Final datasheet

EconoPACK™3 module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and NTC

Features

- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\ nom}$ = 75 A / I_{CRM} = 150 A
  - Low $V_{CE,sat}$
  - $T_{vj,op}$ = 150°C
  - TRENCHSTOP™ IGBT7
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - Integrated NTC temperature sensor
  - Standard housing
  - Solder contact technology
  - Isolated base plate

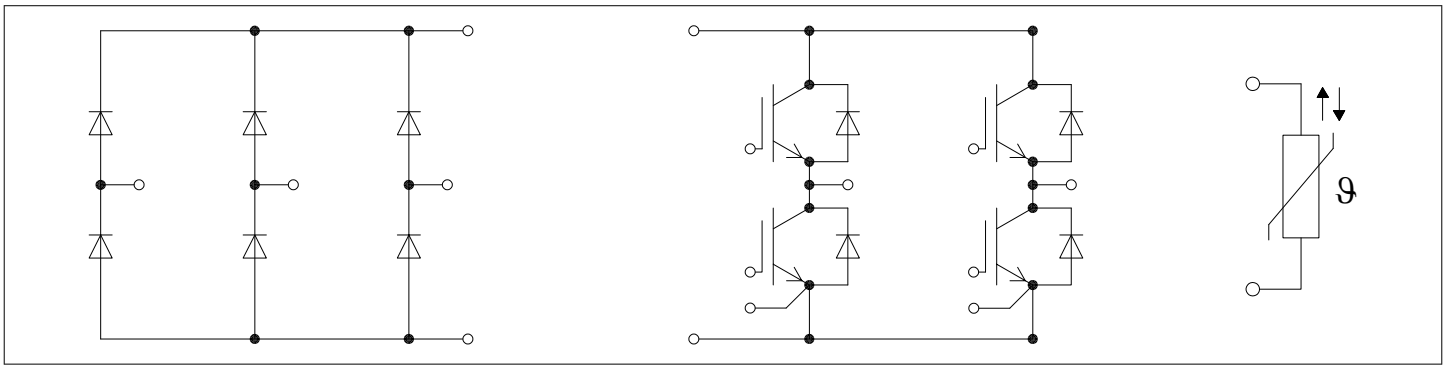
Potential applications

- High-power converters
- Medium-voltage converters

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	3.4	kV
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, f = 50 Hz, *t* = 1 min	3.4	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	$d_{Creep\ nom}$	terminal to baseplate, nom.	10.0	mm
Clearance	$d_{Clear\ nom}$	terminal to baseplate, nom.	7.5	mm
Comparative tracking index	*CTI*		> 225	
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}				33		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_C = 25 °C, per switch			2.1		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C = 25 °C, per switch			2.2		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for module mounting	*M*	- Mounting according to valid application note	M5, Screw	3		6	Nm
Weight	*G*				300		g

***Note**: The current under continuous operation is limited to 50 A rms per connector pin.*

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
Continuous DC collector current	I_{CDC}	$T_{vj\ max}$ = 175 °C	T_C = 90 °C	75	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$		150	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 = 75 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.70	1.85	V
			T_{vj} = 125 °C		1.95		
			T_{vj} = 150 °C		2.05		
			T_{vj} = 175 °C		2.10		
Gate threshold voltage	V_{GEth}	I_C = 1.54 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.2	5.8	6.4	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 900 V, T_{vj} = 25 °C			0.7		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			3		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			7.6		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.027		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			3	µA
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 = 75 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω	T_{vj} = 25 °C		0.109		µs
			T_{vj} = 125 °C		0.119		
			T_{vj} = 175 °C		0.124		
Rise time (inductive load)	t_r	I_C = 75 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω	T_{vj} = 25 °C		0.016		µs
			T_{vj} = 125 °C		0.021		
			T_{vj} = 175 °C		0.025		
Turn-off delay time (inductive load)	t_{doff}	I_C = 75 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 6.8 Ω	T_{vj} = 25 °C		0.344		µs
			T_{vj} = 125 °C		0.433		
			T_{vj} = 175 °C		0.472		
Fall time (inductive load)	t_f	I_C = 75 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 6.8 Ω	T_{vj} = 25 °C		0.274		µs
			T_{vj} = 125 °C		0.498		
			T_{vj} = 175 °C		0.640		
Turn-on energy loss per pulse	E_{on}	I_C = 75 A, V_{CC} = 900 V, L_σ = 23 nH, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω, di/dt = 2700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		8.4		mJ
			T_{vj} = 125 °C		13.5		
			T_{vj} = 175 °C		16.7		
Turn-off energy loss per pulse	E_{off}	I_C = 75 A, V_{CC} = 900 V, L_σ = 23 nH, V_{GE} = ±15 V, R_{Goff} = 6.8 Ω, dv/dt = 3500 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		11.9		mJ
			T_{vj} = 125 °C		19		
			T_{vj} = 175 °C		23.2		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
SC data	I_{SC}	$V_{GE} \le 15$ V, $V_{CC} = 1000$ V, $V_{CEmax}=V_{CES}-L_{sCE}*di/dt$	$t_P \le 8$ µs, $T_{vj} = 150$ °C		330		A
			$t_P \le 6$ µs, $T_{vj} = 175$ °C		320		
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.486	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 1$ W/(m·K)			0.0706		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

