Fast response / 150mA Regulator IC
Monolithic IC MM3416

Outline

This IC is a 150 mA regulator capable of a fast transient response. It makes it possible to have a fast transient response together with an unloaded current consumption of 42μ A typ.
Moreover, through use of an ultra-small package of 1 mm/□, the device makes its contribution to the down-sized specification required in mobile devices.

Features

1. Fast response	Drop of 120 mV on current rise of 0→150mA High ripple rejection ration of 75dB typ.
2. Built in soft-start	Reduced rush current at startup
3. Ultra-small package PLP-4A	Contributes to downsized specification

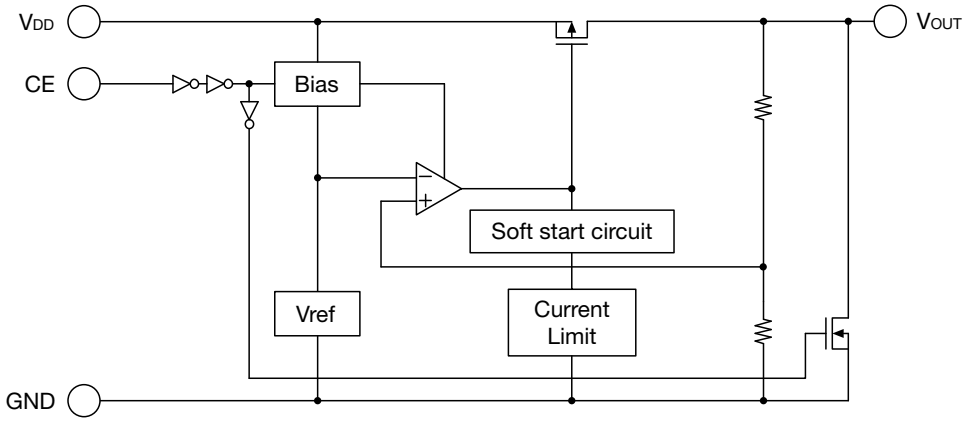
Package

SOT-25A
SC-82ABB
PLP-4A

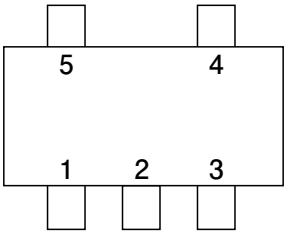
Applications

1. Mobile phones
2. Digital still cameras
3. Camcorders etc.

Block Diagram

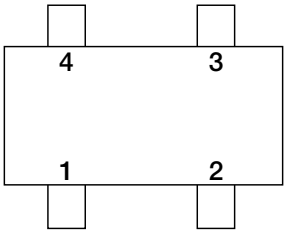


Pin Assignment



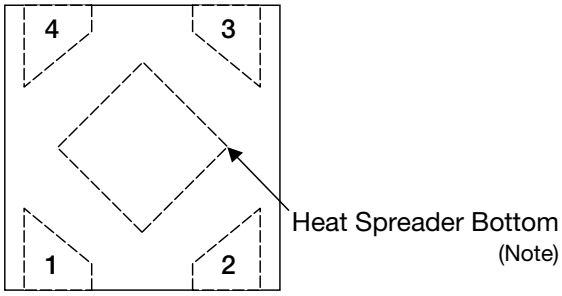
SOT-25A
(TOP VIEW)

1	VDD
2	GND
3	CE
4	NC
5	VOUT



SC-82ABB
(TOP VIEW)

1	CE
2	GND
3	VOUT
4	VDD



PLP-4A
(TOP VIEW)

1	VOUT
2	GND
3	CE
4	VDD

Note : Heat Spreader Bottom with GND

Pin Description

SOT-25A

Pin No.	Pin name	Functions
1	V_{DD}	Voltage-supply pin
2	GND	GND pin
3	CE	ON/OFF-Control pin CE: Low → OUTPUT: OFF CE: High → OUTPUT: ON Connect CE pin with V_{DD} pin, when it is not used.
4	NC	No connection
5	V_{OUT}	Output pin

SC-82ABB

Pin No.	Pin name	Functions
1	CE	ON/OFF-Control pin CE: Low → OUTPUT: OFF CE: High → OUTPUT: ON Connect CE pin with V_{DD} pin, when it is not used.
2	GND	GND pin
3	V_{OUT}	Output pin
4	V_{DD}	Voltage-supply pin

PLP-4A

Pin No.	Pin name	Functions
1	V_{OUT}	Output pin
2	GND	GND pin
3	CE	ON/OFF-Control pin CE: Low → OUTPUT: OFF CE: High → OUTPUT: ON Connect CE pin with V_{DD} pin, when it is not used.
4	V_{DD}	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}	6.5		V
Output Current	I_{OUT}	200		mA
Power Dissipation	Pd	350(Note1)	SOT-25A	mW
		330(Note2)	SC-82ABB	
		400(Note3)	PLP-4A	

Note1 : With the double sided PC Board of glass epoxy (60 × 40 × 1.6^{t}mm)

Note2 : With the double sided PC Board of glass epoxy (100 × 40 × 0.8^{t}mm)

Note3 : With the double sided PC Board of glass epoxy

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_{DDOP}	1.7~5.5	V
Output Current	I_{OUT}	0~150	mA

