

- **150-mA Load Current Without External Power Transistor**
- **Adjustable Current-Limiting Capability**
- **Input Voltages up to 40 V**
- **Output Adjustable From 2 V to 37 V**
- **Direct Replacement for Fairchild μA723C**

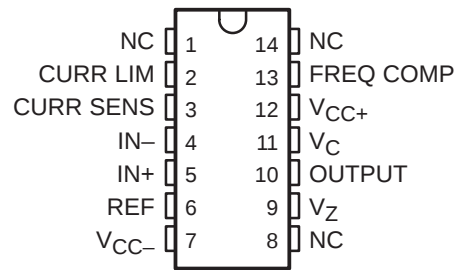
description

The μA723 is a precision integrated-circuit voltage regulator, featuring high ripple rejection, excellent input and load regulation, excellent temperature stability, and low standby current. The circuit consists of a temperature-compensated reference-voltage amplifier, an error amplifier, a 150-mA output transistor, and an adjustable-output current limiter.

The μA723 is designed for use in positive or negative power supplies as a series, shunt, switching, or floating regulator. For output currents exceeding 150 mA, additional pass elements can be connected as shown in Figures 4 and 5.

The μA723C is characterized for operation from 0°C to 70°C.

**D OR N PACKAGE
(TOP VIEW)**

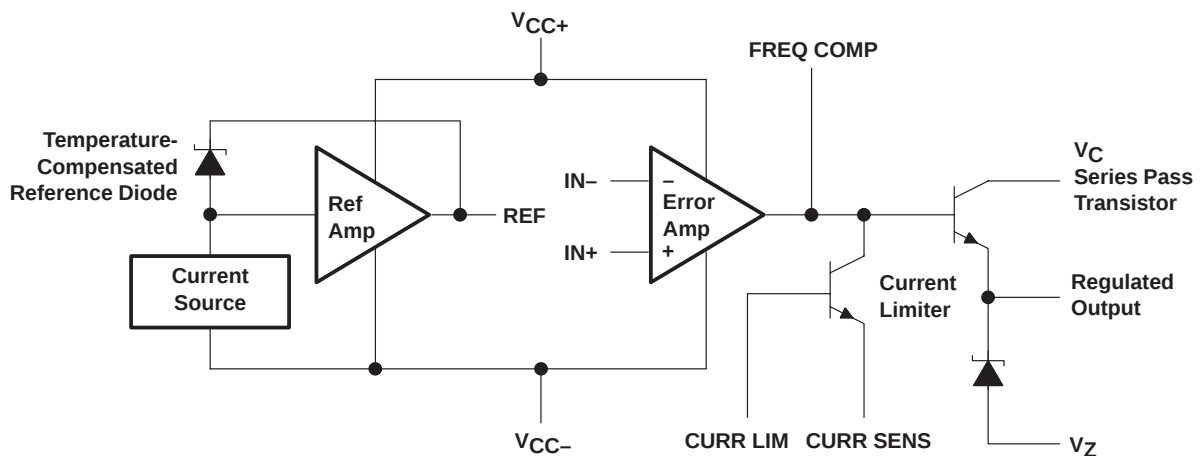


AVAILABLE OPTIONS

T _A	PACKAGED DEVICES		CHIP FORM (Y)
	PLASTIC DIP (N)	SMALL OUTLINE (D)	
0°C to 70°C	μA723CN	μA723CD	μA723Y

The D package is available taped and reeled. Add the suffix R to the device type (e.g., μA723CDR). Chip forms are tested at 25°C.

functional block diagram



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1999, Texas Instruments Incorporated

[illegible]

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Peak voltage from V_{CC+} to V_{CC-} ($t_w \leq 50$ ms)	50 V
Continuous voltage from V_{CC+} to V_{CC-}	40 V
Input-to-output voltage differential	40 V
Differential input voltage to error amplifier	± 5 V
Voltage between noninverting input and V_{CC-}	8 V
Current from V_Z	25 mA
Current from REF	15 mA
Package thermal impedance, θ_{JA} (see Notes 1 and 2): D package	86°C/W
N package	101°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package	260°C
Storage temperature range, T_{stg}	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES:

1. Maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can impact reliability.
2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions

	MIN	MAX	UNIT
Input voltage, V_I	9.5	40	V
Output voltage, V_O	2	37	V
Input-to-output voltage differential, $V_C - V_O$	3	38	V
Output current, I_O		150	mA
Operating free-air temperature range, T_A	μA723C		0 70 °C

electrical characteristics at specified free-air temperature (see Notes 3 and 4)

PARAMETER	TEST CONDITIONS	T_A	μA723C			UNIT
			MIN	TYP	MAX	
Input regulation	$V_I = 12\text{ V to }V_I = 15\text{ V}$	25°C		0.1	1	mV/V
	$V_I = 12\text{ V to }V_I = 40\text{ V}$	25°C		1	5	
	$V_I = 12\text{ V to }V_I = 15\text{ V}$	0°C to 70°C			3	
Ripple rejection	f = 50 Hz to 10 kHz, $C_{ref} = 0$	25°C		74		dB
	f = 50 Hz to 10 kHz, $C_{ref} = 5\text{ }\mu\text{F}$	25°C		86		
Output regulation		25°C		-0.3	-2	mV/V
		0°C to 70°C			-6	
Reference voltage, V_{ref}		25°C	6.8	7.15	7.5	V
Standby current	$V_I = 30\text{ V}, I_O = 0$	25°C		2.3	4	mA
Temperature coefficient of output voltage		0°C to 70°C		0.003	0.015	%/°C
Short-circuit output current	$R_{SC} = 10\text{ }\Omega, V_O = 0$	25°C		65		mA
Output noise voltage	BW = 100 Hz to 10 kHz, $C_{ref} = 0$	25°C		20		μV
	BW = 100 Hz to 10 kHz, $C_{ref} = 5\text{ }\mu\text{F}$	25°C		2.5		

NOTES: 3. For all values in this table, the device is connected as shown in Figure 1 with the divider resistance as seen by the error amplifier $\leq 10\text{ k}\Omega$. Unless otherwise specified, $V_I = V_{CC+} = V_C = 12\text{ V}$, $V_{CC-} = 0$, $V_O = 5\text{ V}$, $I_O = 1\text{ mA}$, $R_{SC} = 0$, and $C_{ref} = 0$.
4. Pulse-testing techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

electrical characteristics, $T_A = 25^\circ\text{C}$ (see Notes 3 and 4)

