

FEATURES

- Maximum Offset Voltage: 1mV
- Maximum Bias Current: 15nA
- Typical Output Drive: 70mA
- Operates from 1.1V to 40V
- Internal Pull-Up Current
- Output Can Drive Loads Above V^+
- 30 μ A Supply Current (LT1017)
110 μ A Supply Current (LT1018)
- Available in 8-Lead PDIP, 8-Lead Plastic SO, and 16-Lead Plastic SO Packages

APPLICATIONS

- Power Supply Monitors
- Relay Driving
- Oscillators

LT, LT, LTC and LTM are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

DESCRIPTION

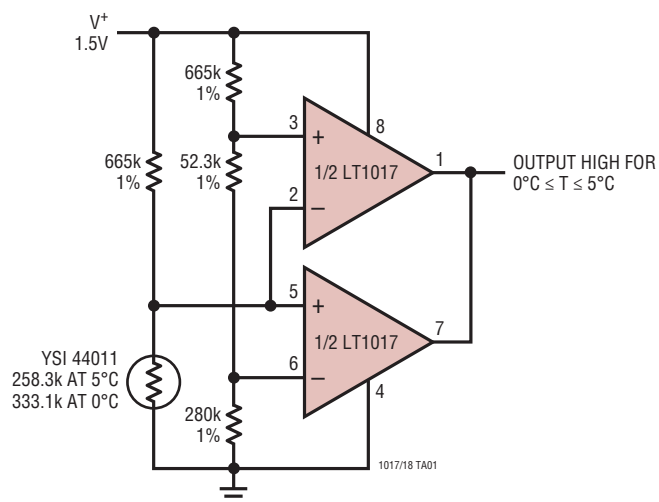
The LT[®]1017/LT1018 are general purpose micropower comparators. The LT1017 is optimized for lowest operating power while the LT1018 operates at higher power and higher speed. Both devices can operate from a single 1.1V cell up to 40V. The output stage includes a class "B" pull-up current source, eliminating the need for an external resistive pull-up and saving power. The output stage is also designed to allow driving loads connected to a supply more positive than the device, as can comparators with open-collector output stages.

Input specifications are also excellent. On-chip trimming minimizes offset voltage, while high gain and common mode rejection ratio keep other input referred errors low. Common mode voltage range includes ground. Special circuitry prevents false output states even if the input is overdriven.

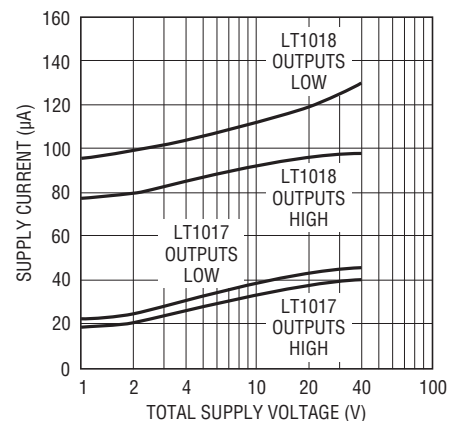
The LT1017/LT1018 are pin compatible with older dual comparators such as 393 type devices.

TYPICAL APPLICATION

1.5V Powered Refrigerator Alarm



Supply Current

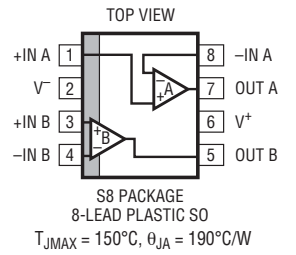
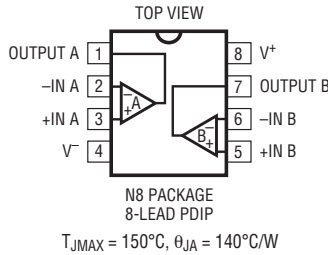
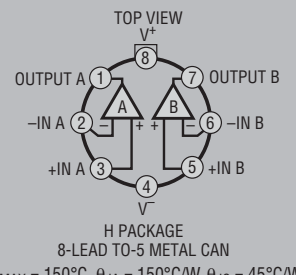
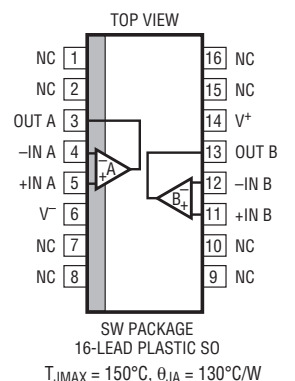


LT1017/LT1018

ABSOLUTE MAXIMUM RATINGS (Note 1)

| | | | |
|---------------------------------|----------------|---|----------------|
| Supply Voltage..... | 40V | Operating Temperature Range | |
| Differential Input Voltage..... | 40V | LT1017M/LT1018M..... | -55°C to 125°C |
| Input Voltage..... | -0.3V to 40V | LT1017C/LT1018C..... | 0°C to 70°C |
| Short-Circuit Duration..... | Indefinite | LT1017I/LT1018I..... | -40°C to 85°C |
| Storage Temperature Range..... | -65°C to 150°C | Lead Temperature (Soldering, 10 sec)..... | 300°C |

PACKAGE/ORDER INFORMATION

| | | | |
|---|--------------------------------|--|--------------|
|  <p>S8 PACKAGE 8-LEAD PLASTIC SO $T_{JMAX} = 150^{\circ}C, \theta_{JA} = 190^{\circ}C/W$</p> | |  <p>N8 PACKAGE 8-LEAD PDIP $T_{JMAX} = 150^{\circ}C, \theta_{JA} = 140^{\circ}C/W$</p> | |
| ORDER PART NUMBER | S8 PART MARKING | ORDER PART NUMBER | PART MARKING |
| LT1017CS8 LT1017IS8 LT1018CS8 LT1018IS8 | 1017 1017I 1018 1018I | LT1017CN8 LT1017IN8 LT1018CN8 | |
|  <p>H PACKAGE 8-LEAD TO-5 METAL CAN $T_{JMAX} = 150^{\circ}C, \theta_{JA} = 150^{\circ}C/W, \theta_{JC} = 45^{\circ}C/W$ OBsolete PACKAGE Consider the 8-Lead Plastic Dip Package For Alternate Source</p> | |  <p>SW PACKAGE 16-LEAD PLASTIC SO $T_{JMAX} = 150^{\circ}C, \theta_{JA} = 130^{\circ}C/W$</p> | |
| ORDER PART NUMBER | PART MARKING | ORDER PART NUMBER | PART MARKING |
| LT1017MH LT1017CH LT1018MH LT1018CH | | LT1017CSW LT1018CSW | |

Order Options Tape and Reel: Add #TR
 Lead Free: Add #PBF Lead Free Tape and Reel: Add #TRPBF
 Lead Free Part Marking: <http://www.linear.com/leadfree/>

*The temperature grade is identified by a label on the shipping container. Consult LTC Marketing for parts specified with wider operating temperature ranges.

