ADP1828 Reference Design

Preliminary Technical Data

FCDC 00118

FEATURES

Three Output Voltages: 3.3 V, 2.5 V, 1.25 V
Output Current: 2.2 A, 3.9 A, 12.7 A
Input Voltage Range: 10.8 V – 13.2 V
Ripple 1-2% ppk of Output Voltage
Transient step ±3%, 25% max load

ADP1828 AND ADP1829 DESCRIPTION

This ADP1828 and ADP1829 reference design uses 10.8 V to 13.2 V for the input voltage. The output voltages and currents are as follows:

- V_{OUT1} = 3.3 V with a maximum output current of 2.2 A and ripple voltage of 40 mV_{pk-pk},
- V_{OUT2} = 2.5 V with a maximum output current of 3.9 A and ripple voltage of 25 mV_{pk-pk},
- V_{OUT3} = 1.25 V with a maximum output current of 12.7 A and ripple voltage of 15 mV_{pk-pk}

Design criteria requires coincidental tracking of V_{OUT2} and V_{OUT3} with V_{OUT1} to guarantee that V_{OUT3} and V_{OUT2} do not exceed nor drop 0.5 V below V_{OUT1} at start up. The transient response is 3% deviation due to 25% instantaneous load step. The nominal switching frequency is synchronized to an external 300 kHz clock with a minimum pulse width of 200 ns. Each output is assumed to have additional distributed output capacitance of at least 25 uF / A of maximum load current comprised of ceramic or low ESR Tantalum and is stable with up to 50 uF / A of maximum load current.

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REVISION HISTORY

4/30/2008—Revision 0: Initial Version
8/07/2008—Revision 1: Changed tracking resistors on VOUT2 and VOUT3. Added second source FETs and Inductors.

GENERAL DESCRIPTION

ADP1828

The ADP1828 is a versatile and synchronous PWM voltage mode buck controller. It drives an all N-channel power stage to regulate an output voltage as low as 0.6 V to 85% of the input voltage and is sized to handle large MOSFETs for point-of-load regulators. The ADP1828 is ideal for a wide range of high power applications, such as DSP and processor core I/O power, and general-purpose power in telecommunications, medical imaging, PC, gaming, and industrial applications. It operates from input bias voltages of 3 V to 18 V with an internal LDO that generates a 5 V output for input bias voltages greater than 5.5 V. The ADP1828 operates at a pin-selectable, fixed switching frequency of either 300 kHz or 600 kHz, or at any frequency between 300 kHz and 600 kHz with a resistor. The switching frequency can also be synchronized to an external clock up to 2× the part's nominal oscillator frequency. The clock output can be used for synchronizing additional ADP1828s (or the ADP1829 controllers), thus eliminating the need for an external clock source. The ADP1828 includes soft start protection to limit any inrush current from the input supply during startup, reverse current protection during soft start for a precharged output, as well as a unique adjustable lossless current-limit scheme utilizing external MOSFET RDSON sensing. For applications requiring power-supply sequencing, the ADP1828 provides a tracking input that allows the output voltage to track during startup, shutdown, and faults. The additional supervisory and control features include thermal overload, undervoltage lockout, and power good. The ADP1828 operates over the −40°C to +125°C junction temperature range and is available in a 20-lead QSOP

ADP1829

The ADP1829 is a versatile, dual output, interleaved, synchronous PWM buck controller that generates two independent outputs from an input voltage of 2.9 V to 18 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 ADP1829 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 ADP1829 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.

