REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

Prepared in accordance with ASME Y14.24

Vendor item drawing

REV																					
PAGE																					
REV																					
PAGE																					
REV STATUS OF PAGES		REV																			
		PAGE			1	2	3	4	5	6	7	8	9	10	11	12	13	14			

PMIC N/A	PREPARED BY Phu H. Nguyen		DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO 43218-3990
Original date of drawing YY MM DD 09-10-21	CHECKED BY Phu H. Nguyen		TITLE MICROCIRCUIT, DIGITAL, ULTRA-LOW POWER PRECISION SERIES VOLTAGE REFERENCE, MONOLITHIC SILICON
	APPROVED BY Thomas M. Hess		
	SIZE A	CODE IDENT. NO. 16236	DWG NO. V62/09648
	REV		PAGE 1 OF 14

1. SCOPE

1.1 Scope. This drawing documents the general requirements of An ultra low-power precision series voltage reference microcircuit, with an operating temperature range of -40°C to +85°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:

V62/09648	-	01	X	B
Drawing number		Device type (See 1.2.1)	Case outline (See 1.2.2)	Lead finish (See 1.2.3)

1.2.1 Device type(s).

Device type	Generic	Output voltage	Circuit function
01	MAX6029	2.048 V	Ultra-Low-Power precision Series Voltage Reference
02	MAX6029	2.500 V	Ultra-Low-Power precision Series Voltage Reference
03	MAX6029	3.000 V	Ultra-Low-Power precision Series Voltage Reference
04	MAX6029	3.300 V	Ultra-Low-Power precision Series Voltage Reference
05	MAX6029	4.096 V	Ultra-Low-Power precision Series Voltage Reference
06	MAX6029	5.000 V	Ultra-Low-Power precision Series Voltage Reference

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

Outline letter	Number of pins	JEDEC PUB 95	Package style
X	8	JEDEC MS012	Small outline
Y	5	JEDEC MO178	Small outline

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

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

1.3 Absolute maximum ratings. 1/

IN to GND .... -0.3 V to +13.0 V
OUT to GND .... -0.3 V to the lower of +6.0 V and (V_{IN} + 0.3 V)
Output to GND short circuit duration .... Continuous
Continuous power dissipation (T_A = +70°C)
Case outline X (derate 5.9 mW/°C above +70°C) .... 470.6 mW
Case outline Y (derate 7.1 mW/°C above +70°C) .... 571 mW
Operating temperature range .... -40°C to +85°C
Storage temperature range .... -65°C to 150°C
Lead temperature (soldering , 10 sec) .... +300°C
Electro Static Discharge (ESD)
Human Body Model (HBM) .... 1000 V
Moisture Sensitivity Level (MSL) .... Level 1

1.4 Thermal data table.

Case outline letter	X	X	Y	Y	Units
PC Board	Single Layer	Multi-Layer 2/	Single Layer	Multi-Layer 2/	
Power dissipation (P_D), maximum at +70°C	471	606	247	313	mW
Power dissipation (P_D) derating above +70°C	5.9	7.6	3.1	3.9	mW/°C
Thermal resistance, junction to case (θ_{JC})	40	38	82	81	°C/W
Thermal resistance, junction to ambient (θ_{JA})	170	132	324	256	°C/W

2. APPLICABLE DOCUMENTS

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

(Applications for copies should be addressed to the Electronic Industries Alliance, 2500 Wilson Boulevard, Arlington, VA 22201-3834 or online at http://www.jedec.org)

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/ 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 the manufacturer web site.

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.

TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions 2/ Device type 01 V_{IN} = 2.5 V	Limits		Unit
			Min	Max	
Output					
Output voltage	V_{OUT}	T_A = +25°C	2.0449	2.051	V
Output voltage temperature coefficient	TCV_{OUT}	3/ 4/		30	ppm/°C
Line regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.5 V to 12. 6 V		200	µV/V
Load regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4 mA		0.7	µV/µA
		I_{OUT} = 0 to -1 mA		5.5	
Output short circuit current	I_{SC}		60 TYP		mA
Long term stability	ΔV_{OUT}/time	1000 hours at +25°C	150 TYP		ppm
Thermal hysteresis		5/	140 TYP		ppm
Dynamic characteristics					
Noise voltage	e_{OUT}	f = 0.1 Hz to 10 Hz	30 TYP		$µV_{P-P}$
		f = 10 Hz to 1 kHz	115 TYP		$µV_{RMS}$
Ripple rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.5 V ±200 mV, f = 120 Hz	43 TYP		dB
Turn ON setting time	t_R	To V_{OUT} = 0.1 % of final value	450 TYP		µs
Input					
Supply voltage Range	V_{IN}		2.5	12.6	V
Supply current	I_{IN}			5.25	µA
Change in supply current	I_{IN}/V_{IN}	V_{IN} = 2.5 V to 12.6 V		1.5	µA/V

