

General Description

The OCH29893 is a single-phase, brushless DC motor driven IC. The device is using high voltage BCD process includes an op-chip Hall sensor for magnetic sensing an amplifier that amplifies the Hall voltage, a low R_{DS(on)} H bridge (full bridge) driver. The OCH29893 has a 3.5V to 28V wide input voltage range.

The OCH29893 integrates soft start function. With soft start function OCH29893 can effectively reduce the peak current when power on, reduce fan driver audible noise and power loss.

The OCH29893 integrates rotor deadlock (RD) signal output in SOT23-6F package.

Full protection features include under-voltage lockout (UVLO), rotor deadlock protection, thermal shutdown and the current-limit protection.

The OCH29893 is available in SIP-4L, SOT23-6F package and is rated over the -40°C to 125°C.

Features

- One-chip Solution (Hall Element + Driver)
- Wide 3.5V to 28V Operating Input Range
- Integrated 0.7Ω full bridge driver
- High Sensitivity Hall Sensor: $\pm 25\text{GS}$
- Built-in Soft On/Off Phase Transition
- Built-in Soft Start and Soft Restart Function
- Lock-shutdown protection & auto-restart function
- Rotor Deadlock (RD) Signal(SOT23-6F)
- Thermal Protection and Automatic Recovery
- **ULTRA-SAFE®**
- **No Support Vcc PWM Speed Control**
- RoHS Compliant
- Available in SIP-4L(TO94), SOT23-6F package

Applications

- Single Coil DC Brushless Fan
- Single Coil DC Brushless Motor

Pin Configuration

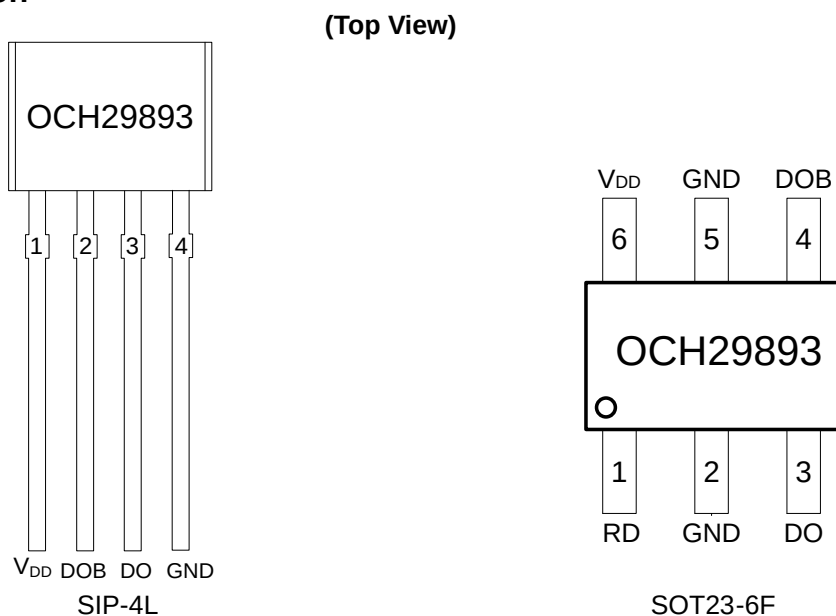


Figure 1, Pin Assignments Of OCH29893

Pin Name	Pin Number		Pin Function
	SIP-4L	SOT23-6F	
VDD	1	6	Positive Power Supply
DOB	2	4	Output 2
DO	3	3	Output 1
GND	4	2、5	Ground
RD	-	1	RD Signal Output



