



High PSRR, low dropout voltage 300mA LDO

MM3864 Series

Overview

This IC is a high speed response 300mA 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 160mV typ. (I_o=200mA) 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°C unless otherwise specified)

- Maximum rating supply voltage : -0.3V to 7V
- Operating voltage range : 2V to 6.5V
- Operating ambient temperature : -40°C to 85°C
- Output current : 300mA
- Input current (OFF) : Typ. 0.01μA
- No-load input current : Typ. 20μA
- Output voltage range : 1V to 5V (0.05V step)
- Output voltage accuracy : ±1% (2.0V≤V_{OUT}(Typ.))
±20mV (V_{OUT}(Typ.)<2.0V)
- Line regulation : Typ. 0.01%/V (1.1V≤V_{OUT}(Typ.), V_{DD}=V_{OUT}(Typ.)+0.5V to 6.5V)
Typ. 0.01%/V (V_{OUT}(Typ.)<1.1V, V_{DD}=V_{OUT}(Typ.)+1.6V to 6.5V)
- Load regulation : Typ. 20mV (I_{OUT}=1mA to 200mA)
Typ. 30mV (I_{OUT}=1mA to 300mA)
- Dropout voltage : Typ. 0.24V (I_{OUT}=300mA, V_{OUT}(Typ.)=3V)
- PSRR : Typ. 75dB (f=1kHz)
- Output capacitor : 1μF (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



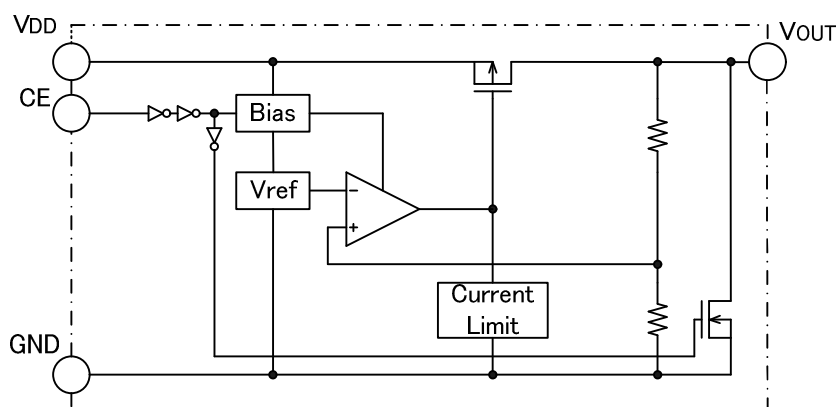


Model Name

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

(A)	Function Type	A	CE=H active, with discharge function
		Z	
(B)	Output voltage rank	10	(A)="A" the output voltage can be designated in the range from 1.00V(10) to 5.00V(50) in 0.1V steps. (A)="Z" the output voltage can be designated in the range from 1.05V(10) to 4.95V(49) in 0.05V steps.
		┐	
		50	
(C)	Package	R	PLP-4C
(D)	Packing specifications	R	R housing (Standard)

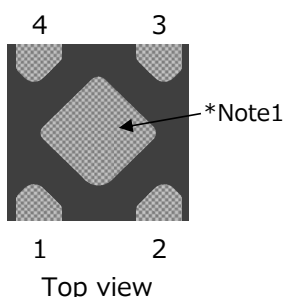
Block Diagram





Pin Configuration

■ PLP-4C



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	°C
Supply voltage	V _{DD}	-0.3	7.0	V
CE input voltage	V _{CE}	-0.3	7.0	V
Output voltage	V _{OUT}	-0.3	V _{DD} +0.3	V
Output current	I _{OUT}	-	500	mA
Power dissipation *Note2	Pd1	-	1300	mW

*Note2: JEDEC51-7 standard

Recommended Operating Conditions

Item	Symbol	Min.	Max.	Unit
Operating ambient temperature	Topr	-40	85	°C
Operating voltage	Vop	2.0	6.5	V
Output current	Iop	0	300	mA

Electrical Characteristics

(V_{DD}=V_{OUT}(Typ.)+1V, V_{CE}=V_{DD}, Ta=25°C 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	-	0.01	0.2	% / V
		V _{OUT} (Typ.)≤1.1V, I _{OUT} =10mA				
		1.6V≤V _{DD} ≤6.5V V _{OUT} (Typ.)<1.05V, I _{OUT} =10mA				
Load regulation 1	V _{LOAD1}	0.1mA≤I _{OUT} ≤200mA	-	20	80	mV
Load regulation 2	V _{LOAD2}	0.1mA≤I _{OUT} ≤300mA	-	30	120	mV
Dropout voltage	V _{io}	Please refer to another page.	-	-	-	V
Ripple rejection *Note3	RR	f=1kHz, V _{ripple} =0.5V I _{OUT} =30mA, V _{OUT} ≥1.0V	-	75	-	dB
Vout temperature coefficient *Note3	ΔV _{OUT} /ΔT _{OP}	I _{OUT} =30mA -40≤Top≤85°C	-	±50	-	ppm/°C

*Note3: The parameter is guaranteed by design.



Electrical Characteristics

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output current limit	Ilim		300	400	-	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	Rdisc		-	780	-	Ω

*Note3: The parameter is guaranteed by design.





