500mA Regulator IC
Monolithic IC MM3413

Outline

This IC is the series regulator that has been developed to be the best choice for stationary as well as mobile equipment in which power consumption shall be reduced when the power is off or the equipment is in its standby mode. The regulator can output the maximum current of 500mA.
This product has a chip enable function to allow further reduction of consumption current.

Features

1. No load input current : 45μA typ.
2. Input current (OFF) : 0.1μA typ.
3. High ripple rejection : 70dB / 1kHz
4. Output capacitor : Compatible with 1μF ceramic capacitor
5. Protection circuit : Current limit circuit and thermal shutdown circuit
6. Current limit circuit
7. Thermal shutdown circuit

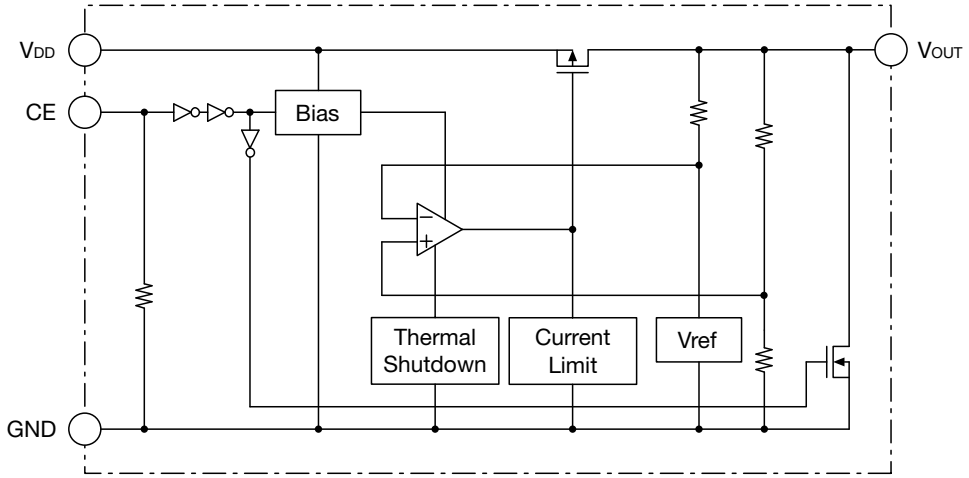
Package

SOT89-5A

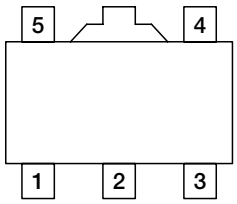
Applications

1. Portable equipments
2. Electric products for home use

Block Diagram



Pin Assignment



SOT89-5A
(TOP VIEW)

1	CE
2	GND
3	NC
4	VOUT
5	VDD

Pin Description

Pin No.	Pin name	Functions	Internal equivalent circuit
1	CE	ON/OFF-Control pin CE: L = OFF, H = ON Connect CE pin with VDD pin, when it is not used.	Please refer to BLOCK DIAGRAM.
2	GND	GND pin	
3	NC	No connection	
4	VOUT	Output pin	
5	VDD	Voltage-Supply pin	

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

Item	Symbol	Ratings	Units
Storage Temperature	T_{stg}	–55~+150	°C
Supply Voltage	V_{DD}	6.5	V
CE Input Voltage	V_{CE}	–0.3~V_{DD}+0.3	V
Output Voltage	V_{OUT}	–0.3~V_{DD}+0.3	V
Output Current	I_{omax}	600	mA
Power Dissipation	Pd	690 (Note1)	mW

Note1 : With the PC Board of glass epoxy. (50 × 50 × 1.6^{t}mm)

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

Item	Symbol	Ratings	Units
Operating Ambient Temperature	T_{jop}	–40~+85	°C
Operating Voltage	V_{op}	2~6	V
Output Current	I_o	0~500	mA

