LMV821, LMV822, LMV824

Single, Dual, Quad Low Voltage, Rail-to-Rail Operational Amplifiers

The LMV821, LMV822, and LMV824 are operational amplifiers with low input voltage offset and drift vs. temperature. In spite of low quiescent current requirements these devices have 5 MHz bandwidth and 1.4 V/μs slew rate. In addition they provide rail−to−rail output swing into 600 Ω loads. The input common−mode voltage range includes ground, and the maximum input offset voltage is only 3.5 mV. Substantially large capacitive loads can be driven by simply adding a pullup resistor or isolation resistor.

The LMV821 (single) is available in a space−saving SC70−5 while the dual and quad also come in ultra small SOIC and TSSOP packages.

Features

- Low Offset Voltage: 3.5 mV
- Very low Offset Drift: 1.0 μV/°C
- High Bandwidth: 5 MHz
- Rail−to−Rail Output Swing into a 600 Ω load
- Capable of driving highly capacitive loads
- Small Packages:
  - LMV821 in SC−70
  - LMV822 in Micro8* and SOIC−8*
  - (*Contact Sales for Package Availability)
  - LMV824 in SOIC−14 and TSSOP−14
- These Devices are Pb−Free and are RoHS Compliant

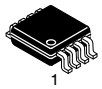
Typical Applications

- Notebook Computers
- PDAs
- Modem Transmitter/ Receivers

ON Semiconductor®

http://onsemi.com

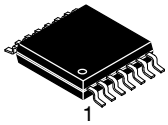
SC−70
CASE 419A



Micro8™
CASE 846A

SOIC−8
CASE 751

SOIC−14
CASE 751A



TSSOP−14
CASE 948G

ORDERING AND MARKING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 11 of this data sheet.

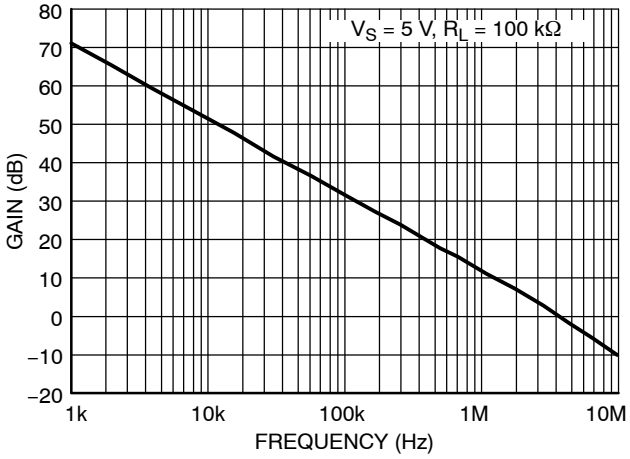


Figure 1. Gain vs. Frequency

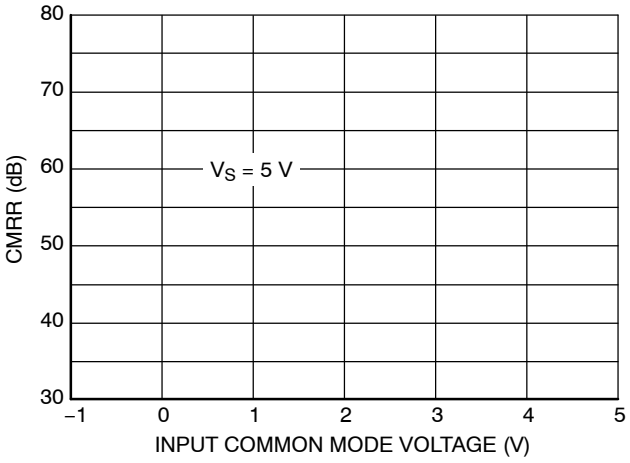
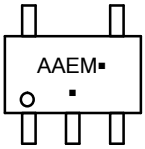


Figure 2. CMRR vs. Input Common Mode Voltage

MARKING DIAGRAMS

SC−70



AAE = Specific Device Code
M = Date Code
▪ = Pb−Free Package

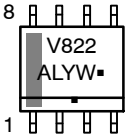
(Note: Microdot may be in either location)

Micro8

V822 = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

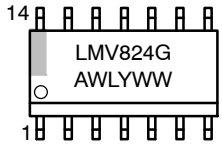
SOIC−8



V822 = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

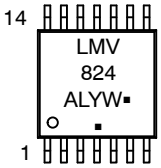
(Note: Microdot may be in either location)

SOIC−14



LMV824 = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

TSSOP−14

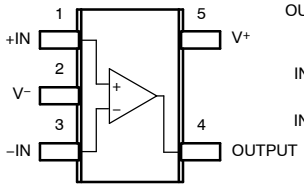


LMV824 = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

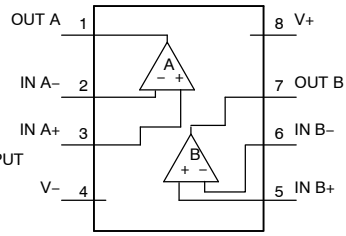
PIN CONNECTIONS

SC70−5



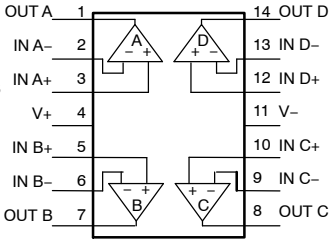
(Top View)

