POWER-GATE™ Solid-State Devices
Dual Rectifier, Medium Package
DRM40
Specification Sheet

Generation 4.0

Made in U.S.A

ABSOLUTE MAXIMUM RATINGS(1)

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

Symbol	Parameter	Min.	Max.	Units
V_A	Anode Voltage, Model DRM40A-xxx	-0.3(2)	21(3)	V
	Anode Voltage, Model DRM40B-xxx	-0.3(2)	39(4)	
V_K	Cathode Voltage (anode voltage at min), Model DRM40A-xxx	-0.6(2)	21(3)	V
	Cathode Voltage (anode voltage at min), Model DRM40B-xxx	-0.6(2)	39(4)	
$V_{R,gndfloat}$(5)	Reverse Voltage (ground floating), Model DRM40A-xxx	-	21	V
	Reverse Voltage (ground floating), Model DRM40B-xxx	-	39	
$I_{F,gndfloat}$(5)	Forward Current (per rectifier, ground floating), DRM40x-100	-	10	A
	Forward Current (per rectifier, ground floating), DRM40x-150		15	
	Forward Current (per rectifier, ground floating), DRM40x-200		20	
	Forward Current (per rectifier, ground floating), DRM40x-250	-	25	
	Forward Current (per rectifier, ground floating), DRM40x-300	-	30	
T_A	Ambient Temperature	-45	+110	°C
V_{IGN}	Ignition Alternator Excitation Trigger Voltage	-39(6)	39(4)	V
$V_{STARTER}$	Starter Alternator Excitation Trigger Voltage	-39(6)	39(4)	
$I_{LED,MAX}$	Remote LED Maximum Current	-	30	mA
$V_{LED(OFF),MAX}$	Remote LED Maximum Voltage (LED Off)	-50	50	V

RECOMMENDED OPERATING CONDITIONS

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

Symbol	Parameter	Min.	Max.	Units
V_A	Anode Voltage, Model DRM40A-xxx	5.6	18	V
	Anode Voltage, Model DRM40B-xxx	5.6	36	
V_K	Cathode Voltage (anode voltage at min), Model DRM40A-xxx	5.5	18	V
	Cathode Voltage (anode voltage at min), Model DRM40B-xxx	5.5	36	
T_A	Ambient Temperature	-40	+105	°C
V_{IGN}	Ignition Alternator Excitation Trigger Voltage	0	36	V
$V_{STARTER}$	Starter Alternator Excitation Trigger Voltage	0	36	

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ELECTRICAL SPECIFICATIONS

All devices ("x" = don't care), all amperages DC, all voltages DC and referenced to ground, T_A = +25 ± 3 °C, 5.6 V ≤ V_A (DRM40A-xxx) ≤ 18 V, 5.6 V ≤ V_A (DRM40B-xxx) ≤ 36 V, all LEDs enabled, unless otherwise specified.

