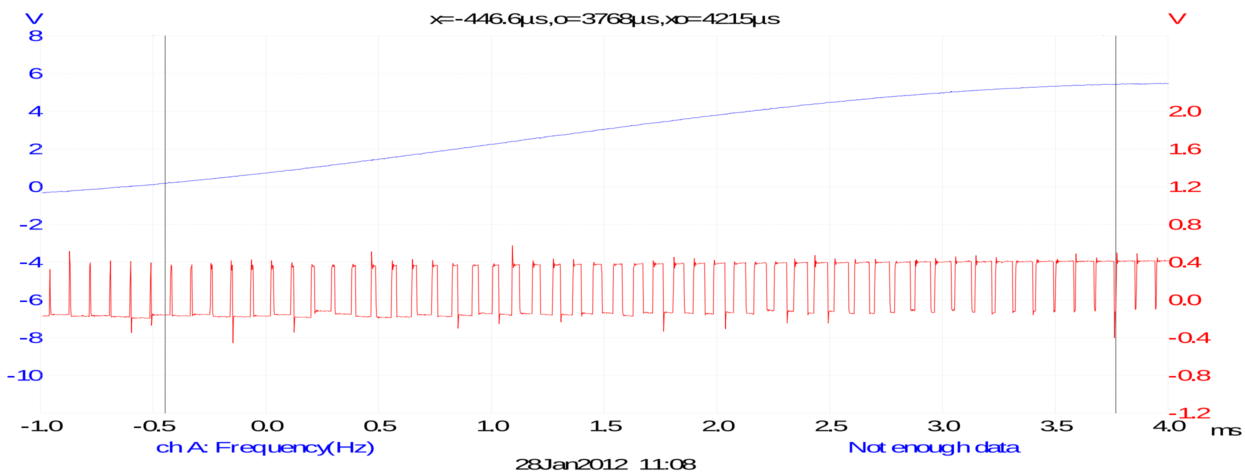
900VDC, up to 250 KHz, 20nS rising slope, Isolated Full Bridge Driver

P/N **EDR83305** is rated 4.7-A (rms)/4.5kW, 30-A (short run), 70-A pulse/60kW \
P/N **EDR83307** is rated at 9.2-A (rms)/8.3kW, 60-A (short run), 120-A pulse/110kW
P/N **EDR83308** is rated at 13-A (rms)/11.5kW, 90-A (short run), 200-A pulse/180kW

Power converters, Bipolar Permanent Magnet Stepping Motors, DC Motor, Piezo-transducers, etc

Qualified for delivering kilowatts of power in ultra-precision PWM applications



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***Electronic Design & Research** is a pioneer in developing and manufacturing high-speed, high-power relays/switches. Since 1998, we have produced vast varieties of Solid-State Modules and Devices. Our products have been used in thousands of defense-related and industrial applications.*

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Signal Switching Separating Network
Sockets for relays, switches, and drivers
Charge-Pump Wide-Band FM detectors
Low-noise, High-Voltage DC/DC converters
DC-3phase AC resonance mode driver for EV
DC-12phase AC resonance mode driver for EV
Perpetual Pulse-width Discriminator, US Patent
½ and H Fuzzy Logic sockets for various relays
Fuzzy-Logic SPDT Relays, Switches, and ½ Drivers
Fully protected, Solid-State DPST Brake, US Patent
Single Pole, Single Throw Relays, and Switches (SPST)
Power-distributing module for Motorcycles, US Patent
Single Pole, Double Throw Relays, and Switches (SPDT)
Double Pole, Single Throw Relays and Switches (DPST)
1-Form B, SPST-NC (normally closed) Solid State Relays
Charge-and-Add, Up/Down DC/DC Converters, US patent
1-Form B and 1-Form A DPST-NC/NO Solid State Relays
μ-Power Controller for Magnetic Latching Valves, US Patent
High Voltage, Nana-Seconds Rise/Fall time, Push-Pull Drivers
Super-low noise preamplifiers for low and high-impedance sources
μ-control, High-Power SPST-NC, normally closed relays, US Patent
High Speed Biases Switch (HSBS-600/601) for Magnetic Resonance Spectroscopy
High-Speed Biases Generator (HSBG-602) for Magnetic Resonance Spectroscopy
Dynamic Disabling Switch (DDS-700/701/702) for Magnetic Resonance Spectroscopy

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For your unique applications that require a different voltage, current, or speed, ordering instructions (on the last page) could be helpful in the creation of a new part and summarizing what you need. Do not hesitate to send us an email at info@vsholding.com for any additional information, delivery schedule, and prices.

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Vladimir A. Shvartsman, Ph.D.
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Technology for people's ideas

A family of High-Speed, Full-Bridge, Isolated (HS-FBI) Drivers

A new family of EDR's third generation all-voltage, optical full-bridge (or H) drivers is a cost effective solution for automotive and other power control applications. Devices assembled in a small 1.95"W x 3.95"L x 1.2"H panel mounting enclosure, capable of delivering up to 6-kW of power. Full 3,000V input-output isolation allows safe interfacing directly to low-power CMOS (or TTL) logics. Essential three available controls (EN, DIR, and BR) offer design flexibilities while making it easily adaptable to a wide range of industrial solutions. An external MCU can control output functions of a HS-FBI by providing a PWM, direction, and brake signals to a load thus allowing using it in precision speed-control and power delivering applications. Switching frequencies up to 500-KHz and a pulse width as short as 400-nS makes HS-FBI driver capable of performing the finest and highly precision power management tasks. No extra heat sink is required for driving a load continuously at rated current.

HS-FBI drivers have found applications in controlling intelligent toys, robots, appliances, power tools, relays, high-speed solenoids, power converters, dc and bipolar stepping motors, TEC, and other power devices.

A large number of HS-FBI drivers are available rated: 24VDC/50A, 75VDC/42A, 150VDC/40, 1,200VDC/2A, and many others rated at various voltages/currents.

A more complete list is offered at the end of this datasheet.

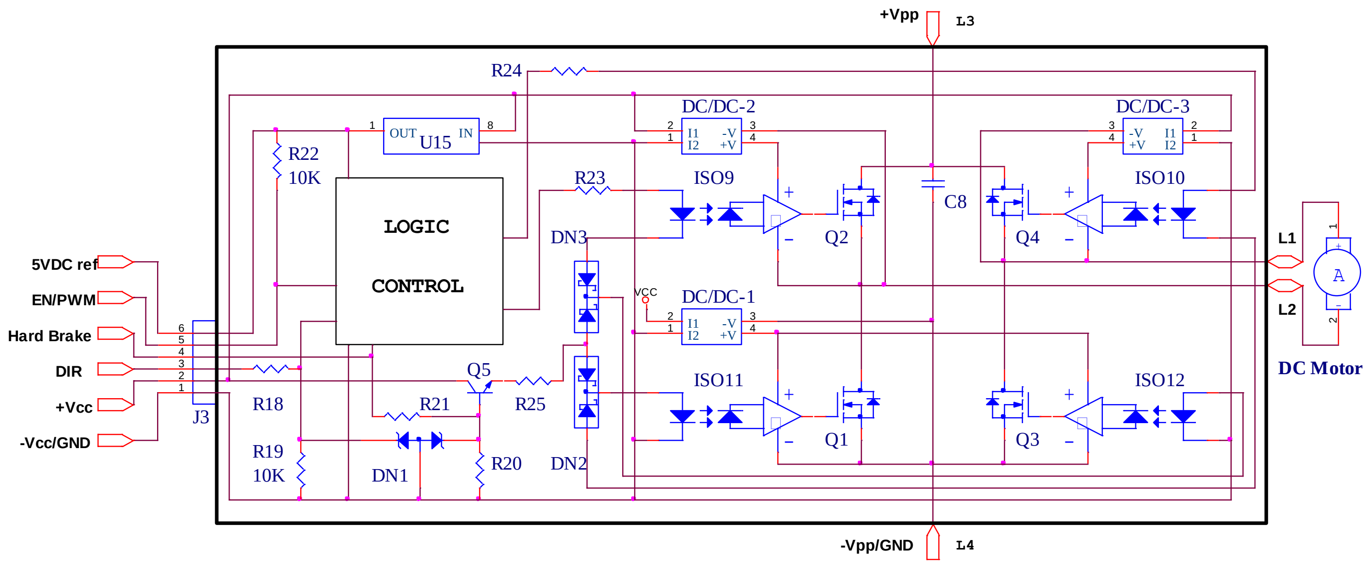

FIG-1 A simplified diagram of the HS-FBI driver

Introduction

A family of opt-isolated HS-FBI drivers designed for motion control applications, though they can be used as Class-D amplifiers, controlling the amount of power delivered to a load, driving Piezo transducers and thermoelectric cooler (TEC) or Peltier devices, etc. Utilizing CMOS's advanced processing technique and modern MOSFET power devices, the drivers are able to achieve extremely low Rds. This benefit, combined with the fast switching speed, provides EE designers with a highly efficient and reliable device for use in a wide range of industrial, space, avionics, and defense applications.

