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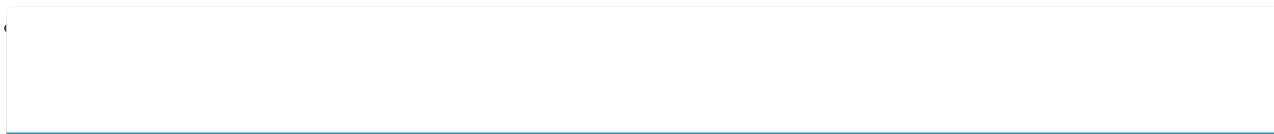
Toshiba TB6605FTG Reference Manual

Motor control closed-loop system



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## Summary of Contents for Toshiba TB6605FTG

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## [Page 4: Introduction](#)

This reference guide describes the usage of Motor Control Closed-loop system incorporating Toshiba's BLDC motor driver IC TB6605FTG. The board is designed as a plug-in board (Shield) for Arduino UNO platform. This document provides guidelines to quickly setup the hardware and software for BLDC motor driver IC performance evaluation.

## [Page 5: Features](#)

Power supply voltage 10V~28V DC Attached motor specifications Middle speed motor 10V~24V/  
0.5A~10A/ Output 26W/ 4000rpm Motor driver output + MosFET N ch+ Nch MosFET (Toshiba  
TK20P04M1) Main ICs TB6605FTG, TC75S51F, TK20P04M1 (Arduino UNO is needed in MCD+MCU  
mode.) MosFET specifications TK20P04M1: NMOS, 40V/20A, DPAK, R<sub>dson</sub>=19mΩ...

## [Page 6: External View](#)

Test pin (VSP) TC75S51F Arduino connector TK20P04M1 TB6605FTG Switch for work mode:  
Motor connector - MCD+OpAmp - MCD+MCU Arduino connector Test pin (HP) Motor switch  
Figure 4-1 External View 2019-Jan-15 © 2019 6 / 31 Toshiba Electronic Devices & Storage  
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## [Page 7: Wiring Connection](#)

0.02A. Note: Phase U/V/W line of motor should be connected with U/V/W on reference model. Do  
not mix Hall U/V/W line and Phase U/V/W line. 2019-Jan-15 © 2019 7 / 31 Toshiba Electronic  
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## [Page 8: Switches](#)

Target speed increases in a counter-clockwise direction In MCD+MCU mode: Target speed  
increases by 100RPM in a counter-clockwise direction. LCD displays target speed is shown as  
below: 2019-Jan-15 © 2019 8 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

## [Page 9: Mcd+Mcu Mode](#)

Block Diagram in Case of MCD+MCU Mode Figure 7-1 Block Diagram in MCD+MCU Mode  
Hardware Connection LCD shield Arduino UNO MCD shield BOTTOM MIDDLE Figure 7-2  
Hardware Connection 2019-Jan-15 © 2019 9 / 31 Toshiba Electronic Devices & Storage  
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Setting 2019-Jan-15 © 2019 10 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

## [Page 11: Arduino Connection](#)

D0, D1: for serial Tx/Rx, debug log out and set target speed xxx: used for motor control IDC, LA  
are not used in the current solution. Figure 7-4 Arduino Connection 2019-Jan-15 © 2019 11 / 31  
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## [Page 12: Lcd Shield](#)

RD022-RGUIDE-01-E LCD Shield Figure 7-5 LCD Shield 2019-Jan-15 © 2019 12 / 31 Toshiba  
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## [Page 13: Usage](#)

Current rotation speed is displayed as "C" parameter of the LCD module. After rotation is  
started, rotation speed is controlled to maintain the current speed even power supply voltage is  
changed. 2019-Jan-15 © 2019 13 / 31 Toshiba Electronic Devices & Storage Corporation  
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## [Page 14: Software On Arduino Uno](#)

\* Refer to next page for how to install 3rd party libraries. LiquidCrystal\_I2C: Display characters  
on LCD shield TimerOne: Use hardware Timer 1 for running an periodic interrupt function 2019-

[Page 15](#) Unzip LiquidCrystal\_I2C.zip and TimerOne.zip Copy folder LiquidCrystal\_I2C and TimerOne to "... \Documents\Arduino\libraries" Check if library is installed: Arduino IDE->Sketch->Include Library-> LiquidCrystalI2C Arduino IDE->Sketch->Include Library-> TimerOne Figure 7-7 Install 2019-Jan-15 © 2019 15 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

