High PSRR, low dropout voltage 200mA LDO

MM3764 Series

Overview

This IC is a high speed response 200mA regulator IC with low quiescent current and high ripple rejection.
No load input current is 20μA typ. and ripple rejection is 75dB typ.
Dropout voltage is low at 80mV typ. (Io=100mA) and the package is a small PLP-4C (1mm x 1mm), ideal for mobile devices.

Features

- High PSRR
- Low dropout voltage
- Small package

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 : 1.6V to 6.5V
- Operating ambient temperature : -40℃ to 85℃
- Output current : 200mA
- Input current (OFF) : Typ. 0.01uA
- No-load input current : Typ. 20uA
- Output voltage range : 0.8V to 5V (0.05V step)
- Output voltage accuracy : ±1% (2.0V≦VOUT(Typ.))
  ±20mV (VOUT(Typ.)<2.0V)
- Line regulation : Typ. 0.01%/V (1.1V≦VOUT(Typ.), VDD=VOUT(Typ.)+0.5V to 6.5V)
  Typ. 0.01%/V (VOUT(Typ.)<1.1V, VDD=VOUT(Typ.)+1.6V to 6.5V)
- Load regulation : Typ. 10mV (IOUT=1mA to 200mA)
- Dropout voltage : Typ. 0.08V (IOUT=100mA, VOUT(Typ.)=3V)
- PSRR : Typ. 75dB (f=1kHz)
- Output capacitor : 1uF (Ceramic capacitor)
- Protection function : Over current protection
- Additional function : ON/OFF control, Auto discharge

Packages

- PLP-4C

Application

- Audio visual equipment
- Portable communication device
- Photographing / Imaging device
- Wearable device

Model Name

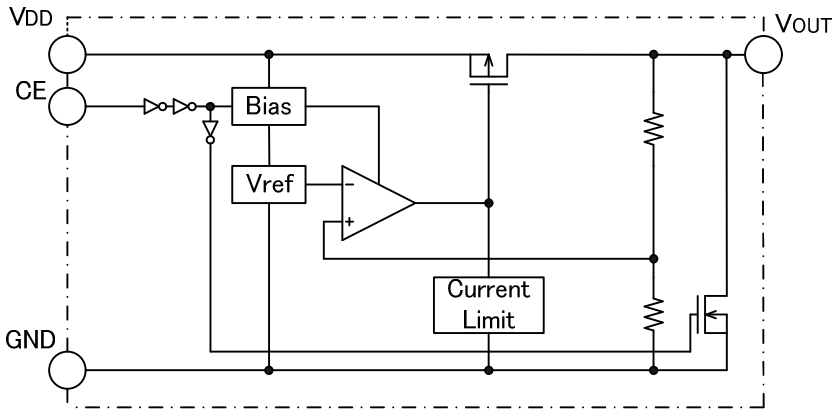
M M 3 7 6 4 X X X X X E

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

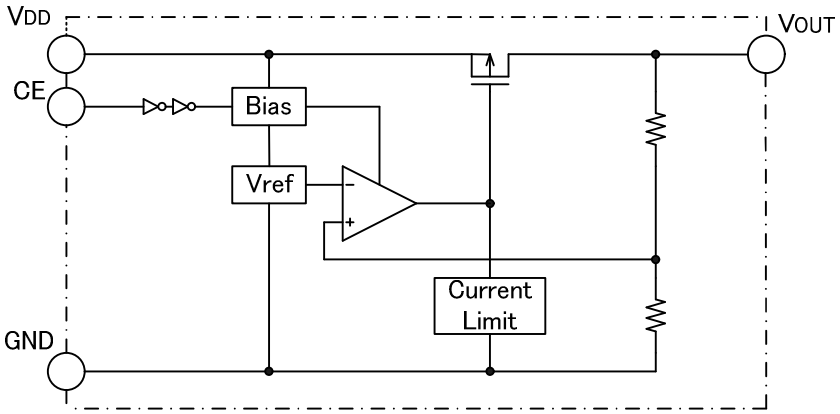
(A)	Function Type	A Z	CE=H active, with discharge function
		C W	CE=H active, without discharge function
(B)	Output voltage rank	08 ≀ 50	(A)="A","C" the output voltage can be designated in the range from 0.80V(08) to 5.00V(50) in 0.1V steps. (A)="Z","W" the output voltage can be designated in the range from 0.85V(08) to 4.95V(49) in 0.05V steps.
(C)	Package	R	PLP-4C
(D)	Packing specifications	R	R housing (Standard)

Block Diagram

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

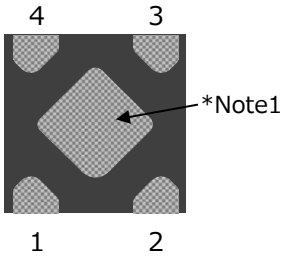


- C, W rank (CE=H active, without discharge function)



Pin Configuration

- PLP-4C



Top view

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

*Note1:Heat spreader bottom with GND.

Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Storage temperature	Tstg	-55	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	VDD+0.3	V
Output current	I_{OUT}	0	400	mA
Power dissipation *Note2	Pd	-	1300	mW

*Note2:JEDEC51-7 standard

Recommended Operating Conditions

Item	Symbol	Min.	Max.	Unit
Operating ambient temperature	Topr	-40	85	℃
Operating voltage	Vop	1.6	6.5	V
Output current	Iop	0	200	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
Input current(OFF)	I_{DDOff}	V_{CE}=0V	-	0.01	1.0	μA
No-Load Input Current	I_{DD}	I_{OUT}=0mA	-	20	50	μA
Output voltage	V_{OUT}	I_{OUT}=10mA V_{OUT}≧2.00V	×0.99	-	×1.01	V
		I_{OUT}=10mA V_{OUT}≦1.95V	-0.02	-	0.02	V
Line regulation	V_{LINE}	V_{OUT}(Typ.)+0.5V≦V_{DD}≦6.5V V_{OUT}(Typ.)≦1.1V, I_{OUT}=10mA	-	0.01	0.2	%/V
		1.6V≦V_{DD}≦6.5V V_{OUT}(Typ.)<1.05V, I_{OUT}=10mA				
Load regulation 1	V_{LOAD}1	0.1mA≦I_{OUT}≦100mA	-	10	40	mV
Dropout voltage	Vio	Please refer to another page.	-	-	-	V
Ripple rejection *Note3	RR	f=1kHz, Vripple=0.5V I_{OUT}=30mA, V_{OUT}≧0.8V	-	75	-	dB
Vout temperature coefficient *Note3	ΔV_{OUT} /ΔT	I_{OUT}=30mA -40≦Top≦85℃	-	±50	-	ppm/℃

*Note3:The parameter is guaranteed by design.

Electrical Characteristics

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output current limit	Ilim		200	-	-	mA
Output short-circuit current	Ishort	V_{OUT}=0V	-	30	-	mA
CE High threshold voltage	V_{CEH}		1.2	-	6.0	V
CE Low threshold voltage	V_{CEL}		-	-	0.3	V
CE High threshold current	I_{CEH}		-0.1	-	0.1	μA
CE Low threshold current	I_{CEL}		-0.1	-	0.1	μA
CL discharge resistance *Note3,4	Rdsc		-	780	-	Ω

*Note3:The parameter is guaranteed by design.

*Note4:This parameter is only MM3764A/Z series.

