Imagis Semiconductor

Technical Document Series (IMG_DOC_DS_ISP5888_V1.0)

5-Channel BTL Motor Drive IC

(ISP5888, Datasheet, Version 1.0)

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Document History

Date	Contents
2011-09-29	Initial Brief Datasheet Release

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1. Overview

1.1 Description

The ISP5888 contains 5 channels voltage-type BTL drivers for Tracking and focus, sled, spindle motors and it contains also 1 channel of bi-directional tray motor. Furthermore it embraces 2 independent precision voltage regulators with adjustable range from 1.24V to 4V.

It supports various applications with pb free and heat-sink package

1.2 Features

- Wide dynamic range (4.0V (Typ.) when VCC = 8V, PVCC =5V, and RL = 8).
- Level shift circuit on chip
- Thermal shutdown circuit on chip.
- Mute mode builtin.
- Two regulator controllers built in. Five drivers building : dual actuator drivers, sled motor driver, spindle driver and tray in / out driver.

1.3 Application

- CD-Player
- CD-ROM
- DVD-Player

1.4 Package Type

28SSOPH-375

1.5 Ordering Information

ISP5888 △ △ △

Package Type	Tape and Reel Option	Lead Free Option
H : 28SSOPH	T : Tube	Blank : not Lead Free
	Balnk : Bulk	L : Lead Free
	TR : Tape and Reel	

1.6 Pin Configuration

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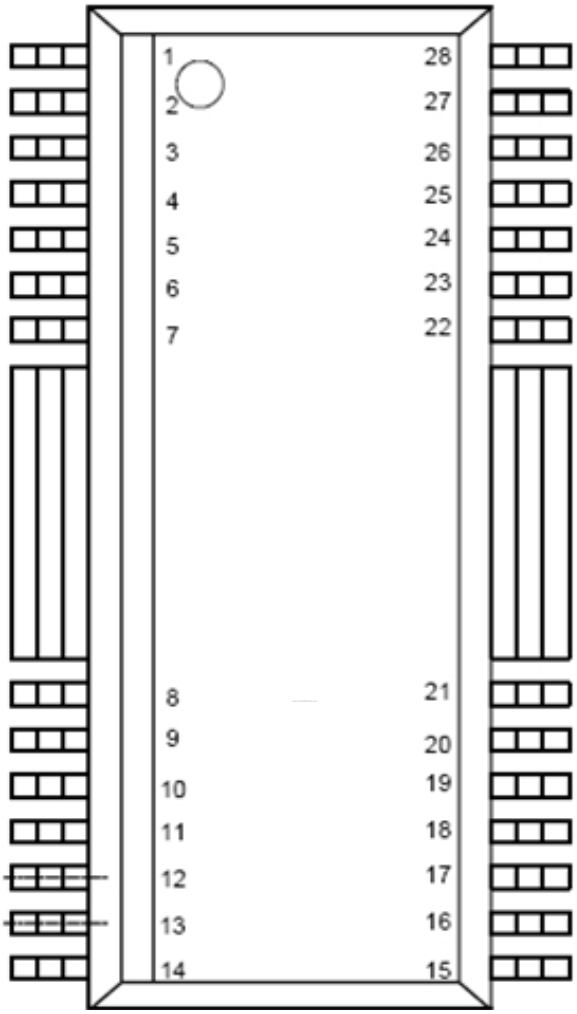


Figure 1.6 Pin Configuration of ISP5888 (Top View)

1.7 Pin Description

NO	SYMBOL	I/O	DESCRIPTION
1	VINFC	I	Input for focus driver
2	TRB_1	O	Connect to external transistor base
3	REG02	I	Regulator voltage output, Connect to external transistor collect
4	VINSL	I	Input for sled driver
5	REG01	I	Regulator voltage output, Connect to external transistor collect
6	FWD	I	Tray driver input signal for forward direction
7	REV	I	Tray driver input signal for reverse direction
8	VCC1	Power1	VCC1 for pre-drive block and power block of sled & tray
9	VOTR-	O	Tray driver output (-)
10	VOTR+	O	Tray driver output (+)
11	VOSL+	O	Sled driver output (+)
12	VOSL-	O	Sled driver output (-)
13	VOFC-	O	Focus driver output (-)
14	VOFC+	O	Focus driver output (+)
15	VOTK+	O	Tracking driver output (+)
16	VOTK-	O	Tracking driver output (-)
17	VOLD+	O	Spindle driver output (+)
18	VOLD-	O	Spindle driver output (-)
19	VCC2	Power2	VCC2 for power block of focus, tracking and spindle
20/24	NC	-	No Connection
21	VCTL	-	Speed control input of tray driver
22	GND	-	Ground
23	VINLD	I	Input for spindle driver
25	TRB_2	O	Connect to external transistor base
26	VINTK	I	Input for tracking driver
27	BIAS	I	Input for reference voltage
28	MUTE	I	Input for mute control

