Three Half-H-Bridge Driver

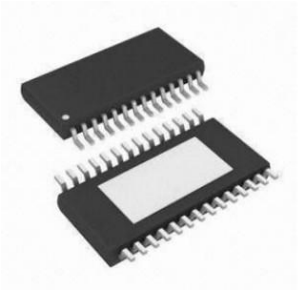
PRODUCT DESCRIPTION

The MS8313 provides three independently controllable half-H-bridge drivers. It can be used to drive solenoids or other loads, mainly to drive a three-phase brushless DC motor. Each output driver channel includes N-channel power MOSFET configured by half-bridge. The MS8313 allows independent external current detection by connecting PGNDx to a SENSE resistance.

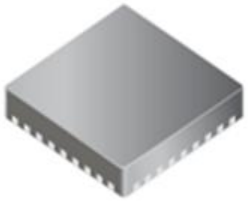
The MS8313 integrates a general comparator, which can be used as current limit circuit or other function circuit.

The MS8313 provides 2.5A peak current or 1.75A RMS output current on each channel of half-bridge.

The chip has the functions of overcurrent protection, short-circuit protection, undervoltage protection and overtemperature protection.



eTSSOP28



QFN36

FEATURES

- Three Half-H-Bridge Drivers
- Drive Three-Phase Brushless DC Motor
- Independent Half-Bridge Control
- Used for Low-side Current Detection Pin
- Low On-resistance of Power MOS
- Maximum Peak Current: 2.5A @24V, 25°C
- Built-in Comparator
- Built-in 3.3V,10mA Low Voltage Drop Regulator (LDO)
- Power Supply: 8V-36V
- Small Package with Thermal Pad

