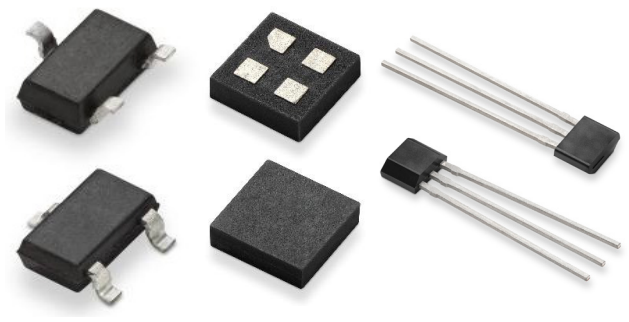
TMR Omnipolar Push Pull Switch Sensor

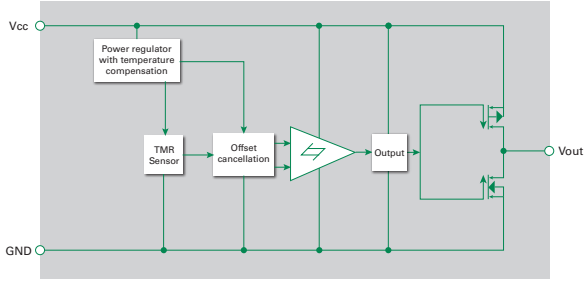
X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

RoHS

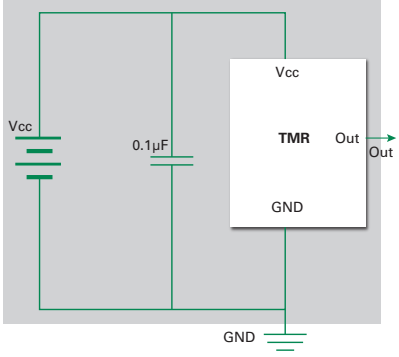


SOT-23-3 LGA-4 TO-92

Functional Block Diagram



TMR Switch Typical Applications Circuit



Note: It is strongly recommended that an external bypass capacitor be connected in-close- proximity to the device between the supply and ground pins to reduce noise. The recommended value for the external bypass capacitor is 0.1µF.

Description

The TX00 TMR Switch family are digital omnipolar magnetic switches that integrate TMR and CMOS technology in order to provide a magnetically triggered digital switch with high sensitivity, high speed, and low power consumption.

They contain a TMR magnetic sensor and CMOS signal processing circuitry within the same package, including an on-chip TMR voltage generator for precise magnetic sensing, a TMR voltage amplifier and comparator plus a Schmitt trigger to provide switching hysteresis for noise rejection, CMOS push-pull output and X axis sensing direction.

An internal band gap regulator is used to provide a temperature compensated supply voltage for internal circuits, permitting a wide range of supply voltages. It operates at low power with fast response, accurate switching points, excellent thermal stability, and immunity to stray field interference. The output of the TX00 switches low (turns on) when the magnetic field parallel to the sensing axis exceeds the operate point threshold, BOP. When the magnetic field is reduced below the release point BRP device output switches high (turns off). The difference between the BOP and the BRP is the hysteresis BH of the device.

Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology
- Low power consumption
- X axis sensing direction
- Operation with North and South Pole
- High Tolerance to External Magnetic Field Interference
- Low Switching Points for High Sensitivity
- Excellent Thermal Stability
- Available in SOT-23-3, LGA-4, TO-92 packages

Applications

- Proximity Switches
- Utility Meters including Gas, Water and Heat Meters
- Speed Sensing
- Low power applications
- Medical devices
- IoT devices

Output Behavior Versus Magnetic Pole

Parameter	Test Conditions	Output (volts)
South Pole	$B > B_{OPS}$	Low (On)
North Pole	$0 > B > B_{RPS}$	High (Off)

Note:
The output is "High" when power is turned on under zero magnetic field.
When a S Pole approaches the pin 1 side, Vout will transition to Low.
When a N Pole approaches the pin 1 side, Vout will transition to High.

