POWER-GATE™ Solid-State Devices
Uni-Directional DC Relay
Specification Sheet

Generation 4.1

Made in U.S.A

ABSOLUTE MAXIMUM RATINGS[1]

All devices ("x" = don't care), all amperages DC, all voltages DC and referenced to relay ground, unless otherwise specified.

Symbol	Parameter	Min.	Max.	Units
V_S	Source Voltage, Models RYx41A-xxx	-0.3[2]	19[3]	V
	Source Voltage, Models RYx41B-xxx	-0.3[2]	37[4]	
V_L	Load Voltage (relay open)	-0.3[2]	V_S + 0.3[5]	V
T_A	Ambient Temperature	-45	110	°C
T_P	Source and Load Post Temperature	-45	130	°C
$V_{TRIG,M}$	Main Trigger Voltage[6]	-37[7]	37[4]	V
$V_{TRIG,O}$	Override Trigger Voltage[8]	-37[7]	37[4]	V
I_{LED}	Remote LED Current	-	30	mA
$V_{LED(OFF)}$	Remote LED Voltage (LED Off)	-50	50	V

RECOMMENDED OPERATING CONDITIONS

All devices ("x" = don't care), all amperages DC, all voltages DC and referenced to relay ground, unless otherwise specified.

Symbol	Parameter	Min.	Max.	Units
V_S	Source Voltage, Models RYx41A-xxx	4.8	18	V
	Source Voltage, Models RYx41B-xxx	4.8	36	
T_A	Ambient Temperature	-40	85	°C
T_P	Source and Load Post Temperature	-40	105	°C
$V_{TRIG,M}$	Main Trigger Voltage[6]	0	36	V
$V_{TRIG,O}$	Override Trigger Voltage[8]	0	36	V

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ELECTRICAL SPECIFICATIONS

All devices ("x" = don't care), all amperages DC, all voltages DC and referenced to device ground, T_A = +25 ± 3 °C, 4.8 V ≤ V_S (RYx41A-xxx) ≤ 18 V, 4.8 V ≤ V_S (RYx41B-xxx) ≤ 36 V, all LEDs enabled, remote active-high main trigger, active-low override trigger, unless otherwise specified.

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_{L,CONT(MAX)}$	Maximum Continuous Load Current[36]	-	-	50	A	Models RYS41x-050, -40 °C ≤ T_A ≤ 85 °C
		-	-	100		Models RYS41x-100, -40 °C ≤ T_A ≤ 85 °C
		-	-	150		Models RYS41x-150, -40 °C ≤ T_A ≤ 85 °C
		-	-	200		Models RYS41x-200, -40 °C ≤ T_A ≤ 85 °C
		-	-	250		Models RYS41x-250, -40 °C ≤ T_A ≤ 85 °C
		-	-	300		Models RYx41x-300, -40 °C ≤ T_A ≤ 85 °C
		-	-	400		Model RYM41x-400, -40 °C ≤ T_A ≤ 85 °C
		-	-	500		Model RYM41x-500, -40 °C ≤ T_A ≤ 85 °C
		-	-	600		Model RYM41x-600, -40 °C ≤ T_A ≤ 85 °C
DF	Continuous Load Current Derating Factor[37]	2.15	-	-	%/°C	T_A> 85 °C
$I_{L,INT(MAX)}$	Maximum Load Interrupt Current	-	-	9 x $I_{L,CONT(MAX)}$	A	-40 °C ≤ T_A ≤ 85 °C
		-	-	8 x $I_{L,CONT(MAX)}$		-85 °C < T_A ≤ 105 °C
$V_{SL,DROP}$	Source-to-Load Voltage Drop[9]	-	10	14	mV	Model RYS41A-050, Load Current = $I_{L,CONT(MAX)}$
		-	17	23		Model RYS41A-100, Load Current = $I_{L,CONT(MAX)}$
		-	23	31		Model RYS41A-150, Load Current = $I_{L,CONT(MAX)}$
		-	27	37		Model RYS41A-200, Load Current = $I_{L,CONT(MAX)}$
		-	32	43		Model RYS41A-250, Load Current = $I_{L,CONT(MAX)}$
		-	36	47		Model RYS41A-300, Load Current = $I_{L,CONT(MAX)}$
		-	34	45		Model RYM41A-300, Load Current = $I_{L,CONT(MAX)}$
		-	37	49		Model RYM41A-400, Load Current = $I_{L,CONT(MAX)}$
		-	41	53		Model RYM41A-500, Load Current = $I_{L,CONT(MAX)}$
		-	43	55		Model RYM41A-600, Load Current = $I_{L,CONT(MAX)}$
		-	16	21		Model RYS41B-050, Load Current = $I_{L,CONT(MAX)}$
		-	27	36		Model RYS41B-100, Load Current = $I_{L,CONT(MAX)}$
		-	29	38		Model RYS41B-150, Load Current = $I_{L,CONT(MAX)}$
		-	33	43		Model RYS41B-200, Load Current = $I_{L,CONT(MAX)}$
		-	39	50		Model RYS41B-250, Load Current = $I_{L,CONT(MAX)}$
		-	45	57		Model RYS41B-300, Load Current = $I_{L,CONT(MAX)}$
		-	35	45		Model RYM41B-300, Load Current = $I_{L,CONT(MAX)}$
		-	36	46		Model RYM41B-400, Load Current = $I_{L,CONT(MAX)}$
		-	40	50		Model RYM41B-500, Load Current = $I_{L,CONT(MAX)}$
		-	41	51		Model RYM41B-600, Load Current = $I_{L,CONT(MAX)}$
MF	Source-to-Load Voltage Drop High Temperature Mulitplication Factor[41]	-	1.4	1.5		T_A = 105 °C
$I_{S,OPEN}$	Operating Current, Relay Triggered Open	16.5	18.0	19.5	mA	$V_{TRIG,M}$ = 0 V[6], OVERRIDETRIG+[8] floating
$I_{S,CLOSED}$	Operating Current, Relay Triggered Closed	19.4	21.7	23.9	mA	$V_{TRIG,M}$ = V_S[6], OVERRIDETRIG+[8] floating
$I_{S,LP}$	Low Power Sleep Mode Operating Current[10]	-	-	2.5	mA	Models RYx41A-xxx, Load terminal floating
		-	-	2.8		Models RYx41B-xxx, Load terminal floating

