

### GENERAL DESCRIPTION

The HI-35851 is an ARINC 429 repeater which ensures that ARINC 429 signals can be reliably received from a transmission source and re-transmitted to another receiver (for example at the end of a long transmission line) that may otherwise not detect the signal of the original transmitter due to signal degradation. The HI-35851 will ensure the original transmitter signal can be relayed efficiently with the same signal integrity as the original source.

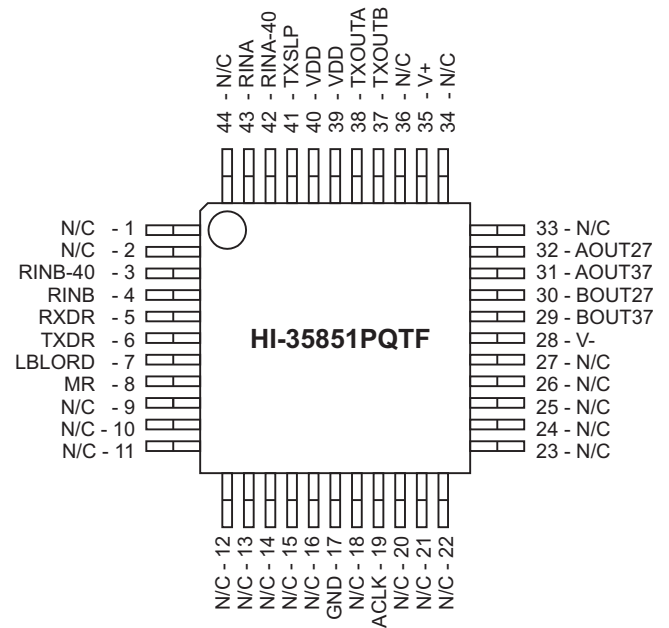
The line receiver input pins and line driver output pins have options with different input resistance and output resistance values respectively, providing flexibility when using external lightning protection circuitry. External digital input control pins are also provided to set the receiver and transmitter data rates, which allow data received from a low speed ARINC 429 bus to be re-transmitted on the output bus at high speed. The device also has an option to flip the bit order of the received 8-bit ARINC 429 label prior to re-transmission.

In addition, the HI-35851 features ARINC 429 digital outputs, which provide an option to utilize an external line driver, for example Holt's HI-8592 or HI-8596. An additional digital output sets the data rate on the external line driver. Using an external HI-8596 line driver allows a repeater combination capable of running from a single 3.3V power supply.

