Specification Ni1000SOT NO TIN

Revision 1.1

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	Description of changes	Editor
1.0	23.01.2017	• Finalization to first release	ToS
1.1	7.02.2017	• Applying documents: update revision of WP-TS-305 • Chapter 2.2: Changing R2_max from 0.3 to 0.5 mm	ToS

Applying Documents

#	Document title	Revision	Owner	Description
1	WP-TS-305 Delivery Specification for SOT223, SOT23, E-Line and SOT4W Packaged Products	7.0	TE Connectivity Sensors Germany GmbH	
2				
3				
4				
5				
6				
7				
8				
9				

1 General Information

Ni1000SOT NO TIN 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 free for laser welding assembly process.

1.1 Applications

Temperature sensing, control and compensation in automotive applications

1.2 Functional Block Diagram

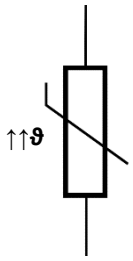


Figure 1: Wiring symbol

1.3 Part Number

Device	Part No.	Package
Ni1000SOT NO TIN	G-NICO-024	SOT23, leadframe material: Alloy 42, no tin coating

Customer Specific Part Number: 735.628-02

1.4 ESD

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

2 Mechanic

2.1 Views

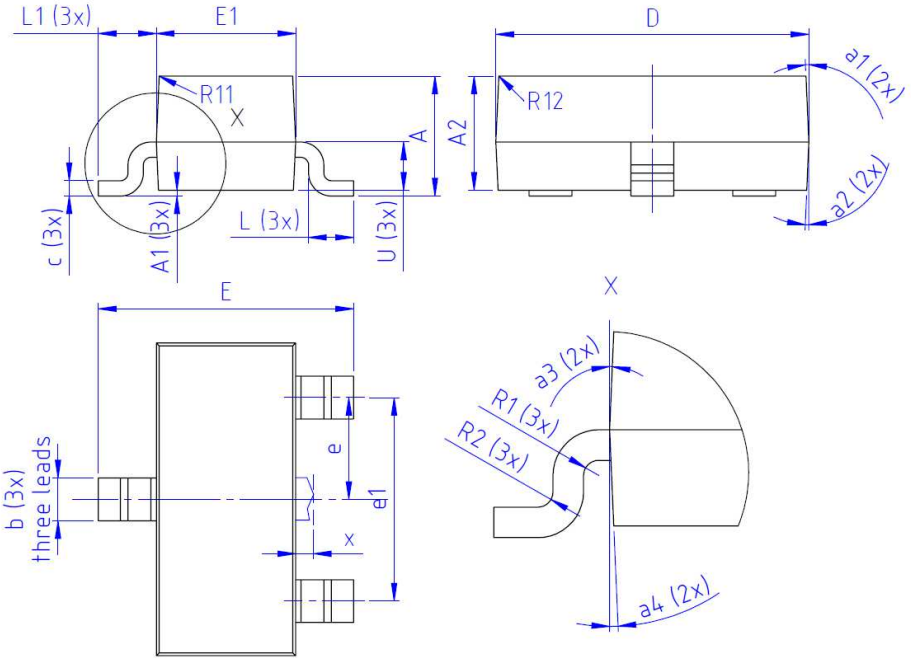


Figure 2: mechanical outline

2.2 Dimensions and Weight

Dimension	Min	Typ	Max	Unit
A	0.91	1.00	1.10	mm
A1	0.01	0.05	0.10	mm
A2	0.90	0.95	1.00	mm
b	0.35	0.40	0.45	mm
c	0.08	0.10	0.12	mm
D	2.94	3.00	3.06	mm
e	0.90	0.95	1.00	mm
E	2.23	2.42	2.64	mm
E1	1.33	1.38	1.43	mm
e1	1.85	1.90	1.95	mm
L	0.32	0.40	0.48	mm
L1	0.45	0.52	0.62	mm
R1	0.03	0.10	0.30	mm
R2	0.05	0.15	0.50	mm
R11	0.00	0.00	0.05	mm
R12	0.00	0.01	0.05	mm
U	0.34	0.39	0.44	mm
X	0.00	0.10	0.25	mm
a1	0	7	14	°
a2	0	7	14	°
a3	0	7	14	°
a4	0	7	14	°

