

5V 3-Phase BLDC Sinusoidal Sensorless Fan Motor Driver

Features:

- Position Sensorless BLDC Drivers (No Hall Sensor Required)
- 180° Sinusoidal Drive, for High Efficiency and Low Acoustic Noise
- Support 2V to 5.5V Power Supplies
- Direction Control:
 - Forward direction: connect DIR pin to GND or leave floating
 - Reverse direction: connect DIR pin to V_{DD}
- Speed Control through Power Supply Modulation (PSM) and/or Pulse-Width Modulation (PWM)
- Built-in Frequency Generator (FG Output Signal)
- Built-in Lock-up Protection and Automatic Recovery Circuit (External Capacitor not Necessary)
- Built-in Over Current Limitation
- Built-in Thermal Shutdown Protection
- No External Tuning Required
- Available Packages:
 - 3 mm x 3 mm TDFN-10

Applications:

- Notebook CPU Cooling Fans
- 5V 3-Phase Brushless DC Motors

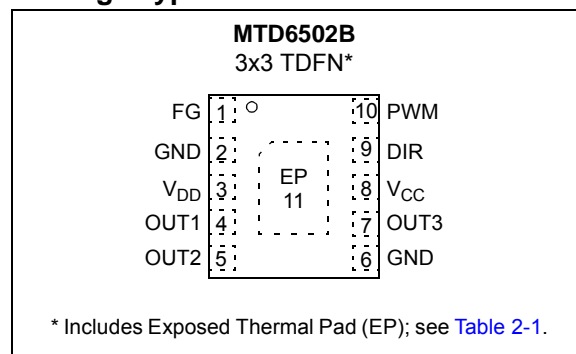
Description:

The MTD6502B device is a 3-phase full-wave driver for brushless sensorless DC motors. It features 180° sinusoidal drive, high torque output and silent drive. With adaptive features, parameters and a wide range of power-supplies (2V to 5.5V), the MTD6502B device is intended to cover a wide range of motor characteristics, while requiring minimum external components. Speed control can be achieved through either power supply modulation or pulse-width modulation (using the PWM digital input pin).

With the compact packaging and minimum bill-of-material (integrated power transistors, no Hall sensor, no external tuning), the MTD6502B is best suited for low-cost fan applications requiring high efficiency and low acoustic noise, such as notebook CPU cooling fans. Frequency generator (FG) output enables the precision speed control in closed-loop applications. The MTD6502B driver includes a lock-up protection mode, which turns off the output current when the motor is under lock condition, and an automatic recovery that enables the fan to run when the lock condition is removed. The motor overcurrent limitation and thermal-shutdown protection are included for safety-enhanced operations.

