METU POWERLAB

Prepared by Serhat ÖZKÜÇÜK

Subject: TI DRV8312 DEVELOPMENT TOOL

http://www.ti.com/tool/DRV8312-69M-KIT

User Manual : http://www.ti.com/lit/ug/spruhj1h/spruhj1h.pdf

MICROCONTROLLER

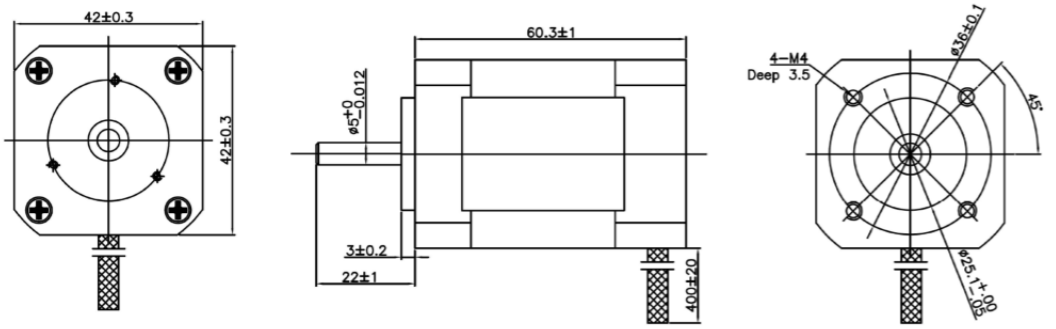
Piccolo TMDSCNCD28069MISO controlCARD

http://www.ti.com/tool/TMDSCNCD28069MISO

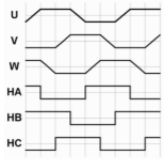
MOTOR

DT4260-24-055-04H-PT 24VDC 4000RPM 1814-0067MOTOR (telcointercon)

REV	DESCRIPTION	BY	DATE
A	Update hall sensor voltage	Jim	02/18/14

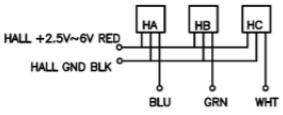


CCW COMMUTATION: VIEWED FROM OUTPUT SHAFT

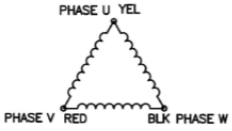


HALL SENSORS: DRV5013AD
(CUSTOMER SUPPLIED MATERIAL)

HALL CONNECTING



THREE-PHASE CONNECTING



NUMBER OF POLES	8
LINE TO LINE RESISTANCE	0.8±10%ohms @20°C
LINE TO LINE INDUCTANCE	1.2±20%mH
NOMINAL VOLTAGE	24V
NOLOAD SPEED	6000±10%RPM
NOLOAD CURRENT	< 0.5A @25°C
RATED TORQUE	0.125N.m
RATED SPEED	4000±10%RPM
PEAK TORQUE	0.38N.m
TORQUE CONSTANT	0.0355N.m/A
BACK EMF	2.71±10%Vrms/Krpm
ROTOR INERTIA	48 g.cm^2
WEIGHT	0.45 Kg

WIRING DIAGRAM

UL1430 AWG20#			UL1430 AWG26#				
PHASE U	PHASE V	PHASE W	HALL +2.5~6V	HALL A	HALL B	HALL C	HALL GND
YEL	RED	BLK	RED	BLU	GRN	WHT	BLK

Approved by(print): Ross Eisenbeis
Signature: Ross Eisenbeis
Title: TI Applications Eng.
Date: 4/24/2014

UNLESS OTHERWISE SPECIFIED:
TOLERANCES :
DECIMALS:
.X ±0.5 ANGULAR:
.XX ±0.25 ±0°30'
.XXX ±0.1
UNIT: mm
DO NOT SCALE DRAWING
MATERIAL:
WEIGHT:
PROJECTION: THIRD ANGLE