Electrical Characteristics

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

Model name	Item							
	Output voltage				Dropout voltage			
	V_{OUT} (V)				V_{IO} (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3864A10	$I_{OUT}=10mA$	0.980	1.000	1.020	$I_{OUT}=200mA$, $V_{OUT}<1.5V$ *Note4	-	660	1300
MM3864Z10		1.030	1.050	1.070				
MM3864A11		1.080	1.100	1.120				
MM3864Z11		1.130	1.150	1.170		-	460	800
MM3864A12		1.180	1.200	1.220				
MM3864Z12		1.230	1.250	1.270		-	400	720
MM3864A13		1.280	1.300	1.320				
MM3864Z13		1.330	1.350	1.370	$I_{OUT}=200mA$, $1.5V \leq V_{OUT}$ $V_{DD}=V_{OUT}(Typ.)-0.2V$	-	360	580
MM3864A14		1.380	1.400	1.420				
MM3864Z14		1.430	1.450	1.470		-	320	500
MM3864A15		1.480	1.500	1.520				
MM3864Z15		1.530	1.550	1.570		-	250	420
MM3864A16		1.580	1.600	1.620				
MM3864Z16		1.630	1.650	1.670		-	230	390
MM3864A17		1.680	1.700	1.720				
MM3864Z17		1.730	1.750	1.770				
MM3864A18		1.780	1.800	1.820				
MM3864Z18		1.830	1.850	1.870				
MM3864A19		1.880	1.900	1.920				
MM3864Z19		1.930	1.950	1.970				
MM3864A20		1.980	2.000	2.020				
MM3864Z20		2.030	2.050	2.071				
MM3864A21		2.079	2.100	2.121				
MM3864Z21		2.129	2.150	2.172				
MM3864A22		2.178	2.200	2.222				
MM3864Z22		2.228	2.250	2.273				
MM3864A23		2.277	2.300	2.323				
MM3864Z23		2.327	2.350	2.374				
MM3864A24		2.376	2.400	2.424				
MM3864Z24		2.426	2.450	2.475				
MM3864A25		2.475	2.500	2.525		-	190	340
MM3864Z25		2.525	2.550	2.576				
MM3864A26		2.574	2.600	2.626				
MM3864Z26		2.624	2.650	2.677				
MM3864A27		2.673	2.700	2.727				
MM3864Z27		2.723	2.750	2.778				
MM3864A28		2.772	2.800	2.828				
MM3864Z28		2.822	2.850	2.879				
MM3864A29		2.871	2.900	2.929				
MM3864Z29		2.921	2.950	2.980				

*Note4: Dropout voltage MAX value in the input and it is confirmed that there is no output abnormal voltage impression the load 200mA in the model less than $V_{out}<1.5V$.





Electrical Characteristics

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

Model name	Item							
	Output voltage				Dropout voltage			
	V_{OUT} (V)				V_{IO} (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3864A30	$I_{OUT}=10mA$	2.970	3.000	3.030	$I_{OUT}=200mA$, $1.5V \leq V_{OUT}$ $V_{DD}=V_{OUT}(Typ.)-0.2V$			
MM3864Z30		3.020	3.050	3.081				
MM3864A31		3.069	3.100	3.131				
MM3864Z31		3.119	3.150	3.182				
MM3864A32		3.168	3.200	3.232				
MM3864Z32		3.218	3.250	3.283				
MM3864A33		3.267	3.300	3.333				
MM3864Z33		3.317	3.350	3.384				
MM3864A34		3.366	3.400	3.434				
MM3864Z34		3.416	3.450	3.485				
MM3864A35		3.465	3.500	3.535				
MM3864Z35		3.515	3.550	3.586				
MM3864A36		3.564	3.600	3.636				
MM3864Z36		3.614	3.650	3.687				
MM3864A37		3.663	3.700	3.737				
MM3864Z37		3.713	3.750	3.788				
MM3864A38		3.762	3.800	3.838				
MM3864Z38		3.812	3.850	3.889				
MM3864A39		3.861	3.900	3.939				
MM3864Z39		3.911	3.950	3.990				
MM3864A40		3.960	4.000	4.040		-	160	280
MM3864Z40		4.010	4.050	4.091				
MM3864A41		4.059	4.100	4.141				
MM3864Z41		4.109	4.150	4.192				
MM3864A42		4.158	4.200	4.242				
MM3864Z42		4.208	4.250	4.293				
MM3864A43		4.257	4.300	4.343				
MM3864Z43		4.307	4.350	4.394				
MM3864A44		4.356	4.400	4.444				
MM3864Z44		4.405	4.450	4.495				
MM3864A45		4.455	4.500	4.545				
MM3864Z45		4.504	4.550	4.595				
MM3864A46		4.554	4.600	4.646				
MM3864Z46		4.603	4.650	4.696				
MM3864A47		4.653	4.700	4.747				
MM3864Z47		4.702	4.750	4.797				
MM3864A48		4.752	4.800	4.848				
MM3864Z48		4.801	4.850	4.898				
MM3864A49		4.851	4.900	4.949				
MM3864Z49		4.900	4.950	4.999				
MM3864A50		4.950	5.000	5.050				





Electrical Characteristics

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

Model name	Item							
	Output voltage				Dropout voltage			
	V_{OUT} (V)				V_{IO} (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3864A10	$I_{OUT}=10mA$	0.980	1.000	1.020	$I_{OUT}=300mA$, $V_{OUT}<2.0V$ *Note5	-	850	1500
MM3864Z10		1.030	1.050	1.070				
MM3864A11		1.080	1.100	1.120				
MM3864Z11		1.130	1.150	1.170		-	690	1200
MM3864A12		1.180	1.200	1.220				
MM3864Z12		1.230	1.250	1.270				
MM3864A13		1.280	1.300	1.320		-	600	1000
MM3864Z13		1.330	1.350	1.370				
MM3864A14		1.380	1.400	1.420				
MM3864Z14		1.430	1.450	1.470		-	500	740
MM3864A15		1.480	1.500	1.520				
MM3864Z15		1.530	1.550	1.570				
MM3864A16		1.580	1.600	1.620				
MM3864Z16		1.630	1.650	1.670				
MM3864A17		1.680	1.700	1.720				
MM3864Z17		1.730	1.750	1.770				
MM3864A18		1.780	1.800	1.820				
MM3864Z18		1.830	1.850	1.870				
MM3864A19		1.880	1.900	1.920				
MM3864Z19		1.930	1.950	1.970	$I_{OUT}=300mA$, $2.0V \leq V_{OUT}$ $V_{DD}=V_{OUT}(Typ.)-0.2V$	-	440	600
MM3864A20		1.980	2.000	2.020				
MM3864Z20		2.030	2.050	2.071				
MM3864A21		2.079	2.100	2.121				
MM3864Z21		2.129	2.150	2.172				
MM3864A22		2.178	2.200	2.222				
MM3864Z22		2.228	2.250	2.273				
MM3864A23		2.277	2.300	2.323		-	310	500
MM3864Z23		2.327	2.350	2.374				
MM3864A24		2.376	2.400	2.424				
MM3864Z24		2.426	2.450	2.475				
MM3864A25		2.475	2.500	2.525				
MM3864Z25		2.525	2.550	2.576				
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MM3864Z28		2.822	2.850	2.879				
MM3864A29		2.871	2.900	2.929				
MM3864Z29		2.921	2.950	2.980				

*Note5: Dropout voltage MAX value in the input and it is confirmed that there is no output abnormal voltage impression the load 300mA in the model less than $V_{out}<2.0V$.





