MITSUMI

1500mA LDO

MM1870 Series

Overview

This IC is a 1.5A LDO with a low saturation voltage.
This device is offered in the PKG TO-252-5 package featuring high heat dissipation and the small-sized PKG HSOP-8 package. It supports reduction of the implementation space.
It includes a thermal shutdown circuit in addition to an over-current protection circuit for protection, and contributes to the reliability improvement of the product.

Overview

- Over current protection
- Thermal shutdown
- Low output voltage
- Low dropout voltage

Main specifications

- Maximum rating supply voltag : -0.3V to 12V
- Operating voltage range : VOUT(Typ.)+0.3 to 10V
- Operating ambient temperatu : -40℃ to 85℃
- Output current : 1.5A
- Input current (OFF) : Max. 1μA
- No-load input current : Typ. 1mA
- Output voltage range : 0.9V to 5V (0.1V step)
- Output voltage accuracy : ±2% (V_{OUT}≧1.5V)
  ±30mV (V_{OUT}＜1.5V)
- Line regulation : Max.20mV (VIN=VOUT(Typ.)+0.5 to VOUT(typ.)+1.5V, IOUT=1mA)
- Load regulation : Typ. 19mV (IOUT=0A to 1.5A)
- Dropout voltage : Typ. 0.26V (I_{OUT}=1.5A)
- PSRR : Typ. 65dB (f=1kHz)
- Output capacitor : 1uF (Ceramic capacitor)
- Protection function : Over current protection, Thermal shutdown
- Additional function : ON/OFF control

Packages

- HSOP-8A
- TO-252-5A

Application

- Audio visual equipment
- Office equipment / Printer
- Home appliance equipment
- CPU Coer power supply

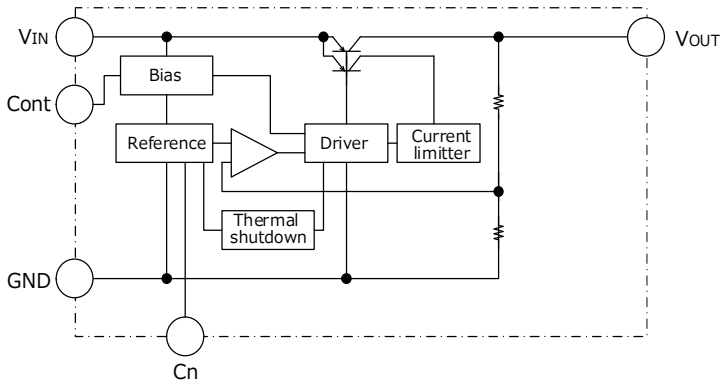
Model Name

M M 1 8 7 0 X X X X X X

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

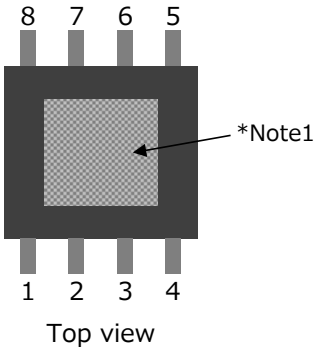
(A)	Function Type		A	Cont=H active、without discharge function
(B)	Output voltage rank		09 ～ 50	Output voltage can be designated in the range from 0.9V(09) to 5.0V(50) in 0.1V steps.
(C)	Package		H	HSOP-8A
			T	TO252-5A
(D)	Packing specifications 1	HSOP-8A	B	B housing (Standard)
			F	F housing
		TO-252-5A	R	R housing (Standard)
			L	L housing
(E)	梱包仕様2 / 環境仕様	HSOP-8A	E	Emboss tape / Halogen contained
		TO-252-5A	E	Emboss tape / Halogen free

Block Diagram



Pin Configuration

- HSOP-8A

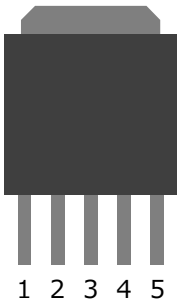


Top view

Pin No.	Pin name	Function
1	V_{OUT}	Output pin
2	NC	No connection
3	GND	GND pin
4	Cn	Noise reduction pin The capacitor is required to connect with input pin more than 1μF. The input pin must be connected by external.
5	Cont	ON/OFF-control pin Connect Cont pin with V_{IN} pin, when it is not used.
6	NC	No connection
7	NC	No connection
8	V_{IN}	Voltage supply pin

*Note1:Heat spreader bottom with GND.

- TO-252-5A



Top view

Pin No.	Pin name	Function
1	Cont	ON/OFF-control pin Connect Cont pin with V_{IN} pin, when it is not used.
2	V_{IN}	Voltage supply pin
3	GND	GND pin
4	Cn	Noise reduction pin The capacitor is required to connect with input pin more than 1μF. The input pin must be connected by external.
5	V_{OUT}	Output pin

Absolute Maximum Ratings

Item		Symbol	Min.	Max.	Unit
Storage temperature		Tstg	-40	150	℃
Junction temperature *Note2		Tj_{MAX}	-	150	℃
Supply voltage		V_{IN}	-0.3	12	V
Cont input voltage		V_{cont}	-0.3	12	V
Output Voltage		V_{OUT}	-0.3	V_{IN}+0.3V	V
Output current		Iomax	0	1.8	A
Power Dissipation 1*Note3	HSOP-8A	Pd1	-	1800	mW
	TO-252-5A		-	2500	mW
Power Dissipation 2*Note4	HSOP-8A	Pd2	-	3500	mW
	TO-252-5A		-	4900	mW

*Note2:In consideration of product life, please examine the use in less than 80%.

