

# SN54LS592, SN54LS593, SN74LS592, SN74LS593 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

SDLS004

D2633, JANUARY 1981 — REVISED MARCH 1988

- Parallel Register Inputs ('LS592)
- Parallel 3-State I/O: Register Inputs/Counter Outputs ('LS593)
- Counter has Direct Overriding Load and Clear
- Accurate Counter Frequency: DC to 20 MHz

## description

The 'LS592 comes in a 16-pin package and consists of a parallel input, 8-bit storage register feeding an 8-bit binary counter. Both the register and the counter have individual positive-edge-triggered clocks. In addition, the counter has direct load and clear functions. A low-going  $\overline{RCO}$  pulse will be obtained when the counter reaches the hex word FF. Expansion is easily accomplished for two stages by connecting  $\overline{RCO}$  of the first stage to  $\overline{CCKEN}$  of the second stage. Cascading for larger count chains can be accomplished by connecting  $\overline{RCO}$  of each stage to CCK of the following stage.

The 'LS593 comes in a 20-pin package and has all the features of the 'LS592 plus 3-state I/O, which provides parallel counter outputs. The tables below show the operation of the enable (CCKEN,  $\overline{CCKEN}$ ) inputs. A register clock enable (RCKEN) is also provided.

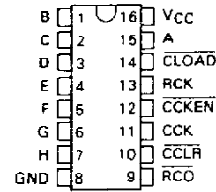
### OUTPUT ENABLE CONTROL ('593 ONLY)

G	$\overline{G}$	A/Q <sub>A</sub> thru H/Q <sub>H</sub>
L	L	input mode
L	H	input mode
H	L	output mode
H	H	input mode

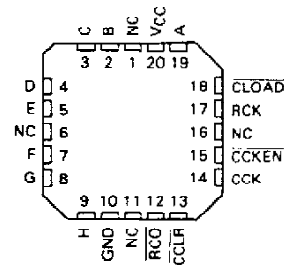
### COUNTER CLOCK ENABLE CONTROL

CCKEN	$\overline{CCKEN}$	EFFECT ON CCK
L	L	Enable
L	H	Disable
H	L	Enable
H	H	Enable