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions	Test Setup Figure
$I_{F,MAX}$	Maximum Forward Continuous Current (per rectifier)	-	-	100	A	Model DRM40x-100, -40 °C ≤ T_A ≤ +105 °C	-
		-	-	150		Model DRM40x-150, -40 °C ≤ T_A ≤ +105 °C	
		-	-	200		Model DRM40x-200, -40 °C ≤ T_A ≤ +105 °C	
		-	-	250		Model DRM40x-250, -40 °C ≤ T_A ≤ +105 °C	
		-	-	300		Model DRM40x-300, -40 °C ≤ T_A ≤ +105 °C	
$I_{SURGE,MAX}$	Maximum Forward Surge Current (per rectifier)	-	-	5 x $I_{F,MAX}$		Pulse width = 2 s, -40 °C ≤ T_A ≤ +105 °C	-
$I_{R,TURN-OFF,MAX}$	Maximum Reverse Turn-Off Current (per rectifier)	-	-	3 x $I_{F,MAX}$		-40 °C ≤ T_A ≤ +105 °C, no loop inductance[7]	-
$L_{LOOP,MAX}$	Maximum Loop Inductance[7]	-	-	568	µH	Model DRM40A-xxx, Reverse Turn-Off Current = 100 A, $T_{cathode\_post}$ = +50 °C	-
		-	-	193		Model DRM40A-xxx, Reverse Turn-Off Current = 150 A, $T_{cathode\_post}$ = +50 °C	
		-	-	92		Model DRM40A-xxx, Reverse Turn-Off Current = 200 A, $T_{cathode\_post}$ = +50 °C	
		-	-	52		Model DRM40A-xxx, Reverse Turn-Off Current = 250 A, $T_{cathode\_post}$ = +50 °C	
		-	-	33		Model DRM40A-xxx, Reverse Turn-Off Current = 300 A, $T_{cathode\_post}$ = +50 °C	
		-	-	115		Model DRM40B-xxx, Reverse Turn-Off Current = 100 A, $T_{cathode\_post}$ = +50 °C	
		-	-	18		Model DRM40B-xxx, Reverse Turn-Off Current = 150 A, $T_{cathode\_post}$ = +50 °C	
		-	-	7.8		Model DRM40B-xxx, Reverse Turn-Off Current = 200 A, $T_{cathode\_post}$ = +50 °C	
		-	-	3.4		Model DRM40B-xxx, Reverse Turn-Off Current = 250 A, $T_{cathode\_post}$ = +50 °C	
		-	-	1		Model DRM40B-xxx, Reverse Turn-Off Current = 300 A, $T_{cathode\_post}$ = +50 °C	
V_F	Forward Voltage Drop[8]	-	30	-	mV	DRM40A-100, Forward Current = $I_{F,MAX}$	-
		-	42	45		DRM40A-100, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	34	-		DRM40A-150, Forward Current = $I_{F,MAX}$	
		-	46	49		DRM40A-150, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	34	-		DRM40A-200, Forward Current = $I_{F,MAX}$	
		-	45	48		DRM40A-200, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	36	-		DRM40A-250, Forward Current = $I_{F,MAX}$	
		-	48	51		DRM40A-250, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	41	-		DRM40A-300, Forward Current = $I_{F,MAX}$	
		-	53	56		DRM40A-300, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	33	-		DRM40B-100, Forward Current = $I_{F,MAX}$	
		-	48	51		DRM40B-100, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	31	-		DRM40B-150, Forward Current = $I_{F,MAX}$	
		-	45	48		DRM40B-150, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	38	-		DRM40B-200, Forward Current = $I_{F,MAX}$	
		-	55	58		DRM40B-200, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	45	-		DRM40B-250, Forward Current = $I_{F,MAX}$	
		-	65	68		DRM40B-250, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
		-	49	-		DRM40B-300, Forward Current = $I_{F,MAX}$	
		-	72	76		DRM40B-300, Forward Current = $I_{F,MAX}$, T_A = +105 °C	
$I_{over,trip}$	Forward Over-current Indicator Trip		1.2 x $I_{F,MAX}$		A	-40 °C ≤ T_A ≤ +105 °C	
$I_{over,reset}$	Forward Over-current Indicator Reset		$I_{over,trip}$ - 10			-40 °C ≤ T_A ≤ +105 °C	
I_S	Operating Current[9]	-	0.8	-	mA	$V_{K,main}$ = $V_{K,aux}$ = 5.5 V, Anode floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	1
		-	1.0	-		$V_{K,main}$ = $V_{K,aux}$ = 12.0 V, Anode floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	1.1	-		$V_{K,main}$ = $V_{K,aux}$ = 18.0 V, Anode floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	1.3	-		Models DRM40B-xxx, $V_{K,main}$ = $V_{K,aux}$ = 24.0 V, Anode floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	1.5	-		Models DRM40B-100 and DRM40B-150, $V_{K,main}$ = $V_{K,aux}$ = 36.0 V, Anode floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
			1.7	-		Models DRM40B-200, DRM40B-250, and DRM40B-300, $V_{K,main}$ = $V_{K,aux}$ = 36.0 V, Anode floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	39	-		V_A = 5.5 V, Cathodes floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	2
		-	40	-		V_A = 12.0 V, Cathodes floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	41	-		V_A = 18.0 V, Cathodes floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	41	-		Models DRM40B-xxx, V_A = 24.0 V, Cathodes floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	43	-		Models DRM40B-xxx, V_A = 36.0 V, Cathodes floating, V_{IGN} = $V_{STARTER}$ = 0 V, Combine not active	
		-	66	-		Models DRM40A-xxx, $V_{K,x}$ = 12.0 V, Anode and other cathode floating, Combine active (COMBINE+ and COMBINE- shorted)	3
		-	68	-		Models DRM40B-xxx, $V_{K,x}$ = 24.0 V, Anode and other cathode floating, Combine active (COMBINE+ and COMBINE- shorted)	

Continued on next page...

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ELECTRICAL SPECIFICATIONS (continued)

All devices ("x" = don't care), all amperages DC, all voltages DC and referenced to ground, T_A = +25 ± 3 °C, 5.6 V ≤ V_A (DRM40A-xxx) ≤ 18 V, 5.6 V ≤ V_A (DRM40B-xxx) ≤ 36 V, all LEDs enabled, unless otherwise specified.

