

Features

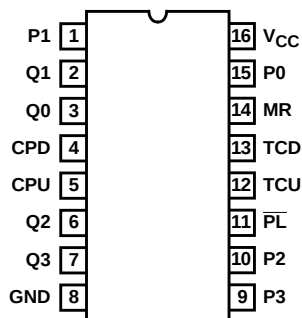
- Synchronous Counting and Asynchronous Loading
- Two Outputs for N-Bit Cascading
- Look-Ahead Carry for High-Speed Counting
- Fanout (Over Temperature Range)
 - Standard Outputs 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range . . . -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: $N_{IL} = 30\%$, $N_{IH} = 30\%$ of V_{CC} at $V_{CC} = 5V$
- HCT Types
 - 4.5V to 5.5V Operation
 - Direct LSTTL Input Logic Compatibility, $V_{IL} = 0.8V$ (Max), $V_{IH} = 2V$ (Min)
 - CMOS Input Compatibility, $I_I \leq 1\mu A$ at V_{OL} , V_{OH}

Description

The 'HC192, 'HC193 and 'HCT193 are asynchronously presettable BCD Decade and Binary Up/Down synchronous counters, respectively.

Pinout

CD54HC192, CD54HC193, CD54HCT193 (CERDIP)
CD74HC192 (PDIP, SOP, TSSOP)
CD74HC193 (PDIP, SOIC)
CD74HCT193 (PDIP)
TOP VIEW



Presetting the counter to the number on the preset data inputs (P0-P3) is accomplished by a LOW asynchronous parallel load input ($\overline{PL}$). The counter is incremented on the low-to-high transition of the Clock-Up input (and a high level on the Clock-Down input) and decremented on the low to high transition of the Clock-Down input (and a high level on the Clock-up input). A high level on the MR input overrides any other input to clear the counter to its zero state. The Terminal Count up (carry) goes low half a clock period before the zero count is reached and returns to a high level at the zero count. The Terminal Count Down (borrow) in the count down mode likewise goes low half a clock period before the maximum count (9 in the 192 and 15 in the 193) and returns to high at the maximum count. Cascading is effected by connecting the carry and borrow outputs of a less significant counter to the Clock-Up and Clock-Down inputs, respectively, of the next most significant counter.

If a decade counter is preset to an illegal state or assumes an illegal state when power is applied, it will return to the normal sequence in one count as shown in state diagram.

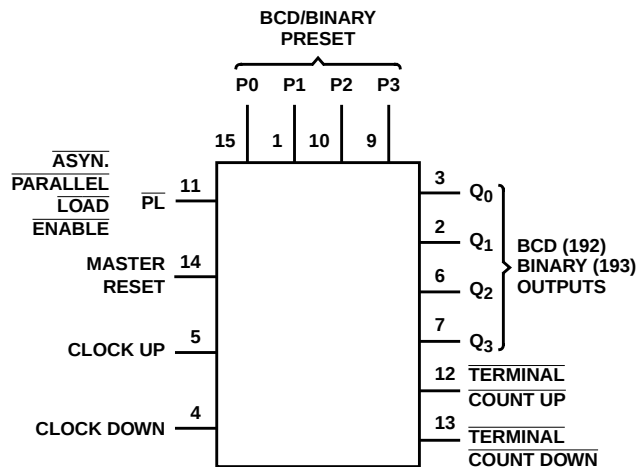
Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC192F3A	-55 to 125	16 Ld CERDIP
CD54HC193F3A	-55 to 125	16 Ld CERDIP
CD54HCT193F3A	-55 to 125	16 Ld CERDIP
CD74HC192E	-55 to 125	16 Ld PDIP
CD74HC192NSR	-55 to 125	16 Ld SOP
CD74HC192PW	-55 to 125	16 Ld TSSOP
CD74HC192PWR	-55 to 125	16 Ld TSSOP
CD74HC192PWT	-55 to 125	16 Ld TSSOP
CD74HC193E	-55 to 125	16 Ld PDIP
CD74HC193M	-55 to 125	16 Ld SOIC
CD74HC193MT	-55 to 125	16 Ld SOIC
CD74HC193M96	-55 to 125	16 Ld SOIC
CD74HCT193E	-55 to 125	16 Ld PDIP

NOTE: When ordering, use the entire part number. The suffixes 96 and R denote tape and reel. The suffix T denotes a small-quantity reel of 250.

