200mA Ultra-Small Regulator IC
Monolithic IC MM3436

Outline

This IC is a high speed response 200mA regulator IC with low quiescent current and high ripple rejection.
No load input current is 20μA typ.
And ripple rejection is 75dB typ. Dropout voltage is low at 80mV typ., and the output current is 200mA.
Therefore the IC applies to most mobile equipment.
Significant space efficiency realized through its ultra-small package size of 1.0 mm × 1.0 mm.

Features

1.	Output current	200mA
2.	No load input current	20μA typ.
3.	Input current (OFF)	0.1μA max.
4.	Output voltage range	0.8-5.0V
5.	Output voltage accuracy	±1% (±20mV, Vo<2V)
6.	Dropout voltage	80mV typ. (I_O=100mA)
7.	Line regulation	±0.2%/V max.
8.	Load regulation	40mV max.(I_O=0.1~100mA)
9.	Ripple rejection	75dB typ. (f=1kHz)
10.	Output Capacitor	1μF

Package

PLP-4A

Applications

1. Cellular phones
2. Digital still cameras
3. Mobile equipments

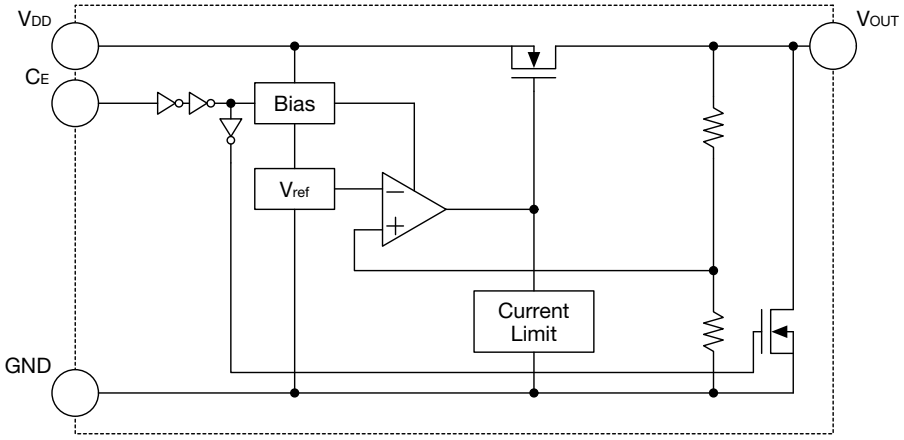
Model Name

M M 3 4 3 6 □ □ □ □ □ E
① ② ③ ④

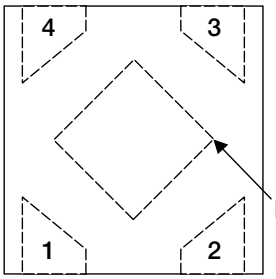
①		②	
Function Type		Voltage Output RANK	
A Z	CE=H-Active, with Discharge Function	08	①="A, B, C" V_O (typ.)=0.8V ①="Z, Y, W" V_O (typ.)=0.85V
B Y	CE=L-Active, with Discharge Function	~	①="A, B, C" V_O (typ.) is 0.1V steps ①="Z, Y, W" V_O (typ.) =0.05V steps
C W	CE=H-Active, without Discharge Function	50	①="A, B, C" V_O (typ.) =5.0V

③		④	
Package		Packing Specifications	
R	PLP-4A (1010 size)	R	R HOUSING (Standard)
		L	L HOUSING

Block Diagram



Pin Assignment



PLP-4A
(TOP VIEW)

1	VOUT
2	GND
3	CE
4	VDD

Pin Description

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

Note1 : Heat Spreader Bottom with GND.

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}	–0.3~+7.0	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}	400	mA
Power Dissipation	Pd	400 (Note2)	mW

Note2 : With the double sided PC Board of glass epoxy. (40 × 40 × 1.6mm copper plane 90%)

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}	1.6~6.5	V
Output Current	I_o	0~200	mA

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

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input Current(OFF)	I_{DDoff}	V_{CE}=0V		0.01	0.1	µA
No-Load Input Current	I_{DD}	I_{OUT}=0mA		20	50	µA
Output Voltage	V_{OUT}	I_{OUT}=10mA (V_{OUT}≧2.0V)	×0.99		×1.01	V
		I_{OUT}=10mA (V_{OUT}≦1.95V)	–0.02		0.02	V
Line Regulation	V_{LINE}	V_O(typ.)+0.5≦V_{DD}≦6.5V V_{OUT}≧1.1V, I_{OUT}=10mA		0.01	0.2	%/V
		1.6V≦V_{DD}≦6.5V V_{OUT}≦1.05V, I_{OUT}=10mA				
Load Regulation	V_{LOAD}	0.1mA≦I_{OUT}≦100mA		10	40	mV
Dropout Voltage	V_{io}	Please refer to another page				V
Ripple Rejection (Note3)	RR	f=1kHz, Vripple=0.5V, I_{OUT}=30mA V_{OUT}≧0.85V		75		dB
		f=1kHz, Vripple=0.5V, I_{OUT}=30mA V_{OUT}=0.8V				
V_{OUT} Temperature Coefficient (Note3)	$\Delta V_{OUT}/\Delta T$	I_{OUT}=30mA, –40≦T_{op}≦+85°C		±50		ppm/°C
Output Current Limit	I_{lim}		200	250		mA
Output Short-Circuit Current	I_{short}	V_{OUT}=0V		30		mA
CE High Threshold Voltage	V_{CEH}		1.2		6.0	V
CE Low Threshold Voltage	V_{CEL}				0.3	V
CE High Threshold Current	I_{CEH}		–0.1		0.1	µA
CE Low Threshold Current	I_{CEL}		–0.1		0.1	µA
CL Discharge Resistance	Rdisc			780		Ω

