

SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

SDLS118 – DECEMBER 1983 – REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

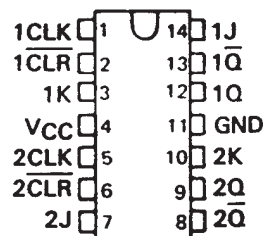
description

The '73, and 'H73, contain two independent J-K flip-flops with individual J-K, clock, and direct clear inputs. The '73, and 'H73, are positive pulse-triggered flip-flops. 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 'LS73A contains 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 predictable operation. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the \bar{Q} output high.

The SN5473, SN54H73, and the SN54LS73A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7473, and the SN74LS73A are characterized for operation from 0°C to 70°C .

SN5473, SN54LS73A . . . J OR W PACKAGE
SN7473 . . . N PACKAGE
SN74LS73A . . . D OR N PACKAGE
(TOP VIEW)



'73
FUNCTION TABLE

INPUTS				OUTPUTS	
CLR	CLK	J	K	Q	\bar{Q}
L	X	X	X	L	H
H		L	L	Q_0	\bar{Q}_0
H		H	L	H	L
H		L	H	L	H
H		H	H	TOGGLE	

'LS73A
FUNCTION TABLE

INPUTS				OUTPUTS	
CLR	CLK	J	K	Q	\bar{Q}
L	X	X	X	L	H
H		L	L	Q_0	\bar{Q}_0
H		H	L	H	L
H		L	H	L	H
H		H	H	TOGGLE	
H	H	X	X	Q_0	\bar{Q}_0

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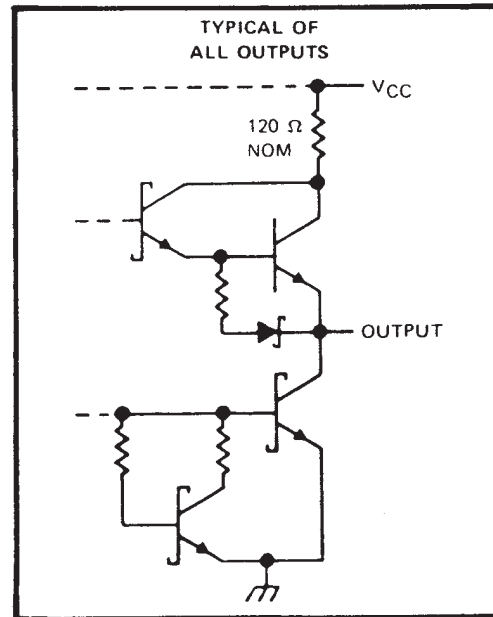
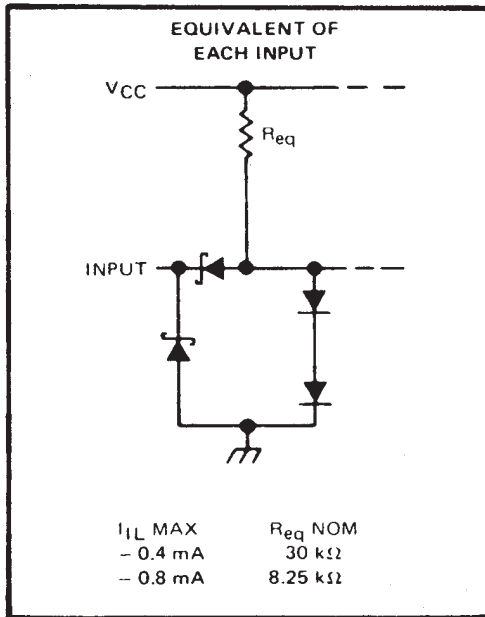
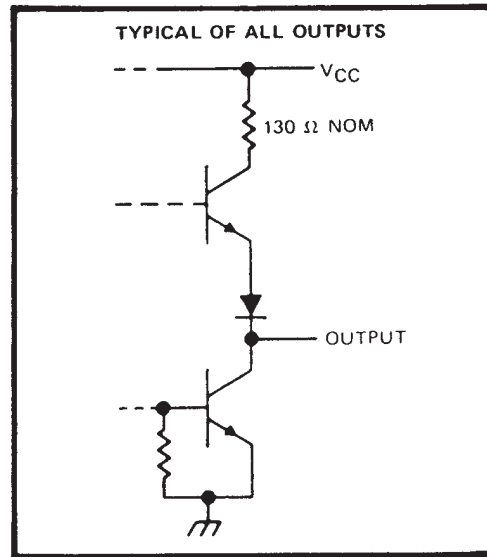
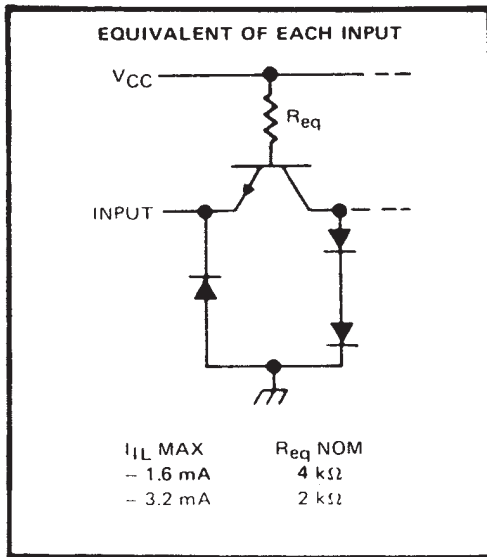
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logic symbols†



