200mA LDO
Monolithic IC MM1856 Series

Outline

This IC is a 200mA Low dropout regulator IC with ON/OFF control.
The IC applies to a standard home equipments, for a maximum operating voltage is 14V.
Package is a small SOT-25A, SC-82ABB.

Features

1.	Maximum operating voltage	14V
2.	Output current	200mA
3.	No load input current	75μA typ.
4.	Input current(OFF)	1μA max.
5.	Output voltage range	1.5~5.0V
6.	Output voltage accuracy	±2%
7.	Dropout voltage	300mV typ. (Io=200mA)
8.	Line regulation	0.1%/V max.
9.	Load regulation	60mV max. (Io=1~200mA)
10.	Ripple rejection	70dB typ. (f=1kHz)
11.	Output Capacitor	1μF
12.	ON/OFF control	
13.	Thermal shutdown	

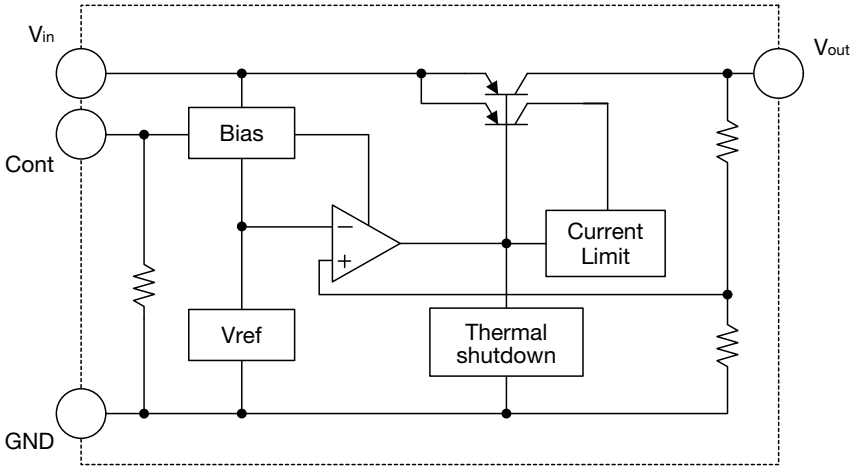
Package

SOT-25A
SC-82ABB

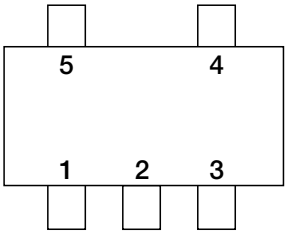
Applications

1. TV
2. BD recorder
3. Printer
4. Game

Block Diagram

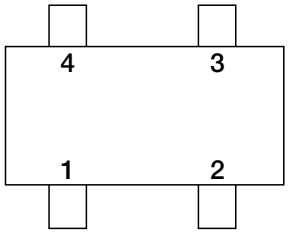


Pin Assignment



1	Vin
2	GND
3	Cont
4	NC
5	Vout

SOT-25A
(TOP VIEW)



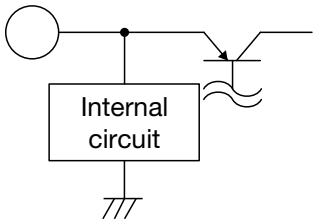
1	Cont
2	GND
3	Vout
4	Vin

SC-82ABB
(TOP VIEW)

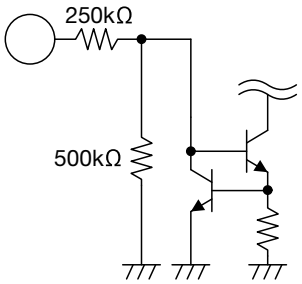
Pin Description

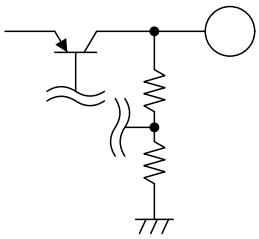
SOT-25A

<table>
<tr><th>Pin No.</th><th>Pin name</th><th>Functions</th><th>Internal equivalent circuit diagram</th></tr>
<tr><td>1</td><td>Vin</td><td>Input pin

The capacitor is required to connect with input pin more than 1µF.</td><td> 
</td></tr>
<tr><td>2</td><td>GND</td><td>Ground</td><td></td></tr>
<tr><td>3</td><td>Cont</td><td>ON/OFF Control pin

<table>
<tr><td>Cont</td><td>OUTPUT</td></tr>
<tr><td>H</td><td>ON</td></tr>
<tr><td>L</td><td>OFF</td></tr>
</table>

Cont pin must be connected with Vin pin, if it is not used.</td><td> 
</td></tr>
<tr><td>4</td><td>NC</td><td>No connection</td><td></td></tr>
<tr><td>5</td><td>Vout</td><td>Output pin

The capacitor must be connected with output pin more than 1µF.</td><td>  </td></tr>
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SC-82ABB

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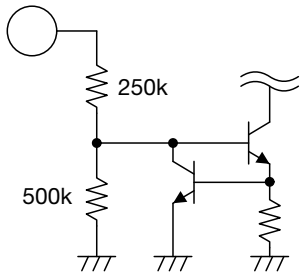
<table><tr><th>Cont</th><th>Vout</th></tr><tr><td>H</td><td>ON</td></tr><tr><td>L</td><td>OFF</td></tr></table>Cont pin must be connected with Vin pin, if it is not used.</td><td> 
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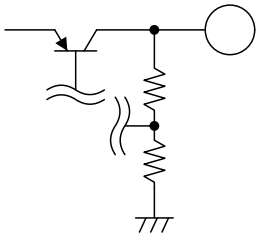
The capacitor must be connected with output pin more than 1µF.</td><td>  </td></tr>
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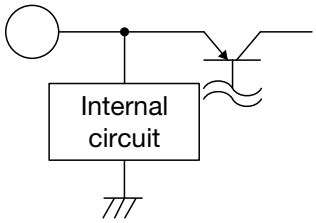
The capacitor is required to connect with input pin more than 1µF.</td><td> 
</td></tr>
</table>

Absolute Maximum Ratings (Except where noted otherwise Ta=25°C)

Item	Symbol	Ratings		Units
Storage Temperature	Tstg	−55~+150		°C
Operating Temperature	Topr	−40~+85		°C
Supply Voltage	Vin	−0.3~+15		V
Cont PIN Voltage	Vcont	−0.3~+15		
Output Current	Iout	350		mA
Power Dissipation	Pd	SOT-25A	350(Note1)	mW
		SC-82ABB	330(Note2)	

Note1 : With the PC Board of glass epoxy. (60 × 40 × 1.6mm)
Note2 : With the PC Board of glass epoxy. Copper foil area 60%. (100 × 100 × 1.6mm)

Recommended Operating Conditions (Except where noted otherwise Ta=25°C)

Item	Symbol	Ratings	Units
Output Current	Iout	0~200	mA
Operating Voltage	Vop	1.8~14	V

Electrical Characteristics 1 (Except where noted otherwise Vin=Vo(typ.)+1V, Io=1mA, Vcont=1.6V, Ta=25°C)

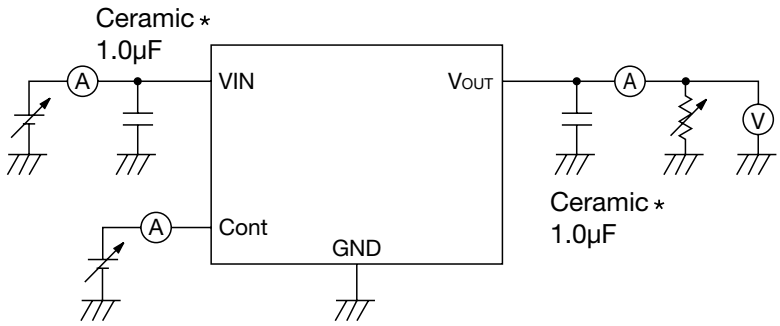
Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
No-Load Input Current	Icc	Io=0mA Vcont=VDD		75	120	µA
Input Current(OFF)	Iccoff	V_{Cont}=0V		0	1	µA
Output Voltage (Note4)	VOUT	Io=1mA	×0.98		×1.02	V
Dropout Voltage (Note5)	Vio	Vin=Vo−0.2V, Io=200mA		0.3	0.5	V
Line Regulation	⊿V1	Vin=Vo+1~14V, Io=1mA			0.1	%/V
Load Regulation	⊿V2	Io=1~200mA		15	60	mV
Vout Temperature Coefficient (Note3)	⊿Vout/⊿T	Ta=−40~+85°C		±100		ppm/°C
Ripple Rejection (Note3)	RR	f=1kHz Vripple=1Vp-p, Io=10mA		70		dB
Cont Pin Input Current	Icont	Vcont=1.6V		3	12	µA
Cont Pin High Threshold Level	VcontH		1.6			V
Cont Pin Low Threshold Level	VcontL				0.3	V

Note3 : The parameter is guaranteed by design.
Note4 : Please refer to another page.
Note5 : The parameter is not guaranteed in the model less than VOUT=2V.

