SOT-23, 44V, Over-the-Top, Micropower, Precision Rail-to-Rail Comparator

FEATURES

- **Operates from 2.7V to 44V**
- **Over-The-Top®: Input Common Mode Range Extends 44V Above V^-, Independent of V^+**
- **Micropower: 35µA I_Q**
- **Offset Voltage: 1.5mV Max**
- **Valid Output with Either Input 5V Below V^-**
- Rail-to-Rail Output Swing
- Output Can Drive Loads Above V^+
- Internal Pull-Up Current
- –40°C to 125°C Operating Temperature Range
- Low Profile (1mm) SOT-23 (ThinSOT™) Package

APPLICATIONS

- Power Supply Monitors
- Relay/Lamp Driver
- Oscillators
- Peak Detector
- Level Shifting

DESCRIPTION

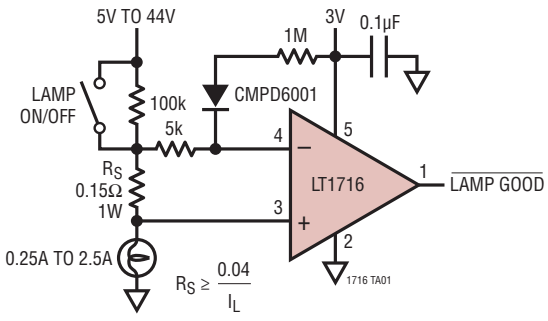
The LT®1716 comparator operates on any total power supply voltage between 2.7V and 44V drawing 35µA of quiescent current. The LT1716 has a unique input stage that can be taken 44V above V^-, independent of V^+ supply. (Built-in resistors protect the inputs for faults below the negative supply of up to 5V.) The inputs can withstand 44V both differential and common mode.

The output stage includes a class "B" pull-up current source, eliminating the need for an external resistive pull-up and saving power. Output voltage swings to within 35mV of the negative supply and 55mV of the positive supply, which makes the comparator a good choice for low voltage single supply operation. The output stage is also designed to drive loads connected to a higher supply than the LT1716 supply, the same as an open collector output stage.

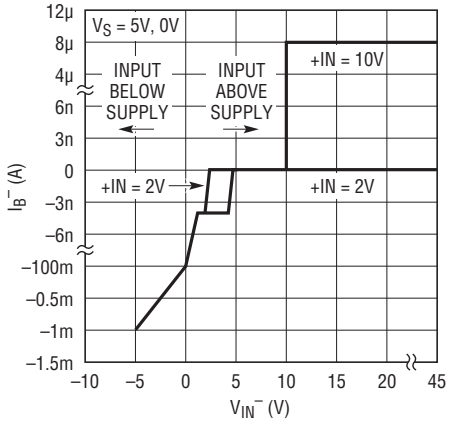
The LT1716 is available in a SOT-23 5-lead package.

TYPICAL APPLICATION

Lamp Monitor



Input Bias Current vs Input Bias Voltage

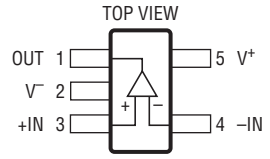


ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (V+ to V–) 44V
Differential Input Voltage 44V
Input Voltage ..... 44V, –5V
Output Short-Circuit Duration (Note 2) ..... Indefinite
Operating Temperature Range (Note 3)
LT1716C/LT1716I ..... –40°C to 85°C
LT1716H ..... –40°C to 125°C
Specified Temperature Range (Note 4)
LT1716C/LT1716I ..... –40°C to 85°C
LT1716H ..... –40°C to 125°C
Maximum Junction Temperature ..... 150°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PIN CONFIGURATION



S5 PACKAGE
5-LEAD PLASTIC TSOT-23

T_{JMAX} = 150°C, θ_{JA} = 250°C/W

ORDER INFORMATION

LEAD FREE FINISH	TAPE AND REEL	PART MARKING*	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE
LT1716CS5#PBF	LT1716CS5#TRPBF	LTYD	5-Lead Plastic TSOT-23	–40°C to 85°C
LT1716IS5#PBF	LT1716IS5#TRPBF	LTYD	5-Lead Plastic TSOT-23	–40°C to 85°C
LT1716HS5#PBF	LT1716HS5#TRPBF	LTYD	5-Lead Plastic TSOT-23	–40°C to 125°C

Consult LTC Marketing for parts specified with wider operating temperature ranges. *The temperature grade is identified by a label on the shipping container.
Consult LTC Marketing for information on non-standard lead based finish parts.

