

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

Prepared in accordance with ASME Y14.24

Vendor item drawing

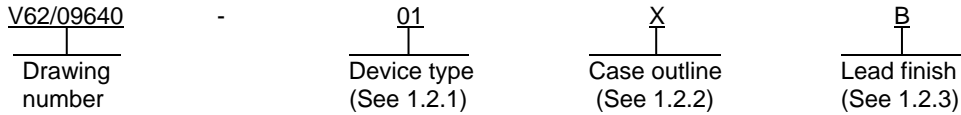
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PMIC N/A	PREPARED BY RICK OFFICER	DLA LAND AND MARITIME COLUMBUS, OHIO 43218-3990	
Original date of drawing YY-MM-DD 11-06-28	CHECKED BY RAJESH PITHADIA	TITLE MICROCIRCUIT, LINEAR, ULTRALOW POWER, VOLTAGE COMPARATOR, MONOLITHIC SILICON	
	APPROVED BY CHARLES F. SAFFLE		
	SIZE A	CODE IDENT. NO. 16236	DWG NO. V62/09640
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1. SCOPE

1.1 Scope. This drawing documents the general requirements of a ultralow power, voltage comparator microcircuit, with an operating temperature range of -55°C to +125°C.

1.2 Vendor Item Drawing Administrative Control Number. The manufacturers 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	MAX921	Single, micropower, voltage comparator with internal hysteresis and 1 % precision reference
02	MAX922	Dual, micropower, voltage comparator
03	MAX923	Dual, micropower, voltage comparator with internal hysteresis and 1 % precision reference
04	MAX924	Quad, micropower, voltage comparator

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	MS-012-AA	Small outline
Y	16	MS-012-AC	Small outline

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

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

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1.3 Absolute maximum ratings. 1/

+V to -V, +V to GND, GND to -V	-0.3 V +12 V
Inputs:	
Current, +IN_, -IN_, HYST	20 mA
Voltage, +IN_, -IN_, HYST	(+V + 0.3 V) to (-V - 0.3 V)
Outputs:	
Current, REF	20 mA
Current, OUT_	50 mA
Voltage, REF	(+V + 0.3 V) to (-V - 0.3 V)
Voltage, OUT_ :	
Device types 01, 04	(+V + 0.3 V) to (GND - 0.3 V)
Device types 02, 03	(+V + 0.3 V) to (-V - 0.3 V)
OUT_ short-circuit duration (+V ≤ 5.5 V)	Continuous
Junction temperature range (T _J)	+150°C
Storage temperature range (T _{STG})	-65°C to +150°C
Lead temperature (soldering, 10 seconds)	+300°C
Electrostatic discharge (ESD):	
Human body model (HBM)	2,500 V
Moisture sensitivity level (MSL)	Level 1

1.4 Recommended operating conditions. 2/

Operating free-air temperature range (T _A)	-55°C to +125°C
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1.5 Thermal data table.

Case outlines	X	X	Y	Y	Unit
PC board	Single layer	Multi-layer 3/	Single layer	Multi-layer 3/	
Power dissipation (P _D) maximum at 70°C	471	606	696	1067	mW
P _D derating above +70°C	5.9	7.6	8.7	13.3	mW/°C
Thermal resistance, junction to case (θ _{JC})	40	38	32	24	°C/W
Thermal resistance, junction to ambient (θ _{JA})	170	132	115	75	°C/W

1/ Stresses beyond those listed under “absolute maximum ratings” 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.

2/ Use of this product beyond the manufacturers design rules or stated parameters is done at the user’s risk. The manufacturer and/or distributor maintain no responsibility or liability for product used beyond the stated limits.

3/ Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to www.maxim-ic.com/thermal-tutorial.

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2. APPLICABLE DOCUMENTS

- JEDEC PUB 95 – Registered and Standard Outlines for Semiconductor Devices
- JEDEC JESD51-7 – High Effective Thermal Conductivity Test Board for Leaded Surface Mount Packages

(Applications for copies should be addressed to the JEDEC Office, 3103 North 10th Street, Suite 240-S, Arlington, VA 22201-2107 or online at <http://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 outlines. The case outlines 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.

