

Low-Saturation 300mA Regulators

Monolithic IC MM159X Series

Outline

This is a 300mA output low-saturation regulator IC with low noise and high ripple rejection ratio. Ceramic capacitors can be used for the output capacitors, and it has an output noise reduction pin and ON/OFF control pin.

Features

- | | |
|-------------------------------------|------------------------------------|
| 1. High precision output voltage | ±2.0% |
| 2. Output current | 300mA |
| 3. Input/output voltage difference | 0.15V typ. (I _o =100mA) |
| 4. High ripple rejection ratio | 70dB typ. |
| 5. Wide operating temperature range | -40~+85°C |
| 6. Output voltage | 1.5~5.0V (0.1V step) |
| 7. Output capacitor | 1μF(ceramic) |

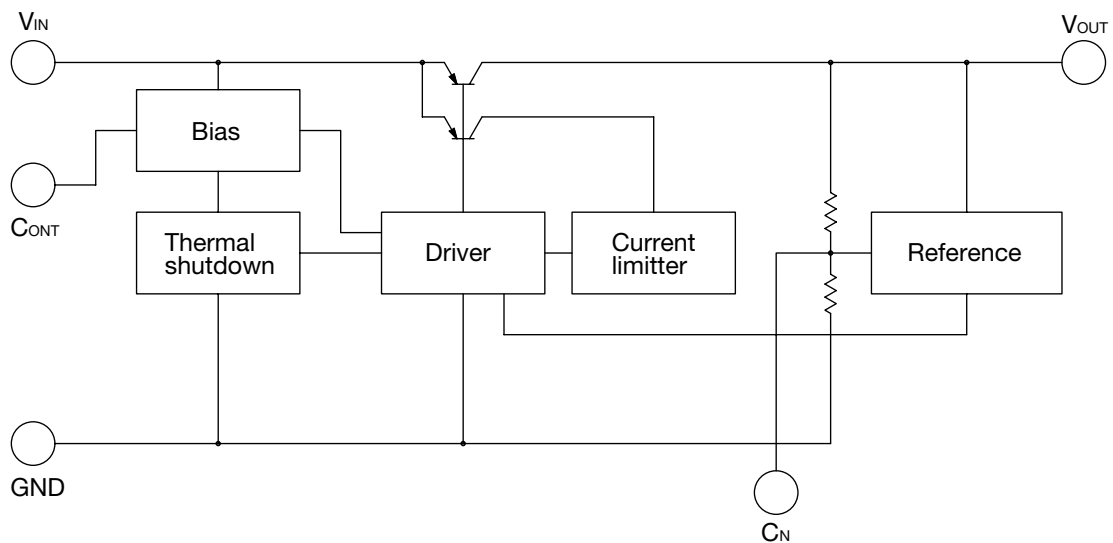
Package

SOP-8D/G

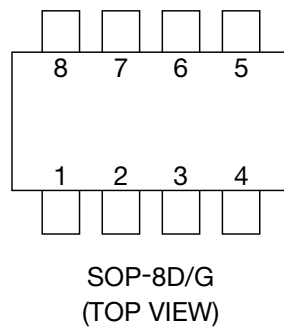
Applications

1. Constant voltage power supply for devices that use batteries
2. Constant voltage power supply for portable communications devices
3. Constant voltage power supply for household electronics products

Block Diagram



Pin Assignment



| | |
|---|------------------|
| 1 | V _{OUT} |
| 2 | NC |
| 3 | GND |
| 4 | C _N |
| 5 | C _{ONT} |
| 6 | NC |
| 7 | NC |
| 8 | V _{IN} |

