

MNLM6142AM-X REV 4A1

 Original Creation Date: 11/21/94
 Last Update Date: 04/28/04
 Last Major Revision Date: 03/09/04

**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

SEE FEATURES SECTION

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (°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 $V_s = 5V$. 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 2.8V to 24V
- CMRR 107dB
- Gain 108dB with $R_l = 10K$
- PSRR 87dB

CONTROLLING DOCUMENTS:

LM6142AMJ-QML 5962-9550301QPA

Applications

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

(Absolute Maximum Ratings)

(Note 1)

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 ≤ Ta ≤ +150 C
Maximum Junction Temperature (Note 2)	150 C
Thermal Resistance ThetaJA (Still Air) (500LF/Min Air flow)	125 C/W 63 C/W
ThetaJC	12 C/W
ESD Tolerance (Note 4)	3000V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and the test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by Tjmax (maximum junction temperature), ThetaJA (package junction to ambient thermal resistance), and TA (ambient temperature). The maximum allowable power dissipation at any temperature is Pdmax = (Tjmax - TA) / ThetaJA or the number given in the Absolute Maximum Ratings, whichever is lower.

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: Human body model, 1.5K Ohms in series with 100pF

Recommended Operating Conditions

(Note 1)

Supply Voltage	2.8V to 24V
Operating Temperature Range	$-55^{\circ}\text{C} \leq T_a \leq +125^{\circ}\text{C}$

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and the test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Electrical Characteristics

DC PARAMETERS: 5.0V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
 DC: $V_+ = 5.0V$, $V_- = 0V$, $V_{cm} = V_o = V_+/2$ and $R_l \geq 100k$ 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	$0V \leq V_{cm} \leq 5V$			280		nA	1
					526		nA	2, 3
Iio	Input Offset Current				30		nA	1
					80		nA	2, 3
CMRR	Common Mode Rejection Ratio	$0V \leq V_{cm} \leq 4V$			84		dB	1
					78		dB	2, 3
		$0V \leq V_{cm} \leq 5V$			66		dB	1
					64		dB	2, 3
PSRR	Power Supply Rejection Ratio	$5V \leq V_+ \leq 24V$			80		dB	1
					78		dB	2, 3
Vcm	Input Common-Mode Voltage Range		1		0	5.0	V	1, 2, 3
Av	Large Signal Voltage Gain	$R_l = 10K$			100		V/mV	4
					33		V/mV	5, 6
Vo	Output Swing	$R_l = 100K$			4.98	0.01	V	4
					4.93	.014	V	5, 6
					4.86	0.1	V	4
		$R_l = 2K$			4.77	0.133	V	5
					4.8	0.133	V	6
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

Electrical Characteristics

AC PARAMETERS: 5.0V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
 AC: $V_+ = 5.0V$, $V_- = 0V$, $V_{cm} = V_o = V_+/2$ and $R_l \geq 100k$ Ohms to $V_+/2$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
+SR	Slew Rate	$-4V \leq V_{in} \leq +4V$, $+V_{cc} = 6V$, $-V_{cc} -6V$, $R_s = 1K$ Ohms, $R_l = 2K$ Ohms $C_{out} = 0$			15		V/uS	4
					9.5		V/uS	5
					11		V/uS	6
-SR	Slew Rate	$+4V \geq V_{in} \geq -4V$, $+V_{cc} = 6V$, $-V_{cc} -6V$, $R_s = 1K$ Ohms, $R_l = 2K$ Ohms $C_{out} = 0$			15		V/uS	4
					9.5		V/uS	5
					11		V/uS	6
GBW	Gain-Bandwidth Product	$f = 50KHz$			10		MHz	4
					6		MHz	5, 6

DC PARAMETERS: 2.8V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
 DC: $V_+ = 2.8V$, $V_- = 0V$, $V_{cm} = V_o = V_+/2$ and $R_l \geq 100k$ 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	$0V \leq V_{cm} \leq 1.9V$			72		dB	1
					63		dB	2, 3
		$0V \leq V_{cm} \leq 2.8V$			62		dB	1
					58		dB	2, 3
PSRR	Power Supply Rejection Ratio	$3V \leq V_+ \leq 5V$			72		dB	1
					58		dB	2, 3
Vcm	Input Common-Mode Voltage Range		1		0	2.8	V	1, 2, 3
Av	Large Signal Voltage Gain	$R_l = 100K$, $V_o = \pm 1.1V$			10		V/mV	4
					1.5		V/mV	5, 6
Vo	Output Swing	$R_l = 100K$			2.76	0.08	V	4
					2.35	0.112	V	5, 6
Is	Supply Current	Per Amplifier				800	uA	1
						880	uA	2, 3