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

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input Current (OFF)	I_{DDoff}	V_{CE}=0V		0.1	1	µA
No-load Input Current	I_{DD}	I_{OUT}=0mA		42	64	µA
Output Voltage (Note4)	V_{OUT}	I_{OUT}=10mA	×0.99 (-20mV)		×1.01 (20mV)	V
Line Regulation	V_{LINE}	I_{OUT}=1mA V_{OUT}+0.5V≦V_{DD}≦5V		0.05	0.10	%/V
Load Regulation	V_{LOAD}	1mA≦I_{OUT}≦150mA			40	mV
Dropout Voltage (Note4)	Vio	I_{OUT}=150mA				V
Output Short-Circuit Current (Note5)	Ilim	V_{OUT}=0V		50		mA
V_{OUT} Temperature Coefficient (Note5)	$\Delta V_{OUT}/\Delta T_{OP}$	I_{OUT}=10mA –40°C≦T_{OP}≦85°C		±100		ppm/°C
Ripple Rejection (Note5)	RR	Vripple=0.5V, I_{OUT}=30mA f=1kHz		75		dB
Output Noise Voltage (Note5)	Vn	I_{OUT}=30mA f_{BW}=10~100kHz		60		µVrms
CE Pin Current (Note5)	I_{CE}			0.5		µA
CE High Threshold Voltage	V_{CEH}		1.5		V_{DD}	V
CE Low Threshold Voltage	V_{CEL}		0		0.3	V
CE pin Transient Response (Note5)	t_{CE}	I_{OUT}=50mA		30		µs
Output NMOS ON Resistance (Note5)	R_{DON}	V_{CE}=0V, V_{DD}=4V		20		Ω

Note4 : Please refer to another page.

Note5 : The parameter is guaranteed by design.

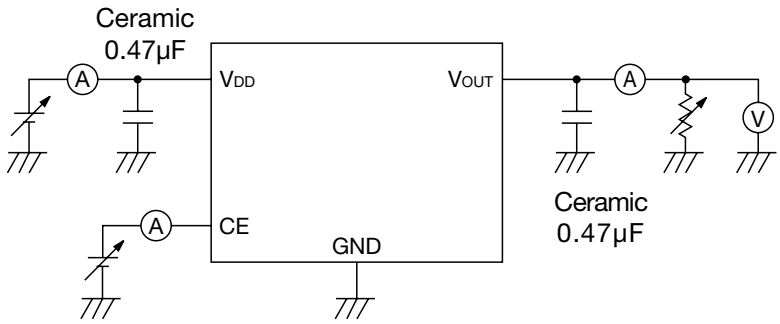
Electrical Characteristics 2 (Except where noted otherwise Ta=25°C, V_{DD}=V_{OUT} (typ.)+1V, V_{CE}=V_{DD})

Model No.	Item							
	Output Voltage				Dropout Voltage (Note6)			
	V_{OUT} (V)				Vio (V)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
MM3416A10	I_{OUT}=10mA	0.980	1.000	1.020	I_{OUT}=150mA 1.0V≦V_{OUT}<1.3V (Note6)		0.63	0.70
MM3416Z10		1.030	1.050	1.070				
MM3416A11		1.080	1.100	1.120				
MM3416Z11		1.130	1.150	1.170				
MM3416A12		1.180	1.200	1.220				
MM3416Z12		1.230	1.250	1.270				
MM3416A13		1.280	1.300	1.320	I_{OUT}=150mA 1.3V≦V_{OUT}<1.6V (Note6)		0.58	0.65
MM3416Z13		1.330	1.350	1.370				
MM3416A14		1.380	1.400	1.420				
MM3416Z14		1.430	1.450	1.470				
MM3416A15		1.485	1.500	1.515				
MM3416Z15		1.535	1.550	1.566				
MM3416A16		1.584	1.600	1.616	I_{OUT}=150mA 1.6V≦V_{OUT}<1.9V V_{DD}=V_{OUT}(typ)−0.2V		0.53	0.60
MM3416Z16		1.634	1.650	1.667				
MM3416A17		1.683	1.700	1.717				
MM3416Z17		1.733	1.750	1.768				
MM3416A18		1.782	1.800	1.818				
MM3416Z18		1.832	1.850	1.869				
MM3416A19		1.881	1.900	1.919	I_{OUT}=150mA 1.9V≦V_{OUT}<2.1V V_{DD}=V_{OUT}(typ)−0.2V		0.41	0.48
MM3416Z19		1.931	1.950	1.970				
MM3416A20		1.980	2.000	2.020				
MM3416Z20		2.030	2.050	2.071				
MM3416A21		2.079	2.100	2.121	I_{OUT}=150mA 2.1V≦V_{OUT}<2.6V V_{DD}=V_{OUT}(typ)−0.2V		0.28	0.36
MM3416Z21		2.129	2.150	2.172				
MM3416A22		2.178	2.200	2.222				
MM3416Z22		2.228	2.250	2.273				
MM3416A23		2.277	2.300	2.323				
MM3416Z23		2.327	2.350	2.374				
MM3416A24		2.376	2.400	2.424				
MM3416Z24		2.426	2.450	2.475				
MM3416A25		2.475	2.500	2.525				
MM3416Z25		2.525	2.550	2.576				
MM3416A26		2.574	2.600	2.626	I_{OUT}=150mA 2.6V≦V_{OUT}<3.1V V_{DD}=V_{OUT}(typ)−0.2V		0.22	0.30
MM3416Z26		2.624	2.650	2.677				
MM3416A27		2.673	2.700	2.727				
MM3416Z27		2.723	2.750	2.778				
MM3416A28		2.772	2.800	2.828				
MM3416Z28		2.822	2.850	2.879				
MM3416A29		2.871	2.900	2.929				
MM3416Z29		2.921	2.950	2.980				
MM3416A30		2.970	3.000	3.030				
MM3416Z30		3.020	3.050	3.081				

