

## 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

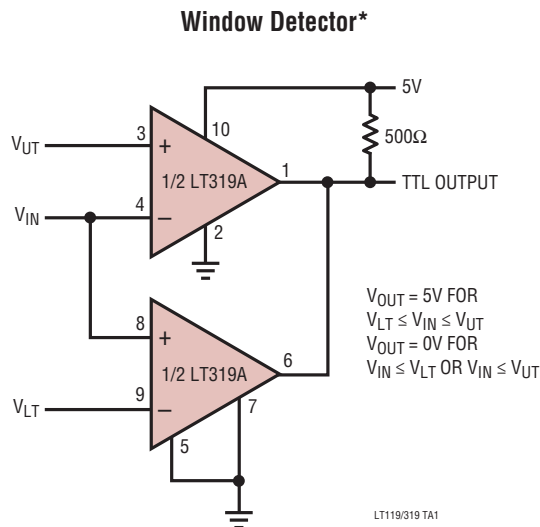
The LT<sup>®</sup>119A is an improved version of the LM119 dual comparator. It features lower input offset voltage and offset current, higher voltage gain, guaranteed common mode rejection and input protection diodes.

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.

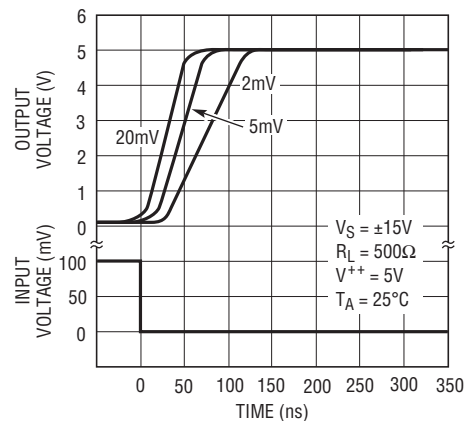
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## TYPICAL APPLICATION



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

**Response Time For Various Input Overdrives**



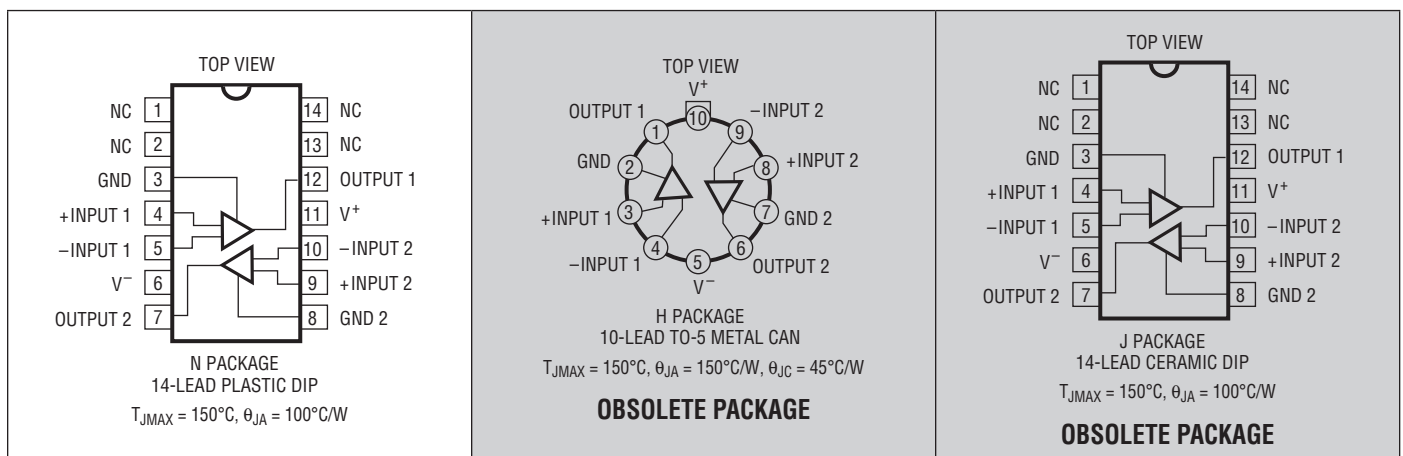
LT119/G19 TA2

# 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  | <b>LT119A, LM119 OBSOLETE .....</b>       | <b>-55°C to 125°C</b> |
| 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)                    |      |   |                       |

