■ General Description

The OCH166A omnipolar Hall effect sensor IC is fabricated from mixed signal CMOS technology. It is comprised of one Hall plate and a CMOS output driver, mainly designed for battery-operation, hand-held equipment (such as Cellular and Cordless Phone, PAD). The total power consumption in normal operation is typically 4μW with a 1.8V power source. South poles of sufficient strength will turn the output on. The output will be turned off under no magnetic field. While the magnetic flux density (B) is larger than operating point (BOP), the output will be turned on (low), the output is held until B is lower than release point (BRP), and then turned off.

The OCH166A is available in TSOT23-3L, DFN1616-6L-EP, DFN1216-4L, DFN1616-6L and SOT553 package. Operating temperature range of the OCH166A is from -40°C to 85°C.

To minimize the BOM cost, capacitors of the MLCC type are supported, and only one external component is needed to complete the application circuit.

■ Features

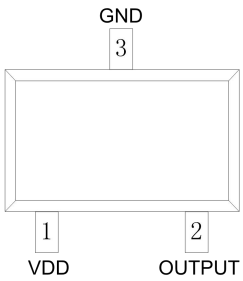
- Micro power consumption ideal for battery-powered applications
- Omnipolar (operation with magnetic field of either north or south pole), easy to use as output
- Input VoltageRange:1.65V to 4.5V
- Very High Sensitivity Hall Sensor
- Chopper stabilized amplifier stage
- Good RF noise immunity
- DFN1216-4L, DFN1216-4L-EP, TSOT23-3L, DFN1616-6L-EP, DFN1616-6L & SOT553 package
- No need the push-high resistance

■ Applications

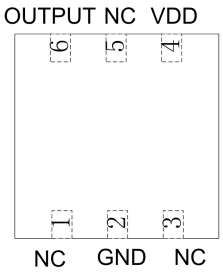
- Cover switch in clam-shell cellular phones
- Cover switch in Notebook PC/PAD
- Contact-less switch in consumer products
- Solid State Switch
- Handheld Wireless Handset Awake Switch
- Lid close sensor for battery-powered devise
- Magnet proximity sensor for reed switch replacement

■ Pin Configuration

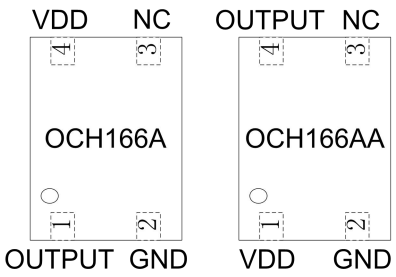
(1)TSOT23-3L (Top View)



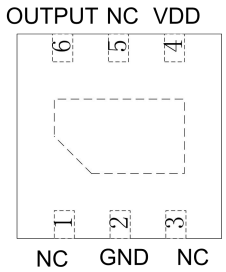
(2) DFN1616-6L (Top View)



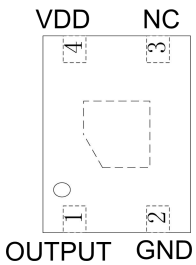
(3) DFN1216-4L (Top View)



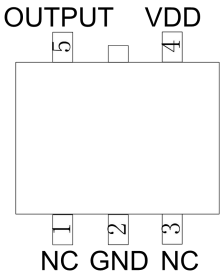
(4) DFN1616-6L-EP (Top View)



(5) DFN1216-4L-EP (Top View)



(6) SOT553 (Top View)

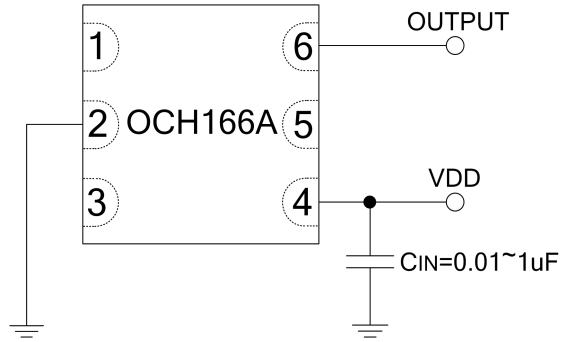


Pin Name	Pin No.					Pin Function
	TSOT23-3L	SOT553	DFN1616-6L DFN1616-6L-EP	DFN1216-4L/ DFN1216-4L-EP OCH166A	DFN1216-4L/ DFN1216-4L-EP OCH166AA	
VDD	1	4	4	4	1	Power Supply Input
GND	3	2	2	2	2	Ground
OUTPUT	2	5	6	1	4	Output Pin
NC	-	1	1，3，5	3	3	Not connected

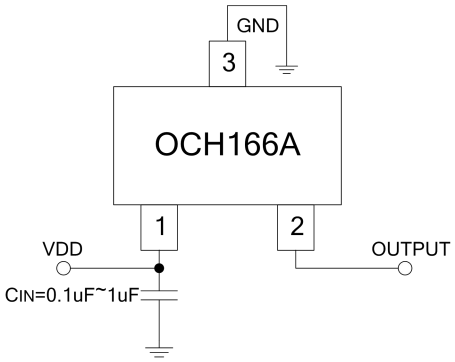
■ Ordering Information

Part Number	Package Type	Packing Qty	B_{OPS} (Gauss)	B_{RPS} (Gauss)	Temperature	Eco Plan	Lead
OCH166ATWAD	TSOT23-3L	7-in reel 3000pcs/reel	±20 ~±60	±10 ~±40	-40～85℃	Green	Cu
OCH166AV4AD	DFN1216-4L	7-in reel 3000pcs/reel	±20 ~±60	±10 ~±40	-40～85℃	Green	Cu
OCH166AEV4AD	DFN1216-4L-EP	7-in reel 3000pcs/reel	±20 ~±60	±10 ~±40	-40～85℃	Green	Cu
OCH166AAV4AD	DFN1216-4L	7-in reel 3000pcs/reel	±20 ~±60	±10 ~±40	-40～85℃	Green	Cu
OCH166AV6AD	DFN1616-6L	7-in reel 3000pcs/reel	±20 ~±60	±10 ~±40	-40～85℃	Green	Cu
OCH166AEV6AD	DFN1616-6L-EP	7-in reel 3000pcs/reel	±20 ~±60	±10 ~±40	-40～85℃	Green	Cu
OCH166ASTAD	SOT553	7-in reel 3000pcs/reel	±20 ~±60	±10 ~±40	-40～85℃	Green	Cu

