

## 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 $\mu$ A Supply Current (LT1017)  
110 $\mu$ 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

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## DESCRIPTION

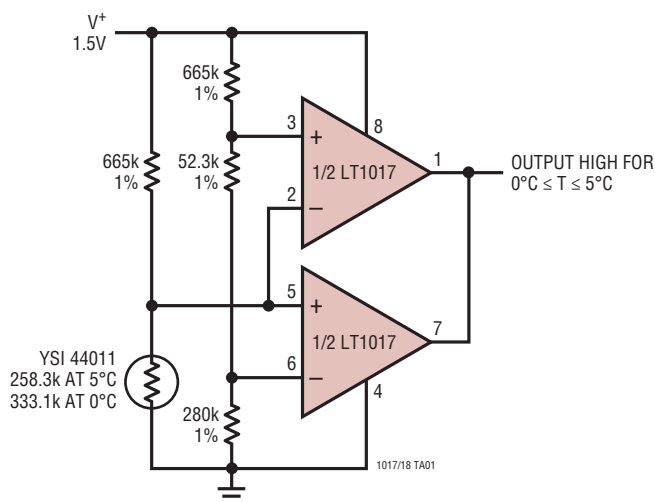
The LT<sup>®</sup>1017/LT1018 are general purpose micropower comparators. The LT1017 is optimized for lowest operating power while the LT1018 operates at higher power and higher speed. Both devices can operate from a single 1.1V cell up to 40V. The output stage includes a class "B" pull-up current source, 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.

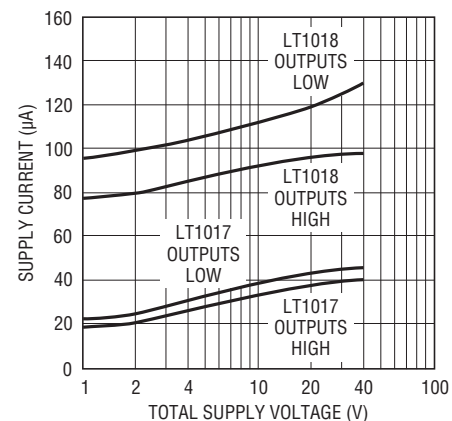
The LT1017/LT1018 are pin compatible with older dual comparators such as 393 type devices.

## TYPICAL APPLICATION

1.5V Powered Refrigerator Alarm



Supply Current

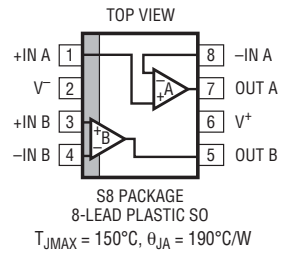
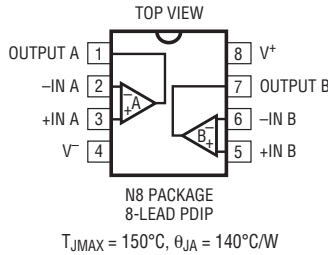
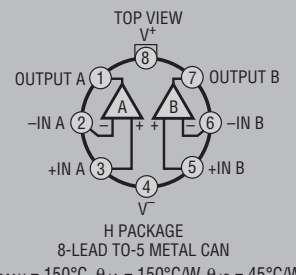
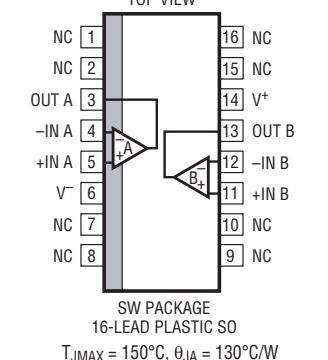


# LT1017/LT1018

## 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 <math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 190^{\circ}C/W</math></p>		 <p>N8 PACKAGE 8-LEAD PDIP <math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 140^{\circ}C/W</math></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 <math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 150^{\circ}C/W, \theta_{JC} = 45^{\circ}C/W</math> <b>OBsolete PACKAGE</b> Consider the 8-Lead Plastic Dip Package For Alternate Source</p>		 <p>SW PACKAGE 16-LEAD PLASTIC SO <math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 130^{\circ}C/W</math></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.

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**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		50	100		50	100	mV

## ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range of  $-55^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  for M grade parts,  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  for I grade parts and  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  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	$\mu\text{A}$	
		● 125°C	0.6	3		1.8	10	$\mu\text{A}$	
Supply Current	$V_S = 5\text{V}$	25°C	30	60		110	250	$\mu\text{A}$	
		● 125°C	40	80		110	250	$\mu\text{A}$	
	$V_S = 40\text{V}$	25°C	40	90		130	250	$\mu\text{A}$	
		● 125°C	55	100		140	270	$\mu\text{A}$	
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	

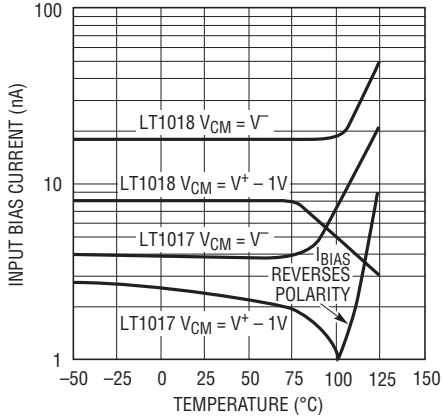
**Note 1:** Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