Electrical Characteristics

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

Model name	Item							
	Output voltage				Dropout voltage			
	V_{OUT} (V)				Vio (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3764A/C08	I_{OUT}=10mA	0.780	0.800	0.820	I_{OUT}=100mA, V_{OUT}<1.5V *Note5	-	500	850
MM3764Z/W08		0.830	0.850	0.870				
MM3764A/C09		0.880	0.900	0.920		-	410	750
MM3764Z/W09		0.930	0.950	0.970				
MM3764A/C10		0.980	1.000	1.020		-	330	650
MM3764Z/W10		1.030	1.050	1.070				
MM3764A/C11		1.080	1.100	1.120				
MM3764Z/W11		1.130	1.150	1.170				
MM3764A/C12		1.180	1.200	1.220		-	230	380
MM3764Z/W12		1.230	1.250	1.270				
MM3764A/C13		1.280	1.300	1.320				
MM3764Z/W13		1.330	1.350	1.370				
MM3764A/C14		1.380	1.400	1.420		-	200	360
MM3764Z/W14		1.430	1.450	1.470				
MM3764A/C15		1.480	1.500	1.520	I_{OUT}=100mA, V_{OUT}≧1.5V V_{DD}=VOUT(Typ.)-0.2V	-	180	290
MM3764Z/W15		1.530	1.550	1.570				
MM3764A/C16		1.580	1.600	1.620		-	160	250
MM3764Z/W16		1.630	1.650	1.670				
MM3764A/C17		1.680	1.700	1.720				
MM3764Z/W17		1.730	1.750	1.770				
MM3764A/C18		1.780	1.800	1.820		-	125	210
MM3764Z/W18		1.830	1.850	1.870				
MM3764A/C19		1.880	1.900	1.920				
MM3764Z/W19		1.930	1.950	1.970				
MM3764A/C20		1.980	2.000	2.020		-	115	195
MM3764Z/W20		2.030	2.050	2.071				
MM3764A/C21		2.079	2.100	2.121				
MM3764Z/W21		2.129	2.150	2.172				
MM3764A/C22		2.178	2.200	2.222				
MM3764Z/W22		2.228	2.250	2.273				
MM3764A/C23		2.277	2.300	2.323				
MM3764Z/W23		2.327	2.350	2.374				
MM3764A/C24		2.376	2.400	2.424				
MM3764Z/W24		2.426	2.450	2.475				
MM3764A/C25		2.475	2.500	2.525		-	95	170
MM3764Z/W25		2.525	2.550	2.576				
MM3764A/C26		2.574	2.600	2.626				
MM3764Z/W26		2.624	2.650	2.677				
MM3764A/C27		2.673	2.700	2.727				
MM3764Z/W27		2.723	2.750	2.778				
MM3764A/C28		2.772	2.800	2.828				
MM3764Z/W28		2.822	2.850	2.879				

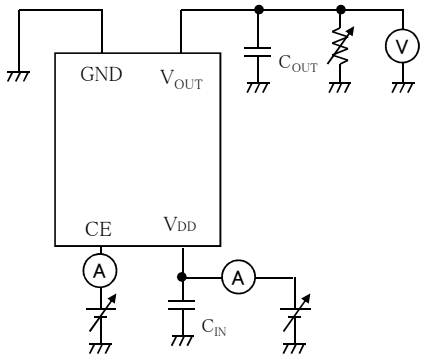
*Note5:Dropout voltage MAX value in the input and it is confirmed that there is no output abnormal voltage impression the load 100mA in the model less than Vout<1.5V.

Electrical Characteristics

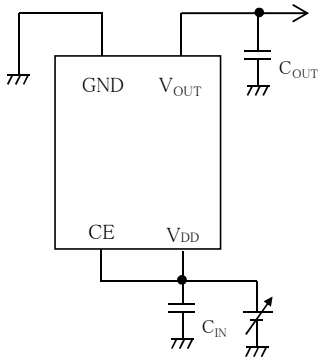
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)

Model name	Item							
	Output voltage				Dropout voltage			
	V_{OUT} (V)				Vio (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3764A/C29	I_{OUT}=10mA	2.871	2.900	2.929	I_{OUT}=100mA, V_{OUT}≧ 1.5V V_{DD}=V_{OUT}(Typ.)-0.2V	-	95	170
MM3764Z/W29		2.921	2.950	2.980				
MM3764A/C30		2.970	3.000	3.030				
MM3764Z/W30		3.020	3.050	3.081				
MM3764A/C31		3.069	3.100	3.131				
MM3764Z/W31		3.119	3.150	3.182				
MM3764A/C32		3.168	3.200	3.232				
MM3764Z/W32		3.218	3.250	3.283				
MM3764A/C33		3.267	3.300	3.333				
MM3764Z/W33		3.317	3.350	3.384				
MM3764A/C34		3.366	3.400	3.434				
MM3764Z/W34		3.416	3.450	3.485				
MM3764A/C35		3.465	3.500	3.535				
MM3764Z/W35		3.515	3.550	3.586				
MM3764A/C36		3.564	3.600	3.636				
MM3764Z/W36		3.614	3.650	3.687				
MM3764A/C37		3.663	3.700	3.737				
MM3764Z/W37		3.713	3.750	3.788				
MM3764A/C38		3.762	3.800	3.838				
MM3764Z/W38		3.812	3.850	3.889				
MM3764A/C39		3.861	3.900	3.939				
MM3764Z/W39		3.911	3.950	3.990				
MM3764A/C40		3.960	4.000	4.040		-	80	140
MM3764Z/W40		4.010	4.050	4.091				
MM3764A/C41		4.059	4.100	4.141				
MM3764Z/W41		4.109	4.150	4.192				
MM3764A/C42		4.158	4.200	4.242				
MM3764Z/W42		4.208	4.250	4.293				
MM3764A/C43		4.257	4.300	4.343				
MM3764Z/W43		4.307	4.350	4.394				
MM3764A/C44		4.356	4.400	4.444				
MM3764Z/W44		4.405	4.450	4.495				
MM3764A/C45		4.455	4.500	4.545				
MM3764Z/W45		4.504	4.550	4.595				
MM3764A/C46		4.554	4.600	4.646				
MM3764Z/W46		4.603	4.650	4.696				
MM3764A/C47		4.653	4.700	4.747				
MM3764Z/W47		4.702	4.750	4.797				
MM3764A/C48		4.752	4.800	4.848				
MM3764Z/W48		4.801	4.850	4.898				
MM3764A/C49		4.851	4.900	4.949				
MM3764Z/W49		4.900	4.950	4.999				
MM3764A/C50		4.950	5.000	5.050				

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. There is a possibility with deterioration and destruction of IC when using it exceeding the absolute maximum rating.
   The absolute maximum rating , Never exceed it. The functional operation is not assured.

2. There is a possibility that it becomes impossible to maintain this performance and reliability IC original
   when using it exceeding recommended operation voltage. Please use it in recommended operation voltage.

3. 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.

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

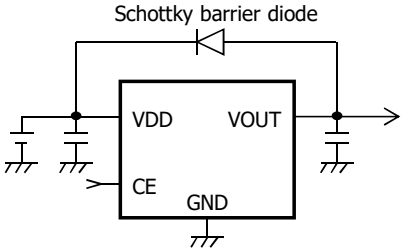
5. The ESR of capacitor must be defined in ESR stability area.
   It is possible to use a ceramic capacitor without ESR resistance for output.
   The ceramic capacitor must be used more than 1.0μF and B temperature characteristics.

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

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

8. CE pull down resistance is not built in this IC.

9. 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.



10. 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.

11. 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.

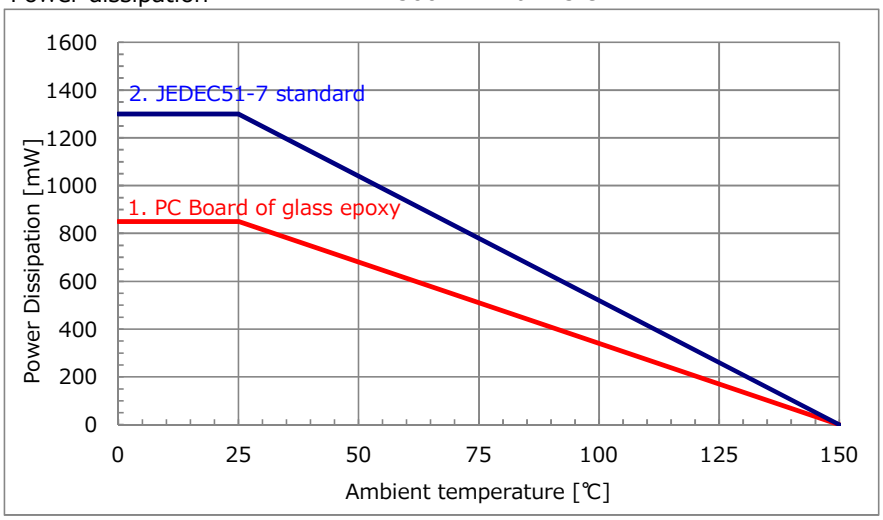
12. The inrush current exceeds ratings flows to the output capacitor when output voltage rise.
    The inrush current depends on the output capacitor, please use it in consideration of the inrush current.

