Final datasheet

XHP™2 module with TRENCHSTOP™ IGBT8 and emitter controlled 8 diode and NTC / pre-applied thermal interface material



Features

- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\ nom}$ = 2000 A / I_{CRM} = 4000 A
  - $T_{vj,op}$ = 175°C
  - Low switching losses
  - High current density
  - Low $V_{CE,sat}$
  - Low inductive design
- Mechanical features
  - High creepage and clearance distances
  - High power and thermal cycling capability
  - High power density
  - Package with CTI > 600

Potential applications

- High-power converters
- Wind turbines
- Motor drives
- Traction

Product validation

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

Description

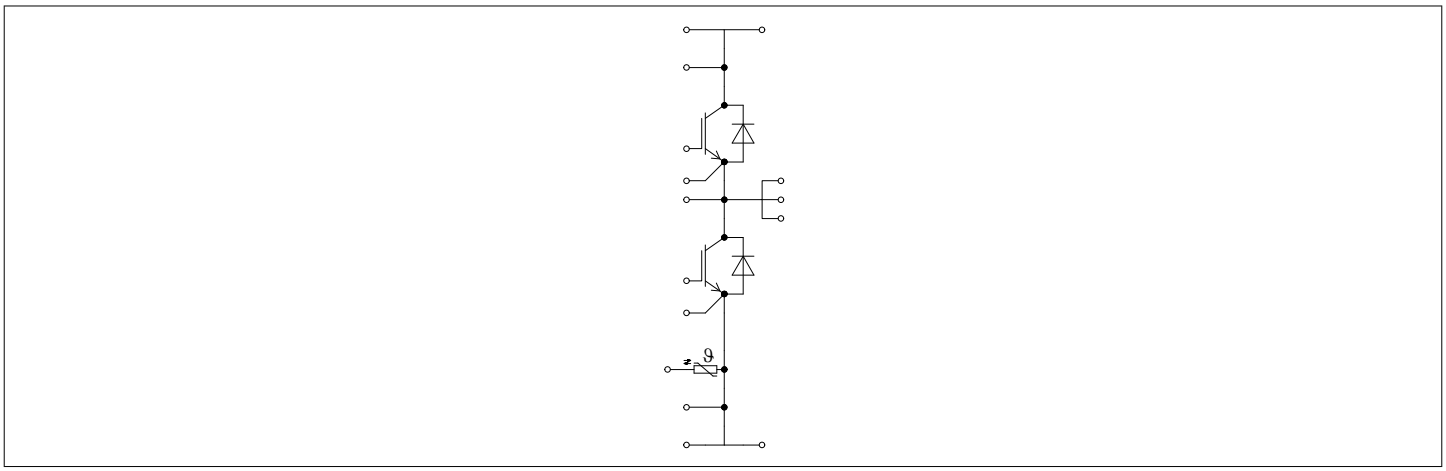


Table of contents

	Table of contents	2
1	**Package**	3
2	**IGBT, Inverter**	3
3	**Diode, Inverter**	5
4	**NTC-Thermistor**	6
5	**Characteristics diagrams**	7
6	**Circuit diagram**	12
7	**Package outlines**	13
8	**Module label code**	14
	Revision history	15
	Disclaimer	16

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	
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}				10		nH
Main emitter inductance 1	$L_{s(E1\text{-}E1m)}$				1.5		nH
Main emitter inductance 2	$L_{s(E2\text{-}E2m)}$				3.5		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_C = 25 °C, per switch			0.27		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C = 25 °C, per switch			0.34		mΩ
Storage temperature	T_{stg}			-40		150	°C
Maximum baseplate operation temperature	T_{BPmax}					150	°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	M3, Screw	0.9		1.1	Nm
			M8, Screw	8		10	
Weight	*G*				1020		g

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	1700	V
Implemented collector current	I_{CN}			2000	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 95 °C	2000	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		4000	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 = 2000 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.65	1.85	V
			T_{vj} = 125 °C		2.00	2.24	
			T_{vj} = 175 °C		2.17	2.43	
Gate threshold voltage	V_{GEth}	I_C = 42.6 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.15	5.80	6.45	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 900 V, T_{vj} = 25 °C			13		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.66		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			186		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.45		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1700 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				200	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 2000 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.39 Ω	T_{vj} = 25 °C		0.41		µs
			T_{vj} = 125 °C		0.47		
			T_{vj} = 175 °C		0.5		
Rise time (inductive load)	t_r	I_C = 2000 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.39 Ω	T_{vj} = 25 °C		0.09		µs
			T_{vj} = 125 °C		0.1		
			T_{vj} = 175 °C		0.115		
Turn-off delay time (inductive load)	t_{doff}	I_C = 2000 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 5.1 Ω	T_{vj} = 25 °C		1.31		µs
			T_{vj} = 125 °C		1.36		
			T_{vj} = 175 °C		1.4		
Fall time (inductive load)	t_f	I_C = 2000 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 5.1 Ω	T_{vj} = 25 °C		0.36		µs
			T_{vj} = 125 °C		0.59		
			T_{vj} = 175 °C		0.7		
Turn-on energy loss per pulse	E_{on}	I_C = 2000 A, V_{CC} = 900 V, L_σ = 20 nH, V_{GE} = ±15 V, R_{Gon} = 0.39 Ω, di/dt = 13200 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		400		mJ
			T_{vj} = 125 °C		650		
			T_{vj} = 175 °C		840		
Turn-off energy loss per pulse	E_{off}	I_C = 2000 A, V_{CC} = 900 V, L_σ = 20 nH, V_{GE} = ±15 V, R_{Goff} = 5.1 Ω, dv/dt = 3300 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		540		mJ
			T_{vj} = 125 °C		680		
			T_{vj} = 175 °C		760		

