HI-8200, HI-8201, HI-8202

Quad 10 Ohm +/-12V outside-the-rails Analog Switch with Open Circuit when Power Off

November 2017

GENERAL DESCRIPTION

The HI-8200 is a quad analog CMOS switch fabricated with Silicon-on-Insulator (SOI) technology for latch-up free operation and maximum switch isolation. High voltage gate drive is entirely created on-chip enabling +/-12V switching range from a single 3.3V or 5V supply. These switches are ideally suited for applications demanding low switch leakage when the power pins are 0V.

At 25°C and with VDD from 3.0V to 5.5V, the switch resistance (RON) is typically 8Ω. RON is independent of VDD. In a switching range of -5V to +5V, the maximum deviation of RON from flat is less than 5%.

These switches conduct equally well in either direction. Power down and Off state leakages are less than 10nA maximum. Charge injection is less than 10pC. Switching times are typically 180ns to the On state and 60ns to the Off state. The onboard charge pump allows an On/Off cycle time of 5KHz for all four switches simultaneously before the switching range becomes restricted.

The HI-8200 provides four each normally open switches when the switch control inputs are low. The HI-8201 provides four each normally closed switches when the switch control inputs are low. The HI-8202 provides a combination of two normally closed and two normally open switches.

Industry-standard plastic package options include 20-pin TSSOP, 16-pin DIP and 16-pin QFN. Ceramic packaging is available on request. All three products are offered in both industrial (-40°C to +85°C) and extended (-55°C to +125°C) temperature range options.

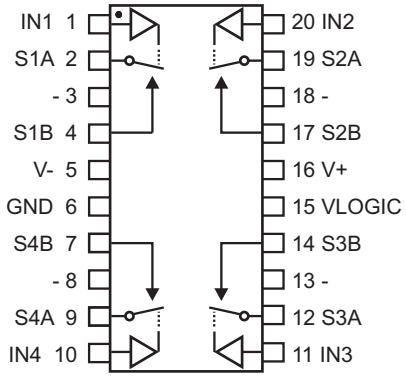
APPLICATIONS

- **Avionics**
- **Data bus isolation**
- **Sample-and-Hold circuits**
- **Test Equipment**
- **Communications Systems**

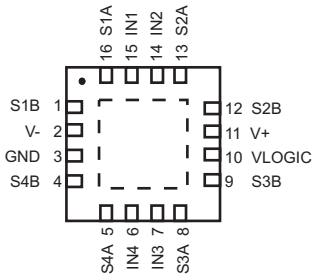
FEATURES

- **CMOS analog switches with up to +/-12V switching range from a single 3.3V or 5V supply**
- **Low RON: 10Ω max at 25°C**
- **Robust CMOS Silicon-on-Insulator (SOI) technology**
- **Switch nodes are open-circuit when chip is powered down**
- **SOI switch isolation with 1nA typical Off leakage**
- **ESD protection > 4KV HBM**
- **Fast switching time with break-before-make**
- **Low power**
- **Extended Temperature Range (-55°C to +125°C)**

PIN CONFIGURATIONS (Top Views)



HI-8200PSx
20-Pin TSSOP package



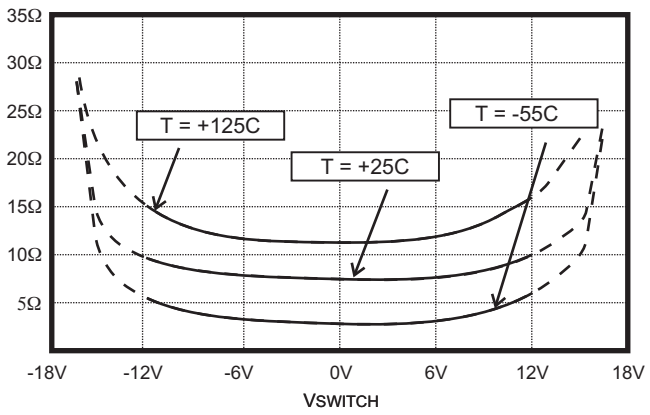
HI-8200PCx
16-pin 5mm x 5mm Chip-scale package
(see page 6 for additional package configurations)

