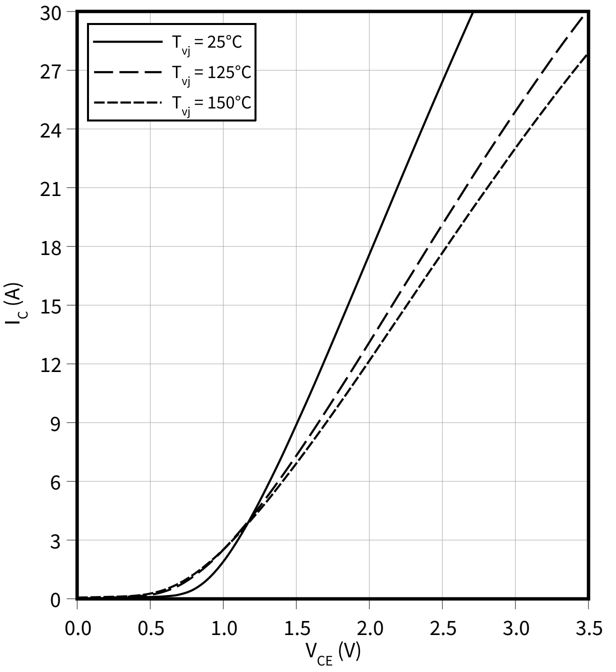
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4*