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TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions +V = 5 V, -V = GND unless otherwise specified	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Power requirements							
Supply voltage range		2/	-55°C to +125°C	All	2.5	11	V
Supply current		+IN = -IN + 100 mV, HYST = REF	+25°C	01		3.2	μA
			-55°C to +125°C			5	
		+IN = -IN + 100 mV	+25°C	02		3.2	
			-55°C to +125°C			5	
		+IN = -IN + 100 mV, HYST = REF	+25°C	03		4.5	
			-55°C to +125°C			7.5	
+IN = -IN + 100 mV	+25°C	04		6.5			
	-55°C to +125°C			11			
Comparator section							
Input offset voltage	V _{OS}	V _{CM} = 2.5 V	-55°C to +125°C	All		±10	V
Input leakage current (-IN, +IN)	I _{INL}	+IN = -IN = 2.5 V	-55°C to +125°C	All		±40	nA
Input leakage current (HYST)	I _{INL}		-55°C to +125°C	01,03	±0.02 typical		nA
Input common mode voltage range			-55°C to +125°C	All	-V	+V - 1.3	V
Common mode rejection ratio	CMRR	-V to (+V - 1.3)	-55°C to +125°C	All		1.0	mV/V
Power supply rejection ratio	PSRR	+V = 2.5 V to 11 V	-55°C to +125°C	All		1.0	mV/V
Voltage noise		100 Hz to 100 kHz	-55°C to +125°C	All	20 typical		μV _{RMS}
Hysteresis input voltage range			-55°C to +125°C	01,03	REF - 0.05 V	REF	V
Response time		Overdrive = 10 mV, 100 pF load	+25°C	All	12 typical		μs
		Overdrive = 100 mV, 100 pF load			4 typical		

See footnotes at end of table.

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TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions +V = 5 V, -V = GND unless otherwise specified	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Comparator section – continued.							
Output high voltage	V _{OH}	I _{OUT} = 10 mA	-55°C to +125°C	All	+V - 0.4		V
Output low voltage	V _{OL}	I _{OUT} = 1.2 mA	-55°C to +125°C	01,04		GND + 0.4	V
				02,03		-V + 0.4	
Reference section							
Reference voltage	V _{REF}		-55°C to +125°C	01,03, 04	1.147	1.217	V
Source current	I _{SOURCE}		+25°C	01,03, 04	15		μA
			-55°C to +125°C		4		
Sink current	I _{SINK}		+25°C	01,03, 04	8		μA
			-55°C to +125°C		2		
Voltage noise		100 Hz to 100 kHz	-55°C to +125°C	01,03, 04	100 typical		μV _{RMS}

See footnotes at end of table.

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TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions +V = 3 V, -V = GND unless otherwise specified	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Power requirements							
Supply current		+IN = (-IN + 100 mV), HYST = REF	+25°C	01		3.0	μA
			-55°C to +125°C			4.8	
		+IN = (-IN + 100 mV)	+25°C	02		3.0	
			-55°C to +125°C			4.8	
		+IN = (-IN + 100 mV), HYST = REF	+25°C	03		4.3	
			-55°C to +125°C			7.2	
+IN = (-IN + 100 mV)	+25°C	04		6.2			
	-55°C to +125°C			10.5			
Comparator section							
Input offset voltage	V _{IO}	V _{CM} = 1.5 V	-55°C to +125°C	All		±10	mV
Input leakage current (-IN, +IN)		+IN = -IN = 1.5 V	-55°C to +125°C	All		±40	nA
Input leakage current (HYST)			-55°C to +125°C	01,03	±0.02 typical		nA
Input common mode voltage range			-55°C to +125°C	All	-V	+V – 1.3	V
Common mode rejection ratio	CMRR	-V to (+V – 1.3)	-55°C to +125°C	All		1	mV/V
Power supply rejection ratio	PSRR	+V = 2.5 V to 11 V	-55°C to +125°C	All		1	mV/V
Voltage noise		100 Hz to 100 kHz	-55°C to +125°C	All	20 typical		μV _{RMS}
Hysteresis input voltage range			-55°C to +125°C	01,03	REF – 0.05	REF	V
Response time		Overdrive = 10 mV, 100 pF load	+25°C	All	14 typical		μs
		Overdrive = 100 mV, 100 pF load			5 typical		
Output high voltage	V _{OH}	I _{OUT} = 6 mA	-55°C to +125°C	All	+V – 0.4		V
Output low voltage	V _{OL}	I _{OUT} = 0.6 mA	-55°C to +125°C	01,04		GND + 0.4	V
				02,03		-V + 0.4	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions +V = 3 V, -V = GND unless otherwise specified	Temperature, T _A	Device type	Limits		Unit
					Min	Max	
Reference section							
Reference voltage	V _{REF}		-55°C to +125°C	All	1.147	1.217	V
Source current	I _{SOURCE}		+25°C	All	15		μA
			-55°C to +125°C		4		
Sink current	I _{SINK}		+25°C	All	8		μA
			-55°C to +125°C		2		
Voltage noise		100 Hz to 100 kHz	-55°C to +125°C	All	100 typical		μV _{RMS}

