

Sine On™

AN ANALOG AND
MIXED-SIGNAL
PRODUCT CATALOG

this issue:

Amplifiers & Comparators



Order the
**Amplifiers and
Comparators
Data Book
2000**

See back cover
for details.

3Q 2000

Issue 2

Single-Supply Amplifiers

- 2 ➤ 880-nA amplifier
- 2 ➤ Fastest 1.8-V CMOS RRIO amplifier
- 3 ➤ Ultra-low-power, 1.8-V amplifier
- 3 ➤ Ultra-low-power amplifier
- 4 ➤ Micropower rail-to-rail I/O amplifiers
- 4 ➤ High-output drive, rail-to-rail I/O (RRIO) amplifiers
- 5 ➤ Low-power, high-output-drive RRIO amplifier
- 5 ➤ 2.7-V single-supply amplifiers
- 6 ➤ Wide input voltage, high output drive
- 6 ➤ BiFET to BiCMOS with high performance amps
- 7 ➤ High-drive amplifier in small package

Comparators

- 7 ➤ Nanopower family of RRIO drain-output comparators

General-Purpose Amplifiers

- 8 ➤ Quad, low-voltage, rail-to-rail-output op amp

Development Tools

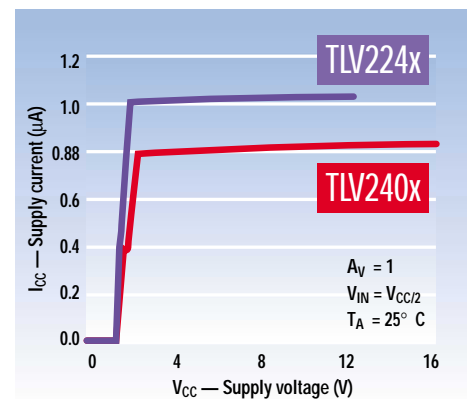
- 8 ➤ Macromodels
- 9 ➤ Single-supply amplifier EVM selection guide

Resources

- 10 ➤ Single-supply amplifiers portfolio snapshot
- 12 ➤ Selection guides
- 15 ➤ Application reports

Ultra-low-power amplifiers
save battery life

Page 2

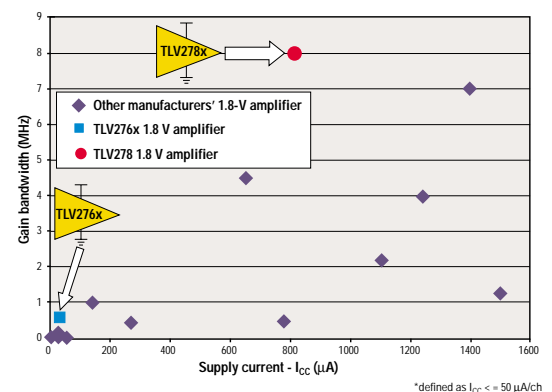


Evaluation modules and
product samples
simplify design solutions

Page 9

High bandwidth amplifiers
at low-supply current

Page 3



Single-Supply Amplifiers

Nanopower amplifier extends battery life

TLV240x

Get samples, datasheets and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with *tlv2401*, *tlv2402* or *tlv2404*




 *Requires samples obtained separately

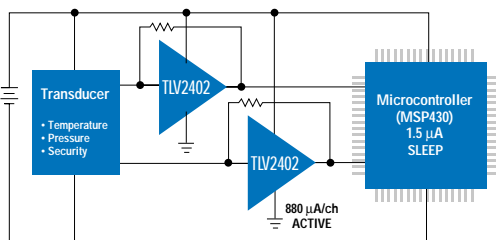
- Current draw of 880 nA/ch (typ) extends battery life
- Rail-to-rail input/output for increased dynamic range
- Wide 2.5-V to 16-V supply voltage enhances flexibility
- Reverse battery protection of 18 V
- Input voltage range exceeds positive rail by 5 V for rugged operation
- Gain bandwidth product: 5.5 kHz
- Applications include: portable and battery-powered systems, wireless, smoke detectors, personal digital assistants (PDAs), mobile phones, security systems, handheld instruments
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP
- Pricing starts at \$0.93 each in quantities of 1,000

TLV2401/2/4 mini-datasheet

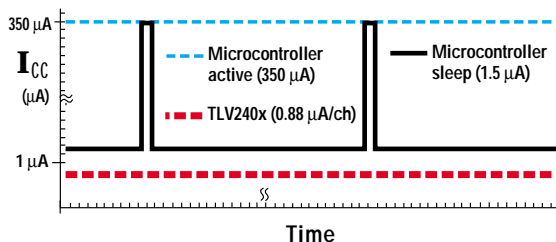
V _{CC} (V)	I _{CC} (nA)	V _{ICR} (V)	CMRR (dB)	V _{IO} (μV)	BW (kHz)
2.5 - 16	880	-0.1 to V _{CC} + 5	120	390	5.5

(Typical, 2.7 V, 25° C, I_{CC} per channel)

Typical monitoring system with TLV240x amplifier and microcontroller



Low duty cycle changes power



Ultra-low-power amplifier for portable applications

TLV224x

Get samples, datasheets and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with *tlv2240*, *tlv2242* or *tlv2244*




 *Requires samples obtained separately

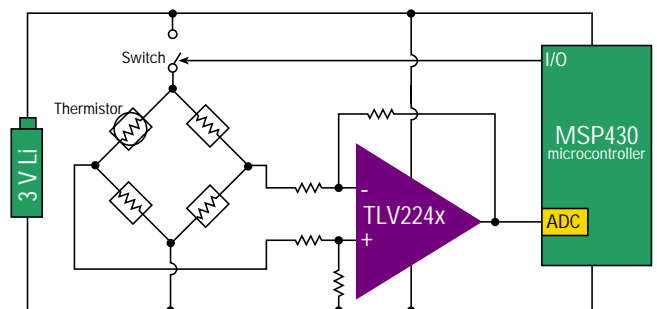
- Ultra-low-power operation: 1 μA/ch for increased battery life
- Low supply voltage (V_{CC} = 2.5 V to 12 V) ideal for battery-powered portable applications
- Rail-to-rail swing of input and output maximizes dynamic range
- Applications include: battery-powered systems, wireless handsets, portable instrumentation, smoke detectors, carbon monoxide detectors, fire alarms, PDAs, active badges, cameras, pagers
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP
- Pricing starts at \$0.81 each in quantities of 1,000

TLV2241/2/4 mini-datasheet

Device	V _{CC} (V)	I _{CC} (μA)	V _{IO} (μV)	I _{IO} (pA)	GBW (kHz)	SR (V/ms)
TLV224x	2.5 - 12	1	600	25	5.5	2

(Typical, 2.7 V, 25° C, I_{CC} per channel)

Differential amplification of temperature in a portable temperature-sensing application



Single-Supply Amplifiers

Fastest 1.8-V CMOS RRIO amplifier

TLV278x

Get samples, datasheets and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with [tlv2780](#), [tlv2781](#), [tlv2782](#), [tlv2783](#), [tlv2784](#) or [tlv2785](#)



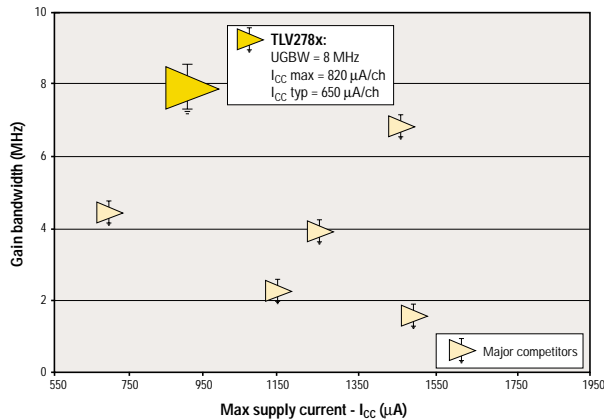
- Low supply voltage ($V_{DD} = 1.8\text{ V to }3.6\text{ V}$): TLV278x can be used throughout the lifetime of 2 AA cells (i.e., two depleted AA cells [$0.9\text{ V} + 0.9\text{ V} = 1.8\text{ V}$])
- Wide gain bandwidth product: 8 MHz
- Quick slew rate: 4.3 V/ μs
- Low power ($I_{DD} = 650\ \mu\text{A/ch}$) extends battery life; $I_{DD(\text{SHDN})} = 0.9\ \mu\text{A/ch}$ extends battery life even further
- Rail-to-rail swing of input and output means more headroom for small-signal operation (more dynamic range)
- Applications include: portables, battery-powered applications, fire alarms, PDAs, wireless handsets
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP, with and without shutdown
- Pricing starts at \$0.79 each in quantities of 1,000

TLV2780*/1*/2*/3*/4*/5* mini-datasheet

V_{DD} (V)	I_{DD} (μA)	BW (MHz)	SR (V/ μs)
1.8 - 3	650	8	4.3

(Typical, 1.8 V, 25° C, I_{DD} per channel)

