

# Features

## Unregulated Converters

- +20/-5V & +15/-3V asymmetric outputs for SiC driver applications
- Qualified with 65kV/ $\mu$ s @ Vcommon mode =1KV
- +15/-9V asymmetric outputs for IGBT driver applications
- Pot-core transformer with separated windings
- High 6.4kVDC isolation in compact SIP7 size
- Low isolation capacitance (10pF max.)
- Optional continuous short circuit protected
- IEC/EN/UL62368-1 certified

**RECOM**  
DC/DC Converter

**RxxP2xxyy**

**2 Watt  
SIP7 for  
SiC and IGBT  
Applications**



### Description

High slew rate SiC transistor drivers require an isolated asymmetric supply of +20/-5V or +15/-3V with high isolation voltage and low isolation capacitance. The RxxP2xxyyD series have been specially designed to fulfill this demanding requirement with 6400VDC isolation and <10pF isolation capacitance. The load on each output can be unequal, as long as the total power remains under 2W. The internal transformer uses a pot-core to physically separate the input and output windings, yet the converter still fits into an industry standard SIP7 case. A special feature of the RxxP2xxyyD converters is output power sharing: they can be used with equal power (asymmetrical current) or equal current (asymmetrical power) loads. Input voltage options of 5, 12, 15 or 24V are available and the RxxP2xxyyD series is safety certified to the latest UL/IEC62368-1 standard.

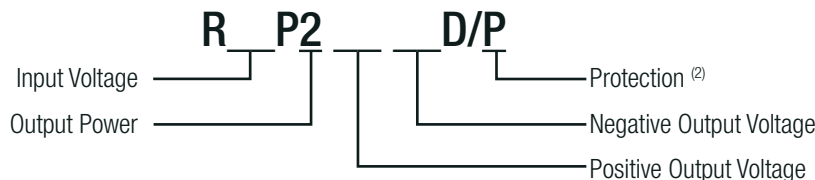
### Selection Guide

| Part Number | Input Voltage [VDC] | Output Voltage [VDC] | Output Current [mA] | Efficiency typ. [%] | max. Capacitive Load <sup>(1)</sup> [ $\mu$ F] |
|-------------|---------------------|----------------------|---------------------|---------------------|------------------------------------------------|
| R12P21503D  | 12                  | +15/-3               | +93/-185            | 84                  | 150/680                                        |
| R15P21503D  | 15                  | +15/-3               | +93/-185            | 81                  | 150/680                                        |
| R24P21503D  | 24                  | +15/-3               | +66/-333            | 82                  | 150/680                                        |
| R05P21509D  | 5                   | +15/-9               | +67/-111            | 82                  | $\pm$ 330                                      |
| R12P21509D  | 12                  | +15/-9               | +67/-111            | 84                  | $\pm$ 330                                      |
| R24P21509D  | 24                  | +15/-9               | +67/-111            | 86                  | $\pm$ 330                                      |
| R05P22005D  | 5                   | +20/-5               | 50/-200<br>+/-80    | 82<br>83            | 47/680                                         |
| R12P22005D  | 12                  | +20/-5               | 50/-200<br>+/-80    | 82                  | 47/680                                         |
| R15P22005D  | 15                  | +20/-5               | 50/-200<br>+/-80    | 83<br>84            | 47/680                                         |
| R24P22005D  | 24                  | +20/-5               | 50/-200<br>+/-80    | 84<br>85            | 47/680                                         |

#### Notes:

Note1: Max. capacitive load is tested at nominal input voltage and full load

### Model Numbering



#### Notes:

Note2: add suffix "/P" for continuous short circuit protection (check for availability)  
without suffix no short circuit protection



UL60950-1 certified  
CAN/CSA-C22.2 No. 60950-1-07 certified  
UL62368-1 certified  
CAN/CSA-C22.2 No. 62368-1-14 certified  
IEC/EN62368-1 certified  
CB Report



[www.recom-power.com/eval-ref-boards](http://www.recom-power.com/eval-ref-boards)

[www.recom-power.com/bier](http://www.recom-power.com/bier)