High-Speed Full Bridge (HS-FBI) drivers can function with two independent power suppliers (V-pp and V-cc) or from a single power source. It provides complete isolation of low-power controls from an output voltage and a high pulsing current caused by a load.

The HS-FBI drivers are built with three controls: PIN# 3 is a DIR/CS (direction), PIN#4 is a BRK (brake), and PIN#5 is an EN/PWM (enable/modulation). The EN/PWM input is tied to the internal reference voltage (5V) vie 10K resistor, the DIR/CS, and BRK to the PIN# 1 (ground) via 10K. Either a mechanical switch or any semiconductor (transistor or CMOS/TTL logic) could be used to control any of the inputs. Once power is applied, the driver is enabled unless the EN/PWM input is connected to the GND. Only the BRK control works at that stage. If the enabled feedback is connected to the GND, the driver goes to a FREE-RUN state. In that state, no current flows through the load, and a motor stops rotating briefly.

The truth table

INPUTS			OUTPUTS	
DIR	**EN**	**BRK**	**L1**	**L2**
L	H	L	OL	OH
H	H	L	OH	OL
X	L	L	Z	Z
X	X	H	OL	OL

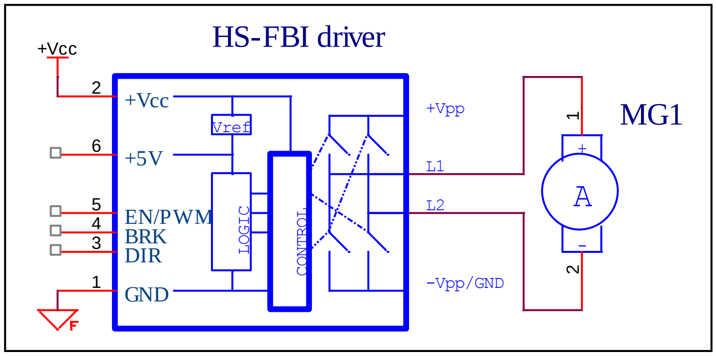

FIG-2. The HS-FBI driver

L = Low logic level; H = High logic level

Z = High Impedance (off-state)

OH = Output High (sourcing current to the output terminal)

OL = Output Low (sinking current from the output terminal)

X = Don' t Care

OUTPUTS		Load (DC Motor)
L1	**L2**	
OL	OH	Moves right (CW)
OH	OL	Moves left (CCW)
Z	Z	Free runs
OL	OL	Brakes (sudden stop)

Two options are available for managing the output: (1) the EN/PWM is low, or (2) the BRK is high. Grounding (applying "low" onto) the EN effectively disconnects a load from Vpp. Applying "high" on the BRK shorts the output terminals. In this case, when the load is a DC Motor both command can be used for stopping the motor's rotation. The BRK stops suddenly or abruptly the motor's rotation, when the EN lets the motor 'free run' to a stop. The table on the left has summarized those

NOTE: In general, the brake control can be applied at any time, though we recommend prior to it executing the EN command for a short period. Once the BRK control applied a significant current rush flows through output transistors. The amount of current depends on the motor's speed and its mass, and the mass of a motor's load, in short the system inertia. As a rule, HS-FBI drivers were design withstanding a "rush current" at least 10x of the rated. Letting the system's friction to dispose some of that energy would be a wise solution.

Vpp (power supply)

Bypass capacitors must be connected to power supply terminals +Vpp/CND physically as close as possible for preventing local parasitic oscillation and overshoots. Depending on a maximum consumption current, a high-frequency electrolytic capacitor of at least 10µF and additional a ceramic capacitor 1.0µF or greater value directly soldered to power pins for high frequency bypassing. It is rather difficult to calculate required values and an experimental trail would provide the best result.

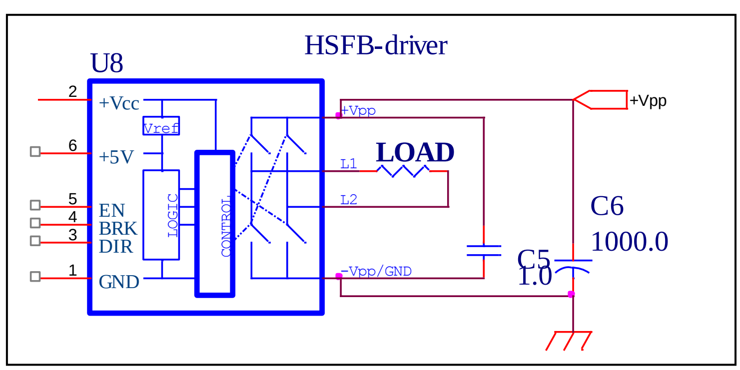

FIG-3 Capacitors C6 & C5 to "clean up" the Vpp

Functions and Basic Operation

The HS-FBI drivers were designed as full bridge drivers for delivering either a steady, pulsing, or an alternative power. They made for a broad range of applications, including a bio-directional speed control for DC Motors and generating full voltage swings for driving piezo transducers. H-drives have only three control inputs (EN/PWM, DIR/CS, and Brake). And are ready to perform various jobs with just a few external components for controlling the start/stop and directions of the rotation. External components would expand applications into delivering a precise amount of power. The EN and DIR controls are high-frequency inputs. The EN can be used for PWM and the DIR for driving a load with an alternated voltage that is twice applied (2xVpp). Since it's capable of delivering pulses with a resolution of 400-nS, the HS-FBI driver is best suited for maintaining DC Motor speed/torque precisely and providing an exact amount of power to any other type of load.

NOTE: Once both powers (Vpp and Vcc) are applied and controls (EN/PWM and BR) are left unconnected, the power will be presented on the output terminals (L1 and L2).

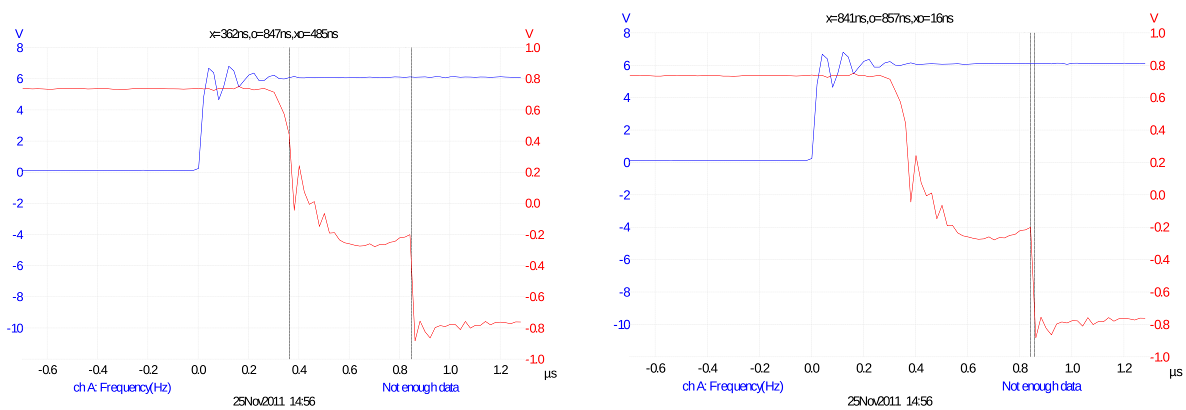

FIG-4. The highest alternated frequency is limited in part by the duration of "dead" time. As shown on the recording, the 'dead" time is equal to 485-nS. For a high-performance switch, 485-nS long "dead" time is excessive, and it was made just for a demonstration. It's usually set to 200-nS. It is a very efficient device that has very high-speed rising/falling slopes (less than 20nS).

Clockwise (CW) and Counterclockwise (CCW) rotations: A required direction of rotation is easy to select by applying a proper voltage onto the DIR input (PIN#3), leaving it unconnected. For a small DC Motor where a sudden stop would cause no damage, there are no requirements for stopping the motor prior to changing the direction of its rotation. The DIR can be changed at any time. A heavy-loaded and powerful motor requires some time to stop until the rotation is completed and can be reversed.

Free continue rotation: As mentioned above, applied power to a load (DC motor) can be interrupted and resumed at any time. That is easily accomplished by connecting the EN (PIN# 5) to the CND (PIN# 1) and rereleasing it. Since the EN is connected to +5VDC via a 10K resistor, any switch, relay, CMOS, TTL, or transistor could remove power from a load by connecting the EN to the ground.

If a motor turns in the wrong direction, re-connect the wires on the motor or output terminals (L1 and L2).

Braking (stop): The HS-FBI output terminals (L1 and L2) can be shortened by applying +5 VDC into PIN# 3. The BRAKE signal overrides any other commands. As long as the brake signal is high, the output terminals remain short. When the BRAKE control is high, the gates of both output transistors Q1 and Q3 are driven to high (FIG.1) and, at the same time, block voltages to gates of Q2 and Q4 MOSFETs.

