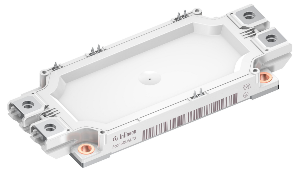
Final datasheet

EconoDUAL™3 module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and PressFIT / NTC

Features



- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\ nom}$ = 900 A / I_{CRM} = 1800 A
  - Integrated temperature sensor
  - High current density
  - Low $V_{CE,sat}$
  - Overload operation up to 175°C
  - TRENCHSTOPTM IGBT7
  - $V_{CE,sat}$ with positive temperature coefficient
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - High power density
  - Isolated base plate
  - PressFIT contact technology
  - Standard housing
  - Direct-cooled base plate

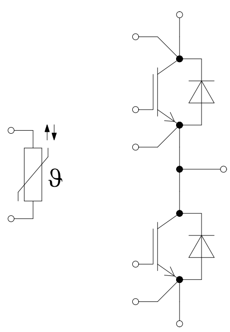
Potential applications

- High-power converters
- Medium-voltage converters
- Motor drives
- Wind turbines

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., (PD2, IEC 60664-1, Ed. 3.0)	> 15	mm
Creepage distance	$d_{Creep\ min}$	terminal to baseplate, min., (PD2, IEC 60664-1, Ed. 3.0)	14.7	mm
Creepage distance	$d_{Creep\ nom}$	terminal to terminal, nom., (PD2, IEC 60664-1, Ed. 3.0)	12.1	mm
Creepage distance	$d_{Creep\ min}$	terminal to terminal, min., (PD2, IEC 60664-1, Ed. 3.0)	11.5	mm
Clearance	$d_{Clear\ nom}$	terminal to baseplate, nom.	> 12.5	mm
Clearance	$d_{Clear\ min}$	terminal to baseplate, min.	12.5	mm
Clearance	$d_{Clear\ nom}$	terminal to terminal, nom.	10.0	mm
Clearance	$d_{Clear\ min}$	terminal to terminal, min.	9.6	mm
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.	
Pressure drop in cooling circuit	Δp	$\Delta V/\Delta t$ = 10.0 dm³/min, 50% water / 50% ethylenglycol, T_F = 60 °C			65		mbar
Maximum pressure in cooling circuit	p					3	bar
Stray inductance module	L_{sCE}				20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_F = 25 °C, per switch			0.8		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
Terminal connection torque	M	- Mounting according to valid application note	M6, Screw	3		6	Nm

(table continues...)

Table 2 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Weight	G			345		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
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_F = 25 °C	800	A
Maximum RMS module DC-terminal current	I_{tRMS}		$T_{Terminal}$ = 90 °C, T_C = 90 °C	580	A
			$T_{Terminal}$ = 105 °C, T_C = 90 °C	565	
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		1800	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 900 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.67	1.85	V
			T_{vj} = 125 °C		1.95		
			T_{vj} = 150 °C		2.02		
			T_{vj} = 175 °C		2.08		
Gate threshold voltage	V_{GEth}	I_C = 18.8 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			8.59		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.28		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			93.8		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.33		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			35	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA

(table continues...)

Table 4 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values Min.	Typ.	Max.	Unit
Turn-on delay time (inductive load)	t_{don}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.33 Ω	T_{vj} = 25 °C		0.174		µs
			T_{vj} = 125 °C		0.195		
			T_{vj} = 150 °C		0.202		
			T_{vj} = 175 °C		0.207		
Rise time (inductive load)	t_r	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.33 Ω	T_{vj} = 25 °C		0.054		µs
			T_{vj} = 125 °C		0.060		
			T_{vj} = 150 °C		0.061		
			T_{vj} = 175 °C		0.065		
Turn-off delay time (inductive load)	t_{doff}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 3 Ω	T_{vj} = 25 °C		0.738		µs
			T_{vj} = 125 °C		0.828		
			T_{vj} = 150 °C		0.850		
			T_{vj} = 175 °C		0.865		
Fall time (inductive load)	t_f	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_{Goff} = 3 Ω	T_{vj} = 25 °C		0.202		µs
			T_{vj} = 125 °C		0.432		
			T_{vj} = 150 °C		0.504		
			T_{vj} = 175 °C		0.573		
Turn-on energy loss per pulse	E_{on}	I_C = 900 A, V_{CC} = 900 V, L_σ = 25 nH, V_{GE} = ±15 V, R_{Gon} = 0.33 Ω, di/dt = 12300 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		54.6		mJ
			T_{vj} = 125 °C		138		
			T_{vj} = 150 °C		172		
			T_{vj} = 175 °C		205		
Turn-off energy loss per pulse	E_{off}	I_C = 900 A, V_{CC} = 900 V, L_σ = 25 nH, V_{GE} = ±15 V, R_{Goff} = 3 Ω, dv/dt = 3800 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		163		mJ
			T_{vj} = 125 °C		245		
			T_{vj} = 150 °C		271		
			T_{vj} = 175 °C		297		
SC data	I_{SC}	V_{GE} = 15 V, V_{CC} = 1000 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 8 µs, T_{vj}=150 °C		2950		A
			t_P ≤ 6 µs, T_{vj}=175 °C		2850		
Thermal resistance, junction to cooling fluid	R_{thJF}	per IGBT, $\Delta V/\Delta t$ = 10.0 dm³/min, 50% water / 50% ethylenglycol, T_F = 60 °C			0.0867		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			900	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1800	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	40200	A^2s
			T_{vj} = 175 °C	27000	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 900 A, V_{GE} = 0 V	T_{vj} = 25 °C		2.34	2.50	V
			T_{vj} = 125 °C		2.24		
			T_{vj} = 150 °C		2.18		
			T_{vj} = 175 °C		2.11		
Peak reverse recovery current	I_{RM}	V_{CC} = 900 V, I_F = 900 A, V_{GE} = -15 V, -di_F/dt = 12900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		992		A
			T_{vj} = 125 °C		1130		
			T_{vj} = 150 °C		1140		
			T_{vj} = 175 °C		1170		
Recovered charge	Q_r	V_{CC} = 900 V, I_F = 900 A, V_{GE} = -15 V, -di_F/dt = 12900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		119		µC
			T_{vj} = 125 °C		210		
			T_{vj} = 150 °C		240		
			T_{vj} = 175 °C		272		
Reverse recovery energy	E_{rec}	V_{CC} = 900 V, I_F = 900 A, V_{GE} = -15 V, -di_F/dt = 12900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		86		mJ
			T_{vj} = 125 °C		141		
			T_{vj} = 150 °C		159		
			T_{vj} = 175 °C		176		
Thermal resistance, junction to cooling fluid	R_{thJF}	per diode, ΔV/Δt = 10.0 dm^3/min, cooling fluid = 50% water / 50% ethylenglycol, T_F = 60 °C			0.135		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 NTC-Thermistor