## PIN CONFIGURATION



## ORDER INFORMATION

| LEAD FREE FINISH  | PART MARKING | PACKAGE DESCRIPTION    | SPECIFIED TEMPERATURE RANGE |
|-------------------|--------------|------------------------|-----------------------------|
| LT319AN#PBF       | LT319AN      | 14-Lead Plastic DIP    | 0°C to 70°C                 |
| LM319N#PBF        | LM319N       | 14-Lead Plastic DIP    | 0°C to 70°C                 |
| OBSOLETE PACKAGES |              |                        |                             |
| LT119AH#PBF       | LT119AH      | 10-Lead TO-5 Metal Can | -55°C to 125°C              |
| LM119H#PBF        | LM119H       | 10-Lead TO-5 Metal Can | -55°C to 125°C              |
| LT319AH#PBF       | LT319AH      | 10-Lead TO-5 Metal Can | 0°C to 70°C                 |
| LM319H#PBF        | LM319H       | 10-Lead TO-5 Metal Can | 0°C to 70°C                 |
| LT119AJ#PBF       | LT119AJ      | 14-Lead Ceramic DIP    | -55°C to 125°C              |
| LM119J#PBF        | LM119J       | 14-Lead Ceramic DIP    | -55°C to 125°C              |
| LT319AJ#PBF       | LT319AJ      | 14-Lead Ceramic DIP    | 0°C to 70°C                 |
| LM319J#PBF        | LM319J       | 14-Lead Ceramic DIP    | 0°C to 70°C                 |

Consult LTC Marketing for parts specified with wider operating temperature ranges.  
Consult LTC Marketing for information on nonstandard lead based finish parts.

For more information on lead free part markings, go to: <http://www.linear.com/leadfree/>  
For more information on tape and reel specifications, go to: <http://www.linear.com/tapeandreeel/>

**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 |             |            | SYMBOL                         |   |
|-----------|-----------------------------|--|--------|------------|-------------|-------|-------------|------------|--------------------------------|---|
|           |                             |  | MIN    | TYP        | MAX         | MIN   | TYP         | MAX        |                                |   |
| $V_{OS}$  | Input Offset Voltage        | $V_S = \pm 15\text{V}$ , $V_{CM} = 0$  |        | 0.3        | 0.5         |       |             | 4          | mV                             |   |
|           |                             | (Note 4)   | ●      | 0.5<br>1.2 | 1.0<br>2.0  |       | 0.7<br>7    | 4          | mV<br>mV                       |   |
| CMRR      | Common Mode Rejection Ratio |  | 90     | 106        |             |       |             |            | dB                             |   |
| $I_{OS}$  | Input Offset Current        | (Note 4)   | ●      | 20<br>75   | 40          |       | 30<br>100   | 75         | nA<br>nA                       |   |
| $I_B$     | Input Bias Current          | (Note 4)   | ●      | 150        | 500<br>1000 |       | 150<br>1000 | 500        | nA<br>nA                       |   |
| $A_V$     | Voltage Gain                |  | 20     | 40         |             | 10    | 40          |            | V/mV                           |   |
|           | Response Time               | (Note 5)   |        | 80         |             |       | 80          |            | ns                             |   |
| $V_{SAT}$ | Saturation Voltage          | $V_{IN} \leq -5\text{mV}$ , $I_O = 25\text{mA}$ ,<br>$V^+ \geq 4.5\text{V}$ , $V^- = 0\text{V}$                      |        | 0.75       | 1.5         |       | 0.75        | 1.5        | V                              |   |
|           |                             | $V_{IN} \leq -6\text{mV}$ , $I_{SINK} \leq 3.2\text{mA}$<br>$T_A \geq 0^\circ\text{C}$<br>$T_A \leq 0^\circ\text{C}$ |        | 0.23       | 0.4<br>0.6  |       | 0.23        | 0.4<br>0.6 | V<br>V                         |   |
|           | Output Leakage Current      | $V_{IN} \geq 5\text{mV}$ , $V_{OUT}$ to $V^- = 35\text{V}$   | ●      | 0.2<br>1   | 2<br>10     |       | 0.2<br>1    | 2<br>10    | $\mu\text{A}$<br>$\mu\text{A}$ |   |
|           | 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 |             |          | SYMBOL        |
|-----------|-----------------------------|---|--------|----------|-------------|-------|-------------|----------|---------------|
|           |                             |   | 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            |
|           |                             | $R_S \leq 5\text{k}$<br>(Note 4)  | ●      | 0.5      | 1<br>2      |       | 2           | 8<br>10  | mV<br>mV      |
| CMRR      | Common Mode Rejection Ratio |   | 90     | 106      |             |       |             |          | dB            |
| $I_{OS}$  | Input Offset Current        | (Note 4)  | ●      | 30<br>60 | 40          |       | 80<br>300   | 200      | nA<br>nA      |
| $I_B$     | Input Bias Current          | (Note 4)  | ●      | 150      | 500<br>1000 |       | 250<br>1200 | 1000     | nA<br>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             |
|           |                             | $V^+ \geq 4.5\text{V}$ , $V^- = 0\text{V}$ ,<br>$V_{IN} \leq -10\text{mV}$ , $I_{SINK} \leq 3.2\text{mA}$ | ●      | 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            |

