Final datasheet

XHP™2 module with TRENCHSTOP™ IGBT8 and emitter controlled 8 diode and NTC

Features

- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\ nom}$ = 1400 A / I_{CRM} = 2800 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

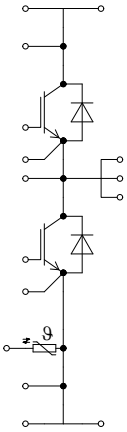
Potential applications

- 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



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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	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			0.31		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C = 25 °C, per switch			0.41		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}			1400	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 85 °C	1400	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		2800	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 = 1400 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.68	1.88	V
			T_{vj} = 125 °C		2.05	2.29	
			T_{vj} = 175 °C		2.23	2.50	
Gate threshold voltage	V_{GEth}	I_C = 28.4 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			8.7		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			124		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.3		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 = 1400 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.22 Ω	T_{vj} = 25 °C		0.385		µs
			T_{vj} = 125 °C		0.410		
			T_{vj} = 175 °C		0.430		
Rise time (inductive load)	t_r	I_C = 1400 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.22 Ω	T_{vj} = 25 °C		0.068		µs
			T_{vj} = 125 °C		0.080		
			T_{vj} = 175 °C		0.091		
Turn-off delay time (inductive load)	t_{doff}	I_C = 1400 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 6.8 Ω	T_{vj} = 25 °C		1.190		µs
			T_{vj} = 125 °C		1.240		
			T_{vj} = 175 °C		1.270		
Fall time (inductive load)	t_f	I_C = 1400 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 6.8 Ω	T_{vj} = 25 °C		0.410		µs
			T_{vj} = 125 °C		0.650		
			T_{vj} = 175 °C		0.760		
Turn-on energy loss per pulse	E_{on}	I_C = 1400 A, V_{CC} = 900 V, L_σ = 20 nH, V_{GE} = ±15 V, R_{Gon} = 0.22 Ω, di/dt = 11300 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		320		mJ
			T_{vj} = 125 °C		530		
			T_{vj} = 175 °C		660		
Turn-off energy loss per pulse	E_{off}	I_C = 1400 A, V_{CC} = 900 V, L_σ = 20 nH, V_{GE} = ±15 V, R_{Goff} = 6.8 Ω, dv/dt = 3450 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		340		mJ
			T_{vj} = 125 °C		450		
			T_{vj} = 175 °C		500		

(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		4350		A
			$t_P = 8$ µs, $T_{vj} = 150$ °C		4600		
Thermal resistance, junction to case	R_{thJC}	per IGBT				25.1	K/kW
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 5$ W/(m·K)			7.6		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			1400	A
Repetitive peak forward current	I_{FRM}	$t_P = 1$ ms		2800	A
I^2t - value	I^2t	$t_P = 10$ ms, $V_R = 0$ V	$T_{vj} = 125$ °C	156	kA^2s
			$T_{vj} = 175$ °C	131	
Maximum power dissipation	P_{RQM}		$T_{vj} = 175$ °C	1400	kW

Table 6 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 1400$ A	$T_{vj} = 25$ °C		1.98	2.15	V
			$T_{vj} = 125$ °C		1.98	2.15	
			$T_{vj} = 175$ °C		1.94	2.09	
Peak reverse recovery current	I_{RM}	$V_{CC} = 900$ V, $I_F = 1400$ A, $V_{GE} = -15$ V, $-di_F/dt = 11300$ A/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		1180		A
			$T_{vj} = 125$ °C		1120		
			$T_{vj} = 175$ °C		1070		

(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 = 1400 A, V_{GE} = -15 V, -di$_F$/dt = 11300 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		220		µC
			T_{vj} = 125 °C		395		
			T_{vj} = 175 °C		500		
Reverse recovery energy	E_{rec}	V_{CC} = 900 V, I_F = 1400 A, V_{GE} = -15 V, -di$_F$/dt = 11300 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		93		mJ
			T_{vj} = 125 °C		177		
			T_{vj} = 175 °C		235		
Thermal resistance, junction to case	R_{thJC}	per diode				44.9	K/kW
Thermal resistance, case to heat sink	R_{thCH}	per diode, λ_{grease} = 5 W/(m·K)			10.4		K/kW
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

