WA3821/WA3822/WA3824

Ultra-Low Power 500kHz, 1.8V, Low-Noise, RRIO CMOS Amplifiers

1. General Description

The WA382x family of single-, dual-, and quad-channel amplifiers features a maximized ratio of gain bandwidth (GBW) to supply current and is ideal for battery- powered applications such as wearables, handsets, tablets, and portable medical devices. Featuring rail-to-rail input and output swings, a wide bandwidth of 500-kHz combined with ultra-low supply current (typical 6.6 μA at V_S=5.5V per amplifier) and low noise (6 μVP-P at 0.1 to 10 Hz) , the WA382x family is an excellent choice for precision or general-purpose, low-current, low-voltage, battery-powered applications. The low input bias current supports these amplifiers to be used in applications with mega-ohm source impedances.

The robust design of the WA382x operational amplifiers provides ease-of-use to the circuit designer: integrated RF/EMI rejection filter, no phase reversal in overdrive conditions, and high electro-static discharge (ESD) protection (5kV HBM). The WA382x amplifiers are optimized for operation at voltages as low as +1.8 V (±0.9 V) and up to +5.5 V (±2.75 V).

The WA3821 (single) is available in both SOT23-5L packages. The WA3822 (dual) is offered in DFN-8L, SOP-8L and MSOP-8L packages. The quad-channel WA3824 is offered in both SOP-14L and TSSOP-14L packages. All of the devices are specified over the extended temperature range of −40 ℃ to +125 ℃.

2. Features

- 500 kHz GBW
- Ultra-Low 6.6 μA Supply Current (at 5.5V Supply, Per Amplifier)
- Low Input Offset Voltage: 0.5 mV
- Single 1.8 V to 5.5 V Supply Voltage Range
- Rail-to-Rail Input and Output
- Internal RF/EMI Filter
- Extended Temperature Range: −40℃ to +125℃

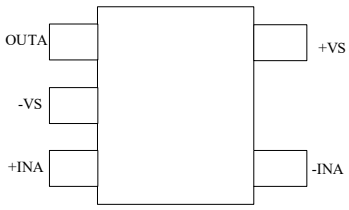
3. Applications

- Battery-Powered Instruments:
  Consumer, Industrial, Medical, Notebooks
- Wearable Fitness Devices
- Audio Outputs
- Sensor Signal Conditioning:
  Sensor Interfaces, Loop-Powered, Active Filters
- Wireless Sensors:
  Home Security, Remote Sensing, Wireless Metering

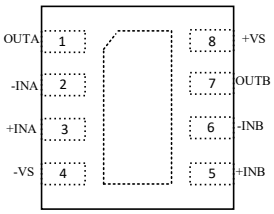
4. Pin Configuration

(Top View)

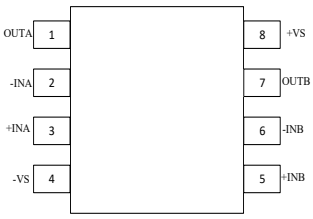
WA3821 SOT23-5L



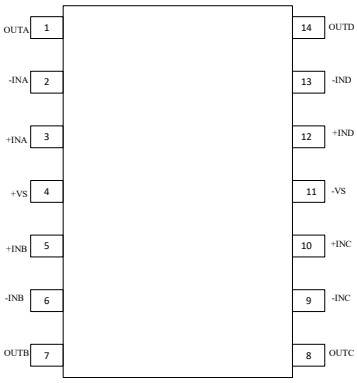
WA3822 DFN-8L



WA3822 SOP-8L /MSOP-8L



WA3824 SOP-14L/TSSOP-14L



5. Pin Description

PIN NUMBER				PIN NAME	I/O	PIN FUNCTION
SOT23-5L	DFN-8L	MSOP-8L	TSSOP-14L			
1	1，7	1，7	1，7，8，14	OUT，OUTA/OUTB OUTC/OUTD	O	Amplifier Output.
2	4	4	4	-Vs	-	Negative Power Supply (Connected to ground for single power supply).
3	3，5	3，5	3，5，10，12	+IN，+INA,+INB +INC,+IND	I	Non-Inverting Input of Amplifier
4	2，6	2，6	2，6，9，13	-IN -INA,-INB -INC,-IND	I	Inverting Input of the Amplifier.
5	8	8	11	+Vs	I	Positive Power Supply.

6. Absolute Maximum Ratings

Operating free-air temperature range (unless otherwise noted)[1]

PARAMETER		RATING	UNIT
Supply Voltage, V_S+ to V_{S-}		10.0	V
Signal Input Terminals: Voltage		(V_{S-}) -0.3 to (V_{S+}) +0.3	V
Signal Input Terminals: Current		±10	mA
Output Short-Circuit		Continuous	
Storage Temperature Range, T_{stg}		–65 ℃ to +150 ℃	ºC
Junction Temperature, T_J		150	ºC
Lead Temperature Range (Soldering 10 sec)		260	ºC
ESD	HBM	±5000	V
	CDM	±2000	V

NOTE1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

7. Recommended Operating Conditions

SYMBOL	PARAMETER		MIN	Typ.	MAX	UNIT
T_A	Operating Ambient Temperature		-40		125	ºC
θ_{JA}	Package Thermal Resistance	SC70-5L		333		ºC/W
		SOT23-5L		190		
		DFN2x2-8L		80		
		MSOP-8L		216		
		SOIC-8L		125		
		TSSOP-14L		112		
		SOIC-14L		115		

8. Electrical Characteristics

(V_S = 5.0V, T_A = +25℃, V_{CM} = V_S /2, V_O = V_S /2, and R_L = 10kΩ connected to V_S /2, unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
V_{OS}	Input offset voltage			±0.5	±2.5	mV
V_{OS} TC	Offset voltage drift			±0.5	±3	μV/℃
PSRR	Power supply rejection ratio	V_S = 2.0 to 5.5 V, V_{CM} < V_{S+} − 2V	98	115		dB
I_B	Input bias current			1		pA
I_{OS}	Input offset current			1		pA
Vn	Input voltage noise	f = 0.1 to 10 Hz		6		μVP-P
en	Input voltage noise density	f = 10 kHz		62		nV/√Hz
		f = 1 kHz		63		
In	Input current noise density	f = 1 kHz		5		fA/√Hz
V_{CM}	Common-mode voltage range		V_{S-} −0.1		V_{S+} +0.1	V
CMRR	Common-mode rejection ratio	V_S = 5.5 V, V_{CM} = −0.1 to 5.5 V	76	92		dB
		V_{CM} = 0 to 5.3 V	70			
		V_S = 2.0 V, V_{CM} = −0.1 to 2.0 V	72	86		
		V_{CM} = 0 to 1.8 V,	68			
R_{IN}	Input resistance		100			GΩ
C_{IN}	Input capacitance	Differential		2.0		pF
		Common mode		3.5		pF
V_{OL}		R_L = 25 kΩ, V_O = 0.05 to 3.5 V	86	97		dB
	Open-loop voltage gain	R_L = 5 kΩ, V_O = 0.15 to 3.5 V	80	92		dB

