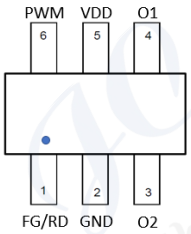
PL396V-A
Single-phase Smart Fan Driver PWM speed control

Applications
- Automotive cooling fan

Package:
TSOT-6pin (2.9x1.6x0.75mm)



Features
- Built-in high sensitivity(10G) hall sensor
- PWM/DC voltage speed control
- PWM open loop and closed loop speed control
- PWM programmable speed curve
- PWM Soft Switching silent control option
- Kickback commutation control and Low EMI
- Soft Start control
- Lead/Lag angle control
- FG/RD open drain output
- Quick start
- Protections
  - Locked protection and automatic restart
  - Current limit/Over current/Short circuit protection
  - Over temperature protection
  - Jump start/load dump/Over voltage protection
- Built-in Zener diode
- High balance and low thermal drift magnetic sensing
- Low power consumption and high driving efficiency
- I2C programming
- AEC Q100 QTP

Absolute Maximum Ratings (Ta=25℃)

Parameter	Symbol	Conditions	Rating	Units
Supply voltage	V_{DD}		-0.3~40	V
Max. output voltage (O1, O2)	V_{OMAX}		-0.3~V_{DD}+0.3	V
Max. output current (O1, O2)	I_{OMAX}		I_{OCP}	mA
Max. FG/RD output voltage	$V_{FG/RD\ MAX}$		-0.3~30	V
Max. FG/RD output current	$I_{FG/RD\ MAX}$		10	mA
Max. input voltage (PWM)	V_{INMAX}		-0.3~30	V
Junction temperature range	Tj		-40~165	°C
Storage temperature	Ts		-55~165	°C

*1: Should not exceed Pdmax

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Electrical Characteristics (T_J=25°C, V_{DD}=12V; unless otherwise noted)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Units
Supply Voltage	V_{DD}		3.2		32*	V
Over Voltage Protection threshold	V_{OVPx}	In V_{DD} rising OTP setting		17~35		V
Over Voltage Protection Hysteresis	V_{OVP_Hys}	In V_{DD} falling		1		V
Over Current Protection	I_{OCP}		1.6	1.8	2	A
Over Current de-bounce time	t_{OCD}			0.5		uS
Output On Resistance (High side+ Low side)	$R_{DS(On)}$	T_J=25℃,V_{DD}=12V, I_O=0.5A	1	1.5	2	ohm
		T_J=25℃,V_{DD}=3.5V, I_O=0.3A	1.1	1.7	2.6	ohm
		T_J=150℃,V_{DD}=12V,I_O=0.5A		2.2		ohm
Supply Current	I_{DD}	Output open		3.5	5	mA
FG(SDA) input H voltage	V_{IHSDA}	I2C mode	2			V
FG(SDA) input L voltage	V_{ILSDA}	I2C mode	GND		0.5	V
FG/RD output sink voltage	$V_{DSFG/RD}$	$I_{FG/RD}$=5mA		0.1	0.3	V
FG/RD output leakage current	I_{FG/RD_Leak}	V_{FG}=12V		0.1	1	uA
PWM digital input H voltage	V_{IHPWM}		2			V
PWM digital input L voltage	V_{ILPMM}		GND		0.5	V
PWM input frequency	f_{PWMI}		0.03		100	KHz
PWM input current	I_{PWM}	V_{PWM}=0V	-200	-150	-100	uA
PWM analog input voltage range (0%~100%)	V_{SP}	VSP mode	0.5		2.4	V
PWM output frequency	f_{PWMO}		20	25	30	KHz
Current limit	I_{CLx}	OTP setting		250~1050		mA
Current limit de-bounce time	t_{CLD}			1.5		uS
Lock detection time	T_{LOCK}	OTP setting	0.32		1.6	S
Lock protection on time	T_{ON}	OTP setting	0.16		1.28	S
Lock protection off/on ratio	T_{OFF}/T_{ON}	OTP setting	6		20	-
Thermal Protection Temperature	TJ_{TSD}	In temperature rising		165		℃
Thermal Protection Hysteresis	ΔT_{TSD}	In temperature falling		25		℃
Magnetic Characteristics (T_J=25°C, V_{DD}=12V, unless otherwise noted)						
Operate Point	B_{OP}		5	10	25	G
Release Point	B_{RP}		-25	-10	-5	G
Hysteresis	B_{HYS}		10	20	40	G

Truth Table

Parameter	Test Condition	O1	O2	Rotation Mode		Lock Mode	
				FG	RD	FG	RD
North Pole	B<Brp	H	L	L	L	H	H
South Pole	B>Bop	L	H	H	L	H	H

O1 Output = High

General Specifications

The PL396V-A is a variable speed smart fan driver IC with built-in Hall sensor. The built-in dynamic offset cancellation of pre-amplifier stage achieves optimal symmetrical magnetic sensing. The output driver provides a PWM soft switching to eliminate acoustic noise. Further, the lead/lag angle commutation phase control to achieve optimal motor efficiency and EMI performance. PL396V-A is also featuring with jump start and load dump protection according to ISO16750-2. This IC is an optimal solution with PWM speed control for Automotive DC brushless fan motor application.