Specifications subject to change without notice.

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ELECTRICAL SPECIFICATIONS (continued)

All devices ("x" = don't care), all amperages DC, all voltages DC and referenced to device ground, T_A = +25 ± 3 °C, 4.8 V ≤ V_S (RYx41A-xxx) ≤ 18 V, 4.8 V ≤ V_S (RYx41B-xxx) ≤ 36 V, all LEDs enabled, remote active-high main trigger, active-low override trigger, unless otherwise specified.

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_{LEAK}	Relay Open Load Leakage Current: Normal Operation (Low Power Sleep Mode[10, 39,40])	-	80 (3)	290 (210)	µA	Model RYS41A-050
		-	80 (1)	100 (20)		Model RYS41A-100
		-	80 (3)	290 (210)		Model RYS41A-150
		-	85 (8)	810 (720)		Model RYS41A-200
		-	95 (14)	1400 (1300)		Model RYS41A-250
		-	100 (17)	1700 (1600)		Models RYx41A-300
		-	100 (1)	920 (820)		Model RYM41A-400
		-	80 (1)	2800 (2700)		Model RYM41A-500
		-	170 (90)	9100 (9000)		Model RYM41A-600
		-	80 (1)	85 (2)		Model RYS41B-050
		-	80 (1)	85 (4)		Model RYS41B-100
		-	80 (1)	85 (4)		Model RYS41B-150
		-	80 (1)	85 (3)		Model RYS41B-200
		-	80 (1)	100 (25)		Model RYS41B-250
		-	80 (3)	150 (70)		Model RYx41B-300
		-	100 (23)	1700 (1600)		Model RYM41B-400
		-	80 (1)	120 (45)		Model RYM41B-500
		-	80 (1)	10100 (10000)		Model RYM41B-600
$V_{TRIG,H}$	Trigger High Threshold Voltage[11]	-	0.91	1.23	V	
$V_{TRIG,L}$	Trigger Low Threshold Voltage[12]	0.52	0.84	-	V	
$V_{TRIG,HYS}$	Trigger Hysteresis Voltage[13]	40	-	88	mV	
$I_{TRIG,AH}$	Active-high Trigger Current[14]	-	34	-	µA	$V_{TRIG,x}$ = 3.3 V[6,8]
		-	173	-		$V_{TRIG,x}$ = 12 V[6,8]
		-	293	-		$V_{TRIG,x}$ = 18 V[6,8]
		-	413	-		$V_{TRIG,x}$ = 24 V[6,8]
		-	653	-		$V_{TRIG,x}$ = 36 V[6,8]
$I_{TRIG,AL}$	Active-low Trigger Leakage Current[14]	-	34	-	µA	$V_{TRIG,x}$ = 0 V[6,8]
$V_{TRIG,ALOCV}$	Active-low Trigger Open Circuit Voltage[14]	-	3.3[15]	-	V	
f_{SW}	Relay Switching Frequency[16]	-	-	1	Hz	

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ELECTRICAL SPECIFICATIONS (continued)

