LTM4655
Low EMI Dual 13V to 40V_{IN}, 12V/4A_{OUT} µModule Regulator

DESCRIPTION

Demonstration circuit 2898A is a dual DC/DC converter with a 13V to 40V input voltage range, two 12V outputs at 4A each featuring the LTM®4655. The LTM4655 is a EN55022B compliant 40V, dual 4A or single 8A step-down or 50W inverting DC/DC µModule® regulator.

The switching frequencies of both channels are set at 1.2MHz on DC2898A. If the output voltage collapses sufficiently due to an overload or short-circuit condition, the internal oscillator will foldback to one-fifth of the LTM4655's programmed switching frequency, protecting the power switch from damage.

Key features of this board include:

- SSFM Jumper for Spread Spectrum Options
- CLKIN Inputs for External Sync
- PGOOD Signals for Each Output

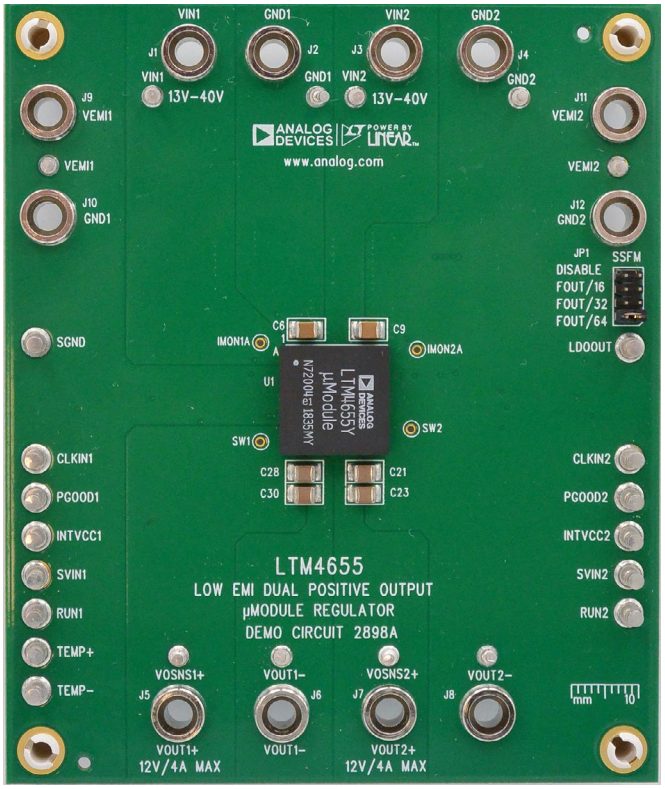
The two channels can be paralleled for higher output current. See the data sheet for more information on setting up the board for paralleling the two outputs.

The LTM4655 data sheet gives a complete description of the device, its operation and application information. The data sheet must be read in conjunction with this demo manual prior to working on or modifying DC2898A.

Design files for this circuit board are available.

BOARD PHOTO

Part marking is either ink mark or laser mark



PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		13		40	V
f_{SW}	Switching Frequency			1.2		MHz
V_{OUT}	Output Voltage	V_{IN} = 14V to 40V, I_{OUT} = 0A to 4A	11.9	12	12.1	V
I_{OUT}	Output Current per Output	V_{IN} = 13.5V	0		4	A
$V_{OUT(AC)}$	Output Ripple (Across C23/C30)	V_{IN} = 28V, I_{OUT} = 4A, 20MHz		10		mV_{P-P}
η	Efficiency	V_{IN} = 28V, I_{OUT} = 4A		89.5		%

QUICK START PROCEDURE

Demo circuit 2898A is an easy way to evaluate the performance of the LTM4655. Refer to Figure 1 for proper measurement equipment setup, and follow the procedure below.

1. With power off, connect the input power supply "+" to VIN1 and VIN2 and "–" to GND1 and GND2. Connect the loads from VOUT1+ to VOUT1–, and VOUT2+ to VOUT2–.
2. Set voltage of the DC power supply at 14V. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 40V.
3. Check for the proper output voltage between VOUT1+ and VOUT1– (V_{OUT1} = 12V). Check for the proper output voltage between VOUT2+ and VOUT2– (V_{OUT2} = 12V).

