

# LX1675 STANDARD EVALUATION KIT USER GUIDE

LX1675 3 PWM DC-DC Buck Converters and Single LDO Controller



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## INTRODUCTION TO PRODUCT

The LX1675 topology contains 3 PWM controllers and a single LDO controller. The PWM controllers provide standard DC to DC Buck conversion. There are a large number of possible configurations of output voltages and currents that can be achieved with the LX1675 controller. Output voltages can be programmed as low as 0.8 volts. Depending on specific parts selection the output currents can range from 1 to 15 amps. To show a typical application a standard evaluation board has been configured. The input voltage range has been set from 9V to 15V even though the maximum input voltage can go up to 24 volts. The PWM feedback loop compensation has been optimized for this input voltage range. The output voltages have been preset for the following voltages of:  $V_{OUT1} = 1.2V$ ,  $V_{OUT2} = 3.3V$ ,  $V_{OUT3} = 5.0V$ , and  $V_{OUT4} = 2.5V$ . The current limit for all PWM outputs are set the same at approximately 4.5amps. The Soft Start sequencing has also been preset so that Vout1 comes up first, then Vout2, then Vout3 and Vout4.

There are two jumper selectable features for the LX1675. The jumper at JB1 can select 300KHz, jumper between pins 2 & 3, or 600KHz operation, jumper between pins 1 & 2. The 600KHz option allows the inductance value to go lower while upping the inductor current rating and maintaining the same level of output voltage ripple. JB2 is the other jumper selection for Shared Faults. With the jumper between pins 1 & 2 the LX1675 has Shared Faults. This means that if one PWM output goes into Hiccup mode because of a current limit, then all the other outputs will go into the same Hiccup mode at the same time. During the Start Up phase of the Hiccup mode the output voltage will follow the preset start up sequence. With the JB2 jumper set between pins 2 & 3 all output voltages will be independent of each other during a fault condition. Only the output having a fault condition will go into the Hiccup mode.

It is customary to use one of the PWM output voltages to be the supply voltage for the LDO voltage output. The output current of the PWM phase can be increased so that it can supply the rated current to its voltage output plus the rated current for the LDO output. The PWM output voltage closest to the LDO output voltage is used to give the lowest power dissipation of the LDO pass transistor. In this case the 3.3V PWM output is used to generate the LDO output of 2.5V.

The  $V_{IN}$  power supply should have more than enough current to supply the total output power plus the power loss of the conversions. The LX1675 datasheet should be referred to for all application type information and functionality.

## KEY FEATURES

- Four Independently Regulated Outputs
- Single Input Supply with Wide Voltage Range: 4.5-24V
- Outputs As Low As 0.8V Generated From a Precision Internal Reference
- Selectable PWM Frequency of 300KHz or 600KHz
- Buffered Reference Voltage Output
- Multiphase Output Reduces Need for Large Input Capacitance at High Currents
- Integrated High Current MOSFET Drivers
- Independent Soft-Start and Power Sequencing
- Adjustable Linear Regulator Driver Output
- No Current-Sense Resistors
- DDR Termination Compliant
- RoHS Compliant for Pb-free

## APPLICATIONS

- Multi-Output Power Supplies
- Video Card Power Supplies
- PC Peripherals
- Portable PC Processor and I/O Supply

## PART SPECIFIC INFORMATION

Part Number	Product Description
LX1675CLQ <sup>1</sup>	Multiple Output LoadSHARE™ PWM

