SN54174, SN54175, SN54LS174, SN54LS175, SN54S174, SN54S175, SN74174, SN74175, SN74LS174, SN74LS175, SN74S174, SN74S175 HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

SDLS068A – DECEMBER 1972 – REVISED OCTOBER 2001

'174, 'LS174, 'S174 . . . HEX D-TYPE FLIP-FLOPS
'175, 'LS175, 'S175 . . . QUADRUPLE D-TYPE FLIP-FLOPS

- '174, 'LS174, 'S174 Contain Six Flip-Flops with Single-Rail Outputs
- '175, 'LS175, 'S175 Contain Four Flip-Flops with Double-Rail Outputs
- Three Performance Ranges Offered: See Table Lower Right
- Buffered Clock and Direct Clear Inputs
- Individual Data Input to Each Flip-Flop
- Applications include:
  - Buffer/Storage Registers
  - Shift Registers
  - Pattern Generators

description

These monolithic, positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic. All have a direct clear input, and the '175, 'LS175, and 'S175 feature complementary outputs from each flip-flop.

Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock input is at either the high or low level, the D input signal has no effect at the output.

These circuits are fully compatible for use with most TTL circuits.

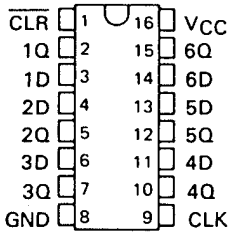
FUNCTION TABLE
(EACH FLIP-FLOP)

INPUTS			OUTPUTS	
CLEAR	CLOCK	D	Q	$\bar{Q}$†
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q_0	$\bar{Q}_0$

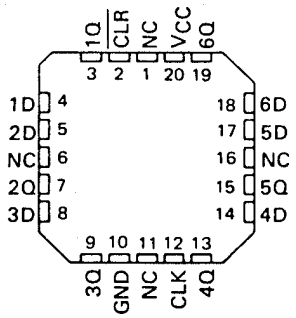
H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated steady-state input conditions were established.
† = '175, 'LS175, and 'S175 only

TYPES	TYPICAL MAXIMUM CLOCK FREQUENCY	TYPICAL POWER DISSIPATION PER FLIP-FLOP
'174, '175	35 MHz	38 mW
'LS174, 'LS175	40 MHz	14 mW
'S174, 'S175	110 MHz	75 mW

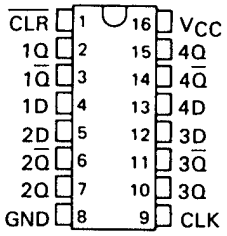
SN54174, SN54LS174, SN54S174 . . . J OR W PACKAGE
SN74174 . . . N PACKAGE
SN74LS174, SN74S174 . . . D OR N PACKAGE
(TOP VIEW)



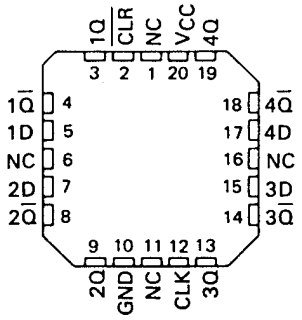
SN54LS174, SN54S174 . . . FK PACKAGE
(TOP VIEW)



SN54175, SN54LS175, SN54S175 . . . J OR W PACKAGE
SN74175 . . . N PACKAGE
SN74LS175, SN74S175 . . . D OR N PACKAGE
(TOP VIEW)



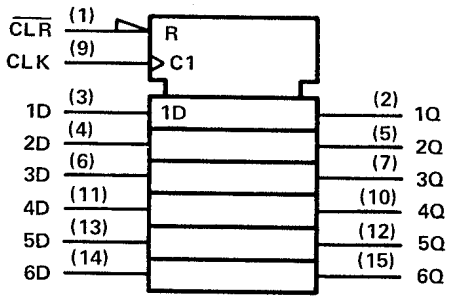
SN54LS175, SN54S175 . . . FK PACKAGE
(TOP VIEW)



