DC1123
QUICK START GUIDE

LTC3562
I²C Quad Synchronous Step-Down DC/DC Regulators

DESCRIPTION

Demonstration circuit 1123 is a I²C Quad Synchronous Step-Down DC/DC Regulators featuring the LTC3562. The LTC3562 is a quad high efficiency monolithic synchronous step-down regulator with an I²C interface. Two regulators are externally adjustable and can have their feedback voltages programmed between 425mV and 800mV in 25mV (Type A). The other two regulators are fixed output regulators whose output voltages can be programmed between 600mV and 3.775V in 25mV steps (Type B). All four regulators operate independently and can be put into pulse skip, LDO, Burst Mode operation or forced Burst Mode operation through I²C control. The Type A regulators have separate RUN pins that can be enabled if I²C control is unavailable.

The 2.85V to 5.5V input range makes the LTC3562 ideally suited for single Li-ion battery powered applications. At low output load conditions, the regulators can be switched into LDO, Burst Mode operation or forced Burst Mode operation, extending battery life in portable systems. The quiescent current drops to under 100µA with all regulators in LDO mode and under 0.1µA when all regulators are shut down

Switching frequency is internally set to 2.25MHz, allowing the use of small surface mount inductors and capacitors. All regulators are internally compensated.

The LTC3562 is offered in a low profile 3mm × 3mm QFN package.

Design files for this circuit board are available. Call the LTC factory.

TABLE 1. Typical Specifications (25°C)

Input Voltage Range: V_{CC}	2.85V to 5.5V (Subject to dropout)
P600A	0.96V to 1.82V, 600mA (Max)
P600B	1.20V to 3.775V, 600mA (Max)
P400A	0.80V to 1.51V, 400mA (Max)
P400B	0.60V to 3.775V, 400mA (Max)

OPERATING PRINCIPLES

The LTC3562 is a highly integrated power management IC that contains four I²C controllable, monolithic, high efficiency step-down regulators. Two regulators provide up to 600ma of output current and the other two regulators produce up to 400ma. All four regulators are 2.25MHz, constant-frequency, current mode switching regulators that can be independently controlled through I²C. All regulators are internally compensated

eliminating the need for external compensation components.

The LTC3562 offers two different types of adjustable step-down regulators. The two Type A regulators (R600A, R400A) can have the feedback voltage adjusted from 425mv to 800mv in 25mv increments. The two Type B regulators (R600B, R400B) can have the output voltages adjusted through I^2C control from 600mv to 3.775V in 25mv increments.

QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, refer to Figure 1 for the proper measurement and equipment setup.

NOTE. 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 VCC or VOUT and GND terminals. See Figure 2 for proper scope probe technique.

1. Place jumpers and load settings in the following positions:

JP1 (RUN600A) = ON

JP2 (RUN400A) = ON

Load 1 = Consant Current 50mA

Load 2 = Constant Current 50mA

Load 3 = Constant Current 50mA

Load 4 = Constant Current 50mA

2. Connect Power Supply PS1 to VIN terminals and adjust to 4.5 Volts to the demo board, as shown in Figure 1.

3. Verify that OUT600A (1.8V) and OUT400A (1.5V) are operational with proper output voltages.

4. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, and efficiency.

5. Open the Quickstart Software as discribed in the DC590 Quick Start Guide

6. Set Jumpers JP1 (RUN400A) and JP2 (RUN600A) to Off Position. Connect Ribbon cable from DC590 demo circuit to J2. The LTC 3562 demonstation software should pop-up automatically when the cable is installed.

7. Using the LTC3562 software GUI. See Figure 3. Set all modes to Burst mode, VOUT 600A to 1.82V, VOUT 600B to 3.3V, VOUT 400A to 1.51V and VOUT 400B to 1.2V. Set all loads to 50mA. Check Auto Update buttons. Click on Enable All button.

8. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, and efficiency.

9. Using the LTC3562 software GUI. Set all modes to Pulse Skip mode, VOUT 600A to 1.82V, VOUT 600B to 3.3V, VOUT 400A to 1.51V and VOUT 400B to 1.2V. Set all loads to 50mA.

10. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, and efficiency.

11. Using the LTC3562 software GUI. Set all modes to Forced Burst mode, VOUT 600A to 1.82V, VOUT 600B to 3.3V, VOUT 400A to 1.51V and VOUT 400B to 1.2V. Set all loads to 50mA.

12. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, and efficiency

13. Using the LTC3562 software GUI. Set all modes to LDO mode, VOUT 600A to 1.82V, VOUT 600B to 3.3V, VOUT 400A to 1.51V and VOUT 400B to 1.2V. Set all loads to 50mA.

14. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, and efficiency

15. Using the LTC3562 software GUI. Set all modes to Burst mode, VOUT 600A to 1.82V, VOUT 600B to 3.3V, VOUT 400A to 1.51V and VOUT 400B to 1.2V. Set all loads to 50mA.

16. Monitor POR600A pin while increasing Load1 until the signal on POR600A goes low. The voltage on P600A will be less than 92% of voltage setting.

17. Set Load1 and Load2 to 450mA. Set Load3 and Load4 to 300mA. Adjust PS1 over the operating range and observe line regulation.

APPLICATION INFORMATION

This demo circuit is designed to demonstrate the full capability of the LTC3562 I^2C Quad Synchronous Step-Down DC-DC Regulator. Not all components are required in all applications. The critical circuit components are on the top of the board near the IC and listed in the Required Circuit Components section of the Bill of Materials, in Figure 5.

The input capacitor network of C1 and R1 is used to dampen source lead inductances that commonly occur in laboratory setups with twisted leads and a bench power supply. When using a USB cable this input damping network will likely not be required. Please note that the in-circuit capacitance of the specified 10uF, 0805 ceramic capacitor for C1 and C2 is less than 5uF each with VIN greater than 4.25 Volts. For good transient response and stability the output capacitor each buck regulator should retain at least 4uF of capacitance over the operating temperature and voltage range.

The output inductors for the OUT600A and OUT600B are the recommended values of 3.3uH while the OUT400A and OUT400B are 4.7uH.

Resistors R4 and R6 are to adjust the output voltage seen on the OUT600A output while R3 and R4 will set the voltage on the OUT400A output.

