



ADP1823, APD2106 and ADP1821 Reference Design

Preliminary Technical Data

FCDC 00043

FEATURES

Six Output Voltages: 1.2 V, 1.8 V, 2.5 V, 3.3 V, 5 V, 12 V

Output Current: 1 A to 4.5 A

Input voltage: 14.4-20.0 V

Ripple 2% ppk of Output Voltage

Transient step $\pm 5\%$, 50% max load

ADP1823, APD2106 AND ADP1821 REFERENCE DESIGN DESCRIPTION

This ADP1823, APD2106 and ADP1821 Reference Design uses 14.4 V to 20.0 V for the input voltage. The output voltages and currents are as follows:

- $V_{OUT1} = 1.2$ V with a maximum output current of 3.9 A,
- $V_{OUT2} = 1.8$ V with a maximum output current of 1.3 A,
- $V_{OUT3} = 3.3$ V with a maximum output current of 4.5 A,
- $V_{OUT4} = 5.0$ V with a maximum output current of 3.84 A,
- $V_{OUT5} = 2.5$ V with a maximum output current of 1.025 A and
- $V_{OUT6} = 12$ V with a maximum output current of 1.2 A.

Design criteria are for coincidental tracking of V_{OUT1} , V_{OUT2} and V_{OUT3} with V_{OUT4} for both turn on and turn off. The ripple and transient assumptions are 2% peak to peak voltage ripple and 5% deviation due to 50% instantaneous load step, except for V_{OUT1} which is 1.5% peak to peak ripple and 5% deviation due to 25% instantaneous load step. The switching frequency is fixed at 300 kHz for V_{OUT1} , V_{OUT2} , V_{OUT3} , V_{OUT4} and V_{OUT6} . V_{OUT5} switches at a fixed frequency of 1.2 MHz

Rev. A

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REVISION HISTORY

7/3/2007—Revision 0: Initial Version

7/4/2007—Revision 1: Added snubber and clamp zener on CS pin on 12 V SEPIC. Changed input voltage to max of 20 V.

7/5/2007—Revision 2: Changed minimum input voltage to 14.4 V. Changed 12 V output to buck converter for higher efficiency and smaller footprint.

GENERAL DESCRIPTION

ADP1823

The ADP1823 is a versatile, dual output, interleaved, synchronous PWM buck controller that generates two independent outputs from an input voltage of 3.7 V to 20 V. Each channel can be configured to provide output voltage from 0.6V to 85% of the input voltage. The two channels operate 180° out of phase, which reduces the current stress on the input capacitor and allows the use of a smaller and lower cost input capacitor.

The ADP1823 operates at a pin-selectable fixed switching frequency of either 300 kHz or 600 kHz. For some noise sensitive applications, it can also be synchronized to an external clock to achieve switching frequency between 300 kHz and 1 MHz. The switching frequency chosen is 300 kHz to get good efficiency over a wide range of input and output conditions.

The ADP1823 includes an adjustable soft start to limit input inrush current, voltage tracking for sequencing or DDR termination, independent power-good output, and a power enable pin. It also provides current-limit and short-circuit protection by sensing the voltage on the synchronous MOSFET.

ADP2106

The ADP2106 is a versatile, single output, synchronous PWM buck controller with integrated synchronous FETs that generates a single output from an input voltage of 2.7 V to 5.5 V. The controller can be configured to provide output voltage from 0.8 V to the input voltage with an output current up to 1.5 A.

The ADP2106 operates at a fixed switching frequency of 1.2 MHz to reduce component size.

The ADP2106 includes an adjustable soft start to limit input inrush current. Inherent to its current mode design it provides current-limit and short-circuit protection by sensing the voltage on the synchronous MOSFET.

ADP1821

The ADP1821 is a versatile and inexpensive, synchronous, pulse width-modulated (PWM), voltage-mode, step-down controller. It drives an all N-channel power stage to regulate an output voltage as low as 0.6 V. The ADP1821 can be configured to provide output voltages from 0.6 V to 85% of the input voltage and is sized to handle large MOSFETs for point-of-load regulators. The ADP1821 is well suited for a wide range of high power applications, such as DSP and processor core power in telecom, medical imaging, high performance servers, and industrial applications. It operates from a 3.0 V to 5.5 V supply with a power input voltage ranging from 1.0 V to 24 V. The ADP1821 operates at a pin-selectable, fixed switching frequency of either 300 kHz or 600 kHz, minimizing external component size and cost. For noise-sensitive applications, it can be synchronized to an external clock to achieve switching frequencies between 300 kHz and 1.2 MHz. The ADP1821 includes soft start protection to limit the inrush current from the input supply during startup, reverse current protection during soft start for precharged outputs, as well as a unique adjustable lossless current-limit scheme utilizing external MOSFET sensing. The ADP1821 operates over the -40°C to +85°C temperature range and is available in a 16-lead QSOP.

