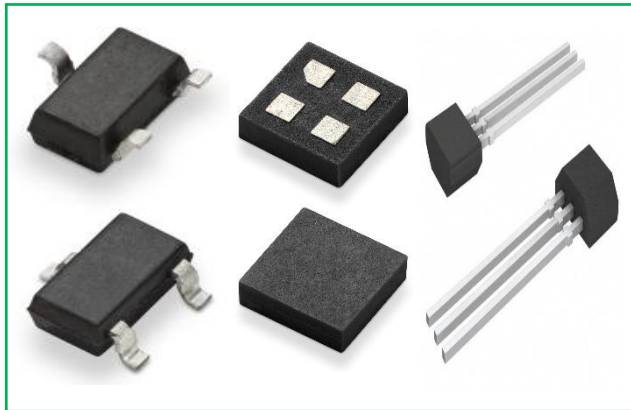


TMR Omnipolar Push Pull Switch Sensor

RoHS



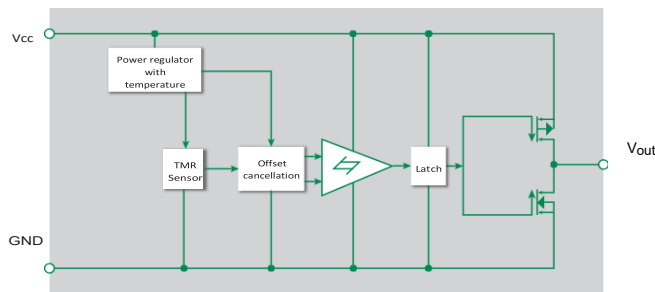
Description

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.

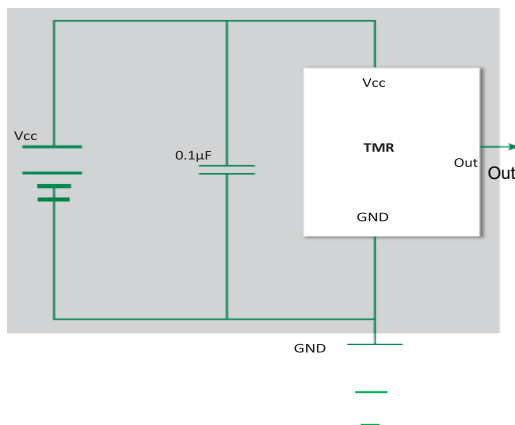
They contain a TMR magnetic sensor and CMOS signal processing circuitry within the same package, including an on-chip TMR voltage generator for precise magnetic sensing, a TMR voltage amplifier and comparator plus a Schmitt trigger to provide switching hysteresis for noise rejection, CMOS push-pull output 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, B_{OP} . When the magnetic field is reduced below the release point B_{RP} device output switches high (turns off). The difference between the B_{OP} and the B_{RP} is the hysteresis BH of the device.

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.

Features

- Tunneling Magnetoresistance (TMR) Technology
- Low power consumption
- X axis sensing direction
- Operation with North and South Pole
- High Tolerance to External Magnetic Field Interference

Benefits

- 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

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, V_{out} will transition to Low.