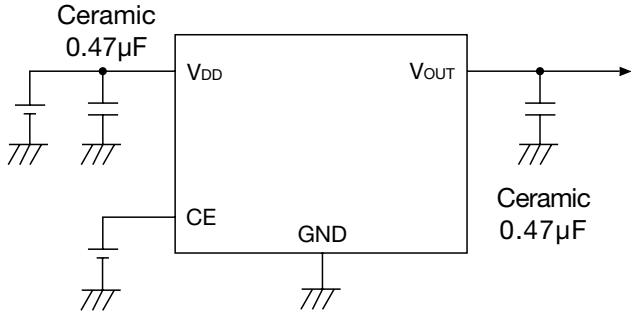
Note6 : Dropout voltage MAX value in the input and it is confirmed that there is no output abnormal voltage impression the load 150mA in the model V_{OUT}<1.6V.

Model No.	Item							
	Output Voltage				Dropout Voltage			
	V_{OUT} (V)				Vio (V)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
MM3416A31	I_{OUT}=10mA	3.069	3.100	3.131	I_{OUT}=150mA 3.1V≦V_{OUT} V_{DD}=V_{OUT}(typ)−0.2V		0.21	0.27
MM3416Z31		3.119	3.150	3.182				
MM3416A32		3.168	3.200	3.232				
MM3416Z32		3.218	3.250	3.283				
MM3416A33		3.267	3.300	3.333				
MM3416Z33		3.317	3.350	3.384				
MM3416A34		3.366	3.400	3.434				
MM3416Z34		3.416	3.450	3.485				
MM3416A35		3.465	3.500	3.535				
MM3416Z35		3.515	3.550	3.586				
MM3416A36		3.564	3.600	3.636				
MM3416Z36		3.614	3.650	3.687				
MM3416A37		3.663	3.700	3.737				
MM3416Z37		3.713	3.750	3.788				
MM3416A38		3.762	3.800	3.838				
MM3416Z38		3.812	3.850	3.889				
MM3416A39		3.861	3.900	3.939				
MM3416Z39		3.911	3.950	3.990				
MM3416A40		3.960	4.000	4.040				

Measuring Circuit



Application Circuit



∗Temperature Characteristics : B

(reference example of external parts)

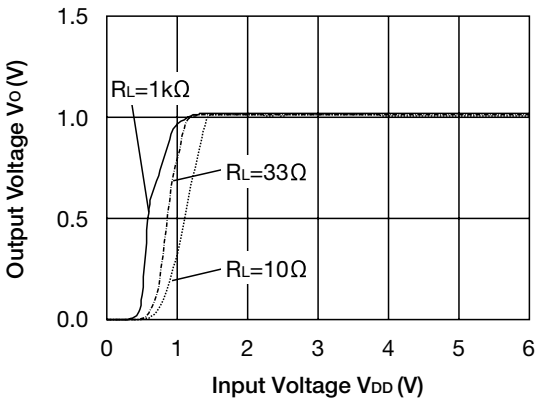
· Output capacitor	Ceramic capacitor 0.47µF
· Input Capacitor	Ceramic capacitor 0.47µF

· Note

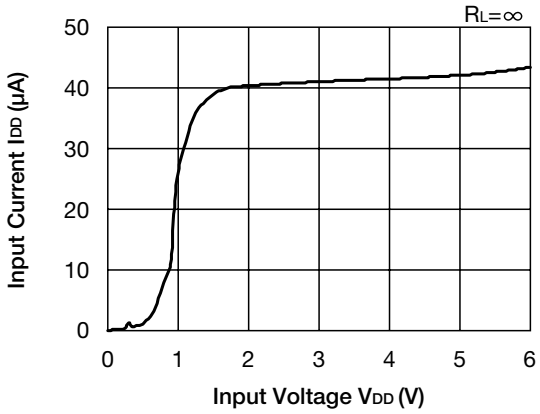
1. The output capacitor is required between output and GND to prevent oscillation.
2. The ESR of capacitor must be defined in ESR stability area.
   It is possible to use a ceramic capacitor without ESR resistance for output.
   The ceramic capacitor must be used more than 0.47µF and B temperature characteristics.
3. The wire of V_{DD} 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=1.0V) (Except where noted otherwise Ta=25°C, V_{DD}=V_{OUT} (typ.) +1V, V_{CE}=V_{DD})

