







LM4040-N/-Q1 Precision Micropower Shunt Voltage Reference

1 Features

TEXAS

- SOT-23 AEC Q-100 Grades 1 and 3 Available
- Small Packages: SOT-23, TO-92, and SC70
- No Output Capacitor Required
- **Tolerates Capacitive Loads**
- Fixed Reverse Breakdown Voltages of 2.048 V, 2.5 V, 3 V, 4.096 V, 5 V, 8.192 V, and 10 V
- Key Specifications (2.5-V LM4040-N)
 - Output Voltage Tolerance (A Grade, 25°C): ±0.1% (Maximum)
 - Low Output Noise (10 Hz to 10 kHz): $35 \mu V_{rms}$ (Typical)
 - Wide Operating Current Range: 60 µA to 15
 - Industrial Temperature Range: −40°C to +85°C
 - Extended Temperature Range: -40°C to
 - Low Temperature Coefficient: 100 ppm/°C (Maximum)

2 Applications

- Portable, Battery-Powered Equipment
- Data Acquisition Systems
- Instrumentation
- **Process Controls**
- **Energy Management**
- Product Testing
- Automotives
- Precision Audio Components

3 Description

Ideal for space-critical applications, the LM4040-N precision voltage reference is available in the subminiature SC70 and SOT-23 surface-mount package. The advanced design of the LM4040-N eliminates the need for an external stabilizing capacitor while ensuring stability with any capacitive load, thus making the LM4040-N easy to use. Further reducing design effort is the availability of several fixed reverse breakdown voltages: 2.048 V. 2.5 V. 3 V. 4.096 V. 5 V, 8.192 V, and 10 V. The minimum operating current increases from 60 µA for the 2.5-V LM4040-N to 100 uA for the 10-V LM4040-N. All versions have a maximum operating current of 15 mA.

The LM4040-N uses a fuse and Zener-zap reverse breakdown voltage trim during wafer sort to ensure that the prime parts have an accuracy of better than ±0.1% (A grade) at 25°C. Bandgap reference temperature drift curvature correction and low dynamic impedance ensure stable reverse breakdown voltage accuracy over a wide range of operating temperatures and currents.

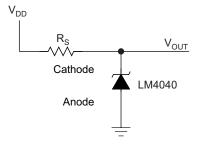
Also available is the LM4041-N with two reverse breakdown voltage versions: adjustable and 1.2 V. See the LM4041-N data sheet (SNOS641).

Device Information(1)

	PART NUMBER	PACKAGE	BODY SIZE (NOM)
		TO-92 (3)	4.30 mm × 4.30 mm
	LM4040-N	SC70 (5)	2.00 mm × 1.25 mm
		SOT-23 (3)	2.92 mm × 1.30 mm
	LM4040-N-Q1	SOT-23 (3)	2.92 mm × 1.30 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Shunt Reference Application Schematic



LM4040-N, LM4040-N-Q1

1

2

3

4

5

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016



www.ti.com

Table of Contents

Features 1	
Applications 1	
Description 1	
Revision History3	
Pin Configuration and Functions 4	
Specifications5	
6.1 Absolute Maximum Ratings 5	
6.2 ESD Ratings 5	
6.3 Recommended Operating Conditions6	
6.4 Thermal Information	
6.5 Electrical Characteristics: 2-V LM4040-N V _R Tolerance Grades 'A' And 'B'; Temperature Grade 'I' 7	
6.6 Electrical Characteristics: 2-V LM4040-N V _R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'I'	
6.7 Electrical Characteristics: 2-V LM4040-N V _R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E'	7
6.8 Electrical Characteristics: 2.5-V LM4040-N V _R Tolerance Grades 'A' And 'B'; Temperature Grade 'I' (AEC Grade 3)	8
6.9 Electrical Characteristics: 2.5-V LM4040-N V _R Tolerance Grades 'C', 'D', and 'E'; Temperature Grade 'I' (AEC Grade 3)	
6.10 Electrical Characteristics: 2.5-V LM4040-N V _R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E' (AEC Grade 1)	9
6.11 Electrical Characteristics: 3-V LM4040-N V _R	4.0
Tolerance Grades 'A' And 'B'; Temperature Grade	10
"	11
6.12 Electrical Characteristics: 3-V LM4040-N V _R Tolerance Grades (C', 'D', And 'E'; Temperature Grade 'I'	
6.13 Electrical Characteristics: 3-V LM4040-N V _R	12
Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E'	
6.14 Electrical Characteristics: 4.1-V LM4040-N V _R Tolerance Grades 'A' And 'B'; Temperature Grade 'I'	
6.15 Electrical Characteristics: 4.1-V LM4040-N V _R Tolerance Grades 'C' and 'D'; Temperature Grade 'I'	13
6.16 Electrical Characteristics: 5-V LM4040-N V _R Tolerance Grades 'A' And 'B'; Temperature Grade 'I'	

	6.17 Electrical Characteristics: 5-V LM4040-N V _R Tolerance Grades 'C' And 'D'; Temperature Grade 'I'
	6.18 Electrical Characteristics: 5-V LM4040-N V _R Tolerance Grades 'C' And 'D'; Temperature Grade 'E'
	6.19 Electrical Characteristics: 8.2-V LM4040-N V _R Tolerance Grades 'A' And 'B'; Temperature Grade 'I'
	6.20 Electrical Characteristics: 8.2-V Lm4040-N V _R Tolerance Grades 'C' And 'D'; Temperature Grade 'I'
	6.21 Electrical Characteristics: 10-V LM4040-N V _R Tolerance Grades 'A' And 'B'; Temperature Grade 'I'
	6.22 Electrical Characteristics: 10-V LM4040-N V _R Tolerance Grades 'C' And 'D'; Temperature Grade 'I'
	6.23 Typical Characteristics
7	Parameter Measurement Information
8	Detailed Description
	8.1 Overview
	8.2 Functional Block Diagram
	8.3 Feature Description
	8.4 Device Functional Modes
9	Application and Implementation 34
	9.1 Application Information
	9.2 Typical Applications
10	Power Supply Recommendations 41
11	l Layout 41
	11.1 Layout Guidelines 41
	11.2 Layout Example
12	2 Device and Documentation Support 42
	12.1 Documentation Support42
	12.2 Related Links
	12.3 Community Resources 42
	12.4 Trademarks
	12.5 Electrostatic Discharge Caution
	12.6 Glossary
13	,
	Information 42
	13.1 SOT-23 and SC70 Package Marking Information 42



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

www.ti.com

4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

C	hanges from Revision J (August 2015) to Revision K	Page
<u>.</u>	Updated pinout diagrams	4
С	hanges from Revision I (April 2015) to Revision J	Page
<u>C</u>	hanges from Revision I (April 2015) to Revision J Added ESD Ratings table, Feature Description section, Device Functional Modes section, Application and Implementation section, Power Supply Recommendations section, Layout section, Device and Documentation	Page

Changes from Revision G (July 2012) to Revision H

Changes from Revision H (April 2013) to Revision I

Page

Page

Added some of the latest inclusions from new TI formatting and made available of the automotive grade for the

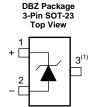
LM4040-N, LM4040-N-Q1

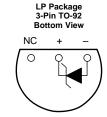


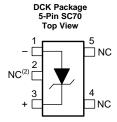
www.ti.com

SNOS633K-OCTOBER 2000-REVISED JUNE 2016

5 Pin Configuration and Functions







Pin Functions

Till Tullottolis										
		PIN		1/0	DESCRIPTION					
NAME	SOT-23	TO-92	SC70	1/0	DESCRIPTION					
Anode	2	1	1	0	Anode pin, normally grounded					
Cathode	1	2	3	I/O	Shunt Current/Output Voltage					
NC	3 ⁽¹⁾	_	2 ⁽²⁾	_	Must float or connect to anode					
NC	_	3	4, 5	_	No connect					

(1) This pin must be left floating or connected to pin 2.(2) This pin must be left floating or connected to pin 1.

Copyright © 2000-2016, Texas Instruments Incorporated Product Folder Links: LM4040-N LM4040-N-Q1 Submit Documentation Feedback

Submit Documentation Feedback

Copyright © 2000-2016, Texas Instruments Incorporated

Product Folder Links: LM4040-N LM4040-N-Q1



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

6 Specifications

www.ti.com

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)(2)

		MIN	MAX	UNIT
Reverse current			20	mA
Forward current			10	mA
	SOT-23 (M3) package		306	mW
Power dissipation (T _A = 25°C) ⁽³⁾	TO-92 (Z) package		550	mW
20 0)	SC70 (M7) package		241	mW
	TO-92 (Z) package SC70 (M7) package SOT-23 (M3) Package Peak Reflow (30 sec) TO-92 (Z) Package Soldering (10 sec) SC70 (M7) Package Peak Reflow (30 sec)		260	°C
Soldering temperature (4)	TO-92 (Z) Package Soldering (10 sec)		260	°C
SC70 (M7) package 241 SOT-23 (M3) Package Peak Reflow (30 sec) 260 TO-92 (Z) Package Soldering (10 sec) 260	°C			
Storage temperature		-65	150	°C

- (1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
- (3) The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), R_{BJA} (junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is PD_{max} = (T_{Jmax} T_A)/R_{BJA} or the number given in the *Absolute Maximum Ratings*, whichever is lower. For the LM4040-N, T_{Jmax} = 125°C, and the typical thermal resistance (R_{BJA}), when board mounted, is 326°C/W for the SOT-23 package, and 180°C/W with 0.4° lead length and 170°C/W with 0.125° lead length for the TO-92 package and 415°C/W for the SC70 Package.
- (4) For definitions of Peak Reflow Temperatures for Surface Mount devices, see the TI Absolute Maximum Ratings for Soldering Application Report (SNOA549).

6.2 ESD Ratings

			VALUE	UNIT
		Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 (1)		
V _(ESD)	Electrostatic discharge	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±200	V

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

LM4040-N, LM4040-N-Q1



SNOS633K-OCTOBER 2000-REVISED JUNE 2016

www.ti.com

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)(1)(2)

		MIN	MAX	UNIT
Temperature	Industrial Temperature	-40°C ≤ T _A ≤ 85		°C
$(T_{min} \le T_A \le T_{max})$	Extended Temperature	-40 ≤ T _A ≤ 125°C		°C
	LM4040-N-2.0	60	15	μA to mA
	LM4040-N-2.5	60	15	μA to mA
	LM4040-N-3.0	62	15	μA to mA
Reverse Current	LM4040-N-4.1	68	15	μA to mA
	LM4040-N-5.0	74	15	μA to mA
	LM4040-N-8.2	91	15	μA to mA
	LM4040-N-10.0	100	15	μA to mA

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Recommended Operating Conditions indicate conditions for which the device is functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
- (2) The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), R_{BJA} (junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is PD_{max} = (T_{Jmax} T_A)/R_{BJA} or the number given in the Absolute Maximum Ratings, whichever is lower. For the LM4040-N, T_{Jmax} = 125°C, and the typical thermal resistance (R_{BJA}), when board mounted, is 326°C/W for the SOT-23 package, and 180°C/W with 0.4" lead length and 170°C/W with 0.125" lead length for the TO-92 package and 415°C/W for the SC70 package.

6.4 Thermal Information

		LM4			
	THERMAL METRIC ⁽¹⁾	DBZ (SOT-23)	LP (TO-92)	DCK (SC70)	UNIT
		3 PINS	3 PINS	5 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	291.9	166	267	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	114.3	88.2	95.6	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	62.3	145.2	48.1	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	7.4	32.5	2.4	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	61	N/A	47.3	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application

Product Folder Links: LM4040-N LM4040-N-Q1

Product Folder Links: LM4040-N LM4040-N-Q1

Copyright © 2000-2016. Texas Instruments Incorporated



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

6.5 Electrical Characteristics: 2-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'I'

all other limits $T_A = T_J = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and $\pm 0.2\%$, respectively.

	PARAMETER		TEST CONDITIONS		MIN ⁽¹⁾	TYP	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				2.048		٧
	Reverse Breakdown		LM4040AIM3 LM4040AIZ				±2	
V_{R}		rse Breakdown	LM4040BIM3 LM4040BIZ LM4040BIM7				±4.1	mV
	Voltage Tolerance (2)	Ι _R = 100 μΑ	LM4040AIM3 LM4040AIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±15	
			LM4040BIM3 LM4040BIZ LM4040BIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±17	mV
	Minimum Operating		$T_A = T_J = 25$ °C			45	60	μA
I _{RMIN}	Current		$T_A = T_J = T_{MIN}$ to T_{MAX}				65	μΑ
	Average Reverse Breakdown Voltage	$I_R = 10 \text{ mA}$				±20		ppm/°C
ΔV _R /ΔΤ		I _R = 1 mA	$T_{A} = T_{J} = 25^{\circ}C$			±15		ppm/°C
7 1 K/ 7 1	Temperature Coefficient ⁽²⁾	1R = 1 111/1	$T_A = T_J = T_{MIN}$ to T_{MAX}				±100	ррпі, С
	Cocmoient	$I_R = 100 \mu A$				±15		ppm/°C
	Reverse Breakdown	$I_{RMIN} \le I_R \le 1 \text{ mA}$	$T_A = T_J = 25$ °C			0.3	0.8	mV
$\Delta V_R/\Delta I$	Voltage Change with	tage Change with		$T_A = T_J = T_{MIN}$ to T_{MAX}			1	1110
R	Operating Current Change (3)	1 mA ≤ I _R ≤ 15 mA	$T_A = T_J = 25$ °C			2.5	6	mV
	Chango	1 1111/2 1g = 10 1111/	$T_A = T_J = T_{MIN}$ to T_{MAX}				8	111.4
Z_R	Reverse Dynamic Impedance	I _R = 1 mA, f = 120 Hz, I _{AC} = 0.1 I _R				0.3	0.8	Ω
e_N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz				35		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA				120		ppm
V _{HYST}	Thermal Hysteresis (4)	$\Delta T = -40$ °C to 125°C				0.08%		

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±((ΔV_R/ΔT)(maxΔT)(V_R)]. Where, ΔV_R/ΔT is the V_R temperature coefficient, maxΔT is the maximum difference in temperature from the reference point of 25°C to T_{MIN} or T_{MAX}, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65°C$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100$ ppm/°C × 100 °C

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100 ^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ± 2.5 V \times 0.75% = ± 19 mV.

(3) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Product Folder Links: I M4040-N I M4040-N-Q1

(4) Thermal hysteresis is defined as the difference in voltage measured at 25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.





SNOS633K-OCTOBER 2000-REVISED JUNE 2016

www.ti.com

6.6 Electrical Characteristics: 2-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'I'

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and $\pm 2\%$, respectively.