13. The CE terminal can Apply the voltage within Maximum Ratings (7V) at the VDD terminal
    is in an open state. In this state, when the voltage such as noises is applied to VDD terminal,
    the voltage is output on Vout terminal.

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.

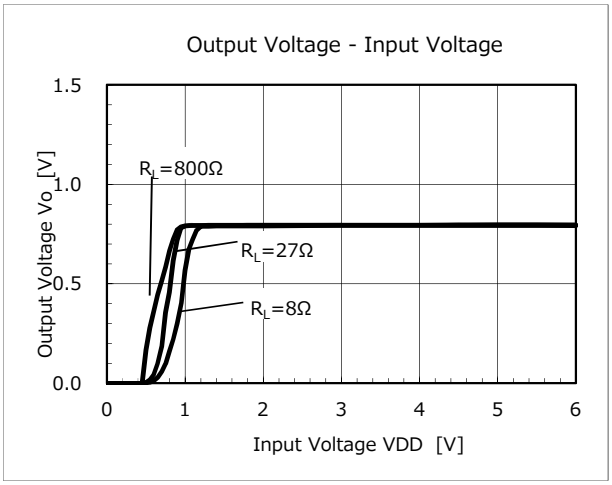
- PLP-4C
  1. PC Board of glass epoxy
     Board size 100mm×100mm t=1.6mm Copper foil area 80%
     Power dissipation 850mW Ta=25℃
  2. JEDEC51-7 standard (4 layer FR-4 board)
     Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
     Power dissipation 1300mW Ta=25℃

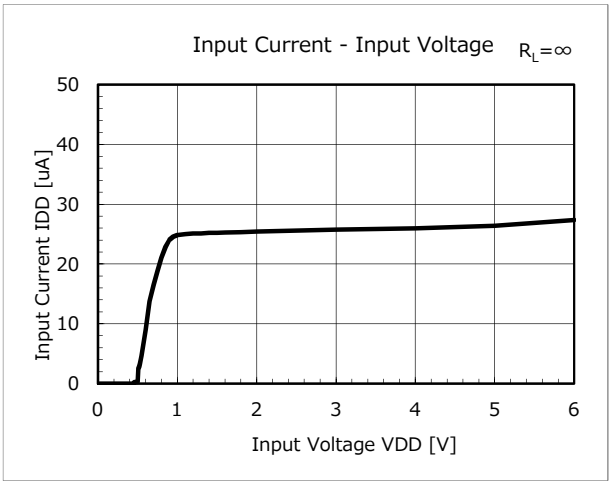


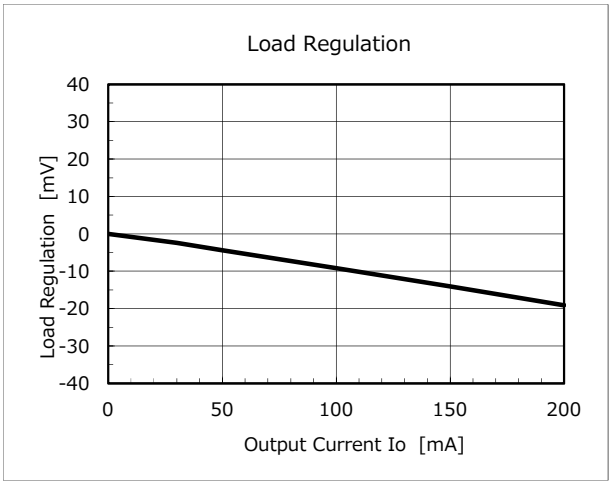
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

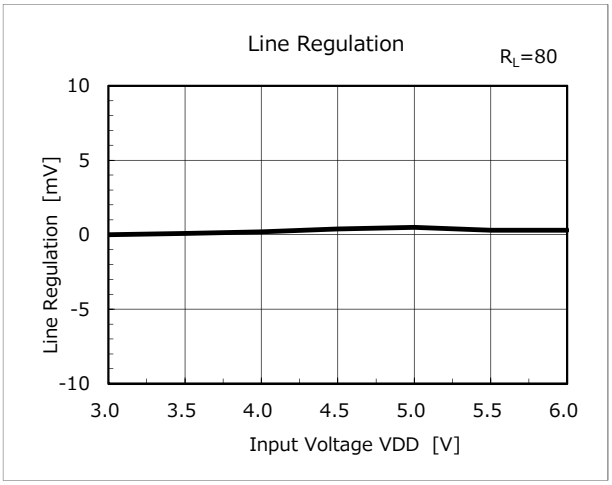
Typical Performance Characteristics (0.8V)

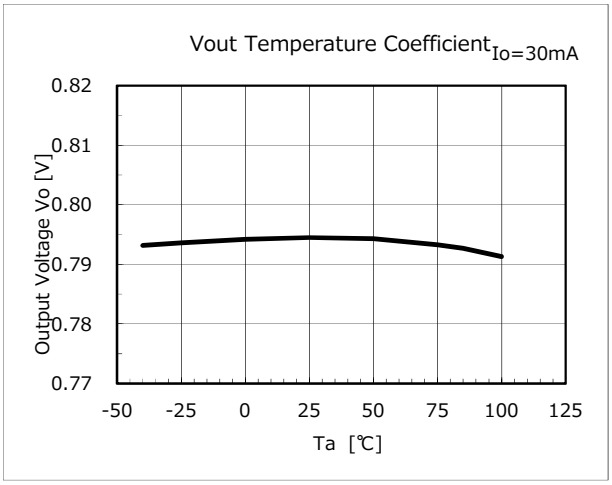
(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25℃ unless otherwise specified)





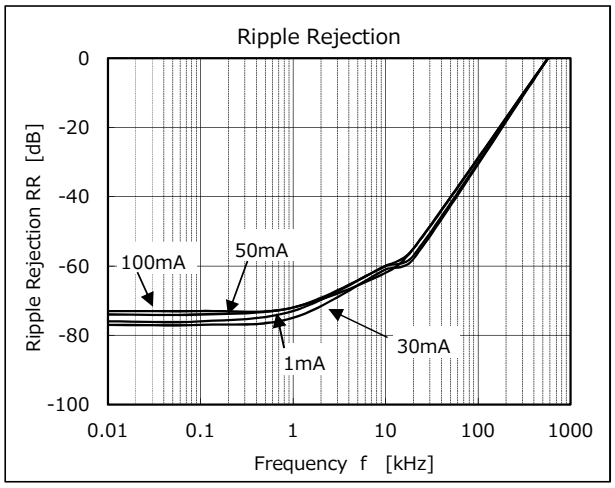


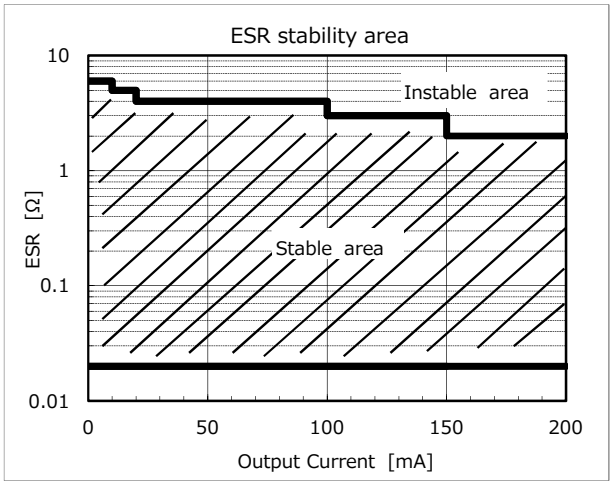


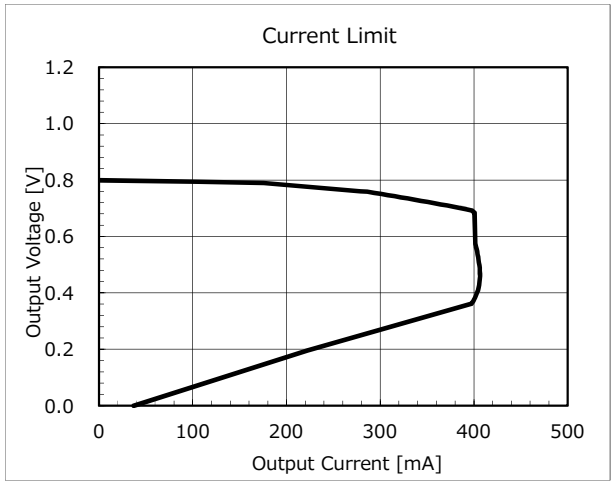


Typical Performance Characteristics (0.8V)