Table 1.7 Pin Description

1.8 Internal Block Diagram

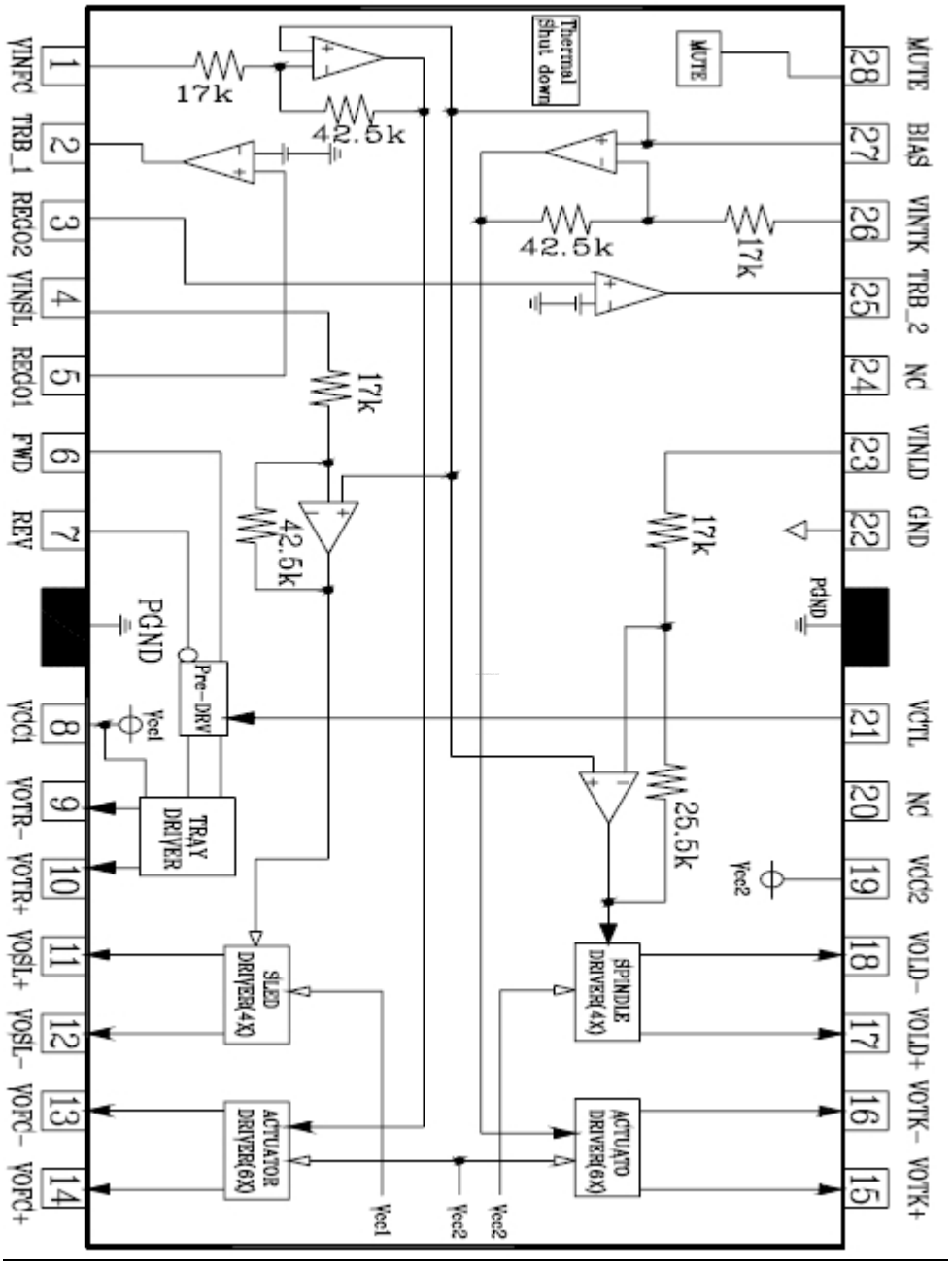


Figure 1.8 Internal Block Diagram

1.9 Absolute Maximum Ratings

Parameter	Symbol	Limits	Units
Supply Voltage	VCC1/VCC2	13.5	V
Power Dissipation	Pd	1.7	W
Operate Temperature Range	Topr	-35 ~ +85	°C
Storage Temperature Range	Tstg	-55 ~ +150	°C
ESD MM		300	V
ESD HBM		3000	V

[Pd] When mounted on a 70mm×70mm×1.6mm glass epoxy board.
Reduced by 13.6mW for each increase in Ta of 1℃

[Tstg] Should not exceed Pd or SOA and Tj=150℃ values

Table 1.9 Absolute Maximum Ratings

1.10 Recommended Operating Conditions (Ta = 25℃)

Parameter	Symbol	Limits	Units
Power Supply Voltage	VCC1	4.3 ~ 13.2	V
	VCC2	4.3 ~ VCC1	V

Table 1.10 Recommended Operating Conditions

2. Electrical Characteristics

(Unless otherwise specified Ta=25℃, Vcc1=12V, Vcc2=5V, BIAS=2.5V, RL=8Ω/12Ω/20Ω/45Ω)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent current	Iqc		-	30	-	mA
Voltage for Mute on	Vston		0	-	0.5	V
Voltage for Mute off	Vstoff		2	-	5	V
Actuator Driver : Focus , Tracking						
Output Offset Voltage	Voo		50	-	50	mV
Maximum output Voltage	Vom	12Ω Load	3.6	4	-	V
Voltage Gain	Gv	VIN=BIAS+0.2Vpp ac @1khz	21.5	23.5	25.5	dB
