

AM26C32

QUADRUPLE DIFFERENTIAL LINE RECEIVER

SLLS104I – DECEMBER 1990 – REVISED SEPTEMBER 2004

- Meets or Exceeds the Requirements of ANSI TIA/EIA-422-B, TIA/EIA-423-B, and ITU Recommendation V.10 and V.11
- Low Power, $I_{CC} = 10 \text{ mA Typ}$
- $\pm 7\text{-V}$ Common-Mode Range With $\pm 200\text{-mV}$ Sensitivity
- Input Hysteresis . . . 60 mV Typ
- $t_{pd} = 17 \text{ ns Typ}$
- Operates From a Single 5-V Supply
- 3-State Outputs
- Input Fail-Safe Circuitry
- Improved Replacements for AM26LS32
- Available in Q-Temp Automotive
 - High Reliability Automotive Applications
 - Configuration Control/Print Support
 - Qualification to Automotive Standards

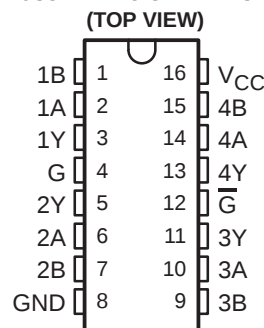
description/ordering information

The AM26C32 is a quadruple differential line receiver for balanced or unbalanced digital data transmission. The enable function is common to all four receivers and offers a choice of active-high or active-low input. The 3-state outputs permit connection directly to a bus-organized system. Fail-safe design specifies that if the inputs are open, the outputs always are high.

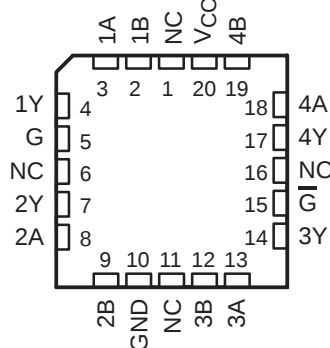
The AM26C32 devices are manufactured using a BiCMOS process, which is a combination of bipolar and CMOS transistors. This process provides the high voltage and current of bipolar with the low power of CMOS to reduce the power consumption to about one-fifth that of the standard AM26LS32, while maintaining ac and dc performance.

The AM26C32C is characterized for operation from 0°C to 70°C . The AM26C32I is characterized for operation from -40°C to 85°C . The AM26C32Q is characterized for operation from -40°C to 125°C . The AM26C32M is characterized for operation over the full military temperature range of -55°C to 125°C .

AM26C32C . . . D, N, OR NS PACKAGE
AM26C32I . . . D, N, NS, OR PW PACKAGE
AM26C32Q . . . D PACKAGE
AM26C32M . . . J OR W PACKAGE



AM26C32M . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection



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**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

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description/ordering information (continued)

ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP (N)	Tube of 25	AM26C32CN	AM26C32CN
	SOIC (D)	Tube of 40	AM26C32CD	AM26C32C
		Reel of 2500	AM26C32CDR	
	SOP (NS)	Reel of 2000	AM26C32CNSR	26C32
–40°C to 85°C	PDIP (N)	Tube of 25	AM26C32IN	AM26C32IN
	SOIC (D)	Tube of 40	AM26C32ID	AM26C32I
		Reel of 2500	AM26C32IDR	
	SOP (NS)	Reel of 2000	AM26C32INSR	26C32I
	TSSOP (PW)	Tube of 90	AM26C32IPW	26C32I
–40°C to 125°C	SOIC (D)	Tube of 40	AM26C32QD	AM26C32QD
–55°C to 125°C	CDIP (J)	Tube of 25	AM26C32MJ	AM26C32MJ
	CFP (W)	Tube of 150	AM26C32MW	AM26C32MW
	LCCC (FK)	Tube of 55	AM26C32MFK	AM26C32MFK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE (each receiver)

