

## FEATURES

- *Guaranteed* Maximum 0.5mV Input Offset Voltage
- Input Protection Diodes
- Operates From Single 5V Supply
- 25mA Drive Capability
- 80ns Response Time

## APPLICATIONS

- Window Detectors
- High Speed One Shot
- Relay/Lamp Drivers
- Voltage Controlled Oscillators

## DESCRIPTION

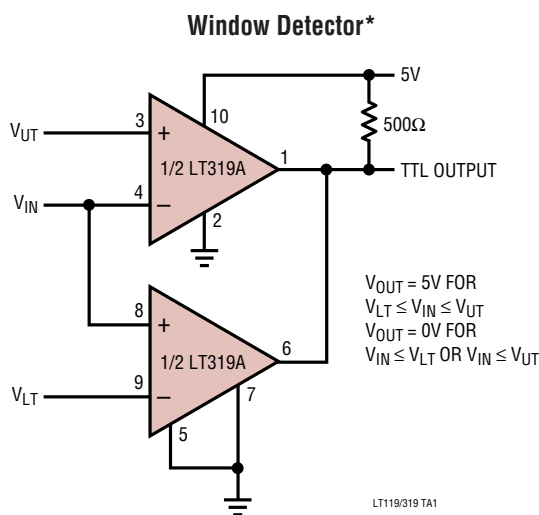
The LT<sup>®</sup>119A is an improved version of the LM119 dual comparator. It features lower input offset voltage and offset current, higher voltage gain, guaranteed common mode rejection and input protection diodes.

The LT119A is capable of operation over a supply range from 5V to  $\pm 15$ V and can drive 25mA loads from each open collector output. A separate ground pin allows the LT119A to isolate system grounds.

Linear Technology Corporation's advanced processing, design techniques and reliability make the LT119A/LT319A an ideal choice over previous devices in most comparator applications.

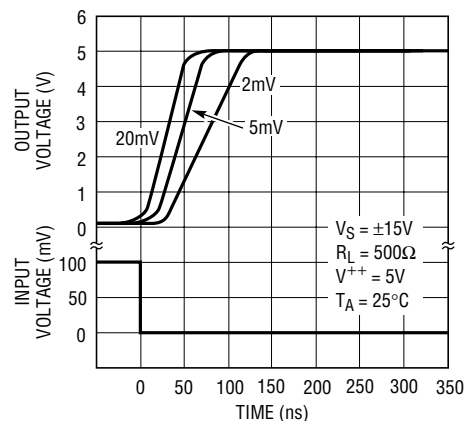
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## TYPICAL APPLICATION



\*ALLOWED WINDOW FOR SINGLE 5V SUPPLY IS 1.2V TO 3.8V

## Response Time for Various Input Overdrives



# LT119A/LT319A LM119/LM319

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage .....	36V	Output Short-Circuit Duration .....	10s
Output to Negative Supply Voltage .....	36V	Operating Temperature Range	
Ground to Negative Supply Voltage .....	25V	LT119A, LM119 <b>OBsolete</b> .....	-55°C to 125°C
Ground to Positive Supply Voltage .....	18V	LT319A, LM319 .....	0°C to 70°C
Differential Input Voltage (Note 6) .....	±5V	Storage Temperature Range .....	-65°C to 150°C
Differential Input Current (Note 6) .....	±5mA	Lead Temperature (Soldering, 10 sec) .....	300°C
Input Voltage (Note 2)			

## PACKAGE/ORDER INFORMATION

<p>H PACKAGE 10-LEAD TO-5 METAL CAN <math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 150^{\circ}C/W, \theta_{JC} = 45^{\circ}C/W</math></p>	ORDER PART NUMBER	<p>N PACKAGE 14-LEAD PLASTIC DIP <math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 100^{\circ}C/W</math></p> <p>J PACKAGE 14-LEAD CERAMIC DIP <math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 100^{\circ}C/W</math></p>	ORDER PART NUMBER
	<p>LT119AH LM119H LT319AH LM319H</p> <p><b>OBsolete PACKAGE</b></p>		<p>LT319AN LM319N</p> <p>LT119AJ LM119J LT319AJ LM319J</p> <p><b>OBsolete PACKAGE</b></p>

Consult LTC Marketing for parts specified with wider operating temperature ranges.