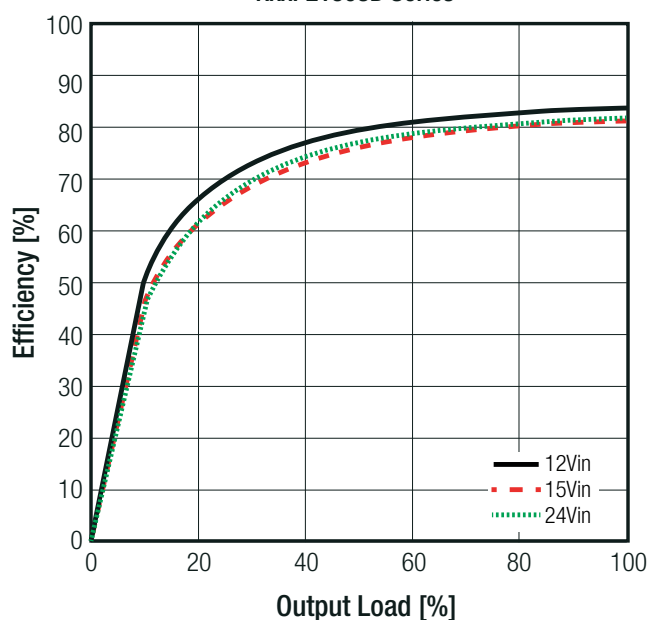
**Specifications** (measured @ Ta= 25°C, nominal Input and full load after warm-up time unless otherwise noted)

### BASIC CHARACTERISTICS

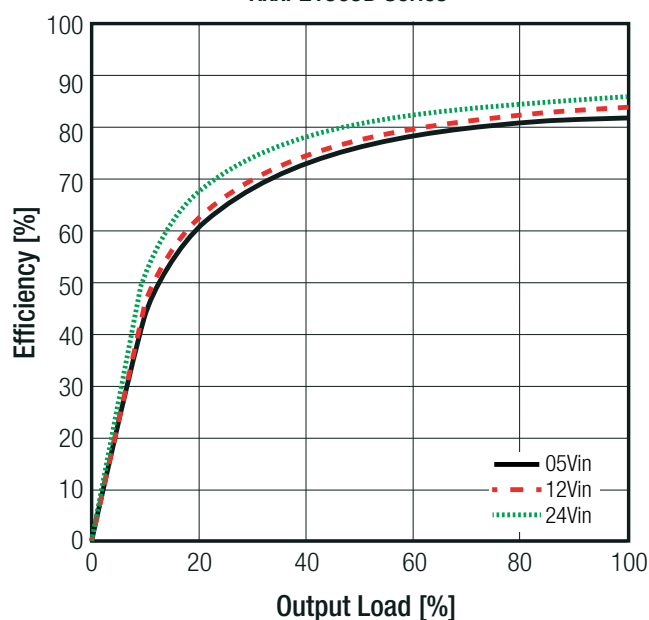
| Parameter                    | Condition       |       | Min.           | Typ.  | Max.     |
|------------------------------|-----------------|-------|----------------|-------|----------|
| Internal Input Filter        |                 |       | capacitor type |       |          |
| Input Voltage Range          | nom. Vin=       | 5Vin  | 4.5VDC         |       | 5.5VDC   |
|                              |                 | 12Vin | 10.8VDC        |       | 13.2VDC  |
|                              |                 | 15Vin | 13.5VDC        |       | 16.5VDC  |
|                              |                 | 24Vin | 21.6VDC        |       | 26.4VDC  |
| Minimum Load                 |                 |       | 0%             |       |          |
| Start-up Time                |                 |       |                | 5ms   |          |
| Internal Operating Frequency |                 |       | 20kHz          | 50kHz |          |
| Output Ripple and Noise      | 20MHz bandwidth |       |                |       | 200mVp-p |