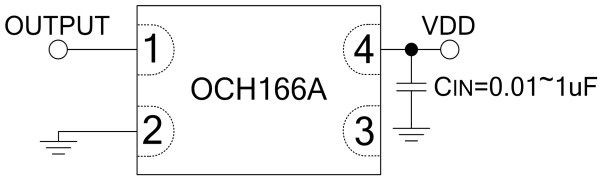
■ Application Circuit



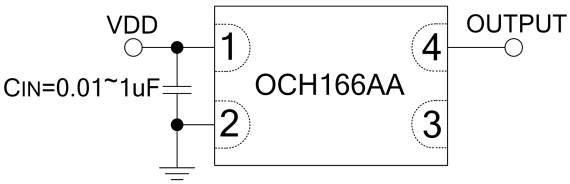
DFN1616-6L/DFN1616-6L-EP



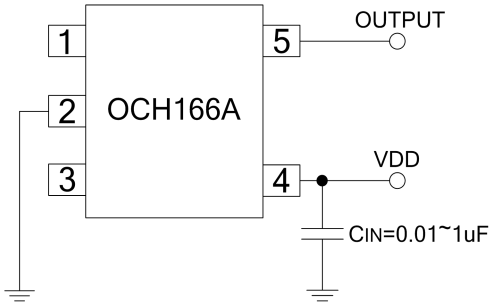
TSOT23-3L



DFN1216-4L /DFN1216-4L-EP



DFN1216-4L

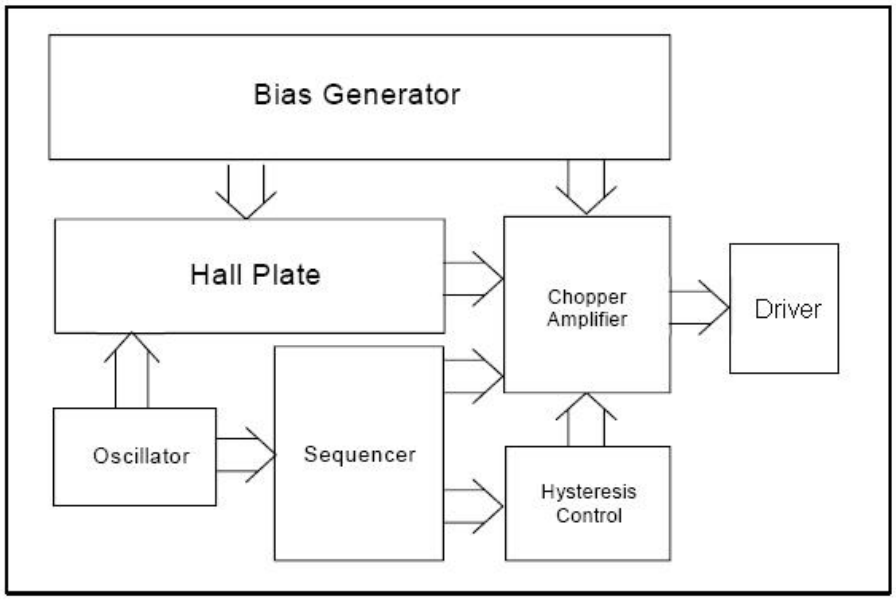


SOT553

Figure 1, application circuit

Note: C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 0.01~1uF.

■ Block Diagram



■ Absolute Maximum Ratings[1] (T_A=25°C unless otherwise noted)

Parameter		Symbol	Rating	Unit
VDD to GND		V_{DD}	-0.3 to5	V
Magnetic Flux Density		B	Unlimited	
Storage Temperature Range		T_S	-55 to +150	℃
Operating Junction Temperature Range		T_J	-40 to 150	℃
Package Power Dissipation	TSOT23-3L	P_D	180	mW
	DFN1216-4L		230	
	DFN1616-6L		500	
	DFN1616-6L-EP		550	
	SOT553		230	

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

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	V_{DD}	Operating	1.65 ~ 4.5	V
Operating Temperature Range	T_A	Operating	-40 ~ +85	℃

■ Electrical Characteristics

(Unless otherwise noted，typical values are at T_A=25℃, V_{DD}=1.8V)

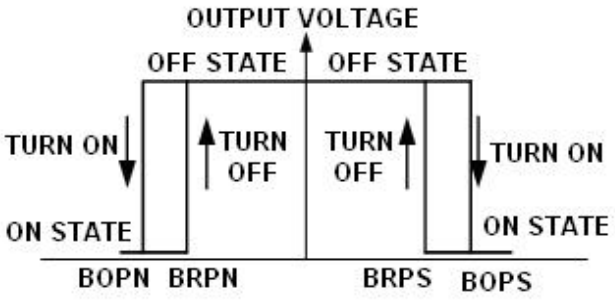
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{OH}	Output Off Voltage (High side)	I_{OUT}=+1mA	V_{DD}-0.3	V_{DD}-0.1	V_{DD}+0.3	V
V_{OL}	Output On Voltage (Low side)	I_{OUT}=-1mA	-0.3	0.1	+0.3	V
I_{OFF}	Output Leakage Current	V_{OUT}=4.5V, Output off	-	<0.1	1.0	μA
I_{DD}(EN)	Supply Current	Chip enable, T_A=25 ℃ , V_{DD}= 1.8V	-	0.9	1.5	mA
I_{DD}(EN)		Chip enable, T_A=-40~85℃, V_{DD}= 1.65~4.5V	-	1.0	2.0	mA
I_{DD}(DIS)		Chip disable, T_A=25 ℃ ,V_{DD}= 1.8V	-	0.8	1.6	μA
I_{DD}(DIS)		Chip disable, T_A=-40~85℃, V_{DD}= 1.65~4.5V	-	1.0	2.0	μA
I_{DD}(AVG)		Average supply current, T_A=25℃, V_{DD}=1.8V	-	1.7	4.0	μA
I_{DD}(AVG)		Average supply current, T_A=-40~85℃, V_{DD}= 1.65~4.5V	-	2.2	5.0	μA
T_{awake}	Awake Time	-	-	30	80	μs
T_{period}	Period	-	-	30	80	ms
D.C.	Duty Cycle	-	-	0.1	-	%

