DESCRIPTION

The AO2325 have a high gain-bandwidth product of 11MHz, a slew rate of 9V/μs, and a quiescent current of 1.1mA per amplifier at 5V.

The AO2325 is designed to provide optimal performance in low voltage and low noise systems. They provide rail-to-rail output swing into heavy loads. The input common mode voltage range includes ground, and the maximum input offset voltage is 3.5mV for AO2325.

They are specified over the extended industrial temperature range (-40℃ to +125℃). The operating range is from 2.1V to 5.5V.

The AO2325 is available in DFN8(2x2) package.

FEATURES

- Single-Supply Operation from +2.1V ~ +5.5V
- Rail-to-Rail Input / Output
- Gain-Bandwidth Product: 11MHz (Typ.)
- Low Input Bias Current: 1pA (Typ.)
- Low Offset Voltage: 3.5mV (Max.)
- High Slew Rate: 9V/μs
- Settling Time to 0.1% with 2V Step: 0.3μs
- Low Noise: $8nV/\sqrt{HZ}$@10kHZ
- Quiescent Current: 1.1mA per Amplifier (Typ.)
- Operating Temperature: -40°C ~ +125°C

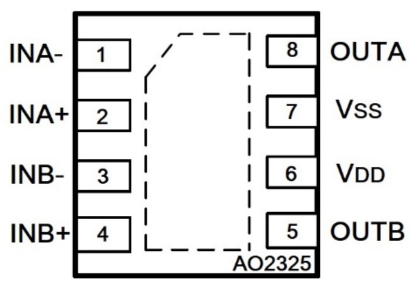
APPLICATION

- Sensors
- Active Filters
- Cellular and Cordless Phones
- Laptops and PDAs
- Audio
- Handheld Test Equipment
- Battery-Powered Instrumentation
- A/D Converters

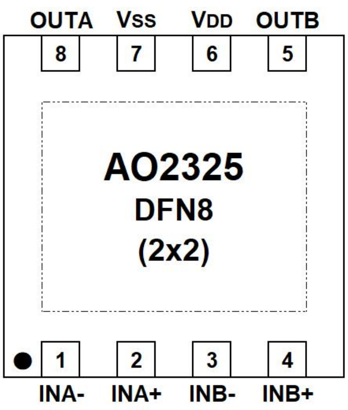
ORDERING INFORMATION

Package Type	Part Number	
DFN8 (2x2) SPQ: 3,000pcs/Reel	J8	AO2325J8R
		AO2325J8VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

TYPICAL APPLICATION



PIN DESCRIPTION



DFN8(2x2), J8
Top View

Pin #	Symbol	Functions
1	INA-	Inverting Input, Channel A
2	INA+	Noninverting Input, Channel A
3	INB-	Inverting Input, Channel B
4	INB+	Noninverting Input, Channel B
5	OUTB	Output, Channel B
6	V_{DD}	Positive Power Supply Input.
7	V_{SS}	Ground or Negative Power Supply Input.
8	OUTA	Output, Channel A

ABSOLUTE MAXIMUM RATINGS

T_A=+25℃,unless otherwise specified

Power Supply Voltage (V_{DD} to V_{SS})		-0.5V ~ +7.5V
Analog Input Voltage (IN+ or IN-)		V_{SS} -0.5V ~ V_{DD} +0.5V
PDB Input Voltage		V_{SS} -0.5V ~ +7V
Operating Temperature Range		-40℃ ~ +125℃
Junction Temperature		+160℃
Storage Temperature Range		-55℃ ~ +150℃
Lead Temperature (soldering, 10sec)		+260℃
ESD Susceptibility	Human Body Mode	8KV
	Machine Mode	400V

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

At Vs=5V, T_A = +25℃, V_{CM} = V_S/2, R_L = 600Ω, unless otherwise noted.