### Efficiency vs. Load

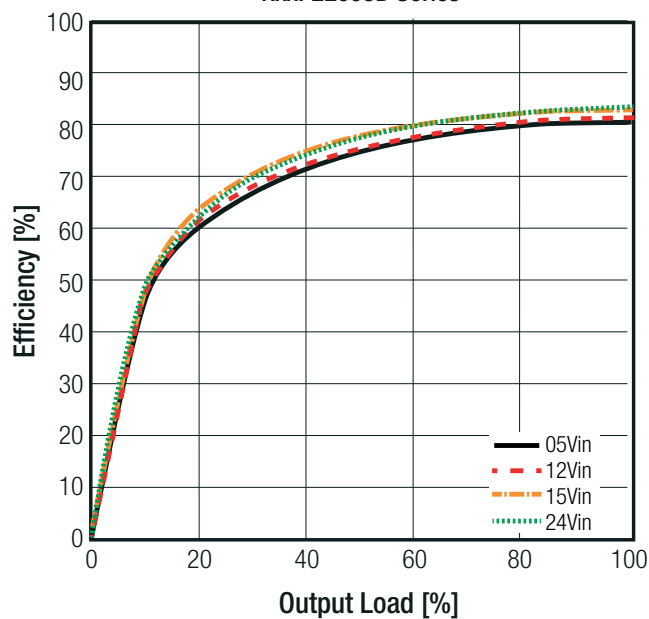
RxxP21503D Series



RxxP21509D Series



RxxP22005D Series



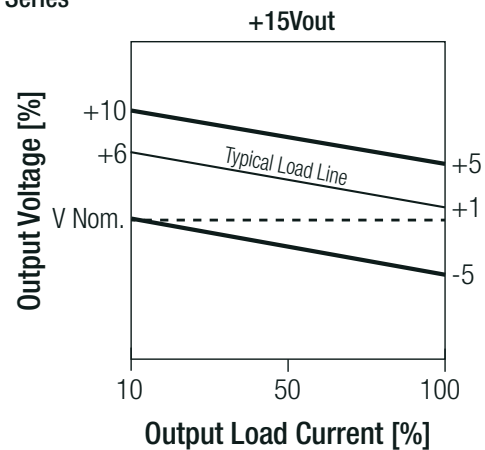
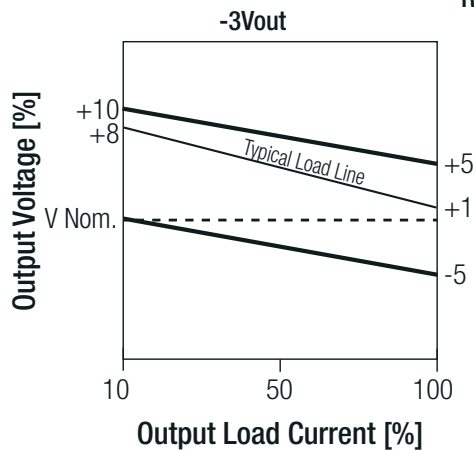
**Specifications** (measured @  $T_a = 25^\circ\text{C}$ , nominal input and full load after warm-up time unless otherwise noted)

# REGULATIONS

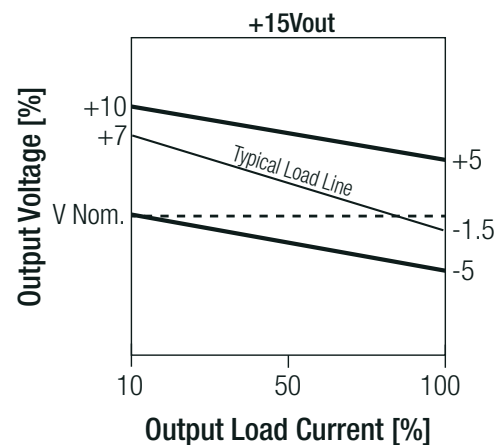
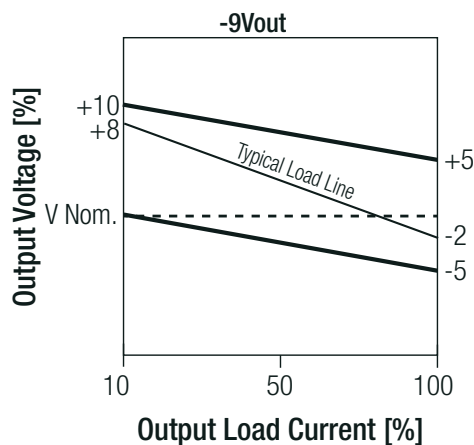
| Parameter       | Condition                        | Values                |
|-----------------|----------------------------------|-----------------------|
| Output Accuracy |                                  | $\pm 5.0\%$ max.      |
| Line Regulation | low line to high line, full load | 1.2%/1% $V_{in}$ typ. |
| Load Regulation | 10% to 100% load                 | 10.0% max.            |

