Specification Ni1000SOT

Revision 3.0

Customer Acceptance

Company: _____

Address: _____

Date: _____

Name: _____

Function: _____

Signature: _____

TE Connectivity Sensors Germany GmbH
Hauert 13, D-44227 Dortmund, Germany

Content

History of changes

Revision	Date	History of changes	Editor
00	18.04.2001	• Creation of first specification	
1.0	16.11.2009	• Modification of limits, new document layout	
2.0	06.05.2011	• Marking: Increase of housing number because of change of mold material and production place • Qualification: new / changed requirements • Sample test: Introduction of test for packing size 10000 pieces	
3.0	07.10.2016	• General: New layout, change language to English, product picture included, changing name to Ni1000SOT • Marking: increase of housing number because of new sensing element • Packing size: only 10000 pieces per reel available	**ToS**

Applying Documents

#	Document title	Revision	Owner	Description
1	WP-TS-305 Delivery Specification for SOT223, SOT23, E-Line and SOT4W Packaged Products	06	TE Connectivity Sensors Germany GmbH	
2				
3				
4				
5				
6				
7				
8				
9				

1 General Information

Ni1000SOT is a nickel thin film resistance temperature detector (RTD) that is suitable for use in contact temperature sensing.

The devices are manufactured by PVD-deposition on a silicon substrate. The thin film structure is covered by a passivation layer for environmental protection and enhanced stability. The nickel elements are mounted on lead frames and encapsulated in SOT23 packages. This technology allows the production of miniature, low cost, high precision temperature sensors.

The characteristics of the temperature sensor comply with the former DIN 43760 standard. It is qualified for the most demanding automotive applications (incl. exposure to hot oil) and is suitable for many more applications in harsh environments.

The lead frame of the used package consist of Alloy 42 with a thin silver surface. The leads are tin coated for reflow soldering assembly process.

1.1 Applications

Temperature sensing, control and compensation in automotive applications

1.2 Functional Block Diagram

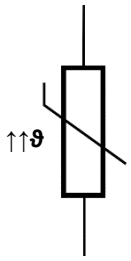


Figure 1: Wiring symbol

1.3 Part Number

Device	Part No.	Package
Ni1000SOT	G-NICO-001	SOT23, leadframe material: Alloy 42, tin coating

Customer Specific Part Number: 735.628-01

1.4 ESD

This component can be damaged by ESD. TE Connectivity recommends the handling with appropriate precaution.

