500mA LDO with output voltage switching function.

MM3532A Series

Overview

This IC is a multi-out (*1) 500mA regulator with output voltage switching function.
Instead of conventional 2 power supply structure for the 1.8 V ⇔ 3.3 V output voltage of the SDXC card, it is now possible to structure with 1 product by the output switching CV terminal, realizing simplification and low power consumption of the system. It can also support the low power consumption type application by arbitrary voltage setting.
There are 2 types of output current, 150mA(MM3532T)/500mA(MM3532A), supporting wide range of applications.
The package has adopted small and high heat dissipation type SSON-6A (1820 size) that is appropriate for high density implementation.

*1 Multi-Out: A function to switch the output voltage value (VOUT) between VOUT- H / VOUT- L by switching the voltage Low/High applied to the output voltage control terminal (CV).
VOUT can be set to VOUT- H by setting the CV terminal to Low, and VOUT can be set to VOUT- L by setting the CV terminal to High. In case of SDXC card support, it will be VOUT- H = 3.3 V and VOUT- L = 1.8 V.

Features

- Multi-out for SDXC

Main specifications

- Maximum rating supply voltage : -0.3V to 6.5V
- Operating voltage range : 1.6V to 6V
- Operating ambient temperature : -40℃ to 85℃
- Output current : 500mA
- Input current (OFF) : Typ. 0.1uA
- No-load input current : Typ. 50uA
- Output voltage range : 1.2V to 3.3V
- Output voltage accuracy : ±1% (1.5V≦V_{OUT}(Typ.))
  : ±15mV (V_{OUT}(Typ.)<1.5V)
- Line regulation : Typ. 0.01%/V (V_{DD}=V_{OUT}(Typ.)+0.5V to 5V)
- Load regulation : Typ. 15mV (I_{OUT}=1mA to 200mA)
- Dropout voltage : Typ. 0.07V (I_{OUT}=100mA, V_{OUT}(Typ.)=3.3V)
  : Typ. 0.09V (I_{OUT}=100mA, V_{OUT}(Typ.)=1.8V)
- PSRR : Typ. 70dB (f=1kHz)
- Output capacitor : 1.0uF (Ceramic capacitor)
- Protection function : Over current protection, Thermal shutdown
- Additional function : ON/OFF control, Auto discharge, Multi-out

Packages

- SSON-6A

Application

- Audio visual equipment
- Portable communication device
- Photographing / Imaging device
- Office equipment / Printer
- Power supply for memory card

Mitsumi Electric CO.,LTD.
Semiconductor Business Division
Strategy Engineering Department
tel:+81-46-230-3470

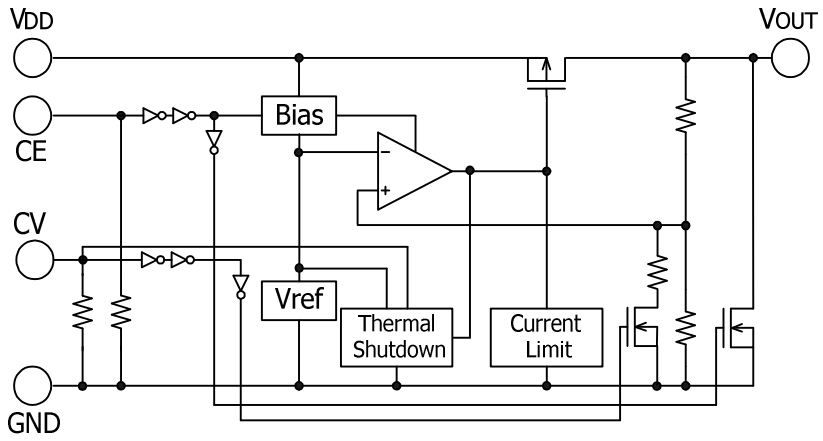
Model Name

M M 3 5 3 2 A X X X X X

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

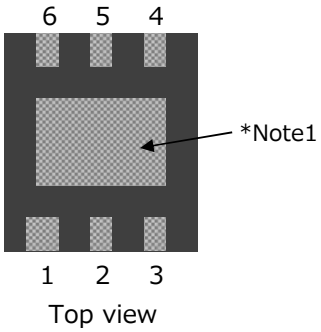
(A)	Function Type	A	Output current 500mA
		T	Output current 150mA
(B)	Output voltage rank	00	Two-digit serial number starting with "00" for V_{OUT}-H and V_{OUT}-L combinations.
		≀	
(C)	Package	R	SSON-6A
(D)	Packing specifications 1	R	R housing (Standard)
		L	L housing
(E)	Packing specifications 2	E	Emboss tape / Halogen Free

Block Diagram



Pin Configuration

- SSON-6A



Top view

Pin No.	Pin name	Function
1	V_{OUT}	Output pin
2	CV	Output control pin VC=L:V_{OUT}=V_{OUT}-H VC=H:V_{OUT}=V_{OUT}-L When the voltage of the terminal CV is higher than the voltage of the terminal V_{DD}, it becomes test mode. In that case, please note that there is a possibility that the output voltage is turned off.
3	GND	GND pin
4	CE	ON/OFF-control pin Connect CE pin with V_{DD} pin, when it is not used. The CE terminal performs pull-down by internal resistance.
5	NC	No connection
6	V_{DD}	Voltage supply 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	6.5	V
Cont input voltage	V_{CE}	-0.3	6.5	V
CV input voltage	V_{CV}	-0.3	V_{DD}+0.3V	V
Output Voltage	V_{OUT}	-0.3	6.5	V
Output current	Iomax	0	600	mA
Power Dissipation *Note2	Pd	-	1250	mW

*Note2:JEDEC51-7 standard 114.3mm×76.2mm t=1.6mm

Recommended Operating Conditions

Item	Symbol	Min.	Max.	Unit
Operating Ambient temperature	Topr	-40	85	℃
Operating voltage	Vop	1.6	6.0	V
Output Current	Iop	0	500	mA

Electrical Characteristics

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
No-Load Input Current	I_{DDOff}	V_{CE}=0V V_{OUT}(TYP.)+1.0V≦V_{DD}≦6.0V	-	0.1	1.0	μA
Input Current(OFF)	I_{DD}	I_{OUT}=0mA	-	50	80	μA
Output voltage	V_{OUT}	I_{OUT}=10mA, 1.5V≦V_{OUT}	×0.99	-	×1.01	V
		I_{OUT}=10mA, V_{OUT}<1.5V	-0.015	-	0.015	
Line Regulation	V_{LINE}	V_{OUT}(TYP.)+0.5V≦V_{DD}≦5.0V I_{OUT}=100mA	-	0.01	0.20	%/V
Load Regulation	V_{LOAD}	1mA≦I_{OUT}≦200mA	-	15	30	mV
Dropout Voltage	Vio	Please refer to another page.	-	-	-	V
Output short-circuit current *Note3	Ishort	V_{OUT}=0V	-	60	-	mA
Vout temperature coefficient *Note3	ΔV_{OUT} /ΔT_{OP}	I_{OUT}=10mA -40≦Top≦85℃	-	±100	-	ppm/℃
Ripple rejection *Note3	RR	f=1kHz, Vripple=0.5V, I_{OUT}=100mA	-	70	-	dB
CE High threshold voltage	V_{CEH}		1.5	-	6.5	V
CE Low threshold voltage	V_{CEL}		0	-	0.3	V
CE pin current	I_{CE}		-	0.5	-	μA

Electrical Characteristics

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
CV high threshold voltage	V_{CVH}		1.5	-	V_{DD}	V
CV low threshold voltage	V_{CVL}		0	-	0.3	V
CV Pin current *Note3	I_{CV}		-	0.5	-	μA
Thermal shut down detect Temperature *Note3	T_{SD}		-	150	-	℃
Thermal shut down release Temperature *Note3	T_{SR}		-	125	-	℃
Output NMOS ON resistance *Note3	R_{DON}		-	60	-	Ω
Output ON resistance	R_{ON}	I_{OUT}=500mA , CV=GND V_{DD}=V_{OUT}(TYP.)-0.2V	-	0.72	1.00	Ω

*Note3:The parameter is guaranteed by design.

