800mA BTL Linear Fan Motor Driver

DESCRIPTION

EUM6883 is a single-phase full wave DC fan motor driver. It is used as an interface between a HALL IC and a single coil brushless motor. With its BTL linear control and low saturation output stages, EUM6883 silently and efficiently drives a fan motor. The functions built in EUM6883 are linear control drive mode, fan tachometer, lock detection, automatic restart, Hall Bias and thermal shutdown. When output voltage changes from L to H (or H to L), linear control mode gently drives the output stage. This makes EUM6883 suitable for the electronics equipment which required low noise and high reliability. If the motor is stalled by the external force, overdrive current may incur coil overheat or burning. To prevent this, the lock detection circuit shuts off the driver. The automatic restart circuit resumes powering up the driver after a few seconds. Rotation detection open drain output is pulled down when a motor runs. FG is the Fan tachometer output, and HB provides bias supply for a Hall sensor.

FEATURES

- Linear Control for Single-Phase Full Wave Drive
- Wide Input Range 1.8V~13.8V
- Low Saturation Output Voltage 0.5V @250mA
- FG Tachometer Output
- Lock Detection, Automatic Restart
  - RD = L when Rotation; RD = H when Stop
- 1.5V Hall Bias
- Thermal Shutdown Protection
- Available in MSOP-10 Package
- RoHS Compliant and 100% Lead (Pb)-Free, Halogen-Free

APPLICATIONS

- CPU Cooling Fan
- Car Audio Cooler
- Power Supply Cooling Fan

Block Diagram

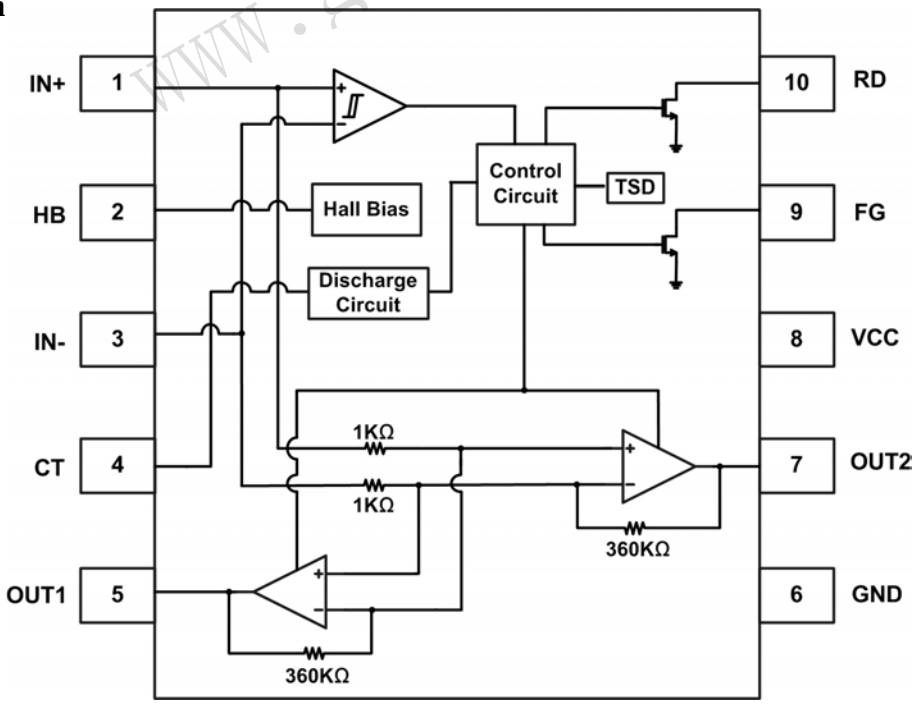
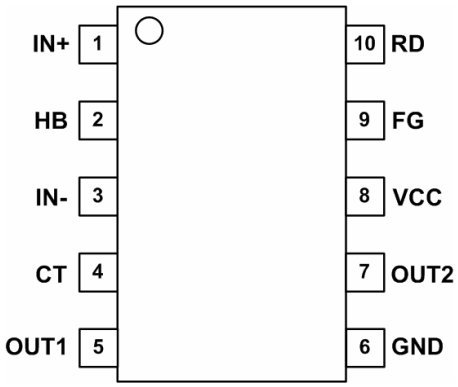


Figure 1.

