

M56782FP

4 CHANNEL ACTUATOR DRIVER

DESCRIPTION

The M56782FP is a semiconductor integrated circuit in order to drive 4ch actuator.

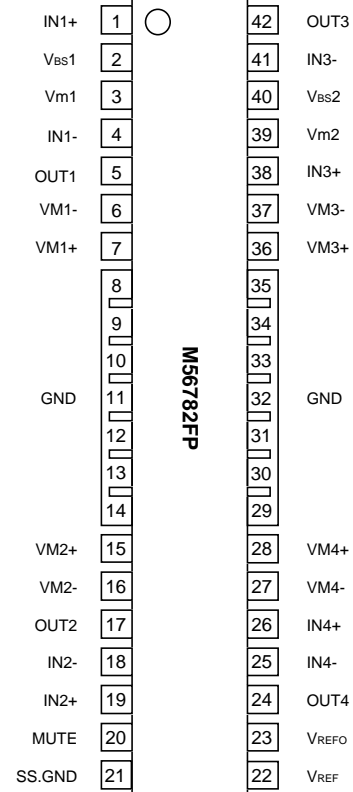
FEATURES

- Large power dissipation
- 3.3V DSP available.
- Low saturation voltage.
(Typical 1.35V at load current 0.5A and no bootstrap condition.)
- There are two motor power supplies.
Vm1 CH1, 2 motor power supply-1
Vm2 CH3, 4 motor power supply-2
- Flexible Input amp. setting. (It enables PWM control.)
- Low cross-over distortion.
- Wide supply voltage range. (4.5V – 13.2V)
- Built-in Thermal Shut Down circuit.
- Built-in Mute circuit.

APPLICATION

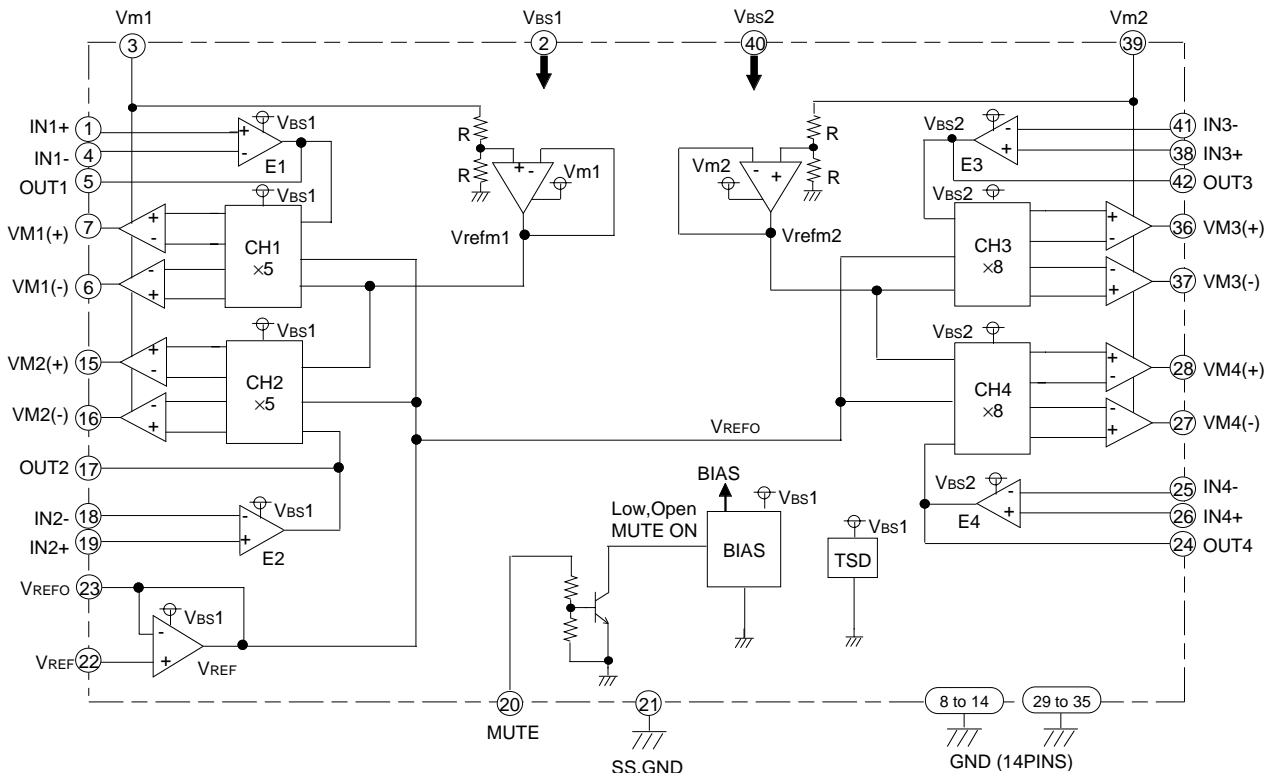
MD, CD-audio, CD-ROM, VCD, DVD etc.