***Note**: $T_{vjop} > 150$ °C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.*

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			75	A
Repetitive peak forward current	I_{FRM}	$t_P = 1$ ms		150	A
I^2t - value	I^2t	$t_P = 10$ ms, $V_R = 0$ V	$T_{vj} = 125$ °C	600	A^2s
			$T_{vj} = 175$ °C	510	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 75$ A, $V_{GE} = 0$ V	$T_{vj} = 25$ °C		2.35	2.50	V
			$T_{vj} = 125$ °C		2.25		
			$T_{vj} = 150$ °C		2.20		
			$T_{vj} = 175$ °C		2.10		
Peak reverse recovery current	I_{RM}	$V_{CC} = 900$ V, $I_F = 75$ A, $V_{GE} = -15$ V, $-di_F/dt = 2700$ A/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		119		A
			$T_{vj} = 125$ °C		111		
			$T_{vj} = 175$ °C		110		

(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 = 75 A, V_{GE} = -15 V, -di$_F$/dt = 2700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		9.3		µC
			T_{vj} = 125 °C		18.2		
			T_{vj} = 175 °C		24		
Reverse recovery energy	E_{rec}	V_{CC} = 900 V, I_F = 75 A, V_{GE} = -15 V, -di$_F$/dt = 2700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		4.6		mJ
			T_{vj} = 125 °C		10.1		
			T_{vj} = 175 °C		13.7		
Thermal resistance, junction to case	R_{thJC}	per diode				0.732	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, λ_{grease} = 1 W/(m·K)			0.0880		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

***Note**: T_{vjop} > 150 °C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.*

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	2200	V
Maximum RMS forward current per chip	I_{FRMSM}	T_C = 110 °C		135	A
Maximum RMS current at rectifier output	I_{RMSM}	T_C = 110 °C		150	A
Surge forward current	I_{FSM}	t_p = 10 ms	T_{vj} = 25 °C	1580	A
			T_{vj} = 150 °C	1290	
I^2t - value	I^2t	t_p = 10 ms	T_{vj} = 25 °C	7990	A^2s
			T_{vj} = 150 °C	5300	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 168 A	T_{vj} = 25 °C		1.15	1.25	V
			T_{vj} = 125 °C		1.10		
			T_{vj} = 150 °C		1.10		
Reverse current	I_r	T_{vj} = 150 °C, V_R = 2200 V			2		mA
Thermal resistance, junction to case	R_{thJC}	per diode				0.368	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, λ_{grease} = 1 W/(m·K)			0.0680		K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

***Note**: According to standard IEC 60749-23, rev. 1.1, 2011-03, HTRB is performed at 125°C*

5 NTC-Thermistor

Table 9 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

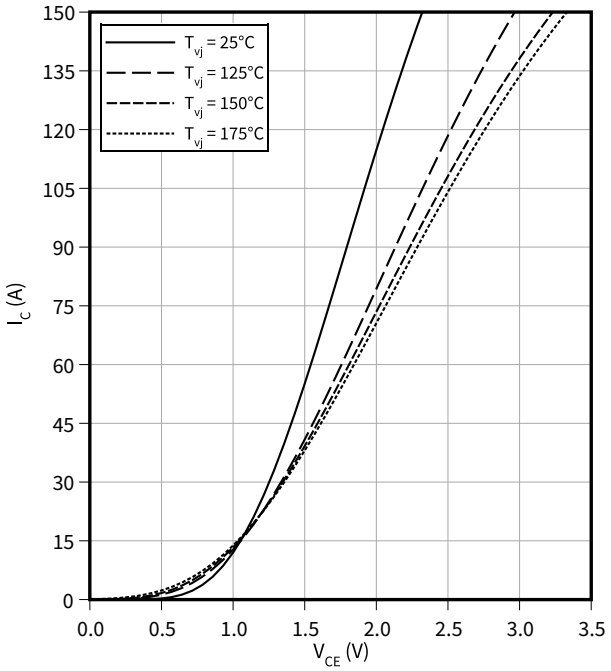
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.*

