Low current consumption 150mA LDO

MM3534 Series

Overview

This IC is a low current consumption 150mA LDO.
The IC can be better low current consumption and load transient by bias boost circuit. Therefore the IC is ideal for mobile applications.

Features

- Low quesient current
- High speed response
- High accuracy output voltage

Main specifications

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

- Maximum rating supply voltage : -0.3V to 7V
- Operating voltage range : 1.7V to 6V
- Operating ambient temperature : -40℃ to 85℃
- Output current : 150mA
- Input current (OFF) : Typ. 0.1uA
- No-load input current : Typ. 0.9uA (V_{OUT}(Typ.)≦3.3V)
  Typ. 1.2uA (3.3V<V_{OUT}(Typ.))
- Output voltage range : 1.2V to 5V (0.1V step)
- Output voltage accuracy : ±0.8% (2.0V≦V_{OUT}(Typ.))
  ±16mV (V_{OUT}(Typ.)<2.0V)
- Line regulation : Typ. 0.02%/V (V_{DD}=V_{OUT}(Typ.)+0.5V to 6V)
- Load regulation : Typ. 10mV (I_{OUT}=1mA to 150mA)
- Dropout voltage : Typ. 0.24V (I_{OUT}=150mA, V_{OUT}(Typ.)=3V)
- PSRR : Typ. 50dB (f=1kHz)
- Output noise voltage : Typ. 60uVrms (f_{BW}=10Hz to 100kHz, I_{OUT}=30mA)
- Output capacitor : 0.1uF (Ceramic capacitor)
- Protection function : Over current protection
- Additional function : ON/OFF control, Auto discharge

Packages

- SC-82ABB
- SOT-25A

Application

- Audio visual equipment
- Photographing / Imaging device
- Health care device
- Home appliance equipment

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Model Name

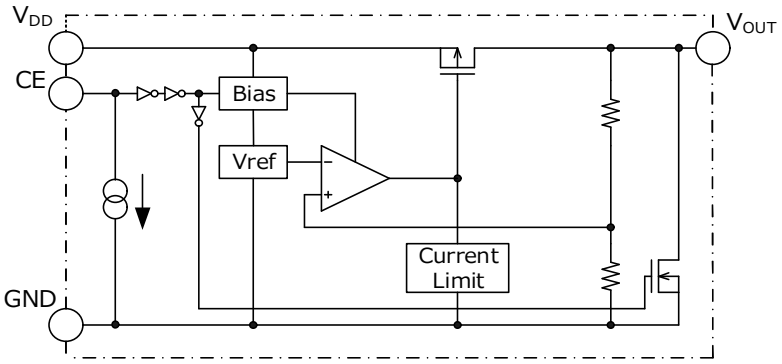
M M 3 5 3 4 X X X X X E

Series name (A) (B) (C) (D)

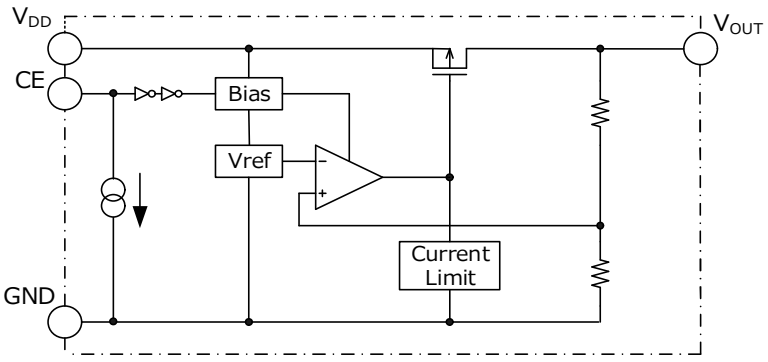
(A)	Function Type	A	CE=H active, with discharge function
		C	CE=H active, without discharge function
(B)	Output voltage rank	12 ≀ 50	The output voltage can be designated in the range from 1.00V(10) to 5.00V(50) in 0.1V steps.
(C)	Package	U	SC-82ABB
		N	SOT-25A
(D)	Packing specifications	R	R housing (Standard)
		L	L housing

Block Diagram

- A rank (CE=H active, with discharge function)



- C rank (CE=H active, without discharge function)



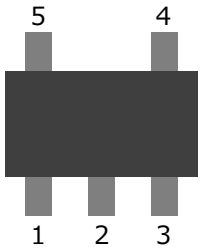
Pin Configuration

- SC-82ABB

Top view

Pin No.	Pin name	Function
1	CE	ON/OFF-control pin Connect CE pin with VDD pin, when it is not used. The CE terminal performs pull-down by constant current.
2	GND	GND pin
3	V_{OUT}	Output pin
4	V_{DD}	Voltage supply pin

- SOT-25A



Top view

Pin No.	Pin name	Function
1	V_{DD}	Voltage supply pin
2	GND	GND pin
3	CE	ON/OFF-control pin Connect CE pin with VDD pin, when it is not used. The CE terminal performs pull-down by constant current.
4	NC	No connection
5	V_{OUT}	Output pin

Absolute Maximum Ratings

Item		Symbol	Min.	Max.	Unit
Storage temperature		Tstg	-55	150	℃
Junction temperature		Tj_{MAX}	-	150	℃
Supply voltage		V_{DD}	-0.3	7.0	V
CE input voltage		V_{CE}	-0.3	7.0	V
Output voltage		V_{OUT}	-0.3	V_{DD}+0.3V	V
Output current		Iomax	0	200	mA
Power dissipation 1	SC-82ABB	Pd1	-	330	mW
*Note1	SOT-25A		-	350	mW
Power dissipation 2	SC-82ABB	Pd2	-	650	mW
*Note2	SOT-25A		-	700	mW

*Note1:両面ガラスエポキシ基板実装時

*Note2:JEDEC51-7規格

Recommended Operating Conditions

Item	Symbol	Min.	Max.	Unit
Operating ambient temperature	Topr	-40	85	℃
Operating voltage	Vop	1.7	6.0	V
Output current	Iop	0	150	mA

Electrical Characteristics

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

The specifications with under bar are guaranteed by design.

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input current(OFF)	I_{DDOff}	V_{CE}=0V	-	0.1	1.0	μA
No-Load Input Current	I_{DD}	1.2V≦V_{OUT}≦3.3V I_{OUT}=0mA	-	0.9	1.5	μA
		3.4V≦V_{OUT}≦5.0V I_{OUT}=0mA	-	1.2	2.0	μA
Output voltage	V_{OUT}	V_{OUT}＞2.0V	×0.992	-	×1.008	V
		V_{OUT}≦2.0V	-16	-	16	mV
		V_{OUT}＞2.0V -40≦Ta≦85℃	×0.978	-	×1.022	V
		V_{OUT}≦2.0V -40≦Ta≦85℃	-44	-	44	mV
Line regulation	V_{LINE}	V_{OUT}(Typ.)+0.5V≦V_{DD}≦6.0V	-	0.02	0.10	%/V
Load regulation	V_{LOAD}	1mA≦I_{OUT}≦150mA	-	10	20	mV
Dropout voltage	Vio	Please refer to another page.	-	-	-	V

Electrical Characteristics

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

The specifications with under bar are guaranteed by design.

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Ripple rejection *Note3	RR	f=1kHz, Vripple=0.5V I_{OUT}=30mA	-	50	-	dB
Output noise voltage *Note3	Vn	f_{BW}=10Hz～100kHz I_{OUT}=30mA	-	60	-	μVrms
Vout temperature coefficient *Note3	ΔV_{OUT} /ΔT	-40≦Ta≦85℃	-	±80	-	ppm/℃
Output short-circuit current *Note3	Ishort	V_{OUT}=0V	-	100	-	mA
CE High threshold voltage	V_{CEH}		1.5	-	V_{DD}	V
CE Low threshold voltage	V_{CEL}		0	-	0.3	V
CE pin current *Note3	I_{CEH}		-	0.3	-	μA
Output NMOS ON resistance *Note3,4	R_{DON}	V_{CE}=0V, V_{DD}=4V	-	10	-	Ω

*Note3:The parameter is guaranteed by design.

*Note4:This parameter is only MM3534A series.

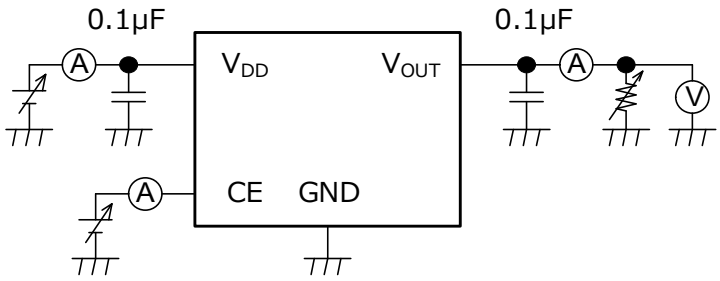
Electrical Characteristics

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)
The specifications with under bar are guaranteed by design.

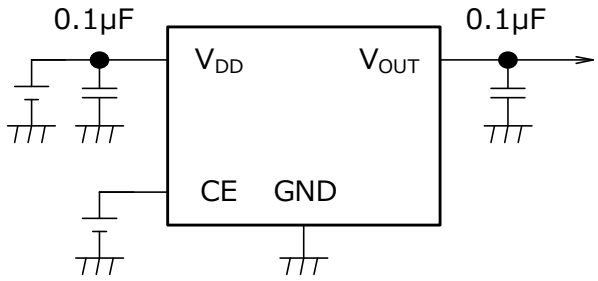
Model name	Item							
	Output voltage				Dropout voltage			
	V_{OUT} (V)				Vio (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3534A/C12	I_{OUT}=1mA	1.184	1.200	1.216	I_{OUT}=150mA 1.2V≦V_{OUT}<2.4V *Note5	-	0.76	1.05
MM3534A/C13		1.284	1.300	1.316				
MM3534A/C14		1.384	1.400	1.416				
MM3534A/C15		1.484	1.500	1.516		-	0.53	0.80
MM3534A/C16		1.584	1.600	1.616				
MM3534A/C17		1.684	1.700	1.716		-	0.44	0.65
MM3534A/C18		1.784	1.800	1.816				
MM3534A/C19		1.884	1.900	1.916				
MM3534A/C20		1.984	2.000	2.016		-	0.34	0.50
MM3534A/C21		2.083	2.100	2.117				
MM3534A/C22		2.182	2.200	2.218				
MM3534A/C23		2.282	2.300	2.318				
MM3534A/C24		2.381	2.400	2.419				
MM3534A/C25		2.480	2.500	2.520	I_{OUT}=150mA 2.5V≦V_{OUT}≦5.0 V_{DD}=V_{OUT}(Typ.)-0.2V	-	0.28	0.40
MM3534A/C26		2.579	2.600	2.621				
MM3534A/C27		2.678	2.700	2.722				
MM3534A/C28		2.778	2.800	2.822		-	0.24	0.32
MM3534A/C29		2.877	2.900	2.923				
MM3534A/C30		2.976	3.000	3.024				
MM3534A/C31		3.075	3.100	3.125				
MM3534A/C32		3.174	3.200	3.226				
MM3534A/C33		3.274	3.300	3.326				
MM3534A/C34		3.373	3.400	3.427				
MM3534A/C35		3.472	3.500	3.528				
MM3534A/C36		3.571	3.600	3.629				
MM3534A/C37		3.670	3.700	3.730				
MM3534A/C38		3.770	3.800	3.830				
MM3534A/C39		3.869	3.900	3.931				
MM3534A/C40		3.968	4.000	4.032				
MM3534A/C41		4.067	4.100	4.133				
MM3534A/C42		4.166	4.200	4.234				
MM3534A/C43		4.266	4.300	4.334				
MM3534A/C44		4.365	4.400	4.435				
MM3534A/C45		4.464	4.500	4.536				
MM3534A/C46		4.563	4.600	4.637				
MM3534A/C47		4.662	4.700	4.738				
MM3534A/C48		4.762	4.800	4.838				
MM3534A/C49		4.861	4.900	4.939				
MM3534A/C50		4.960	5.000	5.040				

*Note5: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 less than Vout<2.5V.

