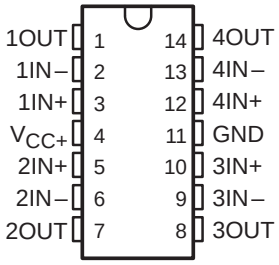
TLV821 SINGLE/TLV822 DUAL/TLV824 QUAD OPERATIONAL AMPLIFIERS

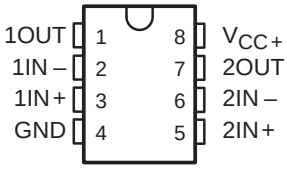
SLOS296A – FEBRUARY 2000 – REVISED MAY 2000

- **2.7-V and 5-V Performance**
- **No Crossover Distortion**
- **Low Supply Current at V_{CC+} = 5 V:**
  - **TLV821 . . . 0.3 mA Typ**
  - **TLV822 . . . 0.5 mA Typ**
  - **TLV824 . . . 1 mA Typ**
- **Rail-to-Rail Output Swing**
- **Pin-to-Pin Compatible with LMV821, LMV822, and LMV824 Devices**
- **Package Options Include Plastic Small-Outline (D), Small-Outline Transistor (SOT-23 DBV, SC-70 DCK), and Thin Shrink Small-Outline (PW) Packages**

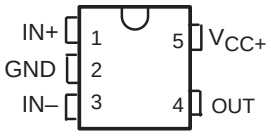
TLV824 . . . D OR PW PACKAGE
(TOP VIEW)



TLV822 . . . D OR PW PACKAGE
(TOP VIEW)



TLV821 . . . DBV OR DCK PACKAGE
(TOP VIEW)



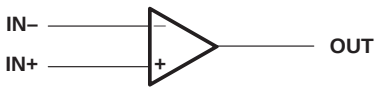
description

The TLV821, TLV822, and TLV824 devices are low-voltage (2.5 V to 5.5 V) low-power operational amplifiers, designed to be functionally and pin-to-pin compatible with the LMV821, LMV822, and LMV824 devices. Electrical characteristics are very similar to the LMV3xx operational amplifiers (low supply current, rail-to-rail outputs, input common-mode range, which includes ground). The TLV8xx devices have a significantly higher bandwidth (8 MHz typically) and a 2.5-V/μs slew rate. The TLV821 is a single, the TLV822 is a dual, and the TLV824 is a quad operational amplifier.

These devices are the most cost-effective solution for applications requiring low-voltage/low-power operation and space-saving considerations. The TLV821 is available in the ultra-small DCK package, which is approximately half the size of the DBV package. The DCK package saves space on PC boards and enables the design of small portable electronic devices (cordless and cellular phones, laptops, PDAs, PCMIAs). It also allows the designer to place the device closer to the signal source to reduce noise pickup and increase signal integrity.

The TLV821I, TLV822I, and TLV824I devices are characterized for operation from –40°C to 85°C.

symbol (each amplifier)



PRODUCT PREVIEW

AVAILABLE OPTIONS

T_A	PACKAGE TYPE	PACKAGED DEVICES		
		SINGLE	DUAL	QUADRUPLE
–40°C to 85°C	5-pin SOT	TLV821IDCKR	—	—
		TLV821IDBVR	—	—
	8-pin SOIC	—	TLV822ID	—
	8-pin TSSOP	—	TLV822IPWR	—
	14-pin SOIC	—	—	TLV824ID
	14-pin TSSOP	—	—	TLV824IPWR

The D package is available taped and reeled. Add the suffix R to the device type (e.g., TLV824IDR).
The DCK, DBV, and PW packages are only available left-end taped and reeled.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC} (see Note 1) . . . . . 5.5 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±5.5 V
Input voltage range, V_I (either input) . . . . . 0 to 5.5 V
Duration of output short circuit (one amplifier) to ground at (or below) T_A = 25°C,
$V_{CC} \leq$ 5.5 V (see Note 3) . . . . . Unlimited
Operating virtual junction temperature . . . . . 150°C
Package thermal impedance, θ_{JA} (see Notes 4 and 5): D (8-pin) package . . . . . 97°C/W
D (14-pin) package . . . . . 86°C/W
DBV package . . . . . 347°C/W
DCK package . . . . . 389°C/W
PW (8-pin) package . . . . . 149°C/W
PW (14-pin) package . . . . . 113°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or PW package . . . . . 260°C
Storage temperature range, T_{stg} . . . . . –65 to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values (except differential voltages and V_{CC} specified for the measurement of I_{OS}) are with respect to the network GND.
2. Differential voltages are at IN+ with respect to IN–.
3. Short circuits from outputs to V_{CC} can cause excessive heating and eventual destruction.
4. Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) – T_A)/\theta_{JA}$. Selecting the maximum of 150°C can affect reliability.
5. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