*Note4:When the voltage of the terminal CV is higher than the voltage of the terminal VDD, it becomes test mode. In that case, please note that there is a possibility that the output voltage is turned off.

Electrical Characteristics

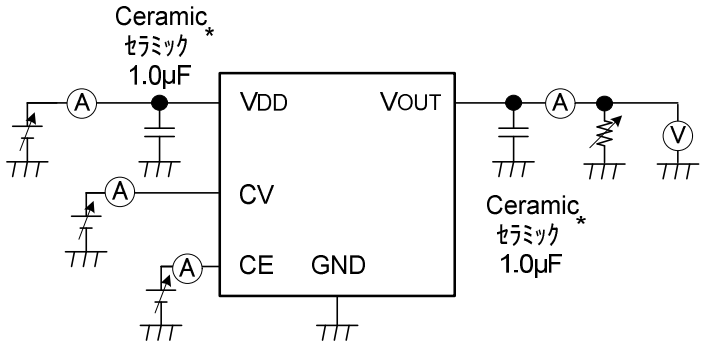
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃, unless otherwise specified)

Model name	Item							
	Output voltage H				Output voltage L			
	V_{OUT} - H (V)				V_{OUT} - L (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3532A00	I_{OUT}=10mA CV=GND	3.267	3.300	3.333	I_{OUT}=10mA CV=V_{DD}	1.782	1.800	1.818
MM3532A01		3.069	3.100	3.131		1.782	1.800	1.818

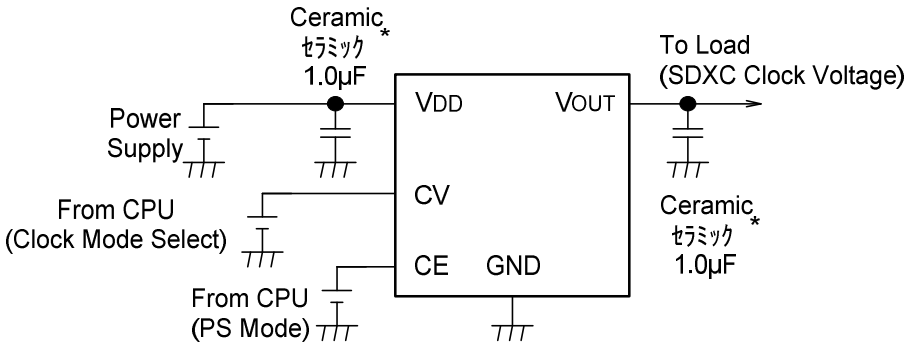
Model name	Item							
	Output Voltage1 H				Output Voltage1 L			
	Vio1 - H (V)				Vio1 - L (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3532A00	I_{OUT}=100mA CV=GND	-	0.07	0.10	I_{OUT}=100mA CV=V_{DD}	-	0.09	0.18
MM3532A01		-	0.07	0.10		-	0.09	0.18

Model name	Item							
	Output Voltage2 H				Output Voltage2 L			
	Vio2 - H (V)				Vio2 - L (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3532A00	I_{OUT}=500mA CV=GND	-	0.36	0.50	I_{OUT}=500mA CV=V_{DD}	-	0.43	0.86
MM3532A01		-	0.36	0.50		-	0.43	0.86

Test Circuit



Application Circuit



(Example of external parts)

- Output capacitor Ceramic capacitor 1.0μF
- Input Capacitor Ceramic capacitor 1.0μF *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 Input 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 1.0μF 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 an unstable operation when you use the capacitor with intense capacitance change .
   The capacitor has the dependency at the power-supply voltage and the temperature.
   The capacity value changes by the environment used. Please evaluate IC in the set.

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

9. There is a possibility that IC generates heat when the output terminal is short-circuited.
   However, the thermal shutdown circuit operates, and it will do operation that protects IC.
   The thermal shutdown circuit is designed only to shut the IC off to prevent thermal runaway.
   Do not continue to use the IC in an environment where the operation of this circuit is assumed.
   The characteristic changes depending on the substrate condition.

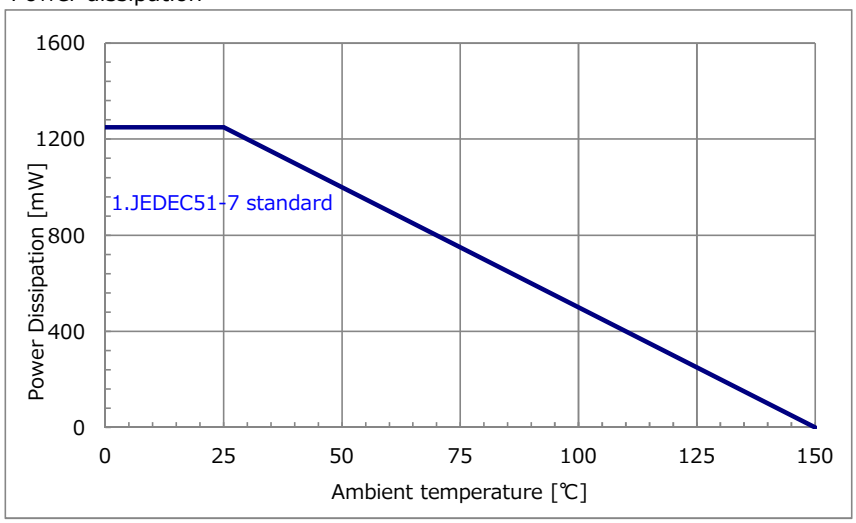
About Power Dissiopation

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.