F	PARAMETER		TEST CONDITI	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 100 μA				2.048		V
			LM4040CIM3	$T_A = T_J = 25^{\circ}C$			±10	
			LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±23	
V_R	Reverse Breakdown	Ι _R = 100 μΑ	LM4040DIM3	$T_A = T_J = 25$ °C			±20	mV
	Voltage Tolerance (3)	Ι _R = 100 μΑ	LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±40	IIIV
			LM4040EIZ	$T_A = T_J = 25^{\circ}C$			±41	
			LM4040EIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±60	
			LM4040CIM3	$T_A = T_J = 25$ °C		45	60	
		g	LM4040CIZ LM4040CIM7	$T_{A}=T_{J}=T_{MIN} \ to \ T_{MAX}$			65	
	Minimum Operating		LM4040DIM3 LM4040DIZ LM4040DIM7	$T_A = T_J = 25$ °C		45	65	μA
I _{RMIN}	Current			$T_A = T_J = T_{MIN}$ to T_{MAX}			70	μΑ
			LM4040EIZ	$T_A = T_J = 25^{\circ}C$		45	65	
			LM4040EIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			70	
		I _R = 10 mA				±20		
			LM4040CIM3	$T_A = T_J = 25$ °C		±15		
	A	_	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	
A)/ /AT	Average Reverse Breakdown Voltage	l = 1 mΛ	LM4040DIM3	$T_A = T_J = 25^{\circ}C$		±15		nnm/°C
ΔVR/ΔI	Temperature Coefficient ⁽³⁾	I _R = 1 mA	LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	ppm/°C
			LM4040EIZ	$T_A = T_J = 25^{\circ}C$		±15		
			LM4040EIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
ΔV _R /ΔT		I _R = 100 μA				±15		

- (1) Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
-) Typicals are at T_J = 25°C and represent most likely parametric norm.
- 3) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[(ΔV_F/ΔT)(maxΔT)(V_R)]. Where, ΔV_R/ΔT is the V_R temperature coefficient, maxΔT is the maximum difference in temperature from the reference point of 25°C to T _{MIN} or T _{Max}, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/}^{\circ}\text{C} \times 65^{\circ}\text{C}$ B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/}^{\circ}\text{C} \times 65^{\circ}\text{C}$ C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/}^{\circ}\text{C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/}^{\circ}\text{C} \times 65^{\circ}\text{C}$ E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/}^{\circ}\text{C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$ D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$ E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x 0.75% = ±19 mV.



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Electrical Characteristics: 2-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'I' (continued)

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and +2% respectively

ı	PARAMETER		TEST CONDITIO	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
			LM4040CIM3 LM4040CIZ LM4040CIM7	$T_A = T_J = 25$ °C $T_A = T_J = T_{MIN}$ to T_{MAX}		0.3	0.8	
		I _{RMIN} ≤ I _R ≤ 1 mA	LM4040DIM3	$T_A = T_J = 25$ °C		0.3	1	
			LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	
	Reverse Breakdown		LM4040EIZ	$T_A = T_J = 25$ °C		0.3	1	
$\Delta V_R/\Delta I_R$	Voltage Change		LM4040EIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	mV
ΔVR/ΔIR	with Operating Current Change ⁽⁴⁾		LM4040CIM3	$T_A = T_J = 25$ °C		2.5	6	1117
	ouncil orlange		LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			8	
		1 mA ≤ I _R ≤ 15 mA	LM4040DIM3 LM4040DIZ LM4040DIM7	$T_A = T_J = 25$ °C		2.5	8	
				$T_A = T_J = T_{MIN}$ to T_{MAX}			10	
			LM4040EIZ	$T_A = T_J = 25$ °C		2.5	8	
			LM4040EIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	
			LM4040CIM3 LM4040CIZ LM4040CIM7			0.3	0.9	
Z _R	Reverse Dynamic Impedance		LM4040DIM3 LM4040DIZ LM4040DIM7			0.3	1.1	Ω
			LM4040EIZ LM4040EIM7			0.3	1.1	
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz				35		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA				120		ppm
V _{HYST}	Thermal Hysteresis (5)	$\Delta T = -40$ °C to 125°C				0.08%		

- (4) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- Thermal hysteresis is defined as the difference in voltage measured at 25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.





SNOS633K - OCTOBER 2000-REVISED JUNE 2016

6.7 Electrical Characteristics: 2-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E'

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and ±2%, respectively.

	PARAMETER		TEST CONDITI	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				2.048		V
			LMAGAGOEMG	$T_A = T_J = 25^{\circ}C$			±10	
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	±30						
V_R	Reverse Breakdown	1 4004	LMAGAGDEMO	$T_A = T_J = 25^{\circ}C$			±20	mV
	Voltage Tolerance (3)	I _R = 100 μA	LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±50	mv
			LMAGAGEEMS	$T_A = T_J = 25^{\circ}C$			±41	
			LIVI4040EEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±70	
			LMAGAGOEMG	$T_A = T_J = 25^{\circ}C$		45	60	
			LIM4040CEIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			68	
	Minimum Operating			$T_A = T_J = 25^{\circ}C$		45	65	
I _{RMIN}	Current		LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			73	μA
				$T_A = T_J = 25^{\circ}C$		45	65	
			LM4040EEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			73	
		I _R = 10 mA				±20	±41 ±70 60 68 65 73 65 73 ±100 ±150 0.8 1 1.2 1	
	Average Reverse Breakdown Voltage Temperature			$T_A = T_J = 25^{\circ}C$		±15		
	_		LM4040CEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	
$V_R/\Delta T \begin{tabular}{l l} $T_A = T_J = T_{MIN} \ to \ T_{MAX} \\ \hline \\ V_R/\Delta T \begin{tabular}{l l} $I_R = 10 \ mA \end{tabular} \begin{tabular}{l l} $I_R = 10 \ mA \end{tabular} \begin{tabular}{l l} $I_R = 10 \ mA \end{tabular} \begin{tabular}{l l} $LM4040CEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l l} $LM4040DEM3 \end{tabular} \begin{tabular}{l l} $T_A = T_J = 25^\circ C \end{tabular} \begin{tabular}{l}$								
ΔV _R /Δ I	Temperature	I _R = 1 mA	LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	ppm/°
	Coefficient			$T_A = T_J = 25^{\circ}C$		±15		
			LM4040EEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		I _R = 100 μA				±15		
				$T_A = T_J = 25^{\circ}C$		0.3	0.8	
			LM4040CEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1	
				$T_A = T_J = 25^{\circ}C$		0.3	1	
		$I_{RMIN} \le I_R \le 1 \text{ mA}$	LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	
				$T_A = T_J = 25^{\circ}C$		0.3	1	
$\Delta V_R/\Delta I$			LM4040EEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	
R R	Operating Current					2.5	6	mV
	Change (**)		LM4040CEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			8	
						2.5	8	
		$1 \text{ mA} \le I_R \le 15 \text{ mA}$	LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	-
						2.5	8	
			LM4040EEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	

- (1) Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at T_J = 25°C and represent most likely parametric norm.
- The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, max ΔT is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where max $\Delta T = 65$ °C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x

Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Copyright © 2000-2016. Texas Instruments Incorporated



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Electrical Characteristics: 2-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E' (continued)

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and ±2%, respectively.

	PARAMETER		TEST CONDITIONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
			LM4040CEM3	0.3		0.9	
Z_R	Reverse Dynamic Impedance	$I_R = 1 \text{ mA}, f = 120 \text{ Hz},$ $I_{\Delta C} = 0.1 I_R$	LM4040DEM3		0.3	1.1	Ω
	mpodanoo	AC = OTT R	LM4040EEM3		0.3	0.9	
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz			35		μV_{rms}
ΔV _R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA			120		ppm
V _{HYST}	Thermal Hysteresis (5)	ΔT = -40°C to 125°C			0.08%		

⁽⁵⁾ Thermal hysteresis is defined as the difference in voltage measured at 25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

6.8 Electrical Characteristics: 2.5-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'I' (AEC Grade 3)

all other limits T_A = T_I = 25°C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and +0.2% respectively

	PARAMETER		TEST CONDITIO	NS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 100 μA				2.5		V
			LM4040AIM3	$T_A = T_J = 25$ °C			±2.5	
V_R	Davis - Davidski		LM4040AIZ LM4040AIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±19	
	Reverse Breakdown Voltage Tolerance ⁽³⁾	$I_R = 100 \mu A$	LM4040BIM3	$T_A = T_J = 25$ °C			±5	mV
			LM4040BIZ LM4040BIM7 LM4040QBIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±21	
	Minimum Operating		$T_A = T_J = 25$ °C			45	60	
I _{RMIN}	Current		$T_A = T_J = T_{MIN}$ to	T _{MAX}			65	μA
	A	I _R = 10 mA				±20		
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage	1 1 2 2	T _A = T _J = 25°C			±15		ppm/°C
ΔVR/ΔI	Temperature Coefficient ⁽³⁾	I _R = 1 mA	$T_A = T_J = T_{MIN}$ to	T _{MAX}			±100	ppm/ C
	Coemcient	I _R = 100 μA				±15		

Typicals are at T_J = 25°C and represent most likely parametric norm.

The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, $max\Delta T$ is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where $\max \Delta T = 65^{\circ} \text{C}$ is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/}^{\circ}\text{C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Copyright © 2000-2016. Texas Instruments Incorporated

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x $0.75\% = \pm 19 \text{ mV}.$

Submit Documentation Feedback

LM4040-N, LM4040-N-Q1



SNOS633K - OCTOBER 2000-REVISED JUNE 2016

www.ti.com

Electrical Characteristics: 2.5-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'I' (AEC Grade 3) (continued)

all other limits $T_A = T_J = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and ±0.2%, respectively.

	PARAMETER		TEST CONDITIONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown	I _{RMIN} ≤ I _R ≤ 1 mA	$T_A = T_J = 25$ °C		0.3	0.8	
$\Delta V_R/\Delta I$	Voltage Change with	IRMIN = IR = I IIIA	$T_A = T_J = T_{MIN}$ to T_{MAX}			1	mV
R	Operating Current Change (4)	1 mA ≤ I _R ≤ 15 mA	$T_A = T_J = 25$ °C		2.5	6	IIIV
	Change	I IIIA S IR S IO IIIA	$T_A = T_J = T_{MIN}$ to T_{MAX}			8	
Z _R	Reverse Dynamic Impedance	$I_R = 1 \text{ mA}, f = 120 \text{ Hz}, \\ I_{AC} = 0.1 I_R$			0.3	0.8	Ω
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz			35		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA			120		ppm
V _{HYST}	Thermal Hysteresis (5)	ΔT = −40°C to 125°C			0.08%		

⁽⁴⁾ Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.

⁽⁵⁾ Thermal hysteresis is defined as the difference in voltage measured at 25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

6.9 Electrical Characteristics: 2.5-V LM4040-N V_R Tolerance Grades 'C', 'D', and 'E'; Temperature Grade 'I' (AEC Grade 3)

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and ±2%, respectively.

	PARAMETER		TEST CONDITION	IS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				2.5		٧
			LM4040CIZ	$T_A = T_J = 25$ °C			±12	
			LM4040CIM3 LM4040CIM7 LM4040QCIM3	$T_A = T_J = T_{MIN} \ to \ T_{MAX}$			±29	
V_R			LM4040DIZ	$T_A = T_J = 25$ °C			±25	
	Reverse Breakdown Voltage Tolerance ⁽³⁾	Ι _R = 100 μΑ	LM4040DIM3 LM4040DIM7 LM4040QDIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±49	mV
			LM4040EIZ	$T_A = T_J = 25$ °C			±50	
			LM4040EIM3 LM4040EIM7 LM4040QEIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±74	
			LM4040CIZ	$T_A = T_J = 25$ °C		45	60	
			LM4040CIM3 LM4040CIM7 LM4040QCIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			65	
	Minimum Operation		LM4040DIZ	$T_A = T_J = 25$ °C		45	65	
I _{RMIN}	Minimum Operating Current		LM4040DIM3 LM4040DIM7 LM4040QDIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			70	μA
			LM4040EIZ	$T_A = T_J = 25$ °C		45	65	
			LM4040EIM3 LM4040EIM7 LM4040QEIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			70	
		I _R = 10 mA				±20		
			LM4040CIZ	$T_A = T_J = 25$ °C		±15		
			LM4040CIM3 LM4040CIM7 LM4040QCIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	
	Average Reverse		LM4040DIZ	$T_A = T_J = 25$ °C		±15		
$\Delta V_R / \Delta T$	Breakdown Voltage Temperature Coefficient (3)	I _R = 1 mA	LM4040DIM3 LM4040DIM7 LM4040QDIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	ppm/°C
			LM4040EIZ	$T_A = T_J = 25$ °C		±15		
			LM4040EIM3 LM4040EIM7 LM4040QEIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		$I_R = 100 \mu A$				±15		

Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.

Typicals are at T_J = 25°C and represent most likely parametric norm.

The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, $max\Delta T$ is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where $\max \Delta T = 65^{\circ} \text{C}$ is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/}^{\circ}\text{C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x $0.75\% = \pm 19 \text{ mV}.$

Copyright © 2000-2016. Texas Instruments Incorporated

Submit Documentation Feedback

SNOS633K - OCTOBER 2000-REVISED JUNE 2016



www.ti.com

LM4040-N, LM4040-N-Q1

Electrical Characteristics: 2.5-V LM4040-N V_R Tolerance Grades 'C', 'D', and 'E'; Temperature Grade 'I' (AEC Grade 3) (continued)

all other limits T_A = T_J = 25°C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1% and ±2%, respectively.

	PARAMETER		TEST CONDITIONS	3	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
			LM4040CIZ LM4040CIM3 LM4040CIM7 LM4040QCIM3	$T_A = T_J = 25$ °C $T_A = T_J = T_{MIN} \text{ to } T_{MAX}$		0.3	0.8	
			LM4040DIZ	$T_A = T_J = 25$ °C		0.3	1	
		I _{RMIN} ≤ I _R ≤ 1 mA	LM4040DIM3 LM4040DIM7 LM4040QDIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	
			LM4040EIZ	$T_A = T_J = 25$ °C		0.3	1	
$\Delta V_R/\Delta I$			LM4040EIM3 LM4040EIM7 LM4040QEIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	mV
R	Operating Current Change (4)		LM4040CIZ LM4040CIM3	$T_A = T_J = 25$ °C		2.5	6	IIIV
			LM4040CIM3 LM4040CIM7 LM4040QCIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			8	
			LM4040DIZ LM4040DIM3	$T_A = T_J = 25$ °C		2.5	8	
		1 mA ≤ I _R ≤ 15 mA	LM4040DIM7 LM4040QDIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	
			LM4040EIZ LM4040EIM3	$T_A = T_J = 25^{\circ}C$		2.5	8	
			LM4040EIM7 LM4040QEIM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	
			LM4040CIZ LM4040CIM3 LM4040CIM7 LM4040QCIM3			0.3	0.9	
Z _R	Reverse Dynamic Impedance	I _R = 1 mA, f = 120 Hz I _{AC} = 0.1 I _R	LM4040DIZ LM4040DIM3 LM4040DIM7 LM4040QDIM3			0.3	1.1	Ω
			LM4040EIZ LM4040EIM3 LM4040EIM7 LM4040QEIM3			0.3	1.1	
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz		·		35		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA				120		ppm
V _{HYST}	Thermal Hysteresis (5)	ΔT= -40°C to 125°C				0.08%		

⁽⁴⁾ Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Submit Documentation Feedback

Product Folder Links: LM4040-N LM4040-N-Q1

Product Folder Links: LM4040-N LM4040-N-Q1

⁽⁵⁾ Thermal hysteresis is defined as the difference in voltage measured at 25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

6.10 Electrical Characteristics: 2.5-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E' (AEC Grade 1)

all other limits $T_A = T_{.I} = 25^{\circ}C$. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and +2% respectively

1	PARAMETER		TEST CONDITION	s	MIN ⁽¹⁾	TYP(2)	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 100 μA				2.5		V
			LM4040CEM3	$T_A = T_J = 25$ °C			±12	
			LM4040QCEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±38	
V_R	Reverse Breakdown	I _R = 100 μA	LM4040DEM3	$T_A = T_J = 25$ °C			±25	mV
	Voltage Tolerance (3)	Ι _R = 100 μΑ	LM4040QDEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±63	IIIV
			LM4040EEM3	$T_A = T_J = 25$ °C			±50	
			LM4040QEEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±88	
			LM4040CEM3	$T_A = T_J = 25$ °C		45	60	
			LM4040QCEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			68	
	Minimum Operating		LM4040DEM3	$T_A = T_J = 25$ °C		45	65	
I _{RMIN}	Current		LM4040QDEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			73	μA
			LM4040EEM3	$T_A = T_J = 25$ °C		45	65	
			LM4040QEEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			73	
	Average Reverse	I _R = 10 mA				±20		
	Breakdown Voltage Temperature Coefficient ⁽³⁾		LM4040CEM3	$T_A = T_J = 25$ °C		±15		
			LM4040QCEM3 $T_A = T_J = T_{MIN}$ to T_{MAX}	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	
$\Delta V_R/\Delta T$			LM4040DEM3	$T_A = T_J = 25$ °C		±15		ppm/°C
ΔVR/ΔI		I _R = I IIIA	LM4040QDEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	ррпі/ С
			LM4040EEM3	$T_A = T_J = 25$ °C		±15		
			LM4040QEEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		I _R = 100 μA				±15		
			LM4040CEM3	$T_A = T_J = 25$ °C		0.3	0.8	
			LM4040QCEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1	
		$I_{RMIN} \le I_R \le 1 \text{ mA}$	LM4040DEM3	$T_A = T_J = 25$ °C		0.3	1	
		I _{RMIN} > I _R > I IIIA	LM4040QDEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	
	Reverse Breakdown		LM4040EEM3	$T_A = T_J = 25$ °C		0.3	1	
$\Delta V_R/\Delta I$	Voltage Change		LM4040QEEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	mV
R	with Operating Current Change ⁽⁴⁾		LM4040CEM3	$T_A = T_J = 25$ °C		2.5	6	IIIV
	Current Change (7		LM4040QCEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			8	
		1 1 15 1	LM4040DEM3	$T_A = T_J = 25$ °C		2.5	8	
		1 mA ≤ I _R ≤ 15 mA	LM4040QDEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	
			LM4040EEM3	$T_A = T_J = 25$ °C		2.5	8	
			LM4040QEEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	

- (1) Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at $T_J = 25^{\circ}$ C and represent most likely parametric norm.
- The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, max ΔT is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where max $\Delta T = 65$ °C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$ C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Copyright © 2000-2016. Texas Instruments Incorporated

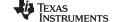
E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x

Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Submit Documentation Feedback





www.ti.com

LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Electrical Characteristics: 2.5-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E' (AEC Grade 1) (continued)

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and ±2%, respectively.