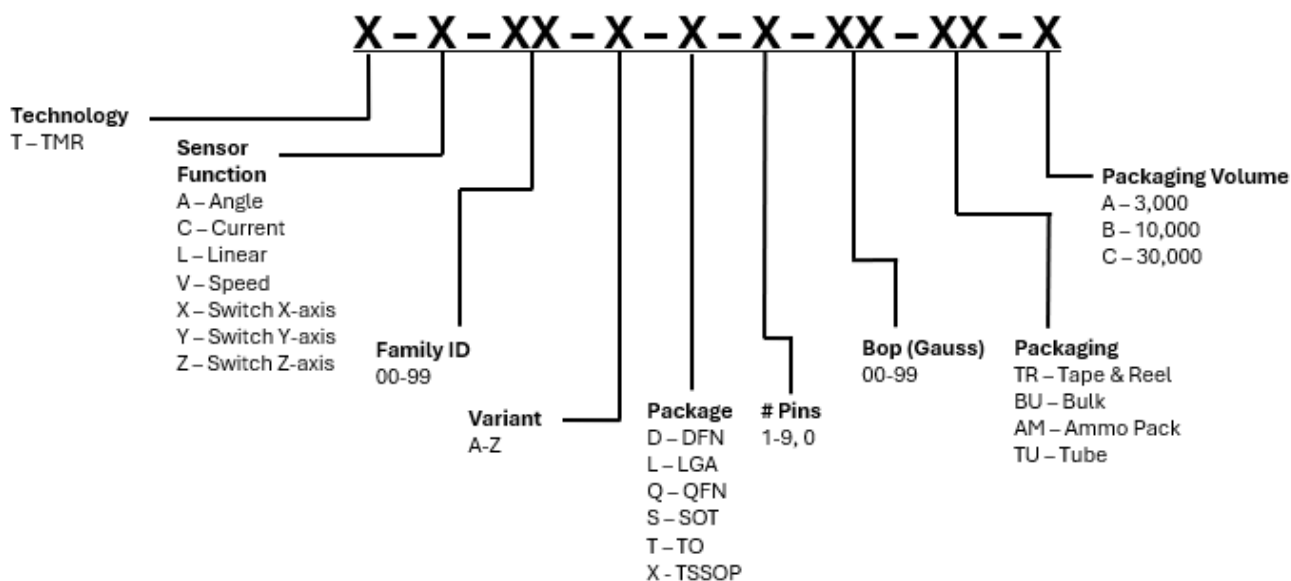
When a N Pole approaches the pin 1 side, V_{out} will transition to High

Product Configuration Guide

Part Number	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 Ratings

Ratings specified at $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

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

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 $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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 $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

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

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.

TX00AL430TRA - Electrical & Magnetic Characteristics

Ratings specified at $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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 $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	$-40 \sim 125$	$^{\circ}\text{C}$
T_{STG}	Storage Temperature	$-50 \sim 150$	$^{\circ}\text{C}$
$I_{OUTSINK}$	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 (@ $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$)

Ratings specified at $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	

TX00AS314TRA/TX00AT314TRA - Absolute Maximum Ratings

Ratings specified at $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	$^{\circ}\text{C}$
T_{STG}	Storage Temperature	-50 ~ 150	$^{\circ}\text{C}$
$I_{OUTSINK}$	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 $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	μA	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 $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	$^{\circ}\text{C}$
T_{STG}	Storage Temperature	-50 ~ 150	$^{\circ}\text{C}$
$I_{OUTSINK}$	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.

TX00AS317TRA - Electrical & Magnetic Characteristics

Ratings specified at $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	μA	Output Open
F	Frequency	-	1.0	-	kHz	
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 $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	$-40 \sim 125$	$^{\circ}\text{C}$
T_{STG}	Storage Temperature	$-50 \sim 150$	$^{\circ}\text{C}$
$I_{OUTSINK}$	Output Current	9.0	mA

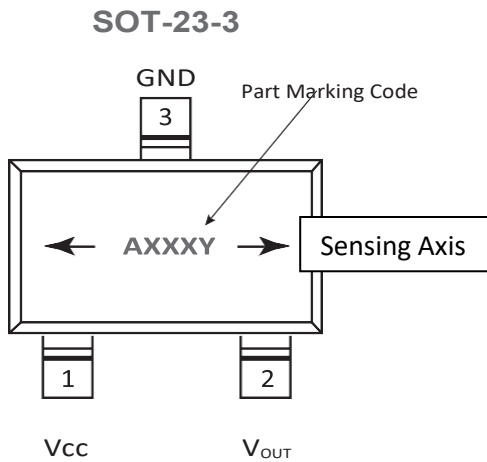
Note: Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may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