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Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$t_{TRIG,HOLD}$	Trigger Hold Time[14,17]	45	-	-	ms	
I_{OI1}	Over-current Threshold - Level 1[18]		2 x $I_{L,CONT(MAX)}$		A	
t_{OI1}	Over-current Shutdown Delay - Level 1	-	60	-	s	
I_{OI2}	Over-current Threshold - Level 2[18]	-	2.5 x $I_{L,CONT(MAX)}$	-	A	
t_{OI2}	Over-current Shutdown Delay - Level 2	-	10	-	s	
I_{OI3}	Over-current Threshold - Level 3[18]	-	3 x $I_{L,CONT(MAX)}$	-	A	
t_{OI3}	Over-current Shutdown Delay - Level 3	-	1	-	s	
I_{OI4}	Over-current Threshold - Level 4[18]	-	4 x $I_{L,CONT(MAX)}$	-	A	
t_{OI4}	Over-current Shutdown Delay - Level 4	-	20	-	ms	
I_{OI5}	Over-current Threshold - Level 5[18]	-	5 x $I_{L,CONT(MAX)}$	-	A	
t_{OI5}	Over-current Shutdown Delay - Level 5	-	4	-	ms	
I_{OI5}	Over-current Threshold - Level 6[18]	-	6 x $I_{L,CONT(MAX)}$	-	A	
t_{OI5}	Over-current Shutdown Delay - Level 6	-	2	-	ms	
$t_{OI,D}$	Over-current Detection Delay[19]	-	-	2	ms	
I_{SC}	Short-circuit Threshold[18]	-	7x $I_{L,CONT(MAX)}$	-	A	
t_{SC}	Short-circuit Shutdown Delay	-	-	1	ms	
$\Delta I_{OI/SC}$	Over-current/Short-circuit Threshold Tolerance[20]	-15	-	15	%	
$t_{OI/SC,LOCK}$	Over-current/Short-circuit Lockout Period[21]	-	10	-	s	
-	Over-current Fault LED Blinks - Level 1[22]	-	1	-	-	
-	Over-current Fault LED Blinks - Level 2[22]	-	2	-	-	
-	Over-current Fault LED Blinks - Level 3[22]	-	3	-	-	
-	Over-current Fault LED Blinks - Level 4[22]	-	4	-	-	
-	Over-current Fault LED Blinks - Level 5[22]	-	5	-	-	
-	Over-current Fault LED Blinks - Level 6[22]	-	6	-	-	
-	Short-circuit Fault LED Blinks[22]	-	6	-	-	

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ELECTRICAL SPECIFICATIONS (continued)

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Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
T_{OFF}	Internal Over-temperature Shutdown	-	135	-	°C	
T_{RESET}	Internal Over-temperature Reset	-	130	-	°C	
f_{OTLED}	Over-temperature Fault LED Blink Frequency[23]	-	3.8	-	Hz	
$\Delta V_{UV/OV}$	Under- and Over-voltage Threshold Tolerance[24]	-1	±0.5	1	%	
$t_{UV/OV,Dmin}$	Under- and Over-voltage Minimum Shutdown Delay	-	-	1.5	ms	
Δt	Timing Tolerance[25]	-2	±1	2	%	
$V_{S,PWRDWN}$	Source Voltage Power-down Threshold	-	3.8	-	V	
$V_{S,WARNON}$	Source Voltage Warning On Threshold[26]	-	4.7	-	V	
$V_{S,WARNOFF}$	Source Voltage Warning Off Threshold[26]	-	4.8	-	V	
$t_{D,CLOSE}$	Turn-on (Relay Open-to-Close) Delay[27]	-	-	2	ms	
$t_{D,OPEN}$	Turn-off (Relay Close-to-Open) Delay[28]	-	-	3	ms	
t_{RISE}	Load Voltage Rise Time[29]	-	-	4	µs	Models RYx41A-xxx: V_S = 12 V, R_L = 120 Ω[30] Models RYx41B-xxx: V_S = 24 V, R_L = 240 Ω[30]
t_{FALL}	Load Voltage Fall Time[31]	-	-	50	µs	Models RYx41A-xxx: V_S = 12 V, R_L = 120 Ω[30] Models RYx41B-xxx: V_S = 24 V, R_L = 240 Ω[30]
t_{CC}	Cold Crank Tolerance Time[32]	-	-	7	ms	Applied V_S step = 12 to 3 V
$t_{D,PWRUP}$	Power-up Delay[33]	-	650	-	ms	Models RYx41A-xxx: Applied V_S step = 0 to 12 V Models RYx41B-xxx: Applied V_S step = 0 to 24 V
t_{WD}	Low Power Sleep Mode Watchdog Time[34]	-	8	-	s	

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NOTES

1. Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. Exposure to any absolute maximum rating condition for extended periods may affect device reliability and lifetime.

2. Refer to application sheet APS-0705-41 for more information.

3. Transient-protected to 40 V. Additional external protection may be required in some applications; see application sheet APS-0705-41.

4. Transient-protected to 60 V. Additional external protection may be required in some applications; see application sheet APS-0705-41.

5. Exceeding this rating will cause current to flow through the MOSFET body diodes, leading to MOSFET failure.

6. $V_{TRIG,M}$ equals difference between MAINTRIG+ and relay ground (MAINTRIG- is internally connected to relay ground through 330 Ω resistor and is generally not required for active-high type to simplify connection to mechanical trigger switch).

7. Transient protected to -60 V. Additional external protection may be required in some applications; see application sheet APS-0705-41.

8. $V_{TRIG,O}$ equals difference between OVERRIDETRIG+ and relay ground terminal (OVERRIDETRIG- is internally connected to relay ground through 330 Ω resistor and is generally not required for active-high type, but is often used for active-low type to simply connection to mechanical trigger switch)

9. Voltage drop tested under pulsed conditions with pulse length $\leq$ 2 s.

10. Low power sleep mode is a non-standard feature. Refer to application sheet APS-0705-41 for more information.

11. $V_{TRIG,H}$ is the threshold to activate/deactivate both the main and override triggers for active-high/active-low configurations, respectively.