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

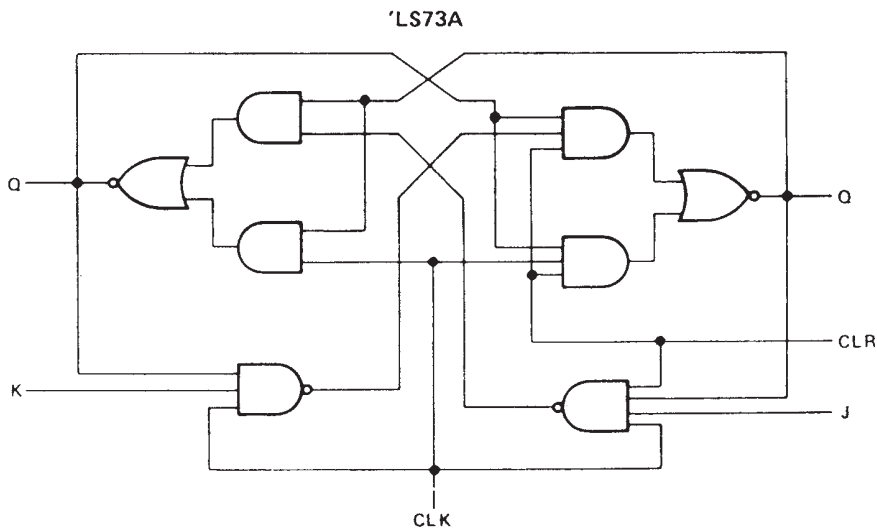
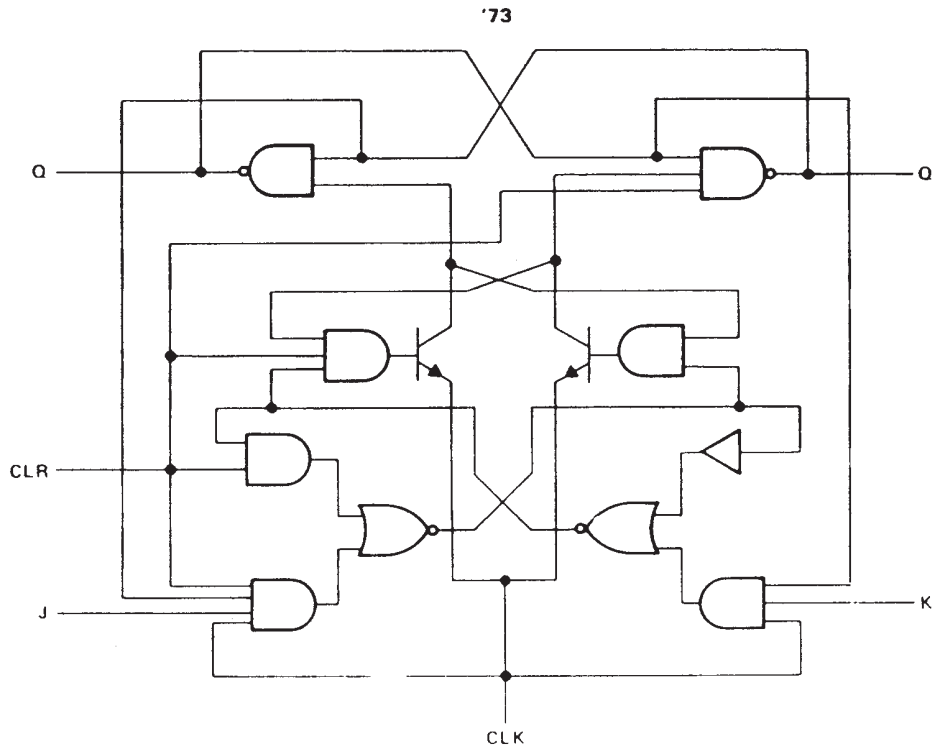
schematics of inputs and outputs



