SINGLE PHASE HALL EFFECT LATCH WITH LOCKED PROTECTION AH478

General Description

The AH478 is a single coil Hall sensor with output drivers designed for brush-less DC motor application. This IC consists of one H-bridge driver for motor's coil driving and has automatic lock shutdown and restart function relatively. To avoid coil burning, rotor lock shutdown detection circuit shut down the output driver if the rotor is blocked and then the automatic recovery circuit will try to restart the motor. This function repeats while rotor is blocked. Until the blocking is removed, the motor recovers running normally.

If a magnetic flux density is larger than threshold B_{OP}, the DO is turned to sink and DOB is turned to drive. This output state is held until a magnetic flux density reversal falls below $B_{RP,}$ causing DO to be turned to drive and DOB turned to sink.

This IC is available in TO-95 package.

Features

- On-chip Hall Sensor
- Rotor-locked Shutdown
- Automatically Restart
- Operating Voltage: 3.5 to 18V
- High Output Sourcing/Sinking Capability up to 300mA
- Bi-direction H-type Output Drivers for Single Coil
- Internal Bandgap Regulator for Temperature Compensation
- Low Output Switching Current Noise
- Operating Temperature: -20 to 85°C
- Low Profile TO-95 Package
- ESD Rating: 3000V (Human Body Model)

Applications

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

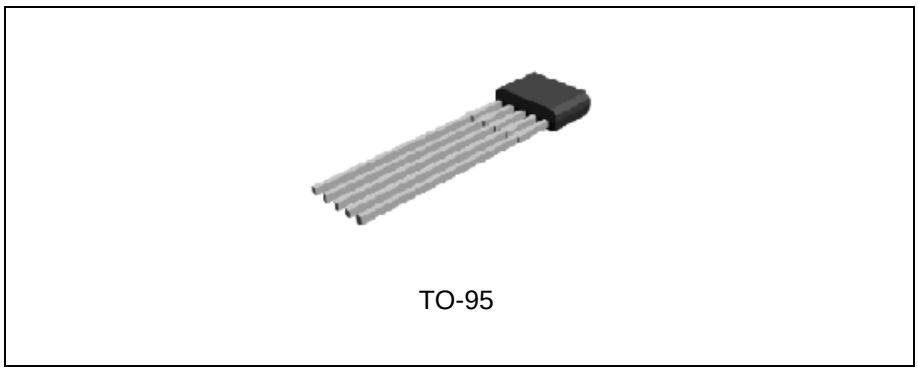


Figure 1. Package Type of AH478

Pin Configuration

Z5 Package
(TO-95)

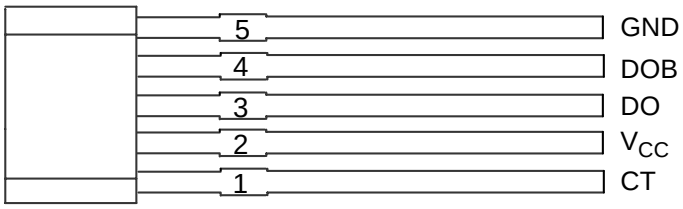


Figure 2. Pin Configuration of AH478 (Front View)

Pin Description

Pin Number	Pin Name	Function
1	CT	Lock and rotation setting capacitor terminal
2	V_{CC}	Supply voltage
3	DO	Output 1
4	DOB	Output 2
5	GND	Ground

