2540
QUAD POWER DRIVER

Combining logic gates and inverting high-current bipolar outputs, these quad Darlington power drivers provide interface between low-level signal-processing circuits and power loads totaling 360 W. Each of the four independent outputs can sink up to 1.8 A in the ON state with peak inrush currents to 2.5 A. The four power outputs are each comprised of an open-collector Darlington driver and an internal flyback/clamp diode for switching inductive leads. They feature a minimum breakdown and sustaining voltage of 50 V. The logic inputs are compatible with TTL and 5 V CMOS logic systems.

Typical applications include print heads, relays, solenoids, and dc stepping motors. These drivers can also be used to drive high-current incandescent lamps, LEDS, and heaters

Part Numbers: UDN2540B and A2540SLB

Pinout Diagram
(A2540SLB)

Dwg. PP-017-3

Features

■ 1.8 A Continuous Output Current

■ Output Voltage to 50 V

■ TTL and 5 V CMOS Compatible Inputs

■ Efficient Input/Output Pinning

■ Integral Transient-Suppression Diodes

■ Replaces L6221A and L6221CD

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17
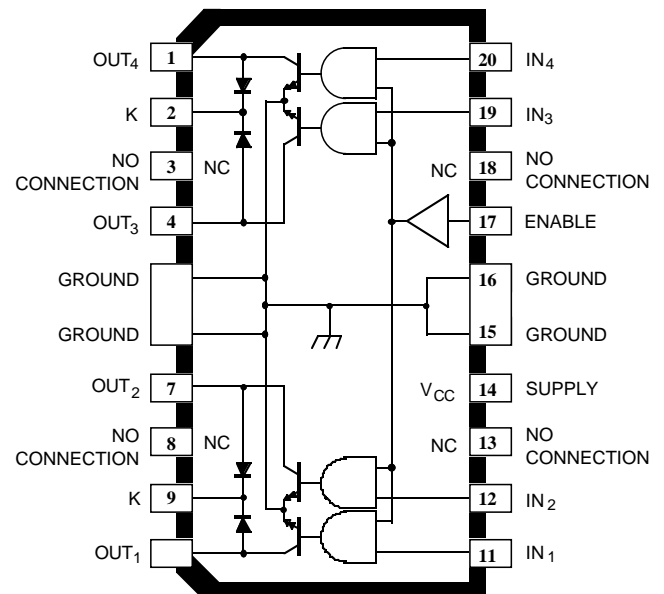
2916 THRU 2919 AND 6219
DUAL FULL-BRIDGE PWM MOTOR DRIVERS

Part Numbers	Package	Max. Output Voltage	Continuous Output Current	Peak Output Current	Protection	Features
UDN2916B	DIP	45 V	±750 mA	±1 A	yes	1/2 step
UDN2916EB	PLCC					
UDN2916LB	SOIC					
UDQ2916B	DIP					
UDQ2916EB	PLCC					
UDQ2916LB	SOIC					
UDN2917EB	PLCC	45 V	±1.5 A	±1.75 A	yes	1/2 step
UDQ2917EB						
A2919SB	DIP	45 V	±750 mA	±1 A	yes	1/4 step
A2919SLB	SOIC					
L6219DS	SOIC	45 V	±750 mA	±1 A	yes	1/2 step

PWM Current-Control Circuitry
(2917 shown, quarter-step devices include independent 2-bit reference voltage dividers)

Dwg. EP-007-2A

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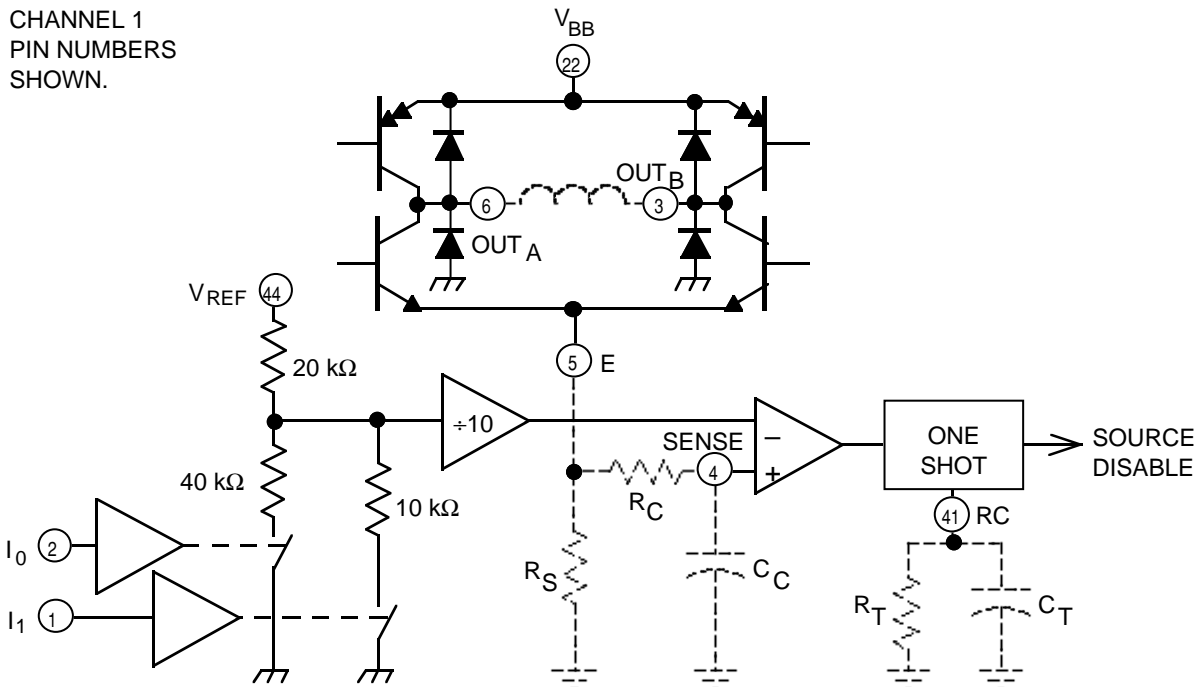
Dual full-bridge motor drivers are designed to drive both windings of a bipolar stepper motor or bidirectionally control two dc motors. Both bridges include internal pulse-width modulation (PWM) control of the output current. Satlington outputs combine the low voltage drop of a saturated transistor and the high peak current capability of a Darlington.

For PWM current control, the maximum output current is determined by the user's selection of a reference voltage and sensing resistor. With quarter-step operation, two logic-level inputs select output current limits of 0, 33 or 41, 67, or 100% of the maximum level. A PHASE input to each bridge determines load current direction.

The bridges include both ground clamp and flyback diodes for protection against inductive transients. Internally generated delays prevent cross-over currents when switching current direction. Special power-up sequencing is not required. Thermal protection circuitry disables the outputs if the chip temperature exceeds safe operating limits.

Features

- 750 mA Continuous Output Current
- 45 V Output Sustaining Voltage
- Internal Clamp Diodes
- Internal PWM Current Control
- Low Output Saturation Voltage
- Internal Thermal Shutdown Circuitry

**PWM Current-Control Circuitry
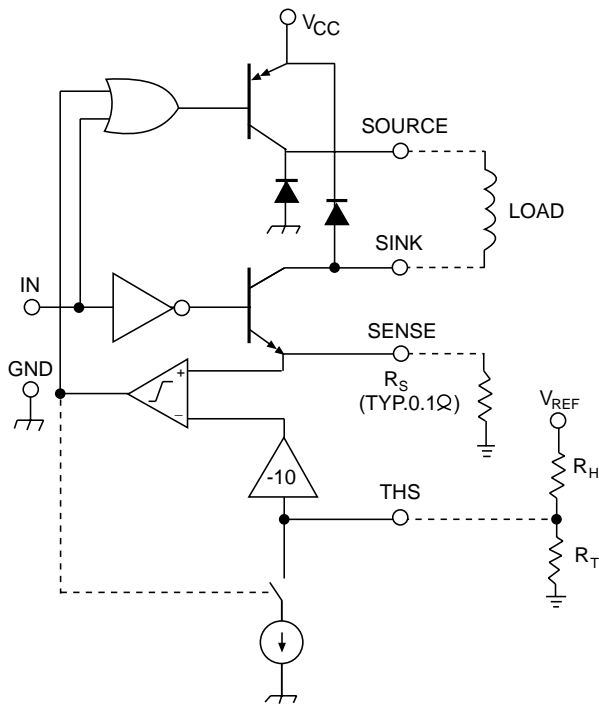with Quarter Stepping**
(UDN2916B shown)

'B' PACKAGE, CHANNEL 1 PIN NUMBERS SHOWN.