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
GBW	Gain bandwidth product			500		kHz
SR	Slew rate	G = +1, C_L = 100 pF, V_O = 1.5 to 3.5 V		0.25		V/μs
THD+N	Total harmonic distortion + noise	G = +1, f = 1 kHz, R_L = 2 kΩ, V_O = 1 V_{RMS}		0.005		%
t_S	Settling time	To 0.1%, G = +1, 1V step		6		μs
		To 0.01%, G = +1, 1V step		7		μs
t_{OR}	Overload recovery time	To 0.1%, V_{IN} * Gain > V_S		10		μs
V_{OH}	High output voltage swing	R_L = 25 kΩ	V_{S+} -8	V_{S+} -5		mV
		R_L = 5 kΩ	V_{S+} -36	V_{S+}-26		
V_{OL}	Low output voltage swing	R_L = 25 kΩ		V_{S-}+4	V_{S-}+6	mV
		R_L = 5 kΩ		V_{S-}+16	V_{S-}+24	
I_{SC}	Short-circuit current			±45		mA
V_S	Operating supply voltage		1.8		5.5	V
I_Q	Quiescent current (per amplifier)	V_S = 2.0V, T_A = +25℃		5.2	6.5	μA
		V_S = 5.5V, T_A = +25℃		6.6	8.5	

9. Typical Performance Characteristics

(V_S = 5.0V, T_A = +25℃, V_{CM} = V_S/2, V_O = V_S/2, and R_L = 10kΩ connected to V_S/2, unless otherwise noted.)

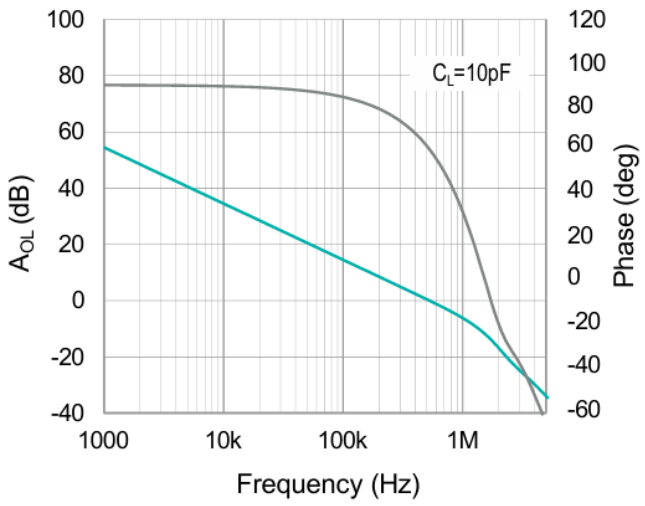


Figure 1 Open-loop Gain and Phase as a function of Frequency.

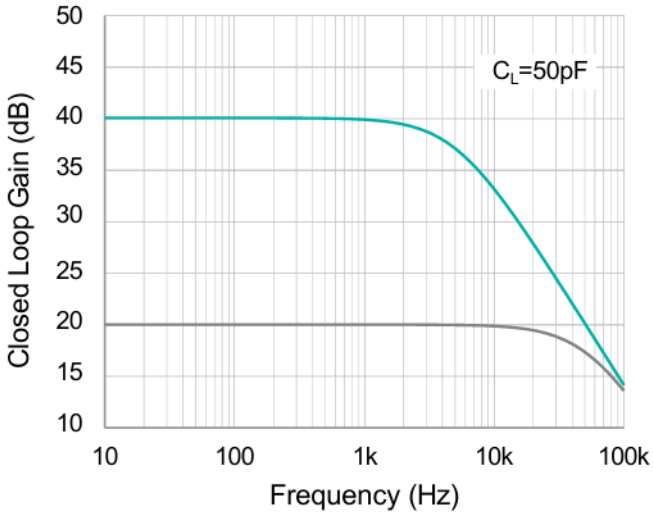


Figure 2 Closed-Loop Gain as a function of Frequency.

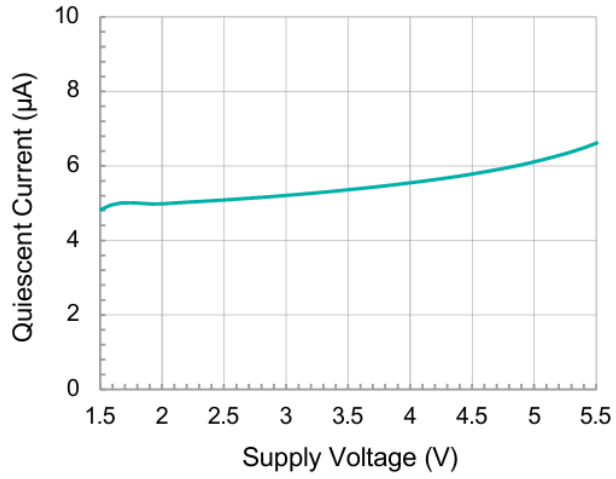


Figure 3 Quiescent Current as a function of Supply Voltage.

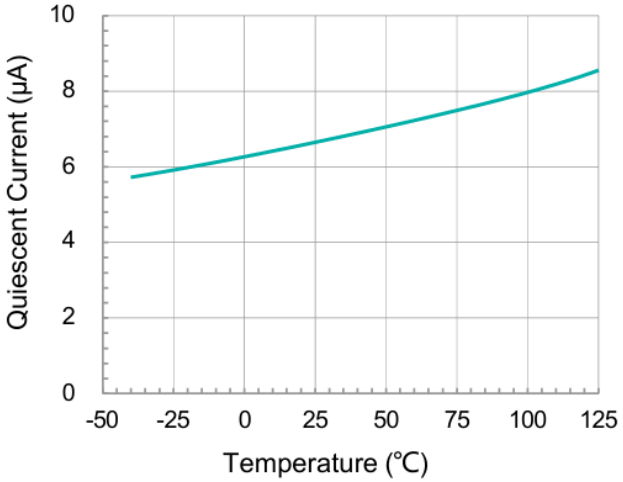


Figure 4 Quiescent Current as a function of Temperature.

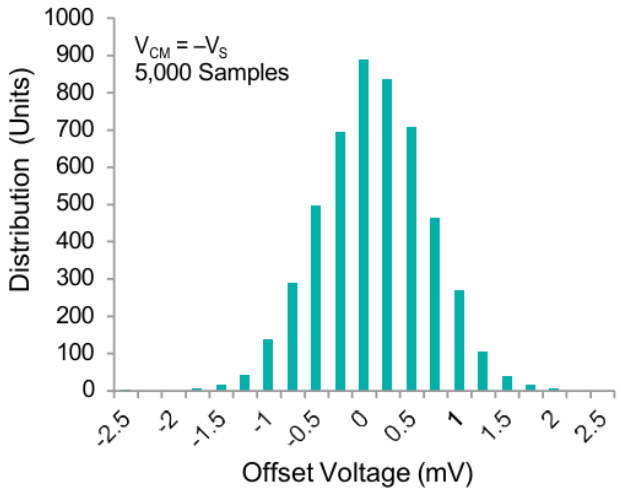


Figure 5 Offset Voltage Production Distribution.