PIN CONFIGURATION (TOP VIEW)



Outline 42P9R-A

BLOCK DIAGRAM



PIN FUNCTION

Terminal	Symbol	Terminal function	Terminal	Symbol	Terminal function
①	IN1+	E1 amplifier non-inverted input	④②	OUT3	E3 amplifier output
②	Vbs1	Bootstrap power supply	④①	IN3-	E3 amplifier inverted input
③	Vm1	Motor power supply	④⑩	Vbs2	Bootstrap power supply
④	IN1-	E1 amplifier inverted input	③⑨	Vm2	Motor power supply
⑤	OUT1	E1 amplifier output	③⑧	IN3+	E3 amplifier non-inverted input
⑥	VM1(-)	CH1 inverted output	③⑦	VM3(-)	CH3 inverted output
⑦	VM1(+)	CH1 non-inverted output	③⑥	VM3(+)	CH3 non-inverted output
⑧ – ⑭	GND	Motor GND	②⑨ – ③⑤	GND	Motor GND
⑮	VM2(+)	CH2 non-inverted output	②⑧	VM4(+)	CH4 non-inverted output
⑯	VM2(-)	CH2 inverted output	②⑦	VM4(-)	CH4 inverted output
⑰	OUT2	E2 amplifier output	②⑥	IN4+	E4 amplifier non-inverted input
⑱	IN2-	E2 amplifier inverted input	②⑤	IN4-	E4 amplifier inverted input
⑲	IN2+	E2 amplifier non-inverted input	②④	OUT4	E4 amplifier output
⑳	MUTE	mute	②③	VREFO	Reference voltage output
㉑	SS.GND	Small signal GND	②②	VREF	Reference voltage input

ABSOLUTE MAXIMUM RATING (Ta = 25°C)

Symbol	Parameter	Conditions	Rating	Units
Vbs	Bootstrap power supply	Vbs power supply	15	V
Vm	Motor power supply	Vm power supply	15	V
Io	Output Current		500	mA
Vin	Maximum input voltage of terminals	①, ④, ⑱, ⑲, ⑳, ㉒ PIN	0 – Vbs1	V
		⑲, ⑳, ㉑, ㉒ PIN	0 – Vbs2	V
Pt	Power dissipation	Free Air	1.2	W
Kθ	Thermal derating	Free Air	9.6	mW/°C
Tj	Junction temperature		150	°C
Topr	Operating temperature		-20 – +75	°C
Tstg	Storage temperature		-40 – +150	°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Limits			Units
		Min.	Typ.	Max.	
Vm1, Vm2	Motor power supply		5.0		V
Vbs1, Vbs2	Bootstrap power supply		Vm + 1.0		V

