www.agelectronica.com
www.agelectronica.com

NTE ELECTRONICS, INC.
44 FARRAND STREET
BLOOMFIELD, NJ 07003
(973) 748–5089

NTE1720
Integrated Circuit
Pulse Width Modulator (PWM) Regulator

Description:

The NTE1720 PWM switching regulator control circuit contains all the essential circuitry to implement single–ended or push–pull switching regulators. Included on the circuit are oscillator, voltage reference, a pulse width modulator, error amplifier, overload protection circuitry and output drivers.

A substance zener reference has been used to provide excellent stability with time and the reference has been used to provide excellent stability with time and the reference is trimmed at the wafer level to provide an initial accuracy of 2%. Additionally, the oscillator is trimmed to provide a medium tolerance of 6%.

Features:

- Reference Tolerance: ±2%
- Oscillator Tolerance: ±6%
- Long Term Stability: 10mV/1000 Hrs
- Operates Above 100kHz

Applications:

- Switching Power Supplies
- Motor Speed Control
- Off–Line Power Converters

Absolute Maximum Ratings:

Input Voltage, V_I 40V
Reference Output Current 50mA
Output Current (Each Output) 100mA
Oscillator Charging Current (Pin6 or Pin7) 5mA
Internal Power Dissipation (Note 1), P_D 1W
Operating Temperature Range, T_{opr} . . . . . –55°C to +125°C
Storage Temperature Range, T_{stg} . . . . . –65°C to +150°C
Lead Temperature (During soldering, 10 sec), T_L . . . . . +300°C

Note 1. For operating at elevated temperatures, the NTE1720 is derated at 150°C/W to a maximum junction temperature of 115°C.

www.agelectronica.com
www.agelectronica.com

www.agelectronica.com
www.agelectronica.com

Electrical Characteristics: (T_A = +25°C, V_{IN} = 20V, f = 20kHz unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
Reference Section					
Output Voltage		4.8	5.8	5.2	V
Line Regulation	V_{IN} = 8V to 40V	–	10	20	mV
Load Regulation	I_L = 0mA to 20	–	20	50	mV
Ripple Rejection	t = 120Hz	–	66	–	dB
Short Circuit Current Limit	V_{REF} = 0	–	100	–	mA
Temperature Stability		–	0.3	1	%
Long Term Stability		–	20	–	mV/kHz
Oscillator Section					
Maximum Frequency	C_T = 0.001pF, R_T = 2kΩ	–	300	–	kHz
Initial Accuracy	R_T and C_T Constant	–	6	–	%
Voltage Stability	V_{IN} = 8V to 40V	–	–	1	%
Temperature Stability		–	2	–	%
Output Amplitude	Pin3	–	3.5	–	µs
Output Pulse Width	C_T = 0.01µF, T_A = 25°C	–	0.5	–	µs
Error Amplifier Section					
Input Offset Voltage	V_{CM} = 2.5V	–	0.5	5	mV
Input Bias Current	V_{CM} = 2.5V	–	2	10	µA
Open Loop Voltage Gain		72	80	–	dB
Common–Mode Voltage		1.8	–	3.4	V
Common–Mode Rejection Ratio		–	70	–	dB
Small Signal Bandwidth	A_V = 0dB	–	3	–	MHz
Output Voltage		0.5	–	3.8	V
Comparator Section					
Minimum Duty Cycle		–	–	0	%
Maximum Duty Cycle		45	40	–	%
Input Threshold	Zero Duty Cycle	–	1	–	V
Input Bias Current		–	1	–	µA
Current Limiting Section					
Sense Voltage	Pin 9 = 2V with Error Amplifier Set for Max Out	180	200	220	mV
Sense Voltage T.C.		–	0.2	–	mV/°C
Common–Mode Voltage		–1	–	1	V
Output Section (Each Output)					
Collector–Emitter Voltage		40	–	–	V
Collector Leakage Current	V_{CE} = 40V	–	0.1	50	µA
Saturation Voltage	I_C = 50mA	–	1	2	V
Emitter Output Voltage	V_{IN} = 20V	17	16	–	V
Rise Time	R_C = 2kΩ	–	0.2	–	µs
Fall Time	R_C = 2kΩ	–	0.1	–	µs
Total Standby Current	V_{IN} = 40V, Note 2	–	8	10	mA

Note 2. Standby current does not include the oscillator charging current, error and current limit dividers, and the outputs are open circuit.

www.agelectronica.com
www.agelectronica.com

www.agelectronica.com
www.agelectronica.com

APPLICATIONS INFORMATION: (Functional Description and Pin Functions)

Voltage Regulator

The Internal 5V regulator (Input Pin15, output Pin16) supplies a regulated 5V to all Internal circuitry, as well as up to 50mA for external circuitry. For operation below 8V externally applied.

