GENERAL DESCRIPTION

The HS2105 device is a low-power digital switch Unipolar Hall effect sensor, designed for the most compact and battery-sensitive systems.

The total power consumption in normal operation is typically 2μW with a 1.8V power source. North pole or South pole 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 B_{OP}, the output will be turned on (low), the output is held until B is lower than release point B_{RP}, and then turned off. By incorporating an internal oscillator, the device samples the magnetic field and updates the output at a rate of low frequency for the lowest current consumption.

The HS2105 is available in SOT23-3,SOT553, TO92S and DFN1216-4L Package.

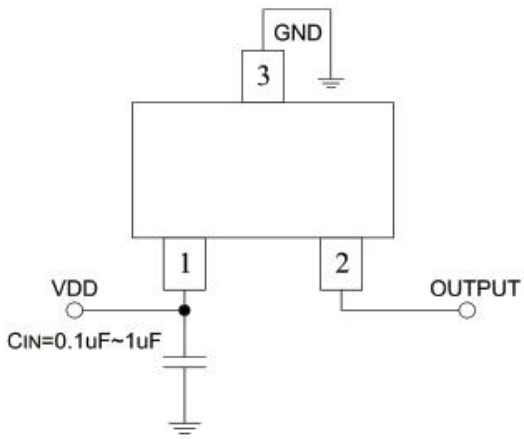
FEATURES

- CMOS Hall IC Technology
- Strong RF noise protection
- 1.8 to 5.5V for battery-powered applications
- Operating in Unipolar mode
- High Sensitivity for reed switch replacement applications
- Low sensitivity drift in crossing of Temp. range
- Low power consumption at 1.1uA @1.8V(Avg)
- High ESD Protection, HBM > ±4KV

APPLICATIONS

- Battery-critical position sensing
- Electricity meter tamper detection
- Cell Phone, laptop, or tablet case sensing
- E-locks, smoke detectors, appliances
- Medical devices, IoT systems
- Valve or solenoid position detection
- Contactless diagnostics or activation

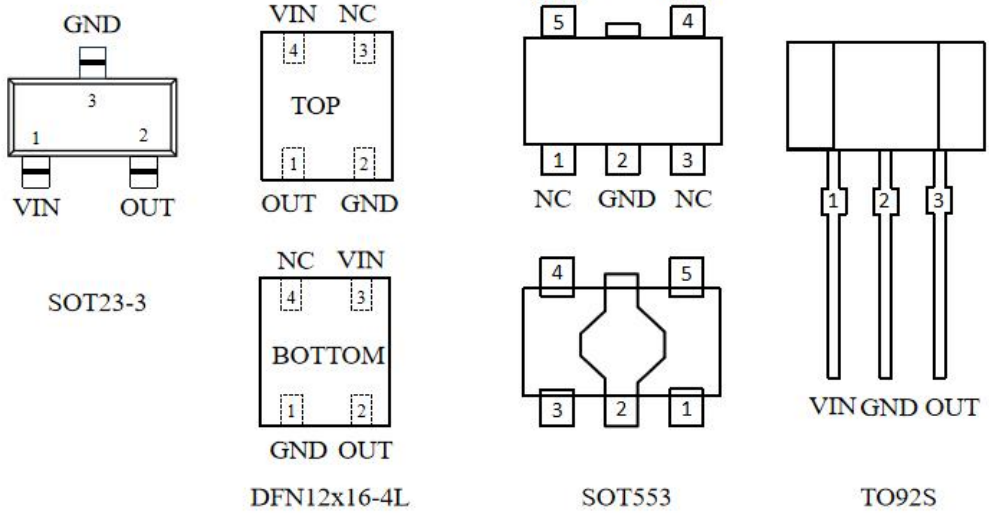
TYPICAL APPLICATION CIRCUIT



ORDER and MARKING INFORMATION

DEVICE ID	Function	BOP	BRP	Hysteresis	PACKAGE	PACKING
HS2105NSC	N Pole	3.0mT	2.1mT	0.9mT	SOT23-3	3000pcs/Reel Tape
HS2105SSE	S Pole	3.0mT	2.1mT	0.9mT	SOT553	3000pcs/Reel Tape
HS2105STC	S Pole	3.0mT	2.1mT	0.9mT	TO92S	1000pcs/Bag
HS2105SDR	S Pole	3.0mT	2.1mT	0.9mT	DFN1216-4L	4000pcs/Reel Tape