   NOTE: If there is no output, or output voltage value is out of the spec, temporarily disconnect the load to make sure that the load is not set too high.

   NOTE: The circuit features frequency foldback to protect the power switches during a fault or output current overload.
4. Once the proper output voltage at each channel is established, adjust the load within the operating range and measure the output voltage regulation, ripple voltage, efficiency and other parameters.

   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 VIN1 or VIN2 and GND terminals, VOUT1+ and VOUT1– terminals, or VOUT2+ and VOUT2– terminals. See Figure 2 for proper scope probe technique.

QUICK START PROCEDURE

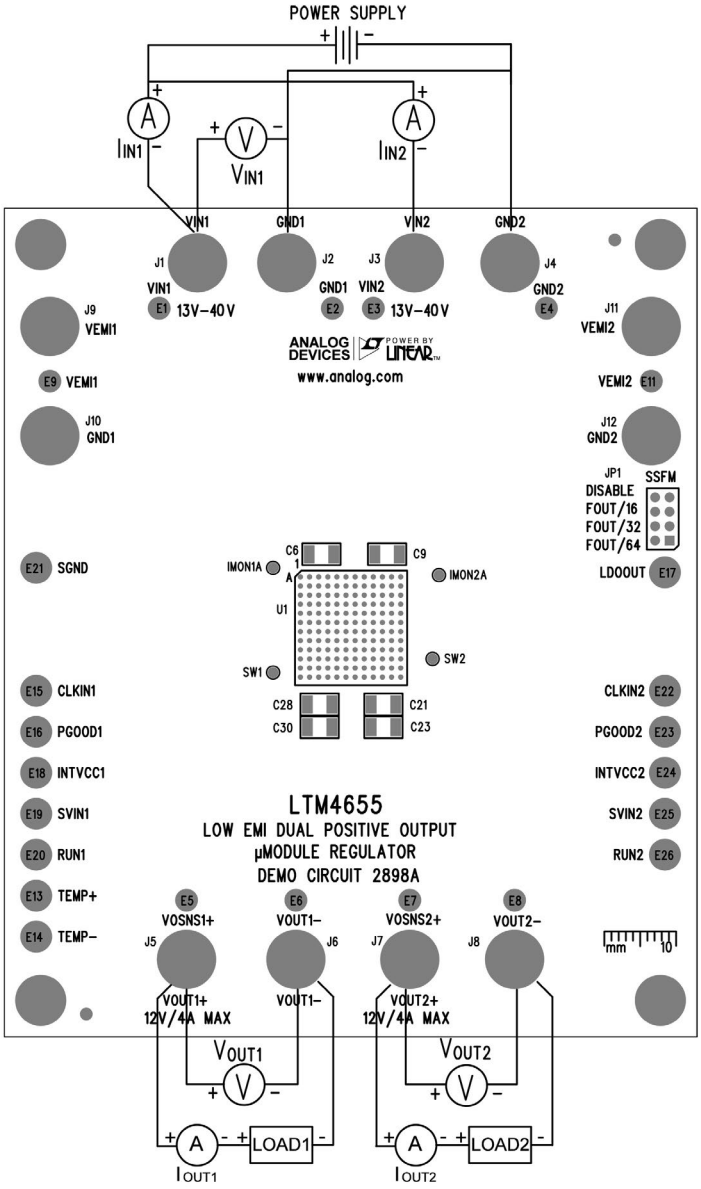


Figure 1. DC2898A Proper Equipment Setup

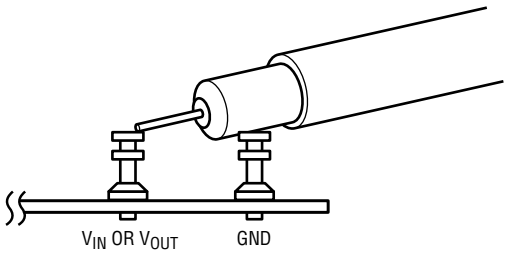


Figure 2. Measuring Input or Output Ripple

QUICK START PROCEDURE

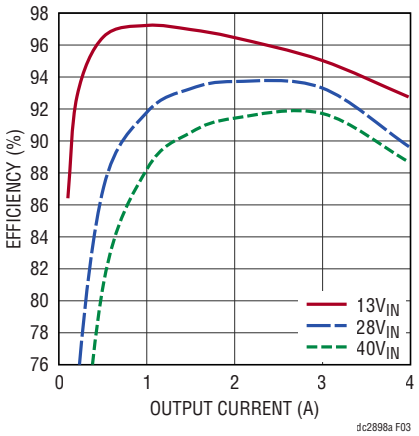


Figure 3. DC2898A Output Efficiency vs Load Current (T_A = 25°C)

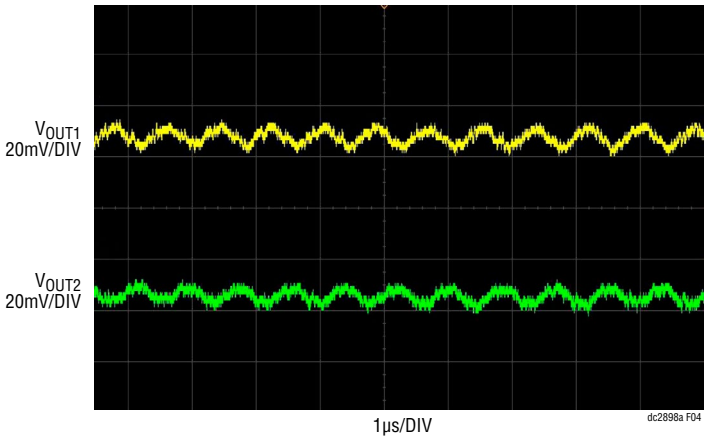


Figure 4. DC2898A Output Ripple

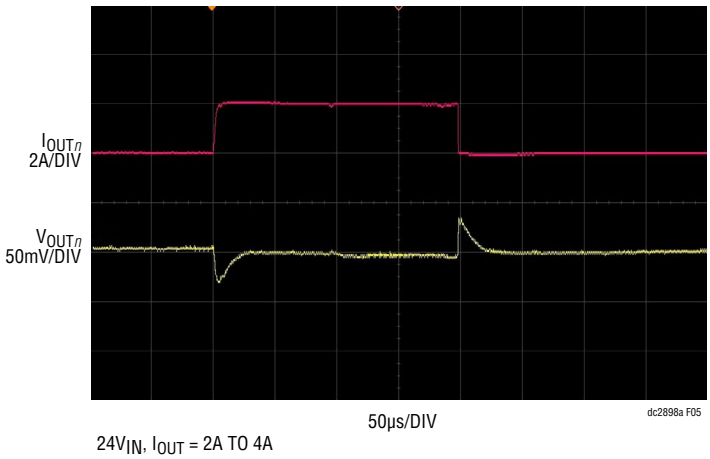


Figure 5. DC2898A Transient Response

QUICK START PROCEDURE

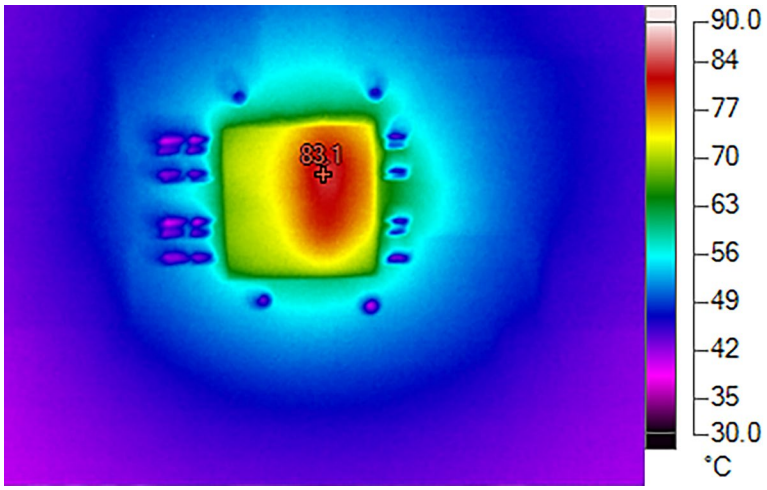


Figure 6. DC2898A Thermal Performance ($14V_{IN}$, $I_{OUT1} = I_{OUT2} = 3.5A$, $T_A = 25°C$, Free Air)

