LTC3612
Isolated RS485/RS422
µModule Transceiver + Power

DESCRIPTION

Demo circuit 1574 is a high efficiency, high frequency step-down converter incorporating the LTC®3612 monolithic synchronous regulator. The DC1574A has an input voltage range of 2.25V to 5.5V and is capable of delivering up to 3A of output current. The output voltage of the DC1574A can be set as low as 0.6V, the reference voltage of the LTC3612. The operating frequency range of the DC1574A is either set to a fixed 2.25 MHz by connecting the frequency pin to SV_{IN}, set by an external resistor, or synchronized to an external clock, with a range up to 4MHz. At low load currents, the DC1574A can operate in both noise sensitive applications (due to the capability of the LTC3612 to operate in pulse-skipping mode) or in high efficiency applications, because the LTC3612 also has Burst-Mode® capability. The Burst Mode clamp can be set externally. Of course, in (forced) continuous mode, or large load current applications, the DC1574A is a very efficient circuit—over 90%. The DC1574A consumes less than 200µA of quiescent current during sleep operation and, during shut-down, it consumes less than 1µA. The DC1574A can track another voltage, due to the LTC3612 track function, for easy power supply sequencing. Extra features include frequency and current fold-back, and an adjustable 0.3V-to-0.6V external reference. Because of the high switching frequency of the LTC3612, which is programmable up to 4 MHz, the DC1574A uses low profile surface mount components. All these features make the DC1574A perfectly suited for portable computer and distributed power applications.

Design files for this circuit board are available at http://www.linear.com/demo/DC1574A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	CONDITIONS	VALUE
Minimum Input Voltage		2.25V
Maximum Input Voltage		5.5V
Run/Shutdown		GND = Shutdown V_{IN} = RUN
Output Voltage Regulation	V_{IN} = 2.25V to 5.5V, I_{OUT} = 0A to 3A	1.2V ±4% (1.152V – 1.248V)
	V_{IN} = 2.25V to 5.5V, I_{OUT} = 0A to 3A	1.8V ±4% (1.728V – 1.872V)
	V_{IN} = 3.1V to 5.5V, I_{OUT} = 0A to 3A	2.5V ±4% (2.4V – 2.6V)
	V_{IN} = 3.9V to 5.5V, I_{OUT} = 0A to 3A	3.3V ±4% (3.168V – 3.432V)
Typical Output Ripple Voltage	V_{IN} = 5V, V_{OUT} = 1.8V, I_{OUT} = 3A (20MHz BW)	<30mV_{P-P}
Burst Mode	V_{IN} = 5V, V_{OUT} = 1.8V	<600mA
Pulse-Skip Mode	V_{IN} = 5V, V_{OUT} = 1.8V	<500mA
Nominal Switching Frequency	R_T = 165k	2 MHz ± 20%

QUICK START PROCEDURE

Table 1. Jumper Description

JUMPER	FUNCTION	RANGE/SETTING (DEFAULT)
JP1	Output Voltage Setting.	1.2V
J1	Mode: Forced Continuous Mode (FCM), Burst Mode (BM or BMEC), or Pulse-Skip Mode(SYNC)	(FCM) – BMEC – BM – PSM
J2	Run	(ON) – OFF
J3	Tracking (TRACK), Internal Soft-Start (INT SS), or External Soft-Start (EXT SS)	(EXT SS) – (INT SS) – TRACK
J4	DDR Memory Termination	(OFF) – ON
J5	External or Internal ITH Compensation	(EXT) – INT
J6	Frequency Setting: Timing Resistor (R_T), Internally Synchronized (2.25 MHz), or Externally Synchronized	(R_T) – INT SYNC – EXT SYNC
J9	External Burst Mode Clamp Voltage	(SET) – EXT

Demonstration Circuit 1574 is easy to set up to evaluate the performance of the LTC3612. For proper measurement equipment configuration, set up the circuit according to the diagram in Figure 1. Before proceeding to test, insert shunts into the 1.2V position of the output voltage header JP1, into the FCM (forced continuous mode) position of MODE header J1, into the OFF position of RUN header J2, into the EXT SS (external soft-start) position of Track/SS header J3, into the OFF position of DDR header J4, into the EXT (external) position of COMP header J5, into the R_T position of R_T/SYNC header J6 and into the SET position of VBMCV header J9.