Electrical Characteristics

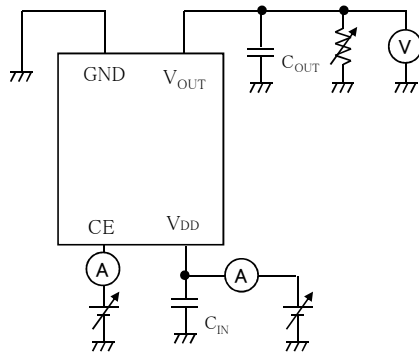
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Model name	Item							
	Output voltage				Dropout voltage			
	V_{OUT} (V)				V_{IO} (V)			
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Max.
MM3864A30	$I_{OUT}=10mA$	2.970	3.000	3.030	$I_{OUT}=300mA$, $2.0V \leq V_{OUT}$ $V_{DD}=V_{OUT}(Typ.)-0.2V$			
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MM3864A38		3.762	3.800	3.838				
MM3864Z38		3.812	3.850	3.889				
MM3864A39		3.861	3.900	3.939				
MM3864Z39		3.911	3.950	3.990				
MM3864A40		3.960	4.000	4.040		-	240	420
MM3864Z40		4.010	4.050	4.091				
MM3864A41		4.059	4.100	4.141				
MM3864Z41		4.109	4.150	4.192				
MM3864A42		4.158	4.200	4.242				
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MM3864A43		4.257	4.300	4.343				
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MM3864Z44		4.405	4.450	4.495				
MM3864A45		4.455	4.500	4.545				
MM3864Z45		4.504	4.550	4.595				
MM3864A46		4.554	4.600	4.646				
MM3864Z46		4.603	4.650	4.696				
MM3864A47		4.653	4.700	4.747				
MM3864Z47		4.702	4.750	4.797				
MM3864A48		4.752	4.800	4.848				
MM3864Z48		4.801	4.850	4.898				
MM3864A49		4.851	4.900	4.949				
MM3864Z49		4.900	4.950	4.999				
MM3864A50		4.950	5.000	5.050				

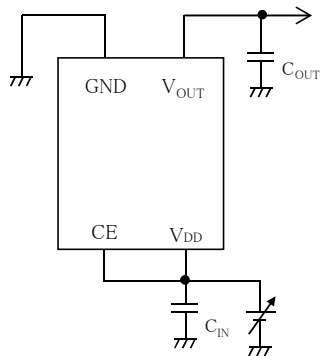




Test Circuit



Application Circuit



(Example of external parts)

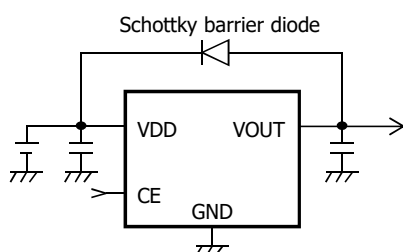
- Output capacitor Ceramic capacitor 1.0 μ F
- Input capacitor Ceramic capacitor 1.0 μ F *Temperature characteristics : B

- 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 1.0 μ F 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 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.

■ PLP-4C

1. PC Board of glass epoxy

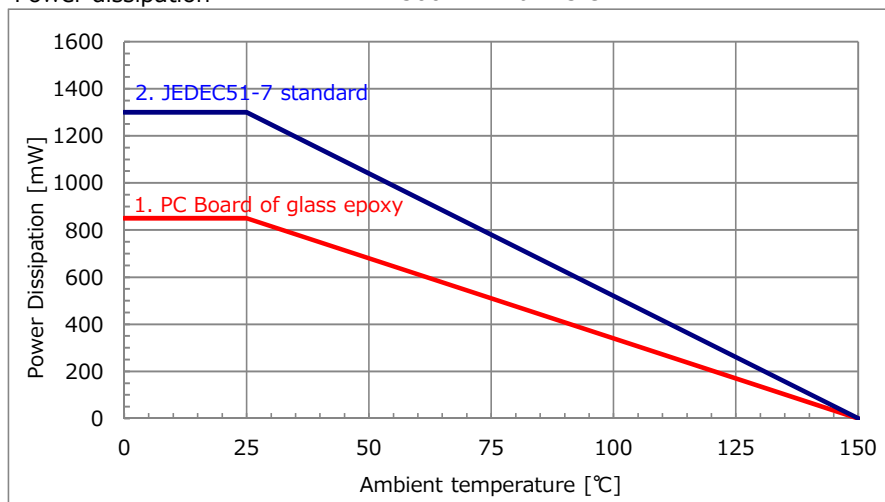
Board size 100mm×100mm t=1.6mm Copper foil area 80%