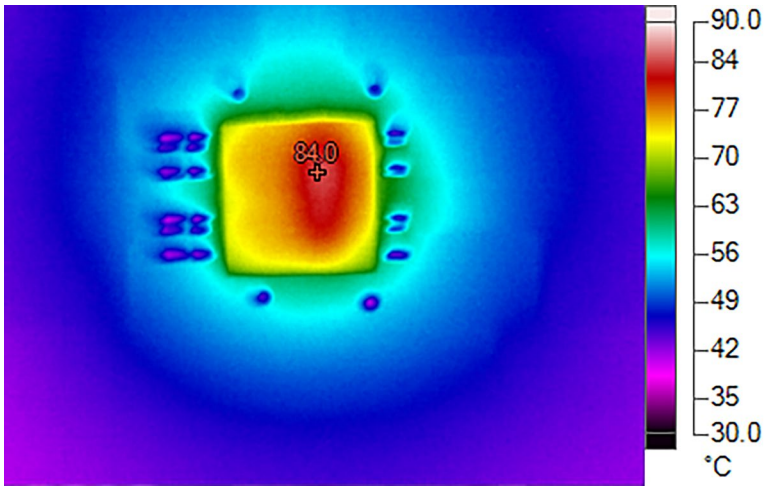


Figure 7. DC2898A Thermal Performance ($24V_{IN}$, $I_{OUT1} = I_{OUT2} = 3.5A$, $T_A = 25°C$, Free Air)

QUICK START PROCEDURE

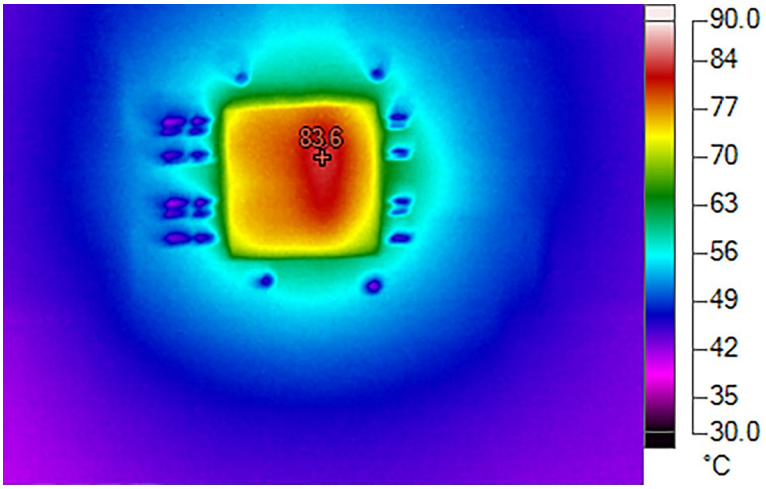


Figure 8. DC2898A Thermal Performance ($40V_{IN}$, $I_{OUT1} = I_{OUT2} = 3A$, $T_A = 25°C$, Free Air)

