
150mA 24V Input LDO

NO.EA-270-130613

OUTLINE

The R1155x Series are CMOS-based 24V input voltage regulators featuring 150mA output that provide high output voltage accuracy and low supply current. Internally, a single IC consists of a voltage reference unit, an error amplifier, and a resistor net for setting output voltage. As protection circuits, the R1155x contains a current limit circuit, a fold-back protection circuit, a thermal shutdown circuit and a reverse current protection circuit.

The R1155x is available in the fixed output voltage type (R1155xxxxB), and the adjustable output voltage type (R1155x001C). The output voltage accuracy for the fixed output voltage type is as high as $\pm 2.0\%$.

The R1155x is available in SOT-89-5 and SOT-23-5 packages.

FEATURES

- Supply Current (I_{SS}) Typ. $7.5\mu\text{A}$ ($V_{IN} = 6.0\text{V}$ or 3.0V)
- Standby Current ($I_{standby}$) Typ. $0.1\mu\text{A}$
- Output Current (I_{OUT}) Min. 150mA ($V_{IN} = 6.0\text{V}$ or 3.0V)
- Output Voltage Accuracy $\pm 2.0\%$
- Package SOT-23-5, SOT-89-5
- Input Voltage Range Max. 24.0V
- Output Voltage Range Fixed Output Voltage Type: 2.5V to 12.0V
..... Adjustable Output Voltage Type: 2.5V ,
..... 2.5V to 23.0V using external resistor.
- Fold-back Protection Circuit Typ. 30mA
- Thermal Shutdown Circuit
- Reverse Current Protection Circuit
- Ceramic Capacitor $C_{OUT} = 4.7\mu\text{F}$ or more

APPLICATIONS

- Power source for home appliances (refrigerators, rice cookers, electric water warmers, etc.)
- Power source for in-car audio systems, in-car navigation systems, ETC systems, and reset circuits
- Power source for laptop personal computers, digital TVs, cordless phones, and private LAN systems for home, and reset circuits
- Power source for copiers, printers, facsimiles, scanners, and reset circuits

BLOCK DIAGRAMS

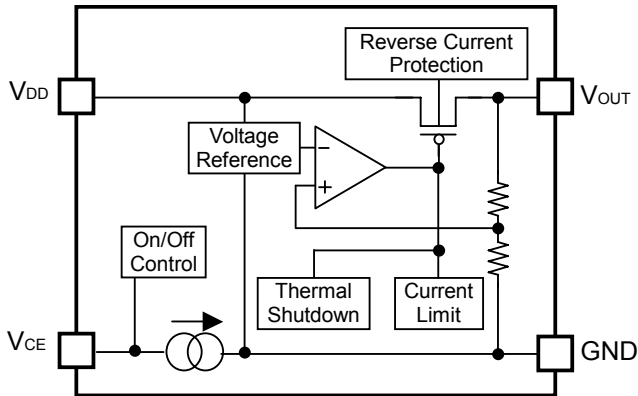


Figure 1. Fixed Output Voltage Type (R1155xxxxB)

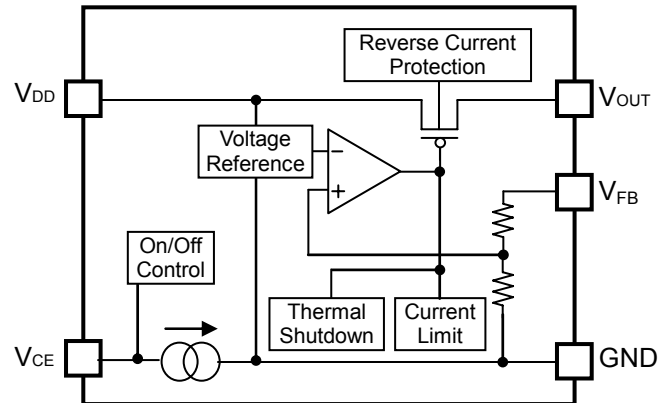


Figure 2. Adjustable Output Voltage Type (R1155x001C)

SELECTION GUIDE

The output voltage, the output voltage type, and the package type for the ICs are user-selectable options.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1155Nxxx*-TR-FE	SOT-23-5	3,000pcs	Yes	Yes
R1155Hxxx*-T1-FE	SOT-89-5	1,000pcs	Yes	Yes

xxx: Designation of the output voltage (V_{SET})
 For Fixed Output Voltage Type: 2.5V (025) to 12V (120) in 0.1V steps
 For Adjustable Output Voltage Type: 2.5V (001) only

*: Designation of the output voltage type
 (B) Fixed Output Voltage Type
 (C) Adjustable Output Voltage Type

PIN CONFIGURATIONS

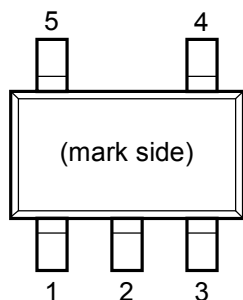


Figure 3. SOT-23-5

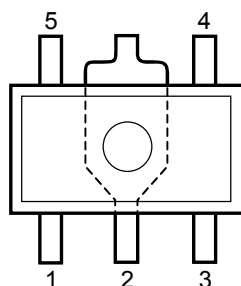


Figure 4. SOT-89-5

PIN DESCRIPTION

R1155N: SOT-23-5

Pin No	Symbol	Description	
1	V_{OUT}	VR Output Pin	
2	GND	Ground Pin	
3	V_{DD}	Input Pin	
4	TP ^{*1}	R1155NxxxB	Test Pin
	V_{FB} ^{*2}	R1155N001C	VR Adjustment Pin
5	CE	Chip Enable Pin ("H" Active)	

As for the adjustable output voltage type (R1155N001C), please refer to *ADJUSTABLE OUTPUT VOLTAGE TYPE SETTING*.

^{*1} The TP pin must be connected to GND.

^{*2} A 24MΩ or less voltage setting resistor must be connected to the V_{FB} pin.

R1155H: SOT-89-5

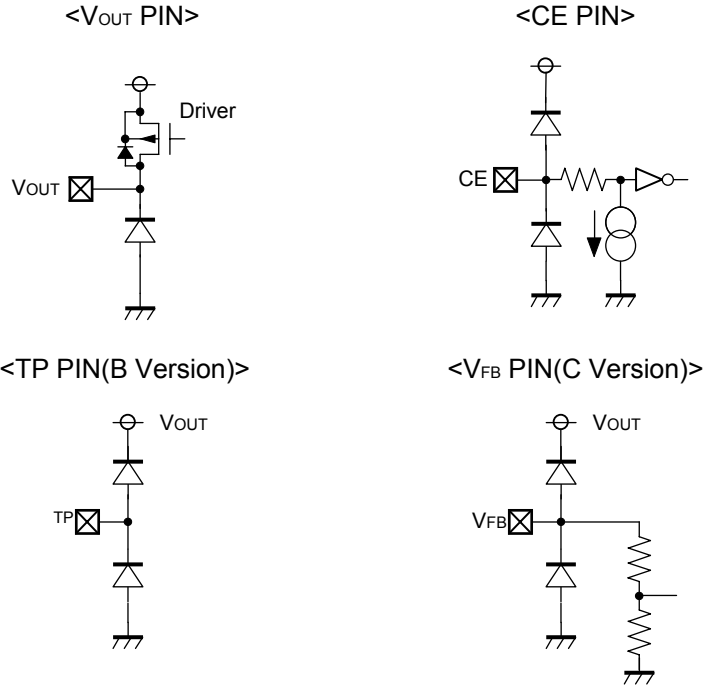
Pin No	Symbol	Description	
1	V_{OUT}	VR Output Pin	
2	GND	Ground Pin	
3	CE	Chip Enable Pin ("H" Active)	
4	TP ^{*1}	R1155HxxxB	Test Pin
	V_{FB} ^{*2}	R1155H001C	VR Adjustment Pin
5	V_{DD}	Input Pin	

As for the adjustable output voltage type (R1155H001C), please refer to *ADJUSTABLE OUTPUT VOLTAGE TYPE SETTING*.

^{*1} The TP pin must be connected to GND.

^{*2} A 24MΩ or less voltage setting resistor must be connected to the V_{FB} pin.

PIN EQUIVALENT CIRCUIT DIAGRAMS



ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit	
V_{IN}	Input Voltage	-0.3 ~ 26	V	
V_{CE}	Input Voltage (CE Pin)	-0.3 to $V_{IN}+0.3$	V	
V_{OUT}	Output Voltage	-0.3 to 26	V	
V_{VFB}	Output Voltage (V_{FB} Pin)	-0.3 to 26	V	
I_{OUT}	Output Current	350	mA	
P_D	Power Dissipation (Standard Land Pattern) ^{*3}	SOT-23-5	420	mW
		SOT-89-5	900	
T_j	Junction Temperature	-40 to 125	°C	
T_{stg}	Storage Temperature Range	-55 to 125	°C	

^{*3} For more information about the Power Dissipation and the Standard Land Pattern, please refer to the next page.

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING RATINGS

Symbol	Item	Ratings	Unit
T_a	Operating Temperature Range	-40 ~ 105	°C
V_{IN}	Input Voltage	3.5 ~ 24	V

RECOMMENDED OPERATING RATINGS

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating ratings. The semiconductor devices cannot operate normally over the recommended operating ratings, even if when they are used over such ratings by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating ratings.

POWER DISSIPATION (SOT-23-5)

Power Dissipation (P_D) of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement. This data is taken from SOT-23-6.