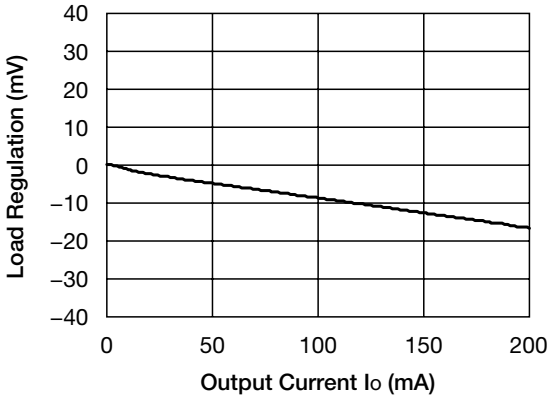
Output Voltage - Input Voltage



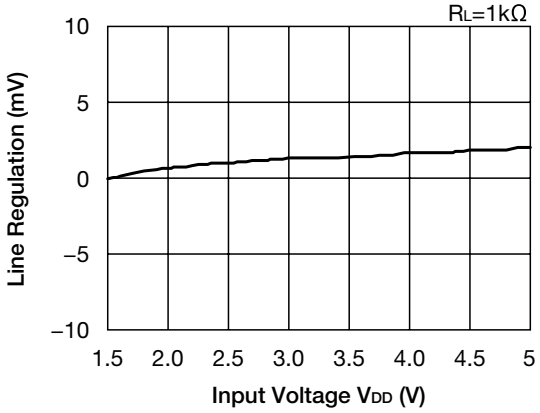
Input Current - Input Voltage



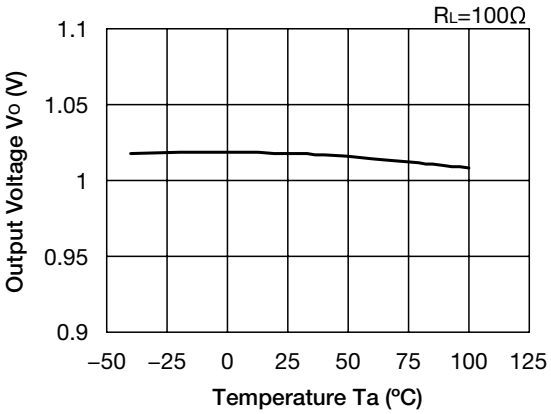
Load Regulation



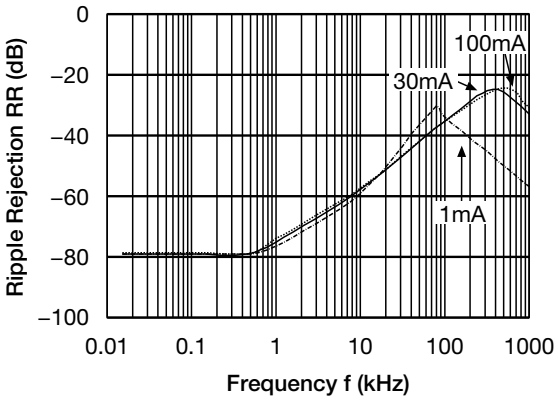
Line Regulation



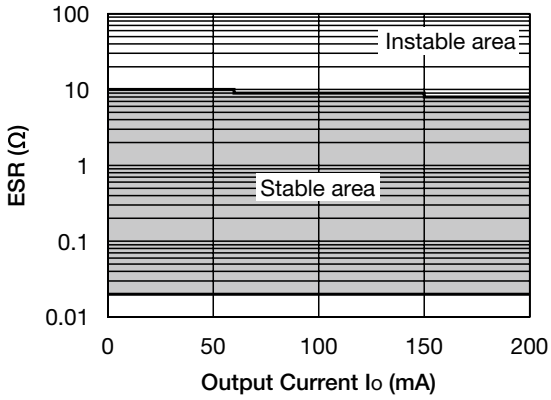
VOUT Temperature Coefficient



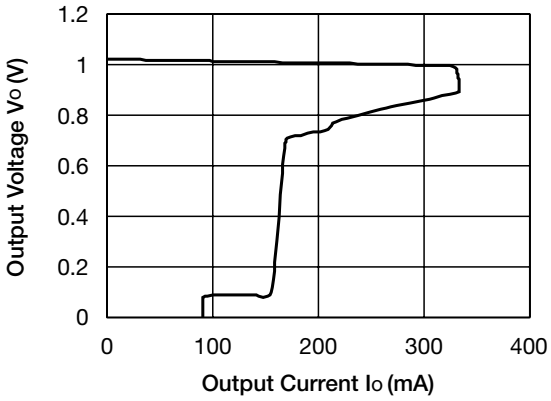
Ripple Rejection



ESR stable area

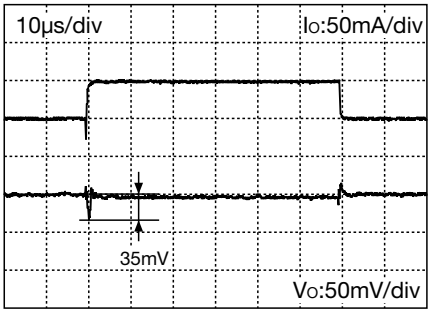


Current Limit

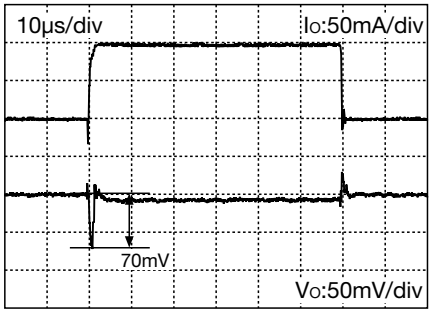


Load Transient Response (VDD=Vo+1V, VCE=VDD, Cin=Co=0.47µF)

