

## DM54LS461/DM74LS461 Octal Counter

### General Description

The LS461 is an 8-bit synchronous counter with parallel load, clear, and hold capability. Two function select inputs ( $I_0$ ,  $I_1$ ) provide one of four operations which occur synchronously on the rising edge of the clock (CK).

The LOAD operation loads the inputs ( $D_7$ – $D_0$ ) into the output register ( $Q_7$ – $Q_0$ ). The CLEAR operation resets the output register to all LOWs. The HOLD operation holds the previous value regardless of clock transitions. The INCREMENT operation adds one to the output register when the carry-in input is TRUE ( $\overline{CI} = \text{LOW}$ ), otherwise the operation is a HOLD. The carry-out ( $\overline{CO}$ ) is TRUE ( $\overline{CO} = \text{LOW}$ ) when the output register ( $Q_7$ – $Q_0$ ) is all HIGHs, otherwise FALSE ( $\overline{CO} = \text{HIGH}$ ).

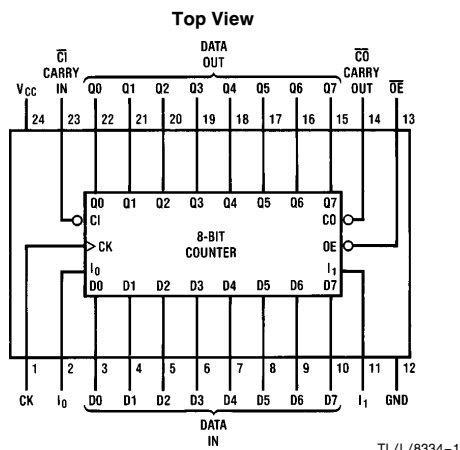
The output register ( $Q_7$ – $Q_0$ ) is enabled when  $\overline{OE}$  is LOW, and disabled (HI-Z) when  $\overline{OE}$  is HIGH. The output drivers will sink the 24 mA required for many bus interface standards.

Two or more LS461 octal counters may be cascaded to provide larger counters. The operation codes were chosen such that when  $I_1$  is HIGH,  $I_0$  may be used to select between LOAD and INCREMENT as in a program counter (JUMP/INCREMENT).

### Features/Benefits

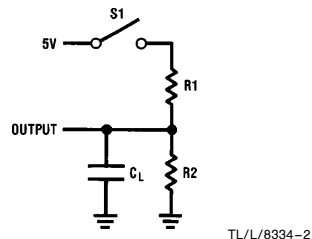
- Octal counter for microprogram-counter, DMA controller and general purpose counting applications
- 8 bits match byte boundaries
- Bus-structured pinout
- 24-pin Skinny Dip saves space
- TRI-STATE® outputs drive bus lines
- Low current PNP inputs reduce loading
- Expandable in 8-bit increments

### Connection Diagram



Order Number DM54LS461J,  
DM74LS461J or DM74LS461N  
See NS Package Number J24F or N24C

### Standard Test Load



### Function Table

$\overline{OE}$	CK	$I_1$	$I_0$	$\overline{CI}$	D7–D0	Q7–Q0	Operation
H	X	X	X	X	X	Z	HI-Z
L	↑	L	L	X	X	L	CLEAR
L	↑	L	H	X	X	Q	HOLD
L	↑	H	L	X	D	D	LOAD
L	↑	H	H	H	X	Q	HOLD
L	↑	H	H	L	X	Q plus 1	INCREMENT

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## Absolute Maximum Ratings

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

Supply Voltage  $V_{CC}$  7V  
Input Voltage 5.5V

Off-State Output Voltage  
Storage Temperature

5.5V  
– 65°C to + 150°C

## Operating Conditions

Symbol	Parameter	Military			Commercial			Units
		Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
$T_A$	Operating Free-Air Temperature	–55		125*	0		75	°C
$t_W$	Width of Clock	Low	40		35			ns
		High	30		25			
$t_{SU}$	Set Up Time	60			50			ns
$t_H$	Hold Time	0	–15		0	–15		

