Micro Power Unipolar Hall-effect Sensor Switch

■ General Description

The BN57Y is Unipolar Hall effect sensor IC is fabricated from mixed signal CMOS technology. It is comprised of one Hall plate and a CMOS output drive, mainly designed for battery-operation. The total power consumption in normal operation is typically 5.6μW with a 2.8V power source.South/North poles of sufficient strength will turn the output on. The output will be turned off under no magnetic field.

The BN57Y is available in DFN1216-4L-EP and SOT553 Package. Operating temperature range of the BN57Y is from -40°C to 85°C.

■ Features

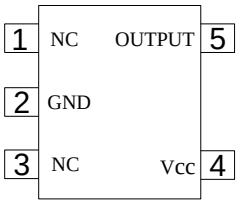
- 2uA Micro power consumption ideal for battery-powered applications
- Input Voltage Range:1.65V to 5.5V
- Very High Sensitivity Hall Sensor
- Chopper stabilized amplifier stage
- Good RF noise immunity
- CMOS Output
- DFN1216-4L-EP、SOT553 package

■ Applications

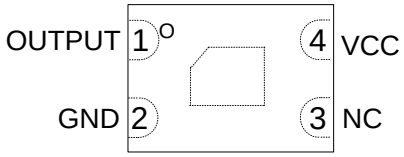
- Solid State Switch
- Bluetooth Headset

■ Pin Configuration

(Top View)



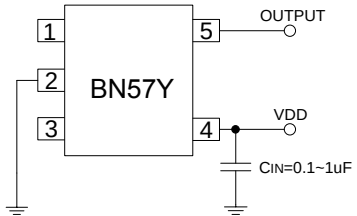
SOT553



DFN1216-4L-EP

Pin Name	Pin Number		Description
	SOT553	DFN1216-EP	
Vcc	4	4	IC Power Supply
OUTPUT	5	1	It is low state during the S magnetic field
GND	2	2	IC Ground
NC	1、3	3	Nc Pin

■ Application Circuit



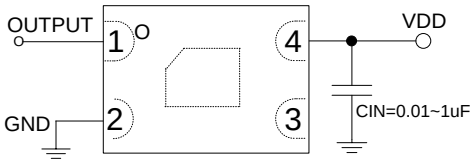


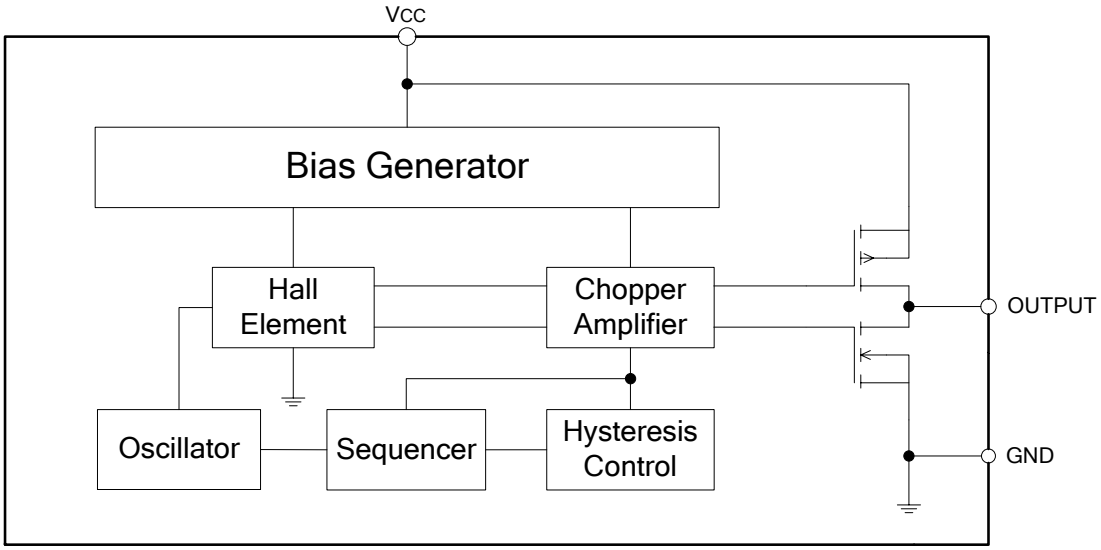
Figure 1, application circuit

Note: C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 0.1~1uF.