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/ Device type 04 comparators work below 2.5 V. See the manufacturer's datasheet under the low voltage operation section for more details.

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Case X

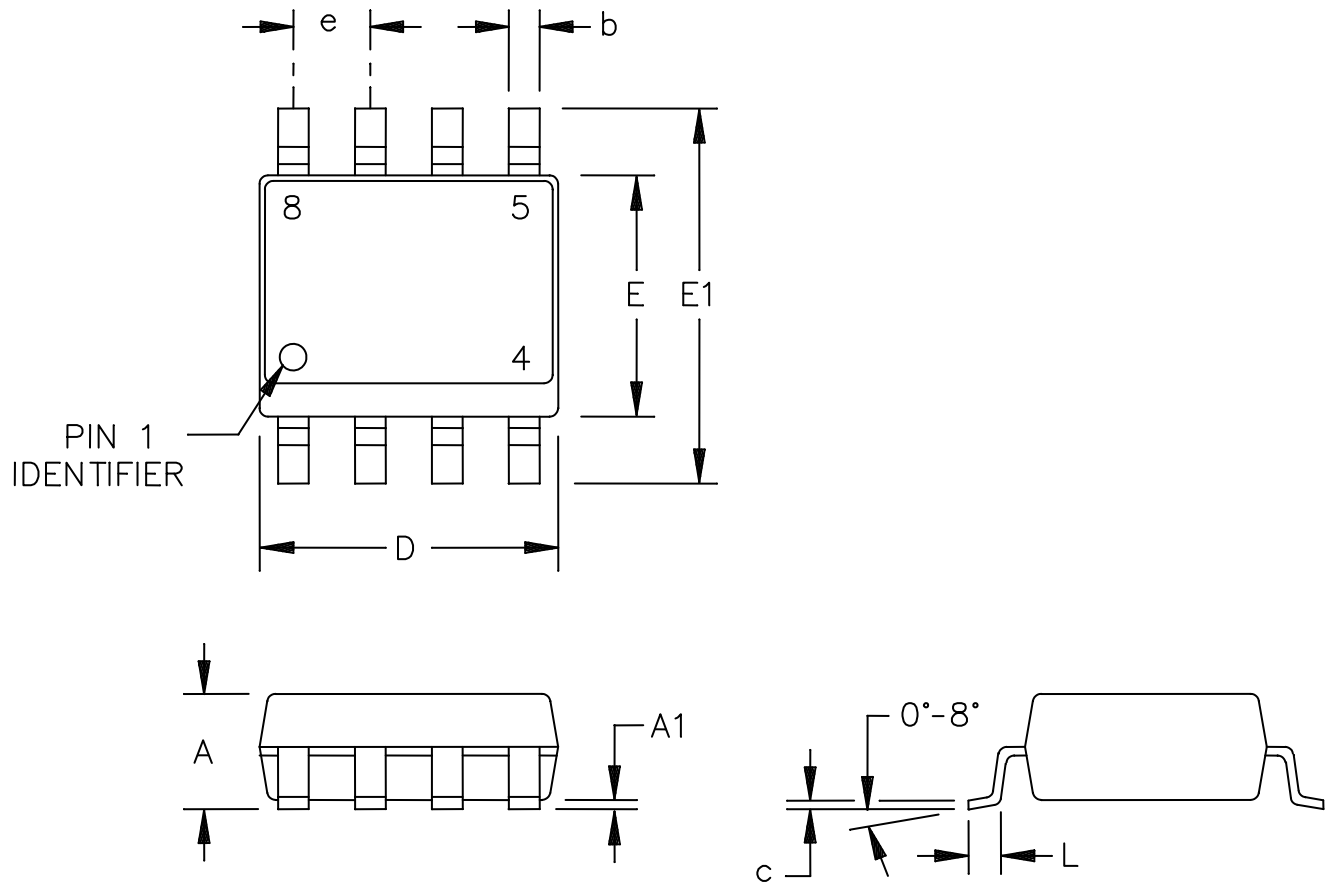


FIGURE 1. Case outline.

<p>DLA LAND AND MARITIME COLUMBUS, OHIO</p>	<p>SIZE A</p>	<p>CODE IDENT NO. 16236</p>	<p>DWG NO. V62/09640</p>
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Case X – continued.

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
b	0.014	0.019	0.35	0.49
c	0.007	0.010	0.19	0.25
