

# KA3084D

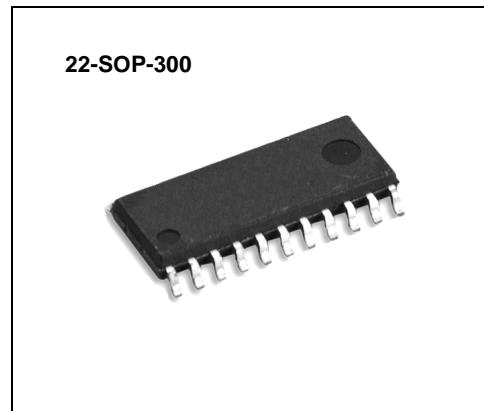
## 2-Phase BLDC Motor Driver

### Features

- Drives the BLDC motor using 2 hall sensors.
- 2-phase, full-wave drive method
- Built-in thermal shutdown (TSD) circuit
- Controls the motor speed through voltage
- Built-in bandgap circuit
- Built-in frequency Generator (FG) & Phase Generator (PG) amplifier & comparator.

### Description

The KA3084D is a monolithic integrated circuit, and it is suitable for drum motor driver of VCR system.



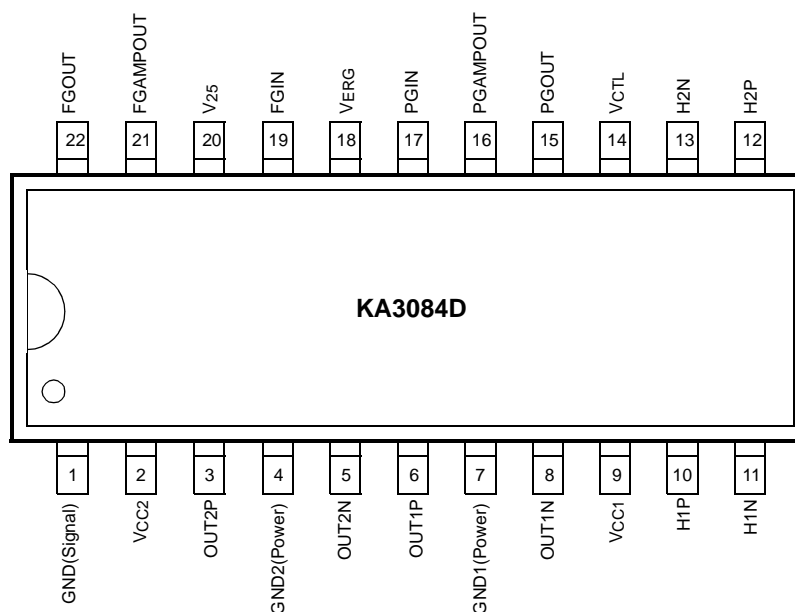
### Target Applications

- Video cassette recorder(VCR) cylinder (drum) motor
- Other 2-phase BLDC motor

### Ordering Information

Device	Package	Operating Temp.
KA3084D	22-SOP-300	-25°C ~ +75°C
KA3084DTF	22-SOP-300	-25°C ~ +75°C