- SSON-6A

1. JEDEC51-7 standard (4 layer FR-4 board)

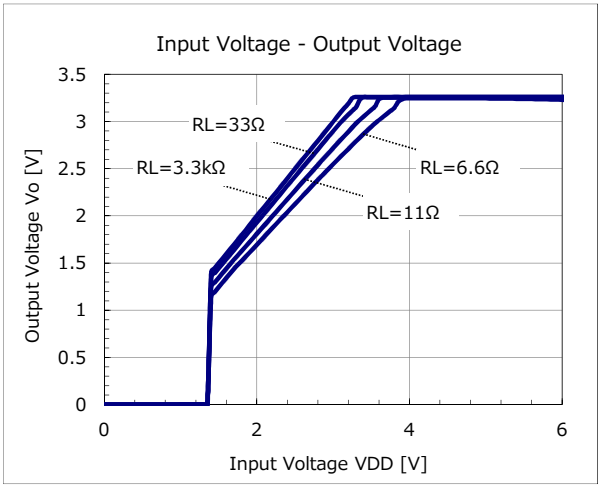
Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
Power dissipation 1250mW Ta=25℃

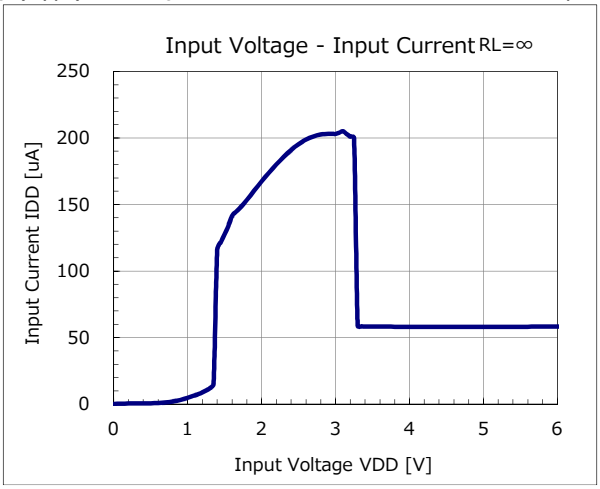


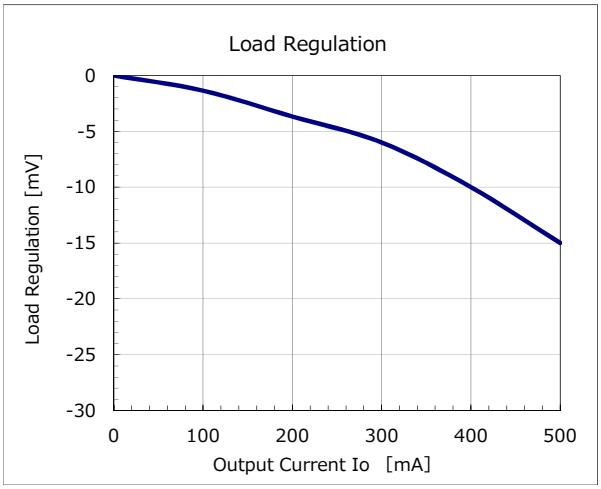
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

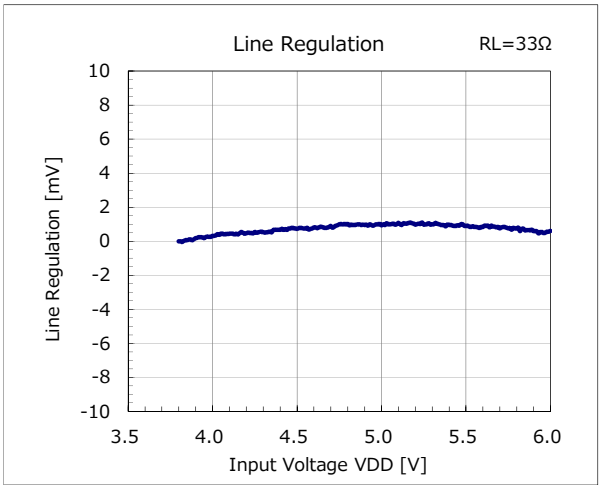
Typical Performance Characteristics (VOUT=3.3V)

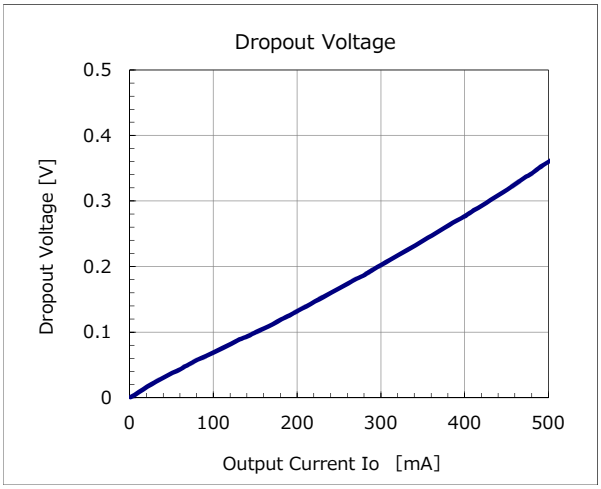
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃, unless otherwise specified)

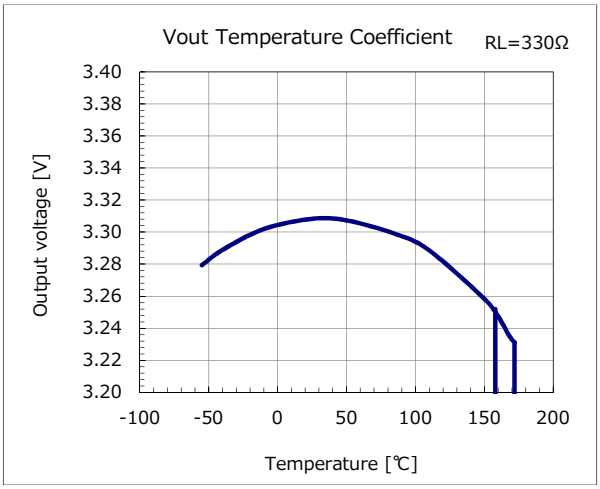






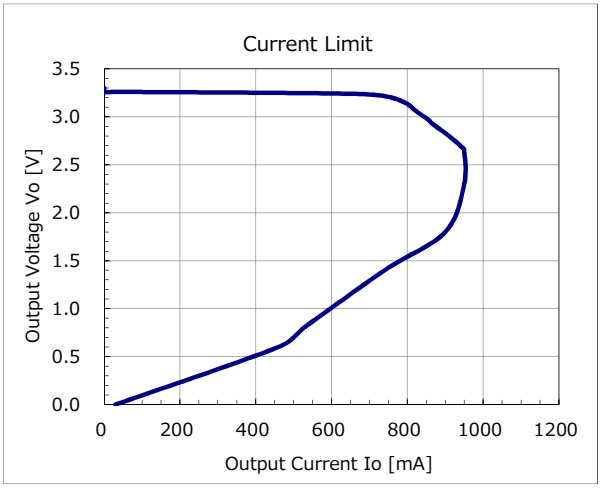


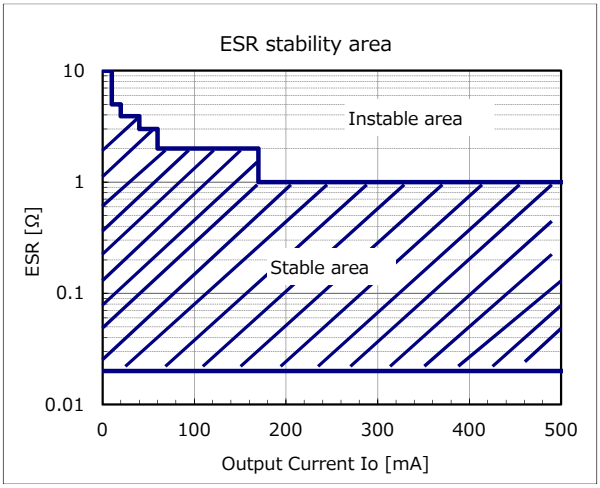




Typical Performance Characteristics (VOUT=3.3V)

