Adjustable type 1A LDO
Monolithic IC MM3687 Series

Outline

This IC is a adjustable type 1A LDO. MM3687 can be adjusted an output voltage from 0.8V to 4.5V by external resistance. Package is HSOP-8D that is small and high power dissipation, therefore MM3687 is suitable for most applications.

Features

1.	Operating maximum input voltage	5.5V
2.	No load input current	270μA typ.
3.	Quiescent current (OFF)	0.3μA typ.
4.	Reference voltage	0.8V typ.
5.	Reference voltage accuracy	±1%
6.	Output voltage range	0.8V to 4.5V
7.	Dropout voltage	0.40V typ. (I_O=1A, V_O=3V)
8.	Line regulation	0.1%/V max.
9.	Load regulation	60mV max. (I_O=1mA to 1A)
10.	Ripple rejection	60dB typ.
11.	Output NMOS ON resistance	30Ω typ.
12.	Soft start function	
13.	Thermal shut down	
14.	Output capacitor	4.7μF

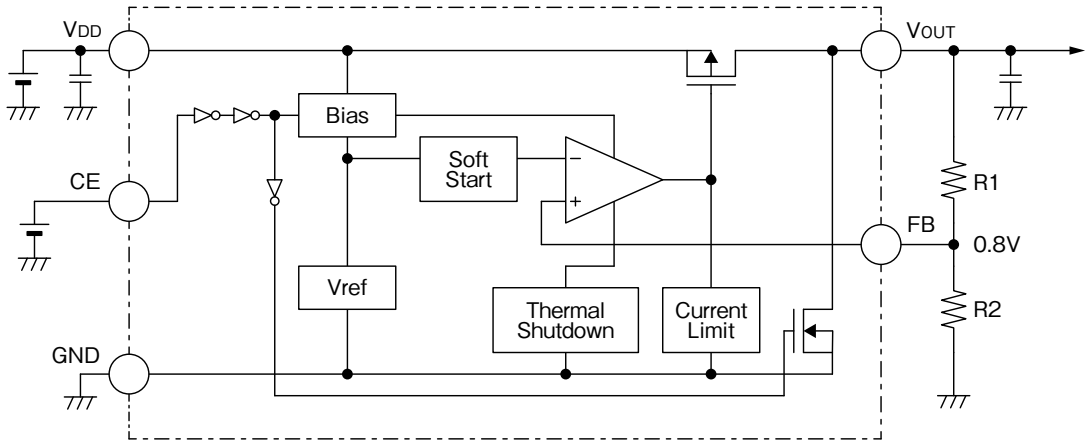
Package

HSOP-8D

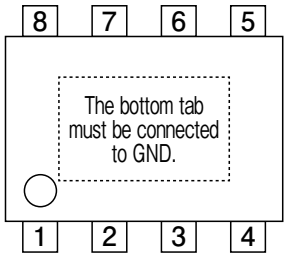
Applications

1. Flat-TV
2. BD Player/ Recorders
3. PCs
4. Games

Block Diagram



Pin Assignment



HSOP-8D
(TOP VIEW)

1	VOUT
2	FB
3	GND
4	NC
5	CE
6	NC
7	NC
8	VDD

Pin Description

Pin No.	Pin name	Functions
1	VOUT	Output pin VOUT Adjustable range : 0.8V to 4.5V
2	FB	Feed back pin Output voltage is adjusted by an external resistance connected FB. FB voltage : 0.8V typ. Recommended adjustable resistance range : R1+R2=5k to 90kΩ
3	GND	Ground pin
4	NC	No connection
5	CE	ON/OFF-Control pin CE: L → Output: OFF CE: H → Output: ON Connect CE pin with VDD pin, when it is not used.
6, 7	NC	No connection
8	VDD	Voltage supply pin

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

Item	Symbol	Ratings	Units
Storage temperature	Tstg	−55 to +150	℃
Junction temperature	TjMAX	150	
Supply voltage	VDD	−0.3 to +6.5	V
CE input voltage	VCE	−0.3 to +6.5	
Output voltage	VOUT	−0.3 to VDD	
Output current	IOMAX	1.2	A
Power Dissipation 1 (Note1)	Pd1	2700	mW

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

Recommended Operating Conditions

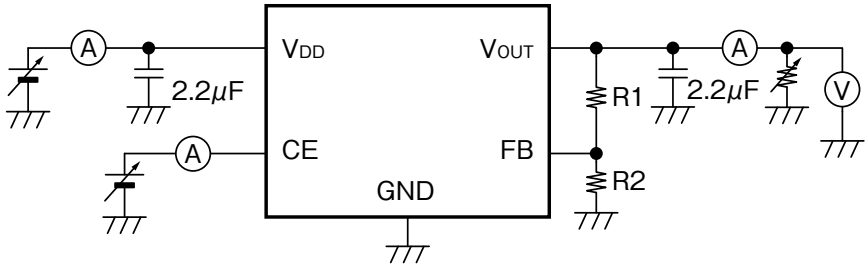
Item	Symbol	Ratings	Units
Operating Junction temperature	Tjopr	−40 to +125	℃
Operating ambient temperature	Topr	−40 to +85	
Operating voltage	Vop	2.4 to 5.5	V
Output voltage range	Vo	0.8 to 4.5	
Output current	IOUT	0 to 1	A

Electrical Characteristics (Except where noted otherwise VDD=VOUT(typ.)+1V, VCE=VDD, Ta=25℃)