SCHEMATIC

Figure 1. Schematic 1.2V @ 3.9A, 1.8V @ 1.3A

1.2V at 3.9A and 1.8V at 1.3A

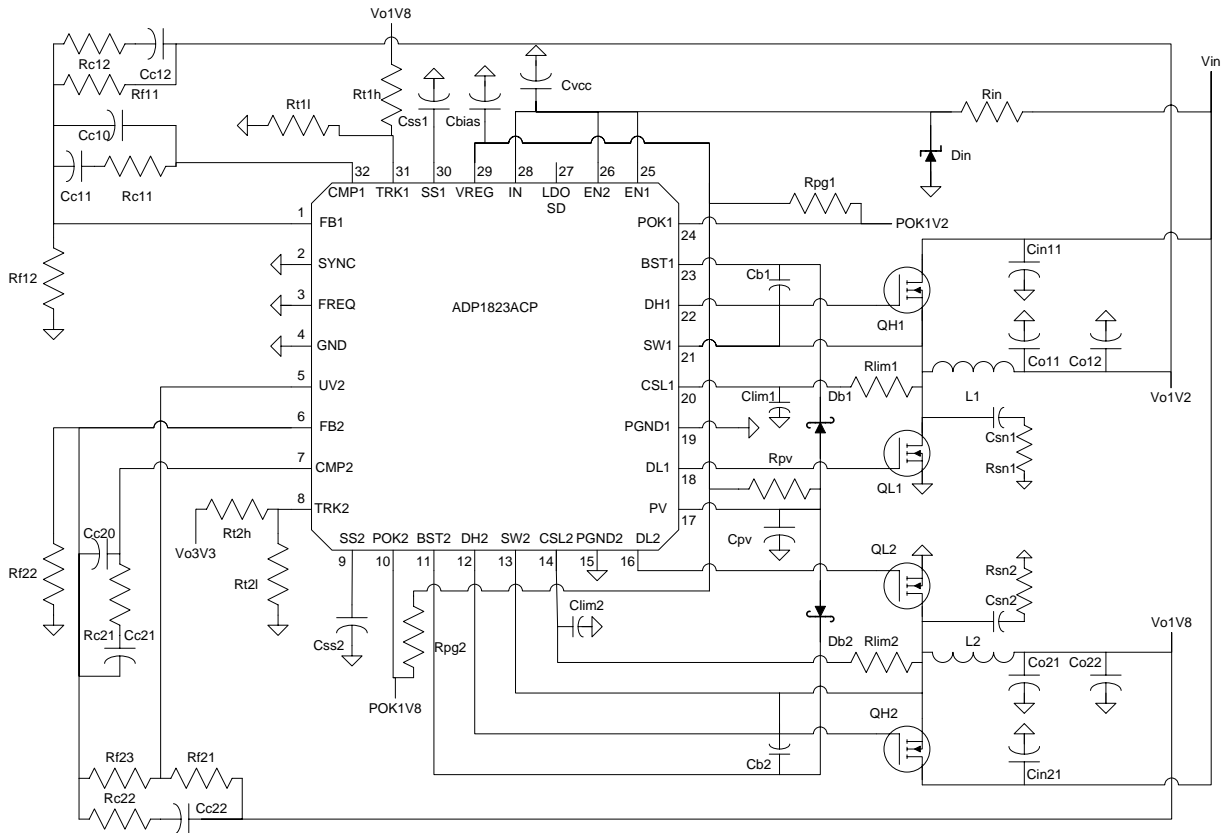


