

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	Delete paragraph 1.4 and incorporate data into paragraph 1.3. Under Table I, with condition of VS = 5 V <u>5</u> , Overdrive recovery time parameter, delete VIN = 5 V and replace with 2.5 V. Update document paragraphs to current requirements. - ro	20-01-15	James R. Eschmeyer



Prepared in accordance with ASME Y14.24

Vendor item drawing

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REV STATUS OF PAGES	REV	A	A	A	A	A	A	A	A	A	A	A	A	A					
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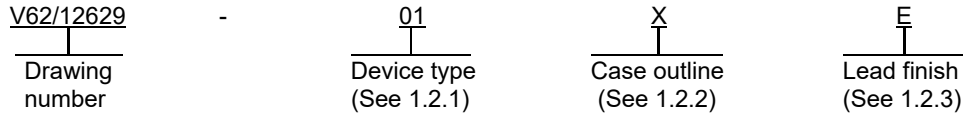
PMIC N/A	PREPARED BY Phu H. Nguyen	DLA LAND AND MARITIME COLUMBUS, OHIO 43218-3990 https://www.dla.mil/LandandMaritime
Original date of drawing YY-MM-DD 12-10-09	CHECKED BY Phu H. Nguyen	TITLE MICROCIRCUIT, LINEAR, LOW DISTORTION DIFFERENTIAL ADC DRIVER, MONOLITHIC SILICON
	APPROVED BY Thomas M. Hess	
	SIZE A	CODE IDENT. NO. 16236
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DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance low distortion differential analog to digital converter (ADC) driver microcircuit, with an operating temperature range of -55°C to +105°C.

1.2 Vendor Item Drawing Administrative Control Number. The manufacturer's PIN is the item of identification. The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation:



1.2.1 Device type(s).

<u>Device type</u>	<u>Generic</u>	<u>Circuit function</u>
01	AD8138-EP	Low distortion differential ADC driver

1.2.2 Case outline(s). The case outline(s) are as specified herein.

<u>Outline letter</u>	<u>Number of pins</u>	<u>JEDEC PUB 95</u>	<u>Package style</u>
X	8	JEDEC MO-187-AA	Mini small outline package

1.2.3 Lead finishes. The lead finishes are as specified below or other lead finishes as provided by the device manufacturer:

<u>Finish designator</u>	<u>Material</u>
A	Hot solder dip
B	Tin-lead plate
C	Gold plate
D	Palladium
E	Gold flash palladium
F	Tin-lead alloy (BGA/CGA)
Z	Other

1.3 Absolute maximum ratings. 1/

Supply voltage	±5.5 V
VOCM	±VS
Output voltage swing	See figures 5 and 6
Internal power dissipation	550 mW
Operating temperature range:	-55°C to +105°C
Storage temperature range	-65°C to 150°C
Lead temperature, (soldering, 10 seconds)	300°C
Junction temperature (T _J)	150°C
Thermal resistance, junction to ambient (θ _{JA})	145°C/W

1/ Stresses beyond those listed under "absolute maximum rating" 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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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2. APPLICABLE DOCUMENTS

JEDEC Solid State Technology Association

JEDEC PUB 95 – Registered and Standard Outlines for Semiconductor Devices

(Copies of these documents are available online at <https://www.jedec.org>.)

3. REQUIREMENTS

3.1 Marking. Parts shall be permanently and legibly marked with the manufacturer's part number as shown in 6.3 herein and as follows:

- A. Manufacturer's name, CAGE code, or logo
- B. Pin 1 identifier
- C. ESDS identification (optional)

3.2 Unit container. The unit container shall be marked with the manufacturer's part number and with items A and C (if applicable) above.

3.3 Electrical characteristics. The maximum and recommended operating conditions and electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.4 Design, construction, and physical dimension. The design, construction, and physical dimensions are as specified herein.

3.5 Diagrams.

3.5.1 Case outline. The case outline shall be as shown in 1.2.2 and figure 1.

3.5.2 Terminal connections. The terminal connections shall be as shown in figure 2.

3.5.3 Terminal function. The terminal function shall be as shown in figure 3.

3.5.4 Maximum power dissipation versus ambient temperature. The maximum power dissipation versus ambient temperature shall be as shown in figure 4.

