

# Low-Saturation voltage 300mA LDO Monolithic IC MM334x Series

## Outline

This IC is a 300mA LDO with an ultra-low saturation voltage.

This device features a 300 mA current capability and high-value ripple rejections of 70dB typ. for protection, it includes an over-current protection circuit and a thermal shutdown circuit.

## Features

1. Supply Current	45 $\mu$ A typ. (No-load) 0.1 $\mu$ A typ. (OFF)
2. Output Voltage Range	1.2V~5.0V
3. Output Voltage accuracy	$V_{OUT} \pm 2\%$
4. Dropout Voltage	0.16V ( $I_O=300\text{mA}$ )
5. Line Regulation	0.02%/V
6. Load Regulation	50mV typ. ( $I_O=1\sim 300\text{mA}$ )
7. Ripple rejection	70dB typ. ( $f=1\text{kHz}$ )
8. Thermal shutdown	
9. Dropout capacitor	1 $\mu$ F

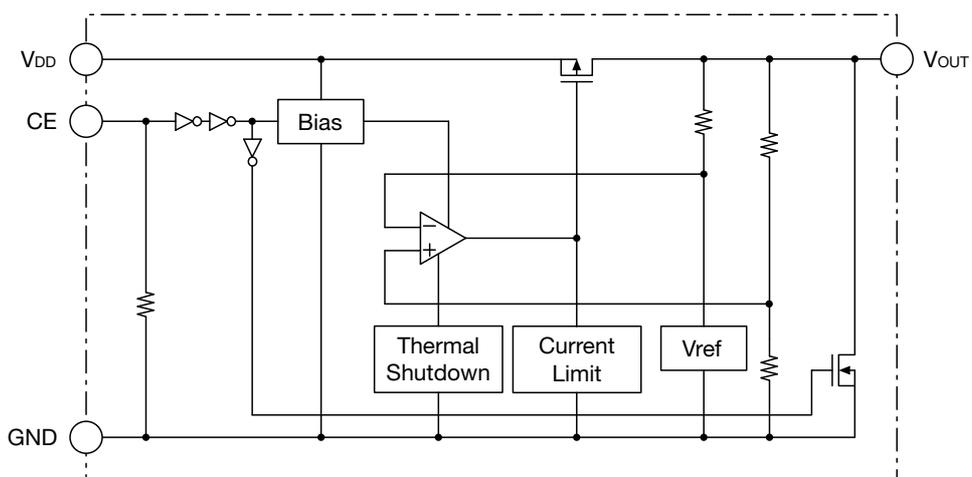
## Package

SSON-6A  
SOP-8D  
SOT-25A

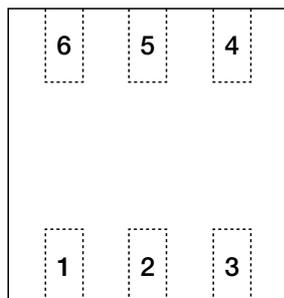
## Applications

1. Mobile phones
2. Digital cameras
3. TVs
4. DVD·Blu-ray recorder

### Block Diagram

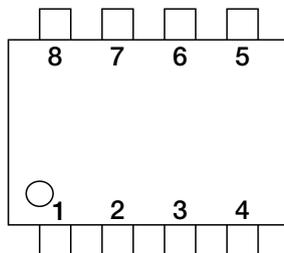


### Pin Assignment



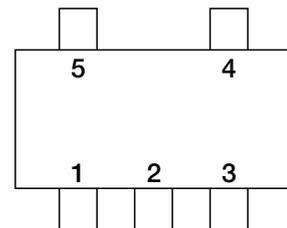
SSON-6A  
(TOP VIEW)

1	$V_{DD}$
2	NC
3	$V_{OUT}$
4	NC
5	GND
6	CE



SOP-8D  
(TOP VIEW)

1	$V_O$
2	NC
3	GND
4	NC
5	CE
6	NC
7	NC
8	$V_{DD}$



SOT-25A  
(TOP VIEW)

1	$V_{DD}$
2	GND
3	CE
4	NC
5	$V_{OUT}$

Pin Description

SSON-6A

Pin No.	Pin name	Functions	
1	V <sub>DD</sub>	Voltage-supply pin	
2,4	NC	No connection	
3	V <sub>OUT</sub>	Output pin	
5	GND	GND pin	
6	CE	ON/OFF-Control pin	
		CE	V <sub>OUT</sub>
		Low	OFF
		High	ON
Connect CE pin with V <sub>DD</sub> pin, when it is not used.			

