

CMOS Presettable Up/Down Counters (Dual Clock With Reset)

High-Voltage Types (20-Volt Rating)

CD40192 – BCD Type

CD40193 – Binary Type

■ CD40192B Presettable BCD Up/Down Counter and the CD40193B Presettable Binary Up/Down Counter each consist of 4 synchronously clocked, gated "D" type flip-flops connected as a counter. The inputs consist of 4 individual jam lines, a PRESET ENABLE control, individual CLOCK UP and CLOCK DOWN signals and a master RESET. Four buffered Q signal outputs as well as CARRY and BORROW outputs for multiple-stage counting schemes are provided.

The counter is cleared so that all outputs are in a low state by a high on the RESET line. A RESET is accomplished asynchronously with the clock. Each output is individually programmable asynchronously with the clock to the level on the corresponding jam input when the PRESET ENABLE control is low.

The counter counts up one count on the positive clock edge of the CLOCK UP signal provided the CLOCK DOWN line is high. The counter counts down one count on the positive clock edge of the CLOCK DOWN signal provided the CLOCK UP line is high.

The CARRY and BORROW signals are high when the counter is counting up or down. The CARRY signal goes low one-half clock cycle after the counter reaches its maximum count in the count-up mode. The BORROW signal goes low one-half clock cycle after the counter reaches its minimum count in the count-down mode. Cascading of multiple packages is easily accomplished without the need for additional external circuitry by tying the BORROW and CARRY outputs to the CLOCK DOWN and CLOCK UP inputs, respectively, of the succeeding counter package.

The CD40192B and CD40193B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (NSR suffix), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

CD40192B, CD40193B Types

Features:

- Individual clock lines for counting up or counting down
- Synchronous high-speed carry and borrow propagation delays for cascading
- Asynchronous reset and preset capability
- Medium-speed operation— $f_{CL} = 8 \text{ MHz (typ.) @ } 10 \text{ V}$
- 5-V, 10-V, and 15-V parametric ratings
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of $1 \mu\text{A}$ at 18 V over full package temperature range; 100 nA at 18 V and 25°C
- Noise margin over full package temperature range:
1 V at $V_{DD} = 5 \text{ V}$ 2 V at $V_{DD} = 10 \text{ V}$
2.5 V at $V_{DD} = 15 \text{ V}$
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications:

- Up/down difference counting
- Multistage ripple counting
- Synchronous frequency dividers
- A/D and D/A conversion
- Programmable binary or BCD counting

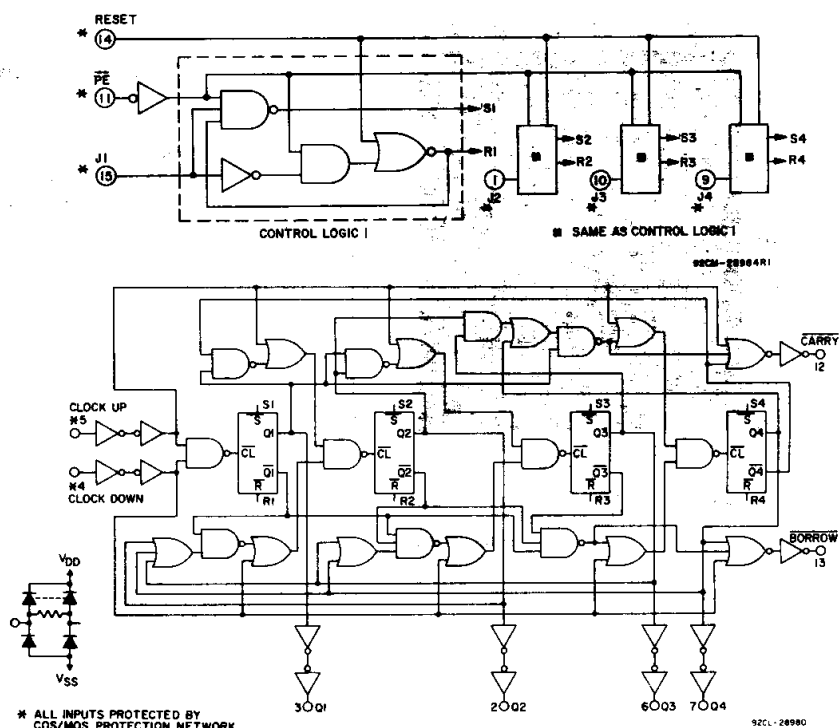
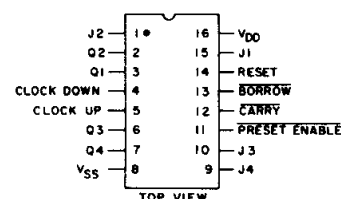
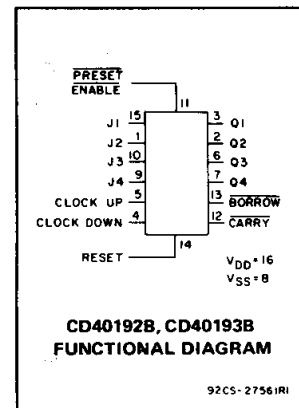


