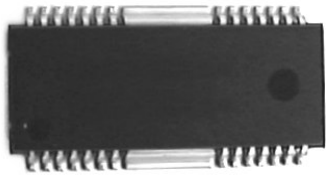
4-CH MOTOR DRIVER

The KA3010D is a monolithic integrated circuit, and suitable for 4-CH motor driver which drives tracking actuator, focus actuator, sled motor and loading motor of CD/CD-ROM/DVD system, and can also drive spindle motor of CD system.

28-SSOPH-375



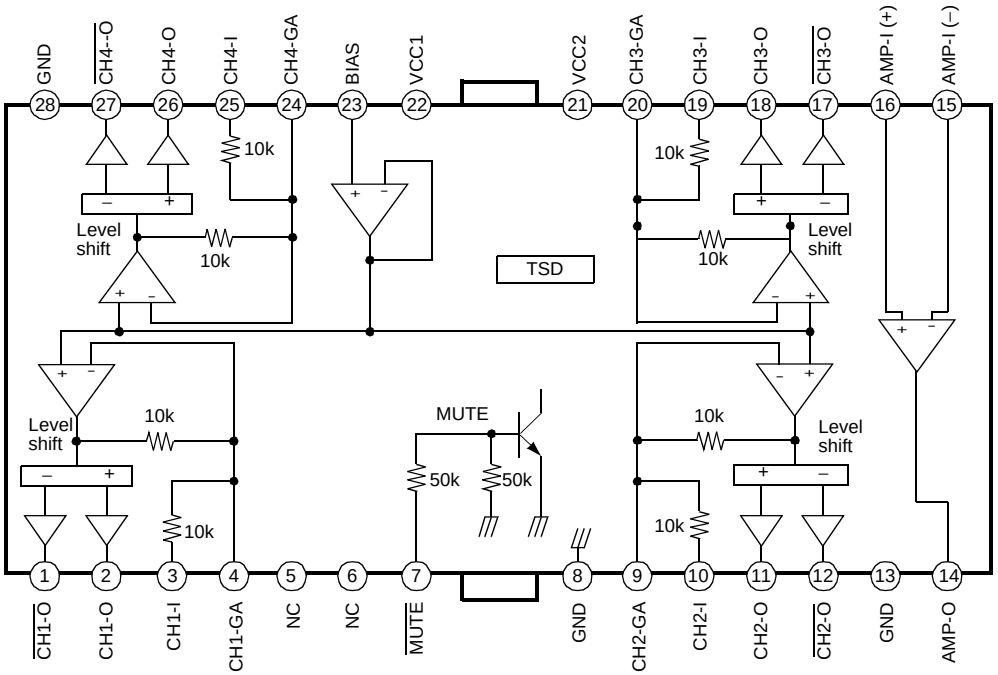
FEATURES

- 1-phase, full-wave, linear DC motor driver
- Wide dynamic range:
  - — V_{CC}=5V, R_L=8Ω → V_{OM}=3.0V
  - — V_{CC}=12V, R_L=24Ω → V_{OM}=9.5V
- Output gain adjustable
- Built in op-amp
- Built in mute function
- Built in level shift circuit
- Built in thermal shutdown function