SOP-8D

Pin No.	Pin name	Functions	
1	V <sub>OUT</sub>	Output pin	
2,4	NC	No connection	
3	GND	GND pin	
5	CE	ON/OFF-Control pin	
		CE	V <sub>OUT</sub>
		Low	OFF
		High	ON
Connect CE pin with V <sub>DD</sub> pin, when it is not used.			
6,7	NC	No connection	
8	V <sub>DD</sub>	Voltage-supply pin	

SOT-25A

Pin No.	Pin name	Functions	
1	V <sub>DD</sub>	Voltage-supply pin	
2	GND	GND pin	
3	CE	ON/OFF-Control pin	
		CE	V <sub>OUT</sub>
		Low	OFF
		High	ON
Connect CE pin with V <sub>DD</sub> pin, when it is not used.			
4	NC	No connection	
5	V <sub>OUT</sub>	Output pin	

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

Item	Symbol	Ratings	Units
Storage Temperature	T <sub>STG</sub>	-55~+150	°C
Supply Voltage	V <sub>DD</sub>	6.5	V
CE input Voltage	V <sub>CE</sub>	-0.3~V <sub>DD</sub> +0.3	V
Output Voltage	V <sub>OUT</sub>	-0.3~V <sub>DD</sub> +0.3	V
Output Current	I <sub>omax</sub>	350	mA
Power Dissipation	Pd	950(Note1)	SOP-8D
		180(Note2)	SSON-6A
		350(Note3)	SOT-25A
			mW

Note1 : With the double sided PC Board of glass epoxy  
(Copper plane 80%, 192 × 142 × 1.2<sup>t</sup>mm)

Note2 : With the double sided PC Board of glass epoxy  
(Copper plane 80%, 25 × 252 × 1.6<sup>t</sup>mm)

Note3 : With the double sided PC Board of glass epoxy  
(Copper plane 60%, 25 × 25 × 1.6<sup>t</sup>mm)

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

Item	Symbol	Ratings	Units
Operating Ambient Temperature	T <sub>JOP</sub>	-40~85	°C
Operating Voltage	V <sub>OP</sub>	2~6	V
Output Current	I <sub>O</sub>	0~300	mA

**Electrical Characteristics 1** (Except where noted otherwise V<sub>DD</sub>=V<sub>OUT</sub>(typ.)+1V, V<sub>CE</sub>=V<sub>DD</sub>, Ta=25°C)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input Current(OFF)	I <sub>DDoff</sub>	V <sub>CE</sub> =0V		0.1	1.0	μA
No-Load Input Current	I <sub>DD</sub>	I <sub>OUT</sub> =0mA		45	70	μA
Output Voltage	V <sub>OUT</sub>	I <sub>OUT</sub> =30mA	×0.98		×1.02	V
Line Regulation	V <sub>LINE</sub>	V <sub>DD</sub> =V <sub>O</sub> (typ.)+0.5~6V, I <sub>OUT</sub> =30mA (V <sub>OUT</sub> ≤1.6V, V <sub>DD</sub> =2.2~6V)		0.02	0.10	%/V
Load Regulation	V <sub>LOAD</sub>	1mA≤I <sub>OUT</sub> ≤300mA		50	120	mV
Dropout Voltage	V <sub>IO</sub>	Please refer to another page				V
Ripple Rejection 1 (Note4)	RR1	f=1kHz, V <sub>ripple</sub> =0.5V, I <sub>OUT</sub> =30mA (V <sub>OUT</sub> ≤1.7V, V <sub>DD</sub> =V <sub>OUT</sub> +1.2V)		70		dB
Ripple Rejection 2 (Note4)	RR2	f=10kHz, V <sub>ripple</sub> =0.5V, I <sub>OUT</sub> =30mA (V <sub>OUT</sub> ≤1.7V, V <sub>DD</sub> =V <sub>OUT</sub> +1.2V)		50		dB
V <sub>OUT</sub> Temperature Coefficient (Note4)	ΔV <sub>OUT</sub> /ΔT	I <sub>OUT</sub> =30mA -40°C≤T <sub>OP</sub> ≤85°C		±100		ppm/°C
Output Noise Voltage (Note4)	V <sub>n</sub>	f <sub>BW</sub> =10~100kHz I <sub>OUT</sub> =30mA		30		μV <sub>rms</sub>
Output Short-circuit Current (Note4)	I <sub>lim</sub>	V <sub>OUT</sub> =0V		40		mA
CE Pull-down Resistance	R <sub>pd</sub>		0.7	2	8	MΩ
CE High Threshold Voltage	V <sub>CEH</sub>		1.5		V <sub>DD</sub>	V
CE Low Threshold Voltage	V <sub>CEL</sub>		0		0.3	V
Output NMOS ON resistance	R <sub>DON</sub>	V <sub>CE</sub> =0V V <sub>DD</sub> =4V(V <sub>OUT</sub> <3V)		60		Ω

Note4 : The parameter is guaranteed by design.

