LMV321

General Purpose, Low Voltage, Rail-to-Rail Output Amplifier

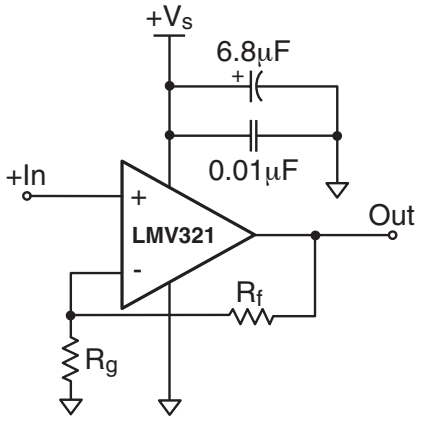
Features at +2.7V

- 80µA supply current
- 1.2MHz gain bandwidth product
- Output voltage range: 0.01V to 2.69V
- Input voltage range: -0.25V to +1.5V
- 1.5V/µs slew rate
- Directly replaces other industry standard LMV321 amplifiers
- Package options (SC70-5 and SOT23-5)
- Fully specified at +2.7V and +5V supplies
- Operating temperature range: -40°C to +125°C

Applications

- Low cost general purpose applications
- Cellular phones
- Personal data assistants
- A/D buffer
- DSP interface
- Smart card readers
- Portable test instruments
- Keyless entry
- Infrared receivers for remote controls
- Telephone systems
- Audio applications

Typical Application

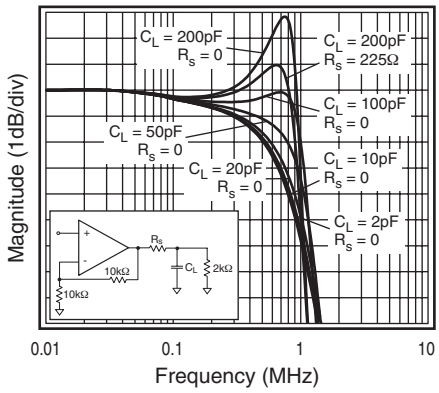


Description

The LMV321 is a low cost, voltage feedback amplifier that consumes only 80µA of supply current. The LMV321 is designed to operate from 2.7V (±1.35V) to 5.5V (±2.75V) supplies. The common mode voltage range extends below the negative rail and the output provides rail-to-rail performance.

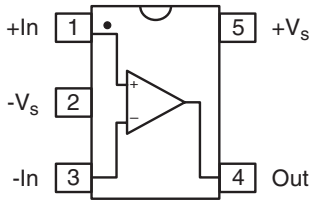
The LMV321 is designed on a CMOS process and provides 1.2MHz of bandwidth and 1.5V/µs of slew rate at a low supply voltage of 2.7V. The combination of low power, rail-to-rail performance, low voltage operation, and tiny package options make the LMV321 well suited for use in personal electronics equipment such as cellular handsets, pagers, PDAs, and other battery powered applications.

Frequency Response vs. C_L



Pin Assignments

SC70-5/SOT23-5



Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
Supply Voltages	0	+6	V
Maximum Junction Temperature	–	+175	°C
Storage Temperature Range	-65	+150	°C
Lead Temperature, 10 seconds	–	+260	°C
Input Voltage Range	$-V_S$ -0.5	$+V_S$ +0.5	V

Recommended Operating Conditions

Parameter	Min.	Max.	Unit
Operating Temperature Range	-40	+125	°C
Power Supply Operating Range	2.5	5.5	V

Package Thermal Resistance

Package	θ_{JA}
5 lead SC70	331.4°C/W
5 lead SOT23	256°C/W

Electrical Specifications

(T_C = 25°C, V_S = +2.7V, G = 2, R_L = 10kΩ to V_S/2, R_f = 10kΩ, $V_{O\ (DC)}$ = V_{CC}/2; unless otherwise noted)

