

## 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

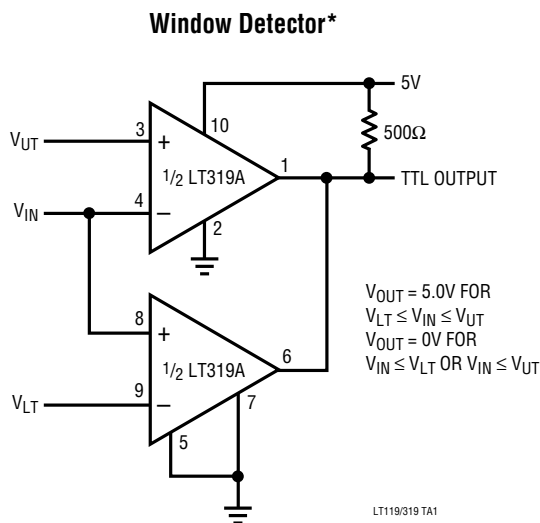
## DESCRIPTION

The LT119A 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.

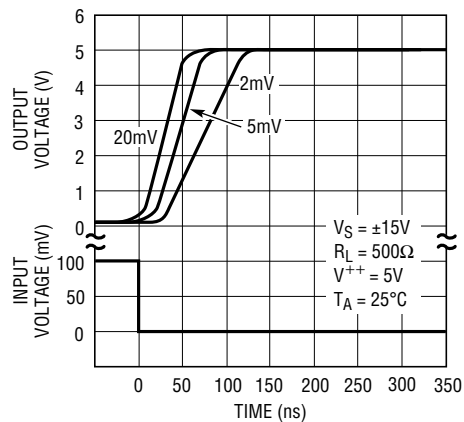
Linear Technology Corporation's advanced processing, design techniques and reliability make the LT119A/LT319A an ideal choice over previous devices in most comparator applications.

## TYPICAL APPLICATION



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

**Response Time for Various Input Overdrives**



LT119/319 TA2

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage .....	36V
Output to Negative Supply Voltage .....	36V
Ground to Negative Supply Voltage .....	25V
Ground to Positive Supply Voltage .....	18V
Differential Input Voltage (Note 5) .....	$\pm 5V$
Differential Input Current (Note 5) .....	$\pm 5mA$
Input Voltage (Note 1)	
Output Short-Circuit Duration .....	10s
Operating Temperature Range	
LT119A, LM119 .....	$-55^{\circ}C$ to $125^{\circ}C$
LT319A, LM319 .....	$0^{\circ}C$ to $70^{\circ}C$
Storage Temperature Range .....	$-65^{\circ}C$ to $150^{\circ}C$
Lead Temperature (Soldering, 10 sec) .....	$300^{\circ}C$

## PACKAGE/ORDER INFORMATION

TOP VIEW	ORDER PART NUMBER
<p>H PACKAGE 10-LEAD TO-5 METAL CAN</p> <p><math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 150^{\circ}C/W</math>, <math>\theta_{JC} = 45^{\circ}C/W</math></p>	LT119AH LM119H LT319AH LM319H
<p>J PACKAGE      N PACKAGE 14-LEAD CERAMIC DIP    14-LEAD PLASTIC DIP</p> <p><math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 100^{\circ}C/W</math> (J) <math>T_{JMAX} = 85^{\circ}C</math>, <math>\theta_{JA} = 100^{\circ}C/W</math> (N)</p>	LT119AJ LM119J LT319AJ LM319J LT319AN LM319N

Consult factory for Industrial and Military grade parts.

## ELECTRICAL CHARACTERISTICS (Note 2)

SYMBOL	PARAMETER	CONDITIONS		LT119A			LT119			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
$V_{OS}$	Input Offset Voltage	(Note 3)	●		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 3)	●		20	40		30	75	nA
						75			100	nA
$I_B$	Input Bias Current	(Note 3)	●		150	500		150	500	nA
						1000			1000	nA
$A_V$	Voltage Gain			20	40		10	40		V/mV
	Response Time	(Note 4)			80			80		ns
$V_{SAT}$	Saturation Voltage	$V_{IN} \leq -5mV$ , $I_O = 25mA$ $V^+ \geq 4.5V$ , $V^- = 0V$ $V_{IN} \leq -6mA$ , $I_{SINK} \leq 3.2mA$ $T_A \geq 0^{\circ}C$ $T_A \leq 0^{\circ}C$			0.75	1.5		0.75	1.5	V
					0.23	0.4		0.23	0.4	V
						0.6			0.6	V
	Output Leakage Current	$V_{IN} \geq 5mV$ , $V_{OUT} = 35V$	●		0.2	2		0.2	2	$\mu A$
					1	10		1	10	$\mu A$
	Input Voltage Range	$V_S = \pm 15V$ $V^+ = 5V$ , $V^- = 0V$	●	-12	$\pm 13$	12	-12	$\pm 13$	12	V
			●	1		3	1		3	V