Pin Description

| Pin No. | Pin name | Function | Internal equivalent circuit diagram |
|---------|------------------|--------------------|-------------------------------------|
| 1 | V _{OUT} | Output pin | |
| 2 | NC | | |
| 3 | GND | Ground pin | |
| 4 | C _N | Noise decrease pin | |

| Pin No. | Pin name | Function | Internal equivalent circuit diagram | | | | | | |
|------------------|------------------|--|-------------------------------------|--------|---|----|---|-----|--|
| 5 | C _{OUT} | Control pin <table border="1" style="margin-left: 20px;"> <tr> <td>C_{OUT}</td> <td>Output</td> </tr> <tr> <td>H</td> <td>ON</td> </tr> <tr> <td>L</td> <td>OFF</td> </tr> </table> | C _{OUT} | Output | H | ON | L | OFF | |
| C _{OUT} | Output | | | | | | | | |
| H | ON | | | | | | | | |
| L | OFF | | | | | | | | |
| 6 | NC | No connection | | | | | | | |
| 7 | NC | No connection | | | | | | | |
| 8 | V _{IN} | Input pin | | | | | | | |

Absolute Maximum Ratings (T_a=25°C)

| Item | Symbol | Ratings | Units |
|---------------------|------------------|----------|-------|
| Storage temperature | T _{STG} | -55~+150 | °C |
| Supply voltage | V _{IN} | -0.3~+13 | V |
| Allowable loss | P _d | 950 *1 | mW |

Note : *1 With the double sided PC Board of glass epoxy
(Copper plane 80%, 192X142X1.2mm)

Recommended Operating Conditions

| Item | Symbol | Ratings | Units |
|-----------------------|------------------|----------------------------|-------|
| Operating temperature | T _{OPR} | -40~+85 | °C |
| Output current | I _{OUT} | 0~300 | mA |
| Operating voltage | V _{OP} | V _o Typ.+0.5~13 | V |

Electrical Characteristics 1 (Except where noted otherwise, Ta=25°C, VIN=VO+2V, VCONT=1.6V)

| Item | Symbol | Measurement conditions | Min. | Typ. | Max. | Units |
|---|-----------------------|--|-------|------|----------------------|--------|
| No-Load input current | I _{CC} | I _o =0mA | | 2.2 | 5 | mA |
| Input current (OFF) | I _{CCOFF} | V _{CONT} =0V | | 0 | 1 | μA |
| Output voltage *2 | V _{OUT} | I _o =1mA | ×0.98 | | ×1.02 | V |
| Dropout voltage *3 | V _{IO} | V _{IN} =V _O -0.2V, I _o =100mA | | 0.15 | 0.3 | V |
| Line regulation | ΔV ₁ | V _{IN} =V _O +1.5~V _O +2.5V, I _o =1mA | | 10 | 20 | mV |
| Load regulation | ΔV ₂ | I _o =0~300mA | | 20 | 120 | mV |
| V _{OUT} temperature coefficient *1 | ΔV _{OUT} /ΔT | T _j =-40~+85°C | | 100 | | ppm/°C |
| Ripple rejection *1 | RR | f=120Hz V _{RIPPLE} =1V, I _o =100mA | 50 | 70 | | dB |
| Output noise voltage *1 | V _N | fBW=20~80kHz, C _N =470pF, I _{OUT} =100mA | | 75 | | μVrms |
| | | fBW=20~80kHz, C _N =OPEN, I _{OUT} =100mA | | 150 | | |
| CONT pin input current | I _{CONT} | V _{CONT} =5V | 10 | 20 | 30 | μA |
| CONT pin high threshold level | V _{CONTH} | | 1.6 | | V _{IN} +0.3 | V |
| CONT pin low threshold level | V _{CONTL} | | -0.3 | | 0.4 | V |

Note1 : *1. The parameter is guaranteed by design.

Note2 : *2. Please refer to follow.

Note3 : *3. The parameter is not guaranteed in the model less than V_{OUT}=2V.