TX00BS317TRA - Electrical & Magnetic Characteristics

Ratings specified at $T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{V}$

Symbol	Characteristic	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	

Pin Configuration and Sensing Direction of Magnetic Field

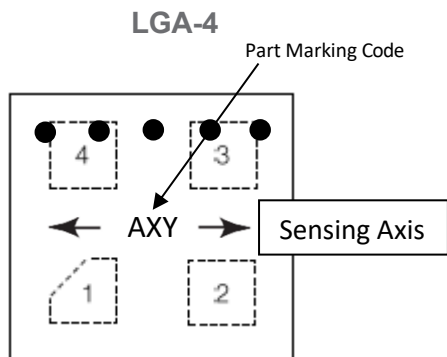
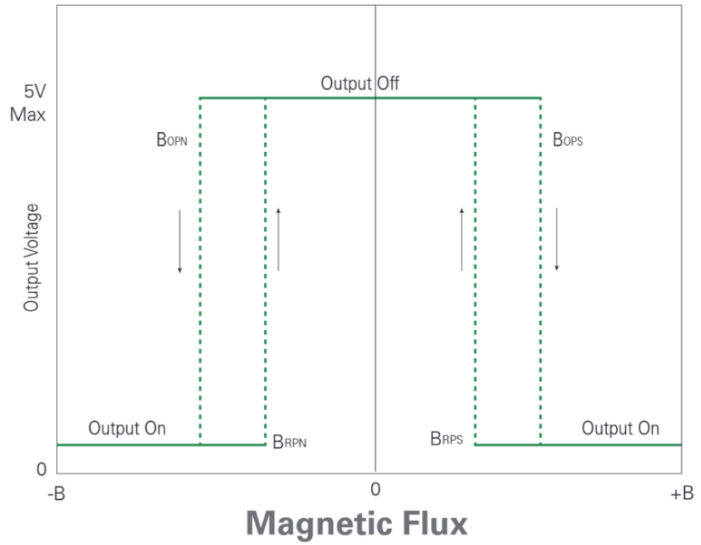


Part Marking Code:

Axxx: A = TX00AS317TRA; xxx = Julian manufactured date; y = manufactured year Moisture

Sensitivity Level: Rating is 3 Pick and Place Nozzle: Samsung CN140 or equivalent

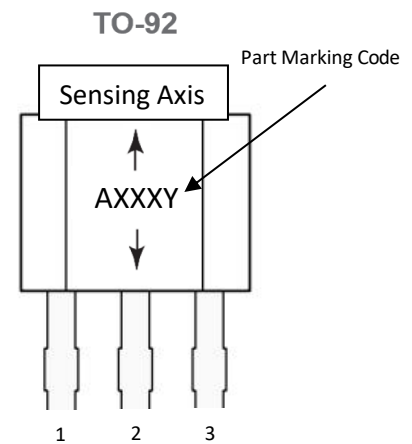
Pin Name	Pin No. SOT-23-3	Pin Function
V _{CC}	1	Supply Voltage
V _{OUT}	2	Output
GND	3	Ground



Part Marking Code:

AXY: # dots = 1st digit WW (1-5), A = TX00AL409XXX; X = 2nd digit WW; Y = Last digit of year