## ELECTRICAL CHARACTERISTICS (Note 2)

SYMBOL	PARAMETER	CONDITIONS		LT119A			LT119			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
	Differential Input Voltage		●			±5			±5	V
$I_S$	Supply Current	$V^+ = 5V, V^- = 0V$			4.3			4.3		mA
$I_S$	Positive Supply Current	$V_S = \pm 15V$			8	11.5		8	11.5	mA
$I_S$	Negative Supply Current	$V_S = \pm 15V$			3	4.5		3	4.5	mA
$V_{OS}$	Input Offset Voltage	$V_S = \pm 15V, V_{CM} = 0V$			0.3	0.5			8	mV
$V_{OS}$	Input Offset Voltage	$R_S \leq 5k$ (Note 3)	●		0.5	1 2		2	8 10	mV mV
CMRR	Common-Mode Rejection Ratio			90	106					dB
$I_{OS}$	Input Offset Current	(Note 3)	●		30	40 60		80	200 300	nA nA
$I_B$	Input Bias Current	(Note 3)	●		150	500 1000		250	1000 1200	nA nA
$A_V$	Voltage Gain			20	40		8	40		V/mV
	Response Time	(Note 4)			80			80		ns
$V_{SAT}$	Saturation Voltage	$V_{IN} \leq -10mV, I_{SINK} = 25mA$ $T_A = 25^\circ C$ $V^+ \geq 4.5V, V^- = 0V$ $V_{IN} \leq -10mV, I_{SINK} \leq 3.2mA$	●		0.75	1.5		0.75	1.5	V
	Output Leakage Current	$V_{IN} \geq 10mV, V_{OUT} = 35V$			0.2	10		0.2	10	μA
	Input Voltage Range	$V_S = \pm 15V$ $V^+ = 5V, V^- = 0V$	● ●		±13	3		±13	3	V V
	Differential Input Voltage		●			±5			±5	V
$I_S$	Supply Current	$V^+ = 5V, V^- = 0V$			4.3			4.3		mA
$I_S$	Positive Supply Current	$V_S = \pm 15V$			8	12.5		8	12.5	mA
$I_S$	Negative Supply Current	$V_S = \pm 15V$			3	5		3	5	mA

The ● denotes specifications which apply over the full operating temperature range.

**Note 1:** For supply voltages less than ±15V, the maximum input voltage is equal to the supply voltage.

**Note 2:** Unless otherwise noted, supply voltage equals ±15V and  $T_A = 25^\circ C$ . The ground pin is grounded. Note that the maximum voltage allowed between the ground pin and  $V^+$  is 18V. Do not tie the ground pin to  $V^-$  when the power supply voltage exceeds ±9V. The offset voltage, offset current and bias current specifications apply for all supply voltages between ±15V and 5V unless otherwise specified.

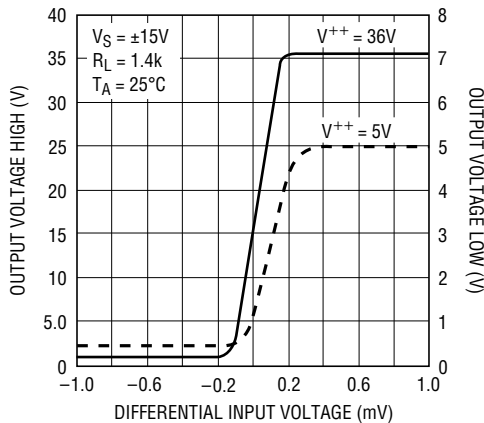
**Note 3:** The offset voltages and currents given are the maximum values required to drive the output within 1V of either supply with a 1mA load, thus these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

