

## DESCRIPTION

The HI-8444 and HI-8445 are quad ARINC 429 line receiver ICs available in a 20-pin TSSOP package. The HI-8448 contains 8 independent ARINC 429 line receivers. The technology is analog / digital CMOS. The device is designed to operate from either a 5V or 3.3V supply. Each receiver channel translates incoming ARINC 429 data bus signals to a pair of TTL / CMOS outputs.

The optional HI-8444-10, HI-8445-10 and HI-8448-10 are designed to be used with an external 15 Kohm series resistor. The "-10" devices meet the lightning protection requirements of DO-160G, level 3, waveforms 3, 4, 5A, and 5B.

The TESTA and TESTB inputs bypass the analog inputs for testing purposes. They force the receiver outputs to the specified ZERO, ONE or NULL state. The ARINC inputs are ignored when the device is in the test mode.

The HI-8445 is identical to the HI-8444 except the TESTA and TESTB pins are not available.

## FEATURES

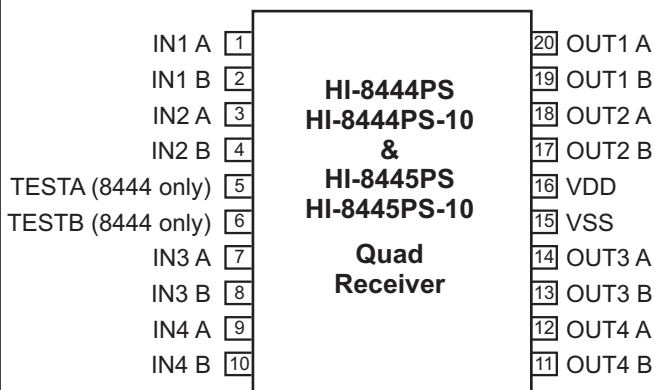
- Direct ARINC 429 quad or octal line receivers in small footprint packages
- 3.3V or 5.0V single supply operation
- Test inputs bypass analog inputs and force digital outputs to a one, zero, or null state
- ARINC inputs are internally lightning protected per DO-160G level 3 (-10 configuration only)
- Hi-Rel processing options available

## FUNCTION TABLE

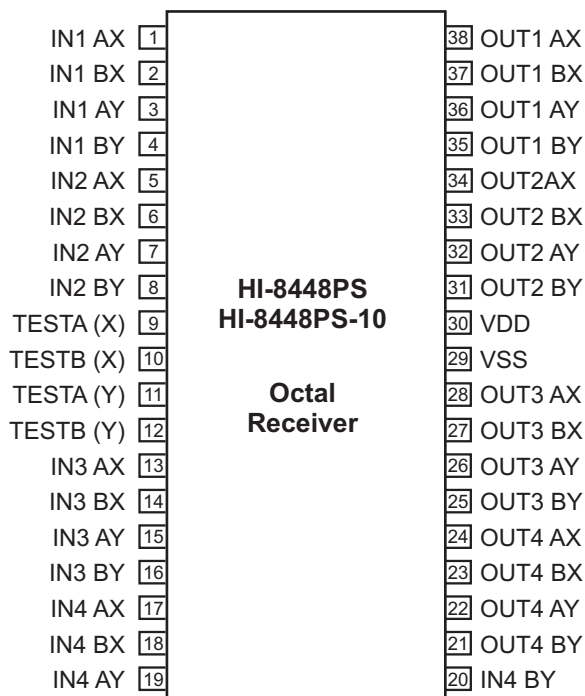
| ARINC INPUTS<br>INA - INB | TESTA | TESTB | OUTA | OUTB |
|---------------------------|-------|-------|------|------|
| -2.5 to +2.5 V            | 0     | 0     | 0    | 0    |
| < -6.5 V                  | 0     | 0     | 0    | 1    |
| > +6.5 V                  | 0     | 0     | 1    | 0    |
| X                         | 0     | 1     | 0    | 1    |
| X                         | 1     | 0     | 1    | 0    |
| X                         | 1     | 1     | 0    | 0    |

## PIN CONFIGURATIONS

(See page 6 for additional pin configurations)