Electrical Characteristics

AC PARAMETERS: 2.8V ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
 AC: $V_+ = 2.8V$, $V_- = 0V$, $V_{cm} = V_o = V_+/2$ and $R_l \geq 100k$ 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: $V_+ = 24V$, $V_- = 0V$, $V_{cm} = V_o = V_+/2$ and $R_l \geq 100k$ Ohms to $V_+/2$

Vio	Input Offset Voltage				2		mV	1
					4.8		mV	2, 3
Vo	Output Swing	$R_l = 10K$ 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

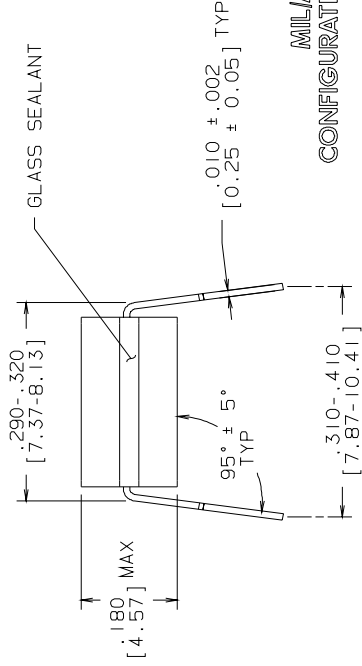
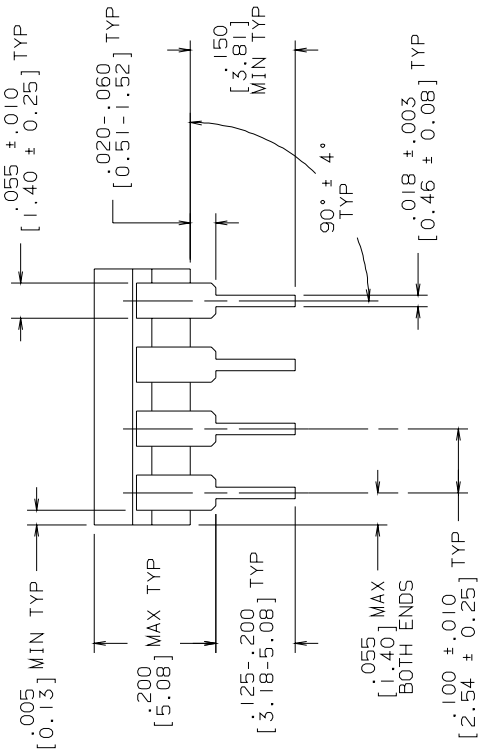
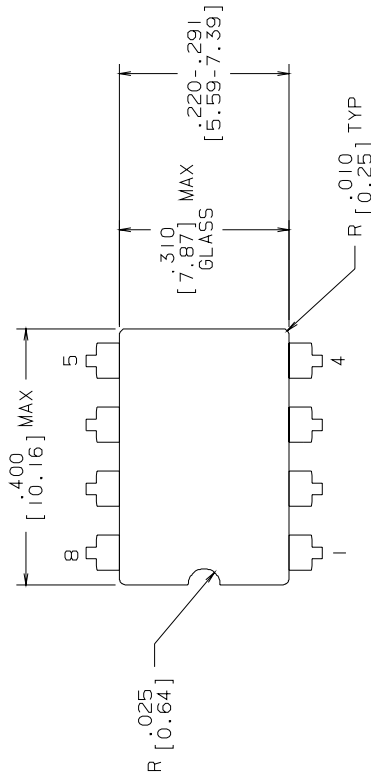
Note 1: Input Common-Mode voltage range is Guaranteed by CMRR.

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.