Dwg. EP-007B

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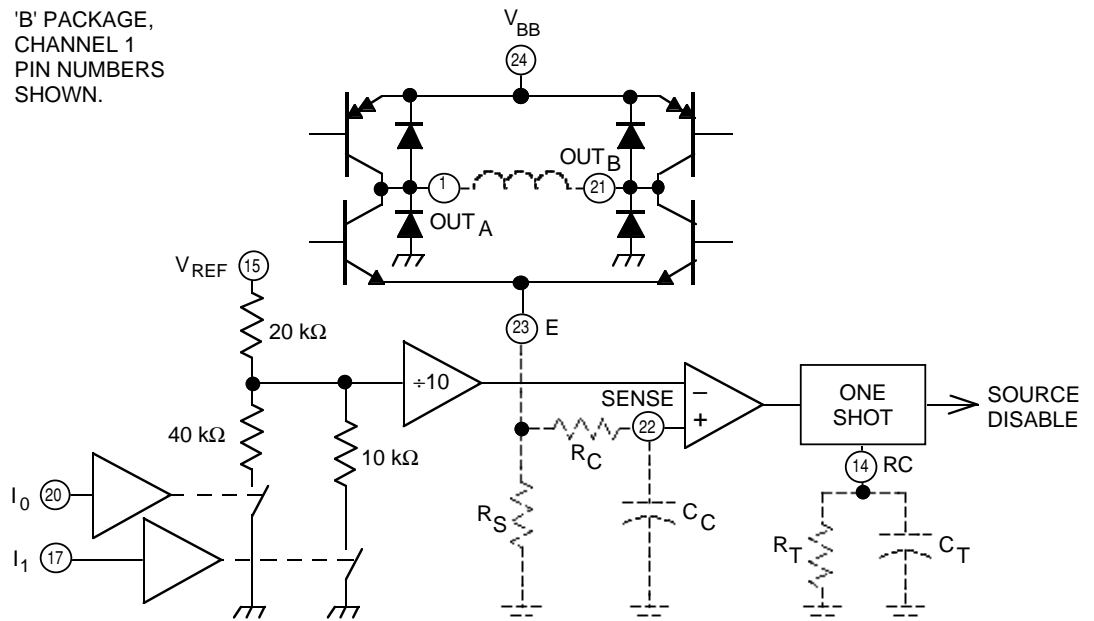
2962
DUAL HALF-BRIDGE PWM SOLENOID/MOTOR DRIVER

Features

- ■ 4 A Peak Output
- ■ 45 V Min. Sustaining Voltage
- ■ Internal Clamp Diodes
- ■ TTL/PMOS/CMOS Compatible Inputs
- ■ High-Speed Chopper

Part Number: UDN2962W

Functional Block Diagram
(One of Two Drivers)

Using PWM to minimize power dissipation and maximize load efficiency, this dual driver is recommended for impact printer solenoids and stepper motors. It is comprised of two source/sink driver pairs and can be connected to drive two independent loads or a single load in the full-bridge configuration. Both drivers include output clamp/flyback diodes, input gain and level shifting, a voltage regulator for single-supply operation, and pulse-width modulated output-current control circuitry. Inputs are compatible with most TTL, DTL, LSTTL, and low-voltage CMOS or PMOS logic.

The peak output current and hysteresis for each source/sink pair is set independently. Output current, threshold voltage, and hysteresis are set by the user's selection of external resistors. At the specified output-current trip level, the source driver turns OFF. The internal clamp diode then allows current to flow without additional input from the power supply. When the lower current trip point is reached, the source driver turns back ON.

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3932
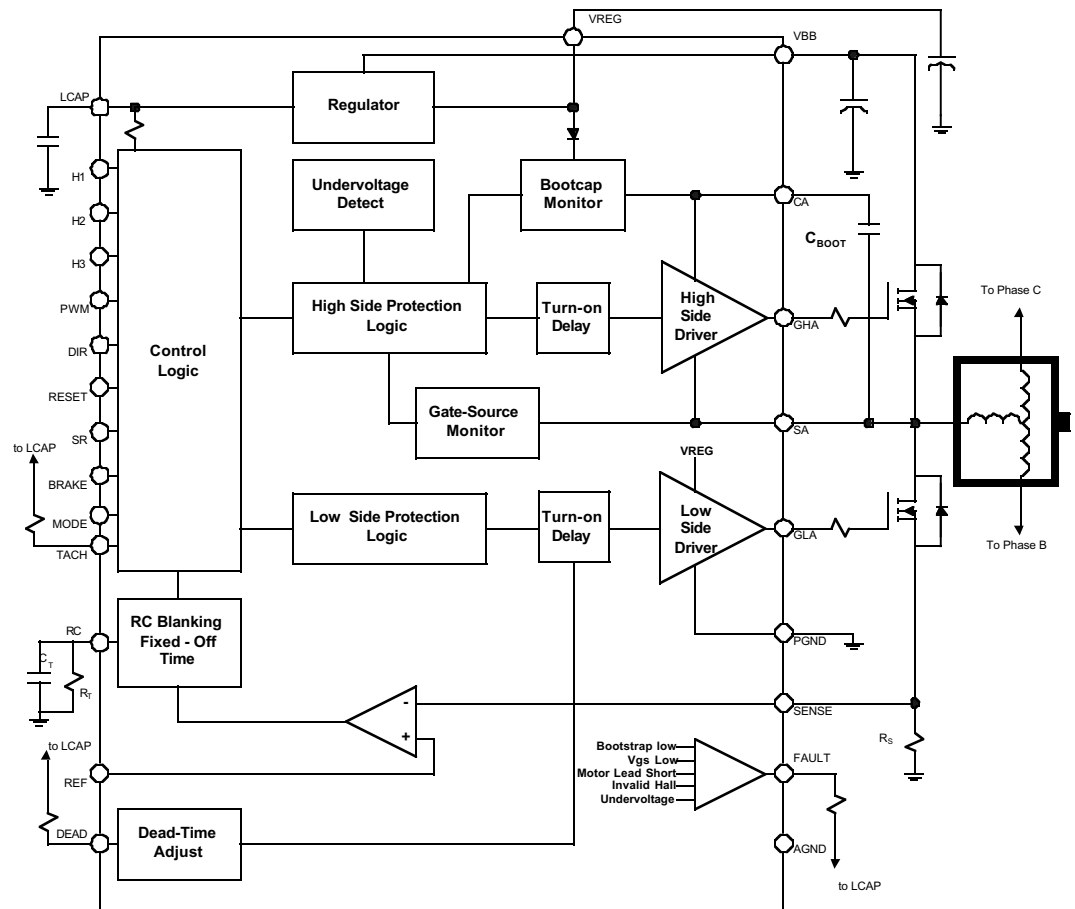## THREE-PHASE BRUSHLESS DC MOTOR CONTROLLER

Features and Benefits

■ Drives Wide Range of N-Channel MOSFETs
■ Sources 1.25 A for Gate Turn-On
■ Sinks 2.5 A for Gate Turn-Off
■ Synchronous Rectification
■ Power MOSFET Protection
■ Adjustable Dead Time for Cross Conduction Protection
■ Fast and Slow Current Decay Modes
■ Internal PWM Current Control
■ PWM Torque-Control Input
■ Motor Lead Short-to-Supply and Ground Protection
■ Internal 5 V Regulator
■ Direction Control
■ Brake Input
■ Fault Diagnostic Output
■ Tachometer Output
■ Thermal Shutdown
■ Undervoltage Protection

Part Number: A3932SEQ

N·E·W

Functional Block Diagram & Typical Application

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3933

## THREE-PHASE BRUSHLESS DC MOTOR CONTROLLER

Features and Benefits

- Drives External N-Channel FETs
- Intelligent High-Side Gate Drive
- Selectable Coast or Dynamic Brake on Power Down
- Adjustable Dead Time
  for Cross-Conduction Protection
- Selectable Fast or Slow Current-Decay Modes
- Internal PWM Peak Current Control
- Reset/Coast Input
- 120° Hall Commutation with Internal Pullup
- Operation From 12 V to 28 V
  Internal 5-V Regulator
- Low-Side Synchronous Rectification
- Direction Control
- PWM Speed-Control Input
- Fault-Diagnostic Output
- Under-Voltage Protection