*Note3:PC Board of glass epoxy 37mm×37mm t=1.6mm Copper foil area 80% / HSOP-8A

:PC Board of glass epoxy 40mm×40mm t=1.6mm Copper foil area 80% / TO-252-5A

*Note4:JEDEC51-7 standard 114.3mm×76.2mm t=1.6mm Copper foil area 80%

Recommended Operating Conditions

Item	Symbol	Min.	Max.	Unit
Operating Ambient temperature	Topr	-40	85	℃
Operating voltage *Note5	Vop	V_{OUT}(Typ.)+0.3	10	V
Output Current	Iop	0	1.5	A

*Note5: The Operating Voltage is (V_{OUT}+0.35V)～10V in the model less than V_{OUT}=1V.

Electrical Characteristics

(Ta=25℃, VIN=VOUT+0.5V, Vcont=0.8V, IOUT=1mA, unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
No-Load Input Current	I_{CC}	I_{OUT}=0mA	-	1	2	mA
Input Current(OFF)	I_{CCOFF}	V_{CONT}=0V	-	0	1	μA
Output Voltage *Note6	V_{OUT}	I_{OUT}=1mA	×0.98	-	×1.02	V
Dropout Voltage *Note7	Vio	V_{IN}=V_{OUT}-0.1V I_{OUT}=1.5A	-	0.26	0.38	V
Line Regulation	V_{LINE}	V_{IN}=V_{OUT}+0.5V~V_{OUT}+1.5V I_{OUT}=1mA	-	10	20	mV
Load Regulation *Note8	V_{LOAD}	I_{OUT}=0A~1.5A	-	19	50	mV

*Note6:Please refer to another page.

*Note7:The parameter is not guaranteed in the model less than Vout=1.0V.

*Note8:The parameter is guaranteed by design.

Electrical Characteristics

(特記無き場合、Ta=25℃, V_{IN}=V_{OUT}(Typ.)+0.5V, Vcont=0.8V, I_{OUT}=1mA)

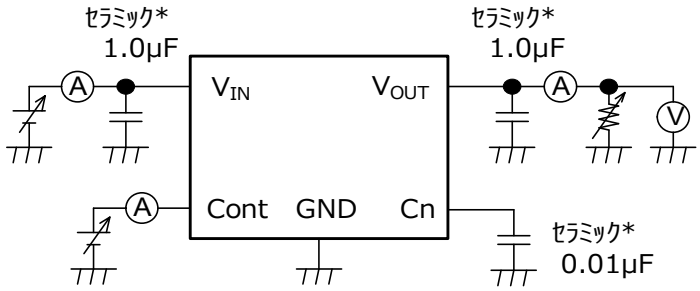
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
VOUT Temperature Coefficient *Note8	ΔV_{OUT} /ΔT	-40≦Ta≦85℃	-	±100	-	ppm/℃
Ripple Rejection *Note8	RR	f=1kHz, Vripple=0.5V I_{OUT}=250mA	50	65	-	dB
Output Noise Voltage *Note8	Vn	fBW=20Hz~80kHz, Cn=0.01μF fBW=20Hz~80kHz, Cn=OPEN	- -	60 150	- -	μVrms
Cont Pin Input Current	Icont		-	0.3	0.6	μA
Cont Pin High Threshold Voltage	VcontH		0.8	-	10	V
Cont Pin Low Threshold Voltage	VcontL		-0.3	-	0.2	V

*Note8:The parameter is guaranteed by design.