10178ff

ELECTRICAL CHARACTERISTICS The ● denotes the specifications which apply over the full operating temperature range of –55°C to 85°C for M grade parts, –40°C to 85°C for I grade parts and 0°C to 70°C for C grade parts.

| PARAMETER | CONDITIONS | | LT1017 | | | LT1018 | | | UNITS |
|------------------------------|--|------------|--------|-----|-----|--------|-----|-----|-------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| Offset Voltage (Note 2) | $\pm 0.75V \leq V_S \leq \pm 20V$ | 25°C | | 0.4 | 1 | | 0.4 | 1 | mV |
| | | ● 125°C | | 0.5 | 1.4 | | 0.5 | 1.4 | mV |
| Bias Current | $\pm 0.75V \leq V_S \leq \pm 20V$ | 25°C | | 5 | 15 | | 15 | 75 | nA |
| | | ● 125°C | | 7 | 25 | | 18 | 100 | nA |
| Offset Current | $\pm 0.75V \leq V_S \leq \pm 20V$ | 25°C | | 0.4 | 2 | | 1 | 8 | nA |
| | | ● 125°C | | 0.5 | 3 | | 1.6 | 12 | nA |
| Common Mode Rejection Ratio | $V_S = \pm 20V, -20V \leq V_{CM} \leq 19.1V$ | 25°C | 105 | 115 | | 105 | 115 | | dB |
| | | ● 125°C | 100 | 115 | | 100 | 115 | | dB |
| Power Supply Rejection Ratio | $\pm 0.75V \leq V_S \leq \pm 20V$ | 25°C | 96 | 110 | | 96 | 110 | | dB |
| | | ● 125°C | 95 | 105 | | 95 | 105 | | dB |
| Gain | No Load, $V_{OUT} = \pm 19.9V$ (Note 3) | 25°C | 110 | 115 | | 110 | 125 | | dB |
| | | ● 125°C | 105 | 115 | | 105 | 120 | | dB |
| Output Sink Current | $V^+ = 4.5V, V^- = 0V$ Overdrive > 30mV | 25°C | 30 | 65 | | 35 | 70 | | mA |
| | | ● 125°C | 25 | 50 | | 25 | 50 | | mA |
| Output Source Current | $V^+ = 40V, V^- = 0V$ $V_{IN} = 5mV, V_{OUT} = 0.4V$ | 25°C | 30 | 75 | | 75 | 250 | | μA |
| | | ● 125°C | 25 | 70 | | 50 | 220 | | μA |
| Negative Output Saturation | $I_{OUT} = 0mA$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 25°C | | 5 | 20 | | 5 | 15 | mV |
| | | ● 25°C | | 35 | 60 | | 35 | 60 | mV |
| Positive Output Saturation | $I_{OUT} = 0\mu A$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 25°C | | 40 | 80 | | 35 | 80 | mV |
| | | ● 25°C | | 175 | 250 | | 175 | 250 | mV |
| Output Sink Current | $V^+ = 1.2V, V^- = 0V$ $V_{IN} = 5mV, V_{OUT} = 0.4V$ | 25°C | 25 | 35 | | 70 | 140 | | μA |
| | | ● 125°C | 15 | 20 | | 45 | 120 | | μA |
| Output Source Current | $V^+ = 40V, V^- = 0V$ $V_{IN} = 5mV, V_{OUT} = 0.4V$ | 25°C | 25 | 75 | | 50 | 200 | | μA |
| | | ● 125°C | 25 | 75 | | 50 | 200 | | μA |
| Negative Output Saturation | $I_{OUT} = 0mA$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 25°C | | 5 | 20 | | 8 | 20 | mV |
| | | ● 25°C | | 40 | 75 | | 35 | 70 | mV |
| Positive Output Saturation | $I_{OUT} = 0mA$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 25°C | | 75 | 150 | | 70 | 150 | mV |
| | | ● 25°C | | 150 | 300 | | 150 | 300 | mV |
| Negative Output Saturation | $I_{OUT} = 0mA$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 25°C | | 600 | 900 | | 500 | 900 | mV |
| | | ● 25°C | | 600 | 900 | | 500 | 900 | mV |
| Negative Output Saturation | $I_{OUT} = 0mA$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 125°C | | 25 | 50 | | 10 | 40 | mV |
| | | ● 125°C | | 60 | 100 | | 60 | 100 | mV |
| Positive Output Saturation | $I_{OUT} = 0\mu A$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 125°C | | 100 | 200 | | 110 | 200 | mV |
| | | ● 125°C | | 300 | 600 | | 300 | 400 | mV |
| Positive Output Saturation | $I_{OUT} = 0\mu A$ $V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$ | 125°C | | 50 | 100 | | 50 | 100 | mV |
| | | ● 125°C | | 300 | 300 | | 300 | 300 | mV |

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range of -55°C to 85°C for M grade parts, -40°C to 85°C for I grade parts and 0°C to 70°C for C grade parts.

| PARAMETER | CONDITIONS | | LT1017 | | | LT1018 | | | UNITS |
|---------------------------|--|------------|--------|------|-----|--------|-----|---------------|-------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| Leakage Current | $V_S = 5\text{V}$, $V_{\text{OUT}} = 40\text{V}$ $V_{\text{IN}} \geq 100\text{mV}$ | 25°C | 0.5 | 3 | | 1 | 8 | μA | |
| | | ● 125°C | 0.6 | 3 | | 1.8 | 10 | μA | |
| Supply Current | $V_S = 5\text{V}$ | 25°C | 30 | 60 | | 110 | 250 | μA | |
| | | ● 125°C | 40 | 80 | | 110 | 250 | μA | |
| | $V_S = 40\text{V}$ | 25°C | 40 | 90 | | 130 | 250 | μA | |
| | | ● 125°C | 55 | 100 | | 140 | 270 | μA | |
| Minimum Operating Voltage | $I_{\text{OUT}} = 1\text{mA}$ | 25°C | | 1.15 | | | 1.2 | V | |
| | | ● | | 1.15 | | | 1.2 | V | |
| | | 125°C | | 1.15 | | | 1.2 | V | |

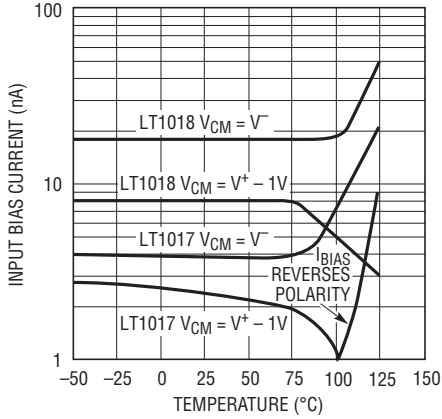
Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Offset voltage is guaranteed over a common mode voltage range of $V^- \leq V_{\text{IN}} \leq (V^+ - 0.9\text{V})$.