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued 1/

Test	Symbol	Conditions 2/ Device type 02 V_{IN} = 2.7 V		Limits Min	Limits Max	Unit
Output						
Output voltage	V_{OUT}	T_A = +25°C	Case outline Y	2.4963	2.5038	V
			Case outline X	2.495	2.505	
Output voltage temperature coefficient	TCV_{OUT}	3/ 4/			30	ppm/°C
Line regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.7 V to 12. 6 V			230	µV/V
Load regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4 mA			0.6	µV/µA
		I_{OUT} = 0 to -1 mA			6.2	
Drop out voltage 6/	V_{IN} - V_{OUT}	I_{OUT} = 0			100	mV
		I_{OUT} = 4 mA			200	
Output short circuit current	I_{SC}			60 TYP		mA
Long term stability	ΔV_{OUT}/time	1000 hours at +25°C		150 TYP		ppm
Thermal hysteresis		5/		140 TYP		ppm
Dynamic characteristics						
Noise voltage	e_{OUT}	f = 0.1 Hz to 10 Hz		39 TYP		μV_{P-P}
		f = 10 Hz to 1 kHz		137 TYP		μV_{RMS}
Ripple rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.7 V ±200 mV, f = 120 Hz		34 TYP		dB
Turn ON setting time	t_R	To V_{OUT} = 0.1 % of final value		700 TYP		µs
Input						
Supply voltage Range	V_{IN}			2.7	12.6	V
Supply current	I_{IN}				5.75	µA
Change in supply current	I_{IN}/V_{IN}	V_{IN} = 2.7 V to 12.6 V			1.5	µA/V

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued 1/

Test	Symbol	Conditions 2/ Device type 03 V_{IN} = 3.2 V	Limits		Unit
			Min	Max	
Output					
Output voltage	V_{OUT}	T_A = +25°C	2.9955	3.0045	V
Output voltage temperature coefficient	TCV_{OUT}	3/ 4/		30	ppm/°C
Line regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.2 V to 12. 6 V		250	µV/V
Load regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4 mA		0.6	µV/µA
		I_{OUT} = 0 to -1 mA		6.5	
Drop out voltage 6/	V_{IN} - V_{OUT}	I_{OUT} = 0		100	mV
		I_{OUT} = 4 mA		200	
Output short circuit current	I_{SC}		60 TYP		mA
Long term stability	ΔV_{OUT}/time	1000 hours at +25°C	150 TYP		ppm
Thermal hysteresis		5/	140 TYP		ppm
Dynamic characteristics					
Noise voltage	e_{OUT}	f = 0.1 Hz to 10 Hz	39 TYP		$µV_{P-P}$
		f = 10 Hz to 1 kHz	161 TYP		$µV_{RMS}$
Ripple rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.2 V ±200 mV, f = 120 Hz	37 TYP		dB
Turn ON setting time	t_R	To V_{OUT} = 0.1 % of final value	775 TYP		µs
Input					
Supply voltage Range	V_{IN}		23.2	12.6	V
Supply current	I_{IN}			6.75	µA
Change in supply current	I_{IN}/V_{IN}	V_{IN} = 3.2 V to 12.6 V		1.5	µA/V