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



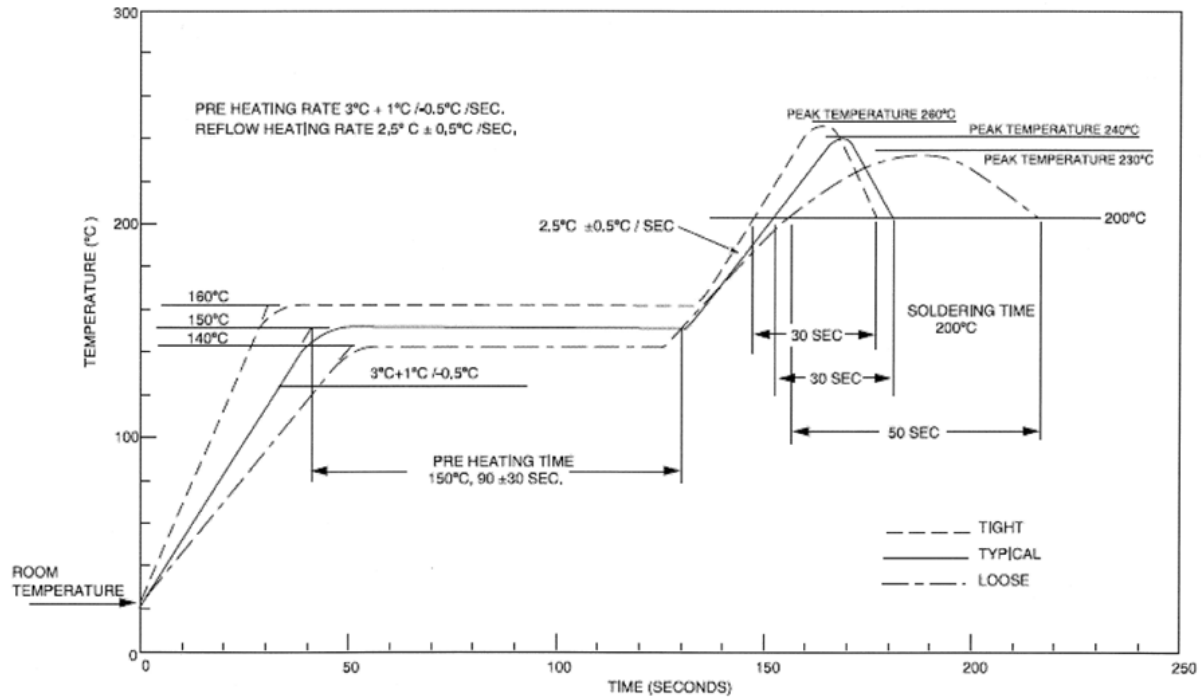
Part Marking Code:

Axxx: A = TX00AT317TRA; xxx = Julian manufactured date; y = manufactured year Moisture

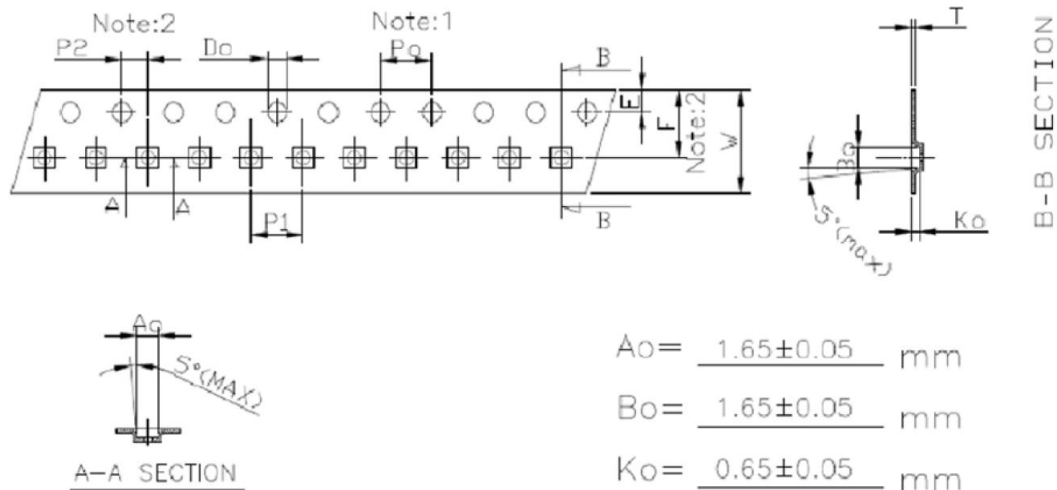
Sensitivity Level: Rating is 3 Pick and Place Nozzle: Samsung CN140 or equivalent