Note 3: No load gain is guaranteed but not tested (LT1017 only).

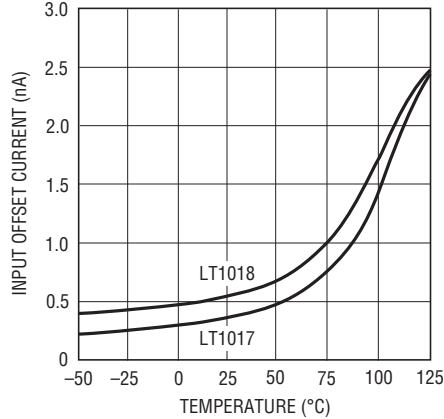
TYPICAL PERFORMANCE CHARACTERISTICS

Input Bias Current



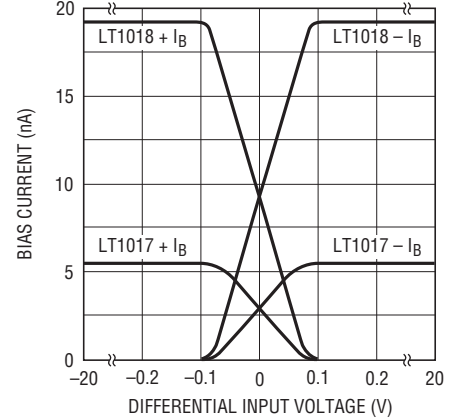
1017/18 G01

Input Offset Current



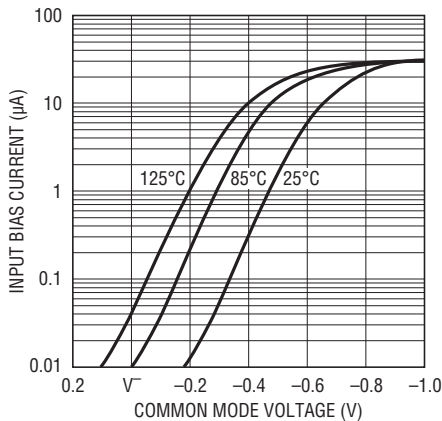
1017/18 G02

Bias Current vs Differential Input



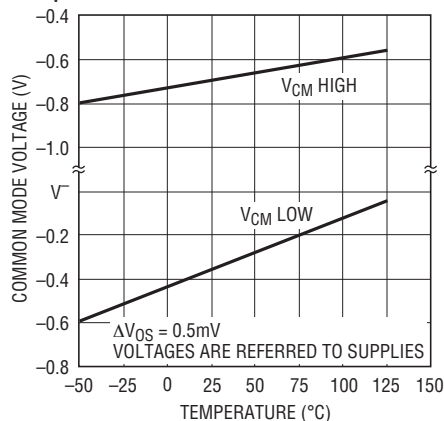
1017/18 G03

Input Bias Current with Inputs Driven Below the Supply



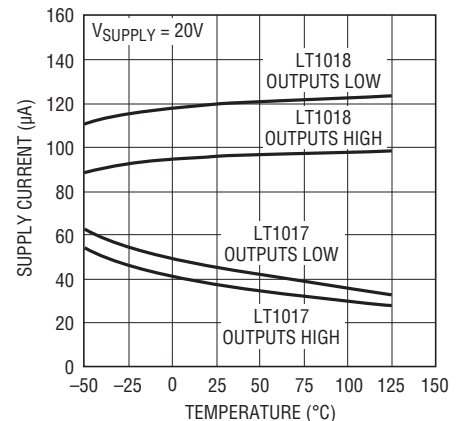
1017/18 G04

Common Mode Limits



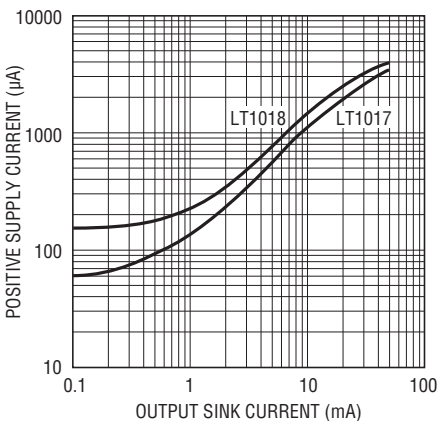
1017/18 G05

Supply Current



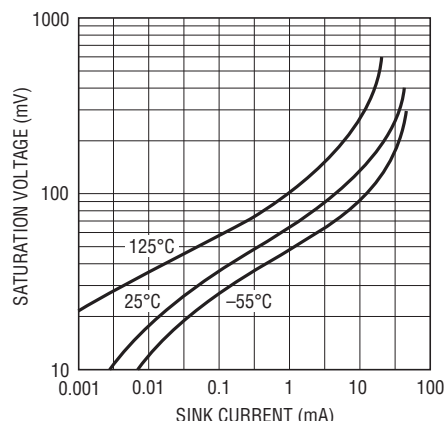