**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).

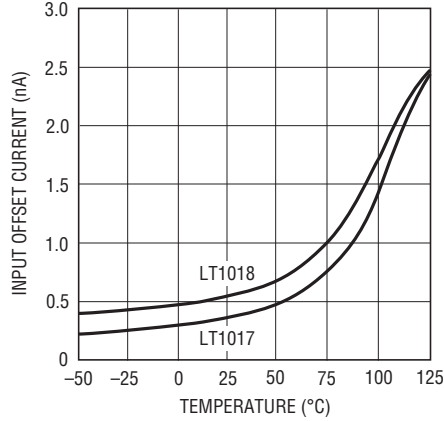
# TYPICAL PERFORMANCE CHARACTERISTICS

**Input Bias Current**



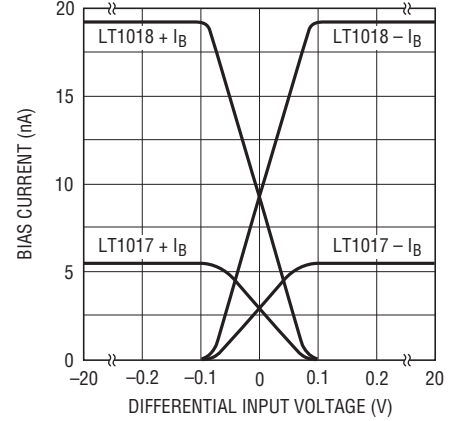
1017/18 G01

**Input Offset Current**



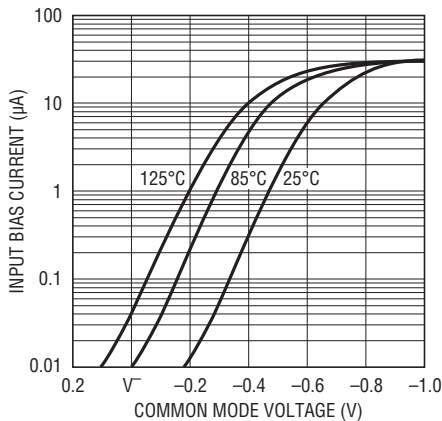
1017/18 G02

**Bias Current vs Differential Input**



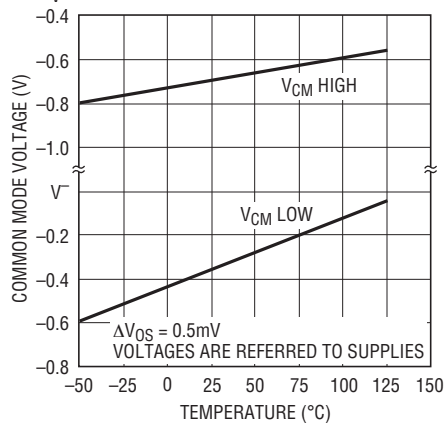
1017/18 G03

**Input Bias Current with Inputs Driven Below the Supply**



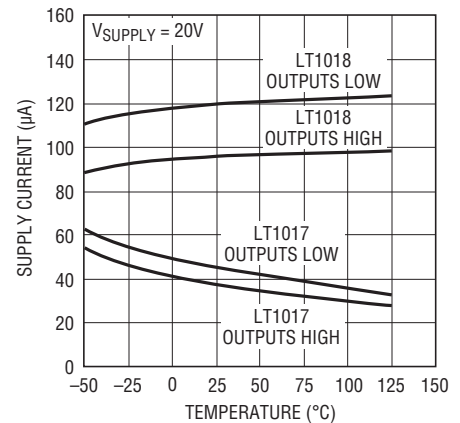
1017/18 G04

**Common Mode Limits**



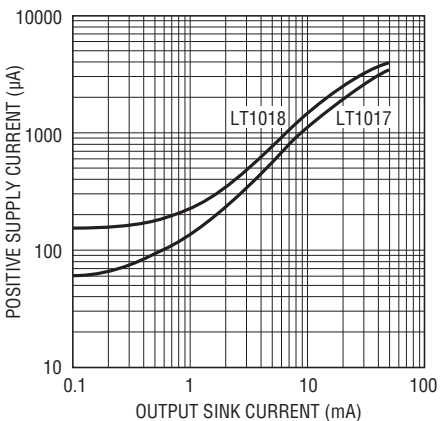
1017/18 G05

**Supply Current**



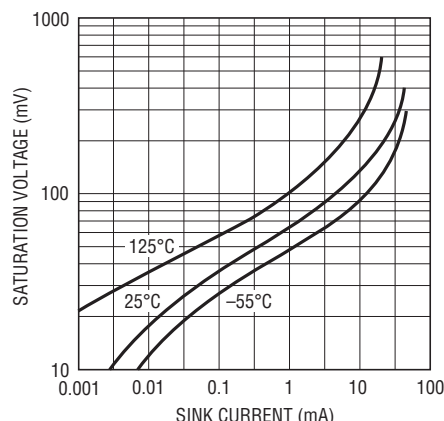
1017/18 G06

**Positive Supply Current**



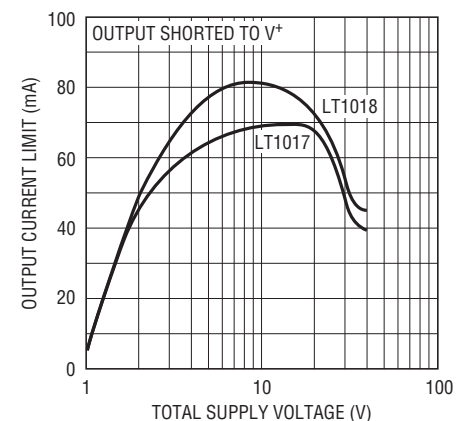
1017/18 G07

**NPN Output Saturation Voltage**



1017/18 G08

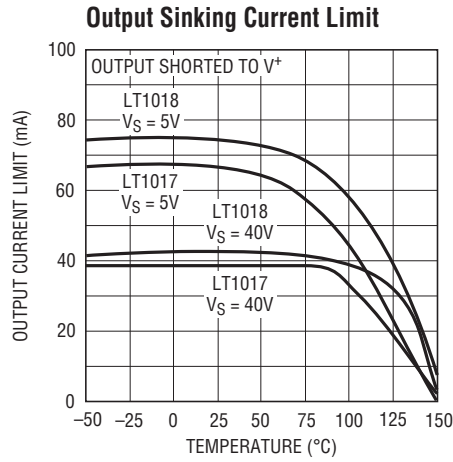
