LM4040-N/LM4040Q-N Precision Micropower Shunt Voltage Reference

Check for Samples: LM4040-N, LM4040Q-N

FEATURES

- **2.5V/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 2.048V, 2.500V,3.000V, 4.096V, 5.000V, 8.192V, and 10.000V**

APPLICATIONS

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

DESCRIPTION

Ideal for space critical applications, the LM4040-N precision voltage reference is available in the sub-miniature SC70 and SOT-23 surface-mount package. The LM4040-N's advanced design 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: 2.048V, 2.500V, 3.000V, 4.096V, 5.000V, 8.192V, and 10.000V. The minimum operating current increases from 60 µA for the 2.5-V LM4040-N to 100 µA for the 10.0-V LM4040-N. All versions have a maximum operating current of 15 mA.

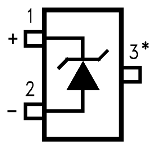
The LM4040-N utilizes fuse and zener-zap reverse breakdown voltage trim during wafer sort to ensure that the prime parts have an accuracy of better than ±0.1% (A grade) at 25°C. Bandgap reference temperature drift curvature correction and low dynamic impedance ensure stable reverse breakdown voltage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

Also available is the LM4041-N with two reverse breakdown voltage versions: adjustable and 1.2V. Please see the LM4041-N data sheet.

Key Specifications (2.5-V LM4040-N)

	VALUE	UNIT
Output voltage tolerance (A grade, 25°C)	±0.1	% (max)
Low output noise (10 Hz to 10 kHz)	35	μV_{rms} (typ)
Wide operating current range	60 to 15	µA to mA
Industrial temperature range	−40 to +85	°C
Extended temperature range	−40 to +125	°C
Low temperature coefficient	100	ppm/°C (max)

Connection Diagrams



*This pin must be left floating or connected to pin 2.

Figure 1. SOT-23 (Top View)
See Package Number DBZ
(JEDEC Registration TO-236AB)

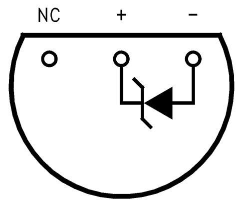
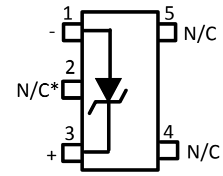


Figure 2. TO-92 (Bottom View)
See Package Number LP



*This pin must be left floating or connected to pin 1.

Figure 3. SC70 (Top View)
See Package Number DCK

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:
R = Reference

Second Field: Voltage Option
J = 2.048V Voltage Option
2 = 2.500V Voltage Option
K = 3.000V Voltage Option
4 = 4.096V Voltage Option
5 = 5.000V Voltage Option
8 = 8.192V Voltage Option
0 = 10.000V Voltage Option

Third Field: Initial Reverse Breakdown Voltage or Reference Voltage Tolerance
A = ±0.1%
B = ±0.2%
C = +0.5%
D = ±1.0%
E = ±2.0%

Part Marking	Field Definition
RJA (SOT-23 only)	Reference, 2.048V, ±0.1%
R2A (SOT-23 only)	Reference, 2.500V, ±0.1%
RKA (SOT-23 only	Reference, 3.000V, ±0.1%
R4A (SOT-23 only)	Reference, 4.096V, ±0.1%
R5A (SOT-23 only)	Reference, 5.000V, ±0.1%
R8A (SOT-23 only)	Reference, 8.192V, ±0.1%
R0A (SOT-23 only)	Reference, 10.000V, ±0.1%
RJB	Reference, 2.048V, ±0.2%
R2B	Reference, 2.500V, ±0.2%
RKB	Reference, 3.000V, ±0.2%
R4B	Reference, 4.096V, ±0.2%
R5B	Reference, 5.000V, ±0.2%
R8B (SOT-23 only)	Reference, 8.192V, ±0.2%
R0B (SOT-23 only)	Reference, 10.000V, ±0.2%
RJC	Reference, 2.048V, ±0.5%
R2C	Reference, 2.500V, ±0.5%
RKC	Reference, 3.000V, ±0.5%
R4C	Reference, 4.096V, ±0.5%
R5C	Reference, 5.000V, ±0.5%

R8C (SOT-23 only)	Reference, 8.192V, ±0.5%
R0C (SOT-23 only)	Reference, 10.000V, ±0.5%
RJD	Reference, 2.048V, ±1.0%
R2D	Reference, 2.500V, ±1.0%
RKD	Reference, 3.000V, ±1.0%
R4D	Reference, 4.096V, ±1.0%
R5D	Reference, 5.000V, ±1.0%
R8D (SOT-23 only)	Reference, 8.192V, ±1.0%
R0D (SOT-23 only)	Reference, 10.000V, ±1.0%
RJE	Reference, 2.048V, ±2.0%
R2E	Reference, 2.500V, ±2.0%
RKE	Reference, 3.000V, ±2.0%

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.

Absolute Maximum Ratings(1)(2)

Reverse Current		20 mA
Forward Current		10 mA
Power Dissipation (T_A = 25°C)(3)	SOT-23 (M3) Package	306 mW
	TO-92 (Z) Package	550 mW
	SC70 (M7) Package	241 mW
Storage Temperature		−65°C to +150°C
Soldering Temperature(4)	SOT-23 (M3) Package Peak Reflow (30 sec)	+260°C
	TO-92 (Z) Package Soldering (10 sec)	+260°C
	SC70 (M7) Package Peak Reflow (30 sec)	+260°C
ESD Susceptibility	Human Body Model(5)	2 kV
	Machine Model(5)	200V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings 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) 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), θ_{JA} (junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $PD_{max} = (T_{Jmax} - T_A)/\theta_{JA}$ 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 (θ_{JA}), 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).
(5) The human body model is a 100 pF capacitor discharged through a 1.5 kΩ resistor into each pin. The machine model is a 200 pF capacitor discharged directly into each pin.

Operating Ratings[1][2]

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

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings 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), θ_{JA} (junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $PD_{max} = (T_{Jmax} - T_A)/\theta_{JA}$ 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 (θ_{JA}), 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.

2.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'A' and 'B'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and ±0.2%, respectively.

Symbol	Parameter	Conditions	Typical(1)	LM4040AIM3 LM4040AIZ — Limits(2)	LM4040BIM3 LM4040BIZ LM4040BIM7 Limits(2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	2.048			V
	Reverse Breakdown Voltage Tolerance(3)	I_R = 100 µA		±2.0	±4.1	mV (max)
				±15	**±17**	mV (max)
I_{RMIN}	Minimum Operating Current		45			µA
				60	60	µA (max)
				65	**65**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient(3)	I_R = 10 mA	±20			ppm/°C
		I_R = 1 mA	±15	**±100**	**±100**	ppm/°C (max)
		I_R = 100 µA	±15			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change(4)	$I_{RMIN} \leq I_R \leq$ 1 mA	0.3			mV
				0.8	0.8	mV (max)
				1.0	**1.0**	mV (max)
		1 mA ≤ I_R ≤ 15 mA	2.5			mV
				6.0	6.0	mV (max)
				8.0	**8.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.3			Ω
				0.8	0.8	Ω (max)
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			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(maxΔT)(V_R)]. Where, $\Delta V_R/\Delta T$ 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

2.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'C', 'D', and 'E'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0% and ±2.0%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040CIM3 LM4040CIZ LM4040CIM7 Limits (2)	LM4040DIM3 LM4040DIZ LM4040DIM7 Limits (2)	— LM4040EIZ LM4040EIM7 Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	2.048				V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 100 µA		±10	±20	±41	mV (max)
				±23	**±40**	**±60**	mV (max)
I_{RMIN}	Minimum Operating Current		45				µA
				60	65	65	µA (max)
				65	**70**	**70**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±20				ppm/°C
		I_R = 1 mA	±15	**±100**	**±150**	**±150**	ppm/°C (max)
		I_R = 100 µA	±15				ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \le I_R \le$ 1 mA	0.3				mV
				0.8	1.0	1.0	mV (max)
				1.0	**1.2**	**1.2**	mV (max)
		1 mA $\le I_R \le$ 15 mA	2.5				mV
				6.0	8.0	8.0	mV (max)
				8.0	**10.0**	**10.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz $I_{AC} = 0.1\ I_R$	0.3				Ω
				0.9	1.1	1.1	Ω(max)
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				%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

2.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'C', 'D', and 'E'; Temperature Grade 'E'