### FEATURES

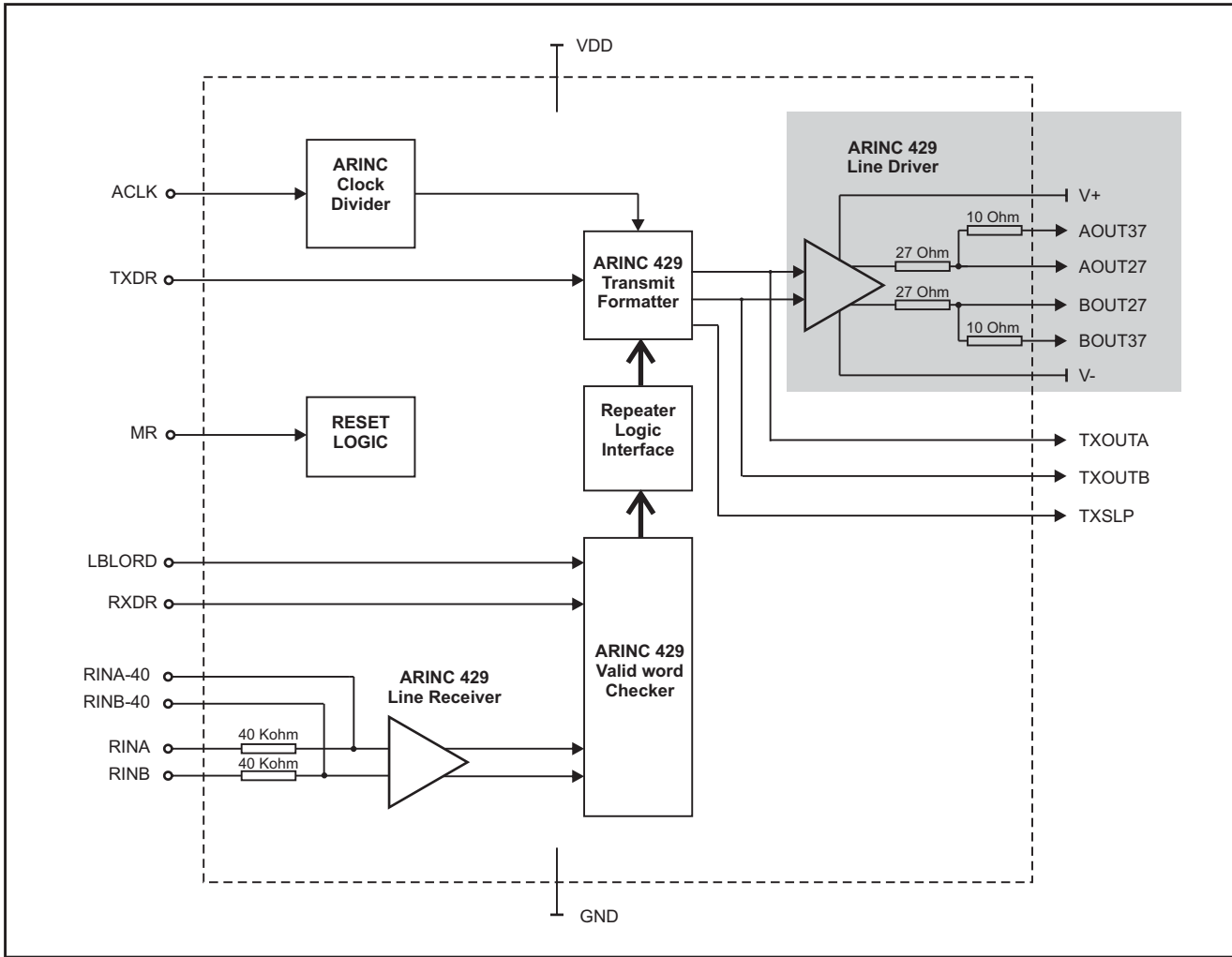
- ARINC 429 specification compliant
- 3.3V or 5.0V logic supply operation
- No microprocessor necessary
- On-chip analog line driver and receiver connect directly to ARINC 429 bus
- Independent pin programmable Transmit and Receive data rate/slope
- Re-transmit ARINC 429 low speed data at high speed
- External input or output resistor options provide flexibility of additional external lightning protection
- Pin programmable label bit-order control
- 3.3V single-supply solution using external Holt line driver
- Low Power
- Extended temperature range

### PIN CONFIGURATION (Top View)



44 - Pin Plastic Quad Flat Pack (PQFP)