CD54/74HC192, CD54/74HC193, CD54/74HCT193

Functional Diagram



TRUTH TABLE

CLOCK UP	CLOCK DOWN	RESET	PARALLEL LOAD	FUNCTION
↑	H	L	H	Count Up
H	↑	L	H	Count Down
X	X	H	X	Reset
X	X	L	L	Load Preset Inputs

H = High Voltage Level, L = Low Voltage Level, X = Don't Care, ↑ = Transition from Low to High Level

CD54/74HC192, CD54/74HC193, CD54/74HCT193

Absolute Maximum Ratings

DC Supply Voltage, V_{CC} -0.5V to 7V
 DC Input Diode Current, I_{IK}
 For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ $\pm 20mA$
 DC Output Diode Current, I_{OK}
 For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ $\pm 20mA$
 DC Output Source or Sink Current per Output Pin, I_O
 For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$ $\pm 25mA$
 DC V_{CC} or Ground Current, I_{CC} or I_{GND} $\pm 50mA$

Thermal Information

Package Thermal Impedance, θ_{JA} (see Note 1):
 E (PDIP) Package $67^{\circ}C/W$
 M (SOIC) Package $73^{\circ}C/W$
 NS (SOP) Package $64^{\circ}C/W$
 PW (TSSOP) Package $108^{\circ}C/W$
 Maximum Junction Temperature $150^{\circ}C$
 Maximum Storage Temperature Range $-65^{\circ}C$ to $150^{\circ}C$
 Maximum Lead Temperature (Soldering 10s) $300^{\circ}C$
 (SOIC - Lead Tips Only)

Operating Conditions

Temperature Range (T_A) $-55^{\circ}C$ to $125^{\circ}C$
 Supply Voltage Range, V_{CC}
 HC Types 2V to 6V
 HCT Types 4.5V to 5.5V
 DC Input or Output Voltage, V_I , V_O 0V to V_{CC}
 Input Rise and Fall Time
 2V 1000ns (Max)
 4.5V 500ns (Max)
 6V 400ns (Max)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. The package thermal impedance is calculated in accordance with JESD 51-7.

DC Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS			25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V _I (V)	I _O (mA)	V _{CC} (V)	MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES												
High Level Input Voltage	V _{IH}	-	-	2	1.5	-	-	1.5	-	1.5	-	V
				4.5	3.15	-	-	3.15	-	3.15	-	V
				6	4.2	-	-	4.2	-	4.2	-	V
Low Level Input Voltage	V _{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V
				4.5	-	-	1.35	-	1.35	-	1.35	V
				6	-	-	1.8	-	1.8	-	1.8	V
High Level Output Voltage CMOS Loads	V _{OH}	V _{IH} or V _{IL}	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output Voltage TTL Loads	V _{OH}	V _{IH} or V _{IL}	-4	4.5	3.98	-	-	3.84	-	3.7	-	V
			-5.2	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads	V _{OL}	V _{IH} or V _{IL}	4	4.5	-	-	0.26	-	0.33	-	0.4	V
			5.2	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} or GND	-	6	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I _{CC}	V _{CC} or GND	0	6	-	-	8	-	80	-	160	μA

CD54/74HC192, CD54/74HC193, CD54/74HCT193

DC Electrical Specifications (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS			25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V _I (V)	I _O (mA)	V _{CC} (V)	MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HCT TYPES												
High Level Input Voltage	V _{IH}	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	V _{IL}	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	V _{OH}	V _{IH} or V _{IL}	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
High Level Output Voltage TTL Loads			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			4	4.5	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} to GND	-	5.5	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I _{CC}	V _{CC} or GND	-	5.5	-	-	8	-	80	-	160	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	ΔI _{CC} (Note 2)	V _{CC} - 2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	μA

NOTE:

- For dual-supply systems theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

HCT Input Loading Table

INPUT	UNIT LOADS
P0-P3	0.4
MR	1.45
PL	0.85
CPU, CPD	1.45

NOTE: Unit Load is ΔI_{CC} limit specified in DC Electrical Specifications table, e.g. 360µA max at 25°C.

CD54/74HC192, CD54/74HC193, CD54/74HCT193

Prerequisite For Switching Specifications

PARAMETER	SYMBOL	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES										
Pulse Width CPU, CPD 192	t _W	2	115	-	-	145	-	175	-	ns
		4.5	23	-	-	29	-	35	-	ns
		6	20	-	-	25	-	30	-	ns
CPU, CPD 193	t _W	2	100	-	-	125	-	150	-	ns
		4.5	20	-	-	25	-	30	-	ns
		6	17	-	-	21	-	26	-	ns
$\overline{\text{PL}}$	t _W	2	80	-	-	100	-	120	-	ns
		4.5	16	-	-	20	-	24	-	ns
		6	14	-	-	17	-	20	-	ns
MR	t _W	2	100	-	-	125	-	150	-	ns
		4.5	20	-	-	25	-	30	-	ns
		6	17	-	-	21	-	26	-	ns
Set-up Time Pn to $\overline{\text{PL}}$	t _{SU}	2	80	-	-	100	-	120	-	ns
		4.5	16	-	-	20	-	24	-	ns
		6	14	-	-	17	-	20	-	ns
Hold Time Pn to $\overline{\text{PL}}$	t _H	2	0	-	-	0	-	0	-	ns
		4.5	0	-	-	0	-	0	-	ns
		6	0	-	-	0	-	0	-	ns
Hold Time CPD to CPU or CPU to CPD	t _H	2	80	-	-	100	-	120	-	ns
		4.5	16	-	-	20	-	24	-	ns
		6	14	-	-	17	-	20	-	ns
Recovery Time $\overline{\text{PL}}$ to CPU, CPD	t _{REC}	2	80	-	-	100	-	120	-	ns
		4.5	16	-	-	20	-	24	-	ns
		6	14	-	-	17	-	20	-	ns
MR to CPU, CPD	t _{REC}	2	5	-	-	5	-	5	-	ns
		4.5	5	-	-	5	-	5	-	ns
		6	5	-	-	5	-	5	-	ns
Maximum Frequency CPU, CPD 192	f _{MAX}	2	5	-	-	4	-	3	-	MHz
		4.5	22	-	-	18	-	15	-	MHz
		6	24	-	-	21	-	18	-	MHz
CPU, CPD 193	f _{MAX}	2	5	-	-	4	-	3	-	MHz
		4.5	25	-	-	20	-	17	-	MHz
		6	29	-	-	24	-	20	-	MHz
HCT TYPES										
Pulse Width CPU, CPD 192	t _W	2	-	-	-	-	-	-	-	ns
		4.5	23	-	-	29	-	35	-	ns
		6	-	-	-	-	-	-	-	ns
CPU, CPD 193	t _W	2	-	-	-	-	-	-	-	ns
		4.5	23	-	-	29	-	35	-	ns
		6	-	-	-	-	-	-	-	ns