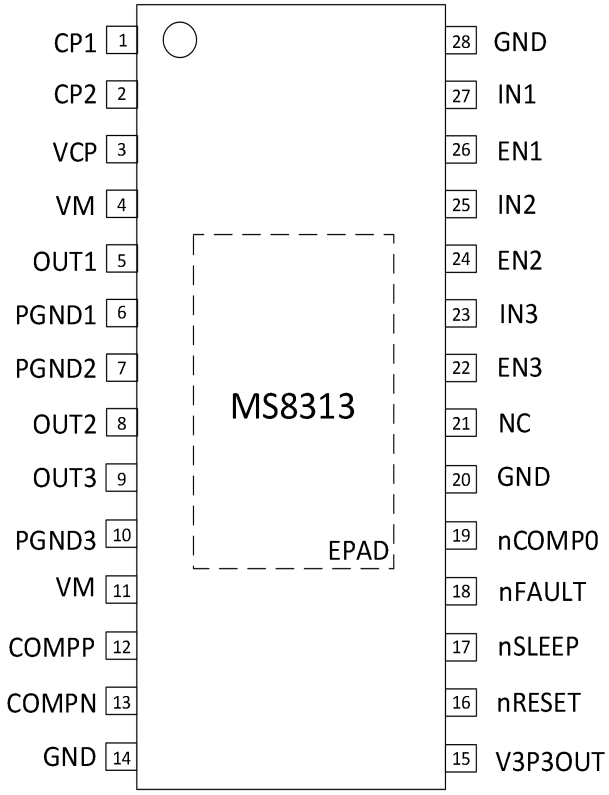
APPLICATIONS

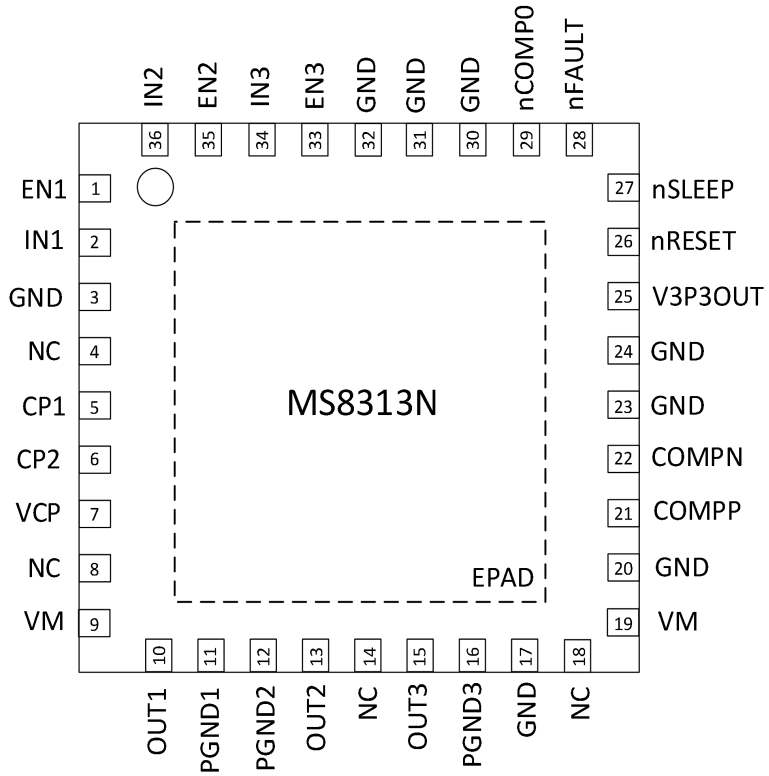
- HVAC Motor
- Consumer Products
- Office Automation Device
- Factory Automation
- Robot

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS8313	eTSSOP28	MS8313
MS8313N	QFN36	MS8313N

