High Speed Current Mode Pulse Width Modulators

DESCRIPTION

The LT1241M/883 series devices are 8-Pin, fixed frequency, current mode, pulse width modulators. These devices are manufactured using LTC's high speed bipolar process. They are designed to be improved plug compatible versions of the industry standard UC1842 type PWM circuits. The LT1241M/883 series devices are optimized for off-line and DC-to-DC converter applications. They contain all of the necessary circuitry including a temperature compensated reference, high gain error amplifier, current sensing comparator, and a high current totem pole output stage ideally suited to driving power MOSFET's. These devices have both improved speed and lower quiescent current (8mA typ.) than existing devices. Start-up current has been reduced to less than 250μA. Cross conduction current spikes in the totem pole output stage have been eliminated, making 500kHz operation practical. In addition several new features have been incorporated that make them easier to use. Blanking has been added to the current sense comparator to prevent the leading edge current spike from prematurely tripping the comparator. This minimizes or eliminates the filter that is normally required. Eliminating this filter allows the current sense loop to operate with minimum delays. A second comparator is added to the current sense loop with a trip level set at 1.5V. This comparator can override the blanking pulse during fault conditions. The blanking pulse is 100ns under nominal conditions (V_{FB} = 2.5V), and is reduced to zero during start-up and during an output short circuit condition. Trims have been added to the oscillator circuit for both frequency and sink current, and both of these parameters are tightly specified. The output stage is clamped to a maximum V_{OUT} of 18V in the on state. The output and the reference output are actively pulled low during under voltage lockout.

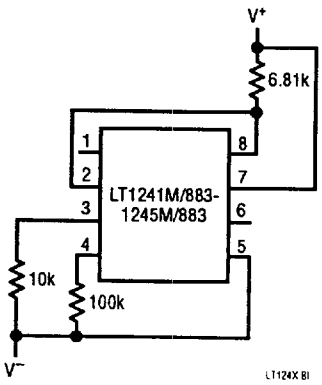
The device is processed to the requirements of MIL-STD-883 Class B to yield circuits usable in precision military applications.

ABSOLUTE MAXIMUM RATINGS

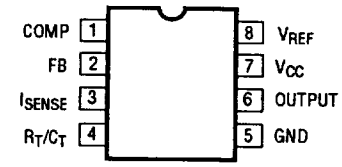
Supply Voltage ..... +25V
Output Current ..... ±1A*
Output Energy (Capacitive Load per Cycle) 5μJ
Analog Inputs (Pins 2,3) ..... −0.3 to +6V
Error Amplifier Output Sink Current 10mA
Power Dissipation at $T_A \leq 25°C$ 1W
Operating Temperature Range
LT124XM ..... −55°C to +125°C
Storage Temperature Range ..... −65°C to 150°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C

*The 1A rating for output current is based on transient switching requirements.

BURN-IN CIRCUIT



PACKAGE/ORDER INFORMATION



ORDER PART NUMBER
LT124X MJ8/883
PART MARKINGS†
LT124X MJ8/883C

† The suffix letter "C" of the part mark indicates compliance per MIL-STD-883, para 1.2.1.1.

