Microsemi

LX13049

VREF @ 800mV, 1.25A, 1.0MHz PWM

PRODUCTION DATA SHEET

DESCRIPTION

The LX13049 operates as a Current Mode PWM Buck regulator that switches to PFM mode under light loads. The entire regulator function is implemented with only a few, low-cost external components.

The LX13049 responds quickly to dynamic load changes using a high bandwidth error amplifier and internal compensation. Tight output voltage regulation is maintained with the temperature compensated 800mV, bandgap reference achieving +/-3.5% regulation tolerance for all line, load and thermal conditions. The output voltage is easily programmed, from 800mV to 90% of V_{IN} with two external resistors

The regulator is capable of providing an output load current up to 1.25A and has no minimum load current requirement for stable operation. Current limit senses on a cycle-by cycle basis to protect the switch. Power conversion efficiency is maximized with PFM mode of operation and low regulator quiescent current.

The LX13049 operational supply voltage range covers 4.0V to 6.0V, features include: power on delay; soft start to limit inrush currents and thermal shutdown during fault conditions.

The 6-pin JEDEC MO-229 package provides a small form factor and low profile at 3x3x1mm with excellent power dissipation capability on surface mount PCB's.

IMPORTANT: For the most current data, consult *MICROSEMI'*s website: **http://www.microsemi.com**

KEY FEATURES

- Few External Components
- 800mv Internal Reference
- Tight Regulation over Line, Load and Temperature
- 4.5V to 5.5V Input Range
- Internal Soft Start Controls Inrush Current
- High Efficiency
- Low Quiescent Current, 600µA
- Fully Fault Protected
- Thin MO-229, 6-Pin Package

APPLICATIONS

- Point of Load Regulation
- DSP, ASIC and Core Voltage Supplies
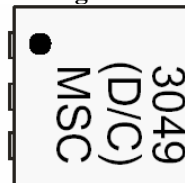- Hard Disk Drives
- Set Top Boxes
- RoHS compliant product

PRODUCT HIGHLIGHT

$$V_{OUT} = (1 + R1/R2) * V_{FB}$$
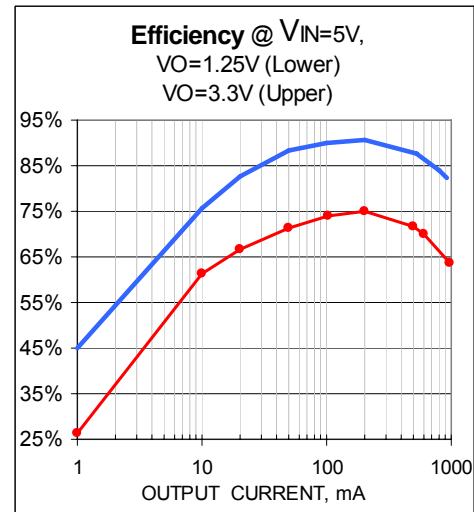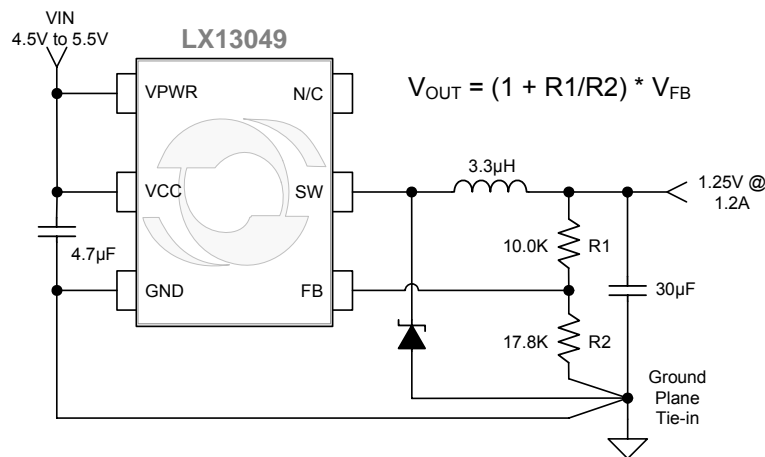
Figure 1 – LX13049 Application Circuit and Typical Efficiency Performance

