National Semiconductor

MICROCIRCUIT DATA SHEET

MNLM6142AM-X REV 2A1

Original Creation Date: 11/21/94
Last Update Date: 10/29/98
Last Major Revision Date: 10/16/98

HIGH SPEED/LOW POWER 17MHz RAIL-TO-RAIL INPUT-OUTPUT OPERATIONAL AMPLIFIERS

General Description

Using patent pending new circuit topologies, the LM6142 provides new levels of performance in applications where low voltage supplies or power limitations previously made compromise necessary. Operating on supplies of 2.7V to 24V, the LM6142 is an excellent choice for battery operated systems, portable instrumentation and other applications.

The greater than rail-to-rail input voltage range eliminates concern over exceeding the common-mode voltage range. The rail-to-rail output swing provides the maximum possible dynamic range at the output. This is particularly important when operating on low supply voltages.

High gain-bandwidth with 650uA/Amplifier supply current opens new battery powered applications where previous higher power consumption reduced battery life to unacceptable levels. The ability to drive large capacitive loads without oscillating functionally removes this common problem.

Industry Part Number

LM6142AM

NS Part Numbers

LM6142AMJ-QML

Prime Die

LM6142

Controlling Document

5962-9550301QPA

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (^{O}C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55

Features

At Vs = 5V. Typ unless noted.

- Rail-to-rail input CMVR -0.25V to 5.25V
- Rail-to-rail output swing 0.005V to 4.995V
- Wide gain-bandwidth: 17MHz (typ)
- Slew Rate:
  - Small signal, 5V/uS
  - Large Signal, 30V/uS
- Low supply current 650uA/Amplifier
- Wide supply range 2.7V to 24V
- CMRR 107dB
- Gain 108dB with Rl = 10K
- PSRR 87dB

Applications

- Battery operated instrumentation
- Portable sonar
- Barcode scanners
- Wireless communications
- Rail-to-rail in-out instrumentation amps

(Absolute Maximum Ratings)
(Note 1)

ESD Tolerance	3000V
Differential Input Voltage	15V
Voltage at Input/Output Pin	(V+) + 0.3V, (V-) - 0.3V
Supply Voltage (V+ - V-)	35V
Current at Input Pin	±10mA
Current at Output Pin (Note 3)	±25mA
Current at Power Supply Pin	50mA
Lead Temperature (Soldering, 10 sec.)	260 C
Storage Temperature Range	-65 C to +150 C
Junction Temperature (Note 4)	150 C
Thermal Resistance	
ThetaJA	
(Still Air)	125 C/W
(500LF/Min Air flow)	63 C/W
ThetaJC	12 C/W

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranted specifications and the test conditions, see the Electrical Characteristics.
Note 2: Human body model, 1.5K Ohms in series with 100pF
Note 3: Applies to both single-supply and split-supply operation. Continuous short circuit operation at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150 C.
Note 4: The maximum power dissipation is a function of Tj(max), ThetaJA, and TA. The maximum allowable power dissipation at any ambient temperature is Pd = [Tj(max) - TA]/ThetaJA. All numbers apply for packages soldered directly into a PC board.

Recommended Operating Conditions

Supply Voltage	2.7V to 24V
Operating Temperature Range	-55C to +125C

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranted specifications and the test conditions, see the Electrical Characteristics.

Electrical Characteristics

DC PARAMETERS: 5.0V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: V+ = 5.0V, V- = 0V, Vcm = Vo = V+/2 and Rl > 1M Ohms to V+/2

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vio	Input Offset Voltage					1.0	mV	1
						2.5	mV	2, 3
Iib	Input Bias Current	0V ≤Vcm≤ 5V				280	nA	1
		0V ≤Vcm≤ 5V				526	nA	2, 3
Iio	Input Offset Current					30	nA	1
						80	nA	2, 3
CMRR	Common Mode Rejection Ratio	0V ≤Vcm≤ 4V			84		dB	1
		0V ≤Vcm≤ 4V			78		dB	2, 3
		0V ≤Vcm≤ 5V			66		dB	1
		0V ≤Vcm≤ 5V			64		dB	2, 3
PSRR	Power Supply Rejection Ratio	5V ≤V+≤ 24V			80		dB	1
		5V ≤V+≤ 24V			78		dB	2, 3
Vcm	Input Common-Mode Voltage Range		1		0	5.0	V	1, 2, 3
Av	Large Signal Voltage Gain	Rl = 10K			100		V/mV	4
					33		V/mV	5, 6
Vo	Output Swing	Rl = 100K			4.98	0.01	V	4
					4.93	.014	V	5, 6
		Rl = 2K			4.86	0.1	V	4
						0.133	V	5
					4.8	0.133	V	6
		Rl = 3K			4.77		V	5
Isc	Output Short Circuit Current	Sourcing			10		mA	1
					2.0	35	mA	2, 3
		Sinking			10		mA	1
					4.0	35	mA	2, 3
Is	Supply Current	Per Amplifier				800	uA	1
						880	uA	2, 3