Fig. 1 – CD40192B logic diagram (BCD).

CD40192B, CD40193B Types

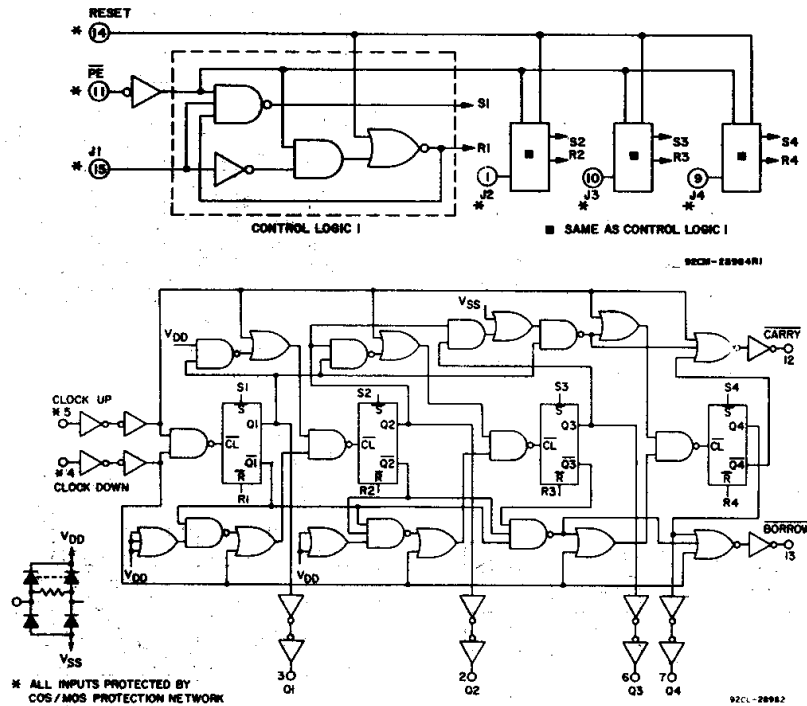


Fig. 2 - CD40193B logic diagram (binary).

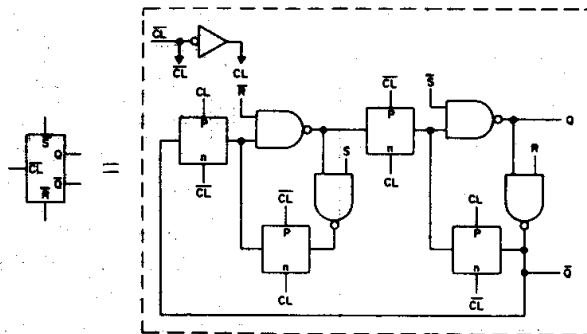


Fig. 4 - Internal logic of Flip-flop.

TRUTH TABLE

CLOCK UP	CLOCK DOWN	PRESET ENABLE	RESET	ACTION
	1	1	0	COUNT UP
	1	1	0	NO COUNT
1		1	0	COUNT DOWN
1		1	0	NO COUNT
X	X	0	0	PRESET
X	X	X	1	RESET

1 = HIGH LEVEL

0 = LOW LEVEL

X = DON'T CARE

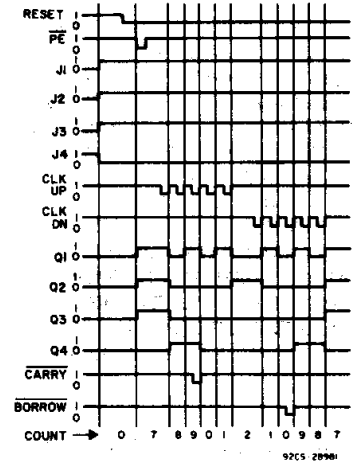


Fig. 3 - CD40192B timing diagram.