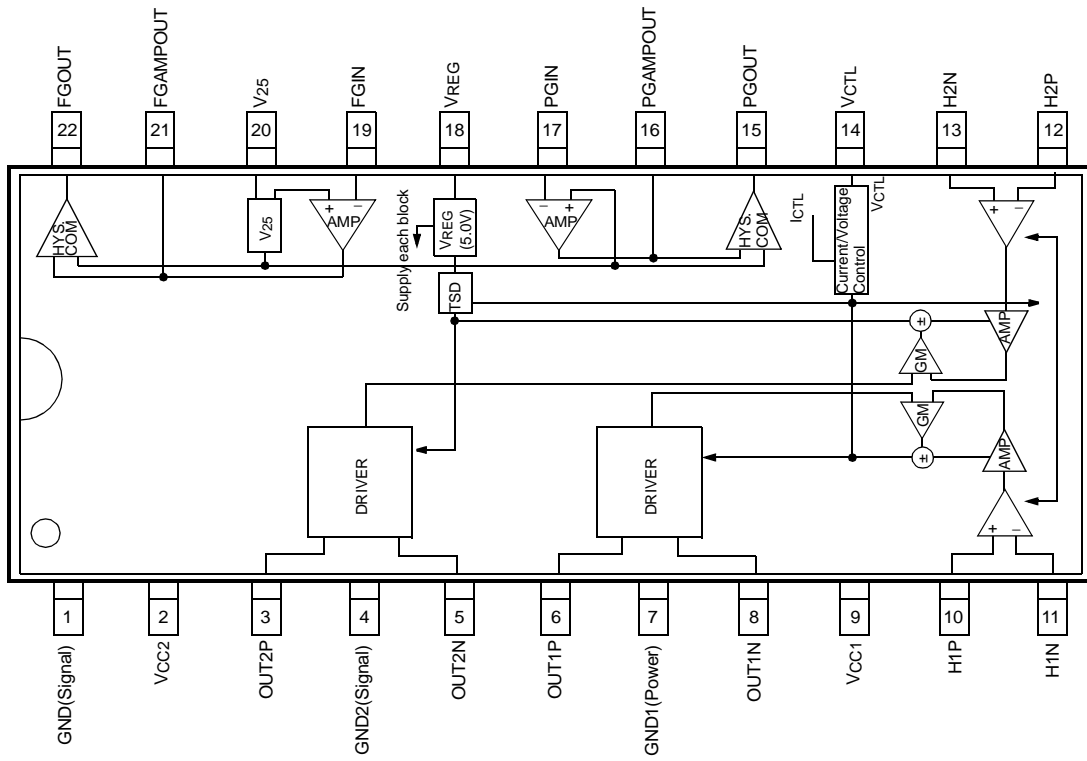
## Pin Assignments



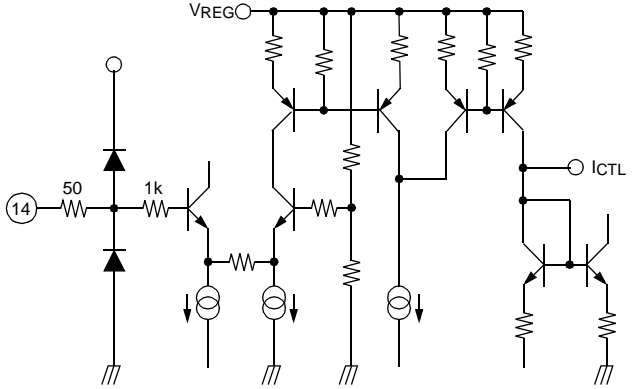
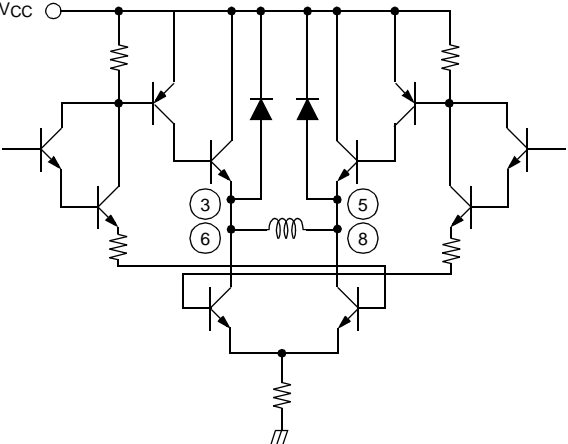
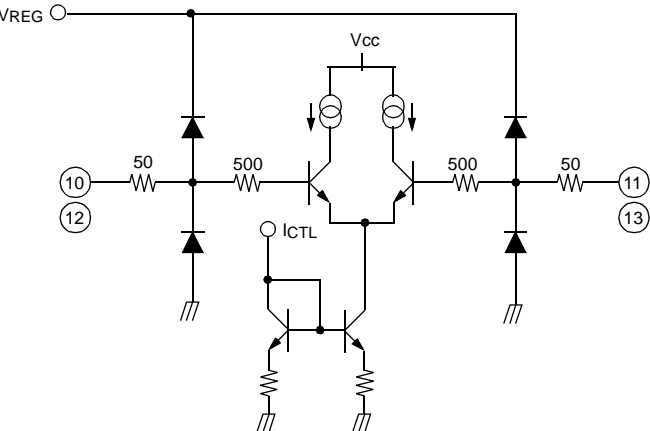
## Pin Definitions

Pine Number	Pin Name	I/O	Pin Function Description
1	GND (Signal)	-	Ground (Signal)
2	VCC2	-	Power supply 2
3	OUT2P	O	Output drive 2(P)
4	GND2 (Power)	-	Power ground 2
5	OUT2N	O	Output drive 2(N)
6	OUT1P	O	Power supply 1(P)
7	GND1 (Power)	-	Power ground 1
8	OUT1N	O	Output drive 1(N)
9	VCC1	-	Power supply 1
10	H1P	I	Hall signal input 1P
11	H1N	I	Hall signal input 1N
12	H2P	I	Hall signal input 2P
13	H2N	I	Hall signal input 2N
14	VCTL	I	Voltage control (Motor speed control)
15	PGOUT	O	Phase generator output
16	PGAMPOUT	O	Phase generator amp. output
17	PGIN	I	Phase generator input
18	VREG	O	Regurated voltage
19	FGIN	I	Frequency generator input
20	V25	I/O	Reference voltage
21	FGAMPOUT	O	Frequency generator amp. output
22	FGOUT	O	Frequency generator output

