Ordering number : ENA0288

SANYO Semiconductors
DATA SHEET

# LV8227LG — Bi-CMOS IC For MD and UMD System Motor Driver IC

## Overview

The LV8227LG is a system motor driver IC that implements all the motor driver circuits needed for MD and UMD (Universal Media Disk) products. The LV8227LG provides a three-phase PWM spindle driver, a sled driver (as two three-phase stepping motor driver channels), and focus and tracking drivers (as two PWM H bridge driver channels). Since the LV8227LG uses Bi-CMOS process, it can contribute to further miniaturization, thinner from factors, and lower power in end products.

## Functions

- PWM H bridge motor drivers (2 channels)
- Three-phase stepping motor driver (2 channels)

## Specifications

### Absolute Maximum Ratings at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Supply voltage range 1 | $V_{CC}$ max | | 6.5 | V |
| Supply voltage range 2 | VG max | | 15.0 | V |
| Output block supply voltage | VM max | | 6.5 | V |
| H-bridge channel 1 and 2 output current | $I_O$ max1 | | 0.3 | A |
| Three-phase half-bridge channel 1 output current | $I_O$ max2 | | 0.3 | A |
| Three-phase half-bridge channel 2 output current | $I_O$ max3 | | 0.6 | A |
| Allowable power dissipation 1 | Pd max1 | Independent IC | 0.3 | W |
| Allowable power dissipation 2 | Pd max2 | Mounted on the specified board * | 1.45 | W |
| Operating temperature | Topr | | -20 to +85 | °C |
| Storage temperature | Tstg | | -55 to +150 | °C |

The specified board *: 50×40×0.8mm$^3$ 4-layer glass-epoxy circuit board.

### Allowable Operating Ranges at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Control circuit supply voltage | $V_{CC}$ | | 1.6 to 5.0 | V |
| Predriver supply voltage | VG | | VM+5.0 to 12.0 | V |
| Output block supply voltage | VM | | 2.3 to 5.0 | V |


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**Electrical Characteristics** at Ta = 25°C, $V_{CC}$ = 2.4V, VM = 3.6V, VG = 9.5V

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Control circuit supply voltage | | | | | | |
| Control circuit supply voltage 1 | $I_{CC}1$ | STALL pin: high (operating)<br>Conditions: ST1 and ST2 pins | | | 15 | μA |
| Control circuit supply voltage 2 | $I_{CC}2$ | STALL pin: low (standby mode) | | | 1.0 | μA |
| Predriver supply voltage | | | | | | |
| Predriver supply voltage 1 | $I_G1$ | STALL pin: high (operating)<br>Conditions: ST1 and ST2 pins<br>H bridge (2 channels): 88.2kHz<br>Three-phase driver (2 channels):176.4kHz | | | 1.5 | mA |
| Predriver supply voltage 2 | $I_G2$ | STALL pin: low (standby mode) | | | 1.0 | μA |
| STALL pin | | | | | | |
| High-level input voltage range | $V_{STALL}H$ | | $V_{CC}$×0.8 | | $V_{CC}$ | V |
| Low-level input voltage range | $V_{STALL}L$ | | 0 | | $V_{CC}$×0.2 | V |
| STALL pin pull-down resistor | $R_{STALL}$ | | 0.33 | 0.6 | 1.0 | MΩ |

