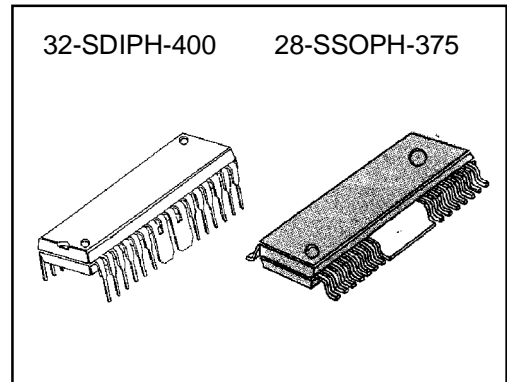## 3-PHASE CAPSTAN MOTOR DRIVER

The KA3080 And KA3080D are a monolithic integrated circuit, and suitable for 3-phase capstan motor driver for VCR system.
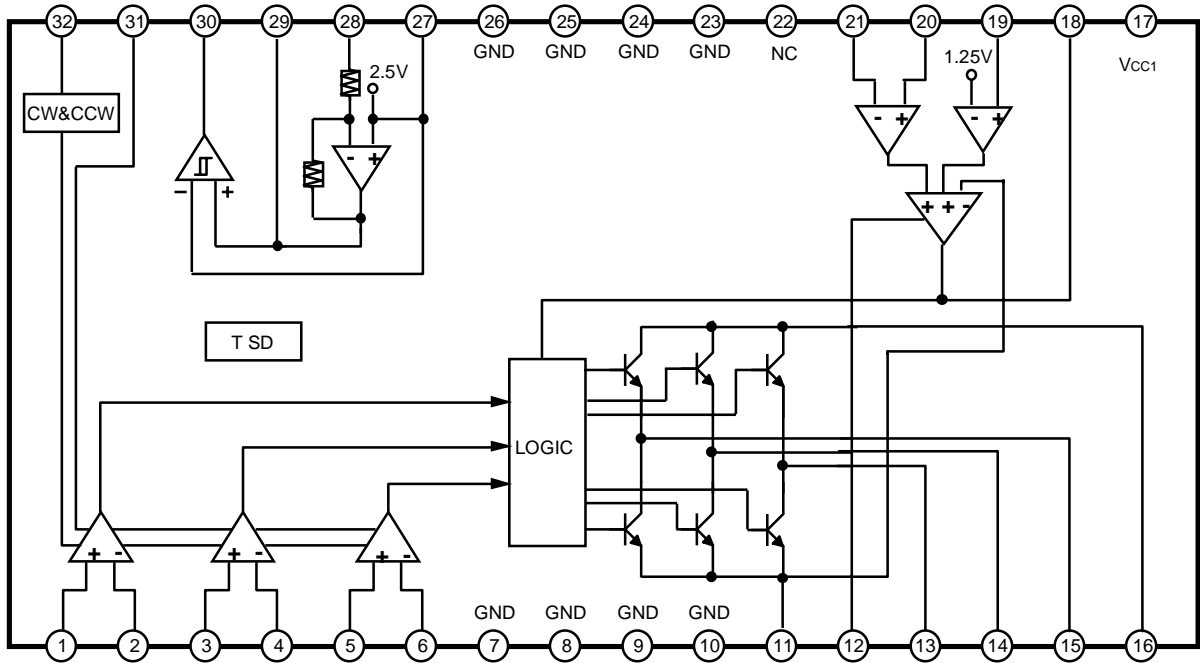
32-SDIPH-400   28-SSOPH-375

FEATURES

- •3-phase, full-wave, linear BLDC motor driver with 3 hall sensors
- • Built-in TSD(Thermal Shut Down) circuit
- • Built-in torque ripple control circuit
- • Built-in output current limiter
- • Motor speed control
- • High output current
- • Built-in FG amplifier with pulse waveforms
- • Built-in hall amplifier
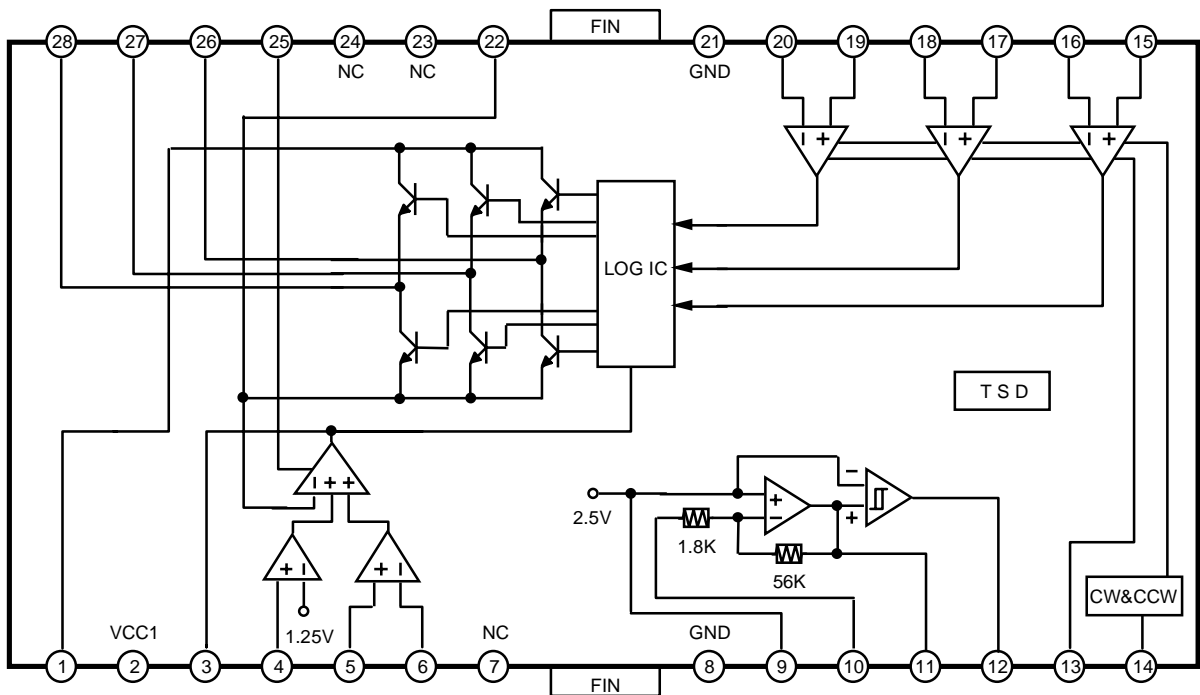- • Built-in CW and CCW circuit

ORDERING INFORMATION

Device	Package	Operating Temperature
KA3080	32-SDIPH-400	- 20℃ ~ + 75℃
KA3080D	28-SSOPH-375	