■ Ordering Information

Part Number	Package Type	Packing Qty	B_{OP} (Gauss)	B_{RP}(Gauss)	Temperature	Eco Plan	Lead
BN57Y	SOT553	3000pcs/Bag	40(Typ.)	30(Typ.)	-40~ +85℃	ROHS	Cu
BN57Y	DFN1216-4L-EP	3000pcs/Bag	40(Typ.)	30(Typ.)	-40~ +85℃	ROHS	Cu

■ Block Diagram



■ Absolute Maximum Ratings (T_A=25°C unless otherwise noted)

Parameter		Symbol	Rating	Unit
V_{CC} to GND		V_{CC}	-0.3 to 6	V
Magnetic Flux Density		B	Unlimited	
Storage Temperature Range		T_S	-65 to +150	℃
Operating Junction Temperature Range		T_J	-40 to +150	℃
Maximum Power Dissipation	SOT553	P_D	230	mW
	DFN1216-4L-EP		500	
Maximum Soldering Temperature(at leads, 10 sec)		T_{LEAD}	260	℃

■ Recommended Operating Conditions (T_A=25°C unless otherwise noted)

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	V_{DD}	Operating	1.65 ~ 5.5	V
Operating Temperature Range	T_A	Operating	-40 ~ +85	℃

■ Electrical Characteristics

(Unless otherwise noted，typical values are at T_A=25℃, V_{DD}=2.8V)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{OH}	Output Off Voltage (High side)	I_{OUT}=+1mA	V_{DD}-0.3	V_{DD}-0.1	V_{DD}+0.3	V
V_{OL}	Output On Voltage (Low side)	I_{OUT}=-1mA	-0.3	0.1	+0.3	V
I_{OFF}	Output Leakage Current	V_{OUT}=5V, Output off	-	<0.1	1	μA
I_{DD}(EN)	Supply Current	Chip enable, T_A=25℃, V_{DD}= 2.8V	-	1.6	2.5	mA
I_{DD}(EN)		Chip enable, T_A=-40~85□, V_{DD}= 1.6~5.5V	-	1.6	4	mA
I_{DD}(DIS)		Chip disable, T_A=25℃,V_{DD}= 1.8V	-	0.6	1.3	μA
I_{DD}(DIS)		Chip disable, T_A=-40~85□, V_{DD}= 1.65~5.5V	-	2	3	μA
I_{DD}(AVG)		Average supply current, T_A=25℃, V_{DD}=2.8V	-	2	4	μA
I_{DD}(AVG)		Average supply current, T_A=-40~85℃, V_{DD}= 1.65~5.5V	-	2	6	μA
T_{awake}	Awake Time	-	-	70	120	μs
T_{period}	Period	-	-	30	80	ms
D.C.	Duty Cycle	-	-	0.23	-	%

■ Magnetic Characteristics

(Unless otherwise noted, typical values are at T_A=25℃, V_{DD}=2.8V)

Parameter	Symbol	Min.	Typ.	Max.	Unit
South Pole Operate Point	B_{OPS}	20	40	58	Gauss
South Pole Release Point	B_{RPS}	10	30	48	
Hysteresis	BHY (|B_{OPS}-B_{RPS}|)	-	10	-	

■ Output Vs. Magnetic Pole

Part Number	Magnetic Pole	Test Conditions	Output Status
BN57Y	South Pole	B > B_{OPS}	Low
	South Pole	B < B_{RPS}	High

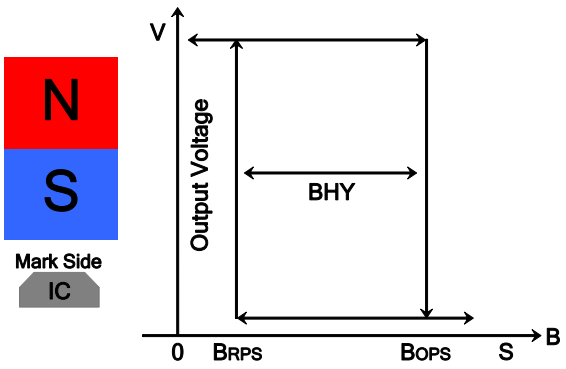
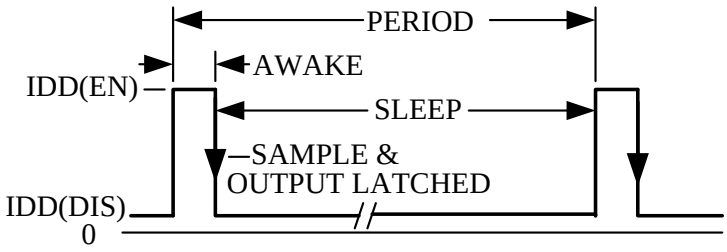


Figure 2,Magnetic Hysteresis Characteristics

■ Functional Description

Low Average Power

Internal timing circuitry activates the sensor for 18μs and deactivates it for the remainder of the period (30ms). A short "awake" time allows for stabilization prior to the sensor sampling and data latching on the falling edge of the timing pulse. The output during the "sleep" time is latched in the last sampled state. The supply current is not affected by the output state.