Note3 : The parameter is guaranteed by design.

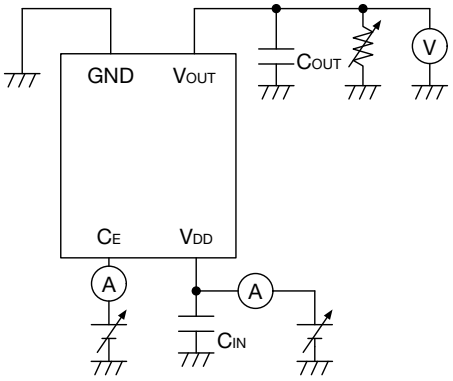
Electrical Characteristics 2 (Except where noted otherwise V_{DD}=V_{OUT}(typ.)+1V, V_{CE}=V_{DD}, Ta=25°C)

Model No.	Item							
	Output Voltage				Dropout Voltage			
	VOUT (V)				Vio (mV)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
MM3436A08	Iout=10mA	0.780	0.800	0.820	I_{OUT}=100mA Vout≦1.5V (Note4)		500	850
MM3436Z08		0.830	0.850	0.870				
MM3436A09		0.880	0.900	0.920			410	750
MM3436Z09		0.930	0.950	0.970				
MM3436A10		0.980	1.000	1.020			330	650
MM3436Z10		1.030	1.050	1.070				
MM3436A11		1.080	1.100	1.120				
MM3436Z11		1.130	1.150	1.170				
MM3436A12		1.180	1.200	1.220			230	380
MM3436Z12		1.230	1.250	1.270				
MM3436A13		1.280	1.300	1.320				
MM3436Z13		1.330	1.350	1.370				
MM3436A14		1.380	1.400	1.420			200	360
MM3436Z14		1.430	1.450	1.470				
MM3436A15		1.480	1.500	1.520	I_{OUT}=100mA Vout≧1.5V V_{DD}=V_{OUT} (typ.) −0.2V		180	290
MM3436Z15		1.530	1.550	1.570				
MM3436A16		1.580	1.600	1.620			160	250
MM3436Z16		1.630	1.650	1.670				
MM3436A17		1.680	1.700	1.720				
MM3436Z17		1.730	1.750	1.770				
MM3436A18		1.780	1.800	1.820			125	210
MM3436Z18		1.830	1.850	1.870				
MM3436A19		1.880	1.900	1.920				
MM3436Z19		1.930	1.950	1.970				
MM3436A20		1.980	2.000	2.020			115	195
MM3436Z20		2.030	2.050	2.071				
MM3436A21		2.079	2.100	2.121				
MM3436Z21		2.129	2.150	2.172				
MM3436A22		2.178	2.200	2.222				
MM3436Z22		2.228	2.250	2.273				
MM3436A23		2.277	2.300	2.323				
MM3436Z23		2.327	2.350	2.374				
MM3436A24		2.376	2.400	2.424				
MM3436Z24		2.426	2.450	2.475				
MM3436A25		2.475	2.500	2.525			95	170
MM3436Z25		2.525	2.550	2.576				
MM3436A26		2.574	2.600	2.626				
MM3436Z26		2.624	2.650	2.677				
MM3436A27		2.673	2.700	2.727				
MM3436Z27		2.723	2.750	2.778				
MM3436A28		2.772	2.800	2.828				
MM3436Z28		2.822	2.850	2.879				
MM3436A29		2.871	2.900	2.929				
MM3436Z29		2.921	2.950	2.980				

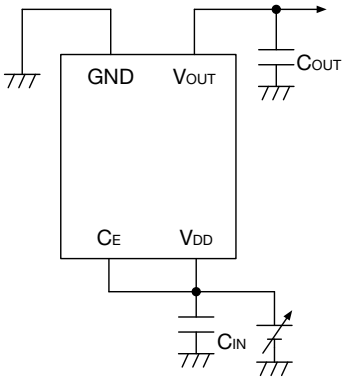
Note4 : Dropout voltage MAX value in the input and it is confirmed that there is no output abnormal voltage impression the load 100mA in the model less than Vout=1.5V.

