

MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



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MOV



GDT



PLED

DRV8870DDAR(MS)

产品手册

产品简介

DRV8870DDAR(MS)是一款全桥 DMOS 有刷电机驱动芯片，最大工作范围 可达±3.5A 和 40V 输入电压，用 PWM 来控制马达驱动的速度和 方向。如果将两个输入均置为低电平，则电机驱动器将进入低功耗 休眠模式。

DRV8870DDAR(MS)集成电流限制功能，该功能基于模拟输入 VREF 以 及 ISEN 引脚的电压。该器件能够将电流限制在某一已知水平， 这可显著降低系统功耗要求，并且无需大容量电容来维持稳定电 压，尤其是在电机启动和停转时。

内部关断功能包含过流保护、短路保护、欠压锁定和过温保护。

DRV8870DDAR(MS)提供一种带有裸露焊盘的 SOP-8 封装，能有效改善 散热性能，且是无铅产品，引脚框采用 100%无锡电镀。

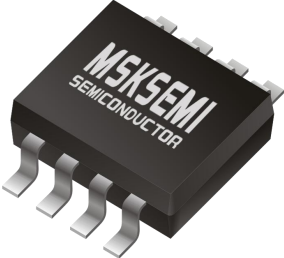
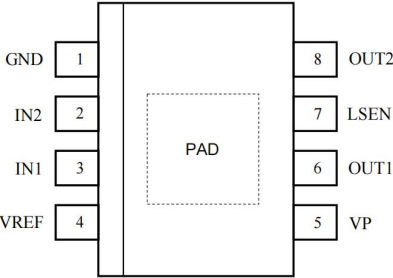
产品特点

- 宽电压供电， 8V-40V
- RDS (ON) 电阻为 600mΩ
- 3.5A 峰值驱动输出， 2A 持续输出能力
- 支持欠压锁定保护
- 低功耗休眠模式
- PWM 电流整流/限流/调向
- 支持短路保护
- 支持过温关断电路
- 自动故障恢复

