

# 19.5-40 Watt Hybrid

## Features

- Rad Hard: TID > 100kRad(Si)
- 2:1 margin: Operates beyond 200kRad TID
- No SEE: LET > 82MeV\*cm<sup>2</sup>/mg
- Proton Resistant: No optocouplers used
- Specifically engineered for 70 VDC satellite bus
- Completely self contained Thick Film Hybrid DC-DC Converter
- No external filter caps required
- Fully isolated design
- "Inhibit-not" function
- Power on soft start
- 200 kHz operation for low ripple and fast response time
- Built-in EMI input filter meets MIL-STD-461C requirements CE01, CE03, CS01, CS02 and CS06
- Short circuit and overvoltage protection
- Capability of external sync for switching frequencies
- Built-in test capability

## Specifications

**INPUT:** 70 VDC nominal

Range: 55 to 90 VDC continuous

### ISOLATION:

Input to case: 500 VDC

Input to output: 500 VDC

Output to case: 100 VDC

### ENVIRONMENT:

Storage temperature: -55°C to +150°C

Shock: 50 G's

Acceleration: 500 G's

Vibration: 30 G's

Grades EU, L, R & S:

Full Power Output at T<sub>case</sub> = +85°C

Linearly derates to zero at T<sub>case</sub> = +115°C

Grades LE, RE & SE:

Full Power Output at T<sub>case</sub> = +125°C

Linearly derates to zero at T<sub>case</sub> = +135°C

Grades L & LE:

TID up to 45kRad(Si)

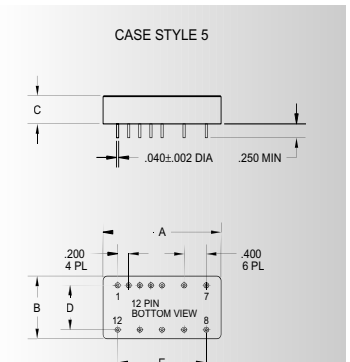
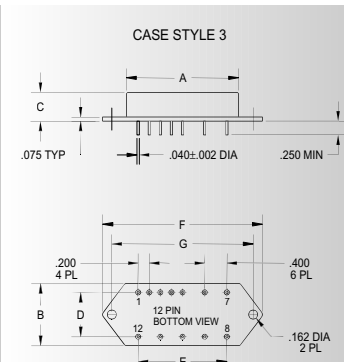
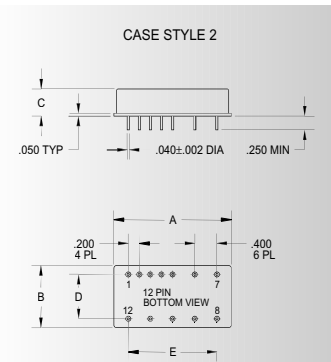
No SEE up to 60MeV\*cm<sup>2</sup>/mg

**WEIGHT:** 90 grams typical

| SINGLE OUTPUT DEVICES |  | 8193-S03.3 (26.4W) |      |      | 8193-S05 (40W) |      |      | 8193-S05.2 (40W) |      |       | 8193-S12 (40W) |       |       |
|-----------------------|--|--------------------|------|------|----------------|------|------|------------------|------|-------|----------------|-------|-------|
| PARAMETER             | CONDITION  | MIN                | TYP  | MAX  | MIN            | TYP  | MAX  | MIN              | TYP  | MAX   | MIN            | TYP   | MAX   |
| Output voltage        | —  | +3.2               | +3.3 | +3.4 | +4.9           | +5.0 | +5.1 | +5.1             | +5.2 | +5.3  | +11.9          | +12.0 | +12.1 |
| Output current        | V <sub>in min</sub> — V <sub>in max</sub>                                      | —                  | —    | 8A   | —              | —    | 8A   | —                | —    | 7.69A | —              | —     | 3.33A |
| Efficiency            | P <sub>out</sub> = max rated load  | 66%                | 69%  | —    | 71%            | 74%  | —    | 71%              | 74%  | —     | 78%            | 82%   | —     |
| Line regulation       | P <sub>out</sub> = max rated load<br>V <sub>in min</sub> — V <sub>in max</sub> | —                  | 10mV | 30mV | —              | 10mV | 50mV | —                | 10mV | 50mV  | —              | 20mV  | 100mV |
| Load regulation       | P <sub>out</sub> = 10% to F.L.   | —                  | 10mV | 30mV | —              | 10mV | 50mV | —                | 10mV | 50mV  | —              | 20mV  | 100mV |
| Output ripple         | F.L. BW 2 MHz<br>mV <sub>pp</sub>  | —                  | 30   | 65   | —              | 40   | 85   | —                | 40   | 85    | —              | 60    | 150   |