**BLOCK DIAGRAM**

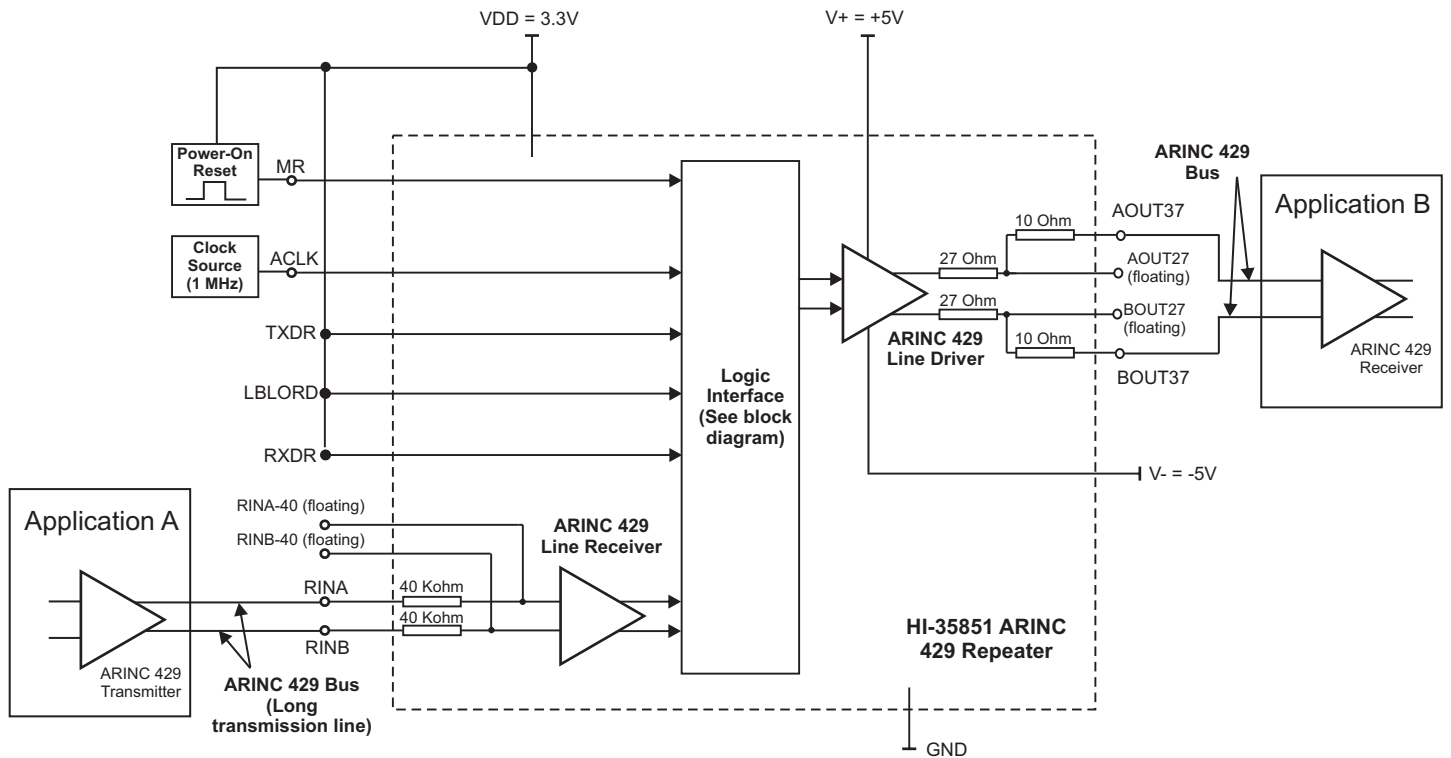


# PIN DESCRIPTIONS

SIGNAL	FUNCTION	DESCRIPTION	NOTE
RINA	INPUT	ARINC receiver positive input. Direct connection to ARINC 429 bus	
RINB	INPUT	ARINC receiver negative input. Direct connection to ARINC 429 bus	
RINA-40	INPUT	Alternate ARINC receiver positive input. Requires external 40K ohm resistor	
RINB-40	INPUT	Alternate ARINC receiver negative input. Requires external 40K ohm resistor	
V+	POWER	Positive 5V power supply to ARINC 429 Line Driver	
AOUT37	OUTPUT	ARINC line driver positive output. Direct connection to ARINC 429 bus	
BOUT37	OUTPUT	ARINC line driver negative output. Direct connection to ARINC 429 bus	
AOUT27	OUTPUT	Alternate ARINC line driver positive output. Requires external 10 ohm resistor	
BOUT27	OUTPUT	Alternate ARINC line driver negative output. Requires external 10 ohm resistor	
V-	POWER	Minus 5V power supply to ARINC 429 Line Driver	
MR	INPUT	Master Reset. A positive pulse resets the receiver and transmitter logic	100K ohm pull-down*
ACLK	INPUT	Master timing source for the ARINC 429 receiver and transmitter	100K ohm pull-down*
VDD	POWER	3.3V or 5.0V logic power	
GND	POWER	Chip GND supply	
RXDR	INPUT	Repeater Rx data rate: 1 = High speed, 0 = Low speed	100K ohm pull-up*
TXDR	INPUT	Repeater Tx data rate: 1 = High speed, 0 = Low speed	100K ohm pull-up*
LBLORD	INPUT	Label order: 1 = Don't Flip Label, 0 = Flip Label	100K ohm pull-up*
TXOUTB	OUTPUT	Digital negative output to external line driver	
TXOUTA	OUTPUT	Digital positive output to external line driver	
TXSLP	OUTPUT	Slew rate control for external line driver. 1 = High speed, 0 = Low speed.	