Care should be taken to ensure that the maximum ratings of the device are not exceeded in worse-case braking situations – high-speed and high-inertia loads.

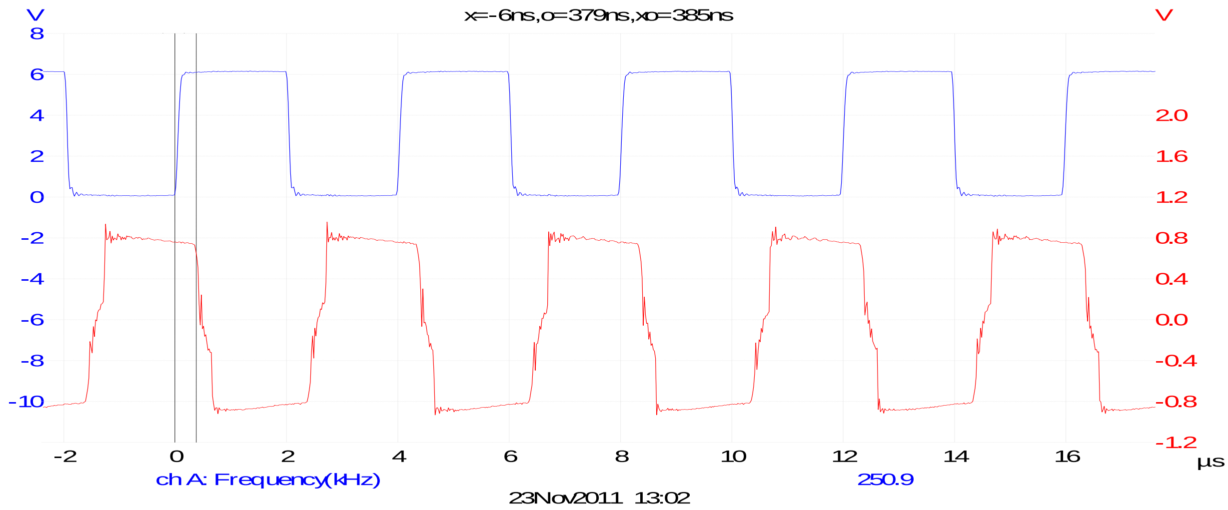

FIG-5. The top is a control signal, and below are waveforms on a load at 250.9 KHz. With 80V voltage applied, the voltage on a load is 160V p-p. A control voltage scale is 1:1; the output scale is 1:100.

<u>Driving a load with alternative power:</u> The direction (DIR) input is designed to change the current flow through a load, thus helping to command a direction of DC Motor rotations, which is not performed frequently. The ability to drive high-speed solenoids has undoubtedly expanded the usefulness of the DIR input, but there is more. The DIR is a high-speed (frequency) input that allows one to "change directions" of the current at extremely high frequencies, FIG.5. That expends applications in the field of DC/DC converging and especially makes the HS-FBI driver useful for low-voltage power sources, like a fusion and photovoltaic cells.

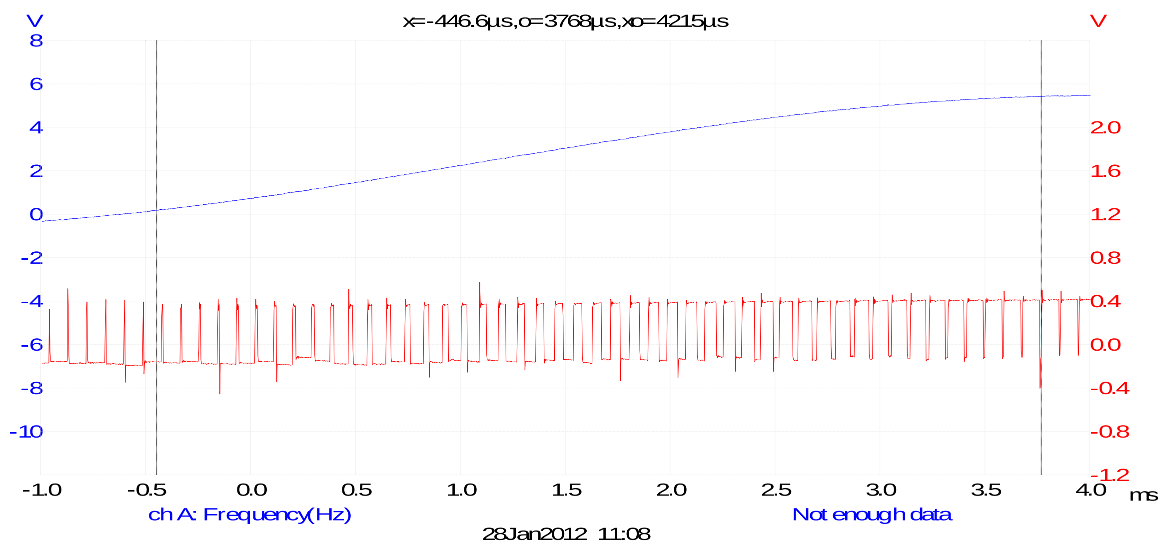

FIG-6. Applying pulses of various durations (top recording) on the EN/PWM input made the HS-FBI deliver an output power accordingly

<u>Pulse Width Modulation (PWM)</u>: The enable (EN) input was designed to disconnect a load from the V pp (power supply). In reality, it manifests as applying power onto a load only during the enable time. The EN input was designed to have a high-speed property. It's helpful in regulating an average load current by accepting an extremely long pulse to as short as a 400-nS pulse. Such flexibility allows controlling an average output current to be maintained with a high degree of accuracy.

Typical application

DC Motor Speed Control with an over-current protection

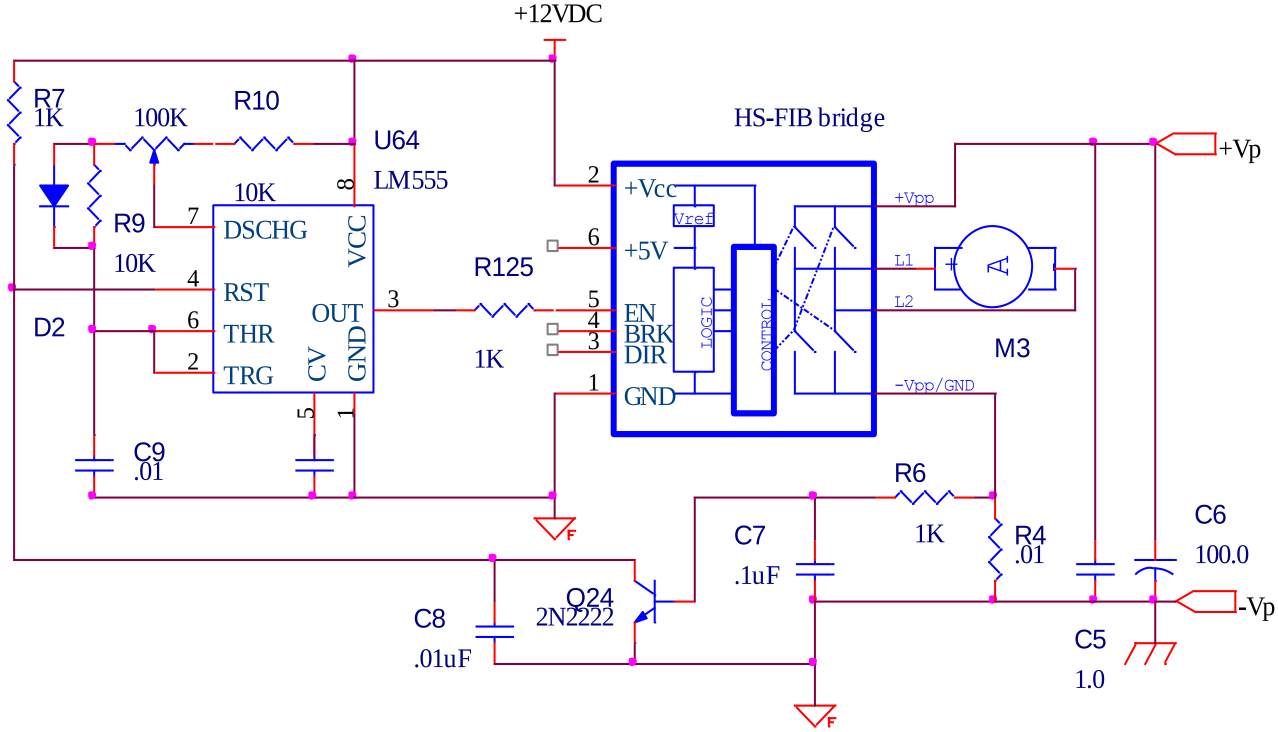

FIG-7 A simplified diagram of the HS-FI driver with overcorrect protection

DC brush motors are increasingly required for a broad range of applications, including robotics, sporting equipment, portable electronics, appliances, medical devices, automotive applications, power tools, and many other automotive fields. The motor itself is a preferred alternative because it is simple, reliable, and low-cost. An advanced and robust H-bridge driver is essential for components for controlling the motor's direction, speed, and braking—the EDR's HS-FBI drivers are designed to do just that. With the addition of a few external components, the HS-FBI becomes a DC motor controller to maintain its precise speed and provide protection from excessive current.