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TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

Product Configuration Guide

Series	Series	Package	Packing Method	B_{OP} (G)	B_{REL} (G)	F (Hz)	V_{CC} Min. (V)	V_{CC} Max. (V)	T_A Range (°C)	T_{STG} Range (°C)
[1]TX00AL409TRA	Nanoampere	LGA-4	Tape & Reel	9	6	50	1.8	5.5	-40 ~ 85	-50 ~ 150
[1]TX00AL430TRA	Nanoampere	LGA-4	Tape & Reel	30	21	50	1.8	5.5	-40 ~ 85	-50 ~ 150
[1]TX00AS307TRA	Nanoampere	SOT-23-3	Tape & Reel	7	5	50	1.8	5.5	-40 ~ 125	-50 ~ 150
[2]TX00AS314TRA	Microamp High Frequency	SOT-23-3	Tape & Reel	14	10	1000	2.8	5.5	-40 ~ 125	-50 ~ 150
[1]TX00AS317TRA	Microamp High Frequency	SOT-23-3	Tape & Reel	17	12	50	1.8	5.5	-40 ~ 125	-50 ~ 150
[2]TX00AT314TRA	Microamp High Frequency	TO-92	Tape & Reel	14	10	1000	2.8	5.5	-40 ~ 125	-50 ~ 150
[1]TX00BS317TRA	Nanoampere	SOT-23-3	Tape & Reel	17	12	1000	1.8	5.5	-40 ~ 125	-50 ~ 150

[1] Country of origin: China
[2] Country of origin: South Korea

TX00AL409TRA - Absolute Maximum Rating

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Values	Unit
B	Magnetic Flux Density	3000	G
V_{ESD}	ESD Level (HBM)	8	kV
T_A	Operating Temperature	-40 ~ 85	°C
T_{STG}	Storage Temperature	-50 ~ 150	°C
T_J	Junction Temperature	150	°C
T_R	Reflow Soldering Temperature	260	°C

Note: Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

TX00AL409TRA - Electrical & Magnetic Characteristics

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Min.	Typ.	Max.	Unit	Conditions
V_{CC}	Supply Voltage	1.8	5.0	5.5	V	Operating
V_{OH}	Output High Voltage	V_{CC} - 0.1	V_{CC} - 0.005	V_{CC}	V	I_{OUT} at 1mA
V_{OL}	Output Low Voltage	0	0.015	0.1	V	I_{OUT} at 1mA
I_{CC}	Supply Current	-	160	-	µA	Output Open
F	Frequency	-	50	-	Hz	
B_{OP}	Operation Point	6	9	12	G	
B_{RP}	Release Point	3	6	9	G	
B_H	Hysteresis	-	3	-	G	

TX00AL430TRA - Absolute Maximum Ratings

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Values	Unit
B	Magnetic Flux Density	3000	G
V_{ESD}	ESD Level (HBM)	8	kV
T_A	Operating Temperature	-40 ~ 85	°C
T_{STG}	Storage Temperature	-50 ~ 150	°C
T_J	Junction Temperature	150	°C
T_R	Reflow Soldering Temperature	260	°C

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TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

TX00AL430TRA - Electrical & Magnetic Characteristics

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Min.	Typ.	Max.	Unit	Conditions
V_{CC}	Supply Voltage	1.8	5.0	5.5	V	Operating
V_{OH}	Output High Voltage	V_{CC} - 0.1	V_{CC} - 0.005	V_{CC}	V	I_{OUT} at 1mA
V_{OL}	Output Low Voltage	0	0.015	0.1	V	I_{OUT} at 1mA
I_{CC}	Supply Current	-	160	-	µA	Output Open
F	Frequency	-	50	-	Hz	
B_{OP}	Operation Point	28	30	36	G	
B_{RP}	Release Point	16	21	26	G	
B_H	Hysteresis	-	9	-	G	