Electrical Characteristics

AC PARAMETERS: 5.0V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: V+ = 5.0V, V- = 0V, Vcm = Vo = V+/2 and Rl > 1M Ohms to V+/2

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
SR	Slew Rate	8Vpp, Vcc = +12V, Rs > 1K Ohms			15		V/uS	4
					10.5		V/uS	5
					11		V/uS	6
GBW	Gain-Bandwidth Product	f = 50Khz			10		MHz	4
					6		MHz	5, 6

DC PARAMETERS: 2.7V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: V+ = 2.7V, V- = 0V, Vcm = Vo = V+/2 and Rl > 1M Ohms to V+/2

Vio	Input Offset Voltage					1.8	mV	1
						4.3	mV	2, 3
Iib	Input Bias Current					250	nA	1
						526	nA	2, 3
Iio	Input Offset Current					30	nA	1
						80	nA	2, 3
CMRR	Common Mode Rejection Ratio	0V ≤Vcm≤ 1.8V			72		dB	1
		0V ≤Vcm≤ 1.8V			63		dB	2, 3
		0V ≤Vcm≤ 2.7V			62		dB	1
		0V ≤Vcm≤ 2.7V			58		dB	2, 3
PSRR	Power Supply Rejection Ratio	3V ≤V+≤ 5V			72		dB	1
		3V ≤V+≤ 5V			58		dB	2, 3
Vcm	Input Common-Mode Voltage Range		1		0	2.7	V	1, 2, 3
Av	Large Signal Voltage Gain	Rl = 100K			10		V/mV	4
					1.5		V/mV	5, 6
Vo	Output Swing	Rl = 100K			2.66	0.08	V	4
					2.25	0.112	V	5, 6
Is	Supply Current	Per Amplifier				800	uA	1
						880	uA	2, 3

Electrical Characteristics

AC PARAMETERS: 2.7V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: V+ = 2.7V, V- = 0V, Vcm = Vo = V+/2 and Rl > 1M Ohms to V+/2

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
GBW	Gain-Bandwidth Product	f = 50KHz			3		MHz	4
					1.5		MHz	5, 6

DC PARAMETERS: 24V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: V+ = 24V, V- = 0V, Vcm = Vo = V+/2 and Rl > 1M Ohms to V+/2

Vio	Input Offset Voltage					2	mV	1
						4.8	mV	2, 3
Vo	Output Swing	Rl = 10K Ohms			23.81	0.15	V	4
					23.62	0.185	V	5, 6
Is	Supply Current	Per Amplifier				1100	uA	1
						1150	uA	2, 3

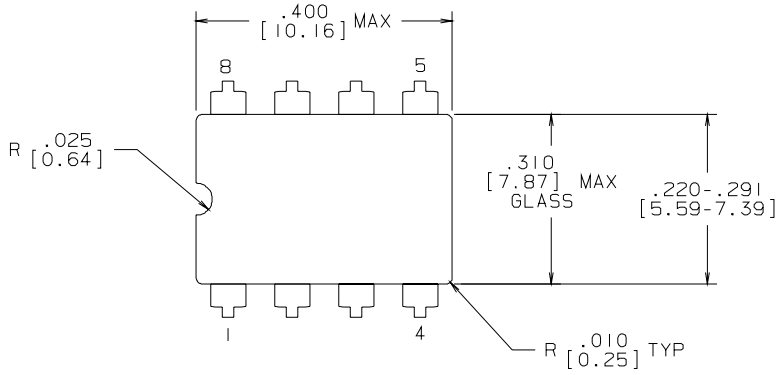
Note 1: Input Common-Mode voltage range is Guaranteed by CMRR.