12. $V_{TRIG,L}$ is the threshold to deactivate/activate both the main and override triggers for active-high/active-low configurations, respectively.

13. $V_{TRIG,HYS} = V_{TRIG,H} - V_{TRIG,L}$

14. Applies to both main and override triggers.

15. 100 kΩ (typical) between MAINTRIG+/OVERRIDETRIG+ and internal 3.3 V.

16. Relay switching frequency is limited internally by firmware. Trigger frequencies in excess of 1 Hz will not cause faster switching.

17. Trigger hold time is defined as the length of time that a trigger voltage must be held above/below $V_{TRIG,H}$/$V_{TRIG,L}$, respectively, in order to yield a valid trigger state change.

18. Over-current and short-circuit thresholds are specifically designed for MOSFET array protection and cannot be changed by customer request. If other current-related shutdowns are desired, refer to available circuit-break thresholds described in application sheet APS-0705-41.

19. Over-current detection delay is defined as the length of time between when an over-current threshold level is first exceeded and when the delay timer begins.

20. Over-current/short-circuit threshold tolerance applies equally to all levels (e.g. if level 1 over-current threshold has a -5% error, then over-current levels 2, 3, 4, and 5, and the short-circuit threshold, will all have the same -5% error).

21. If the relay opens due to an over-current or short-circuit event, relay reset is inhibited for the lockout period. If the relay opens due a circuit-break event, and the circuit-break threshold is greater than $I_{L,CONT(MAX)}$, relay reset by trigger toggle is also inhibited for the lockout period.

23. Over-temperature blinking pattern has equal on- and off-time.

24. Under- and over-voltage shutdown features non-standard. Call manufacturer for more information.

25. Applies to over-current, short-circuit, circuit-break, under-voltage, and over-voltage shutdowns.

NOTES (continued)

26. If the relay is closed when the source voltage falls below $V_{S,WARNON}$, it will stay closed, but the over-current and short-circuit features will revert to a single level. If the relay is open when the source voltage falls below $V_{S,WARNON}$, closing of relay will be inhibited until the source voltage rises above $V_{S,WARNOFF}$.

27. Turn-on delay is defined as the length of time between when a valid trigger state change is detected (refer to note 17) and when the output voltage reaches 10 % of its final value.

28. Turn-off delay is defined as the length of time between when a valid trigger state change is detected (refer to note 17) and when the output voltage reaches 90 % of its final value.

29. Load voltage rise time is defined as the length of time the loadvoltage takes to go from 10 to 90 % of its final value.

30. R_L is the load resistance between the relay output and ground terminals.

31. Load voltage fall time is defined as the length of time the load voltage takes to go from 90 to 10 % of its final value.

32. Cold crank tolerance time is defined as the length of time the relay will remain closed while the source voltage is below the power-down threshold.

33. Power-up delay is defined as the length of time between when the source voltage rises above the warning off theshold ($V_{S,WARNOFF}$) and when the relay is enabled for normal operation.

34. Low power sleep mode watchdog time is defined as the length of time the relay is in its lowest-power state, between wakeup check intervals. Refer to application sheet APS-0705-41for more information.

35. Sleep inhibit/wake-up trip current is defined at the amount of current flowing through the MOSFET array (in either direction) that will cause the sleep timer to be restarted (or stated another way, the current through the MOSFET array must be less than the sleep inhibit/wake-up trip current for the sleep timer to run). This same amount of current will wake-up the device from sleep mode when the relay momentarily wakes up to check the requested current draw through the MOSFET array.

36. Maximum continuous current as specified at 85 °C is achieved using cabling scheme that results in no more than 1 W/ft power dissipa tion for every 100 A. Cable power dissipation larger than 1 W/ft for every 100 A requires a decrease in the maximum ambient tempera ture (or alternatively, operation at ambient temperatures lower than 85 °C can tolerate larger overall cable power dissipation). Please see application sheet APS-0705-41 for more information.

37. To calculate the maximum continuous load current at ambient temperatures between +85 and +105 °C, use the following formula: $I_{L,CONT(MAX)}\{T_A\} = I_{L,CONT(MAX)}\{T_A = 85\ °C\} \times (1 - DF/100 \times (T_A - 85\ °C))$.

38. Load terminal shorted to relay ground terminal.

39. For RYx41A-xxx models, typical/maximum value is specified at V_S = 12 V/18 V,respectively.

40. For RYx41B-xxx models, typical/maximum value is specified at V_S = 24 V/36 V,respectively.

41. To calculate the expected source-to-load voltage at an ambient temperature of 105 °C, multiply the typical and/or maximum voltage drop at an ambient temperature of 25 °C by MF (e.g. $V_{SL,DROP,TYP}\{T_A = 105\ °C\} = MF \times V_{SL,DROP,TYP}\{T_A = 25\ °C\}$).

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TYPICAL PERFORMANCE

Any inductance ("L") noted is the value seen between the source and load terminals.

