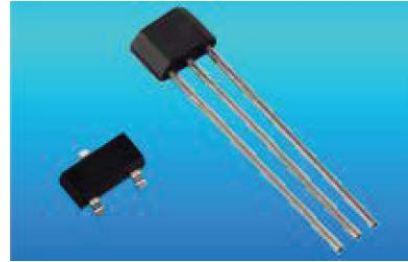


## CMOS Omnipolar High Sensitivity Hall Switch

### 1. Description

The HM90245 Omnipolar Hall effect sensor IC is fabricated from mixed signal CMOS technology. It incorporates advanced chopper-stabilization techniques to provide accurate and stable magnetic switch points.

The output transistor of the HM90245 will be switched on ( $B_{OP}$ ) in the presence of a sufficiently strong South or North magnetic field facing the marked side of the package. The output will be switched off ( $B_{RP}$ ) in the absence of a magnetic field.



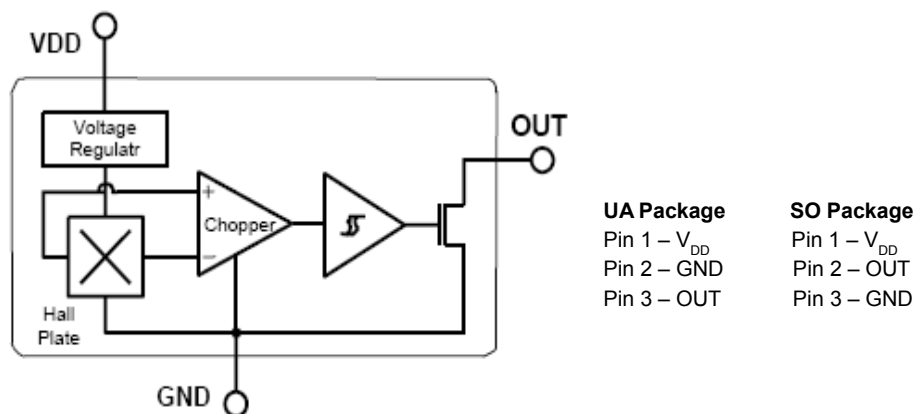
### 2. Features

- ◆ Solid-State Reliability much better than reed switch
- ◆ Omnipolar, output switches with absolute value of North or South pole from magnet
- ◆ Operation from 3.5V to 24V
- ◆ High sensitivity for direct reed switch replacement applications

### 3. Applications

- ◆ Solid state switch
- ◆ Speed detection
- ◆ Interrupter
- ◆ Magnet proximity sensor for reed switch replacement

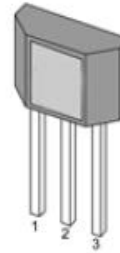
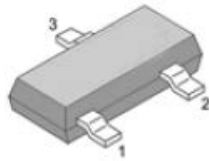
### 4. Functional Block Diagram



## CMOS Omnipolar High Sensitivity Hall Switch

### 5. Pin Definitions and Descriptions

SE Pin No.	UA Pin No.	Name	Type	Function
1	1	V <sub>DD</sub>	Supply	Supply Voltage Pin
2	3	OUT	Output	Open Drain Output Pin
3	2	GND	Ground	Ground Pin



### 6. Glossary of Terms

Glossary	Descriptions
MilliTesla (mT)	Gauss, Units of magnetic flux density: 1mT = 10 Gauss
RoHS	Restriction of Hazardous Substances
SOT	Small Outline Transistor (SOT package) – also referred with the package code “SO”
ESD	Electro-Static Discharge
BLDC	Brush-Less Direct-Current
Operating Point (B <sub>OP</sub> )	Magnetic flux density applied on the branded side of the package which turns the output driver ON (V <sub>OUT</sub> = V <sub>DSon</sub> )
Release Point (B <sub>RP</sub> )	Magnetic flux density applied on the branded side of the package which turns the output driver OFF (V <sub>OUT</sub> = high)

### 7. Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Supply Voltage (operating)	V <sub>DD</sub>	28	V
Supply Current	I <sub>DD</sub>	5	mA
Output Voltage	V <sub>OUT</sub>	28	V
Output Current	I <sub>OUT</sub>	10	mA
Operating Temperature Range	T <sub>A</sub>	-40 to 150	°C
Storage Temperature Range	T <sub>S</sub>	-50 to 165	°C
ESD Sensitivity		4000	V

**Note:** Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum- rated conditions for extended periods may affect device reliability.

