

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

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DESCRIPTION

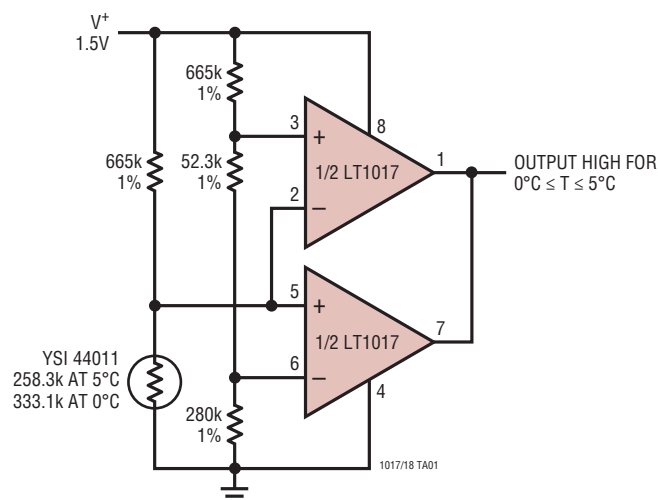
The LT[®]1017/LT1018 are general purpose micropower comparators. The LT1017 is optimized for lowest operating power while the LT1018 operates at higher power and higher speed. Both devices can operate from a single 1.1V cell up to 40V. The output stage includes a class "B" pull-up current source, eliminating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

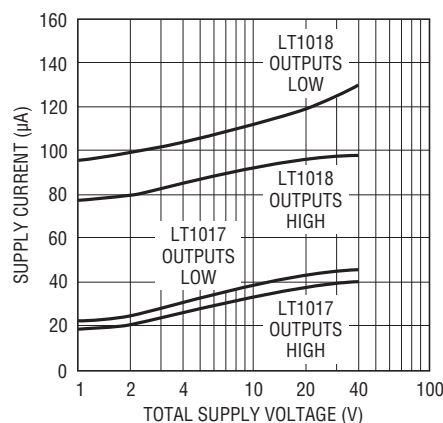
The LT1017/LT1018 are pin compatible with older dual comparators such as 393 type devices.

TYPICAL APPLICATION

1.5V Powered Refrigerator Alarm



Supply Current



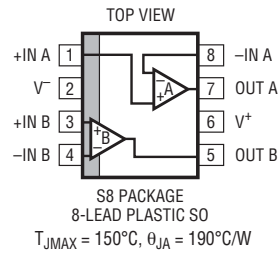
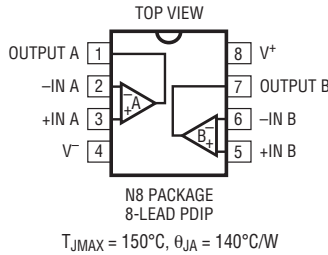
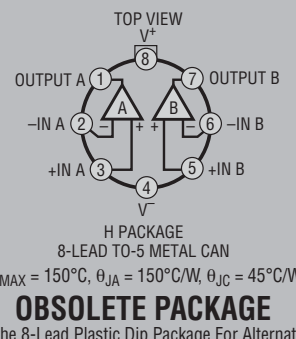
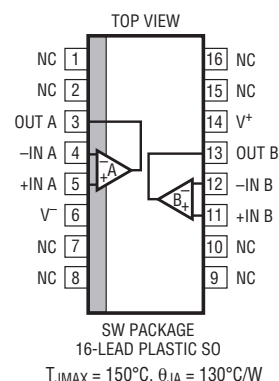
LT1017/LT1018

ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage 40V
 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

 S8 PACKAGE 8-LEAD PLASTIC SO $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 190^{\circ}\text{C/W}$		 N8 PACKAGE 8-LEAD PDIP $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 140^{\circ}\text{C/W}$	
ORDER PART NUMBER	S8 PART MARKING	ORDER PART NUMBER	PART MARKING
LT1017CS8 LT1017IS8 LT1018CS8 LT1018IS8	1017 1017I 1018 1018I	LT1017CN8 LT1017IN8 LT1018CN8	
 H PACKAGE 8-LEAD TO-5 METAL CAN $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 150^{\circ}\text{C/W}$, $\theta_{JC} = 45^{\circ}\text{C/W}$ OBSOLETE PACKAGE Consider the 8-Lead Plastic Dip Package For Alternate Source		 SW PACKAGE 16-LEAD PLASTIC SO $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 130^{\circ}\text{C/W}$	
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
		●		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	$I_{OUT} = 0\mu A$ $= 10\mu A$ $= 0\mu A$ $= 10\mu A$ $= 0\mu A$ $= 10\mu A$	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
		125°C							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	$V_S = 5\text{V}$, $V_{OUT} = 40\text{V}$ $V_{IN} \geq 100\text{mV}$	25°C		0.5	3		1	8	μA
		● 125°C		0.6	3		1.8	10	μA
					5			15	μA
Supply Current	$V_S = 5\text{V}$	25°C		30	60		110	250	μA
		● 125°C		40	80		110	250	μA
					80			300	μA
	$V_S = 40\text{V}$	25°C		40	90		130	250	μA
		● 125°C		55	100		140	270	μA
					100			300	μA
Minimum Operating Voltage	$I_{OUT} = 1\text{mA}$	25°C			1.15			1.2	V
		● 125°C			1.15			1.2	V
					1.15			1.2	V

