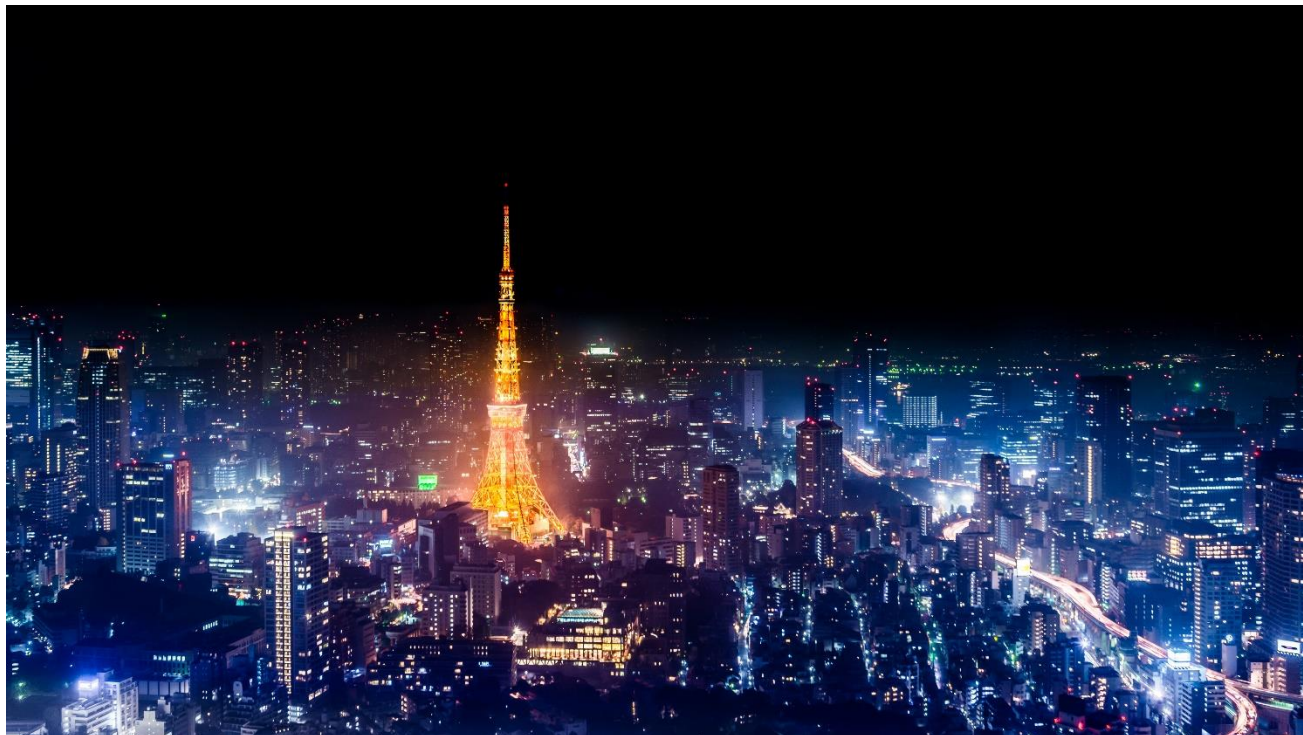


Interfacing FlashRunner 2.0 with Toshiba TB9



UNIVERSAL PRODUCTION IN-SYSTEM PROGRAMMING

HQ and Registered Office
Via Giovanni Agnelli 1
33083 Villotta di Chions (PN) Italy
Società Unipersonale