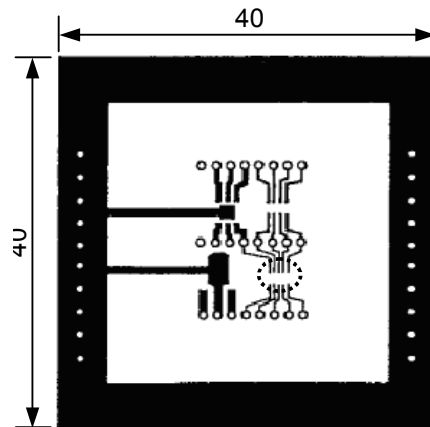
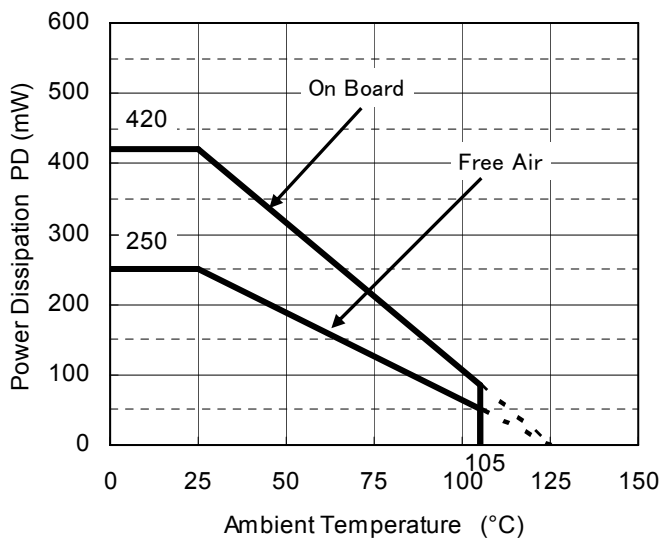
Measurement Conditions

	Standard Land Pattern
Environment	Mounting on Board (Wind Velocity=0m/s)
Board Material	Glass Cloth Epoxy Plastic (Double-sided)
Board Dimensions	40mm x 40mm x 1.6mm
Copper Ratio	Top-side: Approx. 50%, Back-side: Approx. 50%
Through-holes	ϕ 0.5mm x 44pcs

Measurement Result

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

	Standard Land Pattern	Free Air
Power Dissipation	420mW	250mW
Thermal Resistance	$\theta_{ja} = (125-25^\circ\text{C})/0.42\text{W} = 238^\circ\text{C/W}$	400 $^\circ\text{C/W}$



Measurement Board Pattern

IC Mount Area (Unit: mm)

POWER DISSIPATION (SOT-89-5)

Power Dissipation (P_D) of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

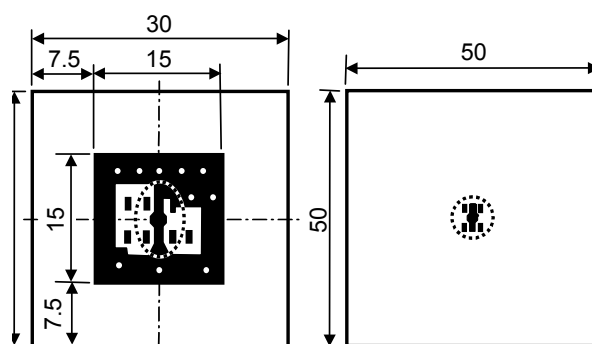
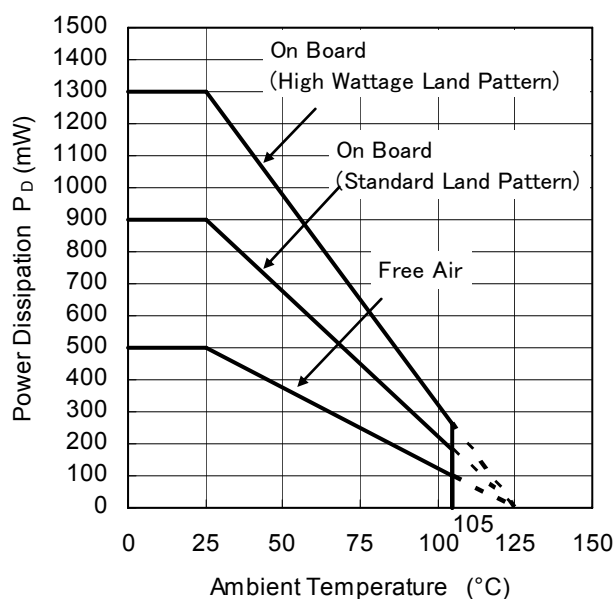
Measurement Conditions

	High Wattage Land Pattern	Standard Land Pattern
Environment	Mounting on Board (Wind Velocity=0m/s)	Mounting on Board (Wind Velocity=0m/s)
Board Material	Glass Cloth Epoxy Plastic (Double-sided)	Glass Cloth Epoxy Plastic (Double-sided)
Board Dimensions	30mm x 30mm x 1.6mm	50mm x 50mm x 1.6mm
Copper Ratio	Top-side: Approx. 20%, Back-side: Approx. 100%	Top-side: Approx. 10%, Back-side: Approx. 100%
Through-hole	$\phi 0.85\text{mm} \times 10\text{pcs}$	-

Measurement Result

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

	High Wattage Land Pattern	Standard Land Pattern	Free Air
Power Dissipation	1300mW	900mW	500mW
Thermal Resistance	77°C/W	111°C/W	200°C/W



High Wattage

Standard

Measurement Board Pattern

 IC Mount Area (Unit : mm)

ELECTRICAL CHARACTERISTICS

 $V_{IN}=V_{CE}=V_{SET}^{*4}+3.0V$, $C_{OUT}=4.7\mu F$, $I_{OUT}=1mA$, unless otherwise noted.

 The specifications surrounded by are guaranteed by Design Engineering at $-40^{\circ}C \leq T_a \leq 105^{\circ}C$.

R1155xxxxB, R1155x001C

(Ta=25°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit	
I_{LIM}	Output Current	$V_{IN}=V_{SET}+4V$	150			mA	
V_{OUT}	Output Voltage (Low Power Mode)	$I_{OUT}=1mA$	Ta=25°C	x0.98	x1.02	V	
			$-40^{\circ}C \leq T_a \leq 105^{\circ}C$	x0.955	x1.03	V	
I_{SS1}	Supply Current (Low Power Mode)	$I_{OUT}=0mA$	$2.5 \leq V_{SET} \leq 4.2V$		7.5	22	μA
			$4.2 < V_{SET} \leq 8.4V$		8.6	22	μA
			$8.4 < V_{SET} \leq 12V$		9.5	22	μA
I_{SS2}	Supply Current (Fast Mode)	$I_{OUT}=10mA$		65	125	μA	
Istandby	Standby Current	$V_{IN}=24V, V_{CE}=0V$		0.1	1.0	μA	
ΔV_{OUT}	Output Voltage Deviation When Switching Mode	$1mA \leq I_{OUT} \leq 6mA$	-1.5	0	1.5	%	
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (Fast Mode)	$6mA \leq I_{OUT} \leq 150mA$	$2.5 \leq V_{SET} \leq 5V$		30	90	mV
			$5 < V_{SET} \leq 12V$		30	100	mV
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Load Regulation (Low Power Mode)	$V_{SET}+0.2V \leq V_{IN} \leq 24V$	$I_{OUT}=1mA$		0.3	1.3	%
	Load Regulation (Fast Mode)	$V_{SET}+0.2V \leq V_{IN} \leq 24V$	$I_{OUT}=10mA$		1.2	2.4	%
V_{DIF}	Dropout Voltage	$I_{OUT}=150mA$	$2.5V \leq V_{SET} < 3.3V$		1.6	2.6	V
			$3.3V \leq V_{SET} < 5V$		0.96	2.1	V
			$5 \leq V_{SET} \leq 12V$		0.55	1.7	V
RR	Ripple Rejection (Fast Mode)	f=1kHz, 0.5Vp-p, $I_{OUT}=10mA$	$2.5 \leq V_{SET} < 5V$		60		dB
			$5 \leq V_{SET} \leq 12V$		50		dB
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Output Voltage Temperature Coefficient	$I_{OUT}=1mA, -40^{\circ}C \leq T_a \leq 105^{\circ}C$		± 100		ppm/ °C	
I_{OUTH}	Fast Mode Switching Current	$I_{OUT}=\text{Light Load} \rightarrow \text{Heavy Load}$	2.4	4.5	6.5	mA	
I_{OUTL}	Low Power Mode Switching Current	$I_{OUT}=\text{Heavy Load} \rightarrow \text{Light Load}$	0.6	1.5	2.4	mA	
I_{SC}	Short Current Limit	$V_{OUT}=0V$		30		mA	
V_{CEH}	CE Input Voltage "H"		1.35		V_{IN}	V	
V_{CEL}	CE Input Voltage "L"		0		0.5	V	
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature		145		°C	
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature		120		°C	
I_{REV}	Reverse Current Limit	CE=GND, $V_{IN}=V_{SET}+0.02V$	$2.5 \leq V_{SET} < 5V$		1.0	3.5	μA
			$5 \leq V_{SET} \leq 12V$		2.0	6.0	μA
V_{REV_DET}	Reverse Current Protection ^{*5} Mode Detection Offset $V_{REV}=V_{DD}-V_{OUT}$	$0 \leq V_{IN} \leq 24.0V, V_{OUT} \geq 2.0V$	20			mV	
V_{REV_REL}	Reverse Current Protection ^{*5} Mode Release Offset	$0 \leq V_{IN} \leq 24.0V, V_{OUT} \geq 2.0V$			220	mV	

All test items listed under *ELECTRICAL CHARACTERISTICS* are done under the pulse load condition ($T_J \approx T_a = 25^{\circ}C$) except for Ripple Rejection and Output Voltage Temperature Coefficient.