Micro8/SOIC−8



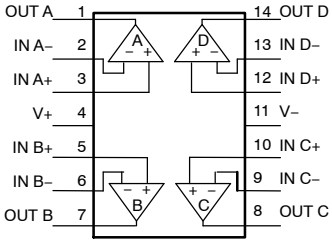
(Top View)

SOIC−14



(Top View)

TSSOP−14



(Top View)

MAXIMUM RATINGS

Symbol	Rating	Value	Unit
V_S	Supply Voltage (Operating Range V_S = 2.7 V to 5.5 V)	5.5	V
V_{IDR}	Input Differential Voltage	± Supply Voltage	V
V_{ICR}	Input Common Mode Voltage Range	−0.5 to (V+) +0.5	V
	Maximum Input Current	10	mA
t_{SO}	Output Short Circuit (Note 1)	Continuous	
T_J	Maximum Junction Temperature (Operating Range −40°C to 85°C)	150	°C
θ_{JA}	Thermal Resistance		°C/W
	SC−70	280	
	Micro8	238	
	SOIC−8	212	
	SOIC−14	156	
	TSSOP−14	190	
T_{STG}	Storage Temperature	−65 to 150	°C
	Mounting Temperature (Infrared or Convection − 20 sec)	235	°C
V_{ESD}	ESD Tolerance Machine Model Human Body Model	200 2000	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Continuous short−circuit operation to ground at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C. Output currents in excess of 45 mA over long term may adversely affect reliability. Shorting output to either V+ or V− will adversely affect reliability.

2.7V DC ELECTRICAL CHARACTERISTICS Unless otherwise noted, all min/max limits are guaranteed for T_A = 25°C, V+ = 2.7 V, V− = 0 V, V_{CM} = V+/2, V_O = V+/2 and R_L > 1 MΩ. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}			1	3.5	mV
		T_A = −40°C to +85°C			4	
Input Offset Voltage Average Drift	TCV_{OS}			1		μV/°C
Input Bias Current	I_B			105	210	nA
		T_A = −40°C to +85°C			315	
Input Offset Current	I_{IO}			0.5	30	nA
		T_A = −40°C to +85°C			50	
Common−Mode Rejection Ratio	CMRR	0 V ≤ V_{CM} ≤ 1.7 V	70	85		dB
		T_A = −40°C to +85°C	68			
Power Supply Rejection Ratio	PSRR	1.5 V ≤ V+ ≤ 4 V, V − = −1 V, V_O = 0 V, V_{CM} = 0.0 V	75	85		dB
		T_A = −40°C to +85°C	70			
Input Common−Mode Voltage Range	V_{CM}	For CMRR ≥ 53 dB and T_A = −40°C to +85°C	−0.2	−0.3 to 2.0	1.9	V
Large Signal Voltage Gain	AV	R_L = 600 Ω, V_O = 0.5 V to 2.5 V	80	95		dB
		T_A = −40°C to +85°C	70			
		R_L = 2 kΩ, V_O = 0.5 V to 2.5 V	83	89		
		T_A = −40°C to +85°C	80			
Output Swing	V_{OH}	R_L = 600 Ω to 1.35 V	2.5	2.58		V
		T_A = −40°C to +85°C	2.4			
	V_{OL}	R_L = 600 Ω to 1.35 V		0.13	0.21	
		T_A = −40°C to +85°C			0.3	
	V_{OH}	R_L = 2 kΩ to 1.35 V	2.6	2.66		
		T_A = −40°C to +85°C	2.5			
	V_{OL}	R_L = 2 kΩ to 1.35 V		0.08	0.12	
		T_A = −40°C to +85°C			0.2	
Output Current	I_O	Sourcing, V_O = 0 V	12			mA
		Sinking, V_O = 2.7 V	12	26		
Supply Current	I_{CC}	LMV821 (Single)		0.242	0.3	mA
		T_A = −40°C to +85°C			0.5	
		LMV822 (Both Applications)		0.5	0.7	
		T_A = −40°C to +85°C			0.9	
		LMV824 (All Four Applications)		1	1.3	
		T_A = −40°C to +85°C			1.5	

2.5V DC ELECTRICAL CHARACTERISTICS Unless otherwise noted, all min/max limits are guaranteed for T_A = 25°C, V+ = 2.5 V, V− = 0 V, V_{CM} = V+/2, V_O = V+/2 and R_L > 1 MΩ. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	T_A = −40°C to +85°C		1	3.5	mV
					4	
Output Swing	V_{OH}	R_L = 600 Ω to 1.25 V	2.3	2.37		V
		T_A = −40°C to +85°C	2.2			
	V_{OL}	R_L = 600 Ω to 1.25 V		0.13	0.20	
		T_A = −40°C to +85°C			0.3	
	V_{OH}	R_L = 2 kΩ to 1.25 V	2.4	2.46		
		T_A = −40°C to +85°C	2.3			
	V_{OL}	R_L = 2 kΩ to 1.25 V		0.08	0.12	
		T_A = −40°C to +85°C			0.20	