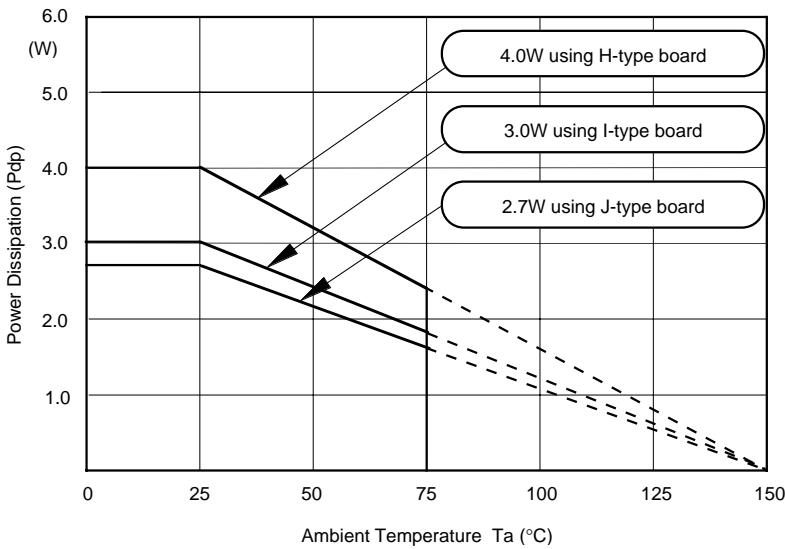
ELECTRICAL CHARACTERISTICS (Ta = 25°C, VBS = Vm = 5V unless otherwise noted)

Symbol	Parameter	Conditions	Limits			Units
			Min.	Typ.	Max.	
Icc1	Supply current - 1	VBS1, VBS2, Vm1, Vm2 current	—	35	50	mA
Icc2	Supply current - 2	VBS1, VBS2, Vm1, Vm2 current at Sleep Mode (MUTE1 = MUTE2 = 0V).	—	1.3	2.2	mA
Vsat1	CH1 – 4 Saturation voltage	Top and Bottom saturation voltage. Load current 0.5A and no bootstrap.	—	1.35	1.9	V
Voff1	CH1 output offset voltage	VREFO = OUT1 = 1.5V	-41	—	41	mV
Voff2	CH2 output offset voltage	VREFO = OUT2 = 1.5V	-41	—	41	mV
Voff3	CH3 output offset voltage	VREFO = OUT3 = 1.5V	-47	—	47	mV
Voff4	CH4 output offset voltage	VREFO = OUT4 = 1.5V	-47	—	47	mV
Gain1	CH1 Voltage Gain between input and output	$\frac{\{VM1(+)-VM1(-)\}}{(OUT1-VREFO)}$	4.5	5	5.5	V/V
Gain2	CH2 Voltage Gain between input and output	$\frac{\{VM2(+)-VM2(-)\}}{(OUT2-VREFO)}$	4.5	5	5.5	V/V
Gain3	CH3 Voltage Gain between input and output	$\frac{\{VM3(+)-VM3(-)\}}{(OUT3-VREFO)}$	7.2	8	8.8	V/V
Gain4	CH4 Voltage Gain between input and output	$\frac{\{VM4(+)-VM4(-)\}}{(OUT4-VREFO)}$	7.2	8	8.8	V/V

ELECTRICAL CHARACTERISTICS (Ta = 25°C, VBS = Vm = 5V unless otherwise noted)

Symbol	Parameter	Conditions	Limits			Units
			Min.	Typ.	Max.	
VinE	E1, 2, 3, 4, amplifier input voltage range	E1, E2 amp	0.5	—	VBS1-2.0	V
		E3, E4 amp	0.5	—	VBS2-2.0	V
VoutE	E1, 2, 3, 4, amplifier output voltage range	E1, E2 amp (no load)	0.5	—	VBS1-0.5	V
		E3, E4 amp (no load)	0.5	—	VBS2-0.5	V
VofE	E1, 2, 3, 4, amplifier offset voltage	Vin = 1.5V (at buffer)	-10	—	+10	mV
linE	E1, 2, 3, 4, amplifier input current	IN+ = IN- = 1.5V	-1.0	-0.05	0	μA
VinVREF	VREF amplifier input voltage range		1.0	—	VBS1-2.0	V
VofVREF	VREF amplifier offset voltage	Vin = 1.5V and ±2mA load	-10	—	+10	mV
linVREF	VREF amplifier input current	VREF = 1.5V	-1.0	-0.05	0	μA
Vmute-on	Mute-on voltage	Mute-on	—	—	0.8	V
Vmute-off	Mute-off voltage	Mute-off	2.0	—	—	V
Imute	Mute terminal input current	Mute terminal input current (at 5V input voltage)	—	170	250	μA

