150mA LDO with output voltage switching function
Monolithic IC MM3532T Series

Outline

This IC is a multi-out*1 150mA 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 (V_{OUT}) between V_{OUT}- H / V_{OUT}- L by switching the voltage Low/High applied to the output voltage control terminal (CV).
V_{OUT} can be set to V_{OUT}- H by setting the CV terminal to Low, and V_{OUT} can be set to V_{OUT}- L by setting the CV terminal to High.
In case of SDXC card support, it will be V_{OUT}- H = 3.3 V and V_{OUT}- L = 1.8 V.

Features

1. Output current	150mA
2. No load input current	50μA typ.
3. Input current (OFF)	0.1μA typ.
4. Output voltage accuracy	±1% (±15mV, V_{OUT}<1.5V)
5. Dropout voltage	0.33V max. (I_{OUT}=100mA/CV=H)
	0.18V max. (I_{OUT}=100mA/CV=L)
6. Line regulation	0.01%/V typ.
7. Load regulation	20mV typ.(I_{OUT}=1~100mA)
8. Protect Function	Overcurrent protection
	Over Temperature protection
9. Output Capacitor	1.0μF (Ceramic)

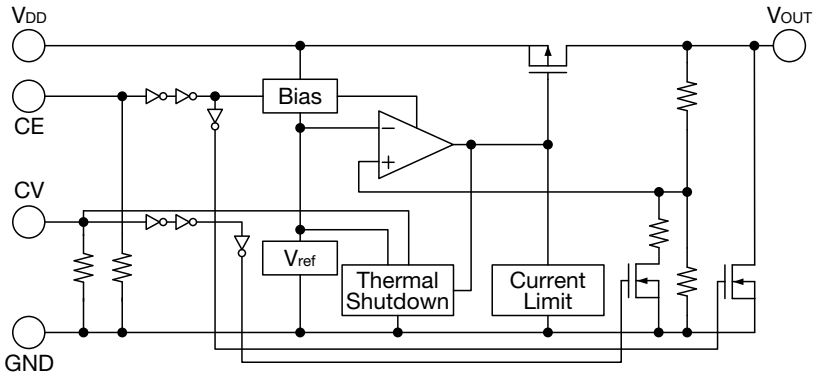
Package

SSON-6A

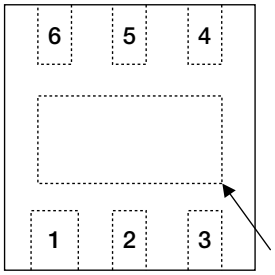
Applications

1. Flat TVs
2. DVD/Blu-ray recorders
3. Digital cameras,Digital video cameras
4. Mobile phones

Block Diagram



Pin Assignment



SSON-6A
(TOP VIEW)

1	VOUT
2	CV
3	GND
4	CE
5	NC
6	VDD

Note1

Note1 : Heat Spreader Bottom with GND.

Pin Description

Pin No.	Pin name	Functions
1	VOUT	Output pin
2	CV	Output Control pin CE: L → OUTPUT: Vo–H CE: H → OUTPUT: Vo–L 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.
3	GND	GND pin
4	CE	ON/OFF-Control pin CE: L → OUTPUT: OFF CE: H → OUTPUT: ON Connect CE pin with VDD pin, when it is not used.
5	NC	No connection
6	VDD	Voltage-Supply pin

Absolute Maximum Ratings (Except where noted otherwise Ta=25°C)

Item	Symbol	Ratings	Units
Storage Temperature	Tstg	−55~+150	°C
Junction Temperature	T_{jMAX}	150	°C
Supply Voltage	V_{DD}	−0.3~+6.5	V
CE input Voltage	V_{CE}	−0.3~+6.5	V
CV input Voltage	V_{CV}	−0.3~V_{DD}+0.3	V
Output Voltage	V_{OUT}	−0.3~+6.5	V
Output Current	Iomax	500	mA
Power Dissipation	Pd	1250(Note2)	mW

Note2 : JEDEC51-7 standard 114.3 × 76.2 × 1.6mm

Recommended Operating Conditions (Except where noted otherwise Ta=25°C)

Item	Symbol	Ratings	Units
Operating Ambient Temperature	Topr	−40~+85	°C
Operating Voltage	Vop	1.6~6.0	V
Output Current	Iop	0~150	mA

Electrical Characteristics 1 (Except where noted otherwise V_{DD}=V_{OUT}(TYP.)+1V, V_{CE}=V_{CV}=V_{DD}, Ta=25°C)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input Current(OFF)	I_{DDOff}	V_{CE}=0V V_{OUT} (TYP.)+1.0V≦V_{DD}≦6.0V		0.1	1.0	µA
No-Load Input Current	I_{DD}	I_{OUT}=0mA		50	80	µA
Output Voltage	V_{OUT}	I_{OUT}=10mA (V_{OUT}≧1.5V)	×0.99		×1.01	V
		I_{OUT}=10mA (V_{OUT}≦1.5V)	−0.015		+0.015	V
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}≦100mA		20	50	mV
Dropout Voltage	Vio	Please refer to another page				V
Output Short-Circuit Current (Note3)	Ishort	V_{OUT}=0V		60		mA
V_{OUT} Temperature Coefficient (Note3)	$\Delta V_{OUT}/\Delta T_{OP}$	I_{OUT}=10mA, −40≦Top≦85°C		±100		ppm/°C
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 (Note3)	I_{CE}			0.5		µA
CV High Threshold Voltage (Note4)	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 ShutDown Detect Temperature (Note3)	T_{SD}			150		°C
Thermal ShutDown Release Temperature (Note3)	T_{SR}			125		°C
Output NMOS ON Resistance (Note3)	R_{DON}			60		Ω
Output ON Resistance	R_{ON}	I_{OUT}=100mA, CV=GND V_{DD}=V_{OUT} (TYP.)−0.2V		1.3	1.8	Ω

Note3 : The parameter is guaranteed by design.