Pin Configurations

Package Type	Pin Configurations
MSOP-10	

Pin Description

PIN	MSOP-10	DESCRIPTION
IN+	1	Hall signal positive input
HB	2	Hall signal bias
IN-	3	Hall signal negative input
CT	4	Lock protection time programmable output
OUT1	5	Motor output 1
GND	6	Ground pin
OUT2	7	Motor output 2
VCC	8	Power supply
FG	9	Rotation speed feedback open drain output
RD	10	Rotation detection open drain output

Ordering Information

Order Number	Package Type	Marking	Operating Temperature Range
EUM6883MIR1	MSOP-10	xxxxx M6883	-30°C to +90°C

EUM6883 □ □ □ □

Lead Free Code
1: Lead-Free, Halogen-Free 0: Lead

Packing
R: Tape & Reel

Operating temperature range
I: Industry Standard

Package Type
M: MSOP

Application Circuit

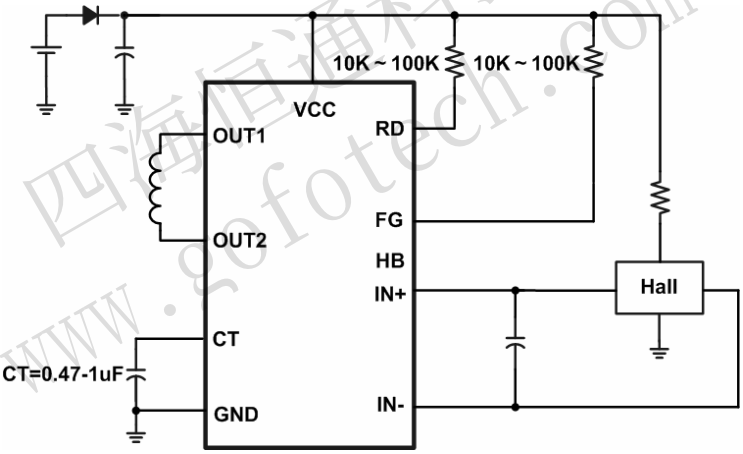


Figure 2.

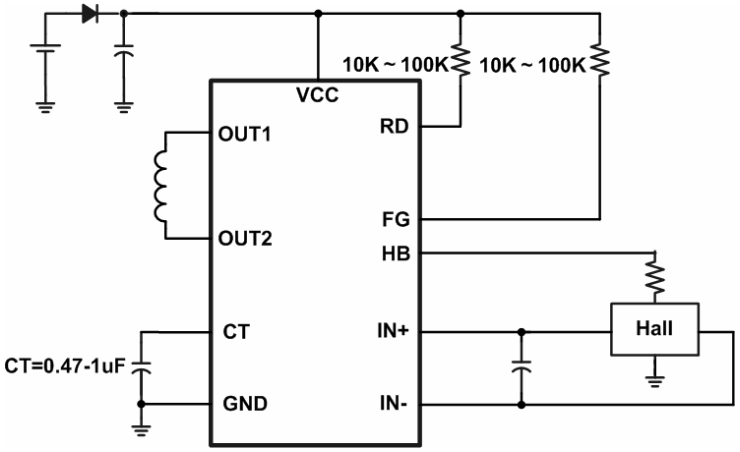


Figure 3.