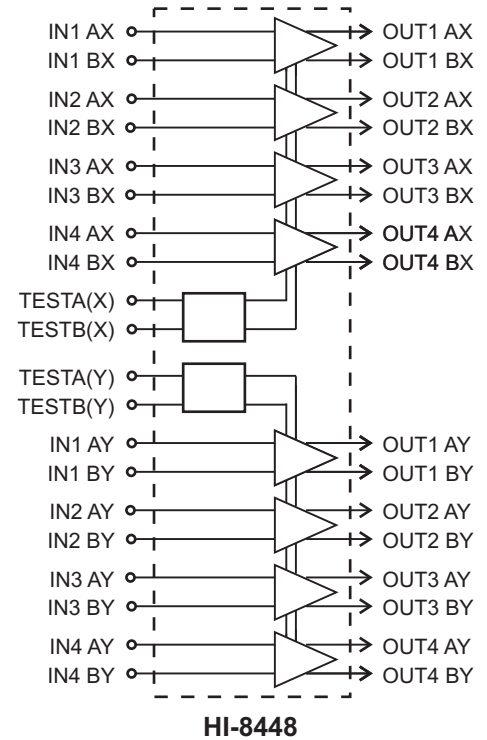
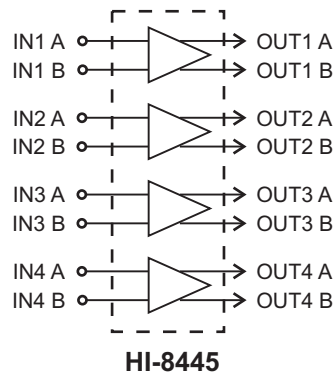
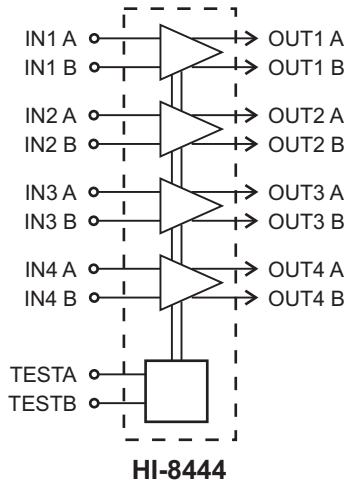


20 Pin Plastic TSSOP package



38 Pin Plastic TSSOP package

## BLOCK DIAGRAMS



## PIN DESCRIPTIONS (HI-8444, HI-8445)

| PIN | SYMBOL | FUNCTION     | DESCRIPTION                            |
|-----|--------|--------------|----------------------------------------|
| 1   | IN1 A  | ARINC input  | Receiver 1 positive input              |
| 2   | IN1 B  | ARINC input  | Receiver 1 negative input              |
| 3   | IN2 A  | ARINC input  | Receiver 2 positive input              |
| 4   | IN2 B  | ARINC input  | Receiver 2 negative input              |
| 5   | TESTA  | Logic input  | Test input. (Not available on HI-8445) |
| 6   | TESTB  | Logic input  | Test input. (Not available on HI-8445) |
| 7   | IN3 A  | ARINC input  | Receiver 3 positive input              |
| 8   | IN3 B  | ARINC input  | Receiver 3 negative input              |
| 9   | IN4 A  | ARINC input  | Receiver 4 positive input              |
| 10  | IN4 B  | ARINC input  | Receiver 4 negative input              |
| 11  | OUT4 B | Logic output | Receiver 4 "ZERO" output               |
| 12  | OUT4 A | Logic output | Receiver 4 "ONE" output                |
| 13  | OUT3 B | Logic output | Receiver 3 "ZERO" output               |
| 14  | OUT3 A | Logic output | Receiver 3 "ONE" output                |
| 15  | VSS    | Power        | Ground                                 |
| 16  | VDD    | Power        | Positive supply voltage 3.3V or 5.0 V  |
| 17  | OUT2 B | Logic output | Receiver 2 "ZERO" output               |
| 18  | OUT2 A | Logic output | Receiver 2 "ONE" output                |
| 19  | OUT1 B | Logic output | Receiver 1 "ZERO" output               |
| 20  | OUT1 A | Logic output | Receiver 1 "ONE" output                |

