0.4V output 150mA LDO

MM1920 Series

Overview

This IC is a 150mA LDO of low operating voltage.
The IC can achieve to operate input voltage 1.2V of one power supply & output voltage 0.4V by bipolar process and original low voltage circuit.
The application can be used for high speed interface power supply.
The small package and an external capacitor 1uF are contributed to small space PCB & low cost.

Features

- Low input voltage
- Low output voltage
- Low noise

Main specifications

- Maximum rating supply voltage : -0.3V to 6.5V
- Operating voltage range : 1.1V to 6V
- Operating ambient temperature : -40℃ to 85℃
- Output current : 150mA
- Input current (OFF) : Typ. 0.1uA
- No-load input current : Typ. 170uA
- Output voltage range : 0.4V
- Output voltage accuracy : ±15mV (IOUT=1mA)
- Line regulation : max. 0.2%/V (VIN=1.2V to 6V)
- Load regulation : Typ. 5mV (IOUT=1mA to 150mA)
- PSRR : Typ. 65dB (f=1kHz)
- Output noise voltage : Typ. 30uVrms (fBW=10 to 100kHz, IOUT=10mA)
- Output capacitor : 1uF (Ceramic capacitor)
- Protection function : Over current protection, Thermal shut down
- Additional function : ON/OFF control

Packages

- SSON-6A
- SOT-25A

Application

- High speed interface
- CMOS image sensor
- Low voltage device

Mitsumi Electric CO.,LTD.
Semiconductor Business Division
Strategy Engineering Department
tel:+81-46-230-3470

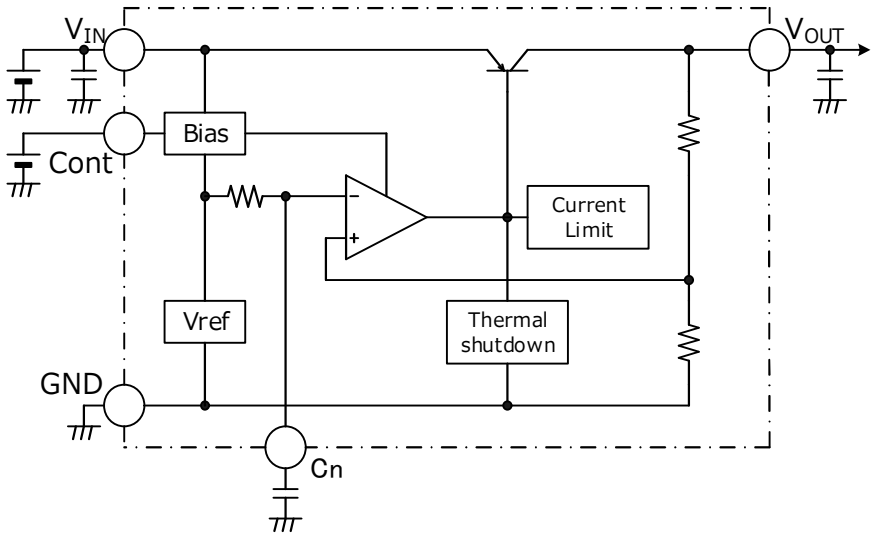
Model Name

M M 1 9 2 0 A 0 4 X X X

Series name (A) (B) (C) (D) (E)

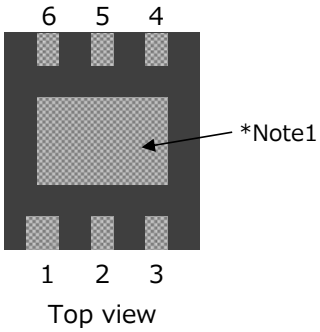
(A)	Function Type	A	Cont=H active
(B)	Output voltage rank	04	Output Voltage can be set the 0.4V(04).
(C)	Package	N	SSON-6A
			SOT-25A
(D)	Packing specifications 1	R	R housing (Standard)
		L	L housing
(E)	Packing specifications 2	E	Emboss tape / Halogen contained (SOT-25A) Halogen free (SSON-6A)

Block Diagram



Pin Configuration

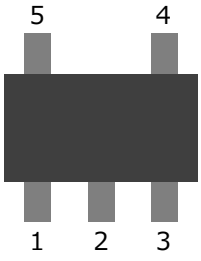
■ SSON-6A



Pin No.	Symbol	Function
1	V_{IN}	Supply voltage pin
2	NC	No connection
3	V_{OUT}	Output voltage pin
4	Cn	Reducing noise pin with capacitor
5	GND	GND pin
6	Cont	Control pin Connect Cont pin with V_{IN} pin, when it is not used.