Parameter	Conditions	Min.	Typ.	Max.	Unit
AC Performance					
Gain Bandwidth Product	C_L = 50pF, R_L = 2kΩ		1.2		MHz
Phase Margin			52		deg
Gain Margin			17		dB
Slew Rate	V_O = 1V_{pp}		1.5		V/µs
Input Voltage Noise	>50kHz		36		nV/√Hz
DC Performance					
Input Offset Voltage[1]			1.7	7	mV
Average Drift			8		µV/°C
Input Bias Current[2]			<1		nA
Input Offset Current[2]			<1		nA
Power Supply Rejection Ratio[1]	DC	50	65		dB
Supply Current[1]			80	120	µA
Input Characteristics					
Input Common Mode Voltage Range[1]	LO	0	-0.25		V
	HI		1.5	1.3	V
Common Mode Rejection Ratio[1]		50	70		dB
Output Characteristics					
Output Voltage Swing	R_L = 10kΩ to V_S/2; LO[1]	0.1	0.01		V
	R_L = 10kΩ to V_S/2; HI[1]		2.69	2.6	V

Min/max ratings are based on product characterization and simulation. Individual parameters are tested as noted. Outgoing quality levels are determined from tested parameters.

Notes:

1. Guaranteed by testing or statistical analysis at +25°C.
2. +IN and -IN are gates to CMOS transistors with typical input bias current of <1nA. CMOS leakage is too small to practically measure.

Electrical Specifications

(T_C = 25°C, V_S = +5V, G = 2, R_L = 10kΩ to V_S/2, R_f = 10kΩ, $V_{O\ (DC)}$ = V_{CC}/2; unless otherwise noted)

Parameter	Conditions	Min.	Typ.	Max.	Unit
AC Performance					
Gain Bandwidth Product	C_L = 50pF, R_L = 2kΩ		1.4		MHz
Phase Margin			73		deg
Gain Margin			12		dB
Slew Rate			1.5		V/µs
Input Voltage Noise	>50kHz		33		nV/√Hz
DC Performance					
Input Offset Voltage[1]			1	7	mV
Average Drift			6		µV/°C
Input Bias Current[2]			<1		nA
Input Offset Current[2]			<1		nA
Power Supply Rejection Ratio[1]	DC	50	65		dB
Open Loop Gain[1]		50	70		dB
Supply Current[1]			100	150	µA
Input Characteristics					
Input Common Mode Voltage Range[1]	LO	0	-0.4		V
	HI		3.8	3.6	V
Common Mode Rejection Ratio[1]		50	75		dB
Output Characteristics					
Output Voltage Swing	R_L = 2kΩ to V_S/2; LO/HI		0.036 to 4.95		V
	R_L = 10kΩ to V_S/2; LO[1]	0.1	0.013		V
	R_L = 10kΩ to V_S/2; HI[1]		4.98	4.9	V
Short Circuit Output Current[1]	sourcing; V_O = 0V	5	+34		mA
	sinking; V_O = 5V	10	-23		mA

Min/max ratings are based on product characterization and simulation. Individual parameters are tested as noted. Outgoing quality levels are determined from tested parameters.

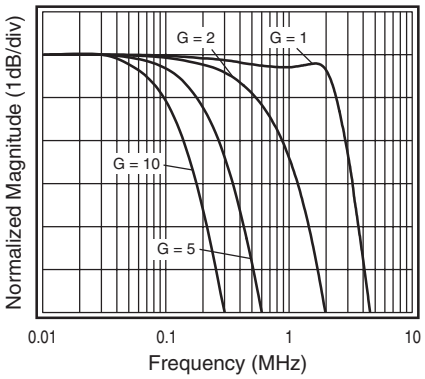
Notes:

1. Guaranteed by testing or statistical analysis at +25°C.
2. +IN and -IN are gates to CMOS transistors with typical input bias current of <1nA. CMOS leakage is too small to practically measure.