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions	Test Setup Figure
I_R	Reverse Leakage Current (per rectifier)	-	-	10	µA	$V_{K,x}$ = 5.5 V, V_A = 0 V	4
		-	-	20		$V_{K,x}$ = 12.0 V, V_A = 0 V	
		-	-	20		Models DRM40A-100, DRM40A-150, and DRM40B-xxx, $V_{K,x}$ = 18.0 V, V_A = 0 V	
		-	-	65		Models DRM40A-200, DRM40A-250, and DRM40A-300, $V_{K,x}$ = 18.0 V, V_A = 0 V	
		-	-	10		Models DRM40B-100 and DRM40B-150, $V_{K,x}$ = 24.0 V, V_A = 0 V	
		-	-	45		Models DRM40B-200, DRM40B-250, and DRM40B-300 $V_{K,x}$ = 24.0 V, V_A = 0 V	
		-	-	20		Models DRM40B-100 and DRM40B-150, $V_{K,x}$ = 36.0 V, V_A = 0 V	
		-	-	350		Models DRM40B-200, DRM40B-250, and DRM40B-300 $V_{K,x}$ = 36.0 V, V_A = 0 V	
$V_{IGN,ON}$	Ignition Alternator Excitation Trigger On Voltage[10]	-	2	-	V		5
$V_{IGN,OFF}$	Ignition Alternator Excitation Trigger Off Voltage[11]	-	$V_{IGN,ON}$ - 0.02	-			
$V_{STARTER,TRIP}$	Starter Alternator Excitation Trigger Trip Voltage[12]	-	2	-	V		6
$V_{STARTER,GO}$	Starter Alternator Excitation Trigger Go Voltage[12]	-	$V_{STARTER,GO}$ - 0.02	-			
I_{IGN}	Ignition Alternator Excitation Trigger Current	-	25	-	µA	V_{IGN} = 5.0 V	7
		-	61	-		V_{IGN} = 12.0 V	
		-	112	-		V_{IGN} = 18.0 V	
		-	173	-		V_{IGN} = 24.0 V	
		-	294	-		V_{IGN} = 36.0 V	
$I_{STARTER}$	Starter Alternator Excitation Trigger Current	-	50	-		$V_{STARTER}$ = 5.0 V	8
		-	121	-		$V_{STARTER}$ = 12.0 V	
		-	223	-		$V_{STARTER}$ = 18.0 V	
		-	344	-		$V_{STARTER}$ = 24.0 V	
		-	585	-		$V_{STARTER}$ = 36.0 V	
$t_{ALTEXC,DELAY}$	Alternator Excitation Delay Time[13]	-	4	-	s		-
$t_{ALTEXC,PULSEON}$	Alternator Excitation Pulse On Time[13]	-	0.5	-	s		-
$t_{ALTEXC,PULSEOFF}$	Alternator Excitation Pulse Off Time[13]	-	0.5	-	s		-
-	Number of Alternator Excitation Pulses[13]	-	-	60			
$I_{COMBINE}$	Combine Trigger Current	-	33	-	µA	COMBINE+ and COMBINE- shorted together	9
$V_{COMBINE+}$	COMBINE+ Floating Voltage	-	3.3	-	V		-
t_{RR}	Rectifier Reverse Recovery Time[14]	-	-	1.3	ms	Models DRM40A-xxx, I_F = $I_{SURGE,MAX}$	-
		-	-	1.5		Models DRM40B-xxx, I_F = $I_{SURGE,MAX}$	
$t_{MOSFET,START}$	MOSFET Start-up Time[15]	-	130	-	ms	V_A = 0 to 12 V, Cathodes floating	-
		-	-	5		V_{Kx} = 14 V to floating, V_A = 12 V	-

