NEW PRODUCT

Description

The AH1390 is a miniature micropower magnetic Unipolar Hall effect switch IC with dual outputs specifically designed for portable and battery powered consumer equipment to home appliances and industrial applications. To support battery powered equipment and low voltage microcontrollers, the AH1390 can operate over the supply range of 1.6V to 3.6V and uses a sleep function to give an average supply current of only 1.3μA at 1.85V. The AH1390 has a 2kV ESD rating on the supply and output pins. To minimize PCB space, the AH1390 is packaged in small low profile X2-DFN1410-4.

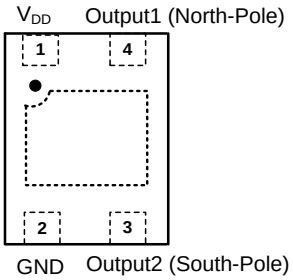
A North pole of sufficient strength will turn Output1 on and a South pole of sufficient strength will turn on Output2. The Output1 is turned on (pulled low) when the magnetic flux density (B), perpendicular to the part marking surface, falls below North field operate point B_{OPN} (-17G typical). The Output1 is held low until B rises above the North field release point B_{RPN} (-11G typical). Similarly, the Output2 will operate (pulled low) when B to the part marking surface rises above South field operate point B_{OPS} (17G typical) and is held low until B falls below the South field release point B_{RPS} (11G typical).

Features

- Two Monolithic Unipolar Hall Switches
  - Operation with a North Pole (Output1) to Part Marking Surface
  - Operation with a South Pole (Output2) to Part Marking Surface
- Supply Voltage of 1.6V to 3.6V
- Micro Power Operation
- Dual Outputs for Independent Pole Detection for Design Flexibility
- Internal Pull-Up and Pull-Down Capability
- Chopper Stabilized Design
  - Superior Temperature Stability
  - Extremely Low Switch-Point Drift
  - Insensitive to Physical Stress
- Good RF Noise Immunity
- Operating Temperature Range: -40°C to +85°C
- 2kV ESD on Supply and Output Pins
- Small Low Profile: X2-DFN1410-4
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.**
- **https://www.diodes.com/quality/product-definitions/**

Pin Assignments

(Top View)



X2-DFN1410-4

Applications

- Smart Cover or Dock Detect for Cellular Phones and Tablet
- Position Detect for Digital Still, Video Cameras and Handheld Gaming Consoles
- Door, Lids and Tray Position Detect Switches Home Appliances and Industrial Applications
- Level, Proximity and Position Switches
- Contact-Less Switches in Home Appliances and Industrial Applications

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

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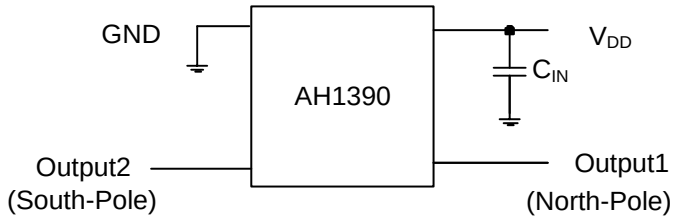
Typical Applications Circuit (Note 4)



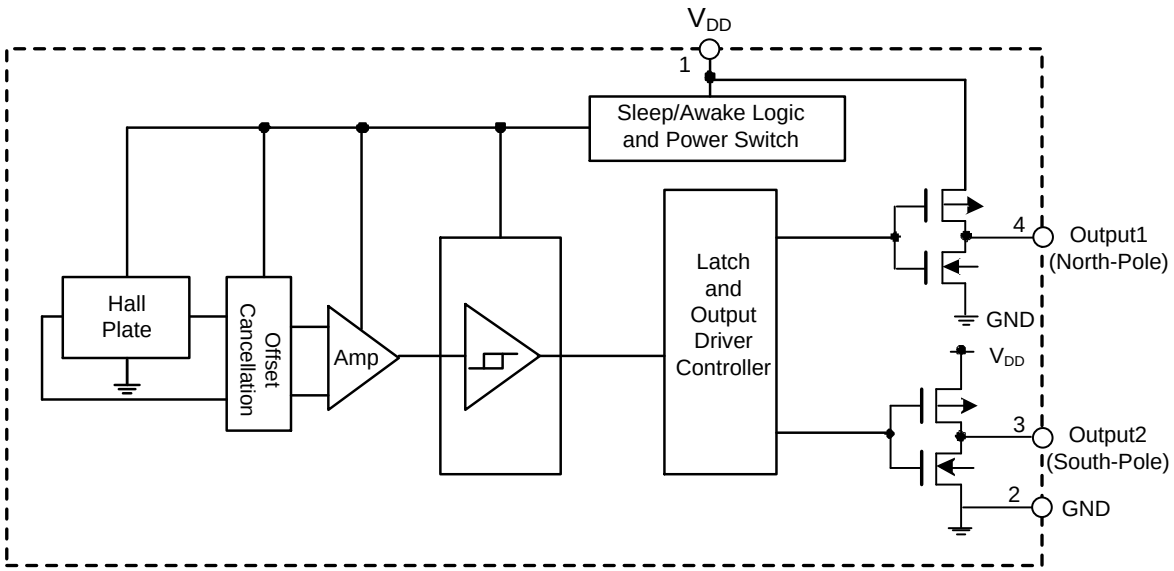
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 100nF typical and should be placed as close to the supply pin as possible.

Pin Descriptions

Package: X2-DFN1410-4

Pin Number	Pin Name	Function
1	V_{DD}	Power Supply Input
2	GND	Ground Pin
3	Output2	Output Pin (South-Pole)
4	Output1	Output Pin (North-Pole)
Pad	Pad	The center exposed pad should be tied to the GND or floating – no connection internally.

Functional Block Diagram



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Absolute Maximum Ratings (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter		Values	Unit
V_{DD}	Supply Voltage (Note 6)		6	V
V_{DD_REV}	Reverse Supply Voltage		-0.3	V
I_{OUTPUT}	Output Current (Source and Sink)		1	mA
B	Magnetic Flux Density		Unlimited	
P_D	Package Power Dissipation	X2-DFN1410-4	230	mW
T_{STG}	Storage Temperature Range		-65 to +150	°C
T_J	Maximum Junction Temperature		+150	°C
ESD HBM	Human Body Model ESD Capability		2	kV

Notes: 5. Stresses greater than the '*Absolute Maximum Ratings*' specified above can cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability can be affected by exposure to absolute maximum rating conditions for extended periods of time.

6. The absolute maximum V_{DD} of 6V is a transient stress rating and is not meant as a functional operating condition. It is not recommended to operate the device at the absolute maximum rated conditions for any period of time.

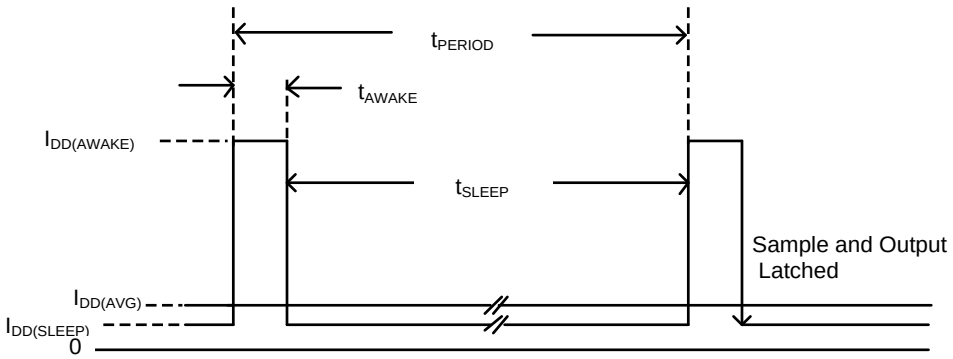
Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Rating	Unit
V_{DD}	Supply Voltage	Operating	1.6 to 3.6	V
T_A	Operating Temperature Range	Operating	-40 to +85	°C

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OL}	Output Low Voltage (On)	I_{OUT} = 0.1mA	—	0.1	0.25	V
V_{OH}	Output High Voltage (Off)	I_{OUT} = -0.1mA	V_{DD}-0.25	V_{DD}-0.1	—	V
$I_{DD(AWAKE)}$	Supply Current	During 'Awake' Period, T_A = +25°C, V_{DD} = 3V	—	720	—	µA
$I_{DD(SLEEP)}$		During 'Sleep' Period, T_A = +25°C, V_{DD} = 3V	—	0.36	—	µA
$I_{DD(AVG)}$	Average Supply Current	T_A = +25°C, V_{DD} = 1.85V	—	1.3	6	µA
		T_A = +25°C, V_{DD} = 3.6V	—	2.2	13	µA
t_{AWAKE}	Awake Time	(Note 7)	30	45	80	µs
t_{PERIOD}	Period	(Note 7)	30	45	80	ms
D.C.	Duty Cycle	—	—	0.1	—	%

Note: 7. When power is initially turned on, the operating V_{DD} (1.6V to 3.6V) must be applied to guarantee the output sampling. The output state is valid after the second operating cycle (typical 100ms).



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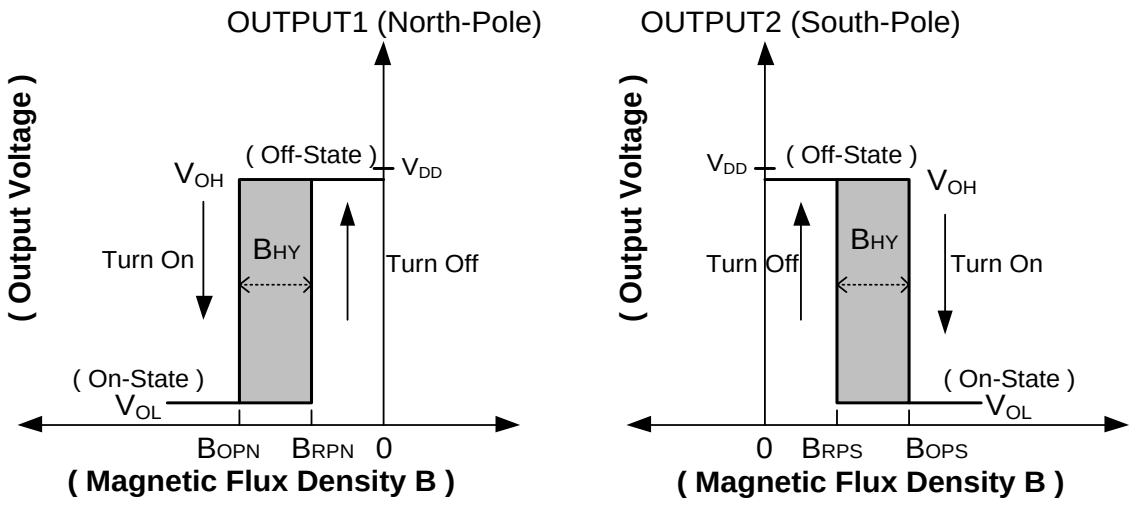
Magnetic Characteristics (Notes 8 and 9) (T_A = +25°C, V_{DD} = 1.85V, unless otherwise specified.)

Standard convention for representing the direction of magnetic field strength and flux density by positive and negative signs is as follows: Magnetic field and flux density from South Pole magnet to the part marking surface of the sensor is positive. Magnetic field and flux density from the North Pole magnet to the part marking surface is negative field. The positive and negative signs in below graph and table follow this standard convention.

(1mT=10 Gauss)

Symbol	Characteristics	Test Condition	Min	Typ	Max	Unit
B_{OPS} (South Pole to Part Marking Side) Output2	Output2 Operation Point	V_{DD} = 1.85V T_A = +25°C	8	17	24	Gauss
		V_{DD} = 1.6V to 3.6V T_A = -40°C to +85°C	6	17	25	
B_{OPN} (North Pole to Part Marking Side) Output1	Output1 Operation Point	V_{DD} = 1.85V T_A = +25°C	-24	-17	-8	
		V_{DD} = 1.6V to 3.6V T_A = -40°C to +85°C	-25	-17	-6	
B_{RPS} (South Pole to Part Marking Side) Output2	Output2 Release Point	V_{DD} = 1.85V T_A = +25°C	3	11	19	
		V_{DD} = 1.6V to 3.6V T_A = -40°C to +85°C	2	11	20	
B_{RPN} (North Pole to Part Marking Side) Output1	Output1 Release Point	V_{DD} = 1.85V T_A = +25°C	-19	-11	-3	
		V_{DD} = 1.6V to 3.6V T_A = -40°C to +85°C	-20	-11	-2	
B_{HY} ($\|B_{OPX}\|$-$\|B_{RPX}\|$)	Hysteresis (Note 10)	—	1	6	—	

Notes:
8. Typical data is at T_A = +25°C, V_{DD} = 1.85V.
9. Maximum and minimum parameter values over operating temperature range are not tested in production, they are guaranteed by design, characterization and process control. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.
10. Typical and minimum hysteresis is guaranteed by design and characterization.



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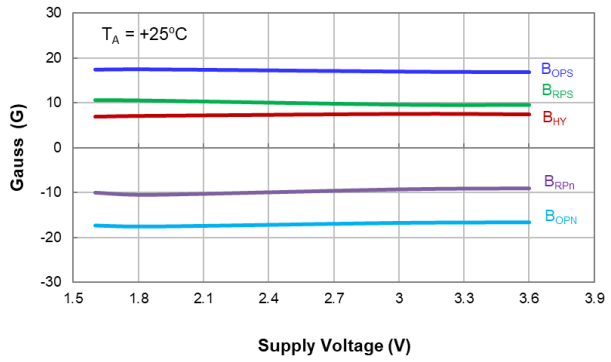
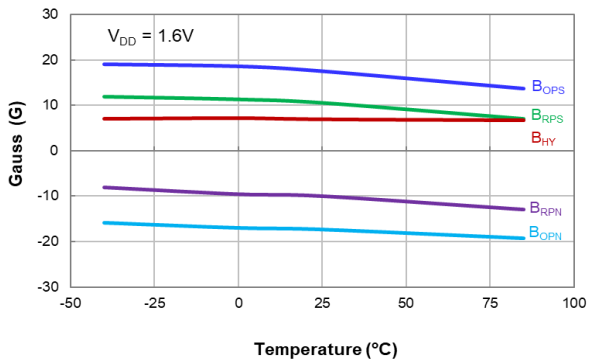
Typical Operating Characteristics

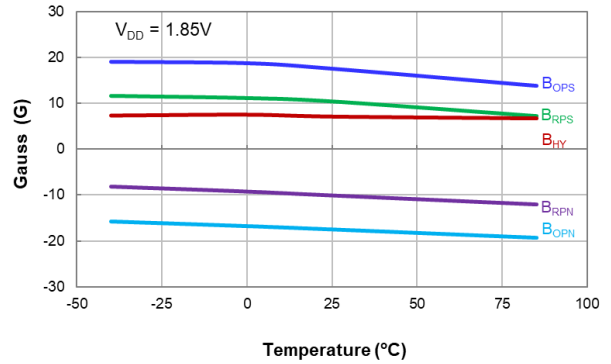
Output Switch Operate and Release Points (Magnetic Thresholds)



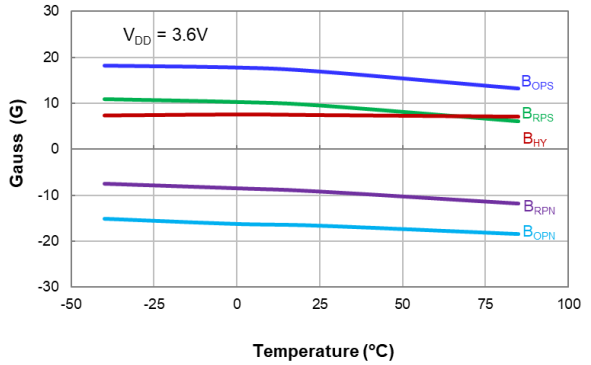
Switch Points B_{OPS} and B_{RPS} vs Supply Voltage



Switch Points B_{OPS} and B_{RPS} vs Temperature

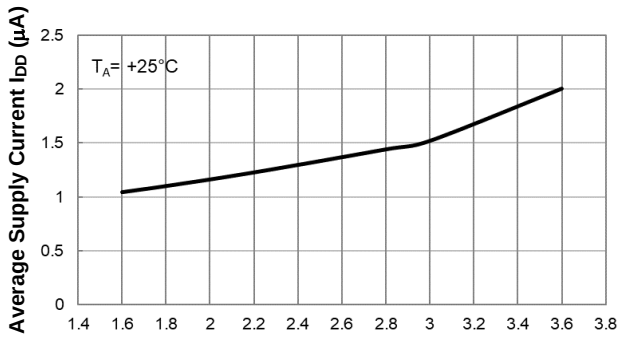


Switch Points B_{OPS} and B_{RPS} vs Temperature

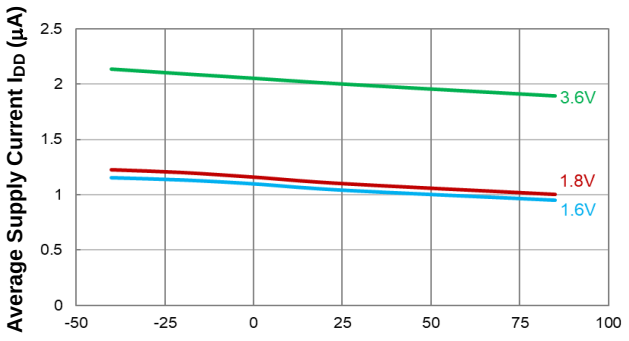


Switch Points B_{OPS} and B_{RPS} vs Temperature

Average Supply Current



Average Supply Current vs. Supply Voltage



Average Supply Current vs. Temperature

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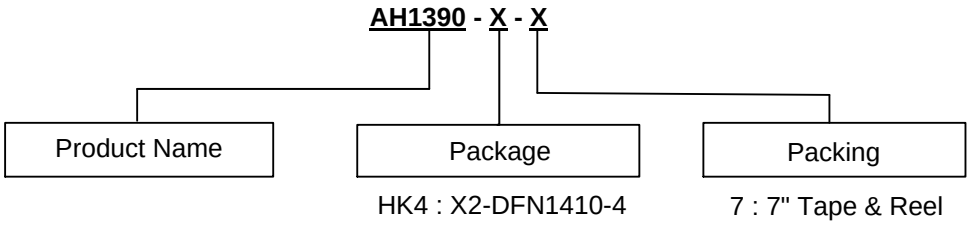
Ordering Information

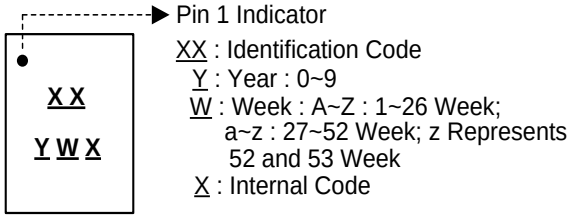


Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
AH1390-HK4-7	HK4	X2-DFN1410-4	4,000/Tape & Reel	-7

Marking Information

(1) Package Type: X2-DFN1410-4

(Top View)



Part Number	Package	Identification Code
AH1390-HK4-7	X2-DFN1410-4	CW

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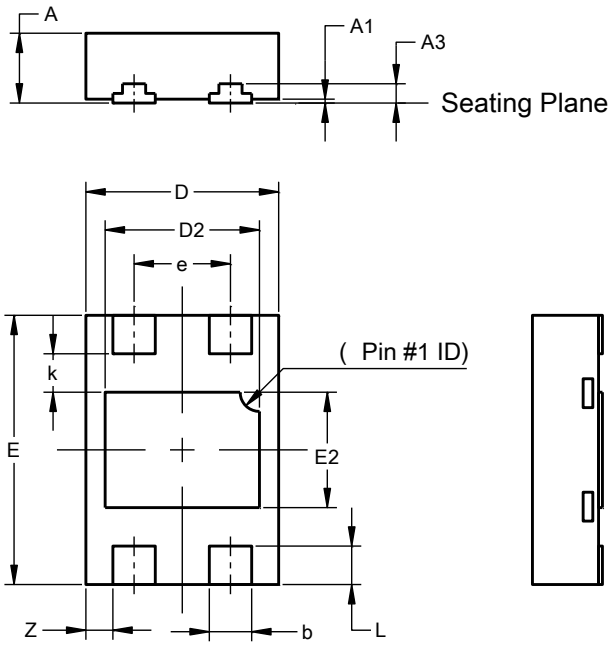
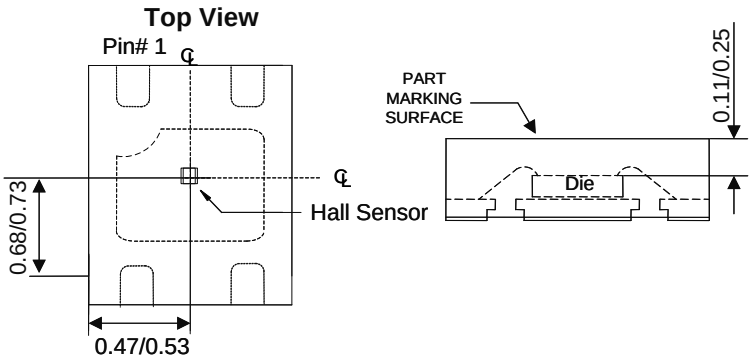
Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: X2-DFN1410-4



X2-DFN1410-4			
Dim	**Min**	**Max**	**Typ**
A	--	0.40	0.37
A1	0.00	0.05	0.02
A3	--	--	0.100
b	0.17	0.27	0.22
D	0.95	1.05	1.00
D2	0.70	0.90	0.80
E	1.35	1.45	1.40
E2	0.50	0.70	0.60
e	0.50BSC		
k	--	--	0.20
L	0.15	0.25	0.20
z	--	--	0.14
All Dimensions in mm			



Sensor Location

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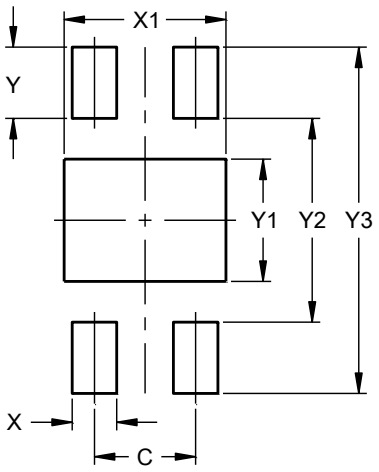
Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: X2-DFN1410-4



Dimensions	Value (in mm)
C	0.50
X	0.22
X1	0.80
Y	0.35
Y1	0.60
Y2	1.00
Y3	1.70

NEW PRODUCT

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