D	0.189	0.197	4.80	5.00
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
E1	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
n	8		8	

NOTES:

1. Controlling dimensions are millimeter, inch dimensions are given for reference only.
2. Dimensions D and E do not include mold flash.
3. Mold flash or protrusions do not exceed 0.15 mm (0.006 inch).
4. Leads to be coplanar within 0.10 mm (.004 inch).
5. Falls within reference to JEDEC MS-012-AA.

FIGURE 1. Case outline - Continued.

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Case Y

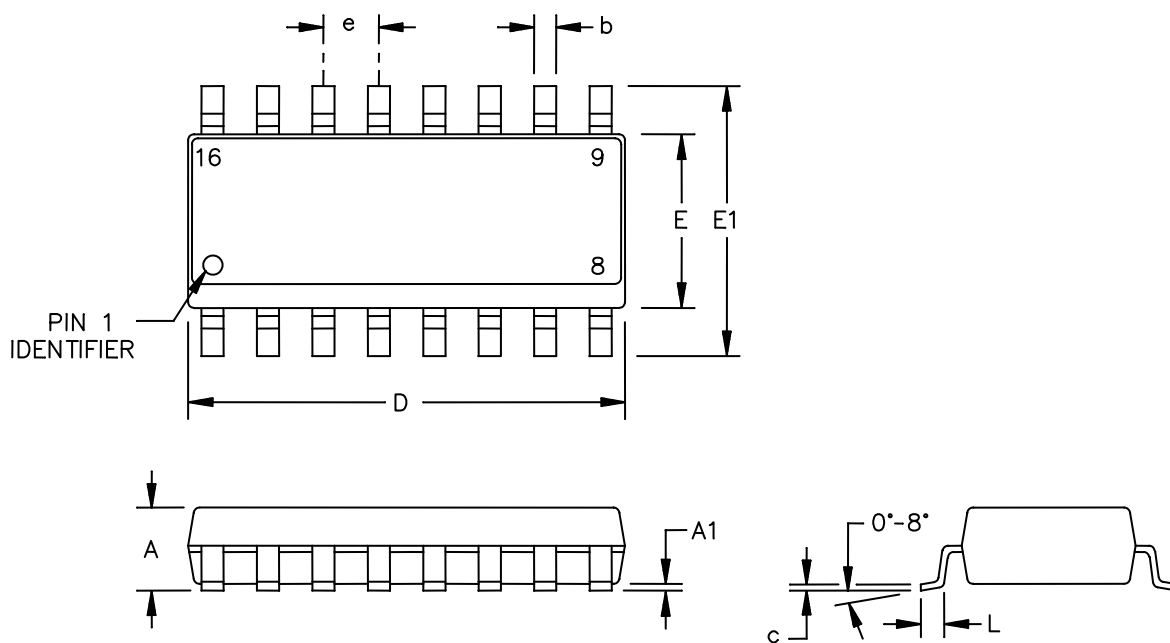


FIGURE 1. Case outline - Continued.