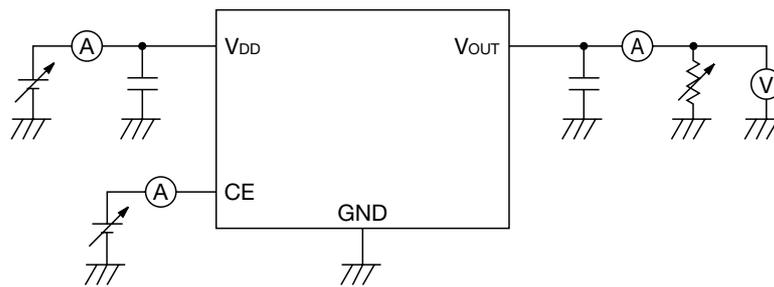
**Electrical Characteristics 2** (Except where noted otherwise  $V_{DD}=V_o(\text{typ.})+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^\circ\text{C}$ )

Output Voltage Vo1, Vo2	Item							
	Output Voltage				Dropout Voltage			
	Vo1, Vo2 (V)				Vio1, Vio2 (V)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
1.2V	1mA ≤ Io ≤ 30mA	1.170	1.200	1.230	SSON-6A(Note5) SOP-8D(Note6) SOT-25A(Note5)			
1.3V		1.270	1.300	1.330				
1.4V		1.370	1.400	1.430				
1.5V		1.470	1.500	1.530	Io=300mA		0.26	0.52
1.6V		1.568	1.600	1.632			0.24	0.46
1.7V		1.666	1.700	1.734			0.22	0.40
1.8V		1.764	1.800	1.836	1.8V ≤ Vo ≤ 2.0V Io=300mA		0.20	0.30
1.9V		1.862	1.900	1.938				
2.0V		1.960	2.000	2.040				
2.1V		2.058	2.100	2.142	2.1V ≤ Vo ≤ 2.7V Io=300mA		0.18	0.27
2.2V		2.156	2.200	2.244				
2.3V		2.254	2.300	2.346				
2.4V		2.352	2.400	2.448				
2.5V		2.450	2.500	2.550				
2.6V		2.548	2.600	2.652				
2.7V		2.646	2.700	2.754	2.5V ≤ Vo ≤ 5.0V Io=300mA		0.16	0.23
2.8V		2.744	2.800	2.856				
2.9V		2.842	2.900	2.958				
3.0V		2.940	3.000	3.060				
3.1V		3.038	3.100	3.162				
3.2V		3.136	3.200	3.264				
3.3V		3.234	3.300	3.366				
3.4V		3.332	3.400	3.468				
3.5V		3.430	3.500	3.570				
3.6V		3.528	3.600	3.672				
3.7V		3.626	3.700	3.774				
3.8V		3.724	3.800	3.876				
3.9V		3.822	3.900	3.978				
4.0V		3.920	4.000	4.080				
4.1V		4.018	4.100	4.182				
4.2V	4.116	4.200	4.284					
4.3V	4.214	4.300	4.386					
4.4V	4.312	4.400	4.488					
4.5V	4.410	4.500	4.590					
4.6V	4.508	4.600	4.692					
4.7V	4.606	4.700	4.794					
4.8V	4.704	4.800	4.896					
4.9V	4.802	4.900	4.998					
5.0V	4.900	5.000	5.100					

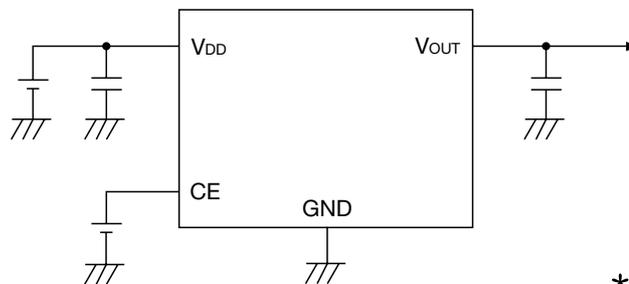
Note5 : The parameter is not guaranteed in the model Vo=1.4V or less.

Note6 : The parameter is not guaranteed in the model less than Vo=1.4V.

## Measuring Circuit



## Application Circuit



\* Temperature Characteristics : B

(Reference example of external parts)

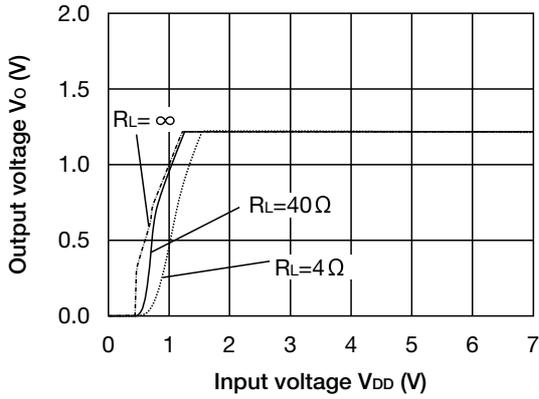
- Output capacitor                      Ceramic capacitor 1 $\mu$ F
- Input capacitor                        Ceramic capacitor 1 $\mu$ F