PIN ASSIGNMENT



PIN DESCRIPTION

SYMBOL	DESCRIPTTION
VDD	Power supply. TI recommends connecting this pin to a ceramic capacitor to ground with a value of at least 0.1 μF.
OUT	Unipolar output that responds to north magnetic poles. Low level effective.
GND	Ground
NC	No Connected

ABSOLUTE MAXIMUM RATINGS (Note 1)

PARAMETER		VALUE
Input Voltage,V_{DD}		-0.3V to 6.0V
Output Voltage, V_{OUT}		0.3V to 6.0V
Output Current (I_{OUT})		1mA
Max Operating Junction Temperature(T_J)		125°C
Ambient Temperature(T_A)		-40°C – 85°C
Maximum Power Dissipation	SOT23-3	400mW
	SOT553	500mW
	TO92S	1W
	DFN1216-4L	1W
Storage Temperature(Ts_{TG})		-40°C - 150°C
Lead Temperature & Time		260°C, 10S

Note1: Absolute Maximum Ratings are threshold limit values that must not be exceeded even for an instant under any condition. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

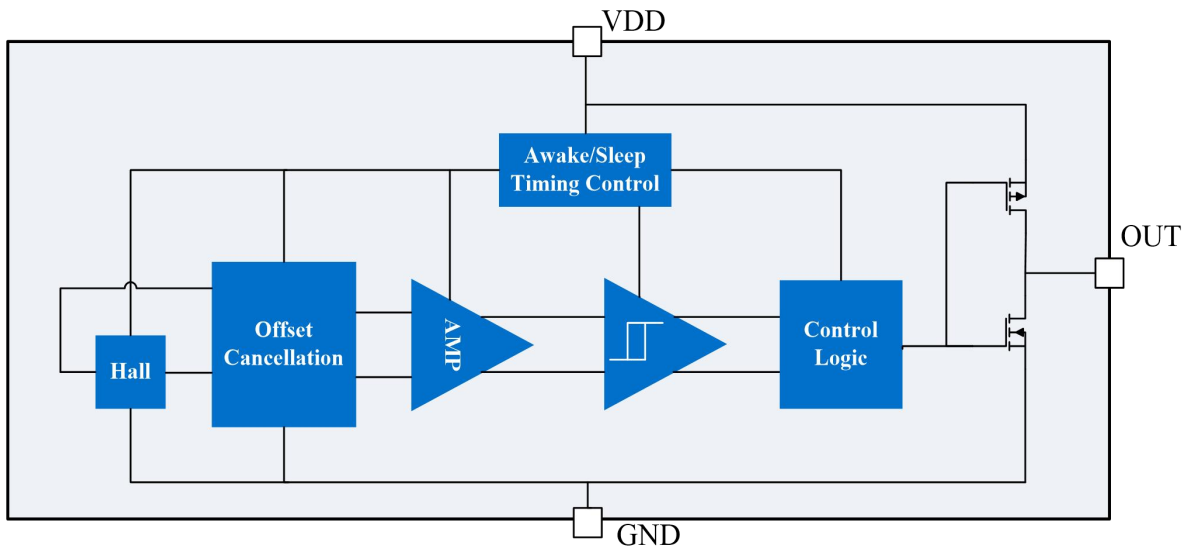
RECOMMANDED OPERATING RANGE

SYMBOL	PARAMETER	VALUE	UNIT
V_{DD}	V_{DD} Supply Voltage	1.8 to 5.5	V
T_{OPT}	Operating Temperature	-40 to +85	°C

ELECTRICAL CHARACTERSTICS (unless otherwise noted,T_{OPT}=25°C, V_{DD}=1.8V)