BLOCK DIAGRAM(32SDIPH)

BLOCK DIAGRAM(28SSOPH)

PIN CONFIGURATIONS(32SDIPH)

K A 3 0 8 0

Top pins (left to right): 32 FR_CTL, 31 TR_CTL, 30 FG_OUT2, 29 FG_OUT1, 28 FG_IN3, 27 FG_IN2, 26, 25, 24 GND, 23, 22 NC, 21 V_REF, 20 V_CTL, 19 I_LIM, 18 CI, 17 V_CC1

Bottom pins (left to right): 1 U+, 2 U−, 3 V+, 4 V−, 5 W+, 6 W−, 7, 8 GND, 9, 10, 11 RS, 12 G_OUT, 13 U_OUT, 14 V_OUT, 15 W_OUT, 16 V_CC2
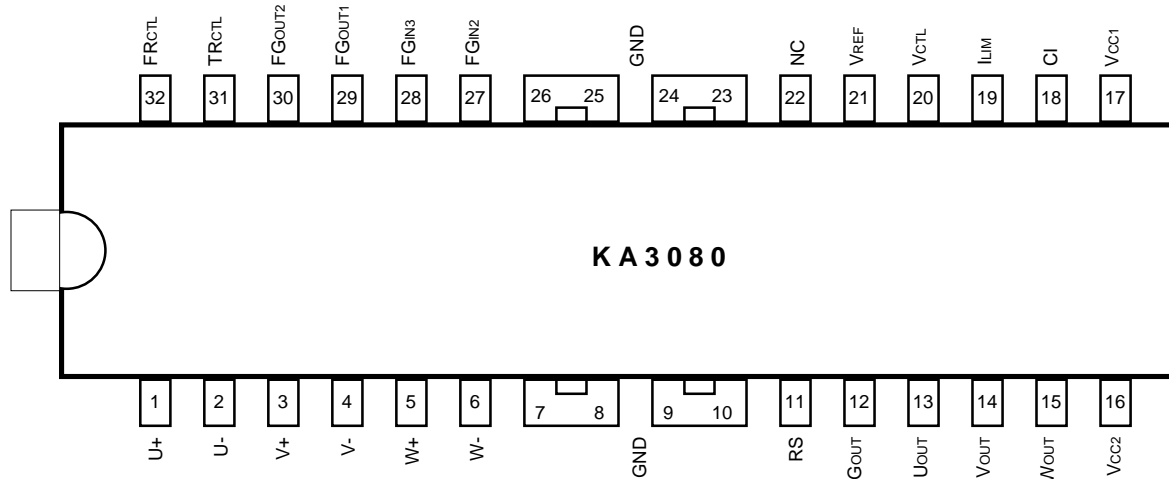
PIN DESCRIPTIONS(32SDIPH)

Pin no.	Symbol	I/O	Description	Pin no.	Symbol	I/O	Description
1	U +	I	U + hall signal input	17	V_CC1	-	Supply voltsge(signal)
2	U −	I	U − hall signal input	18	CI	-	Phase stabilization
3	V +	I	V + hall signal input	19	I_LIM	I	Current limitation
4	V −	I	V − hall signal input	20	V_CTL	I	Voltage control
5	W +	I	W + hall signal input	21	V_REF	I	Voltage control reference
6	W −	I	W − hall signal input	22	NC	-	No Connection
7	GND	-	Ground(signal)	23	GND	-	Ground(signal)
8	GND	-	Ground(signal)	24	GND	-	Ground(signal)
9	GND	-	Ground(signal)	25	GND	-	Ground(signal)
10	GND	-	Ground(signal)	26	GND	-	Ground(signal)
11	RS	O	Output current detection	27	FG_IN2	I	FG AMP input1
12	G_OUT	-	Ground(power)	28	FG_IN3	I	FG AMP input2
13	U_OUT	O	U out	29	FG_OUT1	O	FG AMP output
14	V_OUT	O	V out	30	FG_OUT2	O	FG COMP output
15	W_OUT	O	W out	31	TR_CTL	I	Torque ripple control
16	V_CC2	-	Supply voltsge(power)	32	FR_CTL	I	Forward & reverse control

PIN CONFIGURATIONS(28SSOPH)
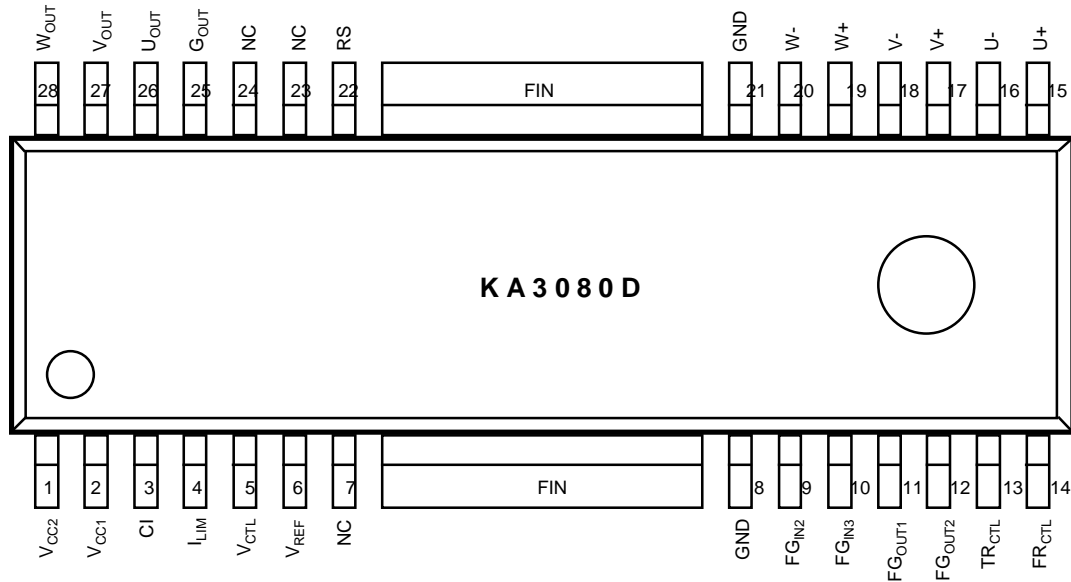
PIN DESCRIPTIONS(28SSOPH)

