

# SN54107, SN54LS107A, SN74107, SN74LS107A DUAL J-K FLIP-FLOPS WITH CLEAR

SDLS036 – DECEMBER 1983 – REVISED MARCH 1988

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

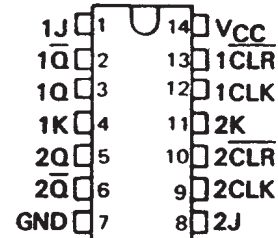
## description

The '107 contain two independent J-K flip-flops with individual J-K, clock, and direct clear inputs. The '107 is a positive pulse-triggered flip-flop. The J-K input data is loaded into the master while the clock is high and transferred to the slave and the outputs on the high-to-low clock transition. For these devices the J and K inputs must be stable while the clock is high.

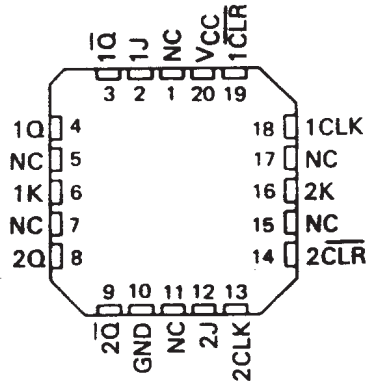
The 'LS107A contain two independent negative-edge-triggered flip-flops. The J and K inputs must be stable prior to the high-to-low clock transition for predictable operation. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the  $\bar{Q}$  output high.

The SN54107 and the SN54LS107A are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74107 and the SN74LS107A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54107, SN54LS107A . . . J PACKAGE  
SN74107 . . . N PACKAGE  
SN74LS107A . . . D OR N PACKAGE  
(TOP VIEW)



SN54LS107A . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

'107  
FUNCTION TABLE

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

'LS107A  
FUNCTION TABLE

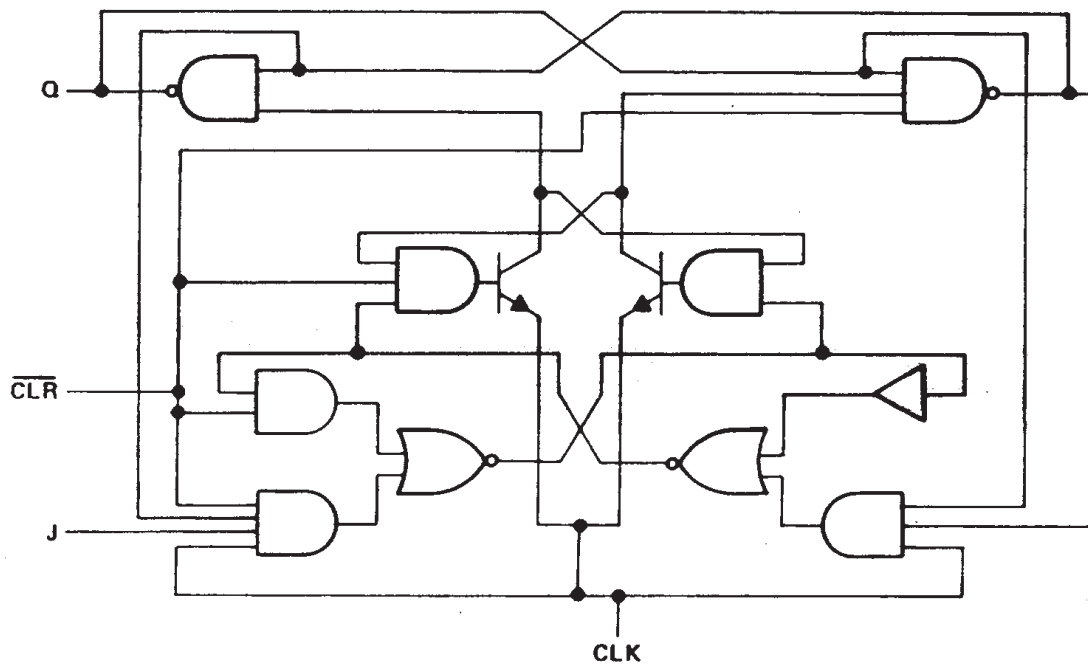
INPUTS				OUTPUTS	
$\overline{\text{CLR}}$	CLK	J	K	Q	$\bar{Q}$
L	X	X	X	L	H
H	$\downarrow$	L	L	$Q_0$	$\bar{Q}_0$
H	$\downarrow$	H	L	H	L
H	$\downarrow$	L	H	L	H
H	$\downarrow$	H	H	TOGGLE	
H	H	X	X	$Q_0$	$\bar{Q}_0$

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.

