

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 42 μ A typ.

Moreover, through use of an ultra-small package of 1 mm/ \square , the device makes its contribution to the downsized specification required in mobile devices.

Features

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Fast response 2. Built in soft-start 3. Ultra-small package PLP-4A | <p>Drop of 120 mV on current rise of 0\rightarrow150mA
 High ripple rejection ration of 75dB typ.
 Reduced rush current at startup
 Contributes to downsized specification</p> |
|---|---|

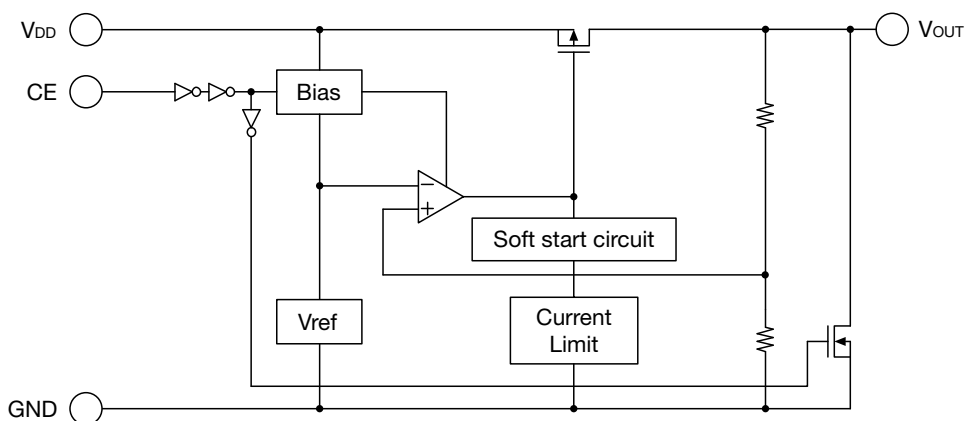
Package

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

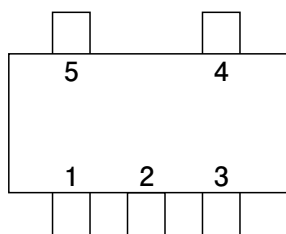
Applications

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

Block Diagram

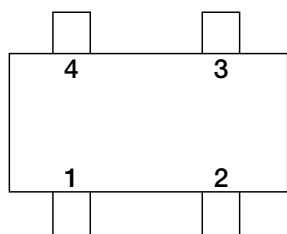


Pin Assignment



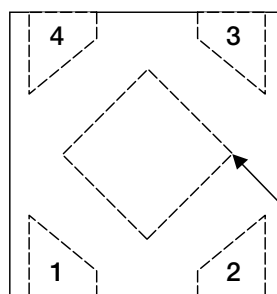
SOT-25A
(TOP VIEW)

1	V _{DD}
2	GND
3	CE
4	NC
5	V _{OUT}



SC-82ABB
(TOP VIEW)

1	CE
2	GND
3	V _{OUT}
4	V _{DD}



PLP-4A
(TOP VIEW)

1	V _{OUT}
2	GND
3	CE
4	V _{DD}

Heat Spreader Bottom
(Note)

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						
		<table border="1"> <tr> <th>CE</th> <th>OUTPUT</th> </tr> <tr> <td>Low</td> <td>OFF</td> </tr> <tr> <td>High</td> <td>ON</td> </tr> </table>	CE	OUTPUT	Low	OFF	High	ON
		CE	OUTPUT					
		Low	OFF					
High	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						
		<table border="1"> <tr> <th>CE</th> <th>OUTPUT</th> </tr> <tr> <td>Low</td> <td>OFF</td> </tr> <tr> <td>High</td> <td>ON</td> </tr> </table>	CE	OUTPUT	Low	OFF	High	ON
		CE	OUTPUT					
		Low	OFF					
High	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						
		<table border="1"> <tr> <th>CE</th> <th>OUTPUT</th> </tr> <tr> <td>Low</td> <td>OFF</td> </tr> <tr> <td>High</td> <td>ON</td> </tr> </table>	CE	OUTPUT	Low	OFF	High	ON
		CE	OUTPUT					
		Low	OFF					
High	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
		330(Note2)	SC-82ABB
		400(Note3)	PLP-4A

Note1 : With the double sided PC Board of glass epoxy
(60 × 40 × 1.6^tmm)

Note2 : With the double sided PC Board of glass epoxy
(100 × 40 × 0.8^tmm)

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)	V _{IO}	I _{OUT} =150mA				V
Output Short-Circuit Current (Note5)	I _{lim}	V _{OUT} =0V		50		mA
V _{OUT} Temperature Coefficient (Note5)	ΔV _{OUT} /ΔT _{OP}	I _{OUT} =10mA -40°C ≤ T _{OP} ≤ 85°C		±100		ppm/°C
Ripple Rejection (Note5)	RR	V _{ripple} =0.5V, I _{OUT} =30mA f=1kHz		75		dB
Output Noise Voltage (Note5)	V _n	I _{OUT} =30mA f _{BW} =10~100kHz		60		μV _{rms}
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.