SCHEMATIC

3.3V at 2.2A and 2.5V at 3.9A

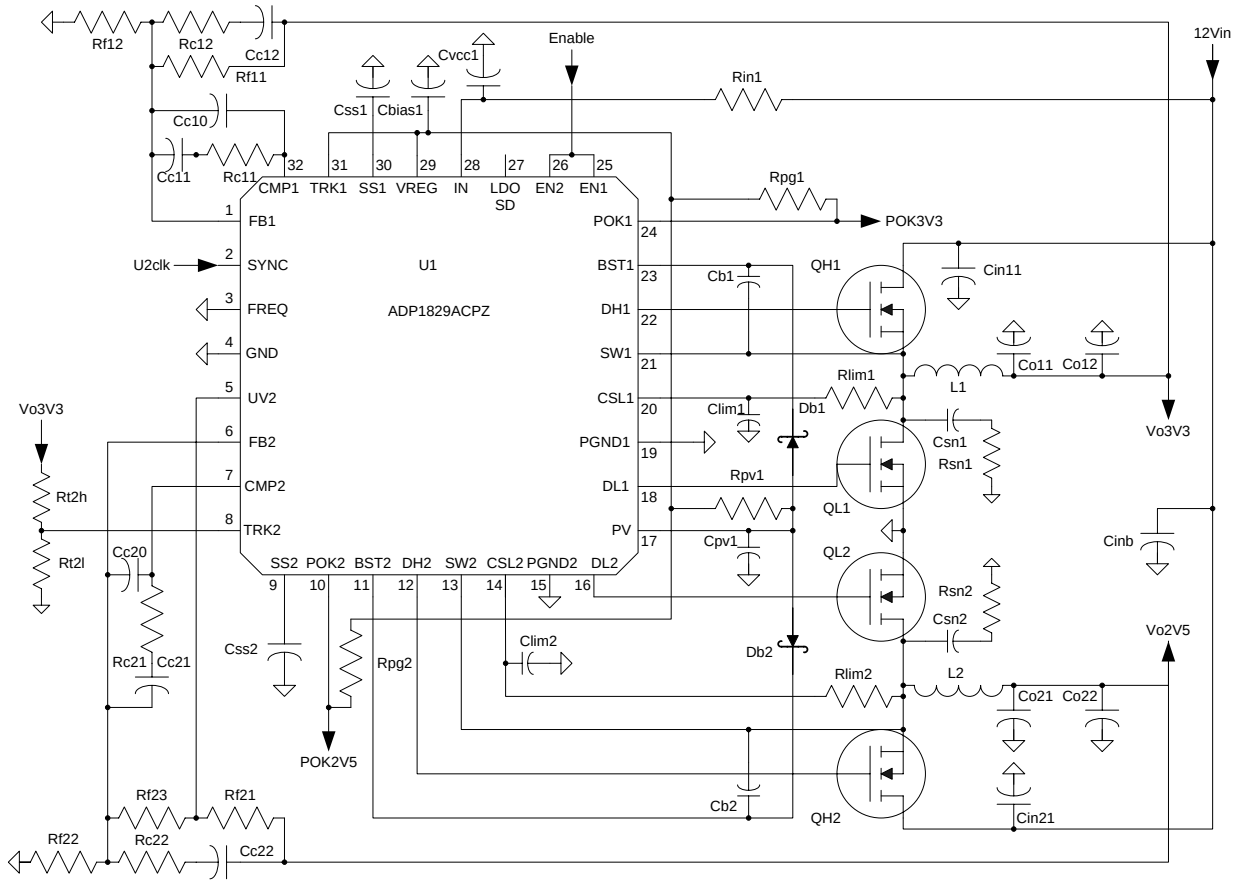

Figure 1. Schematic V_{OUT1} and V_{OUT2}

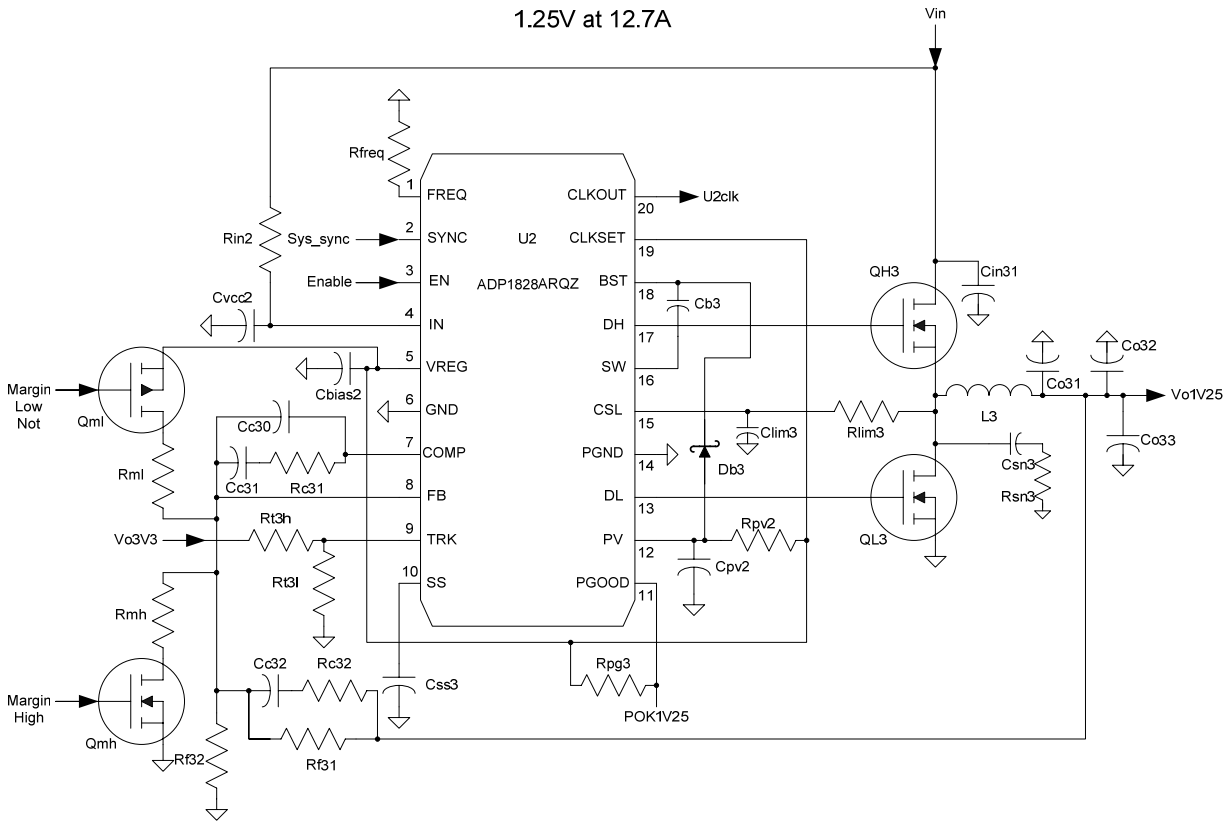

Figure 2. Schematic V_{OUT3}

BILL OF MATERIALS

Table 1. Bill of Materials

Description	Designator	Quantity	Manufacturer	MFR#
Capacitor Ceramic X7R 1.2n 0603 50V	Cc12	1	Vishay	Generic
Capacitor Ceramic COG 56p 0603 50V	Cc10, Cc20	2	Vishay	Generic
Capacitor Ceramic X7R 1.5n 0603 50V	Cc11 Cc21, Cc32	3	Vishay	Generic
Capacitor Ceramic X7R 1u 0603 16V	Cvcc1, Cvcc2, Cbias1, Cbias2, Cpv1, Cpv2	6	Murata	GRM188R71C105KA12D
Capacitor Ceramic X7R 47n 0603 16V	Css1	1	Vishay	Generic
Capacitor Ceramic X7R 10u 1206 16V	Cin11, Cin21, Cin31	3	Murata	GRM31CR71C106KAC7L
Capacitor Ceramic X7R 10n 0603 16V	Css3, Css2	2	Vishay	Generic
Capacitor Ceramic X7R 100n 0603 16V	Cb1, Cb2, Cb3	3	Vishay	Generic
Capacitor Ceramic COG 33p 0603 50V	Clim1, Clim2, Clim3	3	Vishay	Generic
Capacitor Ceramic X7R 1.0n 0603 50V	Cc22	1	Vishay	Generic