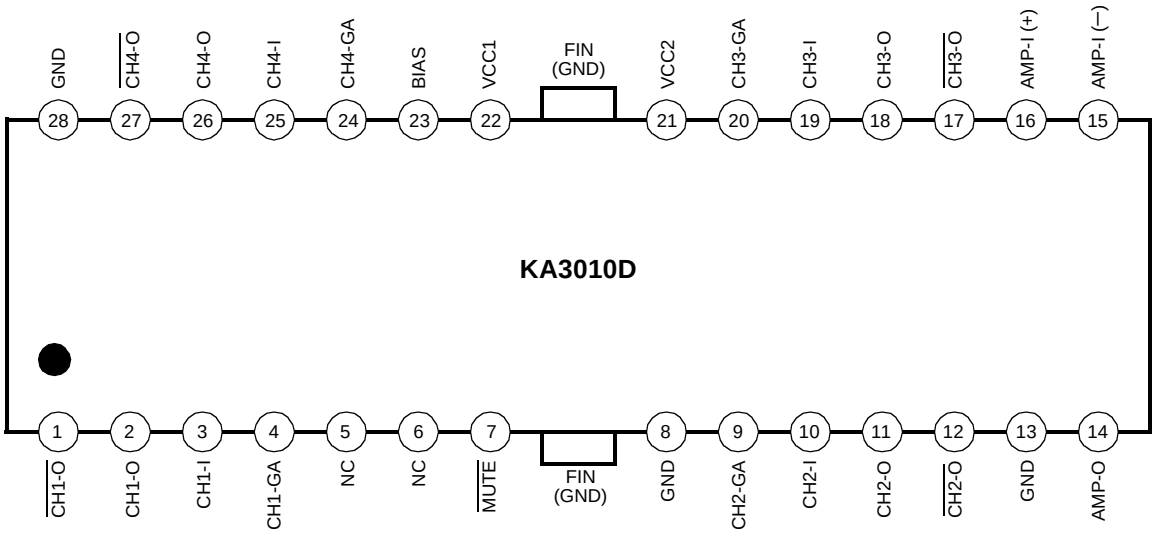
ORDERING INFORMATION

Device	Package	Operating Temperature
KA3010D	28-SSOPH-375	–20°C ~ +75°C

BLOCK DIAGRAM



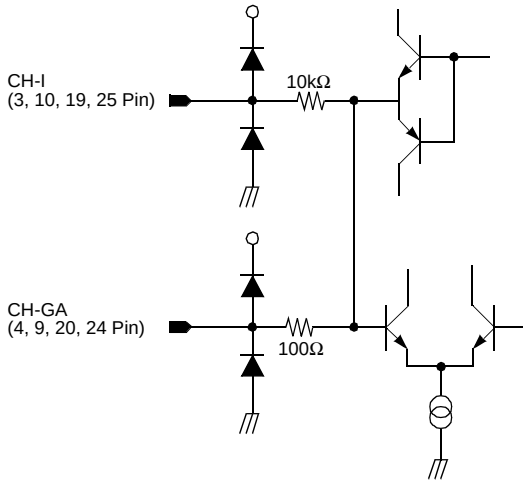
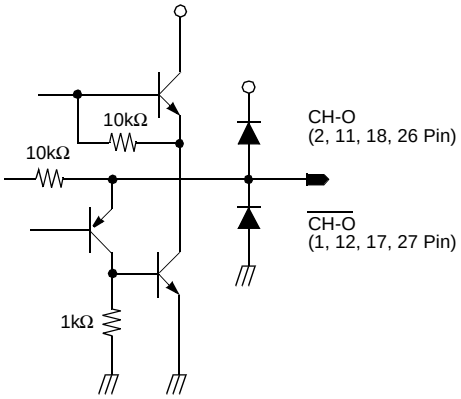
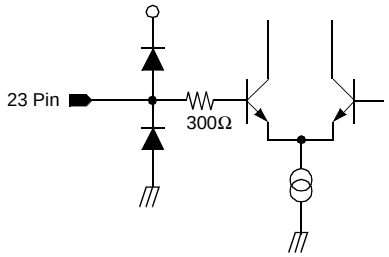
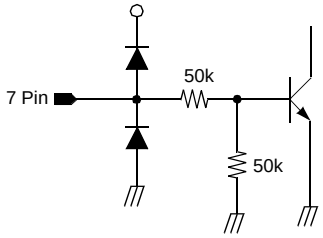
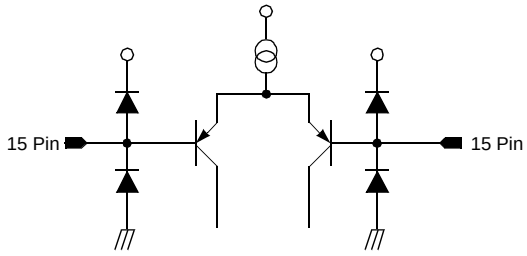
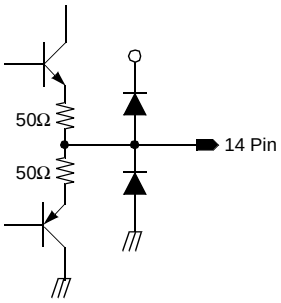
PIN CONFIGURATION



PIN DESCRIPTION

Pin No.	Symbol	I/O	Description	Pin No.	Symbol	I/O	Description
1	$\overline{\text{CH1-O}}$	O	Drive CH 1 output (–)	15	AMP-1 (–)	I	Op-amp input (–)
2	CH1-O	O	Drive CH 1 output (+)	16	AMP-I (+)	I	Op-amp input (+)
3	CH1-I	I	Drive CH 1 input	17	$\overline{\text{CH3-O}}$	O	Drive CH 3 output (–)
4	CH1-GA	I	Drive CH1 input (Adjustable)	18	CH3-O	O	Drive CH 3 output (+)
5	NC	–	No connection	19	CH3-I	I	Drive CH 3 input
6	NC	–	No connection	20	CH3-GA	I	Drive CH 3 input (Adjustable)
7	$\overline{\text{MUTE}}$	I	Mute	21	VCC2	–	Supply voltage 2
8	GND	–	Signal ground	22	VCC1	–	Supply voltage 1
9	CH2-GA	I	Drive CH 2 input (Adjustable)	23	BIAS	I	2.5V bias
10	CH2-I	I	Drive CH 2 input	24	CH4-GA	I	Drive CH 4 input (Adjustable)
11	CH2-O	O	Drive CH 2 output (+)	25	CH4-I	I	Drive CH 4 input
12	$\overline{\text{CH2-O}}$	O	Drive CH 2 output (–)	26	CH4-O	O	Drive CH 4 output (+)
13	GND	–	Power ground	27	$\overline{\text{CH4-O}}$	O	Drive CH 4 output (–)
14	AMP-O	O	Op-amp output	28	GND	–	Power ground