Chopper-Stabilized Technique

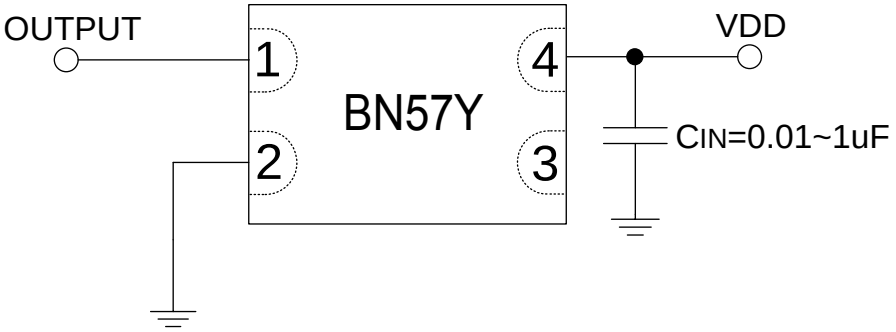
The Hall element can be considered as a resistor array similar to a Wheatstone bridge. A large portion of the offset is a result of the mismatching of these resistors. These devices use a proprietary dynamic offset cancellation technique, with an internal high-frequency clock to reduce the residual offset voltage of the Hall element that is normally caused by device over-molding, temperature dependencies, and thermal stress. The chopper-stabilizing technique cancels the mismatching of the resistor circuit by changing the direction of the current flowing through the Hall plate using CMOS switches and Hall voltage measurement taps, while maintains the Hall voltage signal that is induced by the external magnetic flux. The signal is then captured by a sample-and-hold circuit and further processed using low-offset bipolar circuitry. This technique produces devices that have an extremely stable quiescent Hall output voltage, are immune to thermal stress, and have precise recoverability after temperature cycling. A relatively high sampling frequency is used for faster signal processing capability can be processed.

Magnetic Field Detection Mechanism

The Hall IC cannot detect magnetic fields that run horizontal to the package top layer. Be certain to configure the Hall IC so that the magnetic field is perpendicular to the top layer.

Applications:

BN57Y pole -independent sensing technique allows for operation with either a north or south poles magnet orientation, enhancing the manufacturability of the device. The state-of-the-art technology provides the same output polarity for either pole face.

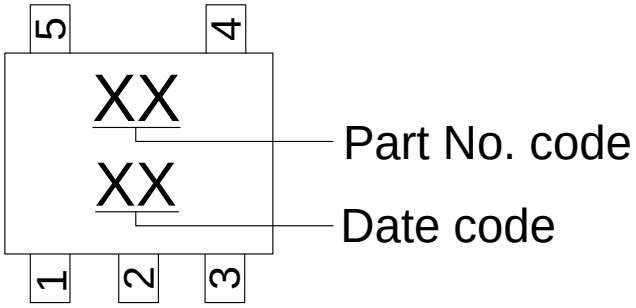


CIN serves two purposes: minimizing ripples on the input voltage and enhancing immunity from RF transmission noises within close proximity. Recommended values are between 0.01uF and 1uF. The larger the capacitance, the better the noise immunity is for the BN57Y