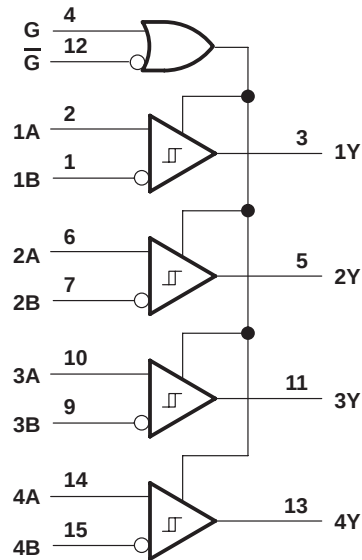
DIFFERENTIAL INPUT	ENABLES		OUTPUT Y
	G	$\overline{G}$	
$V_{ID} \geq V_{IT+}$	H	X	H
	X	L	H
$V_{IT-} < V_{ID} < V_{IT+}$	H	X	?
	X	L	?
$V_{ID} \leq V_{IT-}$	H	X	L
	X	L	L
X	L	H	Z

H = high level, L = low level, X = irrelevant
Z = high impedance (off), ? = indeterminate

AM26C32 QUADRUPLE DIFFERENTIAL LINE RECEIVER

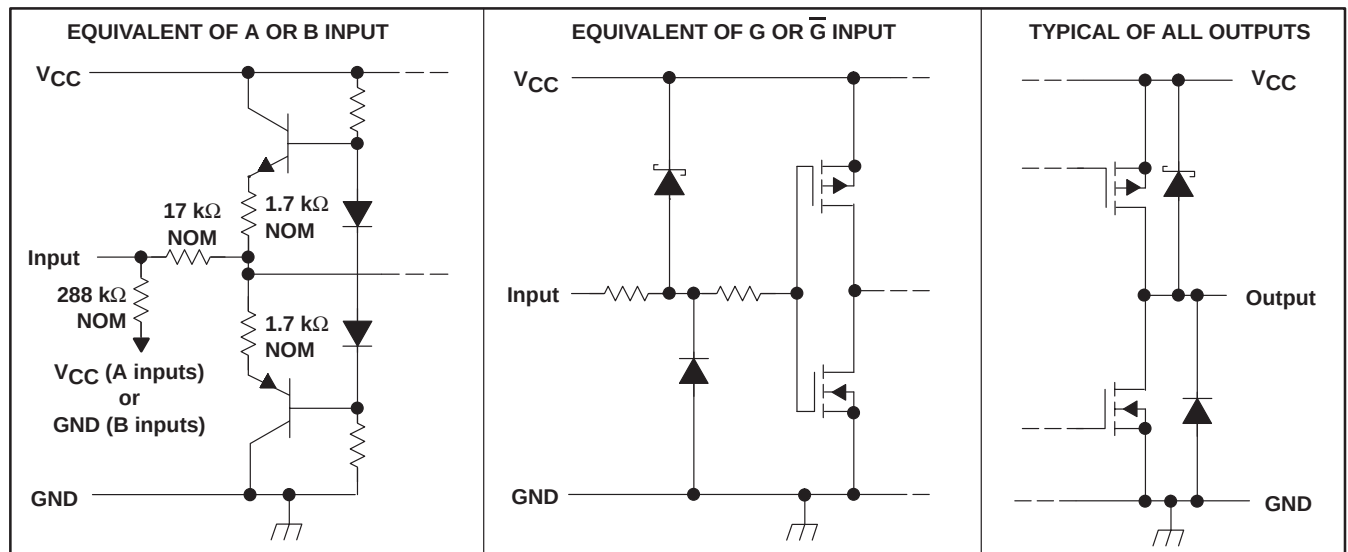
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logic diagram (positive logic)



Pin numbers shown are for the D, J, N, NS, PW, and W packages.

schematics



AM26C32

QUADRUPLE DIFFERENTIAL LINE RECEIVER

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage range, V_I : A or B inputs	-11 V to 14 V
G or $\overline{G}$ inputs	-0.5 V to $V_{CC} + 0.5$ V
Differential input voltage range, V_{ID}	-14 V to 14 V
Output voltage range, V_O	-0.5 V to $V_{CC} + 0.5$ V
Output current, I_O	± 25 mA
Package thermal impedance, θ_{JA} (see Notes 2 and 3): D package	73°C/W
N package	67°C/W
NS package	64°C/W
PW package	108°C/W
Operating virtual junction temperature, T_J	150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	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. All voltage values, except differential output voltage, V_{OD} , are with respect to network GND. Currents into the device are positive and currents out of the device are negative.
2. 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 affect reliability.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			V
V _{IL}	Low-level input voltage			0.8	V
V _{IC}	Common-mode input voltage			±7	V
I _{OH}	High-level output current			−6	mA
I _{OL}	Low-level output current			6	mA
T _A	Operating free-air temperature	AM26C32C	0	70	°C
		AM26C32I	−40	85	
		AM26C32Q	−40	125	
		AM26C32M	−55	125	