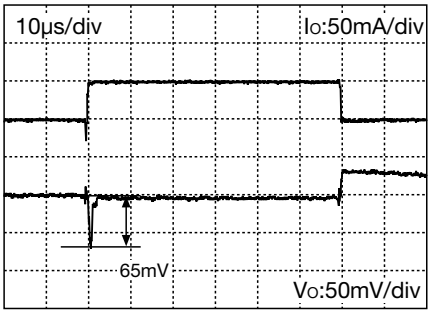
Io:50mA⇔100mA



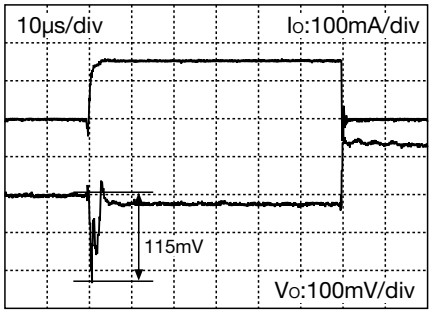
Io:50mA⇔150mA



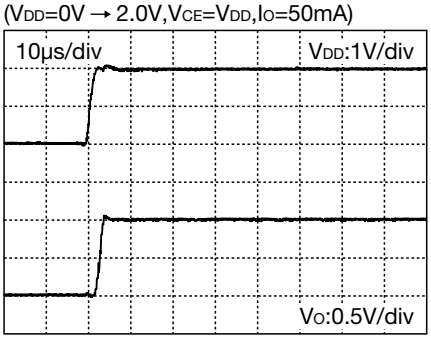
Io:0.1mA ⇔ 50mA



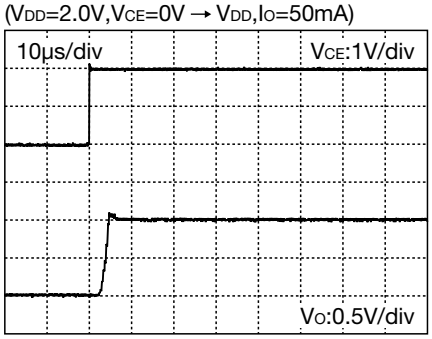
Io:0.1mA ⇔ 150mA



Input rise characteristics
(VDD=0V → 2.0V,VCE=VDD,Io=50mA)

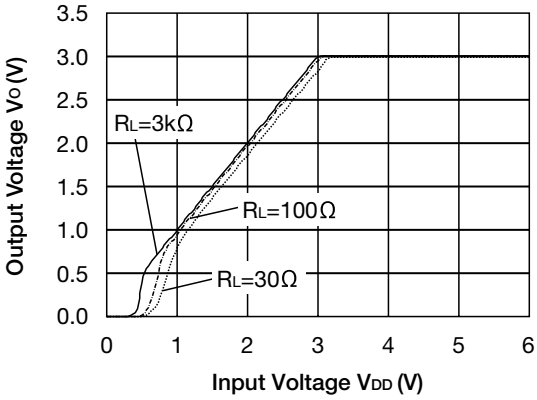


CE rise characteristics
(VDD=2.0V,VCE=0V → VDD,Io=50mA)

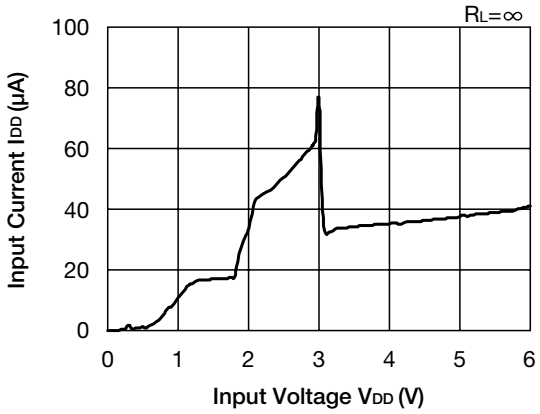


Characteristics (Vo=3.0V) (Except where noted otherwise Ta=25°C, V_{DD}=V_{OUT} (typ.) +1V, V_{CE}=V_{DD})