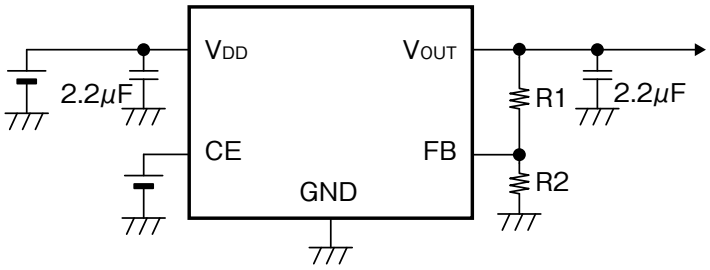
Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input current consumption (OFF)	IDDOFF	VCE=0V		0.3	5.0	μA
Bias current consumption	IDD	IOUT=0mA, VFB=0.8V		270	500	
POR Threshold (Note2)	VPORTH		1.5	1.7	1.9	V
POR Hysteresis (Note2)	VPORHYS			0.1		
Reference voltage	VFB	IOUT=10mA	0.792	0.800	0.808	
Line regulation	VLINE	VOUT(typ.)+0.5V≦VDD≦5.5V		0.05	0.1	%/V
Load regulation	VLOAD	10mA≦IOUT≦1000mA		5	70	mV
Dropout voltage (Note4)	Vio	0.8V≦VOUT<1.2V, IOUT=1A (Note3)		1.00		V
		1.2V≦VOUT<1.5V, IOUT=1A (Note3)		0.80	1.20	
		1.5V≦VOUT<2.0V, IOUT=1A (Note3)		0.70	0.90	
		2.0V≦VOUT<2.7V, IOUT=1A, VDD=VOUT (typ.) −0.2V		0.56	0.84	
		2.7V≦VOUT≦4.5V, IOUT=1A, VDD=VOUT (typ.) −0.2V		0.40	0.60	
Ripple rejection (Note2)	RR	f=1kHz, Vripple=0.5Vp-p, IOUT=10mA, 0.8V≦VOUT≦2V		65		dB
		f=1kHz, Vripple=0.5Vp-p, IOUT=10mA, 2.1V≦VOUT≦3.5V		60		
		f=1kHz, Vripple=0.5Vp-p, IOUT=10mA, 3.6V≦VOUT≦4.5V		55		
Vout temperature coefficient (Note2)	⊿VOUT/⊿T	−40≦Top≦+85℃		100		ppm/℃
Output current	IOUT		1			A
Output short-circuit current (Note2)	Ishort	VOUT=0V		50		mA
Thermal shutdown detect temperature (Note2)	TSD			150		℃
Thermal shutdown release temperature (Note2)	TSR			125		
Output rise time (Note2)	tr			1.0		ms
CE High threshold voltage	VCEH		1.2		6.0	V
CE Low threshold voltage	VCEL				0.3	
CE Pin current	ICE	VCE=2.0V		0.6		μA
Output NMOS ON resistance (Note2)	RDON	VCE=0V, VDD=4V		30		Ω

Note2 : The parameter is guaranteed by design.
Note3 : Dropout voltage maximum value in the input and it is confirmed that there is no output abnormal voltage impression the 1A in the model less than VOUT<2.0V.
Note4 : The minimum operating voltage is 2.4V. Please use it by more than VDD=2.4V.

Measuring Circuit



Application Circuit



(Reference example of external parts)

- Output capacitor (1.8V<VOUT) Ceramic capacitor 2.2μF
- Output capacitor (VOUT≦1,8V) Ceramic capacitor 4.7μF
- Input capacitor Ceramic capacitor 2.2μF *Temperature Characteristics : B
- Adjustable resistance R1+R2 5k to 90kΩ
- VOUT can be decided by formula as below

$$V_O = V_{FB} \times \frac{R_1 + R_2}{R_2}$$

- It is able to an unstable operation when used in capacitance value greater than the recommended value output capacitor.
  Please define the external parts by sufficient evaluation including the temperature characteristics.
  When it becomes the problem with a set, please set the value for input condenser as follows.

  Cout ≦ Cin

- It can not be used in the aluminum electrolytic capacitor alone.
  When using aluminum electrolytic capacitor, please set the value for ceramic capacitor as follows.

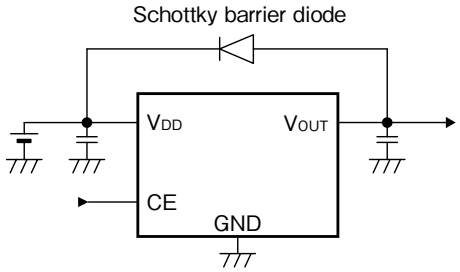
  1.8V<VOUT : 2.2μF or more

  VOUT<1.8V : 4.7μF or more

- 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.

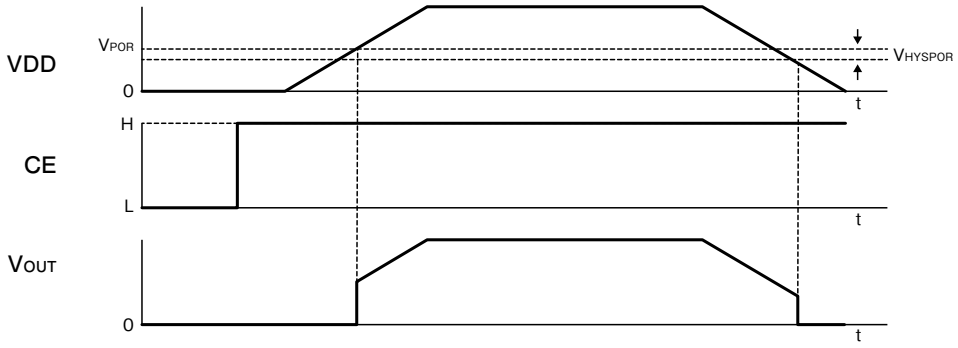
NOTE

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 2.2μF/4.7μF and B temperature characteristics.
6. The wire of V_{DD} and GND is required to print full ground plane for noise and stability.
7. 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.