TX00AS307TRA - Absolute Maximum Ratings

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Values	Unit
V_{CC}	Supply Voltage	7.0	V
V_{RCC}	Reverse Supply Voltage	0.3	V
B	Magnetic Flux Density	4000	G
V_{ESD}	ESD Level (HBM)	4	kV
T_A	Operating Temperature	-40 ~125	°C
T_{SRG}	Storage Temperature	-50 ~150	°C
$I_{OUTSINK}$	Output Current	9.0	mA

Note: Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

TX00AS307TRA - Electrical & Magnetic Characteristics (@TA = +25°C, Vcc = 3.0V)

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Min.	Typ.	Max.	Unit	Conditions
V_{CC}	Supply Voltage	1.8	3.0	5.5	V	Operating
V_{OH}	Output High Voltage	V_{CC} - 0.3	-	V_{CC}	V	
V_{OL}	Output Low Voltage	0	-	0.2	V	
I_{CC}	Supply Current	-	200	-	nA	Output Open
F	Frequency	-	50	-	Hz	
B_{OP}	Operation Point	-	7	-	G	
B_{RP}	Release Point	-	5	-	G	
B_H	Hysteresis	-	2	-	G	

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TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

TX00AS314TRA/TX00AT314TRA - Absolute Maximum Ratings

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Values	Unit
V_{CC}	Supply Voltage	7.0	V
V_{RCC}	Reverse Supply Voltage	0.3	V
B	Magnetic Flux Density	4000	G
V_{ESD}	ESD Level (HBM)	4	kV
T_A	Operating Temperature	-40 ~125	°C
T_{SRG}	Storage Temperature	-50 ~150	°C
$I_{OUTSINK}$	Output Current	9.0	mA

Note: Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

TX00AS314TRA/TX00AT314TRA - Electrical & Magnetic Characteristics

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Min.	Typ.	Max.	Unit	Conditions
V_{CC}	Supply Voltage	2.8	3.0	5.5	V	Operating
V_{OH}	Output High Voltage	V_{CC} - 0.2	-	V_{CC}	V	
V_{OL}	Output Low Voltage	0	-	0.2	V	
I_{CC}	Supply Current	0.5	1.5	2	nA	Output Open
F	Frequency	-	1000	-	Hz	
B_{OP}	Operation Point	10.5	14	17.5	G	
B_{RP}	Release Point	8.4	-	14	G	
B_H	Hysteresis	-	3	-	G	

TX00AS317TRA - Absolute Maximum Ratings

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Values	Unit
V_{CC}	Supply Voltage	7.0	V
V_{RCC}	Reverse Supply Voltage	0.3	V
B	Magnetic Flux Density	4000	G
V_{ESD}	ESD Level (HBM)	4	kV
T_A	Operating Temperature	-40 ~125	°C
T_{SRG}	Storage Temperature	-50 ~150	°C
$I_{OUTSINK}$	Output Current	9.0	mA

Note: Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

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TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

TX00AS317TRA - Electrical & Magnetic Characteristics

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Min.	Typ.	Max.	Unit	Conditions
V_{CC}	Supply Voltage	1.8	3.0	5.5	V	Operating
V_{OH}	Output High Voltage	V_{CC} - 0.3	-	V_{CC}	V	
V_{OL}	Output Low Voltage	0	-	0.2	V	
I_{CC}	Supply Current	0.5	1.5	2.0	nA	Output Open
F	Frequency	-	1.0	-	Hz	
B_{OP}	Operation Point	10	17	25	G	
B_{RP}	Release Point	5	10	20	G	
B_H	Hysteresis	-	7	-	G	

TX00BS317TRA - Absolute Maximum Ratings

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Values	Unit
V_{CC}	Supply Voltage	7.0	V
V_{RCC}	Reverse Supply Voltage	0.3	V
B	Magnetic Flux Density	4000	G
V_{ESD}	ESD Level (HBM)	4	kV
T_A	Operating Temperature	-40 ~125	°C
T_{SRG}	Storage Temperature	-50 ~150	°C
$I_{OUTSINK}$	Output Current	9.0	mA