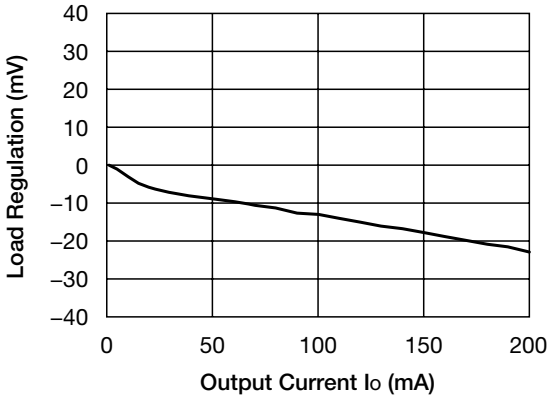
Output Voltage - Input Voltage



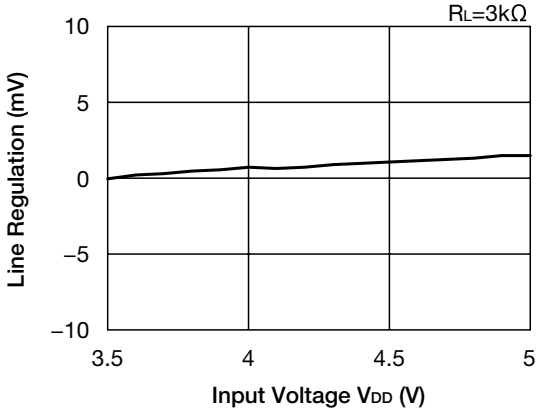
Input Current - Input Voltage



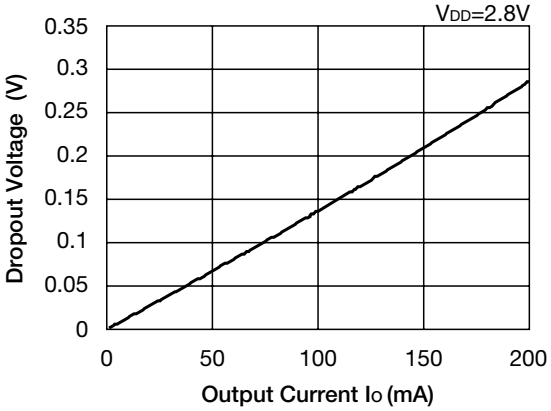
Load Regulation



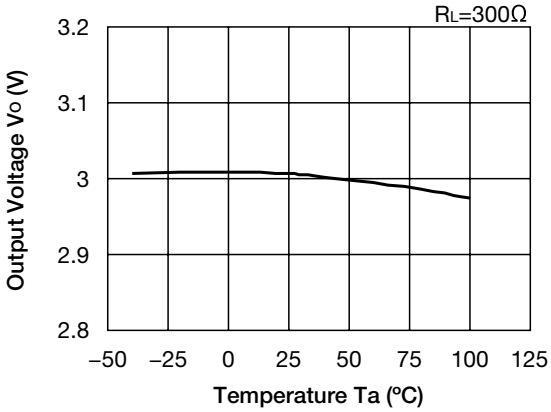
Line Regulation



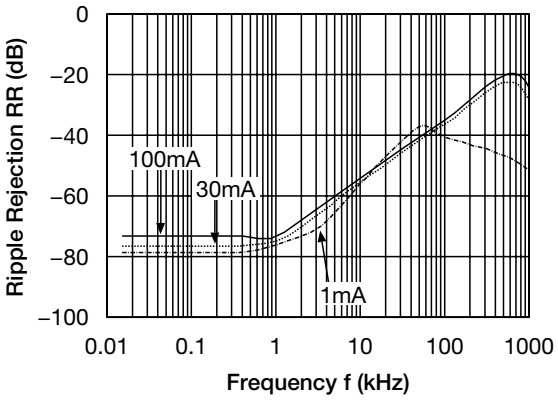
Dropout Voltage



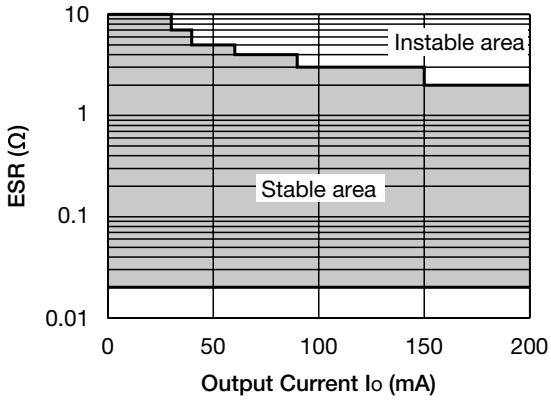
VOUT Temperature Coefficient



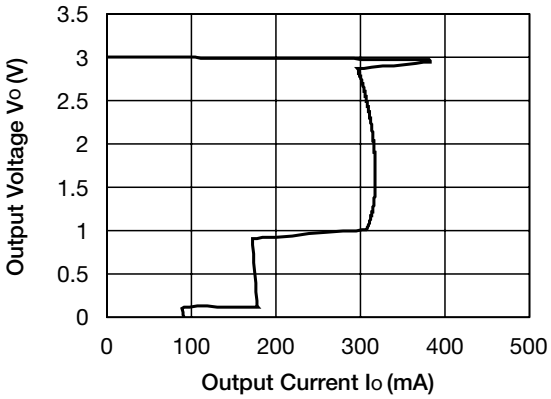
Ripple Rejection



ESR stable area

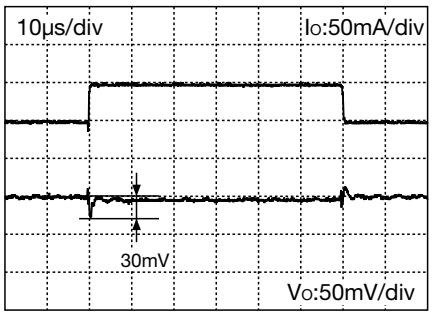


Current Limit

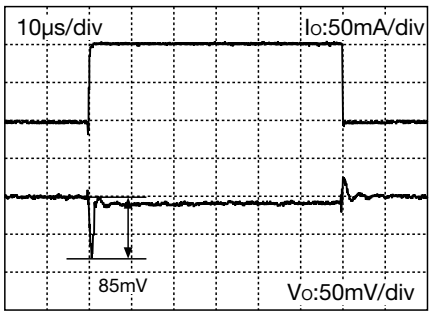


Load Transient Response (VDD=Vo+1V, VCE=VDD, Cin=Co=0.47µF)

