

SN5476, SN54LS76A SN7476, SN74LS76A DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR

SDLS121 – DECEMBER 1983 – REVISED MARCH 1988

- Package Options Include Plastic and Ceramic DIPs and Ceramic Flat Packages
- Dependable Texas Instruments Quality and Reliability

SN5476, SN54LS76A . . . J PACKAGE
SN7476 . . . N PACKAGE
SN74LS76A . . . D OR N PACKAGE
(TOP VIEW)



description

The '76 contains two independent J-K flip-flops with individual J-K, clock, preset, and clear inputs. The '76 is a positive-edge-triggered flip-flop. J-K input is loaded into the master while the clock is high and transferred to the slave on the high-to-low transition. For these devices the J and K inputs must be stable while the clock is high.

The 'LS76A contain two independent negative-edge-triggered flip-flops. The J and K inputs must be stable one setup time prior to the high-to-low clock transition for predicatble operation. The preset and clear are asynchronous active low inputs. When low they override the clock and data inputs forcing the outputs to the steady state levels as shown in the function table.

The SN5476 and the SN54LS76A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7476 and the SN74LS76A are characterized for operation from 0°C to 70°C .

'76
FUNCTION TABLE

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	\bar{Q}
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H [†]	H [†]
H	H	\downarrow	L	L	Q ₀	\bar{Q}_0
H	H	\downarrow	H	L	H	L
H	H	\downarrow	L	H	L	H
H	H	\downarrow	H	H	TOGGLE	
H	H	\downarrow	H	H	TOGGLE	

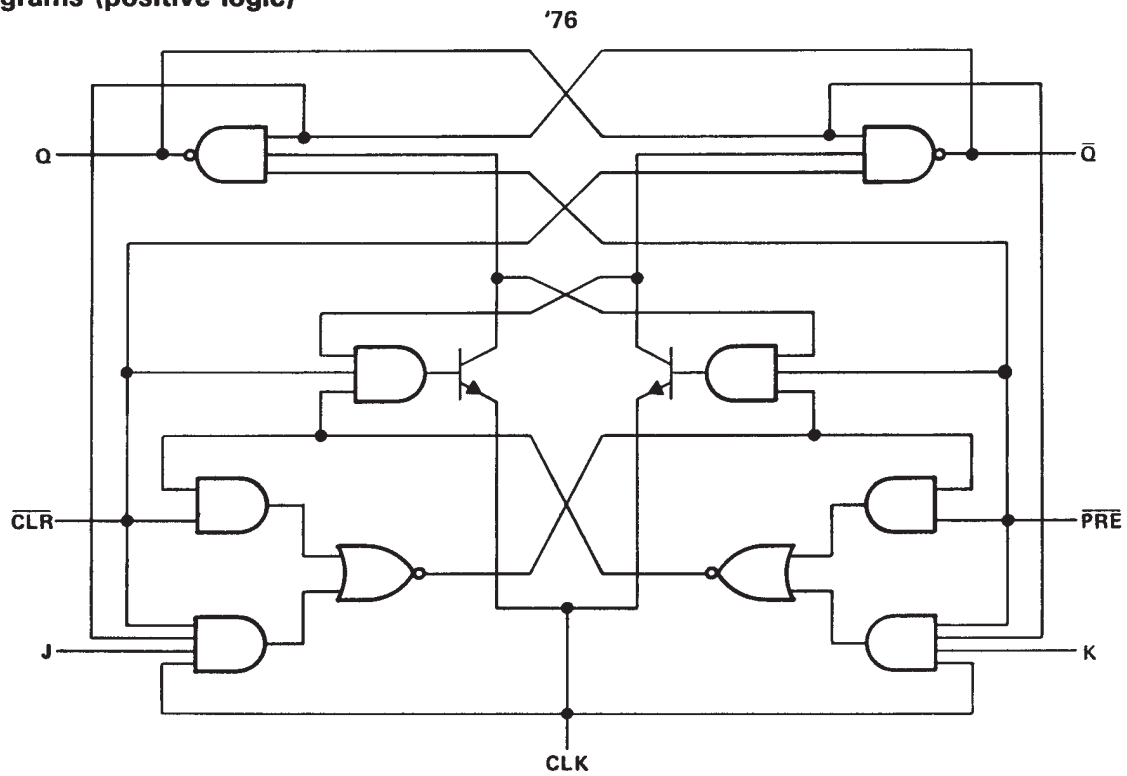
'LS76A
FUNCTION TABLE

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	\bar{Q}
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H [†]	H [†]
H	H	\downarrow	L	L	Q ₀	\bar{Q}_0
H	H	\downarrow	H	L	H	L
H	H	\downarrow	L	H	L	H
H	H	\downarrow	H	H	TOGGLE	
H	H	\downarrow	H	H	Q ₀	\bar{Q}_0

