1 Form C (SPDT) devices

Single Pole Double Throat Relays

Single Pole Double Throat Switches

Video Switches

½ Bridge drivers

N.C./N.O. SPDT relay

High Voltage, NanoSeconds Rise/Fall time, Push-Pull Driver

Fuzzy Logic DIN-driver

Electronic Design & Research Inc.

Under management

Vs Holding LLC

www.vsholding.com

Contents:

Electronic Design & Research Inc. manufactures vast varieties of Solid State Relays, Breakers, Video Switches, ½ Bridge Drivers, H-Bridge Drivers, Push-Pull Drivers, etc. Here is one more family of drivers, the way they work, applications and a data sheets for some of them

NOTES: We are bringing, in an average four new devices to the market per month. Above is just an example of switches/drivers that we keep in our stock in small quantities and ready to ship them at once. For your unique application that required a different voltage, current or speed, Ordering Instruction (please see page #21) could be rather useful. Do not hesitate to send us an email to: info@vsholding.com for any additional information, delivery schedule and prices.

Thank you,

Vladimir A. Shvartsman, Ph.D.
President & CEO
V_Shvartsman@vsholding.com

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

The "T" family of Relays/Switches

Isolated, SPDT/DPST, break-before-make switches

Designed to switch a DC-5MHz signal in nanoseconds

Fuzzy-logic controlled relays offered with a various output voltage and current to satisfy many industrial applications, up to 1200V relays made with MOSFET's and up to 2500V with IGBT. The "T" family also features a three-state PWM input that works well together with most multiphase PWM controllers. Shoot-through protection is integrated to prevent both outputs from conducting simultaneously. The "T" – relay does the best interfaces with three-state logic.

Features:

- **Push-pull output stage for up to ……1,000 A peak**
- **Wide Analog Signal Range …… +/- 2,500V**
- **Chopping frequencies up to …….. 800 KHz**
- **Low "ON" resistance (MOSFET) ……. Milliohms**
- **Low Vce saturation (IGBT) …….. 2V average**
- **High Current Capability, AC/DC switching:**
- **D3S-package …… up to 24 A**
- **D4S-package ……..up to 76 A**
- **Custom packaging ……..up to 1000A**
- **Available -- Unidirectional and bi-directional relays/switches, or for a VDC or VAC power.**
- **Available – SPDT (3 pins) and DPST (NO/NC or 4 pins)**
- **Short propagation delay input-output …… 550 nS**
- **Try-state outputs …… input floating**
- **Break-Before–Make Delay (Typ.) …… 220 nS**
- **Fast Switching Action:**
- **Ton ……100 nS**
- **Toff …….. 100 nS**
- **TTL, CMOS and LMOS Compatible**
- **Three-State PWM input for OFF/OFF output terminals**
- **Single Power Supply ……..5VDC, 12VDC or 24VDC**
- **Fussy Logic Input:**
- **ON for "NO2" …….. 0-1.7 V**
- **ON for "NO1" …….. 3.3V-5V**
- **High input-output isolation …….. 2,750 V**

Applications:

- **Bi-directional switch**
- **½ bridge driver for AC and DC motors**
- **Video signal termination**
- **High Energy pulse formation**
- **Two relays combined for H-bridge driver**
- **High power, High frequency driver**
- **Latch and High-speed solenoid driver**
- **High Energy, Bi-polar pulse formation**
- **A switch for redundant supply systems**
- **High Frequency Analog Switch**
- **Audio Switching**
- **Automatic Test Equipment**
- **Communication Systems**
- **Analog Selector Switch**
- **AC and DC power switch**
- **Audio Signal Multiplexing**
- **Servo-Motor driver**
- **Pulse-Width modulation**
- **High Frequency DC/DC Converters**
- **High Input Voltage DC/DC Converters**
- **Flash-lamp supply for pumping solid-state laser**
- **Driver for a powerful IGBT and large modules**
- **Plasma and Electrostatic Paint**

The EDR's Solid State Relays (SSR) use proprietary and unique design to deliver fast, reliable, bounce-free switching in a compact SIP package. They are an ideal solid-state replacement for large reed and electromechanical (EM) relays. Compared to this old electromagnetic technology, the EDR's SSRs offer significantly lower drive current, small package size, superb speed, high power DC commutation, no susceptibility to magnetic interaction and solid state reliability. All of these are key requirements for the design of today's complex low-power, fast and long-lasting products.

EDR's family of "T" – type Solid State Relays/Switches designed for speed, the T3SxxDxx and more powerful T7SxxDxx relays/switches have the capacity to efficiently switch DC or AC and can deliver a single lesser than 0.7 μS pulse width. The "T" family SSR, a half-bridge MOSFET/IGBT driver is designed to operate at frequencies up to 800 KHz (8 KHz PWM for 1% to 100% duty cycle) and is an ideal choice for high-speed applications such as motor control, SMPS (switch mode power supplies), laser diode driver or a high frequency ultrasound cleaner. The "T" relay/switch can be used in pairs for a full-bridge operation, or triplets in three-phase brushless DC motor driver applications.

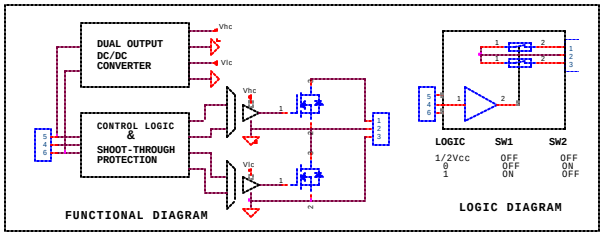
A 1.2 MHz relay/switch is also available with ability to deliver a powerful a > 50 nS pulse.

Functional diagrams of the "T" family

EDR's solid-state relays combined our state-of-the-art SIP6, SIP7 and SIP9 (a custom and with screw-type terminals enclosures are available) encapsulated, vertical-construction packaging with high performance to give our customers a reliable product with a significant saving in board space compare to other relays. EDR rates relays by the maximum current and no heat sink required. We believe that removes confusion about relay capability, cost and space requirements. Below is a functional diagram of the "T" family and we supply relays with any reasonable voltage and current. We can supply relays with any reasonable voltage and current specifications.

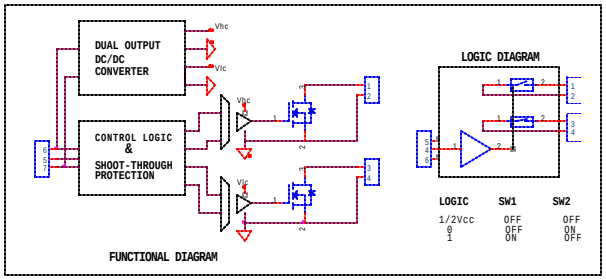
It is a **1 FORM C** or SPDT relay – T3Gvvv**D**aa
A "D" is for DC only applications.

"vvv" should be replaced with a required voltage,
"aa" should be replaced with a required current.



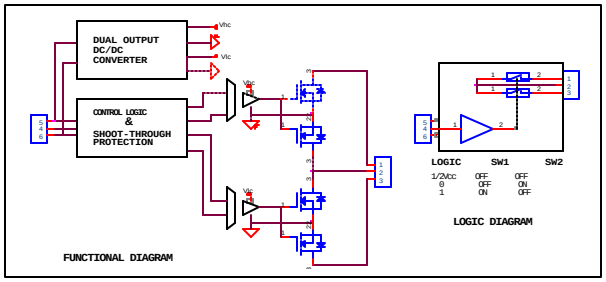
It is a **1 FORM A&B (N.O. & N.C.)** or DPST/SPDT
-- T3Gvvv**Daa** and D4Gvvv**D**aa

"vvv" should be replaced with a required voltage,
"aa" should be replaced with a required current.



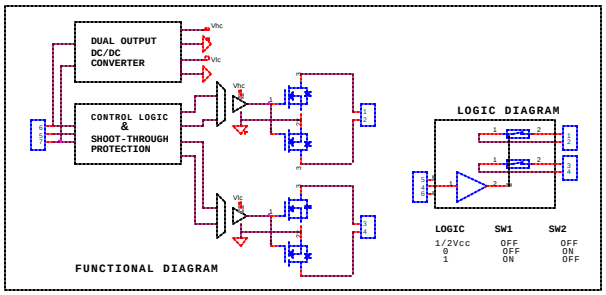
It is a **1 FORM C** or SPDT relay – T3Gvvv**A**aa
"A" is for DC and AC applications.

"vvv" should be replaced with a required voltage,
"aa" should be replaced with a required current.

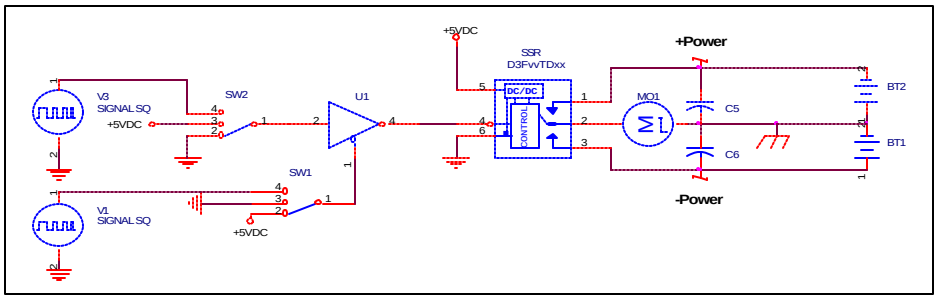


It is a **1 FORM A&B (N.O. & N.C.)** or DPST relay
-- T3Gvvv**A**aa and T4Gvvv**A**aa/
A "A" is for a dual either DC or AC applications.

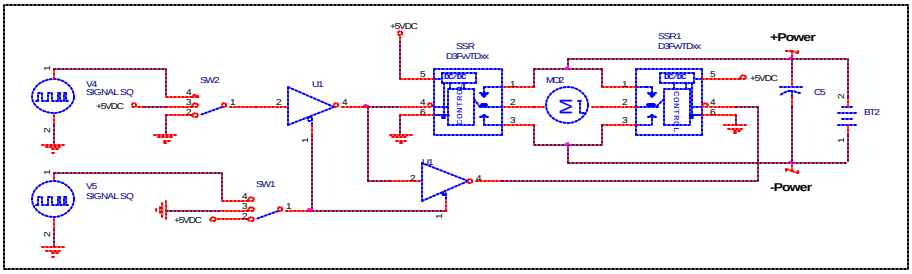
"vvv" should be replaced with a required voltage,
"aa" should be replaced with a required current.



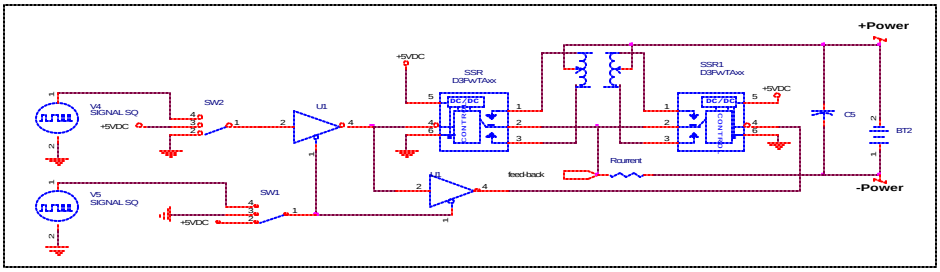
Typical applications



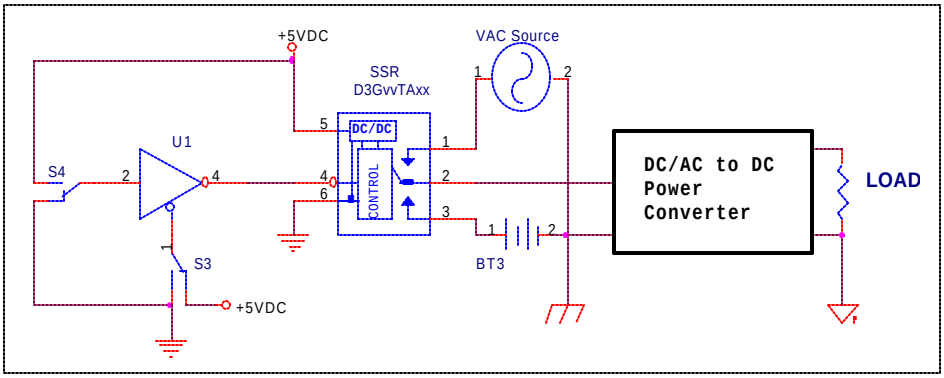
A **1 FORM C** or SPDT relay – T3GvvvDaa can be use as a general-purpose motor driver with a dual-power supply Capable of operating in extremely harsh environments, this device can withstand high ambient temperature, output overload, and repeated power supply transient voltages without damage. The relay can be used in triplets in three-phase brushless DC motor-driver applications.



EDR's "T" relays used in pairs to drive both windings of a bipolar stepper motor or bi-directional control for full-bridge operation with a single-output power source.

