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**

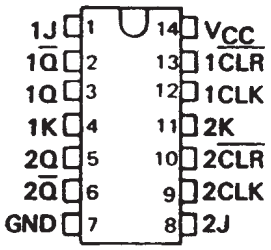
description

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.

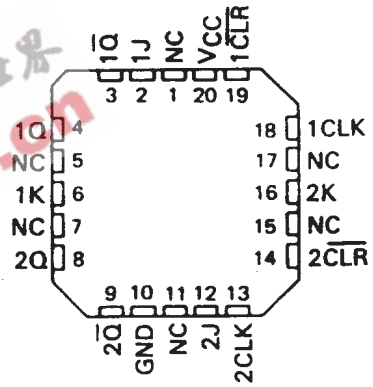
The 'LS107A contain two independent negative-edge-triggered flip-flops. The J and K inputs must be stable prior to the high-to-low clock transition for predictable operation. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the $\overline{Q}$ output high.

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

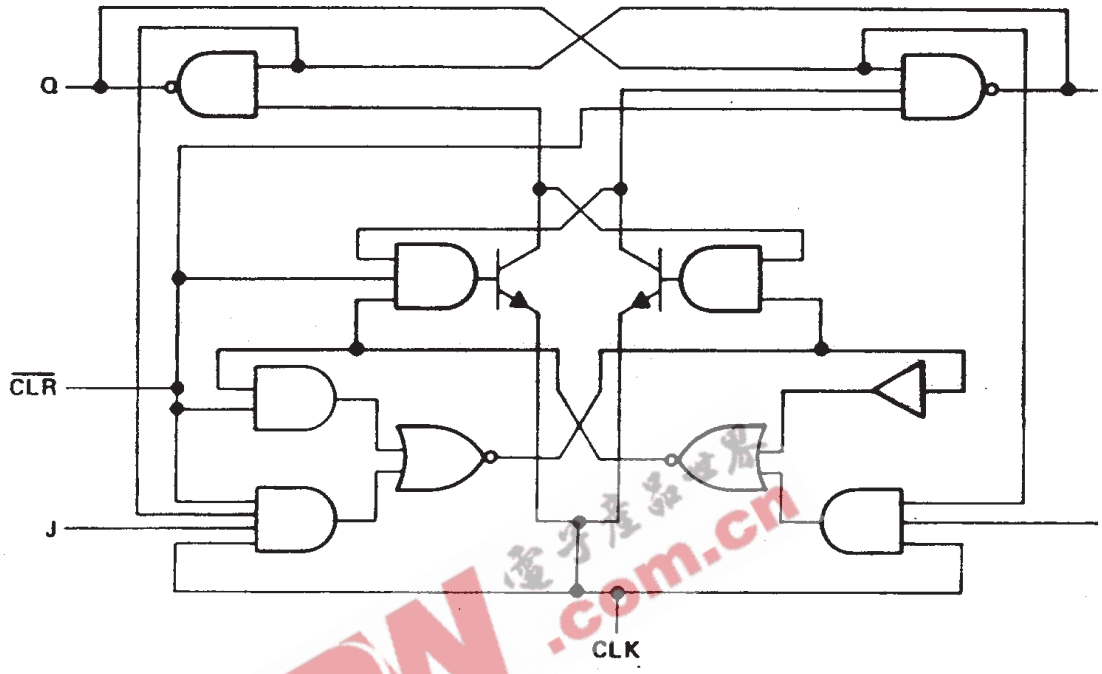
'107
FUNCTION TABLE

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

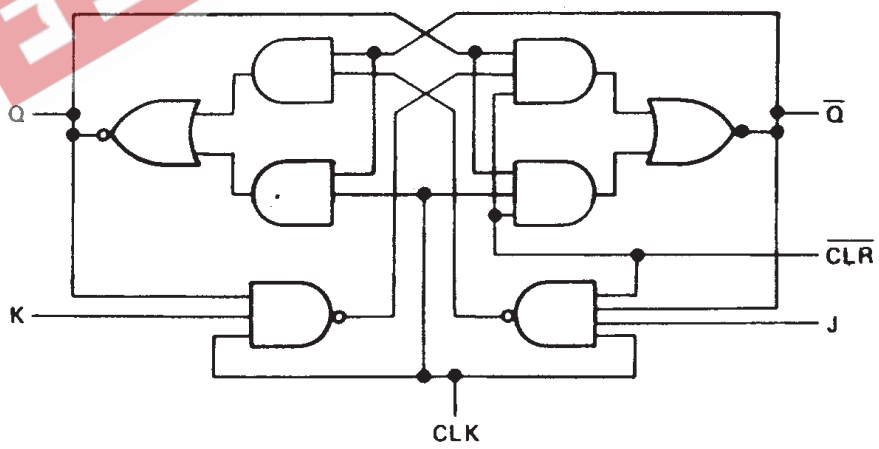
'LS107A
FUNCTION TABLE

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

logic diagrams (positive logic)

