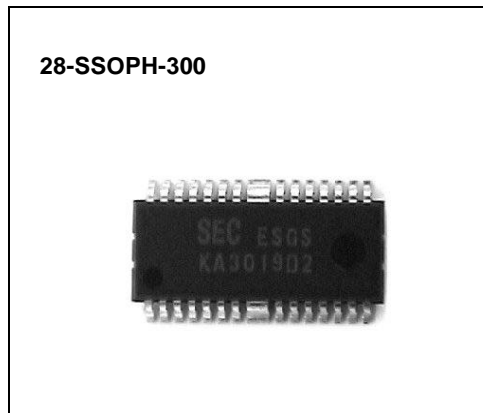


4-CH MOTOR DRIVER

The KA3019D2 is a monolithic integrated circuit, suitable for a 1-ch (Forward.reverse) control DC motor driver and a 3-ch motor driver which drives the focus actuator, tracking actuator, and sled motor of a CD system.

FEATURES

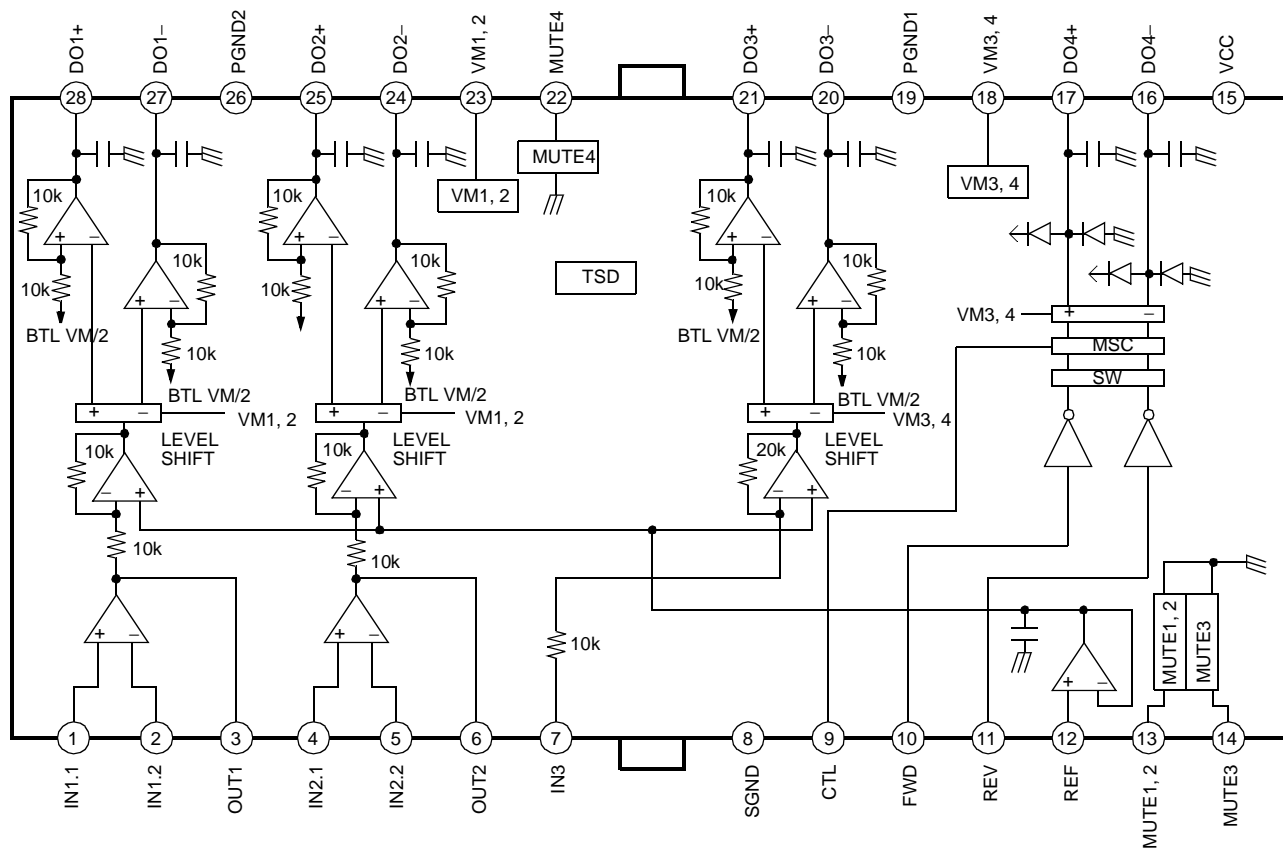
- 3-Channel BTL driver
- 1-Channel forward-reverse control DC motor driver
- Built-in thermal shutdown circuit
- Built-in mute circuit
- Operating supply voltage: 4.5~5.5V
- Corresponds to 3.3V or 5V DSP