	PARAMETER		TEST CONDITIONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
			LM4040CEM3 LM4040QCEM3		0.3	0.9	
Z _R	Reverse Dynamic Impedance	$I_R = 1$ mA, $f = 120$ Hz, $I_{AC} = 0.1$ I_R	LM4040DEM3 LM4040QDEM3		0.3	1.1	Ω
			LM4040EEM3 LM4040QEEM3		0.3	1.1	
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz			35		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA			120		ppm
V _{HYST}	Thermal Hysteresis ⁽⁵⁾	ΔT= -40°C to 125°C			0.08%		

(5) Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

Submit Documentation Feedback Copyright © 2000-2016, Texas Instruments Incorporated Product Folder Links: LM4040-N LM4040-N-Q1

Product Folder Links: LM4040-N LM4040-N-Q1



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

6.11 Electrical Characteristics: 3-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature

all other limits $T_A = T_A = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and ±0.2%, respectively

	PARAMETER		TEST CONDITIO	NS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 100 μA				3		V
			LM4040AIM3	$T_A = T_J = 25$ °C			±3	
V_R	Reverse Breakdown		LM4040AIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±22	
	Voltage Tolerance (3)	I _R = 100 μA	LM4040BIM3	$T_A = T_J = 25$ °C			±6	mV
			LM4040BIZ LM4040BIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±26	
	Minimum Operating		$T_A = T_J = 25$ °C			47	62	μA
I _{RMIN}	Current		$T_A = T_J = T_{MIN}$ to	Гмах			67	μА
	A	I _R = 10 mA				±20		
A\/ /AT	Average Reverse Breakdown Voltage Temperature Coefficient ⁽³⁾	1 1 m A	$T_A = T_J = 25$ °C			±15		ppm/°C
ΔV _R /ΔΙ .		I _R = 1 mA	$T_A = T_J = T_{MIN}$ to	MAX			±100	ppiii/ C
	Coefficient	I _R = 100 μA				±15		
	Reverse Breakdown		$T_A = T_J = 25$ °C			0.6	0.8	
$\Delta V_R/\Delta I$	Voltage Change with	$I_{RMIN} \le I_R \le 1 \text{ mA}$	$T_A = T_J = T_{MIN}$ to	MAX			1.1	mV
R	Operating Current Change (4)	4 4 4 4	$T_A = T_J = 25$ °C			2.7	6	mv
	Change	1 mA ≤ I _R ≤ 15 mA	$T_A = T_J = T_{MIN}$ to	MAX			9	
Z _R	Reverse Dynamic Impedance	I _R = 1 mA, f = 120 Hz, I _{AC} = 0.1 I _R				0.4	0.9	Ω
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz				35		μV_{rms}
ΔV_{R}	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA				120		ppm
V _{HYST}	Thermal Hysteresis (5)	$\Delta T = -40$ °C to 125°C				0.08%		

- (1) Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at T_J = 25°C and represent most likely parametric norm.
- The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, max ΔT is the maximum difference in temperature from the reference point of 25°C to T _{MIN} or T_{MAX}, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where max $\Delta T = 65$ °C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100 \text{°C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Copyright © 2000-2016. Texas Instruments Incorporated

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100 ^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x $0.75\% = \pm 19 \text{ mV}.$

- (4) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

LM4040-N, LM4040-N-Q1



www.ti.com

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

6.12 Electrical Characteristics: 3-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'I'

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and ±2%, respectively.

	PARAMETER		TEST CONDITI	ions	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 100 μA				3		V
			LM4040CIM3	$T_A = T_J = 25$ °C			±15	
			LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±34	
V_R	Reverse Breakdown	I _R = 100 μA	LM4040DIM3	$T_A = T_J = 25$ °C		1	±30	mV
	Voltage Tolerance (3)	I _R = 100 μA	LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±59	IIIV
			LM4040EIM7	$T_A = T_J = 25$ °C			±60	
			LM4040EIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			3 ±15 ±34 ±30 ±59 ±60 ±89 45 60 65 45 65 70 45 65 70 20 15 ±100 15 ±150	
			LM4040CIM3	$T_A = T_J = 25$ °C		45	60	
			LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN} \ to \ T_{MAX}$			65	
	Minimum Operating		LM4040DIM3	$T_A = T_J = 25$ °C		45	65	μA
I _{RMIN}	Minimum Operating Current		70	μΛ				
			LM4040EIM7	$T_A = T_J = 25$ °C		45	65	
			LM4040EIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			70	
		I _R = 10 mA				±20		
			LM4040CIM3	$T_A = T_J = 25$ °C		±15		
	A		LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage	I _R = 1 mA	LM4040DIM3	$T_A = T_J = 25$ °C		±15		ppm/°C
ΔVR/ΔI	Temperature Coefficient ⁽³⁾	IR = I IIIA	LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	ррпі/ С
			LM4040EIM7	$T_A = T_J = 25$ °C		±15		
			LM4040EIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		I _R = 100 μA				±15		

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at T_J = 25°C and represent most likely parametric norm.
- The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, $max\Delta T$ is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where $max\Delta T = 65^{\circ}C$ is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$ D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$ E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100 \text{°C}$

Submit Documentation Feedback

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V × $0.75\% = \pm 19 \text{ mV}.$



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Electrical Characteristics: 3-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'I' (continued)

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and +2% respectively

	PARAMETER		TEST CONDITI	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
			LM4040CIM3 LM4040CIZ	$T_A = T_J = 25$ °C		0.4	0.8	
			LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.1	
		I _{RMIN} ≤ I _R ≤ 1 mA	LM4040DIM3 LM4040DIZ	$T_A = T_J = 25$ °C		0.4	1.1	
		RMIN - R - 1	LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.3	
	Reverse Breakdown		LM4040EIM7	$T_A = T_J = 25$ °C		0.4	1.1	
$\Delta V_R/\Delta I$	Voltage Change		LM4040EIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.3	mV
R	with Operating Current Change (4)		LM4040CIM3 LM4040CIZ	$T_A = T_J = 25$ °C		2.7	6	IIIV
	ourient onlinge		LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			9	
		1 mA ≤ I _R ≤ 15 mA	LM4040DIM3	$T_A = T_J = 25$ °C		2.7	8	
		T IIIA 2 IK 2 IS IIIA	LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}		2.7 8 11 2.7 8 11		
			LM4040EIM7	$T_A = T_J = 25$ °C		2.7	8	
			LM4040EIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			11	
			LM4040CIM3 LM4040CIZ LM4040CIM7			0.4	0.9	
Z_R	Reverse Dynamic Impedance	$I_R = 1 \text{ mA}, f = 120 \text{ Hz}$ $I_{AC} = 0.1 I_R$	LM4040DIM3 LM4040DIZ LM4040DIM7			0.4	1.2	Ω
			LM4040EIM7 LM4040EIZ			0.4	1.2	
e_{N}	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz				35		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA				120		ppm
V _{HYST}	Thermal Hysteresis ⁽⁵⁾	$\Delta T = -40$ °C to 125°C				0.08%		

- (4) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.





SNOS633K - OCTOBER 2000-REVISED JUNE 2016

www.ti.com

6.13 Electrical Characteristics: 3-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E'

all other limits $T_A = T_J = 25$ °C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and ±2%, respectively.

F	PARAMETER		TEST CONDITI	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				3		V
			LM4040CEM3	$T_A = T_J = 25$ °C			±15	
			LM4040CEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±45	
V_R	Reverse Breakdown	1 1004	LM4040DEM3	$T_A = T_J = 25$ °C			±30	mV
	Reverse Breakdown Voltage Tolerance ⁽³⁾	I _R = 100 μA	LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±75	mv
			LM4040EEM3	$T_A = T_J = 25$ °C			±60	
			LIVI4040EEIVIS	$T_A = T_J = T_{MIN}$ to T_{MAX}			±105	
			LM4040CEM3	$T_A = T_J = 25$ °C		47	62	
			LIVI4040CEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			70	
	Minimum Operating		LM4040DEM0	$T_A = T_J = 25$ °C		47	67	
I _{RMIN}	Current		LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			75	μΑ
			1.0440.4055040	$T_A = T_J = 25$ °C		47	67	
			LM4040EEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			75	
		I _R = 10 mA				±20		
			LM40400EM0	$T_A = T_J = 25$ °C		±15		
		LM4040CEM3 $T_A = T_J = T_{MIN} \text{ to } T_{MAX}$ $T_A = T_J = T_{MIN} \text{ to } T_{MAX}$			±100			
A)/ /AT	Average Reverse Breakdown Voltage		$T_A = T_J = 25$ °C		±15		ppm/°C	
$\Delta V_R/\Delta T$	Temperature Coefficient (3)	I _R = 1 mA	LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	ррпі/ С
	Coefficient		LM4040EEM3	$T_A = T_J = 25$ °C		±15		
			LIVI4040EEIVIS	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		I _R = 100 μA				±15		
			LM40400EM0	$T_A = T_J = 25$ °C		0.4	0.8	
			LM4040CEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.1	
			LM4040DEM2	$T_A = T_J = 25$ °C		0.4	1.1	
		$I_{RMIN} \le I_R \le 1 \text{ mA}$	LM4040DEM3	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.3	
	Reverse Breakdown		LM4040EEM3	$T_A = T_J = 25$ °C		0.4	1.1	
۸۱/ /۸۱	Voltage Change		LIVI4040EEIVIS	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.3	mV
$\Delta V_R / \Delta I_R$	with Operating Current Change (4)		LM4040CEM3	$T_A = T_J = 25$ °C		2.7	6.0	IIIV
	Current Change "		LIVI4U4UCEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			9	
		1 - 0 < 1 < 15 - 0 0	LM4040DEM3	$T_A = T_J = 25$ °C		2.7	8	
		1 mA ≤ I _R ≤ 15 mA	LIVI4U4UDEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			11.0	
			LM4040EEM3	$T_A = T_J = 25$ °C		2.7	8	
			LIVI4U4UEEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			11.0	

- (1) Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at T_J = 25°C and represent most likely parametric norm.
- The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm I(\Delta V_R/\Delta T)(max\Delta T)(V_R)I$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, max ΔT is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where max $\Delta T = 65$ °C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x

Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Copyright © 2000-2016. Texas Instruments Incorporated Product Folder Links: LM4040-N LM4040-N-Q1



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

Electrical Characteristics: 3-V LM4040-N V_R Tolerance Grades 'C', 'D', And 'E'; Temperature Grade 'E' (continued)

all other limits $T_A = T_J = 25^{\circ}$ C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$, $\pm 1\%$ and ±2%, respectively.

F	PARAMETER		TEST CONDITIONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
		I _R = 1 mA, f = 120	LM4040CEM3		0.4	0.9	
Z_R	Impodence	Hz,	LM4040DEM3	0.4 1.2	1.2	Ω	
		$I_{AC} = 0.1 I_{R}$	LM4040EEM3		0.4	1.2	
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz			35		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA			120		ppm
V _{HYST}	Thermal Hysteresis ⁽⁵⁾	$\Delta T = -40$ °C to 125°C			0.08%		

(5) Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

6.14 Electrical Characteristics: 4.1-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature

all other limits T_A = T_I = 25°C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and +0.2% respectively

	PARAMETER		TEST CONDITION	IS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				4.096		V
			LM4040AIM3	$T_A = T_J = 25$ °C			±4.1	
V_R	Reverse Breakdown		LM4040AIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}		±31		
	Voltage Tolerance (3)	I _R = 100 μA	LM4040BIM3	$T_A = T_J = 25$ °C			±8.2	mV
			LM4040BIZ LM4040BIM7 $T_A = T_J = T_{MIN}$ to T	$T_A = T_J = T_{MIN}$ to T_{MAX}			±35	
	Minimum Operating		$T_A = T_J = 25$ °C			50	68	
I _{RMIN}	Current		$T_A = T_J = T_{MIN}$ to T_{MAX}				73	μA
	Average Reverse	I _R = 10 mA				±30		
$\Delta V_R/\Delta T$	Breakdown Voltage	1 1 m A	$T_A = T_J = 25$ °C			±20		ppm/°C
ΔVR/ΔI	Temperature Coefficient ⁽³⁾	I _R = 1 mA	$T_A = T_J = T_{MIN}$ to T	MAX			±100	ppiii/ C
	Coefficient	$I_R = 100 \mu A$				±20		
	Reverse Breakdown	$I_{RMIN} \le I_R \le 1 \text{ mA}$	$T_A = T_J = 25^{\circ}C$			0.5	0.9	
$\Delta V_R/\Delta I$	Voltage Change with	IRMIN S IR S I IIIA	$T_A = T_J = T_{MIN}$ to T	MAX			1.2	mV
R	Operating Current Change (4)	Operating Current	$T_A = T_J = 25^{\circ}C$			3	7	IIIV
	Griange ·	1 mA ≤ I _R ≤ 15 mA	$T_A = T_J = T_{MIN}$ to T	MAX			10	

(1) Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.

Typicals are at $T_J = 25^{\circ}$ C and represent most likely parametric norm.

The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, max ΔT is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where max $\Delta T = 65$ °C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100 \text{°C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$ E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Copyright © 2000-2016. Texas Instruments Incorporated

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x

Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

LM4040-N. LM4040-N-Q1

11 Texas Instruments

www.ti.com

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Electrical Characteristics: 4.1-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'l' (continued)

all other limits $T_A = T_J = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and ±0.2%, respectively.

