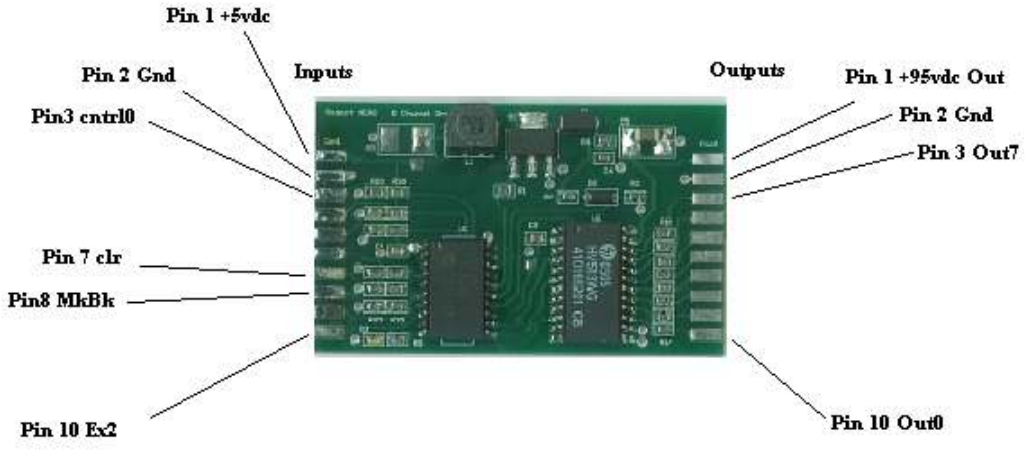
DATASHEET RMDR1000
RADANT MEMS Reconfigurable 8 Channel Driver

Description

The RMDR1000 is designed to drive Radant's RF MEMS switches. The RMDR1000 greatly simplifies the design of MEMS switch gate drives by incorporating all the active components on a single PCB. Using a standard +5 VDC power supply voltage and logic-level control inputs, the device allows the user to easily control up to eight high voltage gate lines. The RMDR1000 offers a superior alternative to discrete drive circuitry.

Features

- On-board 5 VDC to 90 VDC DC-DC converter
- Eight independent gate lines
- "Make-before-break" control line
- DC up to 20 kHz cycle rate
- Low power consumption (2 mA without LED)
- Single +5 VDC power supply required
- User programmable output states
- Brown-out shutdown and startup delay
- Low startup power consumption
- On-board in-circuit reprogrammable flash microcontroller
- Low output voltage ripple
- On-board LED status indicator
- Small size: 2.1"x 1.3"
- Bottom side completely grounded



Absolute Maximum Ratings

Supply Voltage Vdd	-.3Vdc to 6.0Vdc
Logic Input Voltage	-.2V to Vdd+.2v
Operating Temperature Range	-10C to 85C
Storage Temperature Range	-40C to 150C

Electrical Characteristics

Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**
Supply Voltage	Vdd	4.5		5.5	VDC
Supply Current (all outputs low)	Idd		5.0	10	mA
Supply Current (all outputs high)	Idd		5.0	10	mA
Supply Current (1 kHz all outputs low/high)	Idd		5.2	10	mA
Supply Current (5 kHz all outputs low/high)	Idd		6.5	15	mA
Supply Current (20 kHz all outputs low/high)	Idd		11.4	30	mA
Driver Output Low	VoutLow			5	VDC
Driver Output High	VoutHigh	85		95	VDC
DC-DC Output Voltage	Vc	85	90	95	VDC
Output Voltage ripple	Vrip		0.4	1	Vpk-pk
Logic Input Low	Vlogiclow	Gnd		Vdd/4	VDC
Logic Input High	Vlogichigh	Vdd-Vdd/4		Vdd	VDC
Output Capacitive Load(20 kHz switch freq)	Cload	0		10	pF
Output Resistive Load	Rload	10			MΩ
DC-DC Startup Time	Tstart		190	300	ms
High Voltage Output Rise Time	Trise		5	10	µs
High Voltage Output Fall Time	Tfall		5	10	µs
Delay Logic Input To Output (normal operation)	Tdelay		12	16	µs
Delay Logic Input To Output (“make-before-break” operation)	Tmkdy		25	32	µs
ESD logic input protection	Vprot	2			kV

Note: the LED status indicator draws 3mA, disable for reduced power consumption.

