



FEATURES

- Optimised bipolar output voltages for IGBT/ Mosfet gate drives
- Reinforced insulation to UL60950 recognised
- ANSI/AAMI ES60601-1, 1 MOPP/2 MOOP's recognised³
- 5.2kVDC isolation test voltage 'Hi Pot Test'
- Ultra low coupling capacitance
- SIP package style
- 5V, 12V, 15V & 24V inputs
- +15V/-3V, +15V/-5V, +15V/-8.7V, +15V/-15V, +17V/-9V, +18V/-2.5V, +20V/-3.5V & +20V/-5V outputs
- Operation to 100°C
- Characterised CMTI >200kV/μS
- Continuous barrier withstand voltage 2.4kVDC
- Characterised partial discharge performance

PRODUCT OVERVIEW

The MGJ2 series of DC-DC converters is ideal for powering 'high side' and 'low side' gate drive circuits for IGBTs and Mosfets in bridge circuits. A choice of asymmetric output voltages allows optimum drive levels for best system efficiency and EMI. The MGJ2 series is characterised for high isolation and dv/dt requirements commonly seen in bridge circuits used in motor drives and inverters, while the MGJ2 industrial grade temperature rating and construction gives long service life and reliability.

SELECTION GUIDE

| Order Code | Nominal Input Voltage | Output Voltage 1 | Output Voltage 2 | Output Current 1 | Output Current 2 | Input Current at Rated Load | Load Regulation (Typ) | Load Regulation (Max) | Ripple & Noise (Typ) ² | Ripple & Noise (Max) ² | Efficiency (Min) | Efficiency (Typ) | Isolation Capacitance | MTTF ¹ | |
|---------------|-----------------------|------------------|------------------|------------------|------------------|-----------------------------|-----------------------|-----------------------|-----------------------------------|-----------------------------------|------------------|------------------|-----------------------|-------------------|-------|
| | V | V | V | | mA | | % | mVp-p | % | | pF | MIL. | | Tel. | |
| | | | | | | | | | | | | | | kHrs | |
| MGJ2D051505SC | 5 | 15 | -5 | 80 | 40 | 360 | 5.7 | 7 | 30 | 50 | 71 | 76 | 3 | 2095 | |
| MGJ2D051509SC | 5 | 15 | -8.7 | 80 | 40 | 390 | 6 | 7 | 30 | 50 | 73 | 77.5 | 3 | 1902 | |
| MGJ2D051515SC | 5 | 15 | -15 | 67 | 67 | 492 | 7 | 8.5 | 20 | 35 | 74 | 78 | 3 | 2629 | |
| MGJ2D051802SC | 5 | 18 | -2.5 | 80 | 80 | 410 | 9 | 12 | 20 | 50 | 70 | 75 | 3 | 1376 | 31920 |
| MGJ2D052003SC | 5 | 20 | -3.5 | 80 | 80 | 470 | 8 | 11 | 20 | 50 | 72 | 77 | 3 | 1253 | 32603 |
| MGJ2D052005SC | 5 | 20 | -5 | 80 | 40 | 440 | 6.2 | 8 | 30 | 50 | 74 | 78.5 | 3 | 1655 | |
| MGJ2D121503SC | 12 | 15 | -3 | 95 | 95 | 170 | 8 | 10 | 25 | 50 | 76 | 80 | 3 | 2014 | 80644 |
| MGJ2D121505SC | 12 | 15 | -5 | 80 | 40 | 150 | 4.7 | 6 | 30 | 50 | 76 | 80 | 3 | 2339 | |
| MGJ2D121509SC | 12 | 15 | -8.7 | 80 | 40 | 155 | 5.3 | 7.5 | 30 | 50 | 76 | 80 | 3 | 2296 | |
| MGJ2D121515SC | 12 | 15 | -15 | 67 | 67 | 203 | 6.0 | 7 | 24 | 40 | 78 | 82 | 3 | 2707 | |
| MGJ2D121802SC | 12 | 18 | -2.5 | 80 | 80 | 170 | 8 | 11 | 20 | 50 | 74 | 80 | 3 | 1553 | 36519 |
| MGJ2D122003SC | 12 | 20 | -3.5 | 80 | 80 | 190 | 7 | 10 | 20 | 50 | 77 | 82 | 3 | 1371 | 36431 |
| MGJ2D122005SC | 12 | 20 | -5 | 80 | 40 | 195 | 5.5 | 8 | 30 | 45 | 78 | 82 | 3 | 1799 | |
| MGJ2D151505SC | 15 | 15 | -5 | 80 | 40 | 120 | 5 | 7 | 30 | 50 | 75 | 80 | 3 | 2374 | |
| MGJ2D151509SC | 15 | 15 | -8.7 | 80 | 40 | 130 | 5 | 7 | 30 | 50 | 76 | 80 | 3 | 2736 | |
| MGJ2D151515SC | 15 | 15 | -15 | 67 | 67 | 167 | 5.5 | 7 | 23 | 35 | 75 | 79 | 3 | 2100 | |
| MGJ2D151802SC | 15 | 18 | -2.5 | 80 | 80 | 130 | 8 | 11 | 20 | 50 | 73 | 79 | 3 | 1392 | 32908 |
| MGJ2D152003SC | 15 | 20 | -3.5 | 80 | 80 | 150 | 7 | 10 | 20 | 50 | 76 | 81 | 3 | 2000 | 80000 |
| MGJ2D152005SC | 15 | 20 | -5 | 80 | 40 | 145 | 6 | 8 | 30 | 50 | 78 | 81 | 3 | 1864 | |
| MGJ2D241503SC | 24 | 15 | -3 | 95 | 95 | 90 | 8 | 10 | 25 | 50 | 76 | 80 | 4 | 2535 | 70910 |
| MGJ2D241505SC | 24 | 15 | -5 | 80 | 40 | 75 | 4.6 | 7 | 30 | 50 | 75 | 80.5 | 4 | 2194 | |
| MGJ2D241509SC | 24 | 15 | -8.7 | 80 | 40 | 80 | 4.8 | 7 | 30 | 50 | 77 | 82 | 4 | 2275 | |
| MGJ2D241709SC | 24 | 17 | -9 | 80 | 80 | 105 | 6 | 8 | 30 | 50 | 78 | 83 | 4 | 1050 | 47000 |
| MGJ2D241802SC | 24 | 18 | -2.5 | 80 | 80 | 90 | 8 | 11 | 20 | 50 | 74 | 80 | 4 | 1461 | 32315 |
| MGJ2D242003SC | 24 | 20 | -3.5 | 80 | 80 | 90 | 7 | 10 | 20 | 50 | 76 | 82 | 4 | 1333 | 32482 |
| MGJ2D242005SC | 24 | 20 | -5 | 80 | 40 | 90 | 6 | 8 | 30 | 50 | 78 | 82 | 4 | 1725 | |