## ELECTRICAL CHARACTERISTICS

**Note 1:** Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

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

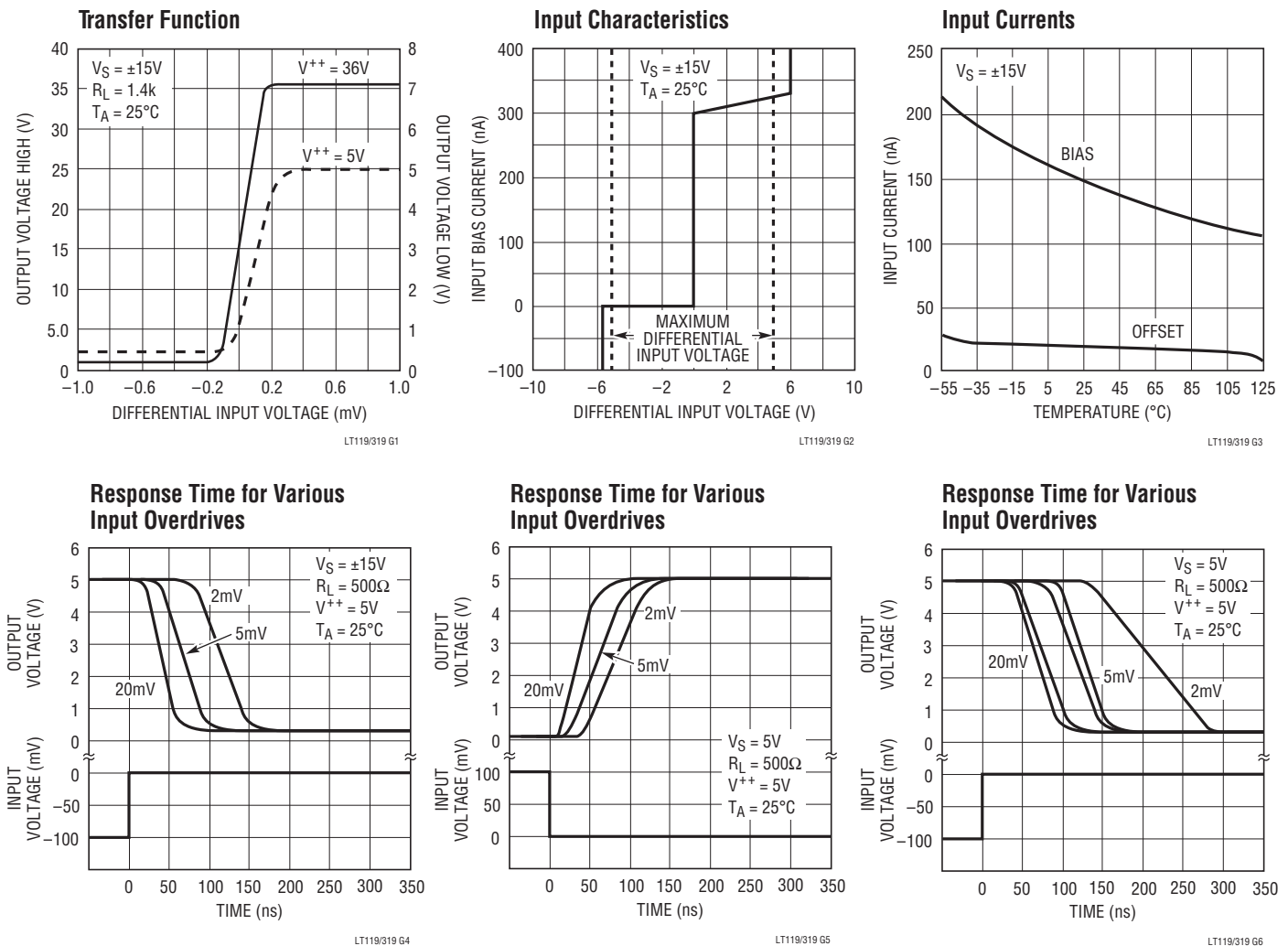
**Note 3:** Unless otherwise noted, supply voltage equals  $\pm 15\text{V}$  and  $V_{CM} = 0\text{V}$ ,  $T_A = 25^\circ\text{C}$ . The ground pin is grounded. Note that the maximum voltage allowed between the ground pin and  $V^+$  is  $18\text{V}$ . Do not tie the ground pin to  $V^-$  when the power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

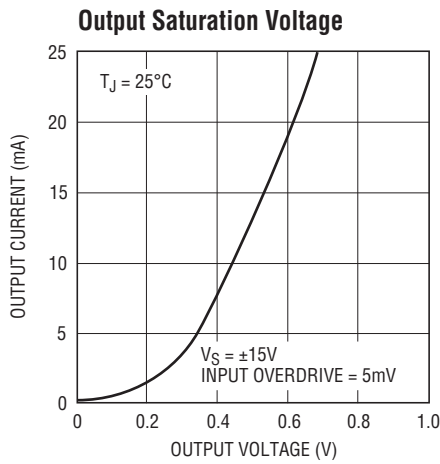
**Note 5:** Response time specified is for a  $100\text{mV}$  input step with  $5\text{mV}$  overdrive.

