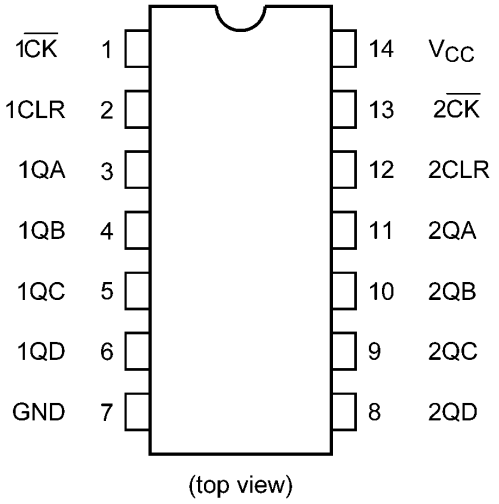
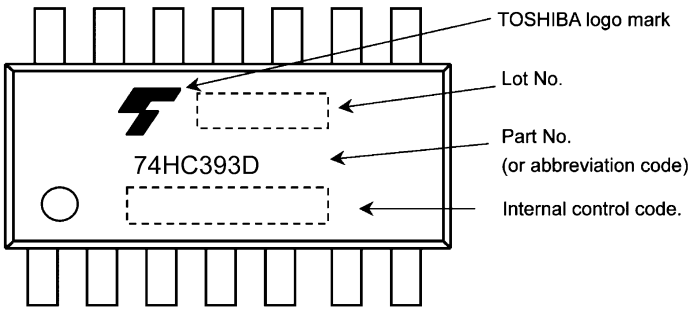
5. Pin Assignment

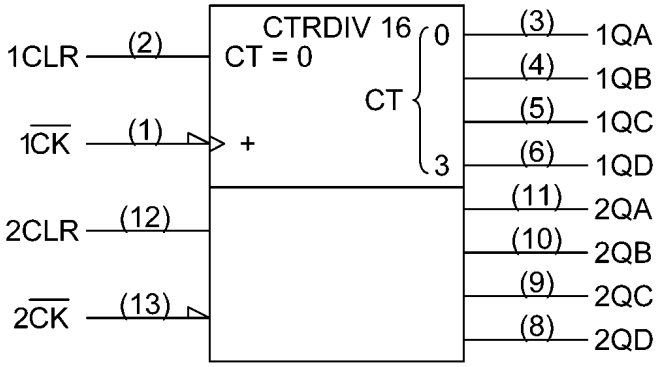


(top view)