CD54/74HC192, CD54/74HC193, CD54/74HCT193

Prerequisite For Switching Specifications (Continued)

PARAMETER	SYMBOL	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$\overline{\text{PL}}$	t_W	2	-	-	-	-	-	-	-	ns
		4.5	16	-	-	20	-	24	-	ns
		6	-	-	-	-	-	-	-	ns
MR	t_W	2	-	-	-	-	-	-	-	ns
		4.5	20	-	-	25	-	30	-	ns
		6	-	-	-	-	-	-	-	ns
Set-up Time P _n to $\overline{\text{PL}}$	t_{SU}	2	-	-	-	-	-	-	-	ns
		4.5	15	-	-	19	-	22	-	ns
		6	-	-	-	-	-	-	-	ns
Hold Time P _n to $\overline{\text{PL}}$	t_H	2	-	-	-	-	-	-	-	ns
		4.5	0	-	-	0	-	0	-	ns
		6	-	-	-	-	-	-	-	ns
Hold Time CPD to CPU or CPU to CPD	t_H	2	-	-	-	-	-	-	-	ns
		4.5	16	-	-	20	-	24	-	ns
		6	-	-	-	-	-	-	-	ns
Recovery Time $\overline{\text{PL}}$ to CPU, CPD	t_{REC}	2	-	-	-	-	-	-	-	ns
		4.5	15	-	-	19	-	22	-	ns
		6	-	-	-	-	-	-	-	ns
MR to CPU, CPD	t_{REC}	2	-	-	-	-	-	-	-	ns
		4.5	5	-	-	5	-	5	-	ns
		6	-	-	-	-	-	-	-	ns
Maximum Frequency CPU, CPD 192	f_{MAX}	2	-	-	-	-	-	-	-	MHz
		4.5	22	-	-	18	-	15	-	MHz
		6	-	-	-	-	-	-	-	MHz
CPU, CPD 193	f_{MAX}	2	-	-	-	-	-	-	-	MHz
		4.5	22	-	-	18	-	15	-	MHz
		6	-	-	-	-	-	-	-	MHz

Switching Specifications Input $t_r, t_f = 6\text{ns}$

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES											
Propagation Delay CPU to $\overline{\text{TCU}}$	$t_{\text{PLH}}, t_{\text{PHL}}$	C _L = 50pF	2	-	-	125	-	155	-	190	ns
		C _L = 50pF	4.5	-	-	25	-	31	-	38	ns
		C _L = 15pF	5	-	10	-	-	-	-	-	ns
		C _L = 50pF	6	-		21	-	26	-	32	ns
CPD to $\overline{\text{TCD}}$	$t_{\text{PLH}}, t_{\text{PHL}}$	C _L = 50pF	2	-	-	125	-	155	-	190	ns
		C _L = 50pF	4.5	-	-	25	-	31	-	38	ns
		C _L = 15pF	5	-	10	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	21	-	26	-	32	ns
CPU to Q _n	$t_{\text{PLH}}, t_{\text{PHL}}$	C _L = 50pF	2	-	-	220	-	270	-	325	ns
		C _L = 50pF	4.5	-	-	43	-	54	-	65	ns
		C _L = 15pF	5	-	18	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	37	-	46	-	55	ns