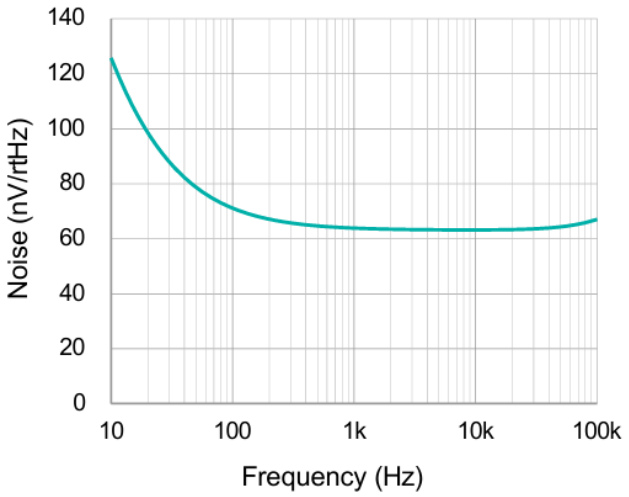


Figure 6 Input Voltage Noise Spectral Density as a function of Frequency.

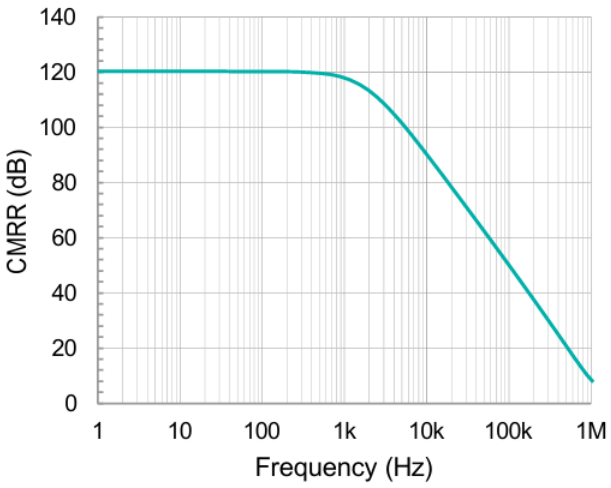


Figure 7 Common-mode Rejection Ratio as a function of Frequency.

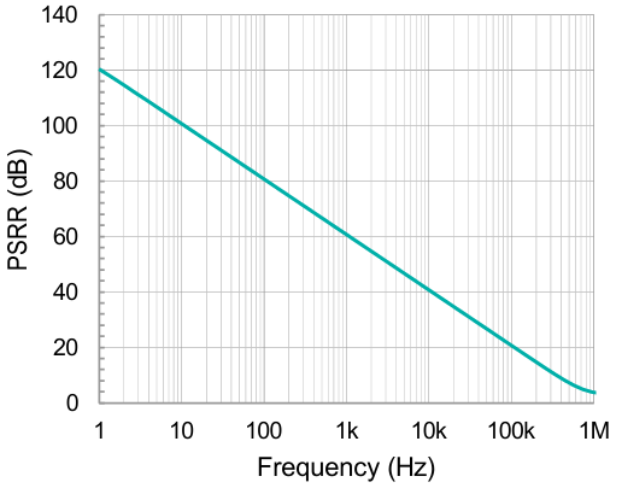


Figure 8 Power Supply Rejection Ratio as a function of Frequency.

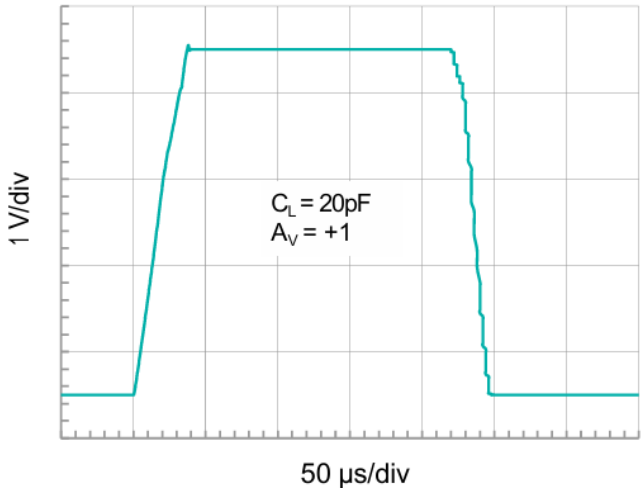


Figure 9 Large Signal Step Response (4V Step).

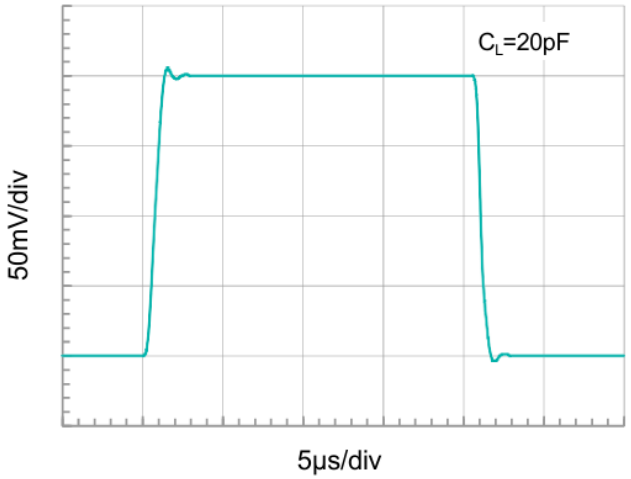


Figure 10 Small Signal Step Response (200mV Step).

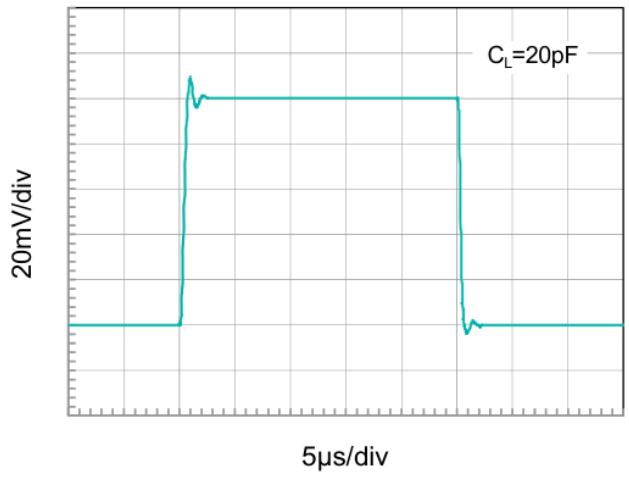


Figure 11 Small Signal Step Response (100mV Step).

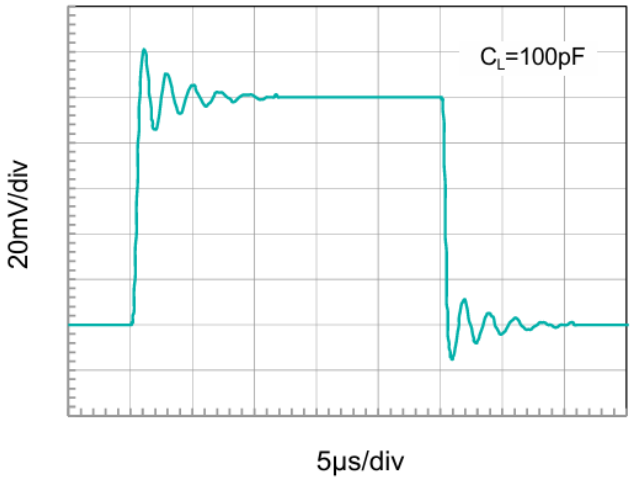


Figure 12 Small Signal Step Response (100mV Step).