TABLE 1 – PART INFORMATION

IC	EVALUATION BOARDS
LX1675CLQ <sup>1</sup>	LX1675 Standard EVAL KIT

TABLE 2 – EVALUATION BOARD INFORMATION

1. LX1675CLQ: Protected by U.S. Patents: 6,285,571 & 6,292,378

SCHEMATIC FOR LX1675 EVAL KIT

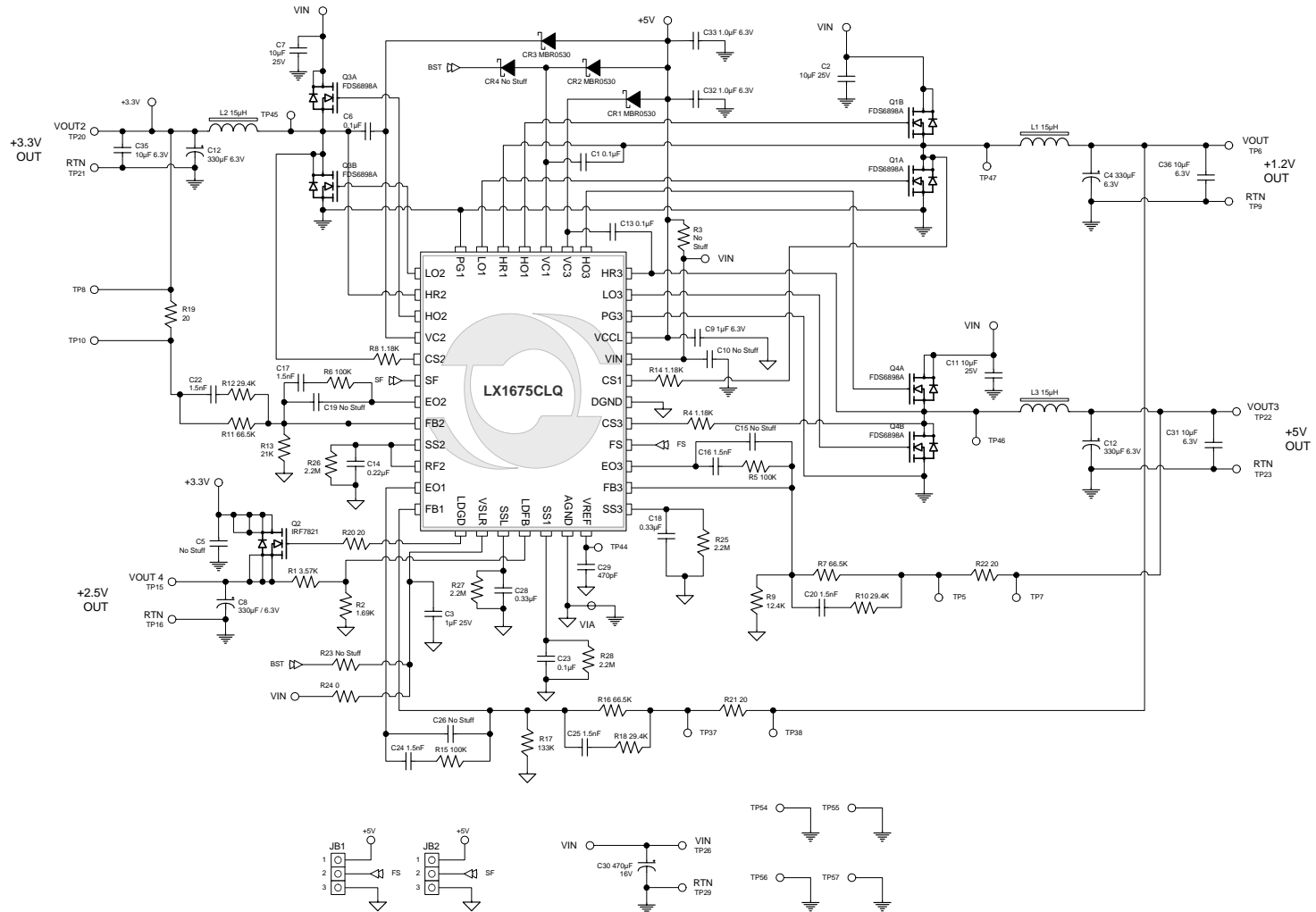


Figure 1 – Evaluation Board Schematic

## EVALUATION BOARD OPERATION

Before powering up the board, make sure the two jumpers are in the locations that best suits your application. Terminal pins are provided for connecting the input power supply and connecting loads to all the output voltage supplies. Many test points have been added to the Evaluation board for signal viewing. Refer to the schematic diagram for connections and test points. The design of each PWM phase is the same but the R & C values for loop compensation may be different depending on the  $V_{IN}$  to  $V_{OUT}$  ratio.