(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} = 1000 V, $V_{CEmax}=V_{CES}-L_{sCE}*di/dt$	t_P = 6 µs, T_{vj} = 175 °C		6350		A
			t_P = 8 µs, T_{vj} = 150 °C		6450		
Thermal resistance, junction to case	R_{thJC}	per IGBT				17.1	K/kW
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material			4.9		K/kW
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°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	1700	V
Continuous DC forward current	I_F			2000	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		4000	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	350	kA^2s
			T_{vj} = 175 °C	295	
Maximum power dissipation	P_{RQM}		T_{vj} = 175 °C	2200	kW

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 2000 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.95	2.12	V
			T_{vj} = 125 °C		1.95	2.12	
			T_{vj} = 175 °C		1.90	2.07	
Peak reverse recovery current	I_{RM}	V_{CC} = 900 V, I_F = 2000 A, V_{GE} = -15 V, $-di_F/dt$ = 12500 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		1480		A
			T_{vj} = 125 °C		1560		
			T_{vj} = 175 °C		1560		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Recovered charge	Q_r	V_{CC} = 900 V, I_F = 2000 A, V_{GE} = -15 V, -di$_F$/dt = 12500 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		325		µC
			T_{vj} = 125 °C		570		
			T_{vj} = 175 °C		740		
Reverse recovery energy	E_{rec}	V_{CC} = 900 V, I_F = 2000 A, V_{GE} = -15 V, -di$_F$/dt = 12500 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		160		mJ
			T_{vj} = 125 °C		290		
			T_{vj} = 175 °C		375		
Thermal resistance, junction to case	R_{thJC}	per diode				32.1	K/kW
Thermal resistance, case to heat sink	R_{thCH}	per diode, Valid with IFX pre-applied Thermal Interface Material			6.7		K/kW
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

4 NTC-Thermistor

Table 7 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

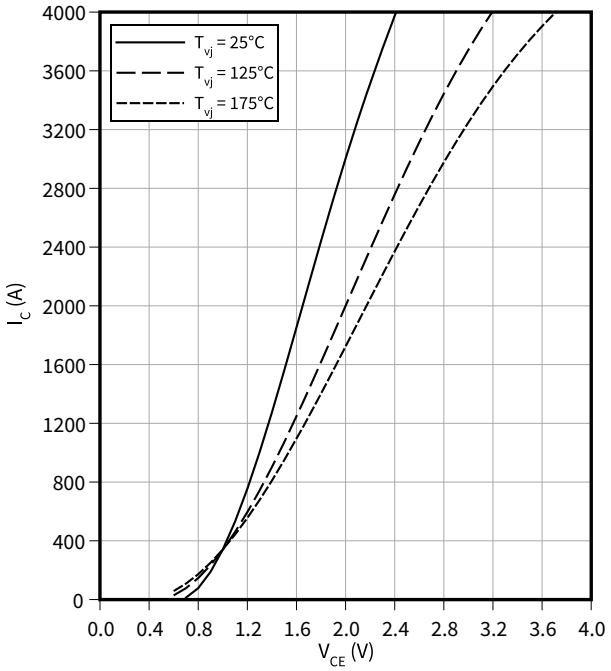
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.*