Test Circuit



Application Circuit



(Example of external parts)

- Output capacitor Ceramic capacitor 0.1μF
- Input capacitor Ceramic capacitor 0.1μF *Temperature characteristics : B

- In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, we shall not be liable for any such problem, nor grant a license therefore.

Note

1. Please use this IC within the stated absolute maximum ratings.
   The IC is liable to malfunction should the ratings be exceeded.

2. Due to restrictions on the package power dissipation, the output current value may not be satisfied.
   Attention should be paid to the power dissipation of the package when the output current is large or the voltage between Iinput and Output is high.

3. The output capacitor is required between output and GND to prevent oscillation.

4. 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 0.1μF and B temperature characteristics.

5. The wire of VDD and GND is required to print full ground plane for noise and stability.

6. The input capacitor must be connected a distance of less than 1cm from input pin.

7. It is able to oscillation when you use the capacitor with intense capacitance change such as micro.
   Please evaluate IC in the set.

8. In case the output voltage is above the input voltage, the overcurrent flow by internal parastic diode from output to input.
   In such application, the external bypass diode must be connected between output and input pin.

9. This IC will limit the output current with the overcurrent protection circuit when the overcurrent and the output do short-circuit.
   However, IC generates heat because of the substrate and use conditions and there is a possibility of destroying it exceeding a permissible loss.
   The characteristic changes depending on the substrate condition.
   Please evaluate IC in the set.

10. Please keep in mind that output voltage may rise by the leakage current of a power transistor if it is used by low load current(Io<10microA) at the time of high temperature.

11. When the terminal VDD(CE) is OFF→ON, the overshoot might be generated.
    The size of the overshoot depends on "output capacity", "output load", a "voltage rank", and "VDD standup speed." and please evaluate it enough with a real machine.
    Please refer to typical performance characteristics of the Turn-ON Transient Response.

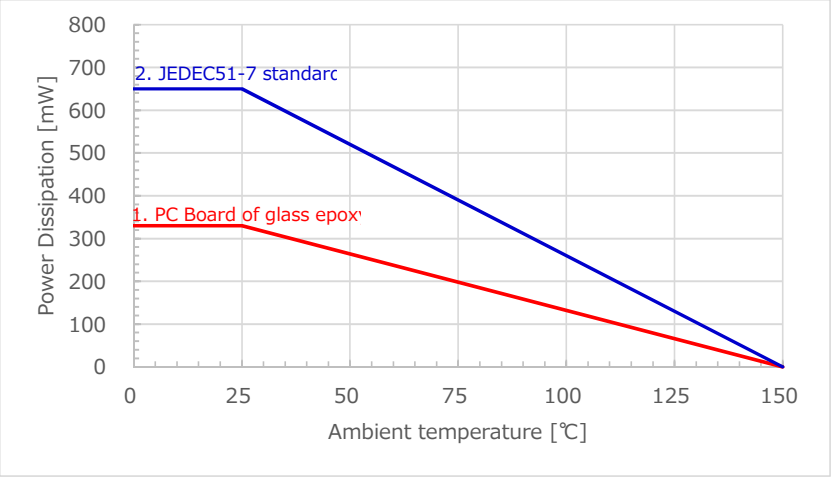
12. There is a possibility of becoming load transient response characteristic deteriorates. when using it with Dropout voltage less than about 1V. Please evaluate it enough when there is no margin in Dropout voltage. Please refer to typical performance characteristics.

13. The CE terminal is pulled down by an internal constant current source.
    The pull-down capability is set to a small value of 0.3μA (Typ.).
    Depending on the value of noise or leak current, pull-down may not be possible.
    Please use the product after thoroughly evaluating it on the actual machine.
    Be sure to design the CE terminal to operate with low impedance (I/O output, etc.), while avoiding pull-down due to open circuit.

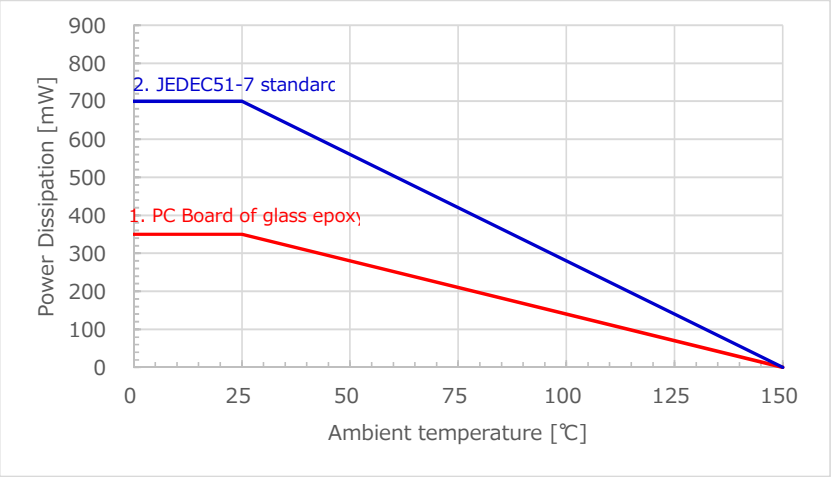
About Power Dissiopation

The Power dissipation change if board to mount IC change because radiative heat fix at board.
It is reference data below, Evaluate IC in the set.

- SC-82ABB
  1. PC Board of glass epoxy
     Board size 100mm×100mm t=1.6mm Copper foil area 10%
     Power dissipation 330mW Ta=25℃
  2. JEDEC51-7 standard (4 layer FR-4 board)
     Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
     Power dissipation 650mW Ta=25℃



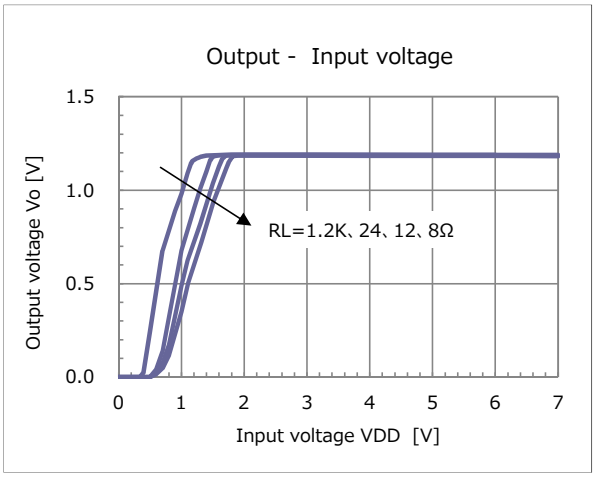
- SOT-25A
  1. 両面ガラスエポキシ基板
     基板サイズ 60mm×400mm t=1.6mm Copper foil area 60%
     許容損失 350mW Ta=25℃
  2. JEDEC51-7規格(4層FR-4基板)
     基板サイズ 114.3mm×76.2mm t=1.6mm Copper foil area 80%
     許容損失 700mW Ta=25℃

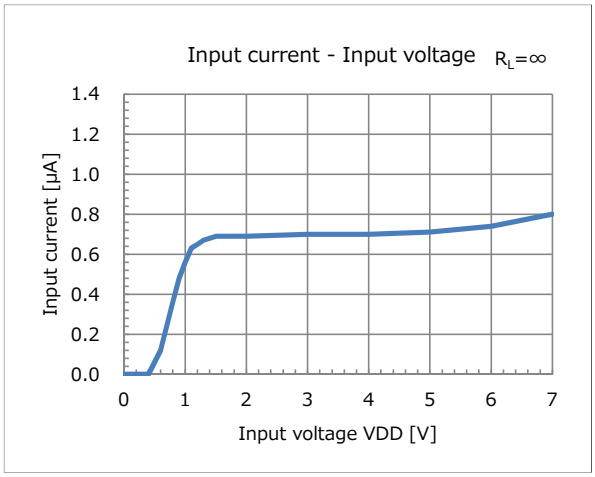


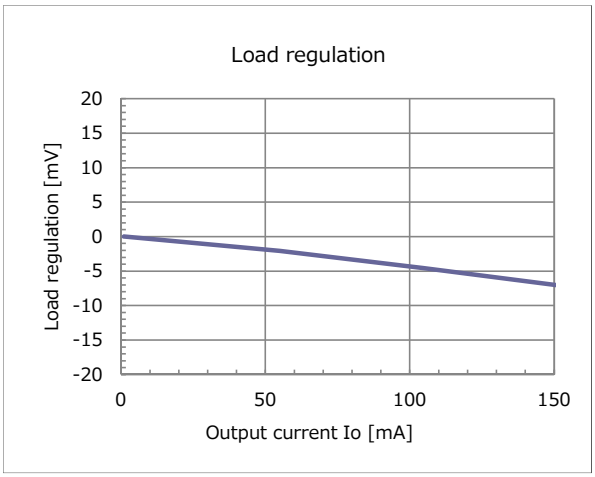
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