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
INPUT CHARACTERISTICS							
Input Offset Voltage	V_{OS}		+25℃	-	0.8	3.5	mV
			-40℃ ~ +125℃	-	-	4.6	
Input Bias Current	I_B			-	1.0	-	pA
Input Offset Current	I_{OS}			-	1.0	-	pA
Input Common Mode Voltage Range	V_{CM}	V_S = 5.5V		-	-0.1~ +5.6	-	V
Common Mode Rejection Ratio	CMRR	V_S = 5.5V, V_{CM} = -0.1V to 4V	+25℃	65	82	-	dB
			-40℃ ~ +125℃	63	-	-	
		V_S = 5.5V, V_{CM} = -0.1V to 5.6V		-	75	-	dB
Open-Loop Voltage Gain	A_{OL}	R_L = 600Ω, V_O = 0.15V to 4.85V	+25℃	80	90	-	dB
			-40℃ ~ +125℃	68	-	-	
		R_L = 10kΩ, V_O = 0.05V to 4.95V		-	108	-	dB
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta_T$			-	2.4	-	μV/℃
OUTPUT CHARACTERISTICS							
Output Voltage Swing from Rail		R_L = 600Ω		-	0.100	-	V
		R_L = 10kΩ		-	0.015	-	V
Output Current	I_{OUT}		+25℃	55	70	-	mA
			-40℃ ~ +125℃	38	-	-	
Closed-Loop Output Impedance		f=100kHz, G=1		-	7.5	-	Ω
POWER SUPPLY							
Operating Voltage Range			+25℃	2.1	-	5.5	V
			-40℃ ~ +125℃	2.1	-	5.5	
Power Supply Rejection Ratio	PSRR	V_S = +2.5V to +5.5V, V_{CM} = (-V_S) + 0.5V	+25℃	74	91	-	dB
			-40℃ ~ +125℃	68	-	-	
Quiescent Current/Amplifier	I_Q	I_{OUT} = 0	+25℃	-	1.10	1.50	mA
			-40℃ ~ +125℃	-	-	1.85	
IDYNAMIC PERFORMANCE							
Gain-Bandwidth Product	G_{BP}	R_L=10kΩ, C_L=100pF		-	11	-	MHz
Phase Margin	φ_O	R_L=0kΩ, C_L=100pF		-	51	-	Degrees
Full Power Bandwidth	B_{WP}	< 1% distortion, R_L=600Ω		-	400	-	kHz
Slew Rate	S_R	G=+1, 2V Step, R_L=10kΩ		-	9	-	V/μs
Settling Time to 0.1%	t_s	G=+1, 2V Step, R_L= 600Ω		-	0.3	-	μs
Overload Recovery Time		V_{IN}xGain=V_S, R_L= 600Ω		-	1.5	-	μs
NOISE PERFORMANCE							
Voltage Noise Density	e_n	f = 1kHz		-	11.5	-	nV / $\sqrt{HZ}$
		f = 10kHz		-	8.0	-	

TYPICAL PERFORMANCE CHARACTERISTICS

At Vs=5V, T_A = +25℃, V_{CM} = V_S/2, R_L = 600Ω, unless otherwise noted.