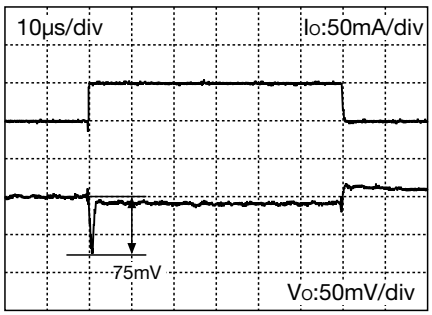
Io:50mA ⇔100mA



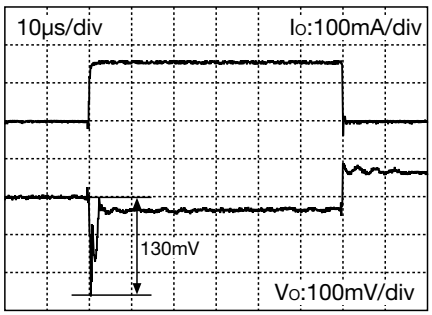
Io:50mA ⇔150mA



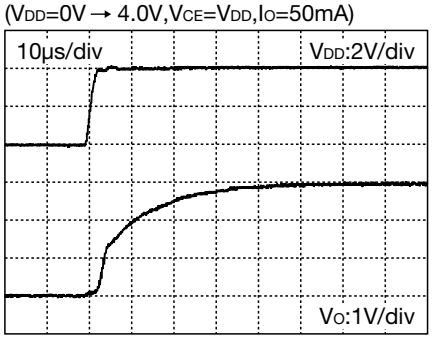
Io:0.1mA ⇔ 50mA



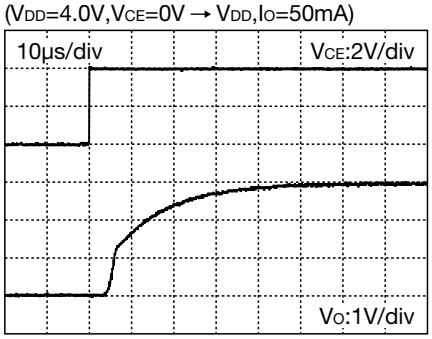
Io:0.1mA ⇔ 150mA



Input rise characteristics
(VDD=0V → 4.0V,VCE=VDD,Io=50mA)

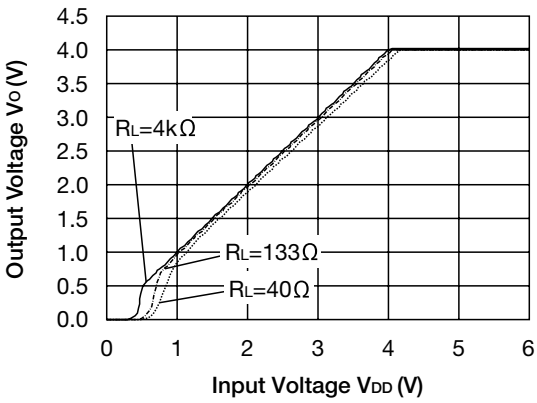


CE rise characteristics
(VDD=4.0V,VCE=0V → VDD,Io=50mA)

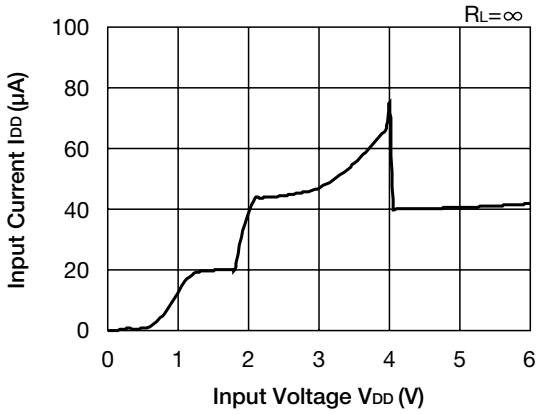


Characteristics (Vo=4.0V) (Except where noted otherwise Ta=25°C, V_{DD}=V_{OUT} (typ.) +1V, V_{CE}=V_{DD})