Part Number: A3933SEQ

NEW

## Functional Block Diagram & Typical Application

Dwg. FP-045

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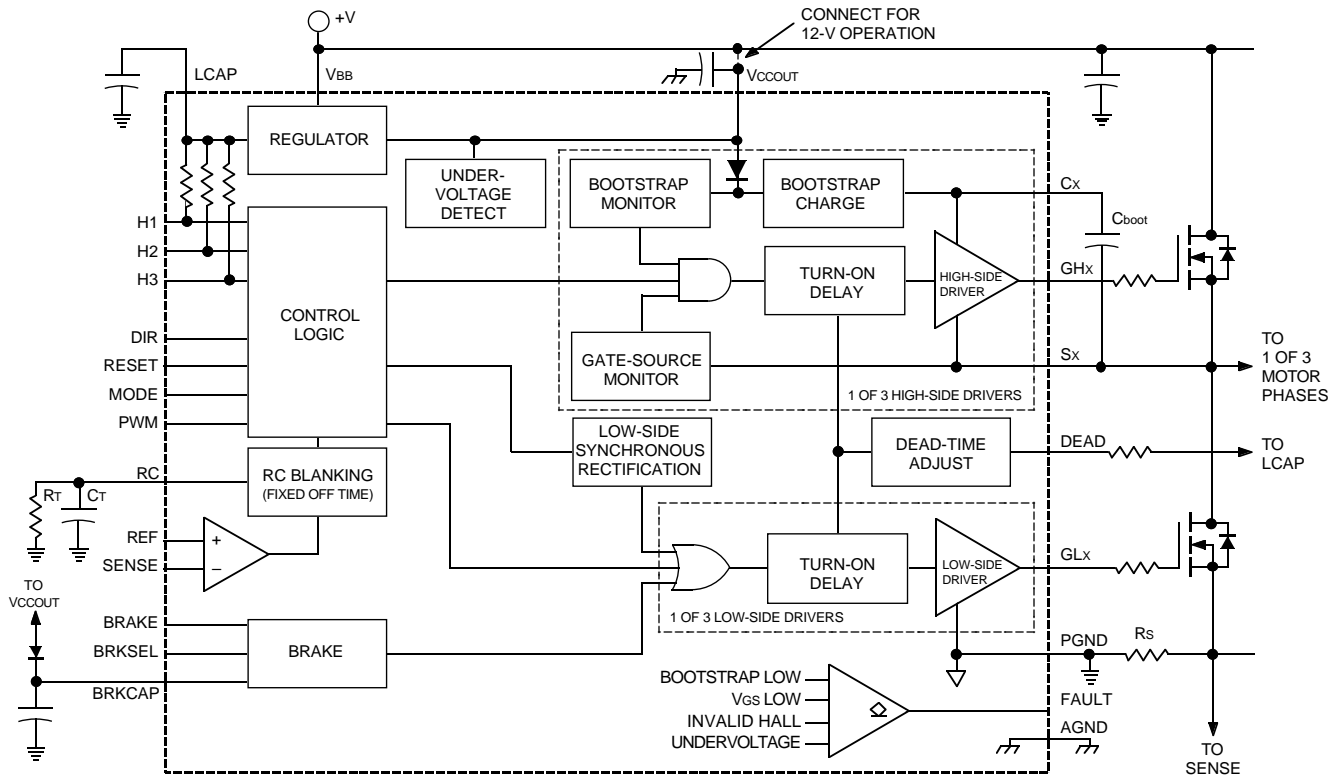
3951, 3952, AND 3953
FULL-BRIDGE PWM MOTOR DRIVERS

Part Numbers	Output Ratings Current	Features
A3951SB A3951SW	±2 A, 50 V	brake
A3952SB A3952SEB A3952SLB A3952SW	±2 A, 50 V	fast/slow decay sleep mode brake
A3953SB A3953SLB	±1.3 A, 50 V	fast/slow decay sleep mode Satlington™ sink brake

Internal fixed off-time PWM current-control circuitry can be used to regulate the maximum load current to a desired value. The peak load current limit is set by the user's selection of an input reference voltage and external sensing resistor. The fixed off-time pulse duration is set by a user-selected external RC timing network. Internal circuit protection includes thermal shutdown with hysteresis, transient-suppression diodes, and crossover current protection. Special power-up sequencing is not required.

When a logic low is applied to the BRAKE input, the braking function is enabled. This overrides ENABLE and PHASE to turn OFF both source drivers and turn ON both sink drivers. The brake function can be used to dynamically brake brush dc motors.

Typical Functional Block Diagram
(A3953SB shown)

Dwg. FP-036-2A

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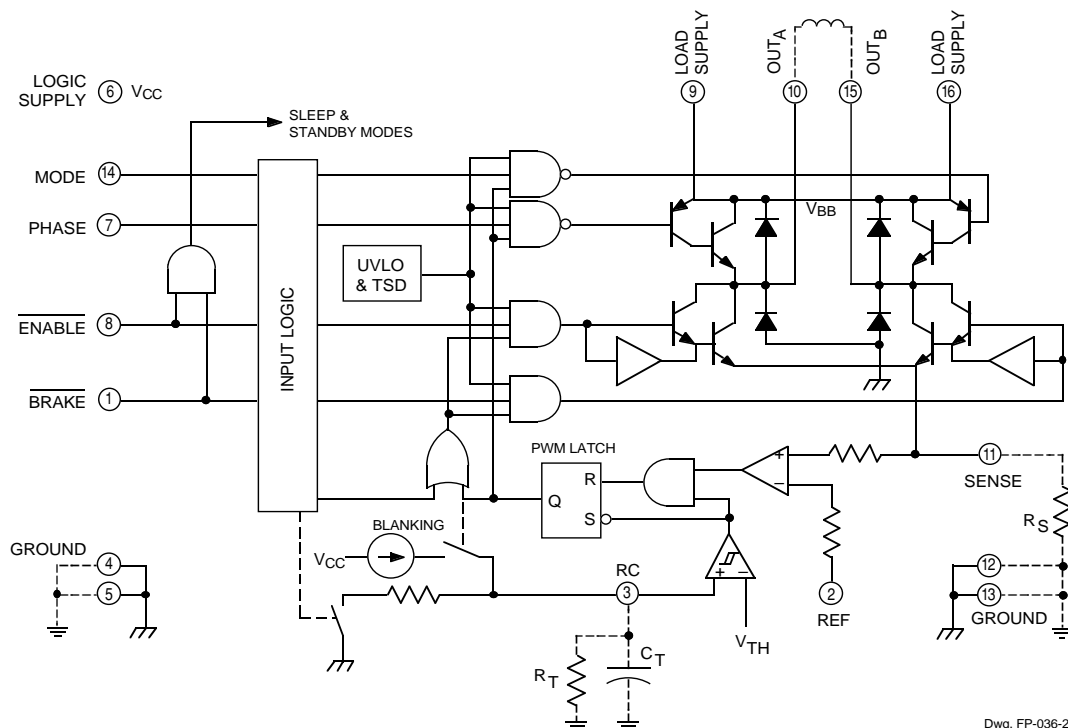
3955 AND 3957
FULL-BRIDGE PWM MOTOR DRIVERS

Features

- ±1.5 A Continuous Output Current
- 50 V Output Voltage Rating
- Internal PWM Current Control
- 3-Bit Non-Linear DAC for 8-Bit Microstepping (3955) or 4-Bit for 16-Bit Microstepping (3957)
- Satlington™ Sink Drivers
- Fast, Mixed Fast/Slow, and Slow Current-Decay Modes
- Internal Transient-Suppression Diodes
- Internal Thermal-Shutdown Circuitry
- Crossover-Current and UVLO Protection

Part Numbers: A3955SB, A3955SLB, A3957SA, and A3957SLB

Intended to drive one winding of a bipolar stepper motor in a microstepping mode. Internal pulse-width modulated (PWM) current control combined with an internal nonlinear digital-to-analog converter allows the motor current to be controlled in full-, half-, quarter-, eighth-, or sixteenth-step (microstepping, 3957 only) modes. Nonlinear increments minimize the number of control lines necessary for microstepping.

Internal circuitry determines whether the PWM current-control circuitry operates in a slow (recirculating) current-decay mode, fast (regenerative) current-decay mode, or in a mixed current-decay mode in which the off time is divided into a period of fast current decay with the remainder of the fixed off time spent in slow current decay. The combination of user-selectable current-sensing resistor and reference voltage, digitally selected output current ratio; and slow, fast, or mixed current-decay modes provides users with a broad, variable range of motor control.

Internal circuit protection includes thermal shutdown with hysteresis, transient-suppression diodes, and crossover current protection. Special power-up sequencing is not required.

