

# Motor Driver for Portable DVD player with DC-DC Step Down Converter AM5898N

The AM5898N is a 4-channel BTL driver IC for driving the motors and actuators such as used in DVD player and consists of two DC-DC Step Down Converters. It is pretty fit for portable DVD player application. Package material is Pb Free for environmental protection.

- **Applications**

BTL driver for portable DVD player with DC-DC power management.

- **Features**

- (A) **4-channel BTL:**

- 1) Two channels are voltage-type BTL drivers for actuators of tracking and focus. Two channels are voltage-type BTL driver for sled and spindle motors. It is also built-in two DC-DC converters.
    - 2) Wide dynamic range for motor drive [3.6V (*typ.*) when  $V_{cc}=5V$ , at  $R_L=20\ \Omega$  load].

- (B) **2 DC-DC Step down converters:**

- 1) Efficiency up to 85%
    - 2) Operation from 4.5~16V
    - 3) Typical frequency operation to 240KHz.
    - 4) Over voltage protection built-in.
    - 5) Over current protection built-in.

- (C) **Common circuit**

- 1) Level shift circuit built-in.
    - 2) Thermal shut down circuit built-in.
    - 3) Mute mode built-in for motor drive. EN1, EN2 mode control for two set of DC-DC step down converters.

● Absolute maximum ratings (Ta=25°C)

| Parameter                    | Symbol           | Limits            | Unit |
|------------------------------|------------------|-------------------|------|
| Supply voltage 1 for driver  | Vcc1             | 13.5              | V    |
| Supply voltage 2 for driver  | Vcc2             | 13.5              | V    |
| Supply voltage for converter | PVcc             | 26                | V    |
| Power dissipation            | P <sub>d</sub>   | 2.2 <sup>*1</sup> | W    |
| Operate Temp range           | T <sub>opr</sub> | -40 ~ +85         |      |
| Storage Temp range           | T <sub>stg</sub> | ** -55 ~ +150     |      |

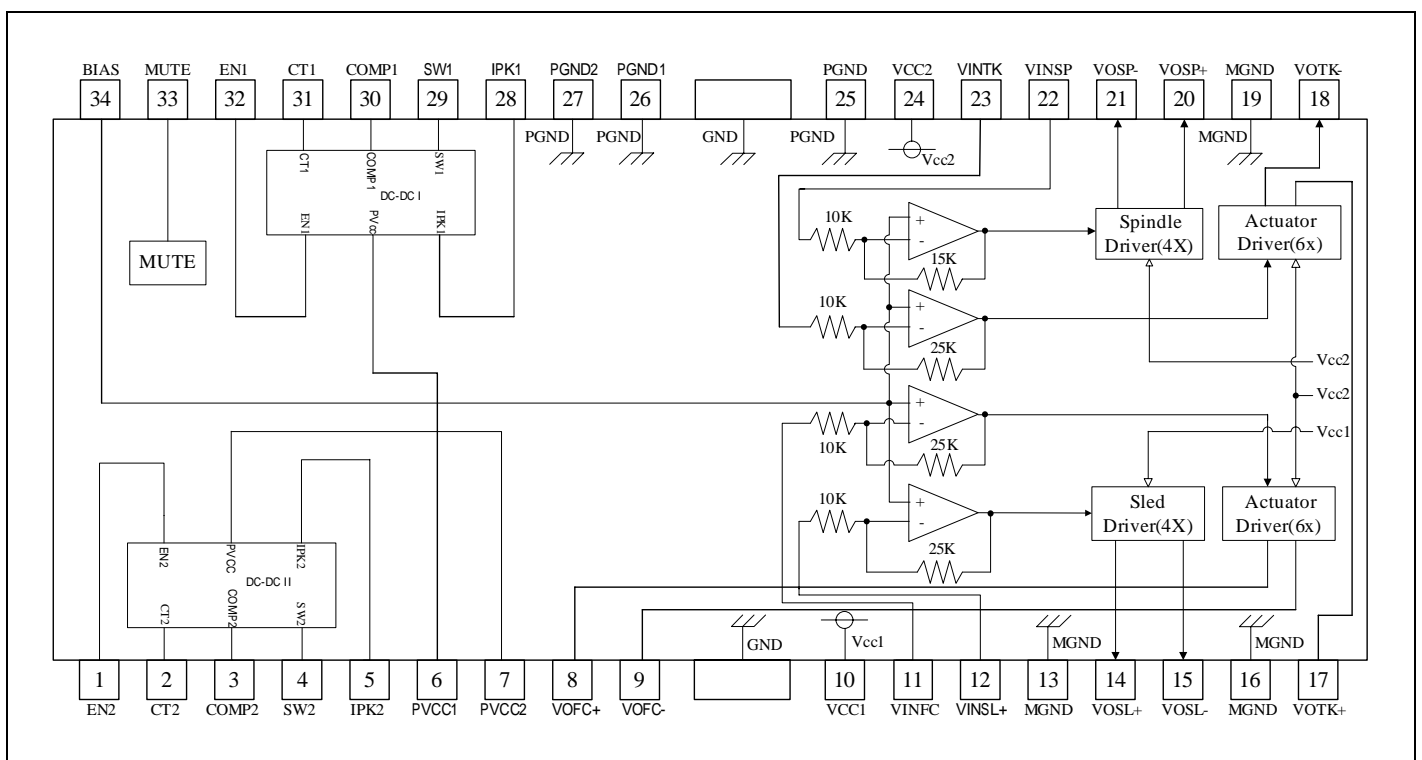
\*70mm×70mm×1.6mm glass epoxy board.