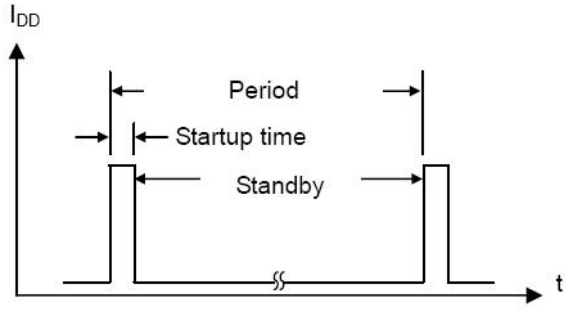
SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
V_{IN}	Input Voltage Range		1.8		5.5	V
I_{DD}	Supply Current	Awake State	-	1.0	1.5	mA
		Sleep State	-	1.4	2.0	μA
		Average	-	1.1	1.6	μA
I_{LKG}	Output Leakage	Output Off	-	-	1.0	μA
V_{OH}	Output High Voltage	B<B_{RP}, I_{OUT}=0.5mA(source)	V_{DD}-0.2	-	-	V
V_{OL}	Output Low Voltage	B_{OP}<B, I_{OUT}=0.5mA(sink)	-	-	0.2	V
T_{START}	Startup Time	Operating	-	24	36	μs
T_{PERIOD}	Period Time	Operating	-	50	100	ms
T_{DUTY}	Duty Cycle		-	0.1	-	%
N Pole of Magnetic specification						
B_{OP}	Operating Point	N Pole to branded side, B>B_{OP},Vout on	-5.0	-3.0	-1.5	mT
B_{RP}	Release Point	N Pole to branded side, B<B_{RP},Vout off	-	-2.1	-0.6	mT
B_{HY}	Hysteresis	|B_{OPX}-B_{RPX}|	-	0.9	-	mT
S Pole of Magnetic specification						
B_{OP}	Operating Point	S Pole to branded side, B>B_{OP},Vout on	1.5	3.0	5.0	mT
B_{RP}	Release Point	S Pole to branded side, B<B_{OP},Vout off	0.6	2.1	-	mT
B_{HY}	Hysteresis	|B_{OPX}-B_{RPX}|	-	0.9	-	mT

BLOCK DIAGRAM



OPERATION DESCRIPTION

The unipolar detection Hall IC adopts an intermittent operation method to save energy. At startup, the Hall elements, amp, comparator and other detection circuit power ON and magnetic detection begins. During standby, the detection circuits power OFF, thereby reducing current consumption. The detection results are held while standby is active, and then output.



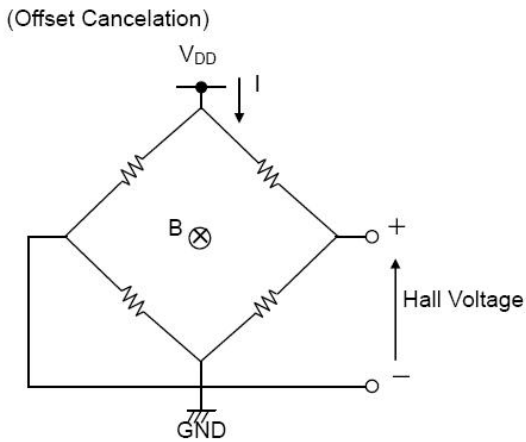
Starup Time: 24μs, Period: 50ms

The Hall elements form an equivalent Wheatstone (resistor) bridge circuit. Offset voltage may be generated by a differential in this bridge resistance, or can arise from changes in resistance due to package or bonding stress. A dynamic offset cancellation circuit is employed to cancel this offset voltage.

When Hall elements are connected as shown in below diagram and a magnetic field is applied perpendicular to the Hall elements,voltage is generated at the mid-point terminal of the bridge. This is known as Hall voltage.

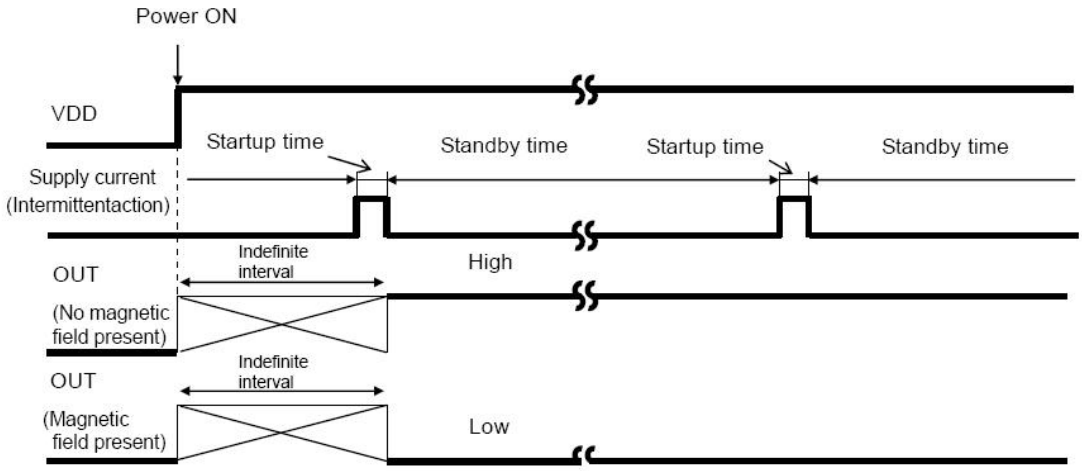
Dynamic cancellation switches the wiring (shown in the figure) to redirect the current flow to a 90° angle from its original path, and thereby cancels the Hall voltage.