# Internal Block Diagram



## Equivalent Circuits

Description	Pin No.	Internal circuit
VCTL	14	
Motor output	3, 5, 6, 8	
Hall input	10, 11, 12, 13	

### Equivalent Circuits (Continued)

Description	Pin No.	Internal circuit
PG, FG amplifier	16, 17 19, 21	
PG, FG hysteresis amplifier	3, 5, 6, 8	

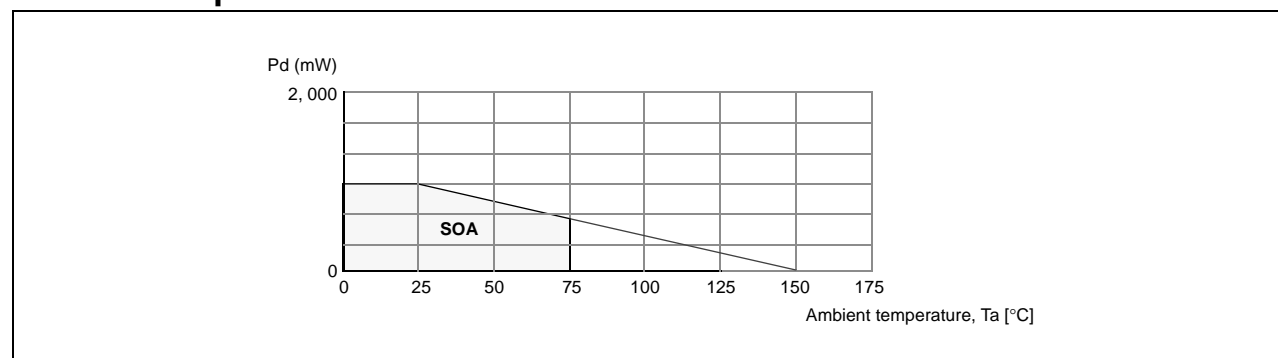
## Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Value	Unit	Remark
Supply voltage	VCCmax	18	V	-
Maxium output current	IOmax	1.0 <sup>note1</sup>	A	-
VREG output current	IREGmax	30	mA	-
Power dissipation	Pd	1 <sup>note2</sup>	W	No heat sink
Operating temperature	TOPR	-25 ~ +75	°C	-
Storage temperature	TSTG	-45 ~ +125	°C	-

### Notes:

- Duty 1 / 100, pulse width 500µs
- 1) When mounted on glass epoxy PCB (76.2 × 114 × 1.57mm)  
2) Power dissipation reduces 8.0mW / °C for using above Ta=25°C. (Without heat-sink)  
3) Do not exceed Pd and SOA(Safe Operating Area).

## Power Dissipation Curve



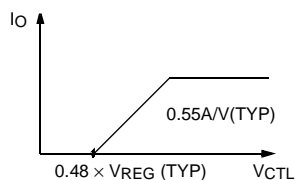
## Recommended Operating Conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max	Units
Operating supply voltage	VCC	8	12	16	V

## Electrical Characteristics

( $T_a=25^\circ\text{C}$ ,  $V_{CC}=12\text{V}$ , unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units
<b>FULL CIRCUIT</b>						
Quiescent current	$I_Q$	$V_{CC}=12\text{V}$	-	8.5	13	mA
<b>VOLTAGE REGULATOR</b>						
Regulated voltage	$V_{REG}$	$V_{CC}=12\text{V}$	4.6	5.0	5.4	V
Regulated voltage	$V_{REG}$	$V_{CC}=12\text{V}$ , $I_{REG}=-20\text{mA}$	4.6	5.0	5.4	V
<b>HALL INPUT</b>						
Hall minimum input level <sup>note</sup>	$V_{INH}$	-	50	-	-	mVp-p
Hall bias current	$I_{BH}$	$V_{CTL}=2.0\text{V}$ , Hall=2.5V	-	0.25	2.0	$\mu\text{A}$
<b>OUTPUT DIRVE</b>						
Output saturation voltage (Upper)	$V_{SU}$	$V_{CTL}=4.5\text{V}$	-	1.3	2.0	V
Output saturation voltage (Lower)	$V_{SL}$	$V_{CTL}=4.5\text{V}$	-	2.0	2.0	V
Output current A	$I_{OUTA}$	$V_{H1P}=2.6\text{V}$ $V_{H1N}=2.4\text{V}$ , $V_{CTL}=3.5\text{V}$	500	700	900	mA
Output current B	$I_{OUTB}$	$V_{H2P}=2.6\text{V}$ $V_{H2N}=2.4\text{V}$ , $V_{CTL}=2.5\text{V}$	500	700	900	mA
<b>VOLTAGE CONTROL</b>						
$V_{CTL}$ reference voltage <sup>note</sup>	$V_{25}$	$0.48 \times V_{REG}$	2.0	2.3	2.5	V
$V_{CTL}$ input range <sup>note</sup>	$V_{CTL}$	-	0	-	$V_{REG}$	V
$V_{CTL}$ offset range	$V_{OFF}$	$V_{CTL}=0 \sim V_{CTL}$	-150	0	+150	mV
$V_{CTL}$ input bias current	$I_{VCTL}$	$V_{CTL}=2.5\text{V}$	-	1.0	6.0	$\mu\text{A}$
Voltage control gain	$G_M$	$V_{CTL}=2.8\text{V}$ , $3.3\text{V}$ $\Delta I_O / \Delta V_{CTL}$ $V_{H1P}=2.6\text{V}$ , $V_{H1N}=2.4\text{V}$	0.38	0.55	0.64	A / V