**Three-Phase Stepping Motor Block (spindle and sled)** at Ta = 25°C, $V_{CC}$ = 2.4V, VM = 3.6V, VG = 9.5V

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Output Block | | | | | | |
| Output on resistance | RonU, V, W | Sum of the high and low-side output on resistances,VG = 9.5V | | 0.75 | 1.40 | Ω |
| Decoder Input Pins<br>(UI1, 2 to WI1, 2 ST1, 2) | | | | | | |
| High-level input voltage range | $V_{IH}$ | | $V_{CC}$×0.8 | | $V_{CC}$ | V |
| Low-level input voltage range | $V_{IL}$ | | 0 | | $V_{CC}$×0.2 | V |
| ST pin pull-down resistor | $R_{ST}$ | | 0.33 | 0.6 | 1.0 | MΩ |
| Comparator Block | | | | | | |
| Input offset voltage | $V_{OFS}$ | | -5 | | +5 | mV |
| Common-mode input voltage range | $V_{CM}$ | | 0 | | VM | V |
| High-level output voltage | $V_{OH}$ | $I_O$ = -0.5mA | $V_{CC}$×0.8 | | $V_{CC}$ | V |
| Low-level output voltage | $V_{OL}$ | $I_O$ = 0.5mA | 0 | | $V_{CC}$×0.2 | V |
| PWM Pin (PWM1,2) | | | | | | |
| High-level input voltage range | $V_{PWM}H$ | | $V_{CC}$×0.8 | | $V_{CC}$ | V |
| Low-level input voltage range | $V_{PWM}L$ | | 0 | | $V_{CC}$×0.2 | V |
| PWM input frequency | $f_{PWM}IN$ | | 88.2 | 176.4 | | kHz |

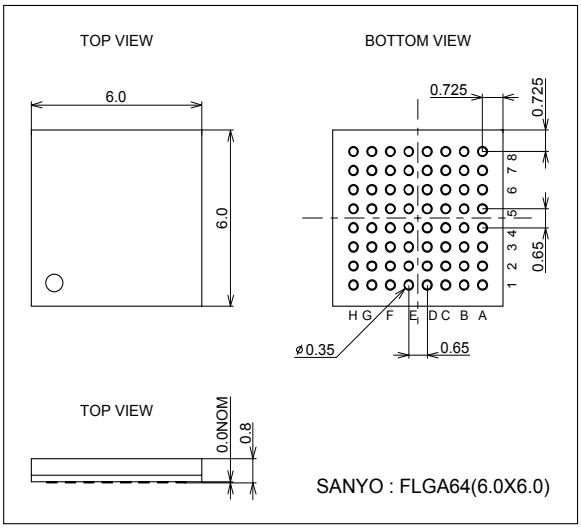
**H-Bridge Block (focus and tracking)** at Ta = 25°C, $V_{CC}$ = 2.4V, VM = 3.6V, VG = 9.5V

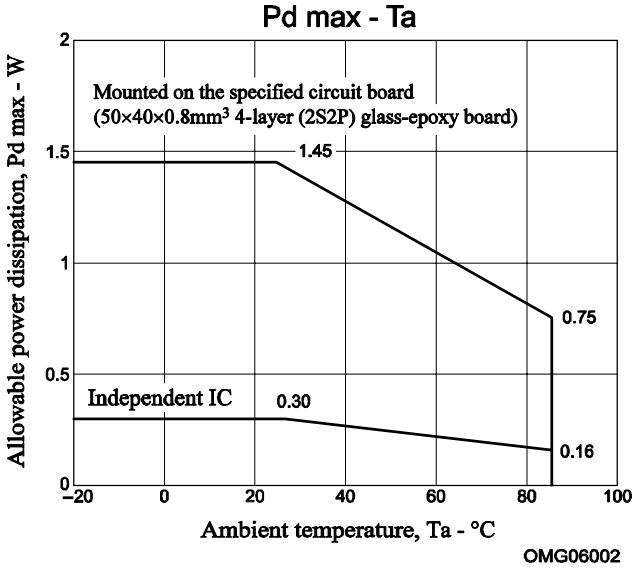
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Output Block | | | | | | |
| Output on resistance | Ron1,2 | Sum of the high and low-side output on resistances<br>VG = 9.5V | | 0.7 | 1.30 | Ω |
| Output transmission delay time (H bridge) | $T_{RISE}$ | Design target value | | 0.1 | | μs |
| | $T_{FALL}$ | Design target value | | 0.1 | | μs |
| Minimum input pulse width | $T_{min}$ | Input pulse width: 89 ns<br>Design target value | | 70 | | ns |
| H-Bridge Input Pins (FI1, FI2, RI1, and RI2) | | | | | | |
| High-level input voltage range | $V_{AI}H$ | | $V_{CC}$×0.8 | | $V_{CC}$ | V |
| Low-level input voltage range | $V_{AI}L$ | | 0 | | $V_{CC}$×0.2 | V |