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







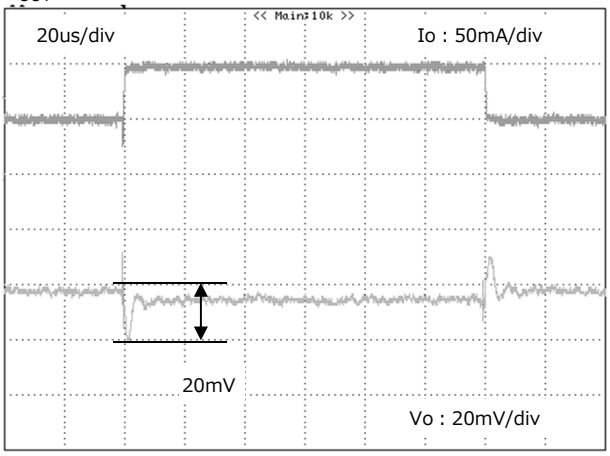
Typical Performance Characteristics (0.8V)

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

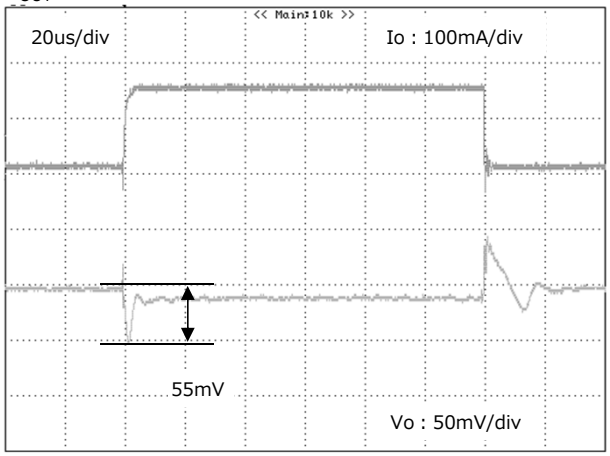
■ Load transient response

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

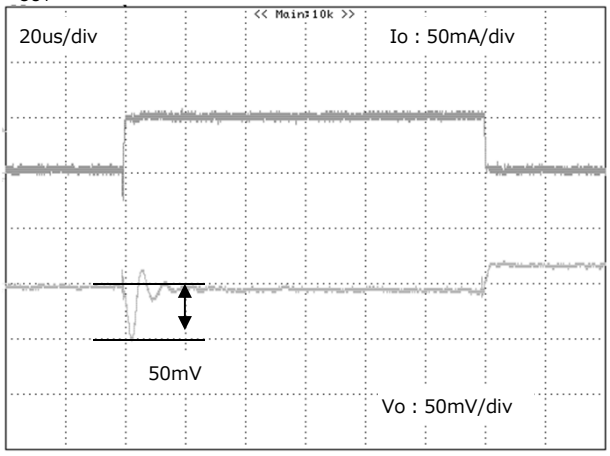
I_{OUT} : 50mA⇔100mA



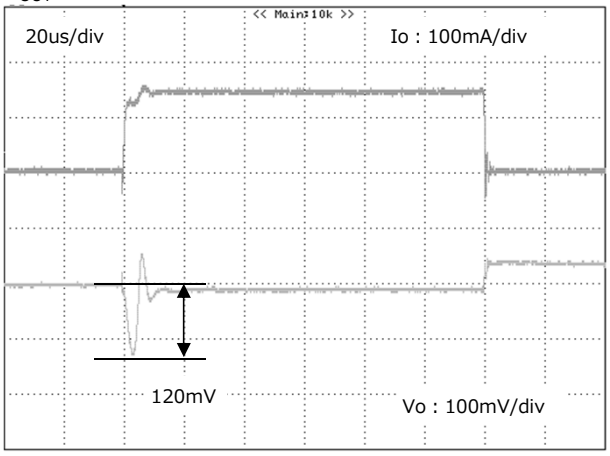
I_{OUT} : 10mA⇔150mA



I_{OUT} : 0.1mA⇔50mA

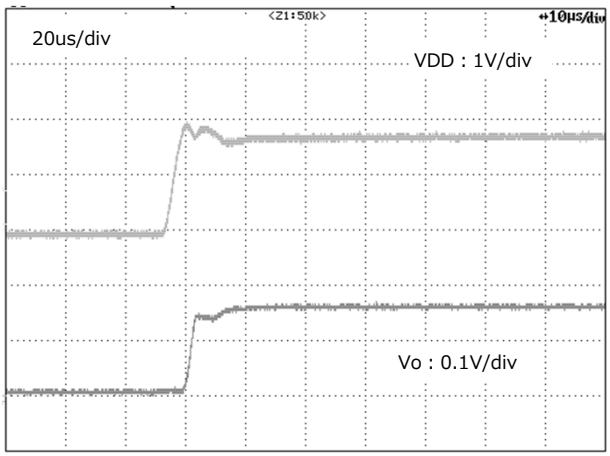


I_{OUT} : 0.1mA⇔150mA



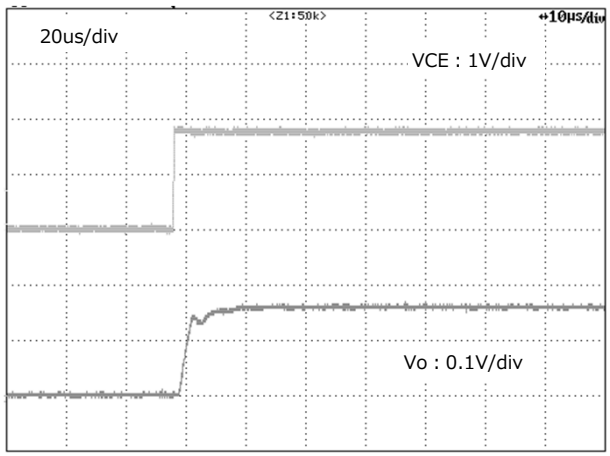
■ Input rise characteristics

(V_{DD}=0V→1.8V, V_{CE}=V_{DD}, I_{OUT}=30mA)



■ CE rise characteristics

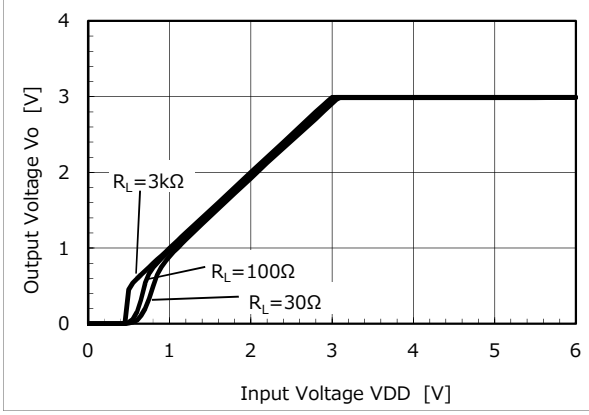
(V_{DD}=1.8V, V_{CE}=0V→V_{DD}, I_{OUT}=30mA)



