UMW AD8515

1.8 V Low Power CMOS Rail-to-Rail Input/Output Operational Amplifier

1.Description

The AD8515 is a rail-to-rail amplifier that can operate from a single-supply voltage as low as 1.8 V. The AD8515 single amplifier, available in 5-lead SOT-23 and 5-lead SC70 packages, is small enough to be placed next to sensors, reducing external noise pickup.The AD8515 is a rail-to-rail input and output amplifier with a gain bandwidth of 5 MHz and typical offset voltage of 1 mV from a 1.8 V supply. The low supply current makes these parts ideal for battery-powered applications. The 2.7 V/μs slew rate makes the AD8515 a good match for driving ASIC inputs such as voice codecs.

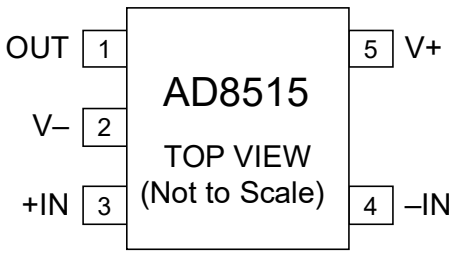
2.Features

- Single-supply operation: 1.8 V to 5 V
- Offset voltage: 6 mV maximum
- Space-saving SOT23-5 and SC70-5 packages
- Slew rate: 2.7 V/μs
- Bandwidth: 5 MHz
- Rail-to-rail input and output swing
- Low input bias current: 2 pA typical
- Low supply current @ 1.8V:450 μA maximum

3.Applications

- Portable communications
- Portable phones
- Sensor interfaces
- Laser scanners
- PCMCIA cards
- Battery-powered devices
- New generation phones
- Personal digital assistants

4.Pinning information



SOT23-5/SC70-5

5.1Electrical Characteristics

V_S=1.8 V, V_{CM}=V_S/2, T_A = 25°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM}=V_S/2		1	6	mV
		−40°C<T_A<+125°C			8	mV
Input Bias Current	I_S	V_S=1.8V		2	30	pA
		−40°C<T_A<+85°C			600	pA
		−40°C<T_A<+125°C			8	nA
Input Offset Current	I_{OS}			1	10	pA
		−40°C<T_A<+125°C			500	pA
Input Voltage Range	CMRR		0		1.8	V
Common-Mode Rejection Ratio		0V≤V_{CM}≤1.8V	50			dB
		−40°C<T_A<+125°C	47			dB
Large Signal Voltage Gain	A_{VO}	R_L=100kΩ, 0.3V≤V_{OUT}≤1.5V	110	400		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			4		μV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L=100μA, −40°C<T_A<+125°C	1.79			V
Output Voltage Low	V_{OL}	I_L=750μA, −40°C<T_A<+125°C	1.77			V
		I_L=100μA, −40°C<T_A<+125°C			10	mV
		I_L=750μA, −40°C<T_A<+125°C			30	mV
Short-Circuit Limit	I_{SC}			20		mA
POWER SUPPLY						
Supply Current/Amplifier	I_{SY}	V_{OUT}=V_S/2		325	450	μA
		–40°C<T_A<+125°C			500	μA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L=10kΩ		2.7		V/μs
Gain Bandwidth Product	GBP			5		MHz

Parameter	Symbol	Conditions	Min	Typ	Max	Units
NOISE PERFORMANCE						
Voltage Noise Density	e_n	f=1kHz		22		nV/√Hz
		f=10kHz		20		nV/√Hz
Current Noise Density	i_n	f=1kHz		0.05		pA/√Hz

5.2Electrical Characteristics

V_S=3V, V_{CM}=V_S/2, T_A = 25°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM}=V_S/2		1	6	mV
		−40°C<T_A<+125°C			8	mV
Input Bias Current	I_S	V_S=3V		2	30	pA
		−40°C<T_A<+85°C			600	pA
		−40°C<T_A<+125°C			8	nA
Input Offset Current	I_{OS}			1	10	pA
		−40°C<T_A<+125°C			500	pA
Input Voltage Range	CMRR		0		3	V
Common-Mode Rejection Ratio		0V≤V_{CM}≤3V	54			dB
		−40°C<T_A<+125°C	50			dB
Large Signal Voltage Gain	A_{VO}	R_L=100kΩ, 0.3V≤V_{OUT}≤2.7V	250	1000		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			4		μV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L=100μA, −40°C<T_A<+125°C	2.99			V
Output Voltage Low	V_{OL}	I_L=750μA, −40°C<T_A<+125°C	2.98			V
		I_L=100μA, −40°C<T_A<+125°C			10	mV
		I_L=750μA, −40°C<T_A<+125°C			20	mV
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S=1.8V to 5V	65	85		dB
		–40°C<T_A<+125°C	57	80		dB
Supply Current/Amplifier	I_{SY}	V_{OUT}=V_S/2		350	450	μA
		–40°C<T_A<+125°C			500	μA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L=10kΩ		2.7		V/μs
Gain Bandwidth Product	GBP			5		MHz

