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DM74121

One-Shot with Clear and Complementary Outputs

General Description

The DM74121 is a monostable multivibrator featuring both positive and negative edge triggering with complementary outputs. An internal $2k\Omega$ timing resistor is provided for design convenience minimizing component count and layout problems. this device can be used with a single external capacitor. Inputs (A) are active-LOW trigger transition inputs and input (B) is and active-HIGH transition Schmitttrigger input that allows jitter-free triggering from inputs with transition rates as slow as 1 volt/second. A high immunity to V_{CC} noise of typically 1.5V is also provided by internal circuitry at the input stage.

To obtain optimum and trouble free operation please read operating rules and one-shot application notes carefully and observe recommendations

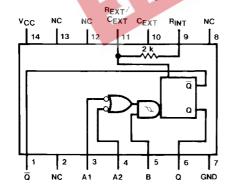
Features

- Triggered from active-HIGH transition or active-LOW transition inputs
- Variable pulse width from 30 ns to 28 seconds
- Jitter free Schmitt-trigger input
- Excellent noise immunity typically 1.2V
- Stable pulse width up to 90% duty cycle
- TTL, DTL compatible
- Compensated for V_{CC} and temperature variations
- Input clamp diodes

Ordering Code:

Order Number	Package Number	Package Description	
DM74121N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide	

Connection Diagram



Function Table

	Inputs		Out	puts
A1	A2	В	Q	Q
L	Х	Н	L	Н
Х	L	Н	L	Н
Х	Х	L	L	Н
Н	Н	Х	L	Н
Н	\downarrow	Н	7	7
\downarrow	Н	Н	7	7
\downarrow	\downarrow	Н	7	ъ
L	Х	1	7	7
Х	L	1	л.	ъ

- H = HIGH Logic Level
- = Positive Going Transition L = LOW Logic Level ↓ = Negative Going Transition
- X = Can Be Either LOW or HIGH

 __ = A Positive Pulse
- ¬∟ = A Negative Pulse

Functional Description

The basic output pulse width is determined by selection of an internal resistor $\boldsymbol{R}_{\text{INT}}$ or an external resistor $(\boldsymbol{R}_{\boldsymbol{X}})$ and capacitor (Cx). Once triggered the output pulse width is independent of further transitions of the inputs and is function of the timing components. Pulse width can vary from a

few nano-seconds to 28 seconds by choosing appropriate $R_{\boldsymbol{X}}$ and $C_{\boldsymbol{X}}$ combinations. There are three trigger inputs from the device, two negative edge-triggering (A) inputs, one positive edge Schmitt-triggering (B) input.

Operating Rules

- 1. To use the internal 2 $k\Omega$ timing resistor, connect the R_{INT} pin to $V_{CC}.$
- 2. An external resistor (R_X) or the internal resistor $(2 \text{ k}\Omega)$ and an external capacitor (C_X) are required for proper operation. The value of C_X may vary from 0 to any necessary value. For small time constants use high-quality mica, glass, polypropylene, polycarbonate, or polystyrene capacitors. For large time constants use solid tantalum or special aluminum capacitors. If the timing capacitors have leakages approaching 100 nA or if stray capacitance from either terminal to ground is greater than 50 pF the timing equations may not represent the pulse width the device generates.
- 3. The pulse width is essentially determined by external timing components R_X and C_X . For $C_X < 1000$ pF see Figure 1 design curves on t_W as function of timing components value. For $C_X > 1000$ pF the output is defined as:

$$\begin{split} t_W &= K \; R_X \; C_X \\ \text{where} \; [R_X \; \text{is in Kilo-ohm}] \\ & [C_X \; \text{is in pico Farad}] \\ & [t_W \; \text{is in nano second}] \end{split}$$

[K ≈ 0.7]