PACKAGE ORDER INFO

T_A (°C)	LD	Plastic MLPD 6 pin 3mm x 3mm RoHS Compliant / Pb-free	Package Marking
0 to 125		**LX13049CLD**	3049 (D/C) MSC

Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. LX13049CLD-TR)

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ABSOLUTE MAXIMUM RATINGS

Input Voltage (VCC or VPWR) .... -0.3V to 7.0V
SW to GND .... -0.3V to (V_{IN} + 0.3V)
VFB to GND .... -0.3V to +2V
SW Peak Current ....Internally Limited
Junction Operating Temperature Range ....0°C to +125°C
Storage Temperature Range, TA ....-65°C to 150°C
Maximum Junction Temperature .... 150°C
Package Peak Temp. for Solder Reflow (40 seconds max. exposure) .... 260°C (+0, -5)

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

PACKAGE PIN OUT

Pin	Name		Pin	Name
1	FB		6	NC
2	GND		5	VCC
3	SW		4	VPWR
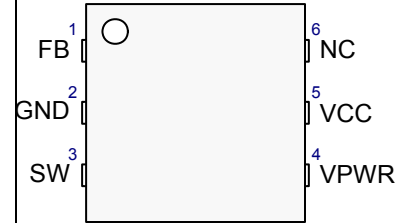
LD PACKAGE
(Top View)

RoHS / Pb-free 100% matte Tin Pin Finish

THERMAL DATA

LD — Plastic MLP 3x3mm MO-229, 6-Pin

THERMAL RESISTANCE-JUNCTION TO CASE, θ_{JC}	4°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	25 to 50°C/W

Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
The θ_{JA} numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

FUNCTIONAL PIN DESCRIPTION

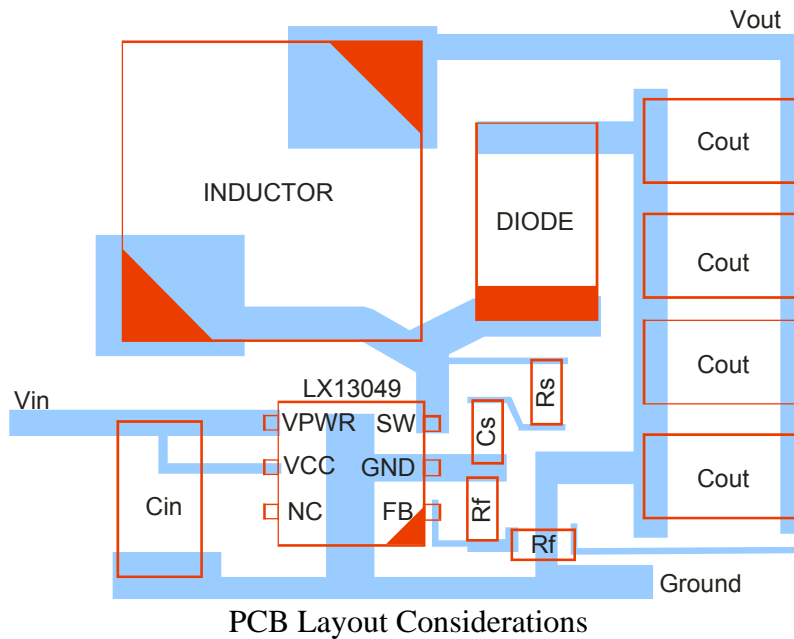| Name	Pin #	Description
VCC	5	Unregulated supply voltage input, ranging from +4V to 6.0V for internal analog control circuitry.
VPWR	4	Unregulated supply voltage input (+4V to 6.0V), high current path, supplies PMOSFET Drain of PWM switch.
FB	1	Feedback input for setting programming output voltage.
GND	2	Circuit ground for IC analog circuitry and high frequency gate drive bias, can be connected to heatsink terminal.
SW	3	Inductor and commutation diode connection point. Connects to internal PMOSFET Source of PWM Switch output.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	LX13049			Unit
		Min	Typ	Max	
Input Operating Voltage Range	V_{IN}	4.5		5.5	V
Continuous Output Current Range	I_{OUT}	0		0.9	A
Output Voltage Range	V_{OUT}	0.8		80% of V_{IN}	V
Operating Junction Temperature	T_J	0		125	°C