Pin no.	Symbol	I/O	Description	Pin no.	Symbol	I/O	Description
1	V_{CC2}	-	Supply voltsge(power)	15	U+	I	U + hall signal input
2	V_{CC1}	-	Supply voltsge(signal)	16	U-	I	U − hall signal input
3	CI	-	Phase stabilization	17	V+	I	V + hall signal input
4	I_{LIM}	I	Current limitation	18	V-	I	V − hall signal input
5	V_{CTL}	I	Voltage control	19	W+	I	W + hall signal input
6	V_{REF}	I	Voltage control reference	20	W-	I	W − hall signal input
7	NC	-	No Connection	21	GND	-	Ground(signal)
8	GND	-	Ground(signal)	22	RS	O	Output current detection
9	FG_{IN2}	I	FG AMP input1	23	NC	-	No Connection
10	FG_{IN3}	I	FG AMP input2	24	NC	-	No Connection
11	FG_{OUT1}	O	FG AMP output	25	G_{OUT}	-	Ground(power)
12	FG_{OUT2}	O	FG COMP output	26	U_{OUT}	O	U out
13	TR_{CTL}	I	Torque ripple control	27	V_{OUT}	O	V out
14	FR_{CTL}	I	Forward & reverse control	28	W_{OUT}	O	W out

ABSOLUTE MAXIMUM RATINGS(Ta = 25℃)

Characteristics	Symbol	Value	Unit	Remark
Supply voltage(Signal)	V_{CC1}	7	V	
Supply voltage(Power)	V_{CC2}	28	V	
Output current	I_{OUT}	1.5	A/phase	$V_{CC1} = 5V$, $V_{CC2} = 16V$
Power dissipation	P_D	2.4	W	32SDIPH
		1.7	W	28SSOPH
Junction temperature	T_j	150	℃	
Operating temperature	T_{OPR}	- 20 ~ + 75	℃	$V_{CC1} = 5V$, $V_{CC2} = 16V$
Storage temperature	T_{STG}	- 40 ~ + 125	℃	

POWER DISSIPATION CURVE

Power dissipation(W)

2.4

32SDIPH

1.7

28SSOPH

25   75   150

Ambient temperature, Ta(℃)
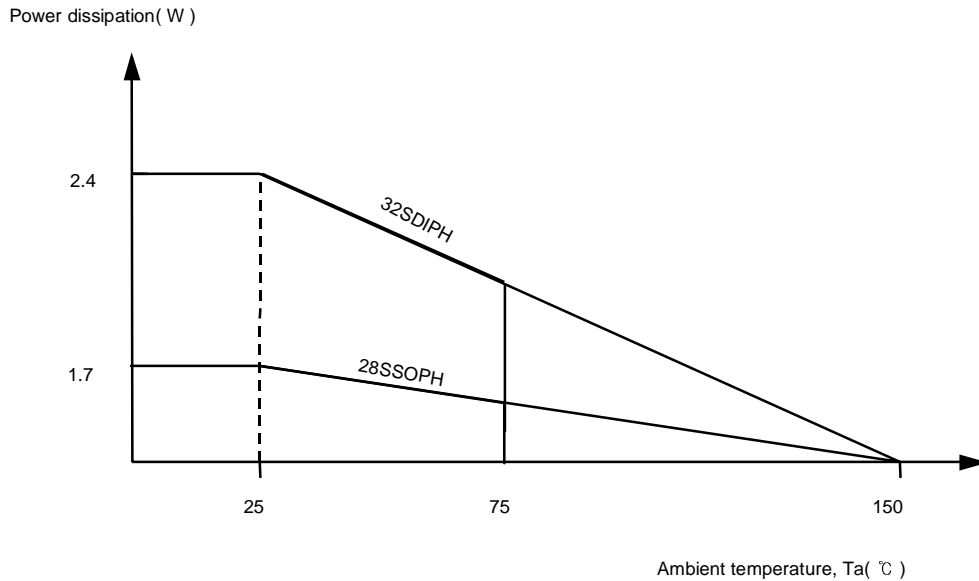
ELECTRICAL CHARACTERISTICS
(V_{CC1}=5V, V_{CC2}=16V, R_S=0.5ohm ,Ta = 25℃, unless otherwisw specified)

Block	Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
TOTAL	Quiescent Input Current(1)	I_{CC1}	V_{CC1}=5V,V_{FR}=5V		5.0	8.5	12.0	mA
	Quiescent Input Current(3)	I_{CC3}	V_{CC1}=7V,V_{FR}=5V		6.0	10.0	15.0	mA
	Quiescent Input Current	I_{O1}	V_{CC2}=16V,V_{LIM}=0V		--	1.5	5.0	mA
	Quiescent Input Current(MAX.)	I_{O1}	V_{CC2}=27V,V_{LIM}=V_{REF}		--	2.7	7.0	mA
OUTPUT	Current Limit Level	GM_{L1}	R_S=0.5Ω	32SDIPH	0.61	0.67	0.73	A/V
				28SSOPH	0.46	0.52	0.58	
	Control Gain	GM_1	V_{IN}=0V	32SDIPH	0.9	1.0	1.1	A/V
				28SSOPH	0.7	0.8	0.9	
	Output AMP. Saturation Voltage4 (Outflow Current)	V_{SU4}	I_{OUT}=0.8A/phase		--	1.8	2.0	V
	Output AMP. Saturation Voltage4 (Inflow Current)	V_{SD4}	I_{OUT}=0.8A/phase		--	1.8	2.0	V
	Limit Current Gap of Phases	LD1	LI_{VU2}-LI_{WU2}		-5	0	5	mA
	Current Gap of Phases	D1	I_{VU1}-I_{WU1}		-5	0	5	mA
	Phase Output Wave Frequency(1)	PF1	15KHz, 5Vp-p		2.45	2.5	2.55	KHz
	Phase Output Wave Frequency(4)	PF4	10KHz, 5Vp-p		1.62	1.67	1.72	KHz
CONTROL	Current Limit Input Current	I19	--		--	350	2000	nA
	Control Input Current	I20	--		--	350	2000	nA
	Input Offset Voltage U	V_{O2U}	--		-50	0	50	mV
ROTATION CONTROL	CW Voltage Range	V_{FRU}	--		1.0	1.3	1.6	V
FG. AMP. & COMP.	FG. AMP. Input DC Voltage	V28(10)	32SDIPH(28SSOPH)		2.2	2.5	2.8	V
	FG. AMP. Reference Voltage	V27(9)	32SDIPH(28SSOPH)		2.2	2.5	2.8	V
	FG. AMP. Voltage Gain	FG_{AV1}	FG_{IN3}=10KHz,60mVp-p		28	31	34	Times
	FG. COMP. Output Frequency	F_{COMP}	FG_{AMPO}=3Vp-p(1KHz)		0.9	1	1.1	KHz
	FG. COMP. Downward Input Threshold Voltage	V_{THDW}	FG_{AMPO}=3→2 Sweep		2.40	2.45	2.50	V
	FG. COMP. Upware Input Threshold Voltage	V_{THUP}	FG_{AMPO}=2→3 Sweep		2.50	2.55	2.60	V
	FG. COMP. Hysteresis	V_{HYS}	--		20	100	180	mV
	FG. Output High Voltage	FG_{HI}	FG_{IN3}=3V		4.2	--	--	V
	FG. Output Low Voltage	FG_{LO}	FG_{IN3}=2V		--	--	0.4	V

## APPLICATION INFORMATION (32SDIPH : Ⓖ , 28SSOPH : (#))

1. HALL INPUT

The input signal of the Hall Sensor requires more amplitude than 100mVo-p. and the operating voltage level of the Hall Sensor is from 1.2V~V_{CC1}-0.8V.