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

Soldering Profile for Lead-free Packages

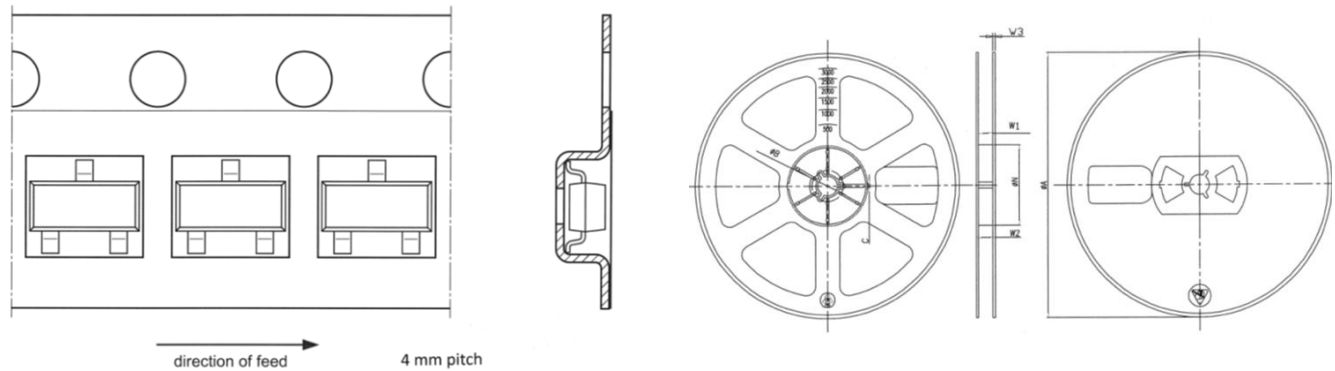


Tape and Reel LGA-4



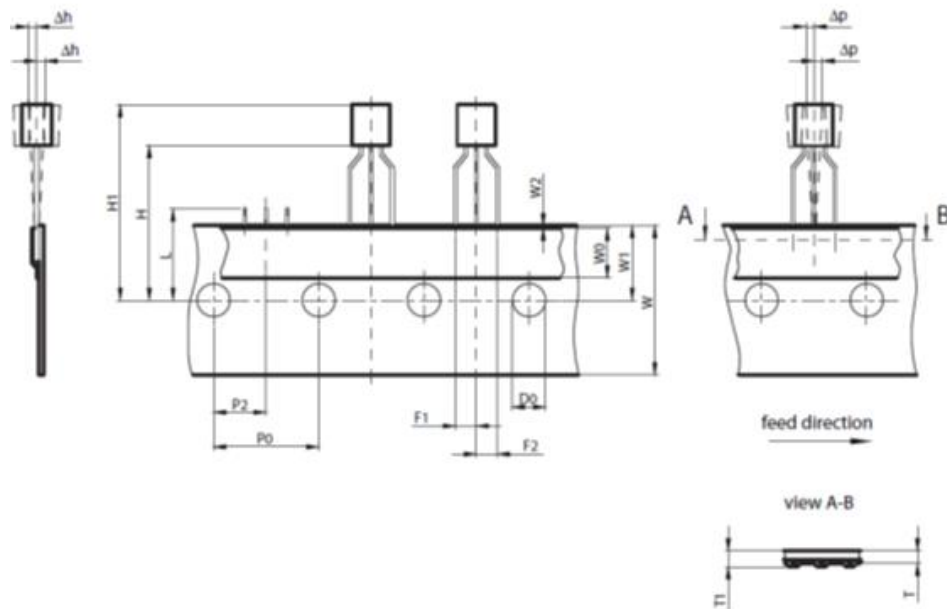
Po	P1	P2	Do	D1	E	F	W	T
$4.00 \pm 0.10\text{mm}$	$4.00 \pm 0.10\text{mm}$	$2.00 \pm 0.05\text{mm}$	$1.50 \pm 0.10\text{mm}$	$1.10 \pm 0.05\text{mm}$	$1.75 \pm 0.10\text{mm}$	$3.50 \pm 0.05\text{mm}$	$8.00 \pm 0.20\text{mm}$	$0.25 \pm 0.02\text{mm}$

Tape and Reel SOT-23-3



$\varnothing A$	$\varnothing N$	$\varnothing B$	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