Fastest 1.8-V CMOS amplifier family



Micropower 1.8-V amplifier maximizes speed and power

TLV276x

Get samples, datasheets and EVMs* at: <http://www.ti.com/sc/docs/products/analog/device.html>
 Replace *device* with [tlv2760](#), [tlv2761](#), [tlv2762](#), [tlv2763](#), [tlv2764](#) or [tlv2765](#)



- Micropower operation of 20 $\mu\text{A/ch}$ consumes less power when operating lifetime is critical
- Delivers wide bandwidth: 500 kHz
- Nanopower shutdown mode: $I_{DD(\text{SHDN})} = 10\ \text{nA/ch}$
- Rail-to-rail swing of input and output means more headroom for small-signal operation (more dynamic range)
- Low supply voltage ($V_{DD} = 1.8\text{ V to }3.6\text{ V}$) for use in battery-powered portable applications
- Applications include: handheld instruments, data converters, smoke detectors, carbon monoxide detectors, fire alarms, PDAs, active badges, cameras, pagers
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP, with and without shutdown
- Pricing starts at \$1.12 each in quantities of 1,000

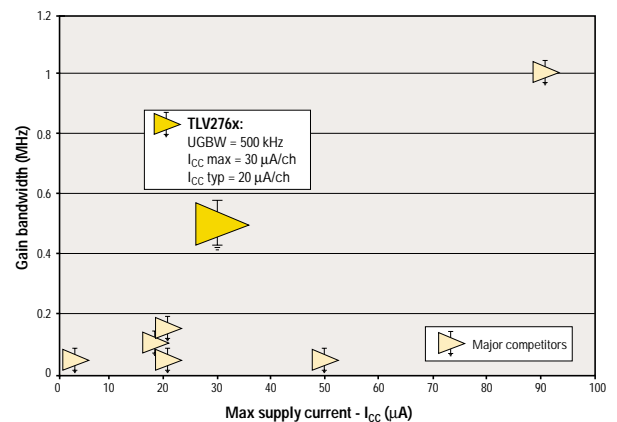
TLV2760*/1*/2*/3*/4*/5* mini-datasheet

V_{DD} (V)	I_{DD} (μA)	BW (kHz)	V_{IO} (μV)
1.8 - 3	650	500	550

(Typical, 2.7 V, 25° C, I_{CC} per channel)

▼ These products are in the product preview stage of development. Contact your distributor or local TI sales office for availability. Availability is expected 1Q '01.

Best bandwidth/supply current combination for micropower 1.8-V amplifiers



Single-Supply Amplifiers

Micropower rail-to-rail input/output amplifiers

TLV245x

Get samples, datasheets, app reports and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with *tlv2450, tlv2451, tlv2452, tlv2453, tlv2454* or *tlv2455*





 *Requires samples obtained separately

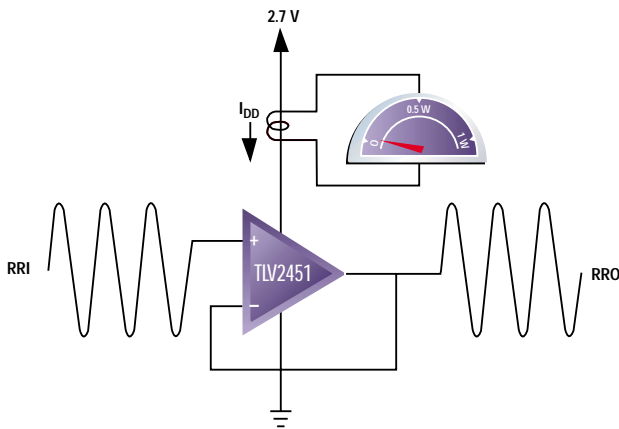
- Rail-to-rail input and output
- Very low supply current of 23 μA /channel (typ), $I_{DD\text{ SHDN}} = 12\text{ nA/ch}$
- Gain bandwidth: 220 kHz
- Supply voltage range: 2.7 V to 6 V
- Output drive capability: $\pm 10\text{ mA}$
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP, with and without shutdown

TLV2450/1/2/3/4/5 mini-datasheet

V_{DD} (V)	I_{DD} (μA)	BW (kHz)	V_{IO} (μV)	I_o (mA)
2.7 - 6	23	500	20	± 10

(Typical, 5 V, 25° C, I_{DD} per channel)

Low supply current consumption



High-output drive, rail-to-rail I/O amplifiers for low-voltage systems

TLV246x

Get samples, datasheets, app reports and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with *tlv2460, tlv2461, tlv2462, tlv2463, tlv2464* or *tlv2465*





 *Requires samples obtained separately

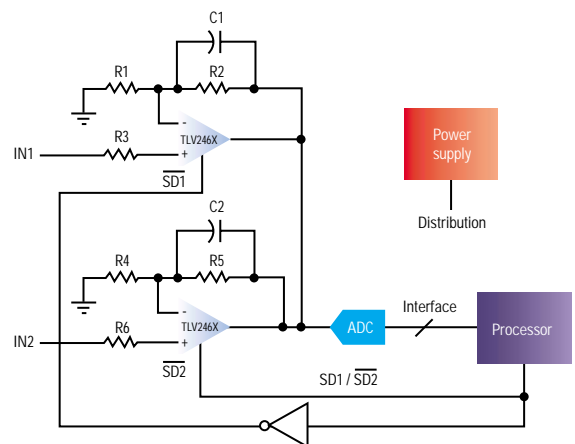
- High-output drive: $\pm 90\text{ mA}$ loads
- Rail-to-rail input and output
- Bandwidth: 6.4 MHz
- Slew rate: 1.6 V/ μs
- Noise voltage: 11 nV/ $\sqrt{\text{Hz}}$ at 1 kHz
- Applications include: analog-to-digital converter drivers, wireless handsets, modems, low-voltage audio
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP, all with and without shutdown
- Pricing starts at \$0.65 each in quantities of 1,000

TLV2460/1/2/3/4/5 mini-datasheet

V_{DD} (V)	I_{DD} (μA)	BW (MHz)	I_o (mA)	V_n (nV/ $\sqrt{\text{Hz}}$)	SR (V/ μs)
2.7 - 6	550	6.4	± 90	11	1.6

(Typical, 5 V, 25° C, I_{DD} per channel)

TLV246x as a multiplexer



Single-Supply Amplifiers

Low-power, 2.7-V CMOS input amplifier

TLV247x

Get samples, datasheets, app reports and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with [tlv2470](#), [tlv2471](#), [tlv2472](#), [tlv2473](#), [tlv2474](#) or [tlv2475](#)





 *Requires samples obtained separately

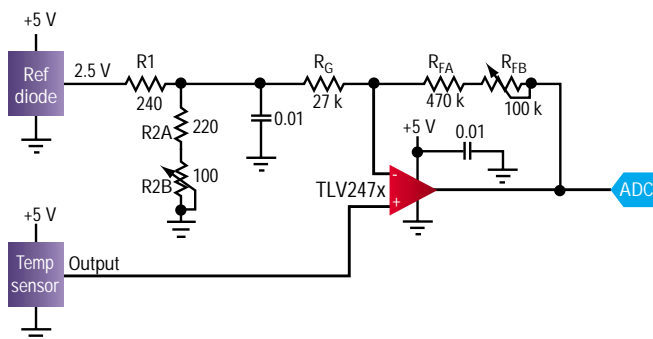
- Rail-to-rail CMOS input provides low-input bias current and output
- Supply voltage operation down to 2.7 V
- Wide bandwidth: 2.8 MHz
- High output drive capability: ±35 mA at 500 mV
- Low supply current of 600 and micropower shutdown of 1 µA/ch saves power
- Applications include: sensor interface, instrumentation, portable or battery-operated equipment, data acquisition circuits
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP, with and without shutdown
- Pricing starts at \$0.65 each in quantities of 1,000

TLV2470/1/2/3/4/5 mini-datasheet

V _{DD} (V)	I _{DD} (µA)	BW (MHz)	I _O (mA)	I _{IB} (pA)	SR (V/µs)
2.7 - 6 V	600 µA	2.8z	±35	2.5	1.5

(Typical, 5 V, 25° C, I_{DD} per channel)

ADC signal-conditioning circuit — (level shifting and amplification)



Fast slew rate, 2.7-V CMOS amplifier

TLV277x

Get samples, datasheets, app reports and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with [tlv2770](#), [tlv2771](#), [tlv2772](#), [tlv2773](#), [tlv2774](#) or [tlv2775](#)





