

Three-Phase Sensorless Motor Driver IC

FEATURES

- Configure Speed Curve by EEPROM
- I²C Communication Interface
- Low Noise Drive
- Sensorless (No Hall Sensors Required)
- Low R_{DS(ON)} Power MOSFETs
- LDO Specification 3.3V / 20mA
- Speed Control Mode includes PWM Control and Analog Voltage Control
- FG Speed Output
- Slew Rate Control
- Lock Detection
- Soft Start
- Low Power Dissipation Mode
- Overvoltage, Overcurrent Protection and Thermal Shutdown

PRODUCT DESCRIPTION

The MS39747TEA is a three-phase motor driver IC, which incorporates sensorless sinusoidal wave drive, and can minimize fan vibration when applied to most of fan drives. Sensorless control eliminates the need of hall sensor for fan application.

The MS39747TEA has a flexible closed-loop speed control system. EEPROM can customize fan speed curve according to specified application. IC can be used without microprocessor after programming.

APPLICATIONS

- White Electric Fan Application
- Automotive Electric Fan Application

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS39747TEA	eTSSOP20	MS39747TEA

BLOCK DIAGRAM

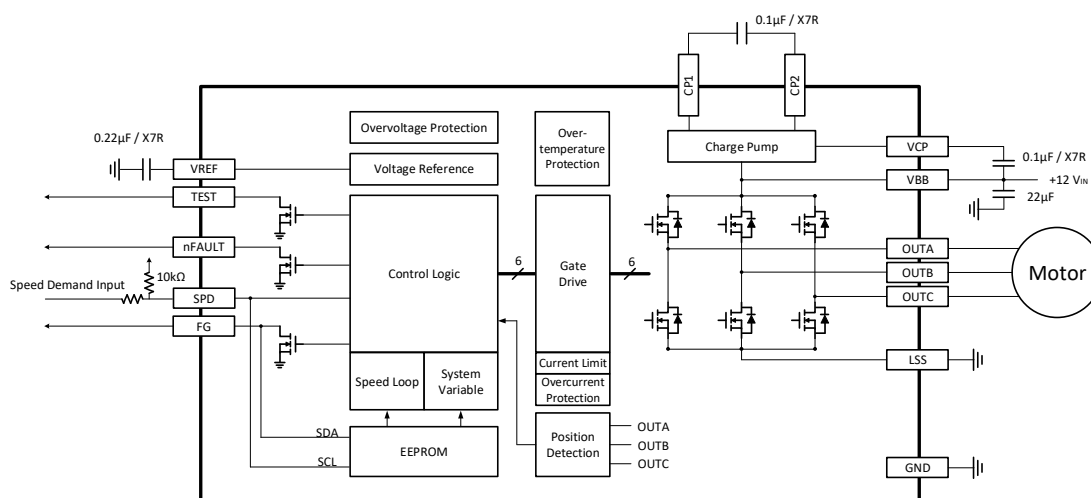
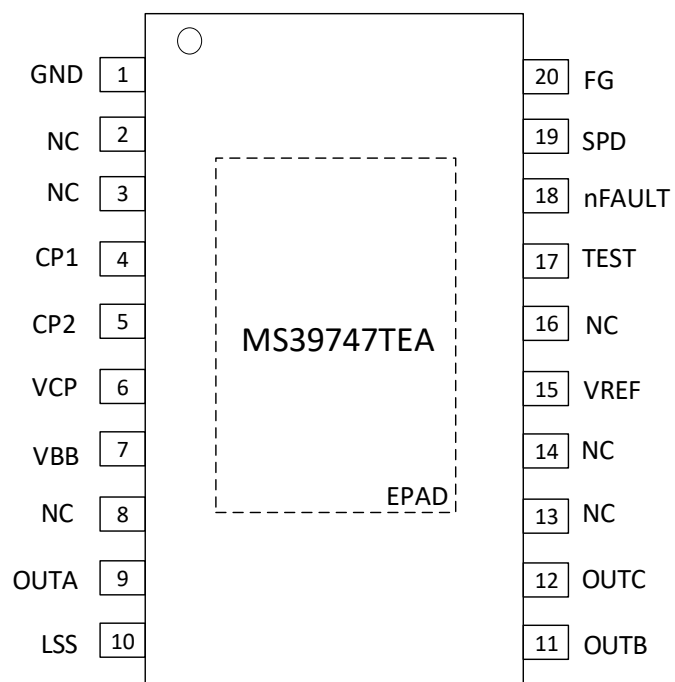