2.7V AC ELECTRICAL CHARACTERISTICS Unless otherwise specified, all limits are guaranteed for T_A = 25°C, V+ = 2.7 V, V− = 0 V, V_{CM} = 1.0 V, V_O = V+/2 and RL > 1 MΩ. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Slew Rate	SR	(Note 2)		1.5		V/uS
Gain Bandwidth Product	GBWP			5		MHz
Phase Margin	θ_m			55		°
Gain Margin	G_m			12.9		dB
Input−Referred Voltage Noise	e_n	f = 1 kHz, V_{CM} = 1 V		12		nV/$\sqrt{Hz}$
Input−Referred Current Noise	i_n	f = 1kHz		0.2		pA/$\sqrt{Hz}$
Total Harmonic Distortion	THD	f = 1 kHz, AV = −2, R_L = 10 kΩ , V_O = 1.8 V_{PP}		0.023		%
Amplifier−to−Amplifier Isolation		(Note 3)		135		dB

2. Connected as voltage follower with input step from 0.5 V to 1.5 V. Number specified is the average of the positive and negative slew rates.
3. Input referred, R_L = 100 kΩ connected to V+/2. Each amp excited in turn with 1kHz to produce V_O = 3 V_{PP}. For Supply Voltages < 3 V, V_O = V+.

5V DC ELECTRICAL CHARACTERISTICS Unless otherwise noted, all min/max limits are guaranteed for T_A = 25°C, V+ = 5 V,V− = 0 V, VCM = V+/2, V_O = V+/2 and R_L > 1 MΩ. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}			1	3.5	mV
		T_A = −40°C to +85°C			4	
Input Offset Voltage Average Drift	TCV_{OS}			1		μV/°C
Input Bias Current	I_B			119	245	nA
		T_A = −40°C to +85°C			380	
Input Offset Current	I_{IO}			0.5	30	nA
		T_A = −40°C to +85°C			50	
Common−Mode Rejection Ratio	CMRR	0 V ≤ V_{CM} ≤ 4.0 V	72	90		dB
		T_A = −40°C to +85°C	70			
Power Supply Rejection Ratio	PSRR	1.7 V ≤ V+ ≤ 4 V, V − = 1 V, V_O = 0 V, V_{CM} = 0.0 V	75	85		dB
		T_A = −40°C to +85°C	70			
Input Common−Mode Voltage Range	V_{CM}	For CMRR ≥ 58 dB and T_A = − 40°C to +85°C	−0.2	−0.2 to 4.3	4.2	V
Large Signal Voltage Gain	A_V	R_L = 600 Ω, V_O = 1.0 V to 4.0 V	87	100		dB
		T_A = −40°C to +85°C	73			
		R_L = 2 kΩ, V_O = 1.0 V to 4.0 V	84	99		
		T_A = −40°C to +85°C	82			
Output Swing	V_{OH}	R_L = 600 Ω to 2.5 V	4.75	4.84		V
		T_A = −40°C to +85°C	4.7			
	V_{OL}	R_L = 600 Ω to 2.5 V		0.17	0.33	
		T_A = −40°C to +85°C			0.4	
	V_{OH}	RL = 2 kΩ to 2.5 V	4.85	4.9		
		T_A = −40°C to +85°C	4.8			
	V_{OL}	R_L = 2 kΩ to 2.5 V		0.1	0.15	
		T_A = −40°C to +85°C			0.2	
Output Current	I_O	Sourcing, Vo = 0 V	20	45		mA
		T_A = −40°C to +85°C	10			
		Sinking, Vo = 5 V	20	40		
		T_A = −40°C to +85°C	15			
Supply Current	I_{CC}			0.3	0.4	mA
		T_A = −40°C to +85°C			0.6	
		LMV822 (Both Applications)		0.5	0.7	
		T_A = −40°C to +85°C			0.9	
		LMV824 (All Four Applications)		1	1.3	
		T_A = −40°C to +85°C			1.5	

5V AC ELECTRICAL CHARACTERISTICS Unless otherwise specified, all limits are guaranteed for T_A = 25°C, V+ = 5 V, V− = 0 V, V_{CM} = 2.0 V, V_O = V+/2 and R_L > 1 MΩ. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Slew Rate	SR	(Note 4)		2		V/μS
Gain Bandwidth Product	GBWP			5.6		MHz
Phase Margin	θ_m			63		°
Gain Margin	G_m			11.7		dB
Input−Referred Voltage Noise	e_n	f = 1 kHz, V_{CM} = 1 V		11		nV/$\sqrt{Hz}$
Input−Referred Current Noise	i_n	f = 1 kHz		0.21		pA/$\sqrt{Hz}$
Total Harmonic Distortion	THD	f = 1 kHz, A_V = −2, R_L = 10 kΩ , V_O = 4.11 VPP		0.012		%
Amplifier−to−Amplifier Isolation		(Note 5)		135		dB

4. Connected as voltage follower with input step from 0.5 V to 3.5 V. Number specified is the average of the positive and negative slew rates.
5. Input referred, R_L = 100 kΩ connected to V+/2. Each amp excited in turn with 1 kHz to produce V_O = 3 V_{PP}. (For Supply Voltages < 3 V, V_O = V+).