 *Requires samples obtained separately

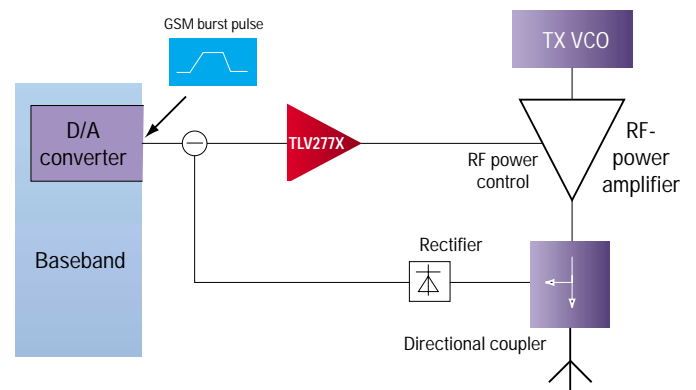
- Exceptional AC performance at 2.7 V:
 - Bandwidth: 4.8 MHz
 - Slew rate: 9 V/µs
- Rail-to-rail output
- Low noise: 21 nV/√Hz (at 1 kHz)
- Applications include: ADC drivers, medical instrumentation, wireless handsets
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP, with and without shutdown
- Pricing starts at \$0.60 each in quantities of 1,000

TLV2470/1/2/3/4/5 mini-datasheet

V _{DD} (V)	I _{DD} /I _{DD(SHDN)} (mA)	BW (MHz)	SR (V/µs)	THD+N
2.7 - 6	1/0.8 mA	4.8	9	0.0085%

(Typical, 2.7 V, 25° C, I_{DD} per channel)

Power sensing in the control loop of a GSM RF-power amplifier



Single-Supply Amplifiers

CMOS amplifiers feature wide input voltage, high output drive

TLV2432/4, TLV2442/4

Get samples, datasheets, app reports and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with *tlv2432*, *tlv2434*, *tlv2442* or *tlv2444*





 *Requires samples obtained separately

- Output swing includes both supply rails
- Wide supply voltage range of $V_{DD} = 2.7\text{ V to }10\text{ V}$
- High output drive of $600\ \Omega$
- Input noise:
 - $V_n = 18\text{ nV}/\sqrt{\text{Hz}}$ (typ) at 1 kHz (TLV243x)
 - $V_n = 16\text{ nV}/\sqrt{\text{Hz}}$ (typ) at 1 kHz (TLV244x)
- Low CMOS input: $I_{IB} = 1\text{ pA}$ (typ)
- Typical application: analog-to-digital/digital-to-analog line drivers; ideal upgrade for TLC27x
- Packaging: available in TSSOP, SOIC, and DIP
- Pricing starts at \$0.70 each in quantities of 1,000

TLV2432/3, TLV2442/4 mini-datasheet

Device	V_{DD} (V)	I_{DD} (μA)	BW	V_{IO} (A grade) (μV)	V_n ($\text{nV}/\sqrt{\text{Hz}}$)
TLV2432/4	2.7 - 10	98	500 kHz	300	18
TLV2442/4	2.7 - 10	725	1.3 MHz	300	16

(Typical, 3 V, 25° C, I_{DD} per channel)

BiFET to BiMOS with high-performance amplifiers

TLC07x/TLC08x

Get samples, datasheets, app reports and EVMs* at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with *tlc070*, *tlc071*, *tlc072*, *tlc073*, *tlc074*, *tlc075*, *tlc080*, *tlc081*, *tlc082*, *tlc083*, *tlc084* or *tlc085*





 *Requires samples obtained separately

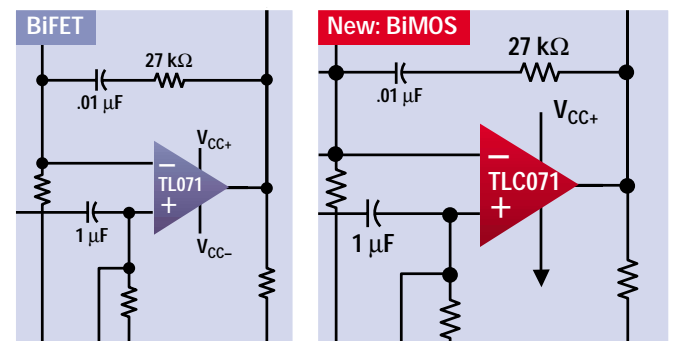
- Wide gain bandwidth: 10 MHz
- Fast slew rate: $16\text{ V}/\mu\text{s}$
- Low distortion: THD + N = 0.002% (typ)
- Low noise:
 - $V_n = 7\text{ nV}/\sqrt{\text{Hz}}$ at 1kHz (TLC07x)
 - $V_n = 8.5\text{ nV}/\sqrt{\text{Hz}}$ at 1kHz (TLC08x)
- Ideal upgrades from dual-supply, BiFET TL07x and TL08x amplifiers
- Packaging: available in MSOP, TSSOP, SOIC and PDIP, with and without shutdown
- Pricing starts at \$0.42 each in quantities of 1,000

TLC070/1/2/3/4/5 mini-datasheet

Device	V_{DD} (V)	$I_{DD}/I_{DD(SHDN)}$ (mA)	BW (MHz)	SR (V/ μs)	V_n ($\text{nV}/\sqrt{\text{Hz}}$)
TLC07x	4.5 - 16	1.9/0.125	10	16	7
TLC08x	4.5 - 16	1.8/0.125	10	16	8.5

(Typical, 5 V, 25° C, I_{DD} per channel)

Upgrade to TLC07x for improved performance



Single-Supply Amplifiers

Amplifier family provides high drive in small packages

TLV411x

Get samples, datasheets, app reports and EVMs* at: www.ti.com/sc/docs/products/analog/tlv4112.html





 *Requires samples obtained separately

- High output drive in excess of 300 mA at 5 V
- Rail-to-rail output
- Low distortion at high frequency: THD + N = 0.025% at 100 Ω
- Wide gain bandwidth: 2 MHz
- Slew rate: 1.5 V/μs
- Applications include: high-current buffers, coil drivers, cable drivers, low-power DC motors
- Packaging: available in MSOP (PowerPAD™), SOIC and PDIP (TLV4112); only the MSOP PowerPAD package will enable the high drive of this device
- Pricing starts at \$0.97 each in quantities of 1,000

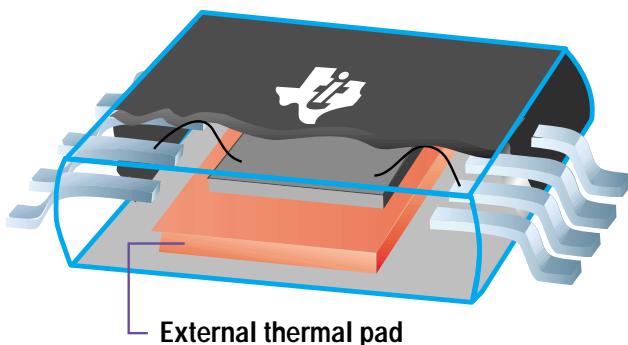
TLV4110*/1*/2*/3* mini-datasheet

V _{DD} (V)	I _{DD} (μA)	I _O (mA)	BW (MHz)	THD (100Ω)
2.5 - 6	700	320	2.7	0.025%

(Typical, 5 V, 25° C, I_{DD} per channel)

▼ These products are in the product preview stage of development. Contact your distributor or local TI sales office for availability. Availability is expected 1Q '01.

Cross-section view of the PowerPAD™ package



Comparators

Nanopower family of RRIO drain output comparators

TLV340x, TLV370x

Get datasheets at: www.ti.com/sc/docs/products/analog/device.html
 Replace *device* with *tlv3401* or *tlv3402*



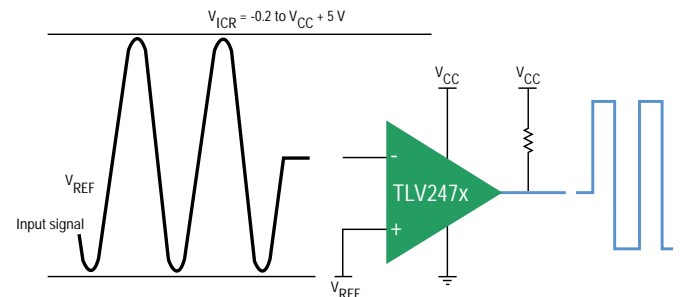
- Nanopower current draw of 470 nA (TLV340x) and 500 nA (TLV370x) (typ), for longer battery life
- Reverse battery protection prevents damage to device
- Inputs can exceed the positive rail by 5 V, which improves ruggedness and suitable apps
- Rail-to-rail input for increased dynamic range
- Wide 2.5-V to 16-V supply voltage for use with multiple Li-Ion cells
- Applications include: low-powered portable applications, wireless handsets, battery-powered devices, metering systems, alarm and monitoring systems
- Packaging: available in SOT-23, MSOP, TSSOP, SOIC and PDIP

TLV3401*/2*/4*, TLV3701*/2*/4* mini-datasheet

Device	Channels	V _{CC} - V (min)	I _{CC} - nA/ch (typ)	I _{IB} - pA (nA)	Output stage
TLV340x	Single/dual	2.5 - 16	470	350	Open drain
TLV370x ⁺	Single/dual	2.5 - 16	500	-	Push-pull

▼ These products are in the product preview stage of development. Contact your distributor or local TI sales office for availability. Expected availability is 4Q '00. ⁺ Availability is expected 1Q '01.

