



钜地半导体
Tudi Semiconductor

Product Specification

TUDI-LM2902KAVMPWREP

QUADRUPLE OPERATIONAL AMPLIFIER

网址 www.sztdbdt.com Q

用芯智造 · 卓越品质

**semiconductor device
manufacturer**

- Design
- research and development
- production
- and sales



FEATURES

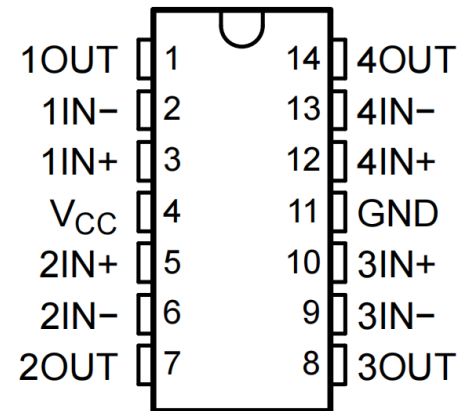
- Controlled Baseline
 - One Assembly/Test Site, One Fabrication Site
- Extended Temperature Performance of -55°C to 125°C
- Enhanced Diminishing Manufacturing

Sources (DMS) Support

- Enhanced Product-Change Notification
- Qualification Pedigree

(1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits

- ESD Protection $<500\text{V}$ Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model $\text{C}=200\text{pF}$, $\text{R}=0$; 1500V Using Charged Device Model
- ESD Human Body Model $>2\text{kV}$ Machine Model $>200\text{V}$ and Charge Device Model $=2\text{kV}$ For K-Suffix Devices.
- Low Supply-Current Drain Independent of Supply Voltage... 0.8mA Typ
- Low Input Bias and Offset Parameters:
 - Input Offset Voltage... 3 mV Typ
 - Input Offset Current... 2 nA Typ
 - Input Bias Current... 20 nA Typ
- Common-Mode Input Voltage Range Includes Ground, Allowing Direct Sensing Near Ground
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage:
 - Non-V devices... 26V
 - V-Suffix devices... 32V
- V-Suffix devices... $32\text{V D Open-Loop Differential Voltage Amplification... } 100\text{ V/mV Typ}$
- Internal Frequency Compensation



D OR PW PACKAGE
(TOP VIEW)