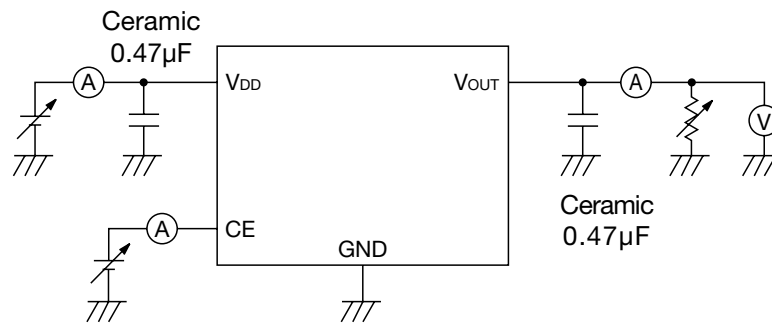
Electrical Characteristics 2 (Except where noted otherwise Ta=25°C, V_{DD}=V_{OUT} (typ.)+1V, V_{CE}=V_{DD})

Model No.	Item								
	Output Voltage				Dropout Voltage (Note6)				
	V _{OUT} (V)				V _{IO} (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					
MM3416Z21		2.129	2.150	2.172					
MM3416A22			2.178	2.200	2.222	I _{OUT} =150mA 2.1V ≤ V _{OUT} < 2.6V V _{DD} =V _{OUT} (typ)-0.2V		0.28	0.36
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	I _{OUT} =150mA 2.6V ≤ V _{OUT} < 3.1V V _{DD} =V _{OUT} (typ)-0.2V		0.22	0.30
MM3416Z25		2.525	2.550	2.576					
MM3416A26	2.574	2.600	2.626						
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						

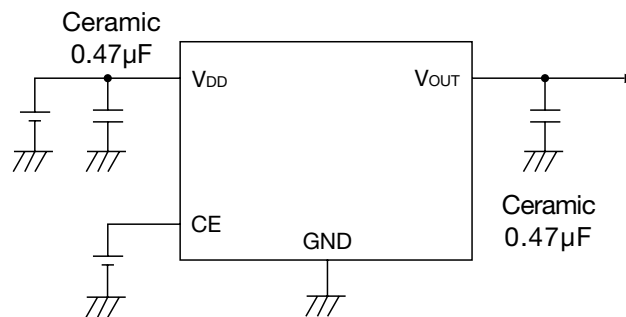
Note6 : Dropout voltage MAX value in the input and it is confirmed that there is no output abnormal voltage impression the load 150mA in the model V_{OUT}<1.6V.

Model No.	Item							
	Output Voltage				Dropout Voltage			
	V _{OUT} (V)				V _{IO} (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)

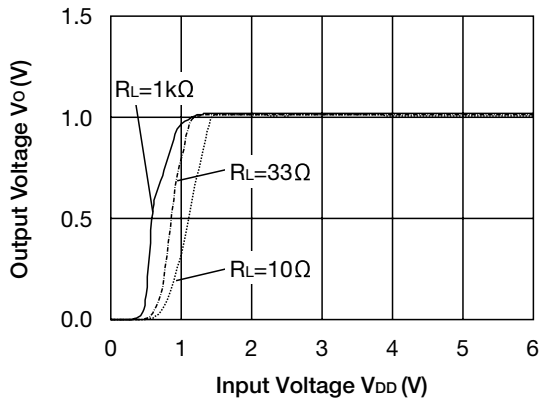
- Output capacitor Ceramic capacitor 0.47µF
- Input Capacitor Ceramic capacitor 0.47µF