		MIN	MAX	UNIT
V_{CC}	Supply voltage (single-supply operation)	2.5	5.5	V
T_A	Operating free-air temperature	–40	85	°C

electrical characteristics at specified free-air temperature, V_{CC+} = 2.7 V, GND= 0 V, V_{CM} = 1 V, V_O = 1.35 V, and R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage			25°C		1	3.5	mV
				–40°C to 85°C			4	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			25°C		1		µV/°C
I_{IB}	Input bias current			25°C		30	90	nA
				–40°C to 85°C			140	
I_{IO}	Input offset current			25°C		0.5	30	nA
				–40°C to 85°C			50	
CMRR	Common-mode rejection ratio	V_{CM} = 0 to 1.7 V		25°C	60	73		dB
				–40°C to 85°C	58			
$+k_{SVR}$	Positive supply-voltage rejection ratio	V_{CC+} = 1.7 V to 4 V, GND = 1 V, V_{CM} = 0, V_O = 0		25°C	60	75		dB
				–40°C to 85°C	58			
$–k_{SVR}$	Negative supply-voltage rejection ratio	V_{CC+} = 1.7 V, GND = –1 V to –3.3 V, V_{CM} = 0, V_O = 0		25°C	60	75		dB
				–40°C to 85°C	58			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB		25°C	–0.2	–0.3		V
					1.9	2		
A_{VD}	Large-signal differential-voltage amplification	R_L = 600 Ω to 1.35 V, V_O = 1.35 V to 2.2 V	Sourcing	25°C	90	100		dB
				–40°C to 85°C	85			
		R_L = 600 Ω to 1.35 V, V_O = 1.35 V to 0.5 V	Sinking	25°C	85	90		
				–40°C to 85°C	80			
		R_L = 2 kΩ to 1.35 V, V_O = 1.35 V to 2.2 V	Sourcing	25°C	95	100		
				–40°C to 85°C	90			
		R_L = 2 kΩ to 1.35 V, V_O = 1.35 V to 0.5 V	Sinking	25°C	90	95		
				–40°C to 85°C	85			
	Output swing	V_{CC+} = 2.7 V, R_L = 600 Ω to 1.35 V	High level	25°C	2.5	2.58		V
				–40°C to 85°C	2.4			
			Low level	25°C		0.13	0.2	
				–40°C to 85°C			0.3	
		V_{CC+} = 2.7 V, R_L = 2 kΩ to 1.35 V	High level	25°C	2.6	2.66		
				–40°C to 85°C	2.5			
			Low level	25°C		0.08	0.12	
				–40°C to 85°C			0.2	

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electrical characteristics at specified free-air temperature, V_{CC+} = 2.7 V, GND = 0 V, V_{CM} = 1 V, V_O = 1.35 V, and R_L > 1 MΩ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
I_O	Output current	V_O = 0 V	Sourcing	25°C	12	16		mA
		V_O = 2.7 V	Sinking	25°C	12	26		
I_{CC}	Supply current	TLV821I		25°C		0.22	0.3	mA
				–40°C to 85°C			0.5	
		TLV822I (both amplifiers)		25°C		0.45	0.6	
				–40°C to 85°C			0.8	
		TLV824I (all four amplifiers)		25°C		0.72	1	
				–40°C to 85°C			1.2	
SR	Slew rate	V_{CC+} = 5 V†		25°C		2		V/μs
GBM	Gain-bandwidth product			25°C		7		MHz
ϕ_m	Phase margin			25°C		61		deg
G_m	Gain margin			25°C		10		dB
	Amplifier-to-amplifier isolation	V_{CC+} = 5 V, R_L = 100 kΩ to 2.5 V‡		25°C		135		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{CM} = 1 V		25°C		28		nV/√Hz
I_n	Equivalent input noise voltage	f = 1 kHz		25°C		0.1		pA/√Hz
THD	Total harmonic distortion	f = 1 kHz, A_{VD} = –2, R_L = 10 kΩ, V_O = 4.1 V_{PP}		25°C		0.01%		