*Note1:Heat spreader bottom with GND.

■ SOT-25A



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3	Cont	Control pin Connect Cont pin with V_{IN} pin, when it is not used.
4	Cn	Reducing noise pin with capacitor
5	V_{OUT}	Output voltage pin

Absolute Maximum Ratings

Item		Symbol	Min.	Max.	Unit
Storage temperature		Tstg	-55	150	℃
Junction temperature		Tj_{MAX}	-	150	℃
Supply voltage		V_{IN}	-0.3	7.0	V
Control voltage		Vcont	-0.3	6.5	V
Output voltage		V_{OUT}	-0.3	V_{IN}+0.3V	V
Output current		Iomax	0	400	mA
Power dissipation *Note2	SSON-6A	Pd	-	1250	mW
	SOT-25A		-	700	mW

*Note2:JEDEC51-7 standard 114.3mm×76.2mm t=1.6mm

Recommended Operating Conditions

Item	Symbol	Min.	Max.	Unit
Operating ambient temperature	Topr	-40	85	℃
Operating voltage	Vop	1.1	6.0	V
Output current	Iop	0	150	mA

Electrical Characteristics

(Ta=25℃, VIN=1.2V, Vcont=1.2V unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input current (OFF)	Iin(off)	Vcont=0V	-	0.1	1.0	μA
No-load input current	Iin	I_{OUT}=1mA	-	170	250	μA
Output voltage	V_{OUT}	I_{OUT}=1mA	0.385	0.400	0.415	V
Line regulation	V_{LINE}	V_{OUT}(Typ.)+0.5V≦V_{IN}≦6.0V	-	-	0.20	%/V
Load regulation	V_{LOAD}	1mA≦I_{OUT}≦150mA	-	5	25	mV
Output current limit	Ilim	V_{OUT}=V_{OUT}(typ.)+0.9V	150	300	-	mA
Output short-circuit current *Note3	Ishort	V_{OUT}=0V	-	150	-	mA
V_{OUT} temperature coefficient *Note3	ΔV_{OUT} /ΔT	-40℃≦Ta≦85℃	-	±100	-	ppm/℃

*Note3:The parameter is guaranteed by design.

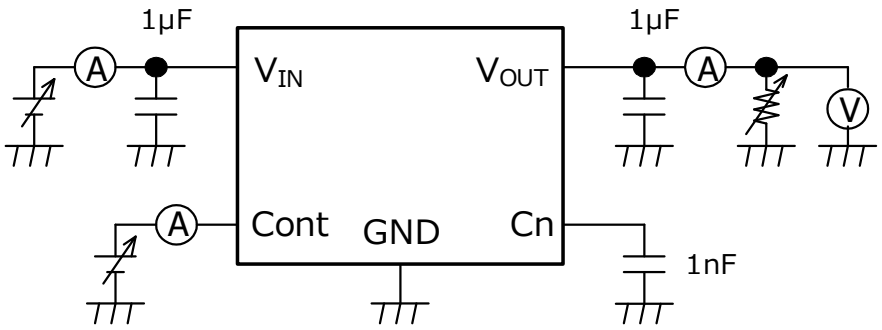
Electrical Characteristics

(Ta=25℃, V_{IN}=1.2V, Vcont=1.2V unless otherwise specified)

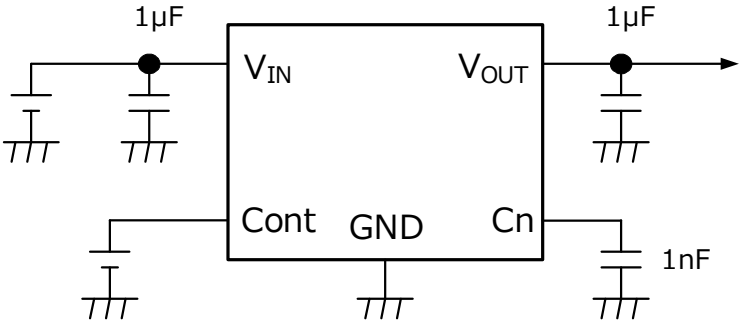
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Ripple rejection *Note2	RR	f=1kHz, Vripple=0.2V V_{OUT}=0.4V, I_{OUT}=10mA Cn=1nf	-	65	-	dB
Output noise voltage *Note2	Vn	fBW=10～100kHz V_{OUT}=0.4V, I_{OUT}=10mA Cn=1nf	-	30	-	μVrms
Thermal shutdown detect temperature	T_{SD}		-	145	-	℃
Thermal shutdown release temperature	T_{SR}		-	110	-	℃
Cont pin input current	Icont	Vcont=1.2V	-	3	4	μA
Cont pin high threshold level	VcontH	V_{OUT}:ON	0.9	-	6.0	V
Cont pin low threshold leve	VcontL	V_{OUT}:OFF	0	-	0.2	V