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DEVICE DATA

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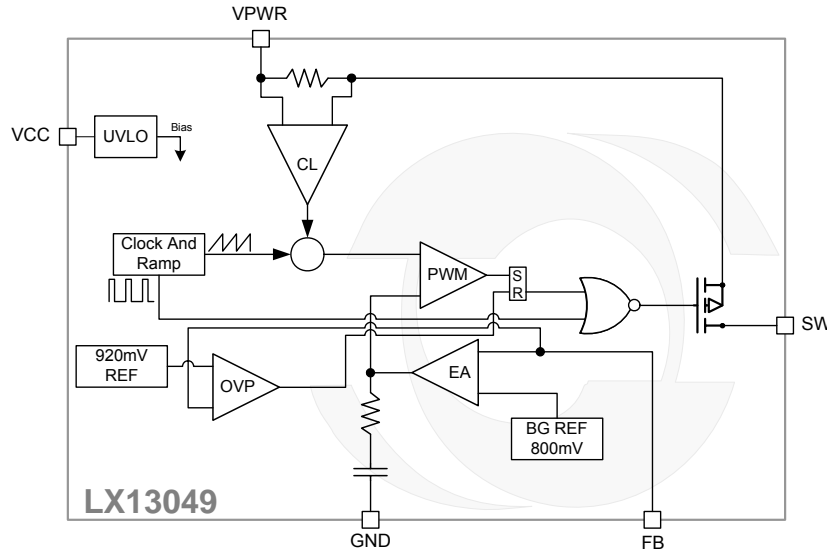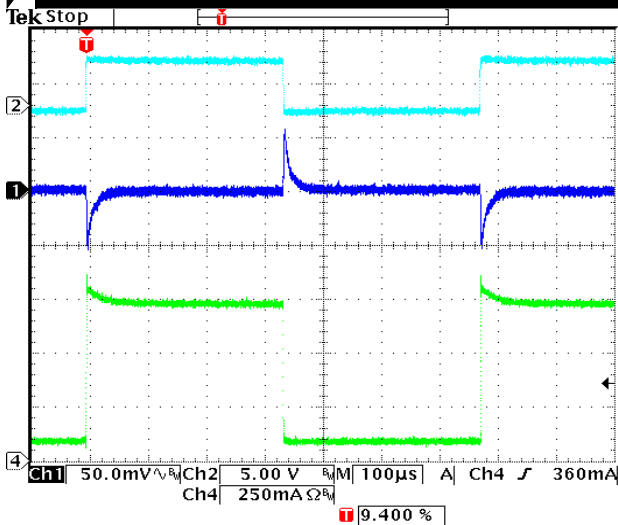## ELECTRICAL CHARACTERISTICS