### Notes:

The note in the chart means items calculated and approved in design not the items proven by actual test result.

## Electrical Characteristics (Continued)

(Ta=25°C, VCC=12V, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units
<b>FULL CIRCUIT</b>						
Shutdown temperature <sup>note</sup>	TSD	-	130	160	-	°C
Temperature hysteresis <sup>note</sup>	THYS	-	-	30	-	°C
<b>FG / PG AMP</b>						
Input offset voltage	VOFS	-	-	0	± 8	mV
Input current	IAMPIN	VIN=2.5V	-	0.2	2.0	μA
Open loop gain <sup>note</sup>	GA	VCC=12V, Signal=500Hz	65	70	-	dB
Output high voltage	VOHA	VIN=2.0V	VREG -1.48	VREG -0.74	-	V
Output low voltage	VOLA	VIN=2.7	-	0.85	1.45	V
<b>COMPARATOR (HYSTERESIS)</b>						
Hysteresis level	VHYS	-	±130	±165	±200	mV
Output low voltage	VOLHYS	VIN=2.0V	-	0.12	0.32	V
Output pull-up resistance	VBHYS	-	7.0	10	13	kΩ

### Notes:

The note in the chart means items calculated and approved in design not the items proven by actual test result.



## Application Informations

### 1. A DIAGRAM SUMMARIZING THE ENTIRE SYSTEM

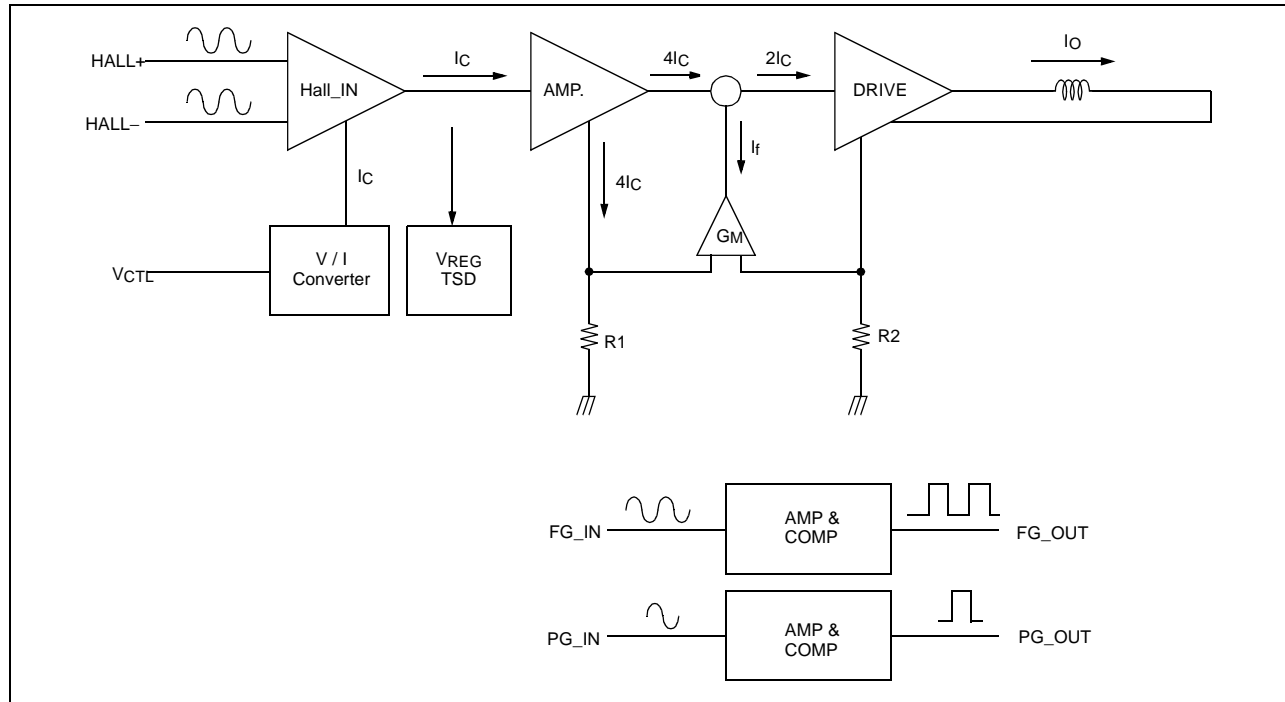


Figure 1.

Figure 1 is a conceptual diagram of the KA3084D. It shows that it turns on or off depending on the signal of the hall sensor used for sensing the rotor position of motor.

