



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 quiescent current
- High speed response
- High accuracy output voltage

## Main specifications

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

- Maximum rating supply voltage : -0.3V to 7V
- Operating voltage range : 1.7V to 6V
- Operating ambient temperature : -40°C to 85°C
- Output current : 150mA
- Input current (OFF) : Typ. 0.1uA
- No-load input current : Typ. 0.9uA ( $V_{OUT}(Typ.) \leq 3.3V$ )  
Typ. 1.2uA ( $3.3V < V_{OUT}(Typ.)$ )
- Output voltage range : 1.2V to 5V (0.1V step)
- Output voltage accuracy :  $\pm 0.8\%$  ( $2.0V \leq V_{OUT}(Typ.)$ )  
 $\pm 16mV$  ( $V_{OUT}(Typ.) < 2.0V$ )
- 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





## Model Name

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

Series name

(A)

(B)

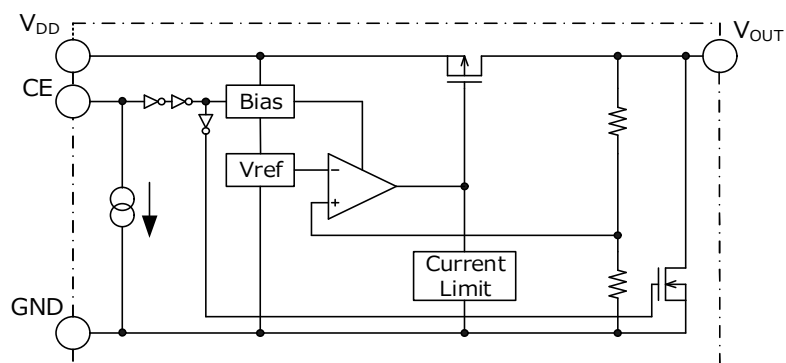
(C)

(D)

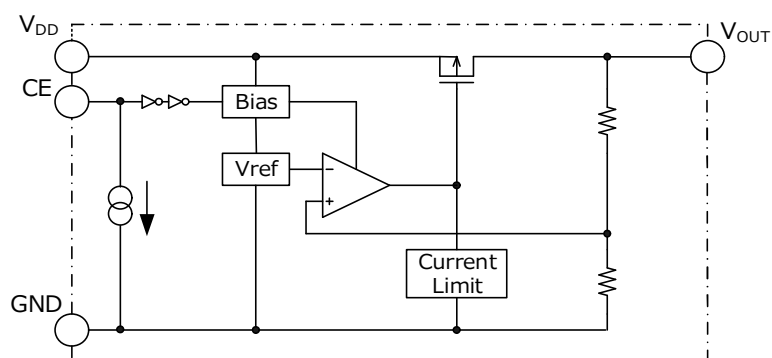
|     |                        |    |                                                                                              |
|-----|------------------------|----|----------------------------------------------------------------------------------------------|
| (A) | Function Type          | A  | CE=H active, with discharge function                                                         |
|     |                        | C  | CE=H active, without discharge function                                                      |
| (B) | Output voltage rank    | 12 | The output voltage can be designated in the range from 1.00V(10) to 5.00V(50) in 0.1V steps. |
|     |                        | ?  |                                                                                              |
|     |                        | 50 |                                                                                              |
| (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)



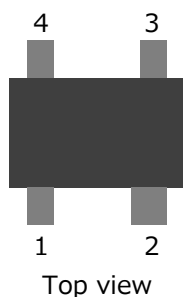
- C rank (CE=H active, without discharge function)





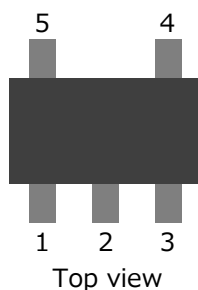
## Pin Configuration

### ■ SC-82ABB



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

### ■ SOT-25A



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



## Absolute Maximum Ratings

| Item                 |          | Symbol | Min. | Max.     | Unit |
|----------------------|----------|--------|------|----------|------|
| Storage temperature  |          | Tstg   | -55  | 150      | ℃    |
| Junction temperature |          | TjMAX  | -    | 150      | ℃    |
| Supply voltage       |          | VDD    | -0.3 | 7.0      | V    |
| CE input voltage     |          | VCE    | -0.3 | 7.0      | V    |
| Output voltage       |          | VOUT   | -0.3 | VDD+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   | °C   |
| Operating voltage             | Vop    | 1.7  | 6.0  | V    |
| Output current                | Iop    | 0    | 150  | mA   |

## Electrical Characteristics

(VDD=VOUT(Typ.)+1V, VCE=VDD, Ta=25°C unless otherwise specified)

The specifications with under bar are guaranteed by design.

| Item                  | Symbol | Conditions                    | Min.          | Typ. | Max.          | Unit |
|-----------------------|--------|-------------------------------|---------------|------|---------------|------|
| Input current(OFF)    | IDDOFF | VCE=0V                        | -             | 0.1  | 1.0           | μA   |
| No-Load Input Current | IDD    | 1.2V≤VOUT≤3.3V<br>IOUT=0mA    | -             | 0.9  | <u>1.5</u>    | μA   |
|                       |        | 3.4V≤VOUT≤5.0V<br>IOUT=0mA    | -             | 1.2  | <u>2.0</u>    | μA   |
|                       |        |                               |               |      |               |      |
| Output voltage        | VOUT   | VOUT> 2.0V                    | ×0.992        | -    | ×1.008        | V    |
|                       |        | VOUT≤2.0V                     | -16           | -    | 16            | mV   |
|                       |        | VOUT> 2.0V<br>-40≤Ta≤85°C     | <u>×0.978</u> | -    | <u>×1.022</u> | V    |
|                       |        | VOUT≤2.0V<br>-40≤Ta≤85°C      | <u>-44</u>    | -    | <u>44</u>     | mV   |
|                       |        |                               |               |      |               |      |
| Line regulation       | VLINE  | VOUT(Typ.)+0.5V≤VDD≤6.0V      | -             | 0.02 | <u>0.10</u>   | %/V  |
| Load regulation       | VLOAD  | 1mA≤IOUT≤150mA                | -             | 10   | <u>20</u>     | mV   |
| Dropout voltage       | Vio    | Please refer to another page. | -             | -    | -             | V    |



## Electrical Characteristics

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

The specifications with under bar are guaranteed by design.

| Item                                   | Symbol                      | Conditions                                     | Min.       | Typ.     | Max.       | Unit             |
|----------------------------------------|-----------------------------|------------------------------------------------|------------|----------|------------|------------------|
| Ripple rejection<br>*Note3             | RR                          | $f=1kHz$ , $V_{ripple}=0.5V$<br>$I_{OUT}=30mA$ | -          | 50       | -          | dB               |
| Output noise voltage<br>*Note3         | $V_n$                       | $f_{BW}=10Hz\sim 100kHz$<br>$I_{OUT}=30mA$     | -          | 60       | -          | $\mu V_{rms}$    |
| Vout temperature coefficient<br>*Note3 | $\Delta V_{OUT} / \Delta T$ | $-40 \leq T_a \leq 85^{\circ}C$                | -          | $\pm 80$ | -          | ppm/ $^{\circ}C$ |
| Output short-circuit current<br>*Note3 | $I_{short}$                 | $V_{OUT}=0V$                                   | -          | 100      | -          | mA               |
| CE High threshold voltage              | $V_{CEH}$                   |                                                | <u>1.5</u> | -        | $V_{DD}$   | V                |
| CE Low threshold voltage               | $V_{CEL}$                   |                                                | 0          | -        | <u>0.3</u> | V                |
| CE pin current<br>*Note3               | $I_{CEH}$                   |                                                | -          | 0.3      | -          | $\mu A$          |
| Output NMOS ON resistance<br>*Note3,4  | $R_{DON}$                   | $V_{CE}=0V$ , $V_{DD}=4V$                      | -          | 10       | -          | $\Omega$         |

\*Note3: The parameter is guaranteed by design.

\*Note4: This parameter is only MM3534A series.



## Electrical Characteristics

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

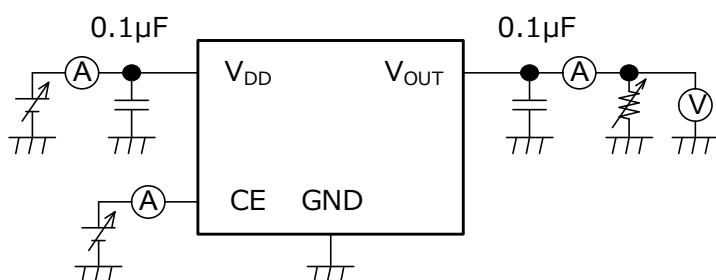
The specifications with under bar are guaranteed by design.

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

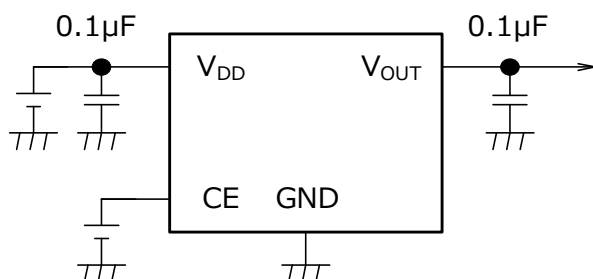
\*Note5: Dropout voltage MAX value in the input and it is confirmed that there is no output abnormal voltage impression the load 150mA in the model less than  $V_{out} < 2.5V$ .



## 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 0.1 $\mu$ F 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( $I_o < 10\mu A$ ) at the time of high temperature.
11. When the terminal VDD(CE) is OFF $\rightarrow$ 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 0.3 $\mu A$  (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 Dissipation

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.