PARAMETER	TEST CONDITIONS	μA723Y			UNIT
		MIN	TYP	MAX	
Input regulation	$V_I = 12\text{ V to }V_I = 15\text{ V}$		0.1		mV/V
	$V_I = 12\text{ V to }V_I = 40\text{ V}$		1		
Ripple rejection	f = 50 Hz to 10 kHz, $C_{ref} = 0$		74		dB
	f = 50 Hz to 10 kHz, $C_{ref} = 5\text{ }\mu\text{F}$		86		
Output regulation			-0.3		mV/V
Reference voltage, V_{ref}			7.15		V
Standby current	$V_I = 30\text{ V}, I_O = 0$		2.3		mA
Short-circuit output current	$R_{SC} = 10\text{ }\Omega, V_O = 0$		65		mA
Output noise voltage	BW = 100 Hz to 10 kHz, $C_{ref} = 0$		20		μV
	BW = 100 Hz to 10 kHz, $C_{ref} = 5\text{ }\mu\text{F}$		2.5		

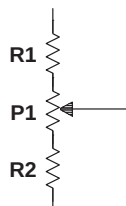
NOTES: 3. For all values in this table, the device is connected as shown in Figure 1 with the divider resistance as seen by the error amplifier $\leq 10\text{ k}\Omega$. Unless otherwise specified, $V_I = V_{CC+} = V_C = 12\text{ V}$, $V_{CC-} = 0$, $V_O = 5\text{ V}$, $I_O = 1\text{ mA}$, $R_{SC} = 0$, and $C_{ref} = 0$.
4. Pulse-testing techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

APPLICATION INFORMATION

Table 1. Resistor Values (kΩ) for Standard Output Voltages

OUTPUT VOLTAGE (V)	APPLICABLE FIGURES (SEE NOTE 5)	FIXED OUTPUT ±5%		OUTPUT ADJUSTABLE ±10% (SEE NOTE 6)		
		R1 (kΩ)	R2 (kΩ)	R1 (kΩ)	P1 (kΩ)	P2 (kΩ)
3.0	1, 5, 6, 9, 11, 12 (4)	4.12	3.01	1.8	0.5	1.2
3.6	1, 5, 6, 9, 11, 12 (4)	3.57	3.65	1.5	0.5	1.5
5.0	1, 5, 6, 9, 11, 12 (4)	2.15	4.99	0.75	0.5	2.2
6.0	1, 5, 6, 9, 11, 12 (4)	1.15	6.04	0.5	0.5	2.7
9.0	2, 4, (5, 6, 9, 12)	1.87	7.15	0.75	1.0	2.7
12	2, 4, (5, 6, 9, 12)	4.87	7.15	2.0	1.0	3.0
15	2, 4, (5, 6, 9, 12)	7.87	7.15	3.3	1.0	3.0
28	2, 4, (5, 6, 9, 12)	21.0	7.15	5.6	1.0	2.0
45	7	3.57	48.7	2.2	10	39
75	7	3.57	78.7	2.2	10	68
100	7	3.57	105	2.2	10	91
250	7	3.57	255	2.2	10	240
–6 (see Note 7)	3, 10	3.57	2.43	1.2	0.5	0.75
–9	3, 10	3.48	5.36	1.2	0.5	2.0
–12	3, 10	3.57	8.45	1.2	0.5	3.3
–15	3, 10	3.57	11.5	1.2	0.5	4.3
–28	3, 10	3.57	24.3	1.2	0.5	10
–45	8	3.57	41.2	2.2	10	33
–100	8	3.57	95.3	2.2	10	91
–250	8	3.57	249	2.2	10	240

- NOTES: 5. The R1/R2 divider can be across either V_O or $V_{(ref)}$. If the divider is across $V_{(ref)}$, use the figure numbers without parentheses. If the divider is across V_O , use the figure numbers in parentheses.
6. To make the voltage adjustable, the R1/R2 divider shown in the figures must be replaced by the divider shown below.



Adjustable Output Circuit

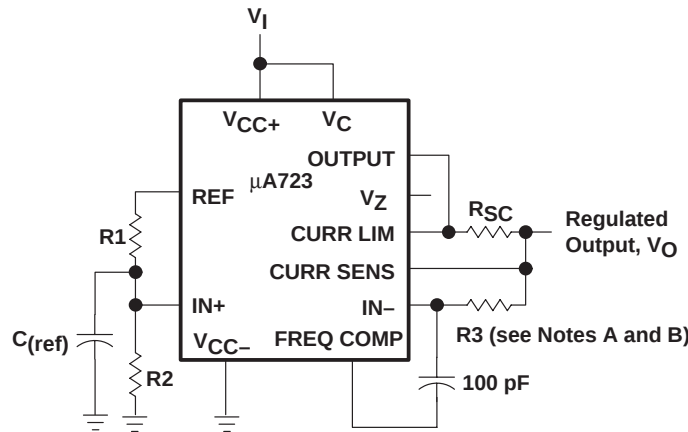
7. For Figures 3, 8, and 10, the device requires a minimum of 9 V between V_{CC+} and V_{CC-} when V_O is equal to or more positive than –9 V.

APPLICATION INFORMATION

Table 2. Formulas for Intermediate Output Voltages

OUTPUTS FROM 2 V TO 7 V SEE FIGURES 1, 5, 6, 9, 11, 12 (4) AND NOTE 5	OUTPUTS FROM 4 V TO 250 V SEE FIGURE 7 AND NOTE 5	CURRENT LIMITING
$V_O = V_{(ref)} \times \frac{R2}{R1 + R2}$	$V_O = \frac{V_{(ref)}}{2} \times \frac{R2 - R1}{R1}$ $R3 = R4$	$I_{(limit)} \approx \frac{0.65 \text{ V}}{R_{SC}}$
OUTPUTS FROM 7 V TO 37 V SEE FIGURES 2, 4, (5, 6, 9, 11, 12) AND NOTE 5	OUTPUTS FROM -6 V TO -250 V SEE FIGURES 3, 8, 10 AND NOTES 5 AND 7	FOLDBACK CURRENT LIMITING SEE FIGURE 6
$V_O = V_{(ref)} \times \frac{R1 + R2}{R2}$	$V_O = -\frac{V_{(ref)}}{2} \times \frac{R1 + R2}{R1}$ $R3 = R4$	$I_{(knee)} \approx \frac{V_O R3 + (R3 + R4) 0.65 \text{ V}}{R_{SC} R4}$ $I_{OS} \approx \frac{0.65 \text{ V}}{R_{SC}} \times \frac{R3 + R4}{R4}$

