1. Application
   This specification applies to DC-DC Converter for telecommunication / data-communication equipment, MPDRX313S. For any other application, please contact us before using this product.

2. Customer Reference
   Customer Spec. Number
   Customer Part Number

3. Murata Part Number
   MPDRX313S

4. Appearance, Dimensions

Marking
   (1) Pin No.1 Marking / MFG ID
   (2) Parts No. PUL
   (3) Lot No. 
   Production factory Mark
   Production Year
   Production Month (1,2,3,…9,0,N,D)

Note:
1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it’s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
5. Pin Number and Function

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SENSE</td>
<td>Output Voltage sense</td>
</tr>
<tr>
<td>2,3,4</td>
<td>Vout</td>
<td>Output Voltage</td>
</tr>
<tr>
<td>5,6,7,8,13,9,10</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>FT</td>
<td>Output Trim</td>
</tr>
<tr>
<td>10</td>
<td>VAR</td>
<td>Vout Adjustment</td>
</tr>
<tr>
<td>11,12</td>
<td>Vin</td>
<td>Input Voltage</td>
</tr>
<tr>
<td>17</td>
<td>SS</td>
<td>Soft Start</td>
</tr>
<tr>
<td>18</td>
<td>N.C.</td>
<td>Non Connect</td>
</tr>
<tr>
<td>19</td>
<td>POW-GOOD1</td>
<td>Power Good</td>
</tr>
<tr>
<td>20</td>
<td>POW-GOOD2</td>
<td>Power Good</td>
</tr>
<tr>
<td>16</td>
<td>ON/OFF</td>
<td>Remote ON/OFF</td>
</tr>
</tbody>
</table>

6. Block Diagram

7. Environmental Conditions

7.1 Operating Temperature Range  
-40°C ~ +85°C

7.2 Storage Temperature Range  
-40°C ~ +85°C

7.3 Operating Humidity Range  
20% ~ 85%  (No water condenses in any cases.)

7.4 Storage Humidity Range  
10% ~ 90%  (No water condenses in any cases.)

↓ Note:
1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, its specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
### 8. Absolute Maximum Rating

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Absolute Rating</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Input Voltage</td>
<td>V</td>
<td>0 V</td>
<td></td>
</tr>
<tr>
<td>POW-GOOD Pin Voltage</td>
<td>V</td>
<td>Vin</td>
<td></td>
</tr>
<tr>
<td>ON/OFF Pin Voltage</td>
<td>V</td>
<td>Vin-0.3</td>
<td></td>
</tr>
<tr>
<td>Maximum POW-GOOD Pin Sink Current</td>
<td>mA</td>
<td>15 mA</td>
<td>Total of PG1 and PG2</td>
</tr>
</tbody>
</table>

No voltage, no matter how instantaneous, shall be applied beyond the absolute maximum voltage rating to this product. If you apply any voltage over this limit the product characteristics will deteriorate or the product itself will be destroyed. Even though it may continue operating for a while after the over-voltage event, its life will likely be shortened significantly. Reliability and life of the module may degrade similarly if the maximum operating voltage rating is continuously exceeded. This product is designed to operate within the maximum operating voltage rating specification.

### 9. Characteristics

#### 9.1. Electrical Characteristics

##### 9.1.1. Input Characteristics (Ta= 25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>Vin</td>
<td>4.5 5.0 5.5 V</td>
<td>V</td>
</tr>
<tr>
<td>Rising UVLO Threshold</td>
<td>UVLOr</td>
<td>- 4.3 - V</td>
<td>V</td>
</tr>
<tr>
<td>Falling UVLO Threshold</td>
<td>UVLOf</td>
<td>- 3.9 - V</td>
<td>V</td>
</tr>
</tbody>
</table>

##### 9.1.2. Interface Characteristics (Ta= 25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Good</td>
<td>PWGL</td>
<td>- 0.87Vo - V</td>
<td>V</td>
</tr>
<tr>
<td>Power Good High threshold</td>
<td>PWGH</td>
<td>- 1.13Vo - V</td>
<td>V</td>
</tr>
<tr>
<td>ON/OFF pin High Voltage</td>
<td>VIH</td>
<td>ON/OFF pin is pulled up to 5V inside of the DC-DC converter. If ON/OFF pin is left open, the DC-DC converter shall be &quot;ON&quot;. This pin will be pulled down to GND inside the DC-DC converter when UVLO events occur. Please do NOT connect this pin to power supply with low impedance line, so as not to damage the converter.</td>
<td></td>
</tr>
<tr>
<td>ON/OFF pin Low Voltage</td>
<td>VIL</td>
<td>OFF 0 - 0.3 V</td>
<td>V</td>
</tr>
<tr>
<td>ON/OFF Pin Output Current</td>
<td>IIL</td>
<td>- 0.02 - mA</td>
<td>mA</td>
</tr>
</tbody>
</table>