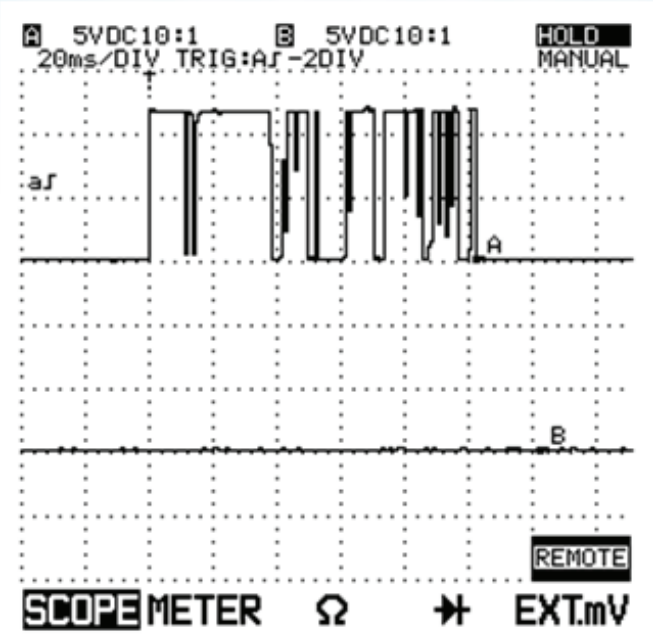


Figure 1: Trigger Noise Immunity (Relay Open)
Top Trace: Trigger Voltage
Bottom Trace: Load Voltage

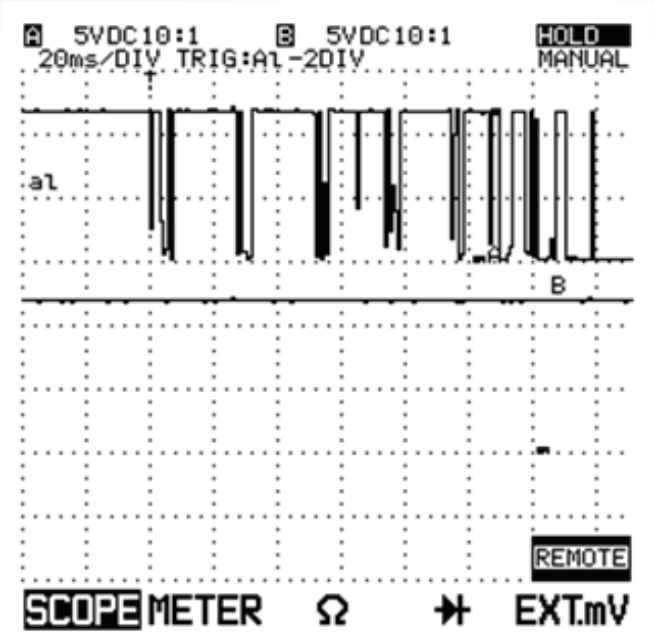


Figure 2: Trigger Noise Immunity (Relay Closed)
Top Trace: Trigger Voltage
Bottom Trace: Load Voltage