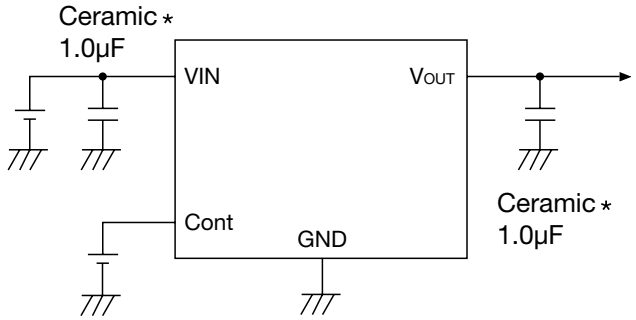
Electrical Characteristics 2 (Except where noted otherwise Vin=Vo(typ.)+1V, Io=1mA, Vcont=1.6V, Ta=25°C)

Model No.	Measurement Conditions	Output Voltage (V)		
		Min.	Typ.	Max.
MM1856A15	Io=1mA	1.470	1.5	1.530
MM1856A16		1.568	1.6	1.632
MM1856A17		1.666	1.7	1.734
MM1856A18		1.764	1.8	1.836
MM1856A19		1.862	1.9	1.938
MM1856A20		1.960	2.0	2.040
MM1856A21		2.058	2.1	2.142
MM1856A22		2.156	2.2	2.244
MM1856A23		2.254	2.3	2.346
MM1856A24		2.352	2.4	2.448
MM1856A25		2.450	2.5	2.550
MM1856A26		2.548	2.6	2.652
MM1856A27		2.646	2.7	2.754
MM1856A28		2.744	2.8	2.856
MM1856A29		2.842	2.9	2.958
MM1856A30		2.940	3.0	3.060
MM1856A31		3.038	3.1	3.162
MM1856A32		3.136	3.2	3.264
MM1856A33		3.234	3.3	3.366
MM1856A34		3.332	3.4	3.468
MM1856A35		3.430	3.5	3.570
MM1856A36		3.528	3.6	3.672
MM1856A37		3.626	3.7	3.774
MM1856A38		3.724	3.8	3.876
MM1856A39		3.822	3.9	3.978
MM1856A40		3.920	4.0	4.080
MM1856A41		4.018	4.1	4.182
MM1856A42		4.116	4.2	4.284
MM1856A43		4.214	4.3	4.386
MM1856A44		4.312	4.4	4.488
MM1856A45		4.410	4.5	4.590
MM1856A46		4.508	4.6	4.692
MM1856A47		4.606	4.7	4.794
MM1856A48		4.704	4.8	4.896
MM1856A49		4.802	4.9	4.998
MM1856A50		4.900	5.0	5.100

Measuring Circuit



Application Circuit



* Temperature Characteristics : B

(Reference example of external parts)

· Output capacitor Ceramic capacitor 1.0µF

· Input capacitor Ceramic capacitor 1.0µF

· In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, we shall not be liable for any such problem, nor grant a license therefore.

· Note

1. There is a possibility with deterioration and destruction of IC when using it exceeding the absolute maximum rating. The absolute maximum rating , Never exceed it. The functional operation is not assured.
2. There is a possibility that it becomes impossible to maintain this performance and reliability IC original when using it exceeding recommended operation voltage.
   Please use it in recommended operation voltage.
3. Due to restrictions on the package power dissipation, the output current value may not be satisfied.
   Attention should be paid to the power dissipation of the package when the output current is large or the voltage between Iinput and Output is high.
4. The output capacitor is required between output and GND to prevent oscillation.
5. 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 temperature characteristics.
6. The wire of VDD and GND is required to print full ground plane for noise and stability.
7. The input capacitor must be connected a distance of less than 1cm from input pin.

8. It is able to an unstable operation when you use the capacitor with intense capacitance change
   The capacitor has the dependency at the power-supply voltage and the temperature.
   The capacity value changes by the environment used. Please evaluate IC in the set.
9. 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.
10. There is a possibility of becoming an unstable operation. when using it with Dropout voltage no margin. Please evaluate it enough when there is no margin in Dropout voltage.
11. The overcurrent protection circuit of the vertical type is built into this IC.
12. There is a possibility that IC generates heat when the output terminal is short-circuited. However, the thermal shutdown circuit operates, and it will do operation that protects IC.
    The thermal shutdown circuit is designed only to shut the IC off to prevent thermal runaway.
    Do not continue to use the IC in an environment where the operation of this circuit is assumed.
    The characteristic changes depending on the substrate condition. Please evaluate IC in the set.
13. The hysteresis circuit is not built into the thermal shutdown circuit. It returns automatically in temperature returned after it shuts down by self-generation of heat. After it returns, it shuts down again by self-generation of heat. It is necessary to change the environment used (IC consumption,temperature) if it operates in upper cycle.

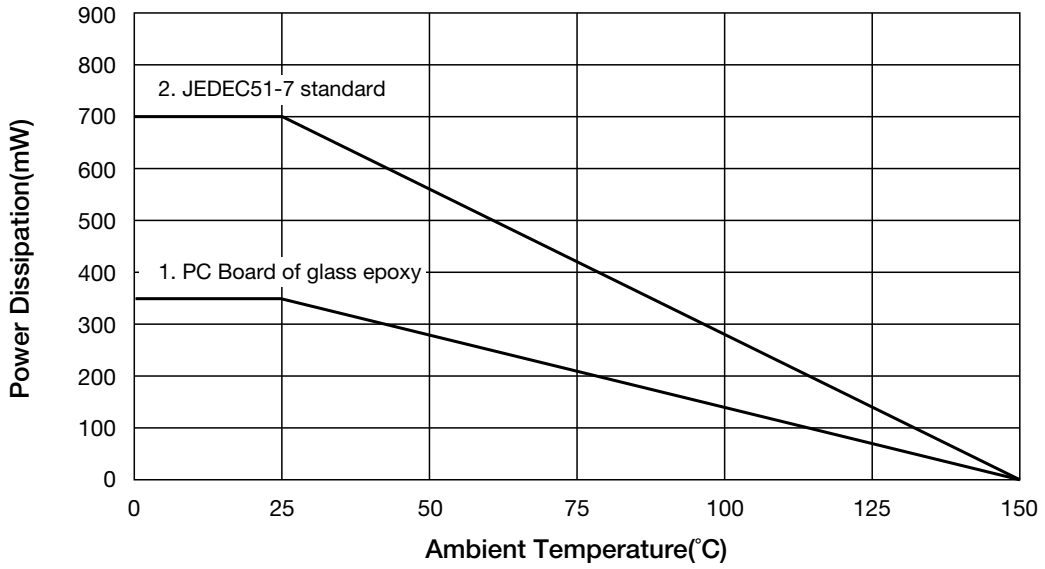
About Power Dissipation

The Power dissipation change if board to mount IC change because radiative heat fix at board.It is reference data below, Evaluate IC in the set.