## PIN DESCRIPTIONS (HI-8448)

| PIN      | FUNCTION     | RECEIVER SET | DESCRIPTION                           |
|----------|--------------|--------------|---------------------------------------|
| IN1 AX   | ARINC input  | X            | Receiver 1 positive input             |
| IN1 BX   | ARINC input  | X            | Receiver 1 negative input             |
| IN1 AY   | ARINC input  | Y            | Receiver 1 positive input             |
| IN1 BY   | ARINC input  | Y            | Receiver 1 negative input             |
| IN2 AX   | ARINC input  | X            | Receiver 2 positive input             |
| IN2 BX   | ARINC input  | X            | Receiver 2 negative input             |
| IN2 AY   | ARINC input  | Y            | Receiver 2 positive input             |
| IN2 BY   | ARINC input  | Y            | Receiver 2 negative input             |
| TESTA(X) | Logic input  | X            | Test input                            |
| TESTB(X) | Logic input  | X            | Test input                            |
| TESTA(Y) | Logic input  | Y            | Test input                            |
| TESTB(Y) | Logic input  | Y            | Test input                            |
| IN3 AX   | ARINC input  | X            | Receiver 3 positive input             |
| IN3 BX   | ARINC input  | X            | Receiver 3 negative input             |
| IN3 AY   | ARINC input  | Y            | Receiver 3 positive input             |
| IN3 BY   | ARINC input  | Y            | Receiver 3 negative input             |
| IN4 AX   | ARINC input  | X            | Receiver 4 positive input             |
| IN4 BX   | ARINC input  | X            | Receiver 4 negative input             |
| IN4 AY   | ARINC input  | Y            | Receiver 4 positive input             |
| IN4 BY   | ARINC input  | Y            | Receiver 4 negative input             |
| OUT4 BY  | Logic output | Y            | Receiver 4 "ZERO" output              |
| OUT4 AY  | Logic output | Y            | Receiver 4 "ONE" output               |
| OUT4 BX  | Logic output | X            | Receiver 4 "ZERO" output              |
| OUT4 AX  | Logic output | X            | Receiver 4 "ONE" output               |
| OUT3 BY  | Logic output | Y            | Receiver 3 "ZERO" output              |
| OUT3 AY  | Logic output | Y            | Receiver 3 "ONE" output               |
| OUT3 BX  | Logic output | X            | Receiver 3 "ZERO" output              |
| OUT3 AX  | Logic output | X            | Receiver 3 "ONE" output               |
| VSS      | Power        |              | Ground supply                         |
| VDD      | Power        |              | Positive supply voltage 3.3V or 5.0 V |
| OUT2 BY  | Logic output | Y            | Receiver 2 "ZERO" output              |
| OUT2 AY  | Logic output | Y            | Receiver 2 "ONE" output               |
| OUT2 BX  | Logic output | X            | Receiver 2 "ZERO" output              |
| OUT2 AX  | Logic output | X            | Receiver 2 "ONE" output               |
| OUT1 BY  | Logic output | Y            | Receiver 1 "ZERO" output              |
| OUT1 AY  | Logic output | Y            | Receiver 1 "ONE" output               |
| OUT1 BX  | Logic output | X            | Receiver 1 "ZERO" output              |
| OUT1 AX  | Logic output | X            | Receiver 1 "ONE" output               |

## ABSOLUTE MAXIMUM RATINGS

|                             |                   |
|-----------------------------|-------------------|
| Supply voltage (VDD)        | -0.3 V to +7 V    |
| Logic input voltage range   | -0.3 V to +5.5 V  |
| ARINC input voltage         | -120 V to + 120 V |
| Solder Temperature (reflow) | 260°C             |
| Storage Temperature         | -65°C to +150°C   |

## RECOMMENDED OPERATING CONDITIONS

|                             |                 |
|-----------------------------|-----------------|
| Supply Voltage              |                 |
| VDD .....                   | 3.0 V to 5.5 V  |
| Operating Temperature Range |                 |
| Industrial Screening .....  | -40°C to +85°C  |
| Hi-Temp Screening .....     | -55°C to +125°C |

