Low noise 300mA LDO
Monolithic IC MM1899 Series

Outline

This IC is a low noise 300mA LDO by bipolar process. The applications by new noise reduction circuit are for a power supply of highly sensitive CMOS image sensor.
It is small space by SOT-25 or small package SSON-6A.

Features

1. Maximum supply voltage	15V
2. Operating input voltage	14V
3. No load input current	140μA typ.
4. Shutdown current	6μA typ.
5. Output voltage range	1.5 to 5.4V
6. Output voltage accuracy	±1%
7. Dropout voltage	0.35V typ. (I_O=300mA)
8. Line regulation	0.1%/V max.
9. Load regulation	60mV max. (I_O=1 to 300mA)
10. V_{OUT} temperature coefficient	±100ppm/℃ typ.
11. Ripple rejection	70dB typ. (f=1kHz)
12. Output noise voltage	30μVrms typ. (f=10 to 100kHz)
13. ON/OFF control pin	
14. Thermal shut down	
15. Output discharge function	
16. Output capacitor	1μF

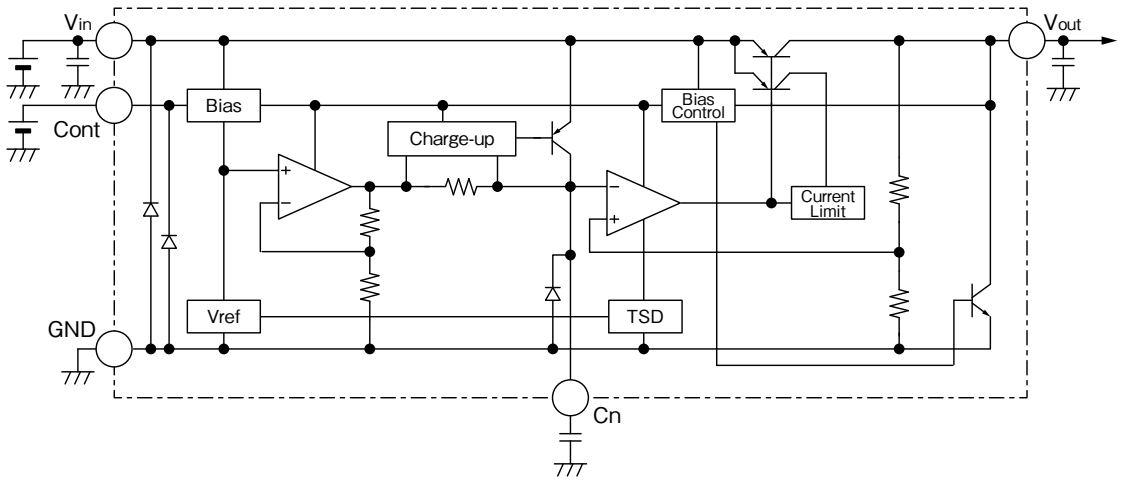
Package

SOT-25
SSON-6A

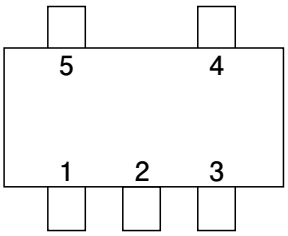
Applications

1. Image sensor
2. Sensor power supply
3. Analog power supply

Block Diagram

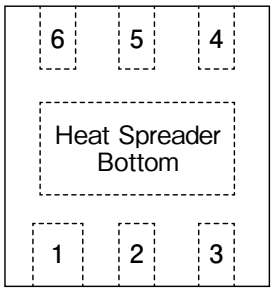


Pin Assignment



SOT-25A
(TOP VIEW)

1	Vin
2	GND
3	Cont
4	Cn
5	Vout



SSON-6A
(TOP VIEW)

1	Vin
2	NC
3	Vout
4	Cn
5	GND
6	Cont

Pin Description

SOT-25A

Pin No.	Pin name	Functions
1	Vin	Supply voltage pin
2	GND	GND pin
3	Cont	Control pin Vcont=H : Output ON Vcont=L : Output OFF
4	Cn	Reducing noise pin with capacitor The pin voltage is changed by the output voltage rank.
5	Vout	Output voltage output pin

SSON-6A

Pin No.	Pin name	Functions
1	Vin	Supply voltage pin
2	NC	No connection
3	Vout	Output voltage output pin
4	Cn	Reducing noise pin with capacitor The pin voltage is changed by the output voltage rank.
5	GND	GND pin
6	Cont	Control pin Vcont=H : Output ON Vcont=L : Output OFF

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

Item	Symbol	Ratings		Units
Supply voltage	Vin	−0.3 to +15		V
V− terminal input voltage	Vcont	−0.3 to +15		
COUT terminal Output voltage	Iout	0 to 400		mA
Junction Temperature	T_{jMAX}	125		℃
Storage Temperature	Tstg	−55 to +125		
Power Dissipation	Pd	SOT-25A	560 (Note1)	mW
		SSON-6A	1000 (Note1)	

Note1 : JEDEC51-7 Standard 114.3mm×76.2mm, t=1.6mm

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

Item	Symbol	Ratings	Units
Operating Ambient temperature	Topr	−40 to +85	℃
Operating Voltage	Vop	2 to 14	V
Output Current	Iop	0 to 300	mA

Electrical Characteristics 1 (Except where noted otherwise Vin=Vout (Typ.) +1V, Iout=1mA, Vcont=1.4V, Ta=25℃)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input current consumption (OFF)	Iin_OFF	Vin=6.0V, Vcont=0V Include discharge circuit		6	12	μA
No-Load input current consumption	Iin			140	220	
Output voltage	Vout	Iout=1mA	×0.99		×1.01	V
Dropout voltage	Vio	Vin=Vout-0.2V, Iout=300mA		0.35	0.50	
Line regulation	⊿Vline	Vin=Vout+1V to 14V, Iout=1mA		0.01	0.10	%/V
Load regulation	⊿Vload	Iout=1m to 300mA		10	60	mV
Vout temperature coefficient (Note2)	⊿Vout/⊿T	Ta=-40 to +85℃		±100		ppm/℃
Ripple rejection (Note2)	RR	f=1kHz, Vripple=1V, Vout=3.0V, Iout=10mA, Cn=0.01μA		70		dB
Output noise voltage (Note2)	Voutn	fBW=10k to 100kHz, Vout=3V, Iout=10mA, Cn=0.01μA		30		μVrms
Cont pin input current	Icont	Vcont=1.4V		4	7	μA
Cont pin High Threshold level	VcontH	Vout : ON	1.4			V
Cont pin Low Threshold level	VcontL	Vout : OFF			0.4	
Output discharge current	Idis	Vin=6.0V, Vcont=0V	100	180		mA

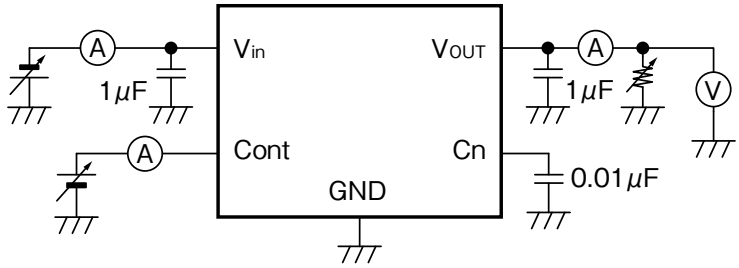
Note2 : The parameter is guaranteed by design.