SOT-25A

1. PC Board of glass epoxy
   Board size 60mm×40mm t=1.6mm Copper foil area 60%
   Power dissipation 350mW Ta=25°C

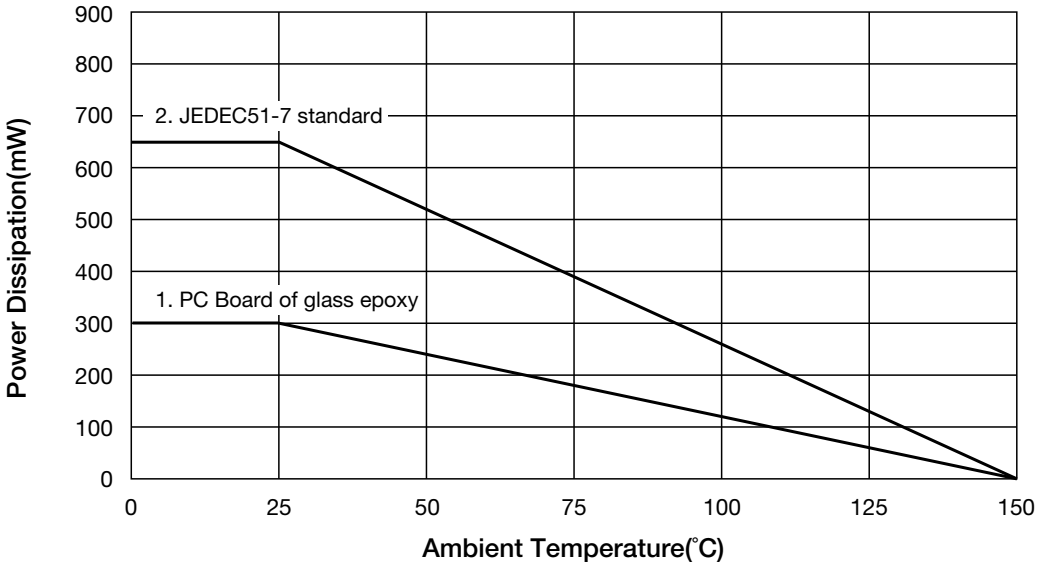
2. JEDEC51-7 standard
   Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
   Power dissipation 700mW Ta=25°C (It is reference value measured by JEDEC51-7 standard.)



SC-82ABB

1. PC Board of glass epoxy
   Board size 100mm×100mm t=1.6mm Copper foil area 60%
   Power dissipation 300mW Ta=25°C

2. JEDEC51-7 standard
   Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
   Power dissipation 650mW Ta=25°C (It is reference value measured by JEDEC51-7 standard.)

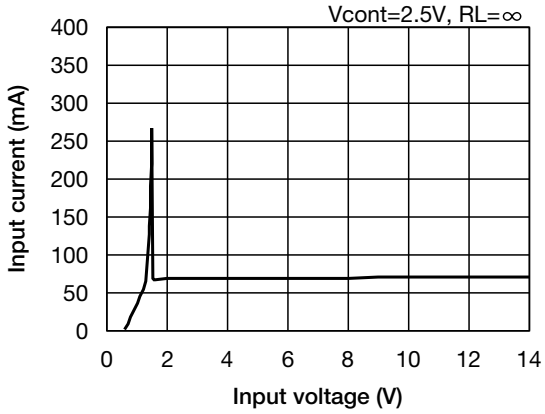


It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

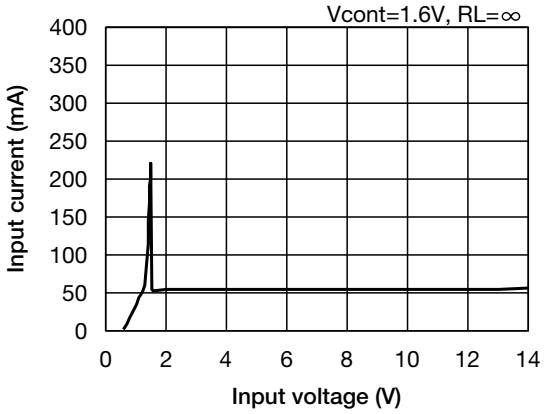
Characteristics (Vo=1.5V)

(Except where noted otherwise Vin=Vo(typ.)+1V, Iout=1mA, Vcont=Vo+1V, Cin=Co=1µF, Ta=25°C)