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

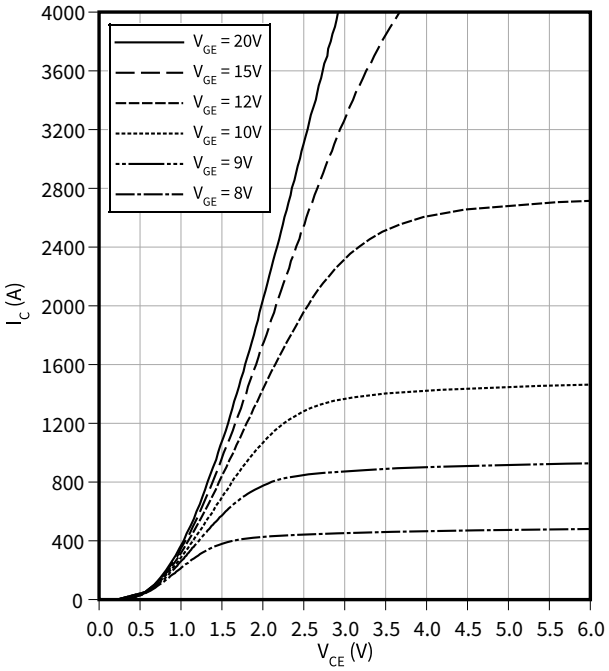
V_{GE} = 15 V



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

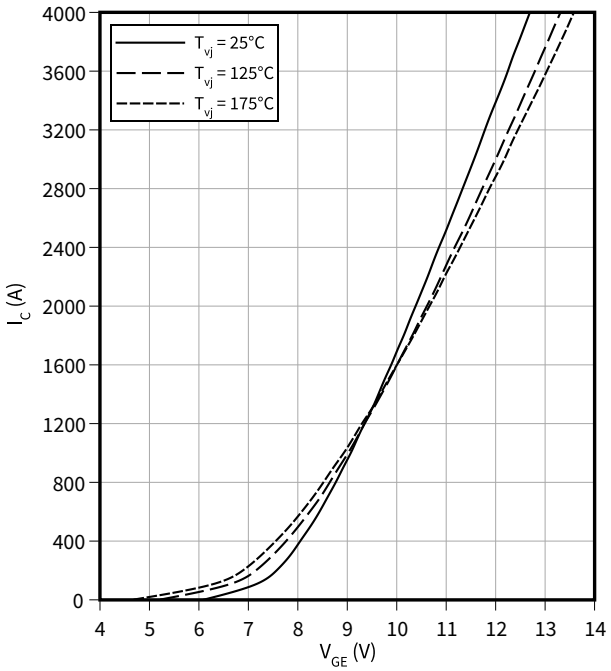
T_{vj} = 175 °C



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

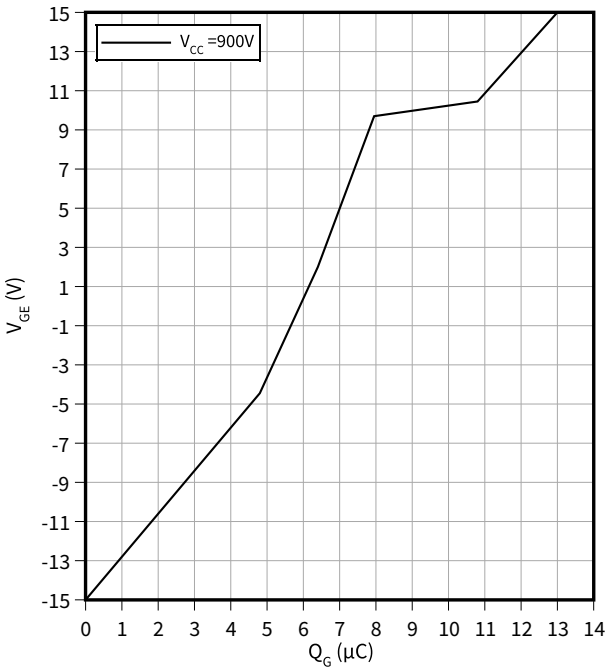
V_{CE} = 20 V



Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$

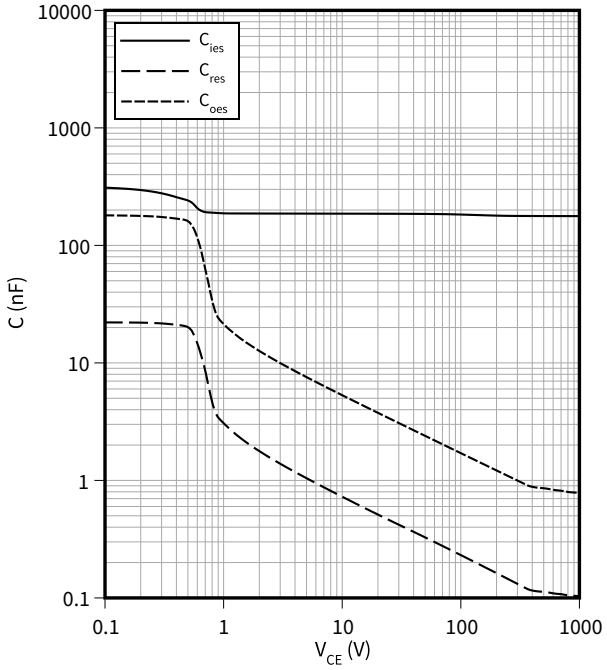
I_C = 2000 A, T_{vj} = 25 °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

