

SIMPLIFY YOUR BOM WITH 40-V & 16-V GENERAL-PURPOSE OPERATIONAL AMPLIFIERS:

OPA992 / OPA2992 / OPA4992, TLV9161 / TLV9162 / TLV9164, & TLV9361 / TLV9362 / TLV9364

New Product Update

Peggy Liska
Product Marketing Engineer

Agenda

- Overview of the latest high-voltage general purpose op amps
- Advantages of high-voltage op amps for simplifying your BOM
- Leveraging new packages for dual-source projects

Please feel free to “chat” **Robert Clifton** who is an applications engineer from the general purpose amplifiers team available to answer questions you have throughout this presentation.

Next Generation of High-Voltage General Purpose Amps

Better Performance, Smaller Packages, Stronger Supply Chain

- Complete family of pin-compatible devices
 - ✓ Single, dual, & quad channel variants
- Wide range of industry-standard & small packages
- Stronger supply chain in demanding market
- Leveraging high-voltage op amps for dual-sourcing projects
 - [Simplify your bill of materials with high-voltage amplifiers](#)
 - [Using an op amp for high-side current sensing](#)
 - [Second-sourcing options for small-package amplifiers](#)

OPAx99x

Highest Performance, 40V, RRIO, Low-noise Amps

**note: only showing dual-channel variants below*

Device	OPA2990	OPA2991	OPA2992
Channels	2	2	2
VCC min (V)	2.7	2.7	2.7
VCC max (V)	40	40	40
Iq 25C max (mA)	0.12	0.56	2.2
GBW/BW (MHz)	1.1	4.5	10.6
Slew Rate (V/uS)	4.5	21	32
Vnoise (nV/Hz)	30	10.8	7
RR In	R-R	R-R	R-R
RR Out	R-R	R-R	R-R
Ibias (typ) (nA)	0.01	0.01	0.01
Vos (Max) (mV)	1.5	0.75	1
Vos Drift (uV/C)	0.6	0.3	0.25

TLV91xx

Highest Performance, 16V, RRIO, Low-noise Amps

**note: only showing dual-channel variants below*

Device	TLV9102	TLV9152	TLV9162
Channels	2	2	2
VCC min (V)	2.7	2.7	2.7
VCC max (V)	16	16	16
Iq 25C max (mA)	0.12	0.56	2.4
GBW/BW (MHz)	1.1	4.5	11
Slew Rate (V/uS)	4.5	21	35
Vnoise (nV/Hz)	30	10.8	6.8
RR In	R-R	R-R	R-R
RR Out	R-R	R-R	R-R
Ibias (typ) (nA)	0.01	0.01	0.01
Vos (Max) (mV)	1.5	0.75	1
Vos Drift (uV/C)	0.6	0.3	0.25

TLV93xx

Strong Performance, 40V, Low-cost Amps

**note: only showing dual-channel variants below*

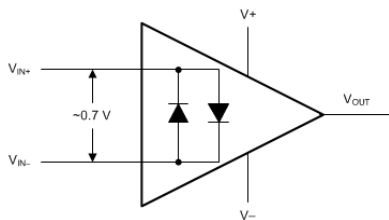
Device	TLV9302	TLV9352	TLV9362
Channels	2	2	2
VCC min (V)	4.5	4.5	4.5
VCC max (V)	40	40	40
Iq 25C max (mA)	0.15	0.65	2.6
GBW/BW (MHz)	1	3.5	10.6
Slew Rate (V/uS)	3	20	25
Vnoise (nV/Hz)	33	15	8.5
RR In	In to V-	In to V-	In to V-
RR Out	R-R	R-R	R-R
Ibias (typ) (nA)	0.005	0.002	0.01
Vos (Max) (mV)	2.5	1.8	1.7
Vos Drift (uV/C)	2	1.5	1.25

Advantages of High-Voltage Op Amps

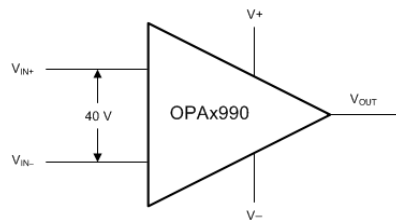
Simplify your bill of materials with high-voltage amplifiers

Use the same amplifier for multiple applications in a system:

- 1 Low offset drift across -40 to 125°C temp range for low-side current, high-side current, and temperature sensing
- 2 Wide supply supports most common rails (2.7 to 40V)
- 3 Mux-friendly inputs enable direct connection to a MUX and closed-loop or open-loop comparator-like topologies

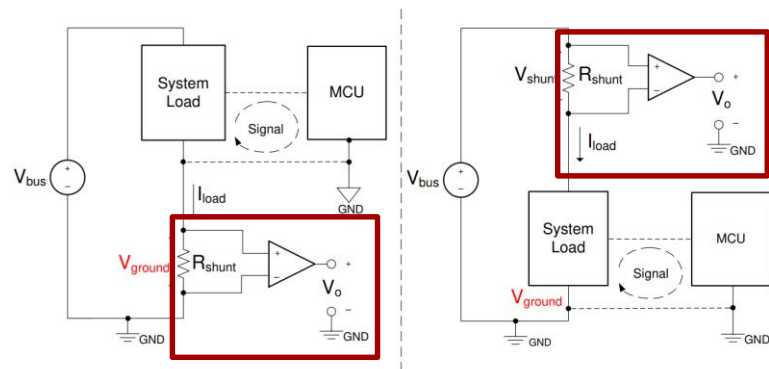


Conventional input protection
limits differential input range



New HV op amps
support full differential input range

Using an op amp for high-side current sensing

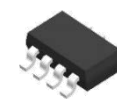


Traditional use-case:
Low-side current sensing

New use-case:
High-side current sensing

- Advantages:
 - Does not create ground disturbances
 - Can detect a load short to ground condition
- Considerations:
 - Common mode voltage must extend to the positive rail (RRI)
 - Check the spec table conditions & graphs for offset voltage

DDF Package



Available Now!

leaded SOT23 package | 8 pins | 0.65mm lead pitch

Features

- Body Size **1.6 mm x 2.9 mm**
- Body + Leads Size 2.8 mm x 2.9 mm
- Lead Pitch 0.65 mm
- Package Height 1.1 mm
- Identical lead pitch as TSSOP, VSSOP

TLV9002	LMV358A	OPA2991	TLV9162
TLV9052	LM358B	OPA2992	TLV9302
TLV9062	LM2904B	TLV9102	TLV9352
LM358LV	OPA2990	TLV9152	TLV9362

Applications

- Electronic Point of Sale (EPOS)
- Building Automation
- Factory Automation & Control
- Motor Drives
- Digital Camera and Lenses
- Portable Speakers

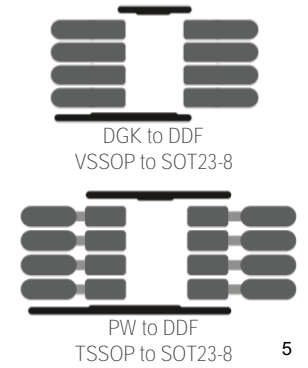
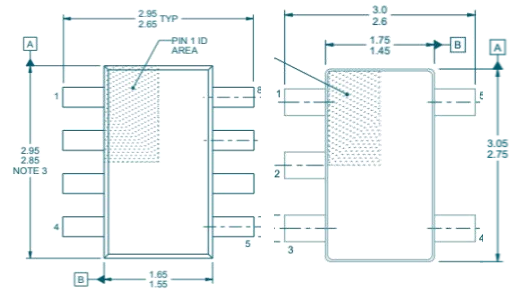
Benefits

- Smallest *leaded* dual package in Amoeba family enables a reduced PCB area without requiring QFN manufacturing techniques
- 0.65mm pin pitch allows for dual-layout techniques with industry standard SOIC, TSSOP, and VSSOP packages

www.ti.com/smallamp-designguide

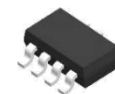
www.ti.com/smallamps

Same Size as DBV (SOT23-5)



DYY Package

leaded SOT23 package | 14 pins | 0.5mm lead pitch



Available Now!