### SN54LS592 . . . J OR W PACKAGE SN74LS592 . . . N PACKAGE (TOP VIEW)

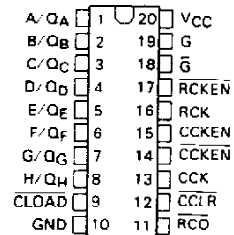


### SN54LS592 . . . FK PACKAGE (TOP VIEW)

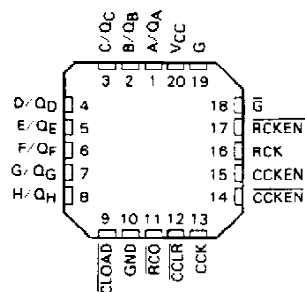


NC — No internal connection

### SN54LS593 . . . J OR W PACKAGE SN74LS593 . . . DW OR N PACKAGE (TOP VIEW)



### SN54LS593 . . . FK PACKAGE (TOP VIEW)



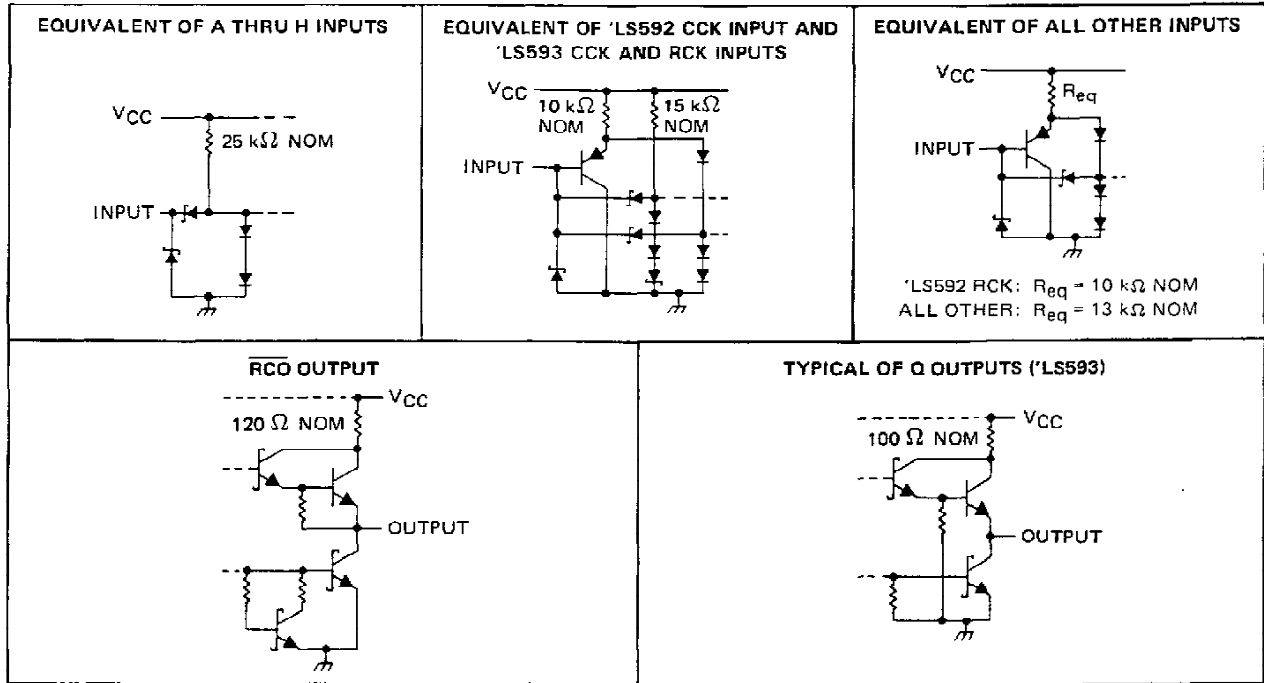
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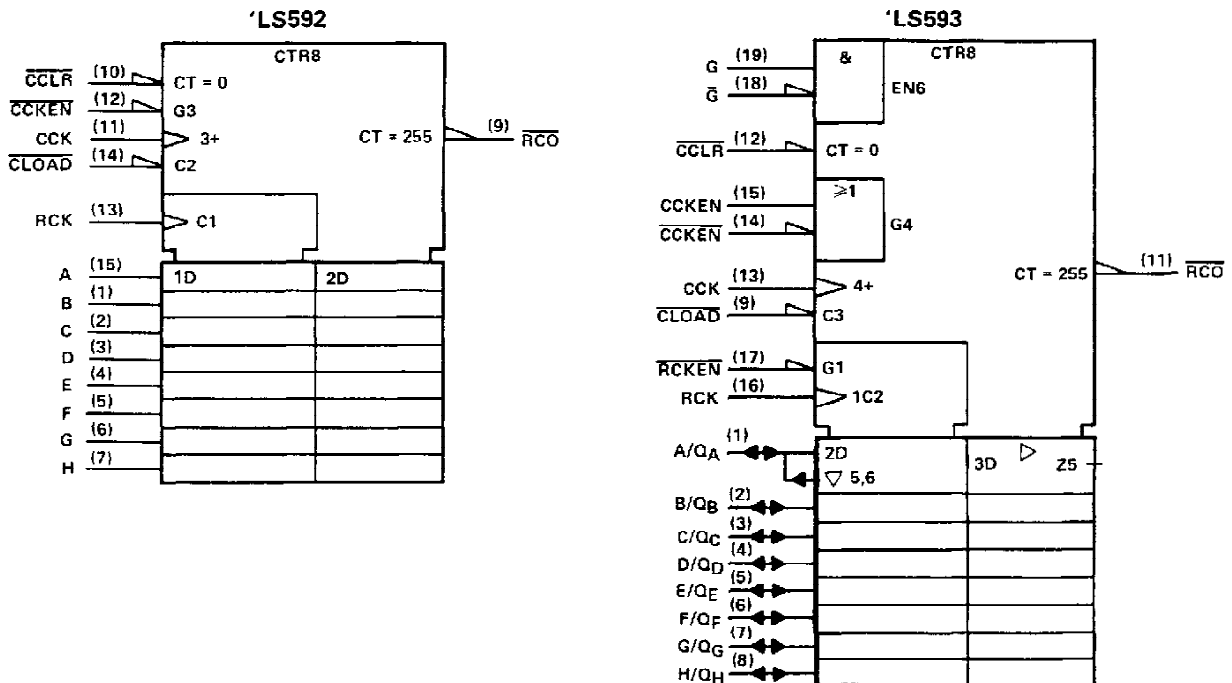
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# SN54LS592, SN54LS593, SN74LS592, SN74LS593 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