The above diagram demonstrates how to employ two controls. Speed control is accomplished with an IC chip (LM555) with a few peripheral components. It generates a train of pulses of various widths for delivering power onto a load (DC Motor). A more extended pulse width translates into a higher power on a load, and that turns into a higher RPM. A pulse width and, eventually, the speed of the motor are controlled with a single 100K potentiometer.

A transistor Q24 controls the reset input of the LM555. When a voltage drops across the resistor R4 due to the current flowing through the load reaching the cut-in voltage, which is usually about 650mV for silicon NPN BJT, the transistor starts conducting. As a result, the voltage on the reset input, pin #4, drops, and that, in turn, low voltage on the output pin #3. Pin #3, connected to the EN controls and low voltage on it, turns off the driver's output

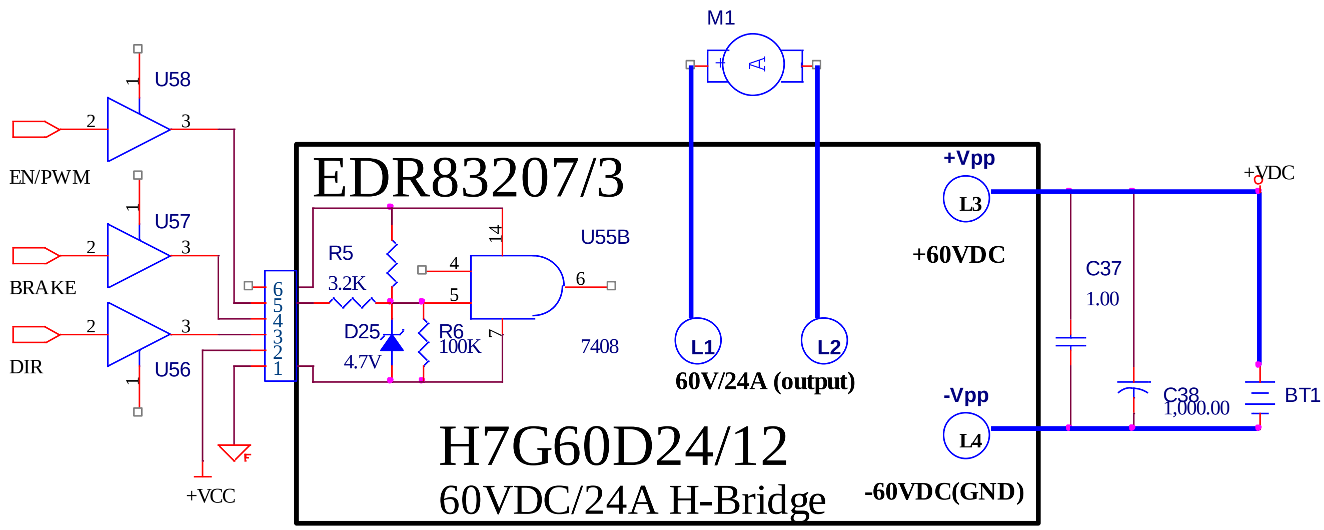

FIG-8. A typical connection of external components to the HS-FBI driver

The family of HS-FBI drivers was designed with effortless exploitation in mind and included minimum essential components for increasing its survivability. Three controlling inputs are low power, high speed, and well protected against industrial environment voltage spikes. The best result obtained is when controls come from semiconductors. Many electromechanical devices can be used for controlling a driver, and a simple de-bouncing circuitry is recommended in such cases—drivers designed to withstand pulsing current that is at least x10 above the rated current. From an example, P/N EDR83207 rated at 24-amperes and 240-amperes of pulsing current and more than 400-A of surge. The ability to withstand a high current surge is advantageous when changing DC Motor's rotations and fast stopping. FIG-9 was prepared to demonstrate a current surge while a DC motor was stopping and rapidly accelerating rotation.

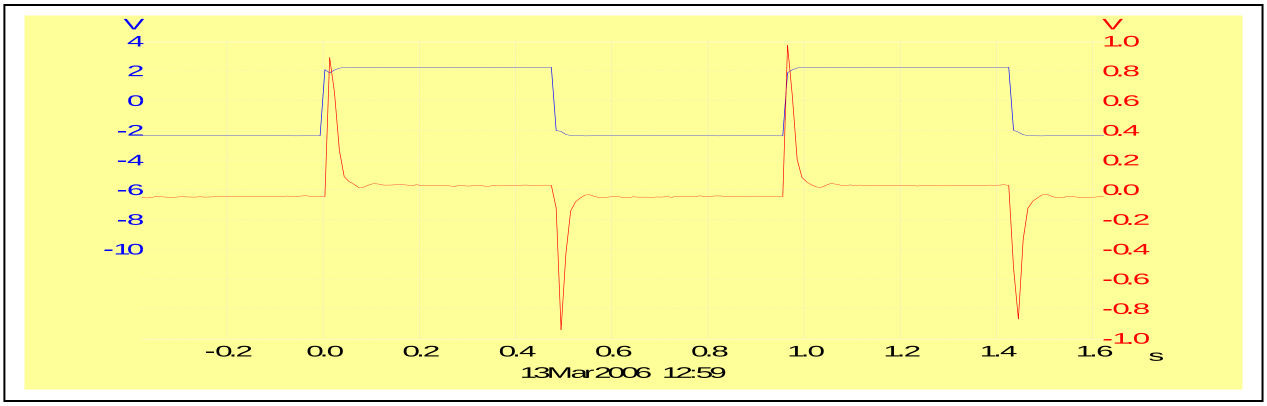

FIG-9. EDR's made H-drivers are capable of withstanding large current surges. The top recording is a voltage across the DC Motor, and the bottom is a current flow through the motor. The polarity of applied voltage changed from -20V to +20V and back to create CW and CCW rotations. When the polarity of the applied voltage is changed, a large current surge is generated, which is a combination of brake and start-up currents.

HS-FBI drivers offer two controls for stopping DC motors in a more orderly way, thus reducing what could generate a destructive current surge and potential structural damage. We recommend using the EN/OFF-BRAKE/ON sequence for stopping a motor and the DIR-BRAKE/OFF-EN/ON for changing the direction of its rotation. Indeed, in a case of emergency, the BRAKE could be applied.

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Technology for people's ideas

4.2 kW (rms) and 63 kW (pulse), Isolated, Full-Bridge Driver

H-driver module for DC motors, Solenoids, etc.

General Description:

The EDR83305 belongs to the family of Full Bridge Drivers designed for motion control applications, driving high-speed solenoids and thermo-cooling devices, piezo-transducers, etc. Utilizing advance processing technique and modern C3M™MOSFET power devices, drivers achieved an extremely low-ON resistance while switching at a high speed. EDR's made device provides designers with extremely efficient and reliable devices for use in wide industrial, space, avionics and defense applications.

EDR83305/c/cc, as a H7G900D4Vcs/Vcc

Features:

- H-driver assembled in a panel mountable, aluminum die-casting box http://www.hammondmfg.com/pdf/1590P1.pdf
- TTL and CMOS compatible inputs
- Deliver up to 4.7-A rms at 25 °C and 3.2-A at 85 °C
- Pulsed current 70-A (PEAK)
- Five different modes (forward rotation, reverse rotation, PWM, disable, and hard brake)
- Low Rds (ON) typically, 0.14 Ohm per shoulder
- Wide range of Vpp (output) voltage, from 0V to 900V
- No problem with under-voltage and it can operate from 0-V to Vpp
- Input connector either screw-type terminals or a http://www.molex.com/pdm_docs/sd/901361206_sd.pdf
- Vcc (power supply) = 5V, 12V or a wide input from 6V to 15V
- Vcs (control signal) = TTL/CMOS compatible, 1mA
- Output terminals are M4 stand-offs (screws provided)

Applications for H-drivers:

- DC and Stepper Motor
- Bi-directional, high-speed solenoid
- Position and Velocity servomechanisms
- Factory and hobby robots
- Numerically controlled machinery
- Piezo-transducers / Doubling applied voltage
- Directly interfaced to a low power CPU
- In any application where a load (motor) and its power supply must be isolated from a control circuitry
- Low-noise (EMI) design allows it be located nearby to sensitive equipment
- It can be use for a precise and high-frequency PWM applications
- Push-Pull (bidirectional) control for electro-hydraulic valves
- **Thermoelectric cooler elements (TCE)**