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. Larger negative voltages will blow internal fuse. If fuse blows, as long as V_A is not more negative than -21/-39 V for model DR40A-xxx/DR40B-xxx, respectively, and is less than V_K, no damage to device will occur. Only use manufacturer-specified fuse for replacement.
3. Transient-protected to 40 V. Additional external protection may be required in some applications.
4. Transient-protected to 60 V. Additional external protection may be required in some applications.
5. Using the rectifier with the device ground disconnected is not recommended. Exceeding any of these ratings will cause excessive heat buildup, leading to MOSFET failure.
6. Transient-protected to -60 V. Additional external protection may be required in some applications.
7. Loop inductances are defined as the external system inductance seen between the common anode and either cathode. See application sheet for further information.
8. Voltage drop tested under pulsed conditions with pulse length ≤ 2 s.
9. I_S sourced from cathode (anode), when V_A < V_K (V_A > V_K).
10. Ignition alternator excitation trigger on voltage defined as the ignition line voltage at which the alternator excitation process begins. Voltage must stay above this value during entire excitation process.
11. Ignition alternator excitation trigger off voltage defined as the ignition line voltage at which the alternator excitation process is terminated and reset; voltage must rise above the ignition alternator trigger on voltage to restart the alternator excitation process.
12. Starter alternator excitation trigger trip voltage is defined as the rising starter line voltage at which the device detects a start event. Starter alternator excitation trigger go voltage is defined as the falling starter line voltage at which the alternator excitation process begins (after the voltage has first risen above $V_{STARTER,TRIP}$). If at any time during the alternator excitation process the starter line voltage rises above $V_{STARTER,TRIP}$, the alternator excitation process will be terminated and the device will wait for the voltage to fall below $V_{STARTER,GO}$ before initiating a new alternator excitation process.
13. See application sheet for more information on the alternator excitation process.
14. Reverse recovery time measured from the time the anode-to-cathode voltage goes negative until the MOSFET array turns completely off. Reverse current may continue to flow through the MOSFET transient voltage supression diodes or the inductive load diode depending on the inductance in the system.
15. MOSFET start-up time is defined as the time from when V_A - V_K becomes positive to when the MOSFETs enter their low-resistance state.

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TEST SETUPS

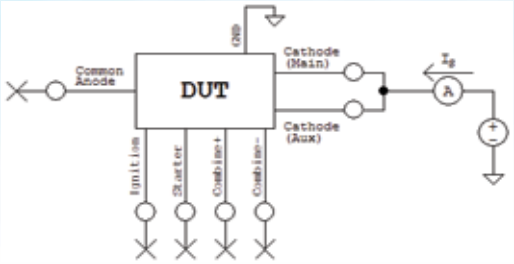

Figure 1: Operating Current ($V_K > V_A$)

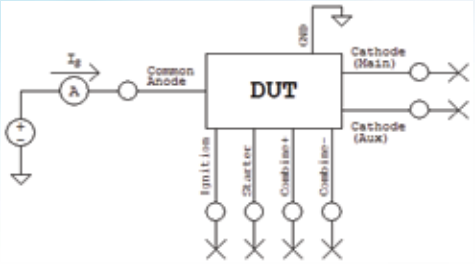

Figure 2: Operating Current ($V_A > V_K$)

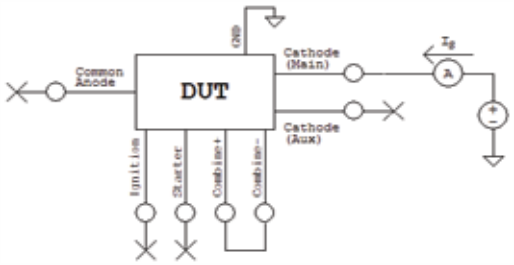

Figure 3: Operating Current (Combine Mode Active)