- If C_X is an electrolytic capacitor a switching diode is often required for standard TTL one-shots to prevent high inverse leakage current Figure 2.
- Output pulse width versus V_{CC} and operation temperatures: Figure 3 depicts the relationship between pulse width variation versus V_{CC}. Figure 4 depicts pulse width variation versus ambient temperature.
- The "K" coefficient is not a constant, but varies as a function of the timing capacitor C_X. Figure 5 details this characteristic.
- 7. Under any operating condition C_X and R_X must be kept as close to the one-shot device pins as possible to minimize stray capacitance, to reduce noise pick-up, and to reduce I X R and Ldi/dt voltage developed along their connecting paths. If the lead length from C_X to pins (10) and (11) is greater than 3 cm, for example, the output pulse width might be quite different from values predicted from the appropriate equations. A non-inductive and low capacitive path is necessary to ensure complete discharge of C_X in each cycle of its operation so that the output pulse width will be accurate.
- 8. V_{CC} and ground wiring should conform to good high-frequency standards and practices so that switching transients on the V_{CC} and ground return leads do not cause interaction between one-shots. A 0.01 μF to 0.10 μF bypass capacitor (disk ceramic or monolithic type) from V_{CC} to ground is necessary on each device. Furthermore, the bypass capacitor should be located as close to the V_{CC} -pin as space permits.

For further detailed device characteristics and output performance please refer to the one-shot application note, AN-366.

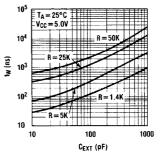


FIGURE 1.

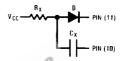


FIGURE 2.

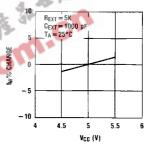
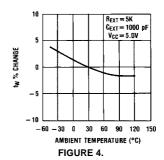
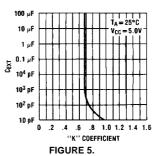


FIGURE 3.





Absolute Maximum Ratings(Note 1)

Supply Voltage 7V Input Voltage 5.5V Operating Free Air Temperature Range 0° C to +70 $^{\circ}$ C Storage Temperature Range -65° C to +150 $^{\circ}$ C

Note 1: 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 tables 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		Min	Nom	Max	Units
V _{CC}	Supply Voltage		4.75	5	5.25	V
V_{T+}	Positive-Going Input Threshold Voltage			1.4	2	V
	at the A Input (V _{CC} = Min)			1.4	2	V
V_{T-}	Negative-Going Input Threshold Voltage)	0.8	1.4		V
	at the A Input (V _{CC} = Min)		0.6	1.4		V
V_{T+}	Positive-Going Input Threshold Voltage			1.5	2	V
	at the B Input (V _{CC} = Min)			1.3	2	V
V_{T-}	Negative-Going Input Threshold Voltage	3	0.8	1.3		V
	at the B Input (V _{CC} = Min)	.0.	0.0	1.3		V
I _{OH}	HIGH Level Output Current	20 13	-0		-0.4	mA
I _{OL}	LOW Level Output Current	N. Cal	417		16	mA
t _W	Input Pulse Width (Note 2)		40			ns
dV/dt	Rate of Rise or Fall of				1	V/s
	Schmidt Input (B) (Note 2)				ļ	V/5
dV/dt	Rate of Rise or Fall of				1	V/µs
	Schmidt Input (A) (Note 2)				ı	ν/μ5
R _{EXT}	External Timing Resistor (Note 2)		1.4		40	kΩ
C _{EXT}	External Timing Capacitance (Note 2)		0		1000	μF
DC	Duty Cycle (Note 2)	$R_T = 2 k\Omega$			67	%
		$R_T = R_{EXT} (Max)$			90	/0
T _A	Free Air Operating Temperature		0		70	°C

