

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

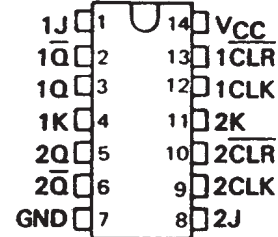
description

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 transistion. For these devices the J and K inputs must be stable while the clock is high.

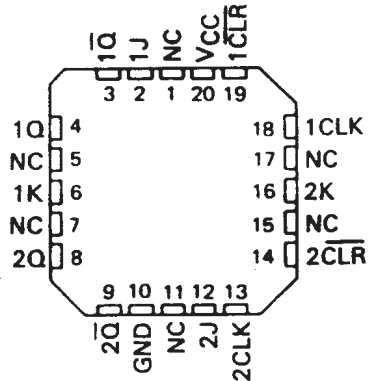
The 'LS107A contain two independent negative-edge-triggered flip-flops. The J and K inputs must be stable prior to the high-to-low clock transition for predictable operation. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the $\bar{Q}$ output high.

The SN54107 and the SN54LS107A are characterized for operation over the full military temperature range of -55°C to 125°C. The SN74107 and the SN74LS107A are characterized for operation from 0°C to 70°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	

'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	$\bar{Q}_0$

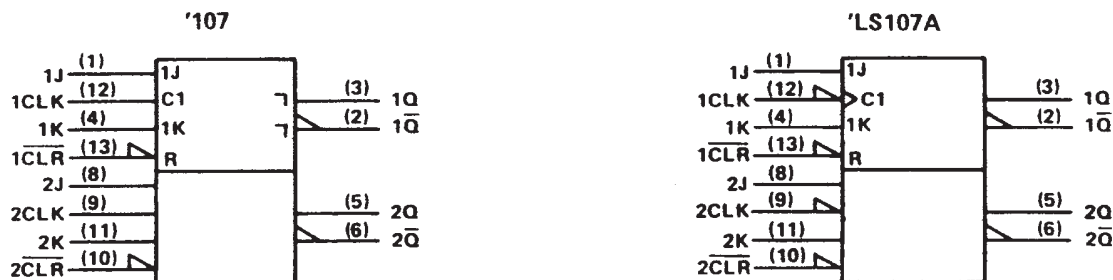
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The diagram shows a J-K flip-flop implemented with two cross-coupled NAND gates and two inverters. The inputs are J, K, and CLK. The output is Q. The circuit includes a feedback loop from Q to the J input and from the complement of Q to the K input. The CLK input is connected to the clock inputs of both NAND gates. The J input is connected to the inputs of the first NAND gate. The K input is connected to the inputs of the second NAND gate. The output Q is connected to the input of the first inverter, and the complement of Q is connected to the input of the second inverter. The outputs of the inverters are connected to the inputs of the NAND gates, forming a feedback loop.

The logic diagram shows a J-K flip-flop implemented with NAND gates. The inputs are J, K, and CLK. The outputs are Q and $\bar{Q}$. The circuit includes a CLR input. The logic is as follows:

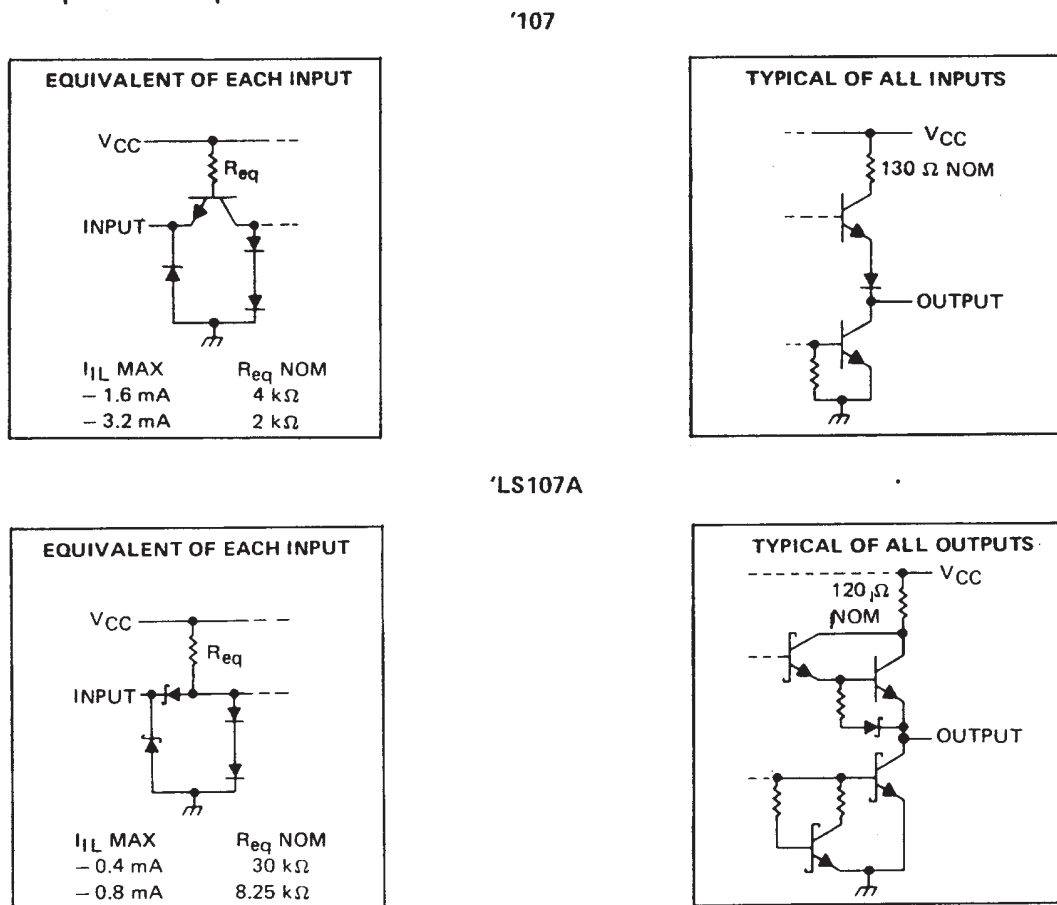
- $\bar{Q}$ is connected to the inputs of two NAND gates (top left and bottom right).
- Q is connected to the inputs of two NAND gates (middle left and middle right).
- K is connected to the inputs of the top left and bottom right NAND gates.
- J is connected to the inputs of the middle left and middle right NAND gates.
- CLK is connected to the inputs of all four NAND gates.
- The CLR input is connected to the inputs of the two middle NAND gates.
- The outputs of the four NAND gates are connected to the inputs of two final NAND gates (top right and bottom left).
- The output of the top right NAND gate is $\bar{Q}$.
- The output of the bottom left NAND gate is Q.