The magnetic signal (only) is maintained in the sample/hold circuit during the offset cancellation process and then released.



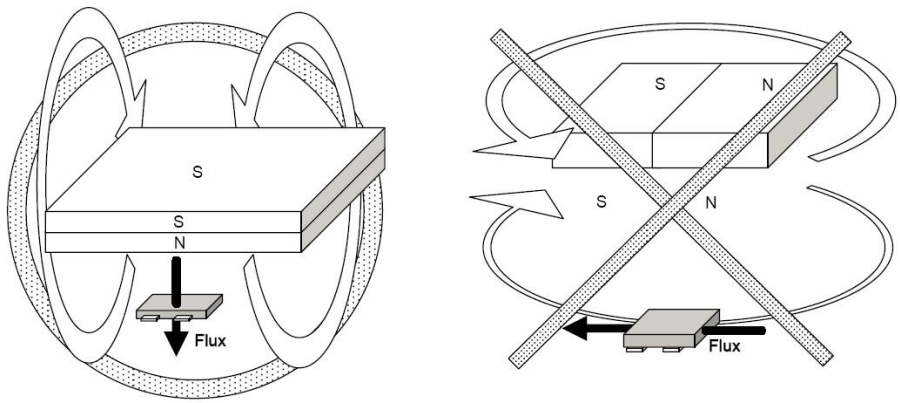
Intermittent Operation at Power ON

The unipolar detection Hall IC adopts an intermittent operation method in detecting the magnetic field during startup. It outputs to the appropriate terminal based on the detection result and maintains the output condition during the standby period. The time from power ON until the end of the initial startup period is an indefinite interval, but it cannot exceed the maximum period, 100ms. To accommodate the system design, the Hall IC output read should be programmed within 100ms of power ON, but after the time allowed for the period ambient temperature and supply voltage.



Magnetic Field Detection Mechanism

The magnetic flux that travels from the bottom to the top of the package is considered positive in this data sheet.This condition exists when a south magnetic pole is near the top of the package. The magnetic flux that travels from the top to the bottom of the package results in negative millitesla values.



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.

Detects and outputs for the S-Pole only.

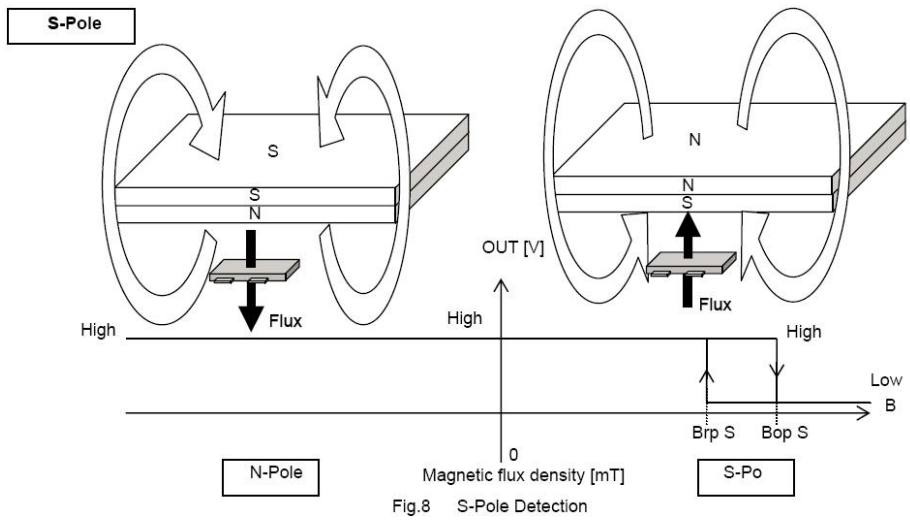
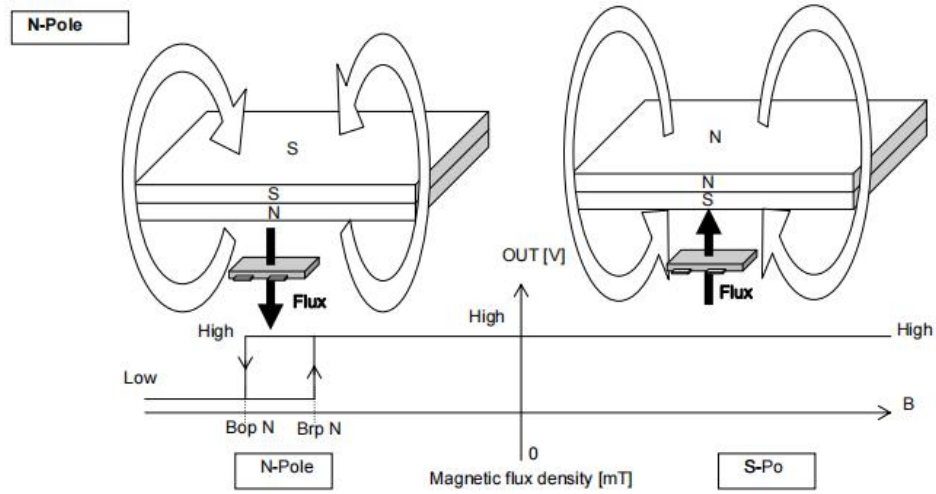