## schematics of inputs and outputs



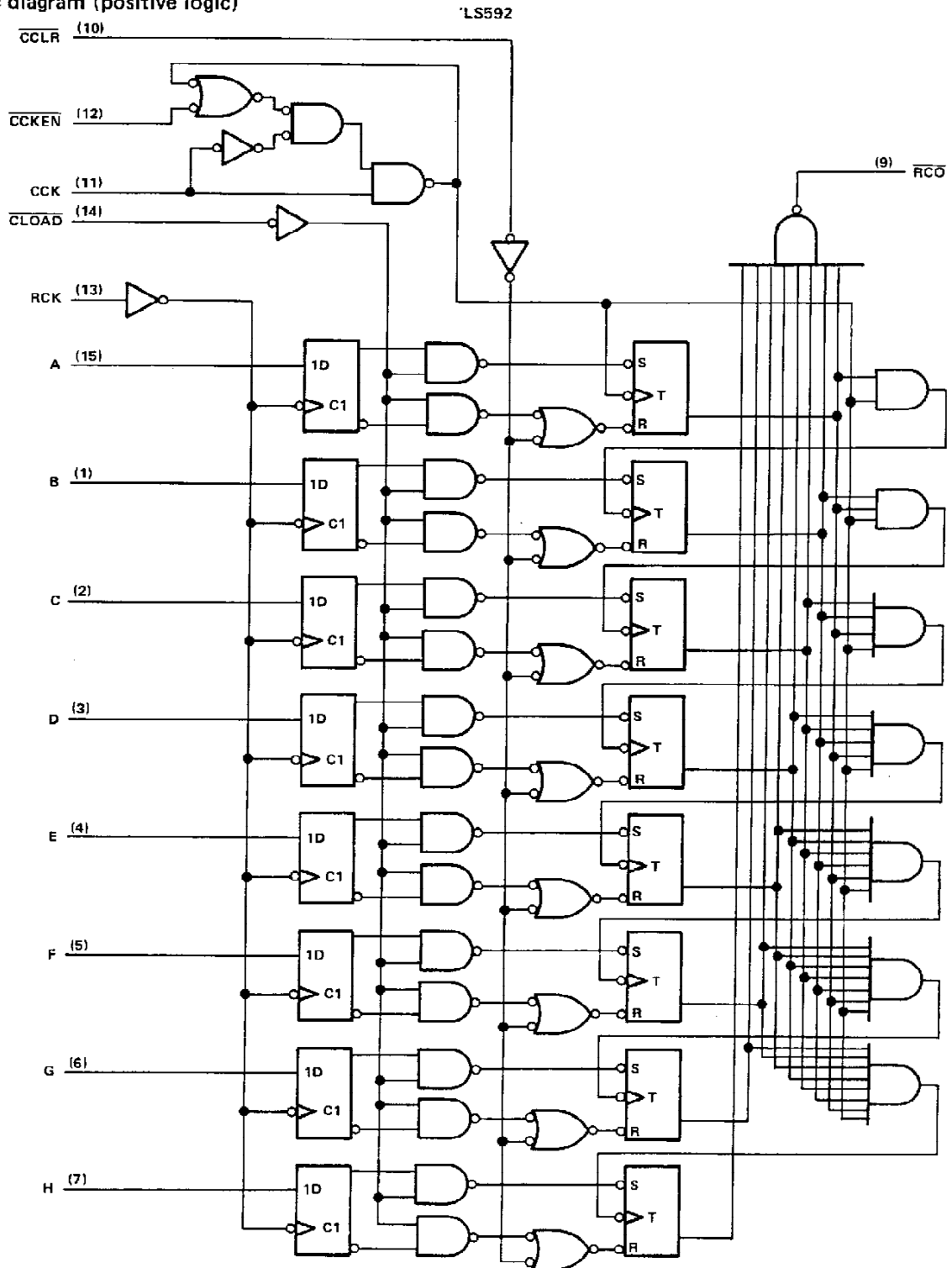
## logic symbols†



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

# SN54LS592, SN74LS592 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

logic diagram (positive logic)

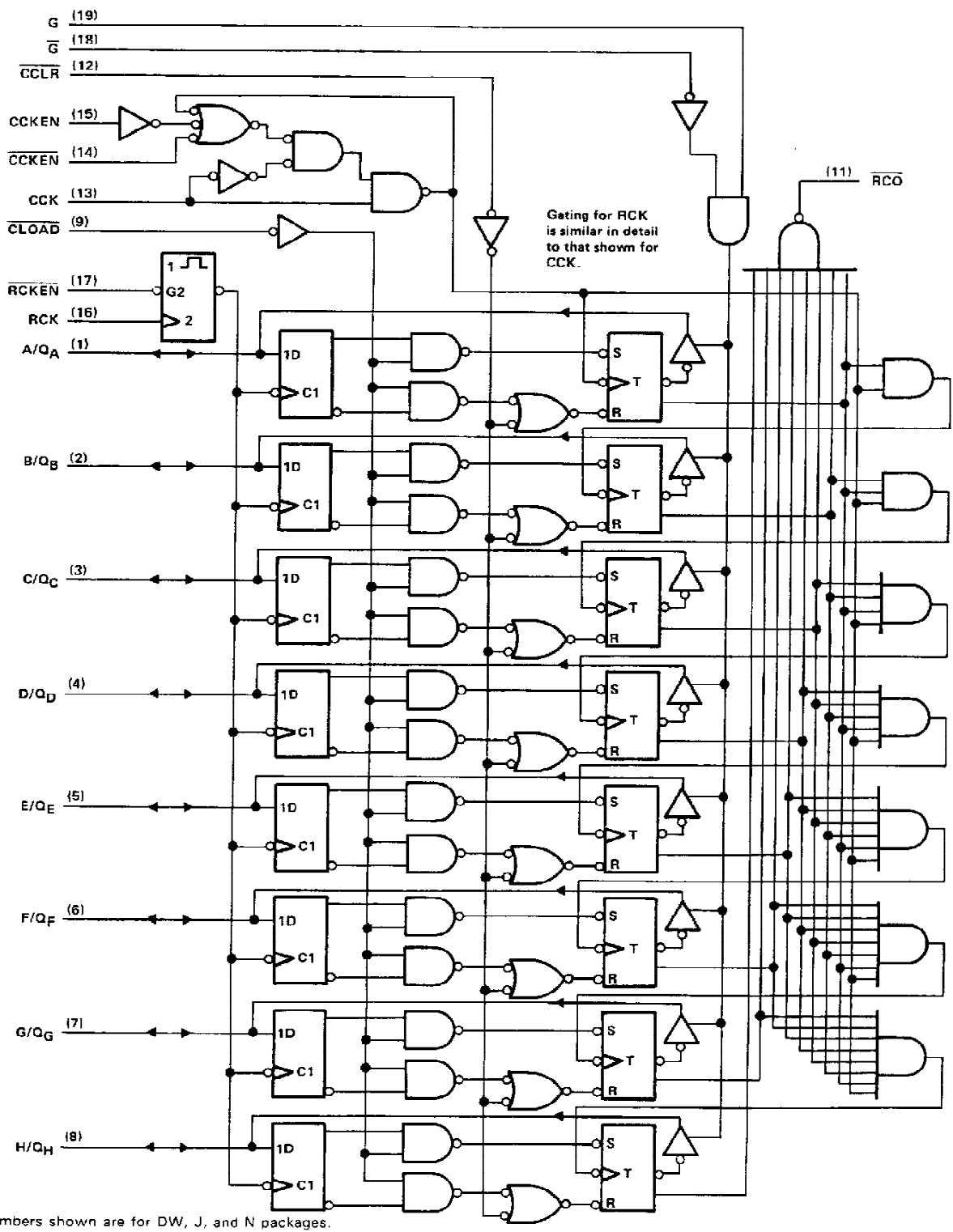


Pin numbers shown are for J, N, and W packages.

# SN54LS593, SN74LS593 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

logic diagram (positive logic)