Nominal weight: 8mg per sensor

2.3 Mechanical Requirements

2.3.1 Die Attach and Wire Bond Scheme:

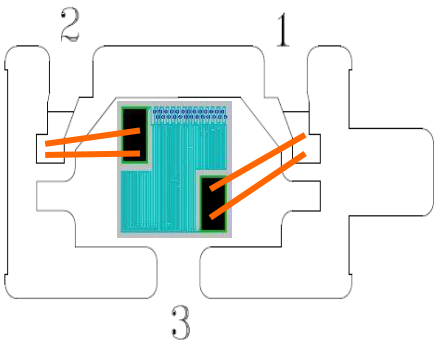


Figure 3: Die attach and wire bond scheme

2.3.2 Footprint

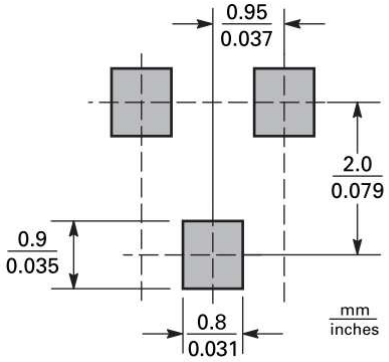
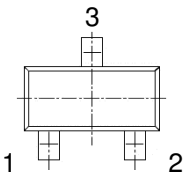


Figure 4: Footprint

2.4 Terminal Connections

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

3 Materials

IMDS ID:	608197877
Die:	Silicon wafer with structured thin film layer of Nickel, Titanium, Tungsten and Gold
Leadframe base material:	Alloy 42, thickness 1000µm (nominal)
Leadframe coating:	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:	**2**
Second and third digit:	Revision of sensor:	**01**
Resulting marking:	**201**	

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:

Parameter	Description	Note
Label size	100 x 50 mm²	
Barcode	Type 39	
Part	NI1000SOT NO TIN	
P/N:	G-NICO-024	
QTY:	Quantity Reel	10000 pcs.
D/C:	Max. 2 Date Codes per Reel	YYWW
Batch:	TE SENSORS Lot number	
Lot No	Max. 2 Lots per Reel	
QTY:	Quantity lot	
Position for the label:	Reel and Pizza-box	

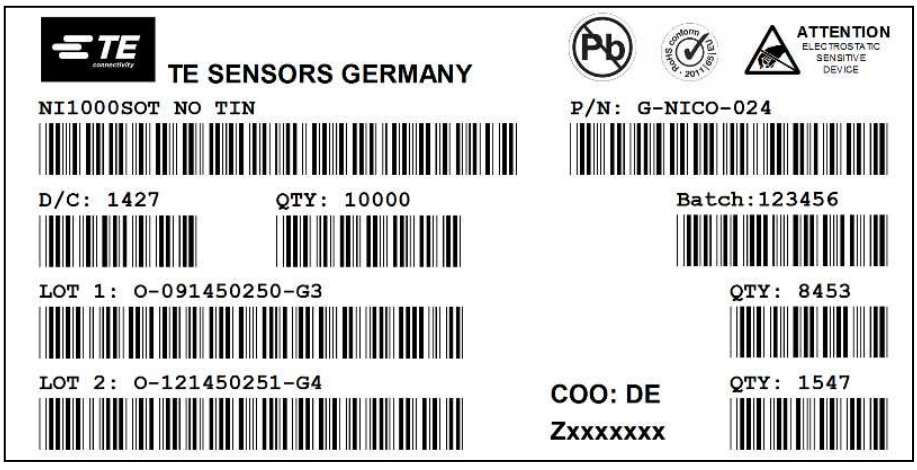


Figure 5 – Label 1

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

Parameter	Description	Note
Label size	100 x 50 mm²	
Barcode	Type 39	
Supplier:	TE SENSORS	
TE SENSORS PO No:	Order number TE SENSORS	
QTY:	Quantity Reel	10000 pcs.
Device:	NI1000SOT NO TIN	
P/N:	G-NICO-024	Item number TE SENSORS
Item:	735628-2	Item number end customer
D/C:	Max. 2 Date Codes per Reel	YYWW
Position for the label:	Pizza-box	