\* 1.Derating: 17.6mW/°C for operation above Ta=25°C

● Guaranteed operating conditions (Ta=25°C)

| Parameter            | Symbol | Limits     | Unit |
|----------------------|--------|------------|------|
| Power supply voltage | Vcc1   | 4.3 ~ 13.2 | V    |
|                      | Vcc2   | 4.3 ~ Vcc1 | V    |
|                      | PVcc   | 4.5 ~ 16   | V    |

● Block diagram



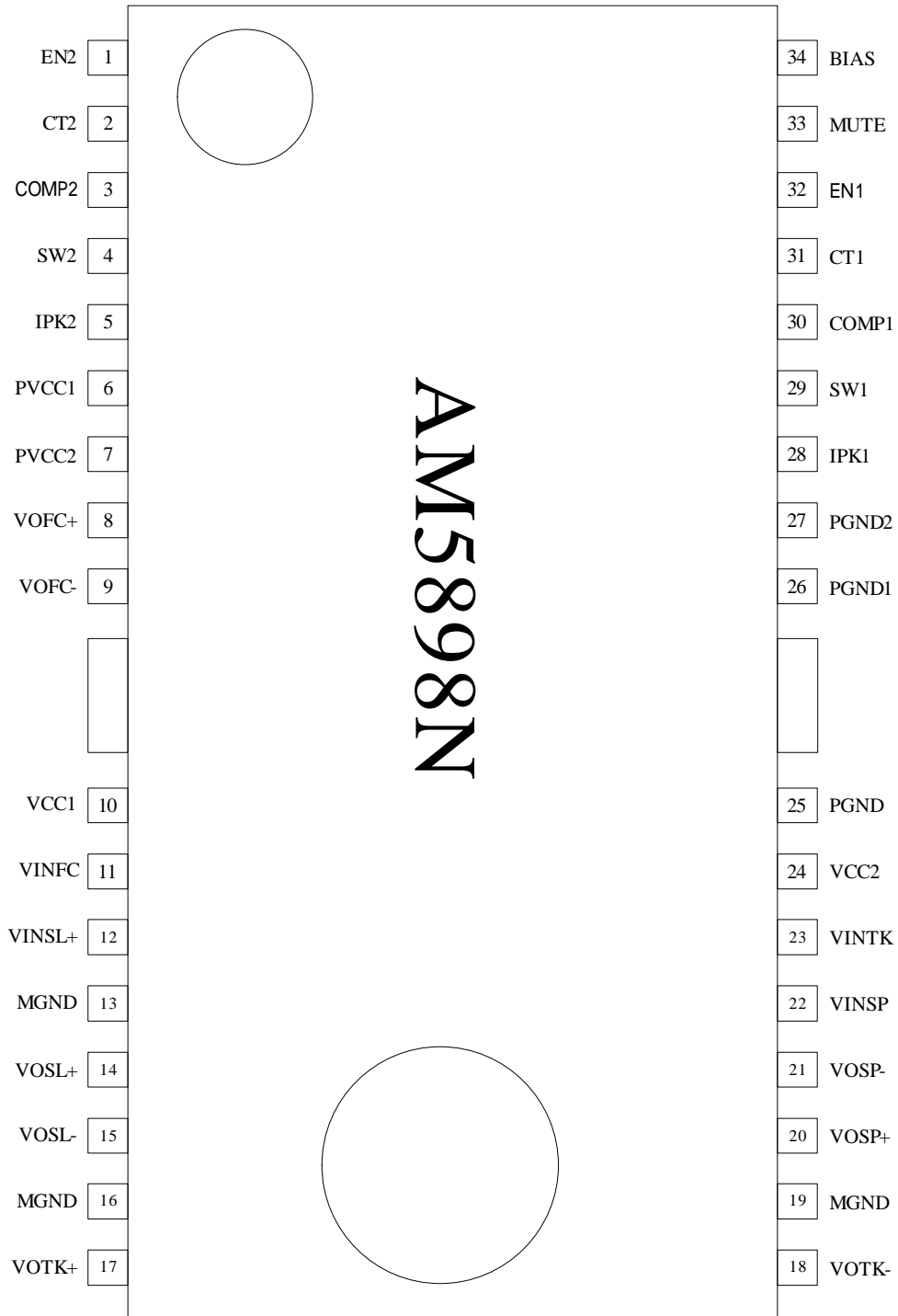
● **Electrical characteristics**

( Unless otherwise specified  $T_a=25^\circ\text{C}$  ,  $V_{cc1}=5\text{V}$ ,  $V_{cc2}=5\text{V}$ ,  $PV_{cc}=12\text{V}$ ,  $\text{BIAS}=1.65\text{V}$ ,  $R_L=8\ \Omega/10\ \Omega/20\ \Omega$  )

| Parameter                           | Symbol       | Limit |      |           | Unit | Conditions                              | P.S |
|-------------------------------------|--------------|-------|------|-----------|------|---|-----|
|                                     |              | Min   | Typ  | Max       |      |   |     |
| Quiescent current                   | $I_{cc}$     | -     | 19   | -         | mA   |   |     |
| Standby current 1                   | $I_{stb1}$   | -     | 3    | -         | mA   | Mute = L, EN1 = H, EN2 = H              |     |
| Standby current 2                   | $I_{stb2}$   | -     | 15   | -         | mA   | Mute = H, EN1 = L, EN2 = L              |     |
| Standby current 3                   | $I_{stb3}$   | -     | 140  | 200       | uA   | Mute = L, EN1 = L, EN2 = L              |     |
| Voltage for mute ON                 | $V_{ston}$   | 0     | -    | 0.5       | V    |   |     |
| Voltage for mute OFF                | $V_{stoff}$  | 2.0   | -    | 5         | V    |   |     |
| Voltage for EN low                  | $V_{ENL}$    | 0     | -    | 0.5       | V    |   |     |
| Voltage for EN High                 | $V_{ENH}$    | 2.0   | -    | 5         | V    |   |     |
| <b>&lt;Actuator drivers&gt;</b>     |              |       |      |           |      |   |     |
| Output offset voltage               | $V_{oo}$     | -     | -    | $\pm 50$  | mV   |   |     |
| Maximum output voltage              | $V_{om}$     | -     | 3.4  | -         | V    | @10 Load                                |     |