The AMP, GM (Feedback) and output blocks are circuits used to determine current gain of KA3084D.

Furthermore, HallIN represents the hall signal switch.

It supplies stable bias to each VREG block. The TSD block is a thermal shutdown circuit that protects the IC during an high temperature inside the IC.

Moreover, FG. and PG. blocks output individual signals generated in the motor using the amplifier and comparator.

These signals transmit motor speed and position data to controller of external servo etc. for their control.

### 2. CURRENT CONTROL

Figure 2 simplifies figure 1.

The supplied IO current drives the motor and the I<sub>c</sub> current controls the motor speed.

Figure 3 is a graph of I<sub>CTL</sub> vs. I<sub>O</sub>.

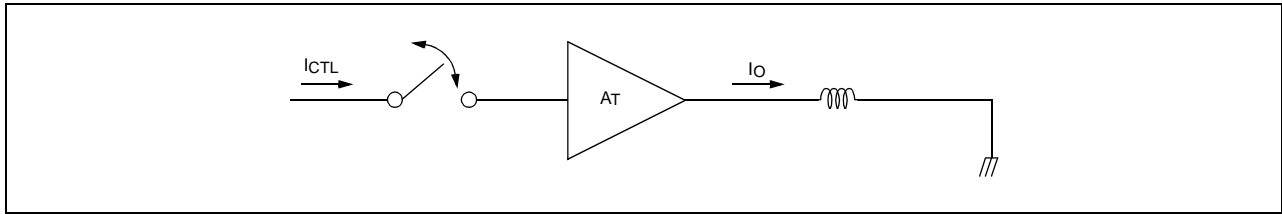


Figure 2.

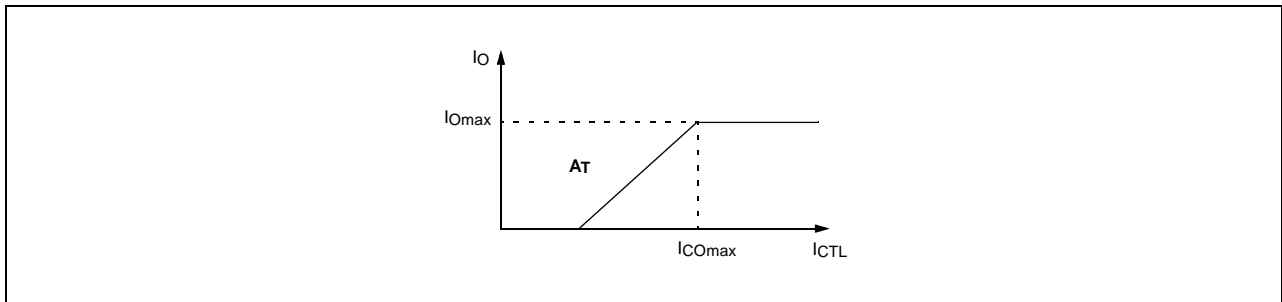


Figure 3.

### 3. VOLTAGE CONTROL

Even though KA3084D command uses  $I_c$  to control the magnitude of  $I_O$ , it can also use voltage. KA3084D mainly uses voltage control and has option to use current control.

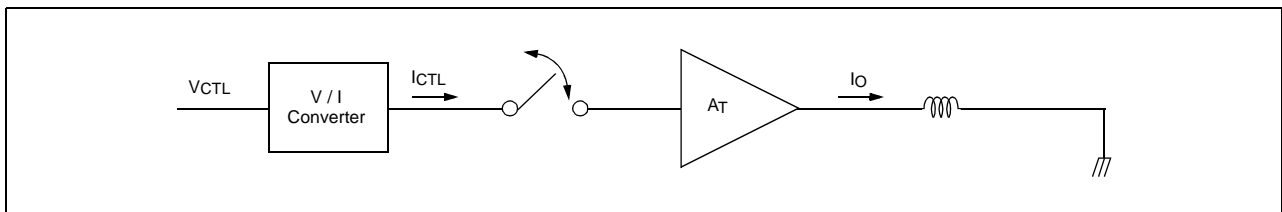


Figure 4.