Model No.	Item							
	Output Voltage				Dropout Voltage			
	VOUT (V)				Vio (mV)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
MM3436A30	Iout=10mA	2.970	3.000	3.030	I_{OUT}=100mA Vout≧1.5V V_{DD}=V_{OUT} (typ.) −0.2V		80	140
MM3436Z30		3.020	3.050	3.081				
MM3436A31		3.069	3.100	3.131				
MM3436Z31		3.119	3.150	3.182				
MM3436A32		3.168	3.200	3.232				
MM3436Z32		3.218	3.250	3.283				
MM3436A33		3.267	3.300	3.333				
MM3436Z33		3.317	3.350	3.384				
MM3436A34		3.366	3.400	3.434				
MM3436Z34		3.416	3.450	3.485				
MM3436A35		3.465	3.500	3.535				
MM3436Z35		3.515	3.550	3.586				
MM3436A36		3.564	3.600	3.636				
MM3436Z36		3.614	3.650	3.687				
MM3436A37		3.663	3.700	3.737				
MM3436Z37		3.713	3.750	3.788				
MM3436A38		3.762	3.800	3.838				
MM3436Z38		3.812	3.850	3.889				
MM3436A39		3.861	3.900	3.939				
MM3436Z39		3.911	3.950	3.990				
MM3436A40		3.960	4.000	4.040				
MM3436Z40		4.010	4.050	4.091				
MM3436A41		4.059	4.100	4.141				
MM3436Z41		4.109	4.150	4.192				
MM3436A42		4.158	4.200	4.242				
MM3436Z42		4.208	4.250	4.293				
MM3436A43		4.257	4.300	4.343				
MM3436Z43		4.307	4.350	4.394				
MM3436A44		4.356	4.400	4.444				
MM3436Z44		4.405	4.450	4.495				
MM3436A45		4.455	4.500	4.545				
MM3436Z45		4.504	4.550	4.595				
MM3436A46		4.554	4.600	4.646				
MM3436Z46		4.603	4.650	4.696				
MM3436A47		4.653	4.700	4.747				
MM3436Z47		4.702	4.750	4.797				
MM3436A48		4.752	4.800	4.848				
MM3436Z48		4.801	4.850	4.898				
MM3436A49		4.851	4.900	4.949				
MM3436Z49		4.900	4.950	4.999				
MM3436A50		4.950	5.000	5.050				

Measuring Circuit



Application Circuit



∗Temperature Characteristics : B Type

(reference example of external parts)

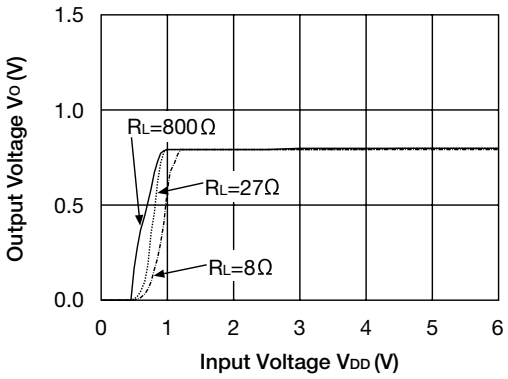
· Output capacitor	Ceramic capacitor 1.0µF
· Input Capacitor	Ceramic capacitor 1.0µF

· Note

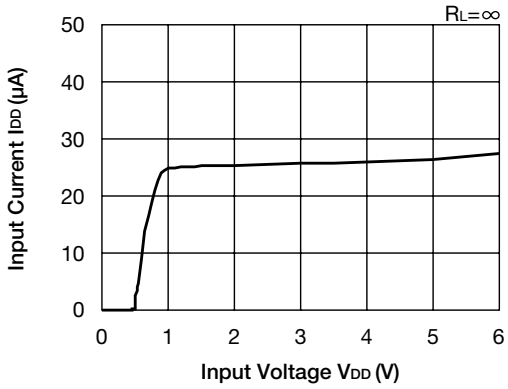
1. The output capacitor is required between output and GND to prevent oscillation.
2. The ESR of capacitor must be defined in ESR stability area.
   It is possible to use a ceramic capacitor without ESR resistance for output.
   The ceramic capacitor must be used more than 1.0µF and B temperature characteristics.
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=0.8V) (Except where noted otherwise $V_{DD}=V_{OUT}$(typ.)+1V, $V_{CE}=V_{DD}$, Ta=25°C)

