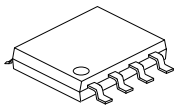
NANOPOWER OPERATIONAL AMPLIFIERS AND PUSH-PULL COMPARATORS



SOP-8

■ DESCRIPTION

The UTC **ULV2702** includes sub-micropower operational amplifier and comparator into a single package that produces excellent micropower signal conditioning with only 1.4μA of supply current. This gives the designer more board space and reduces part counts in systems that require an operational amplifier and comparator. The low supply current makes it an ideal choice for battery powered portable applications where quiescent current is the primary concern. Reverse battery protection guards the amplifier from an over-current condition due to improper battery installation. For harsh environments, the inputs can be taken 5V above the positive supply rail without damage to the device.

The maximum recommended supply voltage is as high as 16V and ensured operation down to 2.5V, with electrical characteristics specified at 2.7V, 5V, and 15V. The 2.5V operation makes it compatible with Li-Ion battery-powered systems and many micro-power microcontrollers.

■ FEATURES

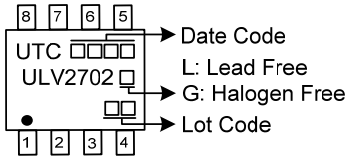
* Micro-Power Operation: 1.4μA
* Input Common-Mode Range Exceeds the Rails: -0.1V~ V_{CC}+ 5V
* Supply Voltage Range: 2.5V ~16V
* Rail-to-Rail Input/Output (Amplifier)
* Reverse Battery Protection Up to 18V
* Gain Bandwidth Product: 5.5kHz (Amplifier)
* Push-Pull CMOS Output Stage (Comparator)
* Specified Temperature Range – T_A =-40°C~125°C

■ ORDERING INFORMATION

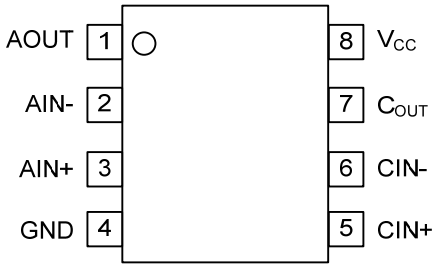
Ordering Number		Package	Packing
Lead Free	Halogen Free		
ULV2702L-S08-R	ULV2702G-S08-R	SOP-8	Tape Reel

ULV2702G-S08-R (1)Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) S08: SOP8 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



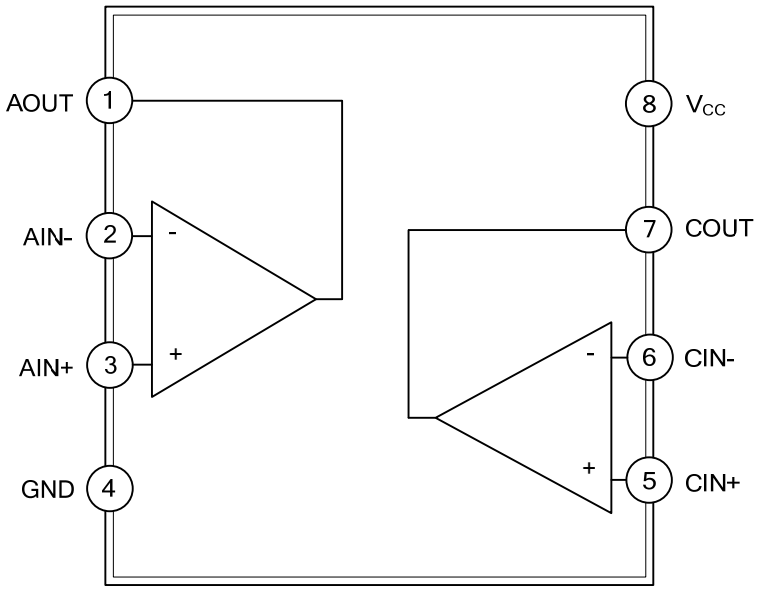
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	AOUT	Output of amplifier
2	AIN-	Inverting Input of amplifier
3	AIN+	Non-inverting Input of amplifier
4	GND	Ground
5	CIN+	Non-inverting Input of comparator
6	CIN-	Inverting Input comparator
7	COUT	Output comparator
8	V_{CC}	Supply voltage

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage (Note 1)	V_{CC}	17	V
Differential Input Voltage	V_{ID}	V_{CC}	V
Input Voltage Range (Note 1,2)	V_I	0 ~ V_{cc}+5	V
Input Current (Any Input)	I_I	±10	mA
Output Current Range	I_O	±10	mA
Maximum Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. All voltage values, except differential voltages, are with respect to ground.
3. Input voltage range is limited to 20V max or V_{CC} + 5V, whichever is smaller.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage	Single Supply	V_{CC}	2.5		16	V
	Split Supply		±1.25		±8	V
Common-Mode Input Voltage Range	Amplifier and Comparator	V_{ICR}	-0.1		V_{CC}+5	V
Operating Free-Air Temperature		T_A	-40		+125	°C