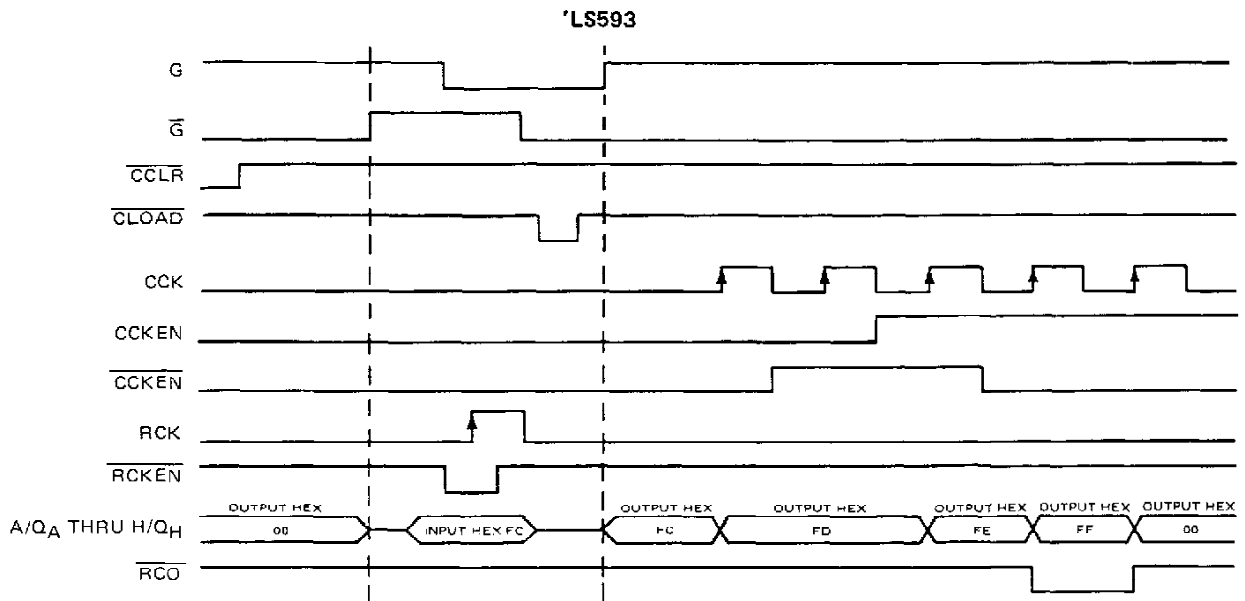
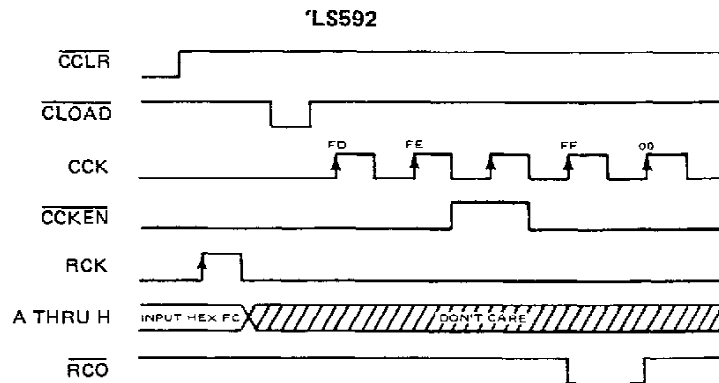
'LS593



Pin numbers shown are for DW, J, and N packages.

**SN54LS592, SN54LS593, SN74LS592, SN74LS593  
8-BIT BINARY COUNTERS WITH INPUT REGISTERS**

**typical operating sequences**



# SN54LS592, SN54LS593, SN74LS592, SN74LS593

## 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage (excluding I/O ports)	7 V
Off-state output voltage (including I/O ports)	5.5 V
Operating free-air temperature range: SN54LS592, SN54LS593	-55°C to 125°C
SN74LS592, SN74LS593	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

### recommended operating conditions

		SN54LS'			SN74LS'			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	$\overline{RCK}$		-1	$\overline{RCK}$		-1	mA
		Q 'LS593 only		-1	Q 'LS593 only		-2.6	
$I_{OL}$	Low-level output current	$\overline{RCK}$		8	$\overline{RCK}$		16	mA
		Q 'LS593 only		12	Q 'LS593 only		24	
$f_{CCK}$	Counter clock frequency	0		20	0		20	MHz
$t_w(\overline{CCK})$	Duration of counter clock pulse	25			25			ns
$t_w(\overline{CCLR})$	Duration of counter clear pulse	20			20			ns
$t_w(\overline{RCK})$	Duration of register clock pulse	20			20			ns
$t_w(\overline{CLOAD})$	Duration of counter load pulse	40			40			ns
$t_{su}$	Register enable setup time	$\overline{RCKEN}$ low to $\overline{RCK} \uparrow$ , 'LS593		20	$\overline{RCKEN}$ low to $\overline{RCK} \uparrow$ , 'LS593		20	ns
$t_{su}$	Counter enable setup time before $\overline{CCK} \uparrow$	$\overline{CCKEN}$ low, 'LS592		30	$\overline{CCKEN}$ low, 'LS592		30	ns
		$\overline{CCKEN}$ low or $\overline{CCKEN}$ high, 'LS593		30	$\overline{CCKEN}$ low or $\overline{CCKEN}$ high, 'LS593		30	
$t_{su}$	Setup time	$\overline{CCLR}$ inactive before $\overline{CCK} \uparrow$		20	$\overline{CCLR}$ inactive before $\overline{CCK} \uparrow$		20	ns
		$\overline{CLOAD}$ inactive before $\overline{CCK} \uparrow$		20	$\overline{CLOAD}$ inactive before $\overline{CCK} \uparrow$		20	
		$\overline{RCK} \uparrow$ before $\overline{CLOAD} \uparrow$ (see Note 2)		30	$\overline{RCK} \uparrow$ before $\overline{CLOAD} \uparrow$ (see Note 2)		30	
		Data A thru H before $\overline{RCK} \uparrow$		20	Data A thru H before $\overline{RCK} \uparrow$		20	
$t_h$	Hold time	Data A thru H after $\overline{RCK} \uparrow$		0	Data A thru H after $\overline{RCK} \uparrow$		0	ns
		All others		0	All others		0	
$T_A$	Operating free-air temperature	-55		125	0		70	°C

NOTE 2: This time insures the data saved by  $\overline{RCK} \uparrow$  will also be loaded into the counter.