Electrical Characteristics 2

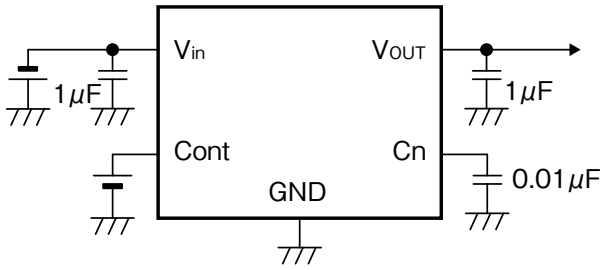
(Except where noted otherwise Vin=Vout (Typ.) +1V, Iout=1mA, Vcont=1.4V, Ta=25℃)

Output voltage	Measurement Conditions	Output Voltage (V)		
		Min.	Typ.	Max.
1.5	Iout=1mA	1.485	1.500	1.515
1.6		1.584	1.600	1.616
1.7		1.683	1.700	1.717
1.8		1.782	1.800	1.818
1.9		1.881	1.900	1.919
2.0		1.980	2.000	2.020
2.1		2.079	2.100	2.121
2.2		2.178	2.200	2.222
2.3		2.277	2.300	2.323
2.4		2.376	2.400	2.424
2.5		2.475	2.500	2.525
2.6		2.574	2.600	2.626
2.7		2.673	2.700	2.727
2.8		2.772	2.800	2.828
2.9		2.871	2.900	2.929
3.0		2.970	3.000	3.030
3.1		3.069	3.100	3.131
3.2		3.168	3.200	3.232
3.3		3.267	3.300	3.333
3.4		3.366	3.400	3.434
3.5		3.465	3.500	3.535
3.6		3.564	3.600	3.636
3.7		3.663	3.700	3.737
3.8		3.762	3.800	3.838
3.9		3.861	3.900	3.939
4.0		3.960	4.000	4.040
4.1		4.059	4.100	4.141
4.2		4.158	4.200	4.242
4.3		4.257	4.300	4.343
4.4		4.356	4.400	4.444
4.5		4.455	4.500	4.545
4.6		4.554	4.600	4.646
4.7		4.653	4.700	4.747
4.8		4.752	4.800	4.848
4.9		4.851	4.900	4.949
5.0		4.950	5.000	5.050
5.1		5.049	5.100	5.151
5.2		5.148	5.200	5.252
5.3		5.247	5.300	5.353
5.4		5.346	5.400	5.454

Measuring Circuit



Application Circuit



* Temperature Characteristics : B

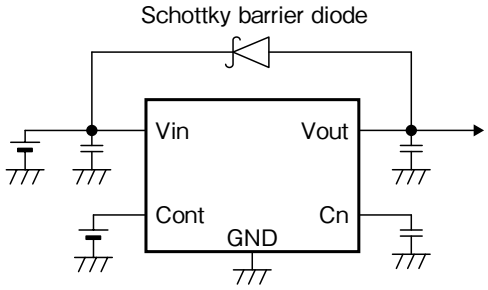
(Reference example of external parts)

· Output capacitor	Ceramic capacitor	1.0μF
· Input capacitor	Ceramic capacitor	1.0μF
· Cn capacitor	Ceramic capacitor	0.01μF

· 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.

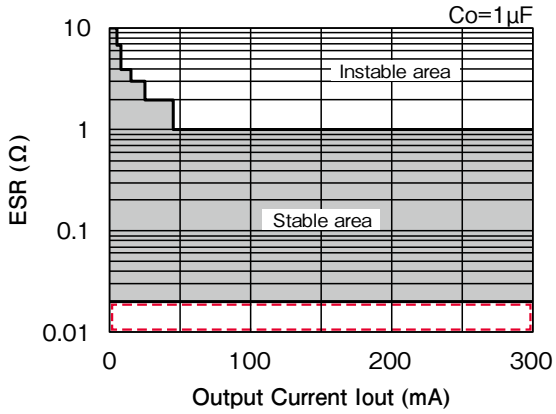
NOTE

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 Input 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 Vin 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. 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.

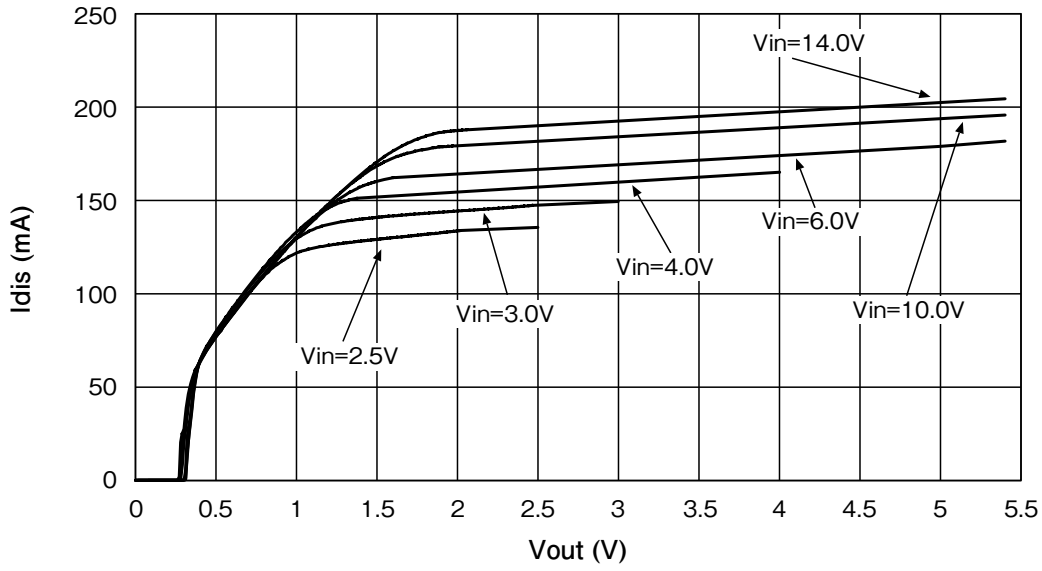


9. It is able to an unstable operation when you use the capacitor with intense capacitance change.
   The capacitor has the dependency at the power-supply voltage and the temperature.
   The capacity value changes by the environment used. Please evaluate IC in the set.
10. The IC has the thermal shutdown protection.
11. This IC will limit the output current with the overcurrent protection circuit when the overcurrent and the output do short-circuit. However, IC generates heat because of the substrate and use conditions and there is a possibility of destroying it exceeding a permissible loss.
    The characteristic changes depending on the substrate condition.
    Please evaluate IC in the set.
12. The IC has the pull-down resistance of the Cont terminal.
13. The overshoot might be generated in start up for hight output voltage rank.
    The overshoot might be generated by ambient temperature and load condition.
    Please evaluate IC in the set.