Capacitor Ceramic X7R 1.2n 0603 50V	Cc31	1	Vishay	Generic
Capacitor Ceramic COG 47p 0603 50V	Cc30	1	Vishay	Generic
Capacitor Ceramic X5R 22u 1206 6.3V	Co11	1	Murata	grm31cr60j226k
Capacitor Ceramic X5R 47u 1206 6.3V	Co21, Co31	2	Murata	grm31cr60j476m
Diode Schottky 200mA SOD-323 40V	Db1, Db2, Db3	3	Diodes inc	BAT54WS
Inductor Ferrite 8.2uH 10.3mm x 10.5mm	L1	1	Coiltronics Coilcraft	DR104-8R2-R MSS1038-702
Inductor Ferrite 3.8uH 10.3mm x 10.5mm	L2	1	Coiltronics Coilcraft	DR104-3R8-R MSS1038-382
Inductor Ferrite 1uH 12.5mm x 12.5mm	L3	1	Coiltronics Coilcraft	DR125-1R0-R MSS1260-102
Single N-Channel MOSFET TSDSON-8 30V	QH1, QL1, QH2, QL2, QH3	5	Infineon Vishay	BSZ088N03MS Si7114DN
Single N-Channel MOSFET TDSON-8 30V	QL3	1	Infineon Vishay	BSC020N03LS Si7658DP
Single P-Channel MOSFET SOT-323 -50V	Qml	1	Diodes inc	BSS84W
Single N-Channel MOSFET SOT-323 60V	Qmh	1	Diodes inc	2N7002W
Zero Ohm Jumper 0603	Rfreq, Rf23	2	Vishay	Generic