## SN54LS592, SN54LS593, SN74LS592, SN74LS593 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

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

PARAMETER	TEST CONDITIONS†		SN54LS*		SN74LS*		UNIT	
			MIN	TYP‡	MAX	MIN		TYP‡
$V_{IK}$	$V_{CC} = \text{MIN.}, I_I = -18 \text{ mA}$				-1.5		V	
$V_{OH}$	'LS593 Q $\overline{RCO}$	$V_{CC} = \text{MIN.}, V_{IH} = 2 \text{ V.}$ $V_{IL} = \text{MAX.}$	$I_{OH} = -1 \text{ mA}$				V	
			$I_{OH} = -2.6 \text{ mA}$		2.4 3.1			
			$I_{OH} = -1 \text{ mA}$		2.4 3.2			
$V_{OL}$	'LS593 Q $\overline{RCO}$	$V_{CC} = \text{MIN.}, V_{IH} = 2 \text{ V.}$ $V_{IL} = \text{MAX.}$	$I_{OL} = 12 \text{ mA}$		0.25 0.4		V	
			$I_{OL} = 24 \text{ mA}$		0.35 0.5			
			$I_{OL} = 8 \text{ mA}$		0.25 0.4			
			$I_{OL} = 16 \text{ mA}$		0.35 0.5			
$I_{OZH}$	'LS593 Q	$V_{CC} = \text{MAX.}, V_{IH} = 2 \text{ V.}$ $V_O = 2.7 \text{ V}$	$V_{IL} = \text{MAX.}$		20		$\mu\text{A}$	
$I_{OZL}$	'LS593 Q	$V_{CC} = \text{MAX.}, V_{IH} = 2 \text{ V.}$ $V_O = 0.4 \text{ V}$	$V_{IL} = \text{MAX.}$		-0.4		mA	
$I_I$	'LS593 Q	$V_{CC} = \text{MAX.}$	$V_I = 5.5 \text{ V}$		0.1		mA	
	Others		$V_I = 7 \text{ V}$		0.1			
$I_{IH}$		$V_{CC} = \text{MAX.}, V_I = 2.7 \text{ V}$			20		$\mu\text{A}$	
$I_{IL}$	CCK	$V_{CC} = \text{MAX.}, V_I = 0.4 \text{ V}$			-0.8		mA	
	RCK		'LS592			-0.2		
			'LS593			-0.8		
	A thru H				-0.4			
	Others				-0.2			
$I_{OS}^{\S}$	'LS593 Q	$V_{CC} = \text{MAX.}, V_O = 0 \text{ V}$			-30 -130		mA	
	$\overline{RCO}$				-20 -100			
$I_{CC}$	'LS592	$V_{CC} = \text{MAX.}$ All possible inputs grounded, All outputs open	$I_{CCH}$		40 60		mA	
			$I_{CCL}$		40 60			
	'LS593		$I_{CCH}$		47 70			
			$I_{CCL}$		53 80			
			$I_{CCZ}$		57 85			

†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 and the duration of the short-circuit should not exceed one second.

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**SN54LS592, SN54LS593, SN74LS592, SN74LS593**  
**8-BIT BINARY COUNTERS WITH INPUT REGISTERS**

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS592			'LS593			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$f_{max}$	CCK ↑	$\overline{RCO}$	$R_L = 1\text{ k}\Omega$ , $C_L = 30\text{ pF}$	20	35		20	35		MHz
$t_{PLH}$	CCK ↑	Q	$R_L = 667\ \Omega$ , $C_L = 45\text{ pF}$				14	21		ns
$t_{PHL}$	CCK ↑	Q					26	39		ns
$t_{PLH}$	$\overline{CLOAD}$ ↓	Q					34	51		ns
$t_{PHL}$	$\overline{CLOAD}$ ↓	Q					28	42		ns
$t_{PHL}$	$\overline{CCLR}$ ↓	Q					25	38		ns
$t_{PZH}$	G ↑	Q					31	47		ns
$t_{PZL}$	G ↑	Q					27	40		ns
$t_{PZH}$	$\overline{G}$ ↓	Q					29	45		ns
$t_{PZL}$	$\overline{G}$ ↓	Q					31	47		ns
$t_{PHZ}$	G ↓	Q					33	50		ns
$t_{PLZ}$	G ↓	Q	$R_L = 667\ \Omega$ , $C_L = 5\text{ pF}$				35	52		ns
$t_{PHZ}$	$\overline{G}$ ↑	Q					26	39		ns
$t_{PLZ}$	$\overline{G}$ ↑	Q					28	42		ns
$t_{PLH}$	CCK ↑	$\overline{RCO}$								
$t_{PHL}$	CCK ↑	$\overline{RCO}$	$R_L = 1\text{ k}\Omega$ , $C_L = 30\text{ pF}$	15	23		14	21		ns
$t_{PLH}$	$\overline{CLOAD}$ ↓	$\overline{RCO}$		20	30		20	30		ns
$t_{PHL}$	$\overline{CLOAD}$ ↓	$\overline{RCO}$		31	47		31	47		ns
$t_{PLH}$	$\overline{CCLR}$ ↓	$\overline{RCO}$		27	41		27	41		ns
$t_{PHL}$	$\overline{CCLR}$ ↓	$\overline{RCO}$		30	45		30	45		ns
$t_{PLH}$	RCK ↑	$\overline{RCO}$	$R_L = 1\text{ k}\Omega$ ; $C_L = 30\text{ pF}$ $\overline{CLOAD} = L$	35	53		42	63		ns
$t_{PHL}$	RCK ↑	$\overline{RCO}$		30	45		33	50		ns