Parameter	Symbol	Conditions	Min	Typ	Max	Units
NOISE PERFORMANCE						
Voltage Noise Density	e_n	f=1kHz		22		nV/√Hz
		f=10kHz		20		nV/√Hz
Current Noise Density	i_n	f=1kHz		0.05		pA/√Hz

5.3Electrical Characteristics

V_S=5V, V_{CM}=V_S/2, T_A=25°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM}=V_S/2		1	6	mV
		−40°C<T_A<+125°C			8	mV
Input Bias Current	I_S	V_S=5V		5	30	pA
		−40°C<T_A<+85°C			600	pA
		−40°C<T_A<+125°C			8	nA
Input Offset Current	I_{OS}			1	10	pA
		−40°C<T_A<+125°C			500	pA
Input Voltage Range	CMRR		0		5	V
Common-Mode Rejection Ratio		0V≤V_{CM}≤5V	60	75		dB
		−40°C<T_A<+125°C	54			dB
Large Signal Voltage Gain	A_{VO}	R_L=100kΩ, 0.3V≤V_{OUT}≤4.7V	450	2000		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			4		μV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L=100μA, −40°C<T_A<+125°C	4.99			V
Output Voltage Low	V_{OL}	I_L=750μA, −40°C<T_A<+125°C	4.98			V
		I_L=100μA, −40°C<T_A<+125°C			10	mV
		I_L=750μA, −40°C<T_A<+125°C			20	mV
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S=1.8V to 5V	65	85		dB
		–40°C<T_A<+125°C	57	80		dB
Supply Current/Amplifier	I_{SY}	V_{OUT}=V_S/2		410	550	μA
		–40°C<T_A<+125°C			600	μA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L=10kΩ		2.7		V/μs
Gain Bandwidth Product	GBP			5		MHz

Parameter	Symbol	Conditions	Min	Typ	Max	Units
NOISE PERFORMANCE						
Voltage Noise Density	e_n	f=1kHz		22		nV/√Hz
		f=10kHz		20		nV/√Hz
Current Noise Density	i_n	f=1kHz		0.05		pA/√Hz

6.Absolute Maximum Ratings T_A= 25°C

T_A=25°C, unless otherwise noted.

Parameter	Rating
supply Voltage	6 V
Input Voltage	GND to V_S
Differential input Voltage	±6 V or ±V_S
Output Short-Circuit Duration to GND	Observe derating curves
Storage Temperature Range KS and RJ Packages	-65°C to +150°C
Operating Temperature Range AD8515	-40°C to +125°C
Junction Temperature Range KS and RJ Packages	-65°C to +150°C
LeadTemperature (Soldering, 60 sec)	300°C