## ELECTRICAL CHARACTERISTICS The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^{\circ}C$ . (Note 3)

SYMBOL	PARAMETER	CONDITIONS	LT119A			LM119			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{OS}$	Input Offset Voltage	$V_S = \pm 15V, V_{CM} = 0$		0.3	0.5			4	mV
		(Note 4)		0.5	1.0	0.7	4	mV	
			●	1.2	2.0	7	mV		
CMRR	Common Mode Rejection Ratio		90	106				dB	
$I_{OS}$	Input Offset Current	(Note 4)		20	40	30	75	nA	
		●			75	100	nA		
$I_B$	Input Bias Current	(Note 4)		150	500	150	500	nA	
		●			1000	1000	nA		
$A_V$	Voltage Gain		20	40	10	40		V/mV	
	Response Time	(Note 5)		80		80		ns	

**ELECTRICAL CHARACTERISTICS** The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at  $T_A = 25^\circ\text{C}$ . (Note 3)

SYMBOL	PARAMETER	CONDITIONS	LT119A			LM119			UNITS	
			MIN	TYP	MAX	MIN	TYP	MAX		
$V_{SAT}$	Saturation Voltage	$V_{IN} \leq -5\text{mV}$ , $I_O = 25\text{mA}$ , $V^+ \geq 4.5\text{V}$ , $V^- = 0\text{V}$		0.75	1.5		0.75	1.5	V	
		$V_{IN} \leq -6\text{mA}$ , $I_{SINK} \leq 3.2\text{mA}$ $T_A \geq 0^\circ\text{C}$		0.23	0.4		0.23	0.4	V	
		$T_A \leq 0^\circ\text{C}$			0.6		0.6		V	
	Output Leakage Current	$V_{IN} \geq 5\text{mV}$ , $V_{OUT}$ to $V^- = 35\text{V}$		0.2 1	2 10		0.2 1	2 10	$\mu\text{A}$ $\mu\text{A}$	
	Input Voltage Range	$V_S = \pm 15\text{V}$	●	-12	$\pm 13$	12	-12	$\pm 13$	12	V
		$V^+ = 5\text{V}$ , $V^- = 0\text{V}$	●	1		3	1		3	V
	Differential Input Voltage		●		$\pm 5$			$\pm 5$	V	
$I_S$	Supply Current	$V^+ = 5\text{V}$ , $V^- = 0\text{V}$		4.3			4.3		mA	
	Positive Supply Current	$V_S = \pm 15\text{V}$		8	11.5		8	11.5	mA	
	Negative Supply Current	$V_S = \pm 15\text{V}$		3	4.5		3	4.5	mA	

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at  $T_A = 25^\circ\text{C}$ . (Note 3)

SYMBOL	PARAMETER	CONDITIONS	LT319A			LM319			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{OS}$	Input Offset Voltage	$V_S = \pm 15\text{V}$ , $V_{CM} = 0\text{V}$		0.3	0.5			8	mV
		$R_S \leq 5\text{k}$ (Note 4)	●	0.5	1 2		2	8 10	mV mV
CMRR	Common Mode Rejection Ratio		90	106				dB	
$I_{OS}$	Input Offset Current	(Note 4)		30	40 60		80	200 300	nA nA
$I_B$	Input Bias Current	(Note 4)		150	500 1000		250	1000 1200	nA nA
$A_V$	Voltage Gain		20	40		8	40		V/mV
	Response Time	(Note 5)		80			80		ns
$V_{SAT}$	Saturation Voltage	$V_{IN} \leq -10\text{mV}$ , $I_{SINK} = 25\text{mA}$		0.75	1.5		0.75	1.5	V
		$V^+ \geq 4.5\text{V}$ , $V^- = 0\text{V}$ , $V_{IN} \leq -10\text{mV}$ , $I_{SINK} \leq 3.2\text{mA}$	●	0.3	0.4		0.3	0.4	V
	Output Leakage Current	$V_{IN} \geq 10\text{mV}$ , $V_{OUT}$ to $V^- = 35\text{V}$		0.2	10		0.2	10	$\mu\text{A}$
	Input Voltage Range	$V_S = \pm 15\text{V}$	●		$\pm 13$			$\pm 13$	V
		$V^+ = 5\text{V}$ , $V^- = 0\text{V}$	●	1		3	1		3
	Differential Input Voltage		●		$\pm 5$			$\pm 5$	V
$I_S$	Supply Current	$V^+ = 5\text{V}$ , $V^- = 0\text{V}$		4.3			4.3		mA
	Positive Supply Current	$V_S = \pm 15\text{V}$		8	12.5		8	12.5	mA
	Negative Supply Current	$V_S = \pm 15\text{V}$		3	5		3	5	mA

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** For supply voltages less than  $\pm 15\text{V}$ , the maximum input voltage is equal to the supply voltage.

