

Evaluation Board information

LXE1684 EVALUATION BOARD USER'S GUIDE

LX1684 BUCK PWM CONTROLLER

Manufactured by:

Microsemi

Power Management Division

Garden Grove

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More than solutions – enabling possibilities

GENERAL DESCRIPTION

The LXE1684 evaluation board is a switching Buck power supply which provides a 3.3V output from a 12V power supply utilizing the LX1684 Microsemi's integrated controller. It can source 0A to 10A and requires no minimum load for proper voltage regulation. The LXE1684 uses 12V as its main power source and 5V to bias the LX1684 IC.

QUICK INSTALLATION GUIDE

It is recommended that you use laboratory power supply with adjustable current limit.

Ground and power wires used to connect power supply to LX1684 should be 4 inches or less each. Wires should be at least 18 Gauge wire or larger, we recommend 16 or 14 Gauge stranded wires for all power wires and ground wires. Additional through hole power and ground pads are provided in order to reduce connector resistance. See silkscreen for more details.

1. Turn off power to 5V and 12V power supplies.
2. Connect 5V, 12V, and GND from power supplies to 5V, 12V and GND connectors of LXE1684.
3. Connect GND and 3.3V output to test load.
4. Turn on power supply.

ENVIRONMENTAL

Ambient Temperature: <70°C

INPUT VOLTAGE REQUIREMENTS

12V / 10A ± 10%
5V / 100mA ±5%

ELECTRICAL SPECIFICATIONS

Parameter	Value
Output voltage	3.3V, 0A to 10A ±5%
Output Current	10A Short Circuit protected.
Switching Frequency	175kHz
Typical Efficiencies	75% at 500mA
	92% at 1A
	90% at 5A
	87% at 10A

DETAILED DESCRIPTION

With Both 5V and 12V power supplies readily available on an AT or ATX desktop power supply, the LX1684 provides a flexible option for choosing either 5V or 12V as power source. Differential current sensing allows more accurate current sensing from 12V which is unavailable in the earlier LX1681/LX1682 controllers. The LXE1684 provides lossless HICCUP mode current limiting eliminating the need for an expensive current sense resistor. The unit can survive an output short circuit condition indefinitely without overstressing onboard power MOSFETS and inductor. Power consumption during output short-circuit and during Hiccup mode is less than 10% of 10A full current load.

Utilizing synchronous Logic Level MOSFET rectification, the LXE1684 features high efficiency conversion (typically 87% at full load of 10A for 12V to 3.3V application). With a switching frequency of about 200KHz, it provides an optimum efficiency and low ripple output voltage over a full range of output current load.

Features

- *High efficiency switching 3.3V power supply*
- *Up to 92% efficiency for 12V to 3.3V application.*
- *Internally compensated 16Mhz bandwidth opamp provides fast transient response*
- *Lossless Hiccup R_{DS_ON} sensing current limit protection*
- ***Voltage mode opamp requires no external compensation***
- *Built in MOSFET drivers reduce overall cost.*
- *Short Circuit protection: Can sustain output short circuit without overstressing MOSFET and inductors on board,*
- *Differential Kelvin current sensing provides superior performance than LX1681/LX1682 in terms of ease of use, accuracy and noise immunity.*

Capacitor selection

The LXE1684 are shipped from factory with aluminum electrolytic capacitors in order to minimize overall cost. The designer should choose long life, 105°C high temperature and high maximum ripple current electrolytic capacitors in order to meet the demand of high ripple currents inherent to DC/DC high current switching power supplies. Traditional aluminum electrolytic capacitors however are bulky in comparison to newer type of special polymer dielectric or organic dielectric capacitors.

The LXE1684 PCB layout therefore is designed with both surface mount pads and through hole pads for its power components such as FETs, inductors and capacitors, can be easily reconfigured to use all surface mount components for high performance and low profile space constrained applications such as video cards, memory power supply and other PCI bus and AGP bus multimedia interface cards.

The major advantage of LX1684 over LX1681 is that with differential current sensing with both positive current sense and negative current sense, the topside power MOSFET can be far away from LX1684 and/or have different voltage and still provide superior performance in comparison with the LX1682. The LX1684 does not limit the power input option to 5V, if current sensing is used. With 5V readily available on desktop AT and ATX power supplies, the LXE1684 can provide a DC to DC power supply which can draw power from 12V, 5V or 3.3V to provide output voltages as low as 1.25V while providing lossless R_{DS_ON} sensing for all power input options. Ripple voltage can be lower than 10mV if high performance Poly capacitors or OSCON capacitors are used. The LX1684 provides stable operation with total output capacitor ESR as low as 5mΩ when used in a DC to DC buck configuration.

