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NTE1765
Integrated Circuit
Dual Channel Current Mode Controller

Description:

The NTE1765 is a high performance, fixed frequency, dual current mode controller in a 16−Lead DIP type package. This device is specifically designed for Off−Line and DC to DC converter applications offering the designer a cost effective solution with minimal external components. The NTE1765 features a unique oscillator for precise duty cycle limit and frequency control, a temperature compensated reference, two high gain error amplifiers, two current sensing comparators, drive output 2 enable pin, and two high current totem pole outputs ideally suited for driving power MOSFETS.

Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle−by−cycle current limiting, and a latch for single pulse metering of each output.

Features:

- Unique Oscillator for Precise Duty Cycle Limit and Frequency Control
- Current Mode Operation to 500kHz
- Automatic Feed Forward Compensation
- Separate Latching PWMs for Cycle−By−Cycle Current Limiting
- Internally Trimmed Reference with Undervoltage Lockout
- Drive Output 2 Enable Pin
- Two High Current Totem Pole Outputs
- Input Undervoltage Lockout with Hysteresis
- Low Start−Up and Operating Current

Absolute Maximum Ratings:

Total Power Supply Current, I_{CC}	50mA
Zener Current, I_Z	50mA
Output Current, Source or Sink (Note 1), I_O	1A
Output Energy (Capacitive Load per Cycle), W	5.0μJ
Current Sense, Enable and Voltage Feedback Inputs, V_{in}	−0.3 to +5.5V
Sync Input, High State (Voltage), V_{IH}	5.5V
Sync Input, Low State (Reverse Current), I_{IL}	−5.0mA
Error Amp Output Sink Current, I_O	10mA
Maximum Power Dissipation (T_A = +25°C), P_D	1.25mW
Thermal Resistance, Junction−to−Ambient, R_{thJA}	100°C/W
Operating Junction Temperature, T_J	+150°C
Operating Ambient Temperature Range, T_A	0° to +70°C
Storage Temperature Range, T_{stg}	−65° to +150°C

Note 1. Maximum package power dissipation limits must be observed.

Electrical Characteristics: (V_{CC} = 15V (Note 2), R_T = 8.2kΩ, C_T = 3.3nF, Note 3 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Section						
Reference Output Voltage	V_{ref}	I_O = 1mA, T_J = +25°C	4.9	5.0	5.1	V
Line Regulation	Reg_{line}	V_{CC} = 11V to 15V	–	2.0	20	mV
Load Regulation	Reg_{load}	I_O = 1mA to 10mA	–	3.0	25	mV
Total Output Variation over Line, Load and Temperature	V_{ref}		4.85	–	5.15	V
Output Short Circuit Current	I_{SC}		30	100	–	mA
Oscillator and PWM Sections						
Total Frequency Variation over Line and Temperature	f_{OSC}	V_{CC} = 11V to 15V, T_A = 0° to +70°C	46.5	49.0	51.5	kHz
Frequency Change with Voltage	$\Delta f_{OSC}/\Delta V$	V_{CC} = 11V to 15V	–	0.2	1.0	%
Duty Cycle at each Output Maximum	DC_{max}		46.0	49.5	52.0	%
Minimum	DC_{min}		–	–	0	%
Sync Input Current High State	I_{IH}	V_{in} = 2.4V	–	170	250	μA
Low State	I_{IL}	V_{in} = 0.8V	–	80	160	μA
Error Amplifiers						
Voltage Feedback Input	V_{FB}	V_O = 2.5V	2.42	2.50	2.58	V
Input Bias Current	I_{IB}	V_{FB} = 5V	–	–0.1	–1.0	μA
Open−Loop Voltage Gain	A_{VOL}	V_O = 2V to 4V	65	100	–	dB
Unity Gain Bandwidth	BW	T_J = +25°C	0.7	1.0	–	MHz
Power Supply Rejection Ratio	PSRR	V_{CC} = 11V to 15V	60	90	–	dB
Output Current Source	I_{Source}	V_O = 3V, V_{FB} = 2.3V	–0.45 2.0	– –1.0	– –	mA mA
Sink	I_{Sink}	V_O = 1.2V, V_{FB} = 2.7V	–	12	–	mA
Output Voltage Swing High State	V_{OH}	R_L = 15k to GND, V_{FB} = 2.3V	5.0	6.2	–	V
Low State	V_{OL}	R_L = 15k to V_{ref}, V_{FB} = 2.7V	–	0.8	1.1	V
Current Sense Section						
Current Sense Input Voltage Gain	A_V	Note 4, Note 5	2.75	3.00	3.25	V/V
Max. Current Sense Input Threshold	V_{th}	Note 4	430	480	530	mV
Input Bias Current	I_{IB}		–	–2	–10	μA
Propagation Delay (Current Sense Input to Output	$t_{PLN(IN/OUT)}$		–	150	300	ns