Features

- Body Size **2.0 mm x 4.2 mm**
- Body + Leads Size 3.25 mm x 4.2 mm
- Lead Pitch 0.5 mm
- Package Height 1.1 mm

TLV9004	LMV324A	OPA4991	TLV9164
TLV9054	LM324B	OPA4992	TLV9304
TLV9064	LM2902B	TLV9104	TLV9354
LM324LV	OPA4990	TLV9154	TLV9364

Applications

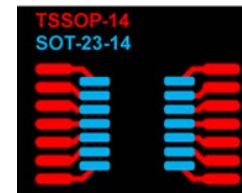
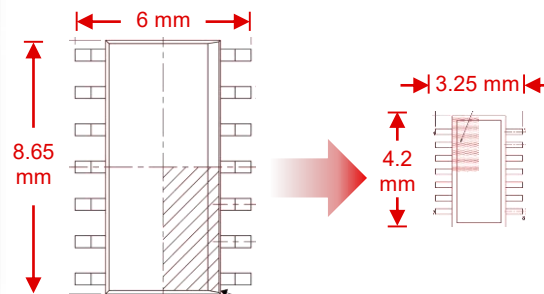
- Battery Packs
- Building Automation
- Factory Automation & Control
- Motor Drives
- Telecommunications Equipment

Benefits

- Smallest *leaded* quad package enables a reduced PCB area without requiring QFN manufacturing techniques
- Dual-source with existing TSSOP packages

75% smaller than SOIC

Dual-source with TSSOP



Industry Leading in Tiny Amps

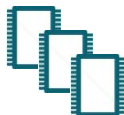
Options for Industrial & Auto



Easy manufacturing for customers



Broad product portfolio



Competitive Edge in Small Packages

World's smallest amplifiers

Down to 0.8 x 0.8mm (1ch), 1 x 1mm (2ch), 2 x 2mm (4ch)

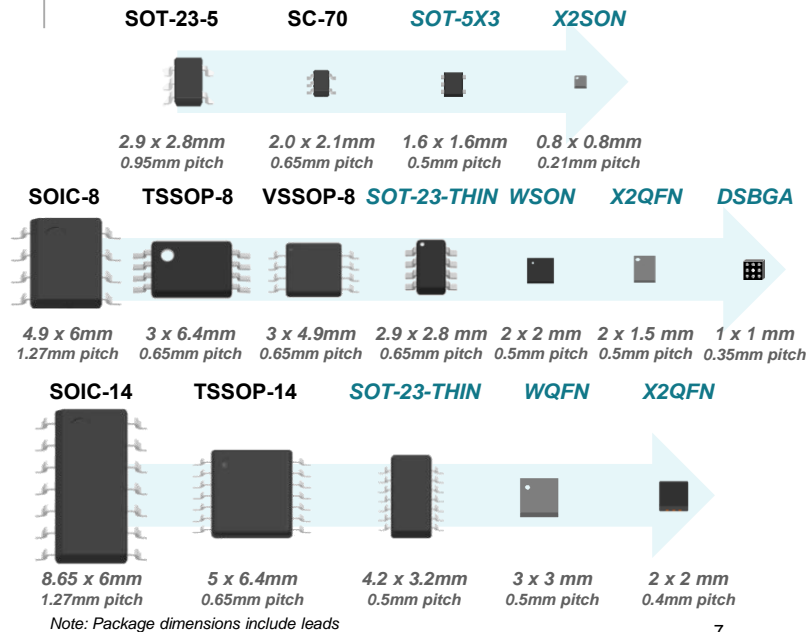
Smallest leaded packages

Meets needs of space-constrained and manufacturing-constrained industrial & automotive designs

Layout compatible options with industry standard packages

Satisfies second-source requirements for commodity devices

Evolution in size – more functions in smaller spaces



Getting started

You can start evaluating these devices and more by leveraging the following:

	Description	Link
Selection tool	Search all TI amplifiers	ti.com/amps
Selection tool	Search all TI operational amplifiers	ti.com/opamps
Selection tool	Search all TI general-purpose op amps (>1mV offset & < 50MHz GBW)	ti.com/gpamps
Product folder	Download datasheet and additional information about the devices mentioned in this presentation	ti.com/product/<device> Example: ti.com/product/opa992
Evaluation boards	EVMs supporting the portfolio of packages	ti.com/tool/DIP-ADAPTER-EVM ti.com/tool/SMALL-AMP-DIP-EVM ti.com/tool/DYY-AMP-EVM (coming soon)
Design tool	Bill of Materials (BOM) & cross reference tool	https://www.ti.com/cross-reference-search/

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