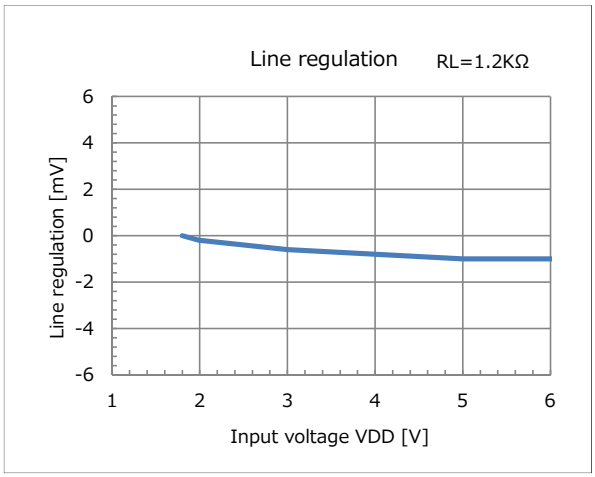
Typical Performance Characteristics (1.2V)

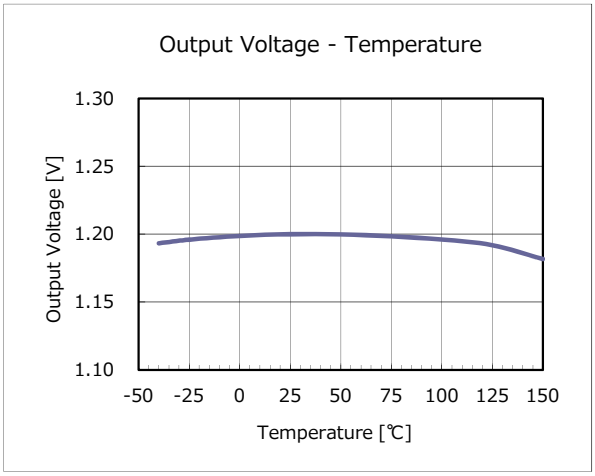
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)





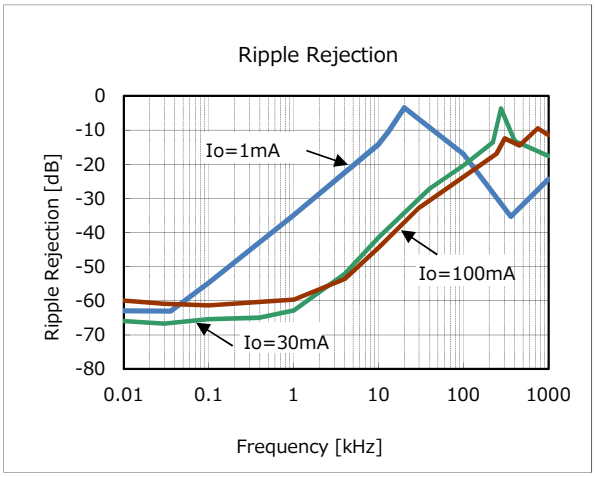


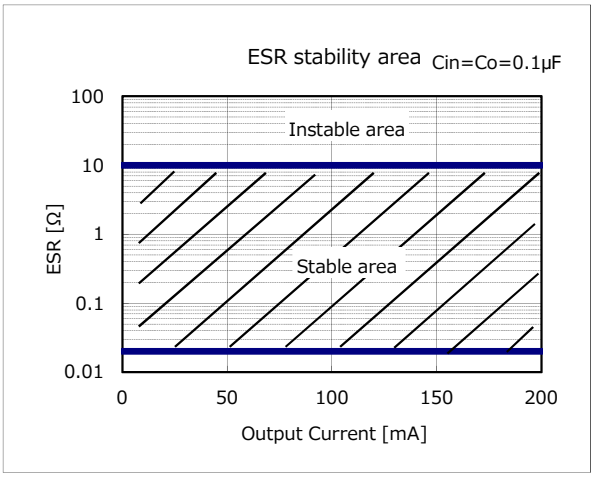


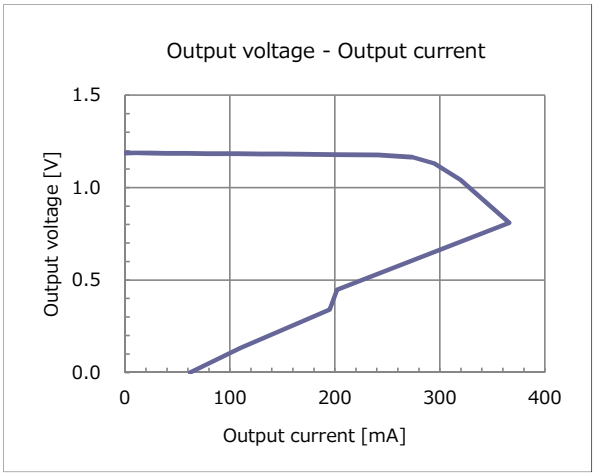


Typical Performance Characteristics (1.2V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)







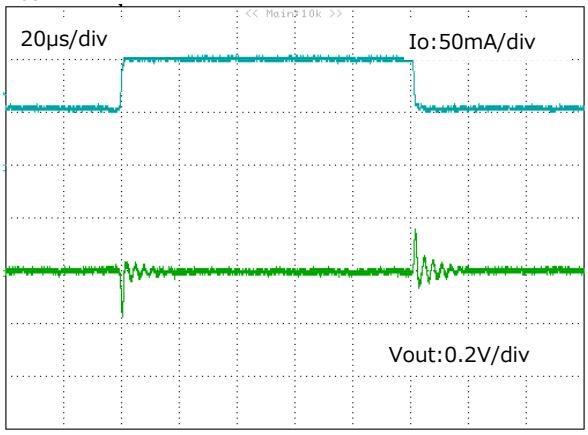
Typical Performance Characteristics (1.2V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

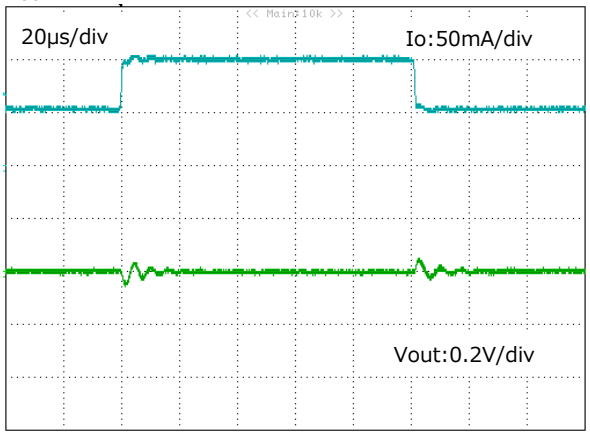
■ Load transient response

(V_{DD}=V_{OUT}+1V,V_{CE}=V_{DD}, Cin=0.1μF)

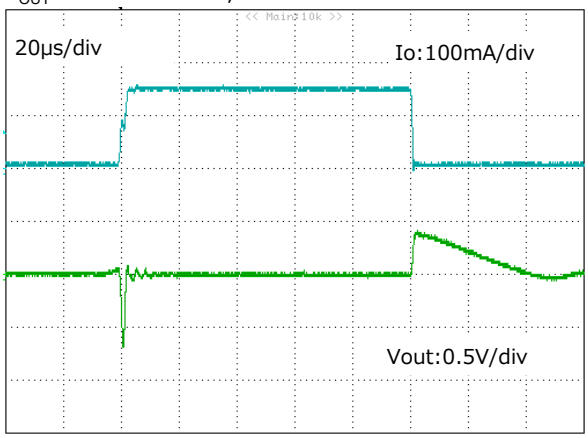
I_{OUT} : 50mA⇔100mA, Co=0.1uF



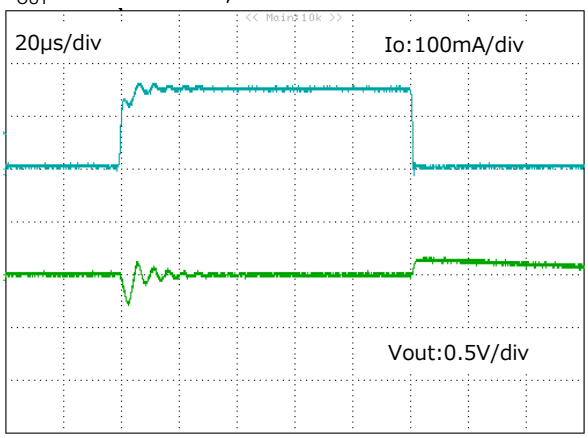
I_{OUT} : 50mA⇔100mA, Co=1uF



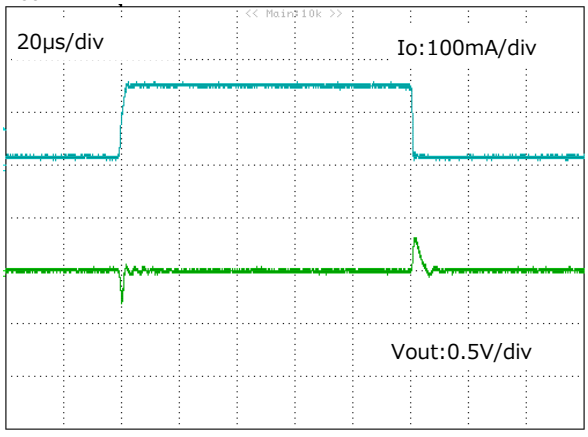
I_{OUT} : 1mA⇔150mA, Co=0.1uF



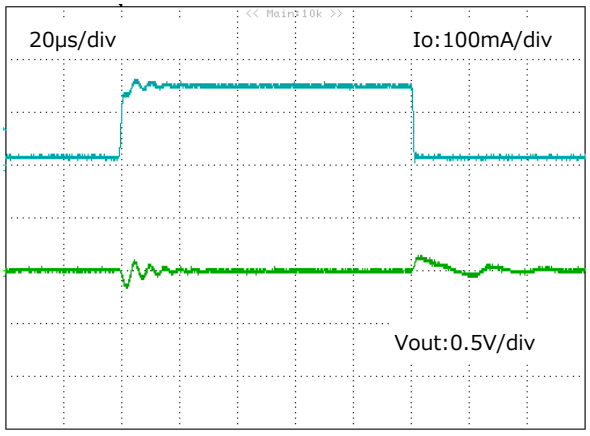
I_{OUT} : 1mA⇔150mA, Co=1uF



I_{OUT} : 10mA⇔150mA, Co=0.1uF



I_{OUT} : 10mA⇔150mA, Co=1uF



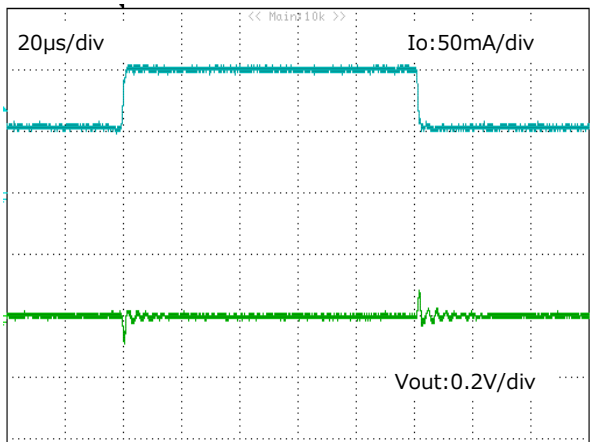
Typical Performance Characteristics (1.2V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