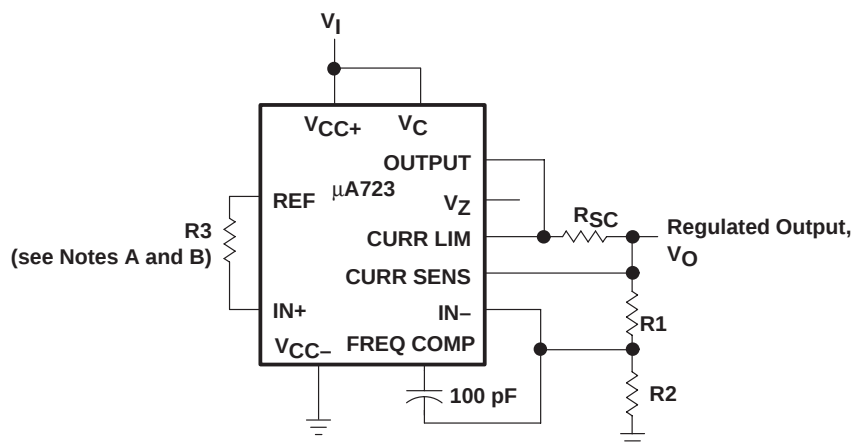
- NOTES: 5. The R1/R2 divider can be across either V_O or $V_{(ref)}$. If the divider is across $V_{(ref)}$, use figure numbers without parentheses. If the divider is across V_O , use the figure numbers in parentheses.
7. For Figures 3, 8, and 10, the device requires a minimum of 9 V between V_{CC+} and V_{CC-} when V_O is equal to or more positive than -9 V.



- NOTES: A. $R3 = \frac{R1 \times R2}{R1 + R2}$ for a minimum α_{V_O}
- B. $R3$ can be eliminated for minimum component count. Use direct connection (i.e., $R3 = 0$).

Figure 1. Basic Low-Voltage Regulator ($V_O = 2 \text{ V to } 7 \text{ V}$)

APPLICATION INFORMATION



- NOTES: A. $R_3 = \frac{R_1 \times R_2}{R_1 + R_2}$ for a minimum α_{V_O}
B. R_3 can be eliminated for minimum component count. Use direct connection (i.e., $R_3 = 0$).

Figure 2. Basic High-Voltage Regulator ($V_O = 7\text{ V to }37\text{ V}$)

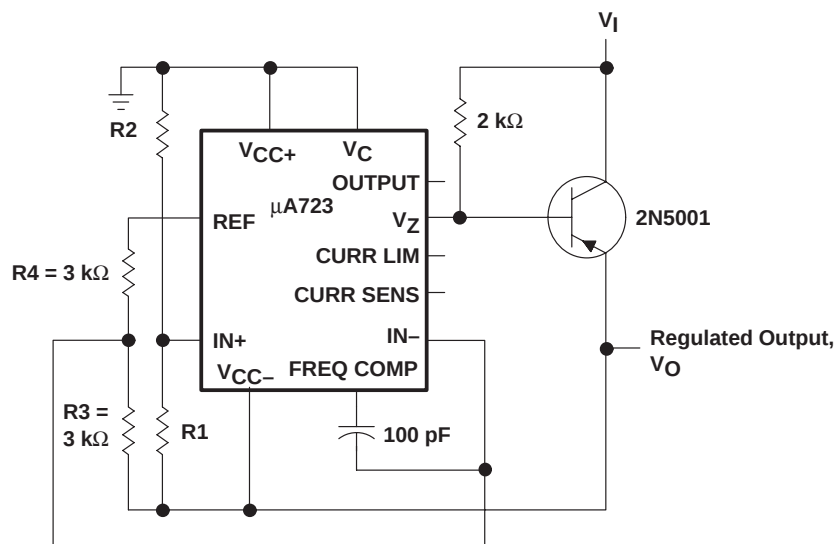


Figure 3. Negative-Voltage Regulator

APPLICATION INFORMATION

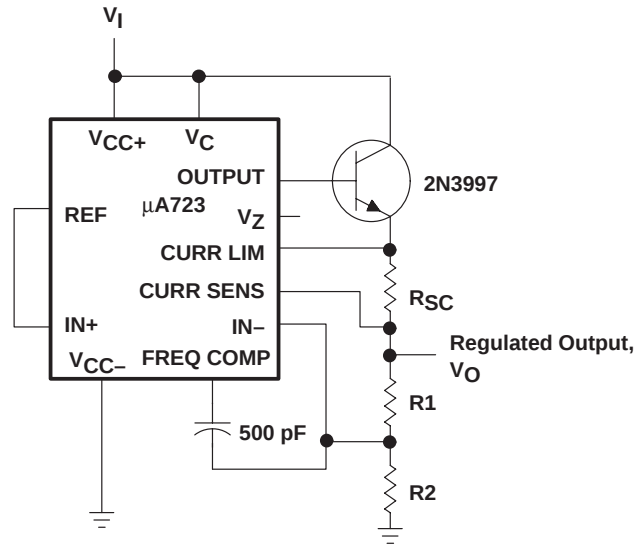


Figure 4. Positive-Voltage Regulator (External npn Pass Transistor)

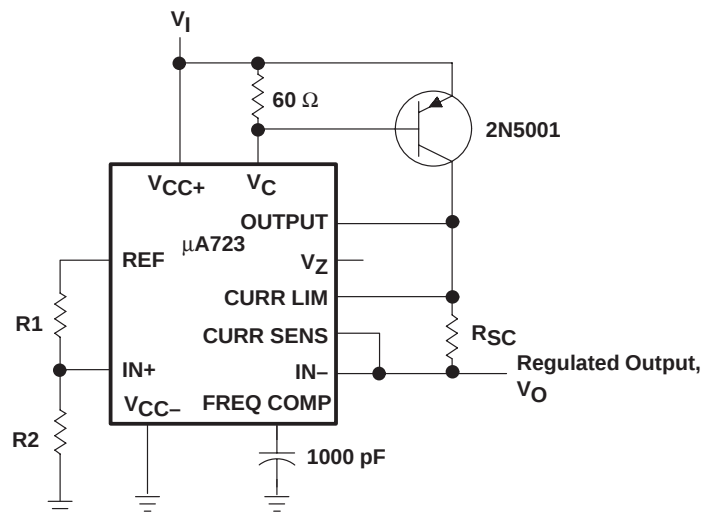


Figure 5. Positive-Voltage Regulator (External pnp Pass Transistor)