If a different output voltage is required one can change the values of the resistors in the feedback resistor divider from the output voltage to the FB pin. The internal reference voltage is 0.8 volts therefore the voltage at the FB pin will be 0.8 volts when the output voltage is in regulation. The calculation of these resistor values is shown in the application section of the datasheet.

The current limit for the PWM outputs has been set at a maximum for the inductors and NMOSFET transistors used on this evaluation board. This is based on the inductor saturation current specification. If a higher output current is desired it will require a higher current rated inductor installed before changing the value of the current limit setting resistor. One will have to select a NMOSFET transistor with a higher current rating for the new application.

The supply voltage for the upper NMOSFET gate drivers is derived from a conventional bootstrap capacitor/Schottky diode arrangement. There is a Schottky diode and capacitor for each PWM phase. In a different type configuration from this board the boost voltage at the VC1 pin has a second diode/filter capacitor to generate a DC supply voltage for the power supply pin of the LDO controller amplifier, VSLR. This would be used when  $V_{IN}$  is fixed at +5 volts only.

Refer to the Standard Evaluation Board Configuration spreadsheet for voltage and current specifications.

### STANDARD CONFIGURATION

- Operation Frequency –
  - Jumper Selectable: 300KHz, 600KHz, or Both(Default)
- Shared Faults –
  - Jumper Selectable: Shared, Independent(Default)
- Input Voltage Range –
  - +9V to +15V
- Output Voltage #1, PWM Phase 1 –
  - Output Voltage +1.2V
  - Output Current 3A
  - Current Limit Set Point 5.0A  $\pm$ 0.5A
  - Ripple Voltage < 15mV<sub>P-P</sub>
  - Input Voltage Rail used for Conversion:  $V_{IN}$
- Output Voltage #2, PWM Phase 2 –
  - Output Voltage +3.3V
  - Output Current 3A
  - Current Limit Set Point 5A  $\pm$  0.5A
  - Ripple Voltage < 25mV<sub>P-P</sub>
  - Input Voltage Rail used for Conversion  $V_{IN}$
- Output Voltage #3, PWM Phase 3 –
  - Output Voltage +5.0V
  - Output Current 3A
  - Current Limit Set Point 5A  $\pm$ 0.5A
  - Ripple Voltage < 30mV<sub>P-P</sub>
  - Input Voltage Rail used for Conversion  $V_{IN}$
- Output Voltage #4, LDO Controller –
  - Output Voltage 2.5V
  - Output Current 2A
  - Ripple Voltage < 5mV<sub>P-P</sub>
  - Input Voltage Rail used for Conversion +3.3V,  $V_{OUT2}$
- Power Up Sequence For Output Voltages –
  - $V_{OUT1}$   $V_{OUT2}$   $V_{OUT3}$   $V_{OUT4}$