6 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

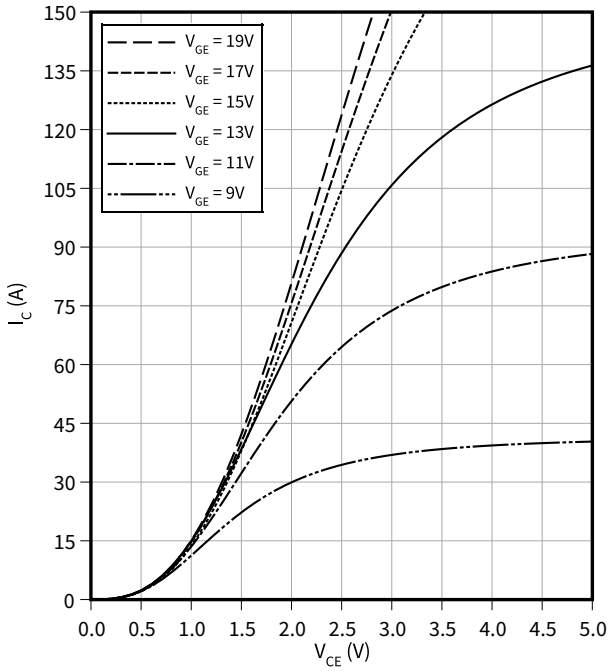
$V_{GE} = 15$ V



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

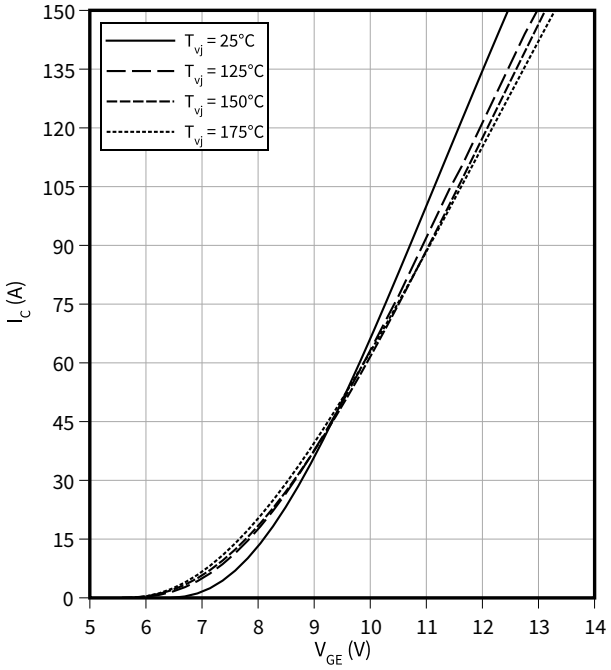
$T_{vj} = 175$ °C



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

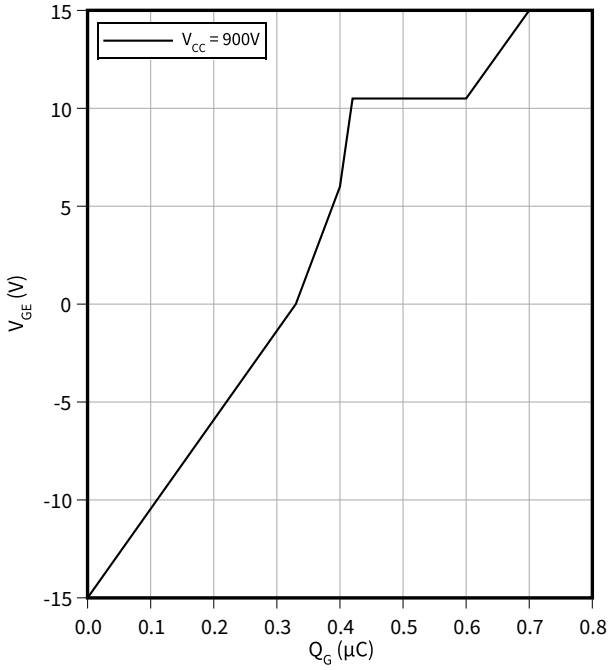
$V_{CE} = 20$ V



Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$

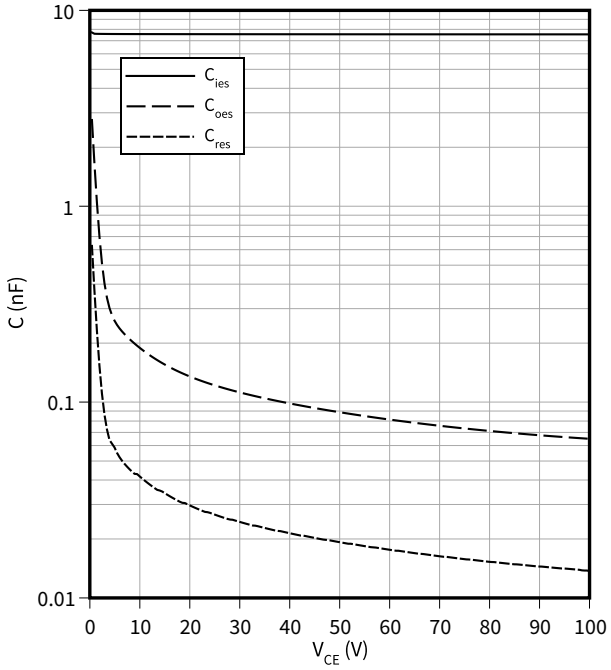
$I_C = 75$ A, $T_{vj} = 25$ °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

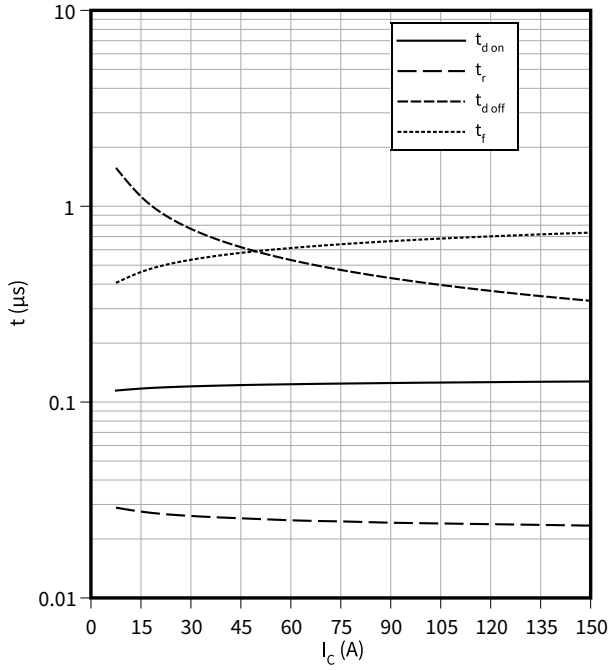
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