Note 2. Adjust V_{CC} above the Start−Up threshold before setting to 15V.

Note 3. For typical values, T_A = +25C; for Min/Max values, T_A = 0° to +70°C. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

Note 4. This parameter is measured at the latch trip point with V_{fb} = 0V.

Note 5. Comparator gain is defined as $A_V = \dfrac{\Delta V \text{ Compensation}}{\Delta V \text{ Current Sense}}$

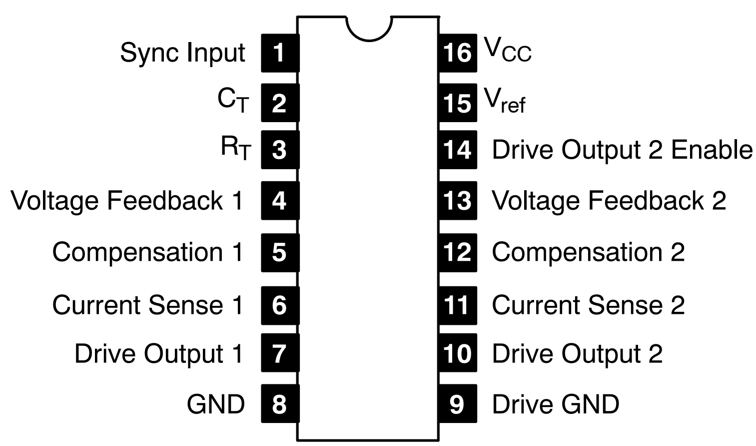
Electrical Characteristics (Cont'd): (V_{CC} = 15V (Note 2), R_T = 8.2kΩ, C_T = 3.3nF, Note 3 unless otherwise specified)