## CMOS Omnipolar High Sensitivity Hall Switch

### 8. DC Electrical Specifications

DC Operating Parameters:  $T_A = 25^{\circ}\text{C}$ ,  $V_{DD} = 5\text{V}$

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	$V_{DD}$	Operating	3.5		24	V
Supply Current	$I_{DD}$	$B < B_{RP}$			5	mA
Output Saturation Voltage	$V_{DSon}$	$I_{OUT} = 20\text{mA}$ , $B > B_{OP}$			0.5	V
Output Leakage Current	$I_{OFF}$	$B < B_{RP}$ , $V_{OUT} = 24\text{V}$		1	10	$\mu\text{A}$
Output Rise Time	$T_R$	$R_L = 1\text{K}\Omega$ , $C_L = 20\text{pF}$		0.25		$\mu\text{s}$
Output Fall Time	$T_F$	$R_L = 1\text{K}\Omega$ , $C_L = 20\text{pF}$		0.25		$\mu\text{s}$
Maximum Switching Frequency	$F_{SW}$			10		KHz
Package Thermal Resistance	$R_{TH}$	Single layer (1S) JEDEC board		301		$^{\circ}\text{C/W}$

### 9. Magnetic Specifications

Operating Parameters:  $T_A = 25^{\circ}\text{C}$ ,  $V_{DD} = 5V_{DC}$

Parameter	Symbol	Min	Typ	Max	Units
Operating Point	$B_{OP}$	-	+/-40	+/-60	Gs
Release Point	$B_{RP}$	+/-10	+/-25	-	Gs
Hysteresis	$B_{HYS}$	-	15	-	Gs

### 10. ESD Protection

Human Body Model (HBM) tests according to: Mil. Std. 883F method 3015.7:

Parameter	Symbol	Limit Values		Unit	Notes
		Min	Max		
ESD Voltage	$V_{ESD}$	$\pm 2$	$\pm 4$	kV	

### 11. Application Information

It is strongly recommended that an external bypass capacitor be connected (in close proximity to the Hall sensor) between the supply ( $V_{DD}$  Pin) and ground (GND Pin) of the device to reduce both external noise and noise generated by the chopper stabilization technique. As is shown in the two figures in next page, a 0.1 $\mu\text{F}$  capacitor is typical.

For reverse voltage protection, it is recommended to connect a resistor or a diode in series with the  $V_{DD}$  pin. When using a resistor, three points are important:

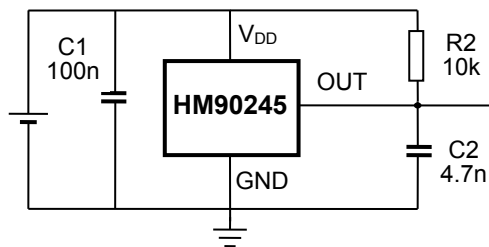
- the resistor has to limit the reverse current to 50mA maximum ( $V_{CC} / R1 \leq 50\text{mA}$ )
- the resulting device supply voltage  $V_{DD}$  has to be higher than  $V_{DD \text{ min}}$  ( $V_{DD} = V_{CC} - R1 \cdot I_{DD}$ )
- the resistor has to withstand the power dissipated in reverse voltage condition ( $P_D =$

## CMOS Omnipolar High Sensitivity Hall Switch

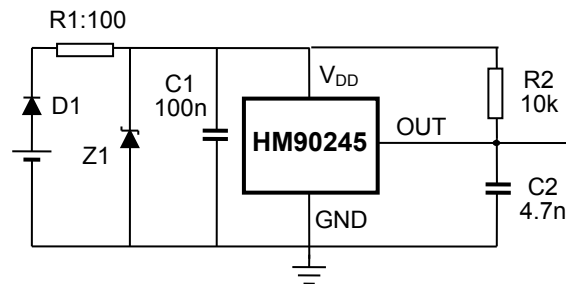
$V_{CC}^2/R1)$

When using a diode, a reverse current cannot flow and the voltage drop is almost constant ( $\approx 0.7V$ ). Therefore, a  $100\Omega/0.25W$  resistor for 5V application and a diode for higher supply voltage are recommended. Both solutions provide the required reverse voltage protection. When a weak power supply is used or when the device is intended to be used in noisy environment, it is recommended the following right figure. The low-pass filter formed by R1 and C1 and the zener diode Z1 bypass the disturbances or voltage spikes occurring on the device supply voltage VDD. The diode D1 provides additional reverse voltage protection.