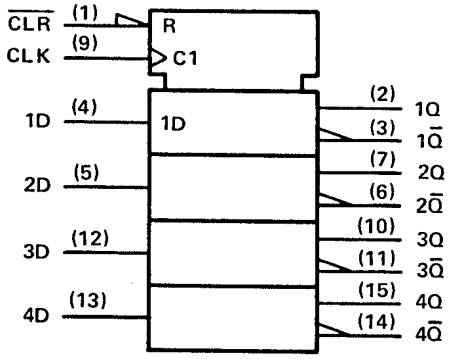
NC – No internal connection

logic symbols†

'174



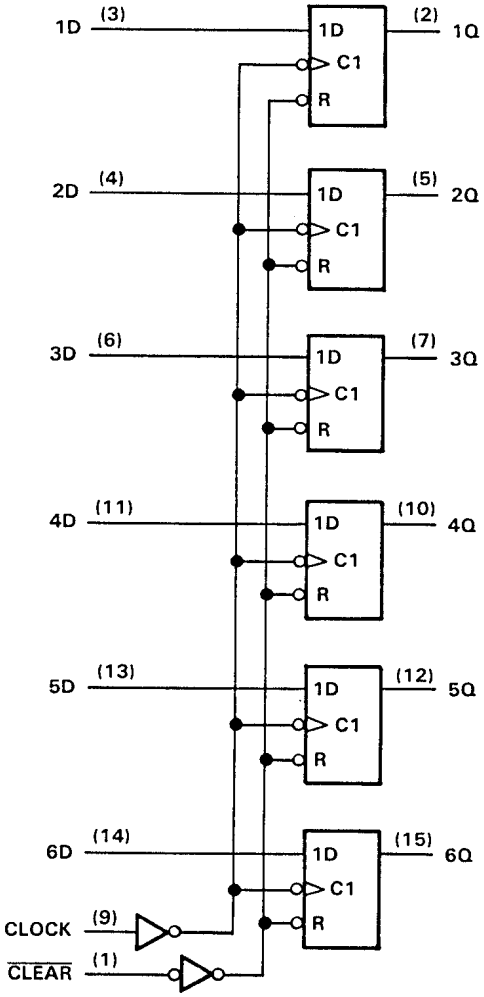
'175



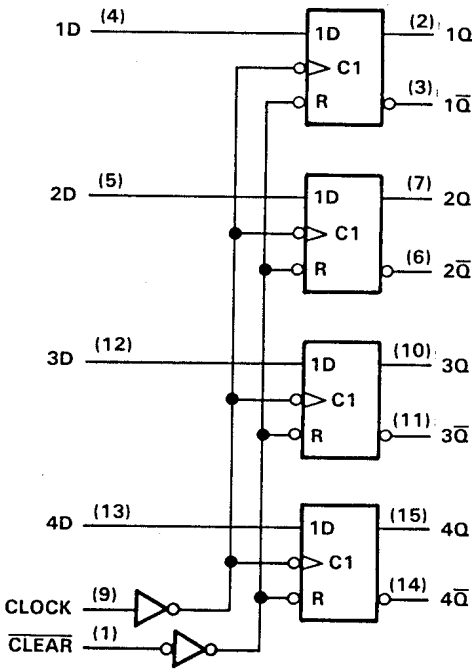
†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, N, and W packages.

logic diagrams (positive logic)

'174, 'LS174, 'S174



'175, 'LS175, 'S175

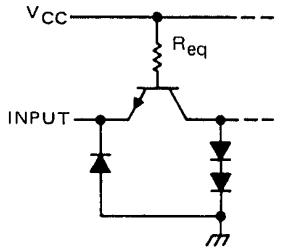


Pin numbers shown are for D, J, N, and W packages.

schematics of inputs and outputs

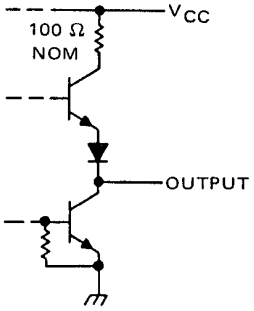
SN54174, SN54175, SN74174, SN74175

EQUIVALENT OF ALL INPUTS



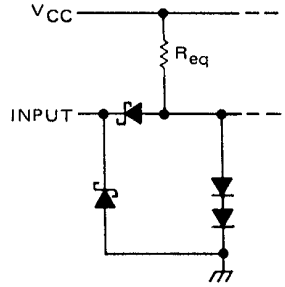
Clock, D: R_{eq} = 8 kΩ NOM
$\overline{\text{Clear}}$: R_{eq} = 4 kΩ NOM

