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# NTE1729
# Integrated Circuit
# Pulse Width Modulator (PWM) Control Circuit

**Description:**

The NTE1729 is an inverter control unit in a 16–Lead DIP type package which provides all the control circuitry for PWM type switching regulators. Included in this device is the voltage reference, dual error amplifiers, oscillator, pulse width modulator, pulse steering flip flop, dual alternating output switches, and dead time control.

**Features:**

- Complete PWM Power Control Circuit
- Adjustable Dead Time: 0 to 100%
- No Double Pulsing of Same Output during Load Transient Condition
- Dual Error Amplifiers have Wide Common Mode Input Voltage Capability: –0.3V to $V_{CC}$ –2V
- Circuit Architecture Provides Easy Synchronization
- Uncommitted Outputs for 250mA Sink or Source
- With Miss–Operation Prevention Circuit for Low Level Supply Voltage

**Absolute Maximum Ratings:** ($T_A$ = +25°C unless otherwise specified)

Supply Voltage, $V_{CC}$ . . . . . 41V
Error Amplifier Input Voltage, $V_{ICM}$ . . . . . $V_{CC}$ +0.3V
Output Voltage, $V_{CER}$ . . . . . 41V
Total Power Dissipation ($T_A$ = +25°C), $P_T$ . . . . . 1000mW
Operating Temperature Range, $T_{opr}$ . . . . . –20° to +85°C
Storage Temperature Range, $T_{stg}$ . . . . . –65° to +150°C

**Recommended Operating Conditions:**

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 7 | – | 40 | V |
| Output Voltage | $V_{CER}$ | –0.3 | – | 40 | V |
| Output Current | $I_C$ | – | – | 200 | mA |
| Error Amplifier Sink Current | $I_{OAMP}$ | – | – | –0.3 | mA |
| Timing Capacitor | $C_T$ | 0.47 | – | 10000 | nF |
| Timing Resistance | $R_T$ | 1.8 | – | 500 | kΩ |
| Oscillation Frequency | $f_{osc}$ | 1 | – | 300 | kHz |
| Operating Temperature | $T_{opt}$ | –20 | – | +70 | °C |

**Electrical Characteristics:** ($V_{CC}$ = +15V, f = 10kHz, –20° ≤ $T_A$ ≤ +70°C, unless otherwise specified)

| Parameter | | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Reference Section** | | | | | | | |
| Output Voltage | | $V_{ref}$ | $I_{ref}$ = 1mA, $T_A$ = +25°C | 4.75 | 5.0 | 5.25 | V |
| Line Regulation | | $REG_{IN}$ | 7V ≤ $V_{CC}$ ≤ 40V, $I_{ref}$ = 1mA, $T_A$ = +25°C | – | 8 | 25 | mV |
| Load Regulation | | $REG_L$ | 1mA ≤ $I_{ref}$ ≤ 10mA, $T_A$ = +25°C | – | 1 | 15 | mV |
| Temperature Coefficient | | $V_{ref}$ | –20° ≤ $T_A$ ≤ +85°C, $I_{ref}$ = 1mA | – | 0.01 | 0.03 | %/°C |
| Short–Circuit Output Current | | $I_{short}$ | $V_{ref}$ = 0, $T_A$ = +25°C, Note 2 | – | 50 | – | mA |
| **Oscillator Section** | | | | | | | |
| Frequency | | $f_{OSC}$ | $C_T$ = 0.01µF, $R_T$ = 12kΩ, $T_A$ = +25°C | – | 10 | – | kHz |
| Standard Deviation of Frequency | | | 7V ≤ $V_{CC}$ ≤ 40V, $C_T$, $R_T$, Const., $T_A$ = +25°C, Note 1 | – | 10 | – | % |
| Frequency Change with Temperature | | | 0° ≤ $T_A$ ≤ +70°C, $C_T$ = 0.01µF, $R_T$ = 12kΩ | – | 1 | 2 | % |
| Frequency Change with Voltage | | | 7V ≤ $V_{CC}$ ≤ 40V, $C_T$ = 0.01µF, $R_T$ = 12kΩ, $T_A$ = +25°C | – | – | 1 | % |
| **Dead–Time Control Section** | | | | | | | |
| Input Bias Current | | | 0 ≤ $V_I$ ≤ 5.25V | – | –2 | –10 | µA |
| Maximum Duty Cycle (Each Output) | | | $V_I$ = 0 | 45 | 49 | – | % |
| Input Threshold Voltage | | $V_{th}$ | Zero Duty Cycle | – | 3.0 | 3.3 | V |
| | | | Maximum Duty Cycle | 0 | – | – | V |
| **Error Amplifier Section** | | | | | | | |
| Input Offset Voltage | | $V_{IO}$ | $V_{OAMP}$ = 2.5V | – | 2 | 10 | mV |
| Input Offset Current | | $I_{IO}$ | $V_{OAMP}$ = 2.5V | – | 25 | 250 | nA |
| Input Bias Current | | | $V_{OAMP}$ = 2.5V | – | 0.2 | 1.0 | mA |
| Common Mode Input Voltage | Low | $V_{ICM}$ | 7V ≤ $V_{CC}$ ≤ 40V | –0.3 | – | – | V |
| | High | | | $V_{CC}$–2 | – | – | V |
| Open–Loop Voltage Amplification | | $A_V$ | $V_{OAMP}$ = 0.5V to 3.5V, $T_A$ = +25°C | 60 | 80 | – | dB |
| Unity Gain Bandwidth | | | $T_A$ = +25°C | 500 | 830 | – | kHz |
| Common Mode Rejection Ratio | | CMRR | $V_{CC}$ = 40V, $T_A$ = +25°C | 65 | 80 | – | dB |
| Output Sink Current | | | $V_{OAMP}$ = 0.7V | 0.3 | 0.7 | – | mA |
| Output Source Current | | | $V_{OAMP}$ = 3.5V | –2 | –10 | – | mA |
| **PWM Section** | | | | | | | |
| Input Threshold Voltage | | | Zero Duty Cycle | – | 4.0 | 4.5 | V |
| Input Sink Current | | | $V_{(Pin3)}$ = 0.7V | 0.3 | 0.7 | – | mA |
| **Output Section** | | | | | | | |
| Collector Cutoff Current | | $I_{CER}$ | $V_{CE}$ = 40V, $V_{CC}$ = 40V | – | 2 | 100 | µA |
| Emitter Cutoff Current | | | $V_{CC}$ = $V_C$ = 40V | – | – | –100 | µA |
| Collector Saturation Voltage | | $V_{CE(sat)}$ | $I_C$ = 200mA, $V_E$ = 0, Common Emitter | 0 | 0.95 | 1.3 | V |
| | | $V_{CE(on)}$ | $I_E$ = 200mA, $V_C$ = 15V, Emitter Follower | – | 1.6 | 2.5 | V |