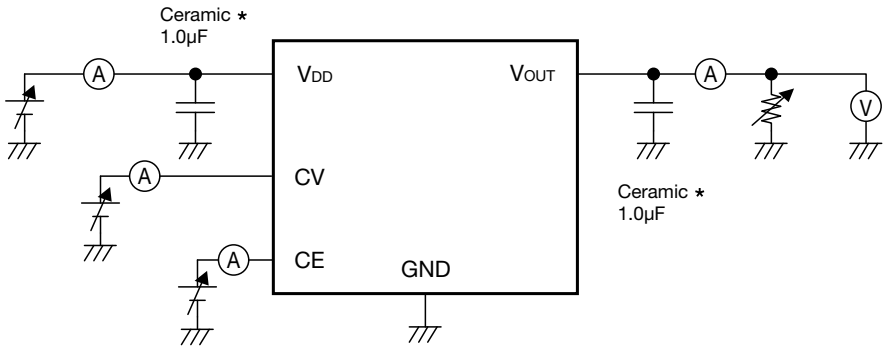
Note4 : When the voltage of the terminal CV is higher than the voltage of the terminal VDD, it becomes test mode.
In that case, please note that there is a possibility that the output voltage is turned off.

Electrical Characteristics 2 (Except where noted otherwise V_{DD}=V_{OUT}(TYP.)+1V, V_{CE}=V_{CV}=V_{DD}, Ta=25°C)

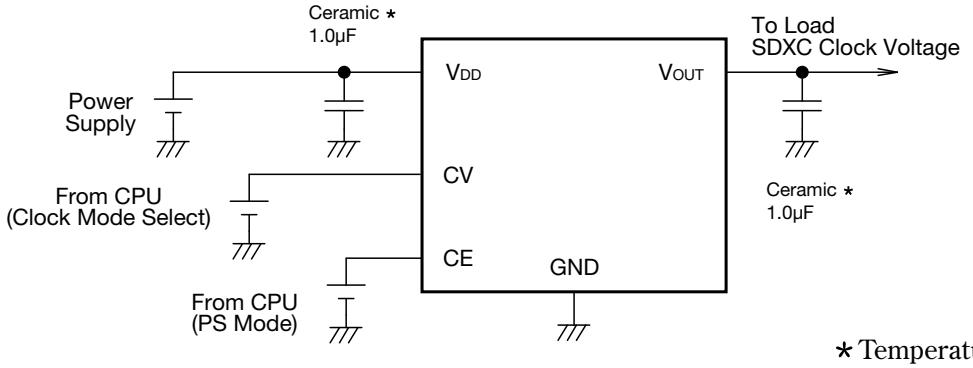
Model No.	Item							
	Output Voltage H				Output Voltage L			
	V_{OUT}- H (V)				V_{OUT}- L (V)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
MM3532T00	I_{OUT}=10mA CV=GND	3.267	3.300	3.333	I_{OUT}=10mA CV=V_{DD}	1.782	1.800	1.818

Model No.	Item							
	Dropoutput Voltage H				Dropoutput Voltage L			
	Vio - H (V)				Vio - L (V)			
	Measurement Conditions	Min.	Typ.	Max.	Measurement Conditions	Min.	Typ.	Max.
MM3532T00	I_{OUT}=100mA CV=GND		0.13	0.18	I_{OUT}=100mA CV=V_{DD}		0.16	0.33

Measuring Circuit



Typical Application Circuit



* Temperature Characteristics : B

(Reference example of external parts)

· Output capacitor Ceramic capacitor 1.0µF
· Input capacitor Ceramic capacitor 1.0µF

· We shall not be liable for any trouble or damage caused by using this circuit.

· 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.

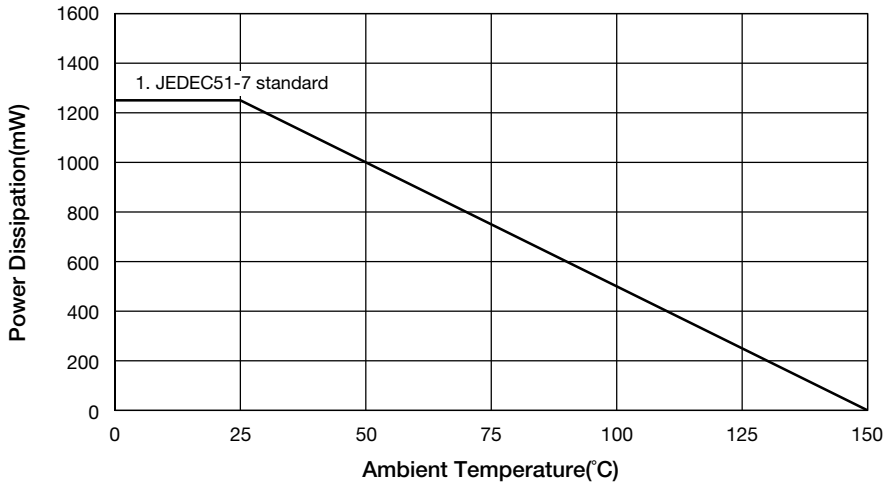
· Note

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 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. 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.
   Please evaluate IC in the set.