· Note

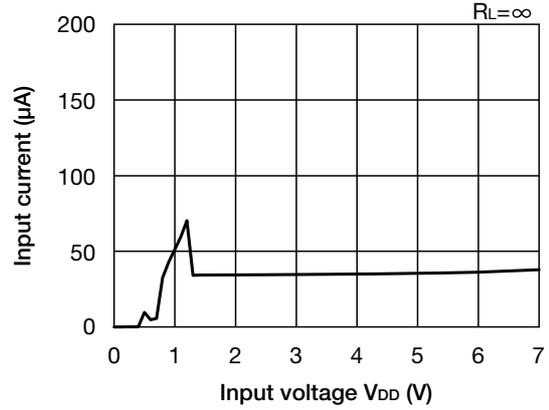
1. The output capacitor is required between output and GND to prevent oscillation.
2. The ESR of capacitor must be defined in ESR stability area.  
It is possible to use a ceramic capacitor without ESR resistance for output.  
The ceramic capacitor must be used more than 1.0 $\mu$ F or and B temperature characteristics.
3. The wire of Vcc and GND is required to print full ground plane for noise and stability.
4. The input capacitor must be connected a distance of less than 1cm from input pin.
5. In case the output voltage is above the input voltage, the overcurrent flow by internal parastic diode from output to input.