14. It is no data in under 0.02Ω of ESR characteristics. (dotted line area)
Don't be measured in this area because ceramic capacitor contain 0.02Ω in parts self.
Ceramic capacitor only can be used without ESR resistance parts.
Please evaluate IC in the set if the capacitor that is low resistance used.



15. Discharge current depend on power supply Vin and output voltage Vout.
Reference to Below current characteristics.

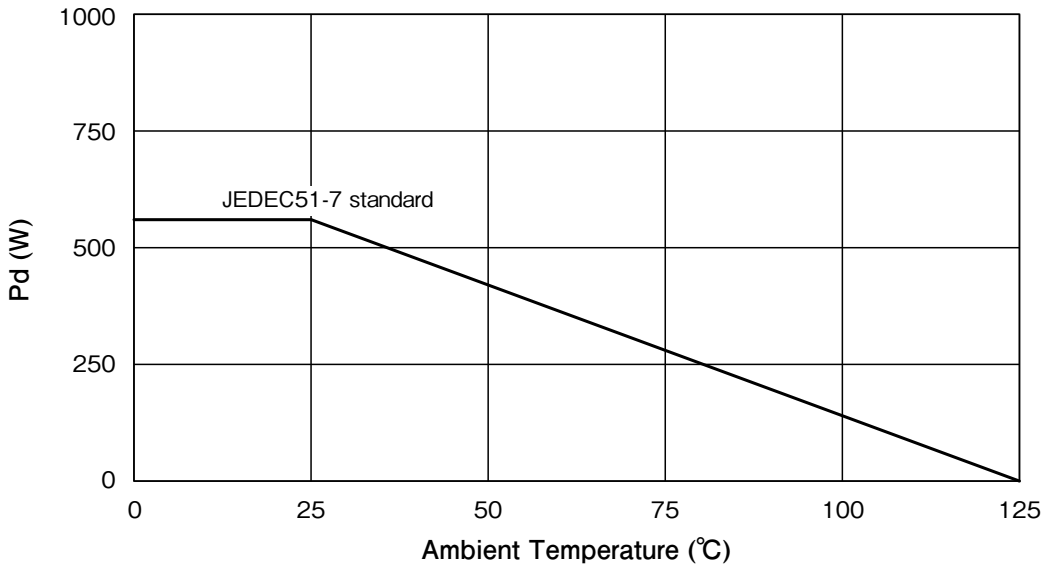


About Power Dissipation

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.

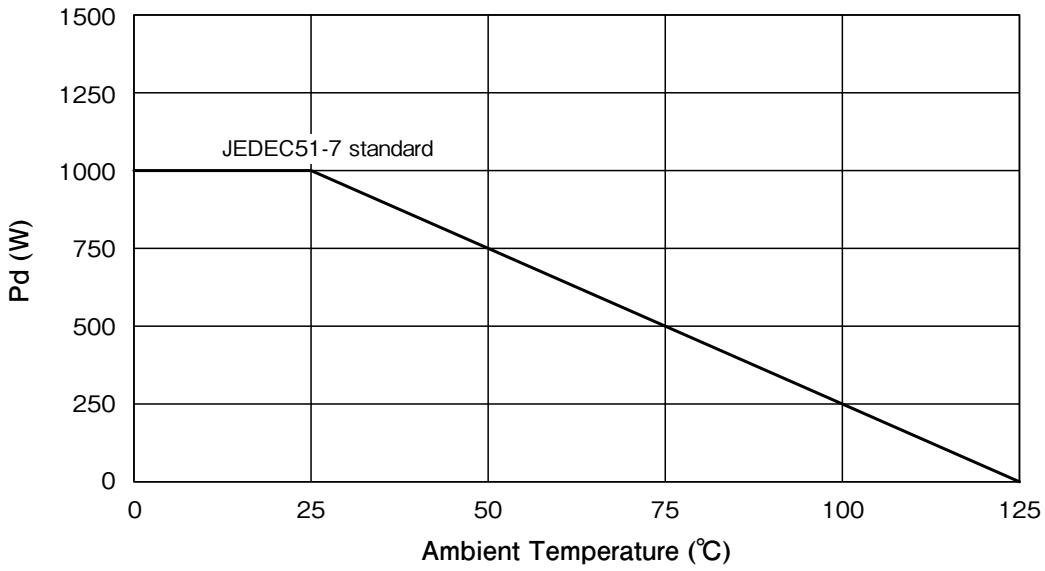
SOT-25A

1. JEDEC51-7 standard
   Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
   Power dissipation



SSON-6A

1. JEDEC51-7 standard
   Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
   Power dissipation 1000mW Ta=25℃ (It is reference value measured by JEDEC51-7 standard.)

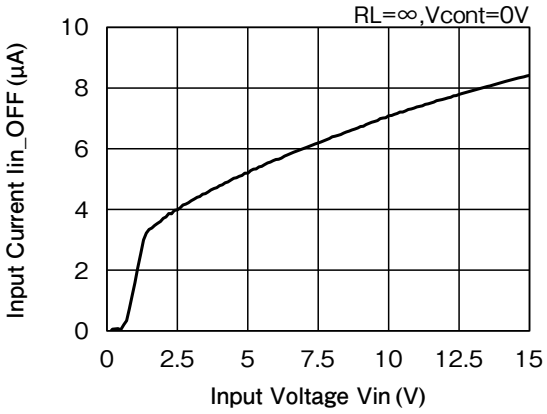


It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.
Considering a products life on reliability, it is recommended to design with a sufficient margin for the power dissipation.

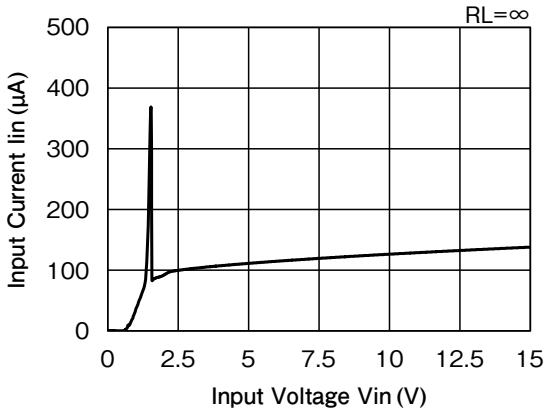
Characteristics (Vo=1.5V)

(Except where noted otherwise Vin=Vo+1V, Vcont=1.4V, Cin=1µF, Co=1µF, Cn=0.01µF, Ta=25℃)

