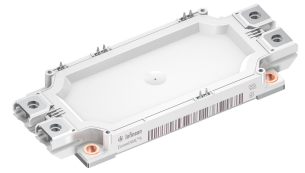


EconoDUAL™3 module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode and NTC

Features

- Electrical features
 - $V_{CES} = 1700\text{ V}$
 - $I_{C\text{ nom}} = 750\text{ A} / I_{CRM} = 1500\text{ A}$
 - Integrated temperature sensor
 - High current density
 - Low $V_{CE,sat}$
 - Overload operation up to 175°C
 - TRENCHSTOP™ IGBT7
 - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
 - High power density
 - Isolated base plate
 - PressFIT contact technology
 - Standard housing



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

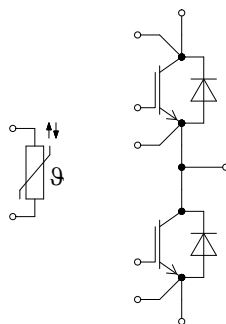


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	3.4	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	15.0	mm
Creepage distance	d_{Creep}	terminal to terminal	13.0	mm
Clearance	d_{Clear}	terminal to heatsink	12.5	mm
Clearance	d_{Clear}	terminal to terminal	10.0	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.	
Stray inductance module	L_{sCE}				20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T _C = 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
Weight	G				345		g

2 IGBT, T1 / T2

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25 \text{ °C}$	1700	V
Continuous DC collector current	I_{CDC}	$T_{vj \max} = 175 \text{ °C}$	$T_C = 80 \text{ °C}$	750	A
Maximum RMS module DC-terminal current	I_{tRMS}		$T_{Terminal} = 90 \text{ °C}$, $T_C = 90 \text{ °C}$	580	A
			$T_{Terminal} = 105 \text{ °C}$, $T_C = 90 \text{ °C}$	565	

(table continues...)
 Datasheet

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$	1500	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	$V_{CE\ sat}$	$I_C = 750\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$	1.70	1.85	V
			$T_{vj} = 125\ ^\circ C$	1.95		
			$T_{vj} = 150\ ^\circ C$	2.05		
			$T_{vj} = 175\ ^\circ C$	2.10		
Gate threshold voltage	V_{GETh}	$I_C = 15.7\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	5.15	5.80	6.45	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CC} = 900\ V$		7.15		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$		0.33		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		78.1		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.275		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1700\ V, V_{GE} = 0\ V, T_{vj} = 25\ ^\circ C$			5	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$			100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 750\ A, V_{CC} = 900\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.33\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.185		μs
			$T_{vj} = 125\ ^\circ C$	0.187		
			$T_{vj} = 150\ ^\circ C$	0.189		
			$T_{vj} = 175\ ^\circ C$	0.191		
Rise time (inductive load)	t_r	$I_C = 750\ A, V_{CC} = 900\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.33\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.050		μs
			$T_{vj} = 125\ ^\circ C$	0.055		
			$T_{vj} = 150\ ^\circ C$	0.056		
			$T_{vj} = 175\ ^\circ C$	0.057		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 750\ A, V_{CC} = 900\ V, V_{GE} = \pm 15\ V, R_{Goff} = 2.2\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.639		μs
			$T_{vj} = 125\ ^\circ C$	0.711		
			$T_{vj} = 150\ ^\circ C$	0.731		
			$T_{vj} = 175\ ^\circ C$	0.751		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Fall time (inductive load)	t_f	$I_C = 750 \text{ A}$, $V_{CC} = 900 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 2.2 \Omega$	$T_{vj} = 25 \text{ °C}$	0.216		μs
			$T_{vj} = 125 \text{ °C}$	0.419		
			$T_{vj} = 150 \text{ °C}$	0.488		
			$T_{vj} = 175 \text{ °C}$	0.556		
Turn-on energy loss per pulse	E_{on}	$I_C = 750 \text{ A}$, $V_{CC} = 900 \text{ V}$, $L_\sigma = 25 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 0.33 \Omega$, $di/dt = 11500 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	69.6		mJ
			$T_{vj} = 125 \text{ °C}$	142		
			$T_{vj} = 150 \text{ °C}$	166		
			$T_{vj} = 175 \text{ °C}$	189		
Turn-off energy loss per pulse	E_{off}	$I_C = 750 \text{ A}$, $V_{CC} = 900 \text{ V}$, $L_\sigma = 25 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 2.2 \Omega$, $dv/dt = 3700 \text{ V}/\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	132		mJ
			$T_{vj} = 125 \text{ °C}$	204		
			$T_{vj} = 150 \text{ °C}$	224		
			$T_{vj} = 175 \text{ °C}$	243		
SC data	I_{SC}	$V_{GE} = 15 \text{ V}$, $V_{CC} = 1000 \text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 8 \mu\text{s}$, $T_{vj} = 150 \text{ °C}$	2600		A
			$t_p \leq 6 \mu\text{s}$, $T_{vj} = 175 \text{ °C}$	2500		
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.0551	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m} \cdot \text{K})$		0.0345		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	°C

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

3 Diode, D1 / D2

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25 \text{ °C}$	1700	V
Continuous DC forward current	I_F		750	A
Repetitive peak forward current	I_{FRM}	$t_p = 1 \text{ ms}$	1500	A

(table continues...)