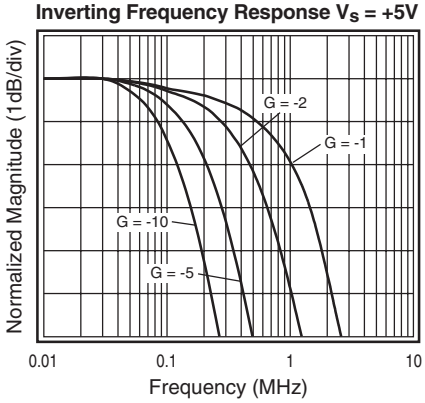
Typical Operating Characteristics

(T_C = 25°C, V_S = +5V, G = 2, R_L = 10kΩ to V_S/2, R_f = 10kΩ, $V_{O\ (DC)}$ = V_{CC}/2; unless otherwise noted)

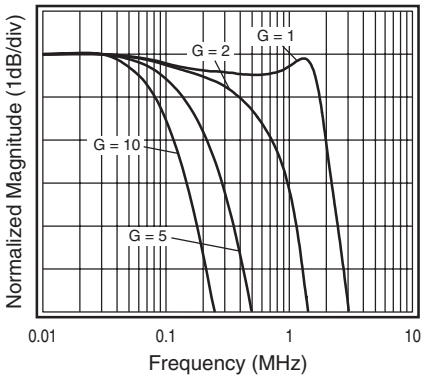
Non-Inverting Freq. Response V_S = +5V



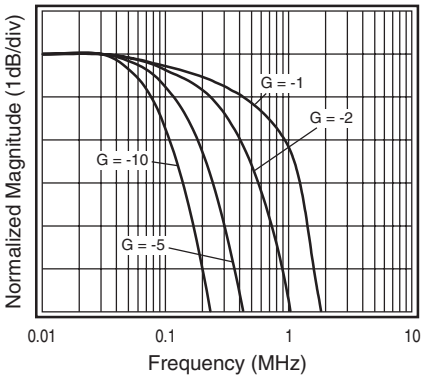
Inverting Frequency Response V_S = +5V



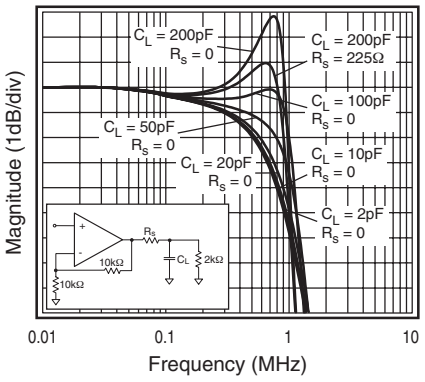
Non-Inverting Freq. Response V_S = +2.7V



