

### Features and Benefits

- **Bipolar Technology**
- **Magnetic Type: Latch**
- **Wide Operating Voltage Range:**  
Supply Voltage 3.8~30V
- **Specified Operating Temperature Range:**  
From  $-40^{\circ}\text{C}$ ~ $150^{\circ}\text{C}$
- **High Magnetic Sensitivity**  
 $B_{OP}=50\text{Gauss}$ ,  $B_{RP}=-50\text{Gauss}$  (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 Communication
- Magnetic Encoder

### Family Members

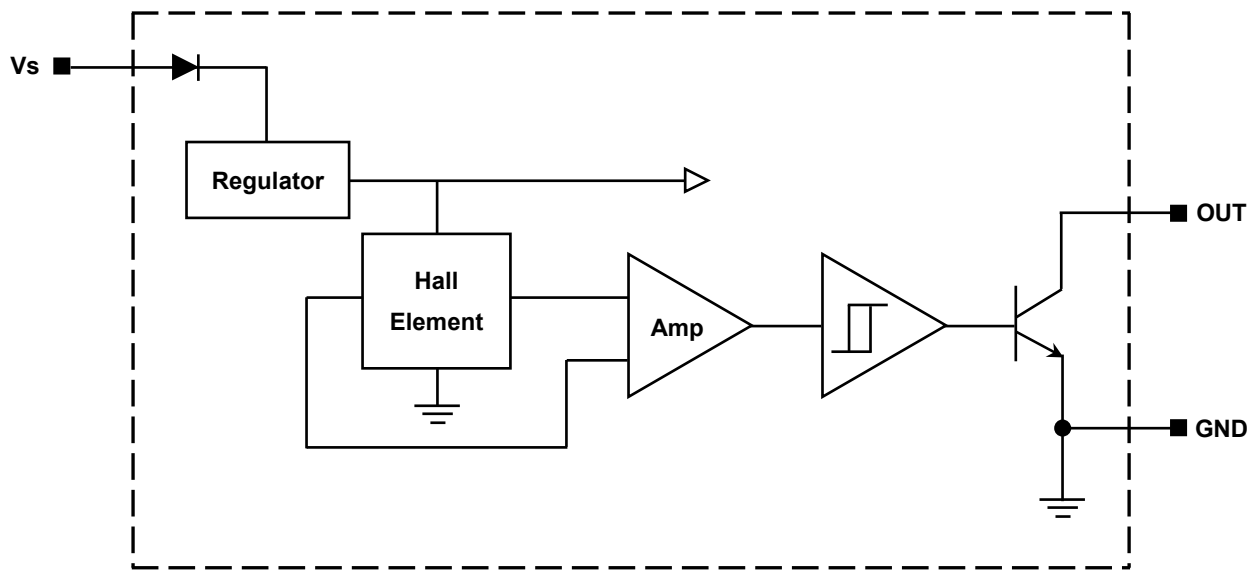
Part number	Description
MT4402A	Flat TO-92 package, bulk packaging (1000pcs/bag)
MT4402A-T	Flat TO-92 package, radial lead, bulk packaging (1000pcs/bag)
MT4402AT	SOT-23 package, tape and reel packaging (3000pcs/bag)
MT4402BT	SOT-89B package, tape and reel packaging (1000pcs/bag)
MT4402ET	SOT-23(thin outline) package, tape and reel packaging (3000pcs/bag)

### General Description

The MT4402 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 MT4402 family provides a variety of packages to customers: SOT-23/SOT-89B for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.



Functional Block Diagram

### Function Description

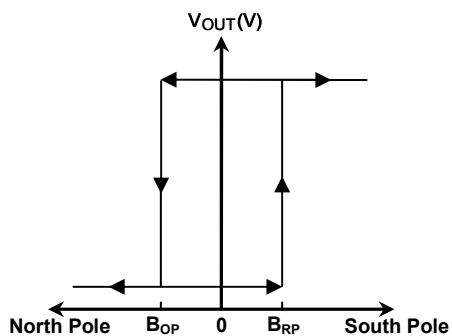
#### Definition of Magnetic Parameters

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

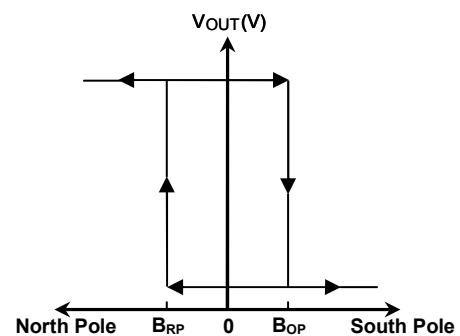
$B_{RP}$ : Release Point, Magnetic flux density applied on the branded side of the package which turns the output driver OFF ( $V_{OUT} = \text{High}$ )

