National Semiconductor

PRELIMINARY
May 1987

DM54ALS590/DM74ALS590 8-Bit Binary Counter with Output Registers

General Description

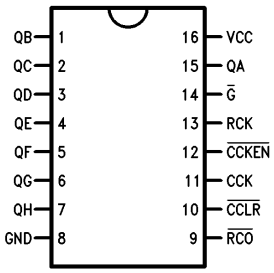
These devices each contain an 8-bit binary counter that feeds an 8-bit storage register. The storage register has parallel outputs. Separate clocks are provided for both the binary counter and the storage register. The binary counter features a direct clear input (CCLR) and a count enable input (CCKEN). For cascading, a ripple carry output (RCO) is provided. Expansion is easily accomplished for two stages by connecting RCO of the first stage to CCKEN of the second stage. Cascading for larger count chains can be accomplished by connecting RCO of each stage to CCK of the following stage.

Both the counter and register clocks are positive edge triggered. If the user wishes to connect both clocks together, the counter state will always be one count ahead of the register. Internal circuitry prevents clocking from the clock enable.

Features

- Advanced oxide-isolated ion-implanted Schottky TTL process
- Switching performance is guaranteed over full temperature and V_{CC} supply range

Connection Diagram



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Order Number DM54ALS590J or DM74ALS590M, N
See NS Package Number J16A, M16A or N16A

This document contains information on a product under development. NSC reserves the right to change or discontinue this product without notice.

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RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	7V
Voltage Applied to Disabled Output	5.5V
Operating Free-Air Temperature Range	
DM54ALS	−55°C to +125°C
DM74ALS	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: *The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.*

Recommended Operating Conditions

Symbol	Parameter		DM54ALS590			DM74ALS590			Units
			Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage		4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High Level Input Voltage		2			2			V
V_{IL}	Low Level Input Voltage				0.7			0.8	V
I_{OH}	High Level Output Current	$\overline{RCO}$			−1			−1	mA
		Q			−1			−2.6	
I_{OL}	Low Level Output Current	$\overline{RCO}$			8			16	mA
		Q			12			24	
f_{CCK}	Counter Clock Frequency		0			0			MHz
f_{RCK}	Register Clock Frequency		0			0			MHz
t_W (CCK)	Width of Counter Clock Pulse								ns
t_W ($\overline{CCLR}$)	Width of Counter Clear Pulse								ns
t_W (RCK)	Width of Register Clock Pulse								ns
t_{SU}	Setup Time	$\overline{CCKEN}$ Low before CCK P							ns
		$\overline{CCLR}$ Inactive before CCK P							
		CCK before RCK P (Note 1)							
t_H	Hold Time	$\overline{CCKEN}$ Low after CCK P							ns
T_A	Free Air Operating Temperature		−55		125	0		70	°C

Note 1: This setup time ensures the register will see stable data from the counter outputs. The clocks may be tied together in which case the register state will be one clock pulse behind the counter.

Electrical Characteristics over recommended free air temperature range

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_{IK}	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = 4.5 to 5.5V, I_{OH} = −0.4 mA		V_{CC} − 2			V
		V_{CC} = Min, I_{OH} = Max		2.4	3.2		
V_{OL}	Low Level Output Voltage	V_{CC} = Min	54/74ALS I_{OL} = 12 mA		0.25	0.4	V
			74ALS I_{OL} = 24 mA		0.35	0.5	
I_{OZH}	Off-State Output Current With High Level Voltage Applied	V_{CC} = Min, V_{IL} = Max, V_{IH} = Min, V_O = 2.7V				20	μA
I_{OZL}	Off-State Output Current With Low Level Voltage Applied	V_{CC} = Min, V_{IL} = Max, V_{IH} = Min, V_O = 0.4V				−20	μA

Electrical Characteristics over recommended free air temperature range (Continued)

