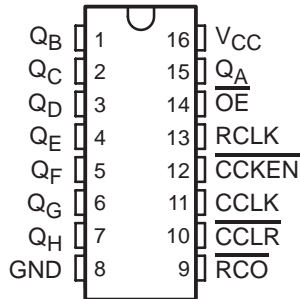


SN54HC590A, SN74HC590A 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

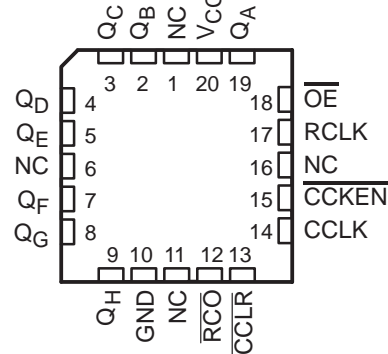
SCLS039F – DECEMBER 1982 – REVISED SEPTEMBER 2003

- 2-V to 6-V V_{CC} Operation
- High-Current 3-State Parallel Register Outputs Can Drive Up To 15 LSTTL Loads
- Low Power Consumption, 80- μ A Max I_{CC}
- Typical $t_{pd} = 14$ ns
- ± 6 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max
- 8-Bit Counter With Register
- Counter Has Direct Clear

SN54HC590A . . . J OR W PACKAGE
SN74HC590A . . . D, DW, OR N PACKAGE
(TOP VIEW)



SN54HC590A . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The 'HC590A devices contain an 8-bit binary counter that feeds an 8-bit storage register. The storage register has parallel outputs. Separate clocks are provided for both the binary counter and storage register. The binary counter features direct clear (\overline{CCLR}) and count-enable (\overline{CCKEN}) inputs. A ripple-carry output (\overline{RCO}) is provided for cascading. Expansion is accomplished easily 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 the counter clock (CCLK) input of the following stage.

CCLK and the register clock (RCLK) inputs are positive-edge triggered. If both clocks are connected together, the counter state always is one count ahead of the register. Internal circuitry prevents clocking from the clock enable.

ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube of 25	SN74HC590AN	SN74HC590AN
	SOIC – D	Tube of 40	SN74HC590AD	HC590A
		Reel of 2500	SN74HC590ADR	
		Reel of 250	SN74HC590ADT	
	SOIC – DW	Tube of 40	SN74HC590ADW	HC590A
Reel of 2000		SN74HC590ADWR		
-55°C to 125°C	CDIP – J	Tube of 25	SNJ54HC590AJ	SNJ54HC590AJ
	CFP – W	Tube of 150	SNJ54HC590AW	SNJ54HC590AW
	LCCC - FK	Tube of 55	SNJ54HC590AFK	SNJ54HC590AFK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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**