INPUT CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|------------------------|---|------|------|------|-------|
| Voltage range | Continuous operation, 5V input types | 4.5 | 5 | 5.5 | V |
| | Continuous operation, 12V input types | 10.8 | 12 | 13.2 | |
| | Continuous operation, 15V input types | 13.5 | 15 | 16.5 | |
| | Continuous operation, 24V input types | 21.6 | 24 | 26.4 | |
| Input reflected ripple | 051505, 051509, 051515, 052003 & 052005 types | | 40 | | mA |
| | 121503, 121505, 121509, 121515, 122003, 122005, 151505, 151509, 151515 & 152005 types | | 20 | | |
| | 051802, 241505, 241509, 241709, 241802 & 242005 types | | 15 | | |
| | 122003, 121802, 151802, 152003, 241503, 241802 & 242003 types | | 10 | | |

1. Calculated using MIL-HDBK-217 FN2 and Telecordia SR-332 calculation model with nominal input voltage at full load.
 2. See ripple & noise test method.
 3. ANSI/AAMI ES60601-1 recognition is currently pending for the MGJ2D241709SC, MGJ2Dxx1515SC, MGJ2Dxx1802SC, MGJ2Dxx1503SC and MGJ2Dxx2003SC variants.

All specifications typical at T_a=25°C, nominal input voltage and rated output current unless otherwise specified.



| OUTPUT CHARACTERISTICS | | | | | |
|----------------------------|---|------|------|------|-------|
| Parameter | Conditions | Min. | Typ. | Max. | Units |
| Rated Power | T _A =-40°C to 100°C | | | 2 | W |
| Voltage Set Point Accuracy | See tolerance envelopes | | | | |
| Line regulation | High V _{IN} to low V _{IN} | | 1.0 | 1.2 | %/% |

| ISOLATION CHARACTERISTICS | | | | | | |
|--------------------------------------|-----------------------------------|-------------------------|---------------------|------|-------|------|
| Parameter | Conditions | Min. | Typ. | Max. | Units | |
| Isolation test voltage | Production tested for 1 second | 5200 | | | VDC | |
| | Qualification tested for 1 minute | 5200 | | | | |
| Resistance | Viso= 500VDC | | 1 | | GΩ | |
| Continuous barrier withstand voltage | Non-safety barrier application | | | 2400 | VDC | |
| Safety standard | UL60950-1 | MGJ2Dxx1515SC types | Basic/supplementary | | 200 | Vrms |
| | | All others | Reinforced | | 150 | |
| | | | Basic/supplementary | | 300 | |
| | ANSI/AAMI ES60601-1 | MGJ2Dxx1515SC types | 1 MOOP | | 200 | |
| | | All others ¹ | 1 MOOP | | 300 | |
| | | | 2 MOOP/1 MOPP | | 200 | |

| GENERAL CHARACTERISTICS | | | | | |
|-------------------------|-------------------------------------|------|------|------|-------|
| Parameter | Conditions | Min. | Typ. | Max. | Units |
| Switching frequency | All other types | | 45 | | kHz |
| | MGJ2Dxx1802SC & MGJ2D241503SC types | | 50 | | |

| TEMPERATURE CHARACTERISTICS | | | | | |
|--------------------------------|--|------|------|------|-------|
| Parameter | Conditions | Min. | Typ. | Max. | Units |
| Specification | All output types (see safety approval section for limitations) | -40 | | 100 | °C |
| Storage | | -55 | | 125 | |
| Case Temperature above ambient | 5V input types | | 24 | | |
| | All other input types | | 20 | | |
| Cooling | Free air convection | | | | |

| ABSOLUTE MAXIMUM RATINGS | |
|---|--|
| Short-circuit protection | Continuous |
| Lead temperature 1mm from case for 10 seconds | 260°C |
| Input voltage V _{IN} , MGJ2D05xxxxSC | 5.5V |
| Input voltage V _{IN} , MGJ2D12xxxxSC | 13.2V |
| Input voltage V _{IN} , MGJ2D15xxxxSC | 16.5V |
| Input voltage V _{IN} , MGJ2D24xxxxSC | 26.4V |
| Wave Solder | Wave Solder profile not to exceed the profile recommended in IEC 61760-1 Section 6.1.3. Please refer to application notes for further information. |

1. ANSI/AAMI ES60601-1 recognition is currently pending for the MGJ2D241709SC, MGJ2Dxx1515SC, MGJ2Dxx1802SC, MGJ2Dxx1503SC and MGJ2Dxx2003SC variants.

TECHNICAL NOTES

ISOLATION VOLTAGE

'Hi Pot Test', 'Flash Tested', 'Withstand Voltage', 'Proof Voltage', 'Dielectric Withstand Voltage' & 'Isolation Test Voltage' are all terms that relate to the same thing, a test voltage, applied for a specified time, across a component designed to provide electrical isolation, to verify the integrity of that isolation.

Murata Power Solutions MGJ2 series of DC-DC converters are all 100% production tested at 5.2kVDC for 1 second and have been qualification tested at 5.2kVDC for 1 minute.

The MGJ2 series is recognised by Underwriters Laboratory, please see safety approval section for more information. When the insulation in the MGJ2 series is not used as a safety barrier, i.e. provides functional isolation only, continuous or switched voltages across the barrier up to 2.4kV are sustainable. This is established by measuring the partial discharge inception voltage in accordance with IEC 60270. Please contact Murata for further information.