FIG-10 H-Driver's top view

Pin Functions

Pin	Functional Description
+Vpp	**Supply voltage, up to 1,700V available**
L	**Output terminal**
R	**Output terminal**
–V pp/GND	**Supply voltage (return)**
+5VDC OUT	**A low power (less than 50mA) source**
EN/PWM	**it is normally high input via 10K pull-up resistor to +5VDC. It is a CMOS compatible, high-speed input and can be used for PWM.**
BRAKE	**brake input is normally low via 10K to the GND. Applying +5VDC enable both output transistors of low shoulders H-bridge to conduct simultaneously thus shorting a load.**
DIR/CS	**it is normally high input via 10K pull-up resistor to +5VDC. It is a CMOS compatible, high-speed input.**
+Vcc	**Power Supply (12VDC or 5VDC) for the internal logic**
-Vcc/GND	**Return of the Vcc**

Absolute Maximum Ratings for EDR83305/2/3 or D7G900D4/5/12

	Parameter	**Max.**	**Units**
Vpp	Power Supply	900	V
Id @ Tc = 25 ^{o}C	Continuous current (average)	4.7	A
Id @ Tc = 85 ^{o}C	Continuous current (average)	3.2	A
I dm @ Tc = 25 ^{o}C	Maximum continues current / .1sec	20	A
Pd@ Tc = 25 ^{o}C	Power Dissipation at 4.7-A current	3.75	W
Pd@ Tc = 85 ^{o}C	Power Dissipation at 3.2-A current	1.8	W
Ids @Tc = 25 ^{o}C	Surge Current	70	A
Vcc	Power Supply to the internal logic	12	V
Top	Operating temperature	-40 to 90	^{o}C
Tstg	Storage Temperature	-55 to 135	^{o}C

Electrical Characteristics @ Tj = 25 ^{o}C (unless otherwise specified), Vcc = 12V, Vpp=800V

	Parameters	Min.	Typ.	Max	Units	Conditions
	INPUT					
Vcc	Supply voltage	11	12	13	VDC	
Icc	Supply current, Vcc = 12V/10 KHz		40		mA	Up to 10 KHz
Icc	Supply current, Vcc = 12V/100 KHz		100		mA	Above 100 KHz
Via	High-level input voltage (EN)	3.2	5	7	V	Connected via 10K to +5VDC
Vil	Low-level input voltage (EN)	0.9	1.0	1.2	V	
Vbrf	Brake control (BR) OFF	0	0	.5	V	Connected via 10K to GND
Vbron	Brake control (BR) ON	4.2	5	6	V	+5V ref. recommended
Vinl	Direction (DIR)			0.9		Low-level input voltage
Vinh	Direction (DIR)	3.15				High-level input voltage
Iinc	Input current to any control			1.0	mA	
	OUTPUT: Load is 300 Ohm					
Vpp	Supply	0	700	800	V	
Icc	Output Disable			2	μA	
Rds	Output Total resistance	0.16	0.17	0.18	Ohm	In either direction, CW & CCW
Ill	Output leakage current		1	100.0	μA	Vpp=900V
T r-slope	Rising slope		10		nS	
Tplh	Propagation delay turn-on time		300	310	nS	
Tphl	Propagation delay turn-off time		300	345	nS	
Trev	Propagation delay, phase reverse			40	nS	
Tdtm	“Dead” time		1500		nS	It can be set at 100nS and higher.
P	Pulse width (minimum)			600	nS	Load resistive
F	Maximum switching frequency			250	KHz	Load resistive

PIN FUNCTIONS (refer to the block diagram)

PIN #	**NAME**	**FUNCTION**
10	-Vpp	Power Supply Return for the Output Stage (Vpp) ground
9	L1	Output L1 of the Bridge, the current flows through the load connected between and the second output L2.
8	L2	Output L1 of the Bridge, the current flows through the load connected between and the second output L2.
7	+Vpp	Supply Voltage for the Power Output Stage. A non-inductive <1.0mF capacitor must be connected between this pin and –Vpp/GND.
6	+5VDC	+5Vref out., 20mA max
5	EN	CMOS/TTL Compatible input of the bridge to enable/disable outputs and turn the driver into a stand-by state
4	BRAKE	CMOS/TTL Compatible input of shorting the load
3	DIR	CMOS/TTL Compatible input of the bridge to set a direction of rotation
2	+Vcc	Supply Voltage for the internal logic.
1	GND	Return of the Vcc.

Absolute Maximum Ratings for EDR83307/2/3 or H7G900D10/5/12
Vcc (power supply) = 5VDC and Vcs (control signal) = 12V

	Parameter	**Max.**	**Units**
Vpp	Power Supply	900	V
Id @ Tc = 25 ^{o}C	Continuous current (average)	9.2	A
Id @ Tc = 85 ^{o}C	Continuous current (average)	6.1	A
I dm @ Tc = 25 ^{o}C	Maximum continues current / .1sec	40	A
Pd@ Tc = 25 ^{o}C	Power Dissipation at 9.2-A current	3.9	W
Pd@ Tc = 85 ^{o}C	Power Dissipation at 6.1-A current	2.0	W
Ids @Tc = 25 ^{o}C	Surge Current	120	A
Vcc	Power Supply to the internal logic	12	V
Top	Operating temperature	-40 to 90	^{o}C
Tstg	Storage Temperature	-55 to 135	^{o}C

Electrical Characteristics @ Tj = 25 ^{o}C (unless otherwise specified), Vcc = 12V, Vpp=800V

	Parameters	Min.	Typ.	Max	Units	Conditions
	INPUT					
Vcc	Supply voltage	11	12	13	VDC	
Icc	Supply current , Vcc = 12V/ 10 KHz		40		mA	Up to 10 KHz
Icc	Supply current, Vcc = 12V/100 KHz		100		mA	Higher than 100 KHz
Vih	High-level input voltage (EN)	3.2	5	7	V	Connected via 10K to +5VDC
Vil	Low-level input voltage (EN)	0.9	1.0	1.2	V	
Vbrf	Brake control (BR) OFF	0	0	.5	V	Connected via 10K to GND
Vbron	Brake control (BR) ON	4.2	5	6	V	+5V ref. recommended
Vinl	Direction (DIR)			0.9		Low-level input voltage
Vinh	Direction (DIR)	3.15				High-level input voltage
Iinc	Input current to any control			1.0	mA	
	OUTPUT: Load is 300 Ohm					
Vpp	Supply	0	700	800	V	
Icc	Output Disable			2	μA	
Rds	Output Total resistance	0.16	0.17	0.18	Ohm	In either direction, CW & CCW
Ill	Output leakage current		1	100.0	μA	Vpp=900V
T r-slope	Rising slope		10		nS	
Tplh	Propagation delay turn-on time		300	310	nS	
Tphl	Propagation delay turn-off time		300	345	nS	
Trev	Propagation delay, phase reverse			40	nS	
Tdtm	“Dead” time		1500		nS	It can be set at 100nS and higher.
P	Pulse width (minimum)			600	nS	Load resistive
F	Maximum switching frequency			250	KHz	Load resistive

PIN FUNCTIONS (refer to the block diagram)

PIN #	**NAME**	**FUNCTION**
10	-Vpp	Power Supply Return for the Output Stage (Vpp) ground
9	L1	Output L1 of the Bridge, the current flows through the load connected between and the second output L2.
8	L2	Output L1 of the Bridge, the current flows through the load connected between and the second output L2.
7	+Vpp	Supply Voltage for the Power Output Stage. A non-inductive <1.0mF capacitor must be connected between this pin and –Vpp/GND.
6	+5VDC	+5Vref out., 20mA max
5	EN	CMOS/TTL Compatible input of the bridge to enable/disable outputs and turn the driver into a stand-by state
4	BRAKE	CMOS/TTL Compatible input of shorting the load
3	DIR	CMOS/TTL Compatible input of the bridge to set a direction of rotation
2	+Vcc	Supply Voltage for the internal logic.
1	GND	Return of the Vcc.