| SINGLE OUTPUT DEVICES |  | 8193-S15 (40W) |       |       | 8193-S28 (40W) |       |       |  |  |  |  |  |  |
|-----------------------|--|----------------|-------|-------|----------------|-------|-------|--|--|--|--|--|--|
| PARAMETER             | CONDITION  | MIN            | TYP   | MAX   | MIN            | TYP   | MAX   |  |  |  |  |  |  |
| Output voltage        | —  | +14.9          | +15.0 | +15.1 | +27.8          | +28.0 | +28.2 |  |  |  |  |  |  |
| Output current        | V <sub>in min</sub> — V <sub>in max</sub>                                      | —              | —     | 2.67A | —              | —     | 1.43A |  |  |  |  |  |  |
| Efficiency            | P <sub>out</sub> = max rated load  | 79%            | 83%   | —     | 78%            | 82%   | —     |  |  |  |  |  |  |
| Line regulation       | P <sub>out</sub> = max rated load<br>V <sub>in min</sub> — V <sub>in max</sub> | —              | 25mV  | 125mV | —              | 50mV  | 250mV |  |  |  |  |  |  |
| Load regulation       | P <sub>out</sub> = 10% to F.L.   | —              | 25mV  | 125mV | —              | 50mV  | 250mV |  |  |  |  |  |  |
| Output ripple         | F.L. BW 2 MHz<br>mV <sub>pp</sub>  | —              | 75    | 180   | —              | 150   | 350   |  |  |  |  |  |  |

| Model No. | Case Style | Pin Count | Mounting                                |
|-----------|------------|-----------|---|
| 8193      | 2          | 12        | Solder Sealed Flangeless PCB Mount      |
| 8193      | F          | 12        | Solder Sealed PCB Mount with Flange     |
| 8193      | J          | 12        | Seam Weld Flangeless PCB Mount          |
| 8193      | JF         | 12        | Seam Weld PCB Mount with Flange         |
| 8193      | XF         | 8         | Seam Weld Chassis Mount with Flange     |
| 8193      | PC         | 10        | Solder Sealed Flangeless PCB Stud Mount |



**TOLERANCES:** ALL DIMENSIONS ±0.01 EXCEPT F = MAX, C = +0.01/-0.02; DRAWINGS IN INCHES.

## Case Dimensions

Units: inches | millimeters

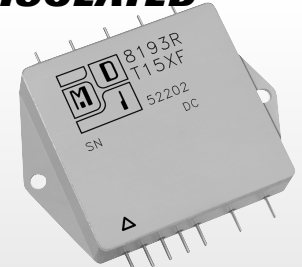
| Case Style | A              | B              | C              | D              | E              | F              | G              |
|------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 2          | 2.205   56.007 | 1.755   44.577 | 0.495   12.573 | 1.400   35.560 | 1.600   40.640 | —   —          | —   —          |
| 3 F        | 2.205   56.007 | 1.755   44.577 | 0.495   12.573 | 1.400   35.560 | 1.600   40.640 | 2.960   75.184 | 2.610   66.294 |
| 5 J        | 2.205   56.007 | 1.755   44.577 | 0.495   12.573 | 1.400   35.560 | 1.600   40.640 | —   —          | —   —          |
| 6 JF       | 2.220   56.388 | 1.760   44.704 | 0.495   12.573 | 1.400   35.560 | 1.600   40.640 | 2.960   75.184 | 2.610   66.294 |
| 8 XF       | 2.220   56.388 | 2.110   53.594 | 0.495   12.573 | —   —          | 1.600   40.640 | 2.960   75.184 | 2.610   66.294 |
| 10 PC      | 2.220   56.388 | 1.760   44.704 | 0.495   12.573 | 1.400   35.560 | 1.600   40.640 | —   —          | —   —          |