^{*4} V_{SET} =Set Output Voltage

^{*5} The operation of reverse current protection circuit is guaranteed when $V_{OUT} \geq 2.0V$. The reverse current protection mode is always turned on when $V_{IN}=0V$.

NOTES CONCERNING EXTERNAL PARTS

Phase Compensation

In the R1155x, phase compensation is provided to secure stable operation even when the load current is varied. For this purpose, use a $4.7\mu\text{F}$ or more output capacitor (C_{OUT}) with good frequency characteristics and proper ESR (Equivalent Series Resistance).

In case of using a tantalum type capacitor and the ESR value of the capacitor is large, the output might be unstable. Evaluate the circuit including consideration of frequency characteristics.

PCB Layout

Ensure the V_{DD} and GND lines are sufficiently robust. If their impedance is too high, noise pickup or unstable operation may result. Connect C_{OUT} with suitable values between the V_{OUT} and GND pins, and as close as possible to the pins. Please refer to Figure 5 and Figure 6 below.

Thermal Shutdown Circuit

The R1155x contains a thermal shutdown circuit, which stops regulator operation if the junction temperature of the R1155x becomes higher than 145°C (Typ.). Additionally, if the junction temperature after the regulator being stopped decreases to a level below 120°C (Typ.), it restarts regulator operation. As a result the operation of the thermal shutdown circuit causes the regulator repeatedly to turn off and on until the causes of overheating are removed. As a consequence a pulse shaped output voltage occurs.

TYPICAL APPLICATIONS

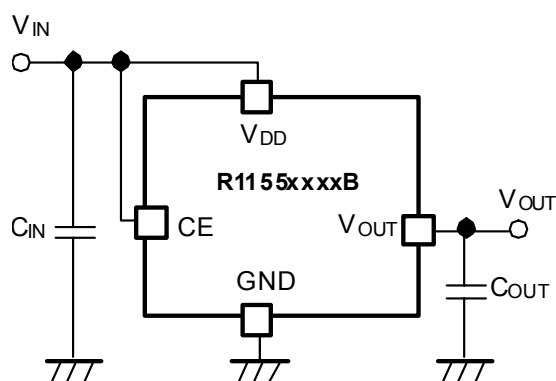


Figure 5. Fixed Output Voltage Type

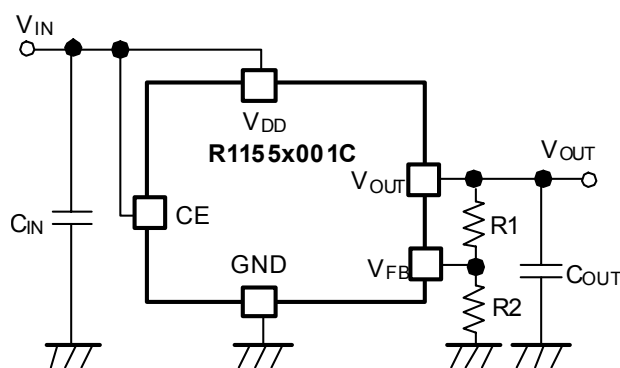


Figure 6. Adjustable Output Voltage Type

POWER ACTIVATION

When starting up the IC using the input voltages of the V_{DD} and CE pins simultaneously with no load, the both pin voltages have to be $0.06V/\text{ms}$ or faster.

When starting up the IC using the both pin voltages at $0.06V/\text{ms}$ or slower with no load, the V_{DD} pin has to be started up before the CE pin.

REVERSE CURRENT PROTECTION CIRCUIT

The R1155x includes a reverse current protection circuit, which stops the reverse current flowing from the V_{OUT} to V_{DD} pins or to GND pin when V_{OUT} becomes more than V_{IN} .

Usually, the LDO using Pch output transistor contains a parasitic diode between V_{DD} pin and V_{OUT} pin. Therefore, if V_{OUT} is more than V_{IN} , the parasitic diode becomes forward direction. As a result, the current flows from V_{OUT} pin to V_{DD} pin.

The ICs of this series switches the mode to the reverse current protection mode before V_{IN} becomes smaller than V_{OUT} by connecting the parasitic diode of Pch output transistor to the backward direction, and connecting the gate to V_{OUT} pin. As a result, the Pch output transistor is turned off and the all the current pathways from V_{OUT} pin to GND pin are shut down to maintain the reverse current lower than $[I_{REV}]$ of the Electrical Characteristics.

Switching to either the normal mode or to the reverse current protection mode is determined by the magnitude of V_{IN} voltage and V_{OUT} voltage. For the stable operation, offset and hysteresis are set as the threshold. The detection/ release thresholds of both normal and reverse current protection modes are specified by $[V_{REV_DET}]$ and $[V_{REV_REL}]$ of the Electrical Characteristics. Therefore, the minimum dropout voltage under the small load current condition is restricted by the value of $[V_{REV_REL}]$.

Figure 7 and Figure 8 show the normal operation mode and reverse current protection mode, respectively. Figure 9 shows the detection/ release timing of reverse current protection function. When giving the V_{OUT} pin a constant-voltage and decreasing the V_{IN} voltage, the dropout voltage will become lower than the $[V_{REV_DET}]$. As a result, the reverse current protection starts to function to stop the load current. By increasing the dropout voltage more than the $[V_{REV_REL}]$, the protection mode will be released to let the load current to flow. If the dropout voltage to be used is smaller than $[V_{REV_REL}]$, the detection and the release may be repeated.

The operation coverage of the reverse current protection circuit is $V_{OUT} \geq 1.5V$. However, under the condition of $V_{IN}=0V$, always the reverse current protection mode is operating.

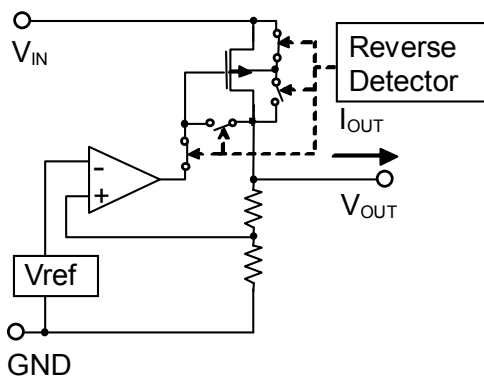


Figure 7. Normal Operation Mode

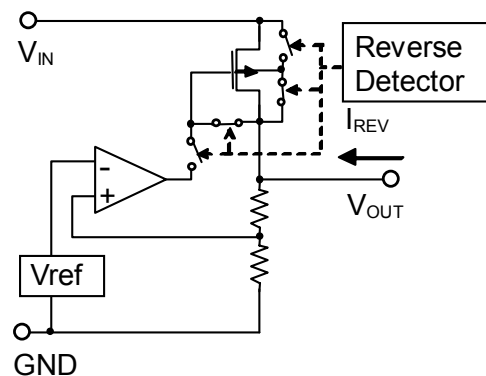


Figure 8. Reverse Current Protection Mode

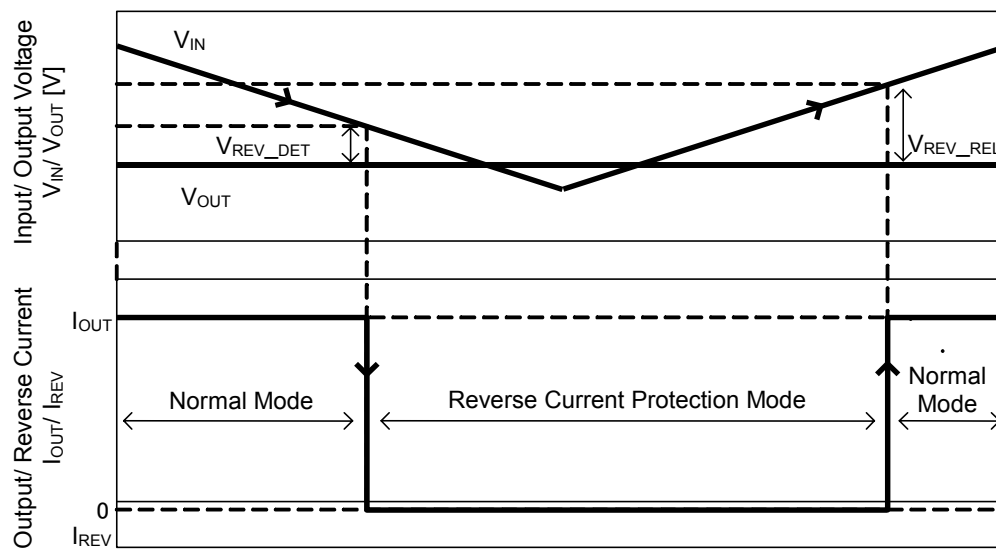


Figure 9. Detection/ Release Timing of Reverse Current Protection Function

ADJUSTABLE OUTPUT VOLTAGE TYPE SETTING

Output Voltage Setting Method (R1155x001C)

The output voltage of the R1155x001C can be adjusted up to 23V by using the external divider resistors (R1, R2). The resistance value for R2 should be set to 24MΩ or less.

By using the following equations, the output voltage can be determined. V_{FB} voltage which is fixed inside the IC is described as $setV_{FB}$. $setV_{FB}$ is 2.5V. When using the R1155x001C with 2.5V, please connect the V_{OUT} pin to the V_{FB} pin.