■ Magnetic Characteristics

(Unless otherwise noted, typical values are at T_A=25℃, V_{DD}=1.8V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
BOPS (south pole to brand side)	Operate Point	20	40	60	Gauss
BOPN (north pole to brand side)		-20	-40	-60	
BRPS (south pole to brand side)	Release Point	10	25	40	
BRPN (north pole to brand side)		-10	-25	-40	
BHY (|BOPX-BRPX|)	Hysteresis	-	15	-	

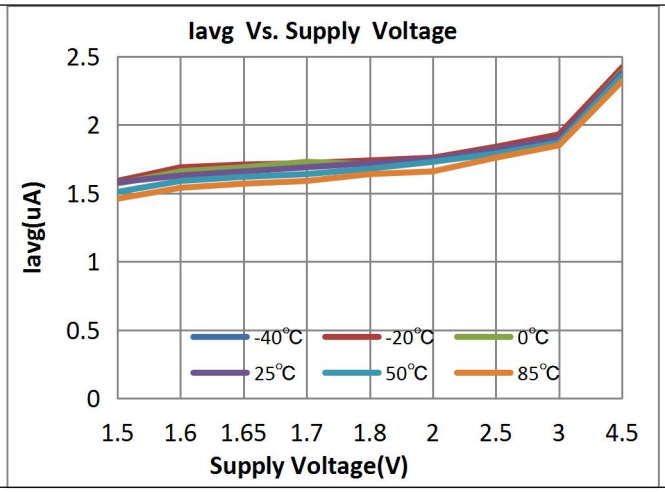
Notes: Operating point and release point will vary with supply voltage and operating temperature.



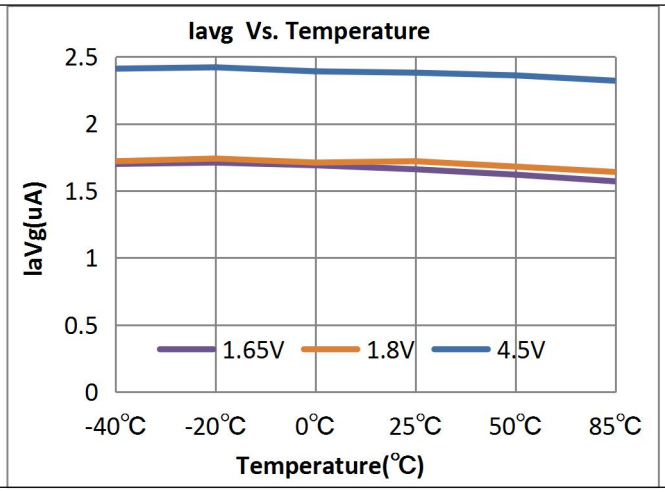
■ Typical Characteristics—OCH166A

(Unless otherwise noted, V_{DD} = 1.8V, T_A = 25℃)

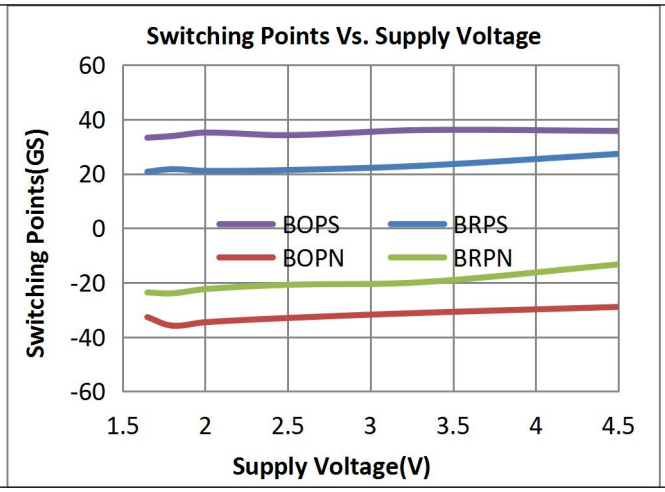
Average Supply Current vs. Supply Voltage