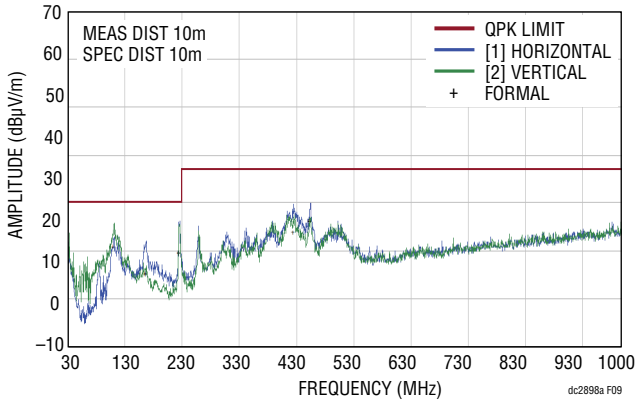
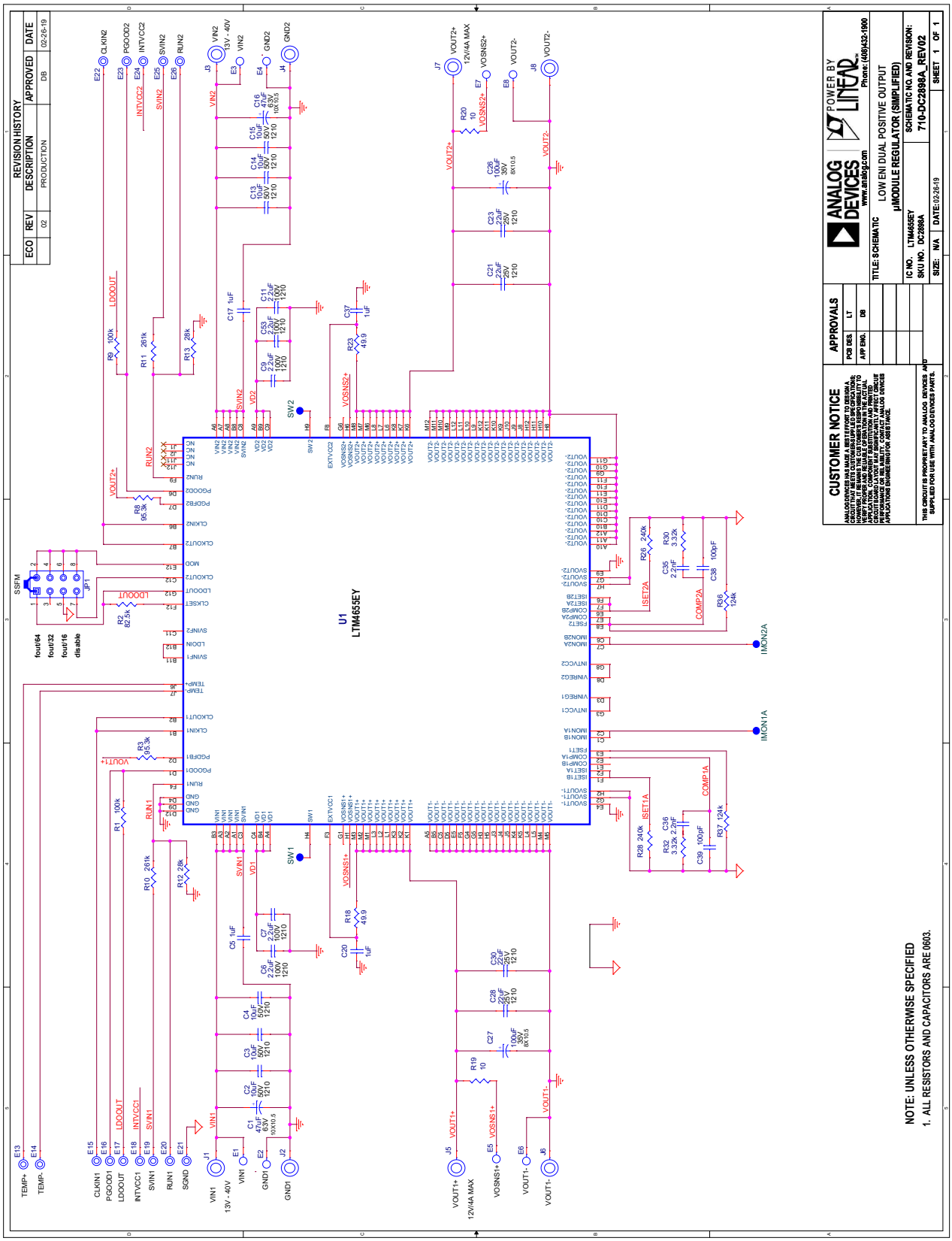