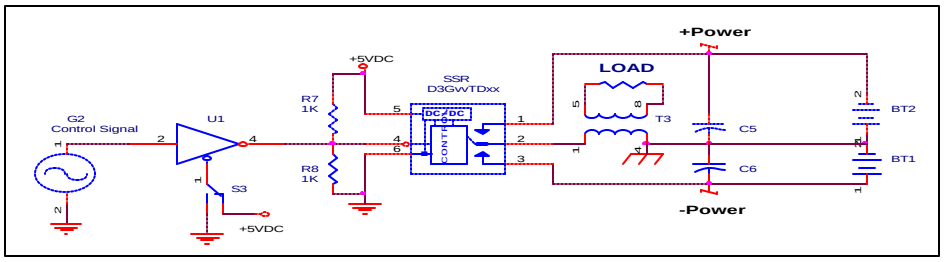


Stepper-Motor Driver

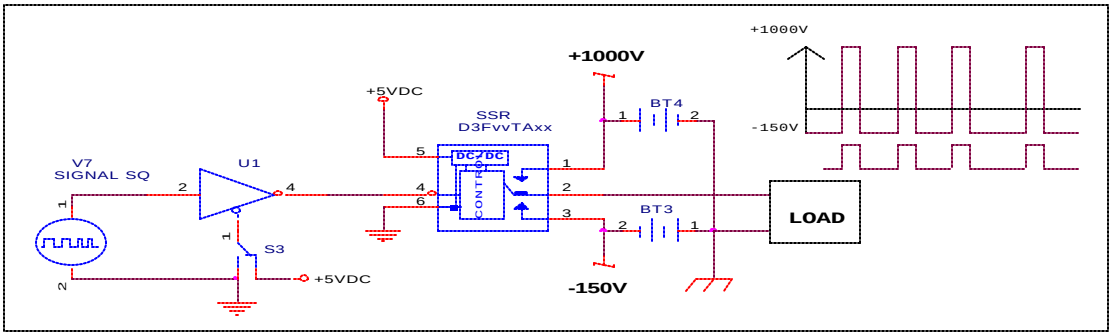


VAC and VDC power management in systems with a battery back-up

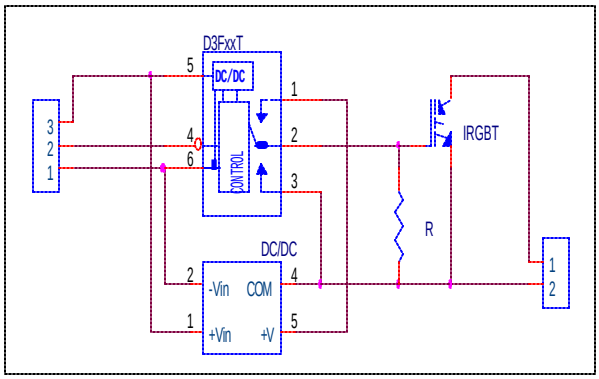
Typical applications (con't)

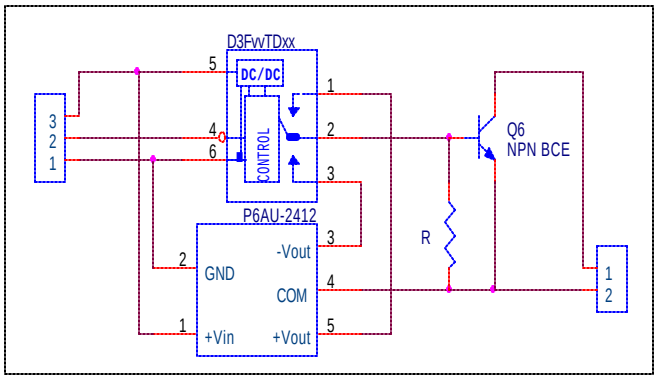


Low-noise, high-power driver for DC/DC converter and high frequency ultrasounds



Generating a high-speed, bi-polar signal for electrostatic painting, plasma and etching





Drive for a powerful, high-speed IGBT and bi-polar transistor

EDR's the "T" family of cost-effective Solid State Relays/Switches has opened endless possibilities and especially significant in view of the increased use of microprocessor-based controls. The simplicity of interfacing of a micro-level of controlling power with a multi-kilowatt load gives an engineer the tool for designing today and tomorrow's equipment. EDR's high-speed relay/switches are compatible with many direct driving integrated devices and input-output galvanic isolation has made them important and valuable components in new designs.

Electronic Design & Research is the front-runner in developing solid-state relays and breakers. Since 1998, we consistently offer superior devices to a growing customer based. From low-cost D1L-type relays to a sophisticated VS092011P200A8/24/NN, an intelligent breaker, EDR offers power devices to meet your forward-looking project requirements.

SPDT Relays/Switches with a fuzzy-logic control input

A unique feature of the "T" type relay/driver is a fuzzy-logic control. The control input designed for the maximum application flexibility and simplicity in interfacing. It is a high impedance input and any 5V CMOS logic can be used to control it. The best result can be obtained with tri-state output logic, like bus-driver IC chips or CPUs. The control input has three defined levels, as that can be seen on the figure, below: 0-1.7V, 1.9-3.2V, and 3.4-5V. That voltage variation allows targeting control any one of terminals or turn "OFF" the driver (terminals) all together. If the control signal remains within the shutdown window (1.9-3.2V), the outputs (pins 1, 2 and 3) are disabled (NO/NO). When the control signal moves on either side of the "shutdown window", it is below 1.7V, or above 3.4V, the pair of terminals 1-2 and 2-3 will change a state from N.O. to N.C. respectively. Otherwise, the control signal's rising and falling thresholds outline in the Electrical Specifications determine when the lower and upper gates are enabled.

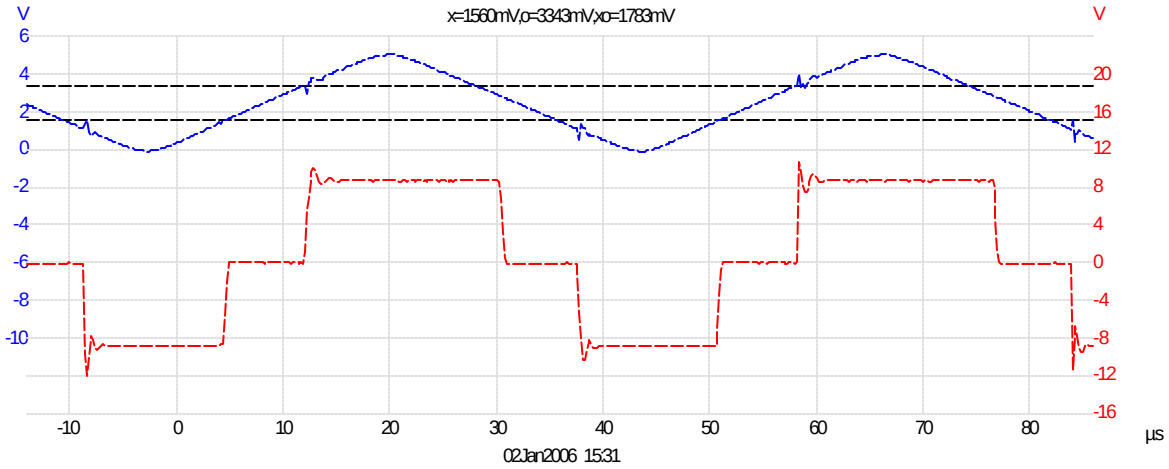


Figure shows a control signal (upper or blue) and a voltage on a load (below or red) When a control signal (a tooth-wave was selected for a better illustration) rises above 3.34V it enables one pier and when it falls blow 1.56V other pair of terminals conducts.

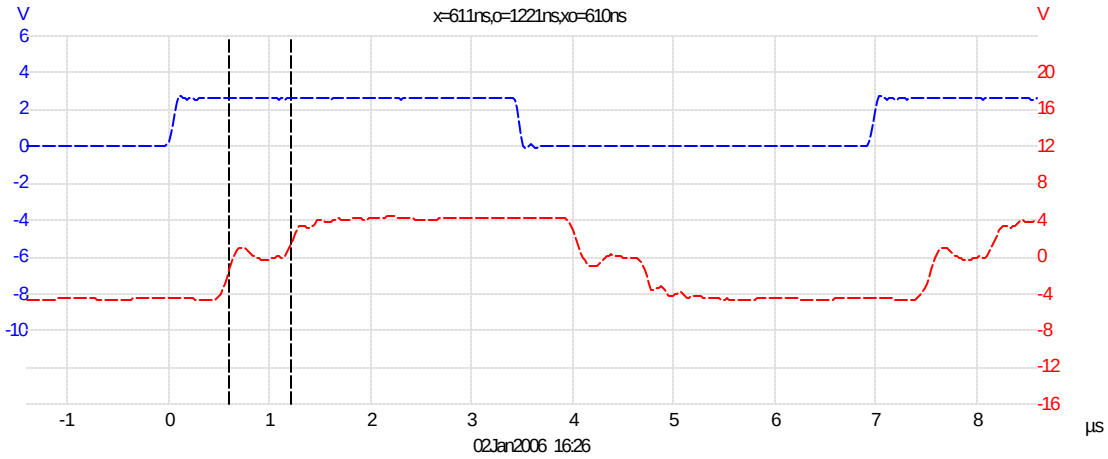


Figure shows break-before-make properties of the "T" type driver. The "dead" time of that driver is about 600 nS and it set during the production. Duration of the "dead" time varies and selected based on a power property. A high-power and high-voltage switches have the "dead' time as longer as 1.5 mS. All video-switches and low power drivers have the "dead" set at about 80 nS. Please let us know if the "dead" time is your concern and what is required.

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

Isolated, a break-before-make switches

The EDR82629 (T3F650A08/5) belongs to the "T" family of a fuzzy-logic controlled relays offers needed flexibility that required in many industrial applications.

Features:

Utilizes only 1.4 sq. in. of PCB area and only 1.15" tall
.8A continuously or up to 6.5 A pulse in a miniature package
High sensitivity, even at high switching frequencies
14 A surge current and only 0.10 Ohms on-state resistance

Please specify power supply and control voltage

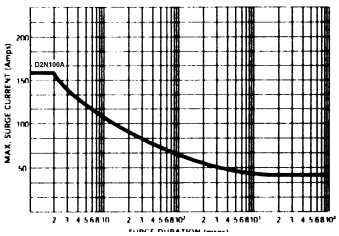
Input Specifications:

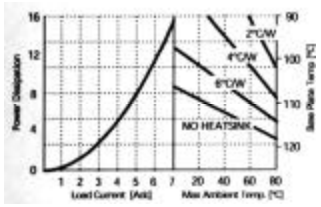
Input Control Voltage (pin 4)	see page #5
Nominal Current	0.5 mA
Power Supply +Vcc (pin 5)	see the order page for selection

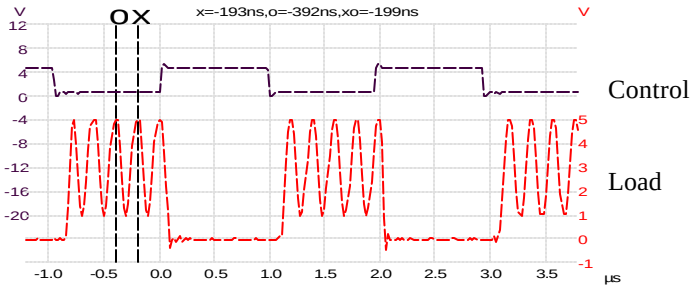
Output Specifications:

Operating DC voltage range	650 VDC p-p
Maximum continuous current	.9 Arms
Maximum surge current (IDM) - .3mS	6.5 A
Continuous current (ID)	3.5 A
Maximum on-state resistance	1.20 Ohm
Rising time	0.017 µS
Delay-on time	0.140 µS
Falling time	0.027µS
Delay-off time	0.098 µS
Maximum switching frequency	400 KHz

*** Test performed with a D3N650D3/24**







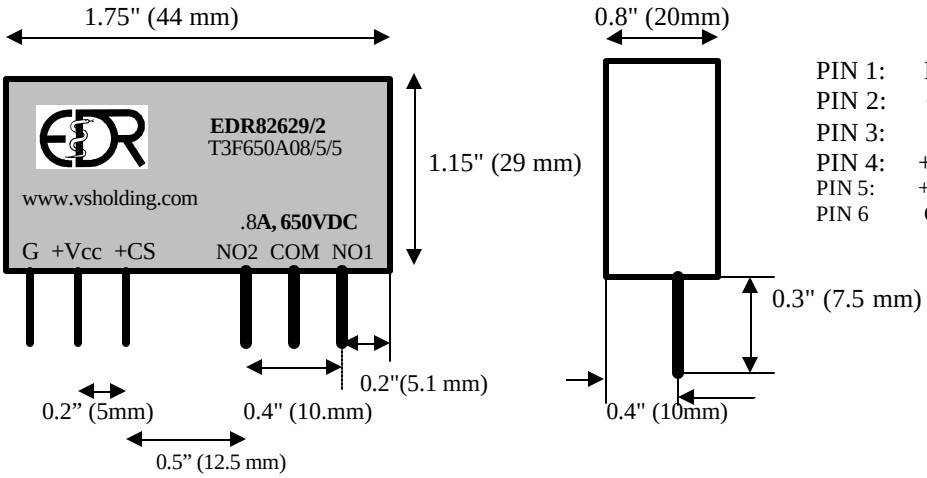
A sample of chopping of 50MHz, 4V signal

General Specifications:

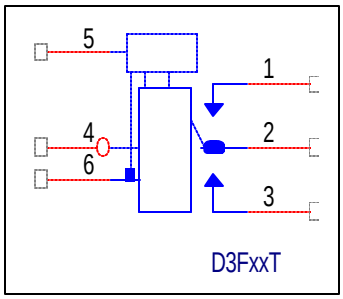
Ambient operating temperature range	-35^0 C to 75^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	2,500VAC

Mechanical Specifications:

Weight (oz)		.2
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR



PIN 1: NO1
PIN 2: COM
PIN 3: NO2
PIN 4: + Control Signal
PIN 5: + Vcc
PIN 6 GND



All Dimensions are in inches (millimeters).