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Case Y – continued.

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
b	0.014	0.019	0.35	0.49
c	0.007	0.010	0.19	0.25
D	0.386	0.394	9.80	10.00
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
E1	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
n	16		16	

NOTES:

1. Controlling dimensions are millimeter, inch dimensions are given for reference only.
2. Dimensions D and E do not include mold flash.
3. Mold flash or protrusions do not exceed 0.15 mm (0.006 inch).
4. Leads to be coplanar within 0.10 mm (.004 inch).
5. Falls within reference to JEDEC MS-012-AC.

FIGURE 1. Case outline - Continued.

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Device types	01	02	03
Case outline	X		
Terminal number	Terminal symbol		
1	GND	OUTA	OUTA
2	-V	-V	-V
3	+IN	+INA	+INA
4	-IN	-INA	-INB
5	HYST	-INB	HYST
6	REF	+INB	REF
7	+V	+V	+V
8	OUT	OUTB	OUTB

Terminal symbol	Description
GND	Ground. Connect to $-V$ for single-supply operation. Output swings from $+V$ to GND.
OUTA	Comparator A output. Sinks and sources current. Swings from $+V$ to $-V$.
$-V$	Negative supply. Connect to ground for single-supply operation (device type 01).
+IN	Noninverting comparator input.
+INA	Noninverting input of comparator A.
-IN	Inverting comparator input.
-INA	Inverting input of comparator A.
-INB	Inverting input of comparator B.
HYST	Hysteresis input. Connect to REF if not used. Input voltage range is from V_{REF} to $V_{REF} - 50$ mV.
REF	Reference output. 1.182 V with respect to $-V$.
+INB	Noninverting input of comparator B.
+V	Positive supply.
OUT	Comparator output. Sinks and sources current. Swings from $+V$ to GND.
OUTB	Comparator B output. Sinks and sources current. Swings from $+V$ to $-V$.

FIGURE 2. Terminal connections.

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Device type	04	
Case outline	Y	
Terminal number	Terminal symbol	Description
1	OUTB	Comparator B output. Sinks and sources current. Swings from +V to GND.
2	OUTA	Comparator A output. Sinks and sources current. Swings from +V to GND.
3	+V	Positive supply.
4	-INA	Inverting input of comparator A.
5	+INA	Noninverting input of comparator A.
6	-INB	Inverting input of comparator B.
7	+INB	Noninverting input of comparator B.
8	REF	Reference output. 1.182 V with respect to -V.
9	-V	Negative supply. Connect to ground for single-supply operation.
10	-INC	Inverting input of comparator C.
11	+INC	Noninverting input of comparator C.
12	-IND	Inverting input of comparator D.
13	+IND	Noninverting input of comparator D.
14	GND	Ground. Connect to -V for single-supply operation.
15	OUTD	Comparator D output. Sinks and sources current. Swings from +V to GND.
16	OUTC	Comparator C output. Sinks and sources current. Swings from +V to GND.

FIGURE 2. Terminal connections – continued.

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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 2 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.

Vendor item drawing administrative control number <u>1/</u>	Device manufacturer CAGE code	Vendor part number <u>2/</u>
V62/09640-01XB	1ES66	MAX921MSA/PR
V62/09640-02XB	1ES66	MAX922MSA/PR
V62/09640-03XB	1ES66	MAX923MSA/PR
V62/09640-04YB	1ES66	MAX924MSE/PR

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

2/ Add "-T" suffix for tape and reel.

CAGE code

1ES66

Source of supply

Maxim Integrated Products
120 San Gabriel Drive
Sunnyvale, CA 94086-5125

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