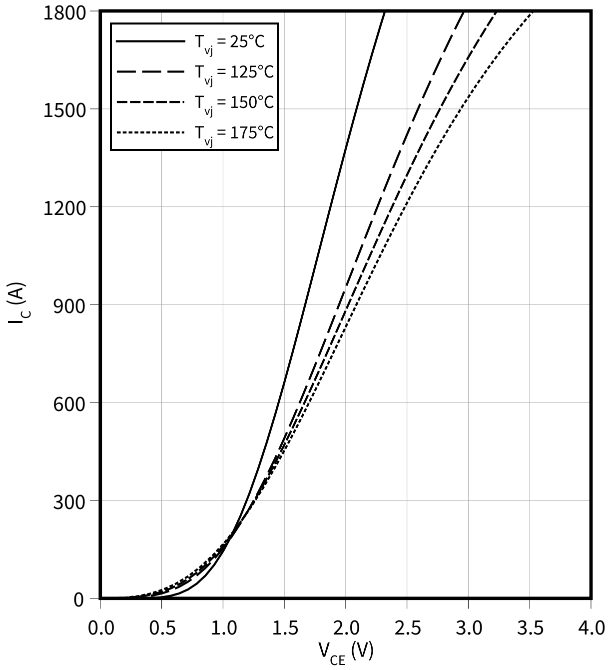
Table 7 Characteristic values

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

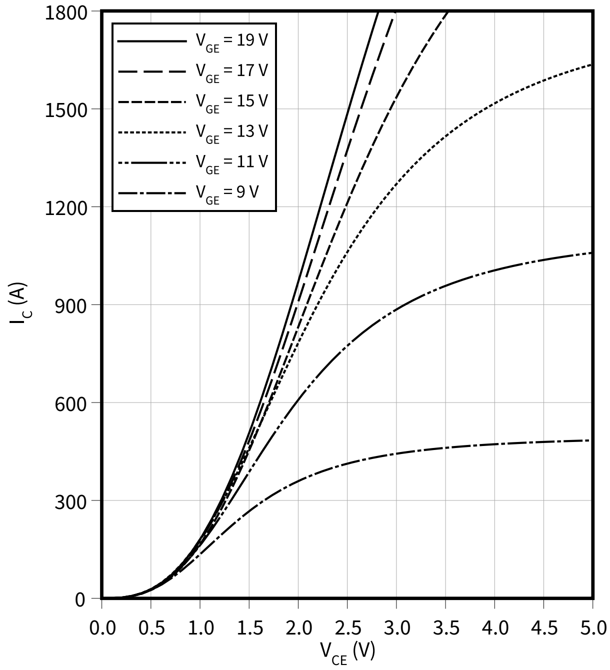
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.*

5 Characteristics diagrams

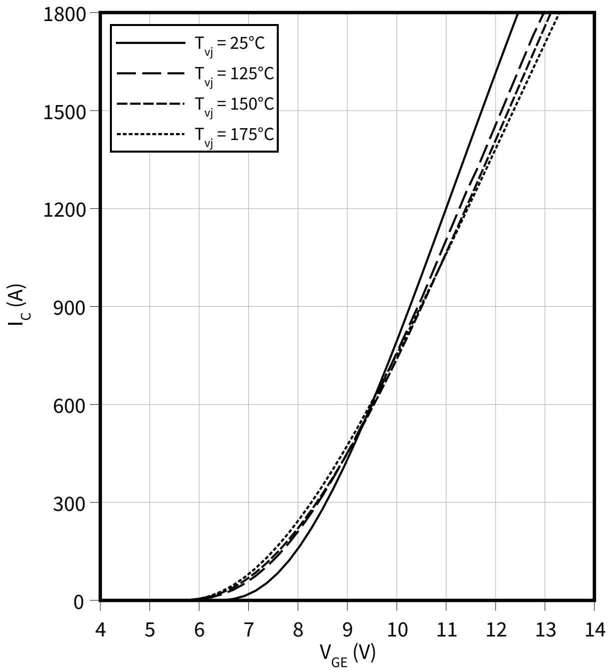
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