PRODUCT OPTIONS								
PART TYPE	IN1	Switch 1	IN2	Switch 2	IN3	Switch 3	IN4	Switch 4
HI-8200	0	Open	0	Open	0	Open	0	Open
	1	Closed	1	Closed	1	Closed	1	Closed
HI-8201	0	Closed	0	Closed	0	Closed	0	Closed
	1	Open	1	Open	1	Open	1	Open
HI-8202	0	Open	0	Closed	0	Closed	0	Open
	1	Closed	1	Open	1	Open	1	Closed

PIN DESCRIPTIONS

SIGNAL	FUNCTION	DESCRIPTION
IN1	Logic Input	HI-8200 and HI-8202 are normally Open when input Low
S1A	Switch Node	Switch 1 Node
S1B	Switch Node	Switch 1 Node
V-	CAP -	Bulk storage capacitor. Add 0.1uF ceramic capacitor to GND. (20V or higher).
GND	Supply	Reference Ground
S4B	Switch Node	Switch 4 Node
S4A	Switch Node	Switch 4 Node
IN4	Logic Input	HI-8200 and HI-8202 are normally Open when input Low
IN3	Logic Input	HI-8201 and HI-8202 are normally Closed when input Low
S3A	Switch Node	Switch 3 Node
S3B	Switch Node	Switch 3 Node
VLOGIC	Supply	3.3V or 5.0V Logic supply
V+	CAP +	Bulk storage capacitor. Add 0.1uF ceramic capacitor to GND. (20V or higher).
S2B	Switch Node	Switch 2 Node
S2A	Switch Node	Switch 2 Node
IN2	Logic input	HI-8201 and HI-8202 are normally Closed when input Low

NOTE: V+ and V- pins are **only** to be used for connection of bulk storage capacitors and **MUST NOT** be loaded.



Typical RON as a function of VSWITCH and Temperature (10mA switch current, VSUPPLY = +3.3V)

ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to GND = 0V)

Supply Voltage, V_{LOGIC} .....7.0V Switch Current (either direction, DC): .....20mA Peak Switch Current (1 ms pulse, 10% duty cycle max.).....100mA Digital Input Voltage (IN1-4):.....-0.3V to V_{LOGIC} + 0.3V	Continuous Power Dissipation (TA=70°C): SO Package (derate 6.7mW/°C above 70°C).....696mW Plastic DIP (derate 10.53 mw/°C above 70°C) .....842mW Thin QFN (derate 21.3mW/°C above 70°C) 1702mW
Operating Temperature Range: (Industrial).....-40°C to +85°C (Hi-Temp).....-55°C to +125°C Maximum Junction Temperature .....175°C	Storage Temperature Range: .....-65°C to +150°C Soldering Temperature: (Ceramic).....60 sec. at +300°C (Plastic - leads).....10 sec. at +280°C (Plastic - body) .....+260°C Max.

NOTE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

V_{LOGIC} = 3.3V or 5.0V, GND = 0V. Operating temperature range (unless otherwise noted).