Table 5 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
I^2t - value	I^2t	$t_P = 10 \text{ ms}, V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ °C}$	A^2s
			$T_{vj} = 175 \text{ °C}$	
			26100	
			23400	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 750 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$	2.35	2.50	V
			$T_{vj} = 125 \text{ °C}$	2.25		
			$T_{vj} = 150 \text{ °C}$	2.20		
			$T_{vj} = 175 \text{ °C}$	2.10		
Peak reverse recovery current	I_{RM}	$V_{CC} = 900 \text{ V}, I_F = 750 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 11900 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	841		A
			$T_{vj} = 125 \text{ °C}$	948		
			$T_{vj} = 150 \text{ °C}$	960		
			$T_{vj} = 175 \text{ °C}$	972		
Recovered charge	Q_r	$V_{CC} = 900 \text{ V}, I_F = 750 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 11900 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	101		μC
			$T_{vj} = 125 \text{ °C}$	188		
			$T_{vj} = 150 \text{ °C}$	216		
			$T_{vj} = 175 \text{ °C}$	243		
Reverse recovery energy	E_{rec}	$V_{CC} = 900 \text{ V}, I_F = 750 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 11900 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	63.8		mJ
			$T_{vj} = 125 \text{ °C}$	112		
			$T_{vj} = 150 \text{ °C}$	129		
			$T_{vj} = 175 \text{ °C}$	146		
Thermal resistance, junction to case	R_{thJC}	per diode			0.105	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$		0.0380		K/W
Temperature under switching conditions	T_{vjop}		-40		175	°C

Note: $T_{vjop} > 150 \text{ °C}$ 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}	$T_{NTC} = 25\text{ °C}$		5		kΩ
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\text{ Ω}$	-5		5	%
Power dissipation	P_{25}	$T_{NTC} = 25\text{ °C}$			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$		3433		K

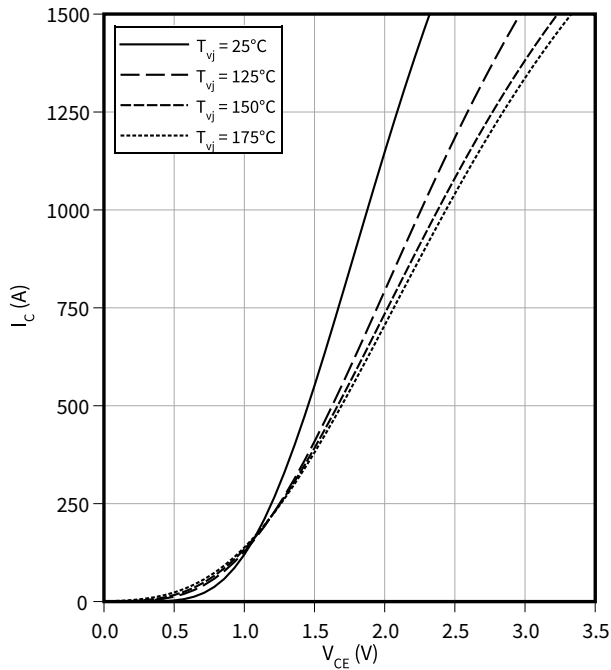
Note: Specification according to the valid application note.

5 Characteristics diagrams

Output characteristic (typical), IGBT, T1 / T2

$I_C = f(V_{CE})$

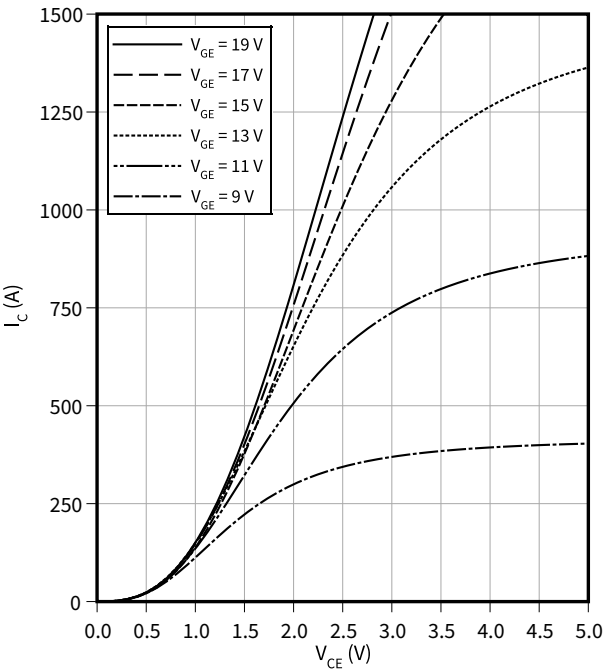
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, T1 / T2