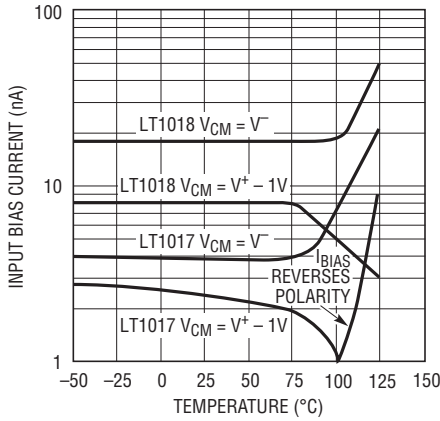
Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

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).

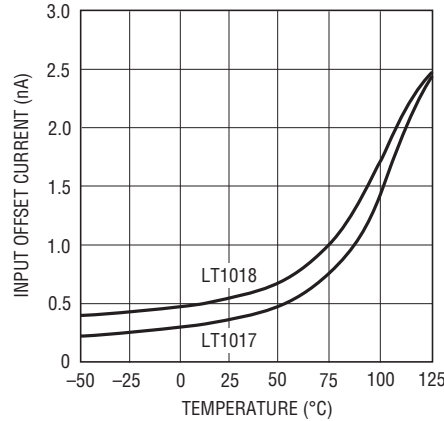
TYPICAL PERFORMANCE CHARACTERISTICS

Input Bias Current



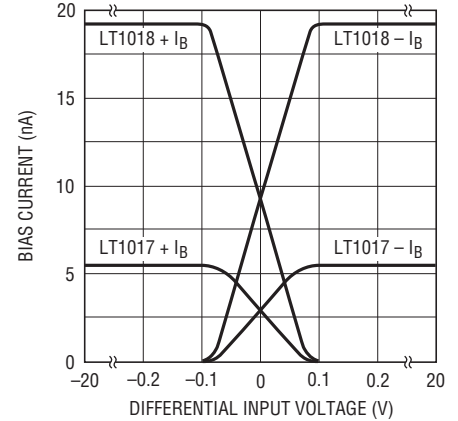
1017/18 G01

Input Offset Current



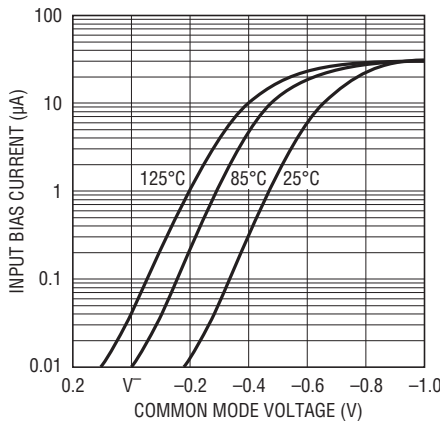
1017/18 G02

Bias Current vs Differential Input



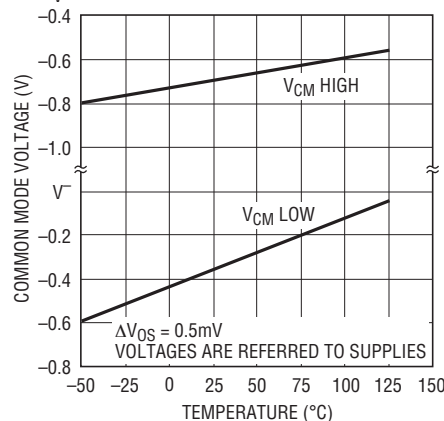
1017/18 G03

Input Bias Current with Inputs Driven Below the Supply



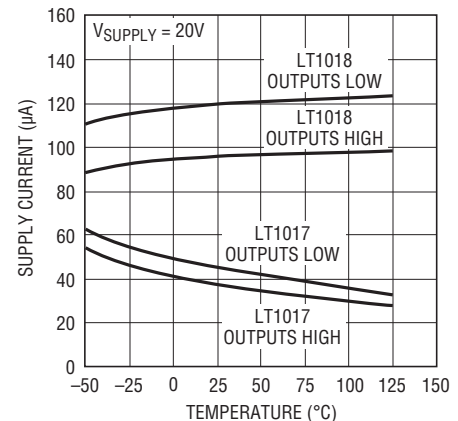
1017/18 G04

Common Mode Limits



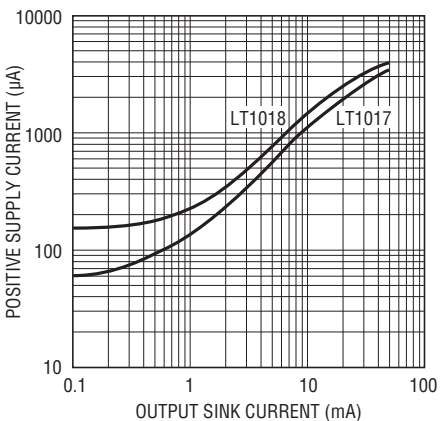
