LTM4705
$20V_{IN}$, Dual 5A Step-Down DC/DC µModule Regulator

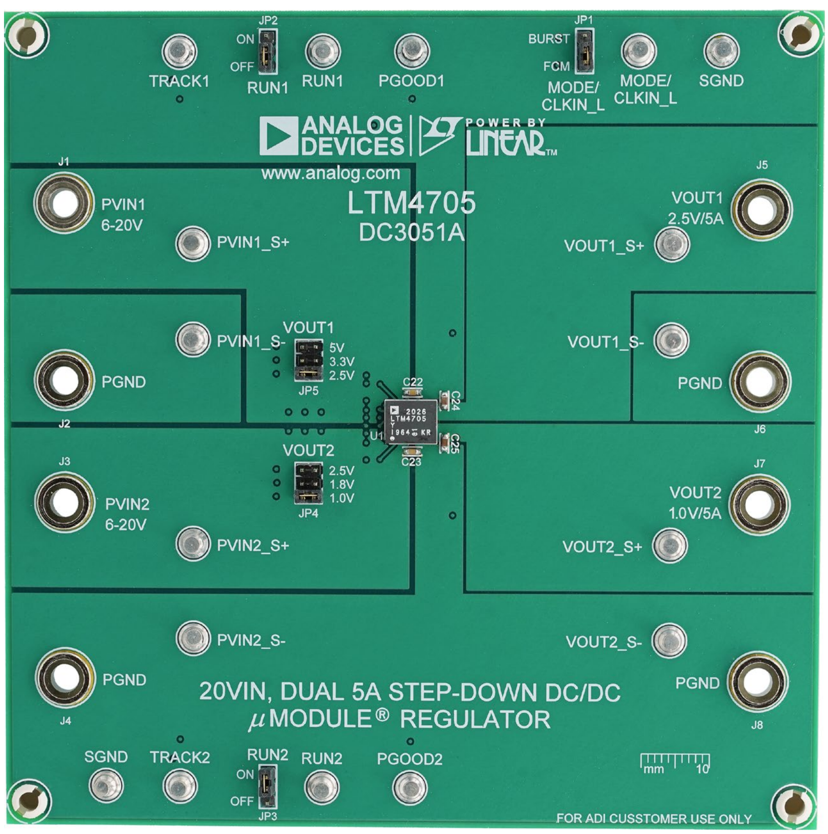
DESCRIPTION

Demonstration circuit 3051A features the LTM®4705, a high efficiency dual 5A or single 10A µModule® DC/DC regulator in a compact and low profile 6.25mm × 7.5mm × 3.22mm BGA package. The LTM4705 can take 3.1V to 20V input and generate 0.6V to 5.5V output (step-down only). The DC3051A demo board is designed to take $6V_{IN}$ to $20V_{IN}$ to dual 5A jumper selectable outputs. The board operates by default at a fixed 1MHz and can be synchronized from 1MHz to 3MHz via the MODE/SYNC pin. With its high switching frequency and current mode architecture, a fast transient response to line and load changes is possible without sacrificing stability. The DC3051A can be used in forced continuous mode or pulse-skipping mode for low noise, or in Burst Mode® operation for high efficiency at light loads. Please see the LTM4705 data sheet for more detailed information.

It is recommended to read the data sheet for the LTM4705 prior to making any changes to the DC3051A.

Design files for this circuit board are available.

BOARD PHOTO



PERFORMANCE SUMMARY Specifications are at T_A = 25°C

PARAMETER	CONDITIONS/NOTES	MIN	TYP	MAX	VALUE
Input Voltage Range		6		20	V
Output Voltage, V_{OUT}	V_{IN} = 6V – 20V, I_{OUT} = 0A to 5A		V_{OUT1} = 2.5 V_{OUT2} = 1		V V
Maximum Output Current, I_{OUT}	V_{IN} = 6V – 20V		5		A
Typical Efficiency	V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT} = 5A V_{IN} = 12V, V_{OUT2} = 1.0V, I_{OUT} = 5A		89.5 79		% %
Peak Efficiency	V_{IN} = 12V, V_{OUT1} = 2.5V V_{IN} = 12V, V_{OUT2} = 1.0V		92 84.5		% %
Default Switching Frequency			1		MHz