3.5.5 Differential output voltage swing versus ambient temperature, $V_S = \pm 5 V$. The differential output voltage swing versus ambient temperature, $V_S = \pm 5 V$ shall be as shown in figure 5.

3.5.6 Differential output voltage swing versus ambient temperature, $V_S = 5 V$. The differential output voltage swing versus ambient temperature, $V_S = 5 V$ shall be as shown in figure 6.

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TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Test conditions	Limits			Unit
			Min	Typ	Max	
\pm DIN to \pm OUT specifications 2/						
Dynamic performance						
-3 dB small signal bandwidth		VOUT = 0.5 V p-p, CF = 0 pF	290	320		MHz
		TMIN to TMAX 3/	256			
		VOUT = 0.5 V p-p, CF = 1 pF		225		
Bandwidth for 0.1 dB Flatness		VOUT = 0.5 V p-p, CF = 0 pF		30		MHz
Large signal bandwidth		VOUT = 2 V p-p, CF = 0 pF		265		MHz
Slew rate		VOUT = 2 V p-p, CF = 0 pF		1150		V/ μ s
Settling time		0.01%, VOUT = 2 V p-p, CF = 1 pF		16		ns
Overdrive recovery time		VIN = 5 V to 0 V step, G = +2		4		ns
Noise/Harmonic performance						
Second Harmonic		VOUT = 0.5 V p-p, 5 MHz, RL, dm = 800 Ω		-94		dBc
		VOUT = 0.5 V p-p, 20 MHz, RL, dm = 800 Ω		-87		
		VOUT = 0.5 V p-p, 70 MHz, RL, dm = 800 Ω		-62		
Third Harmonic		VOUT = 0.5 V p-p, 5 MHz, RL, dm = 800 Ω		-114		dBc
		VOUT = 0.5 V p-p, 20 MHz, RL, dm = 800 Ω		-85		
		VOUT = 0.5 V p-p, 70 MHz, RL, dm = 800 Ω		-57		
IMD		20 MHz		-77		dBc
IP3		20 MHz		37		dBm
Voltage noise (RTI)		f = 100 kHz to 40 MHz		5		nV/ \sqrt Hz
Input current noise		f = 100 kHz to 40 MHz		2		pA/ \sqrt Hz
Input characteristics						
Offset voltage		VOS, dm = VOUT, dm/2; VDIN+ = VDIN- = VOCM = 0 V	-2.5	\pm 1	+2.5	mV
		TMIN to TMAX 3/	-4.8		+4.8	
Input bias current				3.5	7	μ A
		TMIN to TMAX variation		-0.01		μ A/ $^{\circ}$ C
Input resistance		Differential		6		M Ω
		Common mode		3		
Input capacitance				1		pF
Input common mode voltage				-4.7 to +3.4		V
CMRR		Δ VOUT, dm/ Δ VIN, cm; Δ VIN, cm = \pm 1 V,		-77	-70	dB
		TMIN to TMAX 3/			-69	
Output characteristics						
Output voltage swing 4/		Maximum Δ VOUT; single ended output		7.75		V p-p
Output balance error		Δ VOUT, cm/ Δ VOUT, dm; Δ VOUT, dm = 1 V,		-66		dB

See footnote at end of table.

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TABLE I. Electrical performance characteristics - Continued. 1/

Test	Symbol	Test conditions	Limits			Unit
			Min	Typ	Max	
VOCM tp ±OUT specifications <u>2/</u>						
Dynamic performance						
-3dB bandwidth				250		MHz
Slew rate				330		V/μs
Noise						
Input voltage noise (RTI)		f = 0.1 MHz to 100 MHz		17		nV/√Hz
DC performance						
Input voltage range				±3.8		V
Input resistance				200		kΩ
Input offset voltage		VOS, cm = VOUT, cm; VDIN+ = VDIN- = VOVM = 0 V	-3.5	±1	+3.5	mV
		TMIN to TMAX <u>3/</u>	-10.2		+10.2	
Input bias current				0.5		μA
VOVM CMRR		ΔVOUT, dm/ΔVOVM; ΔVOVM = ±1 V,		-75		dB
Gain		ΔVOUT, cm/ΔVOVM; ΔVOVM = ±1 V;	0.9955	1	1.0045	V/V
		TMIN to TMAX <u>3/</u>				
Power supply						
Operating range			±1.4		±5.5	V
Quiescent current			18	20	23	mA
		TMIN to TMAX <u>3/</u>	13.2			
Power supply rejection ratio		ΔVOUT, dm/ΔVS, ΔVS = ±1 V;		-90	-70	dB
		TMIN to TMAX <u>3/</u>				
Operating temperature range			-55		+105	°C

See footnote at end of table.