Electrical Characteristics 1 (Except where noted otherwise V_{DD}=V_O(typ.)+1V, V_{CE}=V_{DD}, Ta=25°C)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input Current(OFF)	I_{DD}off	V_{CE}=0V		0.1	1.0	µA
No-Load Input Current	I_{DD}	I_{OUT}=0mA		45	70	µA
Output Voltage	V_{OUT}	I_{OUT}=30mA	×0.99		×1.01	V
Line Regulation	V_{LINE}	V_{DD}=Vo(typ.)+0.5~6V, I_{OUT}=30mA (V_{OUT}≦1.6V, V_{DD}=2.2~6V)		0.02	0.10	%/V
Load Regulation	V_{LOAD}	1mA≦I_{OUT}≦500mA		50	140	mV
Dropout Voltage	Vio	Please refer to another page				V
Ripple Rejection 1 (Note2)	RR1	f=1kHz, Vripple=0.5V, I_{OUT}=30mA (V_{OUT}≦1.7V, V_{DD}=V_{OUT}+1.2V)		70		dB
Ripple Rejection 2 (Note2)	RR2	f=10kHz, Vripple=0.5V, I_{OUT}=30mA (V_{OUT}≦1.7V, V_{DD}=V_{OUT}+1.2V)		50		dB
V_{OUT} Temperature Coefficient (Note2)	$\Delta V_{OUT}/\Delta T$	I_{OUT}=30mA –40°C≦T_{OP}≦+85°C		±100		ppm/°C
Output Noise Voltage (Note2)	Vn	f_{BW}=10~100kHz I_{OUT}=30mA		30		µVrms
Output Short-circuit Current (Note2)	Ilim	V_{OUT}=0V		40		mA
CE Pull-down Resistance	R_{pd}		0.7	2	8	MΩ
CE High Threshold Voltage	V_{CEH}		1.5		V_{DD}	V
CE Low Threshold Voltage	V_{CEL}		0		0.3	V
Output NMOS ON resistance	R_{DON}	V_{CE}=0V V_{DD}=4V(V_{OUT}<3V)		30		Ω

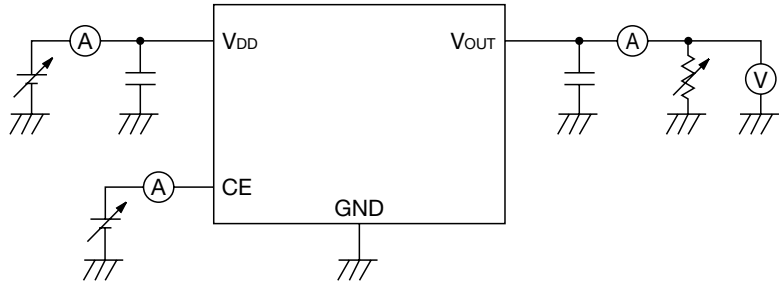
Note2 : The parameter is guaranteed by design.

Electrical Characteristics 2 (Except where noted otherwise $V_{DD}=V_{OUT}$(typ.)+1V, $V_{CE}=V_{DD}$, Ta=25°C)

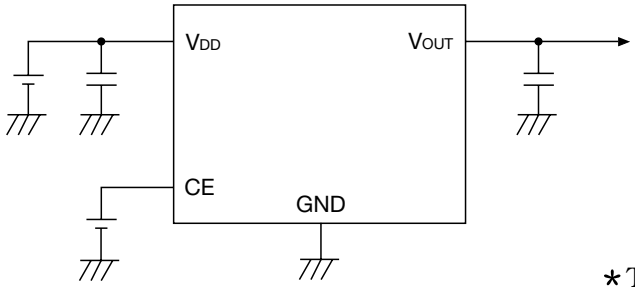
Output Voltage V_O1	Item							
	Output Voltage				Dropout Voltage			
	V_O (V)				Vio (V)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
1.5V	Iout=30mA	1.485	1.5	1.515	(Note3)			
1.6V		1.584	1.6	1.616				
1.7V		1.683	1.7	1.717				
1.8V		1.782	1.8	1.818				
1.9V		1.881	1.9	1.919				
2.0V		1.980	2.0	2.020	2.0V≦V_O≦2.7V I_O=500mA		0.40	0.62
2.1V		2.079	2.1	2.121				
2.2V		2.178	2.2	2.222				
2.3V		2.277	2.3	2.323				
2.4V		2.376	2.4	2.424				
2.5V		2.475	2.5	2.525				
2.57V		2.544	2.57	2.596				
2.6V		2.574	2.6	2.626				
2.7V		2.673	2.7	2.727				
2.8V		2.772	2.8	2.828	2.5V≦V_O≦5.0V I_O=500mA		0.28	0.46
2.9V		2.871	2.9	2.929				
3.0V		2.970	3.0	3.030				
3.1V		3.069	3.1	3.131				
3.2V		3.168	3.2	3.232				
3.3V		3.267	3.3	3.333				
3.4V		3.366	3.4	3.434				
3.5V		3.465	3.5	3.535				
3.6V		3.564	3.6	3.636				
3.7V		3.663	3.7	3.737				
3.8V		3.762	3.8	3.838				
3.9V		3.861	3.9	3.939				
4.0V		3.960	4.0	4.040				
4.1V		4.059	4.1	4.141				
4.2V		4.158	4.2	4.242				
4.3V		4.257	4.3	4.343				
4.4V		4.356	4.4	4.444				
4.5V		4.455	4.5	4.545				
4.6V		4.554	4.6	4.646				
4.7V		4.653	4.7	4.747				
4.8V		4.752	4.8	4.848				
4.9V		4.851	4.9	4.949				
5.0V		4.950	5.0	5.050				

Note3 : The parameter is not guaranteed in the model less than Vo=2.0.