Absolute Maximum Ratings

- VCC,RD and FG to GND ---------- -0.3V to 14V
- Other Pins to GND ---------- -0.3V to 6V
- IFG/IRD ---------- 5mA
- IHB ---------- 10mA
- Power Dissipation (MSOP-10) ---------- 780mW
- Operating Temperature ---------- -30°C +90°C
- Storage Temperature Range ---------- -55°C +150°C
- ESD Ratings
  Human Body Mode ---------- 3kV

Recommended Operating Conditions at T_A = +25°C

- Supply Voltage, VCC ---------- 1.8V to 13.8V
- Common Mode Hall Input Range---------- 0.3V to VCC- 1.5V

Electrical Characteristics

Specifications in standard type face are for T_A=+25℃ and those with **boldface type** apply over the full Operating Temperature Range.(T_A =-30℃ ~+90℃)(VCC＝12V unless otherwise specified.)

Symbol	Parameter	Conditions	EUM6883			Unit
			Min.	Typ.	Max.	
ICC1	Supply current	At drive mode	-	4.5	8	mA
ICC2		At lock mode	-	5	7	
Lock Protection Block						
VCT1	CT discharge voltage		1.1	1.2	1.25	V
VCT2	CT charge voltage		0.58	0.6	0.66	V
ICT1	CT charge current		1.48	1.6	1.84	µA
ICT2	CT discharge current		0.13	0.16	0.18	µA
RCT	CT charge/discharge current ratio	RCT = ICT1 / ICT2	8	10	12	-
Output						
Gio	Input-Output voltage gain		**47**	51	**54**	dB
VOL	Output lower side saturation	Io=250mA	-	0.11	**0.18**	V
VOH	Output upper side saturation	Io=250mA	-	0.39	**0.51**	V
Hall Input and Hall Bias						
VHN	Hall input hysteresis	Zero to Peak Value	7.3	10	12.2	mV
VHB	HB output voltage	IHB=5mA	**1.32**	1.50	**1.61**	V
FG and RD Function						
VFG	FG low voltage	IFG = 5mA	-	90	**180**	mV
IFGL	FG leak current	VFG = 12V	-	0.1	**5**	µA
VRD	RD low voltage	IRD = 5mA	-	90	**180**	mV
IRDL	RD leak current	VRD = 12V	-	0.1	**5**	µA

Application Sections

Hall signal input terminals (H+、H-)

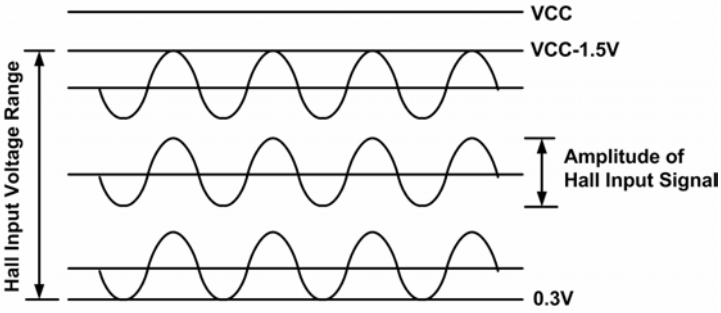


Figure 4. Hall Input Voltage Range

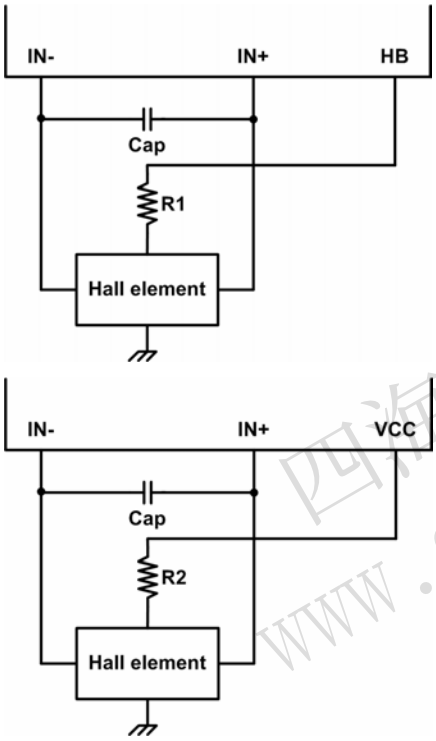


Figure 5. Hall Element

A Hall sensor can be connected to HB or VCC. Use R1 or R2 to limit the current bias to a Hall element. Make sure the hall signal amplitude input within range of 0.3V~Vcc-1.5V. If the noise influences the hall signal on the board, connect a small 100pF ceramic capacitor between IN+ and IN-.