Power dissipation 850mW Ta=25°C

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°C



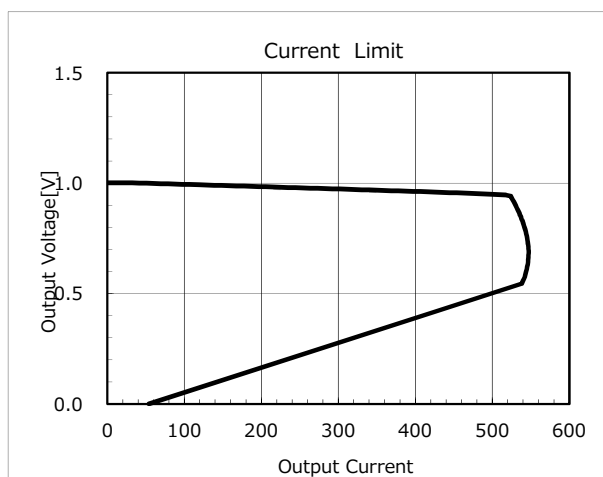
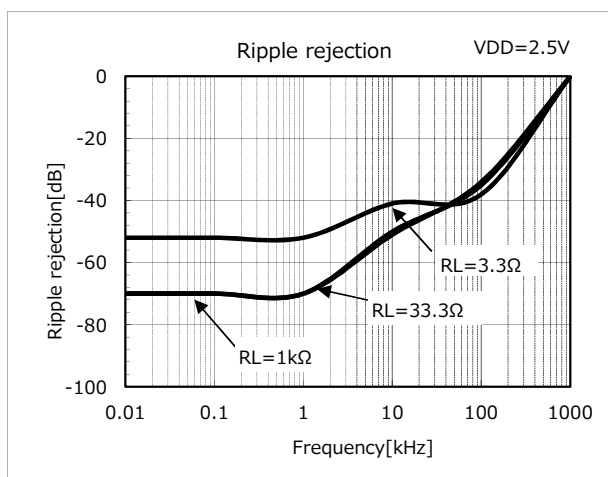
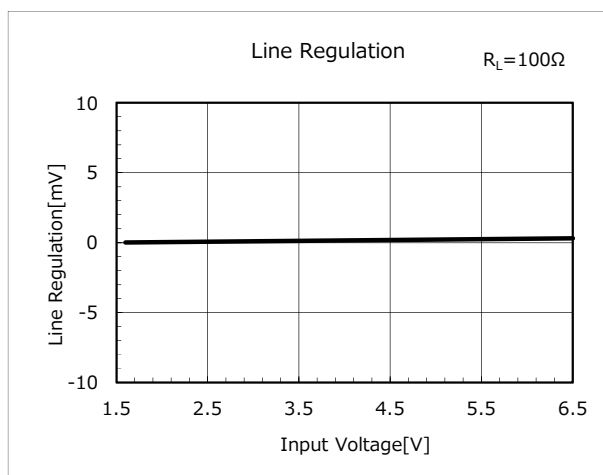
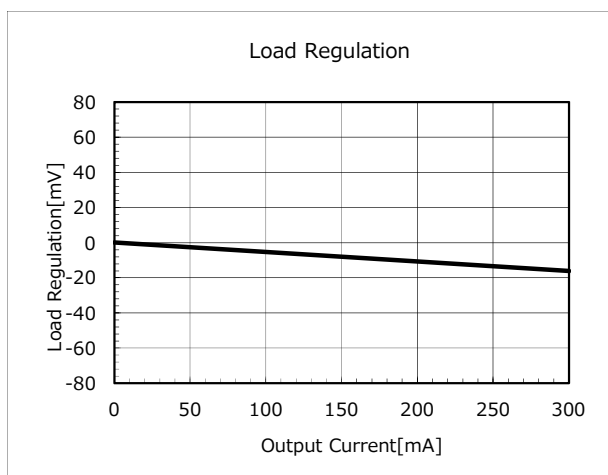
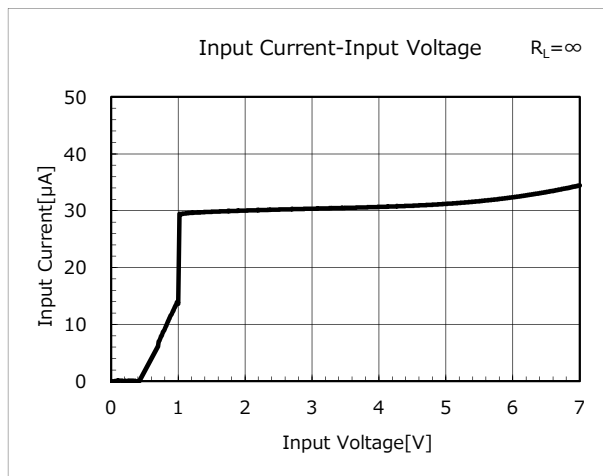
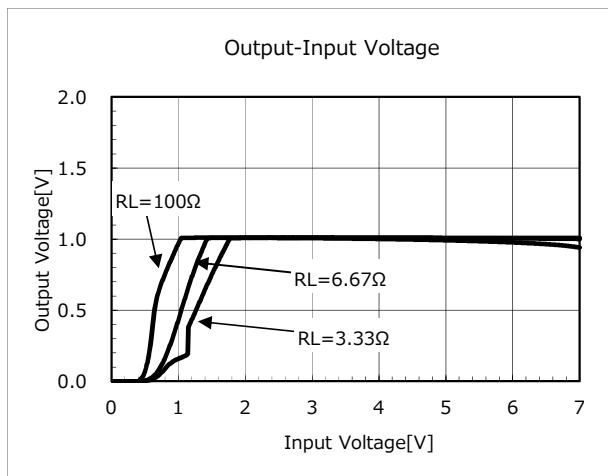
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.





Typical Performance Characteristics (1.0V)