Measuring Circuit



Application Circuit



∗Temperature Characteristics : B

(Reference example of external parts)

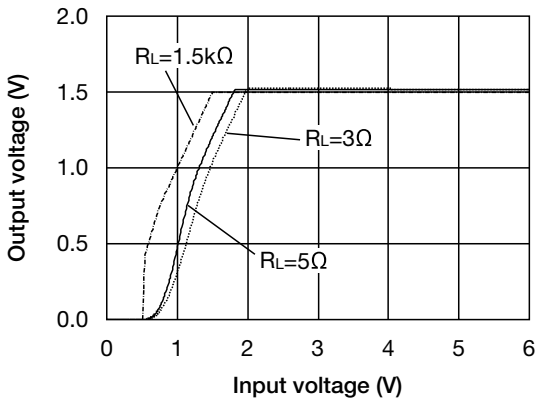
· Output capacitor	Ceramic capacitor 1μF
· Input capacitor	Ceramic capacitor 1μF

· Note

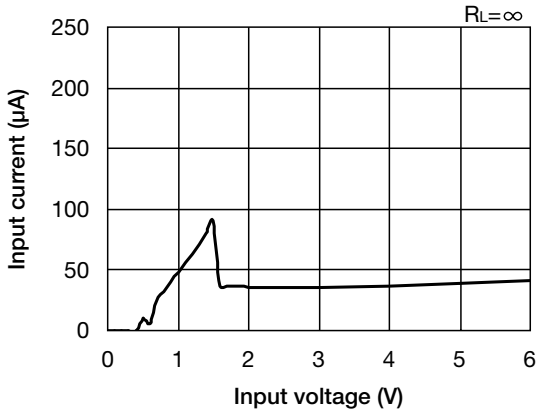
1. The output capacitor is required between output and GND to prevent oscillation.
2. The ESR of capacitor must be defined in ESR stability area.
   It is possible to use a ceramic capacitor without ESR resistance for output.
   The ceramic capacitor must be used more than 1.0μF and B temperature characteristics.
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=1.5V) (Except where noted otherwise V_{DD}=V_{OUT}(typ.)+1V, V_{CE}=V_{DD}, Ta=25°C)