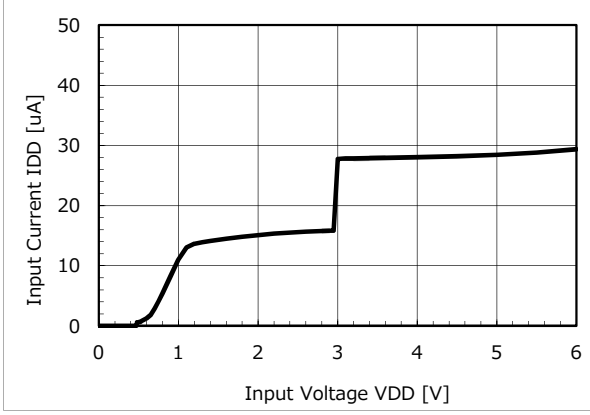
Typical Performance Characteristics (3.0V)

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

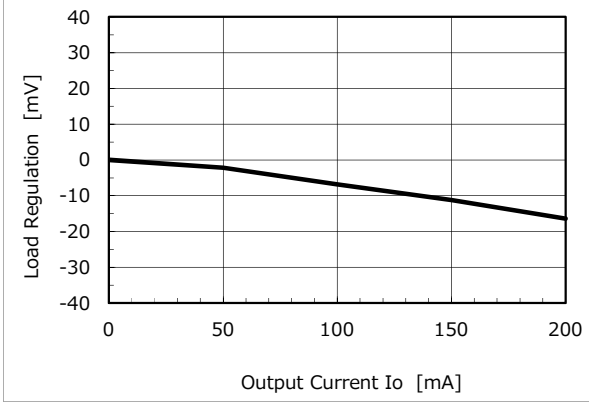
Output Voltage - Input Voltage



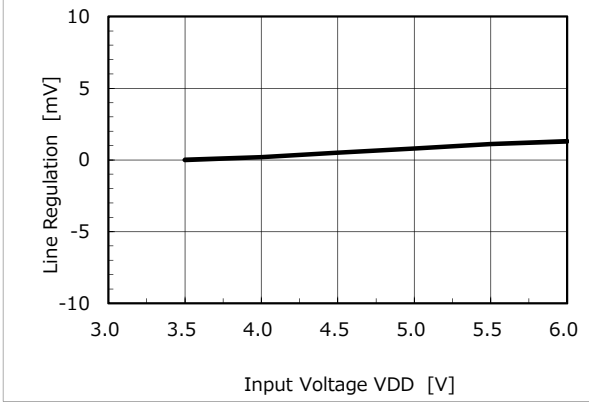
Input Current - Input Voltage R_L=∞



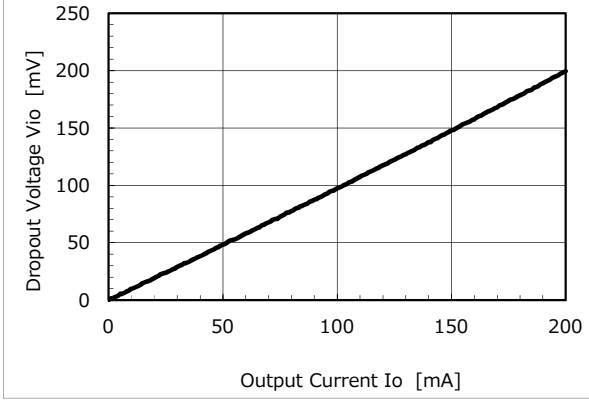
Load Regulation



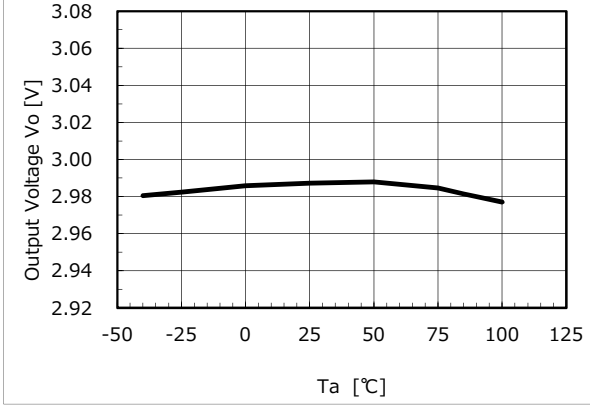
Line Regulation R_L=300



Dropout Voltage VDD=2.8V

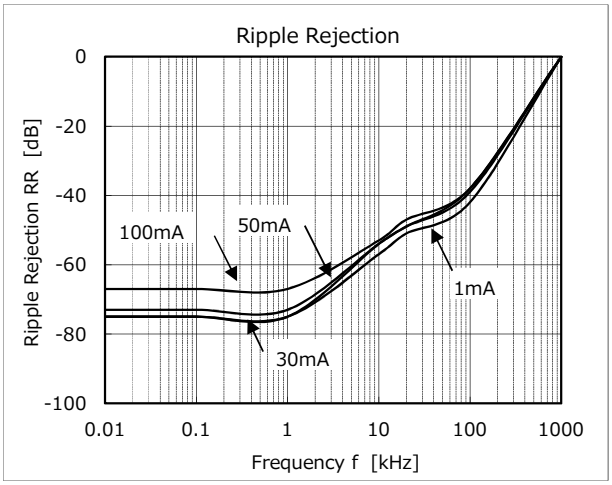


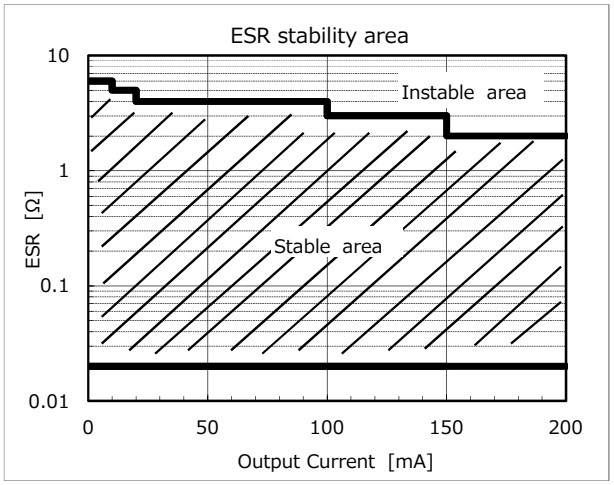
Vout Temperature Coefficient Io=30mA

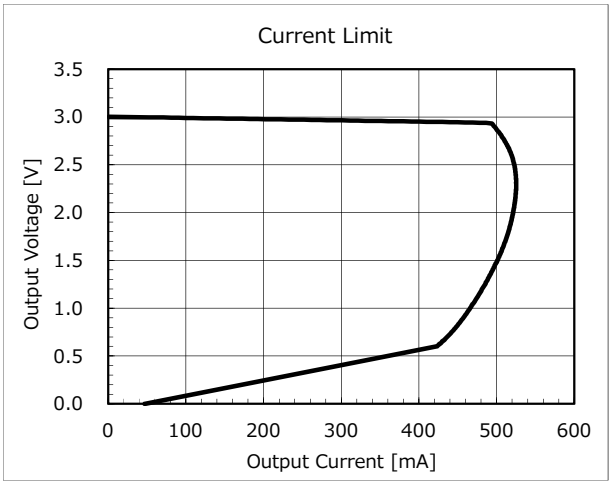


Typical Performance Characteristics (3.0V)

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







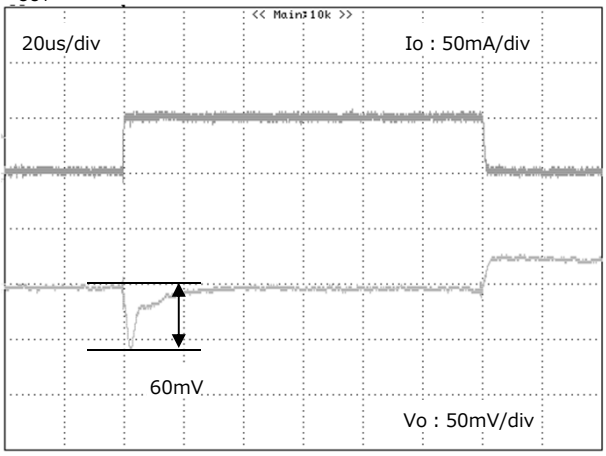
Typical Performance Characteristics (3.0V)