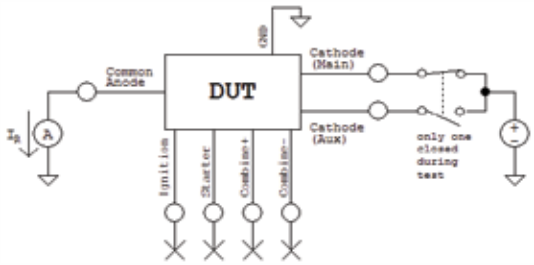

Figure 4: Reverse Leakage Current

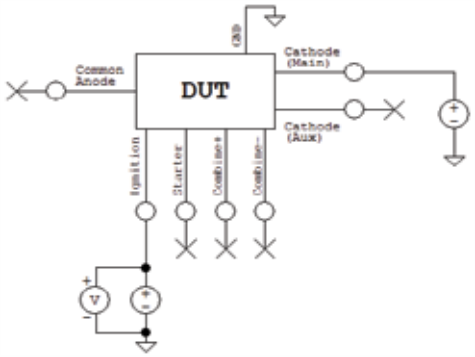

Figure 5: Ignition Alternator Excitation Voltage

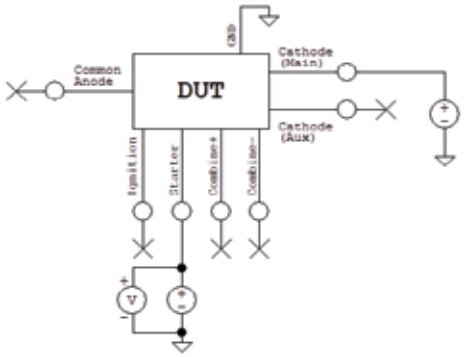

Figure 6: Starter Alternator Excitation Voltage

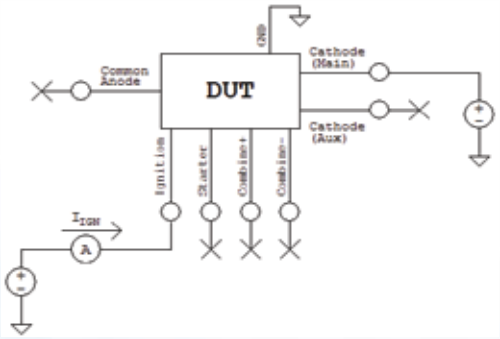

Figure 7: Ignition Alternator Excitation Current

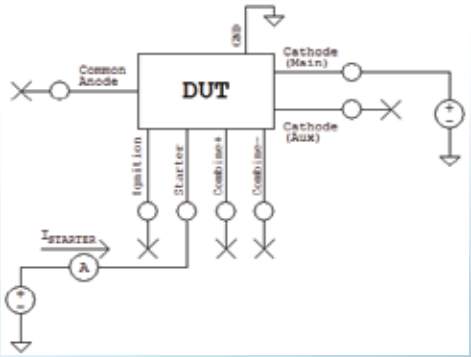

Figure 8: Starter Alternator Excitation Current

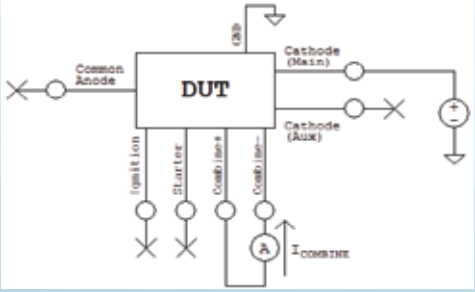

Figure 9: Combine trigger current

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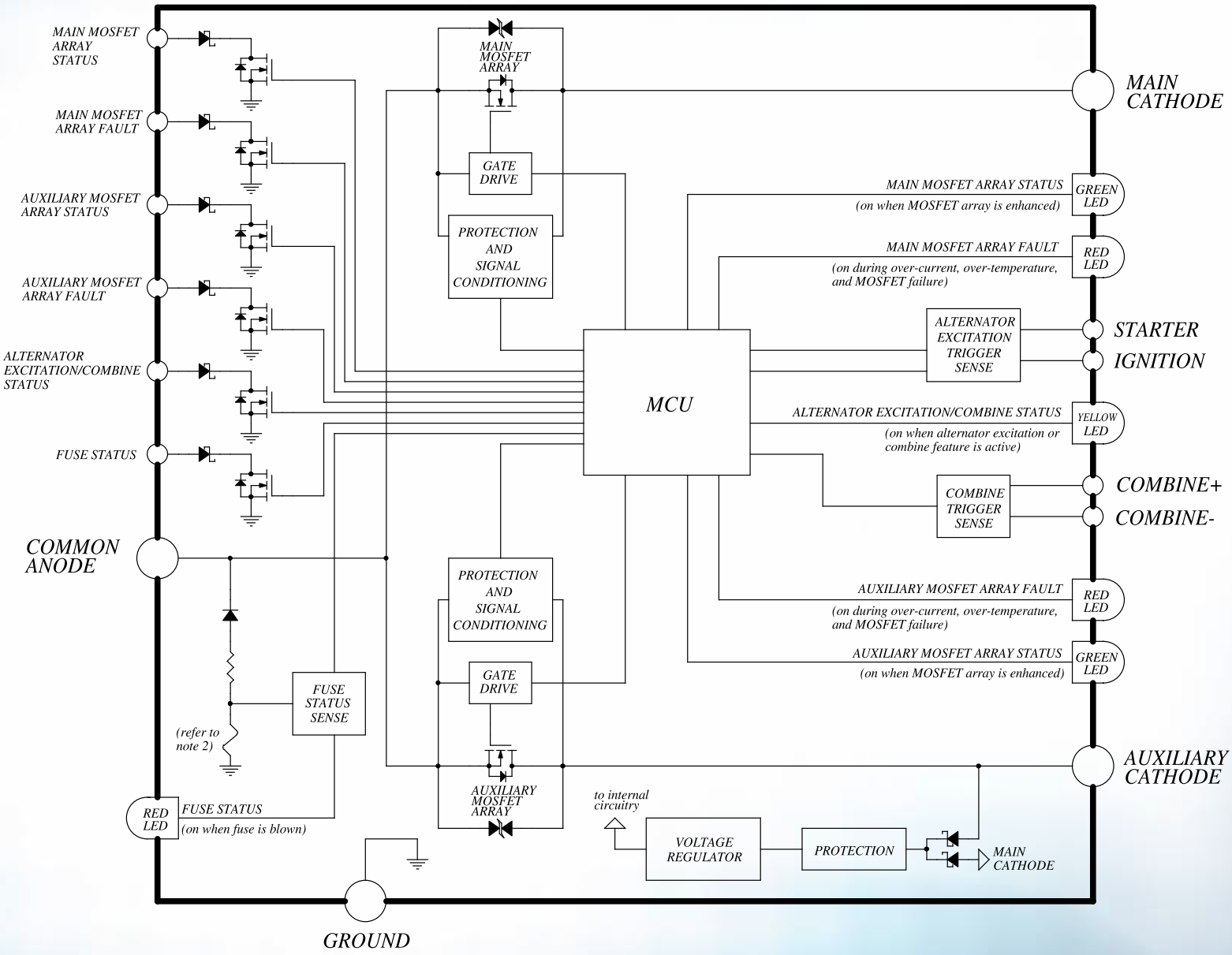
FUNCTIONAL BLOCK DIAGRAM