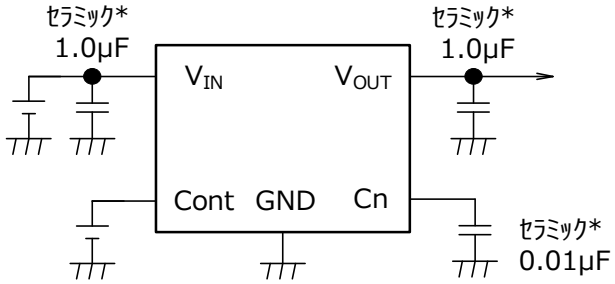
Electrical Characteristics

Model name	Item			
	Output voltage			
	V_{OUT} (V)			
	Conditions	Min.	Typ.	Max.
MM1870A09	$V_{IN}=V_{OUT}$(Typ.)+0.5V	0.870	0.900	0.930
MM1870A10	I_{OUT}=1mA	0.970	1.000	1.030
MM1870A11		1.070	1.100	1.130
MM1870A12		1.170	1.200	1.230
MM1870A13		1.270	1.300	1.330
MM1870A14		1.370	1.400	1.430
MM1870A15		1.470	1.500	1.530
MM1870A16		1.568	1.600	1.632
MM1870A17		1.666	1.700	1.734
MM1870A18		1.764	1.800	1.836
MM1870A19		1.862	1.900	1.938
MM1870A20		1.960	2.000	2.040
MM1870A21		2.058	2.100	2.142
MM1870A22		2.156	2.200	2.244
MM1870A23		2.254	2.300	2.346
MM1870A24		2.352	2.400	2.448
MM1870A25		2.450	2.500	2.550
MM1870A26		2.548	2.600	2.652
MM1870A27		2.646	2.700	2.754
MM1870A28		2.744	2.800	2.856
MM1870A29		2.842	2.900	2.958
MM1870A30		2.940	3.000	3.060
MM1870A31		3.038	3.100	3.162
MM1870A32		3.136	3.200	3.264
MM1870A33		3.234	3.300	3.366
MM1870A34		3.332	3.400	3.468
MM1870A35		3.430	3.500	3.570
MM1870A36		3.528	3.600	3.672
MM1870A37		3.626	3.700	3.774
MM1870A38		3.724	3.800	3.876
MM1870A39		3.822	3.900	3.978
MM1870A40		3.920	4.000	4.080
MM1870A41		4.018	4.100	4.182
MM1870A42		4.116	4.200	4.284
MM1870A43		4.214	4.300	4.386
MM1870A44		4.312	4.400	4.488
MM1870A45		4.410	4.500	4.590
MM1870A46		4.508	4.600	4.692
MM1870A47		4.606	4.700	4.794
MM1870A48		4.704	4.800	4.896
MM1870A49		4.802	4.900	4.998
MM1870A50		4.900	5.000	5.100

Test Circuit



Application Circuit



(Example of external parts)

- Output capacitor Ceramic capacitor 1.0μF
- Input Capacitor Ceramic capacitor 1.0μF
- Cn Capacitor Ceramic capacitor 0.01μF *Temperature characteristics : B

- 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. Please use this IC within the stated absolute maximum ratings.
   The IC is liable to malfunction should the ratings be exceeded.

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 must be used more than 1.0μF and B temperature characteristics.

6. It is likely to oscillate when the output capacity is larger than the input capacitance.
   Please evaluate IC in the set.

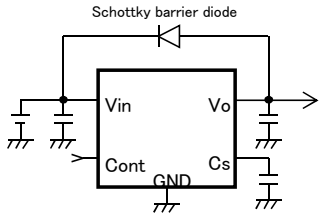
7. The wire of Vin and GND is required to print full ground plane for noise and stability.

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 the fold back type is built into this IC.

11. In case the output voltage is above the input voltage, the overcurrent flow by internal parastic diode from output to input.In such application, the external bypass diode must be connected between output and input pin.



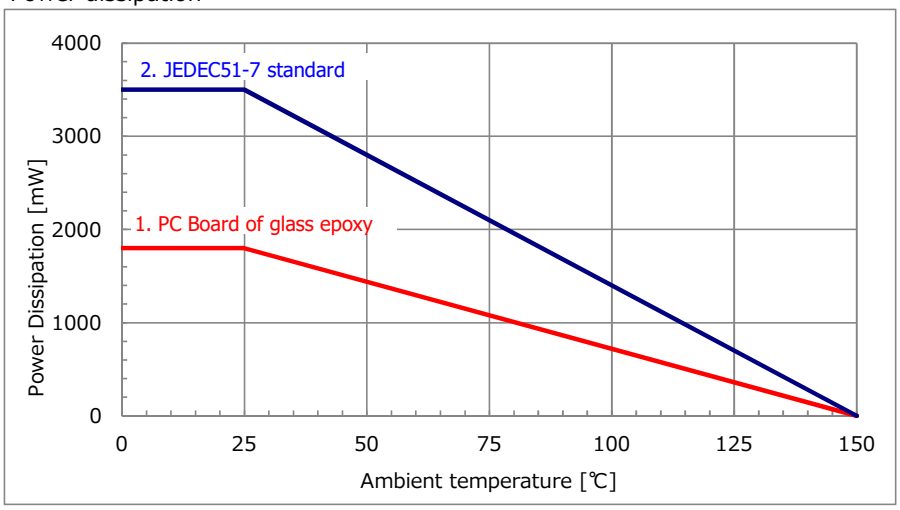
12. There is a possibility that IC generates heat when the output terminal is short-circuited.
    However, the thermal shutdown circuit operates, and it will do operation that protects IC.
    The thermal shutdown circuit is designed only to shut the IC off to prevent thermal runaway.
    Do not continue 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.