Fig.1 Large-Signal Step Response

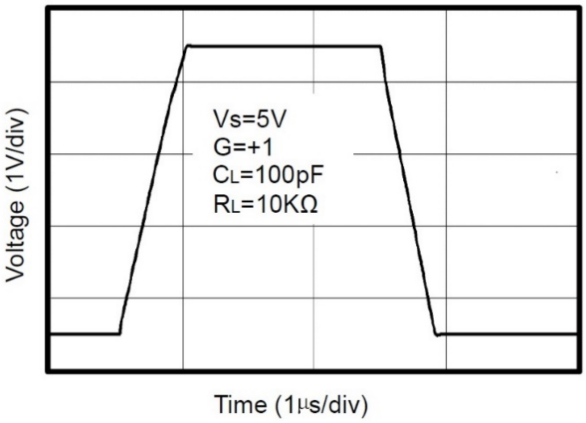


Fig.2 Large-Signal Step Response

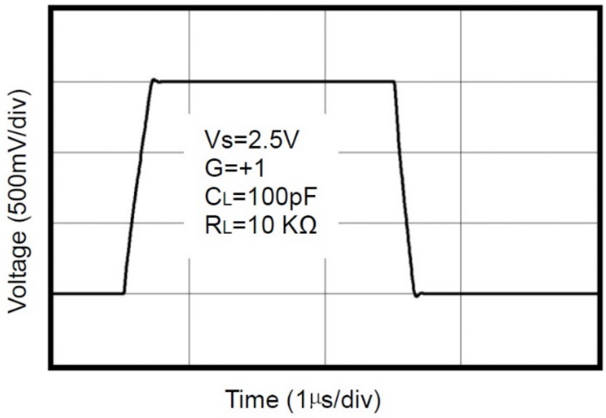


Fig.3 Small-Signal Step Response

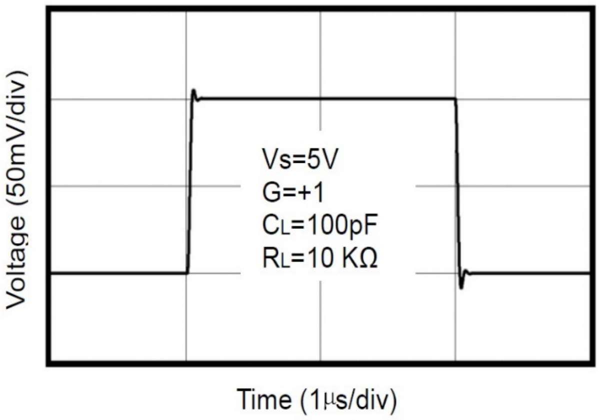


Fig.4 Small-Signal Step Response

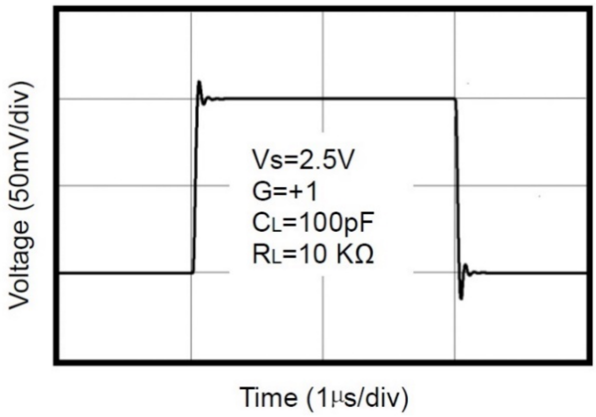


Fig.5 Positive Overload Recovery

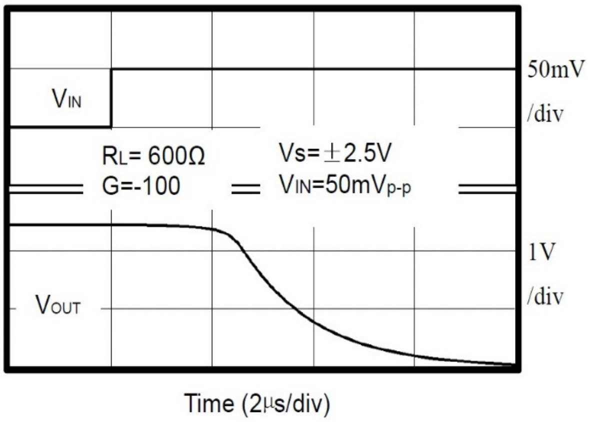


Fig.6 Negative Overload Recovery

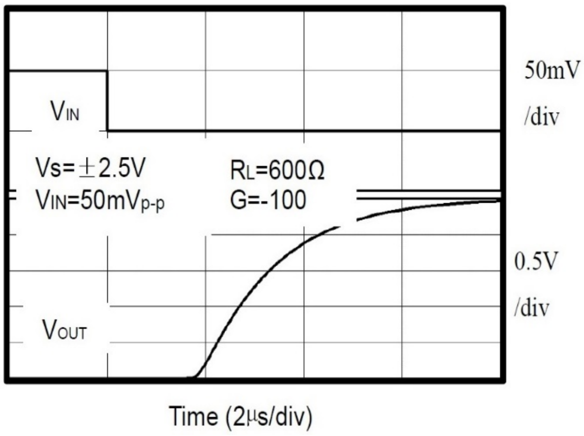