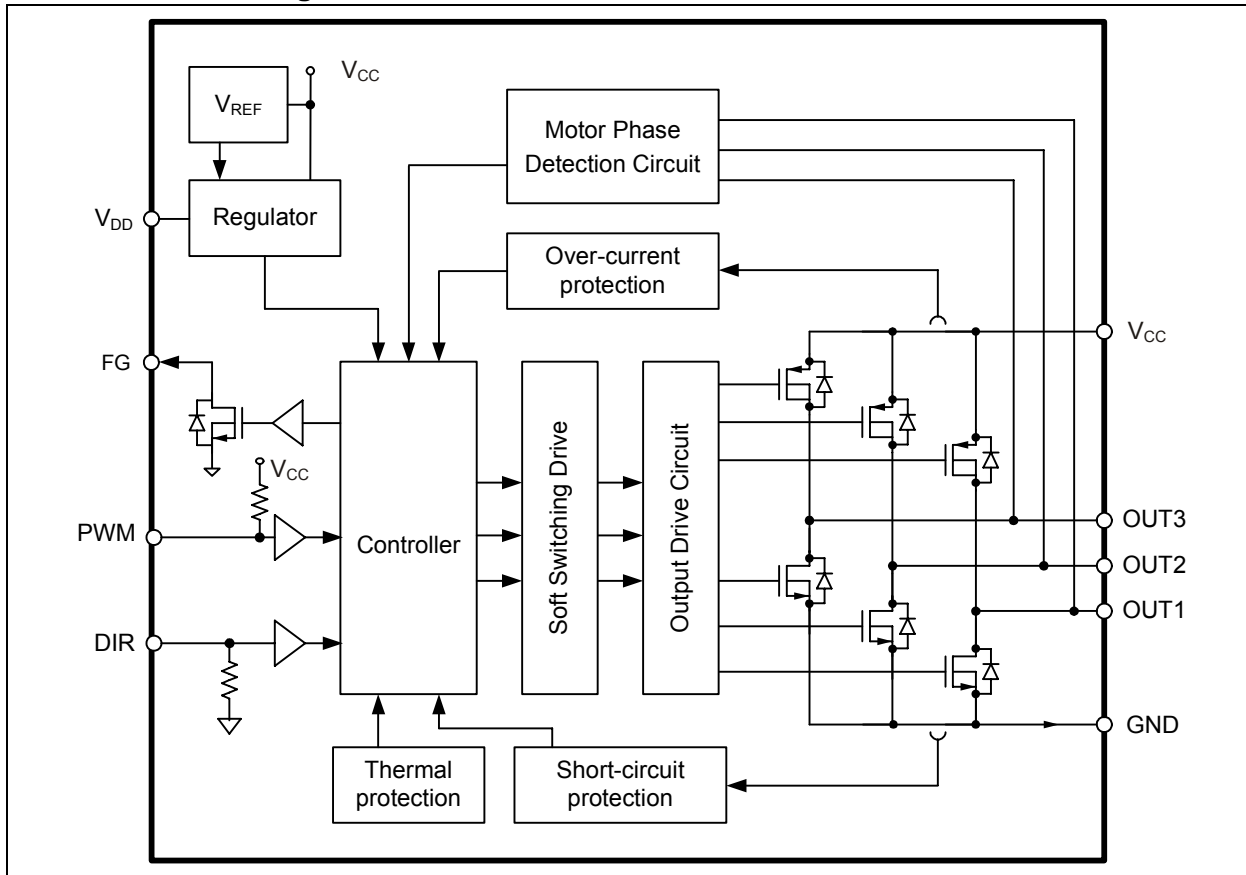
The MTD6502B is available in a compact thermally-enhanced 3 mm x 3 mm TDFN package.

Package Types

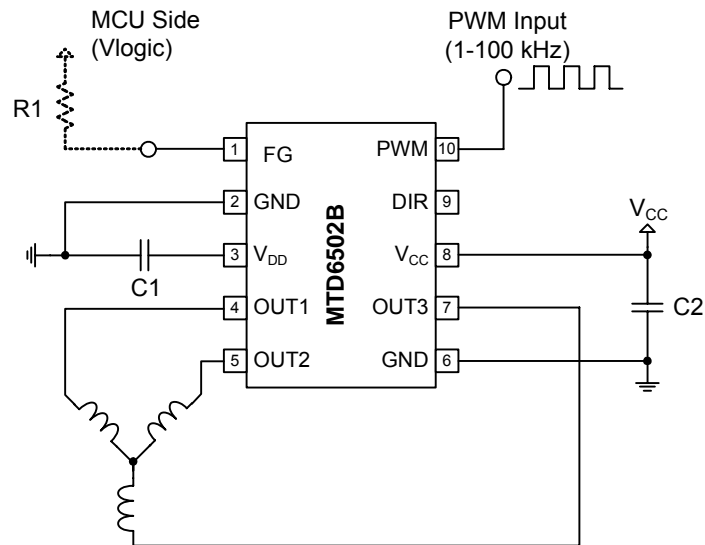


MTD6502B

Functional Block Diagram



Typical Application



Recommended External Components for Typical Application

Element	Type/Value	Comment
C1	$\geq 1 \mu\text{F}$	Connect as close as possible to IC input pins
C2	$\geq 1 \mu\text{F}$	Connect as close as possible to IC input pins
R1	$\geq 10 \text{ k}\Omega$	Connect to V _{logic} on microcontroller side

MTD6502B

NOTES:

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Power Supply Voltage (V_{CC_MAX})	-0.7 to +7.0V
Maximum Output Voltage (V_{OUT_MAX})	-0.7 to +7.0V
Maximum Output Current ⁽²⁾ (I_{OUT_MAX})	1000 mA
FG Maximum Output Voltage (V_{FG_MAX})	-0.7 to +7.0V
FG Maximum Output Current (I_{FG_MAX})	5.0 mA
V_{DD} Maximum Voltage (V_{DD_MAX})	-0.7 to +4.0V
PWM Maximum Voltage (V_{PWM_MAX})	-0.7 to +7.0V
Allowable Power Dissipation ⁽²⁾ (P_{D_MAX})	1.5W
Maximum Junction Temperature (T_J)	+150°C

† **Notice:** Stresses above those listed under “Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Note 1: Reference PCB, according to JEDEC standard EIA/JESD 51-9.