7.1Typical Characteristic

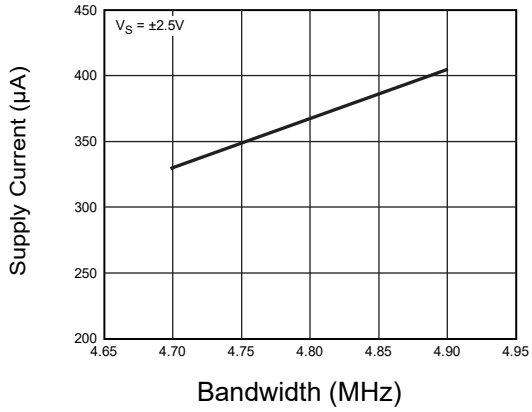


Figure 1: Supply Current vs. Bandwidth

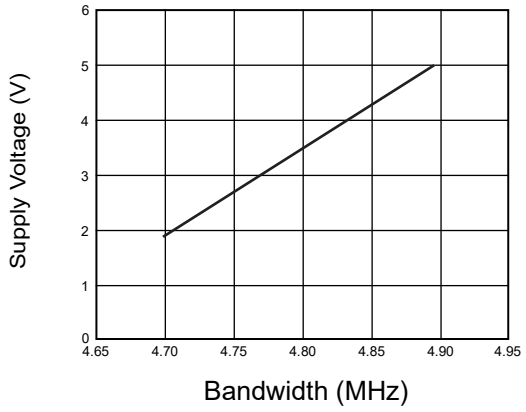


Figure 2: Supply Voltage vs. Bandwidth

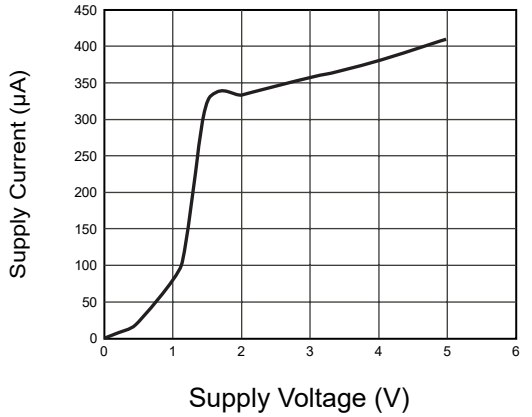


Figure 3: Supply Current vs. Supply Voltage

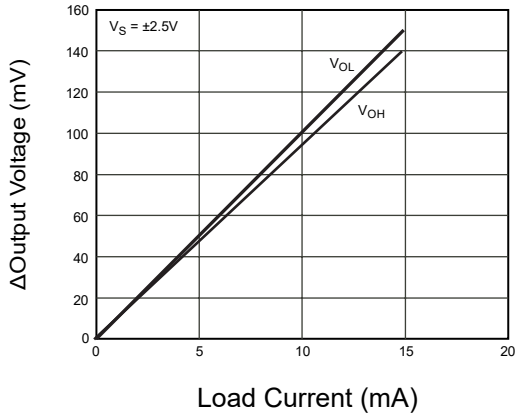


Figure 4: Output Voltage to Supply Rail vs. Load Current

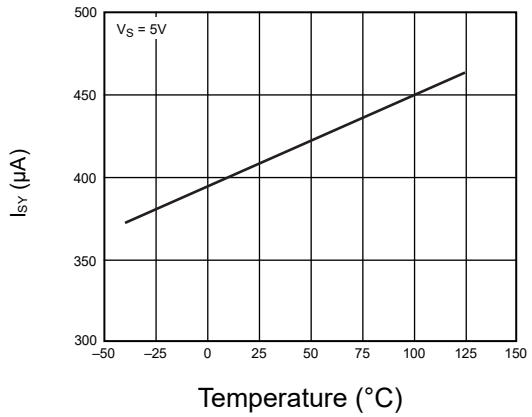


Figure 5: I_{SY} vs. Temperature

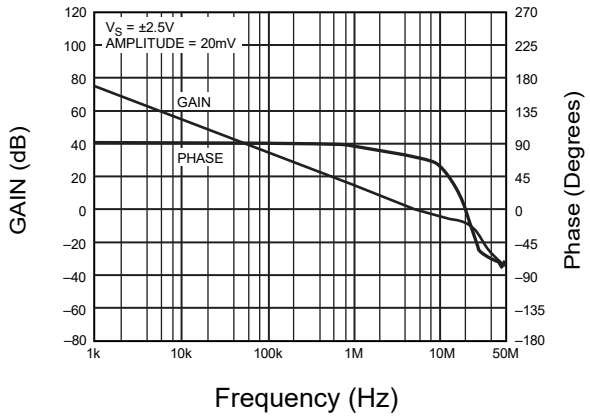