Sled Motor Driver						
Output Offset Voltage	Voosl		-100	-	100	mV
Maximum output Voltage	Vomsl	20Ω Load	7.5	9	-	V
Voltage Gain	Gvsl	VIN=BIAS+0.2Vpp ac @1khz	18.0	20.0	22.0	dB
Spindle Motor driver						
Output Offset Voltage	Voold		-50	-	50	mV
Maximum output Voltage	Vomld	8Ω Load	3.6	4	-	V
Voltage Gain	Gvld	VIN=BIAS+0.2Vpp ac @1khz	13.5	15.5	17.5	dB
Tray Motor driver						
Output saturation Voltage1	Vsat1	Upper + Lower saturation IL=200mA	0.7	1.1	1.5	V
Output saturation voltage Between F/R	△Vsat1	Output saturation voltage1 between FWD and REV	-	-	0.1	V
Output saturation Voltage2	Vsat2	Upper + Lower saturation IL=500mA	1.0	1.55	2.2	V
Output adjustable gain on "H" side voltage	VvtrH	VCTL=2V	7.4	9.2	11	dB

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Tray Motor driver input logic						
High level input voltage	VIH		1.5	-	Vcc	V
Low level input voltage	VIL		-0.3	-	0.5	V
High level input current	IIH	VFWD=VREV=5V	-	180	270	uA
Regulator						
Output voltage	Vreg	IL=500mA	1.5	-	4	V
Load Regulation	Vld	IL=0~500mA	-50	-	50	mV
Line Regulation	Vle	Vcc=4.5~8V,,IL=500mA	-25	-	25	mV

[Regulator] It is based on STA353 PNP application.

Vreg can be set to other voltage with 5% deviation (Output Voltage : 1.5V ~ 4V).