EQUIVALENT CIRCUITS

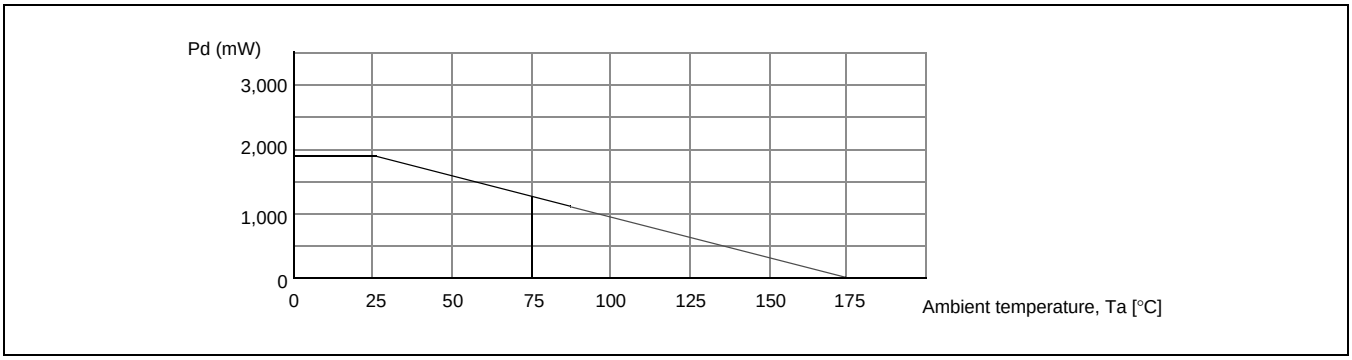
Driver input	Driver output
	
Bias	**Mute**
	
Opamp input	**Op-amp output**
	

ABSOLUTE MAXIMUM RATING (Ta=25°C)

Characteristics	Symbol	Value	Unit
Maximum supply voltage	V_{CC1}, V_{CC2}	15	V
Power dissipation	P_D	1.7[note]	W
Operating temperature	T_{OPR}	–20 ~ +75	°C
Storage temperature	T_{STG}	–55 ~ +150	°C

NOTE:

1. When mounted on 50mm × 50mm × 1mm PCB (Phenolic resin material).
2. Power dissipation reduces 13.6mW / °C for using above Ta=25°C.
3. Do not exceed Pd and SOA.



RECOMMENDED OPERATING CONDITION (Ta=25°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC1}, V_{CC2}	4.5	–	13	V
Operating temperature	T_{OPR}	–25	–	+75	°C

ELECTRICAL CHARACTERISTICS

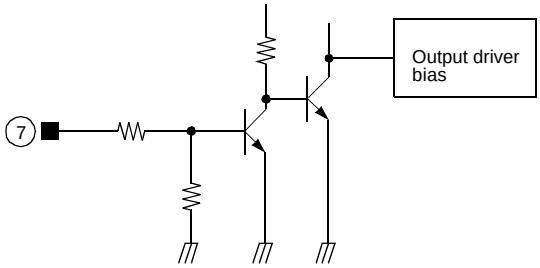
(Ta=25°C, $V_{CC}1=V_{CC}2=5V$, $R_L=8\Omega$)

Characteristic	Symbol	Test conditions	Min.	Typ.	Max.	Unit
DRIVE PART						
Quiescent current	I_{CC}	–	–	9	12	mA
Output offset voltage	V_{OO}	–	–50	0	50	mV
Maximum output voltage	V_{OM}	–	2.0	3.0	–	V
		$V_{CC}1=V_{CC}2=12V$, RL=24Ω	6.5	9.5	–	V
Voltage gain	G_{VC}	$V_{IN}=0.1V_{RMS}$, 1kHz	10.5	12.0	13.5	dB
Ripple rejection ratio	RR	$V_{IN}=0.1V_{RMS}$, 120Hz	–	50	–	dB
Slew rate	SR	120Hz, $2V_{P-P}$	–	0.8	–	V / µs
		$V_{CC}1$ & 2=12V, 120Hz, 4Vp-p	–	1.0	–	V / µs
Mute off voltage	V_{MOFF}	–	2.0	–	–	V
Mute on voltage	V_{MON}	–	–	–	0.5	V
OP-AMP PART						
Input offset voltage	V_{OFOP}	–	–10	0	10	mV
Input bias current	I_{BOP}	–	–	–	300	nA
High level output voltage	V_{OHOP}	–	3	3.9	–	V
		$V_{CC}1=V_{CC}2=12V$	10	10.9	–	V
Low level output voltage	V_{OLOP}	–	–	1.1	1.8	V
Output sink current	I_{SINK}	RL=50Ω	10	30	–	mA
		$V_{CC}1=V_{CC}2=12V$, RL=50Ω	10	95	–	mA
Output source current	I_{SOURCE}	RL=50Ω	10	30	–	mA
		$V_{CC}1=V_{CC}2=12V$, RL=50Ω	10	50	–	mA
Voltage gain	G_{VO}	V_{IN}= –75dB, 1kHz	–	78	–	dB
Slew rate	SR_{OP}	100Hz, 2Vp-p	–	2	–	V / µs
Ripple rejection ratio	RR_{OP}	V_{IN}= –20dB, 120kHz	–	65	–	dB
Common-mode rejection ratio	CMRR	V_{IN}= –20dB, 1kHz	–	84	–	dB