Figure 6: Gain and Phase vs. Frequency

7.2Typical Characteristic

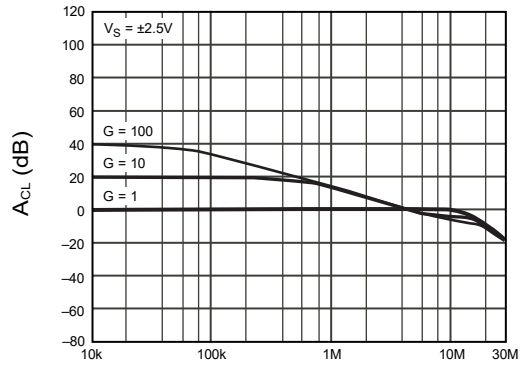


Figure 7: A_{CL} vs. Frequency

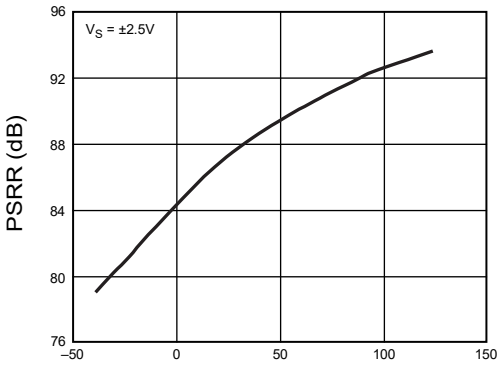


Figure 8: PSRR vs. Temperature

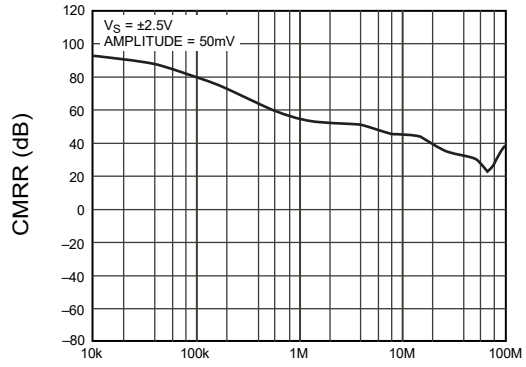


Figure 9: CMRR vs. Frequency

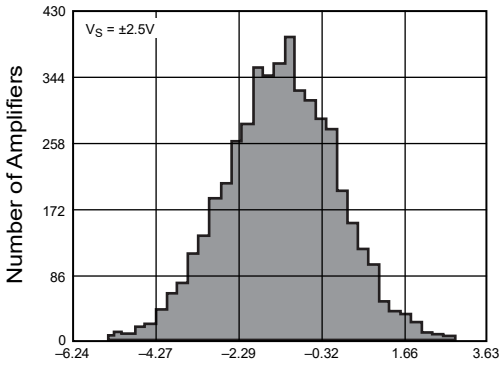


Figure 10: V_{OS} Distribution

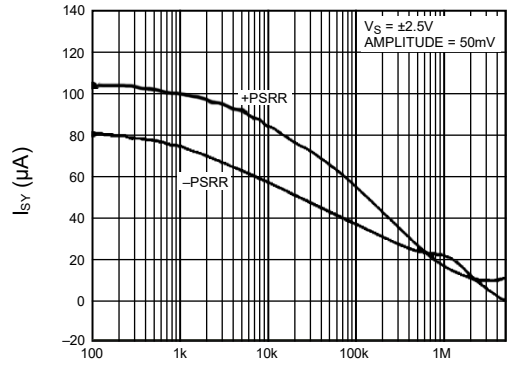


Figure 11: PSRR vs. Frequency

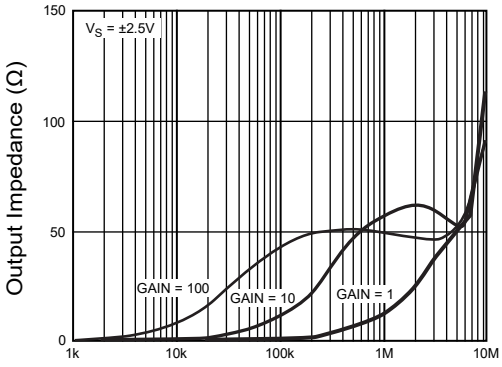