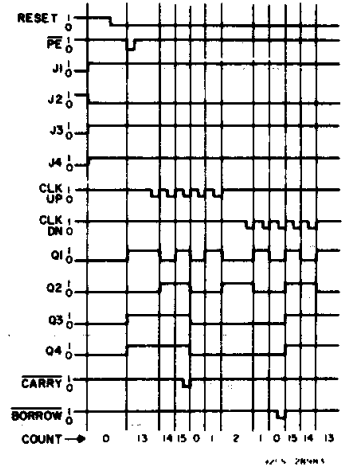


Fig. 5 - CD40193B timing diagram.

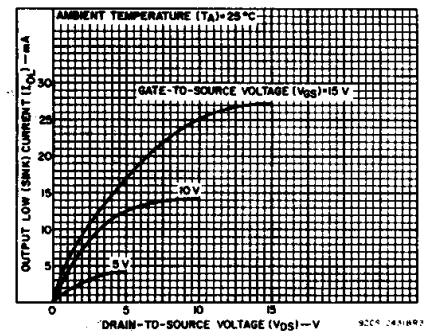


Fig. 6 - Typical output low (sink) current characteristics.

CD40192B, CD40193B Types

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})	
Voltages referenced to V_{SS} Terminal)	-0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS	-0.5V to $V_{DD} + 0.5V$
DC INPUT CURRENT, ANY ONE INPUT	$\pm 10mA$
POWER DISSIPATION PER PACKAGE (P_D):	
For $T_A = -55^\circ C$ to $+100^\circ C$	500mW
For $T_A = +100^\circ C$ to $+125^\circ C$	Derate Linearity at 12mW/ $^\circ C$ to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR	
FOR $T_A =$ FULL PACKAGE-TEMPERATURE RANGE (All Package Types)	100mW
OPERATING-TEMPERATURE RANGE (T_A)	$-55^\circ C$ to $+125^\circ C$
STORAGE TEMPERATURE RANGE (T_{stg})	$-65^\circ C$ to $+150^\circ C$
LEAD TEMPERATURE (DURING SOLDERING):	
At distance $1/16 \pm 1/32$ Inch ($1.59 \pm 0.79mm$) from case for 10s max	$+265^\circ C$

RECOMMENDED OPERATING CONDITIONS at $T_A = 25^\circ C$ (unless otherwise specified)

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges.

CHARACTERISTIC	V_{DD} (V)	LIMITS		UNITS
		Min.	Max.	
Supply Voltage Range (For $T_A =$ Full Temp. Range)	—	3	18	V
Removal Time: RESET or \overline{PE}	5	80	—	ns
	10	40	—	ns
	15	30	—	ns
Pulse Width: RESET	5	480	—	ns
	10	300	—	ns
	15	260	—	ns
\overline{PE}	5	240	—	ns
	10	170	—	ns
	15	140	—	ns
CLOCK	5	180	—	ns
	10	90	—	ns
	15	60	—	ns
Clock Input Frequency	5	—	2	MHz
	10	DC	4	MHz
	15	—	5.5	MHz
Clock Rise & Fall Time	5	—	15	μs
	10	—	15	μs
	15	—	5	μs

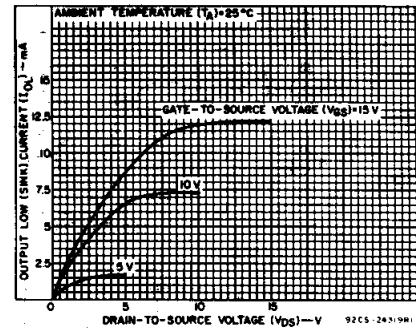


Fig. 7 - Minimum output low (sink) current characteristics.