Fig.8 S-Pole Detection

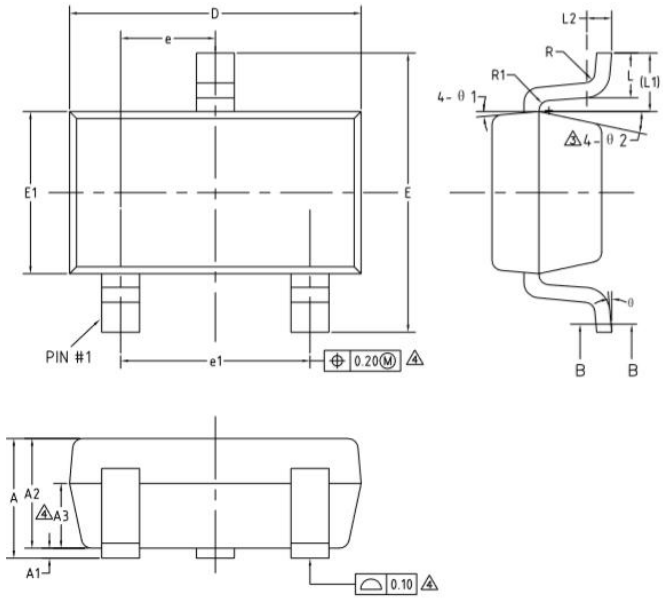
Detects and outputs for the S-Pole only.



Detects and outputs for the N-Pole only.