PARAMETER	SYMBOL	CONDITIONS	FIGURE	MIN	TYP	MAX	UNIT
SWITCH PARAMETERS							
Switch Resistance, 25°C, 10mA	R_{ON}	12V > Vs > -12V	1	6	8	10	Ω
Leakage - (open circuit and power down)	$\|I_{SWLEAK}\|$	12V > Vs > -12V	2		1	10	nA
Leakage - (open circuit and power on)	$\|I_{SWLEAKp}\|$	12V > Vs > -12V	2		1	100	nA
LOGIC INPUTS							
Input High Voltage	V_{IH}			75%			V
Input Low Voltage	V_{IL}					25%	V
Input Current	I_{IH} I_{IL}	80K Ohm pulldown VLogic = 3.3V Vlogic = 5.0V			45 65	 0.5	µA µA µA
SUPPLY							
VLogic Operating Range	VDD			3.0		5.5	V
VLogic Operating Current	IDD	inputs static VLogic = 3.3V Vlogic = 5.0V				1.0 2.5	mA mA
DYNAMIC PARAMETERS							
Max Vin On/Off cycling	fcycle	any load				5	Khz
Turn On Time	T_{ON}		3		180	250	ns
Turn Off time	T_{OFF}		3		80	150	ns
Break-Before-Make Time	T_D		4	40	80		ns
Charge Injection	Q	V_S=0V, R_S=0Ω, 25°C	5		-20		pC
Off Isolation	R_R	f = 1 MHz, 25°C	6		65		dB
Crosstalk	C_R	f = 1 MHz, 25°C	7		90		dB
Capacitance	C_{OFF} C_{ON}	Switch Off, 25°C Switch On, 25°C	8 9		15 60		pF pF
Charge Pump Power On	Tvon	V+ and V- = +/-14.5V VLogic = 5.0V	10	10			ms