THERMAL DERATING



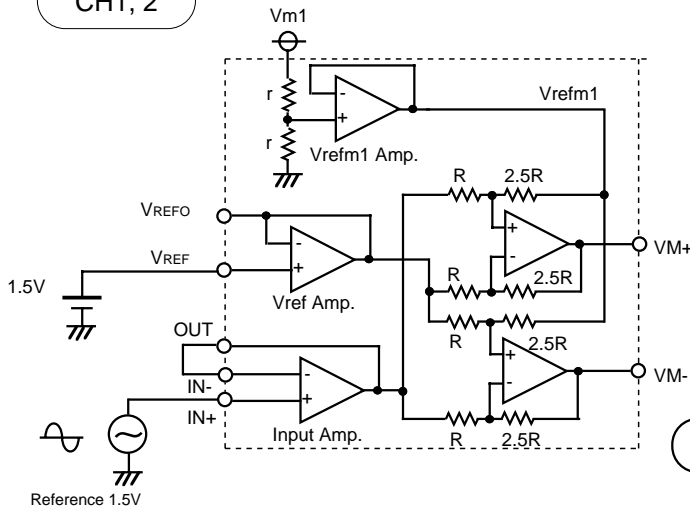
This IC's package is POWER-SSOP, so improving the board on which the IC is mounted enables a large power dissipation without a heat sink.

For example, using an 1 layer glass epoxy resin board, the IC's power dissipation is 2.7W at least. And it comes to 4.0W by using an improved 2 layer board.

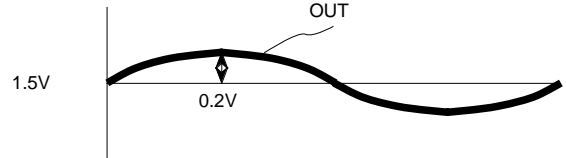
The information of the H, I, J type board is shown in the board information.