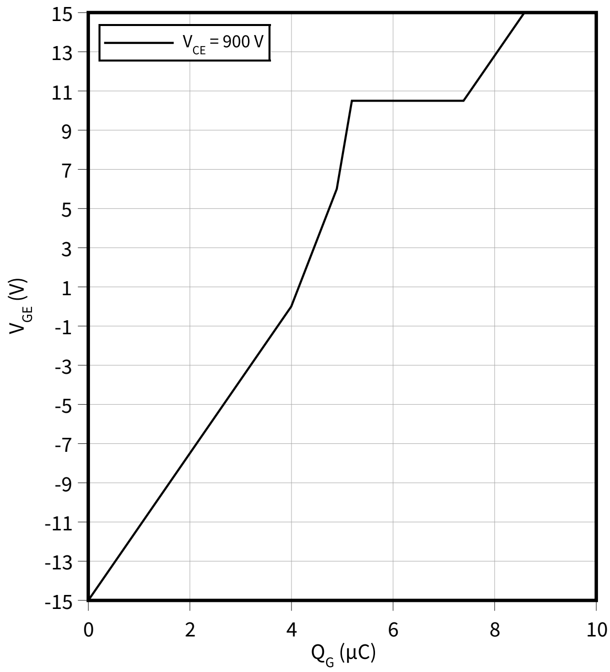
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 175\ °C$



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



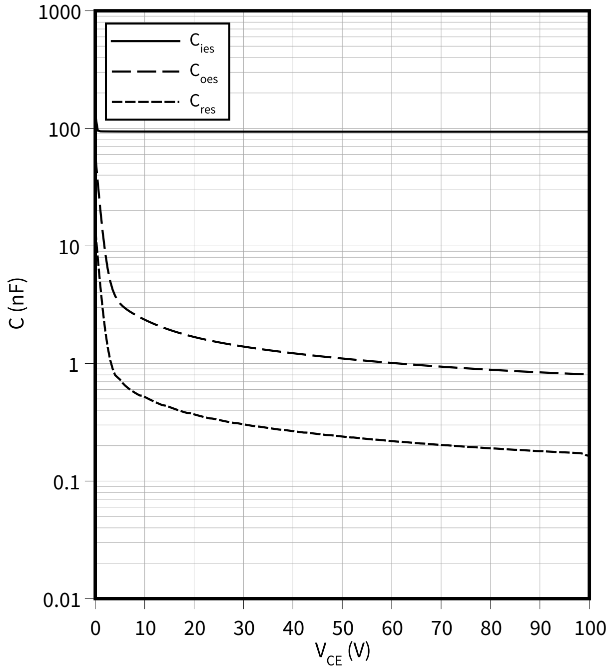
Gate charge characteristic (typical), IGBT, Inverter
$V_{GE} = f(Q_G)$
$I_C = 900\ A,\ T_{vj} = 25\ °C$



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

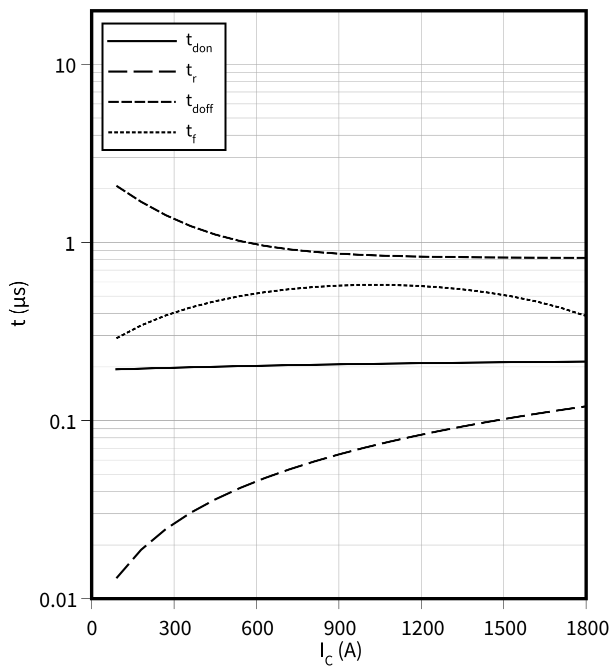
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