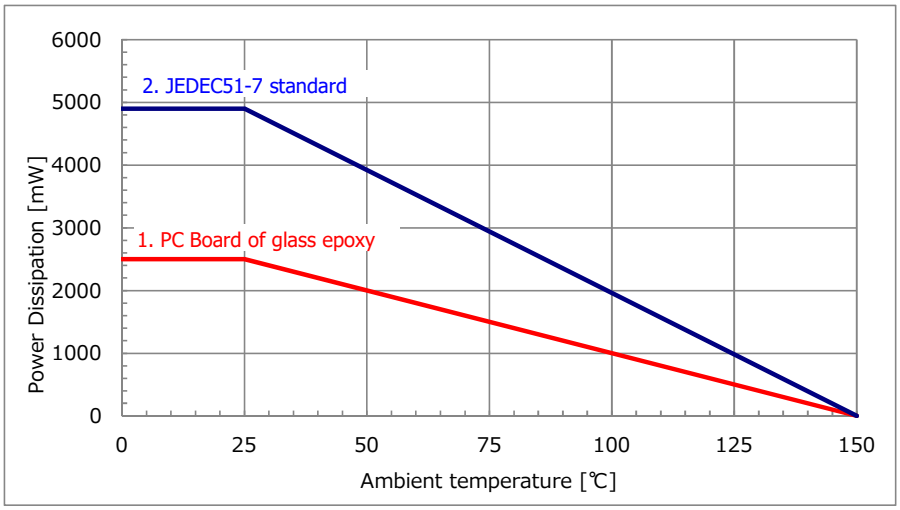
About Power Dissiopation

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.

- HSOP-8A
  1. PC Board of glass epoxy
     Board size 37mm×37mm t=1.6mm Copper foil area 80%
     Power dissipation 1800mW Ta=25℃
  2. JEDEC51-7 standard (4 layer FR-4 board)
     Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
     Power dissipation 3500mW Ta=25℃



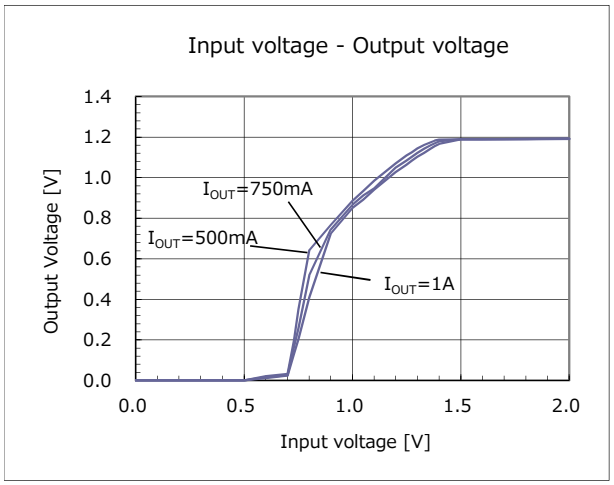
- TO252-5A
  1. PC Board of glass epoxy
     Board size 40mm×40mm t=1.6mm Copper foil area 80%
     Power dissipation 2500mW Ta=25℃
  2. JEDEC51-7 standard (4 layer FR-4 board)
     Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
     Power dissipation 4900mW Ta=25℃

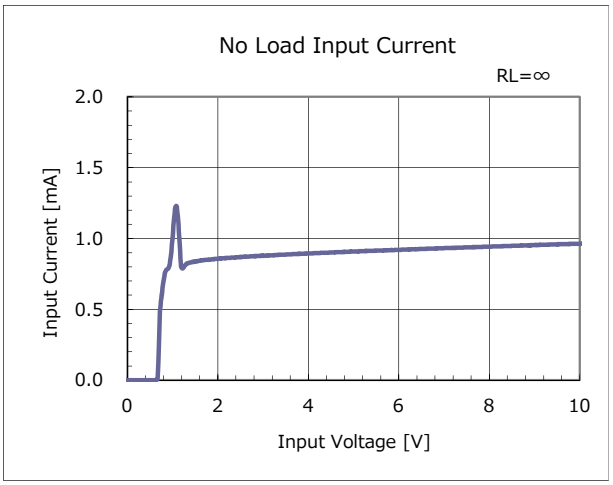


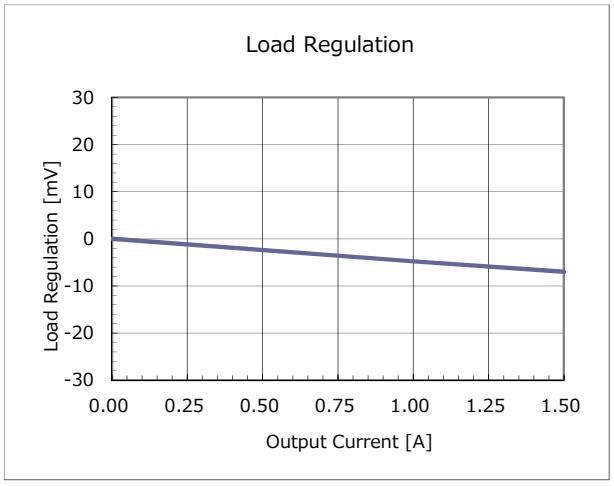
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