Table 2 Electrical Characteristics

3. Application Information

3.1 Thermal Shut Down Circuit

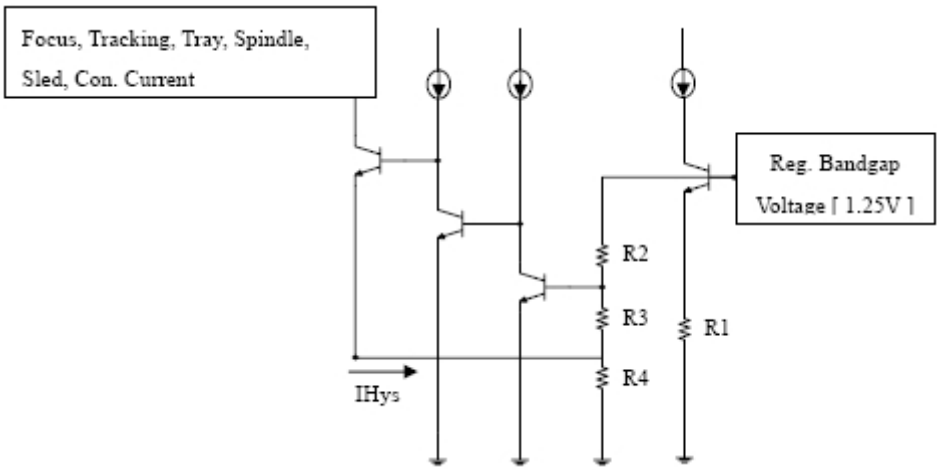


Figure 3.1 Thermal Shut Down Circuit

This IC has a built in thermal shutdown circuit that mutes the output current when the chip Temperature reaches 175℃ (typ.).

The hysteresis is set to 25 ℃ (typ.), so the driver circuits start up again when the chip Temperature falls to 150℃ (typ.).

3.2 BTL Driver Circuits [Focus, Tracking, Sled, Spindle]

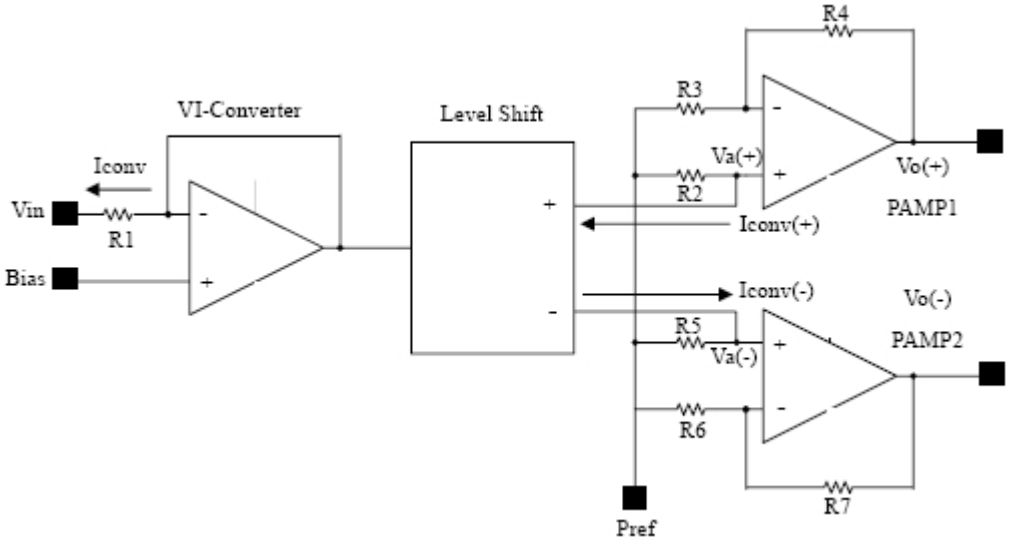


Figure 3.2 BTL Driver Circuits

BTL Driver Circuits are composed of VI-Converter, Level Shifter and Output power Amp.

VI-Converter converts voltage of Vin into current [Iconv]

Iconv = (Vin – Bias) / R1[10KΩ]

Closed loop Voltage Gain Calculation

Va(+) = (R2×Iconv) + Pref Va(-) = (-R5×Iconv) + Pref

Vo(+) = Va(+)×(1 + R4/R3) Vo(-) = Va(-)×(1 + R7/R6)

(* R2 = R5 , R3 = R6, R4 = R7 *)

