Electronic Design & Research
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Technology for people's ideas

NanoSeconds rise/fall time, 4000V push-pull switche

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

4,000V – EDR82848

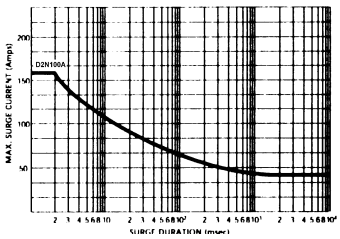
Input Specifications:

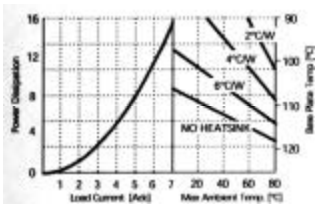
Input Control Voltage (pin 4)		see page #2
Nominal Current		1.0mA/5VDC
Power Supply +5Vcc (pin6)	current	170mA/at 100Hz

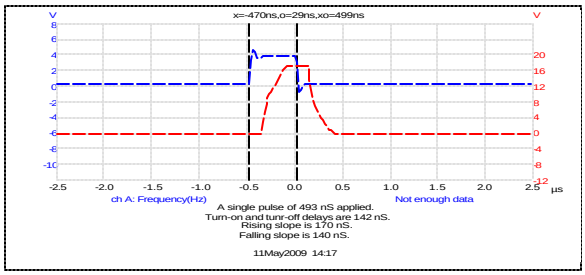
Output Specifications:

Operating voltage range	(Vop)	0V -- 4,000 VDC
Maximum continuous current		1.2 Arms rms
Maximum surge current (IDM) – 1.0mS		100 A
Continuous current (ID) - Pulsed		20 A
Vce(sat), I = 30A,	(max)	3.1V
Rising time		150 nS
Delay-on time		180 nS
Delay-off time		130 nS
Falling time		150 nS
Pulse width ranges		from DC to 500nS
Maximum switching frequency		100 KHz at 1000VDC

All specifications were giving without any heat sink at room temperature







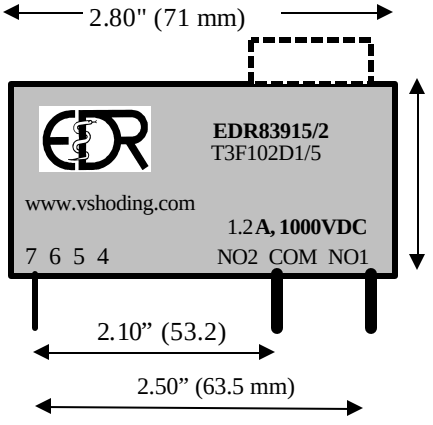
A sample of a single 493 nS pulse

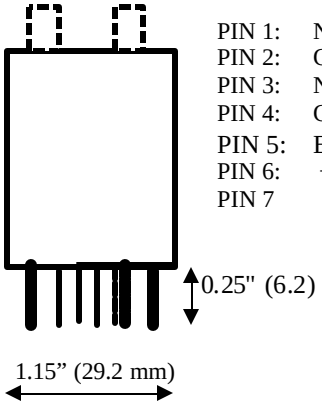
General Specifications:

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	6000 VDC

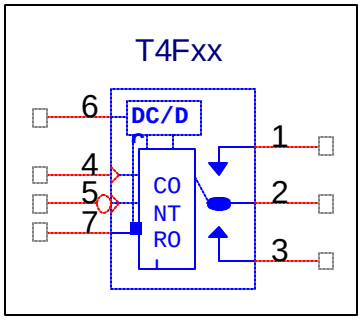
Mechanical Specifications:

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





PIN 1: NO1 (+V)
PIN 2: COM
PIN 3: NO2 (-V)
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 2.80"L x 1.15"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.