· Note

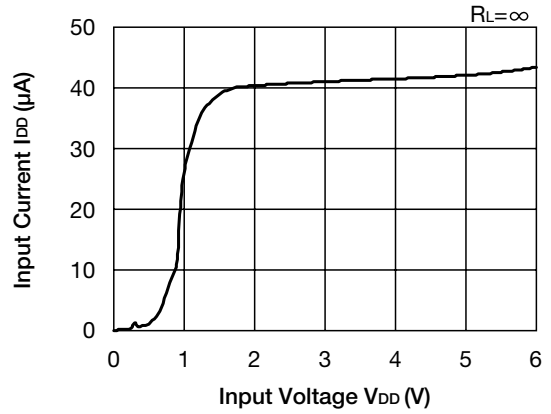
1. The output capacitor is required between output and GND to prevent oscillation.
2. The ESR of capacitor must be defined in ESR stability area.
It is possible to use a ceramic capacitor without ESR resistance for output.
The ceramic capacitor must be used more than 0.47µF and B temperature characteristics.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

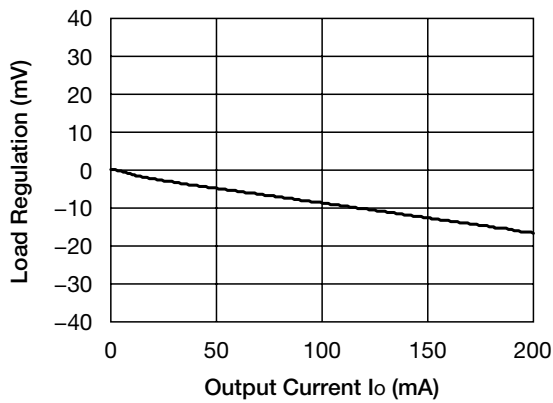
Output Voltage - Input Voltage



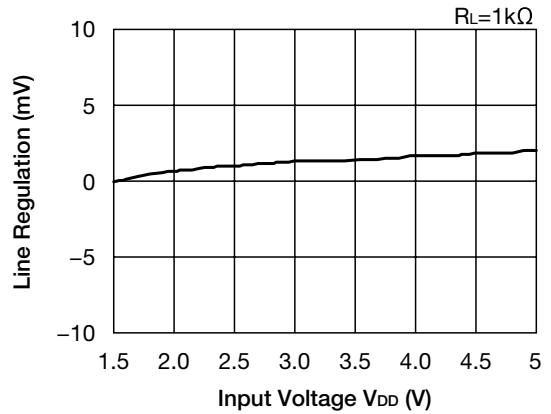