Focus, Tracking closed loop Voltage Gain [R2 = 25KΩ, R3 = 10KΩ, R4 = 20KΩ]

$$\text{Gain} = 20 \log \left[\frac{\{ Vo(+) - Vo(-) \} }{(Vin - Bias)} \right]$$

$$= 20 \log \left[\frac{\{ Va(+)\times(1 + R3/R4) - Va(-)\times(1 + R6/R7) \} }{(Vin – Bias)} \right]$$

$$= 20 \log \left[\frac{\{(R2\times Iconv) + Pref \}\times(1 + R4/R3)]– [\{(-R5\times Iconv) + Pref \}\times(1 + R7/R6)]}{(Vin – Bias)} \right]$$

$$= 20 \log [2\times(25K/10K)\times\{1+(20K/10K)\}]$$

$$= 23.5 \text{ [dB]}$$

Sled closed loop Voltage Gain [R2 = 25KΩ, R3 = 10KΩ, R4 = 10KΩ]

$$\text{Gain} = 20 \log [2\times (25K/10K)\times\{1+(10K/10K)\}]$$

$$= 20 \text{ [dB]}$$

Spindle closed loop Voltage Gain [R2 = 15KΩ, R3 = 10KΩ, R4 = 10KΩ]

$$\text{Gain} = 20 \log [2\times (25K/10K)\times\{1+(10K/10K)\}]$$

$$= 15.5 \text{ [dB]}$$

3.3 Regulator Circuit

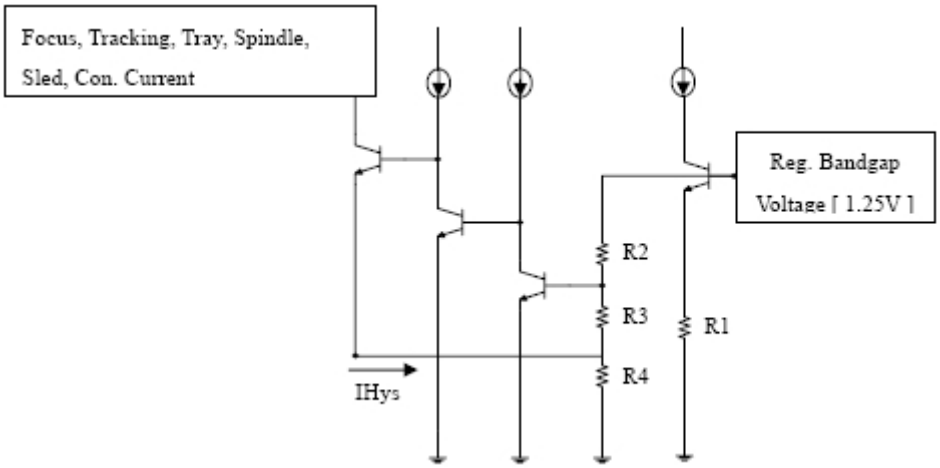


Figure 3.3 Regulator Circuit

The reference voltage (1.25V) is generated by the internal circuit (Band gab reference).

It needs to attach an external power TR [PNP Power TR : STA353*]

The output voltage of the regulator is Calculated as follows.

$$Vout = (1+ R1/R2) \times 1.25$$

3.3V [R1: 16.5K / R2 : 10K]

2.5V [R1: 10K / R2 : 10K]

