

# TimerBlox: Oscillators, One Shots, PWM, Delay, Power on Reset

## DESCRIPTION

Demonstration circuit 1562B is an engineering tool to design and evaluate the LTC699X-X family of TimerBlox® circuits. The center section of the board contains a pre-configured TimerBlox function. DC1562B comes in twelve timing function variations as outlined in Table 1.

Surrounding the center board is a playground prototyping area. The prototyping area has pads for DIP-8, S8, MS8, or S6 packages with bread boarding connections to each pin and two convenient power buses and ground bus surrounding the entire area. This area is for conditioning signals to control the timer function and for adding loads controlled in time.

The center part of the board can be detached as a streamlined circuit, to combine with a pre-existing circuit. For application flexibility, a provision is made for buffering and inverting the output of the timer. An optional NC7W04P6X SC70 package dual inverter can be added at U2 to provide this functionality.

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

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## USING THE DEMO BOARD

To understand the simplicity and flexibility of the TimerBlox function, download the appropriate data sheet from the LTC website, [www.linear.com](http://www.linear.com). Each evaluation board comes with a TimerBlox part, decoupling cap and a bulk decoupling 10 $\mu$ F tantalum cap. Resistors are also installed that configure the TimerBlox device so that they are ready to use by simply adding power. Changing the default configuration of the demo board is a simple matter of determining a few new resistor values. Simply select a pair of resistor values for the DIV value from the data sheet DIV table, calculate the value of  $R_{SET}$  required, replace the resistor on the board, apply power, and go! Single supply power between 2.25V and 5.5V and ground must be supplied directly to the center board.

The outer prototyping section of the board can be used with single or dual supplies as required. **When using the prototyping area, the outermost trace, which is ground, must be connected (hand wired) to the ground on the center board section.** All input and output holes are sized for 65mil turret terminals, or wires can be soldered in the holes directly.

Changing the timer configuration requires changing resistor values on the center board. The resistor lead holes can accept “pressed-in” DIP sockets, or resistors can be soldered directly in the holes. Pads for 0805 surface mount resistors are also included at each position where a leaded resistor could be used. Pads are also included for three 25-turn trim pots which can be used to replace  $R_{SET}$  (R8) for master oscillator frequency adjustment, PSF in (R10) for voltage controlled options, and  $R_{DEV}$  (R7) for frequency divider control to permit real-time adjustments while running.

# DEMO MANUAL DC1562B

## USING THE DEMO BOARD

Table 1. Standard Configuration for Each Version

| DEMO BOARD NUMBER | LTC PART NUMBER | PART MARKING | FUNCTION | CONFIGURED FUNCTION                                             |
|-------------------|-----------------|--------------|----------|-----------------------------------------------------------------|
| DC1562B-A         | LTC6990         | LTDWW        | HF OSC   | 1kHz to 10kHz Voltage Controlled Oscillator                     |
| DC1562B-B         | LTC6991         | LTDWY        | LF OSC   | 1Hz (1Sec) Fixed Frequency Oscillator                           |
| DC1562B-C         | LTC6992-1       | LTDXB        | PWM      | 10kHz 0% to 100% Duty Cycle PWM                                 |
| DC1562B-D         | LTC6992-2       | LTDXD        | PWM      | 10kHz 5% to 95% Duty Cycle PWM                                  |
| DC1562B-E         | LTC6992-3       | LTFCQ        | PWM      | 10kHz 0% to 95% Duty Cycle PWM                                  |
| DC1562B-F         | LTC6992-4       | LTFCV        | PWM      | 10kHz 5% to 100% Duty Cycle PWM                                 |
| DC1562B-G         | LTC6993-1       | LTDXG        | One-Shot | RET* 100ms Positive Output Pulse                                |
| DC1562B-H         | LTC6993-2       | LTDXJ        | One-Shot | RET* Retriggerable 100ms Positive Output Pulse                  |
| DC1562B-I         | LTC6993-3       | LTFMH        | One-Shot | FET** Positive 100ms Output Pulse                               |
| DC1562B-J         | LTC6993-4       | LTFMK        | One-Shot | FET** Retriggerable 100ms Positive Output Pulse                 |
| DC1562B-K         | LTC6994-1       | LTFCV        | Delay    | Output Falling Edge Delayed 100ms from Input Falling Edge       |
| DC1562B-L         | LTC6994-2       | LTFCX        | Delay    | Output Rise/Fall Edges Delayed 100ms from Input Rise/Fall Edges |
| DC1562B-M         | LTC6995-1       | LTGJN        | POR      | 1sec Power on Reset                                             |
| DC1562B-N         | LTC6995-2       | LTGJQ        | POR      | 1sec Power on Reset                                             |