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

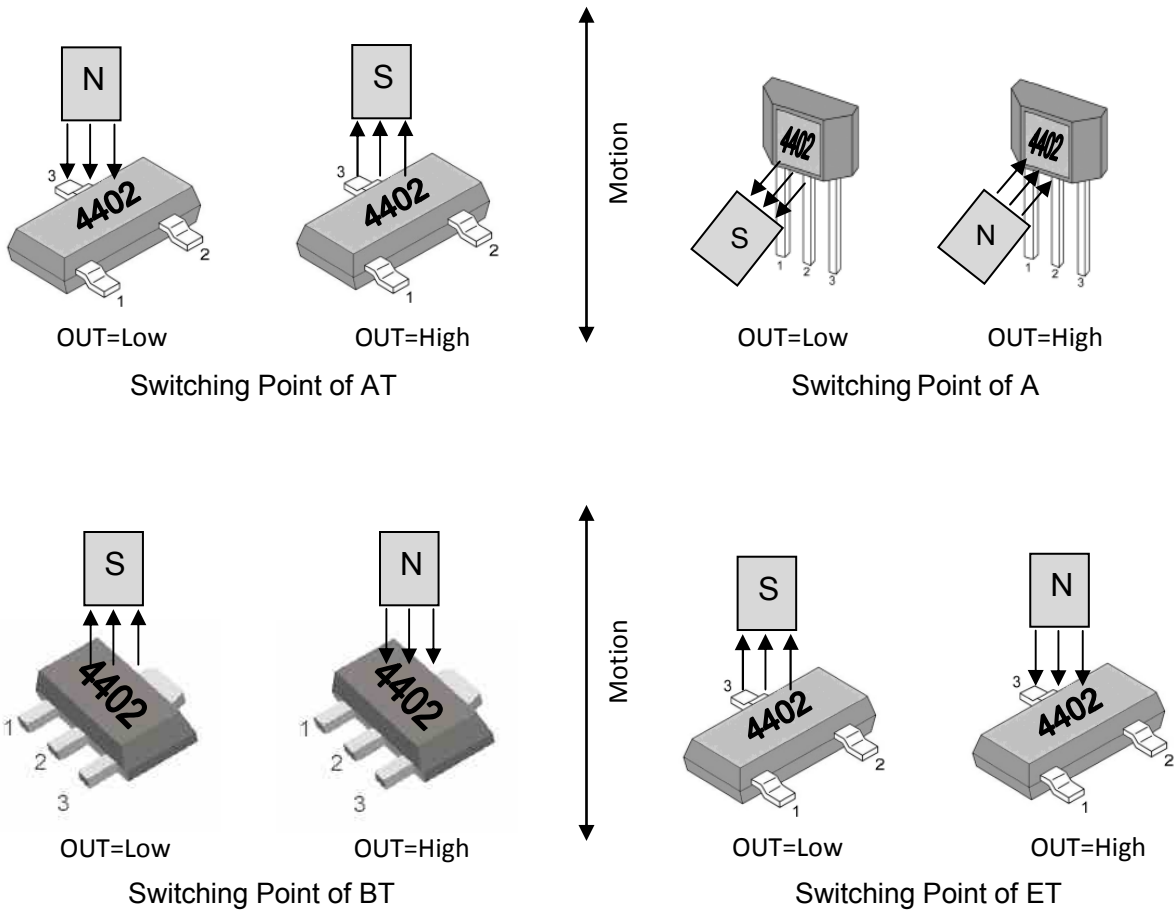
#### Definition of Switching Function



Switching Behavior of AT



Switching Behavior of A, BT and ET



Note: Direction of magnetic flux

### Pin Description

#### MT4402AT

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

#### MT4402A (MT4402A-T)

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

#### MT4402BT

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

#### MT4402ET

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.