CD54/74HC192, CD54/74HC193, CD54/74HCT193

Switching Specifications Input $t_r, t_f = 6\text{ns}$ (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	V_{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
CPD to Q_n	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	2	-	-	220	-	270	-	325	ns
		$C_L = 50\text{pF}$	4.5	-	-	43	-	54	-	65	ns
		$C_L = 15\text{pF}$	5	-	18	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	37	-	46	-	55	ns
$\overline{PL}$ to Q_n	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	2	-	-	220	-	275	-	330	ns
		$C_L = 50\text{pF}$	4.5	-	-	44	-	55	-	66	ns
		$C_L = 15\text{pF}$	5	-	18	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	37	-	47	-	56	ns
MR to Q_n	t_{PHL}	$C_L = 50\text{pF}$	2	-	-	200	-	250	-	300	ns
		$C_L = 50\text{pF}$	4.5	-	-	40	-	50	-	60	ns
		$C_L = 15\text{pF}$	5	-	17	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	34	-	43	-	51	ns
Transition Time Q, TCU, TCD	t_{TLH}, t_{THL}	$C_L = 50\text{pF}$	2	-	-	75	-	95	-	110	ns
			4.5	-	-	15	-	19	-	22	ns
			6	-	-	13	-	16	-	19	ns
Input Capacitance	C_{IN}	$C_L = 50\text{pF}$	-	-	-	10	-	10	-	10	pF
Power Dissipation Capacitance (Notes 3, 4)	C_{PD}	$C_L = 15\text{pF}$	5	-	40	-	-	-	-	-	pF
HCT TYPES											
Propagation Delay CPU to $\overline{TCU}$	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	27	-	34	-	41	ns
		$C_L = 15\text{pF}$	5	-	11	-	-	-	-	-	ns
CPU to $\overline{TCD}$	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	27	-	34	-	41	ns
		$C_L = 15\text{pF}$	5	-	11	-	-	-	-	-	ns
CPU to Q_n	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	40	-	50	-	60	ns
		$C_L = 15\text{pF}$	5	-	17	-	-	-	-	-	ns
CPD to Q_n	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	40	-	50	-	60	ns
		$C_L = 15\text{pF}$	5	-	17	-	-	-	-	-	ns
$\overline{PL}$ to Q_n	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	46	-	58	-	69	ns
		$C_L = 15\text{pF}$	5	-	21	-	-	-	-	-	ns
MR to Q_n	t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	43	-	54	-	65	ns
		$C_L = 15\text{pF}$	5	-	18	-	-	-	-	-	ns
Transition Time Q, TCU, TCD	t_{TLH}, t_{THL}	$C_L = 50\text{pF}$	4.5	-	-	15	-	19	-	22	ns
			4.5	-	-	15	-	19	-	22	ns
Input Capacitance	C_{IN}	$C_L = 50\text{pF}$	-	-	-	10	-	10	-	10	pF
Power Dissipation Capacitance (Notes 3, 4)	C_{PD}	$C_L = 15\text{pF}$	5	-	50	-	-	-	-	-	pF

NOTES:

3. C_{PD} is used to determine the dynamic power consumption, per gate.
4. $P_D = V_{CC}^2 f_i + \sum (C_L V_{CC}^2)$ where f_i = Input Frequency, C_L = Output Load Capacitance, V_{CC} = Supply Voltage.