Boldface limits apply for T_A = T_J = T_{MIN} to T_{MAX}; all other limits T_A = T_J = 25°C. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0% and ±2.0%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040CEM3 Limits (2)	LM4040DEM3 Limits (2)	LM4040EEM3 Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	2.048				V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 100 µA		±10	±20	±41	mV (max)
				±30	**±50**	**±70**	mV (max)
I_{RMIN}	Minimum Operating Current		45				µA
				60	65	65	µA (max)
				68	**73**	**73**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±20				ppm/°C
		I_R = 1 mA	±15	**±100**	**±150**	**±150**	ppm/°C (max)
		I_R = 100 µA	±15				ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \leq I_R \leq$ 1 mA	0.3				mV
				0.8	1.0	1.0	mV (max)
				1.0	**1.2**	**1.2**	mV (max)
		1 mA ≤ I_R ≤ 15 mA	2.5				mV
				6.0	8.0	8.0	mV (max)
				8.0	**10.0**	**10.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.3				Ω
				0.9	1.1	1.1	Ω (max)
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				%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(maxΔT)(V_R)]. Where, $\Delta V_R/\Delta T$ 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

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

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = 25°C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and ±0.2%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040AIM3 LM4040AIZ — LM4040AIM3 Limits (2)	LM4040BIM3 LM4040BIZ LM4040BIM7 LM4040QBIM3 Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	2.500			V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 100 µA		±2.5	±5.0	mV (max)
				±19	**±21**	mV (max)
I_{RMIN}	Minimum Operating Current		45			µA
				60	60	µA (max)
				65	**65**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±20			ppm/°C
		I_R = 1 mA	±15	**±100**	**±100**	ppm/°C (max)
		I_R = 100 µA	±15			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \leq I_R \leq$ 1 mA	0.3			mV
				0.8	0.8	mV (max)
				1.0	**1.0**	mV (max)
		1 mA $\leq I_R \leq$ 15 mA	2.5			mV
				6.0	6.0	mV (max)
				8.0	**8.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.3			Ω
				0.8	0.8	Ω (max)
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			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(maxΔT)(V_R)]. Where, $\Delta V_R/\Delta T$ 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

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

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0% and ±2.0%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040CIZ LM4040CIM3 LM4040CIM7 LM4040QCIM3 Limits (2)	LM4040DIZ LM4040DIM3 LM4040DIM7 LM4040QDIM3 Limits (2)	LM4040EIZ LM4040EIM3 LM4040EIM7 LM4040QEIM3 Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	2.500				V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 100 µA		±12	±25	±50	mV (max)
				±29	**±49**	**±74**	mV (max)
I_{RMIN}	Minimum Operating Current		45				µA
				60	65	65	µA (max)
				65	**70**	**70**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±20				ppm/°C
		I_R = 1 mA	±15	**±100**	**±150**	**±150**	ppm/°C (max)
		I_R = 100 µA	±15				ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \le I_R \le 1$ mA	0.3				mV
				0.8	1.0	1.0	mV (max)
				1.0	**1.2**	**1.2**	mV (max)
		1 mA ≤ I_R ≤ 15 mA	2.5				mV
				6.0	8.0	8.0	mV (max)
				8.0	**10.0**	**10.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz $I_{AC} = 0.1\ I_R$	0.3				Ω
				0.9	1.1	1.1	Ω(max)
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				%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

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

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0% and ±2.0%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040CEM3 LM4040QCEM3 Limits (2)	LM4040DEM3 LM4040QDEM3 Limits (2)	LM4040EEM3 LM4040QEEM3 Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	2.500				V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 100 µA		±12	±25	±50	mV (max)
				±38	**±63**	**±88**	mV (max)
I_{RMIN}	Minimum Operating Current		45				µA
				60	65	65	µA (max)
				68	**73**	**73**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±20				ppm/°C
		I_R = 1 mA	±15	**±100**	**±150**	**±150**	ppm/°C (max)
		I_R = 100 µA	±15				ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \le I_R \le 1$ mA	0.3				mV
				0.8	1.0	1.0	mV (max)
				1.0	**1.2**	**1.2**	mV (max)
		1 mA ≤ I_R ≤ 15 mA	2.5				mV
				6.0	8.0	8.0	mV (max)
				8.0	**10.0**	**10.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$	0.3				Ω
				0.9	1.1	1.1	Ω (max)
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				%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

3.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'A' and 'B'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and ±0.2%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040AIM3 LM4040AIZ — Limits (2)	LM4040BIM3 LM4040BIZ LM4040BIM7 Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	3.000			V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 100 µA		±3.0	±6.0	mV (max)
				±22	**±26**	mV (max)
I_{RMIN}	Minimum Operating Current		47			µA
				62	62	µA (max)
				67	**67**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±20			ppm/°C
		I_R = 1 mA	±15	**±100**	**±100**	ppm/°C (max)
		I_R = 100 µA	±15			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \le I_R \le$ 1 mA	0.6			mV
				0.8	0.8	mV (max)
				1.1	**1.1**	mV (max)
		1 mA ≤ I_R ≤ 15 mA	2.7			mV
				6.0	6.0	mV (max)
				9.0	**9.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$	0.4			Ω
				0.9	0.9	Ω (max)
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			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

3.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'C', 'D', and 'E'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0% and ±2.0%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040CIM3 LM4040CIZ LM4040CIM7 Limits (2)	LM4040DIM3 LM4040DIZ LM4040DIM7 Limits (2)	LM4040EIM7 LM4040EIZ — Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	3.000				V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 100 µA		±15	±30	±60	mV (max)
				±34	**±59**	**±89**	mV (max)
I_{RMIN}	Minimum Operating Current		45				µA
				60	65	65	µA (max)
				65	**70**	**70**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±20				ppm/°C
		I_R = 1 mA	±15	**±100**	**±150**	**±150**	ppm/°C (max)
		I_R = 100 µA	±15				ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \le I_R \le 1$ mA	0.4				mV
				0.8	1.1	1.1	mV (max)
				1.1	**1.3**	**1.3**	mV (max)
		1 mA $\le I_R \le$ 15 mA	2.7				mV
				6.0	8.0	8.0	mV (max)
				9.0	**11.0**	**11.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz $I_{AC} = 0.1\ I_R$	0.4				Ω
				0.9	1.2	1.2	Ω(max)
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				%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

3.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'C', 'D', and 'E'; Temperature Grade 'E'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades C, D and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0% and ±2.0%, respectively.

Symbol	Parameter	Conditions	Typical(1)	LM4040CEM3 Limits(2)	LM4040DEM3 Limits(2)	LM4040EEM3 Limits(2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	3.000				V
	Reverse Breakdown Voltage Tolerance(3)	I_R = 100 µA		±15	±30	±60	mV (max)
				±45	**±75**	**±105**	mV (max)
I_{RMIN}	Minimum Operating Current		47				µA
				62	67	67	µA (max)
				70	**75**	**75**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient(3)	I_R = 10 mA	±20				ppm/°C
		I_R = 1 mA	±15	**±100**	**±150**	**±150**	ppm/°C (max)
		I_R = 100 µA	±15				ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change(4)	$I_{RMIN} \le I_R \le$ 1 mA	0.4				mV
				0.8	1.1	1.1	mV (max)
				1.1	**1.3**	**1.3**	mV (max)
		1 mA $\le I_R \le$ 15 mA	2.7				mV
				6.0	8.0	8.0	mV (max)
				9.0	**11.0**	**11.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.4				Ω
				0.9	1.2	1.2	Ω (max)
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				%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

4.1-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'A' and 'B'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and ±0.2%, respectively.

Symbol	Parameter	Conditions	Typical[1]	LM4040AIM3 LM4040AIZ — Limits[2]	LM4040BIM3 LM4040BIZ LM4040BIM7 Limits[2]	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	4.096			V
	Reverse Breakdown Voltage Tolerance[3]	I_R = 100 µA		±4.1	±8.2	mV (max)
				±31	**±35**	mV (max)
I_{RMIN}	Minimum Operating Current		50			µA
				68	68	µA (max)
				73	**73**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient[3]	I_R = 10 mA	±30			ppm/°C
		I_R = 1 mA	±20	**±100**	**±100**	ppm/°C (max)
		I_R = 100 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change[4]	$I_{RMIN} \le I_R \le 1$ mA	0.5			mV
				0.9	0.9	mV (max)
				1.2	**1.2**	mV (max)
		1 mA $\le I_R \le$ 15 mA	3.0			mV
				7.0	7.0	mV (max)
				10.0	**10.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$	0.5			Ω
				1.0	1.0	Ω (max)
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]	ΔT = −40°C to +125°C	0.08			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

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

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = 25°C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1.0%, respectively.