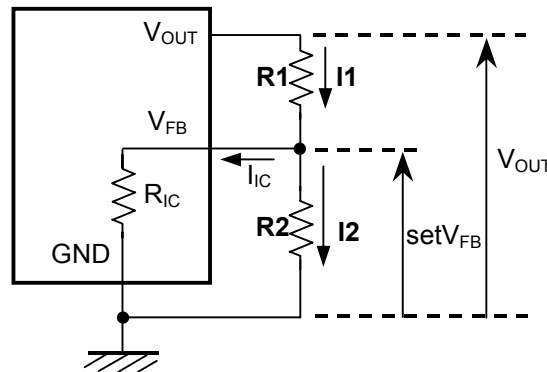


Figure 10. Output Voltage Adjustment Using External Divider Resistors

$$I1 = I_{IC} + I2 \dots\dots\dots (1)$$

$$I2 = setV_{FB} / R2 \dots\dots\dots (2)$$

Thus,

$$I1 = I_{IC} + setV_{FB} / R2 \dots\dots\dots (3)$$

Therefore,

$$V_{OUT} = setV_{FB} + R1 \times I1 \dots\dots\dots (4)$$

Insert Equation (3) into Equation (4), so

$$\begin{aligned} V_{OUT} &= setV_{FB} + R1 \times (I_{IC} + setV_{FB} / R2) \\ &= setV_{FB} \times (1 + R1 / R2) + R1 \times I_{IC} \dots\dots\dots (5) \end{aligned}$$

In Equation (5), $R1 \times I_{IC}$ is the error-causing factor in V_{OUT} .

As for I_{IC} ,

$$I_{IC} = setV_{FB} / R_{IC} \dots\dots\dots (6)$$

Therefore, the error-causing factor $R1 \times I_{IC}$ can be described as follows.

$$\begin{aligned} R1 \times I_{IC} &= R1 \times setV_{FB} / R_{IC} \\ &= setV_{FB} \times R1 / R_{IC} \dots\dots\dots (7) \end{aligned}$$

For better accuracy, choosing $R1 \ll R_{IC}$ reduces this error.

Without the error-causing factor $R1 \times I_{IC}$, the output voltage can be calculated by the following equation.

$$V_{OUT} = setV_{FB} \times ((R1 + R2) / R2) \dots\dots\dots (8)$$

R_{IC} of the R1155x001C is approximately Typ.8.4MΩ ($T_a=25^\circ\text{C}$, guaranteed by Design Engineering). R_{IC} could be affected by the temperature, therefore evaluate the circuit taking the actual conditions of use into account when deciding the resistance values for R1 and R2.

TEST CIRCUITS (R1155xxxxB)

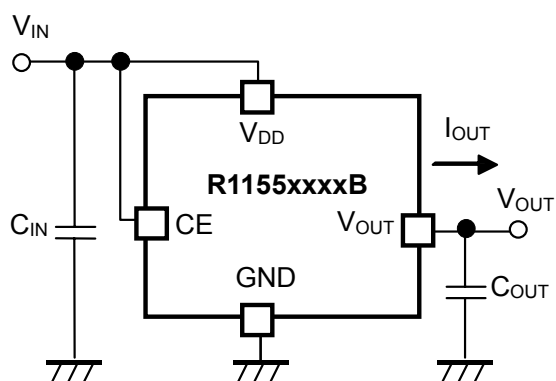


Figure 11. Basic Test Circuit

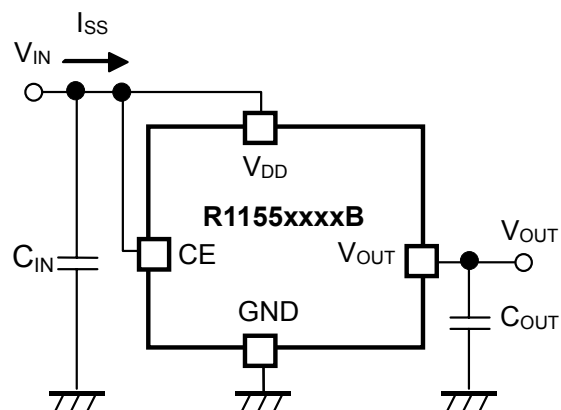


Figure 12. Test Circuit for Supply Current



Figure 13. Test Circuit for Input Transient Response & Ripple Rejection

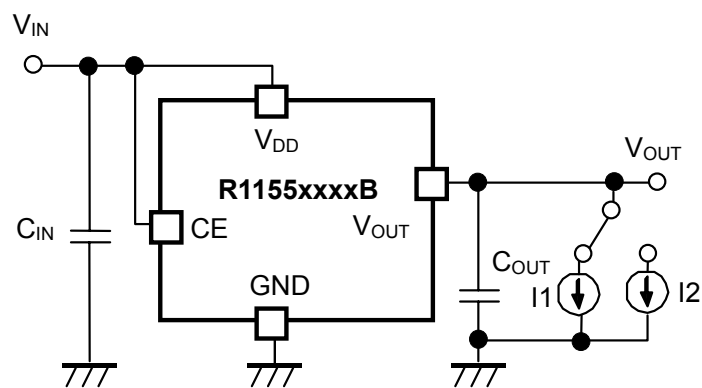


Figure 14. Test Circuit for Load Transient Response

TEST CIRCUITS (R1155x001C)

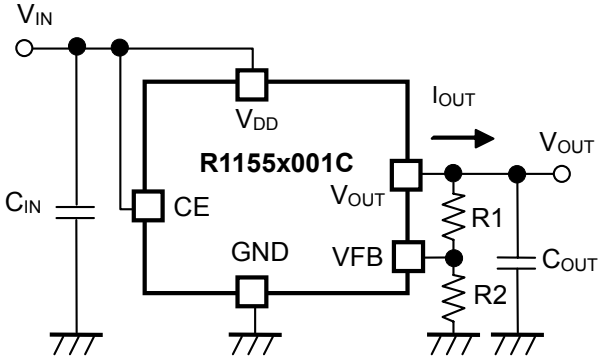


Figure 15. Basic Test Circuit

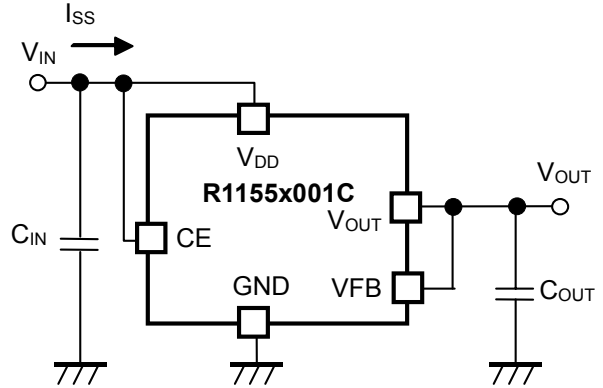


Figure 16. Test Circuit for Supply Current

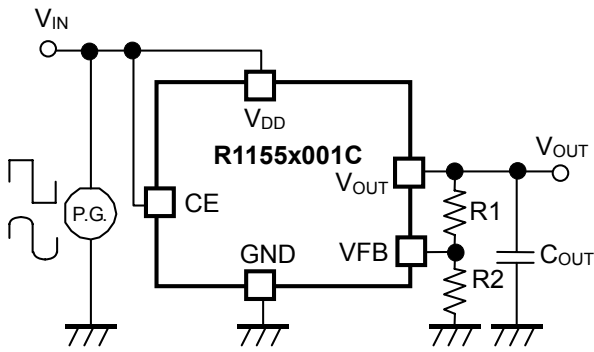


Figure 17. Test Circuit for Input Transient Response & Ripple Rejection

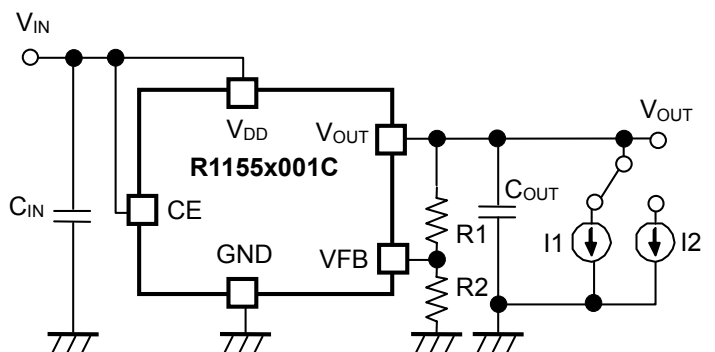


Figure 18. Test Circuit for Load Transient Response

EQUIVALENT SERIES RESISTANCE (ESR) vs. OUTPUT CURRENT (I_{OUT})

It is recommended that a ceramic type capacitor be used for the R1155x. However, other types of capacitors having lower ESR can also be used. The relation between the output current (I_{OUT}) and the ESR of output capacitor is shown below.