Functional Block Diagram
(A3957SLB shown)

Dwg. FP-042-1

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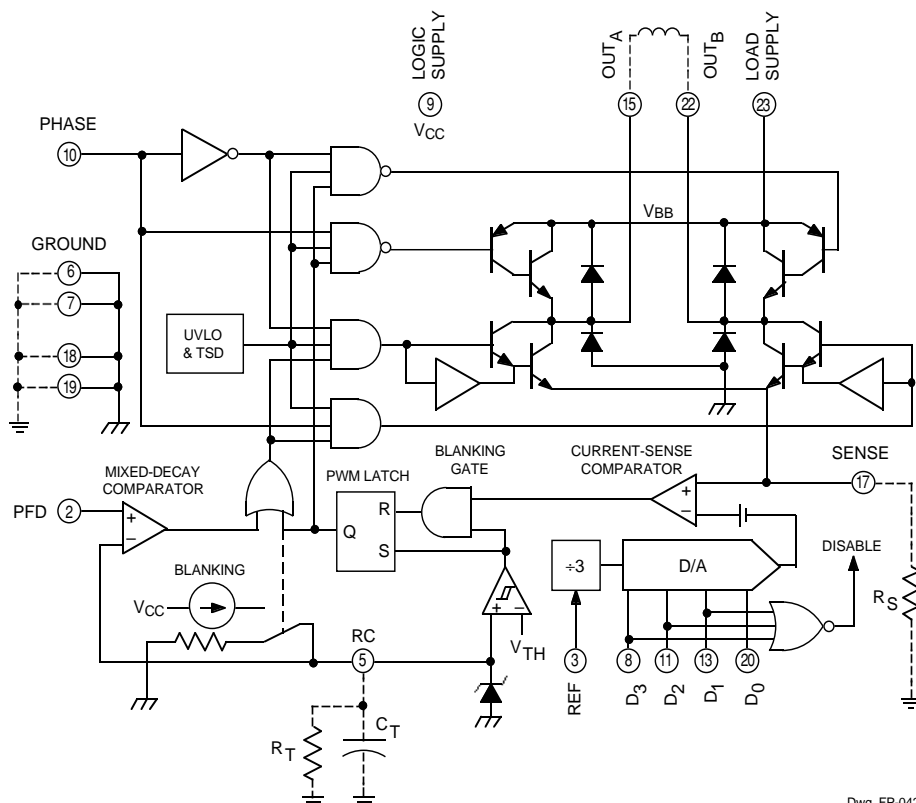
3958
DMOS FULL-BRIDGE PWM MOTOR DRIVER

Features
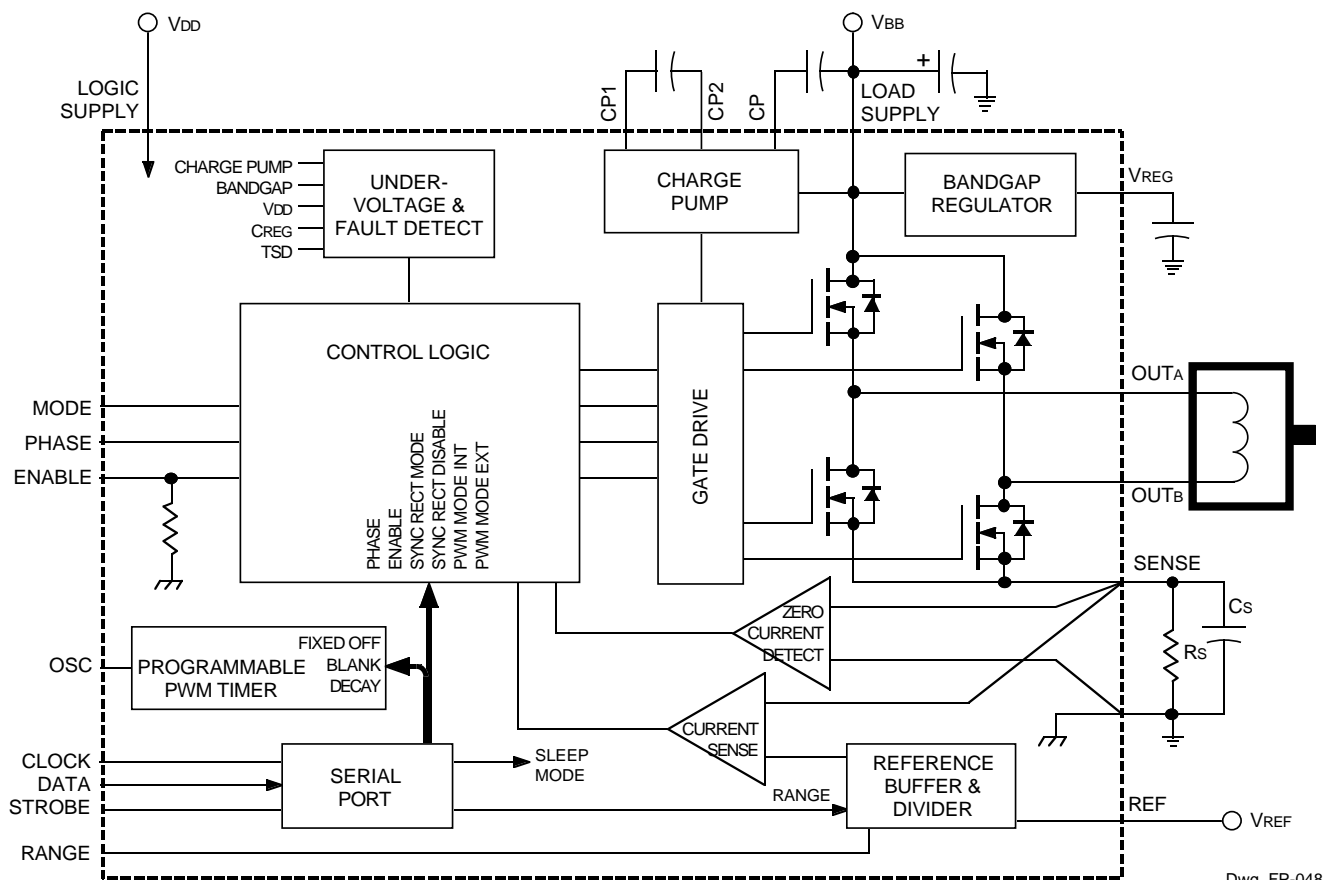
■ ±2 A, 50 V Continuous Output Rating

■ Low $r_{DS(on)}$ Outputs (270 mΩ, Typical)

■ Programmable Mixed, Fast, and Slow Current-Decay Modes

■ Serial Interface Controls Chip Functions

■ Synchronous Rectification for Low Power Dissipation

■ Internal UVLO and Thermal-Shutdown Circuitry

■ Crossover-Current Protection

Part Numbers: A3958SB and A3958SLB

Internal fixed off-time PWM current-control timing circuitry can be programmed via a serial interface to operate in slow, fast, and mixed current-decay modes.

PHASE and ENABLE input terminals are provided for use in controlling the speed and direction of a dc motor with externally applied PWM-control signals. The ENABLE input can be programmed via the serial port to PWM the bridge in fast or slow current decay. Internal synchronous rectification control circuitry is provided to reduce power dissipation during PWM operation.

Functional Block Diagram

Dwg. FP-048

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3966 AND 3968
DUAL FULL-BRIDGE PWM MOTOR DRIVERS

All devices include two H-bridges capable of continuous output currents of ±650 mA and operating voltages to 30 V. Motor winding current can be controlled by the internal fixed-frequency, pulse-width modulated (PWM), current-control circuitry. The peak load current limit is set by the user's selection of a reference voltage and current-sensing resistors.

The fixed-frequency pulse duration is set by a user-selected external RC timing network. The capacitor in the RC timing network also determines a user-selectable blanking window that prevents false triggering of the PWM current-control circuitry during switching transitions.

To reduce on-chip power dissipation, the H-bridge power outputs have been optimized for low saturation voltages. The sink drivers feature Allegro's patented Satlington™ output structure. The Satlington outputs combine the low voltage drop of a saturated transistor and the high peak current capability of a Darlington.