**Typical Three-Wire Application Circuit**



**Automotive and Severe Environment Protection Circuit**



## 12. CMOS Hall IC Technology

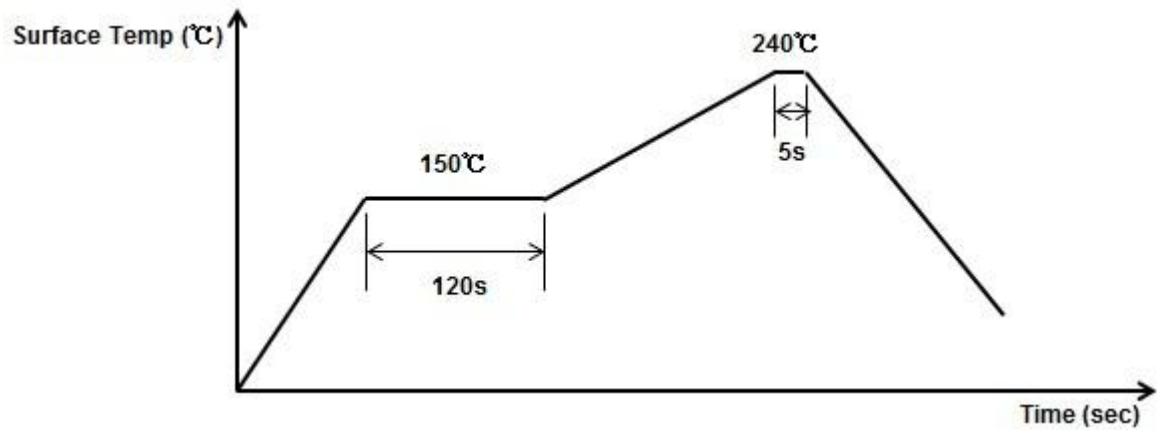
The chopper stabilized amplifier uses switched capacitor techniques to eliminate the amplifier offset voltage, which, in bipolar devices, is a major source of temperature sensitive drift. CMOS makes this advanced technique possible. The CMOS chip is also much smaller than a bipolar chip, allowing very sophisticated circuitry to be placed in less space. The small chip size also contributes to lower physical stress and less power consumption.

## 13. Installation Comments

Consider temperature coefficients of Hall IC and magnetics, as well as air gap and life time variations. Observe temperature limits during wave soldering. Typical IR solder-reflow profile:

- No Rapid Heating and Cooling.
- Recommended Preheating for max. 2minutes at 150°C
- Recommended Reflowing for max. 5seconds at 240°C