| Voltage gain                        | $G_v$        | 21.5  | 23.5 | 25.5      | dB   | $V_{IN}=\text{BIAS}+0.2V_{pp}$ ac @1KHz |     |
| <b>&lt;Sled motor driver&gt;</b>    |              |       |      |           |      |   |     |
| Output offset voltage               | $V_{oofsl}$  | -     | -    | $\pm 100$ | mV   |   |     |
| Maximum output voltage              | $V_{omsl}$   | -     | 3.6  | -         | V    | @20 Load                                |     |
| Closed loop voltage gain            | $G_{vsl}$    | 18    | 20   | 22        | dB   | $V_{IN}=\text{BIAS}+0.2V_{pp}$ ac @1KHz |     |
| <b>&lt;Spindle motor driver&gt;</b> |              |       |      |           |      |   |     |
| Output offset voltage               | $V_{oofld}$  | -     | -    | $\pm 50$  | mV   |   |     |
| Maximum output voltage              | $V_{omax}$   | -     | 3.2  | -         | V    | @8 Load                                 |     |
| Voltage gain                        | $G_{vld}$    | 13.5  | 15.5 | 17.5      | dB   | $V_{IN}=\text{BIAS}+0.2V_{pp}$ ac @1KHz |     |
| Gain error by polarity              | $G_{vld}$    | 0     | 1    | 2         | dB   | $V_{IN}=\text{BIAS}+0.2V_{pp}$ ac @1KHz |     |
| <b>&lt;Step down converter&gt;</b>  |              |       |      |           |      |   |     |
| Oscillator Frequency                | $F_{osc}$    | -     | 240  | -         | KHz  | CT=68PF                                 |     |
| Charge Current                      | $I_{chg}$    | -     | 24   | -         | uA   |   |     |
| Discharge Current                   | $I_{dischg}$ | -     | 144  | -         | uA   |   |     |
| Current Limit Sense Voltage         | $V_{ipk}$    | -     | 200  | -         | mV   | $R_{sc}=0.1$                            |     |
| Comparator Threshold Voltage        | $V_{th}$     | -     | 1.25 | -         | V    |   |     |
| Output Source Current               | $I_{source}$ | -     | 180  | -         | mA   | $V_{out}=0V$                            |     |
| Output Sink Current                 | $I_{sink}$   | -     | 120  | -         | mA   | $V_{out}=9V$                            |     |