## Package Dimensions

unit : mm

3320




## Truth Table - Three-Phase Stepping Motor Block

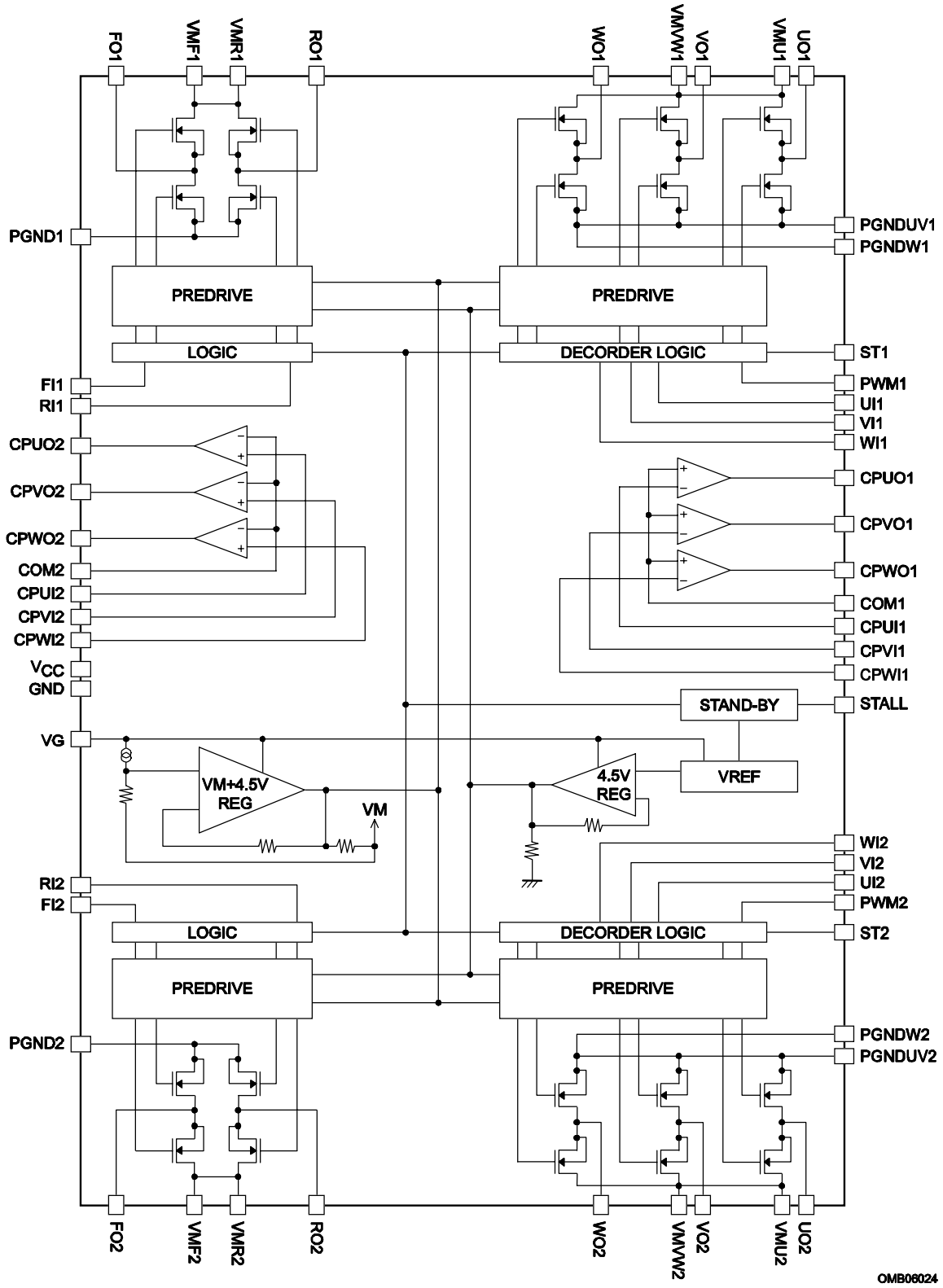
| STALL | ST1, 2 | UI1, 2 | VI1, 2 | WI1, 2 | UO1, 2 | VO1, 2 | WO1, 2 |
|---|---|---|---|---|---|---|---|
| H | L | L | L | L | L | L | L |
| H | L | L | L | H | Z | L | PWM |
| H | L | L | H | L | L | PWM | Z |
| H | L | L | H | H | L | Z | PWM |
| H | L | H | L | L | PWM | Z | L |
| H | L | H | L | H | PWM | L | Z |
| H | L | H | H | L | Z | PWM | L |
| H | L | H | H | H | L | L | L |
| H | H | × | × | × | Z | Z | Z |
| L | × | × | × | × | Z | Z | Z |