$I_C = f(V_{CE})$

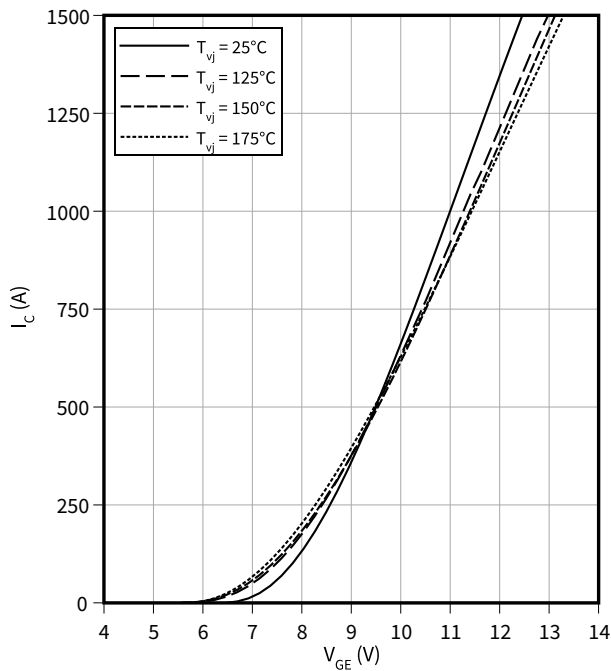
$T_{vj} = 175\text{ °C}$



Transfer characteristic (typical), IGBT, T1 / T2

$I_C = f(V_{GE})$

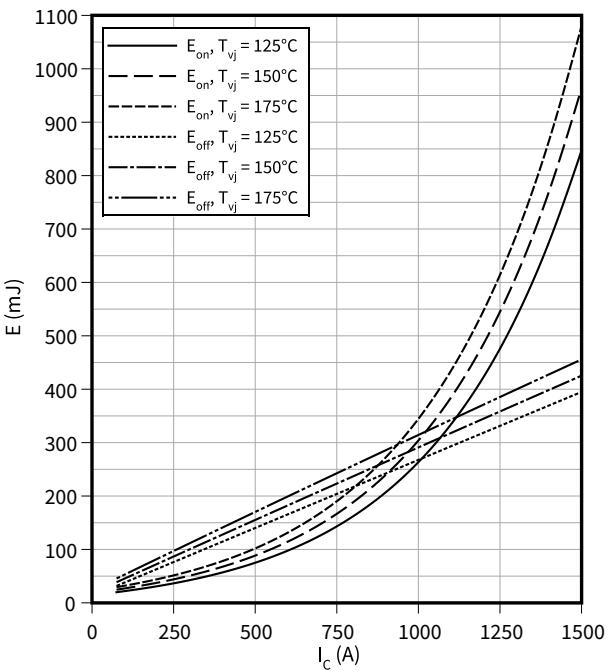
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, T1 / T2

$E = f(I_C)$

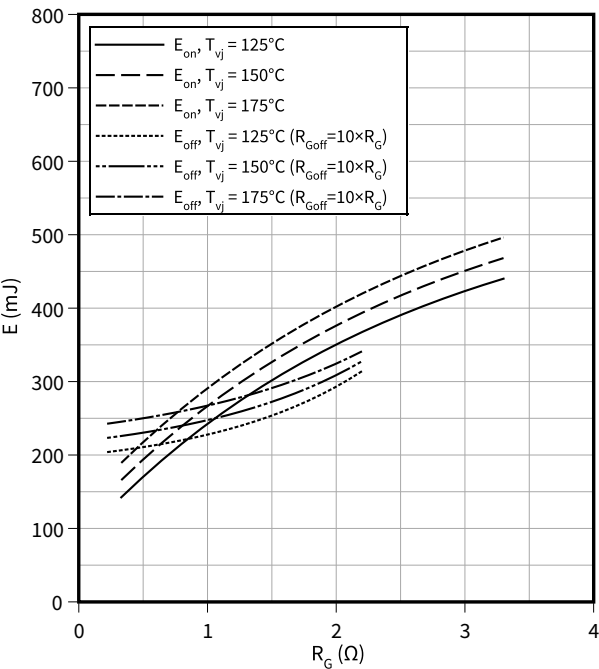
$R_{Goff} = 2.2\text{ }\Omega$, $R_{Gon} = 0.33\text{ }\Omega$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$



5 Characteristics diagrams

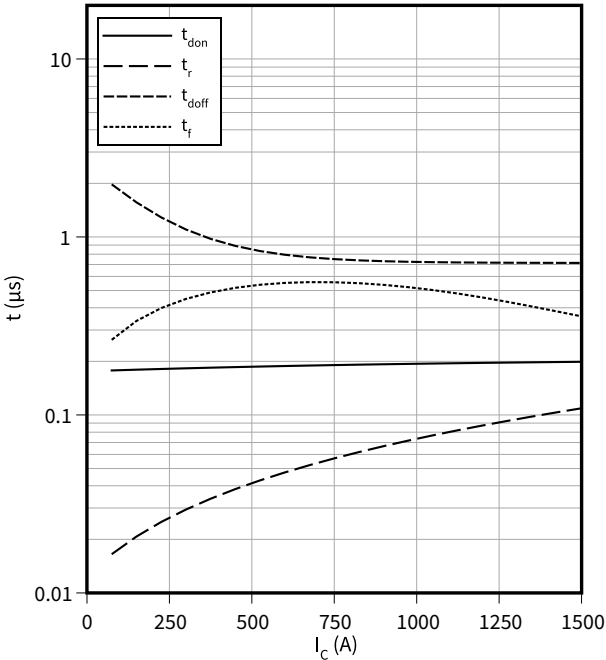
Switching losses (typical), IGBT, T1 / T2