INPUT AND OUTPUT CHARACTERISTICS OF EACH CHANNELS

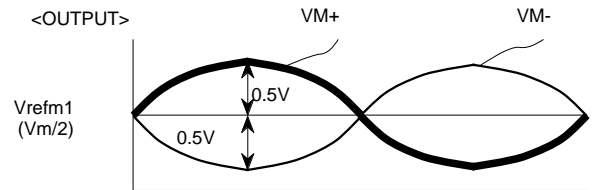
CH1, 2



<INPUT>

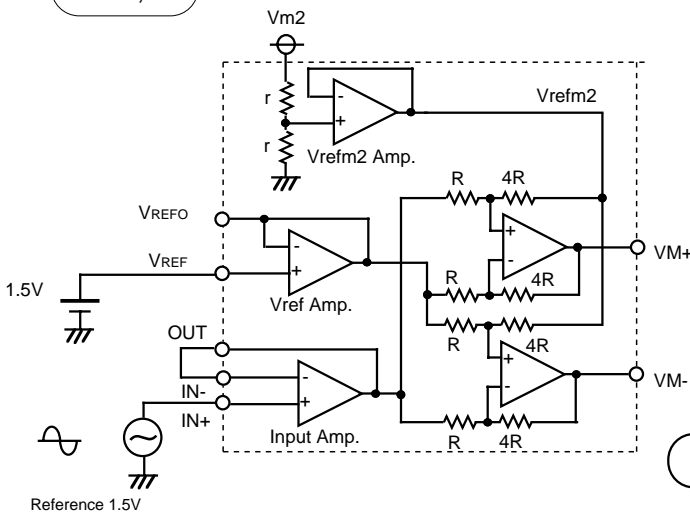


<OUTPUT>

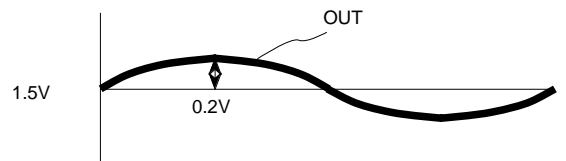


Gain = $\times 5$

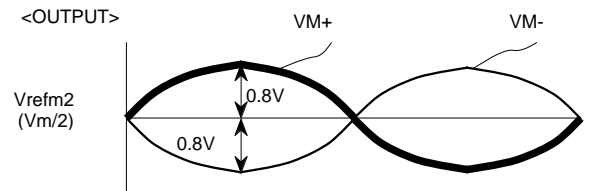
CH3, 4



<INPUT>



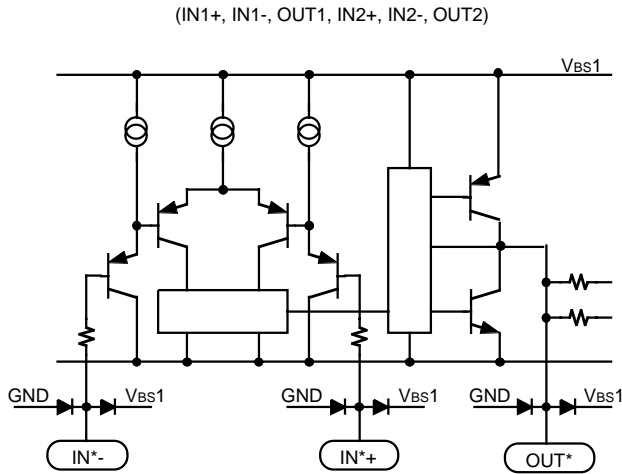
<OUTPUT>



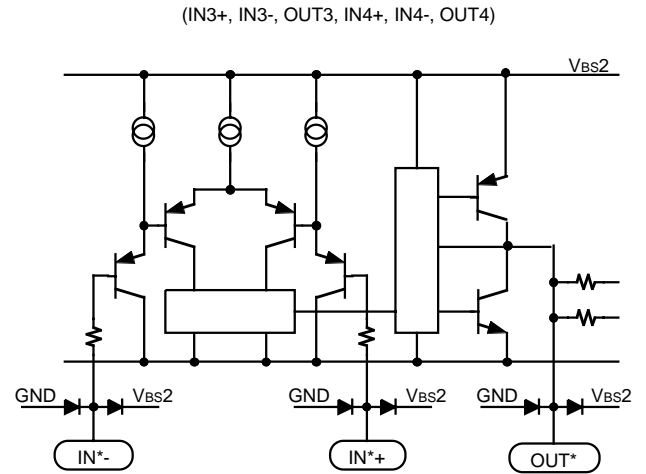
Gain = $\times 8$

I/O TERMINAL EQUIVALENT CIRCUIT

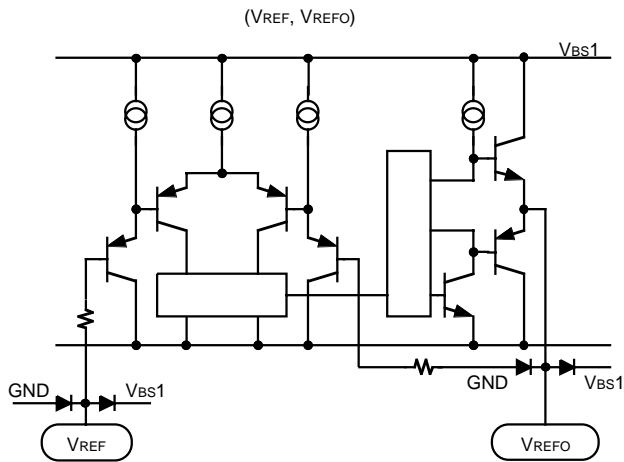
(1) E1, E2 input amplifier I/O terminal equivalent circuit



