

## Introduction

This example shows the design of a servomotor controller. The specific servo used in this design is the TowerPro SG90 - Micro Servo, as shown in Fig.1.



Fig. 1. TowerPro SG90 - Micro Servo

This servo can rotate approximately 180 degrees (90 in each direction), and works just like a standard radio control (RC) model servo. This design will be useful for those wanting simple functionality in a compact space, and not needing the overhead of a microcontroller and dedicated motor controller. Typical with RC servos, the position is determined by PWM. The middle position "0" ~1.5 ms pulse width. The right most position "90" ~2.5 ms, and the most left position "-90" ~0.5 ms. The application circuit of this servomotor design is shown in Fig. 2.

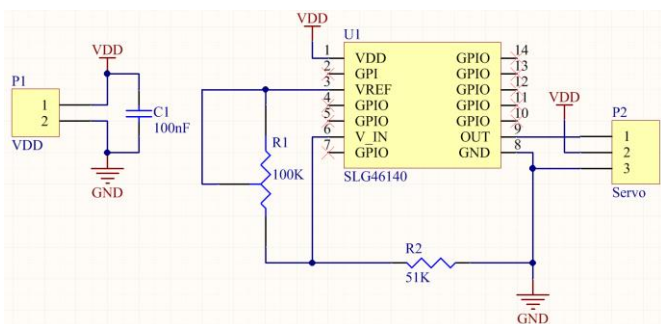


Fig. 2. Servo Control typical application

## Servo Control circuit design

As shown in Fig.3 a controller for the servomotor can be implemented using the following cell blocks: PGA, ADC, CNT1/DLY1, DCMP2/PWM2, OSC and VREF.

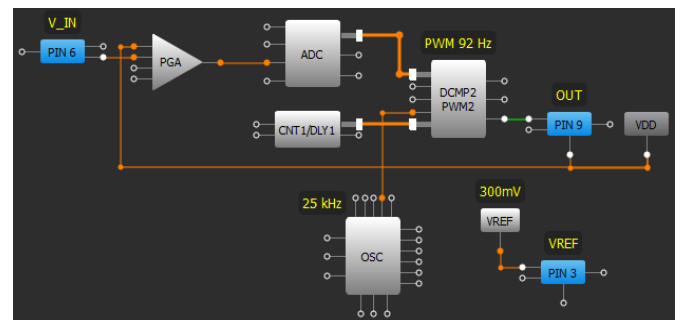


Fig. 3. Servo Control schematic

## Servo Control circuit analysis

V\_IN input voltage should range from 101 mV to 300 mV in order to cover the desired PWM positive duty cycle range of 0.5ms (101mV), and 2.5ms (300mV). CNT1/DLY sets the PWM frequency, ADC sets the duty cycle value. VREF is necessary to limit the upper voltage into the ADC. If VDD voltage were used then most of the potentiometer position setting would be outside the allowed input control range of the servomotor. On the OUT output we see the PWM signal with 92 kHz frequency and range of positive pulse width from 0.5ms to 2.5ms.

The functionality waveforms that describe the device operation are shown in Figs. 4 and 5.

## Related Files

Programming code for [GreenPAK Designer](#).



**Fig 4. Timing waveforms for servomotor position -90 degrees**

- Channel 1 (yellow/top line) – PIN#3 (VREF)
- Channel 2 (light blue/2nd line) – PIN#6 (V\_IN)
- Channel 3 (magenta /3rd line) – PIN#9 (OUT)



**Fig 5. Timing waveforms for servomotor position 90 degrees**

- Channel 1 (yellow/top line) – PIN#3 (VREF)
- Channel 2 (light blue/2nd line) – PIN#6 (V\_IN)
- Channel 3 (magenta /3rd line) – PIN#9 (OUT)

**Conclusion**

A Servo Motor Control can be easily implemented using a GreenPAK4. This design can be very useful

in applications such as: RC models, robotics, etc. Using GreenPAK4 minimizes the use of external components, and lowers the power consumption.

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers who are designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only to develop an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third-party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising from your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Disclaimer Rev.1.01 Jan 2024)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit [www.renesas.com/contact-us/](http://www.renesas.com/contact-us/).