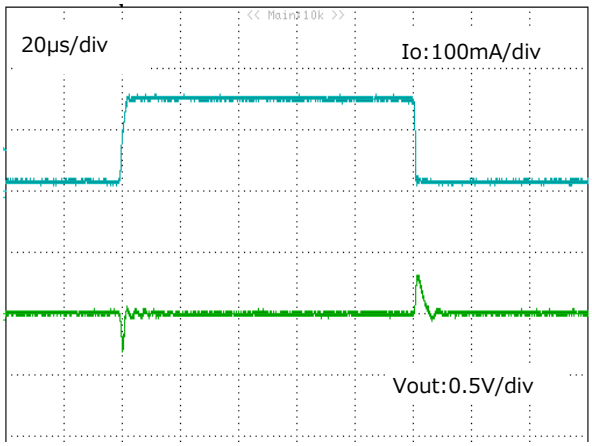
■ Load transient response

(V_{DD}=V_{OUT}+1V,V_{CE}=V_{DD}, Cin=0.1μF)

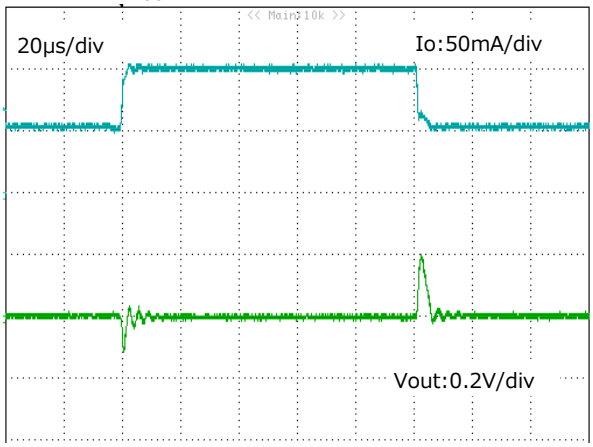
V_{DD}=2.2V, I_{OUT} : 50mA⇔100mA



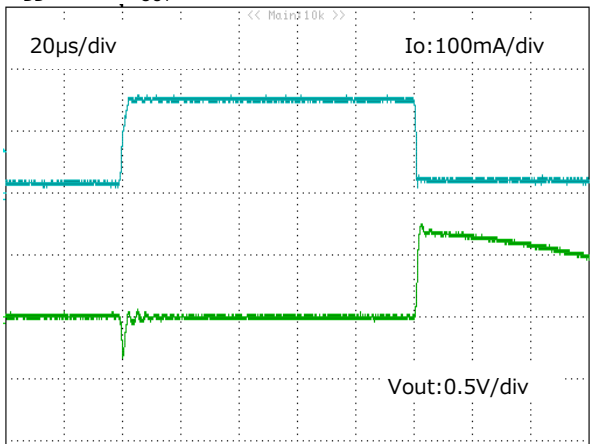
V_{DD}=2.2V, I_{OUT} : 10mA⇔150mA



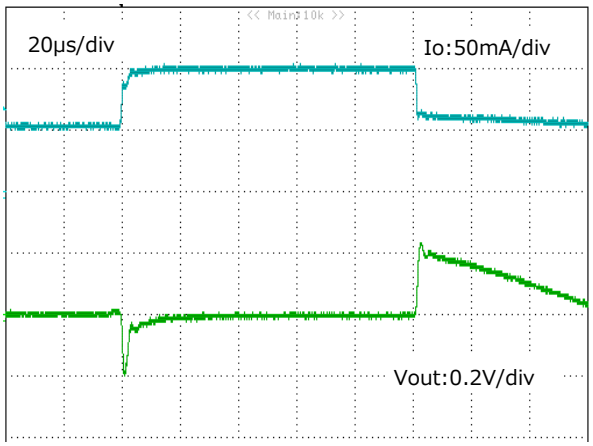
V_{DD}=1.9V, I_{OUT} : 50mA⇔100mA



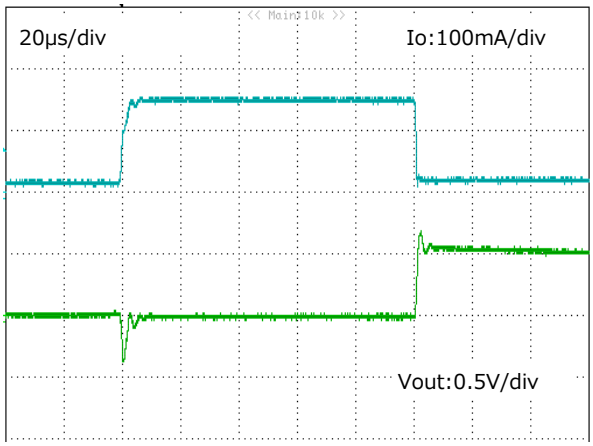
V_{DD}=2.0V, I_{OUT} : 10mA⇔150mA



V_{DD}=1.7V, I_{OUT} : 50mA⇔100mA



V_{DD}=1.8V, I_{OUT} : 10mA⇔150mA



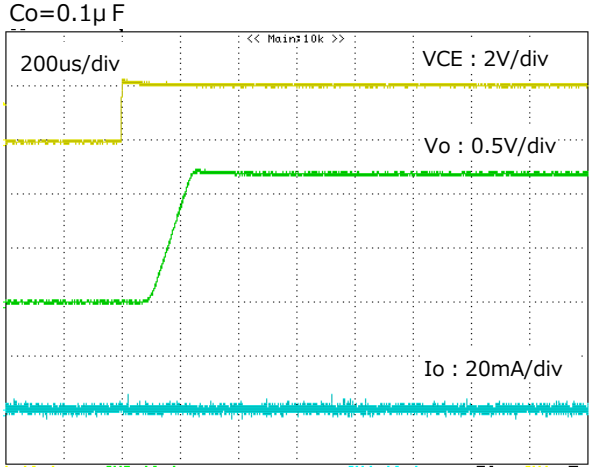
Typical Performance Characteristics (1.2V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

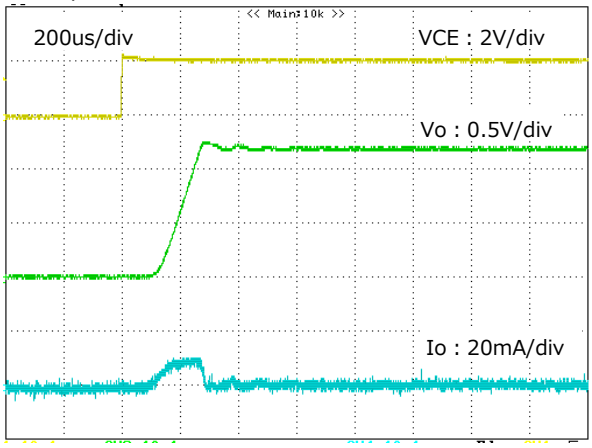
■ Output Rise & Rush Current

(V_{DD}=2.2V,V_{CE}=0→2V, Cin=0.1μF Io=1mA)

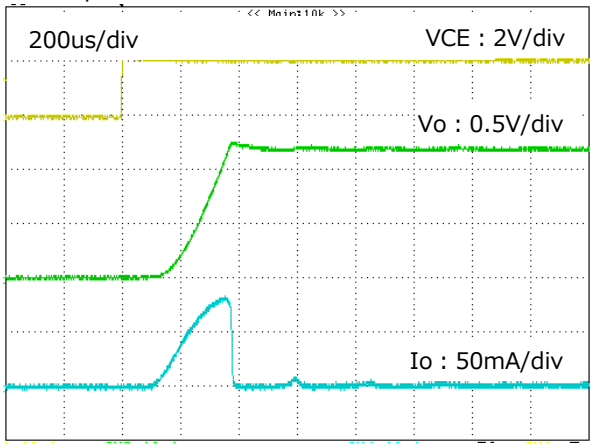
Co=0.1μ F



Co=1μF

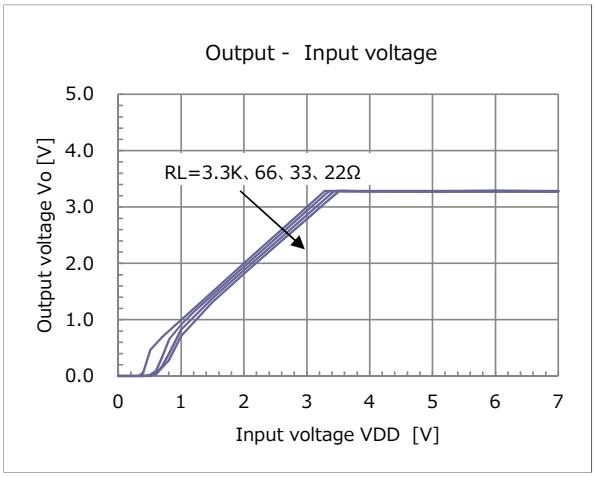


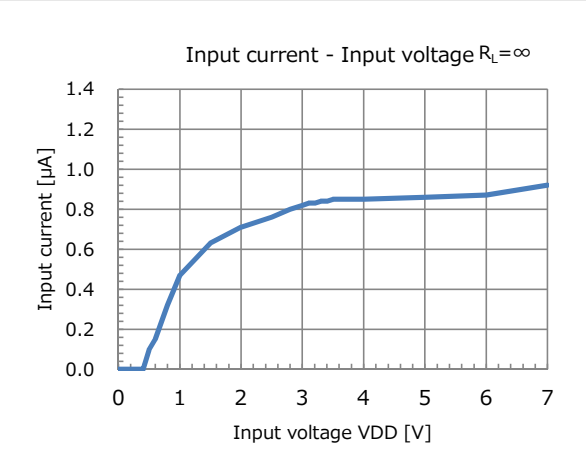
Co=10μF

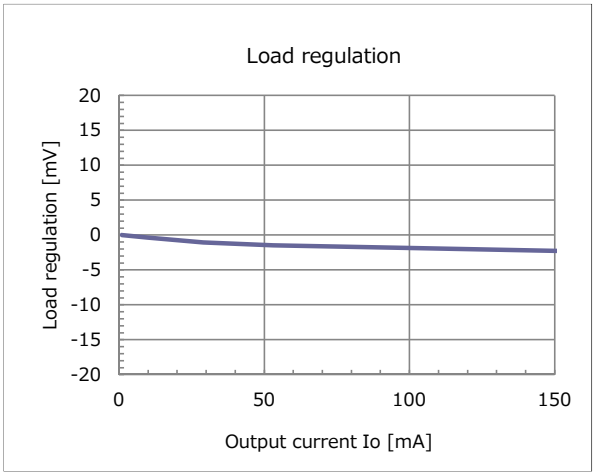


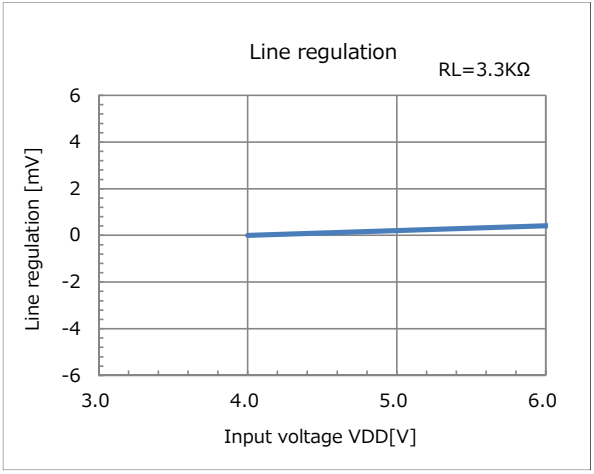
Typical Performance Characteristics (3.3V)

