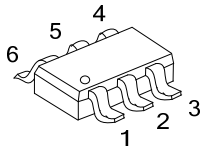
LOW-VOLTAGE RAIL-TO-RAIL OUTPUT CMOS OPERATIONAL AMPLIFIERS WITH SHUTDOWN



SOT-26

■ DESCRIPTION

The UTC **ULV341** devices are single CMOS operational amplifiers, respectively, with low-voltage, low-power, and rail-to-rail output swing capabilities. The PMOS input stage offers offset voltage of 0.3 mV (typical).

These single-supply amplifiers are designed specifically for ultra-low-voltage (1.5 V to 5 V) operation, with a common-mode input voltage range that typically extends from V_{ee}-0.2V to V_{CC}-0.5V from the positive supply rail.

The UTC **ULV341** (single) in the SOT-26 package also offer a shutdown (SHDN) pin that can be used to disable the device. In shutdown mode, the supply current is reduced to 45 pA (typical). The UTC **ULV341** is suitable for the most space-constrained applications.

An extended industrial temperature range from -40°C to 125°C makes the UTC **ULV341** suitable in a wide variety of commercial and industrial applications.

■ FEATURES

* 1.8V and 5V Performance
* Rail-to-Rail Output Swing
* Wide Common-Mode Input Voltage Range: -0.2V to (V+ - 0.5V)
* Input Offset Voltage: 0.3mV (Typical)
* Gain Bandwidth: 2.3MHz (Typical)
* Slew Rate: 0.9V/μs (Typical)
* Turnon Time From Shutdown: 5μs (Typical)
* Input Referred Voltage Noise (at 10 kHz): 20nV $\sqrt{Hz}$

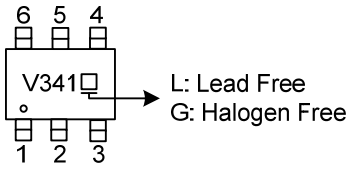
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
ULV341L-AG6-R	ULV341G-AG6-R	SOT-26	Tape Reel

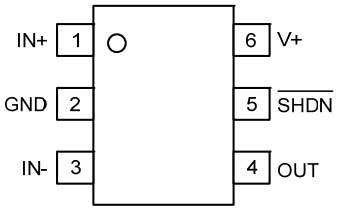
ULV341G-AG6-R
(1) Packing Type
(2) Package Type
(3) Green Package

(1) R: Tape Reel
(2) AG6: SOT-26
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	IN+	Noninverting input
2	GND	Ground
3	IN-	Inverting input
4	OUT	Output
5	$\overline{SHDN}$	Shutdown active low
6	V_+	Positive power supply

■ ABSOLUTE MAXIMUM RATING

(over operating free-air temperature range, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage (Note 1)	V_+	-0.3 ~ 5.5	V
Differential Input Voltage (Note 2)	V_{ID}	±5.5	V
Input Voltage (Either Input or $\overline{\text{Shutdown}}$)	V_I	-0.3 ~ 5.5	V
Output Voltage	V_O	-0.3 ~ V_{CC}+0.3	V
Operating Virtual-Junction Temperature	T_J	+150	°C
Storage Temperature	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 the network GND.
3. Differential voltages are at IN+ with respect to IN-.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage (Single-Supply Operation)	V_+	1.5 ~ 5.5	°C
Operating Free-air Temperature	T_A	-40 ~ +125	°C

■ ELECTRICAL CHARACTERISTICS

(V_+=1.8V, GND=0V, $V_{IC}=V_O=V_+/2$, R_L>1MΩ, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP (Note 1)	MAX	UNIT
Input Offset Voltage	V_{IO}				0.3	4	mV
Input Bias Current	I_{IB}				1	100	pA
Input Offset Current	I_{IO}				6.6		fA
Common-Mode Rejection Ratio	CMRR	$0 \le V_{ICR} \le 1.2V$		60	85		dB
Supply-Voltage Rejection Ratio	k_{SVR}	$1.8V \le V_+ \le 5V$		75	95		dB
Common-Mode Input Voltage Range	V_{ICR}	CMRR ≥ 60dB		0		1.2	V
Large-Signal Voltage Gain (Note 2)	A_V	R_L=10kΩ to 1.35V		70	110		dB
		R_L=2kΩ to 1.35V		65	100		dB
Output Swing (Delta from Supply Rails)	V_O	R_L=2kΩ to 1.35V	Low level		22	50	mV
			High level		25	50	mV
		R_L=10kΩ to 1.35V	Low level		14	20	mV
			High level		7	20	mV
Supply Current	I_{CC}				100	260	μA
Supply Current in Shutdown Mode	$I_{CC(SHDN)}$	V_{SD}=0V			0.01	1	μA
Amplifier Turnon Time	$t_{(ON)}$				5		μs
Recommended Shutdown Pin Voltage Range	V_{SD}	On mode		1.5		1.8	V
		Shutdown mode		0		0.5	V
Output Short-Circuit Current	I_{OS}	Sourcing		6	12		mA
		Sinking		10	20		mA
Slew Rate	SR	R_L=10kΩ (Note3)			0.9		V/us
Unity-Gain Bandwidth	GBW	R_L=10kΩ, C_L=200pF			2.2		MHz
Phase Margin	φ_m	R_L=100kΩ, C_L=200pF			55		°
Gain Margin	G_m	R_L=100kΩ, C_L=200pF			15		dB
Equivalent Input Noise Voltage	V_n	f=1kHz			33		nV/ $\sqrt{Hz}$
Equivalent Input Noise Current	I_n	f=1kHz			0.001		pA/ $\sqrt{Hz}$
Total Harmonic Distortion	THD	f=1kHz, A_V=1, R_L=600kΩ, $V_I=1V_{PP}$			0.015		%