Functional Block Diagram

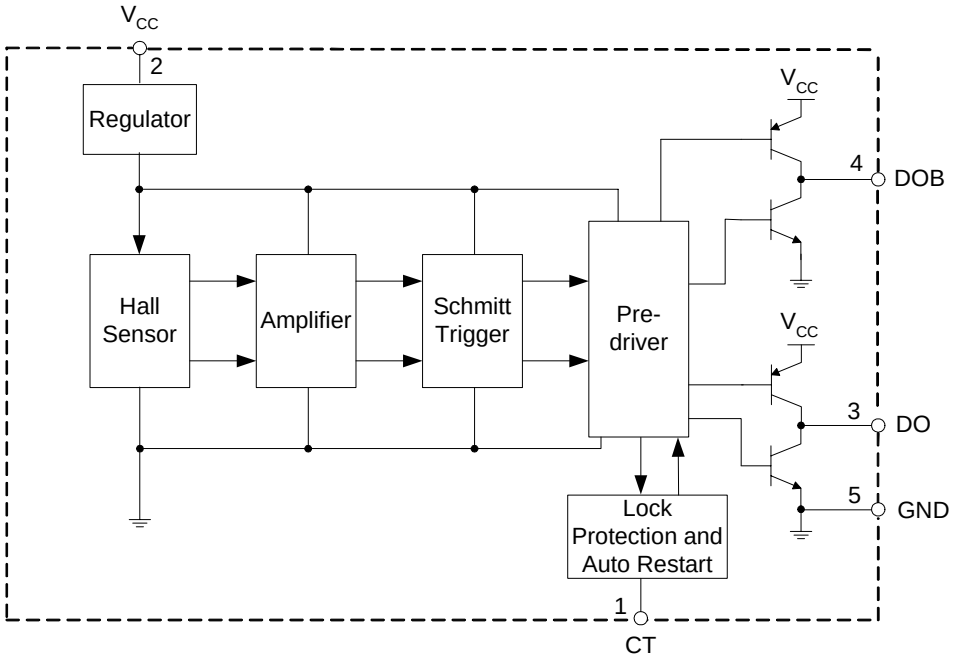
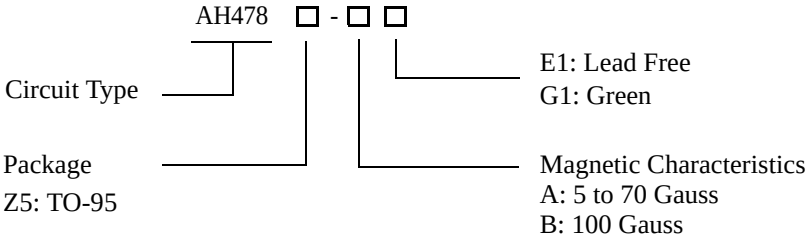


Figure 3. Functional Block Diagram of AH478

Ordering Information



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
TO-95	-20 to 85°C	AH478Z5-AE1	AH478Z5-AG1	AH478Z5-E1	AH478Z5-G1	Bulk
		AH478Z5-BE1	AH478Z5-BG1	AH478Z5-E1	AH478Z5-G1	Bulk

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green package.

Absolute Maximum Ratings (Note 1)

(T_A=25°C)

Parameter		Symbol	Value	Unit
Supply Voltage		V_{CC}	20	V
Magnetic Flux Density		B	Unlimited	Gauss
Output ON Current	Continuous	I_{OUT}	250	mA
	Hold		300	mA
	Peak (start up)		600	mA
Power Dissipation		P_D	600	mW
Thermal Resistance	Die to atmosphere	θ_{JA}	208	°C/W
Storage Temperature		T_{STG}	-50 to 150	°C
ESD (Machine Model)			300	V
ESD (Human Body Model)			3000	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. "Absolute Maximum Ratings" for extended period may affect device reliability.

Recommended Operating Conditions

(T_A=25°C)

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	3.5	18	V
Ambient Temperature	T_A	-20	85	°C

Electrical Characteristics

(T_A=25°C, V_{CC}=14V, unless otherwise specified)

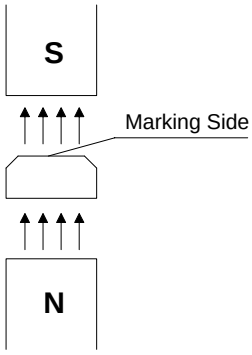
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output Saturation Voltage (Sink)	V_{SAT}	I_{OUT}=150mA		0.2	0.25	V
Output Saturation Voltage (Drive)		I_{OUT}=150mA	V_{CC}-1.0	V_{CC}-0.8	V_{CC}	V
Supply Current	I_{CC}	V_{CC}=20V, output open		14	16	mA
Output ON Time	T_{ON}	R_L=820Ω, C_{CT}=0.47μF		135		ms
Output OFF Time	T_{OFF}	R_L=820Ω, C_{CT}=0.47μF		1		s
Charge Current	I_{CHG}	V_{CT}=1 to 2.5V		3.5		μA
Discharge Current	I_{DHG}	V_{CT}=3.5 to 2.5V		0.5		μA
Duty Ratio	D_R	T_{OFF}/T_{ON}	5	7	10	
Clamp Voltage	V_{CL}	Limiting Voltage		2.8		V
Comparator Voltage	V_{CP}	Limiting Voltage		1.8		V
Thermal Resistance (Junction to Case)	θ_{JC}	TO-95		45		°C/W