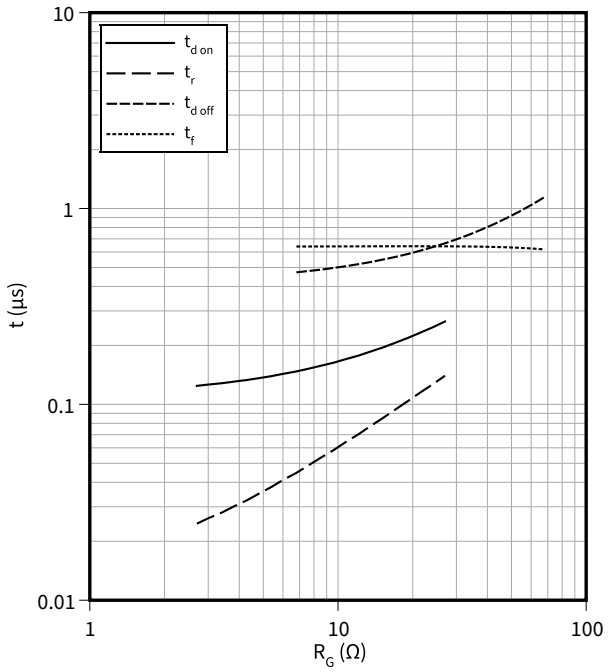
$R_{Goff} = 6.8\ \Omega$, $R_{Gon} = 2.7\ \Omega$, $V_{GE} = \pm 15\ V$, $V_{CC} = 900\ V$, $T_{vj} = 175\ °C$



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

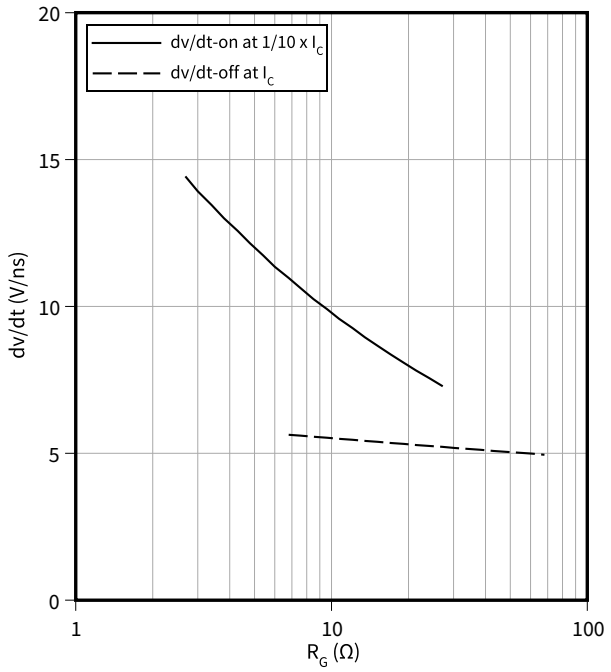
$V_{GE} = \pm 15\ V$, $I_C = 75\ A$, $V_{CC} = 900\ V$, $T_{vj} = 175\ °C$



Voltage slope (typical), Inverter

$dv/dt = f(R_G)$

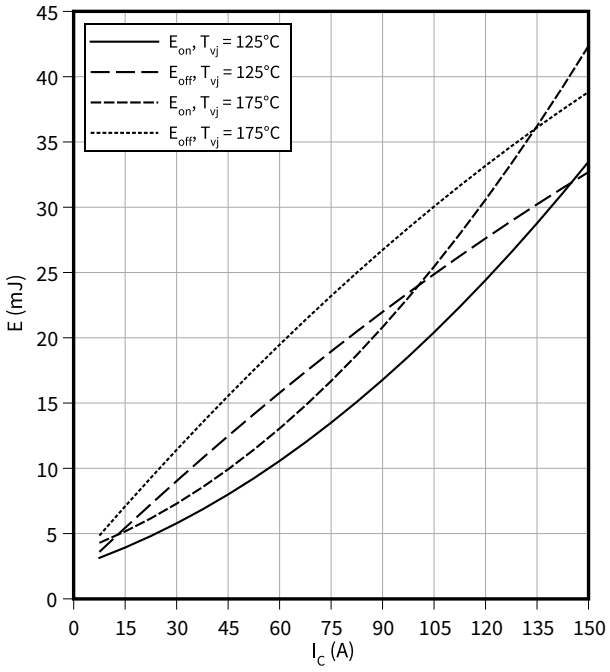
$V_{GE} = \pm 15\ V$, $I_C = 75\ A$, $V_{CC} = 900\ V$, $T_{vj} = 25\ °C$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