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





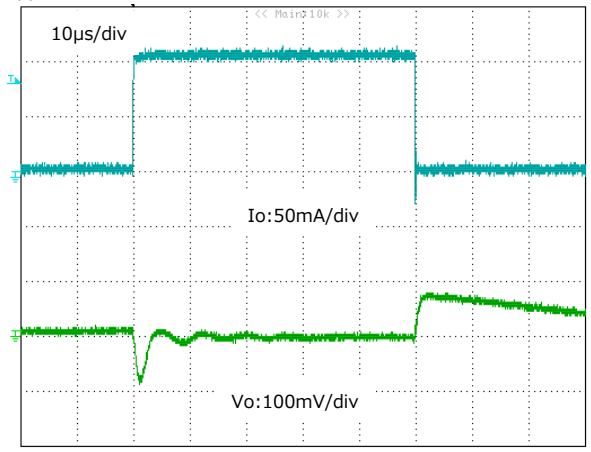
Typical Performance Characteristics (VOUT=3.3V)

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

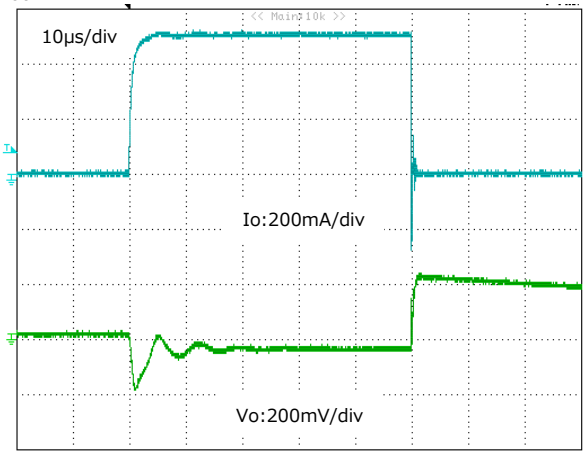
■ Load transient response

(Cin=Co=1μF)