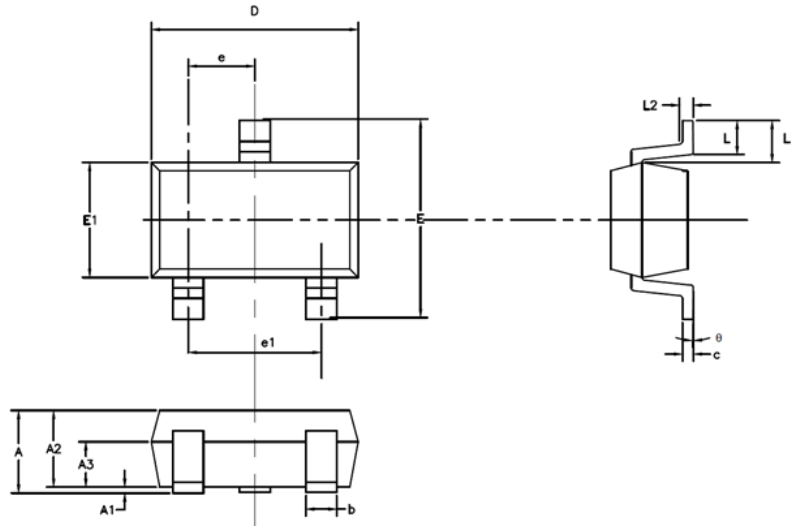
Tape and Reel TO-92



Unit	D0	F1	F2	Δh	L	P0	P2	Δp
mm	4.0	2.54 ± 0.20	2.54 ± 0.20	± 1.0	11.0 max	12.7 ± 0.50	6.25 ± 0.80	± 1.0

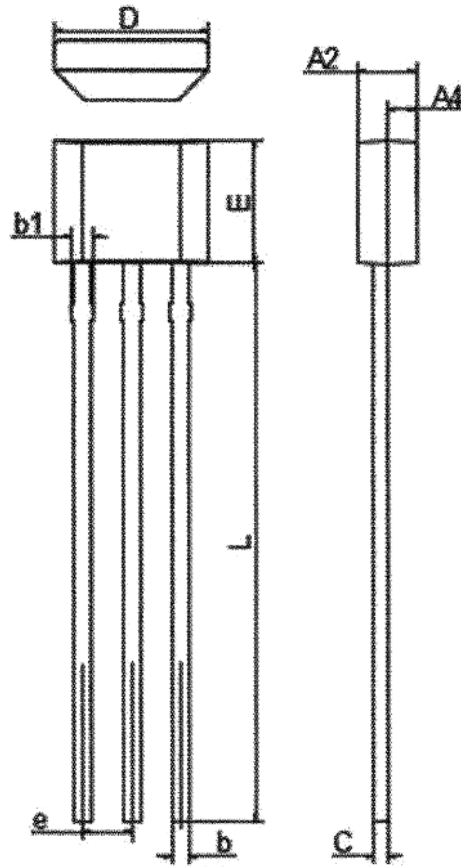
T	T1	W	W0	W1	W2
0.5	0.9	18.0	6.0	9.0	0.3

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°	-	8°	0°	-	8°

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

Important Notice - Littelfuse products are not designed for, and shall not be used for, any purpose (including, without limitation, automotive, military, aerospace, medical, life-saving, life-sustaining or nuclear facility applications, devices intended for surgical implant into the body, or any other application in which the failure or lack of desired operation of the product may result in personal injury, death, or property damage) other than those expressly set forth in applicable Littelfuse product documentation. Warranties granted by Littelfuse shall be deemed void for products used for any purpose not expressly set forth in applicable Littelfuse documentation. Littelfuse shall not be liable for any claims or damages arising out of products used in applications not expressly intended by Littelfuse as set forth in applicable Littelfuse documentation. The sale and use of Littelfuse products is subject to Littelfuse Terms and Conditions of Sale, unless otherwise agreed by Littelfuse.

Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at: www.littelfuse.com/disclaimer-electronics.