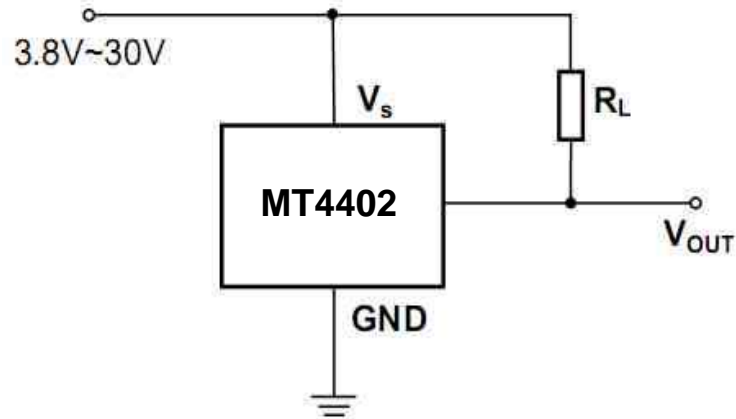
Symbol	Parameters	Min	Max	Units
V <sub>S</sub>	Supply Voltage	-	40	V
V <sub>RCC</sub>	Reverse Battery Voltage	-	-40	V
V <sub>OUT</sub>	Output Voltage	-	60	V
I <sub>OUT</sub>	Continuous output current	-	40	mA
T <sub>A</sub>	Operating Ambient Temperature	-40	150	°C
T <sub>S</sub>	Storage temperature	-50	150	°C
T <sub>J</sub>	Junction temperature	-	165	°C
B	Magnetic flux	No Limit		Gauss

#### MT4402 Series Specifications

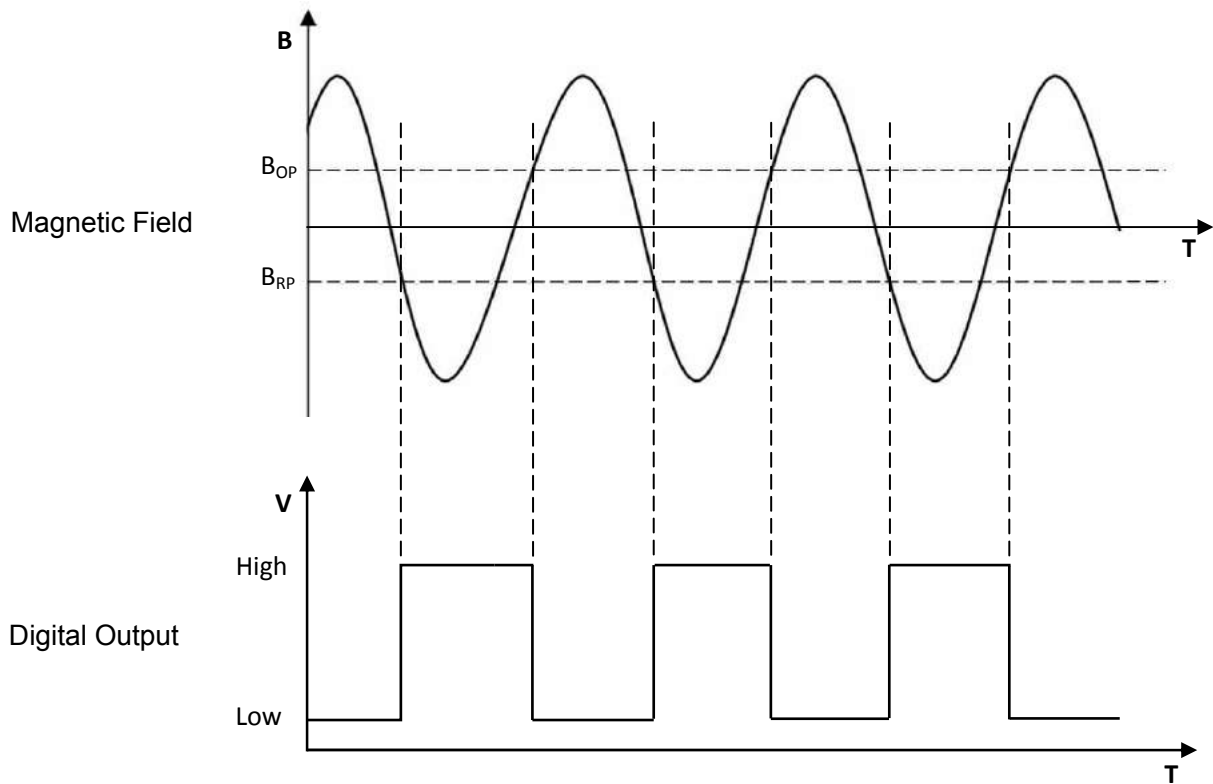
At T<sub>A</sub> = -40°C to 150°C, V<sub>S</sub> = 3.8V to 30V (unless otherwise specified)