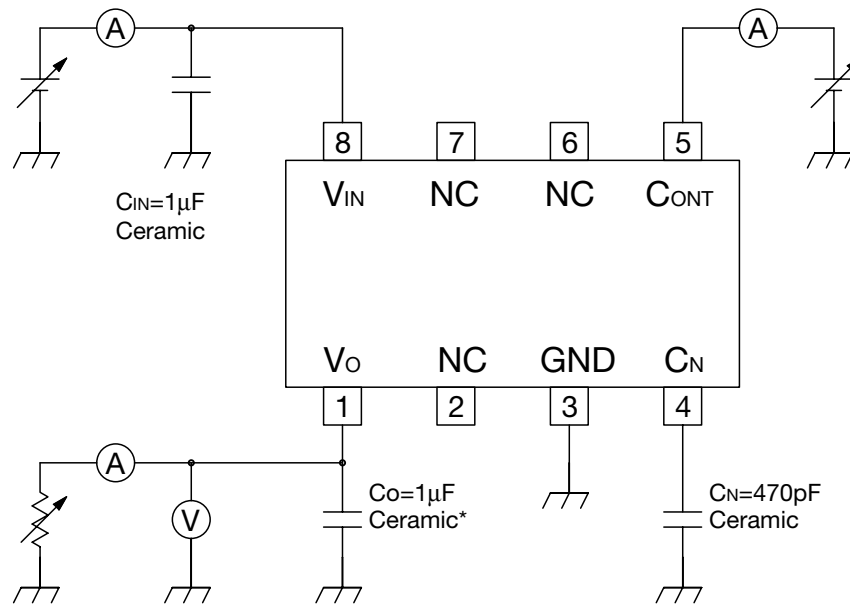
Electrical Characteristics 2

Output Voltage

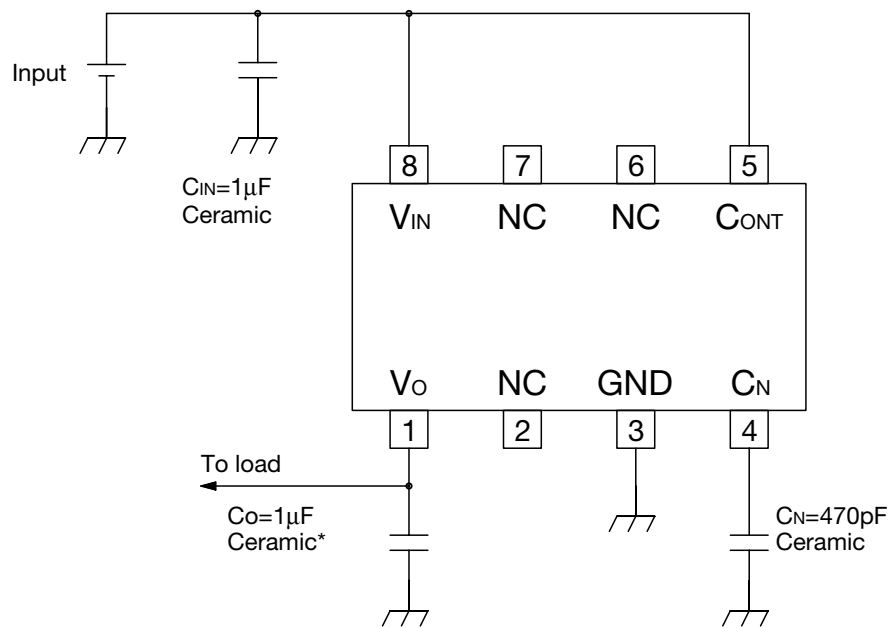
| Product name | Test conditions | Output voltage (V) | | |
|--------------|---------------------|--------------------|-------|-------|
| | | Min. | Typ. | Max. |
| MM1591J | I _o =1mA | 1.764 | 1.8 | 1.836 |
| MM1591K | | 1.862 | 1.9 | 1.938 |
| MM1592A | | 1.960 | 2.0 | 2.040 |
| MM1592B | | 2.058 | 2.1 | 2.142 |
| MM1592C | | 2.156 | 2.2 | 2.244 |
| MM1592D | | 2.254 | 2.3 | 2.346 |
| MM1592E | | 2.352 | 2.4 | 2.448 |
| MM1592F | | 2.450 | 2.5 | 2.550 |
| MM1592G | | 2.548 | 2.6 | 2.652 |
| MM1592H | | 2.646 | 2.7 | 2.754 |
| MM1592J | | 2.744 | 2.8 | 2.856 |
| MM1592K | | 2.842 | 2.9 | 2.958 |
| MM1593A | | 2.940 | 3.0 | 3.060 |
| MM1593B | | 3.038 | 3.1 | 3.162 |
| MM1593C | | 3.136 | 3.2 | 3.264 |
| MM1593D | | 3.234 | 3.3 | 3.366 |
| MM1593E | | 3.332 | 3.4 | 3.468 |
| MM1593F | | 3.430 | 3.5 | 3.570 |
| MM1593G | | 3.528 | 3.6 | 3.672 |
| MM1593H | | 3.626 | 3.7 | 3.774 |
| MM1593J | 3.724 | 3.8 | 3.876 | |
| MM1593K | 3.822 | 3.9 | 3.978 | |