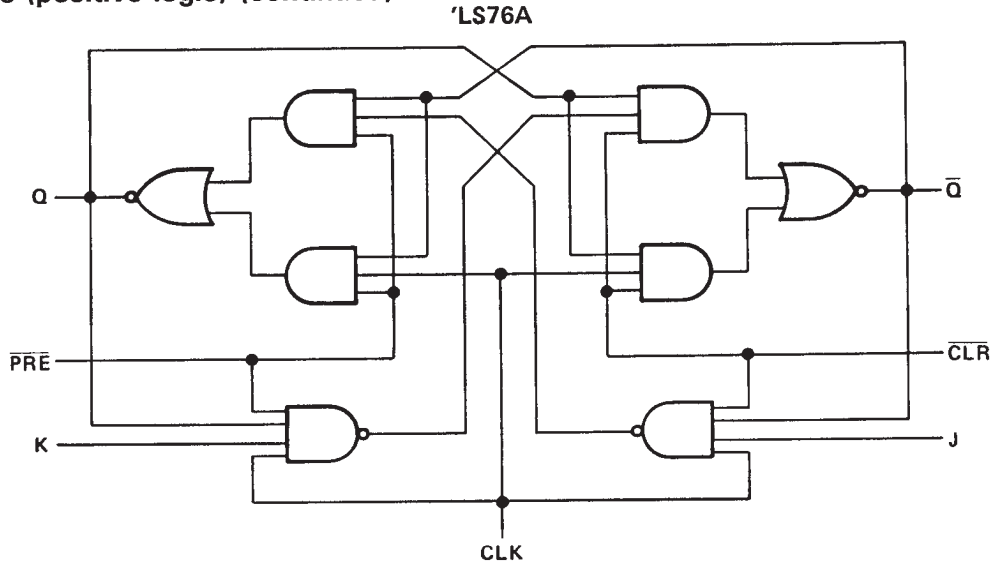
[†] This configuration is nonstable; that is, it will not persist when either preset or clear returns to its inactive (high) level.

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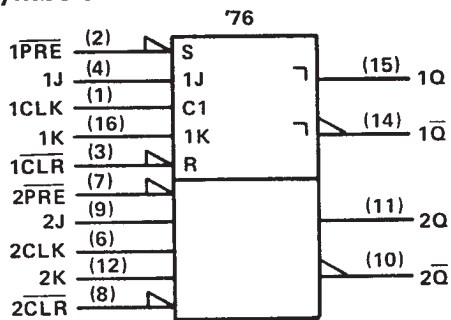
logic diagrams (positive logic)



logic diagrams (positive logic) (continued)