Measurement Conditions:

- Noise Frequency Band: 10Hz to 2MHz
- Measurement Temperature: -40°C to +105°C
- Hatched Area: Noise level is 40 μ V (avg.) or below.
- C_{IN} : 0.1 μ F
- C_{OUT} : 4.7 μ F

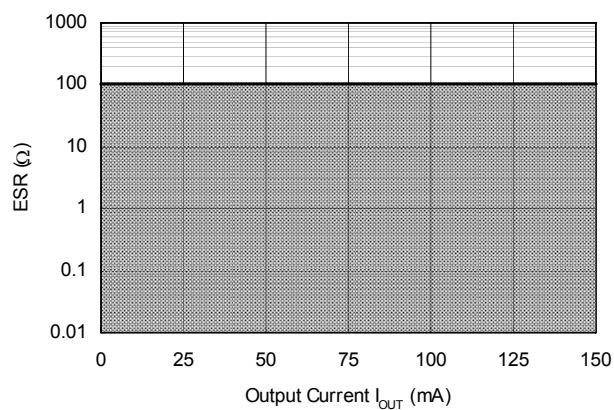
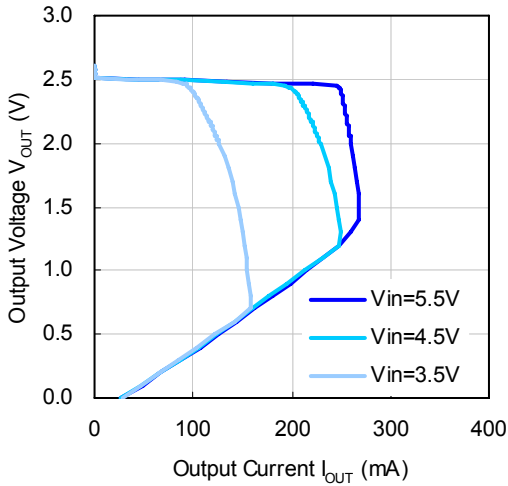


Figure 19. ESR vs. Output Current

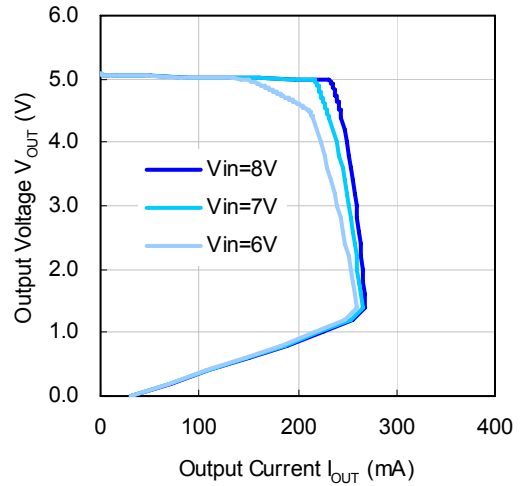
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$, $T_a=25^\circ C$)

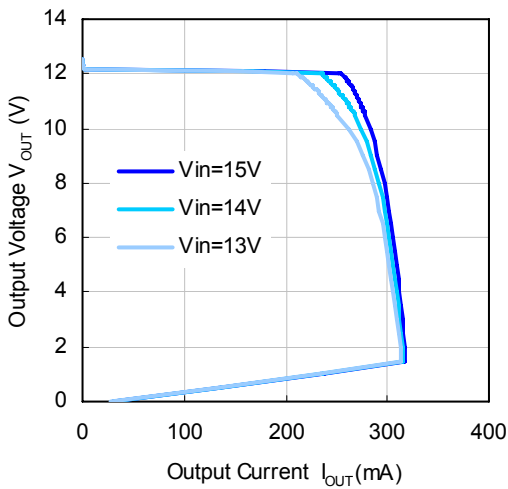
R1155x025B/R1155x001C



R1155x050B

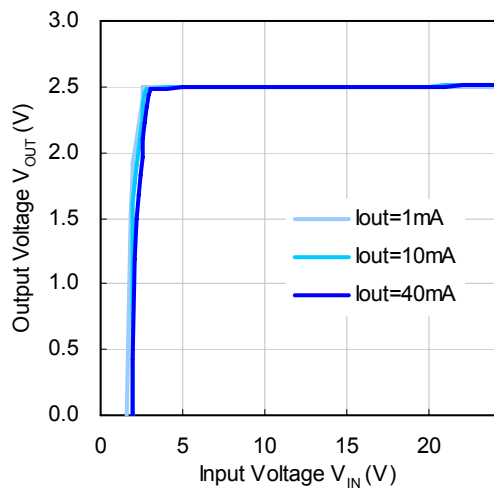


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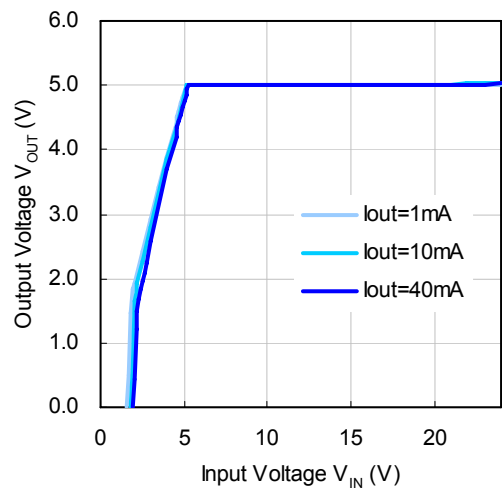


2) Output Voltage vs. Input Voltage ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$, $T_a=25^\circ C$)

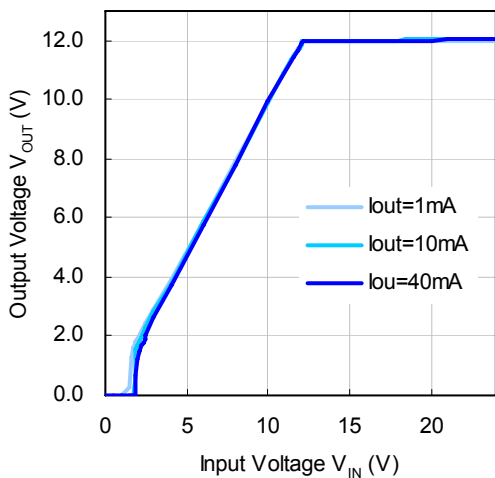
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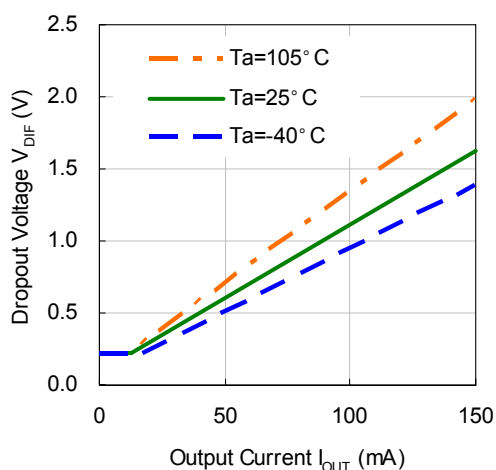


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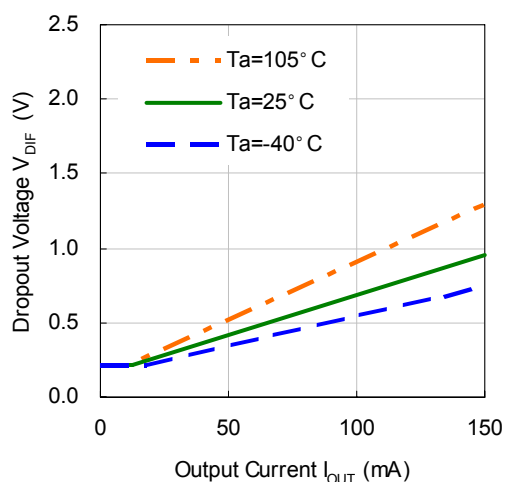


3) Dropout Voltage vs. Output Current ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$)

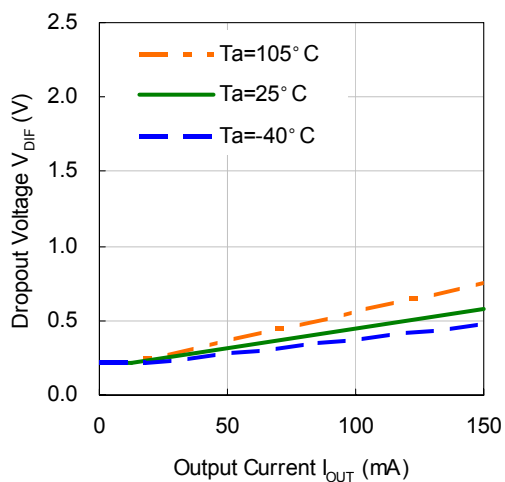
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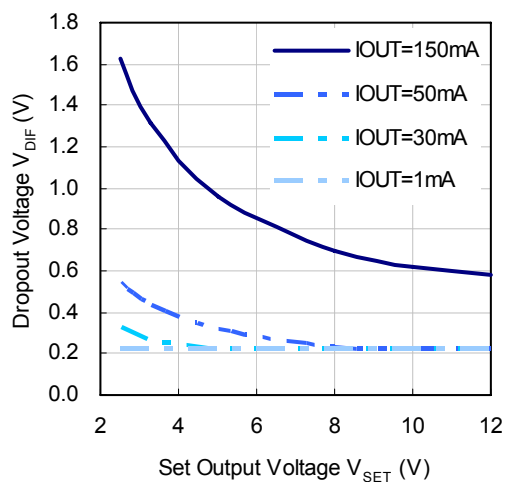
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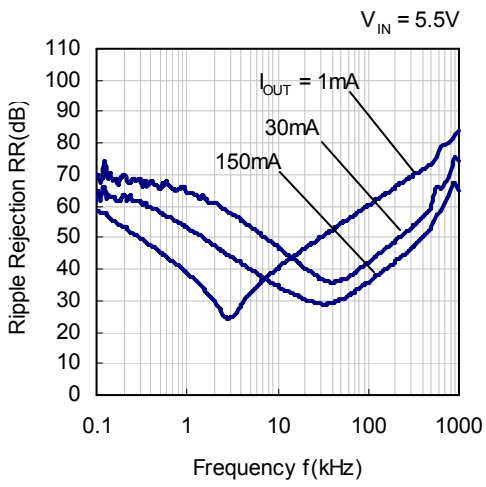


4) Dropout Voltage vs. Set Output Voltage ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$, $T_a=25^\circ C$)