| Product name | Test conditions | Output voltage (V) | | |
|--------------|-----------------------|--------------------|------|-------|
| | | Min. | Typ. | Max. |
| MM1594A | I _o =250mA | 3.920 | 4.0 | 4.080 |
| MM1594B | | 4.018 | 4.1 | 4.182 |
| MM1594C | | 4.116 | 4.2 | 4.284 |
| MM1594D | | 4.214 | 4.3 | 4.386 |
| MM1594E | | 4.312 | 4.4 | 4.488 |
| MM1594F | | 4.410 | 4.5 | 4.590 |
| MM1594G | | 4.508 | 4.6 | 4.692 |
| MM1594H | | 4.606 | 4.7 | 4.794 |
| MM1594J | | 4.704 | 4.8 | 4.896 |
| MM1594K | | 4.802 | 4.9 | 4.998 |
| MM1595A | | 4.900 | 5.0 | 5.100 |

Measuring Circuit



Application Circuit



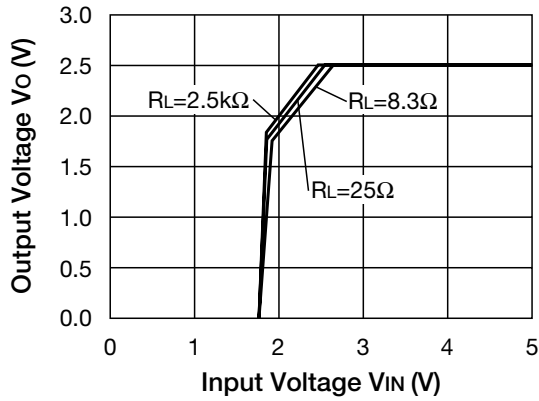
*Temperature Characteristics: B Type (X5R Type)

Note

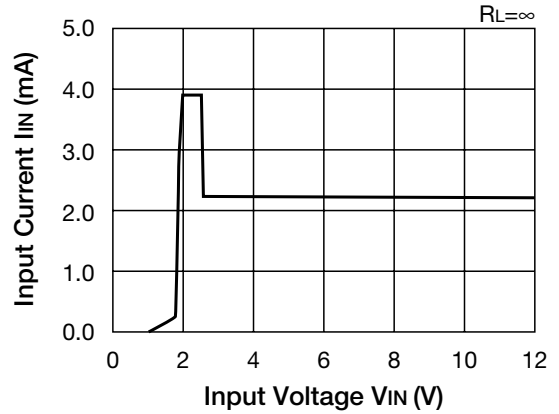
1. The output capacitor is required between output and GND to prevent oscillation.
2. The ESR of capacitor must be defined in ESR stability area.
It is possible to use a ceramic capacitor without ESR resistance for output.
The ceramic capacitor must be used more than 1.0µF and B type (X5R) temperature characteristics.
3. The wire of Vcc and GND is required to print full ground plane for noise and stability.
4. The input capacitor must be connected a distance of less than 1cm from input pin.
5. The capacitor is connected to Cn must have low leakage current characteristics, because Cn pin is high impedance. The rise time will change depending on the capacitance value.
6. In case the output voltage is above the input voltage, the overcurrent flow by internal parasitic diode from output to input. In such application, the external bypass diode must be connected between output and input pin.

