

## 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

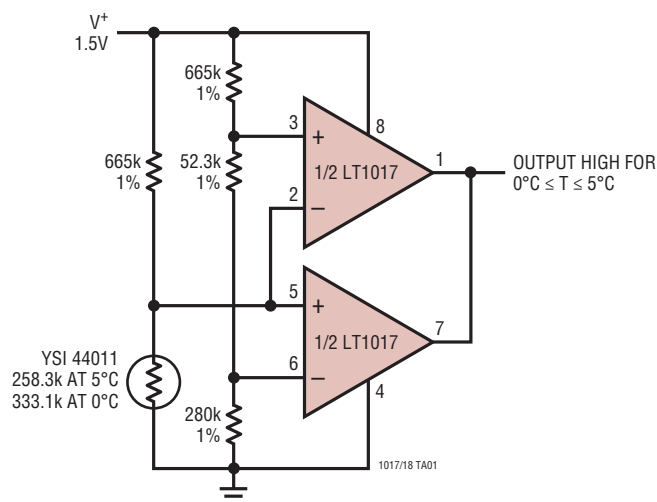
The LT<sup>®</sup>1017/LT1018 are general purpose micropower comparators. The LT1017 is optimized for lowest operating power while the LT1018 operates at higher power and higher speed. Both devices can operate from a single 1.1V cell up to 40V. The output stage includes a class "B" pull-up current source,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

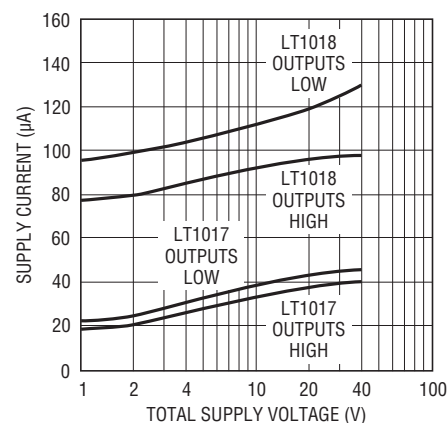
The LT1017/LT1018 are pin compatible with older dual comparators such as 393 type devices.

## TYPICAL APPLICATION

**1.5V Powered Refrigerator Alarm**



**Supply Current**



1017/18 TA02

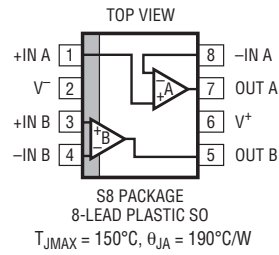
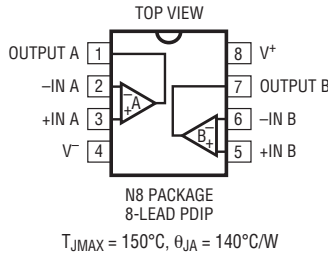
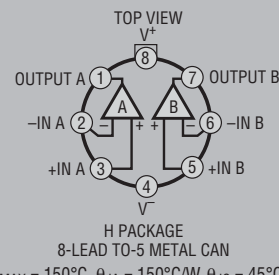
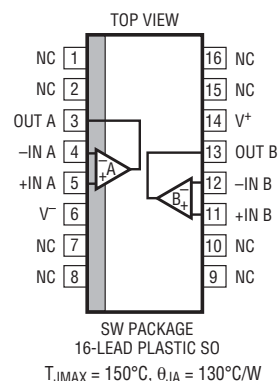
# LT1017/LT1018

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage ..... 40V  
 Differential Input Voltage..... 40V  
 Input Voltage..... -0.3V to 40V  
 Short-Circuit Duration ..... Indefinite  
 Storage Temperature Range..... -65°C to 150°C

Operating Temperature Range  
 LT1017M/LT1018M ..... -55°C to 125°C  
 LT1017C/LT1018C..... 0°C to 70°C  
 LT1017I/LT1018I ..... -40°C to 85°C  
 Lead Temperature (Soldering, 10 sec) ..... 300°C