QUICK START PROCEDURE

Demonstration circuit 3051A provides an easy way to evaluate the performance of the LTM4705. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, connect the input power supply to V_{IN} (6V to 20V) and GND (input return).
2. Connect the output loads between V_{OUT} and GND (Initial load: no load). Refer to Figure 1.
3. Connect the DVMs to the input and output.
4. Check the default jumper position: JP2 (RUN1): OFF; JP3 (RUN2): OFF.
5. Turn on the input power supply and adjust voltage to 6V to 20V;

   NOTE: Make sure that the input voltage does not exceed 22V.
6. Change the following jumpers' position: JP2: ON; JP3: ON.
7. Check for the proper output voltages from VOUT_S+ to VOUT_S– turrets.
8. Once the proper output voltage is established, adjust the loads within the operating range and measure the efficiency, output ripple voltage and other parameters.
9. After completing all tests, adjust the load to 0A, power off the input power supply.

NOTES:

1. When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (–) terminals of an output capacitor. The probe's ground ring needs to touch the (–) lead and the probe tip needs to touch the (+) lead.
2. If the 5V output option is selected, it is recommended to have a minimum V_{IN} of 6.5V to meet the minimum off-time requirement. Refer to the LTM4705 data sheet for more information.
3. The two V_{OUT} rails can be paralleled through some modification and adding some jumper resistors. See the schematic for details.