MOSFET Selection

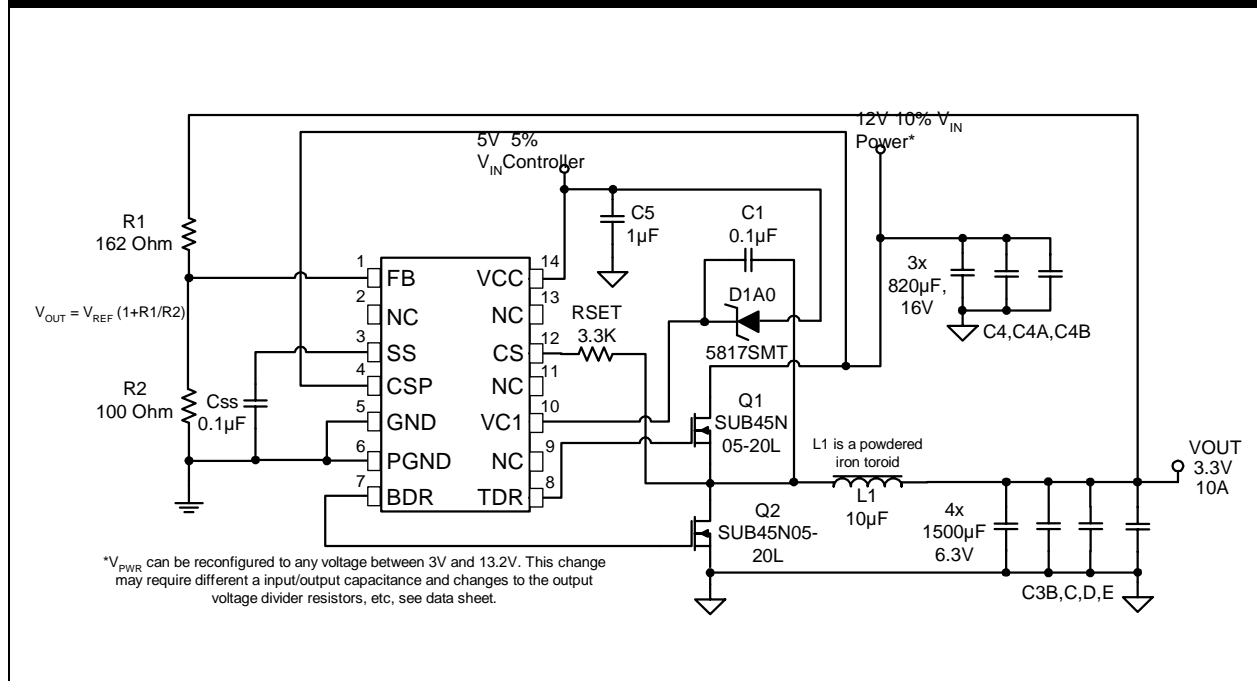
The top and bottom FETs *MUST* be Logic level MOSFETs. For a 12V power input application the total gate capacitance of each MOSFET should be less than 50nC. This is due to the fact that SOIC-14 package has a junction to ambient temperature coefficient of 165°C per Watt. Maximum V_{DS} rating of MOSFETs for 12V operation should be at least 30V.

The LXE1684 can accommodate Top and Bottom MOSFETs with both through hole and surface mount footprints such as TO-220, SMD220, TO-263, TO-252, SOT-223 such as the Vishay Logic MOSFET SUB45N05-20L.

Please refer to LX1684 data sheet for MOSFET selections. For 12V application, care must be taken in selecting MOSFET to make sure that LX1684 junction temperature is within acceptable limits. Die temperature should be less than 125°C.

For 12V to 3.3V application, the current flow through the bottom MOSFET is more than twice the current flow through the top MOSFET. The power supply designer therefore should choose a larger MOSFET and larger heat sink for the bottom MOSFET. Please refer to LX1684 data sheet for calculation of power dissipation on the top and bottom MOSFETs.

LXE1684 Evaluation Board Schematic



LXE1684 COMPONENT LIST

MISCELLANEOUS COMPONENTS

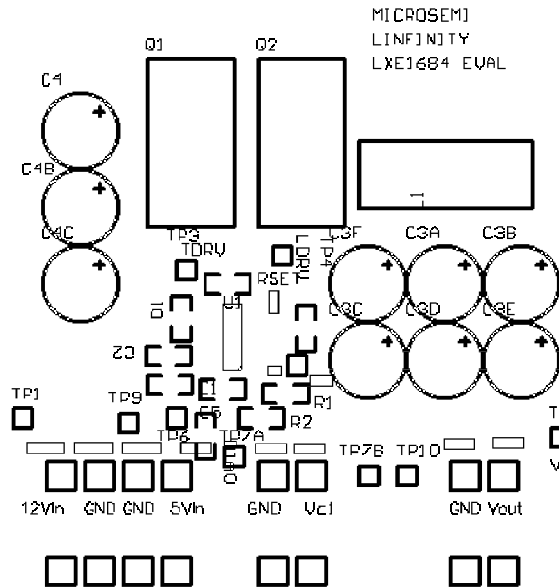
Part Description	Manufacturer & Part #	Reference Designators	Qty
Buck PWM Controller	Microsemi LX1684	U1	1
N-Channel MOSFET	Vishay SUB45N05-20L	Q1, Q2	2
Schottky DIODE	Microsemi 1N5817	D1A0	1
Inductor, 10uH Toroid Iron Powder	Micrometal	L1	1