**Note 4:** Response time specified is for a 100mV input step with 5mV overdrive.

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

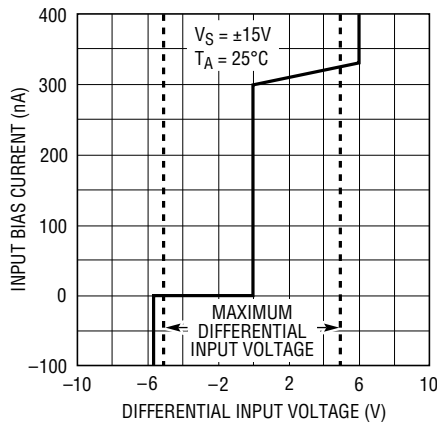
## TYPICAL PERFORMANCE CHARACTERISTICS

Transfer Function



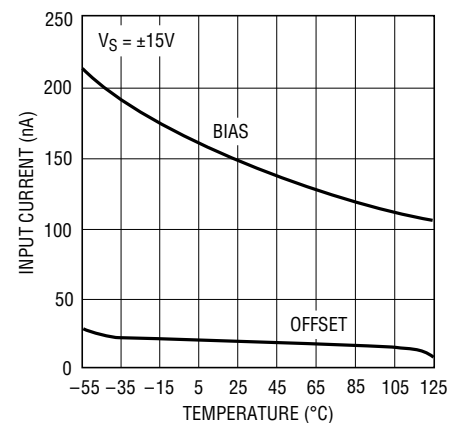
LT119/319 G1

Input Characteristics



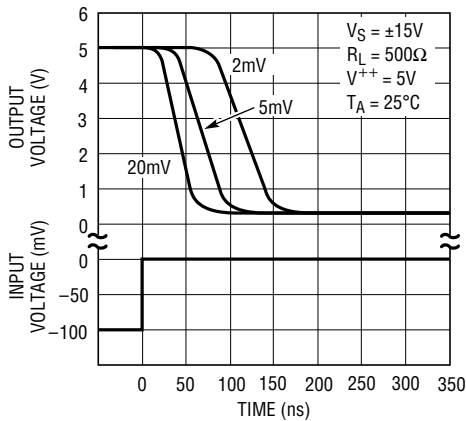
LT119/319 G2

Input Currents



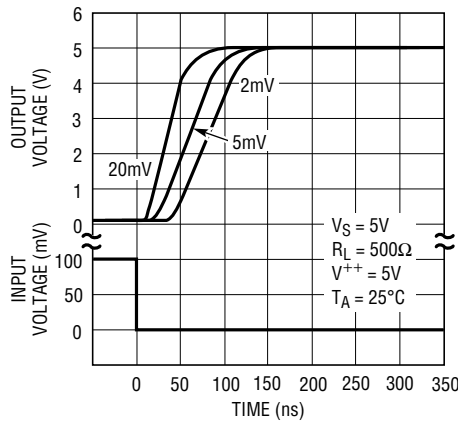
LT119/319 G3

Response Time for Various Input Overdrives