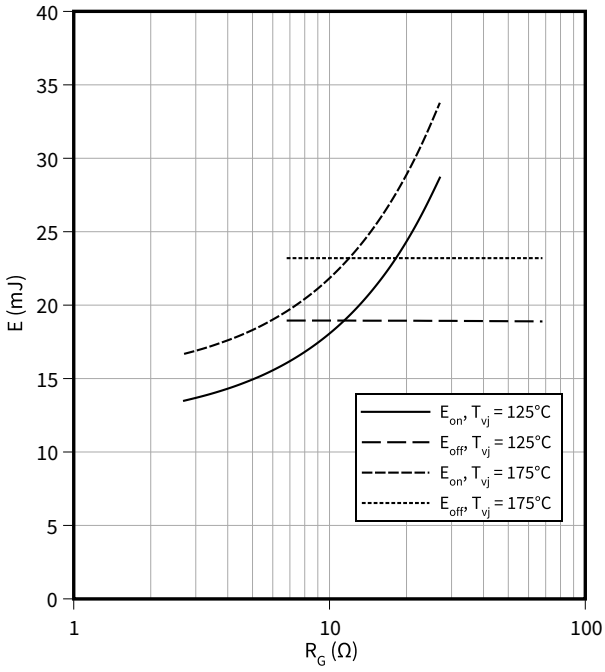
$R_{Goff} = 6.8\ \Omega$, $R_{Gon} = 2.7\ \Omega$, $V_{GE} = \pm 15$ V, $V_{CC} = 900$ V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

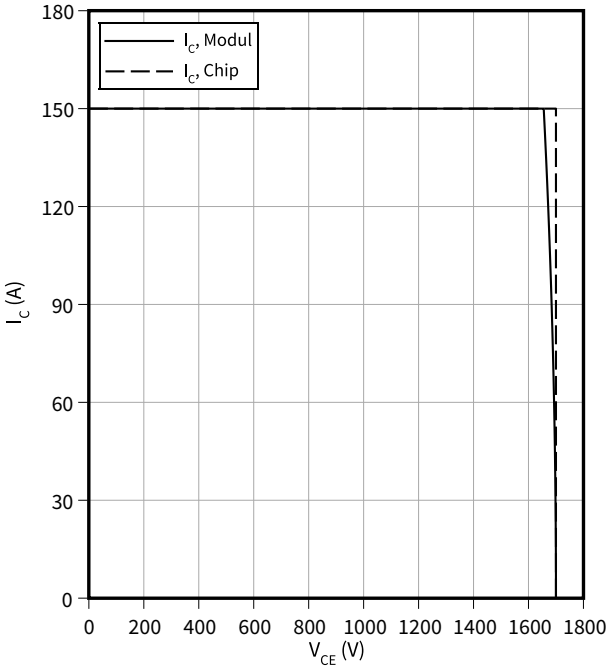
$V_{GE} = \pm 15$ V, $I_C = 75$ A, $V_{CC} = 900$ V



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

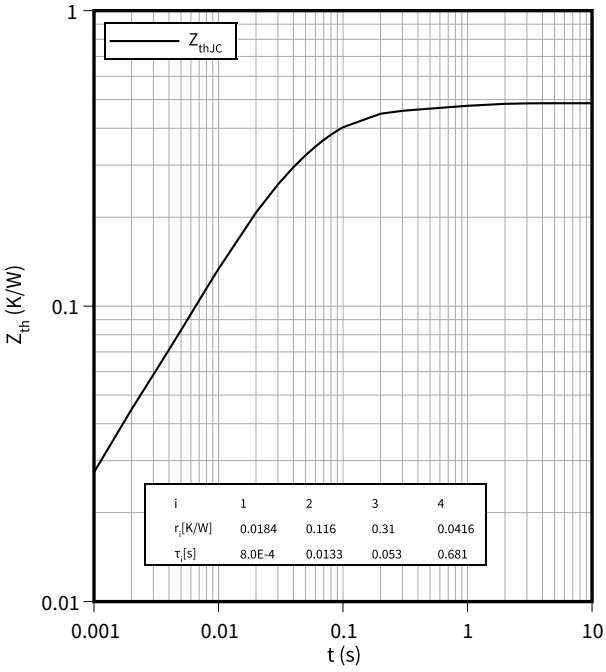
$I_C = f(V_{CE})$

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



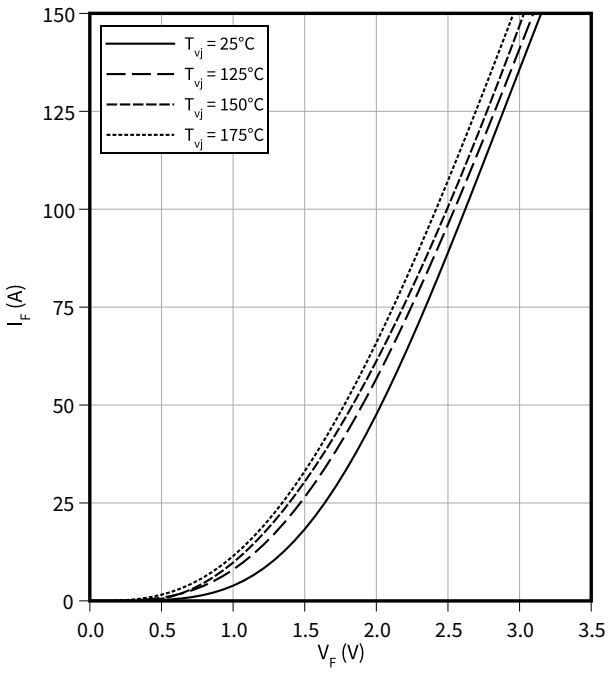
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