Absolute Maximum Ratings for EDR83213/2 or H7G150D10/5
Vcc (power supply) = 5VDC & Vcs (control signal) = 5V

	Parameter	Max.	Units
Vpp (max)	Applied Power Supply (voltage)	150	V
Id @ Tc = 25 ^{o}C	Continuous current (average)	10.0	A
Id @ Tc = 85 ^{o}C	Continuous current (average)	8.1	A
I dm @ Tc = 25 ^{o}C	Maximum continues current / .1sec	90	A
Pd@ Tc = 25 ^{o}C	Power Dissipation at 9.2-A current	3.9	W
Pd@ Tc = 85 ^{o}C	Power Dissipation at 6.1-A current	2.0	W
Ids @Tc = 25 ^{o}C	Surge Current	120	A
Vcc (max)	Power Supply to the internal logic	5.4	VDC
Top	Operating temperature	-40 to 90	^{o}C
Tstg	Storage Temperature	-55 to 135	^{o}C

Electrical Characteristics @ Tj = 25 ^{o}C (unless otherwise specified), Vcc = 12V, Vpp=800V

	Parameters	Min.	Typ.	Max	Units	Conditions
	INPUT					
Vcc	Supply voltage	11	12	13	VDC	
Icc	Supply current , Vcc = 12V/ 10 KHz		40		mA	Up to 10 KHz
Icc	Supply current, Vcc = 12V/100 KHz		100		mA	Higher than 100 KHz
Vih	High-level input voltage (EN)	3.2	5	7	V	Connected via 10K to +5VDC
Vil	Low-level input voltage (EN)	0.9	1.0	1.2	V	
Vbrf	Brake control (BR) OFF	0	0	.5	V	Connected via 10K to GND
Vbron	Brake control (BR) ON	4.2	5	6	V	+5V ref. recommended
Vinl	Direction (DIR)			0.9		Low-level input voltage
Vinh	Direction (DIR)	3.15				High-level input voltage
Iinc	Input current to any control			1.0	mA	
	OUTPUT: Load is 300 Ohm					
Vpp	Supply	0	700	800	V	
Icc	Output Disable			2	μA	
Rds	Output Total resistance	0.16	0.17	0.18	Ohm	In either direction, CW & CCW
Ill	Output leakage current		1	100.0	μA	Vpp=900V
T r-slope	Rising slope		10		nS	
Tplh	Propagation delay turn-on time		300	310	nS	
Tphl	Propagation delay turn-off time		300	345	nS	
Trev	Propagation delay, phase reverse			40	nS	
Tdtm	“Dead” time		1500		nS	It can be set at 100nS and higher.
P	Pulse width (minimum)			600	nS	Load resistive
F	Maximum switching frequency			250	KHz	Load resistive

PIN FUNCTIONS (refer to the block diagram)

PIN #	NAME	FUNCTION
10	-Vpp	Power Supply Return for the Output Stage (Vpp) ground
9	L1	Output L1 of the Bridge, the current flows through the load connected between and the second output L2.
8	L2	Output L1 of the Bridge, the current flows through the load connected between and the second output L2.
7	+Vpp	Supply Voltage for the Power Output Stage. A non-inductive <1.0mF capacitor must be connected between this pin and –Vpp/GND.
6	+5VDC	+5Vref out., 20mA max
5	EN	CMOS/TTL Compatible input of the bridge to enable/disable outputs and turn the driver into a stand-by state
4	BRAKE	CMOS/TTL Compatible input of shorting the load
3	DIR	CMOS/TTL Compatible input of the bridge to set a direction of rotation
2	+Vcc	Supply Voltage for the internal logic.
1	GND	Return of the Vcc.

EDR83305 (H7G900D5) delivers an exact output power (pulse)

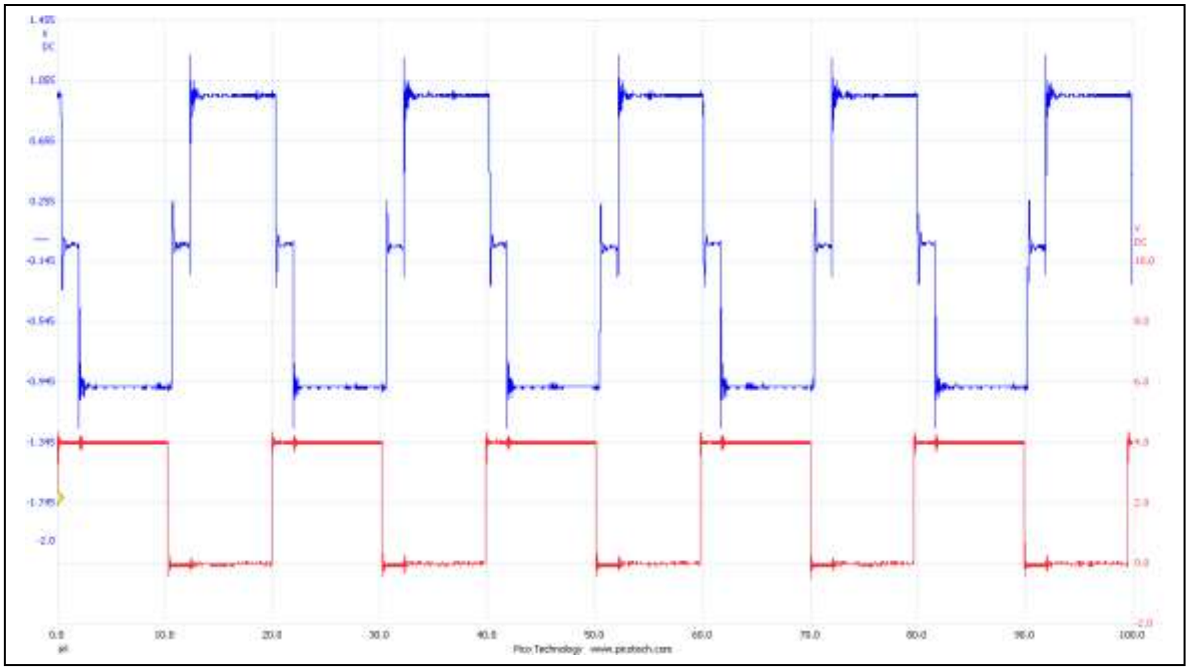

FIG-11
Applied signal is 50KH, Vpp = 100V, Load = 25 Ohm

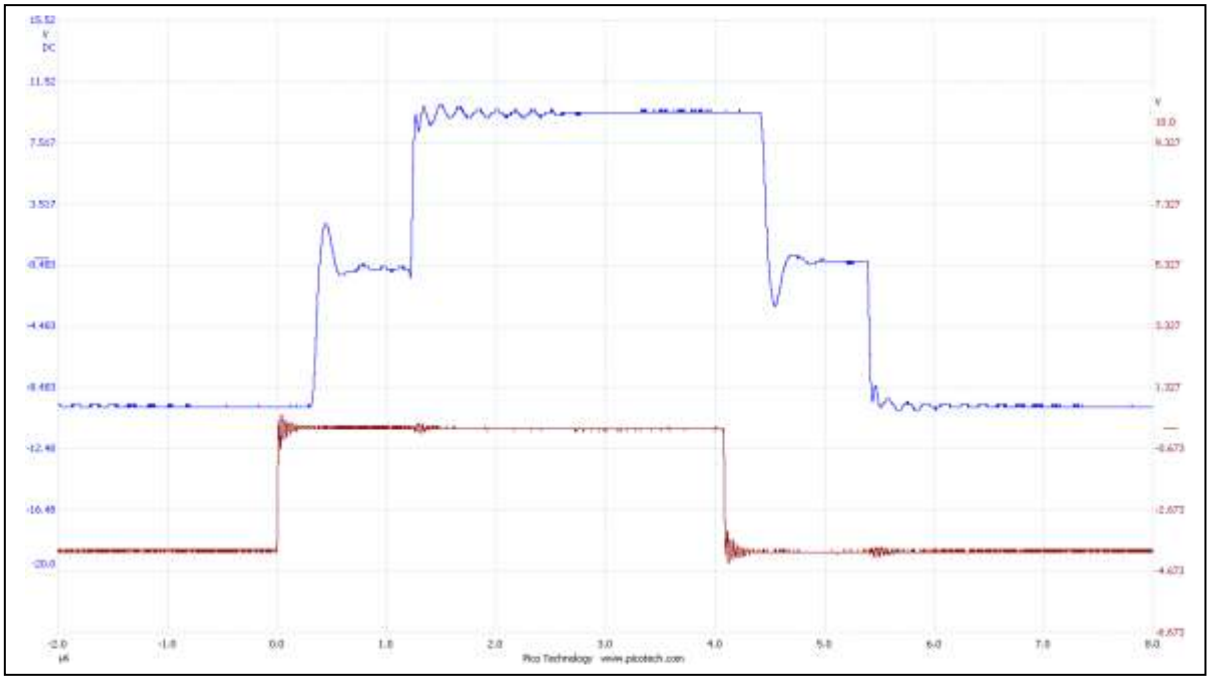

FIG-12
Similar to the recording shown in FIG-11 accept, an applied frequency was 125 KHz