8 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

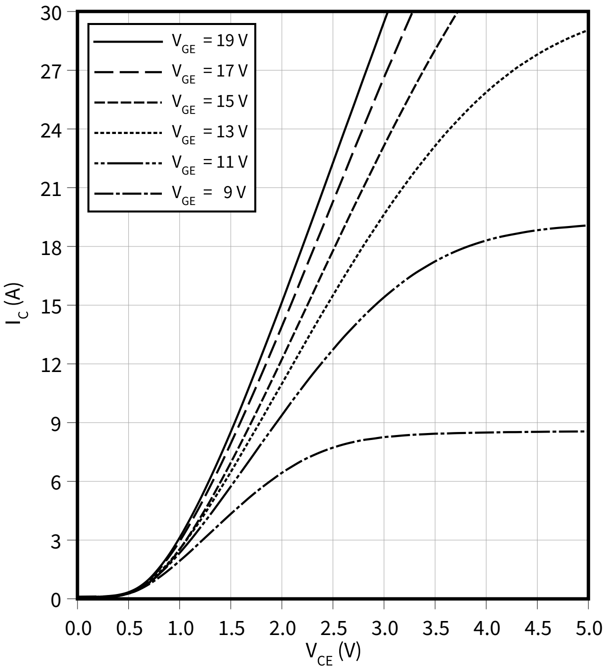
$V_{GE} = 15$ V



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

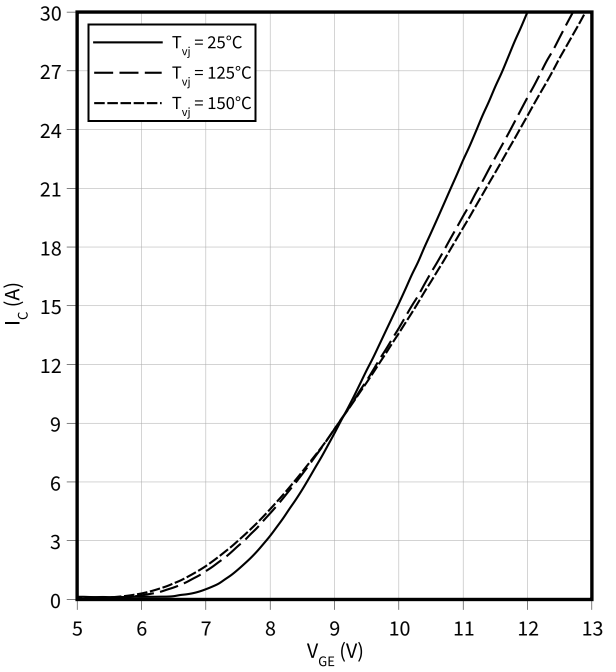
$T_{vj} = 150$ °C



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

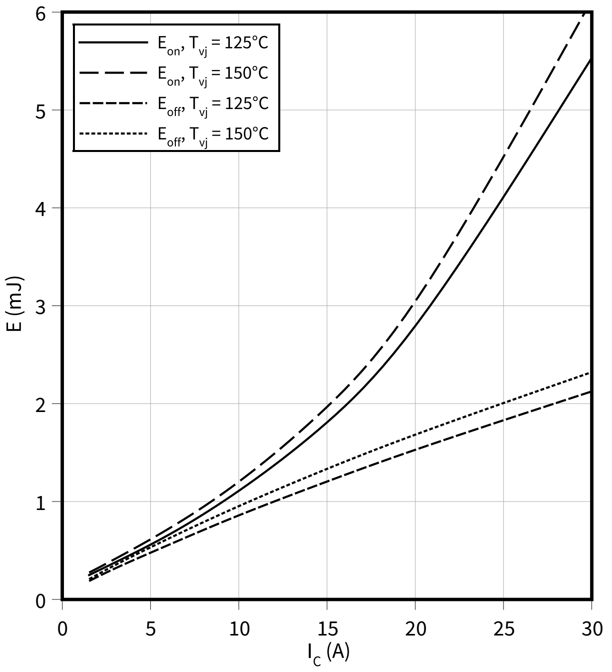
$V_{CE} = 20$ V



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

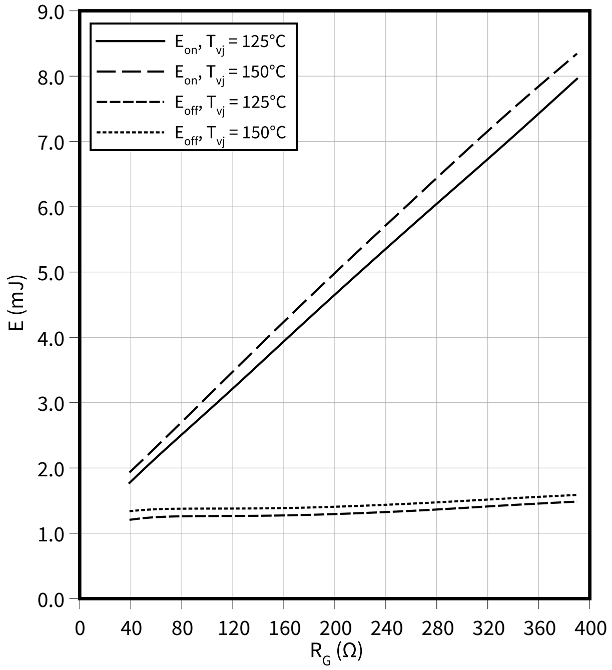
$R_{Goff} = 39\ \Omega$, $R_{Gon} = 39\ \Omega$, $V_{GE} = \pm 15$ V, $V_{CC} = 600$ V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

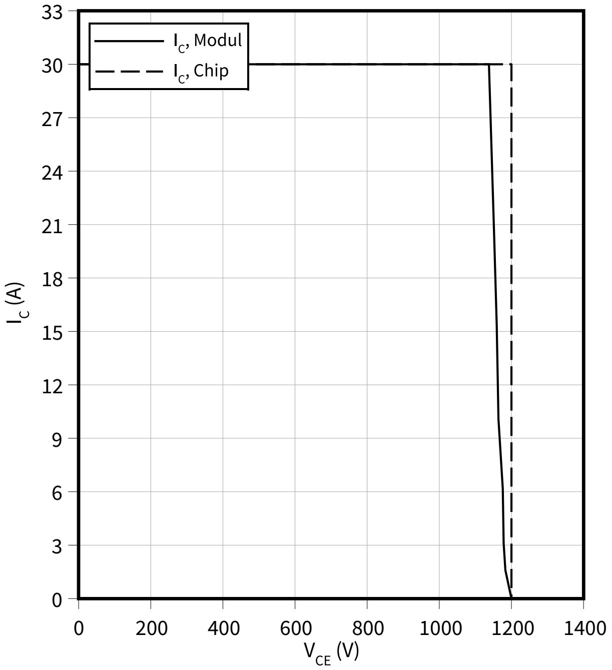
$V_{GE} = \pm15$ V, $I_C = 15$ A, $V_{CC} = 600$ V