**Output Sinking Current Limit**



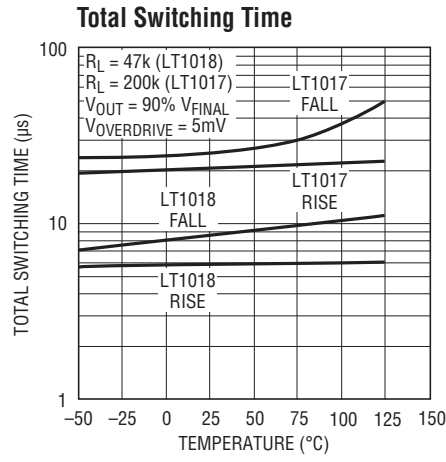
1017/18 G09

# LT1017/LT1018

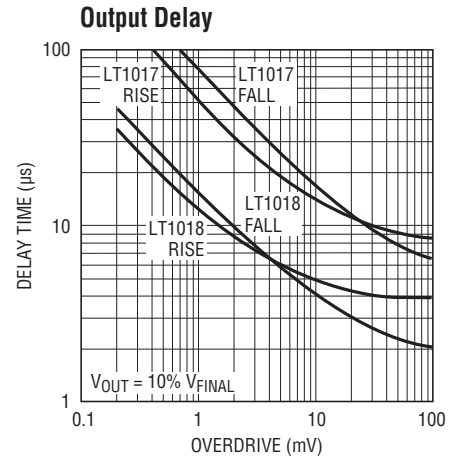
## TYPICAL PERFORMANCE CHARACTERISTICS



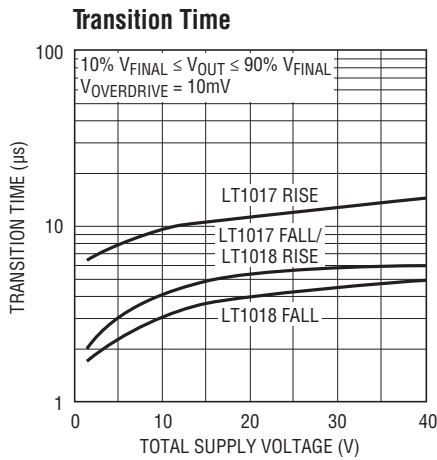
1017/18 G10



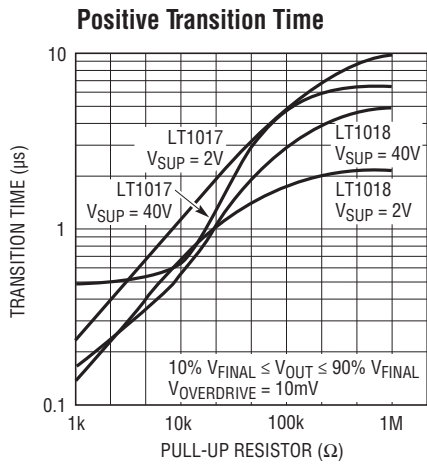
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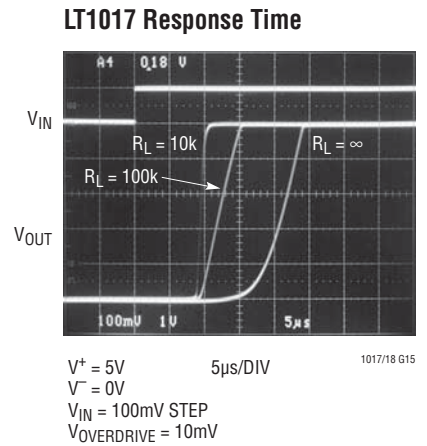
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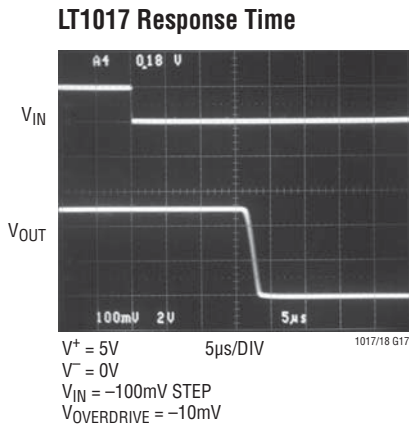
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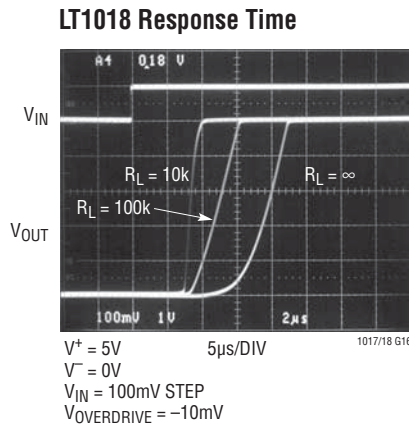
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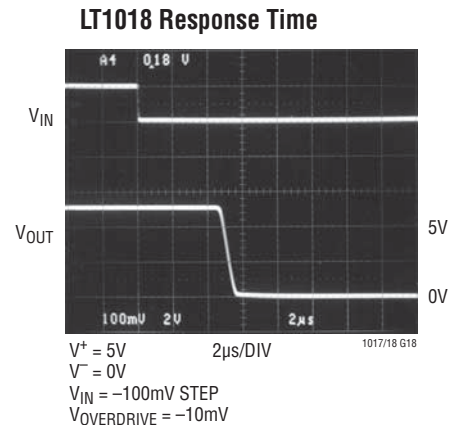
1017/18 G15



1017/18 G17



1017/18 G16

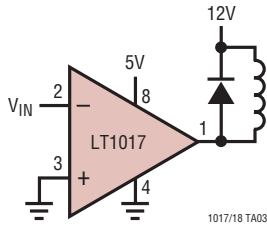


1017/18 G18

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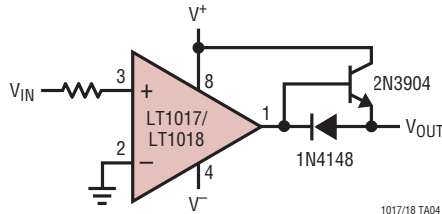
TYPICAL APPLICATIONS