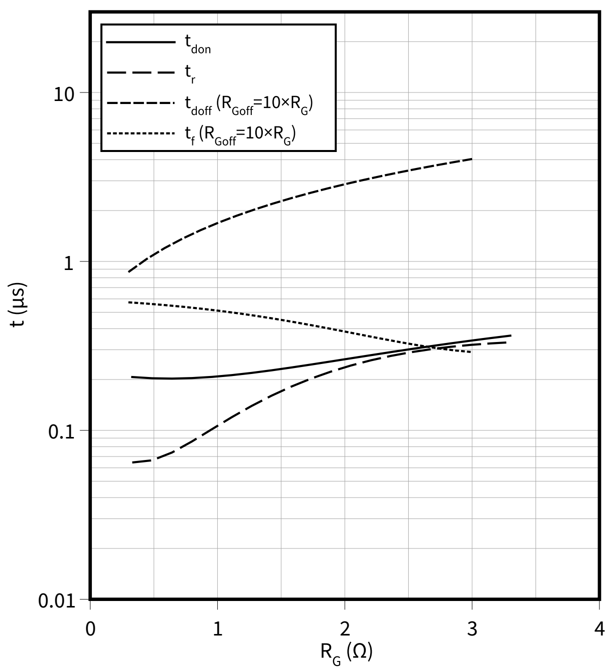
$R_{Goff} = 3\ \Omega$, $R_{Gon} = 0.33\ \Omega$, $V_{CC} = 900$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

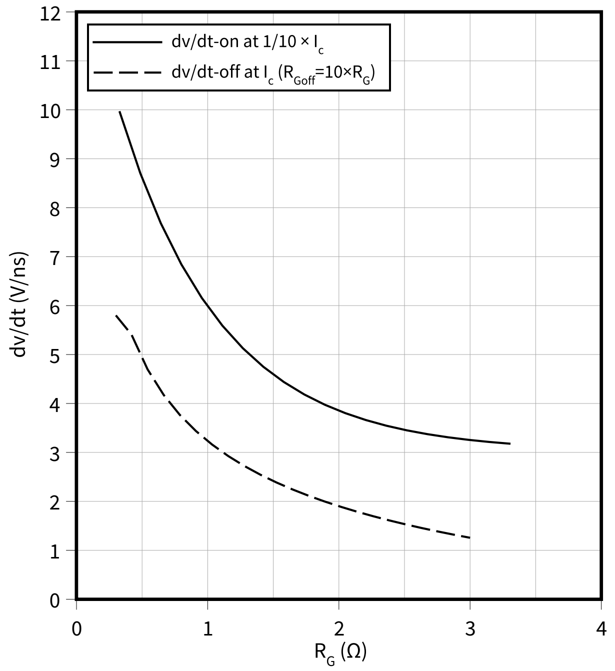
$I_C = 900$ A, $V_{CC} = 900$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Voltage slope (typical), IGBT, Inverter

$dv/dt = f(R_G)$

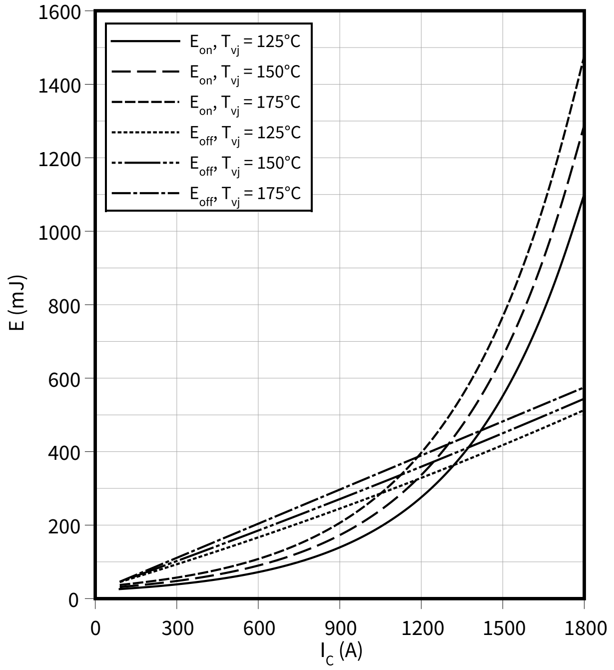
$I_C = 900$ A, $V_{CC} = 900$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 25$ °C



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

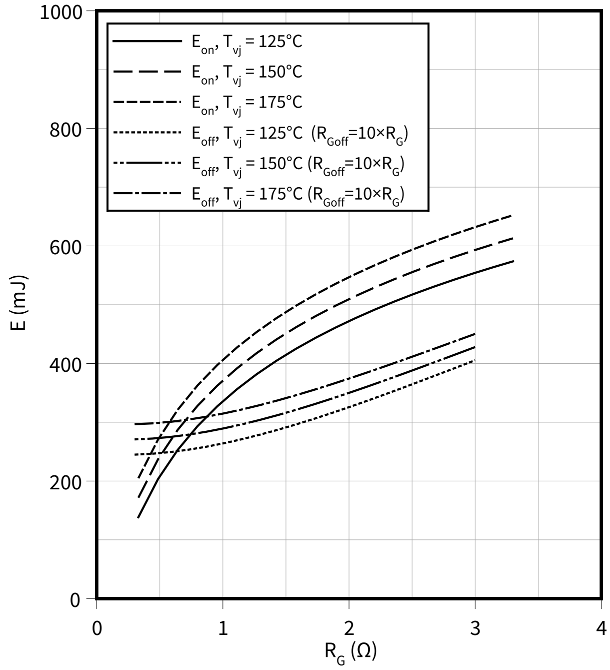
$R_{Goff} = 3\ \Omega$, $R_{Gon} = 0.33\ \Omega$, $V_{CC} = 900$ V, $V_{GE} = \pm 15$ V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