■ Typical Application Circuit

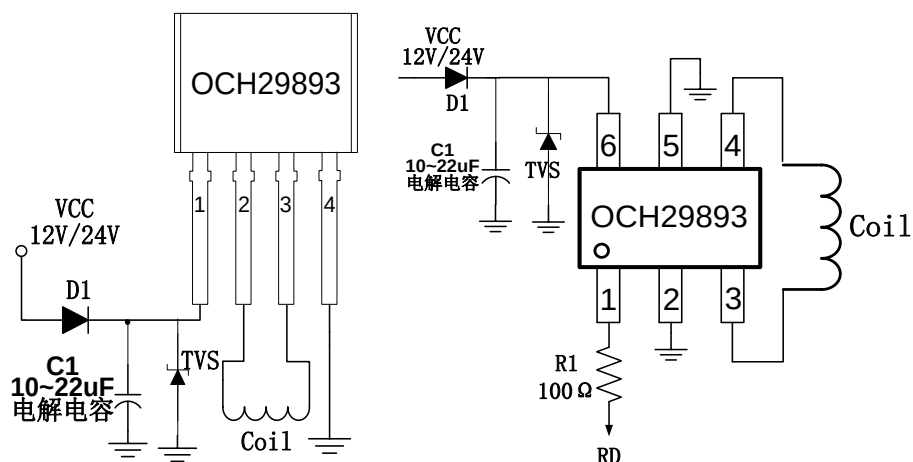


Figure 2, Typical Application Circuit of OCH29893

Note:1. When the power pulse is relatively large (24V application), Must use least C1=4.7μF (ceramic capacitor) capacitor for the decoupling between VDD and GND and place the capacitor as close to the IC as Possible.

2. To avoid high voltage spikes caused by the energy stored in the motor inductor charges back to the input capacitor side, add a voltage clamping transient voltage suppressor (TVS) diode.

■ Ordering Information

Part Number	Signal Type	Package Type	Packing Qty.	B _{OP} (Gauss)	B _{RP} (Gauss)	Temperature	Eco Plan	Lead
OCH29893ME	-	SIP-4L	1000pcs /Bag	25 (Typ.)	-25(Typ.)	-40~ +125°C	ROHS	Cu
OCH29893TOAE	RD	SOT23-6F	3000pcs /Reel	25 (Typ.)	-25(Typ.)	-40~ +125°C	ROHS	Cu

■ Block Diagram

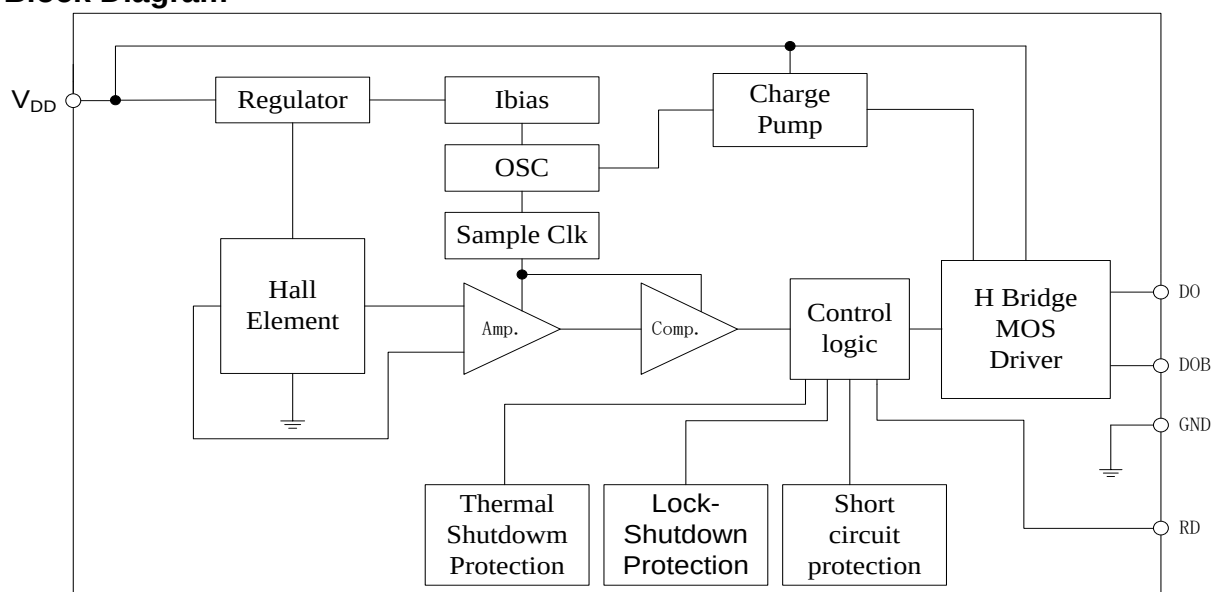


Figure 3, Block Diagram Of OCH29893

■ Absolute Maximum Ratings¹ (T_A=25°C, unless otherwise noted)