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PIN CONFIGURATION



PIN DESCRIPTION

Pin	Name	Type	Description
1	GND	-	Ground
2, 3	NC	-	Not Connection
4	CP1	IO	Charge Pump External Capacitor
5	CP2	IO	Charge Pump External Capacitor
6	VCP	IO	Charge Pump Voltage
7	VBB	-	Power Supply
8	NC	-	Not Connection
9	OUTA	O	Three-phase Output (A)
10	LSS	-	Low-side FET Common Source
11	OUTB	O	Three-phase Output (B)
12	OUTC	O	Three-phase Output (C)
13, 14	NC	-	Not Connection
15	VREF	O	Analog Reference Voltage Output
16	NC	-	Not Connection
17	TEST	O	Start Indication Pin
18	nFAULT	O	Error Indication Pin
19	SPD	I	Speed Requirement Input Pin
20	FG	O	Speed Output Signal
-	EPAD	-	Thermal Pad. Recommended to connected to ground

ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Symbol	Ratings	Unit
Power Supply	V_{BB}	-0.7 ~ 38	V
Logic Input Voltage Range (SPD)	V_{IN}	-0.3 ~ 6	V
Logic Open-Drain Output (FG, nFAULT, TEST)	V_O	-0.3 ~ 6	V
Output Current	I_{OUT}	Internal Limit	A
Output Voltage	V_{OUTX}	$V_{BB} + 1$	V
Charge Pump Voltage	V_{CP}	$V_{BB} - 0.3 \sim V_{BB} + 5$	V
CP1	V_{CP1}	-0.3 ~ $V_{BB} + 0.3$	V
CP2	V_{CP2}	$V_{BB} - 0.3 \sim V_{CP} + 0.3$	V
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	-65 ~ 150	°C
Operating Temperature Range	T_A	-40 ~ 125	°C

ELECTRICAL CHARACTERISTICS

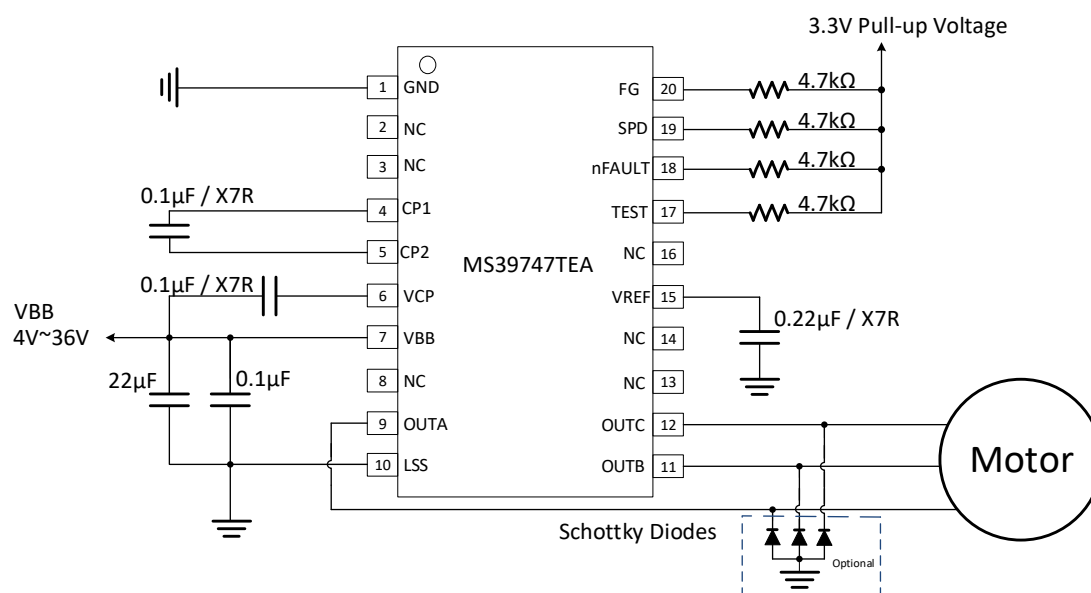
Unless otherwise noted, $T_A = -40^{\circ}\text{C}$ to 125°C , $V_{BB} = 4\text{V}$ to 36V .