Dimensions for SIP4 package	1.15"H x 1.75"L x 0.8"W
Terminals/solder for SIP4 package	control - 0.40", power – 0.6"

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

Powerful Fast, Solid-State ½ Driver

Designed to deliver 84 KW of power in a microsecond

http://www.vsholding.com

Technology for people's ideas

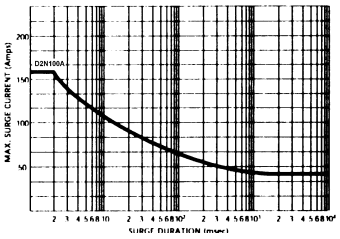
Features: **Utilizes only 1.4 sq. in. of PCB area and only 1.15" tall**
3A continuously or up to a 24A pulse at 10 µS pulse or 100 KHz
High sensitivity, even at high switching frequencies
At 20A current only 1.9 Vce saturated
140 A pulse and 35 A continuously at 110 ^{0} C
Please specify power supply and control voltage

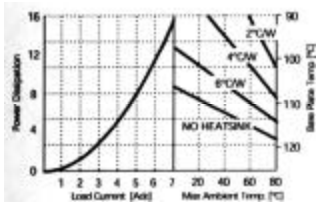
Input Specifications:

Input Control Voltage (pin 4)	see page "selection"
Nominal Current	0.5 mA
Power Supply +Vcc (pin 5)	see the order page for selection

Output Specifications:

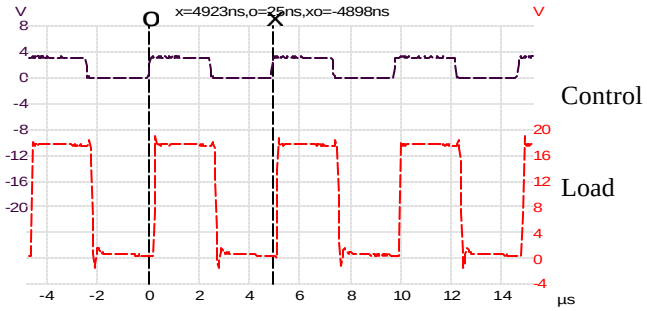
Operating DC voltage range	0 – 600 VDC
Maximum continuous current	3 A rms at 10 KHz
Maximum continuous current	1A rms at 100 KHz
Maximum surge current (IDM) - .03mS	140 A
Continuous current (ID)	24A
Maximum Vce	1.9 V
Rising time	0.025 µS
Delay-on time	0.220 µS
Falling time	0.035µS
Delay-off time	0.200 µS
Maximum switching frequency	400 KHz





General Specifications :

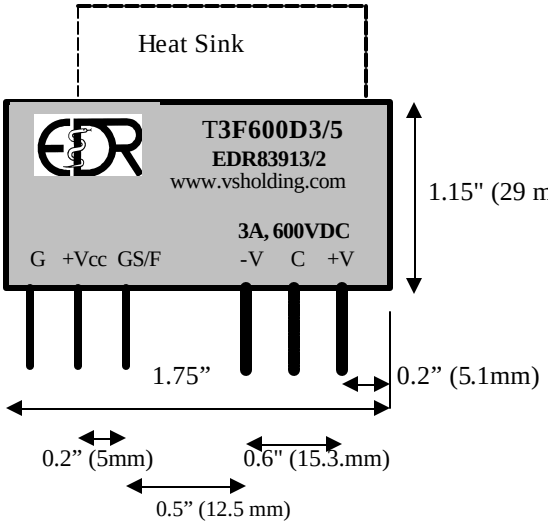
Ambient operating temperature range	-45^0 C to 85^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	3,000VAC

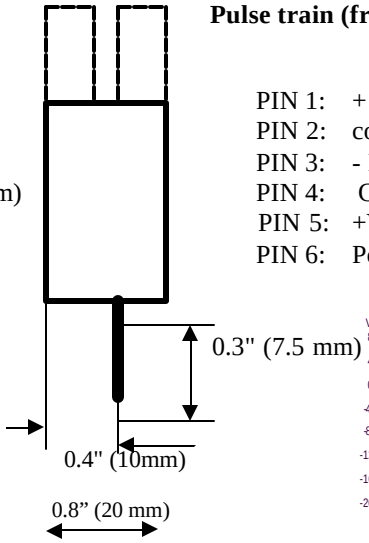


Pulse train (frequency) about 204 KHz

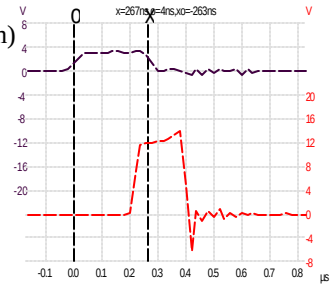
Mechanical Specifications:

Weight (oz)		.2
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR





PIN 1: + LOAD, +V
PIN 2: common LOAD, C
PIN 3: - LOAD, -V
PIN 4: Control Signal, CS/F
PIN 5: +Vcc
PIN 6: Power Supply return, GND



Pulse width 263 nS, 10A

All Dimensions are in inches (millimeters).

Dimensions for SIP4 package	1.15"H x 1.75"L x 0.8"W
Terminals /solder for SIP4 package	control - 0.40", power – 0.6"

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

Isolated, a break-before-make switches

The EDR83914 (T3F500D3/5) belongs to the "H" family of a fussy-logic controlled relays offers needed flexibility that required in many industrial applications.

Features: **Utilizes only 1.4 sq. in. of PCB area and only 1.15" tall**
1.8A continuously or up to 24 A pulse in a miniature package
High sensitivity, even at high switching frequencies
90 A surge current and only 0.22 Ohms on-state resistance

Please specify power supply and control voltage

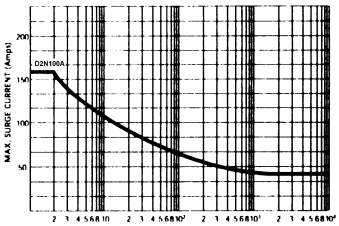
Input Specifications:

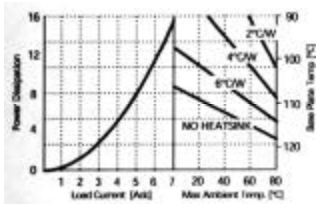
Input Control Voltage (pin 4)	see page #5
Nominal Current	0.3 mA
Power Supply +Vcc (pin6)	see the order page for selection

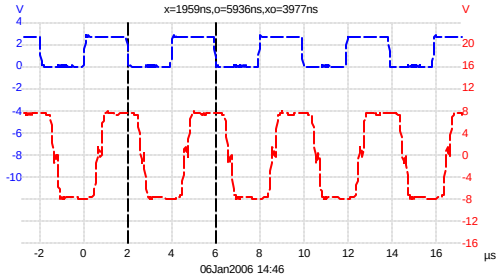
Output Specifications:

Operating DC voltage range	500 VDC
Maximum continuous current	1.8 Arms rms
Maximum surge current (IDM) - 0.1mS	90 A
Continuous current (ID) - Pulsed	24 A
Maximum on-state resistance	0.22 Ohm
Rising time	0.017 µS
Delay-on time	0.140 µS
Falling time	0.027µS
Delay-off time	0.098 µS
Maximum switching frequency	275 KHz

All specifications were giving without any heatsink at room temperature







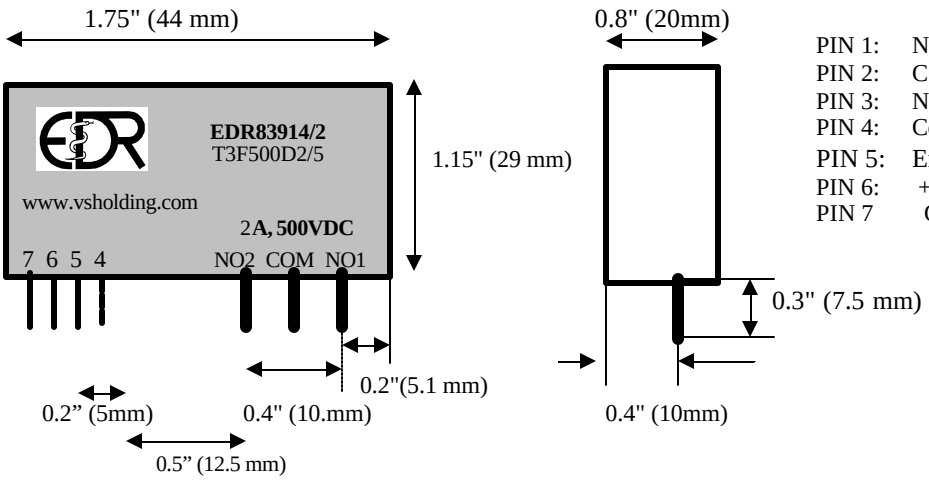
A sample of driving a load at 250 KHz

General Specifications:

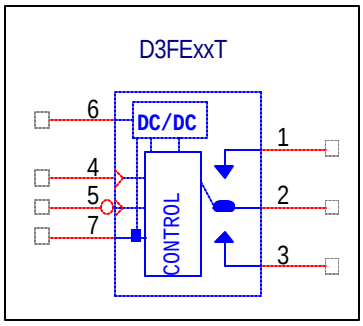
Ambient operating temperature range	-35^0 C to 75^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	3,000VAC

Mechanical Specifications:

Weight (oz)		.2
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR



PIN 1: NO1
PIN 2: COM
PIN 3: NO2
PIN 4: Control Signal (CS)
PIN 5: Enable (EN)
PIN 6: + 5VDC
PIN 7 GND



All Dimensions are in inches (millimeters).

Dimensions for SIP7 package	1.15"H x 1.75"L x 0.8"W
Terminals/solder for SIP7 package	control - 0.20", power – 0.6"

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

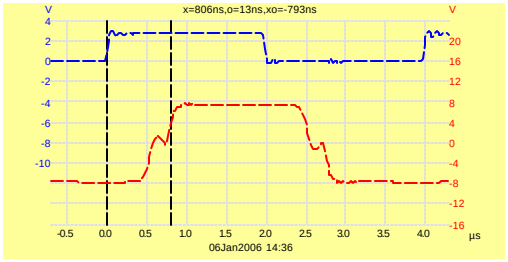
Input Electrical Characteristics (Ta = 25^{0}C) for T3F500A3/5, p/n EDR83914/2

Characteristic	Test Condition	Min	Typ.	Max.	Unit
Control Voltage, low level threshold			1.7		V
Control Voltage, high level threshold			3.3		V
Enable (EN) threshold (pin 5)			1.0	2.0	V
Input Current			0.300		mA

Input Electrical Characteristics (Ta = 25^{0}C)

Power Supply (pins 6), Vcc (200 mA maximum)	4.9	5	5.3	V
Maximum Vcc current at DC – 1.0 KHz		40		mA
Maximum Vcc Current at 275 KHz		200		mA

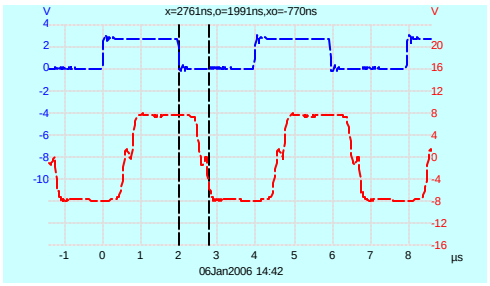
Switching time test – Load – 8.3 Ohm & 2.2 A



Control

Load

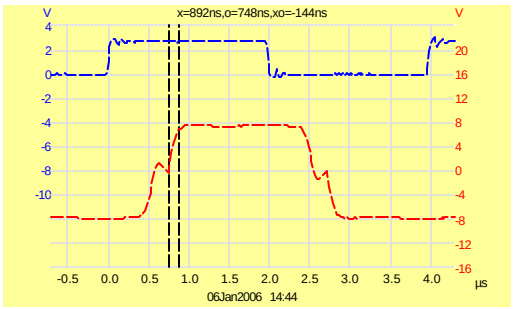
Figure 1 Turn-on delay is 793 nS



Control

Load

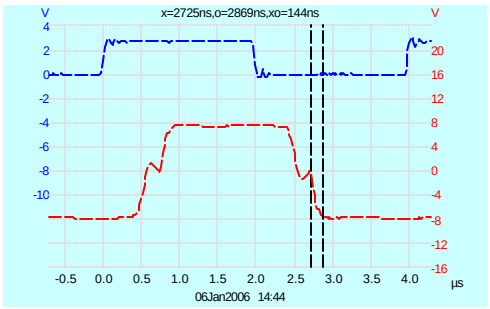
Figure 2 Turn-off delay is 770 nS



Control

Load

Figure 3 Rising Time is 144 nS



Control

Load

Figure 4 Fall Time is 144 nS

FUNCTIONAL TABLE

EN	CS	NO1	NO2
L	X	OFF	OFF
H	2.5V	OFF	OFF
H	5.0V	ON	OFF
H	0V	OFF	ON

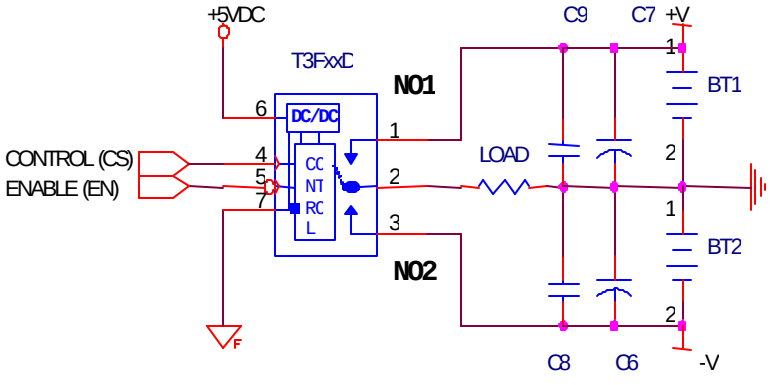


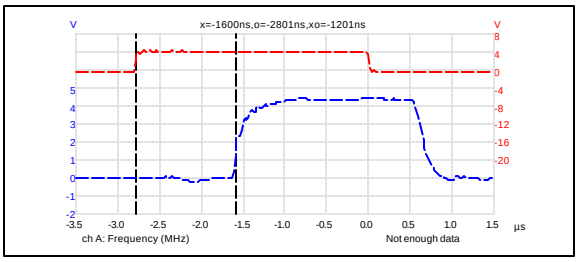
Fig. 5 Switching Time Test Circuit

The enable is connected to +5VDC via a 10K resistor and can be left floating.

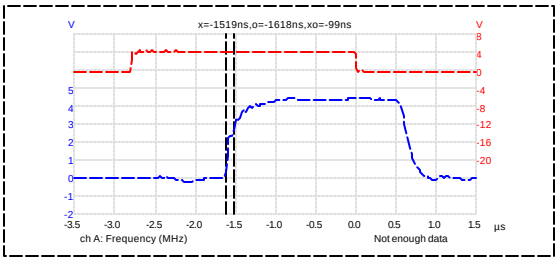
Function Table of the EDR83914

INPUT (control, pin 4)	Output terminals 1-2	Output terminals 2-3
X	OFF	OFF
0V-2V	**ON**	OFF
2V-2.8V	OFF	OFF
2.8V-5V	OFF	**ON**

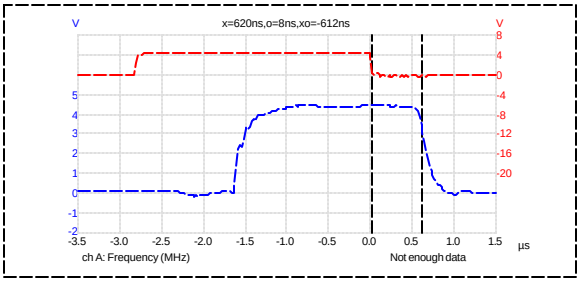
Switching time test: Power is +40VDC or +/-40VDC, a non-inductive load is 5 Ohm & 8 A



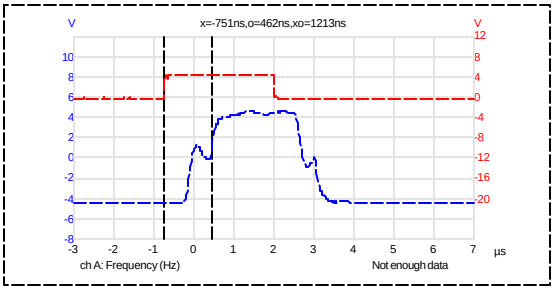
Maximum turn on delay is 1.2mS



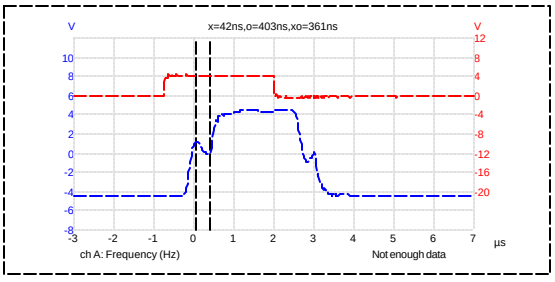
Rising slop is only 0.099 mS

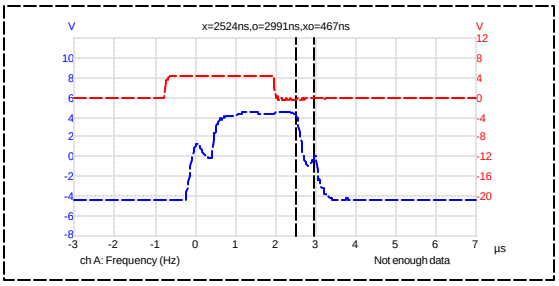


Turn-off delay is 0.612mS

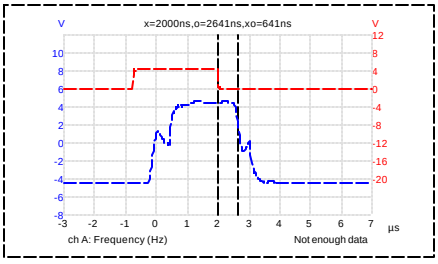


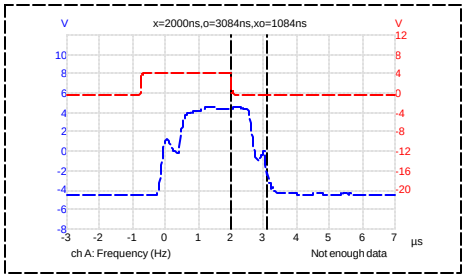
Test of the time-delay with a bi-polar power





The dead time is set to about 400 nS for that particular part. Please contact us if you would need a shorter or longer delay.