Driving Relays



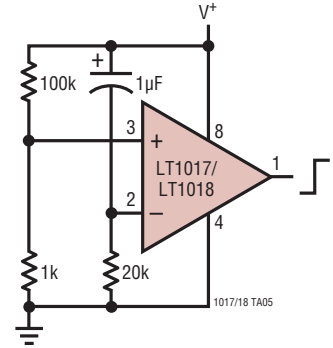
1017/18 TA03

Increasing Positive Output Current



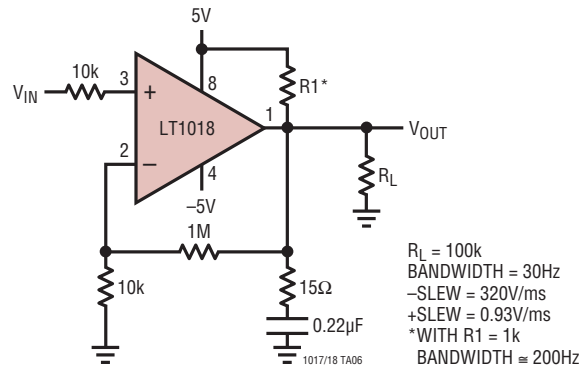
1017/18 TA04

Delay On Power Up



1017/18 TA05

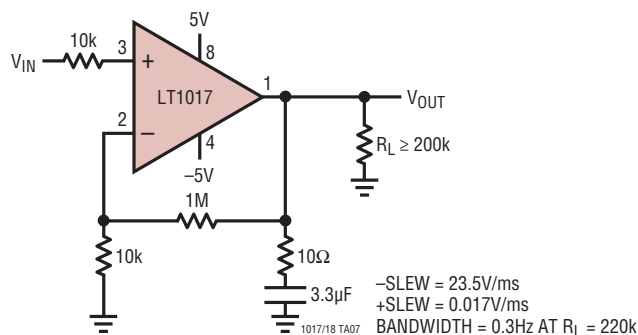
LT1018 Op Amp,  $A_V = 100$



$R_L = 100k$   
 BANDWIDTH = 30Hz  
 -SLEW = 320V/ms  
 +SLEW = 0.93V/ms  
 \*WITH  $R_1 = 1k$   
 BANDWIDTH = 200Hz

1017/18 TA06