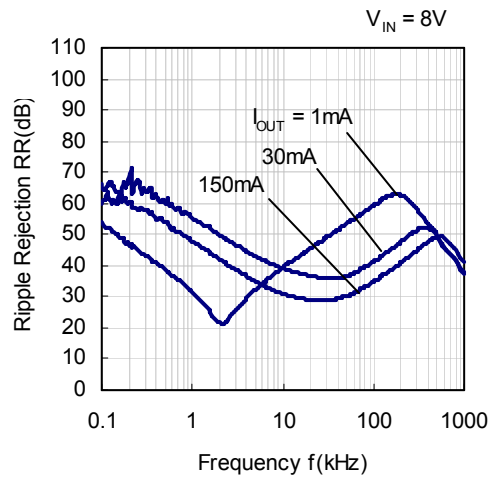


5) Ripple Rejection vs. Frequency (C_{IN} =none, C_{OUT} =4.7 μ F, Ripple=0.2V_{P-P}, Ta=25°C)

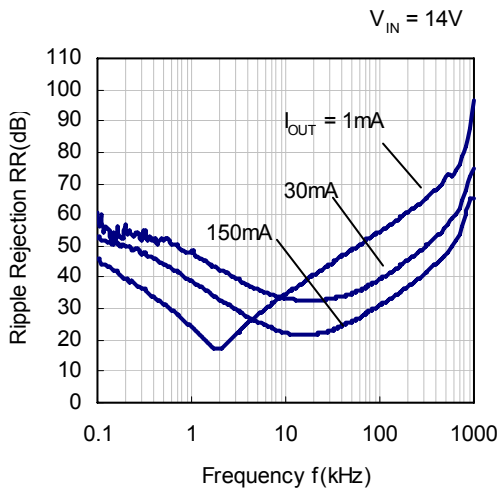
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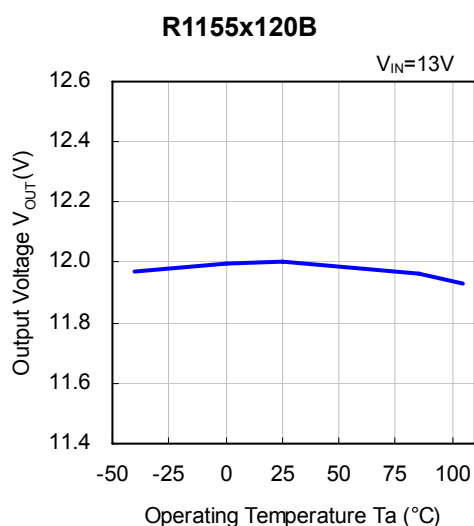
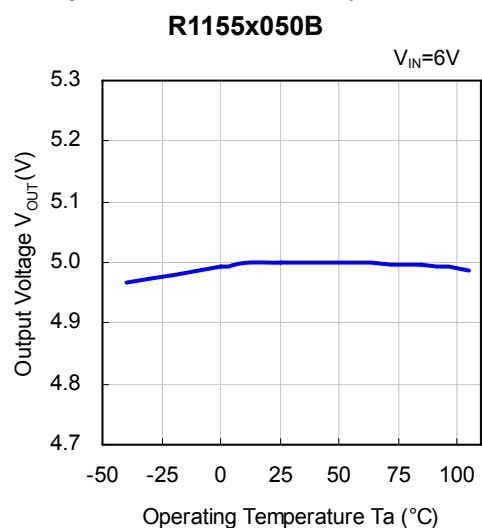
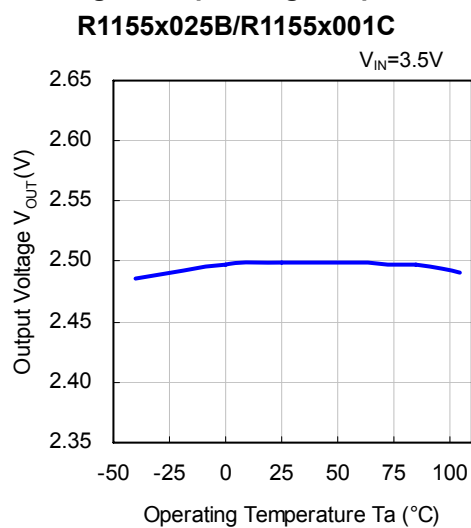
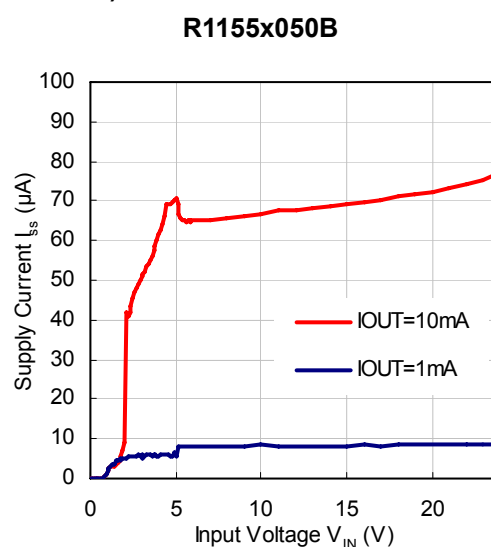
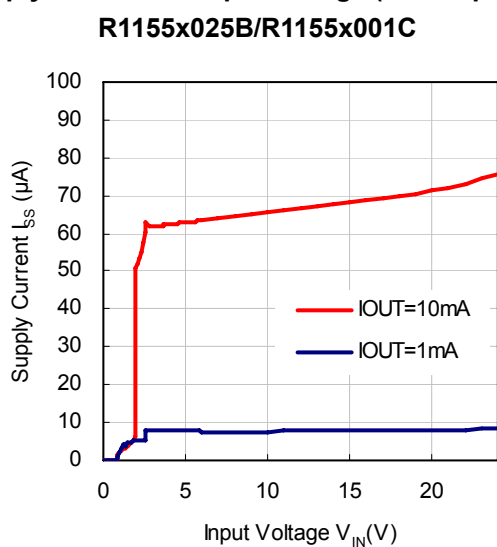


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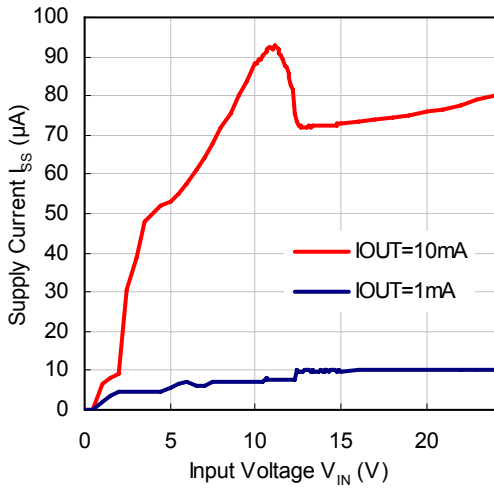


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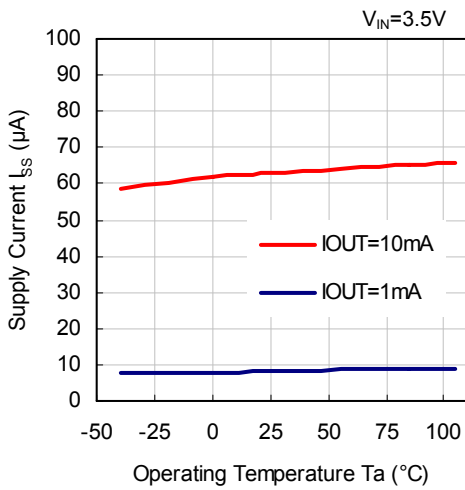
6) Output Voltage vs. Operating Temperature ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$, $T_a=25^\circ C$, $I_{OUT}=1mA$)7) Supply Current vs. Input Voltage ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$, $T_a=25^\circ C$)

R1155x120B

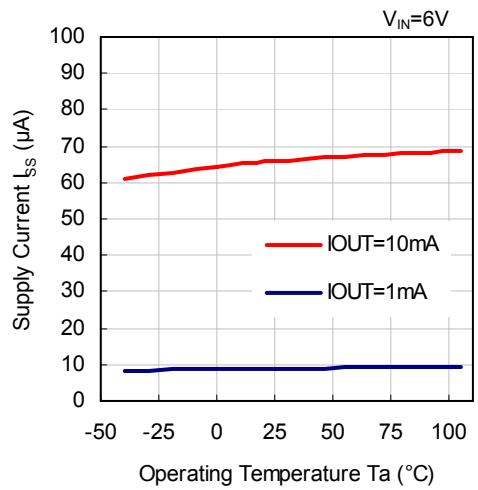


8) Supply Current vs. Operating Temperature ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$)