3.4 Tray Driver Logic input

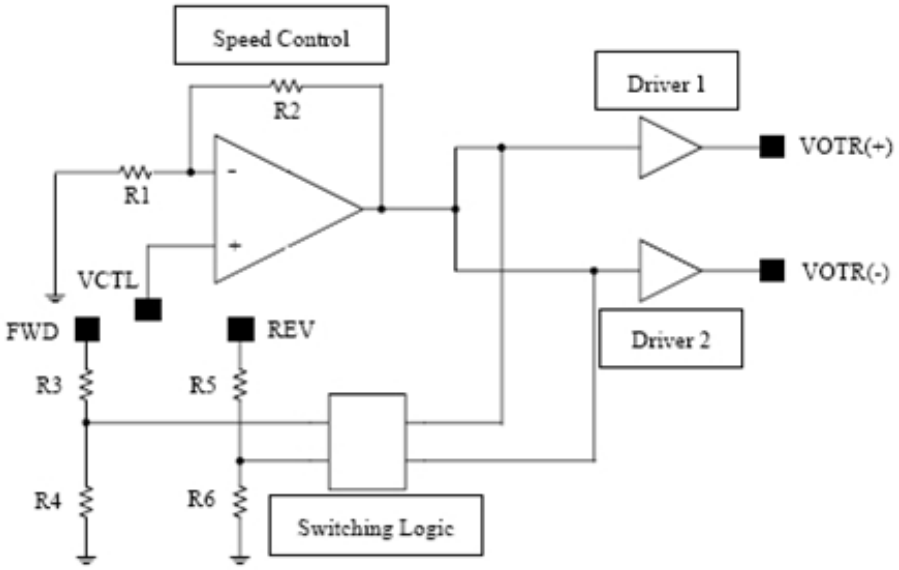


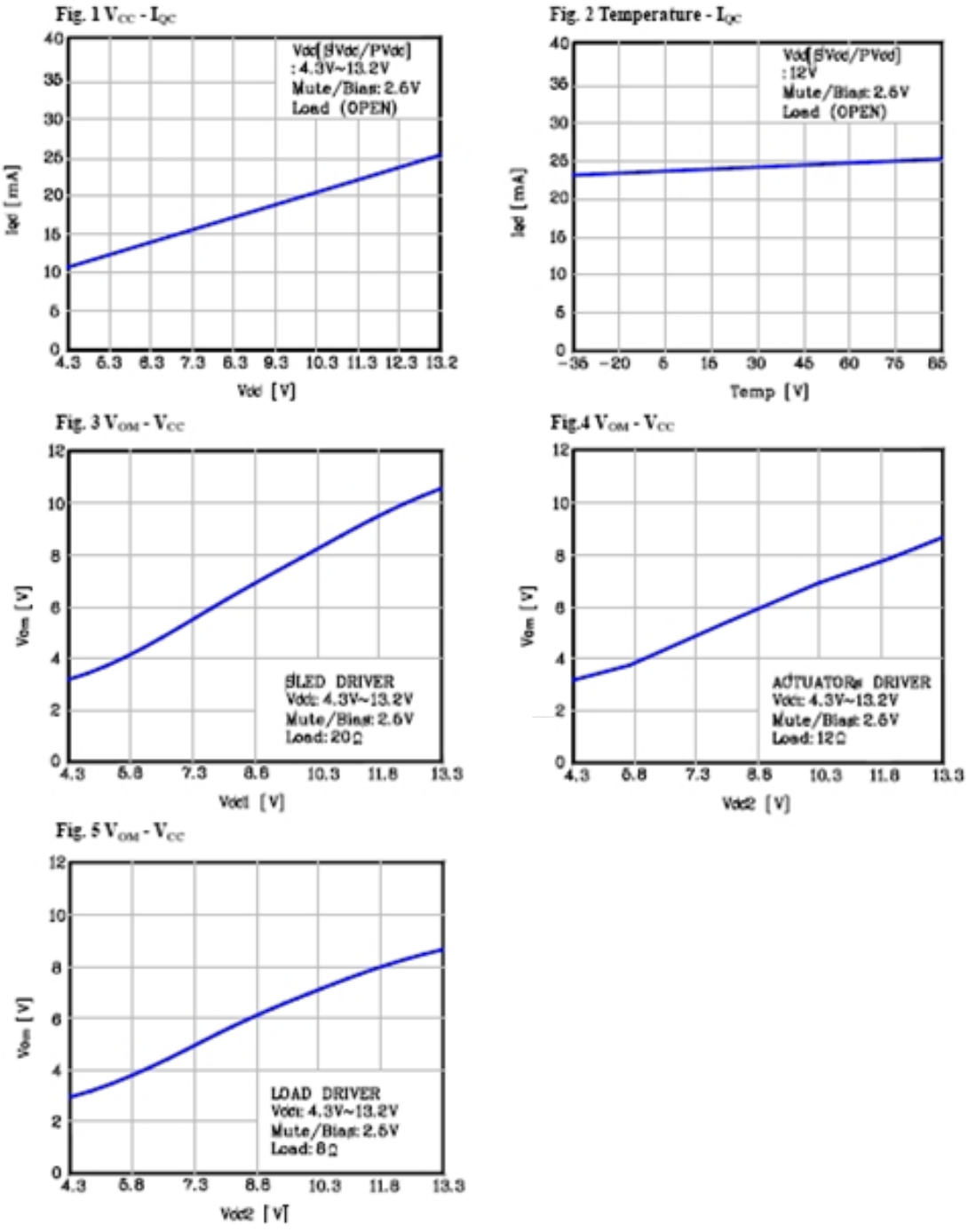
Figure 3.4 Tray Driver Logic input

FWD(pin6)	REV(pin7)	VOTR+(pin10)	VOTR-(pin9)	Function
L	L	OPEN	OPEN	Open mode
L	H	L	H	Reverse mode
H	L	H	L	Forward mode
H	H	L	L	Brake mode