† Connected as voltage follower with 3-V step input. Value specified is the slower of the positive and negative slew rates.
‡ Refers to inputs only. Each amplifier is excited, in turn, with 1 kHz to produce V_O = 3 V_{PP}.

electrical characteristics at specified free-air temperature, V_{CC+} = 5 V, GND= 0 V, V_{CM} = 2 V, V_O = 2.5 V, and R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage			25°C		1	3.5	mV
				–40°C to 85°C			4	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			25°C		1		μV/°C
I_{IB}	Input bias current			25°C		40	100	nA
				–40°C to 85°C			150	
I_{IO}	Input offset current			25°C		0.5	30	nA
				–40°C to 85°C			50	
CMRR	Common-mode rejection ratio	V_{CM} = 0 to 4 V		25°C	62	75		dB
				–40°C to 85°C	60			
$+k_{SVR}$	Positive supply-voltage rejection ratio	V_{CC+} = 1.7 V to 4 V, GND = –1 V, V_{CM} = 0, V_O = 0		25°C	60	75		dB
				–40°C to 85°C	58			
$–k_{SVR}$	Negative supply-voltage rejection ratio	V_{CC+} = 1.7 V, GND = –1 V to –3.3 V, V_{CM} = 0, V_O = 0		25°C	60	75		dB
				–40°C to 85°C	58			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB		25°C	–0.2	–0.3		V
					4.2	4.3		
A_{VD}	Large-signal differential-voltage amplification	R_L = 600 Ω to 2.5 V, V_O = 2.5 V to 4.5 V	Sourcing	25°C	95	105		dB
				–40°C to 85°C	90			
		R_L = 600 Ω to 2.5 V, V_O = 2.5 V to 0.5 V	Sinking	25°C	95	105		
				–40°C to 85°C	90			
		R_L = 2 kΩ to 2.5 V, V_O = 2.5 V to 4.5 V	Sourcing	25°C	95	105		
				–40°C to 85°C	90			
		R_L = 2 kΩ to 2.5 V, V_O = 2.5 V to 0.5 V	Sinking	25°C	95	105		
				–40°C to 85°C	90			
	Output swing	V_{CC+} = 5 V, R_L = 600 Ω to 2.5 V	High level	25°C	4.75	4.84		V
				–40°C to 85°C	4.7			
			Low level	25°C		0.17	0.25	
				–40°C to 85°C			0.3	
		V_{CC+} = 5 V, R_L = 2 kΩ to 2.5 V	High level	25°C	4.85	4.9		
				–40°C to 85°C	4.8			
			Low level	25°C		0.1	0.15	
				–40°C to 85°C			0.2	
I_O	Output current	V_O = 0 V	Sourcing	25°C	20	45		mA
				–40°C to 85°C	15			
		V_O = 5 V	Sinking	25°C	20	40		
				–40°C to 85°C	15			

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electrical characteristics at specified free-air temperature, V_{CC+} = 5 V, GND = 0 V, V_{CM} = 2 V, V_O = 2.5 V, and R_L > 1 MΩ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
I_{CC}	Supply current	TLV821I	25°C		0.3	0.4	mA
			–40°C to 85°C			0.6	
		TLV822I (both amplifiers)	25°C		0.5	0.7	
			–40°C to 85°C			0.9	
		TLV824I (all four amplifiers)	25°C		1	1.3	
			–40°C to 85°C			1.5	
SR	Slew rate	V_{CC+} = 5 V†	25°C	2	2.5		V/μs
GBM	Gain-bandwidth product		25°C		8		MHz
ϕ_m	Phase margin		25°C		67		deg
G_m	Gain margin		25°C		15		dB
	Amplifier-to-amplifier isolation	V_{CC+} = 5 V, R_L = 100 kΩ to 2.5 V‡	25°C		135		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{CM} = 1 V	25°C		24		nV/√Hz
I_n	Equivalent input noise voltage	f = 1 kHz	25°C		0.25		pA/√Hz
THD	Total harmonic distortion	f = 1 kHz, A_{VD} = –2, R_L = 10 kΩ, V_O = 4.1 V_{PP}	25°C		0.01%		

† Connected as voltage follower with 3-V step input. Value specified is the slower of the positive and negative slew rates.
‡ Refers to inputs only. Each amplifier is excited, in turn, with 1 kHz to produce V_O = 3 V_{PP}.

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