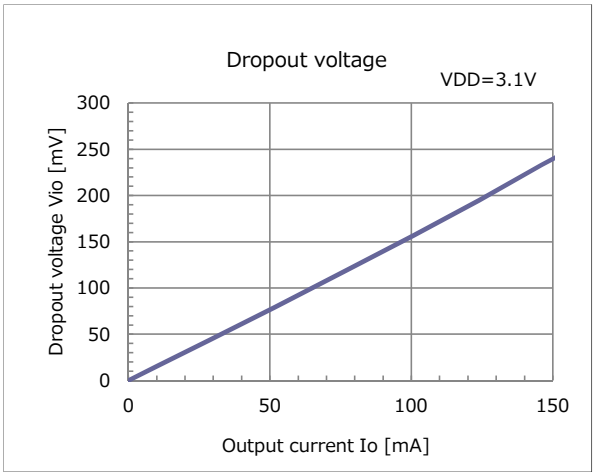
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

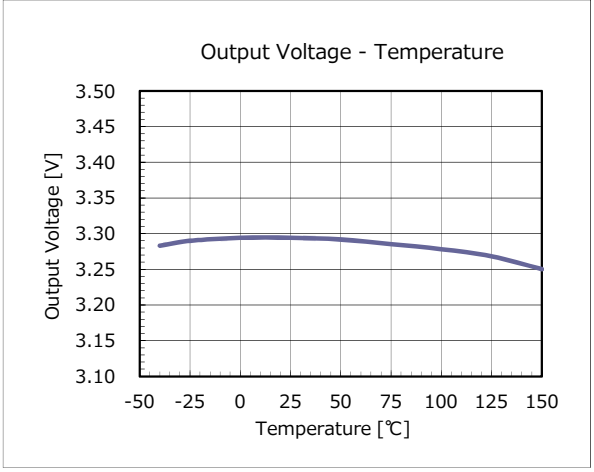






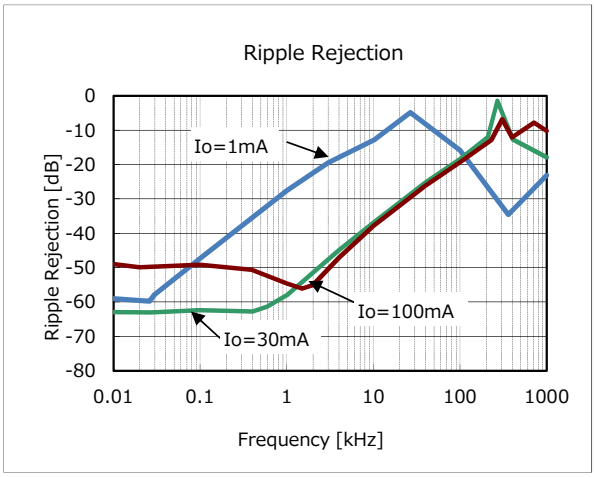


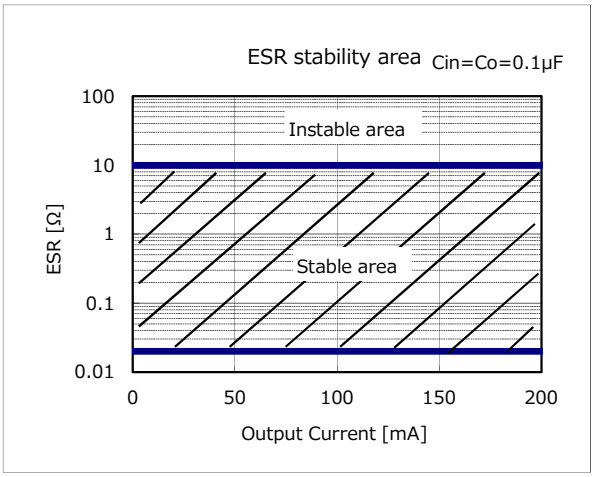


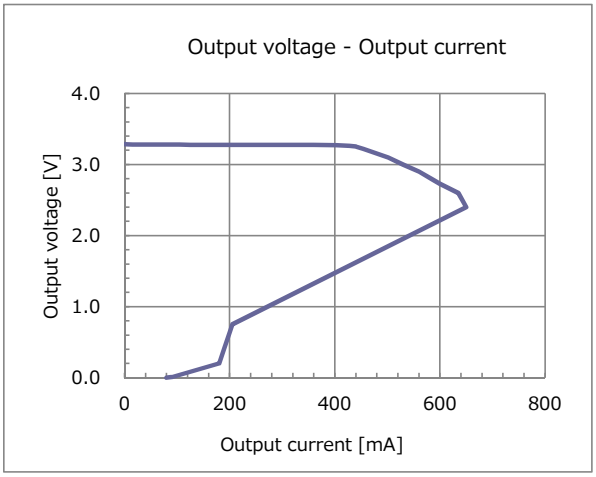


Typical Performance Characteristics (3.3V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)







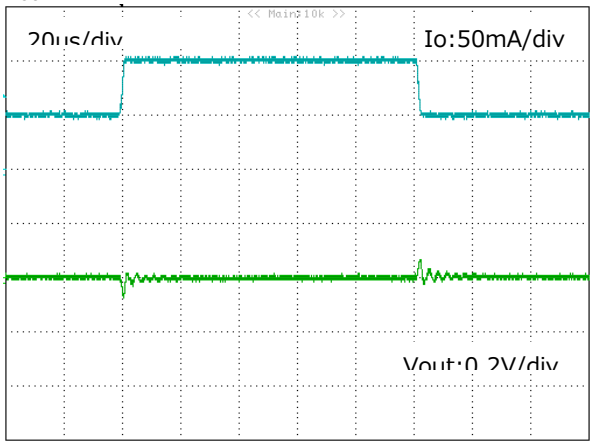
Typical Performance Characteristics (3.3V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

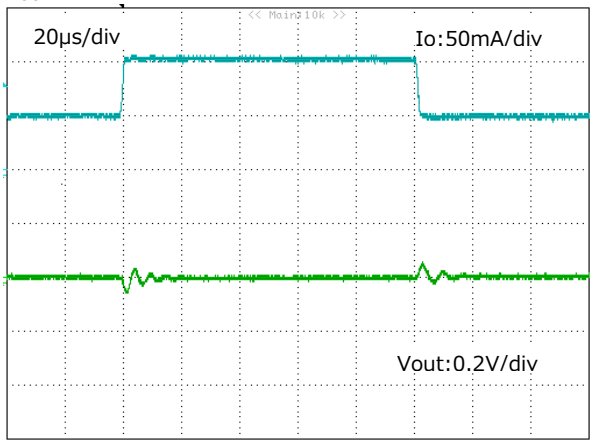
■ Load transient response

(V_{DD}=V_{OUT}+1V,V_{CE}=V_{DD}, Cin=0.1μF)