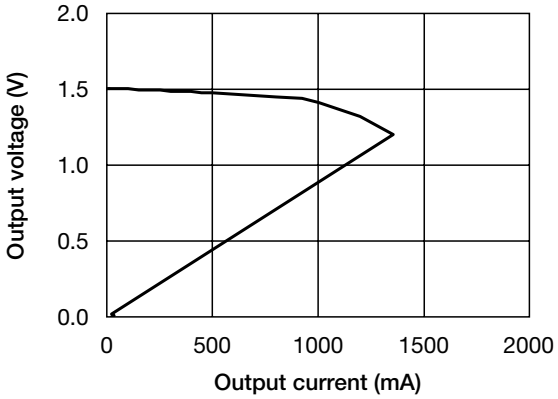
Output - Input voltage



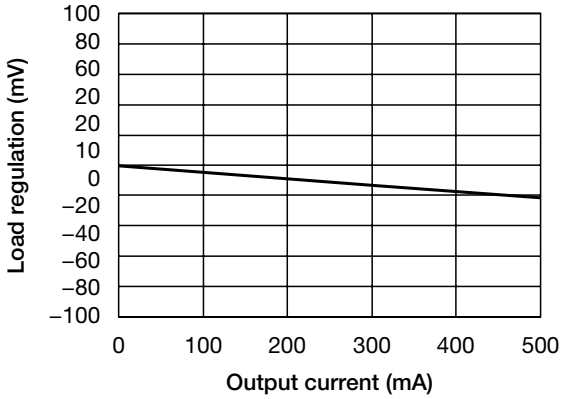
Input current - Input voltage



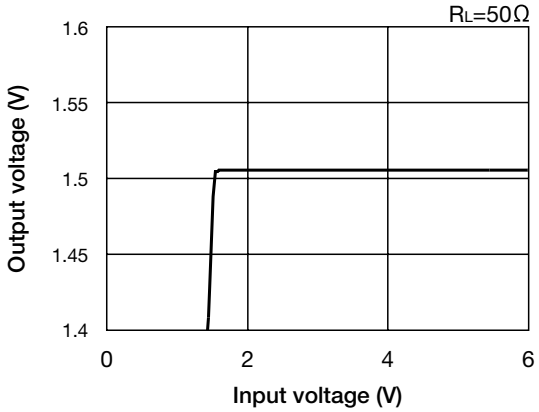
Output voltage - Output current



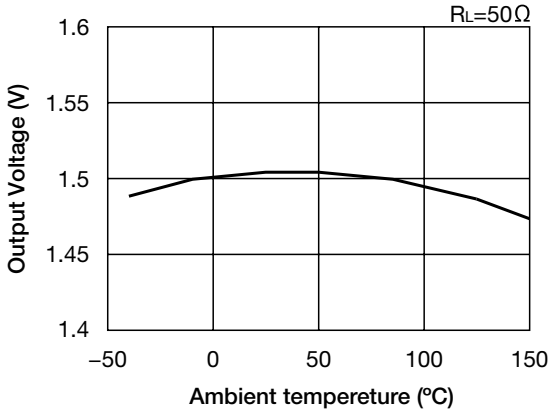
Load regulation



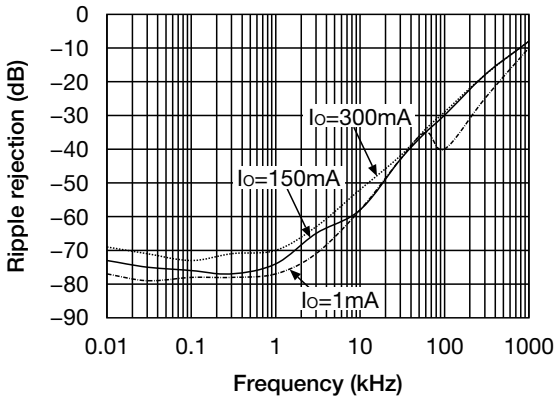
Line regulation



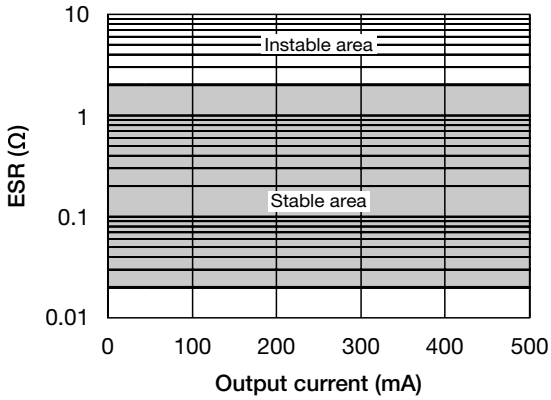
Output voltage - Ambient tempereture



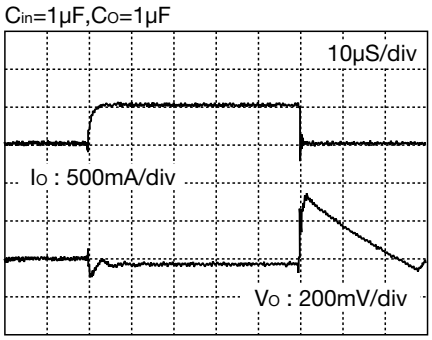
Ripple Rejection



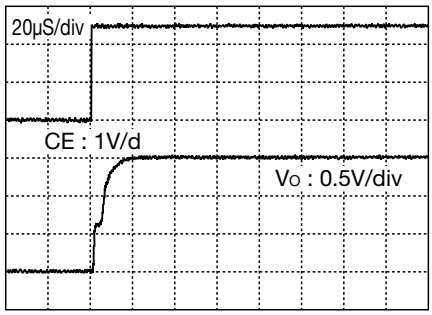
ESR Stable area



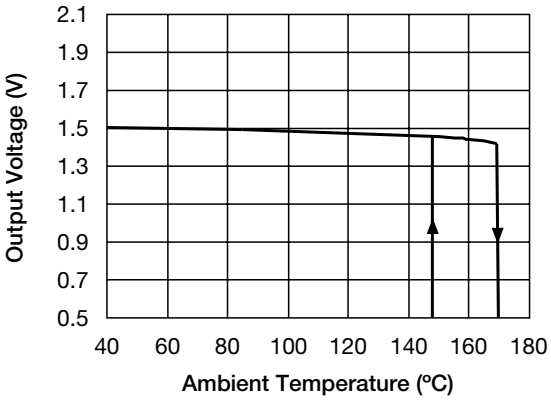
Load transient response (Io=10→500mA)