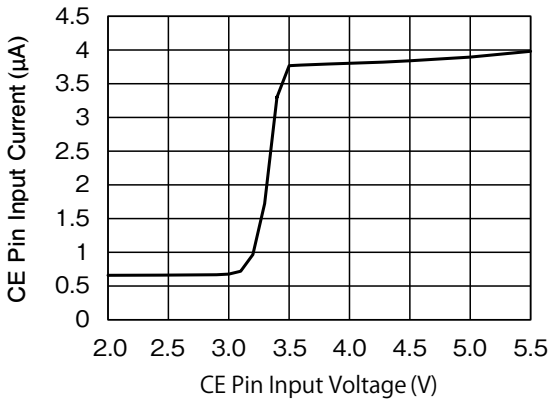


8. The input capacitor must be connected a distance of less than 1cm from input pin.
9. It is able to an unstable operation when you use the capacitor with intense capacitance change.
   The capacitor has the dependency at the power-supply voltage and the temperature.
   The capacity value changes by the environment used. Please evaluate IC in the set.
10. The overcurrent protection circuit of foldback current limit type is built into this IC.
11. 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.
12. 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.
13. The FB terminal is affected by the noise. Please be careful about ways of the wiring enough.
    It is able to an unstable operation when the influence of floating capacity.

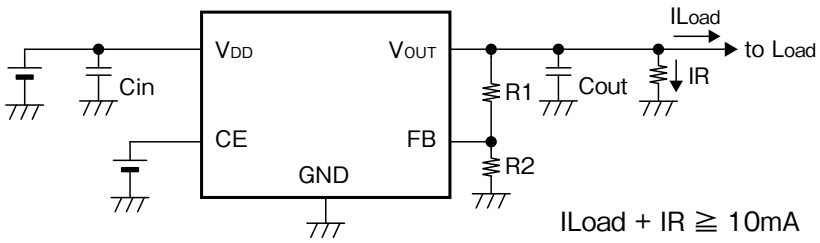
14. The Power ON Reset circuit is built in. Operation is stopped when VDD becomes below a POR threshold value. Please use it so that input voltage does not become less than 2.5V.

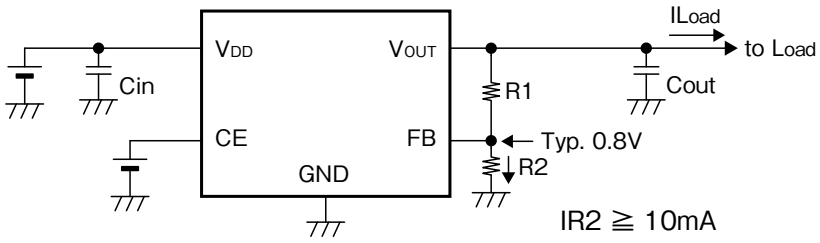


15. When the voltage of CE pin and the VDD pin turns over, the currents of the CE pin increase. When CE pin voltage and VDD pin voltage become the use in the state that turned over, please evaluate IC in the set. The example of a voltage-current characteristic of CE pin at VDD=2.4V is shown as follows.



16. It is able to an unstable operation when you use it with load less than 10mA.
When the operation in load 10mA or less becomes the problem with a set, please connect load as follows to become more than load 10mA.

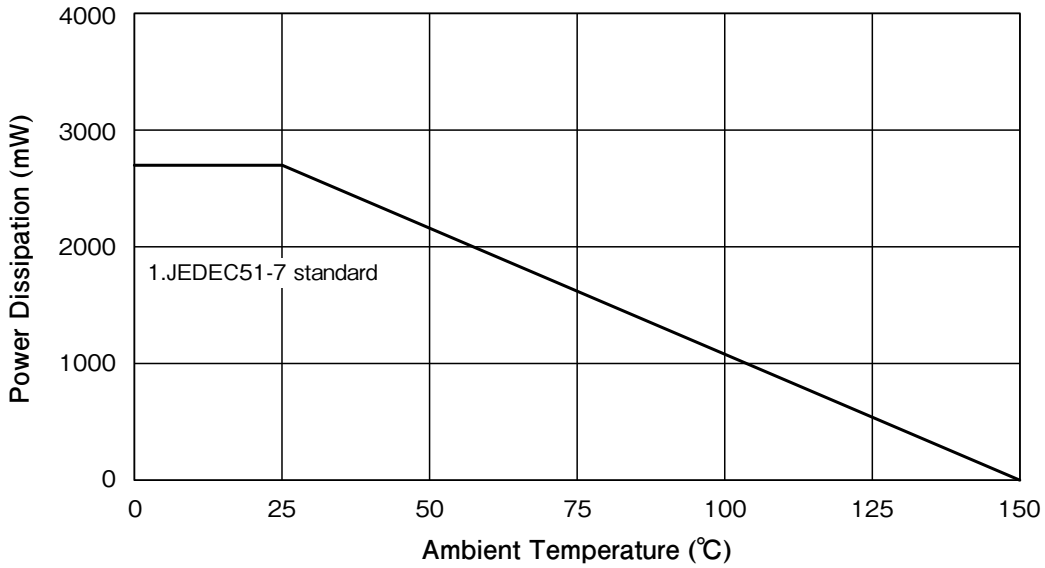




About Power Dissipation

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.

1. JEDEC51-7 standard
   Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
   Power dissipation 2700mW Ta=25°C (It is reference value measured by JEDEC51-7 standard.)