## PACKAGE/ORDER INFORMATION

 <p>S8 PACKAGE 8-LEAD PLASTIC SO <math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 190^{\circ}C/W</math></p>		 <p>N8 PACKAGE 8-LEAD PDIP <math>T_{JMAX} = 150^{\circ}C</math>, <math>\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</math>, <math>\theta_{JA} = 150^{\circ}C/W</math>, <math>\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</math>, <math>\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		MIN	LT1017 TYP	MAX	MIN	LT1018 TYP	MAX	UNITS
Offset Voltage (Note 2)	$\pm 0.75V \leq V_S \leq \pm 20V$	25°C		0.4	1		0.4	1	mV
		●		0.5	1.4		0.5	1.4	mV
		125°C			5		0.7	1.5	mV
Bias Current	$\pm 0.75V \leq V_S \leq \pm 20V$	25°C		5	15		15	75	nA
		●		7	25		18	100	nA
		125°C		10	60			110	nA
Offset Current	$\pm 0.75V \leq V_S \leq \pm 20V$	25°C		0.4	2		1	8	nA
		●		0.5	3		1.6	12	nA
		125°C			20			20	nA
Common Mode Rejection Ratio	$V_S = \pm 20V, -20V \leq V_{CM} \leq 19.1V$	25°C	105	115		105	115		dB
		●	100	115		100	115		dB
		125°C	82	100		95	110		dB
Power Supply Rejection Ratio	$\pm 0.75V \leq V_S \leq \pm 20V$	25°C	96	110		96	110		dB
		●	95	105		95	105		dB
		125°C	82			86	100		dB
Gain	No Load, $V_{OUT} = \pm 19.9V$ (Note 3)	25°C	110	115		110	125		dB
		●	105	115		105	120		dB
		125°C	100			100			dB
	$R_L = 4k, V_{OUT} = \pm 19V$	25°C	100	110		100	110		dB
		●	94			94			dB
Output Sink Current	$V^+ = 4.5V, V^- = 0V$ Overdrive > 30mV	25°C	30	65		35	70		mA
		●	25	50		25	50		mA
		125°C	10	20		10	30		mA
Output Source Current	$V^+ = 40V, V^- = 0V$ $V_{IN} = 5mV, V_{OUT} = 0.4V$	25°C	30	75		75	250		μA
		●	25	70		50	220		μA
		125°C	25	75		50	200		μA
	$V^+ = 1.2V, V^- = 0V$ $V_{IN} = 5mV, V_{OUT} = 0.4V$	25°C	25	35		70	140		μA
		●	15	20		45	120		μA
		125°C	25	40		40	110		μA
Negative Output Saturation	$I_{OUT} = 0mA$ = 0.1mA = 1mA = 10mA = 30mA	$V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$	25°C	5	20	5	15		mV
			25°C	35	60	35	60		mV
			25°C	60	120	60	120		mV
			25°C	120	200	120	250		mV
			25°C	350	600	350	700		mV
	$I_{OUT} = 0mA$ = 0.1mA = 1mA = 10mA = 30mA	$V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$	●	5	20	8	20		mV
			●	40	75	35	70		mV
			●	75	150	70	150		mV
			●	150	300	150	300		mV
			●	600	900	500	900		mV
	$I_{OUT} = 0mA$ = 0.1mA = 1mA = 10mA = 30mA	$V^+ = 4.5V, V^- = 0V$ $V_{IN} = -10mV$	125°C	25	50	10	40		mV
			125°C	60	100	60	100		mV
			125°C	100	200	110	200		mV
		125°C	300	600	300	400		mV	
		125°C			900			mV	
Positive Output Saturation	$I_{OUT} = 0\mu A$ = 10μA = 0μA = 10μA = 0μA = 10μA	25°C	40	80	35	80		mV	
		25°C	175	250	175	250		mV	
		●	45	90	45	90		mV	
		●	190	300	190	300		mV	
		125°C	50	100	50	100		mV	
		125°C		300		300		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	$V_S = 5\text{V}$ , $V_{OUT} = 40\text{V}$ $V_{IN} \geq 100\text{mV}$	$25^{\circ}\text{C}$		0.5	3		1	8	$\mu\text{A}$
		● $125^{\circ}\text{C}$		0.6	3		1.8	10	$\mu\text{A}$
					5			15	$\mu\text{A}$
Supply Current	$V_S = 5\text{V}$	$25^{\circ}\text{C}$		30	60		110	250	$\mu\text{A}$
		● $125^{\circ}\text{C}$		40	80		110	250	$\mu\text{A}$
					80			300	$\mu\text{A}$
	$V_S = 40\text{V}$	$25^{\circ}\text{C}$		40	90		130	250	$\mu\text{A}$
		● $125^{\circ}\text{C}$		55	100		140	270	$\mu\text{A}$
					100			300	$\mu\text{A}$
Minimum Operating Voltage	$I_{OUT} = 1\text{mA}$	$25^{\circ}\text{C}$			1.15			1.2	V
		● $125^{\circ}\text{C}$			1.15			1.2	V
					1.15			1.2	V

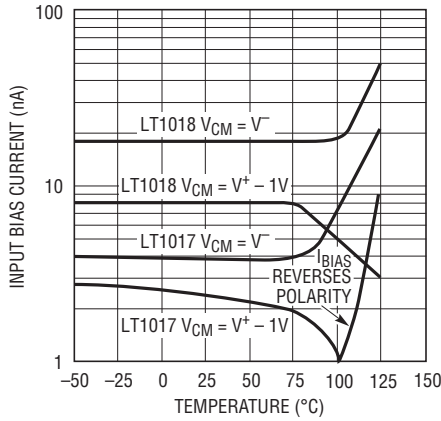
**Note 1:** Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

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

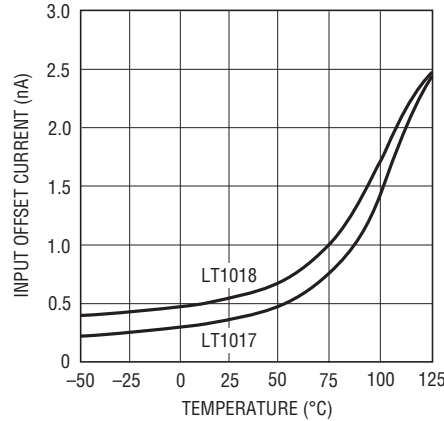
**Note 3:** No load gain is guaranteed but not tested (LT1017 only).