AM26C32

QUADRUPLE DIFFERENTIAL LINE RECEIVER

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electrical characteristics over recommended ranges of V_{CC} , V_{IC} , and operating free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
V_{IT+} Differential input high-threshold voltage	$V_O = V_{OH(min)}$, $I_{OH} = -440 \mu A$	$V_{IC} = -7 V$ to $7 V$		0.2	V
		$V_{IC} = 0$ to $5.5 V$		0.1	
V_{IT-} Differential input low-threshold voltage	$V_O = 0.45 V$, $I_{OL} = 8 mA$	$V_{IC} = -7 V$ to $7 V$		$-0.2^{\ddagger}$	V
		$V_{IC} = 0$ to $5.5 V$		$-0.1^{\ddagger}$	
V_{hys} Hysteresis voltage ($V_{IT+} - V_{IT-}$)			60		mV
V_{IK} Enable input clamp voltage	$V_{CC} = 4.5 V$, $I_I = -18 mA$			-1.5	V
V_{OH} High-level output voltage	$V_{ID} = 200 mV$, $I_{OH} = -6 mA$		3.8		V
V_{OL} Low-level output voltage	$V_{ID} = -200 mV$, $I_{OL} = 6 mA$		0.2	0.3	V
I_{OZ} Off-state (high-impedance state) output current	$V_O = V_{CC}$ or GND		± 0.5	± 5	μA
I_I Line input current	$V_I = 10 V$, Other input at $0 V$			1.5	mA
	$V_I = -10 V$, Other input at $0 V$			-2.5	
I_{IH} High-level enable current	$V_I = 2.7 V$			20	μA
I_{IL} Low-level enable current	$V_I = 0.4 V$			-100	μA
r_i Input resistance	One input to ground	12	17		$k\Omega$
I_{CC} Supply current	$V_{CC} = 5.5 V$		10	15	mA

[†] All typical values are at $V_{CC} = 5 V$, $V_{IC} = 0$, and $T_A = 25^\circ C$.

[‡] The algebraic convention, in which the less positive (more negative) limit is designated minimum, is used in this data sheet for common-mode input voltage.

switching characteristics over recommended ranges of operation conditions, $C_L = 50 pF$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	AM26C32C AM26C32I			AM26C32Q AM26C32M			UNIT
		MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	
t_{PLH} Propagation delay time, low- to high-level output	See Figure 1	9	17	27	9	17	27	ns
t_{PHL} Propagation delay time, high- to low-level output		9	17	27	9	17	27	ns
t_{TLH} Output transition time, low- to high-level output	See Figure 1		4	9		4	10	ns
t_{THL} Output transition time, high- to low-level output			4	9		4	9	ns
t_{PZH} Output enable time to high level	See Figure 2		13	22		13	22	ns
t_{PZL} Output enable time to low level			13	22		13	22	ns
t_{PHZ} Output disable time from high level	See Figure 2		13	22		13	26	ns
t_{PLZ} Output disable time from low level			13	22		13	25	ns

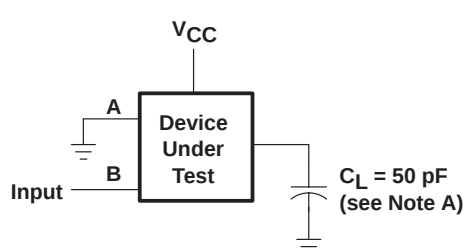
[†] All typical values are at $V_{CC} = 5 V$, $T_A = 25^\circ C$.