TEST CIRCUITS

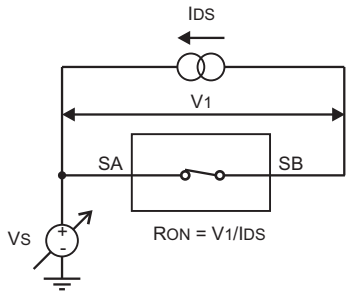


Figure 1 - On Resistance

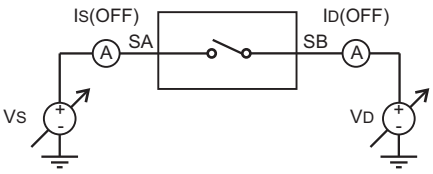


Figure 2 - Off Leakage

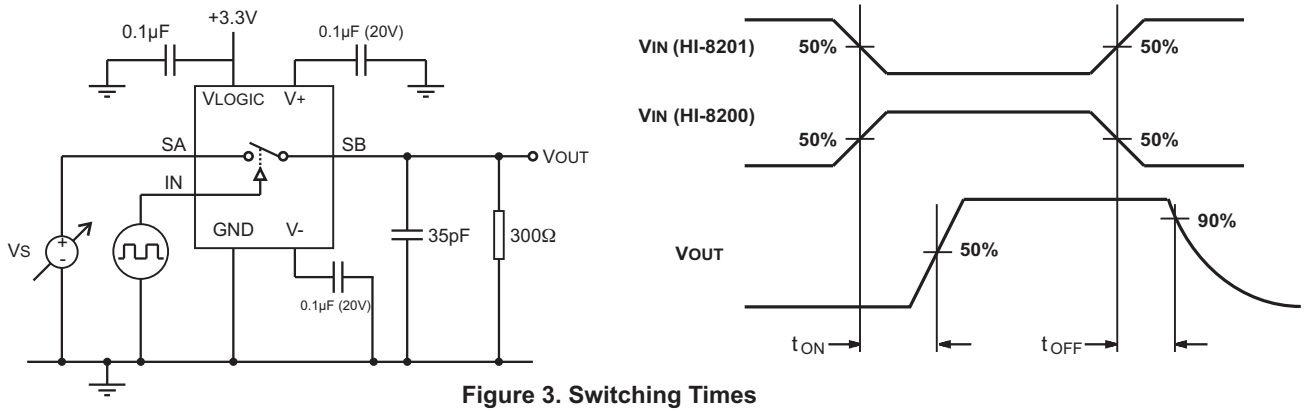


Figure 3. Switching Times

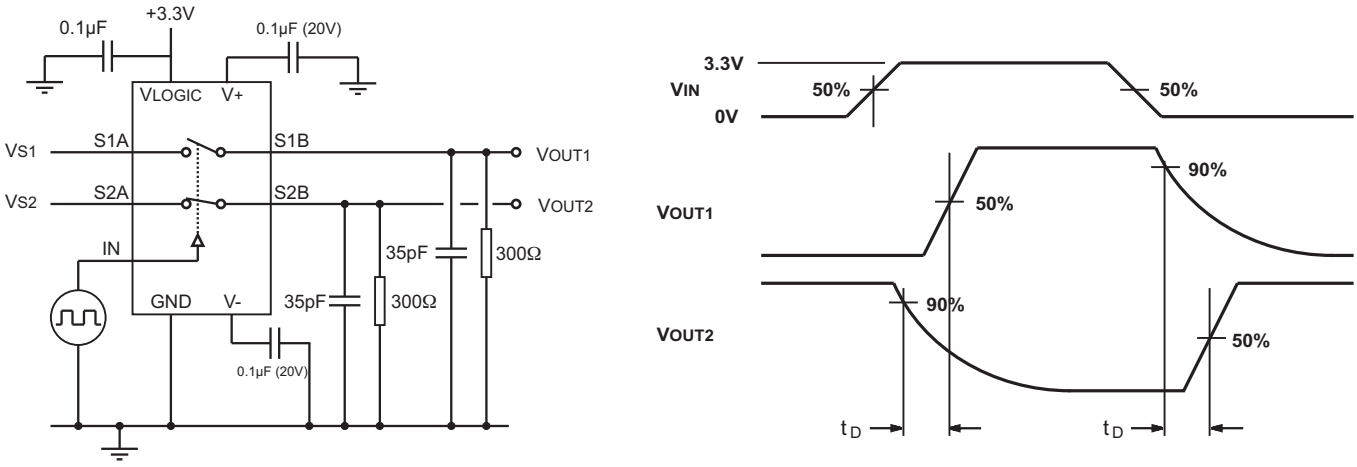
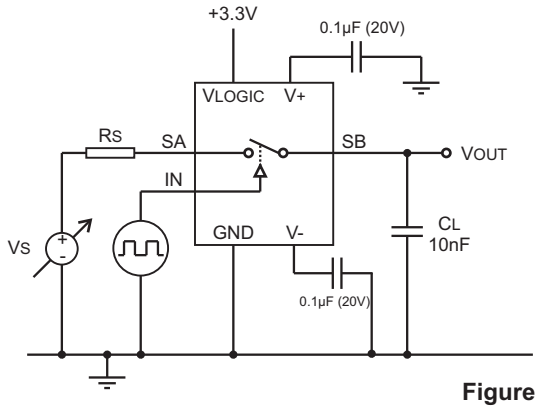


Figure 4. Break-Before-Make Time Delay (HI-8202)