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

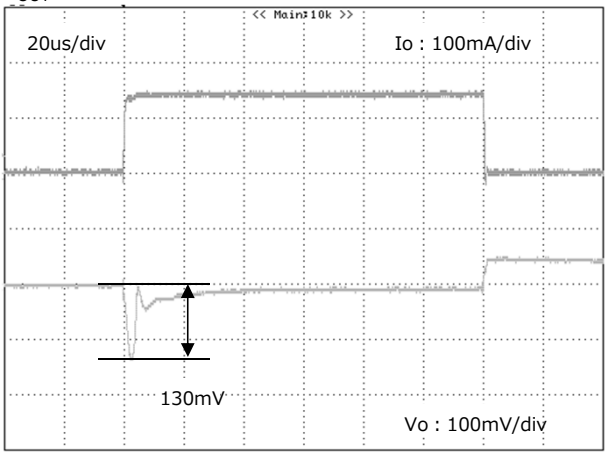
■ Load transient response

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

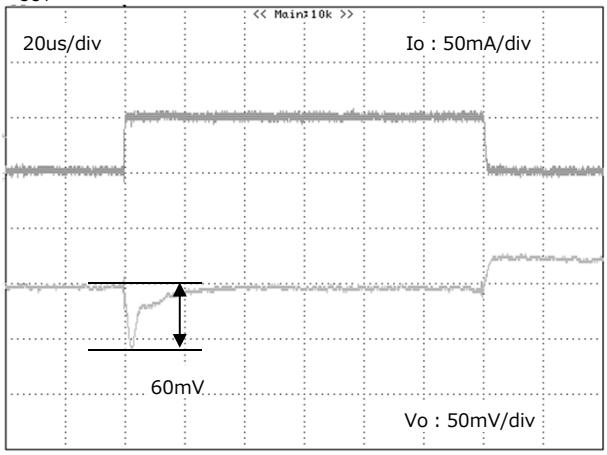
I_{OUT} : 50mA⇔100mA



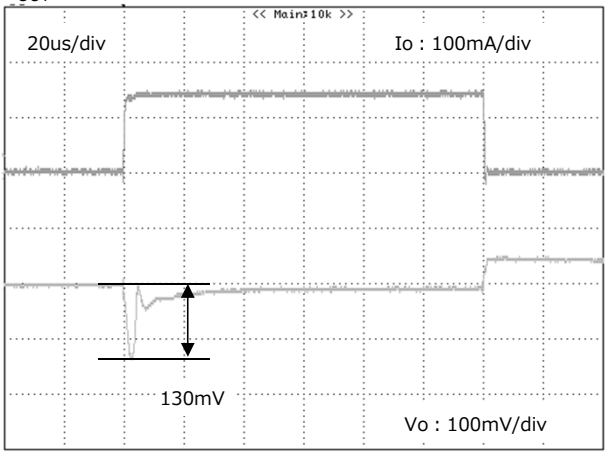
I_{OUT} : 10mA⇔150mA



I_{OUT} : 0.1mA⇔50mA

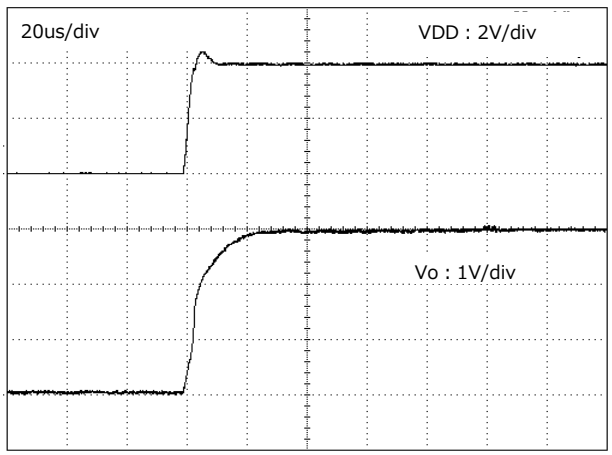


I_{OUT} : 0.1mA⇔150mA



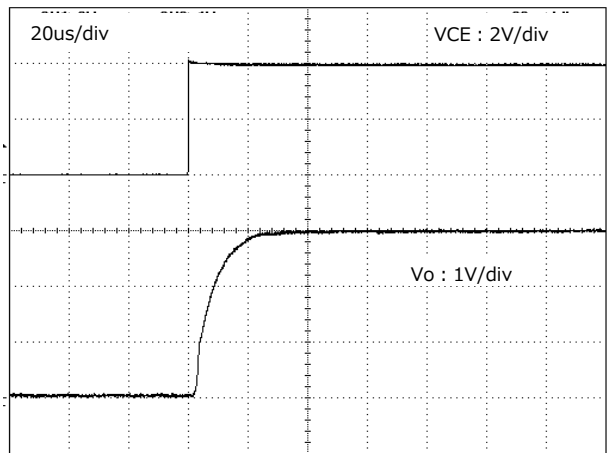
■ Input rise characteristics

(V_{DD}=0V→4.0V, V_{CE}=V_{DD}, I_{OUT}=30mA)



■ CE rise characteristics

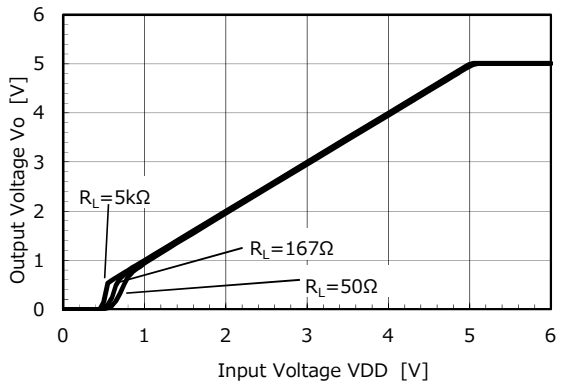
(V_{DD}=4.0V, V_{CE}=0V→V_{DD}, I_{OUT}=30mA)



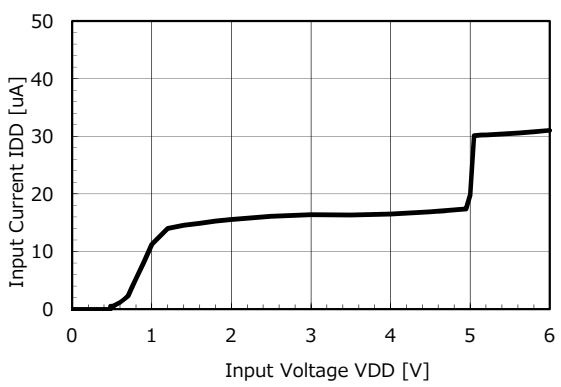
Typical Performance Characteristics (5.0V)

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

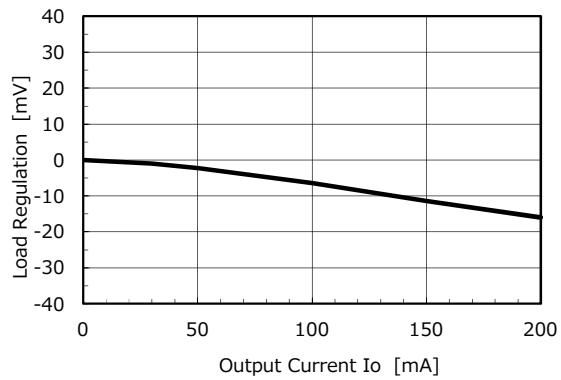
Output Voltage - Input Voltage



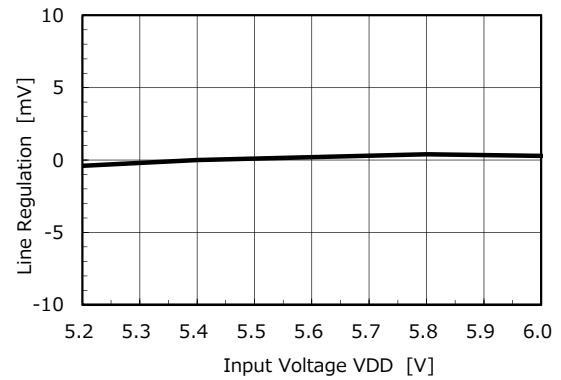
Input Current - Input Voltage $R_L=\infty$



