

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

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 100\text{ A} / I_{CRM} = 200\text{ A}$
 - Low $V_{CE,sat}$
 - Overload operation up to 175°C
 - TRENCHSTOP™ IGBT7
- Mechanical features
 - Integrated NTC temperature sensor
 - Package with $CTI > 400$
 - Al_2O_3 substrate with low thermal resistance
 - PressFIT contact technology



Potential applications

- Auxiliary inverters
- Motor drives
- Servo drives

Product validation

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

Description

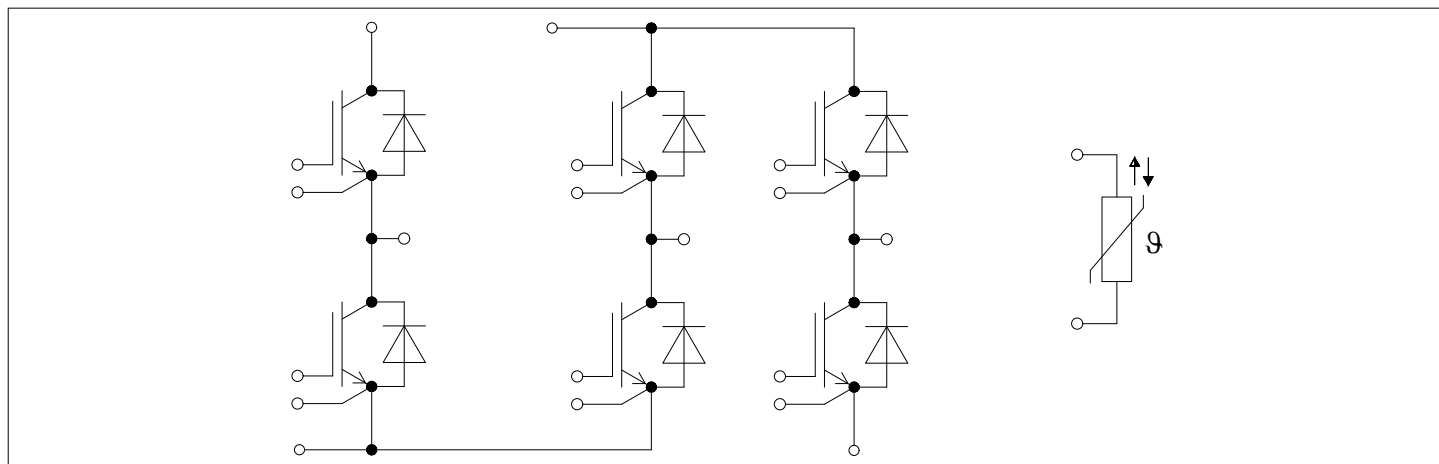


Table of contents

	Description	1
	Features	1
	Potential applications	1
	Product validation	1
	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	13
	Revision history	14
	Disclaimer	15

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	2.5	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	11.2	mm
Creepage distance	d_{Creep}	terminal to terminal	6.8	mm
Clearance	d_{Clear}	terminal to heatsink	9.4	mm
Clearance	d_{Clear}	terminal to terminal	5.5	mm
Comparative tracking index	CTI		> 400	
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}			15		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25 \text{ °C}$, per switch		1.9		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M5, Screw	1.3	1.5	Nm
Weight	G			78		g

Note: The current under continuous operation is limited to 25 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}	$T_{vj} = 25 \text{ °C}$	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$ $T_H = 65 \text{ °C}$	100	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj \text{ op}}$	200	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	$V_{CE\ sat}$	$I_C = 100\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.50	1.80	V
			$T_{vj} = 125\ ^\circ C$		1.64		
			$T_{vj} = 175\ ^\circ C$		1.72		
Gate threshold voltage	V_{GETh}	$I_C = 2.5\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		5.15	5.80	6.45	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CC} = 600\ V$			1.8		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			1.5		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			21.7		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.076		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			20	μA
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}	$I_C = 100\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 4.3\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.161		μs
			$T_{vj} = 125\ ^\circ C$		0.176		
			$T_{vj} = 175\ ^\circ C$		0.183		
Rise time (inductive load)	t_r	$I_C = 100\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 4.3\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.063		μs
			$T_{vj} = 125\ ^\circ C$		0.067		
			$T_{vj} = 175\ ^\circ C$		0.069		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 100\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 4.3\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.329		μs
			$T_{vj} = 125\ ^\circ C$		0.414		
			$T_{vj} = 175\ ^\circ C$		0.456		
Fall time (inductive load)	t_f	$I_C = 100\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 4.3\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.104		μs
			$T_{vj} = 125\ ^\circ C$		0.195		
			$T_{vj} = 175\ ^\circ C$		0.265		
Turn-on energy loss per pulse	E_{on}	$I_C = 100\ A, V_{CC} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 4.3\ \Omega, di/dt = 1200\ A/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		11.8		mJ
			$T_{vj} = 125\ ^\circ C$		15.1		
			$T_{vj} = 175\ ^\circ C$		17		
Turn-off energy loss per pulse	E_{off}	$I_C = 100\ A, V_{CC} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 4.3\ \Omega, dv/dt = 3000\ V/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		6.38		mJ
			$T_{vj} = 125\ ^\circ C$		10.3		
			$T_{vj} = 175\ ^\circ C$		12.7		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}$, $V_{CC} = 800 \text{ V}$, $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$		370		A
		$t_p \leq 8 \mu\text{s}$, $T_{vj} = 150 \text{ }^\circ\text{C}$				
		$t_p \leq 7 \mu\text{s}$, $T_{vj} = 175 \text{ }^\circ\text{C}$		350		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3 \text{ W/(m}\cdot\text{K)}$		0.460		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	$^\circ\text{C}$