Figure 12: Output Impedance vs. Frequency

7.3Typical Characteristic

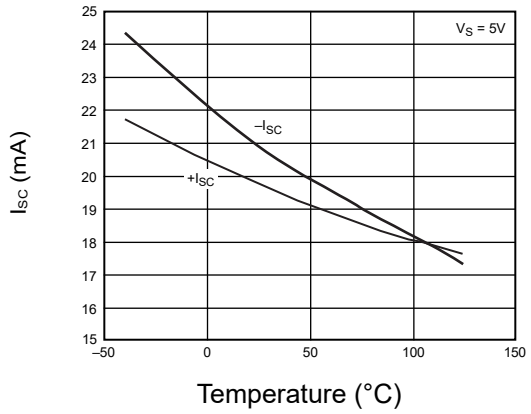


Figure 13: I_{SC} vs. Temperature

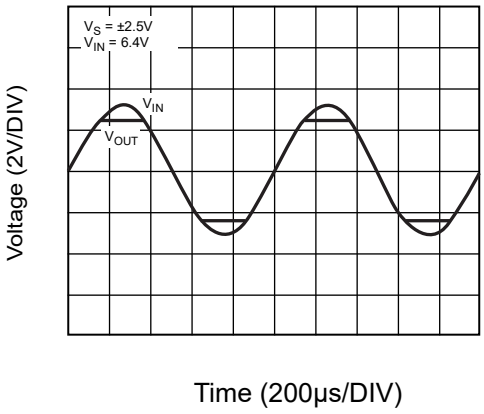


Figure 14: No Phase Reversal

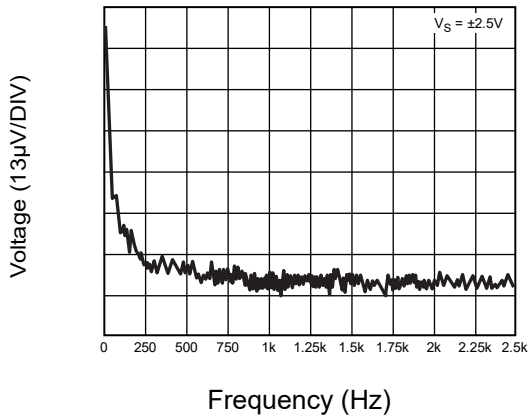


Figure 15: Voltage Noise Density

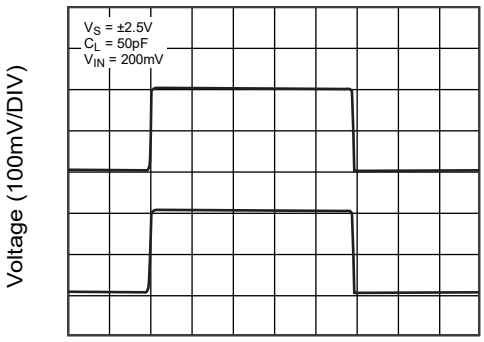


Figure 16: Small Signal Transient Response

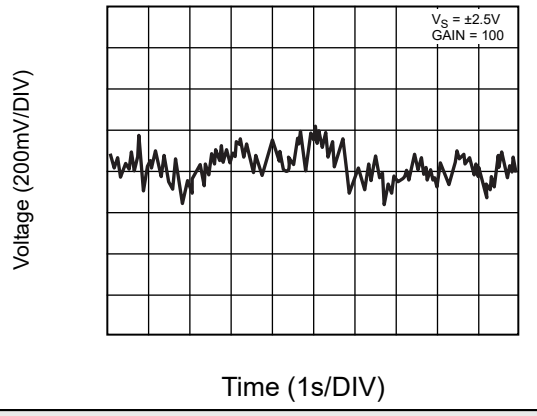


Figure 17: Input Voltage Noise

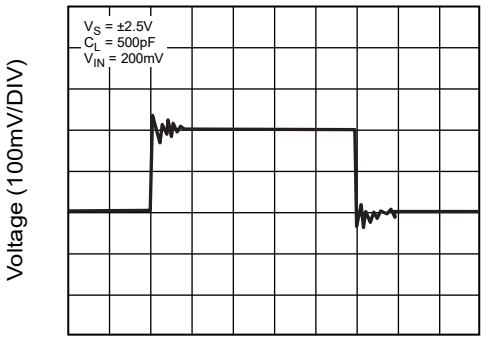