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			ns
		CLK low			47			
		CLR low			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			°C
		− 55			125			°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} = 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	V _{CC} = MAX, V _I = 2.4 V		40		40		μA
	All other			80		80		
I _{IL}	J or K	V _{CC} = MAX, V _I = 0.4 V		– 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 $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$.

§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}	$\overline{\text{CLR}}$	$\bar{Q}$				16	25	ns
t_{PHL}		Q				25	40	ns
t_{PLH}	CLK	Q or $\bar{Q}$				16	25	ns
t_{PHL}						25	40	ns

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



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SN54LS107A, SN74LS107A DUAL J-K FLIP-FLOPS WITH CLEAR

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recommended operating conditions

		SN54LS107A			SN74LS107A			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			ns
		CLR low			25			
t _{su}	Setup time before CLK ↓	data high or low			20			ns
		CLR inactive			25			
t _h	Hold time-data after CLK ↓	0			0			ns
T _A	Operating free-air temperature	− 55			125			°C

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

PARAMETER		TEST CONDITIONS†	SN54LS107A		SN74LS107A		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
	CLR		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
	CLR		60		60		
	CLK		80		80		
I _{IL}	J or K	V _{CC} = MAX, V _I = 0.4 V	– 0.4		– 0.4		mA
	CLR or CLK		– 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 $\bar{Q}$ 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 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}			R _L = 2 kΩ, C _L = 15 pF	30	45		MHz
t _{PLH}	$\overline{\text{CLR}}$ or CLK	Q or $\overline{Q}$			15	20	ns
t _{PHL}					15	20	ns

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



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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⁾
JM38510/00203BCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SN54107J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SN54107J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SN74107N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74107N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74107N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74107N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
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
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
SN74LS107AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS107AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
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	Level-NC-NC-NC
SN74LS107ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS107ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
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
SNJ54107J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SNJ54107J	ACTIVE	CDIP	J	14	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.

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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)



4040083/F 03/03

- 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.

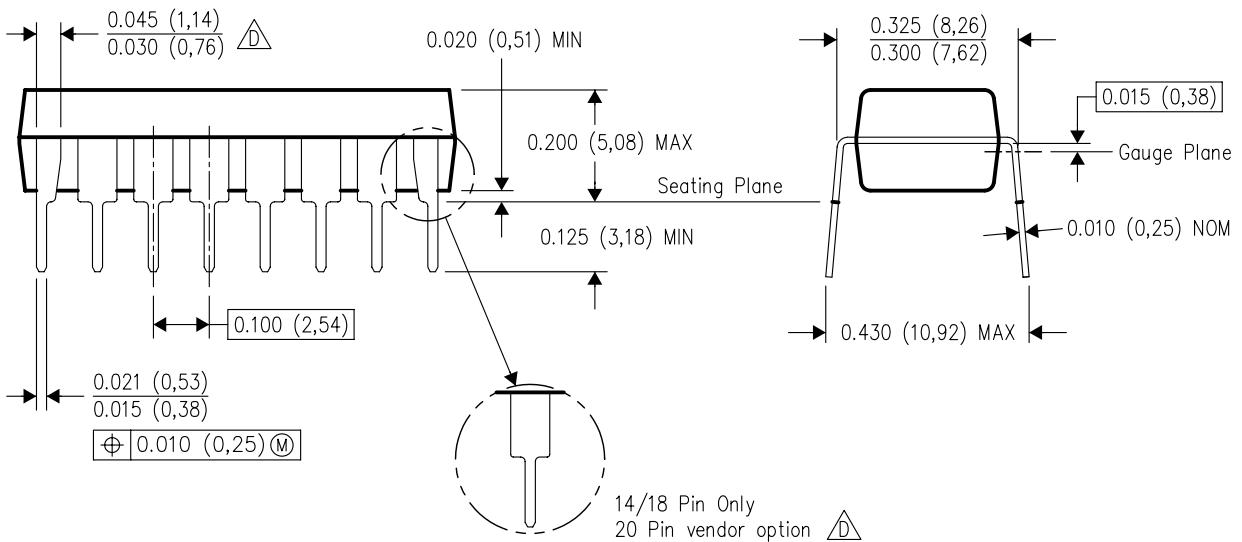
N (R-PDIP-T**)

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-G14)

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 AB.

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.

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

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