	NAME	DATE
DRAWN		
REVIEW	J.C.	02/18/14
ENG APPR.	J.C.	02/18/14

TELCO MOTION

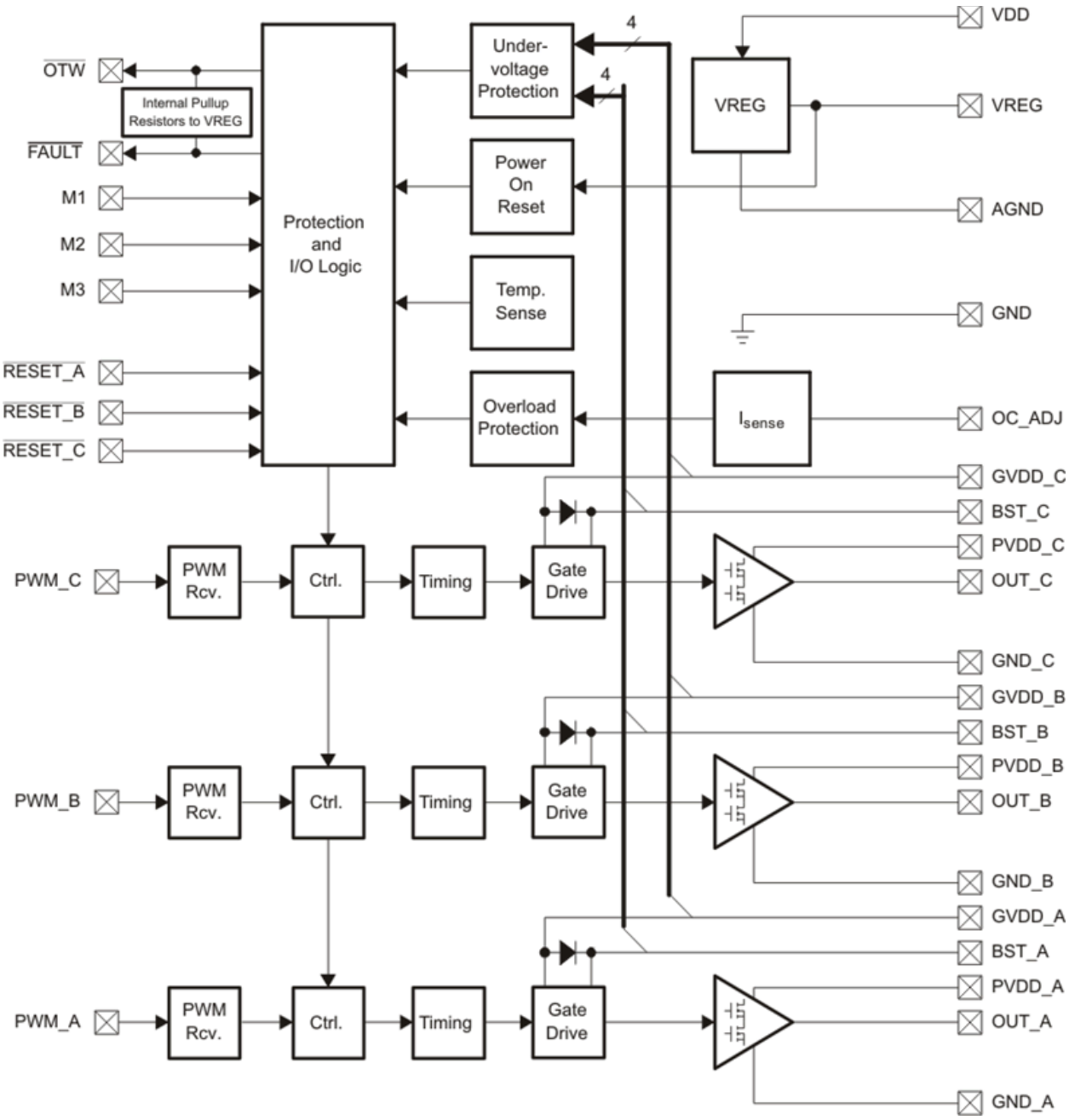
TITLE: NEMA 17 BLDC

SIZE	PART. NO.	REV
	DT4260-24-055-04H-TI	A

SCALE: STAGE: SHEET:1 OF 1

MOTOR DRIVE

DRV8312 IC



SYSTEM PRINCIPLE

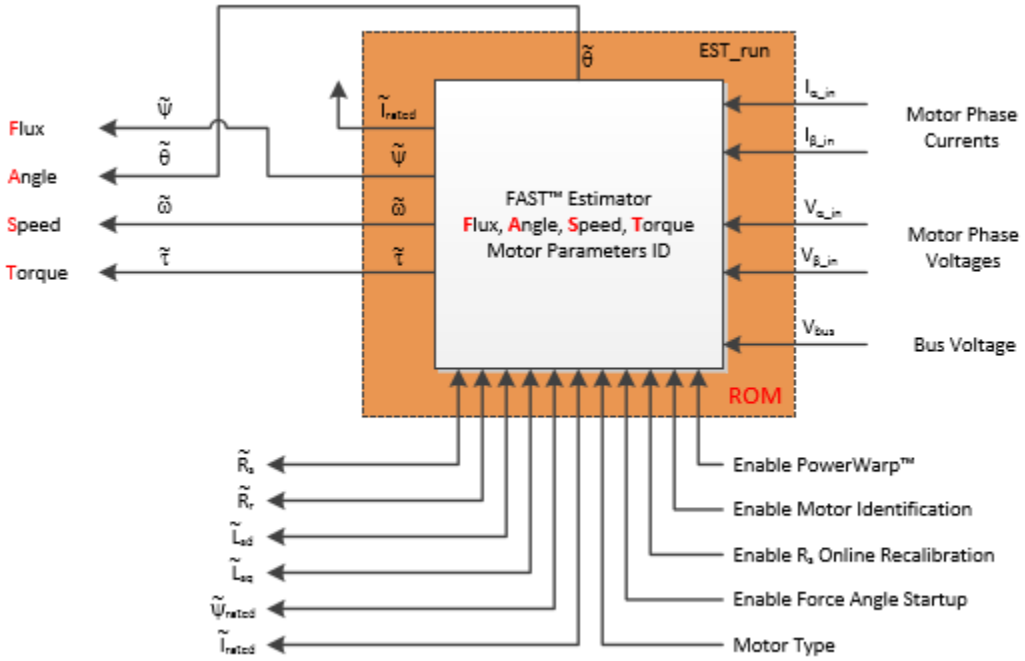


Figure 1-1. FAST - Estimating Flux, Angle, Speed, Torque - Automatic Motor Identification