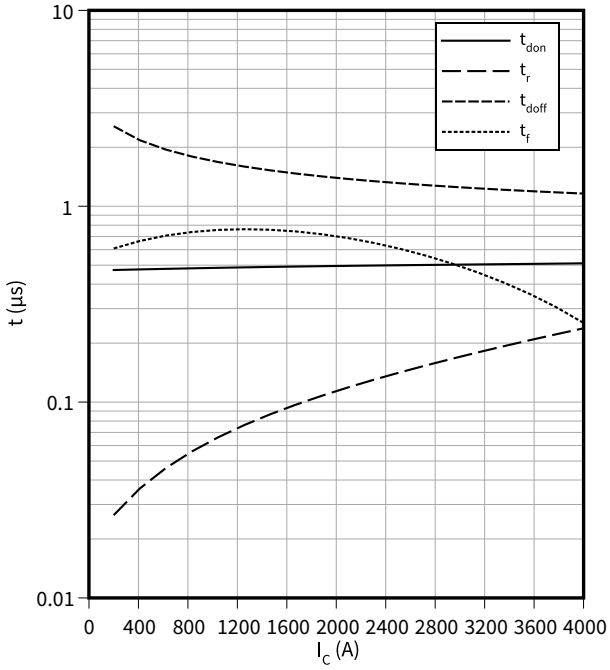
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

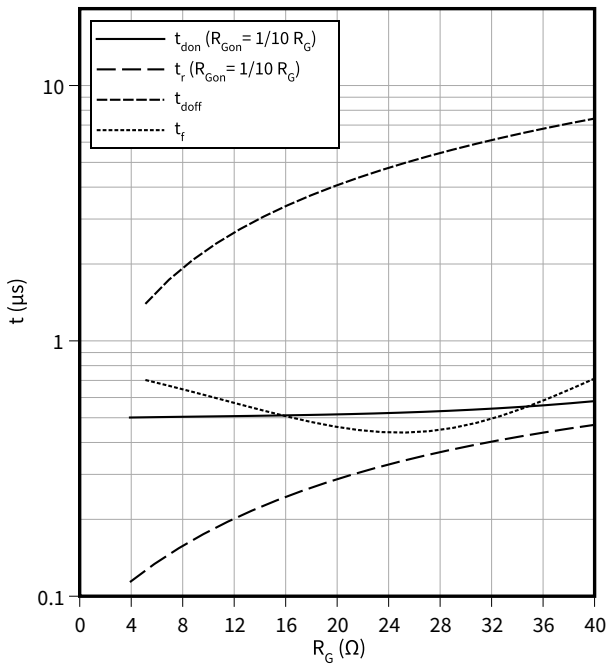
$R_{Gon} = 0.39\ \Omega$, $V_{GE} = \pm 15\ V$, $V_{CC} = 900\ V$, $R_{Goff} = 5.1\ \Omega$, $T_{vj} = 175\ °C$



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

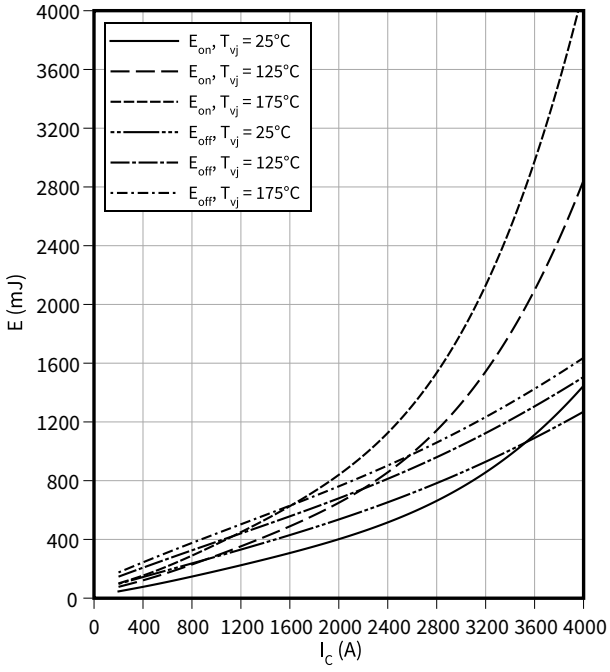
$V_{GE} = \pm 15\ V$, $I_C = 2000\ A$, $V_{CC} = 900\ V$, $T_{vj} = 175\ °C$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

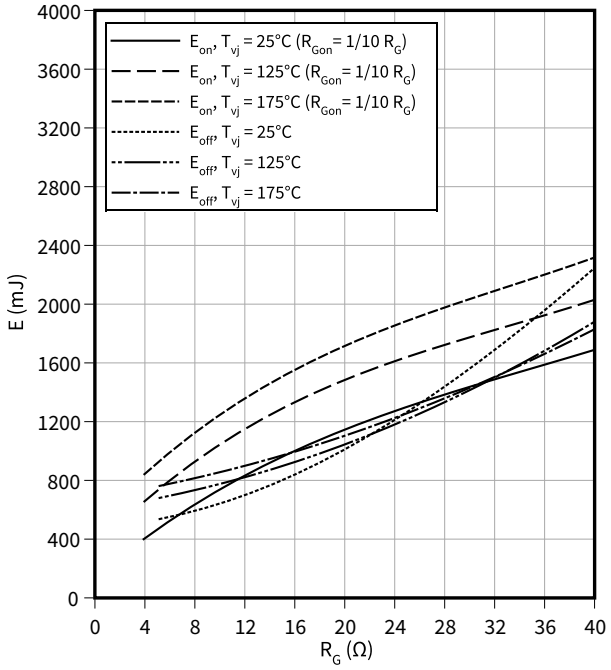
$R_{Goff} = 5.1\ \Omega$, $R_{Gon} = 0.39\ \Omega$, $V_{CC} = 900\ V$, $\pm\ 15\ V$



