MT4401 Series

Latch, Hall-Effect Magnetic Position Sensors

MagnTek

Features and Benefits

- **Bipolar Technology**
- **Magnetic Type: Latch**
- **Wide Operating Voltage Range:**
  Supply Voltage 3.8~30V
- **Specified Operating Temperature Range:**
  From –40℃~150℃
- **High Magnetic Sensitivity**
  B_{OP}=50Gauss, B_{RP}=-50Gauss (typical)
- **Lead Free Package**
  Flat TO-92, SOT-23, SOT-89B
- **Open Collector Output**
- **RoHS Compliant**
  2011/65/EU

Applications

- Automotive, Home appliances, Industrial
- Speed Detection
- Brushless DC Motor Commutation
- Magnetic Encoder

Family Members

Part number	Description
MT4401A	Flat TO-92 package, bulk packaging (1000pcs/bag)
MT4401A-T	Flat TO-92 package, radial lead, bulk pac kaging (1000pcs/bag)
MT4401AT	SOT-23 package, tape and reel packaging (3000pcs/bag)
MT4401BT	SOT-89B package, tape and reel packaging (1000pcs/bag)
MT4401ET	SOT-23(thin outline) package, tape and reel packaging (3000pcs/bag)

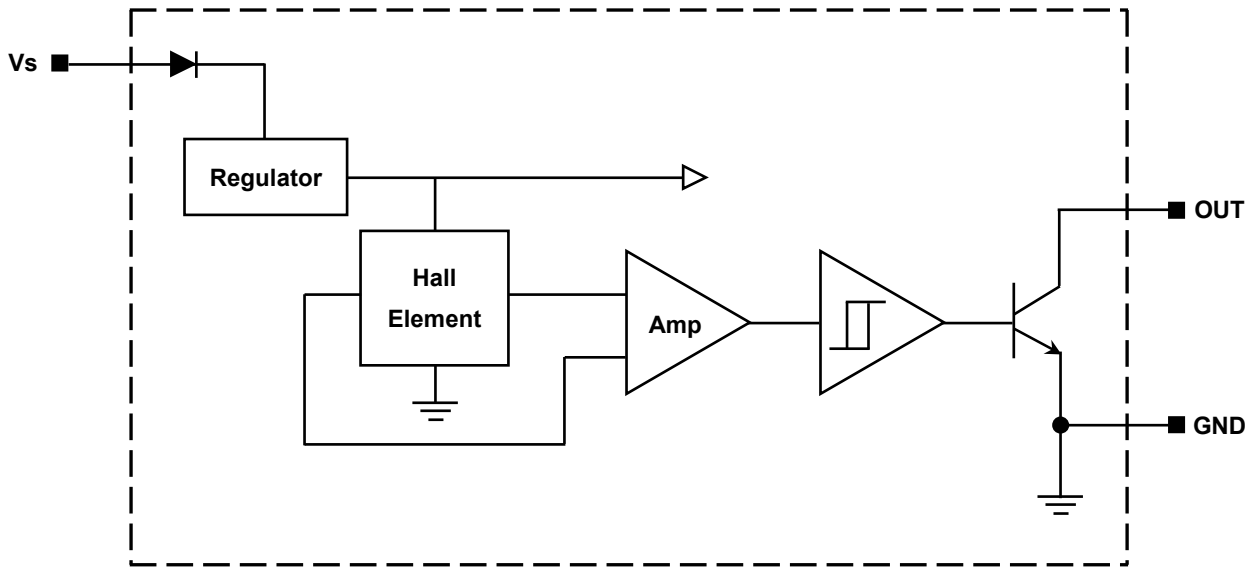
Note: MT4401X-H, X: Package type, -H: Test sorting in 25℃ and 125℃

General Description

The MT4401 family, produced with Bipolar technology, the Hall IC internally includes an on-chip Hall voltage generator, a voltage regulator for operation with supply voltages of 3.8 to 30V, reverse protection diode, temperature compensation circuitry, small-signal amplifier, Schmitt trigger and an open-collector output.

They are designed to respond to alternating North and South poles. While the magnetic flux density(B) is larger than operate point (B_{OP}), the output will be turned on (Low), the output is held until the magnetic flux density(B) is lower than release point (B_{RP}), then turn off (High).

The MT4401 family provides a variety of packages to customers: SOT-23/SOT-89B for surface mount and TO-92 flat for through-hole mount. All packages are RoHS compliant.