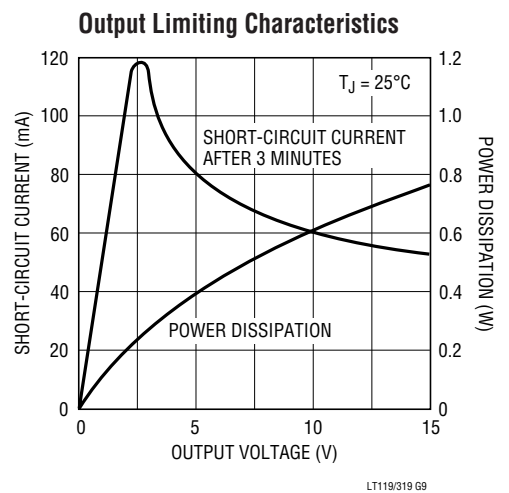
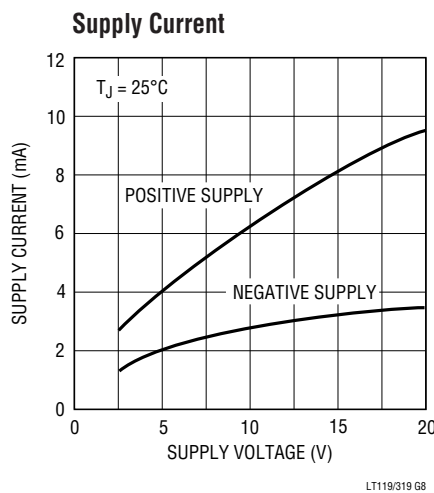
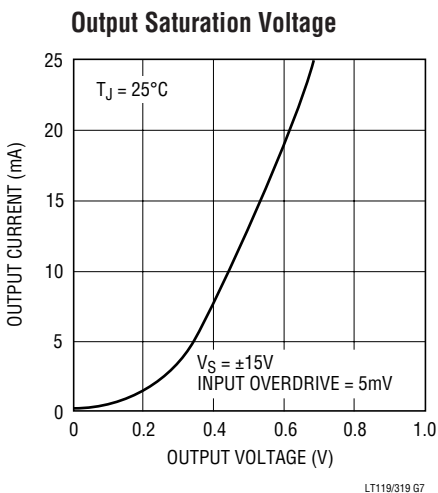
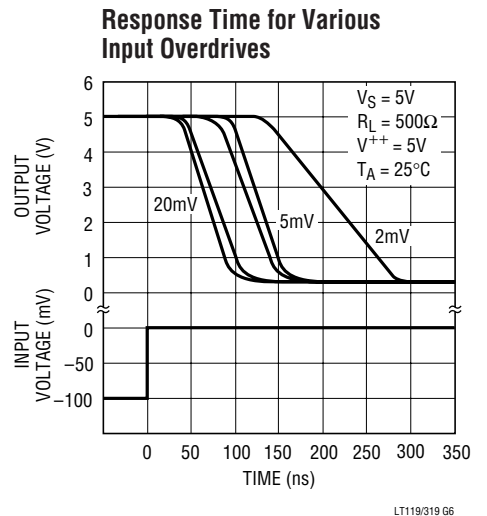
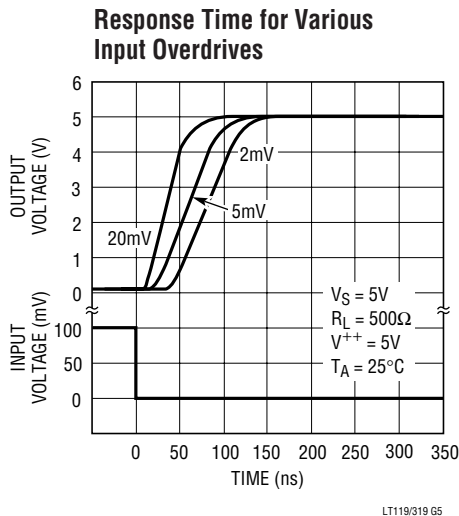
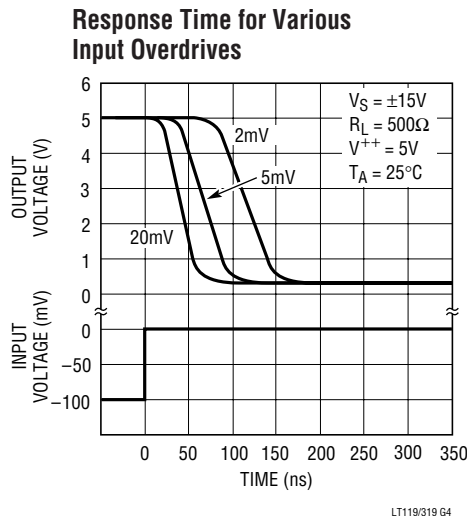
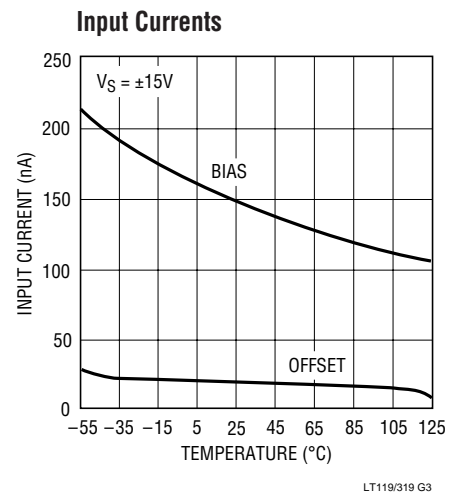
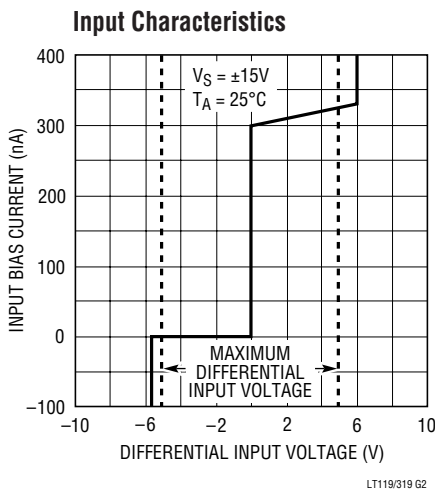
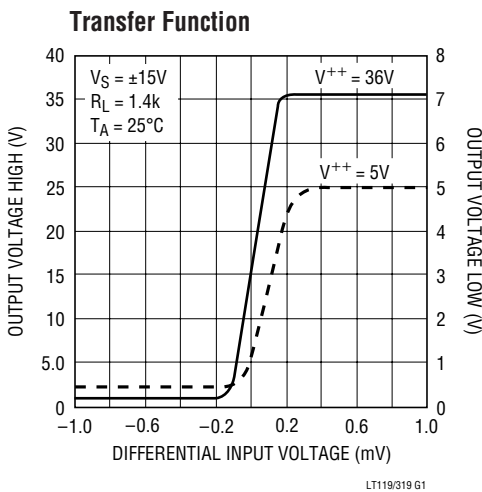
**Note 3:** Unless otherwise noted, supply voltage equals  $\pm 15\text{V}$  and  $V_{CM} = 0\text{V}$ ,  $T_A = 25^\circ\text{C}$ . The ground pin is grounded. Note that the maximum voltage allowed between the ground pin and  $V^+$  is  $18\text{V}$ . Do not tie the ground pin to  $V^-$  when the power supply voltage exceeds  $9\text{V}$ . The offset voltage, offset current and bias current specifications apply for all supply voltages between  $\pm 15\text{V}$  and  $5\text{V}$  unless otherwise specified.