Part Numbers: A3966SA, A3966SLB, A3968SA, and A3968SLB

Features

- ±650 mA Continuous Output Current
- 30 V Output Voltage Rating
- Internal Fixed-Frequency PWM Current Control
- Brake Mode (3968 only)
- Satlington™ Sink Drivers
- User-Selectable Blanking Window
- Internal Ground-Clamp & Flyback Diodes
- Internal Thermal-Shutdown Circuitry
- Crossover-Current Protection and UVLO Protection

Typical Functional Block Diagram
(3966 shown)

Dwg. FP-036-6

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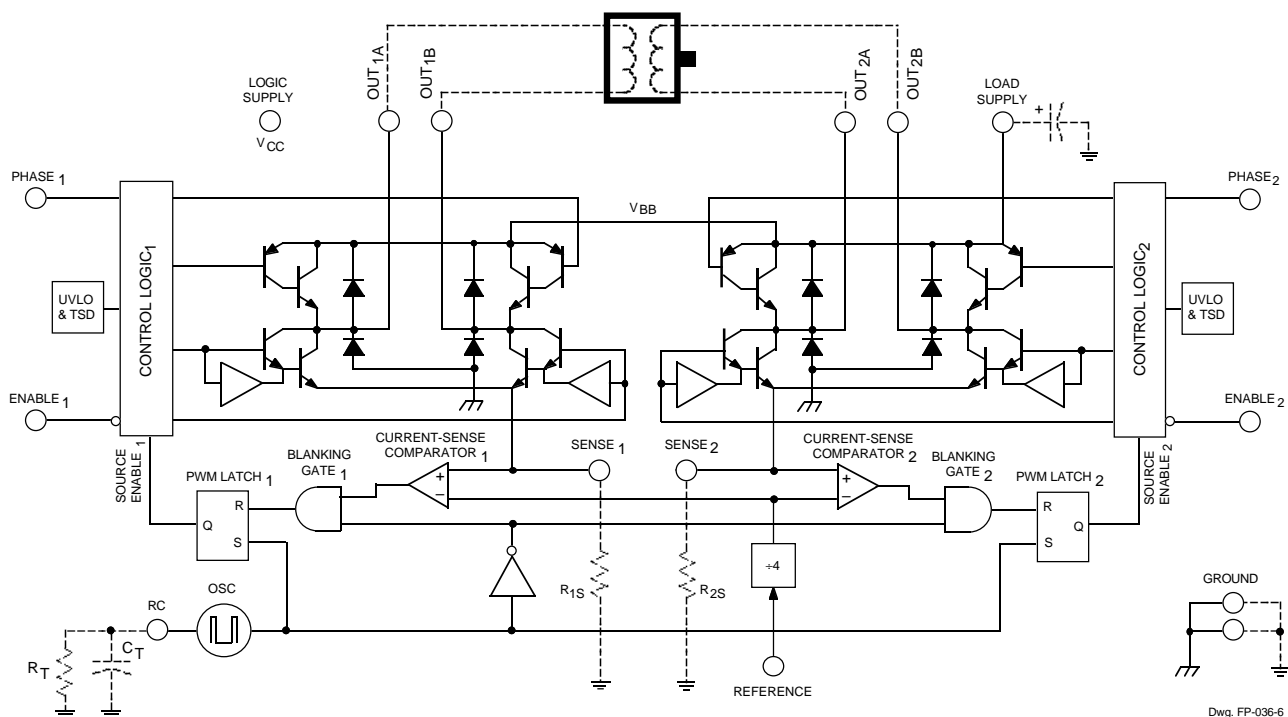
3971
DMOS DUAL FULL-BRIDGE MOTOR DRIVER

Features

- ±2.5 A, 50 V Continuous Output Rating
  Parallel Outputs for 5 A Load Current Capability
- Low $r_{DS(on)}$ Outputs
  (typically 300 mΩ source, 160 mΩ sink)
- Synchronous Rectification
- Internal Undervoltage Monitor
- Crossover-Current Protection
- Connection for External Current Sensing
- Thermal-Shutdown Circuitry

Part Number: A3971SLB

N**E**W

Functional Block Diagram

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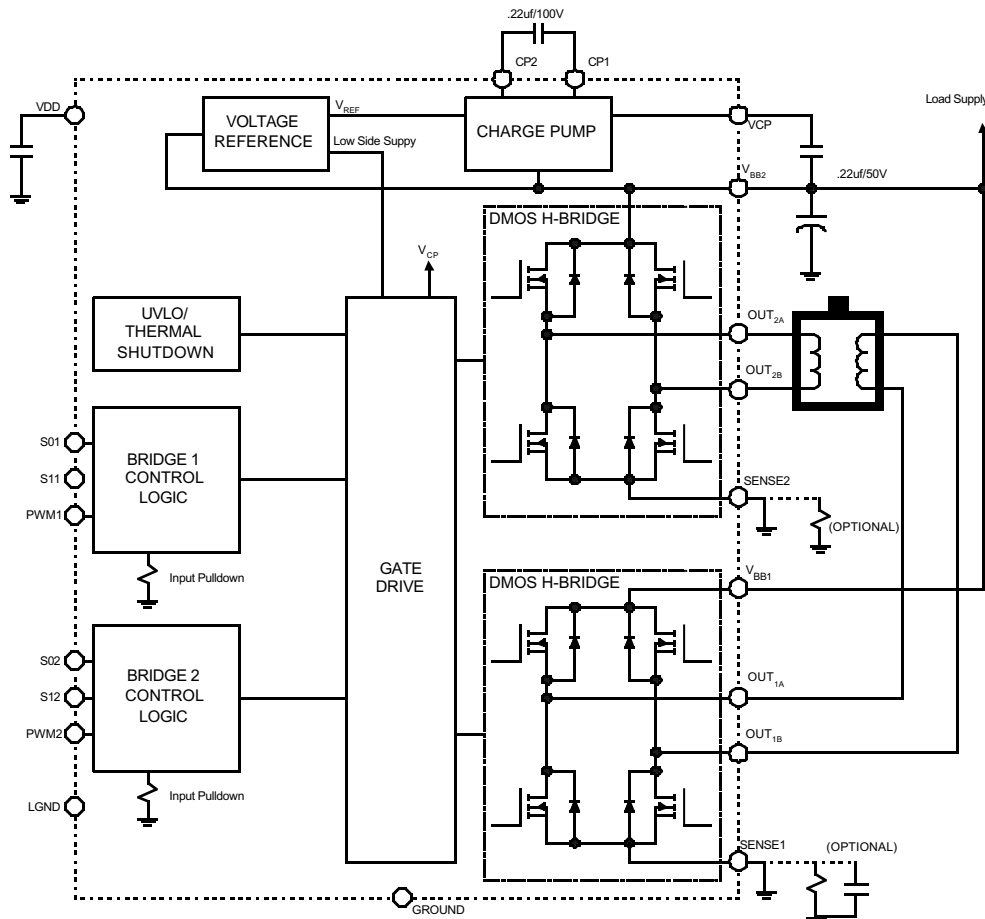
3972
## *DMOS DUAL FULL-BRIDGE PWM MICROSTEPPING MOTOR DRIVER*

Part Number: A3972SB

N E W

Features

- ±1.5 A, 50 V Continuous Output Rating
- Low $r_{DS(on)}$ DMOS Output Drivers
- Optimized Microstepping via 6-Bit Linear DACs
- Programmable Mixed, Fast, and Slow Current-Decay Modes
- Internal 4 MHz Oscillator for Digital Timing
- Internal Transient-Suppression Diodes
- Serial Interface Controls Chip Functions
- Synchronous Rectification for Low Power Dissipation
- Internal UVLO and Thermal Shutdown Circuitry
- Crossover-Current Protection
- Precision 2 V Reference
- Inputs Compatible with 5 V or 3.3 V Control Signals
- Sleep and Idle Modes

Functional Block Diagram

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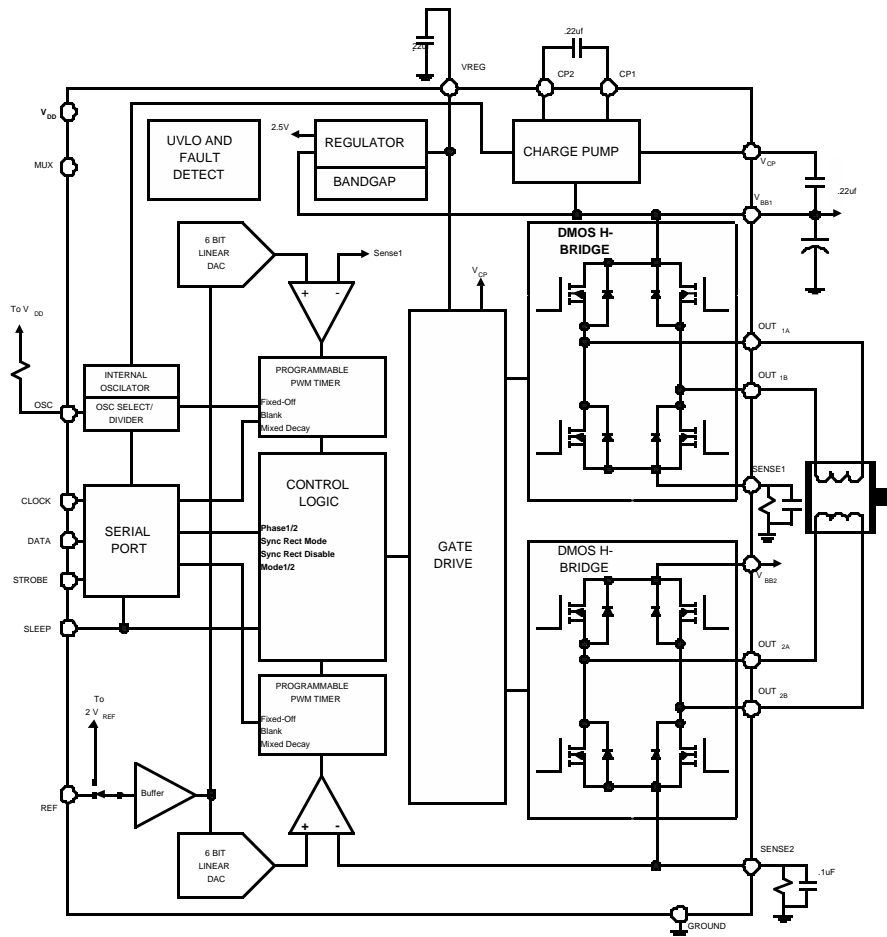
3976
DUAL FULL-BRIDGE
PROTECTED MOTOR DRIVER