2: I_{OUT} is also internally limited, according to limits defined in the [Electrical Characteristics](#).

ELECTRICAL CHARACTERISTICS

Electrical Specifications: Unless otherwise specified, all limits are established for $T_A = +25^\circ\text{C}$

Parameters	Sym	Min	Typ	Max	Units	Conditions
Power Supply Voltage	V_{CC}	2	—	5.5	V	
Power Supply Current	I_{VCC}	—	50	—	μA	PWM = 0, $V_{CC} = 5\text{V}$
OUTx High Resistance	$R_{ON(H)}$	—	0.75	1	Ω	$I_{OUT} = 0.5\text{A}$, $V_{CC} = 5\text{V}$
OUTx Low Resistance	$R_{ON(L)}$	—	0.75	1	Ω	$I_{OUT} = 0.5\text{A}$, $V_{CC} = 5\text{V}$
OUTx Total Resistance	$R_{ON(H+L)}$	—	1.5	2	Ω	$I_{OUT} = 0.5\text{A}$, $V_{CC} = 5\text{V}$
V_{DD} Output Voltage	V_{DD}	—	3	—	V	$V_{CC} = 3.3\text{V to } 5.5\text{V}$
		—	$V_{CC} - 0.2$	—	V	$V_{CC} < 3.3\text{V}$
PWM Input Frequency	f_{PWM}	1	—	100	kHz	
PWM Input H Level	V_{PWM_H}	$0.55 \cdot V_{CC}$	—	V_{CC}	V	
PWM Input L Level	V_{PWM_L}	0	—	$0.2 \cdot V_{CC}$	V	
PWM Internal Pull-Up Current	I_{PWM_L}	—	—	55	μA	PWM = 0
DIR Internal Pull-Down Current	I_{DIR}	—	20	—	μA	
FG Output Pin Low Level Voltage	V_{OL_FG}	—	—	0.25	V	$I_{FG} = -1\text{ mA}$
FG Output Pin Leakage Current	I_{LH_FG}	—	—	10	μA	$V_{FG} = 5.5\text{V}$
Lock Protection Operating Time	T_{RUN}	—	0.5	—	s	
Lock Protection Waiting Time	T_{WAIT}	4.5	5	5.5	s	
Overcurrent Protection	I_{OC_MOT}	—	750	—	mA	
Thermal Shutdown	T_{SD}	—	170	—	$^\circ\text{C}$	
Thermal Shutdown Hysteresis	T_{SD_HYS}	—	25	—	$^\circ\text{C}$	

MTD6502B

TEMPERATURE SPECIFICATIONS

Electrical Specifications: Unless otherwise specified, all limits are established for $V_{CC} = 5.0V$, $T_A = +25^{\circ}C$						
Parameters	Sym	Min	Typ	Max	Units	Conditions
Temperature Ranges						
Operating Temperature	T_{OPR}	-40	—	+125	$^{\circ}C$	
Storage Temperature Range	T_{STG}	-55	—	+150	$^{\circ}C$	
Thermal Package Resistances						
Thermal Resistance, 10L-TDFN	θ_{JA}	—	68	—	$^{\circ}C/W$	

2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 2-1](#).

TABLE 2-1: MTD6502B PIN FUNCTION TABLE

MTD6502B 3x3 TDFN	Type	Name	Function
1	O	FG	Motor speed indication output
2, 6	—	GND	Negative voltage supply (ground)
3	—	V _{DD}	Internal regulator output (for decoupling only)
4	O	OUT1	Single phase coil output pin
5	O	OUT2	Single phase coil output pin
7	O	OUT3	Single phase coil output pin
8	—	V _{CC}	Positive voltage supply for motor driver
9	I	DIR	Motor Rotation Direction: - Forward direction: connect pin to GND or leave floating - Reverse direction: connect pin to V _{DD}
10	I	PWM	PWM input signal for speed control
11	—	EP	Exposed Thermal Pad (EP)

Legend: I = Input; O = Output

MTD6502B

NOTES:

3.0 FUNCTIONAL DESCRIPTION

The MTD6502B generates a full-wave signal to drive a 3-phase sensorless BLDC motor. High efficiency and low-power consumption are achieved due to the CMOS transistors and synchronous rectification drive type.

