

## Quad Half-H-Bridge Driver IC

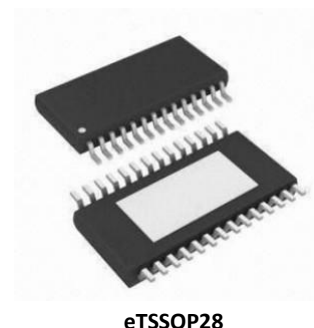
### PRODUCT DESCRIPTION

The MS8844 provides four independently controllable half-H-bridge drivers. It can be used to drive two DC motors, one stepper motor, four solenoids or other loads. Each output driver channel includes N-channel power MOSFET configured by half-bridge.

The MS8844 can provide independent control for each channel input. When adopting separate supply, the reference ground of logic input and nFAULT output is set as one independent group pin.

The MS8844 provides 2.5A peak current or 1.75A RMS output current on each channel of half-bridge.

The MS8844 has the functions of overcurrent protection, short-circuit protection, undervoltage protection and overtemperature protection. It is available in eTSSOP28 package.



eTSSOP28

### FEATURES

- Four Half-H-Bridge Drivers: Drive four solenoids, two DC motors, one stepper motor or other loads
- Independent H-Bridge Control
- Used for Low-side Current Detection Pin
- Low On-resistance of Power FET
- Maximum Peak Current: 2.5A @24V, 25°C
- Built in 3.3V, 10mA Low Voltage Drop Regulator (LDO)
- Power Supply Range: 8V-36V
- Outputs Can be Used in Parallel
- Small Package with Thermal Pad

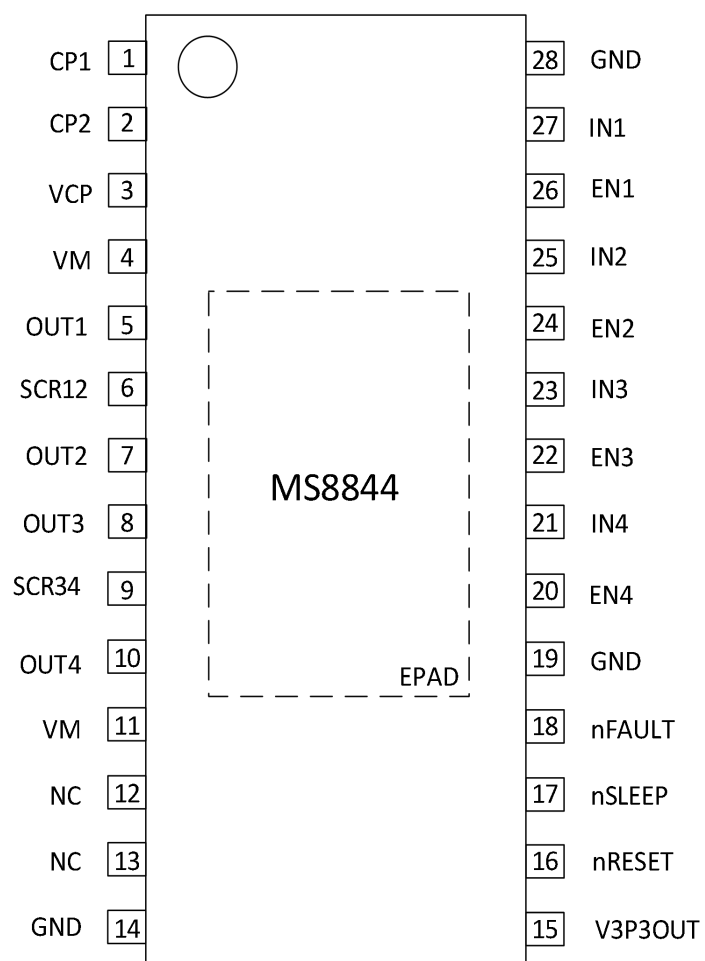
### APPLICATIONS

- Textile Machine
- Consumer Products
- Office Automation Device
- Factory Automation
- Robot