Figure 18: Small Signal Transient Response

7.4Typical Characteristic

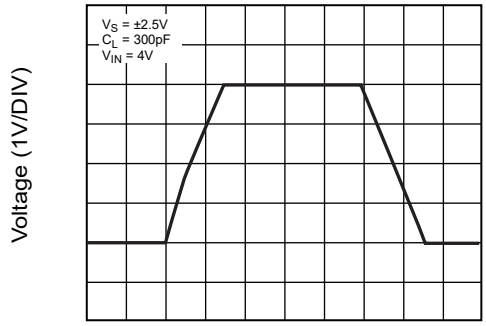


Figure 19: Large Signal Transient Response

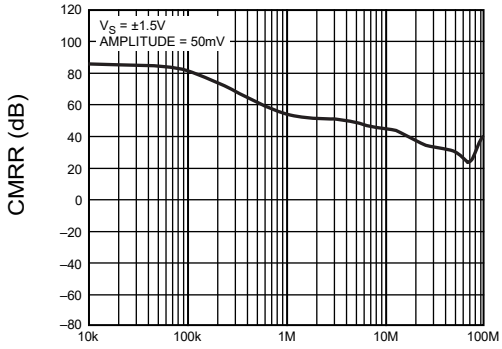


Figure 20: CMRR vs. Frequency

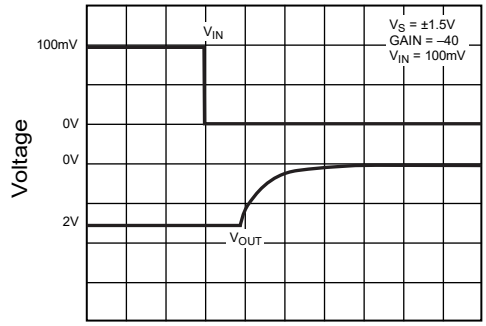


Figure 21: Saturation Recovery

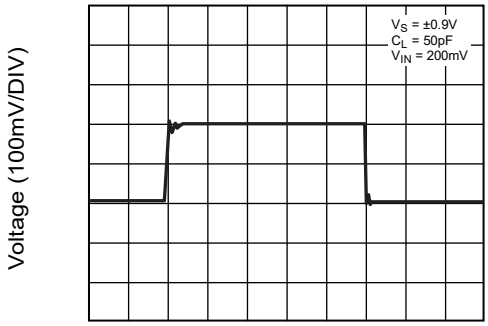


Figure 22: Small Signal Transient Response

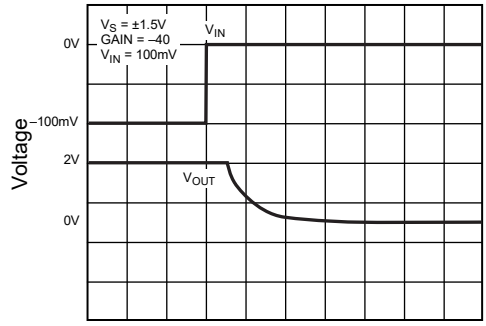


Figure 23: Saturation Recovery