PIN CONFIGURATION

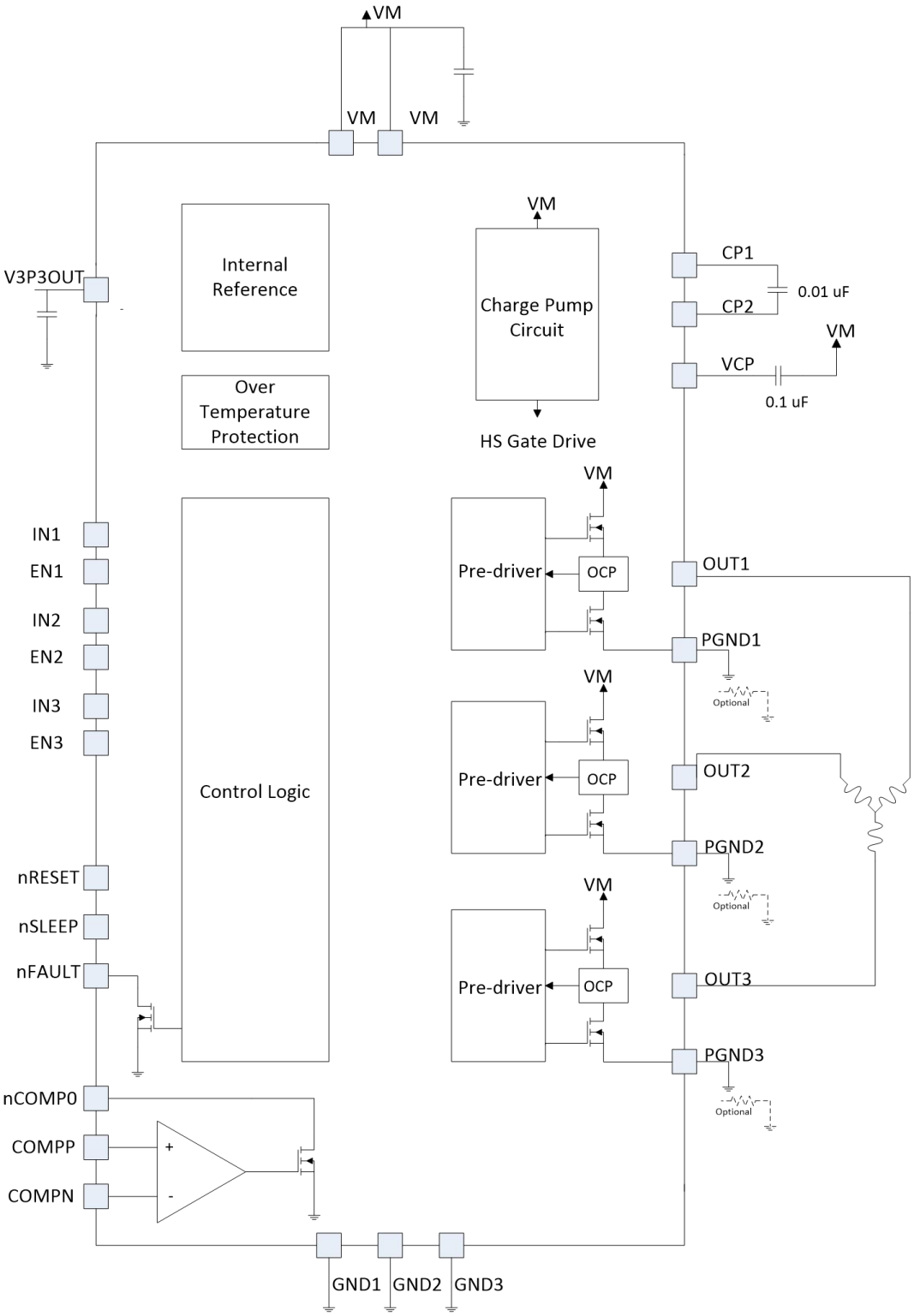




PIN DESCRIPTION

Pin		Name	Type	Description
MS8313	MS8313N			
1	5	CP1	IO	Charge Pump External Capacitance
2	6	CP2	IO	Charge Pump External Capacitance
3	7	VCP	IO	High-side Gate Drive Voltage
4, 11	9,19	VM	-	Power Supply
5	10	OUT1	O	Half Bridge OUT1
6	11	PGND1	-	Lower-side FET Source of Half Bridge OUT1
7	12	PGND2	-	Lower-side FET Source of Half Bridge OUT2
8	13	OUT2	O	Half Bridge OUT2
9	15	OUT3	O	Half Bridge OUT3
10	16	PGND3	-	Lower-side FET Source of Half Bridge OUT3
12	21	COMPP	I	Positive Input of Built-in Comparator
13	22	COMPN	I	Negative Input of Built-in Comparator
14, 20, 28	3, 17, 20, 23, 24, 30, 31, 32	GND	-	Ground
15	25	V3P3OUT	O	Built-in 3.3V LDO Output
16	26	nRESET	I	Reset Input
17	27	nSLEEP	I	Sleep Input
18	28	nFAULT	OD	Fault Indication Pin, Open Drain Output
19	29	nCOMP0	OD	Comparator Output, Open Drain Output
21	4, 8, 18, 14	NC	-	Not Connection
22	33	EN3	I	Channel 3 Enable
23	34	IN3	I	Channel 3 Data In
24	35	EN2	I	Channel 2 Enable
25	36	IN2	I	Channel 2 Data In
26	1	EN1	I	Channel 1 Enable
27	2	IN1	I	Channel 1 Data In
-	-	EPAD	-	Thermal Pad,Recommend to connect with ground

BLOCK DIAGRAM



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	Range	Unit
Power Supply	V_M	-0.3 ~ 40	V
Digital Port Voltage Range	V_{Din}	-0.5 ~ 7	V
Comparator Input Voltage Range	V_{Cin}	-0.5 ~ 7	V
Pin Voltage (PGND1, PGND2, PGND3)	V_{PGND}	± 600	mV
Operating Temperature	T_A	-40 ~ 120	℃
Storage Temperature	T_{stg}	-60 ~ 150	℃
Continuous Output Current	I_{con}	1.75	A

.