3.1 Speed Control

The rotational speed of the motor can be controlled either through the PWM digital input signal, or by acting directly on the power supply (V_{CC}). When the PWM signal is High (or left open), the motor rotates at full speed. When the PWM signal is Low, the motor is stopped (and the IC outputs are set to high-impedance). By changing the PWM duty cycle, the speed can be adjusted. Notice that the PWM frequency has no special meaning for the motor speed and is asynchronous with the activation of the output transistors. Thus, the user has the maximum freedom to choose the PWM system frequency within a wide range (from 1 kHz to 100 kHz), while the output transistor activation always occurs at a fixed rate (20 kHz, or 30 kHz), which is outside of the range of audible frequencies.

Note: The standard output frequency is 30 kHz. The 20 kHz output frequency option is available upon request.

3.2 Motor Rotation Direction

The current carrying order of the outputs depends on the DIR pin state (Rotation Direction) according to [Table 3-1](#).

TABLE 3-1: MOTOR ROTATION DIRECTION OPTIONS (DIR PIN)

DIR Pin State	Rotation Direction	Outputs Activation Sequence
Connected to GND or Floating	Forward	OUT1 → OUT2 → OUT3
Connected to V_{DD}	Reverse	OUT3 → OUT2 → OUT1

3.3 Frequency Generator Function

The Frequency Generator output (FG) is a “Hall-sensor equivalent” digital output, that gives information to an external controller about the speed and phase of the motor. The FG pin is an open collector output, connecting to a logical voltage level through an external pull-up resistor. When a lock (or out-of-sync)

situation is detected by the driver, this output is set to high-impedance until the motor is restarted. Leave the pin open when not used.

Note: FG/2 option is available upon request for 8-pole applications.

3.4 Lock-up Protection and Automatic Restart

If the motor is blocked and cannot rotate freely, a lock-up protection circuit detects this situation and disables the driver (by setting its outputs to high-impedance), in order to prevent the motor coil from burnout. After a “waiting time” (T_{WAIT}), the lock-up protection is released and normal operation resumes for a given time (T_{RUN}). If the motor is still blocked, a new period of waiting time is started. T_{WAIT} and T_{RUN} timings are fixed internally, so that no external capacitor is needed.

3.5 Overcurrent Protection

The motor peak current is limited by the driver to a fixed value (defined internally), thus limiting the maximum power dissipation in the coils.

3.6 Thermal Shutdown

The MTD6502B has a thermal protection function which detects when the die temperature exceeds $T_J = +170^{\circ}\text{C}$. When this temperature is reached, the circuit enters Thermal Shutdown mode, and the outputs OUT1, OUT2 and OUT3 are disabled (high-impedance), avoiding the IC destruction and allowing the circuit to cool down. Once the junction temperature (T_J) has dropped below $+145^{\circ}\text{C}$, the normal operation resumes (thermal detection circuit has $+25^{\circ}\text{C}$ hysteresis function).

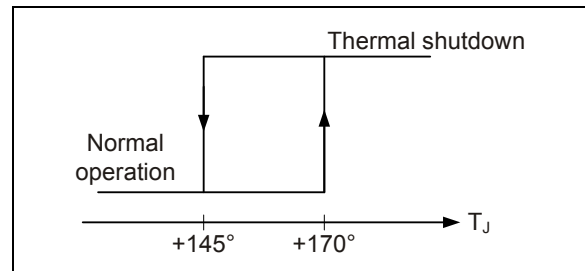


FIGURE 3-1: Thermal Protection Hysteresis.

3.7 Internal Voltage Regulator

V_{DD} voltage is generated internally and is used to supply the internal logical blocks. The V_{DD} pin is used to connect an external decoupling capacitor (1 μF , or higher). Notice that this pin is for IC internal use, and is not designed to supply DC current to external blocks.

MTD6502B

3.8 BEMF Coefficient Setting

K_m is the electro-mechanical coupling coefficient of the motor (also referred to as “motor constant” or “BEMF constant”). Depending on the conventions in use, there may be some inconsistency in the exact definition of K_m and its measurement criteria among different motor manufacturers. In order to work with various motor applications, the MTD6502B offers various options to adopt a wide range of BEMF coefficient. The BEMF coefficient (K_m) is defined as the peak value of the phase-to-phase BEMF voltage, normalized to the electrical speed of the motor.