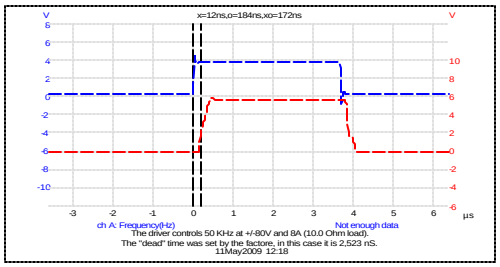
Input Electrical Characteristics (Ta = 25^{0}C) for T3F402D1/5, p/n EDR82848/5

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 (800 mA maximum)		4.9	5	5.5	V
Maximum Vcc current at DC – 1.50 KHz			180		mA
Maximum Vcc Current at 200 KHz			320		mA

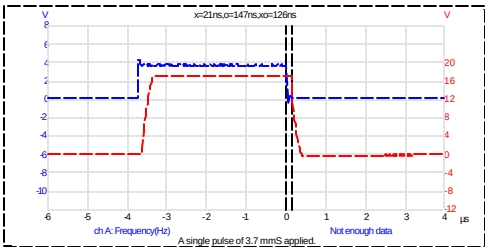
Switching test 1,700VDC, Load – 1000 pF



Control

Load

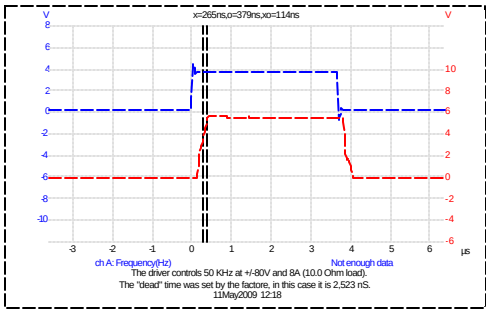
Figure 1 Turn-on delay is 173 nS



Control

Load

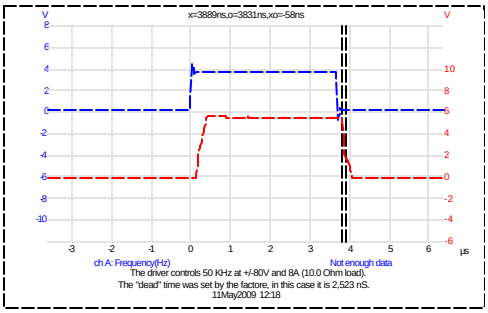
Figure 2 Turn-off delay is 126 nS



Control

Load

Figure 3 Rising time is 114n S



Control

Load