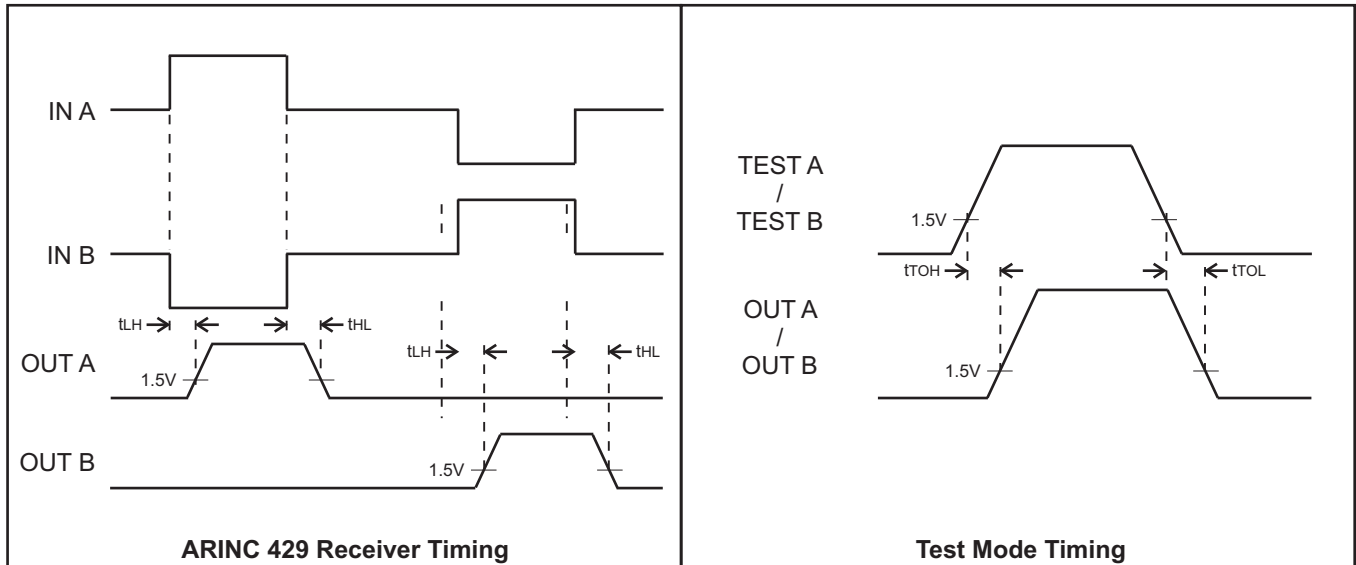
NOTE: Stresses above absolute maximum ratings or outside recommended operating conditions may cause permanent damage to the device. These are stress ratings only. Operation at the limits is not recommended.

## ELECTRICAL CHARACTERISTICS

VDD = 5.0V ± 5% or 3.3V ± 5%, Vss = 0V, TA = Operating Temperature Range (unless or otherwise specified).