TABLE 1: ELECTRICAL CHARACTERISTICS (Notes 1,2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	SUB-GROUP	UNITS
Reference Section						
Output Voltage	T_J =25°C, I_{OUT} = 1mA	4.925	5.000	5.075	1	V
Line Regulation	12V < V_{IN} < 25V		3	20	1,2,3	mV
Load Regulation	1mA < I_{OUT} < 20mA		−6	−25	1,2,3	mV
Total Output Variation	Line, Load, Temp	4.87		5.13	1,2,3	V
Output Short Circuit Current		−30	−90	−180	4,5,6	mA
Oscillator Section						
Initial Accuracy	R_T = 10k, C_T = 3.3nF, T_A = 25°C R_T = 13k, C_T = 500pF, T_A = 25°C	47.5 228	50 248	52.5 268	4 4	kHz kHz
Voltage Stability	12V < V_{CC} < 25V			1	4	%
Clock Ramp Reset Current	V_{OSC} = 2v, T_J = 25°C	7.9	8.2	8.5	1	mA
Error Amplifier Section						
Feedback Pin Input Voltage	V_{PIN1} = 2.5V	2.42		2.58	1,2,3	V
Input Bias Current	V_{FB} = 2.5V			−2	1,2,3	µA
Open Loop Voltage Gain	2 < V_{OUT} < 4V	65	90		4,5,6	dB
Power Supply Rejection Ratio	12V < V_{CC} < 25V	60			1,2,3	dB
Output Sink Current	$V_{PIN\,2}$ = 2.7V, $V_{PIN\,1}$ = 1.1V	2	6		4,5,6	mA
Output Source Current	$V_{PIN\,2}$ = 2.3V, $V_{PIN\,1}$ = 5V	−0.5	−0.75		4,5,6	mA
Output Voltage High Level	$V_{PIN\,2}$ = 2.3V, R_L = 15k to GND	5.0	5.6		4,5,6	V
Output Voltage Low Level	$V_{PIN\,2}$ = 2.7V, R_L = 15k to Pin 8		0.2	1.1	4,5,6	V
Current Sense Section						
Gain		2.85		3.15	4,5,6	V/V
Maximum Current Sense Input Threshold	$V_{PIN\,3}$ < 1.1V	0.90	1.00	1.10	1,2,3	V
Input Bias Current			−1	−10	1,2,3	µA
Delay to Output			50	100	10	ns
Output Section						
Output Low Level	I_{OUT} = 20mA, V_{CC} = 15V I_{OUT} = 200mA, V_{CC} = 15V		0.25 0.75	0.4 2.2	4,5,6	V V
Output High Level	I_{OUT} = 20mA, V_{CC} = 15V I_{OUT} = 200mA, V_{CC} = 15V	12.0 11.75			4,5,6	V V
Output Clamp Voltage	I_{OUT} = 1mA		18	19	4,5,6	V

TABLE 1: ELECTRICAL CHARACTERISTICS (Notes 1,2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	SUB-GROUP	UNITS
Undervoltage Lockout						
Startup Threshold						
LT1241		9.0	9.6	10.2	1,2,3	V
LT1242/LT1244		15	16	17	1,2,3	V
LT1243/LT1245		7.8	8.4	9.0	1,2,3	V
Minimum Operating Voltage						
LT1241/LT1243/LT1245		7.0	7.6	8.2	1,2,3	V
LT1242/LT1244		9.0	10	11	1,2,3	V
Hysteresis						
LT1241		1.6	2.0		1	V
LT1242/LT1244		5.5	6.0		1	V
LT1243/LT1245		0.4	0.8		1	V
PWM						
Maximum Duty Cycle					4	
LT1241/LT1244/LT1245	T_A = 25°C	46	48		4	%
LT1242/LT1243	T_A = 25°C	94	96		4	%
Total Device						
Startup Current			170	250	1,2,3	µA
Operating Current			7	10	1,2,3	mA

Note 1: Unless otherwise specified, V_{CC} = 15V, R_T = 10k, C_T = 3nF.

Note 2: Low duty cycle pulse techniques are used during test to maintain junction temperature close to ambient.

TABLE 2: ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUP
Final Electrical Test Requirements (Method 5004)	1*,2,3,4,5,6
Group A Test Requirements (Method 5005)	1,2,3,4,5,6
Group C and D End Point Electrical Parameters (Method 5005)	1,2,3

* PDA Applies to subgroup 1. See PDA Test Notes.

PDA Test Notes

The PDA is specified as 5% based on failures from group A, subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883 Class B. The verified failures of group A, subgroup 1, after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent for the lot.

Linear Technology Corporation reserves the right to test to tighter limits than those given.