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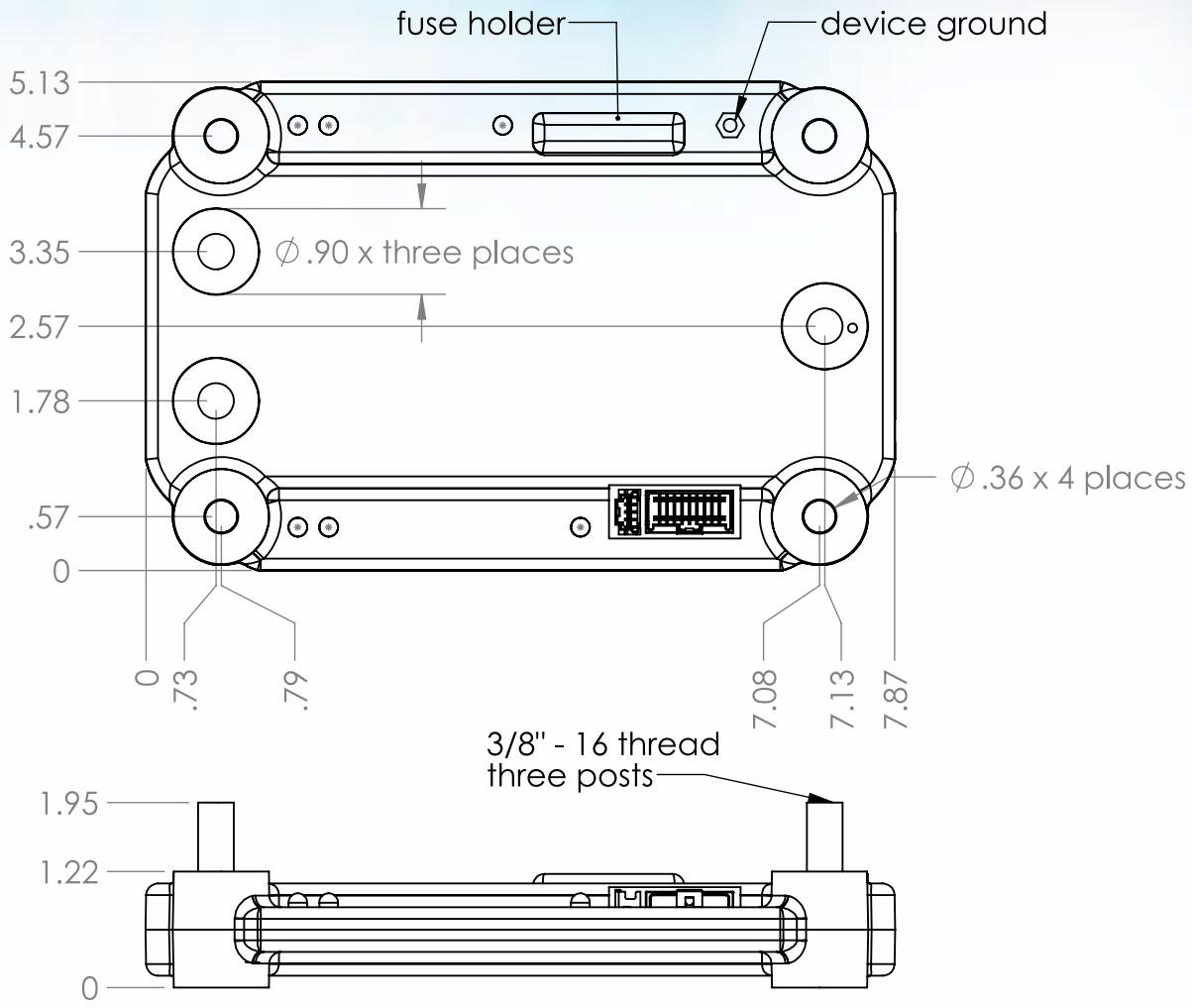
MECHANICAL



Electronic assembly inserted into ABS enclosure and fully encapsulated with silicone elastomer specifically developed for potting electronic modules.