Diagram of a threshold detector for micropower systems



General-Purpose Amplifier

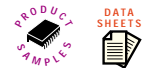
Low-voltage, rail-to-rail output op amp

LMV321/LMV358/LMV324

Get samples and datasheets at:

www.ti.com/sc/docs/products/analog/device.html

Replace *device* with *lmv321*, *lmv358* or *lmv324*



- Specifications meet or exceed those of the basic LM324 device
- Low-voltage operation at $V_{CC} = 2.7\text{ V}$ to 5.5 V with single-supply capability
- Low-power consumption of $102.5\text{ }\mu\text{A}/\text{ch}$ (typ, LMV324) compared to bipolar devices
- Rail-to rail output of 0.065 V to 4.99 V ($V_{CC} = 5\text{ V}$) (typ) for maximum voltage swing
- Input common-mode range: $V_{ICR} = -0.2\text{ V}$ to 4.2 V (typ), which includes ground to increase input voltage swing
- Universal op amp evaluation module simplifies design solution (see page 9)
- Applications include: wireless handsets, pagers, PDAs, portable low-voltage/low-power equipment
- Packaging: available in ultra-small SC-70 and SOT-23 (LMV321); SOIC and space-saving TSSOP (LMV358/LMV324)
- Pricing starts at \$0.27 each in quantities of 1,000

LMV321/LMV358/LMV324 mini-datasheet

Device	Channels	V_{CC} (V)	I_{CC} (μA)	BW (MHz)	V_{ICR} (V)
LMV321	1	2.7 - 5.5	130	1	-0.2 to 4.2
LMV358	2	2.7 - 5.5	105	1	-0.2 to 4.2
LMV324	4	2.7 - 5.5	103	1	-0.2 to 4.2

(Typical, 5 V, 25° C, I_{CC} per channel)

Amplifier Development Tools

Convenient tools for more efficient simulation

Macromodels

Get app report at:

www.ti.com/sc/data/msp/models/macromod.pdf

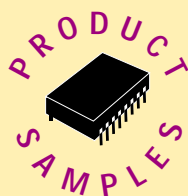


Macromodels are free mini-programs that contain the typical operating characteristics of an amplifier device. These mini-programs are available to download and import into the user's favorite simulation software. This allows the designer to evaluate amplifier device characteristics and operation within simulated designs.

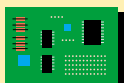
TI provides macromodels for most amplifier devices. These models can be downloaded by selecting the models link from the appropriate product web folder.

Features of TI macromodels:

- Give designers a fairly accurate representation of the operation of the device
- Use ideal elements of SPICE to simulate amplifier characteristics
- Are effective tools for modeling more than one device
- Allow designers to evaluate components early in the design process, saving time



EVALUATION



MODULE

Get design resources fast!

The icons for "product samples" and "evaluation modules" (EVMs) throughout this *Sine On* indicate their availability for products featured. These resources simplify the design process and shorten development time. Visit the web site listed at the beginning of each article to get started.

Samples may be ordered by clicking on the "Pricing/Samples/Availability" option. After following the simple registration process, samples will be promptly shipped to you.

EVM details, including ordering instructions, are available by checking the "Development Tools" option.

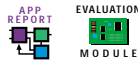
Single-Supply Amplifier EVM Selection Guide



Save design time with five universal op amp evaluation modules and free product samples

To order your universal op amp EVMs call the regional Product Information Center (PIC) (see page 15), or visit us at www.ti.com/sc/docs/tools/analog/amplifiersdevelopmentboards.html

Get app reports and EVMs* at: www.ti.com/sc/docs/tools/analog/amplifiersdevelopmentboards.html



*Requires samples obtained separately

Quick and easy sample evaluation with universal op amp EVMs

Universal op amp evaluation modules (EVMs) are printed circuit boards (PCBs) that greatly reduce design time and eliminate the need for dual in-line samples in the evaluation of TI amplifiers. Universal op amp EVMs feature:

- The ability to evaluate various package types (SOT-23, SOIC, MSOP, TSSOP and PDIP) by choosing the appropriate EVM
- The ability to evaluate single, dual, and/or quad amplifiers using the three to four individual evaluation areas on each board
- Detachable printed circuit development areas for increased portability
- User's manuals with complete board schematic, board layout and easy-to follow example circuits
- Unpopulated universal boards - allowing for evaluation of hundreds of amplifier products with only five types of EVM boards; order samples for use with universal op amp EVMs
- Compatibility with hundreds of amplifier product samples

TI's five universal op amp EVMs can be ordered in two different configurations (single board or package of 20).

Description	Orderable Part Numbers	
	Single EVM (free)▼	Package of 20 (\$50)
Universal op amp EVM (SOT-23, MSOP, SOIC)	SLOP120	UNIV-OPAMP-1B
Universal op amp with shutdown EVM (SOT-23, MSOP, SOIC)	SLOP224	UNIV-OPAMP-2B
Universal op amp EVM with/without shutdown (MSOP/TSSOP)	SLOP247	UNIV-OPAMP-3B
Universal op amp EVM with/without shutdown (SOIC)▼▼	SLOP248	UNIV-OPAMP-4B
Universal op amp EVM with/without shutdown (PDIP)▼▼	SLOP249	UNIV-OPAMP-5B

▼ One free EVM per person or address
 ▼▼ For use with single-supply amplifiers only

Universal op amp EVM selection guide

Each of the five different EVM boards accommodate amplifier samples based on package size (SOT-23, MSOP, TSSOP, SOIC, and PDIP) and shutdown features. Please reference the selection guide below to select the appropriate EVM. The selection guide is also available from www.s.ti.com/sc/techlit/slou060 as an Acrobat Reader file.

Shutdown	Package	SLOP120	SLOP224	SLOP247	SLOP248*	SLOP249*
Single						
Without shutdown	PDIP					■ (8-pin)
	SOIC				■ (8-pin)	
	SOT-23	■ (5-pin)				
	MSOP			■ (8-pin)		
With shutdown	PDIP					■ (8-pin)
	SOIC		■ (8-pin)		■ (8-pin)	
	SOT-23		■ (6-pin)			
	MSOP			■ (8-pin)		
Dual						
Without shutdown	PDIP					■ (8-pin)
	SOIC	■ (8-pin)			■ (8-pin)	
	MSOP	■ (8-pin)				
With shutdown	PDIP					■ (14-pin)
	SOIC		■ (14-pin)		■ (14-pin)	
	MSOP		■ (10-pin)	■ (10-pin)		
Quad						
Without shutdown	PDIP					■ (14-pin)
	SOIC				■ (14-pin)	
	TSSOP			■ (14-pin)		
With shutdown	PDIP					■ (16-pin)
	SOIC				■ (16-pin)	
	TSSOP			■ (16-pin)		

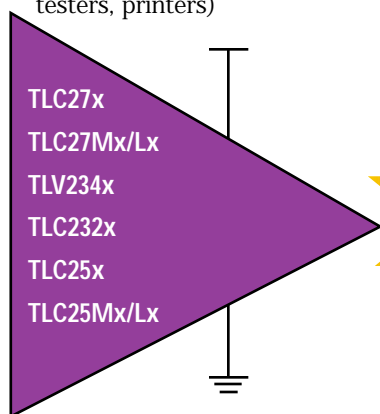
* For use with single-supply amplifiers only

Single-Supply Amplifier Portfolio Snapshot*

Non rail-to-rail CMOS

Most common applications:

- Industrial controls (scanners, motor control, measurement)
- Input/output (I/O) equipment (monitors, testers, printers)



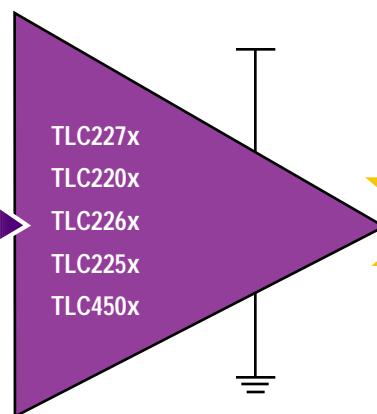
Performance characteristics:

- Original LinCMOS operational amplifiers
- 1.4-V minimum supply voltage variants
- Good bandwidth performance: 8.5 kHz to 1.7 MHz
- Power draw supply current:
17 μ A to 1.6 mA (max)
- Input offset voltage: 500 μ V to 10 mV

First generation, rail-to-rail output (CMOS)

Most common applications:

- Communications equipment (telephone sets, multiplexers, encryption)
- Instrumentation (GPS, Ph meters, measurements)



Improved performance characteristics:

- Rail-to-rail output swing
- Wider bandwidth performance: 200 kHz to 4.7 MHz
- Lower noise V_n (typ): 8 - 19 nV/\sqrt{Hz} at 1 kHz
- Better precision, input offset voltage
80 μ V to 2.5 mV (max)
- High common mode rejection: 75 dB to 100 dB
- TI's first self-calibrating amplifiers
(TLC4501/TLC4502)