Fig.7 Output Voltage Swing vs. Output Current

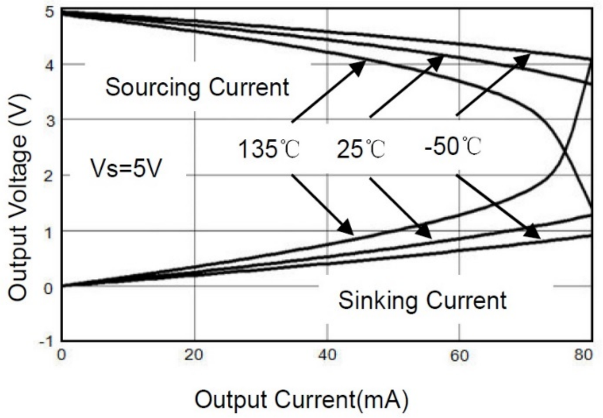


Fig. 8 Supply Current vs. Temperature

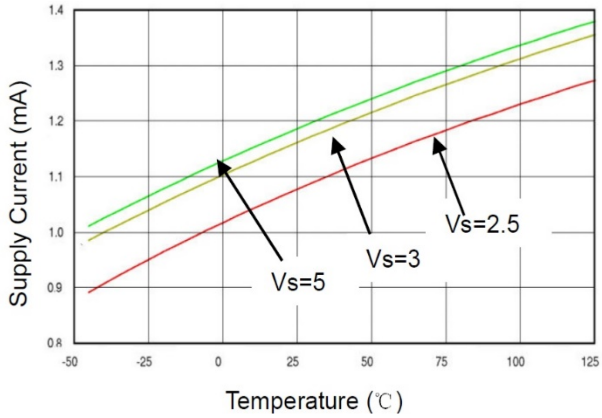


Fig.9 Input Voltage Noise Spectral Density vs. Frequency

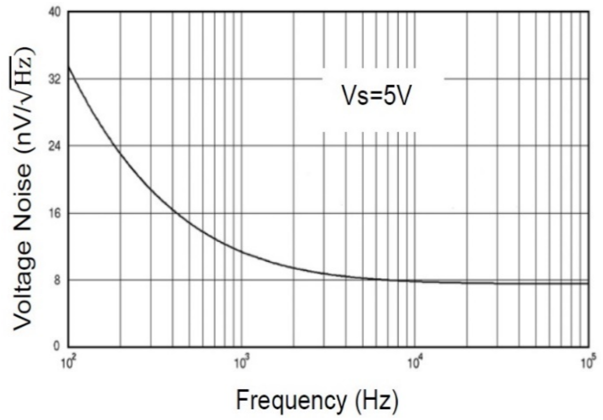


Fig.10 Open Loop Gain, Phase Shift vs. Frequency

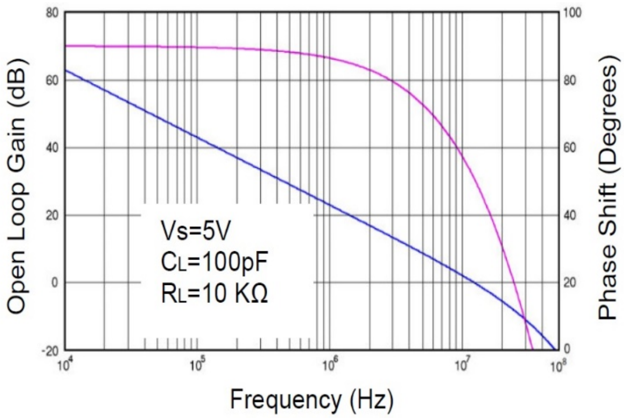


Fig.11 CMRR vs. Frequency

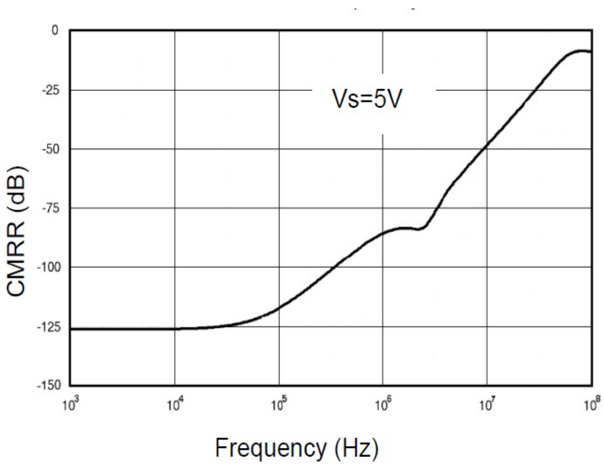
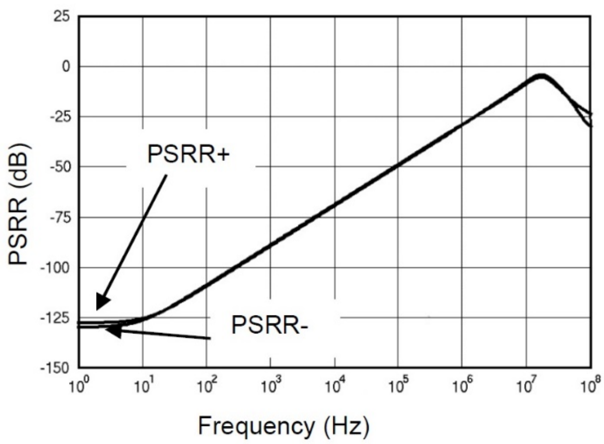