**CMOS Omnipolar High Sensitivity Hall Switch**



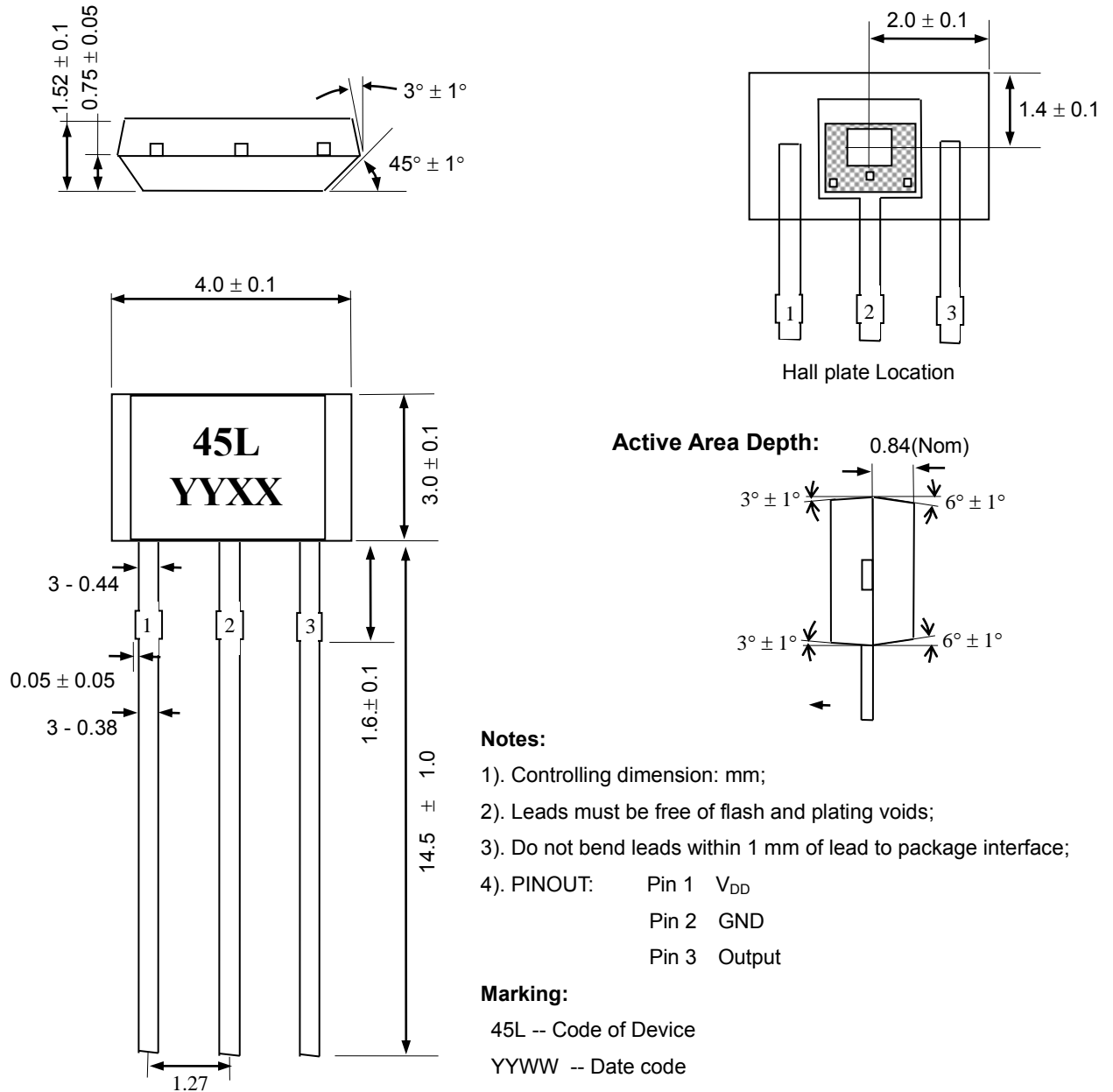
**14. ESD Precautions**

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD). Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

## CMOS Omnipolar High Sensitivity Hall Switch

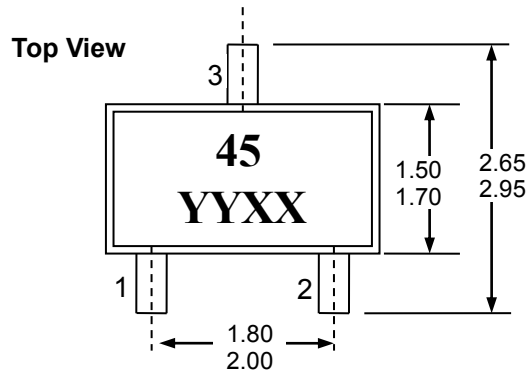
### 15. Package Information

#### 15.1 UA Package (TO-92 flat)



**CMOS Omnipolar High Sensitivity Hall Switch**

**16.2 SO Package (SOT23-3L)**

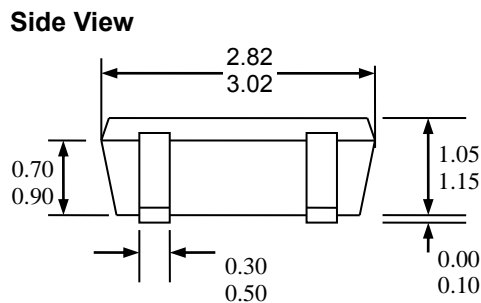


**Notes:**

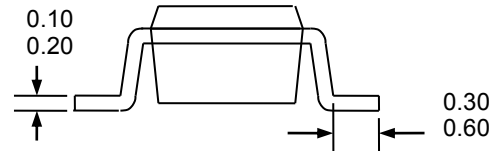
- 1). PINOUT: Pin 1  $V_{DD}$   
Pin 2 Output  
Pin 3 GND
- 2). All dimensions are in millimeters;

**Marking:**

45 -- Code of Device  
 YYWW -- Date code

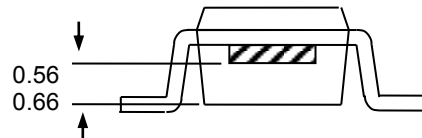
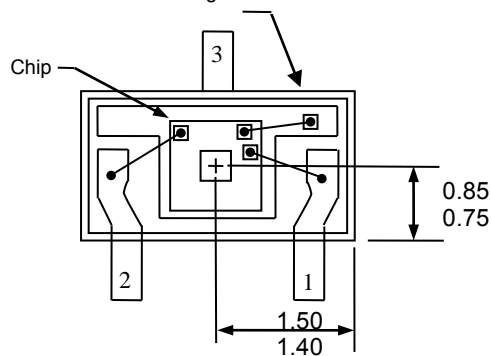


**End View**



**Hall plate location**

Bottom View of SOT-23 Package



**16. Ordering Information**

Part No.	Package Code
HM90245	SO (SOT-3L)
	UA (TO-92)