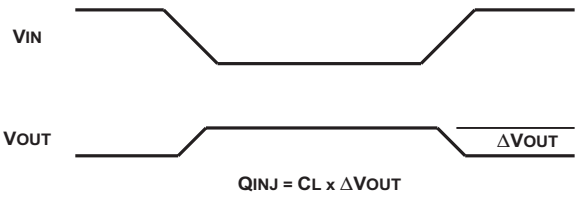


Figure 5. Charge Injection

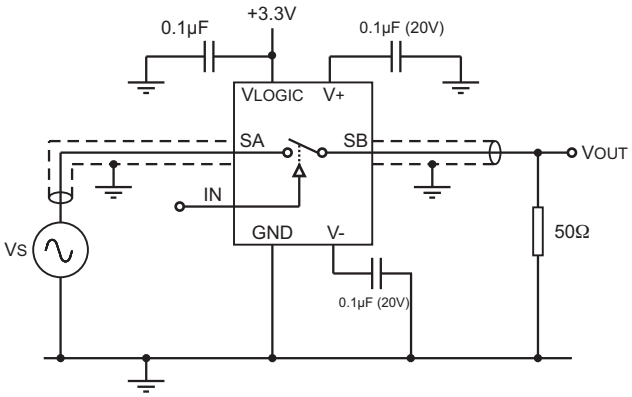


Figure 6 - Off Isolation

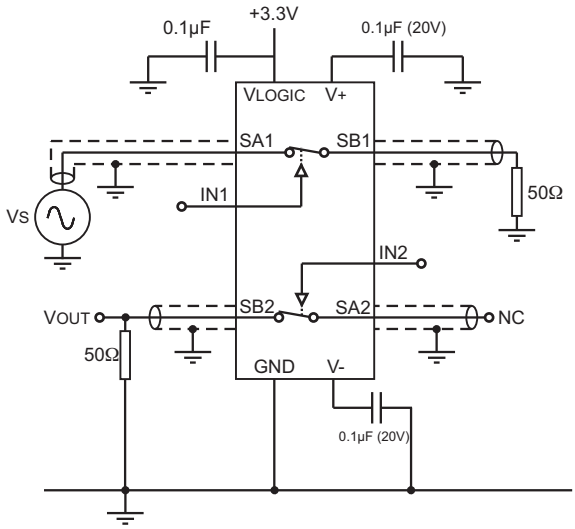


Figure 7 - Channel-to-Channel Crosstalk

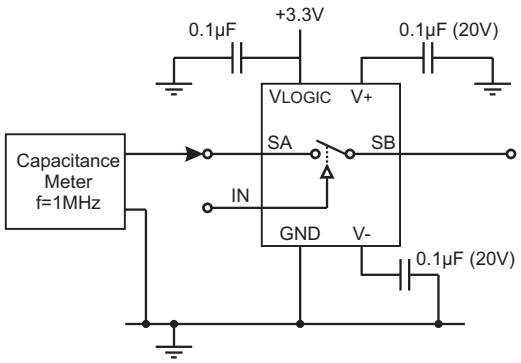


Figure 8 - Off Capacitance

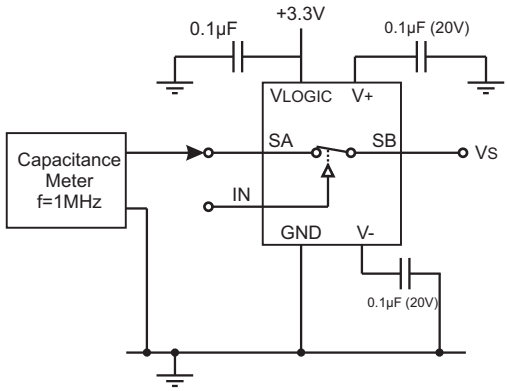
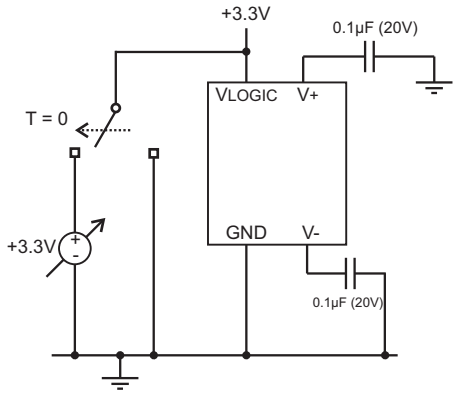