# TYPICAL PERFORMANCE CHARACTERISTICS

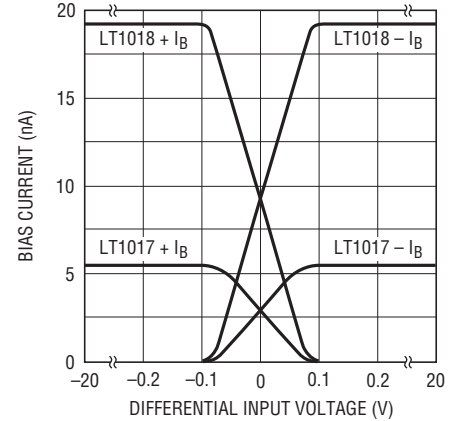
Input Bias Current



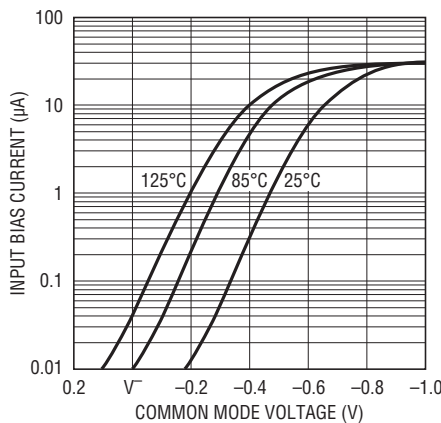
Input Offset Current



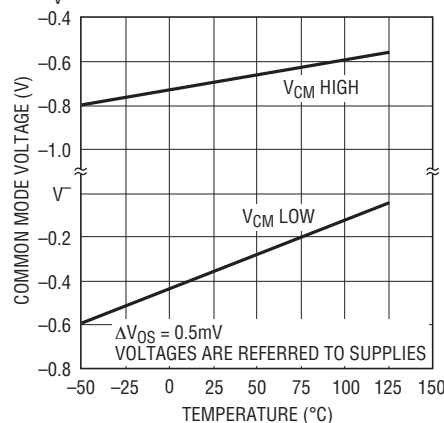
Bias Current vs Differential Input



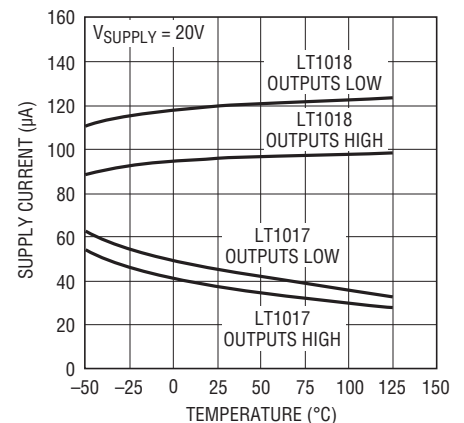
Input Bias Current with Inputs Driven Below the Supply