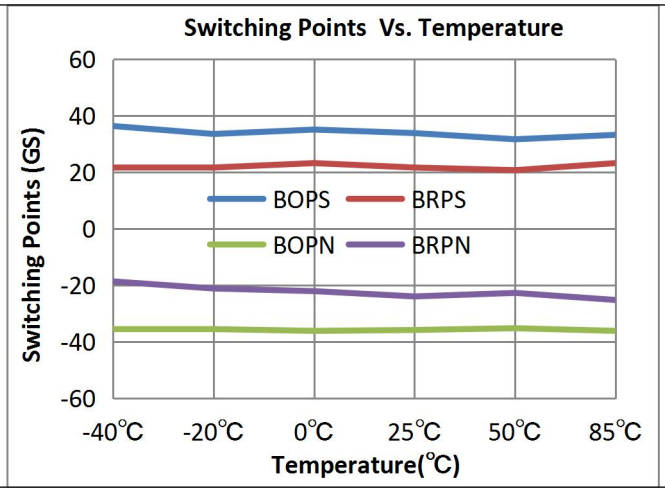
Average Supply Current vs. Temperature



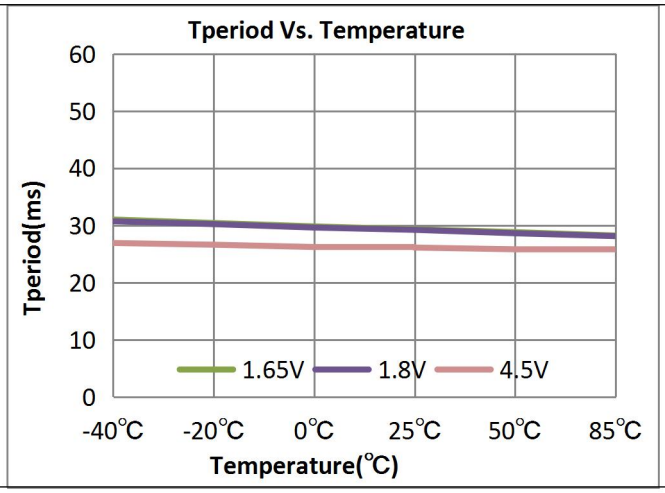
Switch Point vs. Supply Voltage



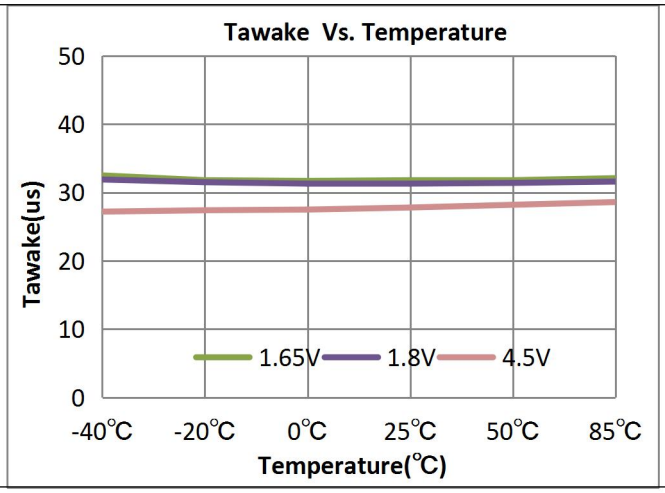
Switch Point vs. Temperature



Period Time vs. Temperature



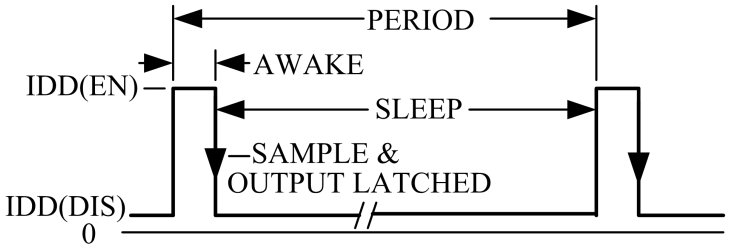
Awake Time vs. Temperature



■ Functional Description

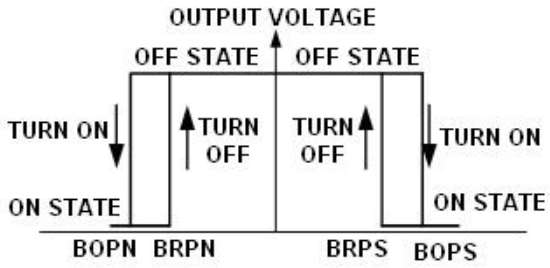
Low Average Power

Internal timing circuitry activates the sensor for 50μs and deactivates it for the remainder of the period(100ms). 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.



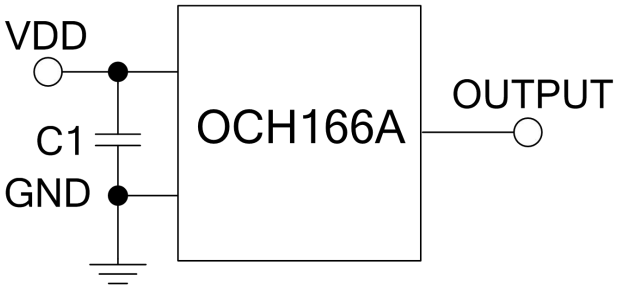
Magnetic Field Detection Mechanism

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.

Operation

The output of this device switches low (turns on) when a magnetic field perpendicular to the Hall sensor exceeds the operate point B_{OPS} (or is less than B_{OPN}). After turn-on, the output is capable of sinking up to 1mA and the output voltage is V_{OUT}(ON). When the magnetic field is reduced below the release point B_{RPS} (or increased above B_{RPN}), the device output switches high (turns off). The difference between the magnetic operates and release points are the hysteresis (Bhys) of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise.

Applications:



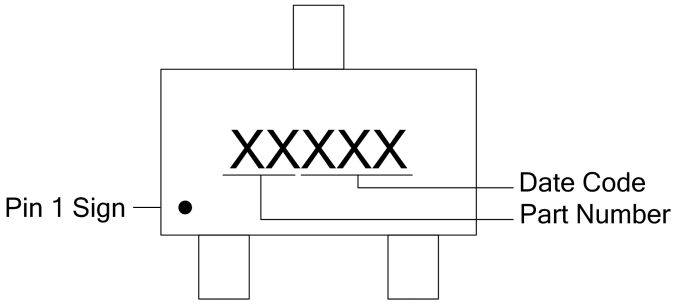
OCH166A's pole-independent sensing technique allows for operation with either a north or south poles magnet orientation, enhancing the manufacturability of the device. The state-of-the-art technology provides the same output polarity for either pole face.

C1 serves two purposes: minimizing ripples on the input voltage and enhancing immunity from RF transmission noises within close proximity. Recommended values are between 10nF and 100nF. The larger the capacitance, the better the noise immunity is for the OCH166A.