TYPICAL OF ALL OUTPUTS



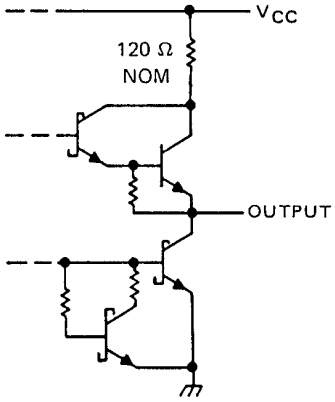
SN54LS174, SN54LS175, SN74LS174, SN74LS175

EQUIVALENT OF ALL INPUTS



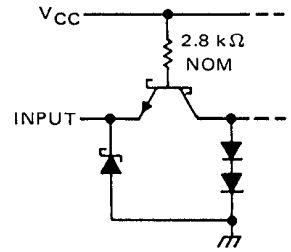
Clock: R_{eq} = 23 kΩ NOM
$\overline{\text{Clear}}$, D: R_{eq} = 28 kΩ NOM

TYPICAL OF ALL OUTPUTS

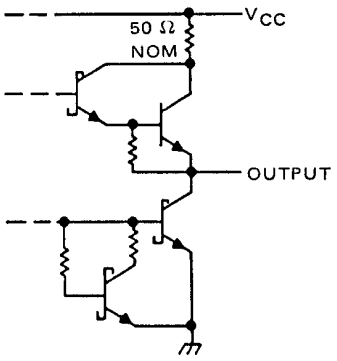


SN54S174, SN54S175, SN74S174, SN74S175

EQUIVALENT OF ALL INPUTS



TYPICAL OF ALL OUTPUTS



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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage . . . . . 5.5 V
Operating free-air temperature range: SN54174, SN54175 Circuits . . . . . −55°C to 125°C
SN74174, SN74175 Circuits . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

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

recommended operating conditions

		SN54174, SN54175			SN74174, SN74175			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}				−800			−800	μA
Low-level output current, I_{OL}				16			16	mA
Clock frequency, f_{clock}		0		25	0		25	MHz
Width of clock or clear pulse, t_w		20			20			ns
Setup time, t_{su}	Data input	20			20			ns
	Clear inactive-state	25			25			ns
Data hold time, t_h		5			5			ns
Operating free-air temperature, T_A		−55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†		MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage					0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −12 mA				−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = −800 μA		2.4	3.4		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = 16 mA			0.2	0.4	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.4 V				40	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V				−1.6	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	SN54′	−20		−57	mA
			SN74′	−18		−57	
I_{CC}	Supply current	V_{CC} = MAX, See Note 2	′174		45	65	mA
			′175		30	45	

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

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

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

NOTE 2: With all outputs open and 4.5 V applied to all data and clear inputs, I_{CC} is measured after a momentary ground, then 4.5 V, is applied to clock.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{max}	Maximum clock frequency	C_L = 15 pF, R_L = 400 Ω, See Note 3	25	35		MHz
t_{PLH}	Propagation delay time, low-to-high-level output from clear (SN54175, SN74175 only)			16	25	ns
t_{PHL}	Propagation delay time, high-to-low-level output from clear			23	35	ns
t_{PLH}	Propagation delay time, low-to-high-level output from clock			20	30	ns
t_{PHL}	Propagation delay time, high-to-low-level output from clock			24	35	ns

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

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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage . . . . . 7 V
Operating free-air temperature range: SN54LS174, SN54LS175 Circuits . . . . . −55°C to 125°C
SN74LS174, SN74LS175 Circuits . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