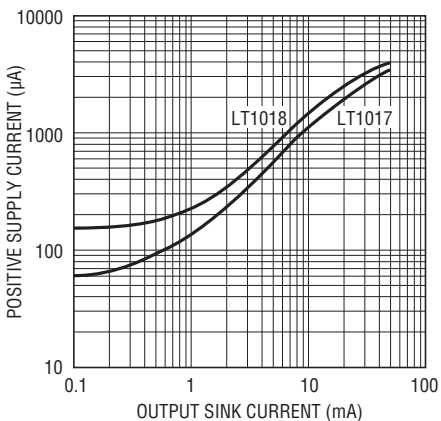
Common Mode Limits



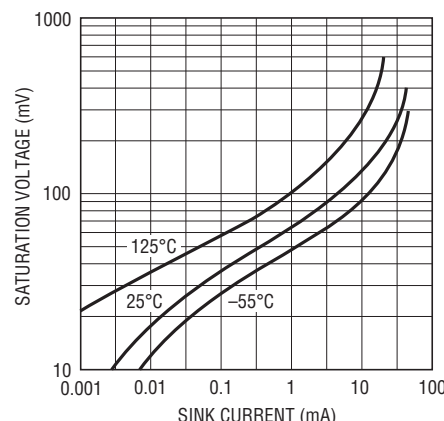
Supply Current



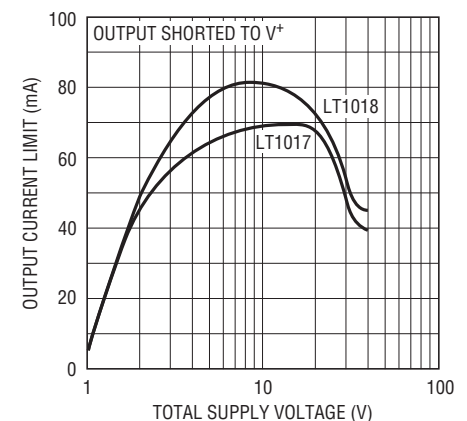
Positive Supply Current



NPN Output Saturation Voltage



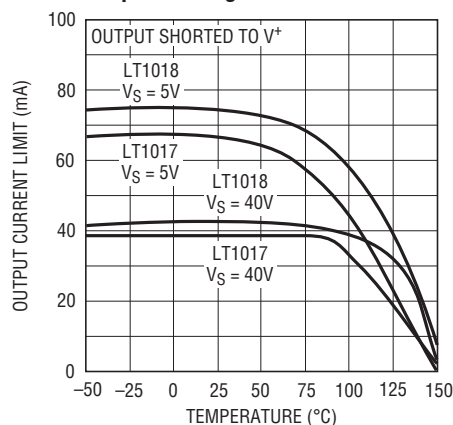
Output Sinking Current Limit



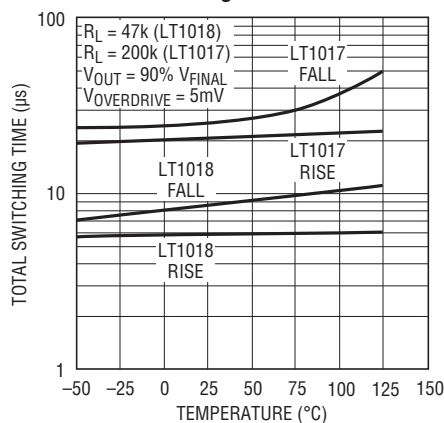
# LT1017/LT1018

## TYPICAL PERFORMANCE CHARACTERISTICS

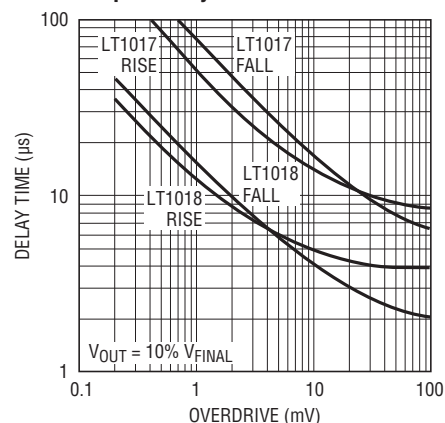
**Output Sinking Current Limit**



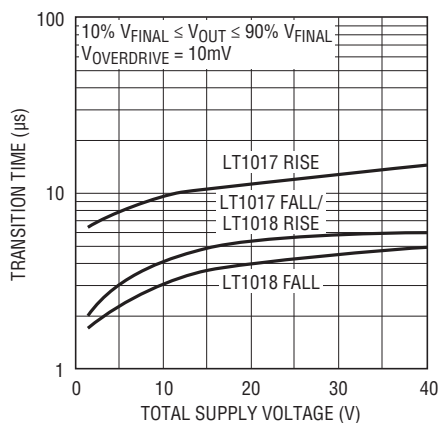
**Total Switching Time**



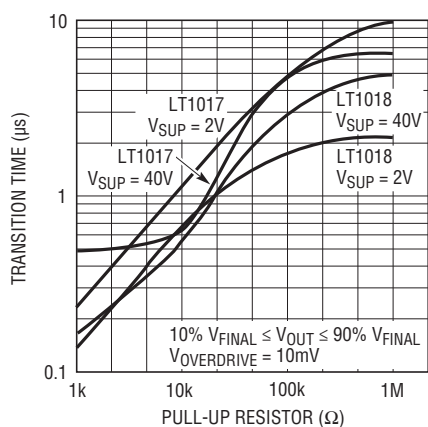