Key Specifications

Device family	Supply voltage (V)	GBW (MHz)	I_{CC} max (mA)	I_{IB} typ (pA)	Channels	SR (typ) (V/ μ s)	V_{IO} max (mV)	V_n (typ) (nV/ \sqrt{Hz})	CMRR
TLC27x	3-16	1.7	1.6	0.6	S/D/Q	3.6	10	25	80
TLC27Mx	3-16	0.525	0.28	0.6	D/Q	0.43	10	32	91
TLC27Lx	3-16	0.085	0.017	0.6	S/D/Q	0.03	10	68	94
TLV234x	2-8	1.7	1.6	0.6	S/D/Q	3.6	8	25	80
TLV232x	2-8	0.027	0.017	0.6	D/Q	0.02	9	68	94
TLC25x	1.4-16	1.7	1.6	0.6	S/D/Q	3.6	10	25	80
TLC25Mx	1.4-16	0.525	0.28	0.6	D/Q	0.43	10	32	91
TLC25Lx	1.4-16	0.085	0.017	0.6	D/Q	0.03	10	68	94
TLC227x	4.4-16	2.18	1.5	1	D/Q	3.6	2.5	9	75
TLC220x	4.6-16	1.8	1.5	1	S/D	2.5	0.5	8	110
TLC226x	4.4-16	0.82	0.25	1	D/Q	0.55	2.5	12	83
TLC225x	4.4-16	0.2	0.0625	1	D/Q	0.12	1.5	19	83
TLC4501	4-16	4.7	1.5	1	S	2.5	0.08	12	100
TLC4502	4-16	4.7	3.5	1	D	2.5	0.1	12	100

*This shows a portion of the single-supply amplifier family of products. Please see pages 12-14 for a complete listing of single-supply amplifiers.

Don't forget to order an EVM to evaluate your samples!
Samples are available for all of these devices.

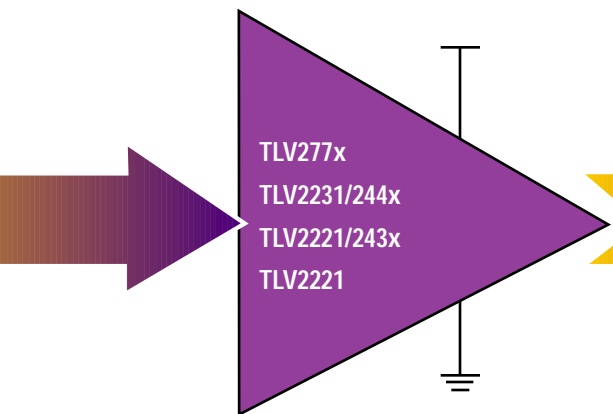
For technical support and ordering literature, see page 15.

Single-Supply Amplifier Portfolio Snapshot*

Second generation, rail-to-rail output (CMOS)

Most common applications:

- Industrial (metering, controls)
- Telecom (phones, line cards)
- Consumer (cameras, audio)



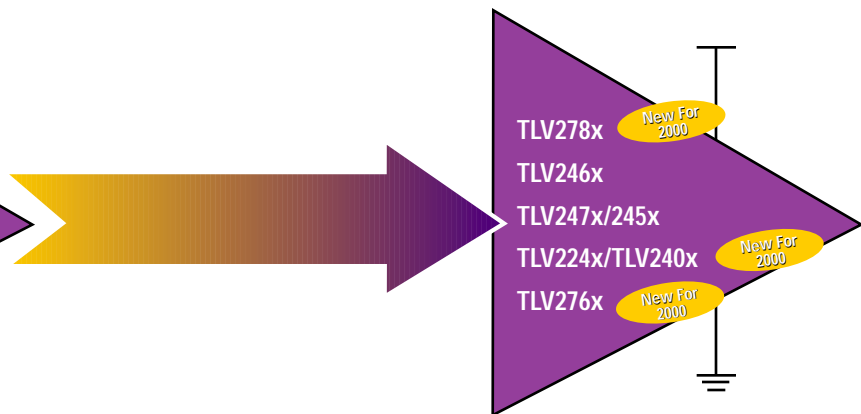
Improved performance characteristics:

- Wider bandwidth at lower voltages:
 - GBW up to 4.8 MHz
 - $2.5\text{ V} \leq V_{CC} (\text{min}) \leq 2.7\text{ V}$
- Low power performance: $I_{CC} (\text{max})$ 25 μA to 2 mA
- Small packaging: SOT-23
- Shutdown available: $I_{CC} (\text{SHDN}) < 1\ \mu\text{A}$ (TLV277x)
- Increased V_{ICR} and output drive over standard CMOS amplifiers

Latest generation, rail-to-rail input/output (CMOS & bipolar)

Most common applications:

- Medical (instrumentation, diagnostic)
- Communications (GSM, router)
- Measure test (portable, glucose, security)



Improved performance characteristics:

- Rail-to-rail input and output
- Wide bandwidth with low supply currents:
 - GBW 5.5 kHz to 8 MHz
 - $1.2\ \mu\text{A} \leq I_{CC} (\text{max}) \leq 750\ \mu\text{A}$
- Low voltage: $1.8\text{ V} \leq V_{CC} (\text{min}) \leq 2.7\text{ V}$
- More standard offerings:
 - Small packaging: SOT-23
 - Shutdown: $I_{CC} (\text{SHDN}) \leq 1\ \mu\text{A}$
- Full family offerings (singles/duals/quads)

Key Specifications

Device family	Supply voltage (V)	GBW (MHz)	$I_{CC} \text{ max}$ (mA)	$I_{IB} \text{ typ}$ (pA)	Channels	SR (typ) (V/ μs)	$V_{IO} \text{ max}$ (mV)	V_n (typ) (nV/ $\sqrt{\text{Hz}}$)	CMRR	Featured in this issue
TLV277x	2.5-5.5	4.8	2	2	S/D/Q	9	2.5	21	84	page 5
TLV2231	2.7-10	2	1.2	1	S	1.6	0.45	15	70	—
TLV244x	2.7-10	1.75	1.1	1	D/Q	1.3	2	18	75	page 6
TLV2221	2.7-10	0.51	0.15	1	S	0.18	0.45	19	85	—
TLV243x	2.7-10	0.5	0.125	1	D/Q	0.25	2	18	90	page 6
TLV2211	2.7-10	0.065	0.025	1	S	0.025	0.45	22	83	—
TLV278x	1.8-3.6	8	0.82	2.5	S/D/Q	4.3	3	18	76	page 3
TLV246x	2.7-6	5.2	0.575	4400	S/D/Q	1.6	2	11	80	page 4
TLV247x	2.7-6	2.8	0.75	2	S/D/Q	1.4	2.2	15	78	page 5
TLV276x	1.8-3.6	0.5	0.028	3	S/D/Q	0.2	3.5	95	70	page 3
TLV245x	2.7-6	0.22	0.035	900	S/D/Q	0.12	1.5	51	86	page 4
TLV240x	2.5-16	0.0055	0.00129	100	S/D/Q	0.0025	1.2	800	120	page 2
TLV224x	2.5-12	0.0055	0.0012	100	S/D/Q	0.002	3	800	100	page 2

*This shows a portion of the single-supply amplifier family of products. Please see pages 12-14 for a complete listing of single-supply amplifiers.

Don't forget to order an EVM to evaluate your samples!
Samples are available for all of these devices.