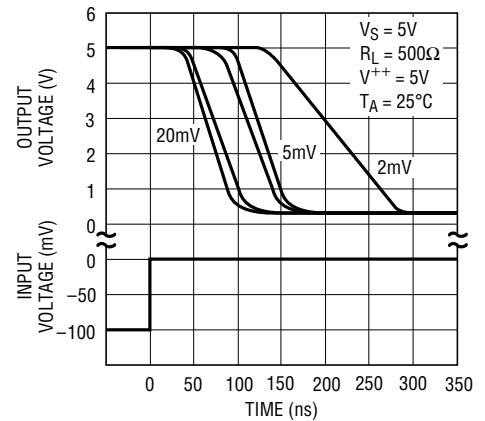
LT119/319 G4

Response Time for Various Input Overdrives



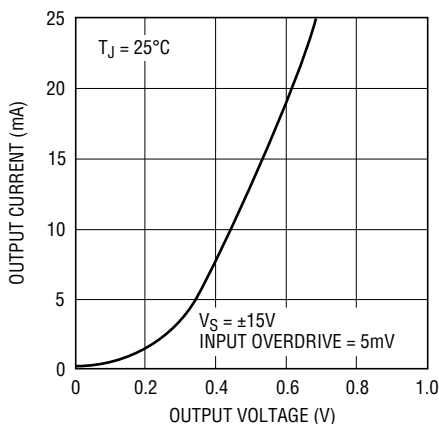
LT119/319 G5

Response Time for Various Input Overdrives



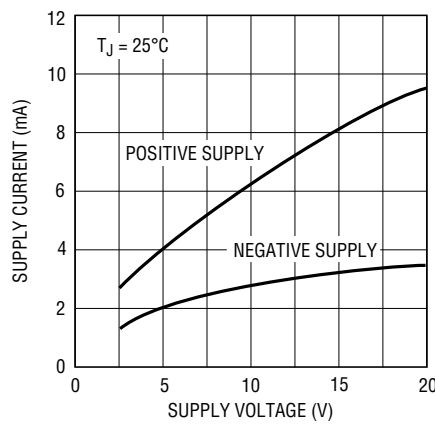
LT119/319 G6

Output Saturation Voltage



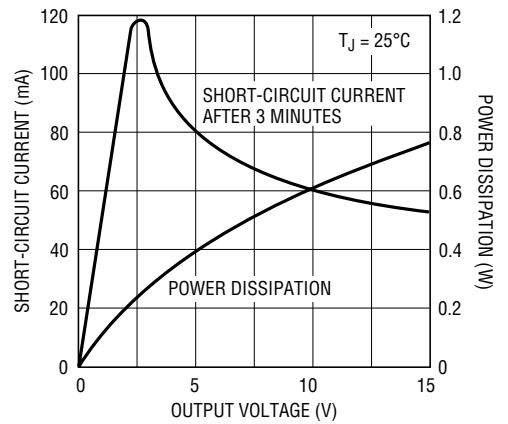
LT119/319 G7

Supply Current



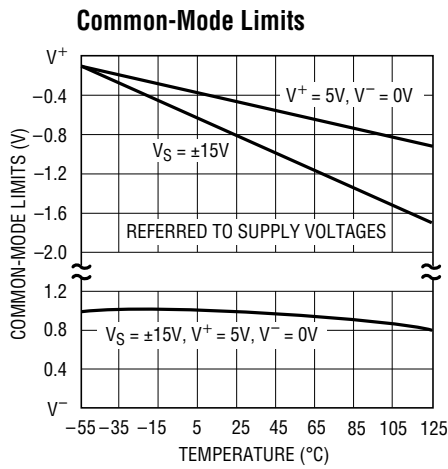
LT119/319 G8

Output Limiting Characteristics