APPLICATION INFORMATION

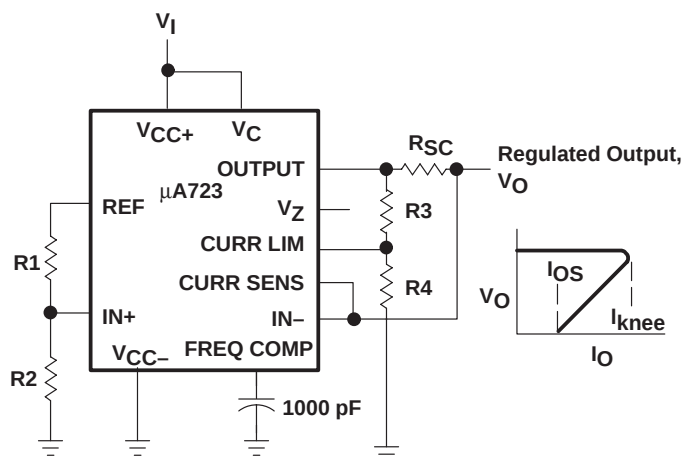


Figure 6. Foldback Current Limiting

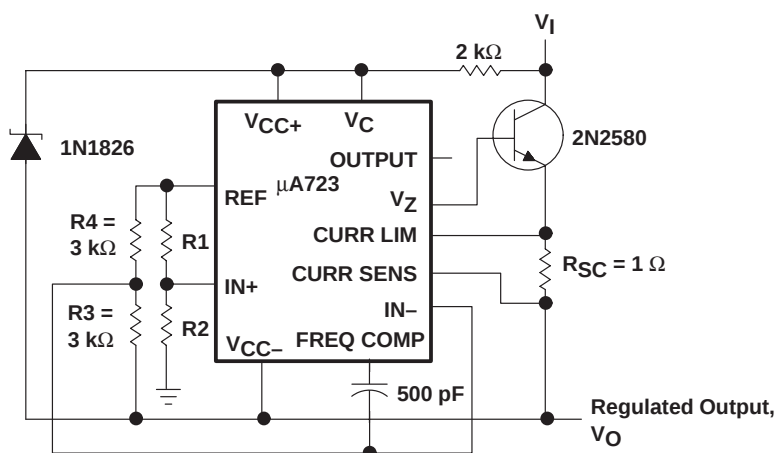


Figure 7. Positive Floating Regulator

APPLICATION INFORMATION

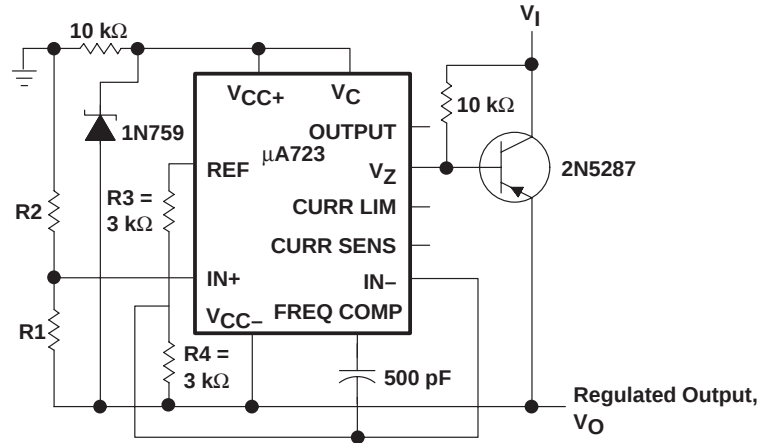
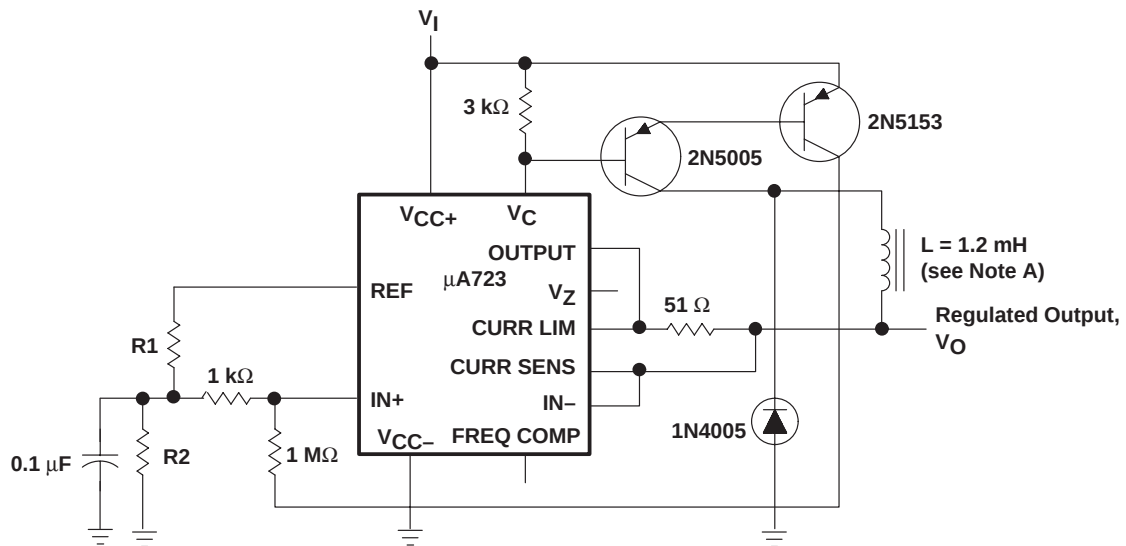