*Note3:The parameter is guaranteed by design.

Test Circuit



Application Circuit



(Example of external parts)

■ Output capacitor	Ceramic capacitor 1.0μF	
■ Input capacitor	Ceramic capacitor 1.0μF	*Temperature Characterisitics : X5R
■ Cn capacitor	Ceramic capacitor 1nF	

■ 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 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.

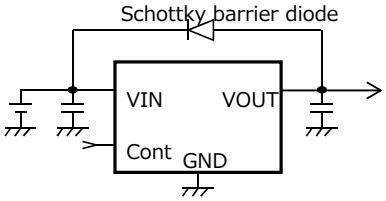
4. The output capacitor is required between output and GND to prevent oscillation.

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 is recommended used to more than 1uF and X5R temperature characteristics.
   The initial tolerance, applied voltage derating, and temperature coefficient must all be considered when selecting output capacitor to ensure the actual capacitance is never less than 0.47uF over the entire operating range.

6. The wire of V_{IN} 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. Please connect the Cn capacitor(Cn) more than 1nF with the Cn terminal.

10. Please do not give the voltage to the Cn terminal.

11. 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.

12. The overcurrent protection circuit of the vertical type is built into this IC.

Note

13. 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.

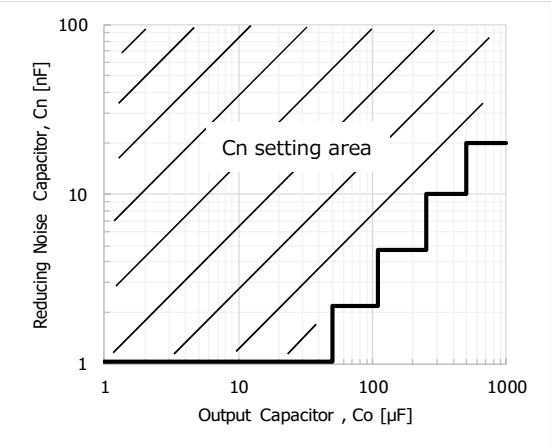
14. It returns automatically in temperature returned after it shuts down by self-generation of heat.
    After it returns, it shuts down again by self-generation of heat.
    It is necessary to change the environment used (IC consumption, temperature)
    if it operates in upper cycle.

15. This IC can be used for Vcont>V_{IN} condition within the maximum ratings.

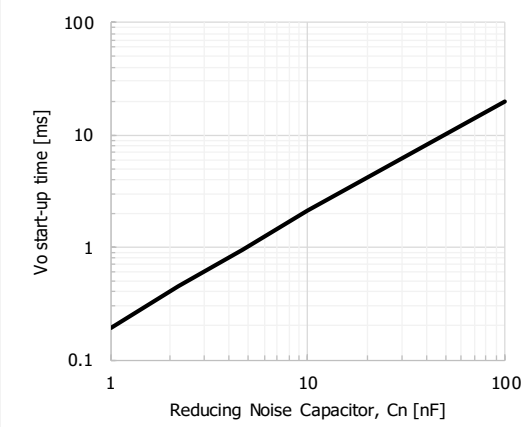
16. If Vcont rise time is longer than 10V/ms, it is possibility that output voltage overshoot.
    There is no problem when starting with V_{IN}=Vcont.