VCC1

More than 1.7V

More than 100mVo-p

More than 1.3V

(15) ①   ② (16)
(17) ③   ④ (18)
(19) ⑤   ⑥ (20)
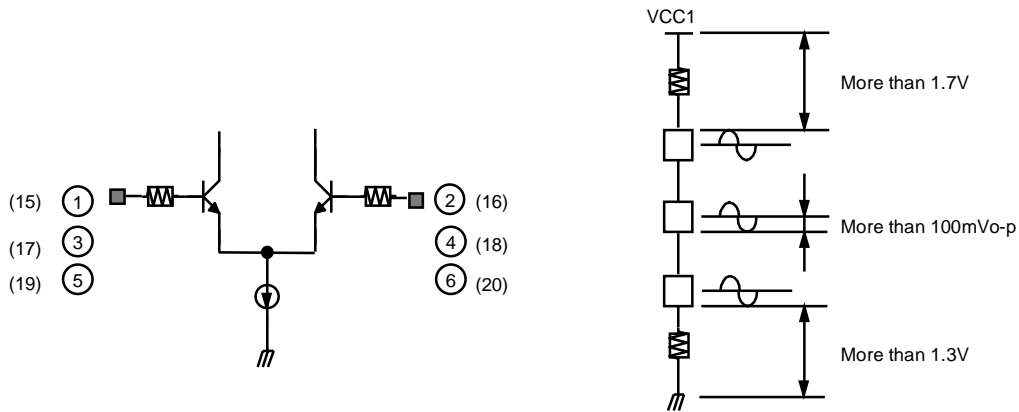
2. OUTPUT CURRENT DETECTION

The R_S(Output Current Sencing) is usually connected with Rs(approx. 0.5Ω), and the motor current is converted to a voltage by the Rs and provided to a feedback amplifier.
The G_{OUT}(Power Ground) is connected to the circuit with the ground side or Rs.

⑯ (1)V_{CC2}
⑬ (26)U_{OUT}
⑭ (27)V_{OUT}
⑮ (28)W_{OUT}
⑪ ⑫
Rs(0.5Ω)   (22 Pin)   (25 Pin)
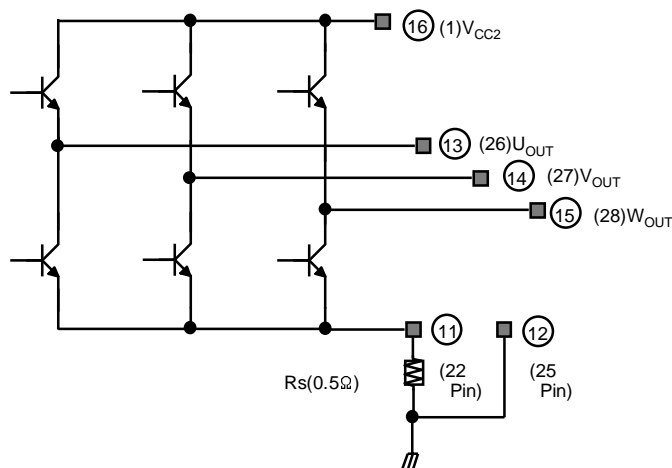
3. MOTOR SPEED CONTROL (INPUT CURRENT LIMITATION)

The maxmum output current is limitted by the I_{LIM}(Current Limiting) voltage as follows.
So a motor speed is controlled by the output current. In case of no-use, it is to be short-circuit with V_{CC1}.

$GM_L = \triangle Io / \triangle V_{LIM} = (Io_2 - Io_1) / (V_{LIM2} - V_{LIM1})$, where $V_{LIM1} = 1.45V \Rightarrow$ Output current $= Io_1$
$V_{LIM2} = 1.55V \Rightarrow$ Output current $= Io_2$
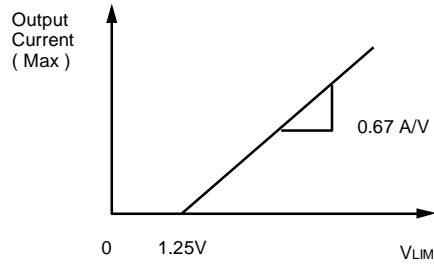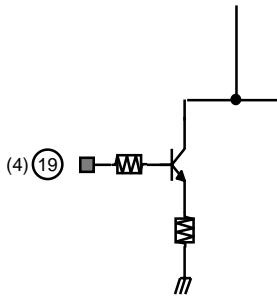
4. MOTOR SPEED CONTROL (INPUT VOLTAGE CONTROL)

The control of motor speed is possible on the conditions of $V_{CTL} \geq V_{REF}$.
The control gain is approx. 1.0 A/V as follows.

$GM = \triangle Io / \triangle V_{CTL} = (Io_2 - Io_1) / (V_{CTL2} - V_{CTL1})$, where $V_{REF} = 2.5V$, $V_{CTL1} = 2.6V \Rightarrow$ Output current $= Io_1$
$V_{REF} = 2.5V$, $V_{CTL2} = 2.7V \Rightarrow$ Output current $= Io_2$
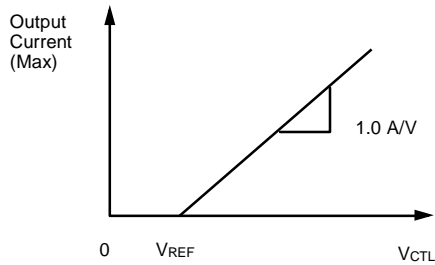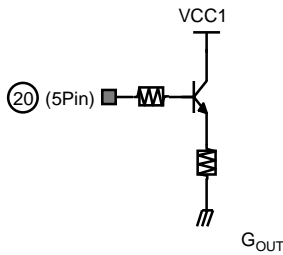
5. VOLTAGE CONTROL REFERENCE
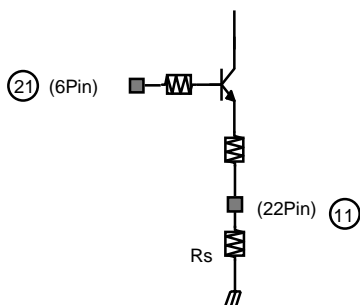
The input voltage range is $2V \leq V_{REF} \leq (V_{CC1} - 2V)$.