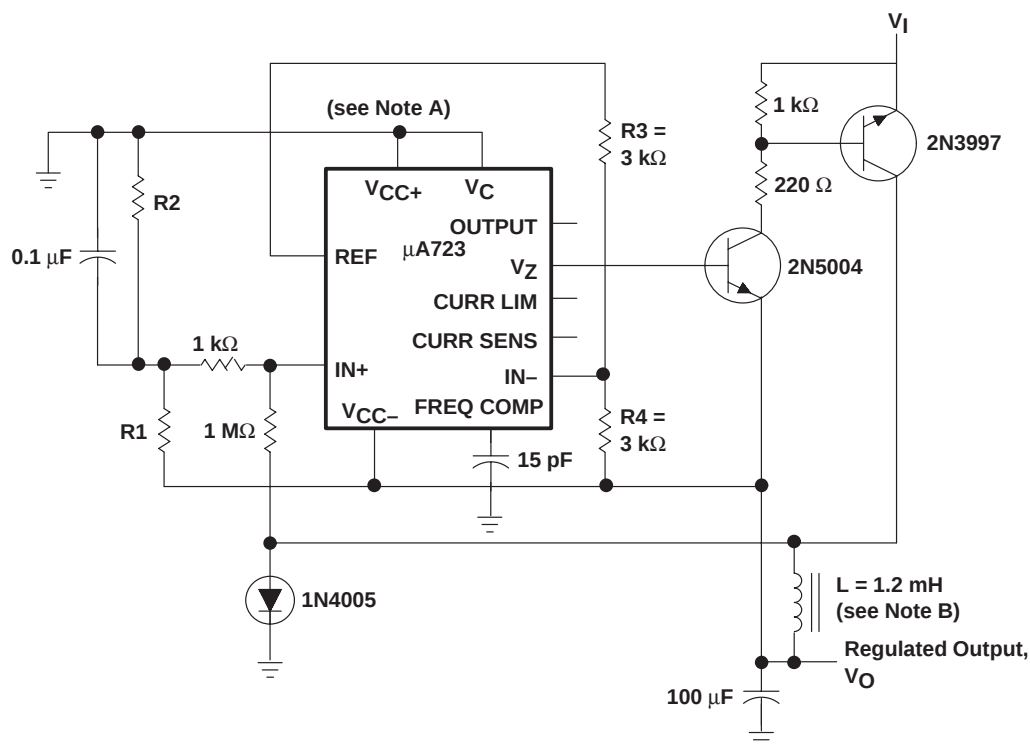
Figure 8. Negative Floating Regulator



NOTE A: L is 40 turns of No. 20 enameled copper wire wound on Ferroxcube P36/22-3B7 potted core, or equivalent, with a 0.009-inch air gap.

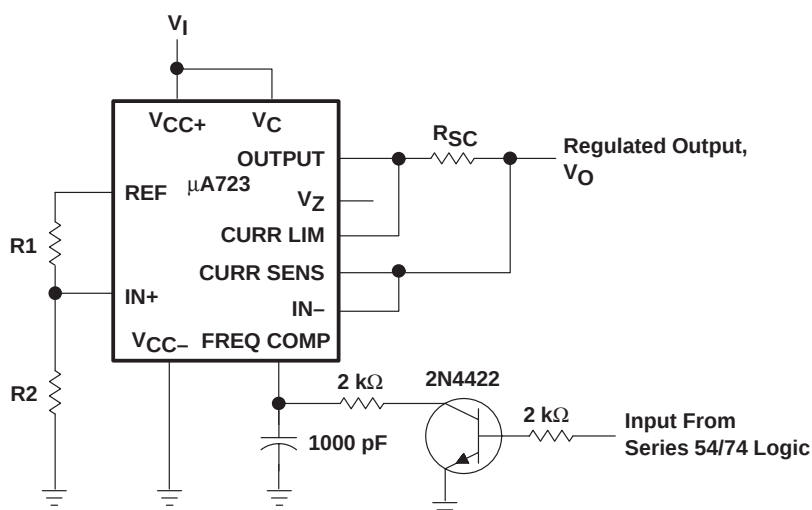
Figure 9. Positive Switching Regulator

APPLICATION INFORMATION



NOTES: A. The device requires a minimum of 9 V between V_{CC+} and V_{CC-} when V_O is equal to or more positive than -9 V.
B. L is 40 turns of No. 20 enameled copper wire wound on Ferroxcube P36/22-3B7 potted core, or equivalent, with a 0.009-inch air gap.

Figure 10. Negative Switching Regulator



NOTE A: A current-limiting transistor can be used for shutdown if current limiting is not required.

Figure 11. Remote Shutdown Regulator With Current Limiting

APPLICATION INFORMATION

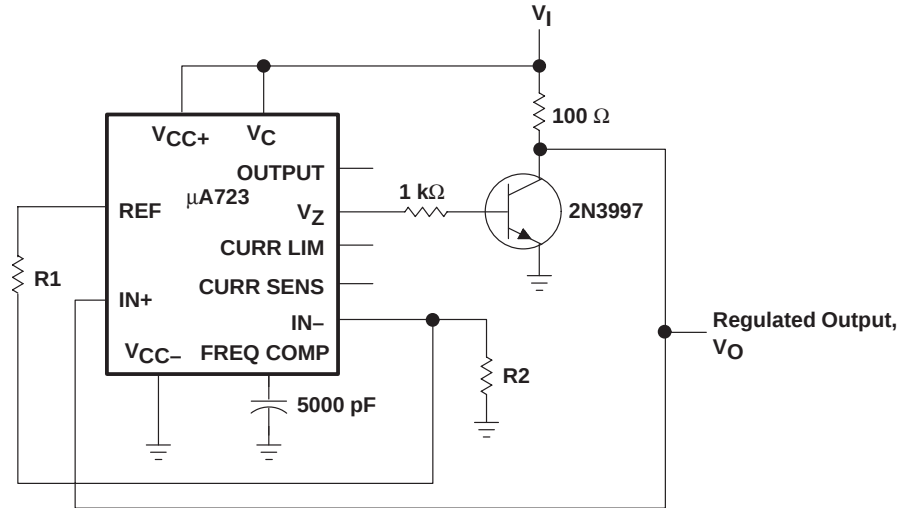


Figure 12. Shunt Regulator

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
UA723CD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UA723C	Samples
UA723CDE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UA723C	Samples
UA723CDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UA723C	Samples
UA723CDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UA723C	Samples
UA723CDRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UA723C	Samples
UA723CDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UA723C	Samples
UA723CJ	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI			
UA723CN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	UA723CN	Samples
UA723CNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	UA723CN	Samples
UA723CNSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UA723	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.

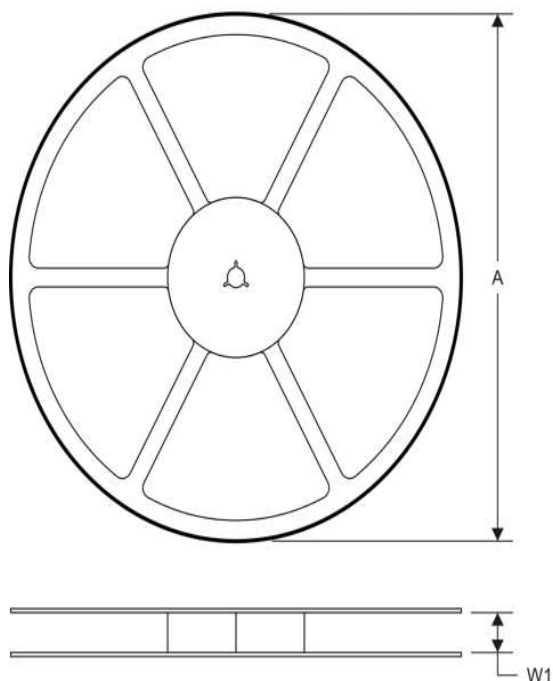
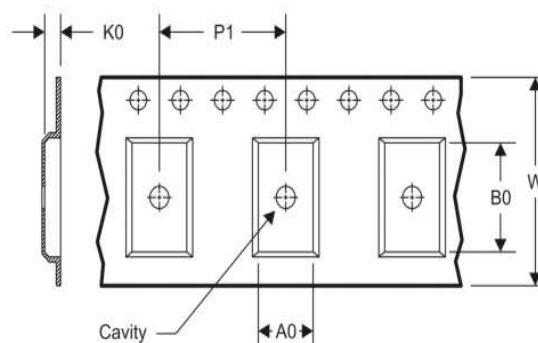
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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⁾ There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.
- ⁽⁵⁾ Multiple Device Markings will be inside parentheses. Only one Device 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 Device Marking for that device.
- ⁽⁶⁾ Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


