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## NTE978/NTE978C/NTE978SM Integrated Circuit Dual Timer

### **Description:**

The NTE978 series dual timing circuit is a highly stable controller capable of producing accurate time delays or oscillation. The NTE978 is a dual NTE955. Timing is provided by an external resistor and capacitor for each timing function. The two timers operate independently of each other sharing only  $V_{CC}$  and GND. The circuits may be triggered and reset on falling waveforms. The output structures may sink or source 200mA.

### **Features:**

- Direct Replacement for 556 Timers
- Replaces Two 555 Timers (NTE955M)
- Timing from Microseconds through Hours
- Operates in both Astable and Monostable Modes
- Adjustable Duty Cycle
- Output can Source or Sink 200mA
- Output and Supply TTL Compatible
- Temperature Stability better than 0.005% per °C
- Normally On and Normally Off Output
- Available in Three Types:
  - NTE978 14-Lead DIP
  - NTE978C 14-Lead DIP (CMOS)
  - NTE978SM SOIC-14 (Surface Mount)

### **Applications:**

- Precision Timing
- Pulse Generation
- Sequential Timing
- Time Delay Generation
- Pulse Width Modulation
- Pulse Position Modulation
- Linear Ramp Generator

### **Absolute Maximum Ratings:**

Supply Voltage,  $V_{CC}$  ..... +18V  
 Power Dissipation (Note 1),  $P_D$  ..... 1620mW  
 Operating Temperature Range,  $T_A$  ..... 0° to +70°C  
 Storage Temperature Range,  $T_{stg}$  ..... -65° to +150°C  
 Lead Temperature (During Soldering, 10sec Max),  $T_L$  ..... +260°C

Note 1. For operating at elevated temperatures the device must be derated based on a +150°C maximum junction temperature and a thermal resistance of +77°C/W for NTE978 and NTE978C and +110°C/W for NTE978SM.

**Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = +5\text{V}$  to  $+15\text{V}$ , unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$			4.5	–	16	V
Supply Current (Each Timer Section)	$I_{CC}$	Low State, Note 2	$V_{CC} = 5\text{V}$ , $R_L = \infty$	–	3	6	mA
			$V_{CC} = 15\text{V}$ , $R_L = \infty$	–	10	14	mA
Timing Error, Monostable Initial Accuracy		$R_A = 1\text{k}$ to $100\text{k}\pm$ , $C = 0.1^\circ\text{F}$ , Note 3		–	0.75	–	%
Drift with Temperature				–	50	–	ppm/ $^\circ\text{C}$
Accuracy over Temperature				–	1.5	–	%
Drift with Supply				–	0.1	–	%/V
Timing Error, Astable Initial Accuracy		$R_A, R_B = 1\text{k}$ to $100\text{k}\pm$ , $C = 0.1^\circ\text{F}$ , Note 3		–	2.25	–	%
Drift with Temperature				–	150	–	ppm/ $^\circ\text{C}$
Accuracy over Temperature				–	3.0	–	%
Drift with Supply				–	0.30	–	%/V
Trigger Voltage	$V_T$	$V_{CC} = 15\text{V}$		4.5	5.0	5.5	V
		$V_{CC} = 5\text{V}$		1.25	1.67	2.0	V
Trigger Current	$I_T$			–	0.2	1.0	$^\circ\text{A}$
Reset Voltage	$V_R$	Note 4		0.4	0.5	1.0	V
Reset Current	$I_R$			–	0.1	0.6	mA
Threshold Current	$I_{TH}$	$V_{TH} = V\text{-Control}$ , Note 5		–	0.03	0.1	$^\circ\text{A}$
		$V_{TH} = 11.2\text{V}$		–	–	250	nA
Control Voltage Level and Threshold Voltage	$V_{CL}$ $V_{TH}$	$V_{CC} = 15\text{V}$		9	10	11	V
		$V_{CC} = 5\text{V}$		2.6	3.33	4.0	V
Pin1, Pin13 Leakage Output High	$I_{dis}$			–	1	100	nA
Pin1, Pin13 Saturation Output Low		Note 6	$V_{CC} = 15\text{V}$ , $I = 15\text{mA}$	–	180	300	mV
			$V_{CC} = 4.5\text{V}$ , $I = 4.5\text{mA}$	–	80	200	mV
Output Voltage Drop (Low)	$V_{OL}$	$V_{CC} = 15\text{V}$	$I_{SINK} = 10\text{mA}$	–	0.1	0.25	V
			$I_{SINK} = 50\text{mA}$	–	0.4	0.75	V
			$I_{SINK} = 100\text{mA}$	–	2.0	2.75	V
			$I_{SINK} = 200\text{mA}$	–	2.5	–	V
		$V_{CC} = 5\text{V}$	$I_{SINK} = 5\text{mA}$	–	0.25	0.35	V
Output Voltage Drop (High)	$V_{OH}$	$V_{CC} = 15\text{V}$	$I_{SOURCE} = 200\text{mA}$	–	12.5	–	V
			$I_{SOURCE} = 100\text{mA}$	12.75	13.3	–	V
		$V_{CC} = 5\text{V}$		2.75	3.3	–	V
Rise Time of Output	$t_{OLH}$			–	100	–	ns
Fall Time of Output	$t_{OHL}$			–	100	–	ns
Matching Characteristics Initial Timing Accuracy		Note 7		–	0.1	2.0	%
Timing Drift with Temperature				–	$\pm 10$	–	ppm/ $^\circ\text{C}$
Drift with Supply Voltage				–	0.2	0.5	%/V

Note 2. Supply current when output high typically 1mA less at  $V_{CC} = 5V$ .

Note 3. Tested at  $V_{CC} = 5V$  and  $V_{CC} = 15V$ .

Note 4. As reset voltage lowers, timing is inhibited and then the output goes low.

Note 5. This will determine the maximum value of  $R_A + R_B$  for 15V operation. The maximum total ( $R_A + R_B$ ) is  $20M_{\pm}$ .

Note 6. No protection against excessive Pin1, Pin13 current is necessary providing the package dissipation rating will not be exceeded.

Note 7. Matching characteristics refer to, the difference between performance characteristics of each timer section.