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.

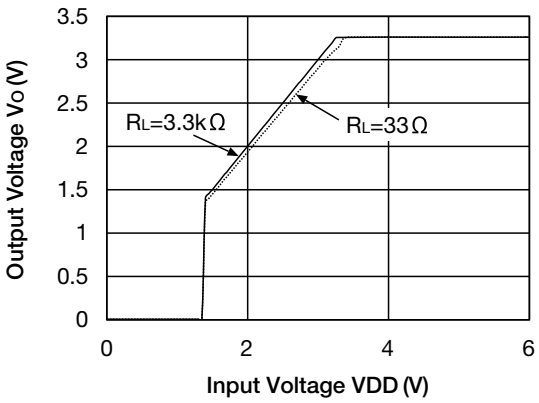
1. JEDEC51-7 standard
   Board size 114.3mm×76.2mm t=1.6mm Copper foil area 80%
   Power dissipation 1250mW Ta=25°C (It is reference value measured by JEDEC51-7 standard.)



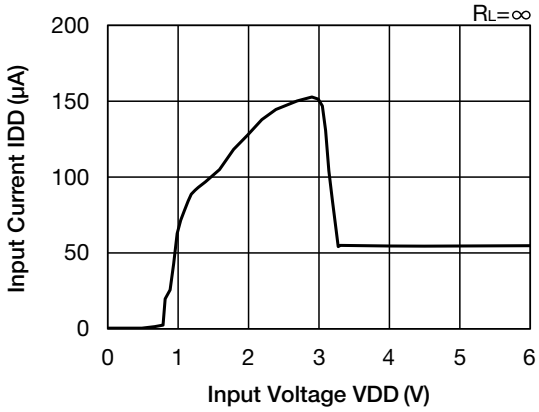
It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate).
By increasing these copper foil pattern area of PCB, Power dissipation improves.

Typical Characteristics (V_{OUT}=3.3V) (Except where noted otherwise V_{DD}=V_{OUT}(TYP.)+1V, V_{CE}=V_{DD}, V_{CV}=GND, Ta=25°C)