REPEATED HIGH-VOLTAGE ISOLATION TESTING

It is well known that repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage.

SAFETY APPROVAL

MGJ2Dxx1515SC

ANSI/AAMI ES60601-1

The MGJ2Dxx1515SC variants are pending recognition by Underwriters Laboratory (UL) to ANSI/AAMI ES60601-1 and provides 1 MOOP (Means Of Operator Protection) based upon a working voltage of 200 Vrms max and 280 Vpk max., between Primary and Secondary and between Primary and its Enclosure, in a maximum ambient temperature of 85°C and/or case temperature limit of 130°C (case temperature measured on the face opposite the pins).

File Number E202895 applies.

UL60950

The MGJ2Dxx1515SC variants have been recognised by Underwriters Laboratory (UL) to UL60950 for basic/supplementary insulation to a working voltage of 200Vrms in a maximum ambient temperature of 85°C and/or case temperature limit of 130°C (case temperature measured on the face opposite the pins).

File number E151252 applies.

Creepage and clearance 2mm

Working altitude 4000m

Fusing

The MGJ2 Series of converters are not internally fused so to meet the requirements of UL an anti-surge input line fuse should always be used with ratings as defined below.

MGJ2D051515SC: 2A

MGJ2D121515SC: 750mA

MGJ2D151515SC: 750mA

All fuses should be UL recognised and rated to 125V.

All other variants

ANSI/AAMI ES60601-1

The MGJ2 series has been recognised by Underwriters Laboratory (UL) to ANSI/AAMI ES60601-1 and provides 1 MOOP (Means Of Operator Protection) based on a working voltage of 300Vrms or 2 MOOP based upon a working voltage of 200 Vrms, and 1 MOPP (Mean Of Patient Protection) based on a working voltage of 200Vrms., between Primary and Secondary. The MGJ2D241709SC, MGJ2Dxx1802SC, MGJ2Dxx1503SC and MGJ2Dxx2003SC variants are currently pending recognition.

File number E202895 applies.

UL60950

The MGJ2 series is recognised by Underwriters Laboratory (UL) to UL60950 for reinforced insulation to a working voltage of 150Vrms and for basic/supplementary insulation to a working voltage of 300Vrms.

File number E151252 applies.

| Over voltage category | OVC I | OVC II |
|-----------------------|---------|---------|
| Working voltage | 150Vrms | 300Vrms |
| Working altitude | 2000m | 2000m |
| Creepage & clearance | 2mm | 2mm |

Fusing

The MGJ2 Series of converters are not internally fused so to meet the requirements of UL an anti-surge input line fuse should always be used with ratings as defined below.

MGJ2D05xxxxSC: 1.25A

MGJ2D12xxxxSC: 750mA

MGJ2D15xxxxSC: 750mA

MGJ2D24xxxxSC: 750mA

All fuses should be UL recognised and rated to 125V.

RoHS COMPLIANCE INFORMATION



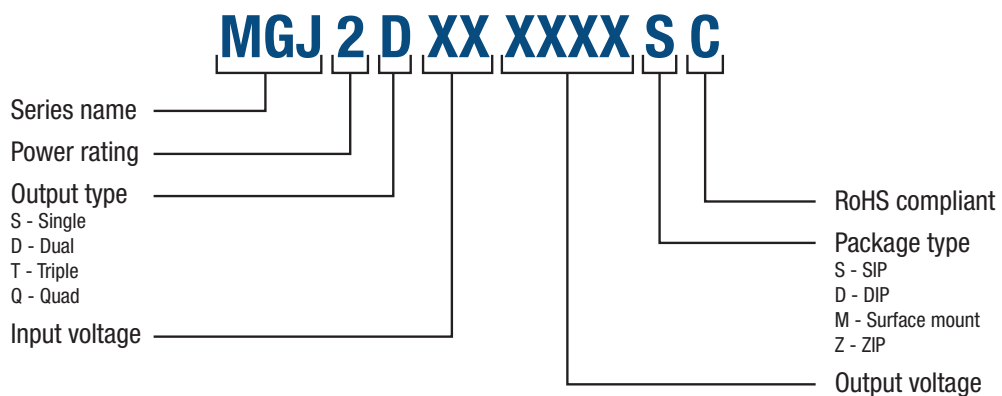
This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260°C for 10 seconds. Please refer to [application notes](#) for further information. The pin termination finish on this product series is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems. For further information, please visit www.murata-ps.com/rohs

ENVIRONMENTAL VALIDATION TESTING

The following tests have been conducted on this product series, as part of our design verification process. The datasheet characteristics specify user operating conditions for this series, please contact Murata if further information about the tests is required.

| Test | Standard | Condition |
|-------------------------------|---|---|
| Temperature cycling | MIL-STD 883 1010, Condition B | 10 cycles between two chambers set to achieve -55°C and +125°C. The dwell time shall not be less than 10min. |
| Humidity bias | JEDEC JESD22-A101 | 85°C ± 2°C, 85% ± 5% R.H. for >1000 hours. |
| High temperature storage life | JEDEC JESD22-A103, Condition A | 125°C +10/-0°C for ≥1000 hours. |
| Vibration | MIL-STD 883 Method 2007, Condition A | 1.5mm pk-pk / 20g pk min, 20-2000Hz, 4 sweeps in each of 3 mutually perpendicular axes at 3 oct/min. |
| Shock | MIL-STD 883 method 2002, Condition A | 500g 1.0ms half sine, 5 shocks in each direction of 3 mutually perpendicular axes. |
| ESD | JEDEC JESD22-A114 | HBM Testing Standard at 3 stress levels; 2.0kV, 4.0kV and 8.0kV. |
| Bump | IEC Class 4M5 of ETS 300 019-2-4 | Shock Spectrum Type II, 6ms duration, 250m/s ² 500 bumps in 6 directions. |
| Solderability | IPC/ECA J-STD-002, Test A and A1 | SnPb (Test A): For lead free solderability the parts are conditioned in a steam ager for 8 hours ±15 min. at a temperature of 93±3°C. Dipped in solder at 255°C ±5°C for 5 +0/-0.5 seconds. Pb-free (Test A1): For leaded solderability the parts are conditioned in a steam ager for 8 hours ±15 min. at a temperature of 93±3°C. Dipped in solder at 245°C ±5°C for 5 +0/-0.5 seconds |
| Solder heat | JEDEC JESD22-B106 | The test sample is subjected to a molten solder bath at 260 ±5°C for 10 seconds (96SC tin/silver/copper). |
| Solder heat (hand) | MIL-STD 202 Method 210, Condition A | The soldering iron is heated to 350°C ± 10°C and applied to the terminations for a duration of 4 to 5 seconds. |
| Solvent cleaning | Resistance to cleaning agents. | Solvent – Novec 71IPA & Topklean EL-20A. Pulsed ultrasonic immersion 45°C- 65°C |
| Solvent Resistance | MIL-STD 883 Method 2015 | Separate samples subjected to solvent A, solvent B and solvent D |
| Lead Integrity (Adhesion) | MIL-STD 883 Method 2025 | Leads are bent through 90° until a fracture occurs. |
| Lead Integrity (Fatigue) | MIL-STD 883 Method 2004, condition B ₂ | The leads are bent to an angle of 15°. Each lead is subjected to 3 cycles. |
| Lead Integrity (Tension/Pull) | MIL-STD 883 Method 2004, Condition A ₁ | Pull of 0.227kg applied for 30 seconds. The force is then increased until the pins snap. |

