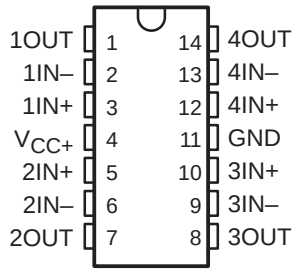
LMV321 SINGLE, LMV358 DUAL, LMV324 QUAD
LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

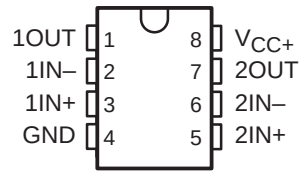
SLOS263C – AUGUST 1999 – REVISED MARCH 2000

- **2.7-V and 5-V Performance**
- **No Crossover Distortion**
- **Low Supply Current:**
  - **LMV321 . . . 130 μA Typ**
  - **LMV358 . . . 210 μA Typ**
  - **LMV324 . . . 410 μA Typ**
- **Rail-to-Rail Output Swing**
- **Package Options Include Plastic Small-Outline (D), Small-Outline Transistor (SOT-23 DBV, SC-70 DCK), and Thin Shrink Small-Outline (PW) Packages**

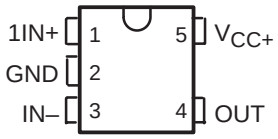
LMV324 . . . D OR PW PACKAGE
(TOP VIEW)



LMV358 . . . D OR PW PACKAGE
(TOP VIEW)



LMV321 . . . DBV OR DCK PACKAGE
(TOP VIEW)



description

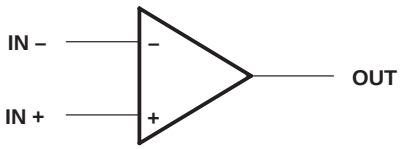
The LMV324 and LMV358 are low-voltage (2.7 V to 5.5 V) versions of the dual and quad operational amplifiers, LM324 and LM358, that operate from 5 V to 30 V. The LMV321 is the single-amplifier version.

The LMV321, LMV324, and LMV358 are the most cost-effective solutions for applications where low-voltage operation, space saving, and low price are needed. They offer specifications that meet or exceed those of the familiar LM358 and LM324 devices. These devices have rail-to-rail output-swing capability, and the input common-mode voltage range includes ground. They all exhibit excellent speed-to-power ratios, achieving 1MHz of bandwidth at 1-V/μs slew rate with low supply current.

The LMV321 is available in the ultra-small DCK package, which is approximately one-half the size of the DBV package. This package saves space on printed circuit boards and enables the design of small portable electronic devices. It also allows the designer to place the device closer to the signal source to reduce noise pickup and increase signal integrity.

The LMV321I, LMV324I, and LMV358I devices are characterized for operation from –40°C to 85°C.

symbol (each amplifier)



AVAILABLE OPTIONS

T_A	PACKAGE TYPE	PACKAGED DEVICES		
		SINGLE	DUAL	QUADRUPLE
–40°C to 85°C	5-pin SOT	LMV321IDCKR LMV321IDBVR	— —	— —
	8-pin SOIC 8-pin TSSOP	— —	LMV358ID LMV358IPWR	— —
	14-pin SOIC 14-pin TSSOP	— —	—	LMV324ID LMV324IPWR

The D package is available taped and reeled. Add the suffix R to the device type (e.g., LMV324DR). 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, 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 . . . . . 197°C/W
D (14-pin) package . . . . . 127°C/W
DBV package . . . . . 347°C/W
DCK package . . . . . 389°C/W
PW (8-pin) package . . . . . 243°C/W
PW (14-pin) package . . . . . 170°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or PW package . . . . . 260°C
DBV or DCK package . . . . . TBD
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 impact 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)	2.7	5.5	V
T_A	Operating free-air temperature	–40	85	°C

electrical characteristics at T_A = 25°C and V_{CC+} = 2.7 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage				1.7	7	mV
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage				5		μV/°C
I_{IB}	Input bias current				11	250	nA
I_{IO}	Input offset current				5	50	nA
CMRR	Common-mode rejection ratio	V_{CM} = 0 to 1.7 V		50	63		dB
k_{SVR}	Supply-voltage rejection ratio	V_{CC} = 2.7 V to 5 V, V_O = 1 V		50	60		dB
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB		0 to 1.7	–0.2 to 1.9		V
	Output swing	R_L = 10 kΩ to 1.35 V	High level	V_{CC}–100	V_{CC}–10		mV
			Low level		60	180	
I_{CC}	Supply current	LMV321I			80	170	μA
		LMV358I (both amplifiers)			140	340	
		LMV324I (all four amplifiers)			260	680	
B_1	Unity-gain bandwidth	C_L = 200 pF			1		MHz
Φ_m	Phase margin				60		deg
G_m	Gain margin				10		dB
V_n	Equivalent input noise voltage	f = 1 kHz			46		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz			0.17		pA/√Hz

electrical characteristics at specified free-air temperature range, V_{CC+} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage			25°C		1.7	7	mV
				–40°C to 85°C			9	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			25°C		5		μV/°C
I_{IB}	Input bias current			25°C		15	250	nA
				–40°C to 85°C			500	
I_{IO}	Input offset current			25°C		5	50	nA
				–40°C to 85°C			150	
CMRR	Common-mode rejection ratio	V_{CM} = 0 to 4 V		25°C	50	65		dB
k_{SVR}	Supply-voltage rejection ratio	V_{CC}= 2.7 V to 5 V, V_O = 1 V, V_{CM} = 1 V		25°C	50	60		dB
V_{ICR}	Common-mode input voltage range	CMMR ≥ 50 dB		25°C	0 to 4	–0.2 to 4.2		V
	Output swing	R_L = 2 kΩ to 2.5 V	High level	25°C	V_{CC}–300	V_{CC}–40		mV
				–40°C to 85°C	V_{CC}–400			
			Low level	25°C		120	300	
				–40°C to 85°C			400	
		R_L = 10 kΩ to 2.5 V	High level	25°C	V_{CC}–100	V_{CC}–10		
				–40°C to 85°C	V_{CC}–200			
			Low level	25°C		65	180	
				–40°C to 85°C			280	
A_{VD}	Large-signal differential voltage gain	R_L = 2 kΩ		25°C	15	100		V/mV
				–40°C to 85°C	10			
I_{OS}	Output short-circuit current	Sourcing, V_O = 0 V		25°C	5	60		mA
		Sinking, V_O = 5 V			10	160		
I_{CC}	Supply current	LMV321I		25°C		130	250	μA
				–40°C to 85°C			350	
		LMV358I (both amplifiers)		25°C		210	440	
				–40°C to 85°C			615	
		LMV324I (all four amplifiers)		25°C		410	830	
				–40°C to 85°C			1160	
B_1	Unity-gain bandwidth	C_L = 200 pF		25°C		1		MHz
ϕ_m	Phase margin			25°C		60		deg
G_m	Gain margin			25°C		10		dB
V_n	Equivalent input noise voltage	f = 1 kHz		25°C		39		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.21		pA/√Hz
SR	Slew rate			25°C		1		V/μs

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