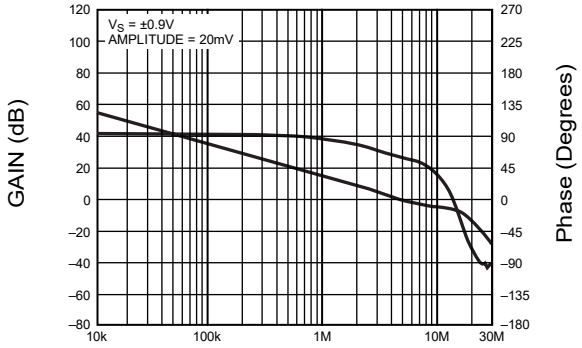


Figure 24: Gain and Phase vs. Frequency

7.5Typical Characteristic

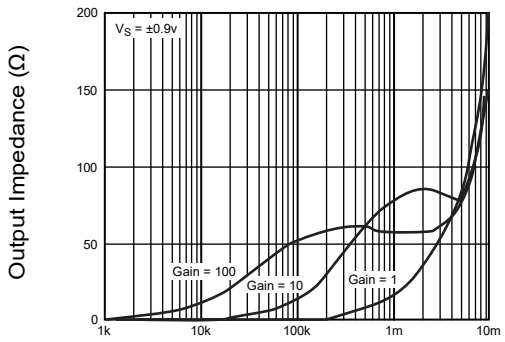


Figure 25: Output Impedance vs. Frequency

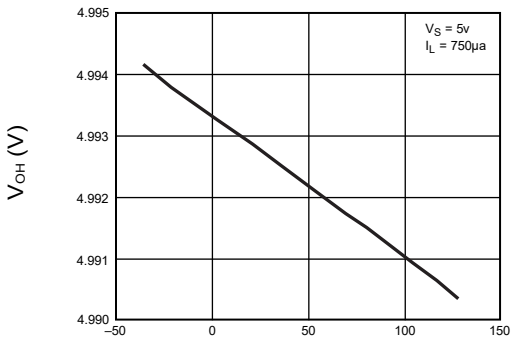


Figure 26: V_{OH} vs. Temperature

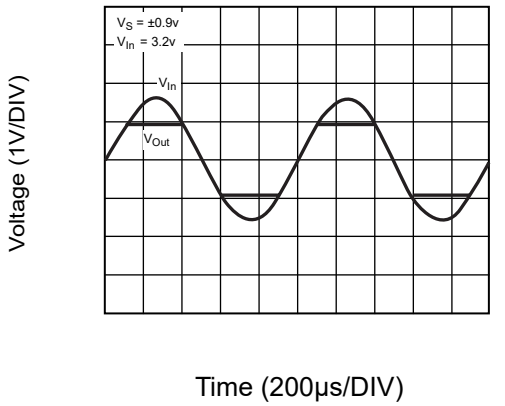


Figure 27: No Phase Reversal

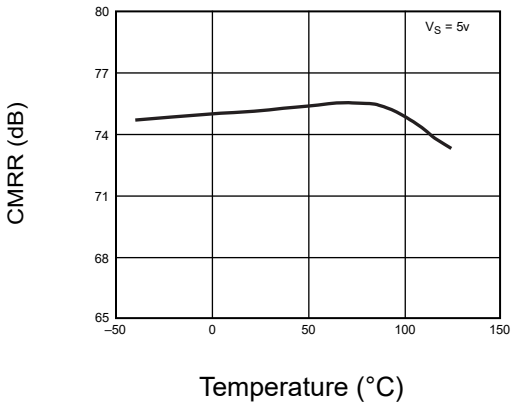


Figure 28: CMRR vs. Temperature

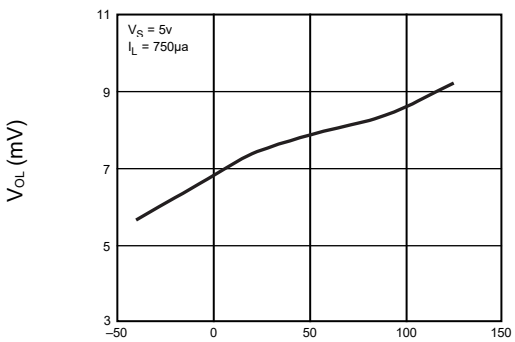
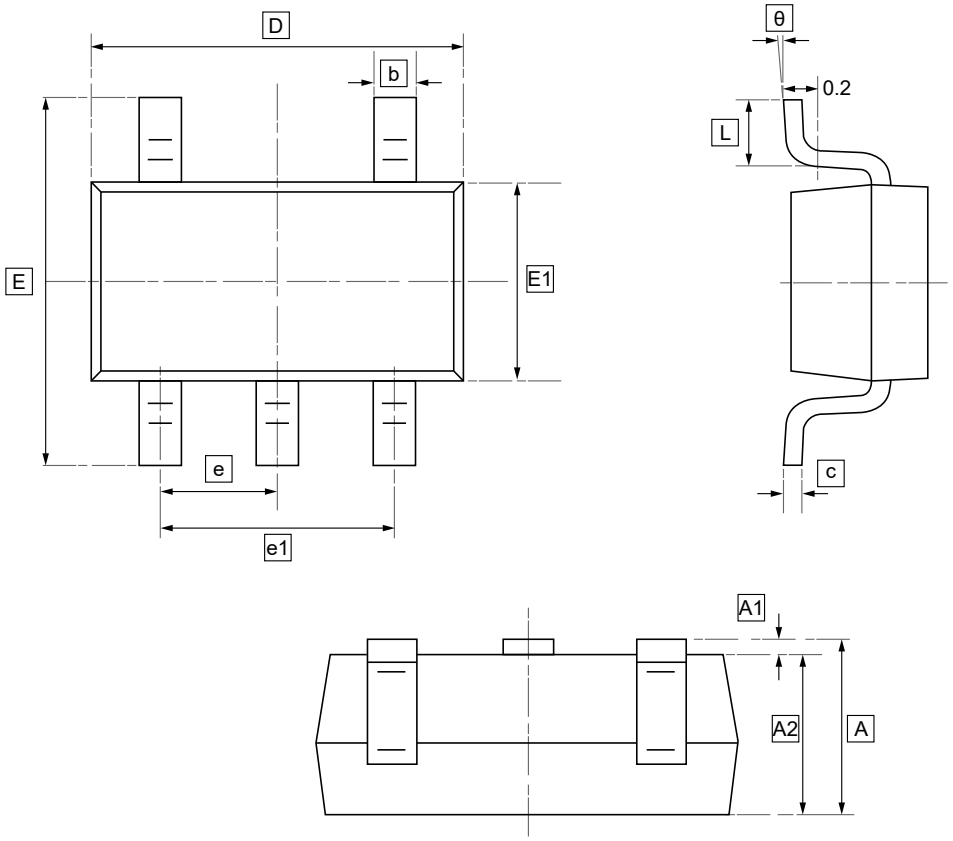