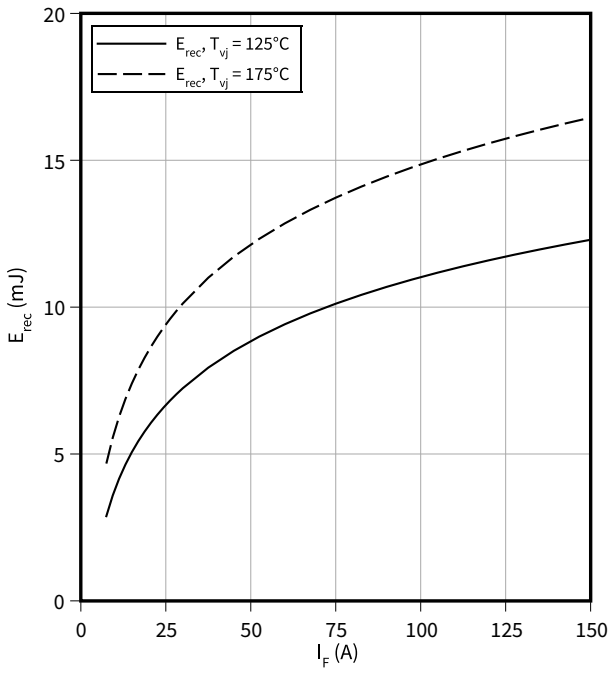
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

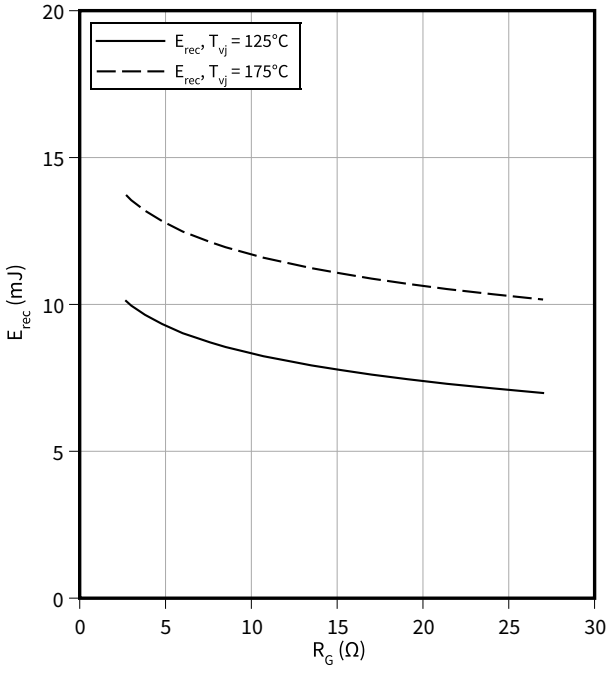
$R_{Gon} = 2.7\ \Omega$, $V_{CC} = 900\ V$