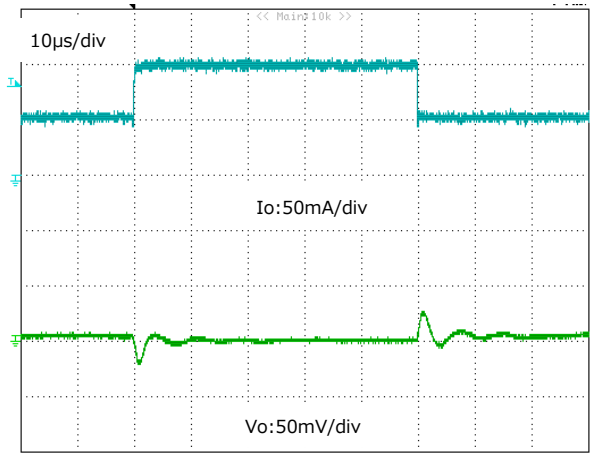
I_{OUT} : 1mA⇔100mA



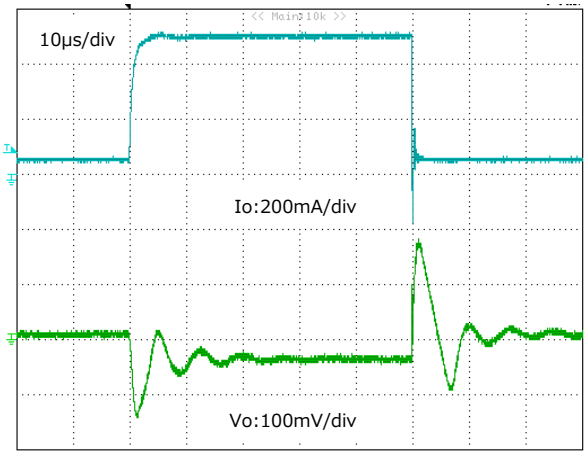
I_{OUT} : 1mA⇔500mA



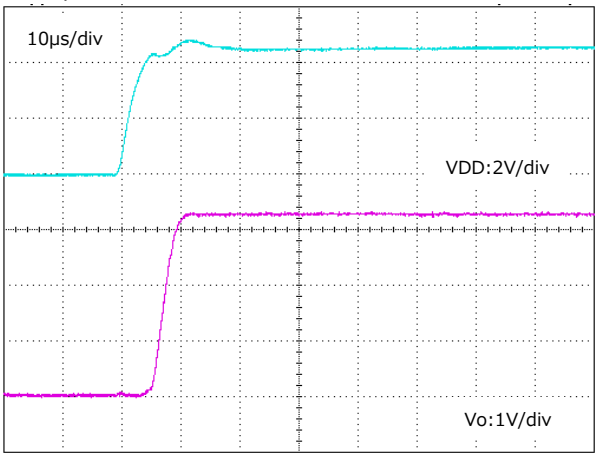
I_{OUT} : 50mA⇔100mA



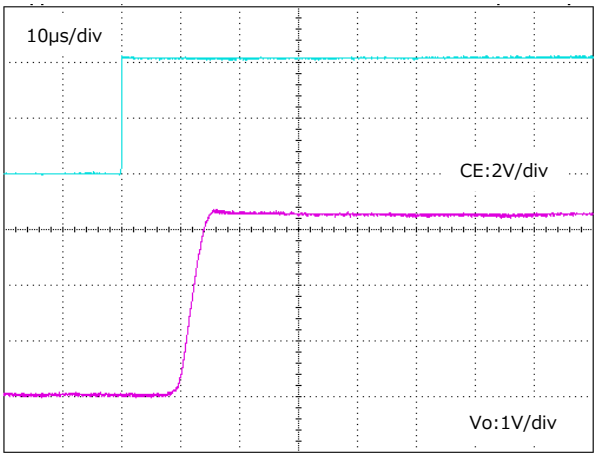
I_{OUT} : 50mA⇔500mA



■ Input rise characteristics

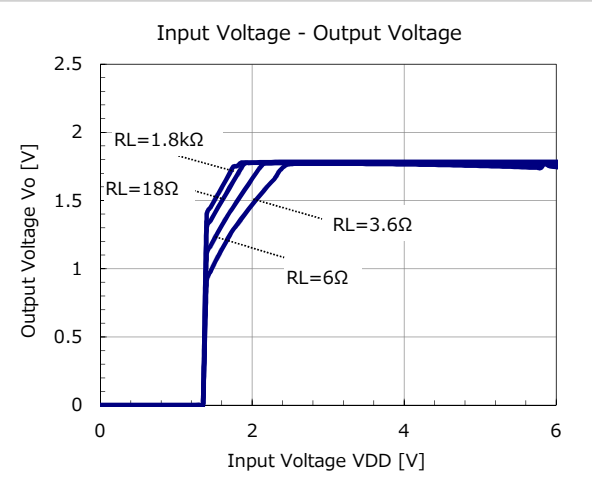


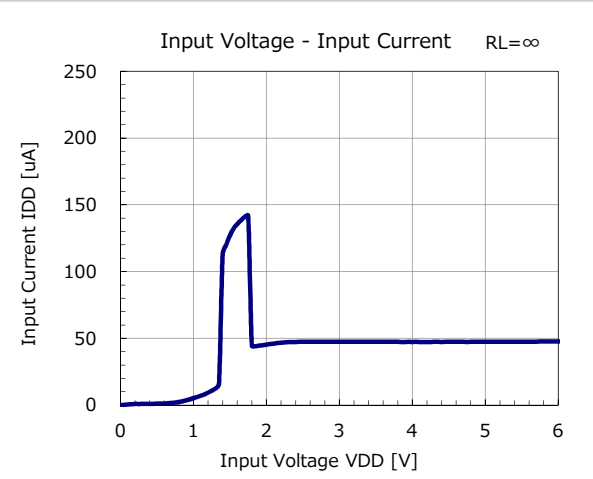
■ CE rise characteristics

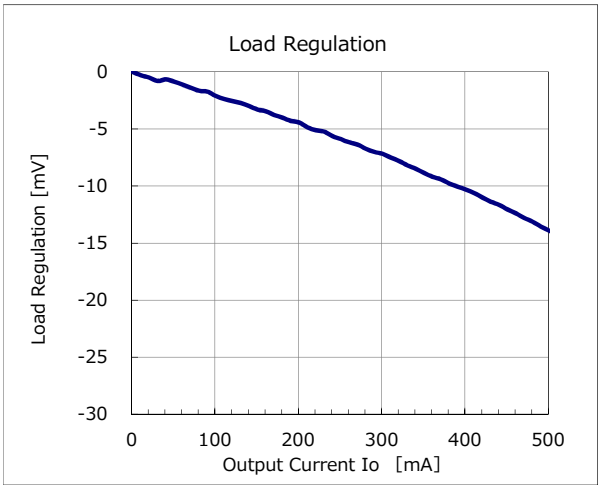


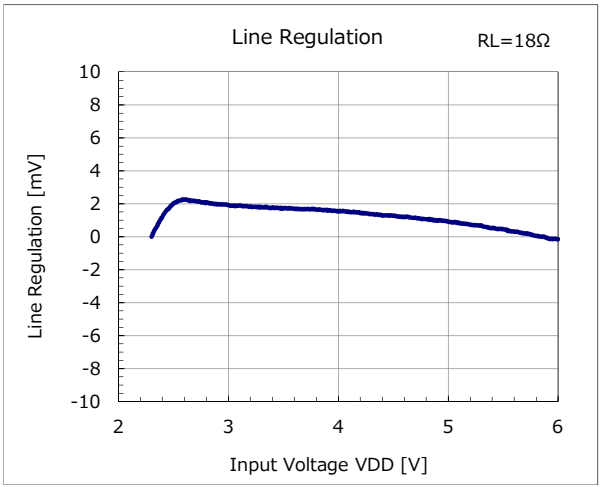
Typical Performance Characteristics (VOUT=1.8V)

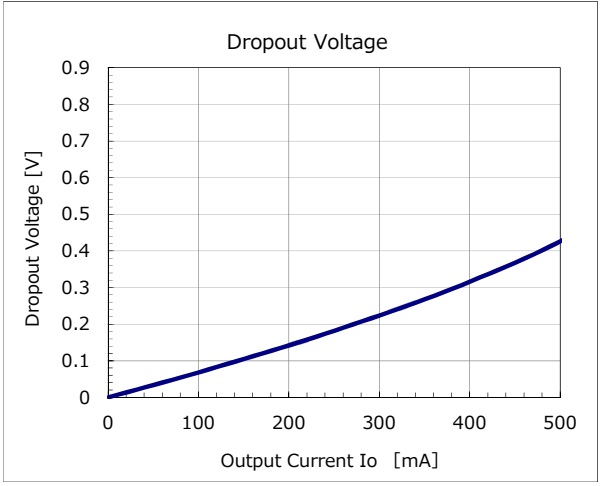
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃, unless otherwise specified)

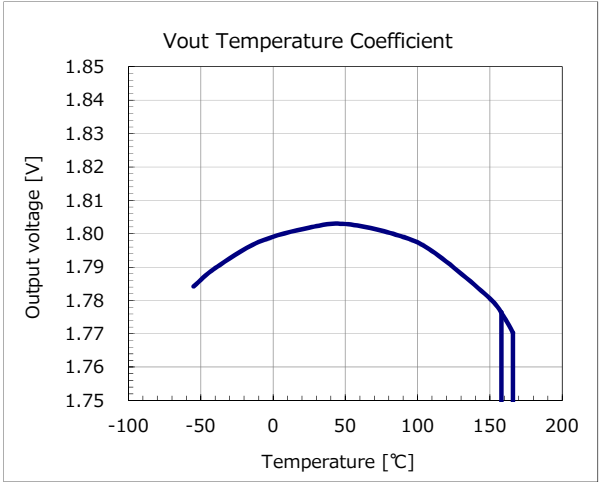






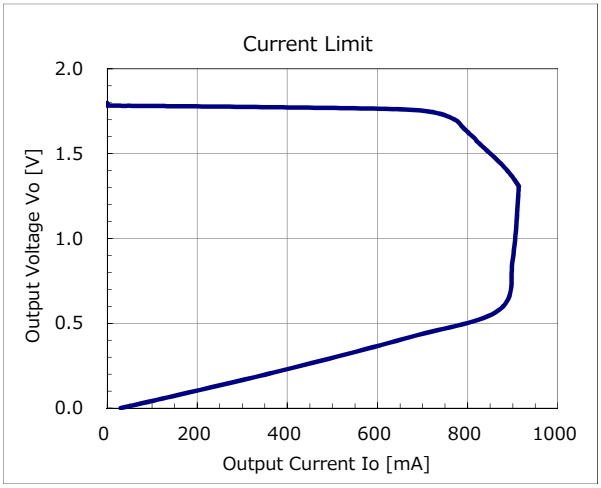


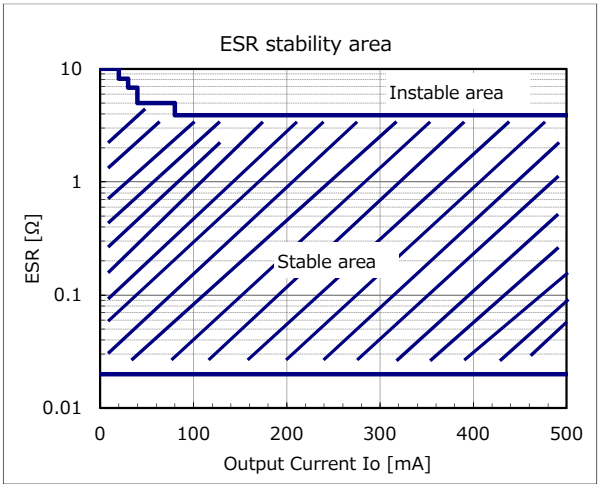




Typical Performance Characteristics (VOUT=1.8V)