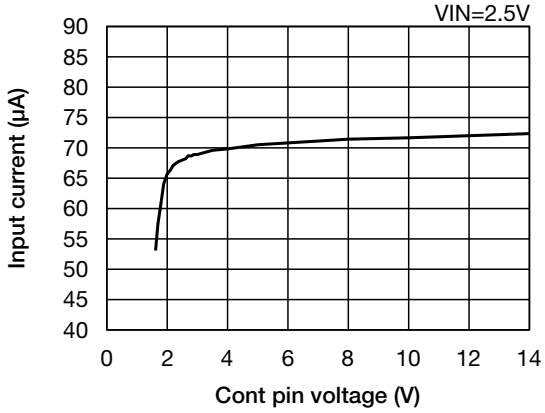
Input voltage - Input current



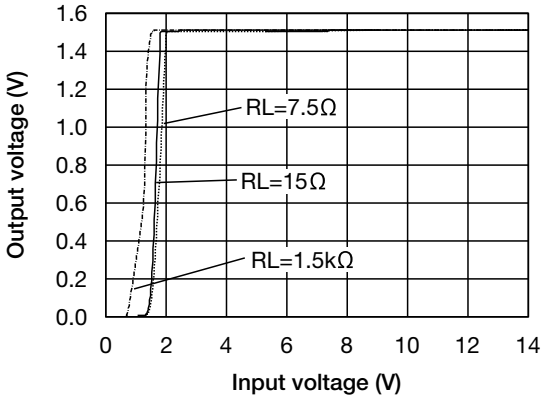
Input voltage - Input current



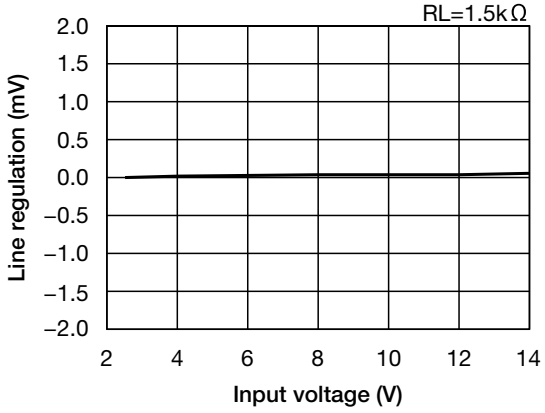
Cont pin voltage - Input current



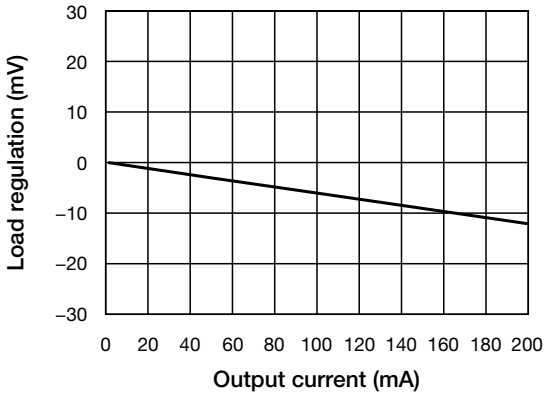
Input voltage - Output voltage



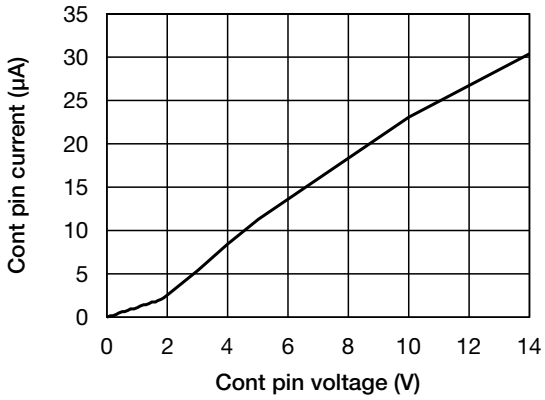
Line regulation



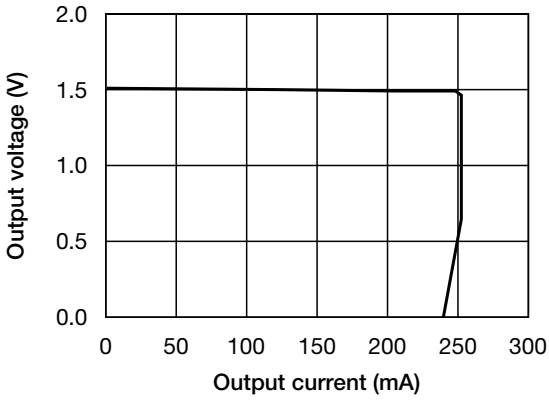
Load regulation



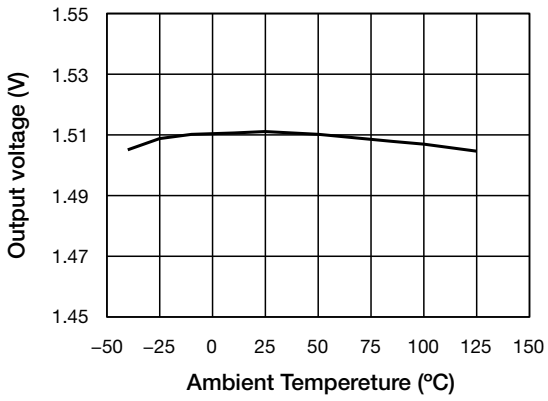
Cont pin voltage - Cont pin current



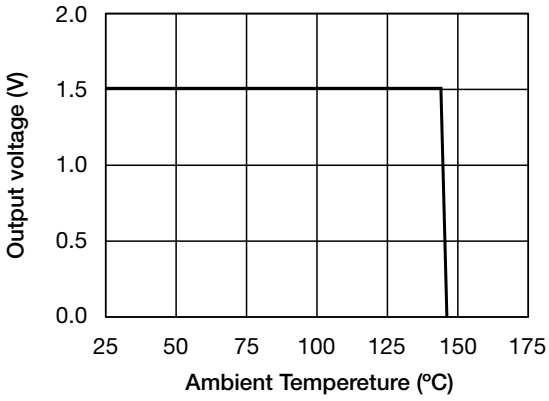
Current Limit



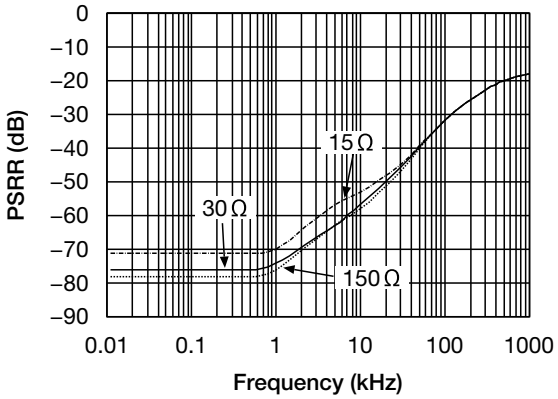
Ambient Tempereture - Output voltage



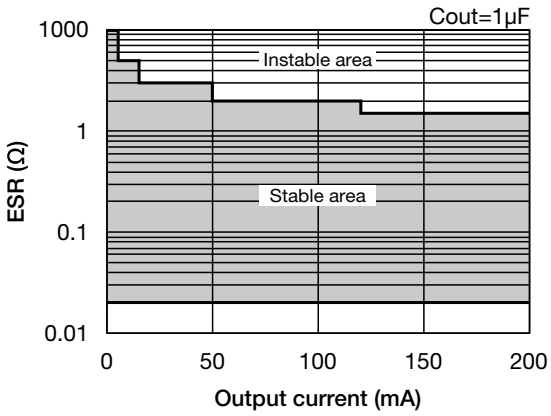
Thermal Shut Down



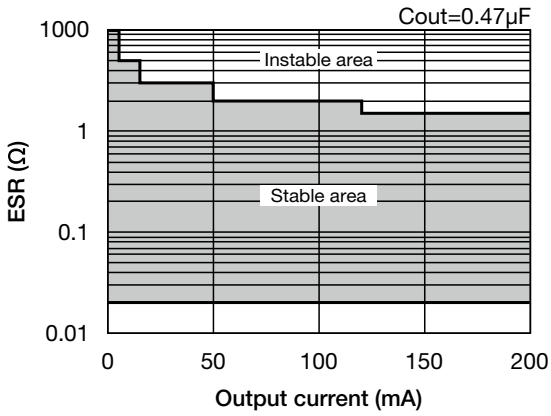
Ripple Rejection



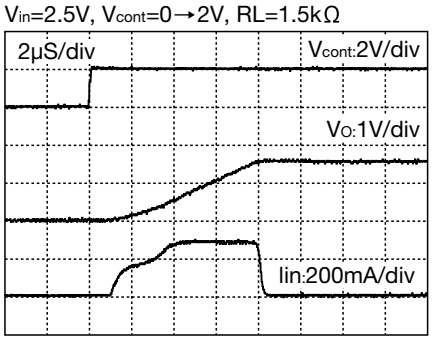
ESR stable area



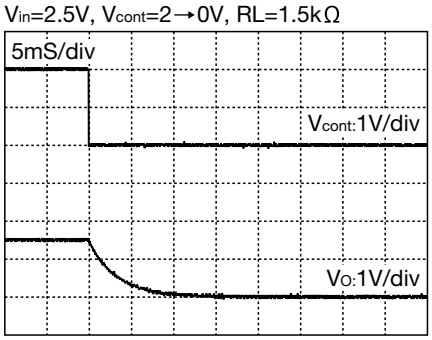
ESR stable area



Turn-On Transient response

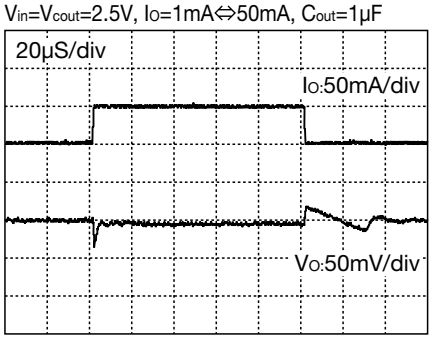


Turn-Off Transient response

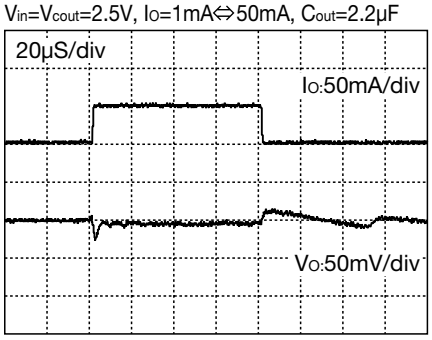


Load Transient response

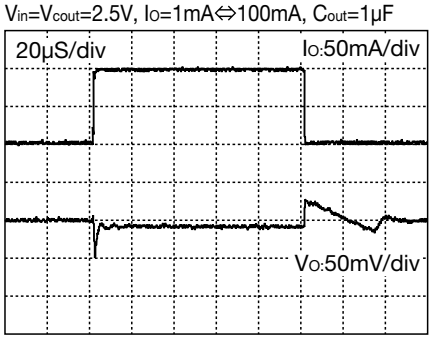
$V_{in}=V_{cout}$=2.5V, I_O=1mA⇔50mA, C_{out}=1μF



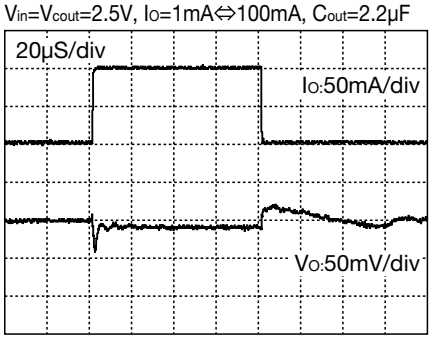
$V_{in}=V_{cout}$=2.5V, I_O=1mA⇔50mA, C_{out}=2.2μF



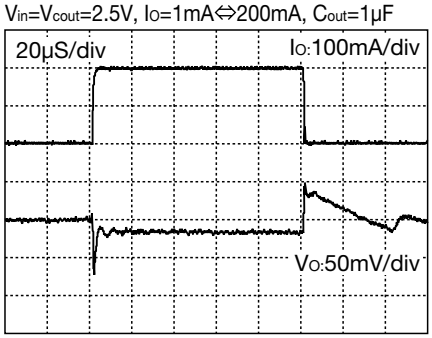
$V_{in}=V_{cout}$=2.5V, I_O=1mA⇔100mA, C_{out}=1μF