**Note 4:** The offset voltages and currents given are the maximum values required to drive the output within  $1\text{V}$  of either supply with a  $1\text{mA}$  load, thus these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

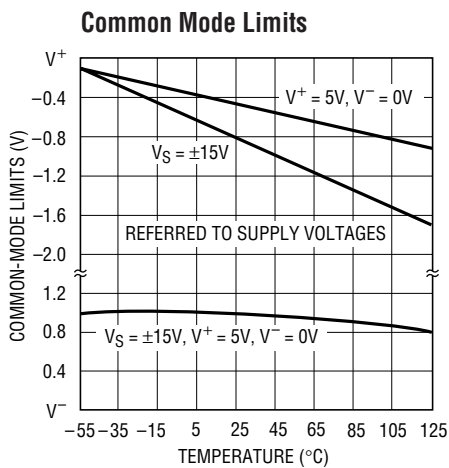
**Note 5:** Response time specified is for a  $100\text{mV}$  input step with  $5\text{mV}$  overdrive.

**Note 6:** Inputs are protected with back-to-back  $5.6\text{V}$  zener diodes. This limits maximum differential input voltage to  $\pm 5\text{V}$  if current is unlimited. Larger differential input drive is allowed if input current is limited to  $\pm 5\text{mA}$  with external resistance.