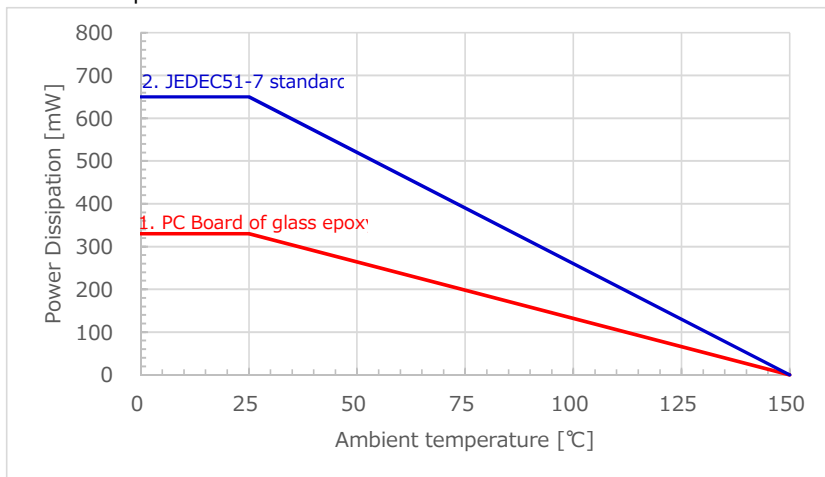
### ■ SC-82ABB

#### 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℃



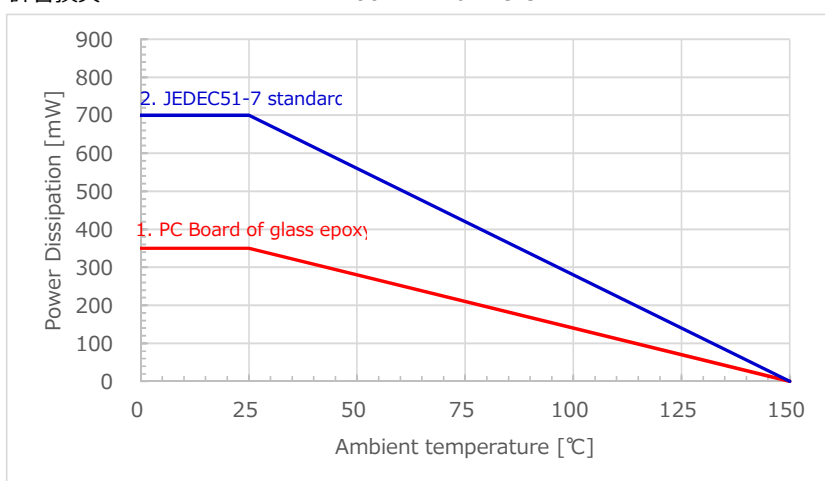
### ■ SOT-25A

#### 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℃



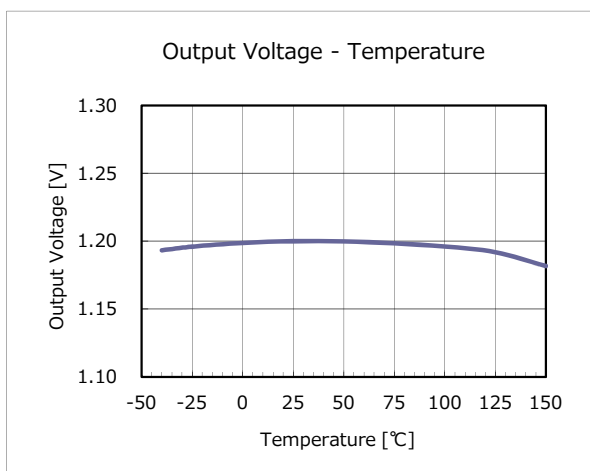
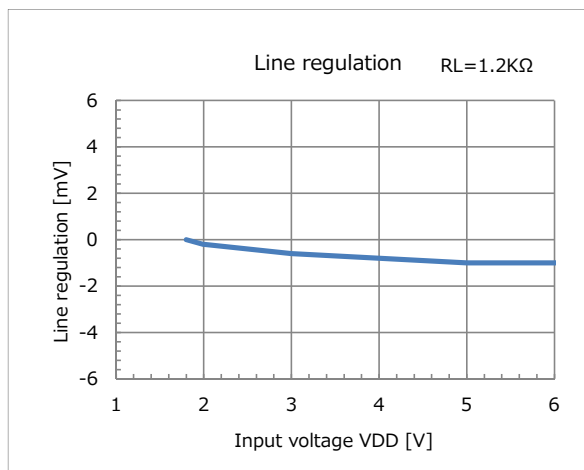
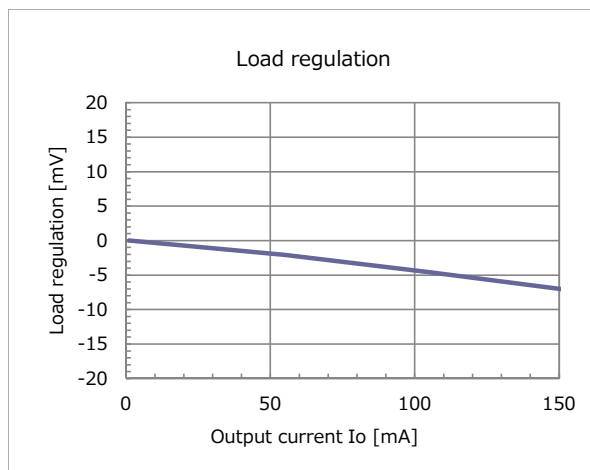
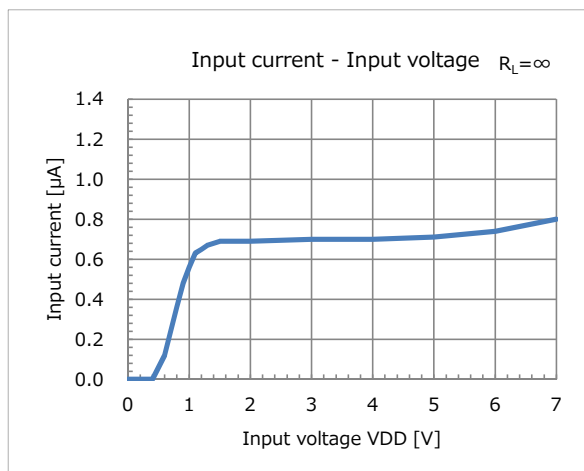
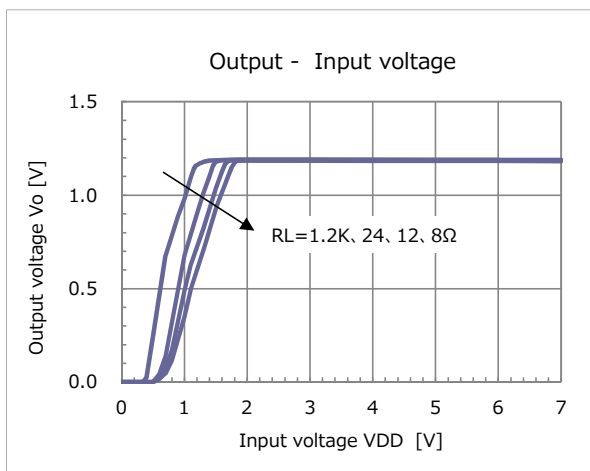
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplate substrate).

By increasing these copper foil pattern area of PCB, Power dissipation improves.



## Typical Performance Characteristics (1.2V)

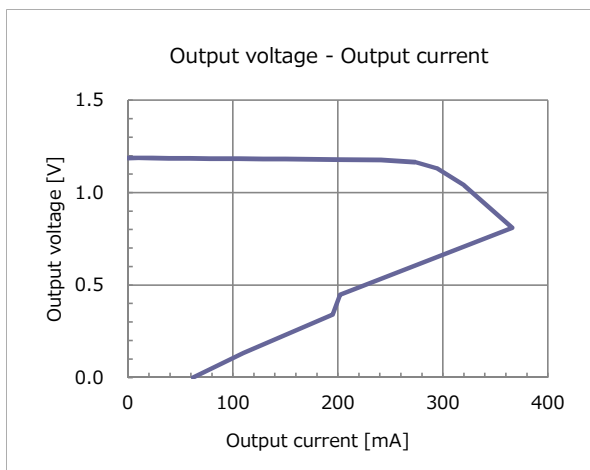
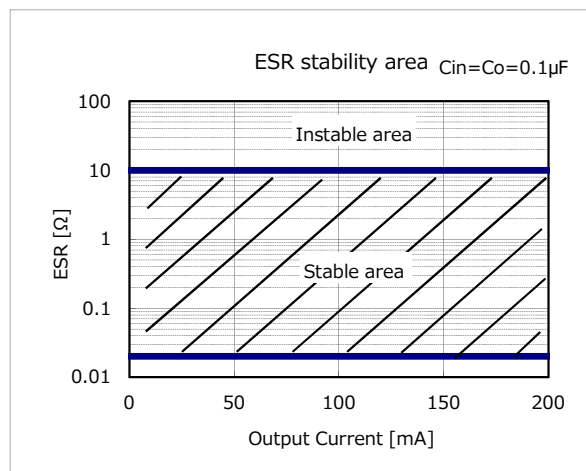
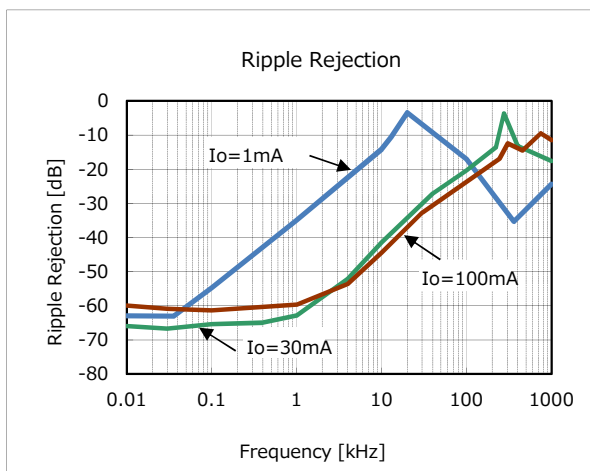
( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)