■ ELECTRICAL CHARACTERISTICS (V_{CC}=2.7, 5V and 15V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
AMPLIFIER DC PERFORMANCE							
Input Offset Voltage	V_{IO}	V_O=V_{CC}/2V, V_{IC} =V_{CC}/2V, R_S=50Ω			390	4000	μV
Common-Mode Rejection Ratio	CMRR	V_{IC}=0~V_{CC}, RS=50Ω	V_{CC}=2.7V	55	73		dB
			V_{CC}=5V	60	80		dB
			V_{CC}=15V	66	90		dB
Large-Signal Differential Voltage Amplification	A_{VD}	V_{CC}=2.7V,$V_{O(PP)}$=1.5V, R_L=500kΩ		130	400		V/mV
		V_{CC}=5V,$V_{O(PP)}$=3V, R_L=500kΩ		300	1000		V/mV
		V_{CC}=15V,$V_{O(PP)}$=8V, R_L=500kΩ		400	1800		V/mV
Power Supply Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$)	PSRR	V_{IC}=V_{CC}/2V, No Load	V_{CC}=2.7~5V	90	120		dB
			V_{CC}=5~15V	94	120		dB
AMPLIFIER AND COMPARATOR INPUT CHARACTERISTICS							
Input Offset Current	I_{IO}	V_O=V_{CC}/2V, V_{IC} =V_{CC}/2V, R_S=50Ω			25	250	pA
Input Bias Current	I_{IB}				100	500	pA
Differential Input Resistance	ri(d)	T_A=25°C			300		MΩ
Common-Mode Input Capacitance	Ci(c)	f=100kHz, T_A=25°C			3		pF
AMPLIFIER OUTPUT CHARACTERISTICS							
High Level Output Voltage	V_{OH}	V_{IC}=V_{CC}/2, I_{OH}=-50μA	V_{CC}=2.7V	2.55	2.65		V
			V_{CC}=5V	4.85	4.95		V
			V_{CC}=15V	14.8	14.95		V
Low Level Output Voltage	V_{OL}	V_{IC}=V_{CC}/2, I_{OL}=50μA			180	260	mV
Output Current	I_O	V_O=0.5V from Rail			±200		μA
Closed-Loop Output Impedance	Z_O	f =100Hz, A_V=10			1.2		kΩ

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
AMPLIFIER DYNAMIC PERFORMANCE							
Unity Gain Bandwidth	UGBW	R_L=500kΩ, C_L=100pF			5.5		kHz
Slew Rate at Unity Gain	SR	$V_{O(pp)}$=0.8V, R_L=500kΩ, C_L=100pF			2.5		V/ms
Phase Margin	φm	R_L=500kΩ, C_L=100pF			60		°
Gain Margin	Gm	R_L=500kΩ, C_L=100pF			15		dB
Settling Time	t_S	V_{CC}=2.7 or 5V, $V_{(STEP)PP}$=1V, C_L=100pF, A_V=-1, R_L=100kΩ	0.1%		1.84		ms
		V_{CC}=15V, $V_{(STEP)PP}$=1V, C_L=100pF, A_V=-1, R_L=100kΩ	0.1%		6.1		ms
			0.01%		32		ms
Equivalent Input Noise Voltage	V_n	f = 0.1~10Hz			5.3		μV_{pp}
		f =100Hz			500		nV $\sqrt{Hz}$
Equivalent Input Noise Current	I_n	f =100Hz			8		fA $\sqrt{Hz}$
SUPPLY CURRENT							
Supply Current (one op-amp and one Comparator)	I_{CC}	V_O=V_{CC}/2	V_{CC}=2.7V or 5V		1.4		μA
			V_{CC}=15V		1.4	1.9	μA
Reverse Supply Current		V_{CC}=-18V, V_I=0V, V_O=Open			50		nA
COMPARATOR DC PERFORMANCE							
Input Offset Voltage	V_{IO}	V_{IC} =V_{CC}/2, R_S=50Ω			250	5000	μV
Offset Voltage Draft	α_{VIO}				3		μV/°C
Common-Mode Rejection Ratio	CMRR	V_{IC}=0~V_{CC}, R_S=50Ω	V_{CC}=2.7V	55	72		dB
			V_{CC}=5V	60	76		dB
			V_{CC}=15V	65	88		dB
Large-Signal Differential Voltage Amplification	A_{VD}				1000		V/mV
Power Supply Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$)	PSRR	V_{IC}=V_{CC}/2V, No Load	V_{CC}=2.7~5V	75	100		dB
			V_{CC}=5~15V	85	105		dB
COMPARATOR OUTPUT CHARACTERISTICS							
Differential Input Resistance	$r_{i(d)}$				300		MΩ
High Level Output Voltage	V_{OH}	V_{IC}=V_{CC}/2, I_{OH}=-50μA, V_{ID}=1V		V_{CC}-320			mV
Low Level Output Voltage	V_{OL}	V_{IC}=V_{CC}/2, I_{OL}=50μA, V_{ID}=-1V			80	200	mV

■ SWITCHING CHARACTERISTICS (V_{CC}=2.7, 5V and 15V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Propagation Response Time, Low-to-High-Level Output	$t_{(PLH)}$	f=10kHz, V_{STEP}=100mV, C_L=10pF, V_{CC}=2.7V	Overdrive=2mV		240		μs
			Overdrive=10mV		64		μs
			Overdrive=50mV		36		μs
Propagation Response Time, High -to- Low -Level Output	$t_{(PHL)}$		Overdrive=2mV		167		μs
			Overdrive=10mV		67		μs
			Overdrive=50mV		37		μs
Rise Time	t_r	C_L=10pF, V_{CC}=2.7V			7		μs
Fall Time	t_f	C_L=10pF, V_{CC}=2.7V			9		μs