TYPICAL PERFORMANCE CHARACTERISTICS

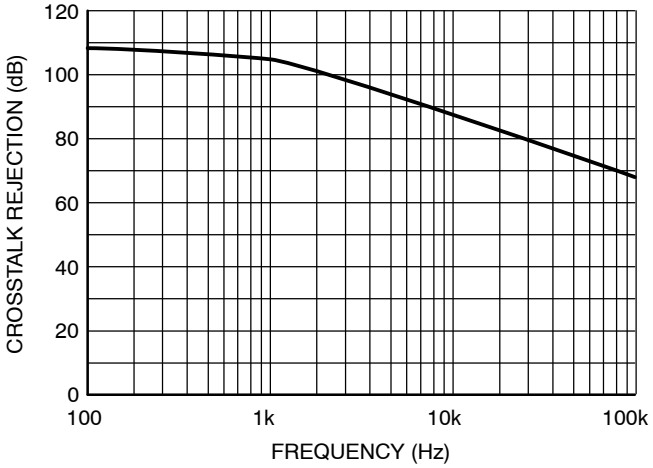


Figure 3. Crosstalk Rejection vs. Frequency

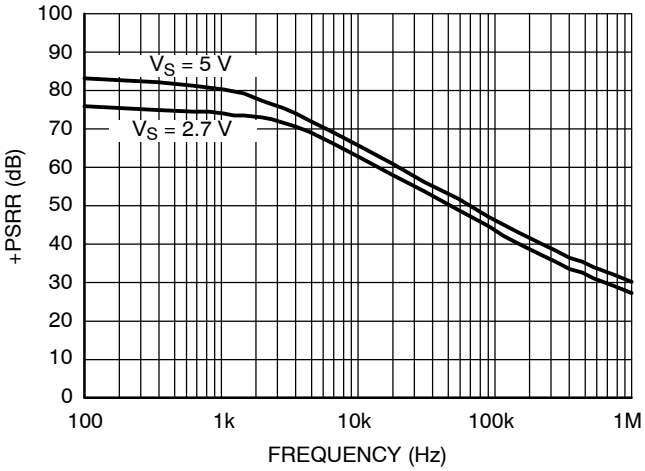


Figure 4. +PSRR vs. Frequency

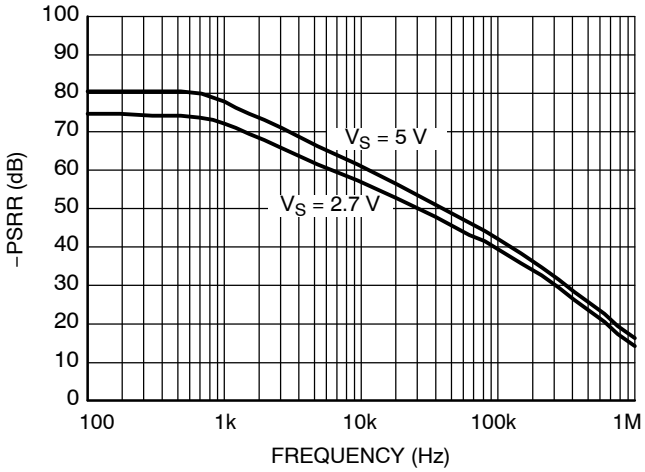


Figure 5. −PSRR vs. Frequency

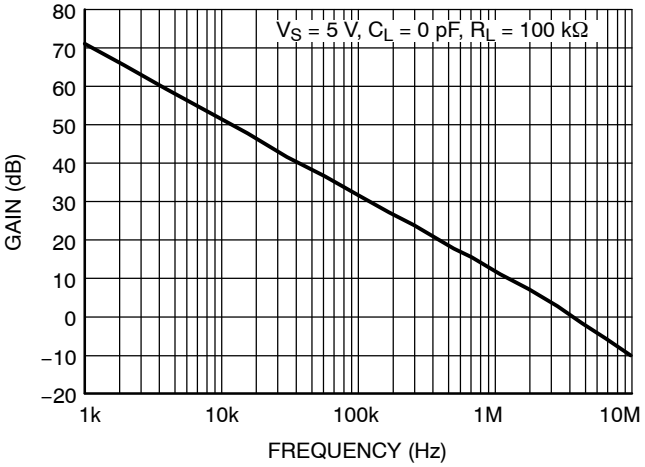


Figure 6. Gain vs. Frequency

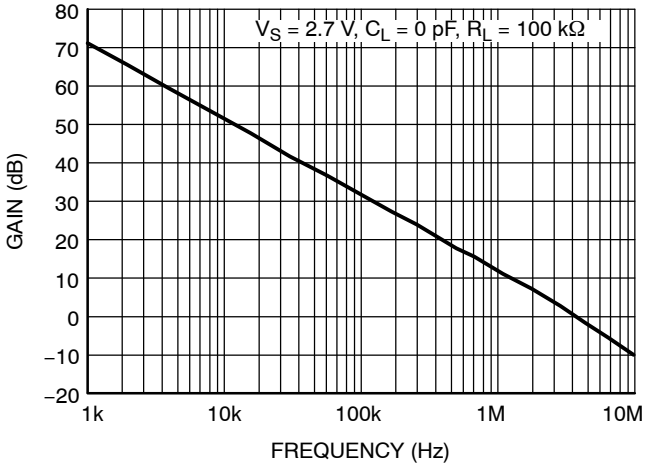


Figure 7. Gain vs. Frequency

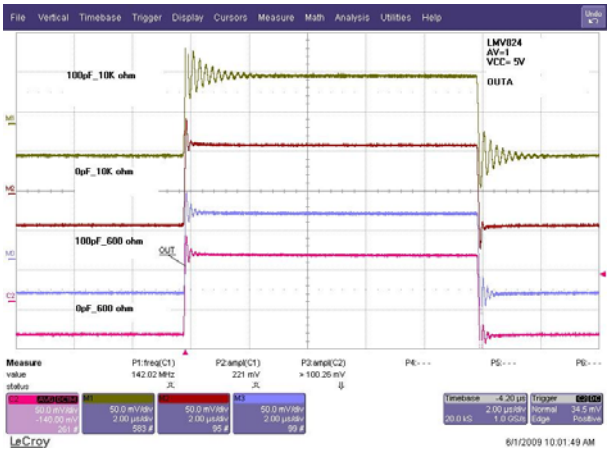


Figure 8. Non−Inverting Stability vs. Capacitive Load

TYPICAL PERFORMANCE CHARACTERISTICS

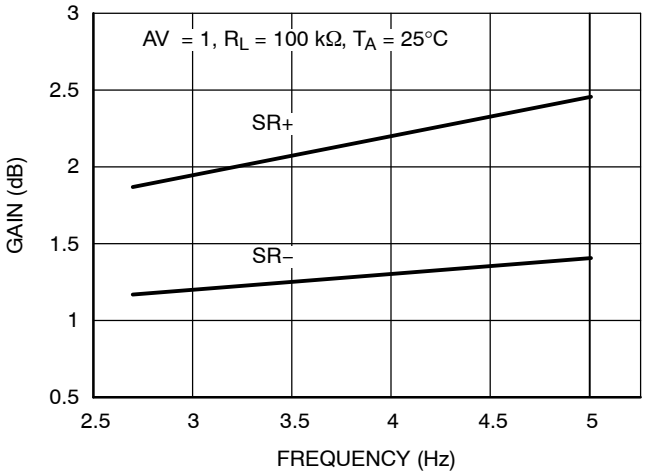


Figure 9. Gain vs. Frequency

Figure 10. Non−Inverting Large Signal Step Response

Figure 11. Non−Inverting Small Signal Step Response

Figure 12. Inverting Large Signal Step Response