When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V_{IN} or V_{OUT} and GND terminals. See Figure 2 for proper scope probe measurement technique.

With the DC1574 set up according to the proper measurement configuration and equipment in Figure 1, apply 6.3V at V_{IN} (Do not hot-plug V_{IN} or increase V_{IN} over the rated maximum supply voltage of 5.5V, or the part may be damaged.). Measure V_{OUT}; it should read 0V. Turn on the circuit by inserting the shunt in header J2 into the ON position. The output voltage should be regulating. Measure V_{OUT}—it should measure 1.2V ±2% (1.176V to 1.224V).

Vary the input voltage from 2.25V to 5.5V and adjust the load current from 0A to 3A. V_{OUT} should regulate around 1.2V. Measure the output ripple voltage; it should measure less than 30mV_{AC}.

Observe the voltage waveform at the switch pins (the other side of the inductor from the output). Verify the switching frequency is between 1.6MHz and 2.4MHz (T = 625ns and 416ns), and that the switch node waveform is rectangular in shape.

Change the J1 shunt from forced continuous mode to Burst Mode operation or pulse-skip mode. Set the input voltage to 5V and the output current to any current less than 600mA. Observe the discontinuous mode of operation at the switch node, and measure the output ripple voltage. It should measure less than 100 mV.

Insert the J2 shunt into the OFF position and move the shunt in the 1.2V output JP1 header into any of the two remaining output voltage option headers: 1.8V (JP2), 2.5V (JP3), or 3.3V (JP4). Just as in the 1.2V V_{OUT} test, the output voltage should read V_{OUT} ±2% tolerance under static line and load conditions and ±1% tolerance under dynamic line and load conditions (±2% total). Also, the circuit operation in discontinuous mode will be the same. When finished, turn off the circuit by inserting the shunt in header J2 into the OFF position.