Turn-On transient response

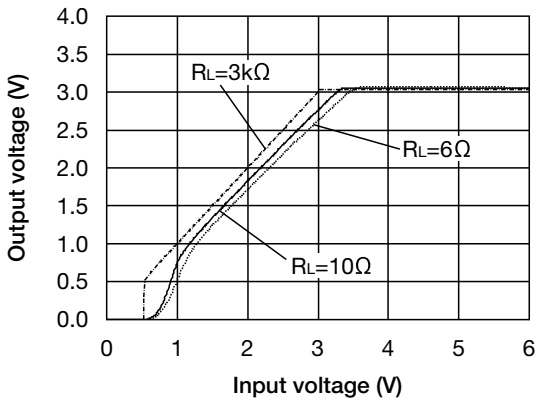


Thermal Shutdown

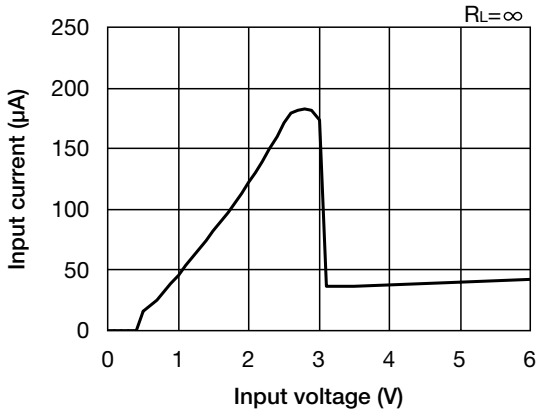


Characteristics (Vo=3.0V) (Except where noted otherwise $V_{DD}=V_{OUT}$(typ.)+1V, $V_{CE}=V_{DD}$, Ta=25°C)