### [Page 16: Connection With Arduino Uno](#)

Connection with Arduino UNO Open closed\_loop\_mcd.ino using Arduino IDE Connect the PC with Arduino board with USB cable Select Board and Port Figure 7-8 Connection with Arduino UNO 2019-Jan-15 © 2019 16 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

### [Page 17: Code Uploading To Arduino Uno](#)

RD022-RGUIDE-01-E Code Uploading to Arduino UNO Verify/compile code till no errors reported Upload program to Arduino board by USB cable Figure 7-9 Code Uploading to Arduino UNO 2019-Jan-15 © 2019 17 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

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RD022-RGUIDE-01-E Serial Monitor of Arduino IDE Monitor Serial output for debugging Figure 7-10 Serial Monitor 2019-Jan-15 © 2019 18 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

### [Page 19: How To Change Kp In Serial Monitor](#)

3. Kp is changed 1. Input Kp value 2. Click Send button When a Kp value is changed, upload the revised sketch to Arduino again. Figure 7-11 Changing Kp value 2019-Jan-15 © 2019 19 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

### [Page 20: Selected Lcd Shield](#)

Please refer to pin assignment in 7.9. Do not use pins for motor and serial. – Use a library provided by vender of your LCD shield and modify the software accordingly. 2019-Jan-15 © 2019 20 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

### [Page 21: Motor Speed Control For Mcd + Mcu](#)

(droop) is exist if use Proportional control only. To mitigate the droop, a compensating bias term (called offset) need to be set in advance. The best measures is add an Integral term into system. Figure 7-12 PID Control 2019-Jan-15 © 2019 21 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

[Page 22](#) If Ki is increasing: Rise time: decrease – Overshoot: increase – Settling time: increase – Droop: Eliminate – Stability: degrade – Figure 7-14 Increase of Ki Value 2019-Jan-15 © 2019 22 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

[Page 23](#) = pidOver2\_U; pidOver\_D = pidOver2\_D; else pidOver\_U = pidOver1\_U; pidOver\_D = pidOver1\_D; if (bias > pidOver\_U) bias = pidOver\_U; else if (bias < pidOver\_D) bias = pidOver\_D; 2019-Jan-15 © 2019 23 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

### [Page 24: Mcd□Op-Amp Mode](#)

• The LA voltage is used as a feedback signal to represent current speed. • The Dif-in is used to adjust output duty to control motor speed. • PWM-in should be connected to GND. Figure 8-1 MCD + Op-Amp Mode 2019-Jan-15 © 2019 24 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

### [Page 25: Block Diagram In Case Of Mcd□Op-Amp](#)

RD022-RGUIDE-01-E Block Diagram In Case of MCD□Op-AMP Figure 8-2 Block Diagram In Case of MCD□Op-Amp 2019-Jan-15 © 2019 25 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

## [Page 26: Usage](#)

If an Error Occurs Power supply LED no "lighting": Check power supply cable and voltage. – Motor no rotation: Check motor connection and Motor Control switch set. – 2019-Jan-15 © 2019 26 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

## [Page 27: Operating Procedure](#)

RD022-RGUIDE-01-E OPERATING PROCEDURE 8.3.1. HW setting for MCD + Op-Amp 8.3.2. Jumper Setting JP4, JP2, JP7 Figure 8-3 Jumper Setting Table 8-2 Jumper Setting 2019-Jan-15 © 2019 27 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

## [Page 28: Speed Control Part](#)

If Dif-in=VMIN makes motor run at min speed, it is recommended to set R5 and R6 so that  $\frac{5 \times 6}{5 + 6} < 3$ . Total resistant of R5 and R6 should be around 50k to 100k. 2019-Jan-15 © 2019 28 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

## [Page 29: Auto Lead Angle Setting](#)

RD022-RGUIDE-01-E Auto Lead Angle Setting For high efficiency, TB6605FTG needs to be set a lead angle parameter. When you use a different motor, change a lead angle parameter if necessary. And also change the TCR parameter for good lead angle value.

## [Page 30: Attached Brushless Motor Parameters](#)

RD022-RGUIDE-01-E 9. ATTACHED BRUSHLESS MOTOR PARAMETERS 2019-Jan-15 © 2019 30 / 31 Toshiba Electronic Devices & Storage Corporation Rev.1.0...

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