CAPACITORS

Part Description	Manufacturer & Part #	Reference Designators	Qty
Capacitor, 0.1µF, Ceramic 1206, 50V	Any	C1,CSS	1
Capacitor, 1500µF, 6.3V, AL Elect.	Panasonic EEU-FC0J152	C3B, C3C, C3D, C3E	4
Capacitor, 820µF, 16V, AL Elect.	Panasonic EEU-FC1C821S	C4, C4B, C4C	3
Capacitor, 1µF, Ceramic 1206	Any	C5	1

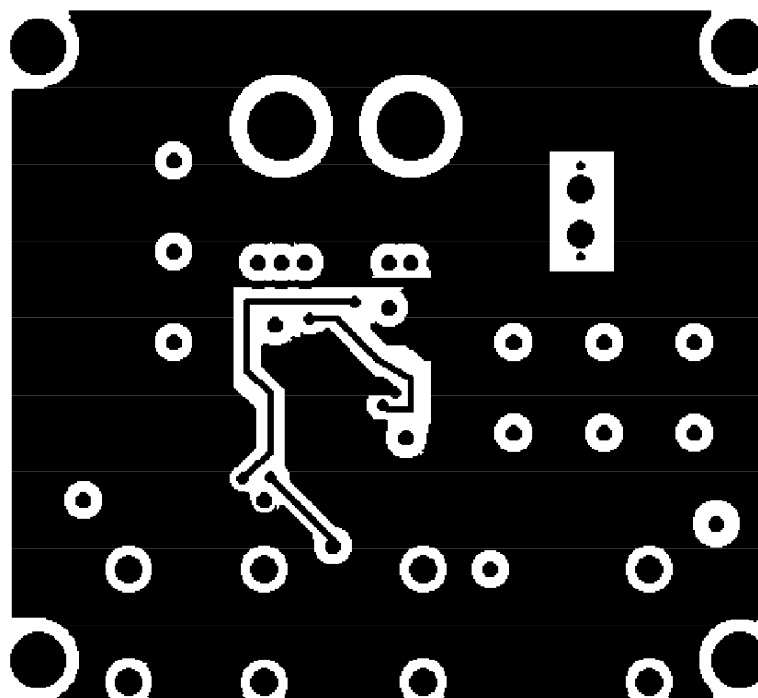
RESISTORS

Part Description	Manufacturer & Part #	Reference Designators	Qty
Resistor, 162, 1%, 1206	Any	R1	1
Resistor, 100, 1%, 1206	Any	R2	1
Resistor, 3.3K, 5%, 1206	Any	RSET	1

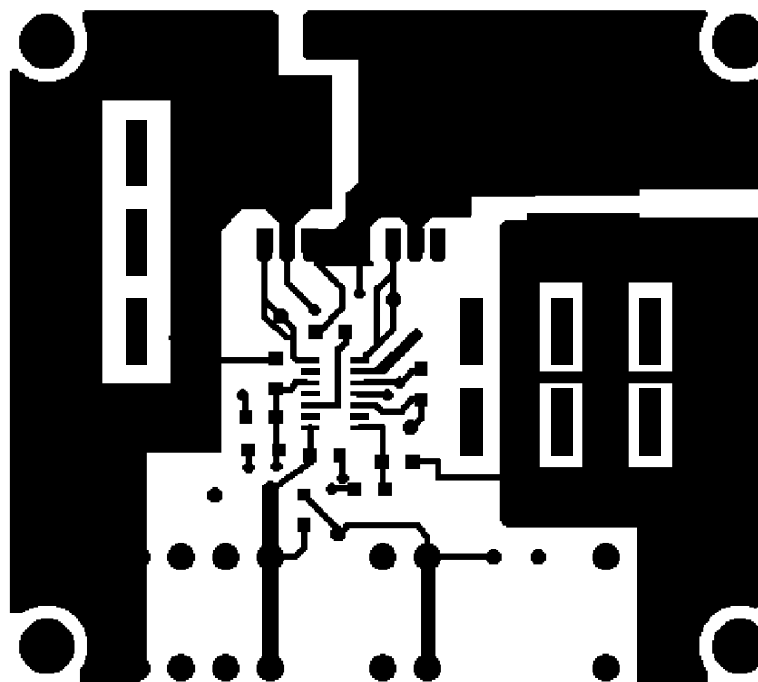


Additional power and ground through hole pads for improved current conduction and ease of use. User can solder wires directly from power supply and to load without removing components.

SILK SCREEN



Solder Side



Component Side