\* Rising Edge Triggered

\*\* Falling Edge Triggered

## USING THE DEMO BOARD

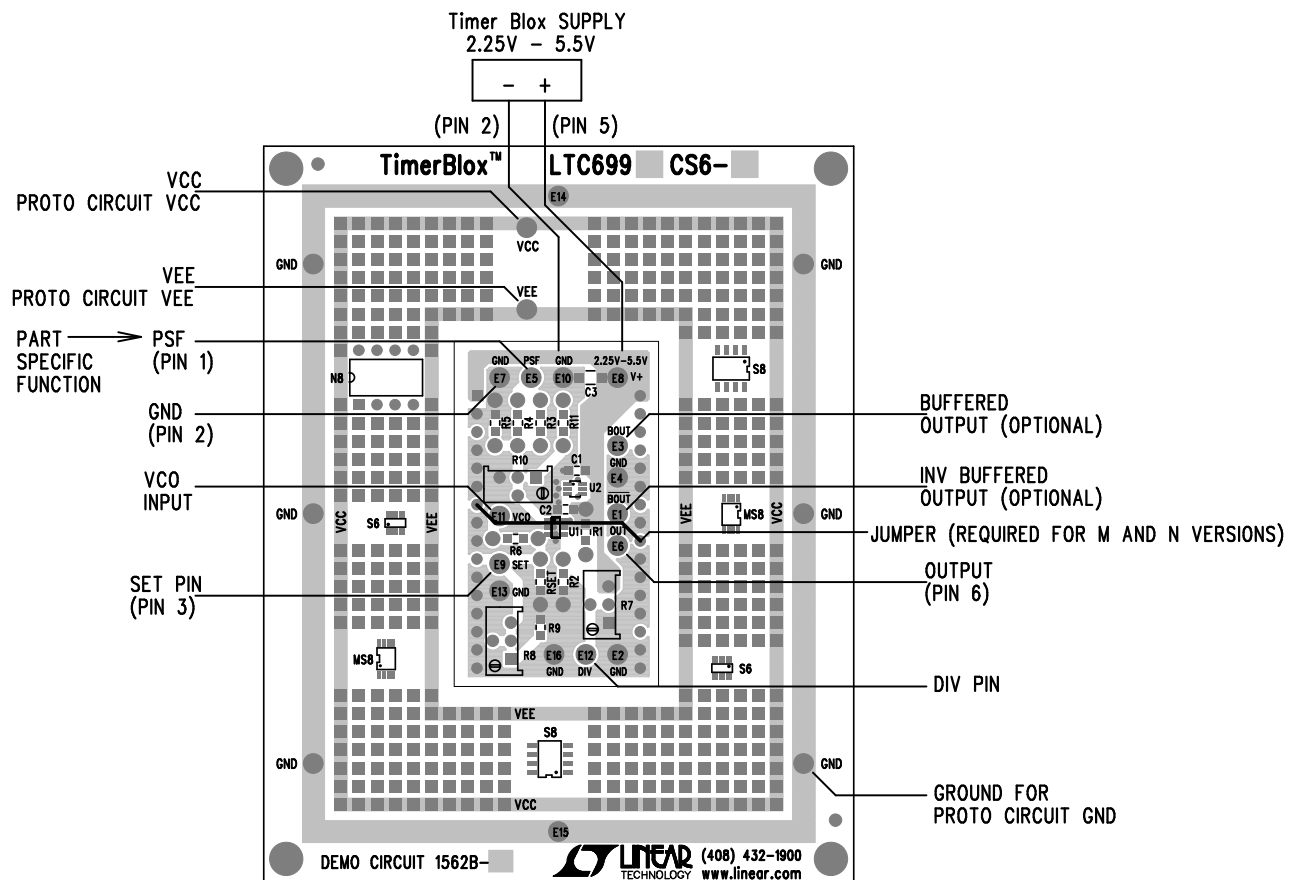


Figure 1. DC1562B-X External Connection Diagram

USING THE DEMO BOARD

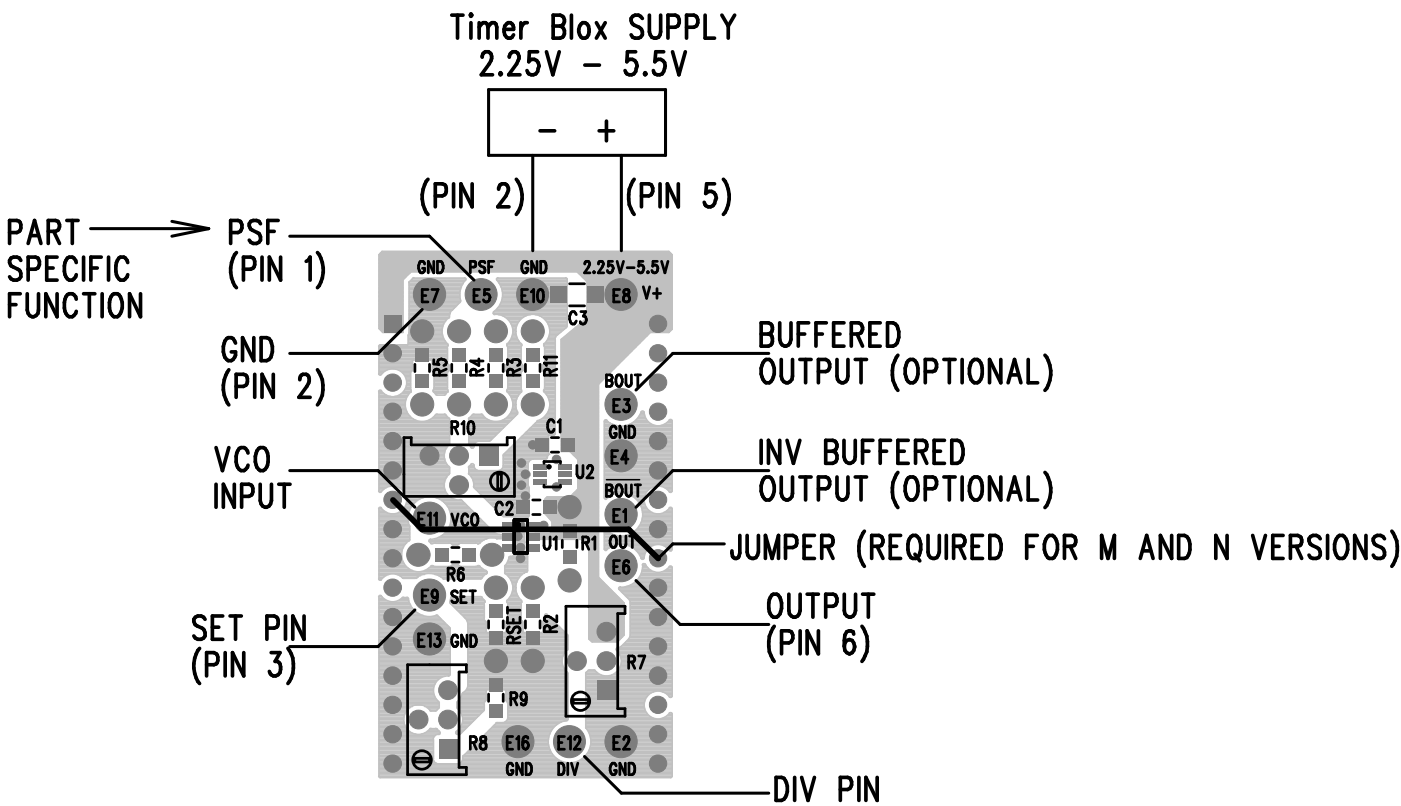


Figure 2. DC1562B-X Center Board Connection Diagram

## DEFAULT CIRCUIT CONFIGURATIONS FOR EACH VERSION

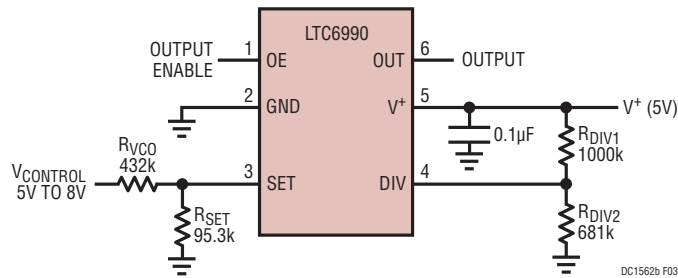


Figure 3. DC1562B-A, 1kHz to 10kHz VCO

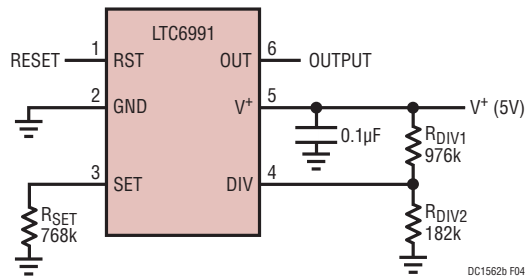


Figure 4. DC1562B-B, 1Hz (1Sec Period) Fixed Frequency Oscillator

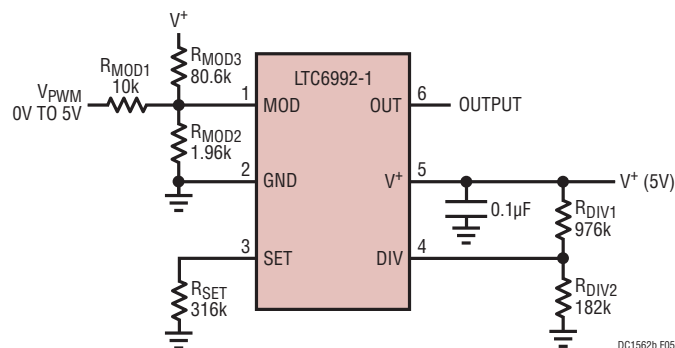


Figure 5. DC1562B-C, 10kHz 0% to 100% Duty Cycle PWM