\* Internal Pull-up or Pull-down

## TYPICAL APPLICATION (100 kbps, High Speed)



## FUNCTIONAL DESCRIPTION

### LINE RECEIVER OPERATION

The HI-35851 has two sets of Line Receiver input pins, RINA/B and RINA/B-40. Only one pair may be used to connect to the ARINC 429 bus. The unused pair must be left floating. The RINA/B pins may be connected directly to the ARINC 429 bus. The RINA/B-40 pins require external 40K ohm resistors in series with each ARINC input. These do not affect the ARINC receiver thresholds. By keeping excessive voltage outside the device, this option is helpful in applications where lightning protection is required.

When using the RINA/B-40 pins, each side of the ARINC bus must be connected through a 40K ohm series resistor in order for the chip to detect the correct ARINC levels. The typical 10 Volt differential signal is translated and input to a window comparator and latch. The comparator levels are set so that with the external 40K ohm resistors, they are just below the standard 6.5 volt minimum ARINC data threshold and just above the standard 2.5 volt maximum ARINC null threshold.

The RXDR digital input pin controls the receiver data rate. This **must** be set to match the incoming data rate of the received signal. **Note:** The re-transmission rate is set by the TXDR digital output and does not need to be the same as the received data rate. This enables data received from a low speed ARINC 429 bus to be re-transmitted on the output bus at high speed. (see Line Driver Operation below).

A digital input pin, LBLORD, provides an option to flip the bit order of the received 8-bit ARINC 429 label prior to re-transmission.

### LINE DRIVER OPERATION

The line driver in the HI-35851 directly drives the ARINC 429 bus. The two ARINC outputs (AOUT37 and BOUT37) provide a differential voltage to produce a +10V One, a -10V Zero, and a 0 Volt Null. The TXDR digital input pin controls both the transmitter data rate and the slope of the differential output signal. No additional hardware is required to control the slope. The re-transmission data rate is independent of the incoming received data rate and may be set to high-speed or low-speed. **Warning: In the case of RXDR = 1 (high-speed) and TXDR = 0 (low speed), the user needs to be careful to avoid data over-run.**

Transmit timing is derived from a 1 MHZ reference clock source. This is provided by applying a 50% duty cycle 1 MHZ clock to the ACLK input pin.

### LINE DRIVER OUTPUT PINS

The HI-35851 AOUT37 and BOUT37 pins have 37.5 Ohms in series with each line driver output, and may be directly connected to an ARINC 429 bus. The alternate AOUT27 and BOUT27 pins have 27 ohms of internal series resistance and require external 10 ohm resistors at each pin. AOUT27 and BOUT27 are for applications where external series resistance is applied, typically for lightning protection devices.

Please refer to the Holt AN-300 Application Note for additional information and recommendations on lightning protection of Holt line drivers and line receivers.

### EXTERNAL LINE DRIVER OPTION

The device also provides ARINC 429 digital outputs which gives an option to utilize an external line driver, for example Holt's HI-8592 or HI-8596. The TXOUTA/B digital transmitter outputs should be connected to the equivalent digital inputs on the external line driver (e.g. TX1IN and TX0IN respectively on HI-8596). The TXSLP digital output should be used to set the data rate on the external line driver (e.g. connect to the SLP input on HI-8596). Using an external HI-8596 line driver provides a repeater combination capable of running from a single 3.3V power supply. **Note: When using an external line driver, V+ should be connected to VDD (logic power) and V- should be connected to GND.**