Note: $T_{vj op} > 150 \text{ }^\circ\text{C}$ is 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}		$T_{vj} = 25\text{ }^{\circ}\text{C}$	1200	V
Continuous DC forward current	I_F			100	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$		200	A
I^2t - value	I^2t	$t_P = 10\text{ ms}$, $V_R = 0\text{ V}$	$T_{vj} = 125\text{ }^{\circ}\text{C}$	970	A^2s
			$T_{vj} = 175\text{ }^{\circ}\text{C}$	860	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 100 \text{ A}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1.72	2.10	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1.59		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	1.52		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}$, $I_F = 100 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 1300 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	49.6		A
			$T_{vj} = 125 \text{ }^\circ\text{C}$	68.4		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	80.5		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}$, $I_F = 100 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 1300 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	5.82		μC
			$T_{vj} = 125 \text{ }^\circ\text{C}$	12		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	16.3		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}$, $I_F = 100 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 1300 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	1.5		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	3.7		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	5.28		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3 \text{ W}/(\text{m}\cdot\text{K})$		0.783		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	$^\circ\text{C}$

Note: $T_{vj\text{ op}} > 150 \text{ }^\circ\text{C}$ is 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}	$T_{NTC} = 25 \text{ }^\circ\text{C}$		5		k Ω
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100 \text{ }^\circ\text{C}$, $R_{100} = 493 \text{ } \Omega$	-5		5	%
Power dissipation	P_{25}	$T_{NTC} = 25 \text{ }^\circ\text{C}$			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

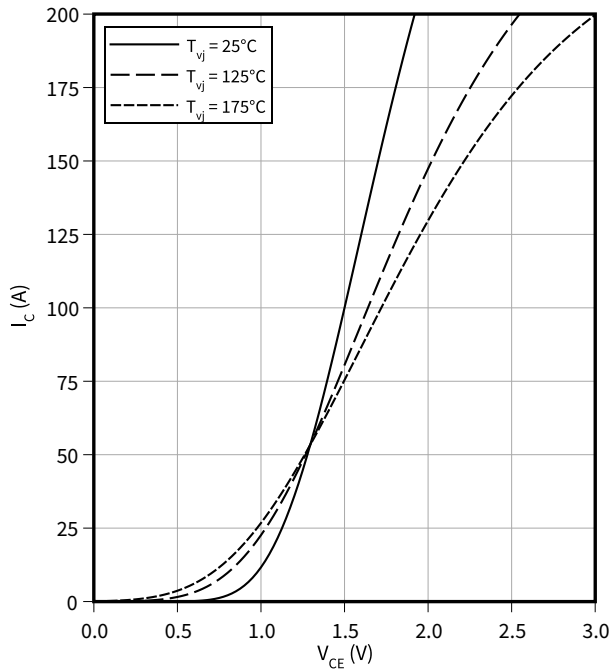
Note: Specification according to the valid application note.

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

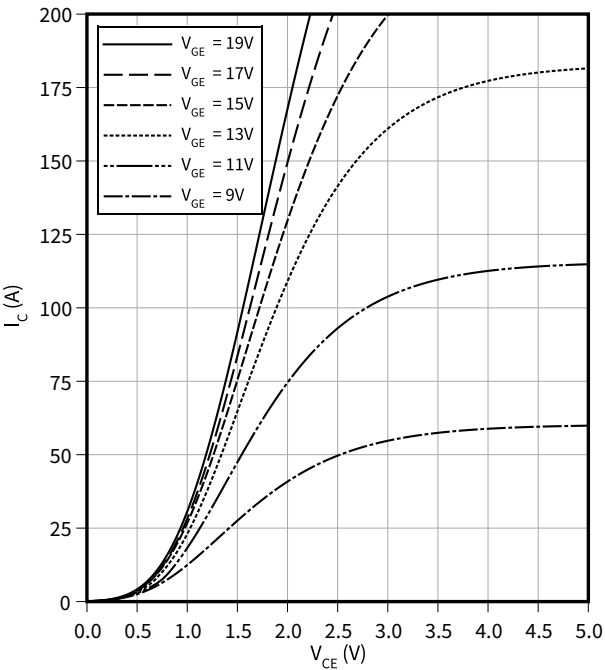
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