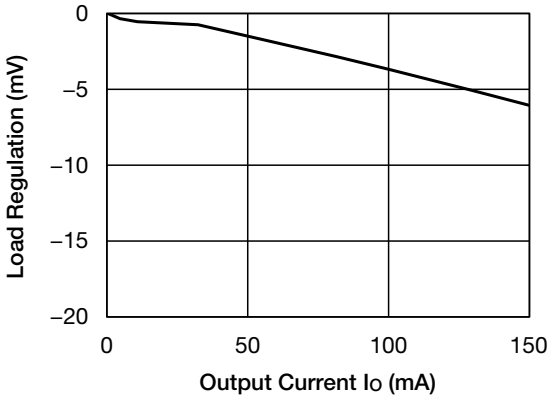
Input Voltage - Output Voltage



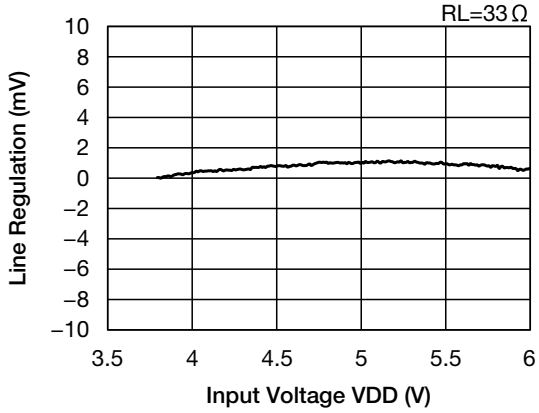
Input Voltage - Input Current



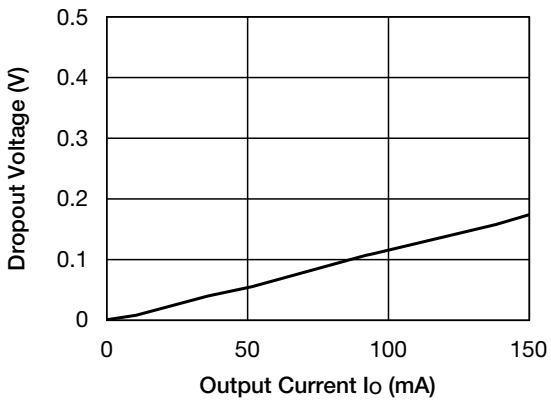
Load Regulation



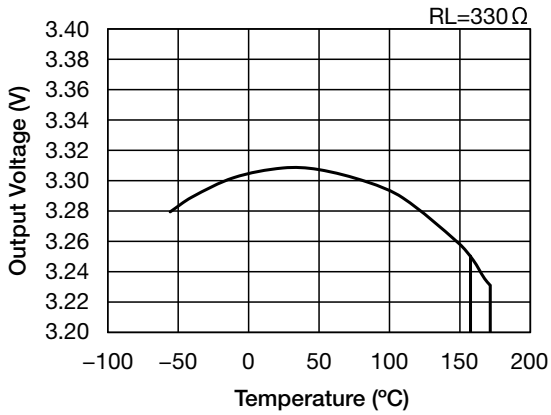
Line Regulation



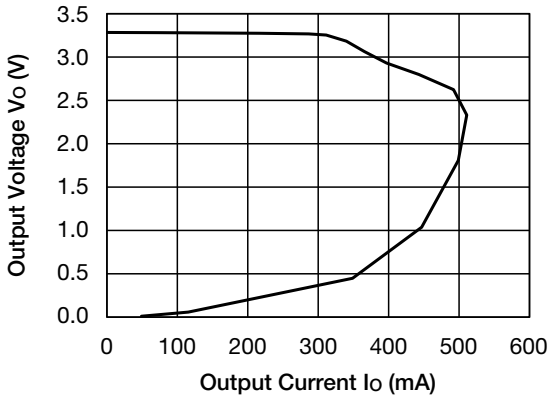
Dropout Voltage



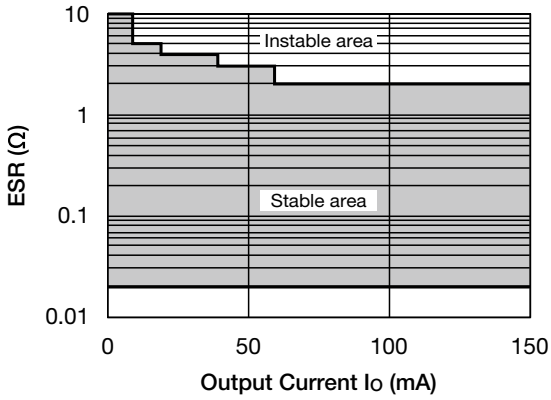
Vout Temperature Coefficient



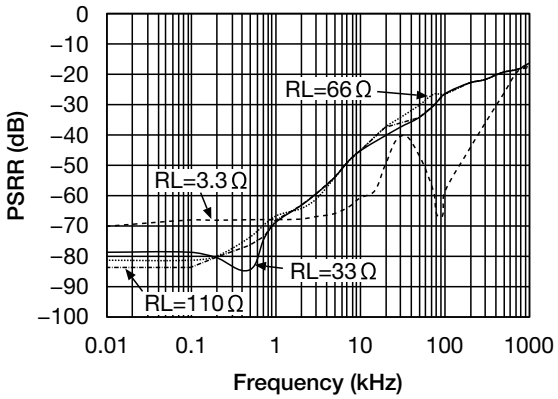
Current Limit



ESR stable area

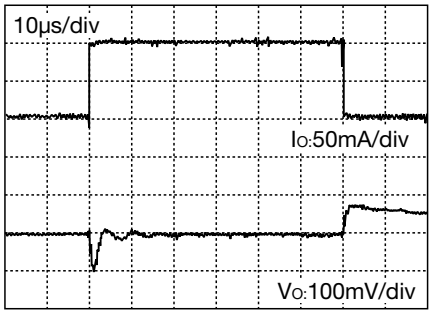


Ripple Rejection

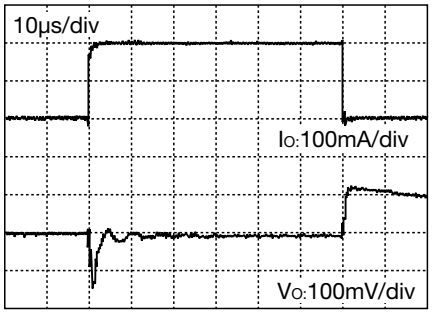


Load Transient response (Cin=Co=1.0μF)