**Characteristics (Vo=1.2V)** (Except where noted otherwise VDD=VOUT (typ.) +1V, VCE=VDD, Ta=25°C)

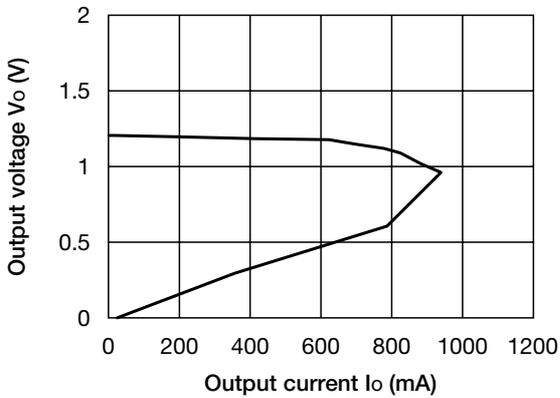
**Output - Input voltage**



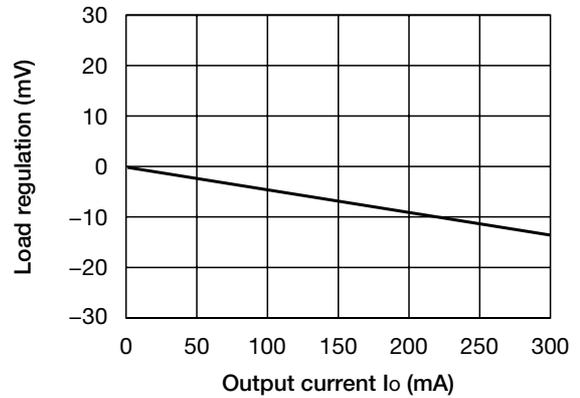
**Input current - Input voltage**



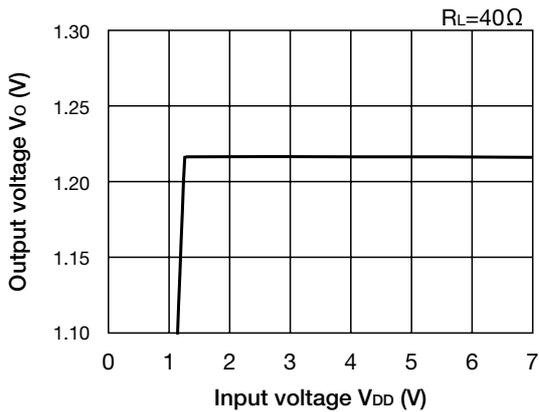
**Output voltage - Output current**



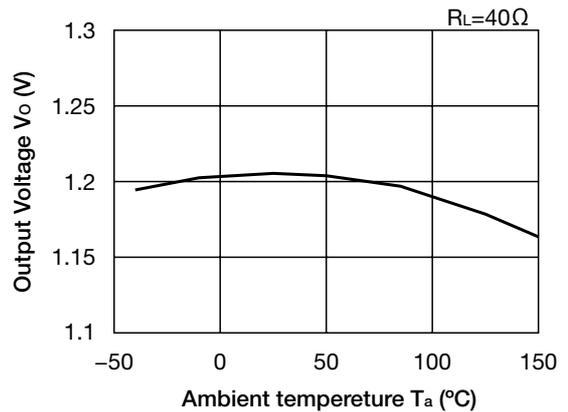
**Load regulation**



**Line regulation**

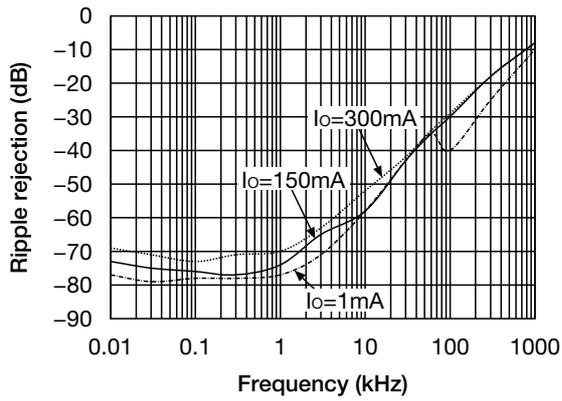


**Output voltage - Ambient temperature**

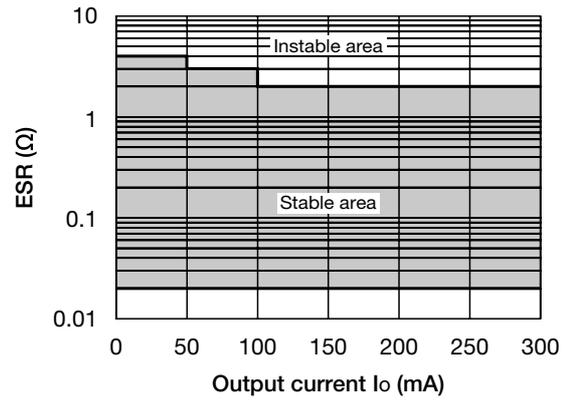


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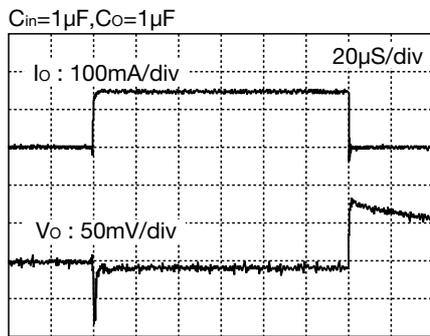
■ Ripple Rejection



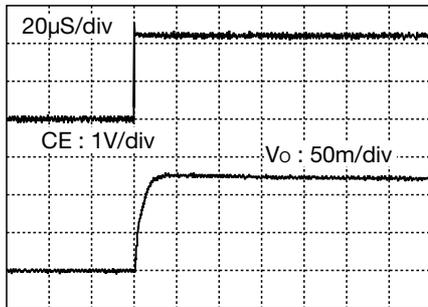
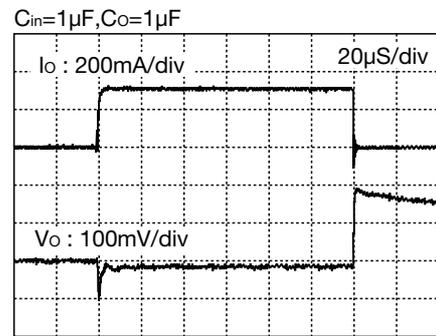
■ ESR Stable area



■ Load transient response ( $I_o = 1 \rightarrow 150\text{mA}$ )

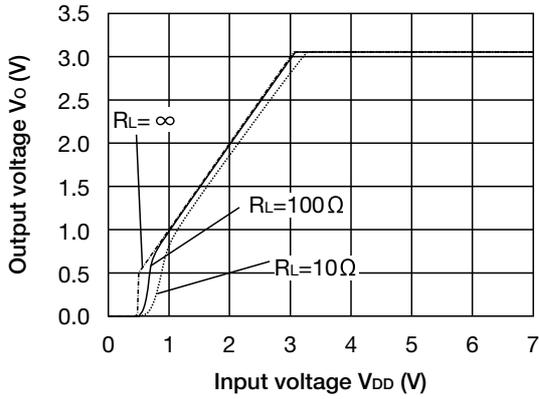


■ Load transient response ( $I_o = 1 \rightarrow 300\text{mA}$ )

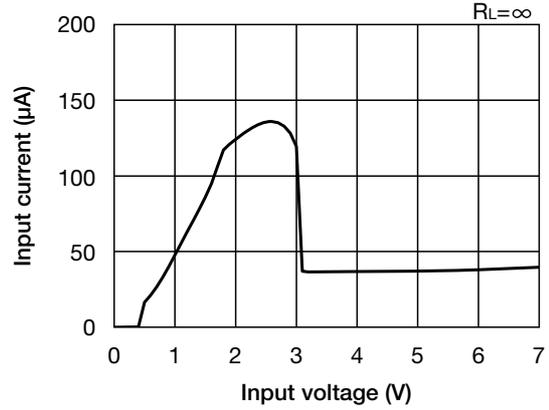


**Characteristics (Vo=3.0V)** (Except where noted otherwise V<sub>DD</sub>=V<sub>OUT</sub> (typ.) +1V, V<sub>CE</sub>=V<sub>DD</sub>, Ta=25°C)