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued 1/

Test	Symbol	Conditions 2/ Device type 04 V_{IN} = 3.5 V	Limits Min	Limits Max	Unit
Output					
Output voltage	V_{OUT}	T_A = +25°C	3.2951	3.3050	V
Output voltage temperature coefficient	TCV_{OUT}	3/ 4/		30	ppm/°C
Line regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.5 V to 12. 6 V		270	µV/V
Load regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4 mA		0.6	µV/µA
		I_{OUT} = 0 to -1 mA		7	
Drop out voltage 6/	$V_{IN} - V_{OUT}$	I_{OUT} = 0		100	mV
		I_{OUT} = 4 mA		200	
Output short circuit current	I_{SC}		60 TYP		mA
Long term stability	ΔV_{OUT}/time	1000 hours at +25°C	150 TYP		ppm
Thermal hysteresis		5/	140 TYP		ppm
Dynamic characteristics					
Noise voltage	e_{OUT}	f = 0.1 Hz to 10 Hz	56 TYP		$µV_{P-P}$
		f = 10 Hz to 1 kHz	174 TYP		$µV_{RMS}$
Ripple rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.5 V ±200 mV, f = 120 Hz	38 TYP		dB
Turn ON setting time	t_R	To V_{OUT} = 0.1 % of final value	1 TYP		ms
Input					
Supply voltage Range	V_{IN}		3.5	12.6	V
Supply current	I_{IN}			7.25	µA
Change in supply current	I_{IN}/V_{IN}	V_{IN} = 3.5 V to 12.6 V		1.5	µA/V

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued 1/

Test	Symbol	Conditions 2/ Device type 05 V_{IN} = 4.3 V		Limits Min	Limits Max	Unit
Output						
Output voltage	V_{OUT}	T_A = +25°C	Case outline Y	4.0899	4.1021	V
			Case outline X	4.088	4.104	
Output voltage temperature coefficient	TCV_{OUT}	3/ 4/			30	ppm/°C
Line regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 4.3 V to 12. 6 V			310	µV/V
Load regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4 mA			0.6	µV/µA
		I_{OUT} = 0 to -1 mA			8.5	
Drop out voltage 6/	V_{IN} - V_{OUT}	I_{OUT} = 0			100	mV
		I_{OUT} = 4 mA			200	
Output short circuit current	I_{SC}			60 TYP		mA
Long term stability	ΔV_{OUT}/time	1000 hours at +25°C		150 TYP		ppm
Thermal hysteresis		5/		140 TYP		ppm
Dynamic characteristics						
Noise voltage	e_{OUT}	f = 0.1 Hz to 10 Hz		72 TYP		μV_{P-P}
		f = 10 Hz to 1 kHz		210 TYP		μV_{RMS}
Ripple rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 4.3 V ±200 mV, f = 120 Hz		36 TYP		dB
Turn ON setting time	t_R	To V_{OUT} = 0.1 % of final value		1.2 TYP		ms
Input						
Supply voltage Range	V_{IN}			4.3	12.6	V
Supply current	I_{IN}				8.75	µA
Change in supply current	I_{IN}/V_{IN}	V_{IN} = 4.3 V to 12.6 V			1.5	µA/V

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued 1/

Test	Symbol	Conditions 2/ Device type 06 V_{IN} = 5.2 V	Limits Min	Limits Max	Unit
Output					
Output voltage	V_{OUT}	T_A = +25°C	4.9925	5.0075	V
Output voltage temperature coefficient	TCV_{OUT}	3/ 4/		30	ppm/°C
Line regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 5.2 V to 12. 6 V		375	µV/V
Load regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4 mA		0.8	µV/µA
		I_{OUT} = 0 to -1 mA		9	
Drop out voltage 6/	V_{IN} - V_{OUT}	I_{OUT} = 0		100	mV
		I_{OUT} = 4 mA		200	
Output short circuit current	I_{SC}		60 TYP		mA
Long term stability	ΔV_{OUT}/time	1000 hours at +25°C	150 TYP		ppm
Thermal hysteresis		5/	140 TYP		ppm
Dynamic characteristics					
Noise voltage	e_{OUT}	f = 0.1 Hz to 10 Hz	90 TYP		μV_{P-P}
		f = 10 Hz to 1 kHz	245 TYP		μV_{RMS}
Ripple rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 5.2 V ±200 mV, f = 120 Hz	38 TYP		dB
Turn ON setting time	t_R	To V_{OUT} = 0.1 % of final value	1.4 TYP		ms
Input					
Supply voltage Range	V_{IN}		5.2	12.6	V
Supply current	I_{IN}			10.5	µA
Change in supply current	I_{IN}/V_{IN}	V_{IN} = 5.2 V to 12.6 V		1.5	µA/V

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/ V_{IN} = 2.5 V, I_{OUT} = 0, T_A = -40°C to 85°C (unless otherwise noted). Typical values are at T_A = +25°C. The device is 100% production tested at T_A = +25°C and is guaranteed by design for T_A = -40°C to 85°C as specified.