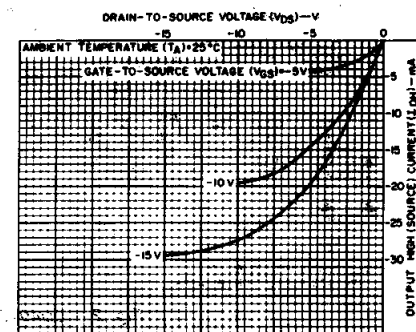


Fig. 8 - Typical output high (source) current characteristics.

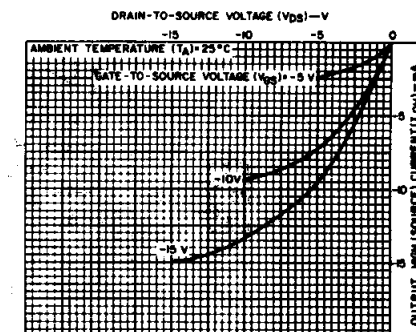


Fig. 9 - Minimum output high (source) current characteristics.

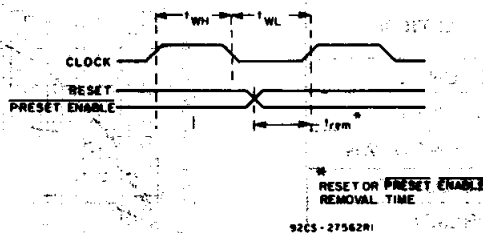


Fig. 10 - Timing diagram defining t_{rem}

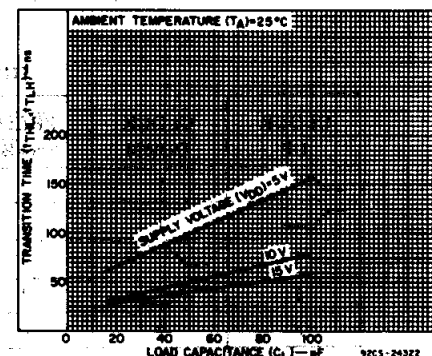


Fig. 11 - Typical transition time as a function of load capacitance.

CD40192B, CD40193B Types

STATIC ELECTRICAL CHARACTERISTICS

CHARACTER- ISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)	+25							
				-55	-40	+85	+125	Min.	Typ.	Max.	
Quiescent Device Current, I _{DD} Max.	—	0,5	5	5	5	150	150	—	0.04	5	μA
	—	0,10	10	10	10	300	300	—	0.04	10	
	—	0,15	15	20	20	600	600	—	0.04	20	
	—	0,20	20	100	100	3000	3000	—	0.08	100	
Output Low (Sink) Current I _{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	—	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	—	
	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	—	
Output High (Source) Current, I _{OH} Min.	4.6	0,5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	—	mA
	2.5	0,5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2	—	
	9.5	0,10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	—	
	13.5	0,15	15	-4.2	-4	-2.8	-2.4	-3.4	-6.8	—	
Output Voltage: Low-Level, V _{OL} Max.	—	0,5	5	0.05				—	0	0.05	V
	—	0,10	10	0.05				—	0	0.05	
	—	0,15	15	0.05				—	0	0.05	
Output Voltage: High-Level, V _{OH} Min.	—	0,5	5	4.95				4.95	5	—	V
	—	0,10	10	9.95				9.95	10	—	
	—	0,15	15	14.95				14.95	15	—	
Input Low Voltage, V _{IL} Max.	0.5, 4.5	—	5	1.5				—	—	1.5	V
	1, 9	—	10	3				—	—	3	
	1.5, 13.5	—	15	4				—	—	4	
Input High Voltage, V _{IH} Min.	0.5, 4.5	—	5	3.5				3.5	—	—	V
	1, 9	—	10	7				7	—	—	
	1.5, 13.5	—	15	11				11	—	—	
Input Current I _{IN} Max.	—	0,18	18	±0.1	±0.1	±1	±1	—	±10 ⁻⁵	±0.1	μA

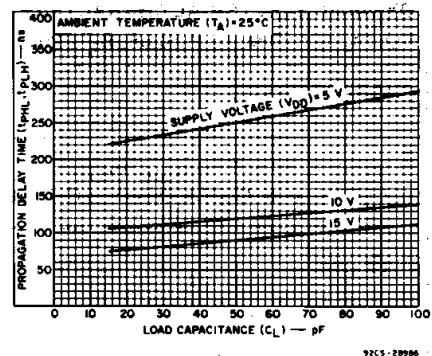


Fig. 12 — Typical propagation delay time as a function of load capacitance.