\*This device is not designed for protection against radioactive rays.

● Pin configuration

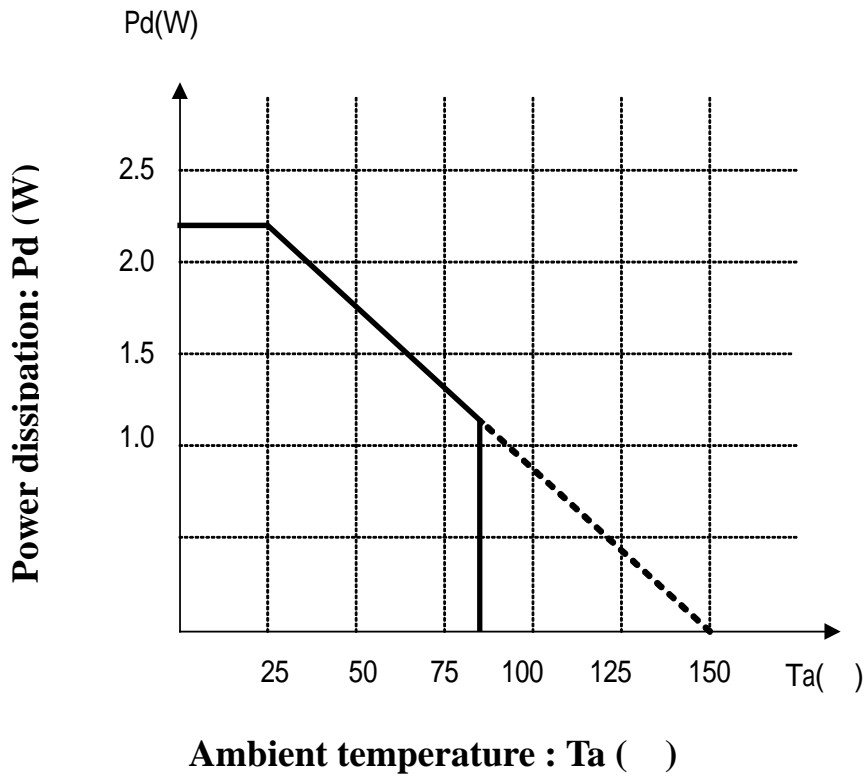


● Pin description

| PIN No | Pin Name | Function  |
|--------|----------|---|
| 1      | EN2      | Enable pin for buck converter 2                     |
| 2      | CT2      | Timing capacitor input 2                            |
| 3      | COMP2    | Comparator inverting input 2                        |
| 4      | SW2      | Switching output 2                                  |
| 5      | IPK2     | Current sense 2                                     |
| 6      | PVcc1    | Vcc for step down converter 1                       |
| 7      | PVcc2    | Vcc for step down converter 2                       |
| 8      | VOFC+    | Focus driver output (+)                             |
| 9      | VOFC-    | Focus driver output (-)                             |
| 10     | Vcc1     | Vcc for power block of sled                         |
| 11     | VINFC    | Input for focus driver                              |
| 12     | VINSL+   | Input for the sled driver                           |
| 13     | MGND     | Ground for motor driver                             |
| 14     | VOSL+    | Sled driver output (+)                              |
| 15     | VOSL-    | Sled driver output (-)                              |
| 16     | MGND     | Ground for motor driver                             |
| 17     | VOTK+    | Tracking driver output (+)                          |
| 18     | VOTK-    | Tracking driver output (-)                          |
| 19     | MGND     | Ground for motor driver                             |
| 20     | VOSP+    | Spindle driver output (+)                           |
| 21     | VOSP-    | Spindle driver output (-)                           |
| 22     | VINSP    | Input for spindle driver                            |
| 23     | VINTK    | Input for tracking driver                           |
| 24     | Vcc2     | Vcc for power block of spindle , tracking and focus |
| 25     | PGND     | Ground for analog ground                            |
| 26     | PGND1    | Ground for step down converter 1                    |
| 27     | PGND2    | Ground for step down converter 2                    |
| 28     | IPK1     | Current sense 1                                     |
| 29     | SW1      | Switching output 1                                  |
| 30     | COMP1    | Comparator inverting input 1                        |
| 31     | CT1      | Timing capacitor input 1                            |
| 32     | EN1      | Enable pin for buck converter 1                     |
| 33     | MUTE     | Input for mute control                              |
| 34     | BIAS     | Input for reference voltage                         |

Notes) Symbol of + and – (output of drivers) means polarity to input pin.  
(For example, if voltage of pin10 is high, pin11 is high.)

● Power dissipation curve :



\*70mm×70mm×1.6mm glass epoxy board.