Linear Control Drive Mode

The output signal of EUM6883 is the amplified version of the hall input signal. When the amplitude of hall signal is small, the output rises or fail slowly. Oppositely, the amplitude of hall signal is big, the output rises and falls quickly. The hall-input/to output gain is about 51dB (TYP). Adjust Hall input bias current and set Hall signal amplitude to get an adequate amplitude of the output signal.

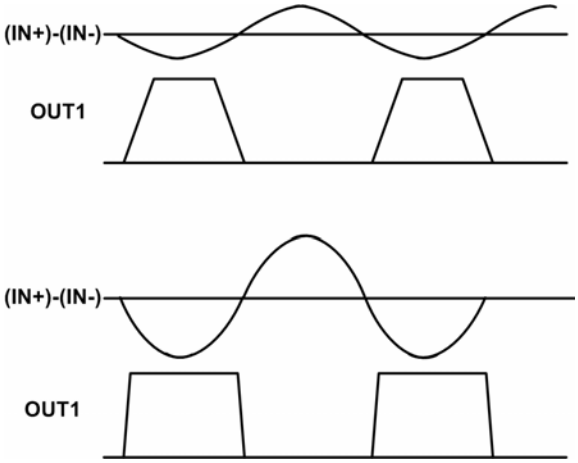


Figure 6.

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Reverse Connection of Power Supply

Reverse connection of power supply will damage the device. Insert a reverse current protection diode between power supply and Vcc pin (see Figure3 and Figure 4.)

Power Supply Line

The motor Back Electromotive Force (BEMF) will causes the motor coil re-circulate current back to power supply. Connect a 1μF ceramic capacitor between VCC and GND to absorb the re-circulating current.

Thermal Design

The thermal design should allow enough margin for actual power dissipation. See Figure 7 for EUM6883 power dissipation data.

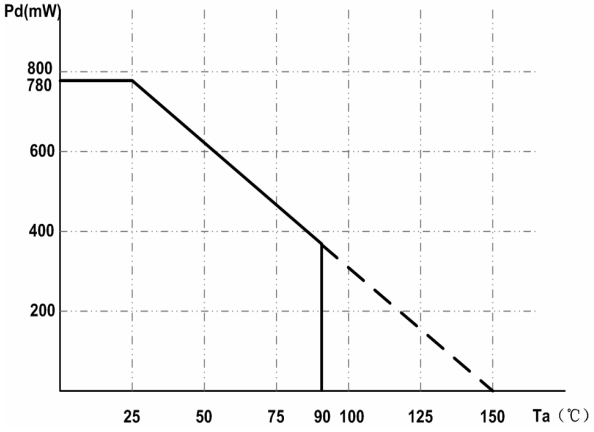


Figure 7. To use temperature above T_A=25°C reduce 6.24mW/°C.

EUM6883 has built in 170℃ thermal shutdown (TSD) with 25℃ hysteresis (See Figure 8).

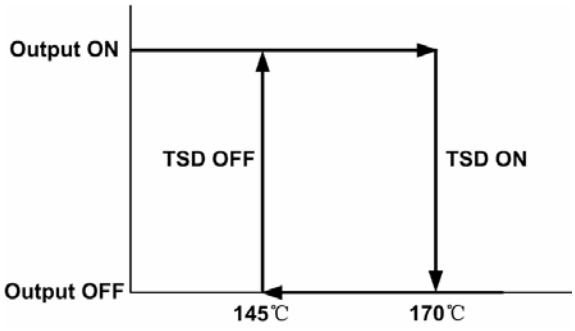


Figure 8.