Specifications are guaranteed over the junction temperature range of: 0°C < T < 125°C for VIN = 4.5V to 5.5V (unless noted otherwise), not all of these parameters are production tested but are assured by design, characterization and correlation with statistical process controls.. Typical values are at TA=23°C.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Feedback Threshold	V_{FBT}	4.0V < VIN < 6.0V	772	800	828	mV
Feedback Input Current	I_{FB-IN}	$V_{FB} = V_{FBT}$ + 10mV			75	nA
PWM Frequency	F_{OP-PWM}	PWM Mode	700		1450	Khz
PFM Mode Transition	IO-PFM	PFM mode		80		mA
Minimum DC Output Current	I_{OUT}		0			mA
Maximum DC Output Current	I_{OUTMAX}	T_J ≤ 70°C			1.25 or 0.7/ duty cycle whichever is less	A
Maximum Duty Cycle	D_{MAX}	$I_{SW} = I_{OUT}$ max	80			%
Closed Loop Load Regulation	$V_{OUT\ Load\ REG}$	10mA<I_{OUT}<$I_{OUT\ MAX}$	-0.5		0.5	%V_{OUT}
Efficiency	η	V_{IN}=5V, V_{OUT}≥1.1V, I_{OUT}= 10mA	55			%
		V_{IN}=5V, V_{OUT}>1.1V, I_{OUT}≥ 150mA	70			%
Quiescent Current	I_Q	$V_{FB} = V_{FBT}$ + 10mV		600	900	µA
P-Channel Switch ON Resistance	$R_{DS(ON)}$	I_{SW} = 0.9A		0.375		Ω
P-Channel Switch Current Limit	$I_{SW\ CL}$	Peak Current at Switch Pin (Not DC Current)	1.1			A
		T_J ≤ 70°C	1.4			
P-Channel Switch Leakage	$I_{SW\ LKG}$	$V_{FB} = V_{FBT}$ + 10mV			5	µA
Soft Start, VOUT Slew Rate	V_{O-SR}	Initial Power On or After a Short Circuit, C_{OUT} = 20µF		21	50	V/ms
Thermal Shutdown	T_{SD}	(Silicon Temperature)	135	150		°C
DC Average In-Rush Current at VCC and VPWR (summed)	I_{INRUSH}	V_{IN} ramping from 0V to 5V having a slew rate of 0.1V/S min to 0.5V/uS max and C_{OUT} = 20µF			550	mA
Output Voltage Overshoot (From either removal of a short circuit condition from V_{OUT} or applied power during start up)	$V_{O\ OS}$	Applied power V_{IN} ramp rate of 0.1V/S min to 0.5V/uS max			5	%
Output Voltage Response to Dynamic Load Change	$V_{O\ OS}$	Output load current change from 100ma to 700ma or 700ma to 100ma, transition time <100ns	-5		5	%
Circuit Output Capacitance	C_{OUT}	Closed Loop stability	20			µF

ELECTRICALS

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APPLICATION SUPPORT

PCB Layout Considerations

1- Maintain separate traces leading from the decoupling capacitor, C_{IN}, to the supply input pins of the IC for VCC and VPWR. This ensures that the noise and voltage drops associated with the high dI/dt pulses from the PWM switching are minimized for the internal control circuitry of the IC.

2- Diode ground should return to C_{OUT} ground with minimum physical distance before joining the IC Ground connection.

3- Feed back resistor return path to ground should be located closely to the IC Pin 2 to avoid V_{OUT} offsets induced by ground drops and noise.

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APPLICATION

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SIMPLIFIED BLOCK DIAGRAM

APPLICATION PERFORMANCE

Dynamic Load Change Response

CH1 = Vout AC Coupled
CH2 = Load Switch
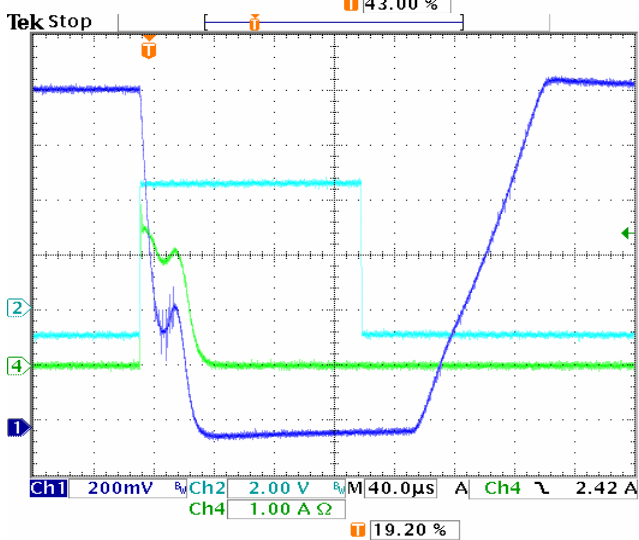CH4 = Output Current, 100mA to 750mA