Symbol	Parameter	Conditions	Typical(1)	LM4040CIM3 LM4040CIZ LM4040CIM7 Limits(2)	LM4040DIM3 LM4040DIZ LM4040DIM7 Limits(2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	4.096			V
	Reverse Breakdown Voltage Tolerance(3)	I_R = 100 µA		±20	±41	mV (max)
				±47	**±81**	mV (max)
I_{RMIN}	Minimum Operating Current		50			µA
				68	73	µA (max)
				73	**78**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient(3)	I_R = 10 mA	±30			ppm/°C
		I_R = 1 mA	±20	**±100**	**±150**	ppm/°C (max)
		I_R = 100 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change(4)	$I_{RMIN} \leq I_R \leq$ 1 mA	0.5			mV
				0.9	1.2	mV (max)
				1.2	**1.5**	mV (max)
		1 mA $\leq I_R \leq$ 15 mA	3.0			mV
				7.0	9.0	mV (max)
				10.0	**13.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.5			Ω
				1.0	1.3	Ω (max)
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)	ΔT = −40°C to +125°C	0.08			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

5.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'A' and 'B'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and ±0.2%, respectively.

Symbol	Parameter	Conditions	Typical[1]	LM4040AIM3 LM4040AIZ — Limits[2]	LM4040BIM3 LM4040BIZ LM4040BIM7 Limits[2]	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	5.000			V
	Reverse Breakdown Voltage Tolerance[3]	I_R = 100 µA		±5.0	±10	mV (max)
				±38	**±43**	mV (max)
I_{RMIN}	Minimum Operating Current		54			µA
				74	74	µA (max)
				80	**80**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient[3]	I_R = 10 mA	±30			ppm/°C
		I_R = 1 mA	±20	**±100**	**±100**	ppm/°C (max)
		I_R = 100 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change[4]	$I_{RMIN} \le I_R \le 1$ mA	0.5			mV
				1.0	1.0	mV (max)
				1.4	**1.4**	mV (max)
		1 mA $\le I_R \le$ 15 mA	3.5			mV
				8.0	8.0	mV (max)
				12.0	**12.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$	0.5			Ω
				1.1	1.1	Ω (max)
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]	ΔT = −40°C to +125°C	0.08			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

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

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = 25°C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1.0%, respectively.

Symbol	Parameter	Conditions	Typical(1)	LM4040CIM3 LM4040CIZ LM4040CIM7 Limits(2)	LM4040DIM3 LM4040DIZ LM4040DIM7 Limits(2)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	5.000			V
	Reverse Breakdown Voltage Tolerance(3)	I_R = 100 µA		±25	±50	mV (max)
				±58	**±99**	mV (max)
I_{RMIN}	Minimum Operating Current		54			µA
				74	79	µA (max)
				80	**85**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient(3)	I_R = 10 mA	±30			ppm/°C
		I_R = 1 mA	±20	**±100**	**±150**	ppm/°C (max)
		I_R = 100 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change(4)	$I_{RMIN} \le I_R \le$ 1 mA	0.5			mV
				1.0	1.3	mV (max)
				1.4	**1.8**	mV (max)
		1 mA $\le I_R \le$ 15 mA	3.5			mV
				8.0	10.0	mV (max)
				12.0	**15.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.5			Ω
				1.1	1.5	Ω (max)
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)	ΔT = −40°C to +125°C	0.08			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(maxΔT)(V_R)]. Where, $\Delta V_R/\Delta T$ 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

5.0-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'C' and 'D'; Temperature Grade 'E'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = 25°C. The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1.0%, respectively.

Symbol	Parameter	Conditions	Typical	LM4040CEM3 Limits (1)	LM4040DEM3 Limits (1)	Units
V_R	Reverse Breakdown Voltage	I_R = 100 µA	5.000			V
	Reverse Breakdown Voltage Tolerance (2)	I_R = 100 µA		±25	±50	mV (max)
				±75	**±125**	mV (max)
I_{RMIN}	Minimum Operating Current		54			µA
				74	79	µA (max)
				83	**88**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (2)	I_R = 10 mA	±30			ppm/°C
		I_R = 1 mA	±20	**±100**	**±150**	ppm/°C (max)
		I_R = 100 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (3)	$I_{RMIN} \le I_R \le$ 1 mA	0.5			mV
				1.0	1.0	mV (max)
				1.4	**1.8**	mV (max)
		1 mA $\le I_R \le$ 15 mA	3.5			mV
				8.0	8.0	mV (max)
				12.0	**15.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.5			Ω
				1.1	1.1	Ω (max)
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 (4)	ΔT = −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.

(2) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.

8.2-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'A' and 'B'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and ±0.2%, respectively.

Symbol	Parameter	Conditions	Typical (1)	LM4040AIM3 LM4040AIZ Limits (2)	LM4040BIM3 LM4040BIZ Limits (2)	Units
V_R	Reverse Breakdown Voltage	I_R = 150 µA	8.192			V
	Reverse Breakdown Voltage Tolerance (3)	I_R = 150 µA		±8.2	±16	mV (max)
				±61	**±70**	mV (max)
I_{RMIN}	Minimum Operating Current		67			µA
				91	91	µA (max)
				95	**95**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient (3)	I_R = 10 mA	±40			ppm/°C
		I_R = 1 mA	±20	**±100**	**±100**	ppm/°C (max)
		I_R = 150 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change (4)	$I_{RMIN} \le I_R \le$ 1 mA	0.6			mV
				1.3	1.3	mV (max)
				2.5	**2.5**	mV (max)
		1 mA $\le I_R \le$ 15 mA	7.0			mV
				10.0	10.0	mV (max)
				18.0	**18.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$	0.6			Ω
				1.5	1.5	Ω (max)
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			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

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

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1.0%, respectively.

Symbol	Parameter	Conditions	Typical[(1)]	LM4040CIM3 LM4040CIZ Limits[(2)]	LM4040DIM3 LM4040DIZ Limits[(2)]	Units
V_R	Reverse Breakdown Voltage	I_R = 150 µA	8.192			V
	Reverse Breakdown Voltage Tolerance[(3)]	I_R = 150 µA		±41	±82	mV (max)
				±94	**±162**	mV (max)
I_{RMIN}	Minimum Operating Current		67			µA
				91	96	µA (max)
				95	**100**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient[(3)]	I_R = 10 mA	±40			ppm/°C
		I_R = 1 mA	±20	**±100**	**±150**	ppm/°C (max)
		I_R = 150 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change[(4)]	$I_{RMIN} \le I_R \le 1$ mA	0.6			mV
				1.3	1.7	mV (max)
				2.5	**3.0**	mV (max)
		1 mA $\le I_R \le$ 15 mA	7.0			mV
				10.0	15.0	mV (max)
				18.0	**24.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$	0.6			Ω
				1.5	1.9	Ω (max)
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			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

10-V LM4040-N Electrical Characteristics
V_R Tolerance Grades 'A' and 'B'; Temperature Grade 'I'

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = 25°C. The grades A and B designate initial Reverse Breakdown Voltage tolerances of ±0.1% and ±0.2%, respectively.

Symbol	Parameter	Conditions	Typical(1)	LM4040AIM3 LM4040AIZ Limits(2)	LM4040BIM3 LM4040BIZ Limits(2)	Units
V_R	Reverse Breakdown Voltage	I_R = 150 µA	10.00			V
	Reverse Breakdown Voltage Tolerance(3)	I_R = 150 µA		±10	±20	mV (max)
				±75	**±85**	mV (max)
I_{RMIN}	Minimum Operating Current		75			µA
				100	100	µA (max)
				103	**103**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient(3)	I_R = 10 mA	±40			ppm/°C
		I_R = 1 mA	±20	**±100**	**±100**	ppm/°C (max)
		I_R = 150 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change(4)	$I_{RMIN} \le I_R \le$ 1 mA	0.8			mV
				1.5	1.5	mV (max)
				3.5	**3.5**	mV (max)
		1 mA $\le I_R \le$ 15 mA	8.0			mV
				12.0	12.0	mV (max)
				23.0	**23.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R	0.7			Ω
				1.7	1.7	Ω (max)
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)	ΔT = −40°C to +125°C	0.08			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) 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, 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

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

Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J = 25°C$. The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1.0%, respectively.