6. TORQUE RIPPLE CONTROL
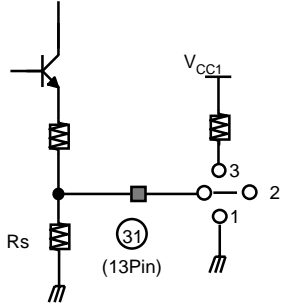
The motor torque ripple is controlled by the T_{RCTL} (Torque Ripple Control) voltege as follows.

1 : GND
2 : Normal mode
3 : Control mode

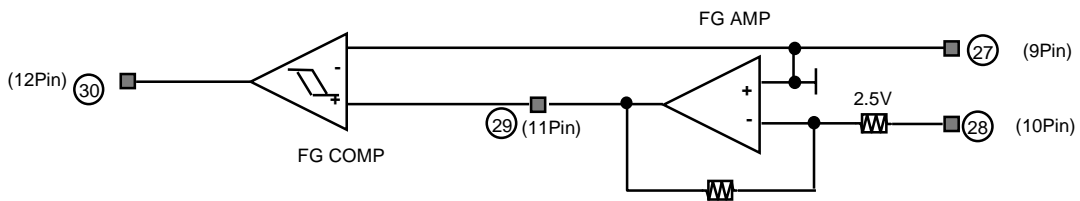## 7. FORWARD & REVERSE ROTATION CONTROL
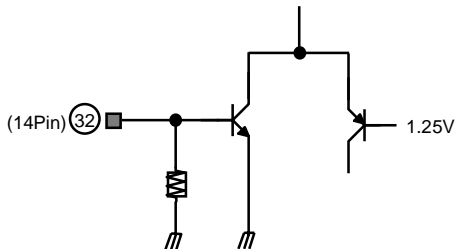
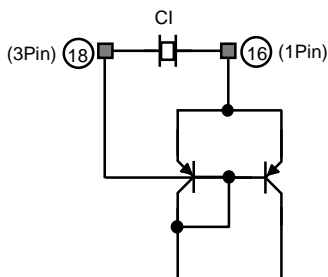Forward mode : $V_{FRCTL} \geq 1.8V$

Reverse mode : $V_{FRCTL} \leq 0.8V$

8. FG AMP

FG AMP is the inversion type. FG AMP is built in both the reference voltage(approx. 2.5V) and the gain setting resistors. The FG COMP generates a square waveforms.
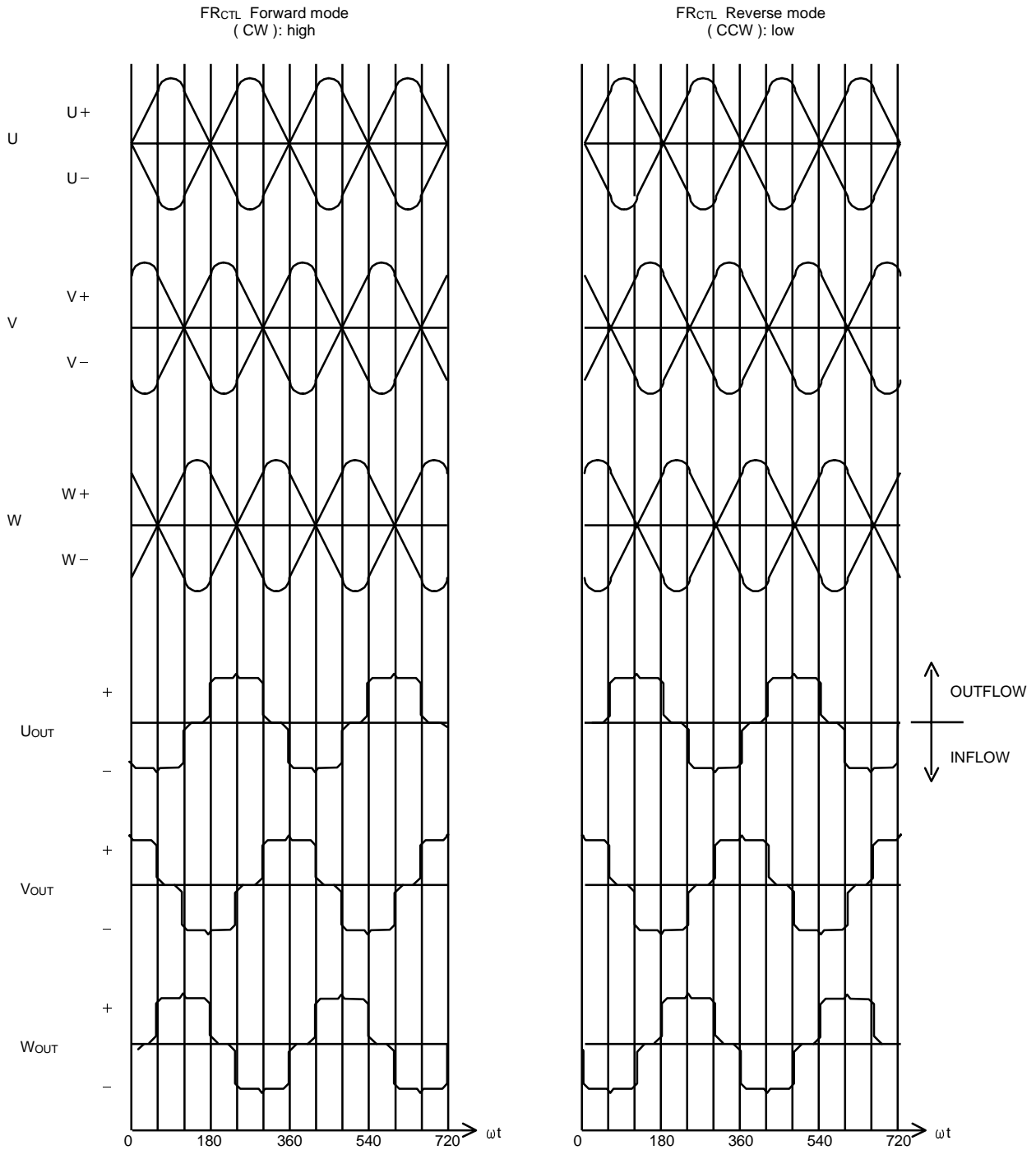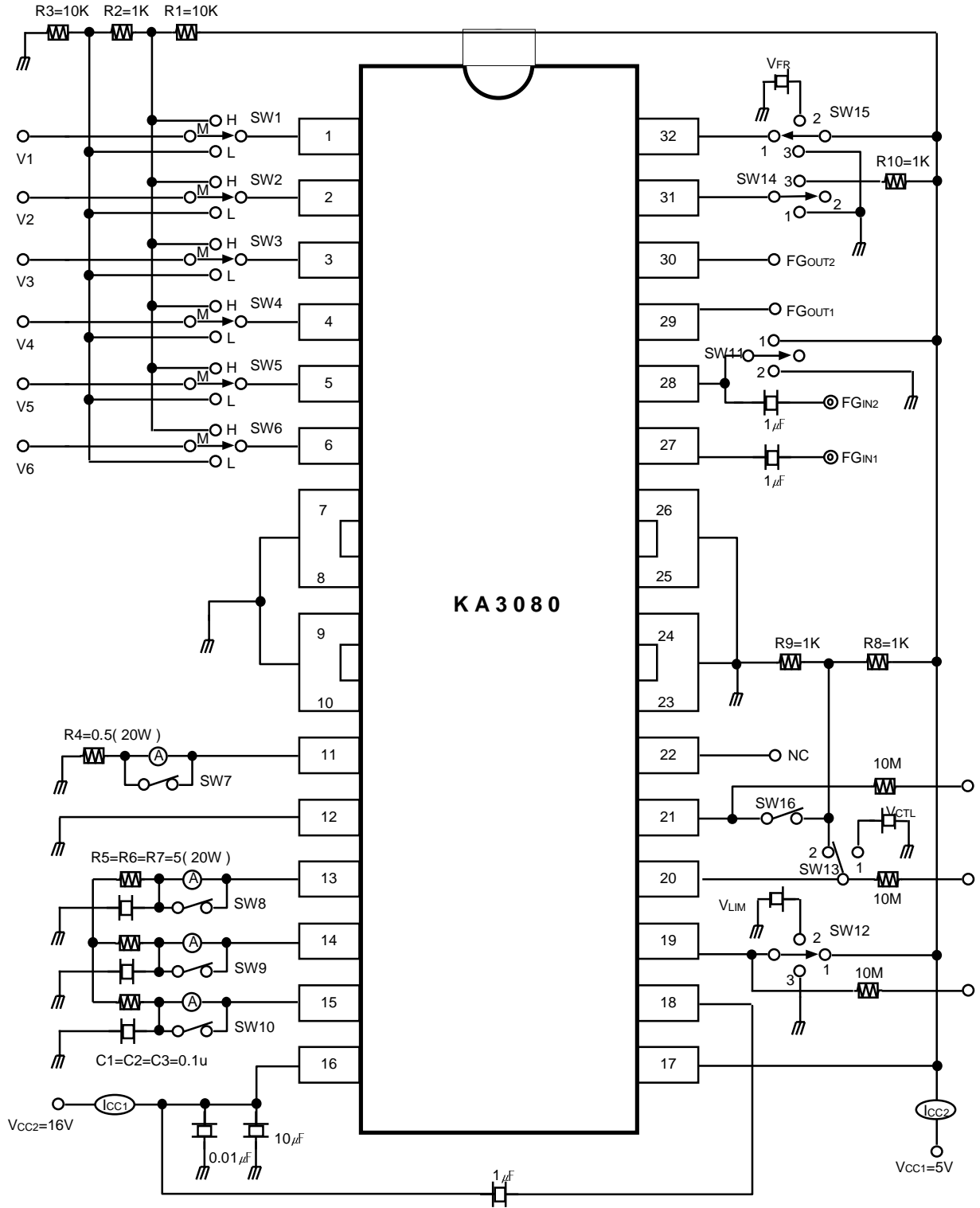
9. PHASE STABILIZATION