1500VDC, 0.8A, 200 KHz, ½ driver/switch

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

Features: **Utilizes only 1.4 sq. in. of PCB area and only 1.15" tall**
0.8 A continuously or up to a 12A pulse at 10 µS pulse
High sensitivity, even at high switching frequencies
4 A pulse and 6 A continuously at 110 ^{0} C

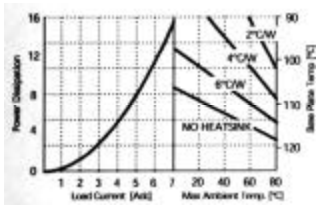
Please specify power supply and control voltage

Input Specifications:

Input Control Voltage (pin 4)	see specifications
Nominal Control Signal Current	0.5 mA
Power Supply +Vcc (pin 5)	see the order page for selection

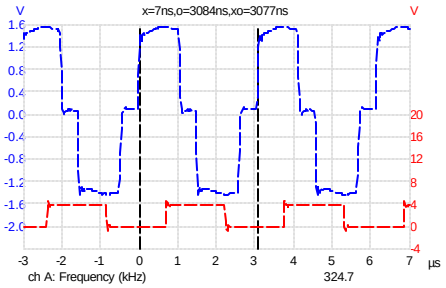
Output Specifications:

Operating DC voltage range	– 1500 to +1500 VDC
Maximum continuous current	.8 A rms at 10 KHz
Maximum continuous current	.3 A rms at 200 KHz
Maximum surge current (IDM) - .03mS	12 A
Continuous current (ID)	4A
Pulsing current	10A
Maximum resistance	7 Ohm
Rising time	37 nS
Delay-on time	270 nS
Falling time (depended on a load)	107 nS (60 Ohm)
Delay-off time	330 nS
Maximum switching frequency	200 KHz



General Specifications :

Ambient operating temperature range	-45^0 C to 85^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	3,000VAC



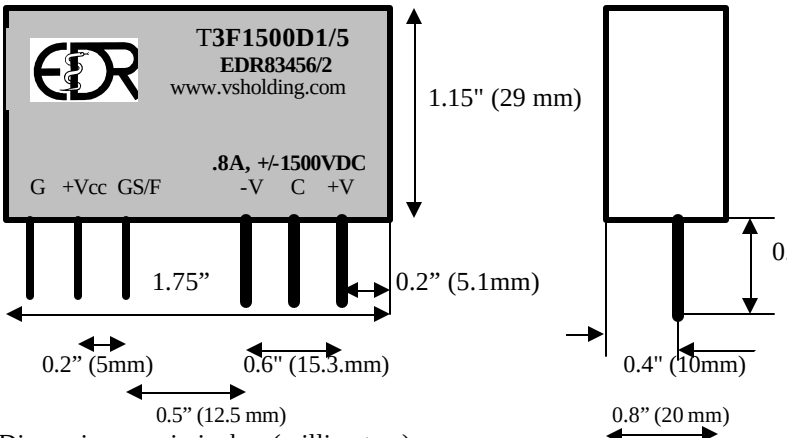
Control

Load

Pulse train (frequency) at 324 KHz

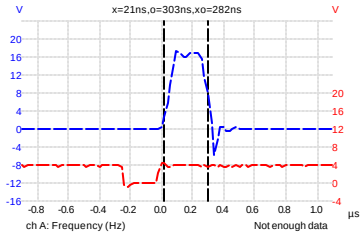
Mechanical Specifications:

Weight (oz)		.2
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR



PIN 1: + LOAD, +1,500V
PIN 2: common LOAD, C
PIN 3: - LOAD, -1,500V
PIN 4: Control Signal, CS/F
PIN 5: +5VDC
PIN 6: Power Supply return, GND

A single Pulse 280nS



All Dimensions are in inches (millimeters).

Dimensions for SIP4 package	1.15"H x 1.75"L x 0.8"W
Terminals /solder for SIP4 package	control - 0.40", power – 0.6"

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

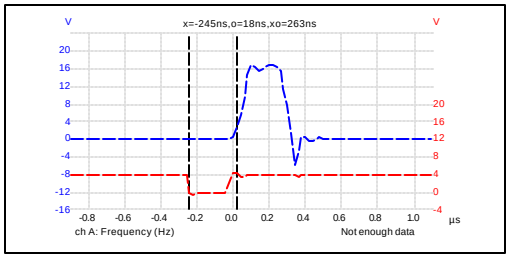
Input Electrical Characteristics (Ta = 25^{0}C) for T3F1500D1/5, p/n EDR83456/2

Characteristic	Test Condition	Min	Typ.	Max.	Unit
Control Voltage, low level threshold			1.7		V
Control Voltage, high level threshold			3.3		V
Input Current			0.300		mA

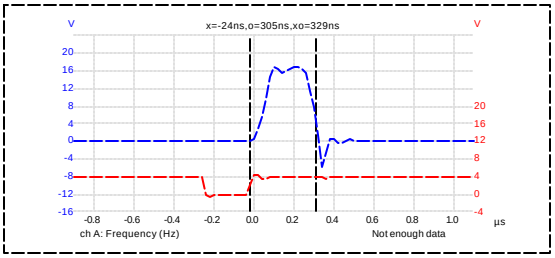
Input Electrical Characteristics (Ta = 25^{0}C)

Power Supply (pins 6), Vcc (200 mA maximum)	4.9	5	5.3	V
Maximum Vcc current at DC – 1.0 KHz		40		mA
Maximum Vcc Current at 200 KHz		180		mA

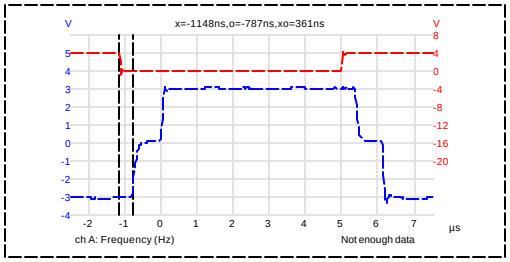
Switching time test: Load – 60.0 Ohm & .4 A



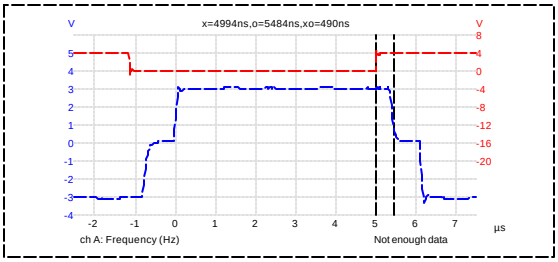
Turn-on delay is 263 nS



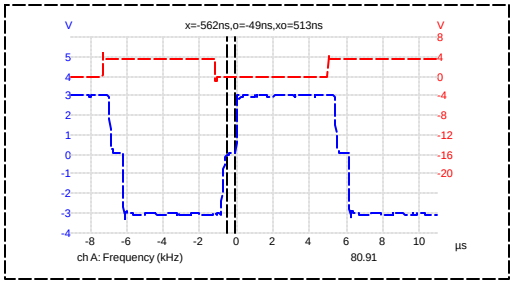
Turn-off delay is 329 nS



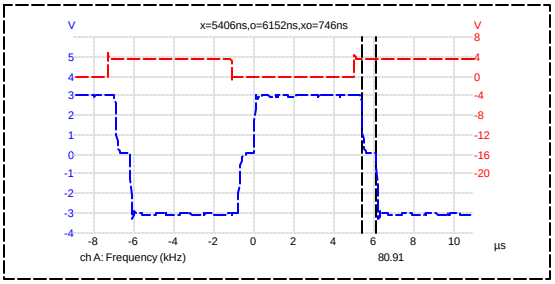
Turn-on delay is 361 nS



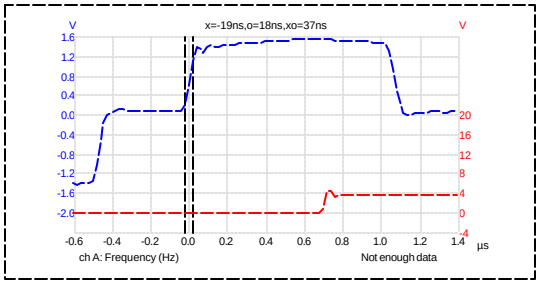
Turn-off delay is 490 nS



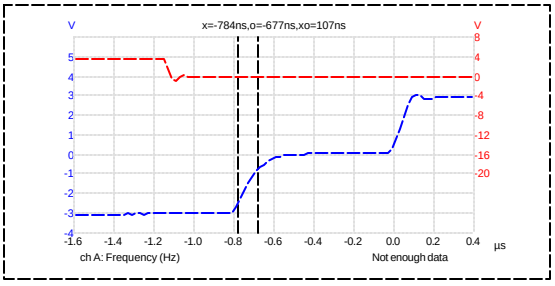
A "dead zone" on the rising front is 361 nS



"Dead zone" on the falling front 4567 nS



Rising slope is 37 nS



A "free" Falling slope is 107 nS. Time depended on the load' impedance

EDR82762 -- 100VDC, 10A, 200 KHz ½ driver/switch

Fuzzy-logic input high powerful driver

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

Features:
- **Utilizes only 1.4 sq. in. of PCB area and only 1.15" tall**
- **10A continuously or up to a 100A pulse at 10 µS pulse**
- **High sensitivity, even at high switching frequencies**
- **Fuzzy-logic input allows individual control of each pair of outputs**

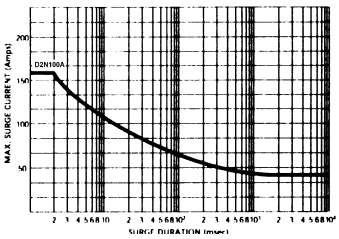
Please specify power supply and control voltage

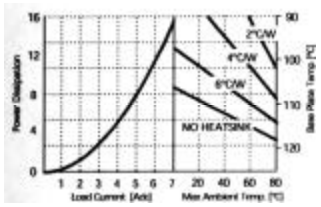
Input Specifications:

Input Control Voltage (pin 4)	see "ordering page"
Nominal Current	0.5 mA
Power Supply +Vcc (pin 5)	see the order page for selection

Output Specifications:

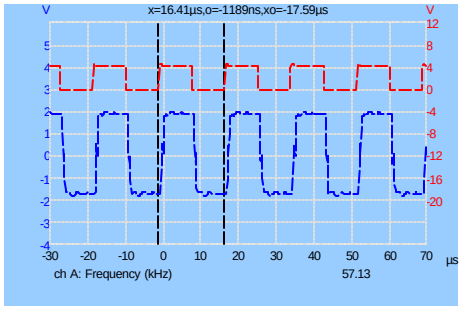
Operating DC voltage range	0 – 100 VDC
Maximum continuous current	10 A rms at 10 KHz
Maximum continuous current	1A rms at 200 KHz
Maximum surge current (IDM) - .03mS	440 A
Continuous current (ID)	90A
Pulsing current	100A
Maximum resistance	0.010 Ohm
Rising time	0.155 µS
Delay-on time	0.220 µS
Falling time	0.095µS (1Ohmload)
Delay-off time	0.200 µS
Dead time (it can be set to any)	0.400 µS (please request a different)
Maximum switching frequency	160 KHz





General Specifications:

Ambient operating temperature range	-45^0 C to 85^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	3,000VAC



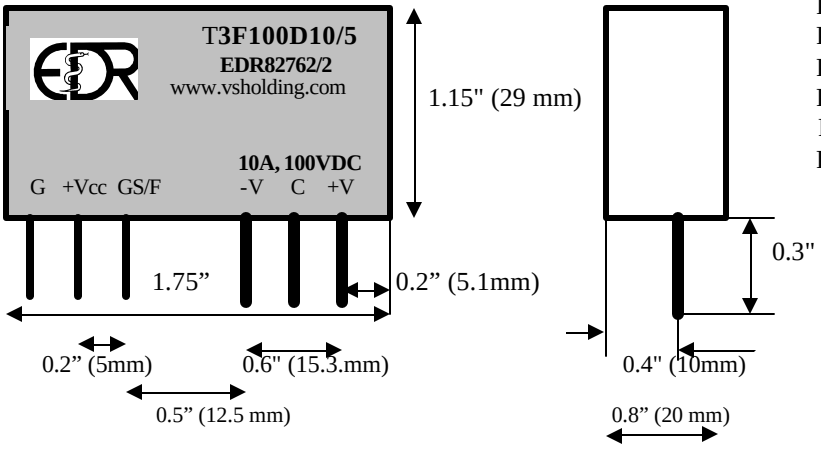
Control

Load

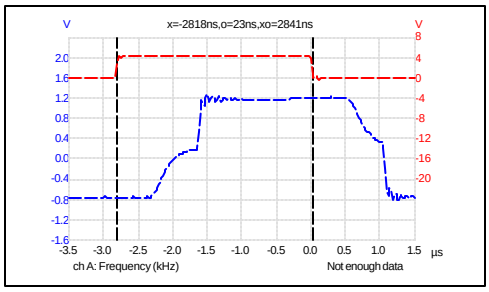
Pulse train (frequency) about 57.1 KHz

Mechanical Specifications:

Weight (oz)		.2
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR



PIN 1: + LOAD, +V
PIN 2: common LOAD, C
PIN 3: - LOAD, -V
PIN 4: Control Signal, CS/F
PIN 5: +5VDC
PIN 6: Power Supply return, GND



Pulse-width

All Dimensions are in inches (millimeters).