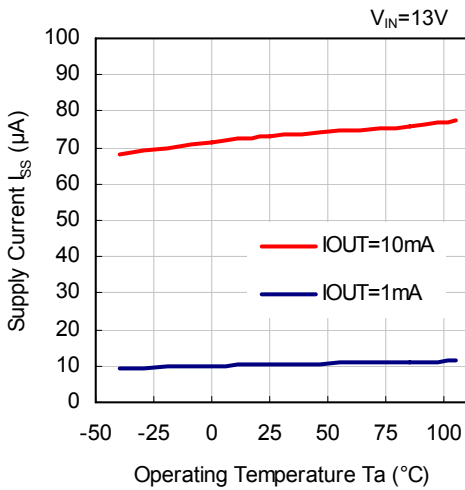
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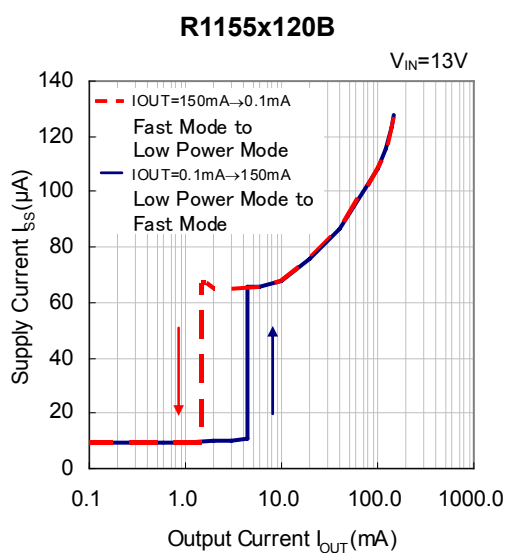
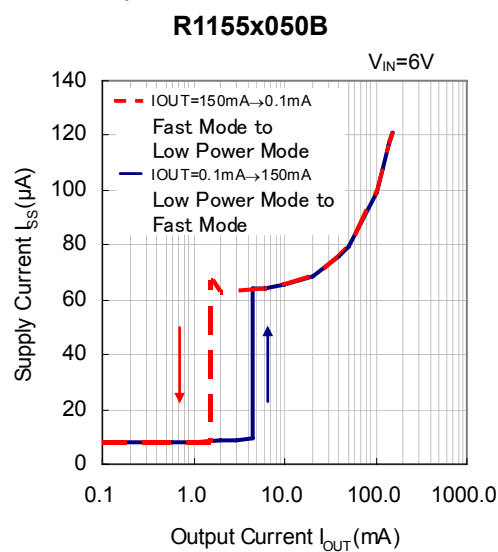
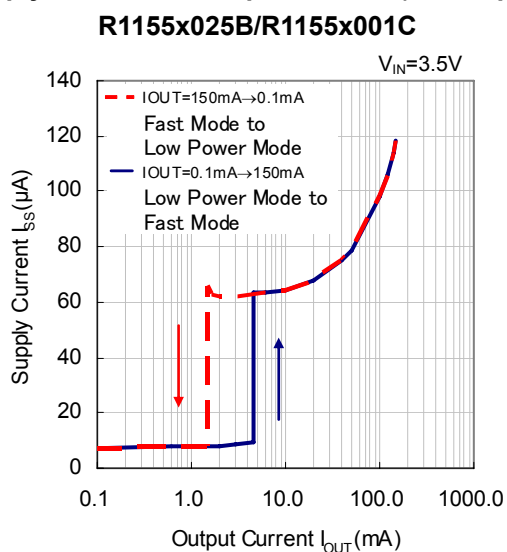
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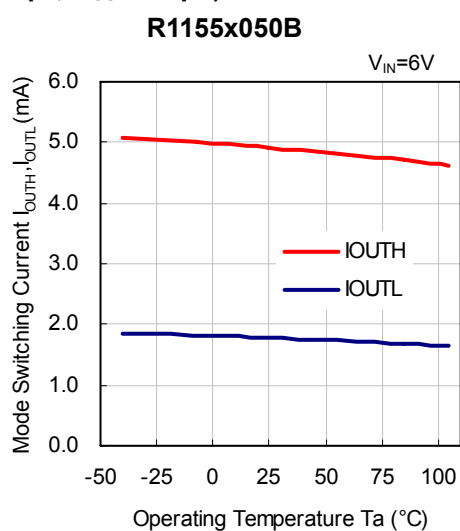
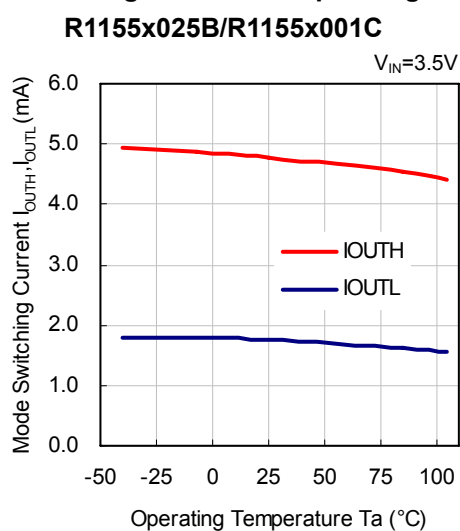
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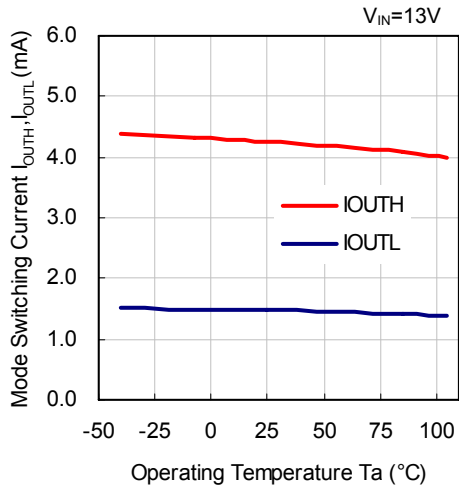
9) Supply Current vs. Output Current ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$, $T_a=25^\circ C$)



10) Mode Switching Current vs. Operating Temperature ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$)

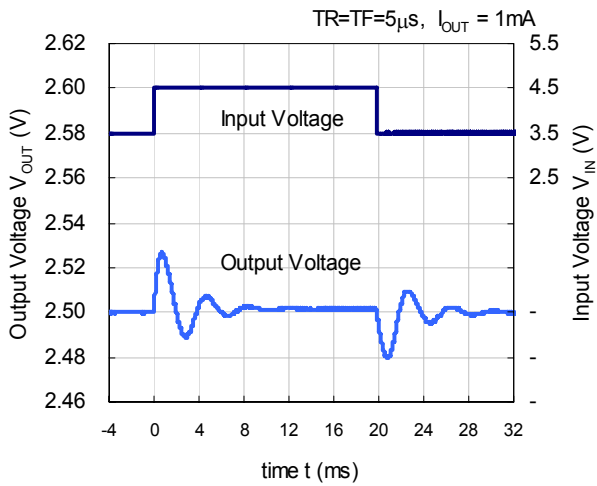


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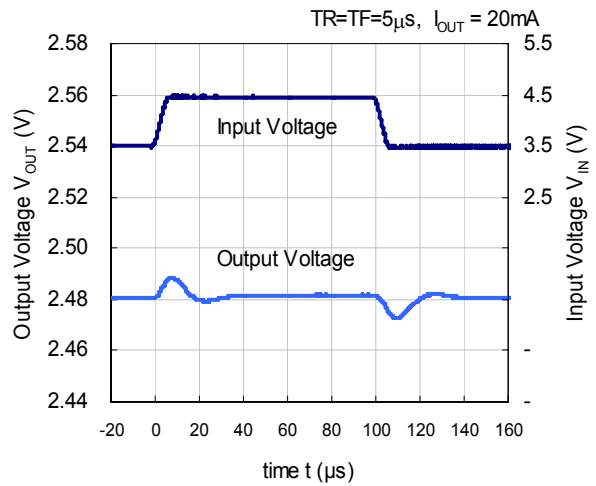


11) Input Transient Response ($C_{OUT}=4.7\mu F, T_a=25^\circ C$)

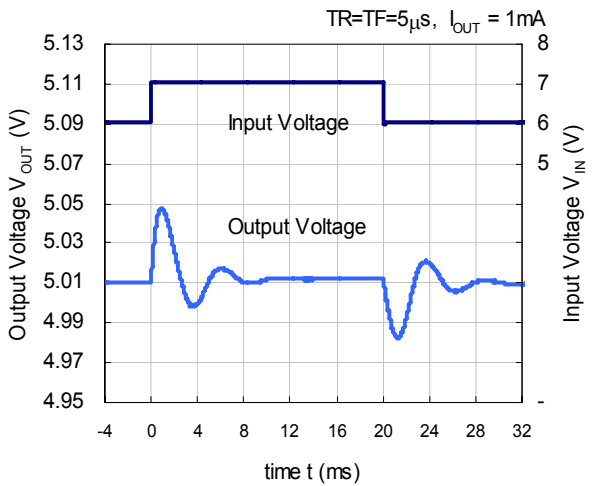
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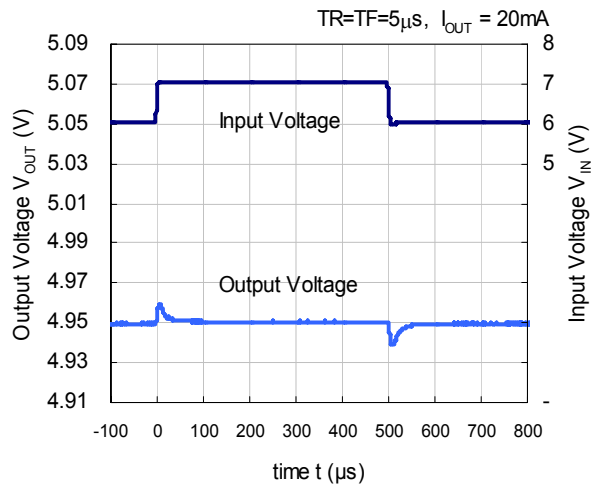
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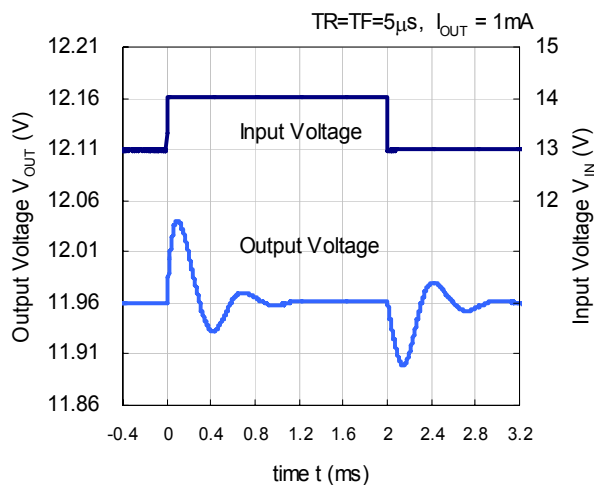
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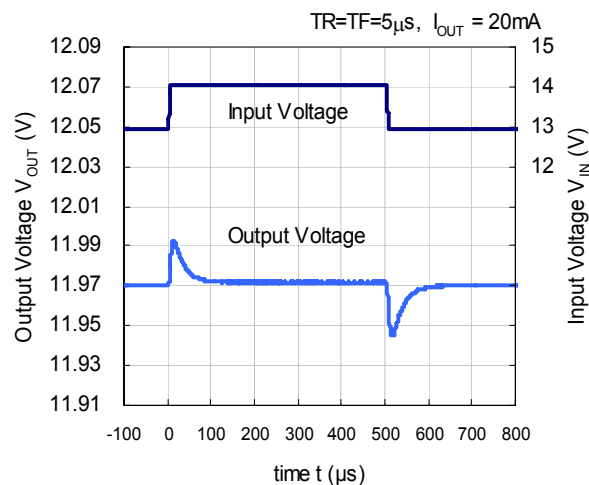
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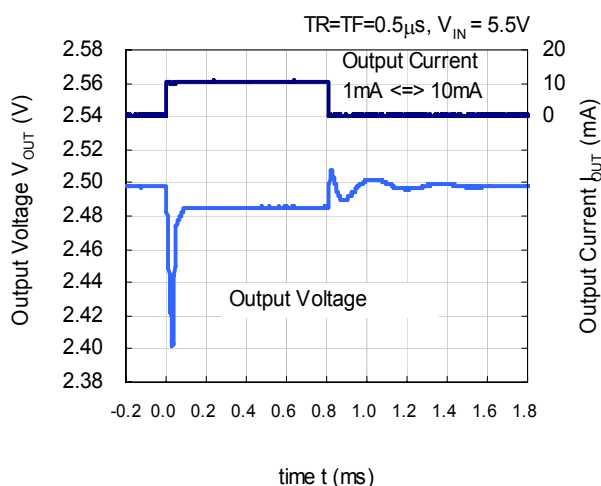