$E = f(R_G)$
 $I_C = 750\text{ A}$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$



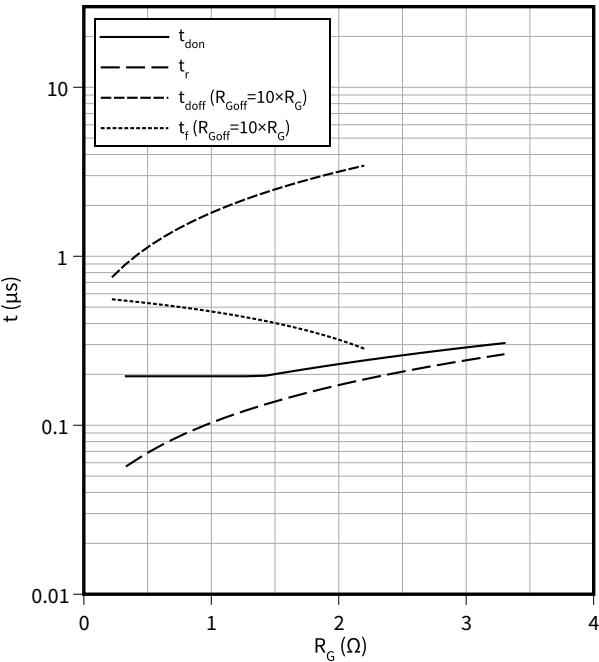
Switching times (typical), IGBT, T1 / T2

$t = f(I_C)$
 $R_{Goff} = 2.2\ \Omega$, $R_{Gon} = 0.33\ \Omega$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 175\text{ °C}$



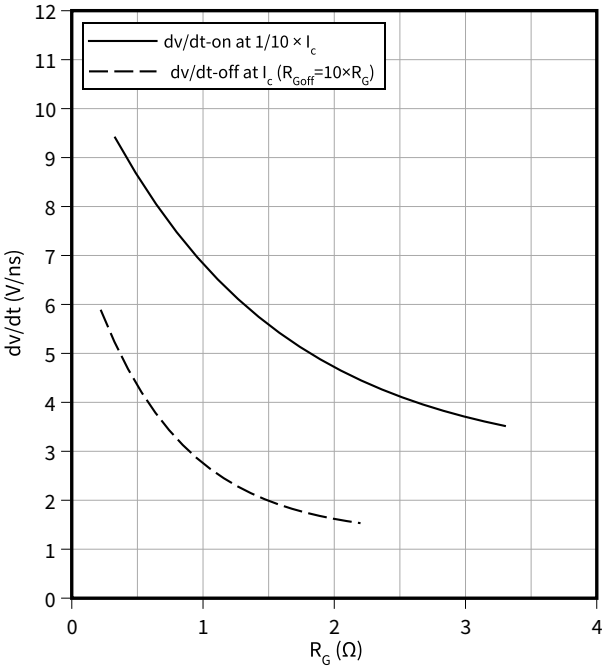
Switching times (typical), IGBT, T1 / T2

$t = f(R_G)$
 $I_C = 750\text{ A}$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 175\text{ °C}$



Voltage slope (typical), IGBT, T1 / T2

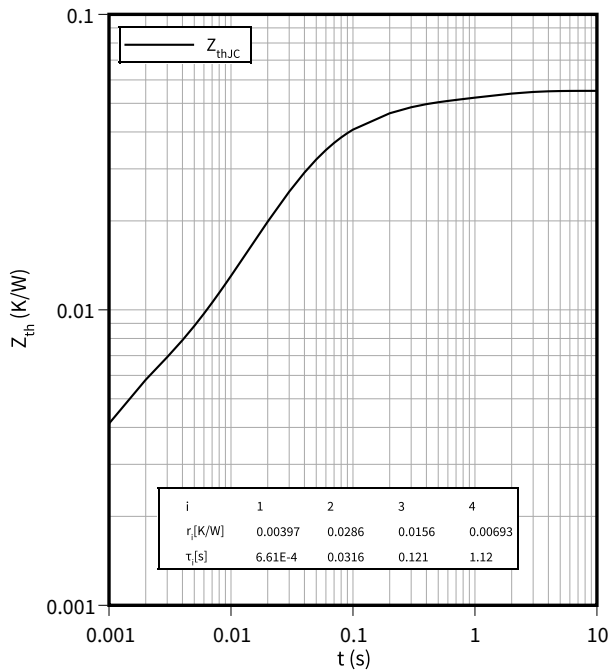
$dv/dt = f(R_G)$
 $I_C = 750\text{ A}$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 25\text{ °C}$



