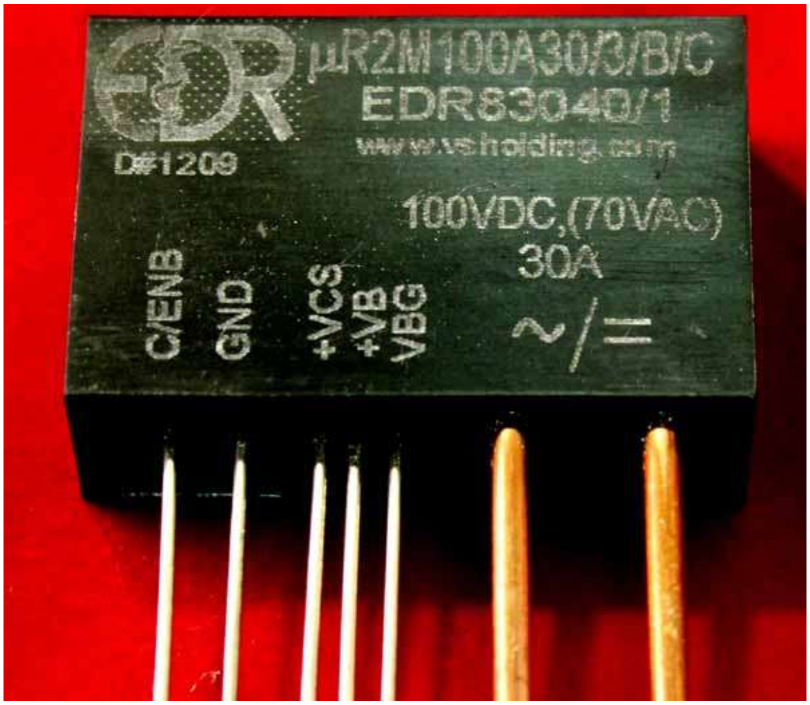
Micro-Power Consumption μSPST-NC (1 Form B) and μSPST-NO (1 Form A) Solid-State Relays for VAC/VDC applications



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

Piezo Drivers
Video Switches
½ Bridge drivers
Cardio Stimulator
Q-type high-pass filters
Precision F-to-V converter
Super-High Resolution EKG
Soft-Landing Solenoid Drivers
50Hz/60Hz Comb Notch filters
H-bridge or Full-bridge Drivers
Super-high Power, Fast Switches
High-power, high-speed Switches
Universal Analog Building Module
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
μ-Power SPST-NC and SPDT-NO Solid-State Relays
Single Pole, Single Trout Relays and Switches, (SPST)
Neutral-cell Multichannel signal processor, US Patent
Power-distributing module for Motorcycles, US Patent
Single Pole, Double Trout Relays and Switches, (SPDT)
Double Pole, Single Trout 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 a low and high impedance sources
μ-control, High-Power SPST-NC, normally closed relays, US Patent

We are working hard, bringing new devices to the market to meet your requests. Above is an incomplete list of the family of devices we have developed and are manufacturing. Most of them are covered by propriety technologies and some of them are so unique and protected by US patents. We keep a small number of popular devices in stock and are ready to ship them on demand. Our production capacities exceed 10,000 devices per month when two production robots are programmed and working at a full speed.

For your unique application that requires a different voltage, current or speed, ordering instructions (on the last page) could be useful in creating a new part and for summarizing what you need. Do not hesitate to send us an email: info@vsholding.com asking for additional information, delivery schedules and/or prices.

Families of μSPST-NC and μSPST-NO relays with ultra-low input power consumption

For years, electromechanical relays have been used in a wide variety of power control electrical applications. Though these mechanical devices, which are built of a coil and contacts, have demonstrated considerable reliability, they suffer from the problems associated with having moving parts. Material fatigue shortens the life span of mechanical relays, and reliability suffers due to shock and vibration. A mechanical relay is subject to arcing and sparking, contacts bouncing, and in applications where it is required to switch a high DC voltage, the cost of a mechanical relay grows very rapidly. The coil switching leads to voltage spikes or fly-back voltage. A coil-operating device requires plenty of power to operate properly and not available for a high power, high switching frequency. Some relays require much more power for energizing their coil. Such a high waste of power has prohibited using many electromechanical relays in modern electronic devices where only a few milliwatt of power is available. Since semiconductor devices started flourishing, and their cost has decreased, solid-state relays became a valuable alternative to electromechanical. Only electromechanical relays with normally closed terminals continue to be king, because a solid-state relay with normally closed (SSR-NC) terminals suffers of production costs. While it was possible to build a SSR-NC with comparable ratings (high current and voltage) using a large number of depletion mode MOSFETs (D-MOSFET) or J-FET, the extremely high cost and large size of such components made it generally impractical.

In 2010 Patent No. US 7,755,414 granted titled by "Very Low Power Consumption Sold State Relay." It describes the techniques for making solid-state relays with normally closed and normally open terminals that need only a few milliwatts to operate. Thousands of devices have been built since that time, and they are operating successfully in portable devices around the world. A solid-state relay with a normally closed terminals (SPST-NC) rated at 100VDC (72VAC) & 30A assembled in 1.75" H x 1.80" L x 0.6" W required only 5 mA at 3.6 V (18-mW) for switching 3-kW.

That was impressive for a while, until we were confronted with demanding requirements for lowering power consumption, needs for higher switching frequency and increasing device longevity. Newly designed μSSR has met those challenges. A μSSR rated at 100VDC & 30A or 3-kW required only 0.4mA at 2.4V or just 0.96 milliwatt for its normal operation. That is almost 20 times improvements over the previous technology. The extremely low power consumption μSSRs as a μSSR-NO (normally open) and μSSR-NC (normally closed) relays are valuable addition for modern portable and handhelds devices.

A PC board designed for accommodating most available MOSFETs on the market. That means you can ask for a device to meet your rating requirements, even if we have not listed it yet. There is no additional fee for a accommodating your specific requirements in any of our already developed and manufactured devices unless some modifications would required.

The μSSR's combined unique design and functionalities surely contributed in delivering outstanding performances, which all those has encouraged us filing a Patent application.

Thank you,

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V_Shvartsman@vsholding.com

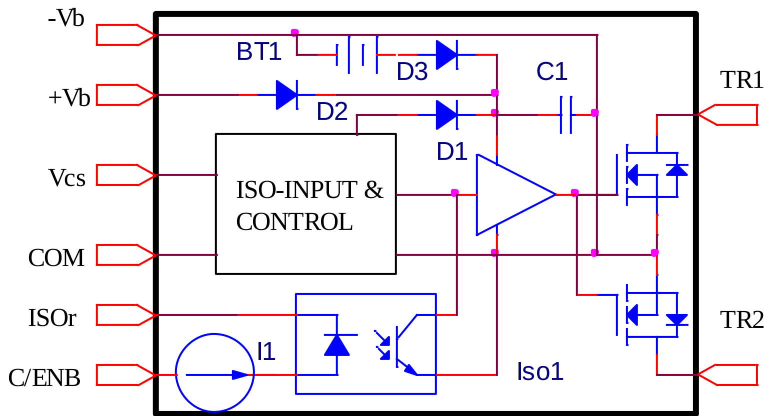


FIG.1. Simplified diagram of the micro-power Solid-State Relay, µSSR

(SPST-NC relays with the ISOr connected to the COM internally have no a terminal the ISOr)

DESCRIPTION

The FIG.1 shows a block-diagram utilized for assembling SPST-NO (normally open) and SPST-NC (normally closed) solid-state relays (SSR). Uniquely designed circuitry makes possible manufacturing devices consuming an extremely low power thus creating a new family of a micro-power consumption solid-state relays (µSSR). The µSSR is a robust, low-power device, ideally suited for portable and remote industrial and defense-related applications. It's a dual-control versatility will meet requirements in many new designs and is best for replacing power-hungry electromechanical relays. Both a SPST-NO normally open relay (1 Form A) and a SPST-NC normally closed relay (1 Form B) are manufactured having differences only in the output MOSFET's driving circuitry. It is a hybrid design. A PC Board that was made for accommodating control components and most popular power MOSFETs allows manufacturing hundreds of various relays. The µSSR comprises a transformer coupled 3,000 V isolation DC/DC converter for delivering a control signal and energy for driving output MOSFETs. Non-tapped primary drives in a push-pull fashion, by pulses from a pulse-frequency modulated (PFM) generator. Derivatives of an input signal control its frequency. It is rather high from the beginning of input pulse and about a half of millisecond later decreases and stays steady until the pulse has ended. The DC/DC converter delivers, highly efficiently, about 13 VDC from 3.0 V/300 µA for driving high-power MOSFETs at about 60 mS chopping rate. More current is required for a higher switching frequency. In addition, it employs current-limiting circuitry, which meets lightning surge testing as per ANSI/TIA-968-B. Other regulatory voltage surge requirements and overvoltage protection is provided.