Test Circuits and Waveforms

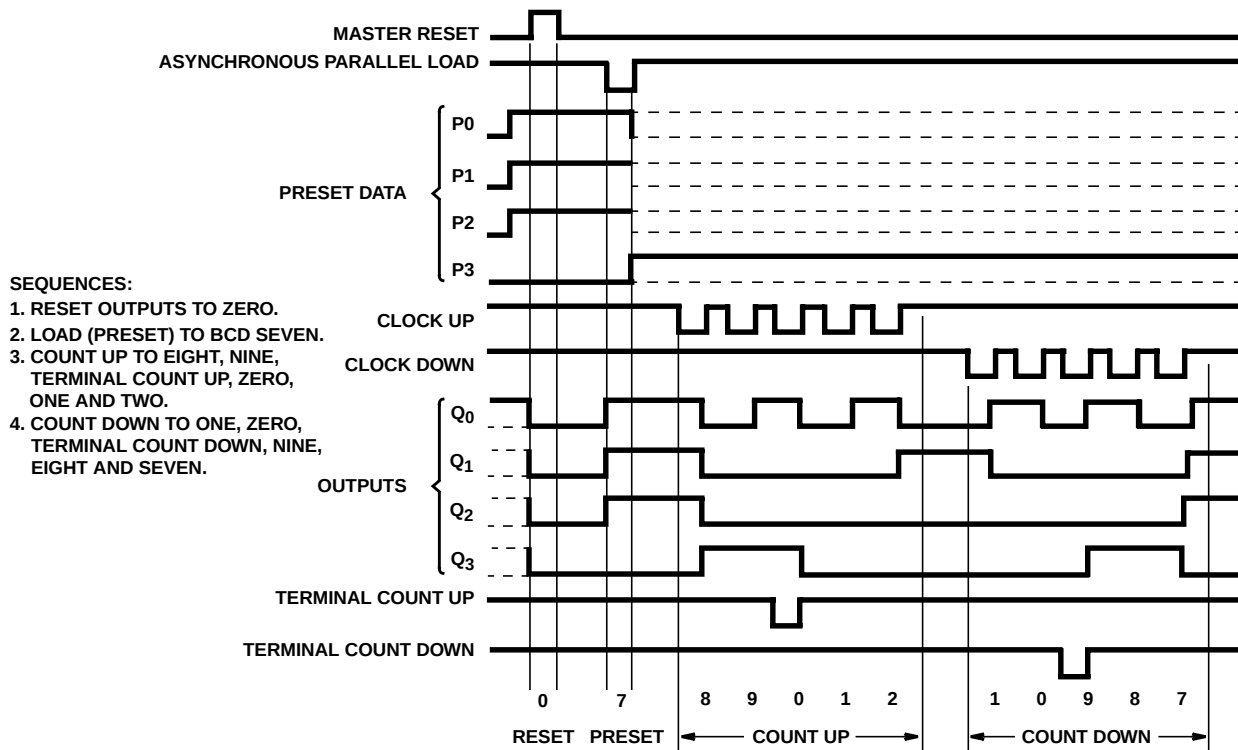


FIGURE 1. 'HC192 SYNCHRONOUS DECADE COUNTERS, TYPICAL RESET, PRESET AND COUNT SEQUENCES

Test Circuits and Waveforms (Continued)