Figure 9. Radiated Emissions Scan of the LTM4655. Producing $24V_{OUT}$ at 7A, from $36V_{IN}$. DC2898A Hardware. $f_{SW} = 1.2MHz$. Measured in a 10m Chamber. Peak Detect Method

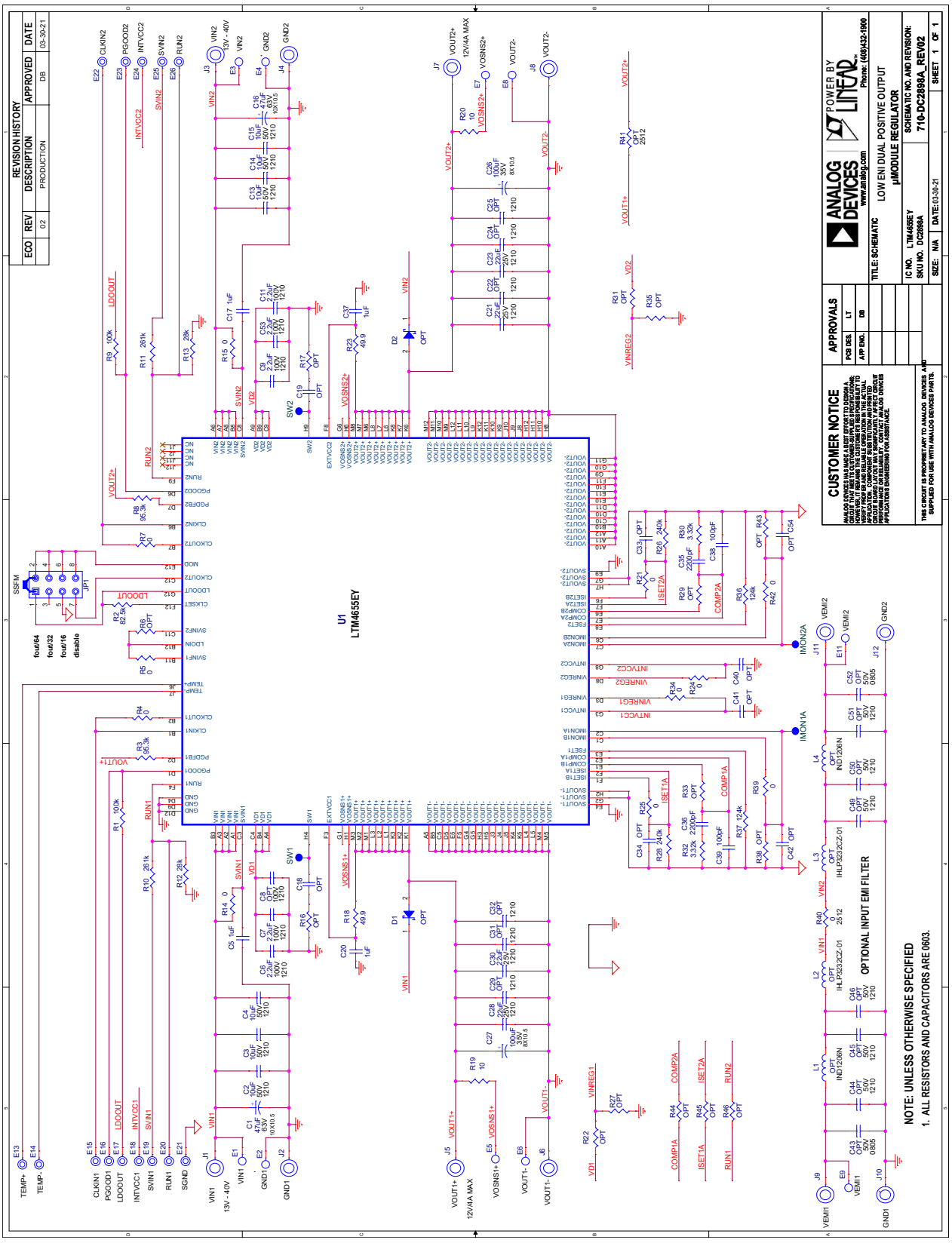
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C16	CAP., 47µF, ALUM POLY HYB, 63V, 20%, SMD 10mm × 10.5mm, AEC-Q200, HVP SERIES	SUN ELECTRONIC INDUSTRIES CORP., 63HVP47M
2	6	C2–C4, C13–C15	CAP., 10µF, X7R, 50V, 10%, 1210, NO SUBS. ALLOWED	MURATA, GRM32ER71H106KA12L
3	4	C5, C17, C20, C37	CAP., 1µF, X5R, 50V, 10%, 0603	AVX, 06035D105KAT2A
4	5	C6, C7, C9, C11, C53	CAP., 2.2µF, X7R, 100V, 10%, 1210	AVX, 12101C225KAT2A
5	4	C21, C23, C28, C30	CAP., 22µF, X7R, 25V, 10%, 1210	SAMSUNG, CL32B226KAJNNNE
6	2	C26, C27	CAP., 100µF, ALUM POLY HYB, 35V, 20%, SMD 8mm × 10.5mm, AEC-Q200, HVP SERIES	SUN ELECTRONIC INDUSTRIES CORP., 35HVP100M
7	2	C35, C36	CAP., 2200pF, X7R, 50V, 10%, 0603	AVX, 06035C222KAT2A
8	2	C38, C39	CAP., 100pF, X7R, 50V, 10%, 0603	AVX, 06035C101KAT2A
9	2	R1, R9	RES., 100k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603100KFKEA
10	1	R2	RES., 82.5k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF8252V
11	2	R3, R8	RES., 95.3k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF9532V
12	2	R10, R11	RES., 261k, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F2613TRF
13	2	R12, R13	RES., 28k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF2802V
14	2	R18, R23	RES., 49.9Ω, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060349R9FKEA
15	2	R19, R20	RES., 10Ω, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