Characteristics (2.5V product Except where noted otherwise, $T_a=25^\circ\text{C}$, $V_{IN}=V_O+2\text{V}$, $V_{CONT}=V_{IN}$, $C_{IN}=1.0\mu\text{F}$, $C_O=1.0\mu\text{F}$)

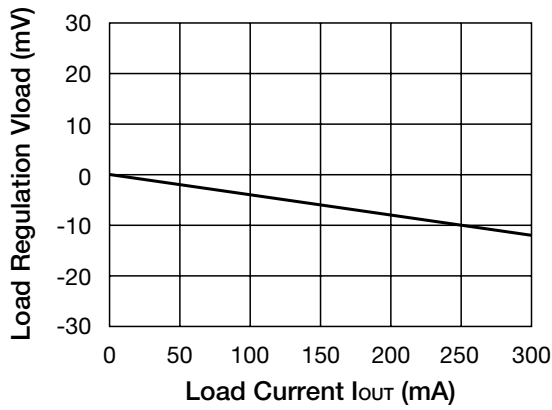
Input Voltage-Output Voltage



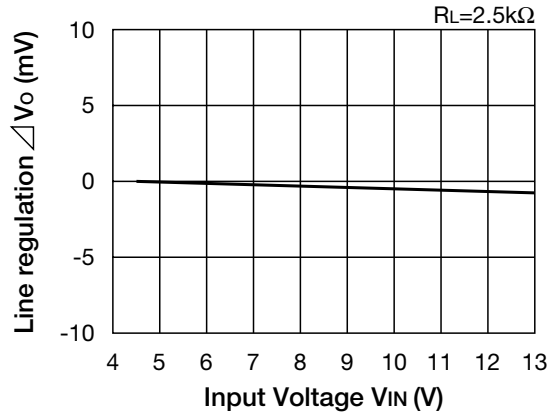
No Load Input Current



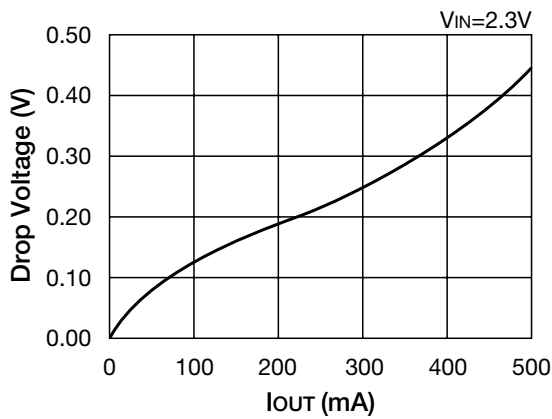
Load Regulation



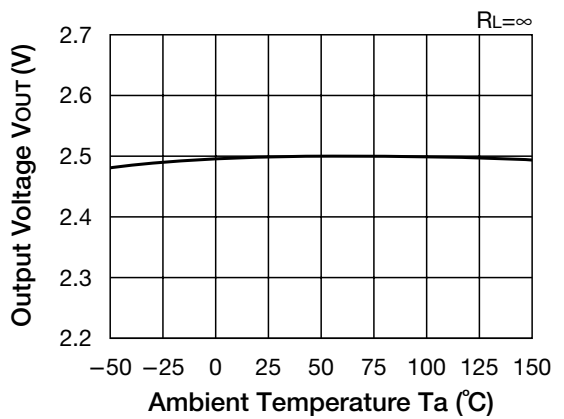
Line Regulation



Drop Voltage

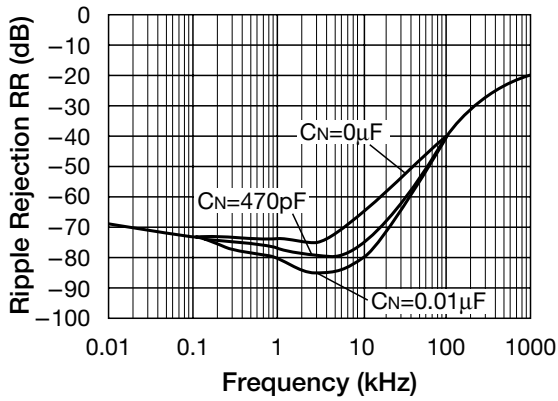


Output Voltage ($I_O=0\text{mA}$)

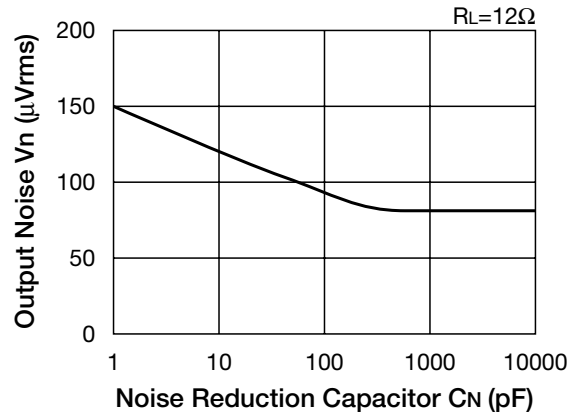


Characteristics (2.5V product Except where noted otherwise, $T_a=25^\circ\text{C}$, $V_{IN}=V_O+2\text{V}$, $V_{CONT}=V_{IN}$, $C_{IN}=1.0\mu\text{F}$, $C_O=1.0\mu\text{F}$)