2 Mechanic

2.1 Views

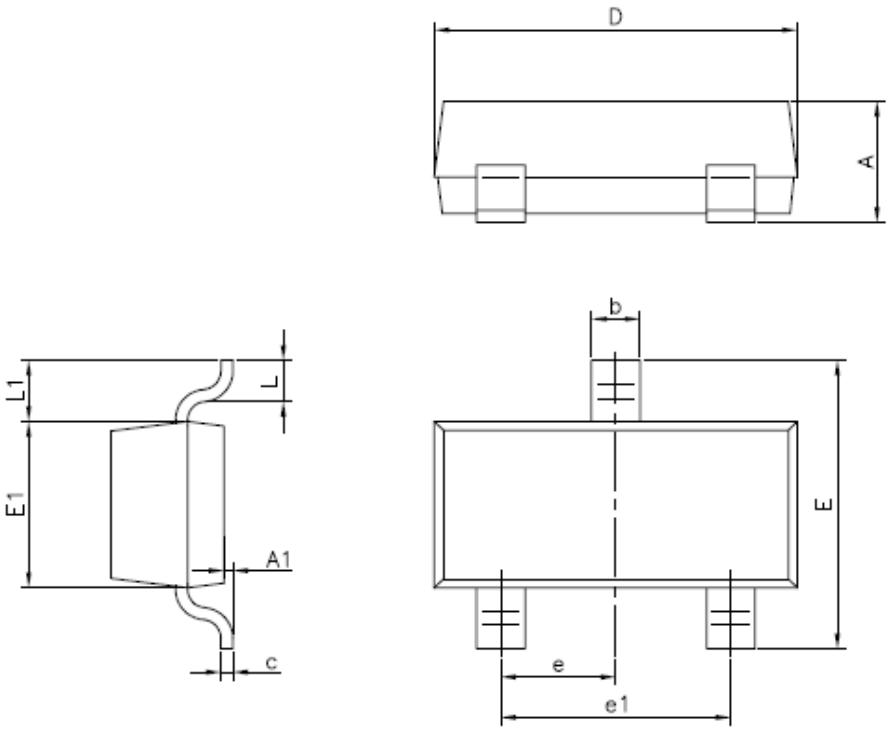


Figure 2: mechanical outline

2.2 Dimensions and Weight

Dimension	Min	Typ.	Max	Unit
A	0.89	1.00	1.12	mm
A1	0.01	0.05	0.10	mm
b	0.30	0.45	0.50	mm
c	0.08	0.10	0.108	mm
D	2.80	3.00	3.04	mm
e	-	0.95 ref	-	mm
e1	-	1.90 ref	-	mm
E	2.10	2.42	2.64	mm
E1	1.20	1.37	1.40	mm
L	0.25	0.30	0.60	mm
L1	0.45	0.54	0.62	mm

Nominal weight: 8mg per sensor

2.3 Mechanical Requirements

2.3.1 Wire and die attach bond scheme:

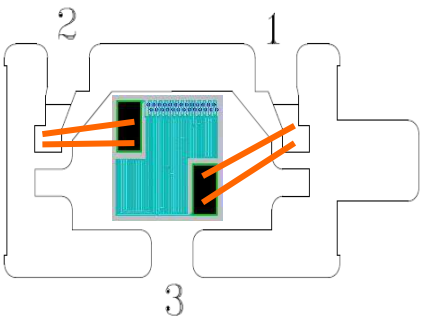


Figure 3: Wire and die attach bond scheme

2.3.2 Footprint

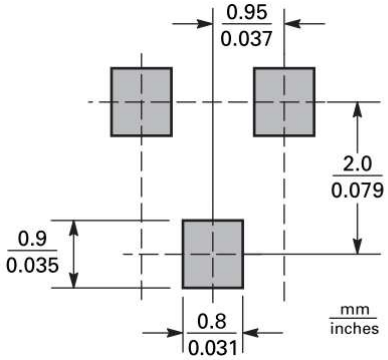
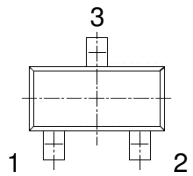


Figure 4: Footprint

2.4 Terminal connections

Top view: 	Pin # 1	Nickel RTD electrical contact
	Pin # 2	Nickel RTD electrical contact
	Pin # 3	Electrically isolated thermal contact

2.5 Recommended assembly process

Reflow soldering at 260°C

Soldering paste: 96Sn4Ag

3 Materials

IMDS ID:	539752560
Die:	Silicon wafer with structured thin film layer of Nickel, Titanium, Tungsten and Gold
Leadframe base material:	Alloy 42, thickness 1000µm (nominal)
Leadframe coating:	Tin coating (> 99.5%), 8 – 10 µm over Ag coating, thickness 0.2µm (nominal), over Cu coating, thickness 0.3µm (nominal)
Bond wires:	Gold, 22µm diameter, two wires per pad
Mold:	GE1030M, Manufacturer: Nitto (Hitachi)

4 Traceability

4.1 Marking on sensor package

Three digit marking on package:

First digit:	Last digit of customer product number:	**1**
Second and third digit:	Revision of sensor:	**06**
Resulting marking:	**106**	

History of last three revisions

104:	Green mould
105:	Green mould and new facility (PCN: P_3946_013)
106:	Green mould and sensing element build on 150mm substrate (PCN: P_5957_013)

4.2 Marking on transportation package:

Two different labels have to be applied:

Label 1: at each reel and pizza box as plain text and 1D barcode:

Description		Note
Label size	100 x 50 mm²	
Barcode	Type 39	
Part	NI1000SOT	
P/N:	G-NICO-001	
QTY:	Quantity Reel	10000 pcs.
D/C:	Max. 2 Date Codes per Reel	YYWW
Batch:	TE Lot number	
Lot No	Max. 2 Lots per Reel	
QTY:	Quantity lot	
Position for the label:	Reel & Pizza Box	

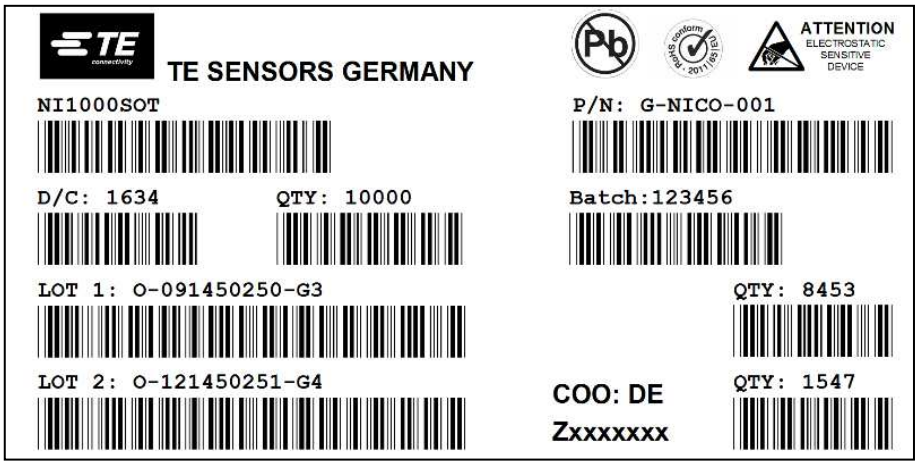


Figure 5 – Label 1

Label 2: at pizza box only as plain text and 1D barcode:

Description		Note
Label size	100 x 50 mm²	
Barcode	Type 39	
MANUFACTURER:	TE SENSORS	
TE PO No:	Order number TE Sensors Germany	
QTY:	Quantity Reel	10000 pcs.
Device:	NI1000SOT	
P/N:	G-NICO-001	Item number TE SENSORS
Item:	735628-1	Item number lead customer
D/C:	Max. 2 Date Codes per Reel	YYWW
Position for the label:	Pizza-box	

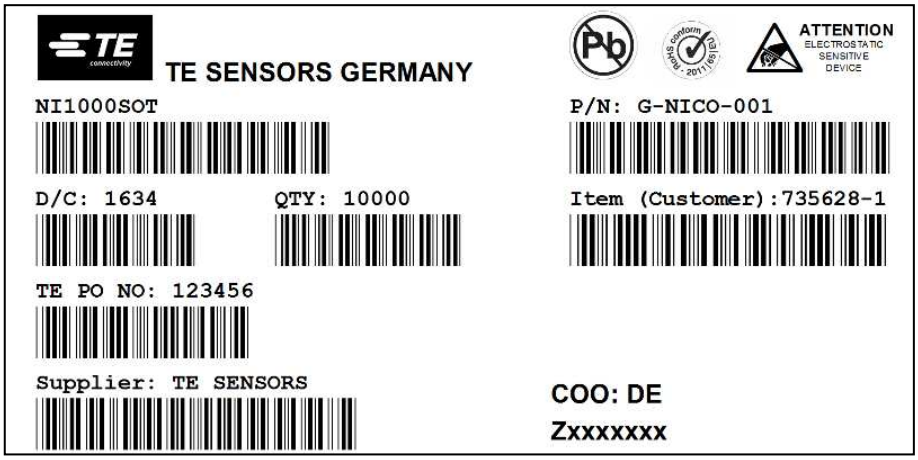


Figure 6 – Label 2

5 Absolute Maximum Ratings

Parameter	Symbol	Unit	Min	Typ.	Max	Condition
Storage Temperature	T_{St}	°C	-55		165	-
Operating Temperature	T_{Op}	°C	-55		165	-
Current	I	mA		1.2	5	-
Vibration resistance	-	-	-	-	-	According VW-Norm 801 01, section 8.1, Performed at customer site
ESD Rating (HBM)	Class	-	-	1B	-	MIL 883E3015.7

Note:

Stress above one or more of the limiting values may cause permanent damage to the device. Exposure to limiting values for extended periods may affect device reliability.