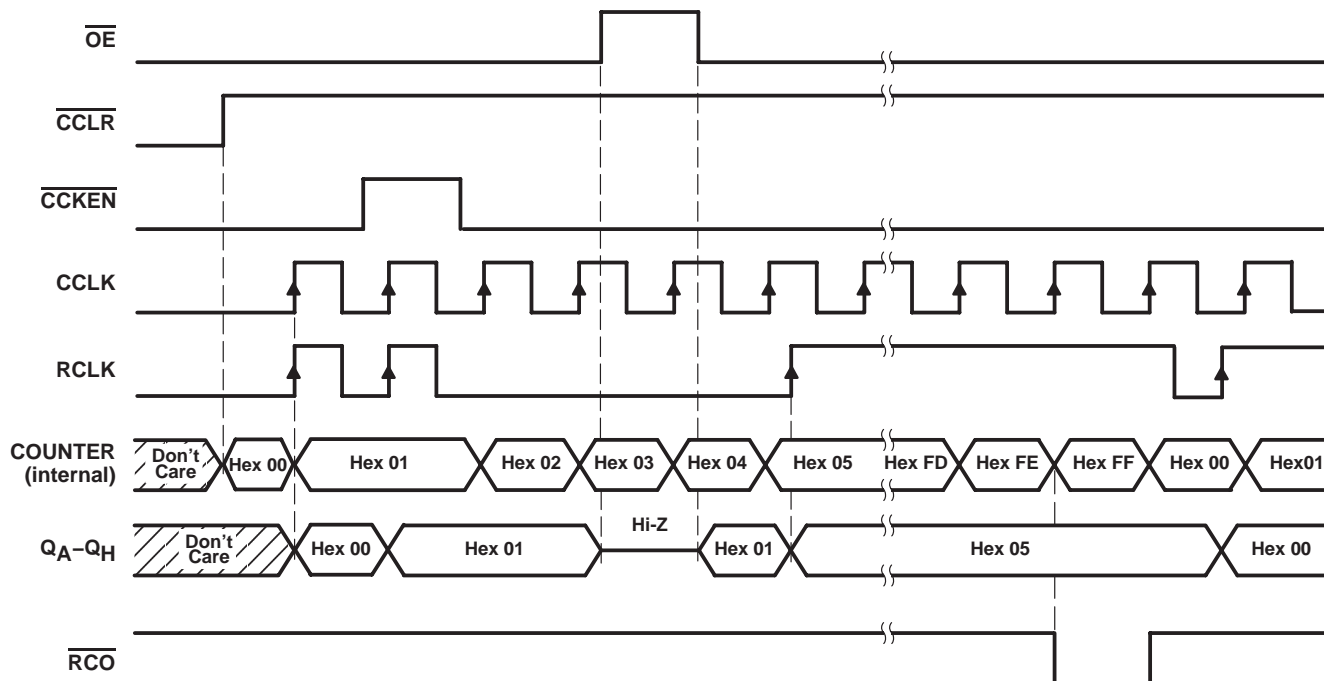
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2003, Texas Instruments Incorporated
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54HC590A, SN74HC590A 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