1017/18 G06

Positive Supply Current



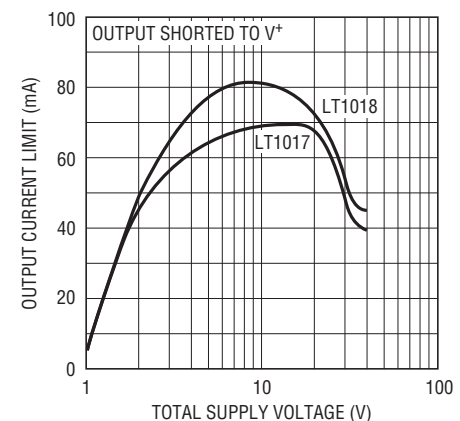
1017/18 G07

NPN Output Saturation Voltage



1017/18 G08

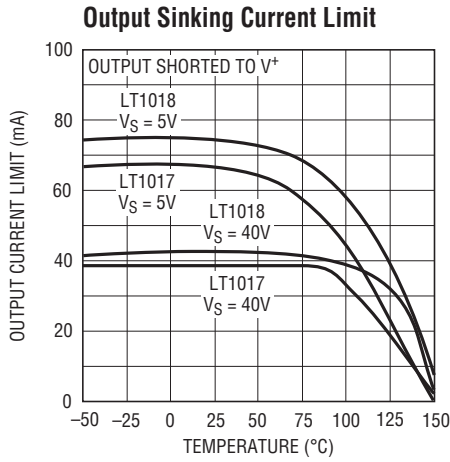
Output Sinking Current Limit



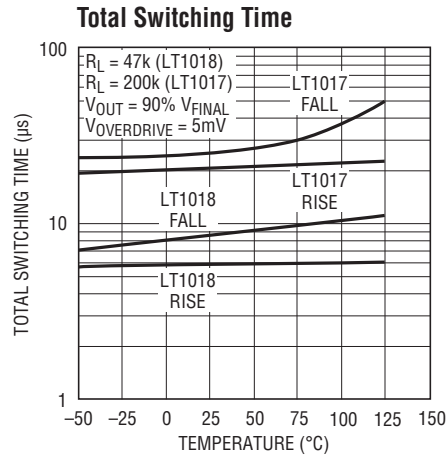
1017/18 G09

LT1017/LT1018

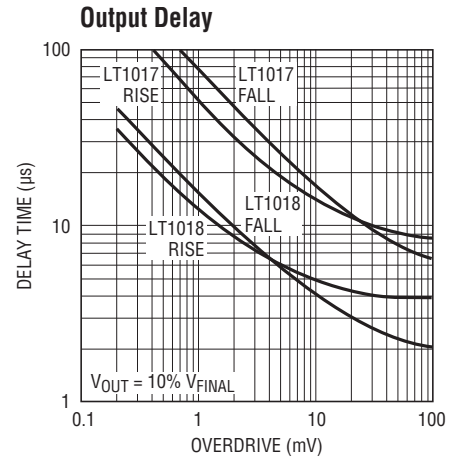
TYPICAL PERFORMANCE CHARACTERISTICS



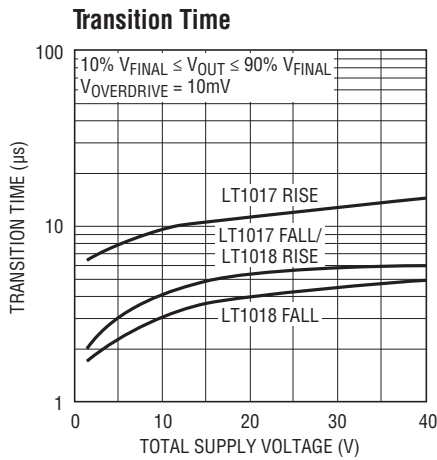
1017/18 G10



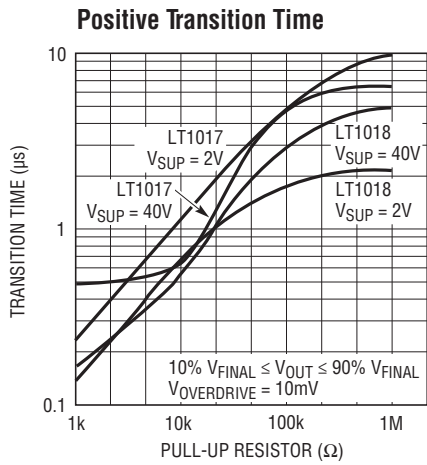
1017/18 G11



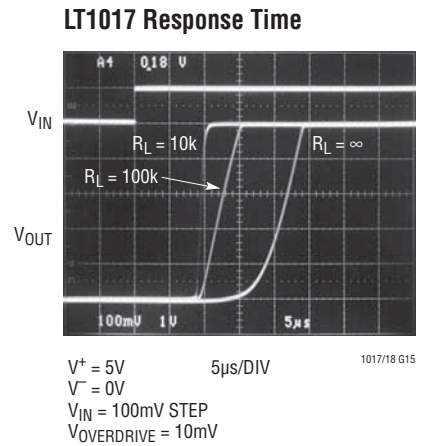
1017/18 G12



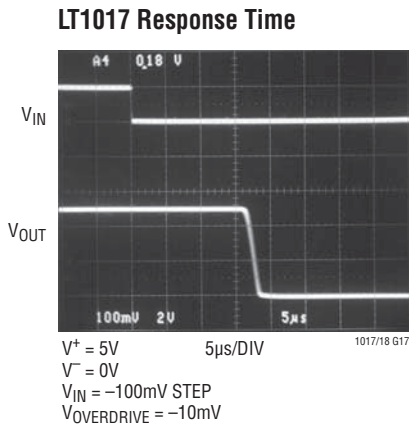
1017/18 G13



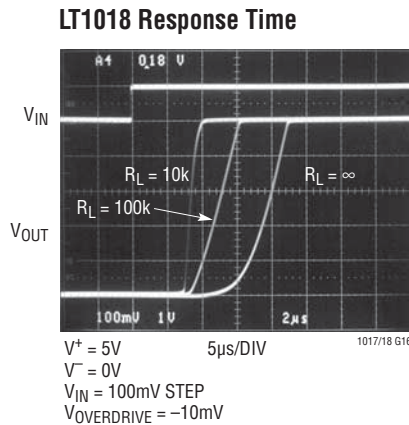