### PRODUCT SPECIFICATION

Part Number	Package	Marking
MS8844	eTSSOP28	MS8844

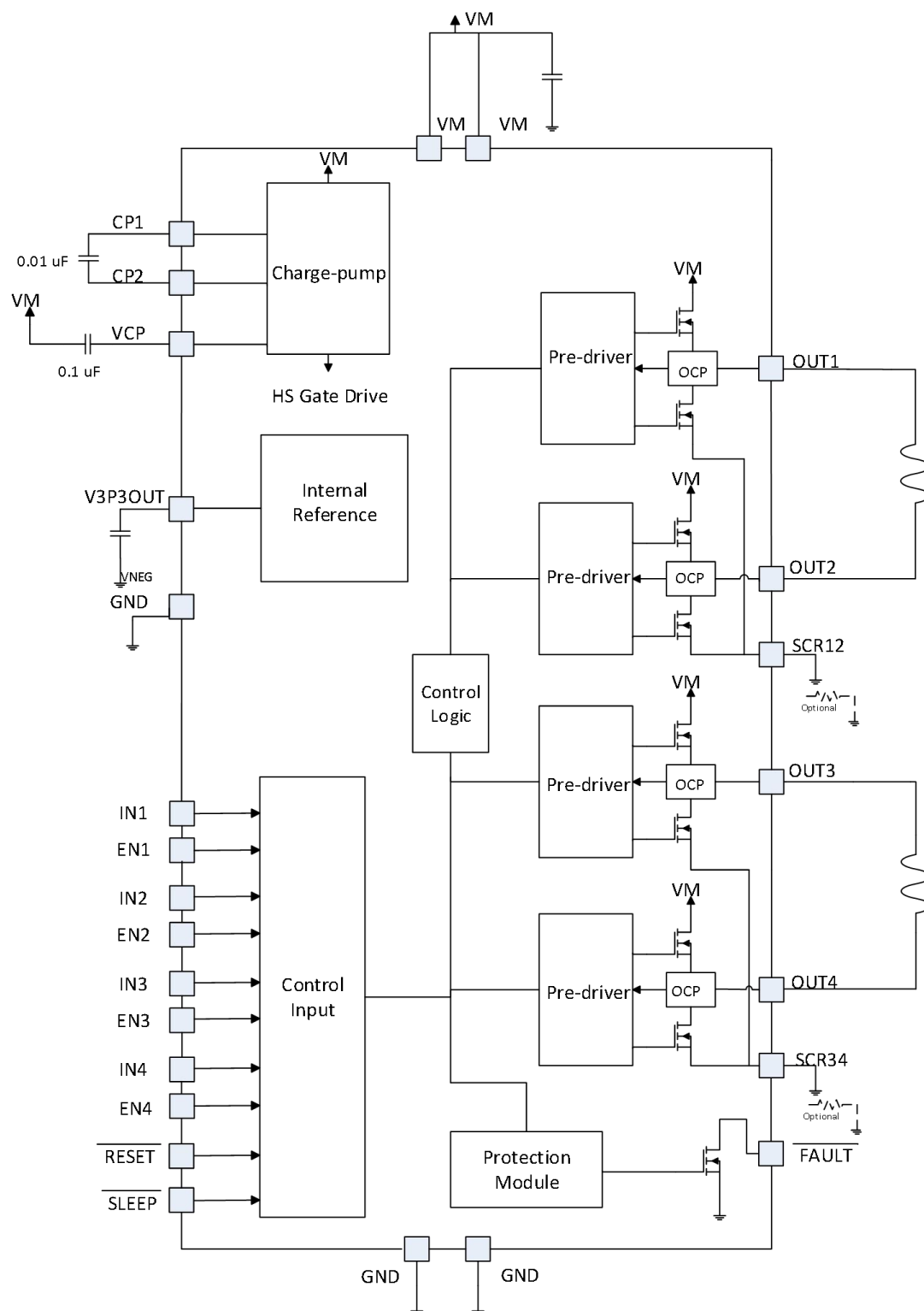
## PIN CONFIGURATION



## PIN DESCRIPTION

Pin	Name	Type	Description
1	CP1	IO	Charge-pump External Capacitance
2	CP2	IO	Charge-pump External Capacitance
3	VCP	IO	High-side Gate Drive Voltage
4	VM	-	Power Supply
5	OUT1	O	OUT1 Output
6	SCR12	-	OUT1, OUT2 Low-side NMOS Source, can connect to sense resistor to set overcurrent protection.
7	OUT2	O	OUT2 Output
8	OUT3	O	OUT3 Output
9	SCR34	-	OUT1, OUT2 Low-side NMOS Source, can connect to sense resistor to set overcurrent protection.
10	OUT4	O	OUT4 Output
11	VM	-	Power Supply
12	NC	-	Not Connected
13	NC	-	Not Connected
14	GND	-	Ground
15	V3P3OUT	O	Built-in 3.3V LDO Output
16	nRESET	I	Reset Input
17	nSLEEP	I	Sleep Input
18	nFAULT	OD	Fault Indication Pin
19	GND	-	Ground
20	EN4	I	Channel 4 Enable
21	IN4	I	Channel 4 Data In
22	EN3	I	Channel 3 Enable
23	IN3	I	Channel 3 Data In
24	EN2	I	Channel 2 Enable
25	IN2	I	Channel 2 Data In
26	EN1	I	Channel 1 Enable
27	IN1	I	Channel 1 Data In
28	GND	-	Ground
-	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 (SCR12, SCR34)	$V_{PGND}$	±600	mV
Operating Temperature	$T_A$	-40 ~ 120	°C
Storage Temperature	$T_{stg}$	-60 ~ 150	°C
Continuous Output Current	$I_{con}$	1.75	A

## ELECTRICAL CHARACTERISTICS

### Power

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply	$V_M$		8		36	V