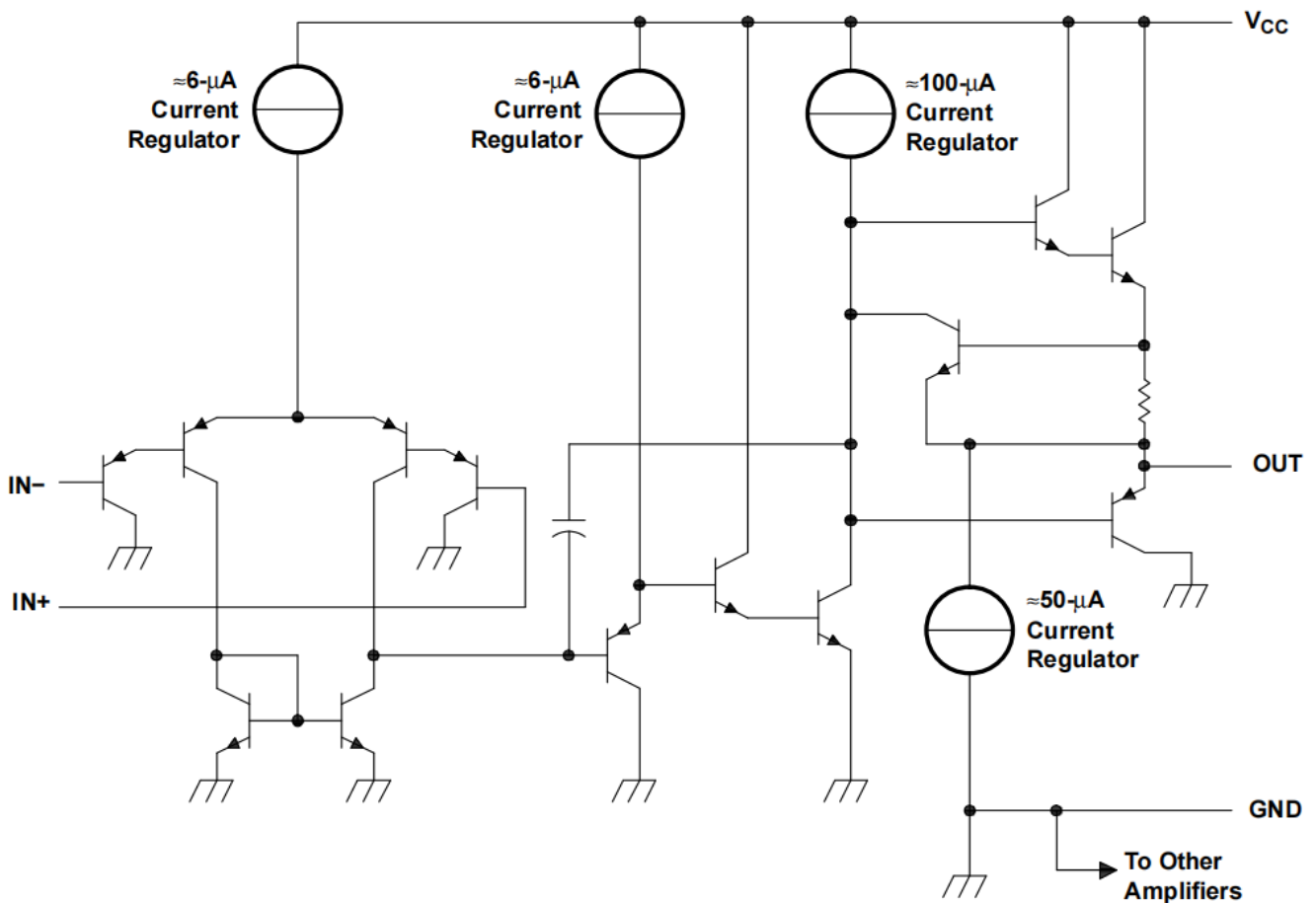
DESCRIPTION

This device consists of four independent high-gain frequency-compensated operational amplifiers that are designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies is possible when the difference between the two supplies is 3 V to 26 V (3 V to 32 V for V-suffixed devices) and V_{CC} is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.



Applications include transducer amplifiers, dc amplification blocks, and all the conventional operational-amplifier circuits that now can be more easily implemented in single-supply voltage systems. For example, the LM2902 can be operated directly from the standard 5-V supply that is used in digital systems and easily provides the required interface electronics without requiring additional $\pm 15\text{-V}$ supplies.

SCHEMATIC (EACH AMPLIFIER)



COMPONENT COUNT (TOTAL DEVICE)	
Epi-FET	1
Transistors	95
Diodes	4
Resistors	11
Capacitors	4



ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		LM2902-EP	LM2902KV-EP	UNIT
V _{CC}	Supply voltage ⁽²⁾	26	32	V
V _{ID}	Differential input voltage ⁽³⁾	±26	±32	V
V _I	Input voltage (either input)	–0.3 to 26	–0.3 to 32	V
Duration of output short circuit (one amplifier) to ground at (or below) T _A = 25°C, V _{CC} ≤ 15 V ⁽⁴⁾		Unlimited	Unlimited	
θ _{JA}	Package thermal impedance ⁽⁵⁾⁽⁶⁾	D package (0 LFPM)	101	°C/W
		PW package	113	
T _J	Operating virtual junction temperature	142	142	°C
T _{stg}	Storage temperature range ⁽⁷⁾	–65 to 150	–65 to 150	°C

- (1) 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.
- (2) All voltage values, except differential voltages and V_{CC} specified for the measurement of I_{OS}, are with respect to the network GND.
- (3) Differential voltages are at IN+ with respect to IN–.
- (4) Short circuits from outputs to V_{CC} can cause excessive heating and eventual destruction.
- (5) 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)/θ_{JA}. Operating at the absolute maximum T_J of 142°C can affect reliability.
- (6) The package thermal impedance is calculated in accordance with JESD 51-7.
- (7) Long term high-temperature storage and/or extended use at maximum recommended operating conditions may result in reduction of overall device life. See http://www.ti.com/ep_quality for additional information on enhanced plastic packaging.