1017/18 G14



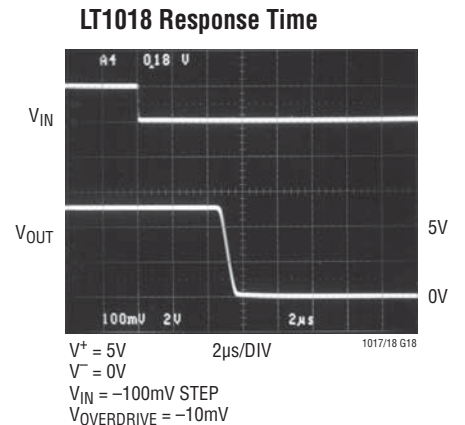
1017/18 G15



1017/18 G17



1017/18 G16

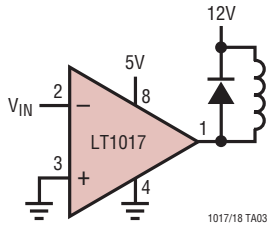


1017/18 G18

10178ff

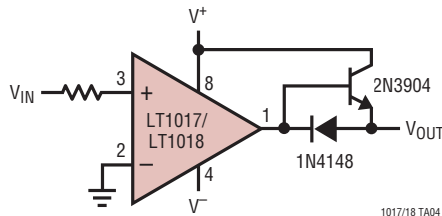
TYPICAL APPLICATIONS

Driving Relays



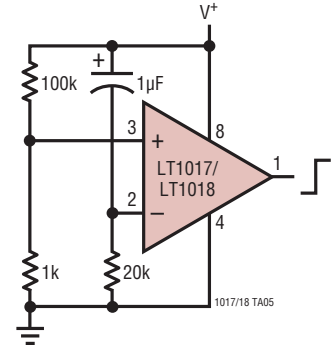
1017/18 TA03

Increasing Positive Output Current



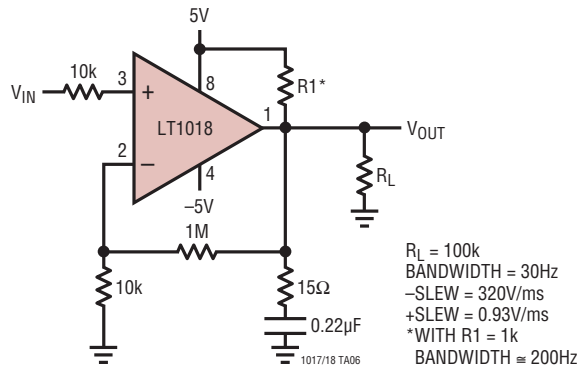
1017/18 TA04

Delay On Power Up



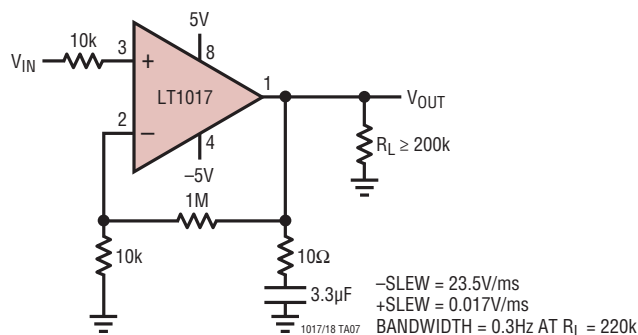
1017/18 TA05

LT1018 Op Amp, $A_V = 100$



1017/18 TA06

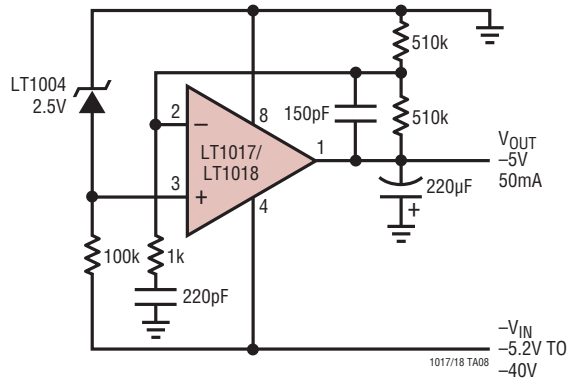
LT1017 Op Amp, $A_V = 100$



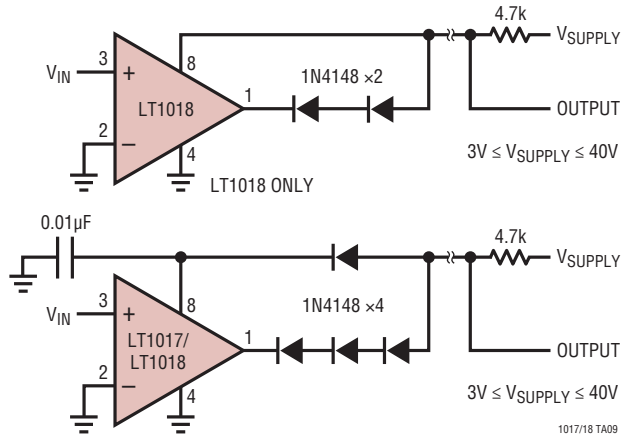
1017/18 TA07