LT1017 Op Amp,  $A_V = 100$

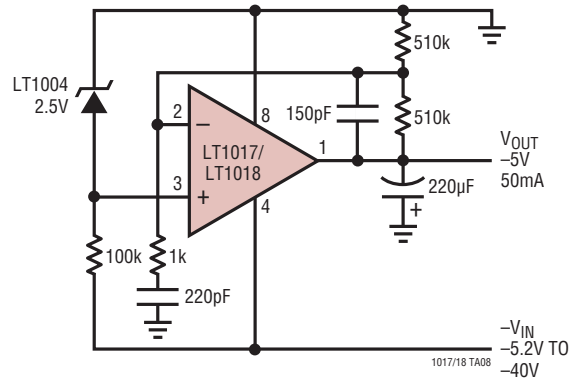


-SLEW = 23.5V/ms  
 +SLEW = 0.017V/ms  
 BANDWIDTH = 0.3Hz AT  $R_L = 220k$

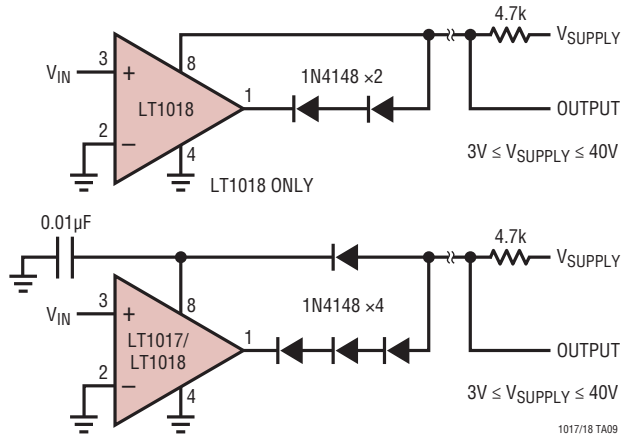
1017/18 TA07

## TYPICAL APPLICATIONS

### Negative Voltage Regulator



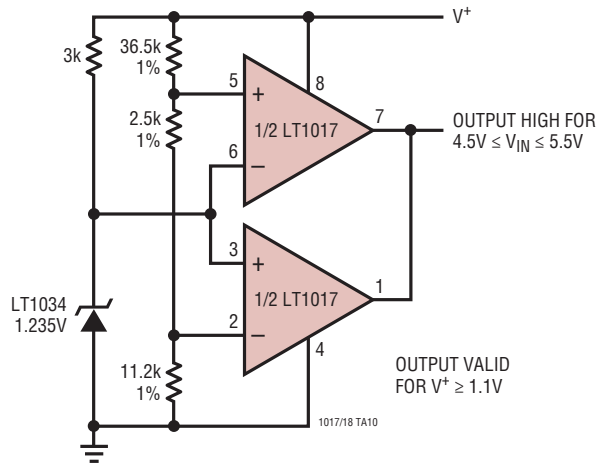
### 2-Wire Comparator



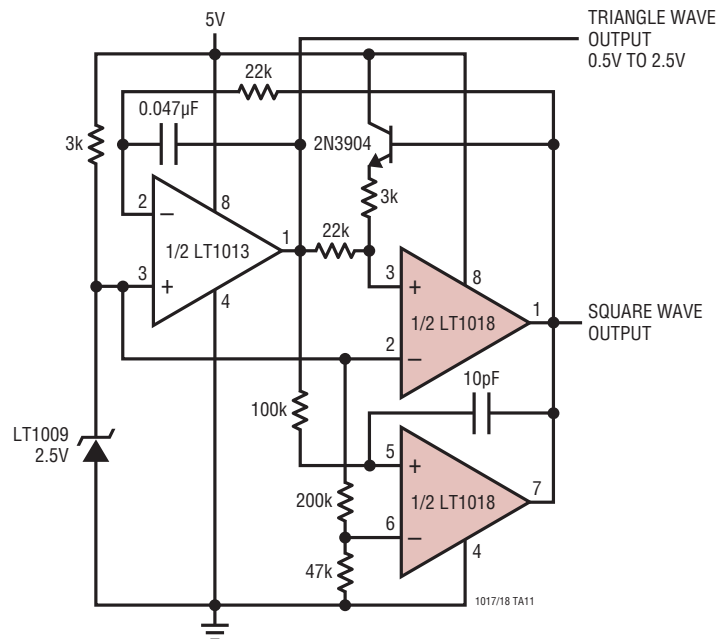


TYPICAL APPLICATIONS