5% Thick Film 10 Ohms 0603	Rin1, Rin2, Rpv1, Rpv2	4	Vishay	Generic
1% Thick Film 10.0k 0603	Rpg1, Rpg2, Rpg3	3	Vishay	Generic
1% Thick Film 20.0k 0603	Rf11, Rf21, Rt2h	3	Vishay	Generic
1% Thick Film 16.2k 0603	Rf31, Rt3h	2	Vishay	Generic
1% Thick Film 6.34k 0603	Rf22	1	Vishay	Generic
1% Thick Film 4.75k 0603	Rt2l	1	Vishay	Generic
1% Thick Film 15.0k 0603	Rf32	1	Vishay	Generic
1% Thick Film 22.1k 0603	Rt3l	1	Vishay	Generic
1% Thick Film 8.2k 0603	Rc31	1	Vishay	Generic
1% Thick Film 100 Ohms 0603	Rc12, Rc22, Rc32	3	Vishay	Generic
1% Thick Film 374k 0603	Rmh	1	Vishay	Generic
1% Thick Film 2.49Meg 0603	Rml	1	Vishay	Generic
1% Thick Film 1.54k 0603	Rlim3	1	Vishay	Generic
1% Thick Film 1.69k 0603	Rlim2	1	Vishay	Generic
1% Thick Film 1.10k 0603	Rlim1	1	Vishay	Generic
1% Thick Film 4.42k 0603	Rf12	1	Vishay	Generic

1% Thick Film 17.8k 0603	Rc11, Rc21	2	Vishay	Generic
2 chan 300k to 600k PWM LFCSP-32	U1	1	Analog Devices	ADP1829ACPZ
1 chan 300k to 600k PWM QSOP-20	U2	1	Analog Devices	ADP1828ARQZ