PRINTED CIRCUIT BOARD LAYOUT

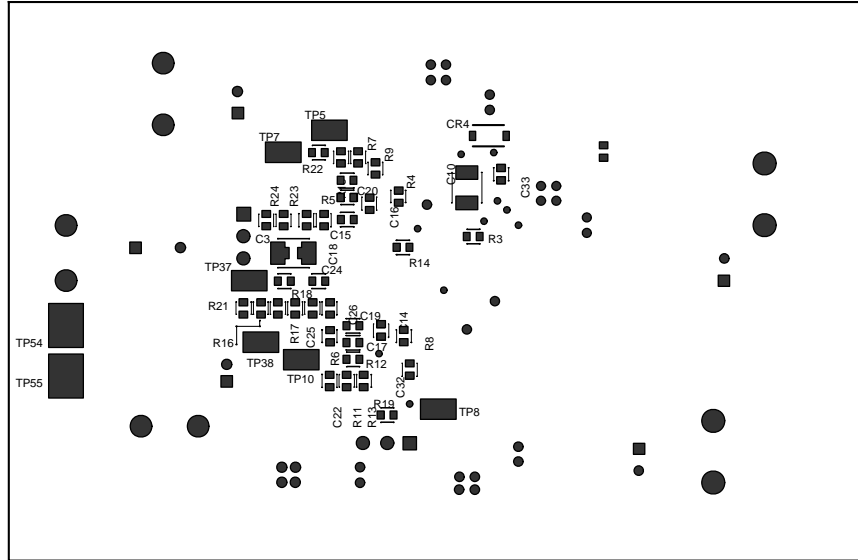


Figure 2 – Bottom Silk Screen

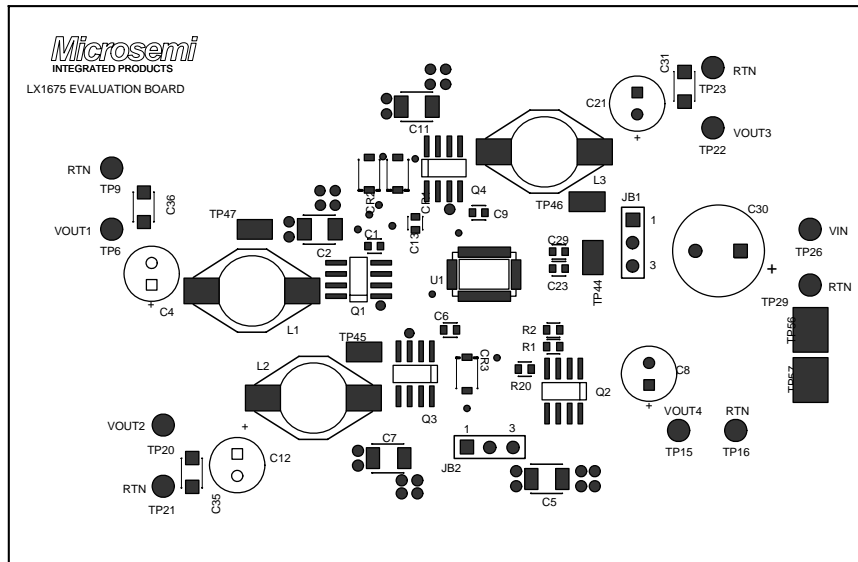


Figure 3 – Top Silk Screen

## BILL OF MATERIALS

## MISCELLANEOUS COMPONENTS

Line Item	Part Description	Manufacturer & Part #		Case	Reference Designators	Qty
1	Microsemi IC 3 Phase Buck Controller	MICROSEMI	LX1675CLQ	MLPQ	U1	1
2	Diode Schottky, 500mA, 30V	ON SEMI	MBR0530		CR1, CR2, CR3	3
3	Inductor, Power, 15 $\mu$ H, 7A	J.W. MILLER	PM3340-150M		L1, L2, L3	3
4	Inductor, Power, 15 $\mu$ H, 7A	COILCRAFT	DO3340P-153ML		L1, L2, L3	Alt
5	MOSFET, Single N-Channel	INT. RECTIFIER	IRF7821	SO8	Q2	1
6	MOSFET, Dual N-Channel	FAIRCHILD	FDS6898A	SO8	Q1, Q3, Q4	3
7	Test Point, 5015 Mini Surface Mount	KEYSTONE	5015		TP5, TP7, TP8, TP10, TP37, TP38, TP44, TP45-TP47	10
8	Terminal, Vector K31 Inboard Pin	VECTOR ELECT.	K31C/M		TP6, TP9, TP15, TP16, TP20-TP23, TP26, TP29	10
9	Test Point, 5016 Compact Surface Mount	KEYSTONE	5016		TP54 - TP57	4
10	Header, 3 Position, Vertical Mount, .100	3M	929647-02-36-I		JB1, JB2	2
11	PCB, LX1675-Standard X1	MICROSEMI	SGE2863 X2		PCB	1
12	No Stuff				CR4	1