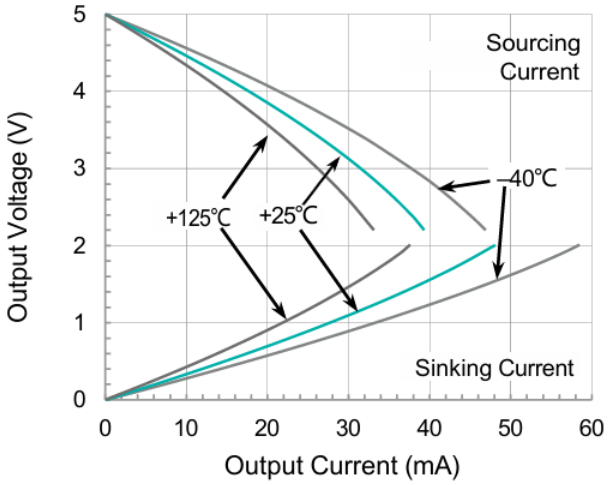


Figure 13 Output Voltage Swing as a function of Output Current.

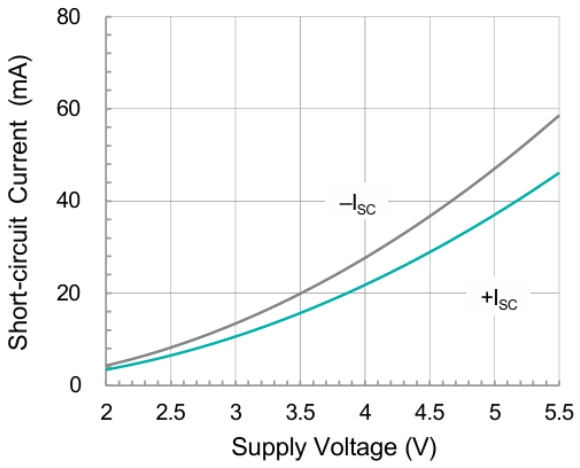


Figure 14 Short-circuit Current as a function of Supply Voltage.

10. Application

10.1 Application Information

Featuring a maximized ratio of GBW-to-supply current, low operating supply voltage, low input bias current, and rail-to-rail inputs and outputs, the WA382x family is an excellent choice for precision or general-purpose, low-current, low-voltage, battery-powered applications. These CMOS operational amplifiers consume an ultra-low 6.6μA (typically at 5.5V supply voltage) supply current per amplifier. The WA382x family is unity-gain stable with a 500kHz GBW product, driving capacitive loads up to 20pF. The capacitive load can be increased to 500pF when the amplifier is configured for a 5V/V gain.

10.2 Operating Voltage

The WA382x family is optimized for operation at voltages as low as +1.8 V (±0.9 V) and up to +5.5 V (±2.75 V). In addition, many specifications apply from –40 ℃ to +125 ℃. Parameters that vary significantly with operating voltages or temperature are illustrated in the Typical Characteristics graphs.

10.3 Rail-To-Rail Input

The input common-mode voltage range of the WA382x series extends 100-mV beyond the negative and positive supply rails. This performance is achieved with a complementary input stage: an N- channel input differential pair in parallel with a P- channel differential pair. The N-channel pair is active for input voltages close to the positive rail, typically VS+–1.4 V to the positive supply, whereas the P-channel pair is active for inputs from 100-mV below the negative supply to approximately VS+–1.4 V. There is a small transition region, typically VS+–1.2 V to VS+–1 V, in which both pairs are on. This 200-mV transition region can vary up to 200-mV with process variation. Thus, the transition region (both stages on) can range from VS+–1.4 V to VS+–1.2 V on the low end, up to VS+–1 V to VS+–0.8 V on the high end. Within this transition region, PSRR, CMRR, offset voltage, offset drift, and THD can be degraded compared to device operation outside this region.

The typical input bias current of the WA382x op- amps during normal operation is approximately 1-pA. In overdriven conditions, the bias current can increase significantly. The most common cause of an overdriven condition occurs when the operational amplifier is outside of the linear range of operation. When the output of the operational amplifier is driven to one of the supply rails, the feedback loop requirements cannot be satisfied and a differential input voltage develops across the input pins. This differential input voltage results in activation of parasitic diodes inside the front-end input chopping switches that combine with electromagnetic interference (EMI) filter resistors to create the equivalent circuit. Notice that the input bias current remains within specification in the linear region.

10.4 Input EMI Filter AND Clamp Circuit

Figure15 shows the input EMI filter and clamp circuit. The WA382x op-amps have internal ESD protection diodes (D1, D2, D3, and D4) that are connected between the inputs and each supply rail. These diodes protect the input transistors in the event of electrostatic discharge and are reverse biased during normal operation. This protection scheme allows voltages as high as approximately 300mV beyond the rails to be applied at the input of either terminal without causing permanent damage. These ESD protection current-steering diodes also provide in-circuit, input overdrive protection, as long as the current is limited to 10mA as stated in the Absolute Maximum Ratings.

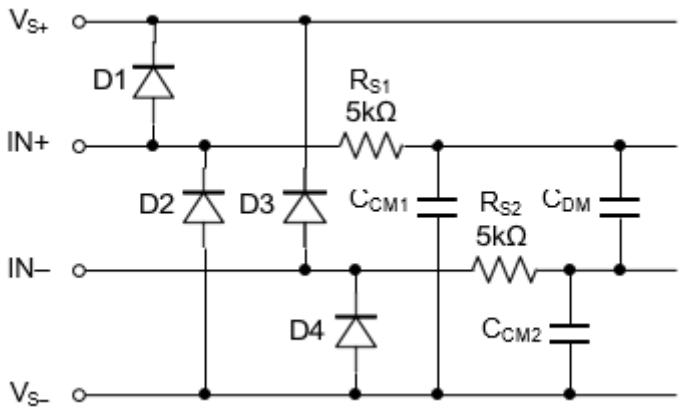


Figure15 Input EMI Filter and Clamp Circuit

Operational amplifiers vary in susceptibility to EMI. If conducted EMI enters the operational amplifier, the dc offset at the amplifier output can shift from its nominal value when EMI is present. This shift is a result of signal rectification associated with the internal semiconductor junctions. Although all operational amplifier pin functions can be affected by EMI, the input pins are likely to be the most susceptible. The EMI filter of the WA382x family is composed of two 5kΩ input series resistors (R_{S1} and R_{S2}), two common-mode capacitors (CCM1 and CCM2), and a differential capacitor (CDM). These RC networks set the −3dB low-pass cutoff frequencies at 35MHz for common-mode signals, and at 22-MHz for differential signals.

10.5 Rail-To-Rail Output

Designed as a micro-power, low-noise operational amplifier, the WA382x delivers a robust output drive capability. A class AB output stage with common- source transistors is used to achieve full rail-to-rail output swing capability. For resistive loads up to 25kΩ, the output swings typically to within 5mV of either supply rail regardless of the power-supply voltage applied. Different load conditions change the ability of the amplifier to swing close to the rails. For resistive loads up to 5kΩ, the output swings typically to within 26mV of the positive supply rail and within 16mV of the negative supply rail.