Capitale sociale €102.040
P.I. 01697470936
C.F. 01697470936
REA PN-97255

D-U-N-S® 51-724-9350
T + 39 0434 421 111
F + 39 0434 639 021

→ **smh-tech.com**

info@smh-tech.com

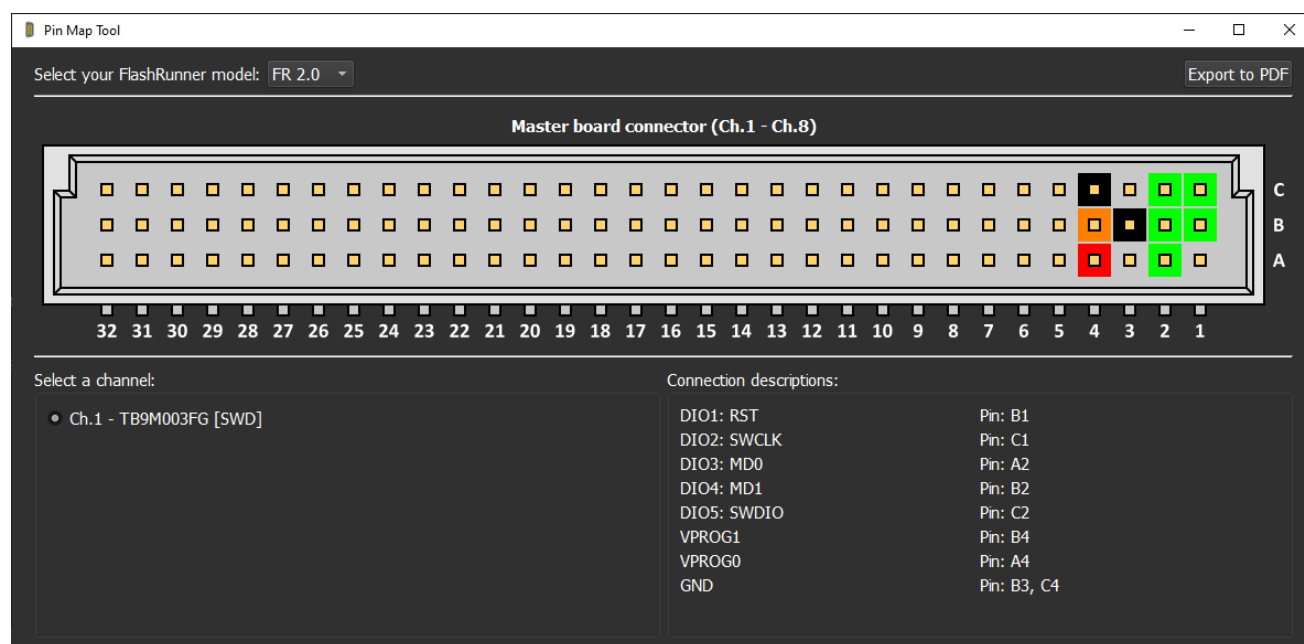
Toshiba TB9 Introduction

The driver **Toshiba TB9** supports the device TB9M003FG, which is a motor predriver IC with a microcontroller unit (MCU) for automotive brushless DC (BLDC) motor applications.

Toshiba TB9 Protocol and PIN map

The driver **Toshiba TB9** supports **SWD** protocol.

Toshiba TB9 PIN MAP



FlashRunner 2.0 uses the standard pins for SWD protocol signals (RST, SWCLK, SWDIO).

The pins DIO3 and DIO4 are used to drive the MD0 and MD1 pins of the TB9 device, in order to enter into Debug Mode and have access to the Flash Memory.

The use of VPROG1 is optional, if possible is preferred to use an external voltage to supply the board.

The external voltage has to be applied after the #TPSTART command, in order to enter into Debug Mode.

Toshiba TB9 Memory Map

Memory Type	Start Address	End Address	Memory Size	Page Size	Blank Value	Address Unit
[F] - Main Flash	0x00000000	0x0000FFFF	64.00 KiB	128	0xFF	BYTE
[P] - Password (virtual address)	0x90000000	0x90000007	8 Byte	8	0xFF	BYTE

Memory Map Tool

Device: **TB9M003FG**
Family: **TBxx**
Manufacturer: **TOSHIBA**
Algorithm: **TB9 - libtb9.so**

	Memory Type	Start Address ^	End Address	Memory Size	Page Size	Blank Value	Address Unit
1	[F] - Flash	0x00000000	0x0000FFFF	64.00 KiB	128	0xFFFFFFFF	BYTE
2	[P] - Password (virtual address)	0x90000000	0x90000007	8 Byte	8	0xFFFFFFFF	BYTE

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The memory map shows the Code Flash Memory at the actual addresses of the device in Debug Mode, and a Password section at a virtual address. You can write into the Password section by using the Dynamic Memory (see command SET_PASSWORD).