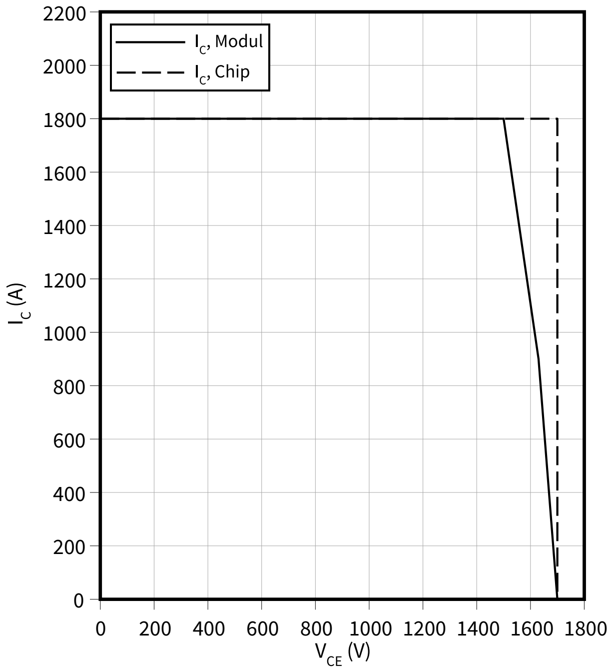
$I_C = 900$ A, $V_{CC} = 900$ V, $V_{GE} = \pm 15$ V



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

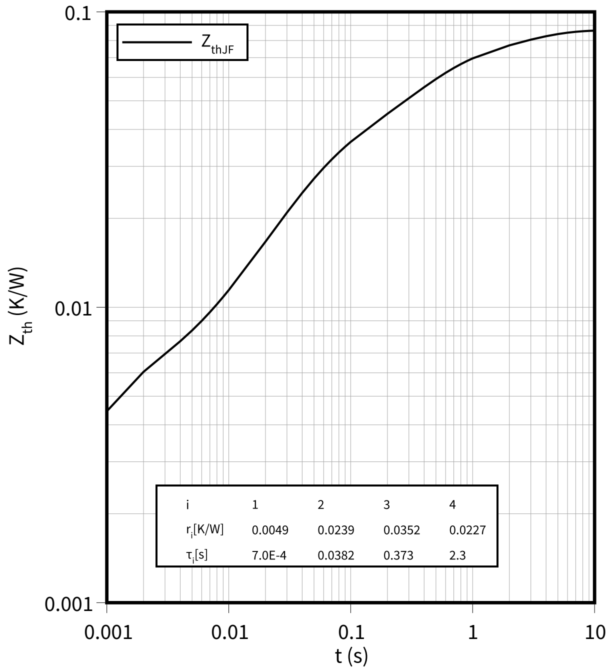
$I_C = f(V_{CE})$

$R_{Goff} = 3\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Transient thermal impedance, IGBT, Inverter

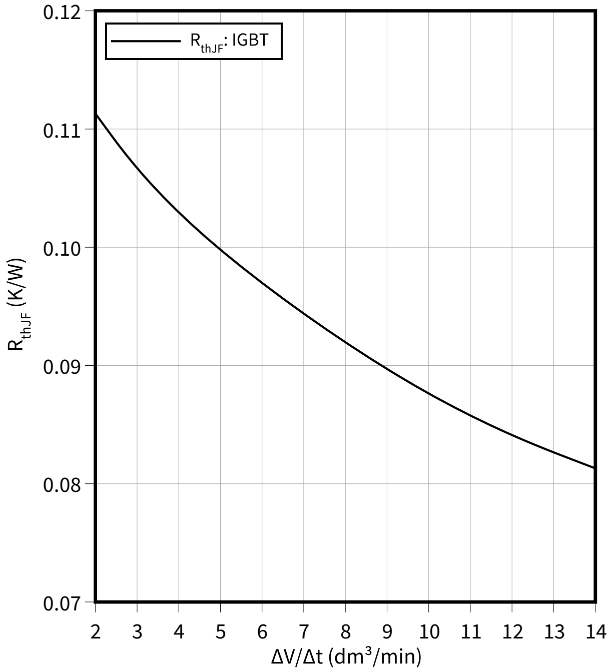
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.0049	0.0239	0.0352	0.0227
τ_i[s]	7.0E-4	0.0382	0.373	2.3