PART NUMBER STRUCTURE



CHARACTERISATION TEST METHODS

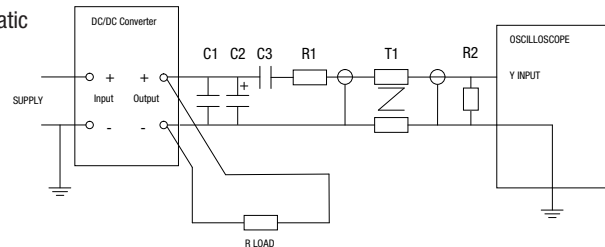
Ripple & Noise Characterisation Method

Ripple and noise measurements are performed with the following test configuration.

| | |
|-------|--|
| C1 | 1µF X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC-DC converter |
| C2 | 10µF tantalum capacitor, voltage rating to be a minimum of 1.5 times the output voltage of the DC-DC converter with an ESR of less than 100mΩ at 100 kHz |
| C3 | 100nF multilayer ceramic capacitor, general purpose |
| R1 | 450Ω resistor, carbon film, ±1% tolerance |
| R2 | 50Ω BNC termination |
| T1 | 3T of the coax cable through a ferrite toroid |
| RLOAD | Resistive load to the maximum power rating of the DC-DC converter. Connections should be made via twisted wires |

Measured values are multiplied by 10 to obtain the specified values.

Differential Mode Noise Test Schematic



APPLICATION NOTES

Minimum load

The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically 1.25 times the specified output voltage if the output load falls to less than 5%.

Gate Drive Applications Advisory Note

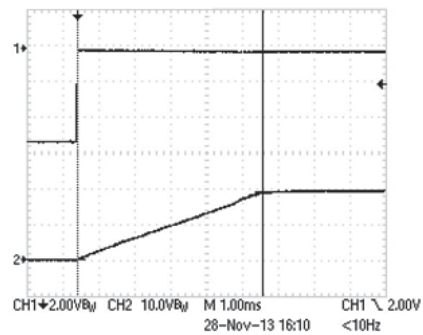
For general guidance for product usage in gate drive applications please refer to [“gate drive application notes”](#).

Capacitive loading and start up

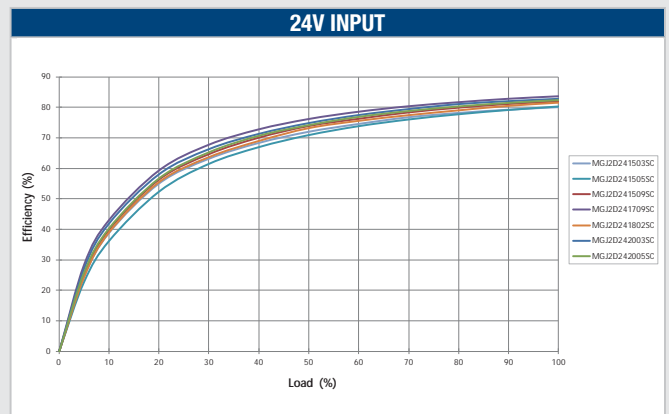
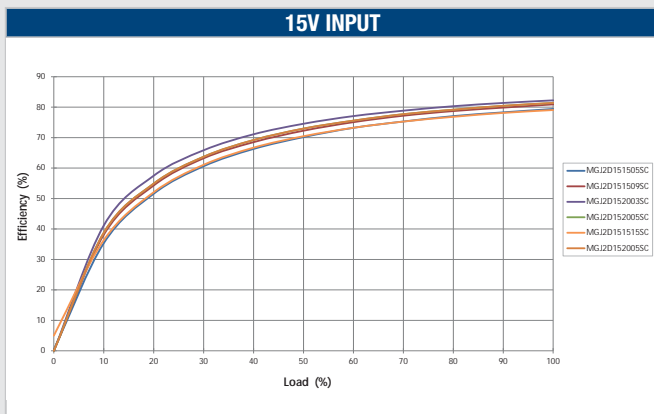
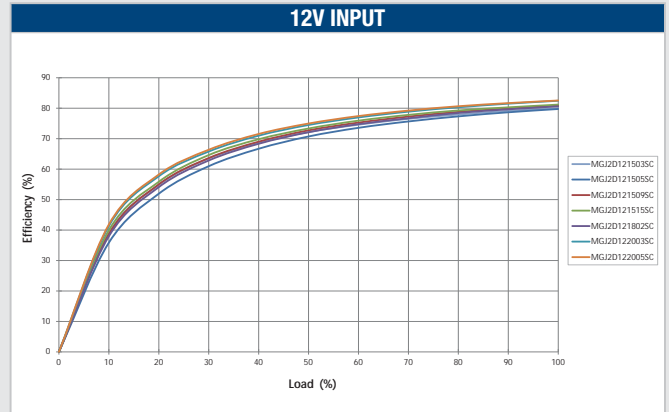
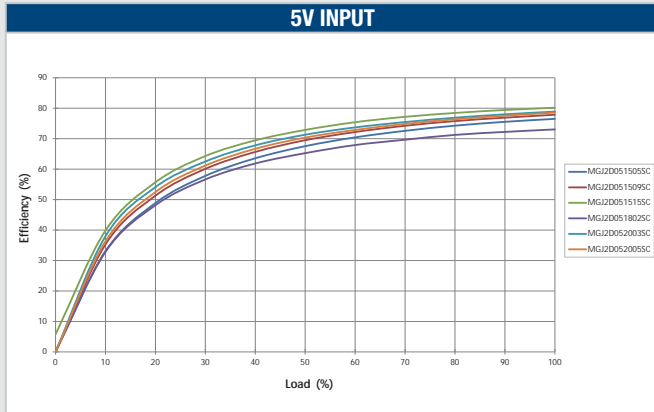
Typical start up times for this series, with a typical input voltage rise time of 2.2µs and output capacitance of 10µF, are shown in the table below. The product series will start into capacitance ranging from 47µF up to 220µF with increased start times.