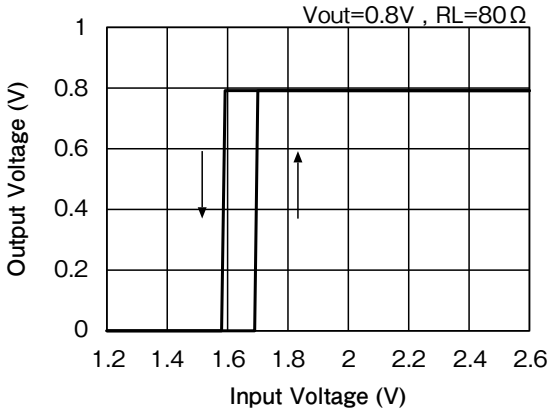


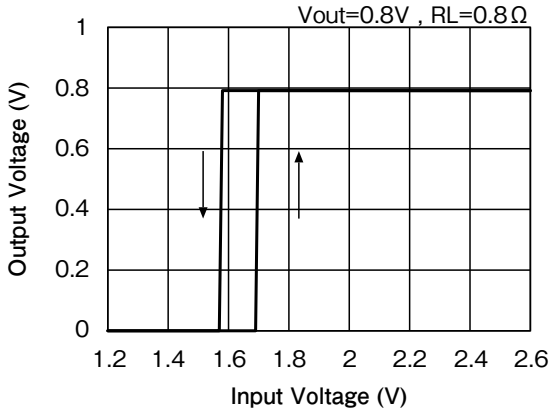
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

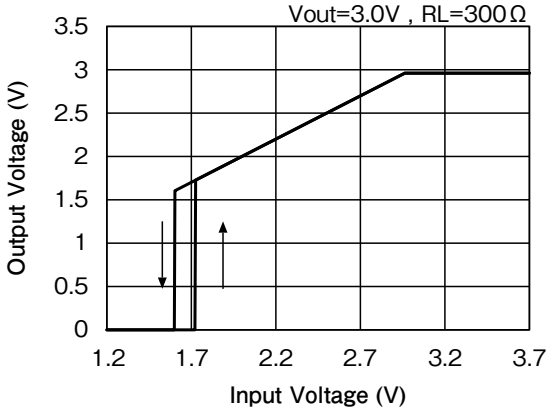
Characteristics

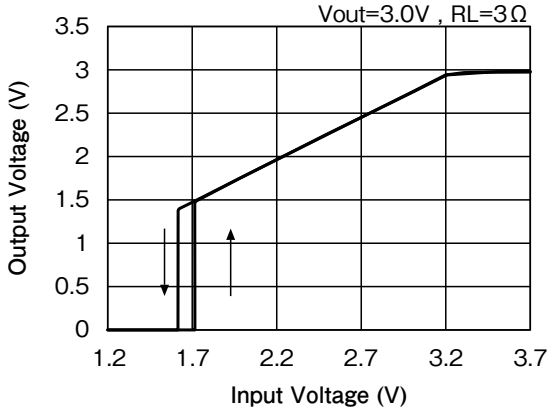
(Except where noted otherwise $V_{DD}=V_{OUT}$(typ.)+1V, $V_{CE}=V_{DD}$, R2=10kΩ, Ta=25℃)

