

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

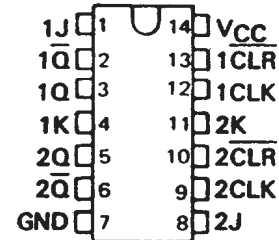
description

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.

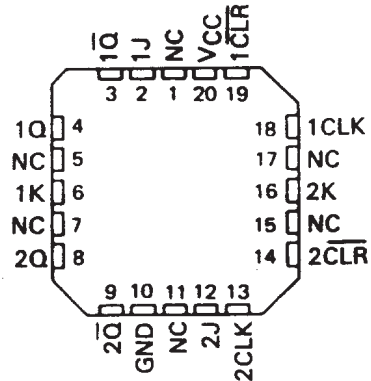
The 'LS107A contain two independent negative-edge-triggered flip-flops. The J and K inputs must be stable prior to the high-to-low clock transition for predictable operation. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the \bar{Q} output high.

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

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.

 **TEXAS
INSTRUMENTS**

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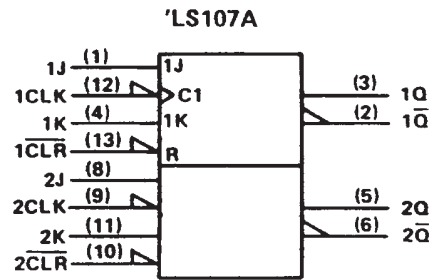
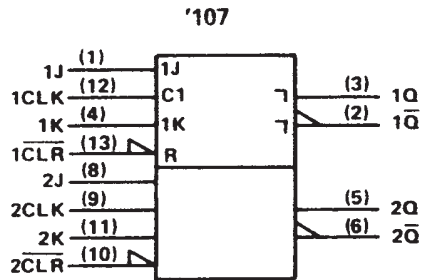
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The diagram shows a J-K flip-flop implemented with two cross-coupled NAND gates and two inverters. The inputs are J, K, and CLK. The output is Q. The circuit includes a feedback loop from Q to the J input and from the complement of Q to the K input.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

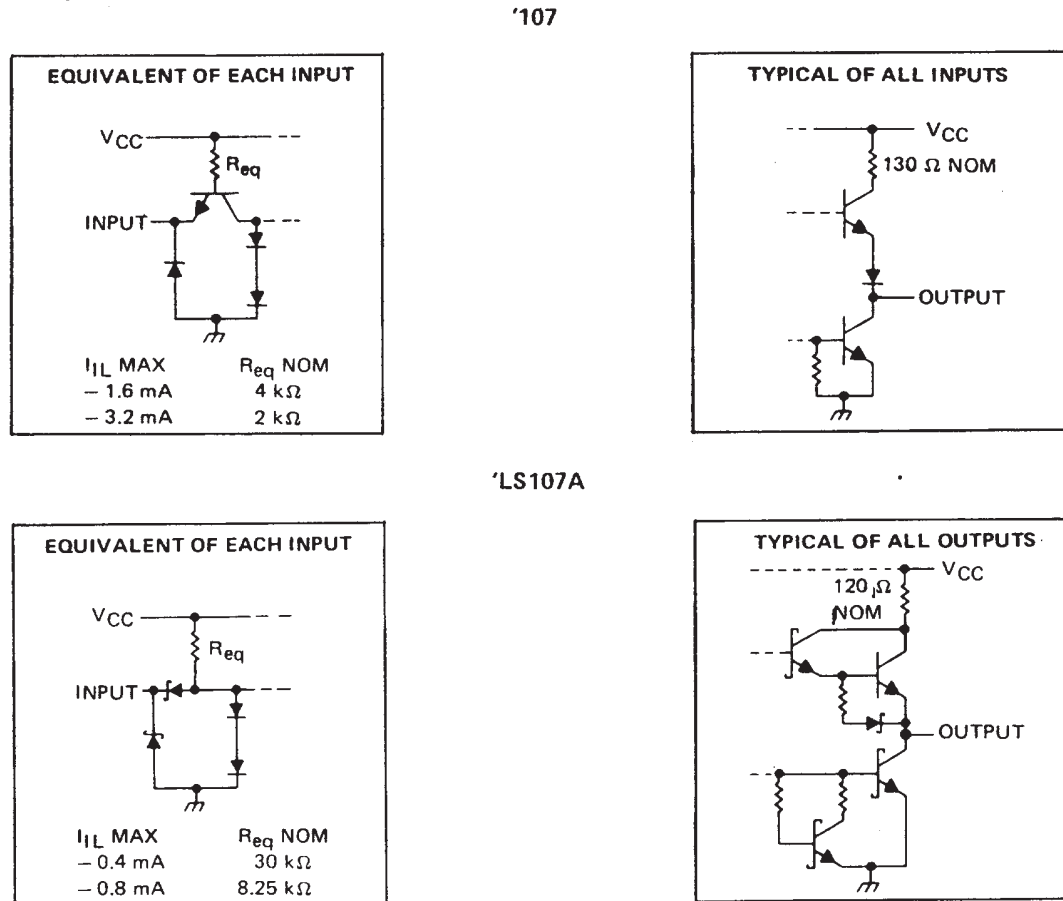
The diagram shows a J-K flip-flop implemented with NAND gates. The inputs are J, K, and CLK. The outputs are Q and \bar{Q} . The circuit includes a CLR input. The logic is as follows:
 - Input J is connected to a NAND gate along with the output \bar{Q} .
 - Input K is connected to a NAND gate along with the output Q.
 - The outputs of these two NAND gates are connected to a central NAND gate.
 - The CLR input is connected to two NAND gates, each of which also has one input connected to the output of the central NAND gate.
 - The outputs of these two NAND gates are connected to the inputs of a final NAND gate, which produces the output Q.
 - The output \bar{Q} is the complement of Q.
 - The CLK input is connected to the clock inputs of the two NAND gates that take J and K as inputs.

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

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	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$				40			40	μA
	All other					80			80	
I_{IL}	J or K	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$				– 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}	$\overline{\text{CLR}}$	\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			20			ns
		CLR low	25			25			
t _{su}	Setup time before CLK ↓	data high or low	20			20			ns
		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, 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}	CLR or CLK	Q or Q̄			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 part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
JM38510/00203BCA	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 00203BCA
SN54107J	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54107J
SN54107J	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54107J
SN74LS107AD	Active	Production	SOIC (D) 14	50 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS107A
SN74LS107AD	Active	Production	SOIC (D) 14	50 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS107A
SN74LS107AN	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS107AN
SN74LS107AN	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS107AN
SN74LS107ANSR	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS107A
SN74LS107ANSR	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS107A
SNJ54107J	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54107J
SNJ54107J	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54107J

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TAPE AND REEL INFORMATION



*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
SN74LS107ANSR	SOP	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)
SN74LS107ANSR	SOP	NS	14	2000	356.0	356.0	35.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74LS107AD	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS107AN	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS107AN	N	PDIP	14	25	506	13.97	11230	4.32

J 14

GENERIC PACKAGE VIEW

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4040083-5/G

J0014A**PACKAGE OUTLINE****CDIP - 5.08 mm max height**

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

EXAMPLE BOARD LAYOUT

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X



4214771/A 05/2017

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.

D0014A**PACKAGE OUTLINE****SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.

EXAMPLE BOARD LAYOUT

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
SCALE:8X



NON SOLDER MASK
DEFINED



SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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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