Note: Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

TX00BS317TRA - Electrical & Magnetic Characteristics

Ratings specified at T_A = +25°C, V_{CC} = 3.0V

Symbol	Characteristics	Min.	Typ.	Max.	Unit	Conditions
V_{CC}	Supply Voltage	1.8	3.0	5.5	V	Operating
V_{OH}	Output High Voltage	V_{CC} - 0.3	-	V_{CC}	V	
V_{OL}	Output Low Voltage	0	-	0.2	V	
I_{CC}	Supply Current	-	200	-	nA	Output Open
F	Frequency	-	50	-	Hz	
B_{OP}	Operation Point	-	17	-	G	
B_{RP}	Release Point	-	12	-	G	
B_H	Hysteresis	-	5	-	G	

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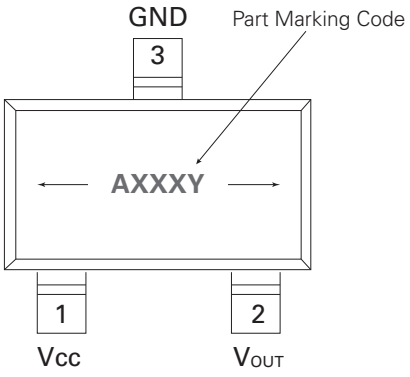
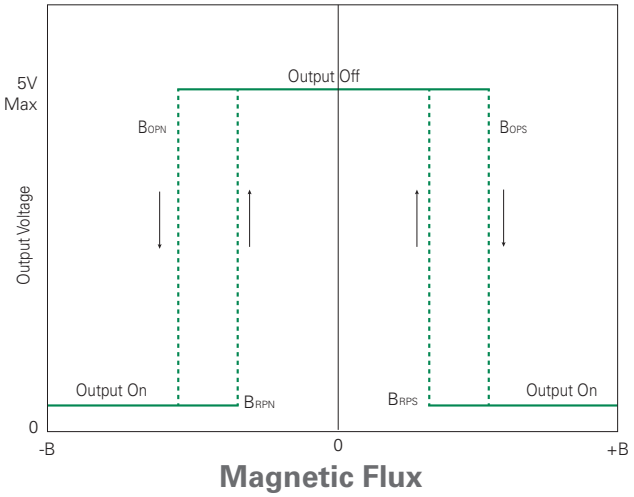
TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

Pin Configuration and Sensing Direction of Magnetic Field

SOT-23-3

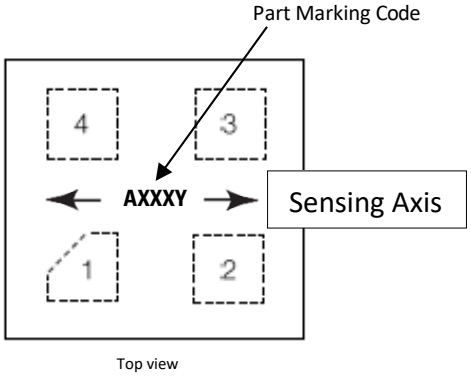




Part Marking Code:
Axxxy: A = TX00AS317TRA; xxx = Julian manufactured date; y = manufactured year Moisture Sensitivity Level: Rating is 3 Pick and Place Nozzle: Samsung CN140 or equivalent

Pin Name	Pin No. SOT-23-3	Pin Function
V_{CC}	1	Supply Voltage
V_{OUT}	2	Output
GND	3	Ground

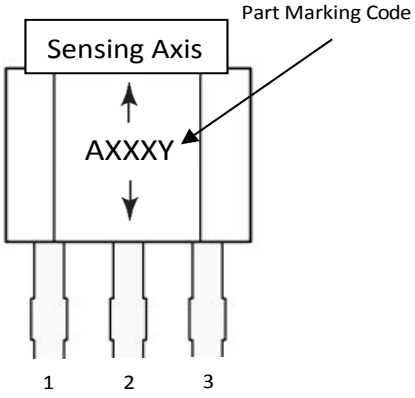
LGA-4



Part Marking Code:
AXXXY: A = TX00AL409XXX; xxx = Julian manufactured date; y = manufactured year Moisture Sensitivity Level: Rating is 3 Pick and Place Nozzle: Samsung CN140 or equivalent