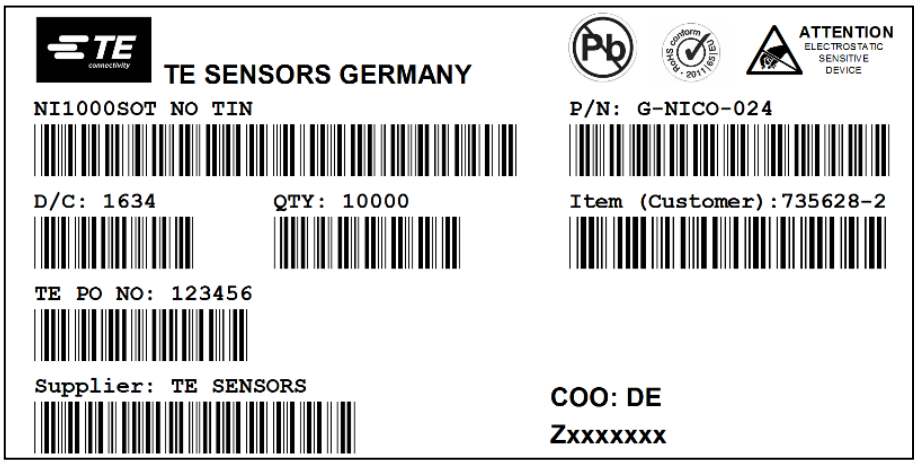


Figure 6 – Label 2

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	---
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: $\Delta T = \pm (0.8 + 0.0045 * \lvert T \rvert)$ in the range of 0 to 160°C $\Delta T = \pm (0.8 + 0.021 * \lvert T \rvert)$ in the range of -55 to 0°C Self heating of sensor: $\Delta T = P/SH$ with electric power $P = R*I^2$ and selfheating coefficient $SH = (1.7 \pm 0.3)$ $^{mW}/_{°C}$ (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)