Symbol	Parameter	Conditions	Typical[1]	LM4040CIM3 LM4040CIZ Limits[2]	LM4040DIM3 LM4040DIZ Limits[2]	Units
V_R	Reverse Breakdown Voltage	I_R = 150 µA	10.00			V
	Reverse Breakdown Voltage Tolerance[3]	I_R = 150 µA		±50	±100	mV (max)
				±115	**±198**	mV (max)
I_{RMIN}	Minimum Operating Current		75			µA
				100	110	µA (max)
				103	**113**	µA (max)
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient[3]	I_R = 10 mA	±40			ppm/°C
		I_R = 1 mA	±20	**±100**	**±150**	ppm/°C (max)
		I_R = 150 µA	±20			ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change[4]	$I_{RMIN} \le I_R \le 1$ mA	0.8			mV
				1.5	2.0	mV (max)
				3.5	**4.0**	mV (max)
		1 mA $\le I_R \le$ 15 mA	8.0			mV
				12.0	18.0	mV (max)
				23.0	**29.0**	mV (max)
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$	0.7			Ω
				1.7	2.3	Ω (max)
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]	ΔT = −40°C to +125°C	0.08			%

(1) Typicals are at T_J = 25°C and represent most likely parametric norm.
(2) 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.
(3) The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(maxΔT)(V_R)]. Where, $\Delta V_R/\Delta T$ 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 over-temperature tolerance for the different grades in the industrial temperature range where maxΔT = 65°C is shown below:
A-grade: ±0.75% = ±0.1% ±100 ppm/°C × 65°C
B-grade: ±0.85% = ±0.2% ±100 ppm/°C × 65°C
C-grade: ±1.15% = ±0.5% ±100 ppm/°C × 65°C
D-grade: ±1.98% = ±1.0% ±150 ppm/°C × 65°C
E-grade: ±2.98% = ±2.0% ±150 ppm/°C × 65°C
The total over-temperature tolerance for the different grades in the extended temperature range where max ΔT = 100 °C is shown below:
C-grade: ±1.5% = ±0.5% ±100 ppm/°C × 100°C
D-grade: ±2.5% = ±1.0% ±150 ppm/°C × 100°C
E-grade: ±3.5% = ±2.0% ±150 ppm/°C × 100°C
Therefore, as an example, the A-grade 2.5-V LM4040-N has an over-temperature Reverse Breakdown Voltage tolerance of ±2.5V × 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.
(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.

Typical Performance Characteristics

Temperature Drift for Different Average Temperature Coefficient

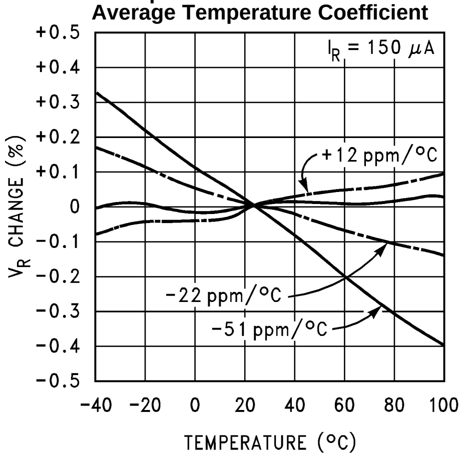


Figure 4.

Output Impedance vs Frequency

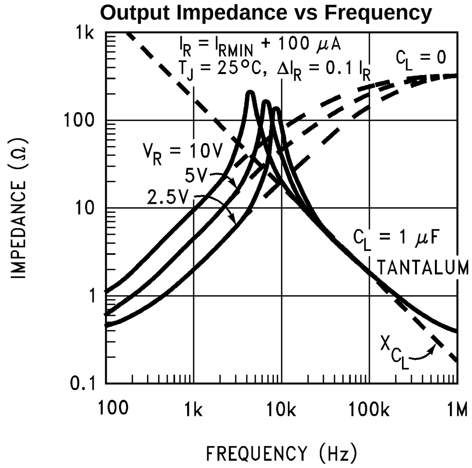


Figure 5.

Output Impedance vs Frequency

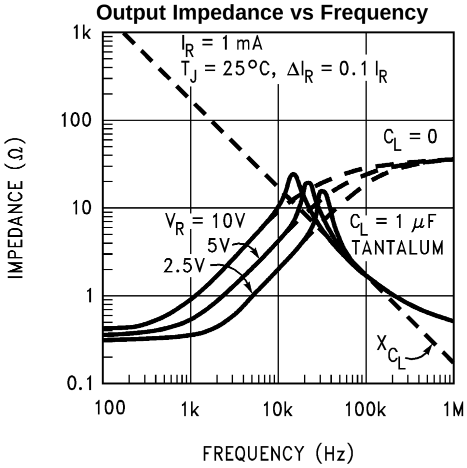


Figure 6.

Reverse Characteristics and Minimum Operating Current

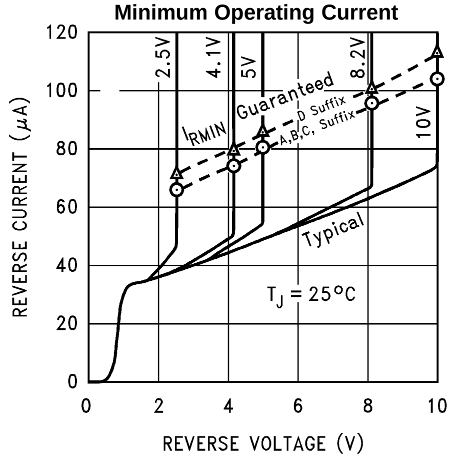


Figure 7.

Noise Voltage vs Frequency

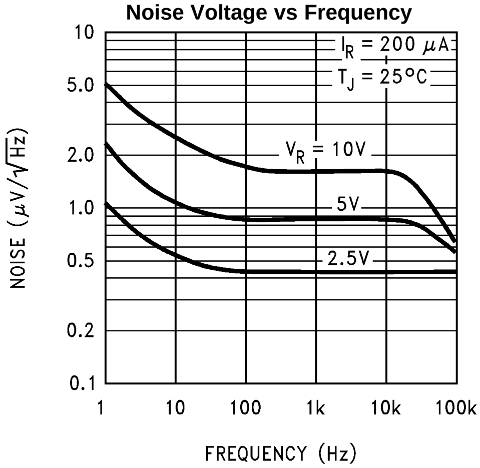


Figure 8.

Start-Up Characteristics

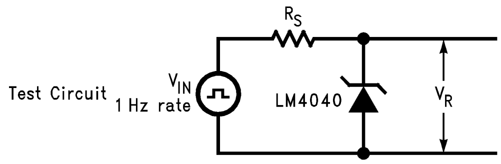


Figure 9.

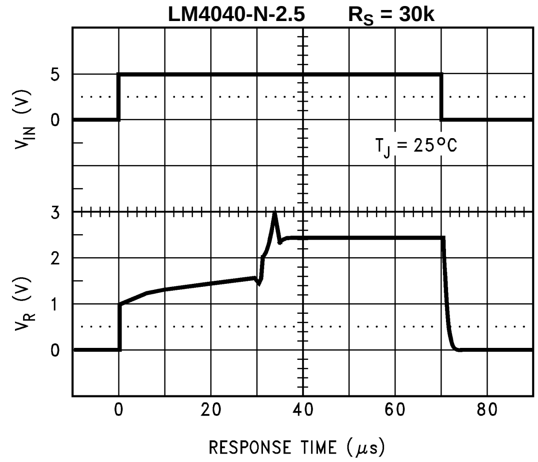


Figure 10.

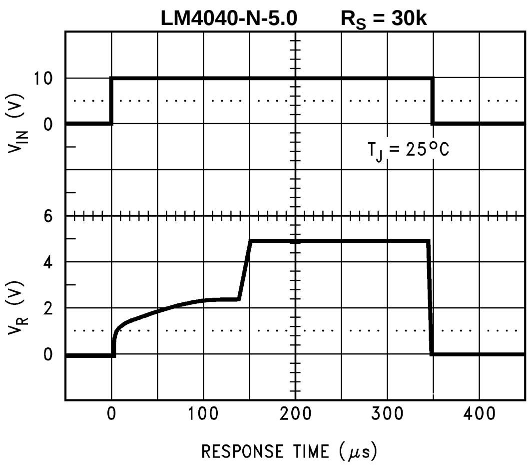


Figure 11.

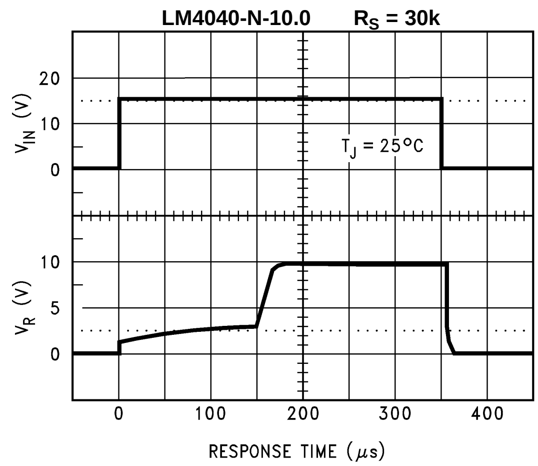
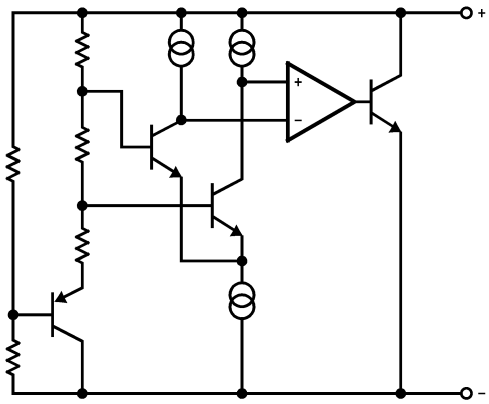


Figure 12.