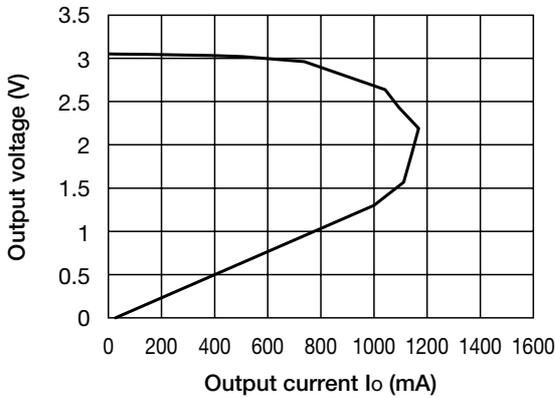
**Output - Input voltage**



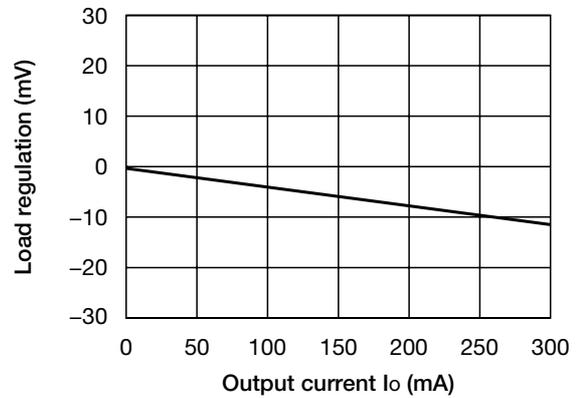
**Input current - Input voltage**



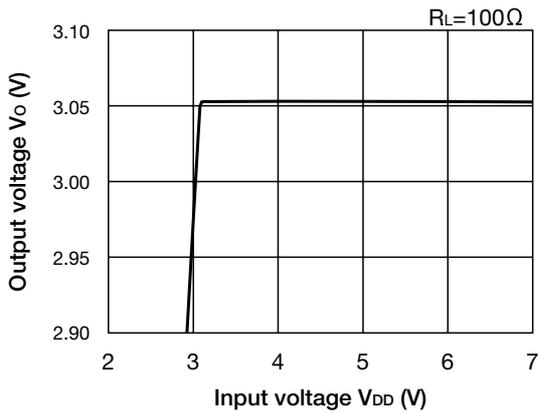
**Output voltage - Output current**



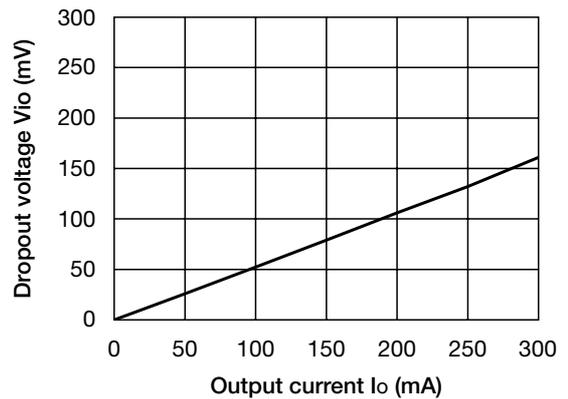
**Load regulation**



**Line regulation**

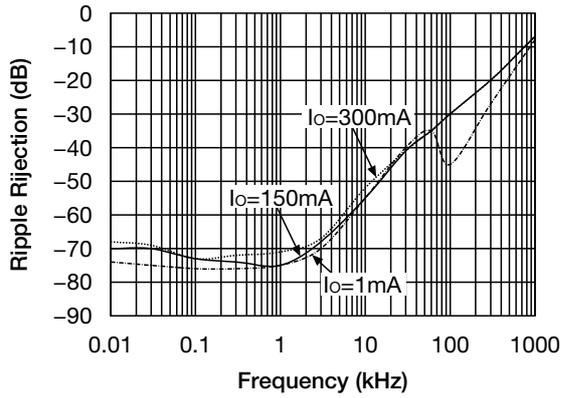


**Dropout voltage**

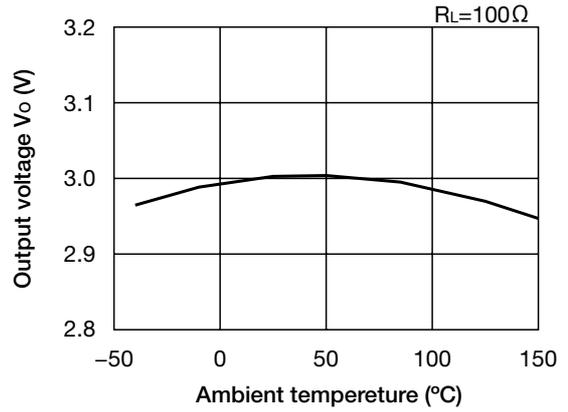


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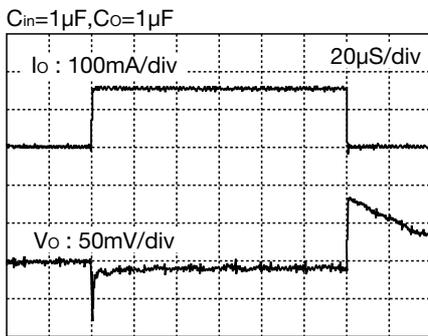
**Ripple Rejection**