Toshiba TB9 Driver Parameters

#TCSETPAR ENTRY_CLOCK

Syntax: **#TCSETPAR** ENTRY_CLOCK <Frequency>

<Frequency> Accepted parameters 4000000, 2000000, 1000000, 500000, 100000 Hz

Description: Set the JTAG/SWD frequency used into Connect procedure before raising the PLL of the device, if device PLL is available.

Note: Default value: 4.00 MHz.

#TCSETPAR SAMPLING_POINT

Syntax: **#TCSETPAR** SAMPLING_POINT <Value>

<Value> Accepted values are in the range 1-16

Description: Use this parameter to permanently set the sampling point of the FPGA. It is recommended to leave this parameter with the default value.

Note: Default value: 17.

Toshiba TB9 Driver Commands

Here you can find the complete list of all available commands based on Toshiba TB9 procedure:

COMMANDS
CONNECT
MASSERASE F
ERASE F
BLANKCHECK F
PROGRAM F
VERIFY F R
VERIFY F S
READ F
DUMP F
SET_PROTECTION
REMOVE_PROTECTION
SET_PASSWORD
REMOVE_PASSWORD
RUN
READ_MEM8
READ_MEM16
READ_MEM32
DISCONNECT

*Verify F R -> Verify Readout method
Verify F S -> Verify Checksum method*

#TPCMD CONNECT

#TPCMD CONNECT

Connect function:

- Power on of the target device and entry
- Unlocking of the device (if locked)

The unlocking procedure of the device compares the 8 bytes of the Password Memory Section with a password. The password sent during the connect command is taken from the Dynamic memory.

For example, you can try to unlock with the password *0123456789ABCDEF* by using:

#DYNMEMSET2 0x90000000 8 0123456789ABCDEF

Here you can find the log of a standard connect with unlock:

```

---#DYNMEMSET2 0x90000000 8 0123456789ABCDEF
>|
---#TPSTART
Load SWD FPGA version 0x00001215.
MD0 and MD1 pin set.
>|
---#TPCMD CONNECT
Protocol selected SWD
Entry Clock is 4.00 MHz.
Trying Hot Plug connect procedure.
IDCODE: 0x0BB11477.
Designer: 0x23B, Part Number: 0xBB11, Version: 0x0.
ID-Code read correctly at 4.00 MHz.
JTAG-SWD Debug Port enabled.
Scanning AP map to find all APs.
AP[0] IDR: 0x04770021, Type: AMBA AHB3 bus.
AP[0] ROM table base address 0xE00FF000.
CPUID: 0x410CC200.
Implementer Code: 0x41 - [ARM].
Found Cortex M0 revision r0p0.
Program counter value is 0xFFFFF000.
Cortex M0 Core halted [0.001 s].
Requested Clock is 25.00 MHz.
Generated Clock is 25.00 MHz.
Good samples: 6 [Range 3-8].
IDCODE: 0x0BB11477.
Designer: 0x23B, Part Number: 0xBB11, Version: 0x0.
ID-Code read correctly at 25.00 MHz.
Unlocking the device with password from dynamic memory:
Device unlocked correctly.
Time for Connect: 0.207 s.
>|

```

#TPCMD MASSERASE

#TPCMD MASSERASE <F>

MASSERASE F: all FLASH memory.

This command erases the content of all the flash memory by setting all bits to 1.

#TPCMD ERASE

#TPCMD ERASE <F> <start address> <size>

ERASE F < start address > < size >: only for selected part of FLASH memory. Start address and size must be aligned to Block Size 0x2000.

This command erases all the content of the flash memory by setting all bits to 1.

#TPCMD BLANKCHECK

#TPCMD BLANKCHECK <F> or **BLANKCHECK** <F> <start address> <size>

BLANKCHECK F: all FLASH memory.

BLANKCHECK F < start address > < size >: only for selected part of FLASH memory.

This command reads all the content of the flash memory and checks that all bits are set to 1. This operation is terminated instantly when a 0 is found. Optionally, it is also possible to send two additional parameters to this command: the address from where to start reading and the number of bytes to check.

#TPCMD PROGRAM

#TPCMD PROGRAM <F> or PROGRAM <F> <start address> <size>

PROGRAM F: all FLASH memory.

PROGRAM F < start address > < size >: only for selected part of FLASH memory.

This command takes the customer's data from the FRB file and programs them into the flash memory. Optionally, it is also possible to send two additional parameters to this command: the address from where to start programming and the number of bytes to be programmed.