Input Current - Input Voltage



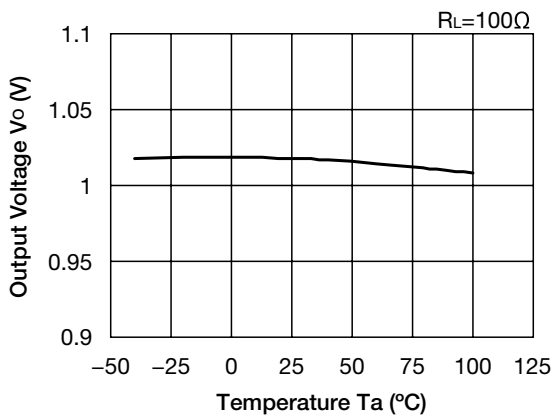
Load Regulation



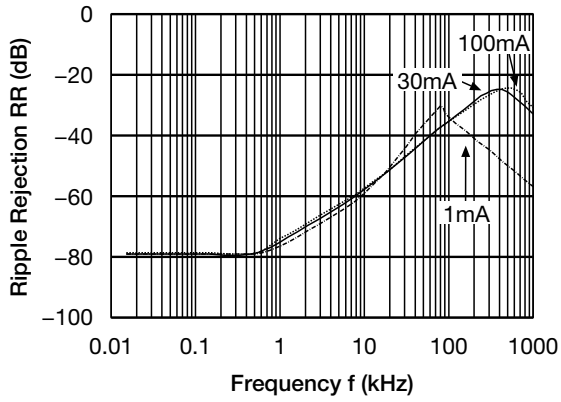
Line Regulation



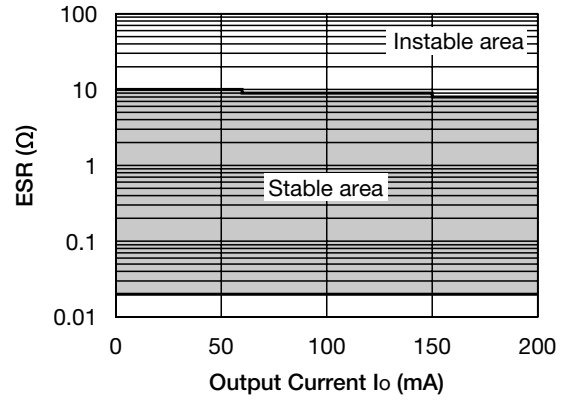
V_{OUT} Temperature Coefficient



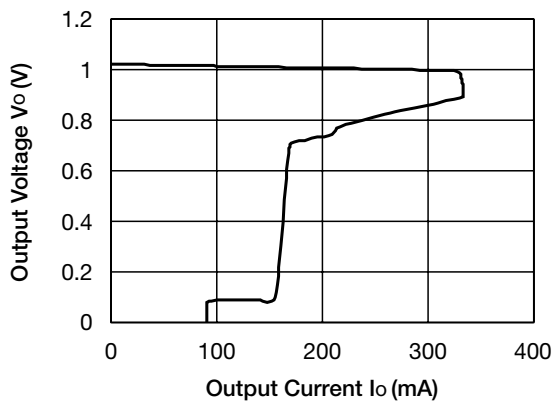
Ripple Rejection



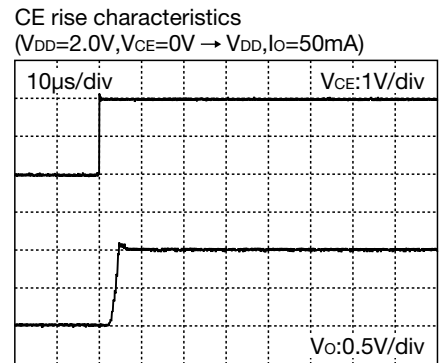
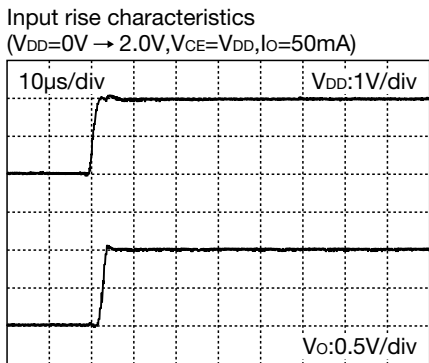
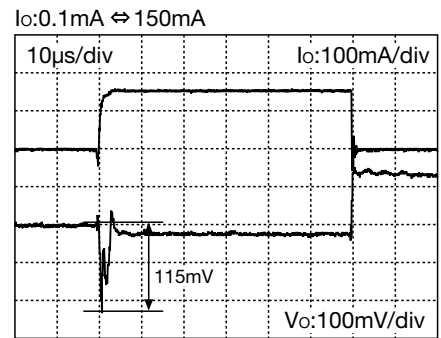
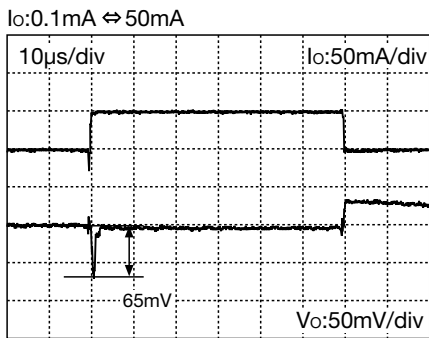
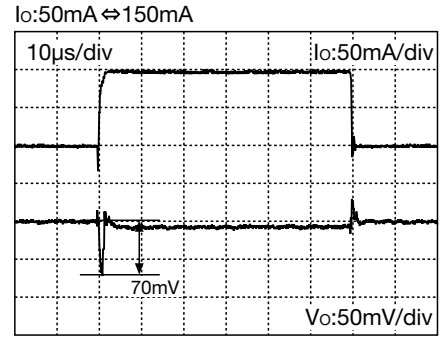
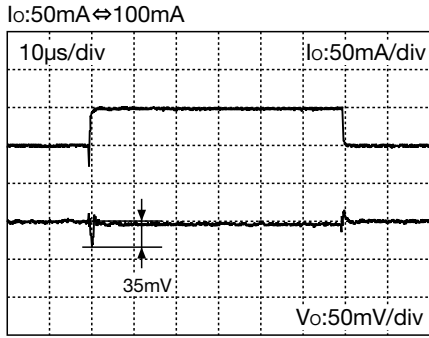
ESR stable area