Pin Name	Pin No. LGA-4	Pin Function
NC	1	Not Connected
V_{CC}	2	Supply Voltage
V_{OUT}	3	Output
GND	4	Ground

TO-92



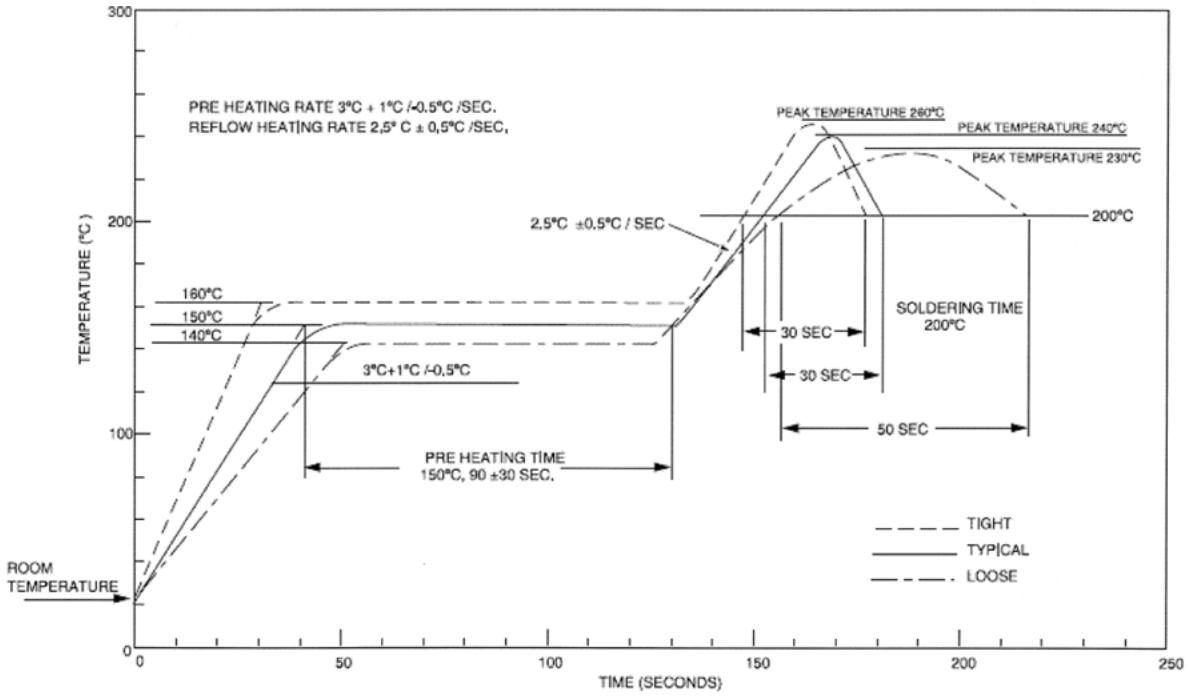
Part Marking Code:
Axxxy; A = TX00AT317TRA, xxx = Julian manufactured date; y = manufactured year Moisture Sensitivity Level: Rating is 3 Pick and Place Nozzle: Samsung CN140 or equivalent

Pin Name	Pin No. TO-92	Pin Function
V_{OUT}	1	Output
GND	2	Ground
V_{CC}	3	Supply Voltage