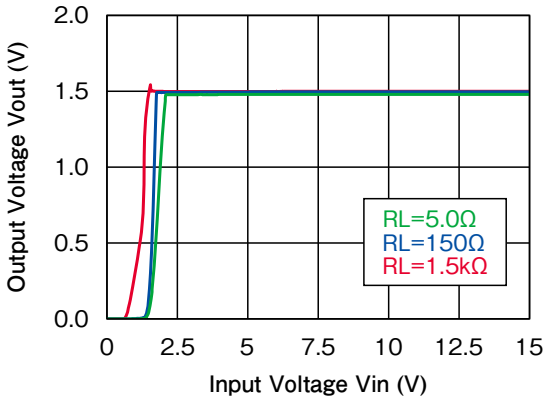
Input Current (OFF) – Input Voltage



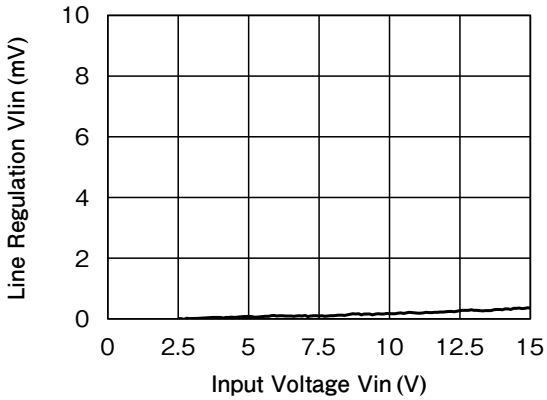
Input Current – Input Voltage



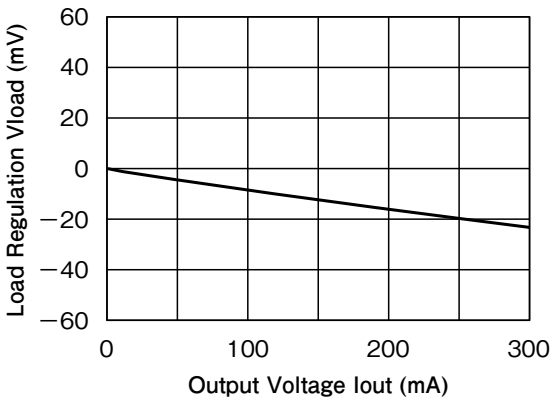
Output Voltage – Input Voltage



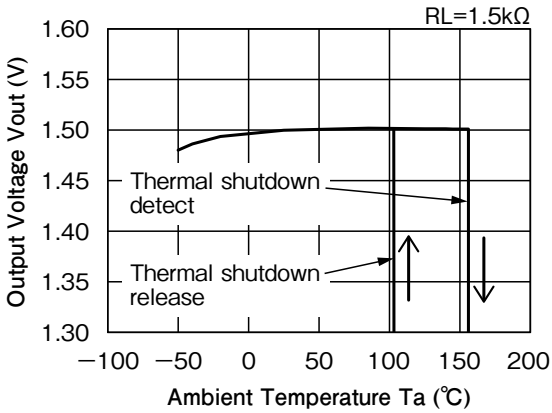
Line Regulation



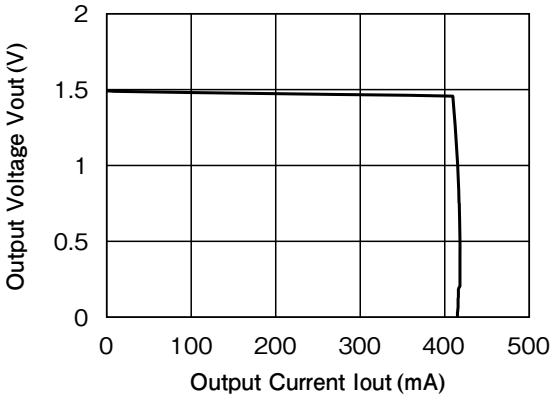
Load Regulation



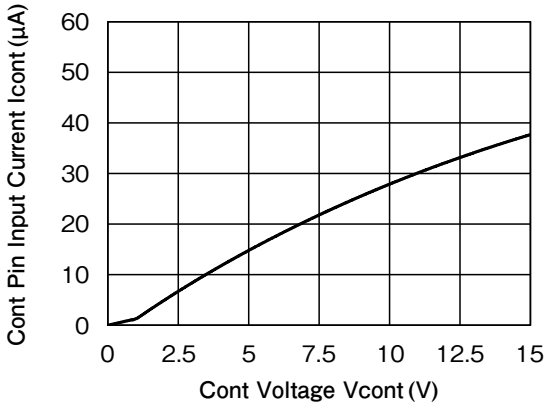
Vout Temperature Coefficient



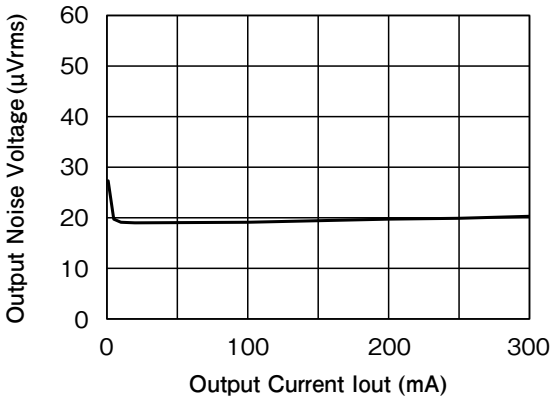
Output Voltage – Output Current



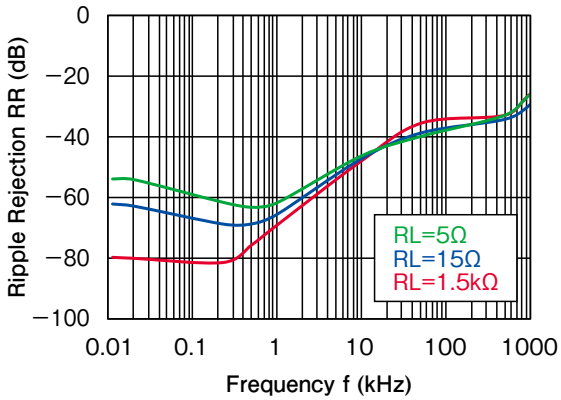
Cont Pin Input Current – Cont Voltage



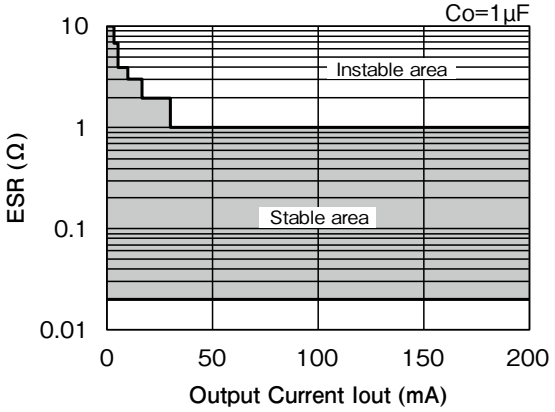
Output Noise Voltage



Ripple Rejection

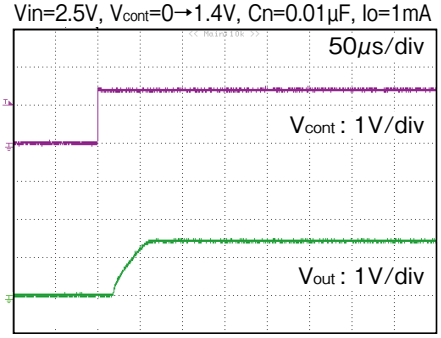


ESR stable area

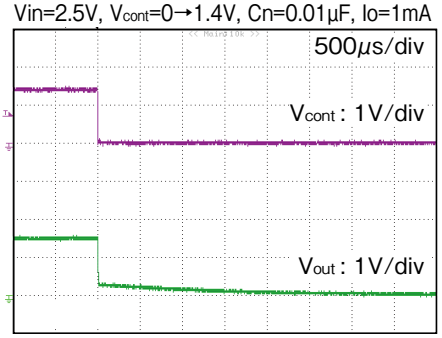


Cont Rise Characteristics

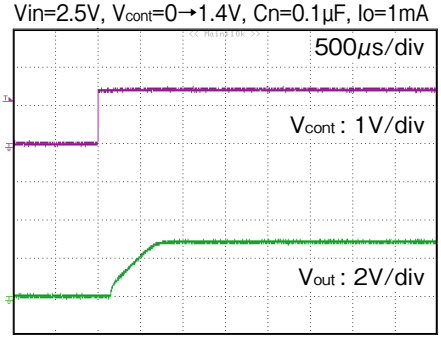
Vin=2.5V, V_{cont}=0→1.4V, Cn=0.01μF, Io=1mA