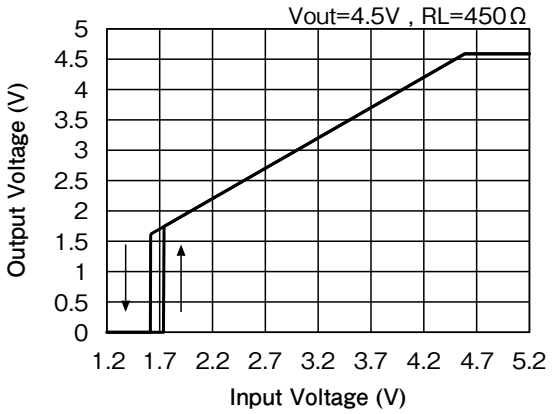
Input voltage – Output voltage

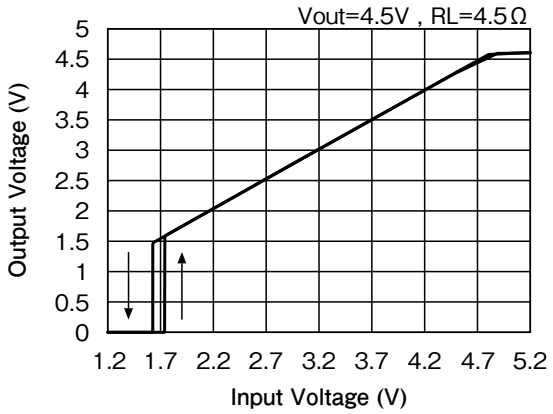




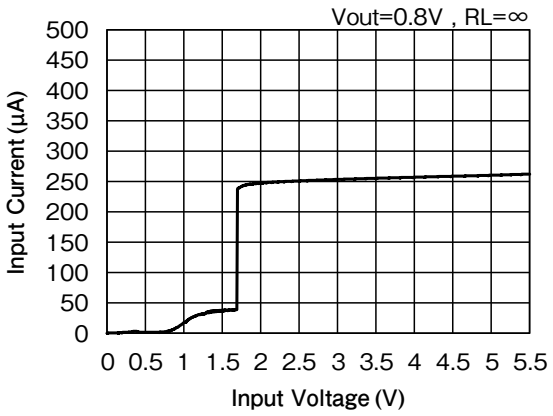


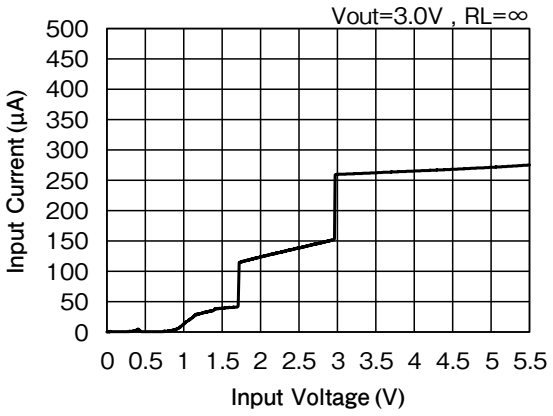


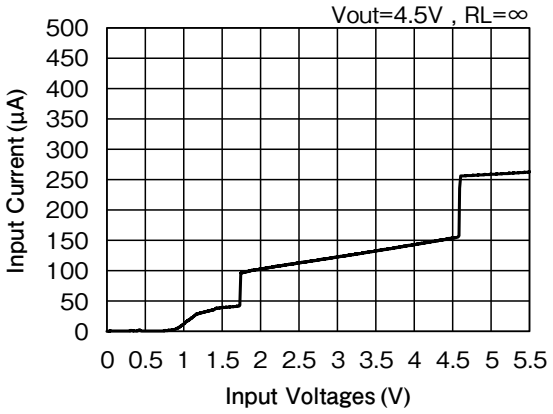




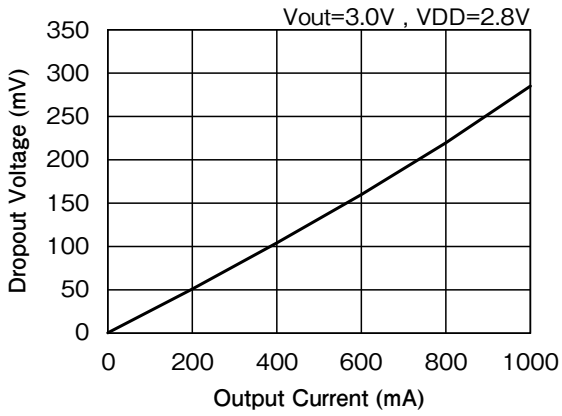
Input voltage – Input voltage

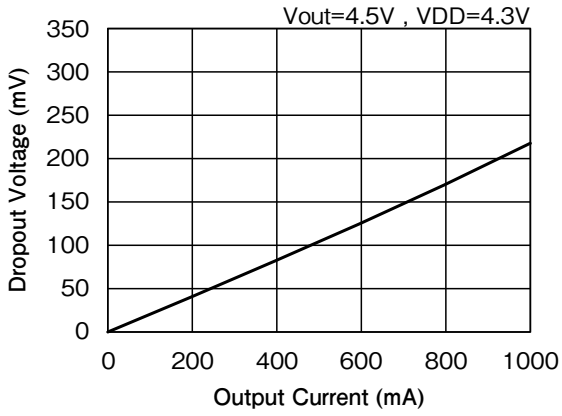




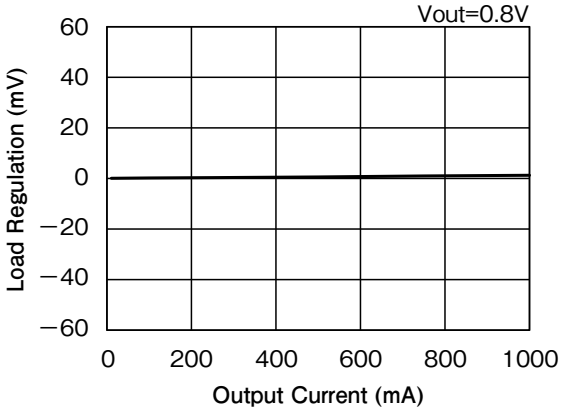


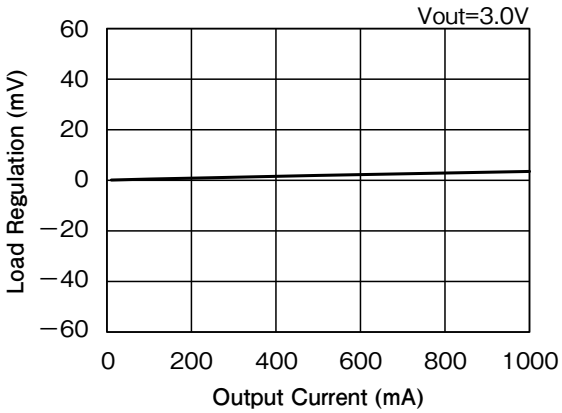
Dropout voltage

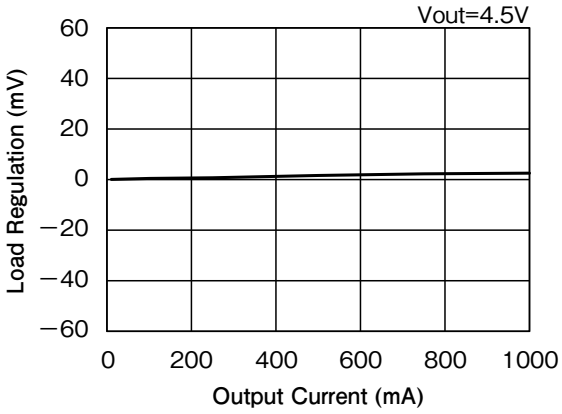




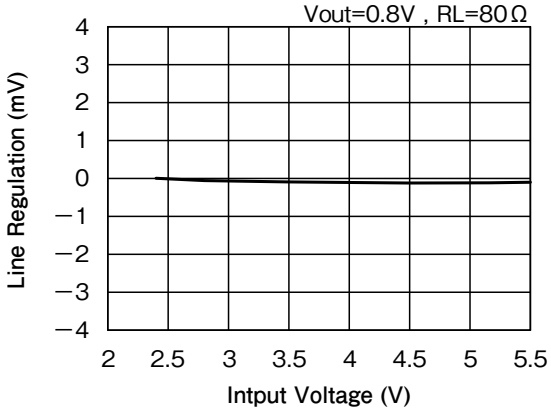
Load regulation