    Operation may become unstable if the rush current at start-up exceeds the current limit.
    It is recommended to set the Cn capacitor for the output capacitor Co as shown in Fig. 12-1.
    Refer to Fig. 12-2 for the relation between Cn capacitor and output voltage start-up times.
    It is only recommended to set the Cn capacitor.
    Ensure that the product is fully evaluated and used in the actual machine.
    * Start-up time = V_{OUT} × 10% to V_{OUT} × 90%

Condition: V_{IN}=1.2V-6V, Cont=0V→1.2V,
Ta=-40℃～85℃



Condition: V_{IN}=1.2V-6V, Cont=0V→1.2V,
Ta=25℃



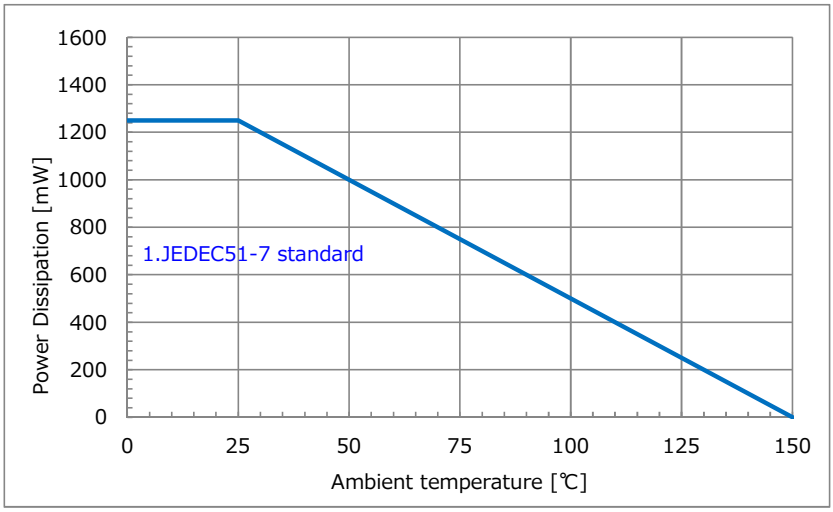
About Power Dissiopation

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.

- SSON-6A

1. JEDEC51-7 standard

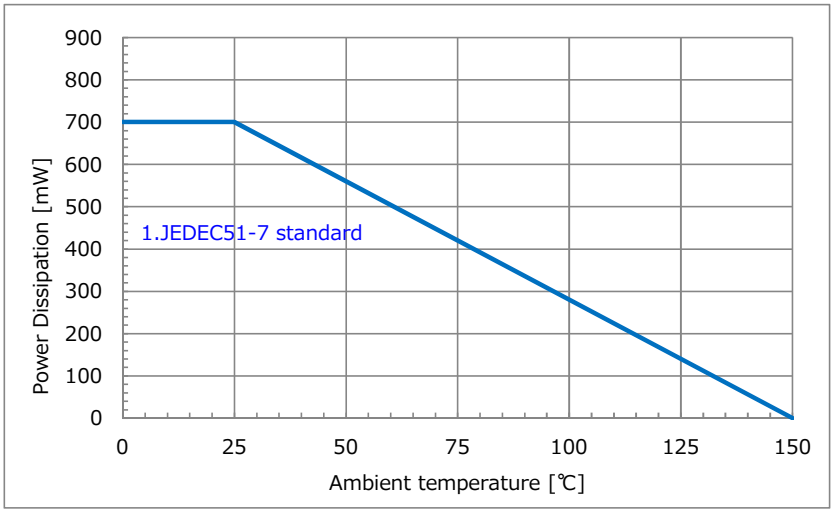
Board size	114.3mm×76.2mm t=1.6mm Copper foil area 80%
Power dissipation	1250mW Ta=25℃



- SOT-25A

1. JEDEC51-7 standard

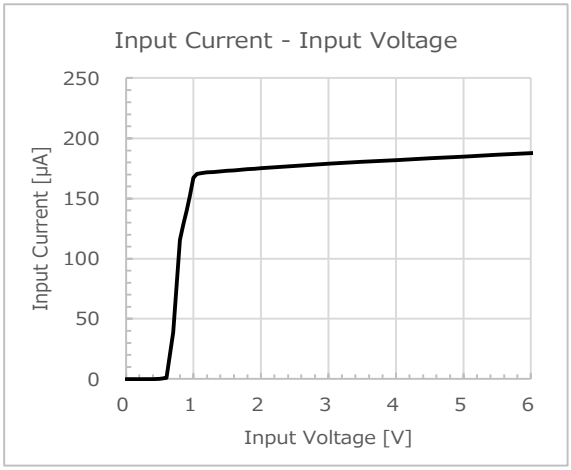
Board size	114.3mm×76.2mm t=1.6mm Copper foil area 80%
Power dissipation	700mW Ta=25℃