	PARAMETER		TEST CONDITIONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
Z _R	Reverse Dynamic Impedance	$I_{R}=1 \text{ mA, f}=120 \text{ Hz,} \\ I_{AC}=0.1 I_{R}$			0.5	1	Ω
e _N	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz			80		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA			120		ppm
V _{HYST}	Thermal Hysteresis (5)	$\Delta T = -40$ °C to 125°C			0.08%		

(5) Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

6.15 Electrical Characteristics: 4.1-V LM4040-N V_R Tolerance Grades 'C' and 'D'; Temperature Grade 'I'

all other limits T_A = T₁ = 25°C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and +1% recoertively

, , ,	respectively.				(1)	(2)	(4)	
	PARAMETER		TEST CONDITIO	DNS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 100 μA				4.096		V
			LM4040CIM3	$T_A = T_J = 25$ °C			±20	
V_{R}	Reverse Breakdown	Ι _R = 100 μΑ	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}	±47	±47	mV	
	Voltage Tolerance (3)	Ι _R = 100 μΑ	LM4040DIM3	$T_A = T_J = 25$ °C			±41	IIIV
			LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±81	
			LM4040CIM3	$T_A = T_J = 25$ °C		50	68	
	Minimum Operating		LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			73	
I _{RMIN}	Current	LN	LM4040DIM3	$T_A = T_J = 25$ °C		50	73	μΑ
			LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			78	
		I _R = 10 mA				±30		
			LM4040CIM3	$T_A = T_J = 25$ °C		±20		
ΔV_R /	Average Reverse Breakdown Voltage	I _R = 1 mA	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	nnm/9C
ΔΤ	Temperature Coefficient ⁽³⁾	I _R = I IIIA	LM4040DIM3	$T_A = T_J = 25$ °C		±20		ppm/°C
	Coefficient		LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		$I_R = 100 \mu A$				±20		

Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.

Typicals are at T_J = 25°C and represent most likely parametric norm.

The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, $max\Delta T$ is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where $\max \Delta T = 65^{\circ} \text{C}$ is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$ D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100 \text{°C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V × 0.75% = +19 mV



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

Electrical Characteristics: 4.1-V LM4040-N V_R Tolerance Grades 'C' and 'D'; Temperature Grade 'I' (continued)

all other limits $T_A = T_J = 25$ °C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$ and $\pm 1\%$, respectively.

	PARAMETER		TEST CONDITIO	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
			LM4040CIM3	$T_A = T_J = 25$ °C		0.5	0.9	
		I _{RMIN} ≤ I _R ≤ 1 mA	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.2	
		I _{RMIN} > I _R > I IIIA	LM4040DIM3	$T_A = T_J = 25$ °C		0.5	1.2	
ΔV_R	Reverse Breakdown Voltage Change with		LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.5	mV
ΔI_R	Operating Current Change (4)		LM4040CIM3	$T_A = T_J = 25$ °C		3	7	IIIV
	Change	4 4 4 4 4	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			10	
		1 mA ≤ I _R ≤ 15 mA	LM4040DIM3	$T_A = T_J = 25$ °C		3	9	
			LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			13	
Z _R	Reverse Dynamic	I _R = 1 mA, f = 120 Hz,	LM4040CIM3 LM4040CIZ LM4040CIM7	•		0.5	1	Ω
∠ _R	Impedance	I _{AC} = 0.1 I _R	LM4040DIM3 LM4040DIZ LM4040DIM7			0.5	1.3	Ω
e_{N}	Wideband Noise	I _R = 100 μA 10 Hz ≤ f ≤ 10 kHz				80		μV_{rms}
ΔV_{R}	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA				120		ppm
V_{HYST}	Thermal Hysteresis (5)	$\Delta T = -40$ °C to 125°C				0.08%		

- (4) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- (5) Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

6.16 Electrical Characteristics: 5-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'I'

all other limits $T_A = T_J = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and $\pm 0.2\%$, respectively.

	PARAMETER		TEST CONDITIO	NS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				5		V
			LM4040AIM3	$T_A = T_J = 25$ °C			±5	
V_R	Reverse Breakdown		LM4040AIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±38	
	Voltage Tolerance (3)	ce ⁽³⁾ I _R = 100 μA Li	LM4040BIM3	$T_A = T_J = 25$ °C			±10	mV
		LM4040BI LM4040BI		$T_A = T_J = T_{MIN}$ to T_{MAX}			±43	

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at T_J = 25°C and represent most likely parametric norm.
- 3) The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±{(ΔV_R/ΔT)(maxΔT)(V_R)}. Where, ΔV_R/ΔT is the V_R temperature coefficient, maxΔT is the maximum difference in temperature from the reference point of 25°C to T_{MIN} or T_{MAX}, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65°C$

B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below: C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100$ ppm/°C × ± 100 ppm/°C

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100 \text{°C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ± 2.5 V x $0.75\% = \pm 19$ mV.

Copyright © 2000–2016, Texas Instruments Incorporated

Submit Documentation Feedback

LM4040-N, LM4040-N-Q1



www.ti.com

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Electrical Characteristics: 5-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'I' (continued)

all other limits $T_A = T_J = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and $\pm 0.2\%$, respectively.

	PARAMETER		TEST CONDITIONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Minimum Operating		$T_A = T_J = 25$ °C		54	74	μA
I _{RMIN}	Current		$T_A = T_J = T_{MIN}$ to T_{MAX}		80		
	Average Deverse	I _R = 10 mA			±30		
$\Delta V_R/\Delta$	Average Reverse Breakdown Voltage	I _R = 1 mA	$T_A = T_J = 25$ °C		±20		ppm/°C
Т	Temperature Coefficient ⁽³⁾	IR = I IIIA	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	ррпі/ С
	Coefficient	$I_R = 100 \mu A$			±20		
	Reverse Breakdown		$T_A = T_J = 25$ °C		0.5	±100 1 1.4 8 12	
	Voltage Change with	$I_{RMIN} \le I_R \le 1 \text{ mA}$	$T_A = T_J = T_{MIN}$ to T_{MAX}				\/
IR	Operating Current Change (4)	1 m A < 1 < 15 m A	$T_A = T_J = 25$ °C		3.5		mV
	Change	1 mA ≤ I _R ≤ 15 mA	$T_A = T_J = T_{MIN}$ to T_{MAX}			12	
Z_R	Reverse Dynamic Impedance	I _R = 1 mA, f = 120 Hz, I _{AC} = 0.1 I _R			0.5	1.1	Ω
e _N	Wideband Noise	$I_R = 100 \mu A$ 10 Hz ≤ f ≤ 10 kHz			80		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA			120		ppm
V _{HYST}	Thermal Hysteresis (5)	ΔT = −40°C to 125°C			0.08%		

- (4) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- (5) Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

6.17 Electrical Characteristics: 5-V LM4040-N V_R Tolerance Grades 'C' And 'D'; Temperature Grade 'I'

all other limits $T_A = T_J = 25$ °C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$ and $\pm 1\%$. respectively.

	PARAMETER		TEST CONDITIO	NS	MIN ⁽¹⁾ TYP ⁽²⁾ MAX ⁽¹⁾			UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				5		V
			LM4040CIM3	$T_A = T_J = 25$ °C			±25	
V_{R}	Reverse Breakdown	1 1004	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±58	mV
	Voltage Tolerance (3)	I _R = 100 μA	LM4040DIM3	$T_A = T_J = 25$ °C	±50	mv		
			LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±99	

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- (2) Typicals are at T_J = 25°C and represent most likely parametric norm.
- The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[(ΔV_R/ΔΤ)(maxΔΤ)(V_R)]. Where, ΔV_R/ΔΤ is the V_R temperature coefficient, maxΔT is the maximum difference in temperature from the reference point of 25°C to T _{MIN} or T_{MAX}, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65 ^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$ D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100°C$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x 0.75% = ±1.9 mV.



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Electrical Characteristics: 5-V LM4040-N V_R Tolerance Grades 'C' And 'D'; Temperature Grade 'I' (continued)

all other limits $T_A = T_J = 25$ °C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$ and $\pm 1\%$, respectively.

	PARAMETER		TEST CONDITIO	NS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT	
			LM4040CIM3	$T_A = T_J = 25^{\circ}C$		54	74		
	Minimum Operating		LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			80		
I _{RMIN}	Current		LM4040DIM3	$T_A = T_J = 25$ °C		54	79	μΑ	
			LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			85		
		I _R = 10 mA				±30			
			LM4040CIM3	$T_A = T_J = 25$ °C		±20			
ΔV _R /Δ	Average Reverse Breakdown Voltage	1 4 55 4	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	100	
Ť	Temperature Coefficient ⁽³⁾	I _R = 1 mA	LM4040DIM3	$T_A = T_J = 25$ °C		±20		ppm/°C	
	Coefficient		LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150		
		I _R = 100 μA				±20			
			LM4040CIM3	$T_A = T_J = 25$ °C		0.5	1		
		I _{RMIN} ≤ I _R ≤ 1 mA	$I_{RMIN} \le I_R \le 1 \text{ mA}$	LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.4	
				LM4040DIM3	$T_A = T_J = 25$ °C		0.5	1.3	
ΔV _R /Δ	Reverse Breakdown Voltage Change with		LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.8	mV	
IR	Operating Current Change (4)		LM4040CIM3	$T_A = T_J = 25$ °C		3.5	8	IIIV	
	Change		LM4040CIZ LM4040CIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			12		
		1 mA ≤ I _R ≤ 15 mA	LM4040DIM3	$T_A = T_J = 25$ °C		3.5	10		
			LM4040DIZ LM4040DIM7	$T_A = T_J = T_{MIN}$ to T_{MAX}			15		
Z _R	Reverse Dynamic	I _R = 1 mA, f = 120 Hz,	$T_A = T_J = 25$ °C			0.5	1.1	Ω	
Z-R	Impedance	$I_{AC} = 0.1 I_{R}$	$T_A = T_J = T_{MIN}$ to	T _{MAX}			1.5	12	
e_{N}	Wideband Noise	$I_R = 100 \mu A$ 10 Hz \leq f \leq 10 kHz				80		μV_{rms}	
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 μA		_		120		ppm	
V _{HYST}	Thermal Hysteresis (5)	$\Delta T = -40$ °C to 125°C				0.08%			

⁽⁴⁾ Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Product Folder Links: LM4040-N LM4040-N-Q1





SNOS633K - OCTOBER 2000-REVISED JUNE 2016

REVISED JUNE 2016 www.ti.com

6.18 Electrical Characteristics: 5-V LM4040-N V_R Tolerance Grades 'C' And 'D'; Temperature Grade 'E'

all other limits $T_A = T_J = 25$ °C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1%, respectively.

	PARAMETER		TEST CONDITION	IS	MIN ⁽¹⁾	TYP	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 100 μΑ				5		V
			LM4040CEM3	$T_A = T_J = 25$ °C			±25	
V_R	Reverse Breakdown	I _R = 100 μA	LIVI4040CEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±75	mV
	Voltage Tolerance (2)	Ι _R = 100 μΑ	LM4040DEM3	$T_A = T_J = 25$ °C			±50	IIIV
			LIVI4040DEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±125	
			LM4040CEM3	$T_A = T_J = 25$ °C		54	74	
l	Minimum Operating		EW4040CEWS	$T_A = T_J = T_{MIN}$ to T_{MAX}			83	μА
RMIN	Current		LM4040DEM3	$T_A = T_J = 25$ °C		54	79	μΛ
			LIVI4040DLIVIS	$T_A = T_J = T_{MIN}$ to T_{MAX}			88	
		I _R = 10 mA				±30		
	Average Reverse		LM4040CEM3	$T_A = T_J = 25$ °C		±20		
ΔV _R /	Breakdown Voltage	I _R = 1 mA	LIVI4040CEIVI3	$T_A = T_J = T_{MIN}$ to T_{MAX}			±20 ±150	nnm/ºi
	Temperature Coefficient ⁽²⁾	IR = I IIIA	LM4040DEM3	$T_A = T_J = 25$ °C		±20		ppiii/ v
	Cocmoloni		EW4040DEW3	$T_A = T_J = T_{MIN}$ to T_{MAX}				
		I _R = 100 μA				±20		
			LM4040CEM3	$T_A = T_J = 25$ °C		0.5	1	
		$I_{RMIN} \le I_R \le 1 \text{ mA}$	ENITOTOCENIO	$T_A = T_J = T_{MIN}$ to T_{MAX}			±75 ±50 ±125 74 83 79 88 ±100	
	Reverse Breakdown	IRMIN - IR - I III/	LM4040DEM3	$T_A = T_J = 25$ °C		0.5		
ΔV _R /	Voltage Change with		EIVITOTOBEIVIO	$T_A = T_J = T_{MIN}$ to T_{MAX}			1.8	±150 1 1.4 1 1.8 8 12
ΔI_R	Operating Current Change (3)		LM4040CEM3	$T_A = T_J = 25$ °C		3.5	8	1114
	Onlingo	1 mA ≤ I _R ≤ 15 mA	EW4040CEWS	$T_A = T_J = T_{MIN}$ to T_{MAX}			12	
		T IIIA = IR = 15 IIIA	LM4040DEM3	$T_A = T_J = 25$ °C		3.5	8	
			EW4040DEW3	$T_A = T_J = T_{MIN}$ to T_{MAX}			15	
Z_R	Reverse Dynamic Impedance	$I_R = 1 \text{ mA}, f = 120 \text{ Hz},$ $I_{AC} = 0.1 I_R$				0.5	1.1	Ω
e _N	Wideband Noise	$I_R = 100 \mu A$ 10 Hz ≤ f ≤ 10 kHz				80		μV_{rms}
ΔV _R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 100 µA				120		ppm
/ _{HYST}	Thermal Hysteresis (4)	ΔT = −40°C to 125°C				0.08%		

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- 2) The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[(ΔN_R/ΔT)(maxΔT)(N_R)]. Where, ΔN_R/ΔT is the V_R temperature coefficient, maxΔT is the maximum difference in temperature from the reference point of 25°C to T _{MIN} or T_{MAX}, and V_R is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150$ ppm/°C × 65°C

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x 0.75% = ±19 mV.

- (3) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- (4) Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

⁽⁵⁾ Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

6.19 Electrical Characteristics: 8.2-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature

all other limits $T_A = T_A = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and IO 20/ reapportively

±0.2 /0,	respectively.							
	PARAMETER		TEST CONDITIO	NS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 150 μA				8.192		V
			LM4040AIM3	$T_A = T_J = 25$ °C			±8.2	
V _R	Reverse Breakdown	I _R = 150 μA	LM4040AIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±61	mV
	Voltage Tolerance (3)	I _R = 150 μA	LM4040BIM3	$T_A = T_J = 25$ °C			±16	mv
			LM4040BIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±70	
	Minimum Operating		$T_A = T_J = 25$ °C			67	91	μA
I _{RMIN}	Current		$T_A = T_J = T_{MIN} t$	o T _{MAX}			95	μА
	A	I _R = 10 mA				±40		
A)/ /AT	Average Reverse Breakdown Voltage	1 4 4	$T_A = T_J = 25$ °C			±20		
Δν _R /Δ1	V _R /ΔT Temperature Coefficient ⁽³⁾	I _R = 1 mA	$T_A = T_J = T_{MIN}$ to	o T _{MAX}			±100	ppm/°C
	Coefficient	I _R = 150 μA				±20		
	Reverse Breakdown		$T_A = T_J = 25$ °C			0.6	1.3	
$\Delta V_R/\Delta I$	Voltage Change with	$I_{RMIN} \le I_R \le 1 \text{ mA}$	$T_A = T_J = T_{MIN}$ to	o T _{MAX}			2.5	mV
R	Operating Current	4 4 4 4 4 5 4	$T_A = T_J = 25$ °C			7	10	mv
	Change (4)	1 mA ≤ I _R ≤ 15 mA	$T_A = T_J = T_{MIN} t$	o T _{MAX}			18	
Z _R	Reverse Dynamic Impedance	I _R = 1 mA, f = 120 Hz, I _{AC} = 0.1 I _R				0.6	1.5	Ω
e _N	Wideband Noise	I _R = 150 μA 10 Hz ≤ f ≤ 10 kHz				130		μV _{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 150 μA				120		ppm
V _{HYST}	Thermal Hysteresis (5)	ΔT = -40°C to 125°C				0.08%		

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at $T_J = 25^{\circ}$ C and represent most likely parametric norm.
- The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, $max\Delta T$ is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where max $\Delta T = 65$ °C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$ B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100 \text{°C}$ D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$

Copyright © 2000-2016. Texas Instruments Incorporated

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x 0.75% = +19 mV

- (4) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

LM4040-N. LM4040-N-Q1



www.ti.com

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

6.20 Electrical Characteristics: 8.2-V Lm4040-N V_R Tolerance Grades 'C' And 'D'; Temperature Grade 'l'

all other limits $T_A = T_L = 25$ °C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$ and ±1%, respectively.