16	2	R26, R28	RES., 240k, 1%, 1/10W, 0603	VISHAY, CRCW0603240KFKEA
17	2	R30, R32	RES., 3.32k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF3321V
18	2	R36, R37	RES., 124k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF1243V
19	1	U1	IC, DC/DC REGULATOR, BGA-144 (16mm × 16mm × 5.01mm)	ANALOG DEVICES, LTM4655EY#PBF
Additional Demo Board Circuit Components				
1	0	C8, C22, C24, C25, C29, C31, C32, C44–C46, C49–C51	CAP., OPTION, 1210	
2	0	C18, C19, C33, C34, C40–C42, C54	CAP., OPTION, 0603	
3	0	C43, C52	CAP., OPTION, 0805	
4	0	D1, D2	DIODE, OPTION, SMA	
5	0	L1, L4	IND., OPTION, 1206	
6	0	L2, L3	IND., OPTION	
7	11	R4, R5, R7, R14, R15, R21, R24, R25, R34, R39, R42	RES., 0Ω, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
8	0	R6, R16, R17, R22, R27, R29, R31, R33, R35, R38, R43–R46	RES., OPTION, 0603	
9	1	R40	RES., 0Ω, 1W, 2512, 7A, AEC-Q200	VISHAY, CRCW25120000Z0EG
10	0	R41	RES., OPTION, 2512	
Hardware: For Demo Board Only				
1	10	E1–E9, E11	TEST POINT, TURRET, 0.064" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2308-2-00-80-00-00-07-0
2	14	E13-E26	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2501-2-00-80-00-00-07-0
3	12	J1–J12	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE, 0.218"	KEYSTONE, 575-4
4	1	JP1	CONN., HDR, MALE, 2×4, 2mm, VERT, ST, THT	WURTH ELEKTRONIK, 62000821121
5	4	MP1–MP4	STANDOFF, NYLON, SNAP-ON, 0.50"	KEYSTONE, 8833
6	1	XJP2	CONN., SHUNT, FEMALE, 2 POS, 2mm	WURTH ELEKTRONIK, 60800213421

SIMPLIFIED SCHEMATIC DIAGRAM



FULL SCHEMATIC DIAGRAM



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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