## Typical Performance Characteristics (1.2V)

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)





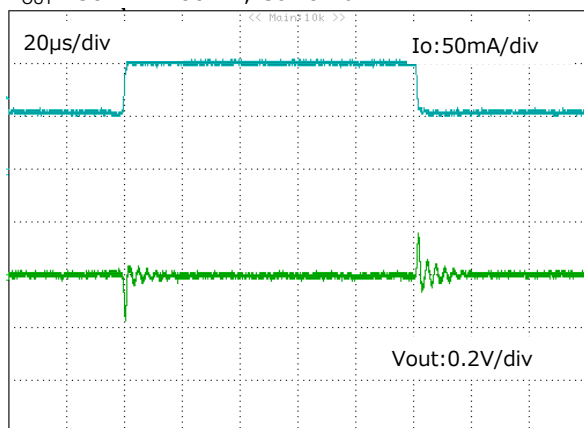
## Typical Performance Characteristics (1.2V)

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

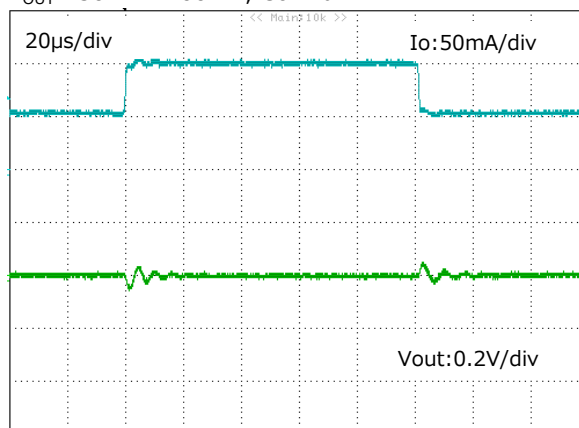
### ■ Load transient response

( $V_{DD}=V_{OUT}+1V$ ,  $V_{CE}=V_{DD}$ ,  $C_{in}=0.1\mu F$ )

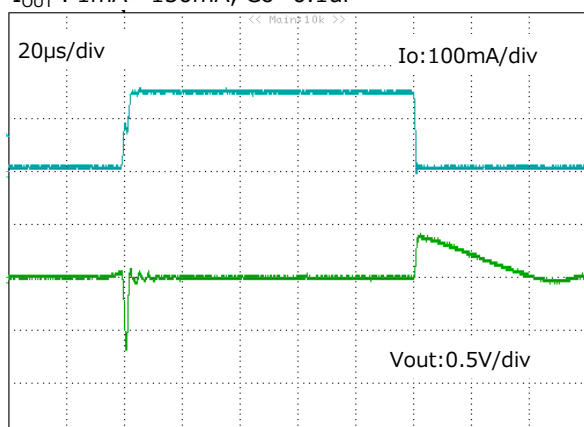
$I_{OUT} : 50mA \Leftrightarrow 100mA$ ,  $C_o=0.1\mu F$



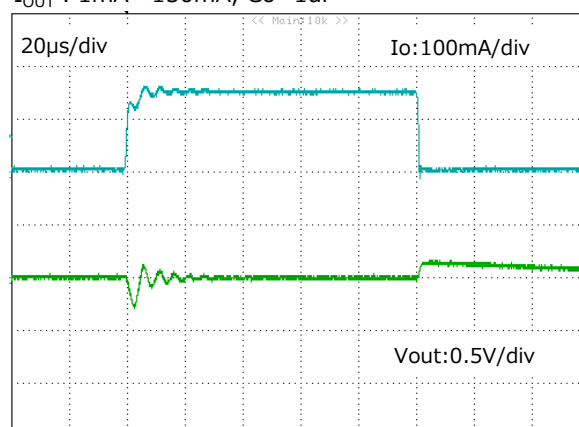
$I_{OUT} : 50mA \Leftrightarrow 100mA$ ,  $C_o=1\mu F$



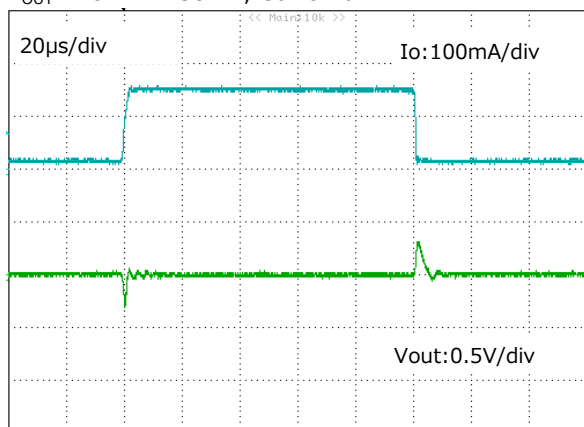
$I_{OUT} : 1mA \Leftrightarrow 150mA$ ,  $C_o=0.1\mu F$



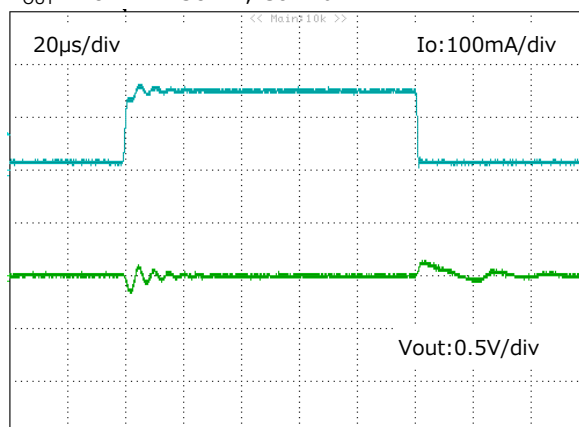
$I_{OUT} : 1mA \Leftrightarrow 150mA$ ,  $C_o=1\mu F$



$I_{OUT} : 10mA \Leftrightarrow 150mA$ ,  $C_o=0.1\mu F$



$I_{OUT} : 10mA \Leftrightarrow 150mA$ ,  $C_o=1\mu F$





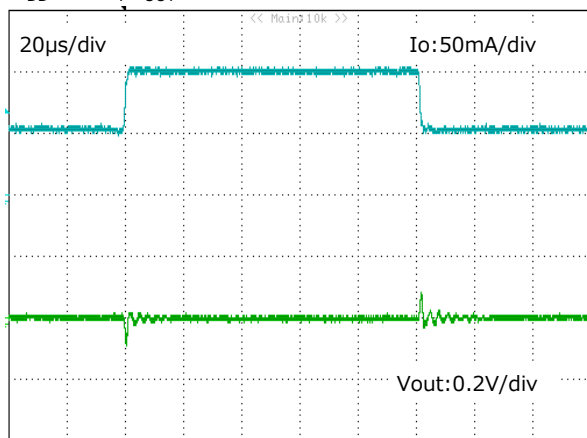
## Typical Performance Characteristics (1.2V)

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

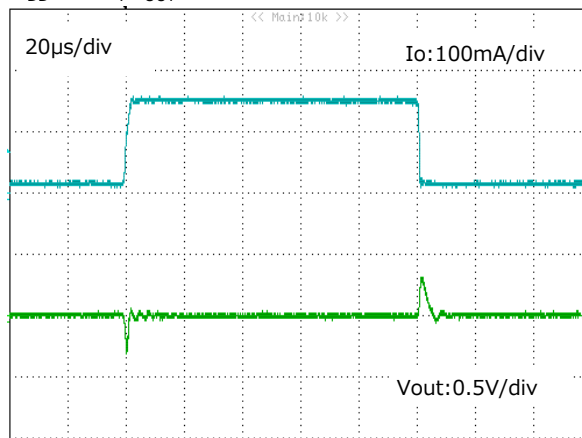
### ■ Load transient response

( $V_{DD}=V_{OUT}+1V$ ,  $V_{CE}=V_{DD}$ ,  $C_{in}=0.1\mu F$ )

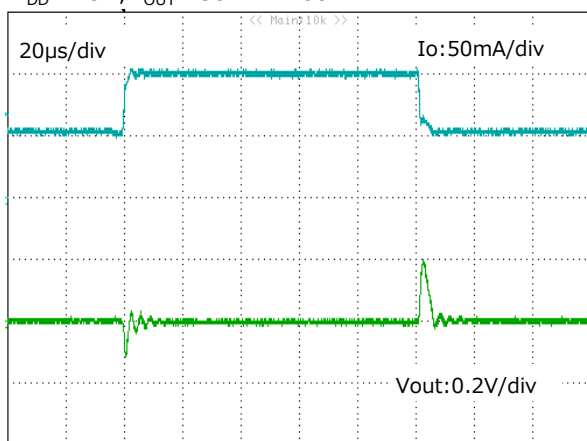
$V_{DD}=2.2V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



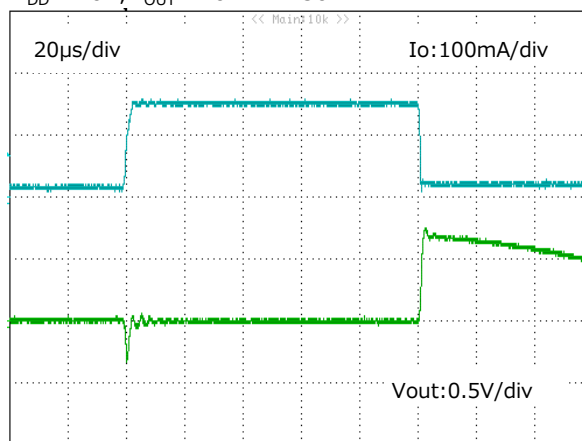
$V_{DD}=2.2V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$