1017/18 G05

Supply Current



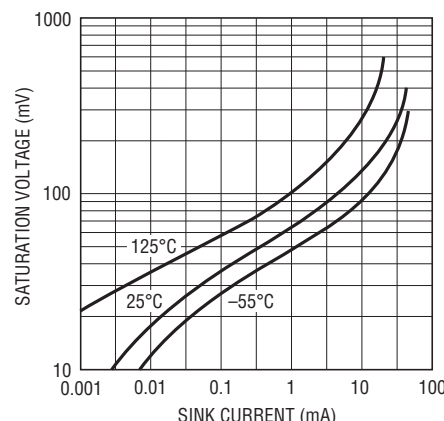
1017/18 G06

Positive Supply Current



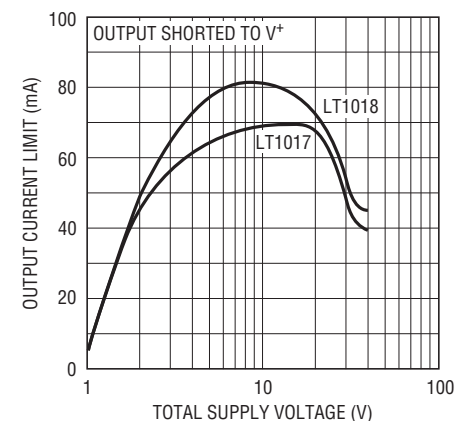
1017/18 G07

NPN Output Saturation Voltage



1017/18 G08

Output Sinking Current Limit

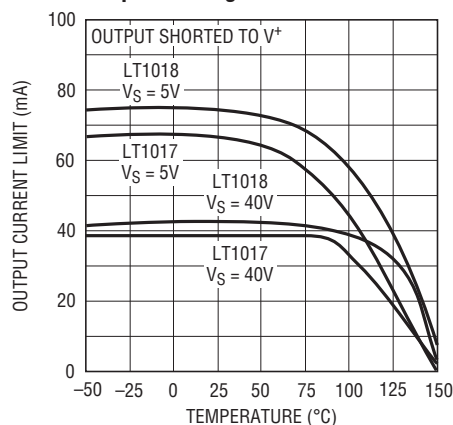


1017/18 G09

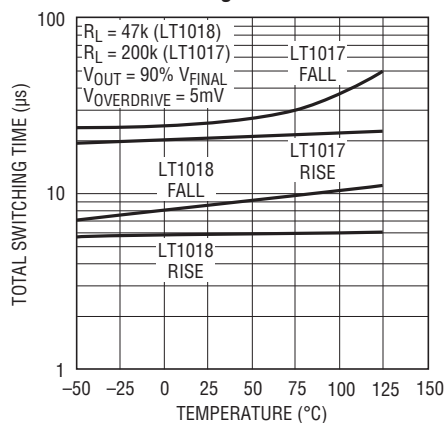
LT1017/LT1018

TYPICAL PERFORMANCE CHARACTERISTICS

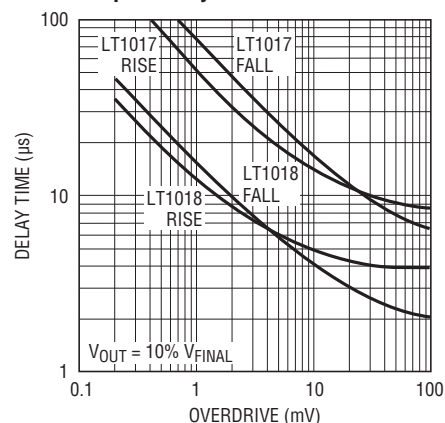
Output Sinking Current Limit



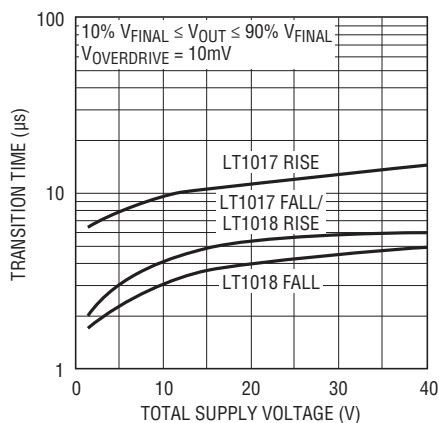
Total Switching Time



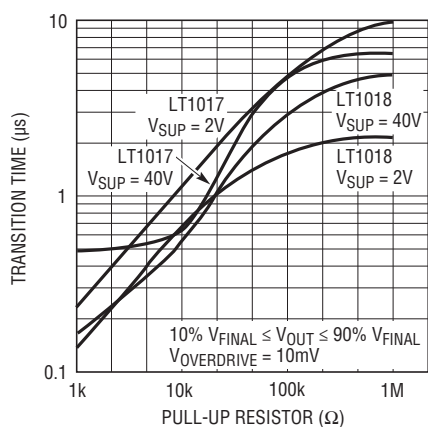
Output Delay



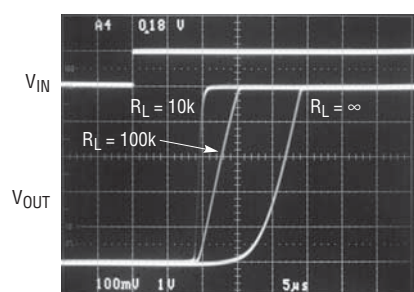