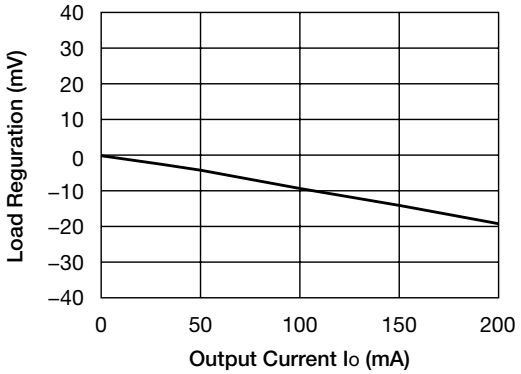
Output – Input voltage



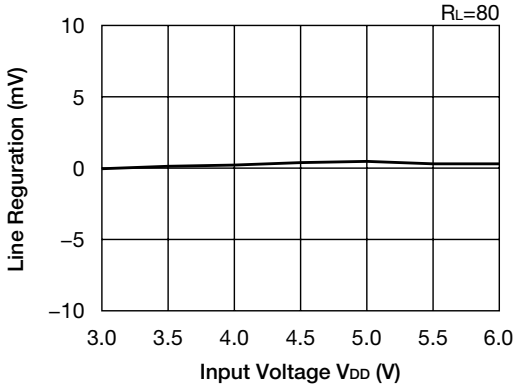
Input current – Input voltage



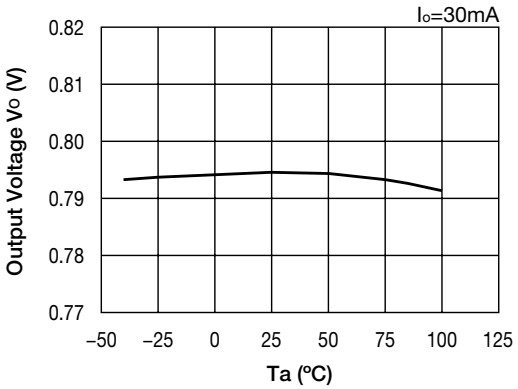
Load regulation



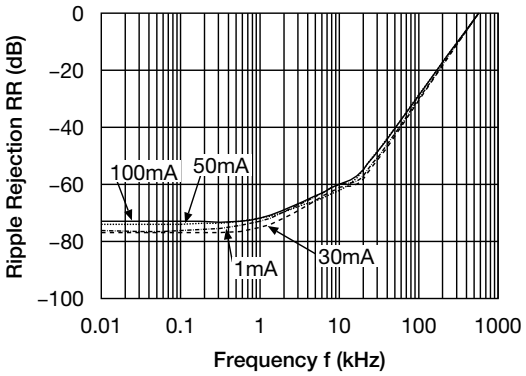
Line regulation



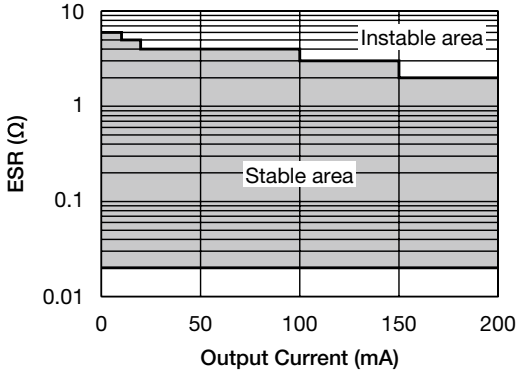
V_{OUT} temperature coefficient



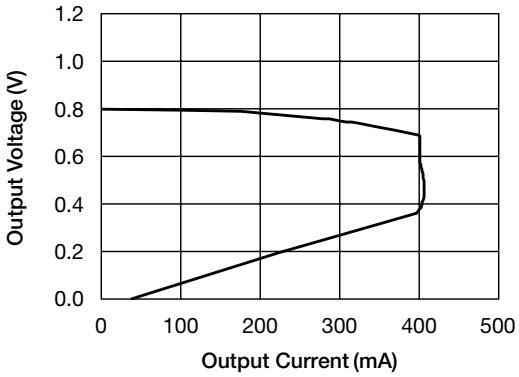
Ripple Rejection



ESR Stable area

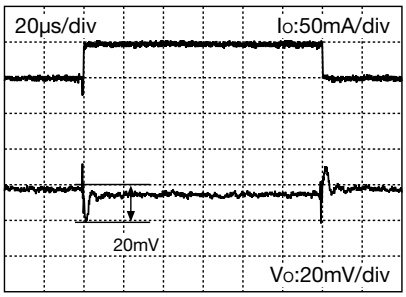


Current limit

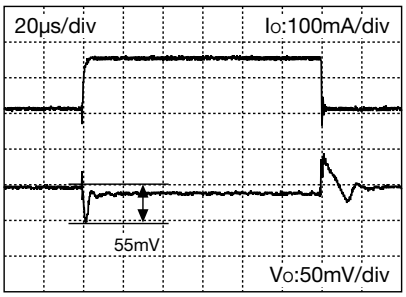


Load transient response (V_{DD}=Vo+1V, V_{CE}=V_{DD}, C_{in}=C_O=1µF)