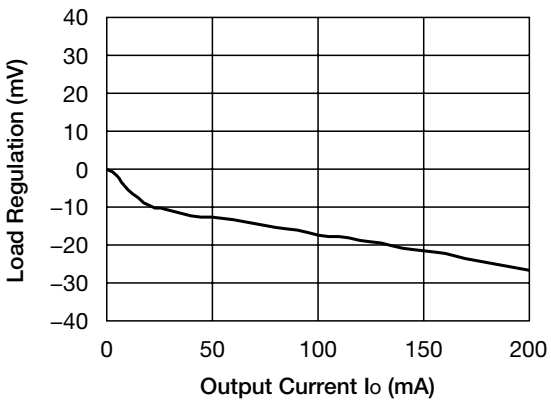
Output Voltage - Input Voltage



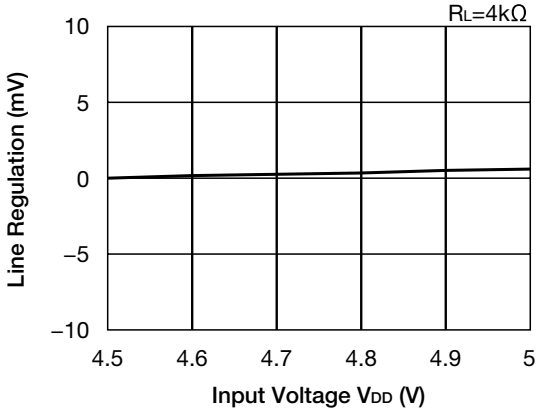
Input Current - Input Voltage



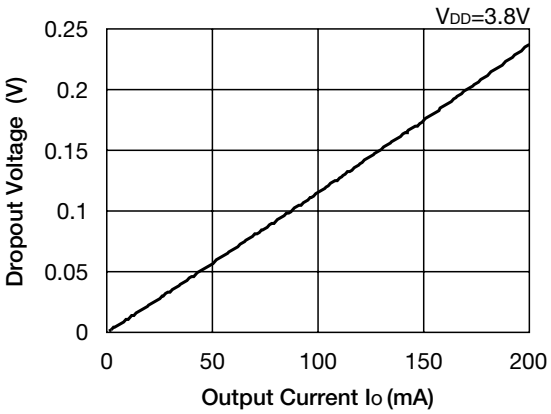
Load Regulation



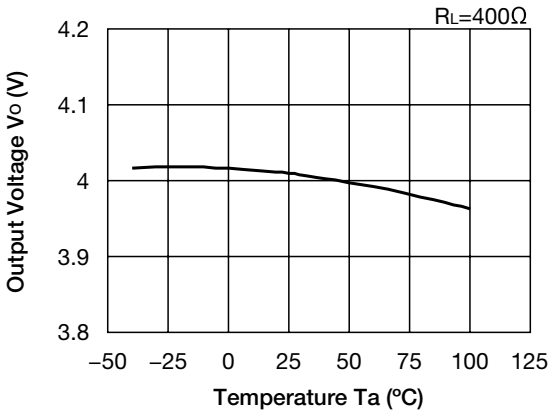
Line Regulation



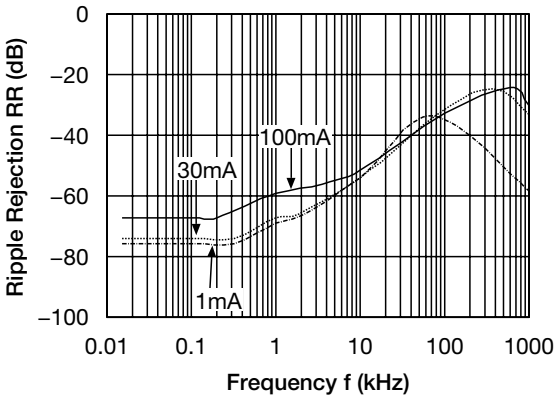
Dropout Voltage



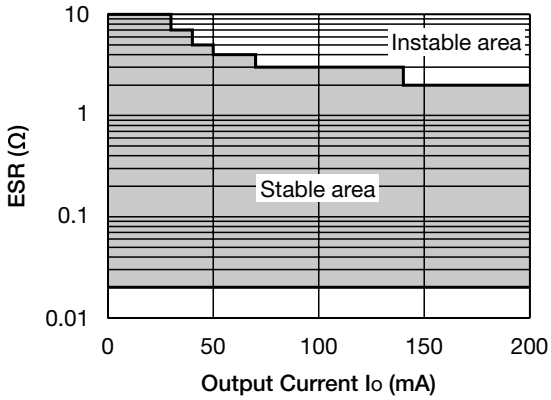
VOUT Temperature Coefficient



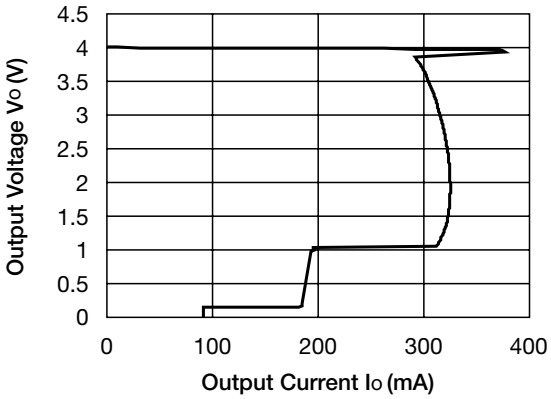
Ripple Rejection



ESR stable area

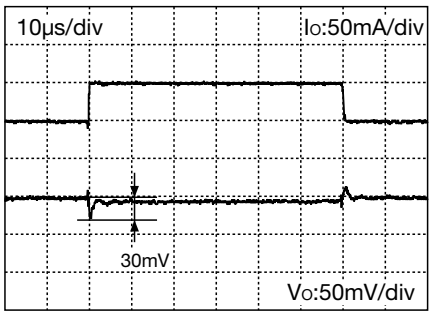


Current Limit

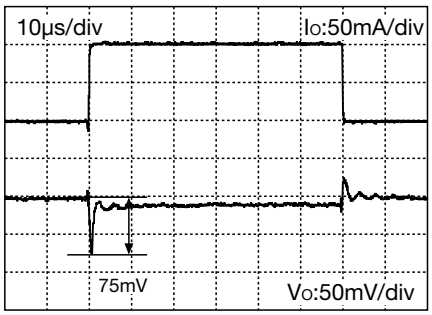


Load Transient Response (VDD=Vo+1V, VCE=VDD, Cin=Co=0.47µF)

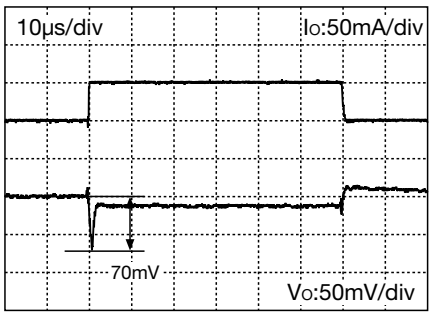
Io:50mA ⇔100mA



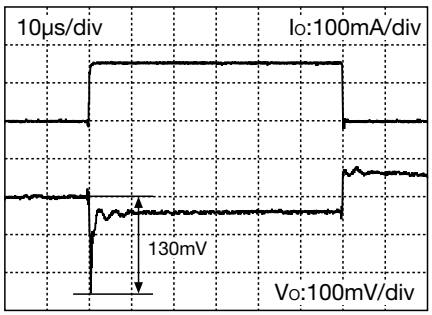
Io:50mA ⇔150mA



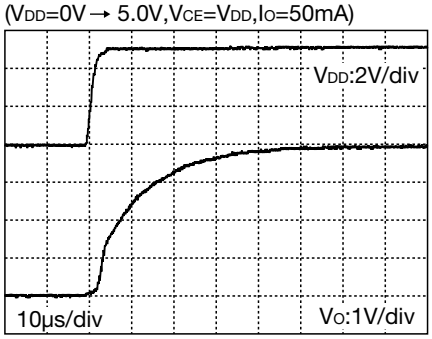
Io:0.1mA ⇔ 50mA



Io:0.1mA ⇔ 150mA



Input rise characteristics
(VDD=0V → 5.0V,VCE=VDD,Io=50mA)



CE rise characteristics
(VDD=5.0V,VCE=0V → VDD,Io=50mA)