Be inserted a capacitor between V_{CC2}.
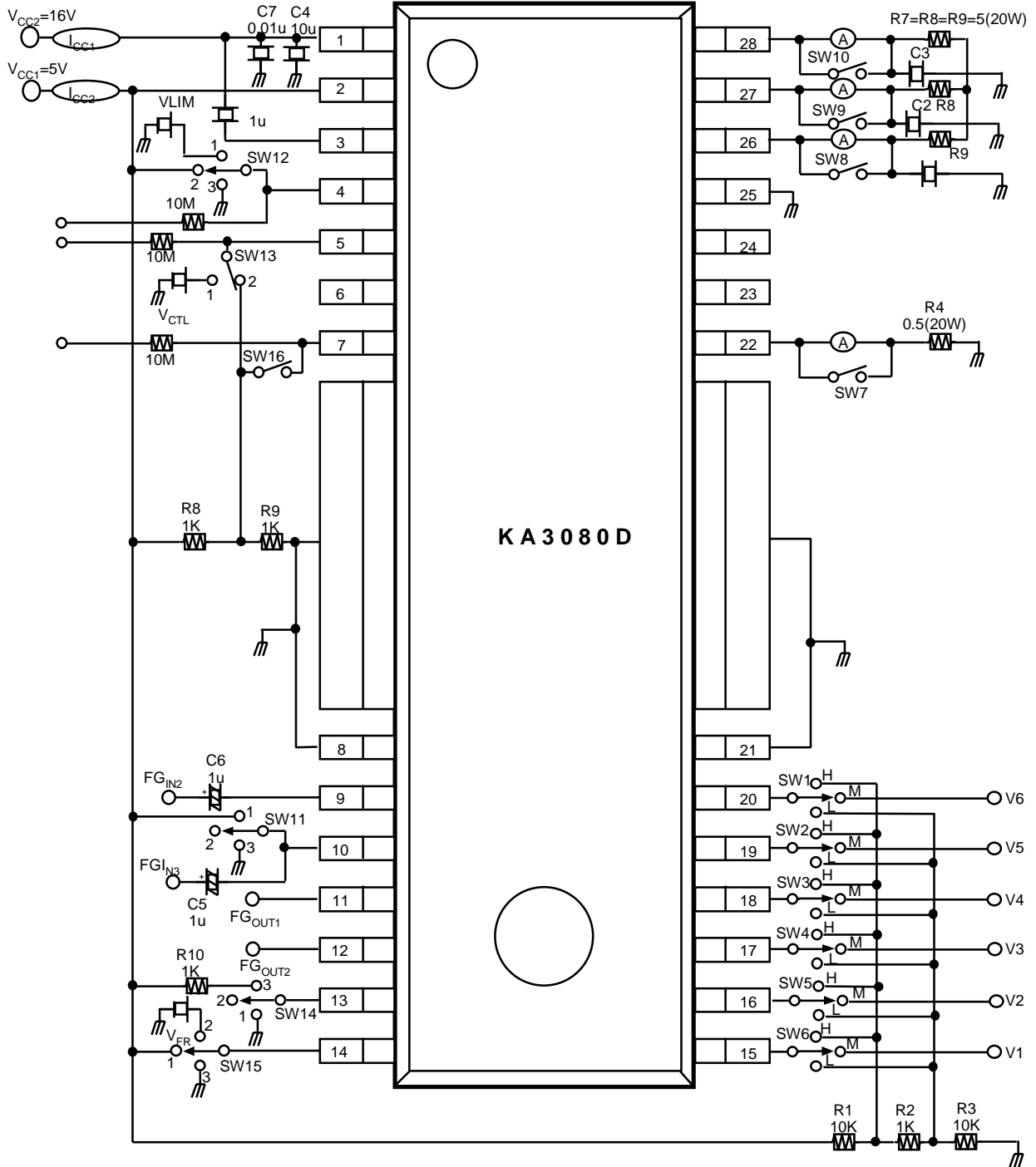This capacitor, approx.$0.1 \mu F$ is for the