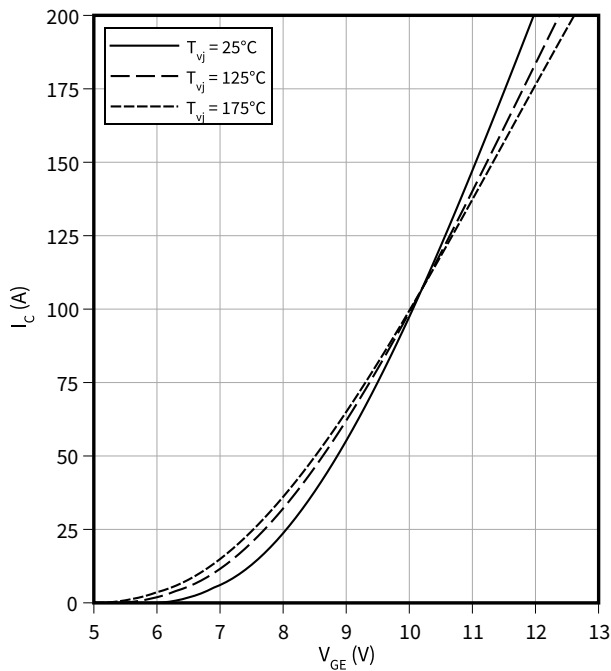
$T_{vj} = 175\text{ °C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

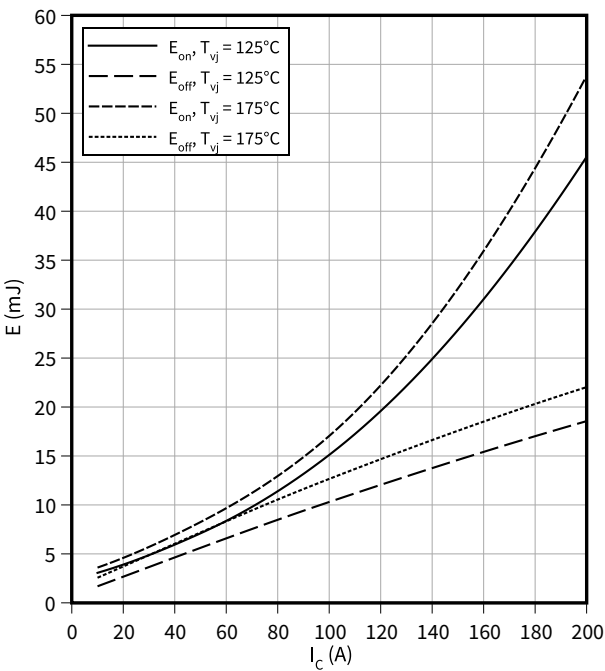
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

$R_{Goff} = 4.3\text{ }\Omega$, $R_{Gon} = 4.3\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $V_{CC} = 600\text{ V}$

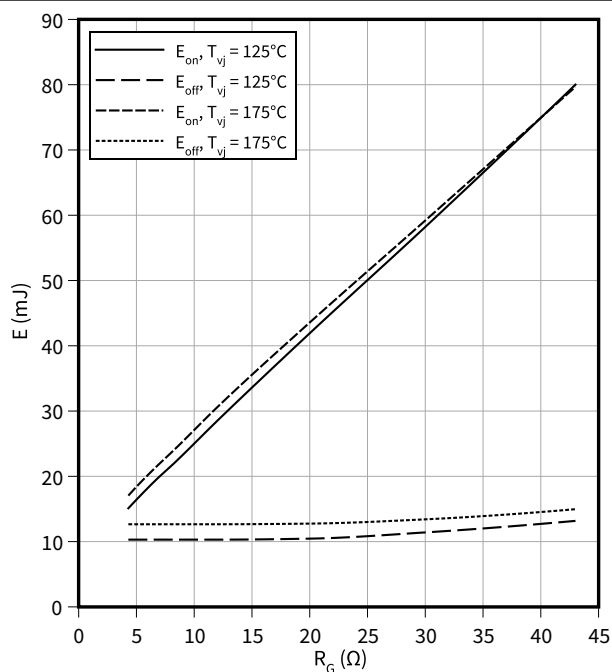


5 Characteristics diagrams

Switching losses (typical), IGBT, Inverter

$$E = f(R_G)$$

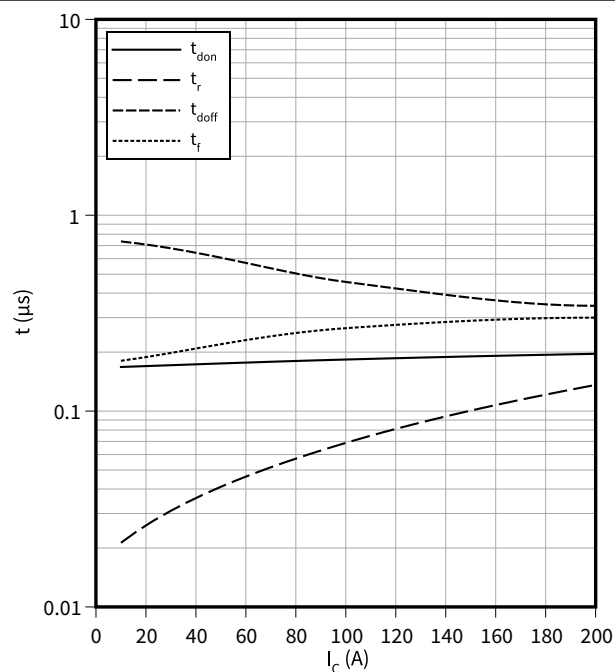
$V_{GE} = \pm 15 \text{ V}$, $I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$