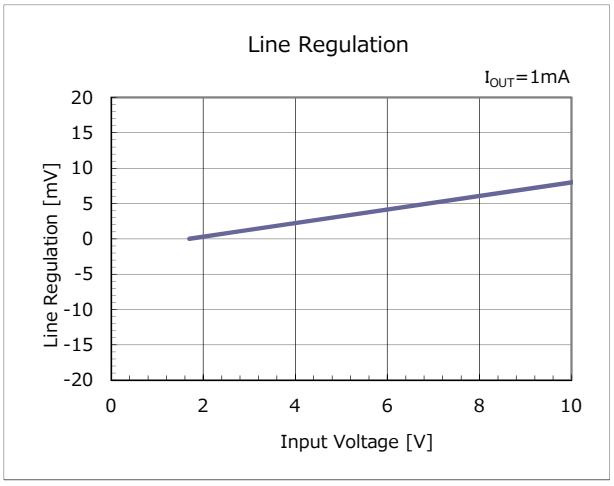
Typical Performance Characteristics (V_{OUT}=1.2V)

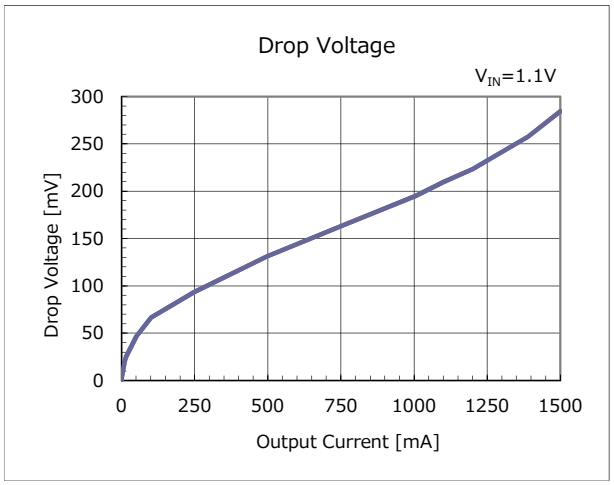
(Ta=25℃, VIN=VOUT+0.5V, Vcont=0.8V, IOUT=1mA, unless otherwise specified)





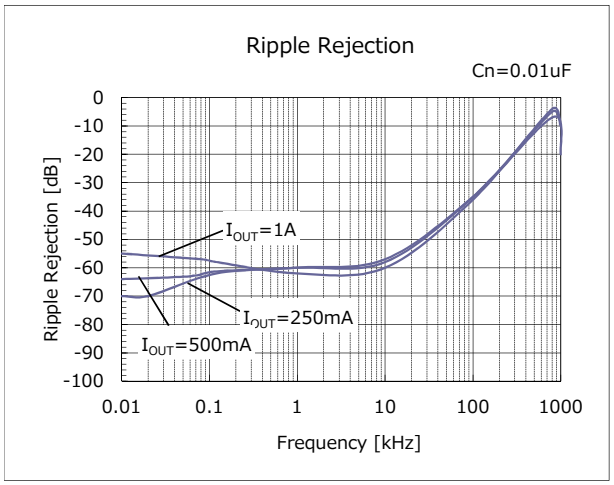


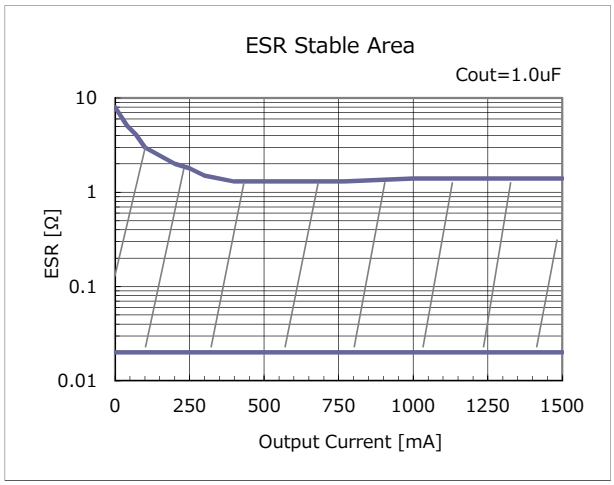


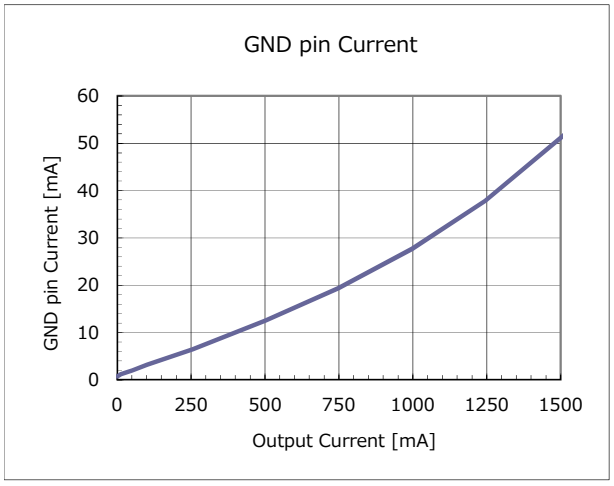


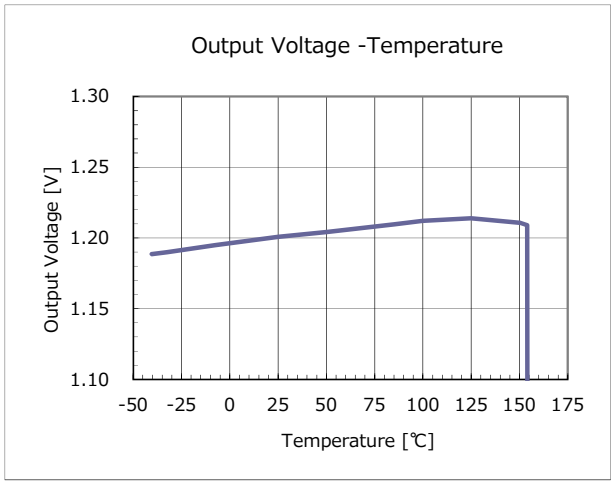
Typical Performance Characteristics (V_{OUT}=1.2V)