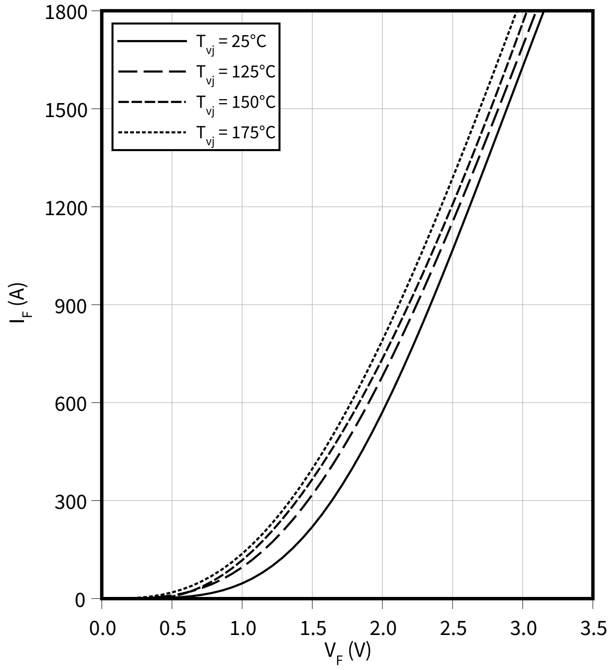
Thermal impedance, IGBT, Inverter

$R_{thJF} = f(\Delta V/\Delta t)$



Forward characteristic (typical), Diode, Inverter

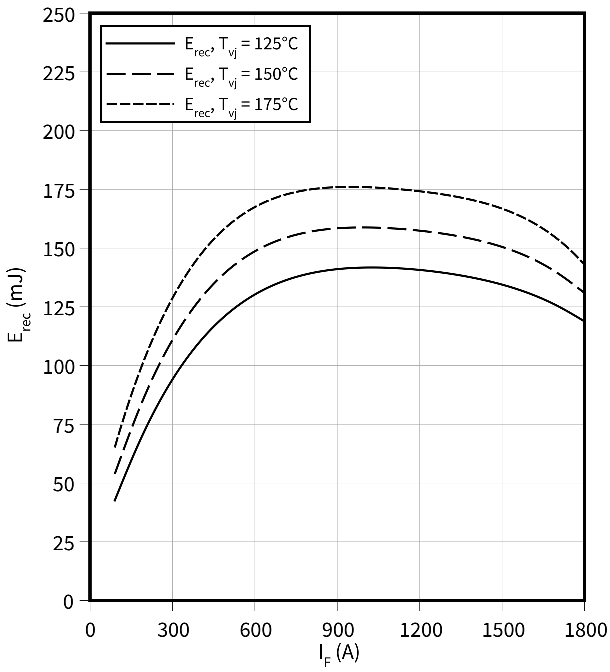
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

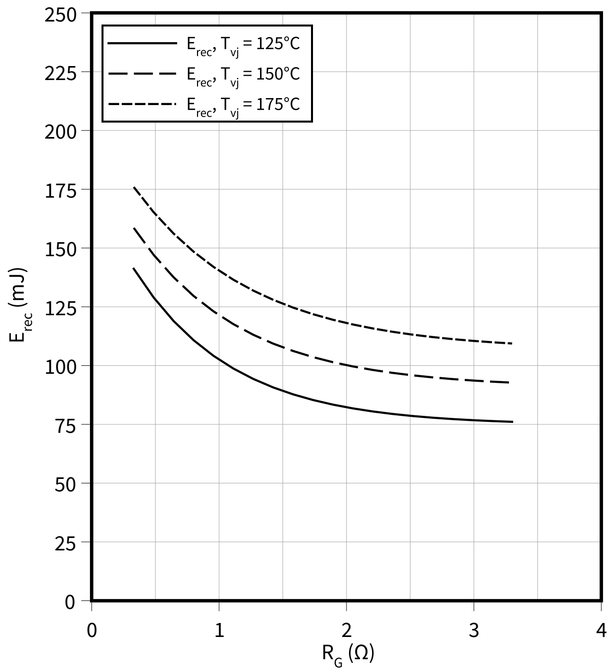
$R_{Gon} = 0.33\ \Omega$, $V_{CC} = 900$ V



