

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: ($T_A = +25^{\circ}C$ 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 ($T_A = +25^{\circ}C$), P_T 1000mW
 Operating Temperature Range, T_{opr} -20° to $+85^{\circ}C$
 Storage Temperature Range, T_{stg} -65° to $+150^{\circ}C$

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	k Ω
Oscillation Frequency	f_{osc}	1	—	300	kHz
Operating Temperature	T_{opt}	-20	—	+70	$^{\circ}C$

Electrical Characteristics: ($V_{CC} = +15V$, $f = 10kHz$, $-20^{\circ} \leq T_A \leq +70^{\circ}C$, 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): ($V_{CC} = +15V$, $f = 10kHz$, $-20^{\circ} \leq T_A \leq +70^{\circ}C$, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit	
Output Section (Cont'd)								
Output Voltage Rise Time	Common Emitter	t_r	$V_{CC} = 15V, R_L = 150\Omega, I_O = 100mA, T_A = +25^{\circ}C$	–	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:

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

Calculation expression of frequency is as follows:

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

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