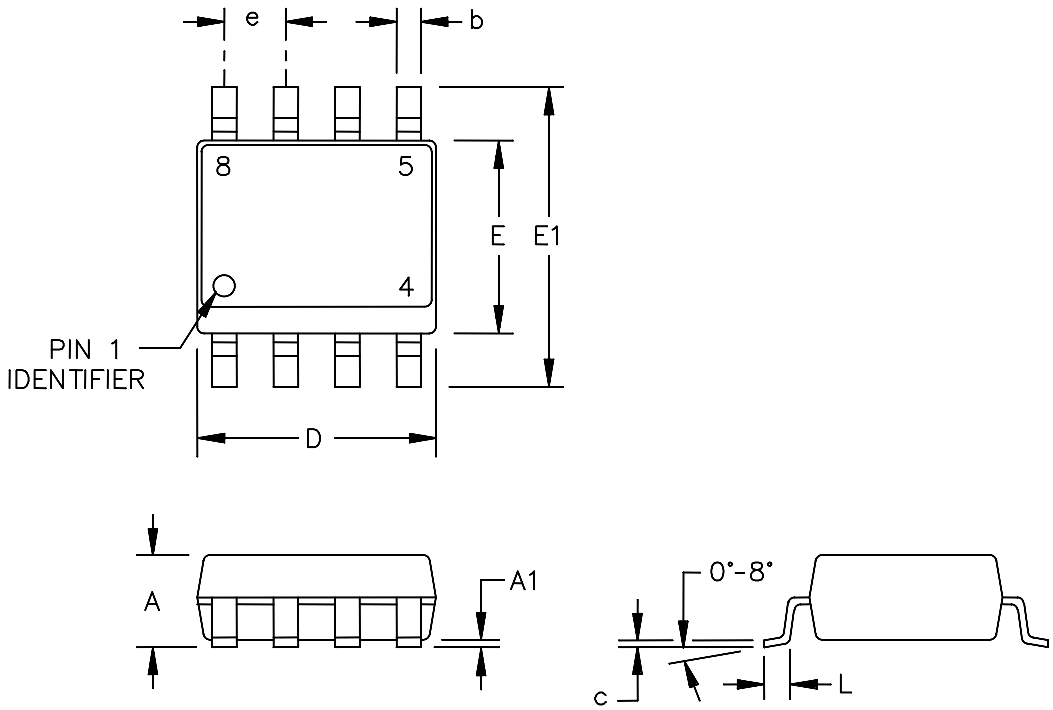
3/ Temperature coefficient is defined by box method: (VMAX – VMIN)/(ΔT x $V_{+25°C}$).

4/ Not production tested. Guaranteed by design.

5/ Thermal hysteresis is defined as the change in T_A = +25°C output voltage before and after temperature cycling of the device (from T_A = -40°C to 85°C). Initial measurement at T_A = +25°C is followed by temperature cycling the device to T_A = +85°C then to T_A = -40°C and another measurement at T_A = +25°C is compared to the origin measurement at T_A = +25°C.

6/ Dropout voltage is the minimum input voltage at which V_{OUT} changes by 0.1% from V_{OUT} at rated V_{IN} and is guaranteed by Load Regulation test.