Symbol	Parameter	Test Condition	Min	Typ	Max	Units
V <sub>S</sub>	Supply Voltage	Operating	3.8	-	30	V
I <sub>S</sub>	Supply Current	B < B <sub>RP</sub>	-	4	10	mA
V <sub>SON</sub>	Output Saturation Voltage	I <sub>OUT</sub> =20mA, B > B <sub>OP</sub>	-	-	0.4	V
I <sub>OFF</sub>	Output Leakage Current	B < B <sub>RP</sub> , V <sub>OUT</sub> =30V	-	-	10	uA
T <sub>R</sub>	Output Rise Time	R <sub>L</sub> =1KOhm, C <sub>L</sub> =20pF	-	-	1.5	us
T <sub>F</sub>	Output Fall Time	R <sub>L</sub> =1KOhm, C <sub>L</sub> =20pF	-	-	1.5	us
F <sub>SW</sub>	Maximum Switching Frequency		100	-	-	KHz
R <sub>TH</sub>	SOT-23 Package Thermal Resistance		-	301	-	°C/W
	TO-92 Package Thermal Resistance		-	230	-	°C/W
	SOT-89B Package Thermal Resistance		-	230	-	°C/W
B <sub>OP</sub>	Magnetic Operating Point	At T <sub>A</sub> = 25°C	10	50	100	Gauss
B <sub>RP</sub>	Magnetic Release Point	At T <sub>A</sub> = 25°C	-100	-50	-10	Gauss
B <sub>HYST</sub>	Hysteresis Window	At T <sub>A</sub> = 25°C,  B <sub>OP</sub> -B <sub>RP</sub>	40	100	160	Gauss