Parameter		Symbol	Rating	Unit
V _{DD} , DO、DOB Pin to GND		V _{DD} , V _{DO} , V _{DOB}	+30	V
Continuous Output Current (SIP-4L)		I _{O(CONT)}	600(12V) 400(24V)	mA
Hold Output Current (SIP-4L)		I _{O(HOLD)}	2(12V) 1.1(24V)	A
Continuous Output Current (SOT23-6F)		I _{O(CONT)}	400(12V) 300(24V)	mA
Hold Output Current(SOT23-6F)		I _{O(HOLD)}	1.5(12V) 1.0(24V)	A
Junction temperature		T _J	160	°C
Continuous power dissipation(T _A =+25°C)	SIP-4L	P _d	0.86	W
	SOT23-6F	P _d	0.5	W
Thermal Resistance	SIP-4	θ _{JA}	157	°C/W
	SOT23-6F	θ _{JA}	236	°C/W
Storage Temperature Range		T _S	-40 to +150	°C
Operating Junction Temperature Range		T _J	-40 to +150	°C
Maximum Soldering Temperature (at leads, 10 sec)		T _{LEAD}	300	°C

■ Recommended Operating Conditions²

Parameter	Symbol	Rating	Unit
V _{DD} Pin Voltage to GND	V _{DD}	3.5 to 28	V
Operating junction Temperature Range	T _{OP}	-40 to +125	°C

Note: 1: Stresses above those listed in absolute maximum ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one absolute maximum rating should be applied at any one time.

2: The device is not guaranteed to function outside of its operating conditions.

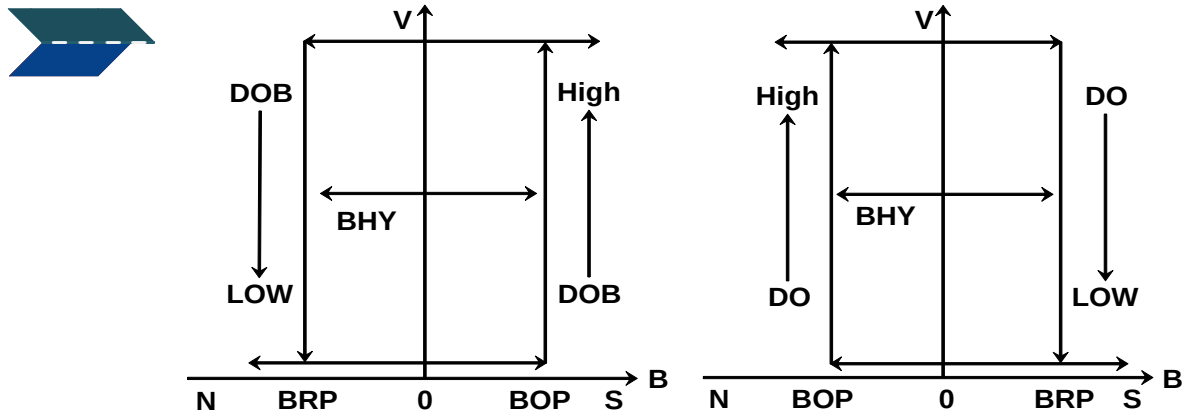
■ Electrical Characteristics

(V_{CC}=12V, T_A = 25°C unless otherwise noted.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply						
Input Voltage	V _{DD}		3.5		28	V
Supply Current	I _{DD}	Output Open	-	2.8	5	mA
Output						
Output On-Resistance	R _{DS(ON)}	I _O =0.4A	-	0.7	-	Ω
PWM output frequency	F _S		-20%	32	+20%	kHz
Soft turn-on angle	θ _{SOFTON}			24		°
Soft turn-off angle	θ _{SOFTOFF}			45		°
RD (SOT23-6F)						
RD low-level voltage	V _{RD}	B>BOP, I _{RD} =10mA	-	-	0.4	V
RD current clamp	I _{RD-CLAMP}	B>BOP, V _{RD} =5V		50		mA
RD leakage current	I _{LEAKAGE}	B<BRP, V _{RD} =28V	-1		1	mA
Protection						
Thermal shutdown threshold	T _{SD}		160	175	-	°C
Thermal shutdown hysteresis	T _{SH}		-	40	-	°C
Locked Protection On Time	T _{ON}		0.34	0.45	0.56	Sec
Locked Protection Off Time	T _{OFF}		2.4	3.2	4	Sec
Output current limit	I _{LIM}		-	1.8	-	A
Magnetic Characteristics						
Operating Point	BOP		5	25	45	Gauss
Release Point	BRP		-45	-25	-5	Gauss
Hysteresis	BHYS		20	50	80	Gauss