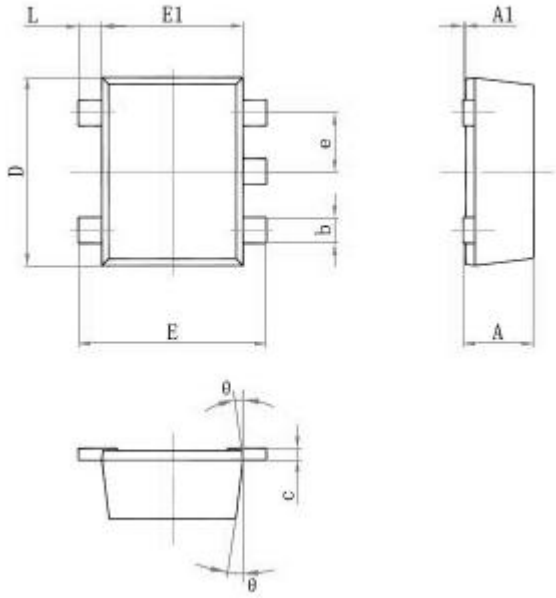
PACKAGE INFORMATION

SOT23-3



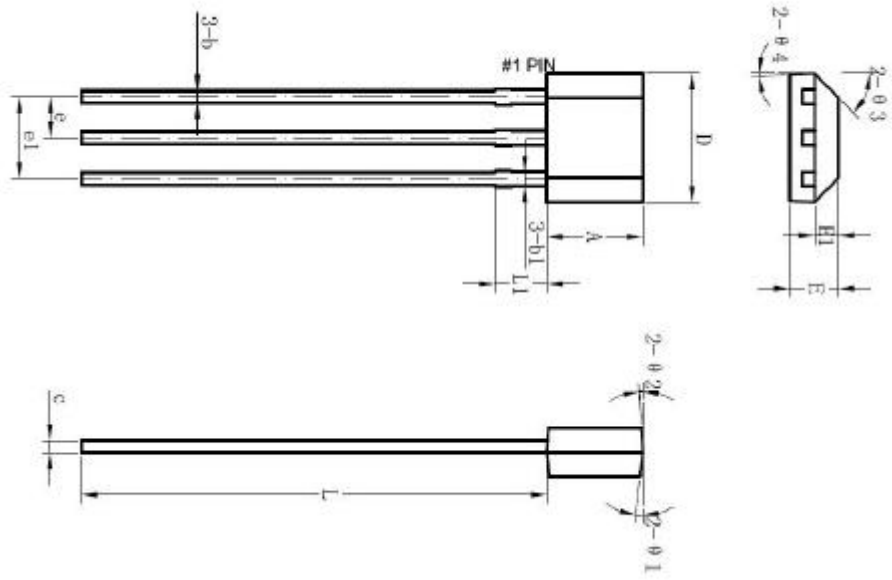
Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	--	--	1.250
A1	0.04	--	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	--	0.41
b1	0.32	0.35	0.38
c	0.15	--	0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e1	1.8	1.9	2.0
e	0.95BSC		
L	0.30	--	0.60
L1	0.60REF		
θ	0	--	8°C

SOT553



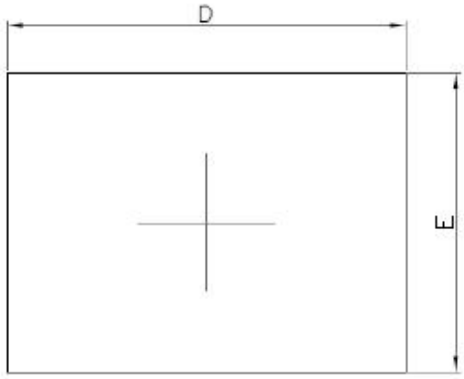
Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	0.525	--	0.600
A1	0	--	0.050
e	0.450	--	0.550
c	0.090	--	0.160
D	1.500	--	1.700
b	0.170	--	0.270
E1	1.100	--	1.300
E	1.500	--	1.700
L	0.100		0.300
θ	--	7°	--

TO92S

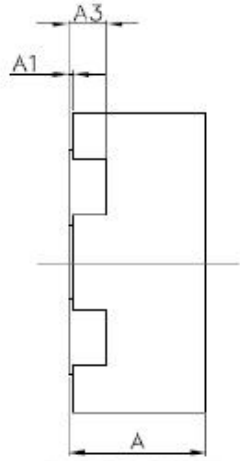


Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	2.90	3.00	3.10
b	0.35	0.39	0.56
b1		0.44	
c	0.36	0.38	0.51
D	3.9	4.0	4.2
E	1.42	1.52	1.62
e		1.27	
e1		2.54	
L	13.5	14.50	15.50
L1		1.60	
θ1		6°	
θ2		3°	
θ3		45°	
θ4		3°	

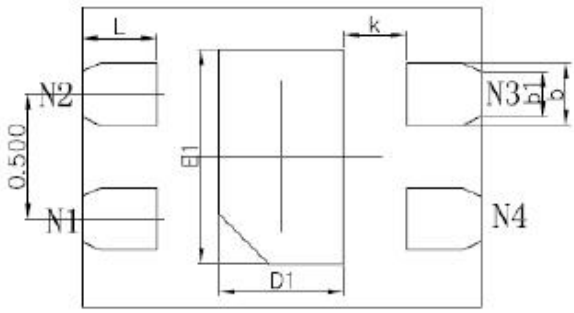
DFN1216-4L



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	0.5	0.55	0.6
A1	0.00	0.02	0.05
A3		0.152REF	
D	1.50	1.60	1.70
E	1.10	1.20	1.30
D1	0.40	0.50	0.60
E1	0.76	0.86	0.96
b		0.18REF	
e		0.50BSC	
L	0.224	0.30	0.376
K		0.25REF	