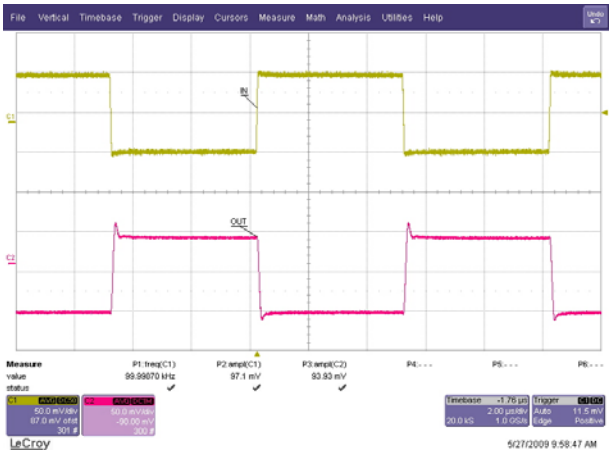


Figure 13. Inverting Small Signal Step Response

APPLICATIONS INFORMATION

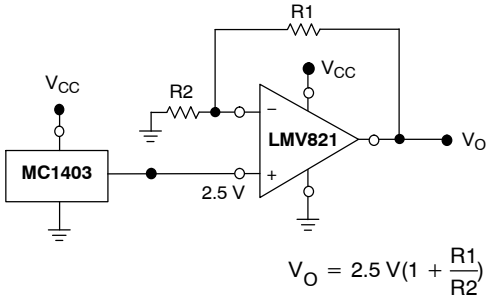


Figure 14. Voltage Reference

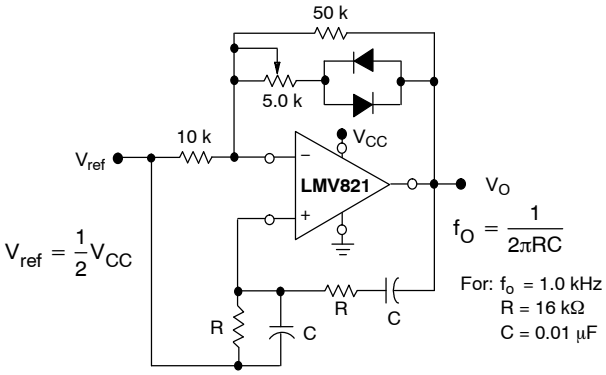
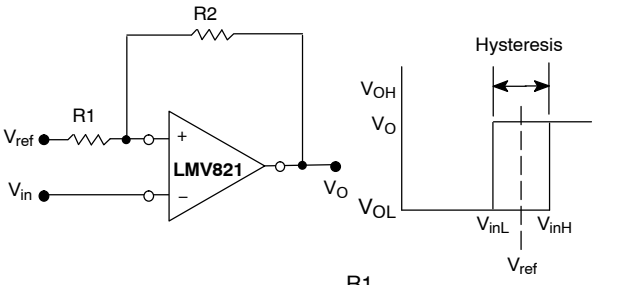


Figure 15. Wien Bridge Oscillator

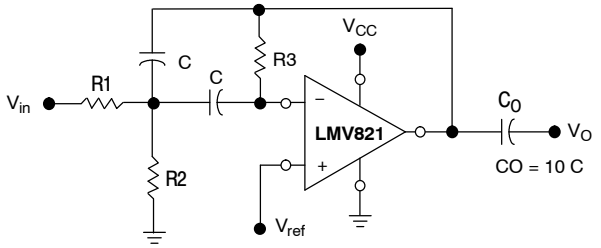


$$V_{in}L = \frac{R1}{R1 + R2}\ (V_{OL} - V_{ref}) + V_{ref}$$

$$V_{in}H = \frac{R1}{R1 + R2}\ (V_{OH} - V_{ref}) + V_{ref}$$

$$H = \frac{R1}{R1 + R2}\ (V_{OH} - V_{OL})$$

Figure 16. Comparator with Hysteresis



Given: f_o = center frequency
$A(f_o)$ = gain at center frequency

Choose value f_o, C

Then : $R3 = \frac{Q}{\pi f_O C}$

$$R1 = \frac{R3}{2\ A(f_O)}$$

$$R2 = \frac{R1\ R3}{4Q^2\ R1 - R3}$$