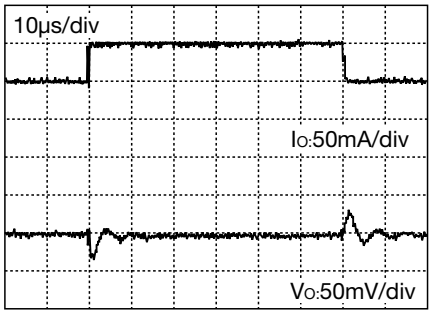
I_O=1mA⇔100mA



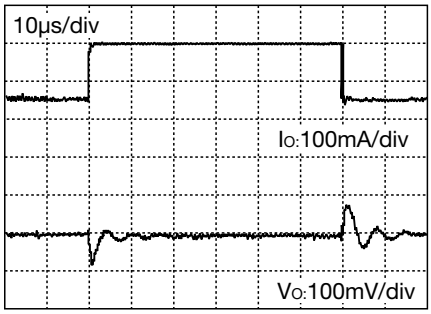
I_O=1mA⇔200mA



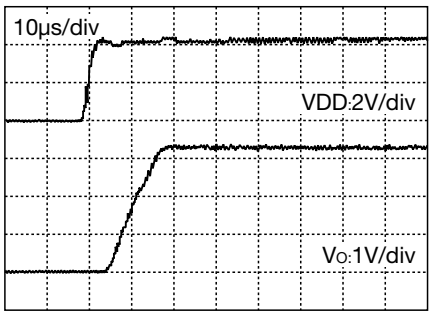
I_O=50mA⇔100mA



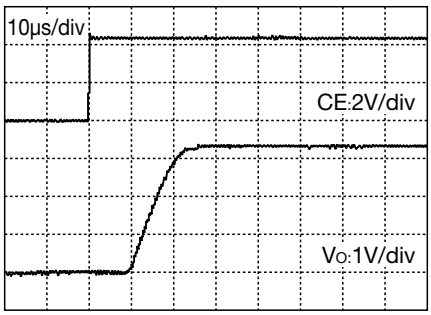
I_O=50mA⇔200mA



Input rise characteristics

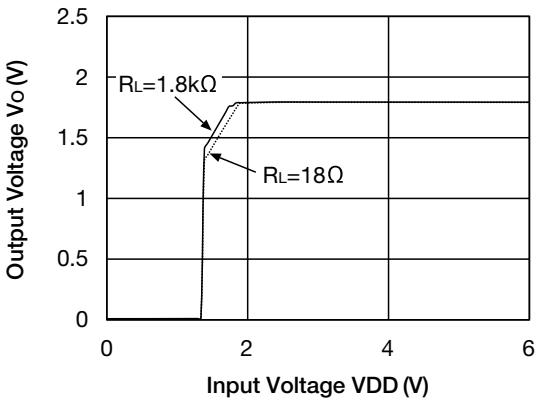


CE rise characteristics

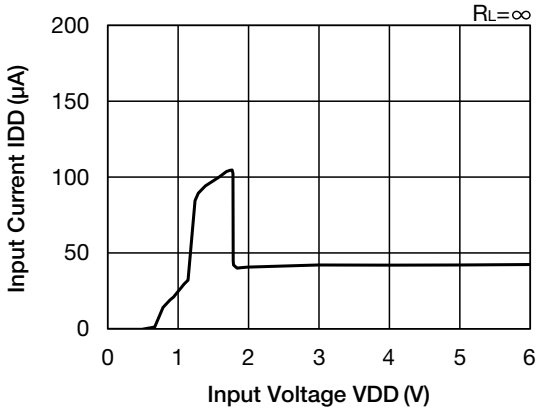


Typical Characteristics (V_{OUT}=1.8V) (Except where noted otherwise V_{DD}=V_{OUT}(TYP.)+1V, V_{CE}=V_{DD}, V_{CV}=GND, Ta=25°C)