4 NTC-Thermistor

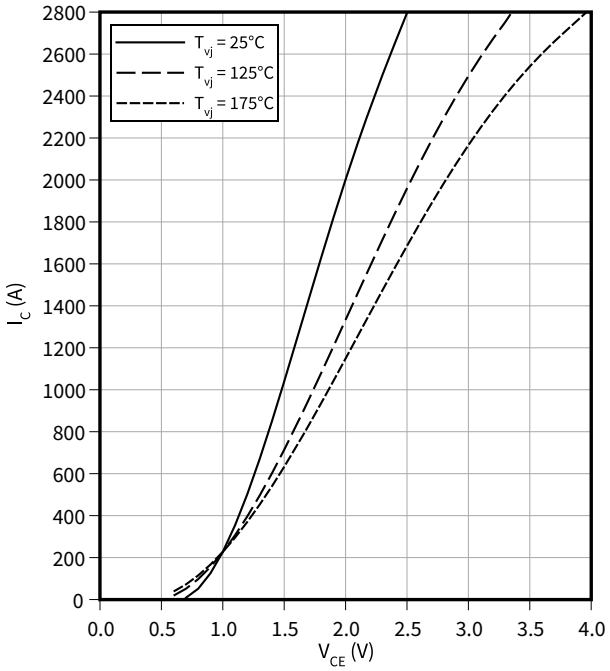
Table 7 **Characteristic values**

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

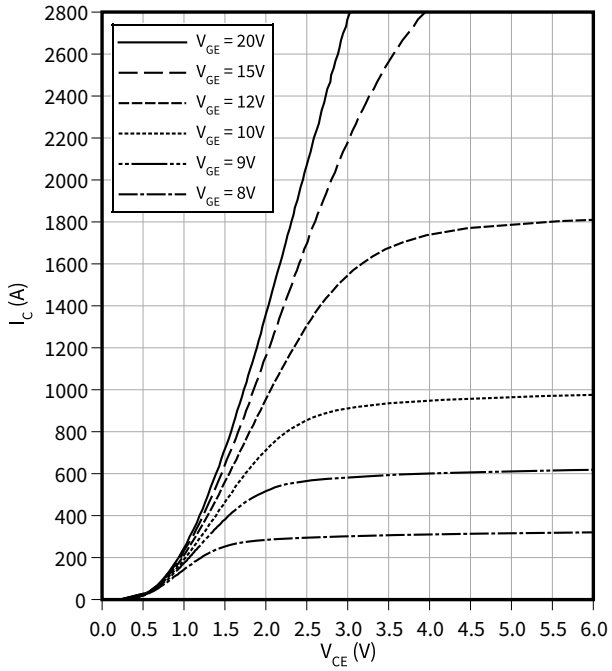
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.*

5 Characteristics diagrams

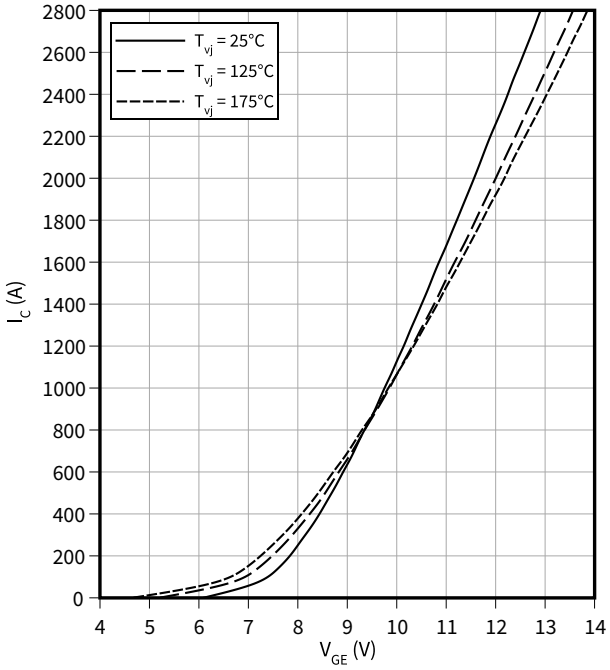
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



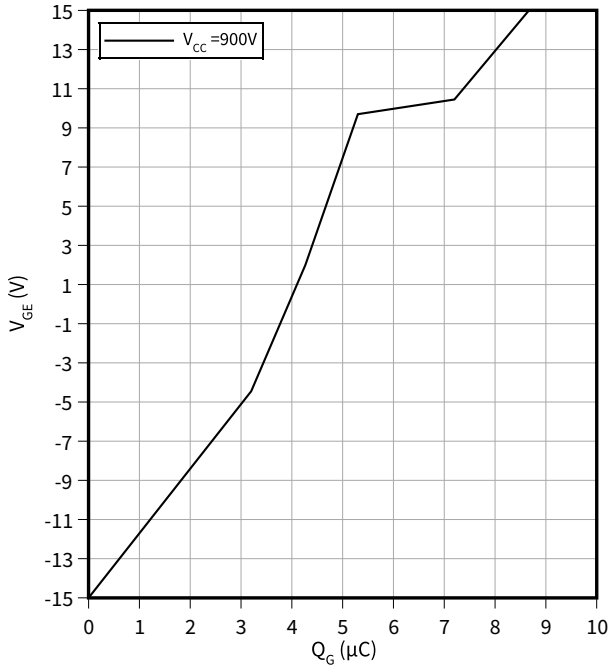
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 175$ °C