DEFAULT CIRCUIT CONFIGURATIONS FOR EACH VERSION

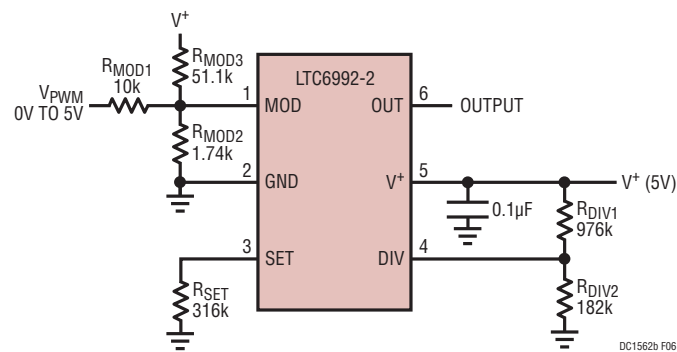


Figure 6. DC1562B-D, 10kHz 5% to 95% Duty Cycle PWM

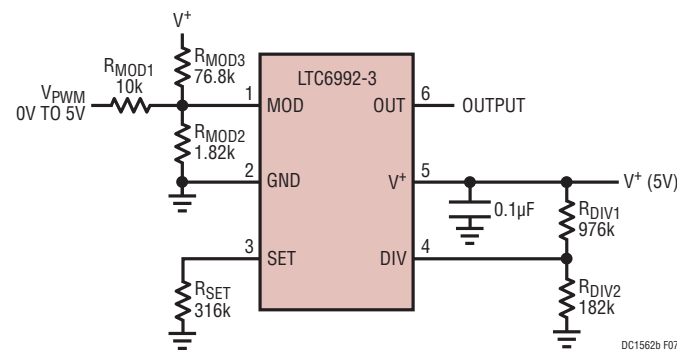


Figure 7. DC1562B-E, 10kHz 0% to 95% Duty Cycle PWM

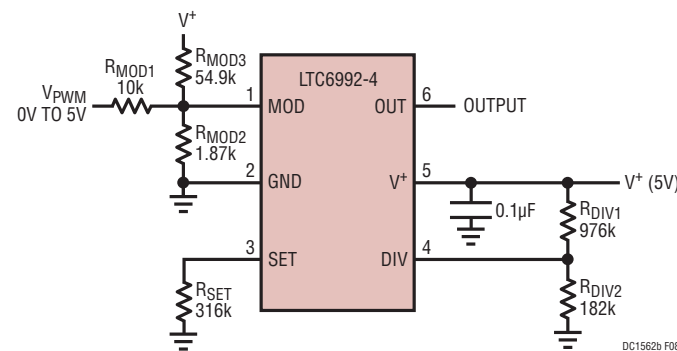


Figure 8. DC1562B-F, 10kHz 5% to 100% Duty Cycle PWM

## DEFAULT CIRCUIT CONFIGURATIONS FOR EACH VERSION

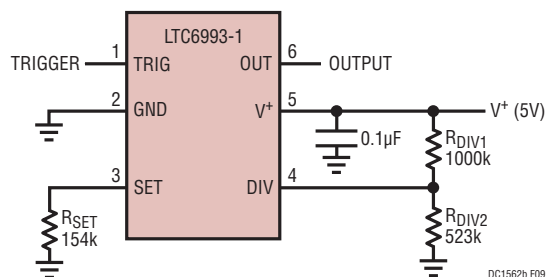


Figure 9. DC1562B-G, Rising Edge Triggered 100ms Positive Output Pulse One-Shot

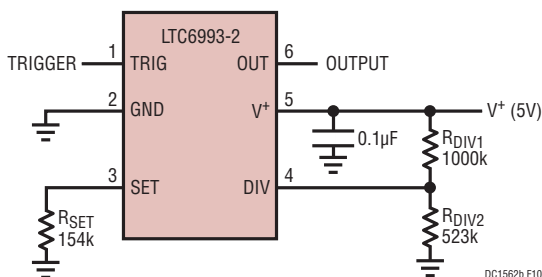