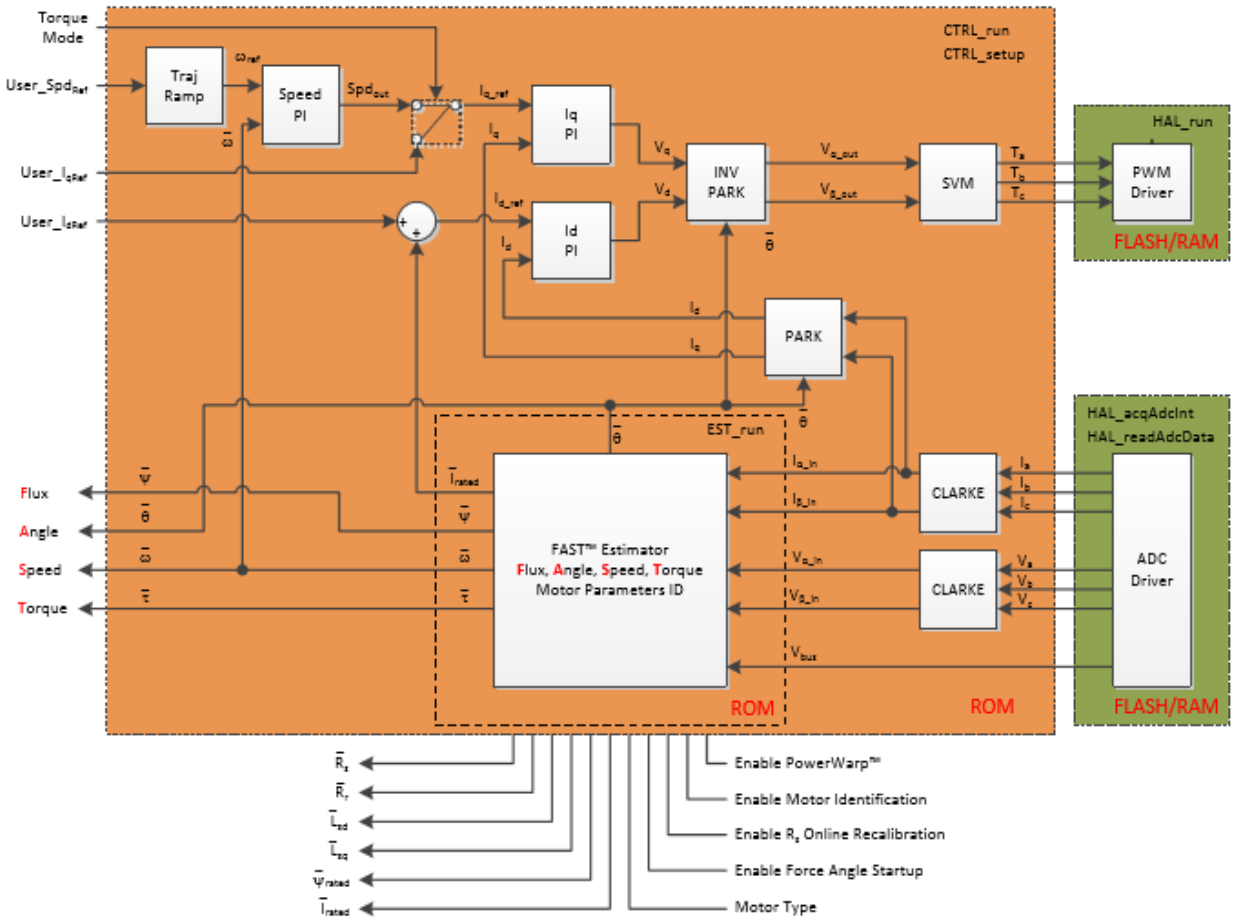


Figure 1-2. i. Block Diagram of Entire InstaSPIN-FOC Package in ROM (except F2802xF devices)