Figure 4 shows the principle of the voltage control.

The  $V_{CTL}$  is the motor speed control voltage, and the  $I_{CTL}$  is converted to current through the V / I converter.

Figure 5 shows the graph of  $V_{CTL}$  vs.  $I_O$ .

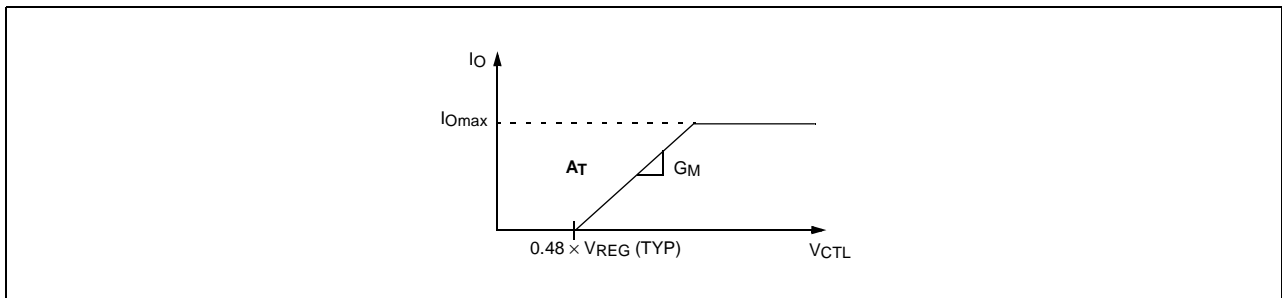
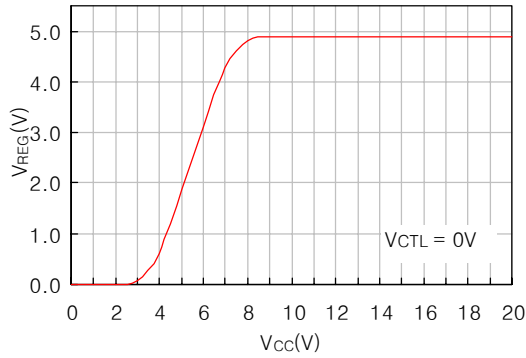
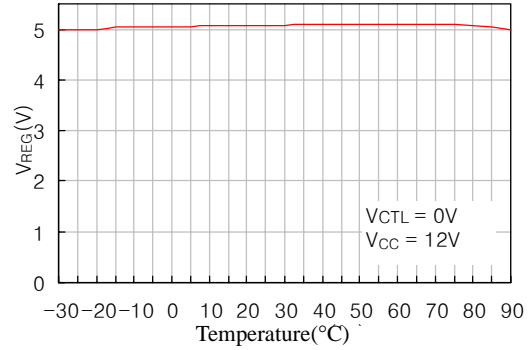


Figure 5.