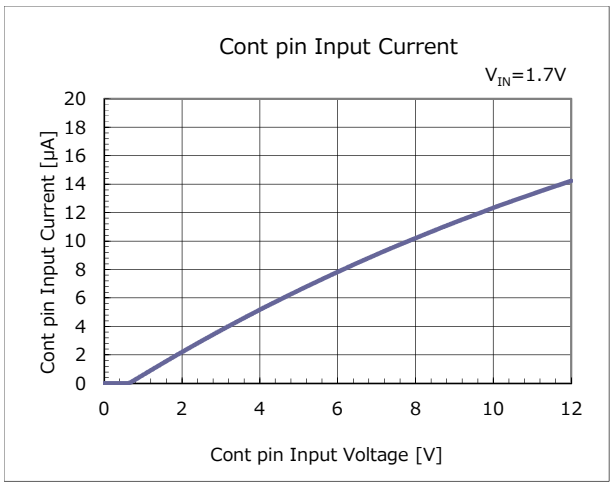
(Ta=25℃, VIN=VOUT+0.5V, Vcont=0.8V, IOUT=1mA, unless otherwise specified)

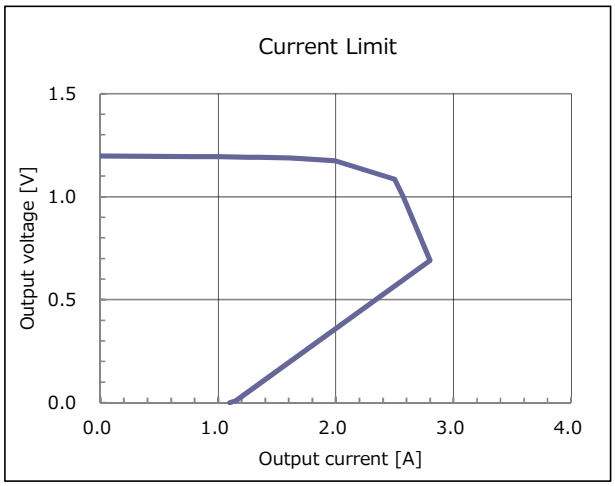






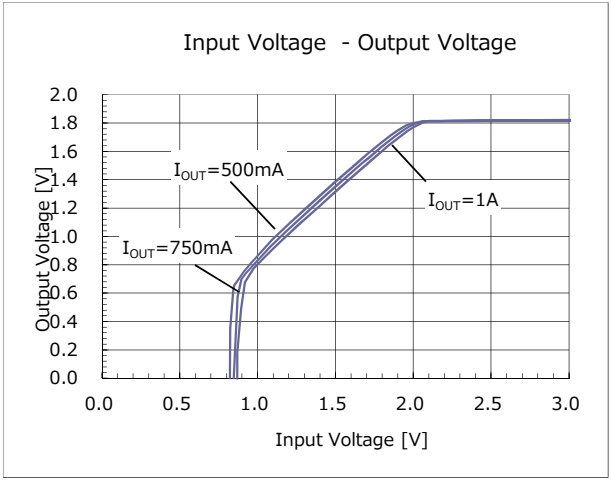


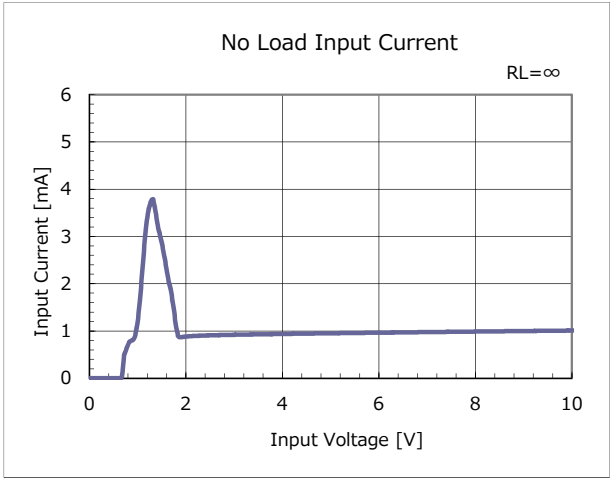


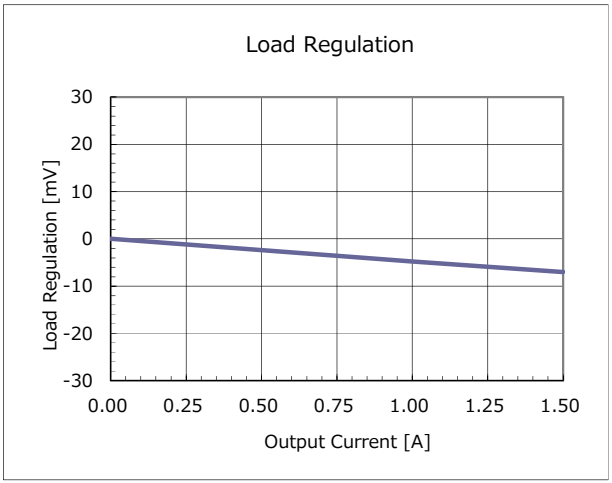


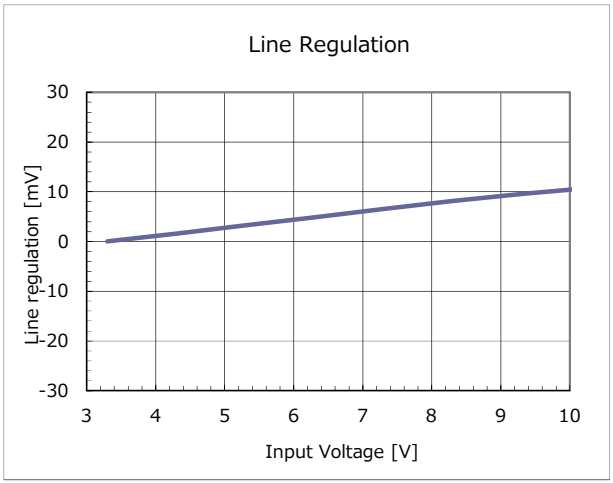