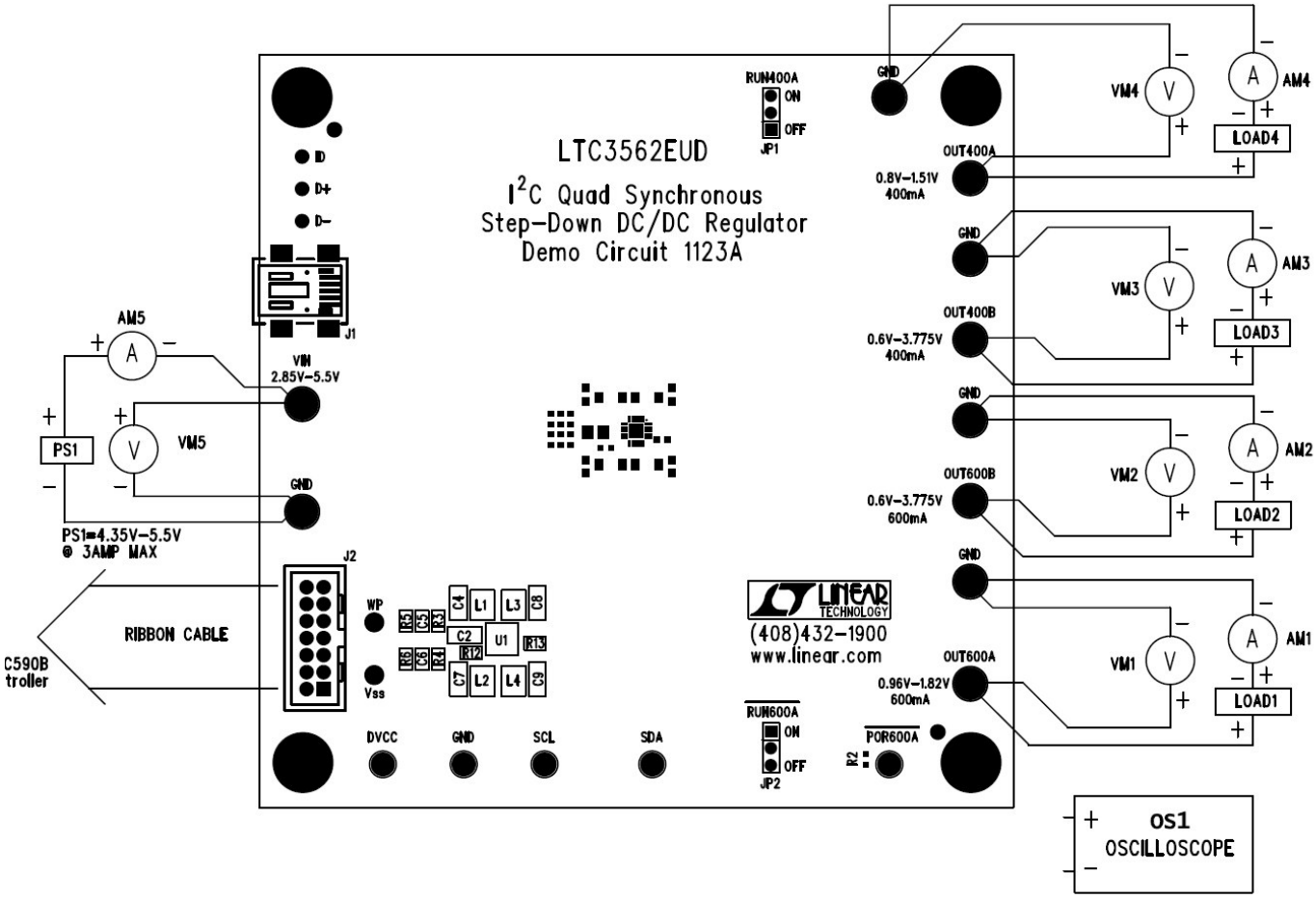

Figure 1. Proper Measurement Equipment Setup

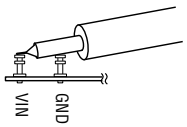

Figure 2. Measuring Input or Output Ripple

Figure 3.