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

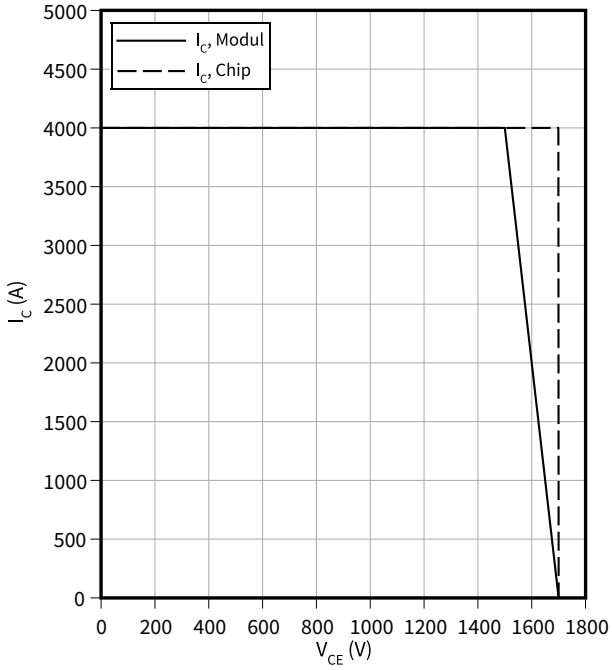
$V_{GE} = \pm 15$ V, $I_C = 2000$ A, $V_{CC} = 900$ V



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

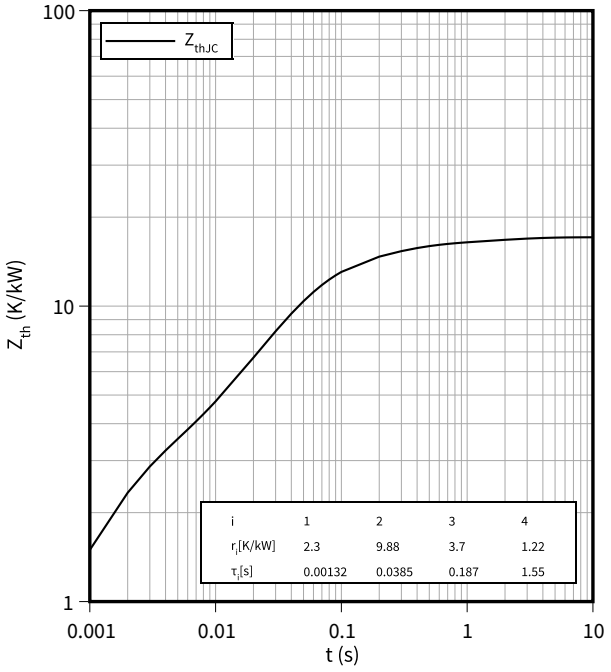
$I_C = f(V_{CE})$

$R_{Goff} \geq 5.1\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



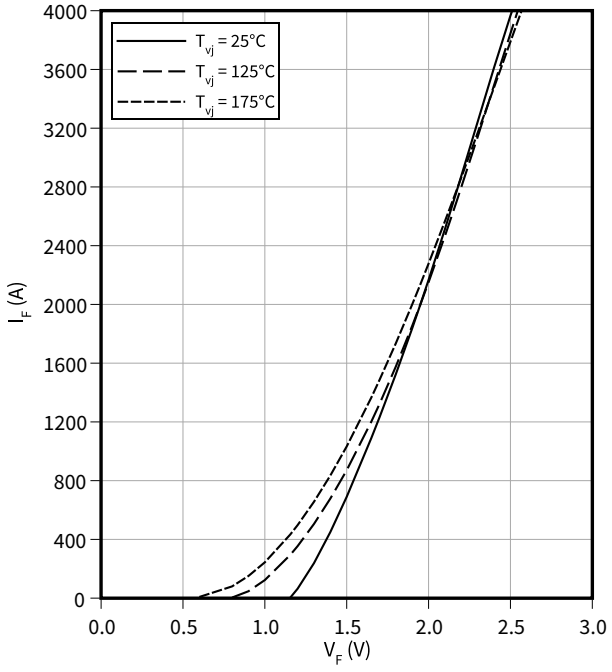
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