Table 1. Lead (terminals) Definitions

In/Out	Symbol		Description
INPUT	Opt. "B"	-Vb	Low side (-VDC) of external (floating) power source
INPUT	Opt. "B"	+Vb	High side (+VDC) of external (floating) power source
INPUT		Vcs	Control signal or high side of power supply (Vc + Vs)
INPUT		COM	Control signal return or low side of power supply
INPUT	Opt. "I"	ISOr	ISO control signal return, low side
INPUT	Opt. "C"	COM + ISOr	COM internally connected with ISOr
INPUT	Opt. "I"	C/ENB	ISO control signal, high side
OUTPUT		TR1	Load or Vss (VDC or VAC)
OUTPUT		TR2	Load or Vss (VDC or VAC)

TERMINALS FUNCTION

The μSSR was designed with two controls (Vcs and C/ENB) with various applications in mind. The main control (Vs/Vc) devised for carrying two functions. It can be used (1) as a power input (Vc) and as an input control signal (Vs) or (2) just as a power input. If such option was selected, C/ENB input terminal is used for an input control signal. Selection one option over another is based on needs for a switching frequency and allowed power to waste. At low switching frequency, lesser then ten times per second, a μSSR can operate with a lesser than 150μW and still be able to switch 3-kW.

The most popular and simplest hook-up is using the Vcs input for a control input signal and a power supply. The current consumption is less than 400μA at 2.4VDC at about 100Hz and it automatically adjusted when more energy is needed for switching at a higher frequency. A current consumption increases almost linearly to 2.5mA at about 1,000-Hz.

In cases when a source for the Vcs cannot provide enough power, additional power can be supply via input terminals –Vb and +Vb. Any isolated power sources, such as a battery, a DC/DC converter, solar cell, etc. that generates any voltage from 7VDC to 15VDC and delivers at least 20 microamperes current can be utilized.

Low power ISO input is usable for various applications. It can be used as an isolated input for an emergency, disabling the Vcs. If a relay is manufactured as normally open (SPST-NO), the output stops conducting once a control voltage is applied onto the ISO, regardless of whether a control voltage is present on the Vcs or not. By the same token, the ISO can be used for controlling the output if the Vcs are engaged as a power source. If a relay assembled as normally closed (SPST-NC), the output starts conducting once a control is applied onto the ISO, regardless of whether the Vcs is activated or not. The ISO input is used for assisting the Vcs recharging of an energy-storing capacitor C1 and/or internal and external batteries.

Output terminals (TR1 and TR2) are made of 0.1" diameter pure copper for a high current flow and all input pins are made of 0.05" diameter copper. A SIP-8 package is designed for mounting on a PC Board.

Both SPST-NO and SPST-NC relays are essentially the same, with a few minor differences. The SPST-NC contains an internal battery and a MOSFET driver that is designed slightly differently. Most of the energy for driving MOSFETs and maintaining their states comes from the capacitor C1. During the driving of MOSFETs, a significant amount of energy is wasted that is restored (recharged) during the first half of millisecond while an input control signal lasts. The internal battery isn't required for a normal operation. It is installed for maintaining the output state for years-long idling.

Reliability and life expectancy of the μSPST device is extremely high. A single vulnerable place could be considered the output or powerful transistors, and if good protection is installed, the μSPST should function forever.

Both, SPST-NO and SPST-NC are encapsulated in a small 1.75" H x 1.80" L x 0.6" W plastic boxes, as a SIP-8 for a PC Board mounting. Other packages are available also.

ORDERING INSTRUCTION

For a μSSR SPST-NO	**μD2M vvv**	**X**	**cc**	**/c**	**/b**
For a μSSR SPST-NC	**μR2M vvv**	**X**	**cc**	**/c**	**/b**

"vvv" must be replaced with a number representing a maximum output voltage,
"X" must be replaced with "A" for AC/DC voltages applications, or
must be replaced with "D" for DC voltage applications, and
"cc" must be replaced with a number representing a maximum output current for continuous (rms) operation.

For an example: μ**R2M100A30/B/C** is a SPST-NC (normally closed) relay, rated at 100VDC (72VAC) & 30 A.
/b is for a relay that has two extra pins for connecting it to an external battery, and
/c is for a relay that has an extra pin for the C/ENB input control.

μSSR SPST-NO (normally open) and SPST-NC (normally closed) relays

The μSSR is uniquely designed, having an input circuitry that is identical for SPST-NO and SPST-NC relays. That advantage can be realized during the development and production of new applications. An R&D engineer would only need to learn once how to use both devices the best way. Schematic and ratings for the input circuitry are the same for both devices.

Table2. ABSOLUTE MINIMUM/MAXIMUM RATINGS (T amb = 25^{o}C, unless otherwise specified)

		Minimum	Maximum	Unit
+Vb	Flouting power source (voltage)	6	17	V
+Vb	Floating power source (current)	0.010	20.0	mA
+Vcs	Control signal (voltage)	2	6.0	V
+Vcs	Control signal (current)	0.230	8	mA
C/ENB	Input voltage	1.8	40	V
C/ENB	Input current	0.07	1	mA
ISOr	Reverse voltage		50	V

Note: Applying the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for an extended time would adversely affect reliability.

Table 3. TYPICAL MINIMUM/MAXIMUM RATINGS (T amb = 25^{o}C, unless otherwise specified)

		Minimum	Maximum	Unit
+Vb	Floating power source	7	15	V
+Vb	Floating power source	0.010	10.0	mA
+Vcs	Control signal (voltage)	2.2	5	V
+Vcs	Control signal (current)	0.230	5	mA
C/ENB	Input voltage	2	32	V
C/ENB	Input current	0.2	.5	mA
ISOr	Reverse voltage		50	V

Note: Typical values and characteristics of the device result of engineering evaluations. Typical values are for informational purposes only and are not part of the testing requirements.

There are some differences between SPST-NC and SPST-NO. It is mostly relating to a MOSFET's gate driver. Both types of relays are available with the same output voltage and current ratings.

Components of both devices operate at very low power consumption and, as a result, life expectancy is extremely long. Of course, good care should be taken in protecting output MOSFETs.

There is no shelf-life limit for SPST-NO (normally open) relays.

There is at least a five-year guarantied shelf life for SPST-NC (normally closed) relays. There is no limit in the life expectancy if the power is applied to the Vcs at least once for 1.0-mS during a 15-day period. Using an external battery extends that shelf-life expectancy accordingly.

Operation & Applications (page #1)

The µSPST (both types, SPST-NC and SPST-NC) allows implementing one of several modes of operation and a simplest of them we called a “direct-controlling mode of operation or a direct mode” As FIG.2 shows the direct mode, which is a similar to hooking up a regular electromechanical or solid-state SPST relay. The Vcs acts as a control input and a power provider. Two output terminals (TR1 and TR2) are for connecting a load and a power. It is an extremely efficient mode of control that required lesser than one milliwatt for a low switching rate.