For less than 10% error from operational amplifier, $((Q_O\ f_O)/BW) < 0.1$ where f_o and BW are expressed in Hz. If source impedance varies, filter may be preceded with voltage follower buffer to stabilize filter parameters.

Figure 17. Multiple Feedback Bandpass Filter

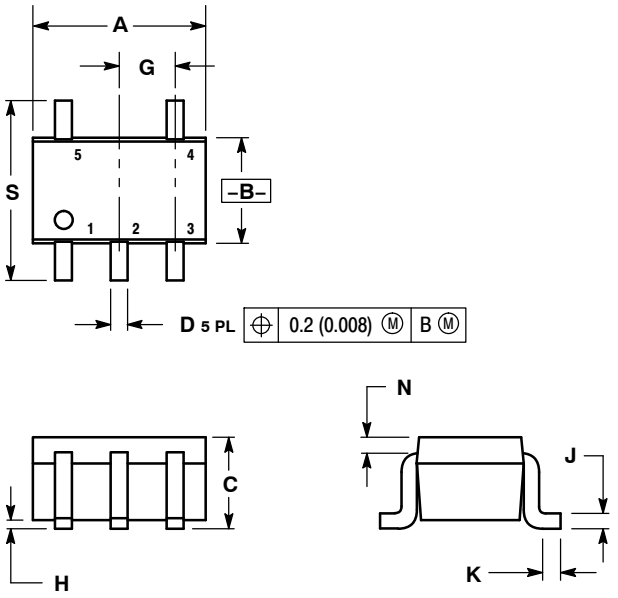
ORDERING INFORMATION

Order Number	Number of Channels	Specific Device Marking	Package Type	Shipping†
LMV821SQ3T2G	Single	AAE	SC−70 (Pb−Free)	3000 / Tape & Reel
LMV822DMR2G*	Dual	V822	Micro8 (Pb−Free)	4000 / Tape & Reel
LMV822DR2G*	Dual	V822	SOIC−8 (Pb−Free)	2500 / Tape & Reel
LMV824DR2G	Quad	LMV824	SOIC−14 (Pb−Free)	2500 / Tape & Reel
LMV824DTBR2G	Quad	LMV 824	TSSOP−14 (Pb−Free)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
*Contact sales for package availability.