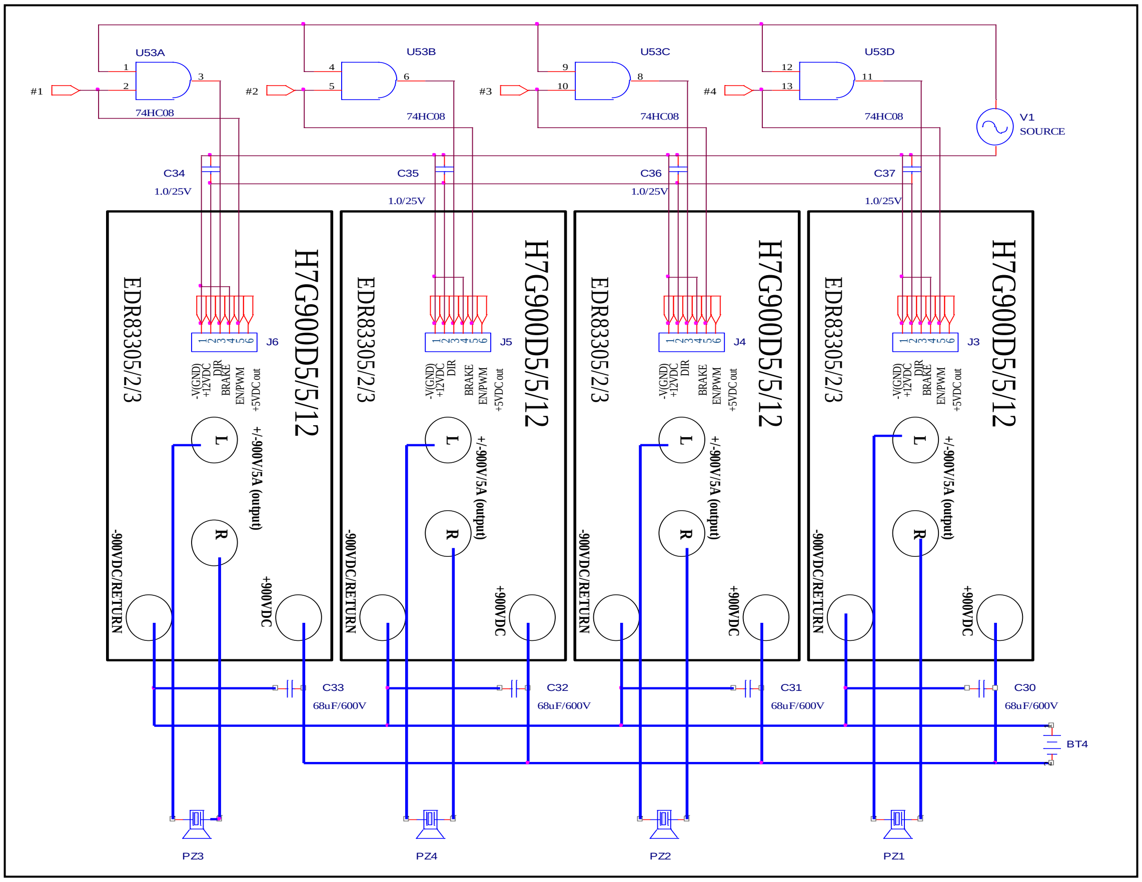

FIG-13

All controls, such as DIR, ENBLE, and BRAKE, were built for high-speed (frequency) operations. Depending on the application, the DIR control can be used for selecting clockwise or counterclockwise rotations while driving a DC motor. It can also be used to double an input voltage. A hooking-up, as shown in FIG-13, doubles an applied voltage, or V out = 2 x Vpp.

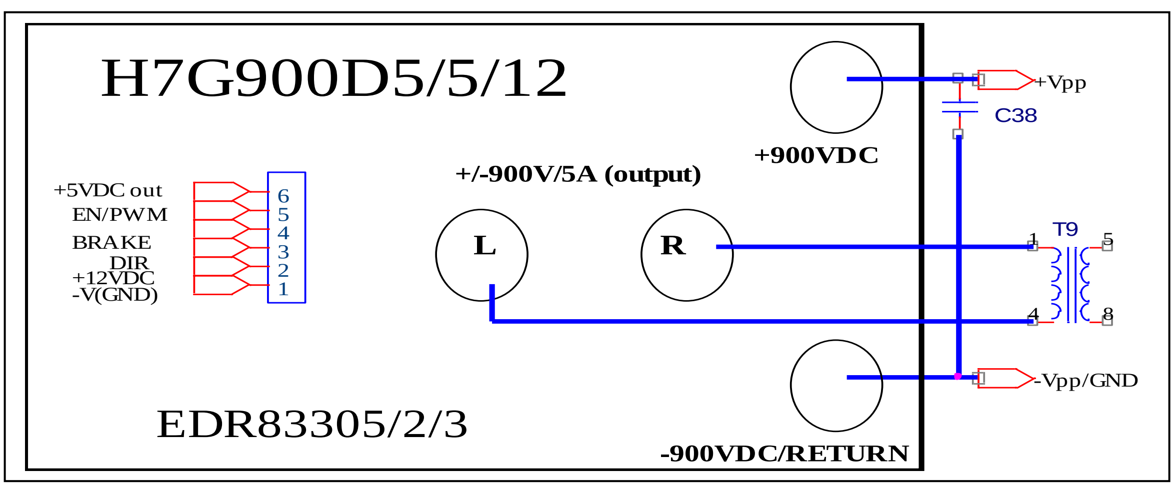

FIG-14

An H-driver can be used as a DC/AC or DC/DC high-power converter by driving a transformer.

Mechanical Dimensions of the H7G package (in inches)

The input connector is http://www.molex.com/pdm_docs/sd/901361206_sd.pdf.
All power terminals are M4.

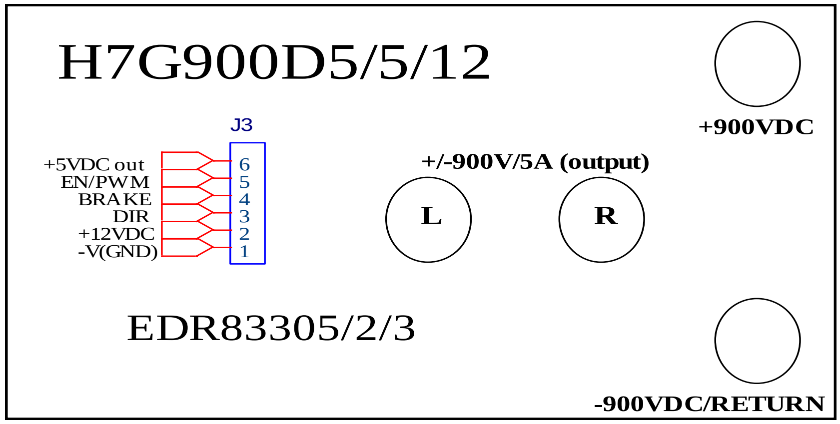

Figure 13

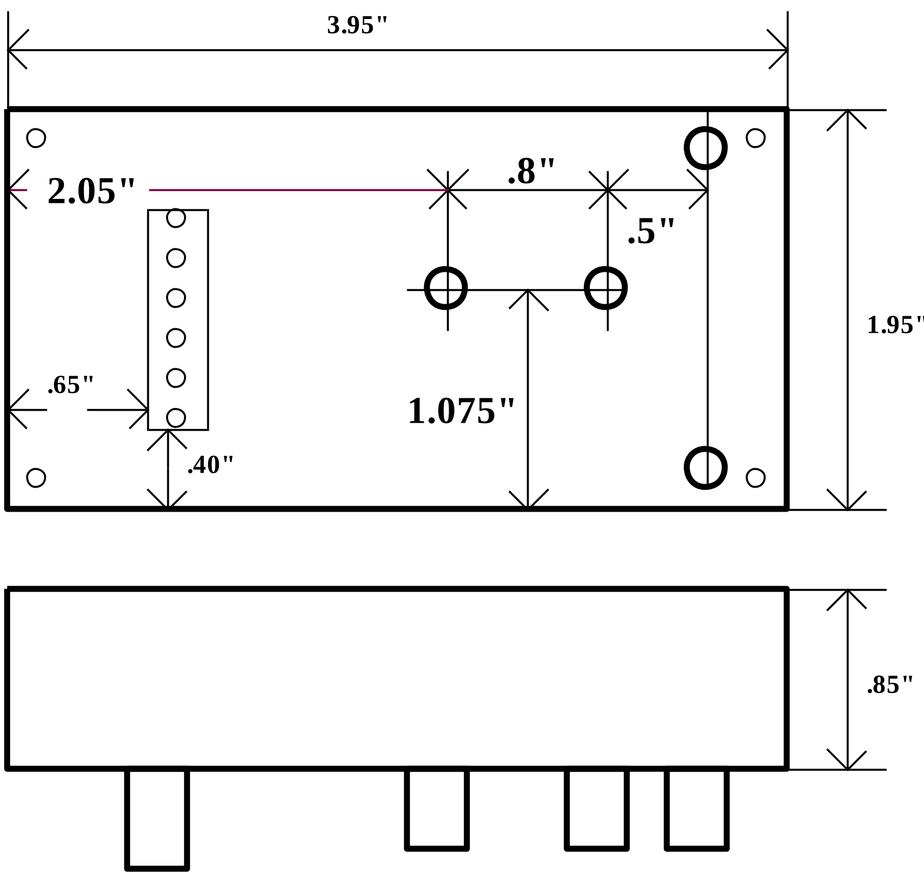

Figure 14

The third generation of all-voltage full-bridge (H-bridge) drivers

Model numbers listed below were assembled in a "7" size enclosure for panel mounting.