Oscillator

The Internal oscillator circuitry sets the frequency of operation for the switching regulator. The oscillator waveform is a ramp from about 1V to 3.5V (Pin7). Frequency is set by a timing resistor from Pin6 to ground and a capacitor from Pin7 to GND. The oscillator period is approximately RC for the recommended range of 1.8K to 100K for R and 0.001μF to 0.1μF for C.

The fall time of the ramp sets the blanking or dead time where both outputs are off in push–pull regulators. This is controlled by the value of the capacitor alone.

Output Transistors

The two output transistors have both the emitters (Pin11 and Pin14) and the collectors available (Pin12 and Pin13). Internal current limiting for both of these transistors is about 100mA. The two transistors are driven 180° out of phase by the flip–flop. For single–ended operation they should be connected in parallel.

Error Amplifier

The differential Input (Pin1 and Pin2) single–ended output (Pin9) transconductance amplifier provides about 80dB of gain, as well as providing a point for loop frequency compensation or electronic shutdown.

DC gain of the loop can be controlled by resistive loading, while AC compensation is usually accomplished with a series R–C conncected from Pin9 to GND. The output impedance at Pin9 is about 5MΩ and current is about 200μA, so external op–amps or voltage sources can easily drive the comparator input. Normally, the 5V reference is divided down to generate a voltage within the common mode range of the error ampliifier.

Synchronous Operation

When an external clock is desired, a clock pulse of approximately 3V can be applied directly to the oscillator output, Pin3. The impedance to GND at this point is approximately 2kΩ. In this configuration, R_T C_T must be selected for a clock period slightly greater than that of the external clock.

If two or more NTE1720 regulators are to be operated synchronously, all oscillator output terminals should be tied together. The oscillator programmed for the minimum clock period will be the master from which all the other operate. In this application, the C_T R_T value of the slaved regulators must be set for a period approximately 10% longer than that of the master regulator. In addition, C_T (master) = 2 C_T (slave) to ensure that the master output pulse, which occurs first, has a wider pulse width and will subsequently reset the slave regulators.

Shutdown

A logic high at Pin10 will shut down the regulator and cause both output transistors to turn off.