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logic diagrams (positive logic)



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

Supply voltage, V_{CC} (See Note 1)	7 V
Input voltage: '73	5.5 V
'LS73A	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.



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recommended operating conditions

		SN5473			SN7473			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		
		\overline{CLR} low		25			25		
t_{su}	Input setup time before CLK \uparrow			0			0	ns	
t_h	Input hold time data after CLK \downarrow			0			0	ns	
T_A	Operating free-air temperature			-55		125	0	70	$^{\circ}C$

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

PARAMETER	TEST CONDITIONS [†]	SN5473			SN7473			UNIT
		MIN	TYP [‡]	MAX	MIN	TYP [‡]	MAX	
V_{IK}	$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$			-1.5			-1.5	V
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -0.4 \text{ mA}$	2.4	3.4		2.4	3.4		V
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 16 \text{ mA}$		0.2	0.4		0.2	0.4	V
I_I	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$			1			1	mA
I_{IH}	J or K			40			40	μA
	\overline{CLR} or CLK			80			80	
I_{IL}	J or K			-1.6			-1.6	mA
	\overline{CLR}			-3.2			-3.2	
	CLK			-3.2			-3.2	
I_{OS} [§]	$V_{CC} = \text{MAX}$	-20		-57	-18		-57	mA
I_{CC} [¶]	$V_{CC} = \text{MAX}$, 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 $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}C$.

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

[¶] Average per flip-flop.

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

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}C$ (see note 3)

PARAMETER [#]	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{max}				15	20		MHz
t_{PLH}	\overline{CLR}	\overline{Q}	$R_L = 400 \Omega$, $C_L = 15 \text{ pF}$		16	25	ns
t_{PHL}		Q			25	40	ns
t_{PLH}	CLK	Q or \overline{Q}			16	25	ns
t_{PHL}					25	40	ns

[#] f_{max} = maximum clock frequency; t_{PLH} = propagation delay time, low-to-high-level output; t_{PHL} = propagation delay time, high-to-low-level output.

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



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recommended operating conditions

	SN54LS73A			SN74LS73A			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			0.7			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		
	CLR low		25	20				
t_{su} Set up time-before CLK ↓	data high or low		20	20		ns		
	CLR inactive		20	20				
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†	SN54LS73A			SN74LS73A			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}	$V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$			-1.5			-1.5	V
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$, $I_{OH} = -0.4 \text{ mA}$	2.5	3.4		2.7	3.4		V
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IL} = \text{MAX}$, $V_{IH} = 2 \text{ V}$, $I_{OL} = 4 \text{ mA}$		0.25	0.4		0.25	0.4	V
	$V_{CC} = \text{MIN}$, $V_{IL} = \text{MAX}$, $V_{IH} = 2 \text{ V}$, $I_{OL} = 8 \text{ mA}$					0.35	0.5	
I_I	J or K			0.1			0.1	mA
	CLR	$V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$		0.3			0.3	
	CLK			0.4			0.4	
I_{IH}	J or K			20			20	μA
	CLR	$V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$		60			60	
	CLK			80			80	
I_{IL}	J or K	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$		-0.4			-0.4	mA
	CLR or CLK			-0.8			-0.8	
$I_{OS}§$	$V_{CC} = \text{MAX}$, See Note 4	-20		-100	-20		-100	mA
I_{CC} (Total)	$V_{CC} = \text{MAX}$, 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 $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

§ 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 \bar{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 $V_O = 2.25 \text{ V}$ 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, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$ (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{max}				30	45		MHz
t_{PLH}	CLR or CLK	Q or \bar{Q}	$R_L = 2 \text{ k}\Omega$, $C_L = 15 \text{ pF}$		15	20	ns
t_{PHL}					15	20	ns

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



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Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
Low Power Wireless	www.ti.com/lpw	Telephony	www.ti.com/telephony
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Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
Low Power Wireless	www.ti.com/lpw	Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
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PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9675101QCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
5962-9675101QDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
5962-9675101QDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
5962-9675101VCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
5962-9675101VCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
5962-9675101VDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
5962-9675101VDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SN54LS73AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54LS73AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN7473N	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN7473N	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN7473N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN7473N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74LS73AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS73AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS73AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS73ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS73ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ54LS73AFD	OBSOLETE	LCCC	FK	20		TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS73AFD	OBSOLETE	LCCC	FK	20		TBD	POST-PLATE	N / A for Pkg Type

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SNJ54LS73AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54LS73AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54LS73AW	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ54LS73AW	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type

⁽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.