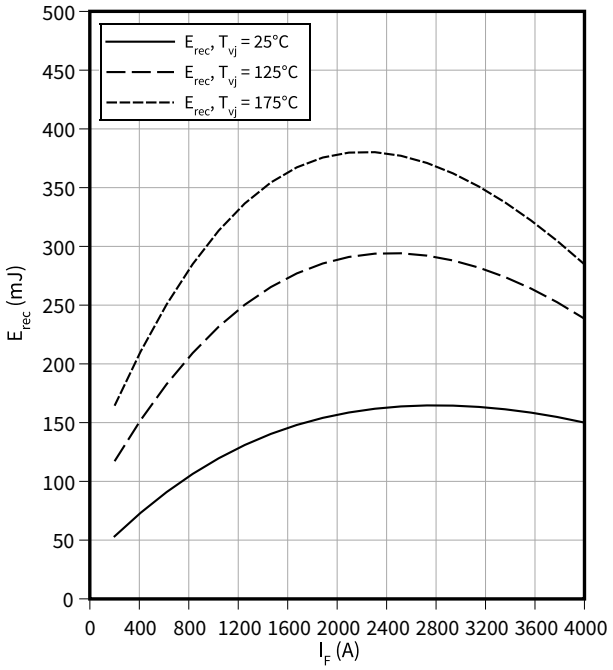
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

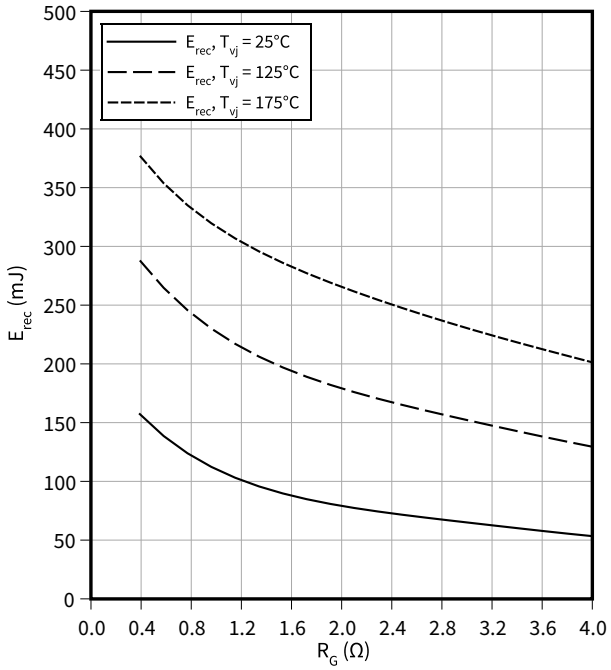
$V_{CE} = 900\ V$, $R_{Gon} = R_{Gon(IGBT)}$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$