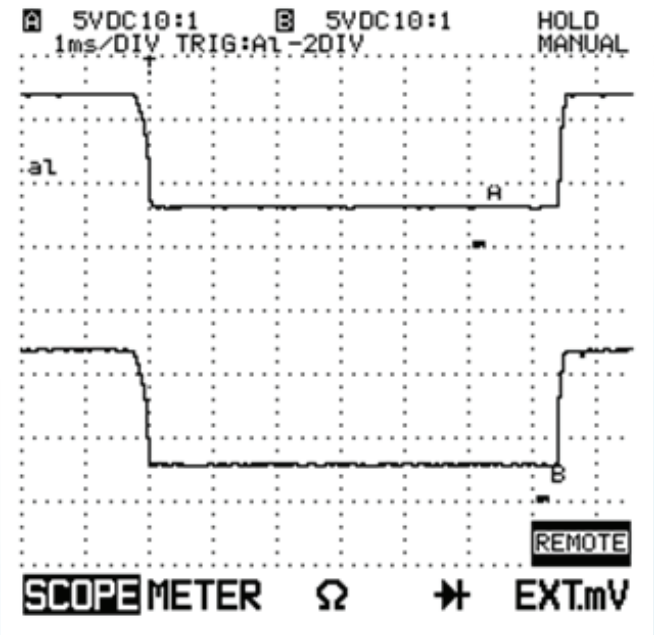
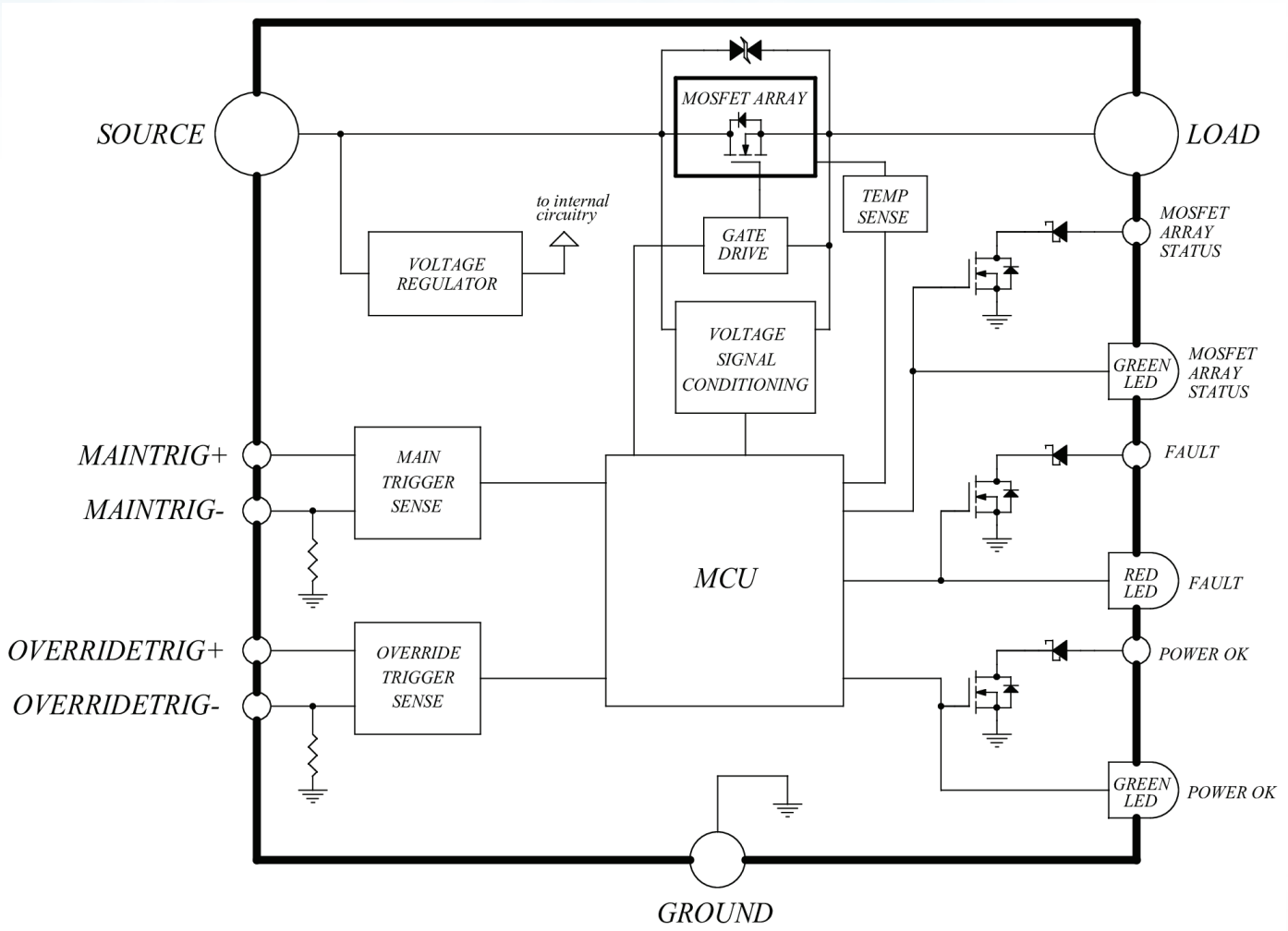


Figure 3: Cold-Crank Performance
Top Trace: Source Voltage
Bottom Trace: Load Voltage

FUNCTIONAL BLOCK DIAGRAM



MOSFET ARRAY STATUS: on when MOSFET array is enhanced
FAULT: on during over-current, short-circuit, circuit-break, over-temperature, and under- and over-voltage
POWER OK: on when source voltage is above minimum allowable

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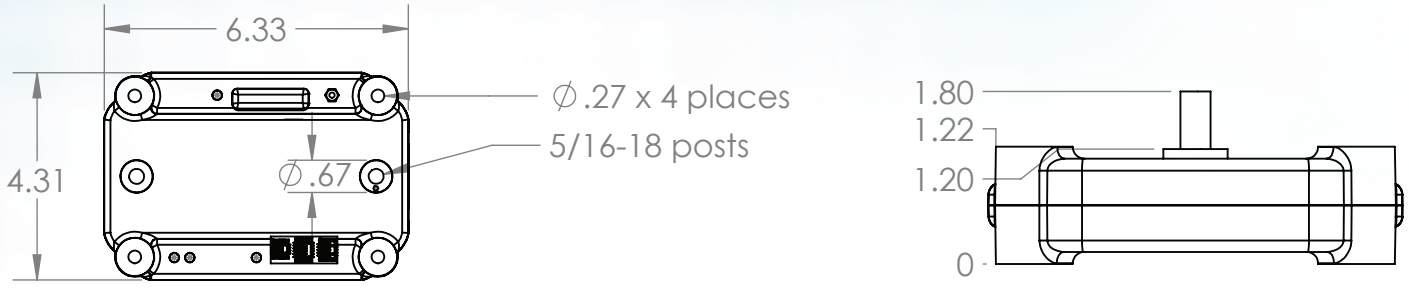
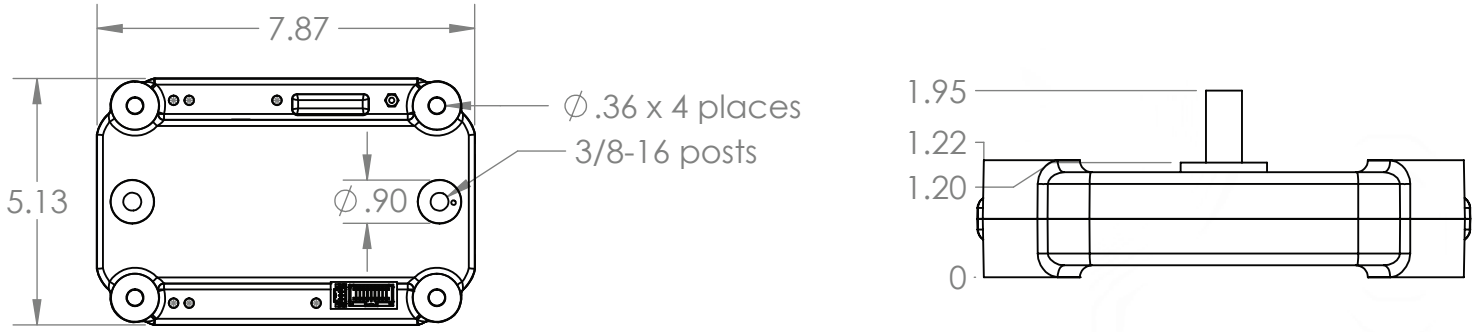
MECHANICAL QUICK SPECIFICATIONS