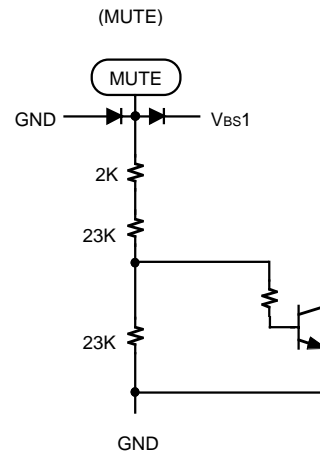
(2) E3, E4 input amplifier I/O terminal equivalent circuit



(3) VREF amplifier I/O terminal equivalent circuit

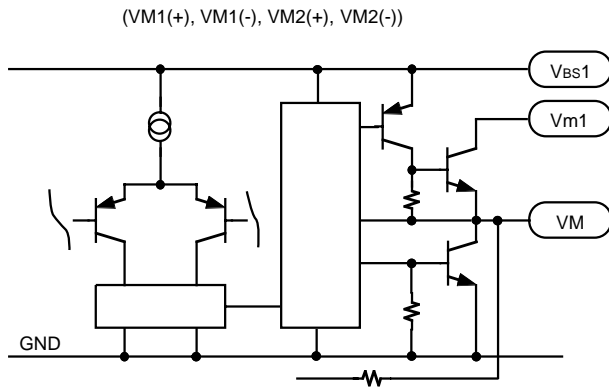


(4) MUTE equivalent circuit



I/O TERMINAL EQUIVALENT CIRCUIT

(5) CH1, CH2 power amplifier output terminal equivalent circuit



The equivalent circuits of an output stage of the power amplifiers are shown in (5) and (6).

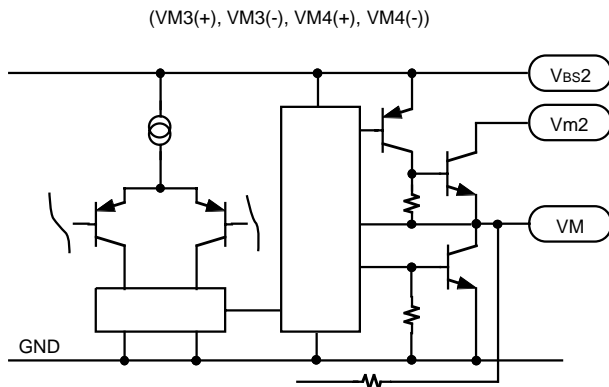
The power supplies of CH1, CH2 are V_{m1} .

And the power supplies of CH3, CH4 are V_{m2} .

The source side of the power amplifier output stage consists of a PNP and a NPN.

In the case of the CH1 and CH2, the emitta of the PNP is connected to V_{BS1} , and in the case of the CH3 and CH4, it is connected to V_{BS2} . So the power of the PNP supplies can be adjusted externally.