6 Electrical Characteristics

6.1 Characteristic data:

Characteristic curve according former DIN 43760	$R(T) = R_0 \cdot (1 + a \cdot T + b \cdot T^2 + c \cdot T^4 + d \cdot T^6)$ with R_0 = 1000 Ohm at 0°C T = temperature in °C a = $5.485*10^{-3}$ b = $6.650*10^{-6}$ c = $2.805*10^{-11}$ d = $-2.000*10^{-17}$ R_{100} = 1618 Ohm at 100°C Tolerances: ΔT= ± (0.8 + 0.0045 * |T|) in the range of 0 to 160°C ΔT= ± (0.8 + 0.021 * |T|) in the range of -55 to 0°C Self heating of sensor: ΔT=P/SH with electric power P=R*I² and selfheating coefficient SH=(1.7 ± 0.3) mW/°C (Ambient air: 23°C; still air)
Long term stability:	ΔR = 0.1 % after 1000h at 150°C
Measurement current (DC):	typ. 1.2 mA; max. 5 mA
Time constant (t_{63})	typ. 0.5 sec (measured in fluor inert liquid, step: 20 … 100°C)

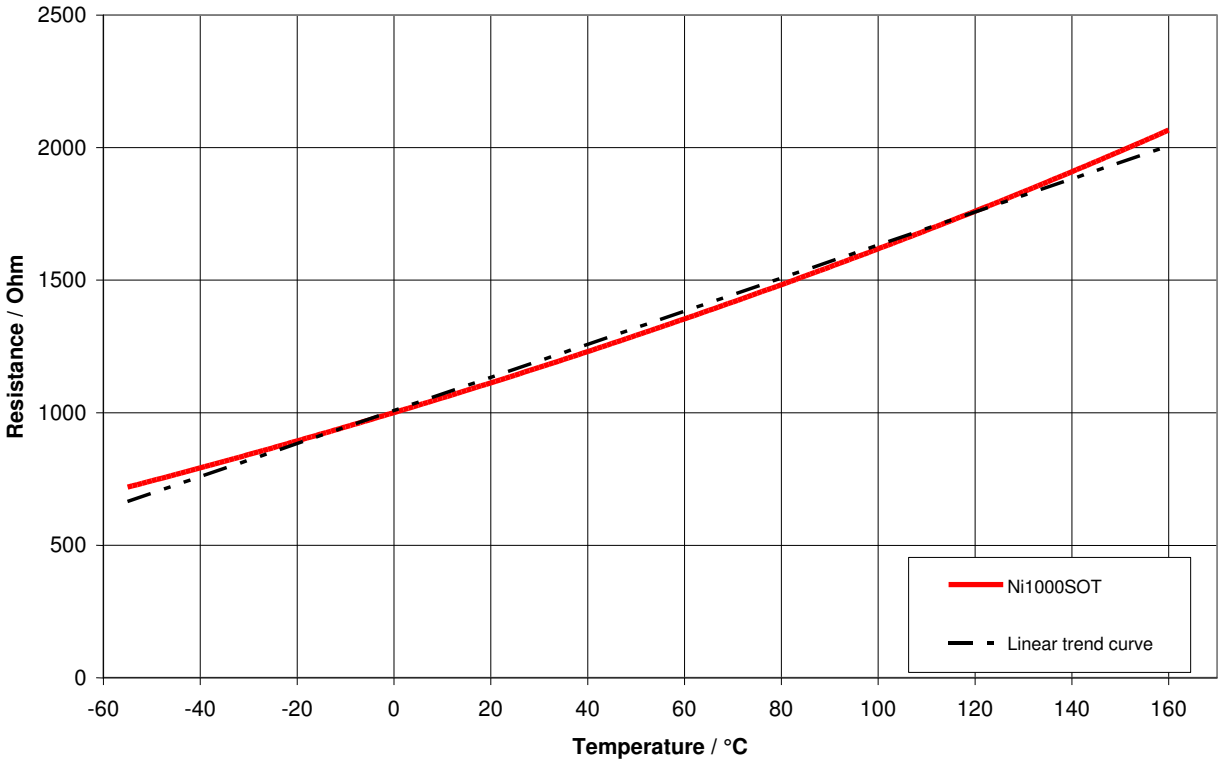


Figure 7: Resistance characteristics

6.2 Resistance table:

Temperature (°C) against Resistance (Ohm).

T(°C)	0	1	2	3	4	5	6	7	8	9
-60	695.2	699.9	704.6	709.3	714.0	718.7	723.4	728.2	733.0	737.8
-50	742.6	747.4	752.2	757.0	761.9	766.8	771.6	776.5	781.4	786.4
-40	791.3	796.3	801.2	806.2	811.2	816.2	821.2	826.3	831.3	836.4
-30	841.5	846.5	851.7	856.8	861.9	867.0	872.2	877.4	882.6	887.8
-20	893.0	898.2	903.4	908.7	913.9	919.2	924.5	929.8	935.1	940.5
-10	945.8	951.2	956.5	961.9	967.3	972.7	978.2	983.6	989.1	994.5
0	1000.0	1005.5	1011.0	1016.5	1022.0	1027.6	1033.1	1038.7	1044.3	1049.9