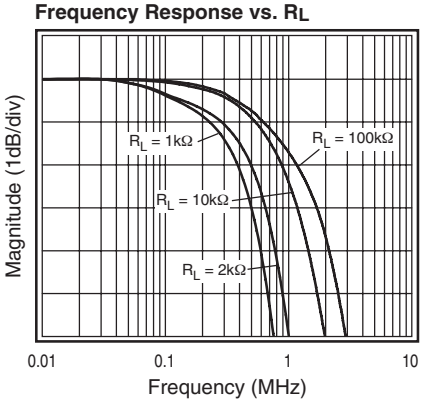
Inverting Freq. Response V_S = +2.7V



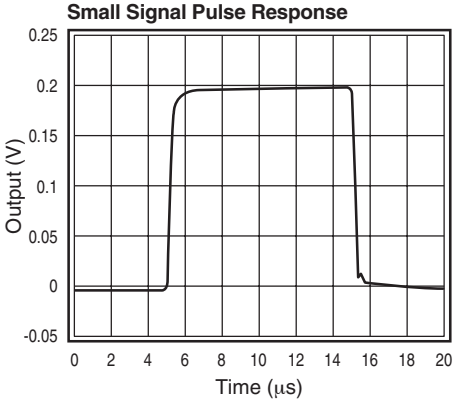
Frequency Response vs. C_L



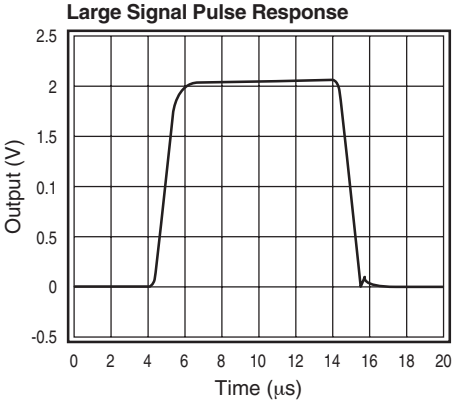
Frequency Response vs. R_L



Small Signal Pulse Response



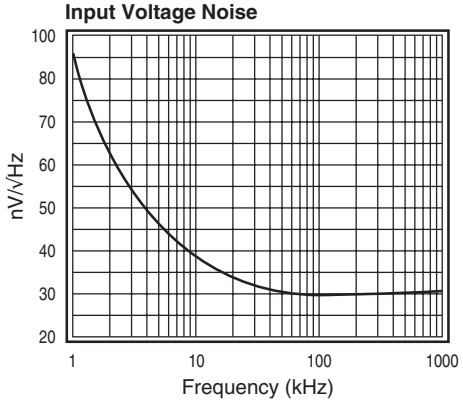
Large Signal Pulse Response



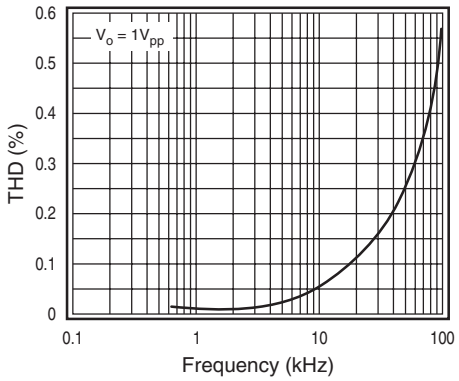
Typical Operating Characteristics

(T_C = 25°C, V_S = +5V, G = 2, R_L = 10kΩ to V_S/2, R_f = 10kΩ, $V_{O\ (DC)}$ = V_{CC}/2; unless otherwise noted)

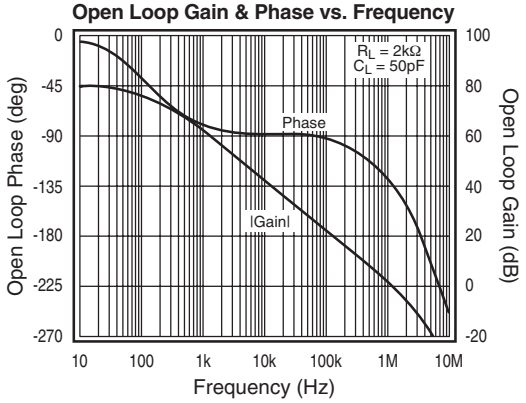
Input Voltage Noise



Total Harmonic Distortion



Open Loop Gain & Phase vs. Frequency



Application Information

General Description

The LMV321 is single supply, general purpose, voltage-feedback amplifier that is pin-for-pin compatible and a drop in replacement with other industry standard LMV321 amplifiers. The LMV321 is fabricated on a CMOS process, features a rail-to-rail output, and is unity gain stable.

The typical non-inverting circuit schematic is shown in Figure 1.

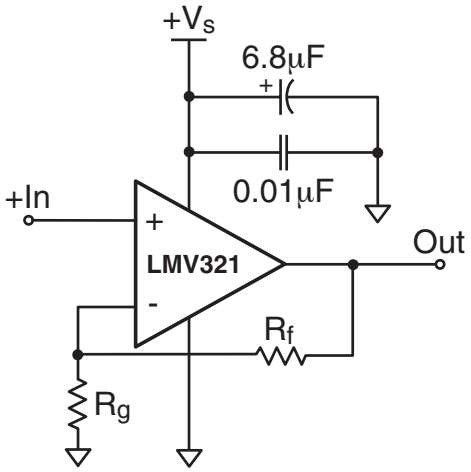


Figure 1: Typical Non-inverting configuration

Power Dissipation

The maximum internal power dissipation allowed is directly related to the maximum junction temperature. If the maximum junction temperature exceeds 150°C, some performance degradation will occur. If the maximum junction temperature exceeds 175°C for an extended time, device failure may occur.