##### 9.1.3. General Characteristics (Ta= 25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage Range</td>
<td>Vout</td>
<td>See the Thermal derating curve in clause 9.1.4</td>
<td>V</td>
</tr>
<tr>
<td>Output Current</td>
<td>Iout</td>
<td>0 - 26 A</td>
<td>A</td>
</tr>
<tr>
<td>Output Voltage Tolerance</td>
<td>Vo tol</td>
<td>Over Vin, I0, Temperature range Rset=1% tolerance</td>
<td>%Vo</td>
</tr>
<tr>
<td>Ripple Voltage</td>
<td>Vrpl</td>
<td>Vin=5.0V, Iout=0~26A BW = 20MHz, Cout=200μF</td>
<td>mV(pp)</td>
</tr>
<tr>
<td>Efficiency</td>
<td>EFF</td>
<td>Vout=5.0V, Iout=26A</td>
<td>%</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>Frq</td>
<td>Vout=1.2V, Iout=26A</td>
<td>kHz</td>
</tr>
</tbody>
</table>

**Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
Note:
1. This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, its specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
The above derating limits apply to this product soldered directly to 101.6*180mm*1.6mm PCB (6 layer, with 70um copper). Any adjacent parts of high temperature may cause overheating. For reliable operation, please ensure that the FET temperature of this product is maintained below 120°C and the inductor temperature is below 106°C.

**Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, it’s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
9.2. Operation Information

9.2.1. Power Good

Powergood signal is appeared within the value of clause 9.1.2 (Open-drain output)

Output voltage is within voltage detection threshold: POW-GOOD is open.
Output Voltage is out of voltage detection threshold : POW-GOOD is connected to GND.

9.2.2. Output voltage sensing

By connecting SENSE-pin to the load, output voltage drop in wiring shall be compensated.

Please do NOT connect SENSE-pin to the output of LC filter that is set to the Vout line. When using this way, this product will not operate properly.

< Caution>
Please connect SENSE-pin to Vout-pin nearby the product, if sense function is not used.

9.2.3. Soft start function

By using the soft start function, ramp-rate of the output-starting is adjustable. Adjustment range of ramp-rate is from 2 to 10ms. Ramp rate is adjusted by external capacitor between SS-pin(17pin) and GND.

The equation of starting time about output voltage

\[ T_d = \frac{C_{ss}(1.2 \times 10^{-8}) \times 0.8}{5 \times 10^{-6} + 2 \times 10^{-4}} \times 0.8 \]  \[ \text{[s]} \]

Css : The capacitance of external capacitor.(F)

9.2.4. ON/OFF control

By using ON/OFF function, the operation of this product can be disabled without disconnection of input voltage.

When ON/OFF-pin(16pin) is left open ...... Output Voltage =ON
When ON/OFF-pin(16pin) is connected to GND ...... Output Voltage =OFF

< Caution>
ON/OFF pin is pulled up inside of the DC-DC converter, so voltage appears up to Vin at ON/OFF pin.
ON/OFF pin will be pulled down to GND inside the DC-DC converter when UVLO events occur. Please do NOT connect this pin to power supply, so as not to damage the converter.

**Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it’s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
9.2.5. Parallel Operation.
This product is incapable of parallel operation

9.2.6. Output Voltage Adjustment
The output voltage can be adjusted from 0.8V to 3.3V by connecting resistors between VAR-pin(10Pin) to GND-pin.
The following equation gives the required external-resistor values to adjust the output voltage to the required Vout.
It is highly recommended that evaluation of the characteristics of this DC-DC converter’s operation under your board conditions be thoroughly conducted.
In case output voltage is used more than 0.9V, please connect FT-pin (9pin) to GND.

\[ \text{RVAR} = \frac{5440}{\text{Vo-adj}[V] - 0.8[V]} \] - 1800 [Ω]

\[ \text{RVAR} = \frac{5440}{\text{Vo-adj}[V] - 0.9[V]} \] - 1800 [Ω]