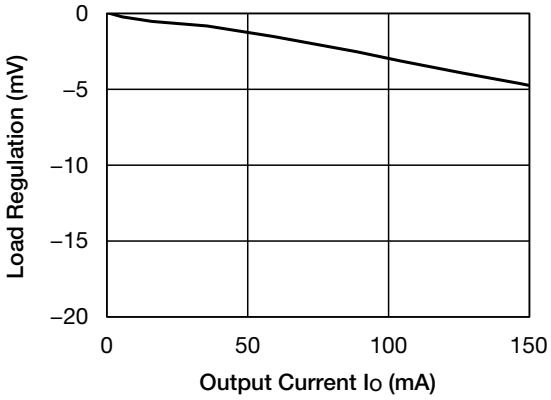
Input Voltage - Output Voltage



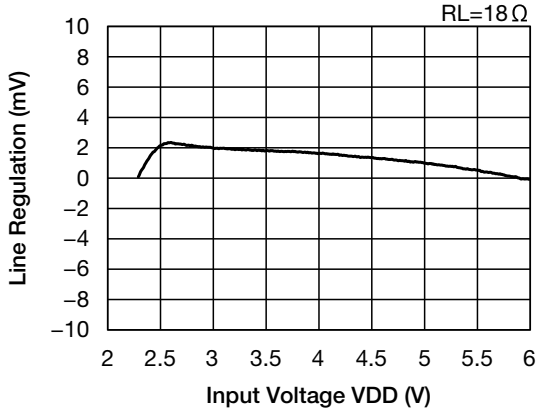
Input Voltage - Input Current



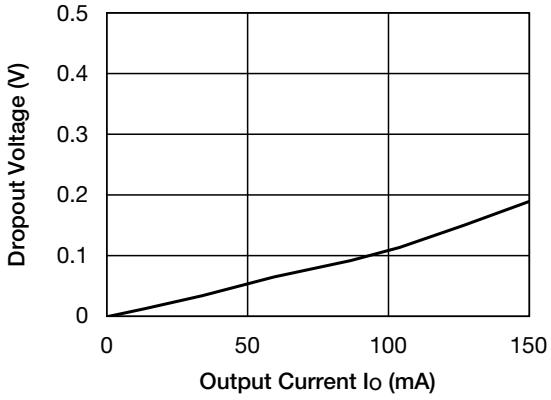
Load Regulation



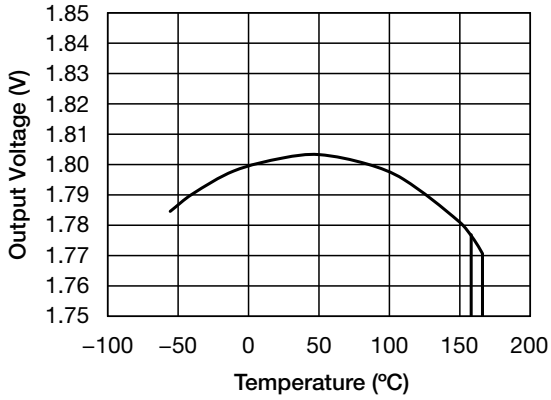
Line Regulation



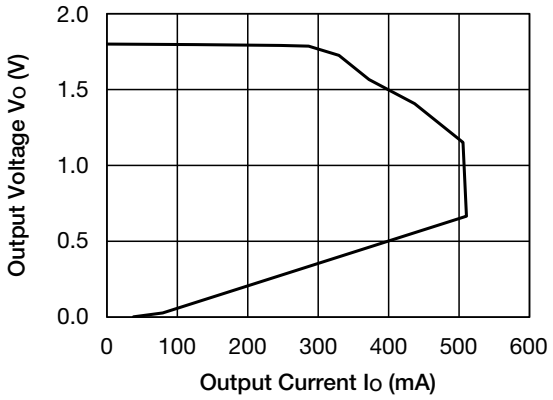
Dropout Voltage



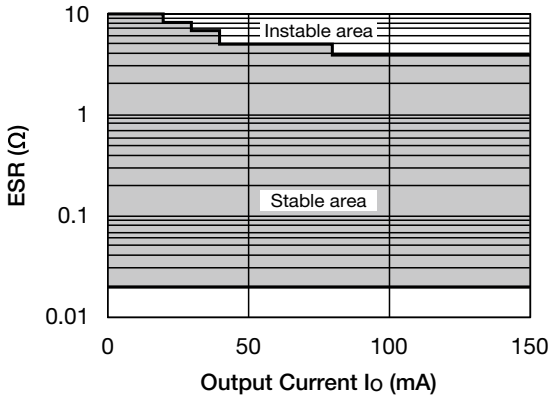
Vout Temperature Coefficient



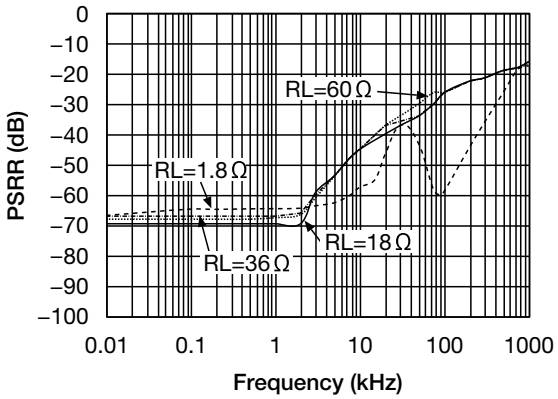
Current Limit



ESR stable area

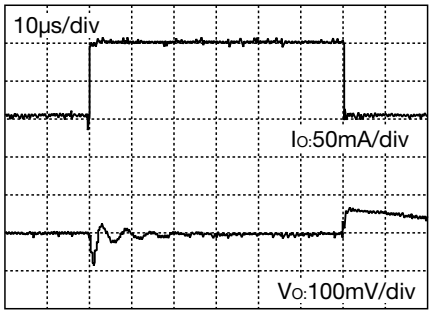


Ripple Rejection

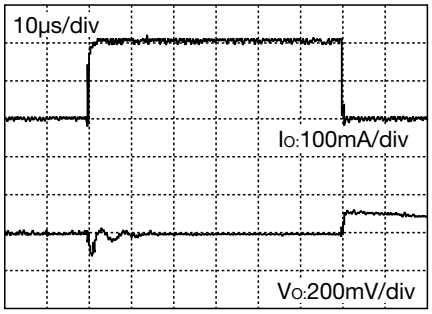


Load Transient response (Cin=Co=1.0μF)