PACKAGE DIMENSIONS

SC−88A (SC−70−5/SOT−353)
CASE 419A−02
ISSUE K

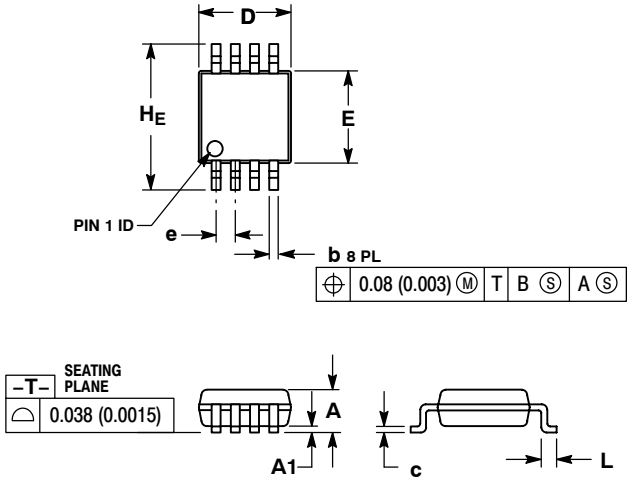


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

PACKAGE DIMENSIONS

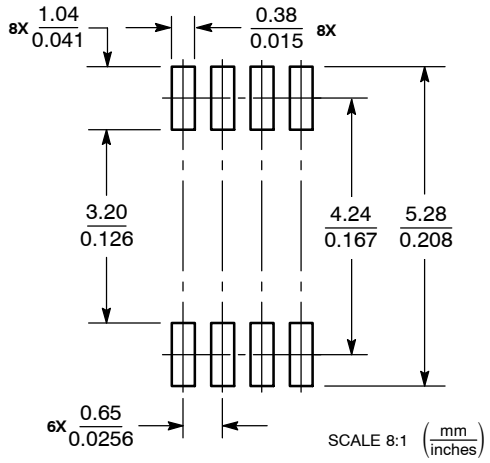
Micro8™
CASE 846A−02
ISSUE H



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. 846A−01 OBSOLETE, NEW STANDARD 846A−02.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	−−	−−	1.10	−−	−−	0.043
A1	0.05	0.08	0.15	0.002	0.003	0.006
b	0.25	0.33	0.40	0.010	0.013	0.016
c	0.13	0.18	0.23	0.005	0.007	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
E	2.90	3.00	3.10	0.114	0.118	0.122
e		0.65 BSC			0.026 BSC	
L	0.40	0.55	0.70	0.016	0.021	0.028
HE	4.75	4.90	5.05	0.187	0.193	0.199

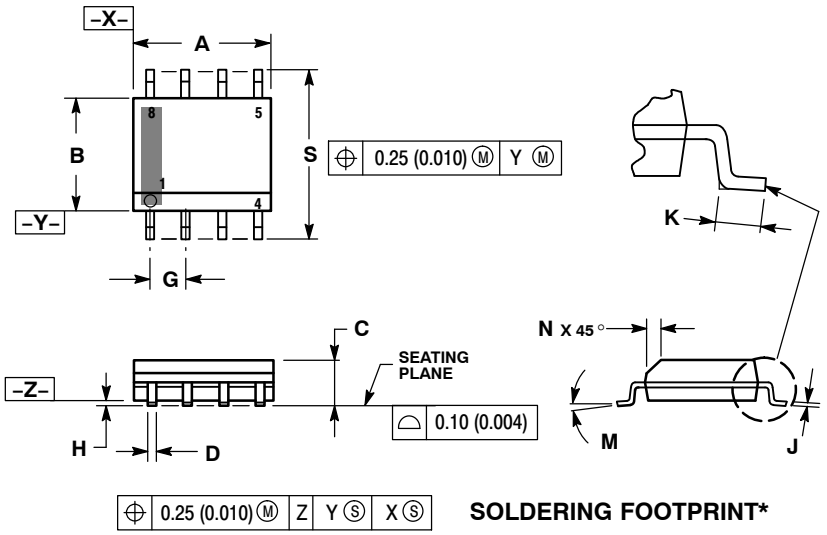
SOLDERING FOOTPRINT*



*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

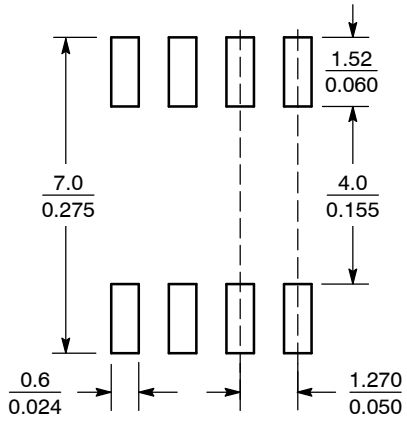
SOIC−8 NB
CASE 751−07
ISSUE AK



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*

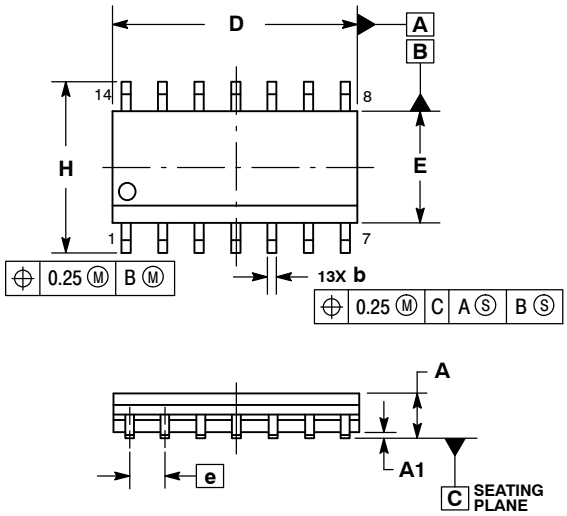


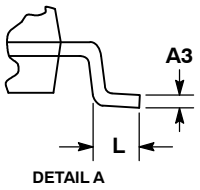
SCALE 6:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