Switching losses (typical), Diode, Inverter

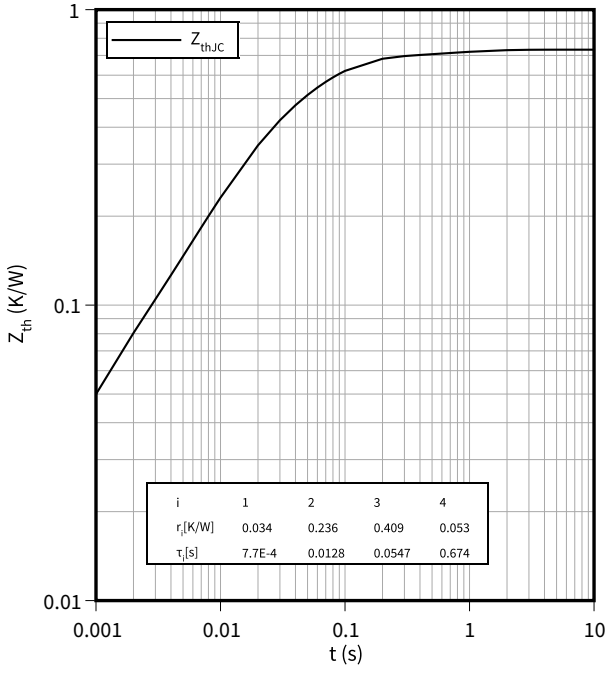
$E_{rec} = f(R_G)$

$I_F = 75\ A$, $V_{CC} = 900\ V$



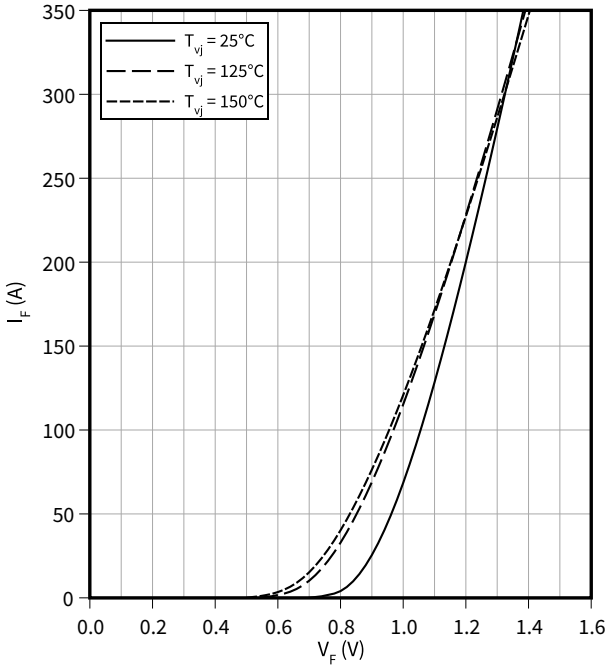
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



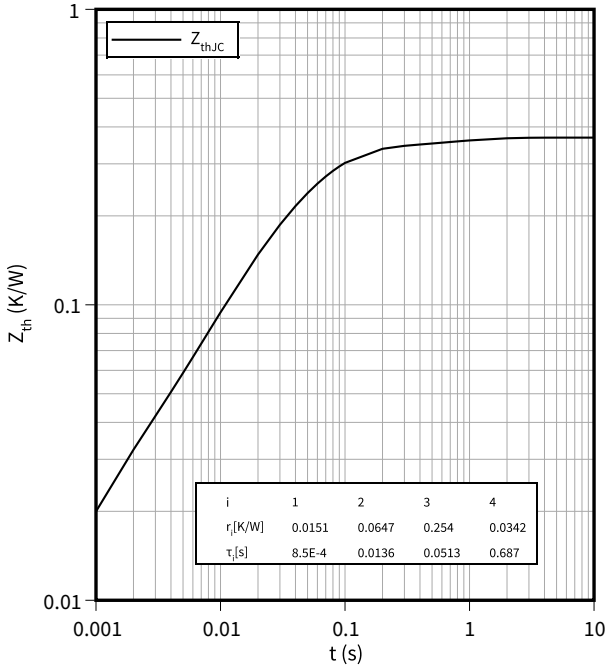
Forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$



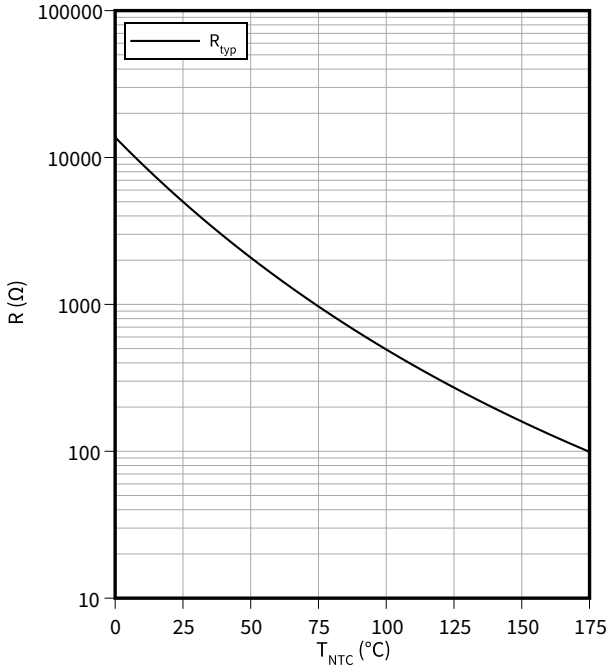
Transient thermal impedance, Diode, Rectifier