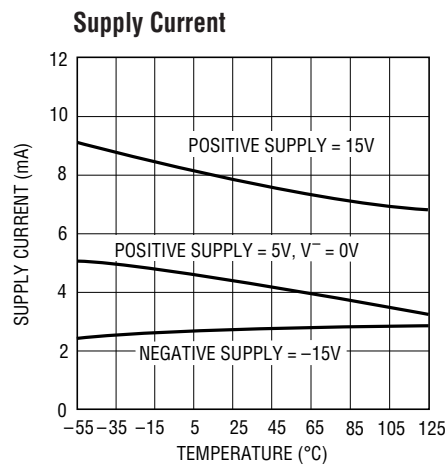
# TYPICAL PERFORMANCE CHARACTERISTICS



## TYPICAL PERFORMANCE CHARACTERISTICS



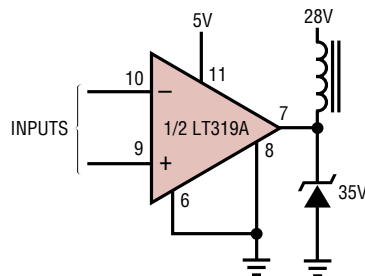
LT119/319 G10



LT119/319 G11

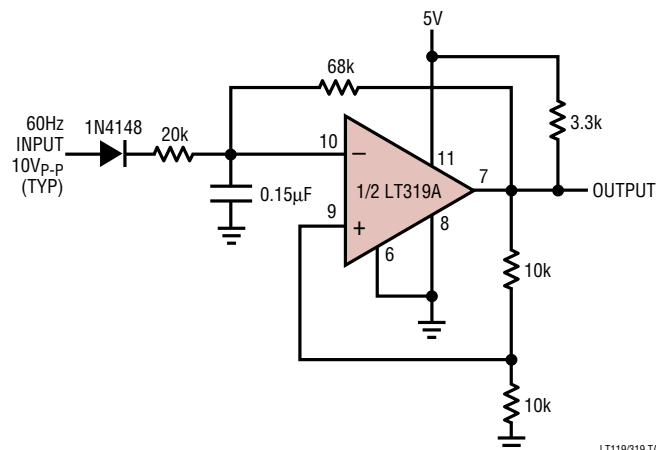
## TYPICAL APPLICATIONS

### Relay Driver



LT119/319 TA3

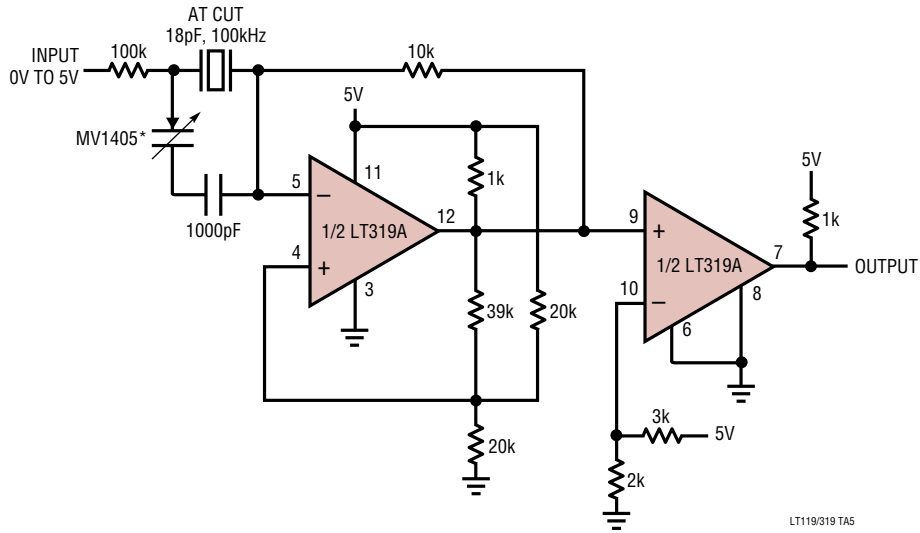
### High Noise Immunity 60Hz Sync Circuit