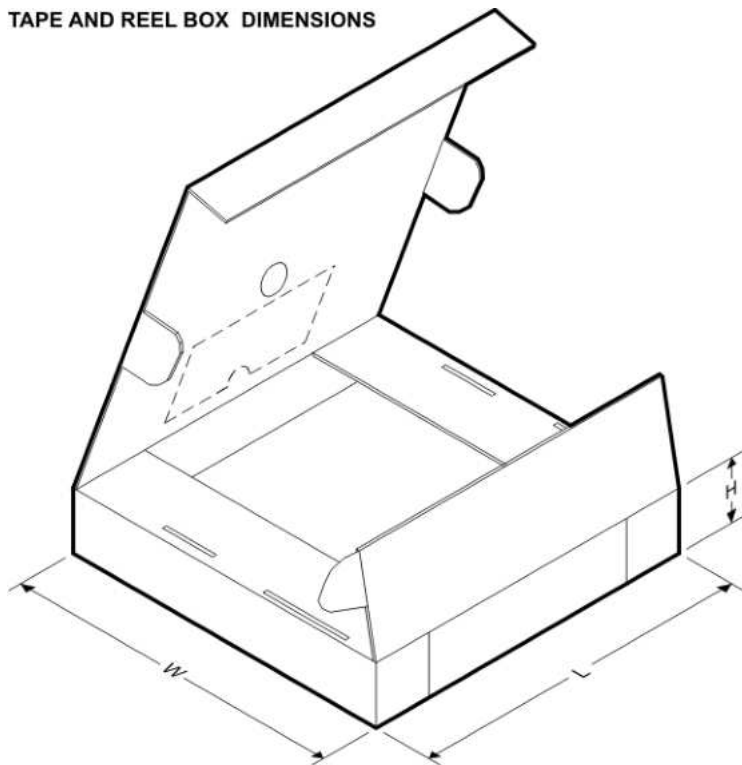
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
UA723CDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
UA723CNSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



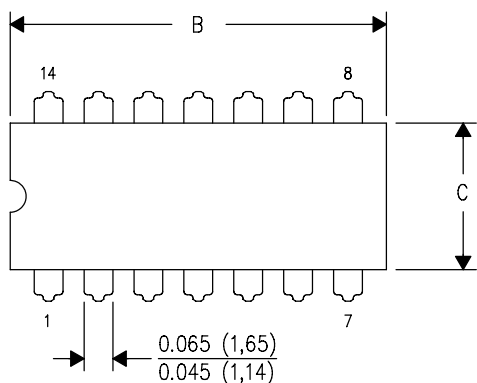
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
UA723CDR	SOIC	D	14	2500	367.0	367.0	38.0
UA723CNSR	SO	NS	14	2000	367.0	367.0	38.0

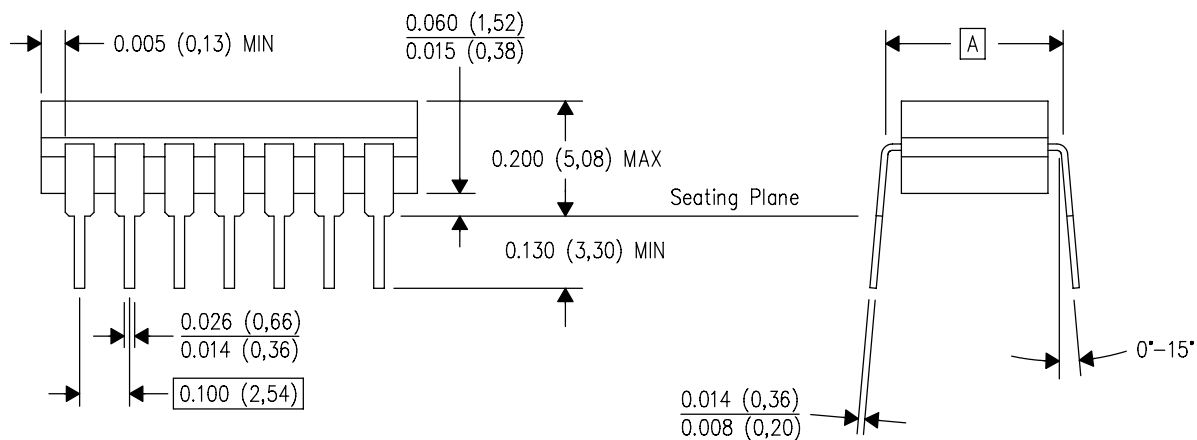
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



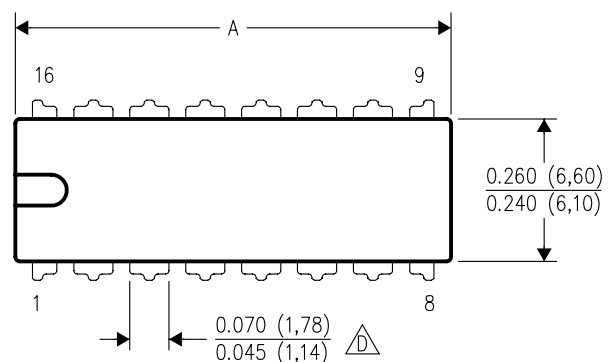
4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