Four intgrated mounting points for user supplied 5/16″ mounting hardware of suitable length.

Brass mounting posts, 3/8 -16 x .75″ with provided brass washers and nylon insert nuts. Mounting torque not to exceed 15 newton-meters.

Molex top-mounted control harness and expansion port for remote monitoring display.

Typical weight post encapsulation including provided hardware is 23.5 ounces (+ /- 10%)

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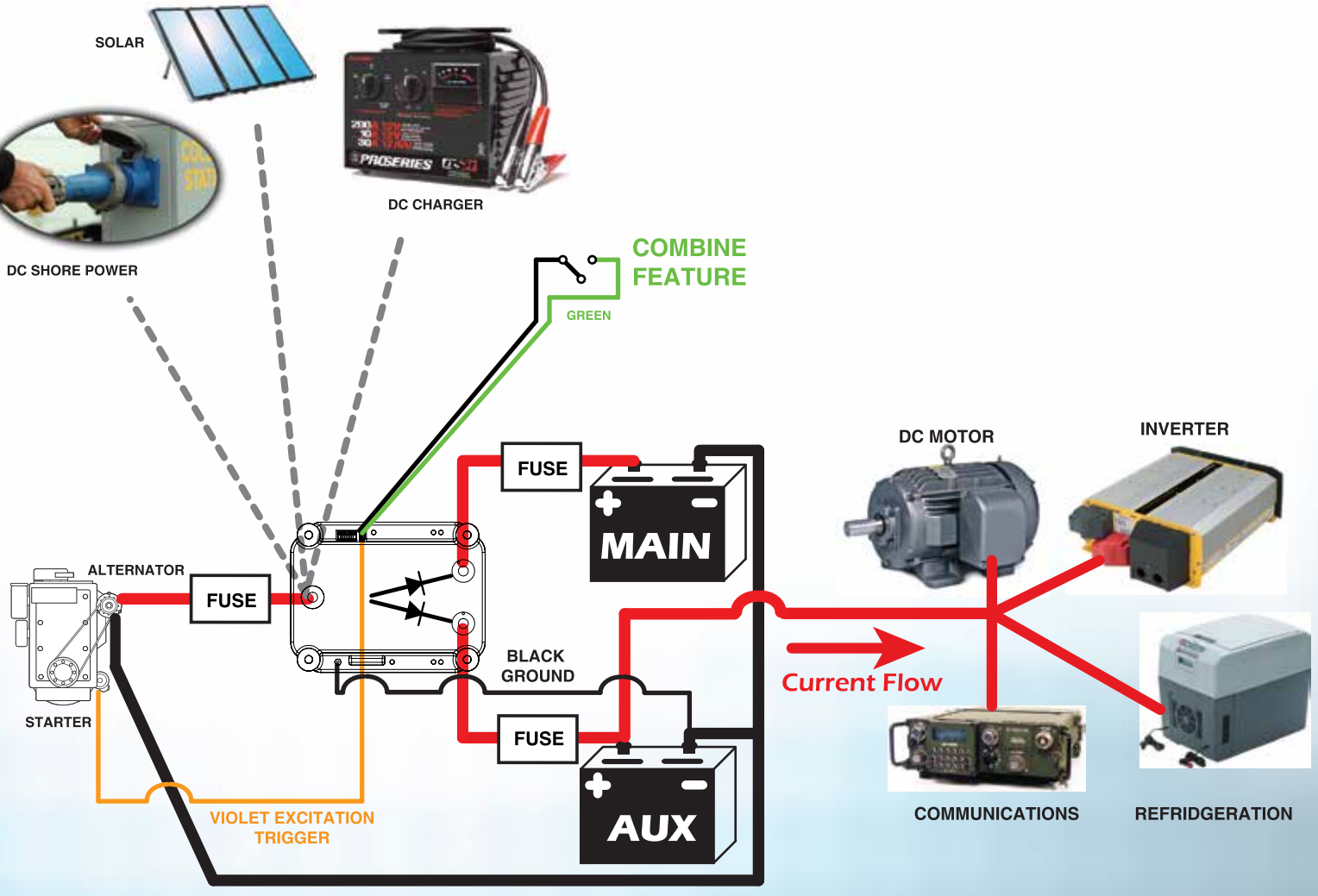
SAMPLE APPLICATIONS