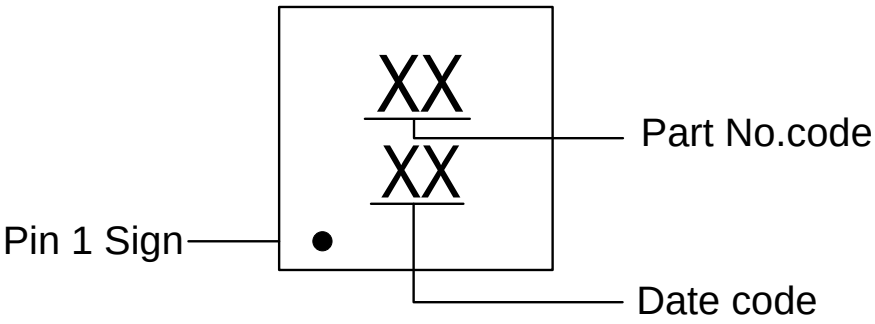
It is strongly recommended that an external bypass capacitor be connected (in close proximity to the Hall sensor) between the supply and ground of the device to reduce both external noise and noise generated by the chopper-stabilization technique. This is especially true due to the relatively high impedance of battery supplies. The simplest form of magnet that will operate these devices is a bar magnet with either pole near the branded surface of the device.