QUICK START PROCEDURE

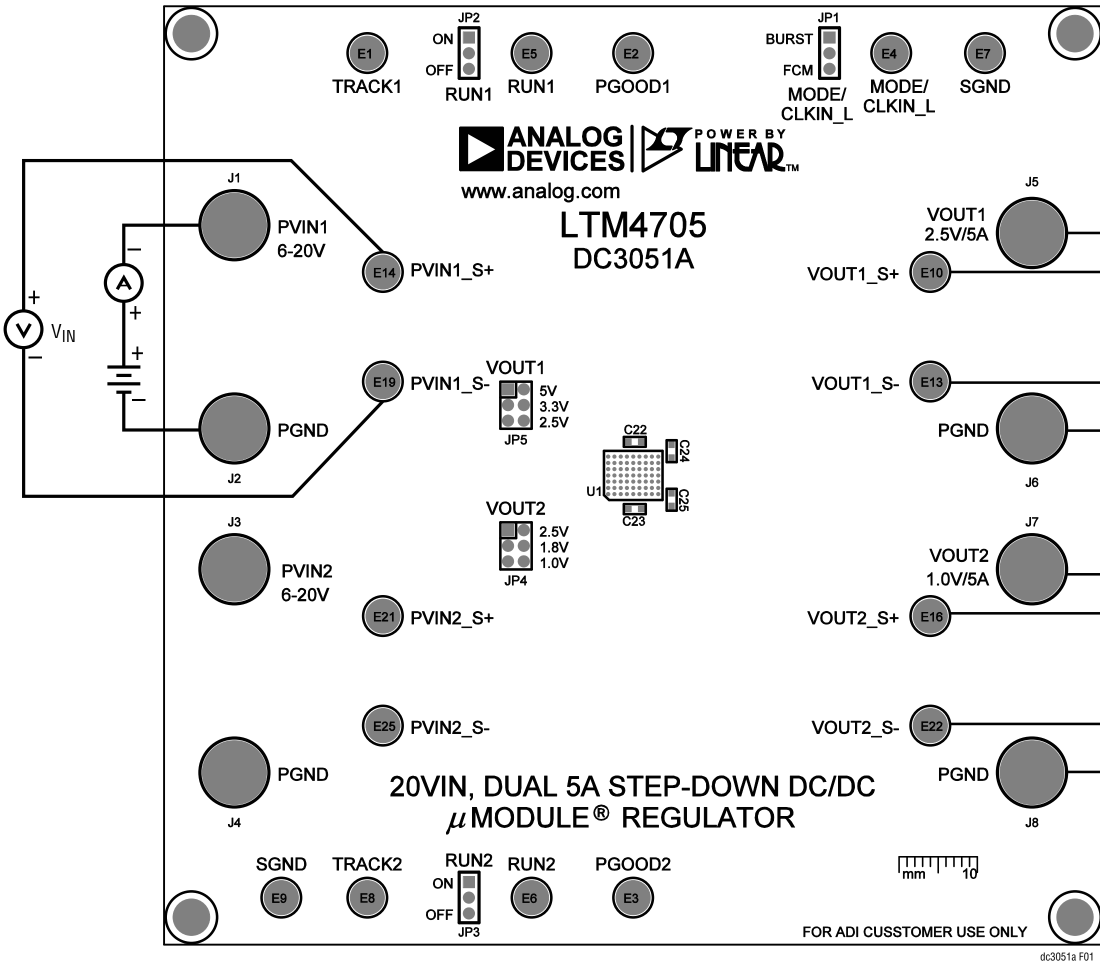


Figure 1. Proper Measurement Equipment Setup

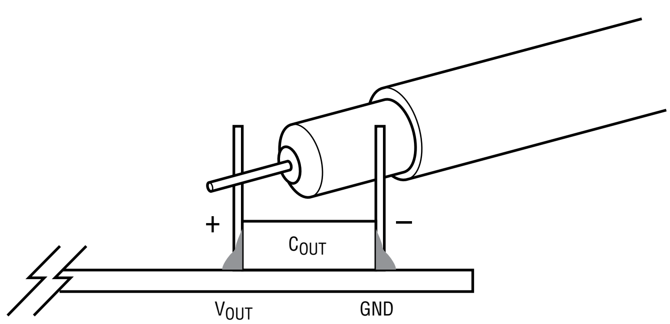


Figure 2. Measuring Output Voltage Ripple

TYPICAL TEST RESULTS

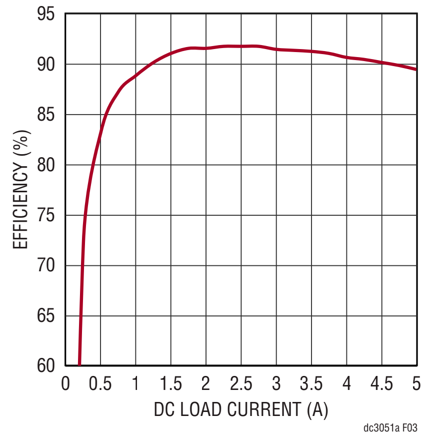


Figure 3. Efficiency vs Load Current at V_{IN} = 12V, V_{OUT1} = 2.5V, f_{SW} = 1MHz, FCM Mode

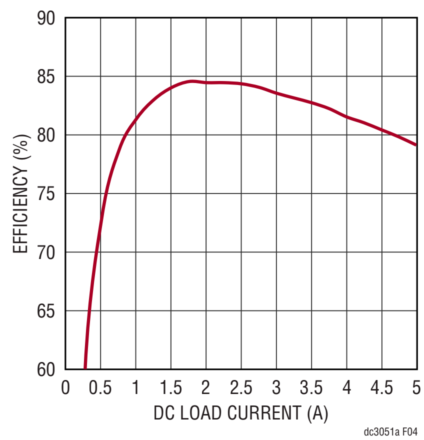


Figure 4. Efficiency vs Load Current at V_{IN} = 12V, V_{OUT2} = 1.0V, f_{SW} = 1MHz, FCM Mode

TYPICAL TEST RESULTS

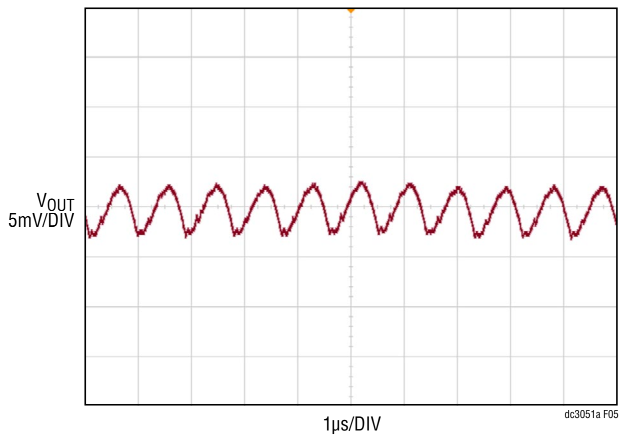


Figure 5. Output Voltage Ripple at V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT1} = 5A, f_{SW} = 1MHz