**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.

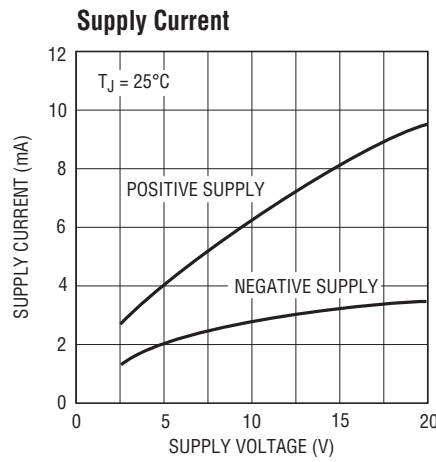
## TYPICAL PERFORMANCE CHARACTERISTICS



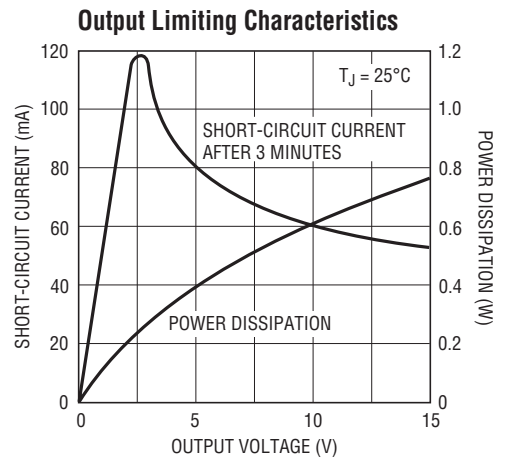
## TYPICAL PERFORMANCE CHARACTERISTICS



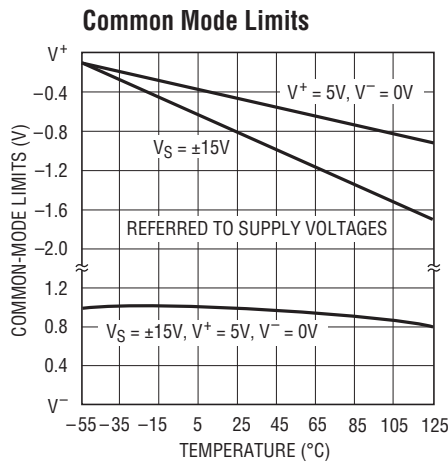
LT119/G19 G7



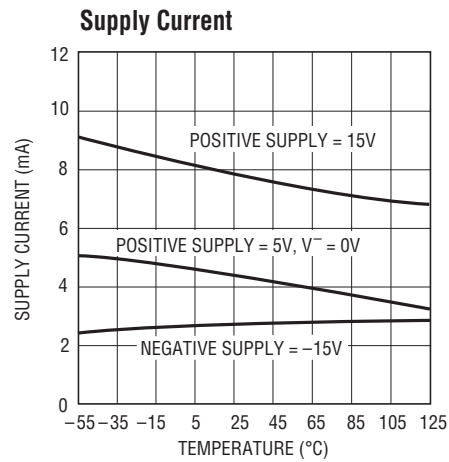
LT119/G19 G8



LT119/G19 G9

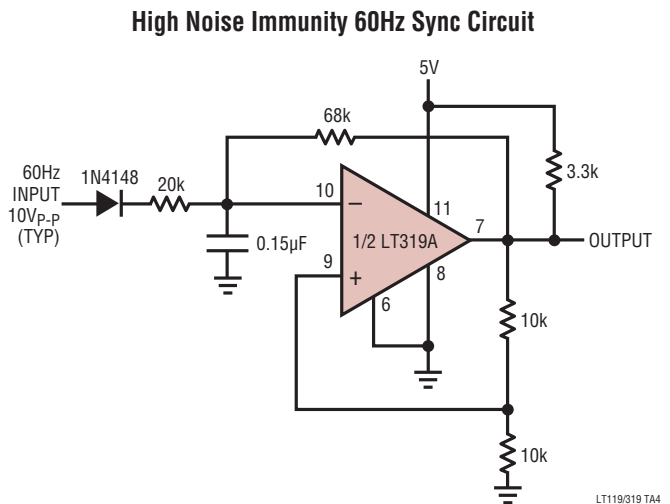
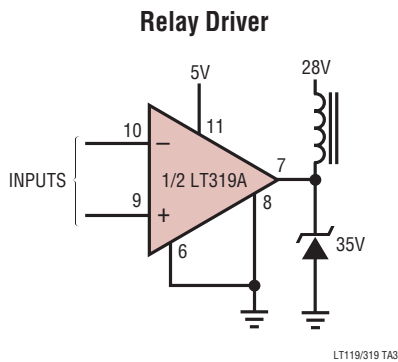