# DC-DC CONVERTERS

## PROTON RAD HARD 100K+™ SERIES

# 8193

### MAGNETICALLY ISOLATED

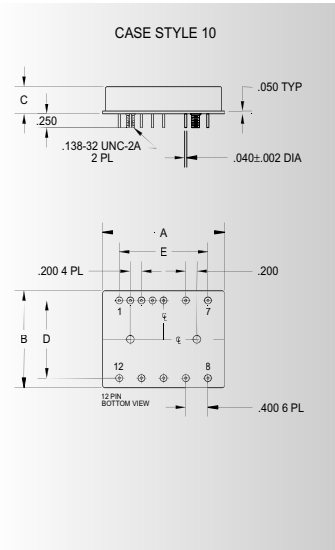
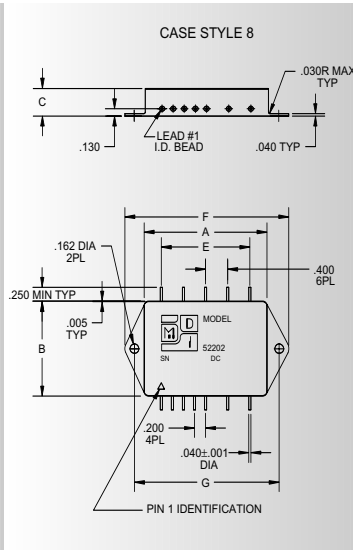
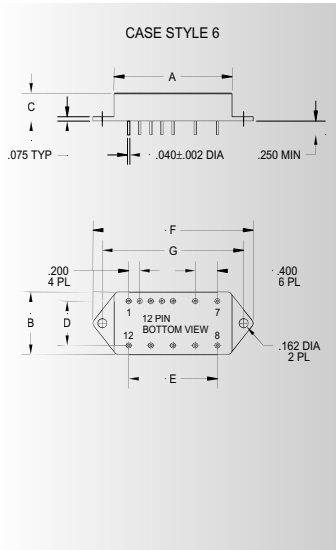


### 70 VDC

| DUAL OUTPUT DEVICES |  | 8193-D05 (40W) |       |       | 8193-D12 (40W) |       |        | 8193-D15 (40W) |       |        |
|---------------------|--|----------------|-------|-------|----------------|-------|--------|----------------|-------|--------|
| PARAMETER           | CONDITION  | MIN            | TYP   | MAX   | MIN            | TYP   | MAX    | MIN            | TYP   | MAX    |
| Output voltage      | $+I_{out} = -I_{out}$  | +4.9           | +5.0  | +5.1  | +11.9          | +12.0 | +12.1  | +14.9          | +15.0 | +15.1  |
|                     |  | -4.9           | -5.0  | -5.1  | -11.9          | -12.0 | -12.1  | -14.9          | -15.0 | -15.1  |
| Output current*     | $V_{in\ min} - V_{in\ max}$                                      | ±150mA         | —     | ±4A   | ±95mA          | —     | ±1.67A | ±76mA          | —     | ±1.33A |
| Efficiency          | $P_{out} = \text{max rated load}$                                | 73%            | 76%   | —     | 78%            | 82%   | —      | 79%            | 83%   | —      |
| Line regulation     | $P_{out} = \text{max rated load}$<br>$V_{in\ min} - V_{in\ max}$ | —              | ±10mV | ±50mV | —              | ±20mV | ±100mV | —              | ±25mV | ±125mV |
|                     |  | —              | ±10mV | ±50mV | —              | ±20mV | ±100mV | —              | ±25mV | ±125mV |
| Load regulation†    | $P_{out} = 10\%$ to F.L.   | —              | ±10mV | ±50mV | —              | ±20mV | ±100mV | —              | ±25mV | ±125mV |
| Output ripple       | F.L. BW 2 MHz<br>mV <sub>pp</sub>                                | —              | 40    | 85    | —              | 60    | 150    | —              | 75    | 180    |

Notes: \*Up to 90% full power available from either output if rated output power is not exceeded; †balanced load conditions.