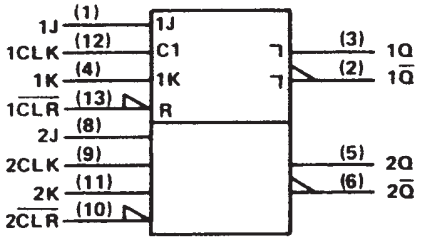


'LS107A

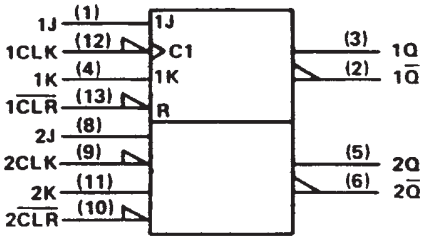


logic symbols†

'107



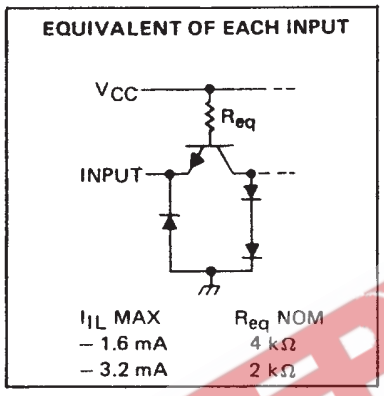
'LS107A

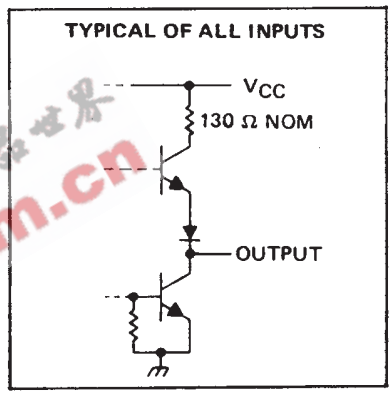


†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, and N packages.

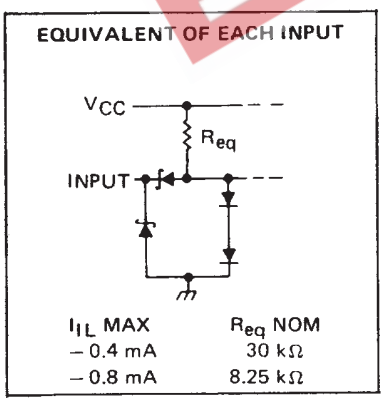
schematic of inputs and outputs

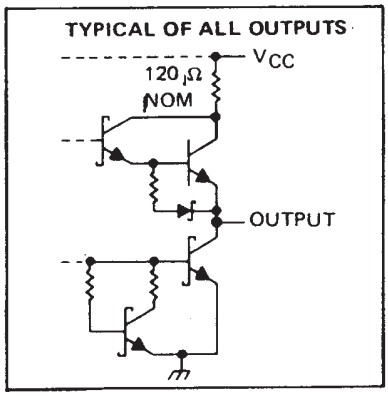
'107





'LS107A





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.

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			
		$\overline{CLR}$ 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} = 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 V, T_A = 25° 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 V, T_A = 25°C (see note 3)

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

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

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			20			ns
		$\overline{CLR}$ low	25			25			
t_{su}	Setup time before CLK↓	data high or low	20			20			ns
		$\overline{CLR}$ 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†			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, I_{OH} = – 0.4 mA	V_{IH} = 2 V,	V_{IL} = MAX,	2.5	3.4		2.7	3.4		V
V_{OL}		V_{CC} = MIN, I_{OL} = 4 mA	V_{IL} = MAX,	V_{IH} = 2 V,		0.25	0.4		0.25	0.4	V
		V_{CC} = MIN, I_{OL} = 8 mA	V_{IL} = MAX,	V_{IH} = 2 V,					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 $\overline{Q}$, 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}	$\overline{CLR}$ 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.