| | Start-up time ms | | Start-up time ms |
|---------------|---------------------|---------------|---------------------|
| MGJ2D051505SC | 3 | MGJ2D151505SC | 2.5 |
| MGJ2D051509SC | 4.5 | MGJ2D151509SC | 3 |
| MGJ2D051515SC | 21 | MGJ2D151515SC | 10.5 |
| MGJ2D051802SC | 4 | MGJ2D151802SC | 3 |
| MGJ2D052003SC | 5 | MGJ2D152003SC | 5 |
| MGJ2D052005SC | 5 | MGJ2D152005SC | 4.5 |
| MGJ2D121503SC | 3 | MGJ2D241503SC | 3 |
| MGJ2D121505SC | 3 | MGJ2D241505SC | 3 |
| MGJ2D121509SC | 4 | MGJ2D241509SC | 3 |
| MGJ2D121515SC | 14.5 | MGJ2D241709SC | 4 |
| MGJ2D121802SC | 5 | MGJ2D241802SC | 3 |
| MGJ2D122003SC | 5 | MGJ2D242003SC | 4 |
| MGJ2D122005SC | 5.5 | MGJ2D242005SC | 4 |

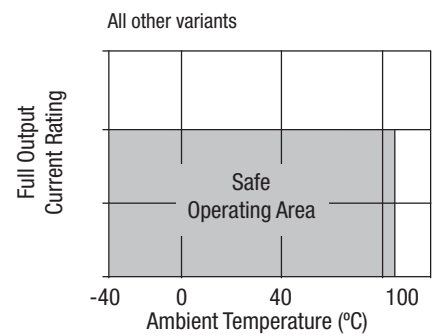
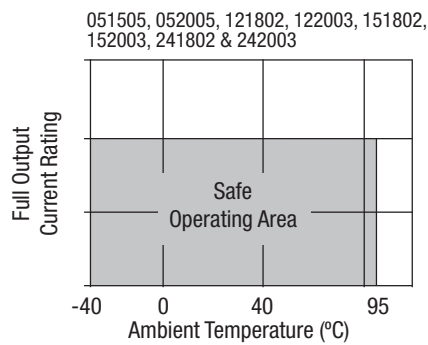
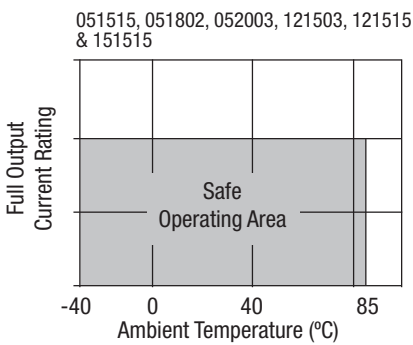
Typical Start-Up Wave Form



EFFICIENCY VS LOAD



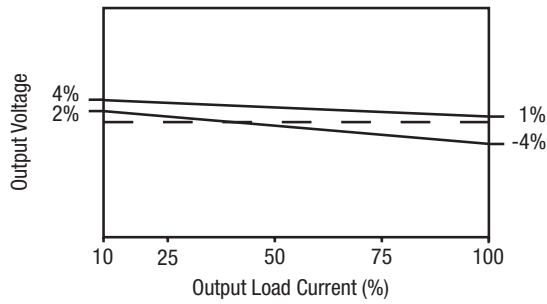
TEMPERATURE DERATING GRAPHS



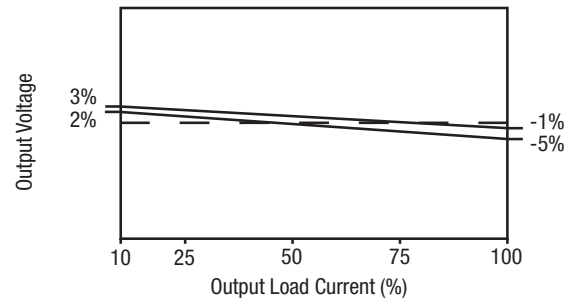
POSITIVE OUTPUT VOLTAGE TOLERANCE ENVELOPES

The voltage tolerance envelopes show typical load regulation characteristics for this product series. The tolerance envelope is the maximum output voltage variation due to changes in output loading and set point accuracy.