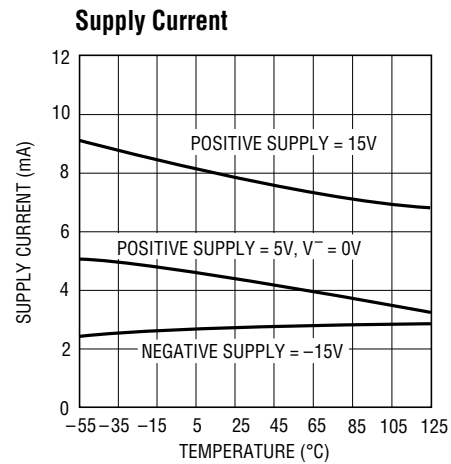


LT119/319 G9

## TYPICAL PERFORMANCE CHARACTERISTICS



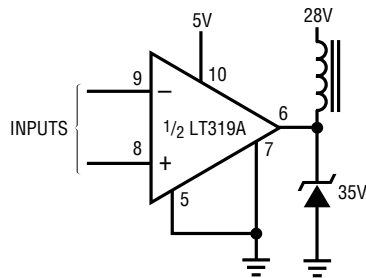
LT119/319 G10



LT119/319 G11

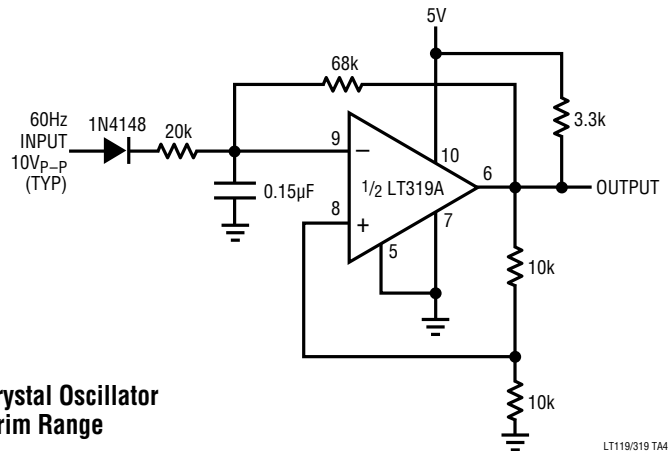
## TYPICAL APPLICATIONS

**Relay Driver**



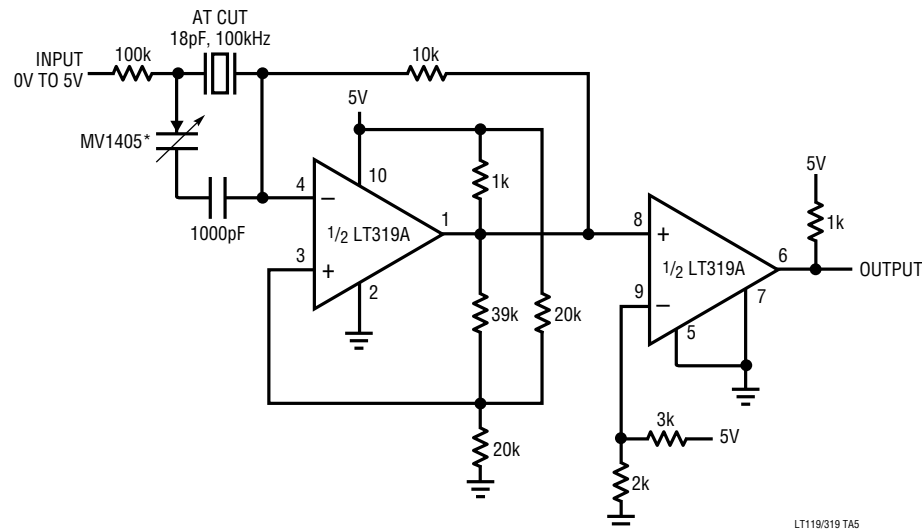
LT119/319 TA3

**High Noise Immunity 60Hz Sync Circuit**



LT119/319 TA4

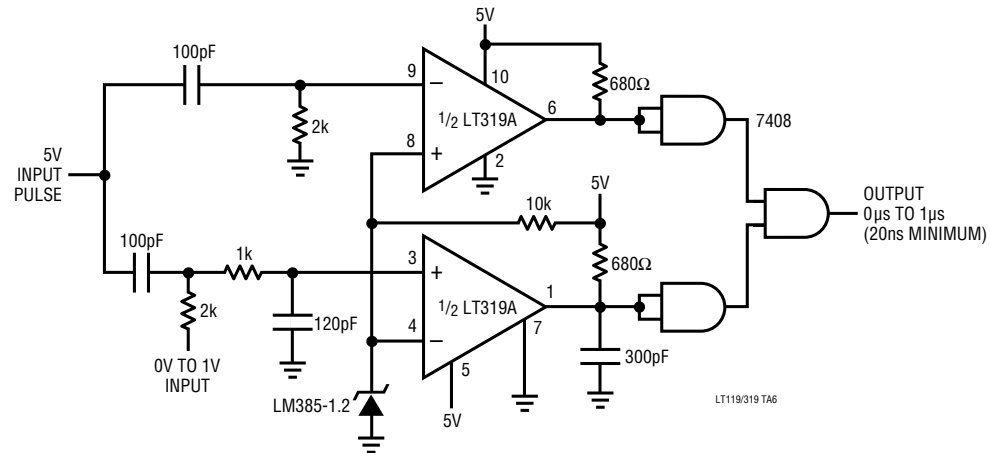
**Voltage Controlled Crystal Oscillator  
With 100PPM Trim Range**