Switching times (typical), IGBT, Inverter

$$t = f(I_C)$$

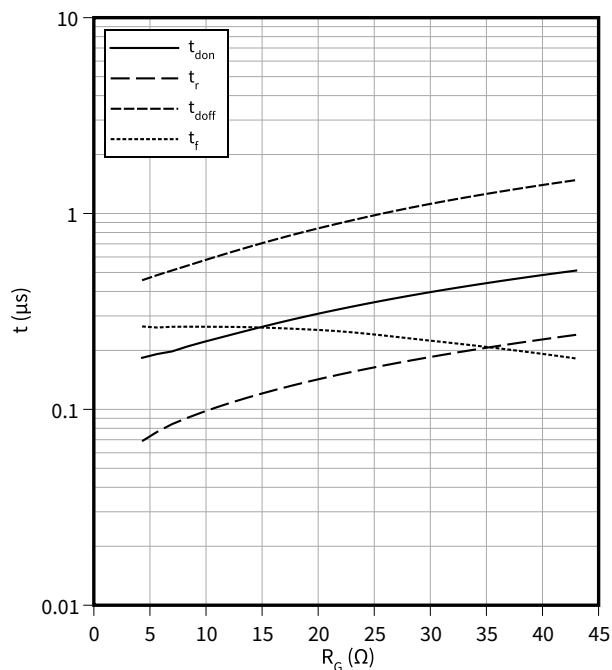
$R_{Goff} = 4.3 \Omega$, $R_{Gon} = 4.3 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ °C}$



Switching times (typical), IGBT, Inverter

$$t = f(R_G)$$

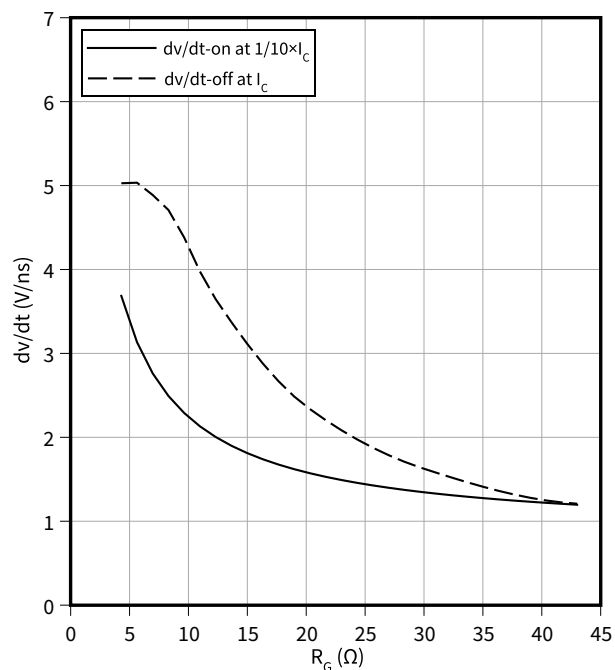
$V_{GE} = \pm 15 \text{ V}$, $I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ °C}$



Voltage slope (typical), IGBT, Inverter

$$dv/dt = f(R_G)$$

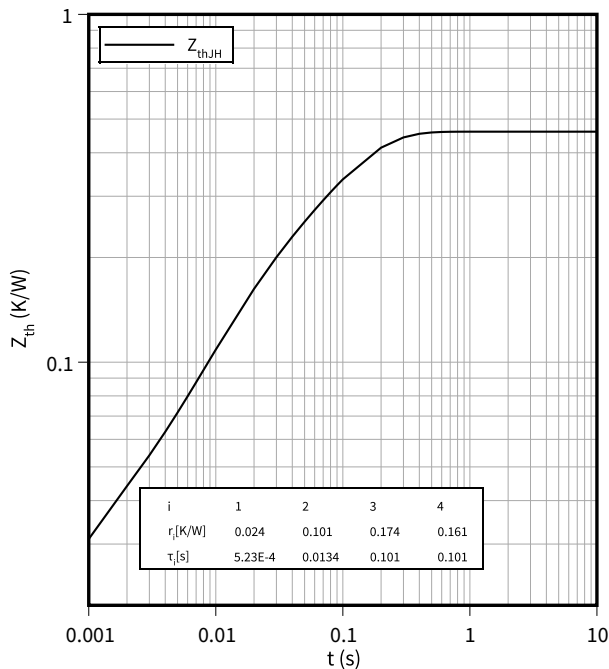
$I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 25 \text{ °C}$



5 Characteristics diagrams

Transient thermal impedance , IGBT, Inverter

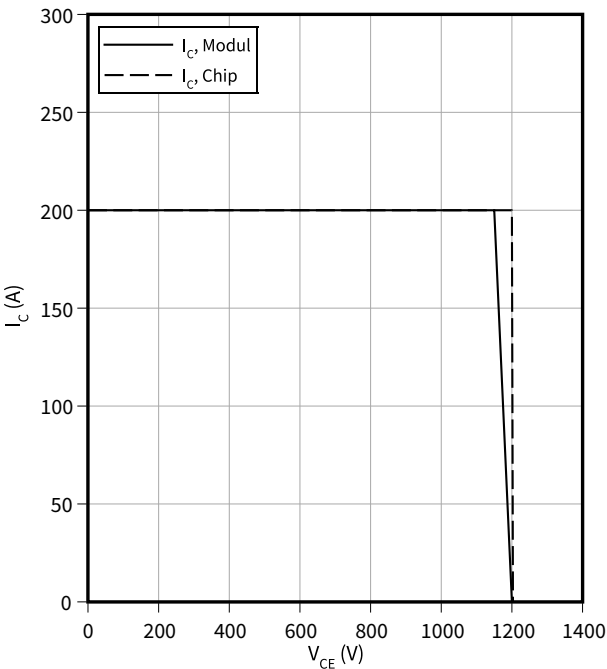
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