Functional Block Diagram



APPLICATIONS INFORMATION

The LM4040-N is a precision micro-power 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: 2.048V, 2.500V, 3.000V, 4.096V, 5.000V, 6.000, 8.192V, and 10.000V. The minimum operating current increases from 60 µA for the LM4040-N-2.048 and LM4040-N-2.5 to 100 µA for the 10.0-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 4.096V version allows single +5V 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 10V or greater, the 8.192V 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_{OUT} 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 13) , an external series resistor (R_S) is connected between the supply voltage and the LM4040-N. R_S determines the current that flows through the load (I_L) and the LM4040-N (I_Q). Since load current and supply voltage may vary, R_S should be small enough to supply at least the minimum acceptable I_Q 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_L 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_Q), and the LM4040-N's reverse breakdown voltage, V_R.

$$R_S = \frac{V_S - V_R}{I_L + I_Q} \quad (1)$$

Typical Applications

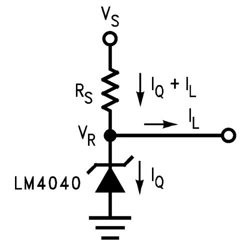
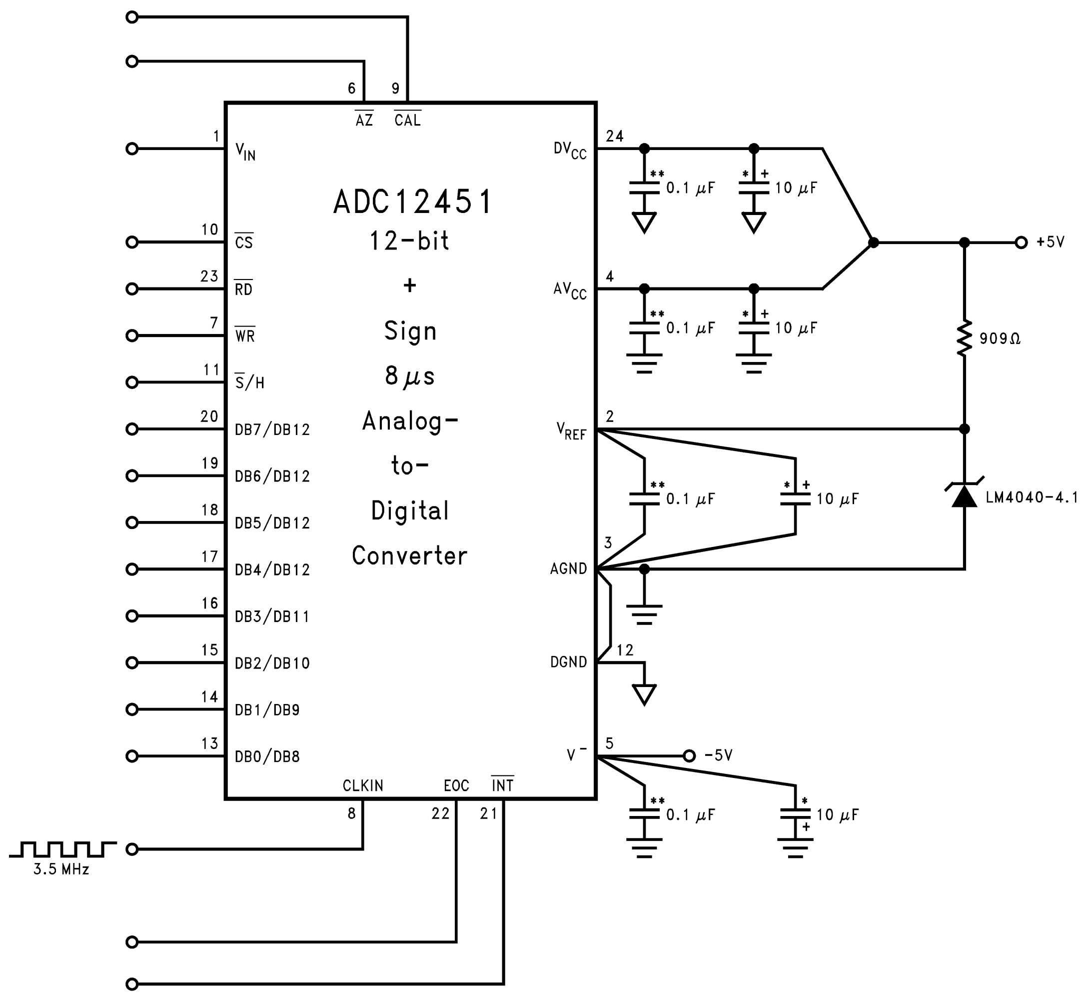
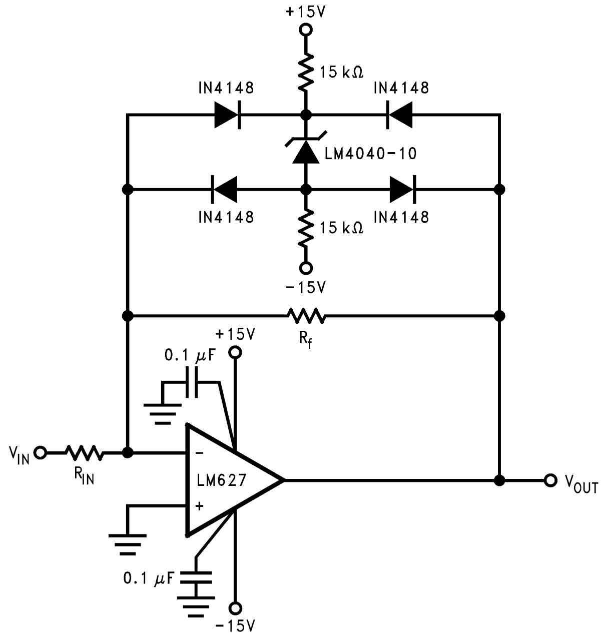


Figure 13. Shunt Regulator



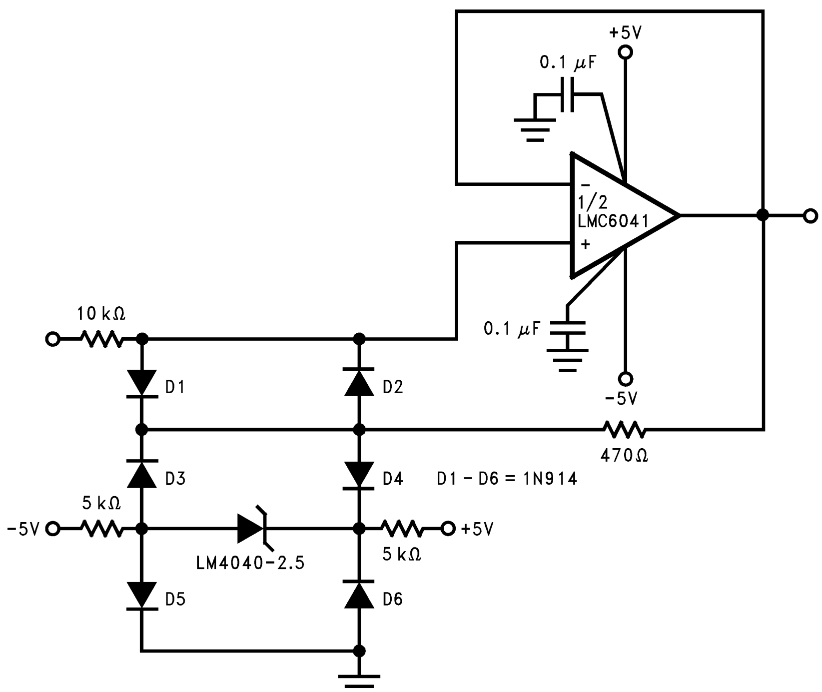
**Ceramic monolithic
*Tantalum

Figure 14. 4.1-V LM4040-N's Nominal 4.096 breakdown voltage gives ADC12451 1 mV/LSB



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

Figure 15. Bounded amplifier reduces saturation-induced delays and can prevent succeeding stage damage.



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

Figure 16. Protecting Op Amp input.