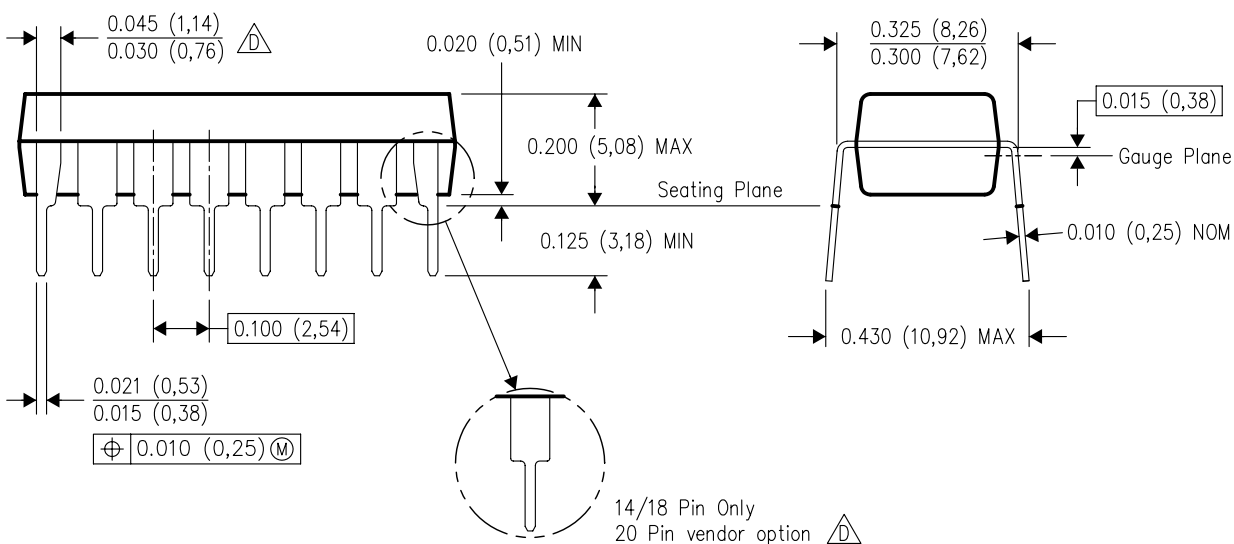
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



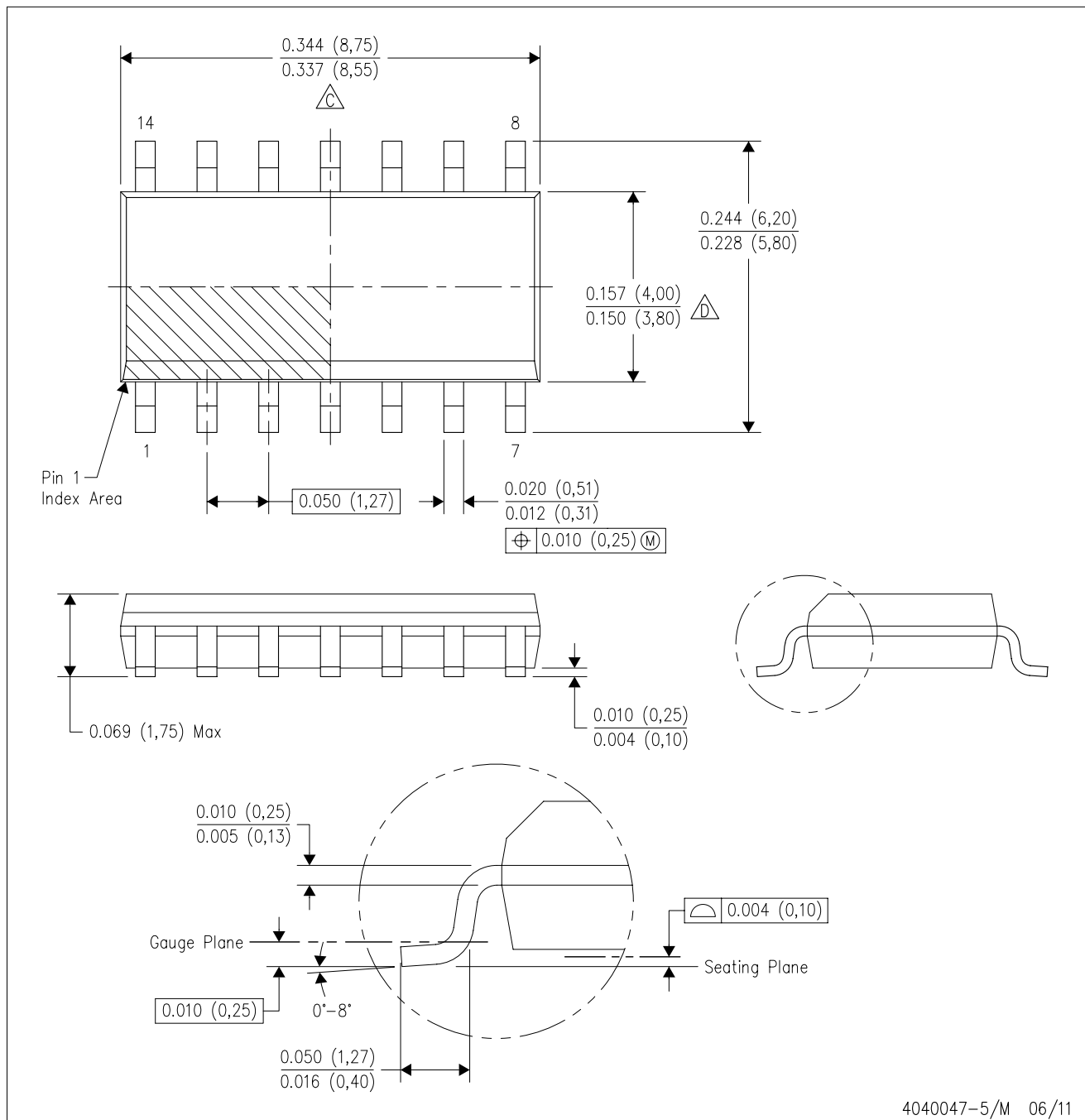
4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