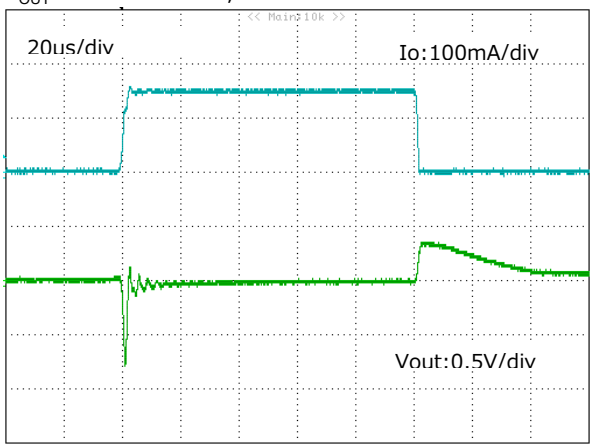
I_{OUT} : 50mA⇔100mA, Co=0.1uF



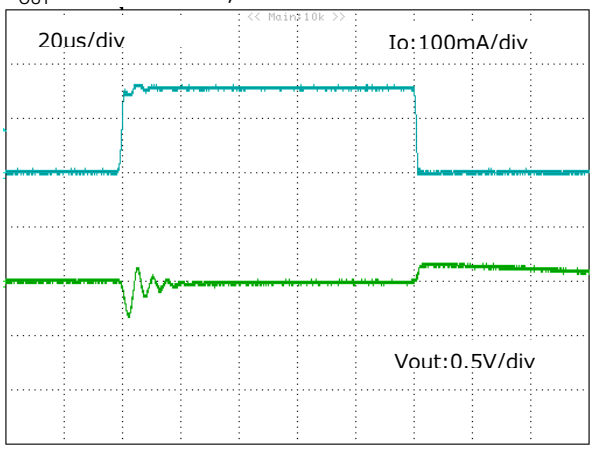
I_{OUT} : 50mA⇔100mA, Co=1uF



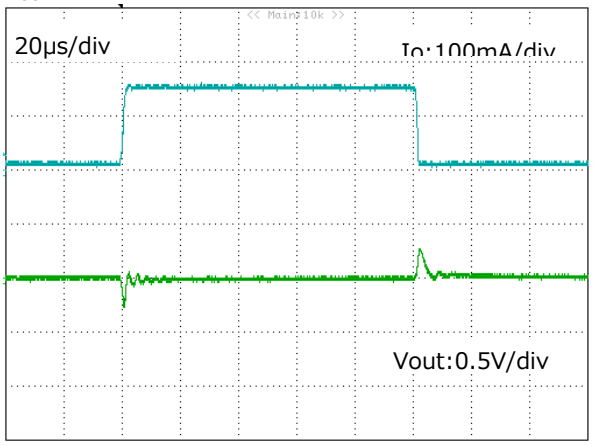
I_{OUT} : 1mA⇔150mA, Co=0.1uF



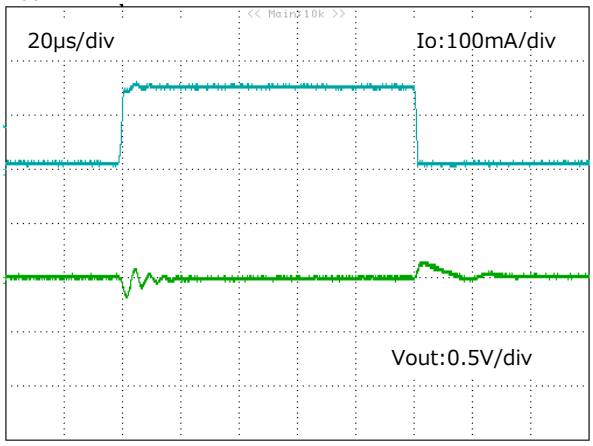
I_{OUT} : 1mA⇔150mA, Co=1uF



I_{OUT} : 10mA⇔150mA, Co=0.1uF



I_{OUT} : 10mA⇔150mA, Co=1uF



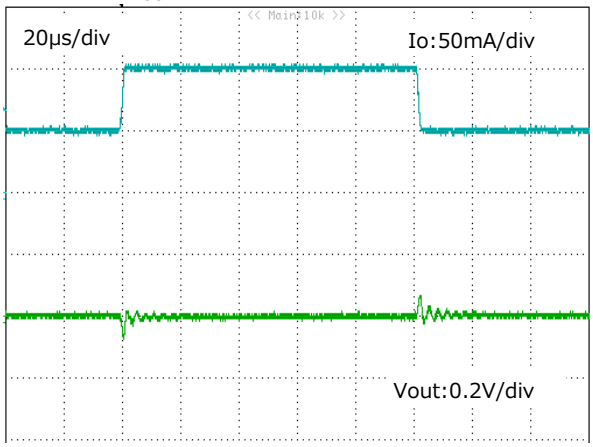
Typical Performance Characteristics (3.3V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

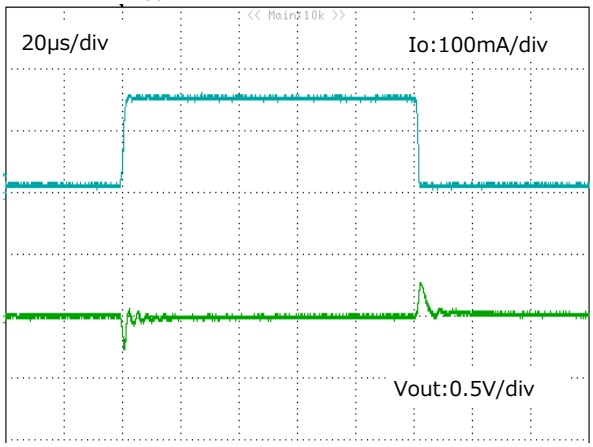
■ Load transient response

(V_{DD}=V_{OUT}+1V,V_{CE}=V_{DD}, Cin=0.1μF)

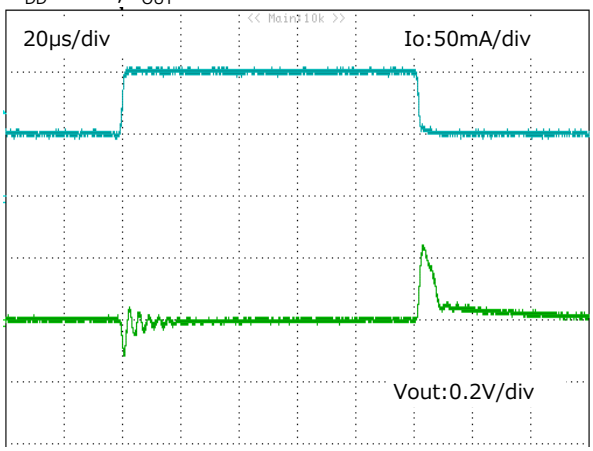
V_{DD}=4.3V, I_{OUT} : 50mA⇔100mA



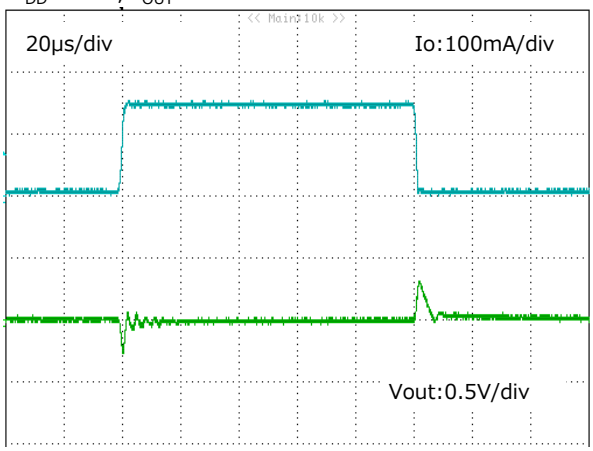
V_{DD}=4.3V, I_{OUT} : 10mA⇔150mA



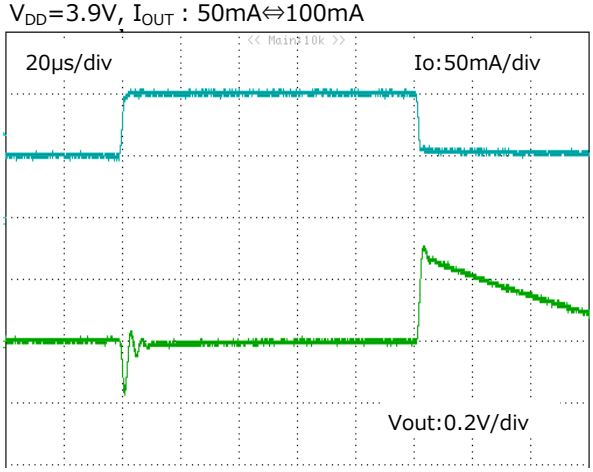
V_{DD}=4.0V, I_{OUT} : 50mA⇔100mA



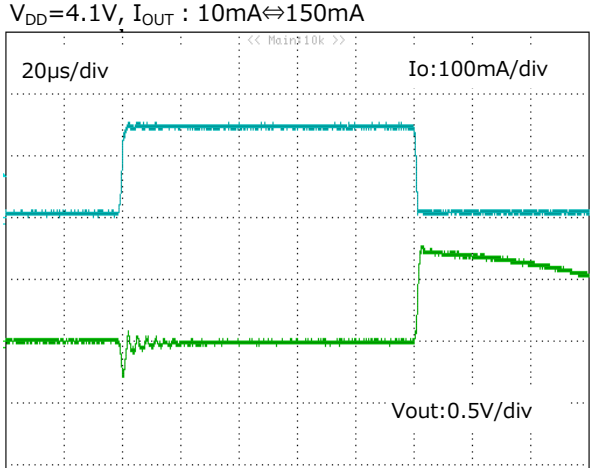
V_{DD}=4.2V, I_{OUT} : 10mA⇔150mA



V_{DD}=3.9V, I_{OUT} : 50mA⇔100mA



V_{DD}=4.1V, I_{OUT} : 10mA⇔150mA



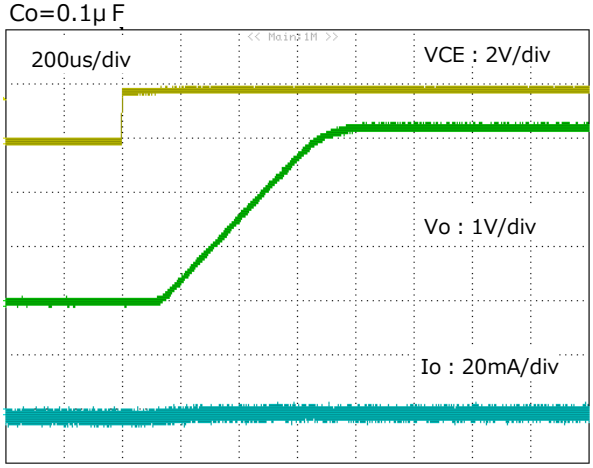
Typical Performance Characteristics (3.3V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

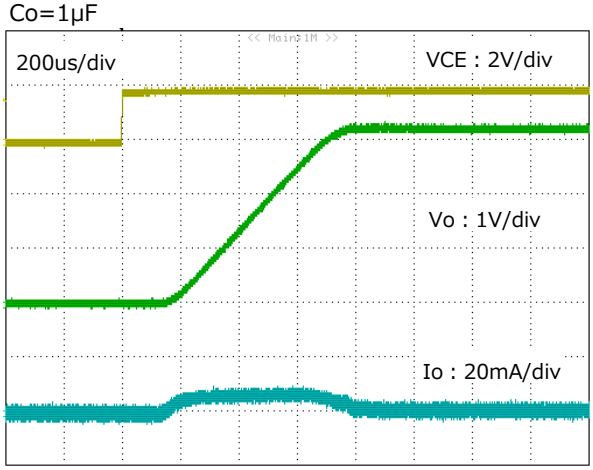
■ Output Rise & Rush Current

(V_{DD}=4.3V,V_{CE}=0→2V, Cin=0.1μF Io=1mA)