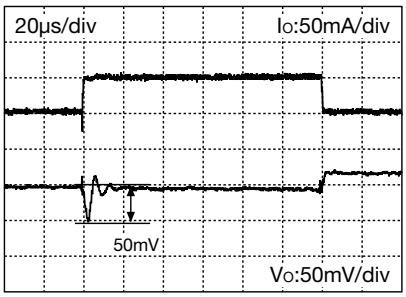
I_O:50mA⇔100mA



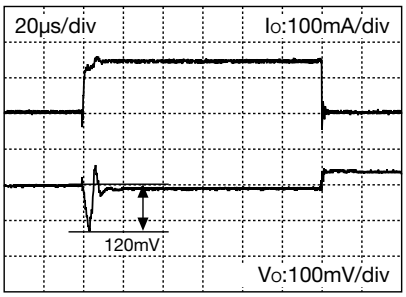
I_O:10mA ⇔150mA



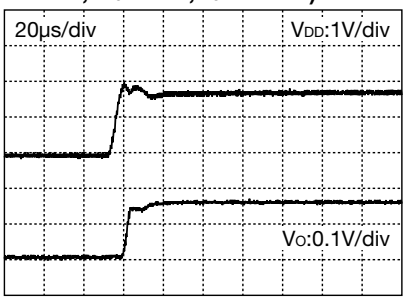
I_O:0.1mA ⇔ 50mA



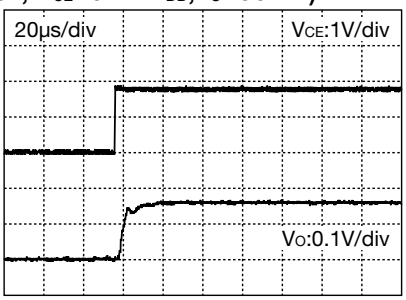
I_O:0.1mA⇔150mA



Input rise characteristics (V_{DD}=0V→1.8V, V_{CE}=V_{DD}, I_O=30mA)

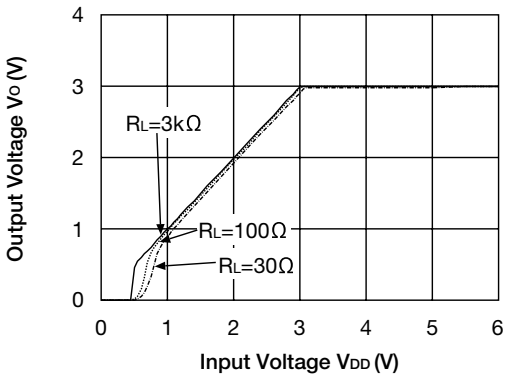


CE rise characteristics (V_{DD}=1.8V, V_{CE}=0V→V_{DD}, I_O=30mA)

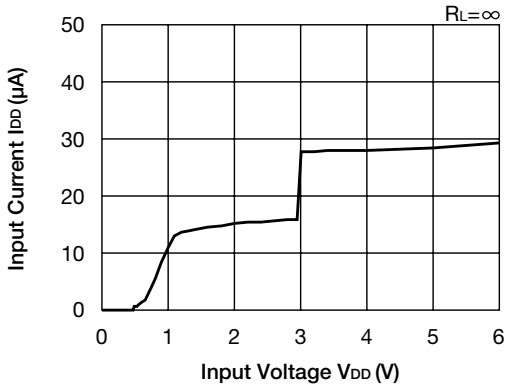


Characteristics (Vo=3.0V) (Except where noted otherwise $V_{DD}=V_{OUT}$(typ.)+1V, $V_{CE}=V_{DD}$, Ta=25°C)