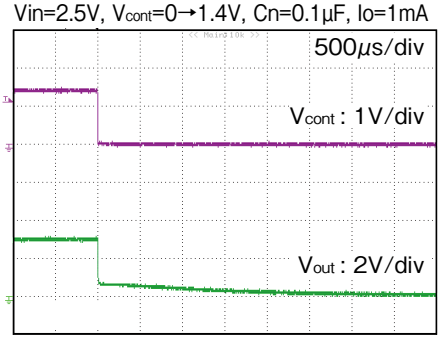
Vin=2.5V, V_{cont}=0→1.4V, Cn=0.01μF, Io=1mA



Vin=2.5V, V_{cont}=0→1.4V, Cn=0.1μF, Io=1mA

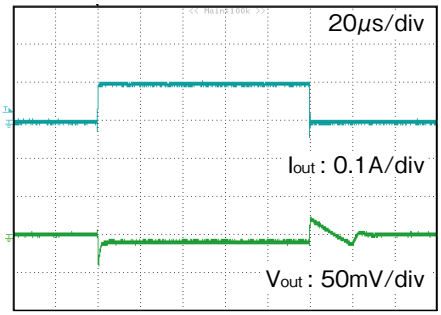


Vin=2.5V, V_{cont}=0→1.4V, Cn=0.1μF, Io=1mA

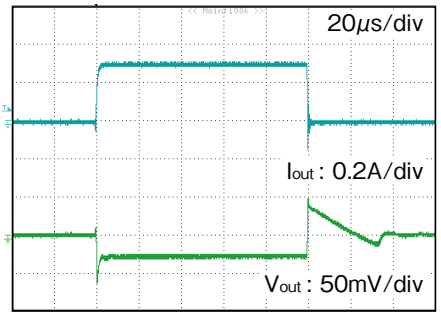


Load Transient Characteristics

I_{out}=1mA⇔100mA



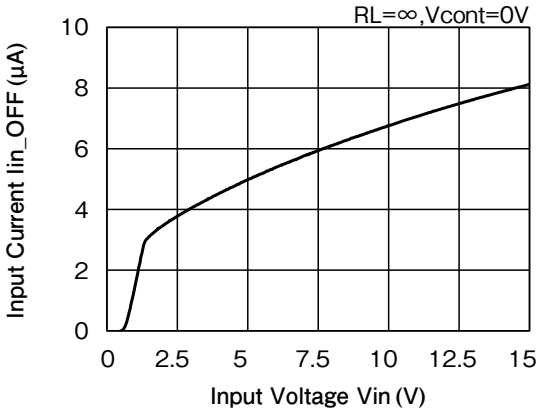
I_{out}=1mA⇔300mA



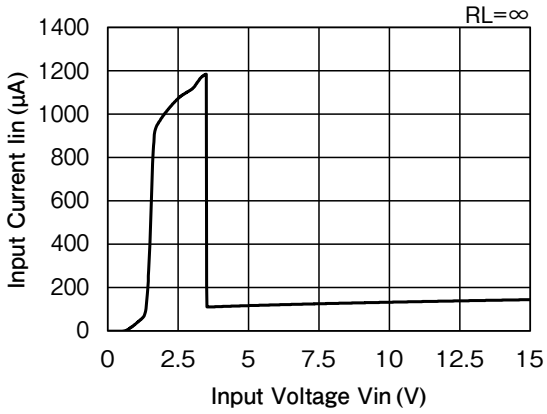
Characteristics (Vo=3.5V)

(Except where noted otherwise Vin=Vo+1V, Vcont=1.4V, Cin=1µF, Co=1µF, Cn=0.01µF, Ta=25℃)