5 Characteristics diagrams

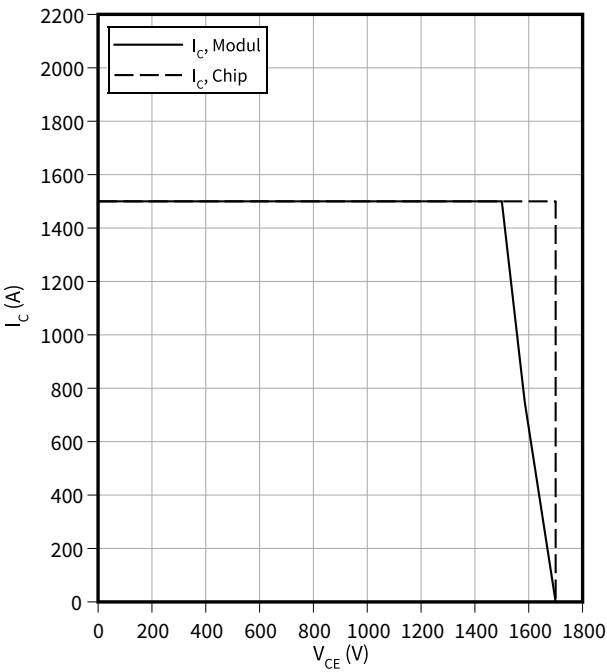
Transient thermal impedance , IGBT, T1 / T2

$Z_{th} = f(t)$



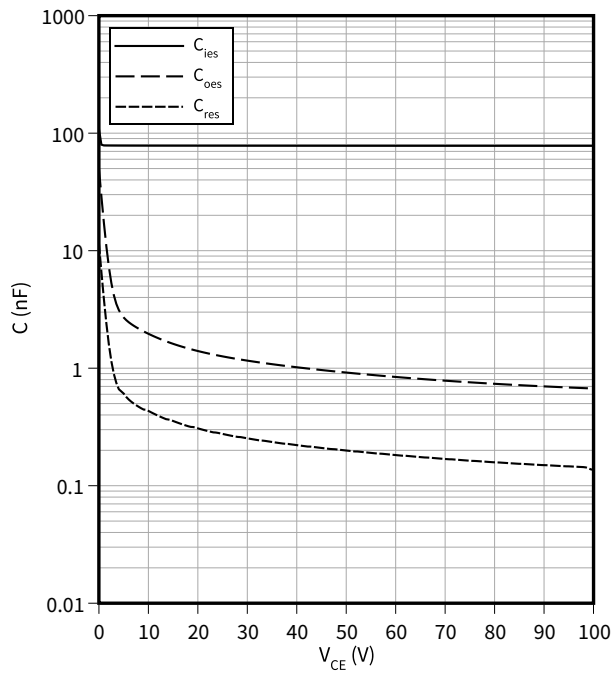
Reverse bias safe operating area (RBSOA), IGBT, T1 / T2

$I_C = f(V_{CE})$
 $R_{Goff} = 2.2 \Omega, V_{GE} = \pm 15 V, T_{vj} = 175 \text{ }^{\circ}\text{C}$



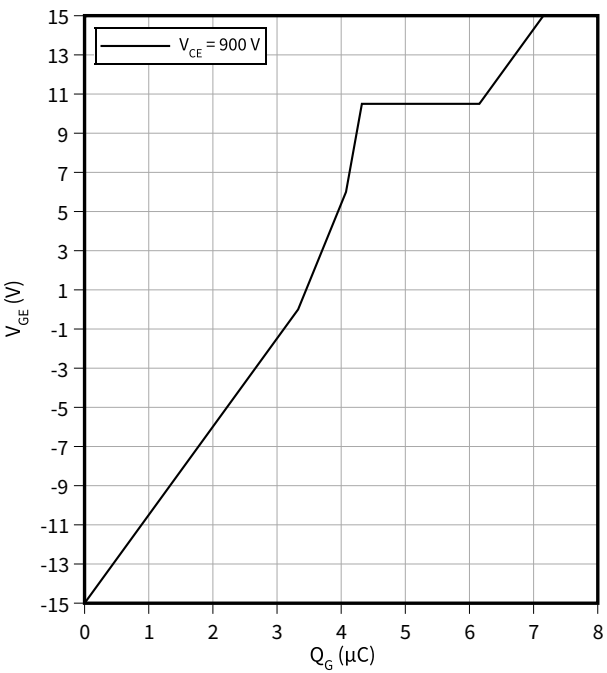
Capacity characteristic (typical), IGBT, T1 / T2

$C = f(V_{CE})$
 $f = 100 \text{ kHz}, V_{GE} = 0 V, T_{vj} = 25 \text{ }^{\circ}\text{C}$