phase stabilization of the circuit.
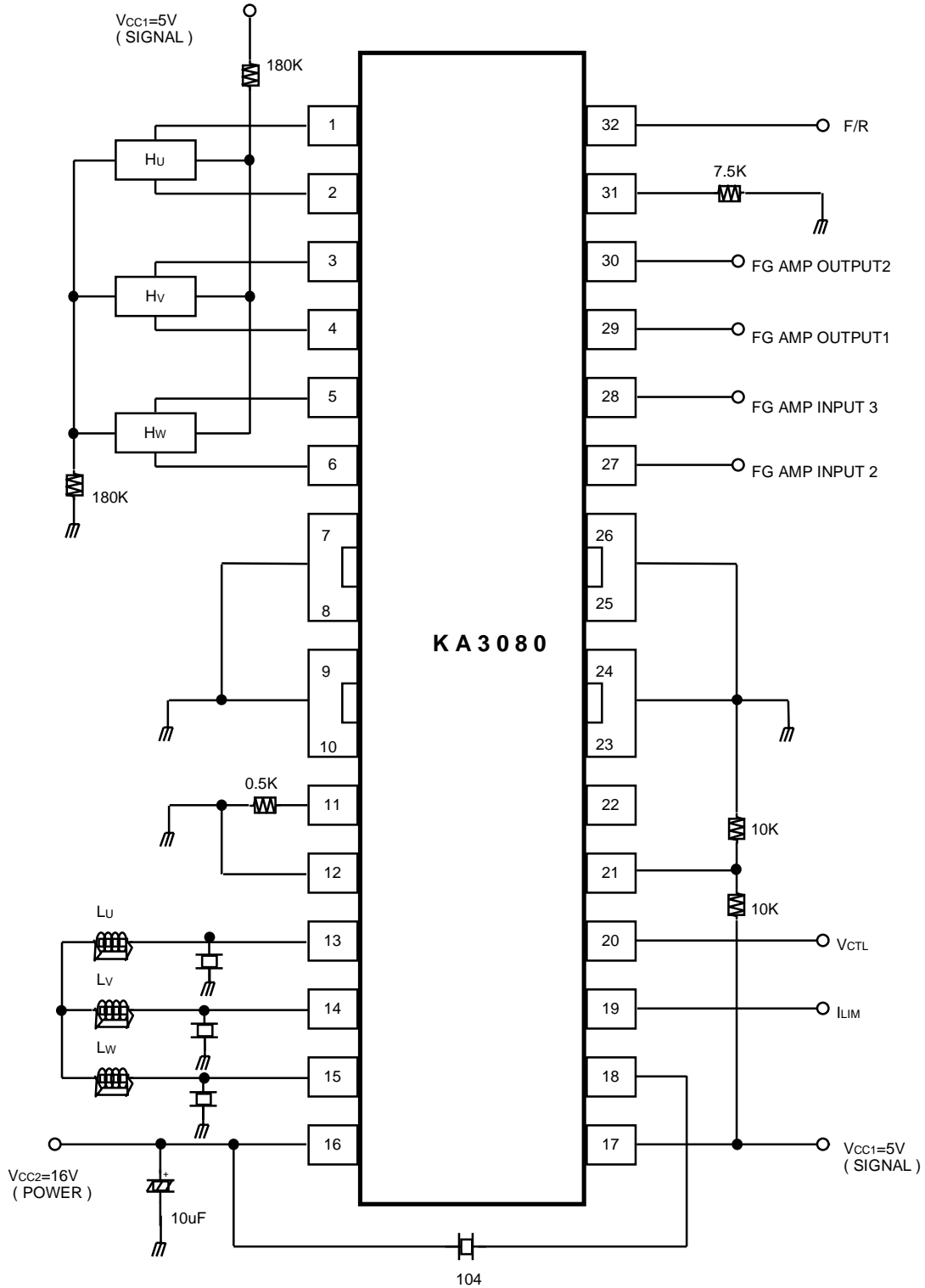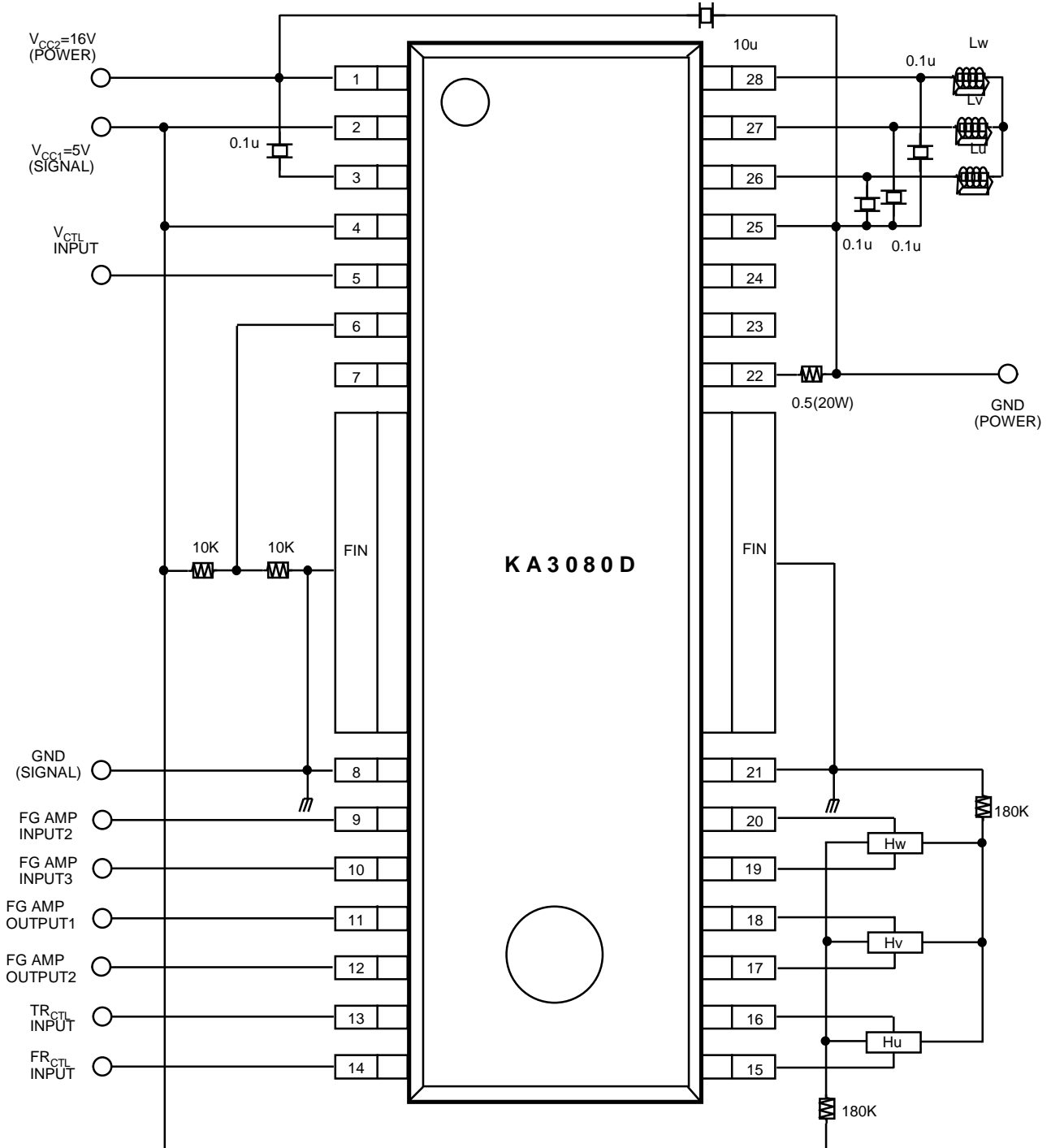
TIMMING CHART