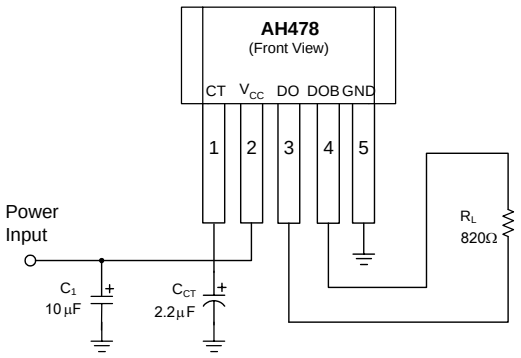
Magnetic Characteristics

(T_A=25°C)

Parameter	Symbol	Grade	Min	Typ	Max	Unit
Operating Point	B_{OP}	A	5		70	Gauss
		B			100	
Releasing Point	B_{RP}	A	-70		-5	Gauss
		B	-100			
Hysteresis	B_{HYS}			70		Gauss

Test Circuit





Typical Performance Characteristics

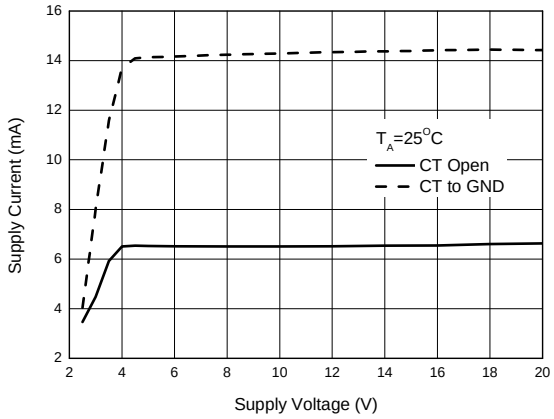


Figure 4. Supply Current vs. Supply Voltage

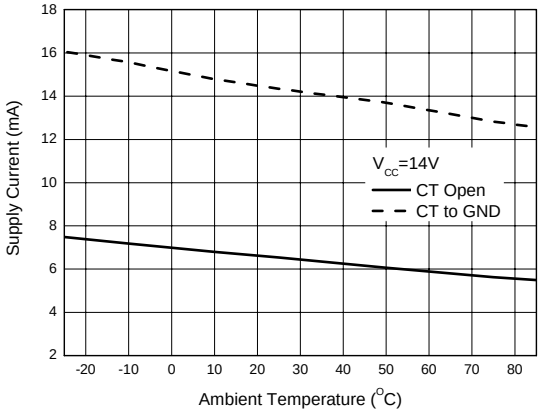


Figure 5. Supply Current vs. Ambient Temperature