6. Marking



7. IEC Logic Symbol

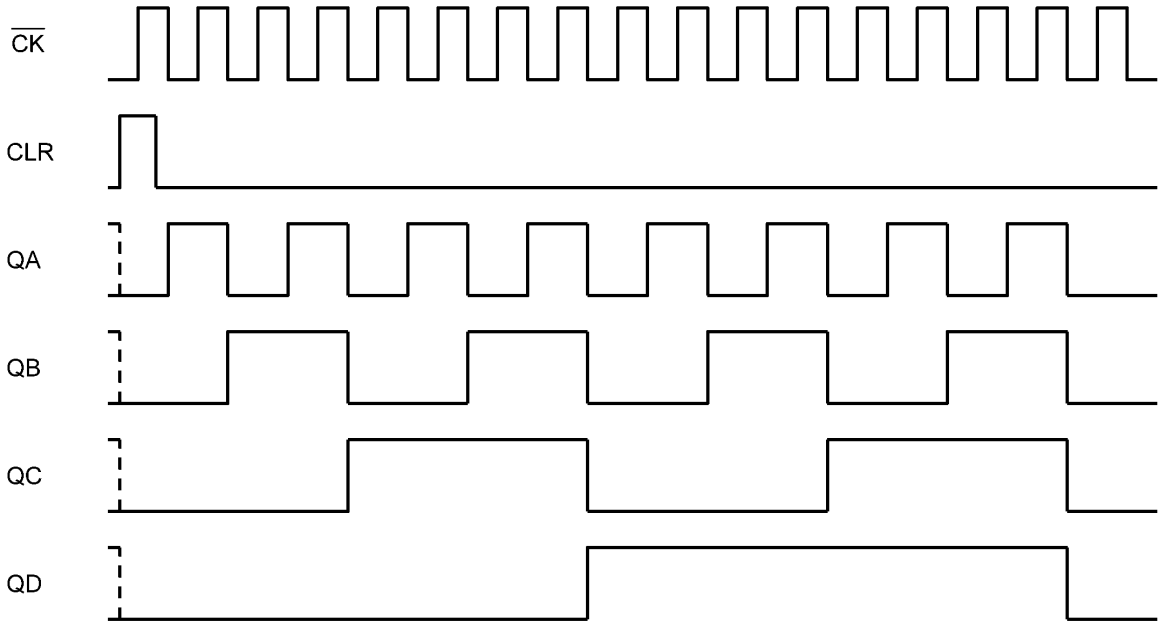


8. Truth Table

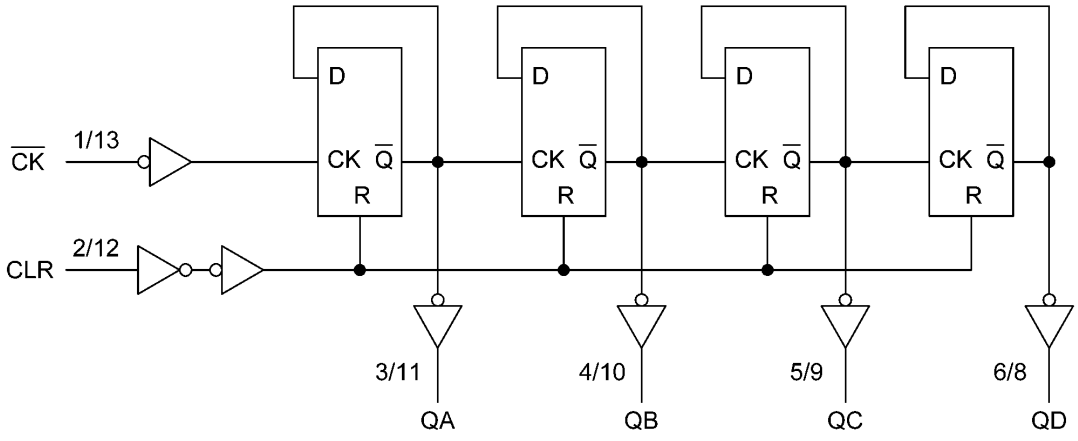
Inputs		Outputs			
$\overline{CK}$	CLR	QA	QB	QC	QD
X	H	L	L	L	L
↓	L	Count up			
↑	L	No change			

X: Don't care

9. Timing Diagrams



10. System Diagram



11. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CC}		-0.5 to 7.0	V
Input voltage	V_{IN}		-0.5 to V_{CC} + 0.5	V
Output voltage	V_{OUT}		-0.5 to V_{CC} + 0.5	V
Input diode current	I_{IK}		±20	mA
Output diode current	I_{OK}		±20	mA
Output current	I_{OUT}		±25	mA
V_{CC}/ground current	I_{CC}		±50	mA
Power dissipation	P_D	(Note 1)	500	mW
Storage temperature	T_{stg}		-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: P_D derates linearly with -8 mW/°C above 85 °C

12. Operating Ranges (Note)

Characteristics	Symbol	Test Condition	Note	Rating	Unit
Supply voltage	V_{CC}	—		2.0 to 6.0	V
Input voltage	V_{IN}	—		0 to V_{CC}	V
Output voltage	V_{OUT}	—		0 to V_{CC}	V
Operating temperature	T_{opr}	—	(Note 1)	-40 to 125	°C
Input rise and fall times	t_r,t_f	V_{CC} = 2.0 V		0 to 1000	ns
		V_{CC} = 4.5 V		0 to 500	
		V_{CC} = 6.0 V		0 to 400	

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

Note 1: Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

13. Electrical Characteristics

13.1. DC Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	—	V
				4.5	3.15	—	—	
				6.0	4.20	—	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.50	V
				4.5	—	—	1.35	
				6.0	—	—	1.80	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -20 μA	2.0	1.9	2.0	—	V
				4.5	4.4	4.5	—	
				6.0	5.9	6.0	—	
			I_{OH} = -4 mA	4.5	4.18	4.31	—	
			I_{OH} = -5.2 mA	6.0	5.68	5.80	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	2.0	—	0.0	0.1	V
				4.5	—	0.0	0.1	
				6.0	—	0.0	0.1	
			I_{OL} = 4 mA	4.5	—	0.17	0.26	
			I_{OL} = 5.2 mA	6.0	—	0.18	0.26	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	—	±0.1	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	—	4.0	μA