10.6 Capactive Load AND Stability

The WA382x family of operational amplifiers is unity-gain stable for loads up to 20pF. However, the capacitive load can be increased to 500pF when the amplifier is configured for a minimum gain of 5V/V.

As with most amplifiers, driving larger capacitive loads than specified may cause excessive overshoot and ringing, or even oscillation. A heavy capacitive load reduces the phase margin and causes the amplifier frequency response to peak. Peaking corresponds to overshooting or ringing in the time domain. Therefore, it is recommended that external compensation be used if the WA382x family requires greater capacitive-drive capability. This compensation is particularly important in the unity- gain configuration, which is the worst case for stability.

A quick and easy way to stabilize the op-amp for capacitive load drive is by adding a series resistor, RISO, between the amplifier output terminal and the load capacitance, as shown in Figure 16. RISO isolates the amplifier output and feedback network from the capacitive load. The bigger the RISO resistor value, the more stable V_{OUT} will be. Note that this method results in a loss of gain accuracy because RISO forms a voltage

divider with the RL. In unity gain applications with relatively small RL (approximately 5kΩ), the capacitive load can be increased up to 100pF.

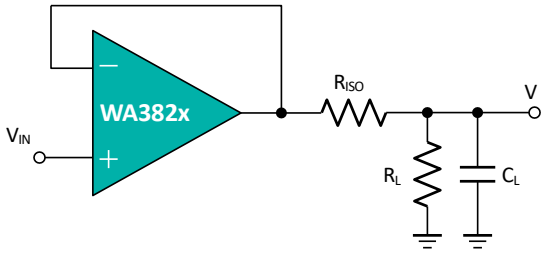


Figure 16. Indirectly Driving Heavy Capacitive Load

An improvement circuit is shown in Figure 17. It provides DC accuracy as well as AC stability. The RF provides the DC accuracy by connecting the inverting signal with the output.

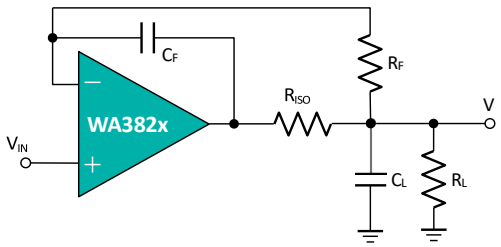


Figure 17. Indirectly Driving Heavy Capacitive Load with DC Accuracy

The CF and RISO serve to counteract the loss of phase margin by feeding the high frequency component of the output signal back to the amplifier's inverting input, thereby preserving phase margin in the overall feedback loop.

For no-buffer configuration, there are two others ways to increase the phase margin: (a) by increasing the amplifier's gain, or (b) by placing a capacitor in parallel with the feedback resistor to counteract the parasitic capacitance associated with inverting node.

10.7 Overload Recovery

Overload recovery is defined as the time required for the operational amplifier output to recover from a saturated state to a linear state. The output devices of the operational amplifier enter a saturation region when the output voltage exceeds the rated operating voltage, either because of the high input voltage or the high gain. After the device enters the saturation region, the charge carriers in the output devices require time to return back to the linear state. After the charge carriers return back to the linear state, the device begins to slew at the specified slew rate. Thus, the propagation delay in case of an overload condition is the sum of the overload recovery time and the slew time. The overload recovery time for the WA382x family is approximately 10μs.

10.8 EMI Rejection Ratio

Circuit performance is often adversely affected by high frequency EMI. When the signal strength is low and transmission lines are long, an op-amp must accurately amplify the input signals. However, all op- amp pins — the non-inverting input, inverting input, positive supply, negative supply, and output pins — are susceptible

to EMI signals. These high frequency signals are coupled into an op-amp by various means, such as conduction, near field radiation, or far field radiation. For example, wires and printed circuit board (PCB) traces can act as antennas and pick up high frequency EMI signals.

Amplifiers do not amplify EMI or RF signals due to their relatively low bandwidth. However, due to the nonlinearities of the input devices, op-amps can rectify these out of band signals. When these high frequency signals are rectified, they appear as a dc offset at the output.

The WA382x op-amps have integrated EMI filters at their input stage. A mathematical method of measuring EMIRR is defined as follows:

10.9 Input-To-Output Coupling

To minimize capacitive coupling, the input and output signal traces should not be parallel. This helps reduce unwanted positive feedback.

10.10 Maximizing Performance Through Proper Layout

To achieve the maximum performance of the extremely high input impedance and low offset voltage of the WA382x op-amps, care is needed in laying out the circuit board. The PCB surface must remain clean and free of moisture to avoid leakage currents between adjacent traces. Surface coating of the circuit board reduces surface moisture and provides a humidity barrier, reducing parasitic resistance on the board. The use of guard rings around the amplifier inputs further reduces leakage currents. Figure 18 shows proper guard ring configuration and the top view of a surface-mount layout. The guard ring does not need to be a specific width, but it should form a continuous loop around both inputs. By setting the guard ring voltage equal to the voltage at the non-inverting input, parasitic capacitance is minimized as well. For further reduction of leakage currents, components can be mounted to the PCB using Teflon standoff insulators.

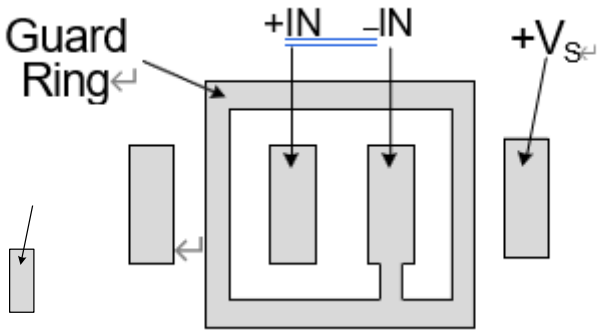


Figure 18. Use a guard ring around sensitive pins

Other potential sources of offset error are thermoelectric voltages on the circuit board. This voltage, also called Seebeck voltage, occurs at the junction of two dissimilar metals and is proportional to the temperature of the junction. The most common metallic junctions on a circuit board are solder-to- board trace and solder-to-component lead. If the temperature of the PCB at one end of the component is different from the temperature at the other end, the resulting Seebeck voltages are not equal, resulting in a thermal voltage error.
This thermocouple error can be reduced by using dummy components to match the thermoelectric error source. Placing the dummy component as close as possible to its partner ensures both Seebeck voltages are equal,

thus canceling the thermocouple error. Maintaining a constant ambient temperature on the circuit board further reduces this error. The use of a ground plane helps distribute heat throughout the board and reduces EMI noise pickup.

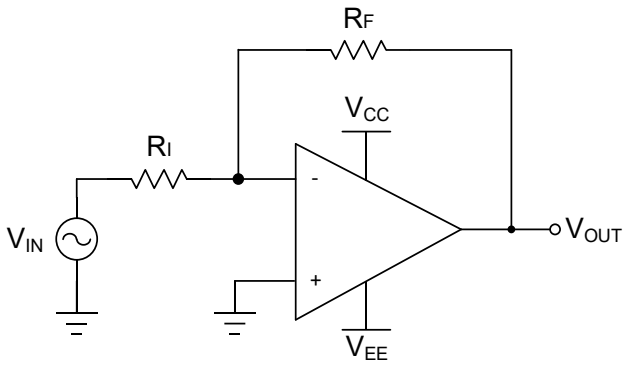
11. Evaluation Modules

Evaluation Modules (EVMs) are available to help evaluate initial circuit performance. We have evaluation modules for different packages, you can contact us to get the evaluation module or schematic.
The module names are listed in the following table.