Functional Block Diagram

Function Description

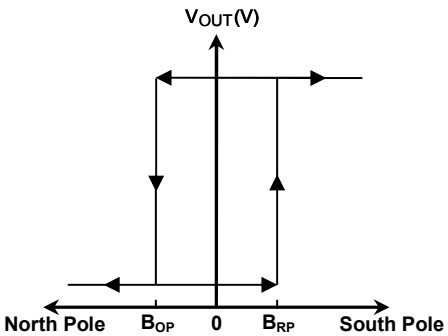
Definition of Magnetic Parameters

B_{OP}: Operating Point, Magnetic flux density applied on the branded side of the package which turns the output driver ON (V_{OUT}=Low)

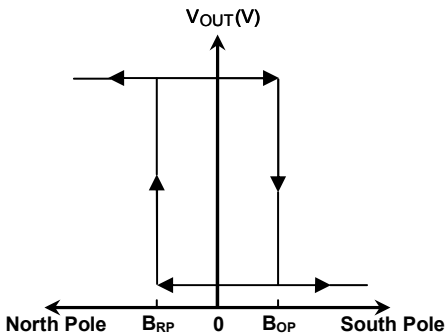
B_{RP}: Release Point, Magnetic flux density applied on the branded side of the package which turns the output driver OFF (V_{OUT}=High)

B_{HYST}: Hysteresis Window, $|B_{OP}-B_{RP}|$

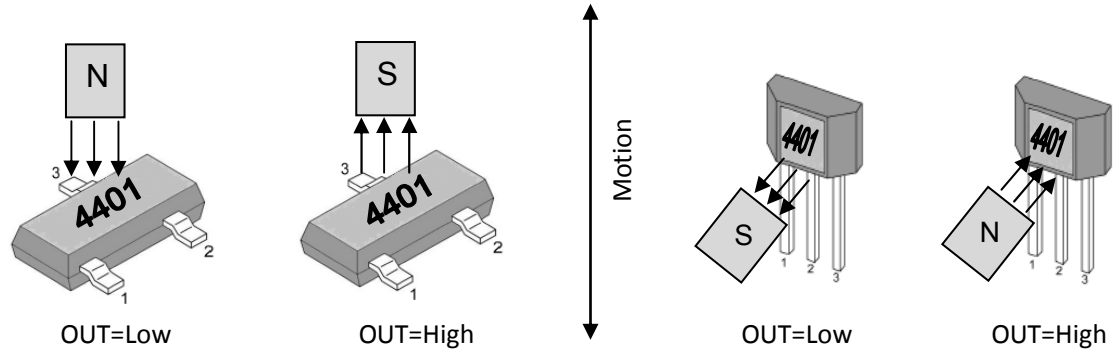
Definition of Switching Function

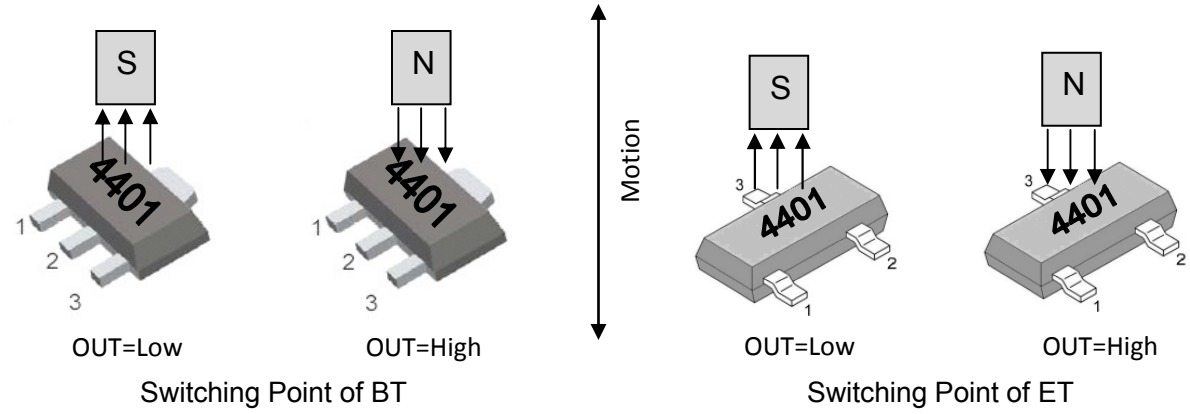


Switching Behavior of AT



Switching Behavior of A, BT and ET





Note: Direction of magnetic flux

Pin Description

MT4401AT

Name	Number	Description
Vs	1	Power
GND	3	Ground
OUT	2	Open-Collector output

MT4401A (MT4401A-T)