LT119/G19 G10



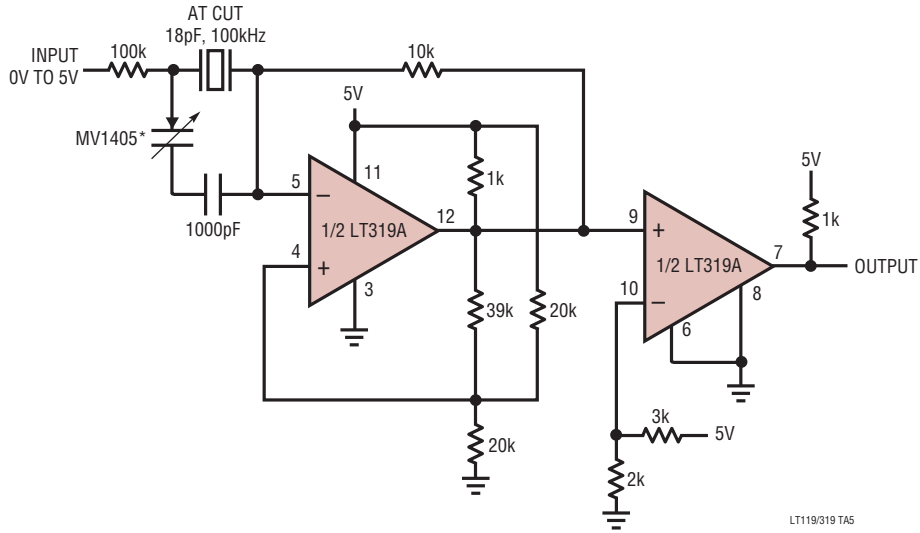
LT119/G19 G11

## TYPICAL APPLICATIONS

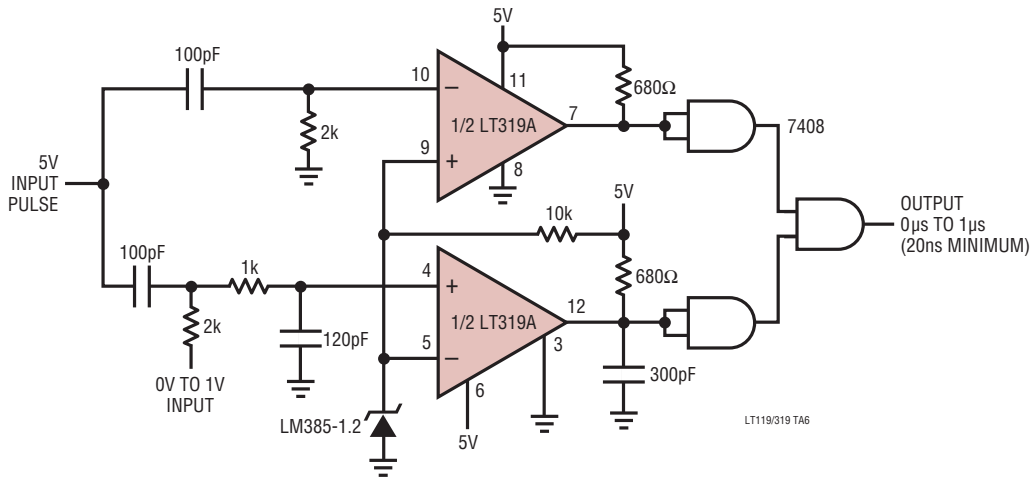


**TYPICAL APPLICATIONS**

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

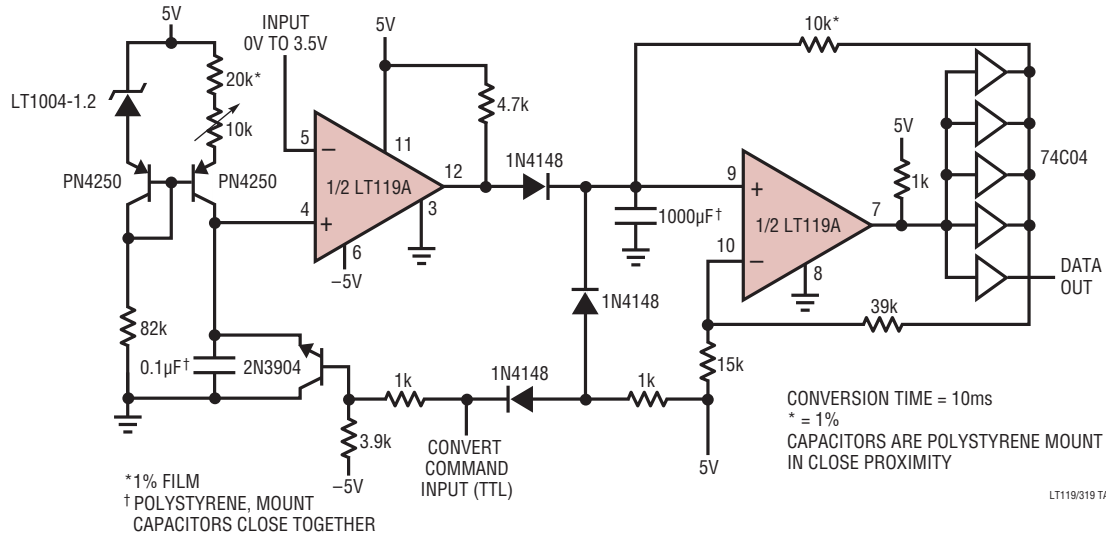


**Voltage Controlled High Speed One Shot**

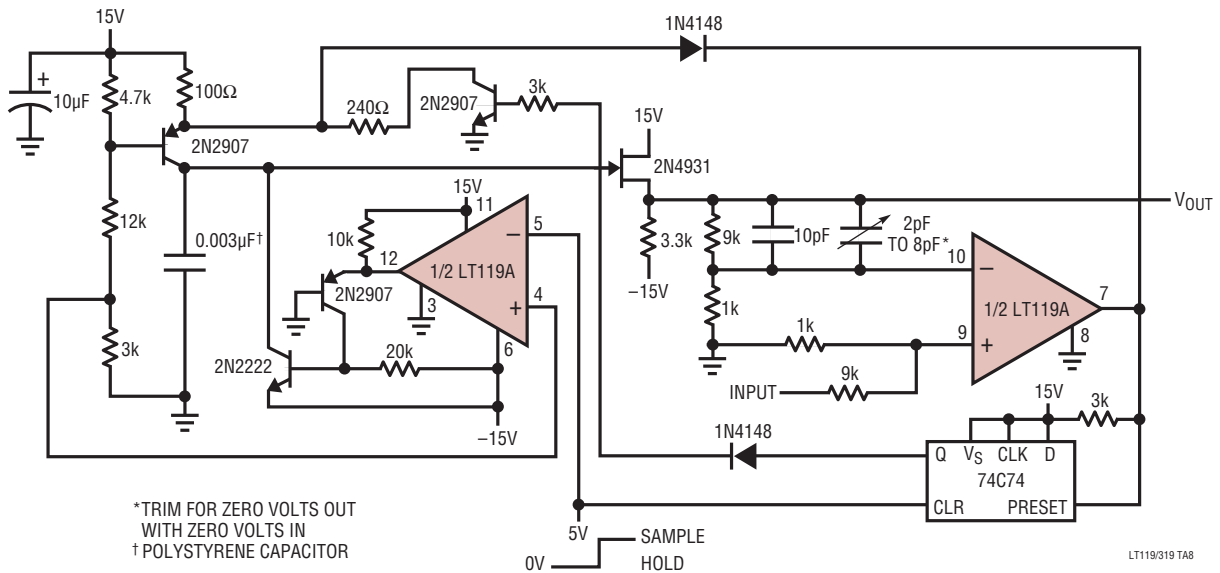