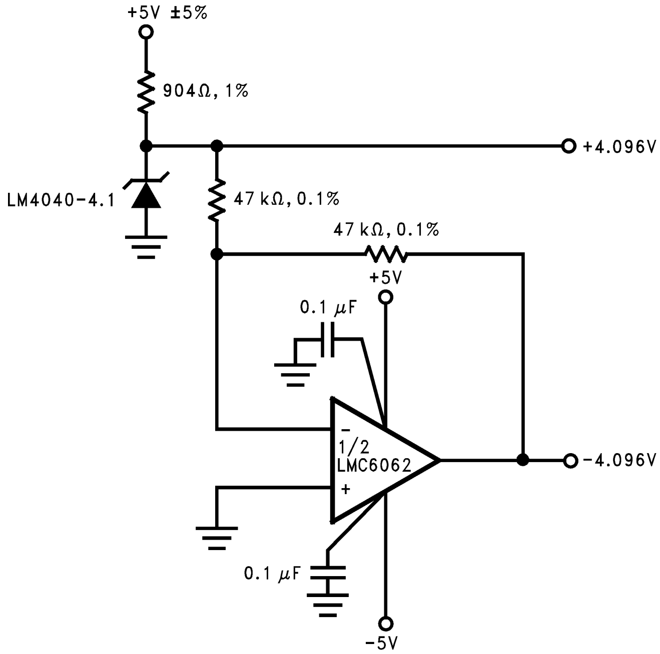
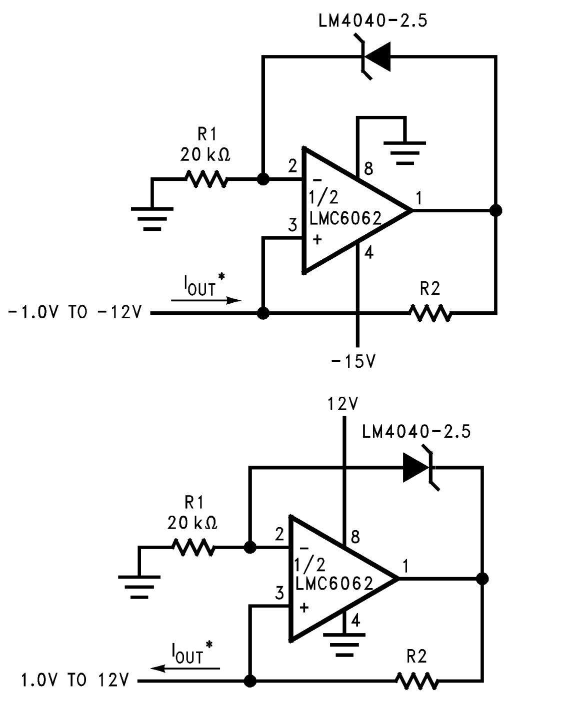


Figure 17. Precision ±4.096V Reference



$$^{*}I_{OUT} = \frac{2.5V}{R2}$$

Figure 18. Precision 1 μA to 1 mA Current Sources

REVISION HISTORY

Changes from Revision G (April 2013) to Revision H	Page
• Changed layout of National Data Sheet to TI format	28

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040AIM3-10.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R0A	Samples
LM4040AIM3-10.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0A	Samples
LM4040AIM3-2.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		RJA	Samples
LM4040AIM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJA	Samples
LM4040AIM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R2A	Samples
LM4040AIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2A	Samples
LM4040AIM3-3.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		RKA	Samples
LM4040AIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKA	Samples
LM4040AIM3-4.1	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R4A	Samples
LM4040AIM3-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4A	Samples
LM4040AIM3-5.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R5A	Samples
LM4040AIM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5A	Samples
LM4040AIM3X-10	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R0A	Samples
LM4040AIM3X-10/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0A	Samples
LM4040AIM3X-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJA	Samples
LM4040AIM3X-2.5	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R2A	Samples
LM4040AIM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2A	Samples
LM4040AIM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKA	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040AIM3X-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4A	Samples
LM4040AIM3X-5.0	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R5A	Samples
LM4040AIM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5A	Samples
LM4040AIZ-10.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040A IZ10	Samples
LM4040AIZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040A IZ2.5	Samples
LM4040AIZ-4.1/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040A IZ4.1	Samples
LM4040AIZ-5.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040A IZ5.0	Samples
LM4040BIM3-10.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R0B	Samples
LM4040BIM3-10.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0B	Samples
LM4040BIM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJB	Samples
LM4040BIM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R2B	Samples
LM4040BIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2B	Samples
LM4040BIM3-3.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		RKB	Samples
LM4040BIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKB	Samples
LM4040BIM3-4.1	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R4B	Samples
LM4040BIM3-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4B	Samples
LM4040BIM3-5.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R5B	Samples
LM4040BIM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5B	Samples
LM4040BIM3-8.2	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R8B	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040BIM3-8.2/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R8B	Samples
LM4040BIM3X-10	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R0B	Samples
LM4040BIM3X-10/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0B	Samples
LM4040BIM3X-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJB	Samples
LM4040BIM3X-2.5	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R2B	Samples
LM4040BIM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2B	Samples
LM4040BIM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKB	Samples
LM4040BIM3X-4.1	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R4B	Samples
LM4040BIM3X-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4B	Samples
LM4040BIM3X-5.0	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R5B	Samples
LM4040BIM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5B	Samples
LM4040BIM7-2.0/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJB	Samples
LM4040BIM7-2.5	ACTIVE	SC70	DCK	5	1000	TBD	Call TI	Call TI		R2B	Samples
LM4040BIM7-2.5/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2B	Samples
LM4040BIM7-5.0/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5B	Samples
LM4040BIM7X-2.5/NOPB	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2B	Samples
LM4040BIZ-10.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040B IZ10	Samples
LM4040BIZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040B IZ2.5	Samples
LM4040BIZ-4.1/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040B IZ4.1	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040BIZ-5.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040B IZ5.0	Samples
LM4040CEM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R2C	Samples
LM4040CEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2C	Samples
LM4040CEM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKC	Samples
LM4040CEM3-5.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R5C	Samples
LM4040CEM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5C	Samples
LM4040CEM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKC	Samples
LM4040CEM3X-5.0	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R5C	Samples
LM4040CEM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5C	Samples
LM4040CIM3-10.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R0C	Samples
LM4040CIM3-10.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0C	Samples
LM4040CIM3-2.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		RJC	Samples
LM4040CIM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJC	Samples
LM4040CIM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R2C	Samples
LM4040CIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2C	Samples
LM4040CIM3-3.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		RKC	Samples
LM4040CIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKC	Samples
LM4040CIM3-4.1	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R4C	Samples
LM4040CIM3-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4C	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040CIM3-5.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R5C	Samples
LM4040CIM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5C	Samples
LM4040CIM3-8.2	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R8C	Samples
LM4040CIM3-8.2/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R8C	Samples
LM4040CIM3X-10	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R0C	Samples
LM4040CIM3X-10/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0C	Samples
LM4040CIM3X-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJC	Samples
LM4040CIM3X-2.5	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R2C	Samples
LM4040CIM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2C	Samples
LM4040CIM3X-3.0	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		RKC	Samples
LM4040CIM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKC	Samples
LM4040CIM3X-4.1	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R4C	Samples
LM4040CIM3X-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4C	Samples
LM4040CIM3X-5.0	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R5C	Samples
LM4040CIM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5C	Samples
LM4040CIM7-2.0/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJC	Samples
LM4040CIM7-2.5/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2C	Samples
LM4040CIM7X-2.5/NOPB	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2C	Samples
LM4040CIZ-10.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040C IZ10	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040CIZ-2.5/LFT8	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040C IZ2.5	Samples
LM4040CIZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040C IZ2.5	Samples
LM4040CIZ-4.1/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040C IZ4.1	Samples
LM4040CIZ-5.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040C IZ5.0	Samples
LM4040DEM3-2.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		RJD	Samples
LM4040DEM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJD	Samples
LM4040DEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2D	Samples
LM4040DEM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKD	Samples
LM4040DEM3-5.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R5D	Samples
LM4040DEM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5D	Samples
LM4040DEM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2D	Samples
LM4040DEM3X-5.0	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R5D	Samples
LM4040DEM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5D	Samples
LM4040DIM3-10.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R0D	Samples
LM4040DIM3-10.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0D	Samples
LM4040DIM3-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJD	Samples
LM4040DIM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R2D	Samples
LM4040DIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2D	Samples
LM4040DIM3-3.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		RKD	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040DIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKD	Samples
LM4040DIM3-4.1	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R4D	Samples
LM4040DIM3-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4D	Samples
LM4040DIM3-5.0	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R5D	Samples
LM4040DIM3-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5D	Samples
LM4040DIM3-8.2/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R8D	Samples
LM4040DIM3X-10	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R0D	Samples
LM4040DIM3X-10/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R0D	Samples
LM4040DIM3X-2.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJD	Samples
LM4040DIM3X-2.5	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R2D	Samples
LM4040DIM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2D	Samples
LM4040DIM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKD	Samples
LM4040DIM3X-4.1	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R4D	Samples
LM4040DIM3X-4.1/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R4D	Samples
LM4040DIM3X-5.0	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R5D	Samples
LM4040DIM3X-5.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5D	Samples
LM4040DIM7-2.0/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJD	Samples
LM4040DIM7-2.5/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2D	Samples
LM4040DIM7-5.0	ACTIVE	SC70	DCK	5	1000	TBD	Call TI	Call TI		R5D	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040DIM7-5.0/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R5D	Samples
LM4040DIZ-10.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040D IZ10	Samples
LM4040DIZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040D IZ2.5	Samples
LM4040DIZ-4.1/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040D IZ4.1	Samples
LM4040DIZ-5.0/LFT1	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040D IZ5.0	Samples
LM4040DIZ-5.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		4040D IZ5.0	Samples
LM4040EEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2E	Samples
LM4040EEM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKE	Samples
LM4040EIM3-2.5	ACTIVE	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI		R2E	Samples
LM4040EIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2E	Samples
LM4040EIM3-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKE	Samples
LM4040EIM3X-2.5	ACTIVE	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI		R2E	Samples
LM4040EIM3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2E	Samples
LM4040EIM3X-3.0/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RKE	Samples
LM4040EIM7-2.0/NOPB	ACTIVE	SC70	DCK	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		RJE	Samples
LM4040QAIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6A	Samples
LM4040QAIM3X2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6A	Samples
LM4040QBIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6B	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4040QBIM3X2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6B	Samples
LM4040QCEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2C	Samples
LM4040QCIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6C	Samples
LM4040QCIM3X2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6C	Samples
LM4040QDEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2D	Samples
LM4040QDIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6D	Samples
LM4040QDIM3X2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6D	Samples
LM4040QEEM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R2E	Samples
LM4040QEIM3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6E	Samples
LM4040QEIM3X2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		R6E	Samples