Ground Pin Voltage	$V_{GNDX}$		-500		500	mV
Built-in LDO Driving Current	$I_{LDO}$		0		10	mA
Built-in LDO Output Voltage	V3P3	I <sub>out</sub> =0 to 10mA	3.1		3.52	V
Operating Current	$I_{VM}$	VM=24V, fPWM<50kHz		1	5	mA
Sleep Mode Current	$I_{VMQ}$	VM=24V		450	800	uA
Undervoltage Protection Voltage	$V_{UVLO}$			6.3	8	V

### Logic Input

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Logic Input High Voltage	$V_{IH}$		2.2		5.25	V
Logic Input Low Voltage	$V_{IL}$			0.6	0.7	V
Hysteresis Window	$V_{HYS}$	VDD=2.7 to 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 Output (Open Drain Output)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Low Voltage	$V_{OL}$	IO=5mA			500	mV
Output High Current	$I_{OH}$	VO=3.3V			1	uA

### H-Bridge Output FET

Parameter	Symbol	Condition	Min	Typ	Max	Unit
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	0.39	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

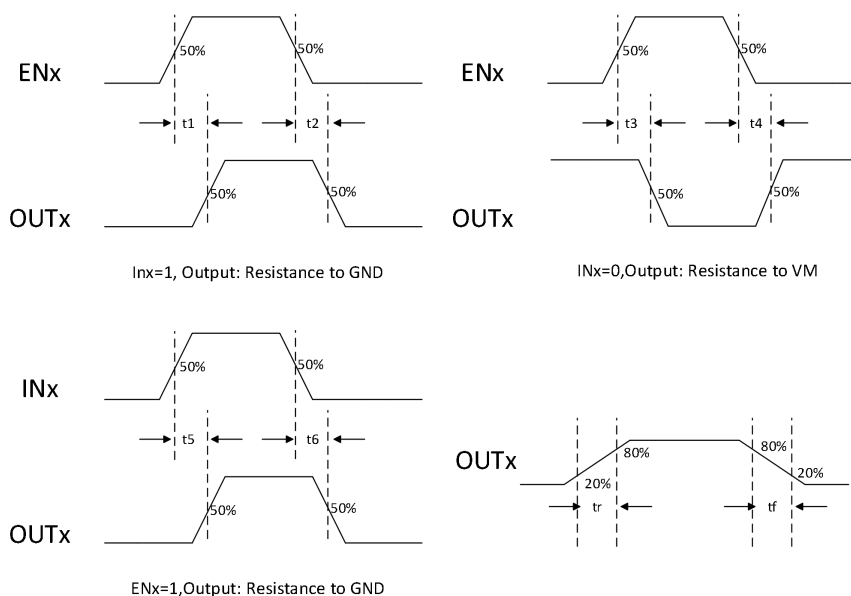
### Protection Circuit

Parameter	Symbol	Condition	Min	Typ	Max	Unit
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	300	500	ns
t6	Delay time from INx Low to OUTx Low	275	475	ns
t7	Output Rise Time	30	150	ns
t8	Output Fall Time	30	150	ns



## FUNCTION DESCRIPTION

### Output Stage

The MS8844 includes four independently controllable half-H-bridge drivers.