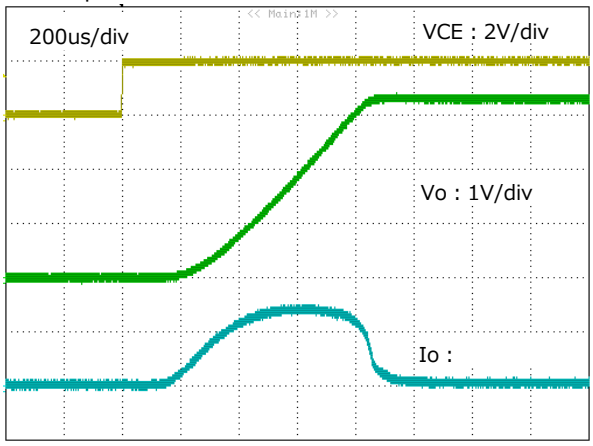
Co=0.1μ F



Co=1μF



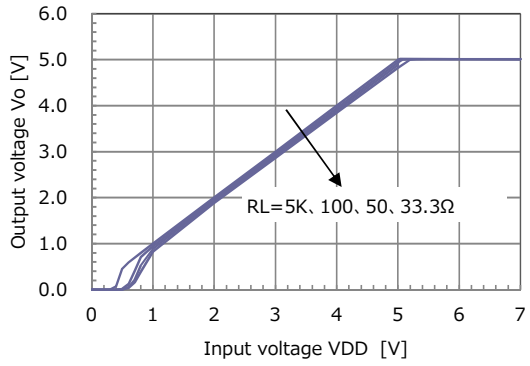
Co=10μF



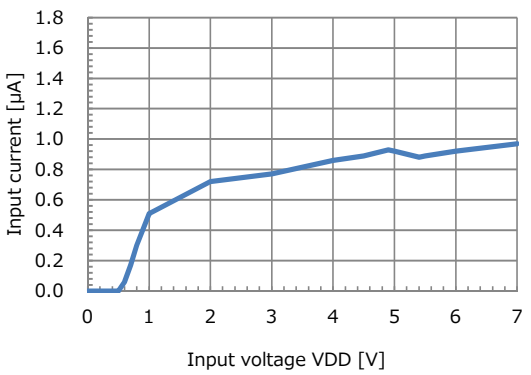
Typical Performance Characteristics (5.0V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

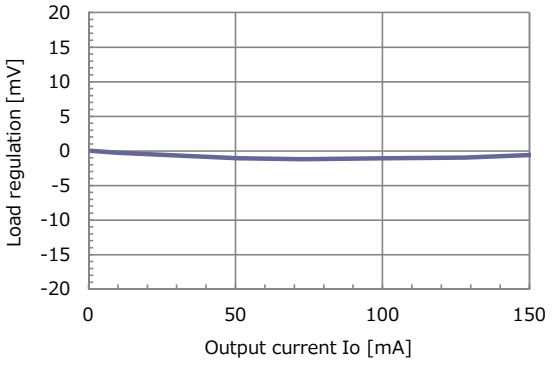
Output - Input voltage



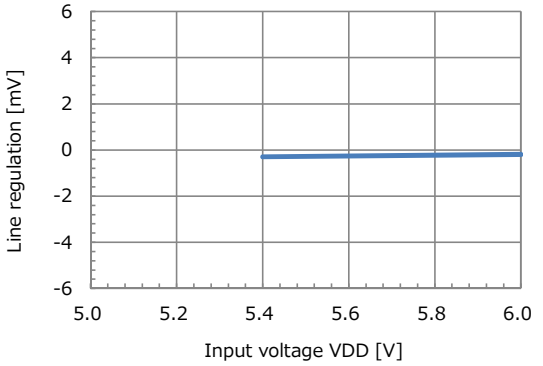
Input current - Input voltage R_L=∞



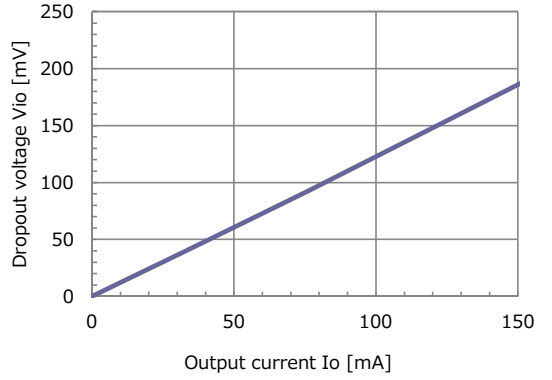
Load regulation



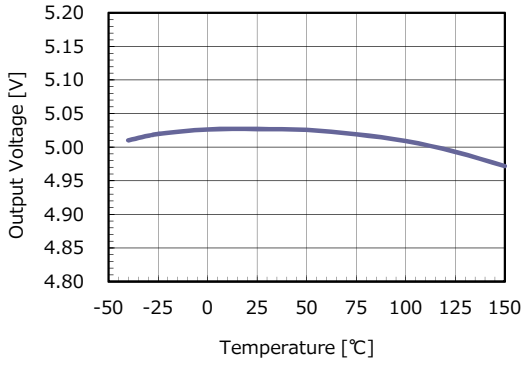
Line regulation RL=5.0KΩ



Dropout voltage VDD=4.8V

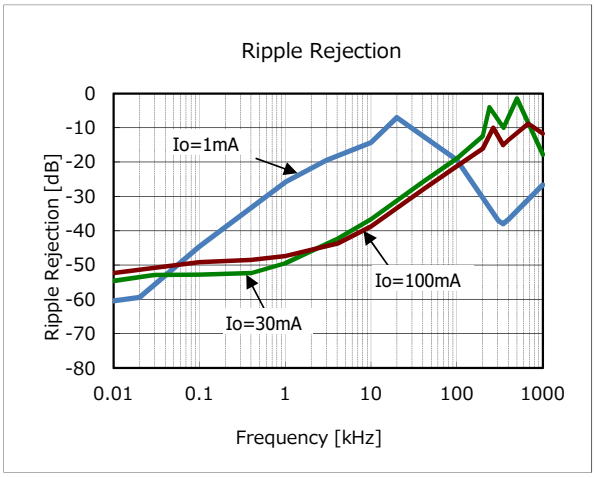


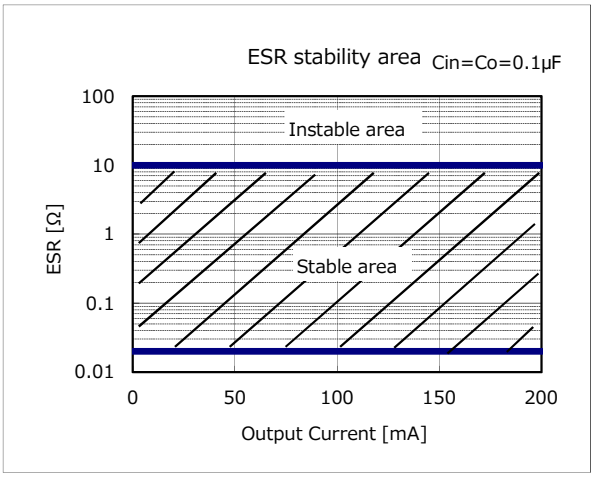
Output Voltage - Temperature

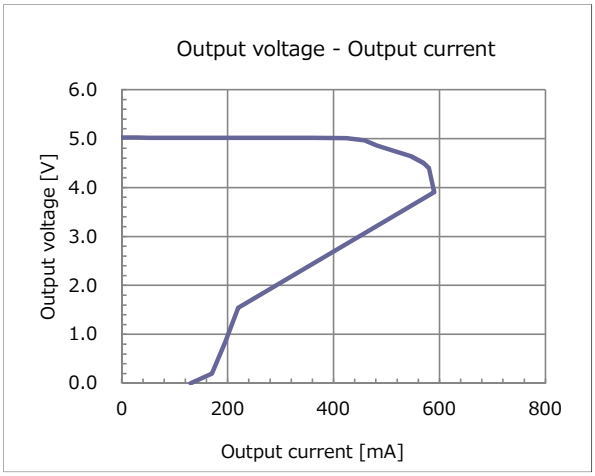


Typical Performance Characteristics (5.0V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)







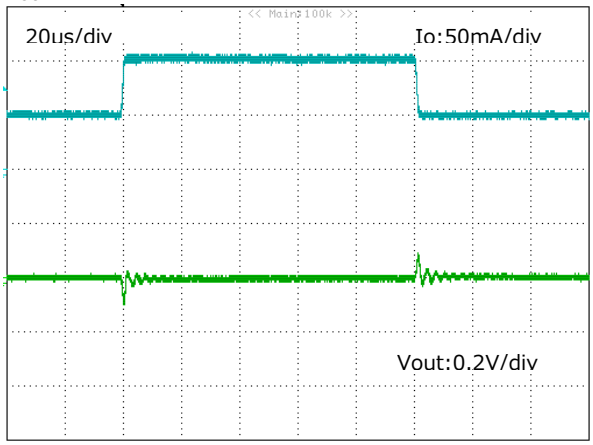
Typical Performance Characteristics (5.0V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

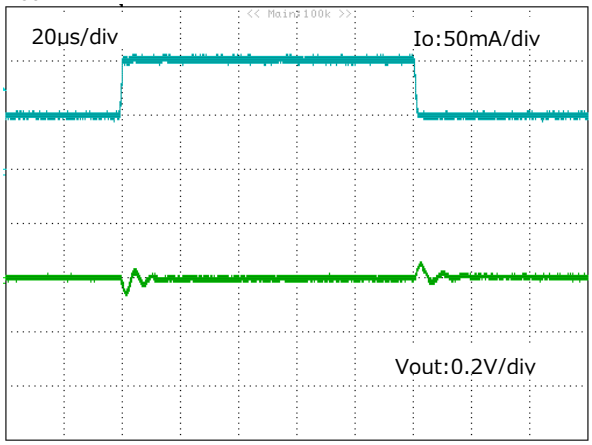
■ Load transient response

(V_{DD}=V_{OUT}+1V,V_{CE}=V_{DD}, Cin=0.1μF)