(6) CH3, CH4 power amplifier output terminal equivalent circuit



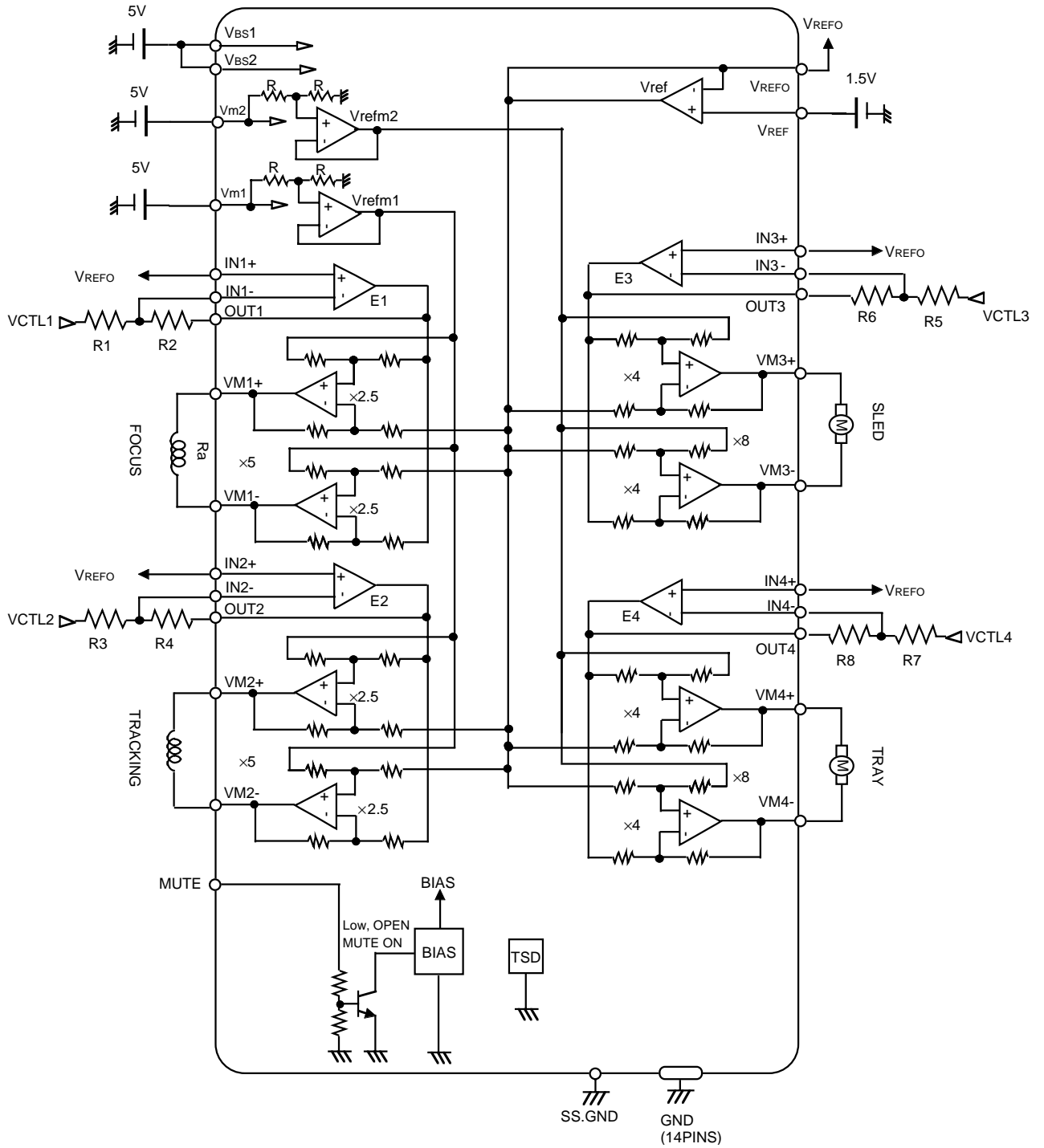
About bootstrap advantage

The output stage of the power amplifiers consists of the preceding components. If V_{BS}^* is provided with higher voltage input than V_{m}^* (The recommendation voltage is V_{m}^*+1V) externally, the output range can be wider than that of $V_{BS}^* = V_{m}^*$.

Please take advantage of this bootstrap function for the system which has many power supplies. And it is the same with the external bootstrap circuit which provides V_{BS}^* with higher voltage inputs than V_{m}^* .

Also the bootstrap can decrease the saturation voltage at the source side of the power amplifier output stage. Therefore, when the outputs of the power amplifiers which drive motors and actuators are fully swung, the power dissipation of the IC will be decreased.

APPLICATION CIRCUIT NO. 1 single input (linear signal) · Direct voltage control



APPLICATION CIRCUIT NO. 2

Differential PWM input · Direct voltage control (FOCUS, TRACKING, SPINDLE, SLED or LOADING)