## TYPICAL APPLICATIONS

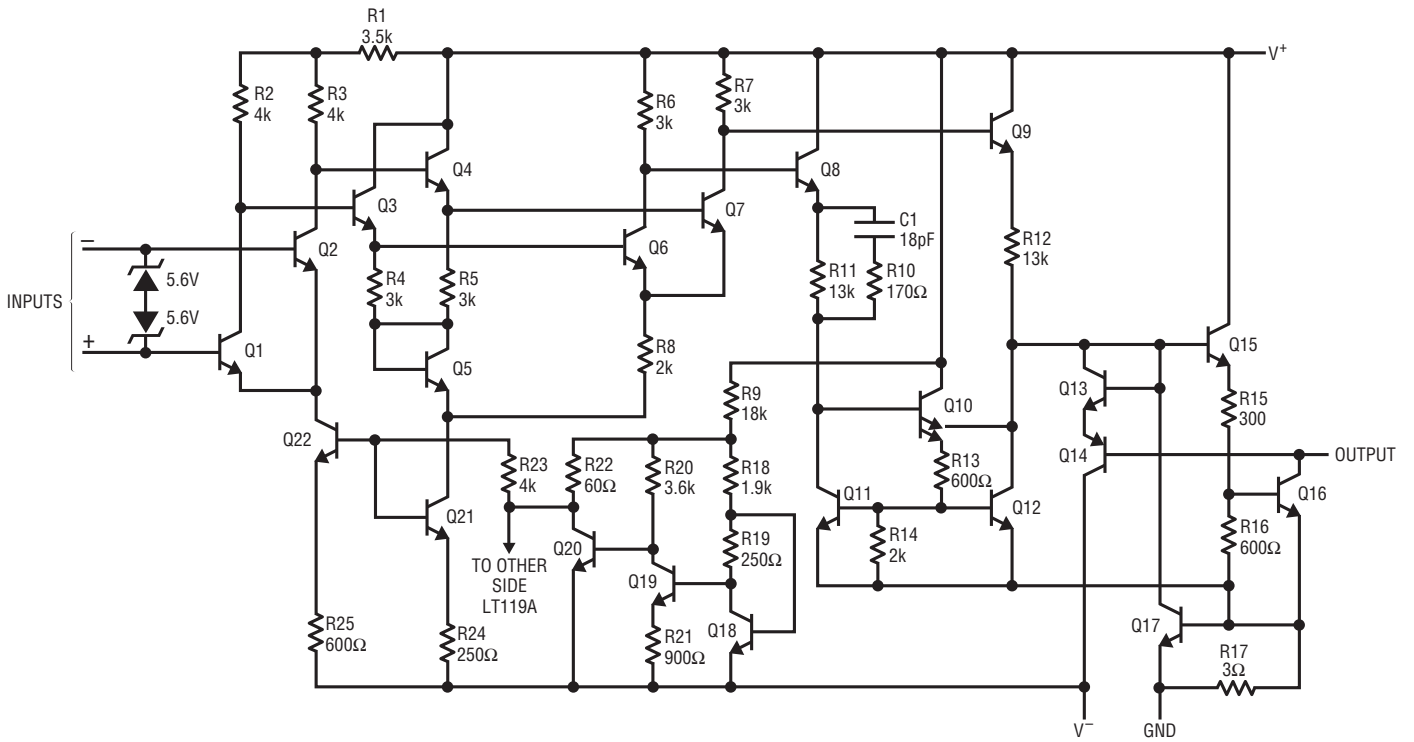
### 10-Bit Serial Output A/D Converter



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



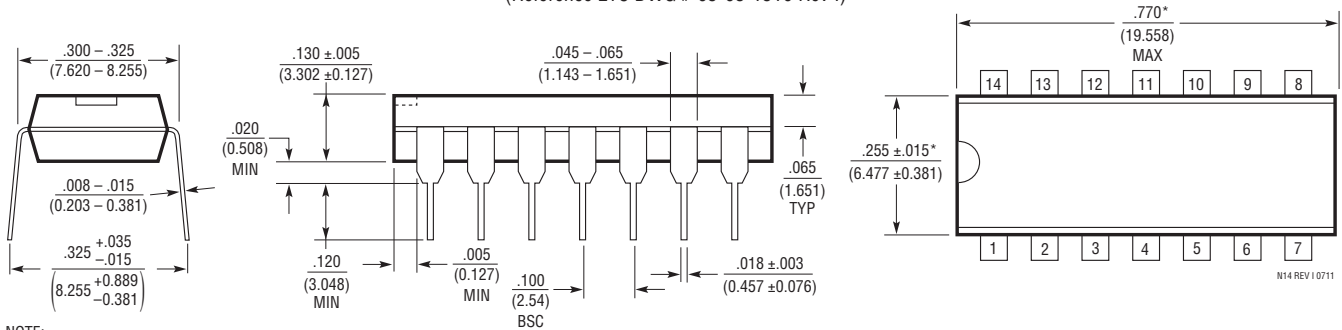
**SCHEMATIC DIAGRAM**



## PACKAGE DESCRIPTION

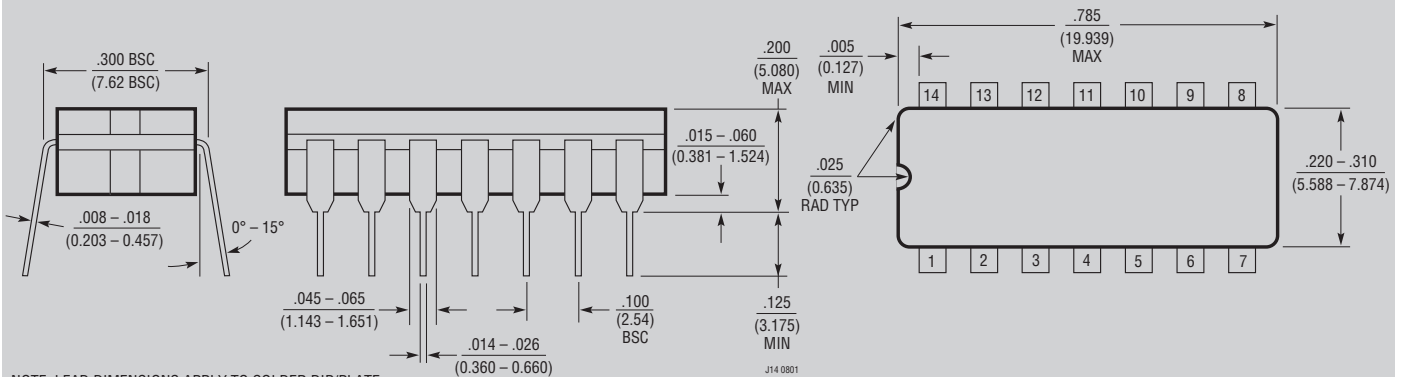
Please refer to <http://www.linear.com/designtools/packaging/> for the most recent package drawings.