### Typical Application Circuit Note: $R_L$ recommend 1KOhm to 10KOhm

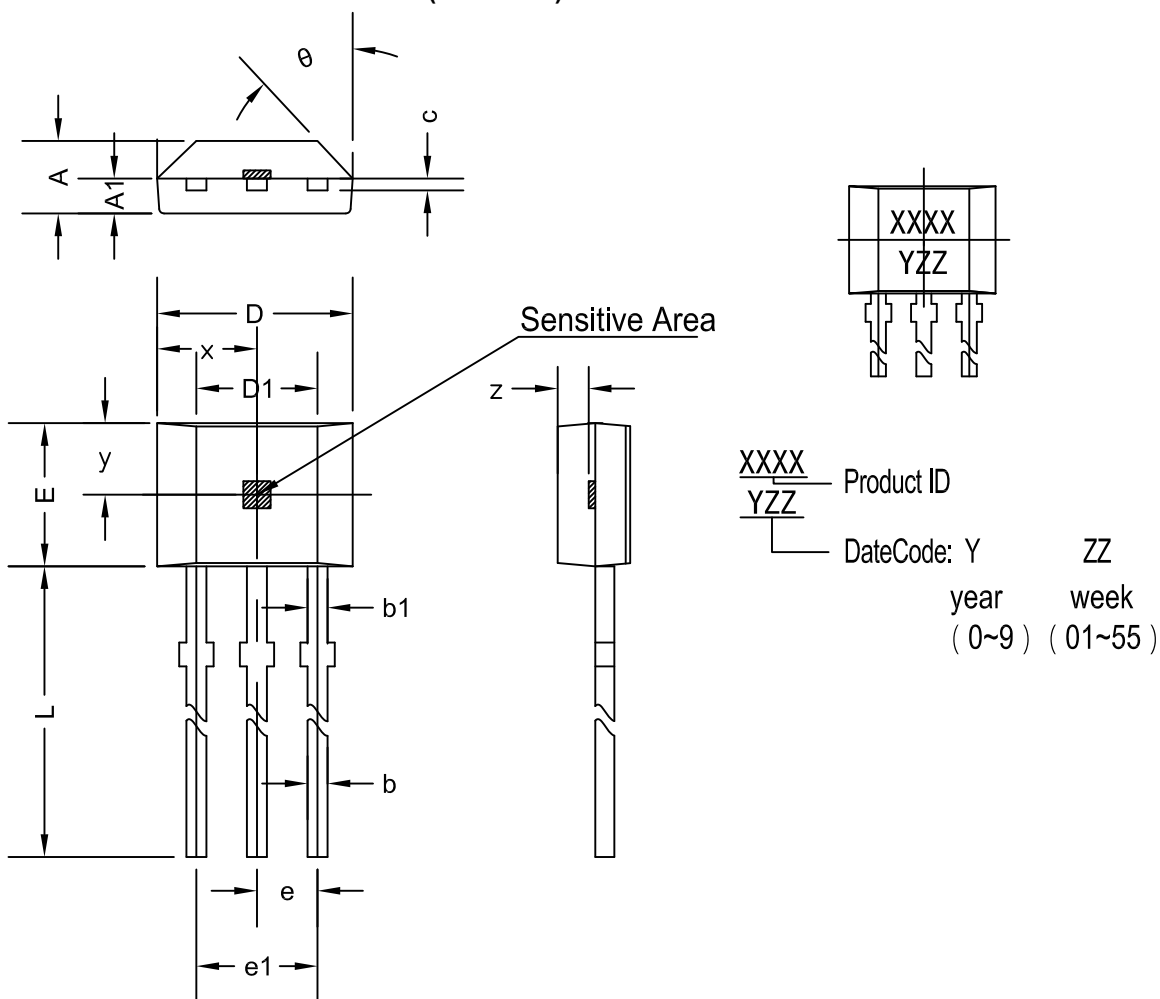


### Typical Output Waveform (The TO-92 package as an example )



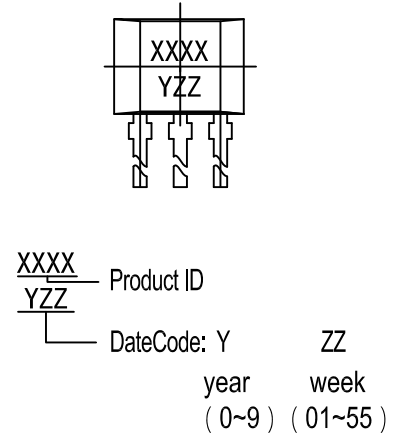
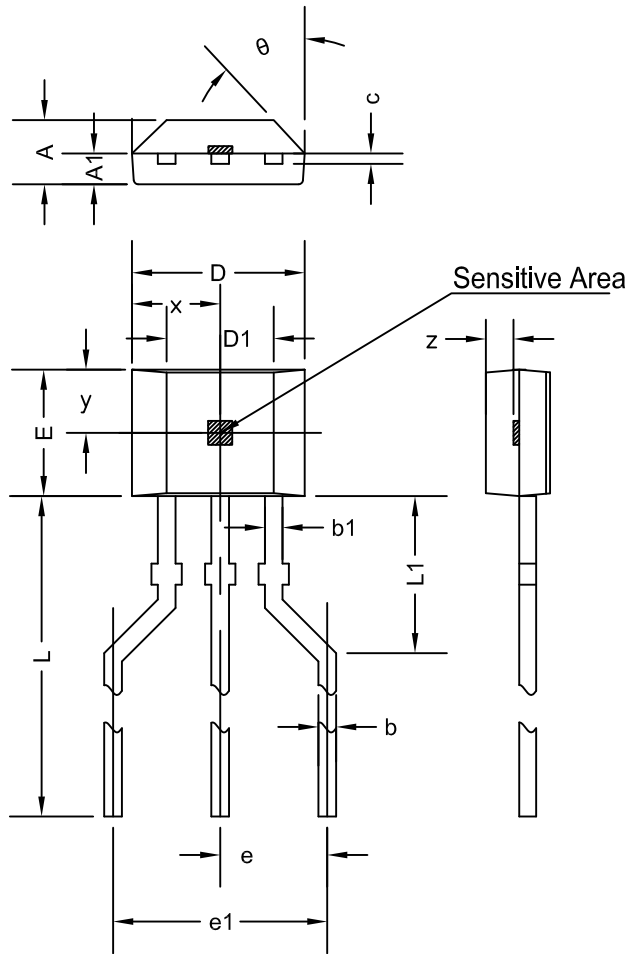
### PACKAGE DESIGNATOR