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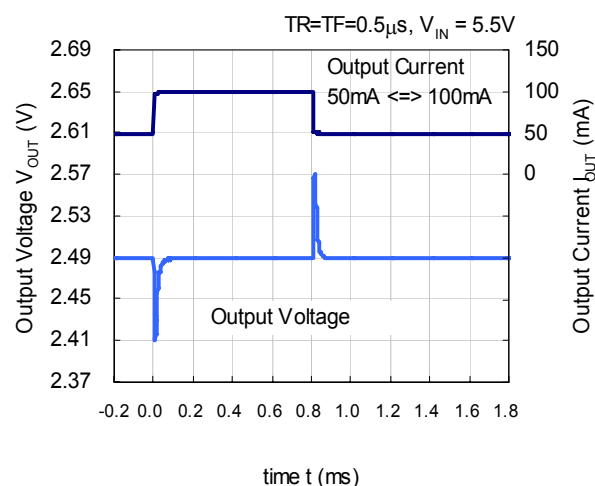


12) Load Transient Response (C_{OUT}=4.7 μ F, Ta=25°C)

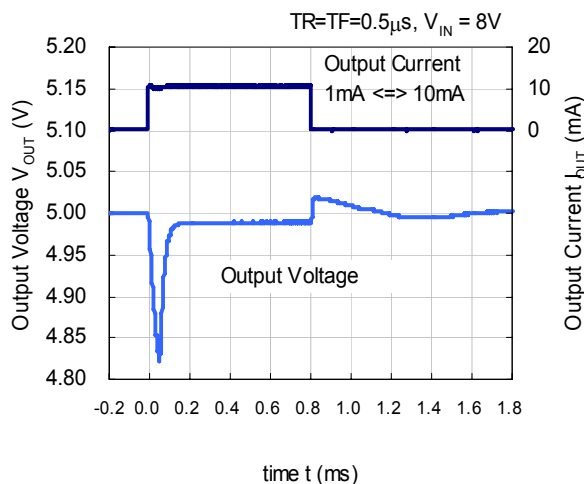
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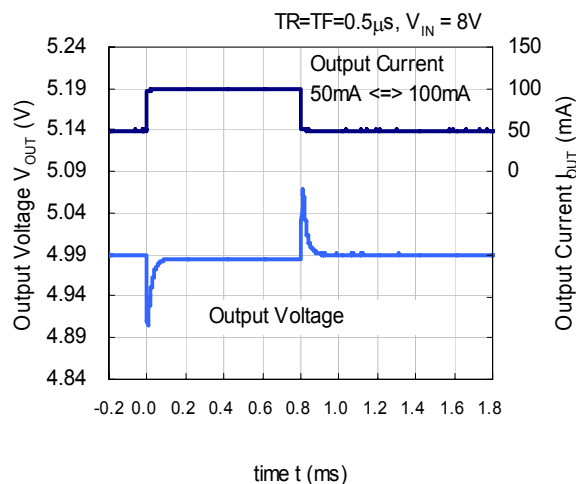
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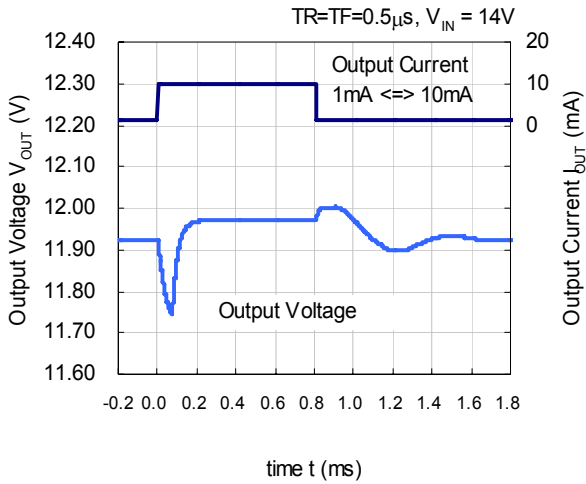
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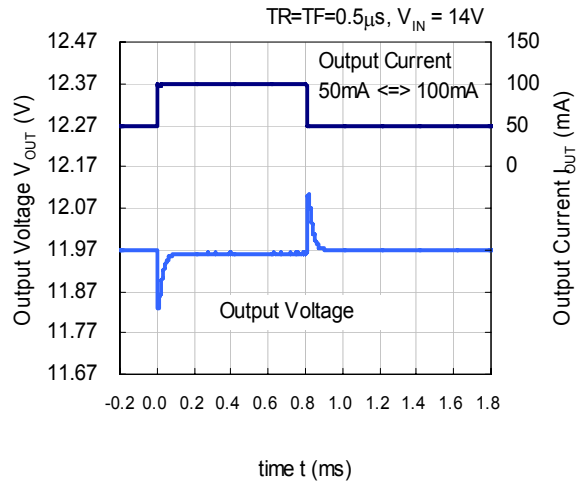
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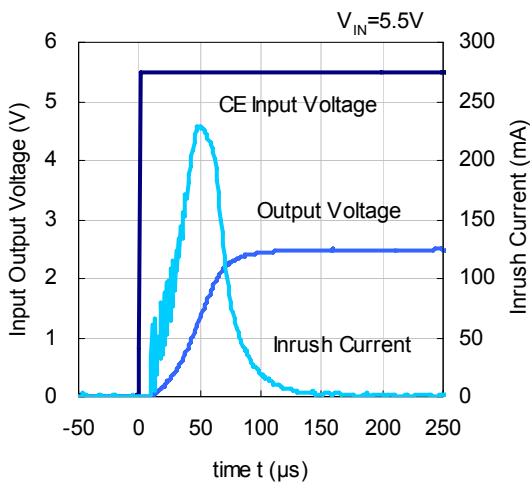


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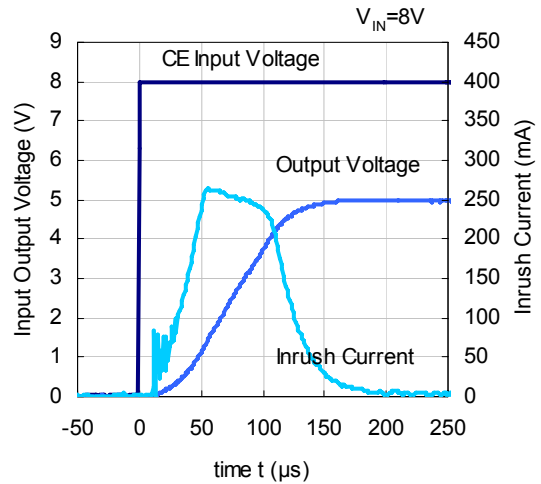


13) CE Input Voltage vs. Output Voltage vs. Inrush Current ($C_{IN}=0.1\mu F$, $C_{OUT}=4.7\mu F$, $T_a=25^\circ C$)

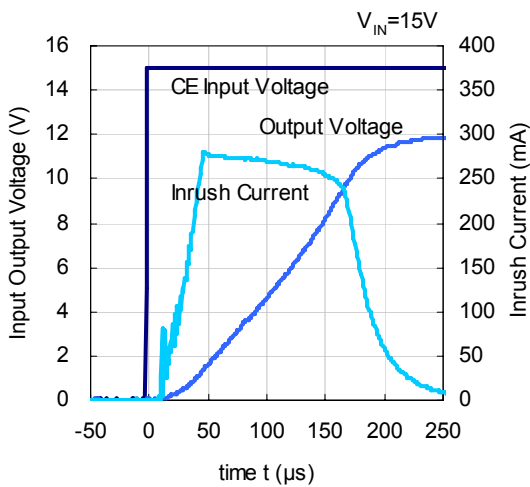
R1155x025B



R1155x050B



R1155x120B





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