Transition Time



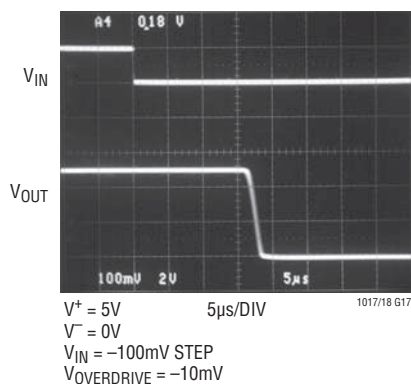
Positive Transition Time



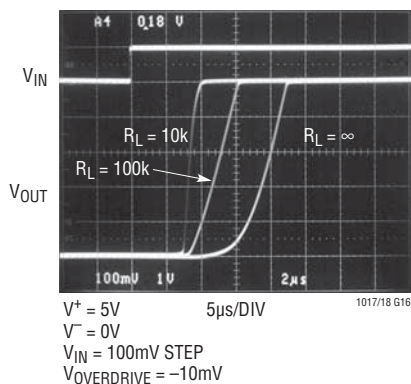
LT1017 Response Time



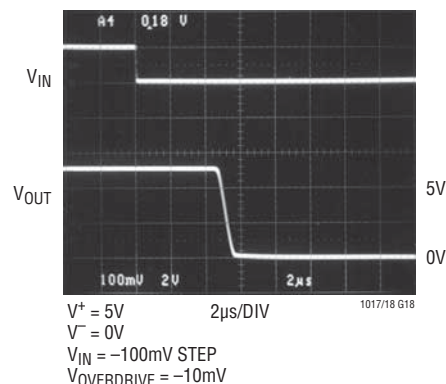
LT1017 Response Time



LT1018 Response Time

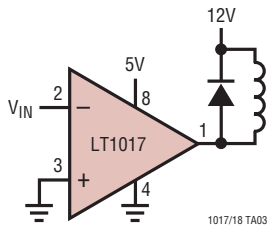


LT1018 Response Time

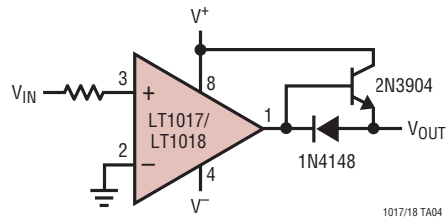


TYPICAL APPLICATIONS

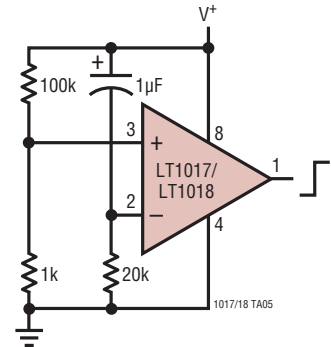
Driving Relays



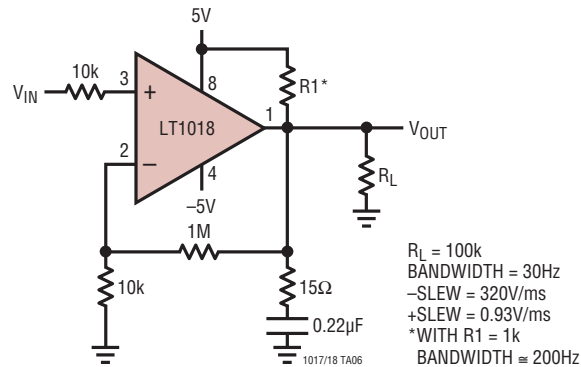
Increasing Positive Output Current



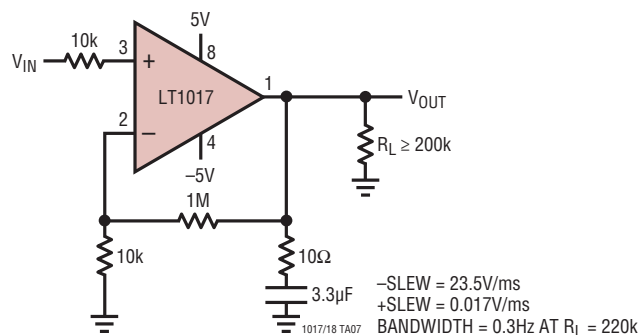
Delay On Power Up



LT1018 Op Amp, $A_V = 100$

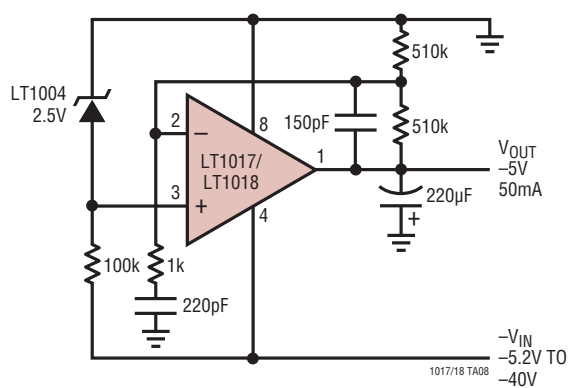