APPLICATION INFORMATION

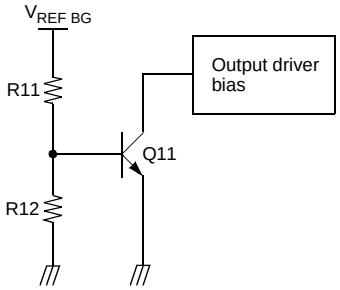
1. MUTEM

Pin #7	Mute circuit
High	Turn-off
Low	Turn-on
Open	Turn-on



- When the mute pin #7 is open or the voltage of the mute pin #7 is below 0.5V, the mute circuit is activated so that the output circuit will be muted.
- When the voltage of the mute pin is above 2V, the mute circuit is stopped and the output circuit is operated normally.
- If the chip temperature rises above 175°C, then the TSD (Thermal shutdown) circuit is activated and the output circuit is muted.

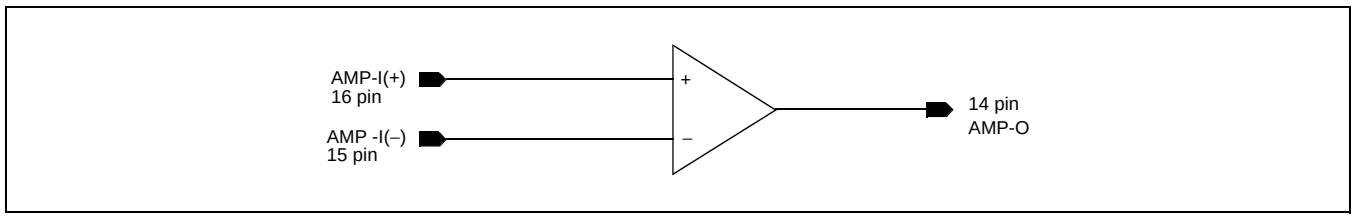
2. TSD (THERMAL SHUTDOWN)



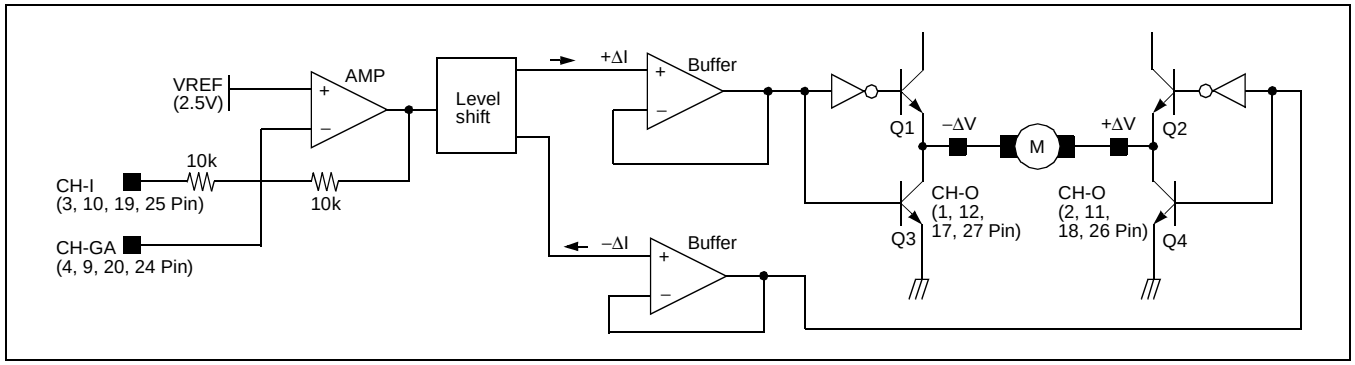
- The $V_{REF\ BG}$ is the output voltage of the band-gap-referenced bias in circuit and acts as the input voltage of the TSD circuit.
- The base-emitter voltage of the TR, Q11 is designed to turn-on at below voltage.
  $V_{BE} = V_{REF\ BG} \times R12 / (R11 + R12) = 460mV$
- When the chip temperature rises up to 175°C, then the turn-on voltage of the Q11 would drop down to 460mV. (Hysteresis: 25°C) Hence, the Q11 would turn on so the output circuit will be muted.