Dimensions for SIP4 package	1.15"H x 1.75"L x 0.8"W
Terminals /solder for SIP4 package	control - 0.40", power – 0.6"

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

75VDC/52VAC, 5A, 200 KHz ½ driver/switch

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

Features: **Utilizes only 1.4 sq. in. of PCB area and only 1.15" tall**
5 A continuously or up to a 70A pulse at 10 µS pulse
High sensitivity, even at high switching frequencies
50 A pulse and 2 A continuously at 110 ^{0} C

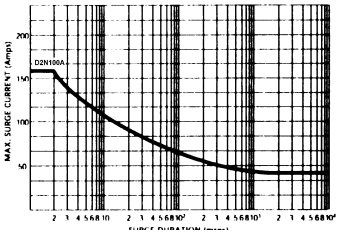
Please specify power supply and control voltage

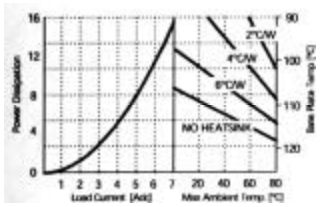
Input Specifications:

Input Control Voltage (pin 4)	see
Nominal Current	0.5 mA
Power Supply +Vcc (pin 5)	see the order page for selection

Output Specifications:

Operating DC voltage range	+/-75VDC (52VAC)
Continuous current (DC-10 KHz)	5 A rms
Continuous current (at 200 KHz)	.8A rms
Maximum surge current (IDM) - .03mS	130 A
Continuous current (ID)	35 A at 25ºC
Pulsing current	70A
Maximum resistance	0.060 Ohm
Rising time	0.090 µS
Delay-on time	1,200 µS
Falling time	0.095µS (1 Ohm)
Delay-off time	0.620 µS
Maximum switching frequency	220 KHz



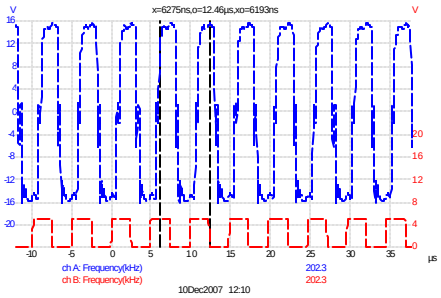


General Specifications:

Ambient operating temperature range	-45^0 C to 85^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	3,000VAC

Mechanical Specifications:

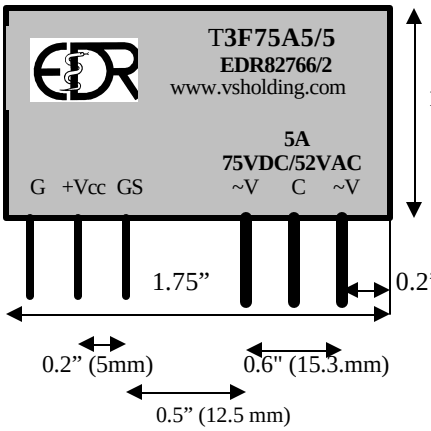
Weight (oz)		.2
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR

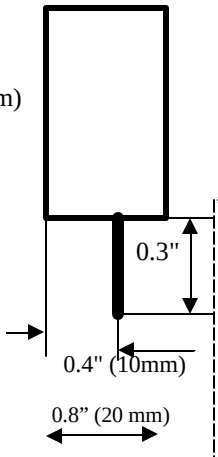


Control

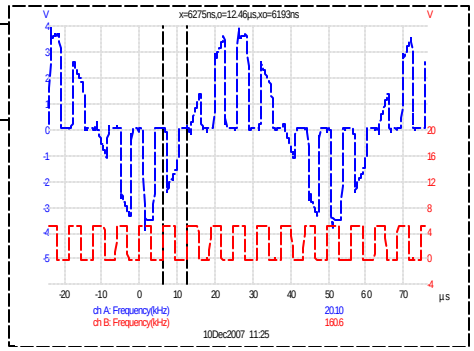
Load

Pulse train (frequency) about 200 KHz





PIN 1: + LOAD, ~V
PIN 2: common LOAD, C
PIN 3: - LOAD, ~V
PIN 4: Control Signal, CS
PIN 5: +5VDC
PIN 6: Power Supply return, GND



All Dimensions are in inches (millimeters).

Dimensions for SIP4 package	1.15"H x 1.75"L x 0.8"W
Terminals /solder for SIP4 package	control - 0.40", power – 0.6"

Transient Protection: All loads are inductive, evenones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

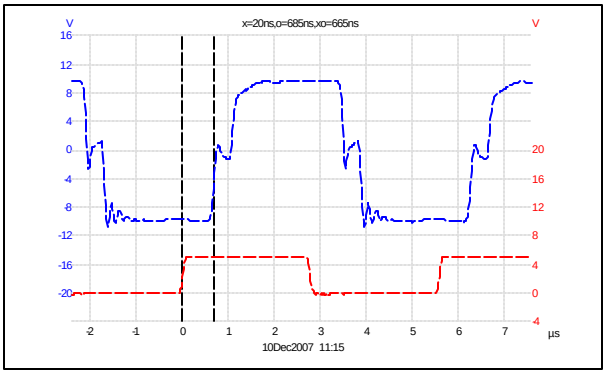
Input Electrical Characteristics (Ta = 25^{0}C) for T3F75A5/2, p/n EDR82766/5

Characteristic	Test Condition	Min	Typ.	Max.	Unit
Control Voltage, low level threshold			1.7		V
Control Voltage, high level threshold			3.3		V
Input Current			0.300		mA

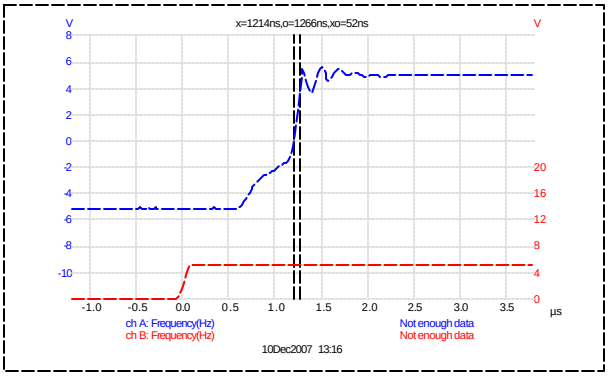
Input Electrical Characteristics (Ta = 25^{0}C)

Power Supply (pins 6), Vcc (200 mA maximum)	4.9	5	5.3	V
Maximum Vcc current at DC – 1.0 KHz		40		mA
Maximum Vcc Current at 100 KHz		200		mA

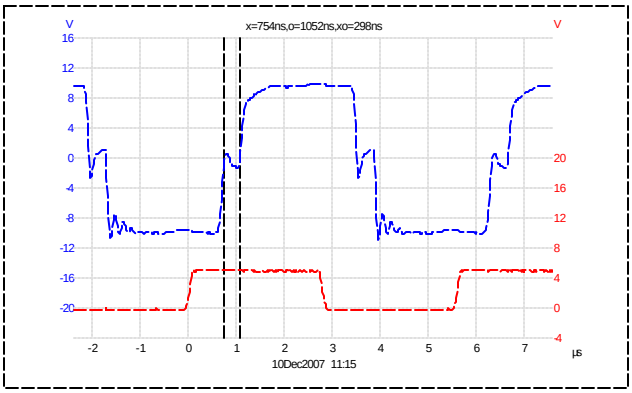
Switching time test – Load – 52.0 Ohm & 1 A



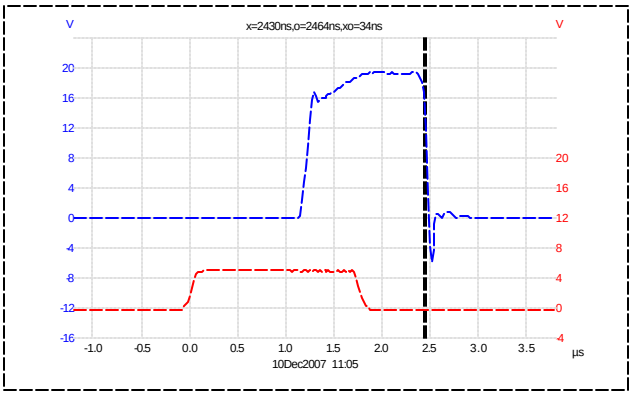
Turn-on delay is 665 nS



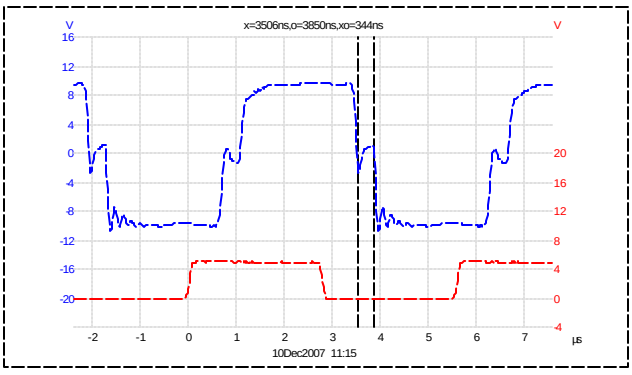
Turn-on slope (Tr) is 52 nS (dual supply)



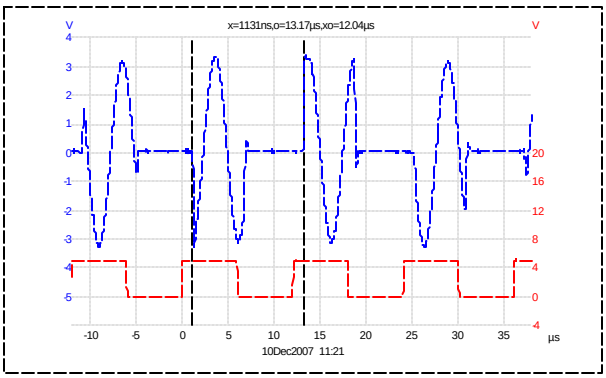
A "dead zone" on the rising front is 296 nS



Turn-on slope (Tr) is 34 nS (single supply)



"Dead zone" on the falling front 344 nS



An example of chipping high-frequency

EDR82710 - 500VDC, 7A High speed, 1/2 Bridge Driver

Fast, powerful break-before-make switch

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

The EDR82710 (T7G500D7) belongs to the "T" family of a fuzzy-logic controlled relays offers needed flexibility that required in many industrial applications.

Features:
- Utilizes only 1.4 sq. in. of PCB area and only 1.15" tall
- 7A continuously or up to 30 A pulse in a miniature package
- High sensitivity, even at high switching frequencies
- 140 A surge current and only 0.01 Ohms on-state resistance

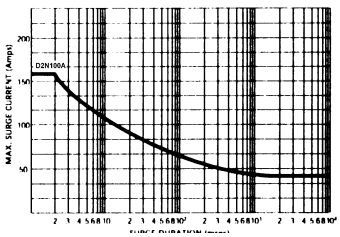
Input Specifications:

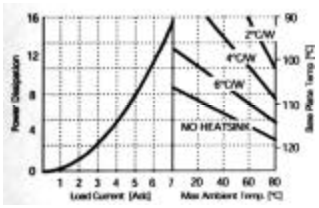
Input Control Voltage (pin 4)	see page #5
Nominal Current	0.3 mA
Power Supply +Vcc (pin6)	see the order page for selection

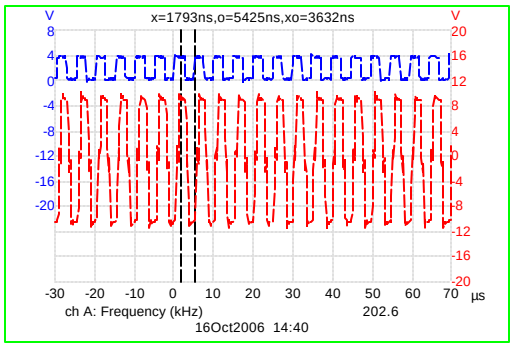
Output Specifications:

Operating DC voltage range	0 - 500 VDC
Rated current, no heatsink	7 Arms rms
Current with a heatsink	15A
Maximum surge current (IDM) - .1mS	140 A
Continuous current (ID) -	30 A
Maximum on-state resistance	0.01 Ohm
Rising time	0.017 µS
Delay-on time	0.140 µS
Falling time	0.027µS
Delay-off time	0.098 µS
Maximum switching frequency	200 KHz

All specifications were giving without any heatsink at room temperature







Control

Load

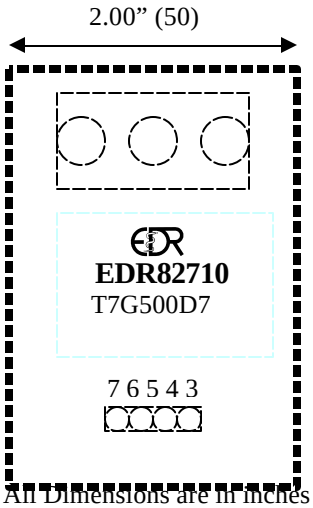
A sample of driving a load at 200 KHz

General Specifications:

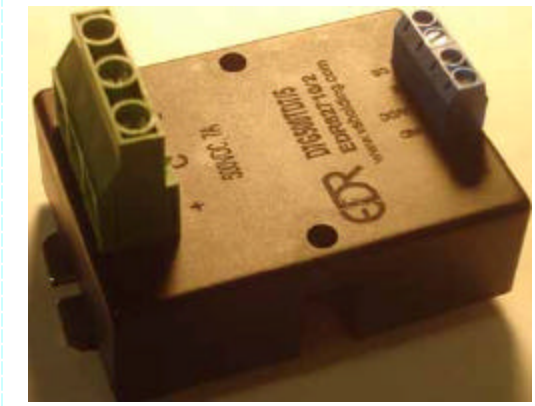
Ambient operating temperature range	-35^0 C to 75^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	2,500VAC

Mechanical Specifications:

Weight (oz)	.2
Encapsulation Epoxies Etc.	50-2366RFR / 50-2366CFR



PIN 1: +OUT
PIN 2: COM
PIN 3: -OUT
PIN 4: Control Signal (CS)
PIN 5: Enable (EN)
PIN 6: +Vdc
PIN 7 GND



All Dimensions are in inches (millimeters).