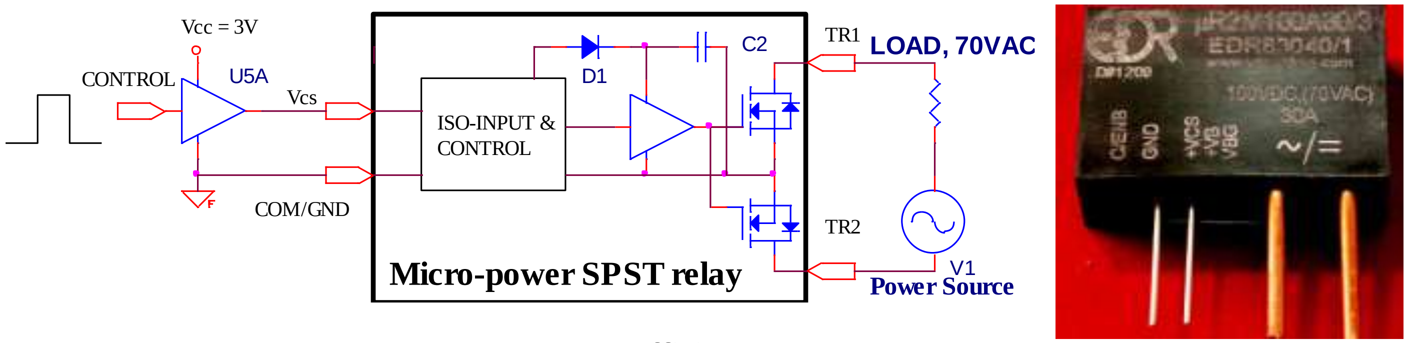


FIG.2. Most efficient µSPST’ hook-up

(A µSSR can be ordered just with four pins, two input terminals and two output terminals)

The basic hook-up of the µSPST allowing the most efficient control is shown on FIG.2. An input current consumption via the Vcs is very small and depends on switching frequency, and, of course, the output power rating. A high-power MOSFET required a measurable amount of energy for its driving. If a chopping (switching) frequency does not exceed a few times per second, the current consumption is about 0.4-mA and increases to 6-mA at 1000 Hz. There are some limitations related to PWM applications and specifically to the shortest possible pulse width. A pulse should be longer than 1.0-mS, which is how much time is required for charging capacitor C3 fully, at the main frequency of 100 Hz, and 1.0-mS is 10%. Increasing the Vcc to 5 V will somewhat extend the frequency range and allows for the application of shorter pulses. Further reduction of power consumption is possible by reducing Vcc to 2.4VDC and/or installing a resistor in series to the Vcs.

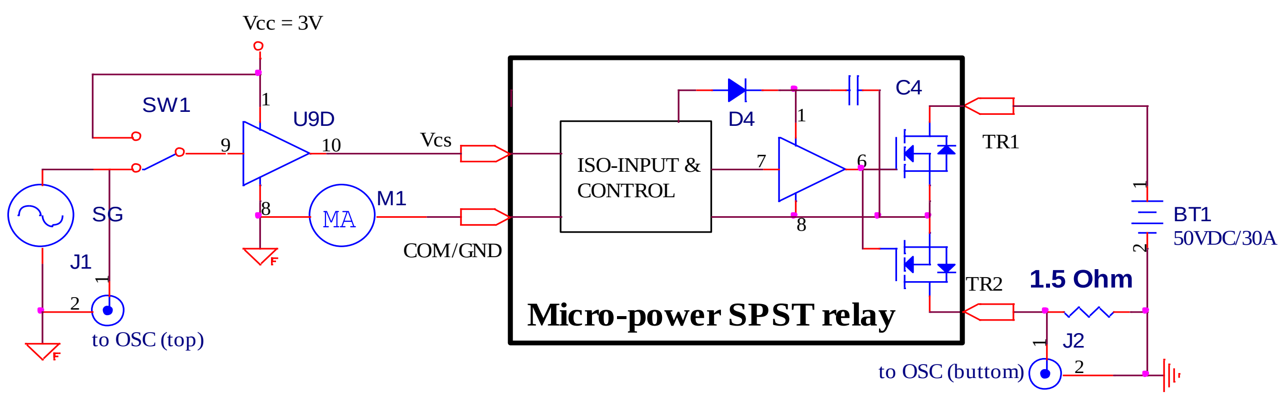
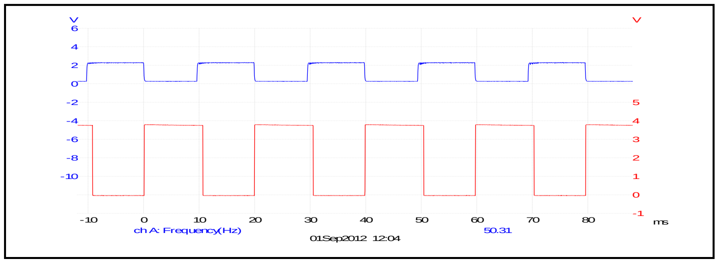


FIG.3. Hook-up diagram used for taking a current consumption measurements

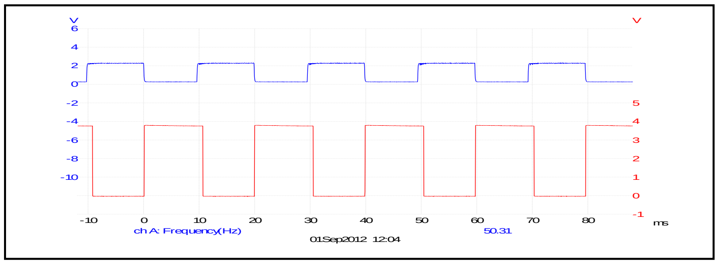
Application notes (continue, page #2), tests were performed with a µR2M100A30/2 relay

A µSPST consumes an extremely low power for its normal operation. Allowing a wide range of voltages to apply, from 2.0VDC to 5.0VDC, a maximum efficiency can be achieved. For a low switching frequency (less than ten switches per second), at Vcs = 2.0VDC, the current is only 240-µA (rms). That makes a µSPST relay power consumption of only 480-µW. Customers can select the optimum (maximum) efficiency depending on their particular application requirements.

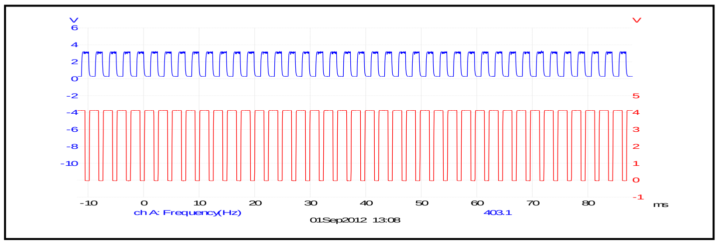
Vcs = 2VDC
Ib = 240-µA at 1.0-Hz
Fmr = 50-Hz (maximum)
Ics = 280-µA
P = 560-µW at 50-Hz



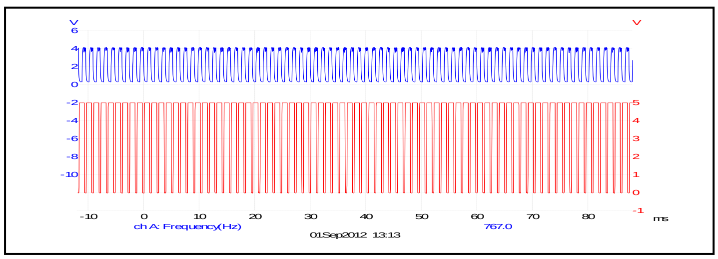
Vcs = 2.7VDC
Ib = 780-µA at 1.0-Hz
Fmr = 200-Hz (maximum)
Ics = 900-µA (rms)
Pw = 2.43-mW at 200-Hz



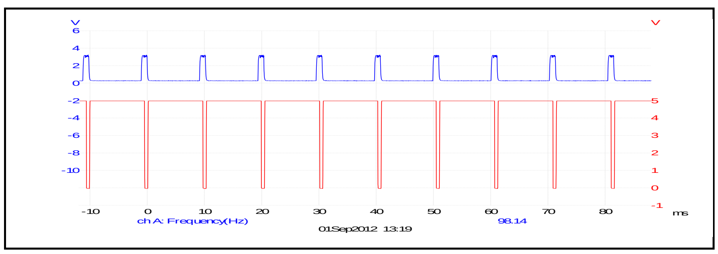
Vcs = 3.0VDC
Ib = 1.00-mA at 1.0-Hz
Fmr = 400-Hz (maximum)
Ics = 1.17-mA (rms)
Pw = 3.51-mW at 400-Hz