**Output Delay**



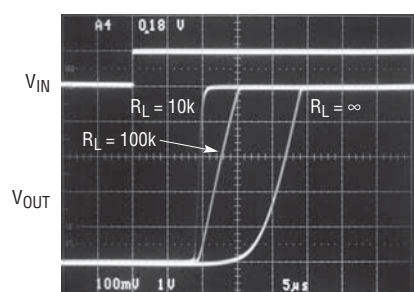
**Transition Time**



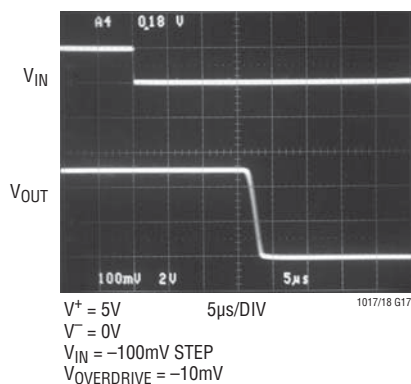
**Positive Transition Time**



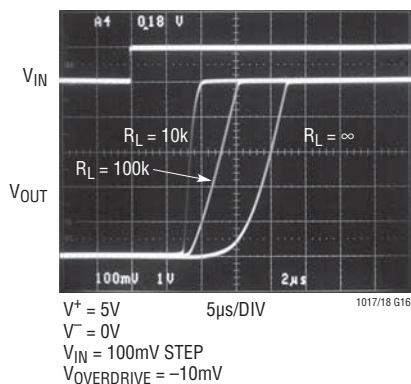
**LT1017 Response Time**



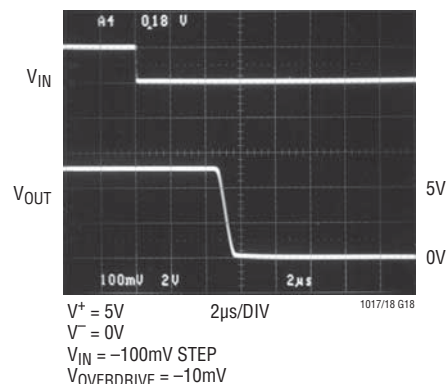
**LT1017 Response Time**



**LT1018 Response Time**

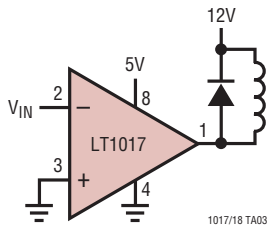


**LT1018 Response Time**

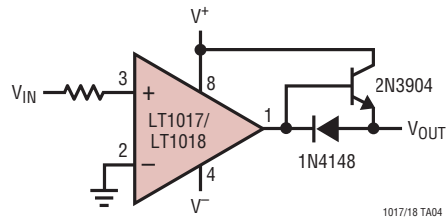


## TYPICAL APPLICATIONS

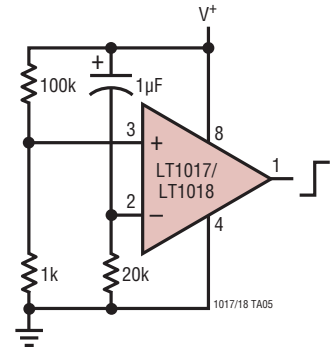
Driving Relays



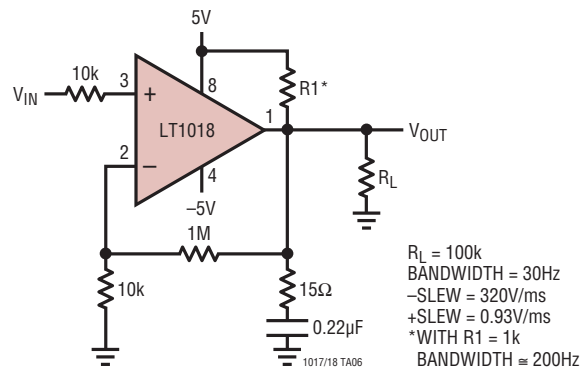
Increasing Positive Output Current