Figure 2. Schematic: 3.3V @ 4.5A and 5.0V @ 3.84A

3.3V at 4.5A and 5.0V at 3.84A

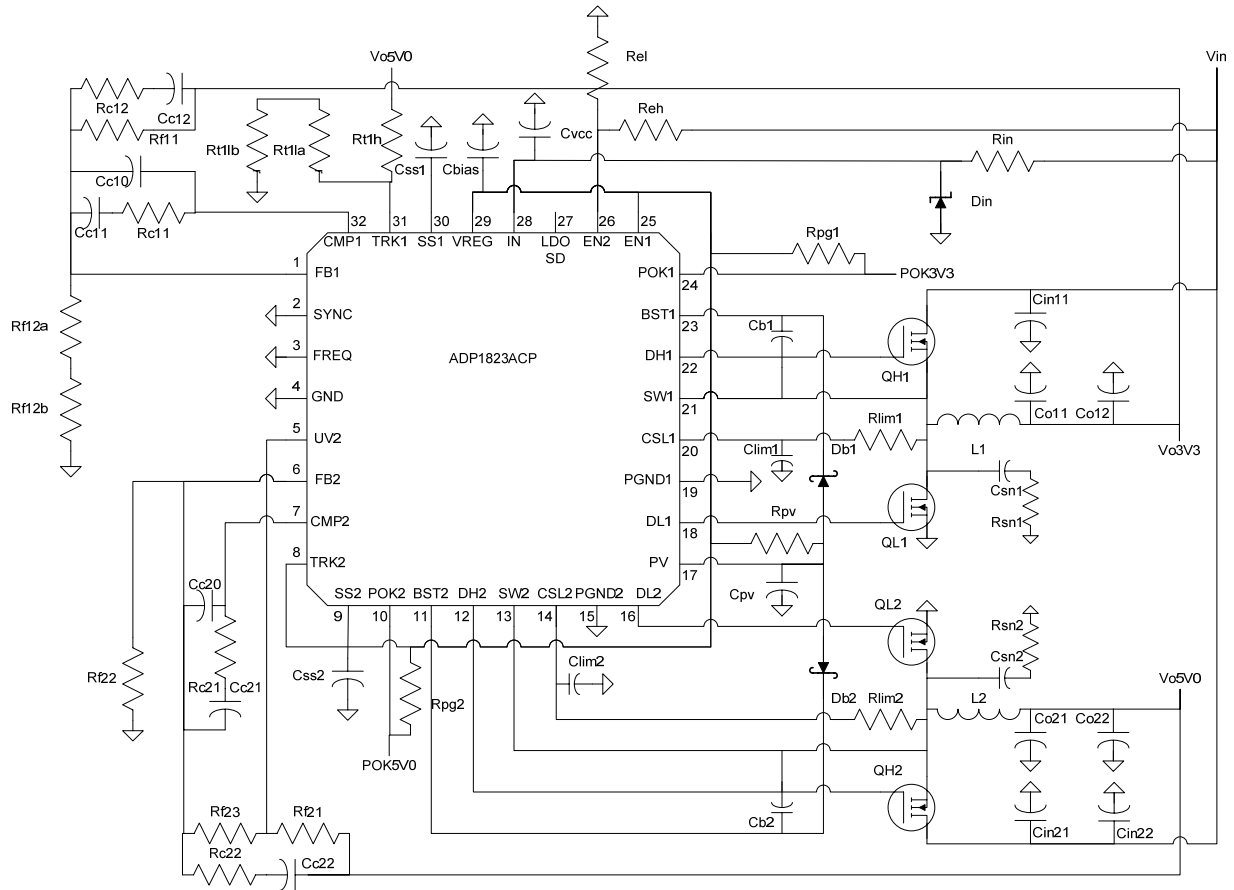


Figure 3. Schematic: 