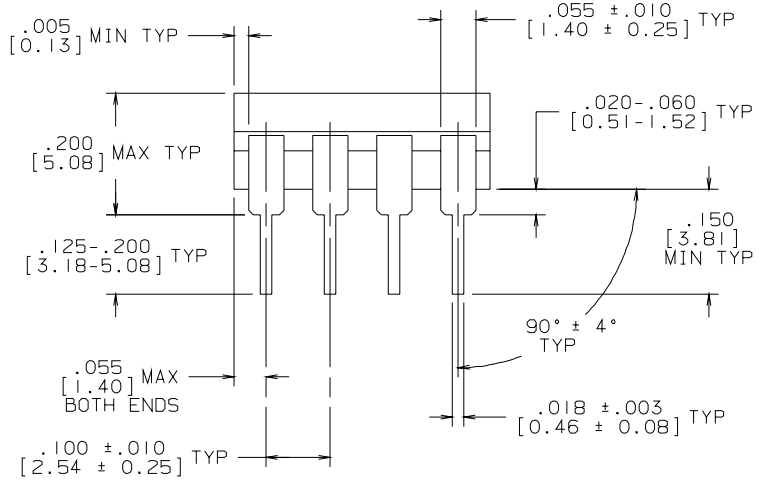
Graphics and Diagrams

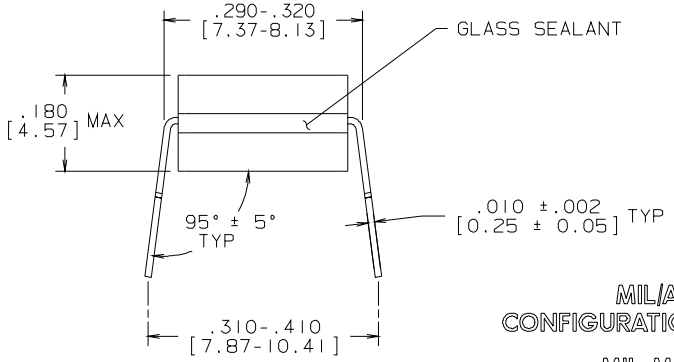
GRAPHICS#	DESCRIPTION
06086HRC4	CERDIP (J), 8 LEAD (B/I CKT)
J08ARL	CERDIP (J), 8 LEAD (P/P DWG)
P000015B	CERDIP (J), 8 LEAD (PIN OUT)

See attached graphics following this page.

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
L	REVISE PER CURRENT STD; REDRAW	10002	09/21/93	TL/







MIL/AERO
CONFIGURATION CONTROL

MIL-M-38510
CONFIGURATION CONTROL

NOTES: UNLESS OTHERWISE SPECIFIED

1. LEAD FINISH TO BE 200 MICROINCHES / 5.08 MICROMETERS MINIMUM SOLDER MEASURED AT THE CREST OF THE MAJOR FLATS.
2. JEDEC REGISTRATION MO-036, VARIATION AA, DATED 04/1981.

CONTROLLING DIMENSION: INCH

APPROVALS	DATE
DRAWN T. LEQUANG	09/21/93
DFTG. CHK.	
ENGR. CHK.	
APPROVAL	

PROJECTION

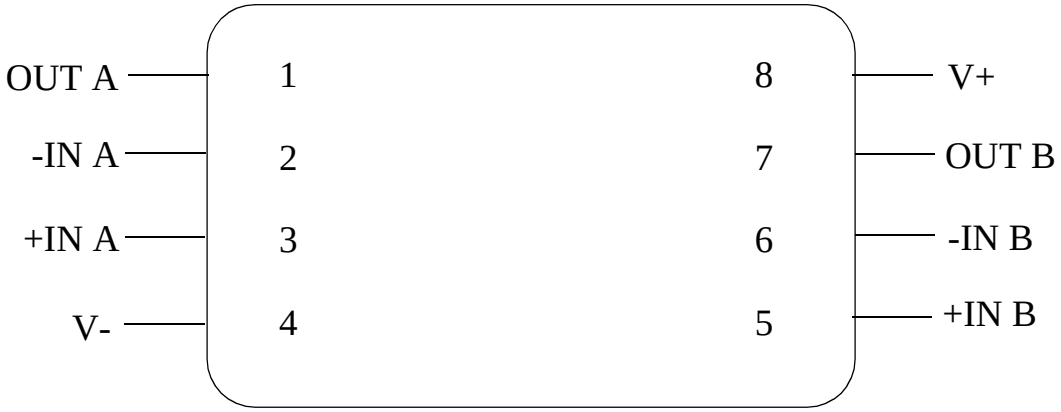
INCH
[MM]

NATIONAL SEMICONDUCTOR CORPORATION
2900 Semiconductor Drive, Santa Clara, CA 95052-8090

CERDIP (J), 8 LEAD

SCALE	SIZE	DRAWING NUMBER	REV
N/A	B	MKT-J08A	L

DO NOT SCALE DRAWING | SHEET 1 OF 1



LM6142AMJ/883

8 - LEAD DIP

CONNECTION DIAGRAM
TOP VIEW

P000015B

National Semiconductor™
MIL/AEROSPACE OPERATIONS
2900 SEMICONDUCTOR DRIVE
SANTA CLARA, CA 95050

Revision History

Rev	ECN #	Rel Date	Originator	Changes
2A1	M0003061	10/29/98	Shaw Mead	MDS: MNLM6142AM-X Rev. 1B1, updated to: MNLM6142AM-X Rev. 2A1. Change: 5V, Vo at Rl=3k, Min. Limit from 4.8V to 4.77V in subgroup 5. Change: 5V, SR, Min. Limit from 11V/uS to 10.5V/uS in subgroup 5. Update: Recommended Operating Conditions. Change: Subgroups for SR and GBW from functional tests to dynamic tests.