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.

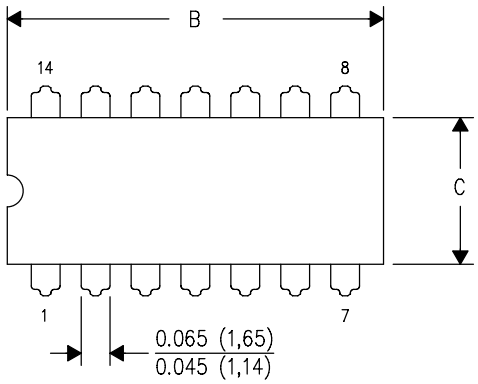
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): 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.

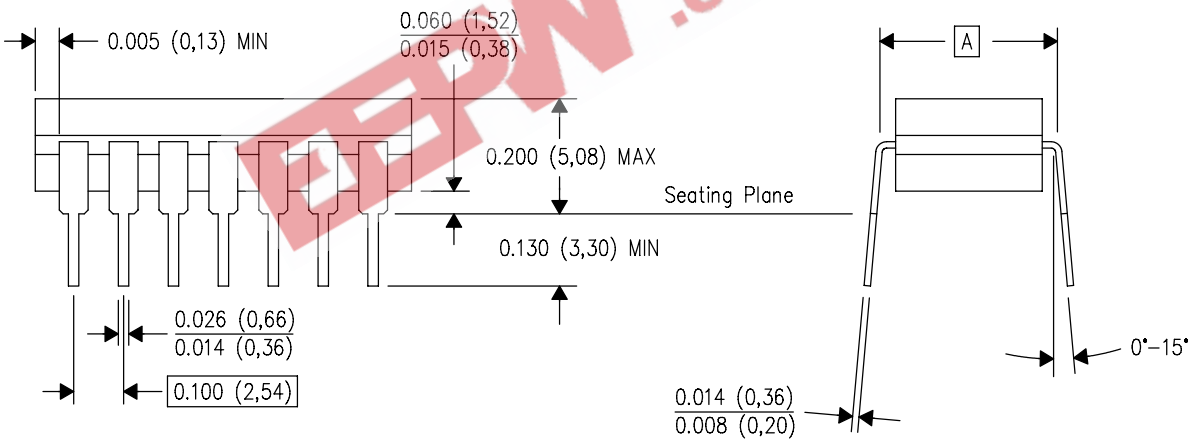
J (R–GDIP–T**)

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)



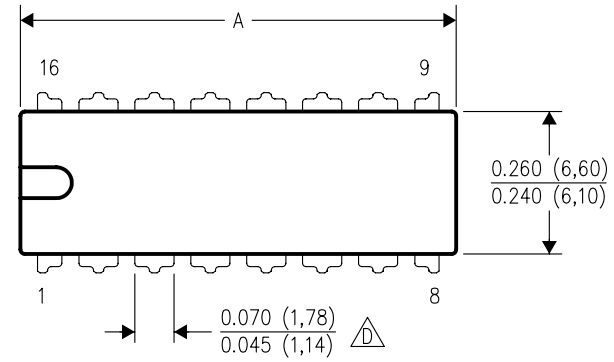
4040083/F 03/03

NOTES:
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**)