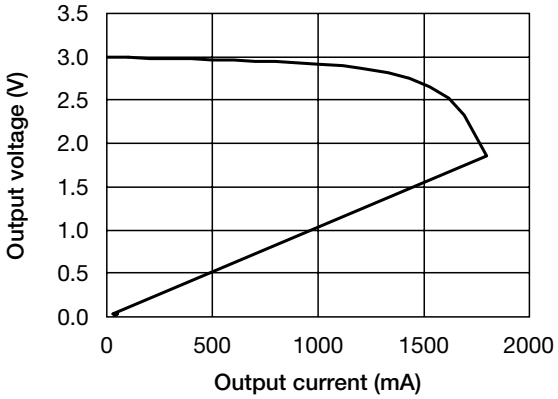
Output - Input voltage



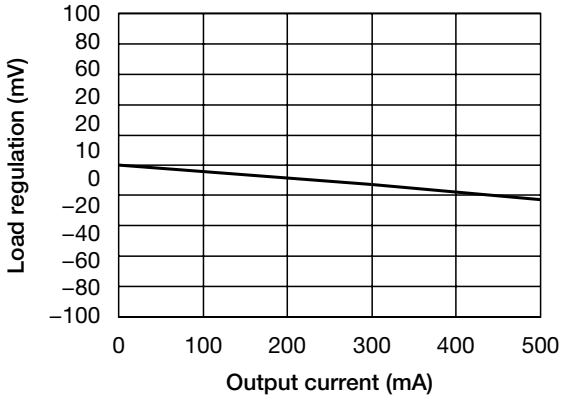
Input current - Input voltage



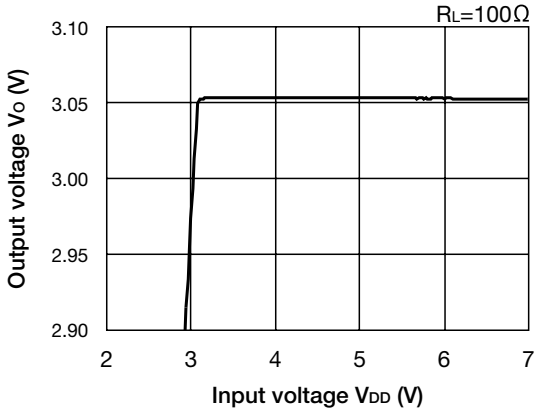
Output voltage - Output current



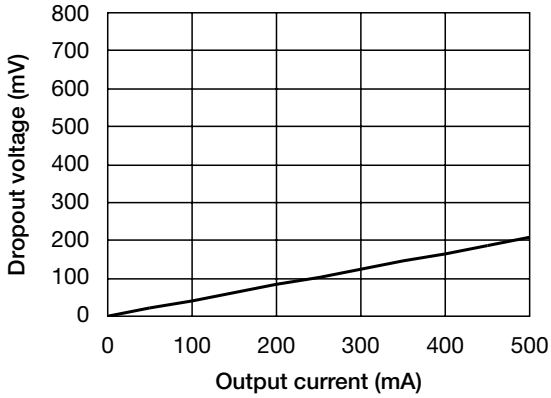
Load regulation



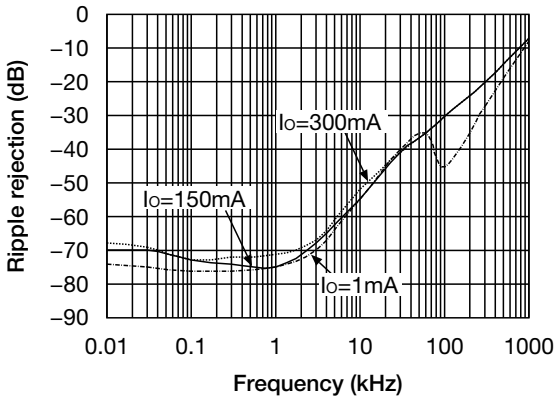
Line regulation



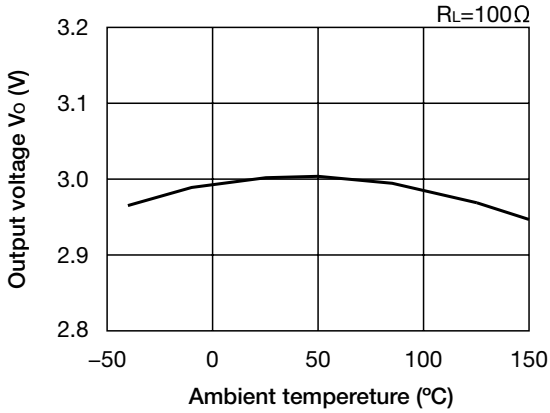
Dropout voltage



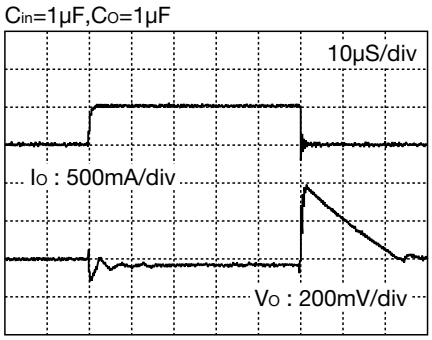
Ripple Rejection



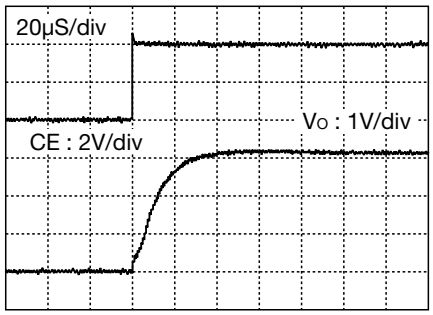
Output voltage - Ambient tempereture



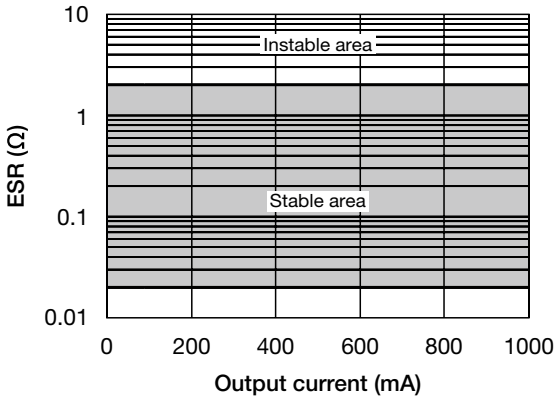
Load transient response (Io=10→500mA)