## Focus and Tracking Blocks

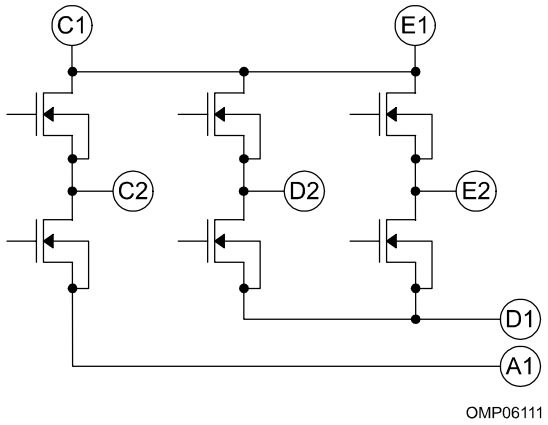
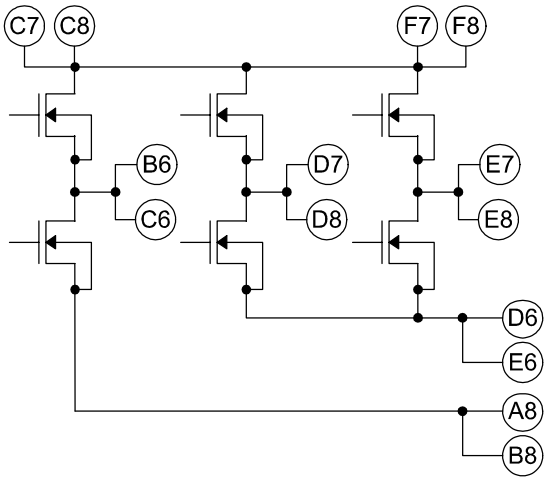
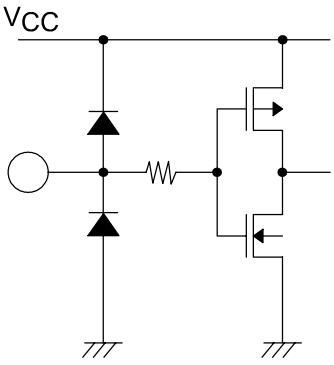
| STALL | FI1, 2 | RI1, 2 | FO1, 2 | RO1, 2 |
|---|---|---|---|---|
| H | L | L | L | L |
| H | L | H | L | H |
| H | H | L | H | L |
| H | H | H | L | L |
| L | × | × | Z | Z |