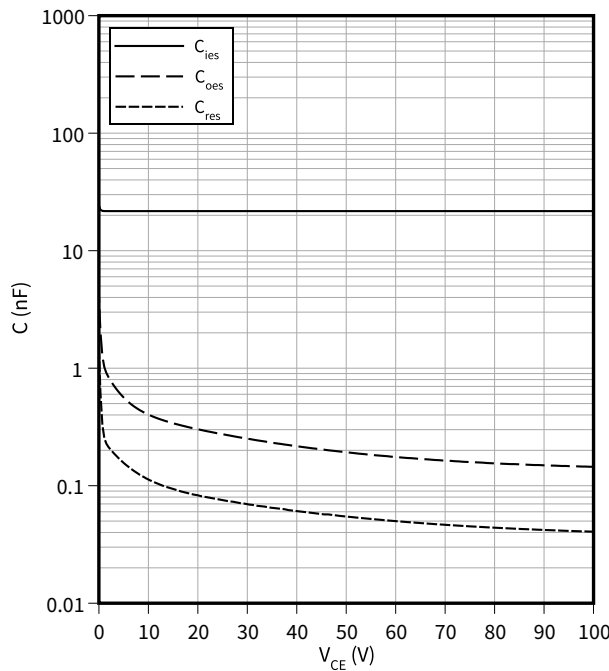
$R_{Goff} = 4.3 \Omega, V_{GE} = \pm 15 V, T_{vj} = 175 ^\circ C$



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

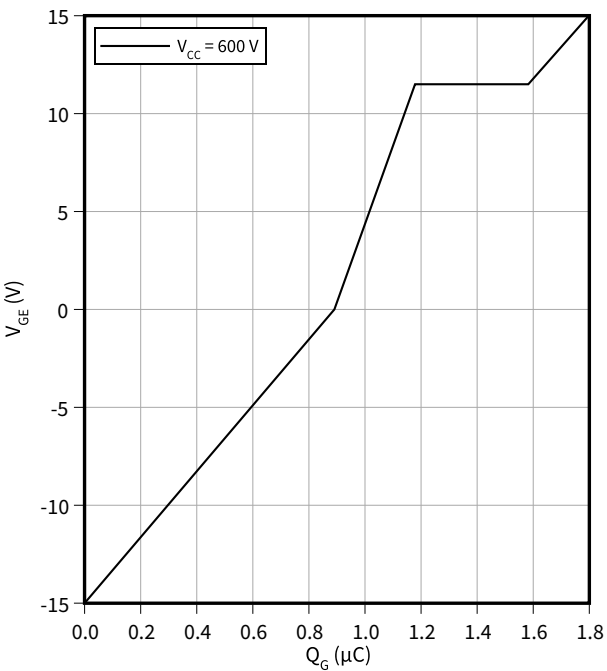
$f = 100 \text{ kHz}, V_{GE} = 0 V, T_{vj} = 25 ^\circ C$



Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$

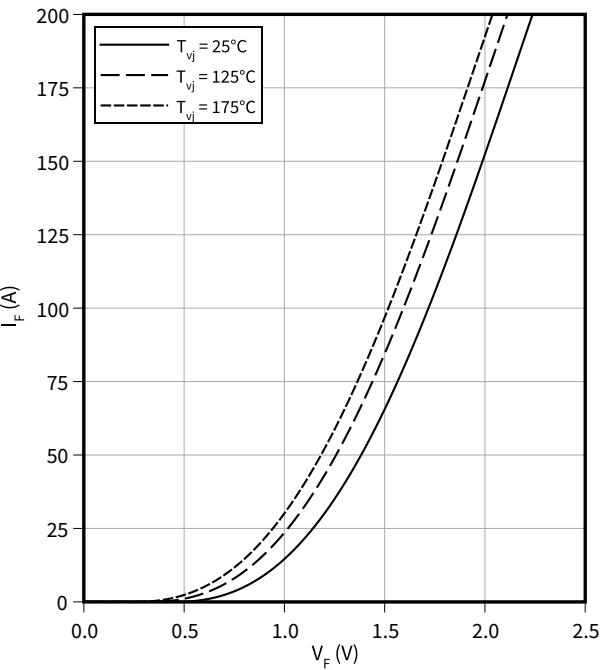
$I_C = 100 A, T_{vj} = 25 ^\circ C$



5 Characteristics diagrams

Forward characteristic (typical), Diode, Inverter

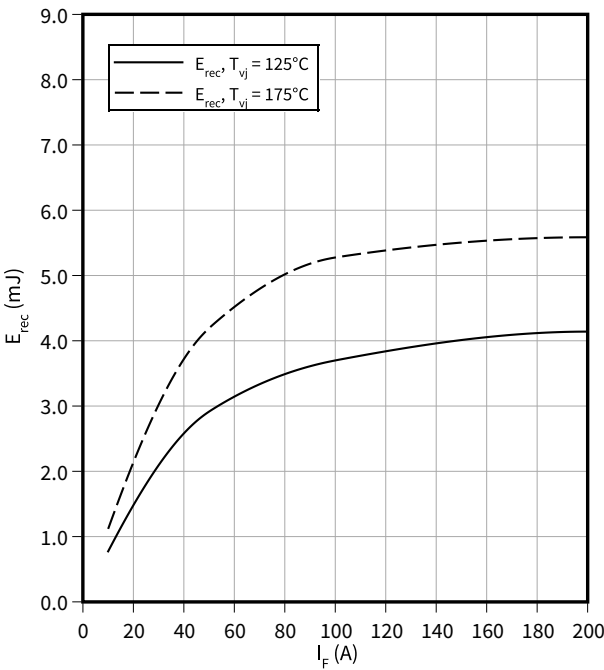
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

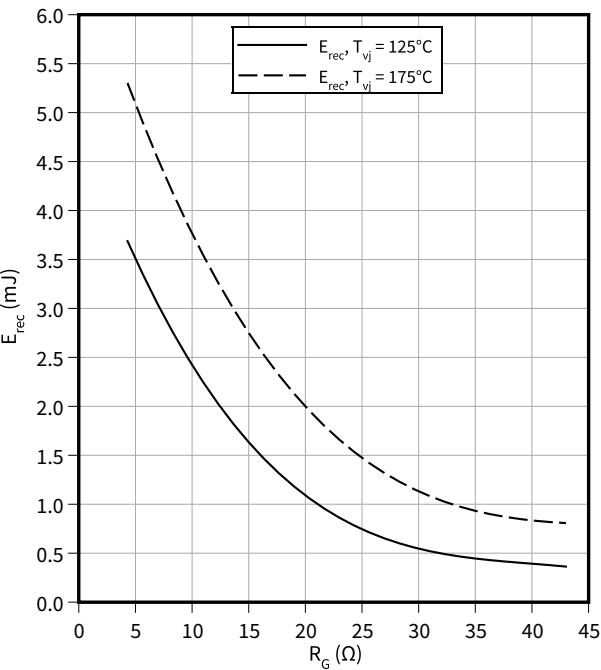
$R_{Gon} = 4.3\ \Omega, V_{CC} = 600\ \text{V}$



Switching losses (typical), Diode, Inverter

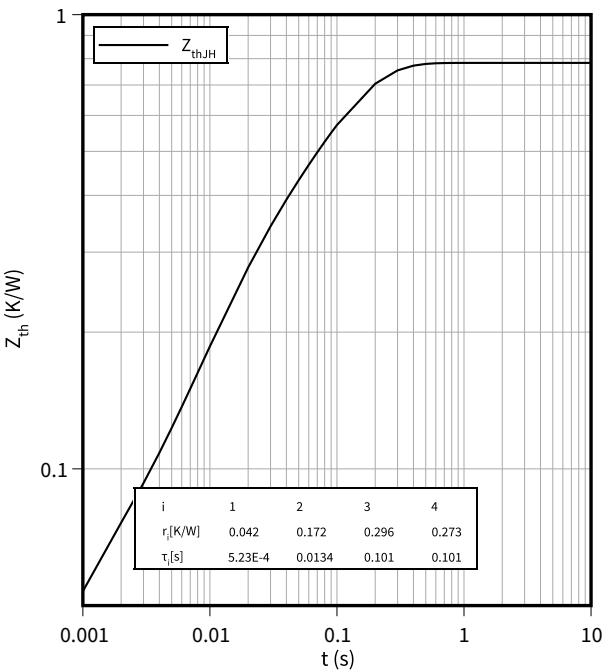
$E_{rec} = f(R_G)$

$I_F = 100\ \text{A}, V_{CC} = 600\ \text{V}$



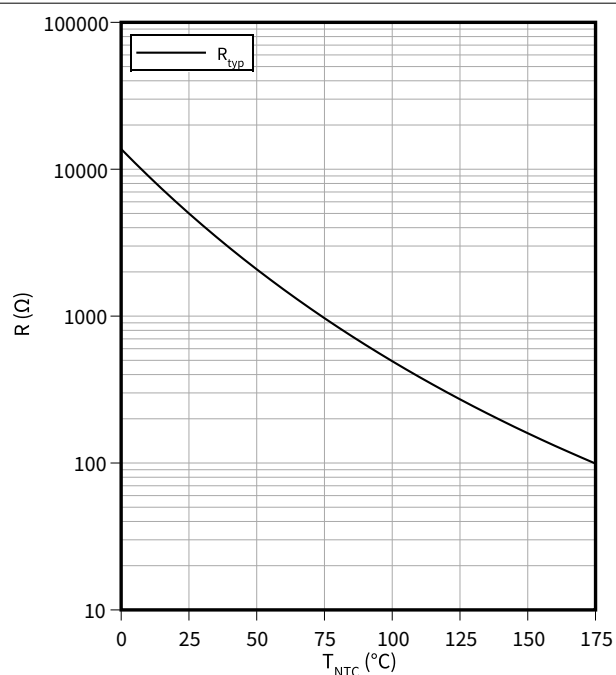
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$$R = f(T_{NTC})$$