SCLS039F – DECEMBER 1982 – REVISED SEPTEMBER 2003

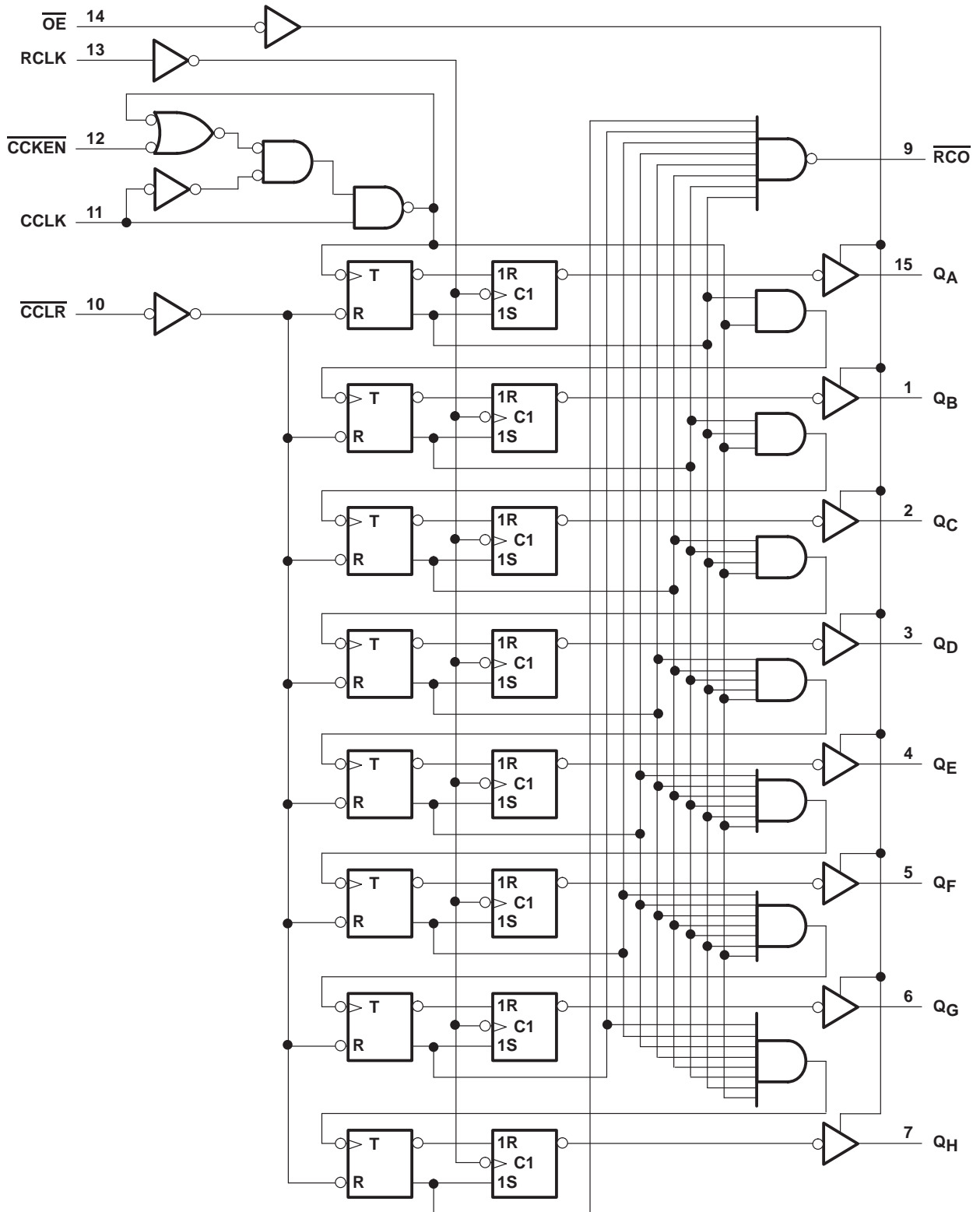
timing diagram



TIMING SEQUENCE

1. Clear Counter (asynchronous).
2. Count up: 0x01. Store 0x00 in register.
3. Inhibit counter clock (CCKEN = HIGH). Store 0x01 in register.
4. Count 0x02, 0x03.
5. 3-state the outputs
6. Count up: 0x04
7. Enable outputs.
8. Continue up: 0x05
9. Store 0x05 in register.
10. Continue counting: 0x06...0xFD, 0xFE, 0xFF, 0x00, etc.
11. Store 0x00 in register.

logic diagram (positive logic)



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

SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS
 SCLS039F – DECEMBER 1982 – REVISED SEPTEMBER 2003

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

PARAMETER	TEST CONDITIONS		V _{CC}	T _A = 25°C			SN54HC590A		SN74HC590A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	V _I = V _{IH} or V _{IL}	I _{OH} = -20 μA	2 V	1.9	1.998		1.9		1.9	V	
			4.5 V	4.4	4.499		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		
		4.5 V	\overline{RCO} , I _{OH} = -4 mA	3.98	4.3		3.7		3.84		
			Q _A -Q _H , I _{OH} = -6 mA	3.98	4.3		3.7		3.84		
			\overline{RCO} , I _{OH} = -5.2 mA	5.48	5.8		5.2		5.34		
6 V	Q _A -Q _H , I _{OH} = -7.8 mA	5.48	5.8		5.2		5.34				
V _{OL}	V _I = V _{IH} or V _{IL}	I _{OL} = 20 μA	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		4.5 V	\overline{RCO} , I _{OL} = 4 mA		0.17	0.26		0.4		0.33	
			Q _A -Q _H , I _{OL} = 6 mA		0.17	0.26		0.4		0.33	
			\overline{RCO} , I _{OL} = 5.2 mA		0.15	0.26		0.4		0.33	
6 V	Q _A -Q _H , I _{OL} = 7.8 mA		0.15	0.26		0.4		0.33			
I _I	V _I = V _{CC} or 0	6 V		±0.1	±100		±1000		±1000	nA	
I _{OZ}	V _O = V _{CC} or 0	6 V		±0.01	±0.5		±10		±5	μA	
I _{CC}	V _I = V _{CC} or 0, I _O = 0	6 V			8		160		80	μA	
C _i		2 V to 6 V		3	10		10		10	pF	

SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS

SCLS039F – DECEMBER 1982 – REVISED SEPTEMBER 2003

timing requirements over recommended operating free-air temperature range (unless otherwise noted)

		V _{CC}	T _A = 25°C		SN54HC590A		SN74HC590A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency	2 V	4		2.5		3.2		MHz
		4.5 V	20		13		16		
		6 V	24		16		19		
t _w	CCLK or RCLK high or low	2 V	125		200		155		ns
		4.5 V	25		38		31		
		6 V	21		32		26		
	CCLR low	2 V	100		150		125		
		4.5 V	20		30		25		
		6 V	17		26		21		
t _{su}	CCKEN low before CCLK↑	2 V	100		150		125		ns
		4.5 V	20		30		25		
		6 V	17		26		21		
	CCLR high (inactive) before CCLK↑	2 V	100		150		125		
		4.5 V	20		30		25		
		6 V	17		26		21		
	CCLK↑ before RCLK↑†	2 V	100		150		125		
		4.5 V	20		30		25		
		6 V	17		26		21		
t _h	CCKEN low after CCLK↑	2 V	50		75		60		ns
		4.5 V	10		15		12		
		6 V	9		13		11		

† This setup time ensures that the register gets stable data from the counter outputs. The clocks may be tied together, in which case the register is one clock pulse behind the counter.

SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS

SCLS039F – DECEMBER 1982 – REVISED SEPTEMBER 2003

switching characteristics over recommended operating free-air temperature range, $C_L = 50 \text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	SN54HC590A				UNIT	
				$T_A = 25^\circ\text{C}$			MIN		MAX
				MIN	TYP	MAX			
f_{\max}			2 V	4	8	2.5	MHz		
			4.5 V	20	35	13			
			6 V	24	40	16			
t_{pd}	CCLK \uparrow	\overline{RCO}	2 V	80	150	225	ns		
			4.5 V	20	31	45			
			6 V	15	26	38			
t_{PLH}	$\overline{CCLR}\downarrow$	\overline{RCO}	2 V	70	130	195	ns		
			4.5 V	18	28	39			
			6 V	14	23	33			
t_{pd}	RCLK \uparrow	Q	2 V	70	140	210	ns		
			4.5 V	18	31	42			
			6 V	14	25	36			
t_{en}	$\overline{OE}\downarrow$	Q	2 V	80	125	185	ns		
			4.5 V	20	30	37			
			6 V	15	28	31			
t_{dis}	$\overline{OE}\uparrow$	Q	2 V	80	125	185	ns		
			4.5 V	20	30	37			
			6 V	15	28	31			
t_t^*		\overline{RCO}	2 V	38	75	110	ns		
			4.5 V	8	15	22			
			6 V	6	13	19			
		Q	2 V	38	60	90			
			4.5 V	8	12	18			
			6 V	6	10	15			

* This parameter is not production tested for the SN54HC590A.

SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS

SCLS039F – DECEMBER 1982 – REVISED SEPTEMBER 2003

switching characteristics over recommended operating free-air temperature range, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	SN74HC590A				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
f _{max}			2 V	4	8	3.2	MHz		
			4.5 V	20	35	16			
			6 V	24	40	19			
t _{pd}	CCLK↑	\overline{RCO}	2 V		80	150	190	ns	
			4.5 V		20	30	38		
			6 V		15	26	33		
t _{PLH}	$\overline{CCLR}\downarrow$	\overline{RCO}	2 V		70	130	165	ns	
			4.5 V		18	26	33		
			6 V		14	22	28		
t _{pd}	RCLK↑	Q	2 V		70	140	175	ns	
			4.5 V		18	28	35		
			6 V		14	24	30		
t _{en}	$\overline{OE}\downarrow$	Q	2 V		80	125	155	ns	
			4.5 V		20	25	31		
			6 V		15	21	26		
t _{dis}	$\overline{OE}\uparrow$	Q	2 V		80	125	155	ns	
			4.5 V		20	25	31		
			6 V		15	21	26		
t _t		\overline{RCO}	2 V		38	75	95	ns	
			4.5 V		8	15	19		
			6 V		6	13	16		
		Q	2 V		38	60	75		
			4.5 V		8	12	15		
			6 V		6	10	13		



SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS
 SCLS039F – DECEMBER 1982 – REVISED SEPTEMBER 2003

switching characteristics over recommended operating free-air temperature range, $C_L = 150 \text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	SN54HC590A				UNIT	
				$T_A = 25^\circ\text{C}$			MIN		MAX
				MIN	TYP	MAX			
t_{pd}	RCLK \uparrow	Q	2 V	100	300	447	ns		
			4.5 V	24	60	90			
			6 V	20	51	77			
t_{en}	\overline{OE}	Q	2 V	90	200	300	ns		
			4.5 V	23	40	60			
			6 V	19	34	51			
t_t^*		Q	2 V	45	210	315	ns		
			4.5 V	17	42	63			
			6 V	13	36	53			

* This parameter is not production tested for the SN54HC590A.

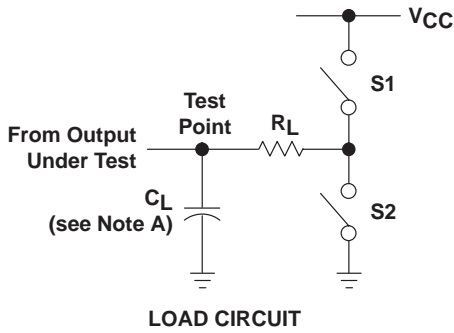
switching characteristics over recommended operating free-air temperature range, $C_L = 150 \text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	SN74HC590A				UNIT	
				$T_A = 25^\circ\text{C}$			MIN		MAX
				MIN	TYP	MAX			
t_{pd}	RCLK \uparrow	Q	2 V	100	300	380	ns		
			4.5 V	24	60	76			
			6 V	20	51	65			
t_{en}	\overline{OE}	Q	2 V	90	200	250	ns		
			4.5 V	23	40	50			
			6 V	19	34	43			
t_t		Q	2 V	45	210	265	ns		
			4.5 V	17	42	53			
			6 V	13	36	45			

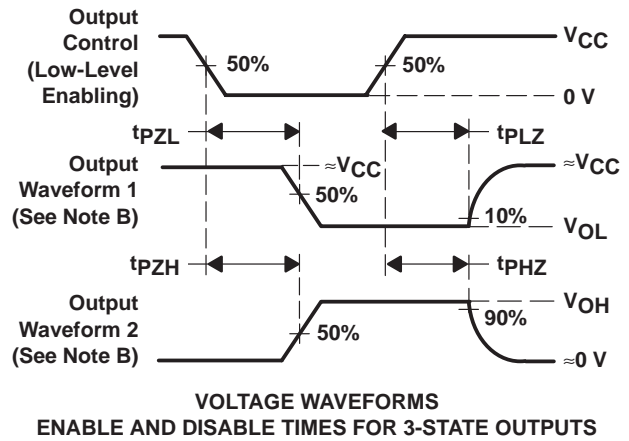
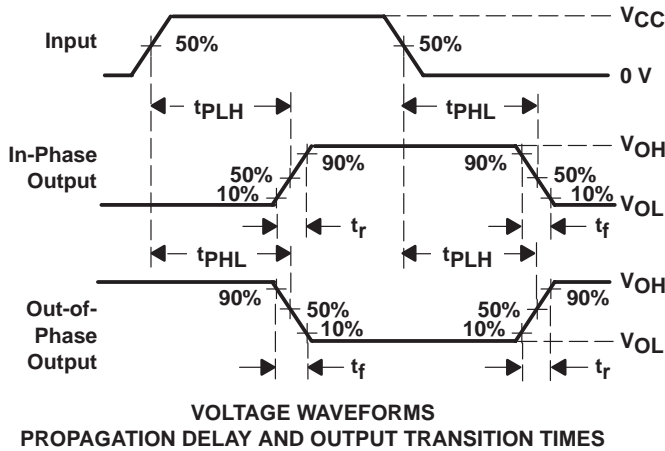
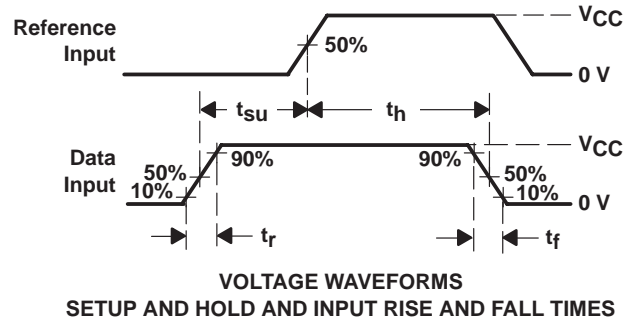
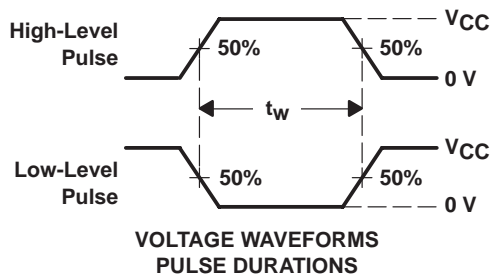
operating characteristics, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load	250	pF