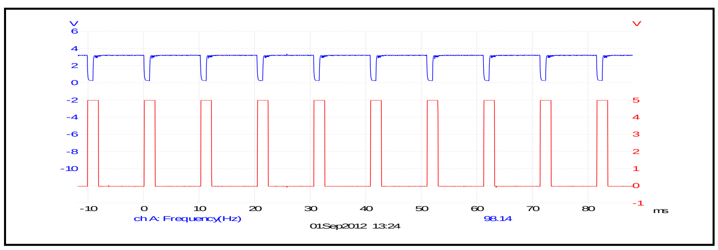
Vcs = 4.0VDC
Ib = 2.13-mA at 1.0-Hz
Fmr = 760-Hz (maximum)
Ics = 2.41-mA (rms)
Pw = 9.64-mW at 760-Hz



Vcs = 3.0VDC
Fpwm = 100-Hz (main frequency)
P = 9.0-mS or 90%
Ics = 290-µA (rms)
Pw = 870-µW



Vcs = 3.0VDC
Fpwm = 100-Hz (main frequency)
P = 1.0-mS or 10%
Ics = 1.39-mA (rms)
Pw = 4.17-mW (rms)



Application notes (continue, page #3)

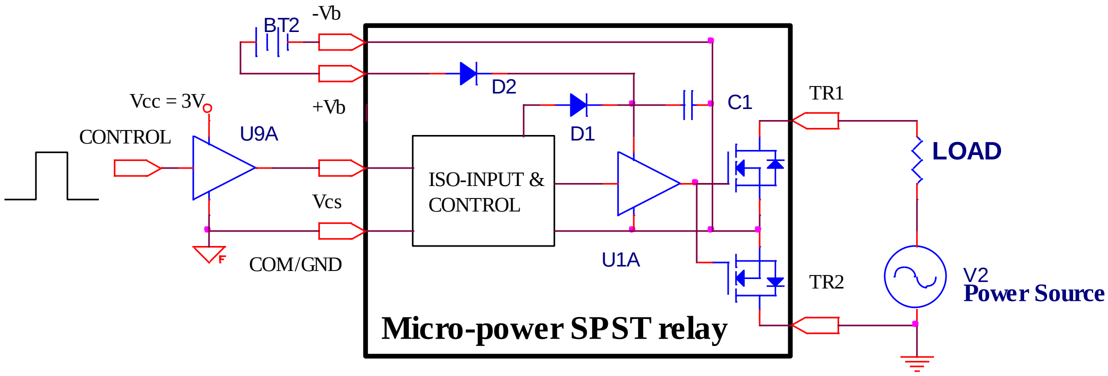


FIG.4. **Connecting an external battery for decreasing a current consumption**

The µSPST design considered means for decreasing and normalizing current consumption provided by a control signal (Vcs). As it shown in FIG.4, terminals –Vb and +Vb allows supply the MOSFET driver with necessary energy for fast switching, thus decreasing a current consumption from the Vcs. Any isolated source of energy such as a DC/DC converter, a solar panel, a battery that deliveries from 6 V to 15 V can be used. A current flow is rather small. It is depending on a frequency of switching, reaches several milliamps in the most demanding regime. An external power source will keeps the capacitor C1 charged and that decreases a current flow to the Vcs and further improve its switching performance.

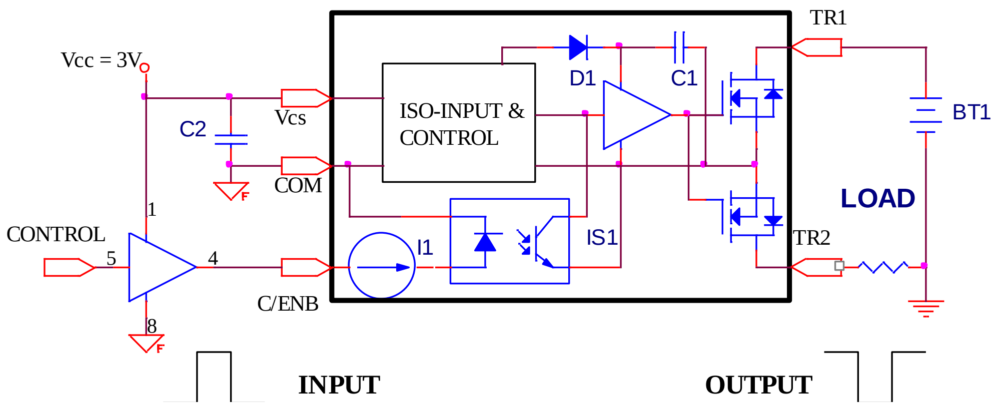


FIG.5. **A hook-up for higher frequency applications**

In cases when a higher switching (chopping) frequency is required and more energy is available, the µSPST meets that challenge by applying a control signal via the C/ENB, as it shown on FIG.5. It should be understood that the µSPST is a low-power consumption device and it wasn't designed for a high-frequency applications. EDR Inc/VSholding LLC manufactures vast varieties of devices, including switches for megawatts of power in nanoseconds. As it is shown on FIG.5, the Vcs inputs are dual-purpose terminals. They can control the relay's output and in cooperation with the C/ENB input; the Vcs can be used for providing power to the relay.

Attention must be paid to the fact that if the C/ENB is used as a control, an output signal is presented in the opposite phase.

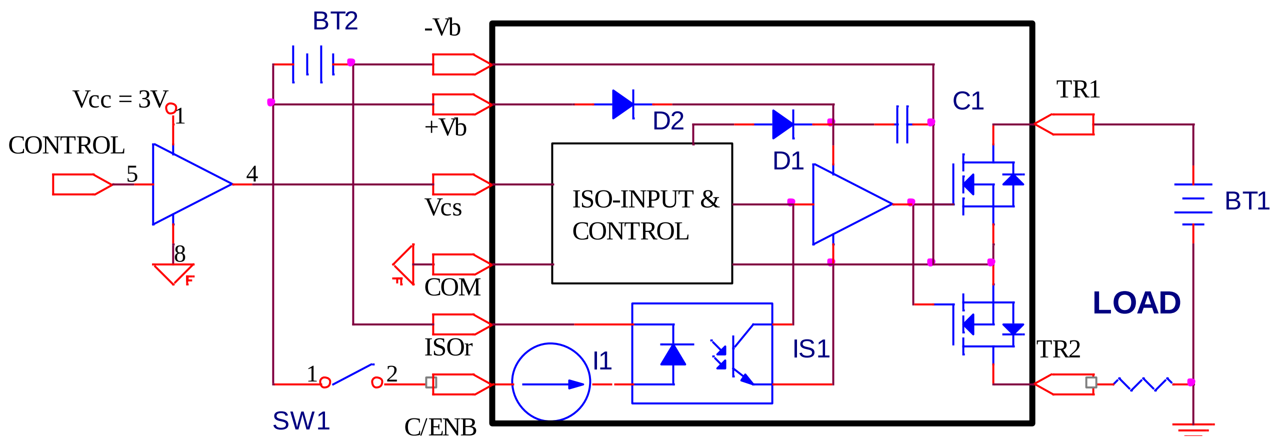


FIG.6. The C/ENB as an emergency control disabling input

The C/ENB input can be used for remote emergency disabling the Vcs. A switch SW1 or any other similar device once activated will shut the driver U1 input via the IS1 and, as a result, the output MOSFETs will remain OFF in SPST-NO and ON in SPST-NC relays.