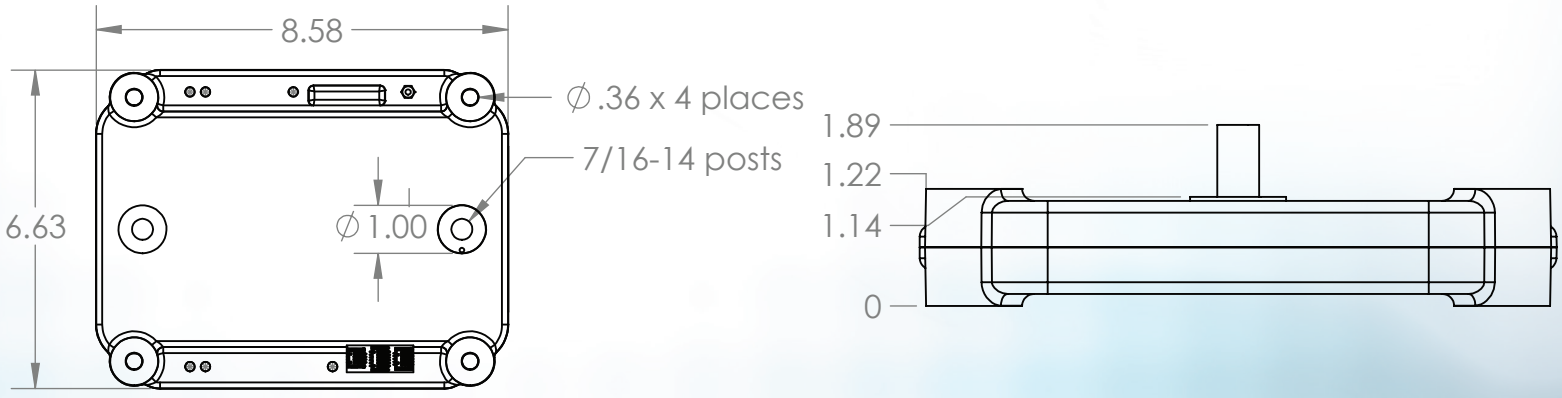
SMALL PACKAGE



MEDIUM PACKAGE



LARGE PACKAGE



Solid models for all packages available for website download.

Polycarbonate enclosure
Dow Corning Sylgard encapsulation
Brass conductive posts
Four integrated reinforced mounting points
6-32 ground connection
LED indicator lights