Read *Sine On* online at www.ti.com/sc/sineon

Selection Guide Amplifiers

Device name	# channels	Package options					Temperature range				V _{CC} [V]		V _{IO} [μV]		I _{CCQ} [μA]			I _{IB} [pA]	CMRR [dB]	V _n , 1kHz [nV/√Hz]	SR [V/μs]	GBW [MHz]	Key specifications	1000-piece pricing (U.S.)		
		SOT-23-6 (DBV, DCK)	PDIP (P, N)	SOIC (D)	TSSOP (PW)	MSOP (DGK, DGS)	0° C - 70° C (C)	-40° C - 85° C (I)	-40° C - 105° C (II)	-40° C - 125° C (III)	55° C - 125° C (M)	min	max	typ	A	max	A	typ	max	typ (shutdown)	typ	typ			typ	typ
RAIL-RAIL INPUT & OUTPUT																										
TLV2241 ¹	S	5	8	8						2.5	12	600		3500		1	1.5		100	100	n/a	0.002	0.0055		μ-power, low voltage	\$0.81
TLV2242 ¹	D		8	8		8				2.5	12	600		3500		2	3		100	100	n/a	0.002	0.0055		μ-power, low voltage	\$1.23
TLV2244 ¹	Q	14	14	14						2.5	12	600		3500		4	6		100	100	n/a	0.002	0.0055		μ-power, low voltage	\$1.73
TLV2401 ¹	S	5	8	8						2.5	16	390		1200		0.88	0.95		100	120	n/a	0.0025	0.0055		nano-power, low voltage	\$0.93
TLV2402 ¹	D		8	8		8				2.5	16	390		1200		1.76	1.9		100	120	n/a	0.0025	0.0055		nano-power, low voltage	\$1.40
TLV2404 ¹	Q	14	14	14						2.5	16	390		1200		3.52	3.8		100	120	n/a	0.0025	0.0055		nano-power, low voltage	\$1.96
TLV2450(A)	S	6	8	8						2.7	6	20		1500	1000	23	34	0.02	500	86	49	0.11	0.22		μ-power, high drive	\$0.71
TLV2451(A)	S	5	8	8						2.7	6	20		1500	1000	23	34		500	86	49	0.11	0.22		μ-power, high drive	\$0.65
TLV2452(A)	D		8	8		8				2.7	6	20		1500	1000	45	70		500	86	49	0.11	0.22		μ-power, high drive	\$0.98
TLV2453(A)	D		14	14			10			2.7	6	20		1500	1000	45	70	0.02	500	86	49	0.11	0.22		μ-power, high drive	\$1.08
TLV2454(A)	Q	14	14	14						2.7	6	20		1500	1000	90	140		500	86	49	0.11	0.22		μ-power, high drive	\$1.37
TLV2455(A)	Q	16	16	16						2.7	6	20		1500	1000	90	140	0.02	500	86	49	0.11	0.22		μ-power, high drive	\$1.51
TLV2460(A)	S	6	8	8						2.7	6	150		2000	1500	550	650	1	1300	85	11	1.6	6.4		low noise, very high drive	\$0.71
TLV2461(A)	S	5	8	8						2.7	6	150		2000	1500	550	650		1300	85	11	1.6	6.4		low noise, very high drive	\$0.65
TLV2462(A)	D		8	8		8				2.7	6	150		2000	1500	1100	1300		1300	85	11	1.6	6.4		low noise, very high drive	\$0.98
TLV2463(A)	D		14	14			10			2.7	6	150		2000	1500	1100	1300	1	1300	85	11	1.6	6.4		low noise, very high drive	\$1.08
TLV2464(A)	Q	14	14	14						2.7	6	150		2000	1500	2200	2600		1300	85	11	1.6	6.4		low noise, very high drive	\$1.37
TLV2465(A)	Q	16	16	16						2.7	6	150		2000	1500	2200	2600	1	1300	85	11	1.6	6.4		low noise, very high drive	\$1.51
TLV2470(A)	S	6	8	8						2.7	6	250		2200	1600	600	900		2.5	84	15	1.5	2.8		low noise, high drive, low input bias	\$0.71
TLV2471(A)	S	5	8	8						2.7	6	250		2200	1600	600	900	2	2.5	84	15	1.5	2.8		low noise, high drive, low input bias	\$0.65
TLV2472(A)	D		8	8		8				2.7	6	250		2200	1600	1200	1800		2.5	84	15	1.5	2.8		low noise, high drive, low input bias	\$0.98
TLV2473(A)	D		14	14			10			2.7	6	250		2200	1600	1200	1800	2	2.5	84	15	1.5	2.8		low noise, high drive, low input bias	\$1.08
TLV2474(A)	Q	14	14	14						2.7	6	250		2200	1600	2400	3600		2.5	84	15	1.5	2.8		low noise, high drive, low input bias	\$1.37
TLV2475(A)	Q	16	16	16						2.7	6	250		2200	1600	2400	3600	2	2.5	84	15	1.5	2.8		low noise, high drive, low input bias	\$1.51
TLV2760 ²	S	6	8	8						1.8	3.6	550		6800		20	30	0.01	3	76	95	0.23	0.5		μ-power, low voltage	preview
TLV2761 ²	S	5	8	8						1.8	3.6	550		6800		20	30		3	76	95	0.23	0.5		μ-power, low voltage	preview
TLV2762 ²	D		8	8		8				1.8	3.6	550		6800		40	60		3	76	95	0.23	0.5		μ-power, low voltage	\$1.12
TLV2763 ²	D		14	14			10			1.8	3.6	550		6800		40	60	0.01	3	76	95	0.23	0.5		μ-power, low voltage	\$1.23
TLV2764 ²	Q	14	14	14						1.8	3.6	550		6800		80	120		3	76	95	0.23	0.5		μ-power, low voltage	preview
TLV2765 ²	Q	16	16	16						1.8	3.6	550		6800		80	120	0.01	3	76	95	0.23	0.5		μ-power, low voltage	preview
TLV2780(A) ²	S	6	8	8						1.8	3.6	250		4500	3000	650	820	0.9	2.5	100	18	5	8		high speed, low voltage	\$0.87
TLV2781(A) ²	S	5	8	8						1.8	3.6	250		4500	3000	650	820		2.5	100	18	5	8		high speed, low voltage	\$0.79
TLV2782(A) ²	D		8	8		8				1.8	3.6	250		4500	3000	1300	1640		2.5	100	18	5	8		high speed, low voltage	\$1.19
TLV2783(A) ²	D		14	14			10			1.8	3.6	250		4500	3000	1300	1640	0.9	2.5	100	18	5	8		high speed, low voltage	\$1.31
TLV2784(A) ²	Q	14	14	14						1.8	3.6	250		4500	3000	2600	3280		2.5	100	18	5	8		high speed, low voltage	\$1.67
TLV2785(A) ²	Q	16	16	16						1.8	3.6	250		4500	3000	2600	3280	0.9	2.5	100	18	5	8		high speed, low voltage	\$1.84
EXTENDED V _{ICR} RAIL-RAIL OUTPUT																										
TLV2422(A)	D		8	8						2.7	10	300		2000	950	100	150		1	90	18	0.02	0.052		μ-power	\$0.66
TLV2432(A)	D		8	8						2.7	10	300		2000	950	200	250		1	90	18	0.25	0.55		low power	\$0.70
TLV2434(A)	Q		14	14						2.7	10	300		2000	950	400	500		1	90	18	0.25	0.55		low power	\$0.98
TLV2442(A)	D		8	8						2.7	10	300		2000	950	1500	2200		1	75	16	1.4	1.81		high speed, high drive	\$0.70
TLV2444(A)	Q		14	14						2.7	10	300		2000	950	3000	4400		1	75	16	1.4	1.81		high speed, high drive	\$0.98
RAIL-RAIL OUTPUT, PRECISION																										
TLC2201(A)	S		8	8						4.6	16	100	80	500	200	1000	1500		1	110	8	2.5	1.8		precision, low noise, high speed	\$1.42
TLC2202(A)	D		8	14						4.6	16	100	80	1000	500	1700	2600		1	100	8	2.5	1.9		precision, low noise, high speed	\$2.51
TLC2652(A)	S		8	8						3.8	16	0.6	0.5	3	1	1500	2400		4	140	23	2.8	1.9		precision (chopper), high speed	\$2.04
TLC2654(A)	S		8	8						3.8	16	5	4	20	10	1500	2400		50	125	13	2	1.9		precision (chopper) low noise, high speed	\$1.67
TLC4501(A)	S		8							4	6			80	40	1000	1500		1	100	12	2.5	4.7		precision, low noise, high drive	\$1.11
TLC4502(A)	D		8							4	6			100	50	2500	3600		1	100	12	2.5	4.7		precision, low noise, high drive	\$1.68
PRECISION																										
TLE2021(A)	S		8	8	8					4	40	120	100	600	300	170	230		25000	110	17/(30)	0.5	1.7		precision, low power	\$0.44
TLE2022(A)	D		8	8						4	40			600	400	450	600		35000	100	17/(30)	0.5	1.7		precision, low power	\$0.67
TLE2024(A)	Q		14	16						4	40			1100	850	800	1200		45000	90	17/(30)	0.5	1.7		precision, low power	\$0.94
RAIL-RAIL OUTPUT, HIGH DRIVE																										
TLV4110(A)	S		8	8		8				2.5	6	175	TBD	3500	TBD	400	600	TBD	0.3	63	26	1.57	2		very high drive, shutdown	preview
TLV4111(A)	S		8	8		8				2.5	6	175	TBD	3500	TBD	400	600		0.3	63	26	1.57	2		very high drive	preview
TLV4112(A)	D		8	8		8				2.5	6	175	TBD	3500	TBD	800	1200		0.3	63	26	1.57	2		very high drive	\$0.97
TLV4113(A)	D		14	14		10				2.																