\*Case Temperature

## Electrical Characteristics Over Operating Conditions

Symbol	Parameter	Test Conditions		Min	Typ†	Max	Units
$V_{IL}$	Low-Level Input Voltage					0.8	V
$V_{IH}$	High-Level Input Voltage			2			V
$V_{IC}$	Input Clamp Voltage	$V_{CC} = \text{MIN}$	$I_I = -18 \text{ mA}$			–1.5	V
$I_{IL}$	Low-Level Input Current	$V_{CC} = \text{MAX}$	$V_I = 0.4 \text{ V}$			–0.25	mA
$I_{IH}$	High-Level Input Current	$V_{CC} = \text{MAX}$	$V_I = 2.4 \text{ V}$			25	μA
$I_I$	Maximum Input Current	$V_{CC} = \text{MAX}$	$V_I = 5.5 \text{ V}$			1	mA
$V_{OL}$	Low-Level Output Voltage	$V_{CC} = \text{MIN}$ $V_{IL} = 0.8 \text{ V}$ $V_{IH} = 2 \text{ V}$	MIL $I_{OL} = 12 \text{ mA}$	2.4		0.5	V
			COM $I_{OL} = 24 \text{ mA}$				
$V_{OH}$	High-Level Output Voltage	$V_{CC} = \text{MIN}$ $V_{IL} = 0.8 \text{ V}$ $V_{IH} = 2 \text{ V}$	MIL $I_{OH} = -2 \text{ mA}$	2.4			V
			COM $I_{OH} = -3.2 \text{ mA}$				
$I_{OZL}$	Off-State Output Current	$V_{CC} = \text{MAX}$ $V_{IL} = 0.8 \text{ V}$ $V_{IH} = 2 \text{ V}$	$V_O = 0.4 \text{ V}$			–100	μA
$I_{OZH}$			$V_O = 2.4 \text{ V}$			100	μA
$I_{OS}$	Output Short-Circuit Current*	$V_{CC} = 5.0 \text{ V}$	$V_{CC} = 0 \text{ V}$	–30		–130	mA
$I_{CC}$	Supply Current	$V_{CC} = \text{MAX}$			120	180	mA

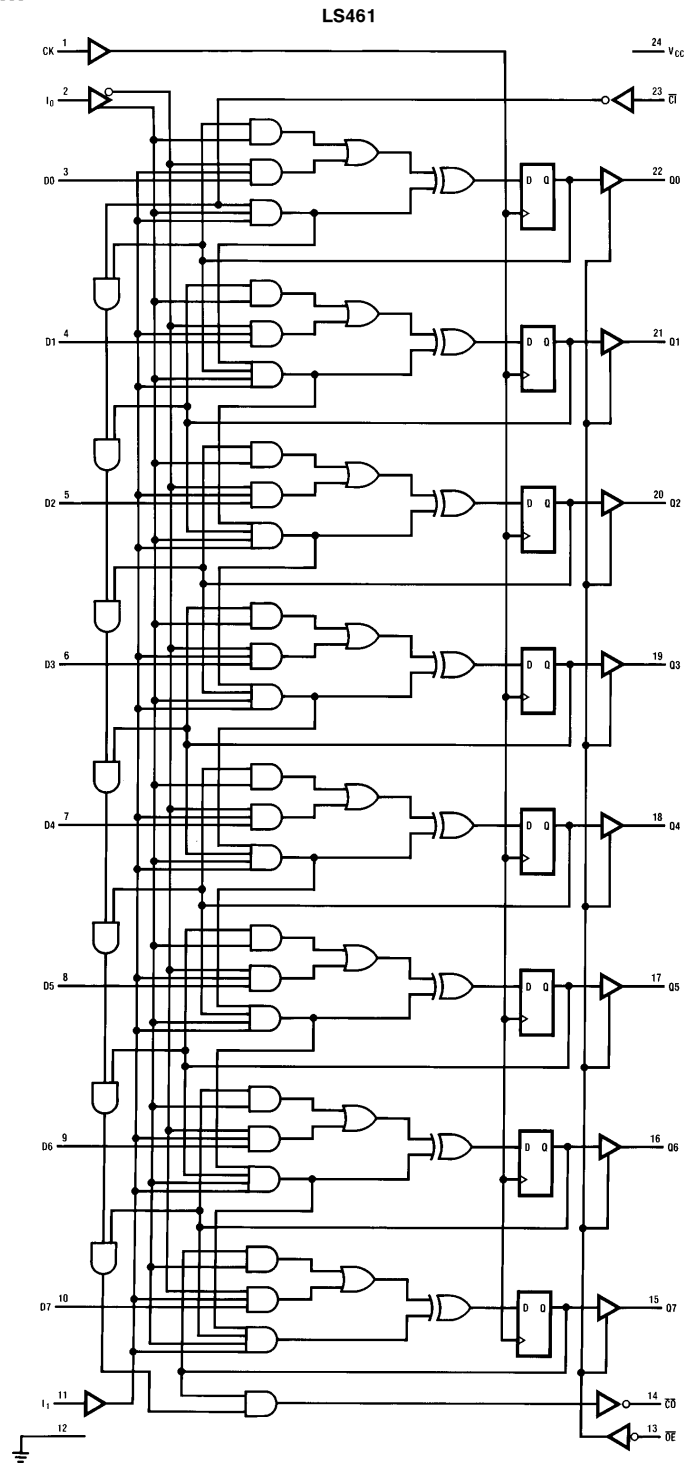
\*No more than one output should be shorted at a time and duration of the short-circuit should not exceed one second