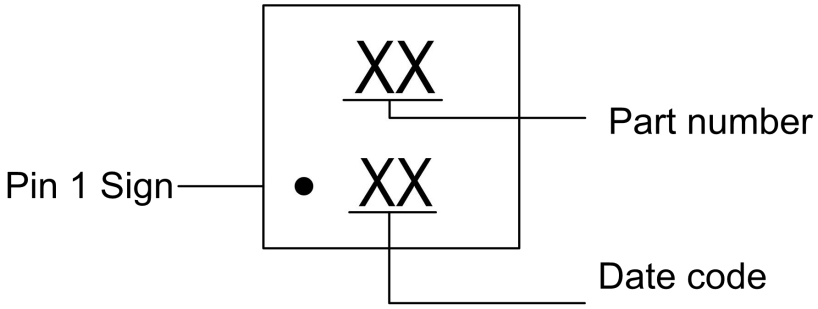
It is strongly recommended that an external bypass capacitor be connected (in close proximity to the Hall sensor) between the supply and ground of the device to reduce both external noise and noise generated by the chopper-stabilization technique. This is especially true due to the relatively high impedance 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

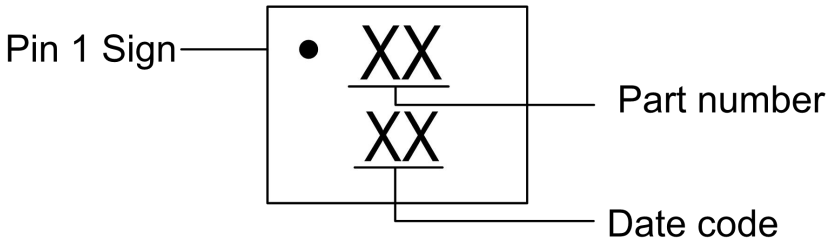
(1) TSOT23-3L



(2) DFN1616-6L/DNF1616-6L-EP/SOT553

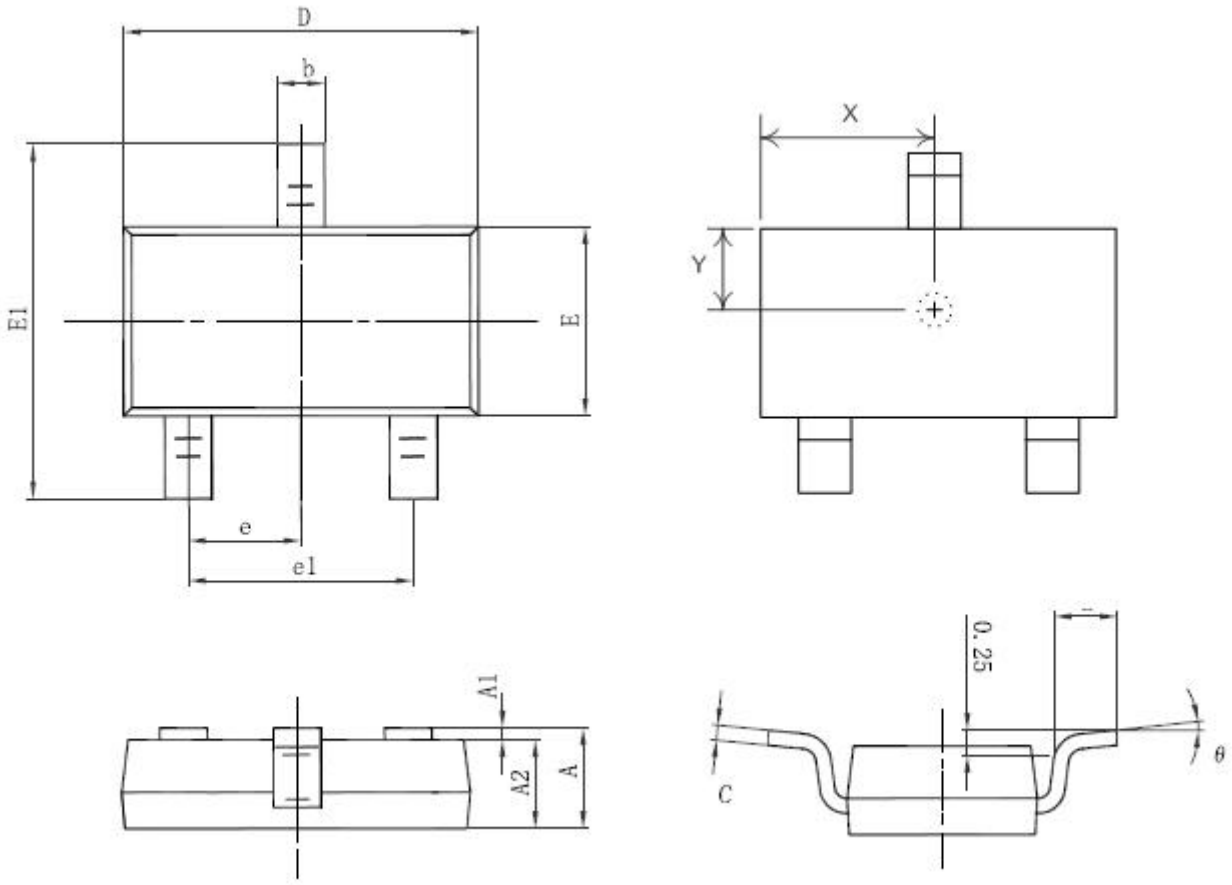


(3) DNF1216-4L/DNF1216-4L-EP



■ Package Information

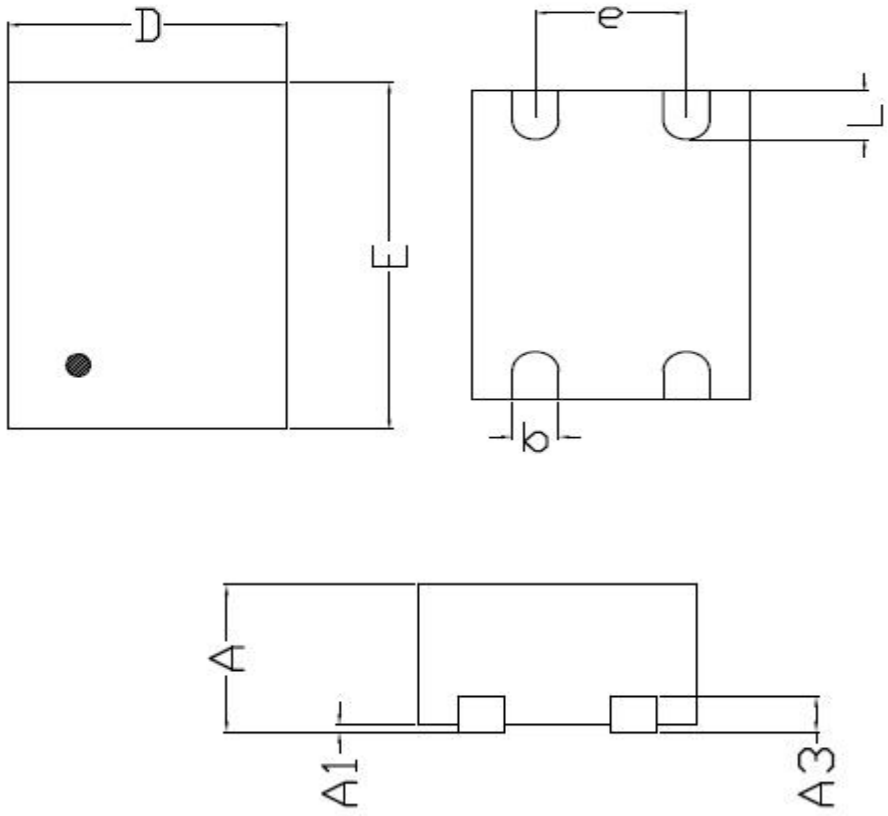
(1) TSOT23-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.900	0.028	0.035
A1	0.000	0.100	0.000	0.004