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



**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>	Samples (Requires Login)
5962-87621012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Call TI	
5962-8762101EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Call TI	
5962-8762101EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Call TI	
5962-8762101FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Call TI	
5962-8762101FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Call TI	
SN54LS592J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SN54LS592J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SN54LS593J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
SN54LS593J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
SN74LS592D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592DR	ACTIVE	SOIC	D	16		TBD	Call TI	Call TI	
SN74LS592DR	ACTIVE	SOIC	D	16		TBD	Call TI	Call TI	
SN74LS592DRE4	ACTIVE	SOIC	D	16		TBD	Call TI	Call TI	
SN74LS592DRE4	ACTIVE	SOIC	D	16		TBD	Call TI	Call TI	
SN74LS592DRG4	ACTIVE	SOIC	D	16		TBD	Call TI	Call TI	
SN74LS592DRG4	ACTIVE	SOIC	D	16		TBD	Call TI	Call TI	
SN74LS592N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS592N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS592N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74LS592N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	

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>	Samples (Requires Login)
SN74LS592NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS592NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS592NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS592NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593DWRG4	ACTIVE	SOIC	DW	20	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>	Samples (Requires Login)
SN74LS593DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS593N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS593N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS593N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI	
SN74LS593N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI	
SN74LS593NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS593NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SNJ54LS592FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54LS592FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54LS592J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SNJ54LS592J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SNJ54LS592W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	
SNJ54LS592W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	
SNJ54LS593FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54LS593FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54LS593J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
SNJ54LS593J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
SNJ54LS593W	OBSOLETE			20		TBD	Call TI	Call TI	
SNJ54LS593W	OBSOLETE			20		TBD	Call TI	Call TI	

<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.

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**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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**OTHER QUALIFIED VERSIONS OF SN54LS592, SN54LS593, SN74LS592, SN74LS593 :**

- Catalog: [SN74LS592](#), [SN74LS593](#)
- Military: [SN54LS592](#), [SN54LS593](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**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
SN74LS592NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74LS593DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS592NSR	SO	NS	16	2000	367.0	367.0	38.0
SN74LS593DWR	SOIC	DW	20	2000	367.0	367.0	45.0

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)

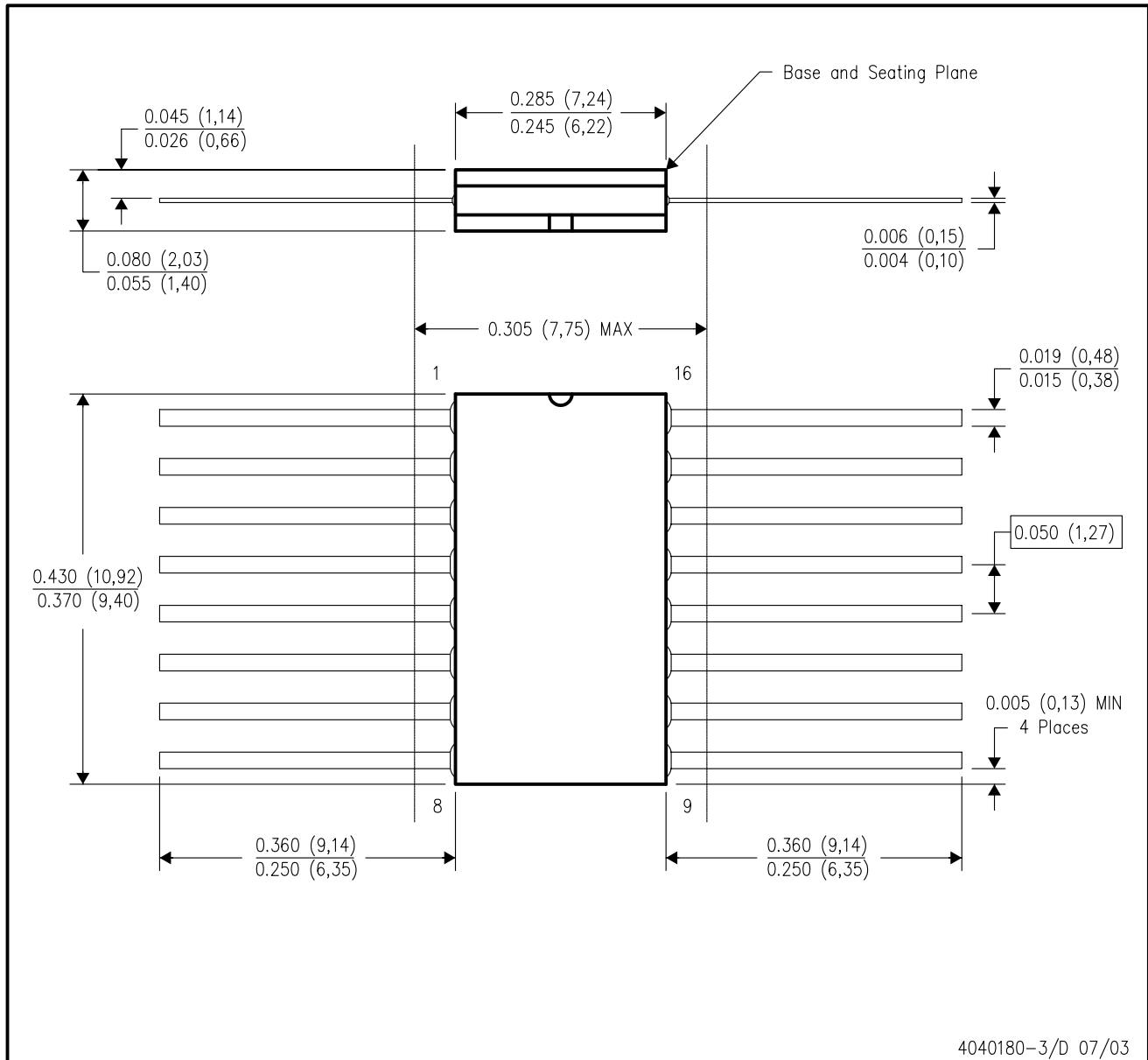


4040083/F 03/03

- 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.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP1-F16 and JEDEC MO-092AC