ELECTRICAL CHARACTERISTICS

at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS ⁽¹⁾	T_A ⁽²⁾	LM2902-EP			UNIT
			MIN	TYP ⁽³⁾	MAX	
V_{IO} Input offset voltage	$V_{CC} = 5\text{ V to } 26\text{ V}$, $V_{IC} = V_{ICRmin}$, $V_O = 1.4\text{ V}$	25°C		3	7	mV
		Full range			10	
I_{IO} Input offset current	$V_O = 1.4\text{ V}$	25°C		2	50	nA
		Full range			300	
I_{IB} Input bias current	$V_O = 1.4\text{ V}$	25°C		-20	-250	nA
		Full range			-500	
V_{ICR} Common-mode input voltage range	$V_{CC} = 5\text{ V to } 26\text{ V}$	25°C		0 to $V_{CC}-1.5$		V
		Full range		0 to $V_{CC}-2$		
V_{OH} High-level output voltage	$R_L = 10\text{ k}\Omega$	25°C		$V_{CC}-1.5$		V
	$V_{CC} = 26\text{ V}$, $R_L = 2\text{ k}\Omega$	Full range		22		
	$V_{CC} = 26\text{ V}$, $R_L \geq 10\text{ k}\Omega$	25°C		23	24	
V_{OL} Low-level output voltage	$R_L \leq 10\text{ k}\Omega$	Full range		5	20	mV
A_{VD} Large-signal differential voltage amplification	$V_{CC} = 15\text{ V}$, $V_O = 1\text{ V to } 11\text{ V}$, $R_L \geq 2\text{ k}\Omega$	25°C		100		V/mV
		Full range		15		
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$	25°C		50	80	dB
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$)		25°C		50	100	dB
V_{O1}/V_{O2} Crosstalk attenuation	$f = 1\text{ kHz to } 20\text{ kHz}$	25°C		120		dB
I_O Output current	$V_{CC} = 15\text{ V}$, $V_{ID} = 1\text{ V}$, $V_O = 0$	25°C		-20	-30	mA
		Full range		-10		
	$V_{CC} = 15\text{ V}$, $V_{ID} = -1\text{ V}$, $V_O = 15\text{ V}$	25°C		10	20	mA
		Full range		5		
	$V_{ID} = -1\text{ V}$, $V_O = 200\text{ mV}$	25°C		30		μA
I_{OS} Short-circuit output current	V_{CC} at 5 V, $V_O = 0$, GND at -5 V	25°C		± 40	± 60	mA
I_{CC} Supply current (four amplifiers)	$V_O = 2.5\text{ V}$, No load	Full range		0.7	1.2	mA
	$V_{CC} = 26\text{ V}$, $V_O = 0.5 V_{CC}$, No load	Full range		1.4	3	

(1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified.

(2) Full range is -55°C to 125°C.

(3) All typical values are at $T_A = 25^\circ\text{C}$.