**Electrical Characteristics (Cont'd):** ($V_{CC}$ = +15V, f = 10kHz, –20° ≤ $T_A$ ≤ +70°C, unless otherwise specified)

| Parameter | | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Output Section (Cont'd)** | | | | | | | |
| Output Voltage Rise Time | Common Emitter | $t_r$ | $V_{CC}$ = 15V, $R_L$ = 150Ω, $I_O$ = 100mA, $T_A$ = +25°C | – | 100 | 200 | ns |
| | Emitter Follower | | | – | 100 | 200 | ns |
| Output Voltage Fall Time | Common Emitter | $t_f$ | | – | 70 | 200 | ns |
| | Emitter Follower | | | – | 70 | 200 | ns |
| **Total Device** | | | | | | | |
| Standby Current | | $I_{CC(S.B.)}$ | $V_{CC}$ = 15V, all other inputs and outputs open | – | 8.0 | 12.5 | mA |
| Bias Current | | $I_{CC(B.I.)}$ | $V_{(Pin4)}$ = 2V | – | 10 | – | mA |

Note 1. Standard deviation is a measure of the statistical distribution about the mean as derived from the formula:

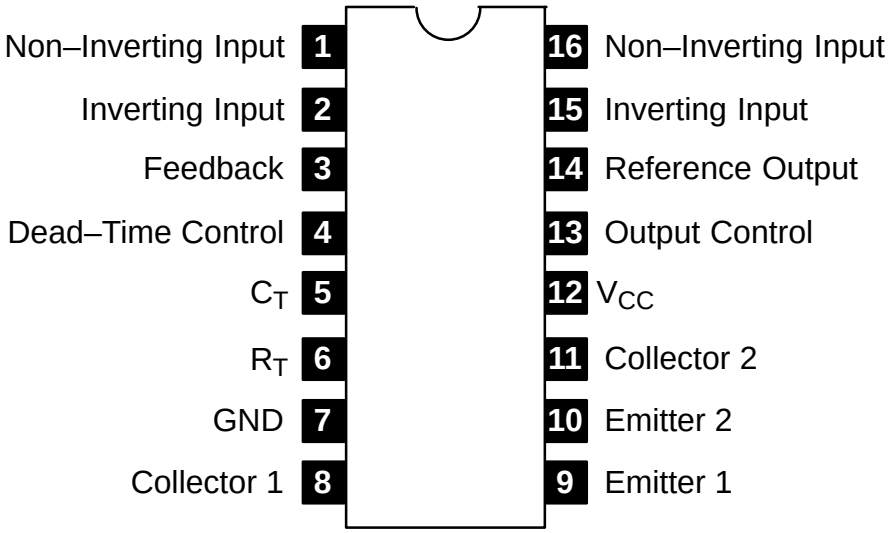
$$\alpha = \sqrt{\frac{\sum_{n=1}^{N} (X_n - \overline{X})^2}{N - 1}}$$