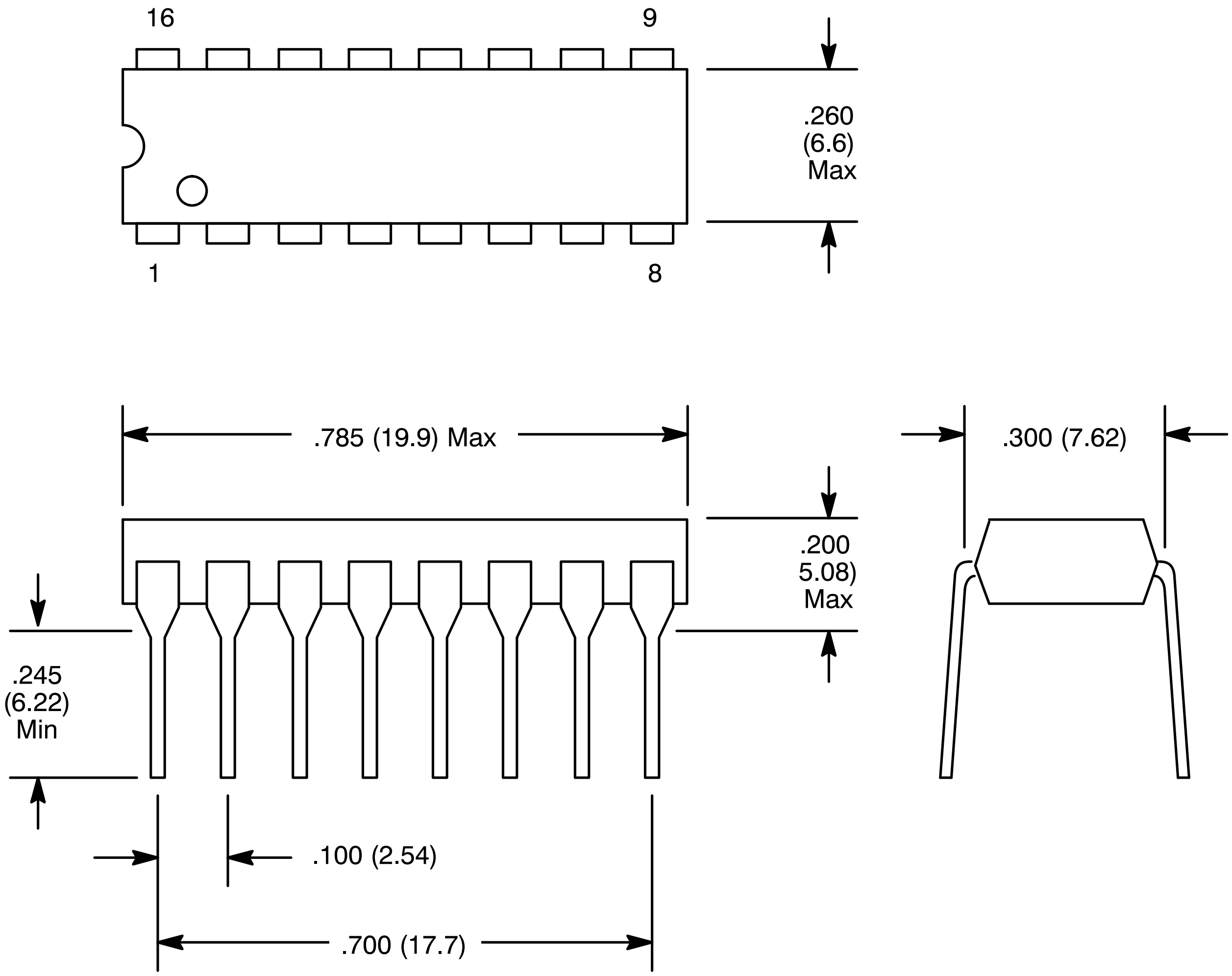
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drive Output 2 Enable Pin						
Enable Pin Voltage High State	V_{IH}	Output 2 Enabled	3.5	–	V_{ref}	V
Low State	V_{IL}	Output 2 Disabled	0	–	1.5	V
Low State Input Current	I_{IB}	V_{IL} = 0V	100	250	400	μA
Drive Outputs						
Output Voltage Low State	V_{OL}	I_{Sink} = 20mA	–	0.1	0.4	V
		I_{Sink} = 200mA	–	1.6	2.5	V
High State	V_{OH}	I_{Source} = 20mA	13.0	13.5	–	V
		I_{Source} = 200mA	12.0	13.4	–	V
Output Voltage with UVLO Activated	$V_{OL(UVLO)}$	V_{CC} = 6V, I_{Sink} = 1mA	–	0.1	1.1	V
Output Voltage Rise Time	t_r	C_L = 1nF	–	28	150	ns
Output Voltage Fall Time	t_f	C_L = 1nF	–	25	150	ns
Undervoltage Lockout Section						
Start–Up Threshold	V_{th}		13	14	15	V
Min. Operating Voltage After Turn–On	$V_{CC(min)}$		9.0	10.0	11.0	V
Total Device						
Power Supply Current Start–Up	I_{CC}	V_{CC} = 12V	–	0.6	1.0	mA
Operating		Note 2	–	20	25	mA
Power Supply Zener Voltage	V_Z	I_{CC} = 30mA	15.5	17.0	19.0	V

Note 2. Adjust V_{CC} above the Start–Up threshold before setting to 15V.

Note 3. For typical values, T_A = +25C; for Min/Max values, T_A = 0° to +70°C. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

Pin Connection Diagram




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