Dimensions for SIP7 package	2.85"H x 2.7"L x 2.0"W
Output Terminals	screw types

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

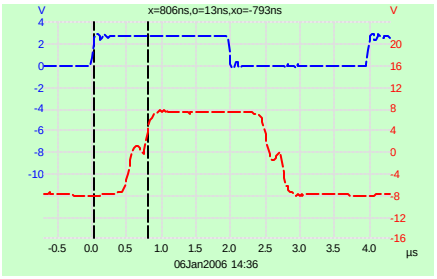
Input Electrical Characteristics (Ta = 25^{0}C) for T7G500D3/5, p/n EDR82710/2

Characteristic	Test Condition	Min	Typ.	Max.	Unit
Control Voltage, low level threshold			1.7		V
Control Voltage, high level threshold			3.3		V
Enable (EN) threshold (pin 5)			1.0	2.0	V
Input Current			0.300		mA

Input Electrical Characteristics (Ta = 25^{0}C)

Power Supply (pins 6), Vcc (200 mA maximum)	4.9	5	5.3	V
Maximum Vcc current at DC – 1.0 KHz		40		mA
Maximum Vcc Current at 275 KHz		200		mA

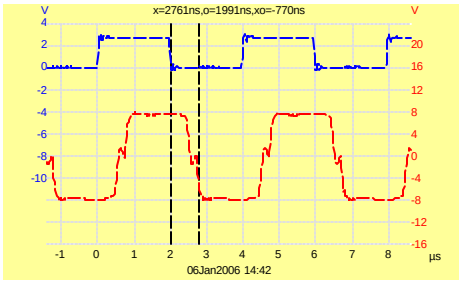
Switching time test – Load – 8.3 Ohm & 2.2 A



Control

Load

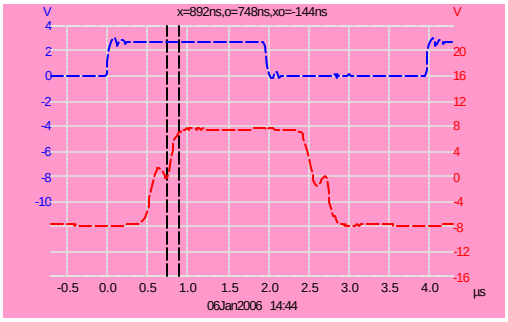
Figure 1 Turn -on delay is 793 nS



Control

Load

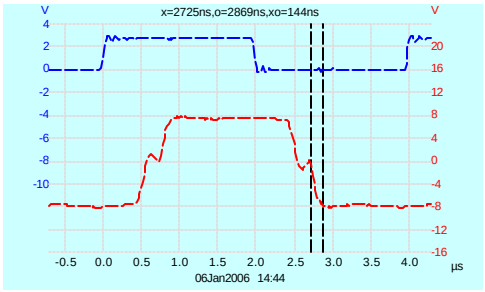
Figure 2 Turn -off delay is 770 nS



Control

Load

Figure 3 Rising Time is 144 nS



Control

Load

Figure 4 Fall Time is 144 nS

FUNCTIONAL TABLE

EN	CS	NO1	NO2
L	X	OFF	OFF
H	2.5V	OFF	OFF
H	5.0V	ON	OFF
H	0V	OFF	ON

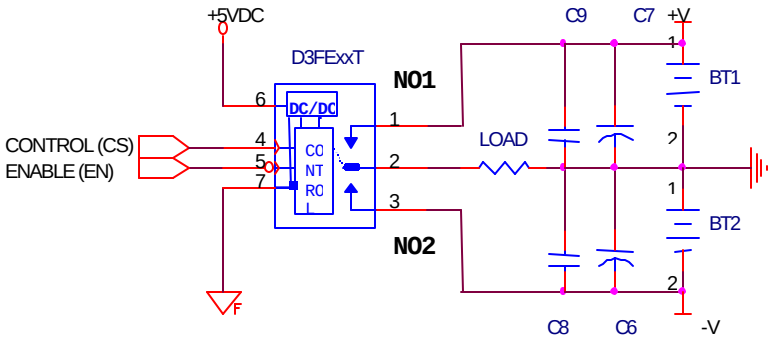


Fig. 5 Switching Time Test Circuit

The enable is connected to +5VDC via a 10K resistor and can be left floating.

EDR82717 - 650VDC, 1.4A SPDT Relay

The EDR82717 is a low cost and belongs to the family of a DC & AC/DC a subminiature ½ drivers, and analog switches

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

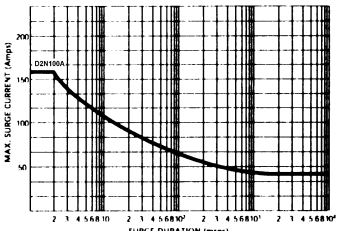
Features:
Utilizes only 0.75 sq. in. of PCB area and only 1.05" tall
1.4A continuously current and no heat sink is required
up to 18 A pulse in a miniature package
CMOS input
7A is a maximum continues current and only 0.060 Ohms on-state resistance

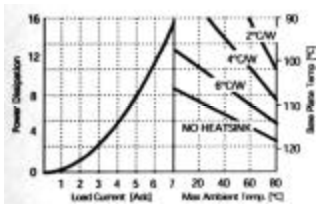
Input Specifications:

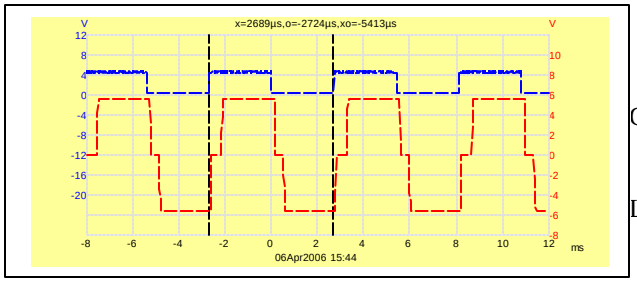
Input Control Voltage (pin 4)	see "order page"
Nominal Current	0.5 mA
Power Supply +Vcc (pin 5)	see the order page for selection

Output Specifications:

Operating DC voltage range	0V -- 650 VDC
Maximum continuous current	1.4 A
Maximum surge current (IDM) - .3mS	18 A
Continuous current (ID)	7 A
Maximum on-state resistance	0.070 Ohm
Rising time	0.034 µS
Delay-on time	0.600 µS
Falling time	0.013µS
Delay-off time	0.200 µS
Maximum switching frequency	500 Hz
"Dead Time"	**580 mS**







Control

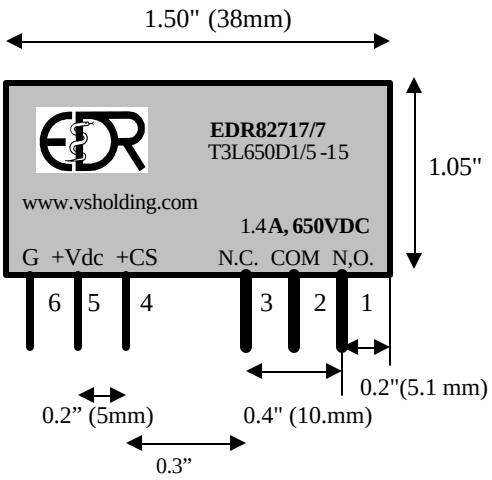
Load

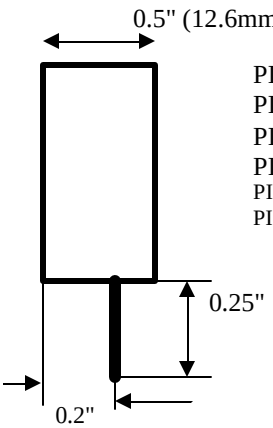
General Specifications:

Ambient operating temperature range	-40^0 C to 85^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	2,500 VAC

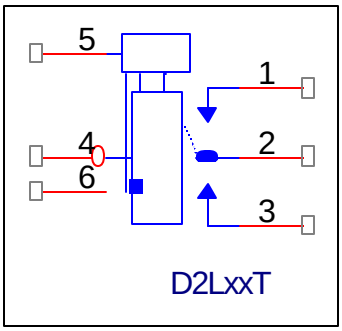
Mechanical Specifications:

Weight (oz)		.2	
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR	A sample of chopping of a bio-polar power





PIN 1: N.O. (normal open)
PIN 2: COM
PIN 3: N.C. (normal close)
PIN 4: + Control Signal
PIN 5: + Vdc (5-15)
PIN 6 GND



All Dimensions are in inches (millimeters).

Dimensions for SIP4 package	1.05"H x 1.5"L x 0.5"W
Terminals/solder for SIP4 package	control - 0.40", power – 0.6"

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

Input Electrical Characteristics (Ta = 25^{0}C) for T2L650D1, p/n EDR82717

Characteristic	Test Condition	Min	Typ.	Max.	Unit
Control voltage range			+Vdc x 0.7		V
Maximum Turn-On Voltage, Vdc=5VDC			3.5		V
Maximum Turn-Off Voltage, Vdc=+5VDC			1.5		V
Input Current			<1		mA

Input Electrical Characteristics (Ta = 25^{0}C) for T2L600D, p/n EDR82628

Power Supply, Vcc	4.7	5	15	V
Power Supply Current	20	22	40	mA

Switching time test, 280VDC & 0.7A; Load – 400 Ohm, voltage attenuation 10:1

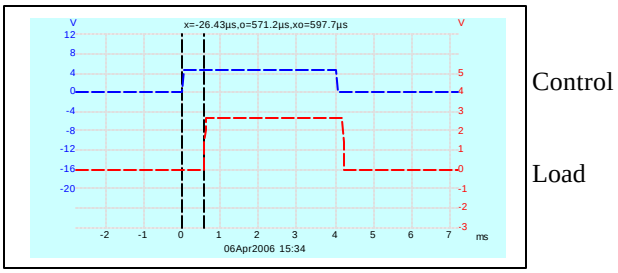


Figure 1 Turn-on delay is 0.6 mS

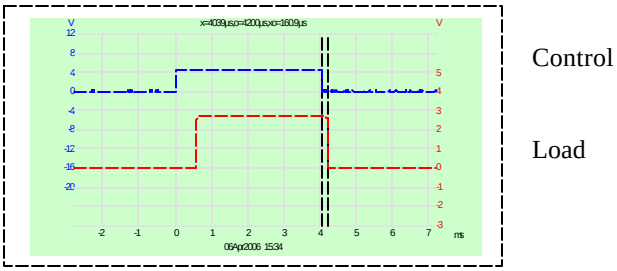


Figure 2 Turn-off delay is 0.2mS

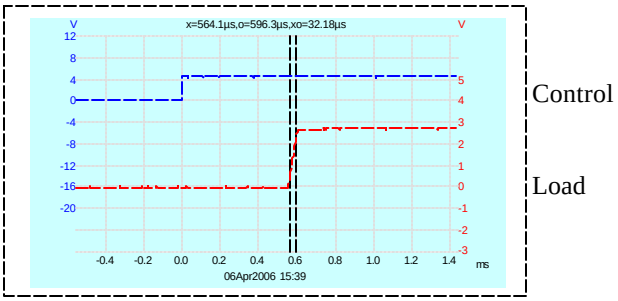


Figure 3 Rising Time is 32.18 µS

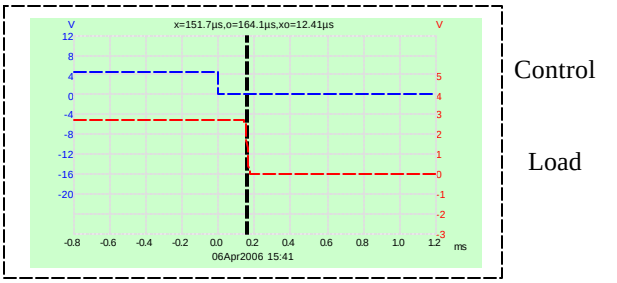


Figure 4 Fall Time is 12.41µS

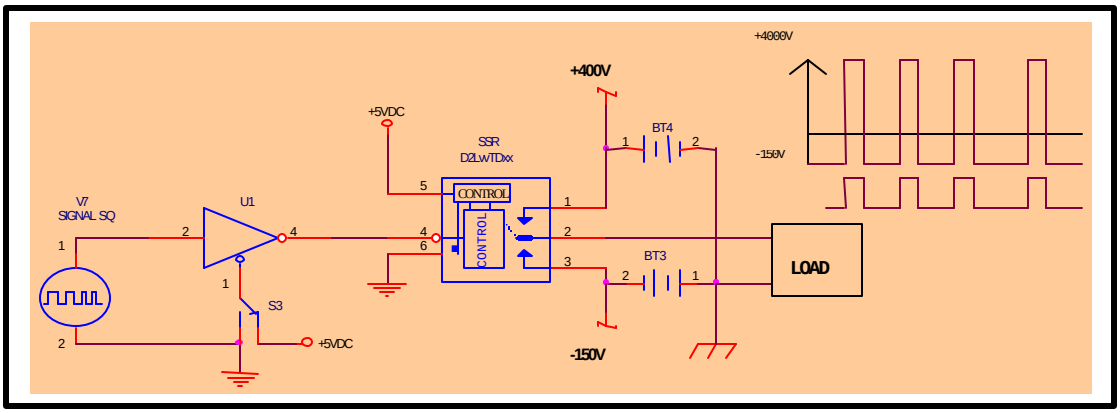


Figure 5. Switching unsymmetrical bi-polar powers

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

Electronic Design & Research
http://www.vsholding.com

Technology for people's ideas

NanoSeconds rise/fall time, High-Voltage push-pull switches

A switch belongs to the family of push-pull switches consists of two alternately controlled solid-state switches, which in turn are made up to a large number of high-speed MOSFETs isolated each other connected in series. The rise and fall times at the switch output are virtually the same and that allow generating an extremely precise, high-voltage, true square-wave pulses.