QUICK START PROCEDURE

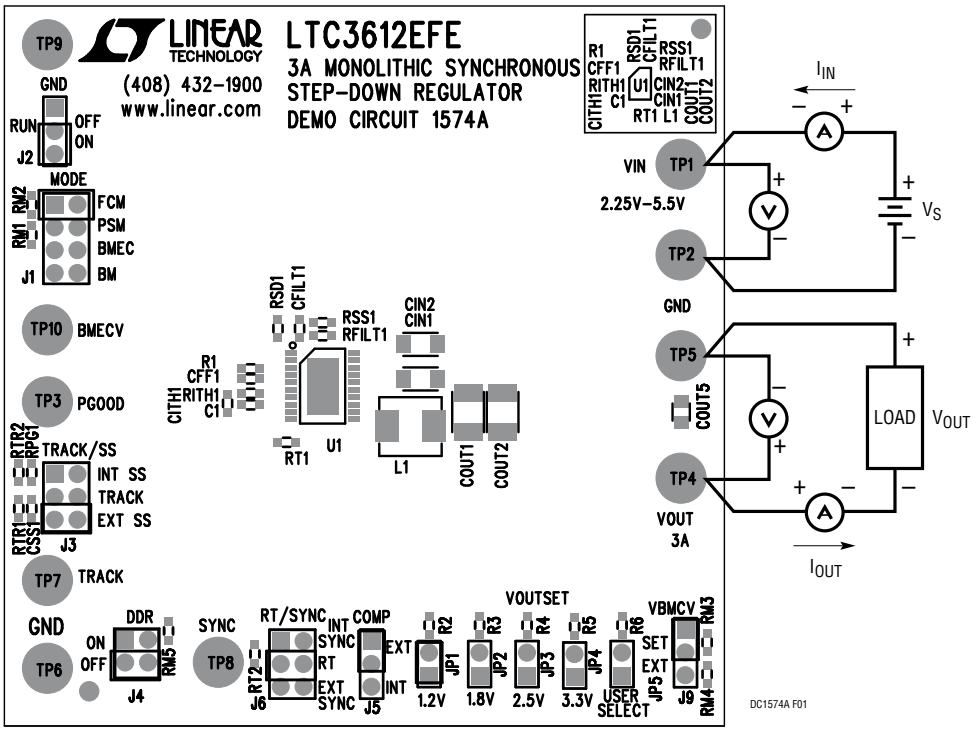


Figure 1. Proper Measurement Equipment Setup

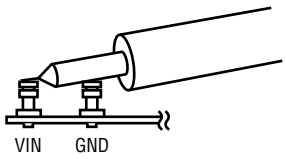
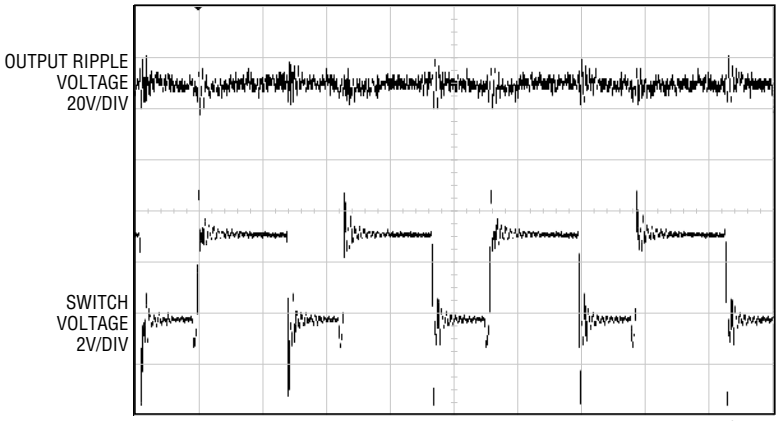