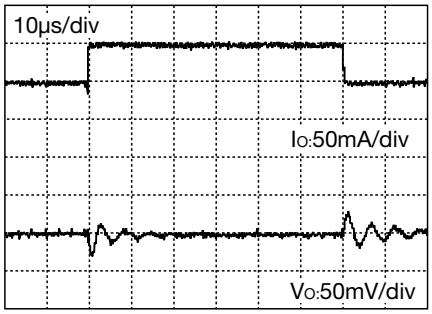
I_O=1mA⇔100mA



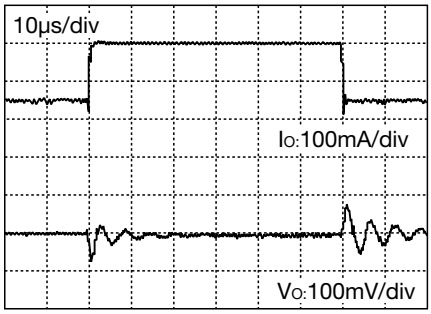
I_O=1mA⇔200mA



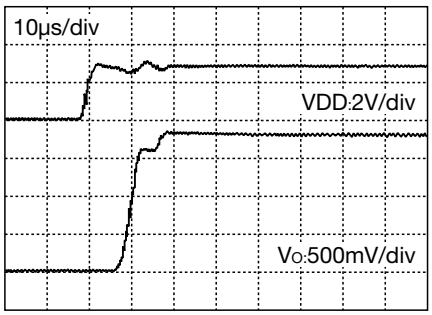
I_O=50mA⇔100mA



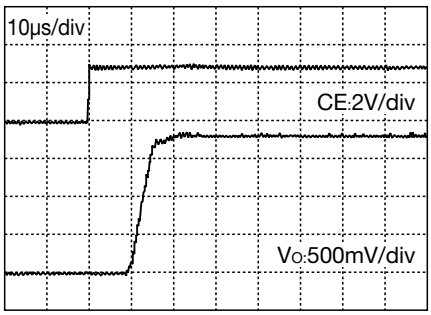
I_O=50mA⇔200mA



Input rise characteristics

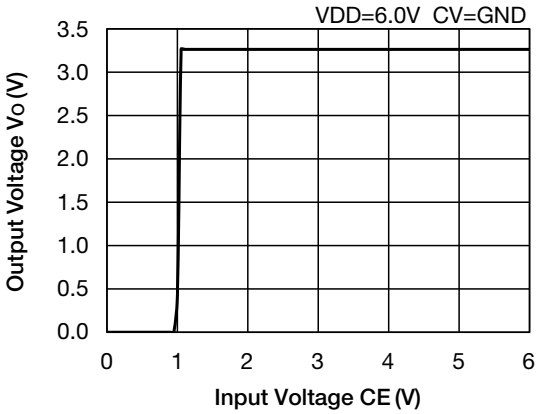


CE rise characteristics

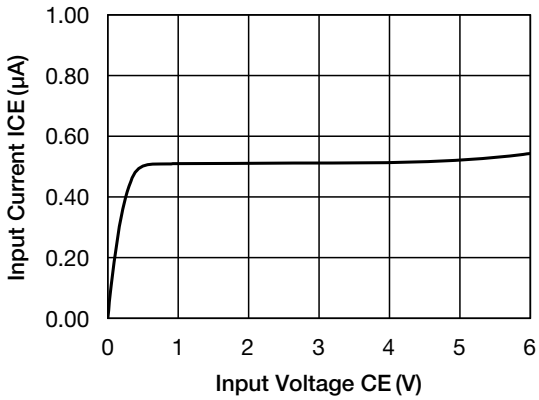


Typical Characteristics (V_{OUT}=3.3V-1.8V) (Except where noted otherwise V_{DD}=V_{OUT}(TYP.)+1V, V_{CE}=V_{DD}, V_{CV}=GND, Ta=25°C)

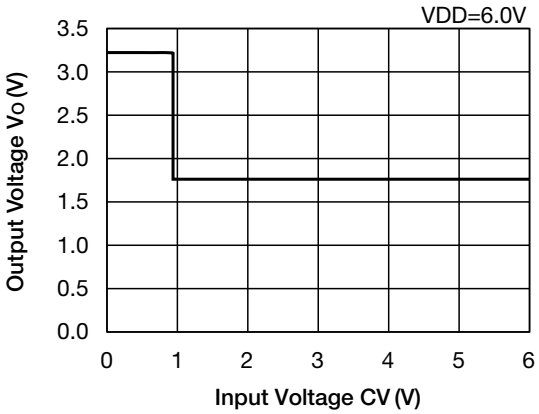
CE Threshold Voltage



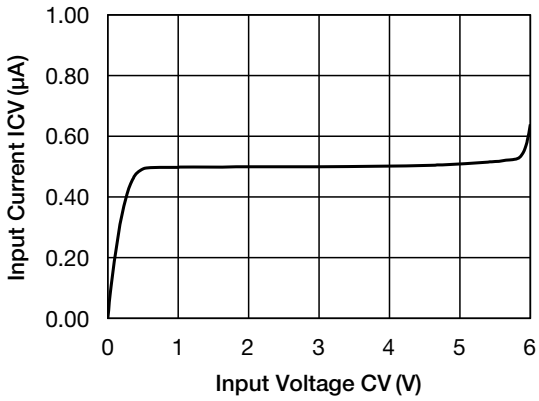
Input Voltage - Input Current ICE



CV Threshold Voltage

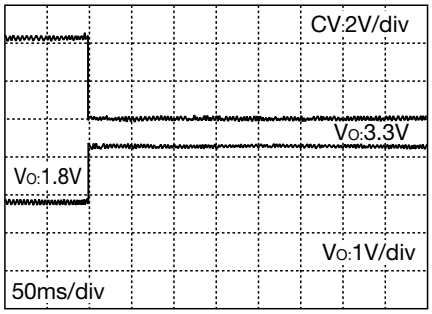


Input Voltage - Input Current ICV

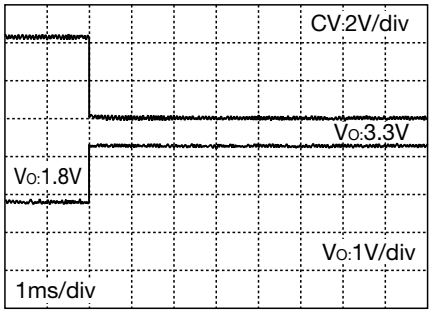


CV Transient response (V_O=1.8V→3.3V)