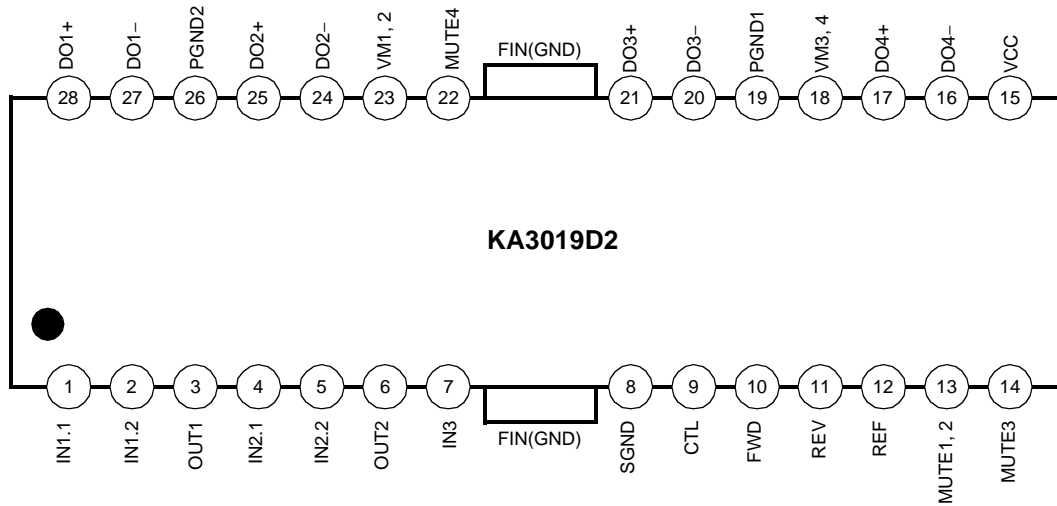
ORDERING INFORMATION

Device	Package	Operating Temperature
KA3019D2	28-SSOPH-300	-35°C ~ +85°C

BLOCK DIAGRAM



PIN CONFIGURATION



PIN DESCRIPTION

Pin No.	Symbol	I/O	Description	Pin No.	Symbol	I/O	Description
1	IN1.1	I	Op-amp CH1 input (+)	15	V _{CC}	-	Signal V _{CC}
2	IN1.2	I	Op-amp CH1 input (-)	16	DO4-	O	Drive4 output (-)
3	OUT1	O	Op-amp CH1 output	17	DO4+	O	Drive4 output (+)
4	IN2.1	I	Op-amp CH2 input (+)	18	VM3, 4	-	BTL CH3, 4 power V _{CC}
5	IN2.2	I	Op-amp CH2 input (-)	19	PGND1	-	CH3, 4 power ground
6	OUT2	O	Op-amp CH2 output	20	DO3-	O	Drive3 output (-)
7	IN3	I	Op-amp CH3 Input	21	DO3+	O	Drive3 output (+)
8	SGND	-	Signal ground	22	MUTE4	-	CH4 mute
9	CTL	I	CH4 motor speed control	23	VM1, 2	-	BTL CH1, 2 power V _{CC}
10	FWD	I	CH4 forward	24	DO2-	O	Drive2 output (-)
11	REV	I	CH4 reverse	25	DO2+	O	Drive2 output (+)
12	REF	I	Bias voltage input	26	PGND2	-	CH1, 2 power ground
13	MUTE1, 2	I	CH1, 2 mute	27	DO1-	O	Drive1 output (-)
14	MUTE3	I	CH3 mute	28	DO1+	O	Drive1 output (+)

EQUIVALENT CIRCUITS

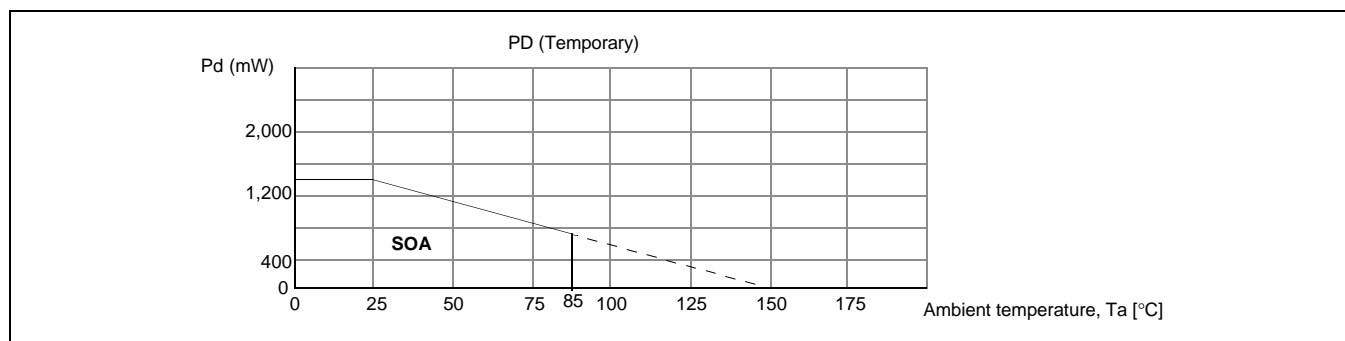
Mute input	Power output
CH3 level shift input	Signal reference input
Error amp input	Loading control input
Error amp output	Loading logic input

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristics	Symbol	Value	Unit
Maximum supply voltage	V_{CCMAX}	7	V
Power dissipation	P_D	@1.4	W
Operating temperature range	T_{OPR}	-35 ~ +85	°C
Storage temperature range	T_{STG}	-55 ~ +150	°C

@:

1. When mounted on a 76.2mm × 114mm × 1.57mm PCB (Phenolic resin material).
2. Power dissipation reduces 11.2mW / °C for using above Ta = 25°C
3. Do not exceed Pd and SOA (Safe operating area).

