



**ELECTRONICS, INC.**  
 44 FARRAND STREET  
 BLOOMFIELD, NJ 07003  
 (973) 748-5089

## **NTE7096 & NTE7097 Integrated Circuit Current Mode Pulse Width Modulator (PWM) Control Circuit**

**Description:**

The NTE7096 and NTE7097 are integrated circuits in 8-Lead DIP type packages that incorporate a new precision temperature-controlled oscillator with an internally trimmed discharge current to minimize variations in frequency. A precision duty-cycle clamp eliminates any need for an external oscillator when at, or near, a 50% duty-cycle condition. Duty-cycles greater than 50% are also possible. Special logic ensures that  $V_{ref}$  is stabilized before the output stage is enabled. Ion-implant resistors provide tighter control of under-voltage lockout.

Other features include low start-up current, pulse-by-pulse current limiting, and high-current totem pole output for driving capacitive loads, such as the gate of a power MOSFET. The output is low in the off state, consistent with N-channel devices.

**Features:**

- Optimized for Off-Line Control
- Internally Trimmed Temperature Compensated Oscillator
- Maximum Duty-Cycle Clamp
- $V_{ref}$  Stabilized before Output Stage is Enabled
- Low Start-Up Current
- Pulse-by-Pulse Current Limiting
- Improved U/V Lockout
- Double Pulse Suppression
- 1% Trimmed Bandgap Reference
- High Current Totem Pole Output

**Absolute Maximum Ratings:**

Supply Voltage ( $I_{CC} < 30mA$ )	Self Limiting
Supply Voltage (Low Impedence Source)	30V
Output Current	$\pm 1A$
Output Energy (Capacitive Load)	5 $\mu$ J
Analog Inputs (Pin2, Pin3)	-0.3V to $V_{CC}$
Error Amp Output Sink Current	10mA

**Electrical Characteristics:** ( $0^{\circ} \leq T_A \leq +70^{\circ}\text{C}$ ,  $V_{CC} = 15\text{V}$ ,  $R_t = 680\Omega$ ,  $C_t = .022\mu\text{F}$ , Note 1 unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Reference Section</b>					
Output Voltage	$T_J = +25^{\circ}\text{C}$ , $I_O = 1\text{mA}$	4.9	5.0	5.1	V
Line Regulation	$12\text{V} \leq V_{IN} \leq 25\text{V}$	–	6	20	mV
Load Regulation	$1\text{mA} \leq I_O \leq 20\text{mA}$	–	6	25	mV
Temperature Stability	Note 2	–	0.2	0.4	mV/ $^{\circ}\text{C}$
Total Output Variation	Line, Load, Temperature, Note 2	4.82	–	5.18	V
Output Noise Voltage	$10\text{Hz} \leq f \leq 10\text{kHz}$ , $T_J = +25^{\circ}\text{C}$ , Note 2	–	50	–	$\mu\text{V}$
Long Term Stability	$T_A = +125^{\circ}\text{C}$ , 1000Hrs., Note 2	–	5	25	mV
Output Short Circuit	$T_A = +25^{\circ}\text{C}$	–30	–100	–180	mA
<b>Oscillator Section</b>					
Initial Accuracy	$T_J = +25^{\circ}\text{C}$	47	52	57	kHz
Voltage Stability	$12\text{V} \leq V_{CC} \leq 25\text{V}$	–	0.2	1.0	%
Temperature Stability	$0^{\circ} \leq T_A \leq +70^{\circ}\text{C}$ , Note 2	–	5	–	%
Amplitude	$V_{PIN4}$ peak to peak	–	1.7	–	V
Discharge Current	$T_J = +25^{\circ}\text{C}$	7.8	8.3	8.8	mA
	$0^{\circ} \leq T_A \leq +70^{\circ}\text{C}$	7.6	–	9.0	mA
<b>Error Amp Section</b>					
Input Voltage	$V_{PIN1} = 2.5\text{V}$	2.42	2.50	2.58	V
Input Bias Current		–	–0.3	–2.0	$\mu\text{A}$
$A_{VOL}$	$2\text{V} \leq V_O \leq 4\text{V}$	65	90	–	dB
Unity Gain Bandwidth	Note 2	0.7	1.0	–	MHz
PSRR	$12\text{V} \leq V_{CC} \leq 25\text{V}$	60	70	–	dB
Output Sink Current	$V_{PIN2} = 2.7\text{V}$ , $V_{PIN1} = 1.1\text{V}$	2	6	–	mA
Output Source Current	$V_{PIN2} = 2.3\text{V}$ , $V_{PIN1} = 5\text{V}$	–0.5	–0.8	–	mA
$V_{OUT}$ High	$V_{PIN2} = 2.3\text{V}$ , $R_L = 15\text{K}$ to GND	5	6	–	V
$V_{OUT}$ Low	$V_{PIN2} = 2.7\text{V}$ , $R_L = 15\text{K}$ to Pin8	–	0.7	1.1	V
<b>Current Sense Section</b>					
Gain	Note 3, Note 4	2.85	3.00	3.15	V/V
Maximum Input Signal	$V_{PIN1} = 5\text{V}$ , Note 3	0.9	1.0	1.1	V
PSRR	$12\text{V} \leq V_{CC} \leq 25\text{V}$ , Note 3	–	70	–	dB
Input Bias Current		–	–2	–10	$\mu\text{A}$
Delay to Output	$T_J = +25^{\circ}\text{C}$ , Note 2	–	150	300	ns
<b>Output Section</b>					
Output Low Level	$I_{SINK} = 20\text{mA}$	–	0.1	0.4	V
	$I_{SINK} = 200\text{mA}$	–	1.5	2.2	V
Output High Level	$I_{SOURCE} = 20\text{mA}$	13.0	13.5	–	V
	$I_{SOURCE} = 200\text{mA}$	12.0	13.5	–	V
Rise Time	$T_J = +25^{\circ}\text{C}$ , $C_L = 1\text{nF}$ , Note 2	–	50	150	ns
Fall Time	$T_J = +25^{\circ}\text{C}$ , $C_L = 1\text{nF}$ , Note 2	–	50	150	ns
Output Leakage	$V_{CC} = 14\text{V}$ , UVLO Active, $V_{PIN6} = 0$	–	–0.01	–10	$\mu\text{A}$
<b>Total Standby Current</b>					
Start-Up Current		–	0.5	1.0	mA
Operating Supply Current	$V_{PIN2} = V_{PIN3} = 0\text{V}$ , $R_T = 10\text{K}$ , $C_T = 3.3\text{nF}$	–	11	17	mA
$V_{CC}$ Zener Voltage	$I_{CC} = 25\text{mA}$	–	34	–	V

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Under-Voltage Lockout Section</b>					
Start Threshold NTE7096		14.5	16.0	17.5	V
NTE7097		7.8	8.4	9.0	V
Minimum Operating Voltage NTE7096	After Turn On	8.5	10.0	11.5	V
NTE7097		7.0	7.9	8.2	V

Note 1. Adjust  $V_{CC}$  above the start threshold before setting at 15V.

Note 2. These parameters, although guaranteed, are not 100% tested in production.

Note 3. Parameter measured at trip point of latch with  $V_{PIN2} = 0$ .

Note 4. Gain defined as:

$$A = \frac{\Delta V_{PIN1}}{\Delta V_{PIN3}} ; 0 \leq V_{PIN3} \leq 0.8V$$

### Pin Connection Diagram