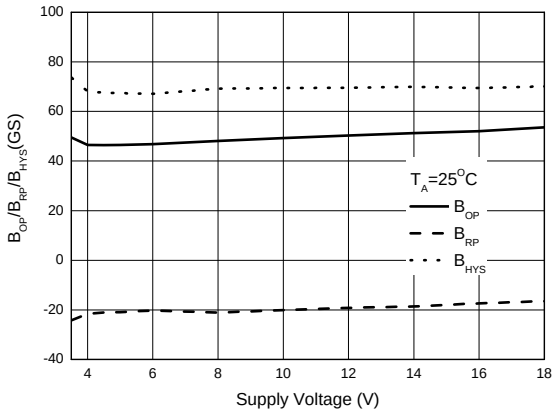


Figure 6. $B_{OP}/B_{RP}/B_{HYS}$ vs. Supply Voltage

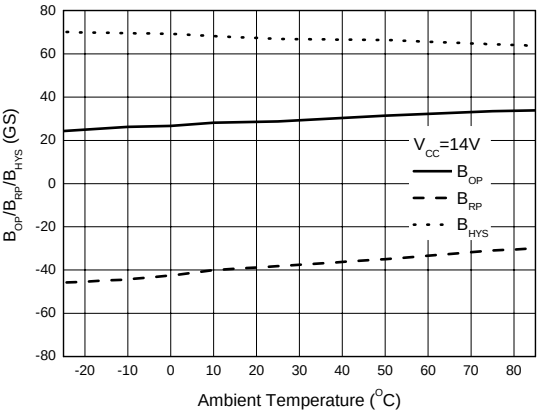


Figure 7. $B_{OP}/B_{RP}/B_{HYS}$ vs. Ambient Temperature

Typical Performance Characteristics (Continued)

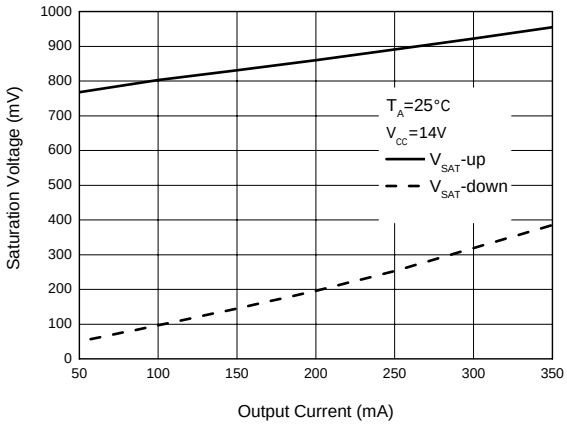


Figure 8. Saturation Voltage vs. Output Current

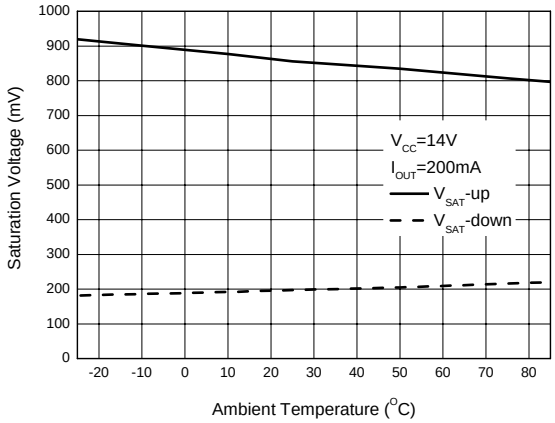


Figure 9. Saturation Voltage vs. Ambient Temperature

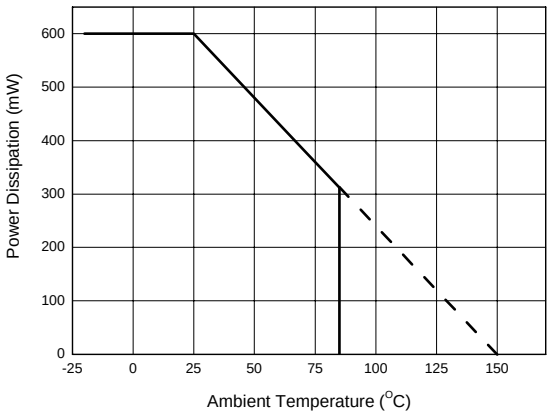
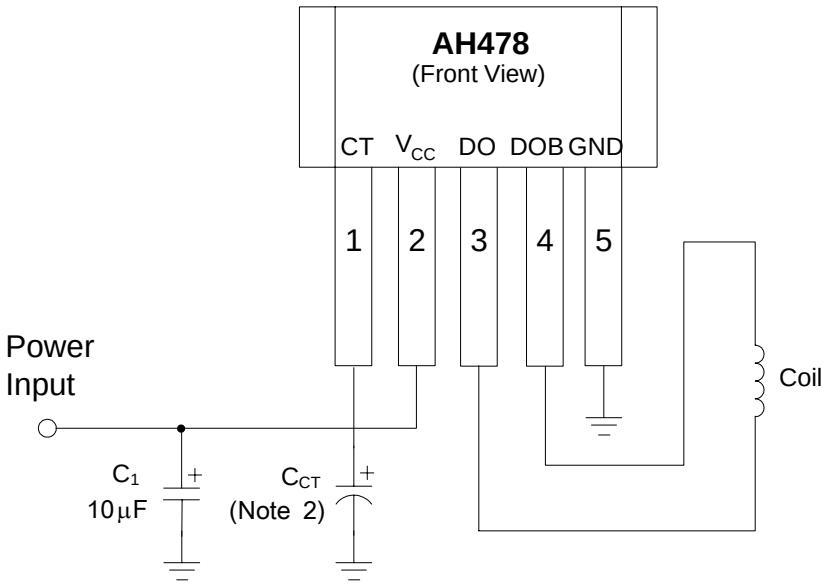