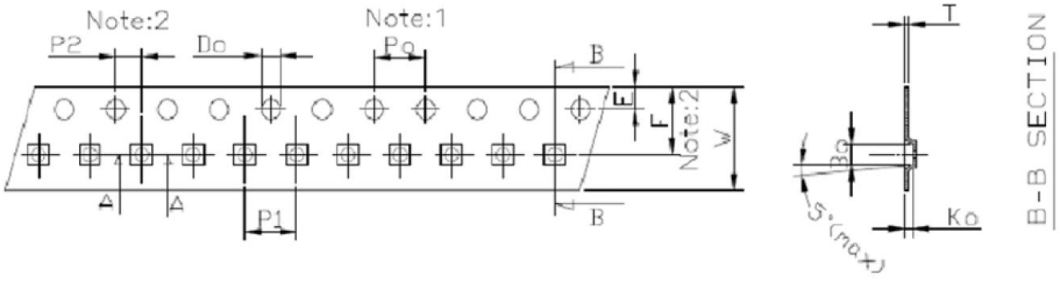
TMR Omnipolar Push Pull Switch Sensor

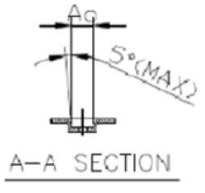
X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

Soldering Profile for Lead-free packages



Tape and Reel LGA-4





Ao= 1.65±0.05 mm

Bo= 1.65±0.05 mm

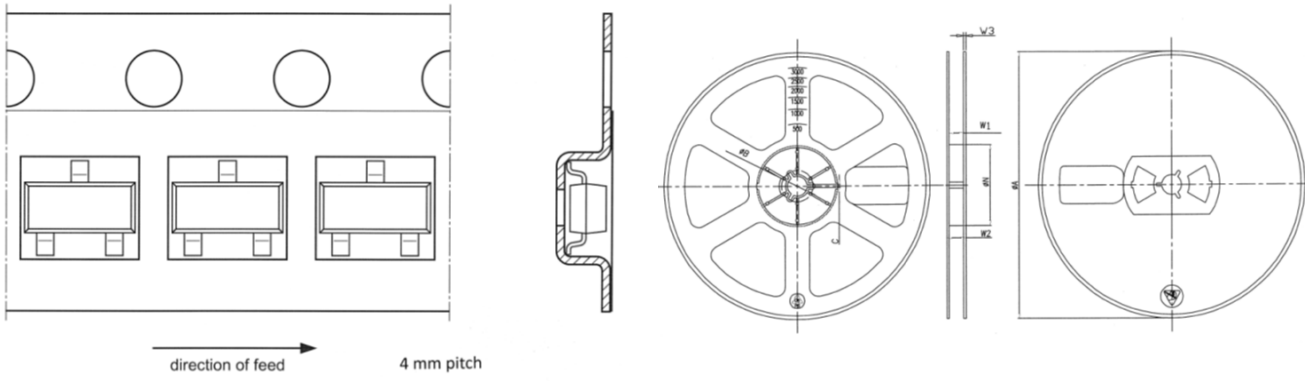
Ko= 0.65±0.05 mm

Po	P1	P2	Do	D1	E	F	W	T
4.00 ± 0.10mm	4.00 ± 0.10mm	2.00 ± 0.05mm	1.50 ± 0.10mm	1.10 ± 0.05mm	1.75 ± 0.10mm	3.50 ± 0.05mm	8.00 ± 0.20mm	0.25 ± 0.02mm