| PARAMETER                                          |                                             | SYMBOL            | CONDITION                                    | MIN                  | TYP | MAX                  | UNITS |
|----------------------------------------------------|---------------------------------------------|-------------------|----------------------------------------------|----------------------|-----|----------------------|-------|
| ARINC INPUTS                                       |                                             |                   |                                              |                      |     |                      |       |
| Input voltage                                      | ONE or ZERO                                 | V <sub>DIN</sub>  | Differential input voltage                   | 6.5                  | 10  | 13                   | V     |
|                                                    | NULL                                        | V <sub>NIN</sub>  | Differential input voltage                   |                      |     | 2.5                  | V     |
|                                                    | Common mode                                 | V <sub>COM</sub>  | With respect to GND                          |                      |     | ±5.0                 | V     |
| Input resistance                                   | INA to INB                                  | R <sub>DIFF</sub> | Supplies floating                            | 30                   | 75  |                      | KΩ    |
|                                                    | Input to V <sub>SS</sub> or V <sub>DD</sub> | R <sub>SUP</sub>  | Supplies floating                            | 19                   | 40  |                      | KΩ    |
| Input hysteresis                                   |                                             | V <sub>HYS</sub>  |                                              | 0.5                  | 1.0 |                      | V     |
| Input capacitance                                  | ARINC differential                          | C <sub>AD</sub>   |                                              |                      | 5   | 10                   | pF    |
|                                                    | ARINC single ended to V <sub>SS</sub>       | C <sub>AS</sub>   |                                              |                      |     | 10                   | pF    |
| TEST INPUTS                                        |                                             |                   |                                              |                      |     |                      |       |
| Logic input voltage                                | High                                        | V <sub>IH</sub>   |                                              | 2.0                  |     |                      | V     |
|                                                    | Low                                         | V <sub>IL</sub>   |                                              |                      |     | 0.8                  | V     |
| Logic input current                                | Sink                                        | I <sub>IH</sub>   | V <sub>IH</sub> =2.0V                        |                      |     | 200                  | μA    |
|                                                    | Source                                      | I <sub>IL</sub>   | V <sub>IL</sub> =0.8V                        | -1.0                 |     |                      | μA    |
| OUTPUTS                                            |                                             |                   |                                              |                      |     |                      |       |
| Logic output voltage                               | High                                        | V <sub>OH</sub>   | I <sub>OH</sub> =-5mA, V <sub>DD</sub> =5.0V | 2.4                  |     |                      | V     |
|                                                    |                                             |                   | I <sub>OH</sub> =-4mA, V <sub>DD</sub> =3.3V | 2.4                  |     |                      | V     |
|                                                    | Low                                         | V <sub>OL</sub>   | I <sub>OL</sub> =5mA, V <sub>DD</sub> =5.0V  |                      |     | 0.4                  | V     |
|                                                    |                                             |                   | I <sub>OL</sub> =4mA, V <sub>DD</sub> =3.3V  |                      |     | 0.4                  | V     |
| Logic output voltage (CMOS)                        | High                                        | V <sub>OH</sub> C | I <sub>OH</sub> =-100μA                      | V <sub>DD</sub> -0.2 |     |                      | V     |
|                                                    | Low                                         | V <sub>OL</sub> C | I <sub>OL</sub> =100μA                       |                      |     | V <sub>SS</sub> +0.2 | V     |
| SUPPLY CURRENT                                     |                                             |                   |                                              |                      |     |                      |       |
| V <sub>DD</sub> current                            |                                             | I <sub>DD</sub>   | HI-8444, HI-8445                             |                      | 5.5 | 10                   | mA    |
|                                                    |                                             |                   | HI-8448                                      |                      | 11  | 20.0                 | mA    |
| SWITCHING CHARACTERISTICS (T <sub>A</sub> = 25 °C) |                                             |                   |                                              |                      |     |                      |       |
| Propagation delay                                  | IN to OUT                                   | t <sub>LH</sub>   | C <sub>L</sub> =50 pF                        |                      | 600 |                      | ns    |
|                                                    |                                             | t <sub>HL</sub>   | C <sub>L</sub> =50 pF                        |                      | 600 |                      | ns    |
| Output rise time                                   |                                             | t <sub>R</sub>    | 10% to 90%                                   |                      | 50  | 80                   | ns    |
| Output fall time                                   |                                             | t <sub>F</sub>    | 90% to 10%                                   |                      | 50  | 80                   | ns    |
| Propagation delay                                  | TEST to OUT                                 | t <sub>TOH</sub>  |                                              |                      | 50  |                      | ns    |
|                                                    |                                             | t <sub>TOL</sub>  |                                              |                      | 50  |                      | ns    |

## TIMING DIAGRAMS



### INTERNAL LIGHTNING PROTECTION (-10 Only)

The HI-8444-10, HI-8445-10 and HI-8488-10 are similar to the "non -10" configurations with the exception that an external 15 Kohm resistor must be added in series with each ARINC input in order to properly detect the ARINC 429 specified input thresholds. This option is especially useful in applications where external lightning protection circuitry is required.

The HI-8444-10, HI-8445-10 and HI-8448-10 will meet the requirements of DO-160G, Level 3, waveforms 3, 4, 5A and 5B with the 15 Kohm series resistors in place.

Please refer to the Holt AN-300 Application Note for additional information and recommendations on lightning protection of Holt Line Drivers and Receivers.