LT1017 Op Amp, $A_V = 100$

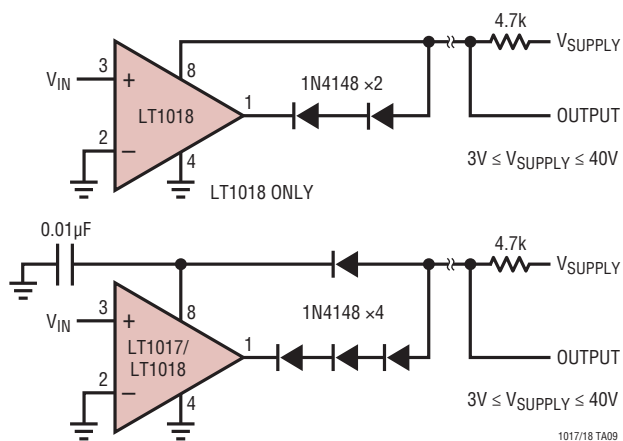


TYPICAL APPLICATIONS

Negative Voltage Regulator

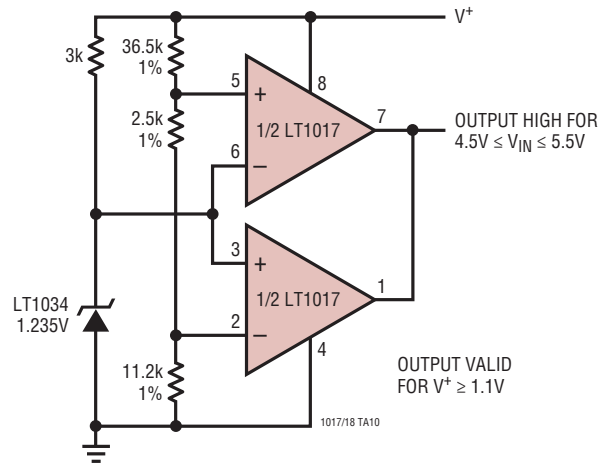


2-Wire Comparator

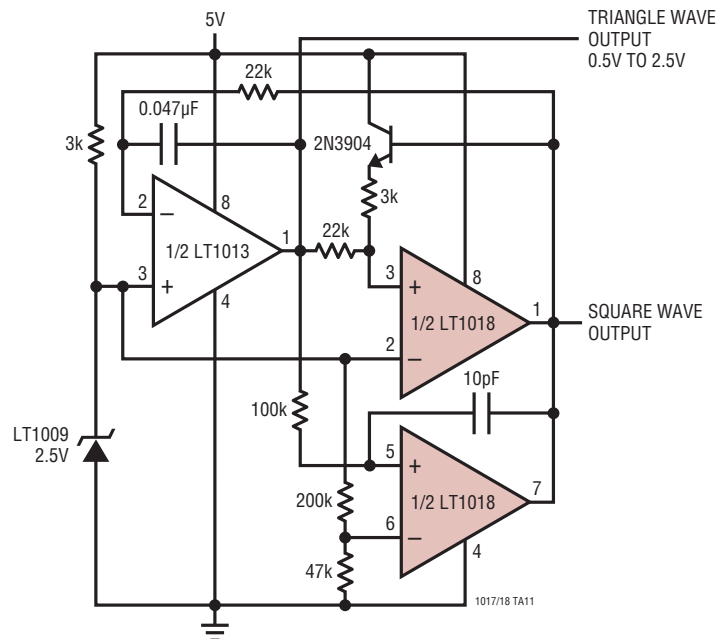


TYPICAL APPLICATIONS

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

The circuit diagram shows a two-stage op-amp configuration. The first stage is a non-inverting amplifier with an input of 1.2V from an LT1004 reference, a feedback resistor of 100k, and a resistor of 200k from the output to the non-inverting input. The output of the first stage is connected to the non-inverting input of the