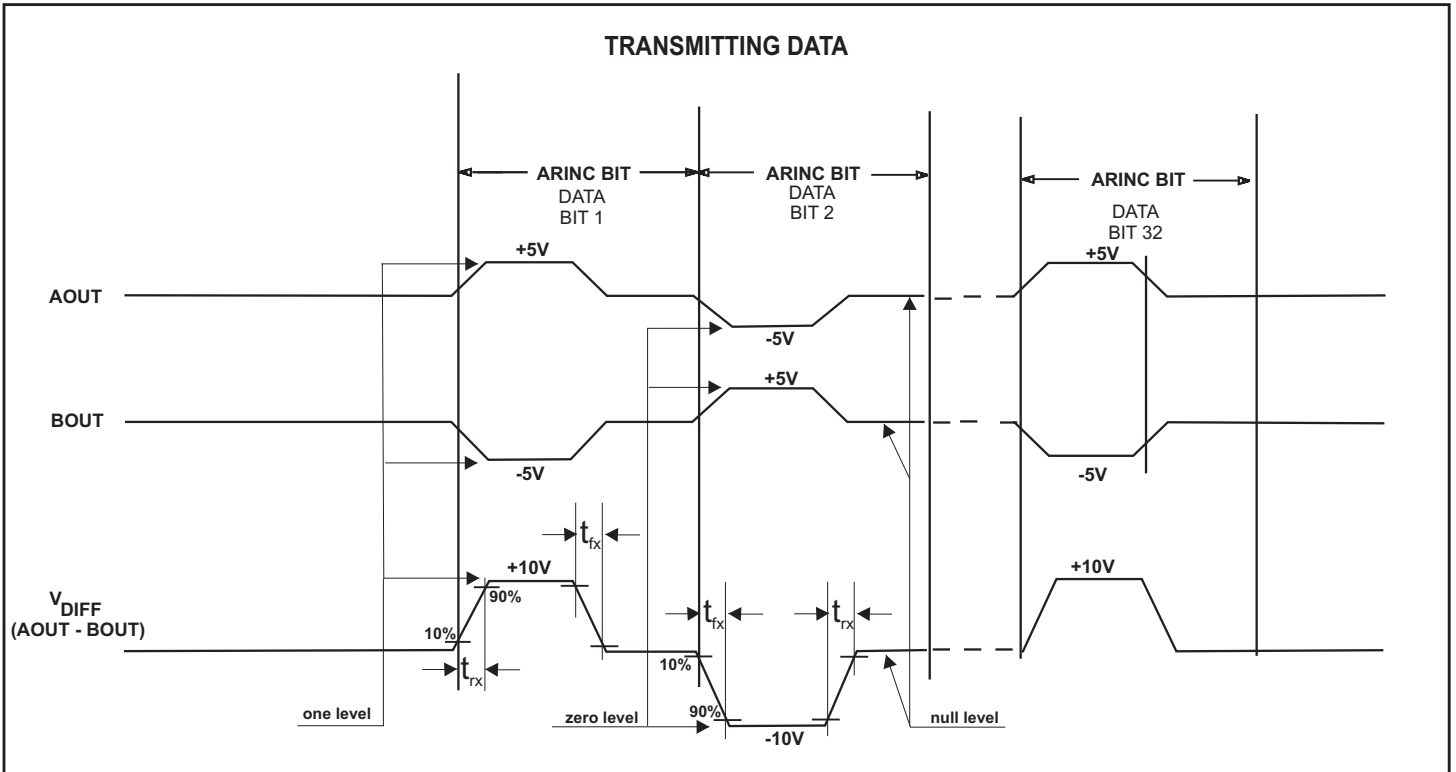
### POWER SUPPLY SEQUENCING

Power supply sequencing should be controlled to prevent large currents during supply turn-on and turn-off. The recommended sequence is V+ followed by VDD, always ensuring that V+ is the most positive supply. The V- supply is not critical and can be applied at any time.

### MASTER RESET (MR)

Application of a Master Reset causes immediate termination of data transmission and data reception.

**TIMING DIAGRAMS**



**ABSOLUTE MAXIMUM RATINGS**

Supply Voltages V <sub>DD</sub> ..... -0.3V to +7.0V V <sub>+</sub> ..... +7.0V V <sub>-</sub> ..... -7.0V	Power Dissipation at 25°C Plastic Quad Flat Pack ..... 1.5 W, derate 10mW/°C
Voltage at pins RINA, RINB ..... -120V to +120V	DC Current Drain per pin ..... ±10mA
Voltage at ARINC pins AOUT, BOUT ... (V <sub>-</sub> ) - 0.3V to (V <sub>+</sub> ) + 0.3V	Storage Temperature Range ..... -65°C to +150°C
Voltage at any other pin ..... -0.3V to V <sub>DD</sub> +0.3V	Operating Temperature Range (Industrial): ..... -40°C to +85°C (Hi-Temp): ..... -55°C to +125°C
Solder temperature (Reflow) ..... 260°C	

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.