	PARAMETER		TEST CONDITI	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	I _R = 150 μA				8.192		V
			LM4040CIM3	$T_A = T_J = 25$ °C			±41	
V_R	Reverse Breakdown	4504	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±94	mV
	Voltage Tolerance (3)	I _R = 150 μA	LM4040DIM3	$T_A = T_J = 25$ °C			±82	mv
			LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±162	
			LM4040CIM3	$T_A = T_J = 25$ °C		67	91	
I _{RMIN}	Minimum Operating		LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			95	μA
RMIN	Current		LM4040DIM3	$T_A = T_J = 25$ °C		67	96	μл
			LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			100	
		$I_R = 10 \text{ mA}$				±40		
	Average Reverse		LM4040CIM3	$T_A = T_J = 25$ °C		±20		
V _R /ΔT	Breakdown Voltage	I _R = 1 mA	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}		±20	±100	ppm/°C
v R/ДI	Temperature Coefficient ⁽³⁾	IR - I IIIA	LM4040DIM3	$T_A = T_J = 25$ °C				
	Cocmoient		LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		$I_R = 150 \mu A$				±20		
			LM4040CIM3	$T_A = T_J = 25$ °C		0.6	1.3	
		$I_{RMIN} \le I_R \le 1 \text{ mA}$	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			2.5	
	Reverse Breakdown	IRMIN = IR = I IIIA	LM4040DIM3	$T_A = T_J = 25$ °C		0.6	1.7	
ΔV _R /ΔI	Voltage Change with		LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±94 ±82 ±162 91 95 96 100 ±100 ±150 1.3 2.5	
R	Operating Current Change (4)		LM4040CIM3	$T_A = T_J = 25$ °C		7	10	1110
	Change	1 mA ≤ I _R ≤ 15 mA	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			18	
		T IIIA = IR = 15 IIIA	LM4040DIM3	$T_A = T_J = 25$ °C		7	15	
			LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			24	
Z_R	Reverse Dynamic	I _R = 1 mA, f = 120 Hz,	LM4040CIM3 LM4040CIZ			0.6	1.5	0
∠ R	Impedance	I _{AC} = 0.1 I _R	LM4040DIM3 LM4040DIZ			0.6	1.9	32
e_N	Wideband Noise	I _R = 150 μA 10 Hz ≤ f ≤ 10 kHz				130		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 150 μA				120		ppm
V _{HYST}	Thermal Hysteresis (5)	ΔT = −40°C to 125°C				0.08%		

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL
 - Typicals are at $T_1 = 25^{\circ}$ C and represent most likely parametric norm.
- The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, max ΔT is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where $\max \Delta T = 65^{\circ}C$ is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100°C$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100 ^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x $0.75\% = \pm 19 \text{ mV}.$

- Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

6.21 Electrical Characteristics: 10-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature

all other limits $T_A = T_A = 25$ °C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of $\pm 0.1\%$ and ±0.2%, respectively

	PARAMETER		TEST CONDITI	ONS	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT
	Reverse Breakdown Voltage	Ι _R = 150 μΑ				10		V
			LM4040AIM3	$T_A = T_J = 25$ °C			±10	
V_R	Reverse Breakdown	I _R = 150 μA	LM4040AIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±75	mV
	Voltage Tolerance (3)	I _R = 150 μA	LM4040BIM3	$T_A = T_J = 25$ °C			±20	IIIV
			LM4040BIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±85	
I	Minimum Operating		$T_A = T_J = 25$ °C			75	100	μA
I _{RMIN}	Current		$T_A = T_J = T_{MIN} t$	o T _{MAX}			103	μА
	Average Reverse	$I_R = 10 \text{ mA}$				±40		
$\Delta V_R/\Delta T$	Breakdown Voltage	I _R = 1 mA	$T_A = T_J = 25$ °C			±20		ppm/°C
Δν _R /Δι	Temperature Coefficient ⁽³⁾	IR = I IIIA	$T_A = T_J = T_{MIN} t$	o T _{MAX}			±100	ррпі/ С
	Coefficient	I _R = 150 μA				±20		
	Reverse Breakdown		$T_A = T_J = 25$ °C			0.8	1.5	
$\Delta V_R/\Delta I$		$I_{RMIN} \le I_R \le 1 \text{ mA}$	$T_A = T_J = T_{MIN} t$	o T _{MAX}			3.5	mV
R	Operating Current Change (4)	4 4 4 4	$T_A = T_J = 25$ °C			8	12	mv
	Change	1 mA ≤ I _R ≤ 15 mA	$T_A = T_J = T_{MIN} \; t$	o T _{MAX}			23	
Z_R	Reverse Dynamic Impedance	$I_R = 1 \text{ mA}, f = 120 \text{ Hz}, I_{AC} = 0.1 I_R$				0.7	1.7	Ω
e _N	Wideband Noise	I _R = 150 μA 10 Hz ≤ f ≤ 10 kHz				180		μV_{rms}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 150 μA				120		ppm
V_{HYST}	Thermal Hysteresis (5)	$\Delta T = -40$ °C to 125°C		·		0.08%		

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
- Typicals are at $T_J = 25^{\circ}$ C and represent most likely parametric norm.
- The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, $max\Delta T$ is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where max $\Delta T = 65$ °C is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$ B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100 \text{°C}$ D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x 0.75% = +19 mV

- (4) Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

LM4040-N. LM4040-N-Q1



SNOS633K - OCTOBER 2000-REVISED JUNE 2016

www.ti.com

6.22 Electrical Characteristics: 10-V LM4040-N V_R Tolerance Grades 'C' And 'D'; Temperature Grade 'l'

all other limits $T_A = T_L = 25$ °C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of $\pm 0.5\%$ and ±1%, respectively.

	PARAMETER		TEST CONDITIO	MIN ⁽¹⁾	TYP ⁽²⁾	MAX ⁽¹⁾	UNIT	
	Reverse Breakdown Voltage	I _R = 150 μA				10		V
			LM4040CIM3	$T_A = T_J = 25$ °C			±50	
V_R	Reverse Breakdown	1 4504	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±115	
	Voltage Tolerance (3)	I _R = 150 μA	LM4040DIM3	$T_A = T_J = 25$ °C			±100	mV
			LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±198	
			LM4040CIM3	$T_A = T_J = 25$ °C		75	100	
I	Minimum Operating		LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			103	μA
I _{RMIN}	Current		LM4040DIM3	$T_A = T_J = 25$ °C		75	110	μА
			LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			113	
		I _R = 10 mA				±40		
	Average Reverse		LM4040CIM3	$T_A = T_J = 25$ °C		±20		
$\Delta V_R/\Delta T$	Breakdown Voltage	I _R = 1 mA	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±100	ppm/°C
ΔV _R /Δ1	Temperature Coefficient ⁽³⁾	I _R = 1 IIIA	LM4040DIM3	$T_A = T_J = 25$ °C		±20		ppiii/ C
	Coefficient		LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			±150	
		I _R = 150 μA				±20		
			LM4040CIM3	$T_A = T_J = 25$ °C		0.8	1.5	
		$I_{RMIN} \le I_R \le 1 \text{ mA}$	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			3.5	
	Reverse Breakdown	IRMIN = IR = I IIIA	LM4040DIM3	$T_A = T_J = 25$ °C		0.8	2	
ΔV _R /ΔΙ	Voltage Change with		LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			4	mV
R	Operating Current Change (4)		LM4040CIM3	$T_A = T_J = 25$ °C		8	12	1110
	Change	1 mA ≤ I _R ≤ 15 mA	LM4040CIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			23	
		I IIIA = IR = 15 IIIA	LM4040DIM3	$T_A = T_J = 25$ °C		8	18	
			LM4040DIZ	$T_A = T_J = T_{MIN}$ to T_{MAX}			29	
Z_R	Reverse Dynamic	I _R = 1 mA, f = 120 Hz,	LM4040CIM3 LM4040CIZ			0.7	1.7	Ω
∠R	Impedance	I _{AC} = 0.1 I _R	LM4040DIM3 LM4040DIZ				2.3	12
e _N	Wideband Noise	I _R = 150 μA 10 Hz ≤ f ≤ 10 kHz				180		μV_{rms}
ΔV_{R}	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I _R = 150 μA				120		ppm
V _{HYST}	Thermal Hysteresis (5)	$\Delta T = -40$ °C to 125°C				0.08%		

- Limits are 100% production tested at 25°C. Limits over temperature are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate AOQL.
 - Typicals are at $T_1 = 25^{\circ}$ C and represent most likely parametric norm.
- The (overtemperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm [(\Delta V_R/\Delta T)(max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, max ΔT is the maximum difference in temperature from the reference point of 25°C to T MIN or TMAX, and VR is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where $\max \Delta T = 65^{\circ}C$ is shown below:

A-grade: $\pm 0.75\% = \pm 0.1\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

B-grade: $\pm 0.85\% = \pm 0.2\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

C-grade: $\pm 1.15\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 65^{\circ}\text{C}$

D-grade: $\pm 1.98\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

E-grade: $\pm 2.98\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 65^{\circ}\text{C}$

The total overtemperature tolerance for the different grades in the extended temperature range where max $\Delta T = 100$ °C is shown below:

C-grade: $\pm 1.5\% = \pm 0.5\% \pm 100 \text{ ppm/°C} \times 100^{\circ}\text{C}$

D-grade: $\pm 2.5\% = \pm 1.0\% \pm 150 \text{ ppm/°C} \times 100°C$

E-grade: $\pm 3.5\% = \pm 2.0\% \pm 150 \text{ ppm/°C} \times 100 ^{\circ}\text{C}$

Therefore, as an example, the A-grade 2.5-V LM4040-N has an overtemperature Reverse Breakdown Voltage tolerance of ±2.5V x $0.75\% = \pm 19 \text{ mV}.$

- Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.
- Thermal hysteresis is defined as the difference in voltage measured at +25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C.

Copyright © 2000-2016. Texas Instruments Incorporated

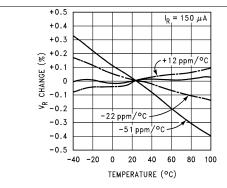
LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

TEXAS INSTRUMENTS

400

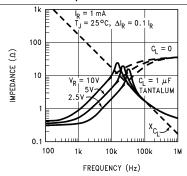
6.23 Typical Characteristics



IMPEDANCE (Ω) TANTALUM 100 10k 100k FREQUENCY (Hz)

Figure 1. Temperature Drift For Different Average Temperature Coefficient

Figure 2. Output Impedance vs Frequency



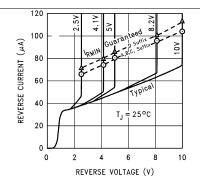


Figure 3. Output Impedance vs Frequency

Figure 4. Reverse Characteristics And Minimum Operating Current

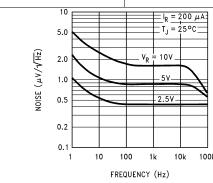


Figure 5. Noise Voltage vs Frequency

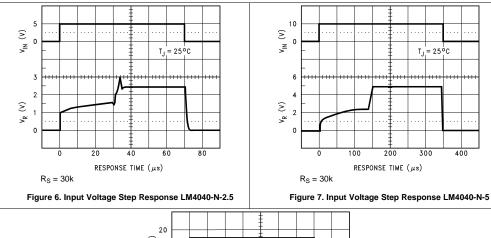
Product Folder Links: LM4040-N LM4040-N-Q1

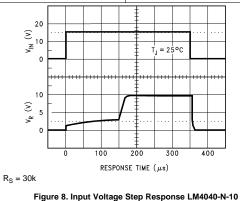
LM4040-N, LM4040-N-Q1

SNOS633K-OCTOBER 2000-REVISED JUNE 2016

www.ti.com

6.23.1 Start-Up Characteristics





7 Parameter Measurement Information

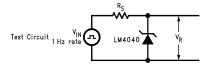


Figure 9. Test Circuit

Copyright © 2000-2016, Texas Instruments Incorporated

Submit Documentation Feedback

Submit Documentation Feedback

Copyright © 2000-2016, Texas Instruments Incorporated

Product Folder Links: LM4040-N LM4040-N-Q1



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

TEXAS INSTRUMENTS

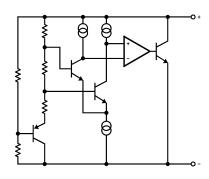
8 Detailed Description

8.1 Overview

www.ti.com

The LM4040 device is a precision micropower shunt voltage reference available in 7 different fixed-output voltage options and three different packages to meet small footprint requirements. The part is also available in five different tolerance grades.

8.2 Functional Block Diagram



8.3 Feature Description

The LM4040 device is effectively a precision Zener diode. The part requires a small guiescent current for regulation, and regulates the output voltage by shunting more or less current to ground, depending on input voltage and load. The only external component requirement is a resistor between the cathode and the input voltage to set the input current. An external capacitor can be used on the input or output, but is not required.

8.4 Device Functional Modes

Copyright © 2000-2016. Texas Instruments Incorporated

The LM4040 device is a fixed output voltage part, where the feedback is internal. Therefore, the part can only operate is a closed loop mode and the output voltage cannot be adjusted. The output voltage will remain in regulation as long as I_R is between I_{RMIN}, see Electrical Characteristics: 2-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'I', and I_{RMAX}, 15 mA. Proper selection of the external resistor for input voltage range and load current range will ensure these conditions are met.

LM4040-N. LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016 www.ti.com

9 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The LM4040-N is a precision micropower curvature-corrected bandgap shunt voltage reference. For space critical applications, the LM4040-N is available in the sub-miniature SOT-23 and SC70 surface-mount package. The LM4040-N has been designed for stable operation without the need of an external capacitor connected between the + pin and the - pin. If, however, a bypass capacitor is used, the LM4040-N remains stable. Reducing design effort is the availability of several fixed reverse breakdown voltages: 2.048 V, 2.5 V, 3 V, 4.096 V, 5 V, 8.192 V, and 10 V. The minimum operating current increases from 60 µÅ for the LM4040-N-2.048 and LM4040-N-2.5 to 100 µA for the 10-V LM4040-N. All versions have a maximum operating current of 15 mA.

LM4040-Ns in the SOT-23 packages have a parasitic Schottky diode between pin 2 (-) and pin 3 (Die attach interface contact). Therefore, pin 3 of the SOT-23 package must be left floating or connected to pin 2.

LM4040-Ns in the SC70 have a parasitic Schottky diode between pin 1 (-) and pin 2 (Die attach interface contact). Therefore, pin 2 must be left floating or connected to pin1.

The 4.096-V version allows single 5-V 12-bit ADCs or DACs to operate with an LSB equal to 1 mV. For 12-bit ADCs or DACs that operate on supplies of 10 V or greater, the 8.192-V version gives 2 mV per LSB.

The typical thermal hysteresis specification is defined as the change in 25°C voltage measured after thermal cycling. The device is thermal cycled to temperature -40°C and then measured at 25°C. Next the device is thermal cycled to temperature 125°C and again measured at 25°C. The resulting V_{OLIT} delta shift between the 25°C measurements is thermal hysteresis. Thermal hysteresis is common in precision references and is induced by thermal-mechanical package stress. Changes in environmental storage temperature, operating temperature and board mounting temperature are all factors that can contribute to thermal hysteresis.