second stage. The second stage is configured as a current source, with its output connected to a load resistor R1 (910k) and a feedback resistor R2 (120k) to ground. The output current is 10V / 2mA = 5A. The circuit is powered by a 5V supply and includes various capacitors (0.1μF, 2000pF, 100μF) and diodes (1N4148) for stability and protection.

Component Values:

- Resistors: 100k, 200k, 910k (R1), 120k (R2)
- Capacitors: 0.1μF, 2000pF, 100μF
- Diodes: 1N4148
- Op-Amps: 1/2 LT1018
- Reference: LT1004 1.2V

Output: 10V, 2mA

Equation:

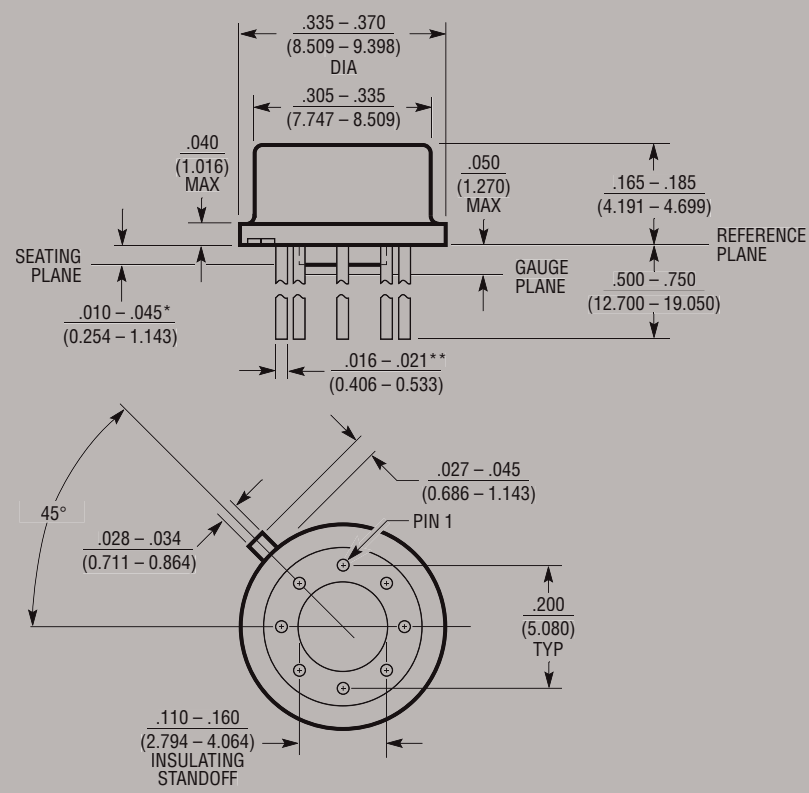
$$V_{OUT} = 1.2 \left(1 + \frac{R_1}{R_2} \right)$$