2.5 V@ 1.025 A and linear regulators at 1.5 V and 3.3 V

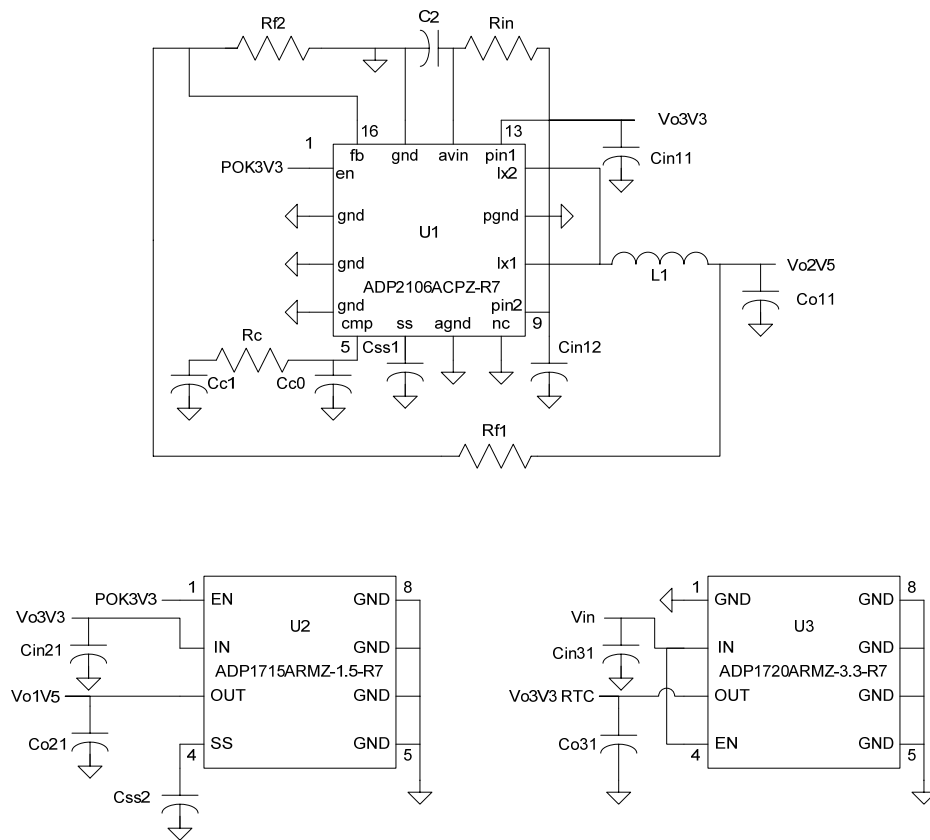
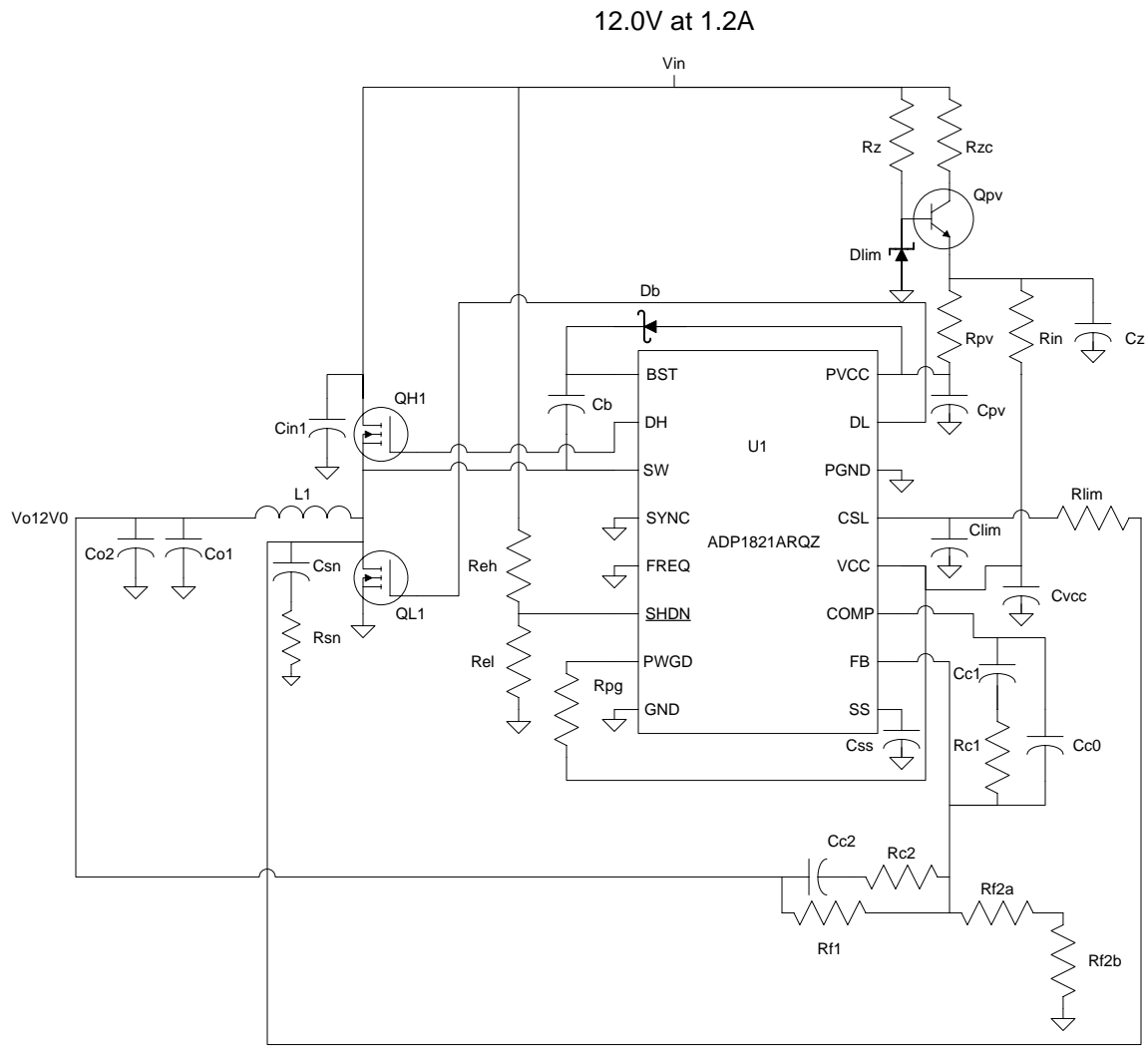