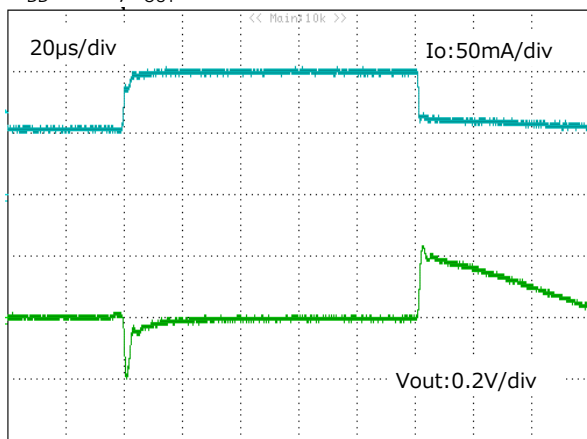
$V_{DD}=1.9V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



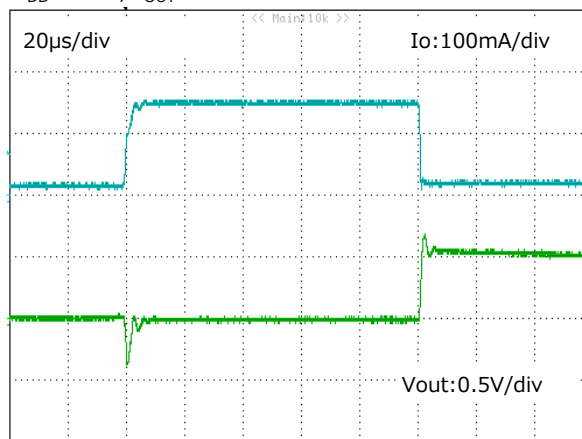
$V_{DD}=2.0V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$



$V_{DD}=1.7V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



$V_{DD}=1.8V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$





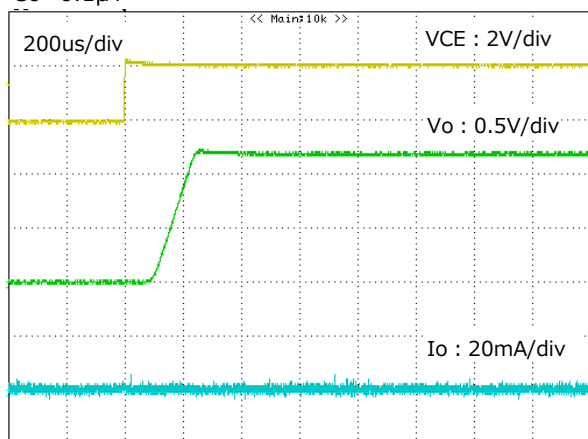
## Typical Performance Characteristics (1.2V)

( $V_{DD}=V_{OUT(Typ.)}+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

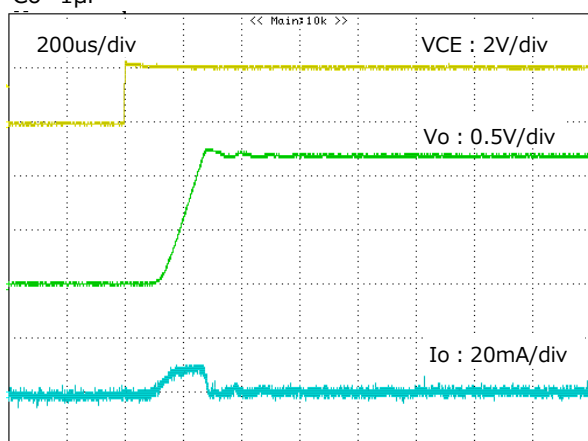
### ■ Output Rise & Rush Current

( $V_{DD}=2.2V$ ,  $V_{CE}=0 \rightarrow 2V$ ,  $C_{in}=0.1\mu F$   $I_o=1mA$ )

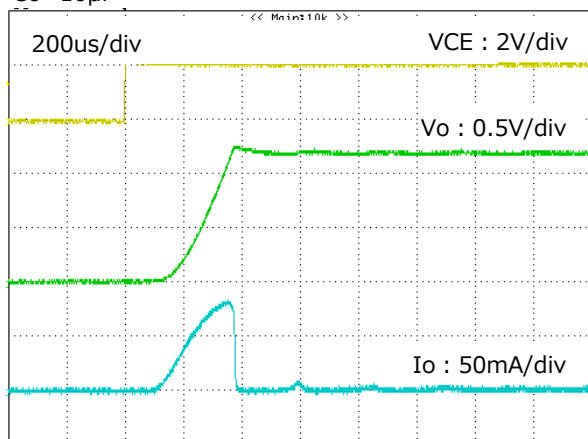
$C_o=0.1\mu F$



$C_o=1\mu F$



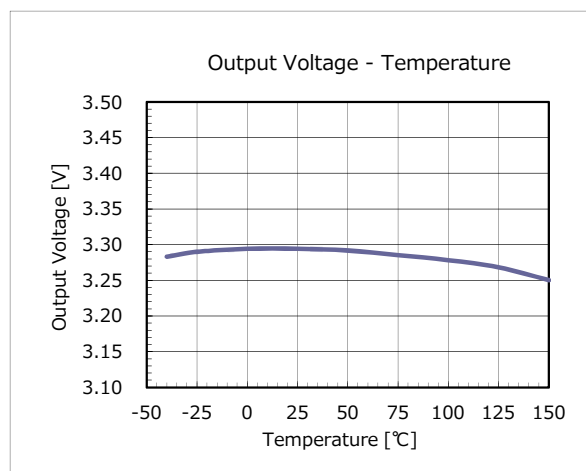
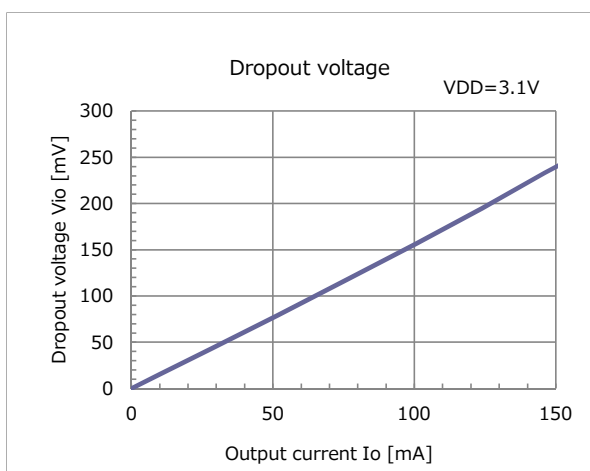
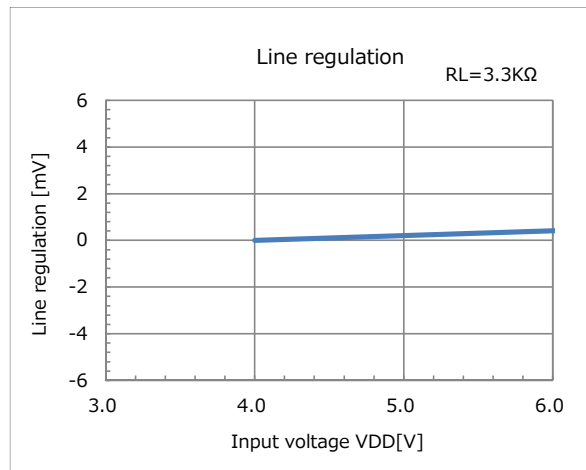
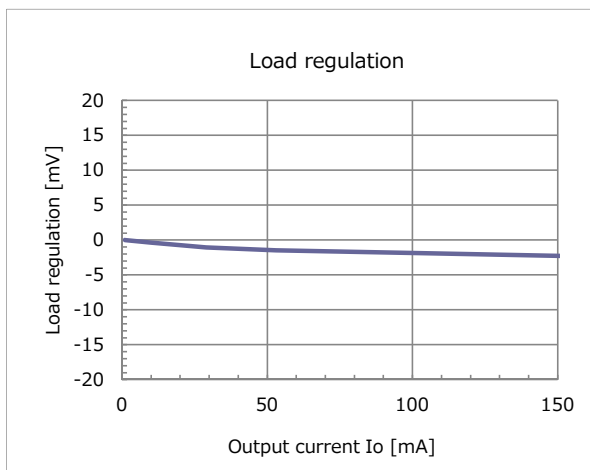
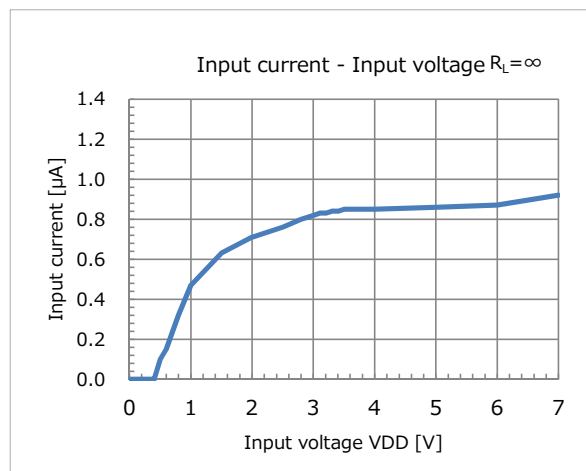
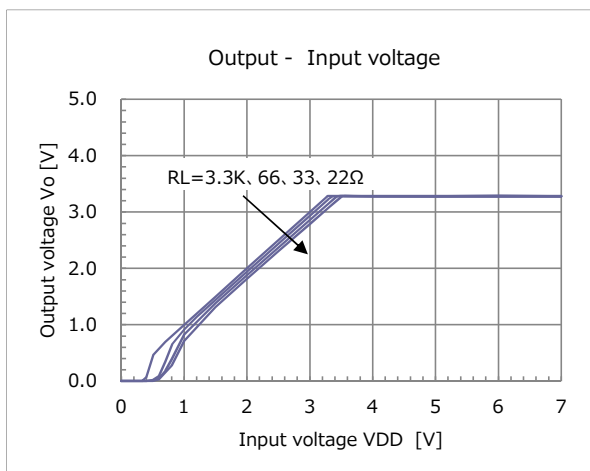
$C_o=10\mu F$