Figure 10. DC1562B-H, Rising Edge Retriggered 100ms Positive Output Pulse One-Shot

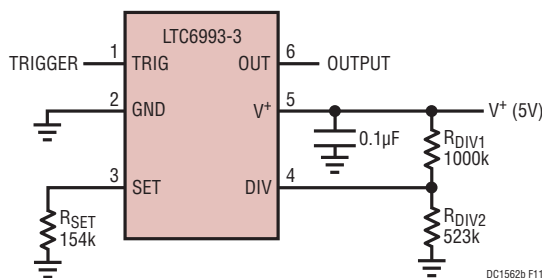


Figure 11. DC1562B-I, Falling Edge Triggered 100ms Positive Output Pulse One-Shot

DEFAULT CIRCUIT CONFIGURATIONS FOR EACH VERSION

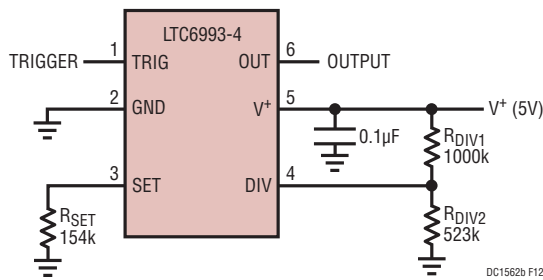


Figure 12. DC1562B-J, Falling Edge Retriggerable 100ms Positive Output Pulse One-Shot

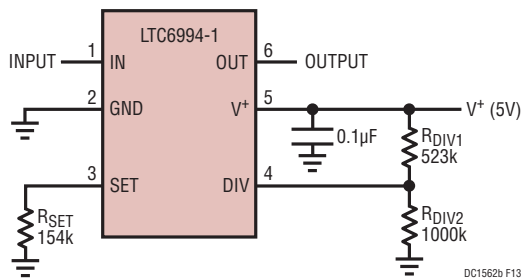


Figure 13. DC1562B-K, 100ms Delayed Output Falling Edge from Input Falling Edge

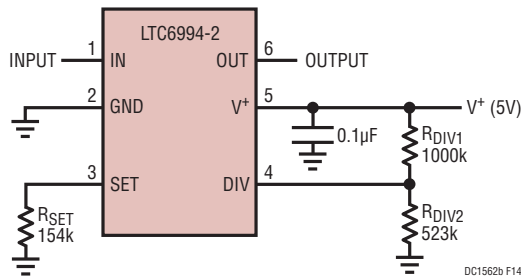


Figure 14. DC1562B-L, 100ms Delayed Output Edge from Input Edge, Both Rising and Falling Edges