Driving Capacitive Loads

The ***Frequency Response vs C_L*** plot on page 4, illustrates the response of the LMV321. A small series resistance (R_s) at the output of the amplifier, illustrated in Figure 2, will improve stability and settling performance. R_s values in the ***Frequency Response vs C_L*** plot were chosen to achieve maximum bandwidth with less than 1dB of peaking. For maximum flatness, use a larger R_s. As the plot indicates, the LMV321 can easily drive a 200pF capacitive load without a series resistance. For comparison, the plot also shows the LMV321driving a 200pF load with a 225Ω series resistance.

Driving a capacitive load introduces phase-lag into the output signal, which reduces phase margin in the amplifier. The unity gain follower is the most sensitive configuration. In a unity gain follower configuration, the LMV321 requires a 450Ω series resistor to drive a 200pF load. The response is illustrated in Figure 3.

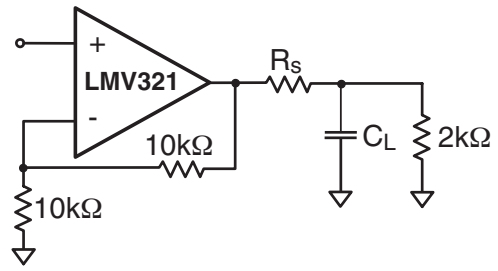


Figure 2: Typical Topology for driving a capacitive load

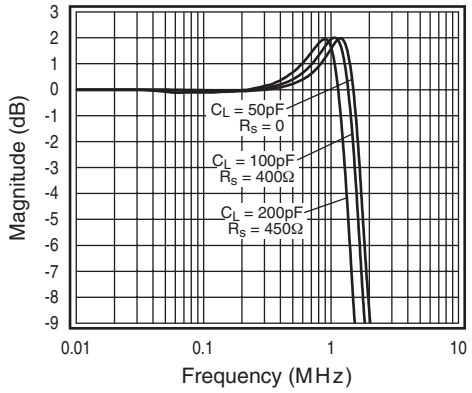


Figure 3: Frequency Response vs C_L for unity gain configuration

Layout Considerations

General layout and supply bypassing play major roles in high frequency performance. Fairchild has evaluation boards to use as a guide for high frequency layout and as aid in device testing and characterization. Follow the steps below as a basis for high frequency layout:

- Include 6.8µF and 0.01µF ceramic capacitors
- Place the 6.8µF capacitor within 0.75 inches of the power pin
- Place the 0.01µF capacitor within 0.1 inches of the power pin
- Remove the ground plane under and around the part, especially near the input and output pins to reduce parasitic capacitance
- Minimize all trace lengths to reduce series inductances

Refer to the evaluation board layouts shown in Figure 5 on page 8 for more information.

Evaluation Board Information

The following evaluation boards are available to aid in the testing and layout of this device:

Eval Bd	Description	Products
KEB013	Single Channel, Dual Supply, SOT23-5 for buffer-style pinout	LMV321AS5X
KEB014	Single Channel, Dual Supply, SC70-5 for buffer-style pinout	LMV321AP5X

Evaluation board schematics and layouts are shown in Figures 4 and 5.