Pin Outs

Input Power and Control Connector			
Pin	ID	Description	Pin-out for re-programming microcontroller*
1	+5Vdc	+5VDC input power supply	Pin 1 +5VDC
2	Gnd	Input Ground connected to Bottom Gnd Plane	Pin 8 Gnd
3	Cntrl0	Logic Control Input 0 with Pull Down	Pin 7 A0
4	Cntrl1	Logic Control Input 1 with Pull Down	Pin 6 A1
5	Cntrl2	Logic Control Input 2 with Pull Down	NC
6	Cntrl3	Logic Control Input 3 with Pull Down	Pin 4 A3
7	Clr	Logic Input Clear Outputs On High with Pull Down	NC
8	BkMk	Logic Input “Make-before-Break” on High with Pull Down	NC
9	Ex0	Extra Logic I/O 0	NC
10	Ex1	Extra Logic I/O 1	NC
Output Connector			
Pin	ID	Description	
1	90Vdc	DC-DC output Voltage	
2	Gnd	Output Ground connected to Bottom Ground Plane	
3	Out7	High Voltage Output Signal 7	
4	Out6	High Voltage Output Signal 6	
5	Out5	High Voltage Output Signal 5	
6	Out4	High Voltage Output Signal 4	
7	Out3	High Voltage Output Signal 3	
8	Out2	High Voltage Output Signal 2	
9	Out1	High Voltage Output Signal 1	
10	Out0	High Voltage Output Signal 0	

* referenced to 8-pin DIP. See page 5 or note on re-programming microcontroller.

Startup Operation

The unit incorporates an intelligent startup mode to avoid high inrush power supply current and spurious undefined output conditions. On startup, the unit is in shutdown mode until the power supply voltage exceeds 2.1 VDC. The unit then blanks the high voltage output driver by loading the serial word $00 into the output buffer while keeping the blanking line activated. The unit then waits for approximately 100 milliseconds before allowing the DC-to-DC converter to charge the output capacitor. Once the DC-to-DC converter reaches the rated 90 VDC output voltage, the red LED indicator is then activated. The user input on the control lines is then read by the microcontroller, and the corresponding data is sent to the high voltage output buffer. The blanking line is then disabled and the unit remains active for normal operation. If the power supply voltage drops below 2.1 VDC for any reason, the microcontroller will enter shutdown mode and will only restart when the power supply voltage again exceeds 2.1 VDC.

Control Operation

The high voltage outputs are controlled with six digital input lines. The Clr line disables all the high voltage outputs. The MkBr mode line (Pin 8) at logic high will keep the last output state active and also activate the new state. In MkBr mode, the old state will remain active for approximately 10 μs before it is disabled, allowing the "make-before-break" operation to proceed. The four control lines (Cntrl0 to Cntrl4) control the output pins (Out0 to Out7). Currently Cntrl3 line is inactive and is for future expansion. The control output states follow the logic table below.

Cntrl0	Cntrl1	Cntrl2	Cntrl3	Clr	Function
Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	
X	X	X	X	H	All output low
L	L	L	X	L	Out0 High
H	L	L	X	L	Out1 High
L	H	L	X	L	Out2 High
H	H	L	X	L	Out3 High
L	L	H	X	L	Out4 High
H	L	H	X	L	Out5 High
L	H	H	X	L	Out6 High
H	H	H	X	L	Out7 High

L= Logic Low
H= Logic High
X= Don't Care

Microcontroller Reprogramming

The on-board microcontroller can be reprogrammed to allow for custom features. The Microchip PIC16F677 located on the PCB is reprogrammed using a five wire custom cable that utilizes to an input connector such as the 24 position edge connector included with the RMDR1000 and an 8 or 16-pin DIP socket. To reprogram the RMDR1000, the following hardware is required: Microchip Technology's PICSTART Plus Development Programmer, a PC with a serial port, and an adapter cable to be built by the user. Microchip's latest version of MPLAB, which is usually supplied with the PICSTART development system, must be loaded on the host computer. Please contact Radant MEMS for the latest 8-channel driver firmware.

The DIP end of the custom programming cable is first inserted into the PICSTART 40-pin ZIF socket, while the edge connector is attached to the PCB. No other power or cables are required. See the pin out table in this datasheet for the adapter cable's wiring diagram. The PIC16F677 datasheet and latest version of MPLAB can be downloaded from Microchip Technology's website.