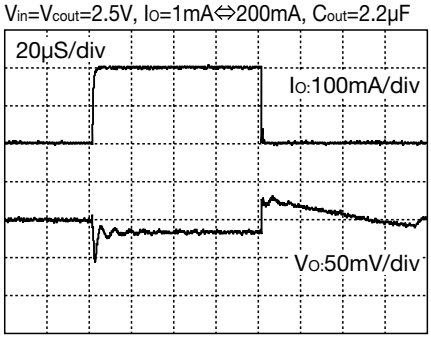
$V_{in}=V_{cout}$=2.5V, I_O=1mA⇔100mA, C_{out}=2.2μF



$V_{in}=V_{cout}$=2.5V, I_O=1mA⇔200mA, C_{out}=1μF



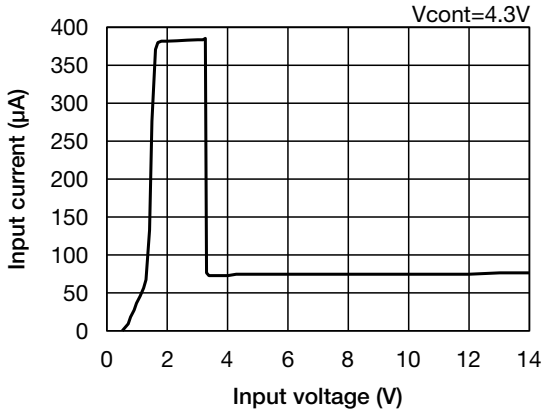
$V_{in}=V_{cout}$=2.5V, I_O=1mA⇔200mA, C_{out}=2.2μF



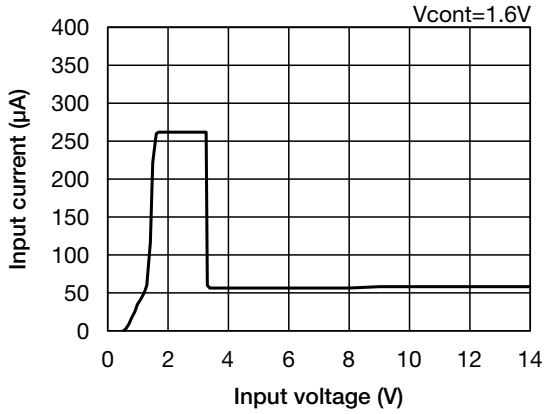
Characteristics (Vo=3.3V)

(Except where noted otherwise Vin=Vo(typ.)+1V, Iout=1mA, Vcont=Vo+1V, Cin=Co=1µF, Ta=25°C)

