

LT3504

Quad 40V/1A Step-Down Switching Regulator with 100% Duty Cycle Operation

DESCRIPTION

The demo circuit 1207A is a quad current mode PWM step-down DC/DC converter featuring the LT[®]3504. The demo circuit is designed for 5V, 3.3V, 2.5V and 1.8V outputs from a 5.4V to 40V input. The current capability of each channel is up to 1A. Individual soft-start and current limit for each output as well as synchronous function simplify the complex design of quad-output power converters.

Each converter is synchronized to either a common external clock input or a resistor programmable 250kHz to 2.2MHz internal oscillator. Programmable frequency allows optimization between efficiency and external component

size. Each output can be independently disabled using its own RUN/SS pin.

The LT3504 data sheet gives a complete description of the device, operation and application information. The data sheet must be read in conjunction with this quick start guide for the demo circuit 1207A.

Design files for this circuit board are available at <http://www.linear.com/demo>

LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

PERFORMANCE SUMMARY Specifications are at T_A = 25°C

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------|--|---|-------|-----|-------|-------|
| V _{IN} | Input Supply Range | | 5.4 | | 40 | V |
| V _{OUT1} | Output Voltage 1 | | 4.75 | 5 | 5.15 | V |
| V _{OUT2} | Output Voltage 2 | | 3.135 | 3.3 | 3.40 | V |
| V _{OUT3} | Output Voltage 3 | | 2.375 | 2.5 | 2.575 | V |
| V _{OUT4} | Output Voltage 4 | | 1.71 | 1.8 | 1.854 | V |
| Frequency | Switching Frequency | | 0.9 | 1 | 1.1 | MHz |
| I _{OUT1} | V _{OUT1} Maximum Output Current | V _{IN} = 5.4 ~ 40V | 1 | | | A |
| I _{OUT2} | V _{OUT2} Maximum Output Current | V _{IN} = 5.4 ~ 40V | 1 | | | A |
| I _{OUT3} | V _{OUT3} Maximum Output Current | V _{IN} = 5.4 ~ 40V | 1 | | | A |
| I _{OUT4} | V _{OUT4} Maximum Output Current | V _{IN} = 5.4 ~ 40V | 1 | | | A |
| V _{OUT1(AC)} | V _{OUT1} Output Ripple | V _{IN} = 5.4 ~ 40V, I _{OUT1} = 1A, BW = 20MHz | | | 20 | mV |
| V _{OUT2(AC)} | V _{OUT2} Output Ripple | V _{IN} = 5.4 ~ 40V, I _{OUT2} = 1A, BW = 20MHz | | | 20 | mV |
| V _{OUT3(AC)} | V _{OUT3} Output Ripple | V _{IN} = 5.4 ~ 40V, I _{OUT3} = 1A, BW = 20MHz | | | 20 | mV |
| V _{OUT4(AC)} | V _{OUT4} Output Ripple | V _{IN} = 5.4 ~ 40V, I _{OUT4} = 1A, BW = 20MHz | | | 20 | mV |

DESCRIPTION

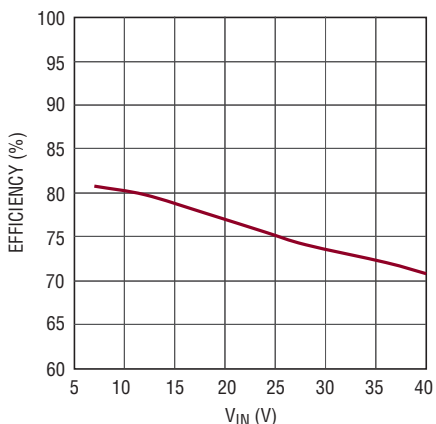


Figure 1. System Efficiency at $f = 1\text{MHz}$ with All Channels Sourcing 1A Current

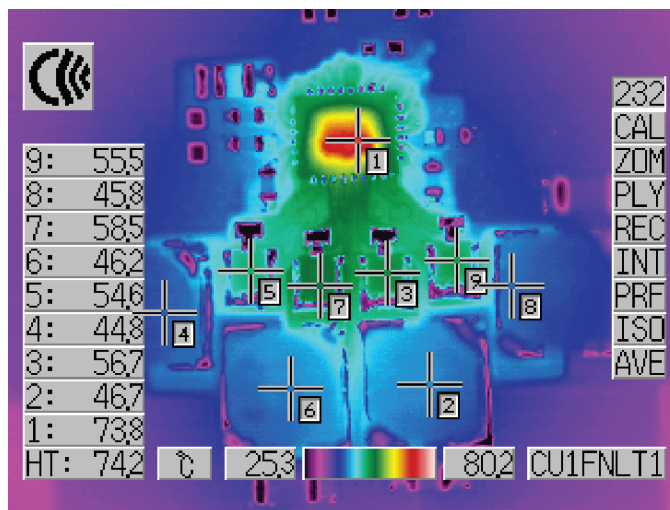


Figure 2. Thermal Image at $V_{IN} = 12\text{V}$, $f = 1\text{MHz}$ with All Channels Sourcing 1A Current

QUICK START PROCEDURE

The demo circuit 1207A is easy to set up to evaluate the performance of the LT3504. Refer to Figure 3 for proper measurement equipment setup and follow the procedure below:

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 VIN or VOUT and GND terminals. See Figure 4 for proper scope probe technique.