(MT4402A) Flat TO-92



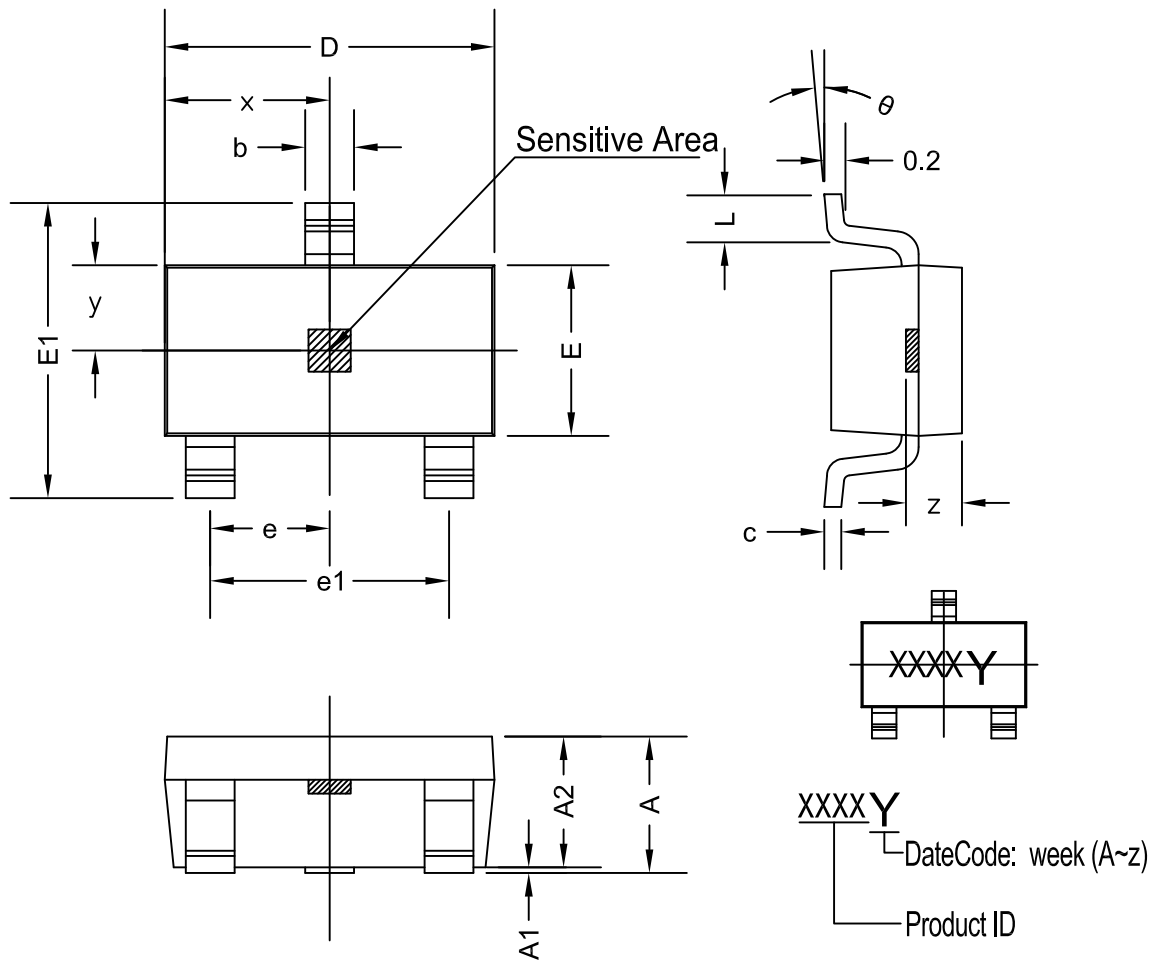
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.670	0.056	0.066
A1	0.660	0.860	0.026	0.034
b	0.350	0.560	0.014	0.022
b1	0.400	0.550	0.016	0.022
C	0.360	0.510	0.014	0.020
D	3.900	4.200	0.154	0.165
D1	2.970	3.270	0.117	0.129
E	2.900	3.280	0.114	0.129
e	1.270 TYP		0.050 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 (MT4402A-T) Flat TO-92 Radial Lead