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

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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OTHER QUALIFIED VERSIONS OF LM4040-N, LM4040-N-Q1 :

- Catalog: LM4040-N

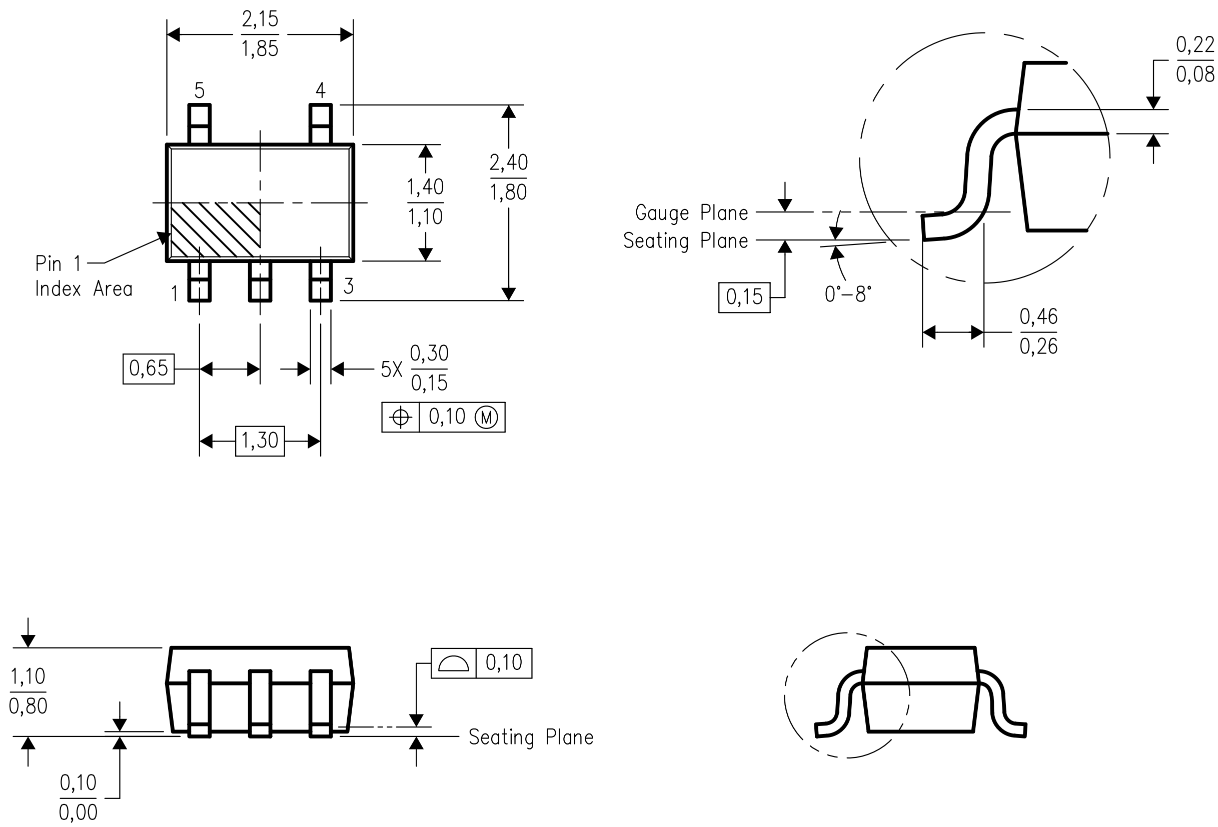
- Automotive: LM4040-N-Q1

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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

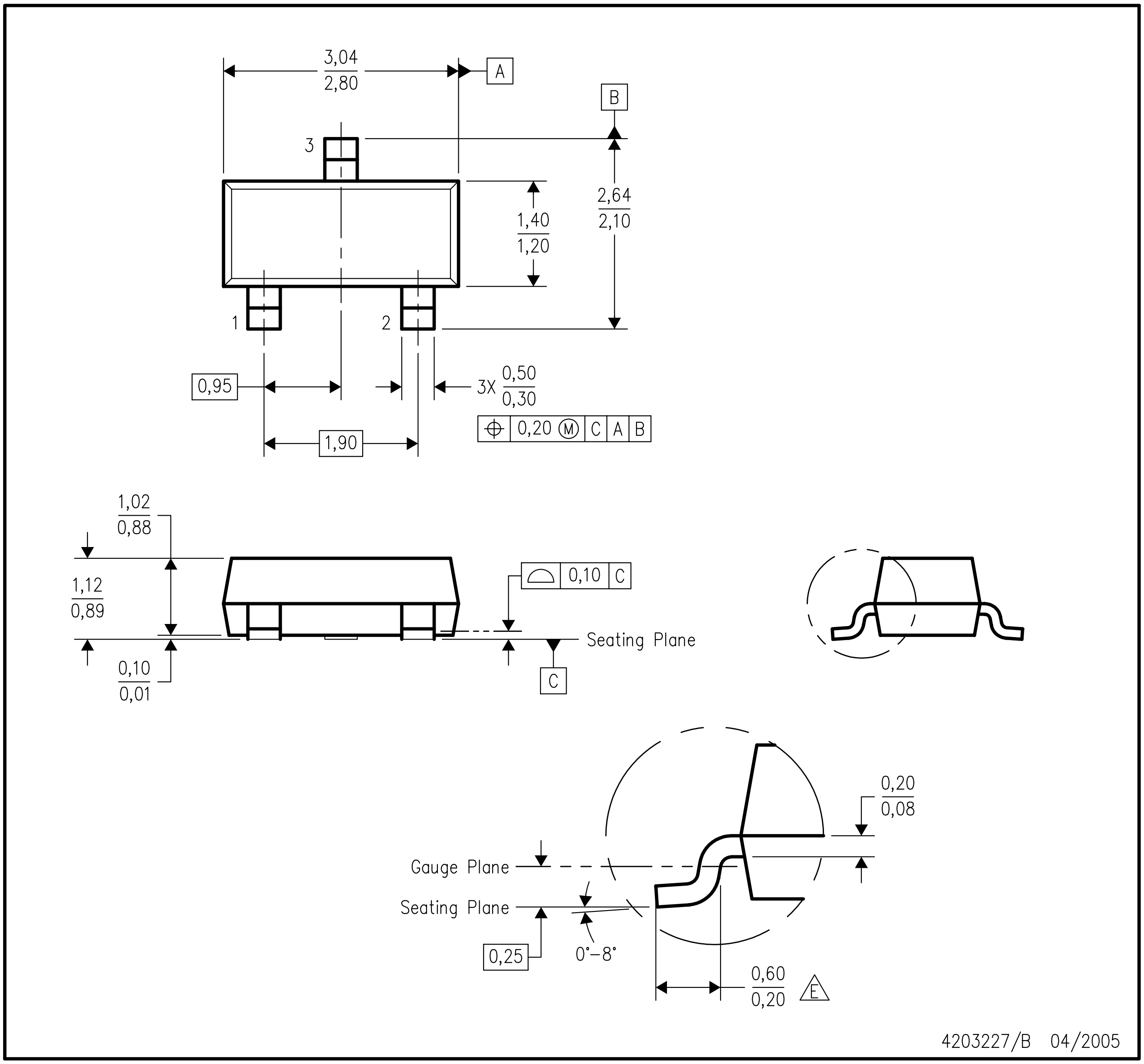
DCK (R-PDSO-G5) PLASTIC SMALL-OUTLINE PACKAGE