Part Numbers: A3976KLB and A3976KB

N E W

Features

- ±500 mA Continuous Output Current
- 35 V Load Dump Survival
- Output Short-Circuit Protection
- Coded Fault Diagnostic Outputs
- Open Load Monitor
- Low-Current Standby Mode
- V_{BB} Overvoltage Shutdown
- Internal Thermal Shutdown Circuitry
- Internal Low-Parasitic Free-Wheeling Diodes
- Crossover Current Protection

Functional Block Diagram

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5804
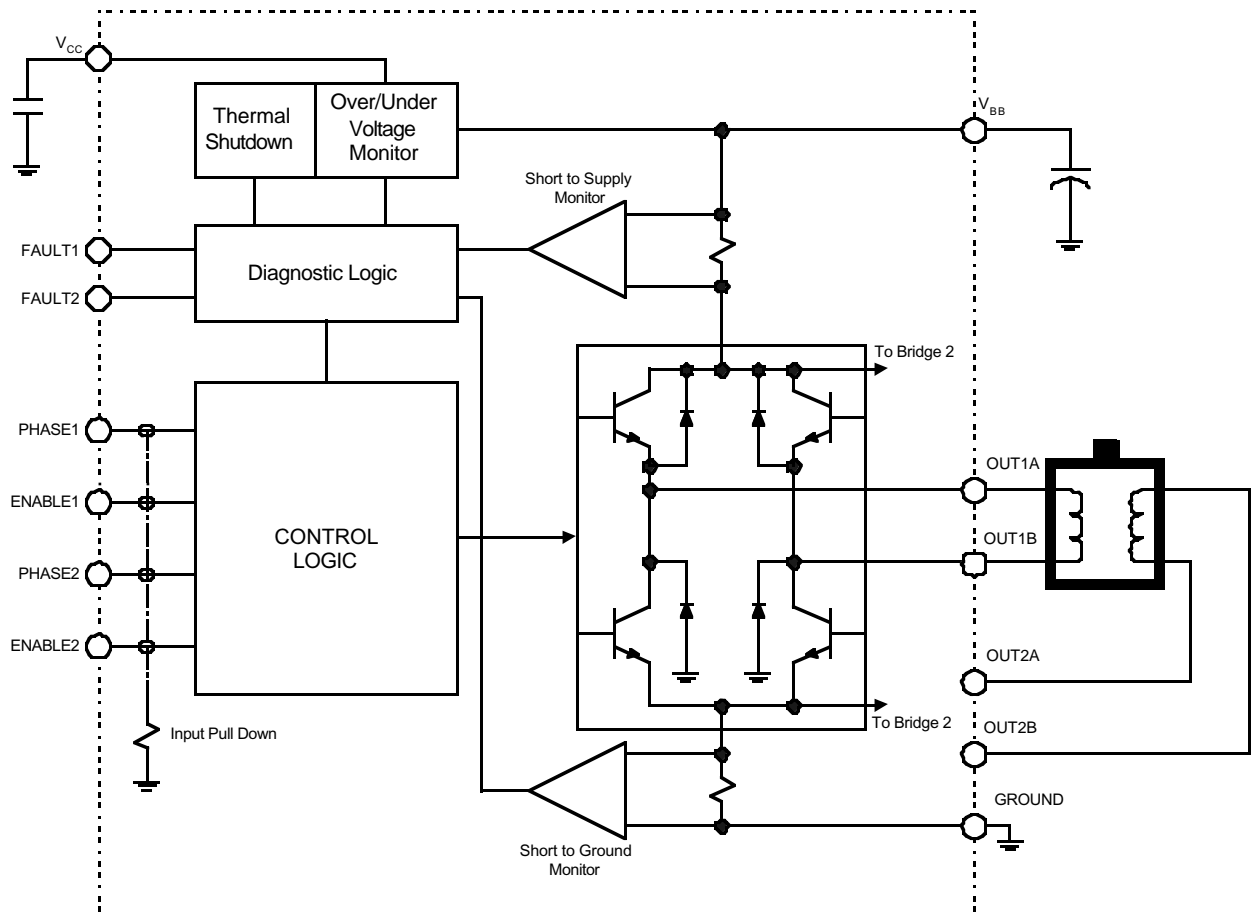
# BiMOS II UNIPOLAR STEPPER-MOTOR TRANSLATOR/DRIVER

Features

- 1.5 A Maximum Output Current
- 35 V Output Sustaining Voltage
- Wave-Drive, Two-Phase, and Half-Step Drive Formats
- Internal Clamp Diodes
- Output Enable and Direction Control
- Power-ON Reset
- Internal Thermal Shutdown Circuitry

Part Numbers: A5804B and UCN5804LB

Combining low-power CMOS logic with high-current and high-voltage bipolar outputs, the UCN5804B and UCN5804LB BiMOS II translator/drivers provide complete control and drive for a four-phase unipolar stepper-motor.

The CMOS logic section provides the sequencing logic, DIRECTION and OUTPUT ENABLE control, and a power-ON reset function. Three stepper-motor drive formats, wave-drive (one-phase), two-phase, and half-step are externally selectable. The inputs are compatible with standard CMOS, PMOS, and NMOS circuits. TTL or LSTTL may require the use of appropriate pull-up resistors to ensure a proper input-logic high.

The wave-drive format consists of energizing one motor phase at a time in an A-B-C-D (or D-C-B-A) sequence. This excitation mode consumes the least power and assures positional accuracy regardless of any winding inbalance in the motor. Two-phase drive energizes two adjacent phases in each detent position (AB-BC-CD-DA). This sequence mode offers an improved torque-speed product, greater detent torque, and is less susceptible to motor resonance. Half-step excitation alternates between the one-phase and two-phase modes (A-AB-B-BC-C-CD-D-DA), providing an eight-step sequence.