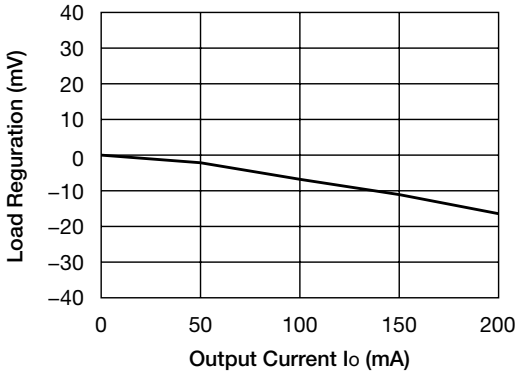
Output – Input voltage



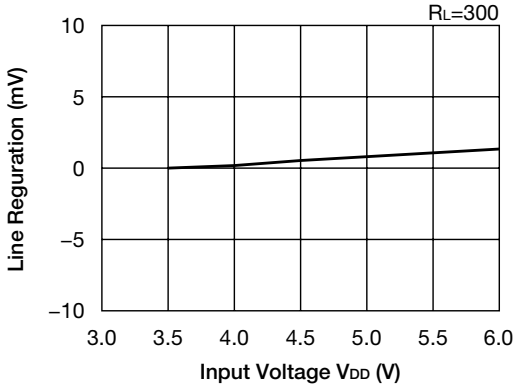
Input current – Input voltage



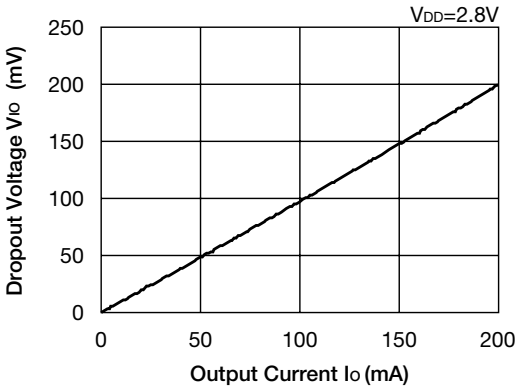
Load regulation



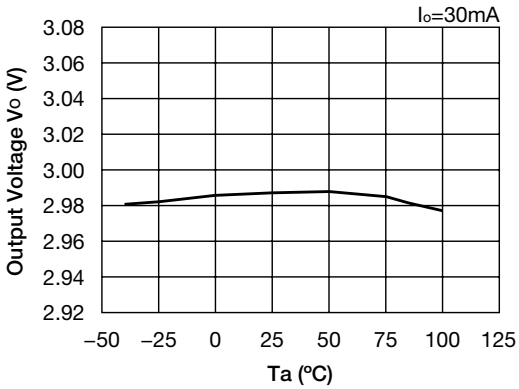
Line regulation



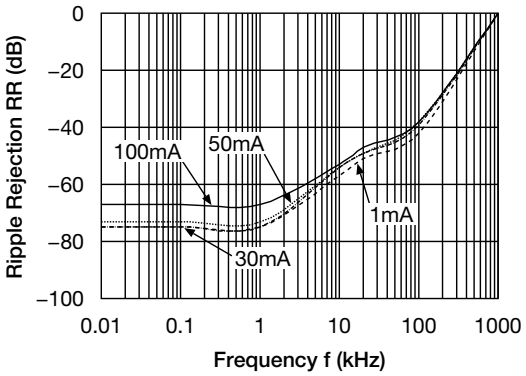
Dropout voltage



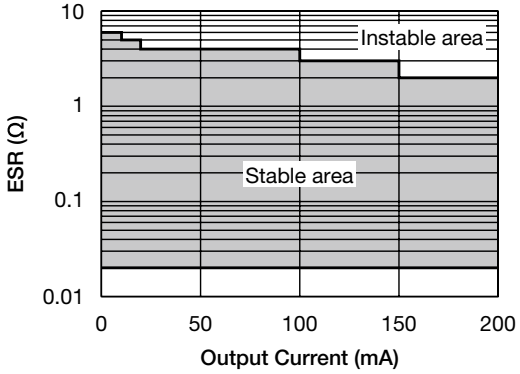
VOUT temperature coefficient



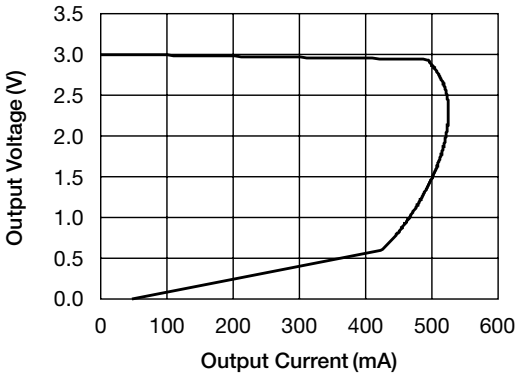
Ripple Rejection



ESR Stable area

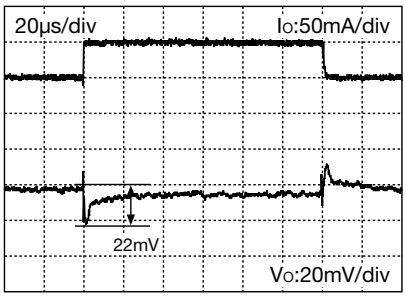


Current limit

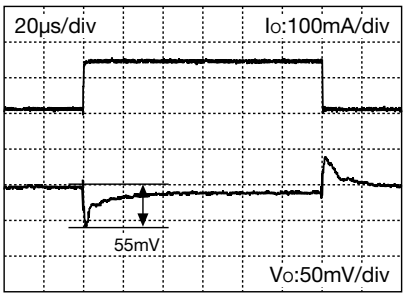


Load transient response (V_{DD}=Vo+1V, V_{CE}=V_{DD}, C_{in}=C_O=1μF)