Selection Guide for Amplifiers (con't)

Device name	# channels	Package options					Temperature range				V _{CC} [V]		V _{IO} [μV]				I _{CC} [μA]		I _{IB} [pA]	CMRR [dB]	V _n , 1kHz [nV/√Hz]	SR [V/μs]	GBW [MHz]	Key specifications	1000-piece pricing (U.S.)		
		SOT-23-5/6 (DBV, DCK)	PDIP (P-N)	SOIC (D)	TSSOP (PW)	MSOP (DGK, DGS)	0° C - 70° C (C)	-40° C - 85° C (I)	-40° C - 105° C (II)	-40° C - 125° C (I)	-55° C - 125° C (II)	min	max	typ	A	max	A	typ	max	typ (shutdown)	typ	typ	typ			typ	typ
RAIL-TO-RAIL OUTPUT, CMOS																											
TLV2211	S	5									2.7	10	450	3000			13	25	1	83	21	0.025	0.065		μ-power	\$0.44	
TLV2221	S	5									2.7	10	610	3000			110	150	1	85	19	0.18	0.51		low power	\$0.44	
TLV2231	S	5									2.7	10	710	3000			850	1200	1	70	15	1.6	2		high speed, low noise, high drive	\$0.44	
TLC2252(A)	D		8	8	8						4.4	16	200	1500	850	70	125			1	83	19	0.12	0.2		μ-power	\$0.66
TLC2254(A)	Q		14	14	14						4.4	16	200	1500	850	140	250			1	83	19	0.12	0.2		μ-power	\$0.92
TLC2262(A)	D		8	8	8						4.4	16	300	2500	950	400	500			1	83	12	0.55	0.82		low power, low noise	\$0.66
TLC2264(A)	Q		14	14	14						4.4	16	300	2500	950	800	1000			1	83	12	0.55	0.71		low power, low noise	\$0.92
TLC2272(A)	D		8	8	8						4.4	16	300	2500	950	3000			1	75	9	3.6	2.18		low noise, high speed	\$0.66	
TLC2274(A)	Q		14	14	14						4.4	16	300	2500	950	4400	6000			1	75	9	3.6	2.18		low noise, high speed	\$0.92
TLV2252(A)	D		8	8	8						2.7	8	200	1500	850	70	125			1	83	19	0.12	0.2		μ-power	\$0.80
TLV2254(A)	Q		14	14	14						2.7	8	200	1500	850	140	250			1	83	19	0.12	0.2		μ-power	\$1.11
TLV2262(A)	D		8	8	8						2.7	8	300	2500	950	400	500			1	83	12	0.55	0.71		low power, low noise	\$0.80
TLV2264(A)	Q		14	14	14						2.7	8	300	2500	950	800	1000			1	83	12	0.55	0.71		low power, low noise	\$1.11
TLV2711	S	5									2.7	10	450	3000			13	25	1	83	21	0.025	0.065		μ-power	\$0.37	
TLV2721	S	5									2.7	10	500	3000			110	150	1	85	19	0.25	0.51		low power	\$0.37	
TLV2731	S	5									2.7	10	700	3000			850	1300	1	70	15	1.6	2		high speed, low noise, high drive	\$0.37	
TLV2770(A)	S		8	8		8					2.5	5.5	360	2500	1600	1000	2000	1	2	96	17	10.5	5.1		very high slew rate, high drive	\$0.66	
TLV2771(A)	S	5									2.5	5.5	360	2500	1600	1000	2000	2	96	17	10.5	5.1			very high slew rate, high drive	\$0.60	
TLV2772(A)	D		8	8		8					2.5	5.5	360	2500	1600	2000	4000	1	2	96	17	10.5	5.1		very high slew rate, high drive	\$0.91	
TLV2773(A)	D		14	14		10					2.5	5.5	360	2500	1600	2000	4000	2	96	17	10.5	5.1			very high slew rate, high drive	\$1.00	
TLV2774(A)	Q		14	14	14						2.5	5.5	360	2500	1600	4000	8000	2	96	17	10.5	5.1			very high slew rate, high drive	\$1.28	
TLV2775(A)	Q		16	16	16						2.5	5.5	360	2500	1600	4000	8000	1	2	96	17	10.5	5.1		very high slew rate, high drive	\$1.40	
RAIL-RAIL OUTPUT, BIPOLAR																											
LMV321	S	5									2.7	5.5	1700	7000			130	250		15000	65	39	1	1		standard	\$0.27
LMV358	D			8	8						2.7	5.5	1700	7000			210	440		15000	65	39	1	1		standard	\$0.29
LMV324	Q			14	14						2.7	5.5	1700	7000			410	830		15000	65	39	1	1		standard	\$0.42
TLV2361	S	5									2	7	1000	6000			1750	2500		20000	85	8	3	7		high speed, low noise	\$0.48
TLV2362	D		8	8	8						2	7	1000	6000			3500	5000		2000	85	8	3	7		high speed, low noise	\$0.60
HIGH SPEED, BICMOS																											
TLC070(A)	S		8	8		8					4.5	16	60	20	1000	750	1900	2500	125	1.5	140	7	16	10		single supply upgrade for TL07x	\$0.46
TLC071(A)	S		8	8		8					4.5	16	60	20	1000	750	1900	2500		1.5	140	7	16	10		single supply upgrade for TL07x	\$0.42
TLC072(A)	D		8	8		8					4.5	16	60	20	1000	750	3800	5000	125	1.5	140	7	16	10		single supply upgrade for TL07x	\$0.63
TLC073(A)	D		14	14		10					4.5	16	60	20	1000	750	3800	5000		1.5	140	7	16	10		single supply upgrade for TL07x	\$0.69
TLC074(A)	Q		14	14	14						4.5	16	390	390	1900	1400	7600	10000	125	1.5	140	7	16	10		single supply upgrade for TL07x	\$0.88
TLC075(A)	Q		16	16	16						4.5	16	390	390	1900	1400	7600	10000		1.5	140	7	16	10		single supply upgrade for TL07x	\$0.97
TLC080(A)	S		8	8		8					4.5	16	60	20	1000	750	1800	2500	125	3	140	8.5	16	10		single supply upgrade for TL08x	\$0.46
TLC081(A)	S		8	8		8					4.5	16	60	20	1000	750	1800	2500		3	140	8.5	16	10		single supply upgrade for TL08x	\$0.42
TLC082(A)	D		8	8		8					4.5	16	60	20	1000	750	3600	5000	125	3	140	8.5	16	10		single supply upgrade for TL08x	\$0.63
TLC083(A)	D		14	14		10					4.5	16	60	20	1000	750	3600	5000		3	140	8.5	16	10		single supply upgrade for TL08x	\$0.69
TLC084(A)	Q		14	14	14						4.5	16	390	390	1900	1400	7200	10000	125	3	140	8.5	16	10		single supply upgrade for TL08x	\$0.88
TLC085(A)	Q		16	16	16						4.5	16	390	390	1900	1400	7200	10000		3	140	8.5	16	10		single supply upgrade for TL08x	\$0.97
HIGH SPEED, BIPOLAR																											
TLE2141(A)	S		8	8							4	44	225	200	1400	1000	3400	4400		8.E+05	118	10.5	42	5.8		high speed & C-load drive, low noise	\$0.46
TLE2142(A)	D		8	8	8						4	44	225	200	1900	1500	6600	8800		8.E+05	118	10.5	42	5.8		high speed & C-load drive, low noise	\$0.70
TLE2144(A)	Q		14	16							4	44	500		3800	3000	13200	17600		8.E+05	118	10.5	42	5.8		high speed & C-load drive, low noise	\$0.98
TL3472*	D		8	8							4	36	1000		10000		7000	9000		1.E+08	97	49	10	4		high speed & C-load drive	\$0.58
STANDARD																											
TLC271(A)	S		8	8							3	16	1100	900	10000	5000	675	1600		0.6	80	25	3.6	1.7		prog. power, high speed	\$0.32
TLC272(A)	D		8	8	8						3	16	1100	900	10000	5000	1400	3200		0.6	80	25	3.6	1.7		high speed, low noise	\$0.49
TLC277	D		8	8							3	16	200		500		1400	3200		0.6	80	25	3.6	1.7		high speed, precision, low noise	\$0.84
TLC274(A)	Q		14	14	14						3	16	1100	900	10000	5000	2800	6400		0.6	80	25	3.6	1.7		high speed, low noise	\$0.69
TLC279	Q		14	14							3	16	320		900		2700	6400		0.6	80	25	3.6	1.7		high speed, precision, low noise	\$1.18
TLV2341 (H)	S		8	8	8						2	8	1100		8000		675	1600		0.6	80	25	3.6	1.7		prog. power, high speed	\$0.53
TLV2342	D		8	8	8						2	8	1100		9000		1400	3200		0.6	80	25	3.6	1.7		high speed	\$0.81
TLV2344	Q		14	14	14						2	8	1100		10000		2700	6400		0.6	80	25	3.6	1.7		high speed	\$1.13
STANDARD, LOW POWER																											
TLC271(A)	S		8	8							3	16	1100	900	10000	5000	105	280		0.6	91	32	0.43	0.525		prog. power, low power	\$0.32
TLC27M2(A)	D		8	8							3	16	1100	900	10000	5000	210	560		0.6	91	32	0.43</				

Selection Guide for Amplifiers (con't)