Typical Performance Characteristics (V_{OUT}=1.8V)

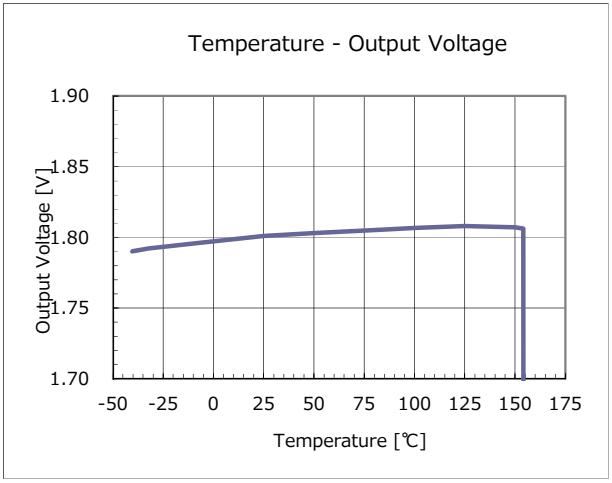
(Ta=25℃, VIN=VOUT+0.5V, Vcont=0.8V, IOUT=1mA, unless otherwise specified)

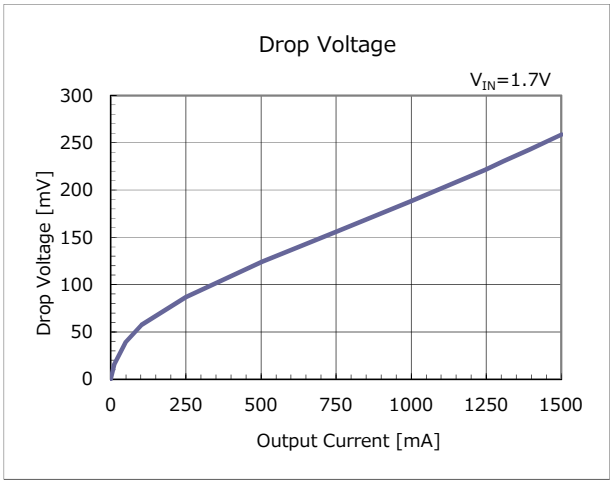












Typical Performance Characteristics (V_{OUT}=3.3V)

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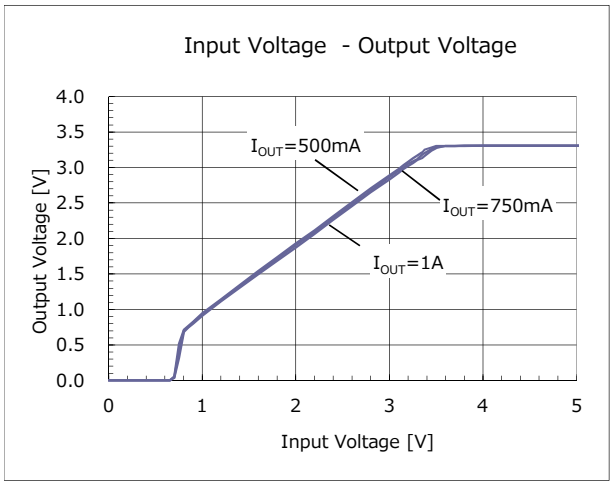