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply						
VBB Current	I _{BB}	Operating (PWM duty < DC_ON)		11	15	mA
	I _{BBS}	V _{BB} = 34V, Low Power Dissipation Mode		6	40	μA
Reference Voltage	V _{REF}	I=0 to 20mA, V _{BB} =6~38V	3.15	3.3	3.45	V
Charge Pump	V _{CP}	V _{BB} =8V (Related to V _{BB})	4.5	5.1	5.6	V
		V _{BB} =4V (Related to V _{BB})	3.5	3.8		V
Logic Inputs and Outputs						
Logic Low Input Voltage	V _{IL}		0		0.8	V
Logic High Input Voltage	V _{IH}		2		5.5	V
Logic Input Hysteresis	V _{HYS}		150	250	500	mV
Logic Input Current (SPD, FG)	I _{IN}	V _{IN} =0 to 5.5V	-5	<1	5	μA
Output Saturation Voltage (TEST, FG, nFAULT)	V _{SAT}	I= 5mA			0.3	V
Output Leakage Current	I _{OUT}	V= 5.5V, Switch OFF			5	μA
MOSFET Gate Driver						
Motor PWM Frequency	f _{PWM}	T _A = 25°C	23.52	24.5	25.48	kHz
		T _A = -40°C to 125°C	23.03		25.97	kHz
On-resistance (Source+SINK)	R _{DS(ON)}	I _{OUT} =1.5A, T _J =25°C, V _{BB} =12V		300		mΩ
		I _{OUT} =1.5A, T _J =125°C,V _{BB} =12V		410	600	
On-resistance (Source)	R _{DS(ON)SRC}	T _J =125°C, V _{BB} =12V		205		
On-resistance (Sink)	R _{DS(ON)SNK}	T _J =125°C, V _{BB} =12V		205		mΩ

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Speed Control						
PWM Input Frequency	f_{PWIN}		34		65000	Hz
Duty On Threshold	DC_{ON}		-0.5		0.5	%
Duty Off Threshold	DC_{OFF}		-0.5		0.5	%
Speed Setpoint	f_{SPD}	PWM Mode, $T_A = 25^\circ C$	-5		5	%
		PWM Mode, $T_A = -40^\circ C$ to $125^\circ C$	-7		7	%
SPD Standby Threshold (Analog)	V_{SPDTH}		0.43	0.7	1	V
SPD ON Threshold	V_{SPDON}	$DC_{ON}=10.2\%$	210	245	290	mV
SPD OFF Threshold	V_{SPDOFF}	$DC_{ON}=10.2\%$, $DCHYS=2.2\%$	160	190	220	mV
SPD MAX Input Value	V_{SPDMAX}			2.49		V
SPD ADC Resolution	V_{SPDLSB}			4.892		mV
SPD ADC Accuracy	SPD_{ACC}	$V_{SPD}=0.2$ to V_{SPDMAX} , $V_{BB}=12V$	-10		10	LSB
Protection Circuit						
Lock Time	t_{LOCK}		-5		5	%
VBB Undervoltage Protection	V_{BBUVLO}	UVLO=0, V_{BB} Rising	3.7	3.85	4	V
		UVLO=1, V_{BB} Rising	8.4	8.65	9.02	V
VBB Undervoltage Hysteresis	V_{BBHYS}	UVLO=0	160	300	480	mV
		UVLO=1	1.8	2	2.2	V
VBB Overvoltage Protection	V_{BBOV}	VBOV=0, V_{BB} Rising	18.2	19	19.8	V
		VBOV=1, V_{BB} Rising	34.5	35.5	37.3	V
VBB Overvoltage Hysteresis	$V_{BBOVHYS}$		1.5	2	2.5	V
VREF Undervoltage	$V_{REFUVLO}$	V_{REF} Rising	2.9	3	3.15	V
VREF Undervoltage Hysteresis	V_{REFHYS}		150	250	350	mV
VREF Overcurrent Limit	V_{REFOCL}	$V_{BB}=12V$	30	65	120	mA
VCP Undervolatge	V_{CPIVLO}	V_{CP} Rising	2.5	2.75	3	V