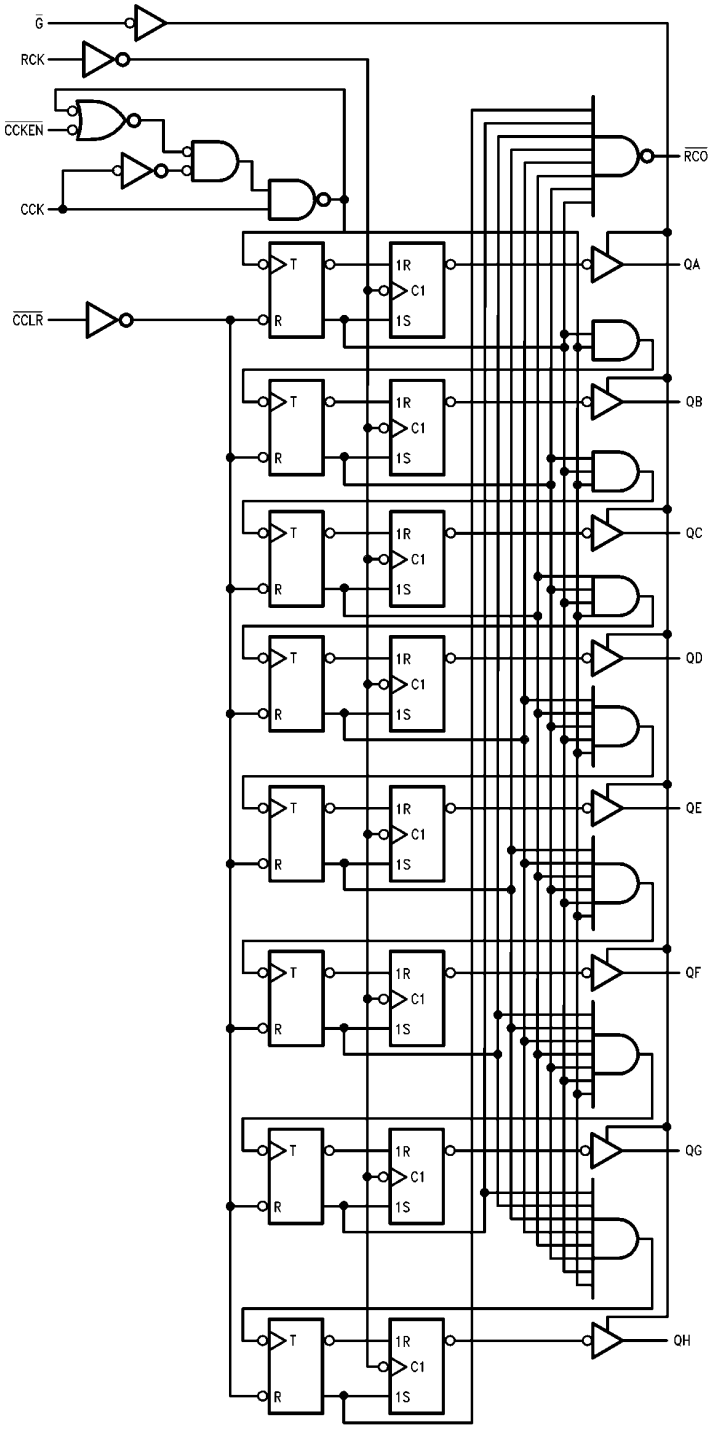
Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
I_I	Input Current at Max Input Voltage	V_{CC} = Max, V_I = 7V				100	μA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V				20	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V				−100	μA
I_O	Output Drive Current	V_{CC} = Max, V_O = 2.25V		−30		−112	mA
I_{CC}	Supply Current	V_{CC} = Max	Outputs High		33		mA
			Outputs Low		46		
			Outputs Disabled		44		

Switching Characteristics over recommended operating free air temperature range

Symbol	Parameter	Conditions	From (Input) To (Output)	DM54ALS590		DM74ALS590		Units
				Min	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	V_{CC} = 4.5 to 5.5V, R_L = 480 Ω, $R_1 = R_2$ = 500Ω, T_A = Min to Max	CCK to $\overline{RCO}$					MHz
t_{PLH}	Propagation Delay Time Low to High Level Output		CCK to $\overline{RCO}$					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		CCK to $\overline{RCO}$					ns
t_{PLH}	Propagation Delay Time Low to High Level Output		$\overline{CCLR}$ to $\overline{RCO}$					ns
t_{PLH}	Propagation Delay Time Low to High Level Output		RCK to Q					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		RCK to Q					ns
t_{PLH}	Propagation Delay Time Low to High Level Output		$\overline{G}$ to Q					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		$\overline{G}$ to Q					ns
t_{PZH}	Output Enable Time to High Level Output		$\overline{G}$ to Q					ns
t_{PZL}	Output Enable Time to Low Level Output		$\overline{G}$ to Q					ns
t_{PHZ}	Output Disable Time from High Level Output		$\overline{G}$ to Q					ns
t_{PLZ}	Output DisableTime from Low Level Output		$\overline{G}$ to Q					ns

Note 1: See Section 5 for test waveforms and output load.