## DEFAULT CIRCUIT CONFIGURATIONS FOR EACH VERSION

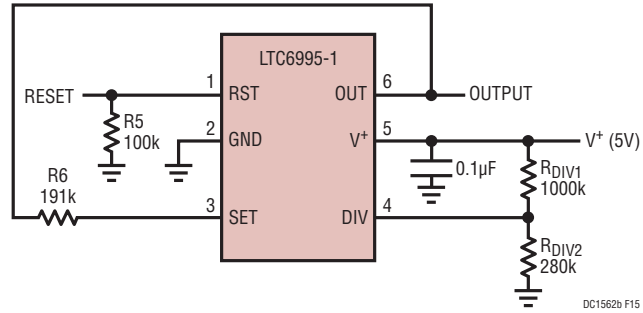


Figure 15. DC1562B-M, 1sec Active Low Power on Reset

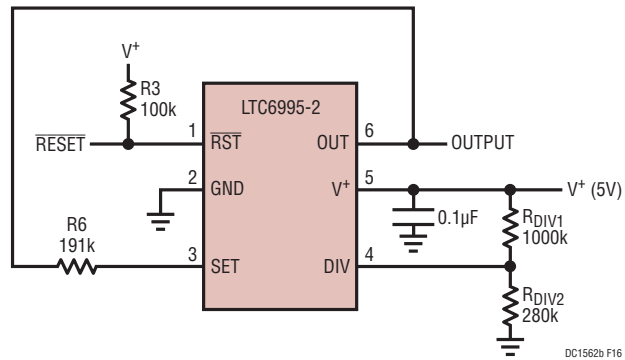


Figure 16. DC1562B-N, 1sec Active Low Power on Reset

# DEMO MANUAL DC1562B

## PARTS LIST

| ITEM | QTY | REFERENCE                              | PART DESCRIPTION                  | MANUFACTURER/PART NUMBER          |
|------|-----|----------------------------------------|-----------------------------------|-----------------------------------|
| 1    | 0   | C1 (OPT.)                              | CAP., 0805                        |                                   |
| 2    | 1   | C2                                     | CAP., CHIP, X7R, 0.1µF, 25V, 0805 | TDK, C2012X7R1H104K               |
| 3    | 1   | C3                                     | Cap., CHIP, X5R, 10µF, 16V, 1206  | TAIYO YUDEN, EMK316BJ106KDT       |
| 4    | 24  | E1-E16, E016-E18, E20-E24              | TESTPOINT, TURRET, .064"          | MILL-MAX, 2308-2-00-80-00-00-07-0 |
| 5    | 0   | R9-R11 (OPT.)                          | RES., 0805                        |                                   |
| 6    | 0   | R7, R8, R10 (OPT.)                     | POT., 3266W or 3266Y              |                                   |
| 7    | 0   | U2 (OPT.)                              | IC., NC7WZ04P6X, SC-70            |                                   |
| 8    | 0   | OPTIONAL SOCKETS FOR LEADED COMPONENTS |                                   | MILL MAX, 8427-0-15-01-30-02-04-0 |

### DC1562B-A

|   |   |           |                               |                          |
|---|---|-----------|-------------------------------|--------------------------|
| 1 | 1 | DC1562B   | GENERAL BOM                   |                          |
| 2 | 1 | R1        | RES., CHIP, 1M, 1% 0805       | VISHAY, CRCW08051M00FKEA |
| 3 | 1 | R2        | RES., CHIP, 681k, 1% 0805     | VISHAY, CRCW0805681KFKEA |
| 4 | 1 | R3        | RES., CHIP, 100k, 1% 0805     | VISHAY, CRCW0805100KFKEA |
| 5 | 1 | R4        | RES., CHIP, 0Ω, 1% 0805       | VISHAY, CRCW08050000Z0EA |
| 6 | 0 | R5 (OPEN) | RES., 0805                    |                          |
| 7 | 1 | R6        | RES., CHIP, 432k, 1% 0805     | VISHAY, CRCW0805432KFKEA |
| 8 | 1 | RSET      | RES., CHIP, 95.3k, 1% 0805    | VISHAY, CRCW080595K3FKEA |
| 9 | 1 | U1        | IC., TimerBlox FAMILY, SOT-23 | LINEAR TECH., LTC6990CS6 |

### DC1562B-B

|   |   |           |                               |                          |
|---|---|-----------|-------------------------------|--------------------------|
| 1 | 1 | DC1562B   | GENERAL BOM                   |                          |
| 2 | 1 | R1        | RES., CHIP, 976k, 1% 0805     | VISHAY, CRCW0805976KFKEA |
| 3 | 1 | R2        | RES., CHIP, 182k, 1% 0805     | VISHAY, CRCW0805182KFKEA |
| 4 | 0 | R3 (OPEN) | RES., 0805                    |                          |
| 5 | 1 | R4        | RES., CHIP, 0Ω, 1% 0805       | VISHAY, CRCW08050000Z0EA |
| 6 | 1 | R5        | RES., CHIP, 100k, 1% 0805     | VISHAY, CRCW0805100KFKEA |
| 7 | 0 | R6 (OPEN) | RES., 0805                    |                          |
| 8 | 1 | RSET      | RES., CHIP, 768k, 1% 0805     | VISHAY, CRCW0805768KFKEA |
| 9 | 1 | U1        | IC., TimerBlox FAMILY, SOT-23 | LINEAR TECH., LTC6991CS6 |