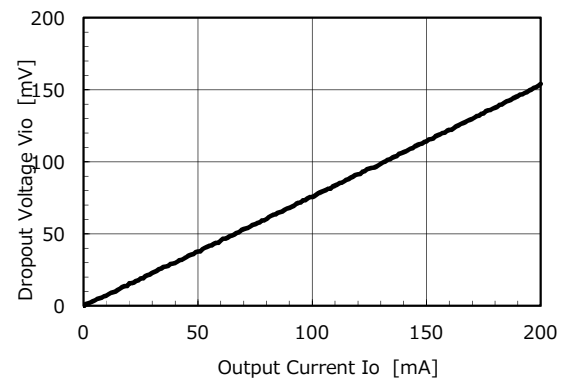
Load Regulation



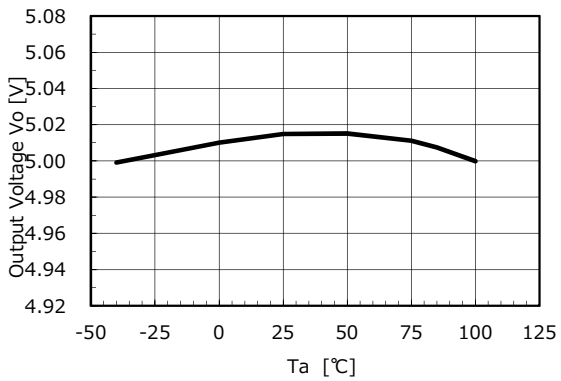
Line Regulation $R_L=\infty$



Dropout Voltage VDD=4.8V

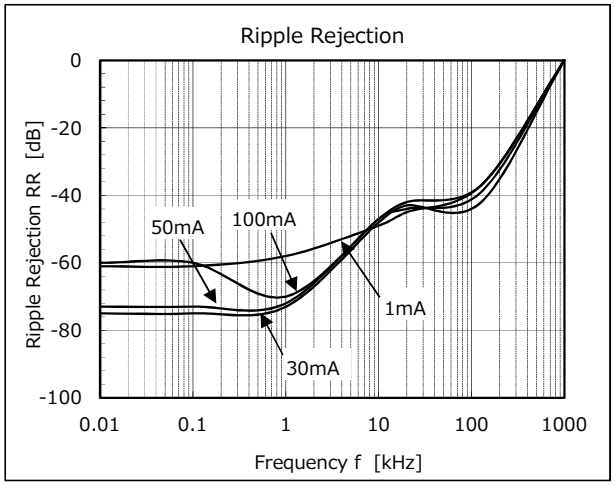


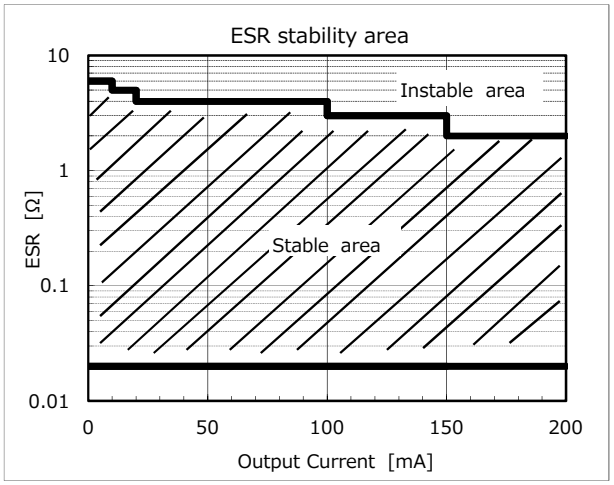
Vout Temperature Coefficient Io=30mA

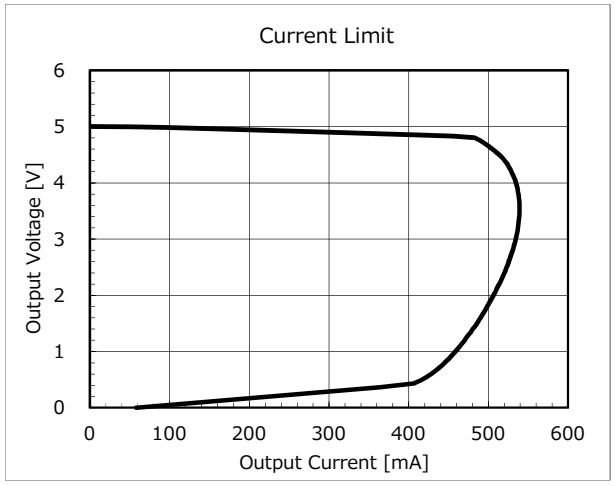


Typical Performance Characteristics (5.0V)

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







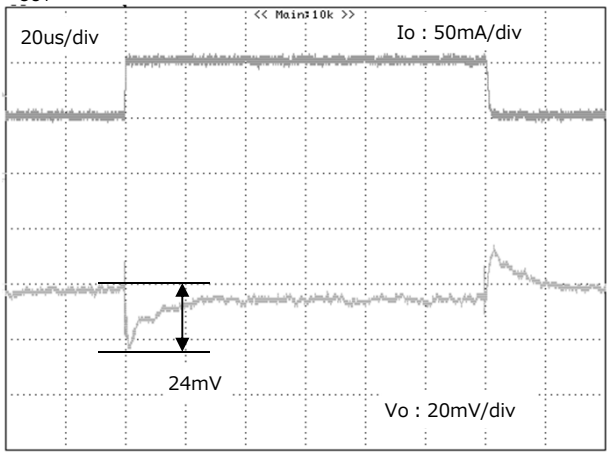
Typical Performance Characteristics (5.0V)