TYPICAL APPLICATIONS

Negative Voltage Regulator

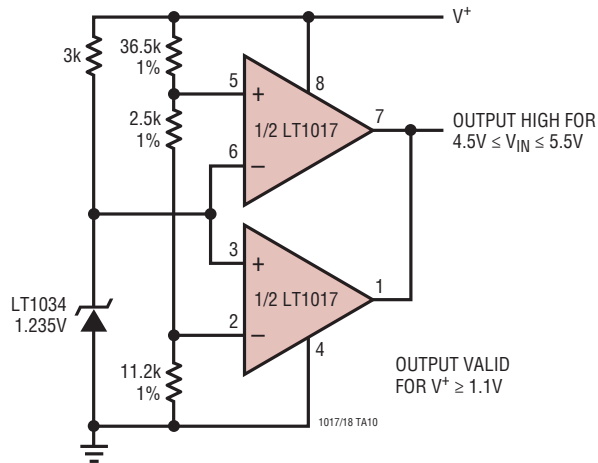


2-Wire Comparator

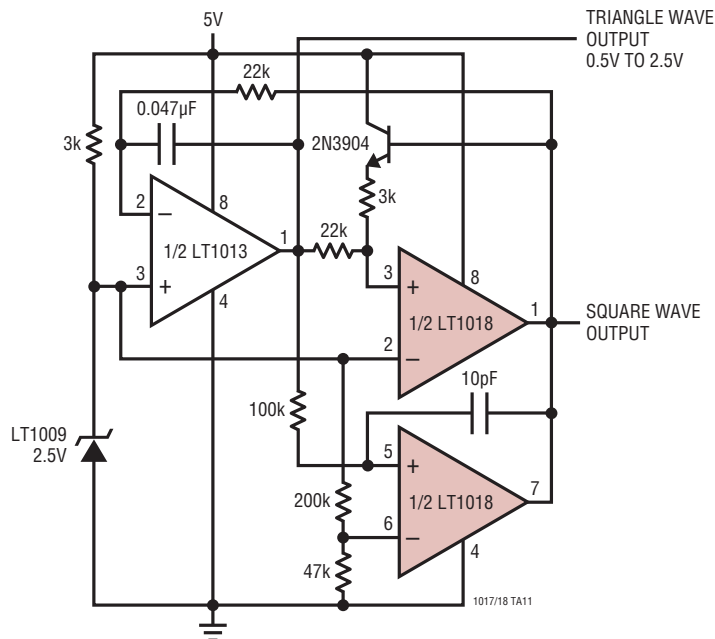


TYPICAL APPLICATIONS

5V Power Supply Monitor

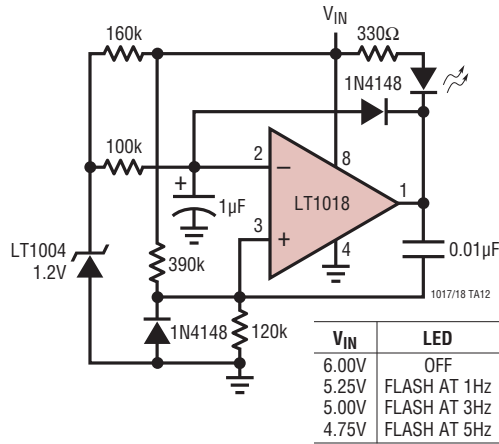


Precise Tri-Wave Generator

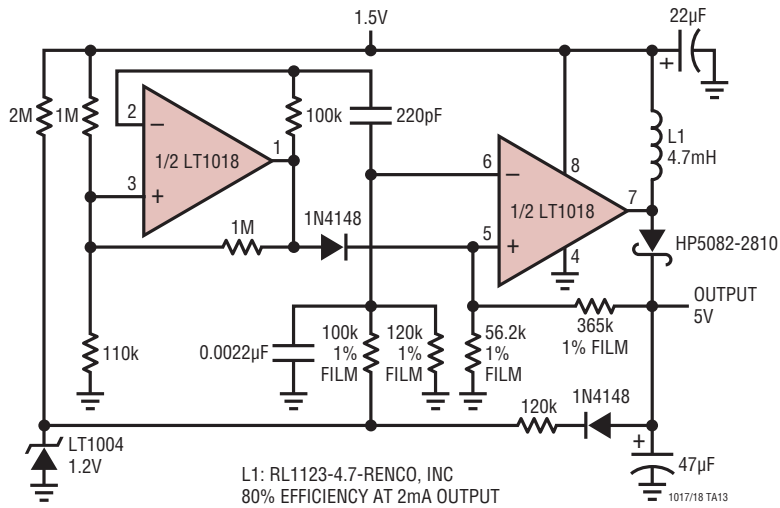


TYPICAL APPLICATIONS

Power Supply Monitor

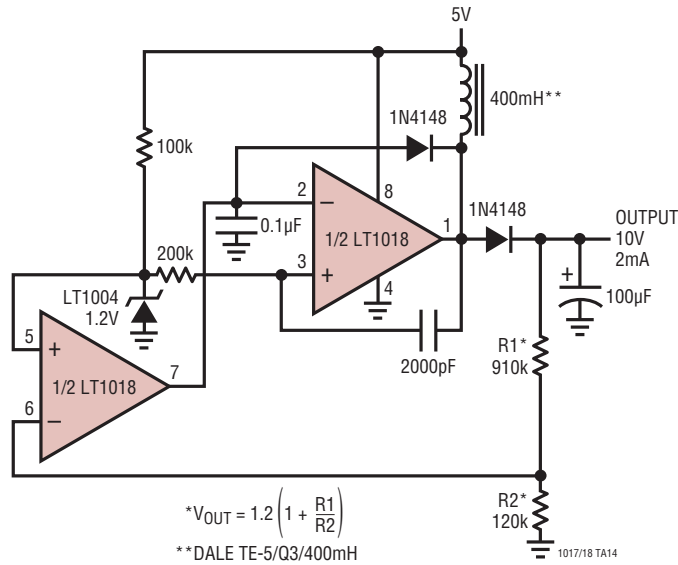


1.5V Input Flyback Regulator

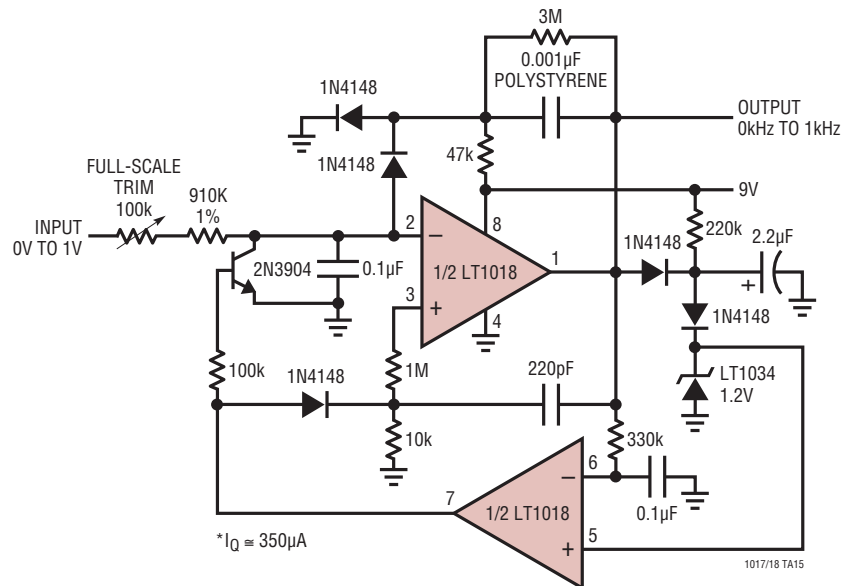


TYPICAL APPLICATIONS

Regulated Step-Up Converter

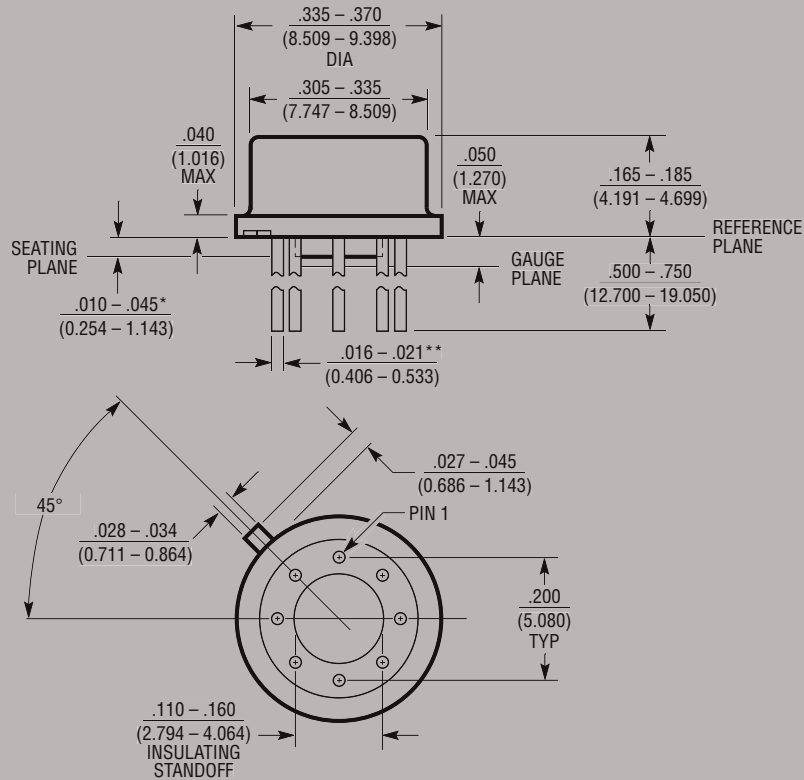


Low Power* V-to-F Converter



PACKAGE DESCRIPTION

H Package