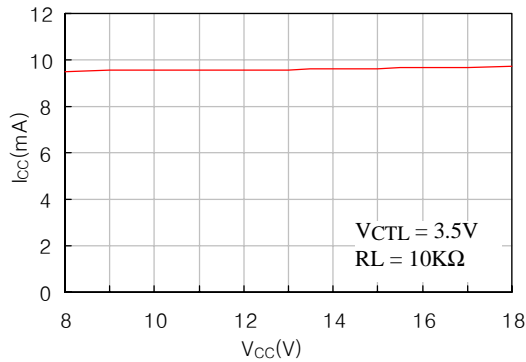
## Typical Performance Characteristics



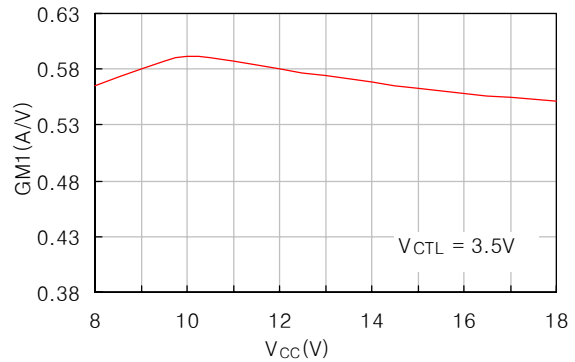
1.  $V_{CC}$  vs  $V_{REG}$



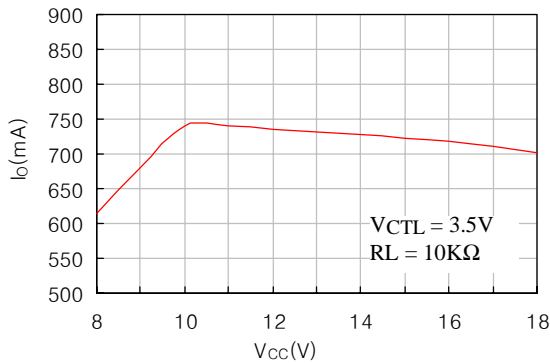
2. Temp. vs  $V_{REG}$



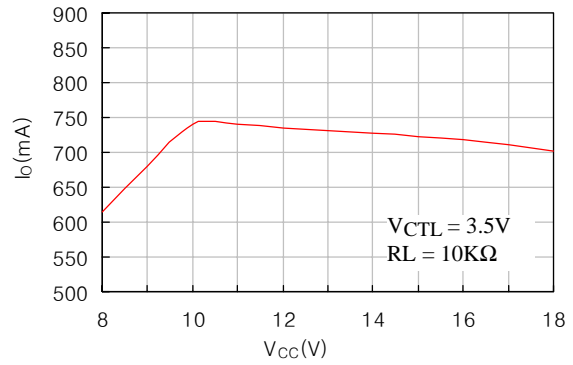
3.  $V_{CC}$  vs  $I_{CC}$