ELECTRICAL CHARACTERISTICS

at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS ⁽¹⁾		T_A ⁽²⁾	LM2902KV-EP			UNIT
				MIN	TYP ⁽³⁾	MAX	
V_{IO} Input offset voltage	$V_{CC} = 5\text{ V to } 32\text{ V},$ $V_{IC} = V_{ICRmin}, V_O = 1.4\text{ V}$	Non-A devices	25°C		3	7	mV
			Full range			10	
		A-suffix devices	25°C		1	3	
			Full range			4.5	
$\Delta V_{IO}/\Delta T$ Temperature drift	$R_S = 0\ \Omega$		Full range		7		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current	$V_O = 1.4\text{ V}$		25°C		2	50	nA
			Full range			150	
$\Delta V_{IO}/\Delta T$ Temperature drift			Full range		10		$\text{pA}/^\circ\text{C}$
I_{IB} Input bias current	$V_O = 1.4\text{ V}$		25°C		-20	-250	nA
			Full range			-500	
V_{ICR} Common-mode input voltage range	$V_{CC} = 5\text{ V to } 32\text{ V}$		25°C		0 to $V_{CC}-1.5$		V
			Full range		0 to $V_{CC}-2$		
V_{OH} High-level output voltage	$R_L = 10\text{ k}\Omega$		25°C		$V_{CC}-1.5$		V
	$V_{CC} = 32\text{ V}, R_L = 2\text{ k}\Omega$		Full range		26		
	$V_{CC} = 32\text{ V}, R_L \geq 10\text{ k}\Omega$		Full range		27		
V_{OL} Low-level output voltage	$R_L = 10\text{ k}\Omega$		Full range		5	20	mV
A_{VD} Large-signal differential voltage amplification	$V_{CC} = 15\text{ V}, V_O = 1\text{ V to } 11\text{ V},$ $R_L \geq 2\text{ k}\Omega$		25°C		25	100	V/mV
			Full range		15		
	Amplifier-to-amplifier coupling ⁽⁴⁾	$f = 1\text{ kHz to } 20\text{ kHz}, \text{ input referred}$	25°C		120		dB
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$		25°C		60	80	dB
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$)			25°C		60	100	dB
V_{O1}/V_{O2} Crosstalk attenuation	$f = 1\text{ kHz to } 20\text{ kHz}$		25°C		120		dB
I_O Output current	$V_{CC} = 15\text{ V}, V_{ID} = 1\text{ V}, V_O = 0$		25°C		-20	-30	mA
			Full range		-10		
	$V_{CC} = 15\text{ V}, V_{ID} = -1\text{ V}, V_O = 15\text{ V}$		25°C		10	20	mA
			Full range		5		
	$V_{ID} = -1\text{ V}, V_O = 200\text{ mV}$		25°C		12	40	μA
I_{OS} Short-circuit output current	V_{CC} at 5 V, GND at -5 V	$V_O = 0,$	25°C		± 40	± 60	mA
I_{CC} Supply current (four amplifiers)	$V_O = 2.5\text{ V},$	No load	Full range		0.7	1.2	mA
	$V_{CC} = 32\text{ V}, V_O = 0.5 V_{CC},$	No load	Full range		1.4	3	

- (1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified.
 (2) Full range is -55°C to 125°C .
 (3) All typical values are at $T_A = 25^\circ\text{C}$.
 (4) Due to proximity of external components, ensure that coupling is not originating via stray capacitance between these external parts. Typically, this can be detected, as this type of coupling increases at higher frequencies.



OPERATING CONDITIONS

$V_{CC} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
SR	Slew rate at unity gain	$R_L = 1\text{ M}\Omega$, $C_L = 30\text{ pF}$, $V_I = \pm 10\text{ V}$ (see Figure 1)	0.5	$\text{V}/\mu\text{s}$
B_1	Unity-gain bandwidth	$R_L = 1\text{ M}\Omega$, $C_L = 20\text{ pF}$ (see Figure 1)	1.2	MHz
V_n	Equivalent input noise voltage	$R_S = 100\ \Omega$, $V_I = 0\text{ V}$, $f = 1\text{ kHz}$ (see Figure 2)	35	$\text{nV}/\sqrt{\text{Hz}}$