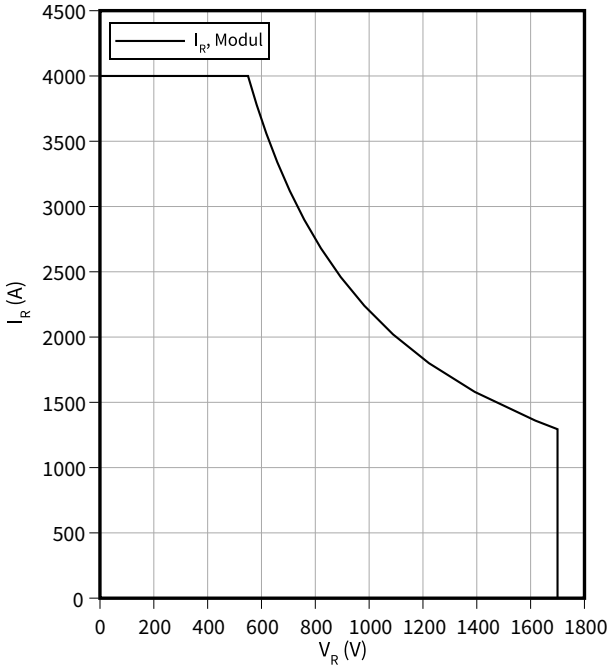
$V_{CC} = 900\ V$, $I_F = 2000\ A$



Safe operating area (SOA), Diode, Inverter

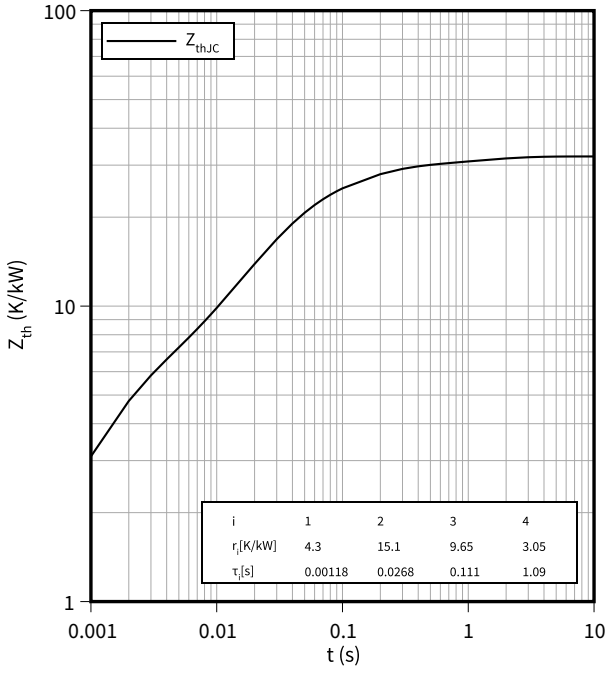
$I_R = f(V_R)$

$T_{vj} = 175\ °C$



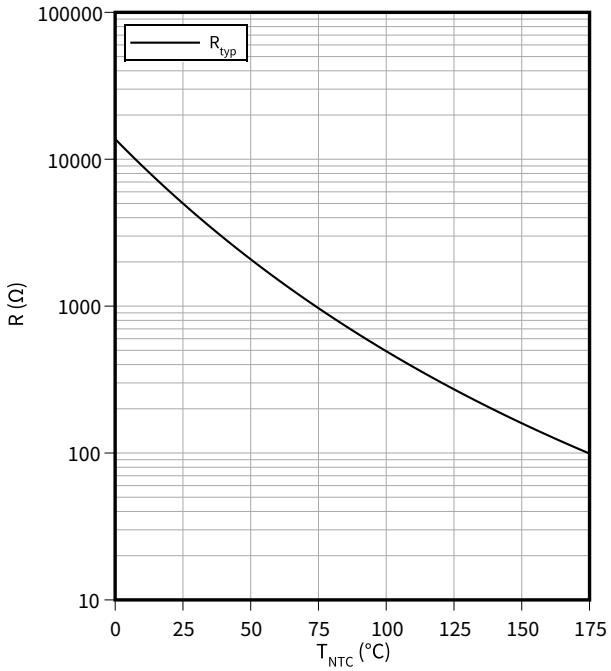
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