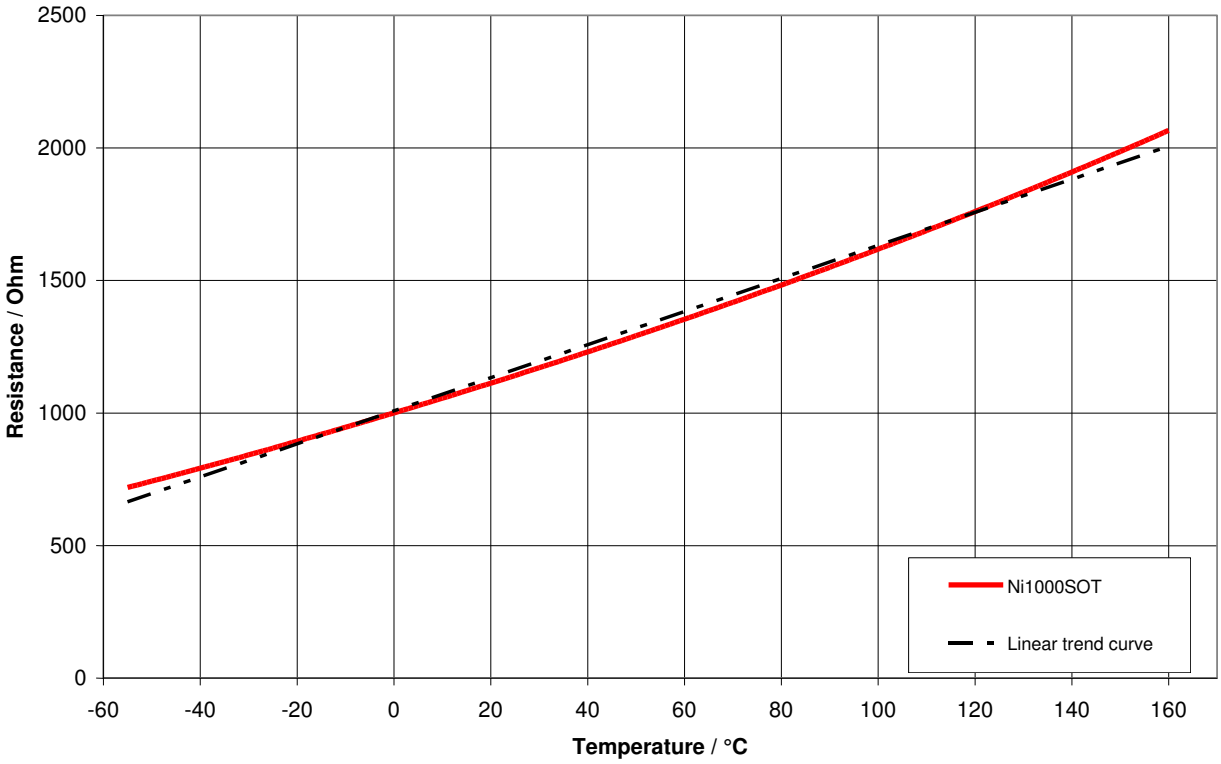


Figure 7: Resistance characteristics

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 Electrical 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 Qualification 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 life time test IEC 60068-2-2	First step: 1638h @ 150°C, Second step: 200h @ 165°C, Medium: Air Operation mode: I_F=1.5mA,	1838h	77	0	0.32%
2	Thermal shock test IEC 60068-2-14, Test Na	-40°C / +150°C, 15min dwell after reaching temperature, Transfer time: < 30sec., Medium: Air Operation mode: not powered, not wired	2000	77	0	0.1%
3	Damp heat cyclic (with frost) IEC 60068-2-38	Operation mode: not powered, not wired	240h	77	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	77	0	0.1%
5	Physical dimensions test	According to AEC-Q200 – see remarks below for conditions and quantity	---	50 + 640	0	---
6	ESD Test	According to AEC-Q200 (HBM)	---	15	0	0.1%

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

Remarks to test 5:

To verify dimensions of all molding cavities the following process steps have to be done:

Verifying trim & form process (5x2 Tool): 5 values each of every specified dimension (A, D, E1, L1, L, c, b, E, A1) 50 parts in total.

Cavity measurements: values of specified dimensions D and E1 for all 640 cavities. Due to separation process there will be no correlation between cavity and value, it will be guaranteed that every cavity will be measured.

7.2 Additional Tests

The following tests will be performed additionally in collaboration with customer. Results of these tests will be part of the test result report but they are not included into internal qualification process and not part of product specification.

No	Test	Test Conditions	Duration / Number of cycles	Pieces
1	Laser welding and injection molding thermal stability / ability analysis a): RTD laser welded on customer leadframe (50 parts) b): Laser welded RTD injection-molded to customer flange group (25 parts of 50 parts from a))	Before laser welding (50 parts): A1. Initial function test (measure value of resistance) A2. Delamination check of 10 parts with the aid of a scanning ultrasonic microscope After laser welding (25 parts): B1. Initial function test (measure value of resistance) B2. X-ray investigation of all parts B3. Delamination check of 10 parts (same 10 parts of A2) with the aid of a scanning ultrasonic microscope After laser welding and injection moulding (25 parts): C1. Initial function test (measure value of resistance) C2. X-ray investigation of all parts C3. Random sample size of 5 parts shall be investigated by 3D-RX Tomography C4. Same 5 parts shall be opened by chemical agent (decapsulation) C5. Same 5 parts visual evaluation of bonding connections by microscope	1x	50
2	Laser welding preconditioning Test: - High temperature storage (7 parts) CECC 50000 - Temperature moisture (7 parts) CECC50000 - RTD laser welded on customer leadframe	Before laser welding (preconditioning): High temperature storage test: 165°C, medium: air, non operating Temperature moisture storage: 85°C / 85% r.h., non operating After laser welding (investigation): EDX topographically analysis and metallographically investigation (micro cross sections) – investigation performed by customer	HTS: 1008h TMS: 1008h	14

7.3 Requalification

A requalification has to be ordered by the customer separately and won't be performed by TE Connectivity 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.