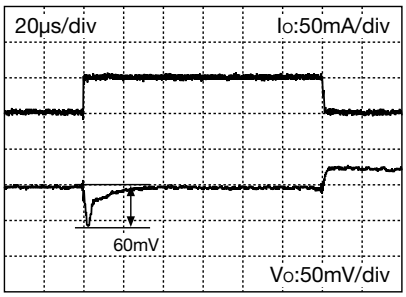
Io:50mA⇔100mA



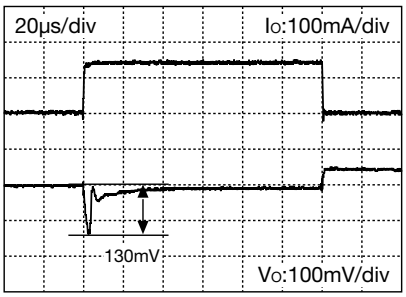
Io:10mA⇔150mA



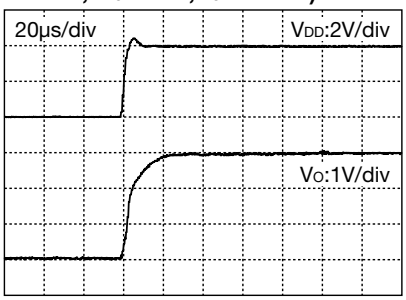
Io:0.1mA⇔50mA



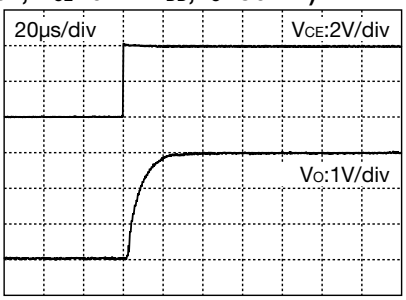
Io:0.1mA⇔150mA



Input rise characteristics
(V_{DD}=0V→4.0V, V_{CE}=V_{DD}, I_O=30mA)

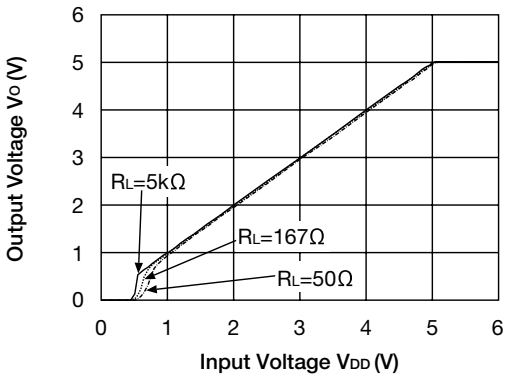


CE rise characteristics
(V_{DD}=4.0V, V_{CE}=0V→V_{DD}, I_O=30mA)

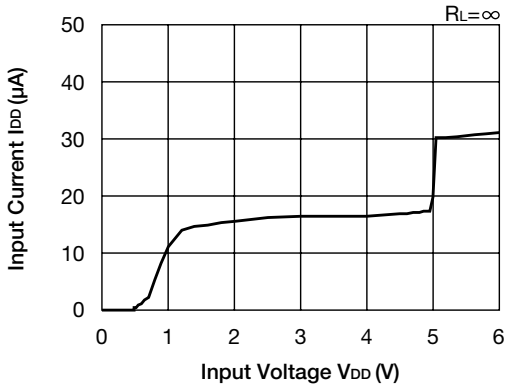


Characteristics (Vo=5.0V) (Except where noted otherwise $V_{DD}=V_{OUT}$(typ.)+1V, $V_{CE}=V_{DD}$, Ta=25°C)