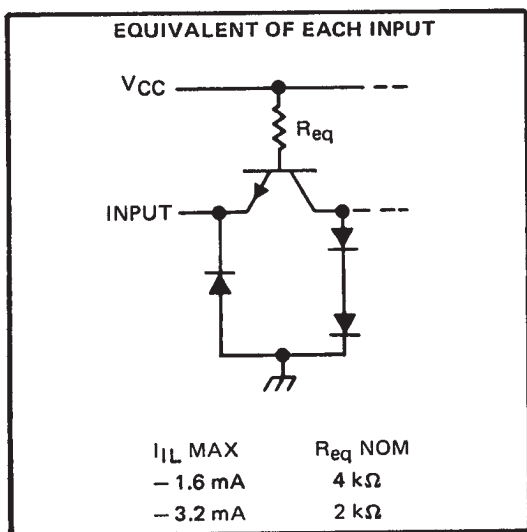


logic symbols†

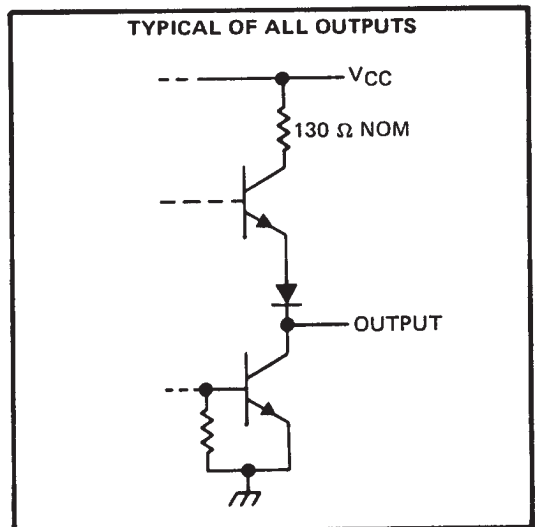


†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

schematics of inputs and outputs



'76

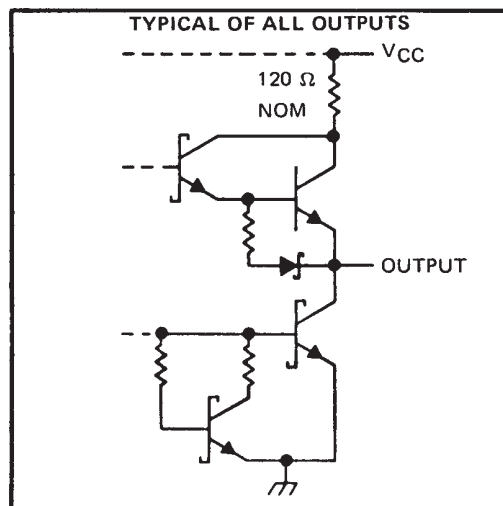
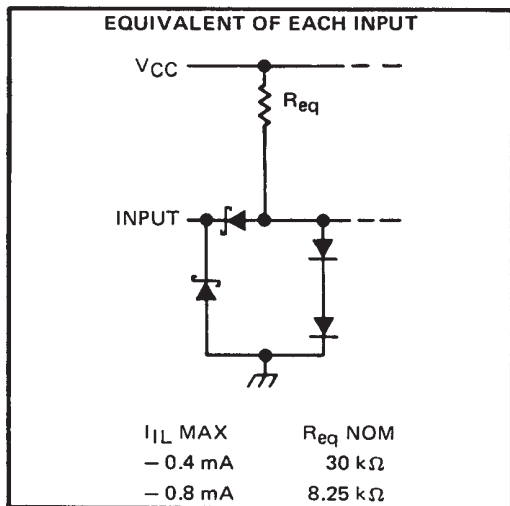


SN5476, SN54LS76A
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schematics of inputs and outputs (continued)

'LS76A



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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: '76	5.5 V
'LS76A	7 V
Operating free-air temperature range: SN54'	-55°C to 125°C
SN74'	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

SN5476, SN54LS76A
SN7476, SN74LS76A
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recommended operating conditions

		SN5476			SN7476			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V _{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage	0.8			0.8			V
I _{OH}	High-level output current	– 0.4			– 0.4			mA
I _{OL}	Low-level output current	16			16			mA
t _w	Pulse duration	CLK high		20	20		ns	
		CLK low		47	47			
		PRE or CLR low		25	25			
t _{su}	Input setup time before CLK ↑	0			0			ns
t _h	Input hold time-data after CLK ↓	0			0			ns
T _A	Operating free-air temperature	– 55	125		0	70		°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN5476			SN7476			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}	V _{CC} = MIN, I _I = – 12 mA	– 1.5			– 1.5			V
V _{OH}	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = – 0.4 mA	2.4	3.4		2.4	3.4		V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OL} = 16 mA		0.2	0.4		0.2	0.4	V
I _I	V _{CC} = MAX, V _I = 5.5 V	1			1			mA
I _{IH}	J or K	40			40			μA
	All other	80			80			
I _{IL}	J or K	– 1.6			– 1.6			mA
	All other	– 3.2			– 3.2			
I _{OS} §	V _{CC} = MAX	– 20	– 57		– 18	– 57		mA
I _{CC} #	V _{CC} = MAX, See Note 2	10 20			10 20			mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

¶ Clear is tested with preset high and preset is tested with clear high.

Average per flip-flop.