#TPCMD VERIFY READOUT

#TPCMD VERIFY <F> <R> or VERIFY <F> <R> <start address> <size>.

VERIFY F R: all FLASH memory.

VERIFY F R < start address > < size >: only for selected part of FLASH memory.

This command reads all the content of the flash memory and checks that it corresponds to FRB data. This operation is terminated instantly when a mismatch is found. Optionally, it is also possible to send two additional parameters to this command: the address from where to start reading and the number of bytes to check.

#TPCMD VERIFY CHECKSUM

#TPCMD VERIFY <F> <S> or VERIFY <F> <S> <start address> <size>.

VERIFY F S: all FLASH memory.

VERIFY F S < start address > < size >: only for selected part of FLASH memory.

This command reads a checksum calculated on all the content of the flash memory and checks that it corresponds to the checksum on the FRB data. This operation is terminated when a mismatch is found. Optionally, it is also possible to send two additional parameters to this command: the address from where to start reading and the number of bytes to check.

#TPCMD READ

#TPCMD READ <F> or READ <F> <start address> <size>

READ F: all FLASH memory.

READ F < start address > < size >: only for selected part of FLASH memory.

This command reads all the content of the flash memory and print it to terminal or log. Optionally, it is also possible to send two additional parameters to this command: the address from where to start reading and the number of bytes to read.

#TPCMD DUMP

#TPCMD DUMP <F> or DUMP <F> <start address> <size>

DUMP F: all FLASH memory.

DUMP F < start address > < size >: only for selected part of FLASH memory.

This command reads all the content of the flash memory and print it to a file. Optionally, it is also possible to send two additional parameters to this command: the address from where to start reading and the number of bytes to read.

#TPCMD SET_PROTECTION

#TPCMD SET_PROTECTION or SET_PROTECTION <start address> <size>

SET_PROTECTION: all FLASH memory.

SET_PROTECTION < start address > < size >: only for selected part of FLASH memory. Start address and size must be aligned to Block Size 0x2000.

This command protects the selected part of FLASH memory from Erase and Program functions.

#TPCMD REMOVE_PROTECTION

#TPCMD REMOVE_PROTECTION

This command removes the protections of FLASH memory.

#TPCMD SET_PASSWORD

#TPCMD SET_PASSWORD

This command sets a password read from dynamic memory. For example, the following commands set the password 0123456789ABCDEF

```
#TPCMD CONNECT
;password setting
#DYNMEMSET2 0x90000000 8 0123456789ABCDEF
#TPCMD SET_PASSWORD
```

When a password is set, the flash memory of the device can't be accessed and no commands are available.

#TPCMD REMOVE_PASSWORD

#TPCMD REMOVE_PASSWORD

This command removes a password previously set.

#TPCMD RUN

#TPCMD RUN <Time[s]>

Move the Reset line up and down quickly if no parameter <Time[s]> is inserted.

#TPCMD RUN <Time[s]> instead moves the Reset line down, waits for the entered time and then sets the Reset line high. This command typically can be used to execute the firmware programmed in the device.

#TPCMD READ_MEM8

#TPCMD READ_MEM8 <Address> <Byte Count>
 <Address> Address in HEX format (i.e., 0x00001000)
 <Byte Count> Byte count in decimal format (i.e., 8 -> eight bytes)

Read memory byte per byte from target device.

#TPCMD READ_MEM16

#TPCMD READ_MEM16 <Address> <16-bit Word Count>
 <Address> Address in HEX format (i.e., 0x00001000)
 <16-bit Word Count> 16-bit Word count in decimal format (i.e., 4 -> four 16-bit words)

Read memory 16-bit word per 16-bit word from target device.

#TPCMD READ_MEM32

#TPCMD READ_MEM32 <Address> <32-bit Word Count>
 <Address> Address in HEX format (i.e., 0x00001000)
 <32-bit Word Count> 32-bit Word count in decimal format (i.e., 2 -> two 32-bit words)

Read memory 32-bit word per 32-bit word from target device.

#TPCMD DISCONNECT

#TPCMD DISCONNECT

Disconnect function. Power off and exit.

Toshiba TB9 Driver Examples

Here you can see a complete example of a Toshiba TB9 project.