10	1055.5	1061.1	1066.8	1072.4	1078.1	1083.8	1089.5	1095.2	1100.9	1106.6
20	1112.4	1118.1	1123.9	1129.7	1135.5	1141.3	1147.1	1153.0	1158.8	1164.7
30	1170.6	1176.5	1182.4	1188.3	1194.2	1200.2	1206.1	1212.1	1218.1	1224.1
40	1230.1	1236.1	1242.2	1248.2	1254.3	1260.4	1266.5	1272.6	1278.8	1284.9
50	1291.1	1297.2	1303.4	1309.6	1315.8	1322.0	1328.3	1334.5	1340.8	1347.1
60	1353.4	1359.7	1366.0	1372.4	1378.7	1385.1	1391.5	1397.9	1404.3	1410.8
70	1417.2	1423.7	1430.1	1436.6	1443.1	1449.7	1456.2	1462.8	1469.3	1475.9
80	1482.5	1489.1	1495.7	1502.4	1509.1	1515.7	1522.4	1529.1	1535.9	1542.6
90	1549.3	1556.1	1562.9	1569.7	1576.5	1583.4	1590.2	1597.1	1604.0	1610.9
100	1617.8	1624.7	1631.7	1638.6	1645.6	1652.6	1659.6	1666.7	1673.7	1680.8
110	1687.9	1695.0	1702.1	1709.3	1716.4	1723.6	1730.8	1738.0	1745.2	1752.5
120	1759.7	1767.0	1774.3	1781.6	1788.9	1796.3	1803.7	1811.1	1818.5	1825.9
130	1833.3	1840.8	1848.3	1855.8	1863.3	1870.9	1878.4	1886.0	1893.6	1901.2
140	1908.9	1916.5	1924.2	1931.9	1939.6	1947.4	1955.1	1962.9	1970.7	1978.5
150	1986.3	1994.2	2002.1	2010.0	2017.9	2025.9	2033.8	2041.8	2049.8	2057.8
160	2065.9									

6.3 Electric Production tests.

100% test: Each sensor die is checked for correct resistance value related to ambient temperature before dicing and packaging. Every packaged sensor is checked for correct bond wire connection and insulation between Pin1+2 against Pin 3.