## DC ELECTRICAL CHARACTERISTICS

V<sub>DD</sub> = 3.3V or 5.0V , V<sub>+</sub> = +5V, V<sub>-</sub> = -5V, GND = 0V, TA = Operating Temperature Range (unless otherwise specified).

PARAMETER	SYMBOL	CONDITIONS	LIMITS			UNIT		
			MIN	TYP	MAX			
<b>ARINC INPUTS - Pins RINA, RINB, RINA-40 (with external 40KOhms), RINB-40 (with external 40KOhms)</b>								
Differential Input Voltage: (RINA to RINB)	ONE	V <sub>IH</sub>	Common mode voltages		6.5	10.0	13.0	V
	ZERO	V <sub>IL</sub>	less than ±30V with		-13.0	-10.0	-6.5	V
	NULL	V <sub>NUL</sub>	respect to GND		-2.5	0	2.5	V
Input Resistance:	Differential To GND To V <sub>DD</sub>	R <sub>I</sub>		-	140	-	KΩ	
		R <sub>G</sub>		-	140	-	KΩ	
		R <sub>H</sub>		-	100	-	KΩ	
Input Current:	Input Sink	I <sub>IH</sub>		-450		200	μA	
	Input Source	I <sub>IL</sub>					μA	
Input Capacitance: (Guaranteed but not tested)	Differential To GND To V <sub>DD</sub>	C <sub>I</sub>	(RINA to RINB)			20	pF	
		C <sub>G</sub>					20	pF
		C <sub>H</sub>					20	pF
<b>LOGIC INPUTS</b>								
Input Voltage:	Input Voltage HI	V <sub>IH</sub>		80% V <sub>DD</sub>		20% V <sub>DD</sub>	V	
	Input Voltage LO	V <sub>IL</sub>					V	
Input Current:	Input Sink	I <sub>IH</sub>		-1.5		1.5	μA	
	Input Source	I <sub>IL</sub>					μA	
	Pull-down Current (MR, ACLK pins)	I <sub>PD</sub>					100	μA
Pull-up Current (RXDR, TXDR, LBLORD pins)	I <sub>PU</sub>		-100				μA	
<b>ARINC OUTPUTS - Pins AOUT37, BOUT37, (or AOUT27, BOUT27 with external 10 Ohms)</b>								
ARINC output voltage (Ref. To GND)	One or zero	V <sub>DOUT</sub>	No load and magnitude at pin,	4.50	5.00	5.50	V	
	Null	V <sub>NOUT</sub>					-0.25	0.25
ARINC output voltage (Differential)	One or zero	V <sub>DDIF</sub>	No load and magnitude at pin,	9.0	10.0	11.0	V	
	Null	V <sub>NDIF</sub>					-0.5	0.5
ARINC output short-circuit current		I <sub>OUT</sub>	Momentary current	80			mA	
<b>LOGIC OUTPUTS</b>								
Output Voltage:	Logic "1" Output Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -100μA I <sub>OL</sub> = 1.0mA	90%V <sub>DD</sub>		10% V <sub>DD</sub>	V	
	Logic "0" Output Voltage	V <sub>OL</sub>					V	
Output Current:	Output Sink	I <sub>OL</sub>	V <sub>OUT</sub> = 0.4V V <sub>OUT</sub> = V <sub>DD</sub> - 0.4V	1.6		-1.0	mA	
	Output Source	I <sub>OH</sub>					mA	
Output Capacitance:		C <sub>O</sub>			15		pF	
<b>Operating Voltage Range</b>								
		V <sub>DD</sub>		3.15		5.25	V	
		V <sub>+</sub>		4.75		5.5	V	
		V <sub>-</sub>		-4.75		-5.5	V	
<b>Operating Supply Current</b>								
V <sub>DD</sub>		I <sub>DD1</sub>			2.5	7	mA	
V <sub>+</sub>		I <sub>DD2</sub>			4	14	mA	
V <sub>-</sub>		I <sub>EE1</sub>			4	12	mA	