TABLE 3-2: KM OPTIONS

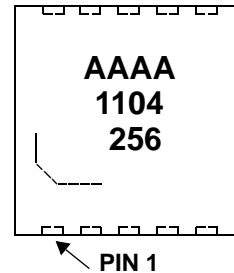
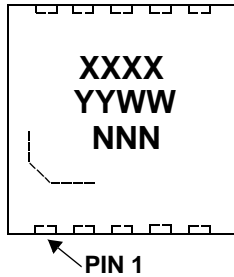
Km (mV/Hz) Range Phase-to-Phase		Option
Min	Max	
3.25	6.5	0
6.5	13	1
13	26	2

4.0 PACKAGING INFORMATION

4.1 Package Marking Information

10-Lead TDFN (3x3x0.9 mm)

Example



Device	Code
MTD6502B-LC1-00	AAAA
MTD6502B-LC1-01	AAAB
MTD6502B-LC1-02	AAAC

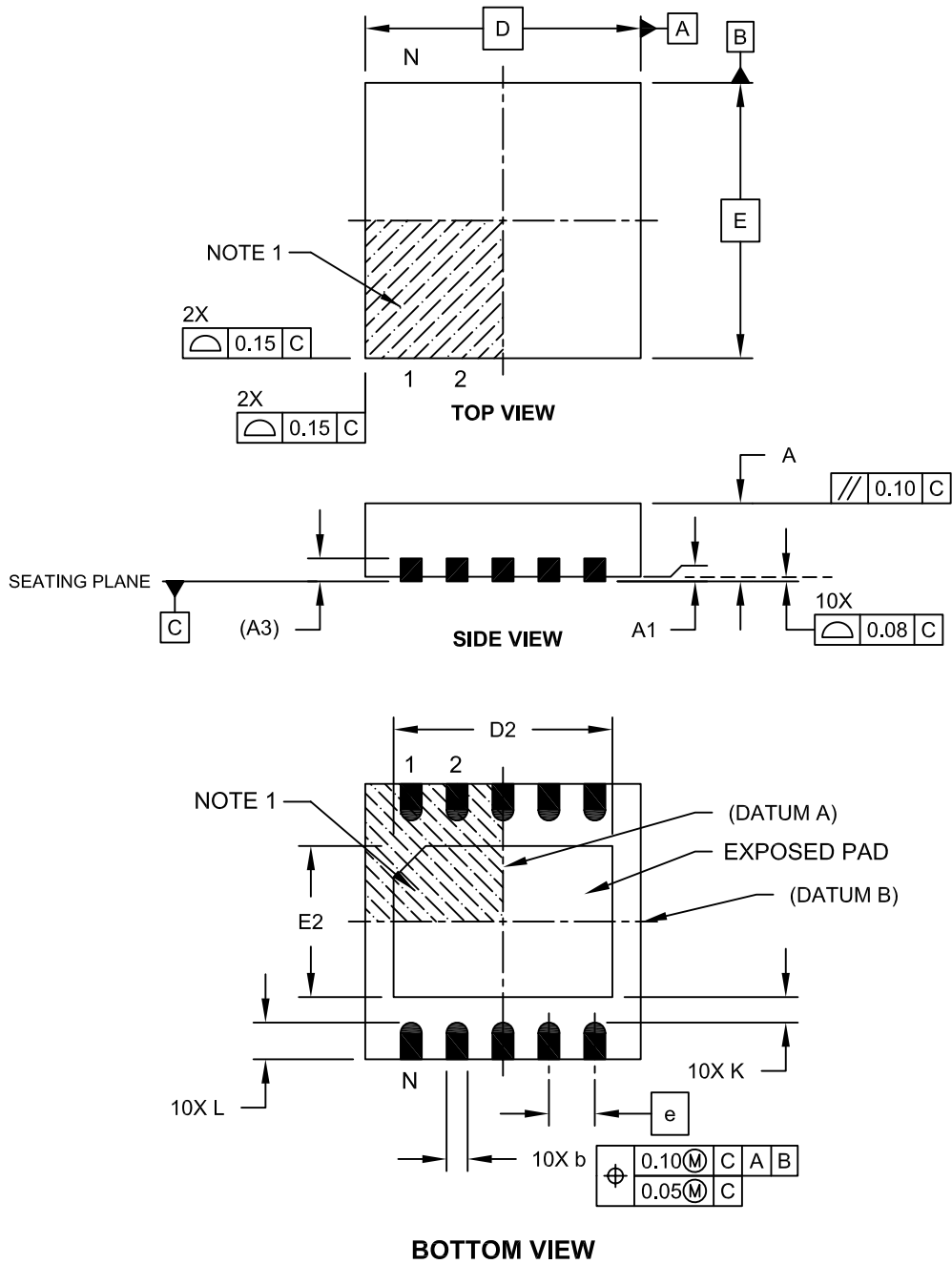
Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