Name	Number	Description
Vs	1	Power
GND	2	Ground
OUT	3	Open-Collector output

MT4401BT

Name	Number	Description
Vs	1	Power
GND	2	Ground
OUT	3	Open-Collector output

MT4401ET

Name	Number	Description
Vs	1	Power
GND	3	Ground
OUT	2	Open-Collector output

Electrical and Magnetic Characteristics

Absolute Maximum Ratings

Absolute maximum ratings are limiting values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

Absolute maximum ratings: all voltages listed are referenced to GND.

Symbol	Parameters	Min	Max	Units
V_S	Supply Voltage	-	40	V
V_{RCC}	Reverse Battery Voltage	-	-40	V
V_{OUT}	Output Voltage	-	40	V
I_{OUT}	Continuous output current	-	40	mA
T_A	Operating Ambient Temperature	-40	150	℃
T_S	Storage temperature	-50	150	℃
T_J	Junction temperature	-	165	℃
B	Magnetic flux	No Limit		Gauss

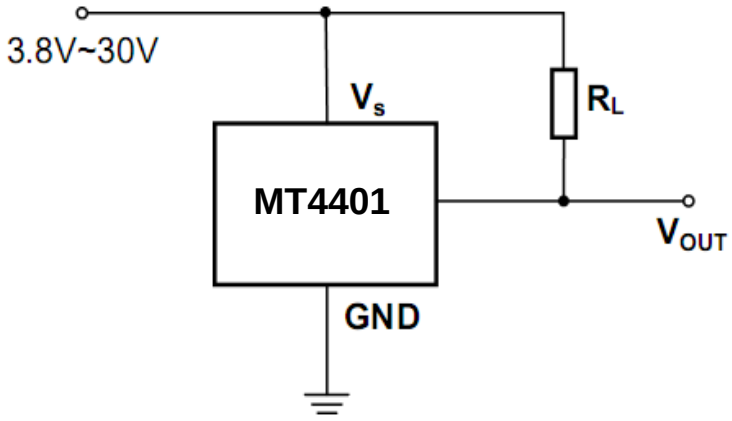
MT4401 Series Specifications

At T_A = -40℃ to 150℃, Vs = 3.8V to 30V (unless otherwise specified)

Symbol	Parameter	Test Condition	Min	Typ	Max	Units
V_S	Supply Voltage	Operating	3.8	-	30	V
I_S	Supply Current	B<B_{RP}	-	4	10	mA
V_{SON}	Output Saturation Voltage	I_{OUT}=20mA, B>B_{OP}	-	-	0.4	V
I_{OFF}	Output Leakage Current	B<B_{RP}, V_{OUT}=30V	-	-	10	uA
T_R	Output Rise Time	R_L=1KOhm, C_L=20pF	-	-	1.5	us
T_F	Output Fall Time	R_L=1KOhm, C_L=20pF	-	-	1.5	us
F_{SW}	Maximum Switching Frequency		100	-	-	KHz
R_{TH}	SOT-23 Package Thermal Resistance		-	301	-	℃/W
	TO-92 Package Thermal Resistance		-	230	-	℃/W
	SOT-89B Package Thermal Resistance		-	230	-	℃/W
B_{OP}	Magnetic Operating Point	At T_A = 25℃	10	50	100	Gauss
B_{RP}	Magnetic Release Point	At T_A = 25℃	-100	-50	-10	Gauss
B_{HYST}	Hysteresis Window	At T_A = 25℃, |B_{OP}-B_{RP}|	40	100	160	Gauss

