

Solid State Pressure Sensor

ANALOG
OUTPUT



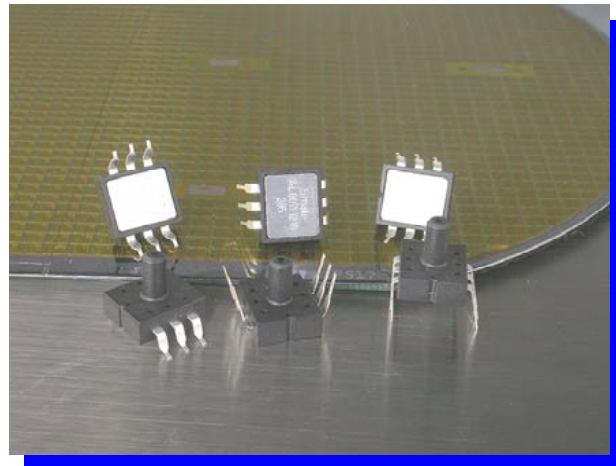
SLP Series - Model 33A

FEATURES

- Easy Design-in
- Temperature Compensated
- Calibrated & Amplified Output
- Low Cost

APPLICATIONS

- Process Control
- HVAC
- Consumer Electronics
- Medical Devices



DESCRIPTION

The SLP Series Model 33A incorporates a piezoresistive pressure sensor and signal conditioning ASIC in 6-pin DIL plastic housing for easy through board assembling. It provides low cost way to use temperature compensated and span calibrated pressure transducer for high volume application at affordable cost.

Pressure ranges from 0.15 to 150 psig. Ratiometric output at 5V excitation is 0.5 to 4.5 V. Custom output can be ordered upon request.

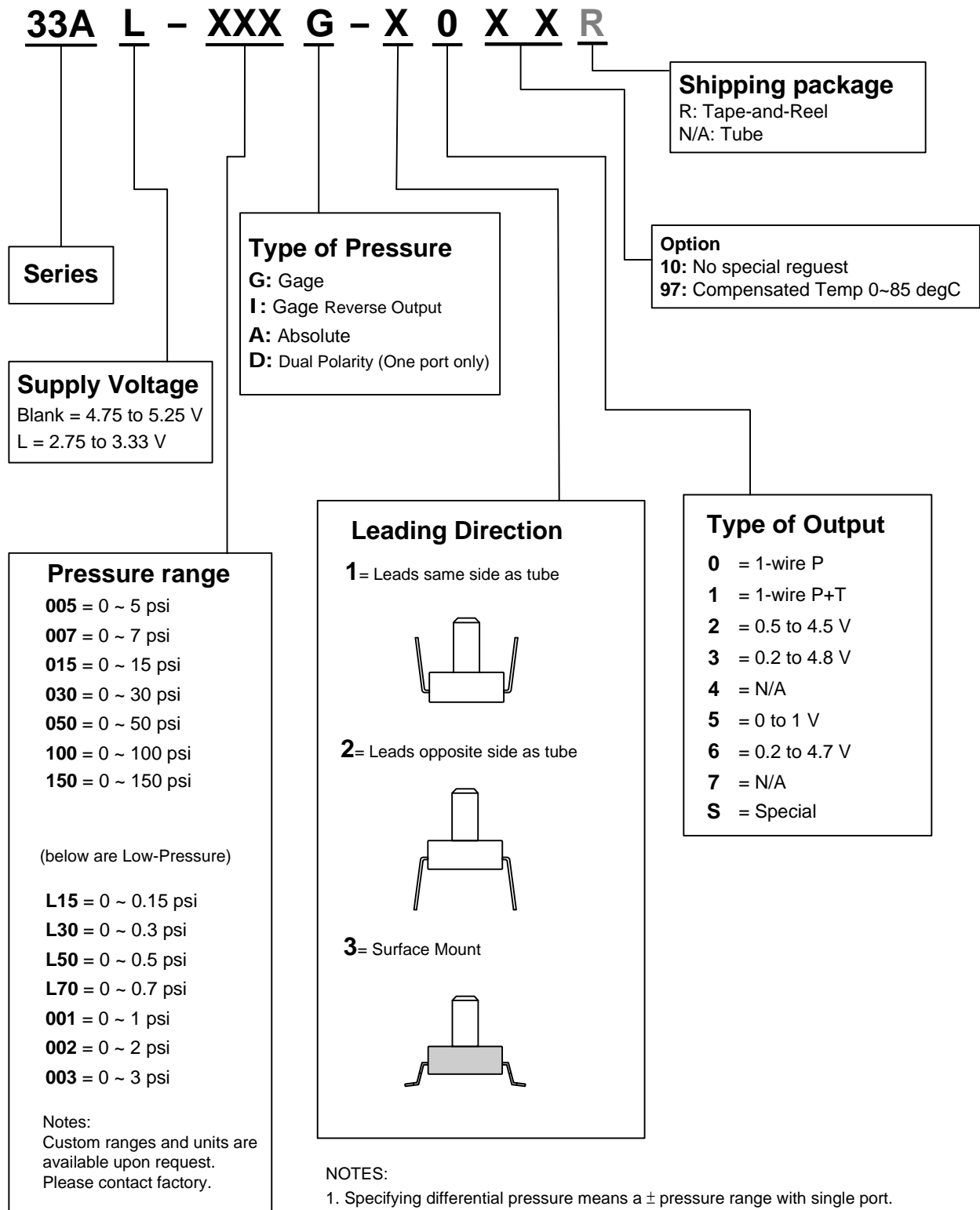
Pressure connection can be achieved through Tygon tube on the pressure port or mounting onto manifold with O-ring.

The Series SLP is also available for digital output. Please refer to data sheet of 33D for detail.

Special configuration is also available upon request.

Ordering Information

Series SLP 33 Analog



NOTES:

1. Specifying differential pressure means a \pm pressure range with single port.
2. Differential pressure can be specified to a maximum of \pm 150 psi.
3. Custom output, pressure range and temperature compensated range are available.
4. Negative gage normally has offset (0.5V) at 0 psi and full scale output (4.5V).
Reverse is also applicable.
5. Accuracy may vary on pressure range
6. SLP is not available for absolute pressure
7. Medium is available for non-corrosive, clean air.
For other medium please contact factory.

Characteristics

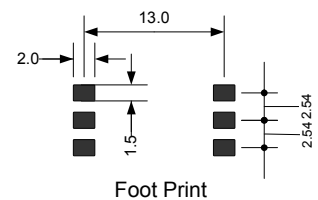
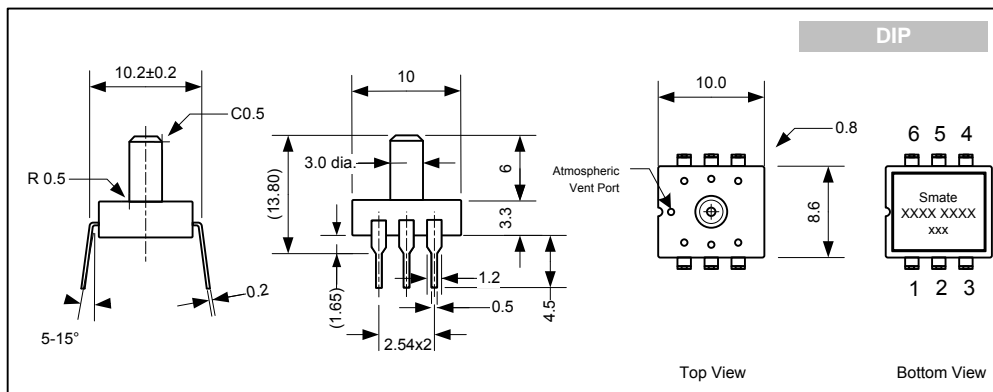
Unless otherwise specified, all parameters are measured at 3/5V, 25 °C and 60% RH

Parameters	Min	Typ	Max	Unit
Supply Voltage ¹	2.75		5.25	V
Supply Current ¹		2.5		mA
Pressure Range ²	5		150	PSI
Zero Output ⁴	0.428	0.50	0.572	V
Span Output ⁴		4.00		V
Accuracy ³			1.8	%FS
Linearity ³	-0.5		+0.5	%FS
Thermal Hysteresis ³	-0.15		+0.15	%FS
Response Time		1	2	ms
Over Pressure ⁵			3X	Rated Pressure
Temp - Compensating	0		+50	°C
Temp - Operating	-20		+85	°C
Temp - Storage	-40		+125	°C

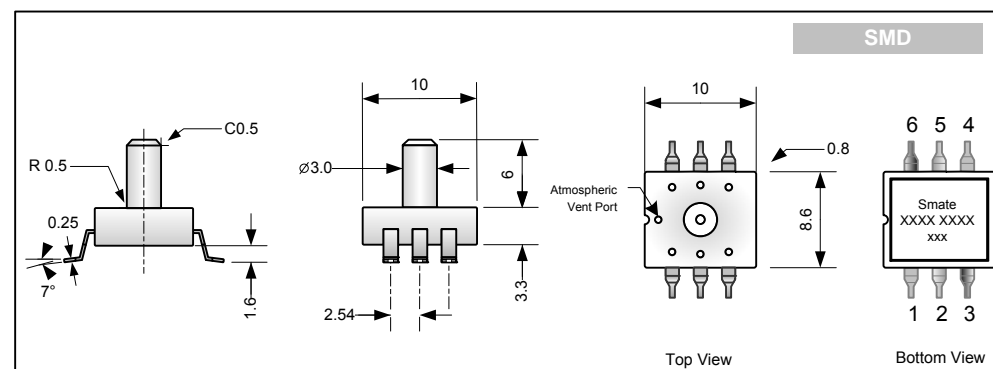
NOTES:

- Supply 3V or 5V must be ordered separately.
- Smaller range and other units are also available for ordering
- Accuracy includes NOL, hysteresis, TCS and TCO over 0/50°C, BFLS definition
- For differential, offset = 2.50V, Span = ±2.00V
- Wetted material: PA, RTV (or Epoxy), glass and silicon
- Output is ratiometric to supply voltage
- Output load resistance to Vss or Vdd: 2.5KΩ (min), 10KΩ (typ)

Dimension



Pin #	Description
6	N.C.
5	V _{DD} *
4	V _{SS}
3	V _{DD}
2	SIG
1	V _{SS} *



NOTE:
 Pin 1 must be left floating.
 A 0.1µF capacitor must be connected between V_{DD} and V_{SS}
 * Pin out configuration may vary, refer to individual data sheet
 Soldering reflow: 250 °C for 5 sec max.

- Pressure Transmitters
- Pressure Meters

Characteristics

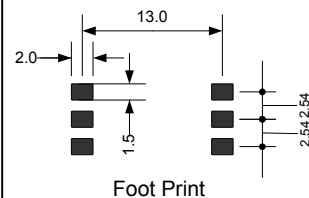
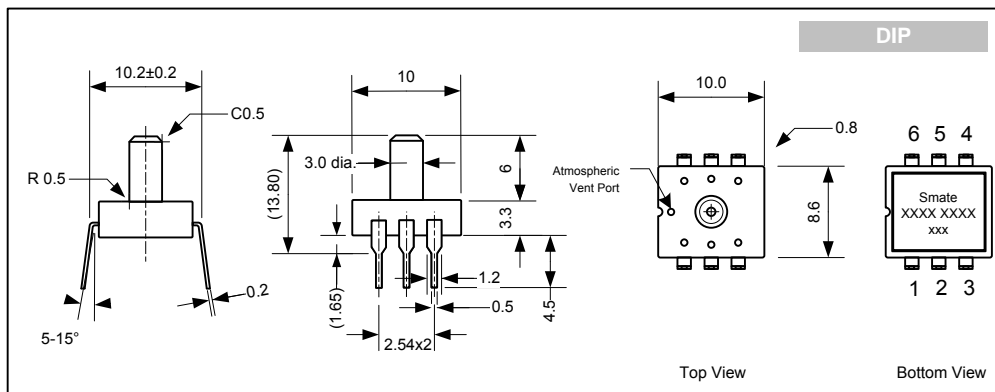
Unless otherwise specified, all parameters are measured at 3/5V, 25 °C and 60% RH

Parameters	Min	Typ	Max	Unit
Supply Voltage ¹	2.75		5.25	V
Supply Current ¹		2.5		mA
Pressure Range ²	0.15		3	PSI
Zero Output ⁴	0.412	0.50	0.588	V
Span Output ⁴		4.00		V
Accuracy ³			2.2	%FS
Linearity ³	-0.5		+0.5	%FS
Thermal Hysteresis ³	-0.15		+0.15	%FS
Response Time		1	2	ms
Over Pressure ⁵			3X	Rated Pressure
Temp - Compensating	0		+50	°C
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Temp - Storage	-40		+125	°C

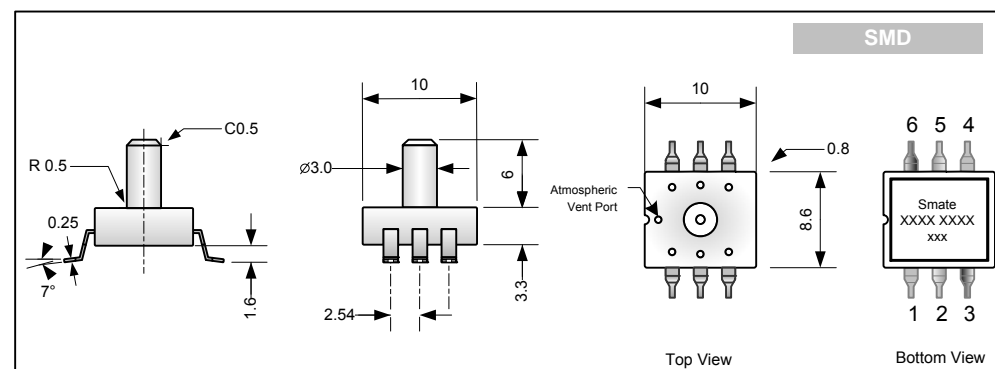
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- Accuracy includes NOL, hysteresis, TCS and TCO over 0/50°C, BFSL definition
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- Zeroing at installation is required

Dimension



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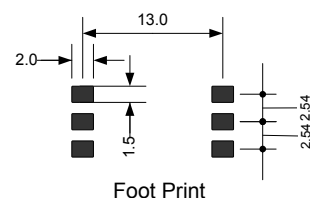
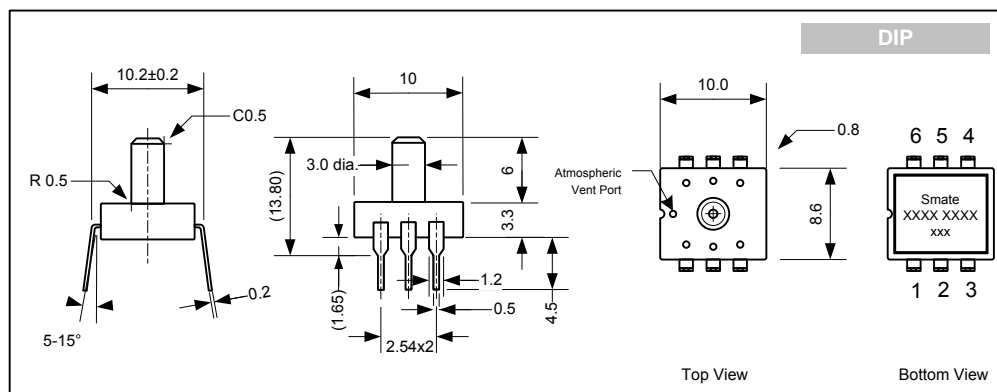
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Linearity ³	-0.5		+0.5	%FS
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Response Time		1	2	ms
Over Pressure ⁵			3X	Rated Pressure
Temp - Compensating	0		+85	°C
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Temp - Storage	-40		+125	°C

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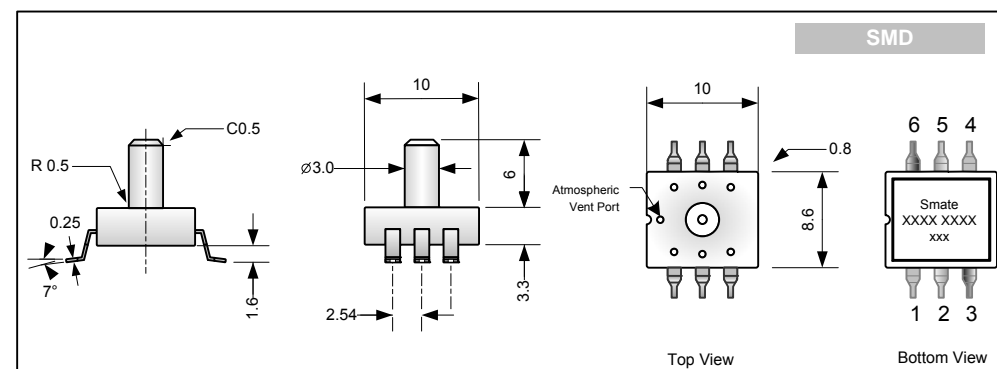
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- Pressure Transmitters
- Pressure Meters

Solid State Pressure Sensor

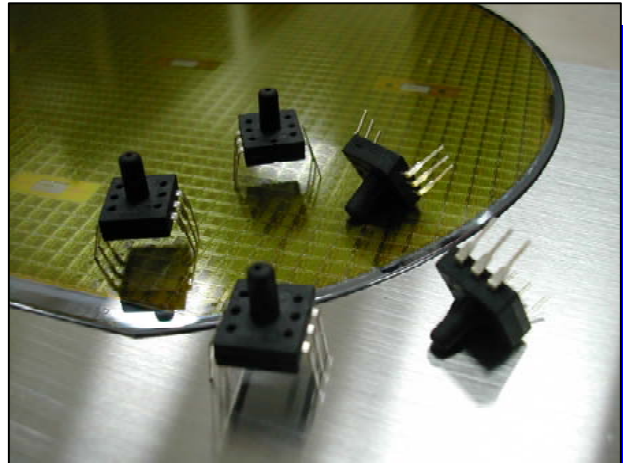
DIGITAL
OUTPUT



SLP Series – Model 33D

FEATURES

- Calibrated Span and Offset
- Low Cost Sensor Element
- Multi-order Temperature Compensation
- Analog Output available
- 0.3 PSI to 100 PSI



DESCRIPTION

The Model 33D is silicon based pressure sensor packaged with an all-in-one ASIC in plastic button cell. Digital compensation of sensor offset, sensitivity, temperature drift and nonlinearity is accomplished in factory via an internal DSP running a correction algorithm with calibration coefficients stored in on-chip EEPROM.

The sensor features 1-wire (OWI) serial output. This offers application microprocessor to access accurate pressure reading without costly signal conditioning.

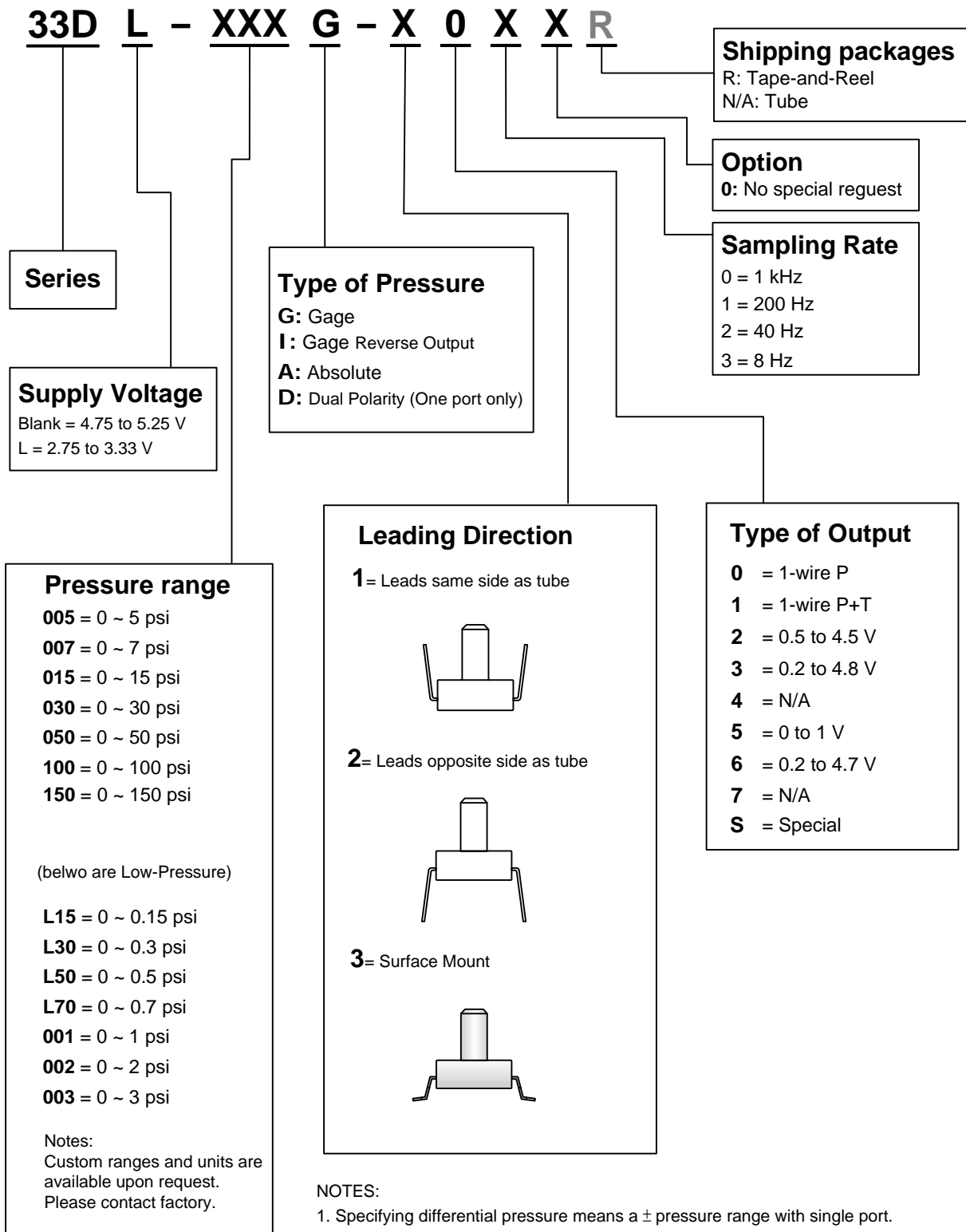
Capable of operation from 2.7 to 5.5 V simplifies sensor excitation.

The Series SLP including Model 33D and 33A, which are available for pressure range from 0.3 psi to 100 psi.

Custom range and calibration are available. Please contact factory for detail.

Ordering Information

Series SLP 33 Digital



NOTES:

1. Specifying differential pressure means a \pm pressure range with single port.
2. Differential pressure can be specified to a maximum of ± 150 psi.
3. Custom output, pressure range and temperature compensated range are available.
4. Negative gage normally has offset (0.5V) at 0 psi and full scale output (4.5V). Reverse is also applicable.
5. Accuracy may vary on pressure range.
6. SLP is not available for absolute pressure.
7. Medium is available for non-corrosive, clean air. For other medium please contact factory.

Characteristics

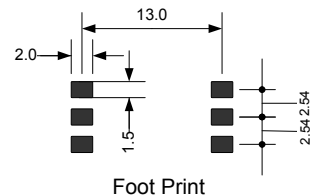
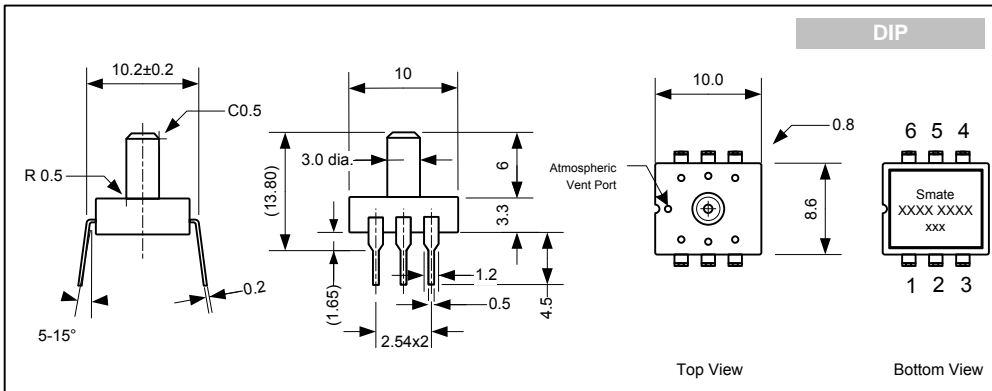
Unless otherwise specified, all parameters are measured at 3/5V, 25 °C and 60% RH

Parameters	Min	Typ	Max	Unit
Excitation ¹	2.75		5.25	V
Pressure range ²	5		100	PSI
Resolution ³		14		Bit
Accuracy ³		±1.8		%FS, +1LSB
Zero Output ⁴		0666		Hex
Full Scale Output ⁴		3999		Hex
Warm-up Time		1	2	ms
Start-up Time			10	ms
Sampling Rate	8		1000	Hz
Temp - Compensating	0		50	°C
Temp - Operating	-20		+85	°C
Temp - Storage	-40		+125	°C
Over Pressure ⁵			3X	Rated Pressure

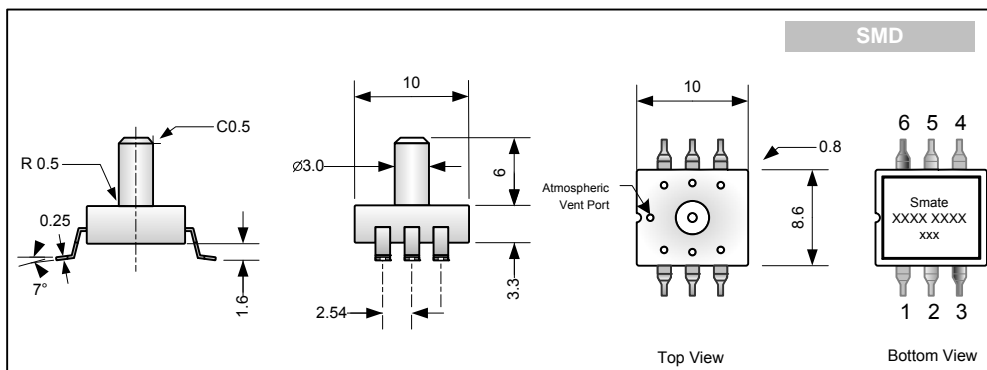
NOTES:

- Supply 3V or 5V must be ordered separately.
- Smaller range and other units are also available for ordering
- Accuracy includes NOL, hysteresis, TCS and TCO over 0/50°C, BFSL definition
- For differential pressure, offset = 2000 hex, FS = 666/3999
- Over-pressure will vary on different range
- Wetted material: PA, RTV (or epoxy), glass and silicon
- Output load resistance to Vss or Vdd: 2.5KΩ (min), 10KΩ (typ)
- Zeroing at installation is required

Dimension



Pin #	Description
6	N.C.
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NOTE:
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 * Pin out configuration may vary, refer to individual data sheet
 Soldering reflow: 250 °C for 5 sec max.

- Pressure Transmitters
- Pressure Meters

Characteristics

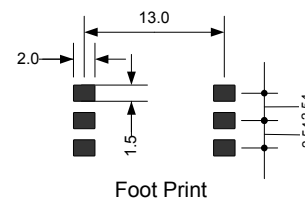
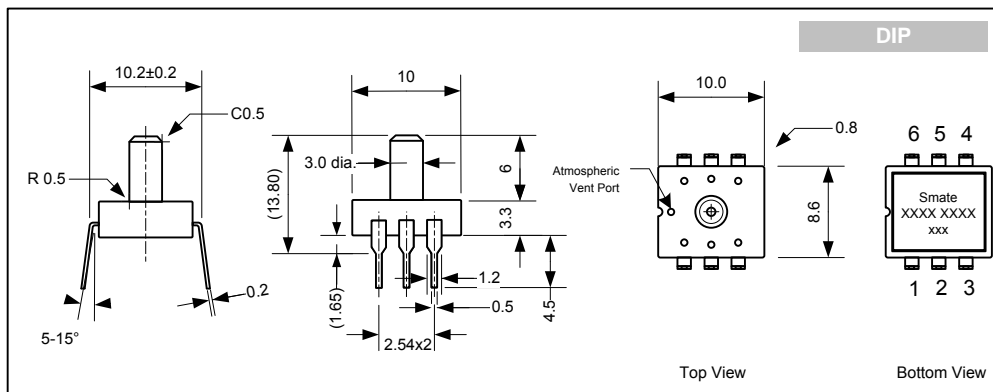
Unless otherwise specified, all parameters are measured at 3/5V, 25 °C and 60% RH

Parameters	Min	Typ	Max	Unit
Excitation ¹	2.75		5.25	V
Pressure range ²	0.15		3	PSI
Resolution ³		14		Bit
Accuracy ³		±2.2		%FS, +1LSB
Zero Output ⁴		0666		Hex
Full Scale Output ⁴		3999		Hex
Warm-up Time		1	2	ms
Start-up Time			10	ms
Sampling Rate	8		1000	Hz
Temp - Compensating	0		50	°C
Temp - Operating	-20		+85	°C
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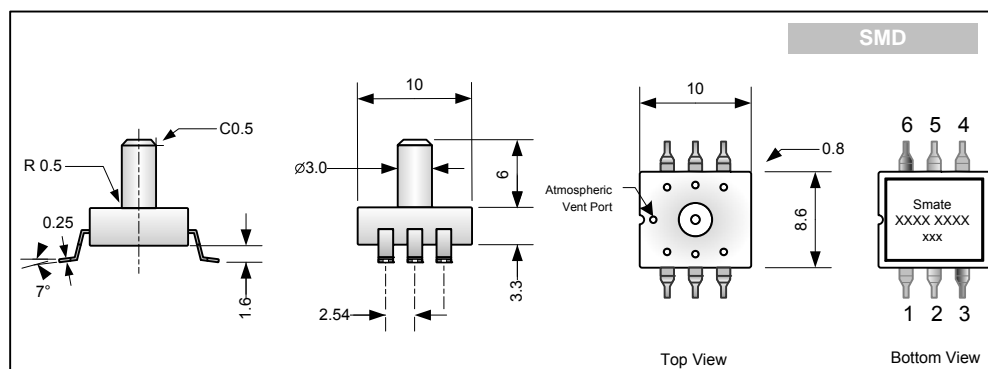
Dimension



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- * Pin out configuration may vary, refer to individual data sheet
- Soldering reflow: 250 °C for 5 sec max.

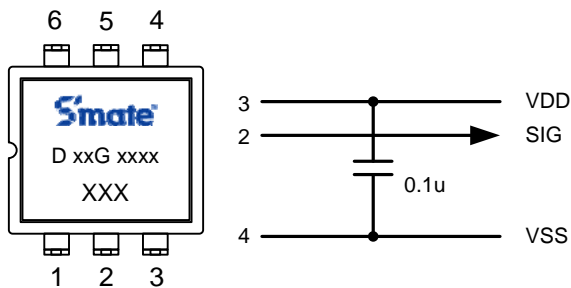


- Pressure Transmitters
- Pressure Meters

Communication Parameters

Parameters	Min	Typ	Max	Unit	Remarks
Pull-Up Resistor (Internal)		30		kohm	Switched on in Output Mode
Rise Time			9	us	Any RC network connected in SIG path must met this rise time
Load Capacitance	0	1	15	nF	
Voltage Level - Low		0	0.2	VDD	Rail-to-rail CMOS Driver
Voltage Level - High	0.8	1		VDD	Rail-to-rail CMOS Driver

Application Circuit



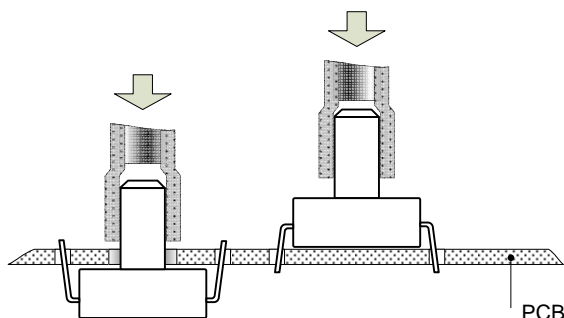
NOTE:

For digital output SIG no load resistor or load capacity are required. No pull down resistor is allowed. If a line resistor or pull-up resistor is used, the requirement for the rise time must be met ($\leq 9\mu s$).

The SIG includes a pull-up resistor of about 100K ohms internally.

All pins have an ESD protection of $>4000V$ and a latch-up protection of $\pm 100mA$ or of $+8V/-4V$ (to VSS)

Recommended Installation



NOTE:

1. Installation is recommended for Tygon tube connection. For other connection, caution must be taken to avoid applying stress to the sensor.

2. The wetted material is PA, RTV (or epoxy), glass and silicon. For media except clean air, please contact factory.

Additional Products

- Pressure Transducers
- Pressure Meters

Communication Interface

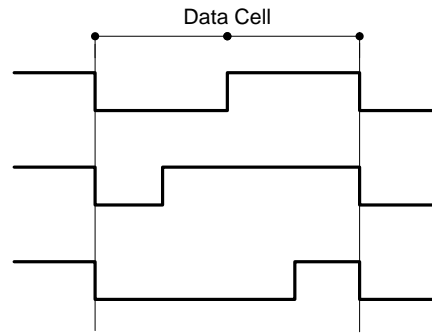
Manchester codes by a transition at the cell boundary are used to represent the binary values of pressure and temperature.

Bit Encoding

Start Bit → 50% duty cycle used to set up strobe time

Logic 1 → 75% duty cycle

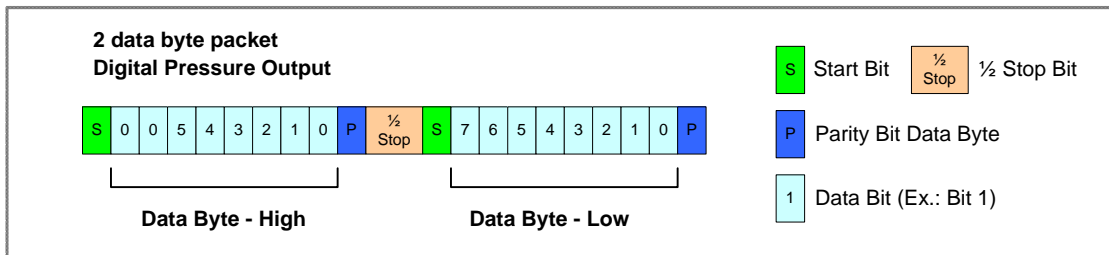
Logic 0 → 25% duty cycle



Read Operation

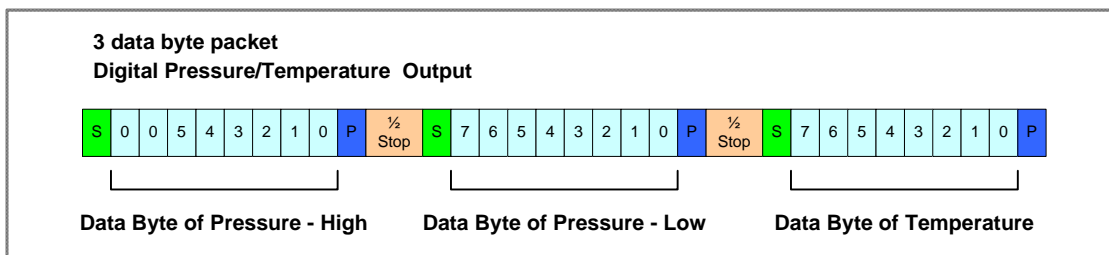
There are two modes (DPT digital pressure output with temperature, and DTO digital pressure out only) available for the output of transducer.

For DPO mode, the transducer first transmits the high byte of pressure data followed by the low byte. The pressure data is 14-bits in resolution, so the upper two bits of the high byte are always zero padded. There is a half stop bit interval between bytes in a packet. That means for the time of half a bit width, the signal level is in high level.



DPO - Digital Pressure Output

For DPT mode, the pressure and temperature will be transmitted as 3 data packets.



DPT - Digital Pressure/Temperature Output



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- Additional Products**
- Pressure Transducers
 - Pressure Meters

How to Interpret the Pressure Value

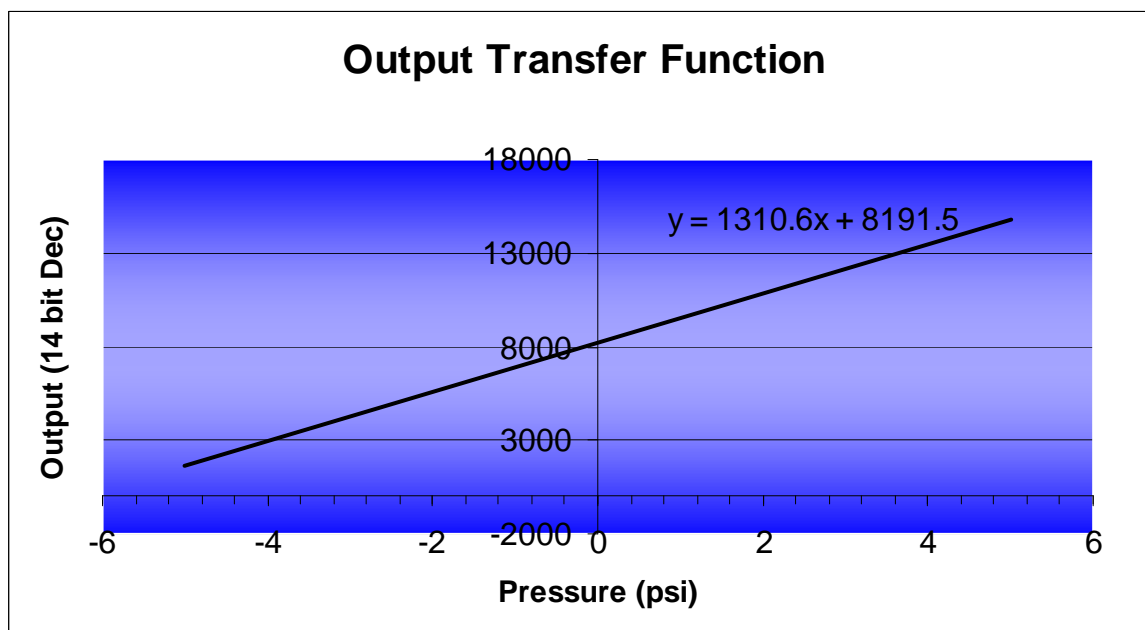
The CCD series pressure sensors have been calibrated to a straight line transfer function. The pressure value can be easily obtained by inserting the output into the transfer function. The process is explained below.

The pressure value is read out as a 14 bit word. The word corresponds to 0x0000 to 0x3FFF in Hex or 0 to 16383 in Decimal.

The first step is to convert the Hex value to Decimal. The calculator supplied with Microsoft Windows will easily do this.

The next step is to port the decimal value into the straight line function shown in the chart below.

The following example is for a -5 to +5 psi transfer function:



The output word is 0x1ABC.

The output word is translated into decimal which is 6844

The decimal word is then inserted into the equation which gives:

$6844 = 1310.6x + 8191.5$ where x is the pressure in psi

We then compute $x = -1.028$ psi

*Note: The transfer function varies for each pressure range. Make sure you use the correct function. If in doubt please consult the factory.

Obtaining the transfer function:

The transfer function is a straight line equation in the standard form $y=mx+c$, where y and x are x,y coordinates, m is the gradient and c is the y -axis intercept.

To compute your straight line transfer function you will simply need the 2 sets of x,y coordinates. These will be supplied to you with outputs of 10%FS and 90% FS by default (custom outputs are available on request).

Example:

Pressure = 0 psi, Output 10% FS

Pressure = 100 psi, Output 90% FS

First we note that the output is 14 bits ie. 0x0000 to 0x3FFF.
In decimal this becomes 0 to 16383.

10% FS is 1638

90% FS is 14745

First we find the gradient m , of our straight line.

$$\begin{aligned} m &= (y_2 - y_1) / (x_2 - x_1) \\ &= (14745 - 1638) / (100\text{psi} - 0\text{psi}) \\ &= 131.07 \end{aligned}$$

Now we substitute this in and we get:

$$y = 131.07x + c$$

We substitute $y=1638$ when $x=0$ and we get

$$c = 1638$$

Which leaves us with our transfer function:

$$y = 131.07x + 1638 \text{ where } y \text{ is the output in Hex and } x \text{ is the corresponding pressure}$$

Note that the pressure x , can be specified in any units bar, psi...etc in which case the transfer function will only be valid for that particular pressure unit.

Additional Products

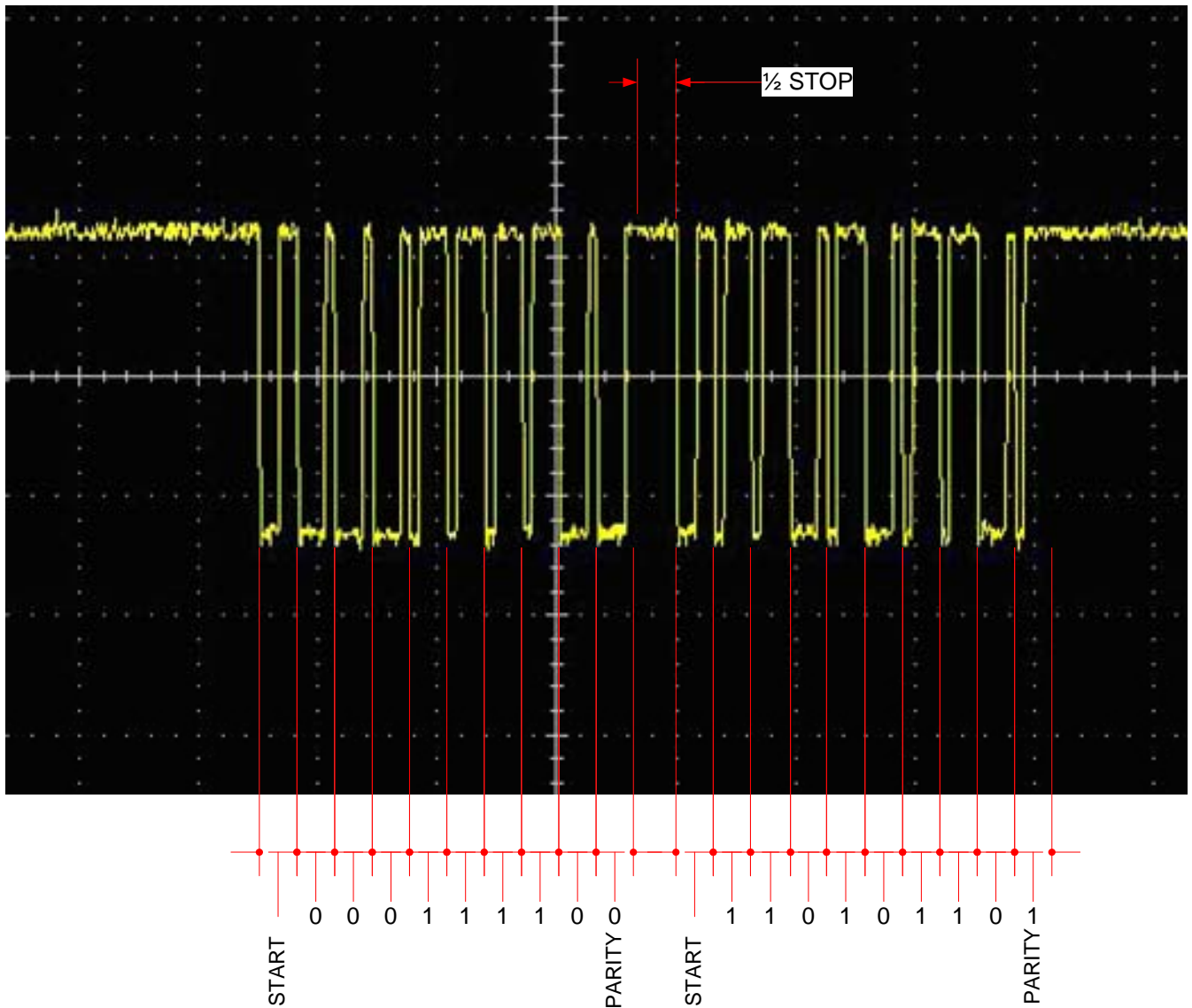
- Pressure Transducers
- Pressure Meters

Waveform Interpretation

The transmission speed depends on the update rate programmed, which ranges from 32K Hz to 8 K Hz. The speed can vary with supply voltage and temperature.

It is important that any software used to read the digital output use the “Start Bit” which is 50% high and 50% low to determine the frequency and then use the frequency to interpret the incoming data. The parity bit is even, that will be 1 or 0 such that the total number of 1 in the word is even.

There is a half stop bit interval between bytes in a packet. That means for the time of half a bit width, the signal level is always in high level.

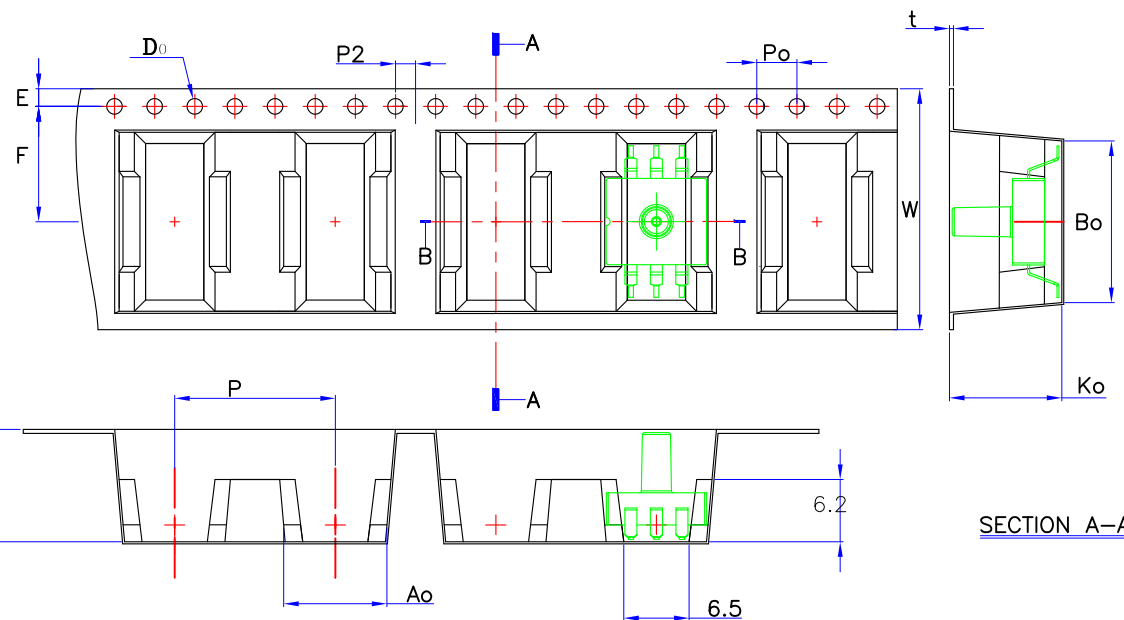
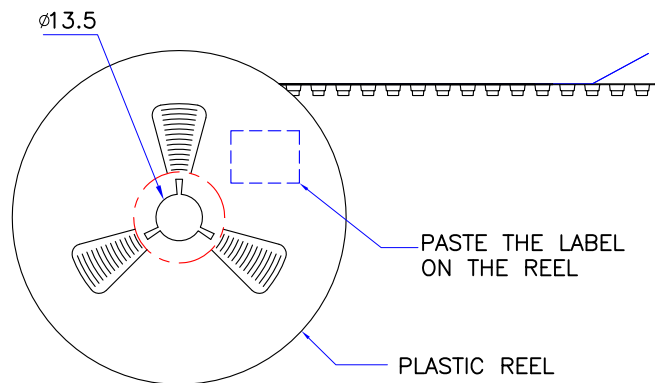
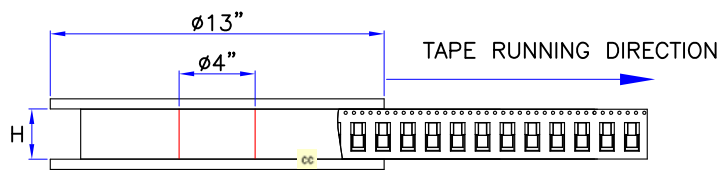


Typical Timing Waveform



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Additional Products
● Pressure Transducers
● Pressure Meters



SECTION A-A

SECTION B-B

NOTE:

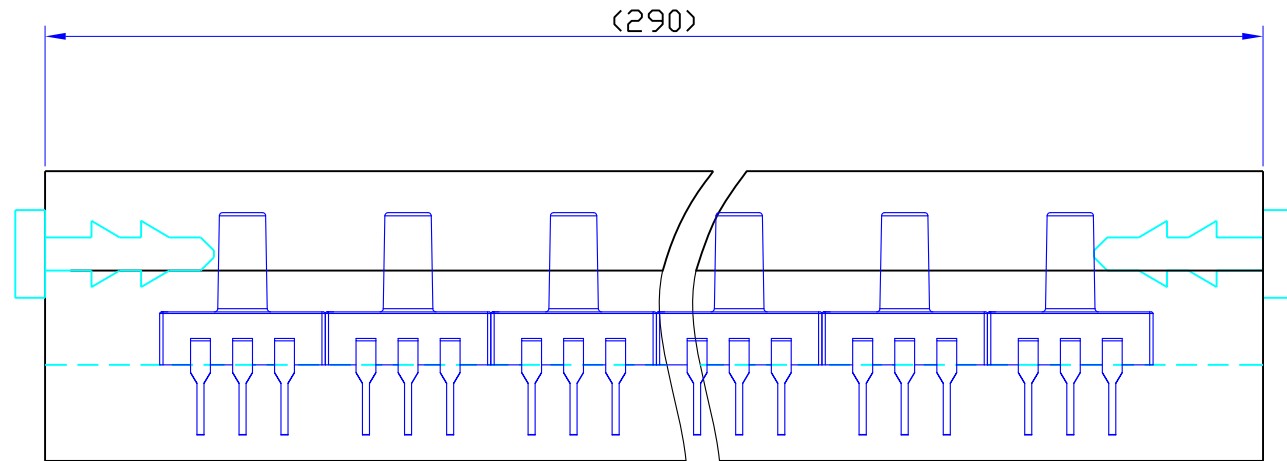
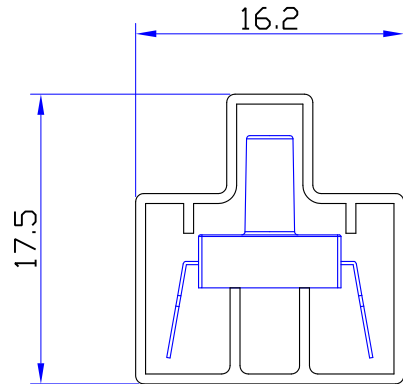
1. Material: Black Polystyrene.
2. Camber not to exceed 1mm in 100mm.
3. 10 sprocket hole pitch cumulative tolerance ± 0.2
4. A_o and B_o measured on a plane 0.3mm above the bottom of the pocket.
5. K_o measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Table SLP	
63410	Carrier Tape
63410-1	Cover Tape
63410-2	13"Reel 24mm

Carrier Length: 21M/22" Paper reel(13" Plastic reelx3), Q'ty=1000pcs/13"reel												
ITEM	W	A_o	B_o	K_o	P	F	E	D_1	D_o	P_o	P_2	t
DIM	24.0 ^{+0.30} _{-0.30}	10.3 ^{+0.10} _{-0.10}	16.00 ^{+0.10} _{-0.10}	11.2 ^{+0.10} _{-0.10}	16.0 ^{+0.10} _{-0.10}	11.5 ^{+0.10} _{-0.10}	1.75 ^{+0.10} _{-0.10}	min.	1.50 ^{+0.10} _{-0.00}	4.00 ^{+0.10} _{-0.10}	2.00 ^{+0.10} _{-0.10}	0.40 ^{+0.05} _{-0.05}

Revision	Description	Date	By	Drawn	Ray	Date	02-05-13	Material	HIPS
				Approved	Allen	Unit	mm	P/N#	Table SLP
				Version	V1.0	Scale	1:1	Description	SLP13" Reel
								Project	SLP
								DWG No.	DN-30502-001

PACKAGE NAME	OUTLINE CODE	CARRIER LENGTH (mm)	END STOP	SPQ STOP	CARRIERS PER BOX
SLP TUBE	SLP	290	Plug	27	T.B.D



27PCS

Note:Tolerance is +/- 0.3 mm unless otherwise specified

Revision	Description	Date	By	Drawn	Ray	Date	01-Apr-13	Material	PVC
				Approved	Shih	Unit	mm	P/N#	63459
				Version	V1.0	Scale	N.T.S	Description	SLP Package
								Project	SLP
								DWG No.	DN-30418-001