## Tolerance Envelope

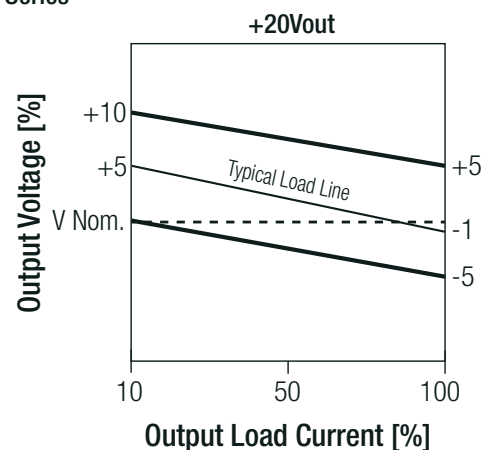
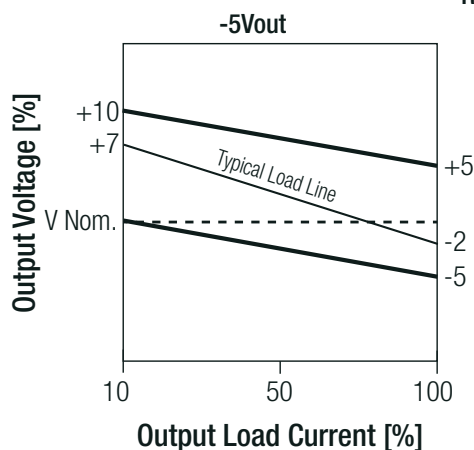
RxxP21503D Series



RxxP21509D Series



RxxP22005D Series



**Specifications** (measured @ Ta= 25°C, nominal input and full load after warm-up time unless otherwise noted)

**PROTECTIONS**

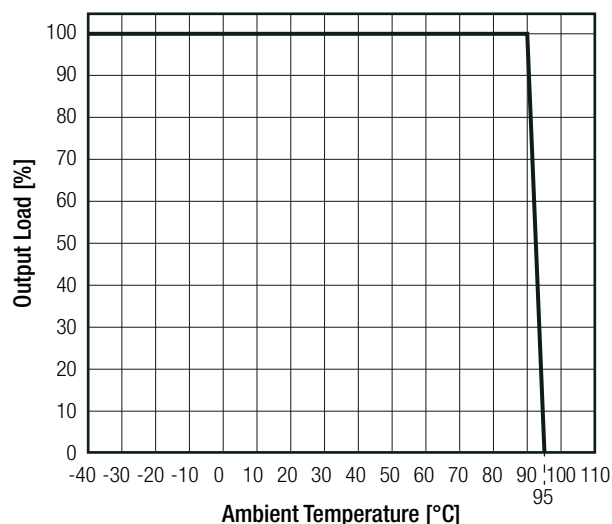
| Parameter                                                                                                               | Condition                |                                                                   | Value                          |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------|--------------------------------|
| Short Circuit Protection                                                                                                | RxxP21509D<br>RxxP22005D | only with suffix “/P”                                             | continuous, automatic recovery |
| Isolation Voltage <sup>(3)</sup>                                                                                        | I/P to O/P               | tested for 1 second<br>tested for 1 minute<br>tested for 1 minute | 6.4kVDC<br>5.2kVDC<br>3kVAC    |
| Isolation Capacitance                                                                                                   |                          |                                                                   | 3pF typ. / 10pF max.           |
| Isolation Resistance                                                                                                    |                          |                                                                   | 15GΩ min.                      |
| Insulation Grade                                                                                                        |                          |                                                                   | basic                          |
| Internal                                                                                                                | clearance/creepage       |                                                                   | 2.0mm                          |
| External                                                                                                                | clearance/creepage       |                                                                   | 7.0mm                          |
| <b>Notes:</b>                                                                                                           |                          |                                                                   |                                |
| Note3: For repeat Hi-Pot testing, reduce the time and/or the test voltage                                               |                          |                                                                   |                                |
| Note4: Refer to local safety regulations if input over-current protection is required. Recommended fuse: slow blow type |                          |                                                                   |                                |

**ENVIRONMENTAL**

| Parameter                   | Condition                             |                | Value                                                         |
|-----------------------------|---------------------------------------|----------------|---------------------------------------------------------------|
| Operating Temperature Range | full load<br>see derating graph below |                | -40°C to +90°C<br>-40°C to +95°C                              |
| Maximum Case Temperature    |                                       |                | +105°C max.                                                   |
| Temperature Coefficient     |                                       |                | ±0.02%/K                                                      |
| Thermal Impedance           |                                       |                | 30K/W                                                         |
| Operating Humidity          | non-condensing                        |                | 5-95% RH max.                                                 |
| Vibration                   |                                       |                | according to MIL-STD-202G                                     |
| Pollution Degree            |                                       |                | PD2                                                           |
| MTBF                        | according to MIL-HDBK-217F, G.B.      | +25°C<br>+90°C | 14600 x 10 <sup>3</sup> hours<br>4000 x 10 <sup>3</sup> hours |