产品用途

- 打印机及办公自动化设备
- 电器
- 机器人
- 工业设备

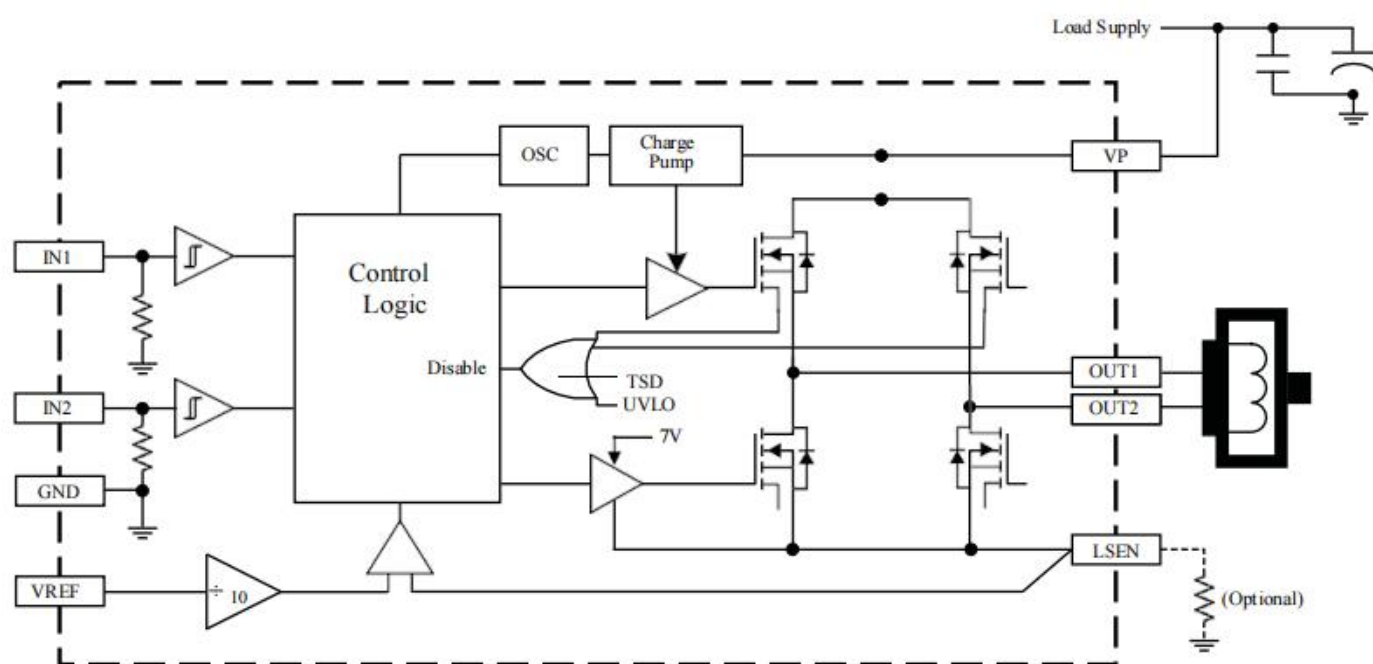
参考信息

封装	管脚定义	丝印
 SOP-8-EP		

管脚定义

Number	Name	Function
1	GND	地
2	IN2	逻辑输入 2
3	IN1	逻辑输入 1
4	VREF	模拟输入
5	VP	功率电源
6	OUT1	DMOS 全桥输出 1
7	LSEN	检测电阻连接
8	OUT2	DMOS 全桥输出 2
—	PAD	散热 pad

功能框图



极限参数

Characteristic	Symbol	Notes	Rating	Unit
功率电源	VP		40	V
逻辑输入	V _{IN}		-0.3 ~ 6	V
V _{LSEN} 输入范围	V _{LSEN}		-0.3 ~ 6	V
Sense Voltage (LSEN pin)	V _{LSEN}		-0.5 ~ 0.5	V
输出电流	I _{OUT}	Duty cycle = 100%	3.5	A
工作温度	T _A	Temperature Range E	-40 ~ 85	°C
最大结温	T _{J(max)}		150	°C
储藏温度	T _{stg}		-55 ~ 150	°C