ELECTRICAL CHARACTERISTICS

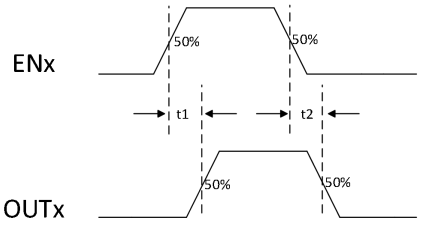
Electrical Parameters

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply	V_M		6.5		36	V
PGNDx Pin Voltage	V_{PGNDX}		-500		500	mV
Built-in LDO Driving Current	I_{LDO}		0		10	mA
Built-in LDO Output Voltage	V3P3	Iout=0 to 10mA	3.1		3.52	V
Operating Supply Current	I_{VM}	VM=24V, fPWM<50kHz		1	5	mA
Sleep Mode Current	I_{VMQ}	VM=24V		500	800	uA
Undervoltage Protection Voltage	V_{UVLO}			6.3	8	V
Logic Input						
Logic Input High Level	V_{IH}		2.2		5.25	V
Logic Input Low Level	V_{IL}			0.6	0.7	V
Hysteresis Window	V_{HYS}	VDD=2.7~3.6V	50		600	mV
Logic Input Low Current	I_{IL}	VIN=0	-5		5	uA
Logic Input High Current	I_{IH}	VIN=3.3V			100	uA
Pull-down Resistance	R_{PD}			80		kΩ
nFAULT and nCOMP0 Output (Open Drain Output)						
Output Low Voltage	V_{OL}	IO=5mA			500	mV
Output High Current	I_{OH}	VO=3.3V			1	uA
Comparator						
Common-mode Voltage Range	V_{CM}		0		5	V
Input Offset Voltage	V_{IO}		-7		7	mV
Input Current	I_{IB}		-300		300	nA
Response Time	tR				2	us
H-bridge Output FET						
High-side FET On-resistance	R_{dson}	VM=24V, IO=1A, Tj=25°C		0.24		Ω
		VM=24V, IO=1A, Tj=85°C		0.29	0.39	Ω
Low-side FET On-resistance	R_{dson}	VM=24V, IO=1A, Tj=25°C		0.24		Ω
		VM=24V, IO=1A, Tj=85°C		0.29	0.39	Ω
Off-state Leakage Current	I_{OFF}		-2		2	uA
Dead Time	t_{DEAD}			100		ns
Protection Circuit						
Overcurrent Protection	I_{OCP}		3			A
Overcurrent protection Detection Time	t_{OCP}			6		us
Thermal Shutdown	T_{TSD}		150	160	180	°C

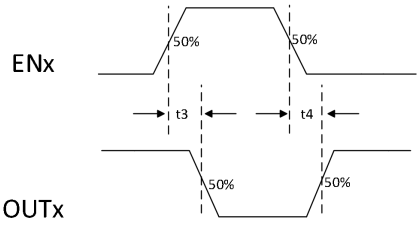
Switch Characteristics

VM=24V, RL=20Ω, TA=25°C

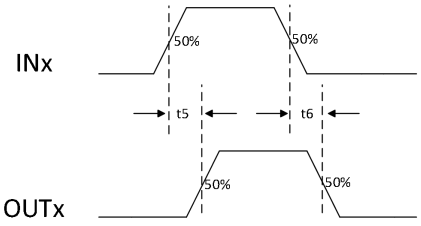
Symbol	Description	Min	Max	Unit
t1	Delay Time from ENx High to OUTx High, INx=1	130	330	ns
t2	Delay Time from ENx Low to OUTx Low, INx=1	275	475	ns
t3	Delay time from ENx High to OUTx Low, INx=0	100	300	ns
t4	Delay time from ENx Low to OUTx High, INx=0	200	400	ns
t5	Delay time from INx High to OUTx High, ENx=1	300	500	ns
t6	Delay time from INx Low to OUTx Low, ENx=1	275	475	ns
tr	Output Rise Time	30	150	ns
tf	Output Fall Time	30	150	ns



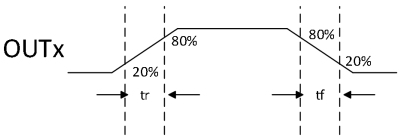
Inx=1, Output: Resistance to GND



INx=0,Output: Resistance to VM



ENx=1,Output: Resistance to GND



FUNCTION DESCRIPTION

Output Stage

The MS8313 includes three half-H-bridge drivers. In addition, the source stages of each half-bridge low-side FETs are independent ports (PGND1, PGND2, PGND3). The current detection function can be realized by grounding the resistance through these ports. If the detection resistor is connected in application, must ensure that the PGNDx port voltage does not exceed ± 500mv.