LMV321 Evaluation Board Schematic Diagrams

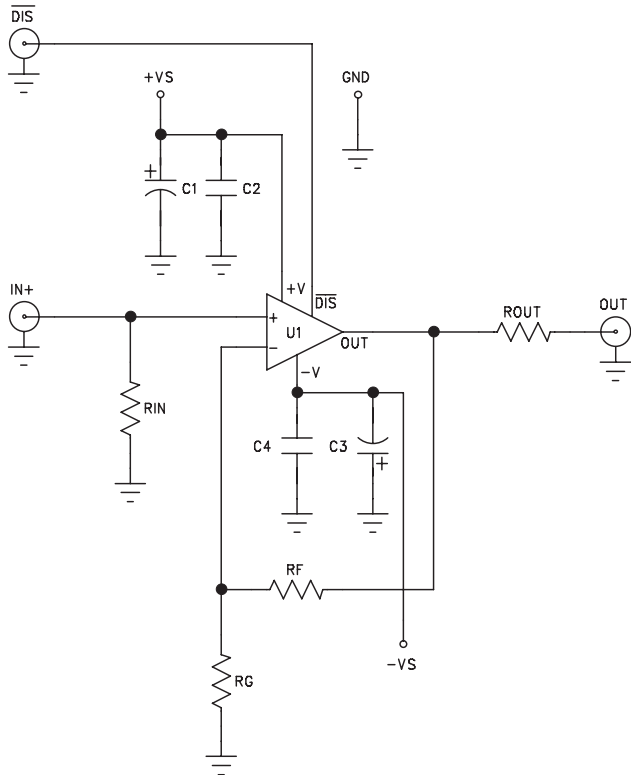


Figure 4a: KEB013 schematic

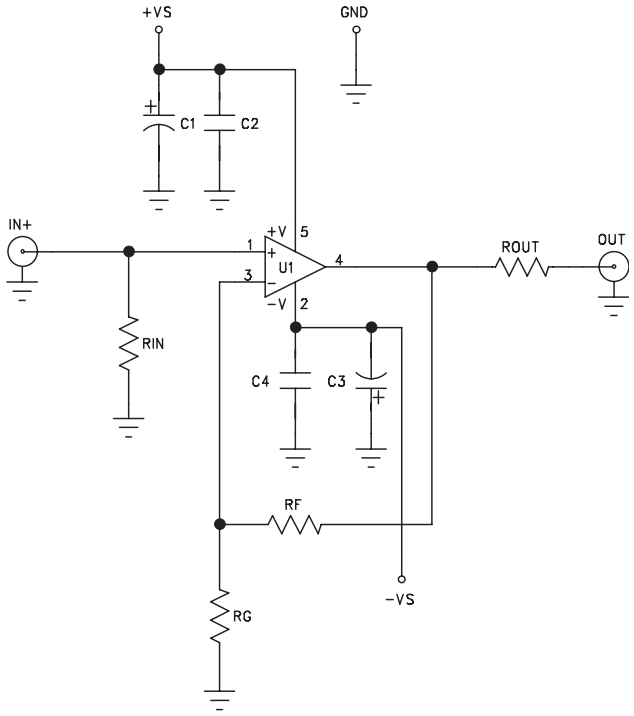


Figure 4b: KEB014 schematic

LMV321 Evaluation Board Layout

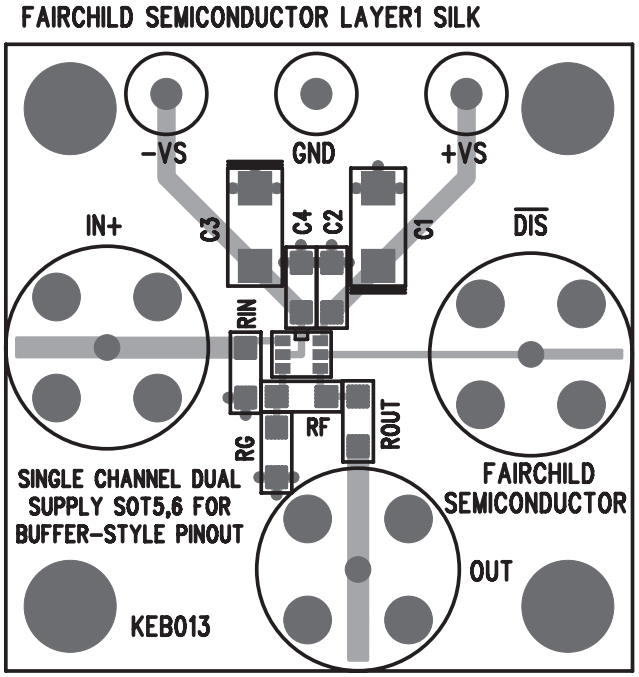


Figure 5a: KEB013 (top side)