For more information on lead free part marking, go to: http://www.linear.com/leadfree/
For more information on tape and reel specifications, go to: http://www.linear.com/tapeandreel/

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range of –40°C ≤ T_A ≤ 85°C, otherwise specifications are at T_A = 25°C. Single supply operation V^+ = 5V, V^- = 0V; V_{CM} = V^+/2 unless otherwise noted. (Note 4)

SYMBOL	PARAMETER	CONDITIONS		LTC1716C/LTC1716I MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	0.5V < V_{CM} < (V_{CC} – 1V)			300	1600	µV
		0°C < T_A < 70°C	●			2100	µV
		–40°C < T_A < 85°C	●			2500	µV
	Input Offset Voltage Drift (Note 5)	0°C < T_A < 70°C	●		2		µV/°C
		–40°C < T_A < 85°C	●		2		µV/°C
I_{OS}	Input Offset Current	V_{CM} = V^+/2	●		3	15	nA
		V_{CM} = 0V	●			1.3	µA
		V_{CM} = 44V	●			0.9	µA
I_B	Input Bias Current	V_{CM} = V^+/2			20	50	nA
			●		35	75	nA
		V^+ = 0V, V_{CM} = 44V			2		nA
		V_{CM} = 0V	●		3	13	µA
		V_{CM} = 44V	●		6	9	µA
		V_{CM} = –5V	●		1	1.4	mA
	Input Voltage Range (Note 7)		●	0.5		44	V
CMRR	Common Mode Rejection Ratio	0.5V ≤ V_{CM} < (V^+ – 1V)	●	89	110		dB
		0.5V ≤ V_{CM} < 44V (Note 6)	●	81	110		dB

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range of –40°C ≤ T_A ≤ 85°C, otherwise specifications are at T_A = 25°C. Single supply operation V^+ = 5V, $V^–$ = 0V; V_{CM} = V^+/2 unless otherwise noted. (Note 4)

SYMBOL	PARAMETER	CONDITIONS		LTC1716C/LT1716I MIN	TYP	MAX	UNITS
PSRR	Power Supply Rejection Ratio	$V^–$ = 0V, V_{CM} = 1.5V; 2.7V < V^+ < 36V	●	95	110		dB
	Minimum Operating Supply Voltage		●		2.4	2.7	V
A_{VOL}	Large-Signal Voltage Gain	R_L = 1k; 1V < V_{OUT} < 4V	 ●	200 100	500		V/mV V/mV
I_S	Supply Current	V^+ = 3V, R_L = Open, V_O = High	 ●		35	50 65	µA µA
		V^+ = 5V, R_L = Open, V_O = High	 ●		35	55 75	µA µA
		V^+ = 12V, R_L = Open, V_O = High	 ●		40	60 85	µA µA
$I_{SC}^–$	Output Sink Current (Note 2)	$V_{OVERDRIVE}$ > 30mV	●	10	20		mA
I_{SC}^+	Output Source Current	$V_{OVERDRIVE}$ = 5mV, V_{OUT} = 1V	●	60	85		µA
V_{OL}	Output Voltage Swing Low (Referred to $V^–$)	I_{SINK} = 0mA, $V_{OVERDRIVE}$ = –10mV I_{SINK} = 0.1mA I_{SINK} = 1mA I_{SINK} = 5mA	● ● ● ●		20 75 200 550	35 110 300 900	mV mV mV mV
V_{OH}	Output Voltage Swing High (Referred to V^+)	I_{SOURCE} = 0µA, $V_{OVERDRIVE}$ = 10mV I_{SOURCE} = 10µA	● ●		30 130	55 185	mV mV
	Leakage Current	V_{OUT} = 40V, $V_{OVERDRIVE}$ > 100mV	●		0.5	2	µA
	Propagation Delay	$V_{OVERDRIVE}$ > 100mV, R_{LOAD} = 10k			3	5.5	µs

The ● denotes the specifications which apply over the full operating temperature range of –40°C ≤ T_A ≤ 85°C, otherwise specifications are at T_A = 25°C. Split supply operation V_S = ±15V, V_{CM} = 0V unless otherwise noted. (Note 4)

SYMBOL	PARAMETER	CONDITIONS		LT1716C/LT1716I MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	–14.5V < V_{CM} < 14V 0°C < T_A < 70°C –40°C < T_A < 85°C	 ● ●		300	1500 2000 2400	µV µV µV
	Input Offset Voltage Drift (Note 5)	0°C < T_A < 70°C –40°C < T_A < 85°C	● ●		2 2		µV/°C µV/°C
I_{OS}	Input Offset Current	V_{CM} = 0V V_{CM} = 29V V_{CM} = –15V	● ● ●		3	15 0.9 1.3	nA µA µA
I_B	Input Bias Current	V_{CM} = 0V	 ●		30 50	60 100	nA nA
		V_{CM} = 29V V_{CM} = –15V V_{CM} = –20V	● ● ●		6 3 1	9 13 1.4	µA µA mA
	Input Voltage Range (Note 7)		●	–14.5		14	V
CMRR	Common Mode Rejection Ratio	–14.5V < V_{CM} < 14V –14.5V < V_{CM} < 29V (Note 6)	● ●	92 81	110 98		dB dB
PSRR	Power Supply Rejection Ratio	V_S = ±1.35V to ±22V	●	90	110		dB
	Minimum Operating Supply Voltage		●		2.4	2.7	V
A_{VOL}	Large-Signal Voltage Gain	R_L = 6k; –14V < V_{OUT} < 14V	 ●	500 400	1000		V/mV V/mV
I_S	Supply Current	V_S = ±15V, R_L = Open, V_O = High	●		40	95	µA
$I_{SC}^–$	Output Sink Current (Note 2)	$V_{OVERDRIVE}$ > 30mV	●	10	20		mA
I_{SC}^+	Output Source Current	$V_{OVERDRIVE}$ = 5mV, V_{OUT} = –14V	●	70	105		µA