Figure 1: Programming Cable

Typical Characteristics

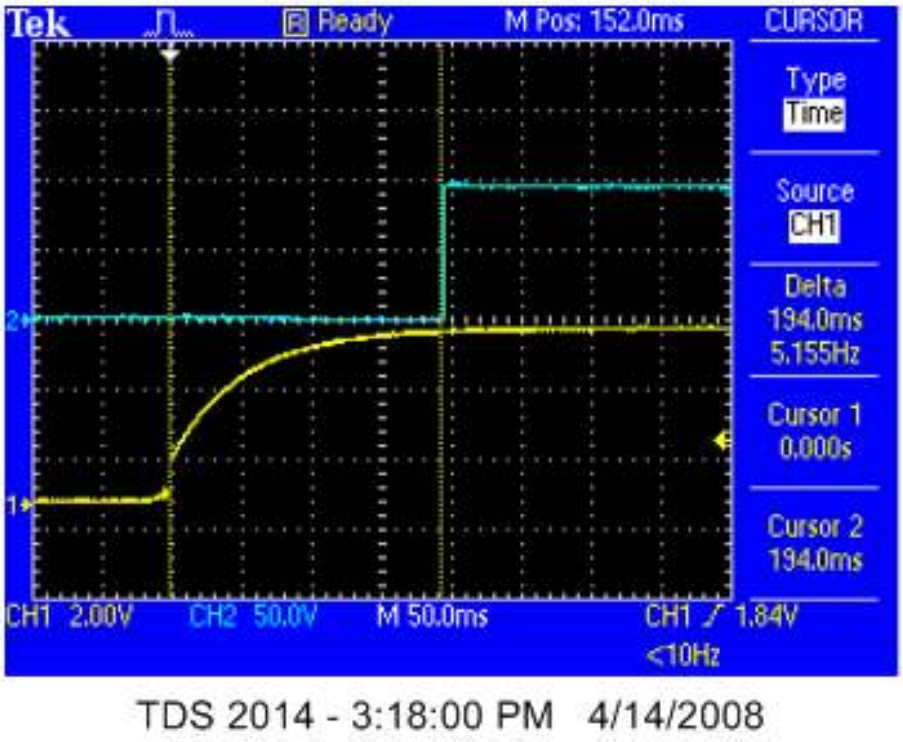


Figure 2: Startup delay time

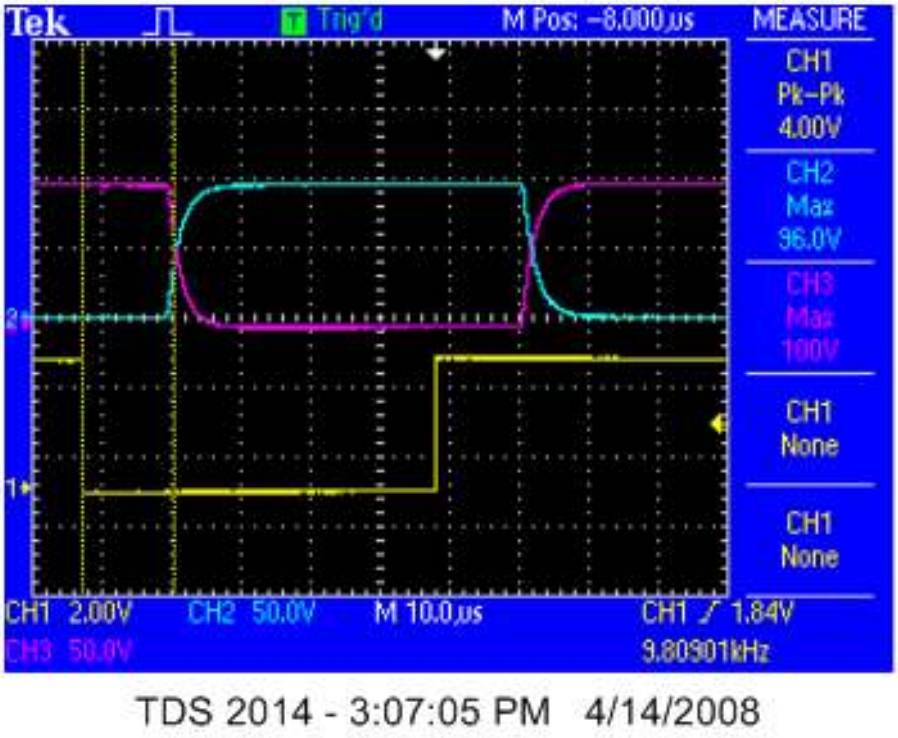