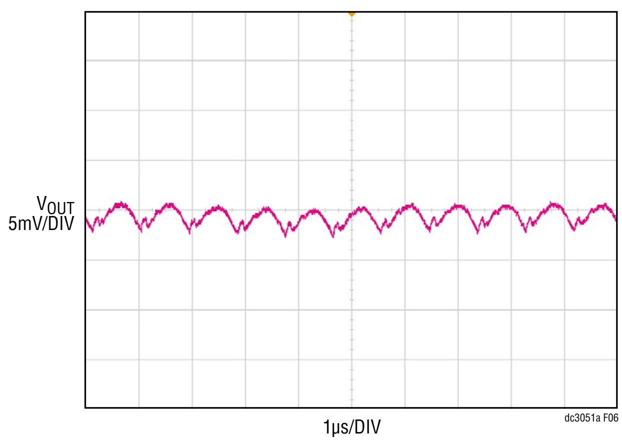


Figure 6. Output Voltage Ripple at V_{IN} = 12V, V_{OUT2} = 1.0V, I_{OUT2} = 5A, f_{SW} = 1MHz

TYPICAL TEST RESULTS

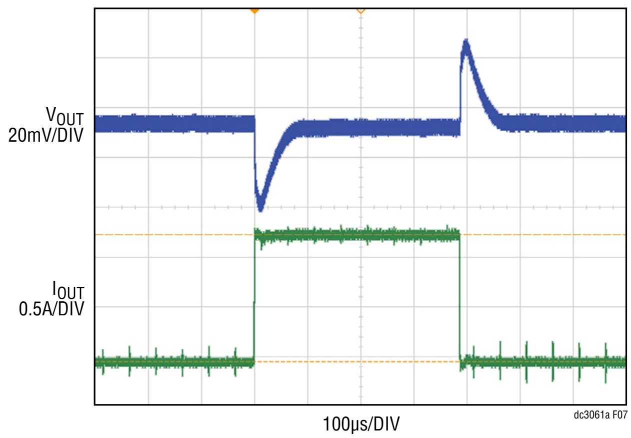


Figure 7. Load Step at V_{IN} = 12V, V_{OUT1} = 2.5V, f_{SW} = 1MHz