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range of –40°C ≤ T_A ≤ 85°C, otherwise specifications are at T_A = 25°C. Split supply operation V_S = ±15V, V_{CM} = 0V unless otherwise noted. (Note 4)

SYMBOL	PARAMETER	CONDITIONS		LT1716C/LT1716I MIN	TYP	MAX	UNITS
V_{OL}	Output Voltage Swing Low (Referred to V^-)	I_{SINK} = 0mA, $V_{OVERDRIVE}$ = –10mV	●		20	35	mV
		I_{SINK} = 0.1mA	●		75	110	mV
		I_{SINK} = 1mA	●		200	300	mV
		I_{SINK} = 5mA	●		550	900	mV
V_{OH}	Output Voltage Swing High (Referred to V^+)	I_{SOURCE} = 0µA, $V_{OVERDRIVE}$ = 10mV	●		45	75	mV
		I_{SOURCE} = 10µA	●		140	210	mV
	Leakage Current	V_{OUT} = 25V, $V_{OVERDRIVE}$ > 100mV	●		0.6	2	µA
	Propagation Delay	$V_{OVERDRIVE}$ > 100mV, R_{LOAD} = 10k			5.5	9	µs

The ● denotes the specifications which apply over the full operating temperature range of –40°C < T_A < 125°C, otherwise specifications are at T_A = 25°C. Single supply operation V^+ = 5V, V^- = 0V; V_{CM} = V_{CC}/2 unless otherwise noted. (Note 4)

SYMBOL	PARAMETER	CONDITIONS		LT1716H MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	0.5V < V_{CM} < (V_{CC} – 1V)			300	1600	µV
			●			2900	µV
	Input Offset Voltage Drift (Note 5)		●		2		µV/°C
I_{OS}	Input Offset Current	V_{CM} = V^+/2	●		3	220	nA
		V_{CM} = 0V	●			1.3	µA
		V_{CM} = 44V	●			0.9	µA
I_B	Input Bias Current	V_{CM} = V^+/2			20	50	nA
			●			900	nA
		V^+ = 0V, V_{CM} = 44V			2		nA
		V_{CM} = 0V	●		3	25	µA
		V_{CM} = 44V	●		6	14	µA
		V_{CM} = –5V	●		1	1.4	mA
	Input Voltage Range (Note 7)			0.5		44	V
CMRR	Common Mode Rejection Ratio	0.5V < V_{CM} < (V^+ – 1V)	●	75	110		dB
		0.5V < V_{CM} < 44V (Note 6)	●	72	110		dB
PSRR	Power Supply Rejection Ratio	V^- = 0V, V_{CM} = 1.5V, 2.7V < V^+ < 36V	●	85	110		dB
	Minimum Operating Supply Voltage		●		2.4	2.7	V
A_{VOL}	Large-Signal Voltage Gain	R_L = 1k, 1V < V_{OUT} < 4V		200	500		V/mV
		R_L = 6k	●	20			V/mV
I_S	Supply Current per Amplifier	V^+ = 3V, R_L = Open, V_O = High			35	50	µA
			●			70	µA
		V^+ = 5V, R_L = Open, V_O = High			35	55	µA
			●			75	µA
		V^+ = 12V, R_L = Open, V_O = High			40	60	µA
			●			85	µA
I_{SC}^-	Output Sink Current (Note 2)	$V_{OVERDRIVE}$ > 30mV	●	5	10		mA
I_{SC}^+	Output Source Current	$V_{OVERDRIVE}$ = 5mV, V_{OUT} = 1V	●	60	110		µA
V_{OL}	Output Voltage Swing Low (Referred to V^-)	I_{SINK} = 0mA, $V_{OVERDRIVE}$ = –10mV	●		20	60	mV
		I_{SINK} = 0.1mA	●		75	170	mV
		I_{SINK} = 1mA	●		200	480	mV
		I_{SINK} = 5mA	●		550	1200	mV
V_{OH}	Output Voltage Swing High (Referred to V^+)	I_{SOURCE} = 0µA, $V_{OVERDRIVE}$ = –10mV	●		50	110	mV
		I_{SOURCE} = 10µA	●		130	220	mV
	Leakage Current	V_{OUT} = 40V, $V_{OVERDRIVE}$ > 100mV	●		1.7	5	µA
	Propagation Delay	$V_{OVERDRIVE}$ > 100mV, R_{LOAD} = 10k			6	9	µs