**RECOMMENDED OPERATING CONDITIONS**

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	4.5	–	5.5	V

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $T_a=25^\circ\text{C}$, $V_{CC}=VM12=VM3$, $4=5\text{V}$)

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Unit
Quiescent current	I_{CC}	$V_{IN}=0\text{V}$	–	8	12	mA
CH Mute on current	I_{MUTECH}	Pin13, Pin14, Pin22=GND	–	1	3	mA
CH Mute on voltage	V_{MONCH}	Pin13, Pin14, Pin22=Variation	–	–	0.5	V
CH Mute off voltage	V_{MOFFCH}	Pin13, Pin14, Pin22=Variation	2	–	–	V
DRIVE PART						
Input offset voltage	V_{IO}	–	–20	–	+20	mV
Output offset voltage	V_{OO}	$V_{IN}=2.5\text{V}$	–40	–	+40	mV
Maximum output voltage 1	V_{OM1}	$R_L=8\Omega$ (CH1, 2)	2.7	3.4	–	V
Maximum output voltage 2	V_{OM2}	$R_L=24\Omega$ (CH3)	3	3.8	–	V
Close loop voltage gain 1	G_{VC1}	$f=1\text{kHz}$, $V_{IN}=0.1V_{RMS}$ (CH1, 2)	10.5	12	13.5	dB
Close loop voltage gain 2	G_{VC2}	$f=1\text{kHz}$, $V_{IN}=0.1V_{RMS}$ (CH3)	16	18	20	dB
Ripple rejection ratio	RR	$V_{IN}=0.1V_{RMS}$, $f=120\text{Hz}$	–	60	–	dB
Slew rate	SR	$V_O=2\text{Vp-p}$, $f=120\text{kHz}$	–	0.8	–	V/ μs
ERROR OP AMP PART						
Input offset voltage	V_{OFOP}	–	–10	–	+10	mV
Input bias current	I_{BOP}	–	–	–	300	nA
High level output voltage	V_{OHOP}		4.5	4.8	–	V
Low level output voltage	V_{OLOP}		–	0.2	0.5	V
Output sink current	I_{SINK}	$R_L=1\text{k}\Omega$	2	4	–	mA
Output source current	I_{SOURCE}	$R_L=1\text{k}\Omega$	2	4	–	mA
Open loop voltage gain	G_{VO}	$V_{IN}=-75\text{dB}$, $f=1\text{kHz}$	–	75	–	dB
Ripple rejection ratio	RR_{OP}	$V_{IN}=-20\text{dB}$, $f=120\text{Hz}$	–	65	–	dB
Slew rate	SR_{OP}	$f=120\text{kHz}$, 2Vp-p	–	1	–	V/ μs
Common mode rejection ratio	CMRR	$V_{IN}=-20\text{dB}$, $f=1\text{kHz}$	–	80	–	dB
Common mode input range	V_{ICM}		–0.3	–	4.5	V
TRAY DRIVE PART ($V_{CC} = VM3$, $4 = 5\text{V}$, $R_L = 45\Omega$)						
Input high level voltage	V_{IH}	–	2	–	–	V
Input low level voltage	V_{IL}	–	–	–	0.5	V
Output voltage	V_O	$V_{CTL}=3.5\text{V}$	2.8	3.5	4.2	V
Output load regulation	ΔV_{RL}	–	–	300	700	mV
Output offset voltage 1	V_{OO1}	$V_{IN}=5\text{V}$, 5V	–10	–	+10	mV
Output offset voltage 2	V_{OO2}	$V_{IN}=0\text{V}$, 0V	–10	–	+10	mV

APPLICATION INFORMATION

1. REFERENCE INPUT

Pin 12 (REF) is a reference Input pin.

- Reference input
The applied voltage at the reference input pin must be between 2V and 6.5V, when $V_{CC}=8.5V$.

2. SEPARATED CHANNEL MUTE FUNCTION

These pins are used for individual channel mute operation.