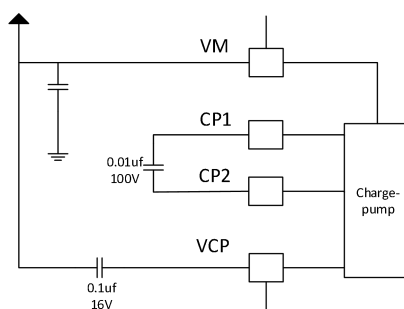
### Channel Control Timing

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

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

### Charge-pump

Because output stages use N-channel FETs, the gate-drive voltage should be higher than power supply to make the FETs fully open. The MS8844 internally integrates charge-pump circuit to generate the high voltage. During normal operation, the charge-pump circuit needs to be connected with two capacitors, as shown in the figure below:



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

### nRESET and nSLEEP Control Functions

When nRESET pin is low, the chip is reset. At the same time, all output channels will be closed, and 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.

When the nSLEEP pin is low, the chip enters low-power-dissipation sleep mode. In this state, the output will be turned off, the charge-pump will also be turned off, and all internal logic reset (including fault signals). In this mode, the 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

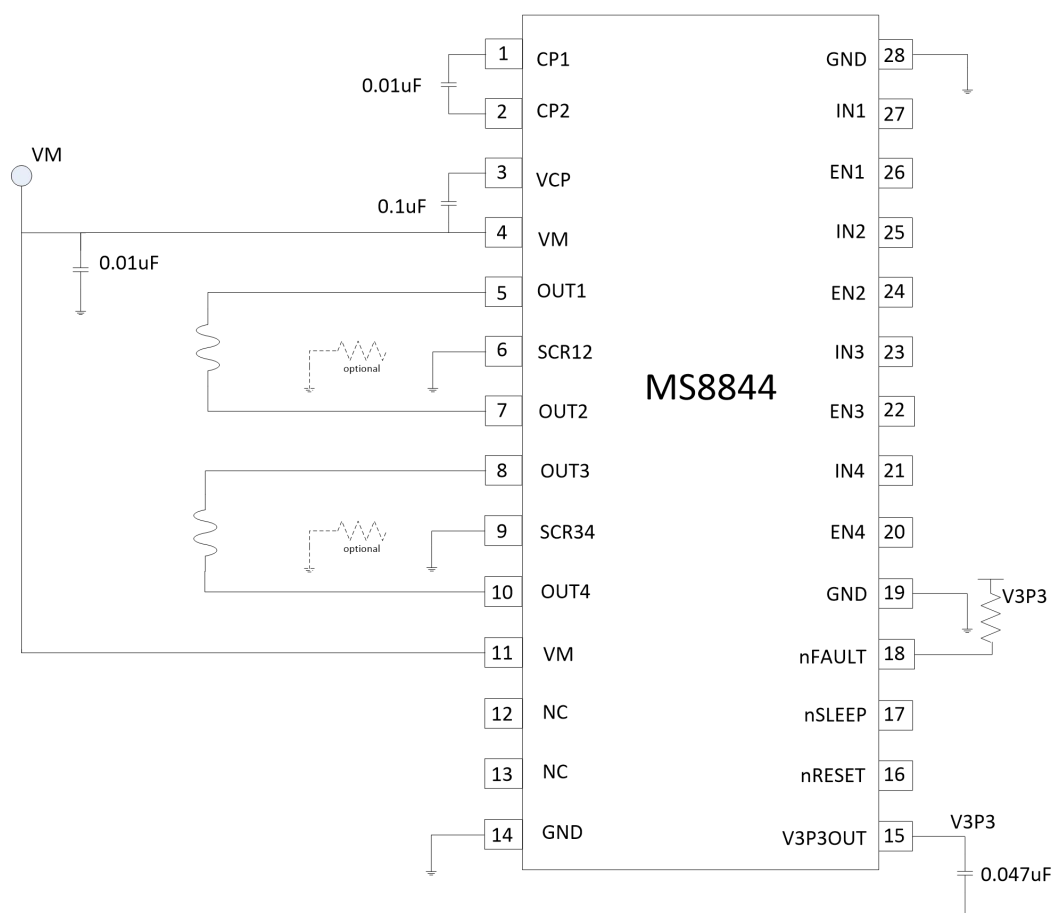
The MS8844 has the functions of undervoltage protection, overcurrent protection and overtemperature protection.

The overcurrent protection of the MS8844 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 6 $\mu$ s), 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 DIAGRAM



The MS8844 is used to drive stepper motor, several brushed DC motors or other inductive loads.