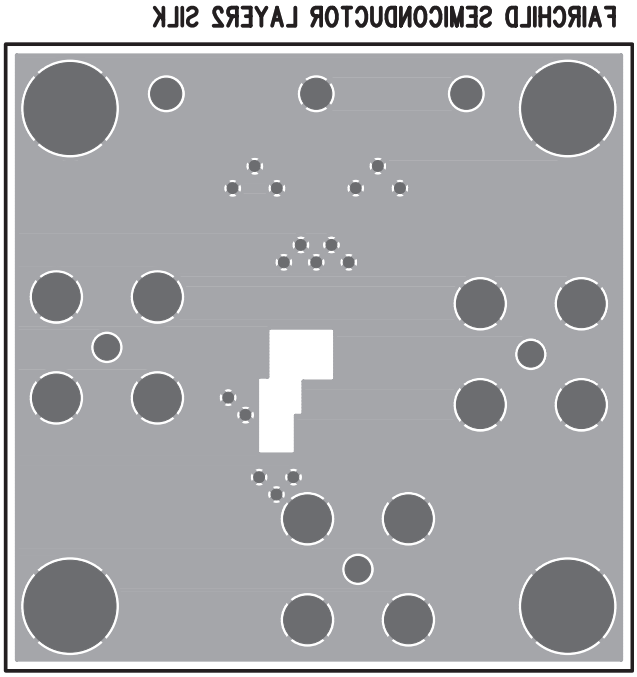


Figure 5b: KEB013 (bottom side)

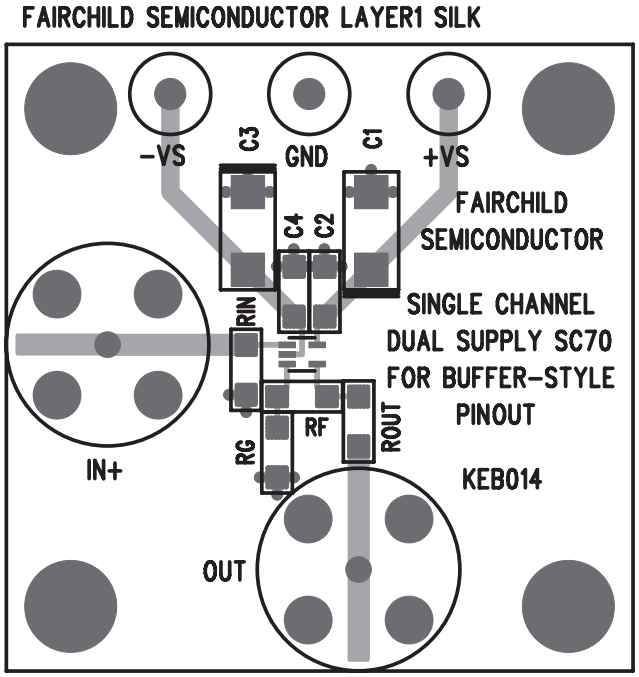


Figure 5c: KEB014 (top side)

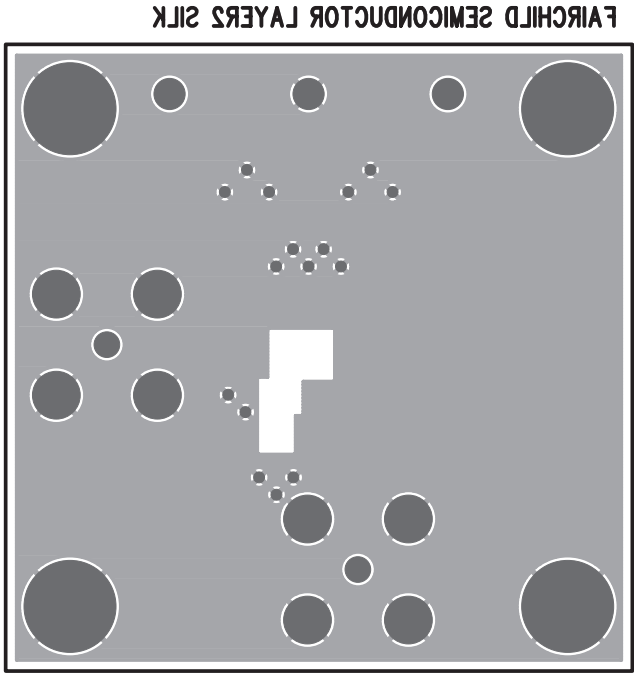


Figure 5d: KEB014 (bottom side)