8-Lead TO-5 Metal Can (.200 Inch PCD)
 (Reference LTC DWG # 05-08-1320)



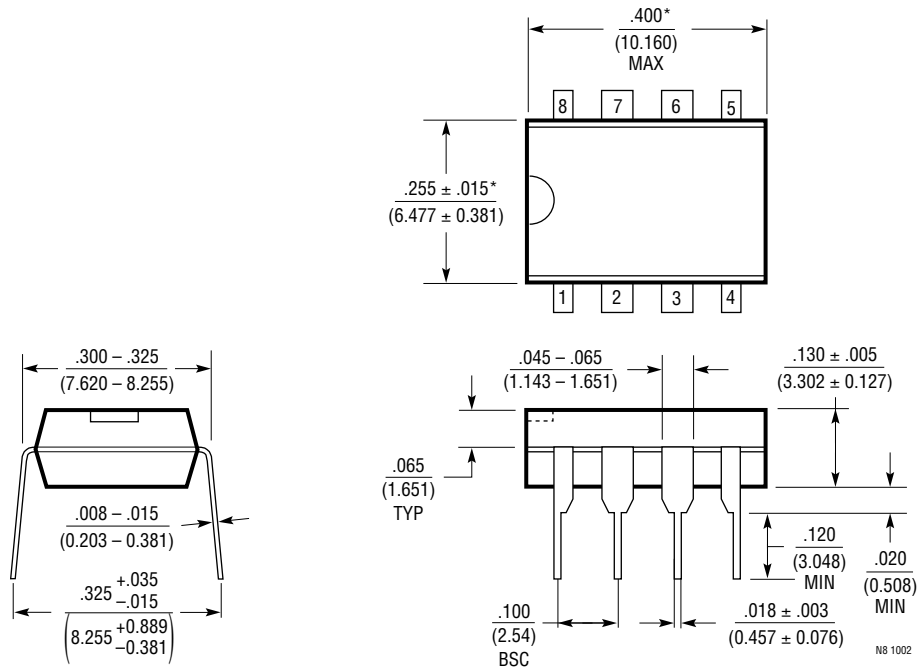
* LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

** FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS $\frac{.016 - .024}{(0.406 - 0.610)}$ H8(TO-5) 0.200 PCD 0204

OBSOLETE PACKAGE

PACKAGE DESCRIPTION

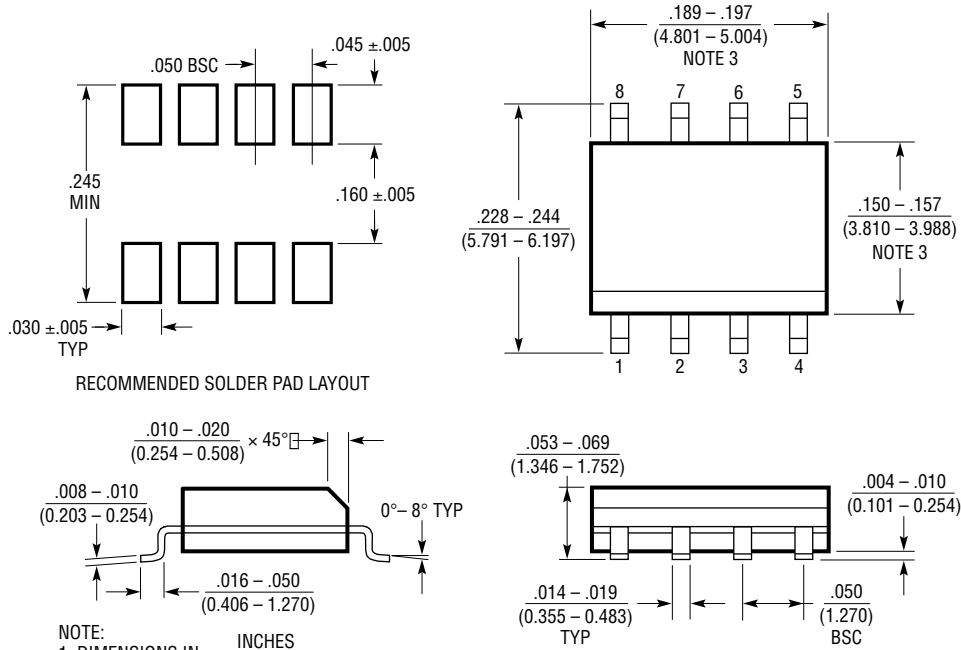
N8 Package
8-Lead PDIP (Narrow .300 Inch)
 (Reference LTC DWG # 05-08-1510)



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)

PACKAGE DESCRIPTION

S8 Package
8-Lead Plastic Small Outline (Narrow .150 Inch)
 (Reference LTC DWG # 05-08-1610)