5V Power Supply Monitor

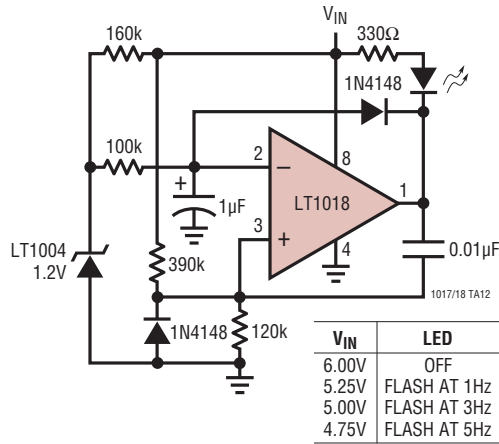


Precise Tri-Wave Generator

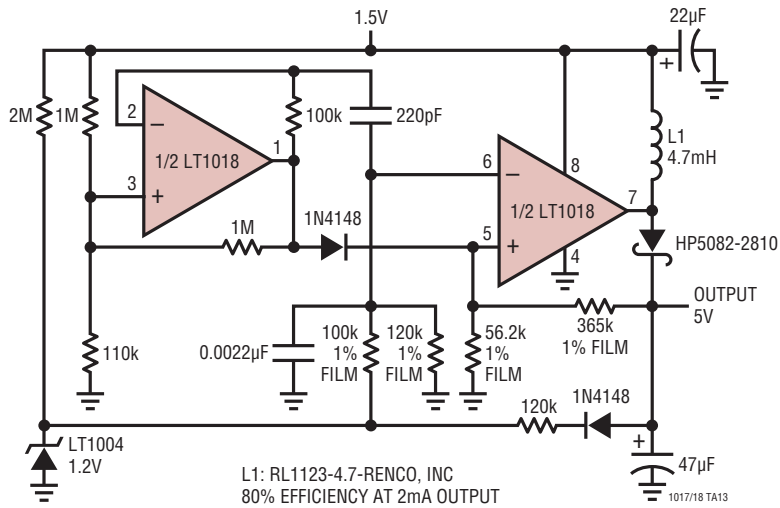


## TYPICAL APPLICATIONS

### Power Supply Monitor

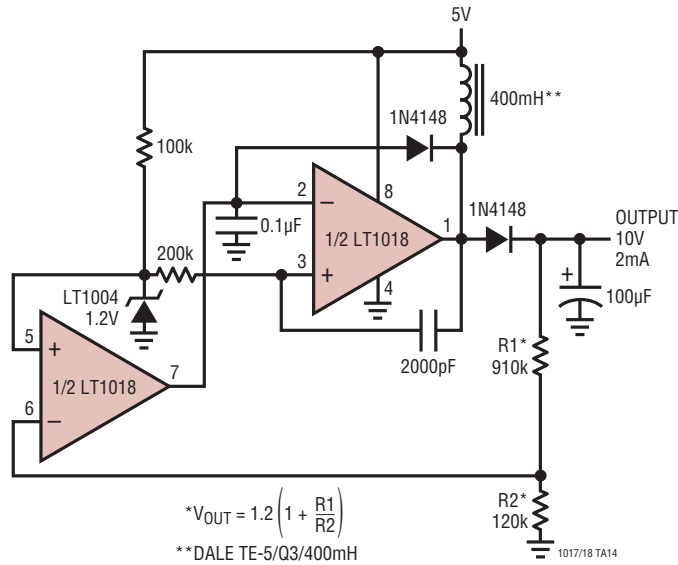


### 1.5V Input Flyback Regulator

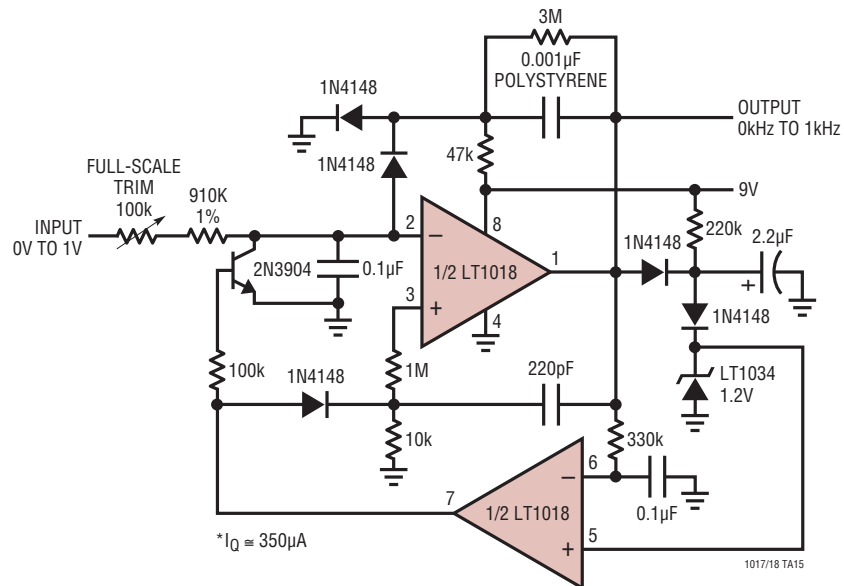


TYPICAL APPLICATIONS

Regulated Step-Up Converter

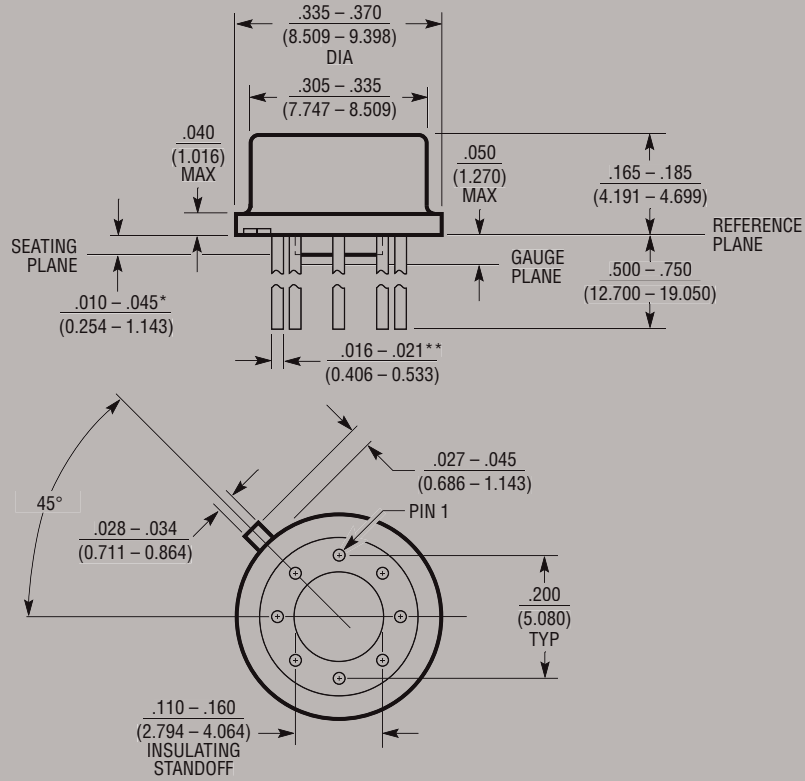