PERFORMANCE

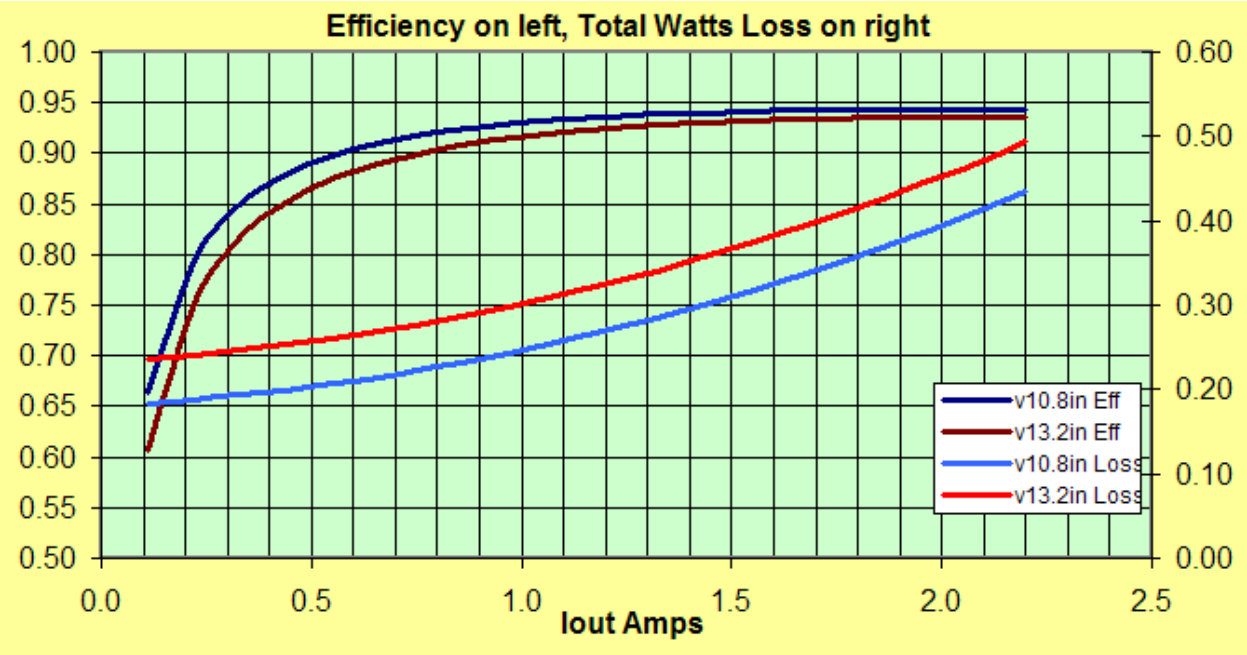

Figure 3. Calculated Efficiency for V_{OUT1}

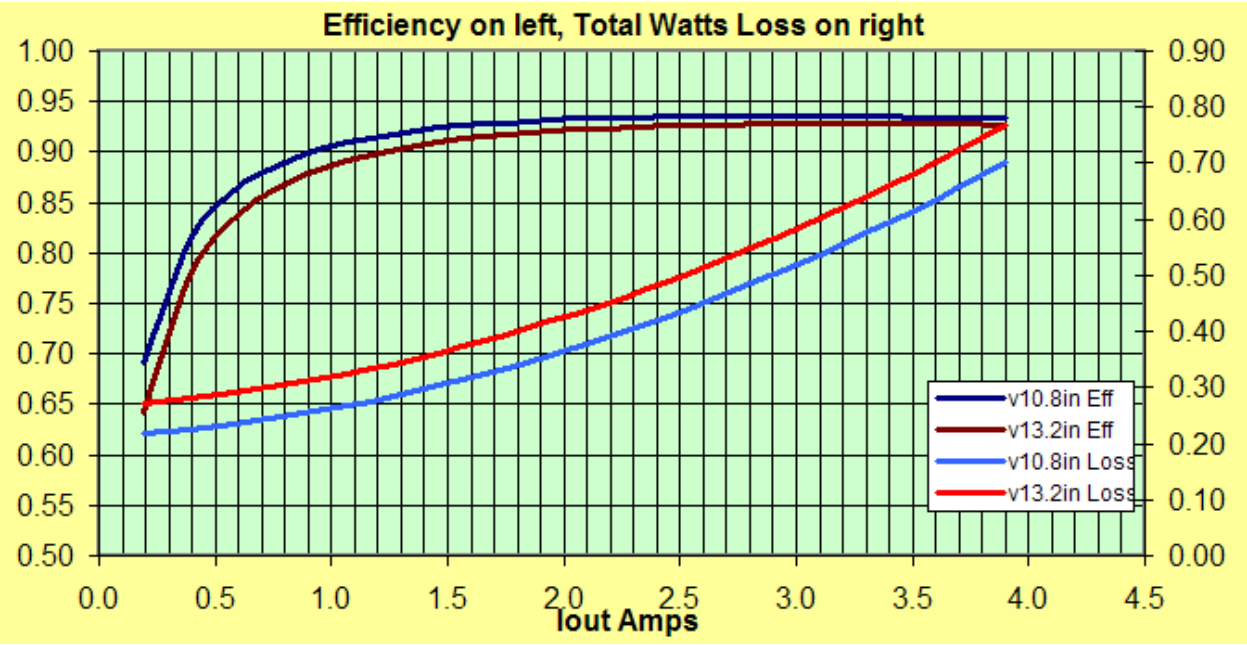

Figure 4. Calculated Efficiency for V_{OUT2}

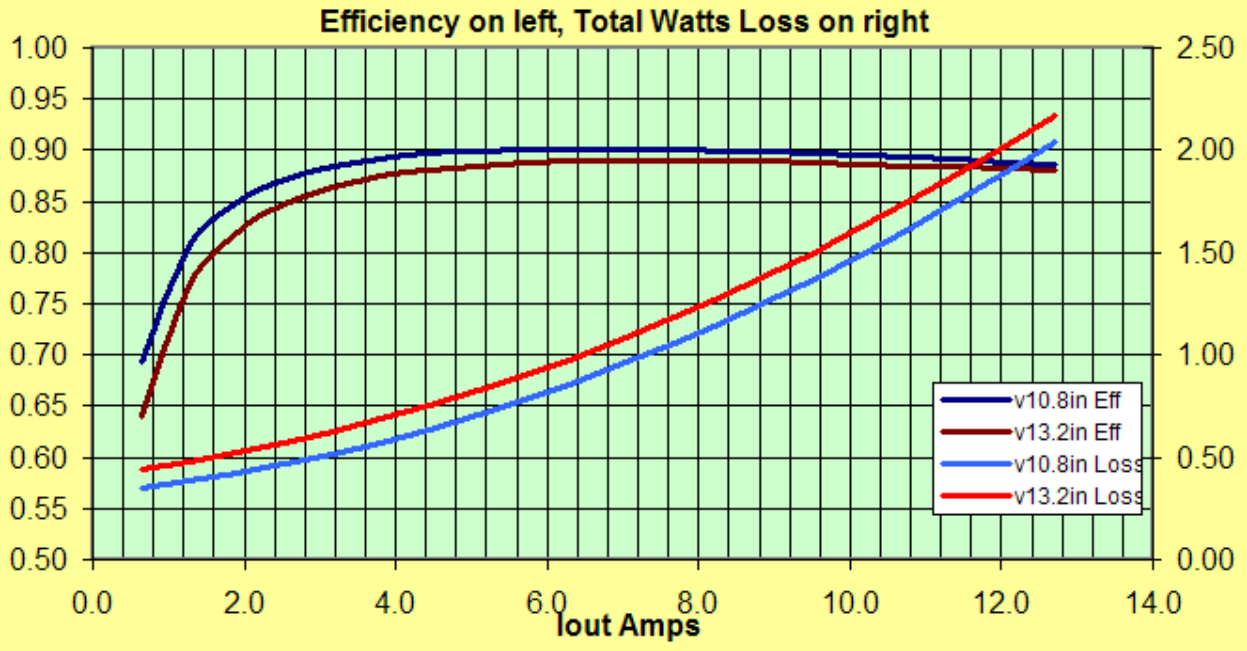

Figure 5. Calculated Efficiency for V_{OUT3}

NOTES:

A reference designator shown on the schematic and not appearing in the Bill of Materials is considered a stuffing option and is not populated.

If a different number, or different type of output capacitors are used on the switching outputs the loop compensation components may need adjustment.