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



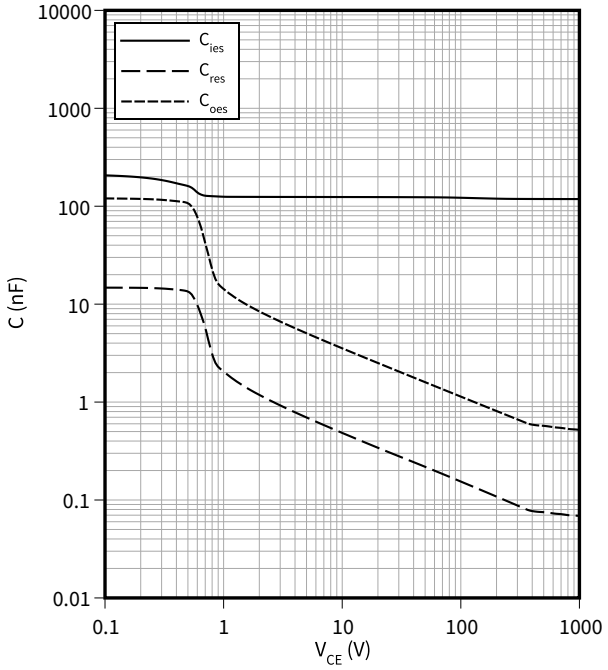
Gate charge characteristic (typical), IGBT, Inverter
$V_{GE} = f(Q_G)$
$I_C = 1400$ A, $T_{vj} = 25$ °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

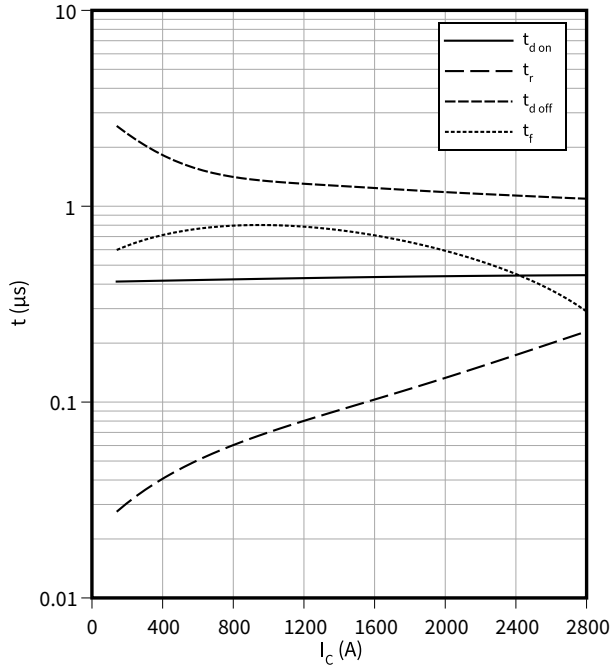
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

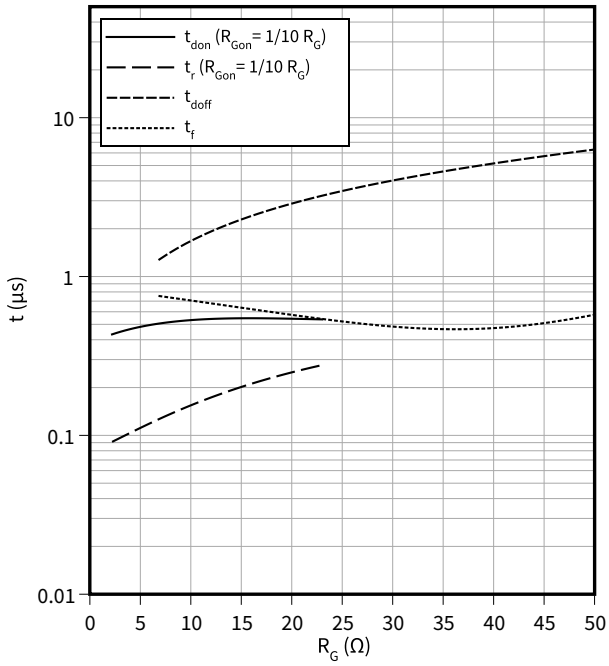
$R_{Goff} = 6.8\ \Omega$, $R_{Gon} = 0.22\ \Omega$, $V_{GE} = \pm 15$ V, $V_{CC} = 900$ V, $T_{vj} = 175$ °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