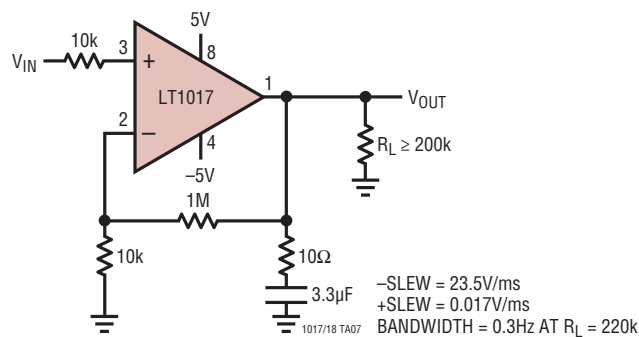
Delay On Power Up



LT1018 Op Amp,  $A_V = 100$

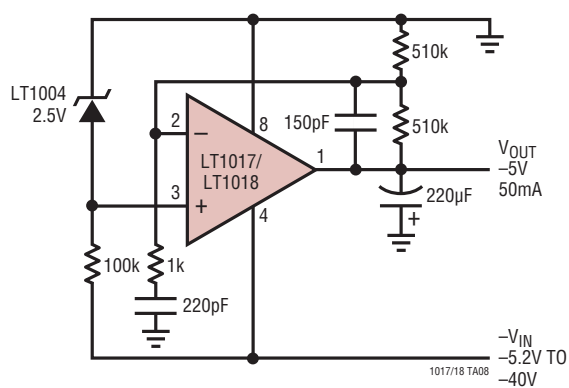


LT1017 Op Amp,  $A_V = 100$

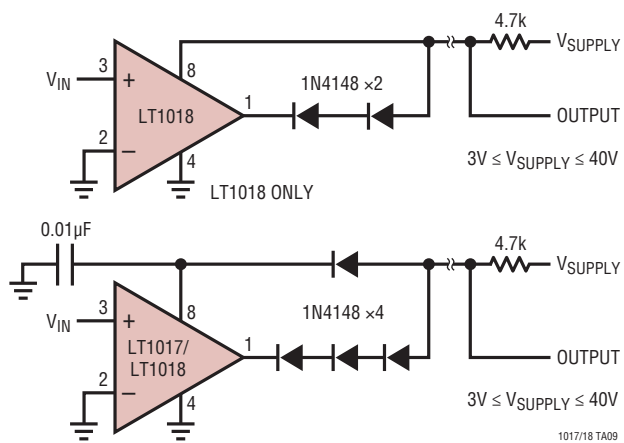


## TYPICAL APPLICATIONS

### Negative Voltage Regulator



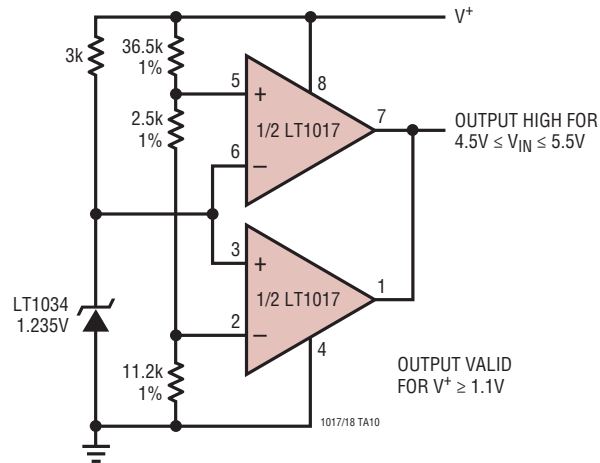
### 2-Wire Comparator



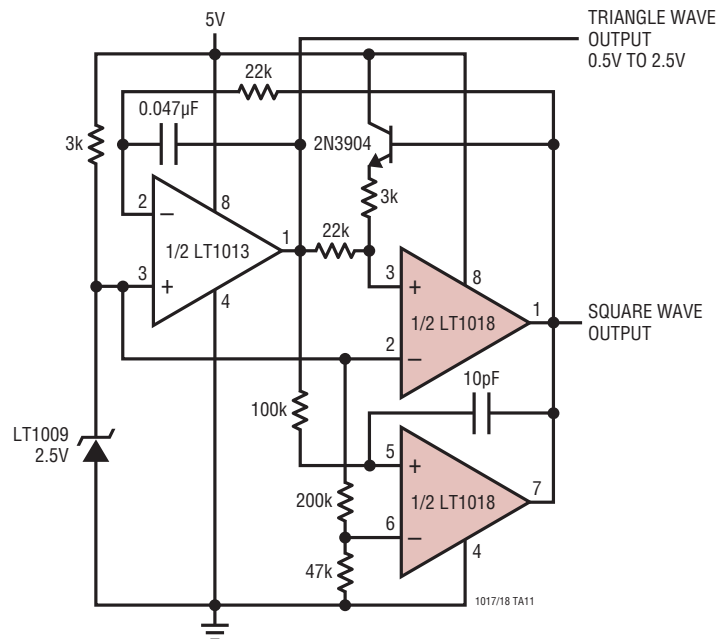


## TYPICAL APPLICATIONS

5V Power Supply Monitor



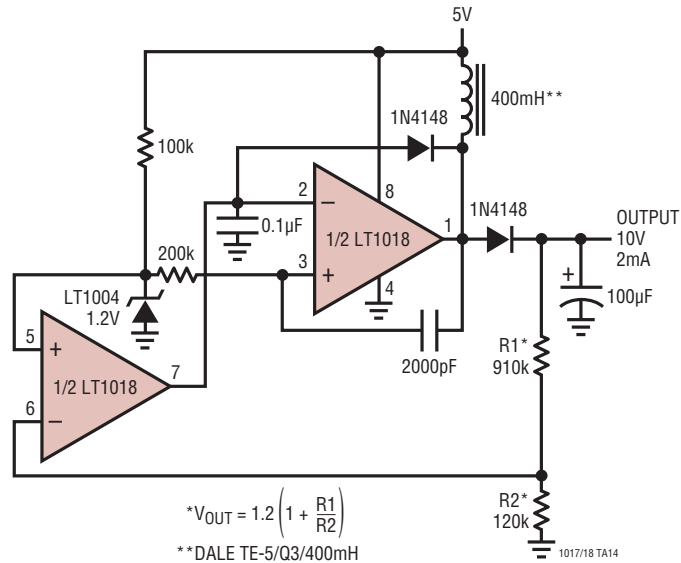
Precise Tri-Wave Generator



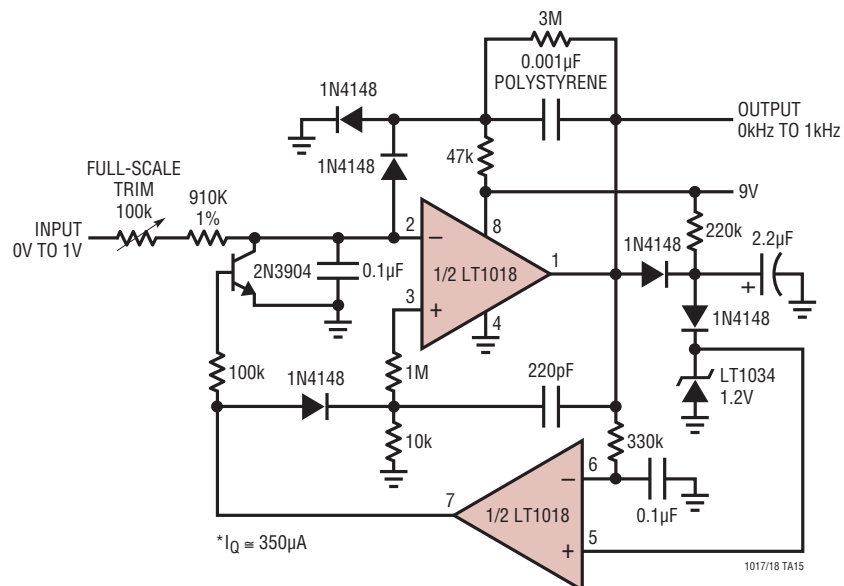
$V_{IN}$	LED
6.00V	OFF
5.25V	FLASH AT 1Hz
5.00V	FLASH AT 3Hz
4.75V	FLASH AT 5Hz