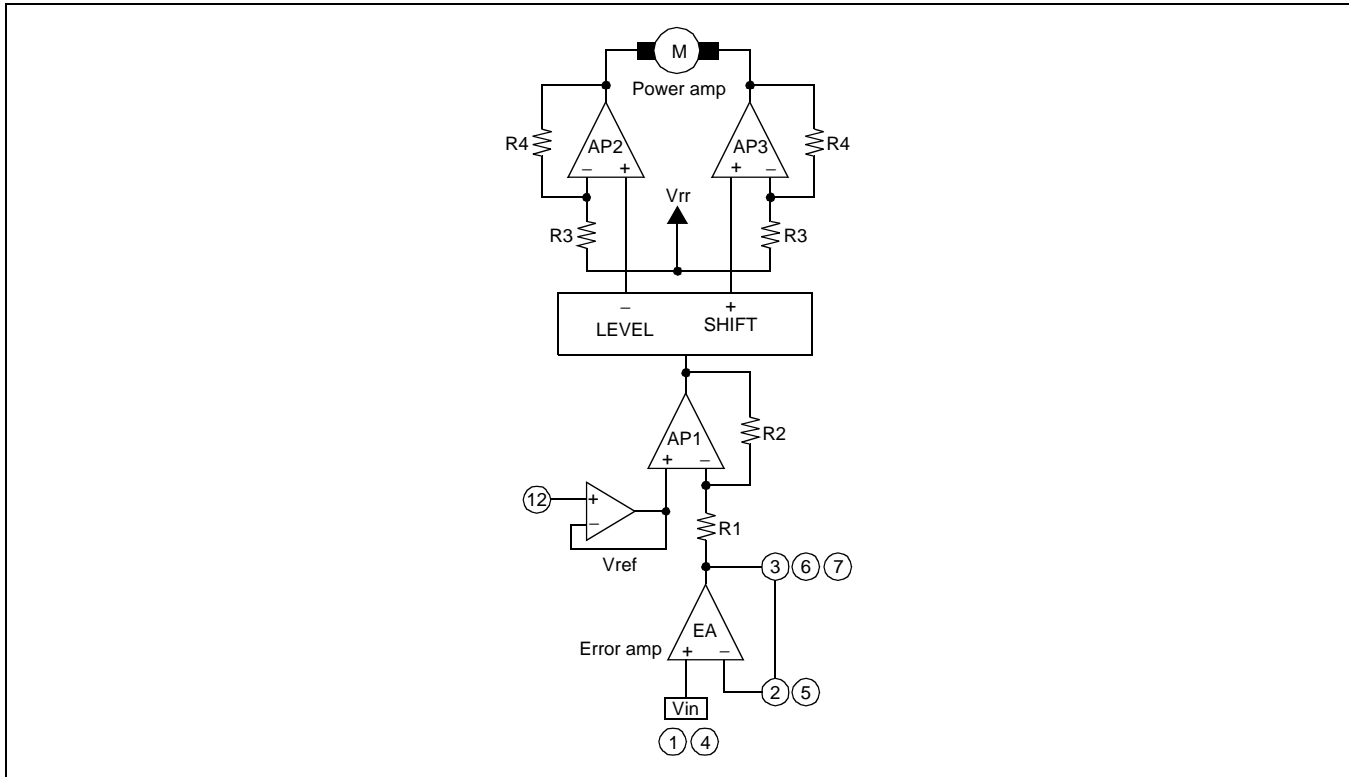
- When the mute pins (pin13, 14 and 22) are Low level, the mute circuits are enabled and the output circuits are muted.
- When the voltage of the mute pins (pin13, 14 and 22) are High level, the mute circuits are disabled and the output circuits operate normally.
- If the chip temperature rises above 175°C, then the thermal shutdown (TSD) circuit is activated and the output circuits are muted.
 - Mute1, 2 (pin 13)-CH1, 2 mute control input pin.
 - Mute3 (pin 14)-CH3 mute control input pin.
 - Mute4(pin22) - CH4 mute control input pin.

3. PROTECTION FUNCTION

Thermal Shutdown (TSD)

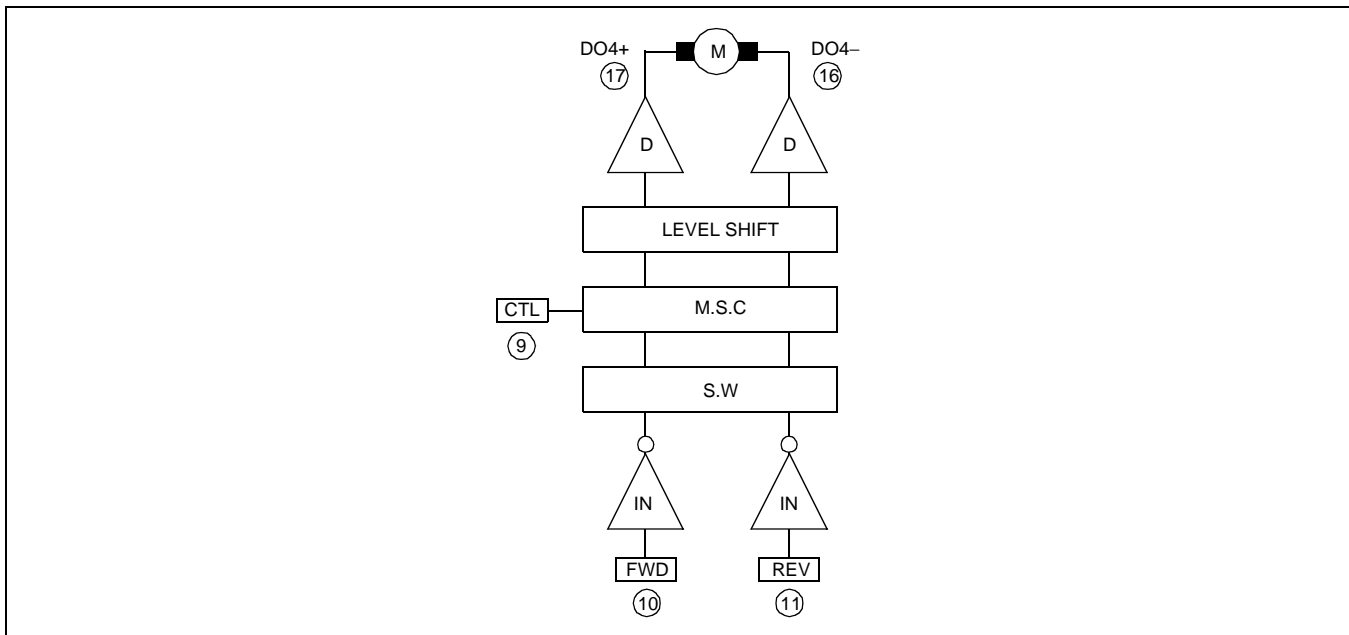
- If the chip temperature rises above 175°C the thermal shutdown (TSD) circuit is activated and the output circuit is in the Mute state, that is Off state.
The TSD circuit has a temperature hysteresis of 25°C.