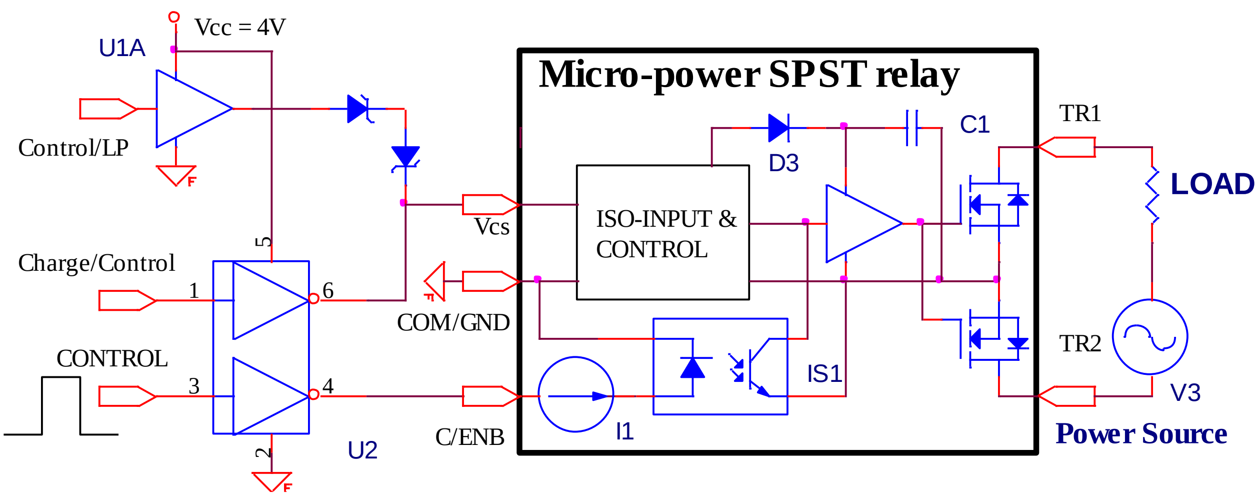
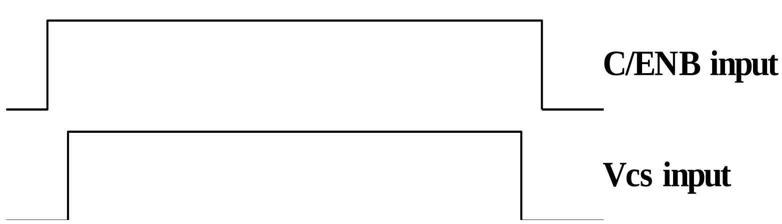


FIG.7. Typical multi-optional controls

A triple controls operation is presented in FIG.7. The CONTROL/LP input can be use for a low current (0.3mA) supplier at a low switching frequency (80 Hz for a 30A relay). The Charge/Control input can be used for higher switching frequencies (800 Hz) and in conjunction with the CONTROL input for even higher switching frequencies (2 KHz). The CONTROL is especially useful in PWM applications, when both inputs can charge an internal bank of energy without disturbing the relay's output.



The Vcs should be applied 0.1 mS after the C/ENB is enabled and removed 0.1mS before the C/ENB is disabled to ensure uninterrupted operation.

1 Form B, SPST-NC, μ-Power SSR

30A Normally Closed Relay, 0.4mA control current at 2.4V

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Technology for people's ideas

FEATURES:

Utilizes only 1.5 sq. in. of PCB area and only 1.15” tall
Sealed Construction for Automatic Soldering and Cleaning
High sensitivity, only 300 μA is required
Very high surge current tolerance
Very low on-state resistance, less than .003 Ohm

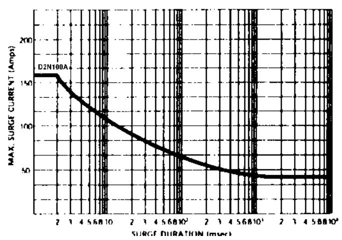
Input Specifications: p/n EDR83040/1

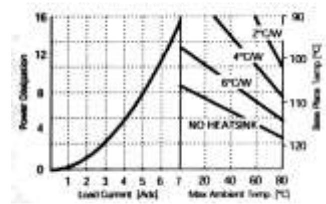
Vcs voltage	2.4V	3V	4.5V
Ics current	0.3mA	1.7mA	3.5mA

Typical Output Specifications (μR2M100A30)

Operating DC voltage range	100VDC (70AVC)	
Maximum continuous current	30A rms	
Maximum surge current (IDM) -	1mS 400 A	
Continues current (ID), 100mS	100 A	
Maximum on-state resistance	.003 Ohm	
Rising time	2.3μS	
Delay-on time	188 μS	
Falling time	2.1μS	
Delay-off time	24 μS	
Maximum switching frequency	800 Hz	
Leakage at maximum rating,	25^oC	40 nA

Test performed at the input current equal to 1.7 mA





General Specifications:

Ambient operating temperature range	-40^0 C to 85^0 C
Ambient storage temperature range	-55^0 C to 125^0 C
Dialectic Strength input-to-output	2,500 V rms (MIN)

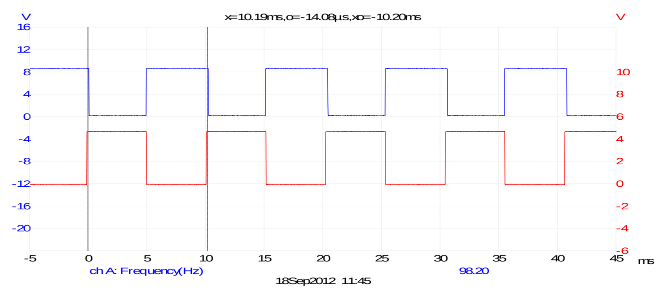
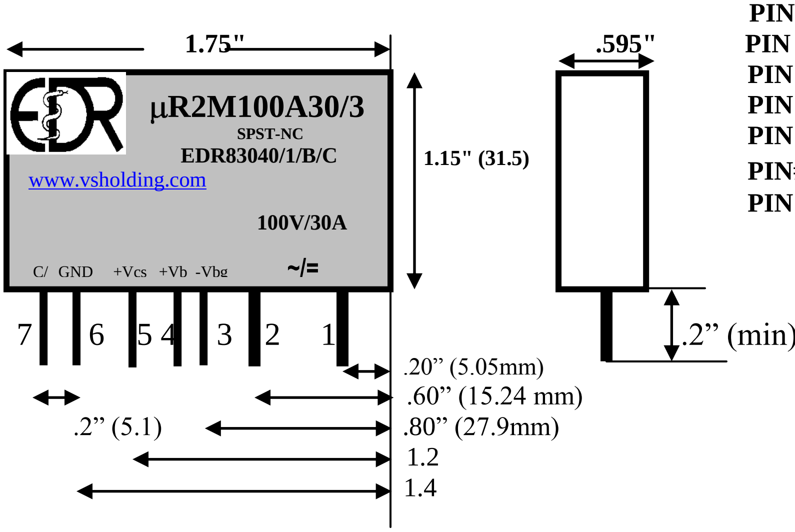


Figure 1
A relay chops at 20 Amp at about 100 Hz.

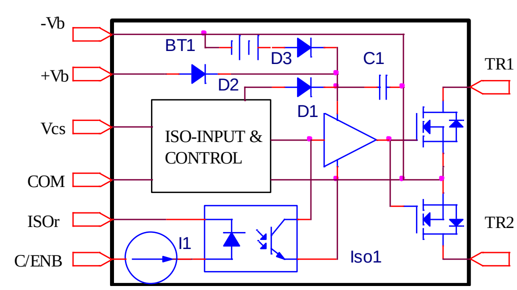
Mechanical Specifications:

Weight (oz)	.08
Encapsulation ResTech	10207/053
Dimensions for #2 package	1.15”H x 1.75”L x 0.595”W
Inputs terminals/pins	.030” diameter
Output terminals pins	.100“ diameter

Information and pins-out for a SIP7 package



PIN #1:	**LOAD or ~/= Power**
PIN #2:	**LOAD OR ~/= POWER**
PIN #3:	**-Vbe (external battery)**
PIN #4:	**+Vbe (external battery)**
PIN #5:	**+Vcs (control/power input)**
PIN#6:	**COM/ISOr (GND)**
PIN #7:	**C/ENB (control)**



NOTE: The terminal ISOr connected to the COM internally.