Low Power\* V-to-F Converter



**PACKAGE DESCRIPTION**

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



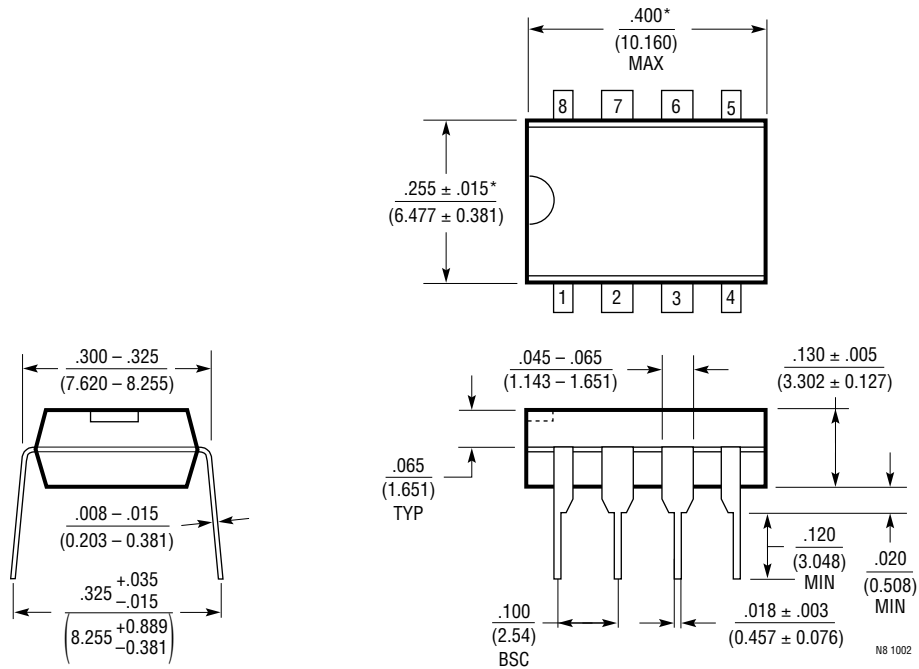
\*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

\*\*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**

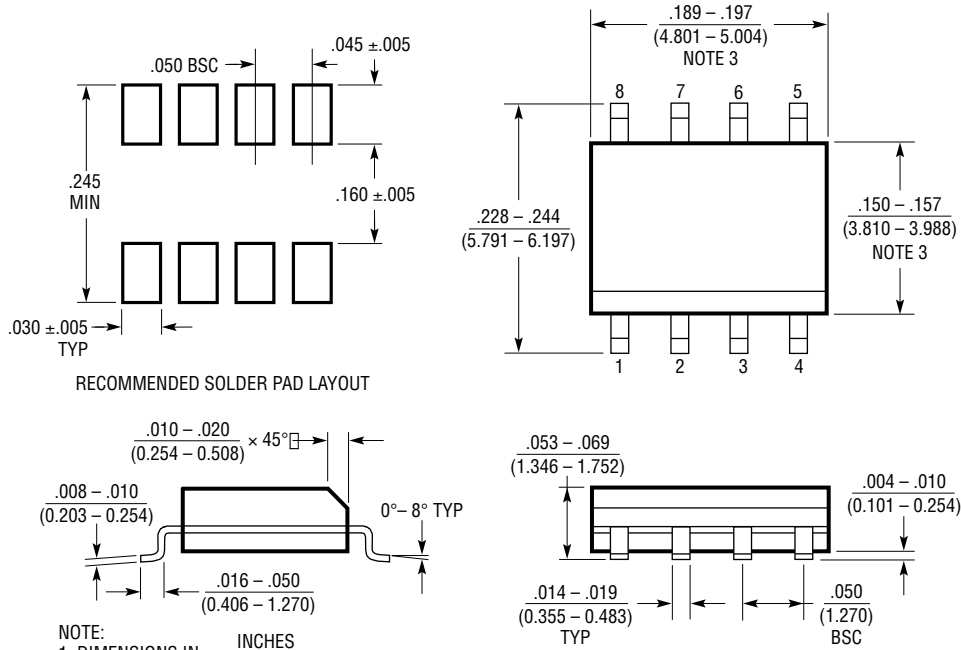
**N8 Package**  
**8-Lead PDIP (Narrow .300 Inch)**  
 (Reference LTC DWG # 05-08-1510)