Z:open

## Block Diagram



## Pin Function

| Pin No. | Symbol | Description | Equivalent circuit |
|---|---|---|---|
| A1<br>D1 | PGNDW1<br>PGNDVU1 | Spindle motor drive power supply<br>Capacitors must be inserted between these pins and ground. |  <br>OMP06111 |
| C2<br>D2<br>E2 | WO1<br>VO1<br>UO1 | Spindle driver output<br>Connect the spindle motor coil to these pins. | |
| C1<br>E1 | VMVW1<br>VMU1 | Spindle output block ground | |
| A8,B8<br>D6,E6 | PGNDW2<br>PGNDVU2 | Sled motor drive power supply<br>Capacitors must be inserted between these pins and ground. |  <br>OMP06112 |
| B6,C6<br>D7,D8<br>E7,E8 | WO2<br>VO2<br>UO2 | Sled driver output<br>Connect the sled motor coil to these pins. | |
| C7,C8<br>F7,F8 | VMVW2<br>VMU2 | Sled output block ground | |
| A2<br>D5 | PWM1<br>PWM2 | Spindle and sled block PWM signal inputs<br>The output transistors will be on when these inputs are high. |  <br>OMP06113 |
| A7<br>B5<br>B7<br>B1<br>D3<br>E2 | UI2<br>VI2<br>WI2<br>UI1<br>VI1<br>WI1 | Spindle and sled block logic inputs | |
| E5<br>H7<br>G3<br>H2 | RI2<br>FI2<br>RI1<br>FI1 | Actuator H-bridge block logic inputs | |

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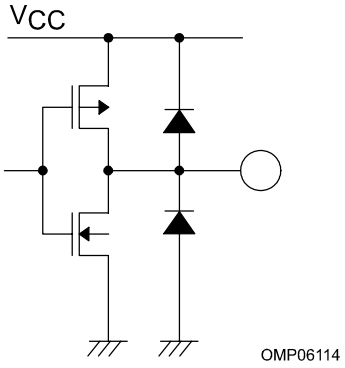
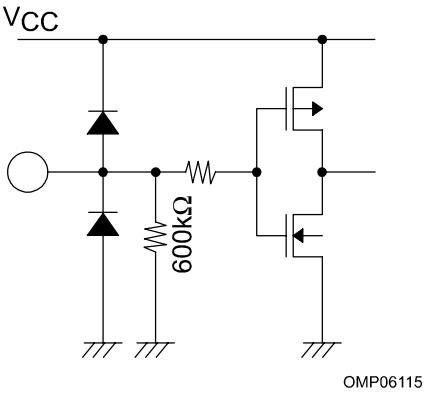
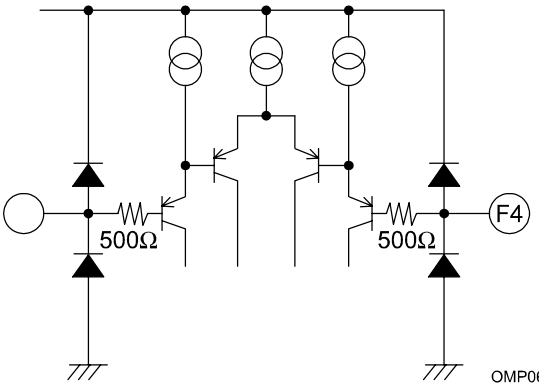
| Pin No. | Symbol | Description | Equivalent circuit |
|---|---|---|---|
| A3<br>B2<br>A4<br>A6<br>C5<br>A5 | CPUO1<br>CPVO1<br>CPWO1<br>CPUO2<br>CPVO2<br>CPWO2 | Comparator outputs |  |
| B3 | VG | Power supply for internal circuits<br>A capacitor must be inserted between this pin and ground. | |
| B4 | GND | Small-signal system circuit ground | |
| C3 | STALL | System start/stop<br>A high-level input specifies the start state. |  |
| F3<br>H6 | ST1<br>ST2 | Muting for the spindle and sled block. The outputs go to the open state when a high level is input. | |
| C4 | VCC | Small-signal system circuit power supply<br>A capacitor must be inserted between this pin and ground. | |
| D4<br>H4<br>G4 | CPUI1<br>CPVI1<br>CPWI1 | Inputs for the OUT sides of the comparators for each of the spindle phases |  |
| F4 | COM1 | Spindle comparator common input | |