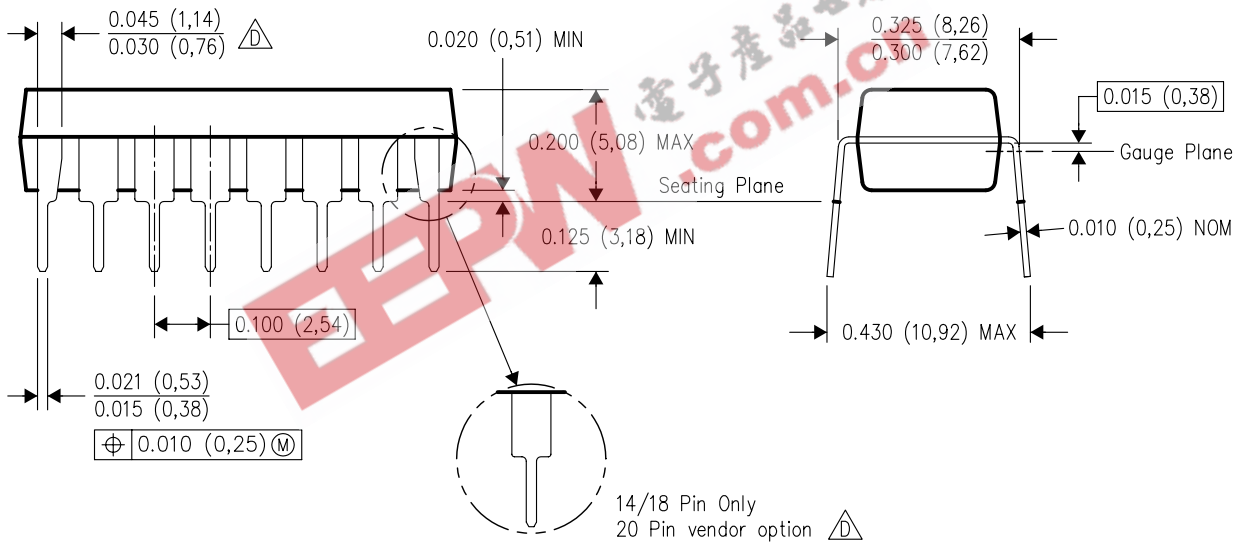
PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