† All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ \text{C}$ .

## Switching Characteristics Over Operating Conditions

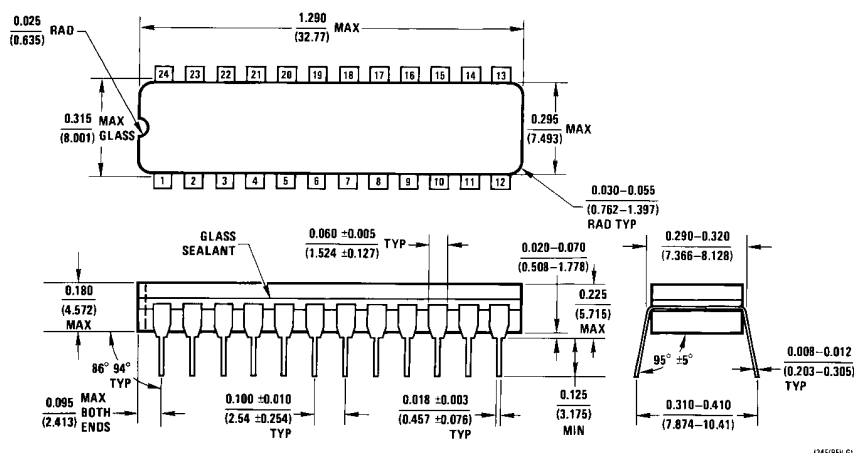
Symbol	Parameter	Test Conditions (See Test Load)	Military			Commercial			Units
			Min	Typ	Max	Min	Typ	Max	
$f_{MAX}$	Maximum Clock Frequency	$C_L = 50 \text{ pF}$ $R_1 = 200 \Omega$ $R_2 = 390 \Omega$	10.5			12.5			MHz
$t_{PD}$	$\overline{CB}\overline{I}$ to $\overline{CB}\overline{O}$ Delay			35	60		35	50	ns
$t_{PD}$	Clock to Q			20	35		20	30	ns
$t_{PD}$	Clock to $\overline{CO}$			55	95		55	80	ns
$t_{PZX}$	Output Enable Delay			35	55		35	45	ns
$t_{PXZ}$	Output Disable Delay			35	55		35	45	ns

# Logic Diagram

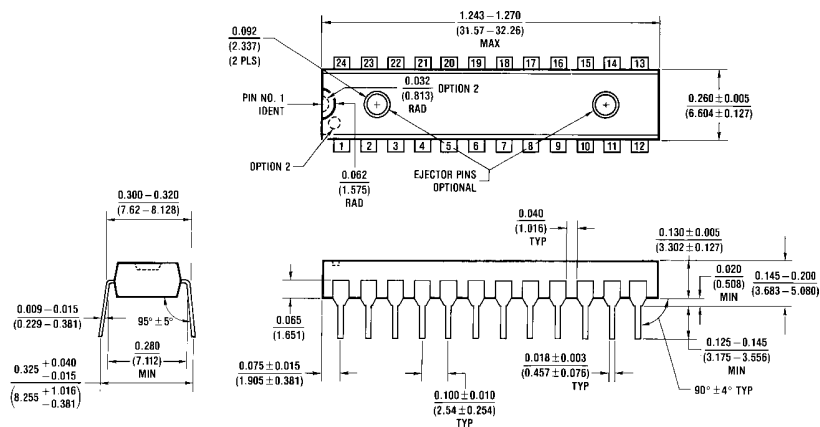


TL/L/8334-3

### Physical Dimensions inches (millimeters)



**24-Pin Narrow Ceramic Dual-In-Line Package (J)**  
**Order Number DM54LS461J or DM74LS461J**  
**NS Package J24F**



**24-Pin Narrow Plastic Dual-In-Line Package (N)**  
**Order Number DM74LS461N**  
**NS Package N24C**

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