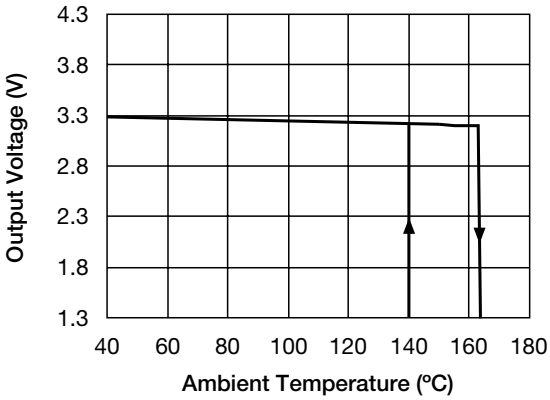
Turn-On transient response



ESR Stable area

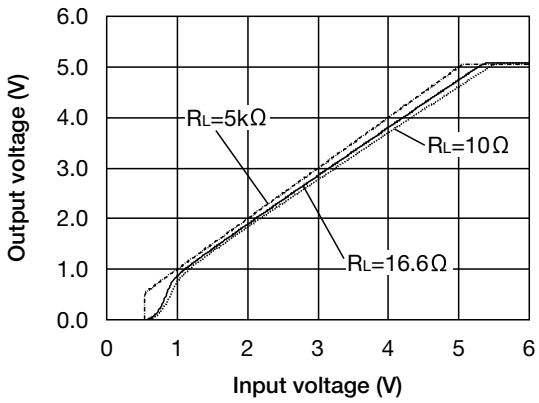


Thermal Shutdown

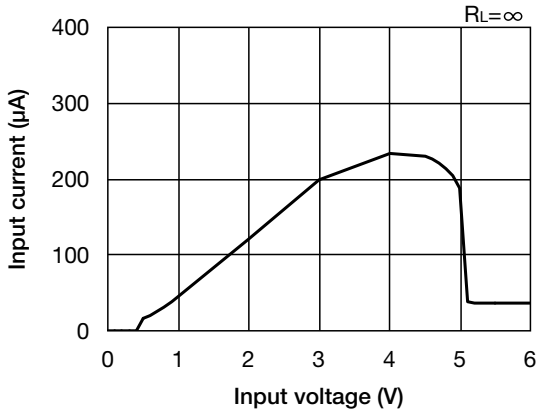


Characteristics (Vo=5.0V) (Except where noted otherwise $V_{DD}=V_{OUT}$(typ.)+1V, $V_{CE}=V_{DD}$, Ta=25°C)