电特性参数

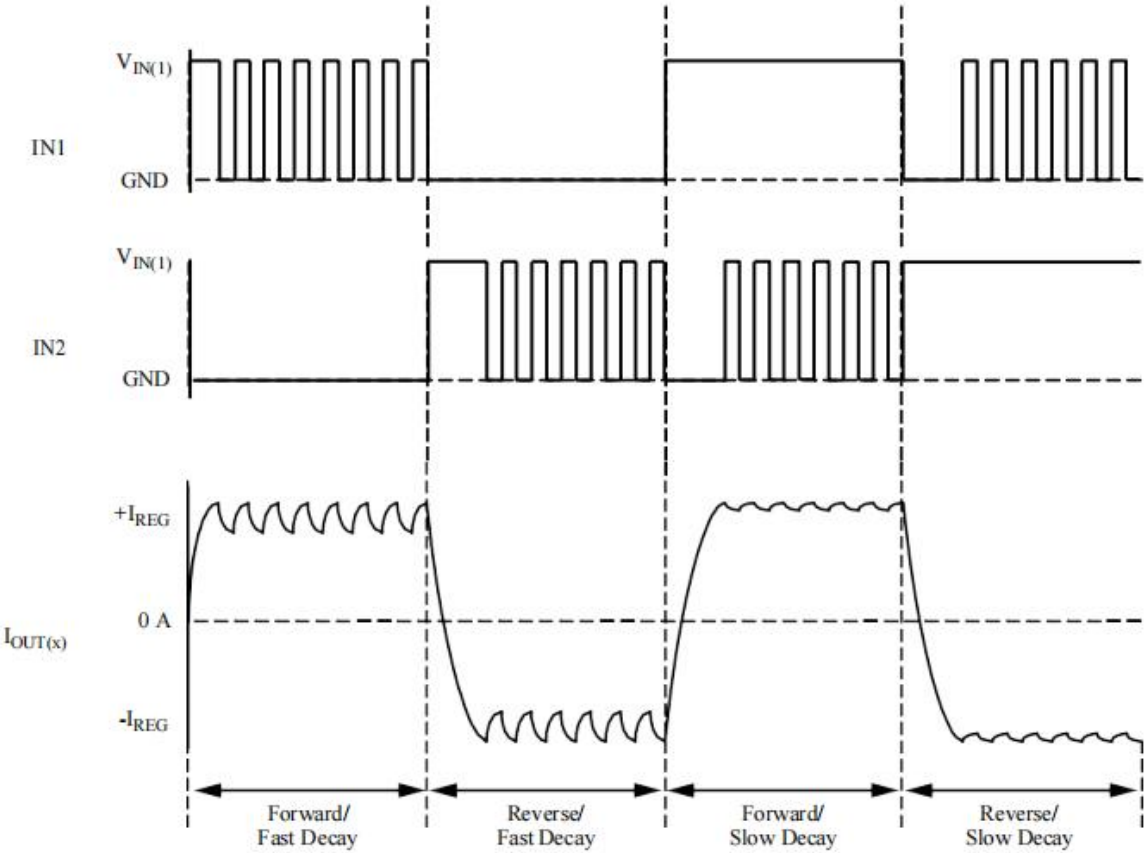
Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
General						
Load Supply Voltage Range	V _P		8	—	40	V
R _{DS(on)} Sink + Source Total	R _{DS(on)}	I _{OUT} = 1 A , T _J = 25°C	—	0.6	0.8	Ω
		I _{OUT} = 1 A , T _J = 150°C	—	1	1.4	Ω
Load Supply Current	I _{VP}	f _{PWM} < 30 kHz	—	5	20	mA
		Low Power Standby mode	—	—	10	μA
Body Diode Forward Voltage	V _f	Source diode, I _f = −2.5 A	—	—	1.5	V
		Sink diode, I _f = 2.5 A	—	—	1.5	V
Logic Inputs						
Logic Input Voltage Range	V _{IN(1)}		2.0	—	—	V
	V _{IN(0)}		—	—	0.8	V
	V _{IN(STANDBY)}	Low Power Standby mode	—	—	0.4	V
Logic Input Current	I _{IN(1)}	V _{IN} = 2.0 V	—	40	100	μA
	I _{IN(0)}	V _{IN} = 0.8 V	—	16	40	μA
Logic Input Pull-Down Resistance	R _{LOGIC(PD)}	V _{IN} = 0 V = IN1 = IN2	—	50	—	kΩ
Timing						
Crossover Delay	COD		50	—	500	ns
VREF Input Voltage Range	V _{REF}		0	—		V
Current Gain	A _V	V _{REF} / I _{SEN} , V _{REF} = 5 V	9.5	—	10.5	V/V
Blank Time	BLANK		2	3		μs
Constant Off-time	t _{off}		16	25	34	μs
Standby Timer	t _{st}	IN1 = IN2 < V _{IN(STANDBY)}	—	1	1.5	ms
Power-Up Delay	pu		—	—	30	μs
Protection Circuits						
UVLO Enable Threshold	V _{UVLO}	V _p increasing	7	7.4	7.8	V
UVLO Hysteresis	V _{UVLOhys}		—	300	—	mV
Thermal Shutdown Temperature	T _{JTSD}	Temperature increasing	—	160	—	°C
Thermal Shutdown Hysteresis	T _{TSDhys}	Recovery = T _{JTSD} − T _{TSDhys}	—	15		°C

模块功能描述

DRV8870DDAR(MS) 是一款有刷直流电机驱动器，VP 单电源供电，内置电荷泵。两个逻辑输入控制 H 桥驱动器，该驱动器由四个 N-MOS 组成，能够以高达 3.5A 的峰值电流双向控制电机。该芯片利用电流衰减预置最大输出电流，能够将电流限制在某一已知水平。如果将两个输入均置为低电平，则电机驱动器将进入低功耗休眠模式。内部关断功能包含过流保护、短路保护、欠压锁定和过温保护。

Characteristic Performance

PWM Control Timing Diagram



PWM Control Truth Table

IN1	IN2	$10 \times V_S > V_{REF}$	OUT1	OUT2	Function
0	1	False	L	H	Reverse
1	0	False	H	L	Forward
0	1	True	H/L	L	Chop (mixed decay), reverse
1	0	True	L	H/L	Chop (mixed decay), forward
1	1	False	L	L	Brake (slow decay)
0	0	False	Z	Z	Coast, enters Low Power Standby mode after 1 ms

Note: Z indicates high impedance.