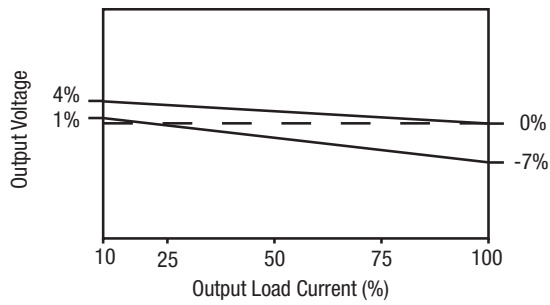
051505, 051509, 151505 & 151509



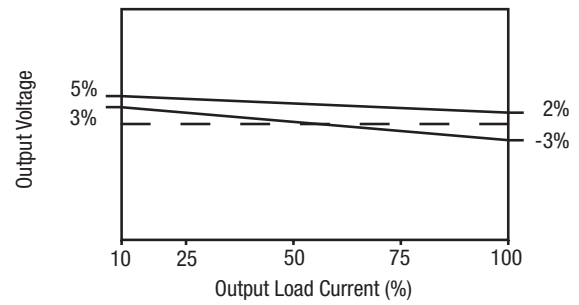
122005, 152005 & 242005



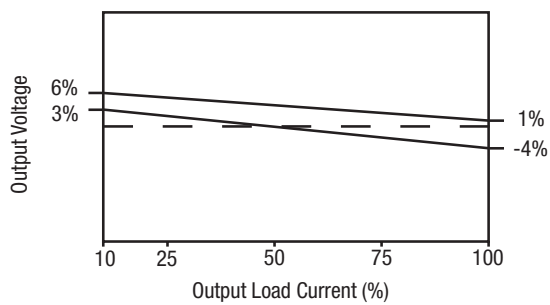
121509, 241509 & 052005



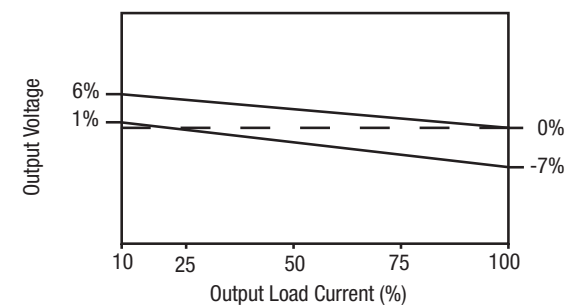
121505 & 241505



121515 & 151515

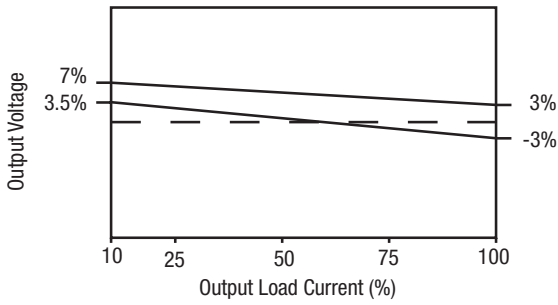


051515

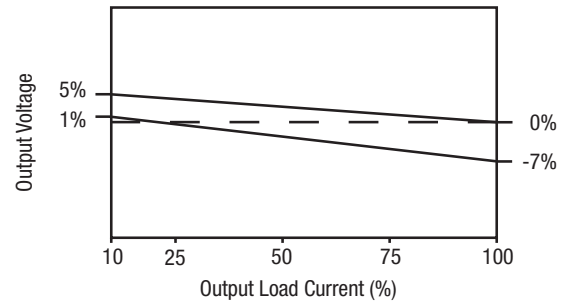


POSITIVE OUTPUT VOLTAGE TOLERANCE ENVELOPES CONTINUED

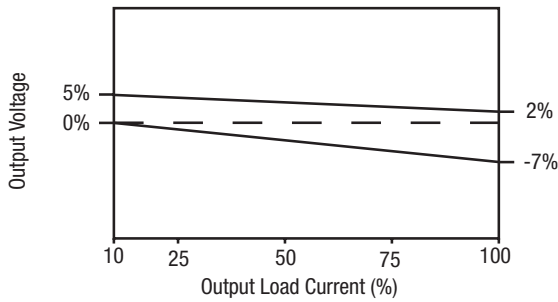
241709



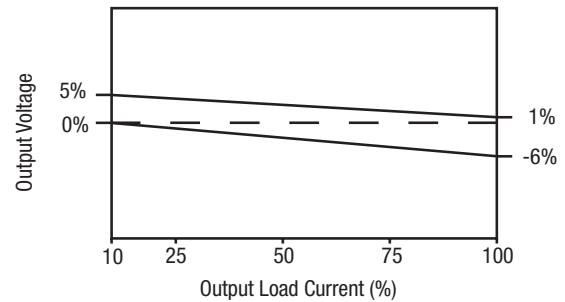
052003



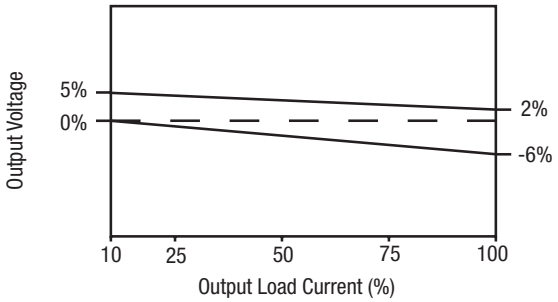
122003, 152003 & 242003



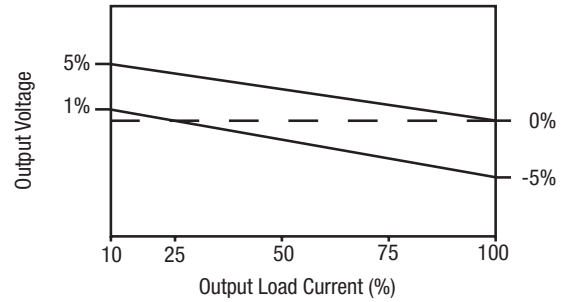
051802



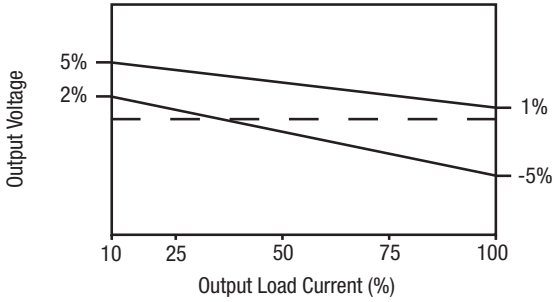
121802, 151802 & 241802



121503

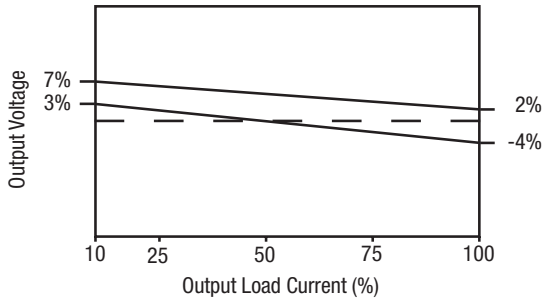


241503