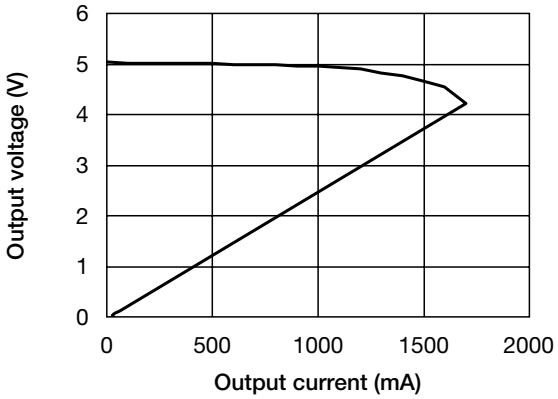
Output - Input voltage



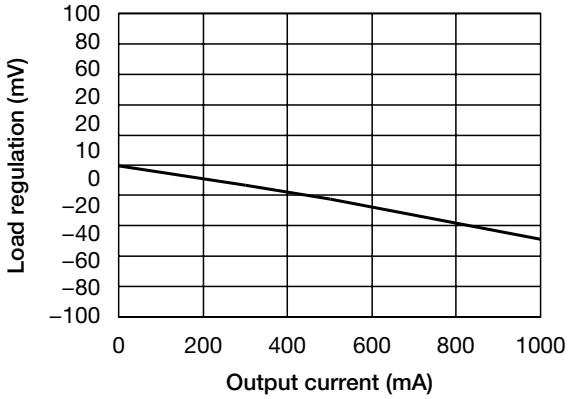
Input current - Input voltage



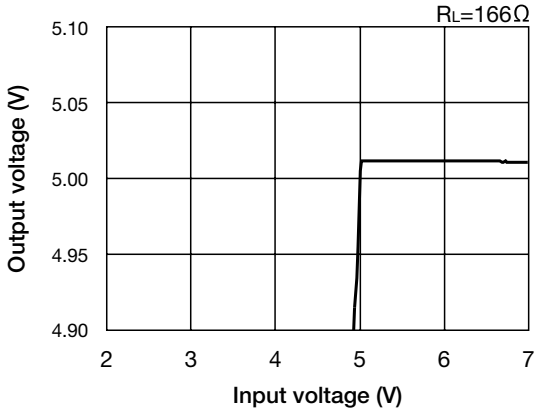
Output voltage - Output current



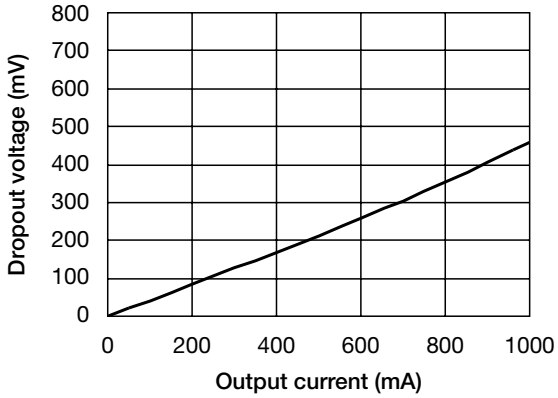
Load regulation



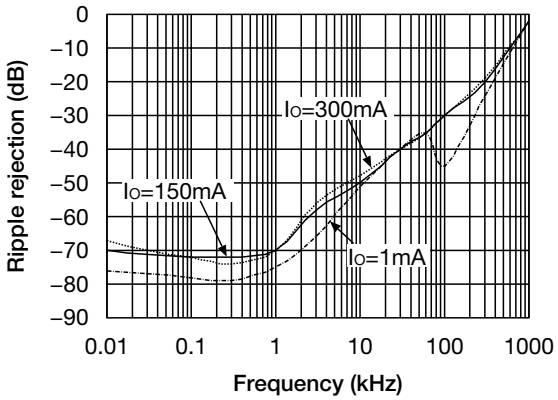
Line regulation



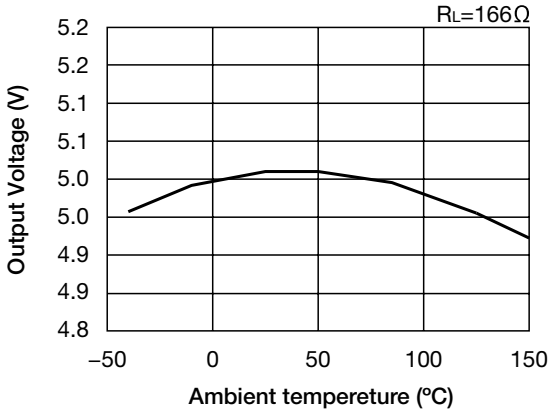
Dropout voltage



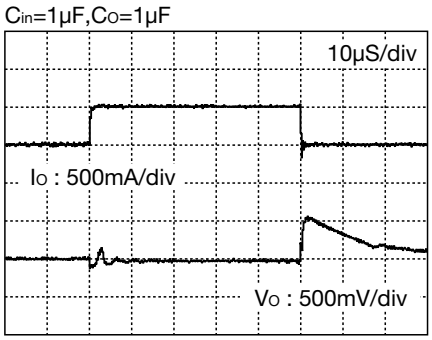
Ripple Rejection



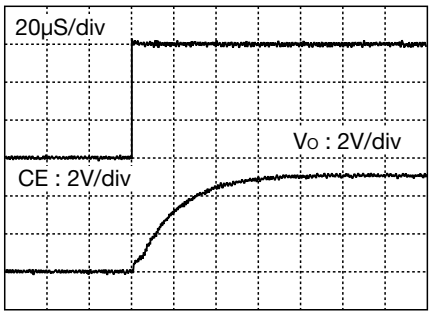
Output voltage - Ambient tempereture



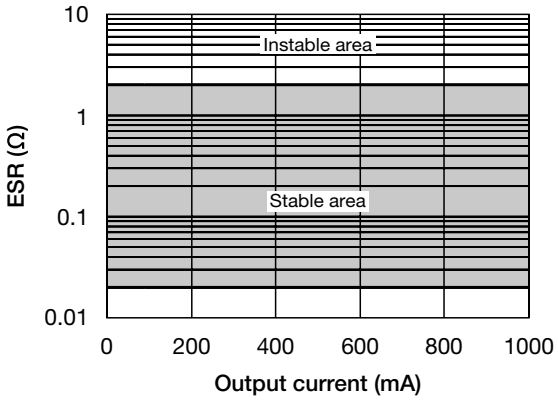
Load transient response (Io=10→500mA)



Turn-On transient response



ESR Stable area



Thermal Shutdown