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

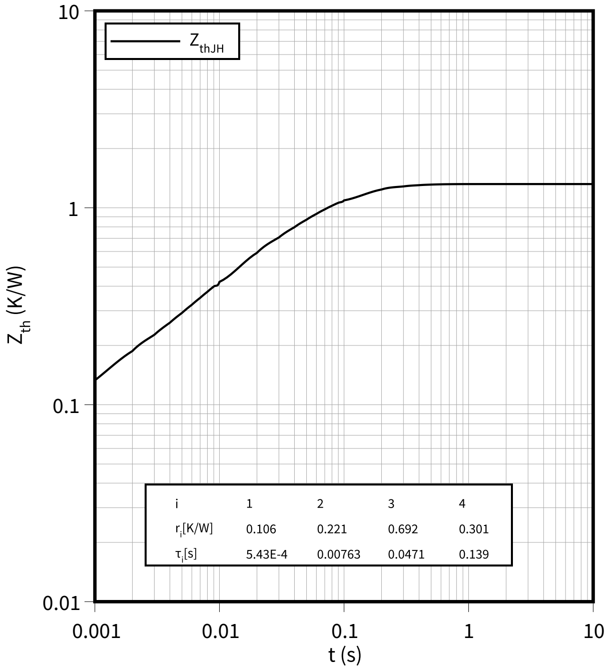
$I_C = f(V_{CE})$

$V_{GE} = \pm15$ V, $T_{vj} = 150$ °C, $R_{Goff} = 39\ \Omega$



Transient thermal impedance, IGBT, Inverter

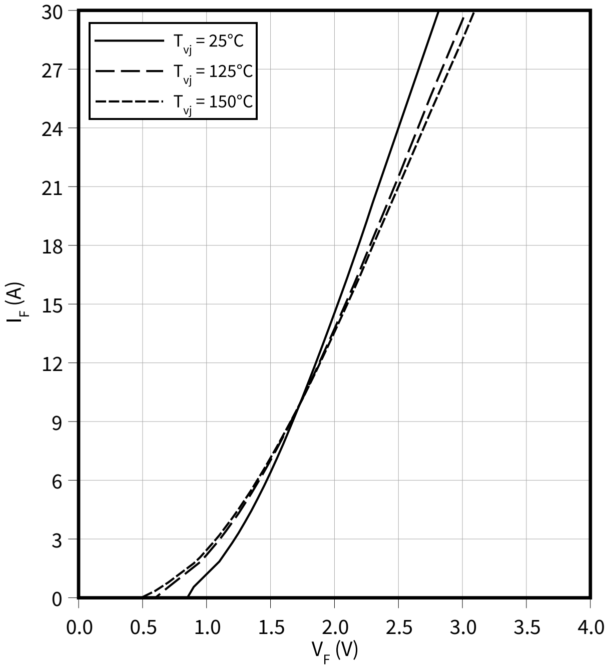
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.106	0.221	0.692	0.301
τ_i[s]	5.43E-4	0.00763	0.0471	0.139

Forward characteristic (typical), Diode, Inverter

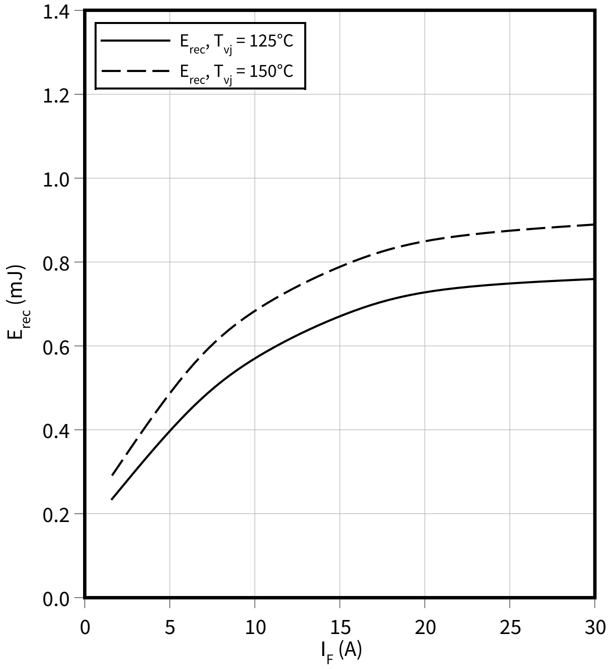
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