The Driver IC architecture block diagram is shown in Fig. 1.

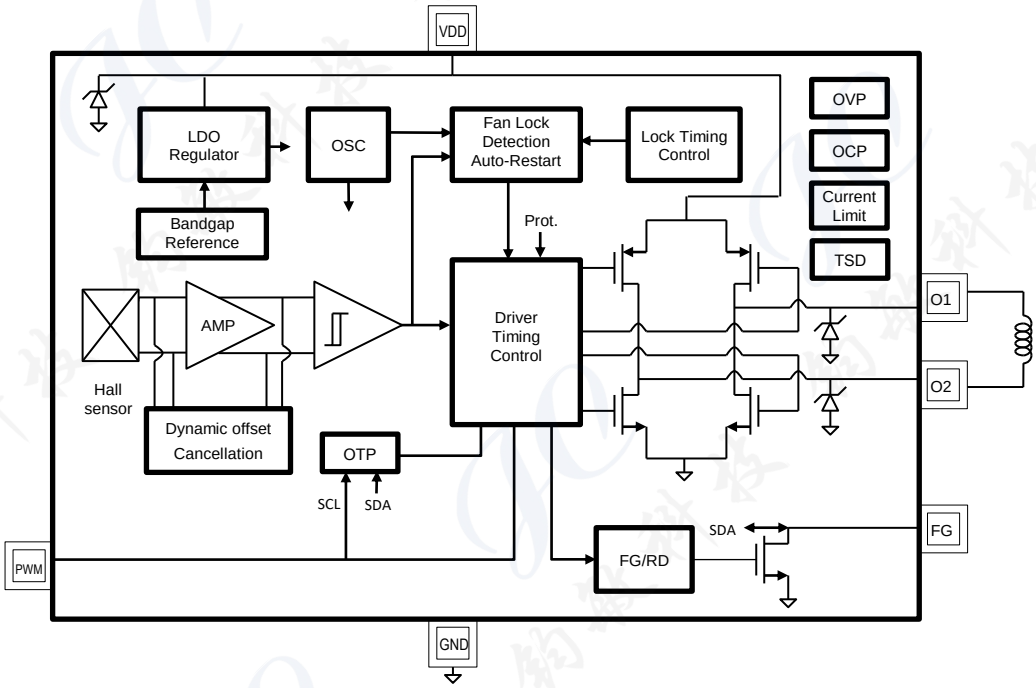


Fig1. Smart Fan Driver IC block diagram

Hall Sensor

This Hall-effect sensor IC integrates sensor, pre-amplifier with dynamic offset cancellation and the hysteresis comparator in single chip. The hysteresis characteristic is illustrated in Fig. 2 and the threshold of the magnetic flux density is +/-10 Gauss.

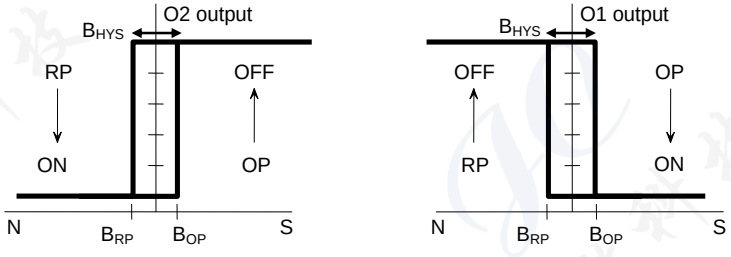
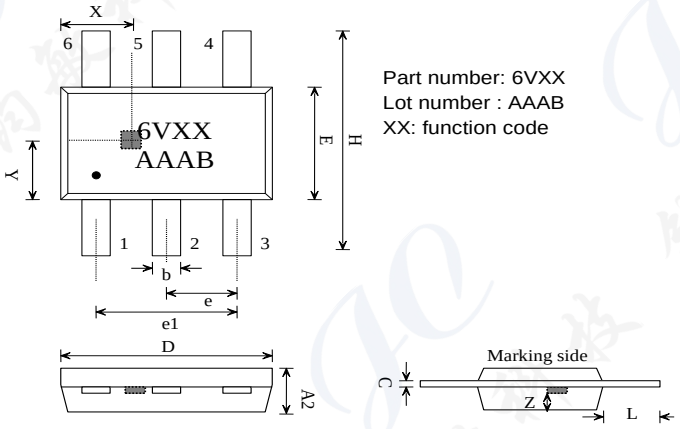