Applications:

- Replacement of thyratrons, ignitrons, cold cathode tubes, electron tubes, spark gaps and electromechanical high-voltage relays
- Pulsed particle accelerator/deflection
- Mass spectrometry & high energy physics
- Radar and microwave modulation
- Laser electronics and electro-optics
- Medical shock wave generators

1,000V – EDR83915

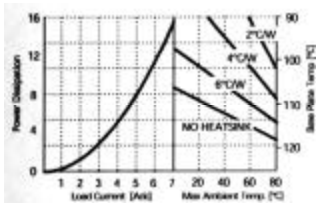
Input Specifications:

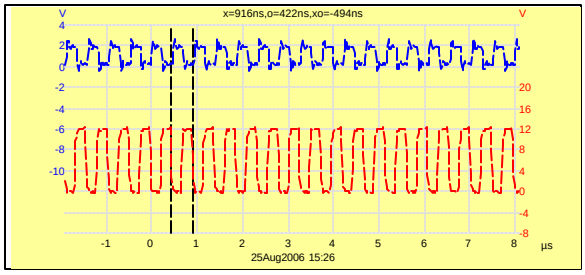
Input Control Voltage (pin 4)	see page #21
Nominal Current	110 mA/5VDC
Power Supply +Vcc (pin6)	see page #21

Output Specifications:

Operating voltage range (Vop)	0V -- 1,000 VDC
Maximum continuous current	1.2 Arms rms
Maximum surge current (IDM) - 0.1mS	40 A
Continuous current (ID) - Pulsed	10 A
Maximum on-state resistance	1.10 Ohm
Rising time	18 nS
Delay-on time	200 nS
Falling time	19 nS
Pulse width range	70 nS to infinity
Maximum switching frequency	150 KHz

All specifications were giving without any heat sink at room temperature





Control

Load

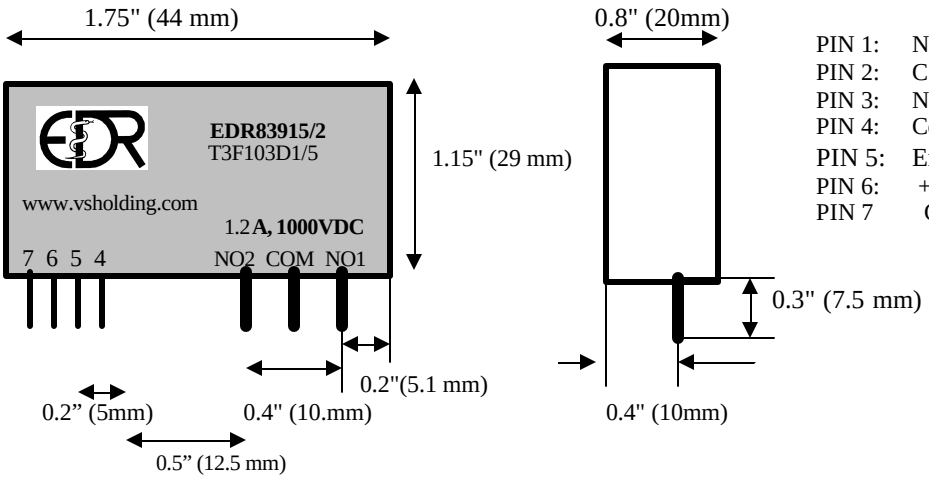
A sample of 2.00 MHz burst frequency

General Specifications:

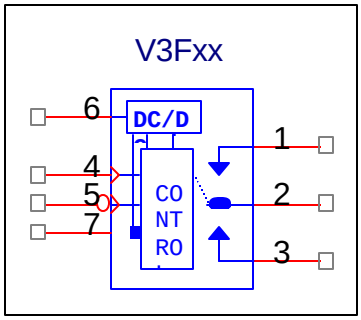
Ambient operating temperature range	-35^0 C to 85^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dielectric Strength input-to-output	3,000VAC

Mechanical Specifications:

Weight (oz)		.2
Encapsulation	Epoxies Etc.	50-2366RFR / 50-2366CFR



PIN 1: NO1
PIN 2: COM
PIN 3: NO2
PIN 4: Control Signal (CS)
PIN 5: Enable (EN)
PIN 6: + 5VDC
PIN 7 GND



All Dimensions are in inches (millimeters).

Dimensions for SIP7 package	1.15"H x 1.75"L x 0.8"W
Terminals/solder for SIP7 package	control - 0.20", power – 0.6"

Transient Protection: All loads are inductive, even ones that are not so obvious or labeled. An inductive load produces a harmful transient voltage, which is much higher than the applied voltage, when it is turned on and off. A SSR built with a MOSFET output acts as an ideal switch and can produce a seemingly "non-inductive" load, which can cause damage if not suppressed. A transient voltage suppressor, which is bi-directional for AC applied voltage and unidirectional for DC applied voltage, should be used to clamp excessive spikes.

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; e-mail: vsholding@vsholding.com

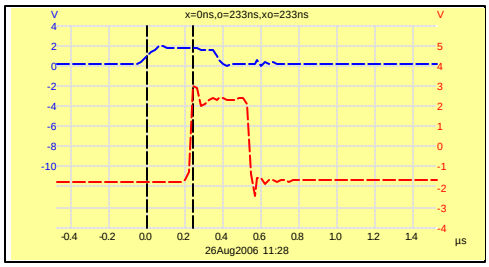
Input Electrical Characteristics (Ta = 25^{0}C) for T3F103D1/5, p/n EDR83915/2

Characteristic	Test Condition	Min	Typ.	Max.	Unit
Control Voltage, low level threshold			1.7		V
Control Voltage, high level threshold			3.3		V
Enable (EN) threshold (pin 5)			1.0	3.0	V
Input Current			0.3		mA

Input Electrical Characteristics (Ta = 25^{0}C)

Power Supply (pins 6), Vcc (200 mA maximum)	4.9	5	5.3	V
Maximum Vcc current at DC – 1.0 KHz		110		mA
Maximum Vcc Current at 150 KHz		200		mA

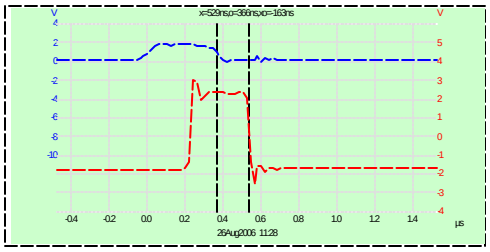
Switching test – +/-400V, Load – 400 Ohm & 1.0 A



Control

Load

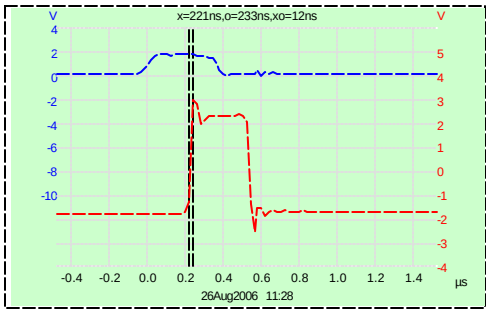
Figure 1 Turn-on delay is 233 nS



Control

Load

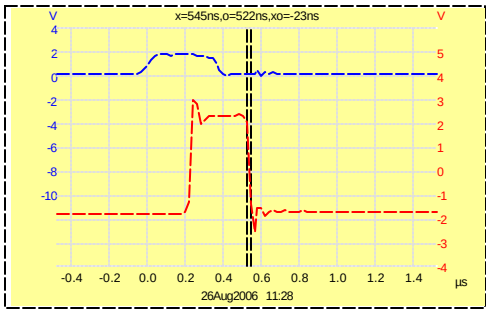
Figure 2 Turn-off delay is 163 nS



Control

Load

Figure 3 Rising time is 12nS



Control

Load

Figure 4 Fall time 23nS

FUNCTIONAL TABLE

EN	CS	NO1	NO2
L	X	OFF	OFF
H	2.5V	OFF	OFF
H	5.0V	ON	OFF
H	0V	OFF	ON

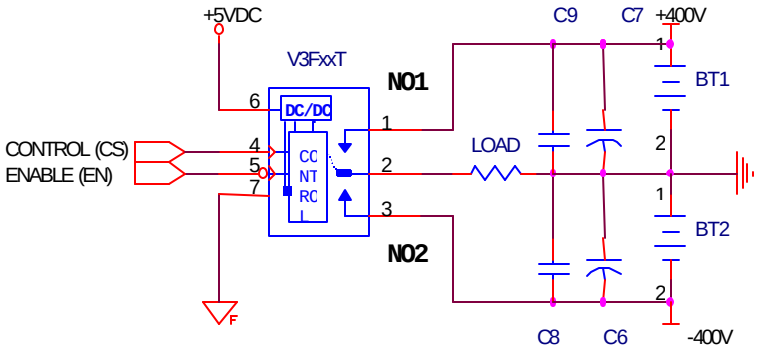


Fig. 5 Switching Time Test Circuit

A switch can be controlled via the enable (EN) input ("L"/"H"), if only + or - power needs to be applied on a load, or via the control (CS) when a bipolar power must applied onto the load.

Test Circuit for forming a fast rising/falling pulse

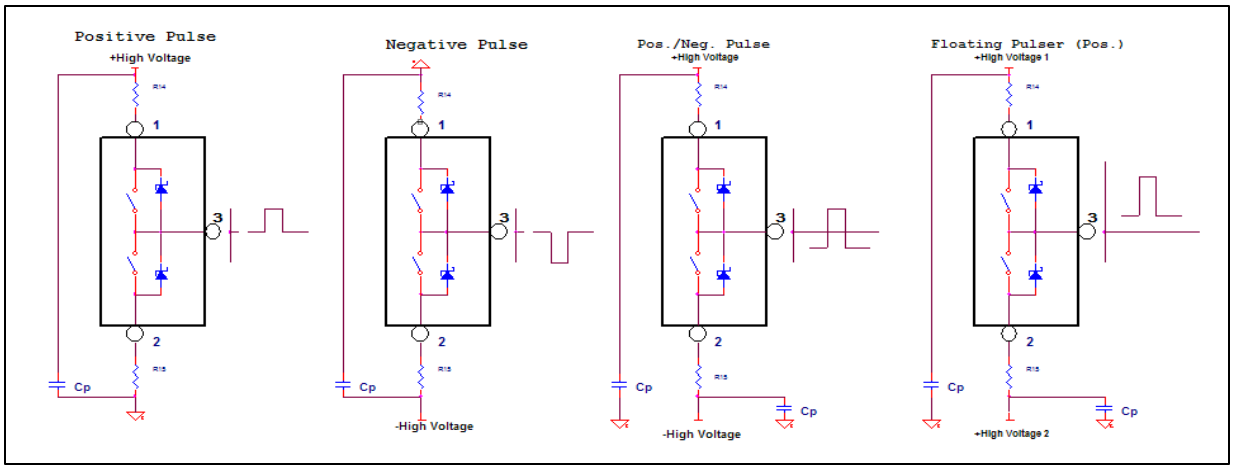


Figure 6 Basic application for generating various polarity pulses

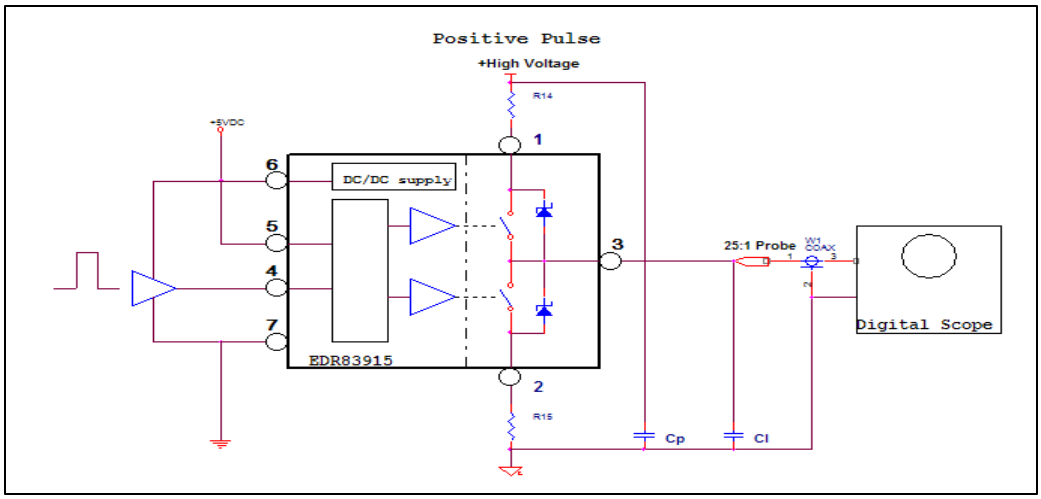


Figure 7 Test Circuit for generating a single polarity pulse

NOTES:

1. **Wiring should be as short as possible**
2. **Capa citor Cp should be at least 50 times of Cl for shortest transition times**
3. **Connected in series resistors R14 and R15 used for dumping and short protection. All measurements refer to 50 Ohm. According to a specific application, resistors can be between 0 (zero) and 1Mohm and should be selected the highest possible to avoid ringing.**
4. **A low impedance linkage between logic GND and earth is very important for interference free operation with a high switching speed.**

A sample of T3F- relays/switches for 1000V and high with similar specifications

Model Number	Package	Vop	Ir (A)	avg.	Id (A)	Idm (A)	Enb.	p/n
T3F102D03	SIP7	0V -- 1000VDC	0.3	M	2.9	10	Y	EDR82823
T3F102D03	SIP6	0V -- 1000VDC	0.3	M	2.9	10	N	EDR82822
T3F102A02	SIP6	+/-1000VDC (700VAC)	0.2	M	2.8	9	N	EDR82906
T3F102A04	SIP6	+/-1000VDC (700VAC)	0.4	M	4	12	N	EDR82901
T3F102D1	SIP6	0V -- 1000VDC	1.2	M	10	40	N	EDR82821
T3F102D1	SIP7	0V -- 1000VDC	1.2	M	10	40	Y	EDR83915
T3F152D04	SIP6	0V – 1500VDC	0.4	M	4	12	N	EDR82856
T3F152A04	SIP6	+/-1500VDC (1050VAC)	0.4	M	4	12	N	EDR82855
T3F252D01	SIP6	0V – 2500VDC	0.1	M	1	6	N	EDR82860
T4F252A01	SIP6	+/-2500VDC (1750VAC)	0.1	M	1	6	N	EDR82868
T3F252D2	SIP6	0V – 2500VDC	2	I	25	80	N	EDR82849
T4F402D1	SIP6	0V – 4000VDC	1	I	30	80	N	EDR82848

Please call for other parts, with a different voltage and current. We do not charge any set-up fee even if you would need a one switch if output MOSFETs could be use in the same design.