## Typical Performance Characteristics (3.3V)

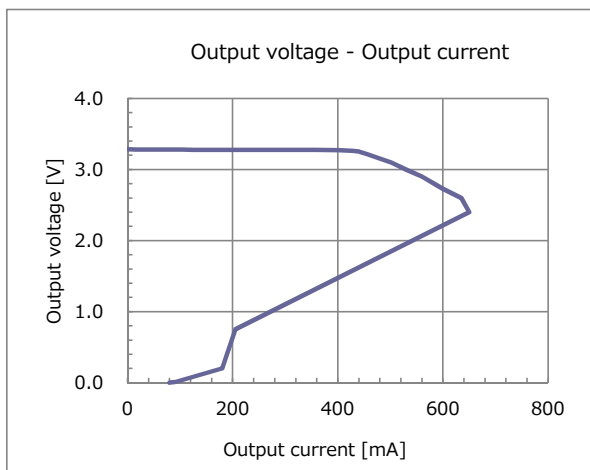
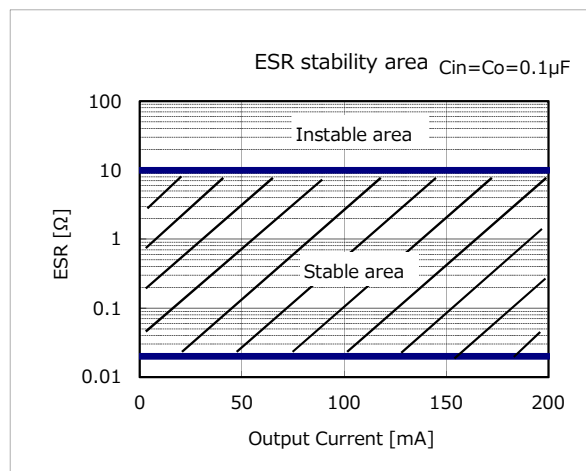
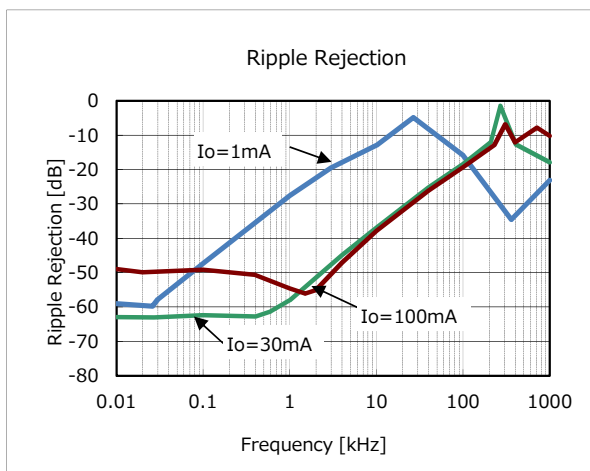
( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)





## Typical Performance Characteristics (3.3V)

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)





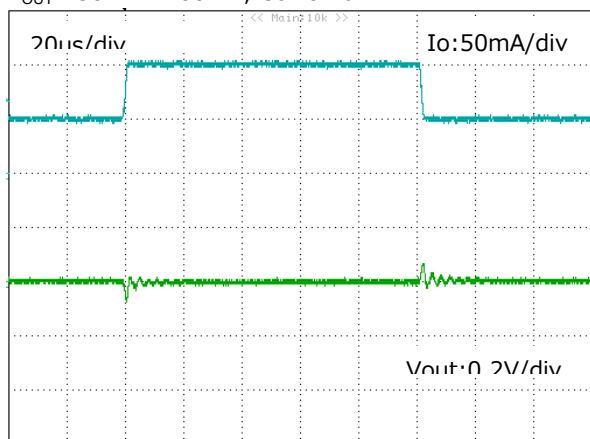
## Typical Performance Characteristics (3.3V)

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

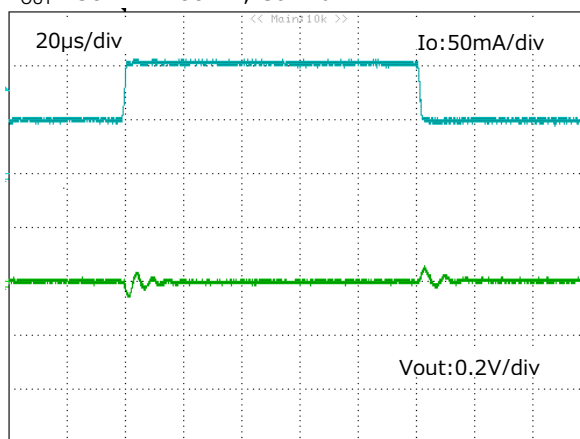
### ■ Load transient response

( $V_{DD}=V_{OUT}+1V$ ,  $V_{CE}=V_{DD}$ ,  $C_{in}=0.1\mu F$ )

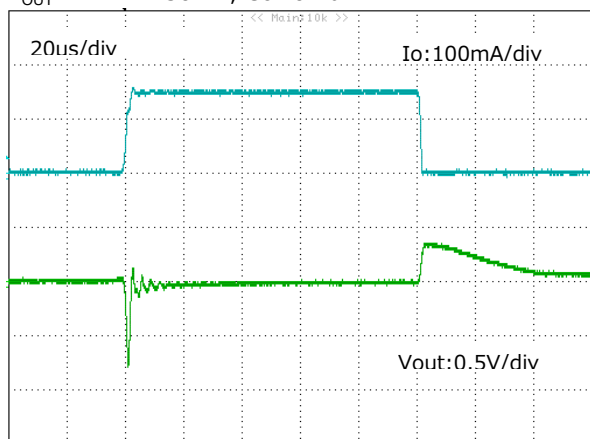
$I_{OUT} : 50mA \Rightarrow 100mA$ ,  $C_o=0.1\mu F$



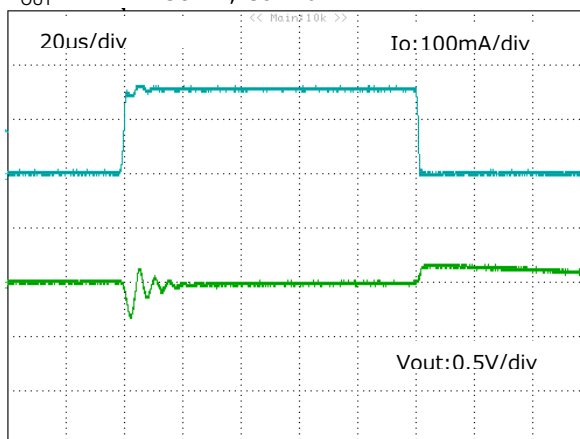
$I_{OUT} : 50mA \Rightarrow 100mA$ ,  $C_o=1\mu F$



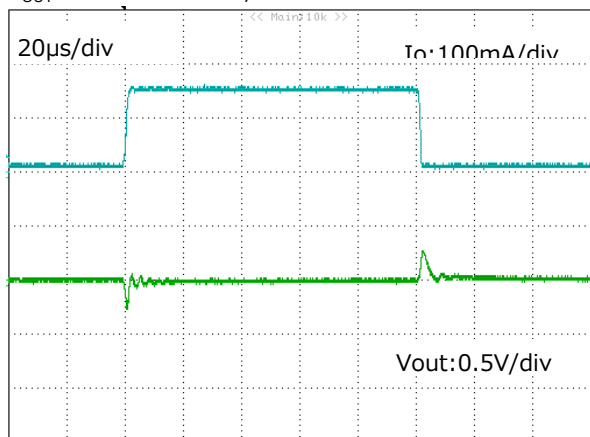
$I_{OUT} : 1mA \Rightarrow 150mA$ ,  $C_o=0.1\mu F$



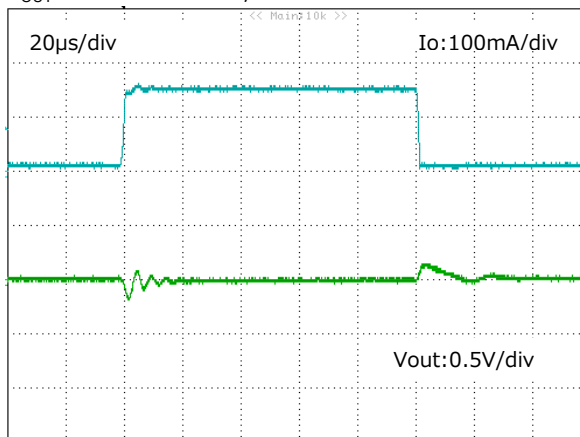
$I_{OUT} : 1mA \Rightarrow 150mA$ ,  $C_o=1\mu F$



$I_{OUT} : 10mA \Rightarrow 150mA$ ,  $C_o=0.1\mu F$



$I_{OUT} : 10mA \Rightarrow 150mA$ ,  $C_o=1\mu F$





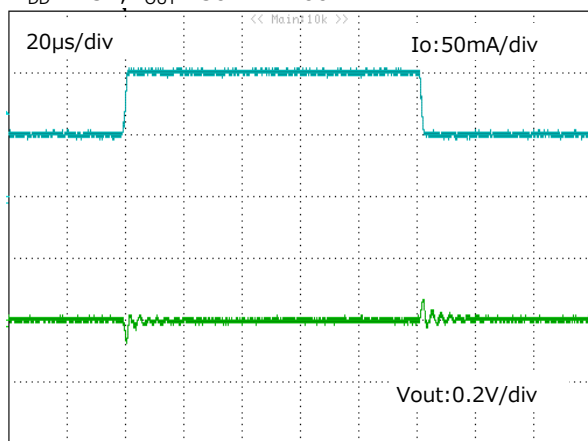
## Typical Performance Characteristics (3.3V)