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

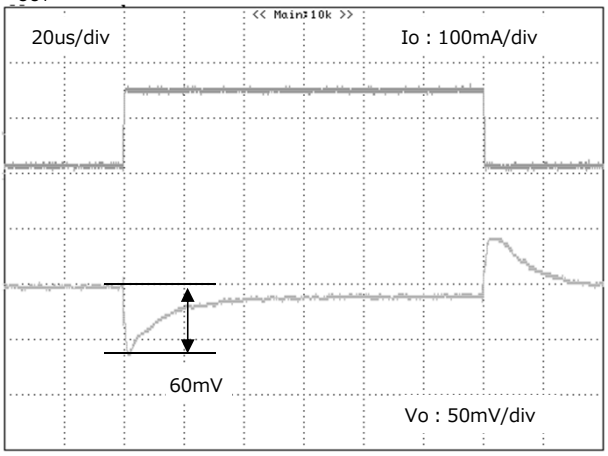
■ Load transient response

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

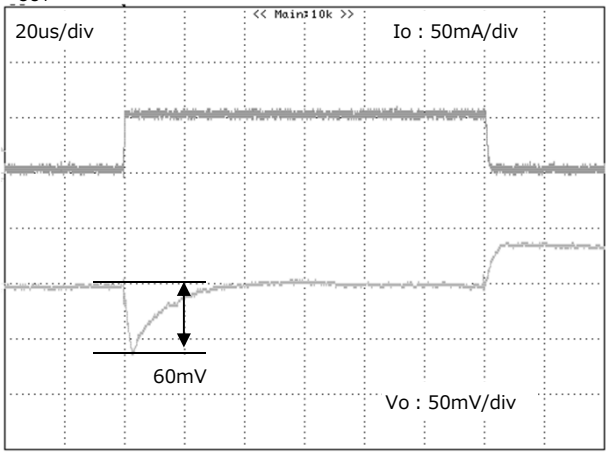
I_{OUT} : 50mA⇔100mA



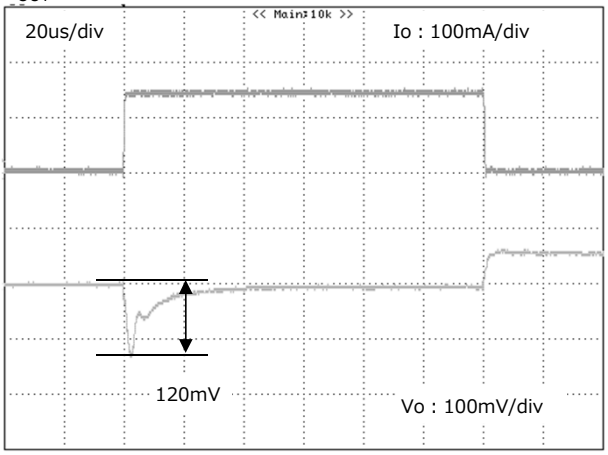
I_{OUT} : 10mA⇔150mA



I_{OUT} : 0.1mA⇔50mA

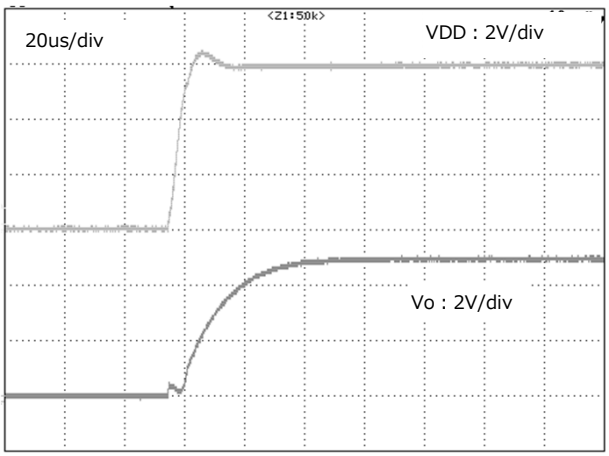


I_{OUT} : 0.1mA⇔150mA



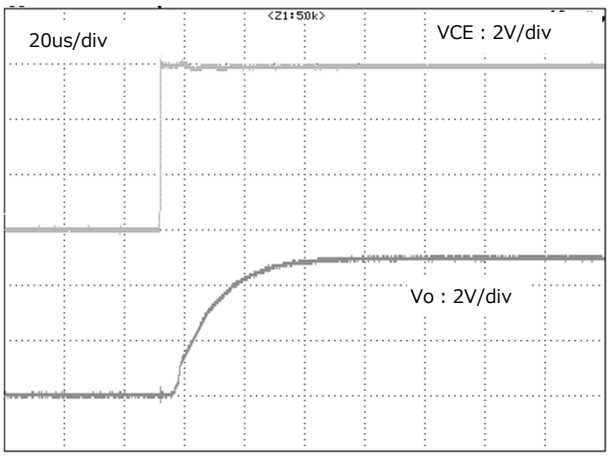
■ Input rise characteristics

(V_{DD}=0V→6.0V, V_{CE}=V_{DD}, I_{OUT}=30mA)



■ CE rise characteristics

(V_{DD}=6.0V, V_{CE}=0V→V_{DD}, I_{OUT}=30mA)



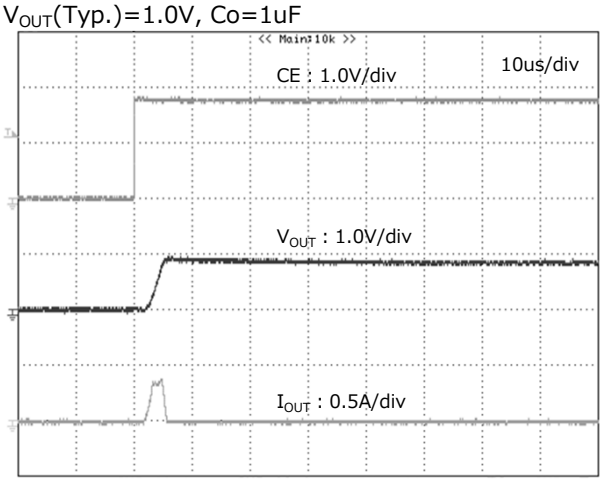
Typical Performance Characteristics (Inrush cur

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

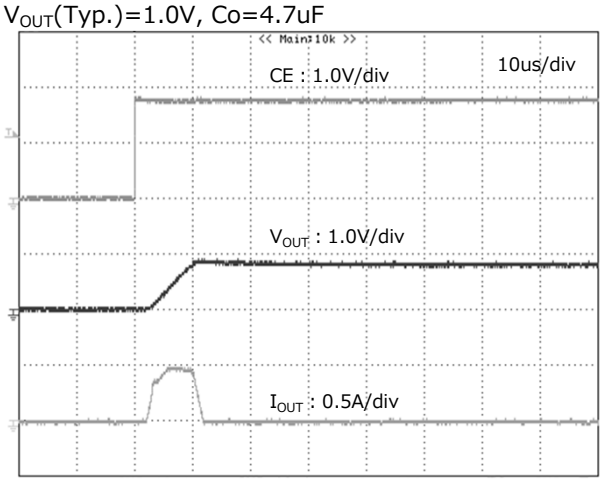
■ Inrush Current

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

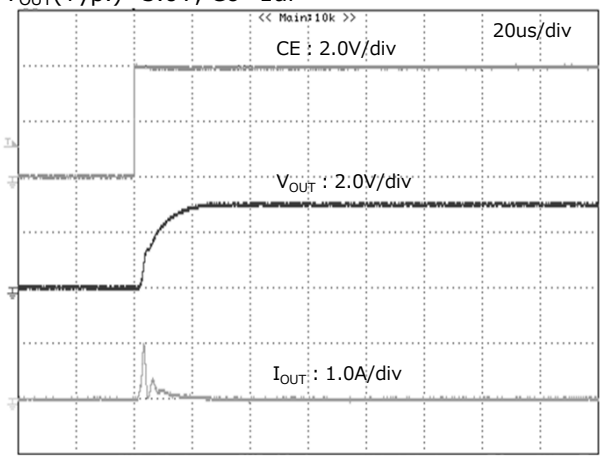
V_{OUT}(Typ.)=1.0V, Co=1uF



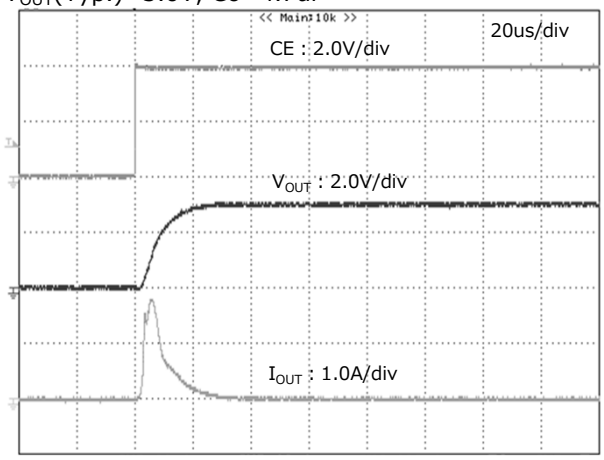
V_{OUT}(Typ.)=1.0V, Co=4.7uF



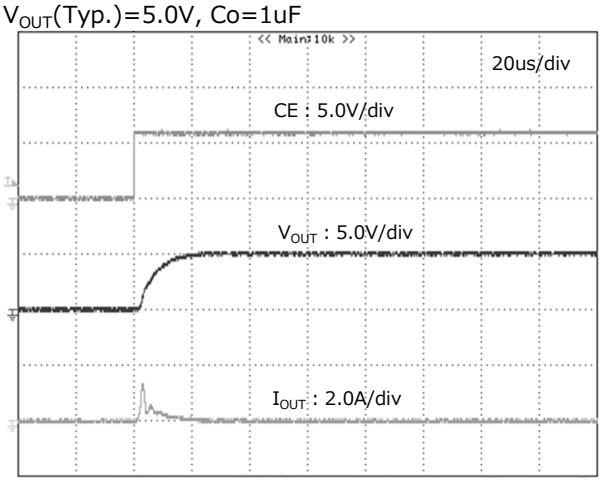
V_{OUT}(Typ.)=3.0V, Co=1uF



V_{OUT}(Typ.)=3.0V, Co=4.7uF



V_{OUT}(Typ.)=5.0V, Co=1uF



V_{OUT}(Typ.)=5.0V, Co=4.7uF