Figure 2. Measuring Input or Output Ripple

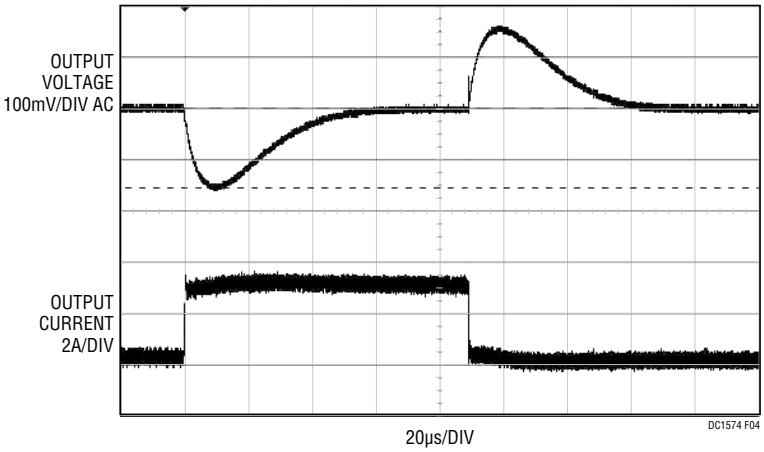
QUICK START PROCEDURE



V_{IN} = 3.3V
V_{OUT} = 1.8V
I_{OUT} = 3A
f_{SW} = 2MHz

Figure 3. Switch Node and Output Ripple Voltage Waveforms

QUICK START PROCEDURE



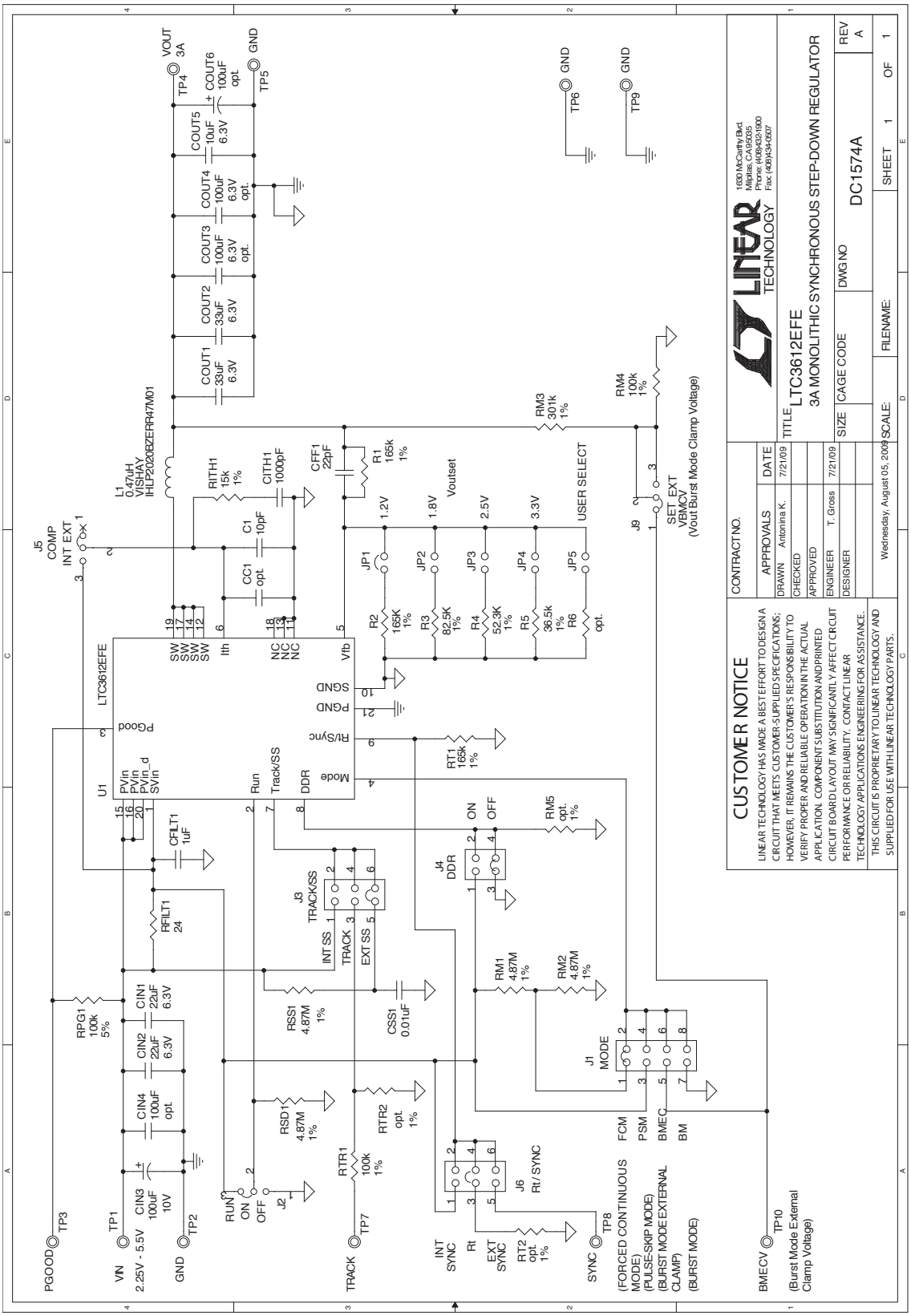
V_{IN} = 3.3V
V_{OUT} = 1.8V
2.5A LOAD STEP (0.5A TO 3A)
FORCED CONTINUOUS MODE
f_{SW} = 2MHz