Dwg. W-194

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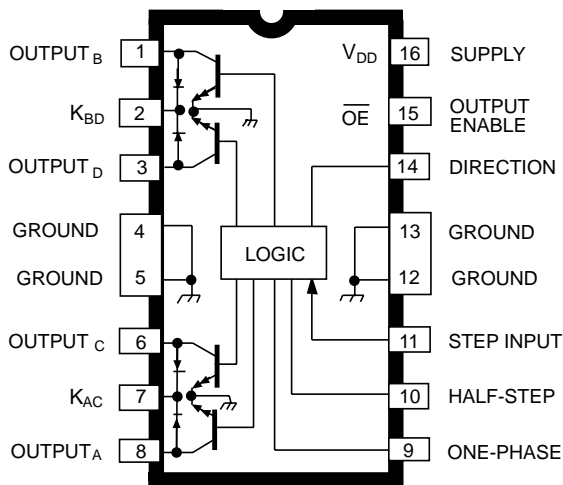
7024, 7026, AND 7029
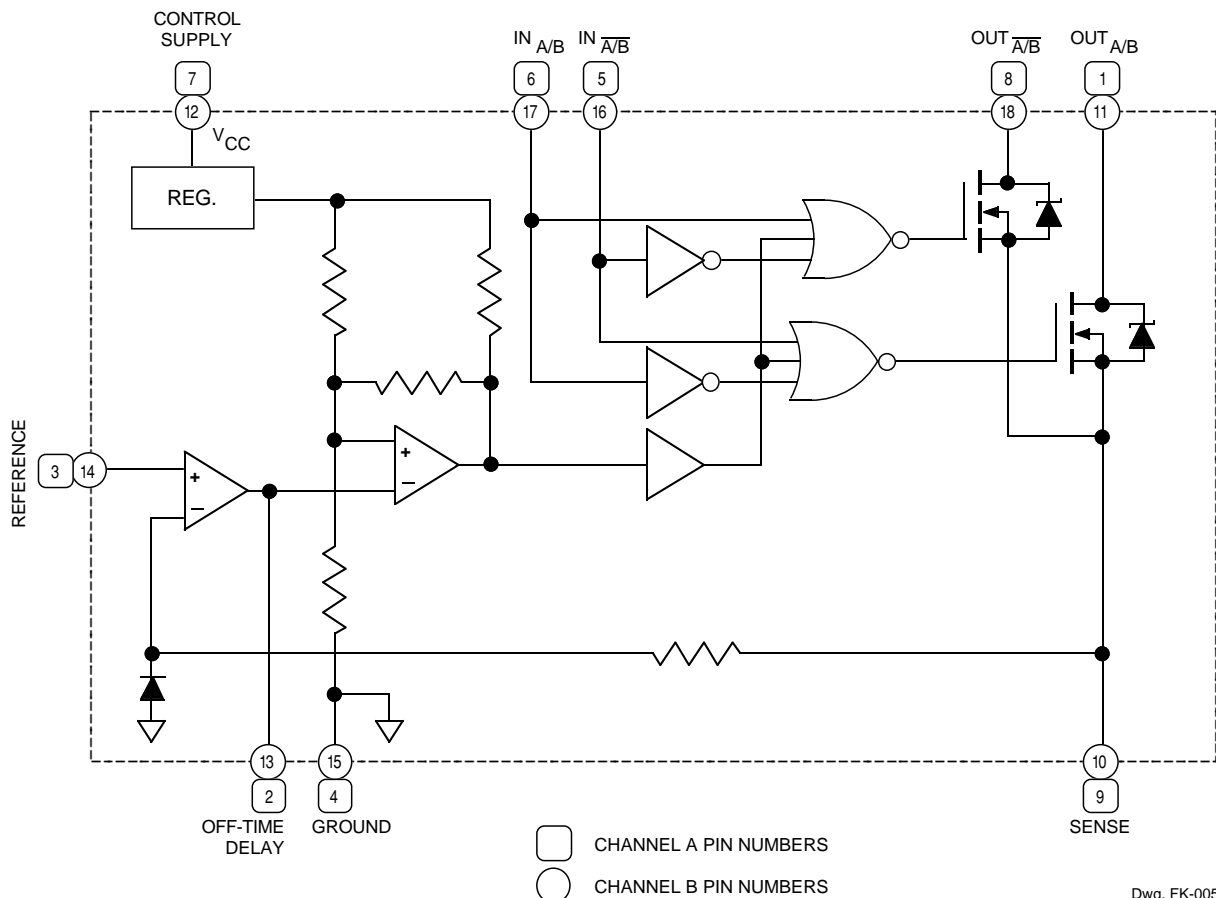## HIGH-CURRENT PWM, UNIPOLAR STEPPER MOTOR CONTROLLER/DRIVERS

Benefits and Features

- Cost-Effective, Multi-Chip Solution
- 'Turn-Key' Motion-Control Module
- Motor Operation to 3 A and 46 V
- 3rd Generation High-Voltage FETs
- 100 V, Avalanche-Rated NMOS
- Low $r_{DS(on)}$ NMOS Outputs
- Advanced, Improved Body Diodes
- Single-Supply Motor/Module Operation
- Half- or Full-Step Unipolar Drive
- High-Efficiency, High-Speed PWM
- Dual PWM Current Control (2-Phase)

- Programmable PWM Current Control
- Low Component Count PWM Drive
- Low Internal Power Dissipation
- Heat Sinking (Normally) Unnecessary
- Electrically Isolated Power Tab
- Logic IC- and µP-Compatible Inputs
- Machine-Insertable Package

Part Number	Package	Output Current
SLA7024M	18-Lead Power-Tab SIP	1.5 A
SLA7026M	18-Lead Power-Tab SIP	3.0 A
SMA7029M	15-Lead SIP	1.5 A

Functional Block Diagram
(SLA7024M and SLA7026M)

Dwg. FK-005

CHANNEL A PIN NUMBERS

CHANNEL B PIN NUMBERS

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7042 AND 7044
MICROSTEPPING, UNIPOLAR PWM, HIGH-CURRENT MOTOR CONTROLLER/DRIVERS

Benefits and Features

- Cost-Effective, Multi-Chip Solution
- 'Turn-Key' Motion-Control Module
- Motor Operation to 3 A and 46 V
- 3rd Generation High-Voltage FETs
- 100 V, Avalanche-Rated NMOS
- Low $r_{DS(on)}$ NMOS Outputs
- Advanced, Improved Body Diodes
- Microstepping Unipolar Drive
- High-Efficiency, High-Speed PWM
- Independent PWM Current Control (2-Phase)
- Digitally Programmable PWM Current Control
- Low Component-Count PWM Drive
- Low Internal-Power Dissipation

- Electrically Isolated Power Tab
- Logic IC- and μP-Compatible Inputs
- Machine-Insertable 18-Pin Power-Tab Package

Part Number	Max. I_{OUT}	Max. $r_{DS(on)}$
SLA7042M	1.5 A	0.67 Ω
SLA7044M	3 A	0.285 Ω

NOTE — The PG001M parallel-to-serial data converter is intended to be used with these devices.

Functional Block Diagram

Dwg. FK-006

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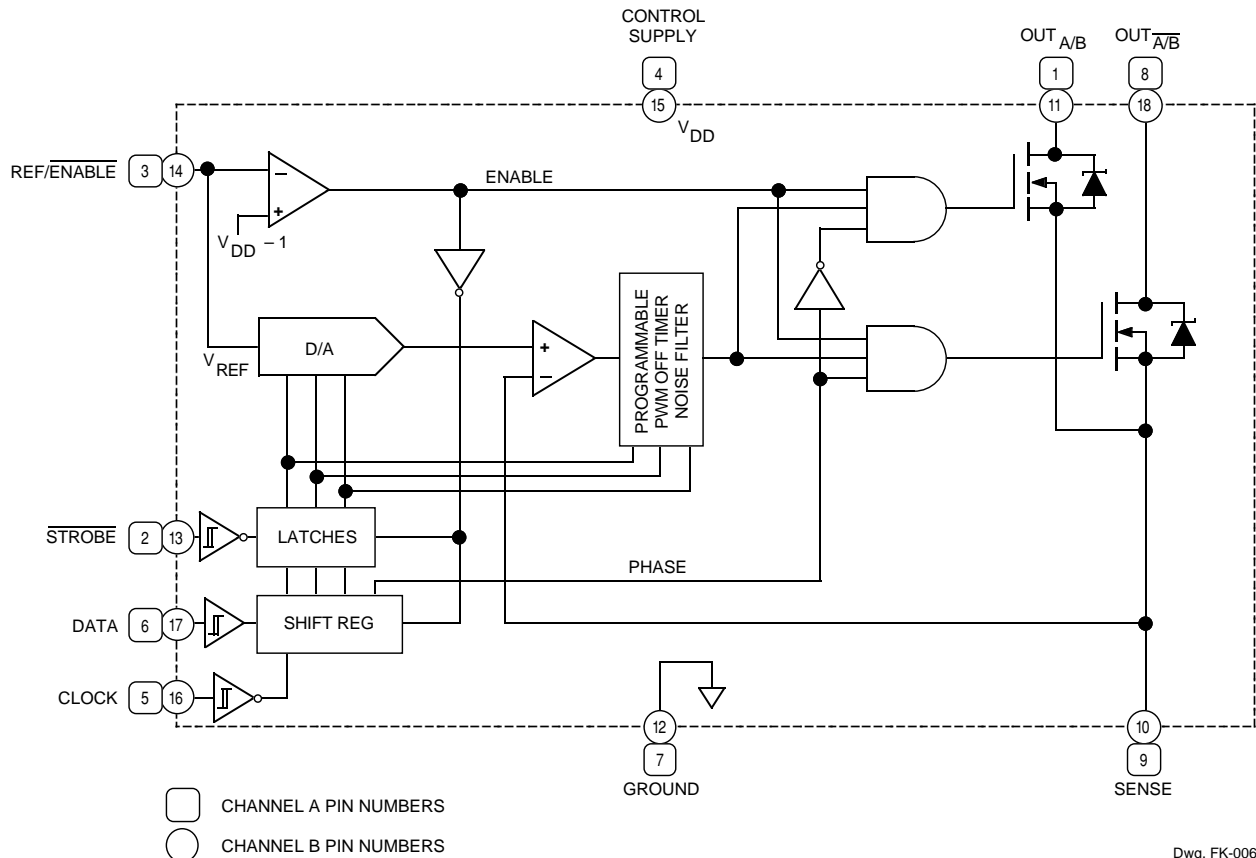
8902-A
3-PHASE BRUSHLESS DC MOTOR
## CONTROLLER/DRIVER WITH BACK-EMF SENSING