DIM \ PINS **	14	16	18	20
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

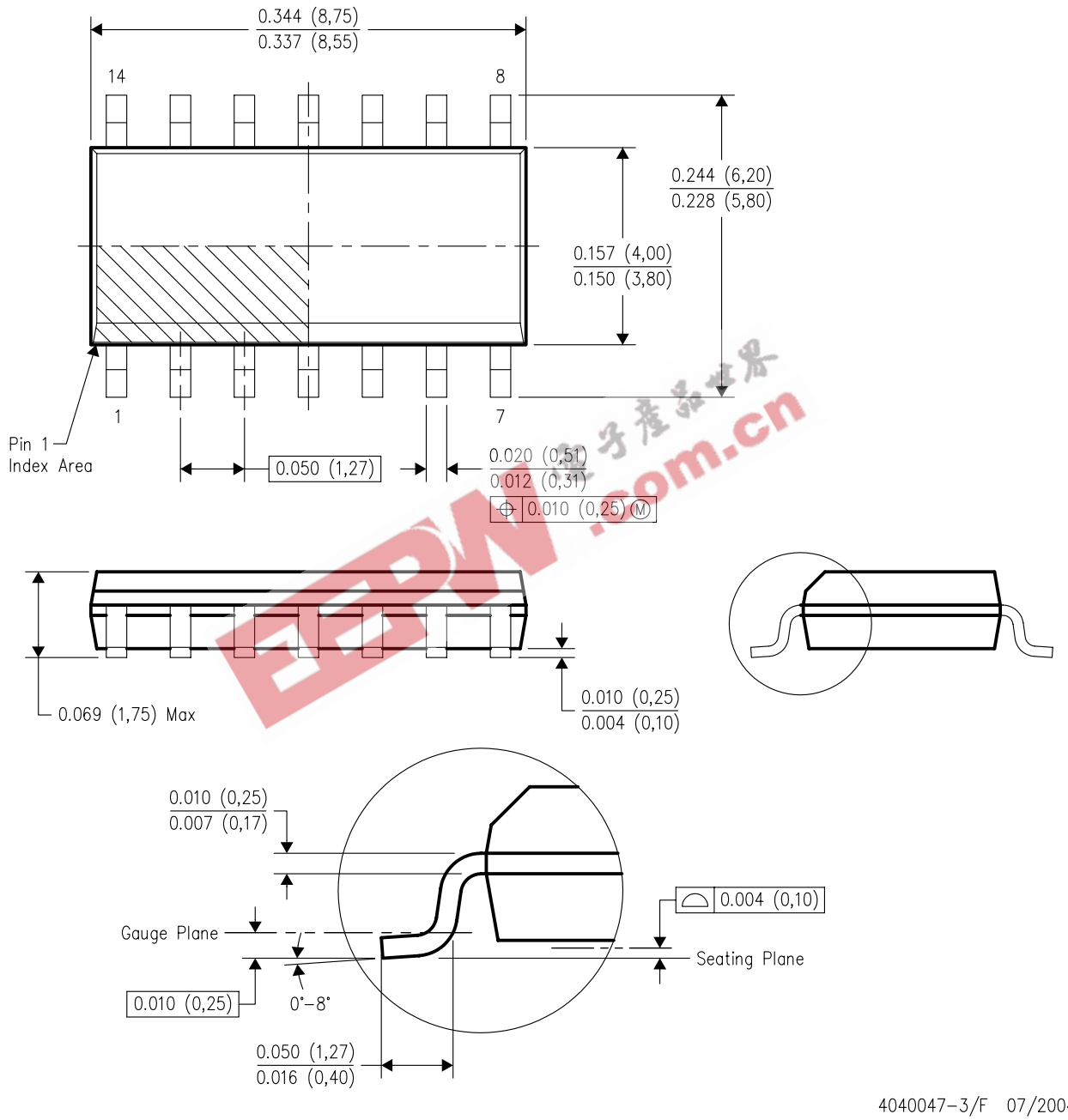
C



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R–PDSO–G14) PLASTIC SMALL–OUTLINE PACKAGE

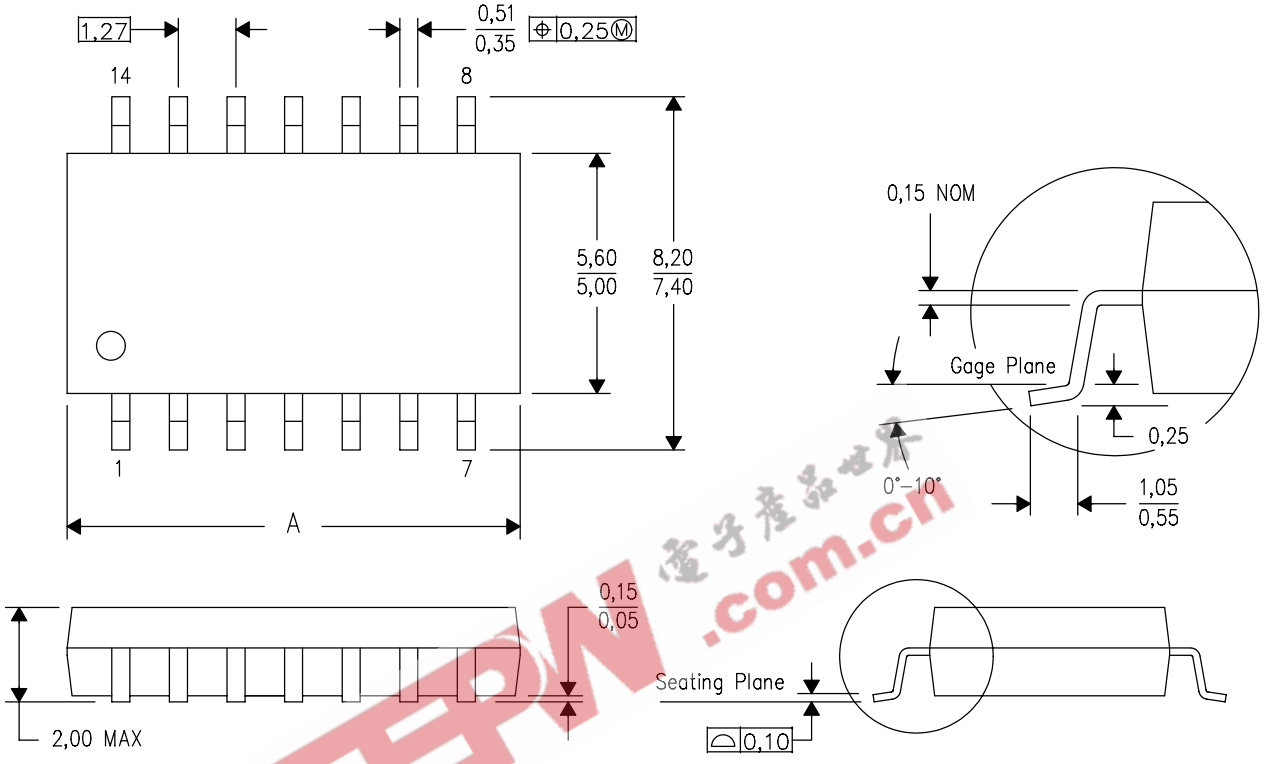


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–012 variation AB.

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

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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