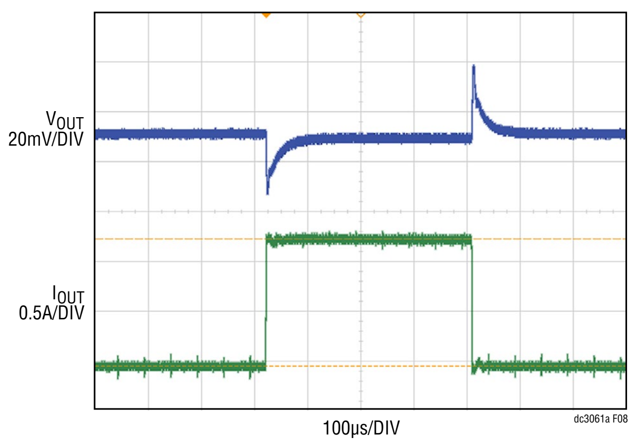


Figure 8. Load Step at V_{IN} = 12V, V_{OUT2} = 1.0V, f_{SW} = 1MHz

TYPICAL TEST RESULTS

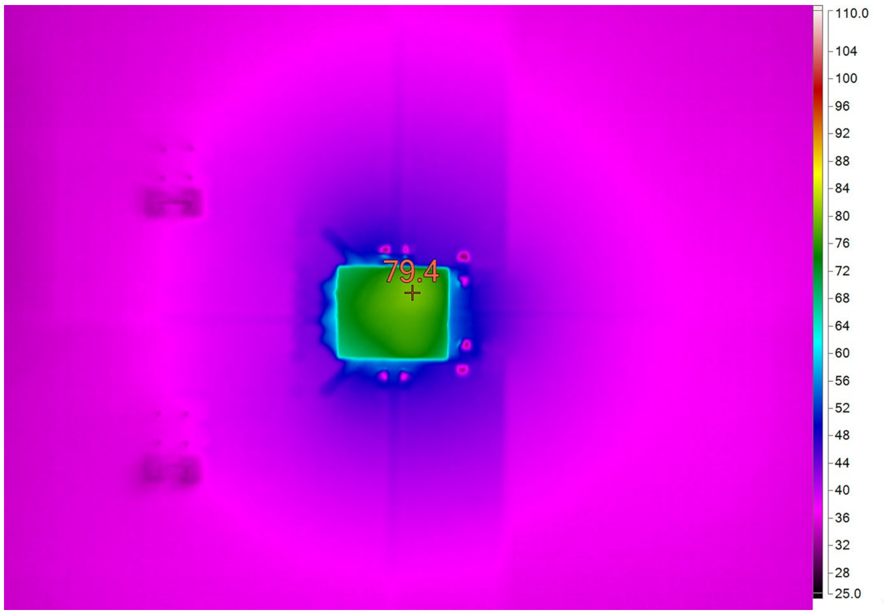
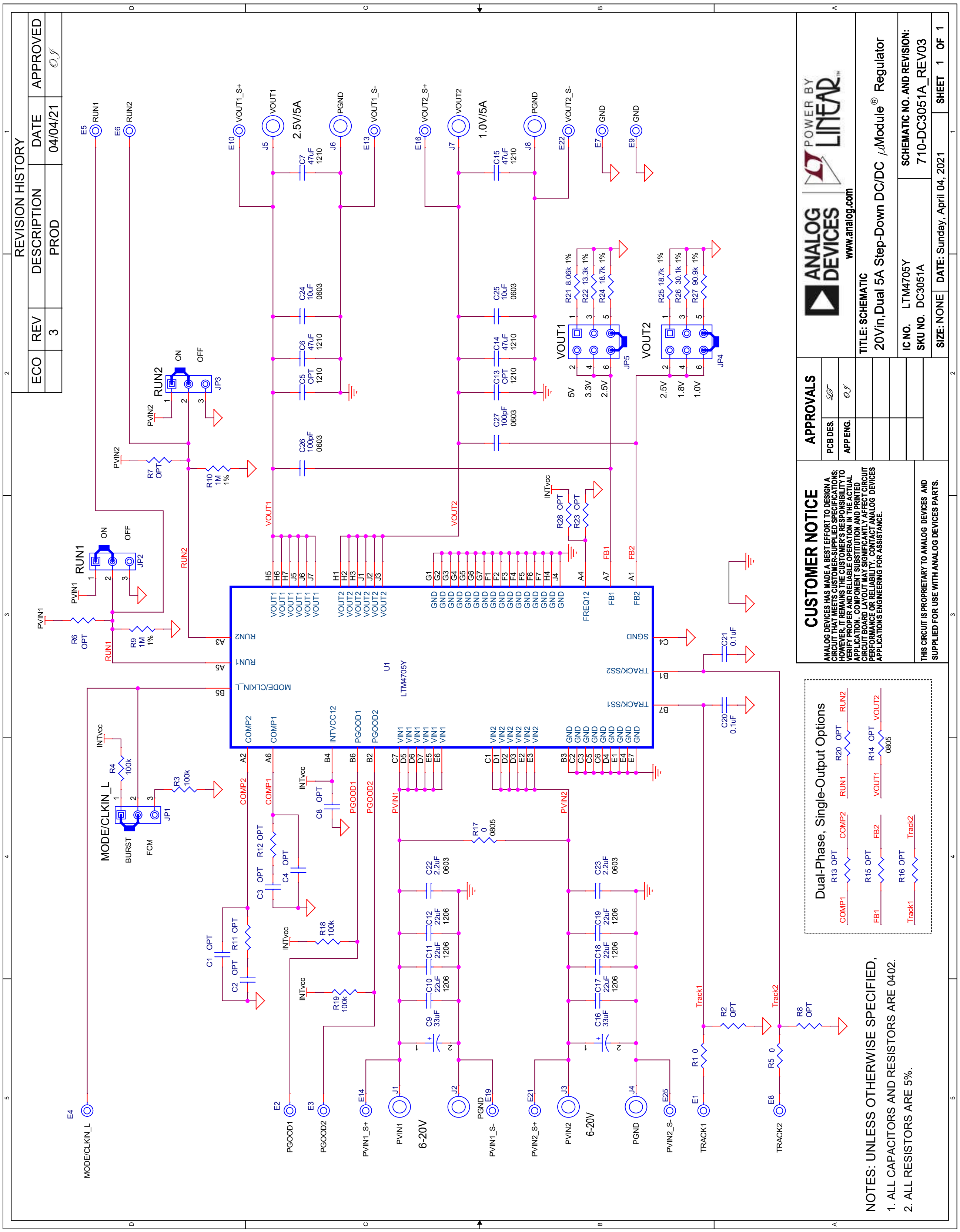