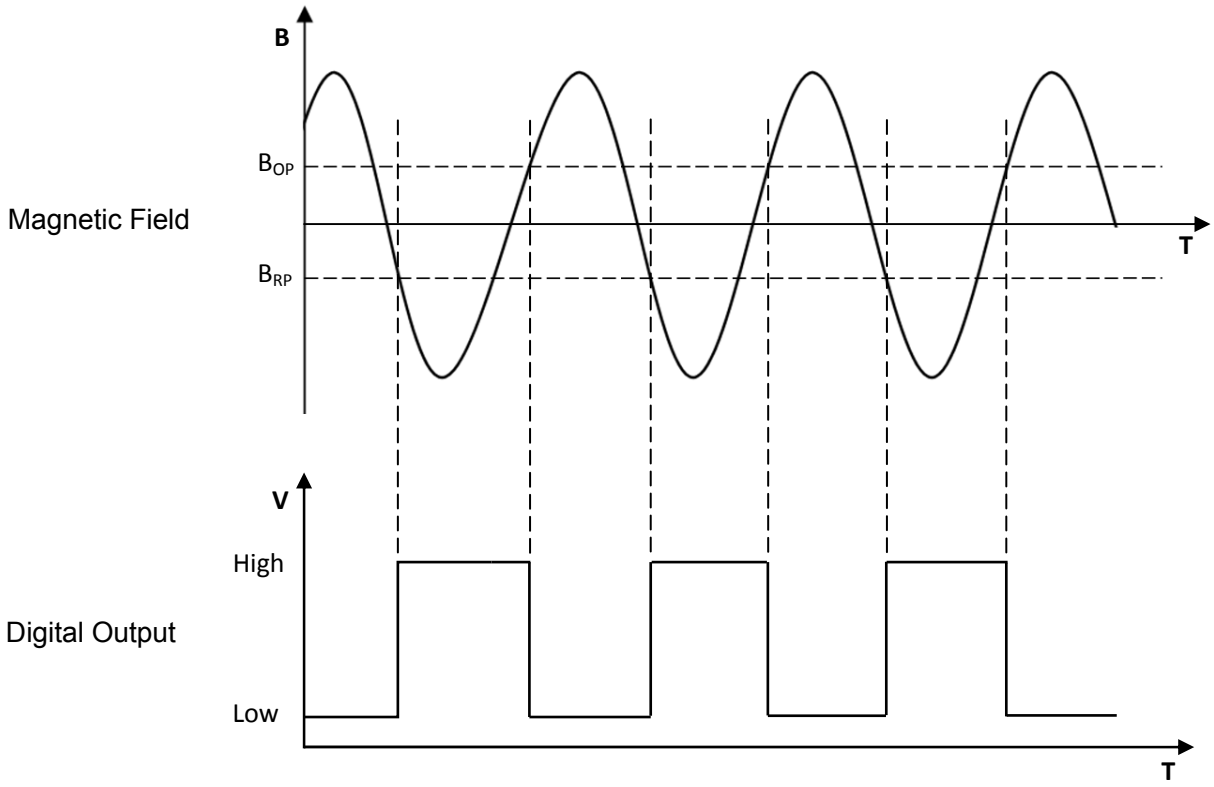
Typical Application Circuit

Note: R_L recommend 1KOhm to 10KOhm



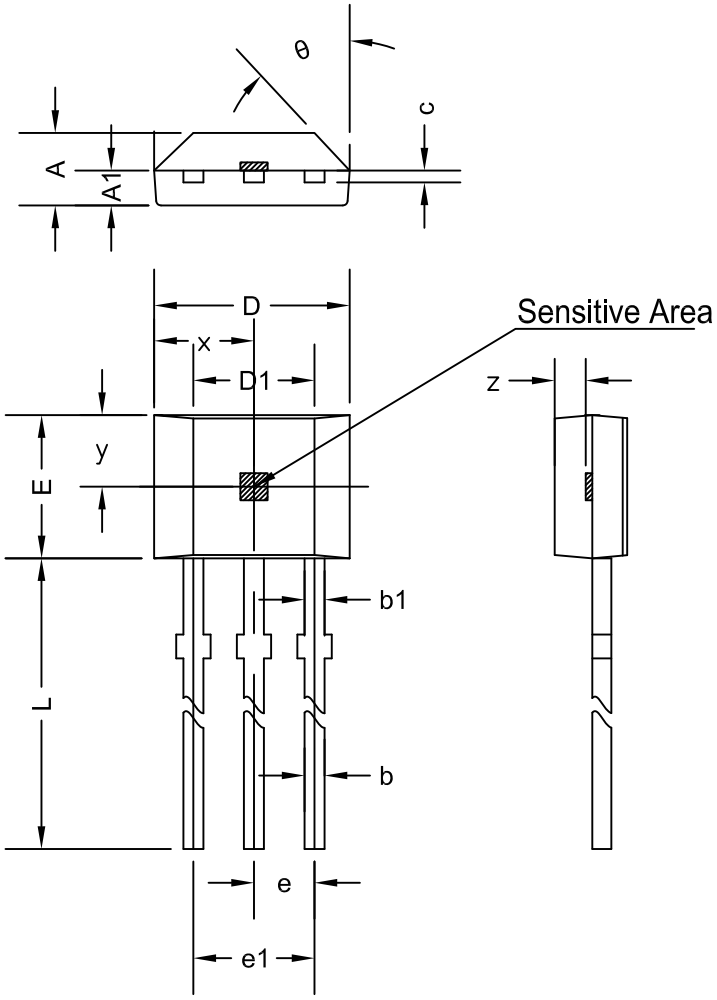
Typical Output Waveform

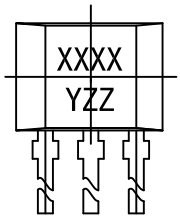
(The TO-92 package as an example)



PACKAGE DESIGNATOR

(MT4401A) Flat TO-92





XXXX
YZZ — Product ID

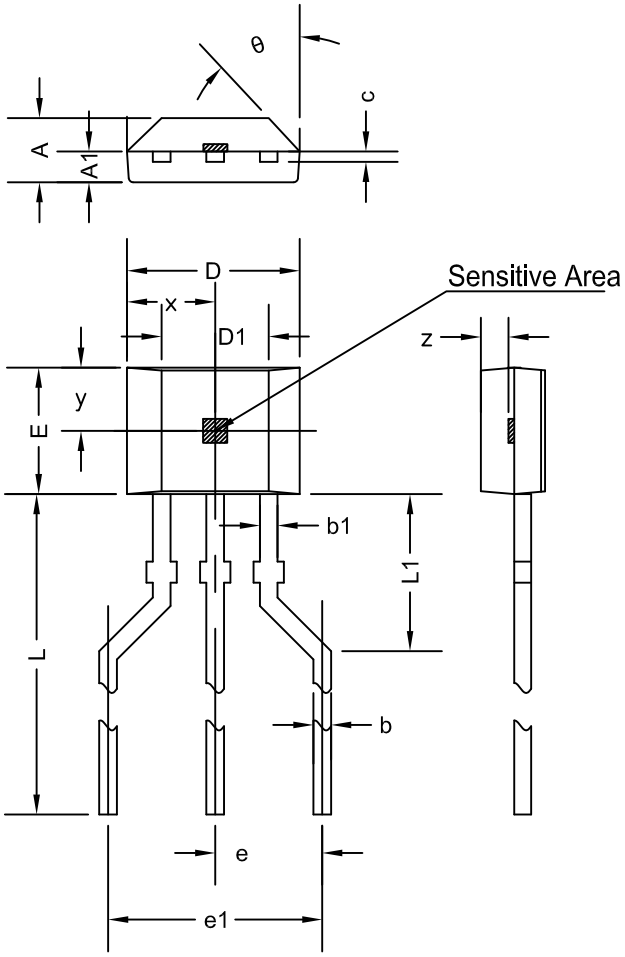
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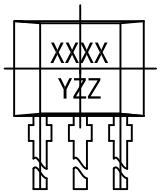
year (0~9) week (01~55)

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.670	0.056	0.066
A1	0.660	0.860	0.026	0.034
b	0.350	0.560	0.014	0.022
b1	0.400	0.550	0.016	0.022
C	0.360	0.510	0.014	0.020
D	3.900	4.200	0.154	0.165
D1	2.970	3.270	0.117	0.129
E	2.900	3.280	0.114	0.129
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	13.500	15.500	0.531	0.610
x	2.025TYP		0.080TYP	
y	1.545TYP		0.061TYP	
z	0.500TYP		0.020TYP	
θ	45˚TYP		45˚TYP	