■ Operating Characteristics



SOT23-6F/SIP-4L

Figure 4, Magnetic Hysteresis Characteristics Of OCH29893

■ Truth Table

SOT23-6F/SIP-4L

Input	Output			Mode
B	DOB	DO	RD	Operation Mode
B _{OP}	H	L	L	
B _{RP}	L	H	L	
B _{OP}	H	H	OFF	Lock Mode
B _{RP}	H	H	OFF	

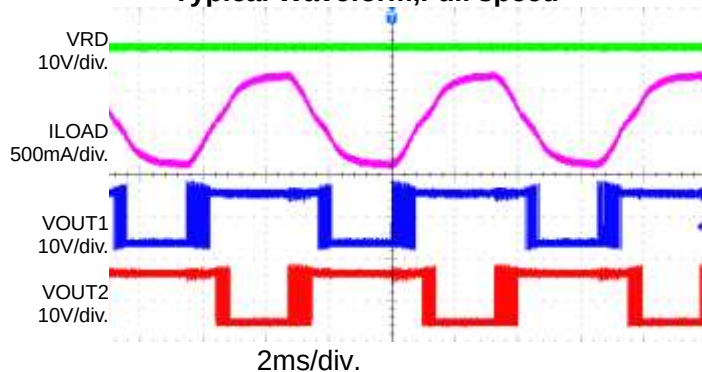


■ Typical Performance Characteristics

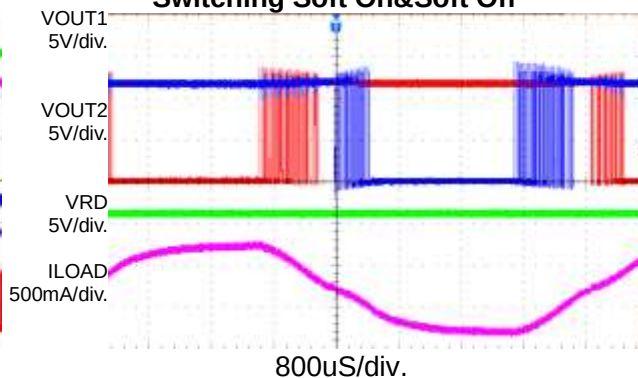
VCC = 12V, TA = 25°C, tested with fan unit, unless otherwise noted.