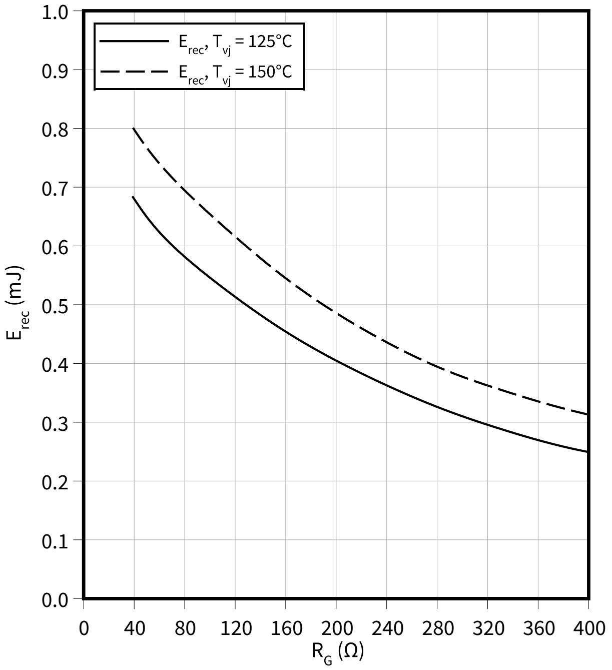
$R_{Gon} = 39\ \Omega$, $V_{CC} = 600\ V$



Switching losses (typical), Diode, Inverter

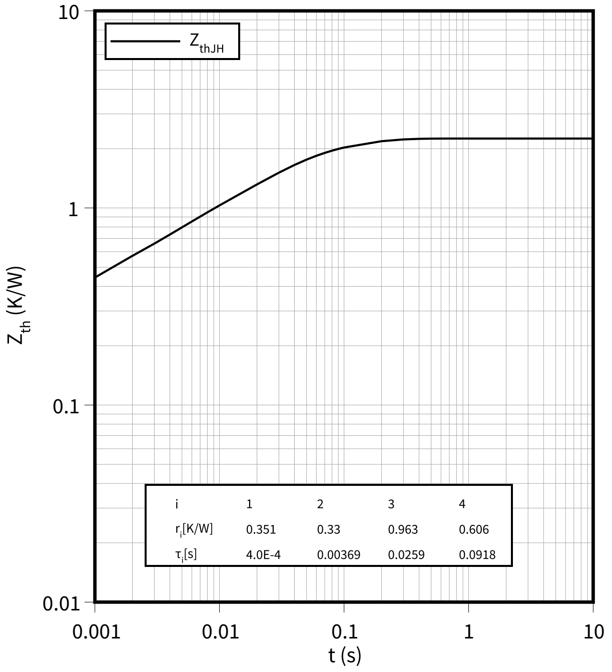
$E_{rec} = f(R_G)$

$I_F = 15\ A$, $V_{CC} = 600\ V$



Transient thermal impedance, Diode, Inverter

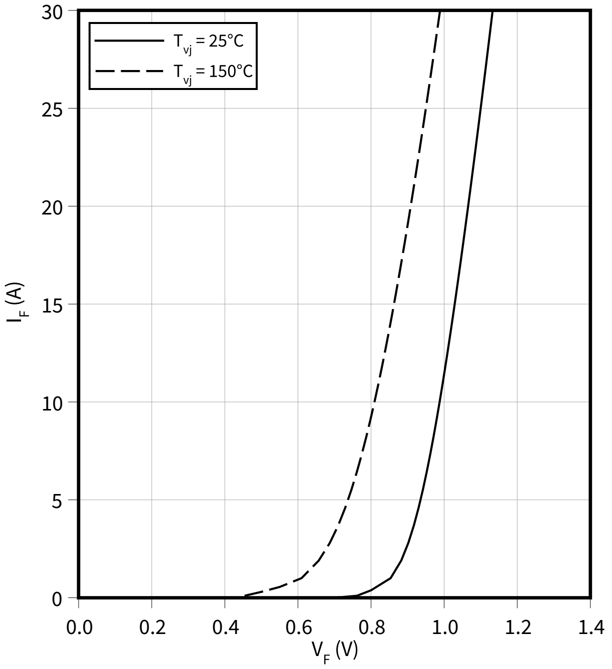
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.351	0.33	0.963	0.606
τ_i[s]	4.0E-4	0.00369	0.0259	0.0918