PACKAGE DESIGNATOR

(MT4401A-T) Flat TO-92 Radial Lead



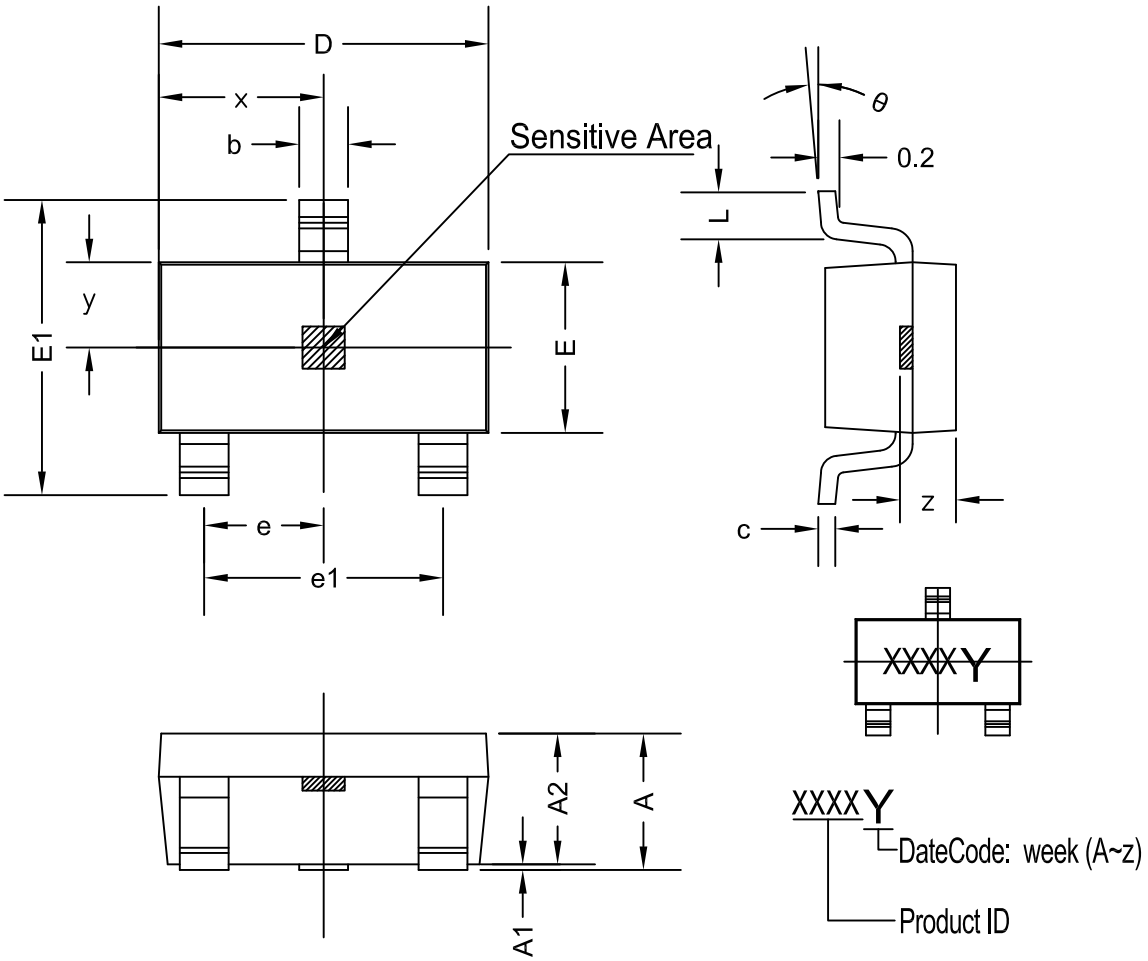


XXXX — Product ID
YZZ

DateCode: Y ZZ
year week
(0~9) (01~55)

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.670	0.056	0.066
A1	0.660	0.860	0.026	0.034
b	0.350	0.560	0.014	0.022
b1	0.400	0.550	0.016	0.022
c	0.360	0.510	0.014	0.020
D	3.900	4.200	0.154	0.165
D1	2.970	3.270	0.117	0.129
E	2.900	3.280	0.114	0.129
e	2.540TYP		0.100TYP	
e1	5.080TYP		0.200TYP	
L	14.300REF		0.563REF	
L1	2.150REF		0.085REF	
x	2.025TYP		0.080TYP	
y	1.545TYP		0.061TYP	
z	0.500TYP		0.020TYP	
θ	45˚TYP		45˚TYP	