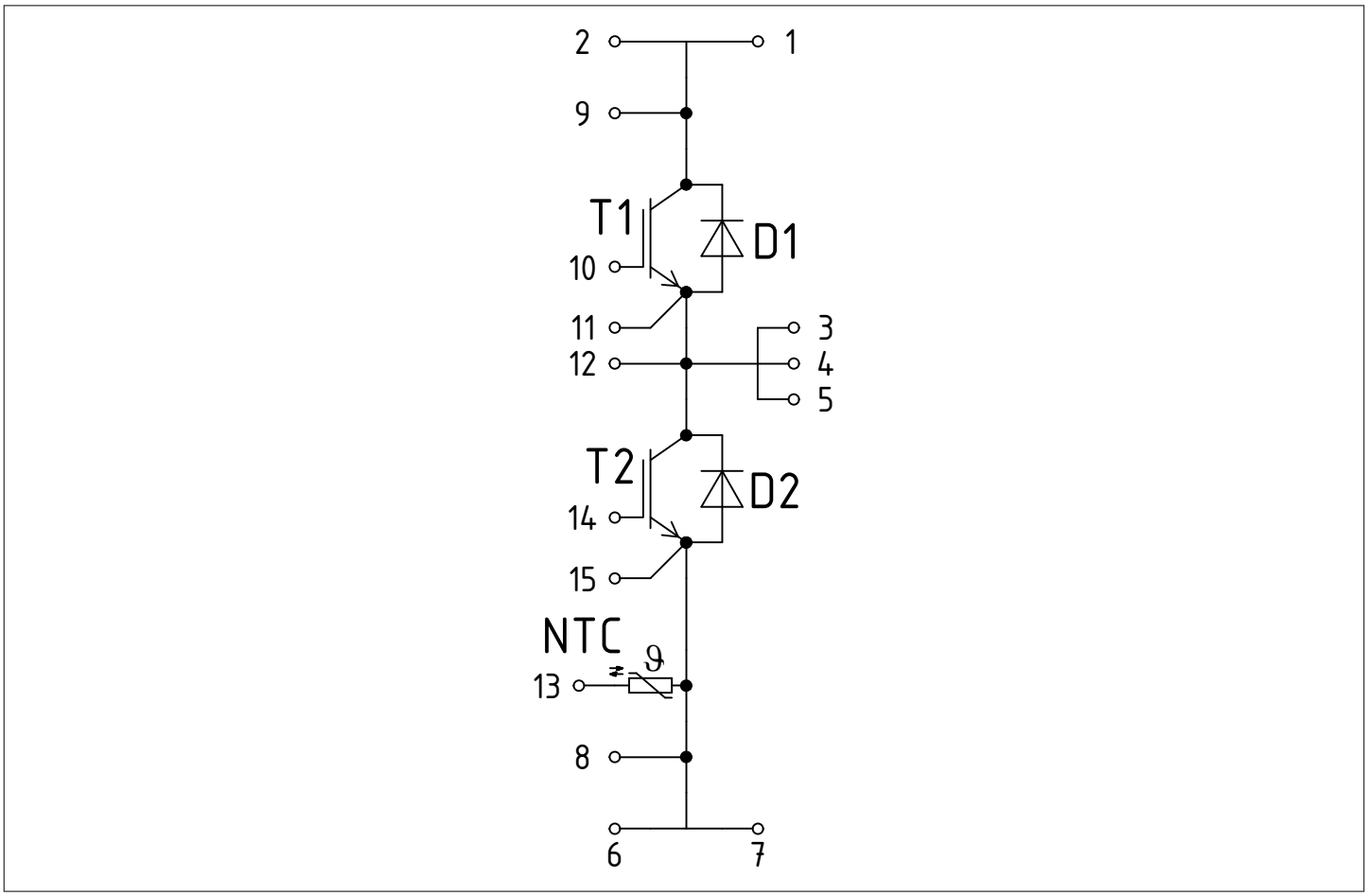


Figure 1

7 Package outlines

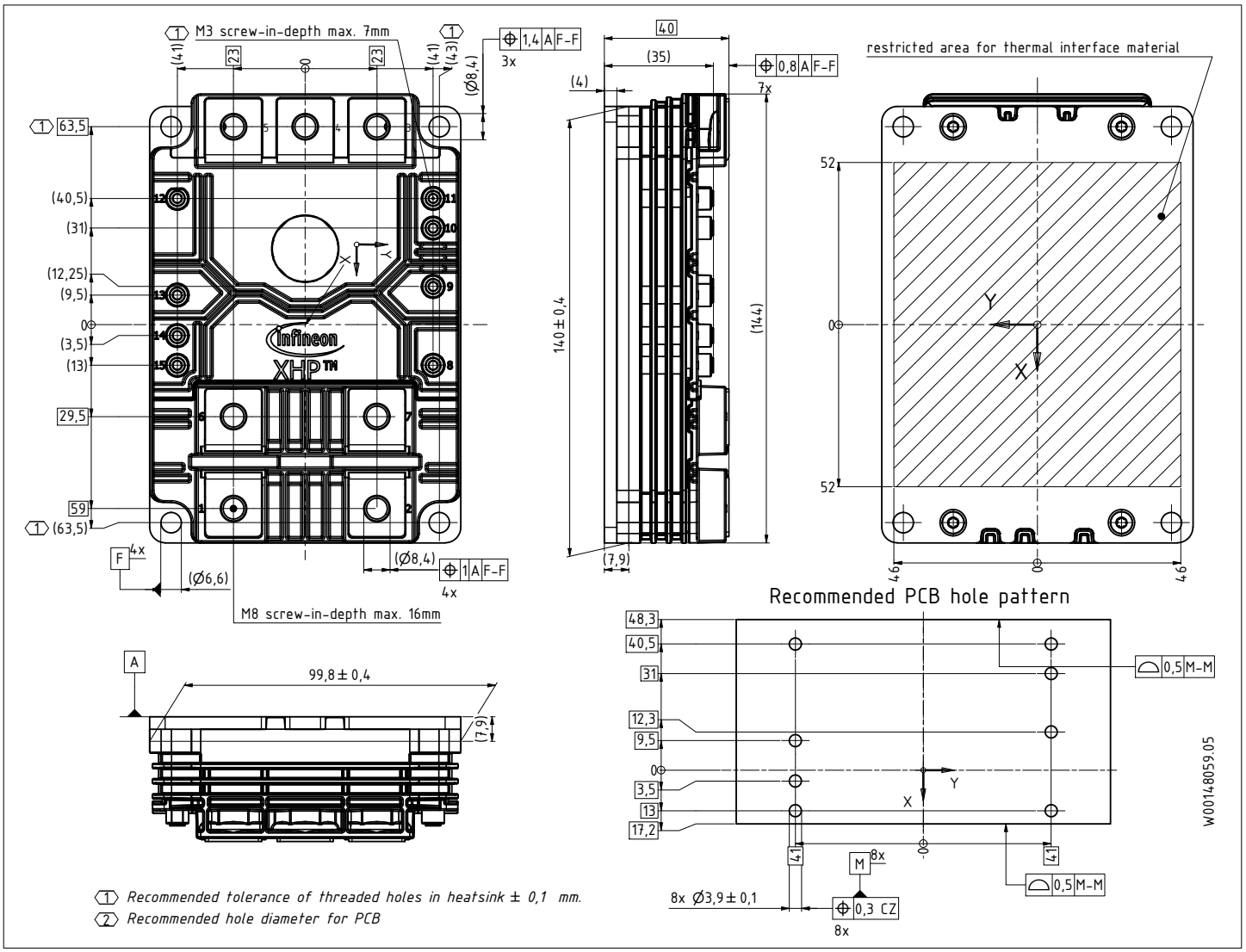


Figure 2

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	2026-05-29	Initial version
1.01	2026-06-08	Final datasheet - Errata

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