3. OP-AMP

Op-amp is integrated in the IC for user's convenience.



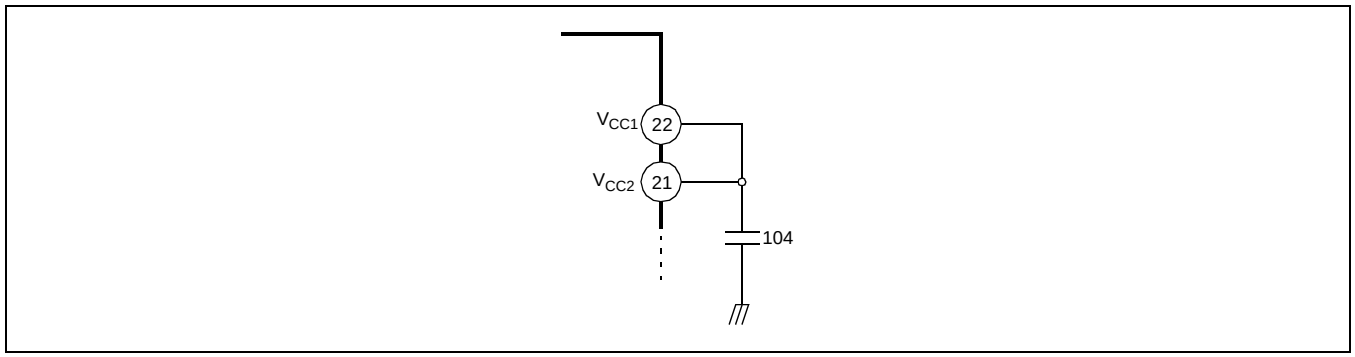
4. DRIVER



- The voltage, V_{REF}, is the reference voltage given by the bias voltage of the pin #23.
- The input signal through the pin #3 is amplified by 10k/10k times and then fed to the level shift.
- The level shift produces the current due to the difference between the input signal and the arbitrary reference signal. The current produced as $+\Delta I$ and $-\Delta I$ is fed into the driver buffer.
- Driver buffer operates the power TR of the output stage according to the state of the input signal.
- The output stage is the BTL driver and the motor is rotating in forward direction by operating TR Q1 and TR Q4. On the other hand, if TR Q2 and TR Q3 is operating, the motor is rotating in reverse direction.
- When the input voltage through the pin #3 is below the V_{REF}, then the direction of the motor in forward direction.
- When the input voltage through the pin #3 is above the V_{REF}, then the direction of the motor in reverse direction.
- If it is desired to change the gain, then the pin #4 can be used.
- The gain (A_V) of the drive circuit is as follows.

$$A_V = 20 \log \left[\frac{4V_{IN}}{V_{IN}} \right] = 12(dB)$$

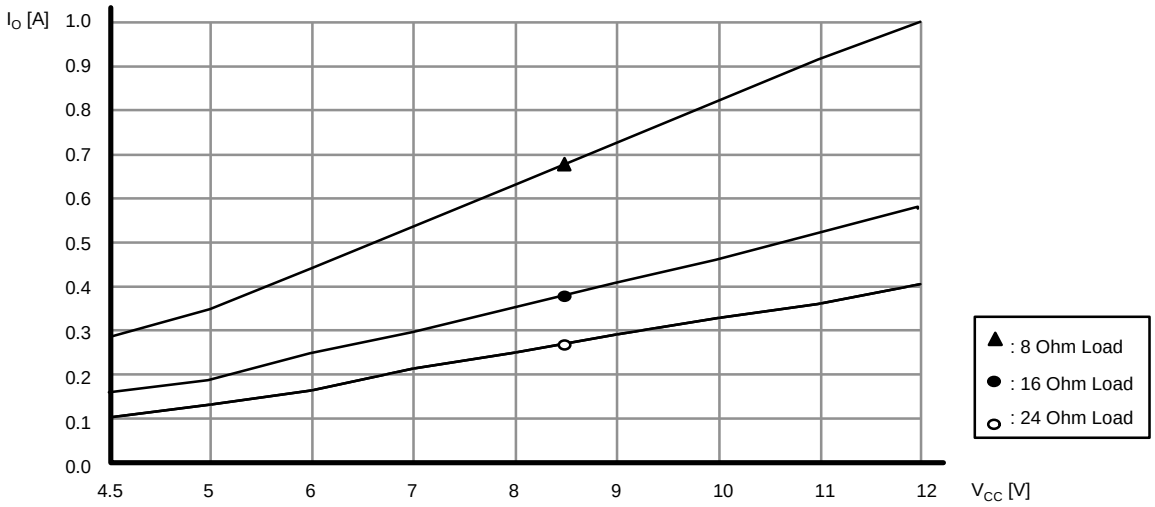
5. Connect a by-pass capacitor, 0.1μF between the supply voltage source.