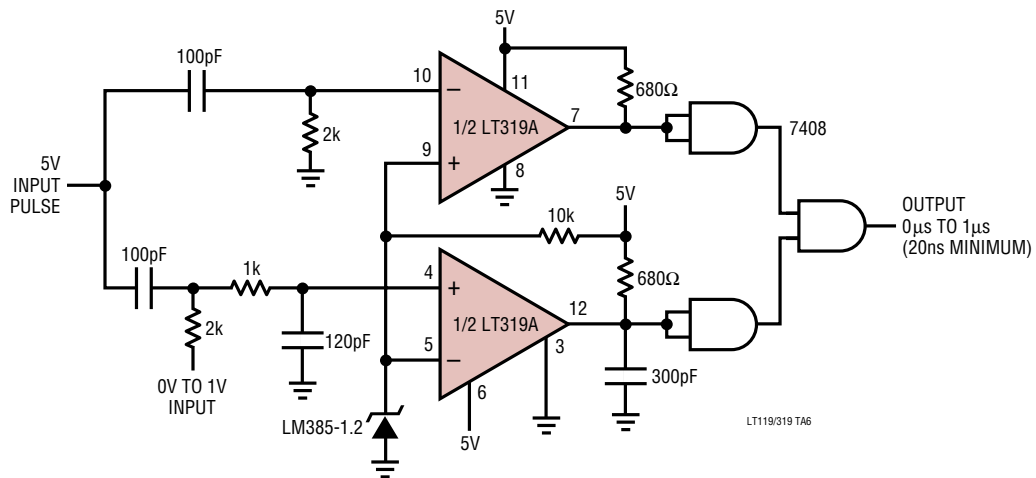
LT119/319 TA4

## TYPICAL APPLICATIONS

Voltage Controlled Crystal Oscillator  
With 100ppm Trim Range

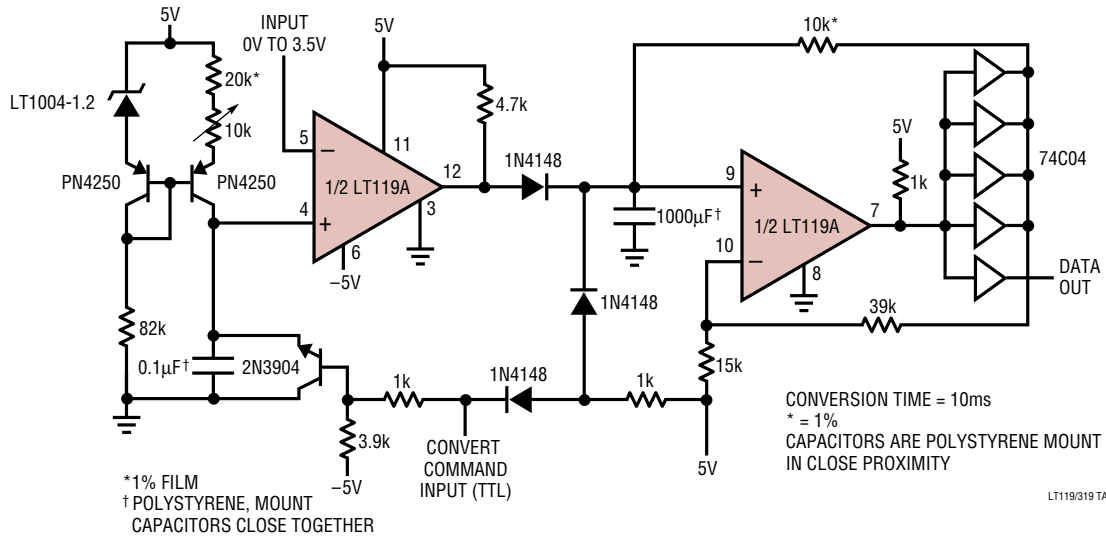


Voltage Controlled High Speed One Shot

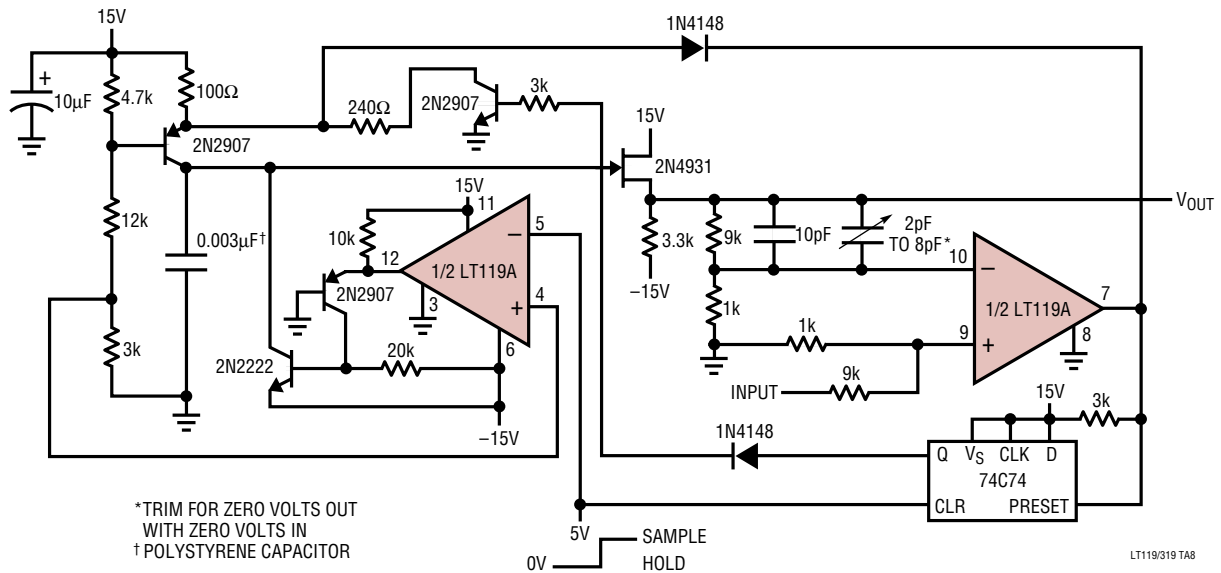