Current Limit

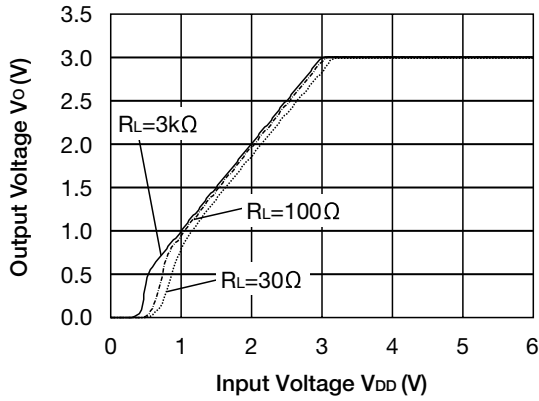


■ Load Transient Response ($V_{DD}=V_o+1V$, $V_{CE}=V_{DD}$, $C_{in}=C_o=0.47\mu F$)

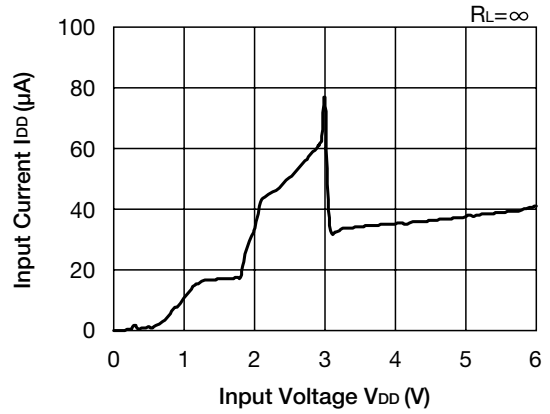


Characteristics (Vo=3.0V) (Except where noted otherwise Ta=25°C, VDD=VOUT (typ.) +1V, VCE=VDD)