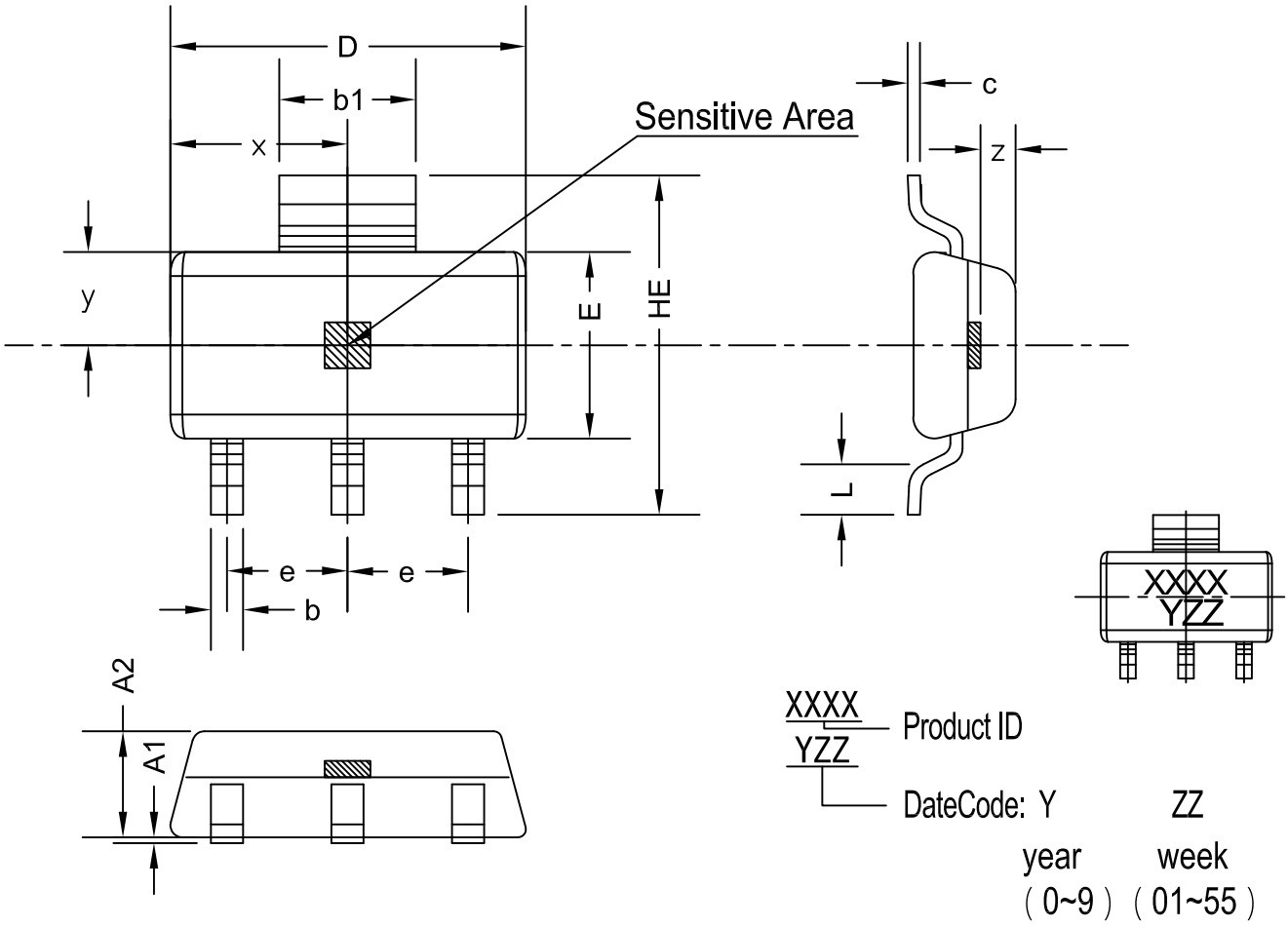
PACKAGE DESIGNATOR
(MT4401AT) SOT-23



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0. 100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
x	1.460TYP		0.057TYP	
y	0.800TYP		0.032TYP	
z	0.600TYP		0.024TYP	
θ	0˚	8˚	0˚	8˚