Sample test: From each reel a specified quantity of sensors are tested for correct resistance and TCR at 0°C and 100°C. The quantity is defined as follows:

10000 Sensors per reel: 34 Samples

7 Lifetime- and requalification tests

7.1 Qualification

Before start of production sensors of the pre-series lot will be tested as shown in the table below.

No	Test	Test Conditions	Duration / Number of cycles	Pieces		Allowed Resistance Drift
				(n)	(c)	
1	High temperature storage CECC 50000	160°C, Medium: Air Operation mode: I_F=1.5mA	1008h	50	0	0.32%
2	Thermal shock test IEC 60068-2-14, Test N	-55°C / +160°C, 15min dwell after reaching temperature, Transfer time: < 10sec., Medium: Air Operation mode: not powered, not wired	1000	50	0	0.1%
3	Damp heat operation storage CECC 50000	85°C / 85% r. h., Medium: Air Operation mode: I_F=1.5mA	1008h	50	0	0.1%
4	Low temperature life time test IEC 60068-2-1	-55°C, Medium: Air Operation mode: I_F=5mA/0mA, alternating operation, period: 2h	1008h	50	0	0.1%
5*)	High temperature storage in oil	750 h at (150 ± 2)°C in engine oil (Castrol 5W-30) with VT = 3,3 V 24 h at (165 ± 2)°C in engine oil (Castrol 5W-30) 750 h at (150 ± 2)°C in engine oil (Castrol 5W-30) with VT = 3,3 V Resistances and operating current values are logged during complete test procedure.	1524h	100	0	0.21%
6*)	Soldering heat resistivity / solderability 50 pcs Ni1000-temperature sensors 735 628-01 soldered on PCB Gr. 420 547-00 of PULS 6PR 009 629-00, assembled at HFK with selective soldering process	Selective soldering process at HFK: Temperature of bath: 297°C, holding time: 1 sec 90% wetting of pins	1x	50	0	0.1%
7*)	Soldering heat resistivity / solderability 50 pcs Ni1000-temperature sensors 735 628-01 soldered on PCB 734 634-00 of TOG 6PR 008 134-01, assembled at Tectron with reflow-soldering	Reflow soldering at Tectron: Soldering temp.: 250°C, Holding time: 03min:40sek 90% wetting of pins	1x	50	0	0.1%

*) Test implementation is done by HFK. Measurement of samples before and after testing is performed by TE Connectivity Sensors Germany GmbH.

All electrical and visual changes after test will be documented and provided to the customer.

7.2 Requalification

A requalification has to be ordered by the customer separately and won't be performed by TE periodically. The required amount of parts will be provided by TE Connectivity Sensors Germany GmbH free of charge, any additional service has to be paid by the customer.

7.3 Material tests

All materials used in the process will be released by checking the corresponding supplier certificates. A regular material analysis from an independent laboratory is not scheduled.

8 Delivery Form

The sensor will be delivered in tape and reel package.
Reel diameter: 13 inch (330mm): 10000 pieces per reel

8.1 Dimensions of reel

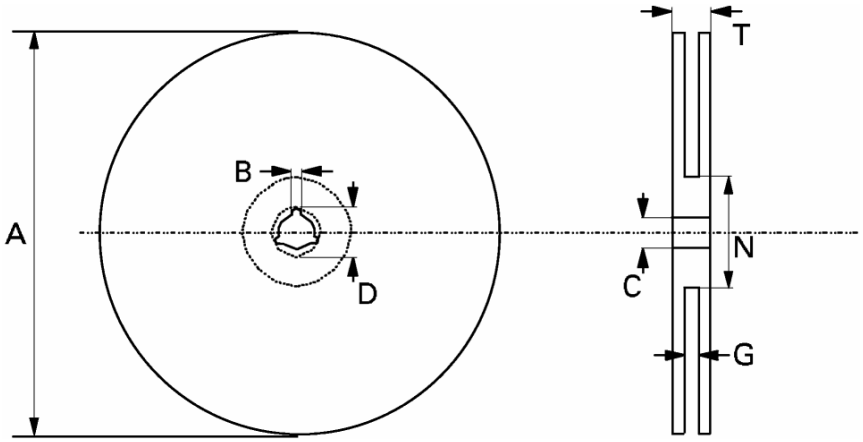
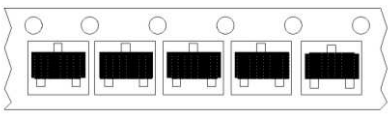