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)

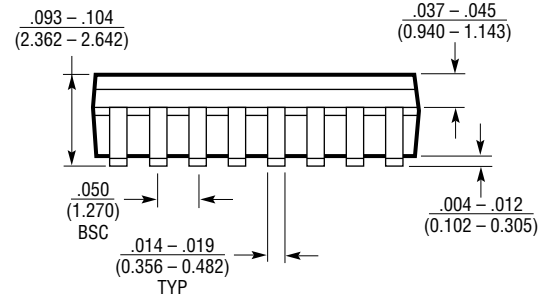
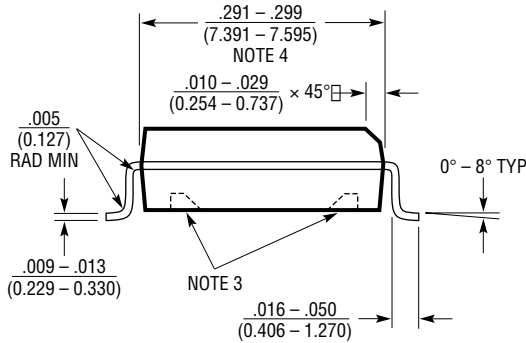
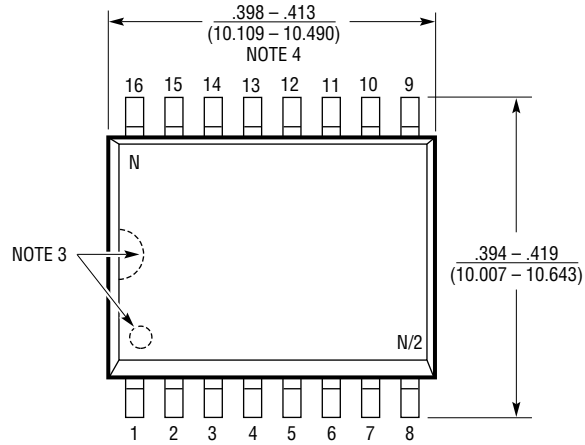
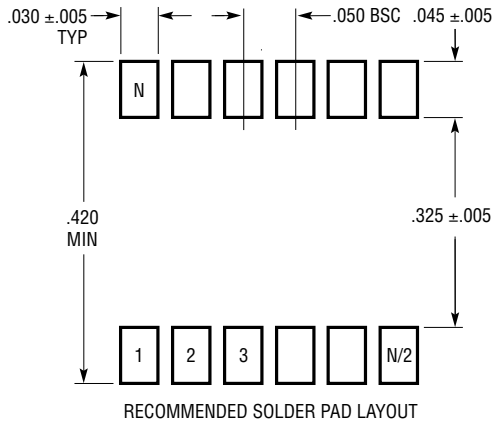


- NOTE:  
 1. DIMENSIONS IN  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$   
 2. DRAWING NOT TO SCALE  
 3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
 MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED  $.006''$  ( $0.15\text{mm}$ )

S08 0303

**PACKAGE DESCRIPTION**

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

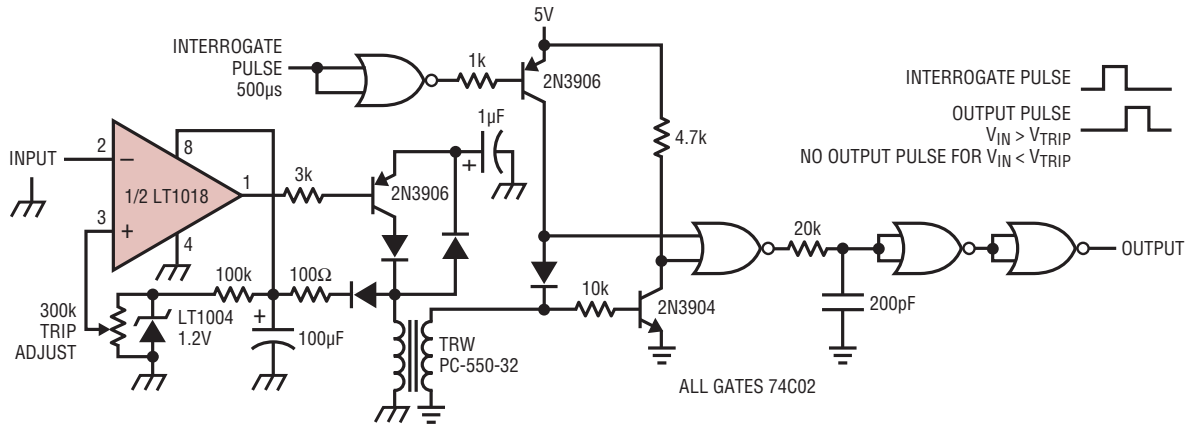


- NOTE:
1. DIMENSIONS IN  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
  2. DRAWING NOT TO SCALE
  3. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS
  4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH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

S16 (WIDE) 0502

## 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



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