## ORDERING INFORMATION

HI - 844xxx x x - xx

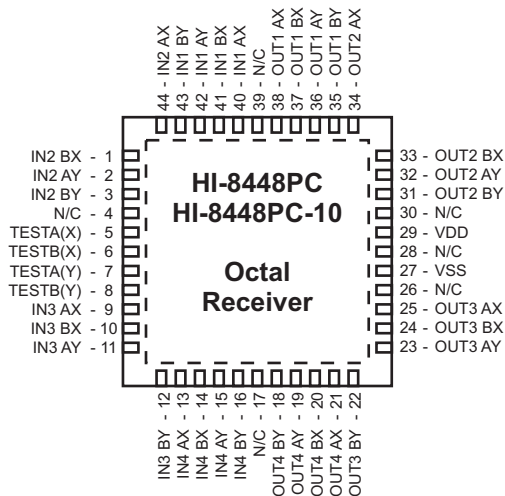
| PART NUMBER    | INPUT SERIES RESISTANCE |                     |
|----------------|-------------------------|---------------------|
|                | BUILT-IN                | REQUIRED EXTERNALLY |
| No dash number | 35 Kohm                 | 0                   |
| -10            | 25 Kohm                 | 15 Kohm             |

| PART NUMBER | LEAD FINISH                              |
|-------------|------------------------------------------|
| Blank       | Tin / Lead (Sn / Pb) Solder              |
| F           | 100% Matte Tin (Pb-free, RoHS compliant) |

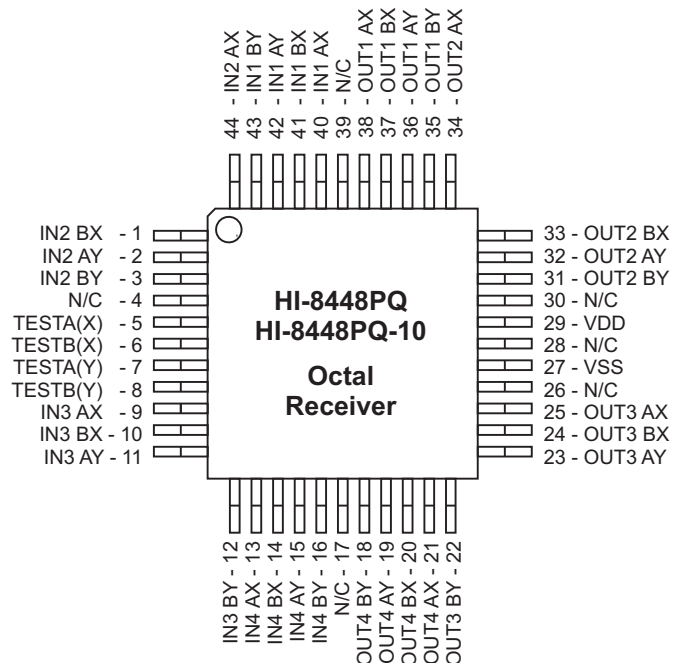
| PART NUMBER | TEMPERATURE RANGE | FLOW | BURN IN |
|-------------|-------------------|------|---------|
| I           | -40°C TO +85°C    | I    | No      |
| T           | -55°C TO +125°C   | T    | No      |

| PART NUMBER | PACKAGE DESCRIPTION                         | TEST PINS |
|-------------|---------------------------------------------|-----------|
| 8444PS      | 20 PIN PLASTIC TSSOP (20HS)                 | Yes       |
| 8445PS      | 20 PIN PLASTIC TSSOP (20HS)                 | No        |
| 8448PQ      | 44 PIN PLASTIC QUAD FLAT PACK PQFP (44PTQS) | Yes       |
| 8448PS      | 38 PIN PLASTIC TSSOP (38HS)                 | Yes       |
| 8448PC      | 44 PIN PLASTIC CHIP-SCALE, LPCC (44PCS)     | Yes       |

## ADDITIONAL PIN CONFIGURATIONS



44 - Pin Plastic 7mm x 7mm  
Chip-Scale Package (QFN)



44-Pin Plastic Quad Flat Pack (PQFP)