Input circuit of 6,7 pin, consider the driver upper and lower unable ducting at the same time, be sure to do it, themotor forward and reverse input by the open mode,
We recommend that the time Period of open state is longer than 10msec

Output high level voltage(VOL+, VOL-) varied with the motor controller,
it can output 3 times voltage of 21pin, and in high level. In this time, the low level voltage input power pipe as the output saturation voltage.

4. Electrical Characteristics Curves



Graph 4. Electrical Characteristics Curves

5. Test Circuit

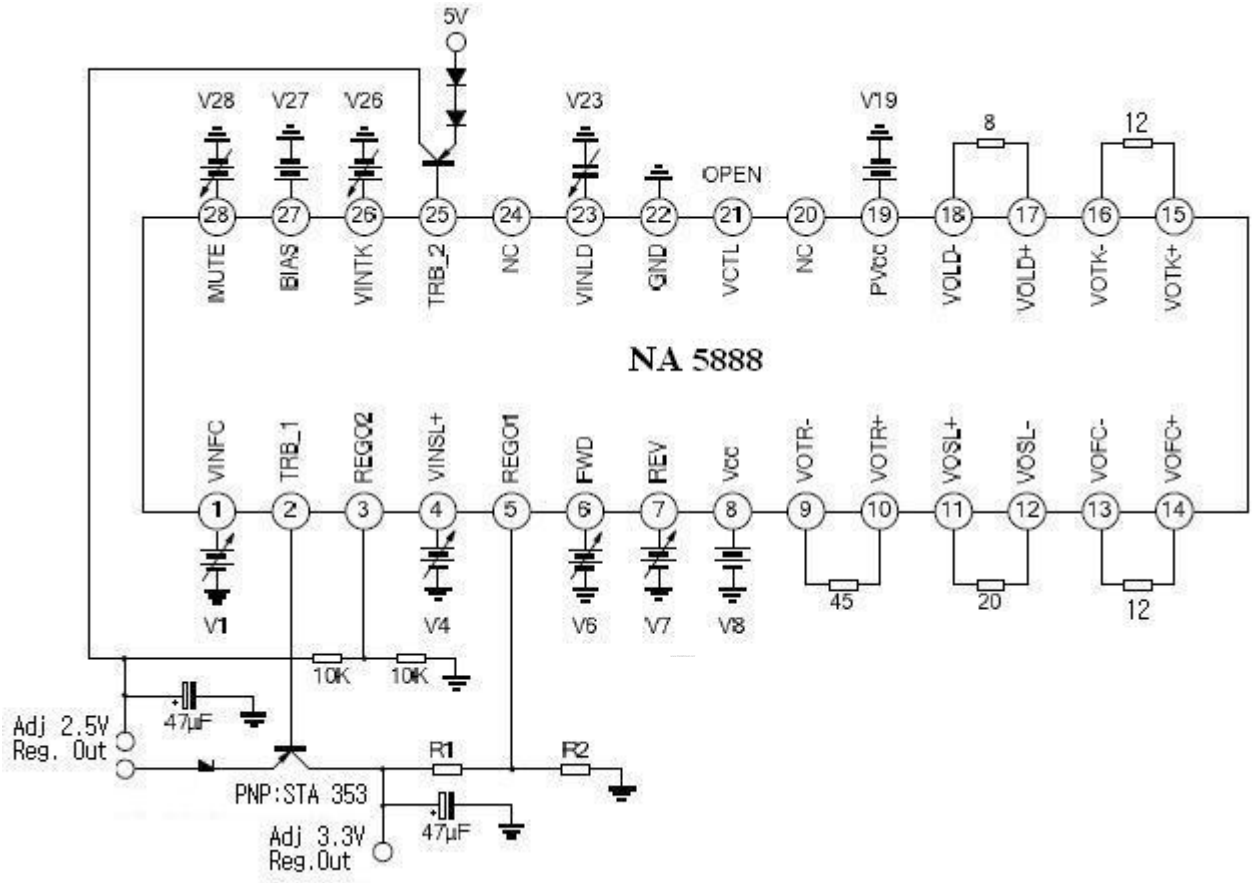


Figure 5. Test Circuit

6. Package Dimension

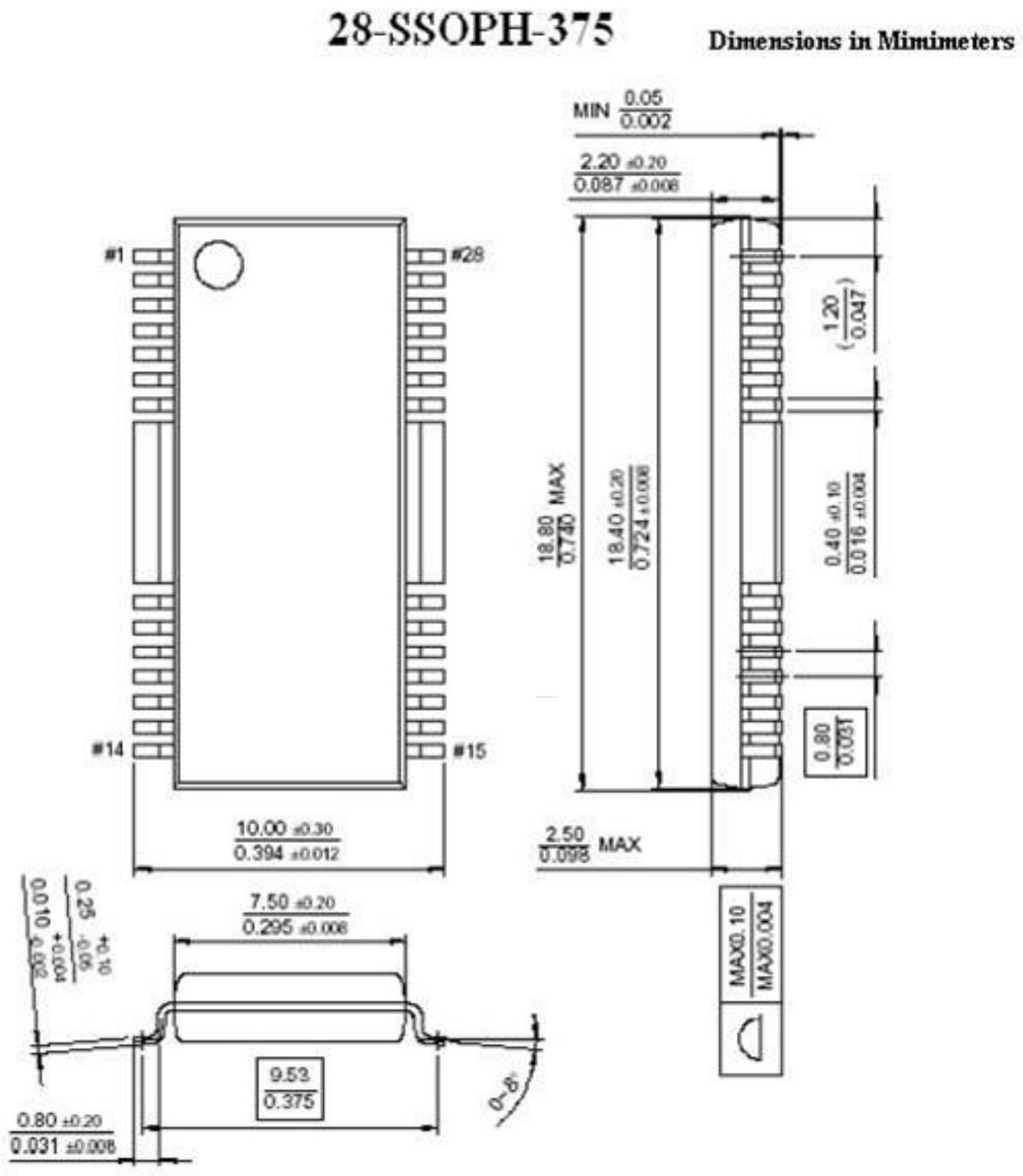


Figure 6. Package Dimension

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