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	

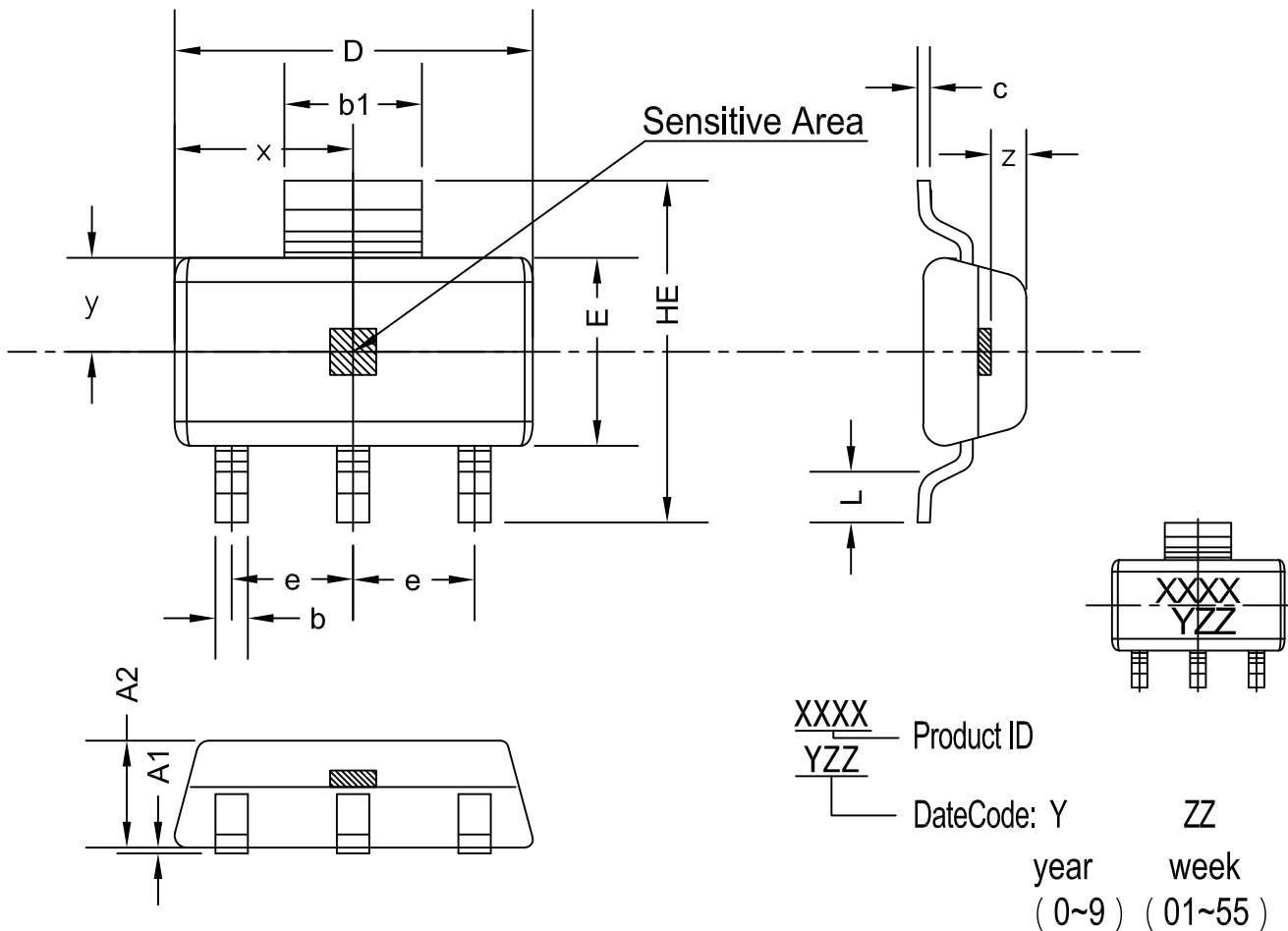
### PACKAGE DESIGNATOR (MT4402AT) SOT-23



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	1.460 TYP		0.057 TYP	
y	0.800 TYP		0.032 TYP	
z	0.600 TYP		0.024 TYP	
θ	0°	8°	0°	8°