\*De-rating is done at 17.6mW/°C for operating above  $T_a=25$

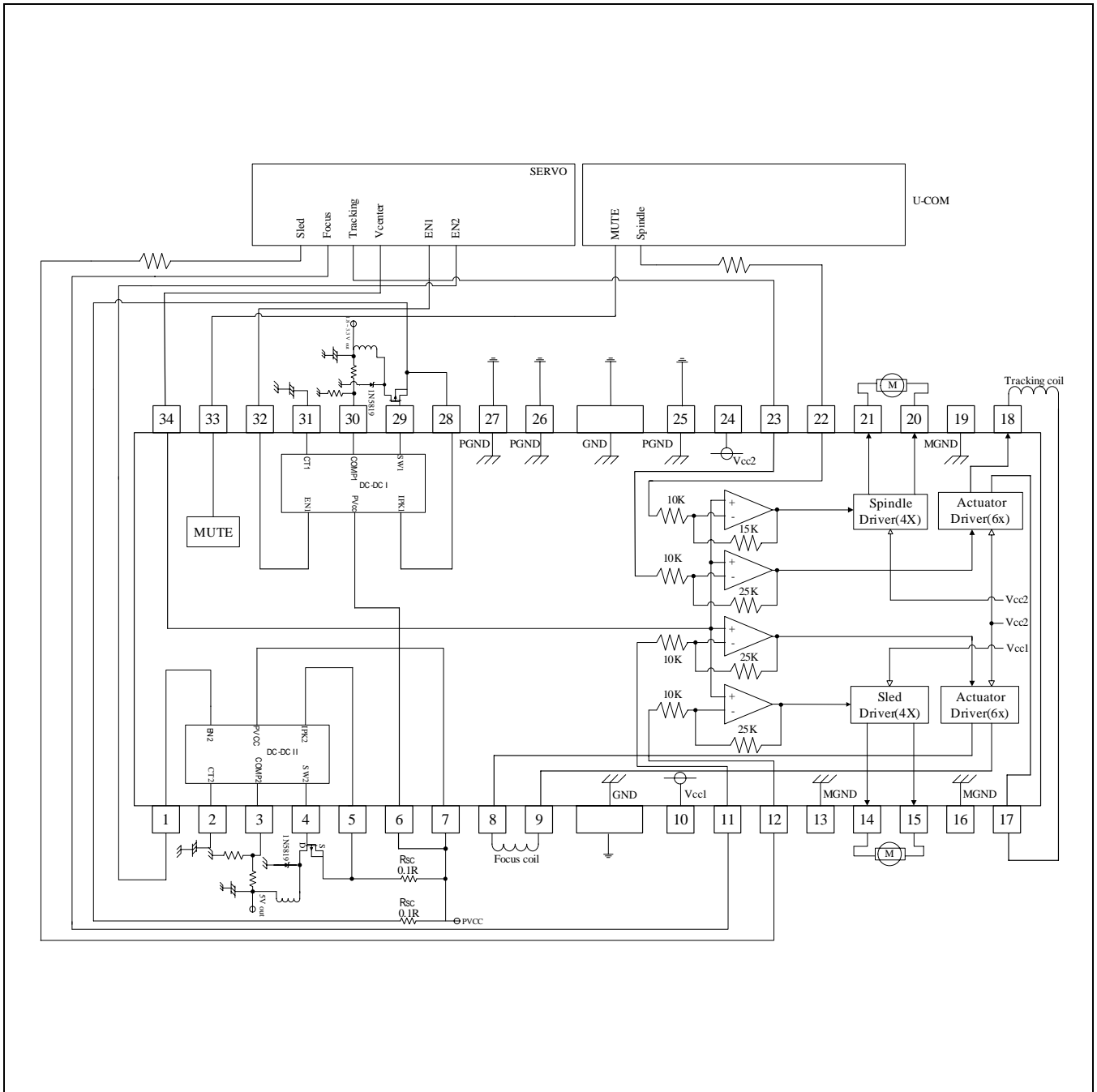
● **Operation notes**

- 1) The built-in thermal shutdown circuit mutes the output current of 4-channel BTL when the chip temperature reaches 175 (typ.). The hysteresis is set to 25 (typ.), so the circuit will start up again when the chip temperature falling to 150 (typ.).
- 2) In case mute pin voltage is under 0.5V or NC, output current is muted (except two DC-DC converter). Mute pin voltage should be more than 2.0V for normal application.
- 3) In case EN pin voltage is under 0.5V or NC, the converter circuit will stop operation. EN pin voltage should be more than 2.0V for normal application.
- 4) Bias pin (pin 34) should be pulled up to more than 1.2V. In case the bias pin voltage is pulled down below 0.9V (typ.), the output current of 4-channel BTL is muted.
- 5) Heat dissipation fins are attached to the GND on the inside of the package. Make sure to connect them to the external GND.
- 6) DC-DC Step down converter: Please refer to application note.
- 7) Truth table of Mute, EN1, EN2