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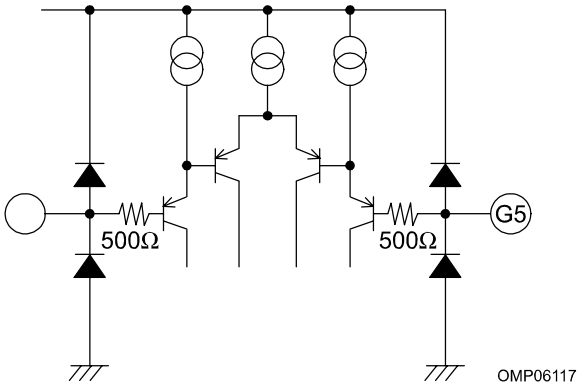
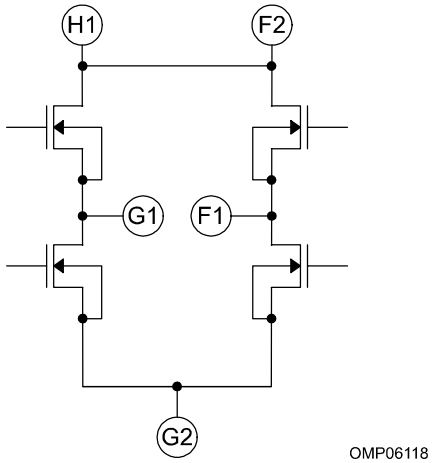
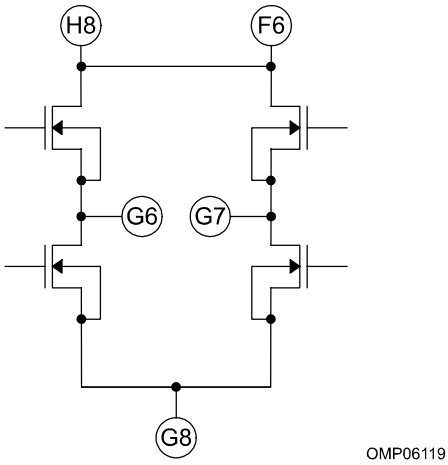
| Pin Number | Symbol | Description | Equivalent circuit |
|---|---|---|---|
| H5<br>F5<br>G4 | CPUI2<br>CPVI2<br>CPWI2 | Inputs for the OUT sides of the comparators for each of the sled phases |  |
| G5 | COM2 | Sled comparator common input | |
| H1<br>F2 | VMF1<br>VMR1 | H bridge 1 drive power supply<br>Capacitors must be inserted between these pins and ground. |  |
| G1<br>F1 | FO1<br>RO1 | H bridge 1 output<br>Connect the actuator coil to these pins. | |
| G2 | PGND1 | H bridge 1 output block ground | |
| H8<br>F6 | VMF2<br>VMR2 | H bridge 2 drive power supply<br>Capacitors must be inserted between these pins and ground. |  |
| G6<br>G7 | FO2<br>RO2 | H bridge 2 output<br>Connect the actuator coil to these pins. | |
| G8 | PGND2 | H bridge 2 output block ground | |

## Pin Assignments

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| A | PGNDW1 | PWM1 | CPUO1 | CPWO1 | CPWO2 | CPUO2 | UI2 | PGNDW2 |
| B | UI1 | CPVO1 | VG | GND | VI2 | WO2 | WI2 | PGNDW2 |
| C | VMVW1 | WO1 | STALL | $V_{CC}$ | CPVO2 | WO2 | VMVW2 | VMVW2 |
| D | PGNDUV1 | VO1 | VI1 | CPUI1 | PWM2 | PGNDUV2 | VO2 | VO2 |
| E | VMU1 | UO1 | WI1 | CPVI2 | RI2 | PGNDUV2 | UO2 | UO2 |
| F | RO1 | VMR1 | ST1 | COM1 | CPWI2 | VMR2 | VMU2 | VMU2 |
| G | FO1 | PGND1 | RI1 | CPWI1 | COM2 | FO2 | RO2 | PGND2 |
| H | VMF1 | FI1 | NC | CPVI1 | CPUI2 | ST2 | FI2 | VMF2 |