Figure 4 Fall time 58n S

Figure 3 Rising Time is 144 nS

Figure 4 Fall Time is 144 nS

FUNCTIONLA TABLE

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

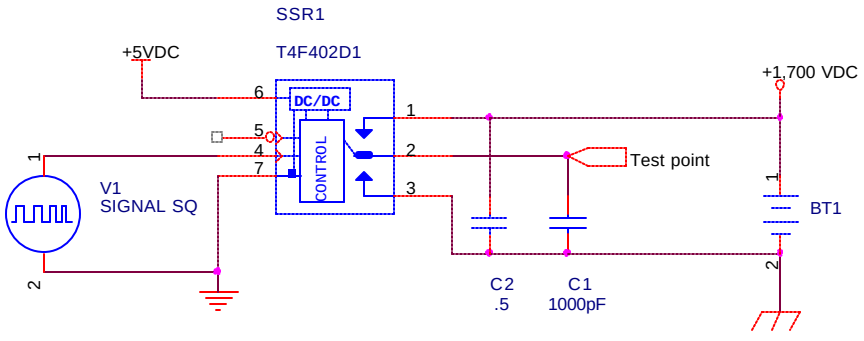


Fig. 5 Switching Time Test Circuit

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

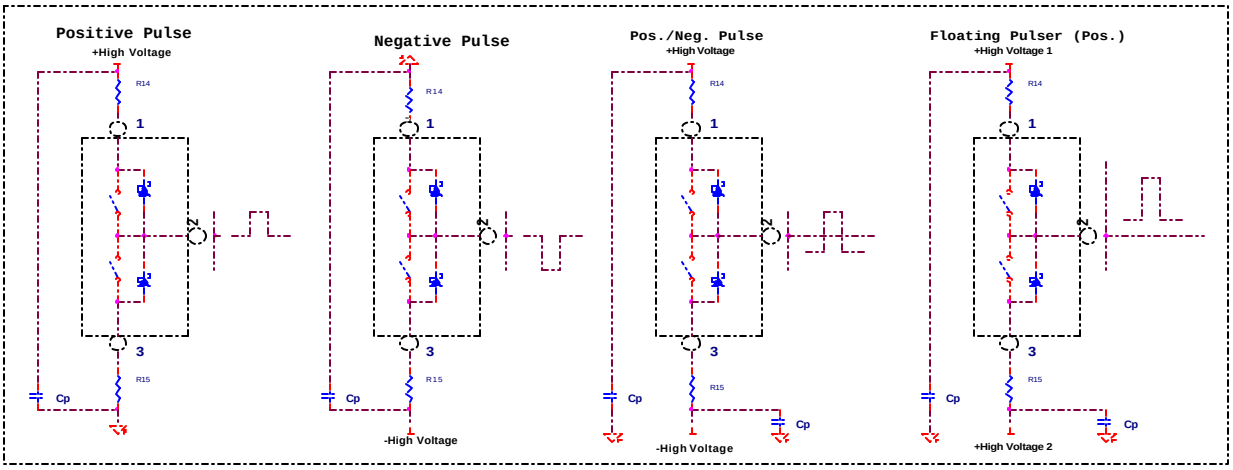


Figure 6 Basic application for generating various polarity pulses

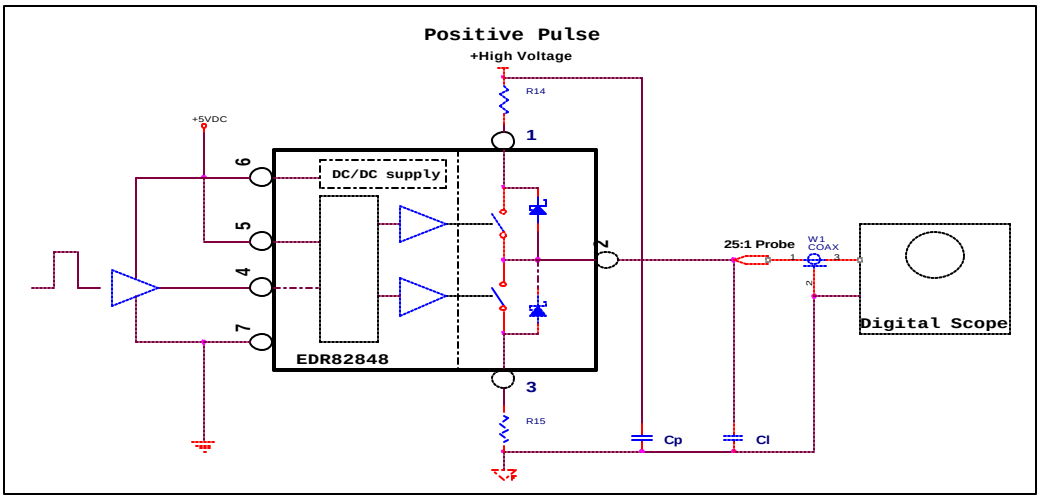


Figure 7. Test Circuit for generating a single polarity pulse

NOTES:

1. **Wiring should be as short as possible**
2. **Capacitor 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