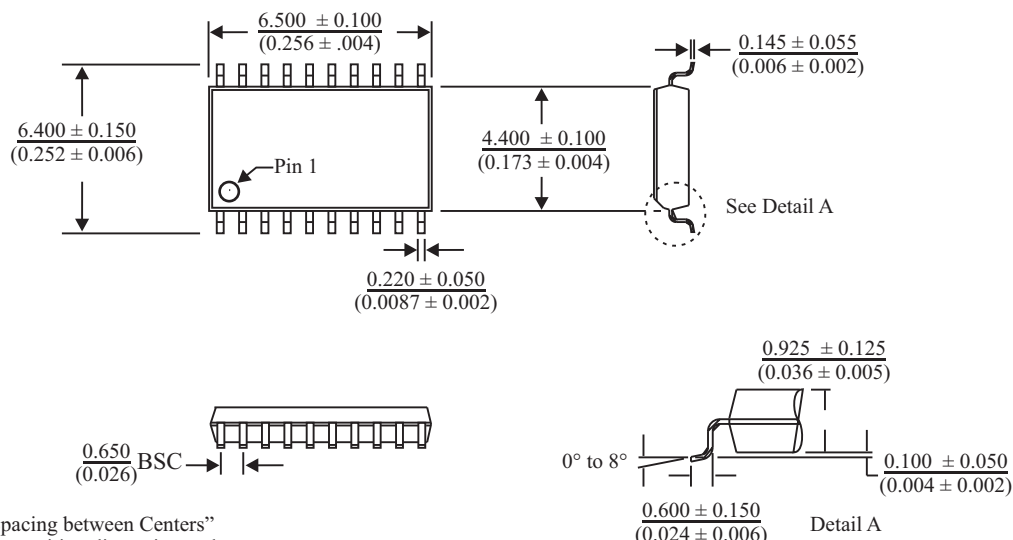
## REVISION HISTORY

| Revision       | Date     | Page | Description of Change                                                                                                                      |
|----------------|----------|------|--------------------------------------------------------------------------------------------------------------------------------------------|
| DS8444, Rev. G | 05/30/08 | 1    | Changed "10 Kohm", "DO-160C/D", and "and 5A" in second paragraph of the Description to "15 Kohm", DO-160E", and "5A, and 5B" respectively. |
|                |          | 1    | Changed "DO-160C/D" in fourth Feature bullet to "DO160E".                                                                                  |
|                |          | 5    | Changed "10 Kohm" in second and third paragraphs and in the Required Series Resistance of the Ordering information to "15 Kohm".           |
|                |          | 5    | Changed "DO-160D" and "4 and 5A" in third paragraph to "DO-160E" and "4, 5A, and 5B" respectively.                                         |
|                |          | 6    | Added Revision History page as new page 6.                                                                                                 |
|                |          | 7    | Renumbered page 6 as page 7                                                                                                                |
|                |          | 8    | Replaced the 44-Pin Plastic Quad Flat Pack (PQFP) drawing with new drawing.                                                                |
|                |          |      |                                                                                                                                            |
| Rev. H         | 05/25/10 |      | Added new package configurations for HI-8448PSx and HI-8448PCx.                                                                            |
| Rev. I         | 10/17/13 |      | Update PQFP and QFN package drawings.                                                                                                      |
| Rev. J         | 11/04/13 |      | Update QFN-44, QFP-44, TSSOP-38 and TSSOP-20 package drawings.<br>Update DO-160E to DO-160G rev. number in text.                           |
| Rev. K         | 12/05/16 |      | Update Absolute Maximum Ratings Table. .                                                                                                   |

### 20-PIN PLASTIC TSSOP

millimeters(inches)