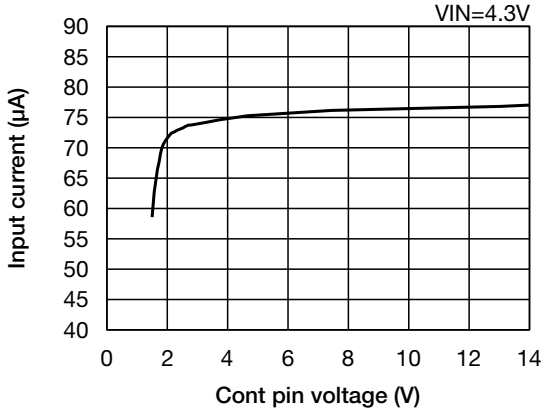
Input voltage - Input current



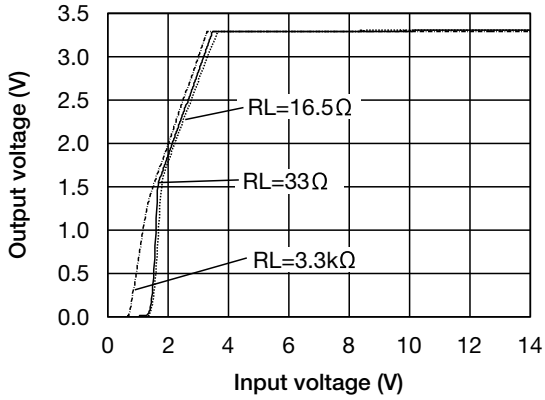
Input voltage - Input current



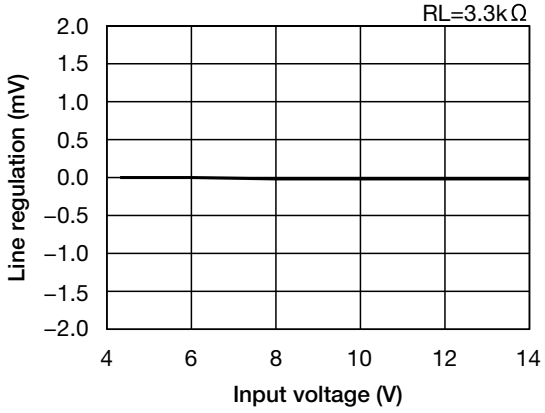
Cont pin voltage - Input current



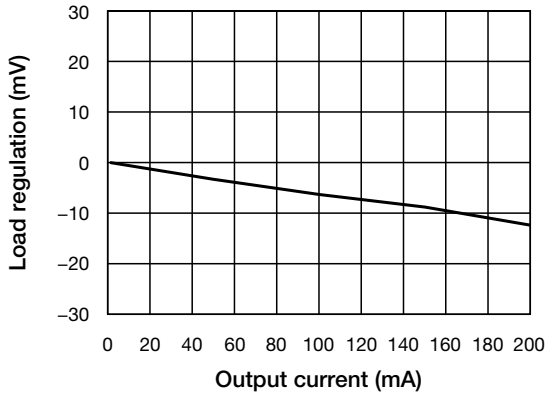
Input voltage - Output voltage



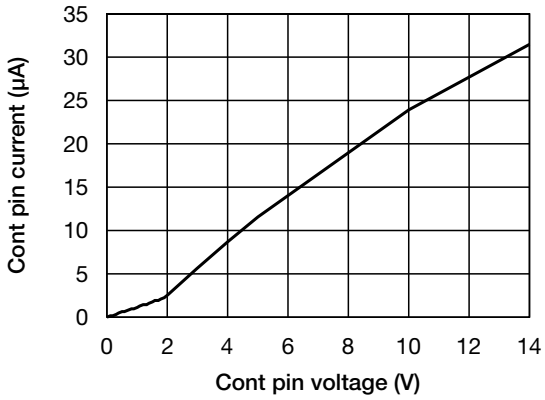
Line regulation



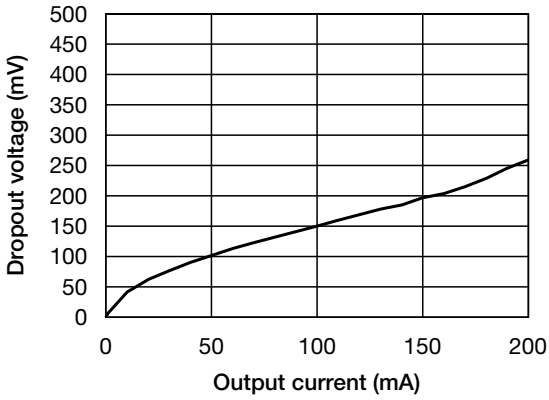
Load regulation



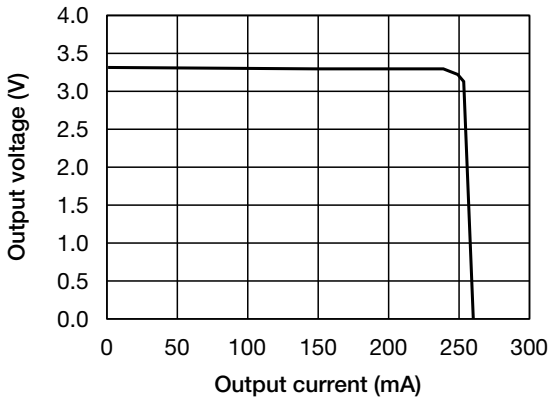
Cont pin voltage - Cont pin current



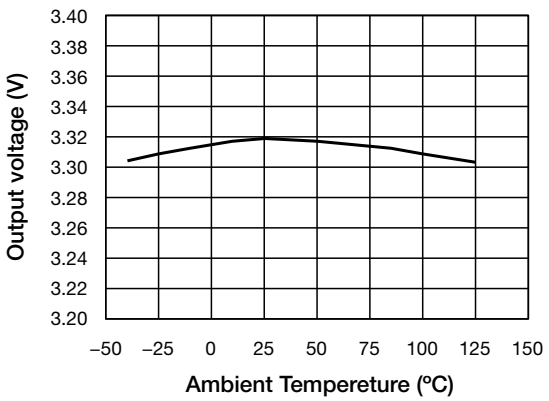
Output current - Dropout voltage



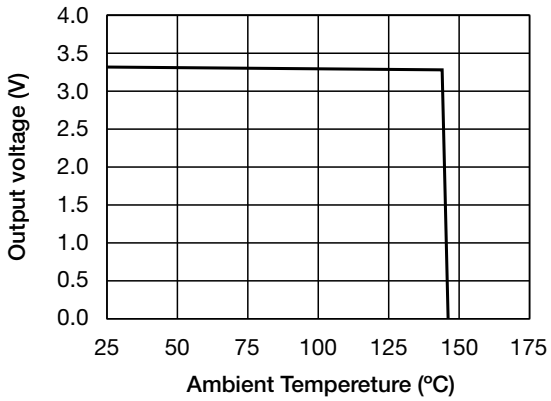
Current Limit



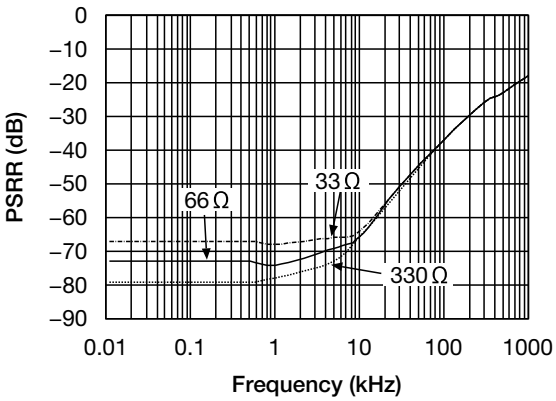
Ambient Tempereture - Output voltage



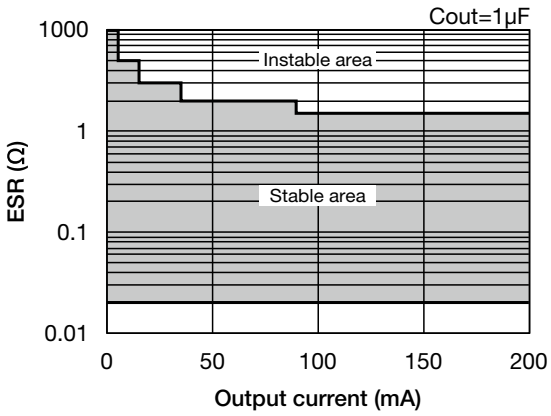
Thermal Shut Down



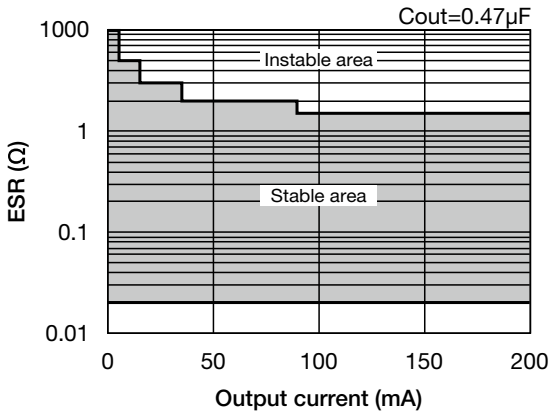
Ripple Rejection



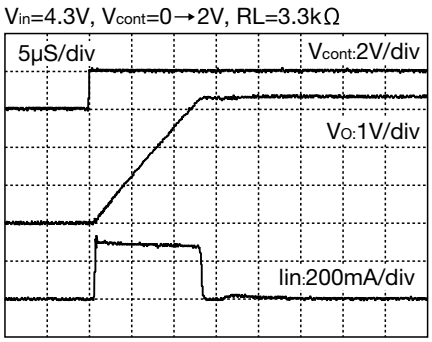
ESR stable area



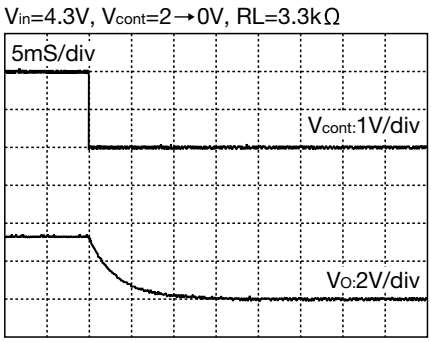
ESR stable area



Turn-On Transient response

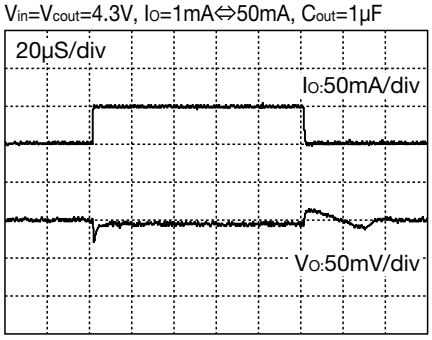


Turn-Off Transient response

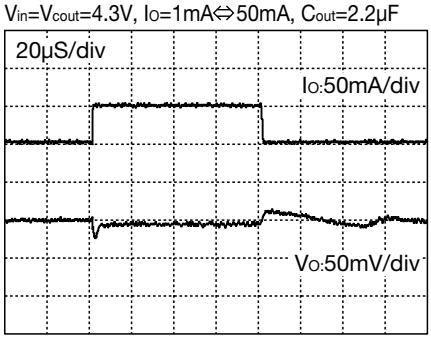


Load Transient response

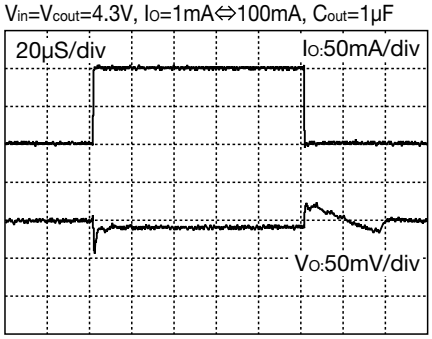
$V_{in}=V_{cout}=4.3V$, $I_O=1mA \Leftrightarrow 50mA$, $C_{out}=1\mu F$



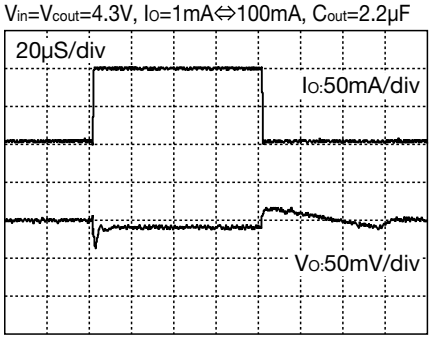
$V_{in}=V_{cout}=4.3V$, $I_O=1mA \Leftrightarrow 50mA$, $C_{out}=2.2\mu F$



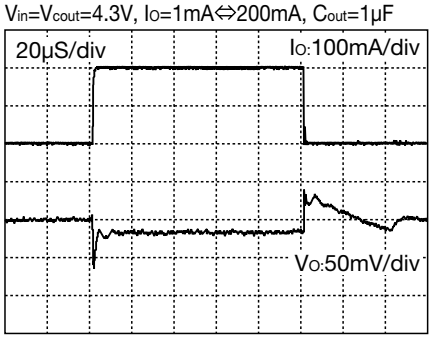
$V_{in}=V_{cout}=4.3V$, $I_O=1mA \Leftrightarrow 100mA$, $C_{out}=1\mu F$