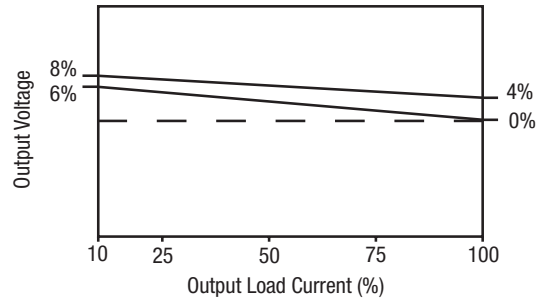


NEGATIVE OUTPUT VOLTAGE TOLERANCE ENVELOPES

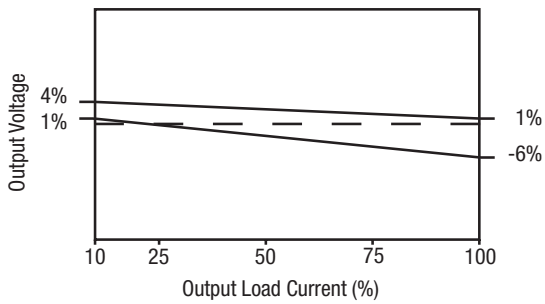
051509, 052005, 121505, 122005, 152005 & 242005



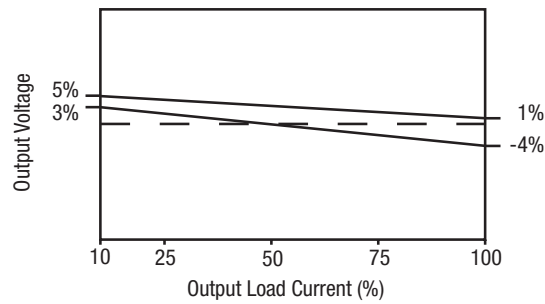
151505



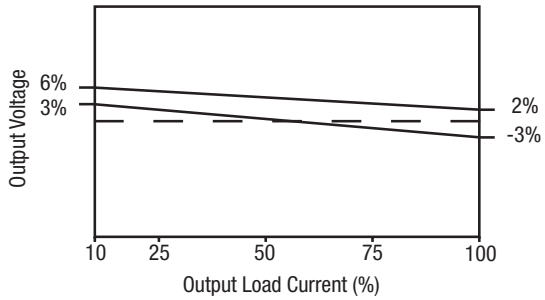
121509 & 241509



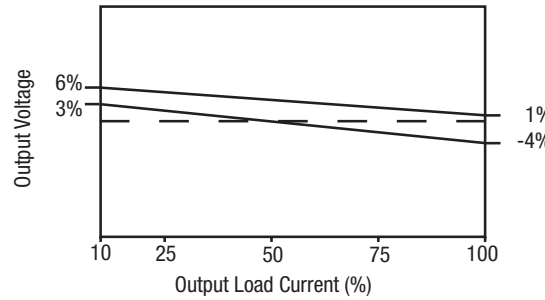
051505



151509 & 241505

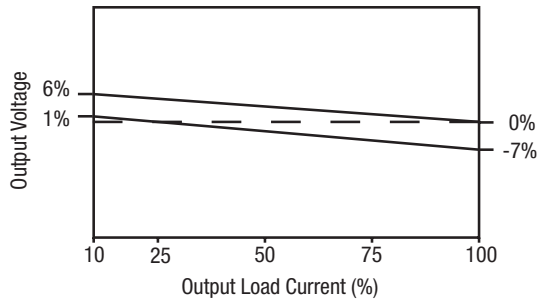


121515 & 151515

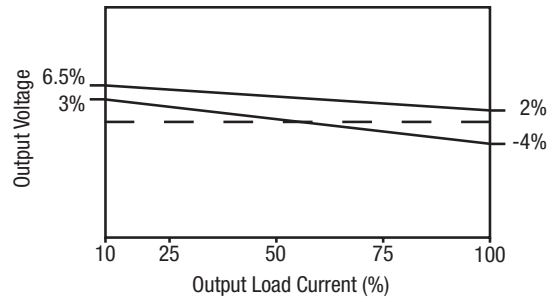


NEGATIVE OUTPUT VOLTAGE TOLERANCE ENVELOPES CONTINUED

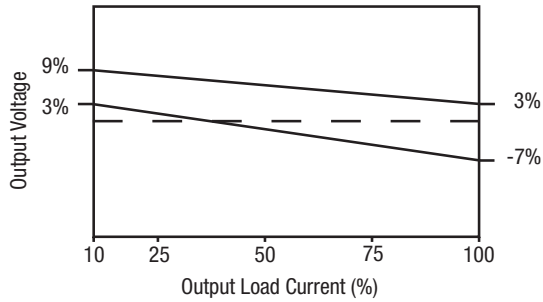
051515



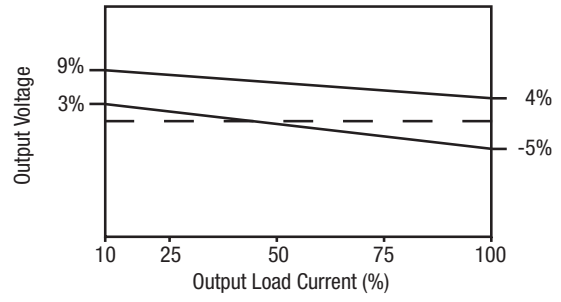
241709



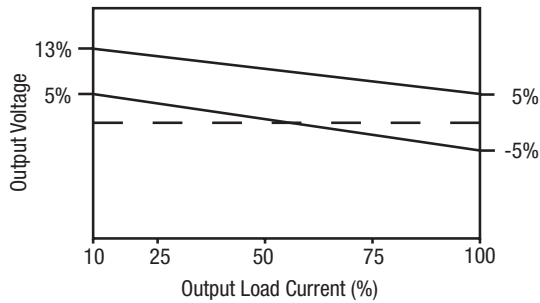
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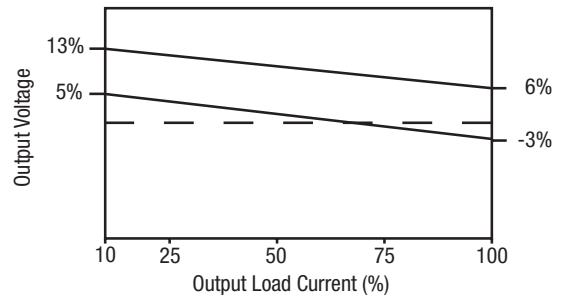
122003, 152003 & 242003