### DC1562B-C

|   |   |           |                              |                            |
|---|---|-----------|------------------------------|----------------------------|
| 1 | 1 | DC1562B   | GENERAL BOM                  |                            |
| 2 | 1 | R1        | RES., CHIP, 976k, 1% 0805    | VISHAY, CRCW0805976KFKEA   |
| 3 | 1 | R2        | RES., CHIP, 182k, 1% 0805    | VISHAY, CRCW0805182KFKEA   |
| 4 | 1 | R3        | RES., CHIP, 80.6k, 1% 0805   | VISHAY, CRCW080580K6FKEA   |
| 5 | 1 | R4        | RES., CHIP, 10k, 1% 0805     | VISHAY, CRCW080510K0FKEA   |
| 6 | 1 | R5        | RES., CHIP, 1.96k, 1% 0805   | VISHAY, CRCW08051K96FKEA   |
| 7 | 0 | R6 (OPEN) | RES., 0805                   |                            |
| 8 | 1 | RSET      | RES., CHIP, 316k, 1% 0805    | VISHAY, CRCW0805316KFKEA   |
| 9 | 1 | U1        | IC., TimerBlox FAMILY SOT-23 | LINEAR TECH., LTC6992CS6-1 |

### DC1562B-D

|   |   |           |                              |                            |
|---|---|-----------|------------------------------|----------------------------|
| 1 | 1 | DC1562B   | GENERAL BOM                  |                            |
| 2 | 1 | R1        | RES., CHIP, 976k, 1% 0805    | VISHAY, CRCW0805976KFKEA   |
| 3 | 1 | R2        | RES., CHIP, 182k, 1% 0805    | VISHAY, CRCW0805182KFKEA   |
| 4 | 1 | R3        | RES., CHIP, 51.1k, 1% 0805   | VISHAY, CRCW080551K1FKEA   |
| 5 | 1 | R4        | RES., CHIP, 10k, 1% 0805     | VISHAY, CRCW080510K0FKEA   |
| 6 | 1 | R5        | RES., CHIP, 1.74k, 1% 0805   | VISHAY, CRCW08051K74FKEA   |
| 7 | 0 | R6 (OPEN) | RES., 0805                   |                            |
| 8 | 1 | RSET      | RES., CHIP, 316k, 1% 0805    | VISHAY, CRCW0805316KFKEA   |
| 9 | 1 | U1        | IC., TimerBlox FAMILY SOT-23 | LINEAR TECH., LTC6992CS6-2 |