Switching losses (typical), Diode, Inverter

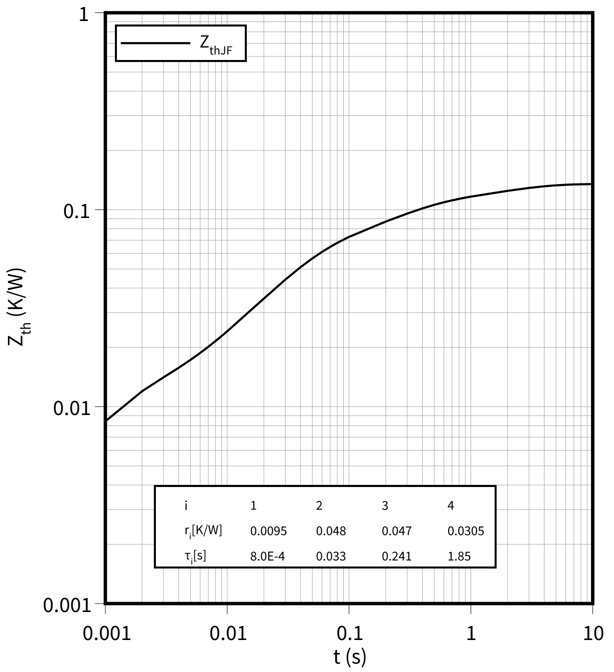
$E_{rec} = f(R_G)$

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



Transient thermal impedance, Diode, Inverter

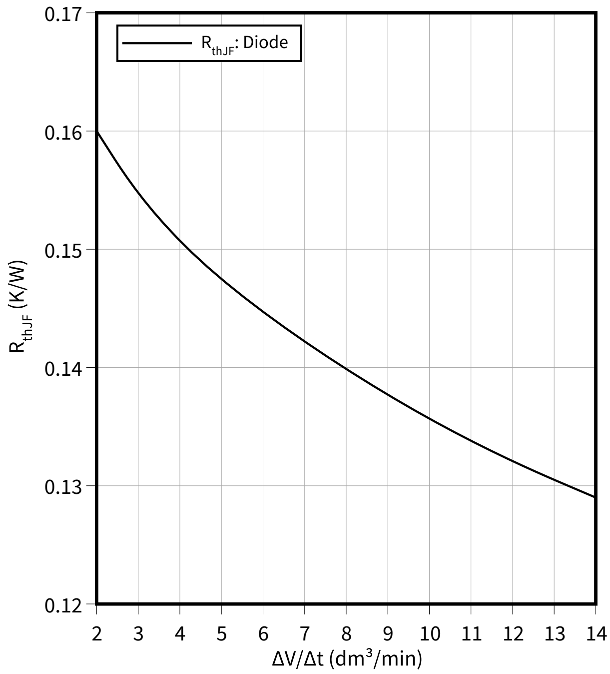
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.0095	0.048	0.047	0.0305
τ_i[s]	8.0E-4	0.033	0.241	1.85

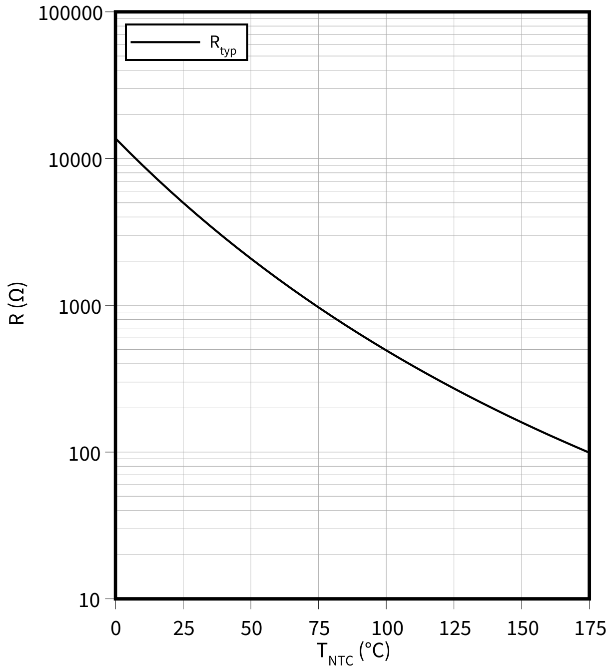
Thermal impedance, Diode, Inverter

$R_{thJF} = f(\Delta V/\Delta t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