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

recommended operating conditions

		SN54LS174 SN54LS175			SN74LS174 SN74LS175			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}				−400			−400	μA
Low-level output current, I_{OL}				4			8	mA
Clock frequency, f_{clock}		0		30	0		30	MHz
Width of clock or clear pulse, t_w		20			20			ns
Setup time, t_{su}	Data input	20			20			ns
	Clear inactive-state	25			25			ns
Data hold time, t_h		5			5			ns
Operating free-air temperature, T_A		−55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†		SN54LS174 SN54LS175			SN74LS174 SN74LS175			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			V
V_{IL}	Low-level input voltage					0.7			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.5			−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL}max, I_{OH} = −400 μA		2.5	3.5		2.7	3.5		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} max	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 8 mA					0.35	0.5	
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7 V				0.1			0.1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V				−0.4			−0.4	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX		−20		−100	−20		−100	mA
I_{CC}	Supply current	V_{CC} = MAX, See Note 2	'LS174		16	26		16	26	mA
			'LS175		11	18		11	18	

† 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 duration of the short-circuit should not exceed one second.
NOTE 2: With all outputs open and 4.5 V applied to all data and clear inputs, I_{CC} is measured after a momentary ground, then 4.5 V, is applied to clock.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS	'LS174			'LS175			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
f_{max} Maximum clock frequency	C_L = 15 pF, R_L = 2 kΩ, See Note 3	30	40		30	40		MHz
t_{PLH} Propagation delay time, low-to-high-level output from clear						20	30	ns
t_{PHL} Propagation delay time, high-to-low-level output from clear			23	35		20	30	ns
t_{PLH} Propagation delay time, low-to-high-level output from clock			20	30		13	25	ns
t_{PHL} Propagation delay time, high-to-low-level output from clock			21	30		16	25	ns

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

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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage . . . . . 5.5 V
Operating free-air temperature range: SN54S174, SN54S175 Circuits . . . . . −55°C to 125°C
SN74S174, SN74S175 Circuits . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

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

recommended operating conditions

		SN54S174, SN54S175			SN74S174, SN74S175			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}				−1			−1	mA
Low-level output current, I_{OL}				20			20	mA
Clock frequency, f_{clock}		0		75	0		75	MHz
Pulse width, t_w	Clock	7			7			ns
	Clear	10			10			
Setup time, t_{su}	Data input	5			5			ns
	Clear inactive-state	5			5			
Data hold time, t_h		3			3			ns
Operating free-air temperature, T_A		−55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†		MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage					0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = −1 mA	SN54S'	2.5	3.4		V
			SN74S'	2.7	3.4		
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = 20 mA				0.5	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				50	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−2	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX		−40		−100	mA
I_{CC}	Supply current	V_{CC} = MAX, See Note 2	'174		90	144	mA
			'175		60	96	

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
‡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 duration of the short-circuit should not exceed one second.
NOTE 2: With all outputs open and 4.5 V applied to all data and clear inputs, I_{CC} is measured after a momentary ground, then 4.5 V, is applied to clock.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{max}	Maximum clock frequency	C_L = 15 pF, R_L = 280 Ω, See Note 3	75	110		MHz
t_{PLH}	Propagation delay time, low-to-high-level $\overline{Q}$ output from clear (SN54S175, SN74S175 only)			10	15	ns
t_{PHL}	Propagation delay time, high-to-low-level Q output from clear			13	22	ns
t_{PLH}	Propagation delay time, low-to-high-level output from clock			8	12	ns
t_{PHL}	Propagation time, high-to-low-level output from clock			11.5	17	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	MSL Peak Temp (3)
JM38510/01702BEA	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
JM38510/01702BFA	OBSOLETE	CFP	W	16		TBD	Call TI	Call TI
JM38510/07105BEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/07105BFA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/07106BEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30106B2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30106BEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30106BFA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30107B2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30107BEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30107BFA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30107SEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/30107SFA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SN54175J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN54LS174J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN54LS175J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN54S174J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN54S175J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN74174N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74175N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74175N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS174D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS174DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS174DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS174DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS174J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN74LS174N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS174N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS174NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS174NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS174NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS175D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS175DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS175DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN74LS175DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS175J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN74LS175N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS175N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS175NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS175NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS175NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S174J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN74S174N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74S174N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74S174NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S174NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S175D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S175DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S175DR	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74S175N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74S175N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74S175NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S175NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54175J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SNJ54175W	OBSOLETE	CFP	W	16		TBD	Call TI	Call TI
SNJ54LS174FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS174J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS174W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS175FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS175J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS175W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S174FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S174J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S174W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S175FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S175J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S175W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC

(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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

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

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265