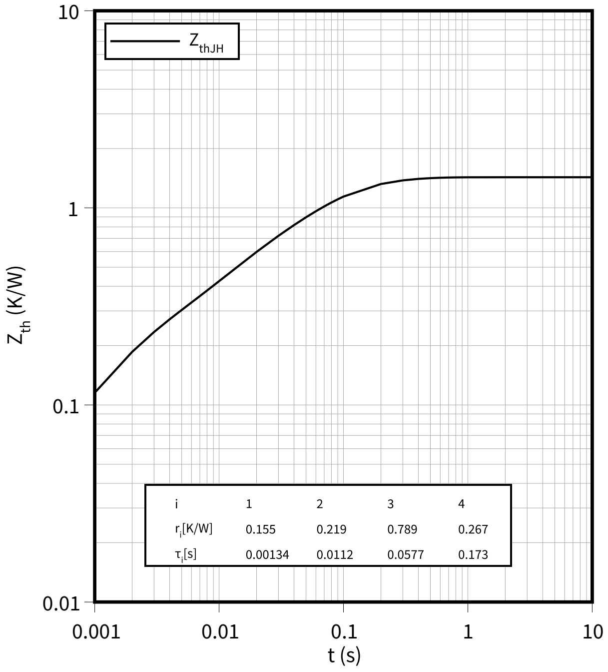
Forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$