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 Circuit diagram

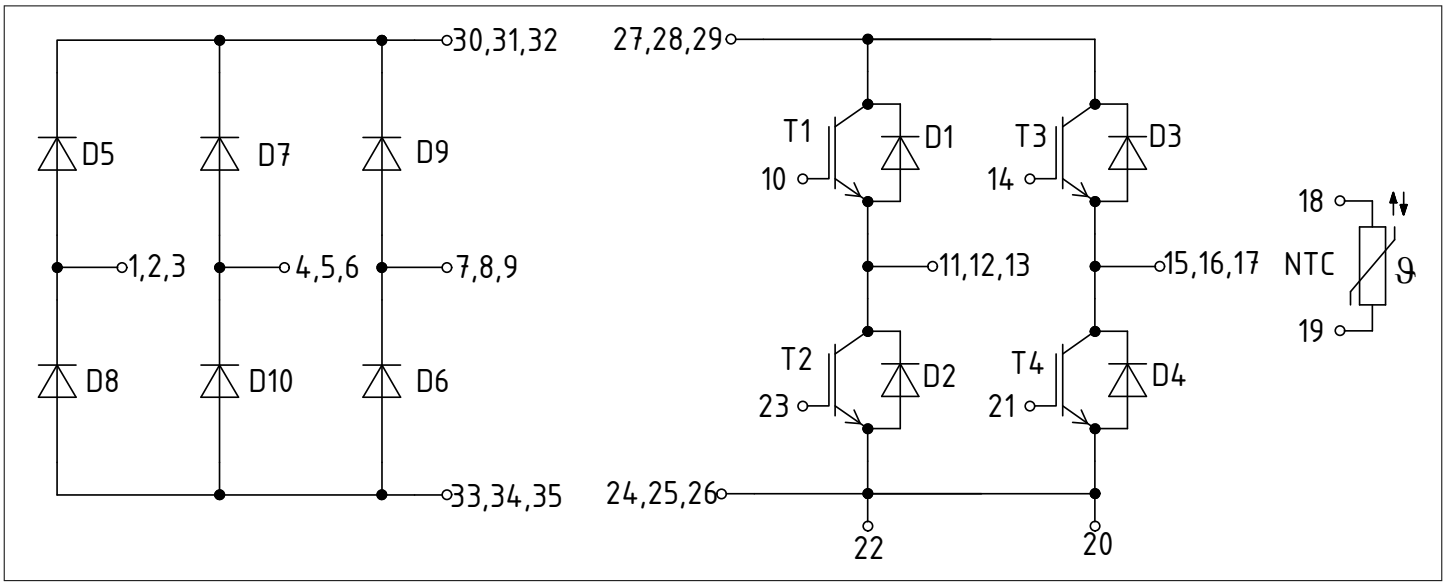


Figure 1

8 Package outlines

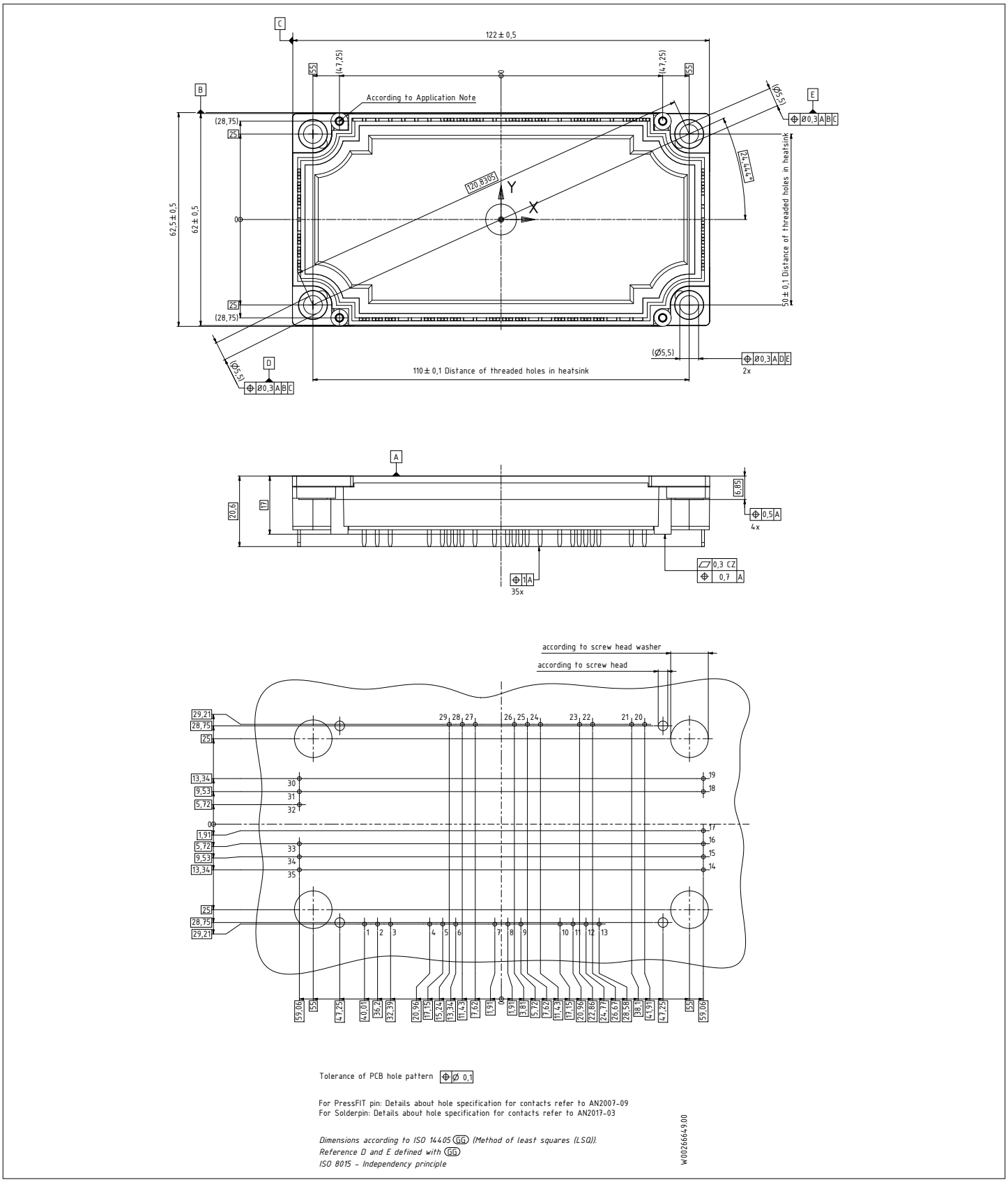


Figure 2

9 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	7154914284655054991530		7154914284655054991530

Figure 3

Revision history

Document revision	Date of release	Description of changes
1.00	2024-12-16	Final datasheet

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