Fig 2. Magnetic Hysteresis Characteristics(Marking side)

Pin Description and Package Information

TSOT-6pin (2.9x1.6x0.75mm)

NAME	Pin	Description
FG/RD(SDA)	1	FG/RD output pin; SDA: programming mode: Data I/O
GND	2	DC ground
O2	3	Second output pin
O1	4	First output pin
VDD	5	DC power supply
PWM(SCL)	6	PWM input pin; SCL: programming mode: Clock input.

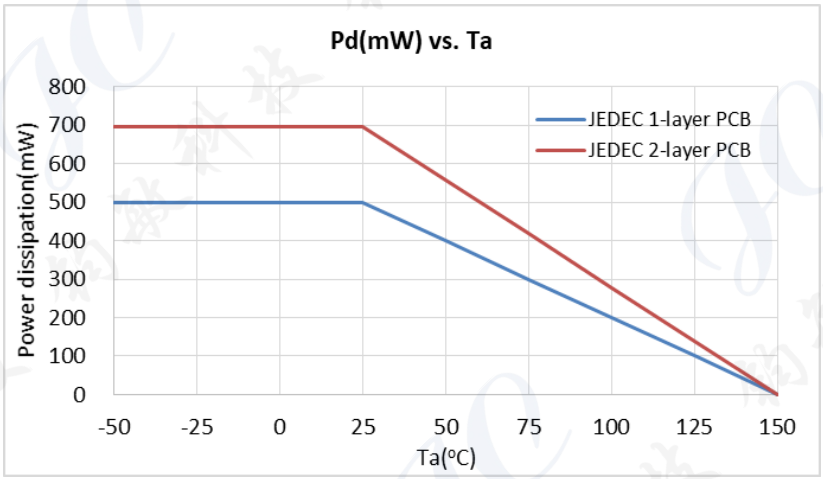


SYMBOLS	DIMENSIONS IN MILLIMETERS(mm)		
	MIN	NOM	MAX
A2	0.70	0.75	0.775
b	0.35	-	0.50
C	0.10	-	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
H	3.60	3.80	4.00
e	0.80	0.95	1.10
e1	1.70	1.90	2.10
L	0.95	1.10	1.25
SENSOR LOCATION			
X	0.85	1.00	1.15
Y	0.65	0.85	0.95
Z	0.20	0.25	0.30