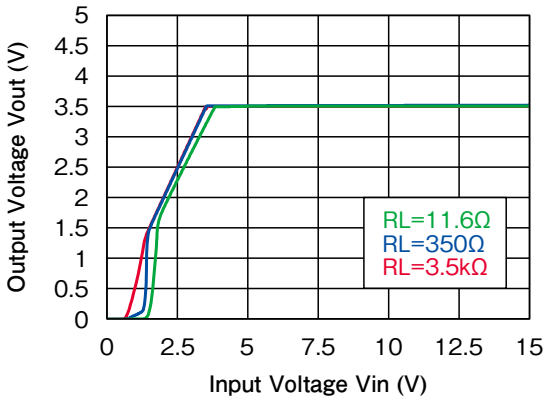
Input Current (OFF) – Input Voltage



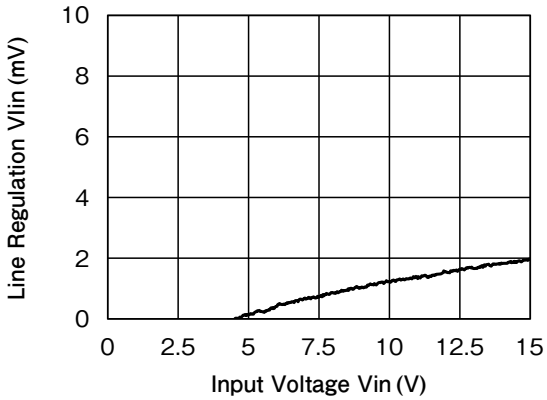
Input Current – Input Voltage



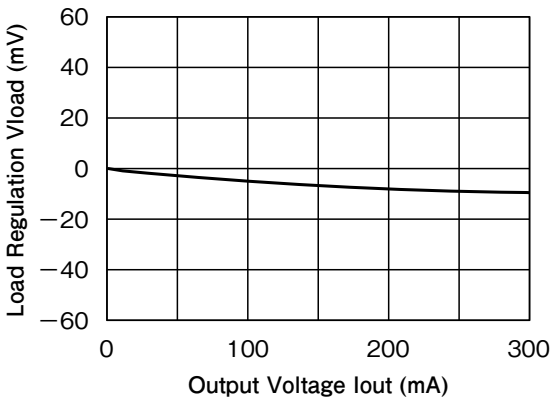
Output Voltage – Input Voltage



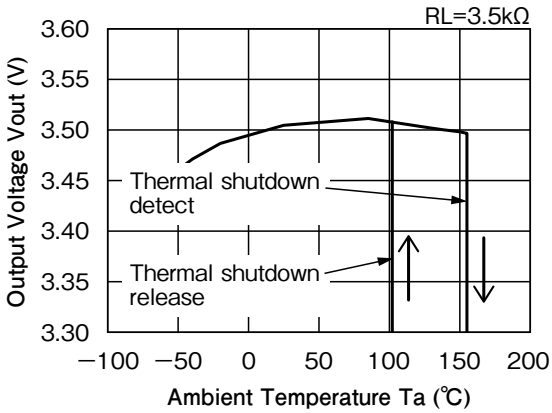
Line Regulation



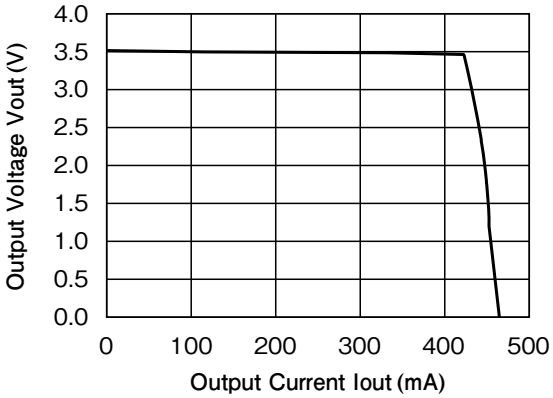
Load Regulation



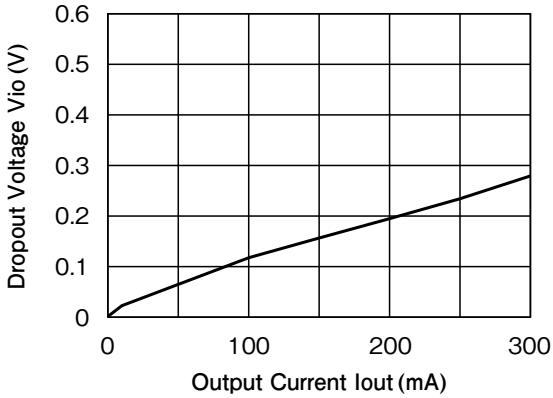
Vout Temperature Coefficient



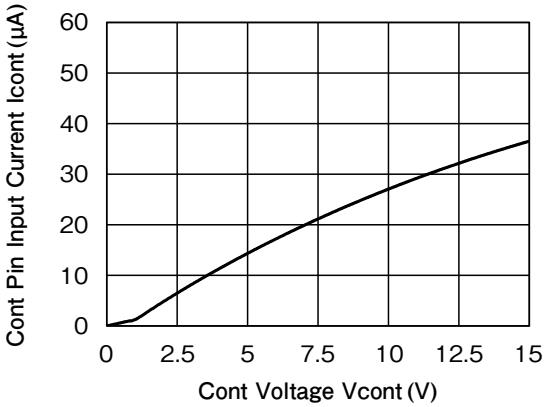
Output Voltage – Output Current



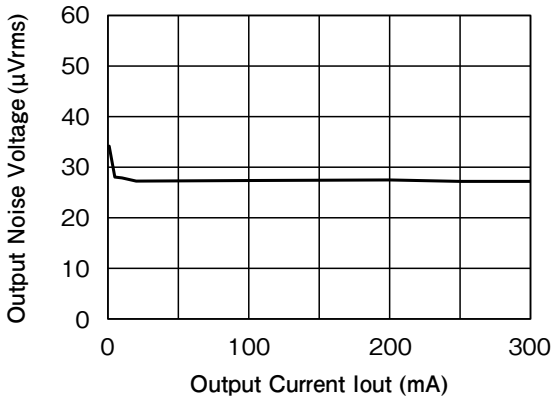
Dropout Voltage – Output Current



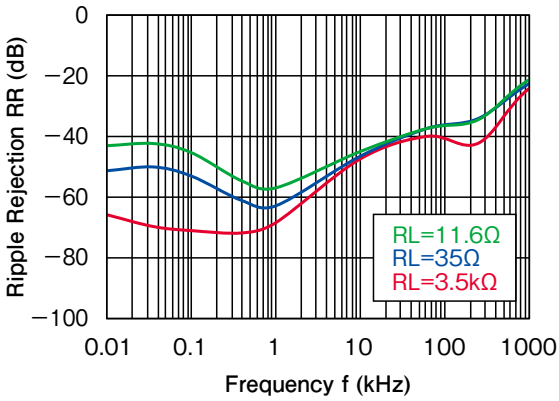
Cont Pin Input Current – Cont Voltage



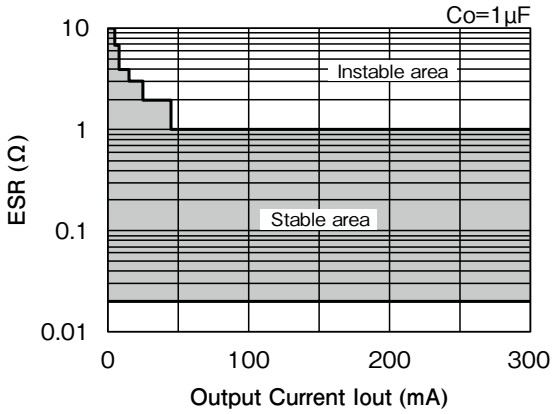
Output Noise Voltage



Ripple Rejection

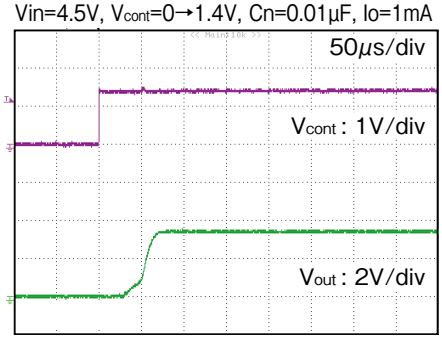


ESR stable area

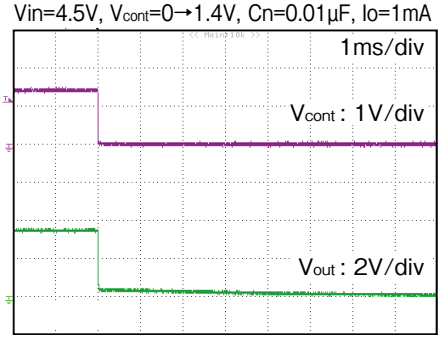


Cont Rise Characteristics

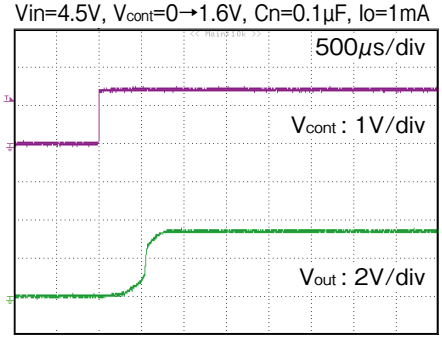
Vin=4.5V, V_{cont}=0→1.4V, Cn=0.01μF, Io=1mA