4. FOCUS, TRACKING ACTUATOR, SLED MOTOR DRIVE PART



- The reference voltage REF is given externally through pin 12.
- The error amp output signal is amplified by R_2 / R_1 times and then fed to the level shift circuit.
- The level shift circuit produces the differential output voltages and drives the two output power amplifiers. Since the differential gain of the output amplifiers is equal to $2 \times (1 + R_4 / R_3)$, the output signal of the error amp is amplified by $(R_2 / R_1) \times 2 \times (1 + R_4 / R_3)$.
- If the total gain is insufficient, the input error amp can be used to increase the gain.
- The bias voltage (V_{rr}) is about a half of the supply voltage (V_M).

5. TRAY, CHANGE MOTOR DRIVE PART

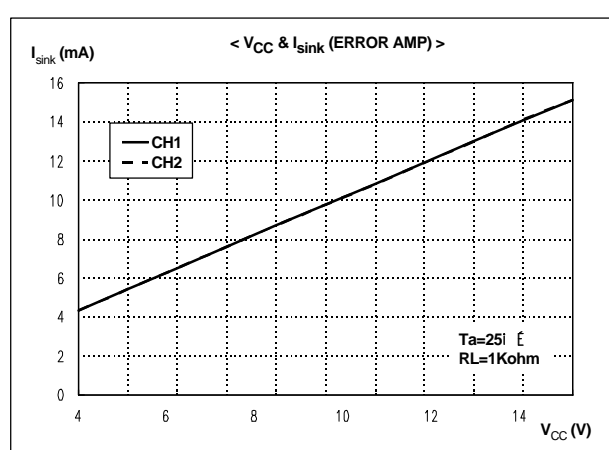
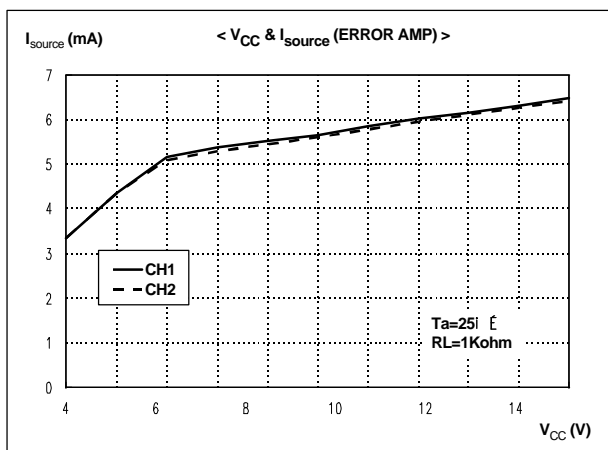
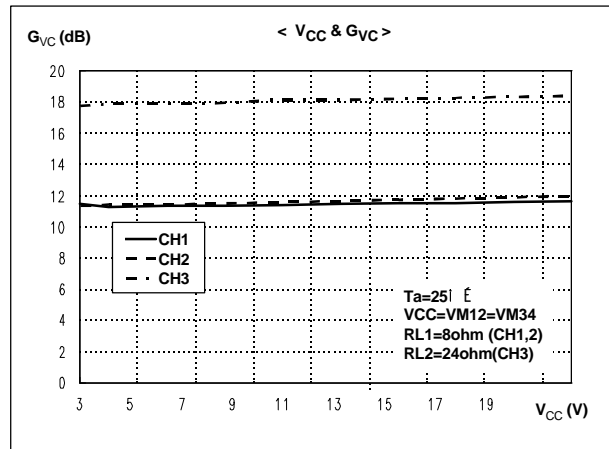
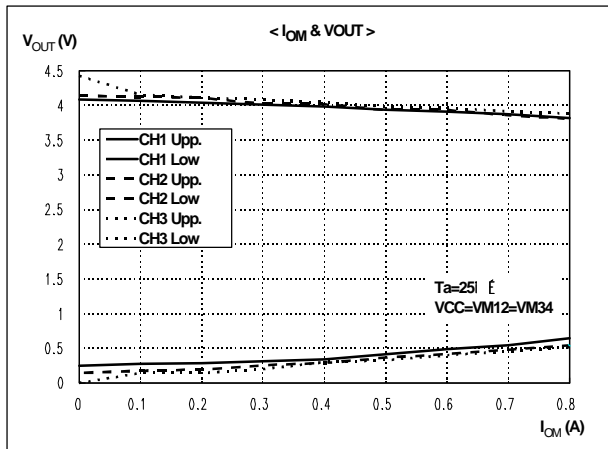
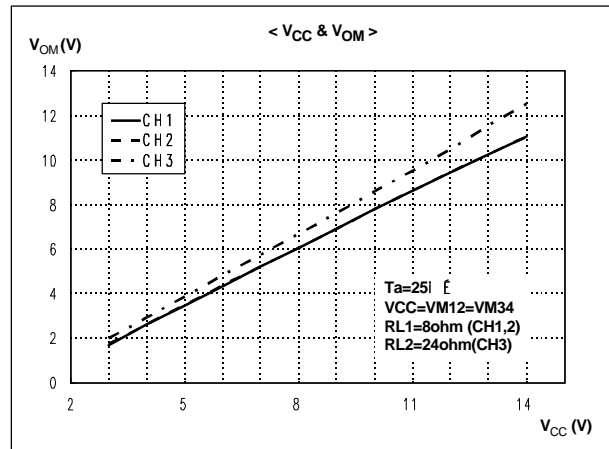
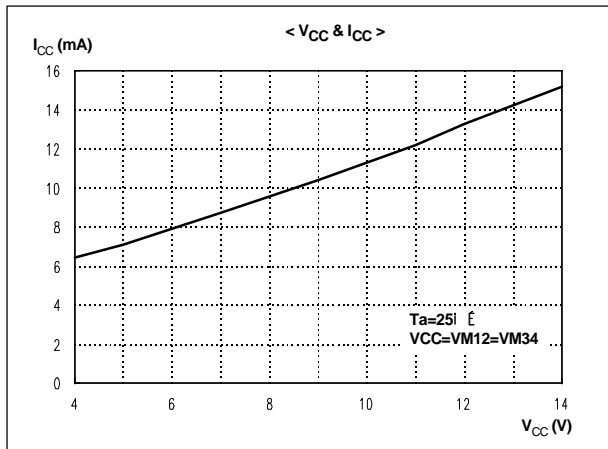