Figure 29: V_{OL} vs. Temperature

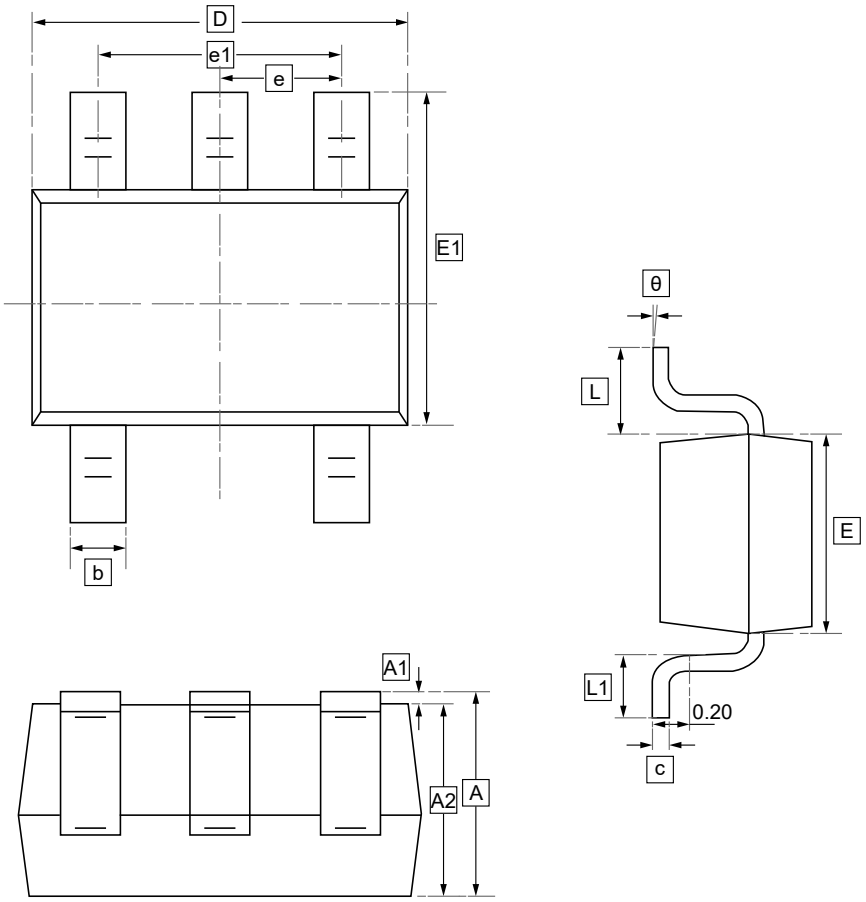
8.1SOT23-5 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E1	E	e	e1	L	θ
Min	1.050	0.000	1.050	0.300	0.100	2.820	1.500	2.650	0.950	1.800	0.300	0°
Max	1.250	0.100	1.150	0.500	0.200	3.020	1.700	2.950	BSC	2.000	0.600	8°

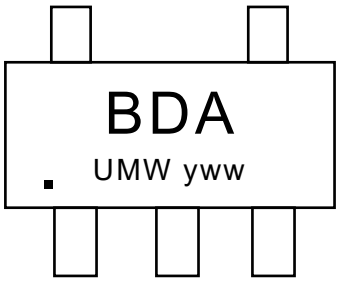
8.2SC70-5 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	e1	L	θ
Min	0.90	0.00	0.90	0.15	0.08	2.05	1.15	2.15	0.65	1.20	0.26	7°
Max	1.10	0.10	1.00	0.35	0.15	2.25	1.35	2.45	TYP	1.40	0.46	REF.

9.Ordering information



y: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW AD8515ARTZ	BDA	SOT23-5	3000	Tape and reel
UMW AD8515ART	BDA	SOT23-5	3000	Tape and reel
UMW AD8515AKSZ	BDA	SC70-5	3000	Tape and reel

10.Disclaimer

UMW reserves the right to make changes to all products, specifications. Customers should obtain the latest version of product documentation and verify the completeness and currency of the information before placing an order.

When applying our products, please do not exceed the maximum rated values, as this may affect the reliability of the entire system. Under certain conditions, any semiconductor product may experience faults or failures. Buyers are responsible for adhering to safety standards and implementing safety measures during system design, prototyping, and manufacturing when using our products to prevent potential failure risks that could lead to personal injury or property damage.

Unless explicitly stated in writing, UMW products are not intended for use in medical, life-saving, or life-sustaining applications, nor for any other applications where product failure could result in personal injury or death. If customers use or sell the product for such applications without explicit authorization, they assume all associated risks.

When reselling, applying, or exporting, please comply with export control laws and regulations of China, the United States, the United Kingdom, the European Union, and other relevant countries, regions, and international organizations.

This document and any actions by UMW do not grant any intellectual property rights, whether express or implied, by estoppel or otherwise. The product names and marks mentioned herein may be trademarks of their respective owners.