13.2. DC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	V
				4.5	3.15	—	
				6.0	4.20	—	
Low-level input voltage	V_{IL}	—		2.0	—	0.50	V
				4.5	—	1.35	
				6.0	—	1.80	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -20 μA	2.0	1.9	—	V
				4.5	4.4	—	
				6.0	5.9	—	
			I_{OH} = -4 mA	4.5	4.13	—	
			I_{OH} = -5.2 mA	6.0	5.63	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	2.0	—	0.1	V
				4.5	—	0.1	
				6.0	—	0.1	
			I_{OL} = 4 mA	4.5	—	0.33	
			I_{OL} = 5.2 mA	6.0	—	0.33	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	40.0	μA

13.3. DC Characteristics (Note) (Unless otherwise specified, T_a = -40 to 125 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	V
				4.5	3.15	—	
				6.0	4.20	—	
Low-level input voltage	V_{IL}	—		2.0	—	0.50	V
				4.5	—	1.35	
				6.0	—	1.80	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -20 μA	2.0	1.9	—	V
				4.5	4.4	—	
				6.0	5.9	—	
			I_{OH} = -4 mA	4.5	3.7	—	
			I_{OH} = -5.2 mA	6.0	5.2	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	2.0	—	0.1	V
				4.5	—	0.1	
				6.0	—	0.1	
			I_{OL} = 4 mA	4.5	—	0.4	
			I_{OL} = 5.2 mA	6.0	—	0.4	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	80.0	μA

Note: Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

13.4. Timing Requirements (Unless otherwise specified, T_a = 25 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Typ.	Limit	Unit
Minimum pulse width ($\overline{CK}$)	$t_{w(L)}$,$t_{w(H)}$	—	2.0	—	75	ns
			4.5	—	15	
			6.0	—	13	
Minimum pulse width (CLR)	$t_{w(H)}$	—	2.0	—	75	ns
			4.5	—	15	
			6.0	—	13	
Minimum removal time	t_{rem}	—	2.0	—	25	ns
			4.5	—	5	
			6.0	—	5	
Clock frequency	f	—	2.0	—	6	MHz
			4.5	—	32	
			6.0	—	38	

13.5. Timing Requirements (Unless otherwise specified, T_a = -40 to 85 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Limit	Unit
Minimum pulse width ($\overline{CK}$)	$t_{w(L)}$,$t_{w(H)}$	—	2.0	95	ns
			4.5	19	
			6.0	16	
Minimum pulse width (CLR)	$t_{w(H)}$	—	2.0	95	ns
			4.5	19	
			6.0	16	
Minimum removal time	t_{rem}	—	2.0	30	ns
			4.5	6	
			6.0	5	
Clock frequency	f	—	2.0	5	MHz
			4.5	27	
			6.0	32	

13.6. Timing Requirements (Note) (Unless otherwise specified, T_a = -40 to 125 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Limit	Unit
Minimum pulse width ($\overline{CK}$)	$t_{w(L)}$,$t_{w(H)}$	—	2.0	110	ns
			4.5	22	
			6.0	18	
Minimum pulse width (CLR)	$t_{w(H)}$	—	2.0	110	ns
			4.5	22	
			6.0	18	
Minimum removal time	t_{rem}	—	2.0	35	ns
			4.5	7	
			6.0	5	
Clock frequency	f	—	2.0	5	MHz
			4.5	24	
			6.0	28	

Note: Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

13.7. AC Characteristics
(Unless otherwise specified, C_L = 15 pF, V_{CC} = 5 V, T_a = 25 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Output transition time	t_{TLH},t_{THL}		—	—	4	8	ns
Propagation delay time ($\overline{CK}$-QA)	t_{PLH},t_{PHL}		—	—	12	20	ns
Propagation delay time ($\overline{CK}$-QB)	t_{PLH},t_{PHL}		—	—	16	31	ns
Propagation delay time ($\overline{CK}$-QC)	t_{PLH},t_{PHL}		—	—	21	38	ns
Propagation delay time ($\overline{CK}$-QD)	t_{PLH},t_{PHL}		—	—	25	46	ns
Propagation delay time (CLR-Qn)	t_{PHL}		—	—	15	26	ns
Maximum clock frequency	f_{MAX}		—	35	72	—	MHz