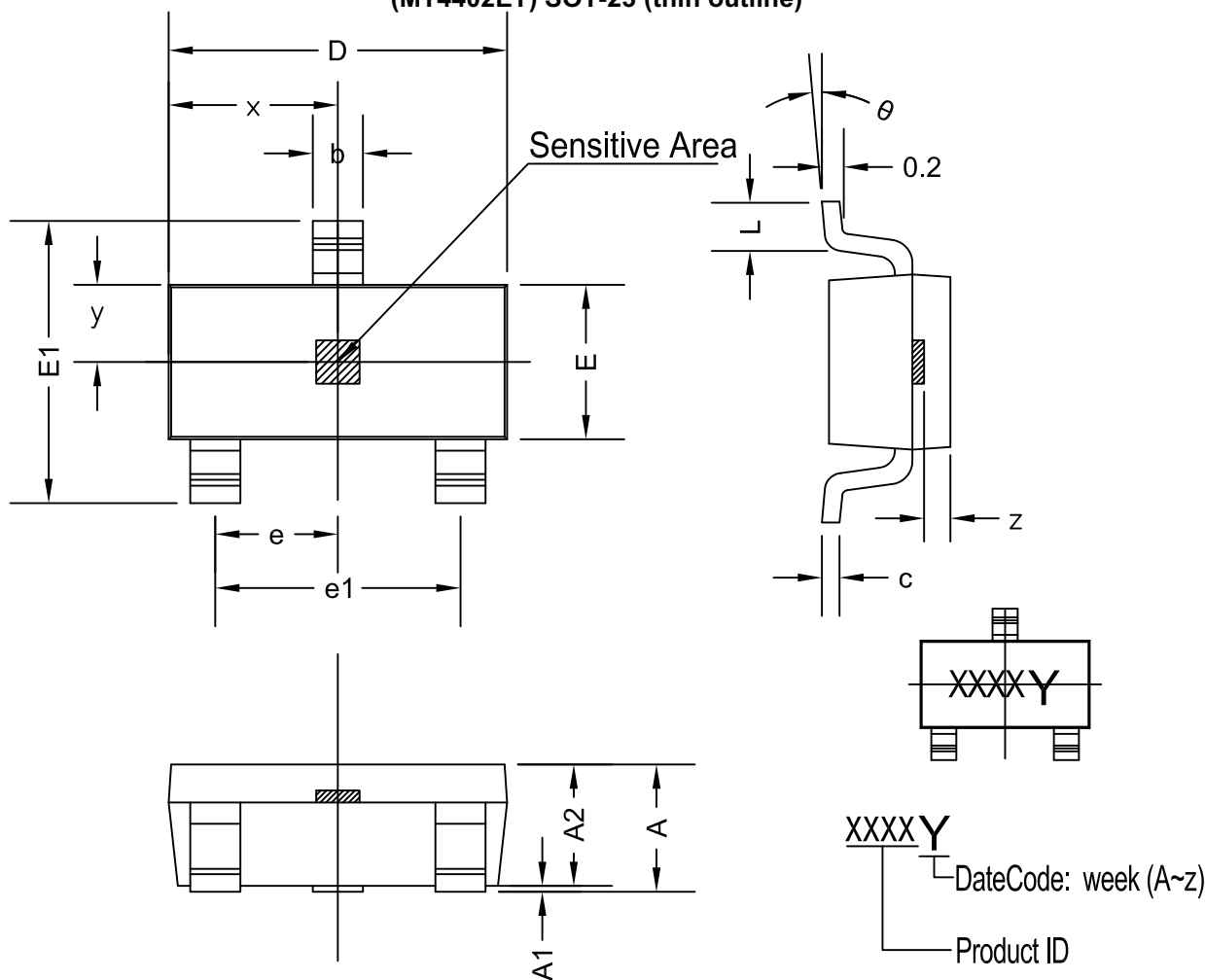


### PACKAGE DESIGNATOR (MT4402BT) SOT-89B



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 (MT4402ET) SOT-23 (thin outline)



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	0.550 REF		0.022 REF	
x	1.460 TYP		0.057 TYP	
y	0.650 TYP		0.026 TYP	
z	0.500 TYP		0.020 TYP	
$\theta$	0°	8°	0°	8°