Figure 4. Schematic: 12.0V@1.2A



BILL OF MATERIALS

Table 1. Vout1, and Vout2 Bill of Materials (1.2 V and 1.8 V)

Description	Designator	Quantity	Manufacturer	MFR#
Capacitor Ceramic COG 560p 0603 50V	Cc12	1	Vishay	Generic
Capacitor Ceramic COG 100p 0603 50V	Cc10	1	Vishay	Generic
Capacitor Ceramic COG 82p 0603 50V	Cc20	1	Vishay	Generic
Capacitor Ceramic X7R 2.2n 0603 50V	Cc11	1	Vishay	Generic
Capacitor Ceramic X7R 1u 0603 16V	Cbias, Cpv	2	Murata	GRM188R71C105KA12D
Capacitor Ceramic X7R 1u 0603 25V	Cvcc	1	Murata	GRM188R71E105KA12D
Capacitor Ceramic X7R 22n 0603 16V	Css1, Css2	2	Vishay	Generic
Capacitor Ceramic X7R 10u 1206 25V	Cin11	1	Murata	GRM31CR71E106KA12L
Capacitor Ceramic X7R 4.7u 1206 25V	Cin21	1	Murata	GRM31CR71E475KA88L
Capacitor Ceramic X7R 100n 0603 16V	Cb1, Cb2	2	Vishay	Generic
Capacitor Ceramic COG 33p 0603 50V	Clim1, Clim2	2	Vishay	Generic
Capacitor Ceramic X7R 3.3n 0603 50V	Cc21	1	Vishay	Generic
Capacitor Ceramic X7R 1.2n 0603 50V	Cc22	1	Vishay	Generic
Capacitor Ceramic X7R 22u 1210 10V	Co11, Co12, Co21, Co22	4	Murata	GRM32ER71A226KE20L
Diode Schottky 200mA SOD-323 40V	Db1, Db2	2	Diodes inc	BAT54H
Diode Zener 200mW SOD-323 18V	Din	1	Diodes inc	MMSZ5248BS
Inductor Ferrite 3.8uH 10.4mm x 10.4mm	L1	1	Toko	B966AS-3R9N
Inductor Ferrite 15uH 10.2mm x 10mm	L2	1	Toko	B952AS-150M
Single N-Channel MOSFET SO8 30V	QH1	1	Vishay	Si4394DY
Single N-Channel MOSFET SO8 30V	QL1	1	Vishay	Si4324DY
Single N-Channel MOSFET 1206-8 30V	QH2	1	Vishay	Si5402bdc
Single N-Channel MOSFET SO8 30V	QL2	1	Vishay	Si4684DY
5% Thick Film 10 Ohms 0603	Rpv, Rf23	2	Vishay	Generic
1% Thick Film 200 Ohms 0603	Rin	1	Vishay	Generic
1% Thick Film 10.0k 0603	Rpg1, Rpg2, Rf22, Rt2l	4	Vishay	Generic
1% Thick Film 20.0k 0603	Rf11, Rf21, Rt1h, Rt2h, Rf12, Rt1l	6	Vishay	Generic
1% Thick Film 47.0 Ohms 0603	Rc22	1	Vishay	Generic
1% Thick Film 620 Ohms 0603	Rlim1, Rlim2	2	Vishay	Generic
1% Thick Film 91.0 Ohms 0603	Rc12	1	Vishay	Generic
1% Thick Film 5.60k 0603	Rc11	1	Vishay	Generic
1% Thick Film 6.20k 0603	Rc21	1	Vishay	Generic
2 chan 300k to 600k PWM LFCSP-32	U1	1	Analog Devices	ADP1823ACPZ