TMR Omnipolar Push Pull Switch Sensor

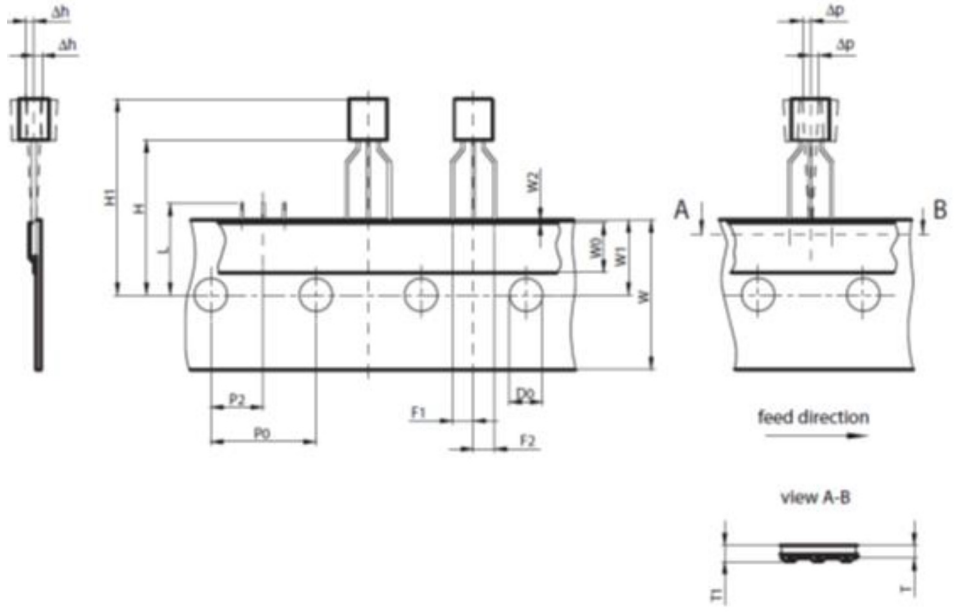
X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

Tape and Reel SOT-23-3



ØA	ØN	ØB	C	W1	W2	W3
178±2	54±2	13.2±0.3	2.2±0.3	8.4±1.5/0.0	12 MAX	1.4±0.4

Tape and Reel TO-92



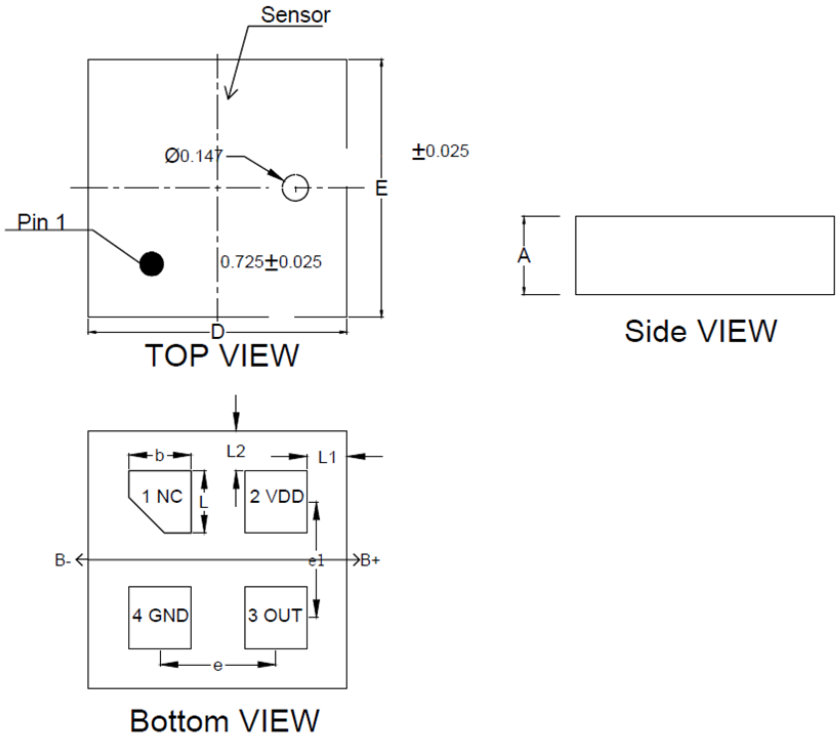
Unit	D0	F1	F2	Δh	L	P0	WP2	Δp
mm	4.00	2.54 ± 0.20	2.54 ± 0.20	± 1.0	11.0 max	12.7 ± 0.50	6.25 ± 0.80	± 1.0