**Truth table** (     : active     × : inactive     -- : don't care )

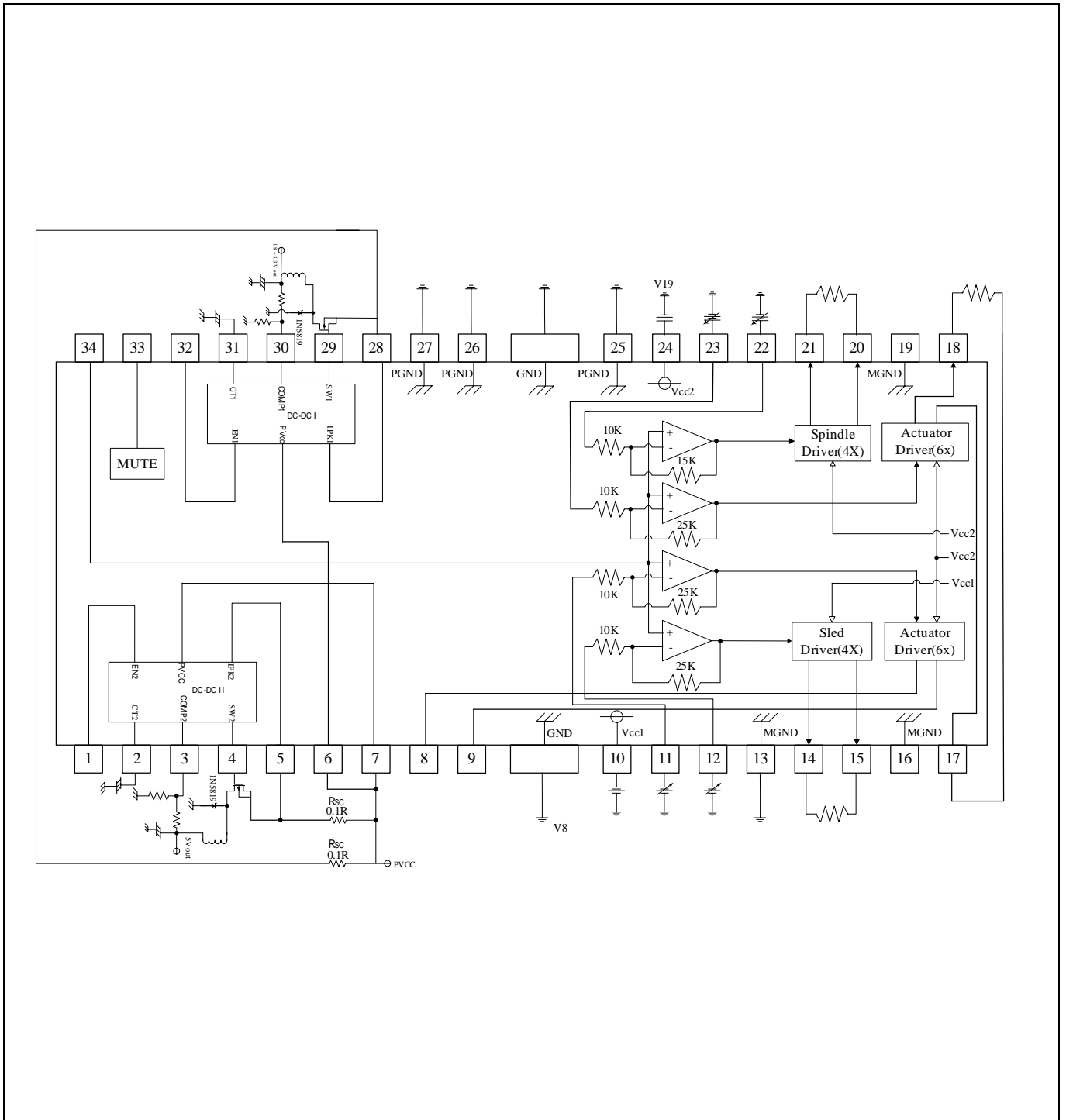
| Mute | EN 1 | EN 2 | Motor Channel | DC-DC ctrl I | DC-DC ctrl II |
|------|------|------|---------------|--------------|---------------|
| H    | --   | --   |               | --           | --            |
| --   | H    | --   | --            |              | --            |
| --   | --   | H    | --            | --           |               |
| L    | L    | L    | ×             | ×            | ×             |