Logic Diagram



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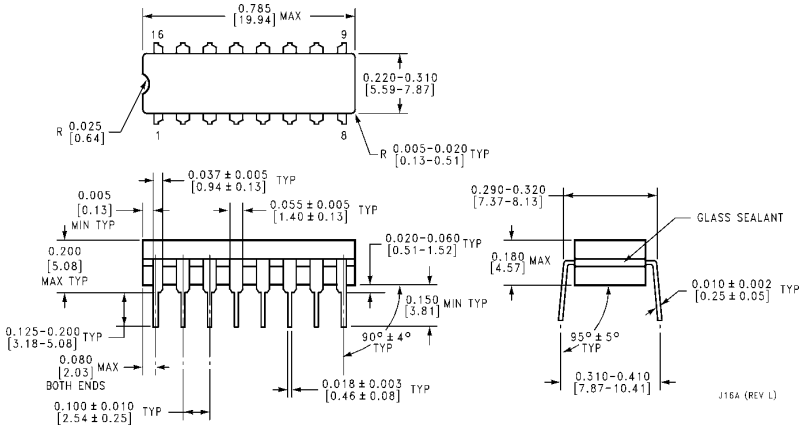
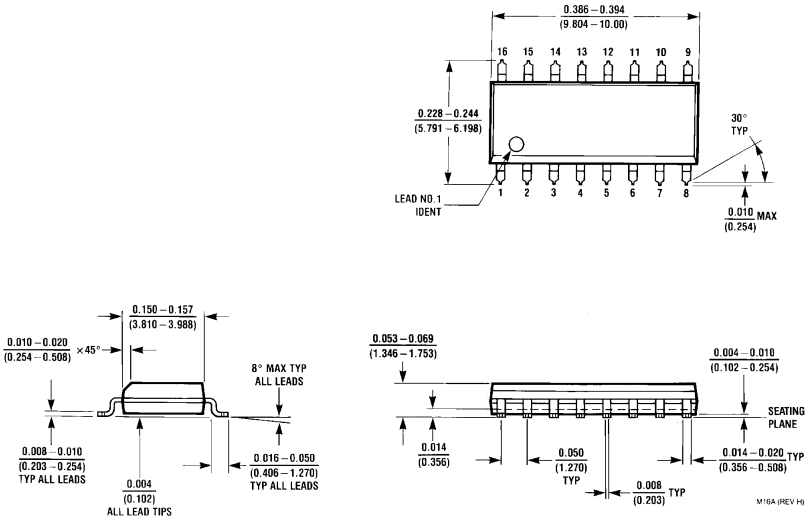
Physical Dimensions inches (millimeters)

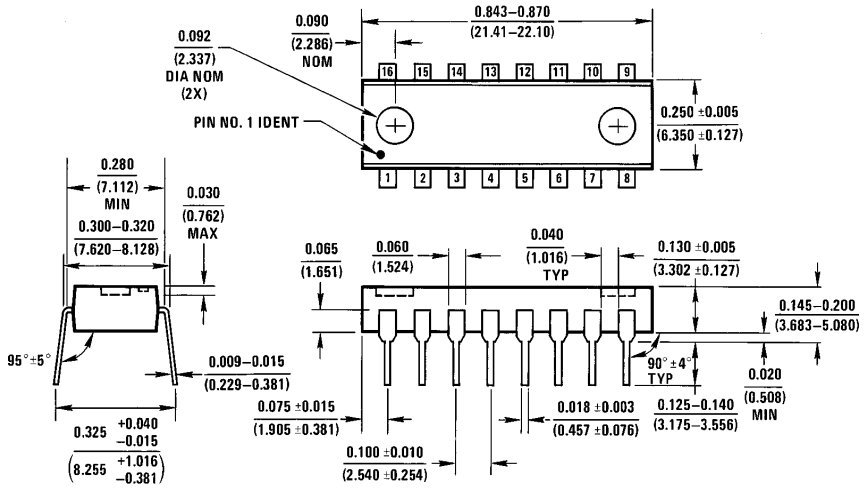


Ceramic Dual-In-Line Package (J)
Order Number DM54ALS590J
NS Package Number J16A



S.O. Package (M)
Order Number DM74ALS590M
NS Package Number M16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number DM74ALS590N
NS Package Number N16A

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