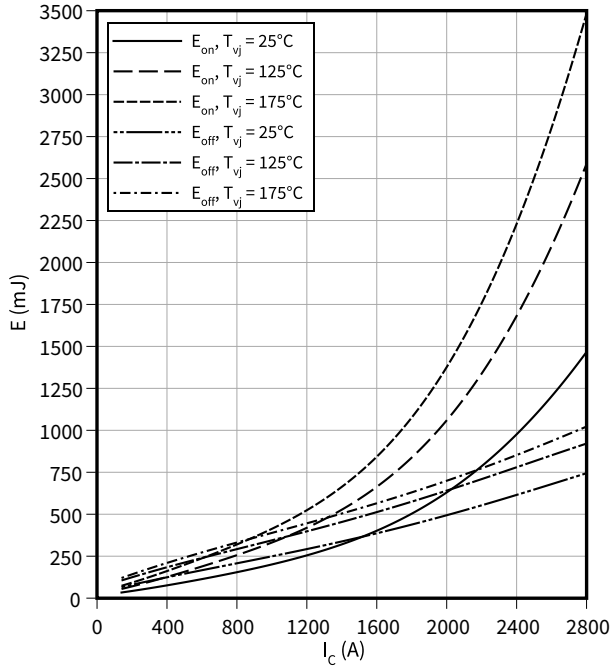
$V_{GE} = \pm 15$ V, $I_C = 1400$ A, $V_{CC} = 900$ V, $T_{vj} = 175$ °C



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

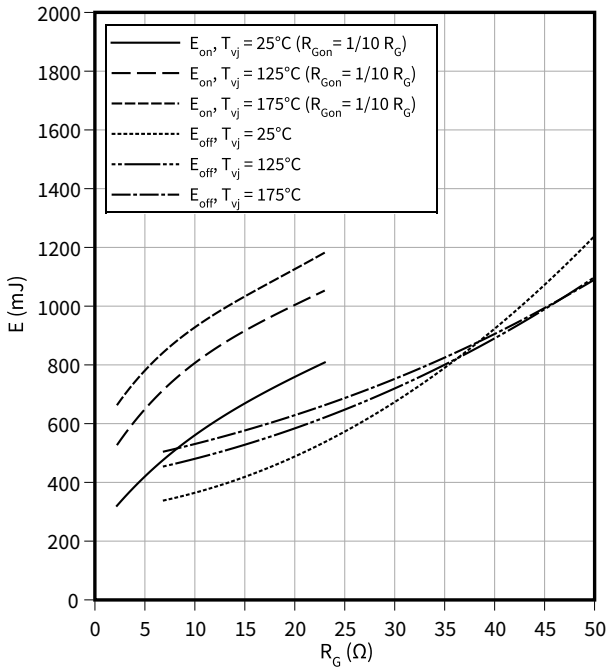
$R_{Goff} = 6.8\ \Omega$, $R_{Gon} = 0.22\ \Omega$, $V_{CC} = 900$ V, ± 15 V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

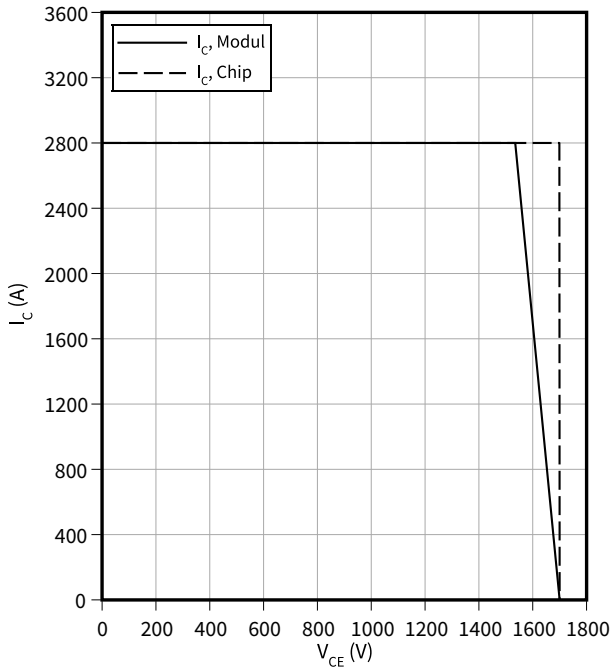
$V_{GE} = \pm 15$ V, $I_C = 1400$ A, $V_{CC} = 900$ V