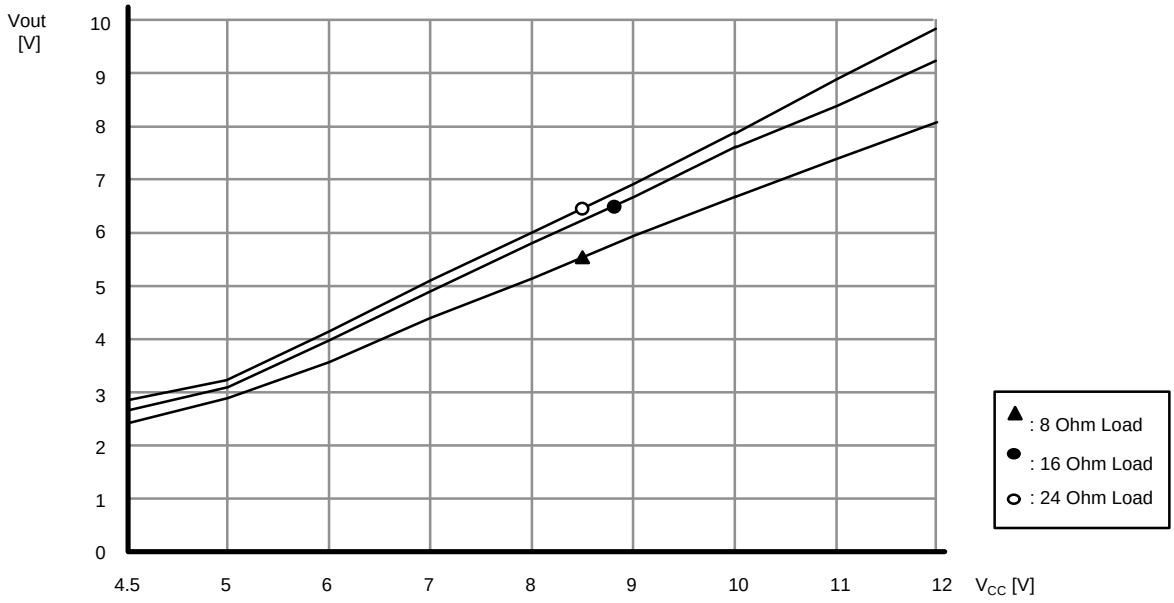
6. Radiation fin is connecting to the internal GND of the package.
Connect the fin to the external GND.