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

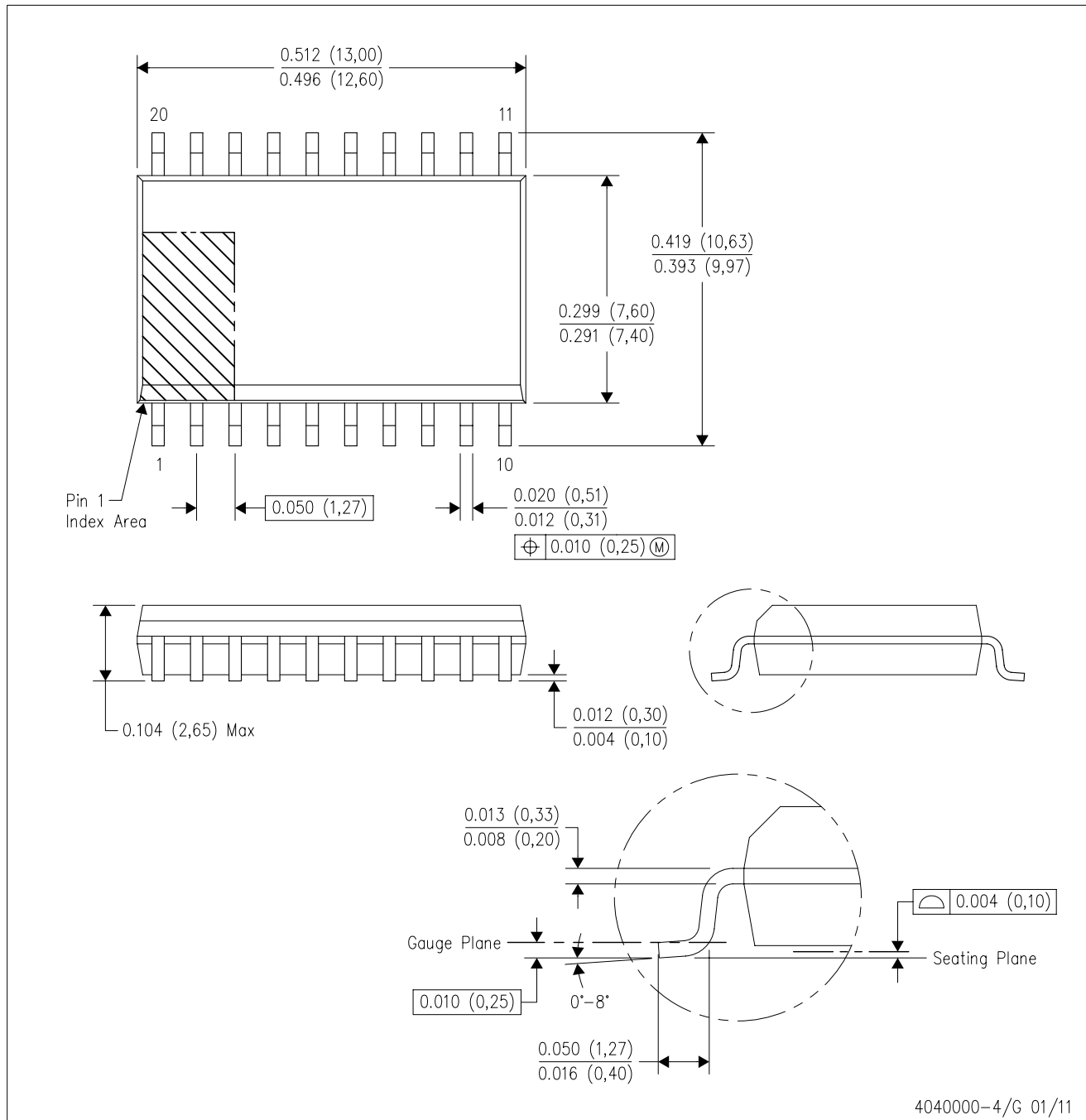
16 PINS SHOWN



- 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.

DW (R-PDSO-G20)

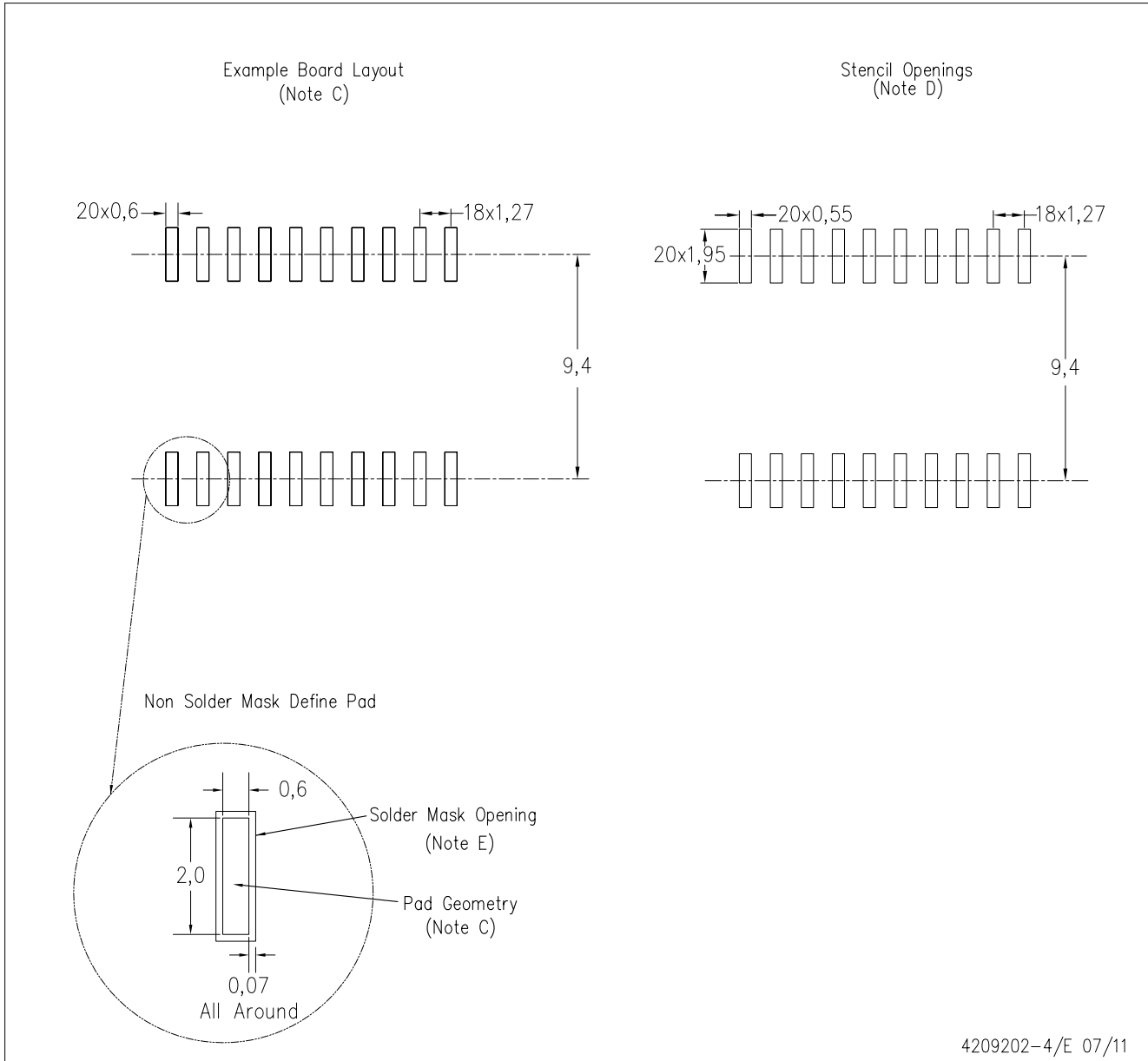
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - 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-013 variation AC.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