( $V_{DD}=V_{OUT(Typ.)}+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

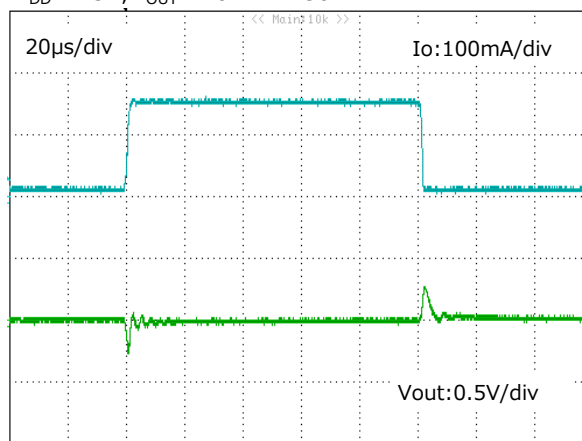
### ■ Load transient response

( $V_{DD}=V_{OUT}+1V$ ,  $V_{CE}=V_{DD}$ ,  $C_{in}=0.1\mu F$ )

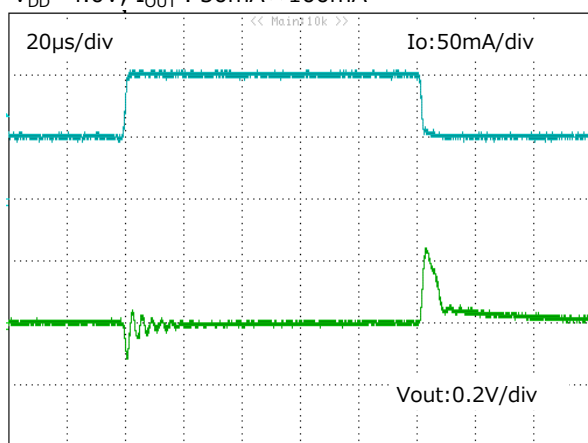
$V_{DD}=4.3V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



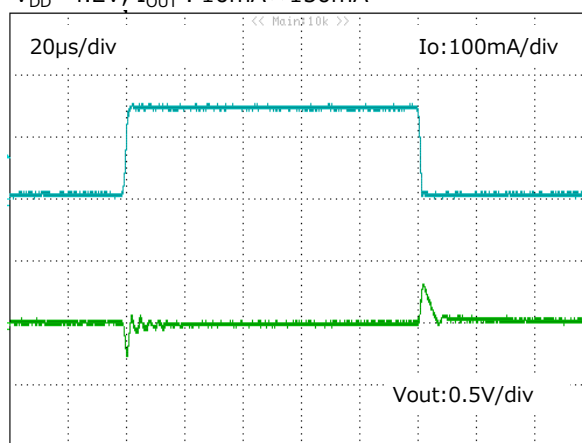
$V_{DD}=4.3V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$



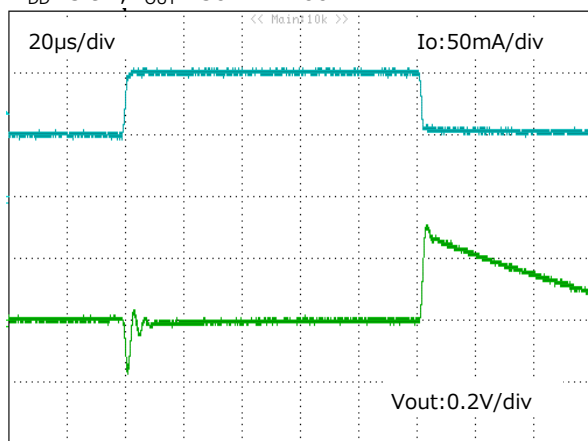
$V_{DD}=4.0V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



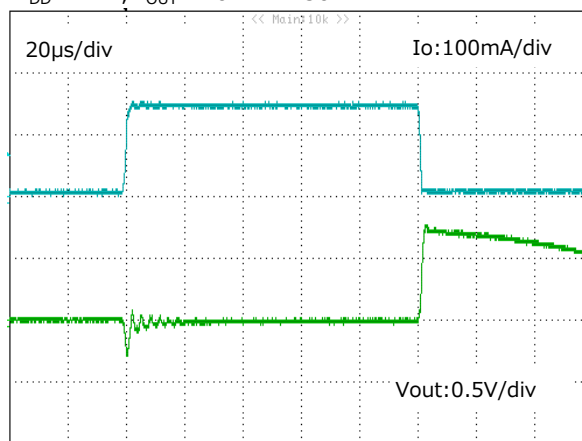
$V_{DD}=4.2V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$



$V_{DD}=3.9V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



$V_{DD}=4.1V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$





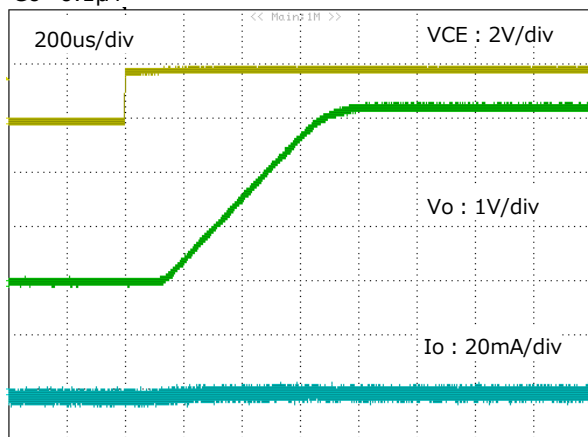
## Typical Performance Characteristics (3.3V)

( $V_{DD}=V_{OUT(Typ.)}+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

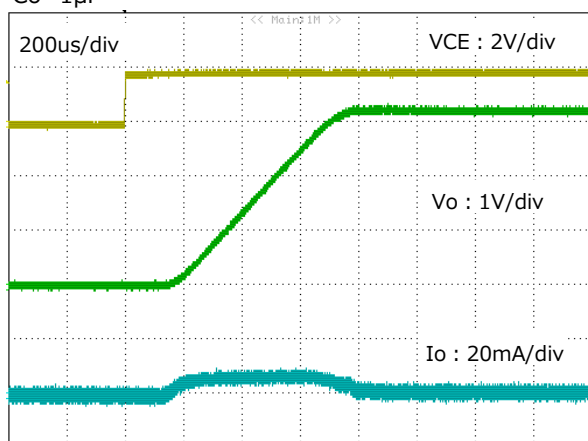
### ■ Output Rise & Rush Current

( $V_{DD}=4.3V$ ,  $V_{CE}=0 \rightarrow 2V$ ,  $C_{in}=0.1\mu F$   $I_o=1mA$ )