Gate charge characteristic (typical), IGBT, T1 / T2

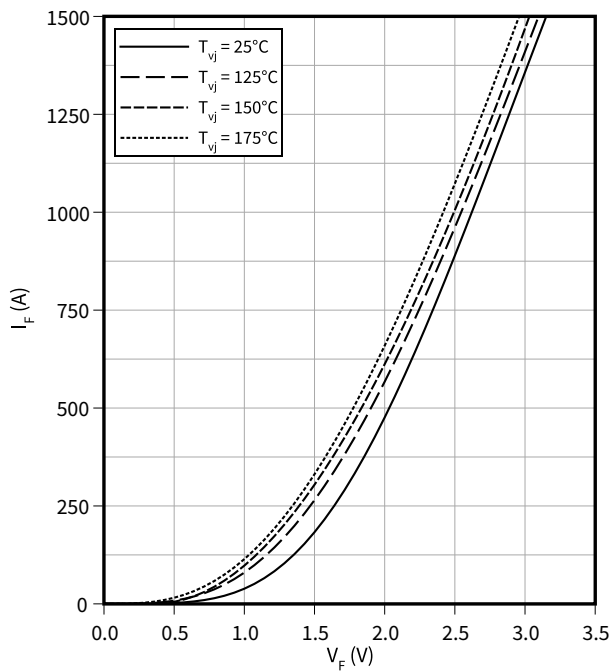
$V_{GE} = f(Q_G)$
 $I_C = 750 A, T_{vj} = 25 \text{ }^{\circ}\text{C}$