Note 2: T_A = 25°C and V_{CC} = 5V

Electrical Characteristics

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

Symbol	Parameter	Conditions		Min	Typ (Note 3)	Max	Units
VI	Input Clamp Voltage	$V_{CC} = Min, I_I = -12 \text{ mA}$				-1.5	V
V _{OH}	HIGH Level Output	V _{CC} = Min, I _{OH} = Max,		2.4	3.4		V
	Voltage	$V_{IL} = Max, V_{IH} = Min$		2.4	3.4		V
V _{OL}	LOW Level Output	$V_{CC} = Min, I_{OL} = Max,$			0.2	0.4	V
	Voltage	$V_{IH} = Max, V_{IL} = Min$			0.2	0.4	V
I	Input Current @	// - Mov // - F F//				1	mA
	Max Input Voltage	$V_{CC} = Max, V_1 = 5.5V$ 1	'	IIIA			
I _{IH}	HIGH Level	$V_{CC} = Max$,	A1, A2			40	
	Input Current	$V_I = 2.4V$	В			80	μΑ
I _{IL}	LOW Level	$V_{CC} = Max$,	A1, A2			-1.6	mA
	Input Current	$V_I = 0.4V$	В			-3.2	IIIA
Ios	Short Circuit Output Current	V _{CC} = Max (Note 4)	•	-18		-55	mA
I _{CC}	Supply Current	V _{CC} = Max	Quiescent		13	25	mA
			Triggered		23	40	111/2

Note 3: All typicals are at $V_{CC} = 5V$, $T_A = 25^{\circ}C$.

Note 4: Not more than one output should be shorted at a time.

Symbol	Parameter	From (Input)	Conditions		Max	
Symbol	Parameter	To (Output)	Conditions	Min		Un
t _{PLH}	Propagation Delay Time	A1, A2	C _{EXT} = 80 pF		70	
	LOW-to-HIGH Level Output	to Q	R _{INT} to V _{CC}		70	
t _{PLH}	Propagation Delay Time	B to	C _L = 15 pF		55	
	LOW-to-HIGH Level Output	Q	$R_L = 400\Omega$		33	
t _{PHL}	Propagation Delay Time	A1, A2	1		80	
	HIGH-to-LOW Level Output	to Q			00	
t _{PHL}	Propagation Delay Time	В	1		65	
	HIGH-to-LOW Level Output	to Q			00	
t _{W(OUT)}	Output Pulse	A1, A2 or B	C _{EXT} = 80 pF			
	Width Using the	to Q, \overline{Q}	R _{INT} to V _{CC}	70	150	
	Internal Timing Resistor		$R_L = 400\Omega$	70	150	ı
			C _L = 15 pF			
t _{W(OUT)}	Output Pulse	A1, A2	C _{EXT} = 0 pF			
	Width Using Zero	to Q, \overline{Q}	R _{INT} to V _{CC}		50	
	Timing Capacitance		$R_L = 400\Omega$		30	
			$C_L = 15 pF$	-4		
t _{W(OUT)}	Output Pulse	A1, A2	C _{EXT} = 100pF	110		
	Width Using External	to Q, Q	$R_{INT} = 10 \text{ k}\Omega$	600	800	
	Timing Resistor	100	$R_L = 400\Omega$	000	000	
			C _L = 15pF			
		A1, A2	C _{EXT} = 1 μF			
		to Q, \overline{Q}	$R_{INT} = 10 \text{ k}\Omega$	6	8	
			$R_L = 400\Omega$	U	U	
			C _L = 15 pF			

Physical Dimensions inches (millimeters) unless otherwise noted 0.740 - 0.770 (18.80 - 19.56)(2.286) 14 13 12 14 13 12 11 10 9 8 INDEX AREA 0.250 ± 0.010 (6.350 ± 0.254) PIN NO. 1 PIN NO. 1 IDENT 1 2 3 4 5 6 7 1 2 3 $\frac{0.092}{(2.337)}$ DIA $\frac{0.030}{(0.762)}$ MAX OPTION 02 0.135 ± 0.005 $\frac{0.300 - 0.320}{(7.620 - 8.128)}$ (3.429 ± 0.127) 0.065 $\frac{0.145 - 0.200}{(3.683 - 5.080)}$ 0.060 (1.524) 4° TYP Optional (1.651)¥ $\frac{0.008 - 0.016}{(0.203 - 0.406)} \text{ TYP}$ (0.508)0.125 - 0.150 (3.175 - 3.810) 0.014-0.023 TYP $\frac{0.100 \pm 0.010}{(2.540 \pm 0.254)}$ TYP (0.356 - 0.584)0.050 ± 0.010 (1.270 - 0.254) TYP 0.325 + 0.040 - 0.015 $8.255 + 1.016 \\ -0.381$ N14A (REV F)

14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N14A

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