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





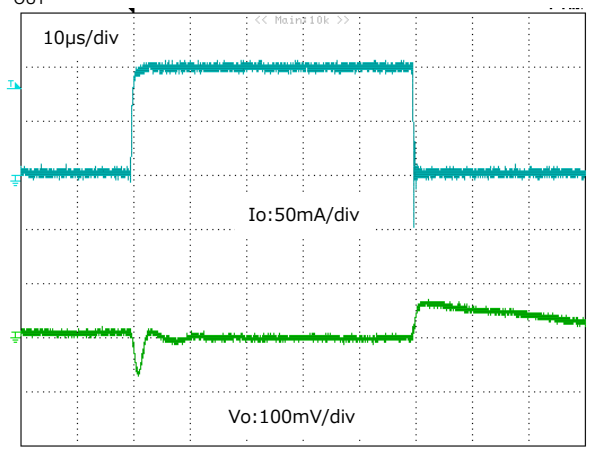
Typical Performance Characteristics (VOUT=1.8V)

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

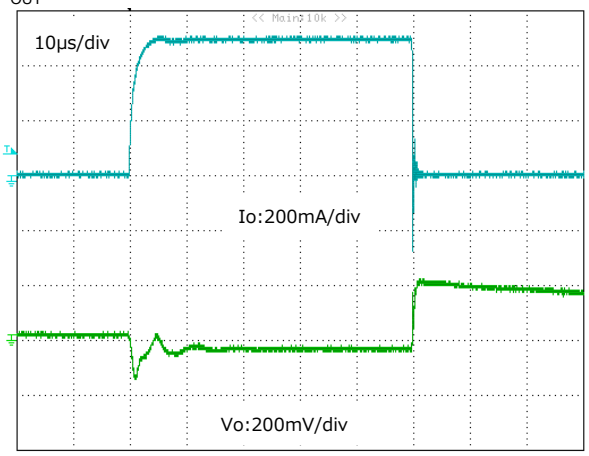
■ Load transient response

(Cin=Co=1μF)