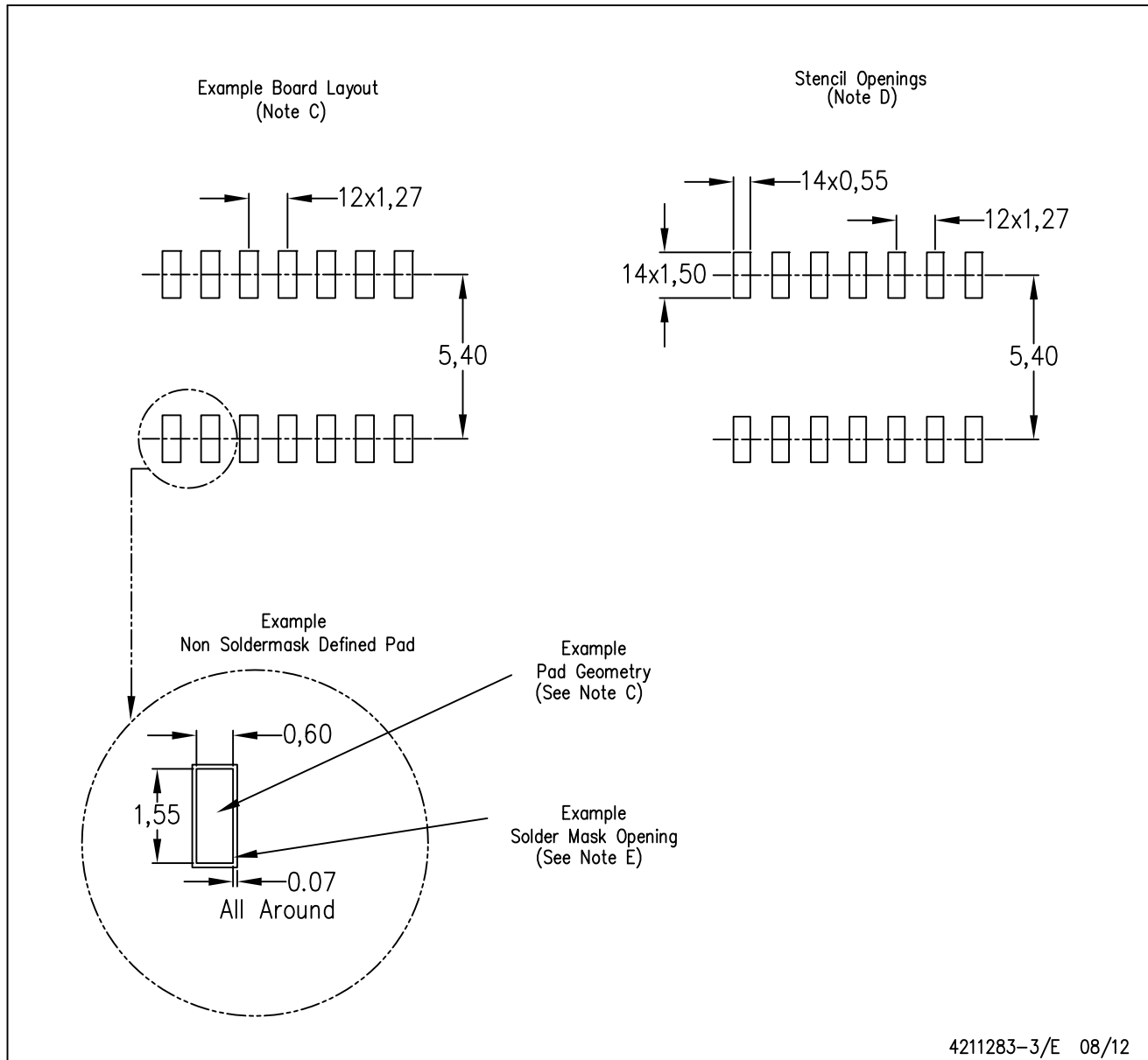
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



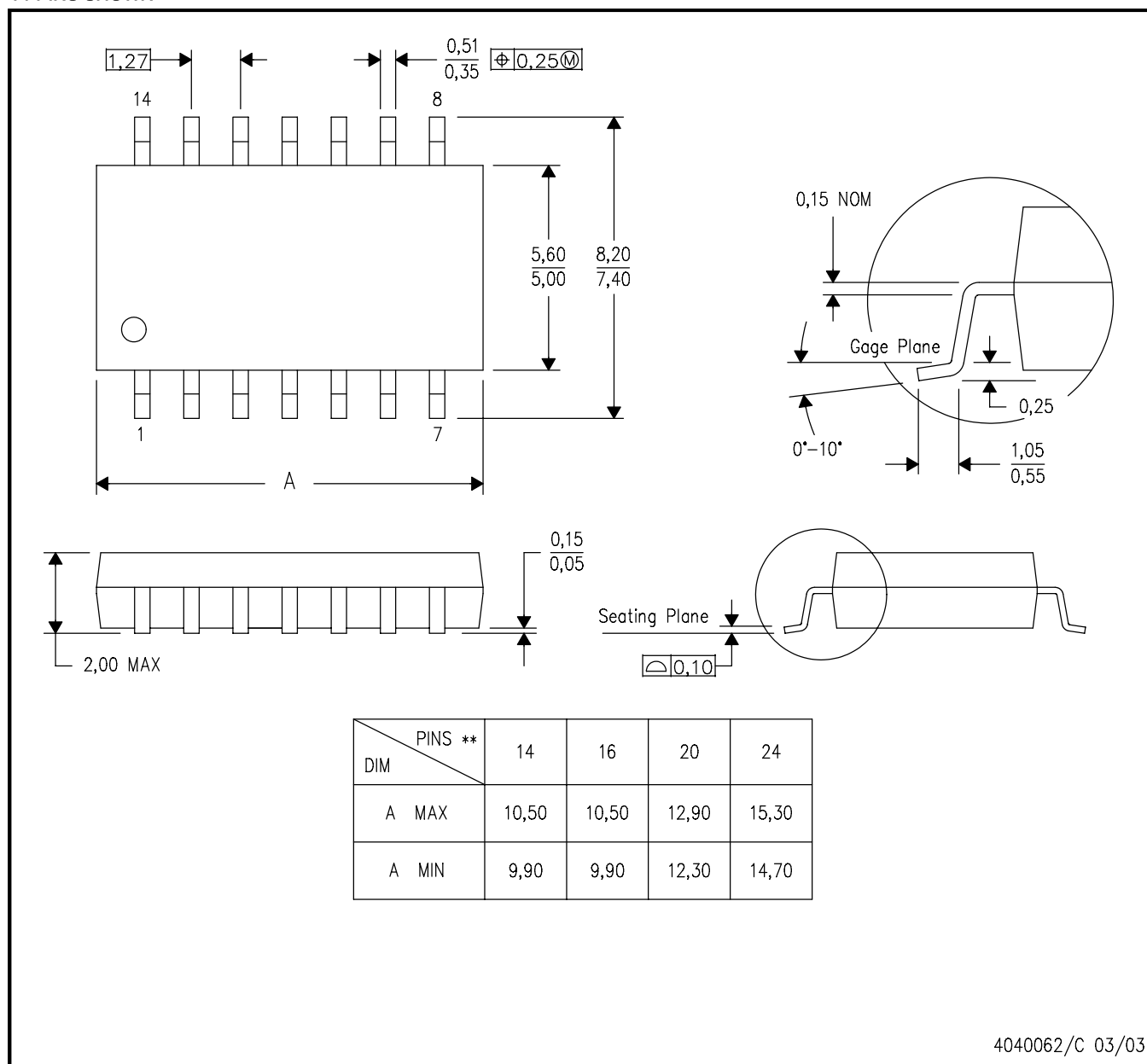
- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- 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, not to exceed 0,15.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com