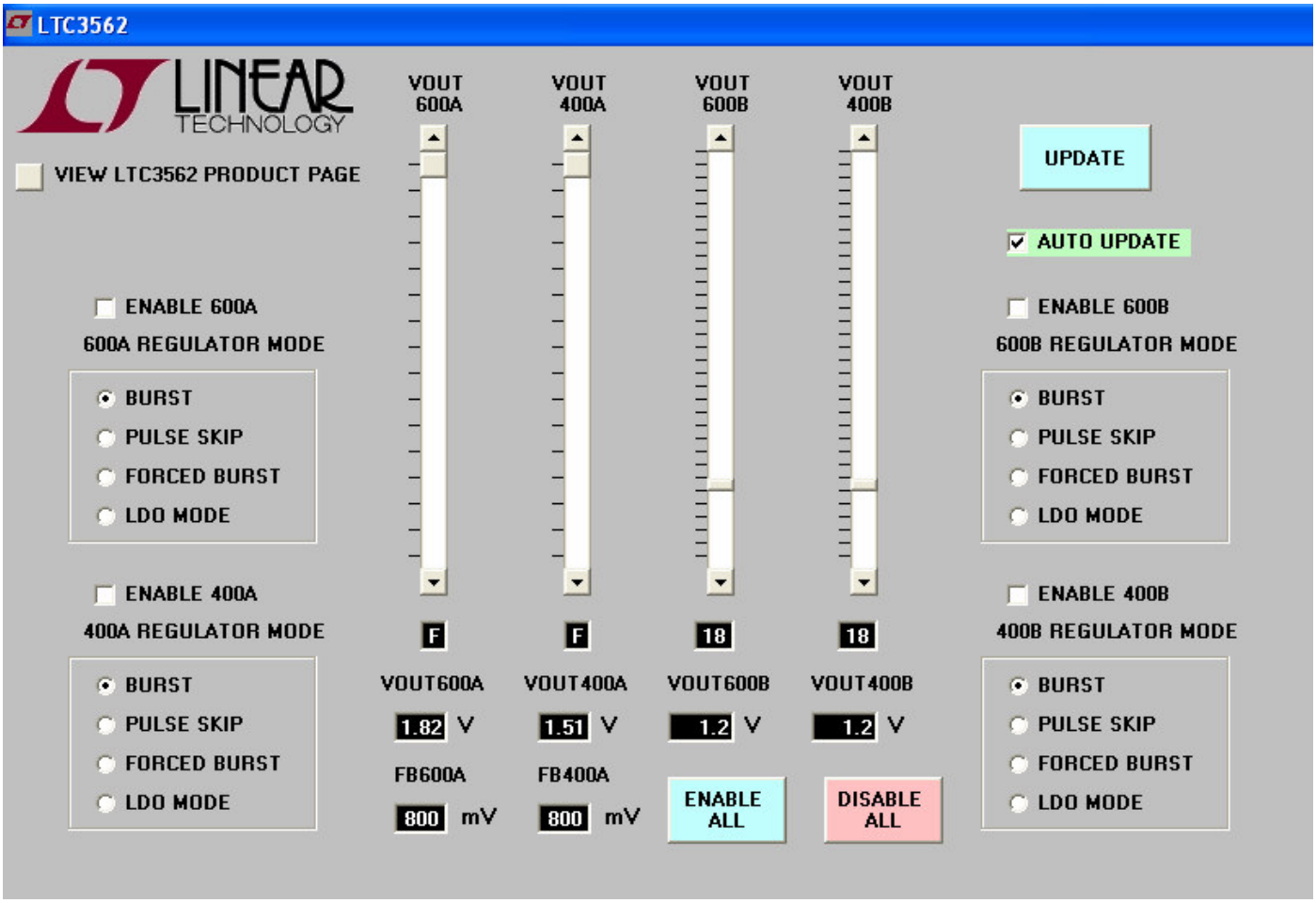

Figure 3. Graphical User Interface

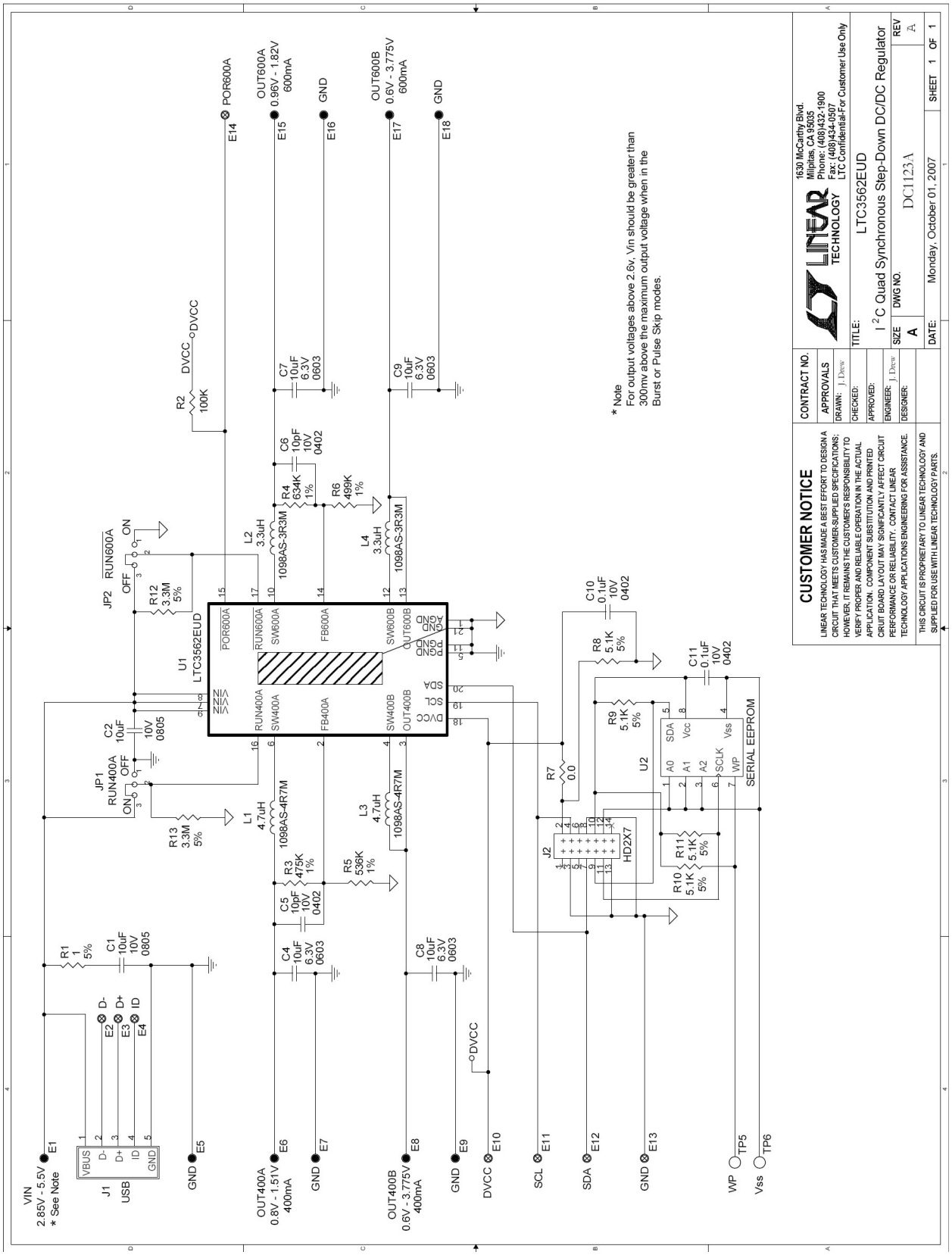

Figure 4. Circuit Schematic

Item	Qty	Reference - Des	Part Description	Manufacturer, Part #
REQUIRED CIRCUIT COMPONENTS:				
1	1	C2	CAP, CHIP X5R, 10uF, 10V, 0805	Murata, GRM21BR61A106KE19
2	4	C4,C7,C8,C9	CAP, CHIP,X5R, 10uF, 6.3V, 0603	TDK, C1608X5R0J106M
3	2	C5,C6	CAP, CHIP, COG, 10pF, 50v, 0402	Murata, GRM1555C1H100JZ01D
4	2	L2,L4	INDUCTOR, 3.3uH, 0.120 Ohms, 1.0A	TOKO, 1098AS-3R3M
5	2	L1,L3	INDUCTOR, 4.7uH, 0.155 Ohms, 0.88A	TOKO, 1098AS-4R7M
6	1	R3	RES, 0402, 475K OHMS, 1%, 1/16w	VISHAY, CRCW0402475KFKED
7	1	R4	RES, 0402, 634K OHMS, 1%, 1/16w	VISHAY, CRCW402634KFKED
8	1	R5	RES, 0402, 536K OHMS, 1%, 1/16w	VISHAY, CRCW402536KFKED
9	1	R6	RES, 0402, 499K OHMS, 1%, 1/16w	VISHAY, CRCW0402499KFKED
10	2	R12,R13	RES, 0402, 3.3M OHMS, 5%, 1/16w	VISHAY, CRCW04023M30JNED
11	1	U1	I^2C QUAD SYNCHRONOUS STEP-DOWN DC/DC REGULATOR	LINEAR TECH, LTC3562EUD
ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:				
1	2	C10,C11	CAP, CHIP, X5R, 0.1uF, 10V	TDK, C1005X5R1A104K
2	1	C1	CAP, CHIP,X5R, 10uF, 10V	TDK, C2012X5R0J106M
3	1	R7	RES, 0402, 0.0 Ohms, 1/16w	VISHAY, CRCW04020000Z0ED
4	1	R2	RES, 0402, 100K Ohms, 5%, 1/16w	VISHAY, CRCW0402100KJNED
5	4	R8,R9,R10,R11	RES, 0402, 5.1K OHMS, 5%, 1/16w	VISHAY, CRCW04025K1JNED
6	1	R1	RES, 0402, 1 OHM, 5%, 1/16w	VISHAY, CRCW04021R00JNED
7	1	U2	SERIAL EEPROM	MICROCHIP, 24LC025-I/ST
HARDWARE FOR DEMO BOARD ONLY:				
1	2	JP1,JP2	HEADER,3 PINS, 2mm	SAMTEC, TMM-103-02-L-S
2	2	JP1,JP2	SHUNT, 2mm	SAMTEC, 2SN-BK-G
3	1	J1	CONN, USB MINI-B	TYCO, 1734035-2
4	1	J2	HEADER, 2X7 PIN, 0.079CC	MOLEX/WALDEN, 87831-1420
5	10	E1,E5,E6,E7,E8, E9,E15,E16,E17, E18	TURRET, 0.09 DIA	MILL-MAX, 2501-2
6	8	E2,E3,E4,E10,E11, E12,E13,E14	TURRET, 0.061 DIA	MILL-MAX, 2308-2
7	4		STAND-OFF, NYLON 0.25" tall (SNAP ON)	KEYSTONE, 8831 (SNAP ON)

Figure 5. Bill of Materials