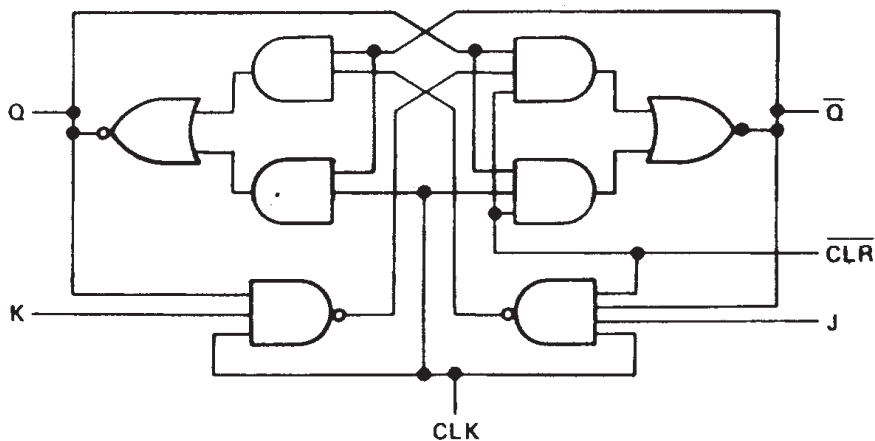


SN54107, SN54LS107A,  
 SN74107, SN74LS107A  
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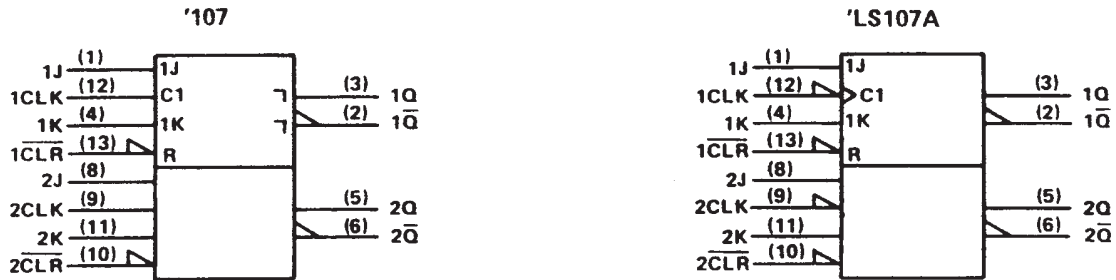
logic diagrams (positive logic)