PACKAGE DESIGNATOR

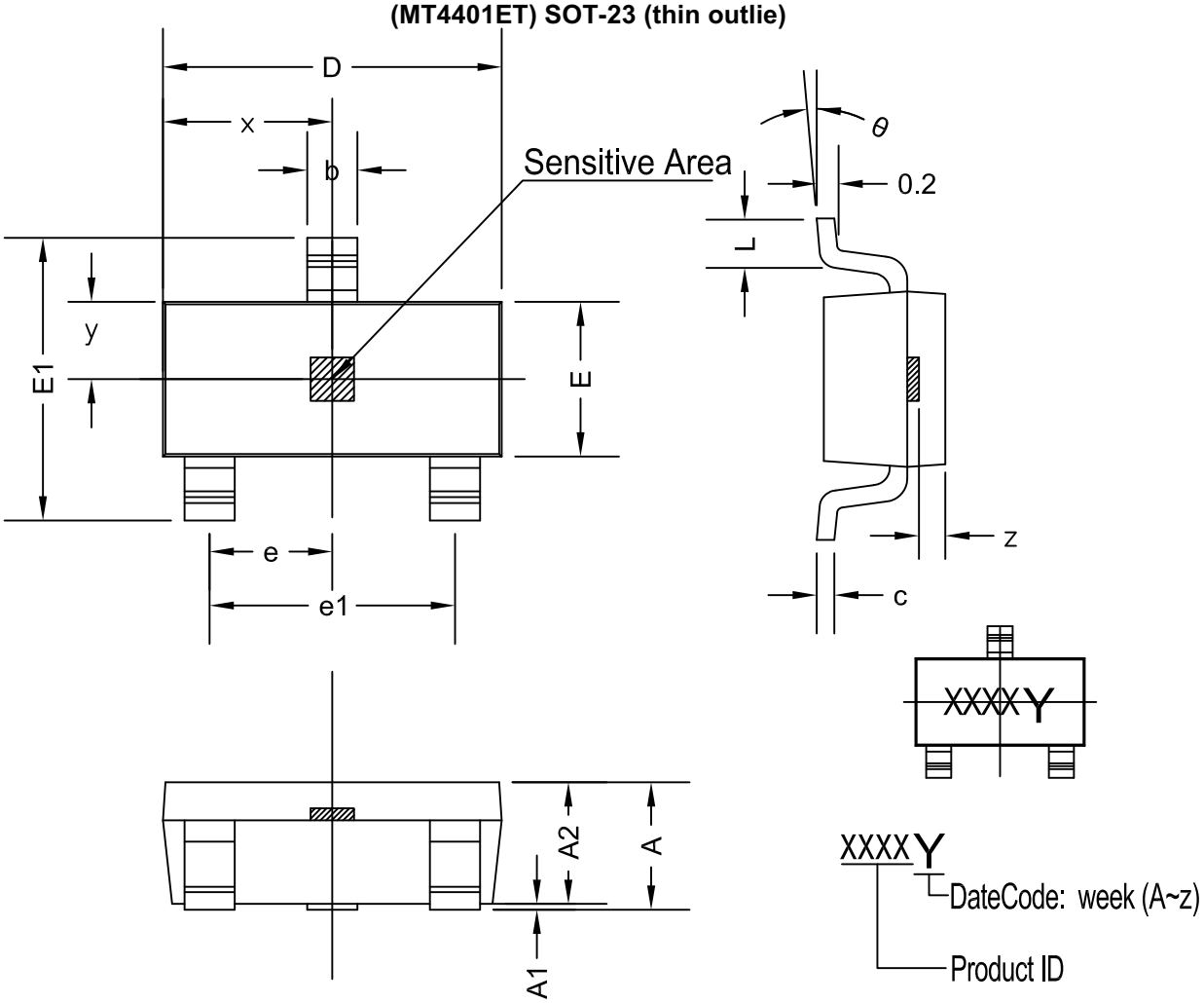
(MT4401BT) SOT-89B



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A1	0.000	0.100	0.000	0.004
A2	1.220	1.420	0.048	0.056
b	0.300	0.500	0.012	0.020
b1	1.600	1.800	0.063	0.070
D	4.400	4.600	0.173	0.181
c	1.152 REF		0.045 REF	
E	2.400	2.600	0.094	0.102
HE	4.000	4.400	0.157	0.173
e	1.500 TYP		0.060 TYP	
L	0.350	0.550	0.014	0.022
x	2.250TYP		0.089TYP	
y	1.250TYP		0.049TYP	
z	0.300TYP		0.012TYP	

PACKAGE DESIGNATOR

(MT4401ET) SOT-23 (thin outlie)



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0. 080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550REF		0.022REF	
x	1.460TYP		0.057TYP	
y	0.650TYP		0.026 TYP	
z	0.500TYP		0.020TYP	
θ	0°	8°	0°	8°