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

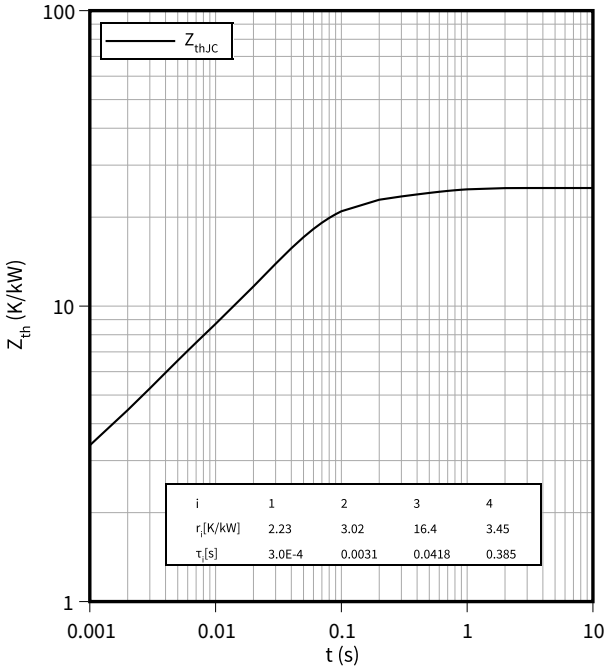
$I_C = f(V_{CE})$

$R_{Goff} \geq 6.8\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



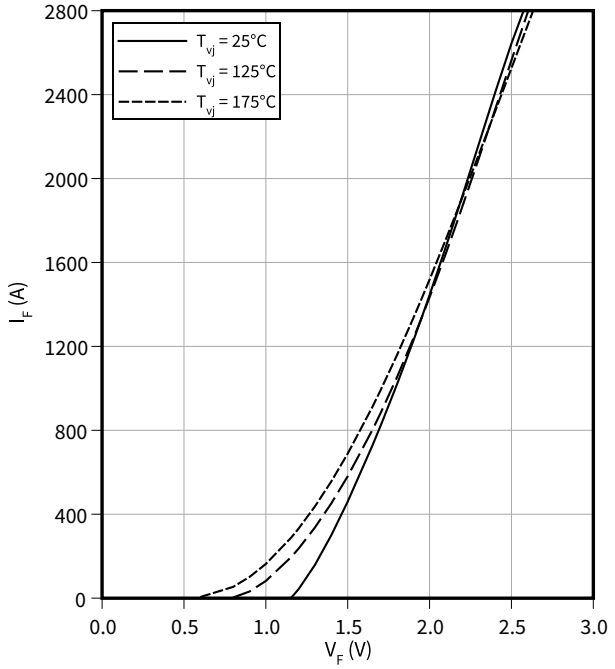
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

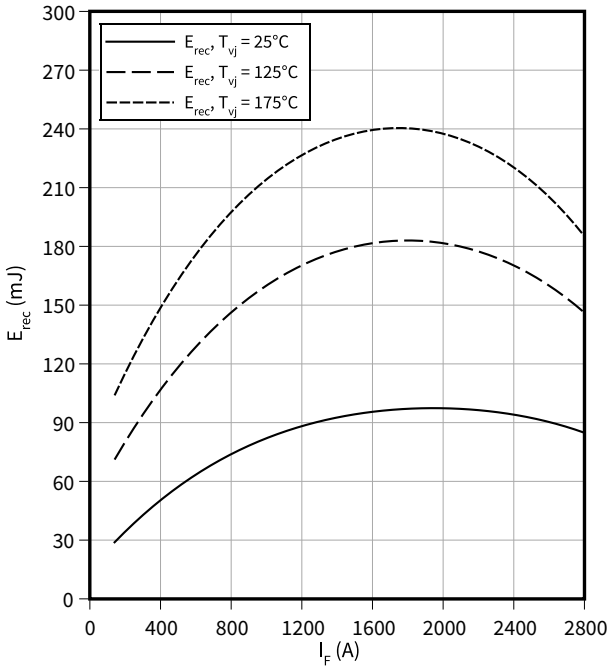
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