TSD ON (TYP. : 170℃) All output transistor OFF.
TSD OFF (TYP. : 145℃) Reset ordinary motion.
(The temperature hysteresis is 25℃ <TYP.>)

Lock Protection and Auto Restart

When the motor lock is detected, outputs will be turned off by the lock protection function. After a few seconds, the auto restart circuit tries to start motor. If the motor lock persists, the lock protection will turn off outputs again for a few seconds until next restart time comes. The lock protection and restart time can be set by the capacitor between CT and GND. See EUM6883 operation truth table below.

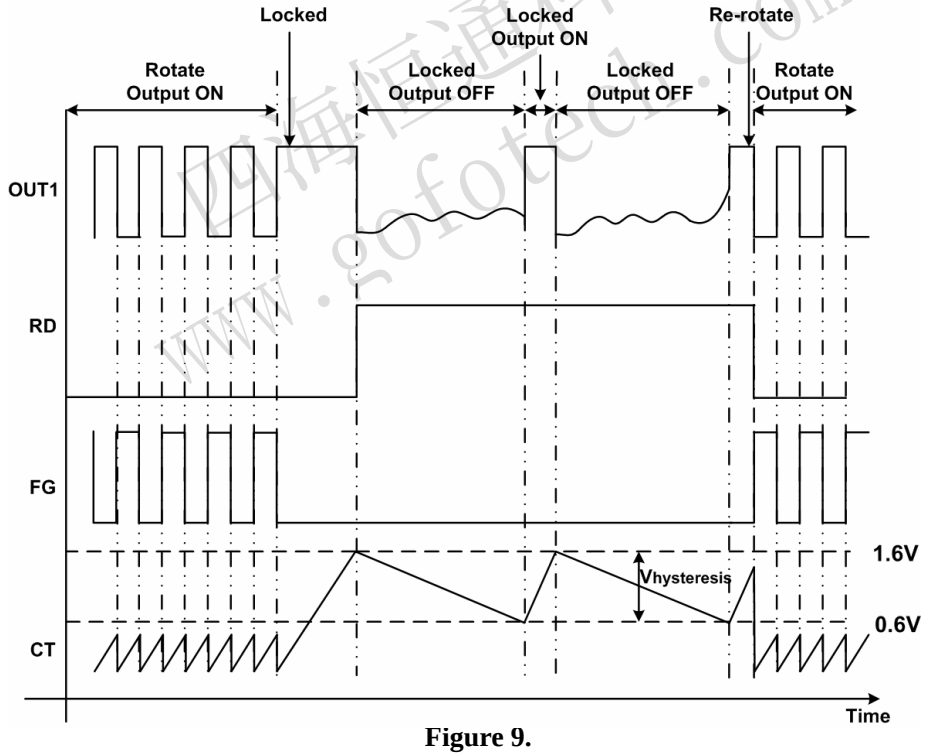


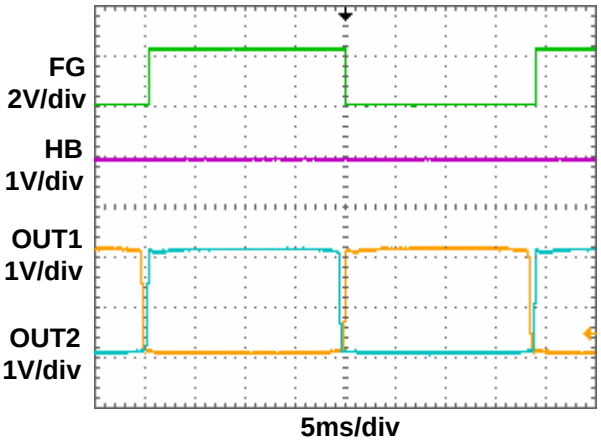
Figure 9.