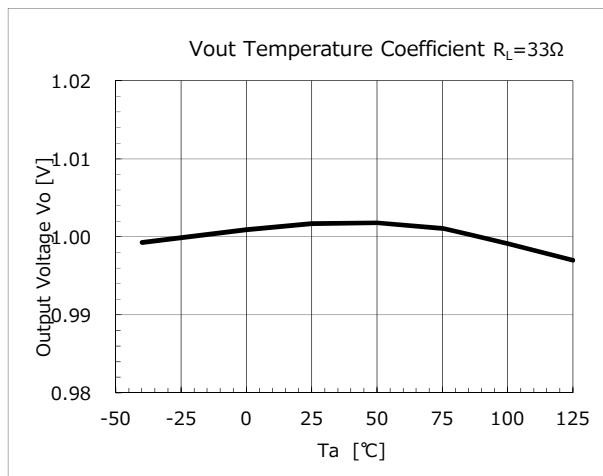
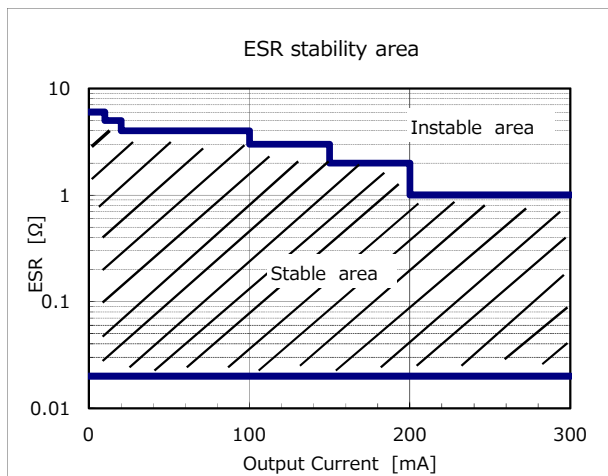
($V_{DD}=V_{OUT(Typ.)}+1V$, $V_{CE}=V_{DD}$, $T_a=25^{\circ}C$ unless otherwise specified)





Typical Performance Characteristics (1.0V)

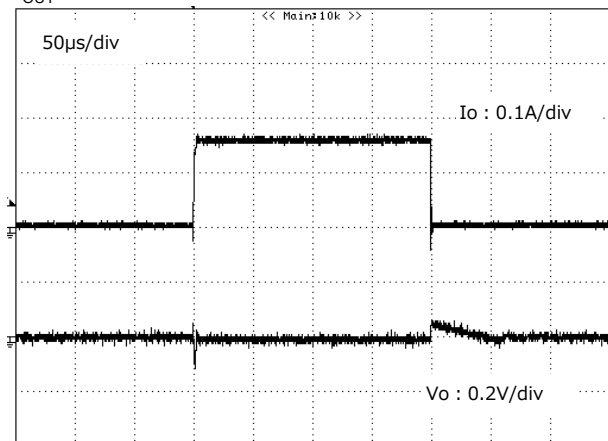
$(V_{DD}=V_{OUT(Typ.)}+1V, V_{CE}=V_{DD}, T_a=25^{\circ}C \text{ unless otherwise specified})$



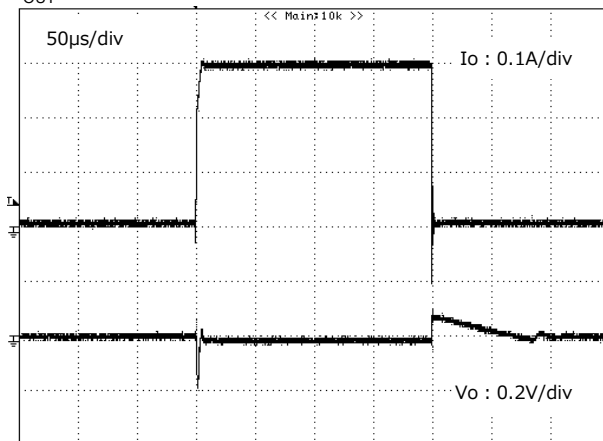
Load transient response

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

$I_{OUT} : 1mA \Leftrightarrow 150mA$

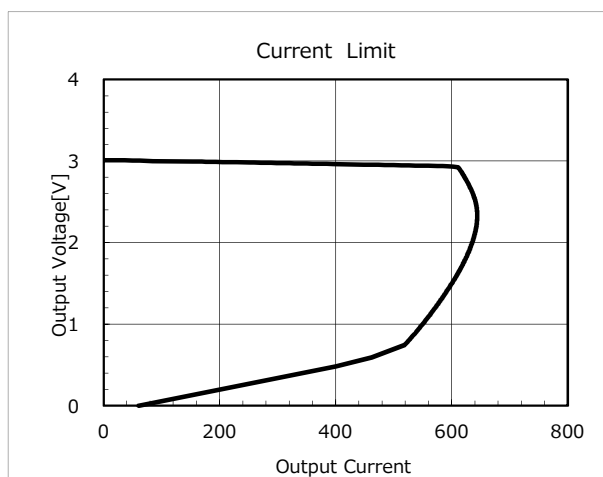
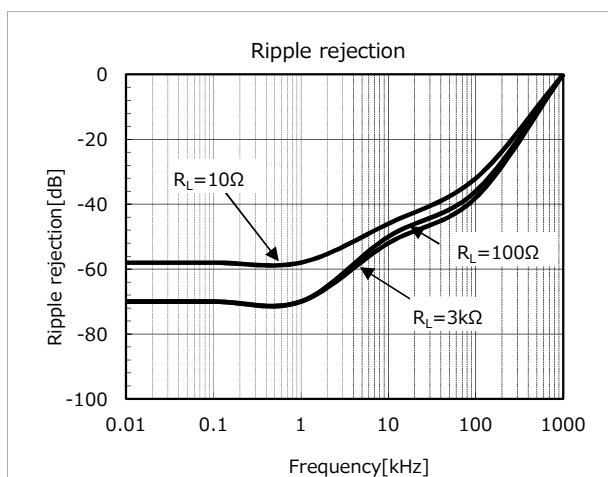
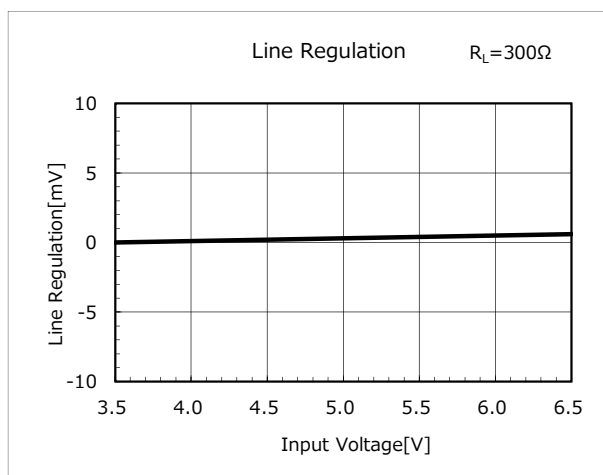
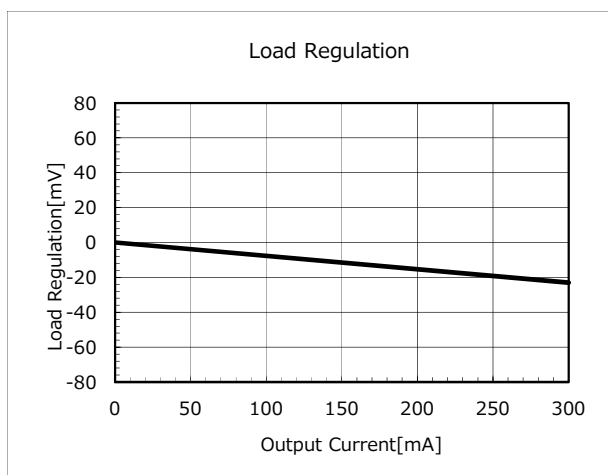
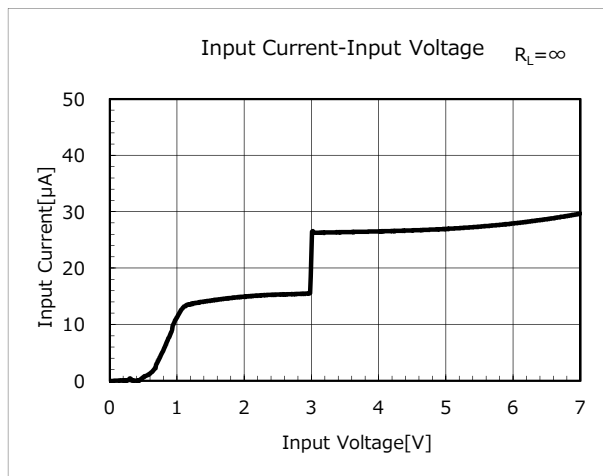
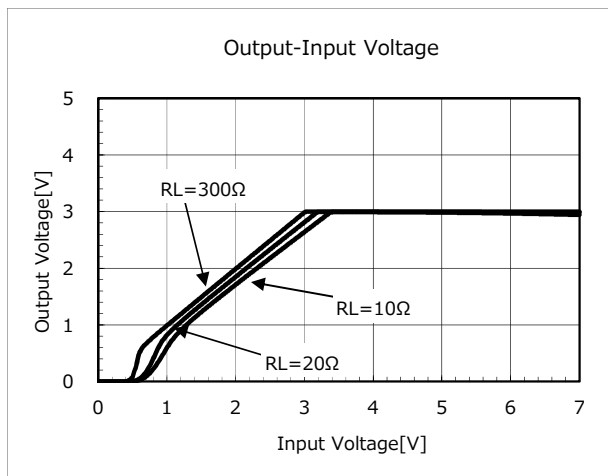