Toshiba TB9 example Commands

```

!ENGINEMASK 0x00000001
#LOADDRIVER libtb9.so TOSHIBA TBxx TB9M003FG
#TCSETDEV VDDMIN 5000
#TCSETDEV VDDMAX 5000
#TCSETDEV FOSCMIN 1000000
#TCSETDEV FOSCMAX 40000000
#TCSETDEV IDCODE 0x0BB11477
#TCSETDEV IDCODE MSK 0xFFFFFFFF
#TCSETDEV CORE M0
#TCSETDEV MEMMAP 0 F 0 0x00000000 0x0000FFFF 0x2000 0x80 1 96 0x0 0x0 0xFFFFFFFF 0x0 0
#TCSETDEV MEMMAP 1 P 0 0x90000000 0x90000007 0x0 0x8 1 0 0x0 0x0 0xFFFFFFFF 0x0 0
!CRC 0x47292FE5
#TCSETPAR ENTRY_CLOCK 4000000
#TCSETPAR FOSC 40000000
#TCSETPAR PROTCCLK 25000000
#TCSETPAR PWDOWN 100
#TCSETPAR PWUP 100
#TCSETPAR RSTDOWN 100
#TCSETPAR RSTDRV OPENDRAIN
#TCSETPAR RSTUP 100
#TCSETPAR VPROG0 5000
#TCSETPAR VPROG1 12000
#TCSETPAR CMODE SWD
#TPSETSRC 64KiB.frb
#DYNMEMCLEAR
#DYNMEMSET2 0x90000000 8 0123456789ABCDEF
#TPSTART
#TPCMD CONNECT
#TPCMD SET_PASSWORD
#TPCMD MASSERASE F
#TPCMD BLANKCHECK F
#TPCMD PROGRAM F
#TPCMD VERIFY F R
#TPCMD VERIFY F S
#TPCMD DISCONNECT
#TPEND

```

Toshiba TB9 example Real Time Log

```

---#TPSTART
Load SWD FPGA version 0x00001215.
MD0 and MD1 pin set.
>|
---#TPCMD CONNECT
Protocol selected SWD
Entry Clock is 4.00 MHz.
Trying Hot Plug connect procedure.
IDCODE: 0x0BB11477.
Designer: 0x23B, Part Number: 0xBB11, Version: 0x0.
ID-Code read correctly at 4.00 MHz.
JTAG-SWD Debug Port enabled.
Scanning AP map to find all APs.
AP[0] IDR: 0x04770021, Type: AMBA AHB3 bus.
AP[0] ROM table base address 0xE00FF000.
CUID: 0x410CC200.

```



```

Implementer Code: 0x41 - [ARM].
Found Cortex M0 revision r0p0.
Program counter value is 0x0360BD12.
Cortex M0 Core halted [0.001 s].
Requested Clock is 25.00 MHz.
Generated Clock is 25.00 MHz.
Good samples: 6 [Range 3-8].
IDCODE: 0x0BB11477.
Designer: 0x23B, Part Number: 0xBB11, Version: 0x0.
ID-Code read correctly at 25.00 MHz.
Time for Connect: 0.207s.
>-
---#TPCMD SET_PASSWORD
Setting Password read from Dynamic Memory.
Time for Set Password: 0.011 s.
>-
---#TPCMD MASSERASE F
Time for Masserase F: 0.064 s.
>-
---#TPCMD BLANKCHECK F
Time for Blankcheck F: 0.034 s.
>-
---#TPCMD PROGRAM F
Time for Program F: 1.329 s.
>-
---#TPCMD VERIFY F R
Time for Verify Readout F: 0.053 s.
>-
---#TPCMD VERIFY F S
Time for Verify Checksum 32bit F: 0.025 s.
>-
---#TPCMD DISCONNECT
>-

```

Toshiba TB9 example Programming Times

All the 64 kB flash memory:

Operation	Timings FlashRunner 2.0
Time for Connect	0.207s
Time for Masserase	0.064s
Time for Blankcheck	0.034s
Time for Program F	1.329s
Time for Verify F R	0.055s
Time for Verify F S	0.026s
Cycle Time	1.770s

Toshiba TB9 Driver Changelog

Info about driver version 1.00 - 06/12/2023

Supported TB9M003FG.