Figure 10. Power Dissipation vs. Ambient Temperature

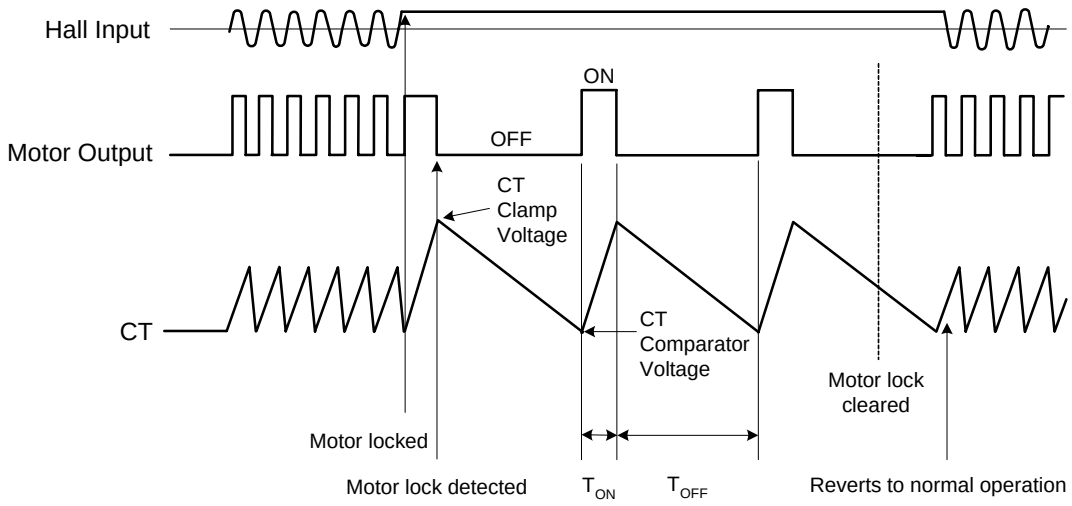
Typical Application



Note 2: The capacitance of C_{CT} can be selected from 1μF to 3.3μF, and the recommended value is 2.2μF.

Figure 11. Typical Application of AH478

Operating Diagram (Note 3)



Note 3: The automatic restart circuit detects a motor lock condition and automatically turns off the output current. When the lock is cleared, the IC automatically restarts and allows the motor to run. In AH478, automatic restart is performed in the following manner. A motor lock condition is detected when the Hall signal stops switching. The output is ON when CT pin is being charged, and OFF when CT pin is being discharged.