$I_{OUT} : 1mA \Leftrightarrow 300mA$



Typical Performance Characteristics (3.0V)

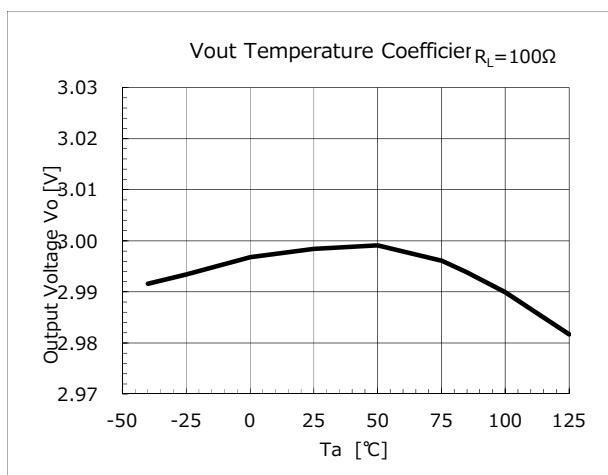
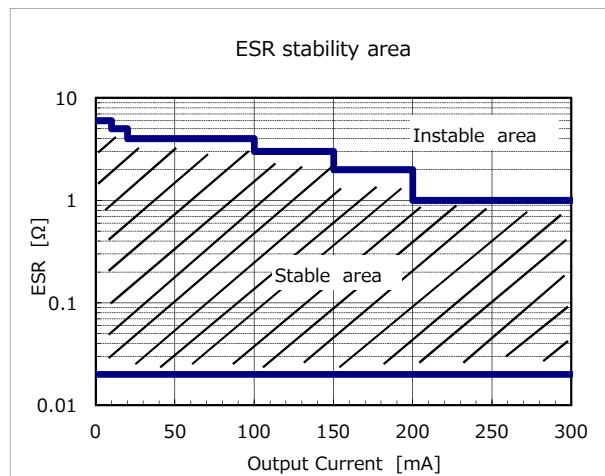
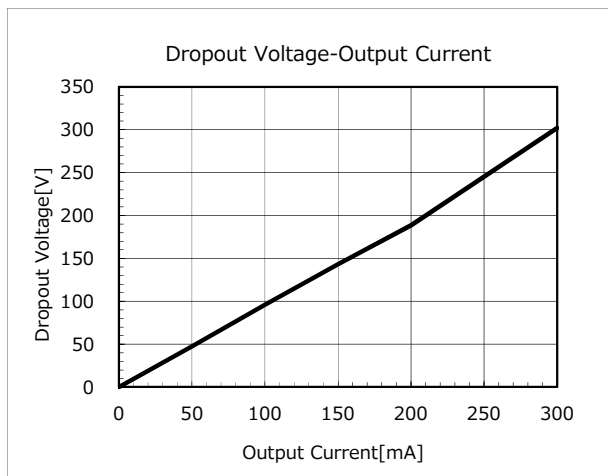
($V_{DD}=V_{OUT(Typ.)}+1V$, $V_{CE}=V_{DD}$, $T_a=25^{\circ}C$ unless otherwise specified)





Typical Performance Characteristics (3.0V)