Simplified diagram of the micro-power SSR

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 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 an AC applied voltage and unidirectional for a DC applied voltage, should be used to clamp excessive spikes

The C/ENB input characteristics						
PARAMETERS	CONDITION	SYMBOL	MIN	TYP	MAX	UNIT
Input control current		Ic/enb	.090	.2	1.0	mA
Input voltage		Vc/enb	2.4	5	32	V
Input reverse current	Vc/enb = -50V	Ir			10	µA
Input control current	Vcs = 3VDC	Ics	.870	1.3	2.8	mA
Switching frequency	Ic/enb = 0.2 µA	F	50	200	1,000	Hz
Isolation voltage				4,000		Vrms
Operating temperature			-40		+85	^{o}C

Table 4

NOTE: The Ic/enb is not switching-frequency depended.

The Vcs input characteristics						
PARAMETERS	CONDITION	SYMBOL	MIN	TYP	MAX	UNIT
Input control current	F = DC to 50Hz	Ics	.230	1.1	3.1	mA
Input control voltage	F = DC to 50HZ	Vcs	2.4	3	5	V
Input control current	Ics vs F, Vcs=3.0VDC	Ics	.500	1.7	2.7	mA
Switching frequency		F	50	500	800	
Isolated voltage				3,000		Vrms
Operating temperature			-40		+85	^{o}C

Table 5

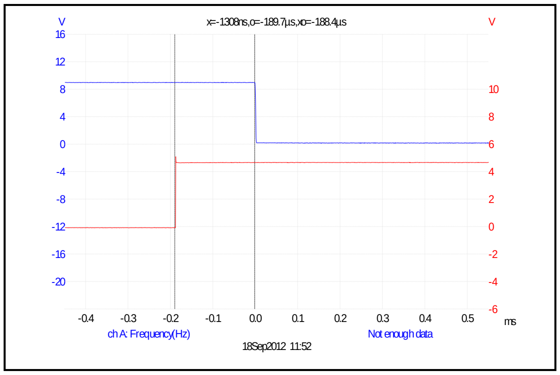
NOTE: The Ics is switching-frequency depended.

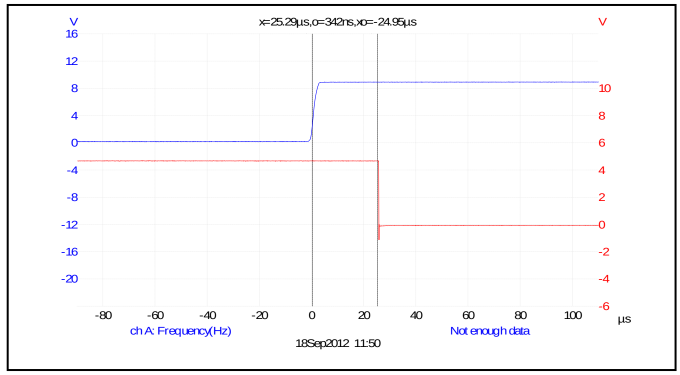
Application reminders:

Providing a dual control via the Vcs and C/EBN, the µSSR delivers useful flexibility to a designer's desire to have specific and unique application solutions. Here are just a few obvious points.

1. Via the Vcs is the simplest and most efficient way to control a relay. An extremely low power consumption of less than 800 µW has made the µSSR essential device work with portable and remote equipment.
2. If an increased current consumption by the Vcs during a high frequency switching might overload a source of a control signal, the C/ENB input can be use for controlling the µSSR instead. The C/ENB requires less than 150 µA and is irrelevant to a switching frequency, thus giving the µSSR ability to easily interfacing with any type of equipment.
3. The C/ENB can be used as the Vcs disabling control.
4. The C/ENB can be used for a pulse-width modulation (PWM).
5. The C/ENB can be used for charging the internal bank of energy.