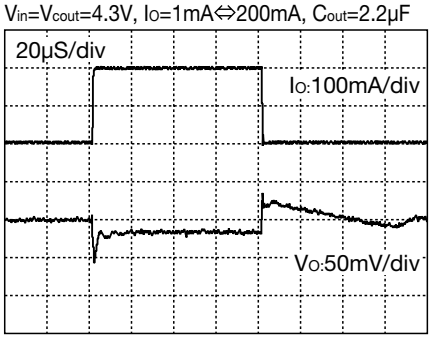
$V_{in}=V_{cout}=4.3V$, $I_O=1mA \Leftrightarrow 100mA$, $C_{out}=2.2\mu F$



$V_{in}=V_{cout}=4.3V$, $I_O=1mA \Leftrightarrow 200mA$, $C_{out}=1\mu F$

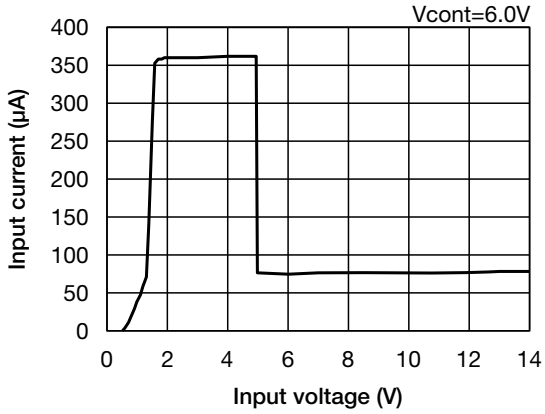


$V_{in}=V_{cout}=4.3V$, $I_O=1mA \Leftrightarrow 200mA$, $C_{out}=2.2\mu F$

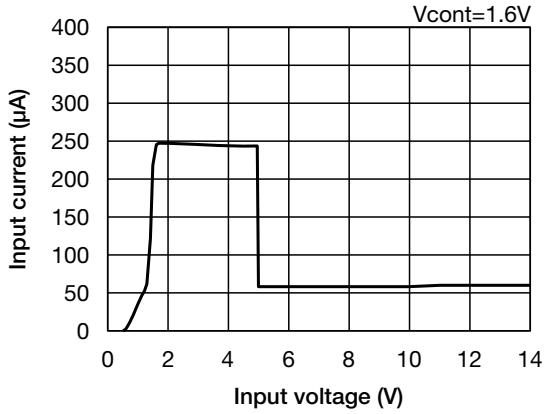


Characteristics (Vo=5.0 V) (Except where noted otherwise Vin=Vo(typ.)+1V, Iout=1mA, Vcont=Vo+1V, Cin=Co=1µF, Ta=25°C)