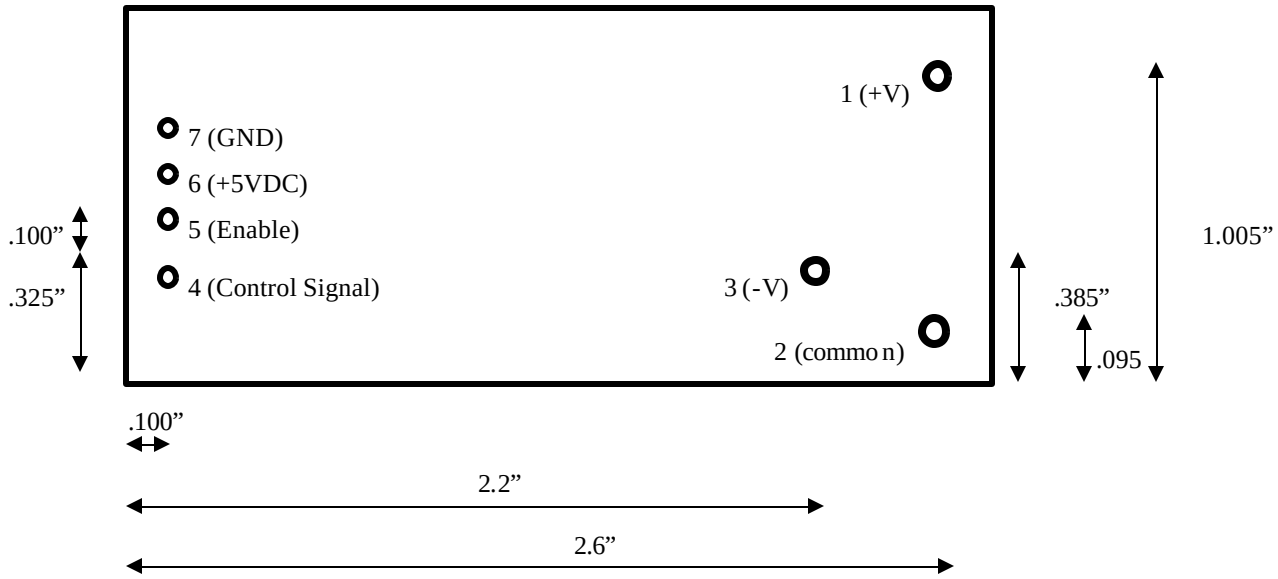
Model Number	Vop	Ir (A) avg.	Transistor	Id (A)	Idm (A)	Enb.	p/n
T4F102D03	0V -- 1000VDC	0.3	MOSFET	2.9	10	Y	EDR82843
T4F102D1	0V -- 1000VDC	1.2	MOSFET	10	40	Y	EDR82844
T4F152D04	0V – 1500VDC	0.4	MOSFET	4	12	N	EDR82845
T4F252D01	0V – 2500VDC	0.1	MOSFET	1	6	N	EDR82846
T4F252D2	0V – 2500VDC	2	IGBT	25	80	N	EDR82847
T4F402D1	0V – 4000VDC	1.2	IGBT	20	100	Y	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.

Here are some of our high-voltage, fast switches

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
T3F252D2	SIP6	0V – 2500VDC	2	I	25	80	N	EDR82849

Pins-out of the p/n EDR82848 and others of that family (view from the bottom)

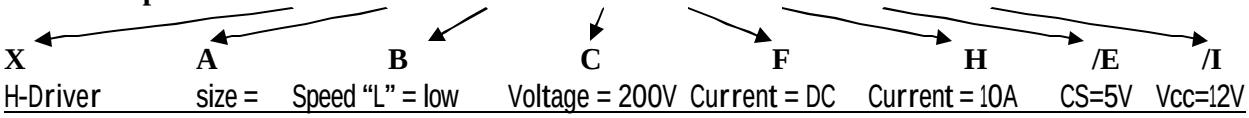


We recommend having at least .5” space between the switch and other surrounding subjects.

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).

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, 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, 15, 24, 48, 3-20 and 18-38 that is for 3VDC, 5VDC, 12VDC, 15VDC, 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		
15VDC	0	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

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