Typical Waveform,

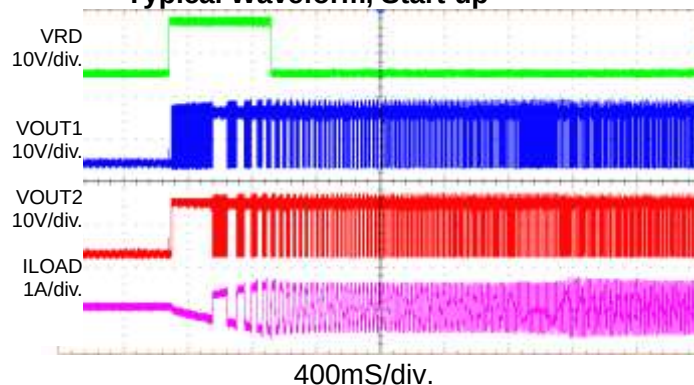
Typical Waveform, Full speed



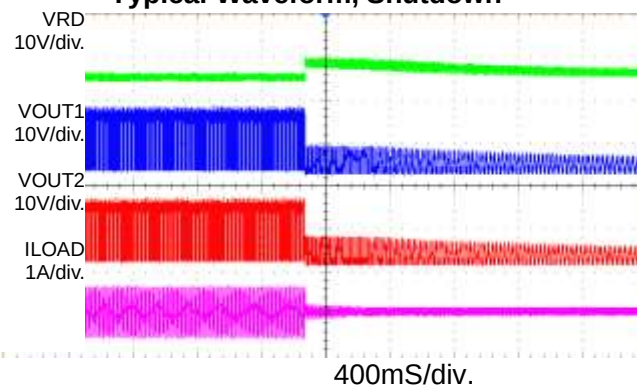
Switching Soft On&Soft Off



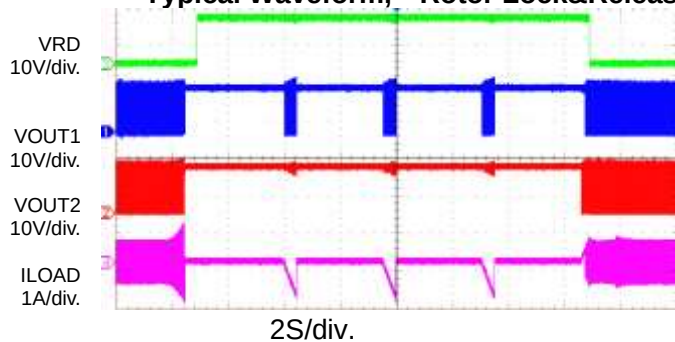
Typical Waveform, Start-up



Typical Waveform, Shutdown



Typical Waveform, Rotor Lock&Release



Output Switch Principle

The OCH29893 built in a Hall-effect sensor plane to sense the vertical magnetic flux density (B). There are two output drivers in OCH29893 to drive Single-phase DC brushless fan or motor. When the South pole magnetic field is close to the IC marking surface and the magnetic flux density higher than operate point (Bop), the DO pin output will turned to drive (Low) and the DOB pin output will turned to sink (High). When the South pole magnetic field far away the IC marking surface and North pole magnetic field close to the IC marking surface until the magnetic flux density higher than release point (Brp), the DO pin output will turned to sink (High) and the DOB pin output will turned to drive (low).

Rotor Lock and Restart Protection

The OCH29893 built in a rotor lock and restart protection, if the IC cannot detect the Hall sensor signal change during the detection Ton time , all MOSFETs of the H-bridge are turned off. After Toff recovery time , the IC attempts to start up again automatically.

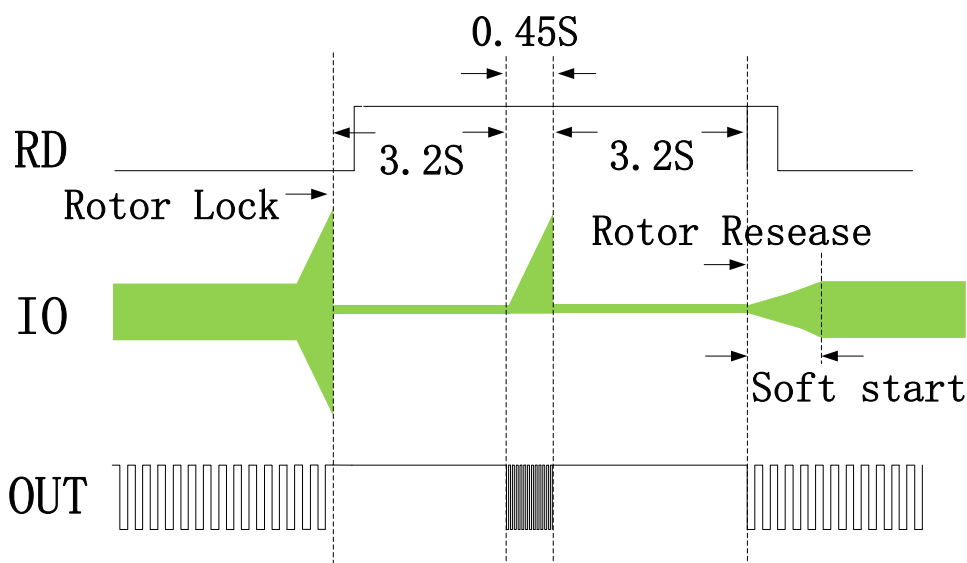


Figure 5, OCH29893 Rotor Lock and restart protection

Soft Switch

The IC controls the H-bridge MOSFET switching to reduce speed variation and increase system efficiency. With IC does soft on transition and soft off transition to keep smooth current and reduce fan vibration.