Parameter	Symbol	Condition	Min	Typ	Max	Unit
VCP Undervoltage Hysteresis	V_{CPHY}			110		mV
Overcurrent Limit	I_{OCL}	$V_{BB}=8V$	2.5	3	3.5	A
Overcurrent Protection	I_{OCP}		3.94	7		A
Thermal Shutdown Temperature	T_{JTSD}	Temperature Rising	150	165	180	°C
Thermal Shutdown Hysteresis	ΔT_J	Recovery Temperature = $T_{JTSD} - \Delta T_J$		20		°C
I ² C Timing						
SCL Clock Frequency	f_{CLK}		3		400	kHz
Bus Blank Time between Start/Stop	t_{BUF}		1.3			μs
Hold Time of Start Condition	$t_{HD:START}$		0.6			μs
Setup Time of Start Condition	$t_{SU:START}$		0.6			μs
SCL Low Time	t_{LOW}		1.3			μs
SCL High Time	t_{HIGH}		0.6			μs
DATA Setup Time	$t_{SU:DATA}$		100			μs
DATA Hold Time	$t_{HD:DATA}$		0		900	μs
Setup Time of Stop Condition	$t_{SU:STOP}$		0.6			μs

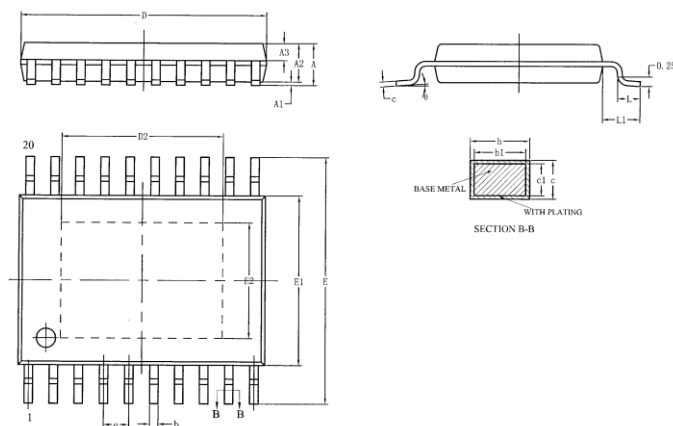
TYPICAL APPLICATION



Note: it is necessary to add Schottky diodes when motor phase current is more than 2A in application. The parameter select for Schottky diode should be more than application voltage and application current.

PACKAGE OUTLINE DIMENSIONS

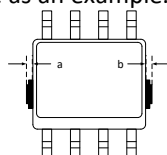
eTSSOP20



Symbol	Dimensions in Millimeters		
	Min	Typ	Max
A	-	-	1.20
A1	0.05	-	0.15
A2	0.80	1.00	1.05
A3	0.39	0.44	0.49
b	0.20	-	0.29
b1	0.19	0.22	0.25
c	0.13	-	0.18
c1	0.12	0.13	0.14
D	6.40	6.50	6.60
D2	4.10	4.20	4.30
E2	2.90	3.00	3.10
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00REF		
θ	0	-	8°

Note: In addition to the package size, a and b are allowed to have the maximum size of 0.15mm for waste glue simultaneously.

The diagram is as follows: taking SOP8 package as an example.



MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description



Product Name: MS39747TEA

Product Code: XXXXXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specification

Device	Package	Piece/Reel	Reel/Box	Piece/Box	Box/Carton	Piece/Carton
MS39747TEA	eTSSOP20	3000	1	3000	8	24000

STATEMENT

- All Revision Rights of Datasheets Reserved for Ruimeng. Don't release additional notice.
Customer should get latest version information and verify the integrity before placing order.
- When using Ruimeng products to design and produce, purchaser has the responsibility to observe safety standard and adopt corresponding precautions, in order to avoid personal injury and property loss caused by potential failure risk.
- The process of improving product is endless. And our company would sincerely provide more excellent product for customer.

**MOS CIRCUIT OPERATION PRECAUTIONS**

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.



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