Model Number	V min to V max	Id (A) cont.	I dm	p/n
H7G24D22/v/x	0 – 24 VDC	22 A	250	EDR83200/I/E
H7G24D42/v/x	0 – 24 VDC	42 A	500	EDR83201/I/E
H7G30D26/v/x	0 – 30 VDC	26 A	300	EDR83012/I/E
H7G30D14/v/x	0 – 30 VDC	14 A	180	EDR83009/I/E
H7G40D16/v/x	0 – 40 VDC	16 A	200	EDR83202/I/E
H7G40D28/v/x	0 – 40 VDC	28A	290	EDR83204/I/E
H7G55D18/v/x	0 – 55 VDC	18A	200	EDR83205/I/E
H7G55D24/v/x	0 – 55 VDC	24A	280	EDR83206/I/E
H7G60D5/v/x	0 – 60 VDC	5 A	50	EDR82985/I/E
H7G60D9/v/x	0 – 60 VDC	8.5 A	90	EDR82998/I/E
H7G60D24/v/x	0 – 60 VDC	24 A	240	EDR83207/I/E
H7G60D40/v/x	0 – 60 VDC	40 A	440	EDR83221/I/E
H7G60D70/v/x	0 – 60VDC	70 A	500	EDR83304/I/E
H7G75D15/v/x	0 – 75 VDC	15 A	170	EDR83208/I/E
H7G75D22/v/x	0 – 75 VDC	22 A	250	EDR83209/I/E
H7G75D30/v/x	0 – 75 VDC	30 A	350	EDR83215/I/E
H7G100D10/v/x	0 – 100 VDC	10 A	140	EDR83210/I/E
H7G100D17/v/x	0 – 100 VDC	17 A	210	EDR83211/I/E
H7G100D30/v/x	0 – 100 VDC	30 A	350	EDR83212/I/E
H7G150D10/v/x	0 – 150 VDC	10 A	120	EDR83216/I/E
H7G150D13/v/x	0 – 150 VDC	13 A	150	EDR83217/I/E
H7G150D24/v/x	0 – 150 VDC	25 A	280	EDR83218/I/E
H7G150D24/v/x	0 – 150 VDC	24 A	300	EDR83219/I/E
H7G500D2/v/x	0 – 500 VDC	2 A	12	EDR83222/I/E
H7G600D2/v/x	0 – 600 VDC	2 A	12	EDR83223/I/E
H7G650D3/v/x	0 -- 650 VDC	3.2 A	20	EDR83306/I/E
H7G800D2/v/x	0 – 800 VDC	2 A	10	EDR83224/I/E
H7G900D07/v/x	0 – 900 VDC	.7A	7	EDR83225/I/E
H7G900D5/v/x	0 – 900 VDC	4.7 A	30	EDR83305/I/E
H7G900D10//v/x	0 -- 900VDC	9.3 A	60	EDR83307/I/E
H7G900D13//v/x	0 -- 900VDC	13 A	90	EDR83308/I/E
H7G122D03/v/x	0 – 1,200 VDC	.3 A	4	EDR83226/I/E
H7G172D06/v/x	0 – 1,700 VDC	.6 A	4	EDR83309/I/E
H7G172D2/v/x	0 – 1,700 VDC	1.3 A	8	EDR83310/I/E
H7G172D3/v/x	0 – 1,700 VDC	2.6 A	12	EDR83311/I/E

Above are just samples of drivers that were assembled in the H7G package. There are hundreds of additional drivers with various voltage/current ratings available in the same package. All drivers are built with the same control circuitry, and the difference is only in the type of output transistors (powerful MOSFETs). Do not hesitate to ask for a 30VDC/1A driver if you need one. That brings some savings due to the transistors used for assembling a 30VDC/1A driver costing less than for a 30VDC/26A driver.

Our standard, off-shelf drivers are offered with two standard Vcc = 5VDC and 12VDC. Please do not hesitate to ask for another VCC. In many cases, it would not add to the essential cost. The same applied to Vcs (control signals).

Selection and Ordering Instruction for EDRs made Solid State Modules such as Relays, Switches, Breakers, ½ and H-bridge Drivers, etc.

Notes: During the past ten years, the rapid development of new and additional [products gave us no choice but to expand, modify, and unify part descriptions. Below is the third modification. Our module description will be marked according to the specifications below, but p/n EDRxxxxx will stay the same for items already in circulation (already sold).

Part description: *H* *3* *L* *200* *D* *10* */5* */12*

X	A	B	C	F	H	/E	/I
H-Driver	size =	Speed "L" = low	Voltage = 200V	Current = DC	Current = 10A	CS=5V	Vcc=12V

"X" module type

D	Solid-State Relay or Switch with output terminals: SPST-NO (normally open)
R	Solid-State Relay or Switch with output terminals: SPST-NC (normally closed)
W	Solid-State Relay or Switch with output terminals: DPST
T	Drivers, such as ½-bridge or an SPDT relay, which can work as a ½ driver
M	Driver, such as a switch with a built-in PWM controller
H	Full-bridge (H-bridge) Driver
C	Relay with built-in de-bouncing or a turn-on/off delay
B	Solid State Breaker and brake control modules

"A" package dimensions

1	0.615"H x 1.48"L x 0.290"W
2	1.75"H x 1.80"L x 0.595"W
3	1.125"H x 1.75"L x 0.8"W
4	1.15"H x 2.0"L x 0.92"W
5	1.15"H x 2.8"L x 1.15"W
6	DIP24, 0.375"H x 0.925"L x 0.53"W
7	panel mount, .82"H x 3.95"L x 1.96"W
8	.575"H x 1.1"L x .2"W
9	panel mount 3"H x 10"L x 8"W
0	DIN type enclosure, 2.36"H x 2.36"L x 1.5"W, for 35mm DIN Rail
P	panel mount, .8"H x 2.275" L x 1.75"W
R	panel mount, 1.82"H x 6.0"L x 3.3"W

"B" Speed - A device's ability to turn ON/OFF output terminal(s) times per second

L	a low-speed relay/switch, rated DC - 200 Hz, direct driving control
A	a low speed relay/switch, AC input relays
N	a medium speed relay/switch, rated DC - 25 KHz, direct driving control
G	a medium speed relay/switch, rated DC - 25 KHz, low current control and power
F	a fast relay/switch, rated up to DC - 350 KHz, low current control and power
S	a super-fast relay/switch, rated DC - 1.4 MHz, low current control and power
U	a super-fast relay/switch, rated DC – 1.2 MHz, direct driving control
V	Fast, High Voltage Solid-State Switches with Nanoseconds rise time

"C" Output Voltage - a maximum allowed voltage between output terminals, up to 100kV

It must be replaced with the required voltage, and we offer the closest and highest value available.
Note: In an "AC" -relay, a voltage specified a peak-to-peak maximum voltage, and the maximum VAC could be calculated by multiplying a maximum allowed voltage by a factor of 0.7

"F" A relay can be used to control either AC, DC, or AC/DC power

A	- a relay/switch designed to switch/chop an AC/DC power
D	- a relay/switch designed to switch/chop a DC power
"none"	- relay with a SCR or TRIAC on the output to control only AC power

"H" A maximum allowed RMS CURRENT (Ampere) without a heat sink

We can manufacture a device for any required current.

"I" Some of our products use an internal DC/DC converter to provide power to the internal electronics. Varieties voltages are available: 5VDC+/-5%, 12VDC+/-5%, 24VDC+/-5% and 48VDC+/-5%. For a wider input power voltage swing, please add "W" after the voltage. For an example, 24W is for 24V +/-12V.

"E" We offer several standard control voltages: 5VDC, 12VDC, 24VDC, 48VDC, 3-20VDC, and 18-38VDC. Please specify the input control voltage, for example, D1L30D12/xx. Replace xx with a 3, 5, 12, 24, 48, 3-20, and 18-38 that is for 3VDC, 5VDC, 12VDC, 24VDC, 48VDC, 3-20VDC and 18-38VDC. Respectful control voltage is represented at the end of the part number in the following way, for example, EDR82653/1 and EDR82653/8. Both relays are almost the same, and the difference is only an applied control voltage, "1" is for 3VDC, and "8" is for 18-38VDC;

Control Voltage	#	Control Voltage	#	Control Voltage	#
3VDC	1	5VDC	2	12VDC	3
24VDC	4	48VDC	5	26VDC	6
3-20VDC	7	18-38VDC	8	90-120VAC	9
74VDC	10				

"Z" A relay/switch built with the following standard isolations

"L" or "none"	type relay is 2500 V
"N"	type relay is 3000V, 4000VDC ("H4"), and 5200 ("H5") VDC.

"T" Turn-on delays; "S" for seconds, "M" for milliseconds, "U" for microseconds, M102 – 100 mS turn-off delay, 102M mS – turn-on delay