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TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS73ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	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)
SN74LS73ADR	SOIC	D	14	2500	346.0	346.0	33.0

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



4040140/D 10/96

- 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 metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

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)

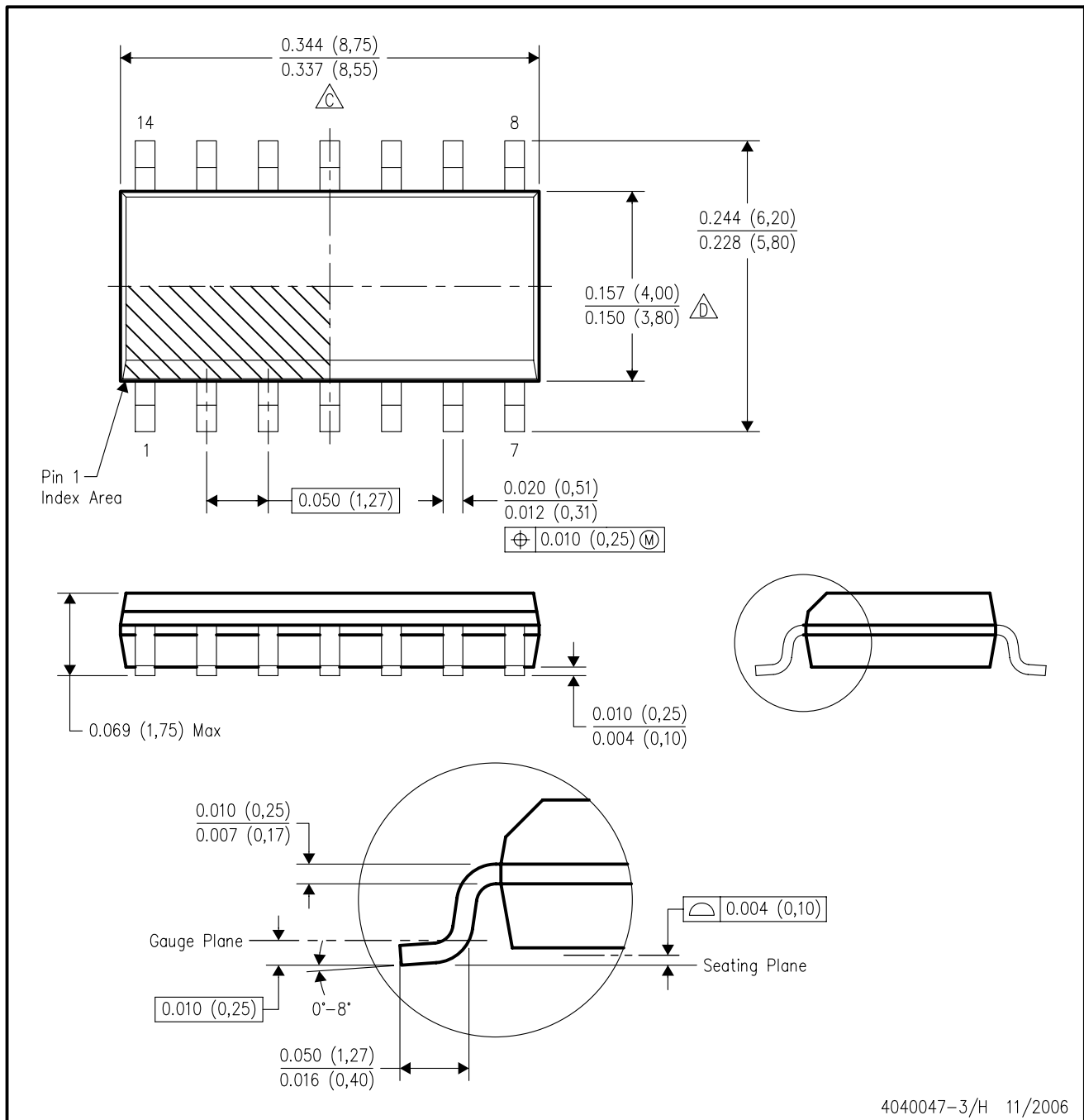


4040083/F 03/03

- 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.