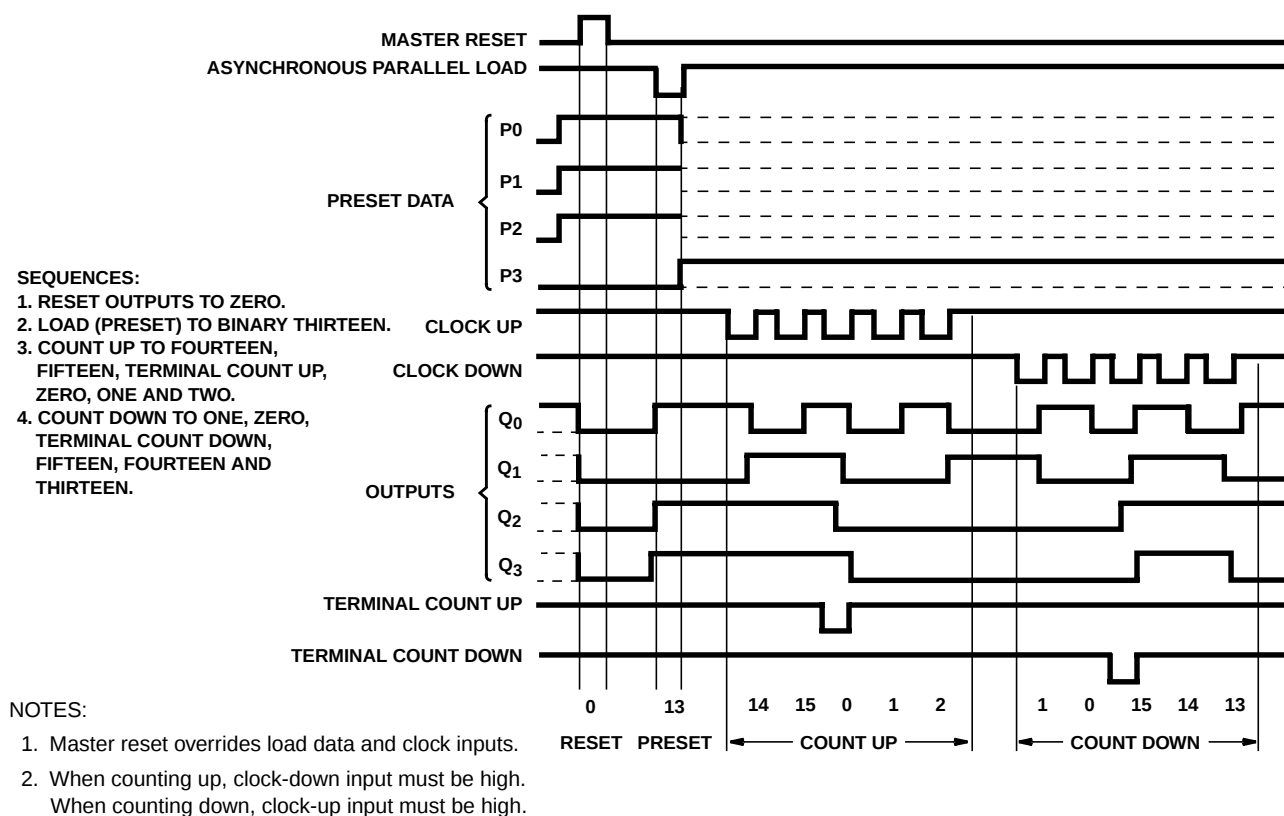


FIGURE 2. 'HC193 SYNCHRONOUS BINARY COUNTERS, TYPICAL RESET, PRESET AND COUNT SEQUENCES

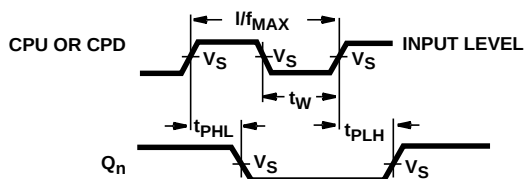


FIGURE 3. CLOCK TO OUTPUT DELAYS AND CLOCK PULSE WIDTH

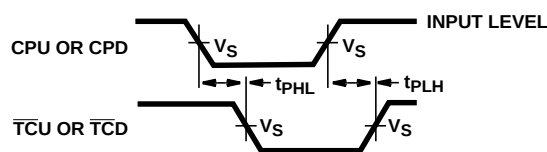


FIGURE 4. CLOCK TO TERMINAL COUNT DELAYS

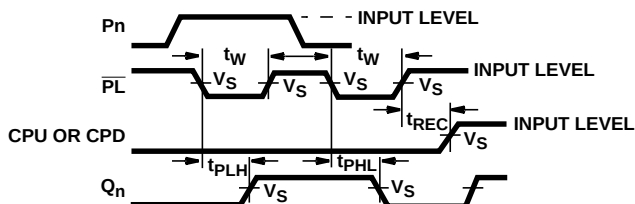


FIGURE 5. PARALLEL LOAD PULSE WIDTH, PARALLEL LOAD TO OUTPUT DELAYS, AND PARALLEL LOAD TO CLOCK RECOVERY TIME

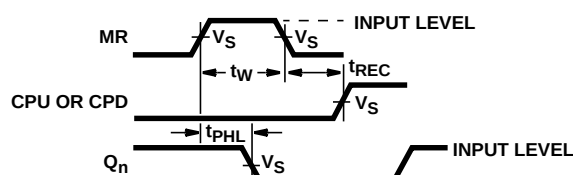


FIGURE 6. MASTER RESET PULSE WIDTH, MASTER RESET TO OUTPUT DELAY AND MASTER RESET TO CLOCK RECOVERY TIME

Test Circuits and Waveforms (Continued)

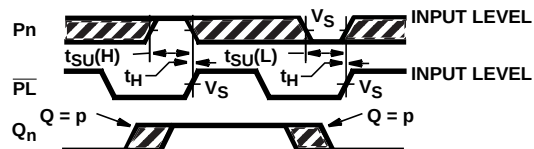


FIGURE 7. SET-UP AND HOLD TIMES DATA TO PARALLEL LOAD (PL)

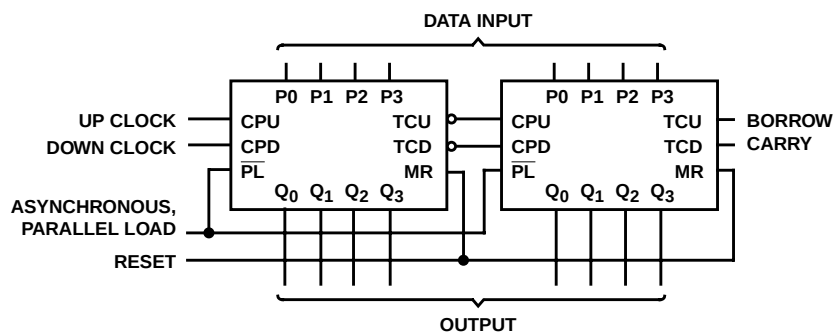
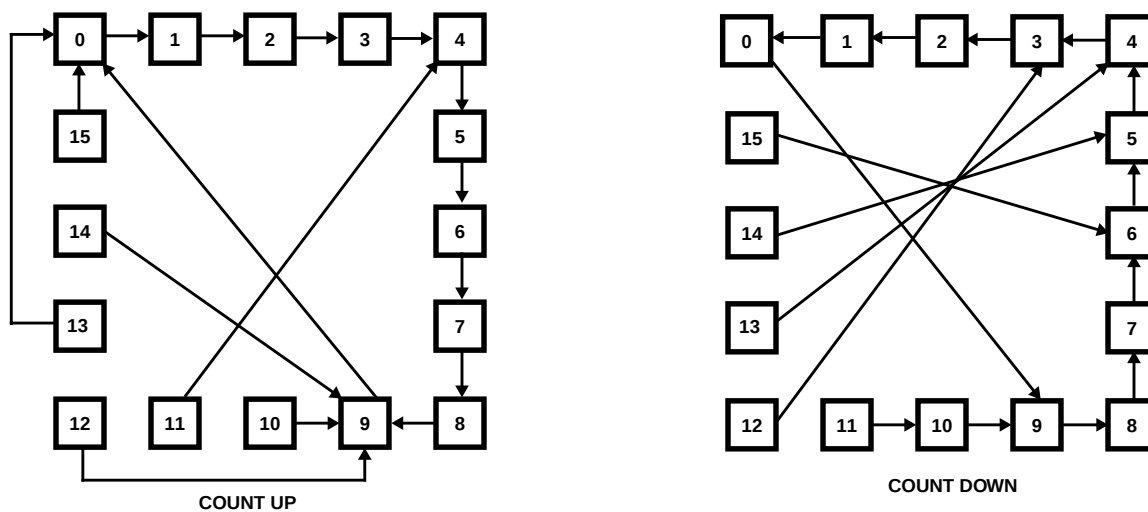


FIGURE 8. CASCADED UP/DOWN COUNTER WITH PARALLEL LOAD



NOTE: Illegal states in BCD counters corrected in one count.