Thermal resistance

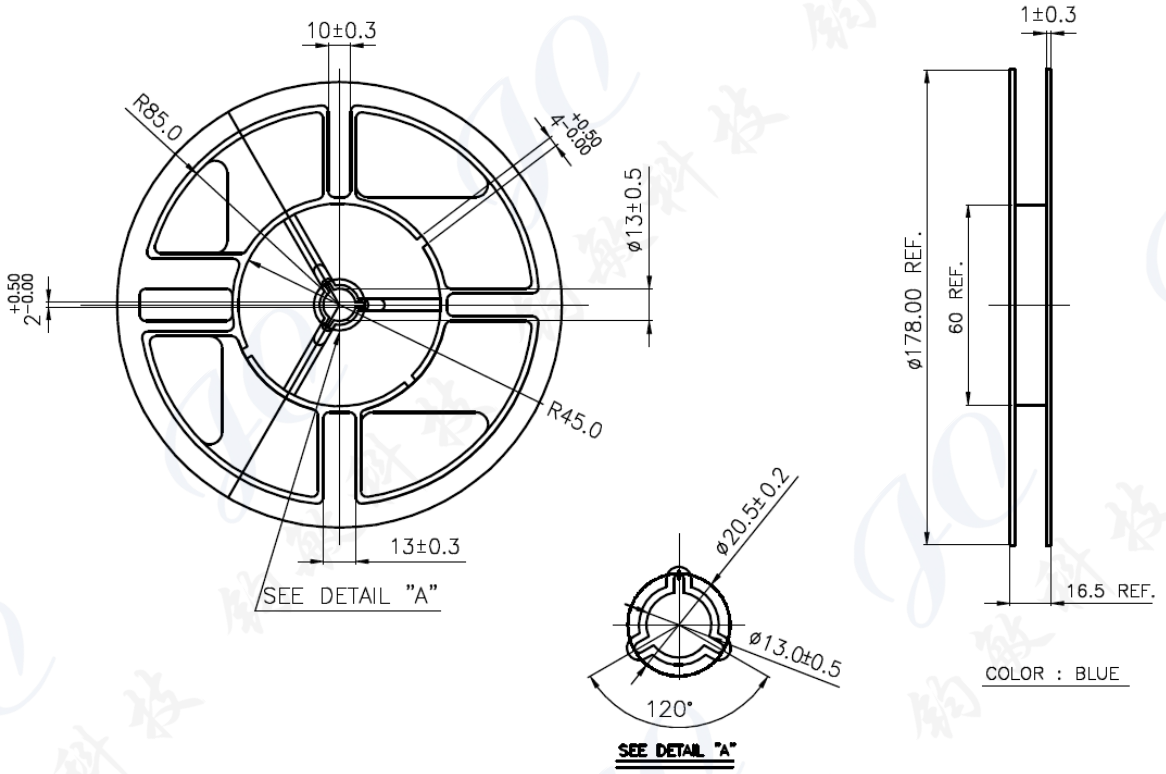
TSOT-6pin

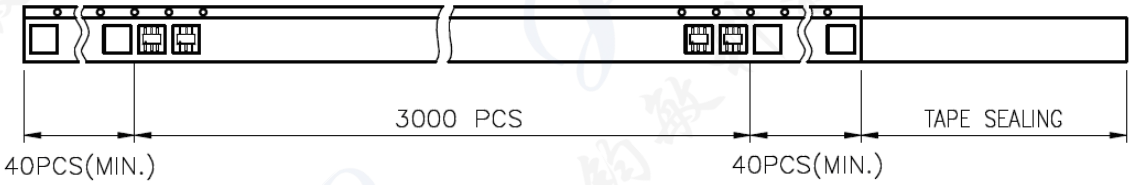
Parameter	Symbol	Conditions	Rating	Units
Junction to ambient thermal resistance	θ_{JA_1s0p}	TSOT-6L, 1-layer PCB, JEDEC standard test board, still-air	240	°C/W
Junction to case thermal resistance	θ_{JC}		15	°C/W
Junction to ambient thermal resistance	θ_{JA_2s0p}	TSOT-6L, 2-layer PCB, JEDEC standard test board, still-air	180	°C/W
Junction to case thermal resistance	θ_{JC}		15	°C/W



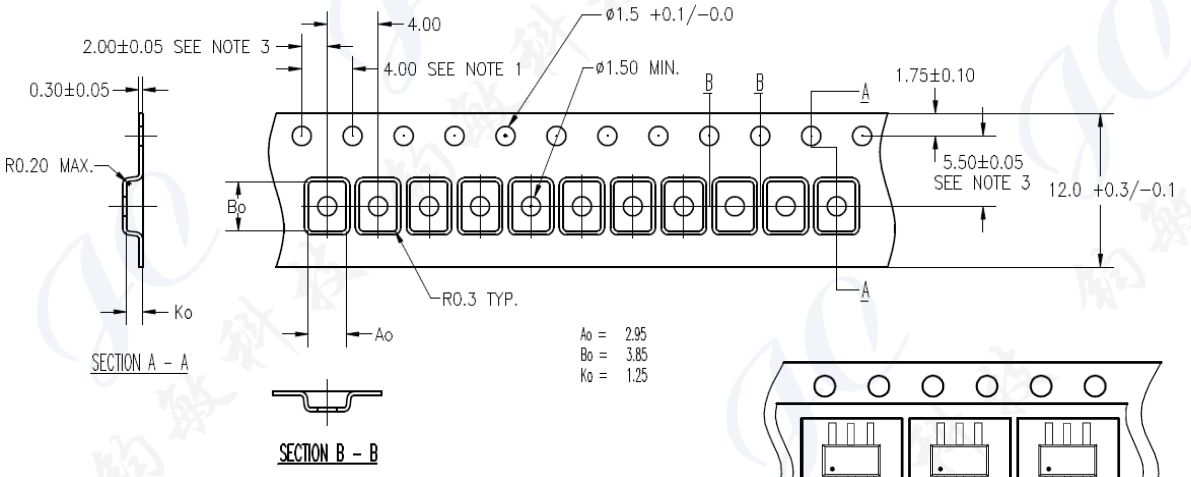
Carrier Tape & Reel specifications

TSOT-6pin





USER DIRECTION OF FEED



TSOT-26 (F/P : 2.2mm 平腳)

QUANTITY: 3000 EA/PER REEL, 4 REEL/BOX

Revision history table

Revision Date	Description of Revision
2023/11/27	● First release.