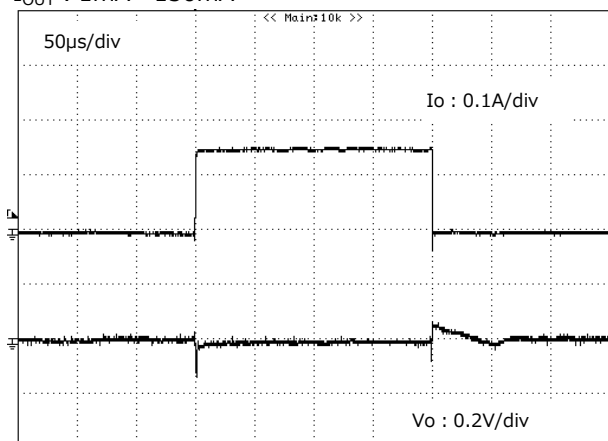
($V_{DD}=V_{OUT}(\text{Typ.})+1\text{V}$, $V_{CE}=V_{DD}$, $T_a=25^\circ\text{C}$ unless otherwise specified)



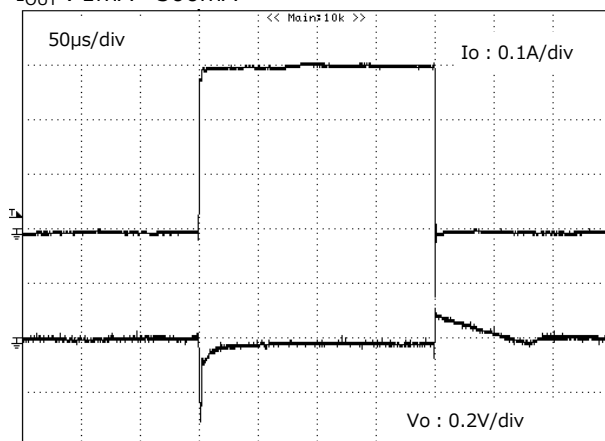
Load transient response

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

$I_{OUT} : 1\text{mA} \Leftrightarrow 150\text{mA}$

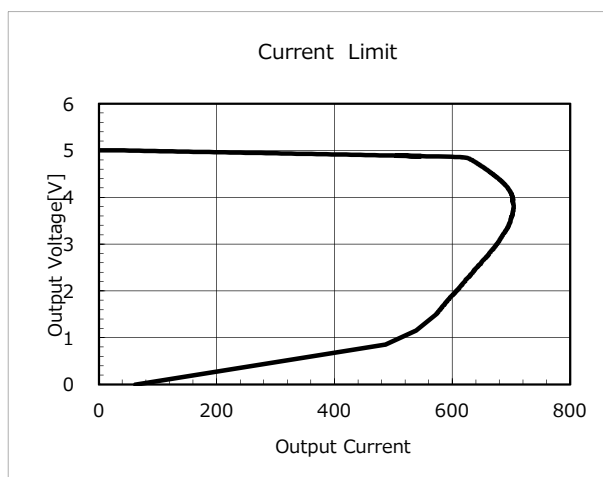
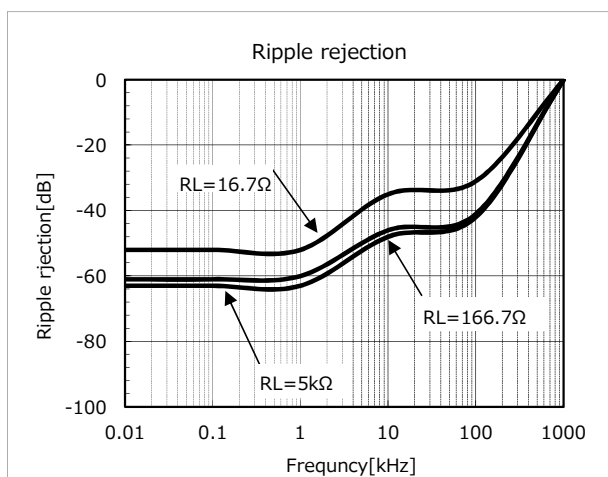
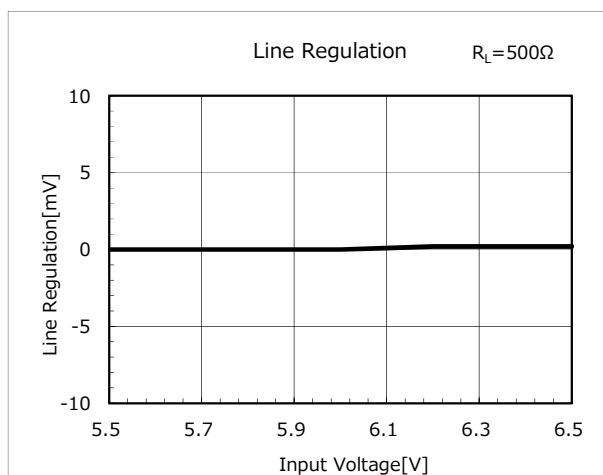
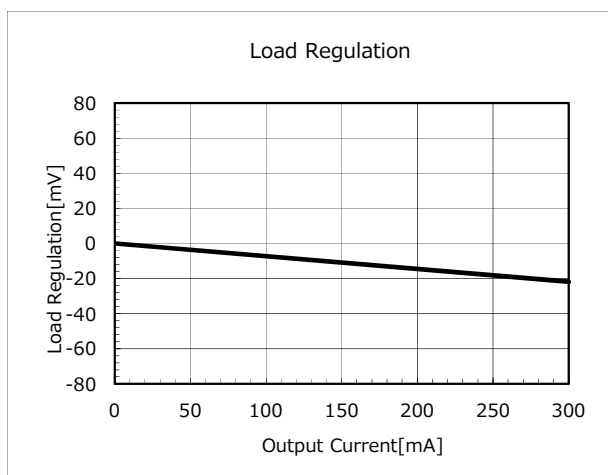
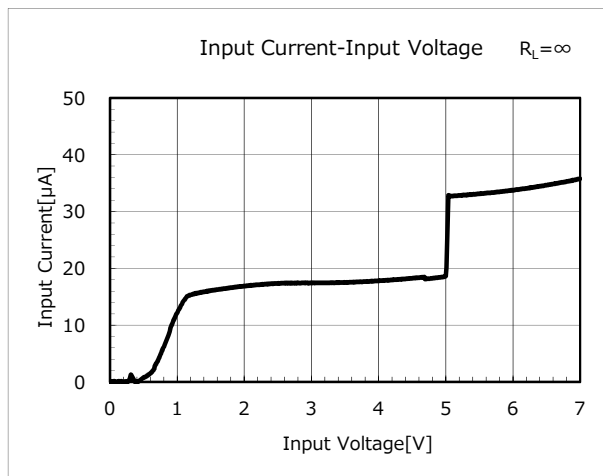
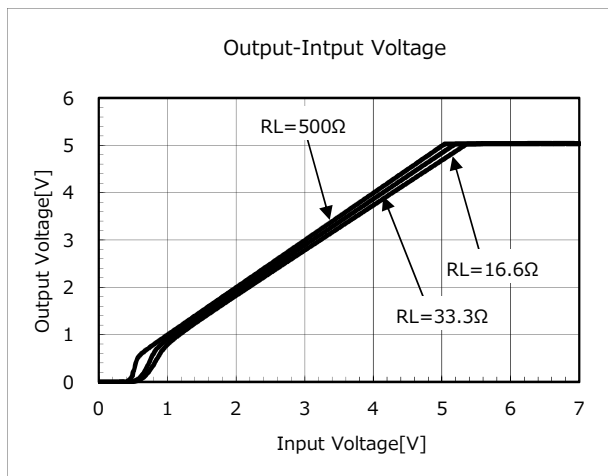