Fig.12 PSRR vs. Frequency



DETAILED INFORMATION

The AO2325 op amp is unity-gain stable and suitable for a wide range of general-purpose applications. The small footprints of the AO2325 series packages save space on printed circuit boards and enable the design of smaller electronic products.

Power Supply Bypassing and Board Layout

The AO2325 operates from a single 2.1V to 5.5V supply or dual ±1.05V to ±2.75V supplies. For best performance, a 0.1μF ceramic capacitor should be placed close to the V_{DD} pin in single supply operation. For dual supply operation, both V_{DD} and V_{SS} supplies should be bypassed to ground with separate 0.1μF ceramic capacitors.

Low Supply Current

The low supply current (typical 1.1mA per channel) of the AO2325 will help to maximize battery life. AO2325 is ideal for battery powered systems.

Operating Voltage

The AO2325 operates under wide input supply voltage (2.1V to 5.5V). In addition, all temperature specifications apply from -40 ℃ to +125 ℃. Most behavior remains unchanged throughout the full operating voltage range. These guarantees ensure operation throughout the single Li-Ion battery lifetime.

Rail-to-Rail Input

The input common-mode range of the AO2325 extends 100mV beyond the supply rails (V_{SS} -0.1V to V_{DD} +0.1V). This is achieved by using complementary input stage. For normal operation, inputs should be limited to this range.

Rail-to-Rail Output

Rail-to-Rail output swing provides maximum possible dynamic range at the output. This is particularly important when operating in low supply voltages. The output voltage of AO2325 can typically swing to less than 2mV from supply rail in light resistive loads (>100kΩ), and 15mV of supply rail in moderate resistive loads (10kΩ).

Capacitive Load Tolerance

The AO2325 is optimized for bandwidth and speed, not for driving capacitive loads. Output capacitance will create a pole in the amplifier's feedback path, leading to excessive peaking and potential oscillation.

If dealing with load capacitance is a requirement of the application, the two strategies to consider are (1) using a small resistor in series with the amplifier's output and the load capacitance and (2) reducing the bandwidth of the amplifier's feedback loop by increasing the overall noise gain. Fig13. Shows a unity gain follower using the series resistor strategy. The resistor isolates the output from the capacitance and, more importantly, creates a zero in the feedback path that compensates for the pole created by the output capacitance.

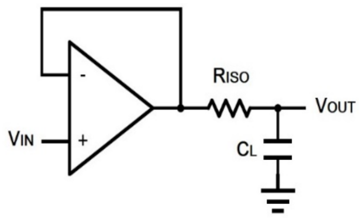
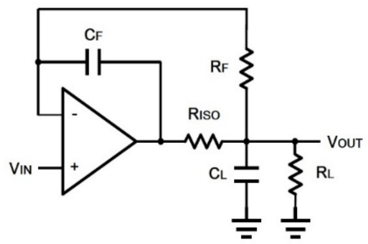


Fig13. Indirectly Driving a Capacitive Load using Isolation Resistor

The bigger the R_{ISO} resistor value, the more stable V_{OUT} will be. However, if there is a resistive load R_L in parallel with the capacitive load, a voltage divider (proportional to R_{ISO} / R_L) is formed, this will result in a gain error. The circuit in Fig 14. is an improvement to the one in Fig 13. R_F provides the DC accuracy by feed-forward the V_{IN} to R_L. C_F and R_{ISO} 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 the phase margin in the overall feedback loop. Capacitive drive can be increased by increasing the value of C_F. This in turn will slow down the pulse response.