13.8. AC Characteristics
(Unless otherwise specified, C_L = 50 pF, T_a = 25 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
Output transition time	t_{TLH},t_{THL}		—	2.0	—	25	75	ns
				4.5	—	7	15	
				6.0	—	6	13	
Propagation delay time ($\overline{CK}$-QA)	t_{PLH},t_{PHL}		—	2.0	—	45	120	ns
				4.5	—	15	24	
				6.0	—	13	20	
Propagation delay time ($\overline{CK}$-QB)	t_{PLH},t_{PHL}		—	2.0	—	60	180	ns
				4.5	—	20	36	
				6.0	—	17	31	
Propagation delay time ($\overline{CK}$-QC)	t_{PLH},t_{PHL}		—	2.0	—	80	220	ns
				4.5	—	25	44	
				6.0	—	21	37	
Propagation delay time ($\overline{CK}$-QD)	t_{PLH},t_{PHL}		—	2.0	—	100	260	ns
				4.5	—	30	52	
				6.0	—	26	44	
Propagation delay time (CLR-Qn)	t_{PHL}		—	2.0	—	55	150	ns
				4.5	—	18	30	
				6.0	—	15	26	
Maximum clock frequency	f_{MAX}		—	2.0	6	22	—	MHz
				4.5	32	67	—	
				6.0	38	77	—	
Input capacitance	C_{IN}		—		—	5	10	pF
Power dissipation capacitance	C_{PD}	(Note 1)	—		—	40	—	pF

Note 1: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation.

$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2$ (per circuit)

13.9. AC Characteristics
(Unless otherwise specified, C_L = 50 pF, T_a = -40 to 85 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit
Output transition time	t_{TLH},t_{THL}	—	2.0	—	95	ns
			4.5	—	19	
			6.0	—	16	
Propagation delay time ($\overline{CK}$-QA)	t_{PLH},t_{PHL}	—	2.0	—	150	ns
			4.5	—	30	
			6.0	—	26	
Propagation delay time ($\overline{CK}$-QB)	t_{PLH},t_{PHL}	—	2.0	—	225	ns
			4.5	—	45	
			6.0	—	38	
Propagation delay time ($\overline{CK}$-QC)	t_{PLH},t_{PHL}	—	2.0	—	275	ns
			4.5	—	55	
			6.0	—	47	
Propagation delay time ($\overline{CK}$-QD)	t_{PLH},t_{PHL}	—	2.0	—	325	ns
			4.5	—	65	
			6.0	—	55	
Propagation delay time (CLR-Qn)	t_{PHL}	—	2.0	—	190	ns
			4.5	—	38	
			6.0	—	33	
Maximum clock frequency	f_{MAX}	—	2.0	5	—	MHz
			4.5	27	—	
			6.0	32	—	
Input capacitance	C_{IN}	—		—	10	pF