D (R-PDSO-G14)

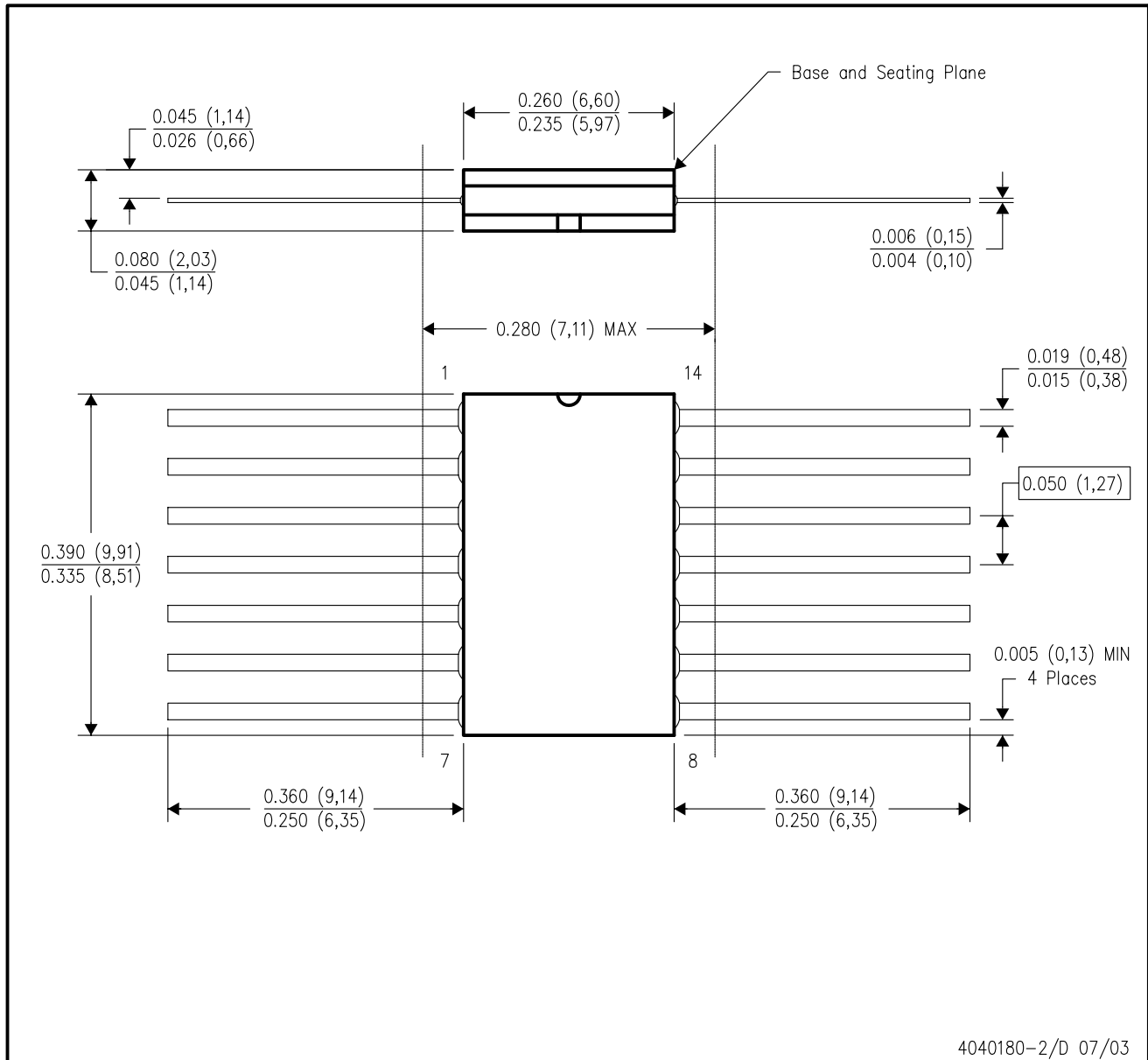
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AB.

W (R-GDFP-F14)

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 GDFP1-F14 and JEDEC MO-092AB

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.

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