A2	0.700	0.800	0.028	0.031
b	0.350	0.500	0.014	0.020
c	0.080	0.200	0.003	0.008
D	2.820	3.020	0.111	0.119
E	1.600	1.700	0.063	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.900(BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°
X	1.410	1.510	0.056	0.059
Y	0.800	0.850	0.031	0.033

■ Package Information

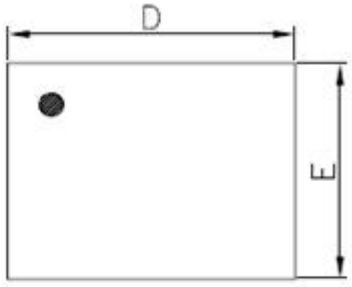
(2) DFN1216-4L

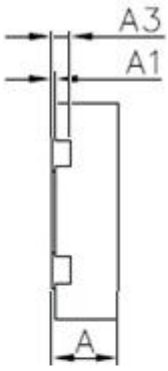


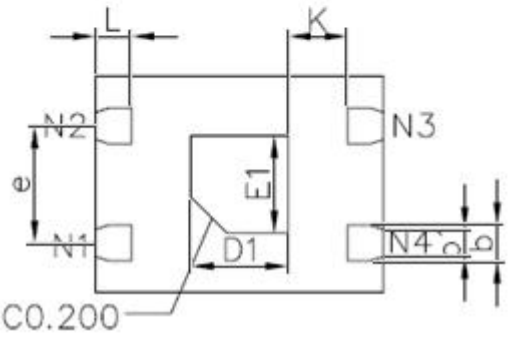
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0. 50	0.55	0.60	0.020	0.022	0.024
A1	0.00	-	0.05	0.000	-	0.002
A3	0.150 (BSC)			0.006 (BSC)		
D	1.15	1.20	1.25	0.045	0.047	0.049
E	1.55	1.60	1.65	0.061	0.063	0.065
L	0.20	0.25	0.30	0.008	0.010	0.011
b	0.15	0.20	0.25	0.006	0.008	0.010
e	0.65 (BSC)			0.026 (BSC)		