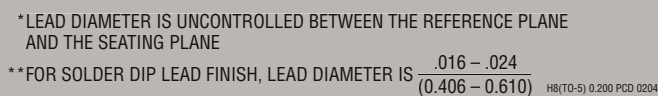
## TYPICAL APPLICATIONS

### Regulated Step-Up Converter



### Low Power\* V-to-F Converter

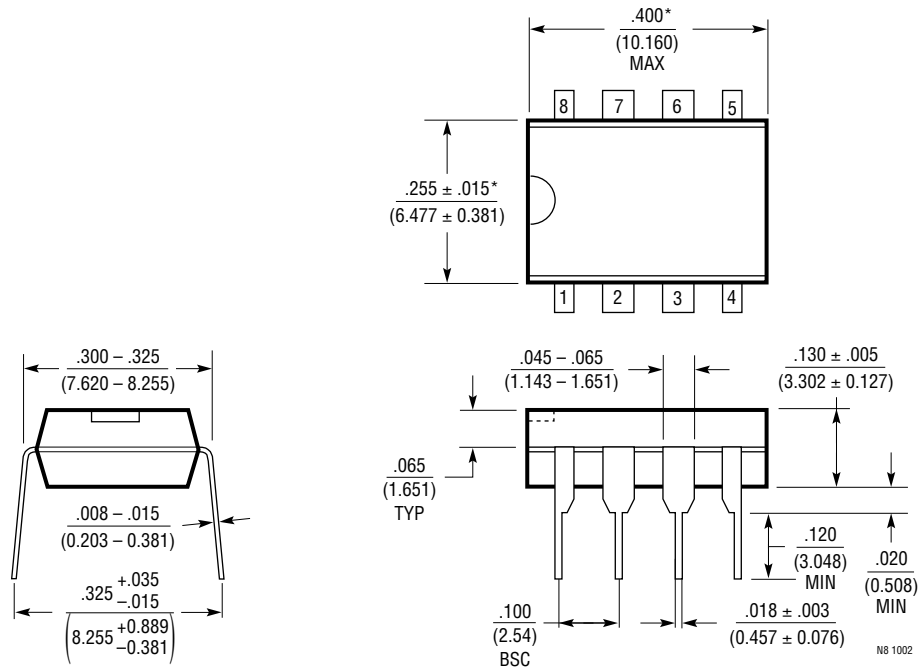




## OBSOLETE PACKAGE

## PACKAGE DESCRIPTION

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

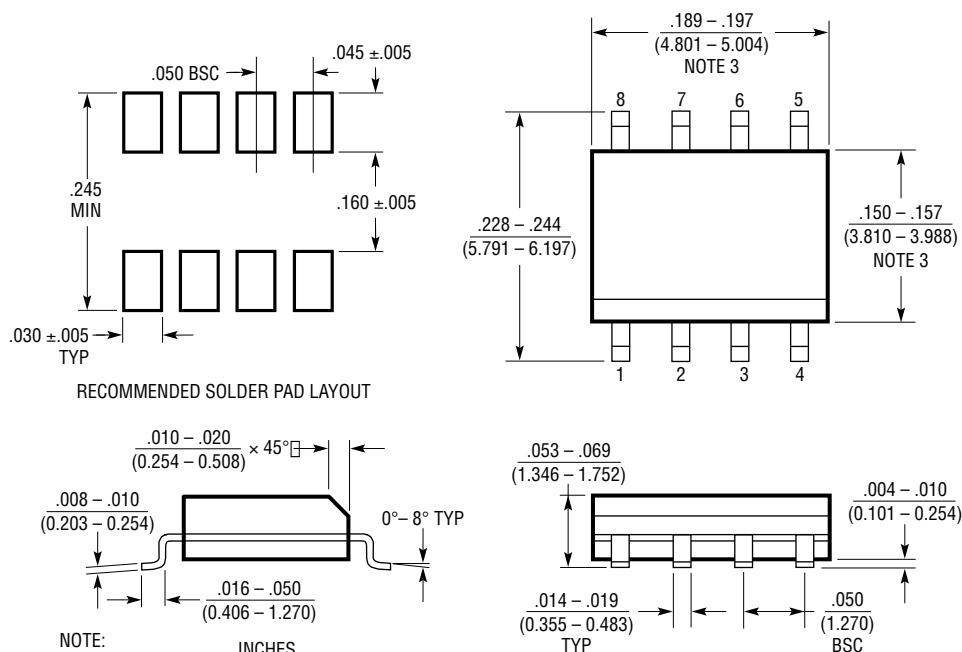


NOTE:  
 1. DIMENSIONS ARE  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$