Case X



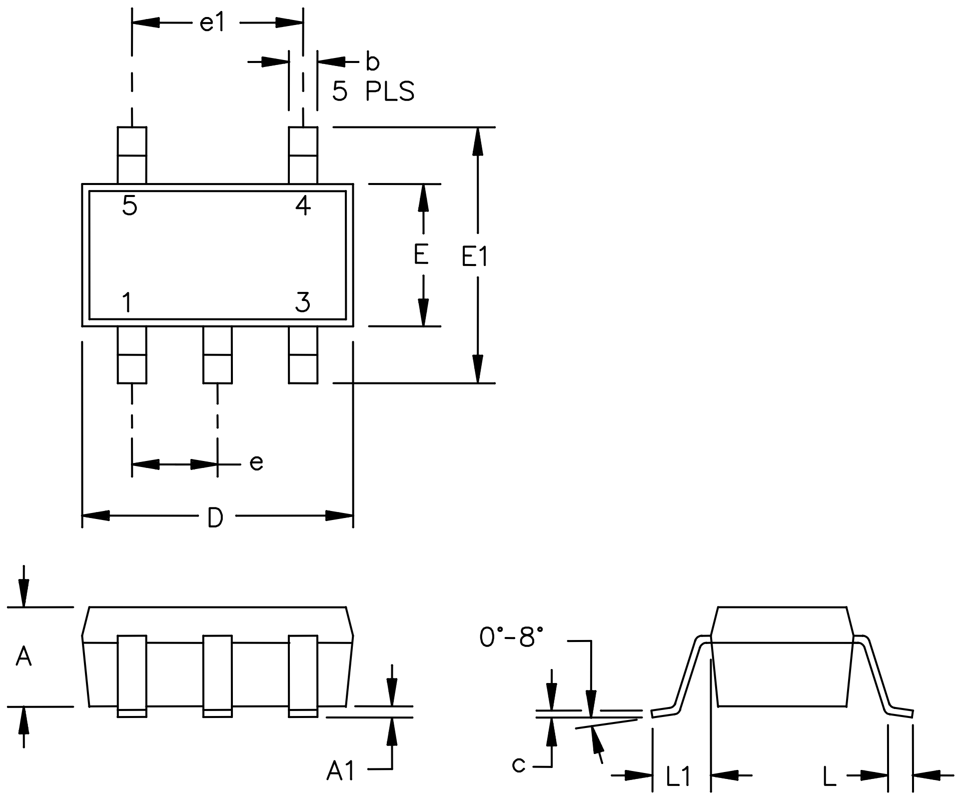
Dimensions									
Symbol	Inches		Millimeters		Symbol	Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	.053	.069	1.35	1.75	e	.050 BSC		1.27 BSC	
A1	.004	.010	0.10	0.25	E	.150	.157	3.80	4.00
b	.014	.019	0.35	0.49	E1	.228	.244	5.80	6.20
c	.007	.010	0.19	0.25	L	.016	.050	0.40	1.27
D	.189	.197	4.80	5.00					

NOTES:

1. D and E do not include mold flash.
2. Mold flash or protrusions not to exceed 0.15 mm (.006”).
3. Leads to be coplanar within 0.10 mm (.004”).
4. Meets JEDEC MS012-AA.
5. Controlling dimensions are millimeters. Inch dimensions are provide for reference only.

FIGURE 1. Case outline.

Case Y



Symbol	Millimeters		Symbol	Millimeters	
	Min	Max		Min	Max
A	0.90	1.45	E	2.60	3.00
A1	0.00	0.15	E1	1.50	1.75
A2	0.90	1.30	e	0.95 BSC	
b	0.35	0.50	e1	1.90 BSC	
c	0.08	0.20	L	0.35	0.60
D	2.80	3.00	L1	0.60 REF	

NOTES:
1. All dimensions are in millimeters.
2. Foot length measured at intercept point between datum A and lead surface.
3. Package outline exclusive of mold flash and metal burr. Mold flash, protrusion or metal burr should not exceed 0.25 mm.
4. Package outline inclusive of soldering plating.
5. Leads to be coplanar within 0.10 mm.
6. Meets JEDEC Mo178, variation AA.
7. Solder thickness measured at flash section of lead between 0.08 mm and 0.15 mm from lead tip.

FIGURE 1. Case outline - Continued.

Case outline X

Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	NC	5	NC
2	IN	6	OUT
3	NC	7	NC
4	GND	8	NC

NC = No internal connection

Case outline Y

Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	IN	4	NC
2	GND	5	OUT
3	NC		

NC = No internal connection

FIGURE 2. Terminal connections.

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.

Vendor item drawing administrative control number 1/	Device manufacturer CAGE code	Vendor part number
V62/09648-01XB	1ES66	MAX6029ESA21 2/
V62/09648-02XB	1ES66	MAX6029ESA25 2/
V62/09648-03XB	1ES66	MAX6029ESA30 2/
V62/09648-04XB	1ES66	MAX6029ESA33 2/
V62/09648-05XB	1ES66	MAX6029ESA41 2/
V62/09648-06XB	1ES66	MAX6029ESA50 2/
V62/09648-01YB	1ES66	MAX6029EUK21 2/
V62/09648-02YB	1ES66	MAX6029EUK25 2/
V62/09648-03YB	1ES66	MAX6029EUK30 2/
V62/09648-04YB	1ES66	MAX6029EUK33 2/
V62/09648-05YB	1ES66	MAX6029EUK41 2/
V62/09648-06YB	1ES66	MAX6029EUK50 2/

1/ The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation.
2/ For tape and reel add –T suffix to the part number.

CAGE code	Source of supply
1ES66	Maxim Integrated Products 120 San Gabriel Dr Sunnyvale, CA 94086-5125