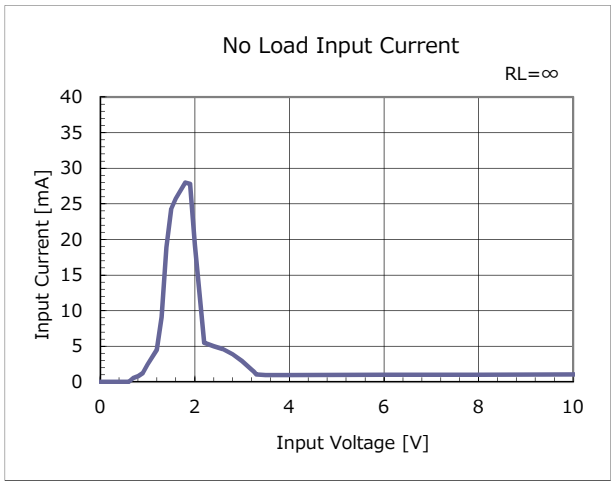

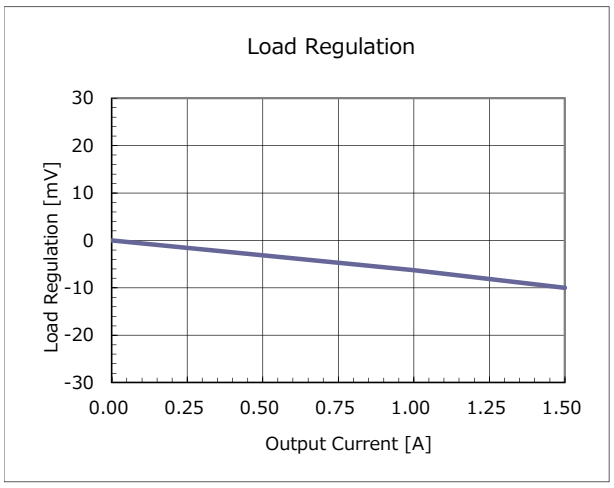

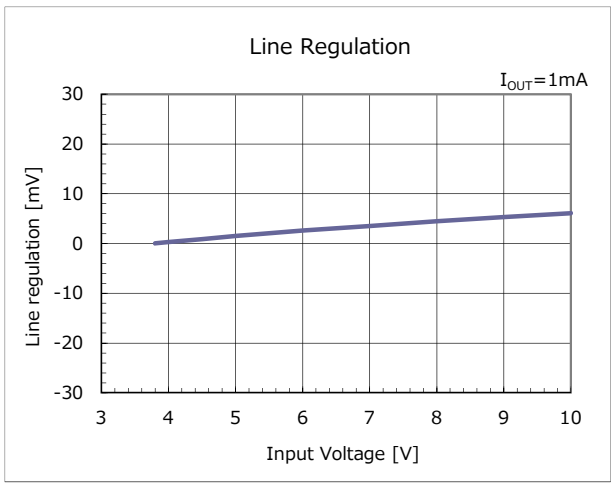

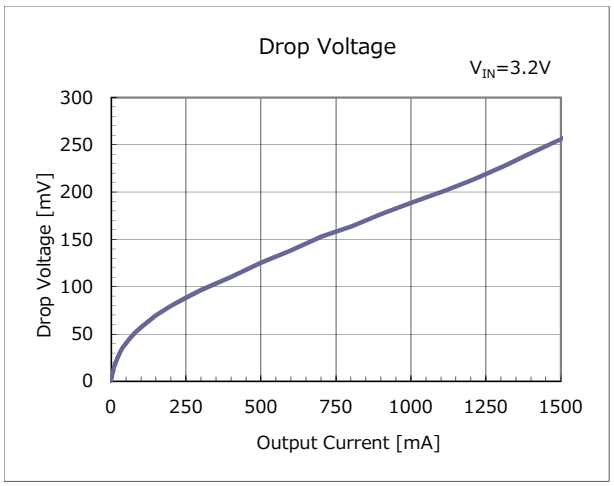

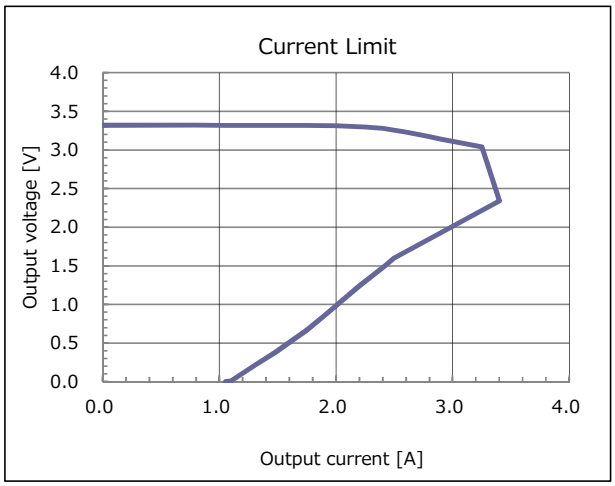

Typical Performance Characteristics (V_{OUT}=5.0V)

(Ta=25℃, VIN=VOUT+0.5V, Vcont=0.8V, IOUT=1mA, unless otherwise specified)