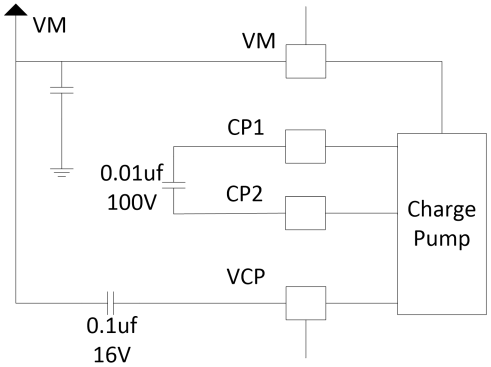
Channel Control Timing

The state of output OUTx is controlled by input signal of INx port, and ENx input signal controls the channel OUTx to close or open. The timing sequence is as follows:

INx	ENx	OUTx
X	0	Z
0	1	L
1	1	H

Charge Pump

Because the output stages use N-channel FETs, the gate-drive voltage should be higher than VM to make the FETs fully open. The MS8313 integrates charge pump circuit to generate high voltage. During normal operation, the charge pump circuit needs to be connected with two capacitors, as shown in the figure below:



When entering sleep mode, the charge pump is turned off.

Built-in Comparator

The MS8313 integrates a comparator, which can be used for current limit or other functions.

nRESET Control Function

When nRESET pin is low, the chip is reset. At the same time, all output channels will be closed, and the input signal will not affect the output. There is a power-on reset circuit internally, so there is no need to drive nRESET pin at power-on reset.

nSLEEP Control Function

When the nSLEEP pin is low, the chip enters the low-power-dissipation sleep mode. In this state, the output will be turned off (high-impedance state), the charge pump will also be turned off, and all internal logic reset (including fault signals). In this mode, output will not be affected by input signal until nSLEEP signal becomes high. When entering working mode from sleep mode, it takes about 1ms, and the output drive reaches the full working state. It should be noted that in the sleep mode, the internal 3.3V LDO will remain operation.

Protection Circuit

The MS8313 has the functions of undervoltage protection, overcurrent protection and overtemperature protection.

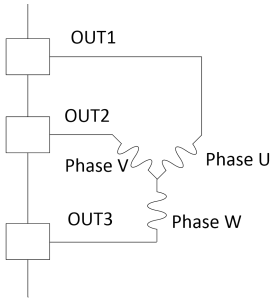
The overcurrent protection of the MS8313 includes two processes: fast response and slow response. In a very short time, if the overcurrent protection threshold of fast response is exceeded, the chip will adopt analog mode to protect the chip from excessive spike current. If the duration time of this spike exceeds the set time (about 6us), the chip will close the corresponding channel and output a low signal on nFAULT. The channel can only be opened by resetting or power on again.

When the chip temperature exceeds the set threshold, the overtemperature protection circuit will work. At this time, all channels will be closed, and nFAULT outputs a low-level signal. When the temperature drops back to safe temperature, the chip will return to normal operation state.

When power supply drops below the threshold of undervoltage protection, the chip will close all channels, reset the internal logic circuit, and output a low-level signal on nFAULT. When the voltage rises above the threshold, the chip will return to normal operation state.

TYPICAL APPLICATION

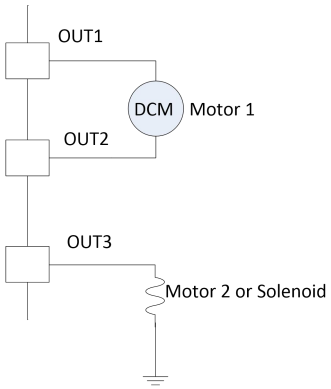
The typical application of the MS8313 is for driving three-phase brushless motor. In this application, the three outputs are connected to the three inputs of the motor respectively, as shown in the figure below:



The operation g timing sequence is as follows:

State	OUT1(Phase U)			OUT2(Phase V)			OUT3(Phase W)		
	IN1	EN1	OUT1	IN2	EN2	OUT2	IN3	EN3	OUT3
1	X	0	Z	1/PWM	1	H/PWM	0	1	L
2	1/PWM	1	H/PWM	X	0	Z	0	1	L
3	1/PWM	1	H/PWM	0	1	L	X	0	Z
4	X	0	Z	0	1	L	1/PWM	1	H/PWM
5	0	1	L	X	0	Z	1/PWM	1	H/PWM
6	0	1	L	1/PWM	1	H/PWM	X	0	Z