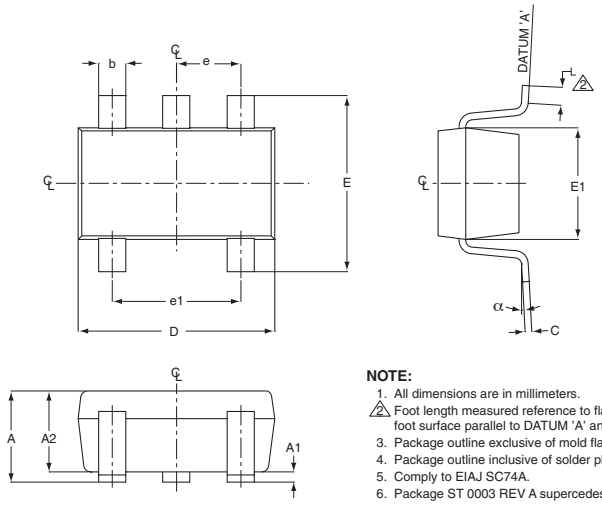
Ordering Information

Model	Part Number	Package	Container	Pack Qty
LMV321	LMV321AP5X	SC70-5	Reel	3000
LMV321	LMV321AS5X	SOT23-5	Reel	3000

Temperature range for all parts: -40°C to +125°C.

Package Dimensions

SOT23-5

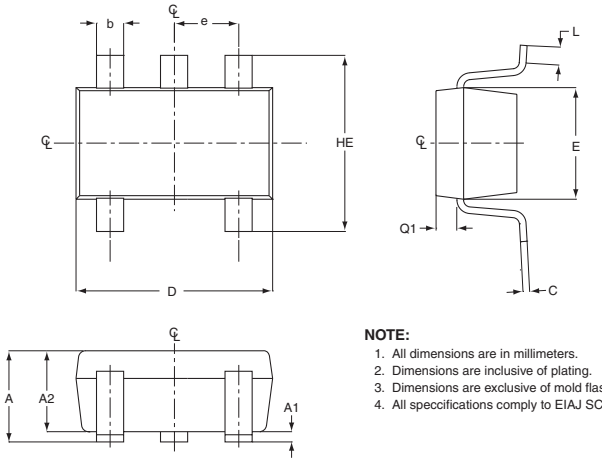


SYMBOL	MIN	MAX
A	0.90	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.25	0.50
C	0.09	0.20
D	2.80	3.10
E	2.60	3.00
E1	1.50	1.75
L	0.35	0.55
e	0.95 ref	
e1	1.90 ref	
α	0°	10°

NOTE:

1. All dimensions are in millimeters.
2. Foot length measured reference to flat foot surface parallel to DATUM 'A' and lead surface.
3. Package outline exclusive of mold flash & metal burr.
4. Package outline inclusive of solder plating.
5. Comply to EIAJ SC74A.
6. Package ST 0003 REV A supercedes SOT-D-2005 REV C.

SC70



SYMBOL	MIN	MAX
e	0.65 BSC	
D	1.80	2.20
b	0.15	0.30
E	1.15	1.35
HE	1.80	2.40
Q1	0.10	0.40
A2	0.80	1.00
A1	0.00	0.10
A	0.80	1.10
c	0.10	0.18
L	1.10	0.30

NOTE:

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating.
3. Dimensions are exclusive of mold flashing and metal burr.
4. All speccifications comply to EIAJ SC70.