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NTE1681 Integrated Circuit High Power Switching Regulator

Description:

The NTE1681 is a stepdown power switching regulator in a 15-Lead Staggered SIP type package delivering 4A at a voltage variable from 5.1V to 40V. Features of this device include soft start, remote inhibit, thermal protection, a reset output for microprocessors and a PWM comparator input for synchronization in multichip configurations.

Efficient operation at switching frequencies up to 200kHz allows a reduction in the size and cost of external filter components. A voltage sense input and SCR drive output are provided for optional crowbar overvoltage protection with an external SCR.

Features:

- 4A Output Current
- 5.1V to 40V Output Voltage Range
- 0 to 100% Duty Cycle Range
- Precise ($\pm 2\%$) On-Chip Reference
- Switching Frequency up to 200kHz
- Very High Efficiency (Up to 90%)
- Very Few External Components
- Soft Start
- Reset Output
- Control Circuit for Crowbar SCR
- Input for Remote Inhibit and Synchronous PWM
- Thermal Shutdown

Absolute Maximum Ratings:

Input Voltage (Pin3), V_i	50V
Input –to–Output Voltage Differenct, $V_i - V_2$	0V
Output DC Voltage, V_2	
Continuous	-1V
Peak ($t = 0.1\mu s, f = 200kHz$)	-7V
Voltage at Pin1 and Pin12, V_1, V_{12}	10V
Voltage at Pin15, V_{15}	15V
Voltage at Pin4, Pin5, Pin7, Pin9, and Pin13, $V_4, V_5, V_7, V_9, V_{13}$	5.5V
Voltage at Pin10 and Pin6, V_{10}, V_6	7V

Voltage at Pin14 ($I_{14} \leq 1\text{mA}$), V_{14} V_i

Absolute Maximum Ratings (Cont'd):

Pin9 Sink Current, I_9 1mA
 Pin11 Source Current, I_{11} 20mA
 Pin14 Sink Current ($V_{14} < 5\text{V}$), I_{14} 50mA
 Power Dissipation ($T_C \leq +90^\circ\text{C}$), P_{tot} 20W
 Operating Junction Temperature Range, T_J -40° to $+150^\circ\text{C}$
 Storage Temperature Range, T_{stg} -40° to $+150^\circ\text{C}$
 Maximum Thermal Resistance, Junction-to-Case, R_{thJC} 3°C/W
 Maximum Thermal Resistance, Junction-to-Ambient, R_{thJA} 35°C/W

Electrical Characteristics: ($V_i = 35\text{V}$, $T_J = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Dynamic Characteristics (Pin6 to GND unless otherwise specified)							
Output Voltage Range	V_O	$V_i = 46\text{V}$, $I_O = 1\text{A}$	V_{ref}	-	40	V	
Input Voltage Range	V_i	$V_O = V_{\text{ref}}$ to 36V, $I_O \leq 3\text{A}$	-	-	46	V	
		$V_O = V_{\text{ref}}$ to 36V, $I_O = 4\text{A}$, Note 1	-	-	46	V	
Line Regulation	Reg_{line}	$V_i = 10\text{V}$ to 40V, $V_O = V_{\text{ref}}$, $I_O = 2\text{A}$	-	15	50	mV	
Load Regulation	Reg_{load}	$V_O = V_{\text{ref}}$	$I_O = 2\text{A}$ to 4A	-	10	30	mW
			$I_O = 0.5\text{A}$ to 4A	-	15	45	mW
Internal Reference Voltage (Pin10)	V_{ref}	$V_i = 9\text{V}$ to 46V, $I_O = 2\text{A}$	5.0	5.1	5.2	V	
Average Temperature Coefficient of Reference Voltage		$T_J = 0^\circ$ to $+125^\circ\text{C}$, $I_O = 2\text{A}$	-	0.4	-	mV/ $^\circ\text{C}$	
Dropout Voltage Between Pin2 & Pin3	V_d	$I_O = 4\text{A}$	-	2.0	3.2	V	
		$I_O = 2\text{A}$	-	1.3	2.1	V	
Current Limiting Threshold (Pin2)	I_{2L}	Pin4 Open, $V_i = 9\text{V}$ to 40V, $V_O = V_{\text{ref}}$ to 36V	4.5	-	7.5	A	
Input Average Current	I_{SH}	$V_i = 46\text{V}$, Output Short-Circuited	-	60	100	mA	
Efficiency	η	$I_O = 3\text{A}$	$V_O = V_{\text{ref}}$	-	75	-	%
			$V_O = 12\text{V}$	-	85	-	%
Supply Voltage Ripple Rejection	SVR	$\Delta V_i = 2V_{\text{rms}}$, $V_O = V_{\text{ref}}$, $I_O = 2\text{A}$, $f_{\text{ripple}} = 100\text{Hz}$	50	56	-	dB	
Switching Frequency	f		85	100	115	kHz	
Voltage Stability of Switching Frequency		$V_i = 9\text{V}$ to 46V	-	0.5	-	%	
Temperature Stability of Switching Frequency		$T_J = 0^\circ$ to $+125^\circ\text{C}$	-	1	-	%	
Maximum Operating Switching Frequency	f_{max}	$V_O = V_{\text{ref}}$, $I_O = 1\text{A}$	200	-	-	kHz	
Thermal Shutdown Junction Temperature	T_{sd}		135	145	-	$^\circ\text{C}$	

Note 1. Using min. 7A Schottky Diode.