DALE TE-5/Q3/400mH

1017/18 TA14

PACKAGE DESCRIPTION

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

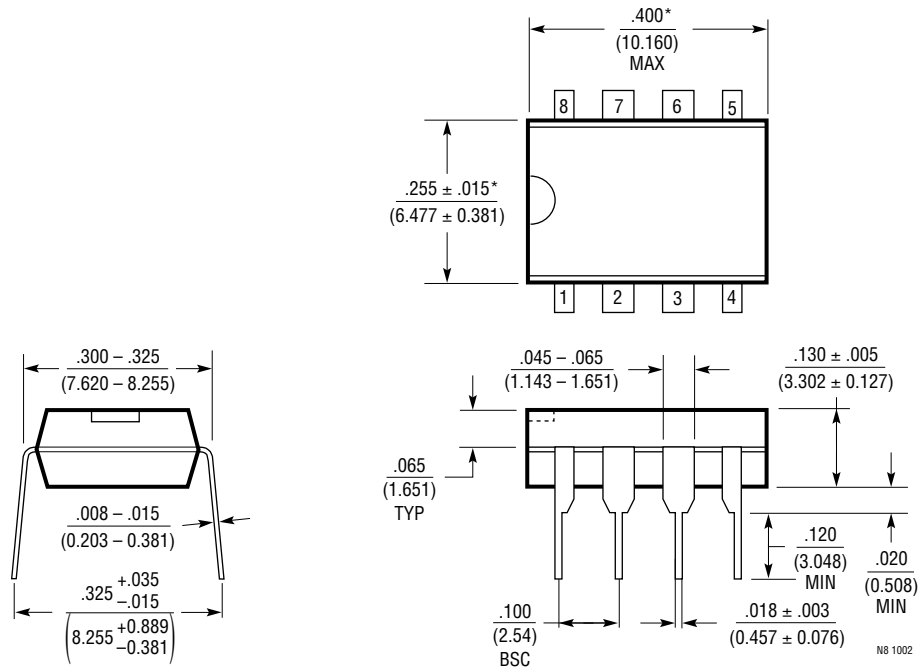


*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE
**FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS .016 - .024 (0.406 - 0.610) H8(TO-5) 0.200 PCD 0204

OBSOLETE PACKAGE

PACKAGE DESCRIPTION

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

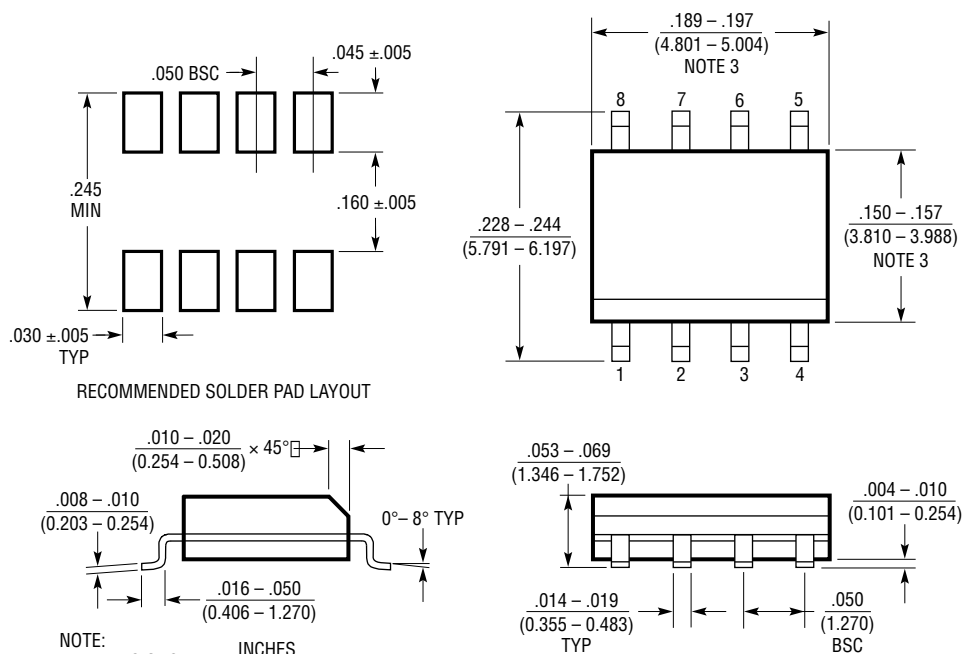


NOTE:
 1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$

*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)