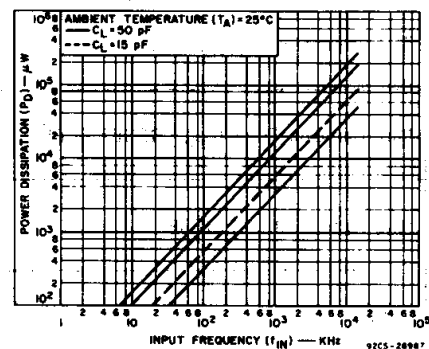
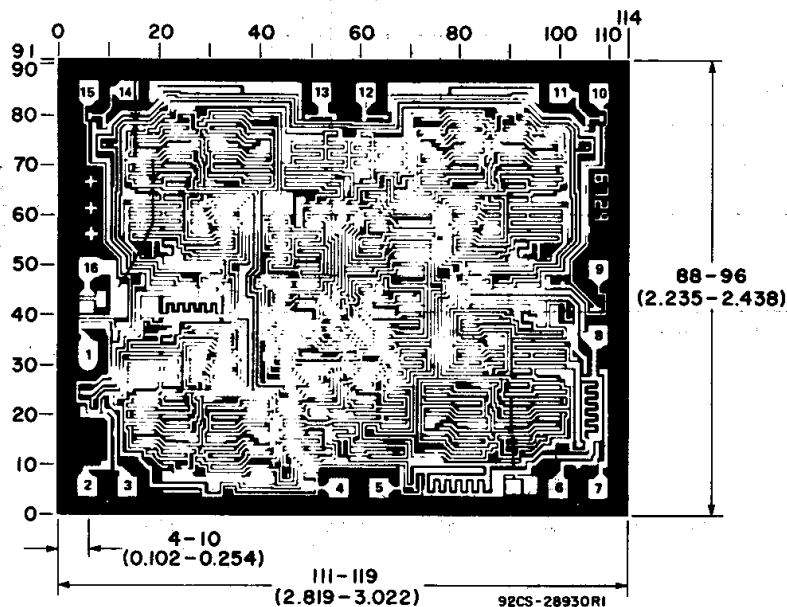


Fig. 13 — Dynamic power dissipation.



Dimensions and pad layout for the CD40192BH (dimensions and pad layout for the CD40193BH are identical).

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10⁻³ inch).

CD40192B, CD40193B Types

DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$

Input $t_r, t_f = 20 \text{ ns}$, $C_L = 50 \text{ pF}$, $R_L = 200 \text{ k}\Omega$

CHARACTERISTIC	V_{DD} (V)	LIMITS			UNITS
		Min.	Typ.	Max.	
Propagation Delay Time t_{PHL}, t_{PLH} : CLOCK UP or CLOCK DOWN to Q, RESET to Q	5 10 15	— — —	250 120 90	500 240 180	ns
\overline{PE} to Q	5 10 15	— — —	200 100 70	400 200 140	ns
CLOCK UP to \overline{CARRY} , CLOCK DOWN to \overline{BORROW}	5 10 15	— — —	160 80 60	320 160 120	ns
RESET or \overline{PE} to \overline{BORROW} or \overline{CARRY}	5 10 15	— — —	300 150 110	600 300 220	ns
Transition Time, t_{THL}, t_{TLH}	5 10 15	— — —	100 50 40	200 100 80	ns
Min. Removal Time, t_{rem} * RESET or \overline{PE}	5 10 15	— — —	40 20 15	80 40 30	ns
Min. Pulse Width, t_w RESET	5 10 15	— — —	240 150 130	480 300 260	ns
\overline{PE}	5 10 15	— — —	120 85 70	240 170 140	ns
CLOCK	5 10 15	— — —	90 45 30	180 90 60	ns
Max. Clock Input Frequency, f_{CL}	5 10 15	2 4 5.5	4 8 11	— — —	MHz
Clock Rise & Fall Time, t_r, t_f	5 10 15	— — —	— — —	15 15 5	μs
Input Capacitance, C_{IN} : RESET	—	—	10	15	pF
All Other Inputs	—	—	5	7.5	pF

* The time required for RESET or PRESET ENABLE control to be removed before clocking (see timing diagram, Fig. 10).