MTD6502B

10-Lead Thin Plastic Dual Flat, No Lead Package (MN) - 3x3x0.8mm Body [TDFN]

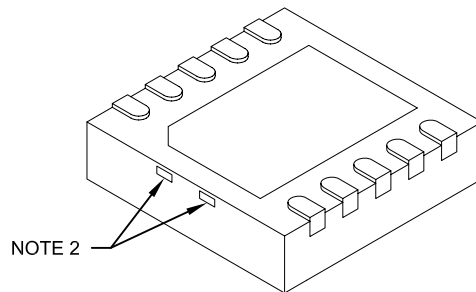
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-185A Sheet 1 of 2

10-Lead Thin Plastic Dual Flat, No Lead Package (MN) - 3x3x0.8mm Body [TDFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N	10		
Pitch	e	0.50 BSC		
Overall Height	A	0.70	0.75	0.80
Standoff	A1	0.00	0.02	0.05
Contact Thickness	A3	0.20 REF		
Overall Length	D	3.00 BSC		
Exposed Pad Length	D2	2.20	2.30	2.35
Overall Width	E	3.00 BSC		
Exposed Pad Width	E2	1.55	1.65	1.70
Contact Width	b	0.18	0.25	0.30
Contact Length	L	0.30	0.40	0.50
Contact-to-Exposed Pad	K	0.20	-	-

Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package may have one or more exposed tie bars at ends.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M
 BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing No. C04-0185A Sheet 2 of 2

MTD6502B

NOTES:

APPENDIX A: REVISION HISTORY

Revision B (May 2011)

- Updated PWM Input H Level value in the Electrical Characteristics table.

Revision A (March 2011)

- Original Release of this Document.

MTD6502B

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

PART NO.		-X	XX	-XX
Device	Tape&Reel		Package	Km Range Value
Device:	MTD6502B-L:		3-Phase BLDC Sinusoidal Sensorless Fan Motor Driver (Tape and Reel)	
Package:	C1 =		Plastic Dual Flat, No Lead Package, 3x3x0.9 mm Body (TDFN)	
Km Range Value:	See Table 3-2 for details.			

Examples:	
a) MTD6502B-LC1-00	Tape and Reel, 10LD TDFN Pkg, Km Range Value = 0
b) MTD6502B-LC1-01	Tape and Reel, 10LD TDFN Pkg, Km Range Value = 1
c) MTD6502B-LC1-02	Tape and Reel, 10LD TDFN Pkg, Km Range Value = 2

MTD6502B

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as “unbreakable.”

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC³² logo, rPIC and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.


FilterLab, Hampshire, HI-TECH C, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniscient Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICkit, PICTail, REAL ICE, rLAB, Select Mode, Total Endurance, TSHARC, UniWinDriver, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2011, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.

ISBN: 978-1-61341-132-2

Microchip received ISO/TS-16949:2002 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELOQ[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

**QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
== ISO/TS 16949:2002 ==**



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Cleveland
Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Farmington Hills, MI
Tel: 248-538-2250
Fax: 248-538-2260

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

Santa Clara
Santa Clara, CA
Tel: 408-961-6444
Fax: 408-961-6445

Toronto
Mississauga, Ontario,
Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon
Hong Kong
Tel: 852-2401-1200
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8569-7000
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Hangzhou
Tel: 86-571-2819-3180
Fax: 86-571-2819-3189

China - Hong Kong SAR
Tel: 852-2401-1200
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8203-2660
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-2566-1512
Fax: 91-20-2566-1513

Japan - Yokohama
Tel: 81-45-471- 6166
Fax: 81-45-471-6122

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-6578-300
Fax: 886-3-6578-370

Taiwan - Kaohsiung
Tel: 886-7-213-7830
Fax: 886-7-330-9305

Taiwan - Taipei
Tel: 886-2-2500-6610
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

UK - Wokingham
Tel: 44-118-921-5869
Fax: 44-118-921-5820

05/02/11



Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331