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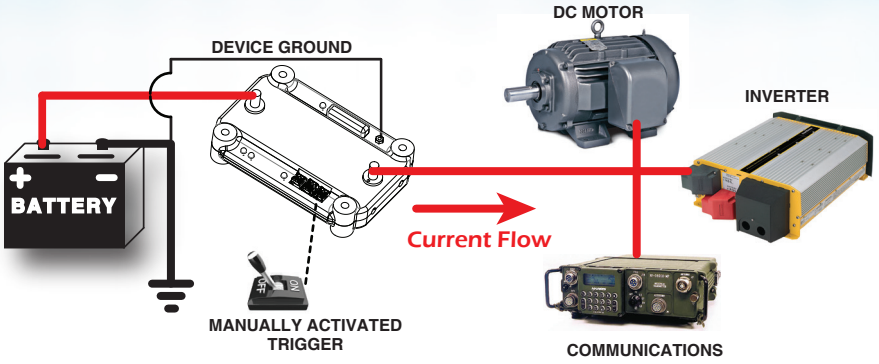
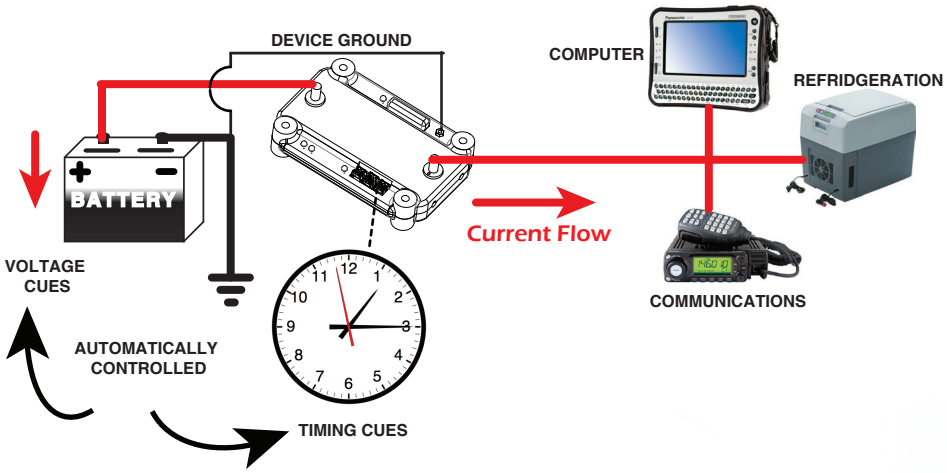
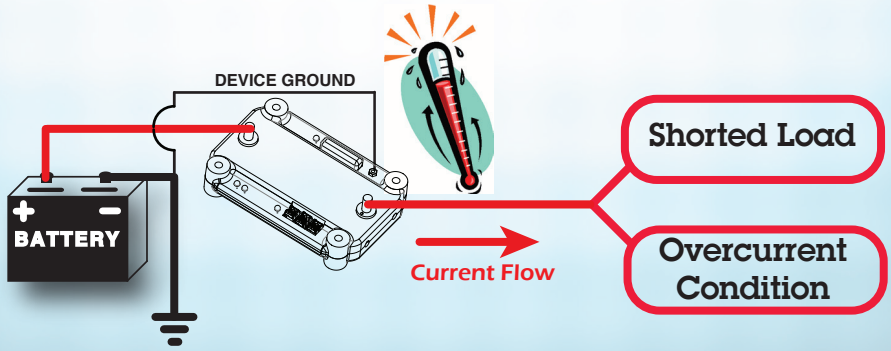
SAMPLE APPLICATIONS



POWER-GATE Uni-directional relay can be manually activated or ignition-switched to power or de-power all high and low current accessories including motors, inverters, communications equipment, lighting, refrigerators/freezers, and sensitive computer equipment.



POWER-GATE Uni-directional relay can be programmed to automatically respond to low-voltage or high voltage battery conditions, and various timing cues making the device highly customizable. The ability to handle both high and low current in a single, easy-to-install module makes POWER-GATE a compelling choice when programmed to behave as a low voltage disconnect and preserve battery health.



POWER-GATE Uni-directional relay can be programmed to respond as a precision circuit breaker. If the device senses a shorted load or an overcurrent condition, the device will "open" and de-power the output.

The device will also respond to over temperature conditions by sensing strategically placed sensors within the sealed module.

REVISION HISTORY

	DATE	DESCRIPTION	PAGE NUMBER (S)
0	03/26/2026	Original Release	

⚠ DANGER / PELIGRO / DANGER /GEFAHR / PERICOLO / PERIGO

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.

- Disconnect all power before installing or working with this equipment.
- Verify all connections and replace all covers before turning on power.

Failure to follow these instructions will result in death or serious injury.

RIESGO DE DESCARGA ELECTRICA O EXPLOSION.

- Desconectar todos los suministros de energia a este equipo antes de trabajar con este equipo.
- Verificar todas las conexiones y colocar todas las tapas antes de energizer el equipo.

El incumplimiento de estas instrucciones puede provocar la muerte o lesiones serias.

RISQUE DE DESCHARGE ELECTRIQUE OU EXPLOSION

- Eteindre toutes les sources d'énergie de cet appareil avant de travailler dessus de cet appareil
- Vérifier tous connections, et remettre tous couverts en olace avant de mettre sous

De non-suivi de ces instructions provoquera la mort ou des lésions sérieuses sérieuses.

GEFAHR EINES ELEKTRISCHE N SCHLAGES ODER EINER EXPLOSION.

- Stellen Sie jeglichen Strom ab, der dieses Gerät versorgt, bevor Sie an dem Gerät Arbeiten durchführen
- Vor der Inbetriebnahme alle Anschlüsse überprüfen und alle Gehäuseteile montieren.

Unterlassung dieser Anweisungen können zum Tode oder zu schweren Verletzungen führen.

RISCHIO DI SCOSSA ELETTRICA O DELL'ESPLOSI ONE.

- Spenga tutta l'alimentazion e che fornisce questa apparecchiatu ra prima del lavorare a questa apparecchiatu ra
- Verificare tutti i collegamenti e sostituire tutte le coperture prima della rotazione sull'alimentazi one

L'omissione di seguire queste istruz ioni provocherà la morte o di lesioni serie

RISCO DE DESCARGA ELÉTTRICA OU EXPLOSÃO

- Desconectar o equipamento de toda á energia antes de instalar ou trabalhar com este equipamen to
- Verificar todas as conexões e recolocar todas as tampas antes de religar o equipamento

O não cumprimento destas instruções pode levar á morte ou lesões sérias.

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