<table>
<thead>
<tr>
<th>Voadj [V]</th>
<th>Calculated RVAR[Ω]</th>
<th>RVAR Example</th>
<th>FT pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>470</td>
<td>470</td>
<td>Short to GND</td>
</tr>
<tr>
<td>2.5</td>
<td>1600</td>
<td>1.6k</td>
<td>Short to GND</td>
</tr>
<tr>
<td>1.8</td>
<td>4240</td>
<td>3.9 k + 330</td>
<td>Short to GND</td>
</tr>
<tr>
<td>1.5</td>
<td>7270</td>
<td>6.8 k + 470</td>
<td>Short to GND</td>
</tr>
<tr>
<td>1.2</td>
<td>16330</td>
<td>16 k + 330</td>
<td>Short to GND</td>
</tr>
<tr>
<td>1.0</td>
<td>52600</td>
<td>47 k + 5.6k</td>
<td>Short to GND</td>
</tr>
<tr>
<td>0.9</td>
<td></td>
<td>Open</td>
<td>Short to GND</td>
</tr>
<tr>
<td>0.8</td>
<td></td>
<td>Open</td>
<td>Open</td>
</tr>
</tbody>
</table>

\* Note:
1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it’s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
9.3. Reliability

9.3.1. Humidity
According to JIS-C-0022.
40 ± 2°C, 90 to 95%RH, 100 hours. Leave for 4 hours at room temperature.
No damage in appearance and no deviation from electrical characteristics (section 9.1.).

9.3.2. Temperature Cycles
Repeat cycle 5 times. Leave 2 hours at room temp.
No damage in appearance and no deviation from electrical characteristics (section 9.1.).

<table>
<thead>
<tr>
<th>Step</th>
<th>Condition</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-40°C ± 3°C</td>
<td>30 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Room Temp.</td>
<td>5-10 minutes</td>
</tr>
<tr>
<td>3</td>
<td>+85°C ± 2°C</td>
<td>30 minutes</td>
</tr>
<tr>
<td>4</td>
<td>Room Temp.</td>
<td>5-10 minutes</td>
</tr>
</tbody>
</table>

9.3.3. Vibration
10 to 55Hz, 1.5mm amplitude (1 minute cycle), 1 hour for each of X, Y, Z directions.
No damage in appearance and no deviation from electrical characteristics (section 9.1.).

9.3.4. Mechanical Shock
20G, 1 time for each X, Y, Z directions.
No damage in appearance and no deviation from electrical characteristics (section 9.1.).

10. Test Circuit
In the following test circuit, the initial values under item 9.1. should be met.

10.1. General Measure Circuit

Note:
1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it’s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
10.2. Ripple Noise Measurement Circuit

Coaxial cable : 1.5D-2V, L=1.5m

DC-DC Converter

Vout

GND

Ceramic Capacitor

Oscilloscope

BW : 20MHz

Terminator

(Keisokugiken TRC-50F)

Equivalent circuit

R : 50Ω

C : 0.01μF

A: Ripple Noise Voltage

B: Ripple Voltage

C: Switching Period

Note:

1. This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, its specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
11. Packaging Specification
   11.1. Tray Dimensions
   DC-DC converter are put the trays. (See Fig.1)

![Fig.1 Diagram]

**Unit:** mm
**General Tolerance:** ±1.5mm

---

**Note:**
1. This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, it’s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
11.2. Contained pieces of products per corrugated box.

Maximum contained products pieces 96pcs./corrugated box

Further plural sheets of corrugated cardboard are placed on the top of the dummy tray according to number of contained trays in order to fill up the space in a corrugated box.

11.3. Packaging Form

Trays with products are lidded and packed in a corrugated box. (See Fig.2)

---

12. Production factory

Komatsu Murata Mfg. Co., Ltd.
Kanazu Murata Mfg. Co., Ltd.
Wakura Murata Mfg. Co., Ltd.

---

 우리나의 데이터는 아래와 같이 변할 수 있습니다. 

Note:

1. This datasheet is downloaded from the website of Murata Manufacturing Co., Ltd. Therefore, its specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
13. **Caution**

1. Be sure to provide an appropriate fail-safe function on your product to prevent secondary damage that may be caused due to abnormal functional or failure of this product.

2. Inrush current protection is not a feature of this product.

3. Please connect the input terminals with the correct polarity. If an error in polarity connection is made this product may be damaged. If this product is damaged internally, an elevated input current may flow, and so this product may exhibit an abnormal temperature rise, or your product may be damaged. Please add a diode and fuse per the following diagram to protect them.

![Diagram](image)

- Please select diode and fuse after confirming the operation of your product.

4. **Limitation of Application**

Please contact us before using this product for the applications listed below which require especially high reliability for the prevention of defects, which might directly cause damage to the third party's life, body or property.

- Aircraft equipment
- Aerospace equipment
- Undersea equipment
- Power plant control equipment
- Medical equipment
- Transportation equipment (vehicles, trains, ships, etc.)
- Traffic signal equipment
- Disaster prevention /crime prevention equipment
- Any other application of similar complexity and/or reliability requirements to the applications listed above.