V_{IN}=5V, L=3.3uH, C_{OUT} = 20uF

APPLICATION
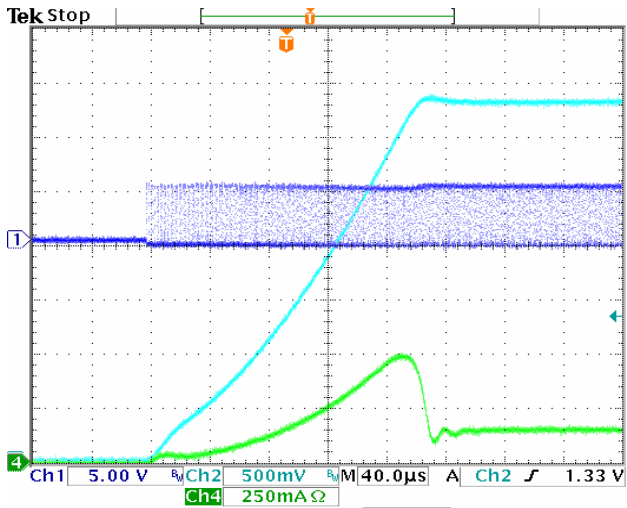
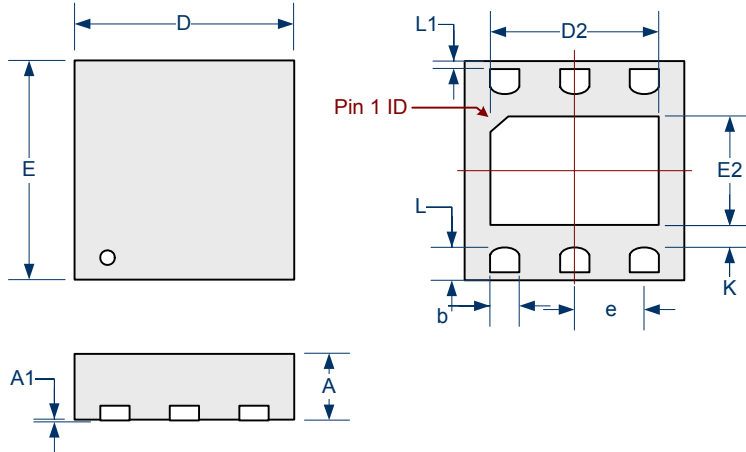**Start-up Inrush Current Control**

CH1 = SW Pin
CH2 = Vout @ 3.32V
CH4 = Input Current

V_{IN}=5V, No Output load, C_{OUT} = 20uF

VOUT Response to Short Circuit Removal

CH1 = Vout programmed at 1.2V
CH2 = Short CKT Duration
CH4 = Output Current

C_{OUT} = 20uF

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APPLICATION

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PACKAGE DIMENSIONS

LD   MO-229 6-Pin Plastic 3 x 3 x .9 mm

Pin 1 ID

Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.80	1.00	0.031	0.039
A1	0.00	0.05	0.000	0.002
K	0.20 MIN		0.008 MIN	
e	0.95 BSC		0.037 BSC	
L	0.30	0.50	0.012	0.020
b	0.30	0.45	0.012	0.018
D2	1.90	2.40	0.075	0.094
E2	1.15	1.65	0.045	0.065
D	3.00 BSC		0.118 BSC	
E	3.00 BSC		0.118 BSC	
L1	0.00	0.15	0.000	0.006

Note:

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

NOTES

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MECHANICAL

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