Features

- DMOS Outputs
- Low $r_{DS(on)}$
- Startup Commutation Circuitry
- Back-EMF Commutation Circuitry
- Serial Port Interface
- Frequency-Locked Loop Speed Control
- Sector Data or Tachometer Signal Input
- Programmable Start-Up Current
- Diagnostics Mode
- Sleep Mode

- Linear Current Control
- Internal Current Sensing
- Dynamic Braking Through Serial Port
- Power-Down Dynamic Braking
- System Diagnostics Data Out
- Data Out Ported in Real Time
- Internal Thermal Shutdown Circuitry

Part Number: A8902CLBA

Typical Functional Block Diagram

Dwg. FP-034

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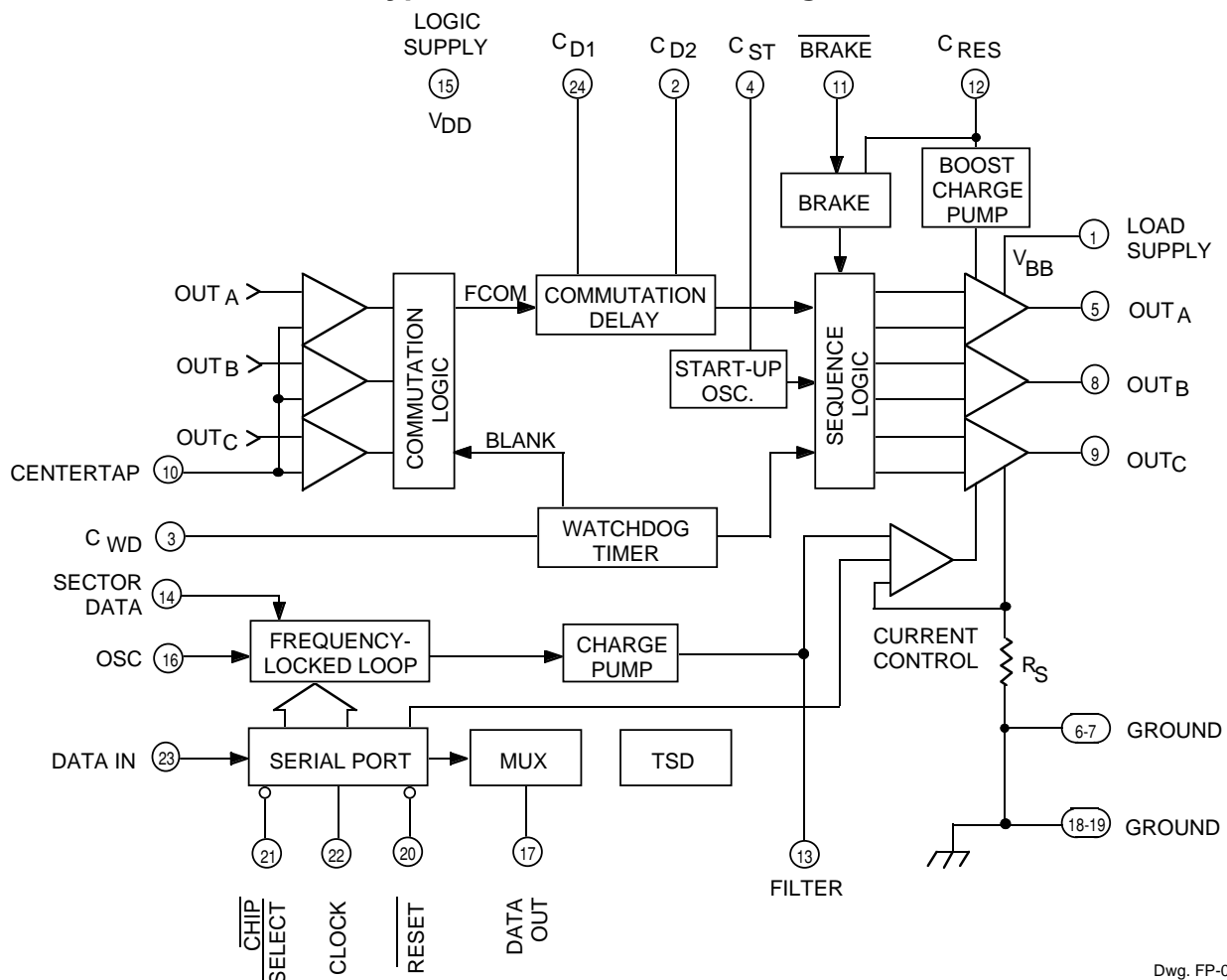
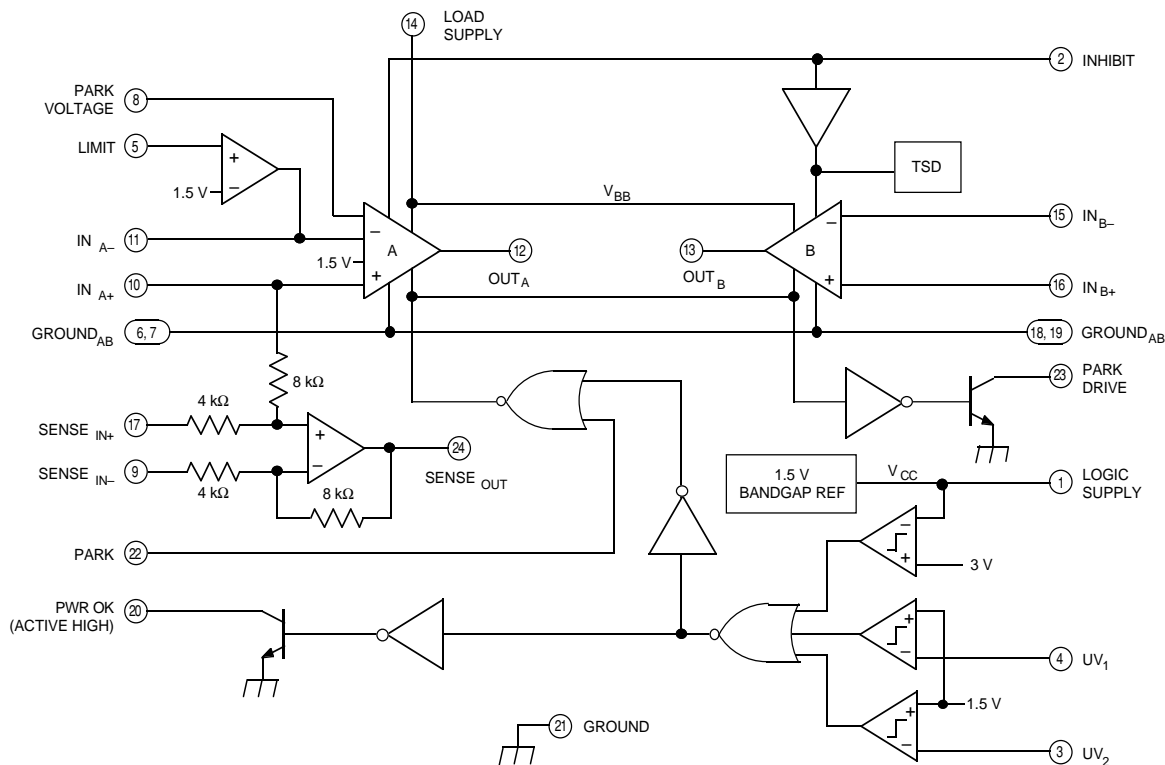# *8932-A AND 8958*
VOICE COIL MOTOR DRIVERS

8932-A Features

- 5 Volt Operation
- Class-B, 2 Ω $r_{DS(on)}$ at 500 mA Output
- Lossless Current Sensing
- Zero Current-Loop Deadband
- High Transconductance Bandwidth
- User-Adjustable Transconductance Gain
- Digital Transconductance Gain Switch (4:1 Ratio)
- 5 Volt Monitor with Selectable UV Trip Point
- Retract Circuitry Functional to 0 Volts
- Sleep Mode Function
- Internal Back-EMF Velocity Loop Option
- Internal Thermal Shutdown Circuitry

Part Numbers: A8932CLWA and A8958CLB

Providing control and drive of the voice coil motor used for head positioning in disk drive applications, these full-bridge drivers can be configured so that their output current is a direct function of an externally applied control voltage or current. This linear current control function is supplemented by additional circuitry to protect the load during system failure or normal system shutdown.

8958 Features

- 8 V to 16 V Operation
- Controlled-Velocity Head Parking
- Zero Deadband
- High Transconductance Bandwidth
- User-Adjustable Transconductance Gain
- ±800 mA Load Current
- Dual Under-Voltage Monitors with Flag and User-Selectable Trip Points
- Internal Thermal Shutdown Circuitry

Functional Block Diagram (8958)

Dwg. FP-020C

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