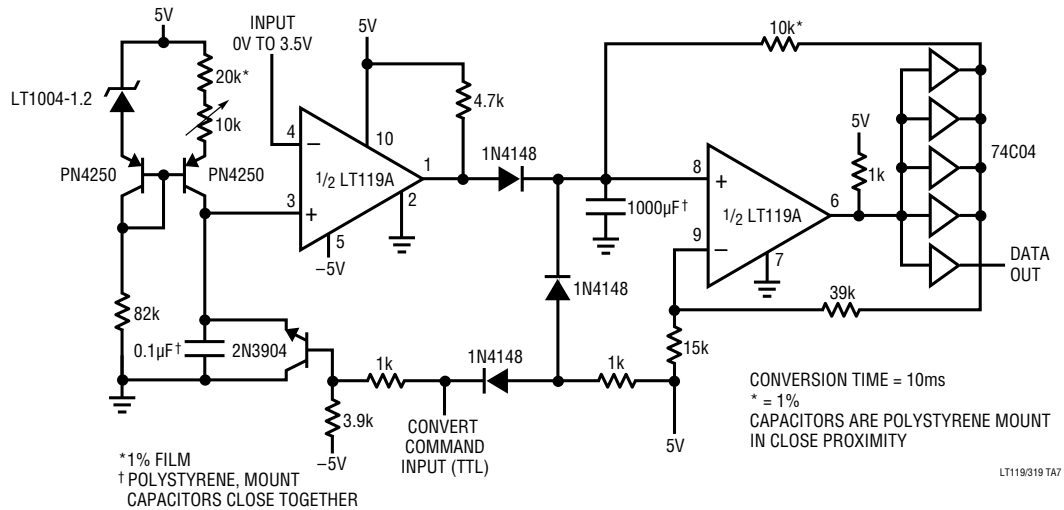
LT119/319 TA5

## TYPICAL APPLICATIONS

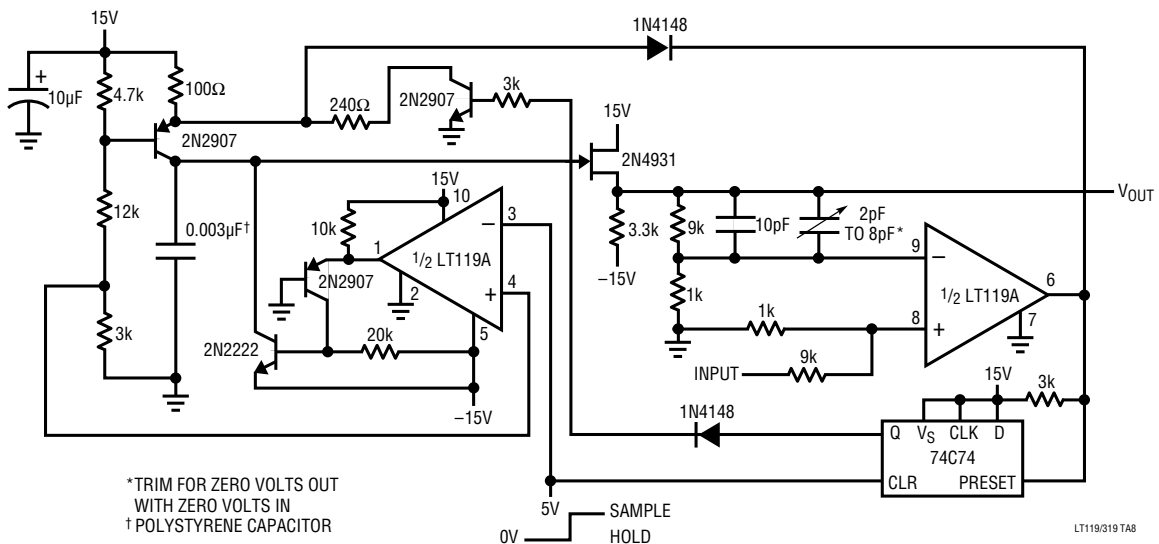
### Voltage Controlled High Speed One Shot