6 Circuit diagram

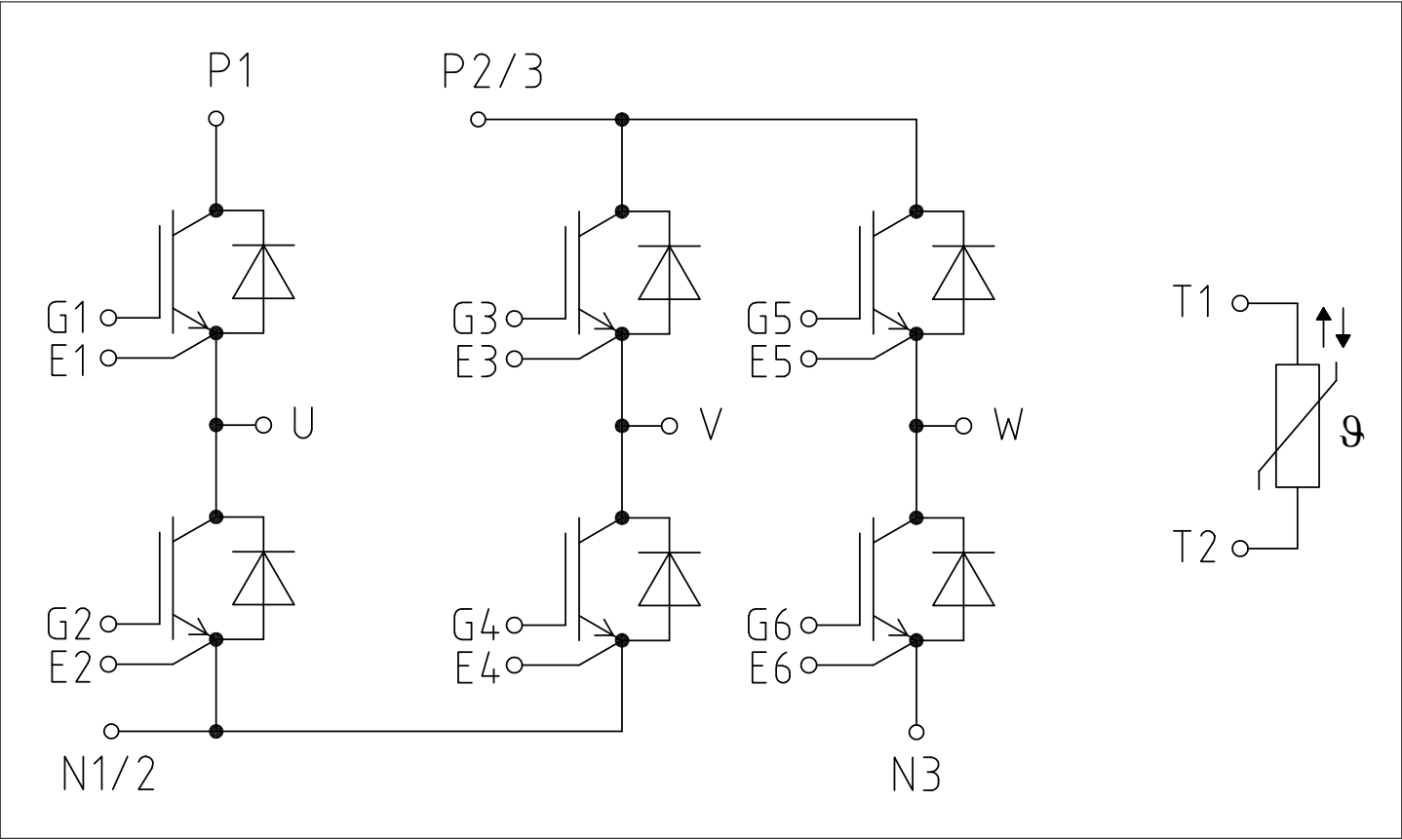


Figure 1

dimensioned for EJT Delta PT WN5451 2S
choose length according to pcb thickness
max. screw-in depth 8,5mm

4x
(Ø4,2)
114
62 ± 0.45
114
109.9 ± 0.45
109.3 ± 0.1 Distance of threaded holes in heat sink
7 ± 0.3
2x Ø5.4 ± 0.1
(Ø3.4)