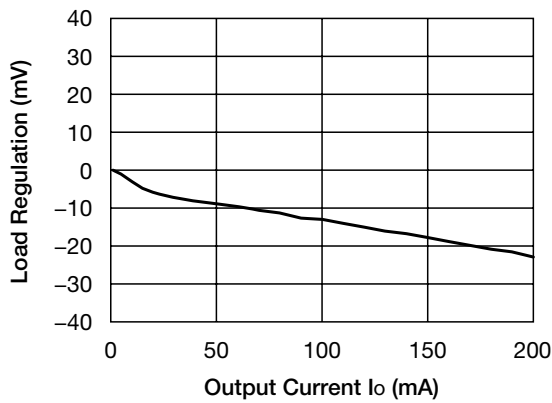
Output Voltage - Input Voltage



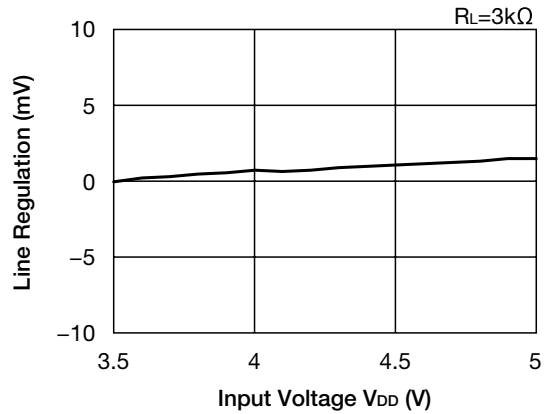
Input Current - Input Voltage



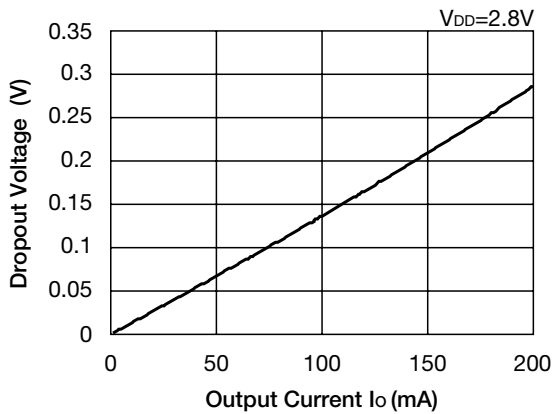
Load Regulation



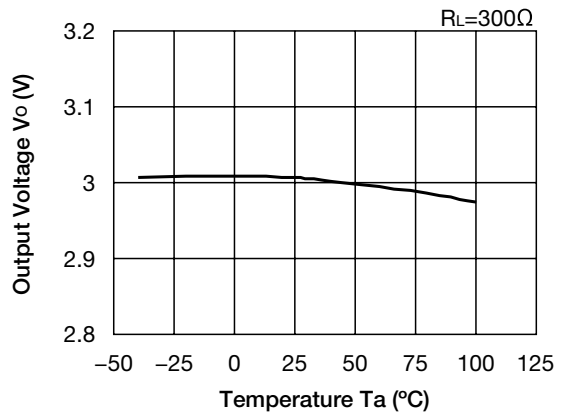
Line Regulation



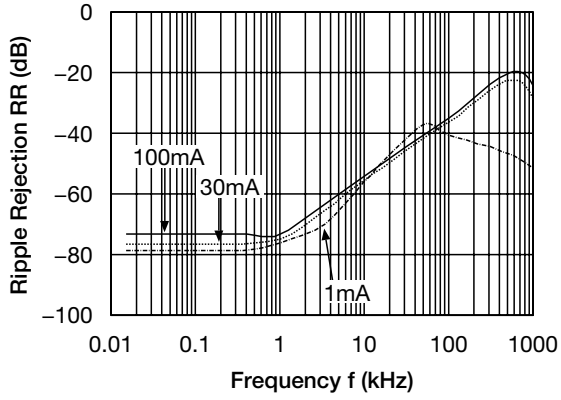
Dropout Voltage



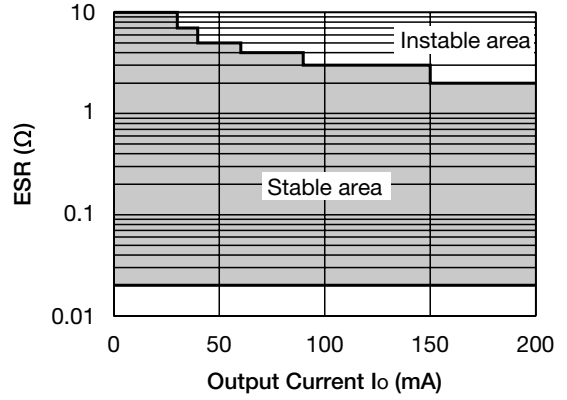
VOUT Temperature Coefficient



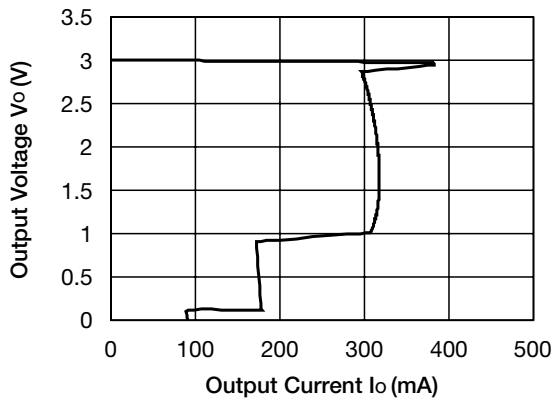
Ripple Rejection



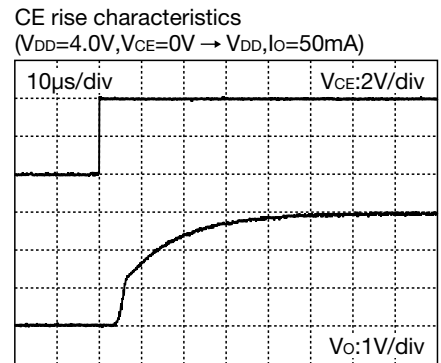
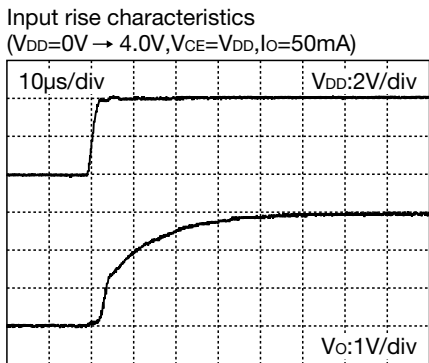
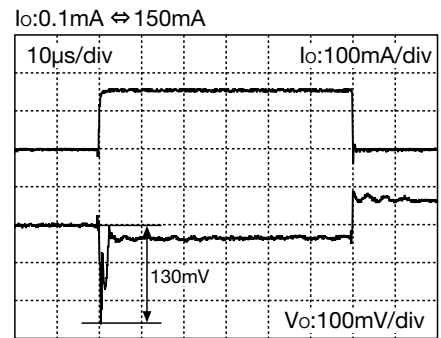
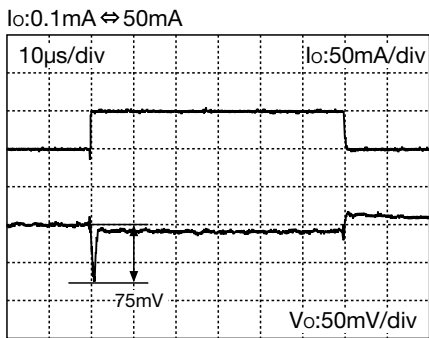
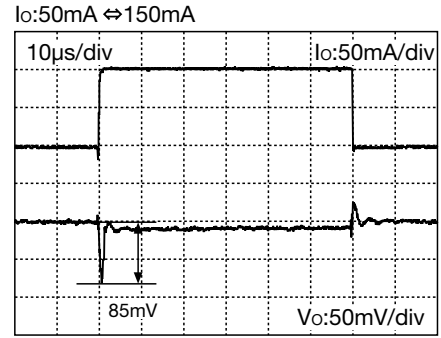
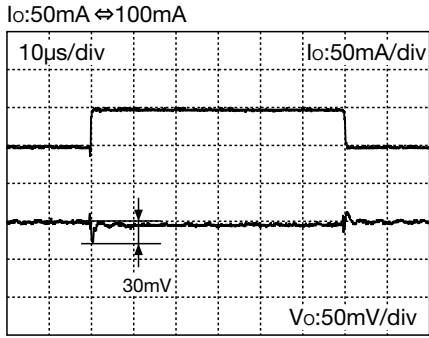
ESR stable area