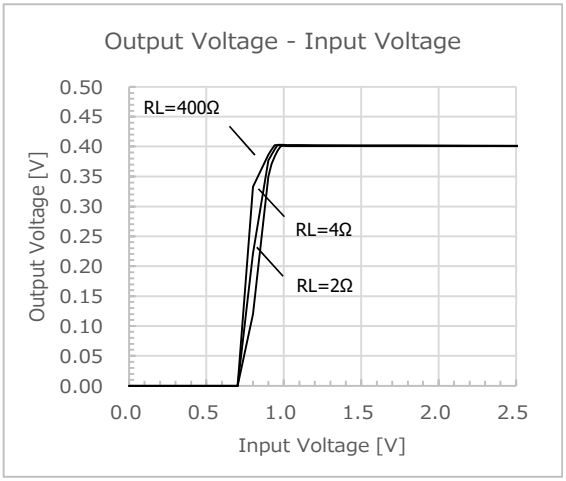


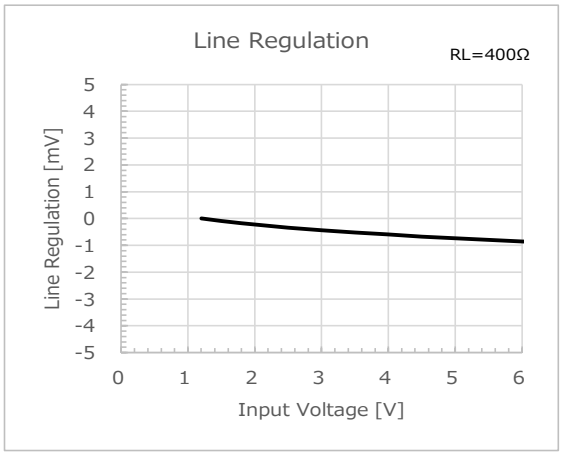
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

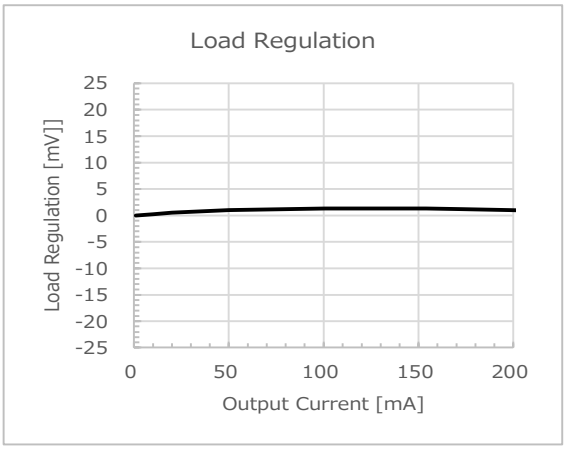
Typical Performance Characteristics (VOUT=0.4V)

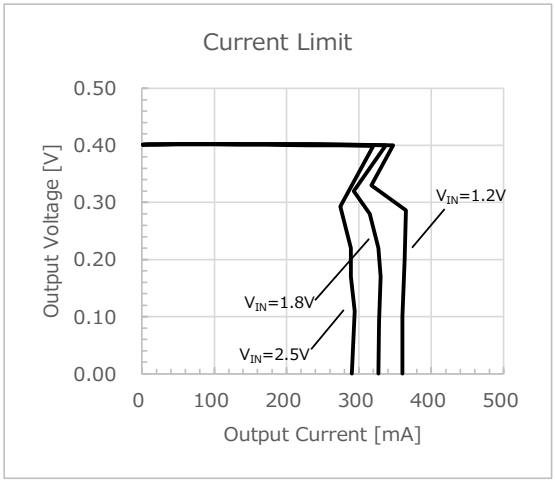
(Ta=25℃, VIN=1.2V, Vcont=1.2V unless otherwise specified)