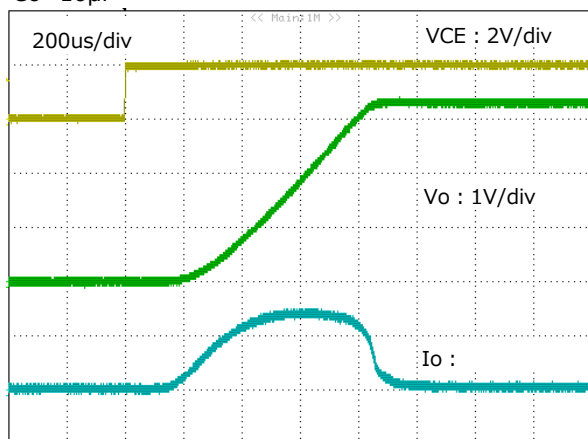
$C_o=0.1\mu F$



$C_o=1\mu F$



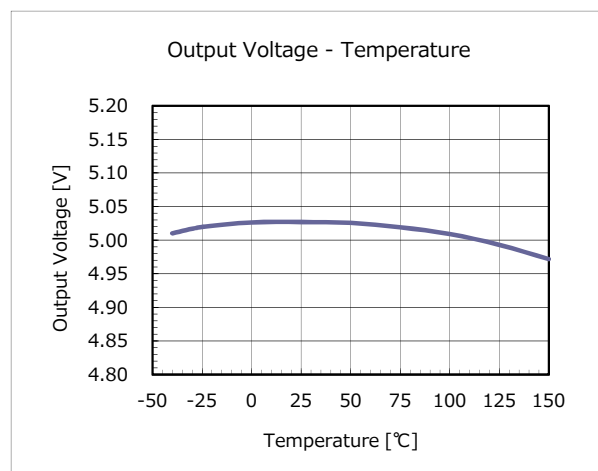
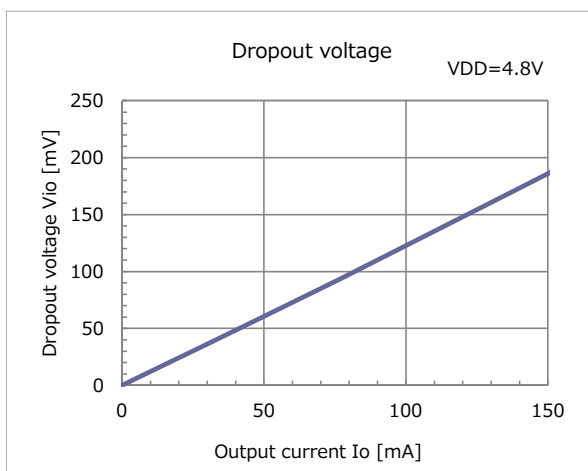
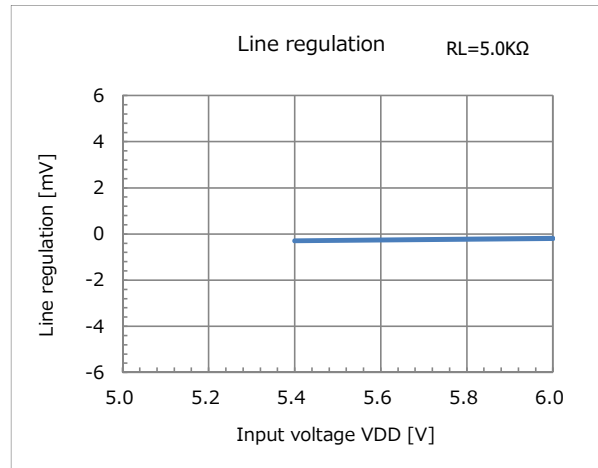
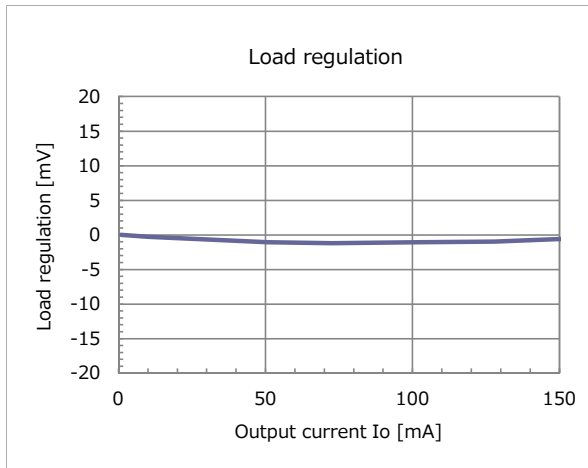
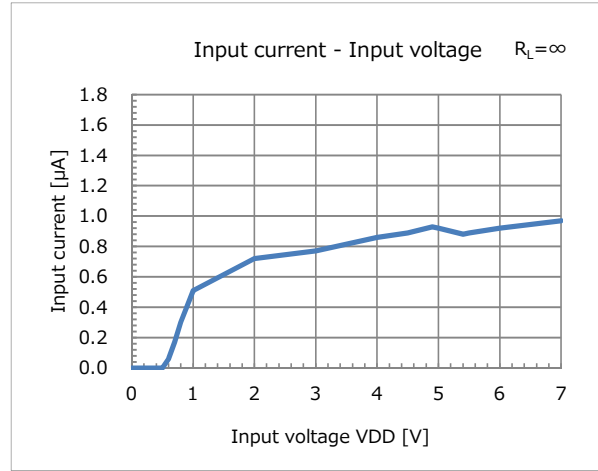
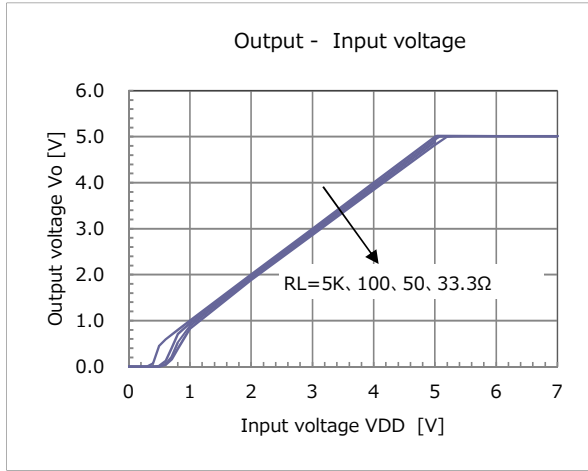
$C_o=10\mu F$





## Typical Performance Characteristics (5.0V)

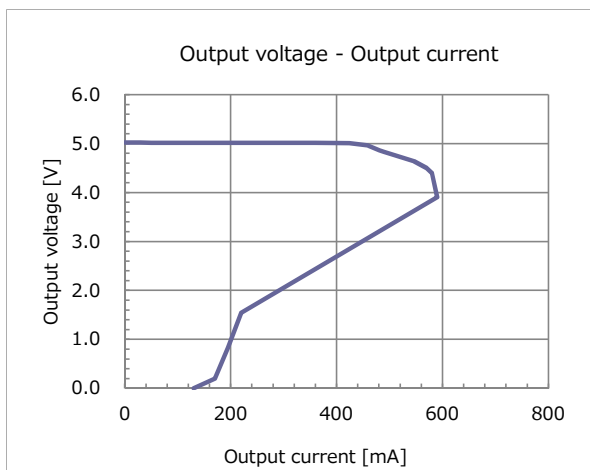
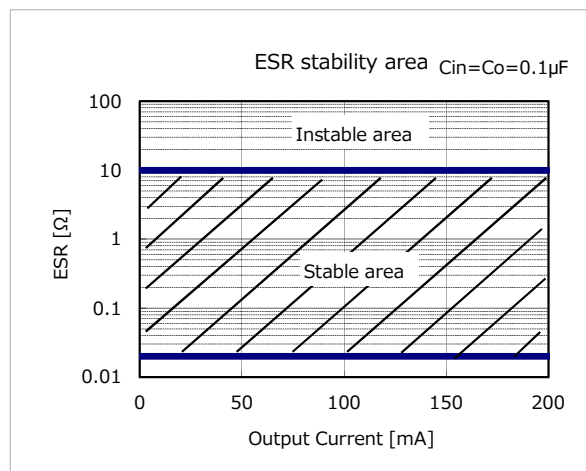
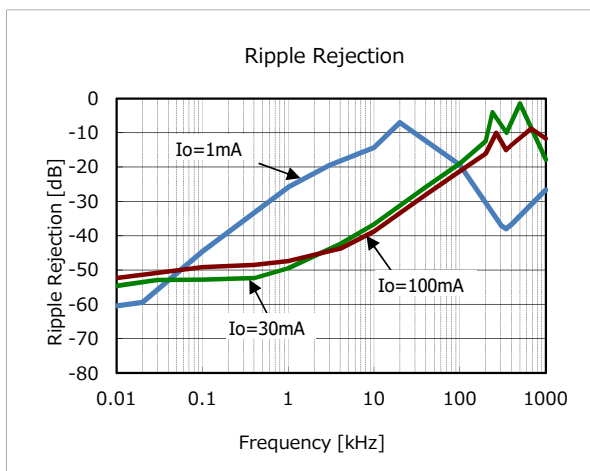
( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)





## Typical Performance Characteristics (5.0V)

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)





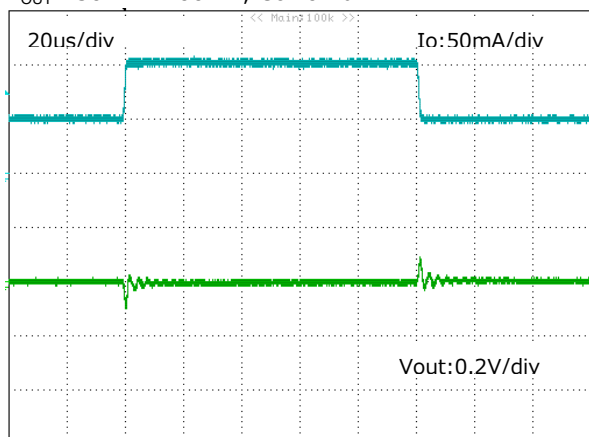
## Typical Performance Characteristics (5.0V)

( $V_{DD}=V_{OUT}(Typ.)+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

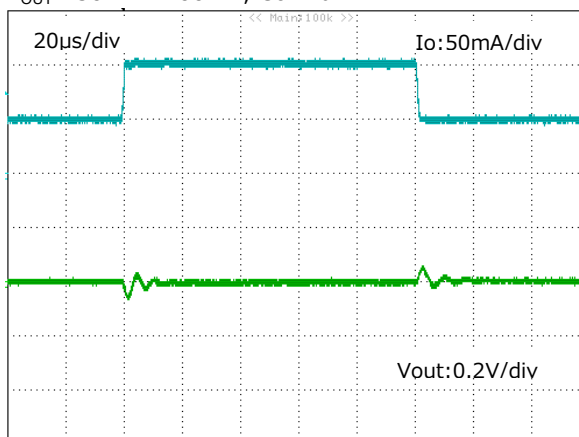
### ■ Load transient response

( $V_{DD}=V_{OUT}+1V$ ,  $V_{CE}=V_{DD}$ ,  $C_{in}=0.1\mu F$ )

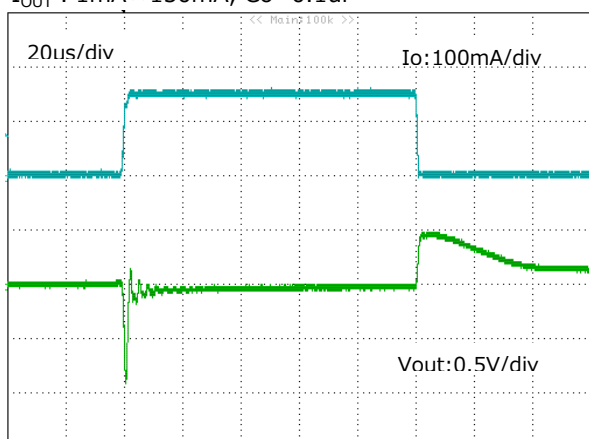
$I_{OUT} : 50mA \Leftrightarrow 100mA$ ,  $C_o=0.1\mu F$



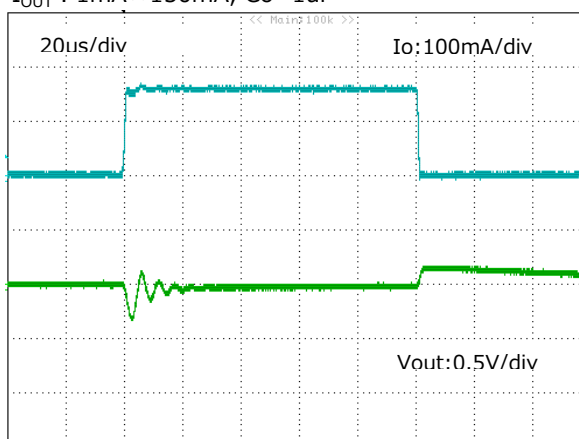
$I_{OUT} : 50mA \Leftrightarrow 100mA$ ,  $C_o=1\mu F$