- Rotational direction control
The forward and reverse rotational direction is controlled by FWD (pin 10) and REV (pin 11) inputs. Conditions are as follows.

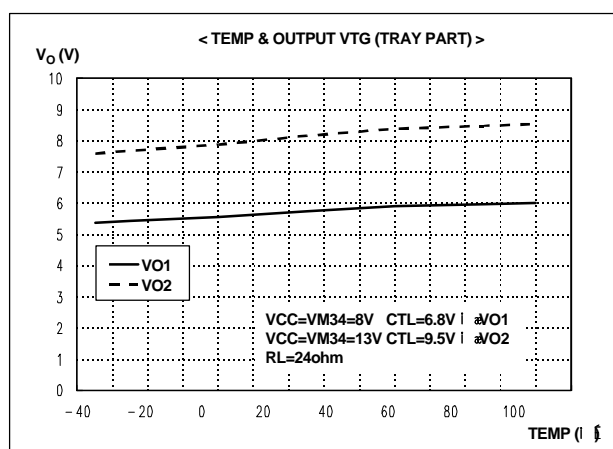
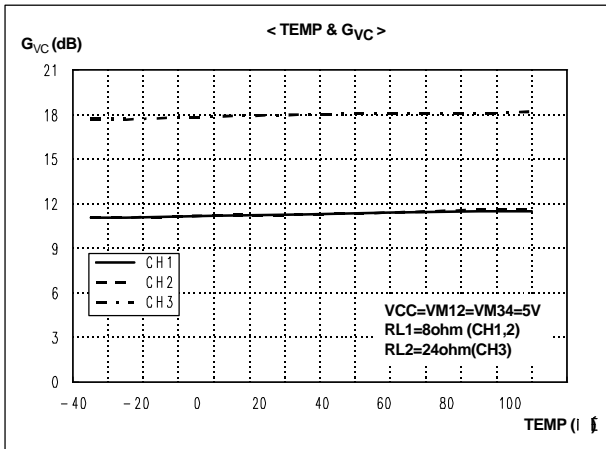
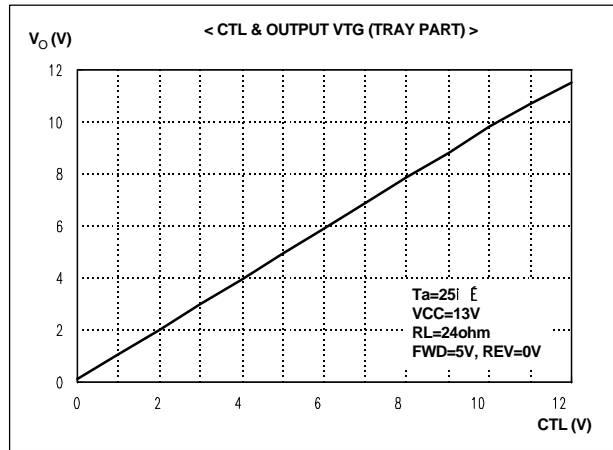
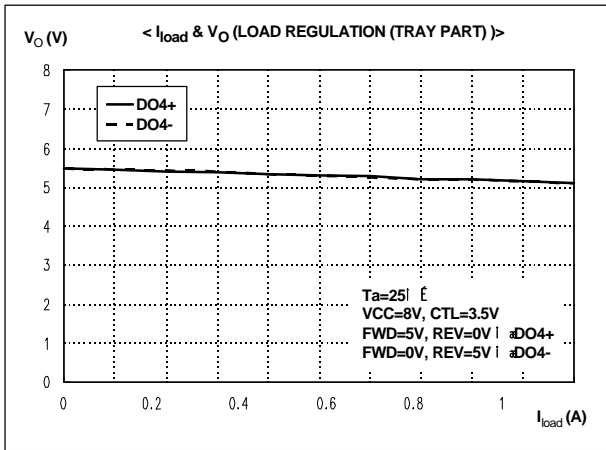
Input		Output		
FWD	REV	DO4+	DO4-	State
H	H	Vr	Vr	Brake
H	L	H	L	Forward
L	H	L	H	Reverse
L	L	Vr	Vr	Brake