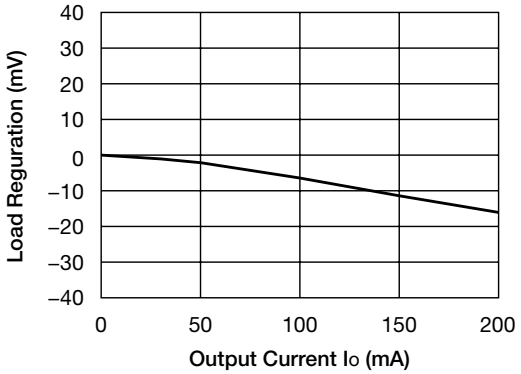
Output – Input voltage



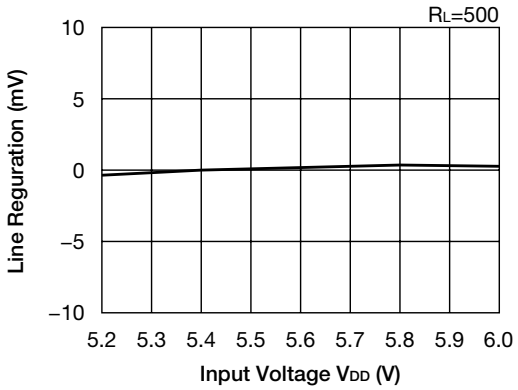
Input current – Input voltage



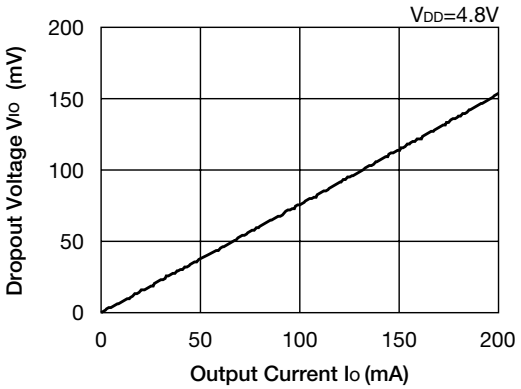
Load regulation



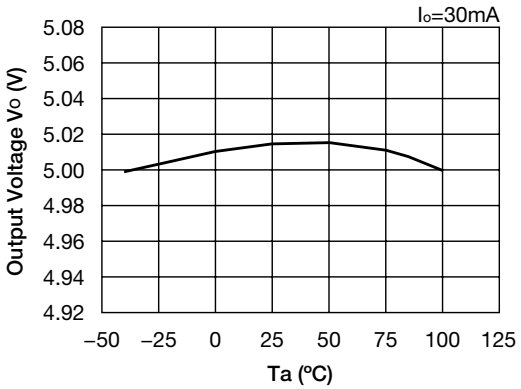
Line regulation



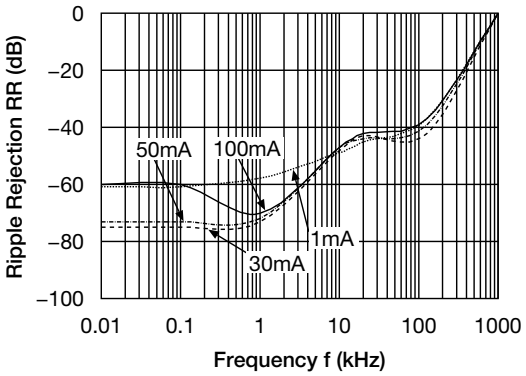
Dropout voltage



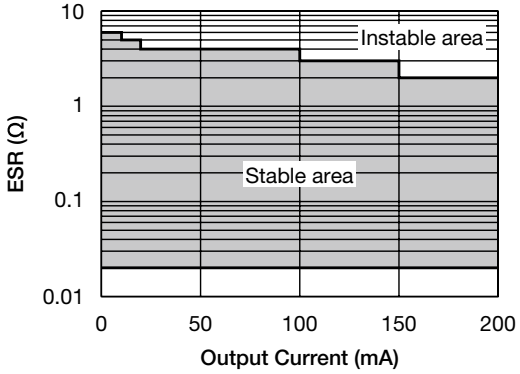
VOUT temperature coefficient



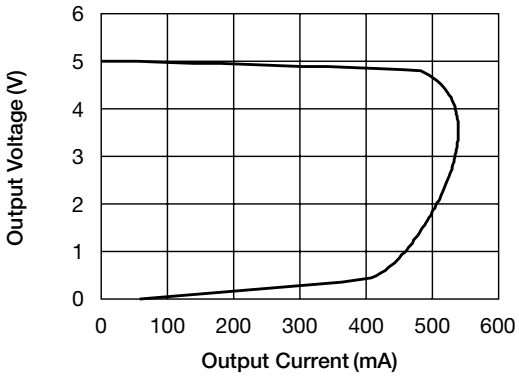
Ripple Rejection



ESR Stable area

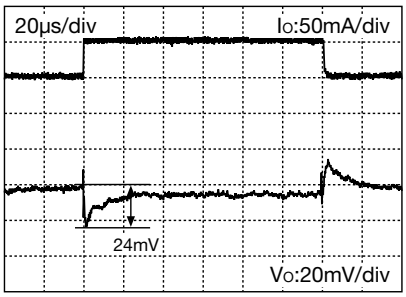


Current limit

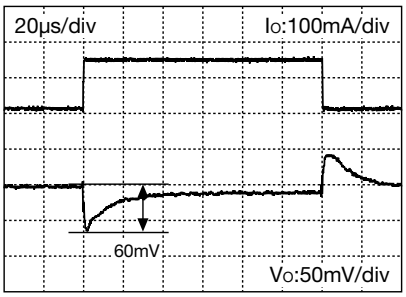


Load transient response (V_{DD}=Vo+1V, V_{CE}=V_{DD}, C_{in}=C_O=1μF)

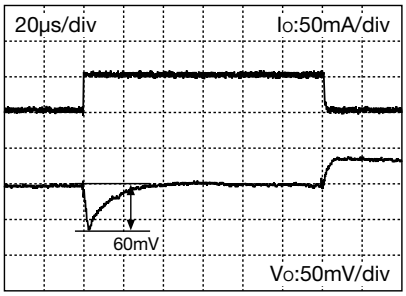
Io:50mA⇔100mA



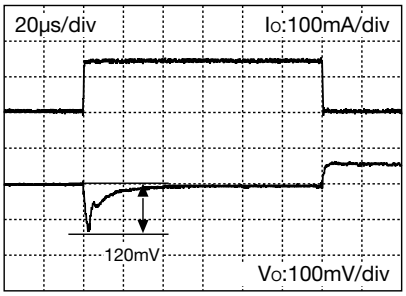
Io:10mA⇔150mA



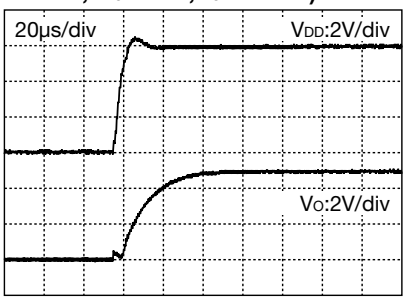
Io:0.1mA⇔50mA



Io:0.1mA⇔150mA



Input rise characteristics
(V_{DD}=0V→6.0V, V_{CE}=V_{DD}, I_O=30mA)



CE rise characteristics
(V_{DD}=6.0V, V_{CE}=0V→V_{DD}, I_O=30mA)