NOTE: Illegal states in BCD counters corrected in one or two counts.

FIGURE 9. 'HC192, 'HCT193 STATE DIAGRAMS

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-8780801EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8780801EA CD54HC192F3A	Samples
5962-9084801MEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9084801ME A CD54HCT193F3A	Samples
CD54HC192F3A	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8780801EA CD54HC192F3A	Samples
CD54HC193F3A	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8772401EA CD54HC193F3A	Samples
CD54HCT193F3A	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9084801ME A CD54HCT193F3A	Samples
CD74HC192E	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HC192E	Samples
CD74HC192EE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HC192E	Samples
CD74HC192NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC192M	Samples
CD74HC192NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC192M	Samples
CD74HC192PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HJ192	Samples
CD74HC192PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HJ192	Samples
CD74HC192PWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HJ192	Samples
CD74HC193E	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HC193E	Samples
CD74HC193EE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HC193E	Samples
CD74HC193M	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC193M	Samples
CD74HC193M96	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC193M	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CD74HC193M96E4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC193M	Samples
CD74HC193MG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC193M	Samples
CD74HC193MT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC193M	Samples
CD74HCT193E	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HCT193E	Samples
CD74HCT193EE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD74HCT193E	Samples

(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), 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.

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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF CD54HC192, CD54HC193, CD54HCT193, CD74HC192, CD74HC193, CD74HCT193 :

- Catalog: [CD74HC192](#), [CD74HC193](#), [CD74HCT193](#)
- Military: [CD54HC192](#), [CD54HC193](#), [CD54HCT193](#)

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
CD74HC192NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
CD74HC192PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD74HC192PWT	TSSOP	PW	16	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD74HC193M96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	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)
CD74HC192NSR	SO	NS	16	2000	367.0	367.0	38.0
CD74HC192PWR	TSSOP	PW	16	2000	367.0	367.0	35.0
CD74HC192PWT	TSSOP	PW	16	250	367.0	367.0	35.0
CD74HC193M96	SOIC	D	16	2500	333.2	345.9	28.6

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.