CurrentControl

通过固定频率的 PWM 电流整流器，流过电机驱动桥臂的电流是被限制的或者是被控制的。在 DC 电机应用中，电流控制功能用于限制开启电流和停转电流。

当一个 H 桥被使能，流过相应桥臂的电流以一个斜率上升，此斜率由直流电压 VP 和电机的电感特性决定。当电流达到设定的阈值，驱动器会关闭此电流，直到下一个 PWM 循环开始。注意，在电流被使能的那一刻，LSEN 管脚上的电压是被忽略的，经过一个固定时间后，电流检测电路才被使能。这个消隐时间一般固定在 2μs。这个消隐时间同时决定了在操作电流衰减时的最小PWM时间。

PWM 目标电流是由比较器比较连接在 LSEN 管脚上的电流检测电阻上的电压乘以一个 10 倍因子和一个参考电压决定。参考电压通过 VREF 输入。以下公式为 100%计算目标电流：

$$I_{\text{Trip}}(\text{A}) = \frac{V_{\text{REF}}(\text{V})}{A_V \times R_{\text{LSEN}}(\Omega)} = \frac{V_{\text{REF}}(\text{V})}{10 \times R_{\text{LSEN}}(\Omega)}$$

电流衰减时序

当电流达到 I_{Trip} ，H 桥的两个下管打开，维持一个 t_{off} 时间(25μs)，然后相应上管再打开。

DEAD TIME

当输出由高电平转变成低电平，或者由低电平转变为高电平，死区时间的存在是为了防止上下管同时导通。死区时间内，输出是一个高阻态。当需要在输出上测量死区时间，需要根据相应管脚当时的电流方向来测量。如果电流是流出此管脚，此时输出端电压是低于地电平一个二极管压降；如果电流是流入此管脚，此时输出端电压是高于电源电压VP 一个二极管压降。

休眠模式

当IN1、IN2 都为低维持 1ms 以上，器件将进入休眠模式，从而大大降低器件空闲的功耗。进入休眠模式后，器件的H 桥被禁止，电荷泵电路停止工作。在 VP 上电时候，如果 IN1、IN2 都为低，芯片是立马进去休眠模式。当 IN1 或 IN2 翻转为高电平且至少维持 5μs，经过延迟约 50μs，芯片恢复到正常的操作状。

保护电路

DRV8870DDAR (MS) 有过流保护，过温保护和欠压保护。

过流保护

芯片内置电流监测以保护芯片不被烧坏。如果输出短路到 VP 或 GND，芯片会输出高阻态并关断输出。这种锁存状态只能通过芯片重新上电来消除。在过流保护过程中，允许芯片超出最大工作条件一段时间后会触发锁存。

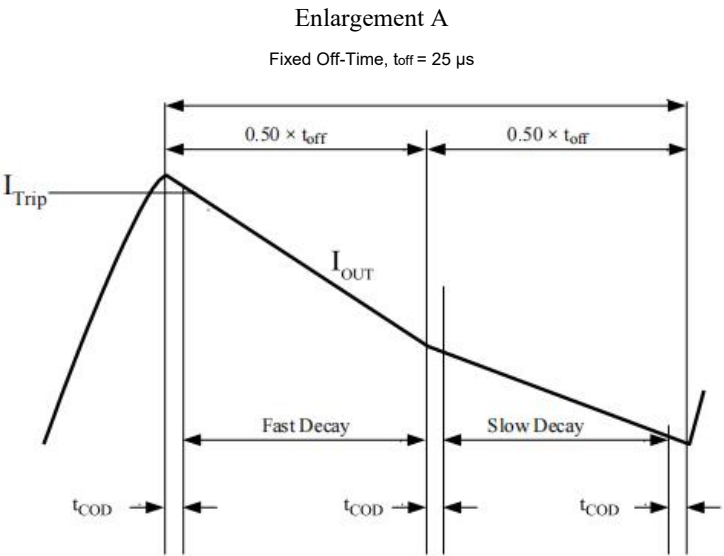
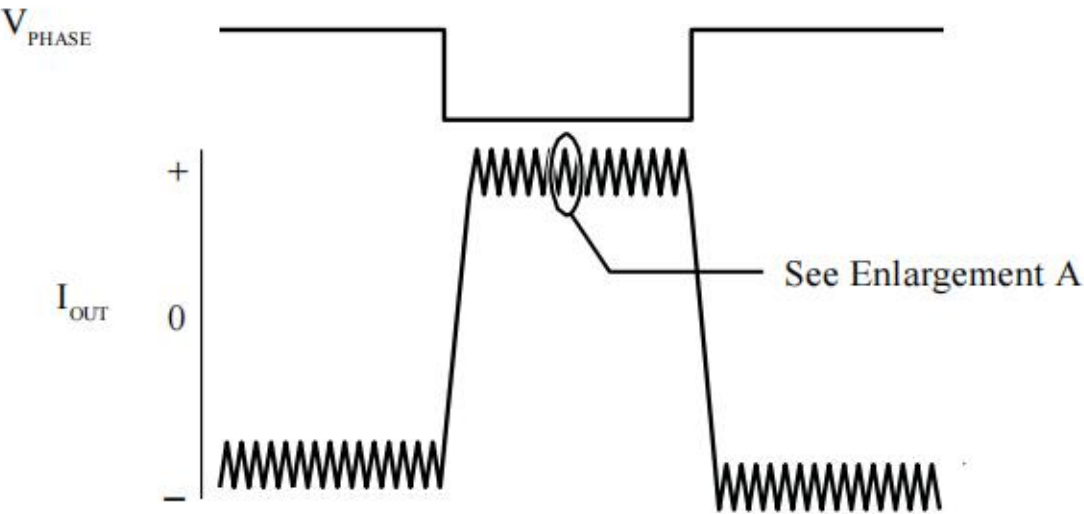
过温保护 (TSD)