EUM6883 Operation Truth Table

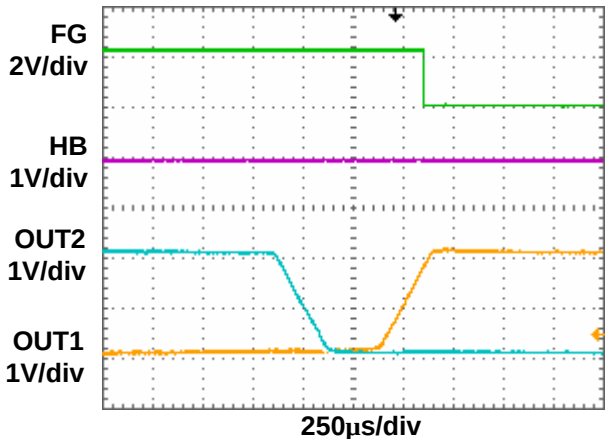
IN-	IN+	CT	OUT1	OUT2	FG	RD	Mode
H	L	L	H	L	L	L	Rotation
L	H		L	H	H		
-	-	H	L	L	-	H	Lock mode

Typical Operating Characteristics

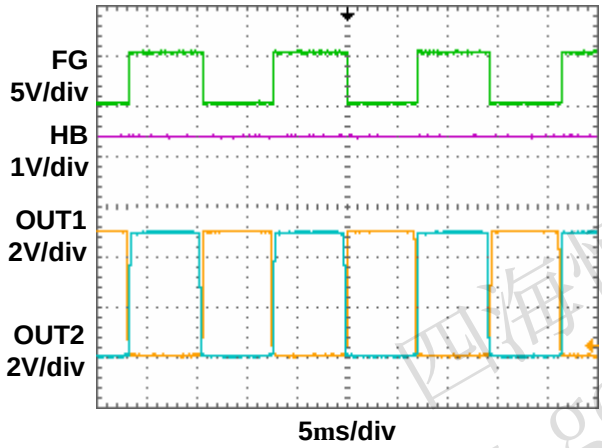
EUM6883 VCC=2.2V (zoom out)



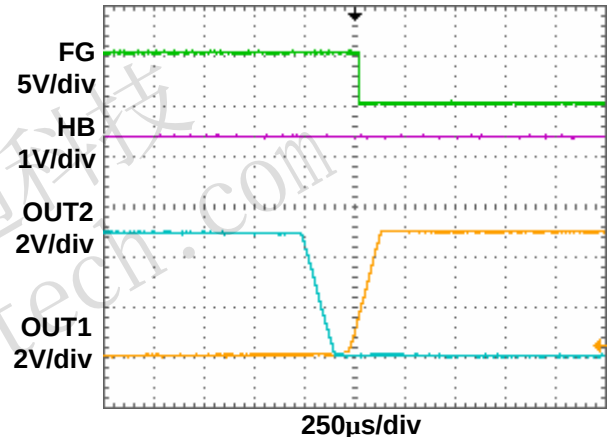
EUM6883 VCC=2.2V (zoom in)



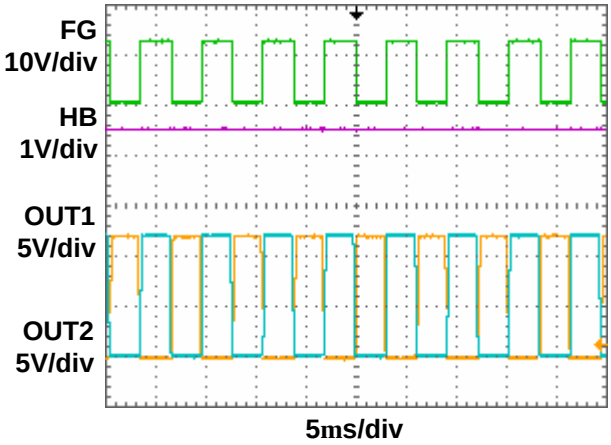
EUM6883 VCC=5.0V (zoom out)