■ Package Information

(3) DFN1216-4L-EP



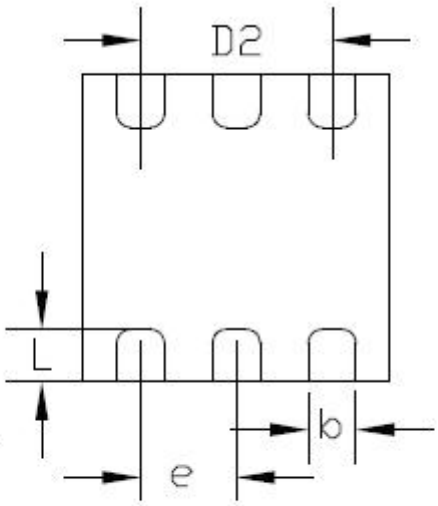


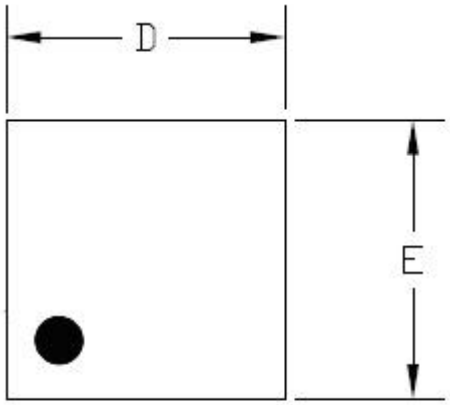


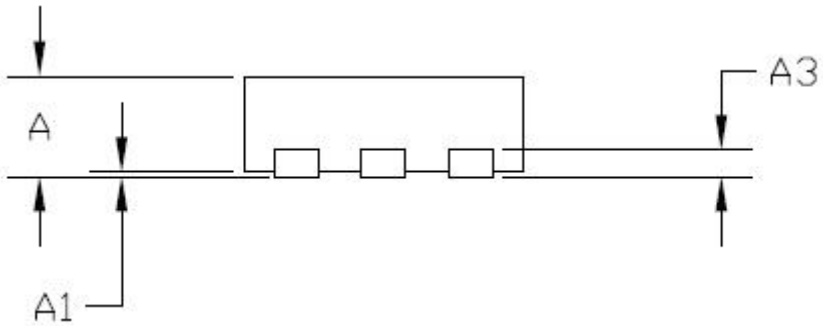
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.320	0.370	0.400	0.013	0.145	0.016
A1	0.000	-	0.050	0.000	-	0.002
A3	0.102 (REF)			0.004 (REF)		
D	1.500	1.600	1.700	0.059	0.63	0.067
E	1.100	1.200	1.300	0.043	0.47	0.051
D1	0.440	0.540	0.640	0.017	0.021	0.025
E1	0.440	0.540	0.640	0.017	0.021	0.025
k	0.330 (REF)			0.013 (REF)		
b	0.150	0.200	0.250	0.006	0.008	0.010
b1	0.150 (REF)			0.006 (REF)		
e	0.650 (BSC)			0.026 (BSC)		
L	0.150	0.200	0.250	0.006	0.008	0.010

■ Package Information

(3) DFN1616-6L



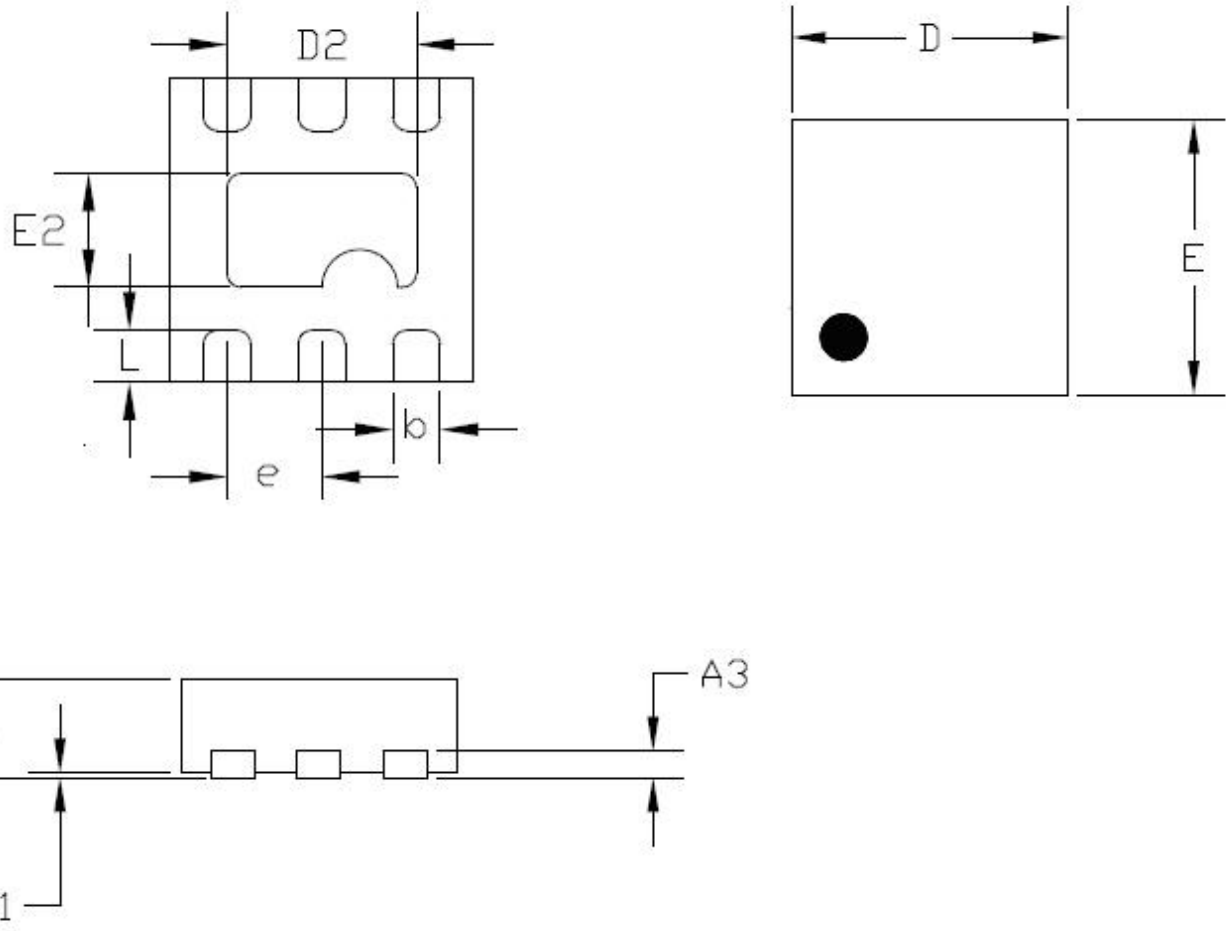




Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0. 500	0.550	0.600	0.020	0.022	0.024
A1	0.000	-	0.050	0.000	-	0.002
A3	0.150 (BSC)			0.006 (BSC)		
D	1.550	1.600	1.650	0.061	0.063	0.065
E	1.550	1.600	1.650	0.061	0.063	0.065
D2	0.900	1.000	1.050	0.035	0.039	0.041
L	0.175	0.275	0.375	0.007	0.011	0.015
b	0.200	0.250	0.300	0.008	0.010	0.012
e	0.500 (BSC)			0.020 (BSC)		