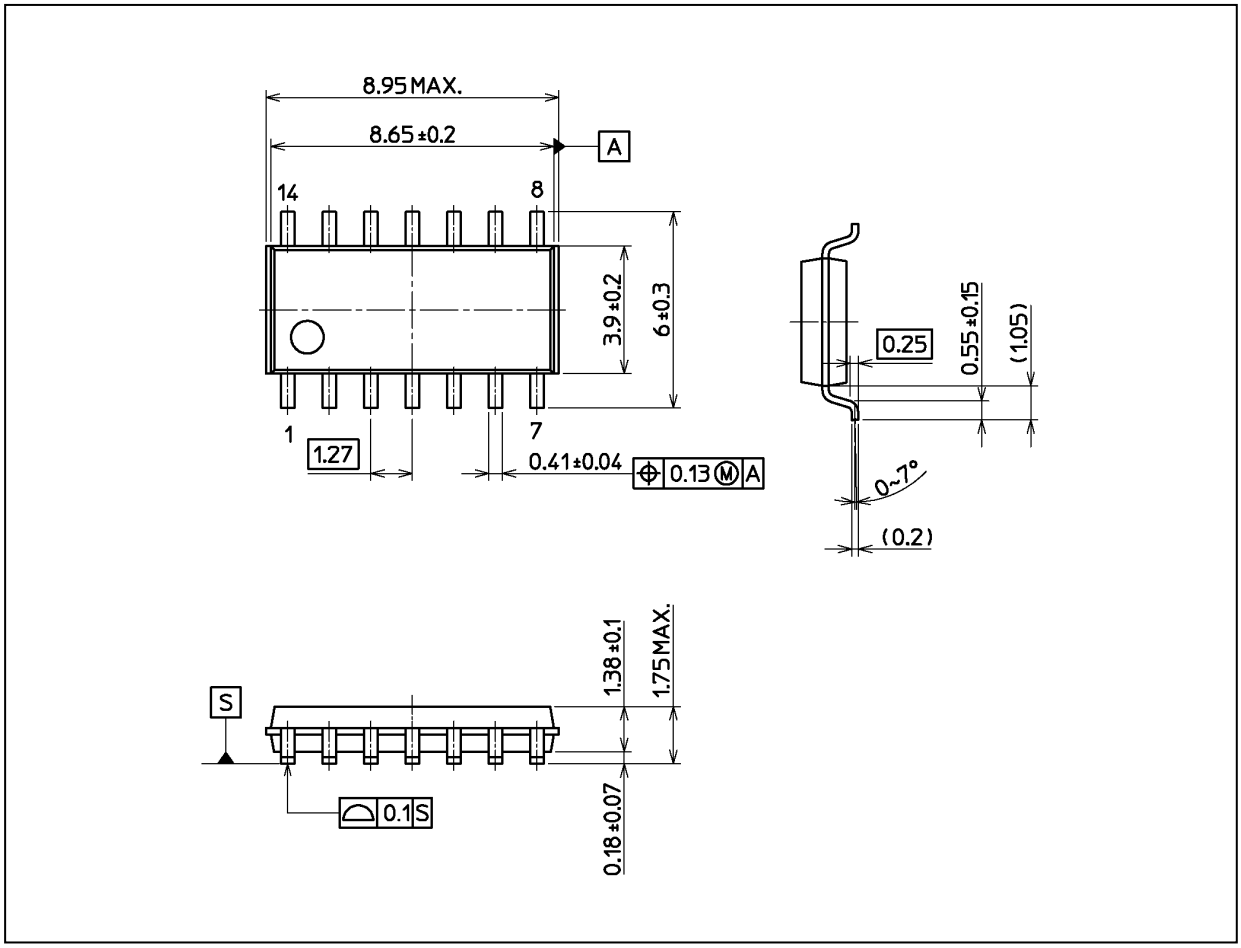
13.10. AC Characteristics (Note)
(Unless otherwise specified, C_L = 50 pF, T_a = -40 to 125 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit
Output transition time	t_{TLH},t_{THL}	—	2.0	—	110	ns
			4.5	—	22	
			6.0	—	18	ns
Propagation delay time ($\overline{CK}$-QA)	t_{PLH},t_{PHL}	—	2.0	—	170	ns
			4.5	—	34	
			6.5	—	30	
Propagation delay time ($\overline{CK}$-QB)	t_{PLH},t_{PHL}	—	2.0	—	255	ns
			4.5	—	51	
			6.0	—	43	
Propagation delay time ($\overline{CK}$-QC)	t_{PLH},t_{PHL}	—	2.0	—	315	ns
			4.5	—	63	
			6.0	—	54	
Propagation delay time ($\overline{CK}$-QD)	t_{PLH},t_{PHL}	—	2.0	—	370	ns
			4.5	—	74	
			6.0	—	63	
Propagation delay time (CLR-Qn)	t_{PHL}	—	2.0	—	220	ns
			4.5	—	44	
			6.0	—	38	
Maximum clock frequency	f_{MAX}	—	2.0	4	—	MHz
			4.5	24	—	
			6.0	28	—	
Input capacitance	C_{IN}	—		—	10	pF

Note: Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

Package Dimensions

Unit: mm



Weight: 0.13 g (typ.)

Package Name(s)
Nickname: SOIC14

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