$I_{OUT} : 1\text{mA} \Leftrightarrow 300\text{mA}$



Typical Performance Characteristics (5.0V)

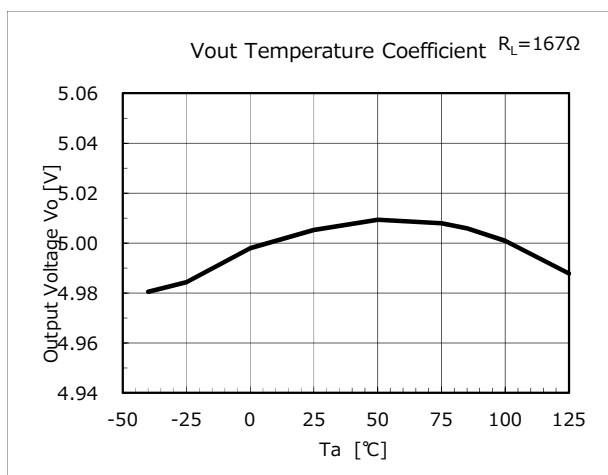
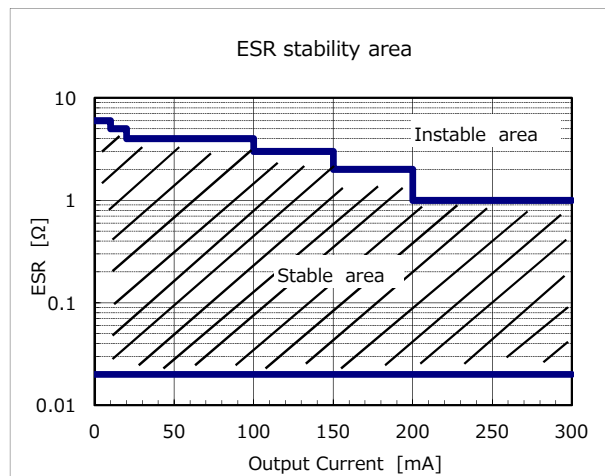
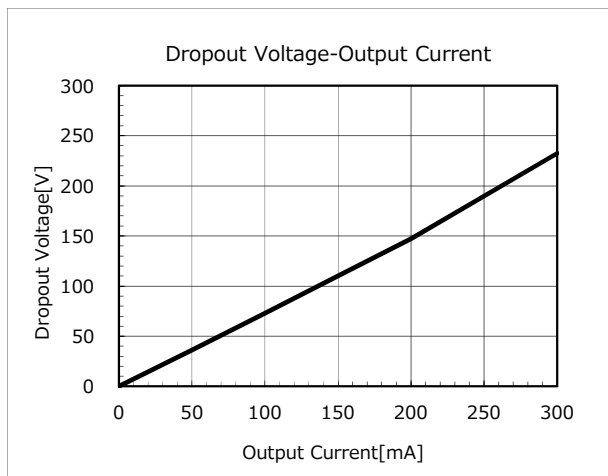
($V_{DD}=V_{OUT(Typ.)}+1V$, $V_{CE}=V_{DD}$, $T_a=25^{\circ}C$ unless otherwise specified)





Typical Performance Characteristics (5.0V)

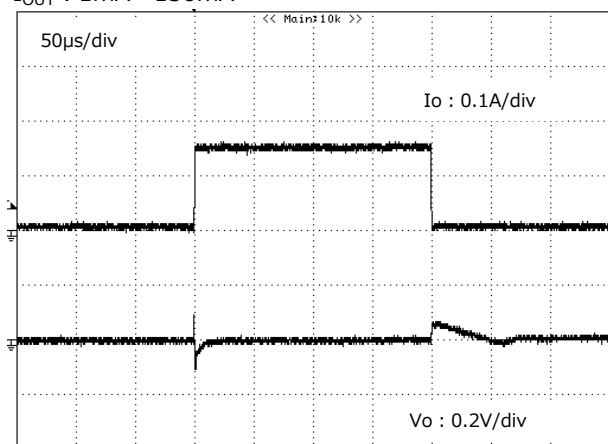
($V_{DD}=V_{OUT}(Typ.)+1V$, $V_{CE}=V_{DD}$, $T_a=25^{\circ}C$ unless otherwise specified)



Load transient response

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

$I_{OUT} : 1mA \Leftrightarrow 150mA$



$I_{OUT} : 1mA \Leftrightarrow 300mA$