### 10-Bit Serial Output A/D Converter

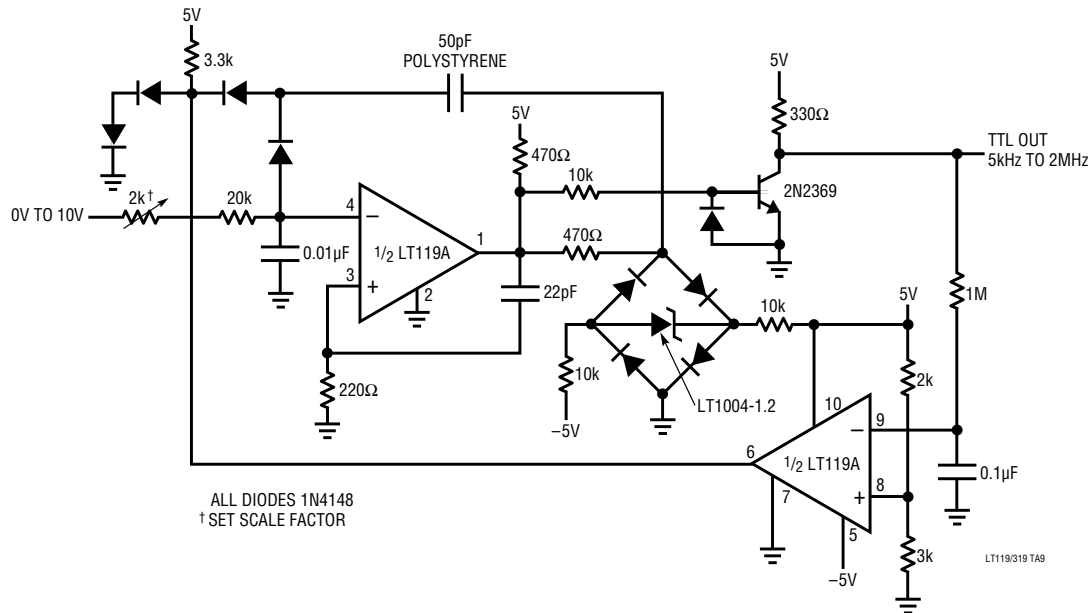


### 5 Microsecond Sample-and-Hold with Zero Hold Step

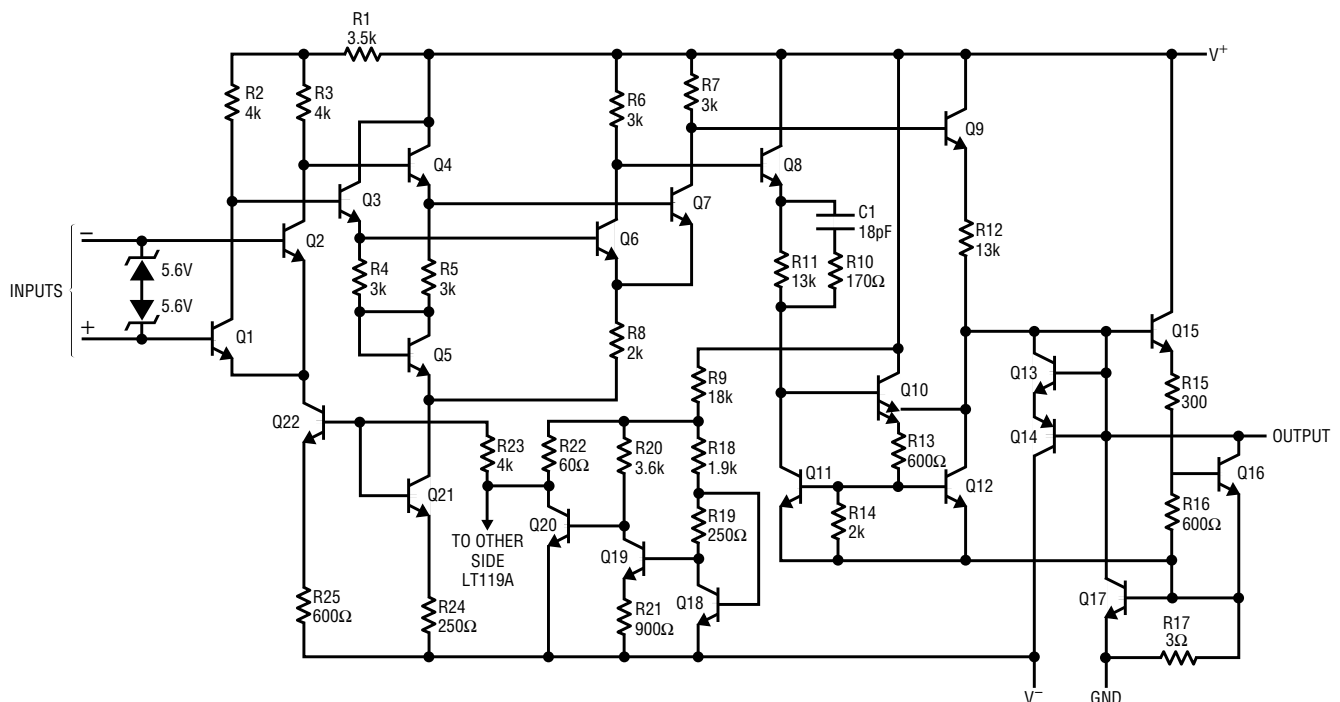


## TYPICAL APPLICATIONS

5kHz to 2MHz V → F Converter



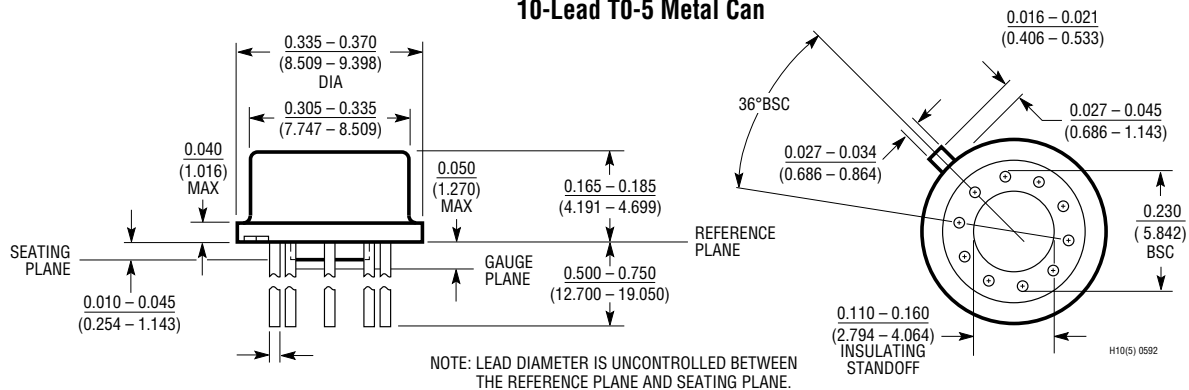