Table 2. Vout3 and Vout4 Bill of Materials (3.3 V and 5.0 V)

Description	Designator	Quantity	Manufacturer	MFR#
Capacitor Ceramic COG 680p 0603 50V	Cc12	1	Vishay	Generic
Capacitor Ceramic COG 68p 0603 50V	Cc10	1	Vishay	Generic
Capacitor Ceramic X7R 1u 0603 16V	Cbias, Cpv	2	Murata	GRM188R71C105KA12D
Capacitor Ceramic X7R 1u 0603 25V	Cvcc	1	Murata	GRM188R71E105KA12D
Capacitor Ceramic X7R 47n 0603 16V	Css1	1	Vishay	Generic
Capacitor Ceramic X7R 220n 0603 16V	Css2	1	Vishay	Generic
Capacitor Ceramic COG 82p 0603 50V	Cc20	1	Vishay	Generic
Capacitor Ceramic X7R 100n 0603 16V	Cb1, Cb2	2	Vishay	Generic
Capacitor Ceramic COG 33p 0603 50V	Clim1, Clim2	2	Vishay	Generic
Capacitor Ceramic X7R 1.8n 0603 50V	Cc11	1	Vishay	Generic
Capacitor Ceramic X7R 2.2n 0603 50V	Cc21	1	Vishay	Generic
Capacitor Ceramic COG 820p 0603 50V	Cc22	1	Vishay	Generic
Capacitor Ceramic X7R 22u 1210 25V	Cin11, Cin21, Cin22	3	Murata	GRM32ER71E226KE15L
Capacitor Ceramic X7R 22u 1210 10V	Co11, Co12, Co21, Co22	4	Murata	GRM32ER71A226KE20L
Diode Schottky 200mA SOD-323 40V	Db1, Db2	2	Diodes inc	BAT54H
Diode Zener 200mW SOD-323 18V	Din	1	Diodes inc	MMSZ5248BS
Inductor Ferrite 5.6uH 10.3mm x 10.3mm	L1	1	Toko	962BS-5R6M
Inductor Ferrite 8.0uH 12.3mm x 12.3mm	L2	1	Toko	931AS-8R0M
Single N-Channel MOSFET SO8 30V	QH1, QH2	2	Vishay	Si4394DY
Single N-Channel MOSFET SO8 30V	QL1, QL2	2	Vishay	Si4324DY
5% Thick Film 10 Ohms 0603	Rpv, Rf23	2	Vishay	Generic
1% Thick Film 200 Ohms 0603	Rin	1	Vishay	Generic
1% Thick Film 10.0k 0603	Rpg1, Rpg2	2	Vishay	Generic
1% Thick Film 22.0k 0603	Rf11, Rf21, Rt1h, Rel	4	Vishay	Generic
1% Thick Film 3.00k 0603	Rf22	1	Vishay	Generic
1% Thick Film 68.0 Ohms 0603	Rc22	1	Vishay	Generic
1% Thick Film 680 Ohms 0603	Rlim2	1	Vishay	Generic
1% Thick Film 750 Ohms 0603	Rlim1	1	Vishay	Generic
1% Thick Film 110k 0603	Reh	1	Vishay	Generic
1% Thick Film 1.00k 0603	Rf12a, Rt1la	2	Vishay	Generic
1% Thick Film 3.90k 0603	Rf12b, Rt1lb	2	Vishay	Generic
1% Thick Film 75 Ohms 0603	Rc12	1	Vishay	Generic
1% Thick Film 7.50k 0603	Rc11	1	Vishay	Generic
1% Thick Film 6.8k 0603	Rc21	1	Vishay	Generic
2 chan 300k to 600k PWM LFCSP-32	U1	1	Analog Devices	ADP1823ACPZ