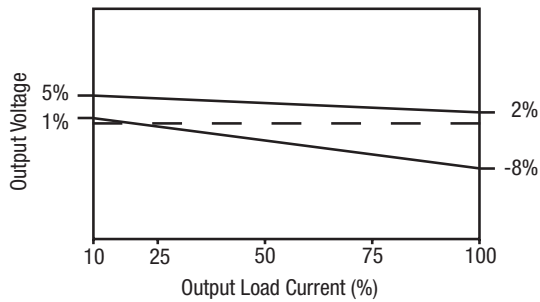
051802



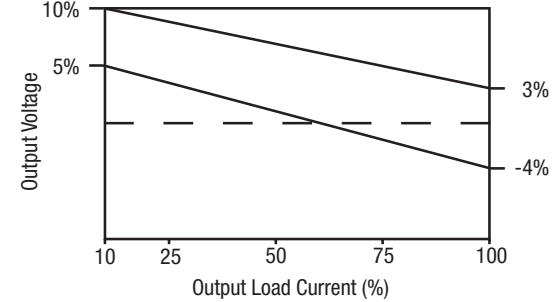
121802, 151802 & 241802



121503

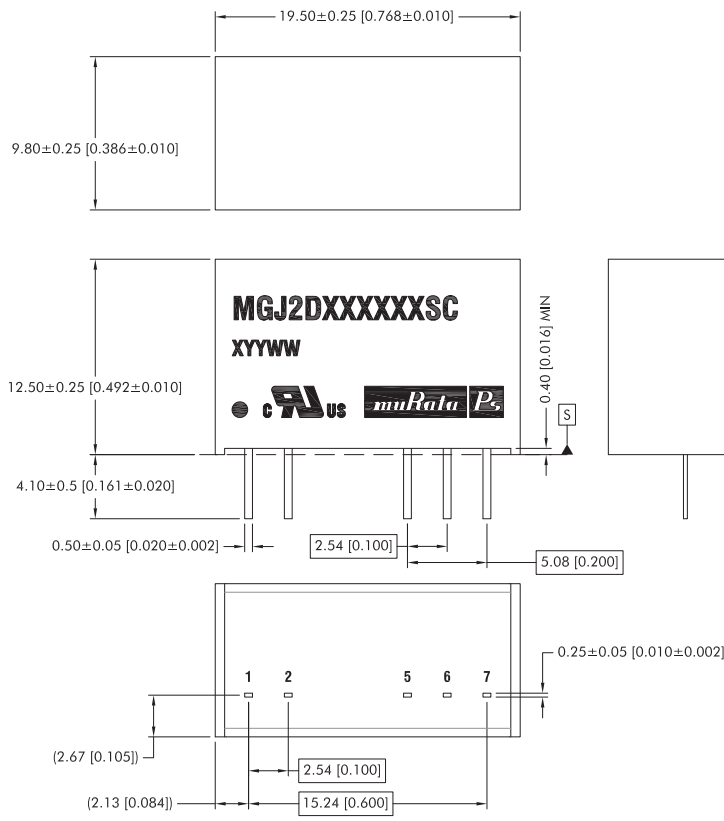


241503



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



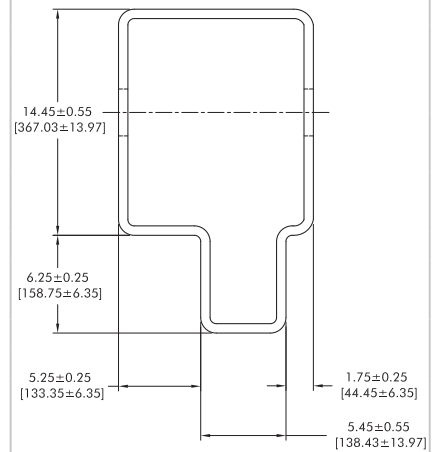
All dimensions in mm ±0.25mm (inches ±0.01). All pins on a 2.54 (0.1) pitch and within ±0.25 (0.01) of true position.

Weight: 4.3g

PIN CONNECTIONS

| Pin Output | |
|------------|----------|
| Pin | Function |
| 1 | +VIN |
| 2 | -VIN |
| 5 | -VOUT |
| 6 | OV |
| 7 | +VOUT |

Tube outline dimensions

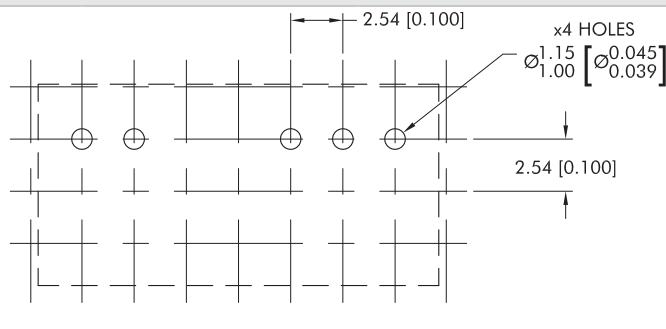


Unless otherwise stated all dimensions in mm (inches).

Tube length : 525mm [20.669] ±2.0 [0.079]

Tube Quantity : 25

RECOMMENDED FOOTPRINT DETAILS



This product is subject to the following **operating requirements** and the **Life and Safety Critical Application Sales Policy**:

Refer to: <https://www.murata.com/en-eu/products/power/requirements>

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