'LS107A

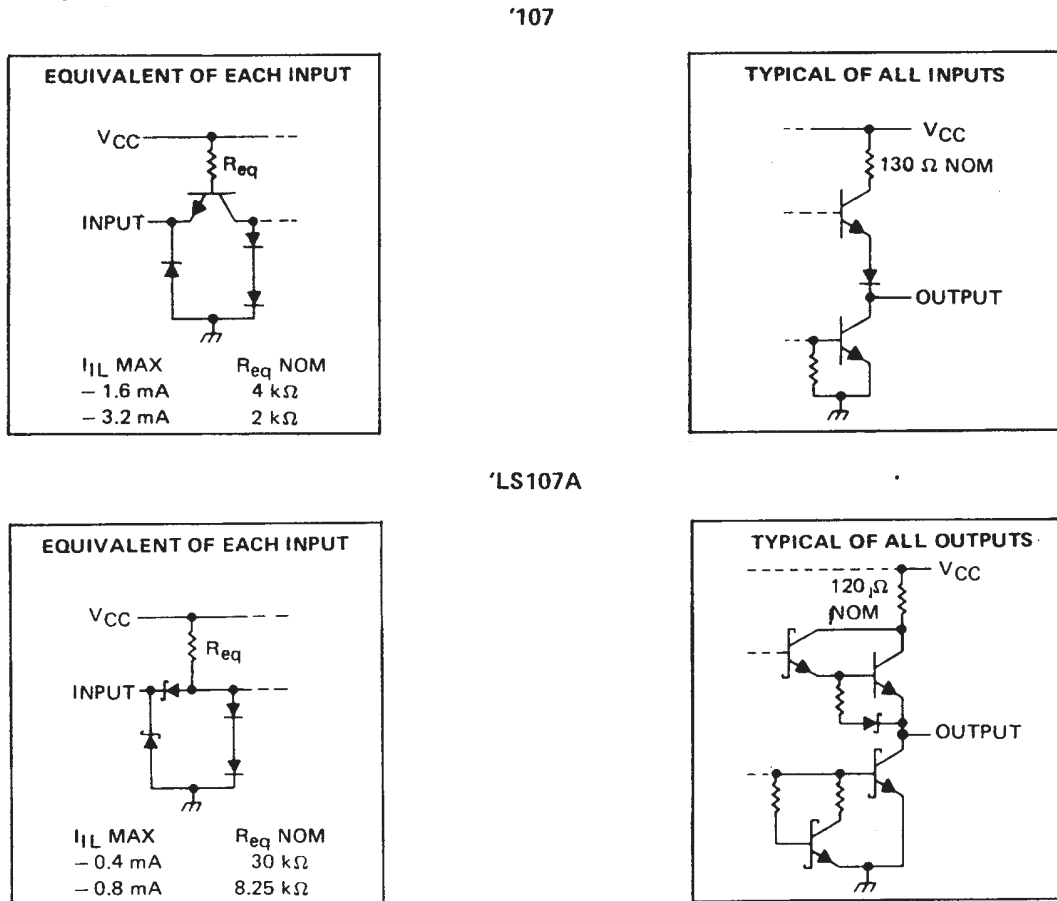


logic symbols †



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

schematic of inputs and outputs



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

Supply voltage, $V_{CC}$ (see Note 1) .....	7 V
Input voltage: '107 .....	5.5 V
'LS107A .....	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.

# SN54107, SN74107 DUAL J-K FLIP-FLOPS WITH CLEAR

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## recommended operating conditions

		SN54107			SN74107			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			
		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†	SN54107			SN74107			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	$\mu\text{A}$
	All other			80			80	
$I_{IL}$	J or K			-1.6			-1.6	mA
	All other			-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  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ \text{C}$ .

§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  $\bar{Q}$  outputs high in turn. At the time of measurement, the clock input is grounded.

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

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

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



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## recommended operating conditions

		SN54LS107A			SN74LS107A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub>	High-level input voltage	2			2			V
V <sub>IL</sub>	Low-level input voltage	0.7			0.8			V
I <sub>OH</sub>	High-level output current	-0.4			-0.4			mA
I <sub>OL</sub>	Low-level output current	4			8			mA
f <sub>clock</sub>	Clock frequency	0	30		0	30		MHz
t <sub>w</sub>	Pulse duration	CLK high		20		20		ns
		CLR low		25		25		
t <sub>su</sub>	Setup time before CLK ↓	data high or low		20		20		ns
		CLR inactive		25		25		
t <sub>h</sub>	Hold time-data after CLK ↓	0			0			ns
T <sub>A</sub>	Operating free-air temperature	-55	125		0	70		°C

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

PARAMETER	TEST CONDITIONS†	SN54LS107A		SN74LS107A		UNIT
		MIN	TYP ‡	MAX	MIN	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA	-1.5		-1.5		V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OH</sub> = -0.4 mA	2.5	3.4	2.7	3.4	V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 4 mA	0.25	0.4	0.25	0.4	V
	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA			0.35	0.5	
I <sub>I</sub>	J or K	0.1		0.1		mA
	CLR	0.3		0.3		
	CLK	0.4		0.4		
I <sub>IH</sub>	J or K	20		20		μA
	CLR	60		60		
	CLK	80		80		
I <sub>IL</sub>	J or K	-0.4		-0.4		mA
	CLR or CLK	-0.8		-0.8		
I <sub>OS</sub> §	V <sub>CC</sub> = MAX, See Note 4	-20	-100	-20	-100	mA
I <sub>CC</sub> (Total)	V <sub>CC</sub> = 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 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<sub>CC</sub> 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<sub>O</sub> = 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f <sub>max</sub>			R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF	30	45		MHz
t <sub>PLH</sub>	$\bar{CLR}$ or CLK	Q or $\bar{Q}$		15	20		ns
t <sub>PHL</sub>				15	20		ns

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



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Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
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Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
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Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
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**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
JM38510/00203BCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54107J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54107J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN74107N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74107N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74107N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74107N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74107NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74107NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS107AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS107AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS107AN3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74LS107AN3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74LS107ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS107ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS107ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
						no Sb/Br)		
SN74LS107ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ANSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ANSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ANSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS107ANSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54107J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54107J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

<sup>(3)</sup> 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
SN74LS107ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LS107ANSR	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)
SN74LS107ADR	SOIC	D	14	2500	346.0	346.0	33.0
SN74LS107ANSR	SO	NS	14	2000	346.0	346.0	33.0



# 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.

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.

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