Figure 4. Load Step Response

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CFF1	CAP., G0G, 22pF, 25V, 5% 0603	AVX, 06033A220JAT2A
2	2	CIN1, CIN2	CAP., X7R, 22µF, 6.3V, 20% 1206(1210)	AVX, 12066C226MAT2A
3	2	COUT1, COUT2	CAP., X5R, 33µF, 6.3V, 20% 1210	MURATA, GRM32DR60J336ME19
4	1	L1	INDUCTOR, 0.47µH IHLP-2020BZ-01	VISHAY, IHLP2020BZERR47M11
5	2	R1, R2	RES., CHIP, 165k, 1/10W, 1% 0603	VISHAY, CRCW0603165KFKEA
6	1	U1	IC., LTC3612EFE TSSOP-20L	LINEAR TECH., LTC3612EFE#PBF
Additional Demo Board Circuit Components				
1	0	CC1 (OPT)	CAP., 0805	OPT
2	1	CFILT1	CAP., X7R, 1µF, 6.3V, 10% 0603	AVX, 06036C105KAT2A
3	1	CIN3	CAP., TANT., 100µF, 10V, 20% 7343	AVX, TPSW107M010R0150
4	0	COUT6 OPT	CAP., TANT., 100µF, 10V, 20% 7343	AVX, TPSW107M010R0150
5	1	CITH1	CAP., X7R, 1000pF, 50V, 10% 0603	AVX, 06035C102KAT2A
6	0	COUT3, COUT4, CIN4 OPT	CAP., X5R, 100µF, 6.3V, 20% 1210 OPT*	MURATA, GRM32ER60J107ME20
7	1	COUT5	CAP., X7R, 10µF, 6.3V, 20% 0805	AVX, 08056C106MAT2A
8	1	CSS1	CAP., X7R, 0.01µF, 50V, 10% 0603	AVX, 06035C103KAT2A
9	1	C1	CAP., C0G, 10pF, 25V, 10% 0603	AVX, 06033A100KAT2A
10	1	RFILT1	RES., CHIP, 24, 1/10W, 5% 0603	VISHAY, CRCW060324R0JNEA
11	1	RITH1	RES., CHIP, 15k, 1/10W, 1% 0603	VISHAY, CRCW060315K0FKEA
12	4	RSS1, RSD1, RM1, RM2	RES., CHIP, 4.87M, 1/10W, 1% 0603	VISHAY, CRCW06034M87FKEA
13	1	RM3	RES., CHIP, 301k, 1/10W, 1% 0603	VISHAY, CRCW0603301KFKEA
14	1	RPG1	RES., CHIP, 100k, 1/10W, 5% 0603	VISHAY, CRCW0603100KJNEA
15	2	RTR1, RM4	RES., CHIP, 100k, 1/10W, 1% 0603	VISHAY, CRCW0603100KFKEA
16	0	RT2, RM5, RTR2, R6 (OPT)	RES., CHIP, OPT. 0603	
17	1	RT1	RES., CHIP, 165k, 1/10W, 1% 0603	VISHAY, CRCW0603165KFKEA
18	1	R3	RES., CHIP, 82.5k, 1/10W, 1% 0603	VISHAY, CRCW060382K5FKEA
19	1	R4	RES., CHIP, 52.3k, 1/10W, 1% 0603	VISHAY, CRCW060352K3FKEA
20	1	R5	RES., CHIP, 36.5k, 1/10W, 1% 0603	VISHAY, CRCW060336K5FKEA
Hardware: For Demo Board Only				
1	5	JP1, JP2, JP3, JP4, JP5	2 PIN 0.079 SINGLE ROW HEADER	SAMTEC, TMM102-02-L-S
2	1	J1	2X4, 0.079 DOUBLE ROW HEADER	SAMTEC, TMM104-02-L-D
3	3	J2, J5, JP9	3 PIN 0.079 SINGLE ROW HEADER	SAMTEC, TMM103-02-L-S
4	2	J3, J6	2X3, 0.079 DOUBLE ROW HEADER	SAMTEC, TMM103-02-L-D
5	1	J4	2X2, 0.079 DOUBLE ROW HEADER	SAMTEC, TMM102-02-L-D
6	8	XJ1-XJ6, XJ9, XJP1	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
7	10	TP1-TP10	TESTPOINT, TURRET, .094" pbf	MILL-MAX, 2501-2-00-80-00-00-07-0

SCHEMATIC DIAGRAM



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