$$T_{ON} = \frac{C * (V_{CL} - V_{CP})}{I_{CHG}} (Sec)$$

$$T_{OFF} = \frac{C * (V_{CL} - V_{CP})}{I_{DHG}} (Sec)$$

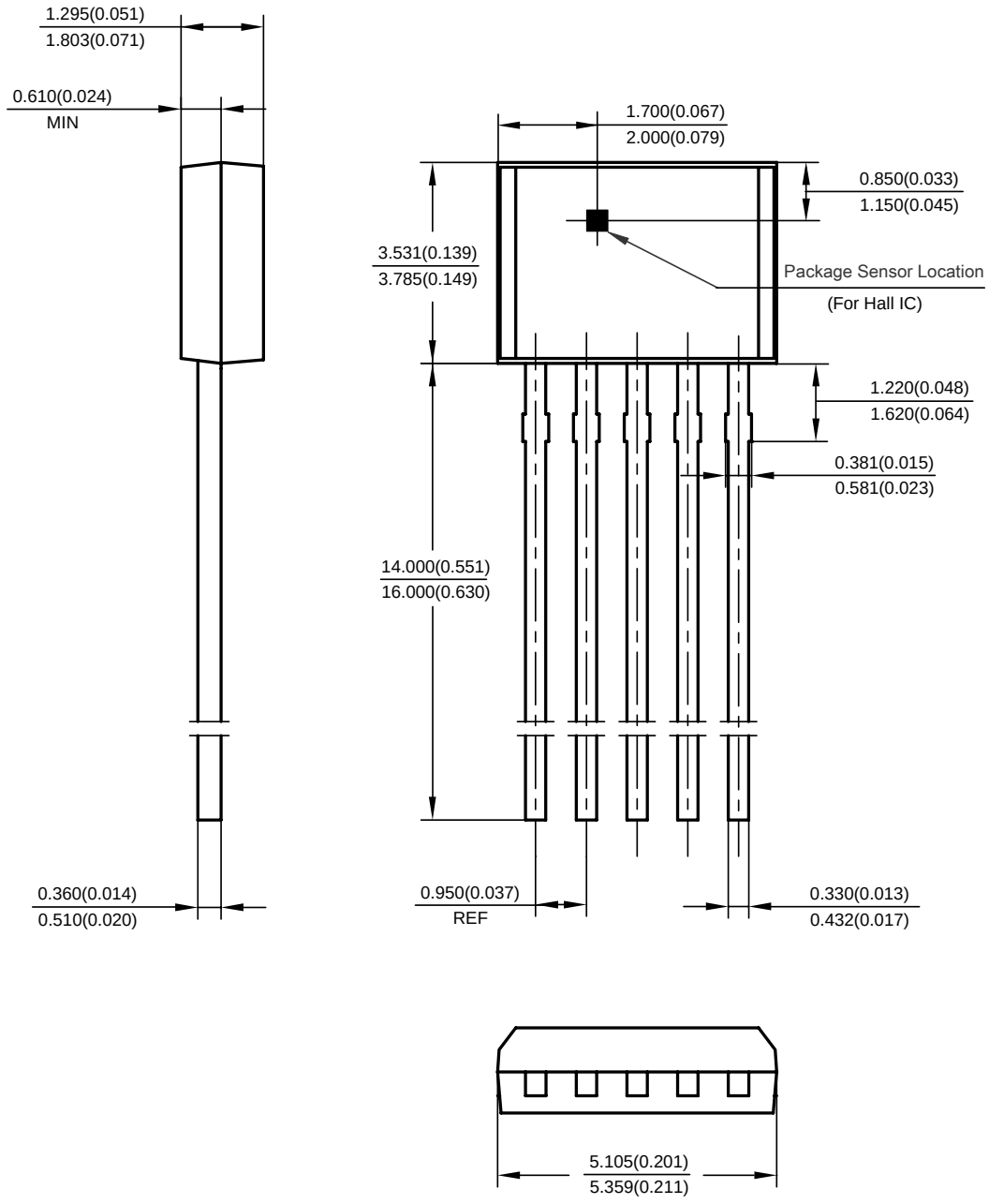
Output ON time (T_{ON}) and OFF time (T_{OFF}) are determined by C, the capacitance of the CT pin external capacitor.

V_{CL} is the CT pin clamp voltage
V_{CP} is the CT pin comparator voltage
I_{CHG} is the CT pin charge current
I_{DHG} is the CT pin discharge current

Figure 12. Control Timing Diagram of AH478

Mechanical Dimensions

TO-95 **Unit: mm(inch)**



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