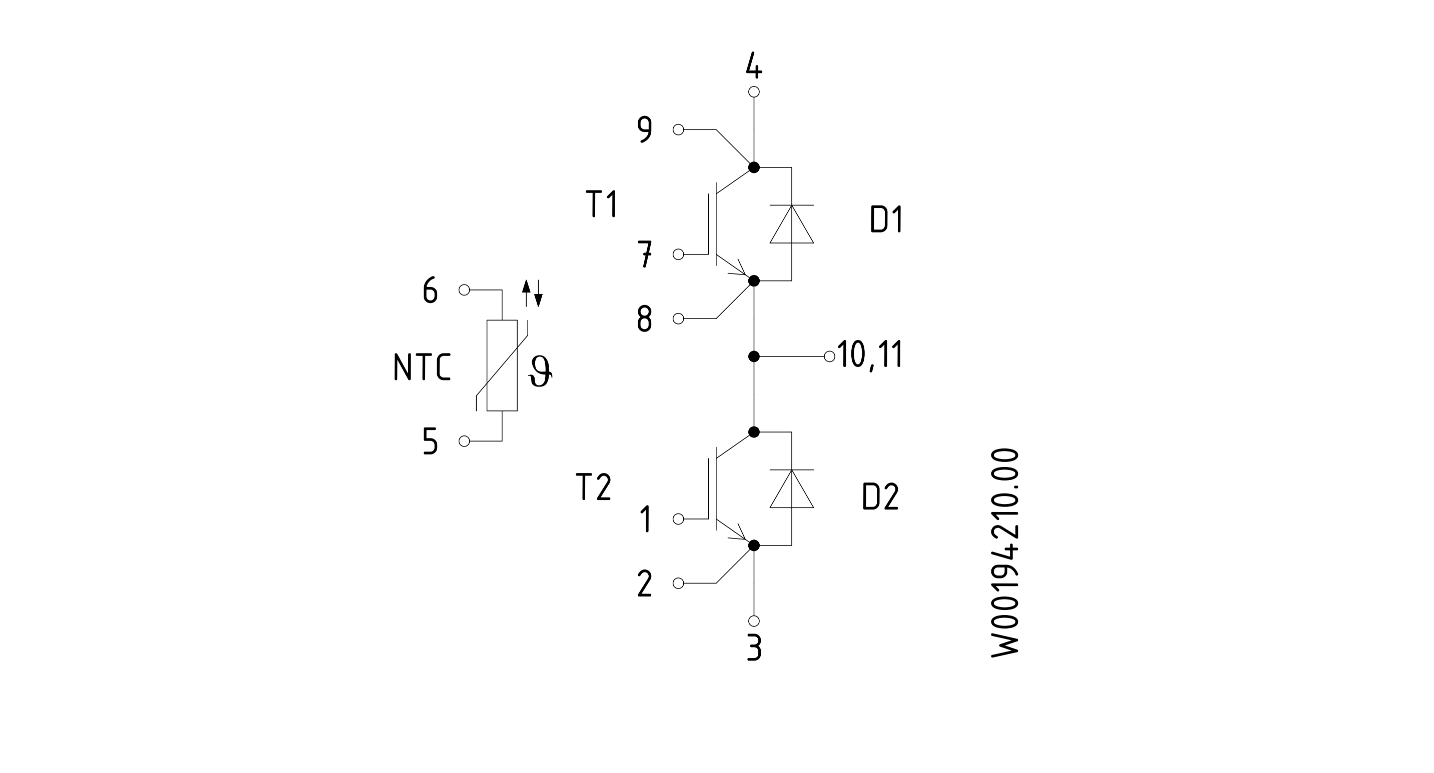
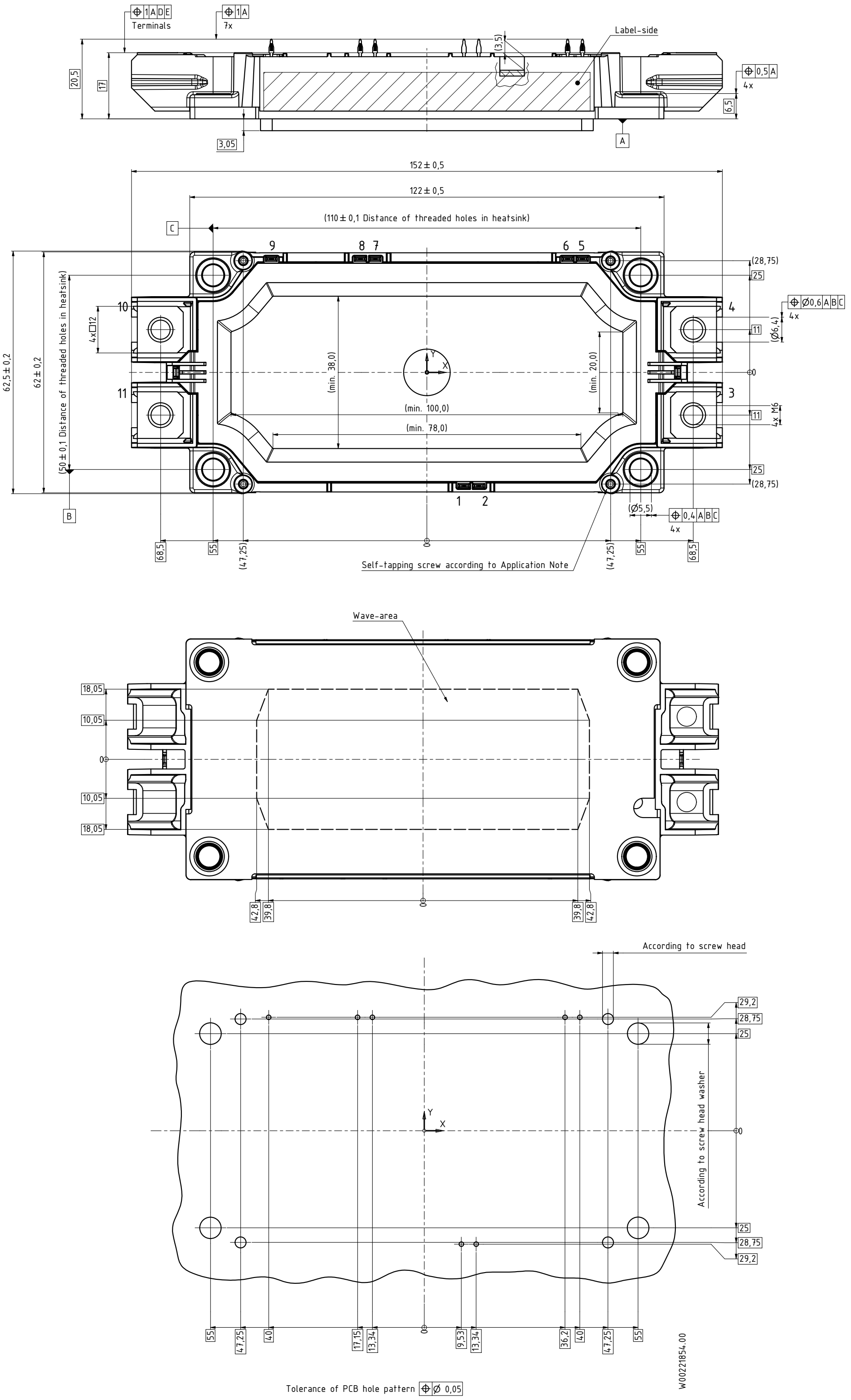


Figure 1

7 Package outlines



Tolerance of PCB hole pattern ⌖ Ø 0,05

For PressFIT pin and solder pin: Details about hole specification for contacts refer to AN2006-05

Dimensions according to ISO 14405 (GG) (Method of least squares (LSQ)).
Reference D and E defined with (GG)
ISO 8015 – Independency principle

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
1.00	2023-11-21	Initial version
1.10	2024-03-11	Final datasheet

Trademarks

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