42.2 ± 0.1
recommended design height
116.4
112

pcb hole pattern

4x Ø3.5
W V T2 T1 U
E5 G5 E3 G8 E2 G2 G1 E1
G6 G4 E6 N3 P2/P3 E4 N1/N2 P1
14.4 36.08 37.88 39.68 41.48 43.28 45.08 46.88 48.68 50.48 52.28 54.08 55.88 57.68 59.48 61.28 63.08 64.88 66.68 68.48 70.28 72.08 73.88 75.68 77.48 79.28 81.08 82.88 84.68 86.48 88.28 90.08 91.88 93.68 95.48 97.28 99.08 100.88 102.68 104.48 106.28 108.08 109.88 111.68 113.48 115.28 117.08 118.88 120.68 122.48 124.28 126.08 127.88 129.68 131.48 133.28 135.08 136.88 138.68 140.48 142.28 144.08 145.88 147.68 149.48 151.28 153.08 154.88 156.68 158.48 160.28 162.08 163.88 165.68 167.48 169.28 171.08 172.88 174.68 176.48 178.28 180.08 181.88 183.68 185.48 187.28 189.08 190.88 192.68 194.48 196.28 198.08 199.88 201.68 203.48 205.28 207.08 208.88 210.68 212.48 214.28 216.08 217.88 219.68 221.48 223.28 225.08 226.88 228.68 230.48 232.28 234.08 235.88 237.68 239.48 241.28 243.08 244.88 246.68 248.48 250.28 252.08 253.88 255.68 257.48 259.28 261.08 262.88 264.68 266.48 268.28 270.08 271.88 273.68 275.48 277.28 279.08 280.88 282.68 284.48 286.28 288.08 289.88 291.68 293.48 295.28 297.08 298.88 300.68 302.48 304.28 306.08 307.88 309.68 311.48 313.28 315.08 316.88 318.68 320.48 322.28 324.08 325.88 327.68 329.48 331.28 333.08 334.88 336.68 338.48 340.28 342.08 343.88 345.68 347.48 349.28 351.08 352.88 354.68 356.48 358.28 360.08 361.88 363.68 365.48 367.28 369.08 370.88 372.68 374.48 376.28 378.08 379.88 381.68 383.48 385.28 387.08 388.88 390.68 392.48 394.28 396.08 397.88 399.68 401.48 403.28 405.08 406.88 408.68 410.48 412.28 414.08 415.88 417.68 419.48 421.28 423.08 424.88 426.68 428.48 430.28 432.08 433.88 435.68 437.48 439.28 441.08 442.88 444.68 446.48 448.28 450.08 451.88 453.68 455.48 457.28 459.08 460.88 462.68 464.48 466.28 468.08 469.88 471.68 473.48 475.28 477.08 478.88 480.68 482.48 484.28 486.08 487.88 489.68 491.48 493.28 495.08 496.88 498.68 500.48 502.28 504.08 505.88 507.68 509.48 511.28 513.08 514.88 516.68 518.48 520.28 522.08 523.88 525.68 527.48 529.28 531.08 532.88 534.68 536.48 538.28 540.08 541.88 543.68 545.48 547.28 549.08 550.88 552.68 554.48 556.28 558.08 559.88 561.68 563.48 565.28 567.08 568.88 570.68 572.48 574.28 576.08 577.88 579.68 581.48 583.28 585.08 586.88 588.68 590.48 592.28 594.08 595.88 597.68 599.48 601.28 603.08 604.88 606.68 608.48 610.28 612.08 613.88 615.68 617.48 619.28 621.08 622.88 624.68 626.48 628.28 630.08 631.88 633.68 635.48 637.28 639.08 640.88 642.68 644.48 646.28 648.08 649.88 651.68 653.48 655.28 657.08 658.88 660.68 662.48 664.28 666.08 667.88 669.68 671.48 673.28 675.08 676.88 678.68 680.48 682.28 684.08 685.88 687.68 689.48 691.28 693.08 694.88 696.68 698.48 700.28 702.08 703.88 705.68 707.48 709.28 711.08 712.88 714.68 716.48 718.28 720.08 721.88 723.68 725.48 727.28 729.08 730.88 732.68 734.48 736.28 738.08 739.88 741.68 743.48 745.28 747.08 748.88 750.68 752.48 754.28 756.08 757.88 759.68 761.48 763.28 765.08 766.88 768.68 770.48 772.28 774.08 775.88 777.68 779.48 781.28 783.08 784.88 786.68 788.48 790.28 792.08 793.88 795.68 797.48 799.28 801.08 802.88 804.68 806.48 808.28 810.08 811.88 813.68 815.48 817.28 819.08 820.88 822.68 824.48 826.28 828.08 829.88 831.68 833.48 835.28 837.08 838.88 840.68 842.48 844.28 846.08 847.88 849.68 851.48 853.28 855.08 856.88 858.68 860.48 862.28 864.08 865.88 867.68 869.48 871.28 873.08 874.88 876.68 878.48 880.28 882.08 883.88 885.68 887.48 889.28 891.08 892.88 894.68 896.48 898.28 900.08 901.88 903.68 905.48 907.28 909.08 910.88 912.68 914.48 916.28 918.08 919.88 921.68 923.48 925.28 927.08 928.88 930.68 932.48 934.28 936.08 937.88 939.68 941.48 943.28 945.08 946.88 948.68 950.48 952.28 954.08 955.88 957.68 959.48 961.28 963.08 964.88 966.68 968.48 970.28 972.08 973.88 975.68 977.48 979.28 981.08 982.88 984.68 986.48 988.

Figure 2

8 Module label code

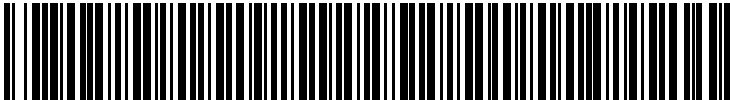
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	<i>Content</i> Module serial number Module material number Production order number Date code (production year) Date code (production week)	<i>Digit</i> 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	<i>Example</i> 71549 142846 55054991 15 30
Example	  71549142846550549911530 71549142846550549911530		

Figure 3

Revision history

Document revision	Date of release	Description of changes
1.00	2022-12-09	Final datasheet

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