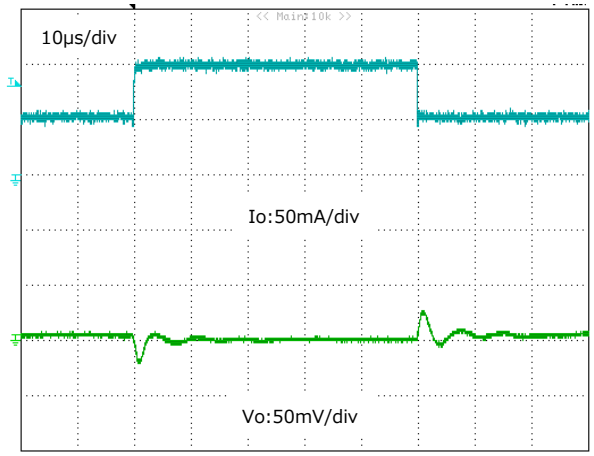
I_{OUT} : 1mA⇔100mA



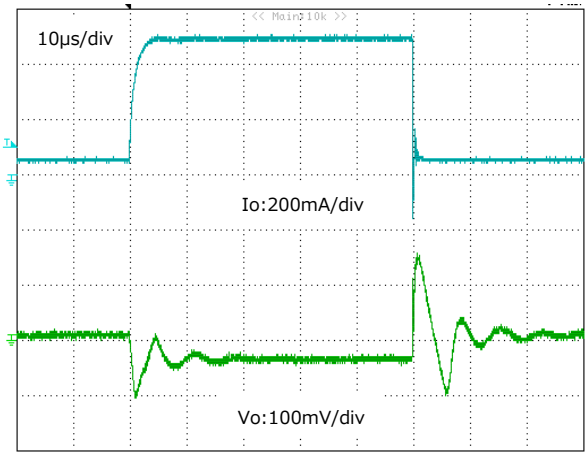
I_{OUT} : 1mA⇔500mA



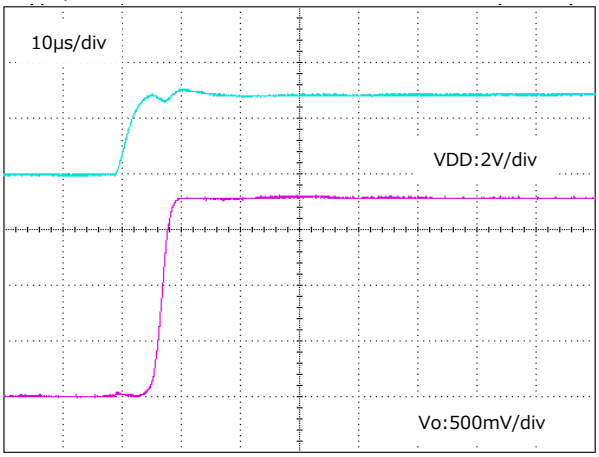
I_{OUT} : 50mA⇔100mA



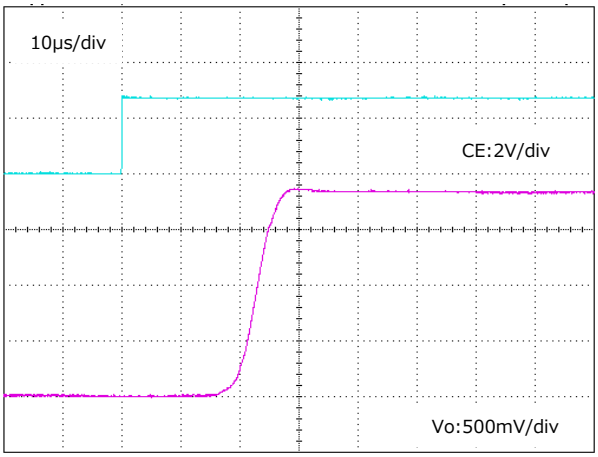
I_{OUT} : 50mA⇔500mA



■ Input rise characteristics

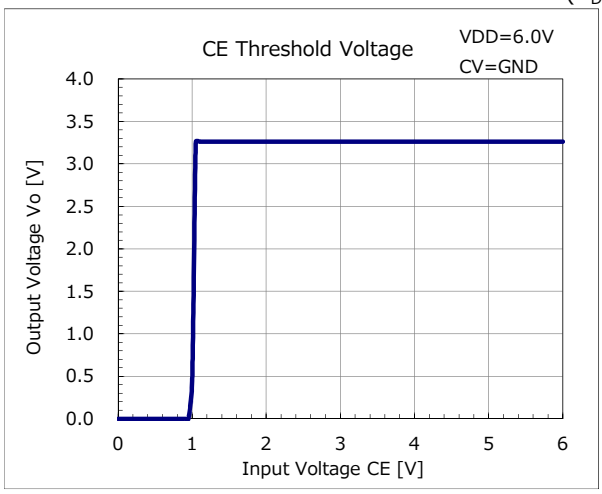


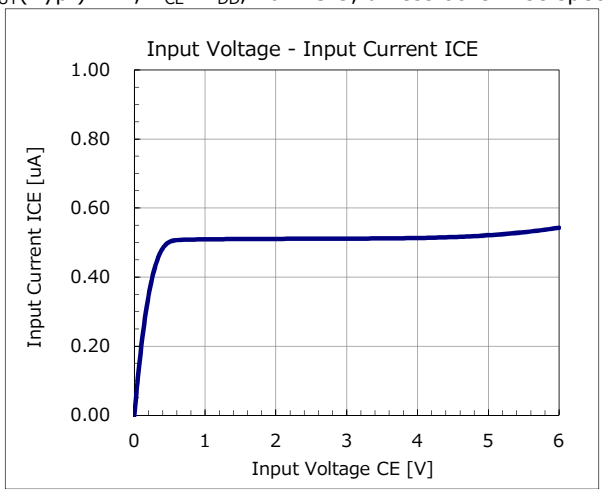
■ CE rise characteristics

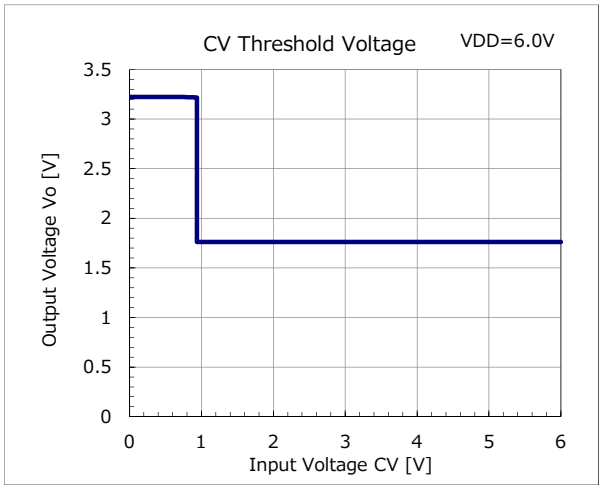


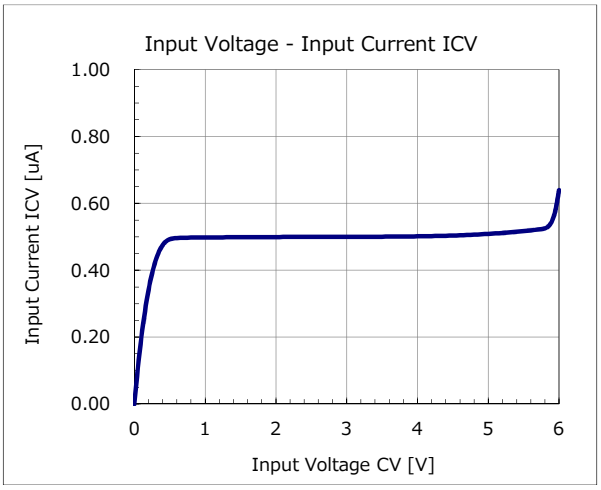
Typical Performance Characteristics (VOUT=3.3V-1.8V)

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







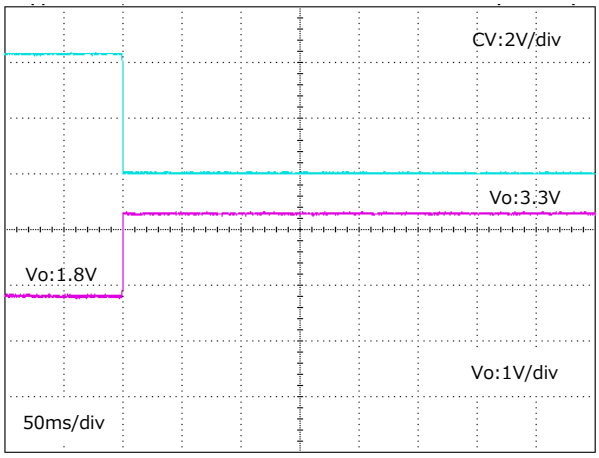


Typical Performance Characteristics (VOUT=3.3V-1.8V)

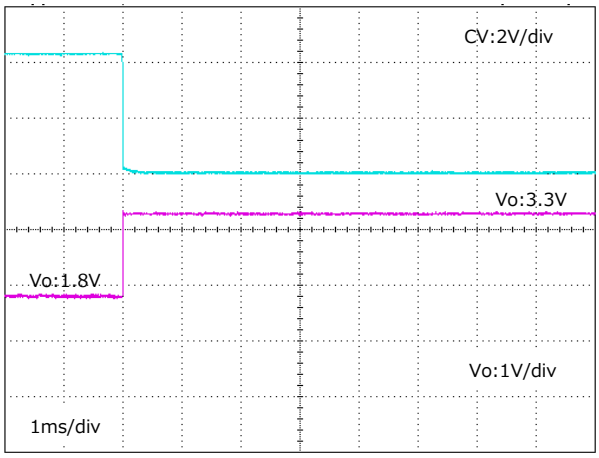
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃, unless otherwise specified)

■ CV transient response (Vo=1.8V→3.3V)

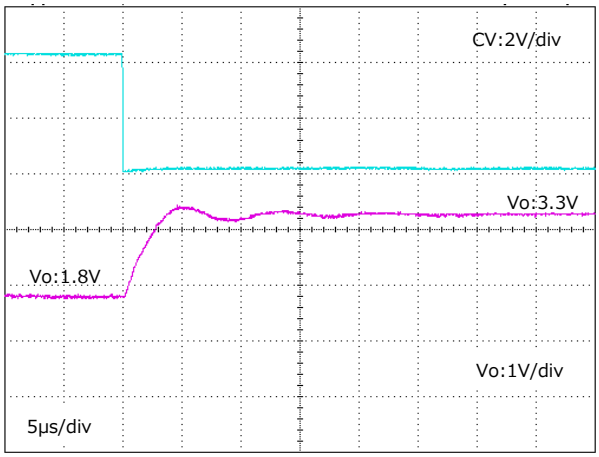
RL=∞



RL=3.3kΩ

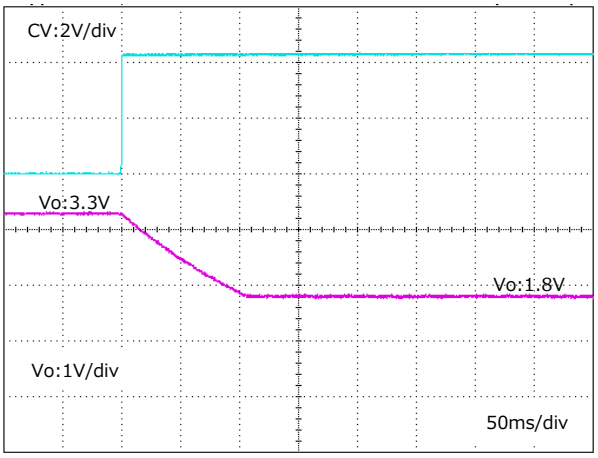


RL=6.6kΩ

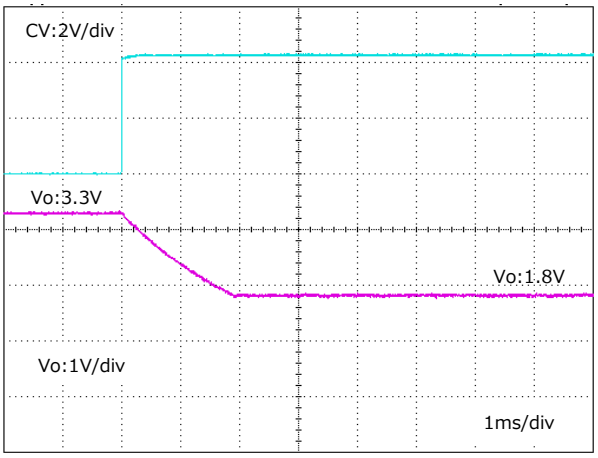


■ CV transient response (Vo=3.3V→1.8V)