Figure 3: Output Delay Times

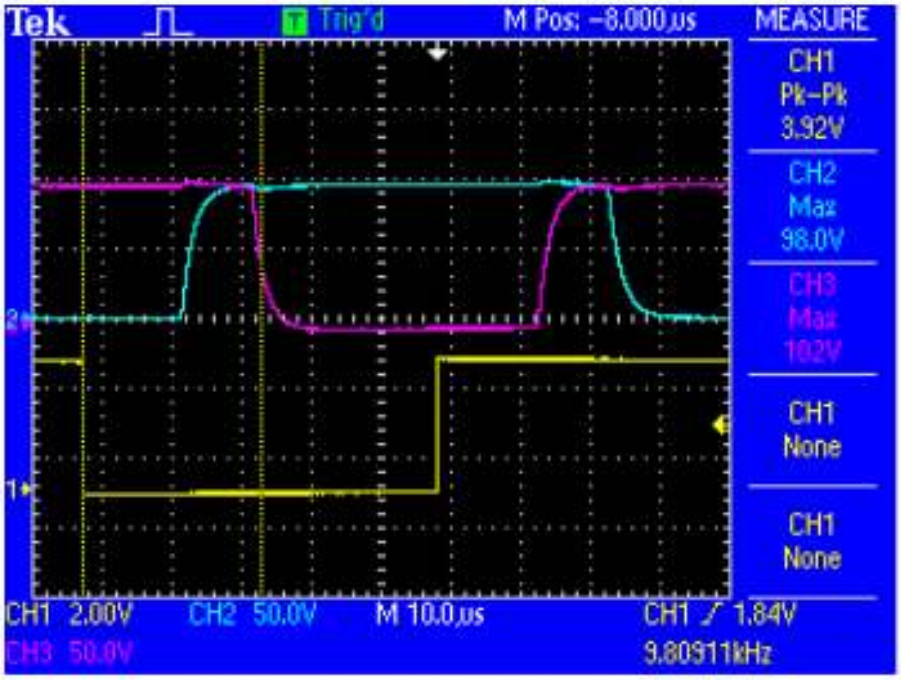


Figure 4: Make before break operation

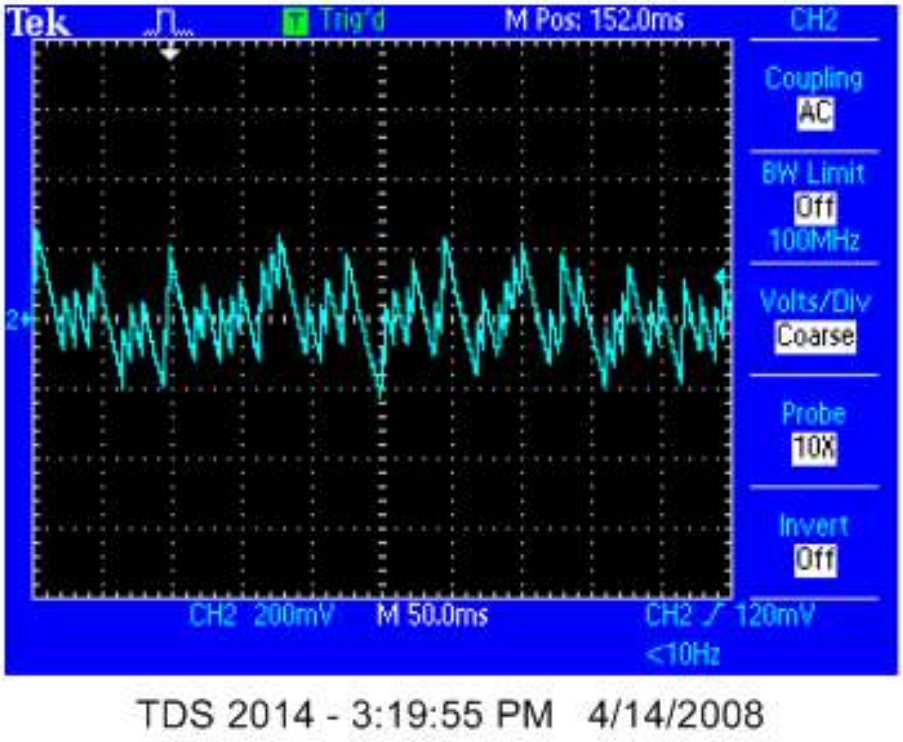


Figure 5: Output noise during on state