PARAMETER MEASUREMENT INFORMATION



PARAMETER	R_L	C_L	S1	S2
t_{en}	1 k Ω	50 pF or 150 pF	Open	Closed
			Closed	Open
t_{dis}	1 k Ω	50 pF	Open	Closed
			Closed	Open
t_{pd} or t_t	--	50 pF or 150 pF	Open	Open



- NOTES: A. C_L includes probe and test-fixture capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 C. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r = 6$ ns, $t_f = 6$ ns.
 D. The outputs are measured one at a time with one input transition per measurement.
 E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 F. t_{PZL} and t_{PZH} are the same as t_{en} .
 G. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
5962-89603012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Call TI	
5962-8960301EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Call TI	
5962-8960301FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Call TI	
SN54HC590AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SN74HC590AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADTG4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590ADWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC590AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74HC590AN3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74HC590ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
SNJ54HC590AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54HC590AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SNJ54HC590AW	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	

⁽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.

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 SN54HC590A, SN74HC590A :

● Catalog: [SN74HC590A](#)

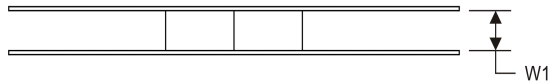
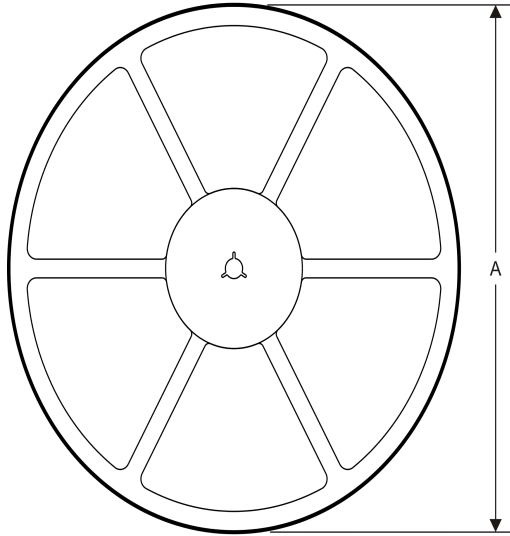
● Military: [SN54HC590A](#)

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
SN74HC590ADR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC590ADWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	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)
SN74HC590ADR	SOIC	D	16	2500	333.2	345.9	28.6
SN74HC590ADWR	SOIC	DW	16	2000	367.0	367.0	38.0

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:
- 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.

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.
 - C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- 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:
- 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.