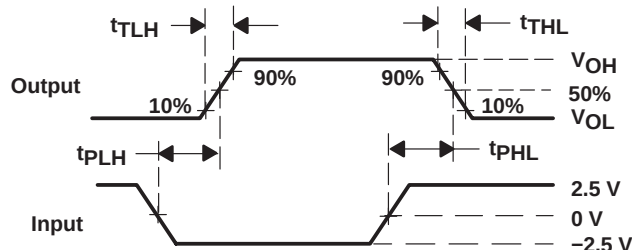
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PARAMETER MEASUREMENT INFORMATION



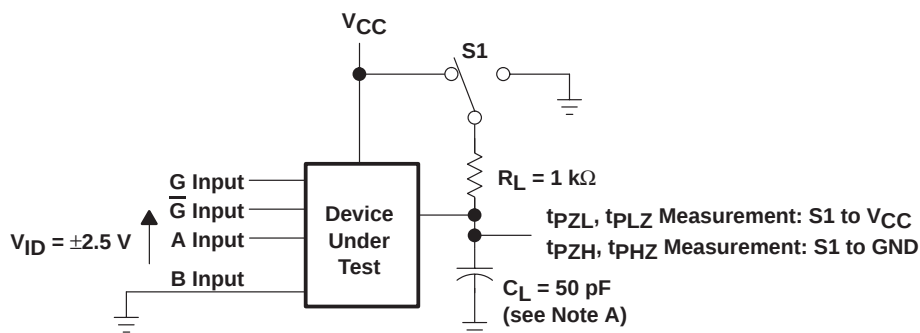
TEST CIRCUIT



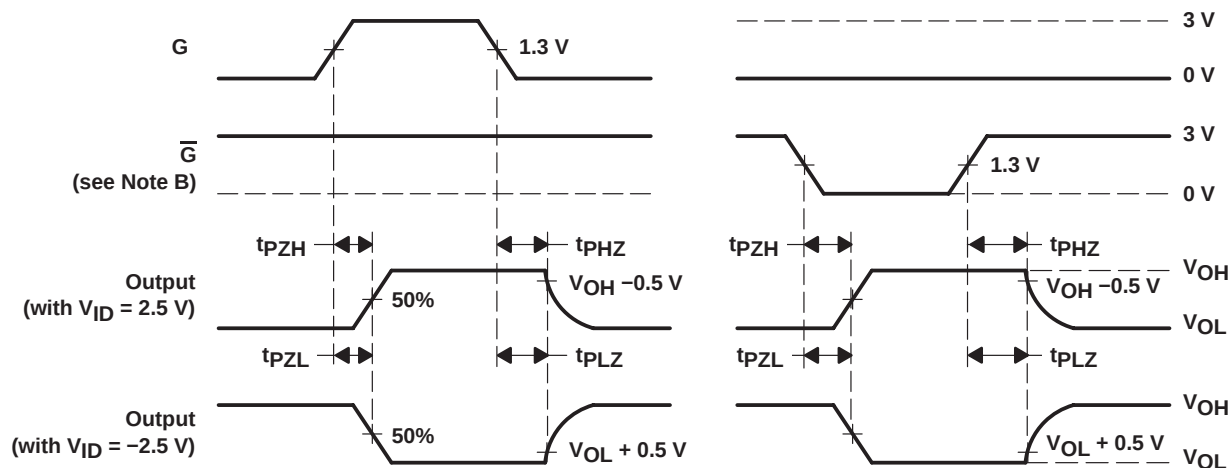
VOLTAGE WAVEFORMS

NOTE A: C_L includes probe and jig capacitance.

Figure 1. Switching Test Circuit and Voltage Waveforms



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.

B. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle ≤ 50%, $t_r = t_f = 6$ ns.

Figure 2. Enable/Disable Time Test Circuit and Output Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9164001Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	Level-NC-NC-NC
5962-9164001QEA	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	Level-NC-NC-NC
5962-9164001QFA	ACTIVE	CFP	W	16	1	TBD	A42 SNPB	Level-NC-NC-NC
AM26C32CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32CDBLE	OBSOLETE	SSOP	DB	16		TBD	Call TI	Call TI
AM26C32CDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32CDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32CN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
AM26C32CNE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
AM26C32CNSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
AM26C32CNSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
AM26C32ID	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32IDBLE	OBSOLETE	SSOP	DB	16		TBD	Call TI	Call TI
AM26C32IDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32IDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32IDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32IDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
AM26C32IN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
AM26C32INE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
AM26C32INSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
AM26C32INSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
AM26C32IPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
AM26C32IPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
AM26C32MFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	Level-NC-NC-NC
AM26C32MJB	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	Level-NC-NC-NC
AM26C32MWB	ACTIVE	CFP	W	16	1	TBD	A42 SNPB	Level-NC-NC-NC
AM26C32QD	ACTIVE	SOIC	D	16	40	TBD	CU NIPDAU	Level-1-220C-UNLIM

(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) 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.