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TABLE I. Electrical performance characteristics - Continued. 1/

Test	Symbol	Test conditions	Limits			Unit
			Min	Typ	Max	
\pm DIN to \pm OUT specifications 5/						
Dynamic performance						
-3 dB small signal bandwidth		VOUT = 0.5 V p-p, CF = 0 pF	280	310		MHz
		TMIN to TMAX 3/	242			
		VOUT = 0.5 V p-p, CF = 1 pF		225		
Bandwidth for 0.1 dB flatness		VOUT = 0.5 V p-p, CF = 0 pF		29		MHz
Large signal bandwidth		VOUT = 2 V p-p, CF = 0 pF		265		MHz
Slew rate		VOUT = 2 V p-p, CF = 0 pF		950		V/ μ s
Settling time		0.01%, VOUT = 2 V p-p, CF = 1 pF		16		ns
Overdrive recovery time		VIN = 2.5 V to 0 V step, G = +2		4		ns
Noise/Harmonic performance						
Second Harmonic		VOUT = 0.5 V p-p, 5 MHz, RL, dm = 800 Ω		-90		dBc
		VOUT = 0.5 V p-p, 20 MHz, RL, dm = 800 Ω		-79		
		VOUT = 0.5 V p-p, 70 MHz, RL, dm = 800 Ω		-60		
Third Harmonic		VOUT = 0.5 V p-p, 5 MHz, RL, dm = 800 Ω		-100		dBc
		VOUT = 0.5 V p-p, 20 MHz, RL, dm = 800 Ω		-82		
		VOUT = 0.5 V p-p, 70 MHz, RL, dm = 800 Ω		-53		
IMD		20 MHz		-74		dBc
IP3		20 MHz		35		dBm
Voltage noise (RTI)		f = 100 kHz to 40 MHz		5		nV/ \sqrt Hz
Input current noise		f = 100 kHz to 40 MHz		2		pA/ \sqrt Hz
Input characteristics						
Offset voltage		VOS, dm = VOUT, dm/2; VDIN+ = VDIN- = VOCM = 0 V	-2.5	\pm 1	+2.5	mV
		TMIN to TMAX 3/	-5.1		+5.1	
Input bias current				3.5	7	μ A
		TMIN to TMAX variation		-0.01		μ A/ $^{\circ}$ C
Input resistance		Differential		6		M Ω
		Common mode		3		
Input capacitance				1		pF
Input common mode voltage				-0.3 to +3.2		V
CMRR		Δ VOUT, dm/ Δ VIN, cm; Δ VIN, cm = 1 V,		-77	-70	dB
		TMIN to TMAX 3/			-69.5	
Output characteristics						
Output voltage swing 4/		Maximum Δ VOUT; single ended output		2.9		V p-p
Output balance error		Δ VOUT, cm/ Δ VOUT, dm; Δ VOUT, dm = 1 V,		-65		dB

See footnote at end of table.