Electrical Characteristics (Cont'd): ($V_i = 35V$, $T_J = +25^\circ C$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
DC Characteristics							
Quiescent Drain Current	I_{3Q}	$V_i = 46V$, $V_7 = 0V$, S1: B, S2: B	$V_6 = 0V$	-	66	85	mA
			$V_6 = 3V$	-	30	40	mA
Output Leakage Current	$-I_{2L}$	$V_i = 46V$, $V_6 = 3V$, $V_7 = 0V$, S1: B, S2: A	-	-	2	mA	
Soft Start							
Source Current	$I_{5\ so}$	$V_6 = 0V$, $V_5 = 3V$	80	130	150	μA	
Sink Current	$I_{5\ si}$	$V_6 = 3V$, $V_5 = 3V$	50	70	120	μA	
Inhibit							
Low Input Voltage	V_{6L}	$V_i = 9V$ to $46V$, $V_7 = 0V$, S1: B, S2: B	-0.3	-	0.8	V	
High Input Voltage	V_{6H}		2.0	-	5.5	V	
Input Current with Low Input Voltage	$-I_{6L}$	$V_i = 9V$ to $46V$, $V_7 = 0V$, S1: B, S2: B	$V_6 = 0.8V$	-	-	10	μA
Input Current with High Input Voltage	$-I_{6H}$		$V_6 = 2V$	-	-	3	μA
Error Amplifier							
High Level Output Voltage	V_{9H}	$V_{10} = 4.7V$, $I_9 = 100\mu A$, S1: A, S2: A	3.5	-	-	V	
Low Level Output Voltage	V_{9L}	$V_{10} = 5.3V$, $I_9 = 100\mu A$, S1: A, S2: E	-	-	0.5	V	
Sink Output Current	$I_{9\ si}$	$V_{10} = 5.3V$, S1: A, S2: B	100	150	-	μA	
Source Output Current	$I_{9\ so}$	$V_{10} = 4.7V$, S1: A, S2: D	100	150	-	μA	
Input Bias Current	I_{10}	$V_{10} = 5.2V$, S1: B	-	2	10	μA	
DC Open Loop Gain	G_v	$V_9 = 1V$ to $3V$, S1: A, S2: C	46	55	-	dB	
Oscillator and PWM Comprator							
Input Bias Current of PWM Comparator	$-I_7$	$V_7 = 0.5V$ to $3.5V$	-	-	5	μA	
Oscillator Source Current	$-I_{11}$	$V_{11} = 2V$, S1: A, S2: B	5	-	-	mA	
Reset							
Rising Threshold Voltage	$V_{12\ R}$	$V_i = 9V$ to $46V$, S1: B, S2: B	V_{ref} -150mV	V_{ref} -100mV	V_{ref} -50mV	V	
Falling Threshold Voltage	$V_{12\ F}$		4.75	V_{ref} -150mV	V_{ref} -100mV	V	
Delay Threshold Voltage	$V_{13\ D}$	$V_{12} = 5.3V$, S1: A, S2: B	4.3	4.5	4.7	V	
Delay Threshold Voltage Hysteresis	$V_{13\ H}$		-	100	-	mV	
Output Saturation Voltage	$V_{12\ S}$	$I_{14} = 16mA$, $V_{12} = 4.7V$, S1, S2: B	-	-	0.4	V	
Input Bias Current	I_{12}	$V_{12} = 0V$ to V_{ref} , S1: B, S2: B	-	1	3	μA	
Delay Source Current	$-I_{13\ so}$	$V_{13} = 3V$, S1: A, S2: B	$V_{12} = 5.3V$	70	110	140	μA
Delay Sink Current	$I_{13\ si}$		$V_{12} = 4.7V$	10	-	-	mA
Output Leakage Current	I_{14}	$V_i = 46V$, $V_{12} = 5.3V$, S1: B, S2: A	-	-	100	μA	
Crowbar							
Input Threshold Voltage	V_1	S1: B	5.5	6.0	6.4	V	
Output Saturation Voltage	V_{15}	$V_i = 9V$ to $46V$, $V_1 = 5.4V$, $I_{15} = 5mA$, S1: A	-	0.2	0.4	V	
Input Bias Current	I_1	$V_1 = 6V$, S1: B	-	-	10	μA	
Output Source Current	$-I_{15}$	$V_i = 9V$ to $46V$, $V_1 = 6.5V$, $V_{15} = 2V$, S1: B	70	100	-	mA	

Pin Connection Diagram
(Front View)