- Motor speed control
 - The motor speed is proportional to the difference voltage between the pin17 (DO4+) and the pin16 (DO4-).
 - By applying the voltage to the pin9 of CTL, the motor speed can be controlled and it is linearly proportional to the applied control voltage.
 - When both VM3, 4 and V_{CC} are 5V, and the applied control voltage is higher than 4V, the motor speed is not proportional to the control voltage but the motor speed becomes constant.
 - If the pin9 is opened, the motor torque becomes maximum.
 - The maximum output swing is 3.8V, when VM3, 4 and V_{CC} are 5V.

ELECTRICAL CHARACTERISTICS CURVES

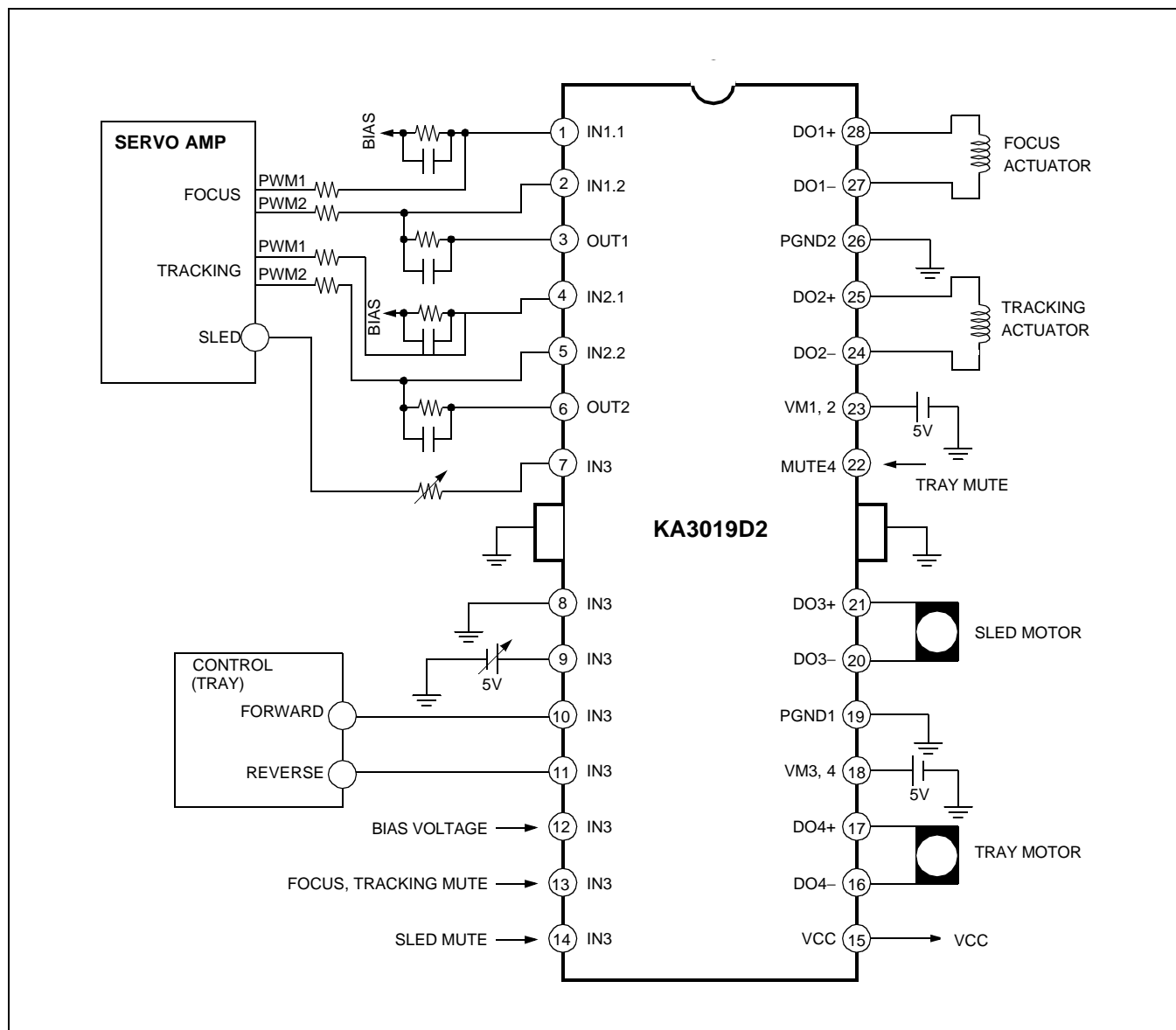


ELECTRICAL CHARACTERISTICS CURVES (Continued)



APPLICATION CIRCUIT 1

(Differential PWM control mode)

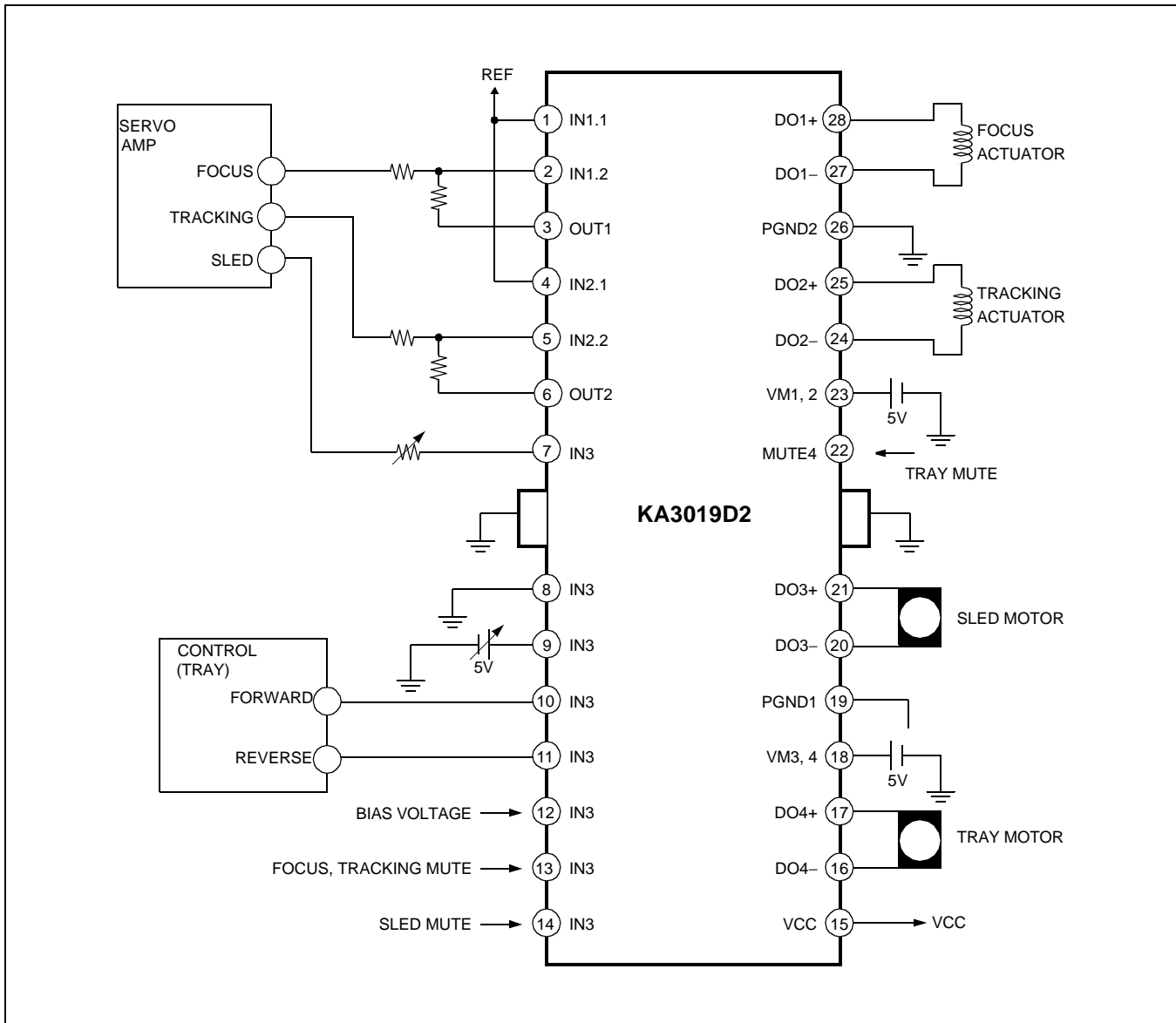


THERMAL SHUT DOWN CIRCUIT

The IC is broken down by the heat when overload condition continues for a long time. So, KA3019D2 has a thermal shut down circuit to prevent this case. At that time temperature of the IC rises over 175°C, the circuit is operating and protects the IC against breakdown.

APPLICATION CIRCUIT 2

(Voltage control mode)



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