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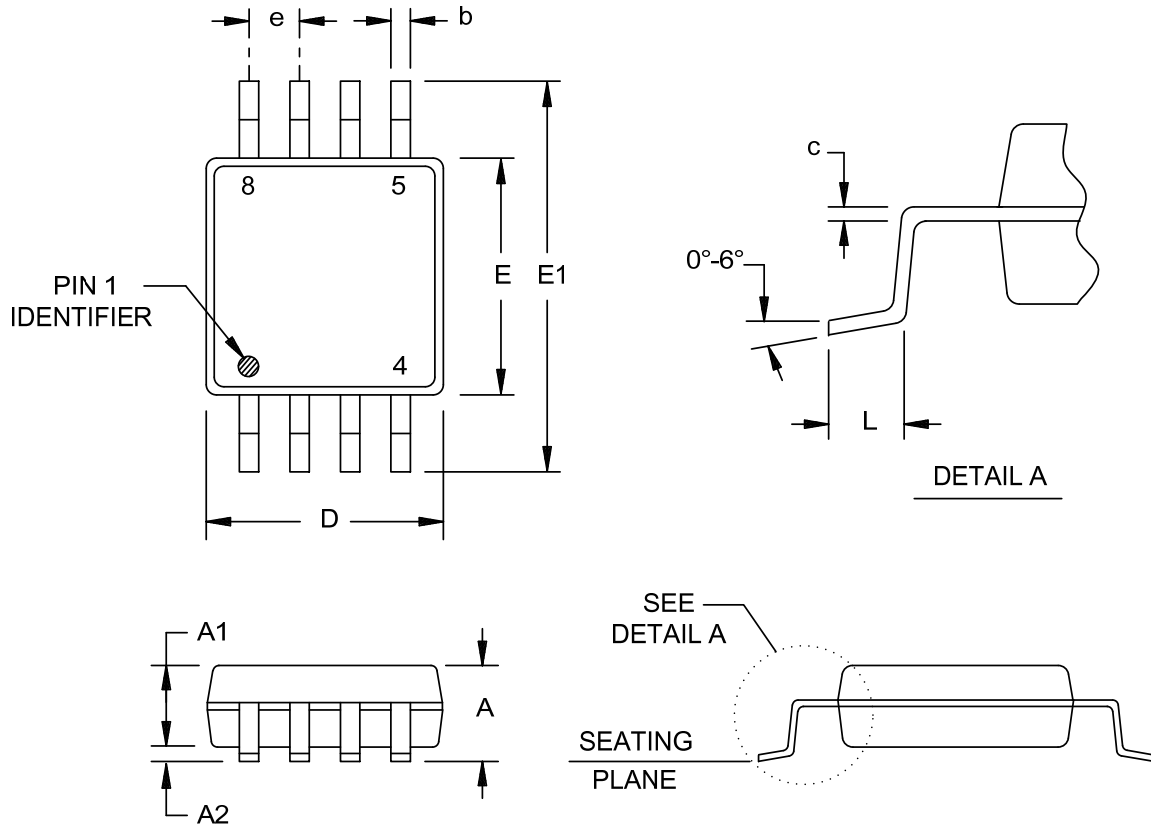
TABLE I. Electrical performance characteristics - Continued. 1/

Test	Symbol	Test conditions	Limits			Unit
			Min	Typ	Max	
VOCM to \pm OUT specifications <u>5/</u>						
Dynamic performance						
-3dB bandwidth				220		MHz
Slew rate				250		V/ μ s
Noise						
Input voltage noise (RTI)		f = 0.1 MHz to 100 MHz		17		nV/ \sqrt Hz
DC performance						
Input voltage range				1.0 to 3.8		V
Input resistance				100		k Ω
Input offset voltage		VOS, cm = VOUT, cm; VDIN+ = VDIN- = VOCM = 0 V	-5	\pm 1	+5	mV
		TMIN to TMAX <u>3/</u>	-9.7		+9.7	
Input bias current				0.5		μ A
VOCM CMRR		Δ VOUT, dm/ Δ VOCM; Δ VOCM = 2.5 \pm 1 V,		-70		dB
Gain		Δ VOUT, cm/ Δ VOCM; Δ VOCM = 2.5 \pm 1 V;	0.9968	1	1.0032	V/V
		TMIN to TMAX <u>3/</u>				
Power supply						
Operating range			2.7		11	V
Quiescent current			15	20	21	mA
		TMIN to TMAX <u>3/</u>	10.6			
Power supply rejection ratio		Δ VOUT, dm/ Δ VS, Δ VS = \pm 1 V		-90	-70	dB
		TMIN to TMAX <u>3/</u>			-57	
Operating temperature range			-55		+105	$^{\circ}$ C