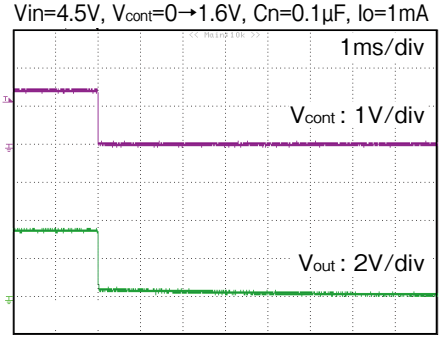
Vin=4.5V, V_{cont}=0→1.4V, Cn=0.01μF, Io=1mA



Vin=4.5V, V_{cont}=0→1.6V, Cn=0.1μF, Io=1mA

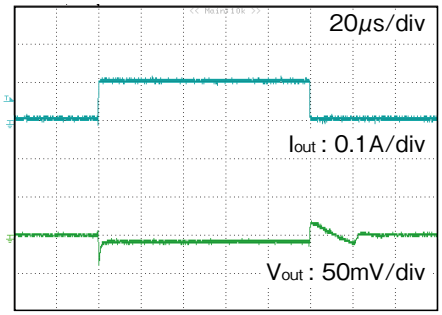


Vin=4.5V, V_{cont}=0→1.6V, Cn=0.1μF, Io=1mA

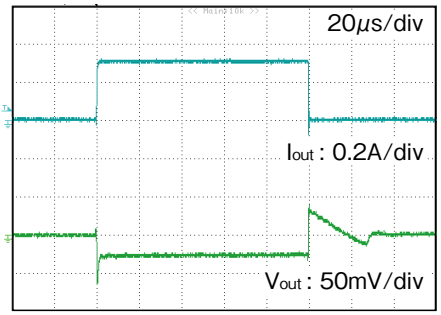


Load Transient Characteristics

I_{out}=1mA⇔100mA



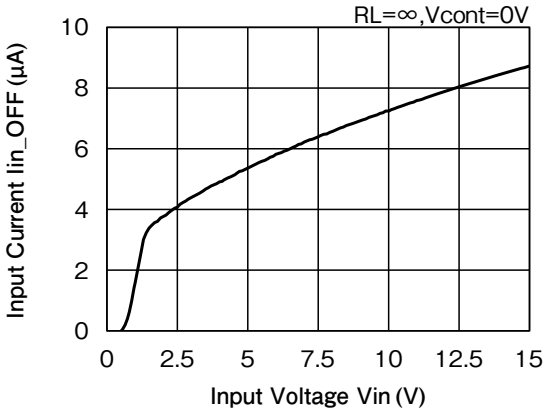
I_{out}=1mA⇔300mA



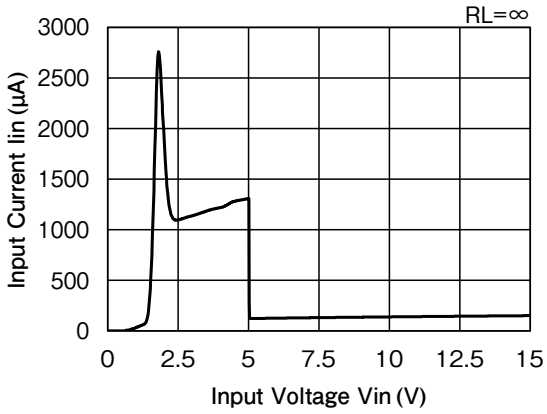
Characteristics (Vo=5.0V)

(Except where noted otherwise Vin=Vo+1V, Vcont=1.4V, Cin=1µF, Co=1µF, Cn=0.01µF, Ta=25℃)