R E V I S I O N S			
LTR	DESCRIPTION	E. C. N.	DATE
L	REVISE PER CURRENT STD; REDRAW	10002	09/21/93
			TL/



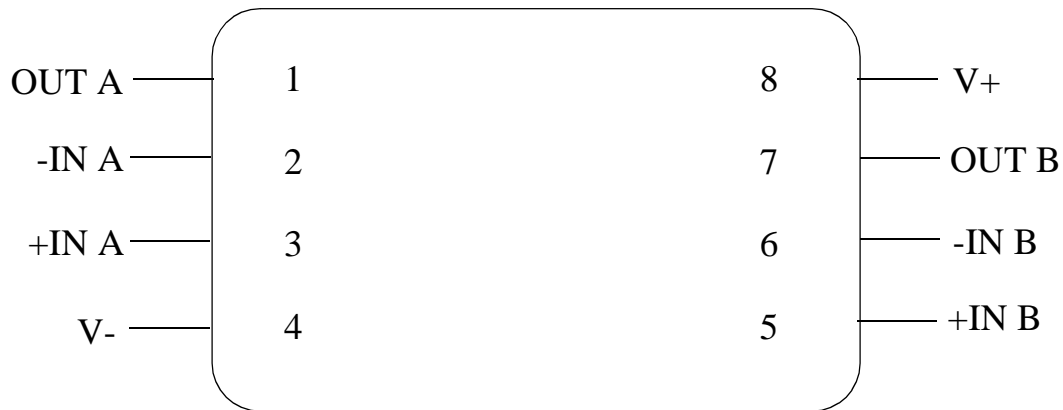
MILAERO
 CONFIGURATION CONTROL
 MIL-M-38510
 CONFIGURATION CONTROL

CONTROLLING DIMENSION: INCH	
APPROVALS	DATE
DRAWN: T. LEQUANG	09/21/93
DFTG. CHK.	
ENGR. CHK.	
APPROVAL	
 PROJECTION INCH [MM]	
SCALE	SIZE
N/A	B
DO NOT SCALE DRAWING	DRAWING NUMBER
	MKT-J08A
SHEET	OF
1	1

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

CERDIP (J),
 8 LEAD

- NOTES: UNLESS OTHERWISE SPECIFIED
- LEAD FINISH TO BE 200 MICROMETERS / 5.08 MICROMETERS MINIMUM SOLDER MEASURED AT THE CREST OF THE MAJOR FLATS.
 - JEDEC REGISTRATION MO-036, VARIATION AA, DATED 04/1981.



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	07/12/00	Shaw Mead	MDS: MNL6142AM-X Rev. 1B1, updated to: MNL6142AM-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.
3A1	M0003723	04/28/04	Rose Malone	Update MDS: MNL6142AM-X, Rev. 2A1 to MNL6142AM-X, Rev. 3A1. Moved Controlling Document from Main Table to Features Section. Changed Features Section, Wide Supply Range and Recommended Operating Conditions Section, Supply Voltage from 2.7V to 2.8V. Re-ordered and Updated Notes in Absolute Maximum Section. Updated Recommended Operating Conditions notes. Removed Rl = 2K condition under DC parametric 5.0V Output Swing. Changed Slew Rate min. limit from 10.5 to 9.5V/uS subgroup 5 and Added Cout = 0 in Conditions under AC parametric 5.0V. Changed DC/AC Sections referring to 2.7V to 2.8V. Changed Conditions in DC Parameters 2.8V section CMRR from $0V \leq V_{cm} \leq 1.8V$ to $0V \leq V_{cm} \leq 1.9V$ and $0V \leq V_{cm} \leq 2.7V$ to $0V \leq V_{cm} \leq 2.8V$ and Vcm Max. limit from 2.7V to 2.8V, AV Rl = 100K, Vo = $\pm 1.1V$. Changed Vo Min. limit Subgroup 4 from 2.66 to 2.76V and Subgroup 5,6 from 2.25 to 2.35V.
4A1	M0004375	04/28/04	Rose Malone	Update MDS: MNL6142AM-X, Rev. 3A1 to Rev. 4A1. Corrected Conditions that applied to all Electricals. Changed Parameter SR to +SR and the conditions. Added Parameter -SR. Changed made to reflect the test program.