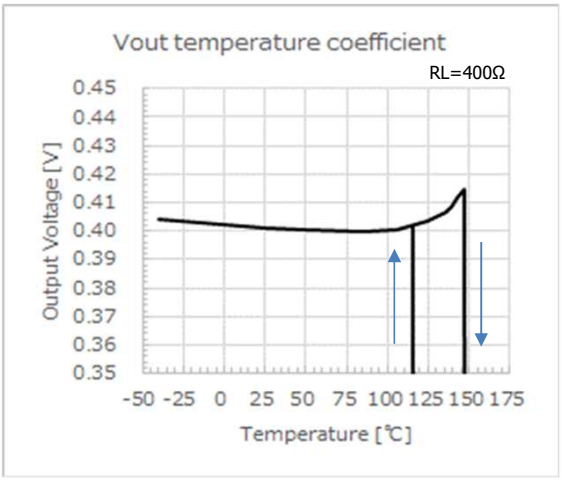






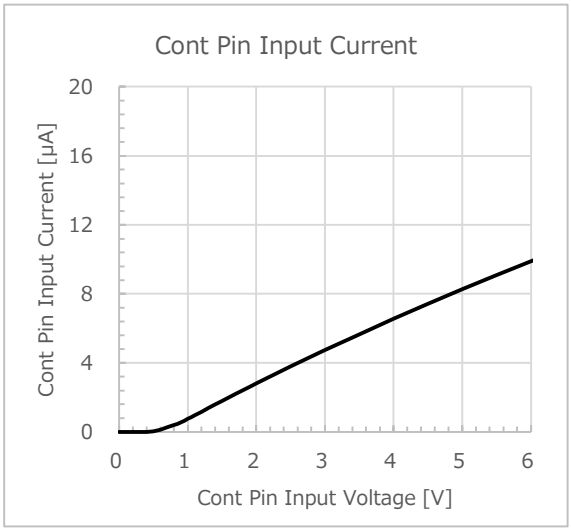


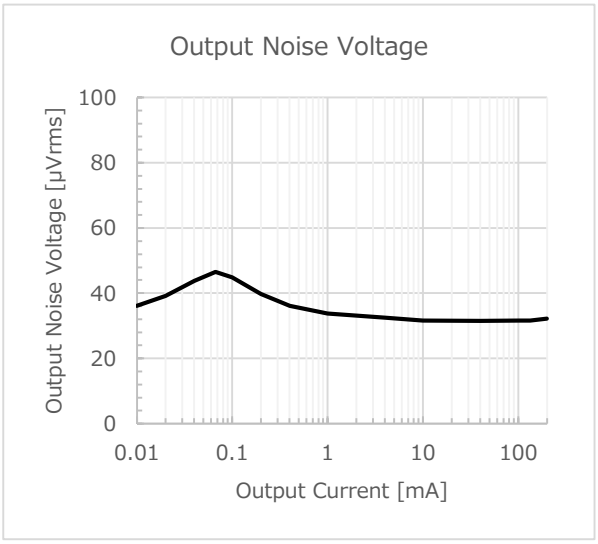


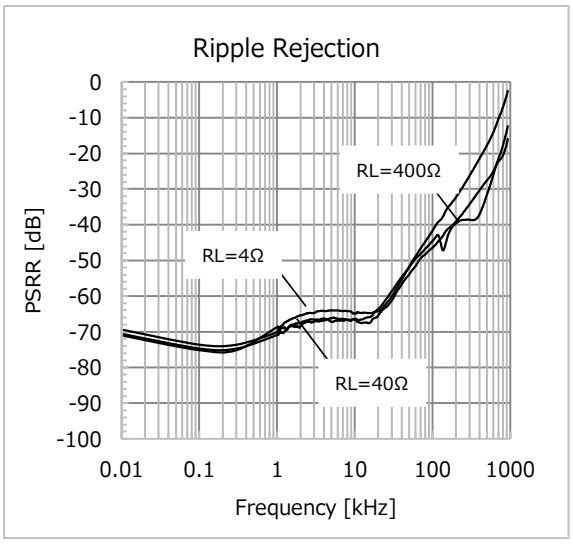


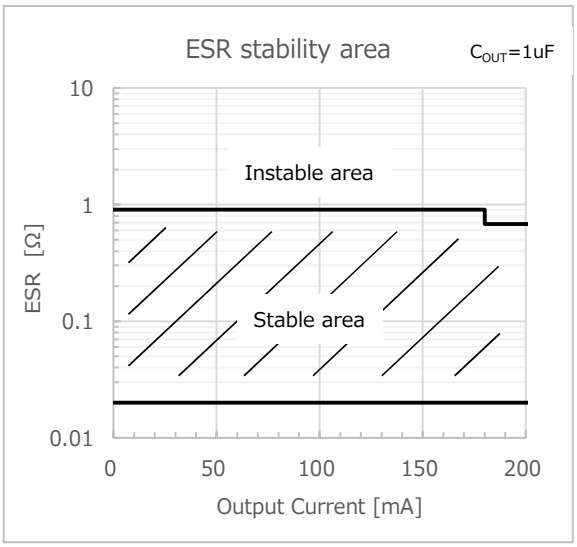
Typical Performance Characteristics (VOUT=0.4V)

