

# 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 250 $\mu$ A. 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.

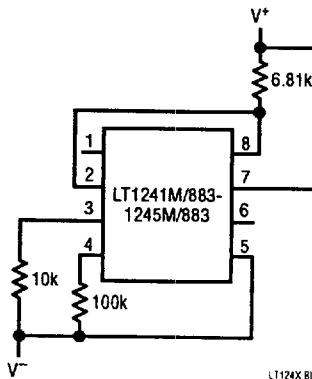
The device is processed to the requirements of MIL-STD-883 Class B to yield circuits usable in precision military applications.

## ABSOLUTE MAXIMUM RATINGS

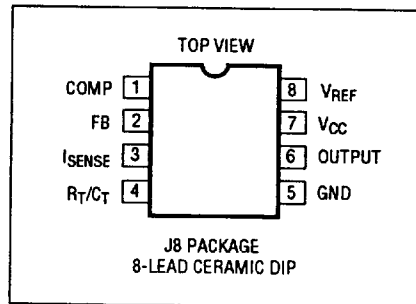
Supply Voltage .....	+25V
Output Current .....	$\pm 1A^*$
Output Energy (Capacitive Load per Cycle) .....	5 $\mu$ J
Analog Inputs (Pins 2,3) .....	-0.3 to +6V
Error Amplifier Output Sink Current .....	10mA
Power Dissipation at $T_A \leq 25^\circ C$ .....	1W
Operating Temperature Range	
LT124XM .....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

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

## BURN-IN CIRCUIT



## PACKAGE/ORDER INFORMATION

 <p>TOP VIEW</p> <p>J8 PACKAGE 8-LEAD CERAMIC DIP</p>	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
<b>Reference Section</b>						
Output Voltage	$T_J = 25^\circ\text{C}$ , $I_{OUT} = 1\text{mA}$	4.925	5.000	5.075	1	V
Line Regulation	$12\text{V} < V_{IN} < 25\text{V}$		3	20	1,2,3	mV
Load Regulation	$1\text{mA} < I_{OUT} < 20\text{mA}$		-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
<b>Oscillator Section</b>						
Initial Accuracy	$R_T = 10\text{k}$ , $C_T = 3.3\text{nF}$ , $T_A = 25^\circ\text{C}$	47.5	50	52.5	4	kHz
	$R_T = 13\text{k}$ , $C_T = 500\text{pF}$ , $T_A = 25^\circ\text{C}$	228	248	268	4	kHz
Voltage Stability	$12\text{V} < V_{CC} < 25\text{V}$			1	4	%
Clock Ramp Reset Current	$V_{OSC} = 2\text{V}$ , $T_J = 25^\circ\text{C}$	7.9	8.2	8.5	1	mA
<b>Error Amplifier Section</b>						
Feedback Pin Input Voltage	$V_{PIN1} = 2.5\text{V}$	2.42		2.58	1,2,3	V
Input Bias Current	$V_{FB} = 2.5\text{V}$			-2	1,2,3	$\mu\text{A}$
Open Loop Voltage Gain	$2 < V_{OUT} < 4\text{V}$	65	90		4,5,6	dB
Power Supply Rejection Ratio	$12\text{V} < V_{CC} < 25\text{V}$	60			1,2,3	dB
Output Sink Current	$V_{PIN2} = 2.7\text{V}$ , $V_{PIN1} = 1.1\text{V}$	2	6		4,5,6	mA
Output Source Current	$V_{PIN2} = 2.3\text{V}$ , $V_{PIN1} = 5\text{V}$	-0.5	-0.75		4,5,6	mA
Output Voltage High Level	$V_{PIN2} = 2.3\text{V}$ , $R_L = 15\text{k}$ to GND	5.0	5.6		4,5,6	V
Output Voltage Low Level	$V_{PIN2} = 2.7\text{V}$ , $R_L = 15\text{k}$ to Pin 8		0.2	1.1	4,5,6	V
<b>Current Sense Section</b>						
Gain		2.85		3.15	4,5,6	V/V
Maximum Current Sense Input Threshold	$V_{PIN3} < 1.1\text{V}$	0.90	1.00	1.10	1,2,3	V
Input Bias Current			-1	-10	1,2,3	$\mu\text{A}$
Delay to Output			50	100	10	ns
<b>Output Section</b>						
Output Low Level	$I_{OUT} = 20\text{mA}$ , $V_{CC} = 15\text{V}$		0.25	0.4	4,5,6	V
	$I_{OUT} = 200\text{mA}$ , $V_{CC} = 15\text{V}$		0.75	2.2		V
Output High Level	$I_{OUT} = 20\text{mA}$ , $V_{CC} = 15\text{V}$	12.0			4,5,6	V
	$I_{OUT} = 200\text{mA}$ , $V_{CC} = 15\text{V}$	11.75				V
Output Clamp Voltage	$I_{OUT} = 1\text{mA}$		18	19	4,5,6	V

**TABLE 1: ELECTRICAL CHARACTERISTICS** (Notes 1,2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	SUB-GROUP	UNITS
<b>Undervoltage Lockout</b>						
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
<b>PWM</b>						
Maximum Duty Cycle					4	
LT1241/LT1244/LT1245	T <sub>A</sub> = 25°C	46	48		4	%
LT1242/LT1243	T <sub>A</sub> = 25°C	94	96		4	%
<b>Total Device</b>						
Startup Current			170	250	1,2,3	μA
Operating Current			7	10	1,2,3	mA

**Note 1:** Unless otherwise specified, V<sub>CC</sub> = 15V, R<sub>T</sub> = 10k, C<sub>T</sub> = 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.



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