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE

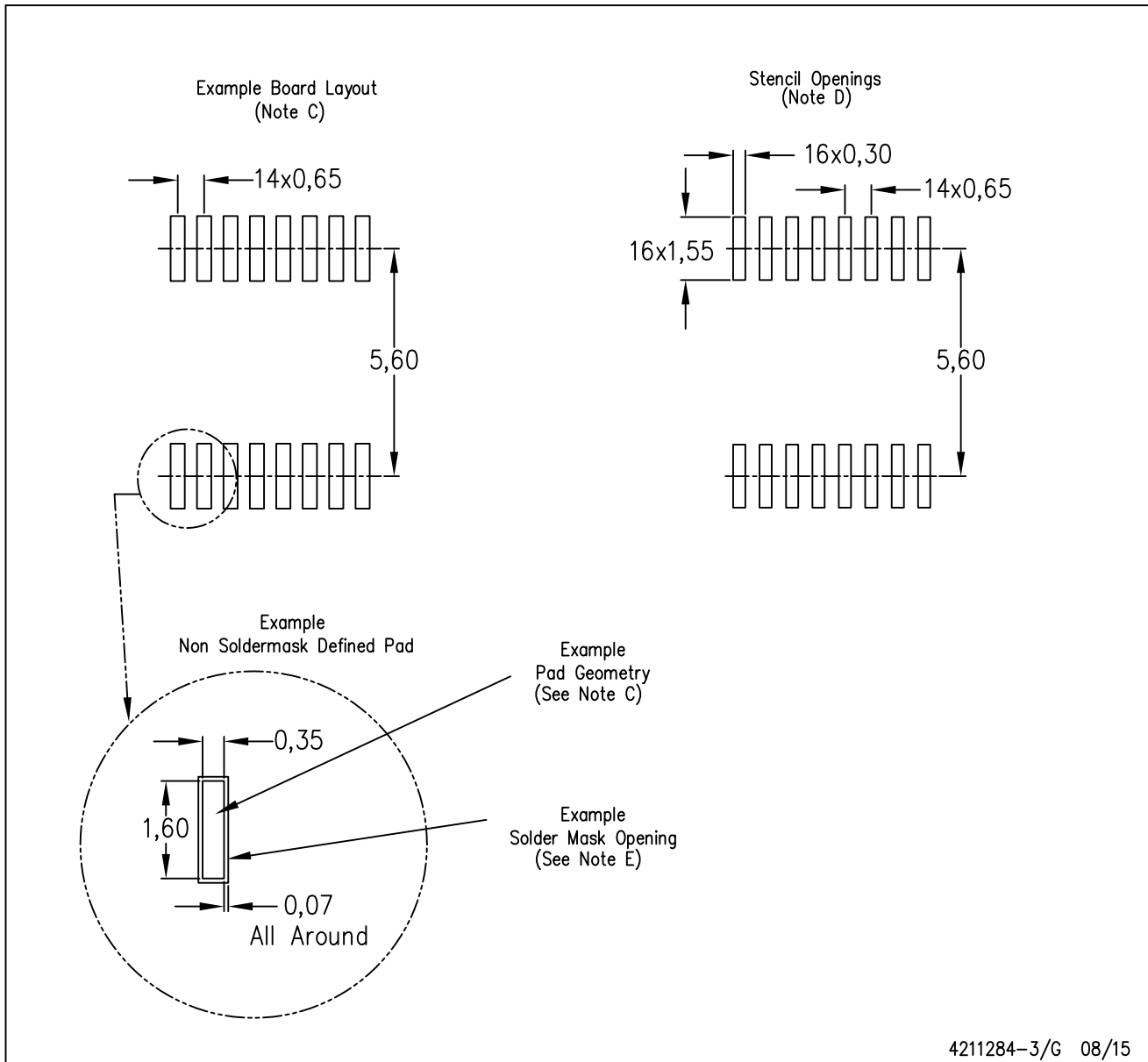


4040064-4/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - 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 0,15 each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153

PW (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.

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.

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.
 - $\triangle C$ 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.
 - $\triangle D$ 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



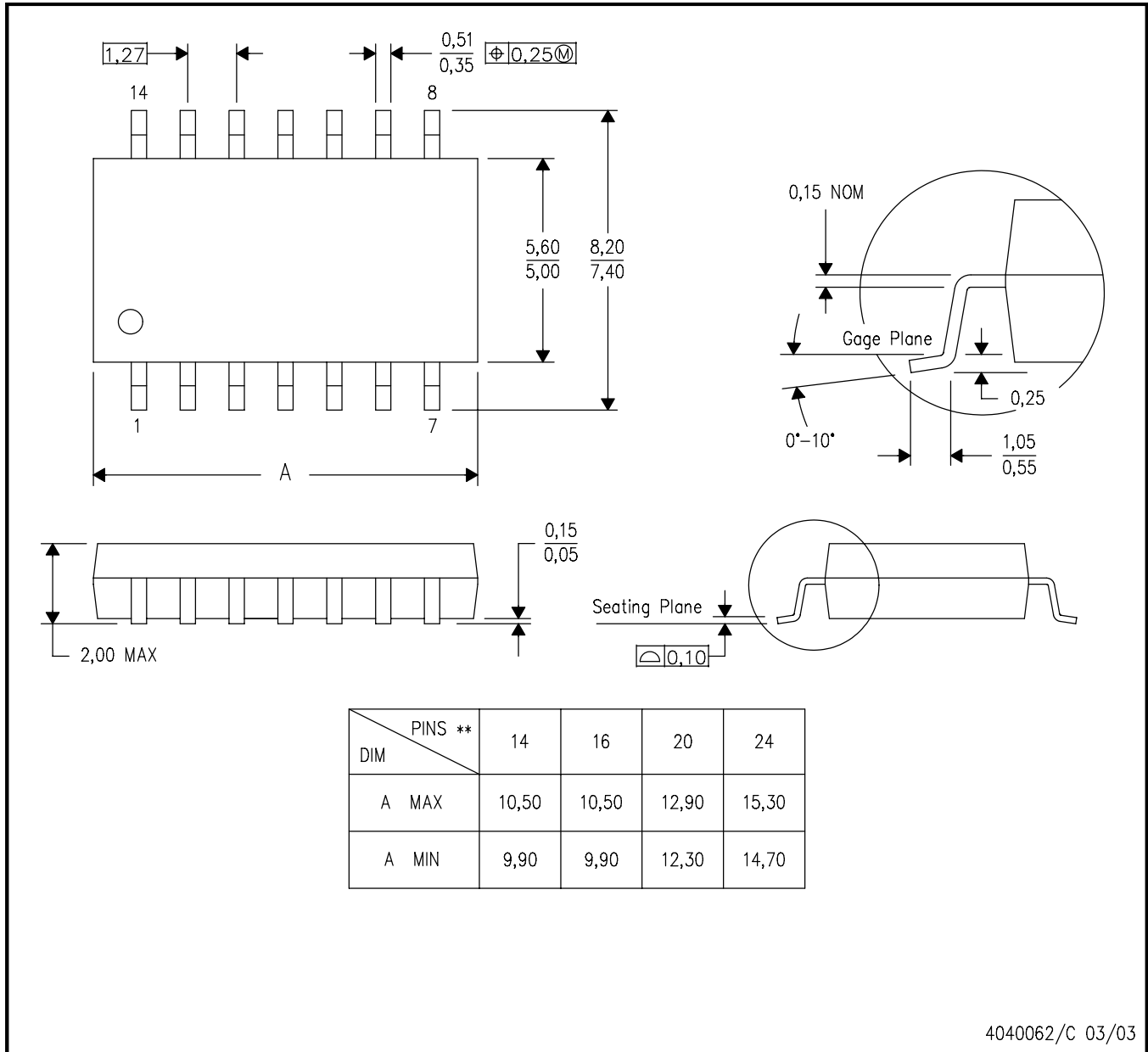
- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should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

IMPORTANT NOTICE

Texas Instruments Incorporated (TI) reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

TI's published terms of sale for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.