# TYPICAL APPLICATIONS

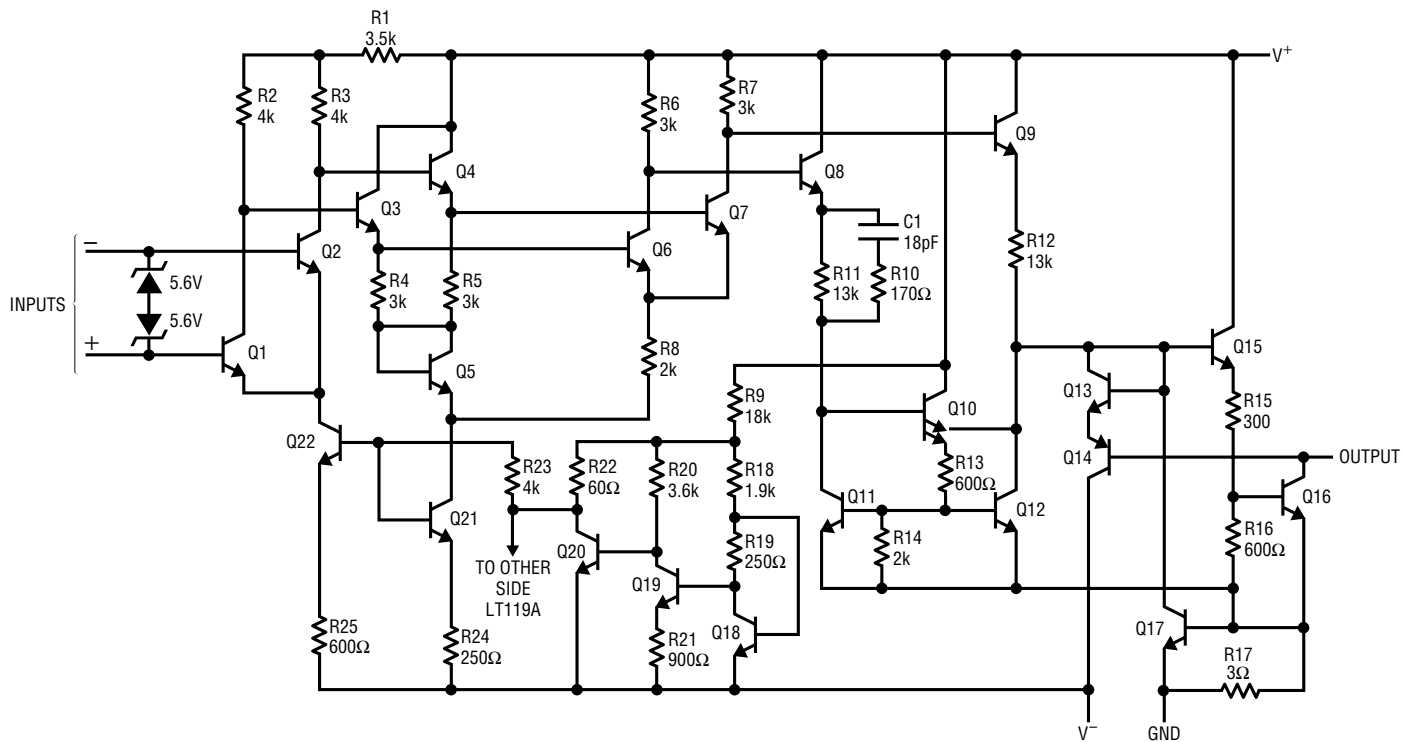
## 10-Bit Serial Output A/D Converter



## 5 Microsecond Sample-and-Hold with Zero Hold Step



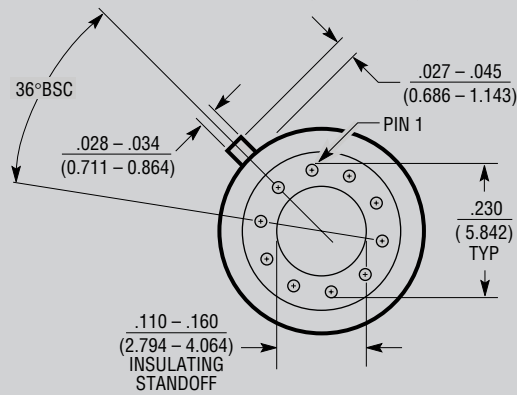
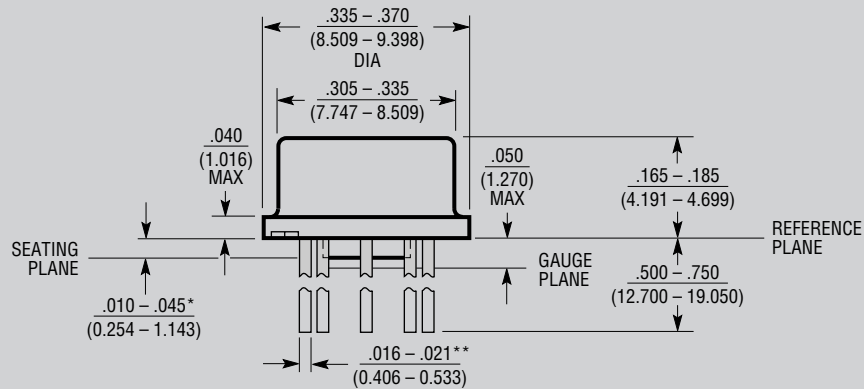
## SCHEMATIC DIAGRAM