**Derating Graph**

(@ Chamber and free air convection)



**Specifications** (measured @ Ta= 25°C, nominal input and full load after warm-up time unless otherwise noted)

### SAFETY AND CERTIFICATIONS

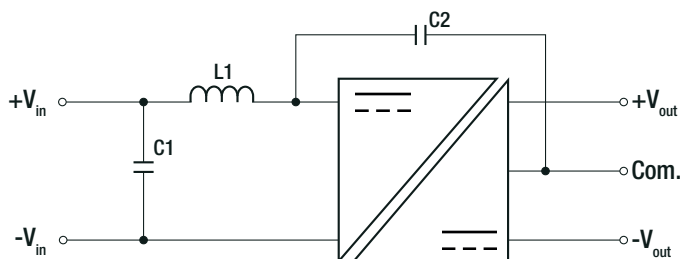
| Certificate Type                                                                                         | Report / File Number | Standard                                                                      |
|----------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------|
| Information Technology Equipment, General Requirements for Safety                                        | E224736-A56-UL       | UL60950-1:2014, 2nd Edition<br>CAN/CSA-C22.2 No. 60950-1-07:2014, 2nd Edition |
| Audio/Video, information and communication technology equipment - Part1: Safety requirements (CB Scheme) | ATTCB106076          | IEC62368-1:2014, 2nd Edition                                                  |
| Audio/Video, information and communication technology equipment - Part1: Safety requirements             |                      | EN62368-1: 2014 + A11:2017                                                    |
| Audio/Video, information and communication technology equipment - Part1: Safety requirements             | E224736-A56-UL       | UL62368-1, 2nd Edition<br>CAN/CSA-C22.2 No. 62368-1-14, 2014                  |
| Medical electrical equipment Part 1: General requirements for basic safety and essential performance     | WD-SE-R-180541-A0    | IEC60601-1:2005 + A1:2012, 3rd Edition<br>EN60601-1:2006 + A12:2014           |
| EAC                                                                                                      | RU-AT.49.09571       | TP TC 004/2011                                                                |
| RoHS 2+                                                                                                  |                      | RoHS 10/10, 2011/65/EU + AM-2015/863                                          |

### EMI Compliance

| EMI Compliance                                                                | Condition                                                  | Standard / Criterion |
|-------------------------------------------------------------------------------|------------------------------------------------------------|----------------------|
| Electromagnetic compatibility of multimedia equipment - Emission requirements | with external components<br>(see filter suggestions below) | EN55032, Class B     |

### EMC Filtering according to EN55032 Class B

#### Component List Class B



| Series     | Vin   | C1    | L1         | C2 <sup>(3)</sup> |
|------------|-------|-------|------------|-------------------|
| RxxP21503D | 12VDC | 2.2µF | 47µH choke | 470pF<br>6kVDC    |
|            | 15VDC |       |            |                   |
|            | 24VDC |       |            |                   |
| RxxP21509D | 12VDC | 10µF  | 10µH choke |                   |
|            | 15VDC | 4.7µF | 22µH choke |                   |
|            | 24VDC | 2.2µF | 47µH choke |                   |
| RxxP22005D | 5VDC  | 10µF  | 10µH choke |                   |
|            | 12VDC | 4.7µF | 22µH choke |                   |
|            | 15VDC |       |            |                   |
|            | 24VDC | 2.2µF | 47µH choke |                   |

#### Notes:

Note5: For SiC or IGBT application's, don't use C2 to decrease system isolation capacitance. Adapt primary filter according specific application