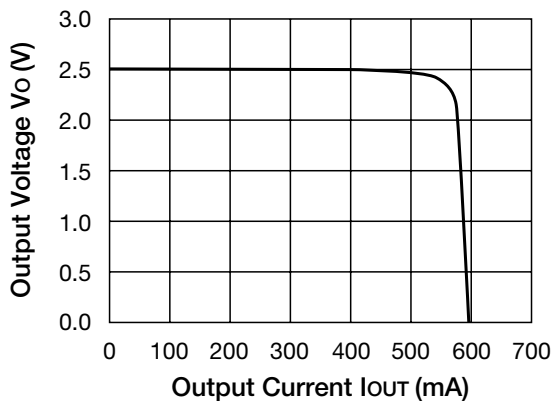
Ripple Rejection



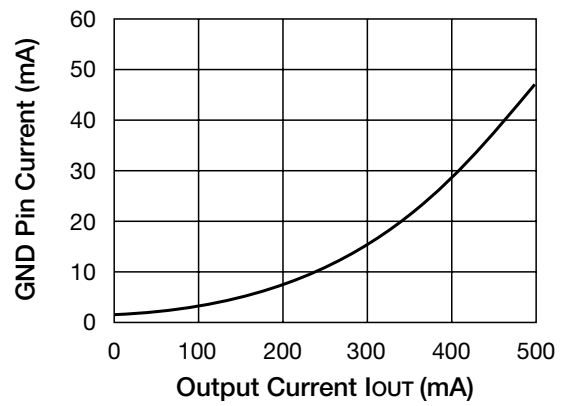
Output Noise



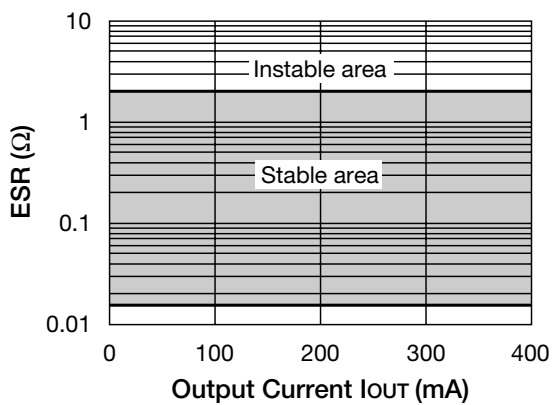
Current Limit Characteristics



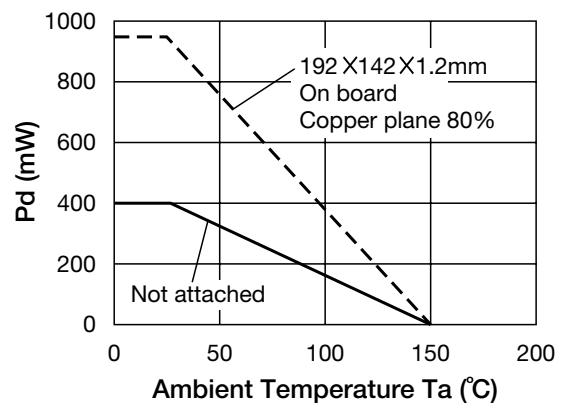
GND Pin Current



ESR Stability Area

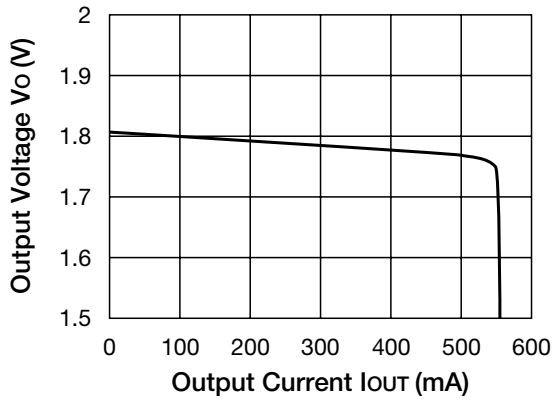


Power Dissipation

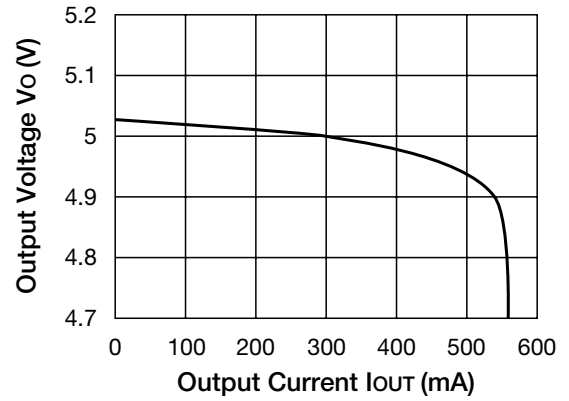