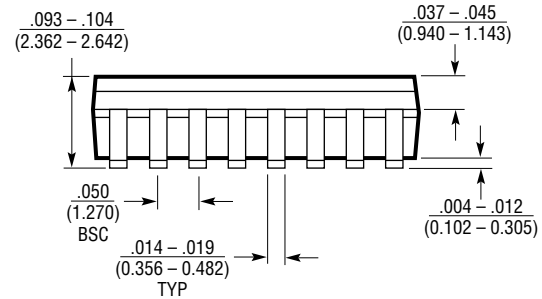
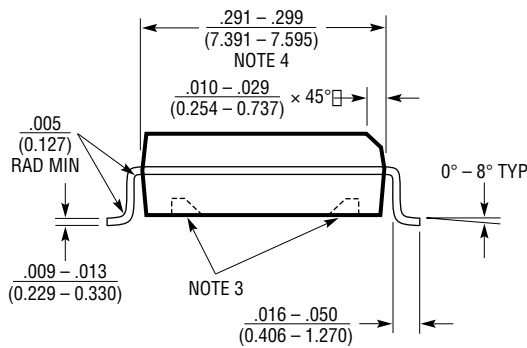
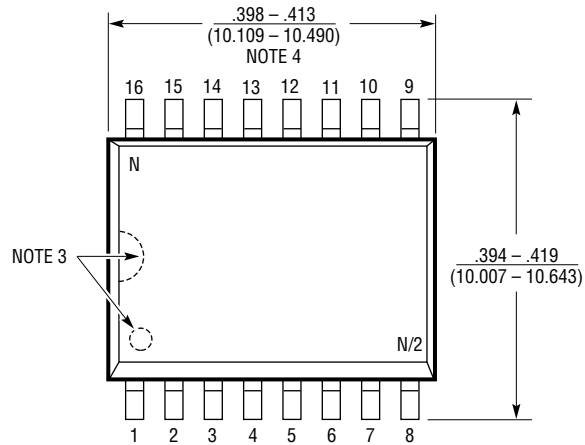
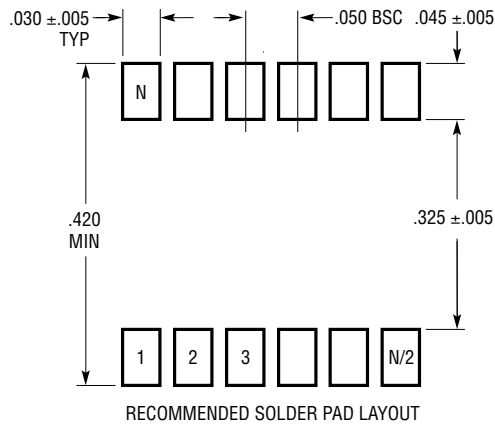
RECOMMENDED SOLDER PAD LAYOUT

- NOTE:
 1. DIMENSIONS IN $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
 2. DRAWING NOT TO SCALE
 3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
 MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED $.006''$ (0.15mm)

S08 0303

PACKAGE DESCRIPTION

SW Package 16-Lead Plastic Small Outline (Wide .300 Inch) (Reference LTC DWG # 05-08-1620)



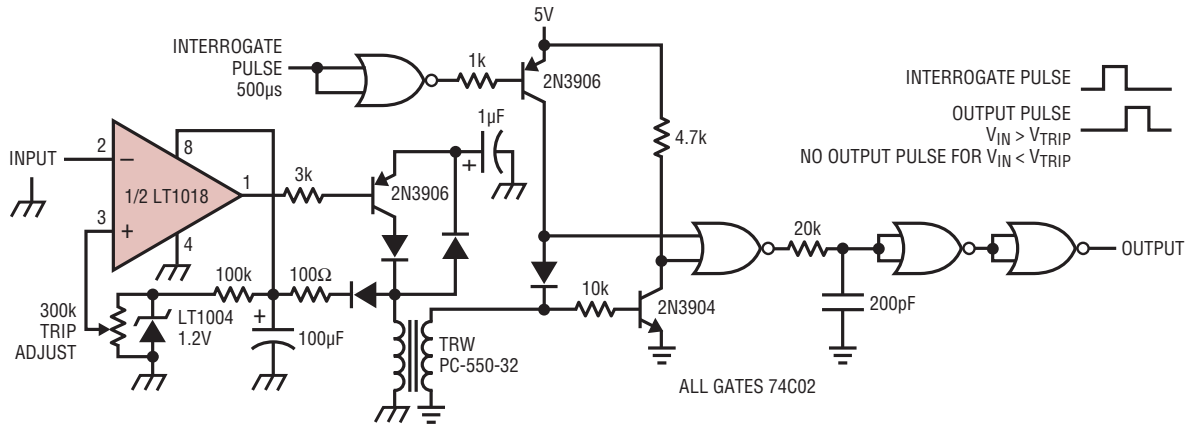
- NOTE:
1. DIMENSIONS IN $\frac{\text{INCHES}}{\text{(MILLIMETERS)}}$
 2. DRAWING NOT TO SCALE
 3. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS
 4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

S16 (WIDE) 0502

LT1017/LT1018

TYPICAL APPLICATION

Fully Isolated Limit Comparator



RELATED PARTS

| PART NUMBER | DESCRIPTION | COMMENTS |
|----------------|---|--|
| LT1011/LT1011A | Voltage Comparators | Improved LT111A, 0.5mV $V_{OS(MAX)}$, 25nA $I_{B(MAX)}$, 3nA $I_{OS(MAX)}$, 250ns $t_{PD(MAX)}$ |
| LT1020 | Micropower Regulator and Comparator | 40μA I_{SUPPLY} , 125mA I_{OUT} , 2.5V Reference Voltage |
| LTC1040 | Dual Micropower Comparator | 1.5μW (1Sample/Second), 0.5mV $V_{OS(MAX)}$, Rail-to-Rail Input |
| LT1120/LT1120A | Micropower Regulator with Comparator and Shutdown | 20μA I_{SUPPLY} , 125mA I_{OUT} , 2.5V Reference Voltage |
| LT319A | Dual Comparators | 0.5mV $V_{OS(MAX)}$, 25mA I_{OUT} , 80ns t_{PD} |
| LT1671 | Single Supply Ground Sensing Comparator | 450μA I_{SUPPLY} , 60ns t_{PD} , 0.8mV V_{OS} |
| LT1716 | Micropower, 44V, SOT-23 Ground Sensing Comparator | Input Common Mode Range Extends from -5V to 44V from Negative Supply |

10178ff