5 Characteristics diagrams

Forward characteristic (typical), Diode, D1 / D2

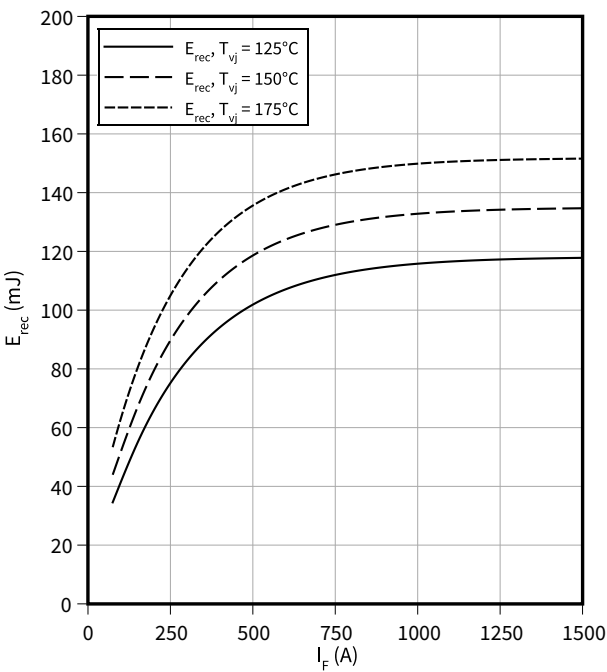
$I_F = f(V_F)$



Switching losses (typical), Diode, D1 / D2

$E_{rec} = f(I_F)$

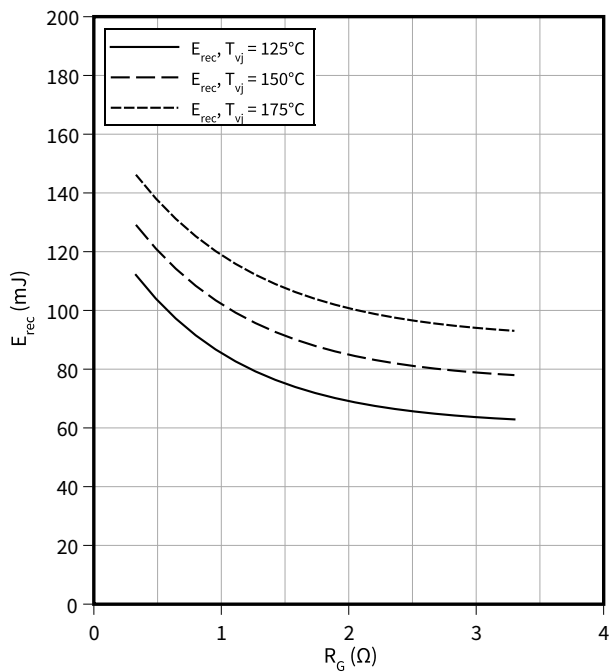
$R_{Gon} = 0.33 \Omega, V_{CC} = 900 V$



Switching losses (typical), Diode, D1 / D2

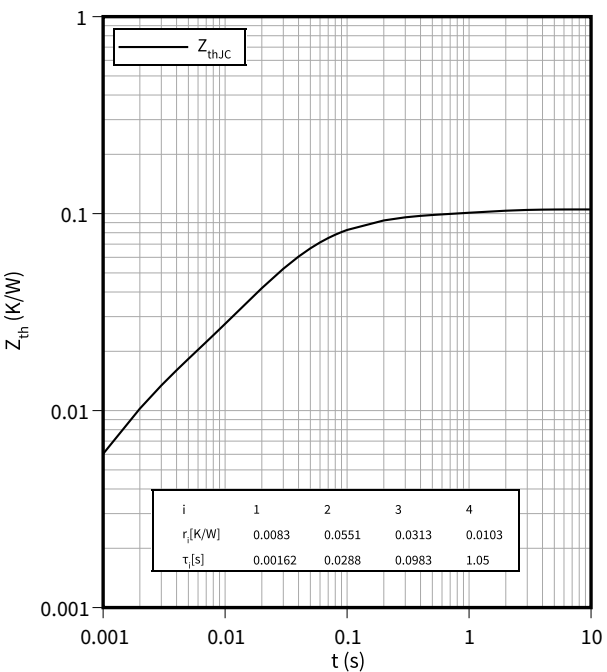
$E_{rec} = f(R_G)$

$I_F = 750 A, V_{CC} = 900 V$



Transient thermal impedance, Diode, D1 / D2

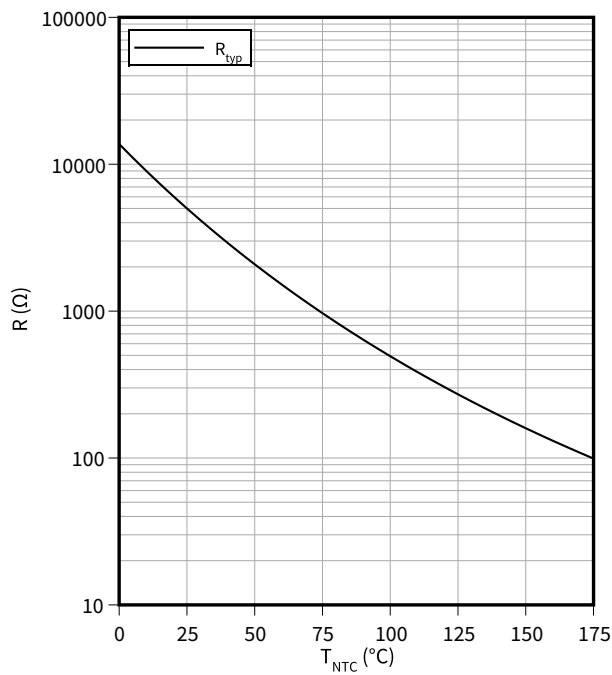