Device name	Package options					Temperature range				V _{CC} [V]		V _{IO} [μV]		I _{CC} [μA]		I _{IB} [pA]	CMRR [dB]	V _n , 1kHz [nV/√Hz]	SR [V/μs]	GBW [MHz]	Key specifications	Pricing 1000-piece pricing (U.S.)			
	# channels	SOT-23-5/6 (DBV, DCK)	PDIP (P, N)	SOLIC (D)	TSSOP (PW)	MSOP (DGK, DGS)	0° C - 70° C (C)	-40° C - 85° C (I)	-40° C - 105° C (II)	-40° C - 125° C (I)	-55° C - 125° C (M)	min	max	typ	A	max	A	typ	max	typ (shutdown)			typ	typ	typ
STANDARD, μ-POWER																									
TLC271(A)	S	8	8			•	•	•	•	•	3	16	1100	900	10000	5000	10	17	0.6	94	68	0.03	0.085	prog. power, μ-power	\$0.32
TLC271L1(A)	S	8	8			•	•	•	•	•	3	16	1100	900	10000	5000	10	17	0.6	94	68	0.03	0.085	μ-power	\$0.36
TLC272(A)	D	8	8			•	•	•	•	•	3	16	1100	900	10000	5000	20	34	0.6	94	68	0.03	0.085	μ-power	\$0.55
TLC272L7	D	8	8			•	•	•	•	•	3	16	170		500		20	34	0.6	94	68	0.03	0.085	μ-power, precision	\$1.12
TLC274(A)	Q	14	14			•	•	•	•	•	3	16	1100	900	10000	5000	40	68	0.6	94	70	0.03	0.085	μ-power	\$1.14
TLC274L9	Q	14	14			•	•	•	•	•	3	16	200		900		40	68	0.6	94	70	0.03	0.085	μ-power, precision	\$1.57
TLV2341 (L)	S	8	8	8		•	•	•	•	•	2	8	1100		8000		10	17	0.6	94	68	0.03	0.085	prog. power, μ-power	\$0.53
TLV2322	D	8	8	8		•	•	•	•	•	2	8	1100		9000		20	34	0.6	94	68	0.03	0.085	μ-power	\$0.66
TLV2324	Q	14	14	14		•	•	•	•	•	2	8	1100		10000		39	68	0.6	94	68	0.03	0.085	μ-power	\$0.93
TLC1078	D	8	8			•	•	•	•	•	1.4	16	160		450		20	34	0.6	95	68	0.032	0.085	μ-power, precision	\$2.44
TLC1079	Q	14	14			•	•	•	•	•	1.4	16	190		850		40	68	0.6	95	68	0.032	0.085	μ-power, precision	\$3.42
STANDARD, BIPOLAR																									
TL343*	S	5				•	•	•	•	•	3	36	2000		10000		700	2800	2.E+05	90	n.a.	1	1	wide supply range, SOT-23, automotive	\$0.33
LM258(A)	D		8			•	•	•	•	•	3	30	3000	2000	5000	3000	700	1200	20000	80	n.a.	n.a.	n.a.	standard	\$0.33
LM358(A)	D	8	8	8		•	•	•	•	•	3	30	3000	2000	7000	3000	700	1200	20000	80	n.a.	n.a.	n.a.	standard	\$0.22
LM2904	D	8	8	8		•	•	•	•	•	3	26	3000		7000		700	1200	20000	80	n.a.	n.a.	n.a.	standard, automotive	\$0.28
LM224(A)	Q		14			•	•	•	•	•	3	30	3000	2000	5000	3000	700	1200	20000	80	n.a.	n.a.	n.a.	standard	\$0.33
LM324(A)	Q	14	14	14		•	•	•	•	•	3	30	3000	2000	7000	3000	700	1200	20000	80	n.a.	n.a.	n.a.	standard	\$0.23
LM2902	Q	14	14	14		•	•	•	•	•	3	26	3000		7000		700	1200	20000	80	n.a.	n.a.	n.a.	standard, automotive	\$0.28

Parameters specified at T_A = 25° C, V_{CC} = 5 V, († 2.7 V), (‡ 1.8 V), (* ±15 V), lowest available temperature range
 (A) refers to precision grades with lower V_{IO} and is part of the device number, e.g., TLV2470A
 Italics indicate devices in product preview stage of development

Selection Guide for Comparators 5 V, 3 V and 1.4 V

Device name	Package options					Temperature range				V _{CC} [V]		V _{IO} [μV]		I _{CC} [μA]		I _{IB} [nA]	V _{ICR} [V]	I _{OL} (mA)	t _{pd} (ns)	Description	Pricing 1000-piece pricing (U.S.)		
	# comparators	SOT-23-5 (DBV)	PDIP (P, N, JG, J)	SOLIC (D)	TSSOP (PW)	MSOP (DGK)	0° C - 70° C (C)	-40° C - 85° C (I)	-20° C - 105° C (II)	-40° C - 125° C (I, O)	-55° C - 125° C (M)	min	max	typ	max	typ	max	typ	max			min	typ
5-V CMOS																							
TLC3702	D	8	8*	8		•	•	•	•	•	3	16	1200	5000	18	40	0.005	0	4	4	2700	μ-power	\$0.41
TLC3704	Q	14	14			•	•	•	•	•	3	16	1200	5000	35	80	0.005	0	4	4	2700	μ-power	\$0.57
TLC393	D	8*	8	8		•	•	•	•	•	3	16	1400	5000	22	40	0.005	0	4	6	2500	μ-power	\$0.42
TLC339	Q	14*	14*			•	•	•	•	•	3	16	1400	5000	44	80	0.005	0	4	6	2500	μ-power	\$0.59
TLC372	D	8*	8*	8		•	•	•	•	•	3	16	1000	5000	150	300	0.005	0	4	4	650	low power	\$0.49
TLC374	Q	14	14*	14		•	•	•	•	•	3	16	1000	5000	300	600	0.005	0	4	4	650	low power	\$0.69
TLV2352	D	8	8	8		•	•	•	•	•	2	8	1000	5000	140	300	0.005	0	4	6	650	low power	\$0.84
TLV2354	Q	14	14	14		•	•	•	•	•	2	8	1000	5000	290	600	0.005	0	4	6	650	low power	\$1.18
5-V BIPOLAR, SOT-23																							
TLV1391	S	5				•	•	•	•	•	2	7	1500	5000	100	150	40	0	3.8	0.6	650	SOT-23, low power	\$0.48
5-V BIPOLAR																							
TLV1393	D	8	8	8		•	•	•	•	•	2	7	1500	5000	0.2	0.3	40	0	3.8	0.6	650	low power	\$0.50
TLV2393	D	8	8	8		•	•	•	•	•	2	7	1500	5000	1.2	1.5	100	0	3.8	6	400	high speed	\$0.63
LM2901	Q	14	14	14		•	•	•	•	•	2	36	2000	7000	0.8	2	25	0	3.5	6	1300	general purpose, automotive	\$0.28
LM2903	D	8	8	8		•	•	•	•	•	2	36	2000	7000	0.8	1	25	0	3.5	6	1300	general purpose, automotive	\$0.28
TL3016	S	8	8			•	•	•	•	•	-7	7	500	3000	10.6	12.5	600	1.25	3.5	10	7.8	high speed	\$1.04
TL3116	S	8	8			•	•	•	•	•	-7	7	500	3000	12.7	14.7	700	0	2.5	10	9.9	high speed	\$1.04
TL712	S	8	8			•	•	•	•	•	n.a.	7	n.a.	n.a.	17	20	n.a.	n.a.	n.a.	16	25	high speed	\$0.84
TL714	S	8	8			•	•	•	•	•	n.a.	7	n.a.	n.a.	7	12	n.a.	n.a.	n.a.	16	6	high speed	\$2.09
3-V CMOS																							
TLV2352	D	8	8	8		•	•	•	•	•	2	8	1000	5000	120	250	0.005	0	2	6	640	low power	\$0.84
TLV2354	Q	14	14	14		•	•	•	•	•	2	8	1000	5000	240	500	0.005	0	2	6	640	low power	\$1.18
3-V BIPOLAR, SOT-23																							
TLV1391	S	5				•	•	•	•	•	2	7	1500	5000	80	125	40	0	1.8	0.5	700	SOT-23, low power	\$0.48
3-V BIPOLAR																							
TLV1393	D	8	8	8		•	•	•	•	•	2	7	1500	5000	160	250	40	0	1.8	0.5	700	low power	\$0.50
TLV2393	D	8	8	8		•	•	•	•	•	2	7	1500	5000	1100	1300	100	0	1.8	4	450	high speed	\$0.63
1.4-V CMOS																							
TLC352	D	8	8			•	•	•	•	•	1.4	16	2000	5000	65	150	0.005	0	0.2	1	n.a.	μ-power	\$0.84
TLC354	Q	14	14			•	•	•	•	•	1.4	16	2000	5000	130	300	0.005	0	0.2	1	n.a.	μ-power	\$1.18

Parameters specified at T_A = 25° C, V_{CC} = 5 V, 3 V or 1.4 V, lowest available temperature range
 *Military temperature range also available in standard plastic package

For technical support and ordering literature, see page 15.

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- 3-V Acceleratometer Featuring TLV2772 Application Report ([slva040](#))
- Analog Applications Journal, May 2000 ([slyt015](#))
- Analog Applications Journal, February 2000 ([slyt012](#))
- Analog Applications Journal, November 1999 ([slyt010](#))
- Analysis of the Sallen-Key Architecture ([sloa024](#))
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