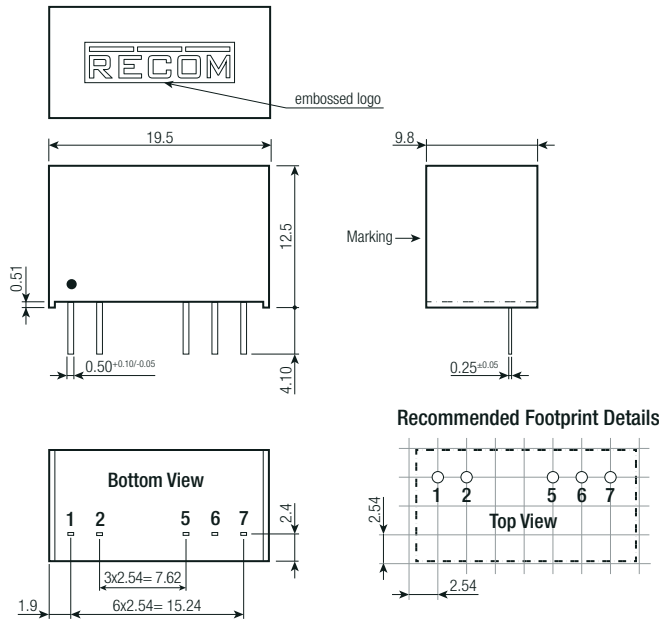
### DIMENSION and PHYSICAL CHARACTERISTICS

| Parameter         | Type                   | Value                                                       |
|-------------------|------------------------|-------------------------------------------------------------|
| Material          | case<br>potting<br>PCB | plastic, (UL94 V-0)<br>epoxy, (UL94 V-0)<br>FR4, (UL94 V-0) |
| Dimension (LxWxH) |                        | 19.5 x 9.8 x 12.5mm                                         |
| Weight            |                        | 4.3g typ.                                                   |

continued on next page

**Specifications** (measured @ Ta= 25°C, nominal input and full load after warm-up time unless otherwise noted)

### Dimension Drawing (mm)



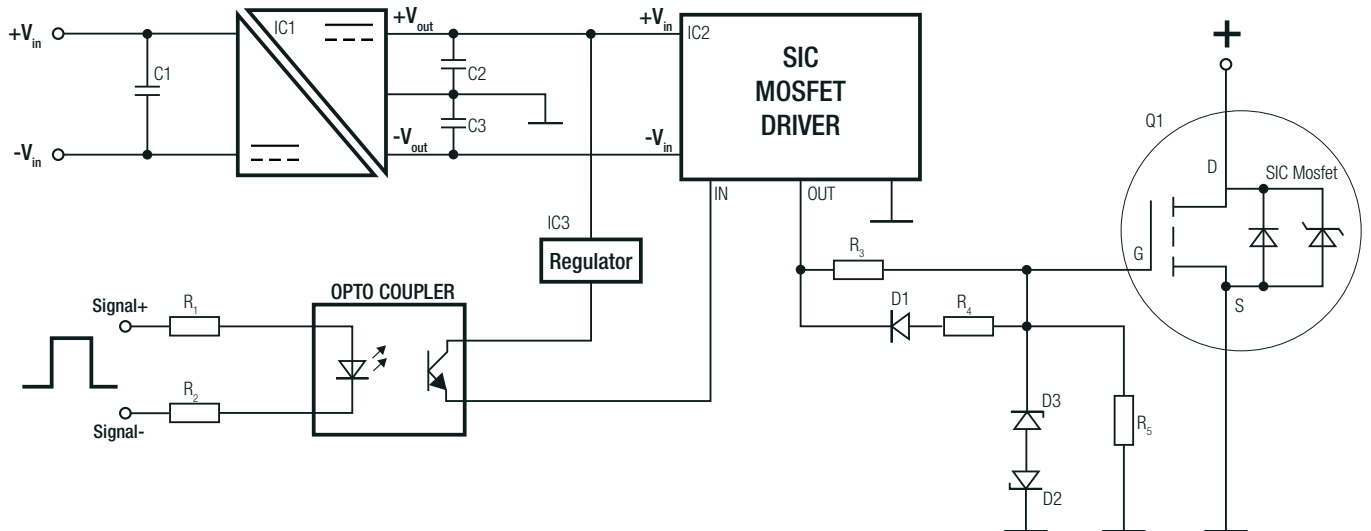
### Pin Connections

| Pin # | Dual  |
|-------|-------|
| 1     | +Vin  |
| 2     | -Vin  |
| 5     | -Vout |
| 6     | Com   |
| 7     | +Vout |

Tolerance: xx.x= ±0.5mm  
xx.xx= ±0.25mm

### INSTALLATION AND APPLICATION

#### Typical Application Circuit



### PACKAGING INFORMATION

|                             |      |                       |
|-----------------------------|------|-----------------------|
| Packaging Dimension (LxWxH) | tube | 520.0 x 22.3 x 12.0mm |
| Packaging Quantity          |      | 25pcs                 |
| Storage Temperature Range   |      | -55°C to +125°C       |
| Storage Humidity            |      | 5-95% RH max.         |

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