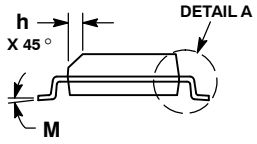
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

SOIC−14
CASE 751A−03
ISSUE K



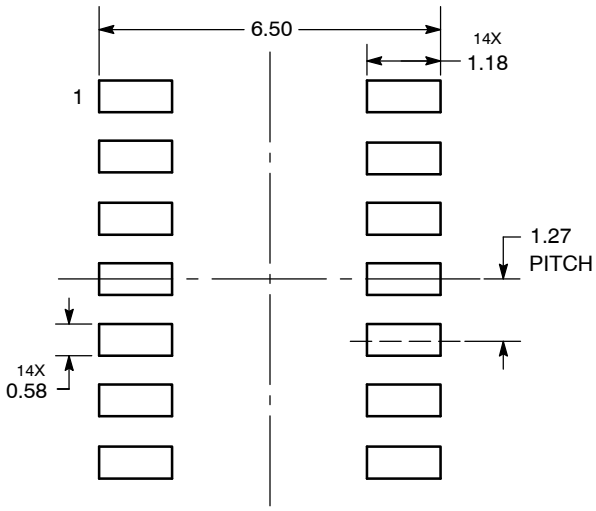




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
A3	0.19	0.25	0.008	0.010
b	0.35	0.49	0.014	0.019
D	8.55	8.75	0.337	0.344
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.019
L	0.40	1.25	0.016	0.049
M	0 °	7 °	0 °	7 °

SOLDERING FOOTPRINT*

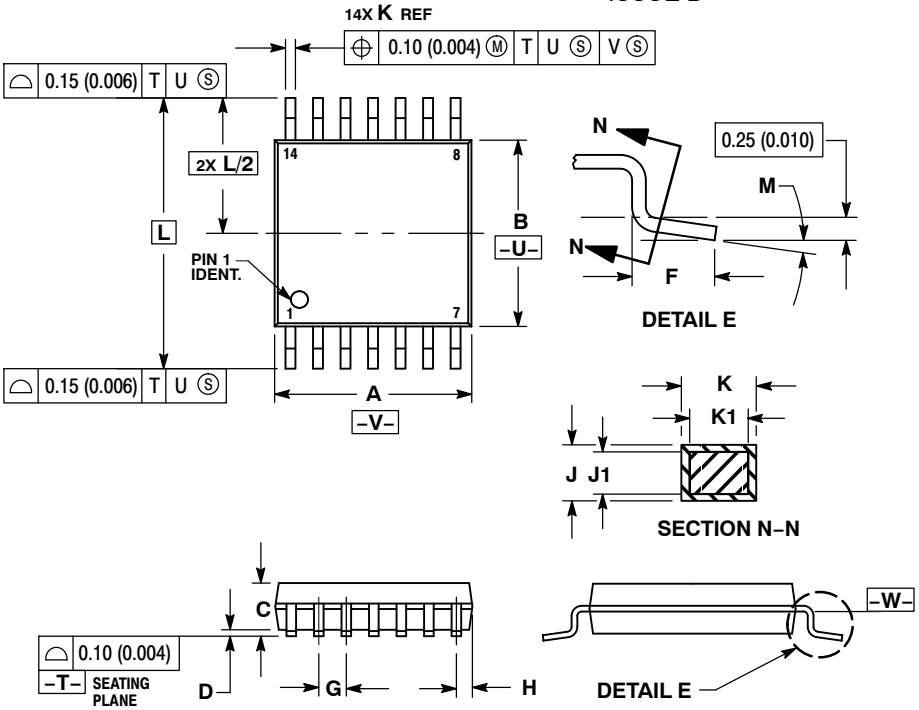


DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

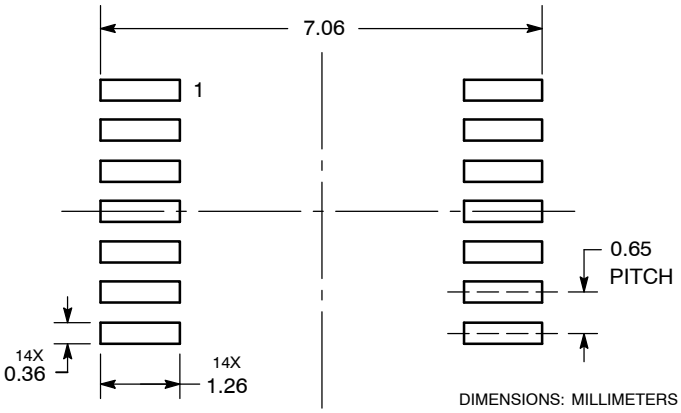
TSSOP−14
CASE 948G
ISSUE B



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0 °	8 °	0 °	8 °

SOLDERING FOOTPRINT



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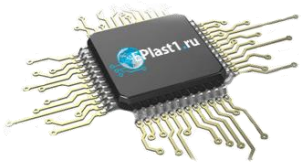

Как с нами связаться

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