FR$_{CTL}$ Forward mode
(CW): high

FR$_{CTL}$ Reverse mode
(CCW): low

U
U +
U −

V
V +
V −

W
W +
W −

U$_{OUT}$
+
−

V$_{OUT}$
+
−

W$_{OUT}$
+
−

OUTFLOW

INFLOW

0   180   360   540   720   ωt

0   180   360   540   720   ωt

TEST CIRCUITS(32SDIPH)

SAMSUNG ELECTRONICS

TEST CIRCUITS(28SSOPH)
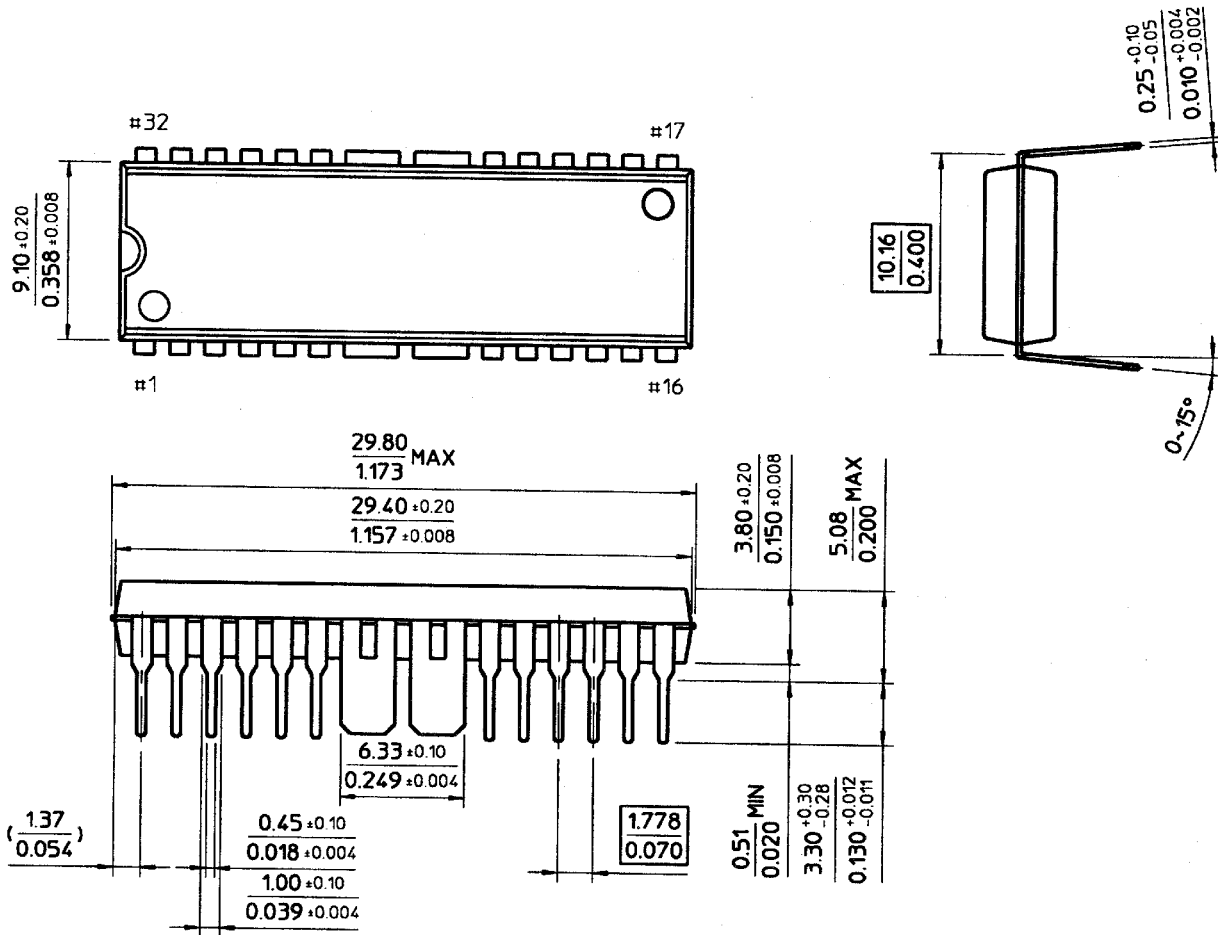
TYPICAL APPLICATIONS(32SDIPH)

TYPICAL APPLICATIONS(28SSOPH)

PACKAGE DIMENSIONS (Unit : mm)

32-SDIPH-400

PACKAGE DIMENSIONS (Unit : mm)

28-SSOPH-375

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