DW (R-PDSO-G16)

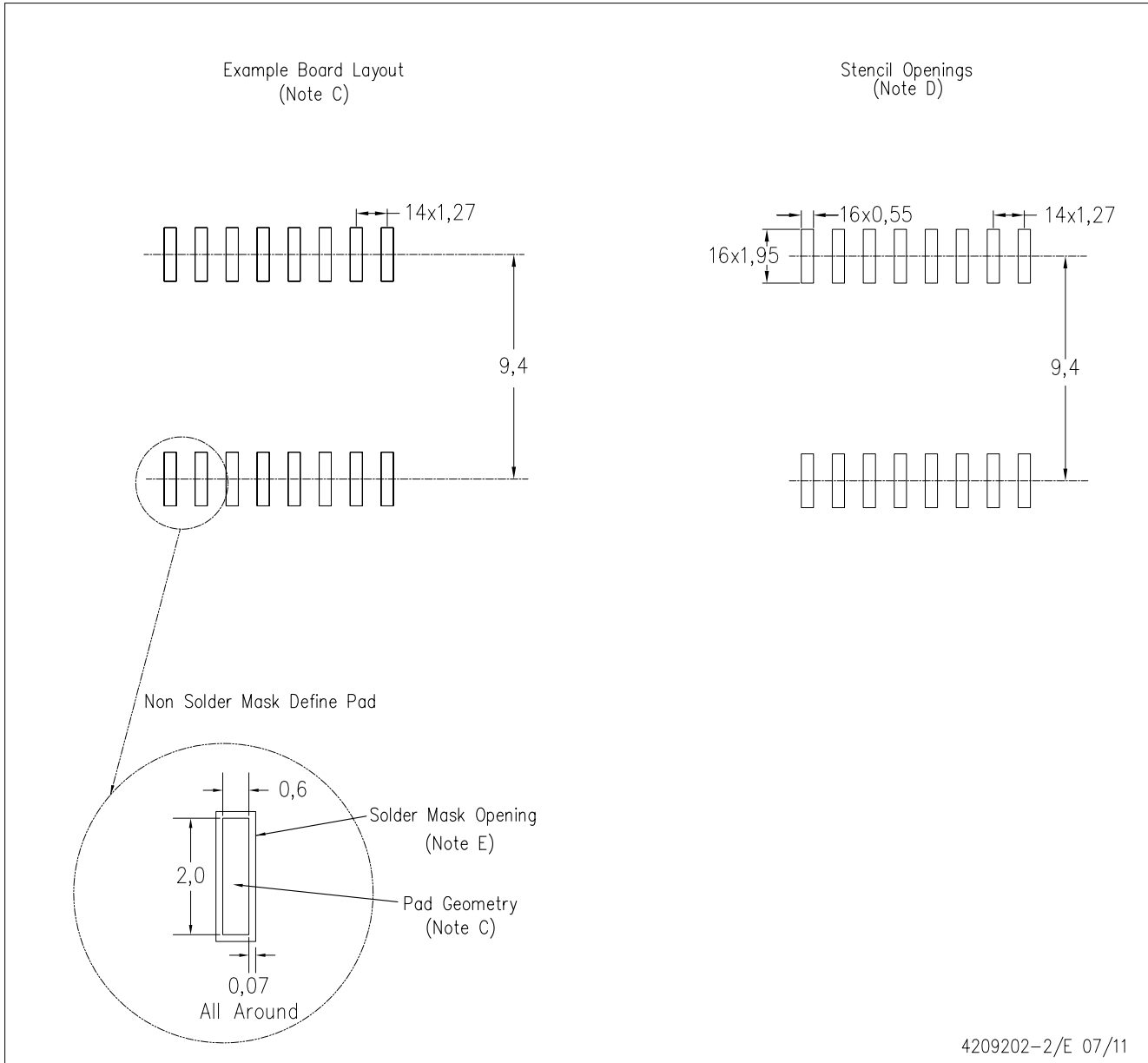
PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-013 variation AA.

DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4209202-2/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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46C and to discontinue any product or service per JESD48B. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information 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.

Reproduction of significant portions of TI information in TI data books or 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 altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community e2e.ti.com