In a conventional shunt regulator application (Figure 10), an external series resistor (R_S) is connected between the supply voltage and the LM4040-N. Rs determines the current that flows through the load (I_I) and the LM4040-N (I_O). Since load current and supply voltage may vary, R_S should be small enough to supply at least the minimum acceptable Io to the LM4040-N even when the supply voltage is at its minimum and the load current is at its maximum value. When the supply voltage is at its maximum and I_I is at its minimum, R_S should be large enough so that the current flowing through the LM4040-N is less than 15 mA.

 R_S is determined by the supply voltage, (V_S) , the load and operating current, $(I_L$ and $I_O)$, and the LM4040-N's reverse breakdown voltage, V_R.

$$R_S = \frac{V_S - V_R}{I_L + I_Q} \tag{1}$$

9.2 Typical Applications

9.2.1 Shunt Regulator

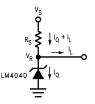


Figure 10. Shunt Regulator Schematic



LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000 - REVISED JUNE 2016

Typical Applications (continued)

9.2.1.1 Design Requirements

 $V_{IN} > V_{OUT}$

www.ti.com

Select Rs such that:

 $I_{RMIN} < I_{R} < I_{RMAX}$ where $I_{RMAX} = 15$ mA

See *Electrical Characteristics: 2-V LM4040-N V_R Tolerance Grades 'A' And 'B'; Temperature Grade 'I'* for minimum operating current for each voltage option and grade.

9.2.1.2 Detailed Design Procedure

The resistor R_S must be selected such that current IR will remain in the operational region of the part for the entire V_{IN} range and load current range. The two extremes to consider are V_{IN} at its minimum, and the load at its maximum, where R_S must be small enough for I_R to remain above I_{RMIN} . The other extreme is V_{IN} at its maximum, and the load at its minimum, where R_S must be large enough to maintain $I_R < I_{RMAX}$. For most designs, 0.1 mA $\leq I_R \leq$ 1 mA is a good starting point.

Use Equation 2 and Equation 3 to set R_S between $R_{S\ MIN}$ and $R_{S\ MAX}$.

$$R_{S_MIN} = \frac{V_{IN_MAX} - V_{OUT}}{I_{LOAD_MIN} + I_{R_MAX}}$$

$$R_{S_MAX} = \frac{V_{IN_MIN} - V_{OUT}}{I_{LOAD_MAX} + I_{R_MIN}}$$
(2)

9.2.1.3 Application Curve

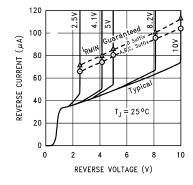


Figure 11. Reverse Characteristics And Minimum Operating Current

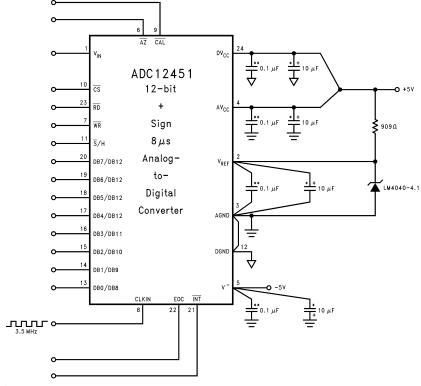
LM4040-N, LM4040-N-Q1

IO-N-Q1

www.ti.com

SNOS633K-OCTOBER 2000-REVISED JUNE 2016 Typical Applications (continued)

9.2.2 4.1-V ADC Application



^{**}Ceramic monolithic

Figure 12. 4.1-V LM4040-N'S Nominal 4.096 Breakdown Voltage Gives ADC12451 1 MV/LSB

9.2.2.1 Design Requirements

The only design requirement is for an output voltage of 4.096 V.

9.2.2.2 Detailed Design Procedure

Using an LM4040-4.1, select an appropriate R_S to sufficiently power the device. Set the target I_R for 1 mA. With an input voltage of 5 V, the resistor can be calculated:

Product Folder Links: LM4040-N LM4040-N-Q1

$$R = \frac{5 \text{ V} - 4.096 \text{ V}}{1 \text{ mA}} = 904 \Omega \tag{4}$$

The closest available resistance of 909 Ω is used here, which in turn yields an I_R of 994 μ A.

Copyright © 2000-2016. Texas Instruments Incorporated

^{*}Tantalum

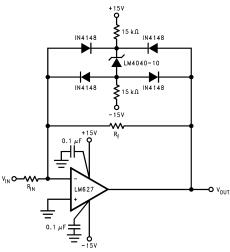


LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

Typical Applications (continued)

9.2.3 Bounded Amplifier



Nominal clamping voltage is ±11.5 V (LM4040-N's reverse breakdown voltage +2 diode V_F).

Figure 13. Bounded Amplifier Reduces Saturation-Induced Delays and Can Prevent Succeeding Stage Damage

9.2.3.1 Design Requirements

Design an amplifier with output clamped at ±11.5 V.

9.2.3.2 Detailed Design Procedure

With amplifier rails of ± 15 V, the output can be bound to ± 11.5 V with the LM4040-10 and two nominal diode voltage drops of 0.7 V.

$$V_{OUTBound} = 2 \times VFWD + VZ \tag{5}$$

$$V_{OLITROUND} = 1.4 \text{ V} + 10 \text{ V}$$
 (6)

Select $R_S = 15 \text{ k}\Omega$ to keep I_R low. Calculate I_R to confirm RS selection.

$$I_R = (V_{IN} - V_{OLIT}) / R$$
, however in this case, the negative supply must be taken into account. (7)

$$I_{R} = (V_{1N+} - V_{1N-} - V_{OUT})/R = (30 \text{ V} - 10 \text{ V}) / (R_{S1} + R_{S2}) = 20 \text{ V} / 30 \text{ k}\Omega = 0.667 \text{ mA}$$
(8)

This is an acceptable value for I_R that will not draw excessive current, but prevents the part from being starved for current.

TEXAS INSTRUMENTS

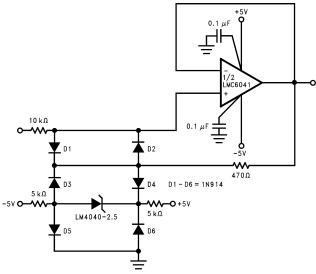
LM4040-N, LM4040-N-Q1

SNOS633K - OCTOBER 2000-REVISED JUNE 2016

www.ti.com

Typical Applications (continued)

9.2.4 Protecting Op-Amp Input



The bounding voltage is ±4 V with the 2.5-V LM4040-N (LM4040-N's reverse breakdown voltage + 3 diode V_F).

Figure 14. Protecting Op Amp Input

9.2.4.1 Design Requirements

Limit the input voltage to the op-amp to ±4 V.

9.2.4.2 Detailed Design Procedure

Similar to Bounded Amplifier, this design uses a LM4040-2.5 and three forward diode voltage drops to create a voltage clamp. The procedure for selecting the R_S resistors, in this case 5 k Ω , is the same as Detailed Design Procedure.

$$I_R = (V_{IN+} - V_{IN-} - V_{OLT}) / R = (10 \text{ V} - 2.5 \text{ V}) / (R_{S1} + R_{S2}) = 7.5 \text{ V} / 10 \text{ k}\Omega = 0.750 \text{ mA}$$
 (9)

Copyright © 2000–2016, Texas Instruments Incorporated

Typical Applications (continued)

9.2.5 Precision ±4.096-V Reference

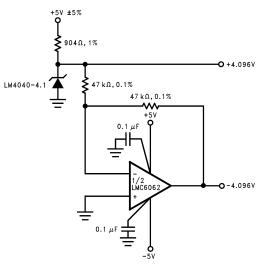


Figure 15. Precision ±4.096-V Reference

9.2.5.1 Design Requirements

Use a single voltage reference to create positive and negative reference rails, ±4.096 V.

9.2.5.2 Detailed Design Procedure

The procedure for selecting the R_S resistor is same as detailed in *Detailed Design Procedure*. The output of the voltage reference is used as the inverting input to the op-amp, with unity gain.

Product Folder Links: LM4040-N LM4040-N-Q1

LM4040-N, LM4040-N-Q1

SNOS633K-OCTOBER 2000-REVISED JUNE 2016

TEXAS INSTRUMENTS www.ti.com

Typical Applications (continued)

9.2.6 Precision Current Sink/Source

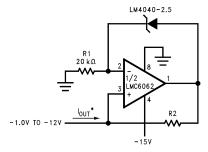


Figure 16. Precision 1-mA Current Sink

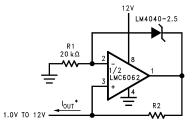


Figure 17. Precision 1-mA Current Source

9.2.6.1 Design Requirements

Create precision 1-mA current sink and/or 1-mA current source.

9.2.6.2 Detailed Design Procedure

Set R1 such that the current through the shunt reference, I_R, is greater than I_{RMIN}. $I_{OUT} = V_{OUT} / R_2$ where V_{OUT} is the voltage drop across the shunt reference. In this case, $I_{OUT} = 2.5 / R_2$

Copyright © 2000-2016, Texas Instruments Incorporated

INSTRUMENTS

10 Power Supply Recommendations

While a bypass capacitor is not required on the input voltage line, TI recommends reducing noise on the input which could affect the output. A 0.1-µF ceramic capacitor or larger is recommended.

11 Layout

www.ti.com

11.1 Layout Guidelines

Place external components as close to the device as possible. Place RS close the cathode, as well as the input bypass capacitor, if used.

11.2 Layout Example

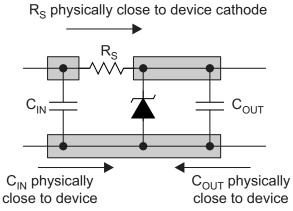


Figure 18. Layout Diagram

Product Folder Links: LM4040-N LM4040-N-Q1

LM4040-N, LM4040-N-Q1



www.ti.com

12 Device and Documentation Support

12.1 Documentation Support

12.1.1 Related Documentation

For related documentation, see the following:

LM4041-N/LM4041-N-Q1 Precision Micropower Shunt Voltage Reference, SNOS641

12.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
LM4040-N	Click here	Click here	Click here	Click here	Click here
LM4040-N-Q1	Click here	Click here	Click here	Click here	Click here
LM4040-N-Q1	Click here	Click here	Click here	Click here	Click here

12.3 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views: see TI's Terms of

TI E2E™ Online Community TI's Engineer-to-Engineer (E2E) Community. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support TI's Design Support Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.4 Trademarks

E2E is a trademark of Texas Instruments.

All other trademarks are the property of their respective owners.

12.5 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

12.6 Glossary

SLYZ022 — TI Glossarv.

This glossary lists and explains terms, acronyms, and definitions.

13 Mechanical, Packaging, And Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

13.1 SOT-23 and SC70 Package Marking Information

Only three fields of marking are possible on the SOT-23's and SC70's small surface. This table gives the meaning of the three fields.

First Field:

Submit Documentation Feedback

SOT-23 and SC70 Package Marking Information (continued)

R = Reference

Second Field: Voltage Option

J = 2.048-V Voltage Option

2 = 2.5-V Voltage Option

K = 3-V Voltage Option

4 = 4.096-V Voltage Option

5 = 5-V Voltage Option

8 = 8.192-V Voltage Option

0 = 10-V Voltage Option

Third Field: Initial Reverse Breakdown Voltage or Reference Voltage Tolerance

 $A = \pm 0.1\%$

 $B = \pm 0.2\%$

C = +0.5%

 $D = \pm 1.0\%$

 $E = \pm 2.0\%$

PART MARKING	FIELD DEFINITION	
RJA (SOT-23 only)	Reference, 2.048 V, ±0.1%	
R2A (SOT-23 only)	Reference, 2.5 V, ±0.1%	
RKA (SOT-23 only)	Reference, 3 V, ±0.1%	
R4A (SOT-23 only)	Reference, 4.096 V, ±0.1%	
R5A (SOT-23 only)	Reference, 5 V, ±0.1%	
R8A (SOT-23 only)	Reference, 8.192 V, ±0.1%	
R0A (SOT-23 only)	Reference, 10 V, ±0.1%	
RJB	Reference, 2.048 V, ±0.2%	
R2B	Reference, 2.5 V, ±0.2%	
RKB	Reference, 3 V, ±0.2%	
R4B	Reference, 4.096 V, ±0.2%	
R5B	Reference, 5 V, ±0.2%	
R8B (SOT-23 only)	Reference, 8.192 V, ±0.2%	
R0B (SOT-23 only)	Reference, 10 V, ±0.2%	
RJC	Reference, 2.048 V, ±0.5%	
R2C	Reference, 2.5 V, ±0.5%	
RKC	Reference, 3 V, ±0.5%	
R4C	Reference, 4.096 V, ±0.5%	
R5C	Reference, 5 V, ±0.5%	
R8C (SOT-23 only)	Reference, 8.192 V, ±0.5%	
R0C (SOT-23 only)	Reference, 10 V, ±0.5%	
RJD	Reference, 2.048 V, ±1.0%	
R2D	Reference, 2.5 V, ±1.0%	
RKD	Reference, 3 V, ±1.0%	
R4D	Reference, 4.096 V, ±1.0%	
R5D	Reference, 5 V, ±1.0%	
R8D (SOT-23 only)	Reference, 8.192 V, ±1.0%	
R0D (SOT-23 only)	Reference, 10 V, ±1.0%	
RJE	Reference, 2.048 V, ±2.0%	
R2E	Reference, 2.5 V, ±2.0%	
RKE	Reference, 3 V, ±2.0%	



www.ti.co

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp
LM4040AIM3-10.0	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040AIM3-10.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
LM4040AIM3-2.0	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040AIM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040AIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
LM4040AIM3-4.1	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040AIM3-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3-5.0	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040AIM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3X-10/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3X-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3X-2.5	NRND	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI
LM4040AIM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3X-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIM3X-5.0	NRND	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI
LM4040AIM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIZ-10.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS	CU SN	N / A for Pkg Type

PAC

& no Sb/Br)

Addendum-Page 1



TEXAS INSTRUMENTS

PAC

www.ti.com								v	ww.ti.com		3-00	ct-2018						
Orderable Device	Status (1)	Package Type	Package Drawing		Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Terde r(á l 51)s	Device De	v Status	Package Typ	e£ Package Drawing		Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp
LM4040AIZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS	CU SN	N / A for Pkg Type		M3X- 410 40A	NRND	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI
LM4040AIZ-4.1/NOPB	ACTIVE	TO-92	LP	3	1800	& no Sb/Br) Green (RoHS	CU SN	N / A for Pkg Type	LM4040BIM3	x-4.1/NZPB 4040A	_ ACTIVE	SOT-23_	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040AIZ-5.0/NOPB	ACTIVE	TO-92	LP	3	1800	& no Sb/Br) Green (RoHS	CU SN	N / A for Pkg Type	LM4040BIM3	x-5.0/N ZOP B 4040A	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040BIM3-10.0	NRND	SOT-23	DBZ	3	1000	& no Sb/Br)	Call TI	Call TI	LM4040BIM7	-2.0/NGPB R0B	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040BIM3-10.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI		IM7-2 8 0B	NRND	SC70	DCK	5	1000	TBD	Call TI	Call TI
LM4040BIM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLI	LM4040BIM7	-2.5/NOPB RJB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040BIM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	& no Sb/Br) TBD	Call TI	Call TI	LM4040BIM7	7-5.0/NOPB R2B	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
LM4040BIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLIV	LM4040BIM7	X-2.5/NOPB R2B	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI
						& no Sb/Br)			111101007	0.0000	- AOTIVE		- 15	_	4000	O (D-110	OLLON	NI / A for Direction