4093553-3/G 01/2007

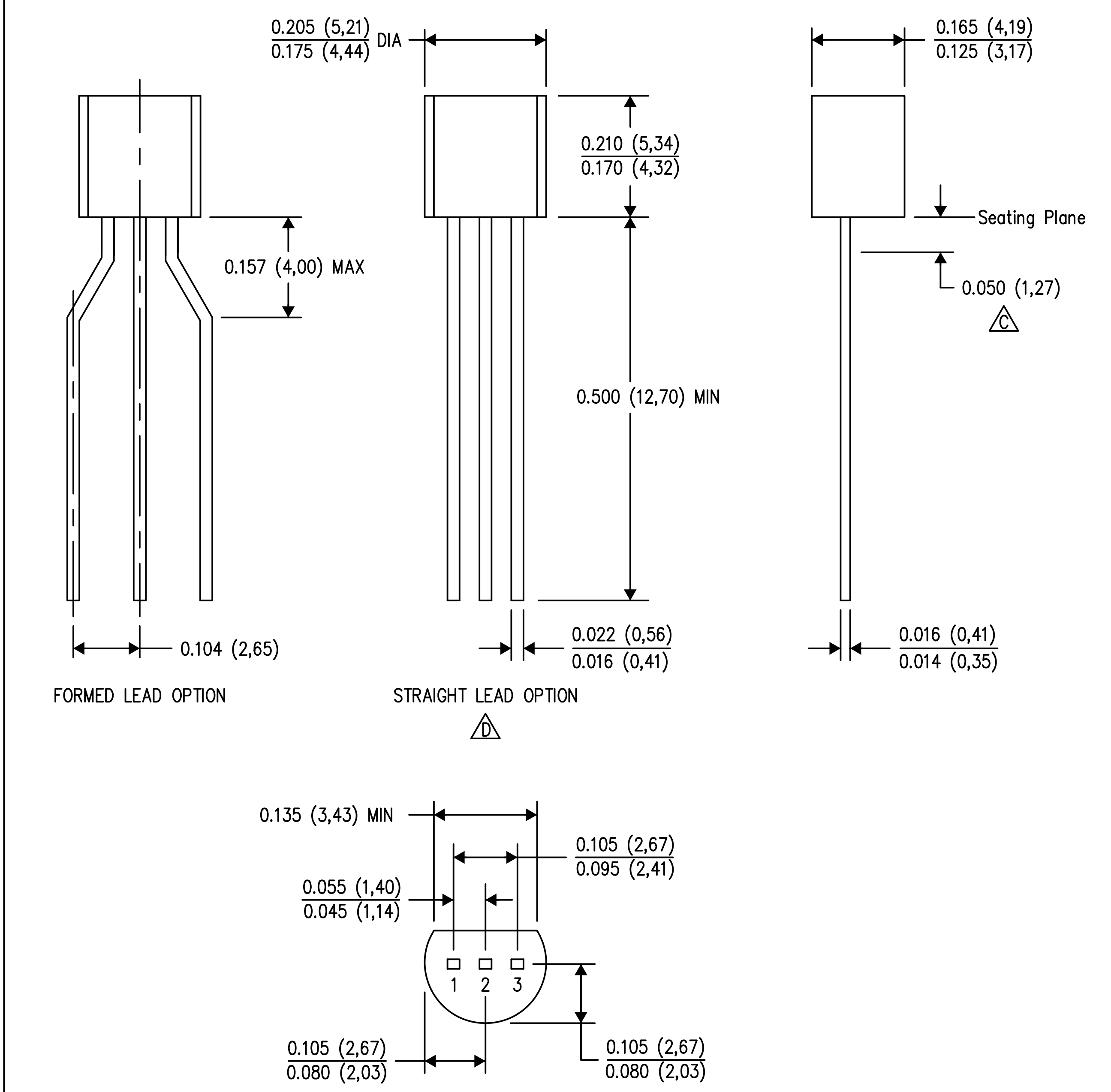
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Falls within JEDEC MO-203 variation AA.

DBZ (R-PDSO-G3) PLASTIC SMALL-OUTLINE



NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
- B. This drawing is subject to change without notice.
- C. Lead dimensions are inclusive of plating.
- D. Body dimensions are exclusive of mold flash and protrusion. Mold flash and protrusion not to exceed 0.25 per side.
- E. Falls within JEDEC TO–236 variation AB, except minimum foot length.

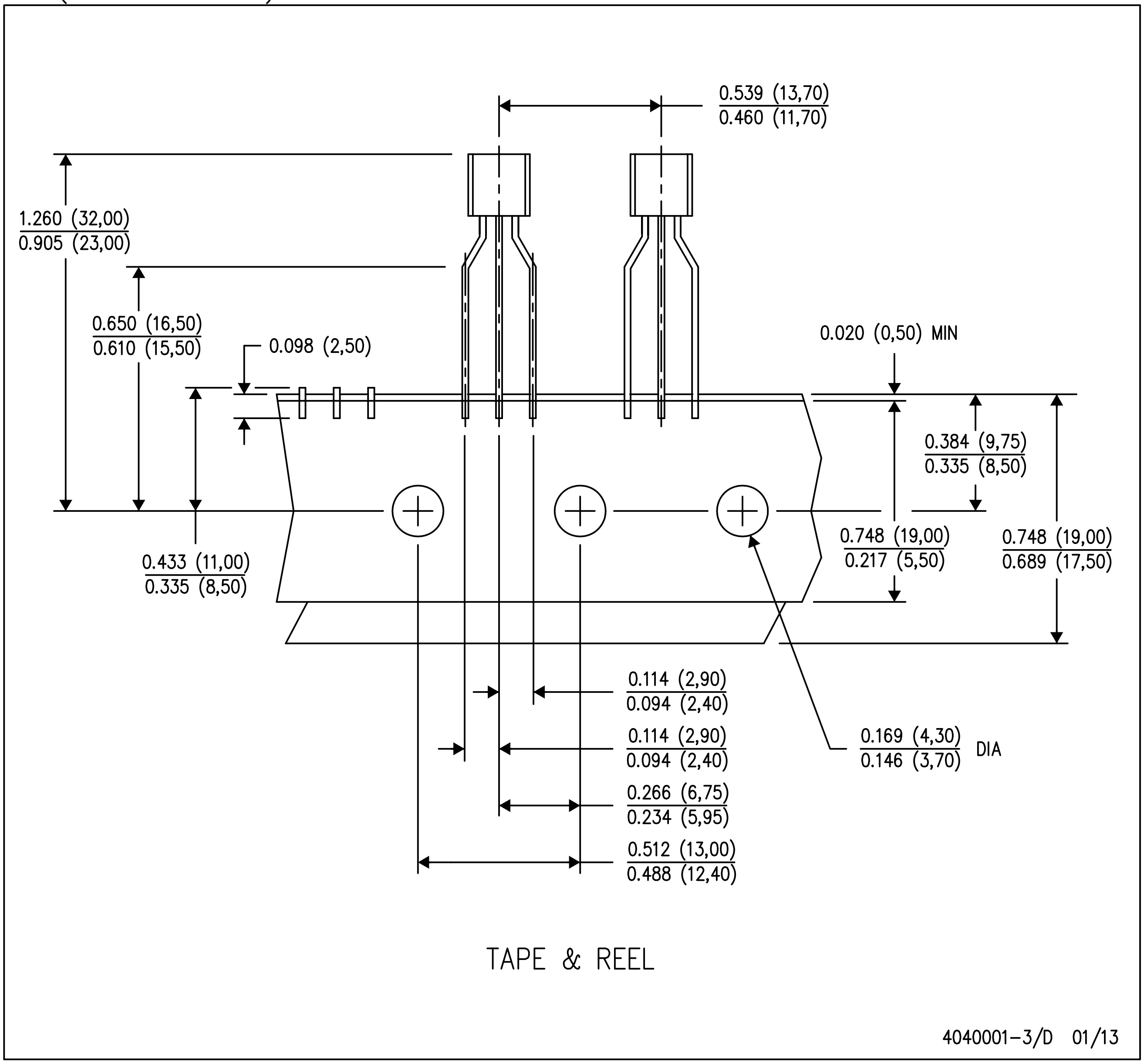
LP (O-PBCY-W3) PLASTIC CYLINDRICAL PACKAGE



4040001-2/D 01/13

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. Falls within JEDEC TO-226 Variation AA (TO-226 replaces TO-92).
E. Shipping Method:
Straight lead option available in either bulk pack or tape & reel.
Formed lead option available in tape & reel or ammo pack.
Specific products can be offered in limited combinations of shipping mediums and lead options.
Consult product folder for more information on available options.

LP (O-PBCY-W3) PLASTIC CYLINDRICAL PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Tape and Reel information for the Formed Lead Option package.

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