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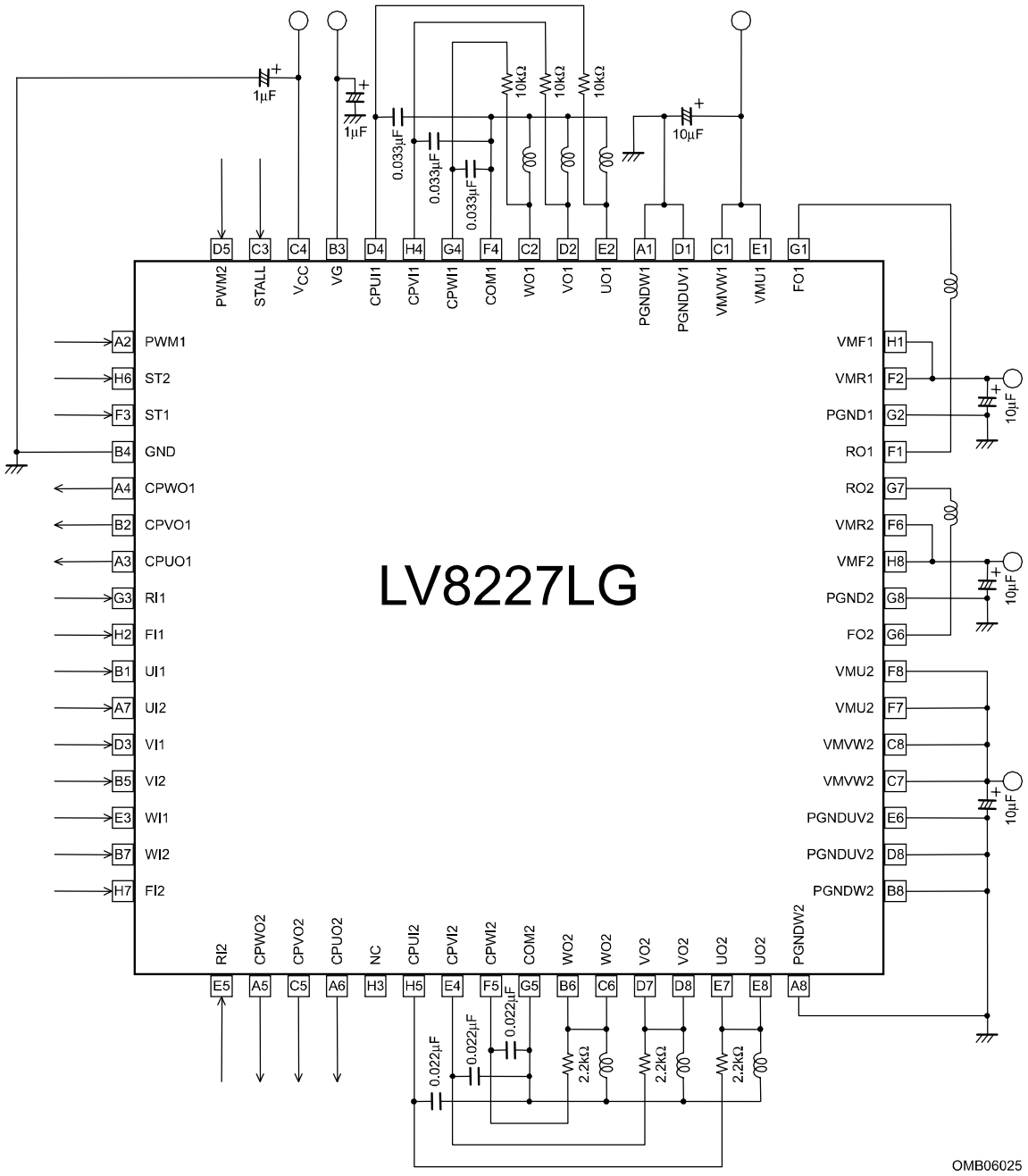
## Application Circuit Example



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