1. Place JP1-JP5 on ON position.
2. With power off, connect the input power supply to VIN and GND.

3. Turn on the power at the input.

NOTE: Make sure that the input voltage does not exceed 40V.

4. Check for the proper output voltages.

NOTE: If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

5. Once the proper output voltages are established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters

QUICK START PROCEDURE

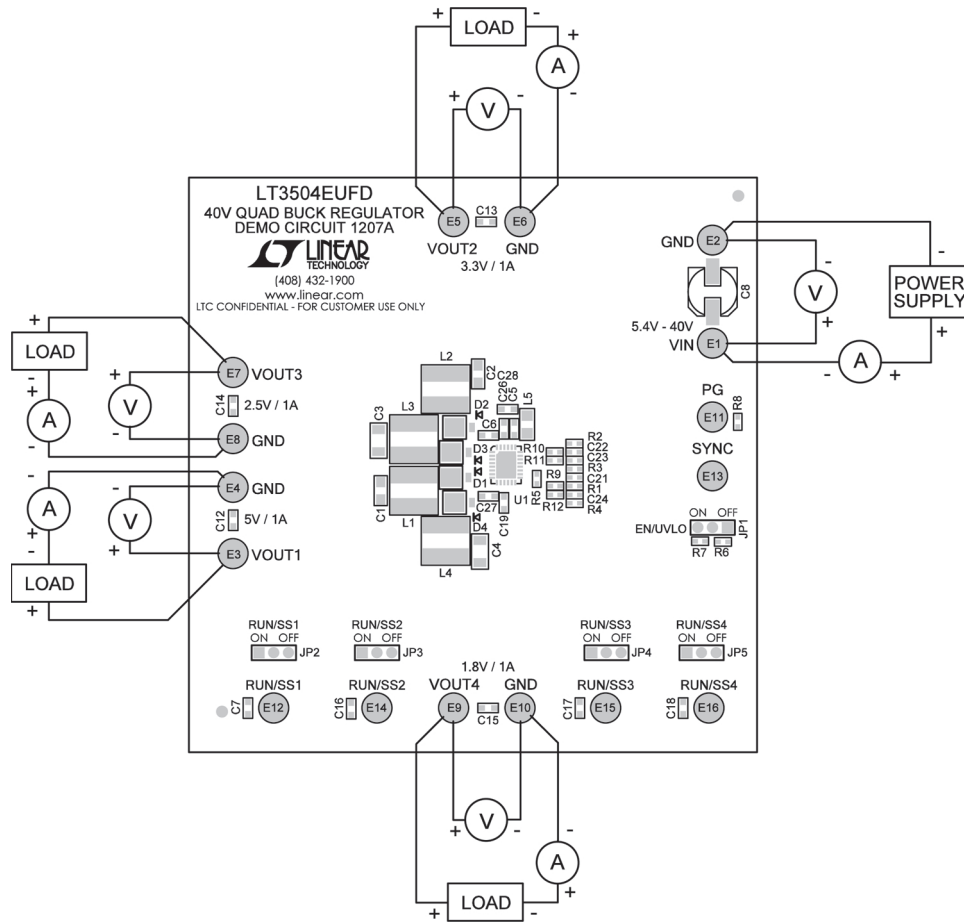


Figure 3. DC1207A Proper Equipment Setup

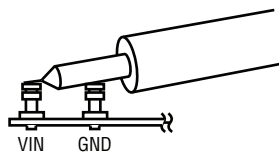


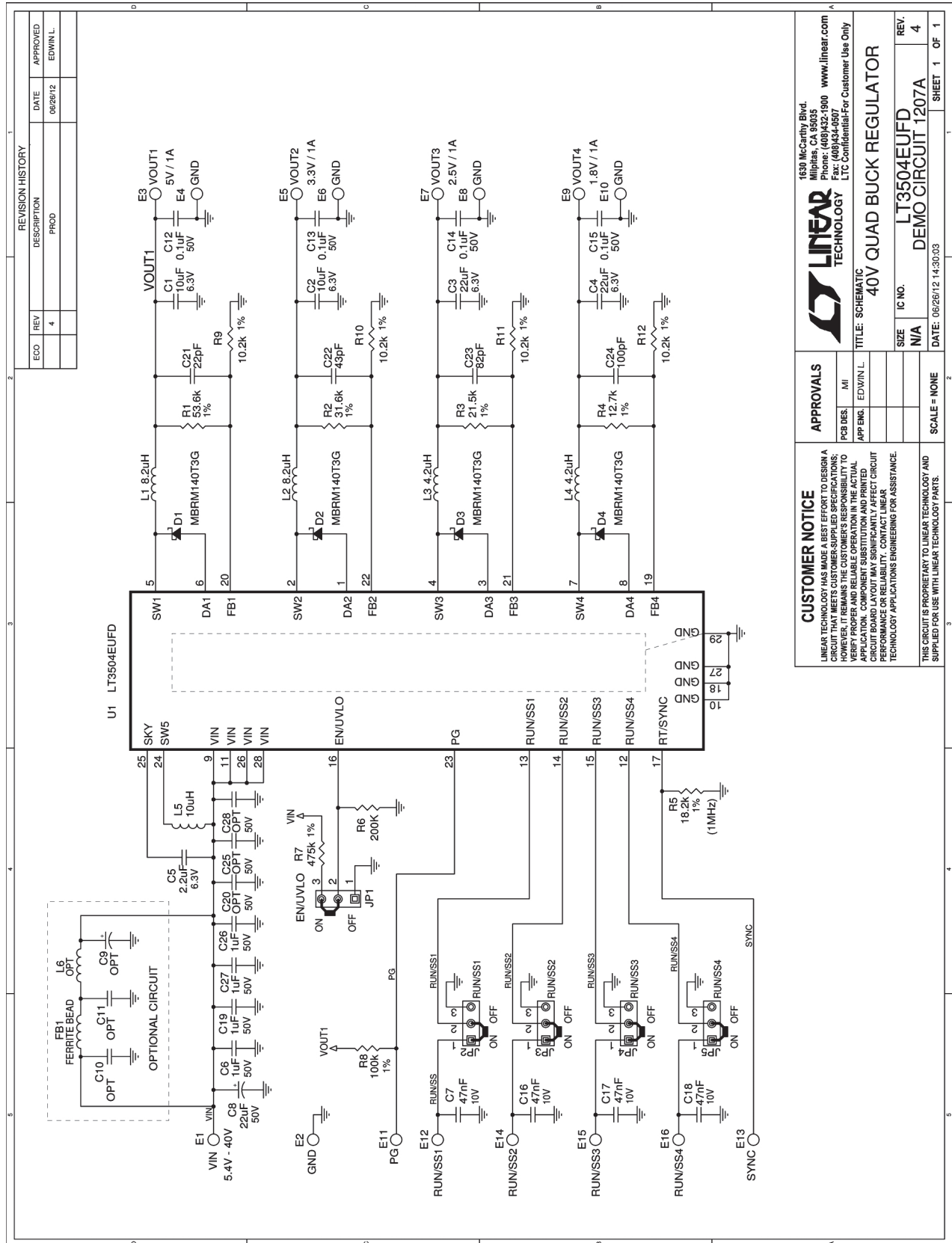
Figure 4. Measuring Input or Output Ripple