14. **Notice**

14.1. **Soldering**

14.1.1. **Flux**

Please solder this product with Rosin Flux that contains of 0.2wt% or less chlorine. Please do not use high activity acid flux or water-soluble flux as they may reduce the reliability of this product.
14.1.2. PCB Land Pattern Recommendation

There are wiring coppers or through-hole via at the bottom side of the DC-DC converter. When you design your PCBs, please be careful not to short the circuit of the DC-DC converter or PCBs.

14.1.3. Soldering Conditions Recommendation

Reflow Soldering
This product is RoHS compliant. The following profile is recommended for the reflow of this product using Pb-free solder paste (Sn-Ag-Cu).

Method : Full convection reflow soldering

Reflow Soldering Profile
JEDEC IPC/JEDEC J-STD-020D
Table 6-2 Classification Reflow Profile
Pb-Free Assembly Large Body

Profile details
Soldering temperature : 245°C+0/-5°C
Soldering time : 30 seconds, 240 to 245°C
Heating time : 60 to 150 seconds, over 217°C
Preheating time : 60 to 120 seconds, 150 to 200°C
Programming rate : 3°C/sec. Max., 217 to 245°C
Descending rate : 6°C/sec. Max.
Total soldering time : 8 minutes Max., 25 to 245°C
Times : 1 time

Parts surface temperature [°C]

Do not vibrate for the products on reflow.
Please need to take care temperature control because mounted parts may come off if the product are left under the high temperature.

Do not reflow DC-DC converter as follows, because DC-DC converter may fall down from a substrate during reflowing.

Note:
1. This datasheet is downloaded from the website of Murata Manufacturing co., Ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
14.2. Cleaning
Please use no-cleaning type flux and do not wash this product.

14.3. Storage
14.3.1. Please store the products in room where the temperature/humidity is stable and direct sunlight cannot come in, and use the products within 6 months after delivery.
Please avoid damp and heat or such places where the temperature greatly changes, as water may condense on this product, and the quality of characteristics may be reduced, and/or be the solderability may be degraded.
If this product needs to be stored for a long time (more than 1 year), this product may be degraded in solderability and/or corroded. Please test the solderability of this product regularly.
Baking before reflow process is unnecessary to store the products under 30 ̊C, 60%RH or less up to 6 months.
In case the storage condition is over above mentioned, if these are unpacked condition, please bake them at 125 ̊C 5 ̊C/24hour. If these are packed in a tape, please bake them before soldering at 60 ̊C 5 ̊C/168hour.

14.3.2. Please do not store this product in places such as:
A dusty place, a place exposed directly to sea breeze, or in an atmosphere containing corrosive gas (Cl2,NH3,SO2,NOX and so on).

14.4. Operational Environment and Operational Conditions
14.4.1. Operational Environment
This product is not water-, chemical- or corrosion-proof. In order to prevent leakage of electricity and abnormal temperature rise of the product, do not operate under the following environmental conditions:
(1) An atmosphere containing corrosive gas (Cl2, NH3, SO2, NOX and so on)
(2) A high-dust environment
(3) Under the exposure of direct sunlight
(4) A location where the likelihood of exposure to water or water condensation exists.
(5) A location exposed to ocean air
(6) Any locations similar to the above

14.4.2. Operational Conditions
Please use this product within specified values (power supply, temperature, input, output and load condition, and so on). If the product is exposed to conditions outside of the specified values reliability of the product may be adversely effected.

14.4.3. Note prior to use
Diminished reliability and/or failure may result if the product is exposed to a high-level static charge, over-rated voltage or reverse voltage. Please avoid the following conditions be avoided prior to use of the product:
(1) Supply of power outside of rated values (see section 8)
(2) Supply of reverse power or inadequate connection of a 0 V(DC)line
(3) Electrostatic discharge from production line and/or operator
(4) Electrification of the product from electrostatic induction
(5) Excessive mechanical shock

14.5. Transportation
Murata recommends that when transporting this product, it be packed so as to avoid damage by mechanical vibration or exposure to adverse conditions such as ocean air, high humidity. It is additionally recommended that appropriate instructions and guidelines be communicated to carriers to prevent exposure to these same conditions.

15. Note
1. Murata recommends that customers ensure that the evaluation and testing of these devices are completed with this product actually assembled on their product.

2. All the items and parameters in this product specification have been prescribed on the premise that Murata’s product is used for the purpose, under the condition and in the environment mutually agreed upon.

This document is for reference only and subject to revision without prior of subsequent notice. Please contact Murata for latest documentation.

Note:
1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it’s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.