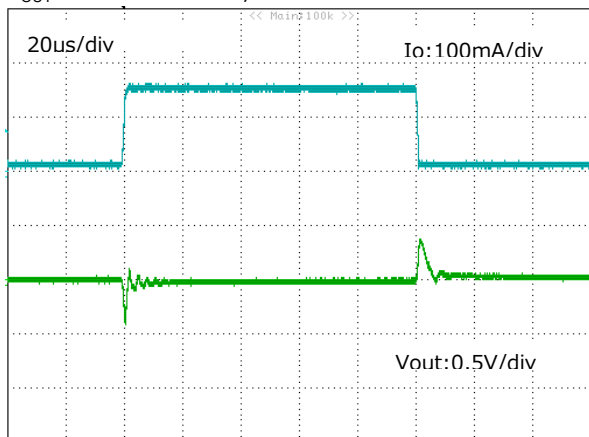
$I_{OUT} : 1mA \Leftrightarrow 150mA$ ,  $C_o=0.1\mu F$



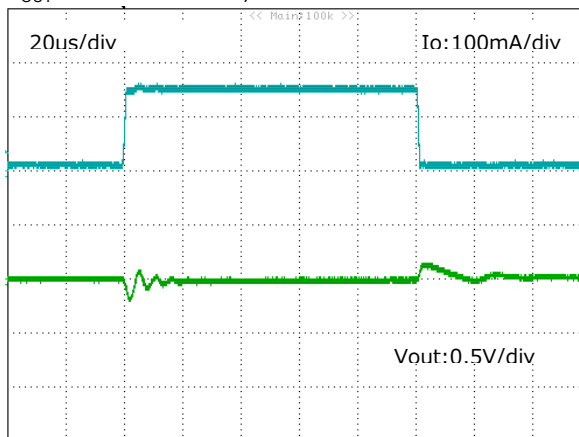
$I_{OUT} : 1mA \Leftrightarrow 150mA$ ,  $C_o=1\mu F$



$I_{OUT} : 10mA \Leftrightarrow 150mA$ ,  $C_o=0.1\mu F$



$I_{OUT} : 10mA \Leftrightarrow 150mA$ ,  $C_o=1\mu F$





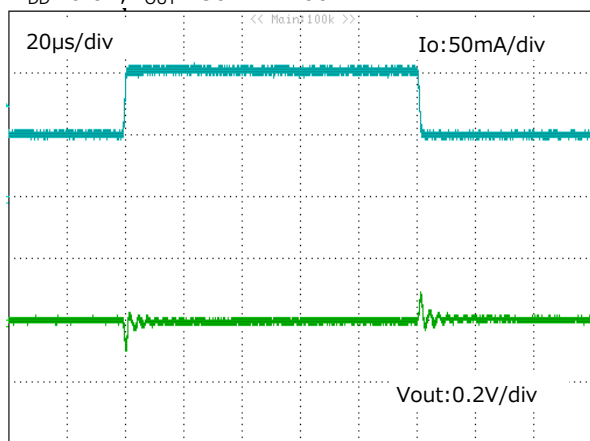
## Typical Performance Characteristics (5.0V)

( $V_{DD}=V_{OUT(Typ.)}+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

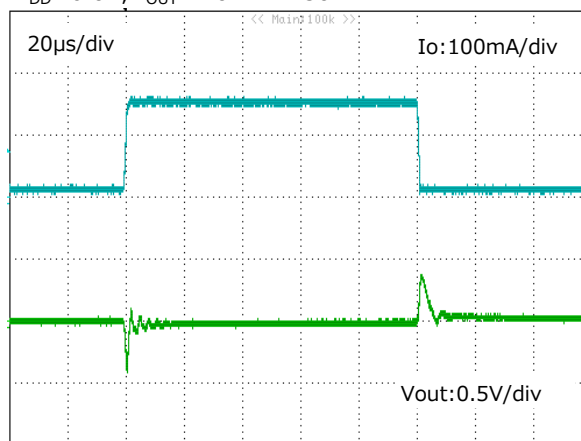
### ■ Load transient response

( $V_{DD}=V_{OUT}+1V$ ,  $V_{CE}=V_{DD}$ ,  $C_{in}=0.1\mu F$ )

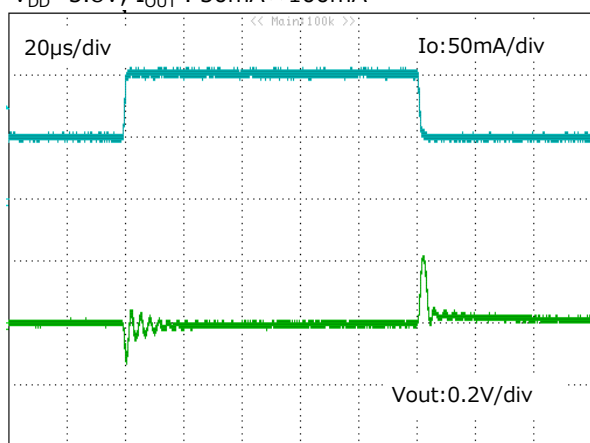
$V_{DD}=6.0V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



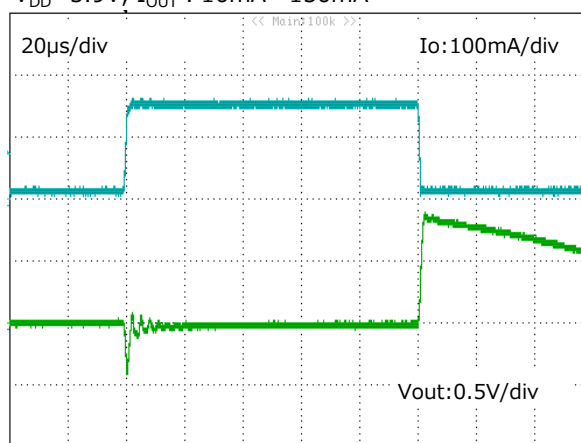
$V_{DD}=6.0V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$



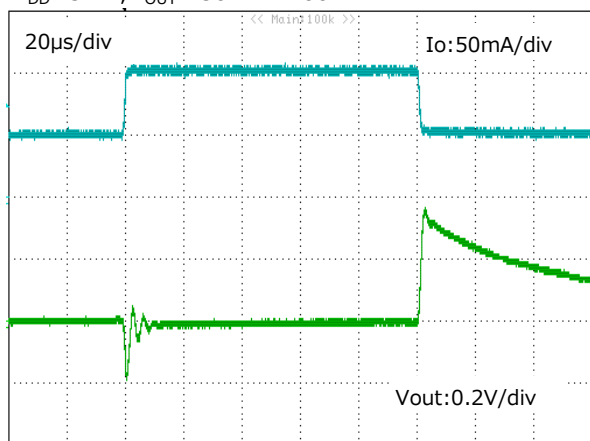
$V_{DD}=5.8V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



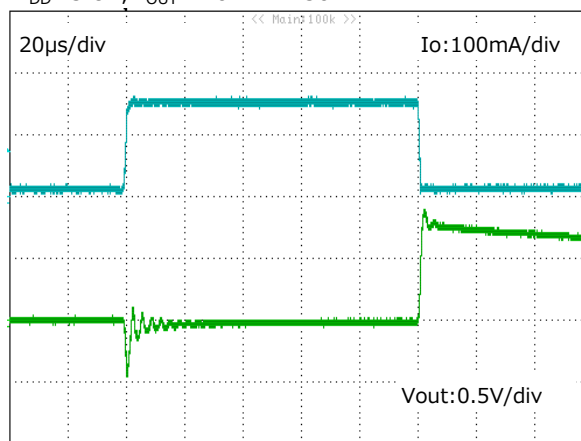
$V_{DD}=5.9V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$



$V_{DD}=5.7V$ ,  $I_{OUT} : 50mA \leftrightarrow 100mA$



$V_{DD}=5.8V$ ,  $I_{OUT} : 10mA \leftrightarrow 150mA$





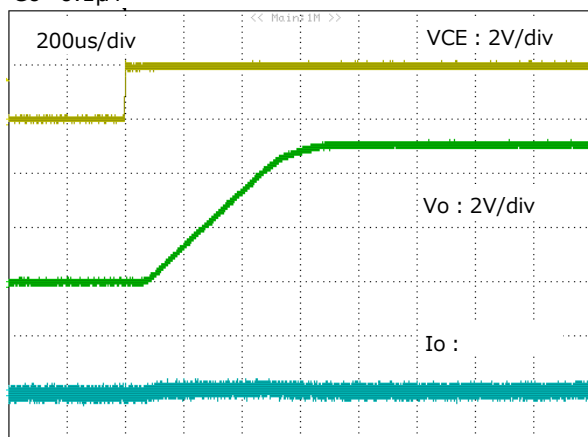
## Typical Performance Characteristics (5.0V)

( $V_{DD}=V_{OUT(Typ.)}+1V$ ,  $V_{CE}=V_{DD}$ ,  $T_a=25^{\circ}C$  unless otherwise specified)

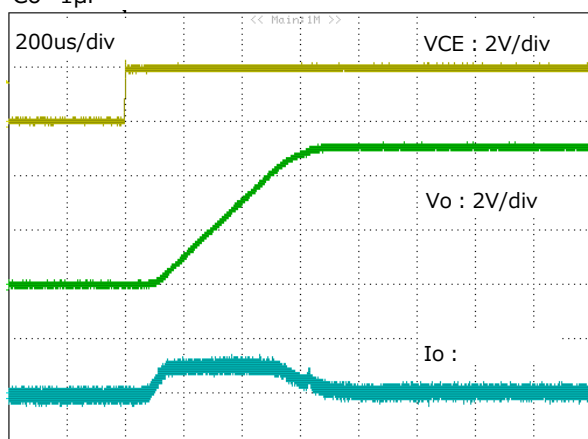
### ■ Output Rise & Rush Current

( $V_{DD}=6.0V$ ,  $V_{CE}=0 \rightarrow 2V$ ,  $C_{in}=0.1\mu F$   $I_o=1mA$ )

$C_o=0.1\mu F$



$C_o=1\mu F$



$C_o=10\mu F$