Transient thermal impedance, Diode, Rectifier

$Z_{th} = f(t)$

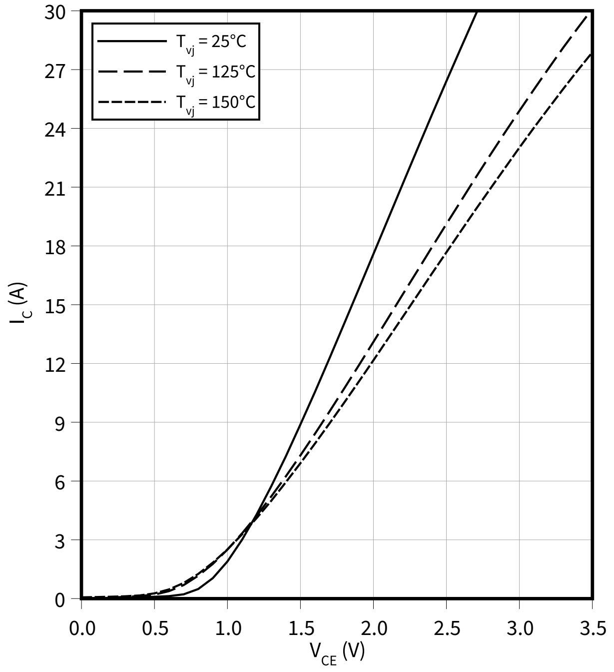


i	1	2	3	4
r_i[K/W]	0.155	0.219	0.789	0.267
τ_i[s]	0.00134	0.0112	0.0577	0.173

Output characteristic (typical), IGBT, Brake-Chopper

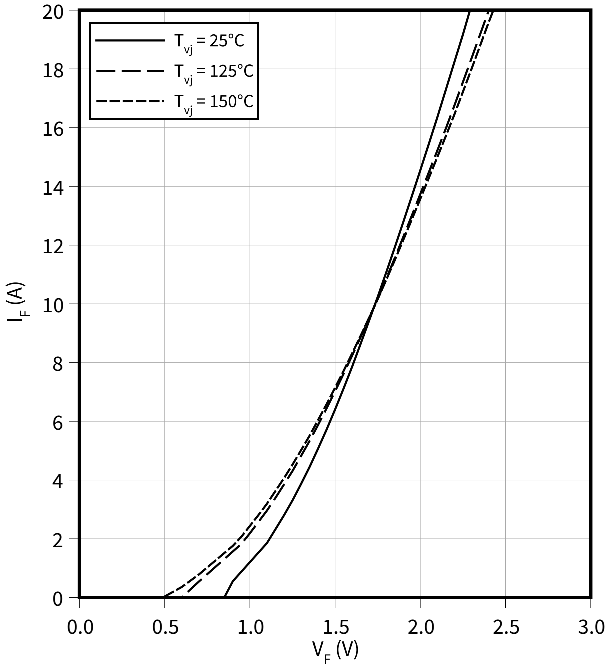
$I_C = f(V_{CE})$

$V_{GE} = 15$ V



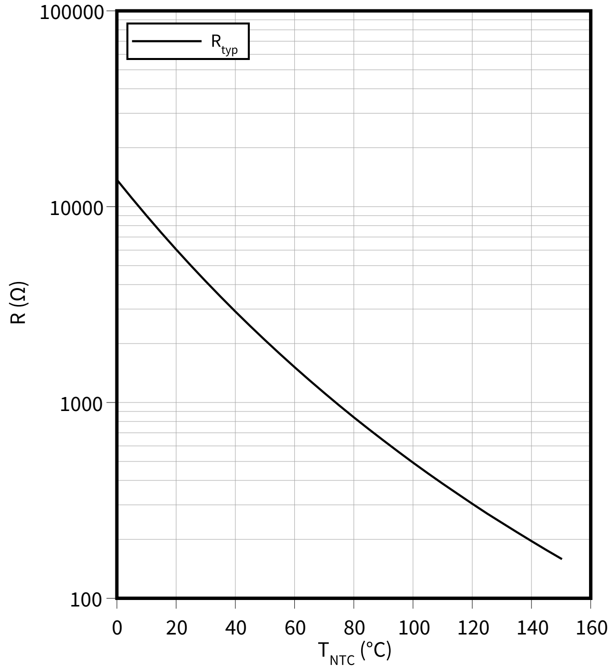
Forward characteristic (typical), Diode, Brake-Chopper

$I_F = f(V_F)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 Circuit diagram