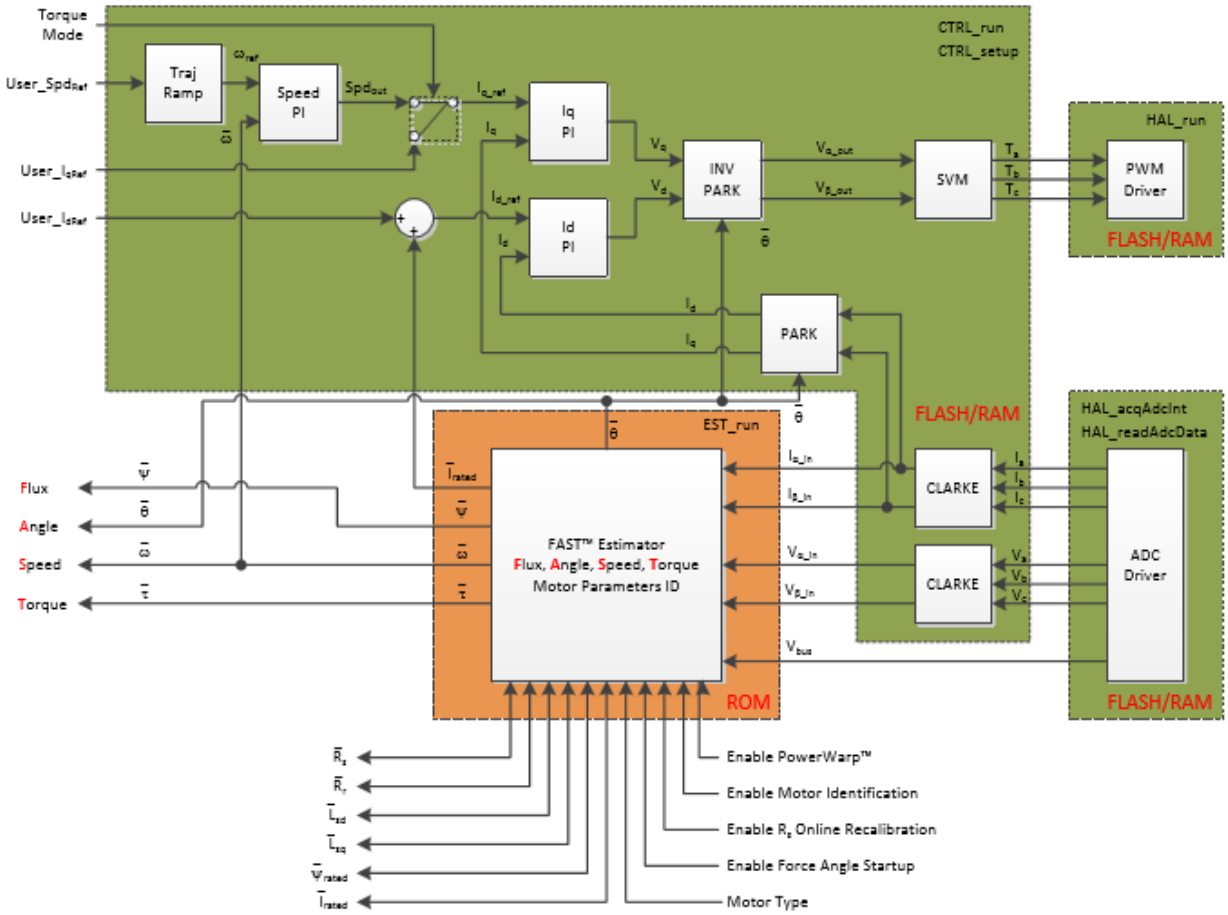


Figure 1-3. Block Diagram of InstaSPIN-FOC in User Memory, with Exception of FAST in ROM

Table 1-1. FAST Estimator vs. Typical Solutions

Topic	Typical Software Sensors and FOC Solutions	TI's FAST Estimator and InstaSPIN-FOC Solution
Electrical Motor Parameters	Motor-model based observers heavily dependent on motor parameters	Relies on fewer motor parameters Off-line parameter identification of motor – no Datasheet required!On-line parameter monitoring and re-estimation of stator resistance
Estimator Tuning	Complex observer tuning done multiple times for speed/loads for each motor	No estimator tuning required. Once motor parameters are identified, it works the same way every time across speed/torque dynamics
Estimator Accuracy	Angle-tracking performance is typically only good at over 5-10Hz with challenges at higher speeds and compensation for field weakening; Dynamic performance influenced by hand tuning of observer; Motor stalls typically crash observer	FAST provides reliable angle tracking which converges within one electrical cycle of the applied waveform, and can track at less than 1 Hz frequency (dependent on quality and resolution of analog sensing)Angle tracking exhibits excellent transient response (even with sudden load transients which can stall the motor, thus enabling a controlled restart with full torque)
Start-up	Difficult or impossible to start from zero speedObserver feedback at zero speed is not stable, resulting in poor rotor angle accuracy and speed feedback	InstaSPIN-FOC includes: • Zero Speed start with forced-angle • 100% torque at start-up • FAST rotor flux angle tracking converges within one electrical cycle FAST is completely stable through zero speed, providing accurate speed and angle estimation.
Current Loop	Tuning FOC current control is challenging – especially for novices	Automatically sets the initial tuning of current controllers based on the parameters identified. User may update gains or use own controllers if desiredThe identification process to fully tune the observer and torque controller takes less than 2 minutes