| TRIPLE OUTPUT DEVICES |  | 8193-T3.3/5 (17.5W) |      |        | 8193-T3.3/12 (24W) |       |        | 8193-T3.3/15 (25.2W) |       |        | 8193-T05 (19.5W) |      |        | 8193-T12 (25.8W) |       |        | 8193-T15 (27W) |       |        |
|-----------------------|--|---------------------|------|--------|--------------------|-------|--------|----------------------|-------|--------|------------------|------|--------|------------------|-------|--------|----------------|-------|--------|
| PARAMETER             | CONDITION  | MIN                 | TYP  | MAX    | MIN                | TYP   | MAX    | MIN                  | TYP   | MAX    | MIN              | TYP  | MAX    | MIN              | TYP   | MAX    | MIN            | TYP   | MAX    |
| Output voltage        | $+I_{out} = -I_{out}$  | +3.2                | +3.3 | +3.4   | +3.2               | +3.3  | +3.4   | +3.2                 | +3.3  | +3.4   | +4.9             | +5.0 | +5.1   | +4.9             | +5.0  | +5.1   | +4.9           | +5.0  | +5.1   |
|                       |  | -4.9                | -5.0 | -5.1   | -11.9              | -12.0 | -12.1  | -14.9                | -15.0 | -15.1  | -4.9             | -5.0 | -5.1   | -11.9            | -12.0 | -12.1  | -14.9          | -15.0 | -15.1  |
| Output current        | $V_{in\ min} - V_{in\ max}$                                      | 400mA               | —    | 4A     | 400mA              | —     | 4A     | 400mA                | —     | 4A     | 90mA             | —    | 3A     | 90mA             | —     | 3A     | 90mA           | —     | 3A     |
|                       |  | ±40mA               | —    | ±450mA | ±40mA              | —     | ±450mA | ±32mA                | —     | ±400mA | ±40mA            | —    | ±450mA | ±40mA            | —     | ±450mA | ±32mA          | —     | ±400mA |
| Efficiency            | $P_{out} = \text{max rated load}$                                | 66%                 | 69%  | —      | 66%                | 69%   | —      | 66%                  | 69%   | —      | 66%              | 69%  | —      | 71%              | 74%   | —      | 71%            | 74%   | —      |
| Line regulation       | $P_{out} = \text{max rated load}$<br>$V_{in\ min} - V_{in\ max}$ | —                   | 10mV | 50mV   | —                  | 10mV  | 50mV   | —                    | 10mV  | 50mV   | —                | 10mV | 50mV   | —                | 10mV  | 50mV   | —              | 10mV  | 50mV   |
|                       |  | —                   | 25mV | 50mV   | —                  | 25mV  | 50mV   | —                    | 25mV  | 50mV   | —                | 25mV | 50mV   | —                | 25mV  | 50mV   | —              | 25mV  | 50mV   |
| Load regulation       | $P_{out} = 10\%$ to F.L.   | —                   | 10mV | 50mV   | —                  | 10mV  | 50mV   | —                    | 10mV  | 50mV   | —                | 10mV | 50mV   | —                | 10mV  | 50mV   | —              | 10mV  | 50mV   |
|                       |  | —                   | 25mV | 50mV   | —                  | 25mV  | 50mV   | —                    | 25mV  | 50mV   | —                | 25mV | 50mV   | —                | 25mV  | 50mV   | —              | 25mV  | 50mV   |
| Output ripple         | F.L. BW 2 MHz<br>mV <sub>pp</sub>                                | —                   | 30   | 65     | —                  | 30    | 65     | —                    | 30    | 65     | —                | 40   | 85     | —                | 40    | 85     | —              | 40    | 85     |
|                       |  | —                   | —    | 50     | —                  | —     | 50     | —                    | —     | 50     | —                | —    | 50     | —                | —     | 50     | —              | —     | 50     |



| 8193-SXX output <24 VDC |             |                       | 8193-SXX output ≥24 VDC |             |                        | 8193-DXX |             |                        | 8193-TXX |             |                        |
|-------------------------|-------------|-----------------------|-------------------------|-------------|------------------------|----------|-------------|------------------------|----------|-------------|------------------------|
| Pin 1                   | bit         | Pin 7 + input         | Pin 1                   | bit         | Pin 7 + input          | Pin 1    | bit         | Pin 7 + input          | Pin 1    | bit         | Pin 7 + input          |
| Pin 2                   | inhibit not | Pin 8 main output     | Pin 2                   | inhibit not | Pin 8 + remote sense   | Pin 2    | inhibit not | Pin 8 + remote sense   | Pin 2    | inhibit not | Pin 8 main output      |
| Pin 3                   | soft start  | Pin 9 main output ret | Pin 3                   | soft start  | Pin 9 - remote sense   | Pin 3    | soft start  | Pin 9 - remote sense   | Pin 3    | soft start  | Pin 9 main output ret  |
| Pin 4                   | sync        | Pin 10 + remote sense | Pin 4                   | sync        | Pin 10 main output     | Pin 4    | sync        | Pin 10 + dual output   | Pin 4    | sync        | Pin 10 + dual output   |
| Pin 5                   | N/C         | Pin 11 adjust         | Pin 5                   | adjust      | Pin 11 N/C             | Pin 5    | adjust      | Pin 11 dual output ret | Pin 5    | N/C         | Pin 11 dual output ret |
| Pin 6                   | input ret   | Pin 12 - remote sense | Pin 6                   | input ret   | Pin 12 main output ret | Pin 6    | input ret   | Pin 12 - dual output   | Pin 6    | input ret   | Pin 12 - dual output   |

Please specify **GRADE LEVEL** for your application. EU grade units will be shipped if no option is specified.

**EU** Engineering Units  
**R** 100 K+™, +85°C military/aerospace  
**L** 45 K, +85°C military/aerospace

**RE** 100 K+™, +125°C military/aerospace  
**S** 100 K+™, +85°C space  
**LE** 45 K, 125°C military/aerospace

**SE** 100 K+™, +125°C space