■ Package Information

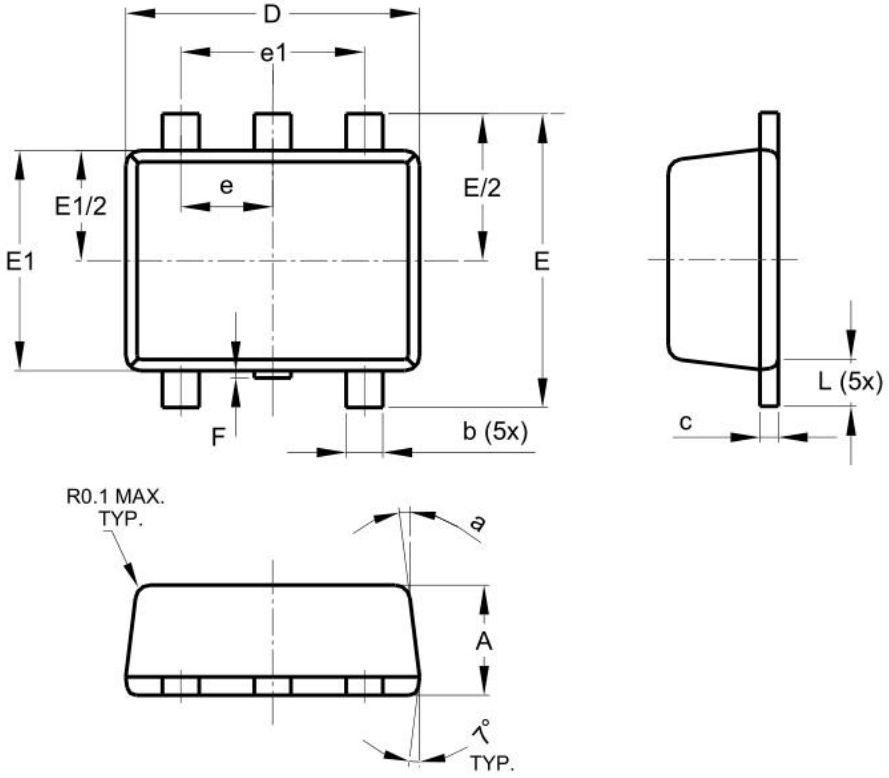
(4) DFN1616-6L-EP



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	>0. 500	0.550	0.600	0.020	0.022	0.024
A1	0.000	-	0.050	0.000	-	0.002
A3	0.150 (BSC)			0.006 (BSC)		
D	1.550	1.600	1.650	0.061	0.063	0.065
E	1.550	1.600	1.650	0.061	0.063	0.065
D2	0.900	1.000	1.050	0.035	0.039	0.041
E2	0.500	0.600	0.650	0.020	0.023	0.026
L	0.175	0.275	0.375	0.007	0.011	0.015
b	0.200	0.250	0.300	0.008	0.010	0.012
e	0.500 (BSC)			0.020 (BSC)		

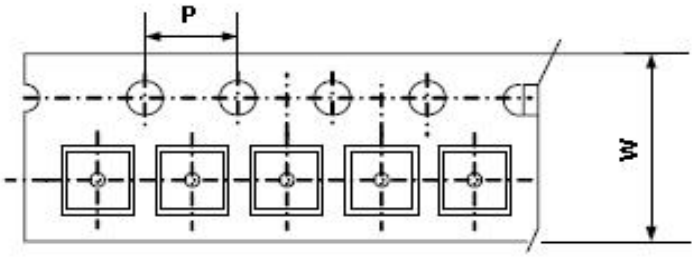
■ Package Information

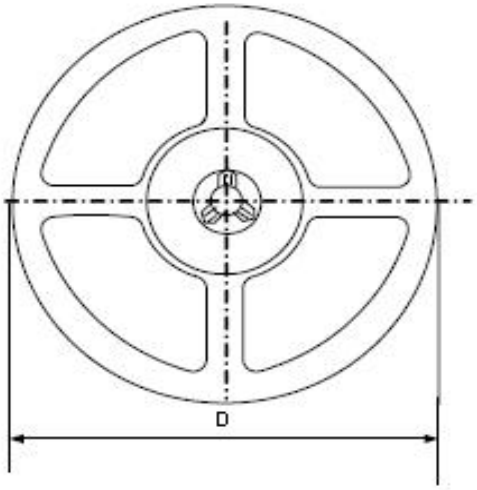
(5) SOT553



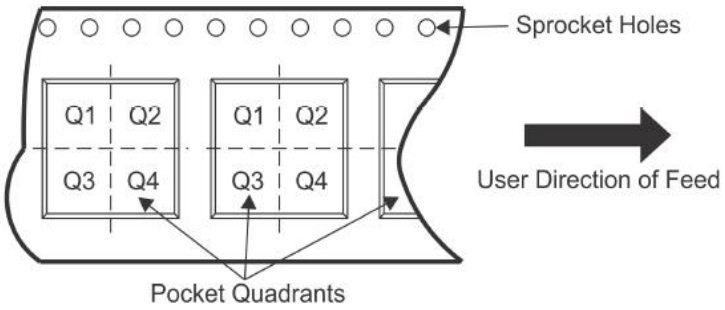
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.55	0.60	0.62	0.22	0.24	0.24
b	0.15	0.20	0.30	0.06	0.08	0.12
c	0.10	0.20	0.18	0.04	0.08	0.07
D	1.50	1.60	1.70	0.59	0.63	0.67
E	1.55	1.60	1.70	0.61	0.63	0.67
E1	1.10	1.20	1.25	0.43	0.47	0.49
e	0.50 (BSC)			0.20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

■ Packing information





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Package Type	Carrier Width(W)	Pitch(P)	Reel Size(D)	Packing Minimum	PIN1 Quadrant
TSOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs	Q3
DFN1216-4L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs	Q2
DFN1216-4L-EP	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs	Q2
DFN1616-6L-EP	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs	Q1
DFN1616-6L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs	Q1
SOT553	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs	Q3

Note: Carrier Tape Dimension, Reel Size and Packing Minimum

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