Current Limit

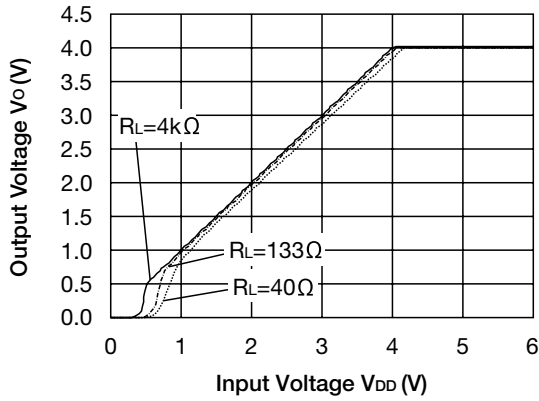


■ Load Transient Response ($V_{DD}=V_o+1V$, $V_{CE}=V_{DD}$, $C_{in}=C_o=0.47\mu F$)

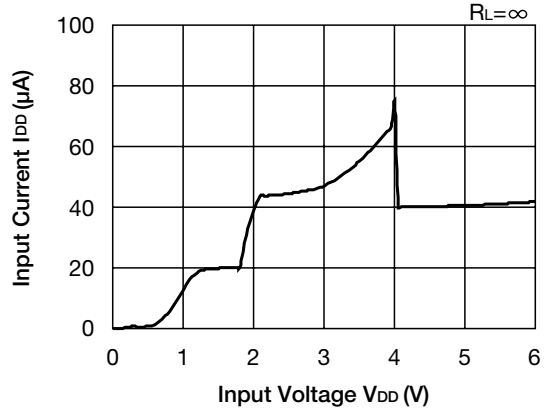


Characteristics (Vo=4.0V) (Except where noted otherwise Ta=25°C, VDD=VOUT (typ.) +1V, VCE=VDD)

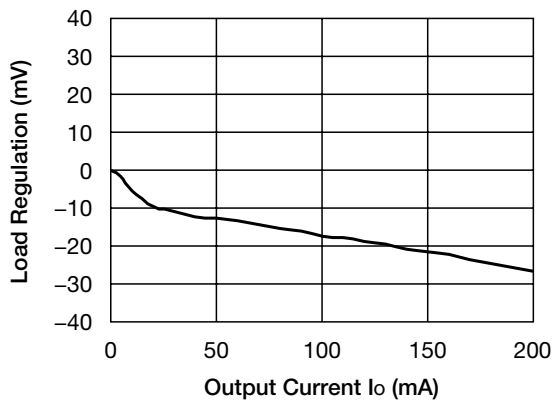
Output Voltage - Input Voltage



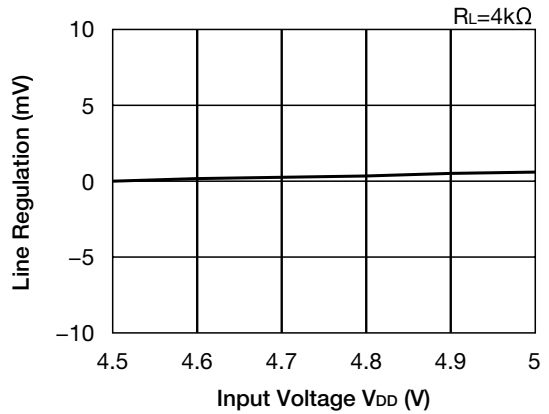
Input Current - Input Voltage



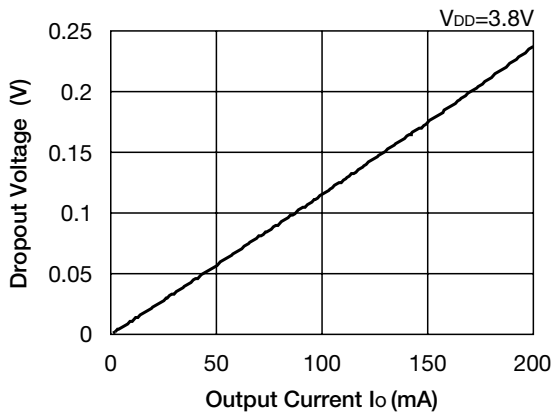
Load Regulation



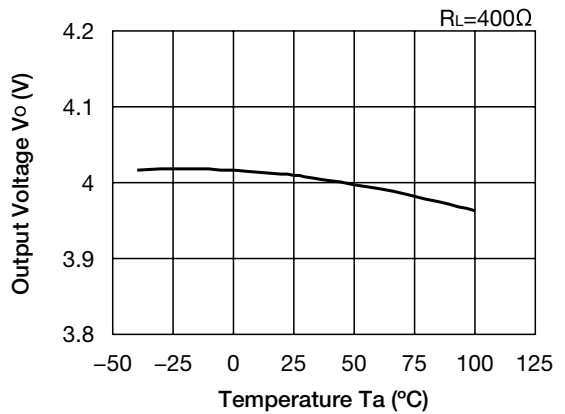
Line Regulation



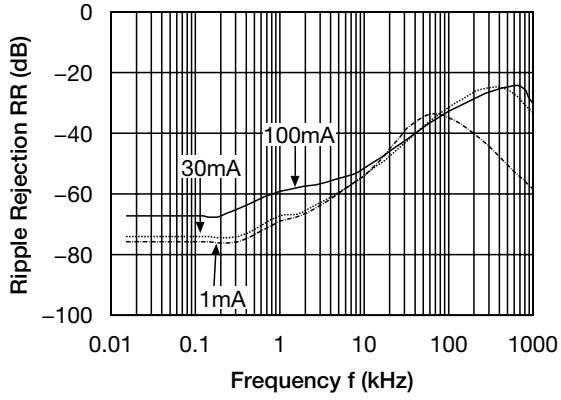
Dropout Voltage



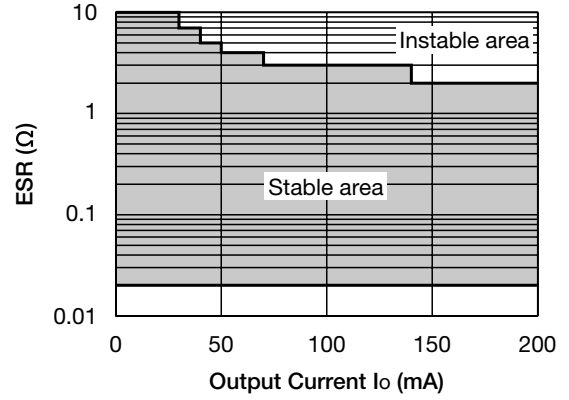
VOUT Temperature Coefficient



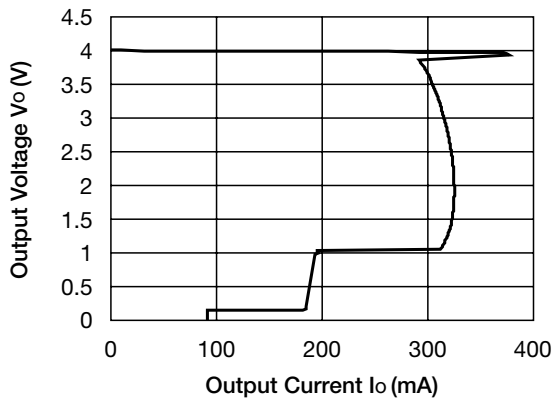
Ripple Rejection



ESR stable area



Current Limit



■ Load Transient Response ($V_{DD}=V_o+1V$, $V_{CE}=V_{DD}$, $C_{in}=C_o=0.47\mu F$)