(Ta=25℃, VIN=1.2V, Vcont=1.2V unless otherwise specified)









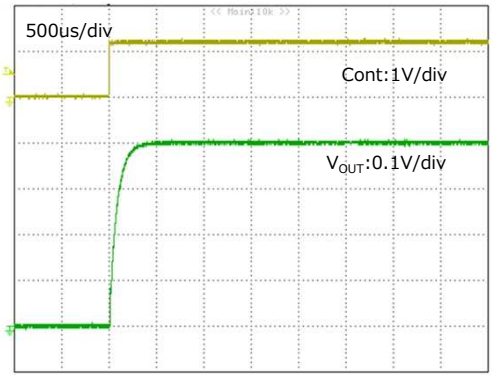
Typical Performance Characteristics (VOUT=0.4V)

(Ta=25℃, VIN=1.2V, Vcont=1.2V unless otherwise specified)

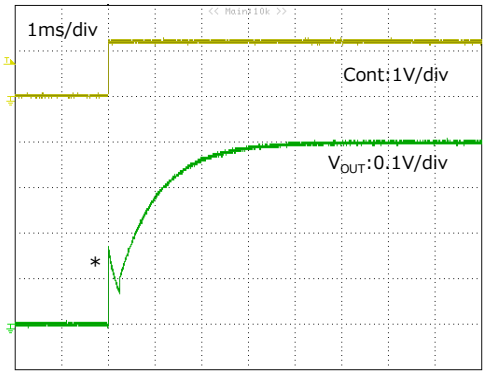
- Cont rise characteristics

V_{IN}=1.2V, Cont=0V to 1.2V, C_{IN}=C_{OUT}=1uF, RL=400Ω

<Cn=1nF>



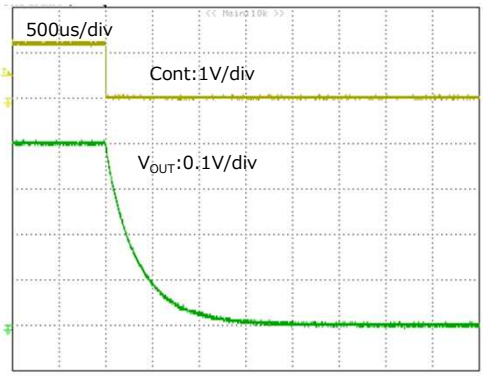
<Cn=10nF>



- Cont rise characteristics

V_{IN}=1.2V, Cont=1.2V to 0V, C_{IN}=C_{OUT}=1uF, RL=400Ω

<Cn=1nF>



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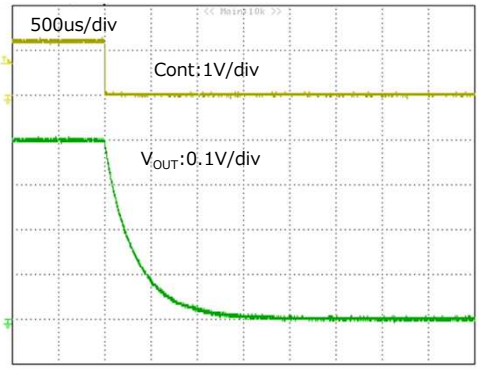
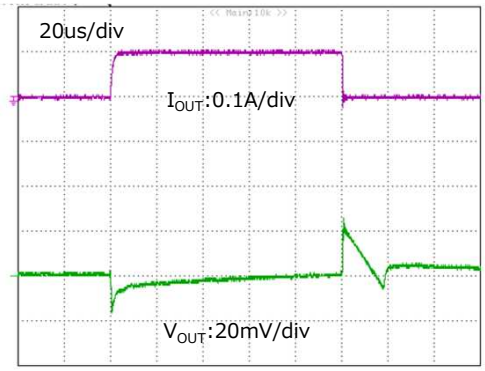


*Output voltage fluctuations of setting voltage or less may occur at start-up when the operating voltage is low.

- V_{OUT} load transient characteristics

V_{IN}=1.2V, Cont=1.2V, Cin=Co=1uF, Cn=1nF

<I_{OUT}=1mA⇔100mA>



<I_{OUT}=1mA⇔150mA>