4.  $V_{CC}$  vs  $GM1$

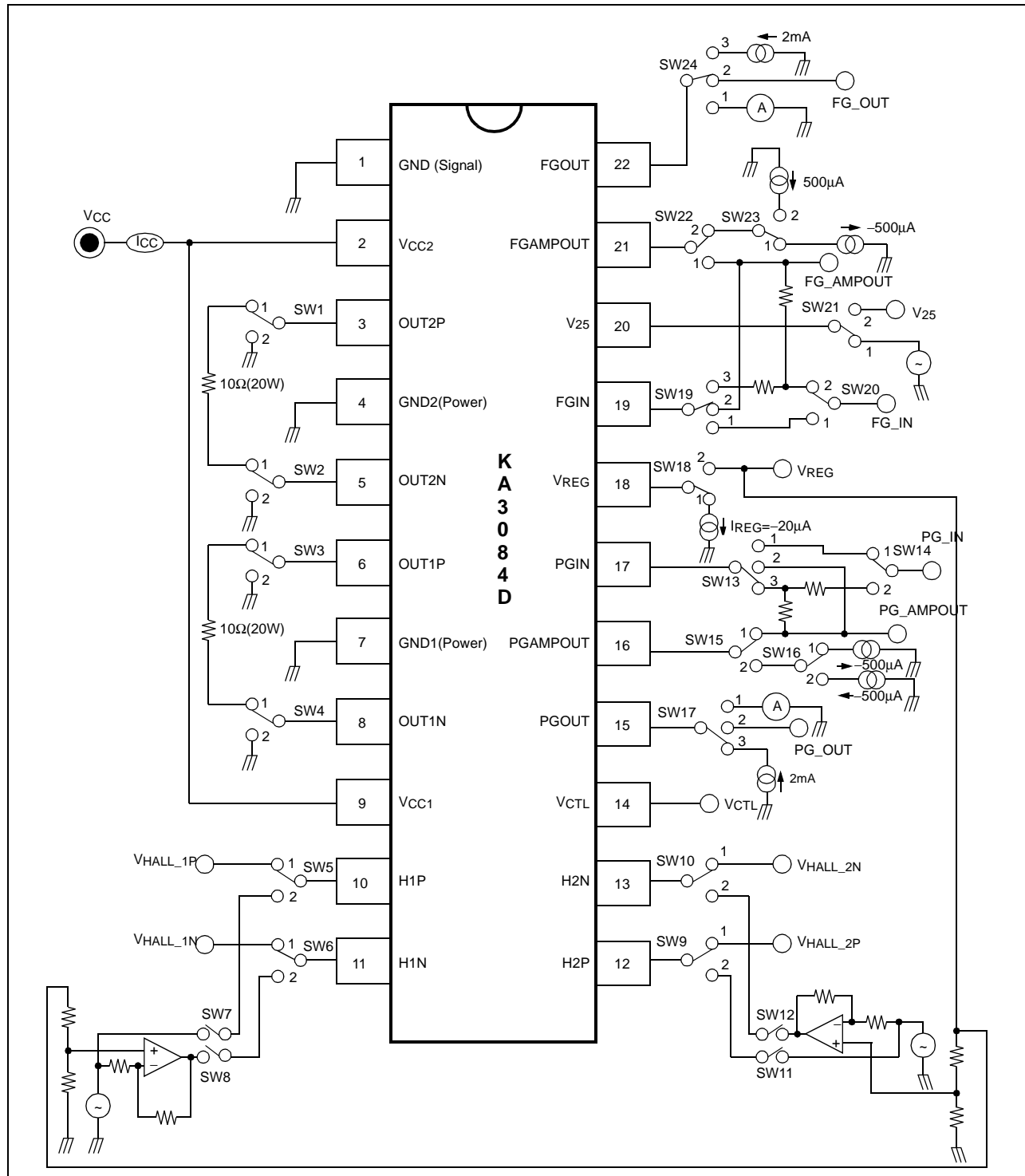


5.  $V_{CC}$  vs  $I_{OA}$

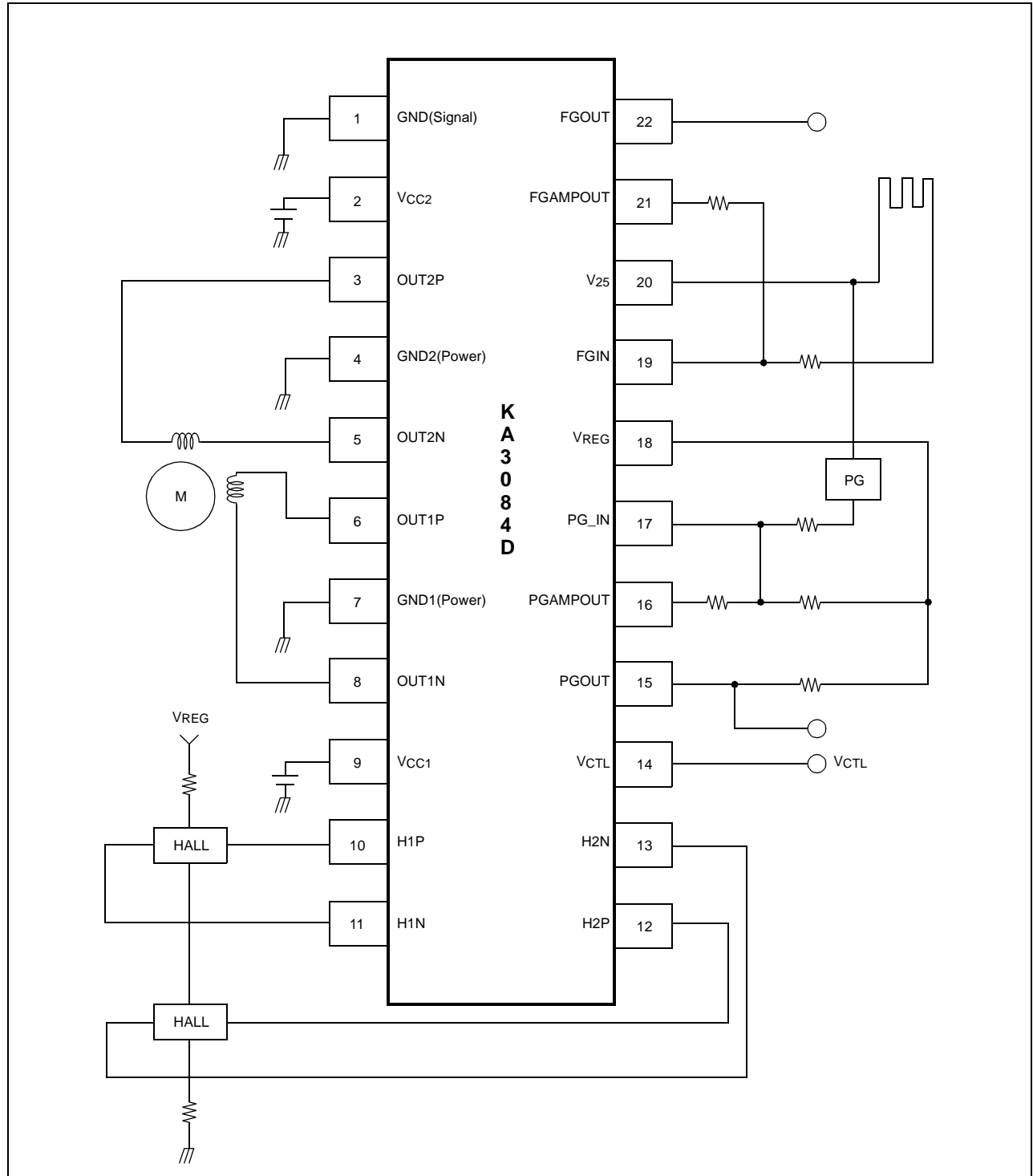


6.  $V_{CC}$  vs  $I_{OB}$

## Test Circuits



# Typical Application Circuits



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