■ Marking Information

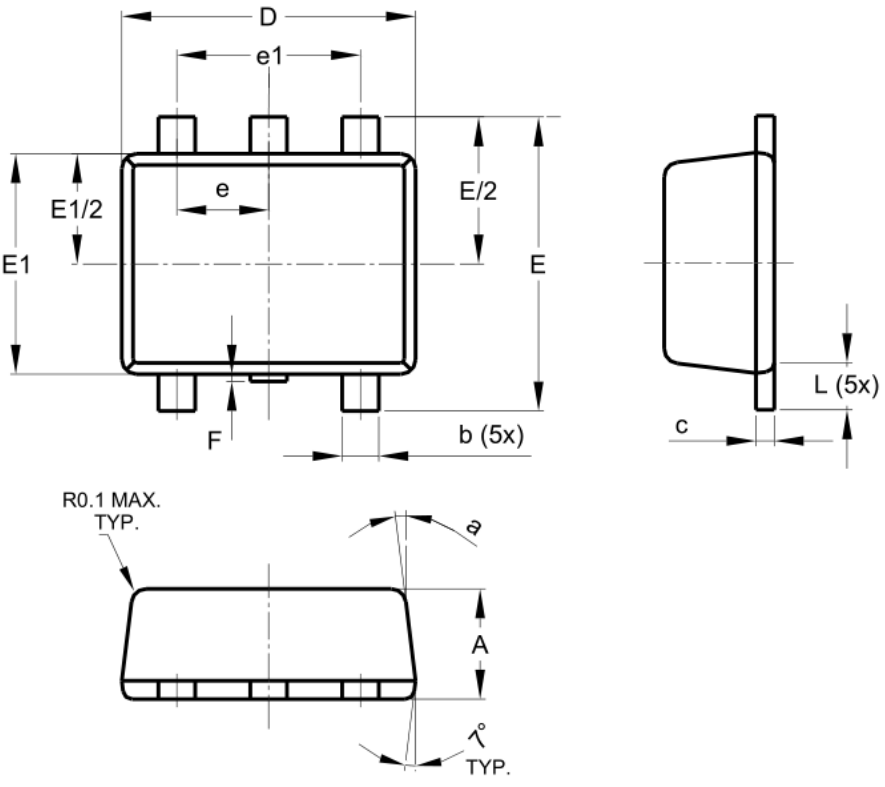
(1) SOT553



(2) DFN1216-4L-EP

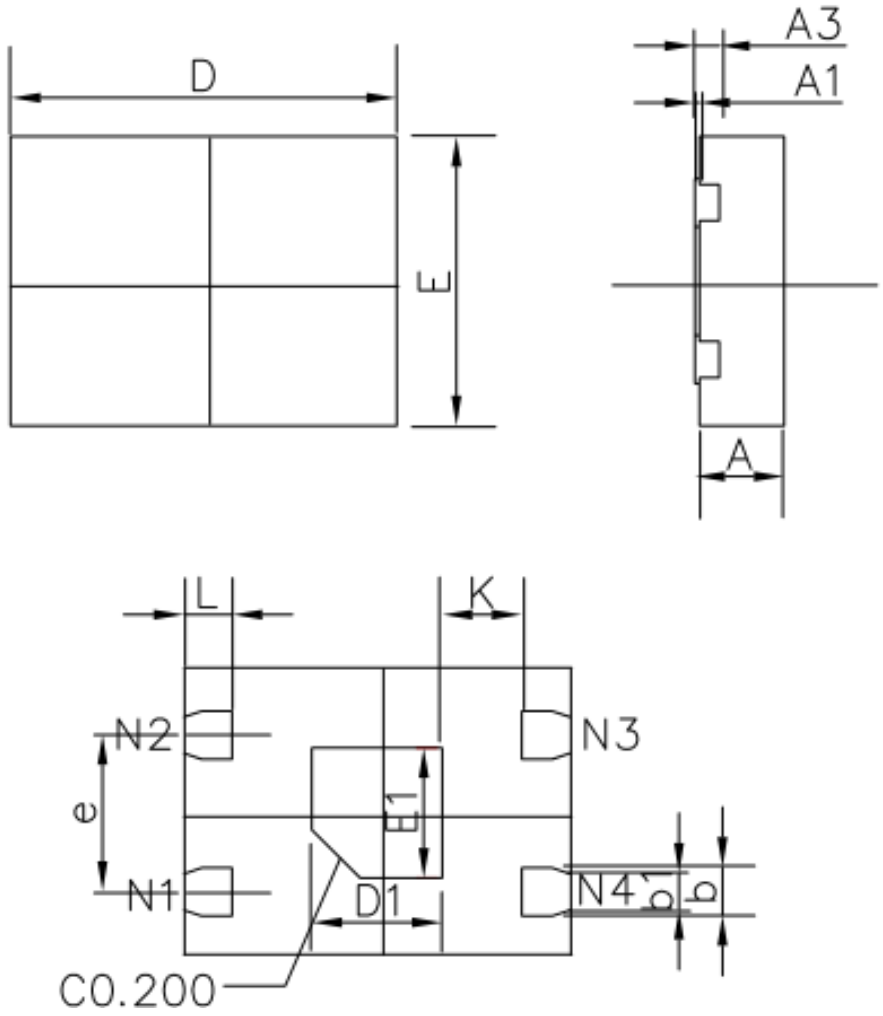


■ Package Information



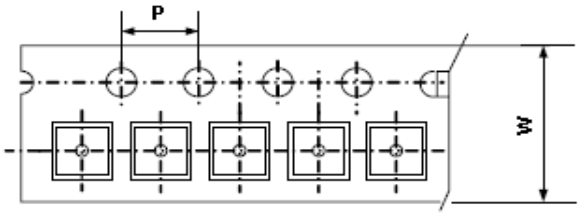
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Norm.	Max.	Min.	Norm.	Max.
A	0.55	0.60	0.62	0.22	0.24	0.24
b	0.15	0.20	0.30	0.06	0.08	0.12
c	0.10	0.20	0.18	0.04	0.08	0.07
D	1.50	1.60	1.70	0.59	0.63	0.67
E	1.55	1.60	1.70	0.61	0.63	0.67
E1	1.10	1.20	1.25	0.43	0.47	0.49
e	0.50 (BSC)			0.20 (BSC)		
e1	1.00 (BSC)			0.39 (BSC)		
F	0.00	-	0.10	0.00	-	0.04
L	0.10	0.20	0.30	0.04	0.08	0.12
a	6°	7°	8°	-	-	-

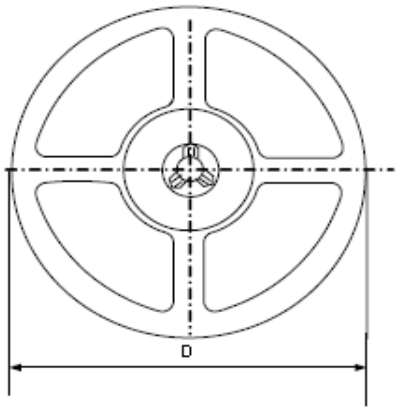
(2) DFN1216-4L-EP



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Norm.	Max.	Min.	Norm.	Max.
A	0.32	0.36	0.4	0.013	0.145	0.016
A1	0.00	0.025	0.05	0.000	0.001	0.002
A3	0.102(BCS)			0.004(BCS)		
D	1.50	1.60	1.70	0.059	0.063	0.067
E	1.10	1.20	1.30	0.043	0.047	0.051
D1	0.44	0.54	0.64	0.017	0.021	0.025
E1	0.44	0.54	0.64	0.017	0.021	0.025
k	0.330 (BSC)			0.013 (BSC)		
b	0.15	0.20	0.25	0.006	0.008	0.01
b1	0.15(BSC)			0.006(BSC)		
e	0.650(BSC)			0.026(BSC)		
L	0.15	0.20	0.25	0.006	0.008	0.01

■ Packing Information





Package Type	Carrier Width (W)	Pitch (P)	Reel Size(D)	Packing Minimum
BN57Y	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum