Honeywell

Force Sensors

FSS Low Profile Force Sensors

FS Series

FEATURES

- True Surface Mount Technology
- Maximum peak reflow temperature of 260 °C [500 °F]
- Compact, commercial grade package
- Robust performance characteristics
- Adaptable package design
- Precision force sensing
- Reliability rated at 20 million MCTF at 25 °C [77 °F]
- Electrically ratiometric output
- Extremely low deflection (30 microns typ. @ Full Scale)
- High ESD resistance 8 kV
- Available signal conditioning
- Optional terminal configurations

TYPICAL APPLICATIONS

- Medical infusion pumps
- Ambulatory noninvasive pump pressure
- Occlusion detection
- Kidney dialysis machines
- Load and compression sensing
- Variable tensions control
- Robotic end-effectors
- Wire bonding equipment

⚠ WARNING

PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

The FS Series sensors provide precise reliable force sensing performance in a compact commercial grade package at a cost effective price. The sensor features a proven sensing technology that uses a specialized piezoresistive micromachined silicon sensing element. The low power, unamplified, uncompensated Wheatstone bridge circuit design provides inherently stable mV outputs over the force range.

Force sensors operate on the principle that the resistance of silicon-implanted piezoresistors will increase when the resistors flex under any applied force. The sensor concentrates force from the applications, through the stainless steel ball, directly to the silicon-sensing element. The amount of resistance changes in proportion to the amount of force being applied. This change in circuit resistance results in a corresponding mV output level change.

The sensor package design incorporates patented modular construction. The use of innovative elastomeric technology and engineered molded plastics result in load excitation capacities of 4.5/5.5 kg over-force. The stainless steel ball provides excellent mechanical stability and is adaptable to a variety of applications. The FSS sensor delivered 20 million operations in Mean Cycles to Failure (MCTF) reliability testing at 50 °C [122 °F]. This test determines the number of possible sensor operations at full scale until failure. Various electric interconnects can accept prewired connectors, printed circuit board mounting, and surface mountings. The unique sensor design also provides a variety of mounting options that include mounting brackets, as well as application specific mounting requirements.

⚠ WARNING

MISUSE OF DOCUMENTATION

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.

PERFORMANCE CHARACTERISTICS @ 5.0 ± 0.01 Vdc Excitation*, 25 °C [77 °F]

Parameter	Min.	Typical	Max.	Units
Null Offset	-15	0	+15	mV
Operating Force	0	–	1500	grams
Sensitivity.	0.1	0.12	14	mV/gram
Linearity (B.FS.L.)**	–	± 1.5	–	% span
Repeatability @ 300 g	–	± 10	–	grams
Null Shift				
25 °C to 2 °C [77 °F to 35.6 °F]	–	± 0.5	–	mV
25 °C to 40 °C [77 °F to 104 °F]	–	± 0.5	–	mV
Sensitivity Shift				
25 °C to 50 °C [77 °F to 122 °F]	–	5.5	–	% span
25 °C to 0 °C [77 °F to 32 °F]	–	5.5	–	% span
Input Resistance	4.0 K	5.0 K	6.0 K	Ohms
Output Resistance	4.0 K	5.0 K	6.0 K	Ohms
Overforce	–	–	4,500	grams
ESD (direct contact, terminals and plunger)	8	–	–	kV

* Non-compensated force sensors, excited by constant current (1.5 mA) instead of voltage, exhibit partial temperature compensation of Span.

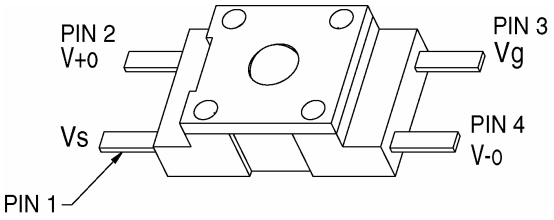
** BFSL: Best Fit Straight Line

ENVIRONMENTAL SPECIFICATIONS

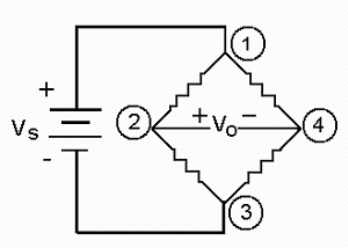
Operating temperature	-40 °C to 85 °C [-40 °F to 185 °F]
Storage temperature	-40 °C to 100 °C [-40°F to 212 °F]
Shock	Qualification tested to 150 g
Vibration	Qualification tested to 0 to 2 kHz, 20 g sine
MCTF	20 million at 25 °C [77 °F]
Solderability	5 sec at 315 °C [599 °F] per lead
Output ratiometric	Within supply range

Note: All force related specifications are established using dead weight or compliant force.

SENSOR PINOUT



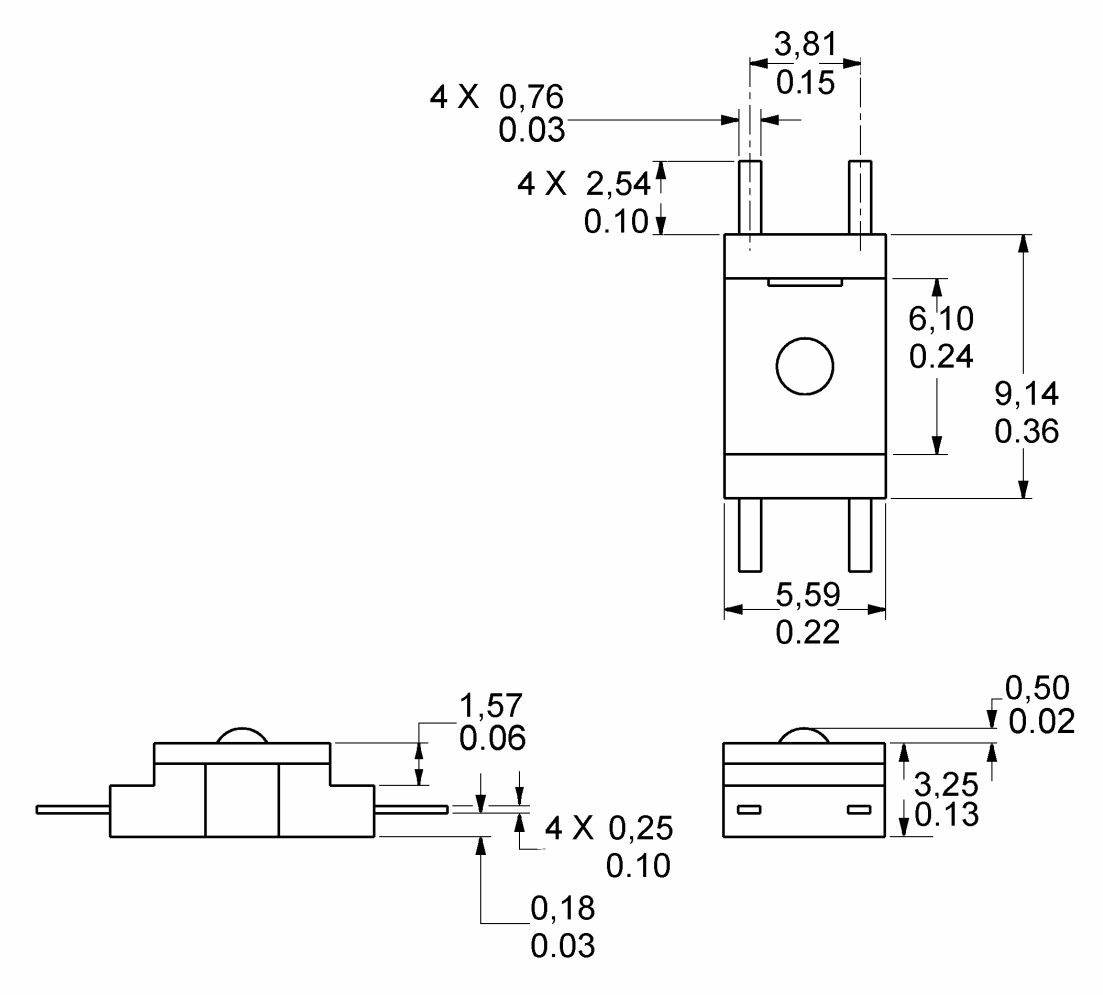
EXCITATION SCHEMATIC
Excitation 5 Vdc Typ., 12 Vdc Max.



FS SERIES CIRCUIT

1. Circled numbers refer to sensor terminals (pins).
   Pin 1 = Supply V_S (+)
   Pin 2 = Output Vo (+)
   Pin 3 = Ground V_g (-)
   Pin 4 = Output V_O (-)
2. The force sensor may be powered by voltage or current. Maximum supply voltage is not to exceed 12 volts. Maximum supply current is not to exceed 1.6 mA. Power is applied across Pin 1 and Pin 3.
3. The sensor output should be measured as a differential voltage across Pin 2 and Pin 4 ($V_O = V_2 - V_4$). The output is ratiometric to the supply voltage. Shifts in supply voltage will cause shifts in output. Neither Pin 2 nor Pin 4 should be tied to ground or voltage supply.

MOUNTING DIMENSIONS (for reference only) mm/in



DESCRIPTION

Catalog Listing	Packing Style
FSS1500NST	Tube
FSS1500NSB	Bubble Pack
FSS1500NSR	Tape and Reel

WARRANTY/REMEDY
Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. **The foregoing is Buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose.**
Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.
For application assistance, current specifications, or name of the nearest Authorized Distributor, contact a nearby sales office. Or call:
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1-815-235-6847 International
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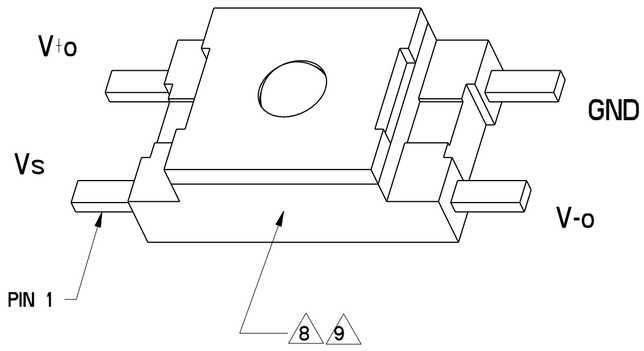
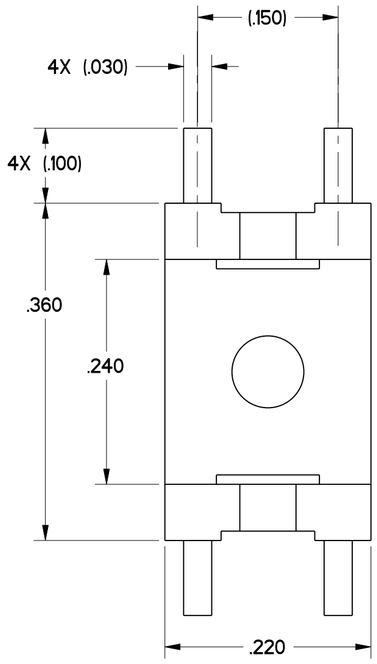
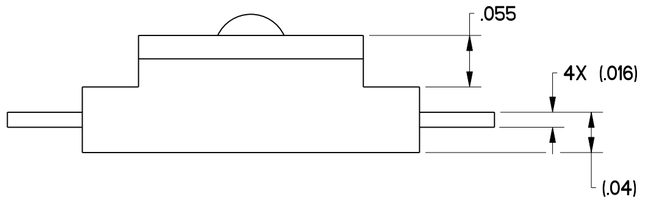
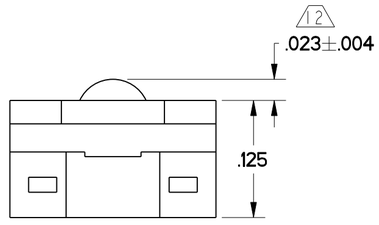




PRE-LAUNCH RELEASE





OPERATING CHARACTERISTICS
at 5.00±.01 VDC, 25°C, UNLESS OTHERWISE NOTED

PARAMETER	MIN	NOM	MAX	UNITS
SUPPLY VOLTAGE	3.0	5.0	6.0	V
OPERATING FORCE	0		1500	grams
NULL OFFSET	-15	0	15	mV
SPAN 4 5	150	180	210	mV
SENSITIVITY	.10	.12	.14	mV/gram
	MIN	TYP	MAX	UNITS
LINEARITY (BFSL) 6	-1.5	±0.7	1.5	% SPAN
REPEATABILITY AT 300g		±1.5		mV
MECHANICAL HYSTERESIS		±0.5		% SPAN
NULL SHIFT 7 (25°C to 0°C, 25°C to 50°C)		±0.5		mV
SPAN SHIFT (25°C to 0°C) 7		5.5		% SPAN
SPAN SHIFT (25°C to 50°C) 7		-5.5		% SPAN
OVER FORCE			4500	grams
	MIN	NOM	MAX	UNITS
INPUT RESISTANCE	4.0K	5.0K	6.0K	ohms
OUTPUT RESISTANCE	4.0K	5.0K	6.0K	ohms
OPERATING TEMPERATURE (-40°C to 85°C)				
STORAGE TEMPERATURE (-40°C to 100°C)				
MCTF 20 MILLION				

CATALOGING SYSTEM

FS S 1500 N S T xx

PACKAGE STYLE
(S) SURFACE MOUNT

OPERATING FORCE RANGE
(1500) 1500 GRAMS

TEMP COMPENSATION
(C) COMPENSATED
(N) NON-COMPENSATED

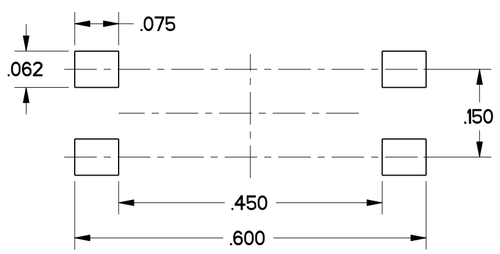
LEAD STYLE
(G) GULL WING
(S) STRAIGHT

PACKING OPTION
(B) BLISTER PACK
(R) TAPE AND REEL
(T) TUBE

SPECIAL FEATURE, BLANK = STANDARD

NOTES
1 - DEVICE IS RATIOMETRIC TO THE SUPPLY VOLTAGE
2 - DEVICE CAN OPERATE WITH CURRENT EXCITATION
3 - ALL FORCE RELATED SPECIFICATIONS ESTABLISHED BY USING DEAD WEIGHT OR COMPLIANT FORCE
4 SPAN IS THE ALGEBRAIC DIFFERENCE BETWEEN OUTPUT AT MAXIMUM RATED OPERATING FORCE AND OUTPUT AT 0 GRAMS
5 SPAN VERIFIED AT 1500 GRAMS
6 MEASURED AT 1500 GRAMS
7 TEMPERATURE ERROR IS CALCULATED WITH RESPECT TO 25°C
8 LASER BRAND CATALOG LISTING AND DATE CODE ON THIS SURFACE. PACKING STYLE IS NOT LASER BRANDED ON PRODUCT
9 PIN 1 IS DESIGNATED BY THE LASER-MARKED SURFACE
10 - MAXIMUM PEAK SMT REFLOW TEMPERATURE OF 200°C [500°F] FOR 10 SECONDS.
11 - MANUAL SOLDERING RECOMMENDATION: 5 SECONDS AT 315°C PER LEAD
12 - NOMINAL DIMENSION AND TOLERANCE APPLY IN BALL-UP ORIENTATION ONLY

SUGGESTED LAND PATTERN
FOR LEAD STYLE "S"



CAUTION
ELECTROSTATIC SENSITIVE DEVICES
DO NOT OPEN OR HANDLE EXCEPT AT A STATIC FREE WORKSTATION
ESD SENSITIVITY: CLASS 3

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE: [X] US(inch) CUSTOMARY [ ] SI(mm) METRIC

NO PLACE	X	±.040	±1
ONE PLACE	.X	±.030	±0,4
TWO PLACE	.XX	±.015	±0,15
THREE PLACE	.XXX	±.005	±
ANGLES		±	±

RAW MATERIAL-COMMERCIAL STANDARD

THIRD ANGLE PROJECTION

DRAWN	SAV	27JUL04
CHECK	SAV	27JUL04

DIMENSIONS ARE TO BE MET BEFORE PROTECTIVE COATINGS ARE APPLIED

3D PTC | ASME Y14.5M-1994

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TITLE: SENSOR, FORCE

SIZE	DWG TYPE	DRAWING NAME	REV
C	1	FS SERIES CHART 1	4

SCALE 8:1 | WEIGHT | SHEET 1 OF 1