DEMO MANUAL DC1207A

PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|-----|-------------------|------------------------------------|----------------------------------|
| Required Circuit Components | | | | |
| 1 | 2 | C1, C2 | CAP, 0805 10 μ F 10% 6.3V X5R | AVX 08056D106KAT2A |
| 2 | 2 | C3, C4 | CAP, 1206 22 μ F 10% 6.3V X5R | AVX 12066D226KAT2A |
| 3 | 1 | C5 | CAP, 0603 2.2 μ F 10% 6.3V X5R | TAIYO YUDEN JMK107BJ225KAT |
| 4 | 4 | C6, C19, C26, C27 | CAP, 0603 1 μ F 10% 50V X5R | TDK C1608X5R1H105K |
| 5 | 4 | C7, C16, C17, C18 | CAP, 0603 47nF 10% 10V X7R | AVX 0603ZC473KAT2A |
| 6 | 1 | C21 | CAP, 0402 22pF 5% 16V NPO | AVX 0402YA220JAT2A |
| 7 | 1 | C22 | CAP, 0402 43pF 5% 25V NPO | AVX 04023A430JAT |
| 8 | 1 | C23 | CAP, 0402 82pF 5% 50V NPO | AVX 04025A820JAT |
| 9 | 1 | C24 | CAP, 0402 100pF 10% 16V X7R | AVX 0402YC101KAT |
| 10 | 4 | D1-D4 | DIODE, SCHOTTKY BARRIER RECTIFIER | ON SEMI MBRM140T3G |
| 11 | 2 | L1, L2 | IND, 8.2 μ H | SUMIDA CDRH5D28-8R2 |
| 12 | 2 | L3, L4 | IND, 4.2 μ H | SUMIDA CDRH5D28-4R2 |
| 13 | 1 | L5 | IND, 10 μ H | TAIYO YUDEN CBC2016100M |
| 14 | 1 | R1 | RES, 0402 53.6k 1% 1/16W | VISHAY CRCW040253K6FKED |
| 15 | 1 | R2 | RES, 0402 31.6k 1% 1/16W | VISHAY CRCW040231K6FKED |
| 16 | 1 | R3 | RES, 0402 21.5k 1% 1/16W | VISHAY CRCW040221K5FKEA |
| 17 | 1 | R4 | RES, 0402 12.7k 1% 1/16W | VISHAY CRCW040212K7FKED |
| 18 | 1 | R5 | RES, 0402 18.2k 1% 1/16W | VISHAY CRCW040218K2FKED |
| 19 | 1 | R6 | RES, 0402 200k 5% 1/16W | VISHAY CRCW0402200KJNED |
| 20 | 1 | R7 | RES, 0402 475k 1% 1/16W | VISHAY CRCW0402475KFKED |
| 21 | 1 | R8 | RES, 0402 100k 1% 1/16W | NIC NRC06F1003TRF |
| 22 | 4 | R9-R12 | RES, 0402 10.2k 1% 1/16W | VISHAY CRCW040210K2FKED |
| 23 | 1 | U1 | IC, 40V QUAD BUCK REGULATOR | LINEAR TECH. LT3504EUFD |
| Additional Demo Board Circuit Components | | | | |
| 1 | 1 | C8 | CAP, 22 μ F 20% 50V ALUM | SANYO 50CE22BS |
| 2 | 0 | C9 | CAP, OPTION | OPTION |
| 3 | 0 | C10 | CAP, 0603 OPTION | OPTION |
| 4 | 0 | C11 | CAP, 1206 OPTION | OPTION |
| 5 | 4 | C12-C15 | CAP, 0603 0.1 μ F 10% 50V X7R | MURATA GRM188R71H104KA93D |
| 6 | 0 | FB1 | FERRITE BEAD OPTION | OPTION |
| 7 | 0 | L6 | IND, OPTION | OPTION |
| Hardware—For Demo Board Only | | | | |
| 1 | 16 | E1-E16 | TURRET | MILL MAX 2501-2-00-80-00-00-07-0 |
| 2 | 5 | JP1-JP5 | HEADER, 3-PIN, 2mm | SAMTEC TMM-103-02-L-S |
| 3 | 5 | JP1-JP5 | SHUNT, 2mm | SAMTEC 2SN-BK-G |

SCHEMATIC DIAGRAM



DEMO MANUAL DC1207A

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [Power Management IC Development Tools](#) category:

Click to view products by [Analog Devices](#) manufacturer:

Other Similar products are found below :

[EVAL-ADM1168LQEBZ](#) [EVB-EP5348UI](#) [MIC23451-AAAYFL EV](#) [MIC5281YMME EV](#) [DA9063-EVAL](#) [ADP122-3.3-EVALZ](#) [ADP130-0.8-EVALZ](#) [ADP130-1.2-EVALZ](#) [ADP130-1.5-EVALZ](#) [ADP130-1.8-EVALZ](#) [ADP1714-3.3-EVALZ](#) [ADP1716-2.5-EVALZ](#) [ADP1740-1.5-EVALZ](#) [ADP1752-1.5-EVALZ](#) [ADP1828LC-EVALZ](#) [ADP1870-0.3-EVALZ](#) [ADP1871-0.6-EVALZ](#) [ADP1873-0.6-EVALZ](#) [ADP1874-0.3-EVALZ](#) [ADP1882-1.0-EVALZ](#) [ADP199CB-EVALZ](#) [ADP2102-1.25-EVALZ](#) [ADP2102-1.875EVALZ](#) [ADP2102-1.8-EVALZ](#) [ADP2102-2-EVALZ](#) [ADP2102-3-EVALZ](#) [ADP2102-4-EVALZ](#) [ADP2106-1.8-EVALZ](#) [ADP2147CB-110EVALZ](#) [AS3606-DB](#) [BQ24010EVM](#) [BQ24075TEVM](#) [BQ24155EVM](#) [BQ24157EVM-697](#) [BQ24160EVM-742](#) [BQ24296MEVM-655](#) [BQ25010EVM](#) [BQ3055EVM](#) [NCV891330PD50GEVB](#) [ISLUSBI2CKIT1Z](#) [LM2744EVAL](#) [LM2854EVAL](#) [LM3658SD-AEV/NOPB](#) [LM3658SDEV/NOPB](#) [LM3691TL-1.8EV/NOPB](#) [LM4510SDEV/NOPB](#) [LM5033SD-EVAL](#) [LP38512TS-1.8EV](#) [EVAL-ADM1186-1MBZ](#) [EVAL-ADM1186-2MBZ](#)