## AC ELECTRICAL CHARACTERISTICS

VDD = 3.3V or 5.0V, V+ = +5V, V- = -5V, GND = 0V, TA = Operating Temperature Range and fclk = 1MHz ±0.1% with 60/40 duty cycle

PARAMETER	SYMBOL	LIMITS			UNITS
		MIN	TYP	MAX	
Master Reset pulse width	tMR	100			ns
Propogation delay times (Delay from start of receive message to start of transmit message):					
RXDR = 1 (High Speed)	t <sub>pRxHS</sub>			360	µs
RXDR = 0 (Low Speed)	t <sub>pRxLS</sub>			2.88	ms
Line driver transition differential times:					
High Speed, high to low	t <sub>fx</sub>	1.0	1.5	2.0	µs
low to high	t <sub>rx</sub>	1.0	1.5	2.0	µs
Low Speed, high to low	t <sub>fx</sub>	5.0	10	15	µs
low to high	t <sub>rx</sub>	5.0	10	15	µs

## ORDERING INFORMATION

HI - 35851 PQ T F

PART NUMBER	LEAD FINISH
F	100% Matte Tin (Pb-free, RoHS compliant)

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

PART NUMBER	PACKAGE DESCRIPTION
PQ	44 PIN PLASTIC QUAD FLAT PACK, PQFP (44PMQS)

## REVISION HISTORY

---

P/N	Rev	Date	Description of Change
DS35851	Prelim.	09/27/2021	Initial Release

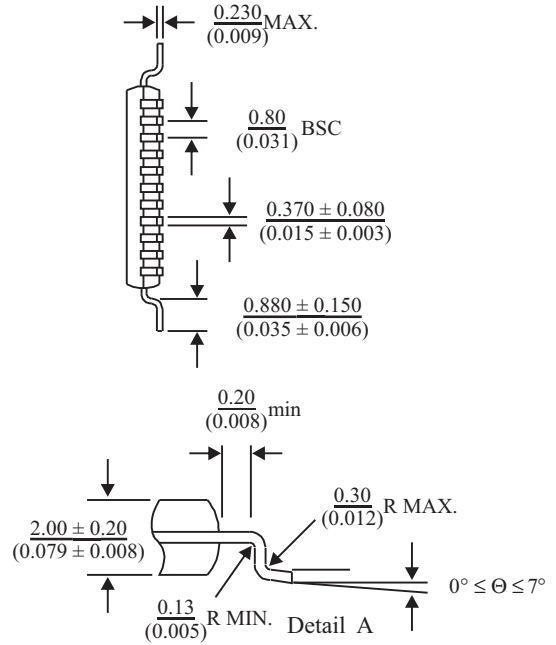
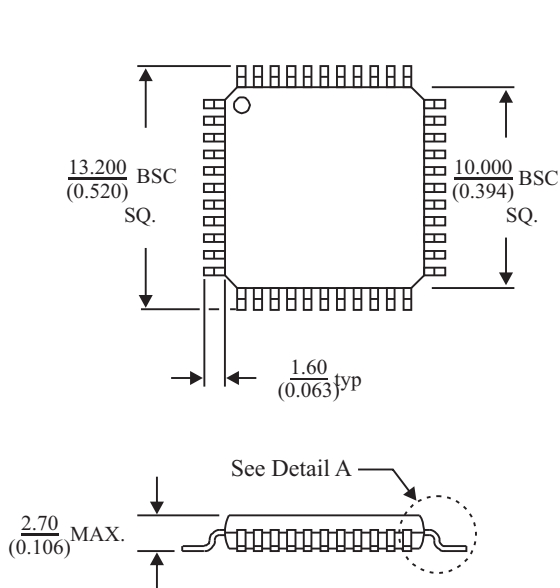
---



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

millimeters (inches)

Package Type: 44PMQS



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