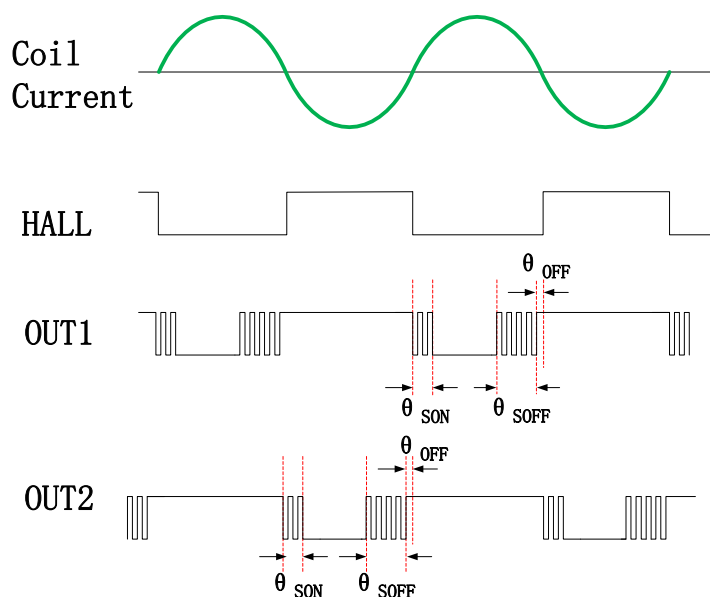


Figure 6, OCH29893 Soft Switch Function



Soft Start

The OCH29893 provides the soft-start function to avoid peak current at power-on and lock-restart moments. The typical soft start time is 1.3S.

Thermal Protection

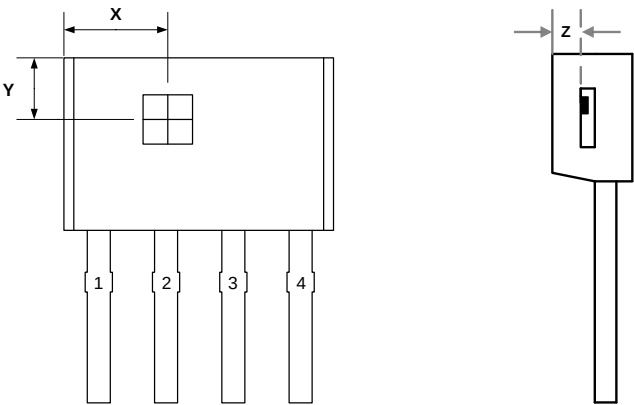
The OCH29893 has a thermal protection. When the internal junction temperature reaches 175°C(Typ.),the output devices will be switched off. When the IC's junction temperature cools by 40°C, the thermal sensor will turn the output devices on again, resulting in a pulsed output during continuous thermal protection.

Special ULTRA-SAFE® Design

The OCH29893 built in a special ULTRA-SAFE® design to protect the error short of any pins. When power on, if the IC is short circuit between any two pins, all MOSFETs of the H-bridge are turned off. After a recovery time, the IC will detection the short circuit whether to remove, the IC attempts to start up again automatically.