## CAPACITORS

Line Item	Part Description	Part Description	Case	Reference Designators	Qty
1	Capacitor, Ceramic, 0.1 $\mu$ F, 16V, 10%, X7R	PANASONIC ECJ-1VB1C104K	0603	C1, C6, C13, C23	4
2	Capacitor, 470 $\mu$ F, 16V FC Series Aluminum Electrolytic	PANASONIC EEU-FC1C471	10x16mm	C30	1
3	Capacitor, Ceramic, 10 $\mu$ F, 25V, 20%, X5R	PANASONIC ECJ-4YB1E106M	1210	C2, C7, C11	3
4	Capacitor, 330 $\mu$ F, 6.3V FM Series Aluminum Electrolytic	PANASONIC EEU-FM0J331	6x11.2mm	C4, C12, C21, C8	4
5	Capacitor, Ceramic, 10 $\mu$ F, 6.3V, 20%, X5R	PANASONIC ECJ-DV50J106M	1206	C31, C35, C36	3
6	Capacitor, Ceramic, 1 $\mu$ F, 25V, 10%	PANASONIC ECJ-2FB1E105K	0805	C3	1
7	Capacitor, Ceramic, 1 $\mu$ F, 6.3V, 10%	PANASONIC ECJ-1VB0J105K	0603	C9, C32, C33	3
8	Capacitor, Ceramic, 0.22 $\mu$ F, 10V, 10%, X5R	PANASONIC ECJ-1VB1A224K	0603	C14	1
9	Capacitor, Ceramic, .0015 $\mu$ F, 50V, X7R	PANASONIC ECJ-1VB1H152K	0603	C16, C17, C20, C22, C24, C25	6
10	Capacitor, Ceramic, 0.33 $\mu$ F, 10V, X7R	PANASONIC ECJ-1VB1A334K	0603	C18, C28	2
11	Capacitor, Ceramic, 470pF, 50V, NPO	PANASONIC ECJ-1VC1H471J	0603	C29	1
12	No Stuff			C15, C19, C26, C34	4

## RESISTORS

Line Item	Part Description	Part Description	Case	Reference Designators	Qty
1	Resistor, 3.57K, 1/16W	PANASONIC ERJ-3EKF3571V	0603	R1	1
2	Resistor, 1.69K, 1/16W	PANASONIC ERJ-3EKF1691V	0603	R2	1
3	Resistor, 1.18K, 1/16W	PANASONIC ERJ-3EKF1181V	0603	R3, R23	2
4	Resistor, 0 Ohm Jumper	PANASONIC ERJ-3GET0R00V		R24	1
5	Resistor, 100K 1/16W	PANASONIC ERJ-3EKF1003V	0603	R5, R6, R15	3
6	Resistor, 66.5K, 1/16W	PANASONIC ERJ-3EKF6652V	0603	R7, R11, R16	3
7	Resistor, 12.4K, 1/16W	PANASONIC ERJ-3EKF1242V	0603	R9	1
8	Resistor, 29.4K, 1/16W	PANASONIC ERJ-3EKF2942V	0603	R10, R12, R18	3
9	Resistor, 21K, 1/16W	PANASONIC ERJ-3EKF2102V	0603	R13	1
10	Resistor, 133K, 1/16W	PANASONIC ERJ-3EKF1333V	0603	R17	1
11	Resistor, 20 Ohm, 1/16W	PANASONIC ERJ-3EKF20R0V	0603	R19, R20, R21, R22	4
12	Resistor, 2.2M Ohm, 1/16W <sup>1</sup>	PANASONIC ERJ-3EKF2204V	0603	R25, R26, R27, R28	4
13	No Stuff			R3, R23	2

<sup>1</sup> R25 - R28 Soldered on top of C14, C18, C23, C28