Name	Package	Evaluation Module
WA3821	SOT23-5	WAYON OPA_EVM-SOT23-5_V1.0

11.1 Typical Application

A typical application for an operational amplifier in an inverting amplifier. This amplifier takes a positive voltage on the negative input through a resistor, and get a negative voltage on the output of the amplifier. So does the negative voltage input.



The supply voltage must be larger than the input voltage range and output range.

11.2 Detailed Design Procedure

Determine the gain required by the inverting amplifier using Equation 1

$$A_V = \frac{V_{OUT}}{V_{IN}} \quad (1)$$

$$A_V = -\frac{1.8}{0.5} = -3.6 \quad (2)$$

Once the desired gain is determined, R_I and R_F should be in kilohm range in case too much current is drawn away. For example, R_I is 10 kΩ and R_F is 36 kΩ, the gain is determined by Equation 3.

$$A_V = -\frac{R_F}{R_I} \quad (3)$$

11.3 Layout of Typical Application Circuits

Layout Guidelines

1.Connect low-ESR, 0.1 μF ceramic bypass capacitors between each supply pin and ground, placed as close to the device as possible.

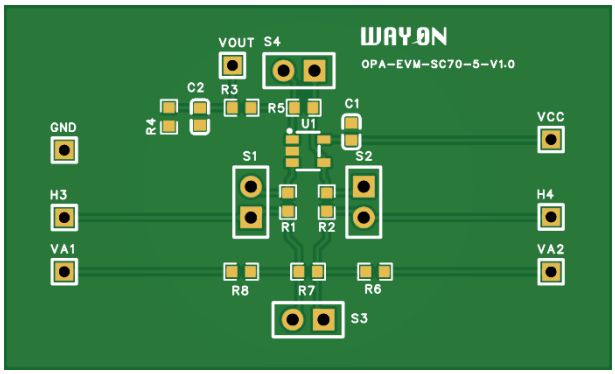
2. Separate grounding for analog and digital portions.

3. Run the input traces as far away from the supply or output traces as possible.

4. Place the external components as close to the device as possible.

5. Keep the length of input traces as short as possible.

Layout Example：



12. Naming Conventions

WA B CCC-DD E

WA: WAYON Analog signal chain;

B: 3 - operational amplifier & comparator;

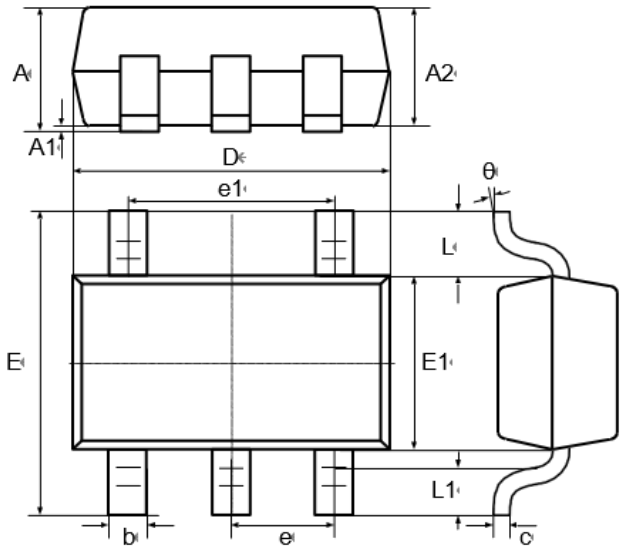
CCC: serial number;

DD: Package;

E: R-Reel & T-tube;

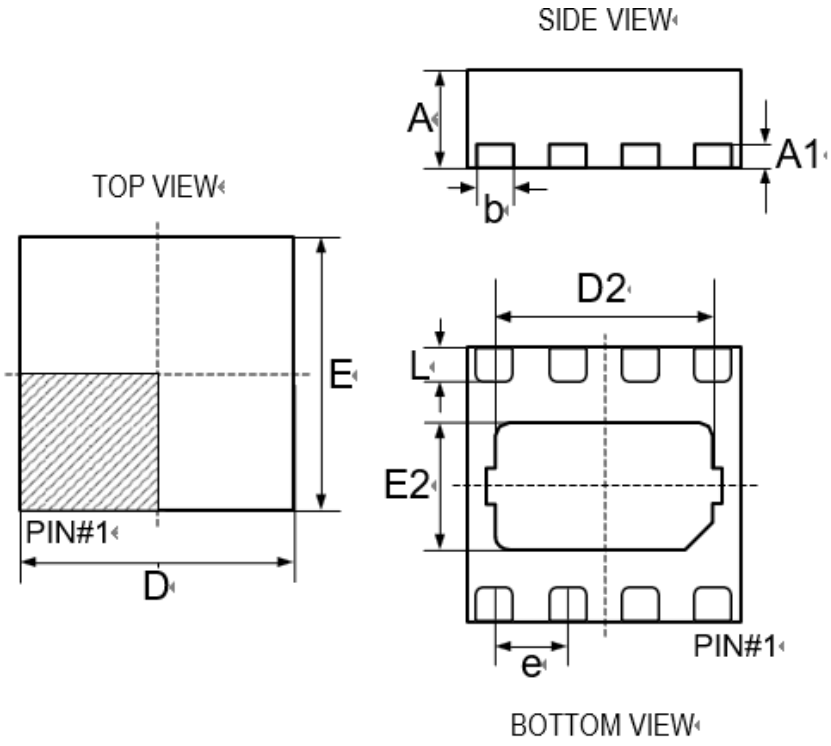
13. Package Information

SOT23-5L



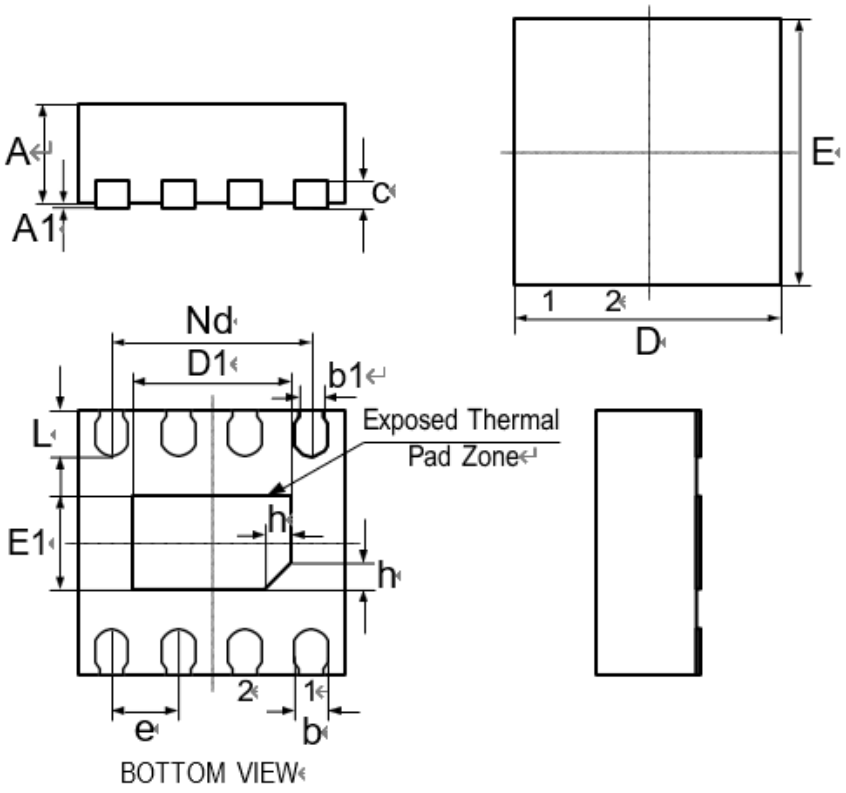
SYMBOL	DIMENSIONS IN MILLIMETERS	
	MIN	MAX
A	-	1.25
A1	0.04	0.10
A2	1.00	1.20
b	0.33	0.41
c	0.15	0.19
D	2.82	3.02
E1	1.50	1.70
E	2.60	3.00
e	0.95BSC	
e1	1.90BSC	
L	0.60REF	
L1	0.30	0.60
Θ	0°	8°