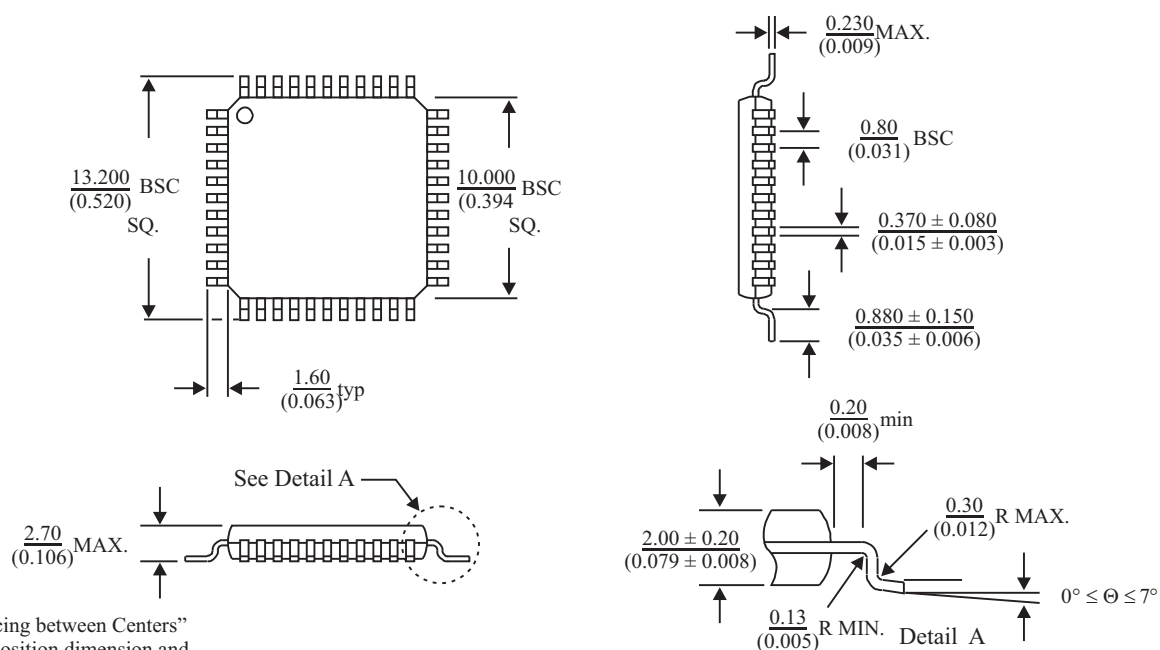
Package Type: 20HS



### 44-PIN PLASTIC QUAD FLAT PACK (PQFP)

millimeters (inches)

Package Type: 44PMQS

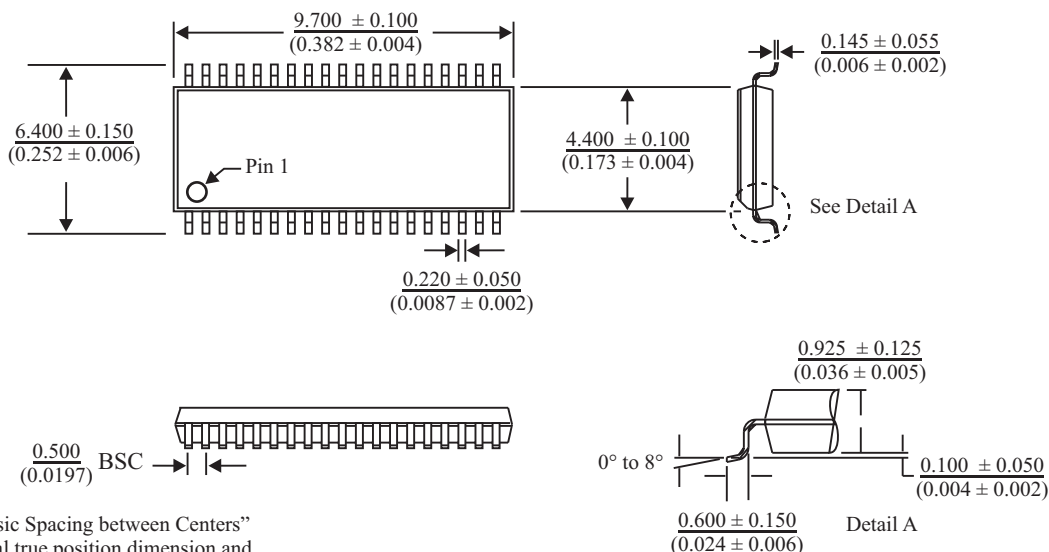




### 38-PIN PLASTIC TSSOP

millimeters (inches)

Package Type: 38HS



### 44-PIN PLASTIC CHIP-SCALE PACKAGE (QFN)

millimeters (inches)

Package Type: 44PCS