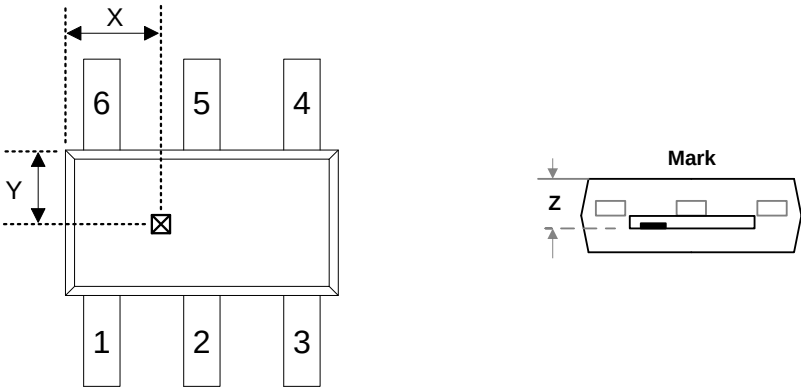


Hall Sensor Location



Orientation	Value	Unit
X	1.95	mm
Y	1.0	mm
Z	0.63	mm

SIP4L

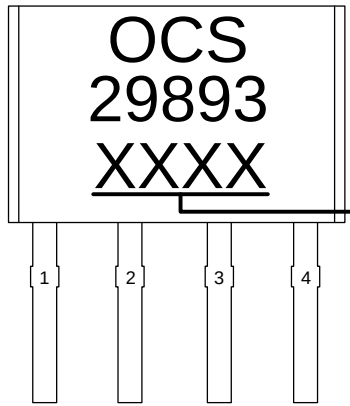


Orientation	Value	Unit
X	1.02	mm
Y	0.74	mm
Z	0.76	mm

SOT23-6F

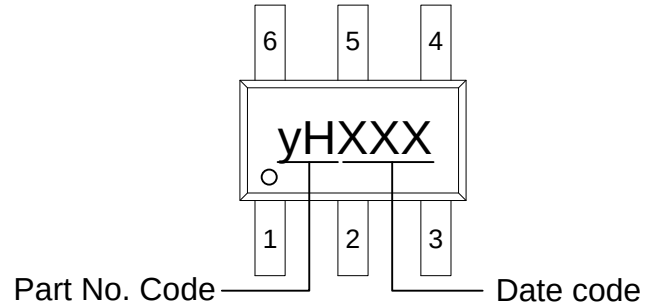


■ Marking Information



SIP-4L

Date code

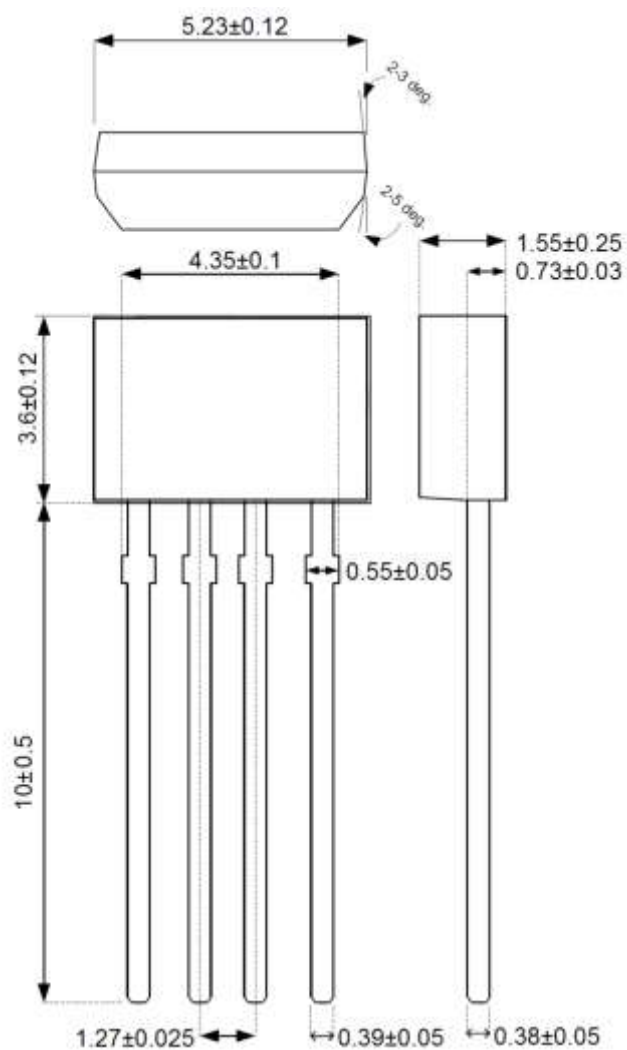


SOT23-6F

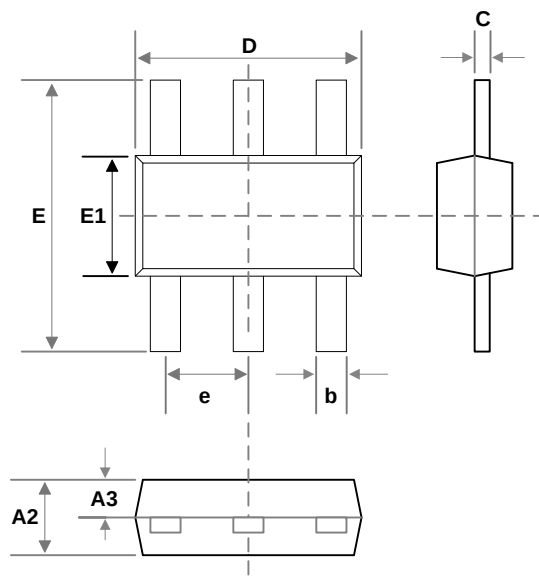


■ Package Information

(1)SIP-4L (Unit:mm)