4209202-4/E 07/11

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

D (R-PDSO-G16)

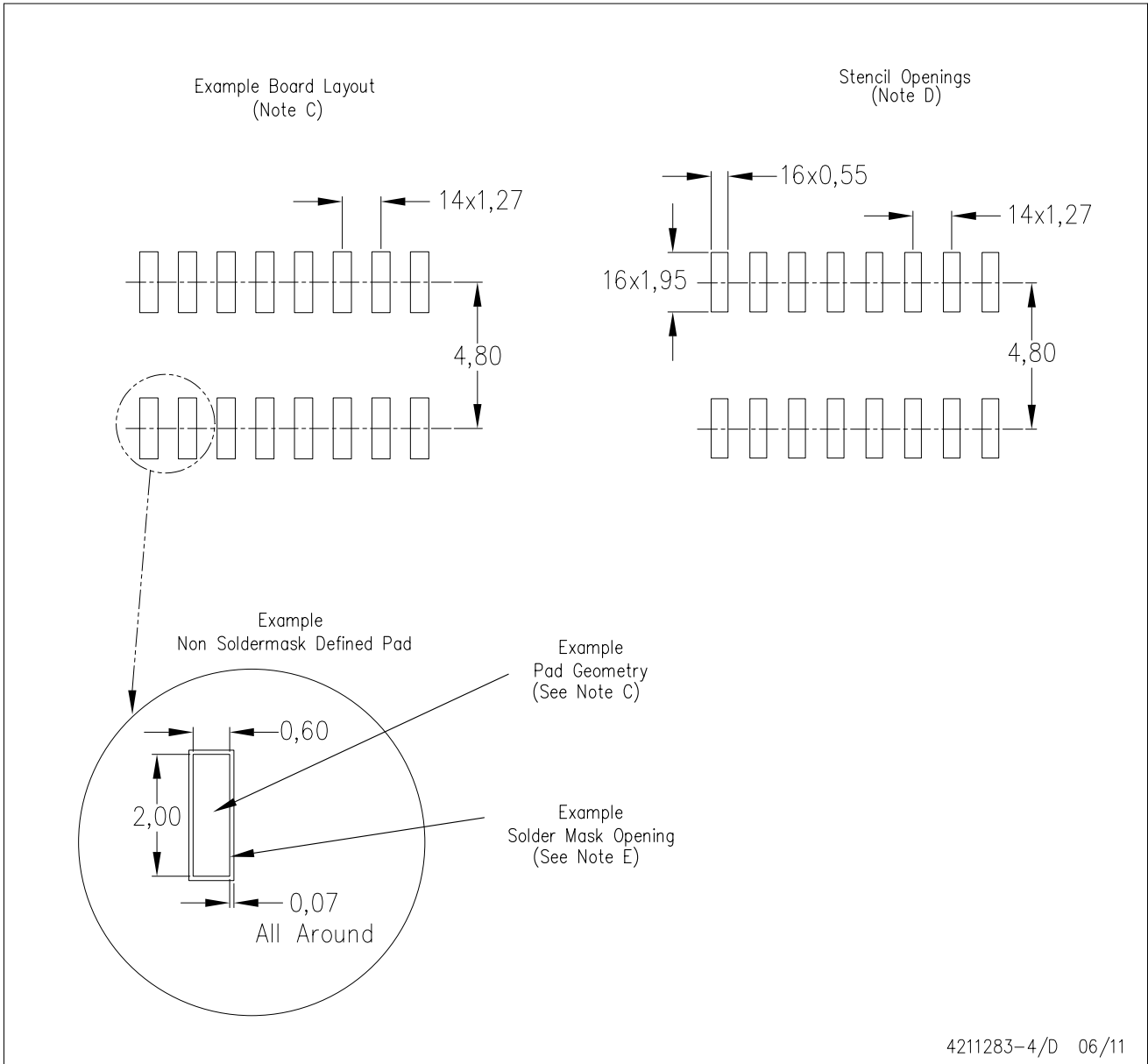
PLASTIC SMALL OUTLINE



- 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 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# 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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