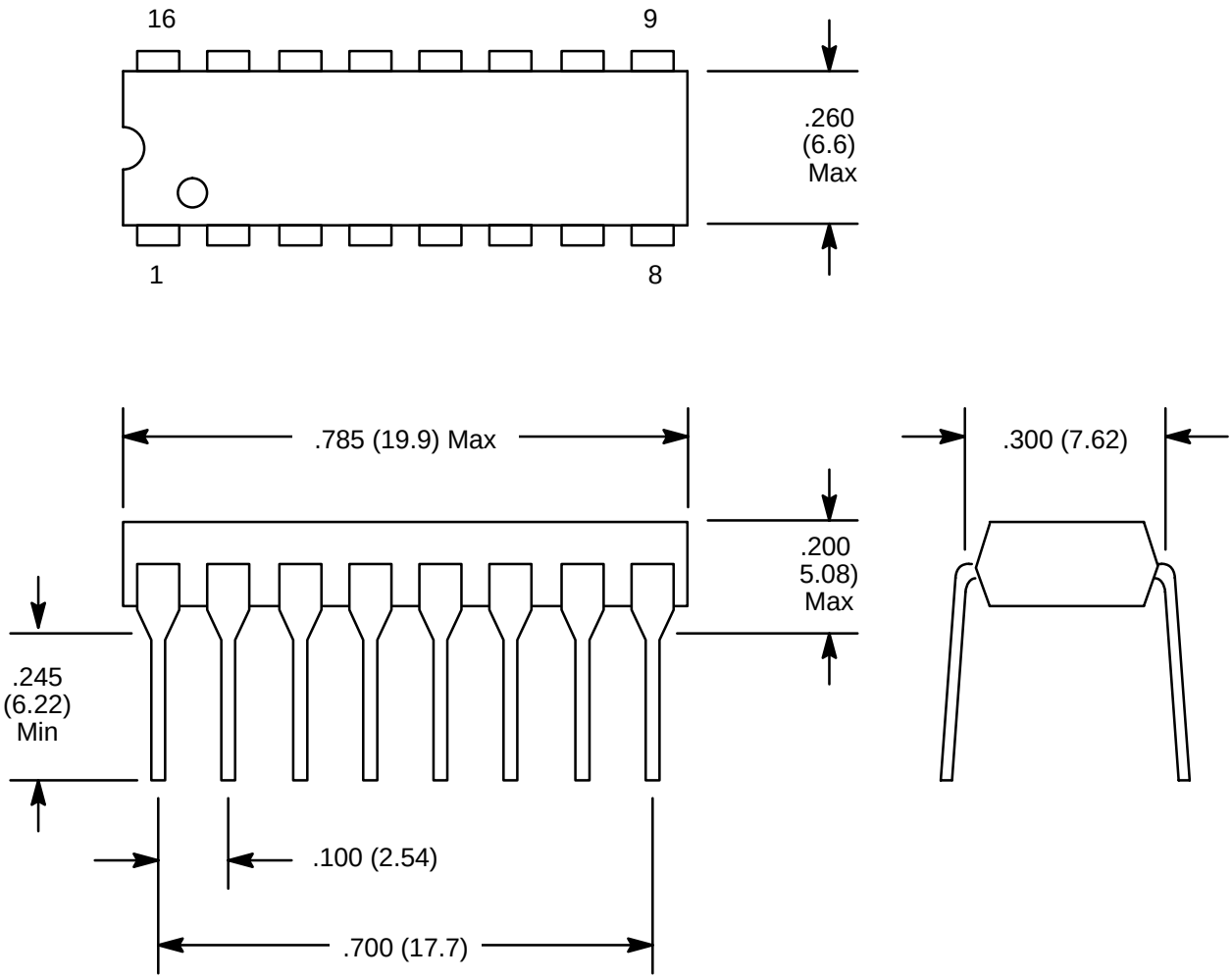
Calculation expression of frequency is as follows:

$$f_{OSC} = \frac{1}{0.817\ R_T \bullet C_T + 1.42 \bullet 10^{-6}}\ (Hz) \qquad [R_T] = \Omega,\ [C_T] = F$$

Note 2. Maximum duration of short–circuit condition is 1sec (non–repetitive).

**Pin Connection Diagram**




16
9
.260
(6.6)
Max
1
8
.785 (19.9) Max
.300 (7.62)
.200
5.08)
Max
.245
(6.22)
Min
.100 (2.54)
.700 (17.7)