DFN1.5x1.5-8L



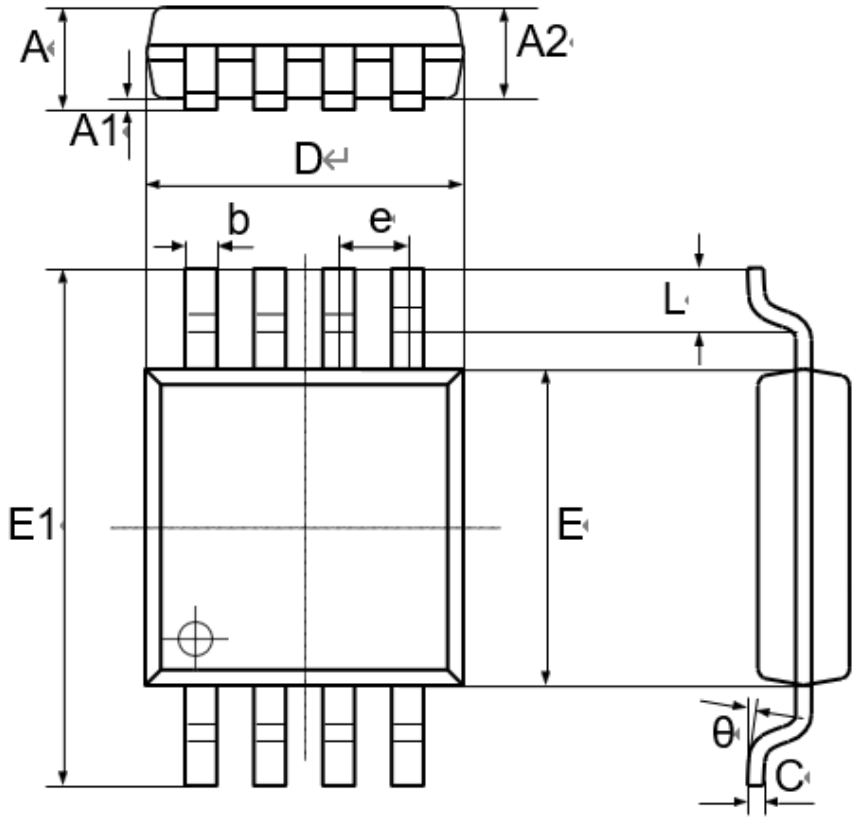
SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	Nom.	MAX
A	0.48	0.53	0.58
A1	0.127REF		
b	0.15	0.20	0.25
D	1.45	1.50	1.55
E	1.15	1.20	1.25
E2	1.45	1.50	1.55
e	0.40BSC		
L	0.125	0.175	0.225

DFN2x2-8L



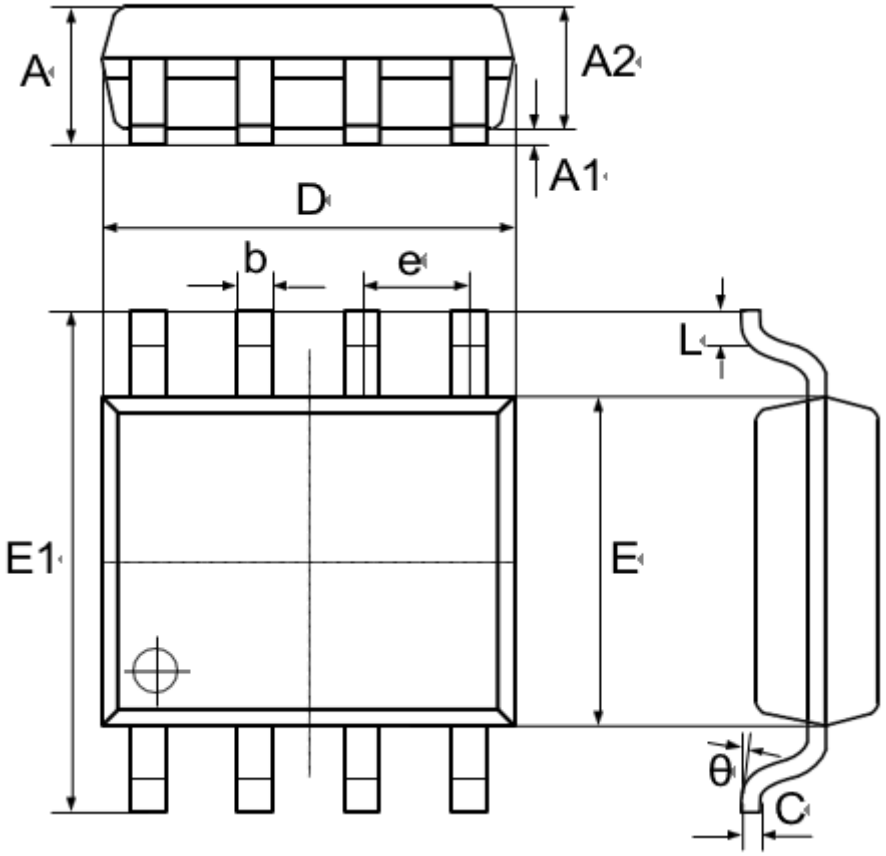
SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	-	0.02	0.05
b	0.20	0.25	0.30
b1		0.18REF	
c	0.18	0.20	0.25
D	1.90	1.20	1.30
D1	1.10	1.20	1.30
Nd		1.50BSC	
E	1.90	2.00	2.10
E1	0.60	0.70	0.80
e		0.50BSC	
L	0.30	0.35	0.40
h	0.15	0.20	0.25