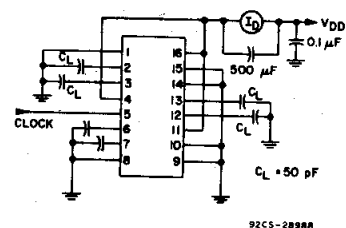


Fig. 14 - Dynamic power dissipation test circuit.

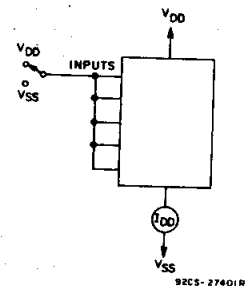


Fig. 15 - Quiescent device current test circuit.

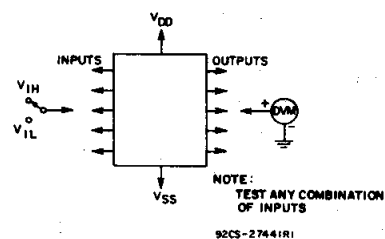


Fig. 16 - Input voltage test circuit.

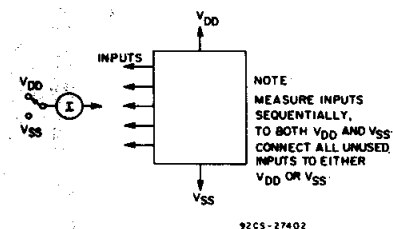


Fig. 17 - Input current test circuit.

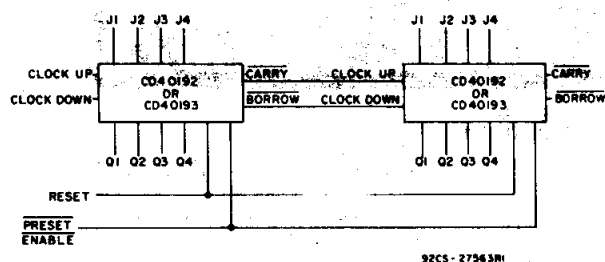


Fig. 18 - Cascaded counter packages.

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)
CD40192BE	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD40192BE
CD40192BE.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD40192BE
CD40192BF	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40192BF
CD40192BF.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40192BF
CD40192BF3A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40192BF3A
CD40192BF3A.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40192BF3A
CD40192BNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD40192B
CD40192BNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD40192B
CD40192BNSR.B	Active	Production	SOP (NS) 16	2000 LARGE T&R	-	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD40192B
CD40193BE	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD40193BE
CD40193BE.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD40193BE
CD40193BF3A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40193BF3A
CD40193BF3A.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40193BF3A
CD40193BNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD40193B
CD40193BNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD40193B
CD40193BNSRE4	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD40193B
CD40193BPW	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM0193B
CD40193BPWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM0193B
CD40193BPWR.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM0193B

⁽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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OTHER QUALIFIED VERSIONS OF CD40192B, CD40192B-MIL, CD40193B, CD40193B-MIL :

- Catalog : [CD40192B](#), [CD40193B](#)
- Military : [CD40192B-MIL](#), [CD40193B-MIL](#)

NOTE: Qualified Version Definitions:

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

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
CD40192BNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
CD40193BNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
CD40193BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD40192BNSR	SOP	NS	16	2000	353.0	353.0	32.0
CD40193BNSR	SOP	NS	16	2000	353.0	353.0	32.0
CD40193BPWR	TSSOP	PW	16	2000	353.0	353.0	32.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD40192BE	N	PDIP	16	25	506	13.97	11230	4.32
CD40192BE	N	PDIP	16	25	506	13.97	11230	4.32
CD40192BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD40192BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD40193BE	N	PDIP	16	25	506	13.97	11230	4.32
CD40193BE	N	PDIP	16	25	506	13.97	11230	4.32
CD40193BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD40193BE.A	N	PDIP	16	25	506	13.97	11230	4.32



NS0016A

PACKAGE OUTLINE

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

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 0.25 mm, per side.