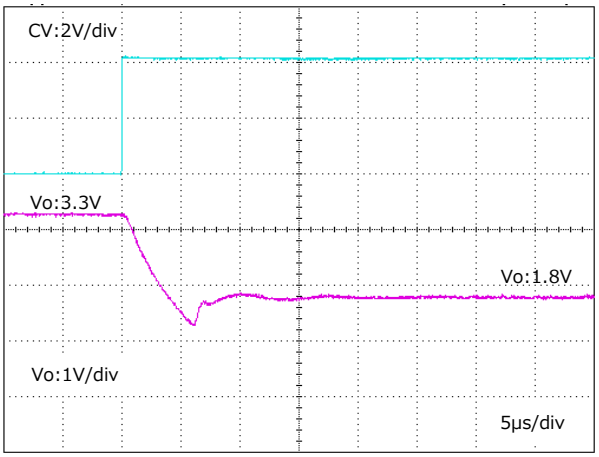
RL=∞



RL=3.3kΩ



RL=6.6kΩ

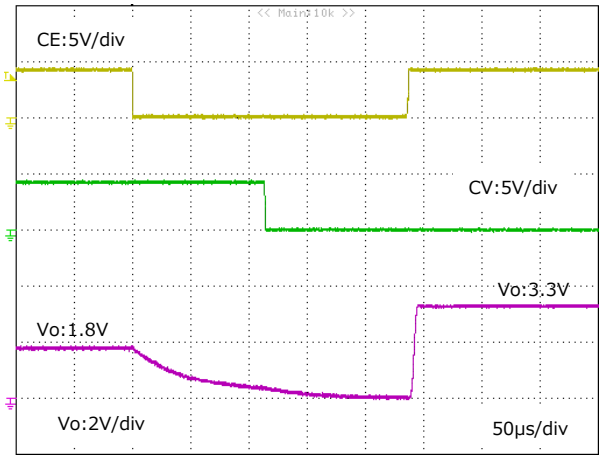


Typical Performance Characteristics (VOUT=3.3V-1.8V)

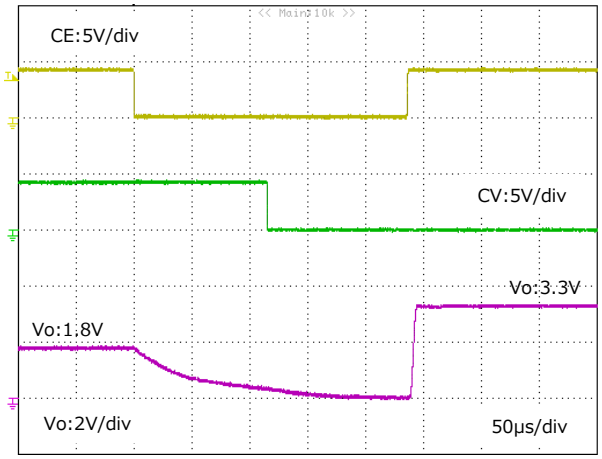
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃, unless otherwise specified)

- CV/CE transient response (Vo=1.8V→0V→3.3V)

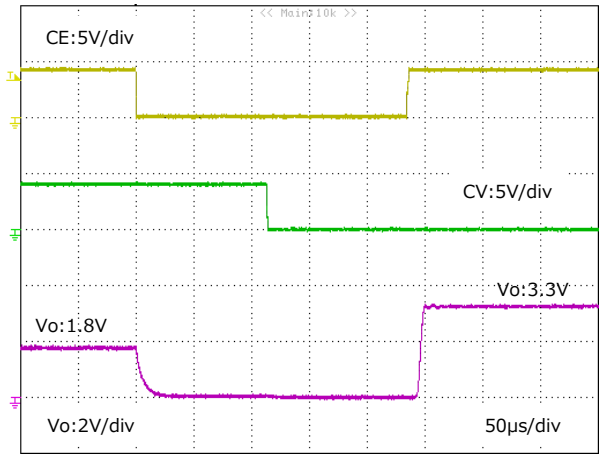
RL=∞



RL=3.3kΩ

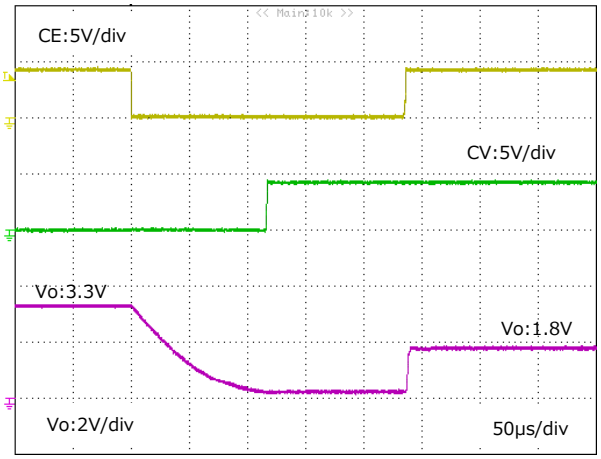


RL=6.6kΩ

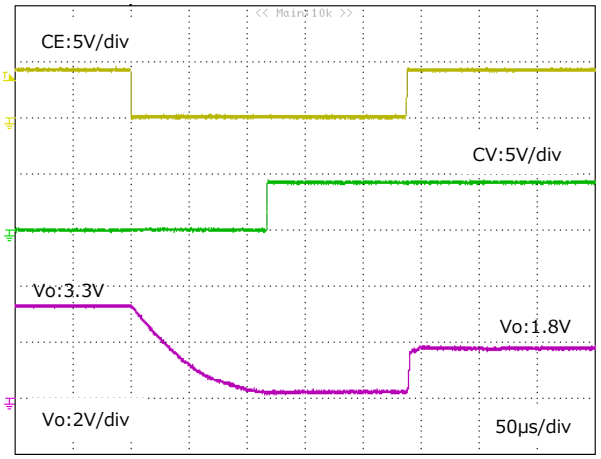


- CV/CE transient response (Vo=3.3V→0V→1.8V)

RL=∞



RL=3.3kΩ



RL=6.6kΩ