The MS8844 output could improve driving ability by parallel use. If according to full bridge structure, any two outputs can be used in parallel. If according to separate half bridge structure, OUT1 and OUT2 must be paralleled, OUT3 and OUT4 in parallel. Because the low-side NMOS source of OUT1 and OUT2 share one SCR12, low-side NMOS source of OUT3 and OUT4 share one SCR34.

If connect one resistor to GND on SCR12,SCR34, the present current could be detected.

The stepper motor is shown as follows:

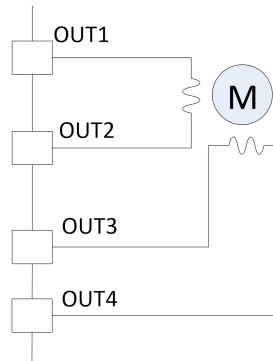


Figure 1. Stepper Motor Connection

The MS8844 also could be used in brushed DC motor:

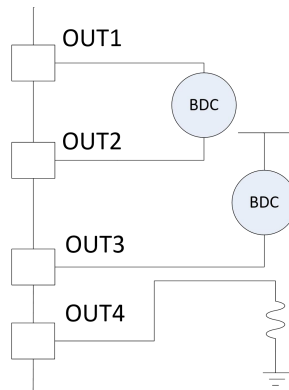


Figure 2. Bidirectionally Drive Brushed Motor, Unidirectionally Drive Brushed Motor, Drive Inductive Load

The operation timing is as follows:

Table 1. Bidirectionally Drive DC Motor

Function	EN1	EN2	IN1	IN2	OUT1	OUT2
Forward Rotation	1	1	PWM	0	H	L
Reverse Rotation	1	1	0	PWM	L	H
Brake	1	1	0	0	L	L
Brake	1	1	1	1	H	H
Coast	0	X	X	X	Z	X
Coast	X	0	X	X	X	Z

Table 2. Unidirectionally Drive DC Motor

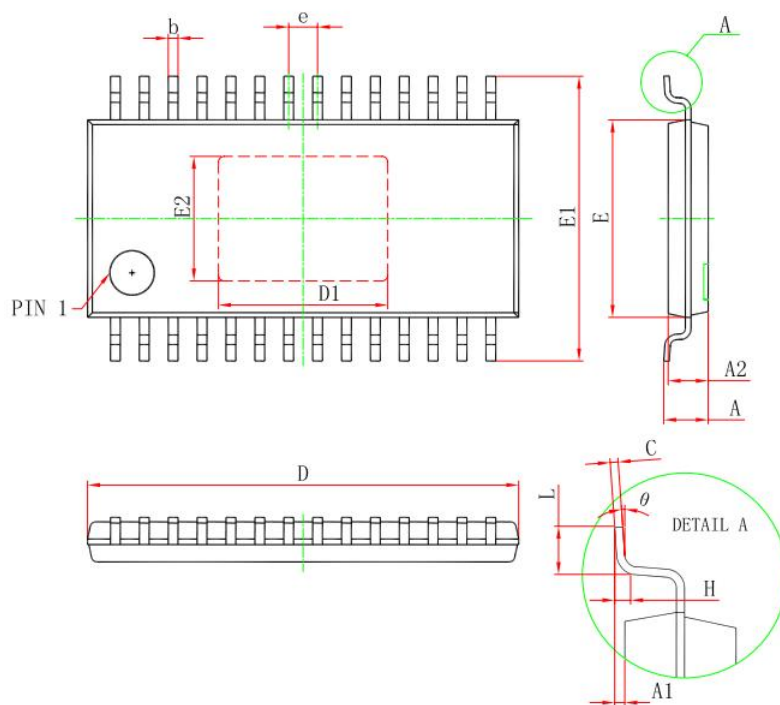
Function	IN3	EN3	OUT3
Open	$\overline{\text{PWM}}$	1	L
Brake	1	1	H
Coast	X	0	Z

Table 3. Drive Inductive Load

Function	IN4	EN4	OUT4
Open	PWM	1	H
Close or Slow Decay	0	1	L
Close or Coast	X	0	Z

# 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	0.0
H	0.25(TYP)		0.01(TYP)	
$\theta$	1°	7°	1°	7°

## MARKING and PACKAGING SPECIFICATIONS

### 1. Marking Drawing Description



Product Name: MS8844

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
MS8844	eTSSOP28	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.



+86-571-89966911



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



[http:// www.relmon.com](http://www.relmon.com)