ELECTRICAL CHARACTERISTICS CURVES

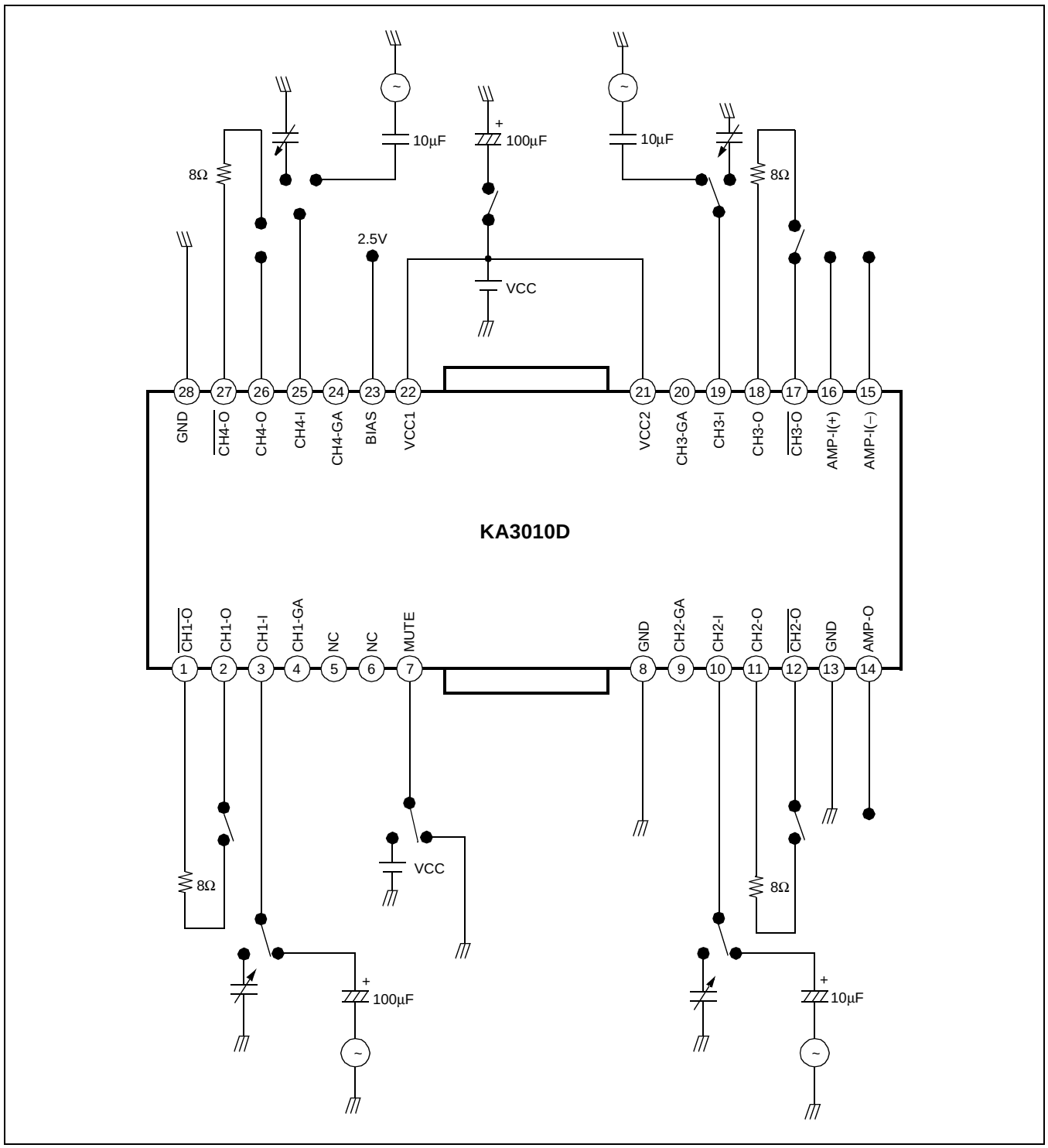
1. V_{CC} vs. output current



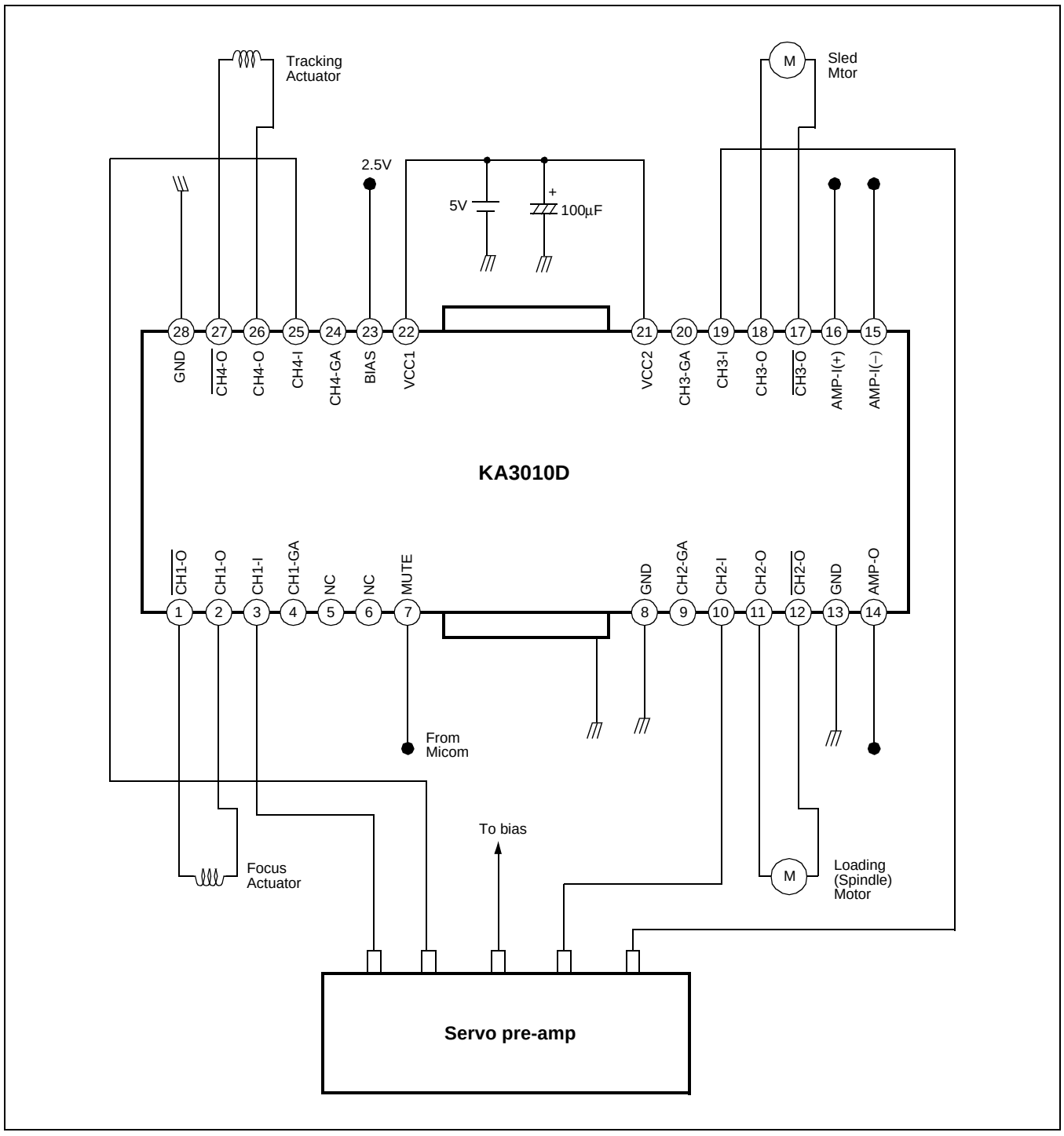
2. V_{CC} vs. Vout