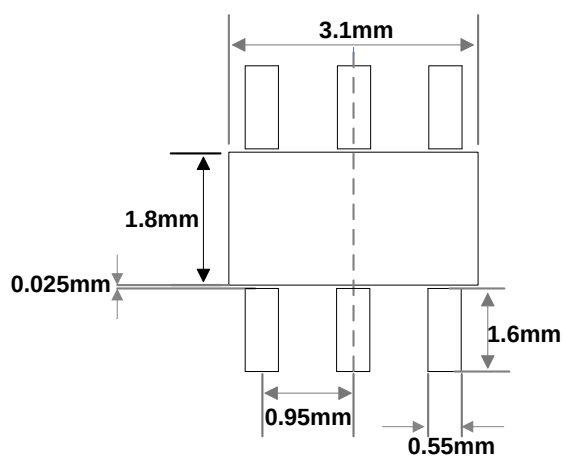


(2)SOT23-6F



Symbol	Dimensions In Millimeters (mm)			Dimensions In Inches (Inch)		
	Min.	Norm.	Max.	Min.	Norm.	Max.
A2	0.70	1.10	1.20	0.03	0.04	0.05
A3	0.40	0.45	0.50	0.01	0.02	0.02
b	0.30	0.40	0.50	0.01	0.02	0.02
C	0.09	0.16	0.26	0.00	0.01	0.01
D	2.70	2.90	3.10	0.11	0.11	0.12
E	3.40	3.60	3.80	0.13	0.14	0.15
E1	1.50	1.60	1.70	0.06	0.06	0.07
e	-	0.95	-	-	0.04	-

Recommended foot print pattern

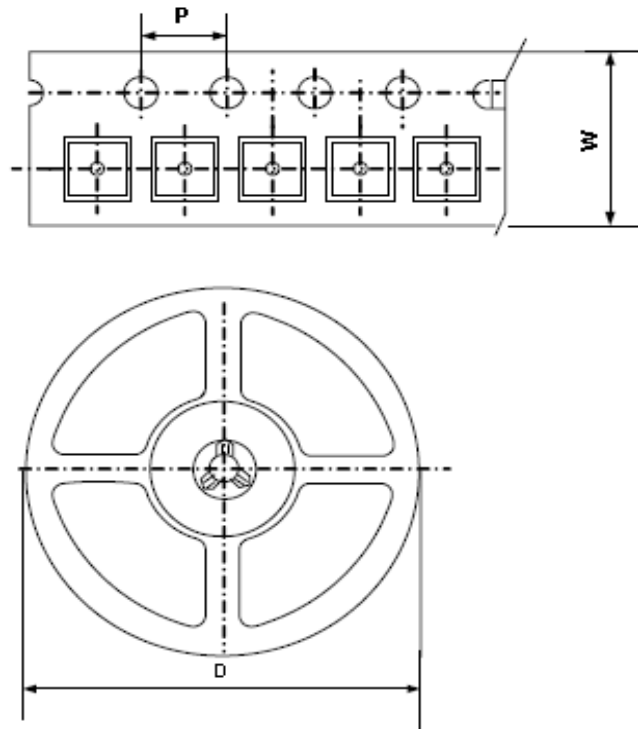


■ Packing Information

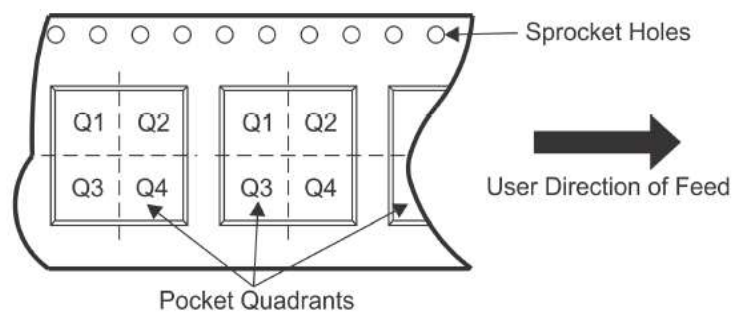
(1) SIP-4L

1. Packing type: Bag
2. Packing minimum: 1000pcs/Bag

(2) SOT23-6F



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Package Type	Carrier Width (W)	Pitch (P)	Reel Size(D)	Packing Minimum	PIN 1 Quadrant
SOT23-6F	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs	Q3

Note: Carrier Tape Dimension, Reel Size and Packing Minimum



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