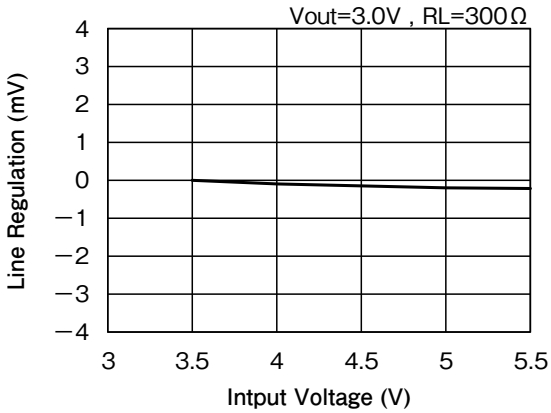




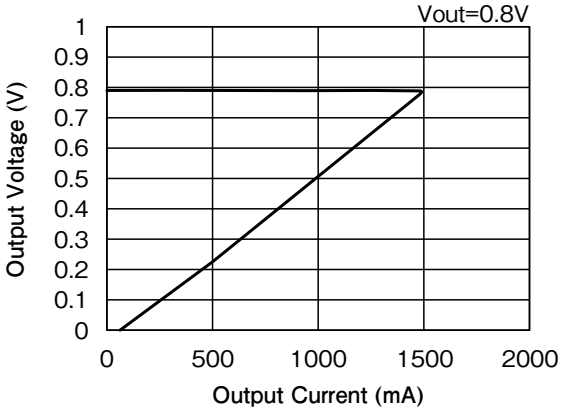


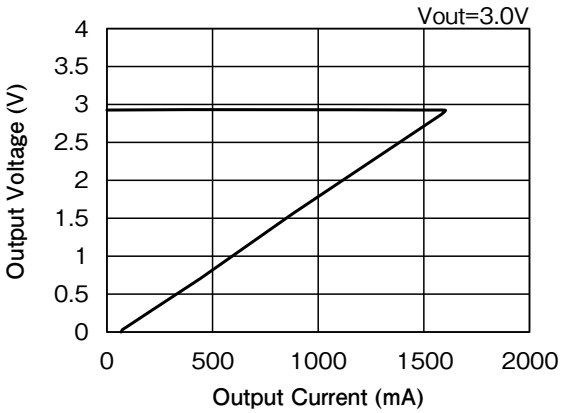
Line regulation

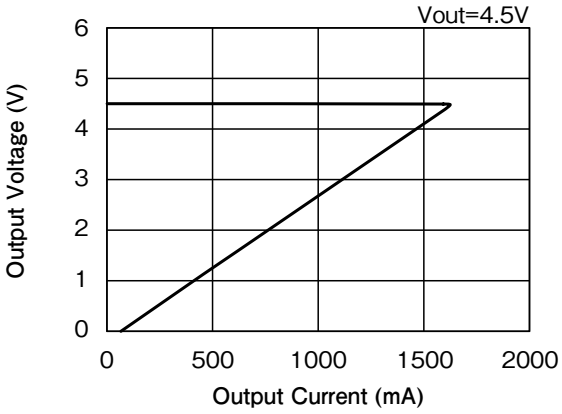




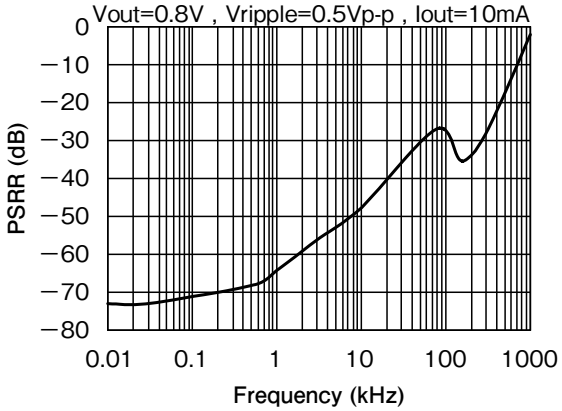
Current limit

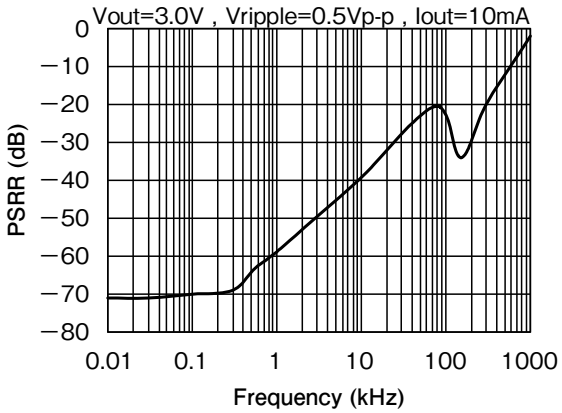


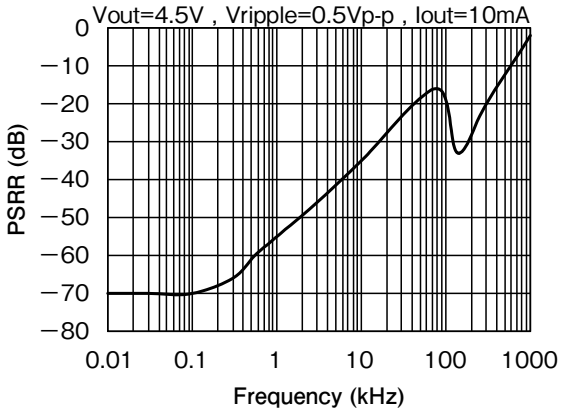




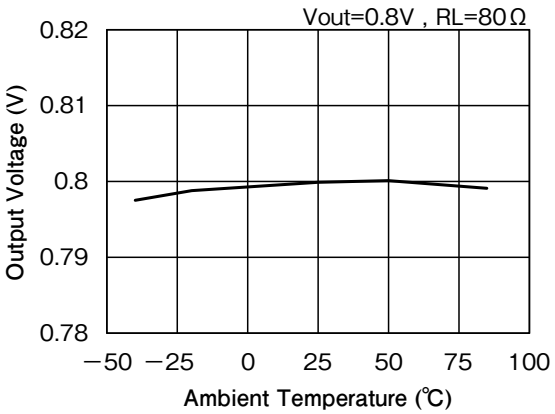
Ripple Rejection

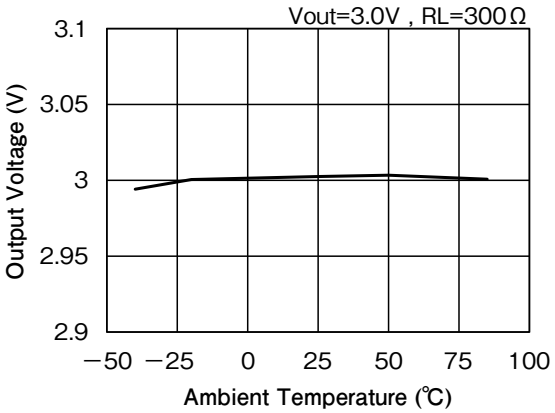


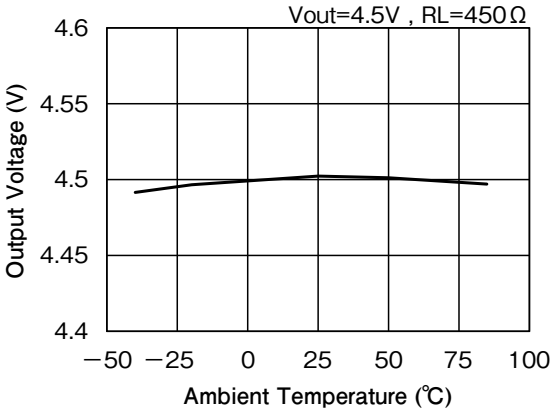




Ambient Temperature – Output voltage

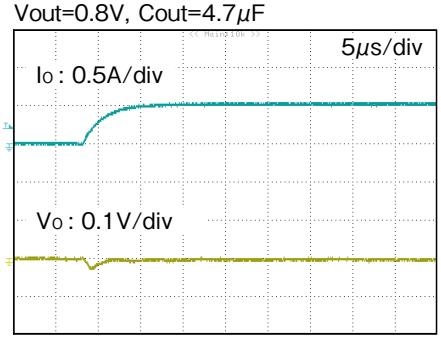