MSOP-8L



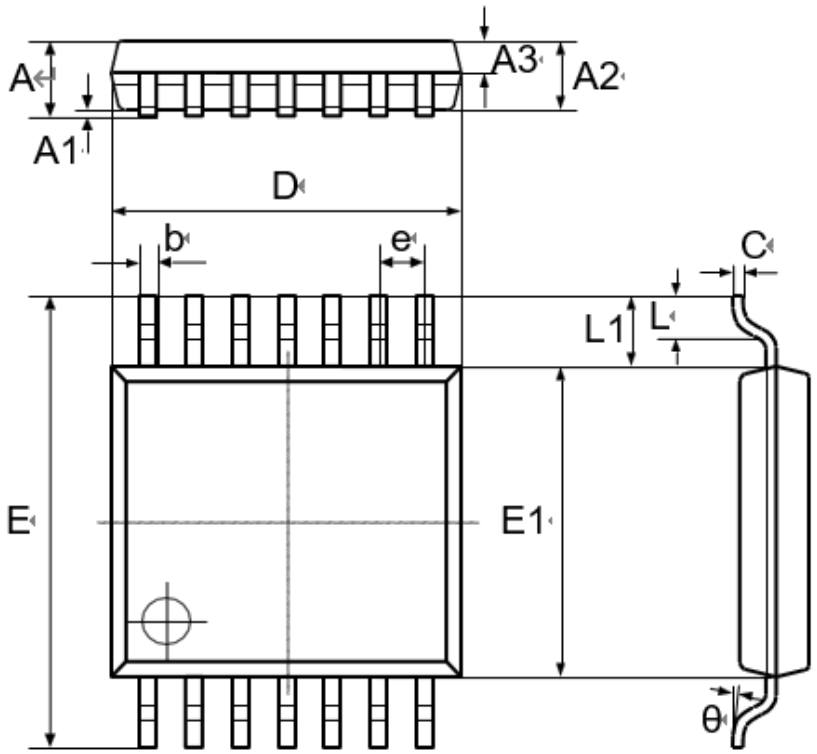
SYMBOL	DIMENSIONS IN MILLIMETERS	
	MIN	MAX
A	0.80	1.10
A1	0.05	0.15
A2	0.75	0.95
b	0.29	0.38
C	0.15	0.20
D	2.90	3.10
E	2.90	3.10
E1	4.70	5.10
e	0.65TYP.	
L	0.40	0.70
Θ	0°	8°

SOP-8L



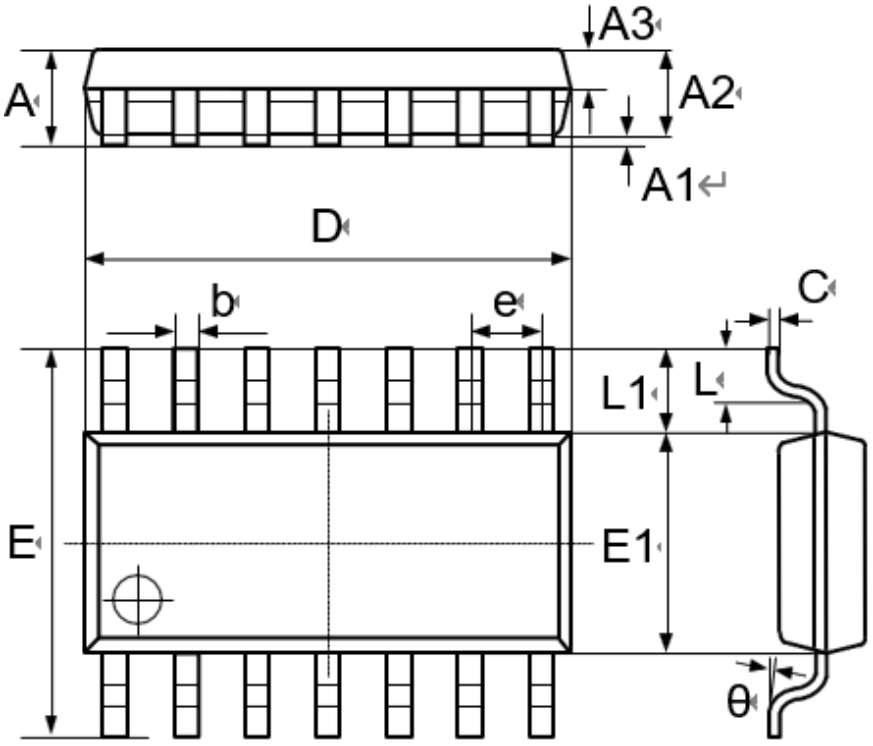
SYMBOL	DIMENSIONS IN MILLIMETERS	
	MIN	MAX
A	1.37	1.67
A1	0.07	0.17
A2	1.30	1.50
b	0.306	0.506
C	0.203TYP.	
D	4.70	5.10
E	3.82	4.02
E1	5.80	6.20
e	1.270TYP.	
L	0.45	0.75
Θ	0°	8°

TSSOP-14L



SYMBOL	DIMENSIONS IN MILLIMETERS	
	MIN	MAX
A	-	1.20
A1	0.05	0.15
A2	0.90	1.05
A3	0.39	0.49
b	0.20	0.29
C	0.13	0.18
D	4.86	5.06
E	6.20	6.60
E1	4.30	4.50
e	0.65TYP.	
L1	1.00REF	
L	0.45	0.75
Θ	0°	8°

SOP-14L



SYMBOL	DIMENSIONS IN MILLIMETERS	
	MIN	MAX
A	1.45	1.85
A1	0.10	0.30
A2	1.35	1.55
A3	0.55	0.75
b	0.406TYP.	
C	0.203TYP.	
D	8.63	8.83
E	5.84	6.24
E1	3.85	4.05
e	1.270TYP.	
L1	1.040REF	
L	0.35	0.75
Θ	2°	8°

14. Ordering Information

PART NUMBER	PACKAGE	PACKING QUANTITY
WA3821-A50R	SOT23-5	3K/Reel
WA3822-S80R	SOP-8	4K/Reel
WA3822-M80R	MSOP-8	3K/Reel

* XXXX is variable.

Contact Information
No.1001, Shiwan(7) Road, Pudong District, Shanghai, P.R.China.201207
Tel: 86-21-50310888 Fax: 86-21-50757680 Email: market@way-on.com
WAYON website: http://www.way-on.com
For additional information, please contact your local Sales Representative.
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The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.
Users should verify actual device performance in their specific applications.

Product Specification Statement

- The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.
- The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. WAYON shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and WAYON assumes no responsibility for the application of the product.
- WAYON strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, WAYON cannot guarantee that the information provided in the product specification is entirely accurate and error-free. WAYON shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications. WAYON reserves the right to revise or update the product specification and the products at any time without prior notice, and the user's continued use of the product specification is considered an acceptance of these revisions and updates. Prior to purchasing and using the product, users should verify the above information with WAYON to ensure that the product specification is the most current, effective, and complete. If users are particularly concerned about product parameters, please consult WAYON in detail or request relevant product test reports. Any data not explicitly mentioned in the product specification shall be subject to separate agreement.
- Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.
- The design of the product is intended to meet civilian needs and is not guaranteed for use in harsh environments or precision equipment. It is not recommended for use in systems or equipment such as medical devices, aircraft, nuclear power, and similar systems, where failures in these systems or equipment could reasonably be expected to result in personal injury. WAYON shall assume no responsibility for any consequences resulting from such usage.
- Users should also comply with relevant laws, regulations, policies, and standards when using the product specification. Users are responsible for the risks and liabilities arising from the use of the product specification and must ensure that it is not used for illegal purposes. Additionally, users should respect the intellectual property rights related to the product specification and refrain from infringing upon any third-party legal rights. WAYON shall assume no responsibility for any disputes or controversies arising from the above-mentioned issues in any form.