Table 3. Vout5 and Linear Regulators Bill of Materials (2.5V, 1.5V and 3.3V)

Description	Designator	Quantity	Manufacturer	MFR#
Capacitor Ceramic X7R 1u 0603 16V	Cin31, Co31	2	Murata	GRM188R71C105KA12D
Capacitor Ceramic X7R 1n 0603 50V	Css1	1	Vishay	Generic
Capacitor Ceramic X7R 10n 0603 16V	Css2	1	Vishay	Generic
Capacitor Ceramic X7R 100n 0603 16V	C2	1	Vishay	Generic
Capacitor Ceramic COG 39p 0603 50V	Cc1	1	Vishay	Generic
Capacitor Ceramic X7R 22u 1210 16V	Co11	1	Murata	GRM32ER71C226KE18L
Capacitor Ceramic X7R 2.2u 0805 16V	Cin11, Cin12, Cin21, Co21	4	Murata	GRM21BR71C225KA12L
Inductor Ferrite 3.3uH 7.6mm x 7.6mm	L1	1	Toko	636CY-3R3M
5% Thick Film 10 Ohms 0603	Rin	1	Vishay	Generic
1% Thick Film 20.0k 0603	Rf2	1	Vishay	Generic
1% Thick Film 42.2k 0603	Rf1	1	Vishay	Generic
1% Thick Film 200k 0603	Rc	1	Vishay	Generic
Integrated 1.2MHz PWM LFCSP-16	U1	1	Analog Devices	ADP2106ACPZ
500mA 1.5V Linear Reg MSOP-8	U2	1	Analog Devices	ADP1715ARMZ-1.5-R7
50mA 3.3V Linear Reg MSOP-8	U3	1	Analog Devices	ADP1720ARMZ-3.3-R7

Table 4. Vout6 (12.0 V)

Description	Designator	Quantity	Manufacturer	MFR#
Capacitor Ceramic COG 100p 0603 50V	Cc0	1	Vishay	Generic
Capacitor Ceramic X7R 3.3n 0603 50V	Cc1	1	Vishay	Generic
Capacitor Ceramic X7R 1.0n 0603 50V	Cc2	1	Vishay	Generic
Capacitor Ceramic X7R 1.0u 0603 16V	Cpv	1	Murata	GRM188R71C105KA12D
Capacitor Ceramic X7R 100n 0603 16V	Cvcc, Cz, Cb, Css	4	Vishay	Generic
Capacitor Ceramic COG 33p 0603 50V	Clim	1	Vishay	Generic
Capacitor Ceramic X7R 22u 1210 25V	Cin1	1	Murata	GRM32ER71E226KE15L
Capacitor Ceramic X7R 22u 1210 16V	Co1	1	Murata	GRM32ER71C226KE18L
No pop 6.3mm 16V SMT	Co2	0	Nippon	APXE160ARA101MF80G
Diode Zener 200mW SOD-323 5V6	Dlim	1	Diodes inc	MMSZ5232BS
Diode Schottky 200mA SOD-323 40V	Db	1	Diodes inc	BAT54H
Inductor Ferrite 22uH 10.4mmx10.4mm	L1	1	Toko	B966BS-220M
Single N-Channel MOSFET SOT-6 30V	QL1,QH1	2	Vishay	Si3456BDV
Single NPN Bipolar SOT-23 40V	Qpv	1	Vishay	Si4684DY
1% Thick Film 3.00k 0603	Rz	1	Vishay	Generic
1% Thick Film 270 Ohms 0603	Rzc	1	Vishay	Generic
5% Thick Film 10 Ohms 0603	Rin, Rpv	2	Vishay	Generic
1% Thick Film 20.0k 0603	Rf1, Rel	2	Vishay	Generic
1% Thick Film 1.00k 0603	Rf2a	1	Vishay	Generic
1% Thick Film 56 Ohms 0603	Rf2b, Rc2	2	Vishay	Generic
1% Thick Film 2.70k Ohms 0603	Rlim	1	Vishay	Generic
1% Thick Film 6.80k 0603	Rc1	1	Vishay	Generic
1% Thick Film 10.0k 0603	Rpg	1	Vishay	Generic
1% Thick Film 100k 0603	Reh	1	Vishay	Generic
1 chan 300k to 600k PWM QSOP-16	U1	1	Analog Devices	ADP1821ARQZ

NOTES

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