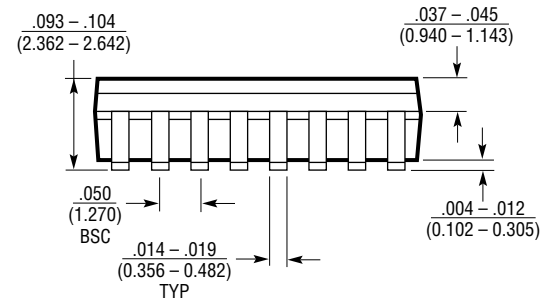
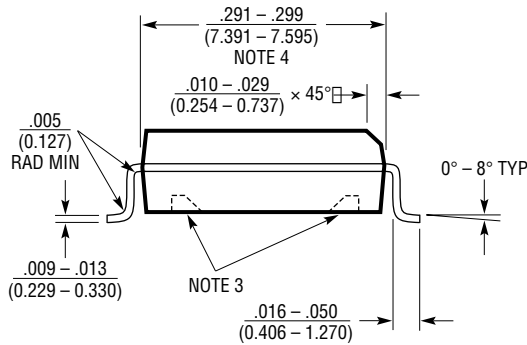
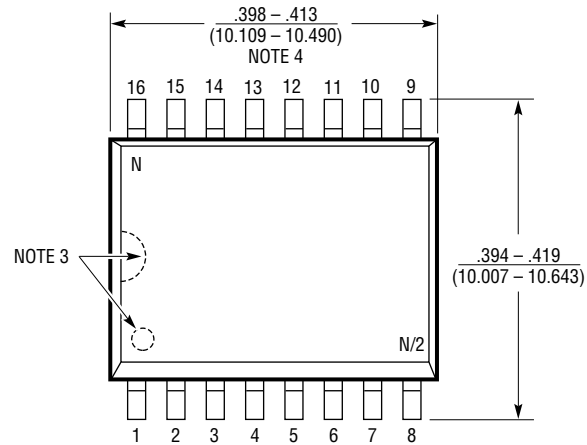
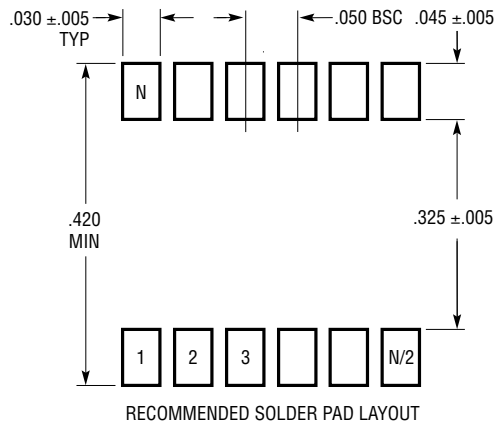


- NOTE:
1. DIMENSIONS IN $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
 2. DRAWING NOT TO SCALE
 3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

S08 0303

PACKAGE DESCRIPTION

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

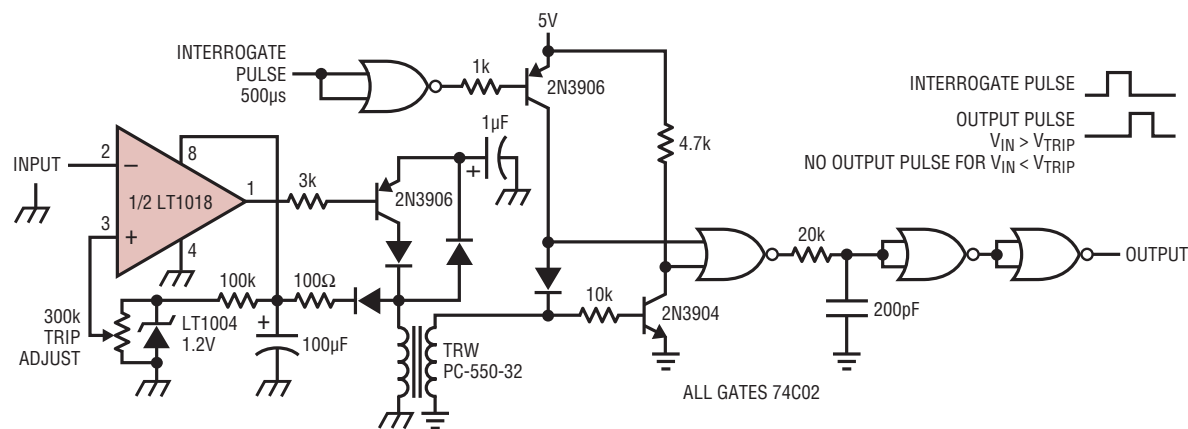


- NOTE:
1. DIMENSIONS IN $\frac{\text{INCHES}}{\text{(MILLIMETERS)}}$
 2. DRAWING NOT TO SCALE
 3. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS
 4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH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

S16 (WIDE) 0502

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