Figure 8: Reel

Dimension	Min	Typ	Max	Unit
A	-	-	330 (13”)	mm
B	1.5	-	-	mm
C	12.8	13	13.2	mm
D	20.2	-	-	mm
N	60.5	62	63.5	mm
G	6.9	8.4 ± 1.5	9.9	mm
T	-	-	14.4	mm

8.2 Orientation of sensors inside tape

Package	Orientation diagrams	Reel size supplied	No. of components	Tape option indicator
SOT 23		13” (330 mm)	10,000	TC
Ordering Information: The tape indicator option is added to the requested device type as a suffix i.e. SOT23 FMMT49 TC				

8.3 Dimension of tape

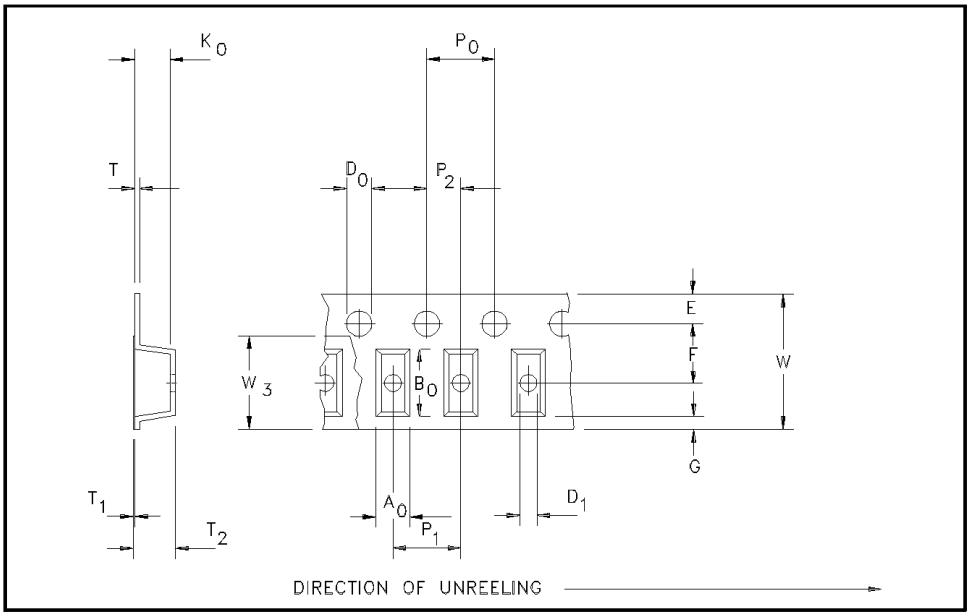


Figure 9: Tape

Dimension	Min	Typ	Max	Unit
Tape Size	-	8	-	mm
A0	-	3.2	-	mm
B0	-	4	-	mm
K0	-	-	2.4	mm
D0	1.45	1.5	1.55	mm
D1	-	1.5	-	mm
E	1.65	1.75	1.85	mm
F	3.495	3.5	3.505	mm
G	-	0.75	-	mm
P0	3.9	4	4.1	mm
P1	-	4	-	mm
P2	1.95	2	2.05	mm
T	-	0.3	0.3	mm
T1	-	0.1	0.1	mm
T2	-	2.5	2.5	mm
W	7.7	8	8.3	mm
W3	-	5.5	-	mm

9 REACh and RoHS conformity

All used substances comply with EC directive 1907/2006 (Registration, Evaluation and Authorisation of Chemicals, REACh) and with EC directive 2002/95/EC (Restriction of Hazardous Substances Directive, RoHS).