\*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)

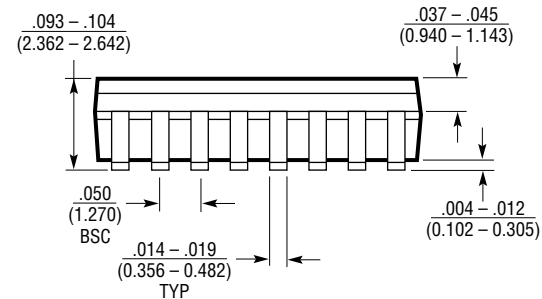
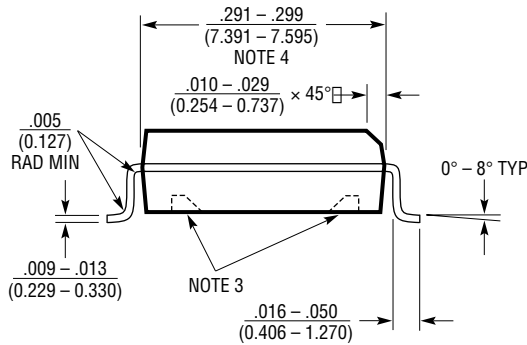
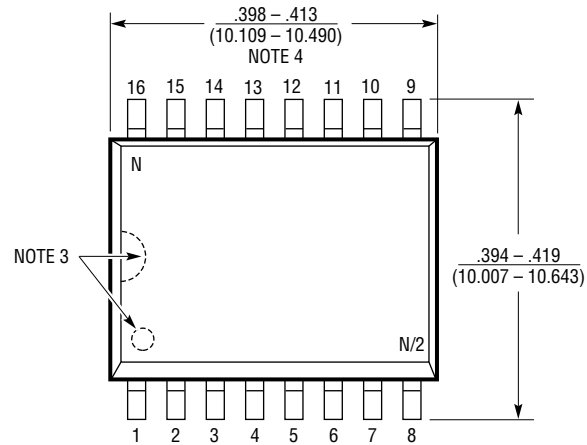
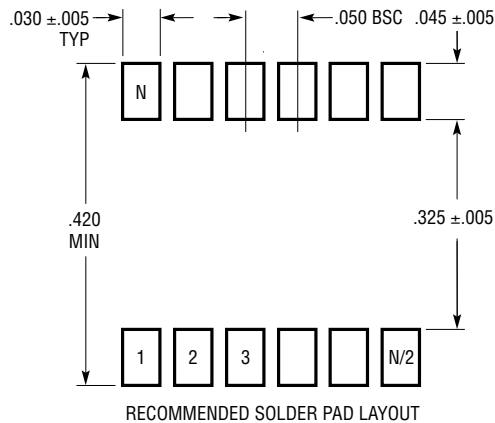


- NOTE:
1. DIMENSIONS IN  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
  2. DRAWING NOT TO SCALE
  3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

S08 0303

# PACKAGE DESCRIPTION

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

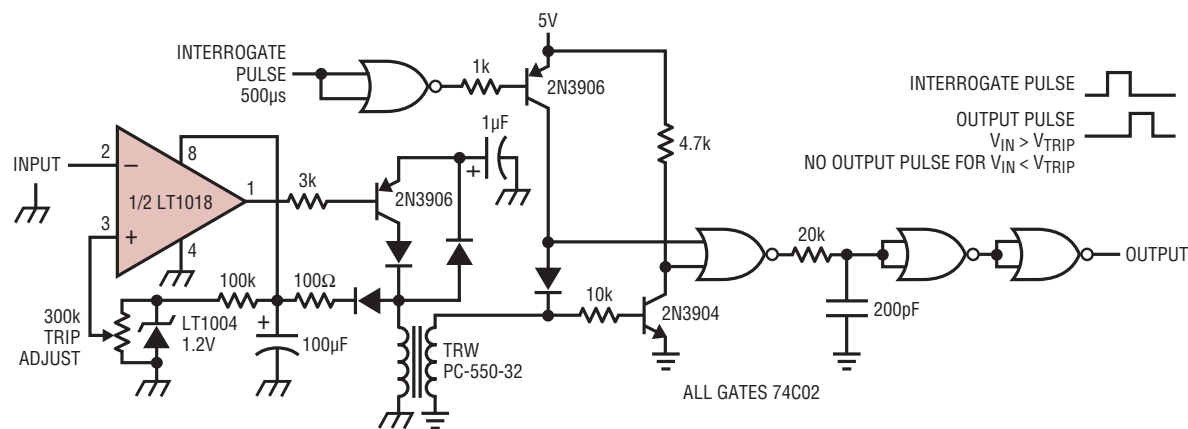


- NOTE:
1. DIMENSIONS IN INCHES (MILLIMETERS)
  2. DRAWING NOT TO SCALE
  3. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS
  4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD 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