Electronic Design & Research
http://www.vsholding.com

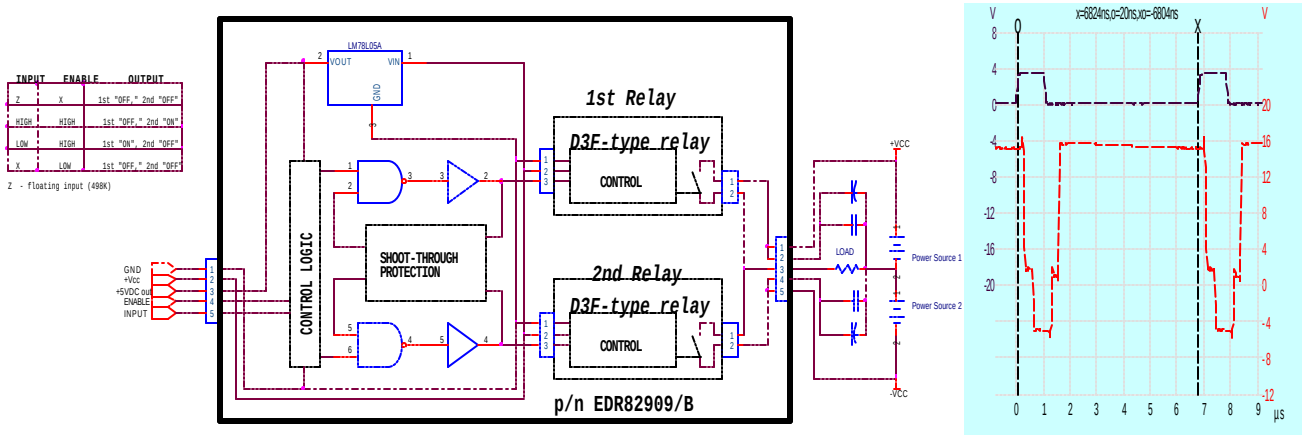
Technology for people's ideas

P/N EDR82909 is a fuzzy logic DIN-driver

Designed for D3G-, D3F- and D3S- families relays/switches

EDR's DIN-driver designed for various industrial applications and easy interfaced with a PLC, I/O cards and control switches. The DIN RAIL is especially useful with a high-speed Solid State Relay, and a high power analog switch applications, as a ½ or a full (H) bridge driver.

The EDR82909/B designed to driver two and EDR82909/F drives four of EDR's D3G- and D3F-types relays in a ½ and H-bridge (full bridge) configurations. It used as a powerful analog, high frequency switch to provide a break-before-make commutation. The EDR82909 is a high frequency driver and optimized to drive two or four Solid State Relays in the break-before-make synchronized sequences. EDR has made switches and the EDR82909 allows creating a 30 A rms driver. The EDR82909 also features a three-state PWM input will prevent a negative transient on the output voltage when the input is being shut down. The EDR82909 has the capacity to switch efficiently at frequency up to 800 KHz. The DIN RAIL has an internal logic circuitry that prevents shoot-through current even at a high switching frequency. A dead time is adjustable by two capacitors, one of each cycle. The timing could the same or different based on the value of each capacitor to meet variety applications and R&D.



Simplified schematic of the EDR82909/B and a load hook-up in a ½ bridge driver application

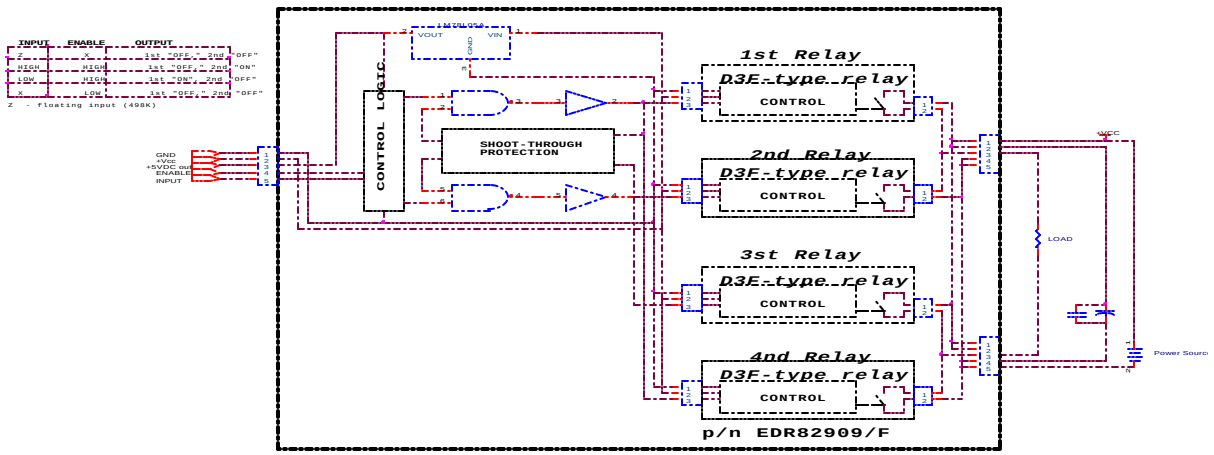
Product Highlights

- Drives two (EDR82909/B) and four (EDR82909/F) EDR's made D3G and D3F- types Solid State Relays/Switches
- Electrical isolation input/output is 3000V or 5200V
- Switching frequency DC to 800 KHz
- Switching current from 0A till 30A rms
- Switching voltage from 0V till 2500 V
- Duty cycle: 0.. 100%
- Input and enable inputs are low power, CMOS
- Shoot-Trough Protection
- Three-State PWM Input for Power Stage Shutdown
- Non of relays activates when the input if floating
- A single power supply
- Matching Delay Between Inverting and No-inverting outputs
- Fussy logic or a three-state input allows easy control of either relay
- The enable can be use for PWM and shot-off
- The input can be use to indented control of either relay
- Add-on p/n EDR82915 allows a precise output power control

Applications

- Inverters
- A low cost Motor driver
- Converter
- Power engineering
- Laser driver and radiology
- RF power driver
- Analog switch
- Power Switching
- Power-Supply Modules
- ½ bridge and full-bridge driver
- Formatting a bio-polar pulse
- Assembling a SPDT and a dual SPDT configuration

The DIN-driver as a full-bridge driver with four EDR's relays



Simplified schematic of the EDR82909/B and a load hook-up in a full-bridge driver application

Functional Pin Description

GND (pin 1)

GND is the ground pin. All control signal and power supply to relays are reference to this node.

Vcc (pin 2)

Connect the Vcc pin to a + of a bias supply. The Vcc depends on what type of relays being used. It could be 5VDC or 12VDC.

+5VDC output (pin 3)

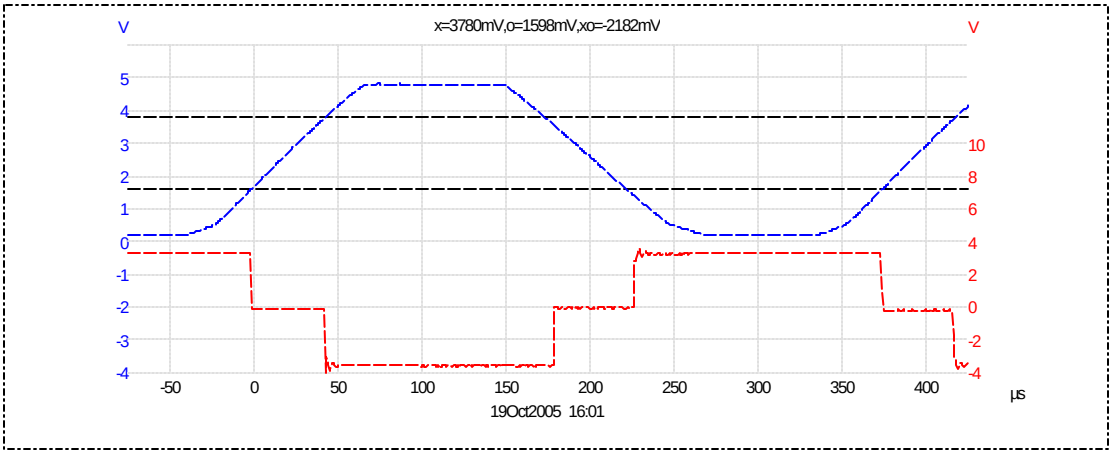
The +5VDC is the output from an internal voltage regulator when +12VDC applied onto Vcc (pin2). It is a low power source and can be used only for external applications. An aggregated load current cannot exceed 50 mA. There is no limit set for the current if Vcc (pin 2) is 5VDC because it passed through.

Enable (pin 4), the low threshold is 1.0V and the high is 2.0V

It is a dual use control (enable) input. Connect this pin to HIGH (+5VDC) or left unconnected to enable the DIN-driver. The LOW is disabled the driver. This input can be use for PWM applications.

INPUT (pin5), from 1.7V to 3.3V is off

The INPUT is the fuzzy or three-state input and controls output relays. An applied signal can enter three distinct states during operation, 0V to 1.7V, 1.7V to 3.3V and 3.3V to Vcc, as it shown on the voltage diagram below. This input can be used to reverse polarity (direction) of a DC Motor.



Voltage-timing diagram of the INPUT signal (top) and relays output (bottom), for demonstrating purpose slopes of the input signal set to a slow rise and fall transitions

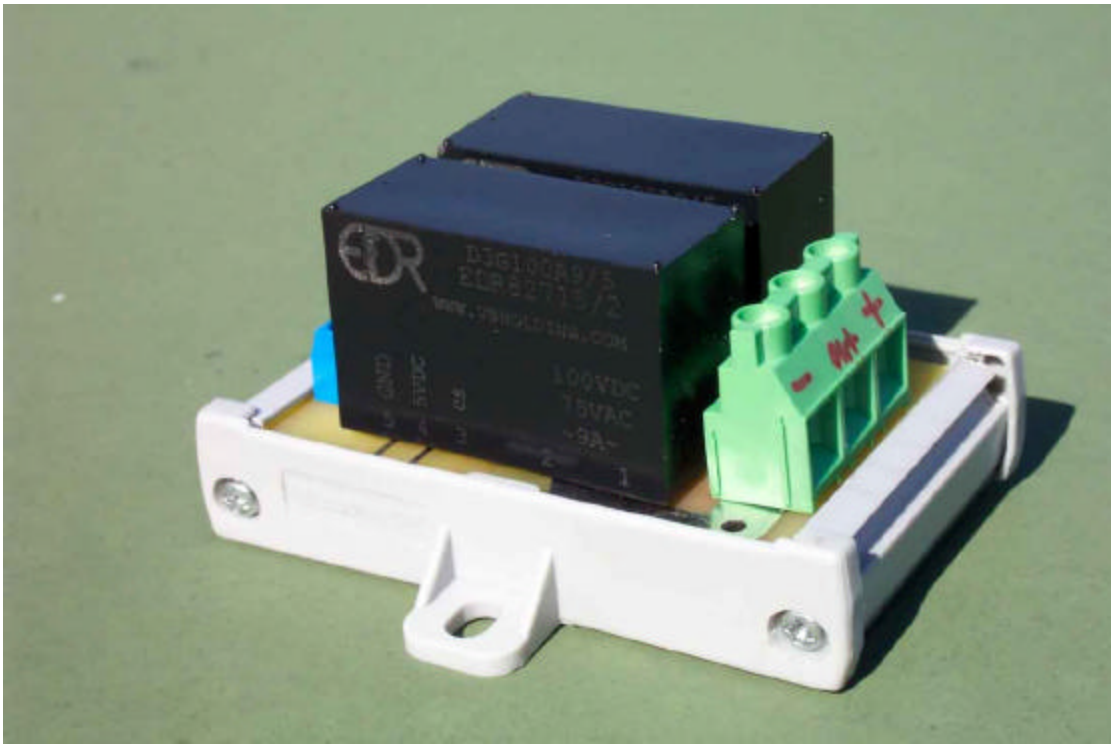
Ordering Information

EDR82909/V/XX

** replace “V” with “B” for a two relays to implement ½ bridge driver, and with “F” for a four relays to implement a full-bridge driver
** replace “XX” with a 05, 09, 12, 15, 24 or 48 with the required power supply (Vcc). The power supply has to be chosen by the type of relay to be installed on the DIN-driver.

Recommended Operating Conditions

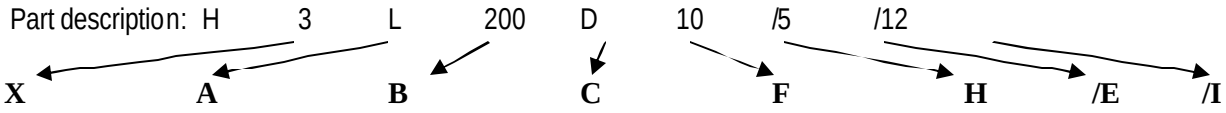
	MIN	TYP	MAX
Supply Voltage, Vcc for EDR82909/V/05		5VDC +/-5%	
Supply Voltage, Vcc	depended on the module	XX +/-10%	
Supply Current Icc, mA	(no relay installed), Vcc=5VDC		1.0
Ambient Temperature Range		-10°C to 90°C	
Input (pin 5) mA		0.25	
The first threshold (pin 5), V			1.7
The second threshold (pin 5), V	3.3		
Enable (pin 4), LOW threshold, V	1.0		
Enable (pin 4), HIGH threshold, V			2
Shoot-Trough Protection, adjustable and set by two capacitors, for 200pF		0.324 µS	



Two D3G-type relays mounted on the EDR82909 for a high frequency chopping

Selection and Ordering Instruction for EDR's made Solid State Modules such as Relays, Switches, Breakers, ½ and Full-bridge Drivers, etc.

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



H-Driver size = Speed "L" = low Voltage = 200V Current = DC Current = 10A CS=5V Vcc=12V

"X" module type

D	Solid State Relay, SPST-NO and SPST-NC switches
T	Driver, such as ½-bridge or a SPDT relay which can work as a ½ driver
M	Driver, such as a switch with 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 brakes control modules

"A" package dimensions

1	0.615"H x 1.48"L x 0.290"W
2	1.15"H x 1.75"L x 0.4"W
3	1.15"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, 0.82"H x 2.7"L x 2.0"W
8	DIN type enclosure, 2.36"H x 2.36" x 1.5"W, for 35mm DIN Rail
9	10" x 8"
P	panel mount, 2.275" x 1.75" x .8"

"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 replace with 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 can be calculated by multiplying a maximum allowed voltage by factor of 0.7

"F" A relay can be use 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

A maximum current limited to a size of the enclosure (box). We can produce a device for any required current in a customer enclosure.

"I" Some of our products use an internal DC/DC converter no provide a 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, as 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 represented at the end of part number in the following way, for an example EDR82653/1 and EDR82653/8. Both relays are almost the same and difference is only an applied control voltage, "1" if for 3VDC and "8" is for 18-38VDC;

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

"Z" A relay/switch built with 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

Electronic Design & Research Inc. ** 7331 Intermodal Dr. ** Louisville ** KY 40258
Tel: 502-933-8660; Fax: 502-933-3422; Sales: 800-336-1337; website: http://www.vsholding.com; e-mail: info@vsholding.com