Figure 9 - On Capacitance



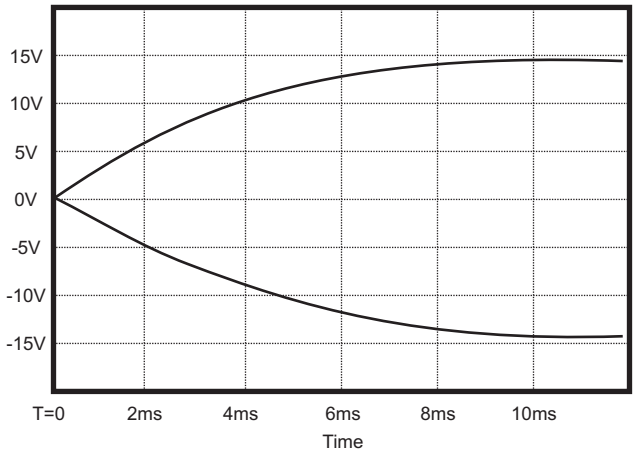
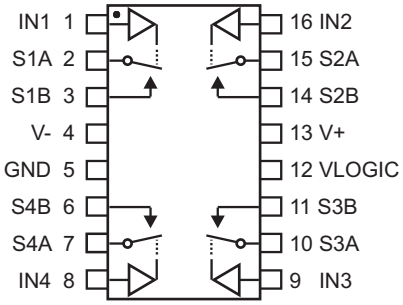


Figure 10. Charge Pump Power On

Additional package configurations



HI-8200PDx

16-Pin DIP package

FREQUENCY RESPONSE

Figure 11 shows a typical frequency response.

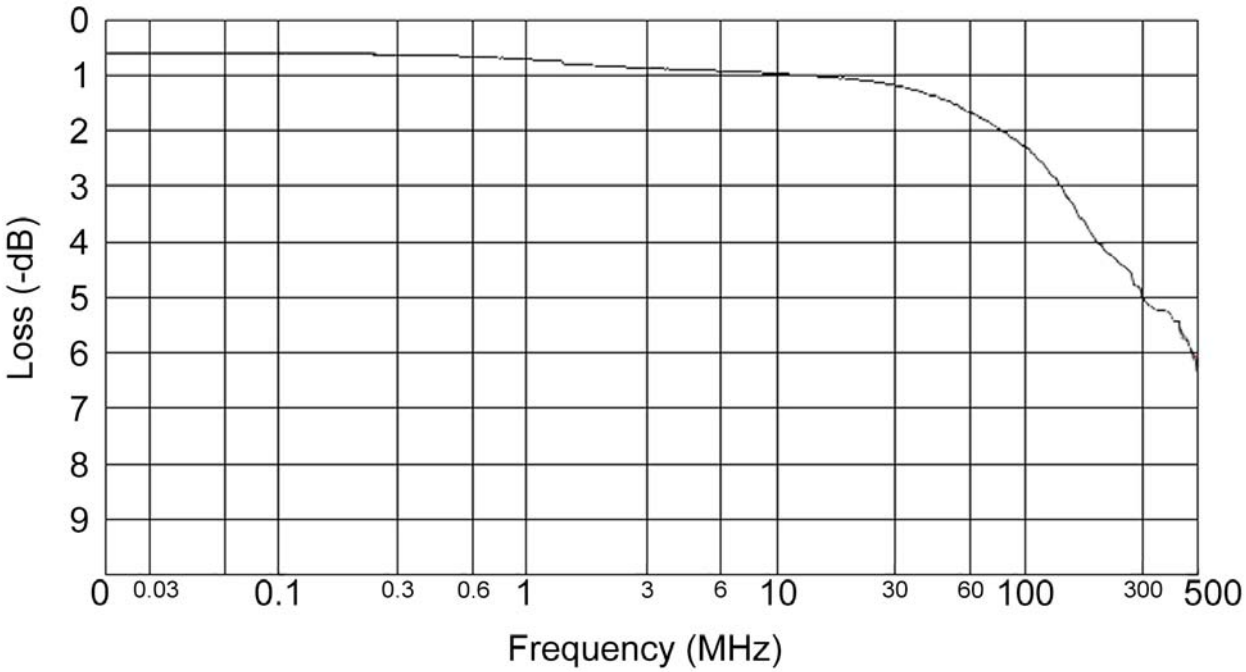


Figure 11. Frequency Response.