## PARTS LIST

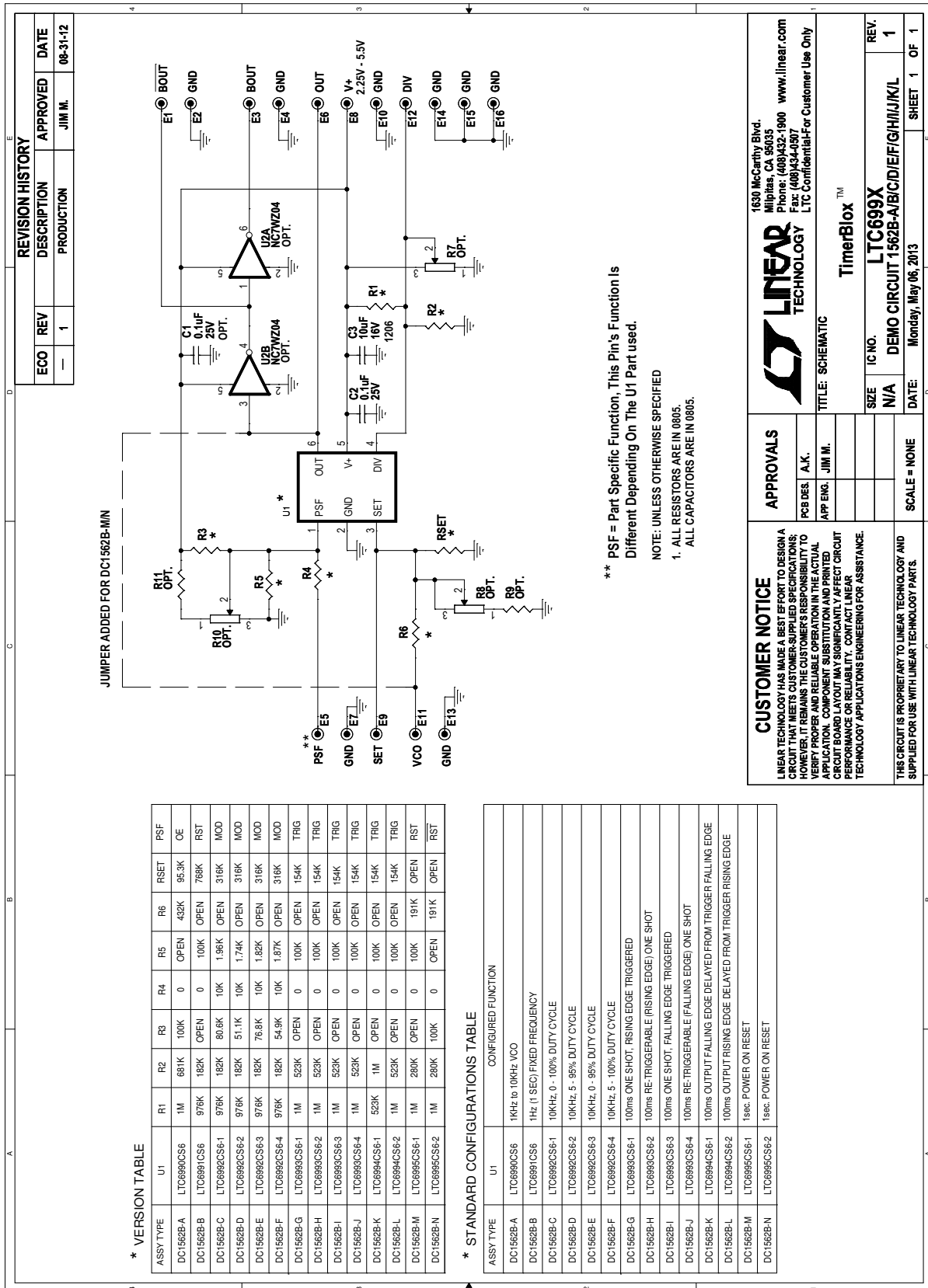
| ITEM             | QTY | REFERENCE | PART DESCRIPTION                 | MANUFACTURER/PART NUMBER   |
|------------------|-----|-----------|----------------------------------|----------------------------|
| <b>DC1562B-E</b> |     |           |                                  |                            |
| 1                | 1   | DC1562B   | GENERAL BOM                      |                            |
| 2                | 1   | R1        | RES., CHIP, 976k, 1% 0805        | VISHAY, CRCW0805976KFKEA   |
| 3                | 1   | R2        | RES., CHIP, 182k, 1% 0805        | VISHAY, CRCW0805182KFKEA   |
| 4                | 1   | R3        | RES., CHIP, 76.8k, 1% 0805       | VISHAY, CRCW080576K8FKEA   |
| 5                | 1   | R4        | RES., CHIP, 10k, 1% 0805         | VISHAY, CRCW080510K0FKEA   |
| 6                | 1   | R5        | RES., CHIP, 1.82k, 1% 0805       | VISHAY, CRCW08051K82FKEA   |
| 7                | 0   | R6 (OPEN) | RES., 0805                       |                            |
| 8                | 1   | RSET      | RES., CHIP, 316k, 1% 0805        | VISHAY, CRCW0805316KFKEA   |
| 9                | 1   | U1        | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6992CS6-3 |
| <b>DC1562B-F</b> |     |           |                                  |                            |
| 1                | 1   | DC1562B   | GENERAL BOM                      |                            |
| 2                | 1   | R1        | RES., CHIP, 976k, 1% 0805        | VISHAY, CRCW0805976KFKEA   |
| 3                | 1   | R2        | RES., CHIP, 182k, 1% 0805        | VISHAY, CRCW0805182KFKEA   |
| 4                | 1   | R3        | RES., CHIP, 54.9k, 1% 0805       | VISHAY, CRCW080554K9FKEA   |
| 5                | 1   | R4        | RES., CHIP, 10k, 1% 0805         | VISHAY, CRCW080510K0FKEA   |
| 6                | 1   | R5        | RES., CHIP, 1.87k, 1% 0805       | VISHAY, CRCW08051K87FKEA   |
| 7                | 0   | R6 (OPEN) | RES., 0805                       |                            |
| 8                | 1   | RSET      | RES., CHIP, 316k, 1% 0805        | VISHAY, CRCW0805316KFKEA   |
| 9                | 1   | U1        | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6992CS6-4 |
| <b>DC1562B-G</b> |     |           |                                  |                            |
| 1                | 1   | DC1562B   | GENERAL BOM                      |                            |
| 2                | 1   | R1        | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 3                | 1   | R2        | RES., CHIP, 523k, 1% 0805        | VISHAY, CRCW0805523KFKEA   |
| 4                | 0   | R3 (OPEN) | RES., 0805                       |                            |
| 5                | 1   | R4        | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5        | RES., CHIP, 100k, 1% 0805        | VISHAY, CRCW0805100KFKEA   |
| 7                | 0   | R6 (OPEN) | RES., 0805                       |                            |
| 8                | 1   | RSET      | RES., CHIP, 154k, 1% 0805        | VISHAY, CRCW0805154KFKEA   |
| 9                | 1   | U1        | IC., TimerBlox FAMILY, SOT-23    | LINEAR TECH., LTC6993CS6-1 |
| <b>DC1562B-H</b> |     |           |                                  |                            |
| 1                | 1   | DC1562B   | GENERAL BOM                      |                            |
| 2                | 1   | R1        | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 3                | 1   | R2        | RES., CHIP, 523k, 1% 0805        | VISHAY, CRCW0805523KFKEA   |
| 4                | 0   | R3 (OPEN) | RES., 0805                       |                            |
| 5                | 1   | R4        | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5        | RES., CHIP, 100k, 1% 0805        | VISHAY, CRCW0805100KFKEA   |
| 7                | 0   | R6 (OPEN) | RES., 0805                       |                            |
| 8                | 1   | RSET      | RES., CHIP, 154k, 1% 0805        | VISHAY, CRCW0805154KFKEA   |
| 9                | 1   | U1        | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6993CS6-2 |
| <b>DC1562B-I</b> |     |           |                                  |                            |
| 1                | 1   | DC1562B   | GENERAL BOM                      |                            |
| 2                | 1   | R1        | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 3                | 1   | R2        | RES., CHIP, 523k, 1% 0805        | VISHAY, CRCW0805523KFKEA   |
| 4                | 0   | R3 (OPEN) | RES., 0805                       |                            |
| 5                | 1   | R4        | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5        | RES., CHIP, 100k, 1% 0805        | VISHAY, CRCW0805100KFKEA   |
| 7                | 0   | R6 (OPEN) | RES., 0805                       |                            |
| 8                | 1   | RSET      | RES., CHIP, 154k, 1% 0805        | VISHAY, CRCW0805154KFKEA   |
| 9                | 1   | U1        | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6993CS6-3 |