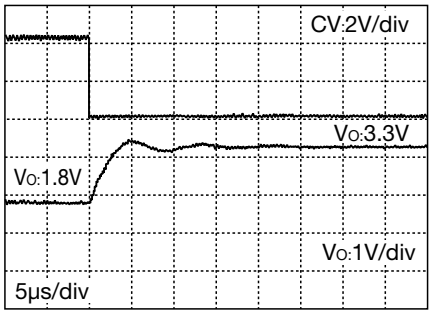
RL= ∞



RL=3.3kΩ

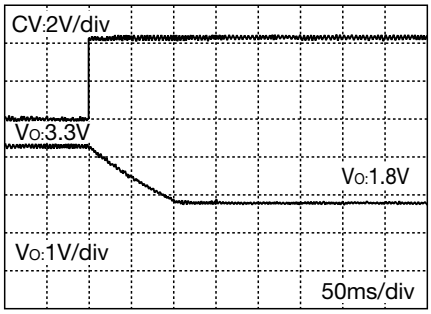


RL=6.6Ω

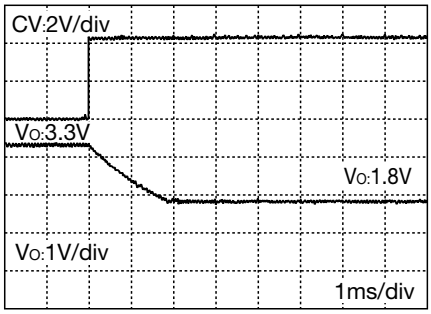


CV Transient response (V_O=3.3V→1.8V)

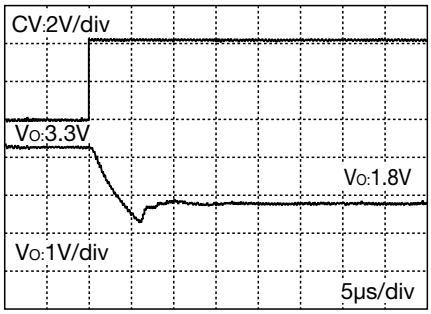
RL= ∞



RL=3.3kΩ

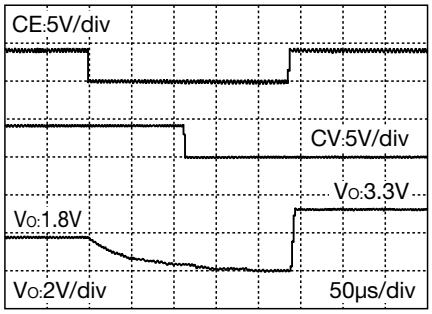


RL=6.6Ω

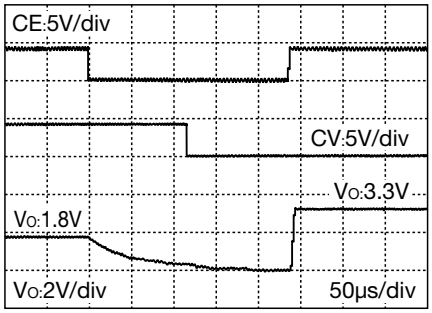


CV/CE Transient response (V_O=1.8V→0V→3.3V)

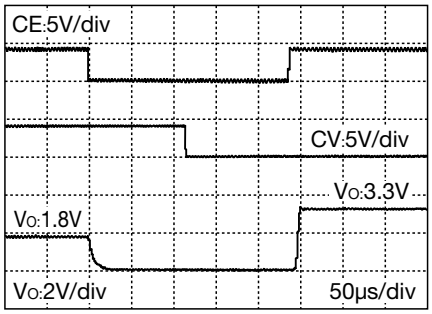
RL= ∞



RL=3.3kΩ

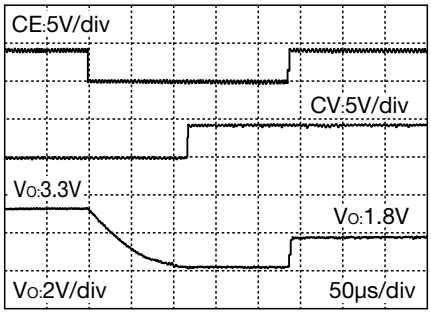


RL=6.6Ω

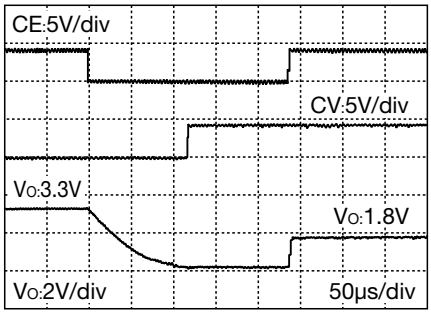


CV/CE Transient response (V_O=3.3V→0V→1.8V)

RL= ∞



RL=3.3kΩ



RL=6.6Ω