如果结温超过安全限制阈值，H 桥的 FET 被禁止。一旦结温降到一个安全水平，所有操作会自动恢复正常。

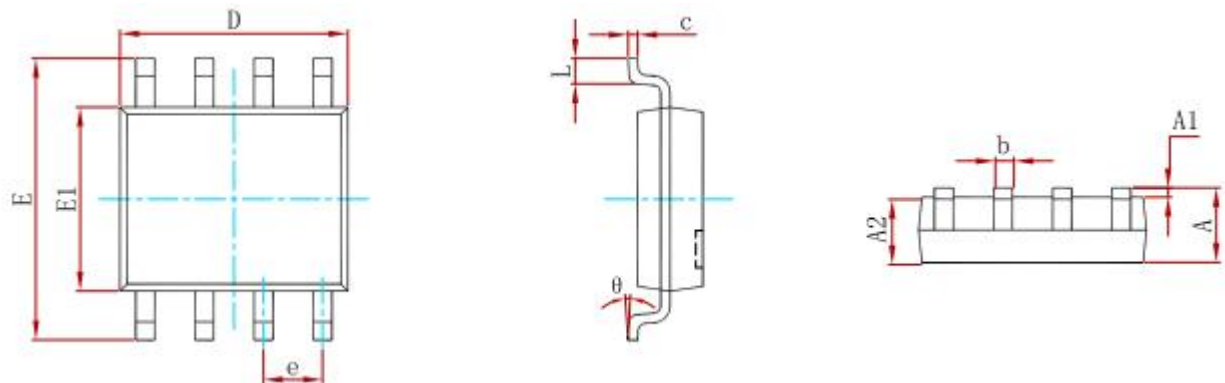
欠压锁定保护(UVLO)

在任何时候，如果 VP 管脚上的电压降到低于欠压锁定阈值，内部所有电路会被禁止，内部所有复位。当 VP 上的电压上升到 UVLO 以上，所有功能自动恢复。

Mixed Decay 运行模式

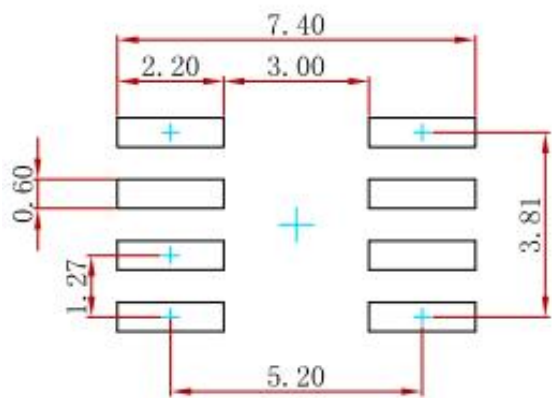


PACKAGE MECHANICAL DATA



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270 (BSC)		0.050 (BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Suggested Pad Layout



Note:
1.Controlling dimension:in millimeters.
2.General tolerance:± 0.05mm.
3.The pad layout is for reference purposes only.

REEL SPECIFICATION

P/N	PKG	QTY
DRV8870DDAR(MS)	SOP-8-EP	2500

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