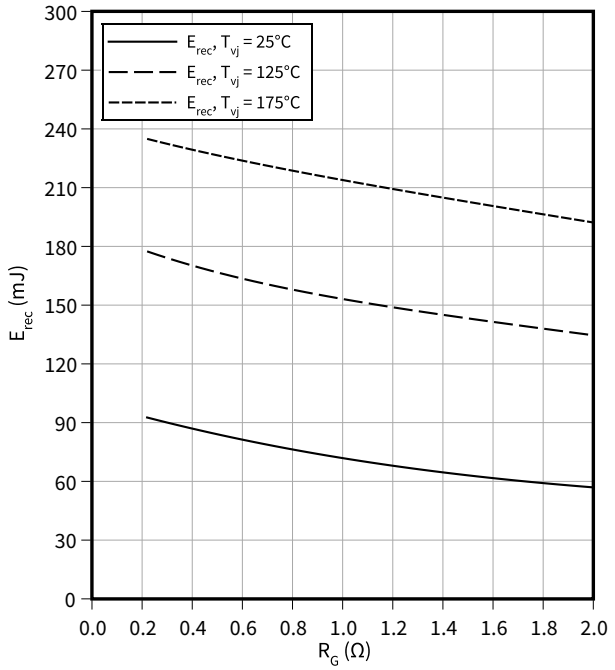
$R_{Gon} = R_{Gon}(IGBT)$, $V_{CC} = 900$ V



Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$

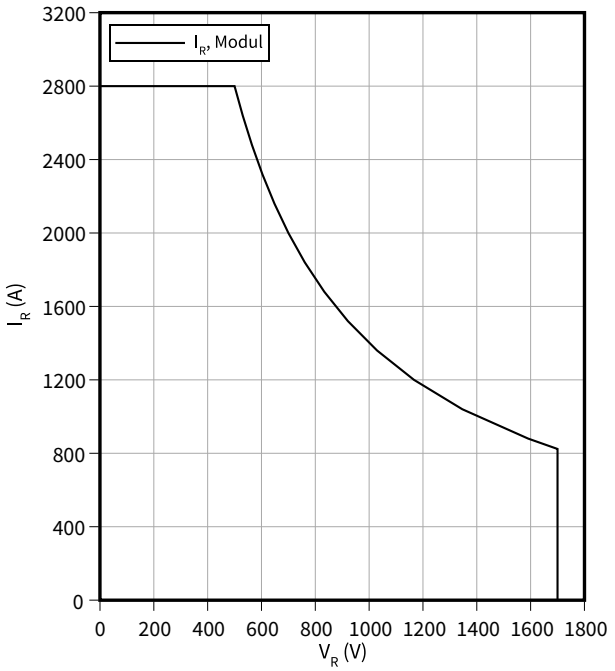
$I_F = 1400$ A, $V_{CC} = 900$ V



Safe operating area (SOA), Diode, Inverter

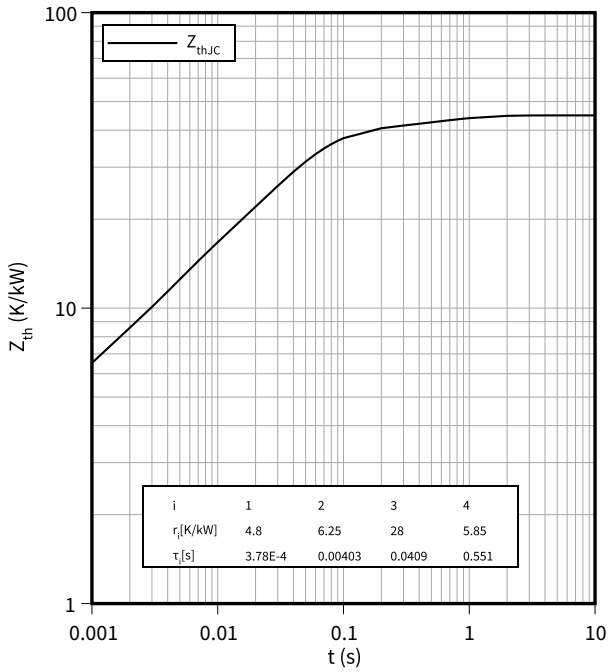
$I_R = f(V_R)$

$T_{vj} = 175$ °C

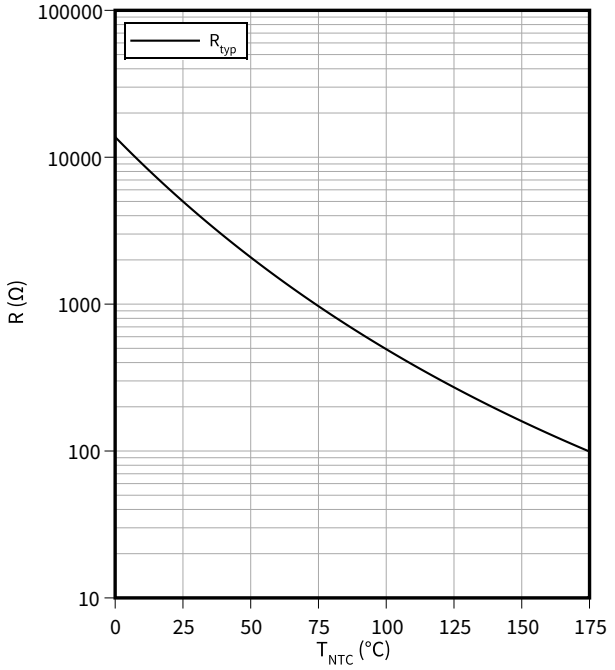


Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor
$R = f(T_{NTC})$



6 Circuit diagram