NOTE 2: With all outputs open, I_{CC} is measured with the Q and \bar{Q} outputs high in turn. At the time of measurement, the clock input is grounded.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT	
f _{max}					15	20		MHz	
t _{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or \bar{Q}	R _L = 400 Ω,	C _L = 15 pF		16	25	ns	
t _{PHL}						25	40	ns	
t _{PLH}	CLK	Q or \bar{Q}					16	25	ns
t _{PHL}							25	40	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



**SN5476, SN54LS76A
SN7476, SN74LS76A
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recommended operating conditions

		SN54LS76A			SN74LS76A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.75	V
V _{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage			0.7			0.8	V
I _{OH}	High-level output current			-0.4			-0.4	mA
I _{OL}	Low-level output current			4			8	mA
f _{clock}	Clock frequency	0		30	0		30	MHz
t _w	Pulse duration	CLK high		20			20	ns
		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low		25			25	
t _{su}	Setup time before CLK↓	data high or low		20			20	ns
		$\overline{\text{CLR}}$ inactive		20			20	
		$\overline{\text{PRE}}$ inactive		25			25	
t _h	Hold time-data after CLK↓	0			0			ns
T _A	Operating free-air temperature	-55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	SN54LS76A			SN74LS76A			UNIT	
			MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V _{IK}		V _{CC} = MIN, I _I = -18 mA			-1.5			-1.5	V	
V _{OH}		V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = MAX, I _{OH} = -0.4 mA	2.5	3.4		2.7	3.4		V	
V _{OL}		V _{CC} = MIN, V _{IL} = MAX, V _{IH} = 2 V, I _{OL} = 4 mA		0.25	0.4		0.25	0.4	V	
		V _{CC} = MIN, V _{IL} = MAX, V _{IH} = 2 V, I _{OL} = 8 mA					0.35	0.5		
I _I	J or K	V _{CC} = MAX, V _I = 7 V			0.1			0.1	mA	
	$\overline{\text{CLR}}$ or $\overline{\text{PRE}}$				0.3			0.3		
	CLK				0.4			0.4		
I _{IH}	J or K	V _{CC} = MAX, V _I = 2.7 V			20			20	μA	
	$\overline{\text{CLR}}$ or $\overline{\text{PRE}}$				60			60		
	CLK				80			80		
I _{IL}	J or K	V _{CC} = MAX, V _I = 0.4 V			-0.4			-0.4	mA	
	All other				-0.8			-0.8		
I _{OS} §		V _{CC} = MAX, See Note 4	-20		-100			-20	-100	mA
I _{CC} (Total)		V _{CC} = MAX, See Note 2		4	6		4	6	mA	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

NOTE 2: With all outputs open, I_{CC} is measured with the Q and $\overline{\text{Q}}$ outputs high in turn. At the time of measurement, the clock input is grounded.

NOTE 4: For certain devices where state commutation can be caused by shorting an output to ground, an equivalent test may be performed with V_O = 2.25 V and 2.125 V for the 54 family and the 74 family, respectively, with the minimum and maximum limits reduced to one half of their stated values.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
f _{max}					30	45		MHz
t _{PLH}	$\overline{\text{PRE}}$, $\overline{\text{CLR}}$ or CLK	Q or $\overline{\text{Q}}$	R _L = 2 kΩ,	C _L = 15 pF		15	20	ns
t _{PHL}						15	20	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



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
5962-9557501QEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9557501QE A SNJ5476J	Samples
5962-9557501QFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9557501QF A SNJ5476W	Samples
5962-9557501QFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9557501QF A SNJ5476W	Samples
7601301EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7601301EA SNJ54LS76AJ	Samples
7601301EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7601301EA SNJ54LS76AJ	Samples
JM38510/00204BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 00204BEA	Samples
JM38510/00204BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 00204BEA	Samples
M38510/00204BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 00204BEA	Samples
M38510/00204BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 00204BEA	Samples
SN5476J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN5476J	Samples
SN5476J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN5476J	Samples
SN54LS76AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54LS76AJ	Samples
SN54LS76AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54LS76AJ	Samples
SNJ5476J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9557501QE A SNJ5476J	Samples
SNJ5476J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9557501QE A SNJ5476J	Samples
SNJ5476W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9557501QF	Samples

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
										A SNJ5476W	
SNJ5476W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9557501QF A SNJ5476W	Samples
SNJ54LS76AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7601301EA SNJ54LS76AJ	Samples
SNJ54LS76AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7601301EA SNJ54LS76AJ	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.

OBSELETE: 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.

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W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within MIL STD 1835 GDFP2-F16

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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

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