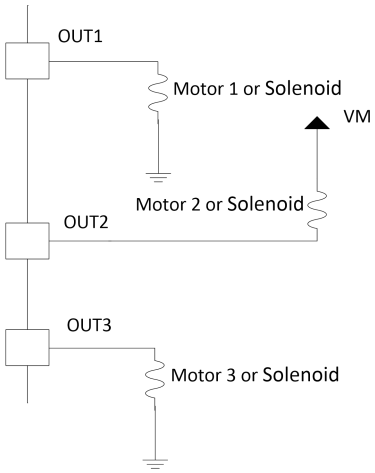
The MS8313 can also be used to drive DC motor and solenoid. The example is as follows:



Motor 1						
Function	IN1	EN1	OUT1	IN2	EN2	OUT2
Close or Coast	X	0	Z	X	X	X
Close or Coast	X	X	X	X	0	X
Forward Rotation	1/PWM	1	H	0	1	L
Reverse Rotation	0	1	L	1/PWM	1	H
Brake or Slow Decay	0	1	L	0	1	L
Brake or Slow Decay	1	1	H	1	1	H

Motor 2			
Function	IN3	EN3	OUT3
Open	1/PWM	1	H
Close or Slow Decay	0	1	L
Close or Coast	X	0	X

The MS8313 can also drive three motors or solenoids independently. The specific application is as follows:



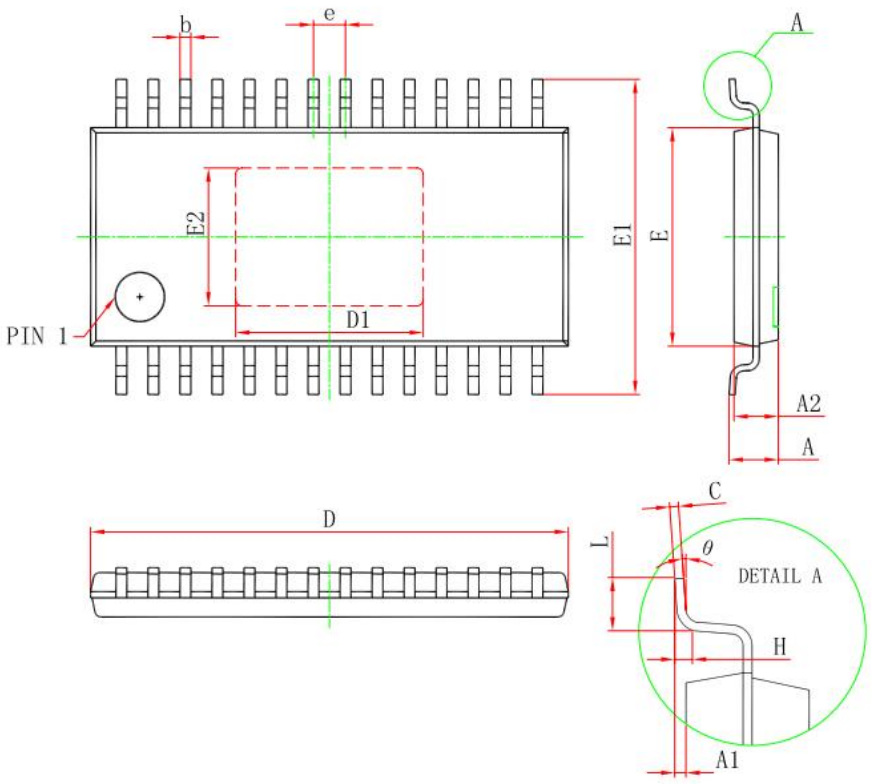
Motor 1 or Solenoid			
Function	IN1	EN1	OUT1
Open	1/PWM	1	H
Close or Slow Decay	0	1	L
Close or Coast	X	0	X

Motor 2 or Solenoid			
Function	IN2	EN2	OUT2
Open	1/PWM	1	H
Close or Slow Decay	0	1	L
Close or Coast	X	0	X