## PACKAGE DESCRIPTION

**H Package**  
**10-Lead TO-5 Metal Can**  
(Reference LTC DWG # 05-08-1322)



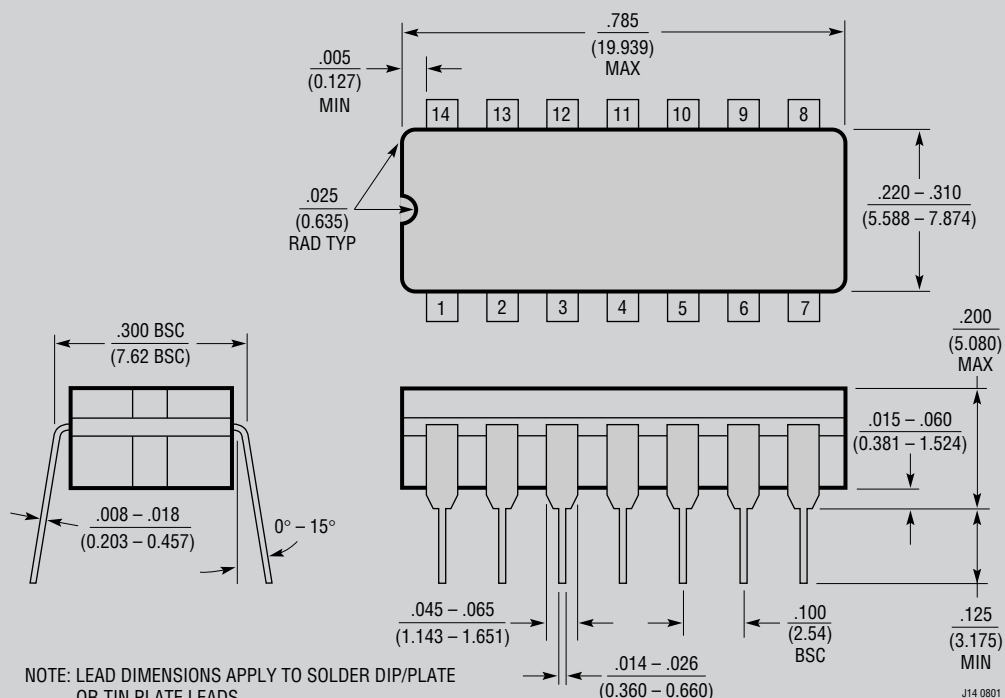
\*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

\*\*FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS  $\frac{.016 - .024}{(0.406 - 0.610)}$  H10(TO-5) 0801

**OBsolete PACKAGE**

## PACKAGE DESCRIPTION

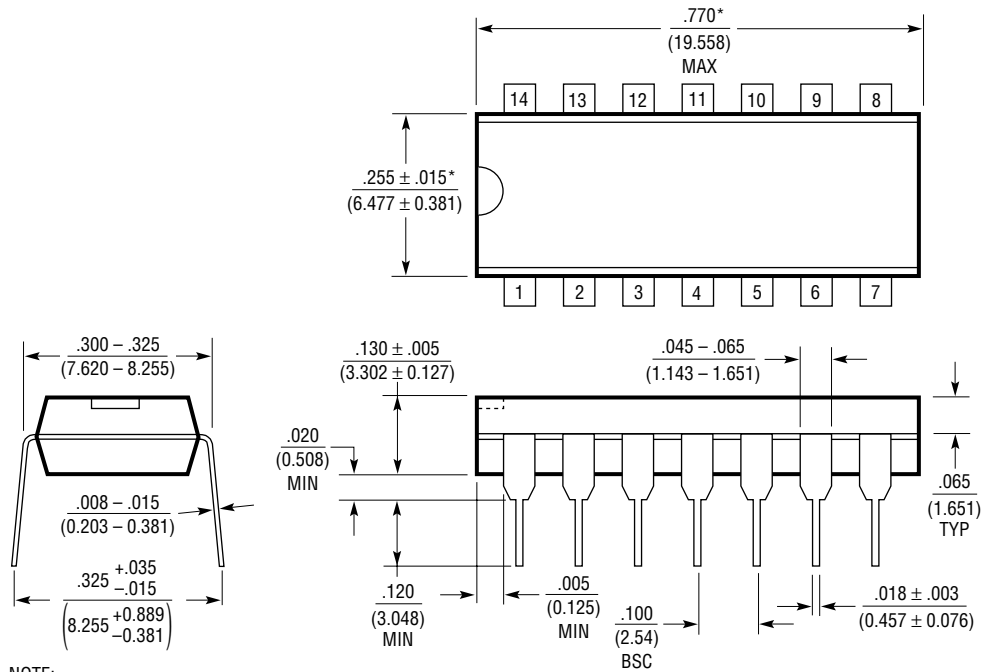
**J Package**  
**14-Lead CERDIP (Narrow .300 Inch, Hermetic)**  
 (Reference LTC DWG # 05-08-1110)



**OBSOLETE PACKAGE**

## PACKAGE DESCRIPTION

**N Package**  
**14-Lead PDIP (Narrow .300 Inch)**  
(Reference LTC DWG # 05-08-1510)



NOTE:  
1. DIMENSIONS ARE  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$

\*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

N14 1002

**TYPICAL APPLICATION**

5kHz to 2MHz V → F Converter