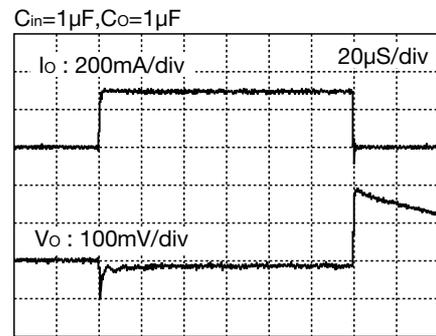
**Output voltage - Ambient temperature**



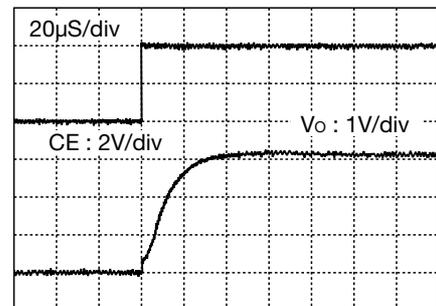
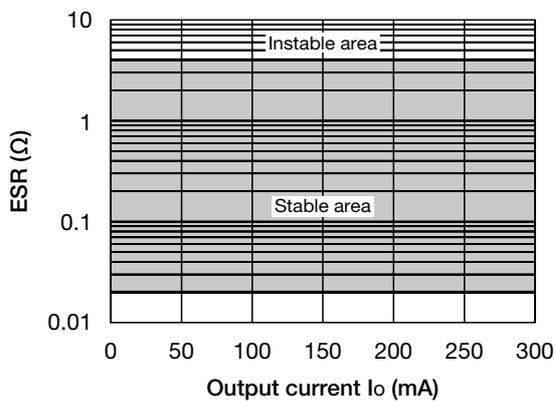
**Load transient response ( $I_o = 1 \rightarrow 150\text{mA}$ )**



**Load transient response ( $I_o = 1 \rightarrow 300\text{mA}$ )**

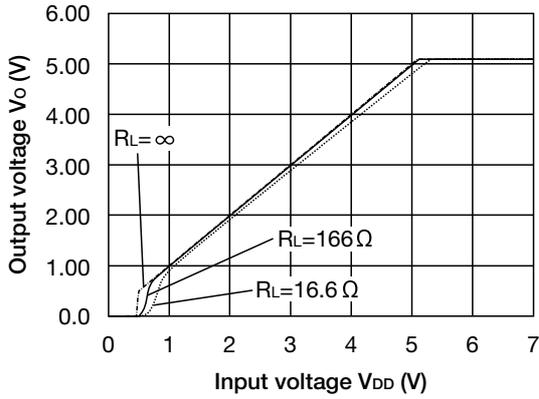


**ESR Stable area**

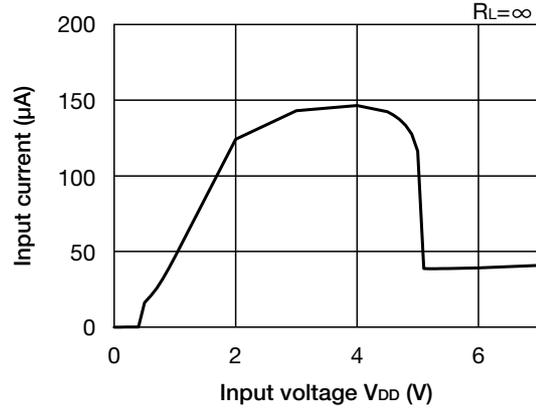


**Characteristics (Vo=5.0V)** (Except where noted otherwise  $V_{DD}=V_{OUT} (typ.) +1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$ )