Feedback Signals	System offsets and drifts are not managed	FAST includes automatic hardware/software calibration and offset compensationFAST requires 2-phase currents (3 for 100% and over-modulation), 3-phase voltages to support full dynamic performance, DCbus voltage for ripple compensation in current controllers FAST includes an on-line stator resistance tracking algorithm
Motor Types	Multiple techniques for multiple motors: standard back-EMF, Sliding Mode, Saliency tracking, induction flux estimators, or "mixed mode" observers	FAST works with all 3-phase motor types, synchronous and asynchronous, regardless of load dynamics. Supports salient IPM motors with different Ls-d and Ls-qIncludes PowerWarp for induction motors = energy savings
Field-Weakening	Field-weakening region challenging for observers – as Back-EMF signals grow too large, tracking and stability effected	FAST estimator allows easy field weakening or field boosting applications due to the stability of the flux estimation in a wide range
Motor Temperature	Angle tracking degrades with stator temperature changes	Angle estimation accuracy is improved from online stator resistance recalibration
Speed Estimation	Poor speed estimation causes efficiency losses in the FOC system and less stable dynamic operation	High quality low noise Speed estimator, includes slip calculation for induction motors
Torque Estimation	Torque and vibration sensors typically required	High bandwidth motor Torque estimator

NOTES

- DSP can provide sensorless drive of BLDC or PMSM
- Beginning of the drive, it identifies the motor parameters (Lsd, Lsq, Rs, Flux, Mag. Current, Rr) for sensorless operation.
- Also defines the inertia of shaft if it is connected any constant load
- There is a bandwidth set in the insta-motion app. With this set rotor of the motor is keeping at a specific position with stator excitations. It uses this set in spinning mode. If BW set high (60 out of 0-100) rotor is locked and unresponsive to disturbances and spinning does not start with lower rpms (0-100).