ORDERING INFORMATION

HI - 820x xx x x

PART NUMBER	LEAD FINISH
Blank	Tin / Lead (Sn / Pb) Solder
F	Pb-free, RoHS compliant

PART NUMBER	TEMPERATURE RANGE	FLOW	BURN IN
I	-40°C TO +85°C	I	NO
T	-55°C TO +125°C	T	NO
M	-55°C TO +125°C	M	YES

PART NUMBER	PACKAGE DESCRIPTION
PC	16 PIN PLASTIC 5 x 5 mm CHIP SCALE (16PCS1) (No M-flow, Pb-free only)
PS	20 PIN PLASTIC TSSOP (20HS)
PD	16 PIN PLASTIC DIP (16P)

PART NUMBER	FUNCTION
8200	QUAD SWITCH, NORMALLY OPEN
8201	QUAD SWITCH, NORMALLY CLOSED
8202	QUAD SWITCH, TWO NORMALLY OPEN, TWO NORMALLY CLOSED

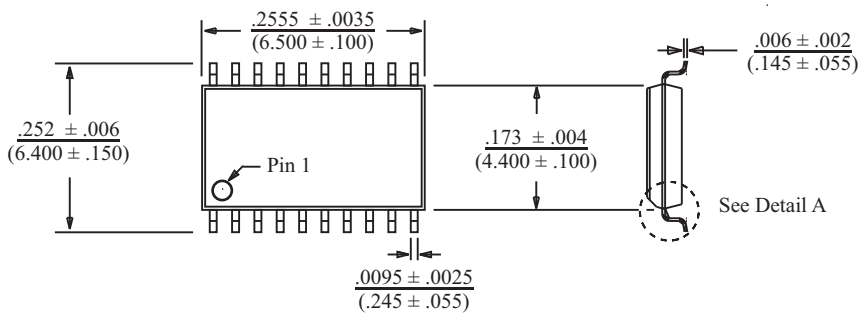
REVISION HISTORY

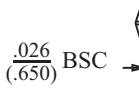
P/N	Rev	Date	Description of Change
DS8200	New	10/18/12	Initial Release
	A	10/22/12	Remove 1MOhm resistor to GND from test circuits. Correct typo in Pin Descriptions
	B	12/18/12	Clarify that V+/V- pins **must not** be loaded. Used **only** for connection of bulk storage caps.
	C	04/18/16	Add leakage spec for power on condition.
	D	11/07/17	Add frequency response curve.

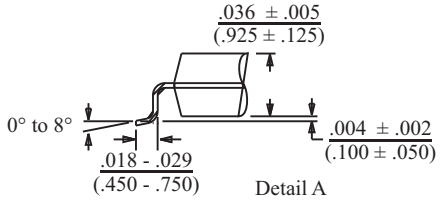
20-PIN PLASTIC TSSOP

inches (millimeters)