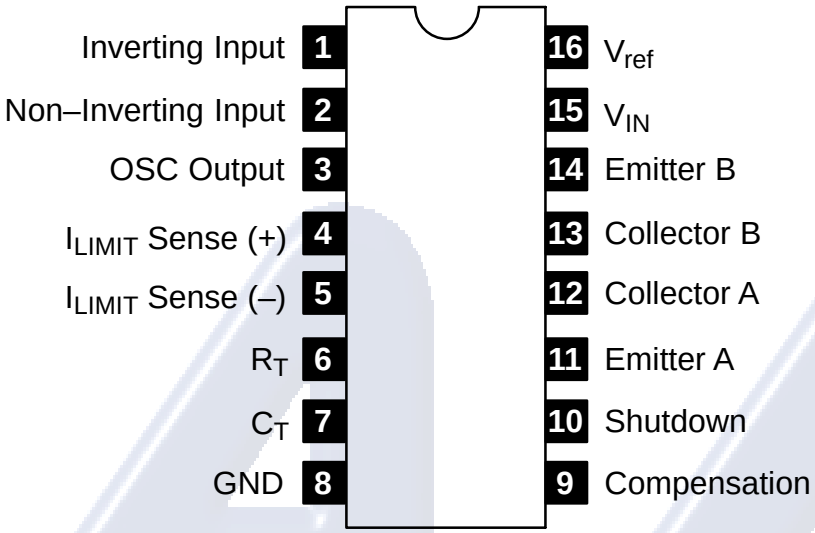
Current Limit

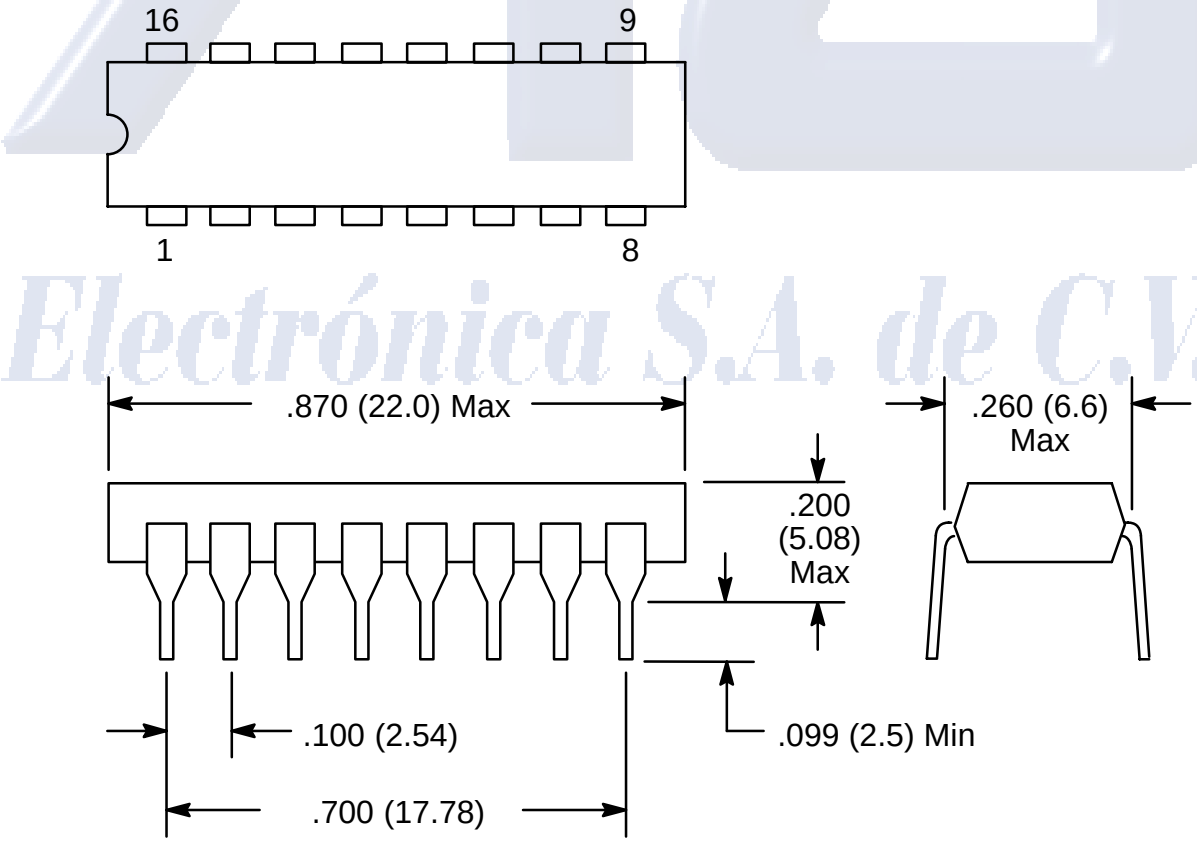
Current limiting is activated when the voltage between Pin4 and Pin5 exceeds 200mV. The output of the current limit amplifier Internally sums with error amplifier to shorten the output pulse width. The gain of the current limit circuitry is relatively low, so current control in limit is typically about 5%. Two areas of caution should be observed with current limiting. First, the reponse time of the current limit is set by the loop roll–off on Pin9. Fast current limiting requires external circuitry. Second, the common–mode range of the current limit amplifier is limited. Even fast spikes outside this range can disrupt operation.

www.agelectronica.com
www.agelectronica.com

www.agelectronica.com
www.agelectronica.com

Pin Connection Diagram





www.agelectronica.com
www.agelectronica.com
www.agelectronica.com
www.agelectronica.com