LM4040BIZ-10.0/NOPB ACTIVE Green (RoHS CU SN N / A for Pkg Type TO-92 1800 LM4040BIM3-3.0 NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI & no Sb/Br) **ACTIVE** SOT-23 DBZ 3 1000 CU SN Level-1-260C-UNLI LM4040BIM3-3.0/NOPB Green (RoHS LM4040BIZ-2.5/NOPB ACTIVE TO-92 LP 3 1800 Green (RoHS CU SN N / A for Pkg Type & no Sb/Br) & no Sb/Br) LM4040BIM3-4.1 NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040BIZ-4.1/NOPB ACTIVE TO-92 LP 3 Green (RoHS CU SN N / A for Pkg Type 1800 LM4040BIM3-4.1/NOPB ACTIVE SOT-23 DBZ Green (RoHS CU SN Level-1-260C-UNLI R4B 3 1000 & no Sb/Br) & no Sb/Br) LM4040BIZ-5.0/NOPB ACTIVE TO-92 LP 1800 CU SN 3 Green (RoHS N / A for Pkg Type LM4040BIM3-5.0 NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI R5B & no Sb/Br) LM4040BIM3-5.0/NOPB ACTIVE SOT-23 DBZ 3 1000 Green (RoHS CU SN Level-1-260C-UNLIM LM4040CEM3-2R5B NRND SOT-23 DBZ 3 Call TI 1000 TBD Call TI & no Sb/Br) **ACTIVE** SOT-23 DBZ 1000 Green (RoHS CU SN Level-1-260C-UNLIM NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040BIM3-8.2 & no Sb/Br) LM4040BIM3-8.2/NOPB **ACTIVE** SOT-23 DBZ 3 1000 Green (RoHS CU SN Level-1-260C-UNLIM LM4040CEM3-3.0/NR3/BB **ACTIVE** SOT-23 DBZ 3 1000 Green (RoHS CU SN Level-1-260C-UNLIM & no Sb/Br) & no Sb/Br) LM4040BIM3X-10/NOPB **ACTIVE** SOT-23 DBZ 3 3000 Green (RoHS CU SN Level-1-260C-UNLIM LM4040CEM3-5R00B NRND SOT-23 DBZ 3 Call TI Call TI 1000 & no Sb/Br) LM4040CEM3-5.0/NOPB **ACTIVE** SOT-23 DBZ 3 1000 Green (RoHS CU SN Level-1-260C-UNLIM LM4040BIM3X-2.0/NOPB ACTIVE SOT-23 DBZ 3 3000 Green (RoHS CU SN Level-1-260C-UNLIM RJB & no Sb/Br) & no Sb/Br) LM4040CEM3X-3.0/NOPB ACTIVE SOT-23 DBZ 3 3000 Green (RoHS CU SN Level-1-260C-UNLIM NRND SOT-23 3 Call TI LM4040BIM3X-2.5 DBZ 3000 TBD Call TI R2B & no Sb/Br) LM4040BIM3X-2.5/NOPB **ACTIVE** SOT-23 DBZ 3 3000 Green (RoHS CU SN Level-1-260C-UNLIM LM4040CEM3X-5.0/RQBPB ACTIVE SOT-23 DBZ 3000 CU SN Level-1-260C-UNLIM 3 Green (RoHS & no Sb/Br) & no Sb/Br) LM4040BIM3X-3.0/NOPB ACTIVE SOT-23 DBZ 3 3000 Green (RoHS CU SN Level-1-260C-UNLIM LM4040CIM3-10R0KB NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI & no Sb/Br) Addendum-Page 2

Addendum-Page 3



TEXAS INSTRUMENTS

MSL Peak Temp Op Toerdipr(2000)e Device Dev Status Package Type: Package Pins Package Eco Plan

PAC

MSL Peak Temp

Lead/Ball Finish

~	INSTRUMENTS
www.ti.com	

Status Package Type Package Pins Package Eco Plan

Orderable Device

513313315 2 51155	(1)	. aciago .,po	Drawing		Qty	(2)	(6)	(3)	op ienspiasop beviee bev	(1)	g dendge Type	Drawing		Qty	(2)	(6)	(3)
LM4040CIM3-10.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN	M LM4040CIM7-2.0/NRUPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CUSN	Level-1-260C-UNLIV
LM4040CIM3-2.0	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	LM4040CIM7-2.5/NRJRB	ACTIVE	SC70	DCK	5	1000	Green (RoHS	CU SN	Level-1-260C-UNLIV
LM4040CIM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLI				5			& no Sb/Br)		
						& no Sb/Br)			LM4040CIM7X-2.5/NOPB	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIV
LM4040CIM3-2.5	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	R2C LM4040CIZ-10.0/NQ-PB	ACTIVE	TO-92	LP	3	1800	Green (RoHS	CU SN	N / A for Pkg Type
LM4040CIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	1120			5			& no Sb/Br)		- 7.
LM4040CIM3-3.0	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	LM4040CIZ-2.5/LRT&C	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type
LM4040CIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN	LM4040CIZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type
LM4040CIM3-4.1	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	LM4040CIZ-4.1/NOPB	ACTIVE	TO-92	- LP	3	1800	Green (RoHS	CU SN	N / A for Pkg Type
LM4040CIM3-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	n R4C			9			& no Sb/Br)		
LM4040CIM3-5.0	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	LM4040CIZ-5.0/NOPB R5C	ACTIVE	TO-92	- LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type
LM4040CIM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	LIVI4040DEIVI3-2.0	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040CIM3-8.2	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	LM4040DEM3-2.0/NOPB R8C	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
LM4040CIM3-8.2/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	М LM4040DEM3-2.5/№9РВ	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
LM4040CIM3X-10/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN	И LM4040DEM3-3.0/№9РВ	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
LM4040CIM3X-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS	CU SN	Level-1-260C-UNLI	LM4040DEM3-5RoJC	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040CIM3X-2.5	NRND	SOT-23	DBZ	3	3000	& no Sb/Br) TBD	Call TI	Call TI	LM4040DEM3-5.0/NOPB R2C	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIV
LM4040CIM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	И ∟м4040ДЕМЗХ-2.5/№В	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
LM4040CIM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	И LM4040DEM3X-5.0/ №6 В	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
LM4040CIM3X-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS	CU SN	Level-1-260C-UNLI	M LM4040DIM3-10 ^{R4C}	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
LM4040CIM3X-5.0	NRND	SOT-23	DBZ	3	3000	& no Sb/Br) TBD	Call TI	Call TI	LM4040DIM3-10.0/NOPB R5C	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIV
LM4040CIM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN		ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIV
									LM4040DIM3-2.5	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI
						Addendum-Pa	age 4								Addendum-P	age 5	

Lead/Ball Finish



TEXAS INSTRUMENTS
3-Oct-2018

PAC

www.ti.com								ļ.	www.ti.com			3-Oct	-2018						
Orderable Device	Status (1)	Package Type	e Package Drawing		Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Terde r(a lbi)	Device	Dev St	atus (1)	Package Typ	e£ Package Drawing		Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp
LM4040DIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIV	M LM4040DIZ	2.5/N ®2B	AC	TIVE	TO-92	<u>L</u> P	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type
LM4040DIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	M LM4040DIZ	4.1/NORIPOB	AC	TIVE	TO-92	<u>LP</u>	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type
LM4040DIM3-4.1	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	LM4040DIZ	-5.0/L R74 D	AC	TIVE	TO-92	LP	3	2000	Green (RoHS	CU SN	N / A for Pkg Type
LM4040DIM3-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLIN	1.140.40.017	R4D		TI) /F	TO 00	LD		4000	& no Sb/Br)	OLLON	NI / A for Dior Tour

					& no Sb/Br)						1			& no Sb/Br)		
NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	LM4040DIZ-5.0/LR#D	ACTIVE	TO-92	LP	3	2000	Green (RoHS	CU SN	N / A for Pkg Type
ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLI									
									ACTIVE	TO-92	LP	3	1800		CU SN	N / A for Pkg Type
NRND		DBZ	3	1000	TBD	Call TI	Call TI	R5D	A OTIVE	00T 00	DD7	_	4000		OLLON	1 1 4 0000 1 15 11 15
ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	ROD	ACTIVE	SO1-23	9	3		& no Sb/Br)		Level-1-260C-UNLIN
ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLI	LM4040EIM3-2.58D	NRND	SOT-23	-	3	1000	TBD	Call TI	Call TI
					& no Sb/Br)			LM4040EIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLIN
ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS	CU SN	Level-1-260C-UNLI									
									ACTIVE	SOT-23	DBZ	3	1000		CU SN	Level-1-260C-UNLI
ACTIVE	SOT-23	DBZ	3	3000		CU SN	Level-1-260C-UNLI		NDND	SOT 22	DP7	2	3000		Call TI	Call TI
NDND	207.00	202	_	0000		0 T	0 11 71									
									ACTIVE	SO1-23	DBZ	3	3000		CU SN	Level-1-260C-UNLI
ACTIVE	SOT-23	DBZ	3	3000		CU SN	Level-1-260C-UNLI		ACTIVE	SOT-23	DB7	3	3000		CLLSN	Level-1-260C-UNLIN
ACTIVE	SOT-23	DR7	3	3000		CHSN	Lovel-1-260C-UNUIV		AOTIVE -	301-23	002	3	3000	& no Sb/Br)	CO 314	Level- 1-2000-UNLIN
ACTIVE	301-23	DBZ	3	3000	& no Sb/Br)	CO SIN	Level- 1-200C-UNLIN	LM4040EIM7-2.0/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS	CU SN	Level-1-260C-UNLIN
ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS	CU SN	Level-1-260C-UNLIN							& no Sb/Br)		
_					& no Sb/Br)			LM4040QAIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLIN
NRND	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	R5D						& no Sb/Br)		
ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIV	LM4040QAIM3X2.5/NOBB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIV	LM4040QBIM3-2.5/NGBB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	LM4040QBIM3X2.5/NOBB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
NRND	SC70	DCK	5	1000	TBD	Call TI	Call TI	LM4040QCEM3-2.5/NDBB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLI
ACTIVE	SC70	DCK	5	1000	Green (RoHS	CU SN	Level-1-260C-UNLIV	R5D						,		
ACTIVE	TO 02	LD	2	1900	& no Sb/Br)	CHEN	N / A for Dkg Time		ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
ACTIVE	10-92	LP	3	1000	& no Sb/Br)	CU SN	N / A for Pkg Type	LM4040QCIM3-2.5/NAPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIN
	ACTIVE NRND ACTIVE NRND ACTIVE ACTIVE ACTIVE ACTIVE ACTIVE	ACTIVE SOT-23 NRND SOT-23 ACTIVE SOT-23 ACTIVE SOT-23 ACTIVE SOT-23 ACTIVE SOT-23 NRND SOT-23 ACTIVE SOT-23 ACTIVE SOT-23 ACTIVE SOT-23 NRND SOT-23 ACTIVE SOT-23 ACTIVE SOT-23 ACTIVE SOT-23 ACTIVE SC70 ACTIVE SC70 ACTIVE SC70 ACTIVE SC70	ACTIVE SOT-23 DBZ NRND SOT-23 DBZ ACTIVE SOT-23 DBZ ACTIVE SOT-23 DBZ ACTIVE SOT-23 DBZ ACTIVE SOT-23 DBZ NRND SOT-23 DBZ ACTIVE SC70 DCK NRND SC70 DCK NRND SC70 DCK ACTIVE SC70 DCK	ACTIVE SOT-23 DBZ 3 NRND SOT-23 DBZ 3 ACTIVE SOT-23 DBZ 3 ACTIVE SOT-23 DBZ 3 ACTIVE SOT-23 DBZ 3 ACTIVE SOT-23 DBZ 3 NRND SOT-23 DBZ 3 ACTIVE SC70 DCK 5 NRND SC70 DCK 5 NRND SC70 DCK 5 ACTIVE SC70 DCK 5	ACTIVE SOT-23 DBZ 3 1000 NRND SOT-23 DBZ 3 1000 ACTIVE SOT-23 DBZ 3 1000 ACTIVE SOT-23 DBZ 3 1000 ACTIVE SOT-23 DBZ 3 3000 ACTIVE SOT-23 DBZ 3 3000 NRND SOT-23 DBZ 3 3000 ACTIVE SOT-23 DBZ 3 3000 ACTIVE SOT-23 DBZ 3 3000 NRND SOT-23 DBZ 3 3000 ACTIVE SC70 DCK 5 1000 ACTIVE SC70 DCK 5 1000	NRND SOT-23 DBZ 3 1000 TBD ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & no Sb/Br) NRND SOT-23 DBZ 3 1000 TBD ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & no Sb/Br) ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & no Sb/Br) NRND SOT-23 DBZ 3 3000 Green (RoHS & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & no Sb/Br) NRND SOT-23 DBZ 3 3000 Green (RoHS & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & no Sb/Br) ACTIVE SC70 <td>NRND SOT-23 DBZ 3 1000 TBD Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3 1000 TBD Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3</td> <td>NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN Level-1-260C-UNLIM NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 1000 Green (ROHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM NRND SOT-23 DBZ 3 3000 TBD Call TI Call TI ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM NRND</td> <td> NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.0/LR#D </td> <td> NRND</td> <td> NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.0/LRRD ACTIVE TO-92 </td> <td> NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.0LRRD ACTIVE TO-92 LP </td> <td> NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.01_RRD ACTIVE TO-92 LP 3 </td> <td> NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.01_RTID ACTIVE TO-92 LP 3 2000 </td> <td> NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.01RRD ACTIVE TO-92 LP 3 2000 Green (RoHS & no Sb/Br) CU SN Level-1-280C-UNLM M4040DIZ-5.01NDPB ACTIVE TO-92 LP 3 2000 Green (RoHS & no Sb/Br) CU SN Level-1-280C-UNLM M4040DIZ-5.01NDPB ACTIVE TO-92 LP 3 1800 Green (RoHS & no Sb/Br) Call TI Call TI Call TI RSD Call TI Call TI Call TI RSD Call TI Call TI </td> <td> NRND SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE TO-92 LP 3 2000 Green (RichS CU SN ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 6,NQF LM040DEIM3-2 6,N</td>	NRND SOT-23 DBZ 3 1000 TBD Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3 1000 TBD Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) ACTIVE SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3 3000 Green (RoHS & CU SN & no Sb/Br) NRND SOT-23 DBZ 3	NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN Level-1-260C-UNLIM NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI ACTIVE SOT-23 DBZ 3 1000 Green (RoHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 1000 Green (ROHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM NRND SOT-23 DBZ 3 3000 TBD Call TI Call TI ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM ACTIVE SOT-23 DBZ 3 3000 Green (ROHS & CU SN Level-1-260C-UNLIM NRND	NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.0/LR#D	NRND	NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.0/LRRD ACTIVE TO-92	NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.0LRRD ACTIVE TO-92 LP	NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.01_RRD ACTIVE TO-92 LP 3	NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.01_RTID ACTIVE TO-92 LP 3 2000	NRND SOT-23 DBZ 3 1000 TBD Call TI Call TI LM4040DIZ-5.01RRD ACTIVE TO-92 LP 3 2000 Green (RoHS & no Sb/Br) CU SN Level-1-280C-UNLM M4040DIZ-5.01NDPB ACTIVE TO-92 LP 3 2000 Green (RoHS & no Sb/Br) CU SN Level-1-280C-UNLM M4040DIZ-5.01NDPB ACTIVE TO-92 LP 3 1800 Green (RoHS & no Sb/Br) Call TI Call TI Call TI RSD Call TI Call TI Call TI RSD Call TI Call TI	NRND SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE TO-92 LP 3 2000 Green (RichS CU SN ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 5,NQFB ACTIVE SOT-23 DBZ 3 1000 Green (RichS CU SN Level-1-260C-UNLIM LM040DEIM3-2 6,NQF LM040DEIM3-2 6,N