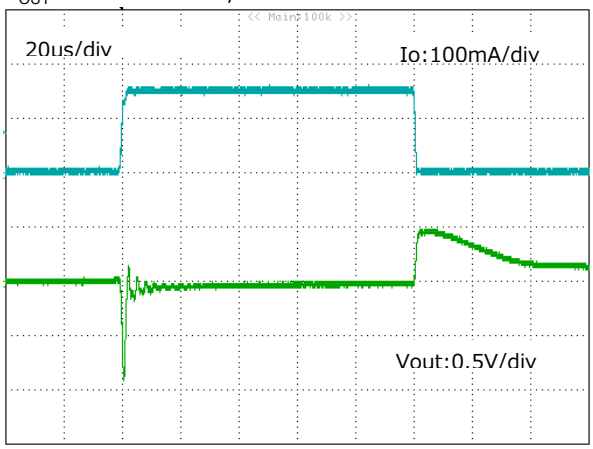
I_{OUT} : 50mA⇔100mA, Co=0.1uF



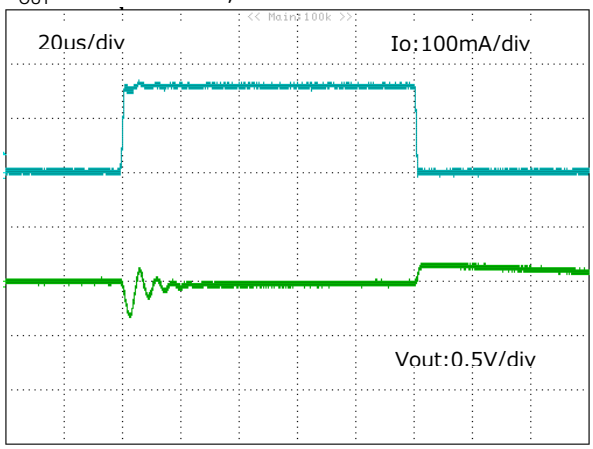
I_{OUT} : 50mA⇔100mA, Co=1uF



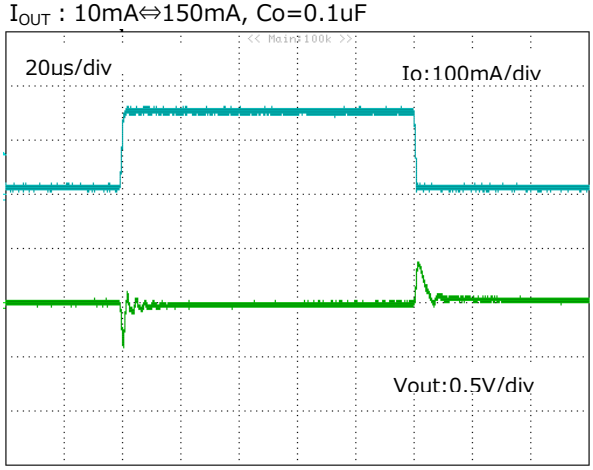
I_{OUT} : 1mA⇔150mA, Co=0.1uF



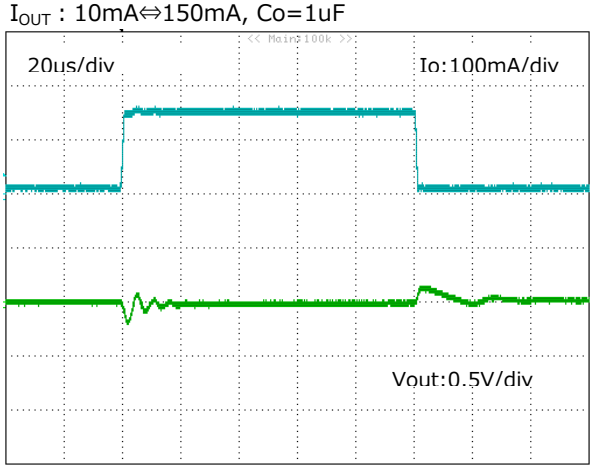
I_{OUT} : 1mA⇔150mA, Co=1uF



I_{OUT} : 10mA⇔150mA, Co=0.1uF



I_{OUT} : 10mA⇔150mA, Co=1uF



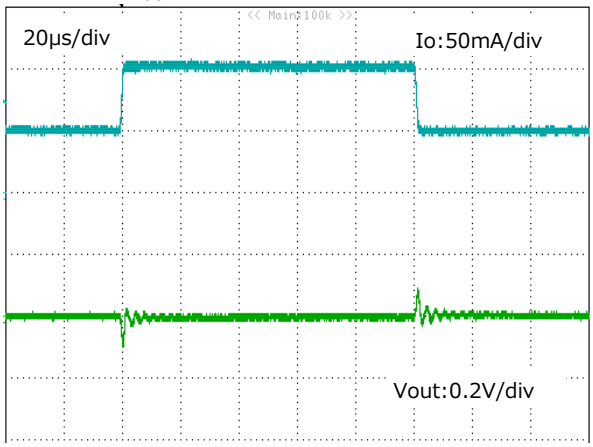
Typical Performance Characteristics (5.0V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

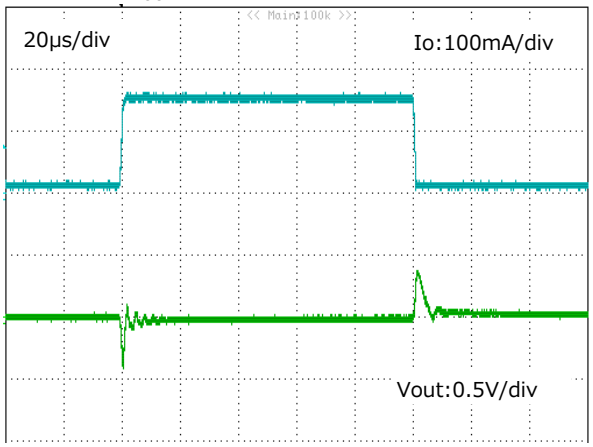
■ Load transient response

(V_{DD}=V_{OUT}+1V,V_{CE}=V_{DD}, Cin=0.1μF)

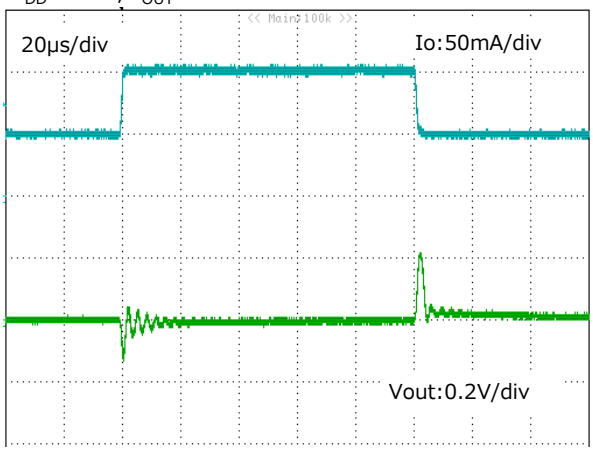
V_{DD}=6.0V, I_{OUT} : 50mA⇔100mA



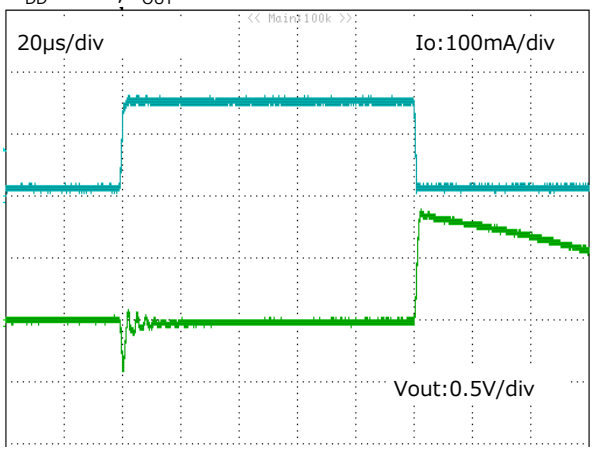
V_{DD}=6.0V, I_{OUT} : 10mA⇔150mA



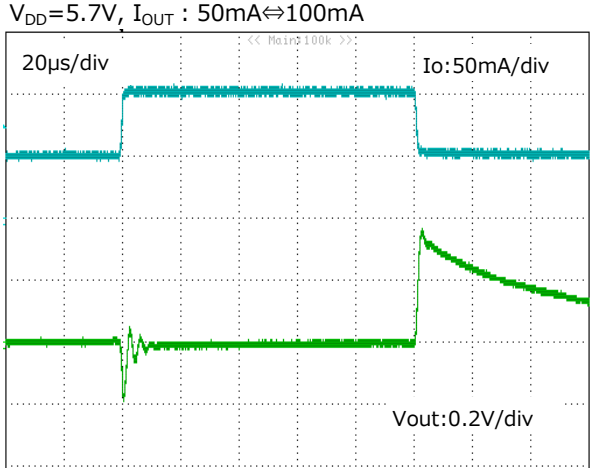
V_{DD}=5.8V, I_{OUT} : 50mA⇔100mA



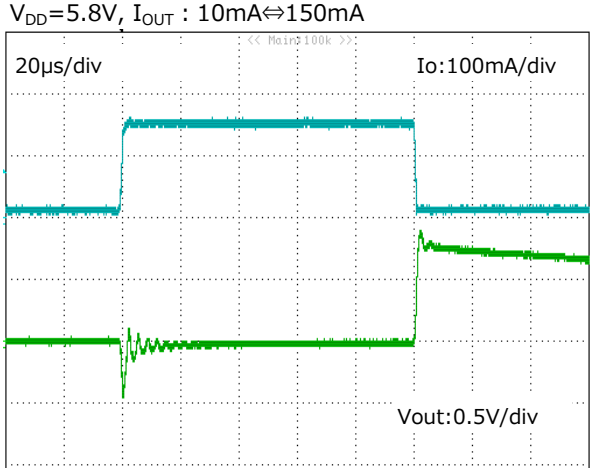
V_{DD}=5.9V, I_{OUT} : 10mA⇔150mA



V_{DD}=5.7V, I_{OUT} : 50mA⇔100mA



V_{DD}=5.8V, I_{OUT} : 10mA⇔150mA



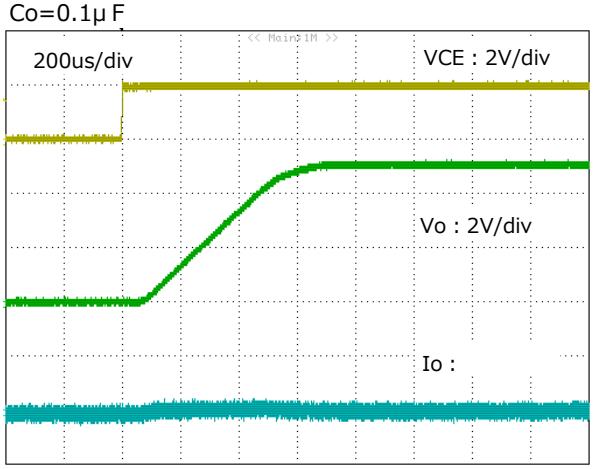
Typical Performance Characteristics (5.0V)

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

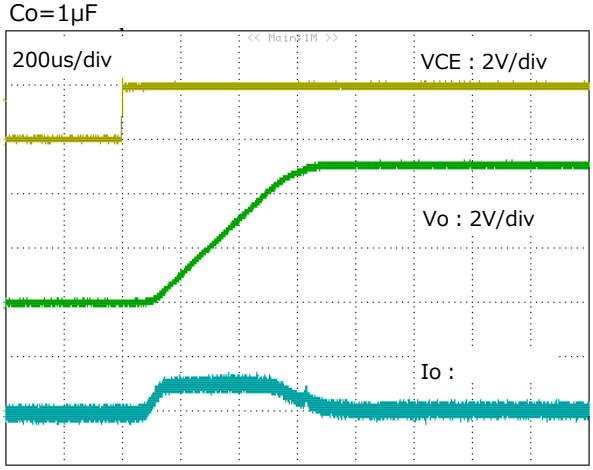
■ Output Rise & Rush Current

(V_{DD}=6.0V,V_{CE}=0→2V, Cin=0.1μF Io=1mA)

Co=0.1μ F



Co=1μF



Co=10μF