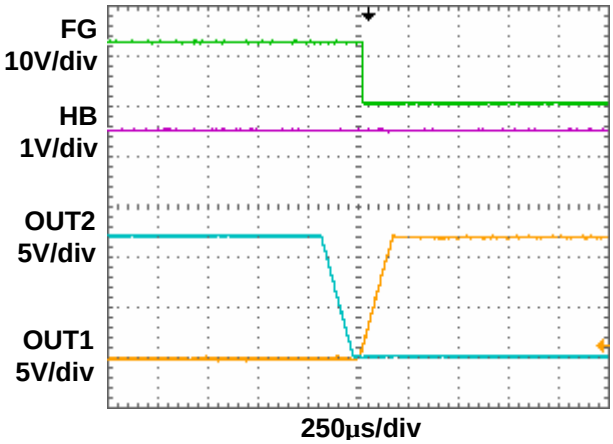
EUM6883 VCC=5.0V (zoom in)



EUM6883 VCC=12V (zoom out)

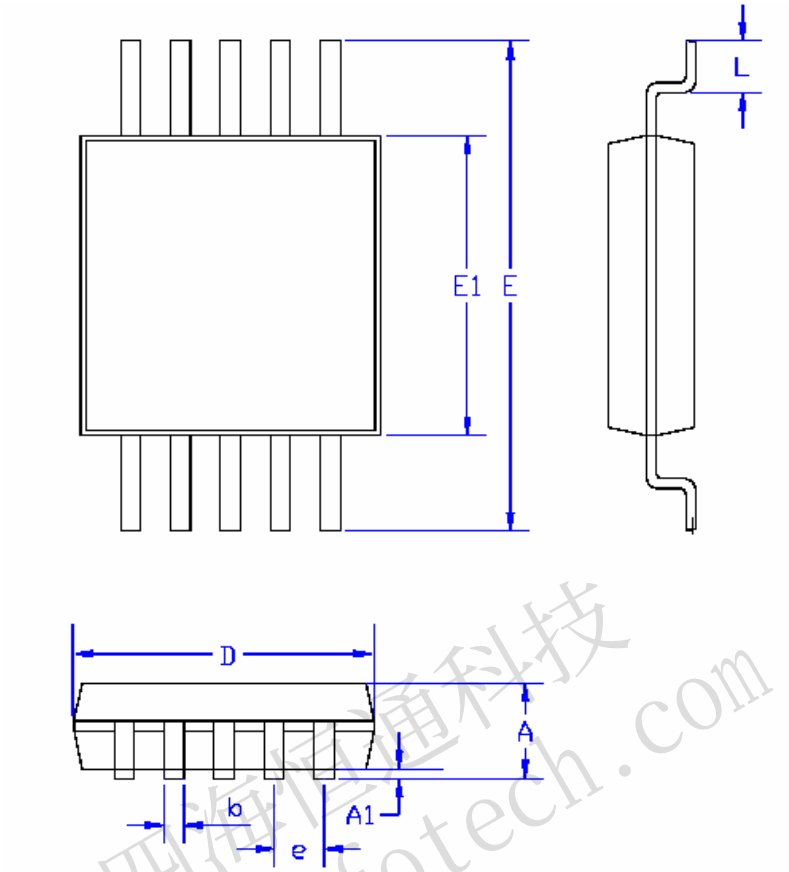


EUM6883 VCC=12V (zoom in)



Packaging Information

MSOP-10



SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	-	1.22	-	0.048
A1	0.00	0.15	0.000	0.006
D	3.00		0.118	
E1	3.00		0.118	
E	4.70	5.10	0.185	0.201
L	0.40	0.80	0.016	0.031
b	0.15	0.33	0.006	0.013
e	0.50		0.020	