Capacitive Load With DC Accuracy

Differential Amplifier

The differential amplifier allows the subtraction of two input voltages or cancellation of a signal common the two inputs. It is useful as a computational amplifier in making a differential to single-end conversion or in rejecting a common mode signal.

Fig 15. shown the differential amplifier using AO2325.

$V_{OUT}=\left(\frac{R_1+R_2}{R_3+R_4}\right)\frac{R_4}{R_1}V_{IN}-\frac{R_2}{R_1}V_{IP}+\left(\frac{R_1+R_2}{R_3+R_4}\right)\frac{R_3}{R_1}V_{REF}$

If the resistor ratios are equal (i.e. $R_1=R_3$ and $R_2=R_4$), then

$V_{OUT}=\frac{R_2}{R_1}(V_{IP}-V_{IN})+V_{REF}$

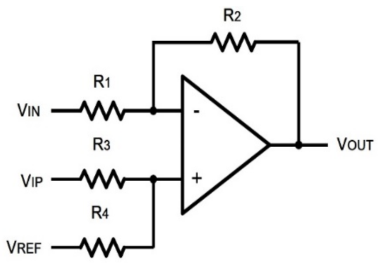


Fig 15. Differential Amplifier

Low Pass Active Filter

The low pass active filter is shown in Fig 16.

The DC gain is defined by $-R_2$ / R_1. The filter has a

-20dB/decade roll-off after its corner frequency $f_C=1/(2\pi R_3C_1)$

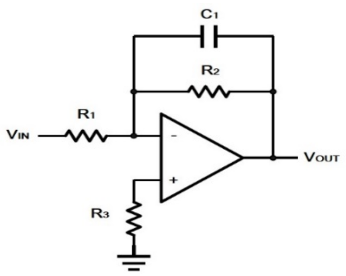


Fig 16. Low Pass Active Filter

Instrumentation Amplifier

The triple AO2325 can be used to build a three-op-amp instrumentation amplifier as shown in Fig 17.

The amplifier in Fig 17. is a high input impedance differential amplifier with gain of R_2 / R_1.

The two differential voltage followers assure the high input impedance of the amplifier.

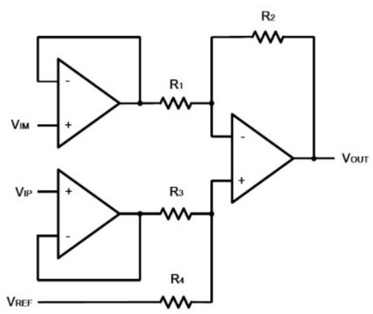
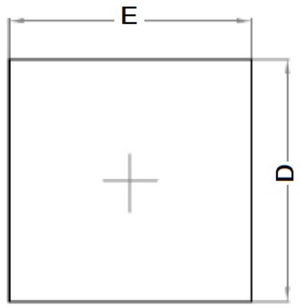


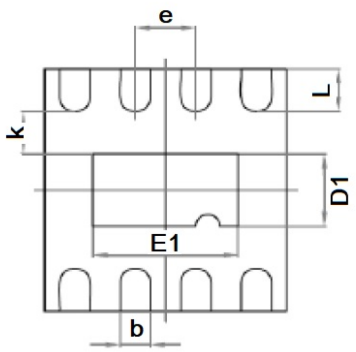
Fig 17. Instrument Amplifier

PACKAGE INFORMATION

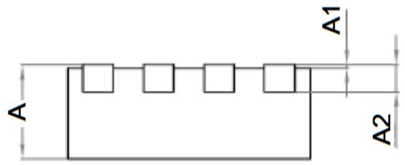
Dimension in DFN8(2x2) (Unit: mm)



Top View



Bottom View



Side View

Symbol	Millimeters	
	Min	Max
A	0.800	0.900
A1	0.000	0.050
A2	0.153	0.253
b	0.180	0.300
D	1.900	2.100
E	1.900	2.100
D1	0.500	0.700
E1	1.100	1.300
e	0.500 BSC	
k	0.200	-
L	0.250	0.450

IMPORTANT NOTICE

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc. 's integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or server property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.