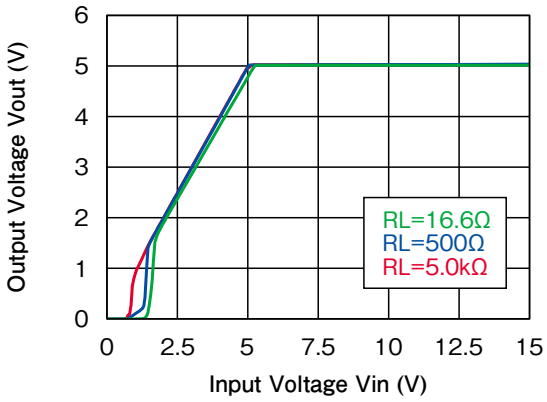
Input Current (OFF) – Input Voltage



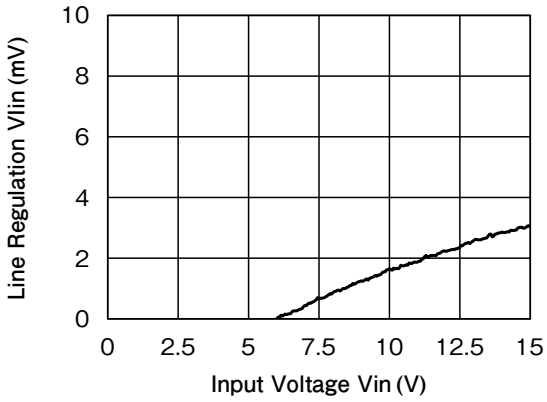
Input Current – Input Voltage



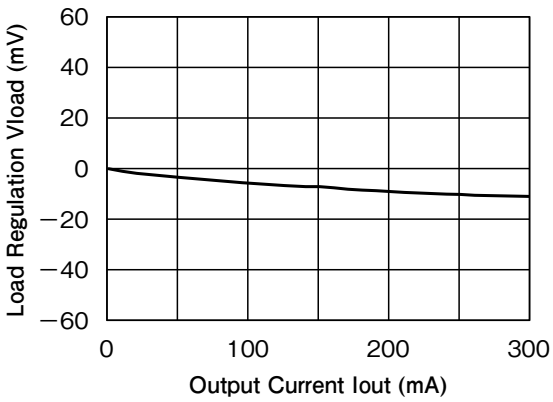
Output Voltage – Input Voltage



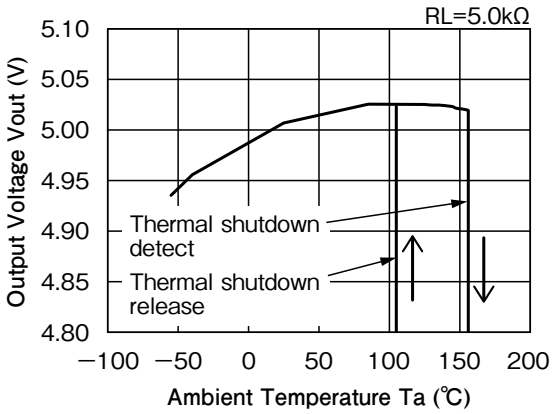
Line Regulation



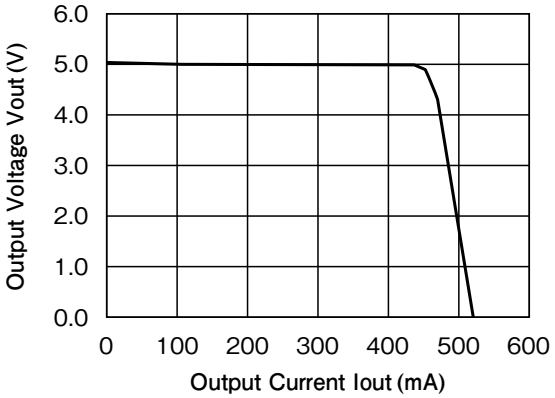
Load Regulation



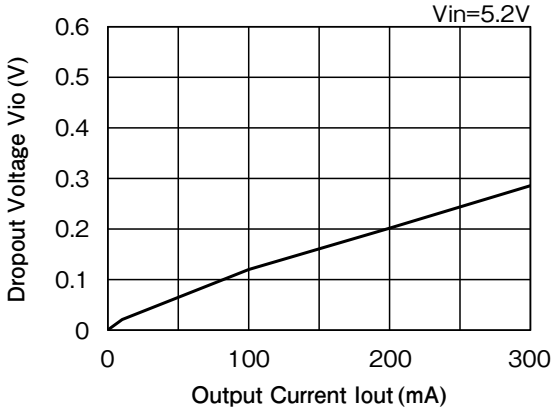
Vout Temperature Coefficient



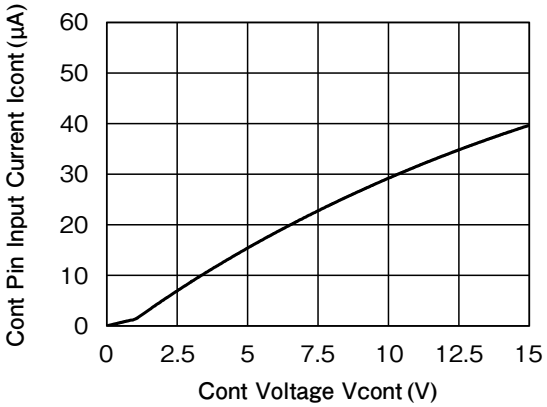
Output Voltage – Output Current



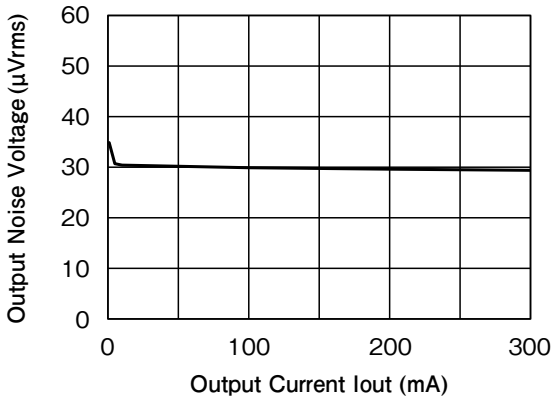
Dropout Voltage – Output Current



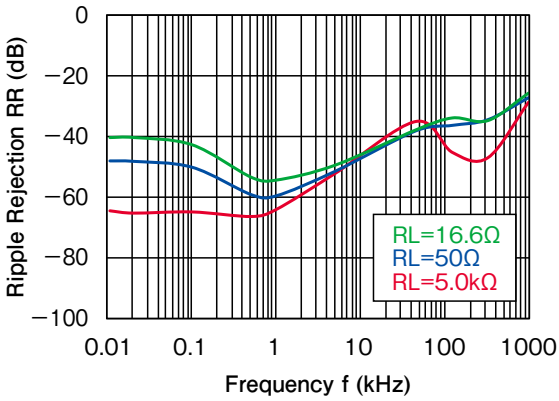
Cont Pin Input Current – Cont Voltage



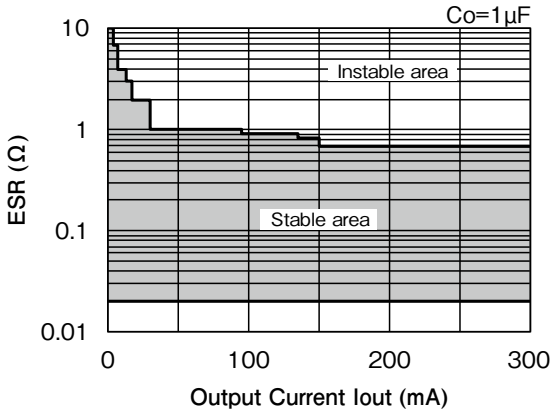
Output Noise Voltage



Ripple Rejection

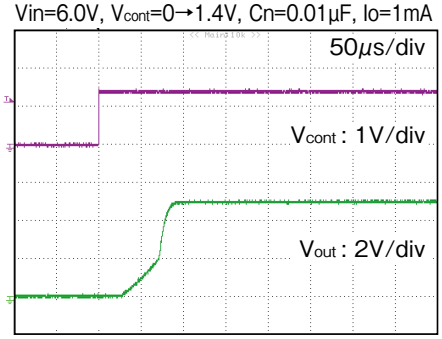


ESR stable area

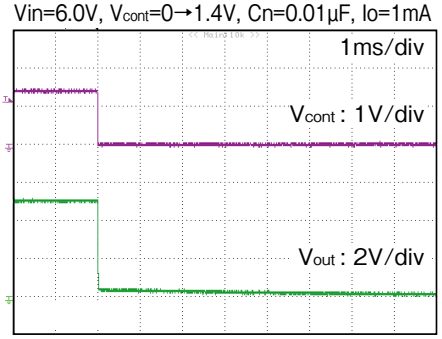


Cont Rise Characteristics

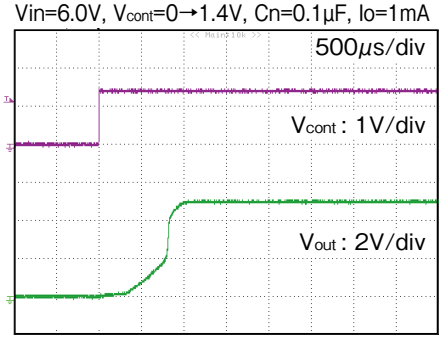
Vin=6.0V, V_{cont}=0→1.4V, Cn=0.01μF, Io=1mA



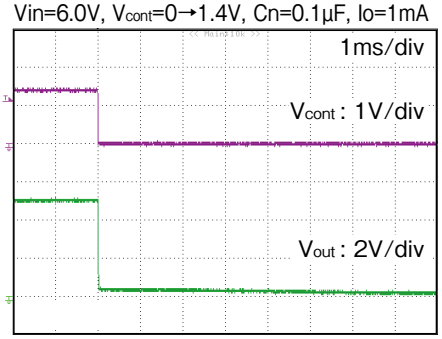
Vin=6.0V, V_{cont}=0→1.4V, Cn=0.01μF, Io=1mA



Vin=6.0V, V_{cont}=0→1.4V, Cn=0.1μF, Io=1mA

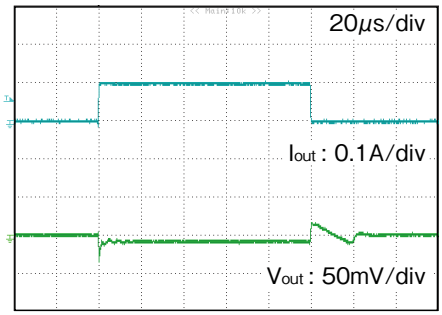


Vin=6.0V, V_{cont}=0→1.4V, Cn=0.1μF, Io=1mA



Load Transient Characteristics

I_{out}=1mA⇔100mA



I_{out}=1mA⇔300mA