- 1/ Testing and other quality control techniques are used to the extent deemed necessary to assure product performance over the specified temperature range. Product may not necessarily be tested across the full temperature range and all parameters may not necessarily be tested. In the absence of specific parametric testing, product performance is assured by characterization and/or design.
- 2/ At 25 $^{\circ}$ C, VS = \pm 5 V, VOCM = 0 V, G = +1, RL, dm = 500 Ω , unless otherwise noted. All specifications refer to single ended input and differential outputs, unless otherwise noted.
- 3/ Specified to \pm 6 sigma over the -40 $^{\circ}$ C to +105 $^{\circ}$ C operating temperature range.
- 4/ Output swing capabilities vary over operating temperature. See FIGURE 5 for more information.
- 5/ At 25 $^{\circ}$ C, VS = 5 V, VOCM = 2.5 V, G = +1, RL, dm = 500 Ω , unless otherwise noted. All specifications refer to single ended input and differential outputs, unless otherwise noted.

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Case X



Dimensions					
Symbol	Millimeters		Symbol	Millimeters	
	Min	Max		Min	Max
A		1.10	D/E	2.80	3.20
A1	0.75	0.95	E1	4.65	5.15
A2	0.05	0.15	e	0.65 BSC	
b	0.25	0.40	L	0.40	0.80
c	0.09	0.23			

NOTES:

1. All linear dimensions are in millimeters.
2. Falls within JEDEC MO-187-AA.

FIGURE 1. Case outline.

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Case outline X			
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	-IN	8	+IN
2	VOCM	7	NC
3	V+	6	V-
4	+OUT	5	-OUT

FIGURE 2. Terminal connections.

Terminal		Description
Number	Mnemonic	
1	-IN	Negative input summing node.
2	VOCM	Voltage applied to this pin sets the common mode output voltage with a ratio of 1:1. For example, 1 Vdc on VOCM sets the dc bias level on +OUT and -OUT to 1 V.
3	V+	Positive supply voltage.
4	+OUT	Positive output. Note that the voltage at -DIN is inverted at +OUT.
5	-OUT	Negative output. Note that the voltage at +DIN is inverted at -OUT.
6	V-	Negative supply voltage.
7	NC	No connect.
8	+IN	Positive input summing node.

FIGURE 3. Terminal function.

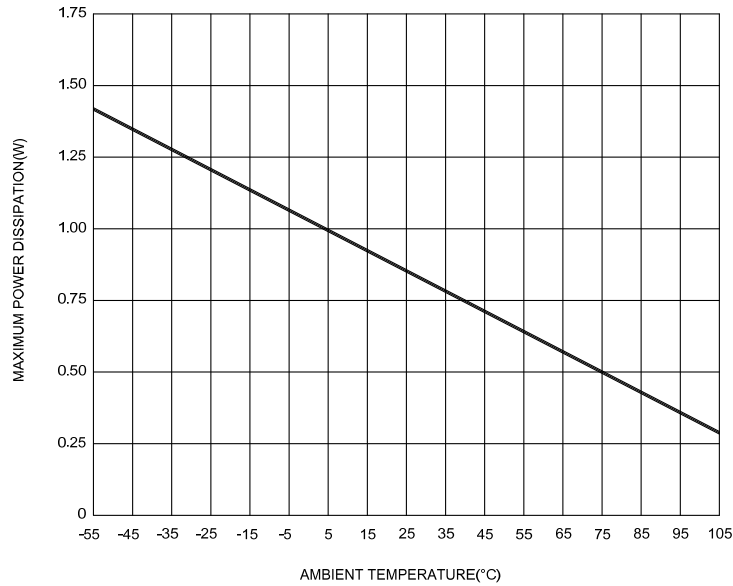


FIGURE 4. Maximum power dissipation versus ambient temperature.