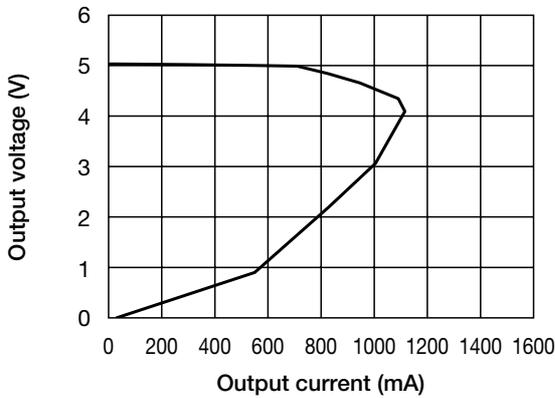
**Output - Input voltage**



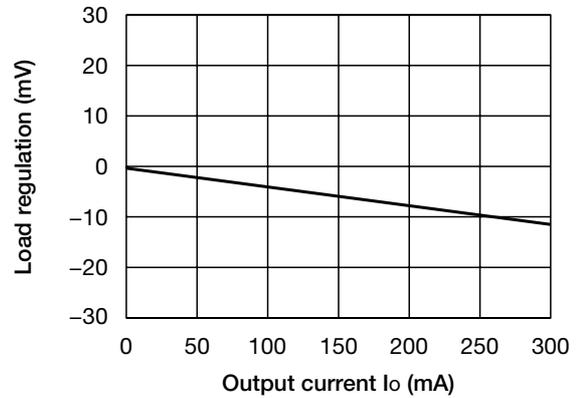
**Input current - Input voltage**



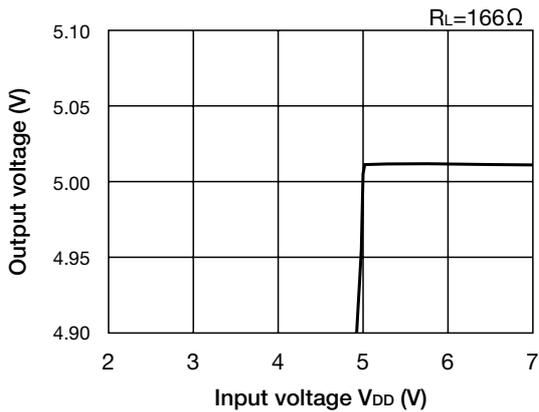
**Output voltage - Output current**



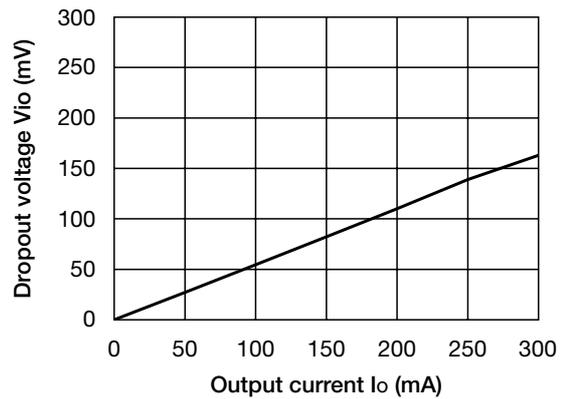
**Load regulation**



**Line regulation**

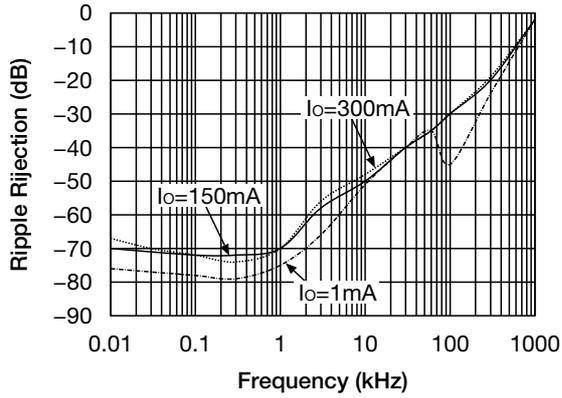


**Dropout voltage**

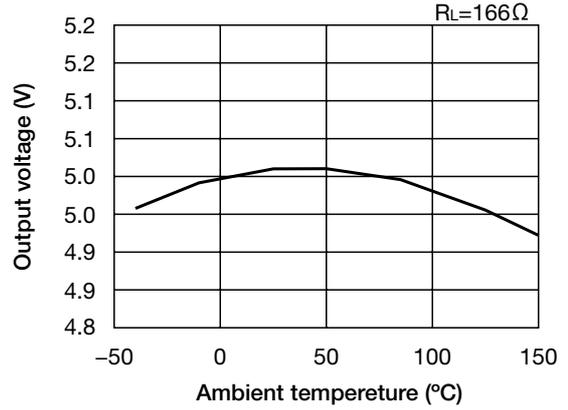


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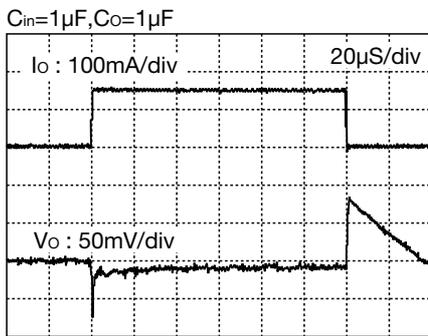
**Ripple Rejection**



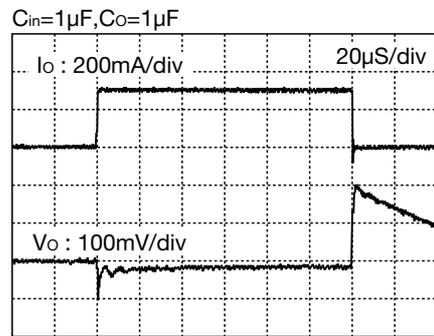
**Output voltage - Ambient temperature**



**Load transient response ( $I_o = 1 \rightarrow 150\text{mA}$ )**



**Load transient response ( $I_o = 1 \rightarrow 300\text{mA}$ )**



**ESR Stable area**