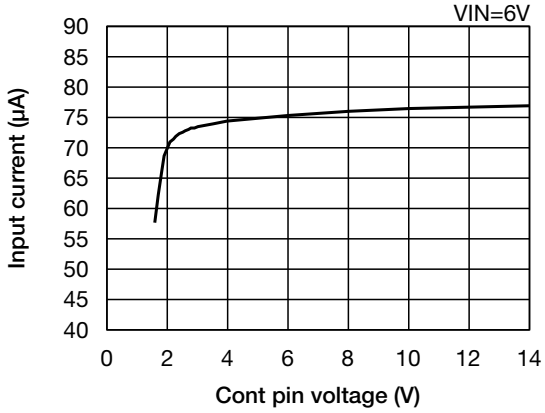
Input voltage - Input current



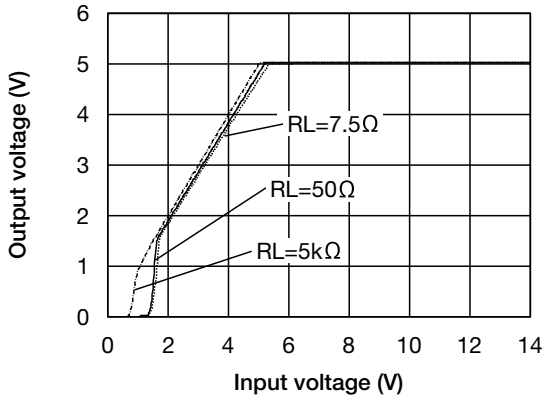
Input voltage - Input current



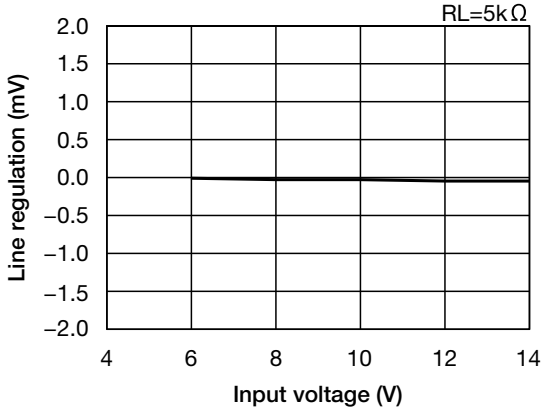
Cont pin voltage - Input current



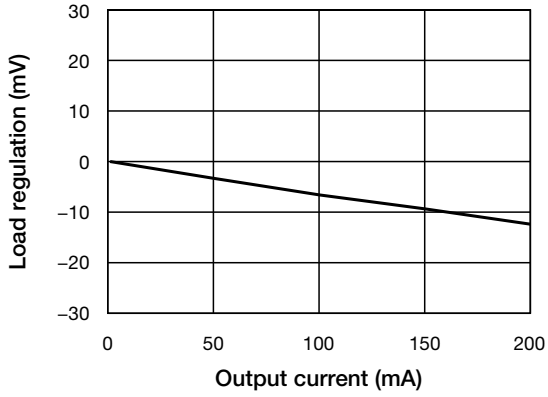
Input voltage - Output voltage



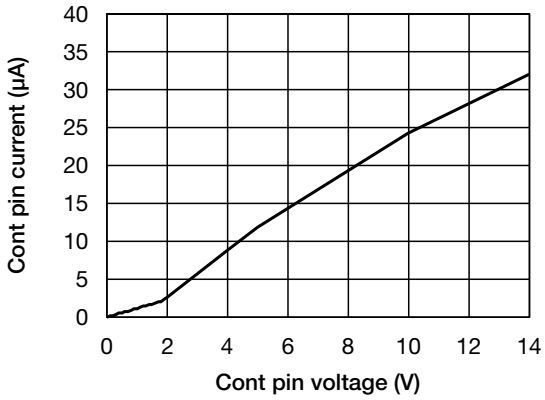
Line regulation



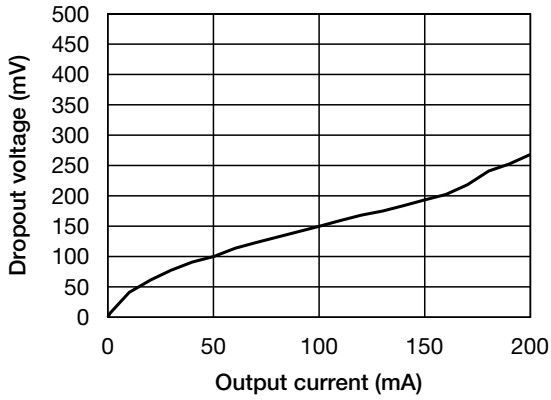
Load regulation



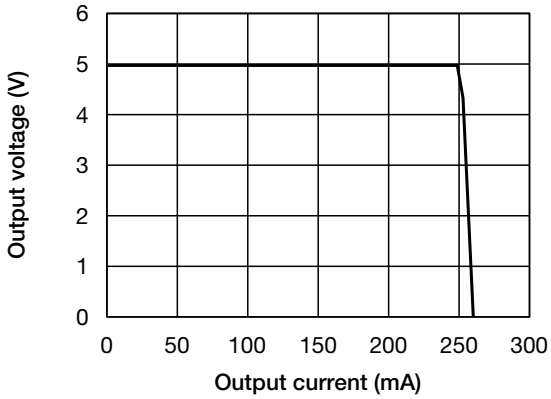
Cont pin voltage - Cont pin current



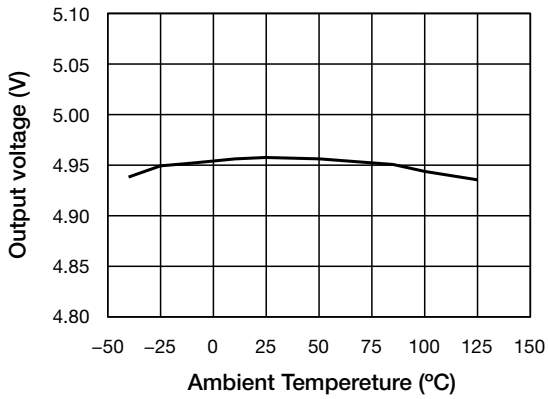
Output current - Dropout voltage



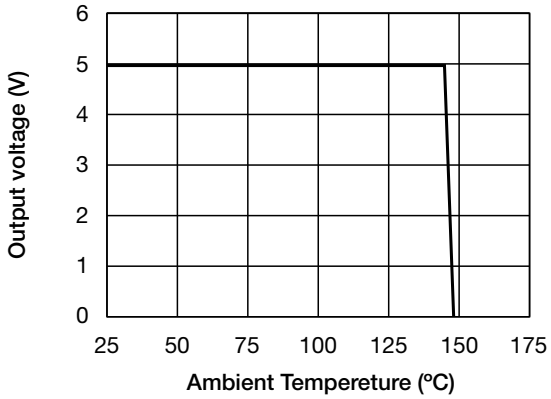
Current Limit



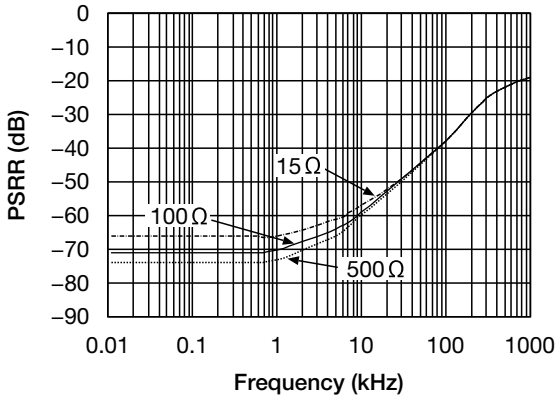
Ambient Tempereture - Output voltage



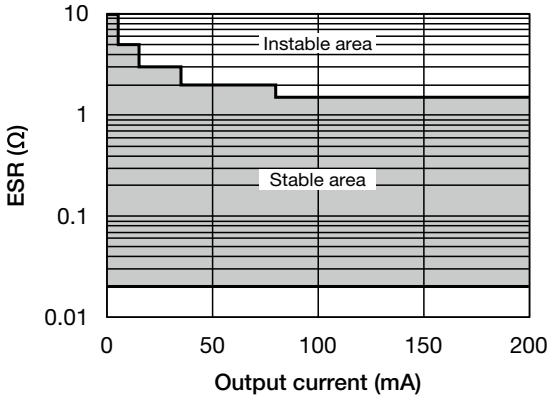
Thermal Shut Down



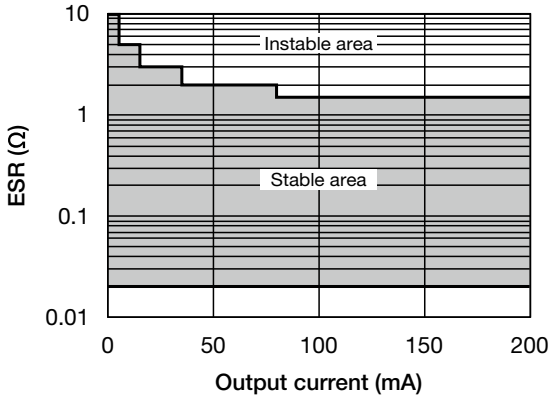
Ripple Rejection



ESR stable area

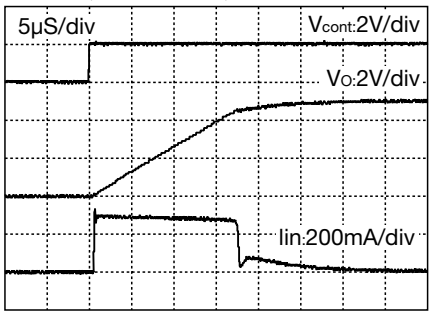


ESR stable area



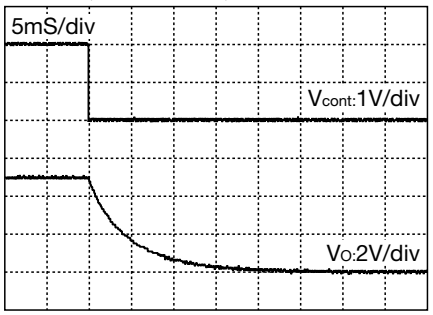
Turn-On Transient response

V_{in}=0.6V, V_{cont}=0→2V, RL=5.0kΩ



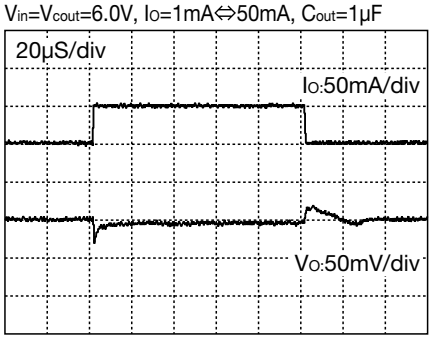
Turn-Off Transient response

V_{in}=6.0V, V_{cont}=2→0V, RL=5.0kΩ

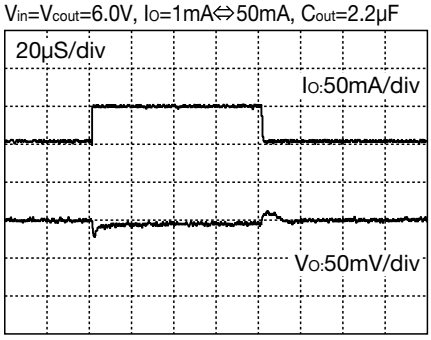


Load Transient response

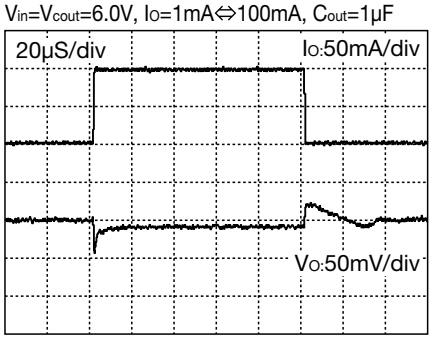
$V_{in}=V_{cout}$=6.0V, I_O=1mA⇔50mA, C_{out}=1μF



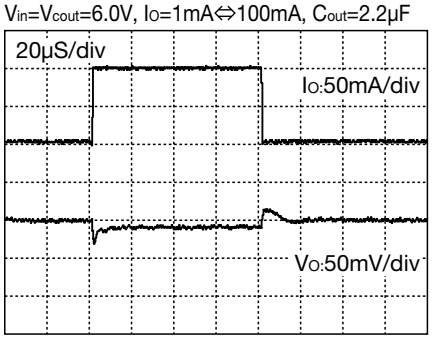
$V_{in}=V_{cout}$=6.0V, I_O=1mA⇔50mA, C_{out}=2.2μF



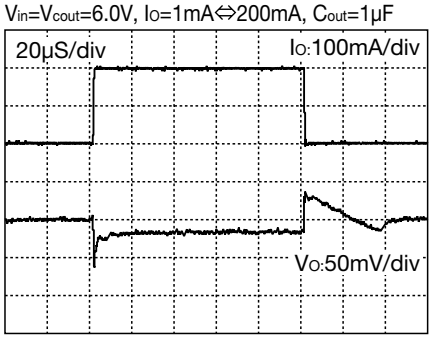
$V_{in}=V_{cout}$=6.0V, I_O=1mA⇔100mA, C_{out}=1μF



$V_{in}=V_{cout}$=6.0V, I_O=1mA⇔100mA, C_{out}=2.2μF



$V_{in}=V_{cout}$=6.0V, I_O=1mA⇔200mA, C_{out}=1μF



$V_{in}=V_{cout}$=6.0V, I_O=1mA⇔200mA, C_{out}=2.2μF