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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 (±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 = 0.1μs, 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 ($I_{14} \le 1mA$), V_{14} . . . . . V_i

Absolute Maximum Ratings (Cont'd):

Pin9 Sink Current, I_9 . . . . . 1mA
Pin11 Source Current, I_{11} 20mA
Pin14 Sink Current ($V_{14} < 5V$), I_{14} 50mA
Power Dissipation ($T_C \le +90°C$), P_{tot} 20W
Operating Junction Temperature Range, T_J . . . . . –40° to +150°C
Storage Temperature Range, T_{stg} . . . . . –40° to +150°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 = 35V, T_J = +25°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 = 46V, I_O = 1A		V_{ref}	–	40	V
Input Voltage Range	V_i	$V_O = V_{ref}$ to 36V, $I_O \le 3A$		–	–	46	V
		$V_O = V_{ref}$ to 36V, I_O = 4A, Note 1		–	–	46	V
Line Regulation	Reg_{line}	V_i = 10V to 40V, $V_O = V_{ref}$, I_O = 2A		–	15	50	mV
Load Regulation	Reg_{load}	$V_o = V_{ref}$	I_O = 2A to 4A	–	10	30	mW
			I_O = 0.5A to 4A	–	15	45	mW
Internal Reference Voltage (Pin10)	V_{ref}	V_i = 9V to 46V, I_O = 2A		5.0	5.1	5.2	V
Average Temperature Coefficient of Reference Voltage		T_J = 0° to +125°C, I_O = 2A		–	0.4	–	mV/°C
Dropout Voltage Between Pin2 & Pin3	V_d	I_O = 4A		–	2.0	3.2	V
		I_O = 2A		–	1.3	2.1	V
Current Limiting Threshold (Pin2)	I_{2L}	Pin4 Open, V_i = 9V to 40V, $V_O = V_{ref}$ to 36V		4.5	–	7.5	A
Input Average Current	I_{SH}	V_i = 46V, Output Short–Circuited		–	60	100	mA
Efficiency	η	I_O = 3A	$V_O = V_{ref}$	–	75	–	%
			V_O = 12V	–	85	–	%
Supply Voltage Ripple Rejection	SVR	$\Delta V_i = 2V_{rms}$, $V_O = V_{ref}$, I_O = 2A, f_{ripple} = 100Hz		50	56	–	dB
Switching Frequency	f			85	100	115	kHz
Voltage Stability of Switching Frequency		V_i = 9V to 46V		–	0.5	–	%
Temperature Stability of Switching Frequency		T_J = 0° to +125°C		–	1	–	%
Maximum Operating Switching Frequency	f_{max}	$V_O = V_{ref}$, I_O = 1A		200	–	–	kHz
Thermal Shutdown Junction Temperature	T_{sd}			135	145	–	°C

Note 1. Using min. 7A Schottky Diode.

Electrical Characteristics (Cont'd): (V_i = 35V, T_J = +25°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, S!: 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 = 100µA, S1: A, S2: A		3.5	–	–	V
Low Level Output Voltage	V_{9L}	V_{10} = 5.3V, I_9 = 100µA, 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)