## SCHEMATIC DIAGRAM



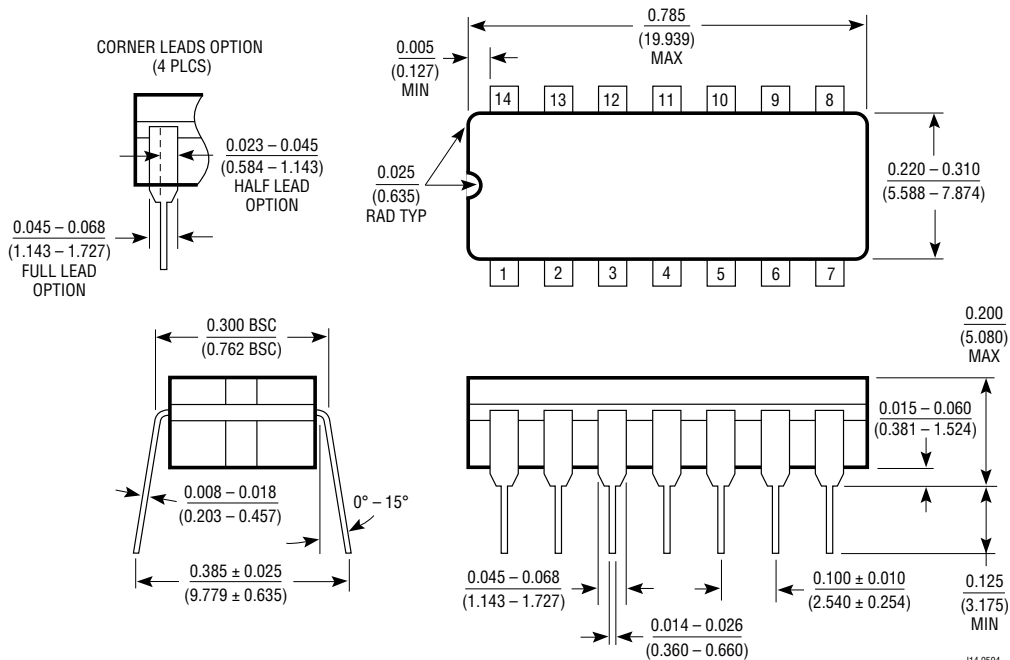
## PACKAGE DESCRIPTION

Dimension in inches (millimeters) unless otherwise noted.

### H Package 10-Lead TO-5 Metal Can



### J Package 14-Lead Ceramic DIP



### N Package 14-Lead Plastic DIP