Motor 3 or Solenoid			
Function	IN3	EN3	OUT3
Open	1/PWM	1	H
Close or Slow Decay	0	1	L
Close or Coast	X	0	X

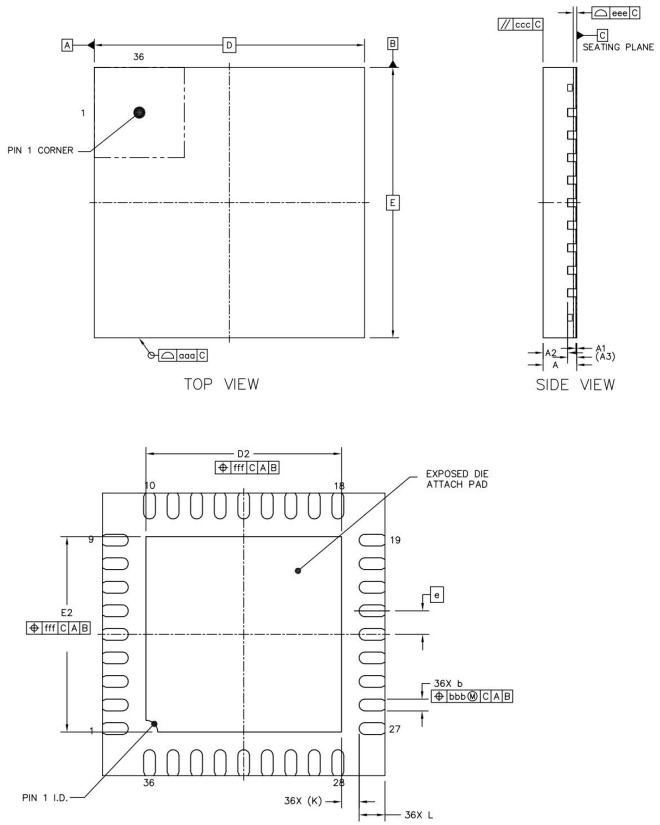
PACKAGE OUTLINE DIMENSIONS

eTSSOP28



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
D	9.600	9.800	0.378	0.386
D1	3.710	3.910	0.146	0.154
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
E2	2.700	2.900	0.106	0.122
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65(BSC)		0.026(BSC)	
L	0.500	0.700	0.02	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

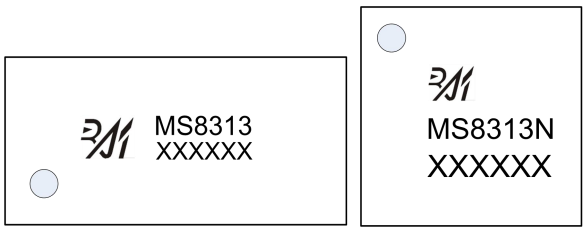
QFN36



		Symbol	Dimensions in Millimeters		
			Min	Typ	Max
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3	0.203REF		
LEAD WIDTH		b	0.2	0.25	0.3
BODY SIZE	X	D	6BSC		
	Y	E	6BSC		
LEAD PITCH		e	0.5BSC		
EP SIZE	X	D2	4.05	4.15	4.25
	Y	E2	4.05	4.15	4.25
LEAD LENGTH		L	0.45	0.55	0.65
LEAD TIP TO EXPOSED PAD EDGE		K	0.375REF		
PACKAGE EDGE TOLERANCE		aaa	0.1		
MOLD FLATNESS		ccc	0.1		
COPLANARITY		eee	0.08		
LEAD OFFSET		bbb	0.1		
EXPOSED PAD OFFSET		fff	0.1		

MARKING and PACKAGING SPECIFICATIONS

1. Marking Drawing Description



Product Name: MS8313, MS8313N

Product Code: XXXXXX

2. Marking Drawing Demand

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

3. Packaging Specifications

Device	Package	Piece/Reel	Reel/Box	Piece/Box	Box/Carton	Piece/Carton
MS8313	eTSSOP28	3000	1	3000	8	24000
MS8313N	QFN36	2000	1	2000	8	16000

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.


+86-571-89966911


Rm701, No.9 Building, No. 1 WeiYe Road, Puyan Street, Binjiang District, Hangzhou, Zhejiang


http:// www.relmon.com