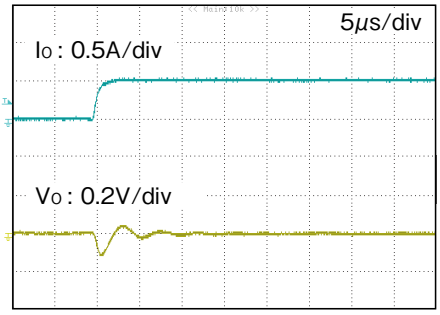


Load transient response (IOUT=10mA→500mA)

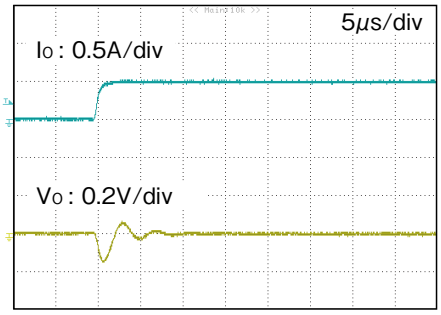
Vout=0.8V, Cout=4.7μF



Vout=3.0V, Cout=2.2μF

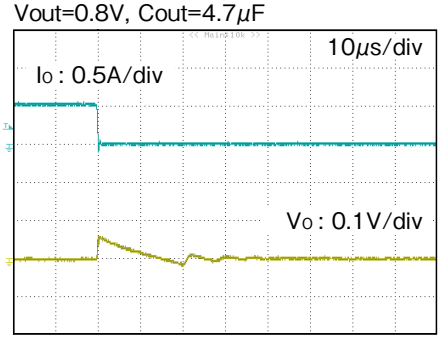


Vout=4.5V, Cout=2.2μF

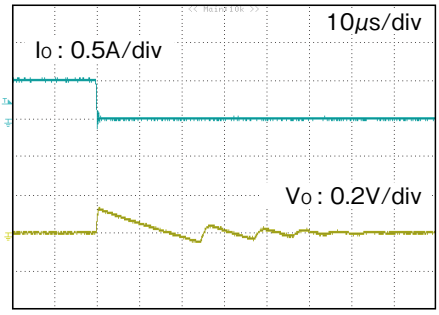


Load transient response (IOUT=500mA→10mA)

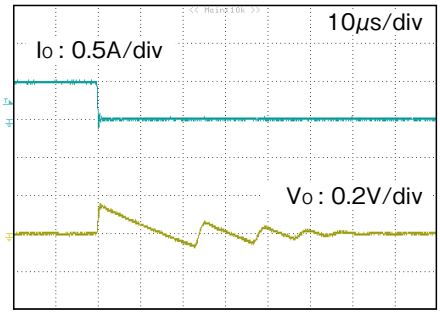
Vout=0.8V, Cout=4.7μF



Vout=3.0V, Cout=2.2μF

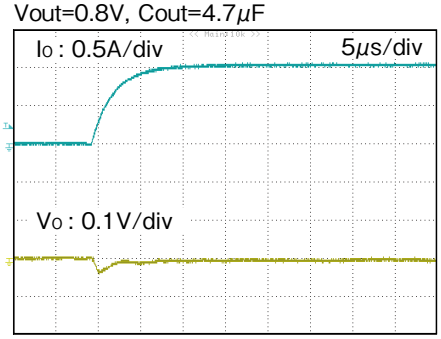


Vout=4.5V, Cout=2.2μF

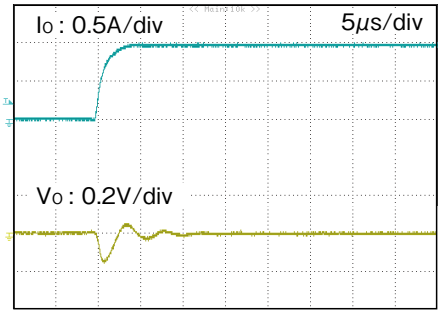


Load transient response (IOUT=10mA→1000mA)