7.4 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

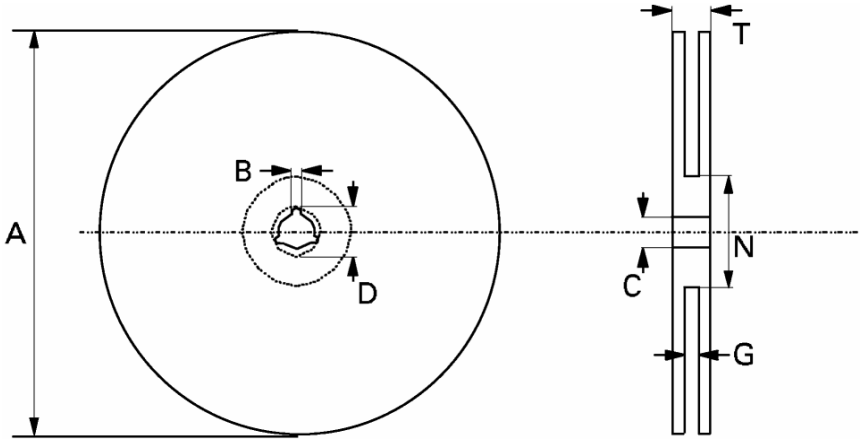
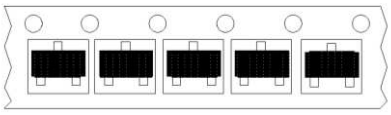


Figure 8: Reel

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

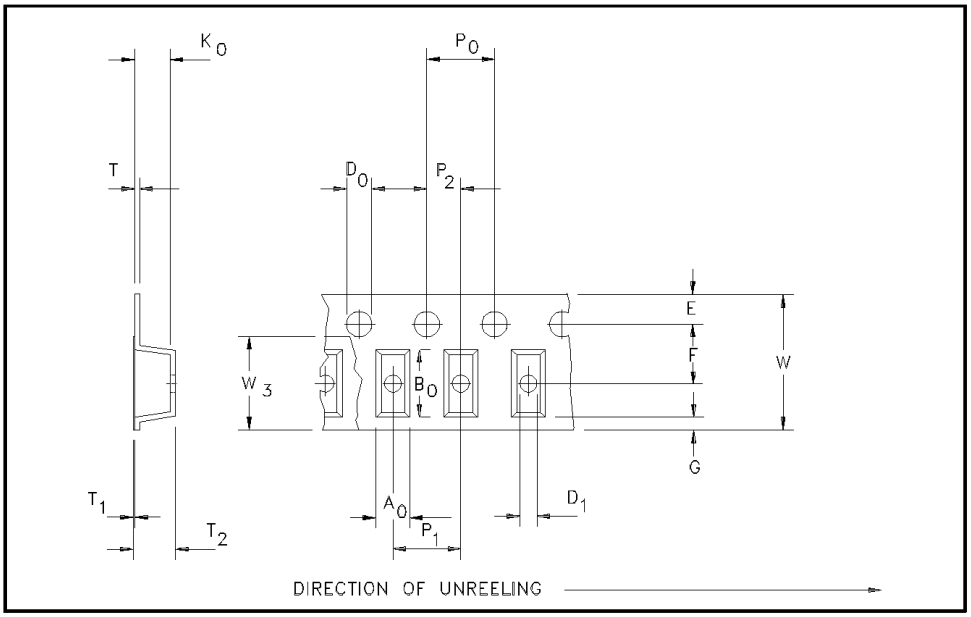


Figure 9: Tape

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