Package Type: 20HS





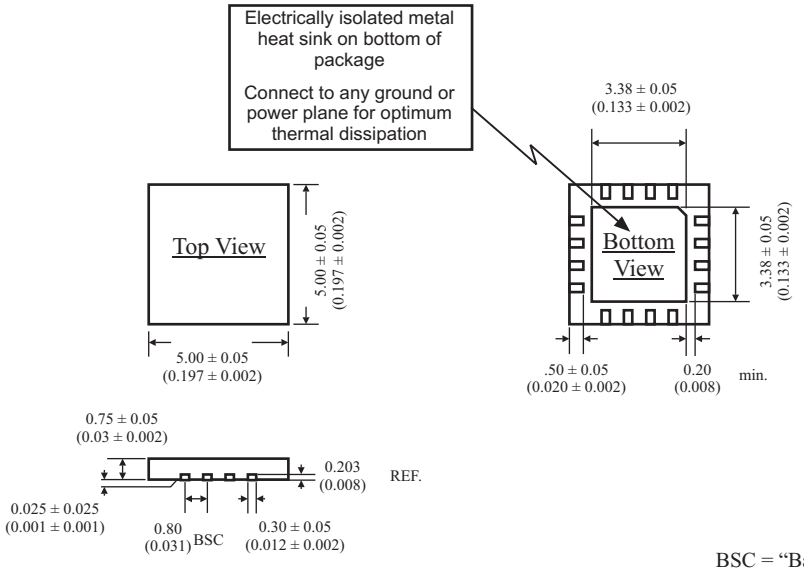


BSC = "Basic Spacing between Centers" is theoretical true position dimension and has no tolerance. (JEDEC Standard 95)

16-PIN PLASTIC CHIP-SCALE PACKAGE

millimeters

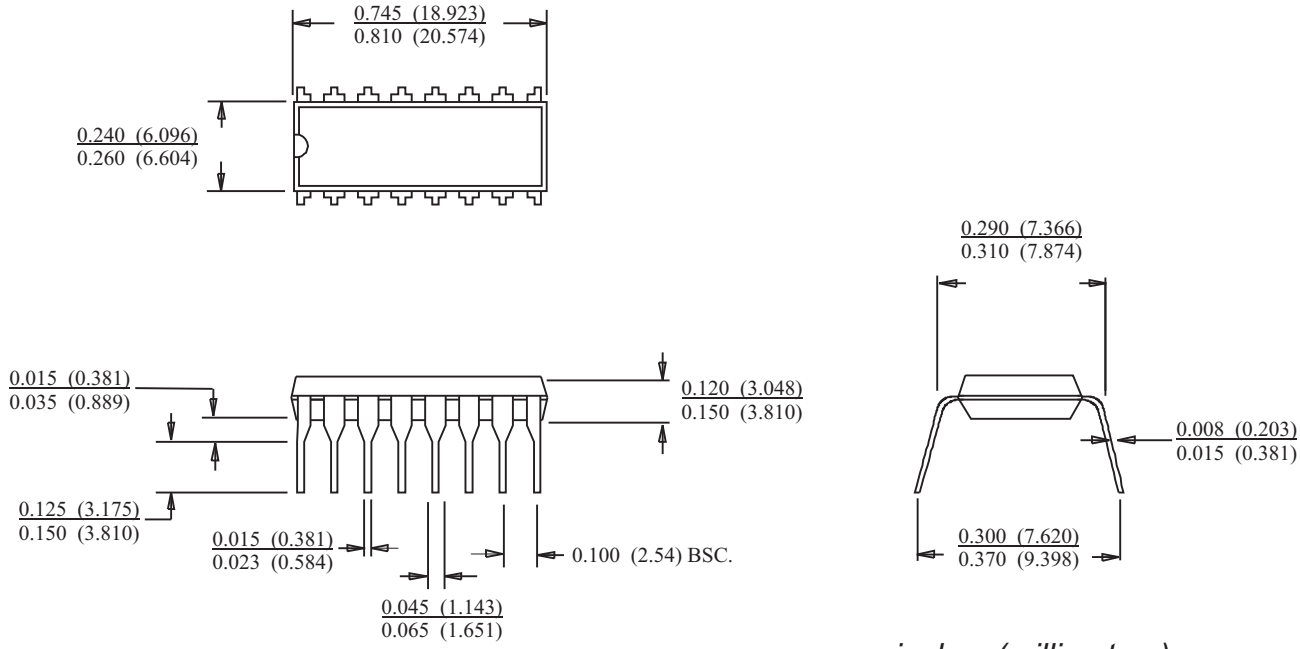
Package Type: 16PCS1



BSC = "Basic Spacing between Centers" is theoretical true position dimension and has no tolerance. (JEDEC Standard 95)

16-PIN PLASTIC DIP

Package Type: 16P



inches (millimeters)