$Z_{th} = f(t)$



5 Characteristics diagrams

Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 **Circuit diagram**

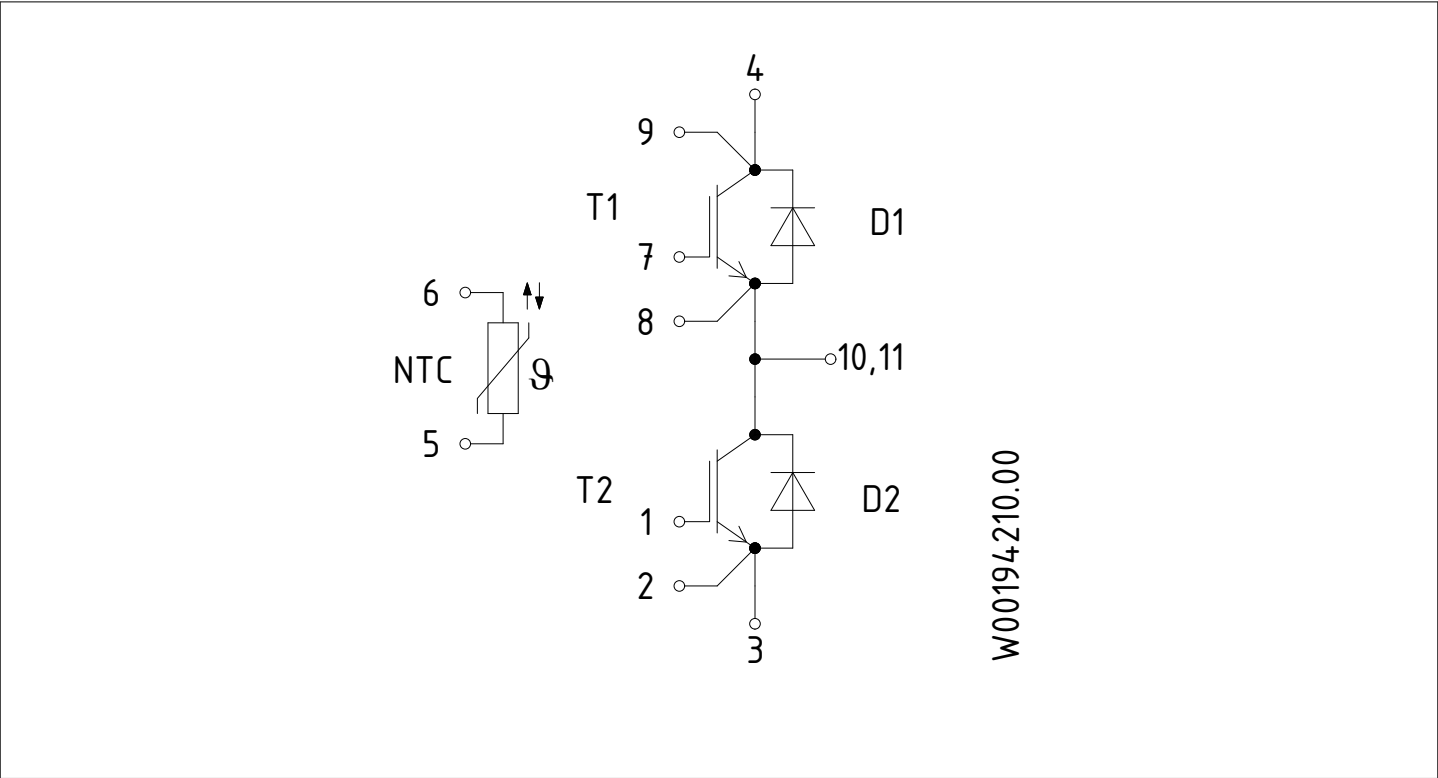


Figure 1

7 Package outlines

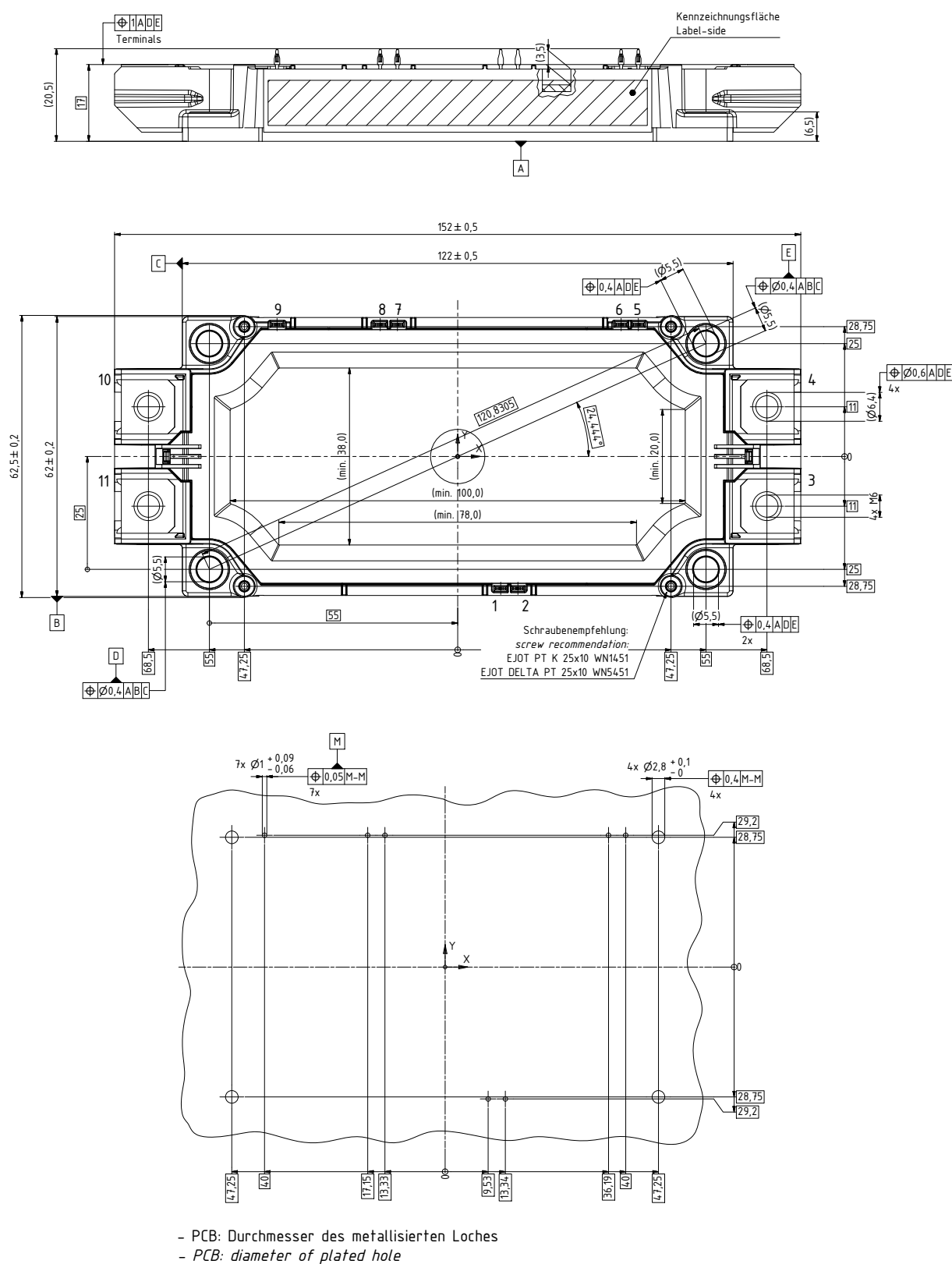


Figure 2

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	 7154914284655054991153071549142846550549911530		

Figure 3

Revision history

Document revision	Date of release	Description of changes
1.00	2022-11-21	Initial version

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