Notes: 1. Typical values represent the most likely parametric norm.

2. $GND+0.2V \le V_O \le V_+-0.2V$.

3. Connected as voltage follower with $2V_{PP}$ step input. Number specified is the slower of the positive and negative slew rates.

■ ELECTRICAL CHARACTERISTICS

(V_+=5V, GND=0V, $V_{IC}=V_O=V_+/2$, R_L>1MΩ, unless otherwise specified.)

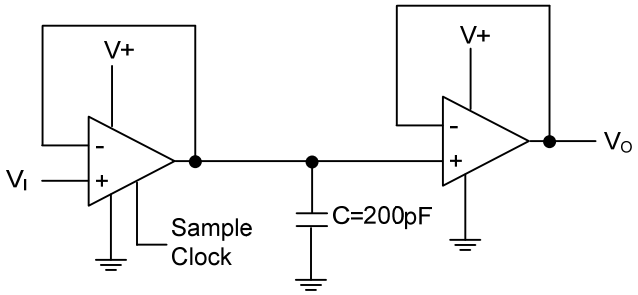
PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP (Note 1)	MAX	UNIT
Input Offset Voltage	V_{IO}				0.3	4	mV
Input Bias Current	I_{IB}				1	200	pA
Input Offset Current	I_{IO}				6.6		fA
Common-Mode Rejection Ratio	CMRR	$0 \le V_{ICR} \le 4.4V$		75	90		dB
Supply-Voltage Rejection Ratio	k_{SVR}	$1.8V \le V_+ \le 5V$		75	95		dB
Common-Mode Input Voltage Range	V_{ICR}	CMRR ≥ 70dB		0		4.4	V
Large-Signal Voltage Gain (Note 2)	A_V	R_L=10kΩ to 2.5V		80	110		dB
		R_L=2kΩ to 2.5V		75	105		dB
Output Swing (Delta from Supply Rails)	V_O	R_L=2kΩ to 2.5V	Low level		40	60	mA
			High level		25	60	mA
		R_L=10kΩ to 2.5V	Low level		18	30	mA
			High level		7	15	mA
Supply Current	I_{CC}				120	320	μA
Supply Current in Shutdown Mode	$I_{CC(SHDN)}$	V_{SD} = 0 V			0.01	1	μA
Amplifier Turnon Time	$t_{(ON)}$				5		μs
Recommended Shutdown Pin Voltage Range	V_{SD}	On mode		4.5		5	V
		Shutdown mode		0		0.8	V
Output Short-Circuit Current	I_{OS}	Sourcing		60	113		mA
		Sinking		80	115		mA
Slew Rate	SR	R_L=10kΩ (Note3)			1		V/us
Unity-Gain Bandwidth	GBW	R_L=10kΩ, C_L=200pF			2.3		MHz
Phase Margin	φ_m	R_L=100kΩ, C_L=200pF			55		°
Gain Margin	G_m	R_L=100kΩ, C_L=200pF			15		dB
Equivalent Input Noise Voltage	V_n	f=1kHz			33		nV/$\sqrt{Hz}$
Equivalent Input Noise Current	I_n	f=1kHz			0.001		pA/$\sqrt{Hz}$
Total Harmonic Distortion	THD	f=1kHz, A_V=1, R_L=600kΩ, V_I=1V_{PP}			0.012		%

Notes: 1. Typical values represent the most likely parametric norm.

2. $GND+0.2V \le V_O \le V_+-0.2V$.

3. Connected as voltage follower with 2V_{PP} step input. Number specified is the slower of the positive and negative slew rates.

■ TYPICAL APPLICATION CIRCUIT



Sample and Hold Circuit Using Two **UTC ULV341**