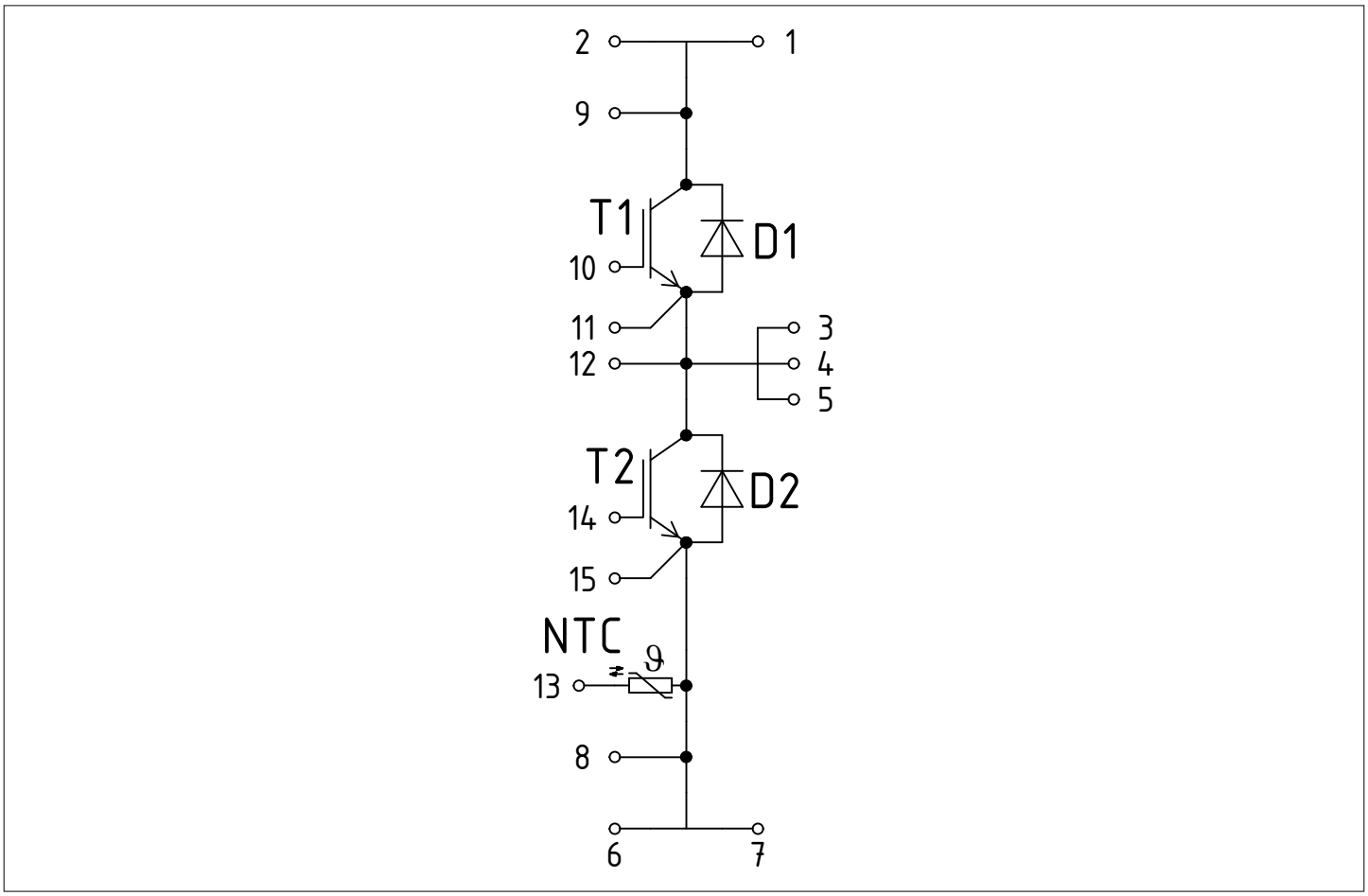


Figure 1

7 Package outlines

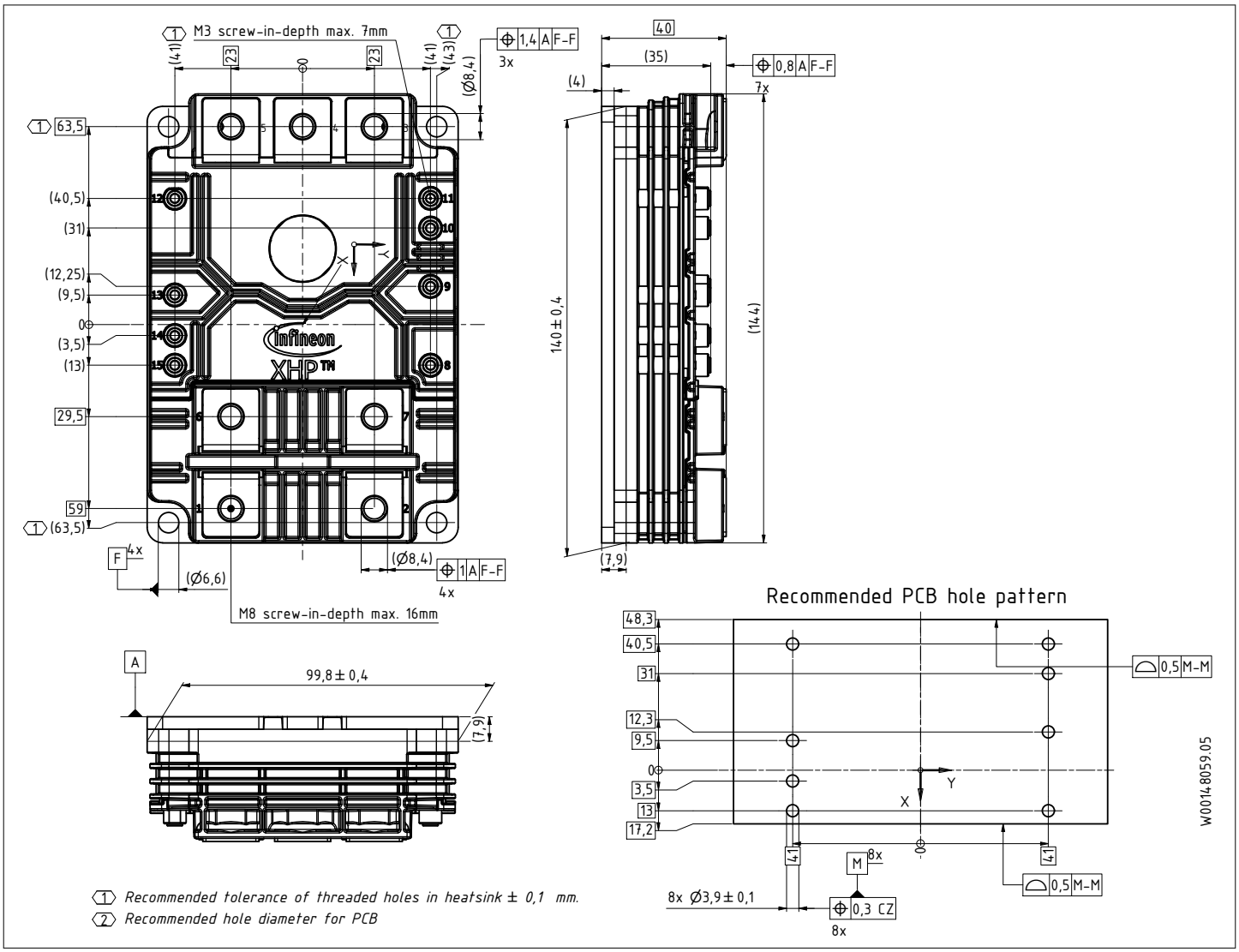


Figure 2

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*	*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	2025-04-25	Target datasheet
0.20	2026-01-21	Initial version
1.00	2026-03-20	Final datasheet

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