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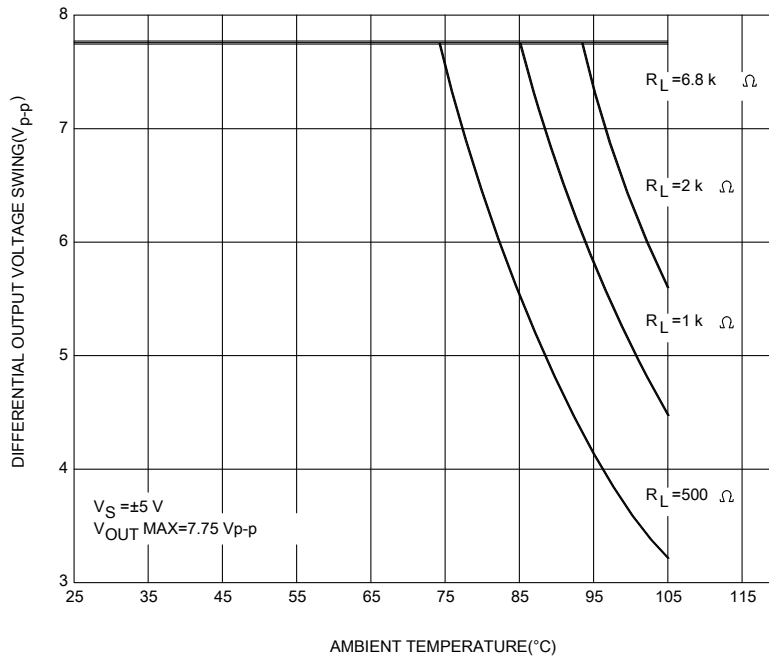


FIGURE 5. Differential output voltage swing versus ambient temperature, $V_S = \pm 5 V$.

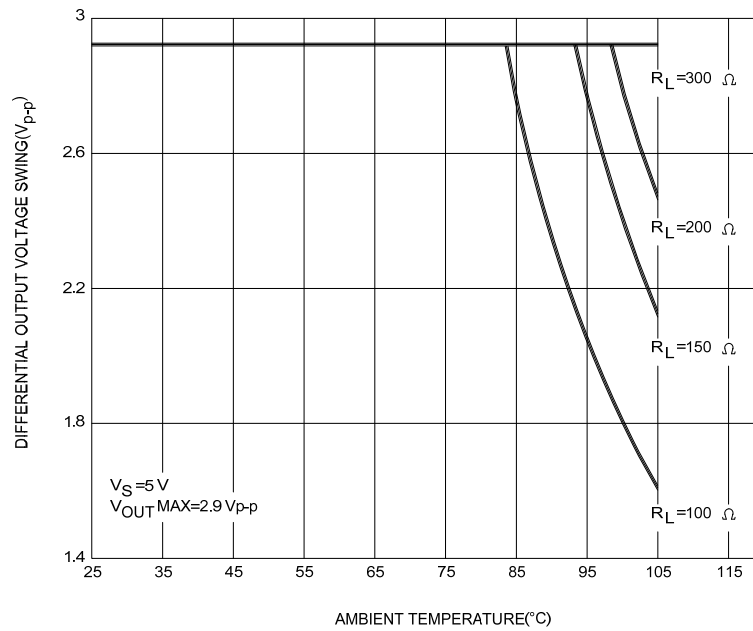


FIGURE 6. Differential output voltage swing versus ambient temperature, $V_S = 5 V$.

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4. VERIFICATION

4.1 Product assurance requirements. The manufacturer is responsible for performing all inspection and test requirements as indicated in their internal documentation. Such procedures should include proper handling of electrostatic sensitive devices, classification, packaging, and labeling of moisture sensitive devices, as applicable.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Preservation, packaging, labeling, and marking shall be in accordance with the manufacturer's standard commercial practices for electrostatic discharge sensitive devices.

6. NOTES

6.1 ESDS. Devices are electrostatic discharge sensitive and are classified as ESDS class 1 minimum.

6.2 Configuration control. The data contained herein is based on the salient characteristics of the device manufacturer's data book. The device manufacturer reserves the right to make changes without notice. This drawing will be modified as changes are provided.

6.3 Suggested source(s) of supply. Identification of the suggested source(s) of supply herein is not to be construed as a guarantee of present or continued availability as a source of supply for the item. DLA Land and Maritime maintains an online database of all current sources of supply at <https://landandmaritimeapps.dla.mil/programs/smcr/>.

Vendor item drawing administrative control number <u>1/</u>	Device manufacturer CAGE code	Vendor part number
V62/12629-01XE	24355	AD8138SRMZ-EP-R7

1/ The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation.

CAGE code

24355

Source of supply

Analog Devices
 Route 1 Industrial Park
 P.O. Box 9106
 Norwood, MA 02062
 Point of contact: 20 Alpha Road
 Chelmsford, MA 01824-4123

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