# DEMO MANUAL DC1562B

## PARTS LIST

| ITEM             | QTY | REFERENCE   | PART DESCRIPTION                 | MANUFACTURER/PART NUMBER   |
|------------------|-----|-------------|----------------------------------|----------------------------|
| <b>DC1562B-J</b> |     |             |                                  |                            |
| 1                | 1   | DC1562B     | GENERAL BOM                      |                            |
| 2                | 1   | R1          | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 3                | 1   | R2          | RES., CHIP, 523k, 1% 0805        | VISHAY, CRCW0805523KFKEA   |
| 4                | 0   | R3 (OPEN)   | RES., 0805                       |                            |
| 5                | 1   | R4          | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5          | RES., CHIP, 100k, 1% 0805        | VISHAY, CRCW0805100KFKEA   |
| 7                | 0   | R6 (OPEN)   | RES., 0805                       |                            |
| 8                | 1   | RSET        | RES., CHIP, 154k, 1% 0805        | VISHAY, CRCW0805154KFKEA   |
| 9                | 1   | U1          | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6993CS6-4 |
| <b>DC1562B-K</b> |     |             |                                  |                            |
| 1                | 1   | DC1562B     | GENERAL BOM                      |                            |
| 3                | 1   | R1          | RES., CHIP, 523k, 1% 0805        | VISHAY, CRCW0805523KFKEA   |
| 2                | 1   | R2          | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 4                | 0   | R3 (OPEN)   | RES., 0805                       |                            |
| 5                | 1   | R4          | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5          | RES., CHIP, 100k, 1% 0805        | VISHAY, CRCW0805100KFKEA   |
| 7                | 0   | R6 (OPEN)   | RES., 0805                       |                            |
| 8                | 1   | RSET        | RES., CHIP, 154K, 1% 0805        | VISHAY, CRCW0805154KFKEA   |
| 9                | 1   | U1          | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6994CS6-1 |
| <b>DC1562B-L</b> |     |             |                                  |                            |
| 1                | 1   | DC1562B     | GENERAL BOM                      |                            |
| 2                | 1   | R1          | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 3                | 1   | R2          | RES., CHIP, 523k, 1% 0805        | VISHAY, CRCW0805523KFKEA   |
| 4                | 0   | R3 (OPEN)   | RES., 0805                       |                            |
| 5                | 1   | R4          | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5          | RES., CHIP, 100k, 1% 0805        | VISHAY, CRCW0805100KFKEA   |
| 7                | 0   | R6 (OPEN)   | RES., 0805                       |                            |
| 8                | 1   | RSET        | RES., CHIP, 154k, 1% 0805        | VISHAY, CRCW0805154KFKEA   |
| 9                | 1   | U1          | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6994CS6-2 |
| <b>DC1562B-M</b> |     |             |                                  |                            |
| 1                | 1   | DC1562B     | GENERAL BOM                      |                            |
| 2                | 1   | R1          | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 3                | 1   | R2          | RES., CHIP, 280k, 1% 0805        |                            |
| 4                | 0   | R3 (OPEN)   | RES., 0805                       |                            |
| 5                | 1   | R4          | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5          | RES., CHIP, 100k, 1% 0805        | VISHAY, CRCW0805100KFKEA   |
| 7                | 1   | R6          | RES., CHIP, 191k, 1% 0805        |                            |
| 8                | 0   | RSET (OPEN) | RES., 0805                       |                            |
| 9                | 1   | U1          | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6995CS6-1 |
| <b>DC1562B-N</b> |     |             |                                  |                            |
| 1                | 1   | DC1562B     | GENERAL BOM                      |                            |
| 2                | 1   | R1          | RES., CHIP, 1M, 1% 0805          | VISHAY, CRCW08051M00FKEA   |
| 3                | 1   | R2          | RES., CHIP, 280k, 1% 0805        |                            |
| 4                | 0   | R3          | RES., CHIP, 100k, 1% 0805        |                            |
| 5                | 1   | R4          | RES., CHIP, 0 $\Omega$ , 1% 0805 | VISHAY, CRCW08050000Z0EA   |
| 6                | 1   | R5 (OPEN)   | RES., 0805                       |                            |
| 7                | 0   | R6          | RES., CHIP, 191k, 1% 0805        |                            |
| 8                | 0   | RSET        | RES., 0805                       |                            |
| 9                | 1   | U1          | IC., TimerBlox FAMILY SOT-23     | LINEAR TECH., LTC6995CS6-2 |

## SCHEMATIC DIAGRAM



dc1562bfa

# DEMO MANUAL DC1562B

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Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

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