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



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)

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

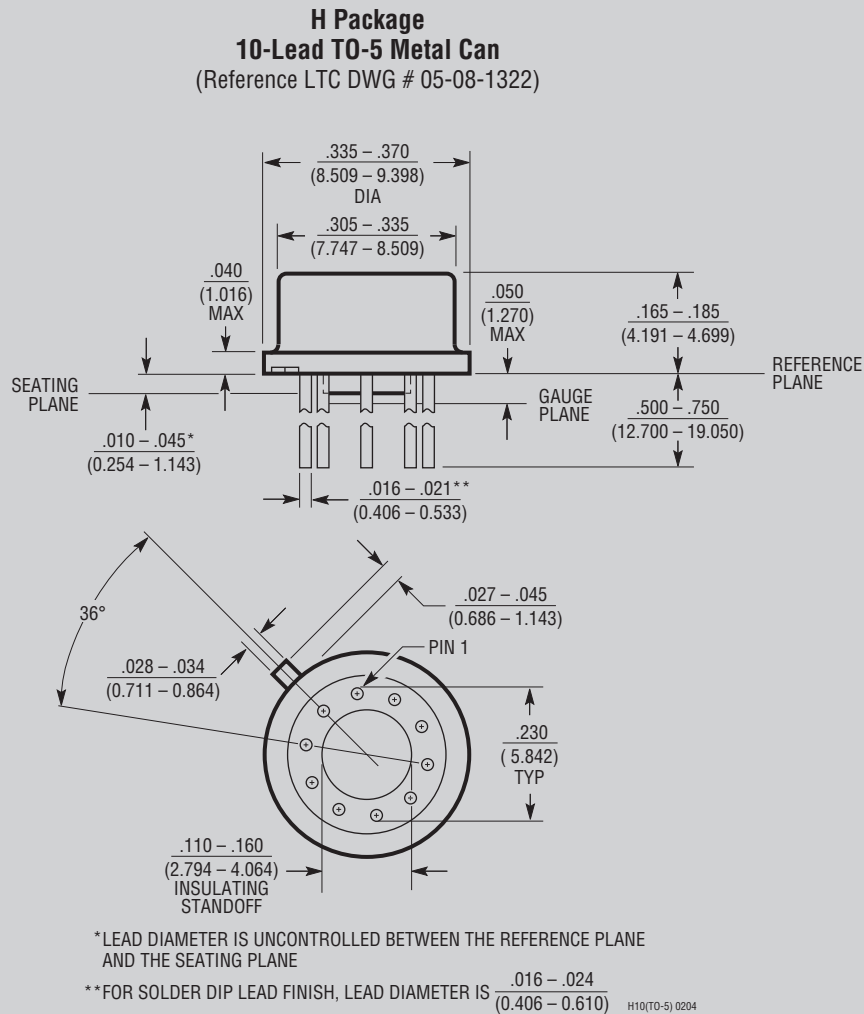


NOTE: LEAD DIMENSIONS APPLY TO SOLDER DIP/PLATE OR TIN PLATE LEADS

**OBSOLETE PACKAGE**

## PACKAGE DESCRIPTION

Please refer to <http://www.linear.com/designtools/packaging/> for the most recent package drawings.



**OBSOLETE PACKAGE**

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## REVISION HISTORY (Revision history begins at Rev C)

| REV | DATE | DESCRIPTION  | PAGE NUMBER |
|-----|------|--|-------------|
| C   | 3/12 | $V_{SAT}$ Conditions corrected from $V_{IN} \leq 6mA$ to $V_{IN} \leq 6mV$ | 3           |