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

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

EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

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

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - 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

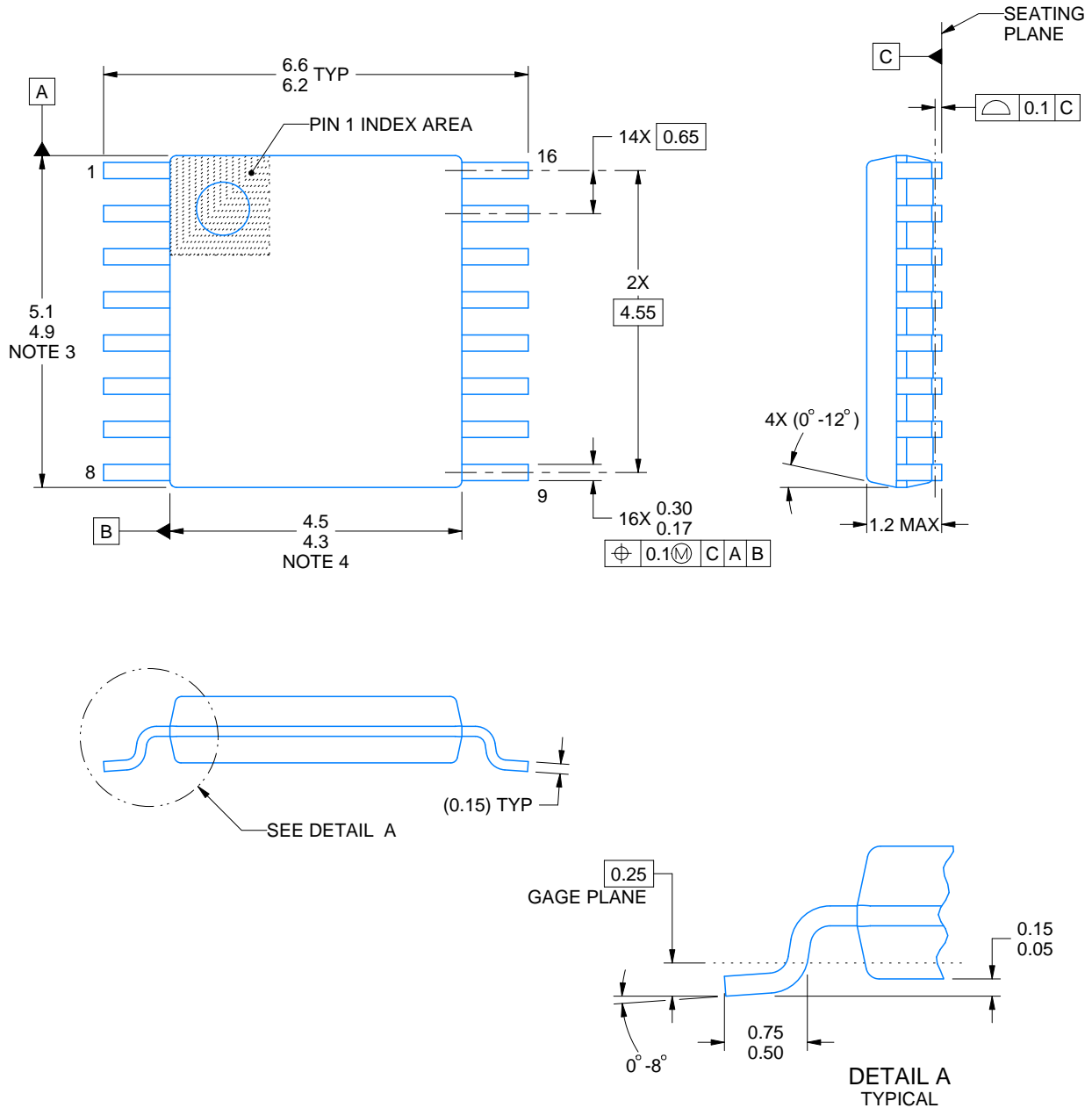


PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



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.



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NOTES:

1. All linear dimensions are in millimeters. Any 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 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



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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

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

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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.

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	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



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.

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