● Application circuit



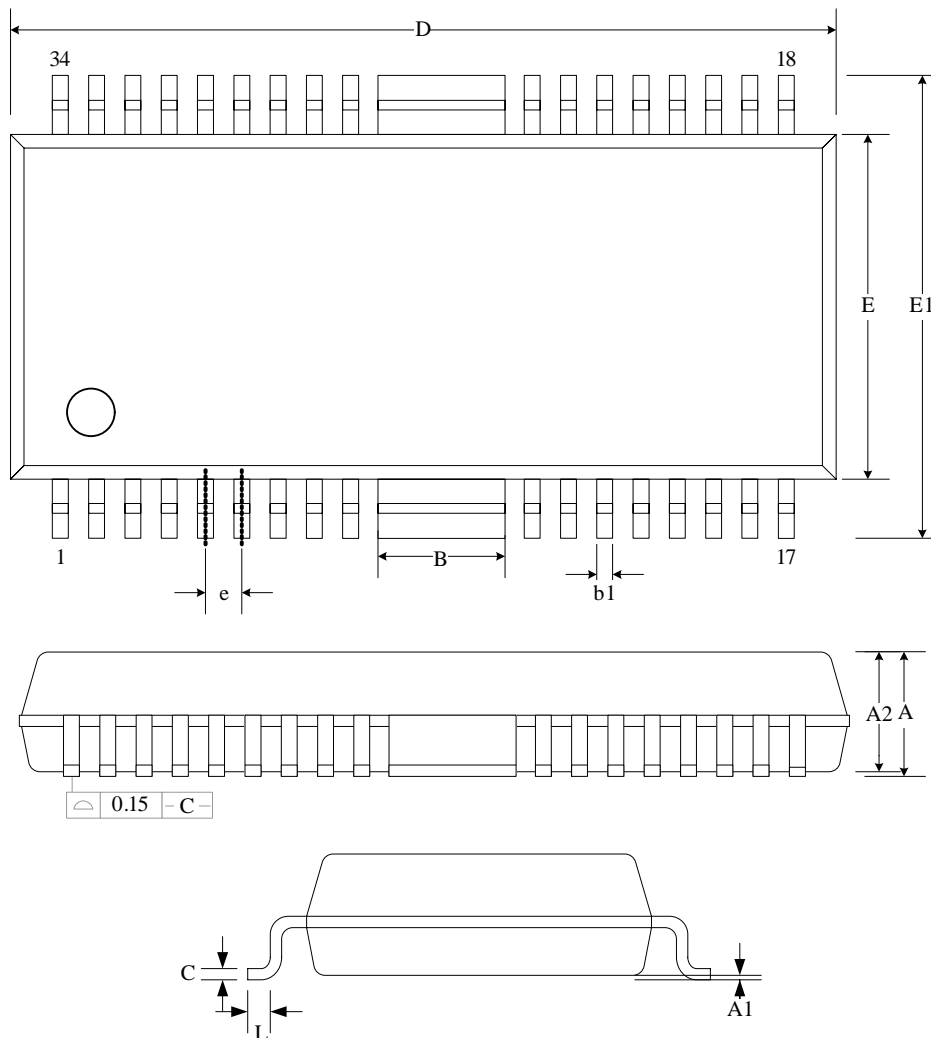


● Testing circuit



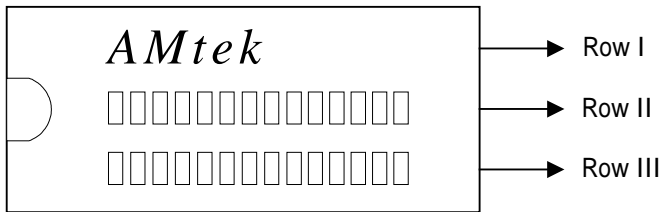
● Packaging outline

HSOP34



| SYMBOL | MILLIMETERS |       | INCHES      |       |
|--------|-------------|-------|-------------|-------|
|        | Min.        | Max.  | Min.        | Max.  |
| A      | -           | 2.75  | -           | 0.108 |
| A1     | -           | 0.3   | -           | 0.012 |
| A2     | -           | 2.45  | -           | 0.096 |
| B      | 2.55        | 2.95  | 0.1         | 0.16  |
| b1     | 0.23        | 0.47  | 0.009       | 0.019 |
| C      | 0.2         | 0.36  | 0.008       | 0.014 |
| D      | 17.89       | 18.8  | 0.704       | 0.740 |
| E      | 7.3         | 7.9   | 0.287       | 0.311 |
| E1     | 9.6         | 10.65 | 0.378       | 0.419 |
| e      | 0.8 (TYP)   |       | 0.031 (TYP) |       |
| L      | 0.3         | 1.27  | 0.012       | 0.05  |

● **Marking Identification**



Row I

AMtek

Row II

AM5898N

Row III

Lot number