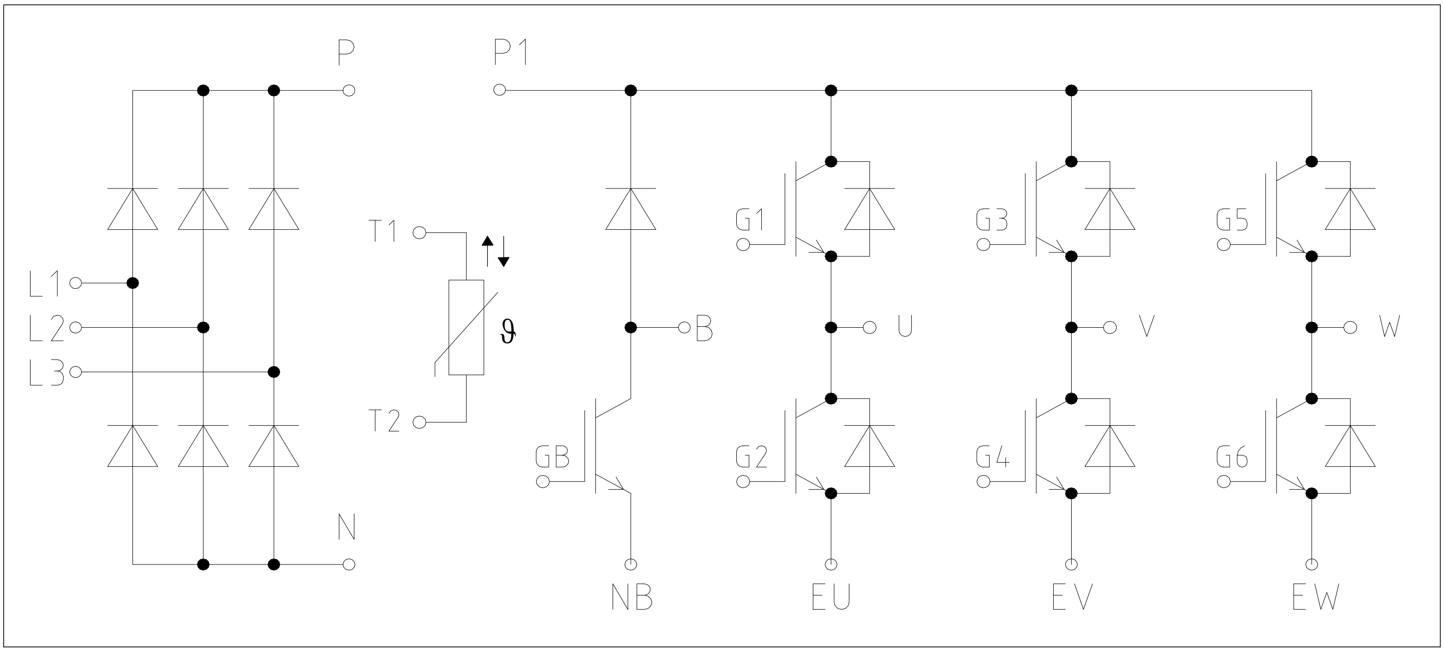
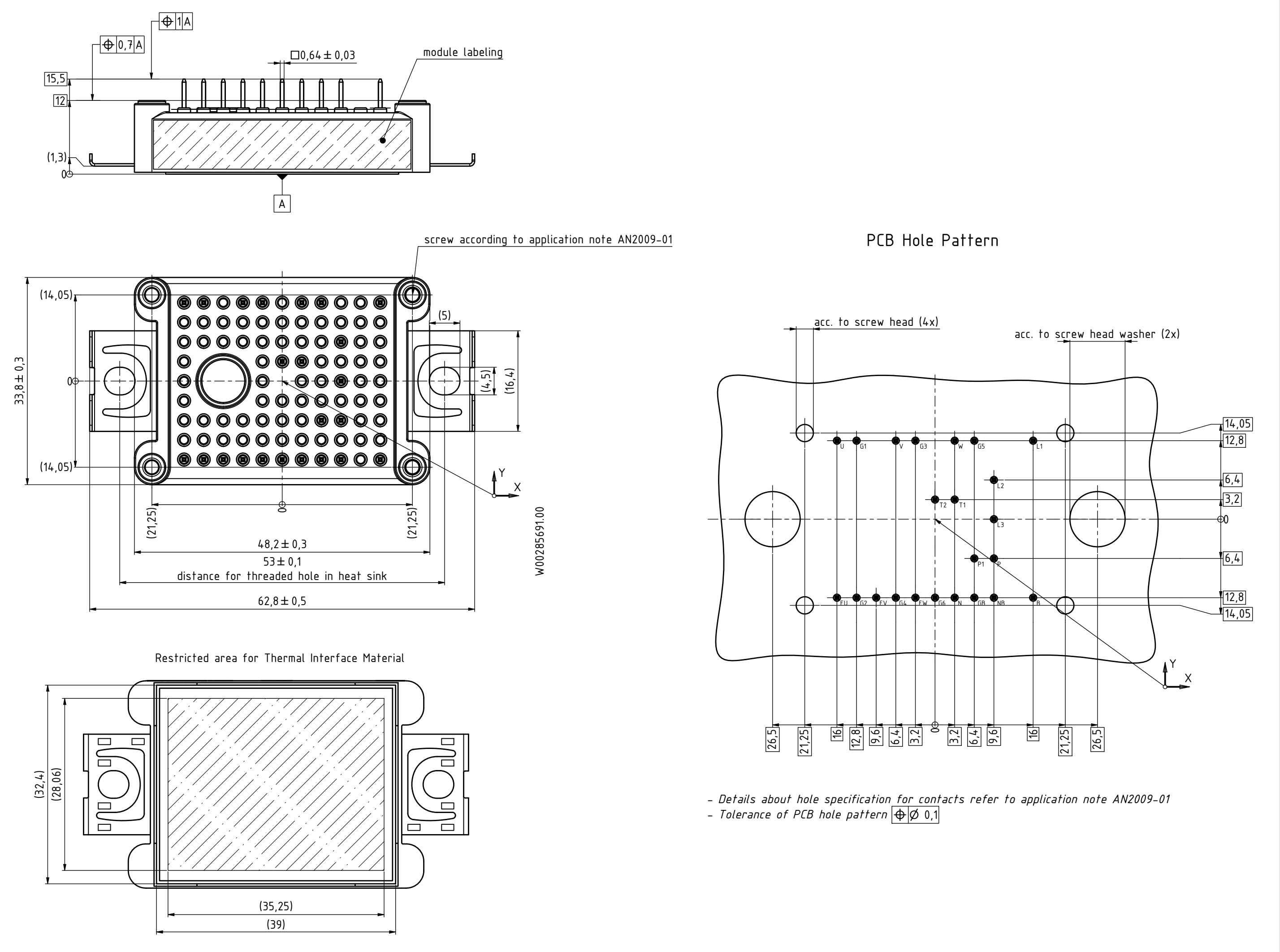


Figure 1

10 Package outlines



- *Details about hole specification for contacts refer to application note AN2009-01*
- *Tolerance of PCB hole pattern* ⌖ Ø 0,1

Figure 2

11 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*	*Digit*	*Example*
	Module serial number	1 – 5	71549
	Module material number	6 - 11	142846
	Production order number	12 - 19	55054991
	Date code (production year)	20 – 21	15
	Date code (production week)	22 – 23	30

Example		
	71549142846550549911530	71549142846550549911530

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2024-12-17	Target datasheet
1.00	2025-01-27	Final datasheet
1.10	2025-04-07	Final datasheet

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