Addendum-Page 6



TEXAS INSTRUMENTS

PAC

www.ti.com

3-Oct-201

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	[5] Notyliplen Device Markings wil Device Marking theses. Only csampstes e Marking contained in parentheses and separated by a "~" will appear on a device. If of the previous line and the two combined represent the entire Device Marking for that device.
LM4040QCIM3X2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	M R6C Samples (6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish
LM4040QDEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	Malue exceeds the maximan column width. Samples
LM4040QDEM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN		mportant Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI base provided by third parties, and makes no representation or ward lives to the accuracy of such information. Efforts are underway to better integrate information.
LM4040QDIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	tontinues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analys II and II suppliers consider certain information to be proprie <mark>tlangual at the CAS numbers and other limited information may not be available for release.</mark>
LM4040QDIM3X2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	h no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Custom
LM4040QEEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLI	OTHER QUALIFIED VERSTONS OF LM4040-N, LM4040-N-Q100ples
LM4040QEEM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS	CU SN	Level-1-260C-UNLI	Catalog d M4040-N R3E

Level-1-260C-UNLIM Automotive: LM4040-N-Q1

Level-1-260C-UNLIM R6E NOTE: Qualified Version Definitions:

LM4040QEIM3-2.5/NOPB

LM4040QEIM3X2.5/NOPB

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

SOT-23

SOT-23

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

3

1000

3000

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

ACTIVE

ACTIVE

(2) RoHS: TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

& no Sb/Br)

Green (RoHS

& no Sb/Br)

Green (RoHS

& no Sb/Br)

CU SN

CU SN

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (CI) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

DBZ

DBZ

Catalog - TI's standard catalog product

• Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

Addendum-Page 8 Addendum-Page 9

⁽¹⁾ The marketing status values are defined as follows:

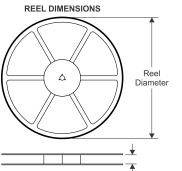


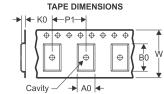
PACKAGE MATERIALS INFORMATION

PACKAGE MATERIALS INFORMATION

31-May-2019 www.ti.com 31-May-2019

TAPE AND REEL INFORMATION



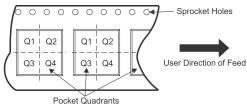


	Dimension designed to accommodate the component width
	Dimension designed to accommodate the component length
	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape

P1 Pitch between successive cavity centers

Reel Width (W1)

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM4040AIM3-10.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-10.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-2.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-2.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-2.5	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-3.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-4.1	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-4.1/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-5.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3-5.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3X-10/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3X-2.5	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040AIM3X-5.0	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3



Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM4040AIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-10.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-10.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-2.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-2.5	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-3.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-3.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-4.1	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-4.1/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-5.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-5.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-8.2	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3-8.2/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-10/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-2.5	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-4.1	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040BIM7-2.0/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040BIM7-2.5	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040BIM7-2.5/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040BIM7-5.0/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040BIM7X-2.5/NOPB	SC70	DCK	5	3000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040CEM3-2.5	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CEM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CEM3-3.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CEM3-5.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CEM3-5.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CEM3X-3.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CEM3X-5.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-10.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-10.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-2.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-2.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-2.5	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-3.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-3.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-4.1	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3

Pack Materials-Page 1

Pack Materials-Page 2



PACKAGE MATERIALS INFORMATION

TEXAS INSTRUMENTS

PACKAGE MATERIALS INFORMATION

www.ti.com 31-May-2019

Device	Package		Pins	SPQ	Reel	Reel	, A0	B0	K0	, P1	, w	Pin1
	Туре	Drawing			Diameter (mm)	Width W1 (mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Quadrant
LM4040CIM3-4.1/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-5.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-5.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-8.2	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3-8.2/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-10/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-2.5	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-5.0	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040CIM7-2.0/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040CIM7-2.5/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040CIM7X-2.5/NOPB	SC70	DCK	5	3000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040DEM3-2.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DEM3-2.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DEM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DEM3-3.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DEM3-5.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DEM3-5.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DEM3X-2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DEM3X-5.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-10.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-10.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-2.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-2.5	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-3.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-4.1	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-4.1/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-5.0	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-5.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3-8.2/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-10/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-2.5	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-5.0	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040DIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3

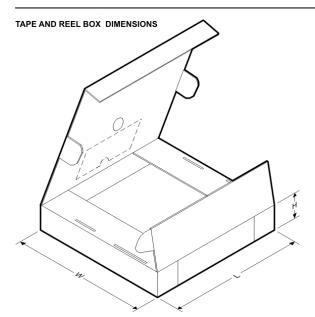
www.ti.com 31-May-2019

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM4040DIM7-2.0/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040DIM7-2.5/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040DIM7-5.0	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040DIM7-5.0/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040EEM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040EIM3-2.5	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040EIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040EIM3-3.0/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040EIM3X-2.5	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040EIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040EIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040EIM7-2.0/NOPB	SC70	DCK	5	1000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
LM4040QAIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QAIM3X2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QBIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QBIM3X2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QCEM3-2.5/NOP B	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QCEM3-3.0/NOP B	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QCIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QCIM3X2.5/NOP B	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QDEM3-2.5/NOP B	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QDEM3-3.0/NOP B	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QDIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QDIM3X2.5/NOP B	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QEEM3-2.5/NOP B	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QEEM3-3.0/NOP B	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QEIM3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM4040QEIM3X2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3



PACKAGE MATERIALS INFORMATION

31-May-2019 www.ti.com



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM4040AIM3-10.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-10.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-2.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-2.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-2.5	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-4.1	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-4.1/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-5.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3-5.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040AIM3X-10/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040AIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040AIM3X-2.5	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040AIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040AIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040AIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040AIM3X-5.0	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040AIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3-10.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0



PACKAGE MATERIALS INFORMATION

31-May-2019 www.ti.com

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM4040BIM3-10.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-2.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-2.5	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-3.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-4.1	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-4.1/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-5.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-5.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-8.2	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3-8.2/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040BIM3X-10/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3X-2.5	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3X-4.1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040BIM7-2.0/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040BIM7-2.5	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040BIM7-2.5/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040BIM7-5.0/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040BIM7X-2.5/NOPB	SC70	DCK	5	3000	210.0	185.0	35.0
LM4040CEM3-2.5	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CEM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CEM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CEM3-5.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CEM3-5.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CEM3X-3.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CEM3X-5.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3-10.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-10.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-2.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-2.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-2.5	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-3.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-4.1	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-4.1/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-5.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-5.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0



PACKAGE MATERIALS INFORMATION

TEXAS INSTRUMENTS

PACKAGE MATERIALS INFORMATION

www.ti.com 31-May-2019

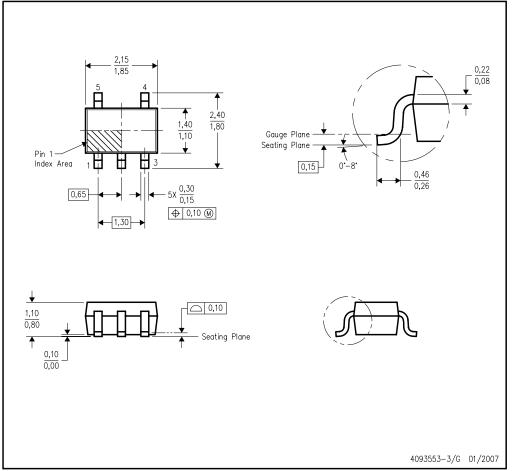
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM4040CIM3-8.2	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3-8.2/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040CIM3X-10/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3X-2.5	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3X-5.0	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040CIM7-2.0/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040CIM7-2.5/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040CIM7X-2.5/NOPB	SC70	DCK	5	3000	210.0	185.0	35.0
LM4040DEM3-2.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DEM3-2.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DEM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DEM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DEM3-5.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DEM3-5.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DEM3X-2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DEM3X-5.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3-10.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-10.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-2.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-2.5	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-4.1	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-4.1/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-5.0	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-5.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3-8.2/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040DIM3X-10/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3X-2.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3X-2.5	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3X-4.1/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3X-5.0	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM3X-5.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040DIM7-2.0/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040DIM7-2.5/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040DIM7-5.0	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040DIM7-5.0/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0

www.ti.com 31-May-2019

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
Device	Раскаде туре	Package Drawing	Pins	SPU	Length (mm)	wiath (mm)	Height (mm)
LM4040EEM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040EIM3-2.5	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040EIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040EIM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040EIM3X-2.5	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040EIM3X-2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040EIM3X-3.0/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040EIM7-2.0/NOPB	SC70	DCK	5	1000	210.0	185.0	35.0
LM4040QAIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QAIM3X2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040QBIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QBIM3X2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040QCEM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QCEM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QCIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QCIM3X2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040QDEM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QDEM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QDIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QDIM3X2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4040QEEM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QEEM3-3.0/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QEIM3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM4040QEIM3X2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0

DCK (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE

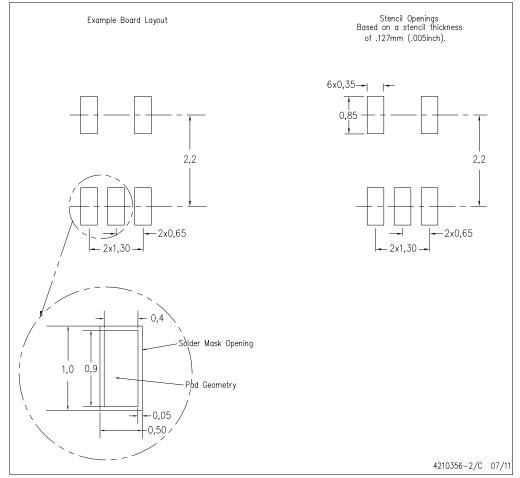


NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Falls within JEDEC MO-203 variation AA.



PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.







Images above are just a representation of the package family, actual package may vary. Refer to the product data sheet for package details.

4203227/C

TEXAS INSTRUMENTS

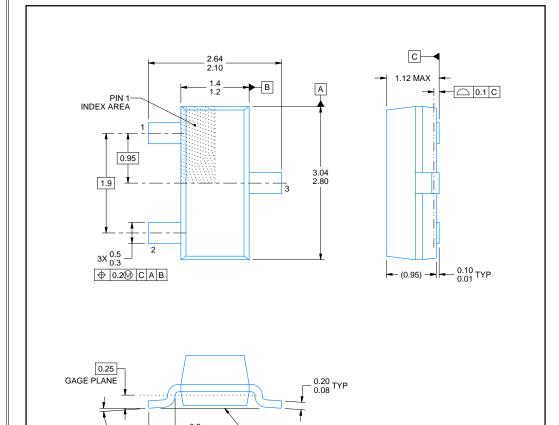
DBZ0003A

PACKAGE OUTLINE

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR

4214838/C 04/2017



NOTES:

- 1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing
- This drawing is subject to change without notice.
 Reference JEDEC registration TO-236, except minimum foot length.



-SEATING PLANE

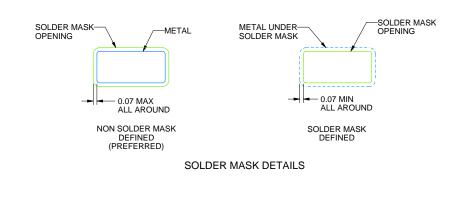
SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR

4214838/C 04/2017

SMALL OUTLINE TRANSISTOR **→** 3X (1.3) 3X (0.6) SYMM 2X (0.95)

LAND PATTERN EXAMPLE

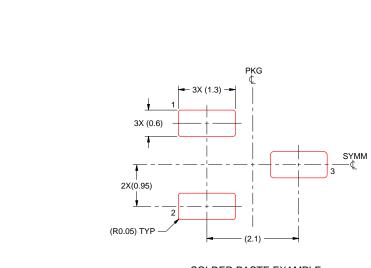


4214838/C 04/2017

NOTES: (continued)

- 4. Publication IPC-7351 may have alternate designs.
- 5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

(R0.05) TYP



SOLDER PASTE EXAMPLE BASED ON 0.125 THICK STENCIL SCALE:15X

NOTES: (continued)

- 6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
- Board assembly site may have different recommendations for stencil design.





LP0003A

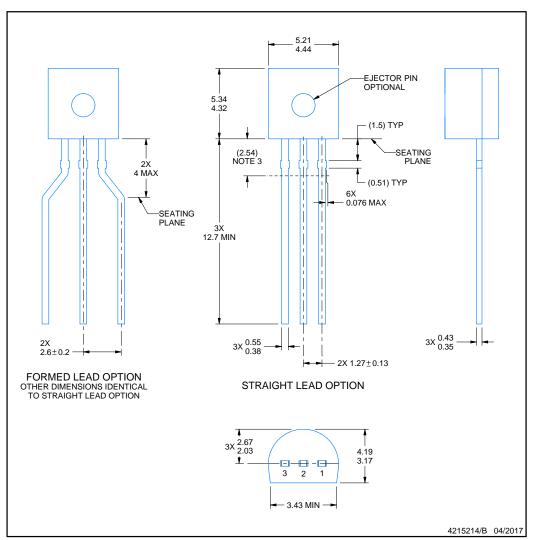




Images above are just a representation of the package family, actual package may vary. Refer to the product data sheet for package details.

4040001-2/F





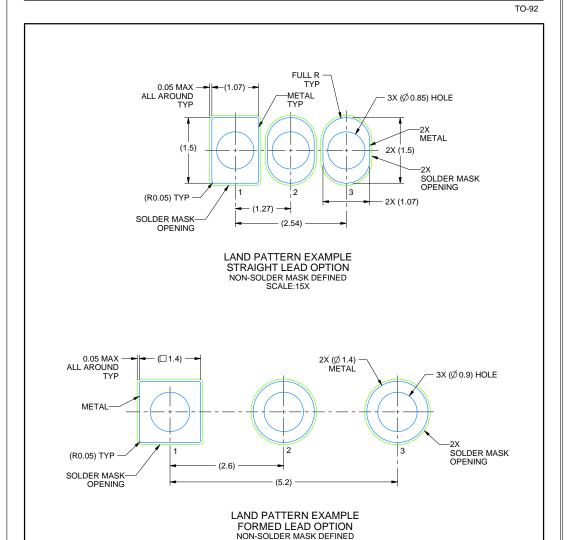
NOTES:

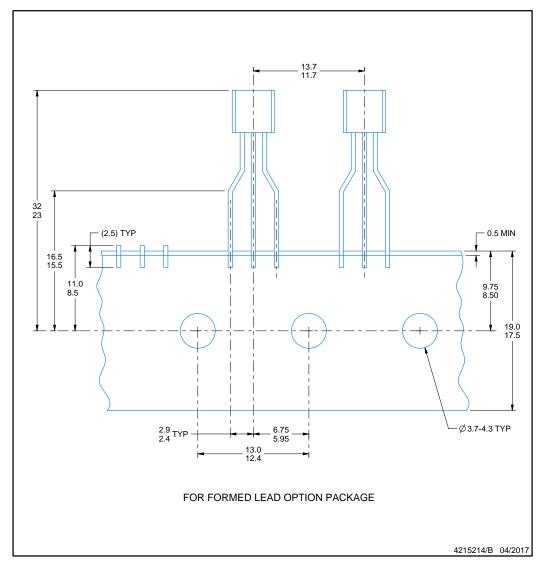
- 1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- 2. This drawing is subject to change without notice.
- Lead dimensions are not controlled within this area.
 Reference JEDEC TO-226, variation AA.
- 5. Shipping method:
- a. Straight lead option available in bulk pack only.
 b. Formed lead option available in tape and reel or ammo pack.
- c. Specific products can be offered in limited combinations of shipping medium and lead options.
- d. Consult product folder for more information on available options.



4215214/B 04/2017

LP0003A





SCALE:15X

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2019, Texas Instruments Incorporated