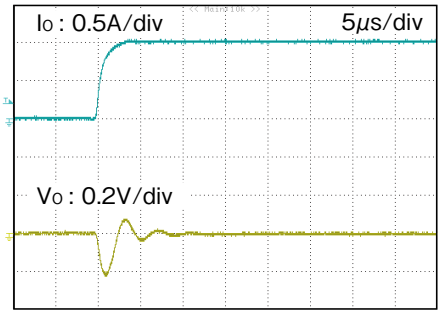
Vout=0.8V, Cout=4.7μF



Vout=3.0V, Cout=2.2μF

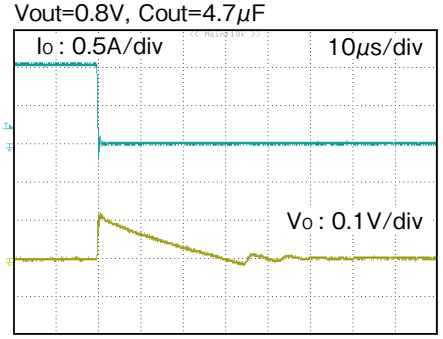


Vout=4.5V, Cout=2.2μF

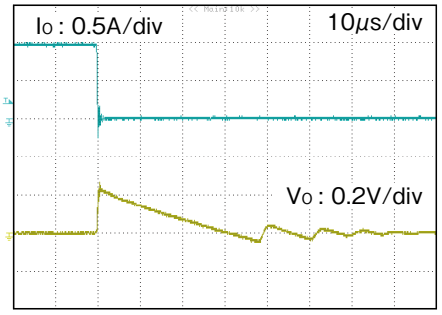


Load transient response (IOUT=1000mA→10mA)

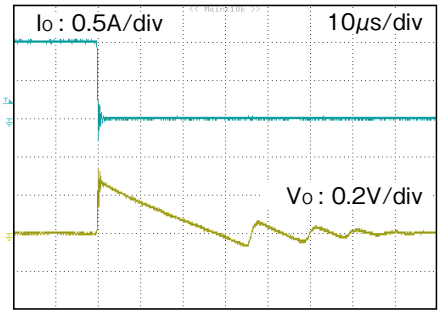
Vout=0.8V, Cout=4.7μF



Vout=3.0V, Cout=2.2μF

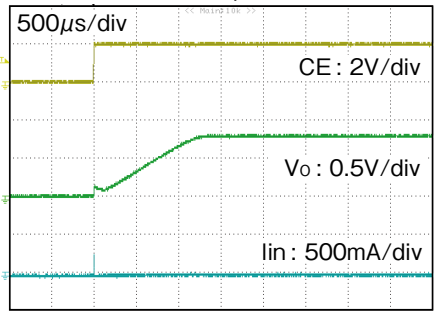


Vout=4.5V, Cout=2.2μF

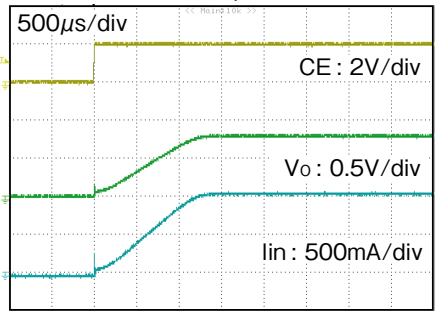


CE transient response (CE=0→2V)

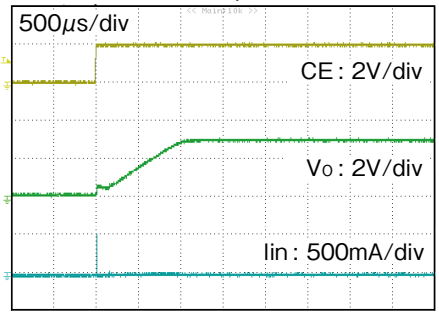
Vout=0.8V, Cout=4.7μF, RL=80Ω



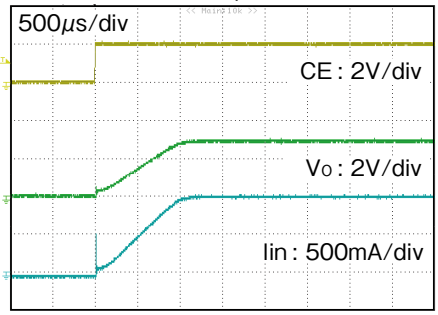
Vout=0.8V, Cout=4.7μF, RL=0.8Ω



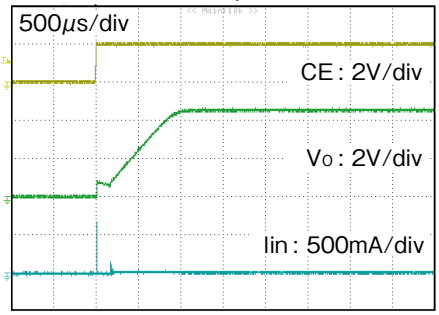
Vout=3.0V, Cout=2.2μF, RL=300Ω



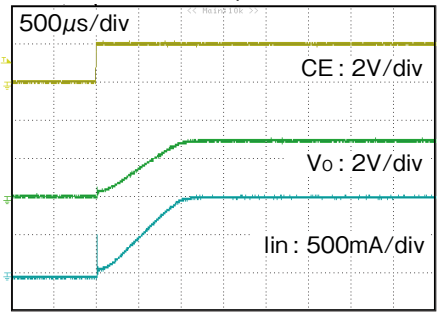
Vout=3.0V, Cout=2.2μF, RL=3Ω



Vout=4.5V, Cout=2.2μF, RL=450Ω



Vout=4.5V, Cout=2.2μF, RL=4.5Ω



ESR stable area