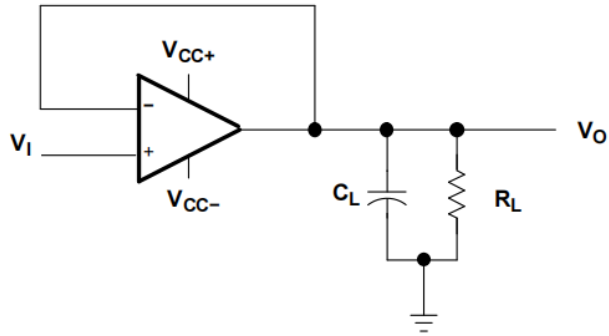


Figure 1. Unity-Gain Amplifier

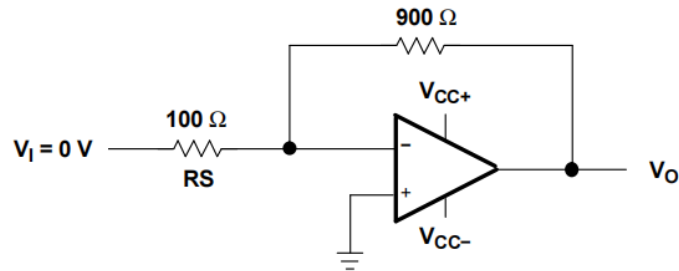


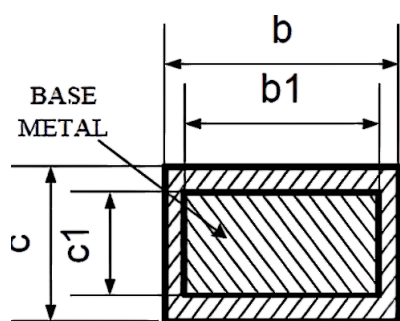
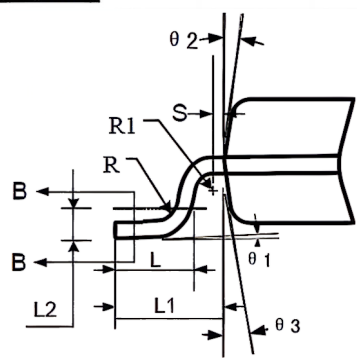
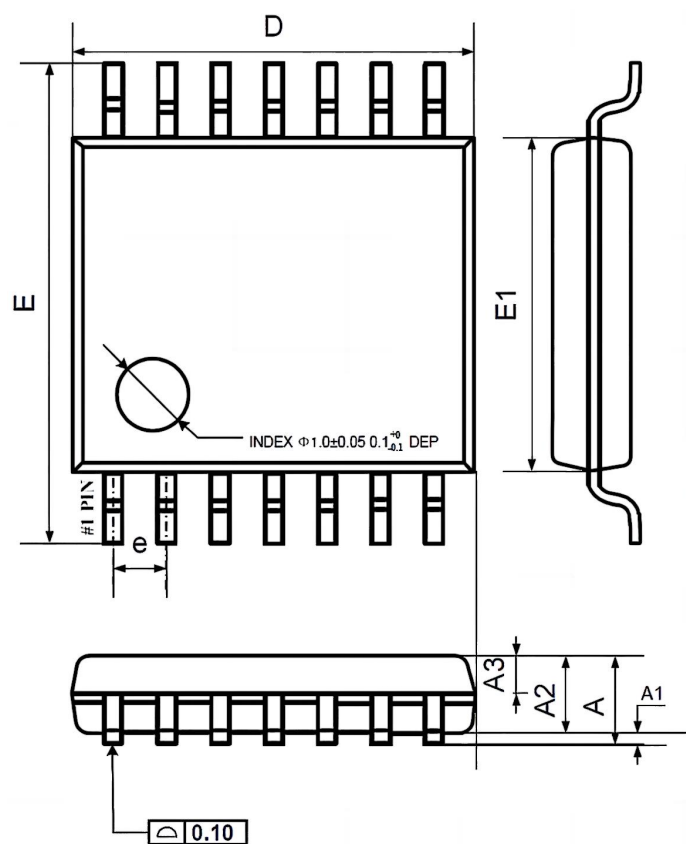
Figure 2. Noise-Test Circuit



ORDERING INFORMATION

Order Number	Package	Package Quantity	Marking On The park
LM2902KAVMPWREP-TUDI	TSSOP14	Tape,Reel,2500	2902KAE
LM2902KAVQPWREP-TUDI	TSSOP14	Tape,Reel,2500	LM2902E

Package TSSOP14



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	—	0.28
b1	0.20	0.22	0.24
C	0.10	—	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	—	—
R1	0.09	—	—
S	0.20	—	—
θ1	0°	—	8°
θ2	10°	12°	14°
θ3	10°	12°	14°



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