Switching time test – Load – 25 Ohm & 20A, a single 100 mS pulse width



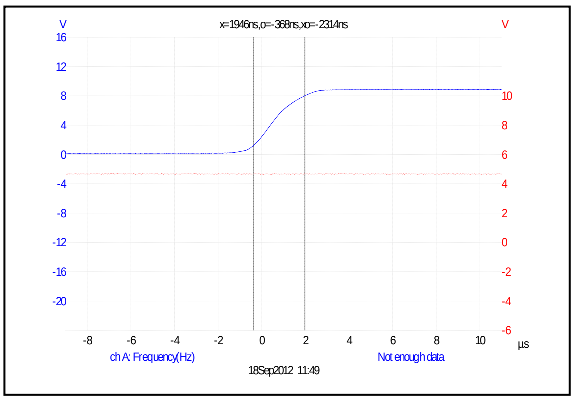


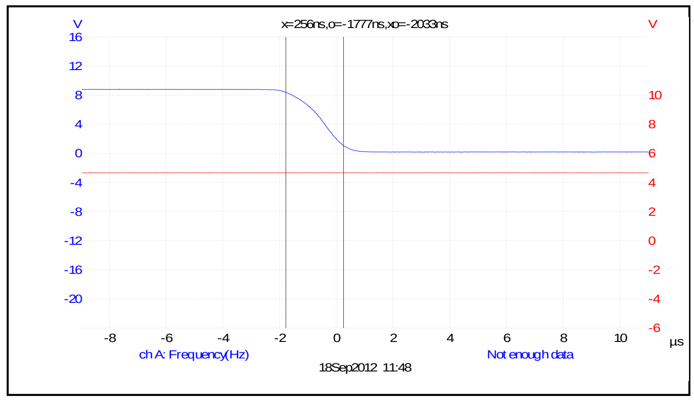
LOAD

CONTROL

FIG.8 Turn-on delay is 188.4µS

FIG.9 Turn-off delay is 24.9µS





LOAD

CONTROL

FIG.10 Rising Time is 2.3µS

FIG.11 Fall Time is 2.03µS

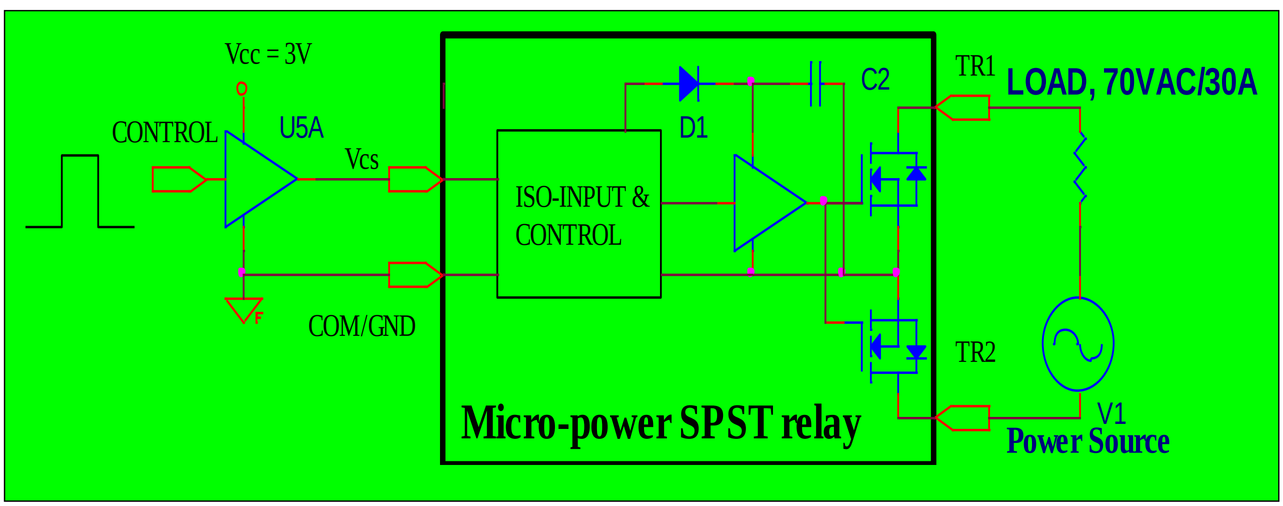


FIG.12
Switching Time Test Circuit

Control via the C/ENB = 3V, Vcs = 3VDC, Ics = 1.51mA

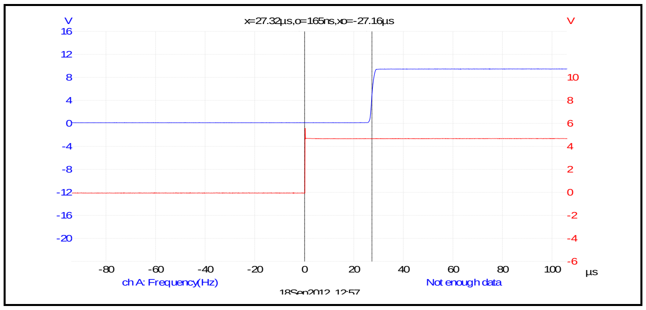


FIG.13

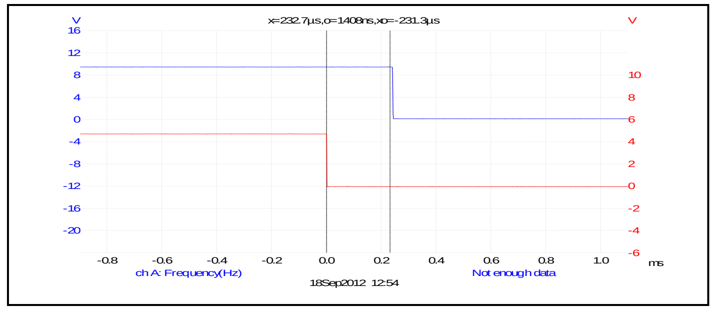


FIG.14

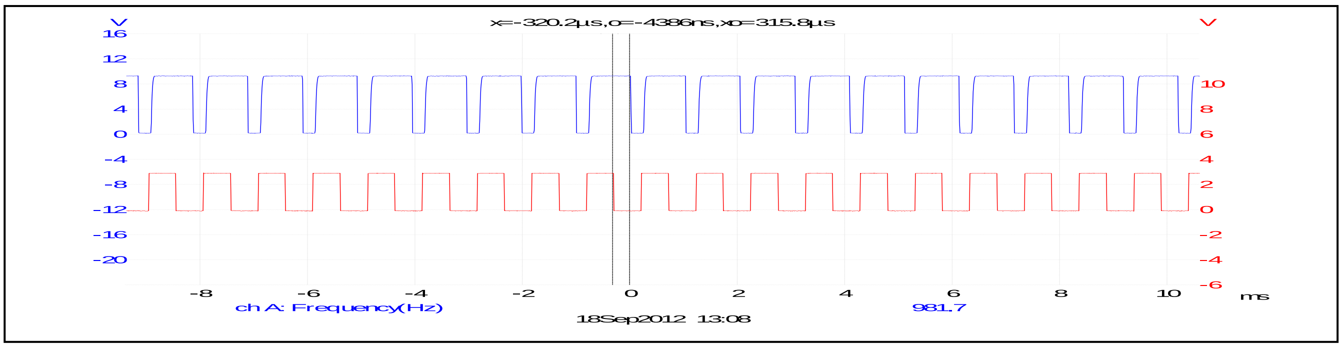


FIG.15

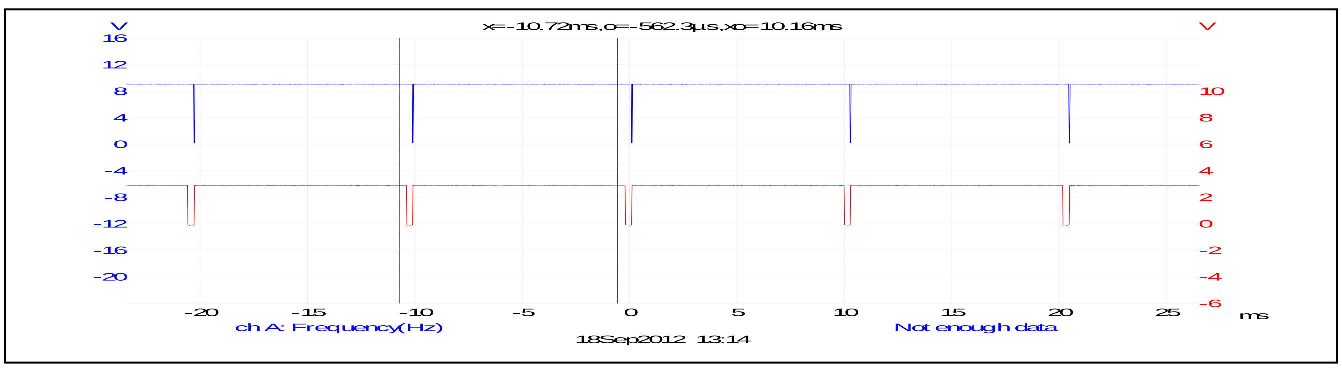


FIG.16

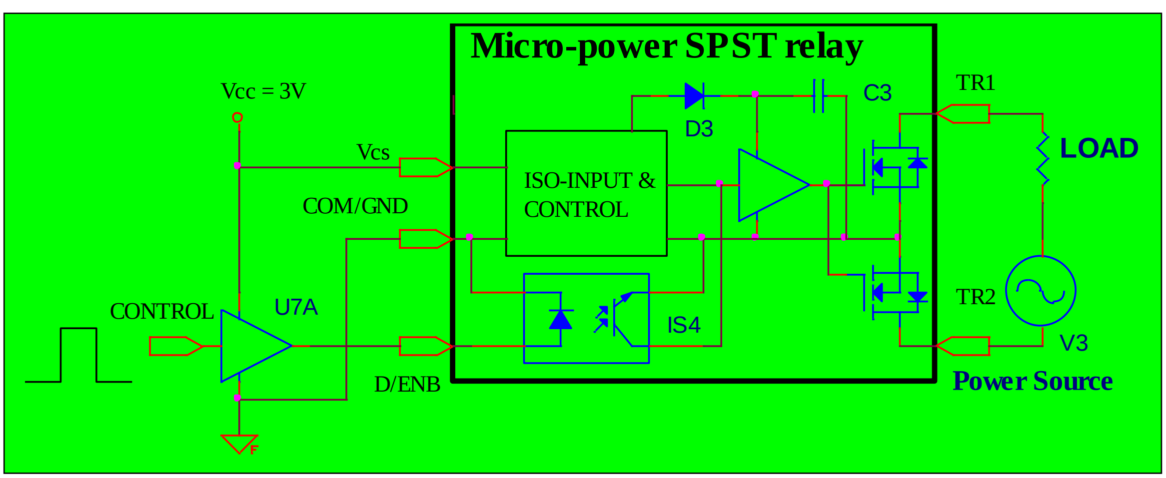


FIG.17

The Vcs=4V, Ics= 2.68mA

1 Form B, SPST-NC Solid State Relays to replace electromechanical relays

OUTPUT SPECIFICATIONS (We rated our SSR's for the maximum current without a heat sink)

Model	V max	Vcc	Id	Idm	p/n
μR2M24D22	0 to 24VDC	24VDC	22	200	EDR83051
μR2M24A20	+/-24VDC	24VDC (16VAC)	20	190	EDR83052
μR2M24D40	0 to 24VDC	24VDC	40	410	EDR83053
μR2M24A40	+/-24VDC	24VDC (16AVC)	40	400	EDR83054
μR2M30D15	0 to 30VDC	30VDC	15	160	EDR83055
μR2M30A14	+/-30VDC	30VDC (21VAC)	14	140	EDR83056
μR2M30D20	0 to 30VDC	30VDC	28	260	EDR83057
μR2M30A20	+/-30VDC	30VDC (21VAC)	26	250	EDR83058
μR2M60D20	0 to 40VDC	40VDC	40	400	EDR83059
μR2M60D20	+/-40VDC	40VDC (28VAC)	39	460	EDR83060
μR2M60D20	0 to 55VDC	55VDC	38	370	EDR83061
μR2M60D20	+/-55VDC	55VDC (38VAC)	37	190	EDR83062
μR2M60D20	0 to 60VDC	60VDC	20	190	EDR83063
μR2M60A18	+/- 60VDC	60VDC (42VAC)	18	160	EDR83064
μR2M60D40	0 to 60VDC	60VDC	40	380	EDR83065
μR2M60A38	+/- 60VDC	60VDC (42VAC)	38	380	EDR83066
μR2M75D16	0 to 75VDC	75VDC	16	150	EDR83067
μR2M75A15	+/- 75VDC	75VDC (52VAC)	15	140	EDR83068
μR2M75D30	0 to 75VDC	75VDC	30	280	EDR83069
μR2M75A28	+/-75VDC	75VDC (52VAC)	28	240	EDR83070
μR2M100D20	0 to 100VDC	100VDC	20	190	EDR83071
μR2M100A20	+/-100VDC	100VDC (70AVC)	20	190	EDR83072
μR2M100D35	0 to 100VDC	100VDC	35	360	EDR83073
μR2M100A30	+/-100VDC	100VDC (70VAC)	30	300	EDR83040
μR2M150D12	0 to 150VDC	150VDC	12	160	EDR83074
μR2M150A12	+/-150VDC	150VDC (115VAC)	12	150	EDR83075
μR2M150A21	0 to 150VDC	150VDC	21	200	EDR83076
μR2M150A20	+/-150VDC	150VDC (115VAC	20	190	EDR83077
μR2M250D5	0 to 250VDC	250VDC	5	50	EDR83078
μR2M250A5	+/-250VDC	250VDC (170VAC)	5	50	EDR83079