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.

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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)

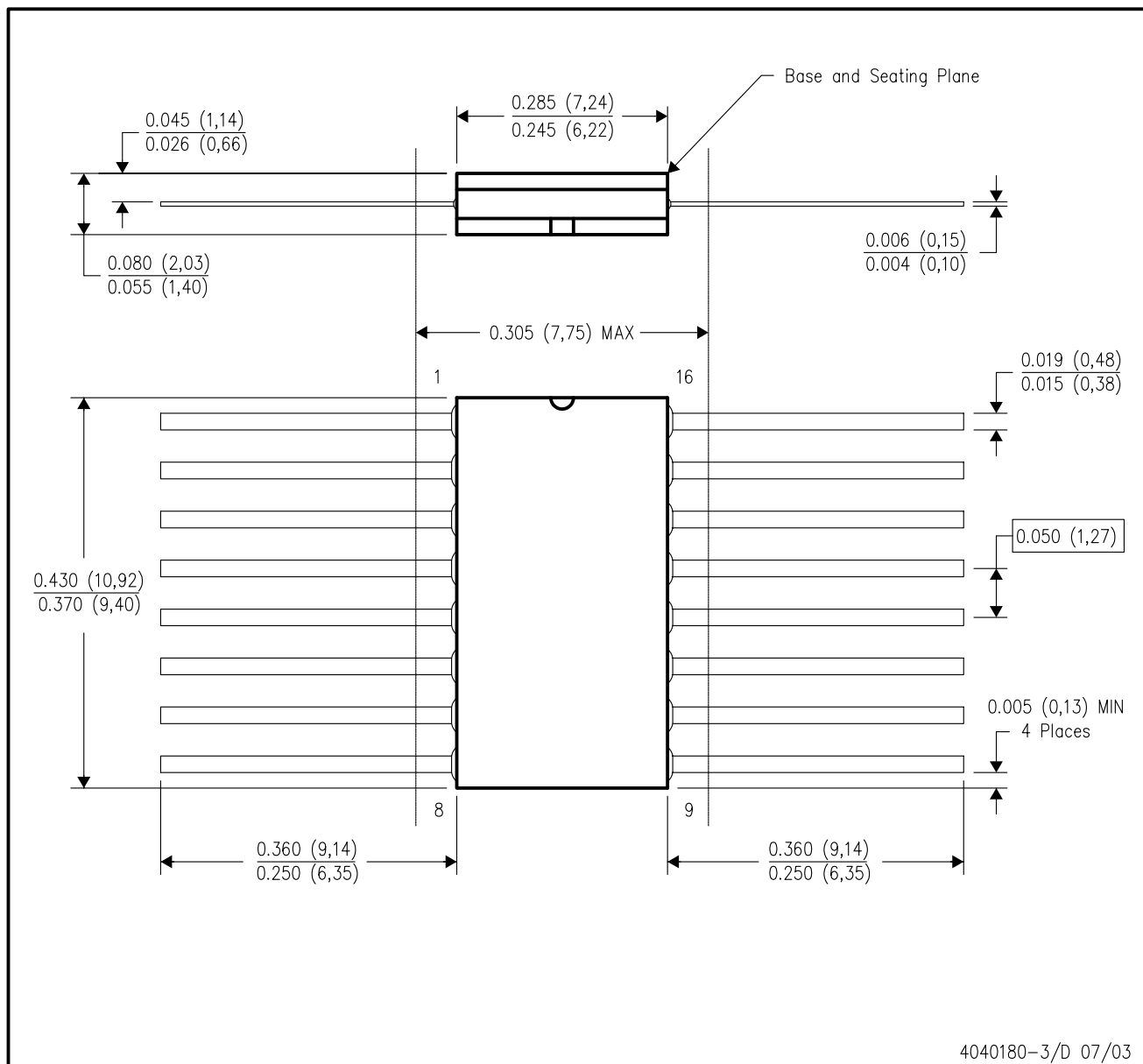


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- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal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

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within MIL STD 1835 GDFP1-F16 and JEDEC MO-092AC

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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



14/18 Pin Only
20 Pin vendor option

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-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-012 variation AC.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 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.
 D. Falls within JEDEC MO-150

PW (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.
 D. Falls within JEDEC MO-153

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