T	T1	W	W0	W1	W2
0.5	0.9	18.0	6.0	9.0	0.3

TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

LGA-4 Package Information



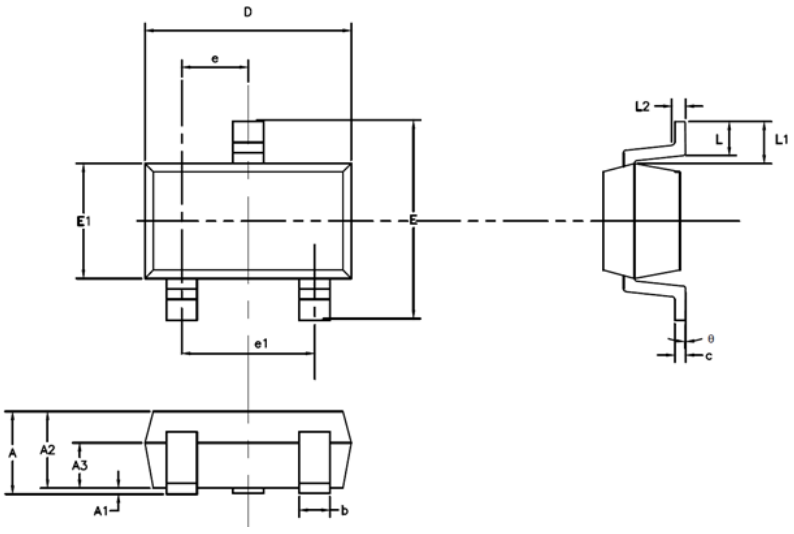
Remark：Lead Plating thickness >=1um (Pure Tin)

Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.386	-	0.486	0.015	-	0.019
D	1.40	-	1.50	0.055	-	0.059
E	1.40	-	1.50	0.055	-	0.059
b	0.30	-	0.40	0.012	-	0.016
L	0.30	-	0.40	0.012	-	0.016
L1	-	0.225 REF	-	-	0.009 REF	-
L2	-	0.225 REF	-	-	0.009 REF	-
e	-	0.650 REF	-	-	0.026 REF	-
e1	-	0.650 REF	-	-	0.026 REF	-

TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

SOT-23-3 Package Information



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	-	1.45	-	-	0.057
A1	0.00	-	0.15	0.000	-	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
A3	0.60	0.65	0.70	0.024	0.026	0.028
b	0.39	-	0.49	0.015	-	0.019
c	0.12	-	0.19	0.005	-	0.007
D	2.85	2.95	3.05	0.112	0.116	0.120
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.55	1.65	1.75	0.061	0.065	0.069
e	0.85	0.95	1.05	0.033	0.037	0.041
e1	1.80	1.90	2.00	0.071	0.075	0.079
L	0.35	0.45	0.60	0.014	0.018	0.024
L1		0.59REF			0.023REF	
L2		0.25BSC			0.01BSC	
Ø	0^0	-	8^0	0^0	-	8^0

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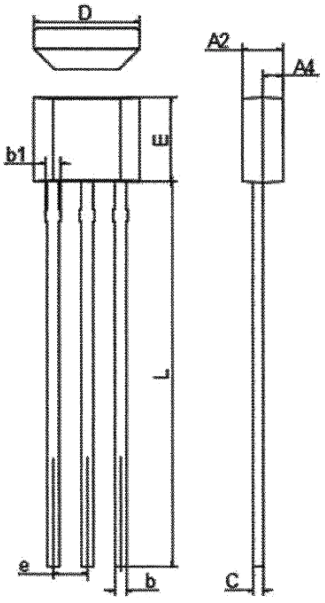
TMR Omnipolar Push Pull Switch Sensor

X-Axis Omnipolar TMR Switch Sensors
Position Sensing, TX00 Family

TO-92 Package Information



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min	Nom	Max	Min	Nom	Max
A2	1.40	1.50	1.60	0.055	0.059	0.063
A4	-	0.75	-	-	0.030	-
b	0.34	0.39	0.42	0.013	0.015	0.017
b1	0.40	0.46	0.50	0.016	0.018	0.020
C	0.37	0.40	0.42	0.015	0.016	0.017
D	3.90	4.10	4.20	0.154	0.161	0.165
E	2.90	3.05	3.30	0.114	0.120	0.130
e	-	1.27	-	-	0.05	-
L	14.00	14.50	15.00	0.551	0.571	0.590

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