Any listed above relay can be encapsulated in a panel-mounting box. In this case, the third symbol, in this case "2" should be replaces with a "P" to make a part as μRPM250A5 and P/N EDR83079/P

A relay of the **μR2M** family offered with two options. For an example, a "/C" suffix at end of a model, as μR2U250A5/C will be shipped with additional control "C/ENB," and with a suffix "/B" like μR2U250A5/C/B with a terminal for connecting an external battery.

All input ratings, specifications and other properties of **μR2M** -type relays are very much resembled the p/n EDR83040 (PAGE #11). There are some differences for various relays related to a switching frequency, turn-on delay, slope, etc. there are somewhat depend on the output rating. Please request a specific data sheet if that is important for your application.

We charge no production set-up fee for an order of 400 and above for any type (input and output specifications) Solid State Relay/Switch and Solid State Breaker.

1 Form A, SPST-NO Solid State Relays to replace electromechanical relays

OUTPUT SPECIFICATIONS (We rated our SSR's for the maximum current without a heat sink)

Model	V max	Vcc	Id	Idm	p/n
µD2M24D22	0 to 24VDC	24VDC	22	200	EDR83080
µD2M24A20	+/-24VDC	24VDC (16VAC)	20	190	EDR83081
µD2M24D40	0 to 24VDC	24VDC	40	410	EDR83082
µD2M24A40	+/-24VDC	24VDC (16AVC)	40	400	EDR83083
µD2M30D15	0 to 30VDC	30VDC	15	160	EDR83084
µD2M30A14	+/-30VDC	30VDC (21VAC)	14	140	EDR83085
µD2M30D20	0 to 30VDC	30VDC	28	260	EDR83086
µD2M30A20	+/-30VDC	30VDC (21VAC)	26	250	EDR83087
µD2M60D20	0 to 40VDC	40VDC	40	400	EDR83088
µD2M60D20	+/-40VDC	40VDC (28VAC)	39	460	EDR83089
µD2M60D20	0 to 55VDC	55VDC	38	370	EDR83090
µD2M60D20	+/-55VDC	55VDC (38VAC)	37	190	EDR83091
µD2M60D20	0 to 60VDC	60VDC	20	190	EDR83092
µD2M60A18	+/- 60VDC	60VDC (42VAC)	18	160	EDR83093
µD2M60D40	0 to 60VDC	60VDC	40	380	EDR83094
µD2M60A38	+/- 60VDC	60VDC (42VAC)	38	380	EDR83095
µD2M75D16	0 to 75VDC	75VDC	16	150	EDR83096
µD2M75A15	+/- 75VDC	75VDC (52VAC)	15	140	EDR83097
µD2M75D30	0 to 75VDC	75VDC	30	280	EDR83098
µD2M75A28	+/-75VDC	75VDC (52VAC)	28	240	EDR83099
µD2M100D20	0 to 100VDC	100VDC	20	190	EDR83100
µD2M100A20	+/-100VDC	100VDC (70AVC)	20	190	EDR83101
µD2M100D35	0 to 100VDC	100VDC	35	360	EDR83102
µD2M100A30	+/-100VDC	100VDC (70VAC)	30	300	EDR83103
µD2M150D12	0 to 150VDC	150VDC	12	160	EDR83104
µD2M150A12	+/-150VDC	150VDC (115VAC)	12	150	EDR83105
µD2M150A21	0 to 150VDC	150VDC	21	200	EDR83106
µD2M150A20	+/-150VDC	150VDC (115VAC	20	190	EDR83107
µD2M250D5	0 to 250VDC	250VDC	5	50	EDR83108
µD2M250A5	+/-250VDC	250VDC (170VAC)	5	50	EDR83109

Any listed above relay can be encapsulated in a panel-mounting box. In this case, the third symbol in this case "2" should be replaces with a "P" to make a part as µDPM250A5 and P/N EDR83109/P

A relay of the **µD2M** family offered with two options. For an example, a "/C" suffix at end of a model, as µD2U250A5/C will be shipped with additional control "C/ENB," and with a suffix "/B" like µD2U250A5/C/B with a terminal for connecting an external battery.

All input ratings, specifications and other properties of **µD2M** -type relays are very much resembled the p/n EDR83040 (PAGE #11). There are some differences for various relays related to a switching frequency, turn-on delay, slope, etc. there are somewhat depend on the output rating. Please request a specific data sheet if that is important for your application.

We charge no production set-up fee for an order of 400 and above for any type (input and output specifications) Solid State Relay/Switch and Solid State Breaker.

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 EDR11111 will stay the same for already items in circulation (already sold).

Part description:	μ	H	3	L	200	D	10	/5	/12
Micro-Power	**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: WITH ONE OR MORE normally closed terminal
- W Solid-State Relay or Switch with output terminals: DPST
- 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 1.75"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 – 500 Hz, direct driving control
- M a low switching frequency, rated DC – 2,000 Hz
- 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 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 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

We can manufacture a device for any required current.

"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
74VDC	10				

"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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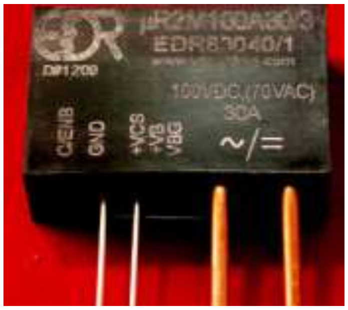
EDR/VSholding Announces New μR2M (1 Form B) and μD2M (1 Form A) Relay Series

Micro-power Solid-State Relays Output to 3.5kW of VAC or VDC with a control of only 0.6mW



Louisville, KY, September 2012: Electronic Design & Research Inc has introduced the μR2M and μD2M series to their industrial solid-state relays product line. These relays are ideal for interfacing portable and remote equipment to high current applications. The features are innovative isolated driver that ensures ultra-low input power consumption of only 300μA at 2.4V, fast rising and falling slopes allowing use of high-power MOSFETS, ultra-low output leakage current, dual control, low Rds, and low cost.

Both SPST-NO and SPST-NC relays are offered for AC and DC output voltages. Encapsulated in a SIP-4, SIP5 and SIP7 box relays measure 1.15" H x 1.75" L x 0.595" W, and in an industrial standard panel mounting box (suffix "P" added). Cost varies on devices and quantities, for an example, μD2M150A20, SPST-NO relay rated at 150 VDC (115 VAC) & 20A rms costs $74.50 ea/100. Click for a data sheet

For more information visit www.vsholding.com or send e-mail to info@vsholding.com

Electronic Design & Research Inc, a Unit of VS Holding LLC, has been the world's innovative leader in manufacturing solid-state switching products for nearly 15 years. The company's comprehensive product line of SSR, SPDT drivers, H-Drivers, Super-High Power Switching Systems, Security Modules, Fog-Bulb relays, Super-Fast High-Voltage Switches, and many more meets a wide range of requirements for industrial, commercial, military and aerospace uses worldwide.