Figure 9. Thermal Performance at V_{IN} = 12V, V_{OUT1} = 2.5V, V_{OUT2} = 1.0V, I_{OUT1} = 5A, I_{OUT2} = 5A, T_A = 23°C, No Forced Airflow

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	4	C6, C7, C14, C15	CAP., 47µF, X7R, 10V, 20%, 1210	MURATA, GRM32ER71A476ME15L
2	2	C9, C16	CAP., 33µF, ALUM. ELECT., 50V, 20%, 6.3mm × 7.7mm	SUN ELECTRONIC INDUSTRIES CORP., 50CE33FS
3	6	C10-C12, C17-C19	CAP., 22µF, X5R, 35V, 20%, 1206	TDK, C3216X5R1V226M160AC
4	2	C20, C21	CAP., 0.1µF, X7R, 25V, 10%, 0402, AEC-Q200	MURATA, GCM155R71E104KE02D
5	2	C22, C23	CAP., 2.2µF, X5R, 35V, 10%, 0603	MURATA, GRM188R6YA225KA12D
6	2	C24, C25	CAP., 10µF, X5R, 10V, 10%, 0603	AVX, 0603ZD106KAT2A
7	2	C26, C27	CAP., 100pF, X7R, 50V, 10%, 0603	AVX, 06035C101KAT2A
8	2	R3, R4	RES., 100k, 5%, 1/16W, 0402, AEC-Q200	ROHM, MCR01MZPJ104
9	2	R9, R10	RES., 1M, 1%, 1/16W, 0402, AEC-Q200	STACKPOLE ELECTRONICS, INC., RMCF0402FT1M00
10	2	R18, R19	RES., 100k, 5%, 1/16W, 0402, AEC-Q200	NIC, NRC04J104TRF
11	1	R21	RES., 8.06k, 1%, 1/16W, 0402, AEC-Q200	NIC, NRC04F8061TRF
12	1	R22	RES., 13.3k, 1%, 1/16W, 0402, AEC-Q200	VISHAY, CRCWs040213K3FKED
13	2	R24, R25	RES., 18.7k, 1%, 1/16W, 0402, AEC-Q200	VISHAY, CRCW040218K7FKED
14	1	R26	RES., 30.1k, 1%, 1/16W, 0402, AEC-Q200	NIC, NRC04F3012TRF
15	1	R27	RES., 90.9k, 1%, 1/16W, 0402, AEC-Q200	NIC, NRC04F9092TRF
16	1	U1	IC, 20V$_{IN}$, DUAL 5A STEP-DOWN, 63-LGA	ANALOG DEVICES, LTM4705Y#PBF
Additional Demo Board Circuit Components				
1	0	C1C4, C8	CAP., OPTION, 0402	
2	0	C5, C13	CAP., OPTION, 1210	
3	2	R1, R5	RES., 0Ω, 1/10W, 0402, AEC-Q200	PANASONIC, ERJ2GE0R00X
4	0	R2, R6, R8, R11, R13, R15, R16, R20, R23, R28	RES., OPTION, 0402	
5	0	R14	RES., OPTION, 0805	
6	1	R17	RES., 0Ω, JUMPER, 0805	VISHAY, WSL080500000ZEA9
Hardware: For Demo Board Only				
1	17	E1E10, E13, E14, E16, E19, E21, E22, E25	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2501-2-00-80-00-00-07-0
2	8	J1-J8	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE, 0.218"	KEYSTONE, 575-4
3	3	JP1-JP3	CONN., HDR, MALE, 1 × 3, 2mm, VERT, ST, THT, NO SUBS. ALLOWED	WURTH ELEKTRONIK, 62000311121
4	2	JP4, JP5	CONN., HDR, MALE, 2 × 3, 2mm, VERT, ST, THT	SULLINS CONNECTOR SOLUTIONS, NRPN032PAEN-RC
5	4	MP1-MP4	STANDOFF, NYLON, SNAP-ON, 0.375"	KEYSTONE, 8832
6	3	XJP1-XJP3	CONN., SHUNT, FEMALE, 2-POS, 2mm	WURTH ELEKTRONIK, 60800213421
7	2	XJP4, XJP5	CONN., SHUNT, FEMALE, 2-POS., 2.54mm	WURTH ELEKTRONIK, 60900213421

SCHEMATIC DIAGRAM



Rev. 0

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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