Diagram 1

POWER-GATE Dual Rectifier allows all batteries in the network to be charged. In the diagram below, the alternator (or alternate charging source like DC shore power, solar array, or DC battery charger) is applying charging current to the anode (input) post of the rectifier. Current passes through two independent MOSFET arrays to Main Battery cathode and Auxiliary Battery cathode. Loads applied to the Auxiliary Battery are isolated from the Main Battery just as Main Battery loads are isolated from Auxiliary Battery.

The Orange alternator excitation circuit ensures that internally regulated alternators are energized by the down-stream battery during the engine cranking process, a necessity when placing an isolator between the alternator and batteries.

The Battery Combine feature causes bi-directional current flow between the two batteries when the two "combine" wires are joined together. Should the Main Battery be discharged to a low, no-start condition, the Auxiliary Battery can be "jumped" to the Main Battery. The use of a momentary switch is recommended to ensure the battery combine feature is disabled by default.



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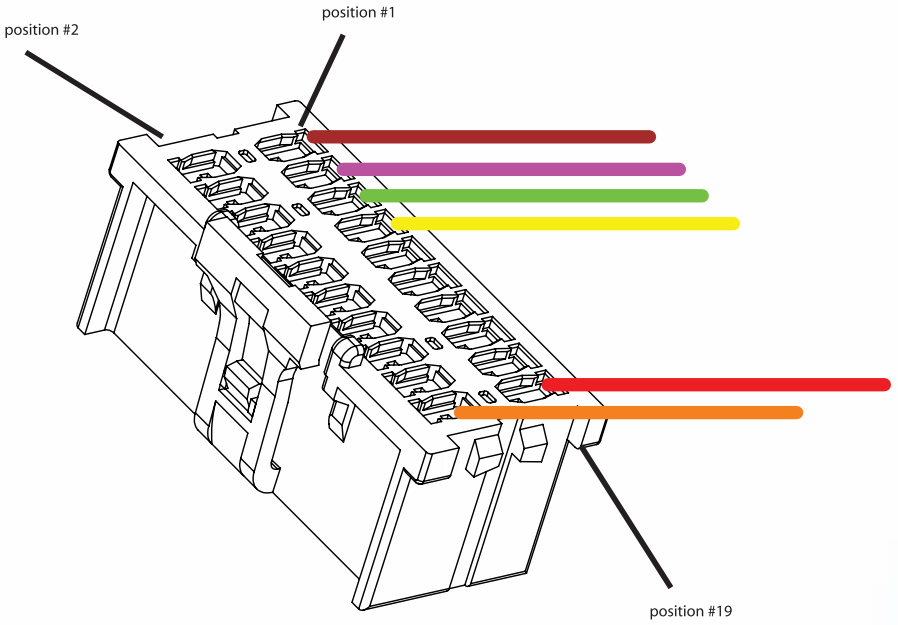
EXTERNAL LED WIRING

The manufacturer strongly recommends the use of remote-mounted visual indicators (LED or lamp) and/or audible indicators (alarm or buzzer) informing the driver of either normal operation or a fault condition. Should a fault condition occur, it is necessary to remove the Dual Rectifier from the electrical circuit and contact the manufacturer for diagnostic support or replacement.

Customer should match the LED / Lamp and/or alarm(s) to the voltage rating of the native electrical system. For example, a 12 volt vehicle will use a 12 volt Dual Rectifier with 12 volt LEDS and alarms. A 24 volt vehicle will use a 24 volt Dual Rectifier with 24 volt LEDS and alarms.

Current draw not to exceed 60mA

Wires coming from the connector are switched to ground when active, so the cathode of the LED should connect to the harness wire, and the anode should connect to the positive source voltage.



DR Accessory Harness 500482

Connector Housing: Molex 51353-2000
Terminals: Molex 0561349000
Wires: 22 AWG, -40° C to +105° C insulation rating
Wire Length: 2 meters

Pinout:	**Wire color:**
1 - Array 1 Status (Auxiliary leg)	BROWN
3 - Alternator Excite/Combine	VIOLET
5 - Array 2 Status (Main leg)	GREEN
7 - Fuse Status	YELLOW
19 - Array 2 Fault (Main leg)	RED
20 - Array 1 Fault (Auxiliary leg)	ORANGE

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NOTES

REVISION HISTORY

REV	DATE	DESCRIPTION	PAGE NUMBER (S)
0	08.24.16	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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