Characteristics (1.8V, 5.0V product Except where noted otherwise, $T_a=25^\circ\text{C}$, $V_{IN}=V_O+2\text{V}$, $V_{CONT}=V_{IN}$, $C_{IN}=1.0\mu\text{F}$, $C_O=1.0\mu\text{F}$)

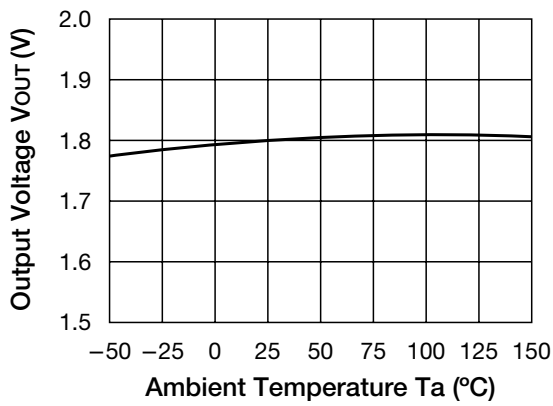
■ Load Regulation($V_O=1.8\text{V}$)



■ Load Regulation($V_O=5.0\text{V}$)



■ Output Voltage($V_O=1.8\text{V}$)



■ Output Voltage($V_O=5.0\text{V}$)