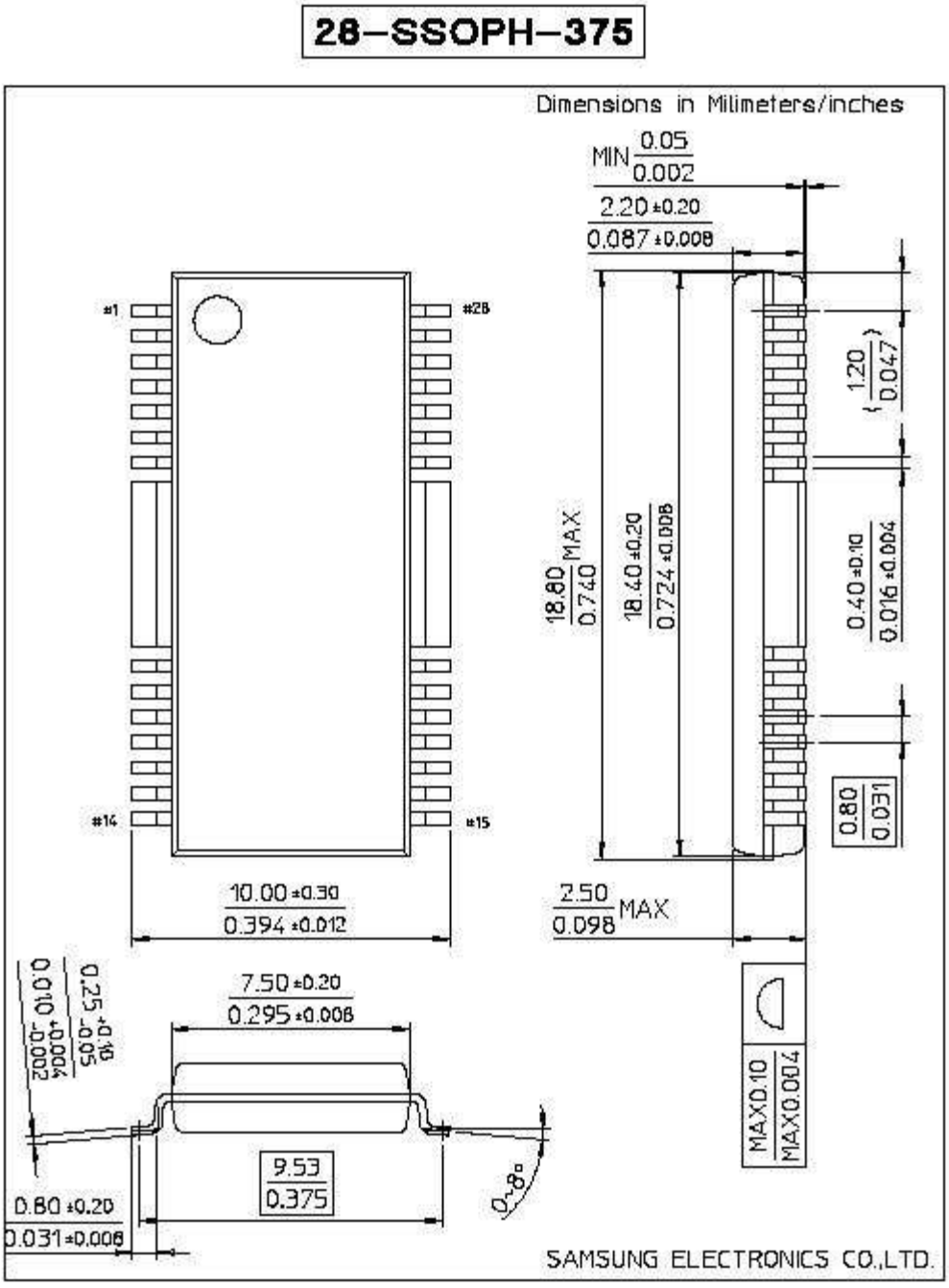
TEST CIRCUIT



APPLICATION CIRCUIT



PACKAGE DIMENSION



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