300 mA Small Dual LDO Regulator for Automotive Applications

No. EC-387-210715

OUTLINE

The RP154x is a voltage regulator that provides high ripple rejection, low dropout voltage, high output voltage accuracy, and low supply current. The RP154x consists of a voltage reference unit, an error amplifier, resistors for setting output voltage, a short current limit circuit, and a chip enable circuit.

The RP154x is available in fixed output voltage options. Besides the low supply current by CMOS, the RP154x offers a low dropout voltage by built-in low ON resistance Tr. as well as an extended battery life by a chip enable function. Compared with the existing CMOS-based regulators, the RP154x is further improved in ripple rejection, line transient response, and load transient response.

The RP154x is offered in a 6-pin SOT-23-6 package for a single input type and an 8-pin DFN2020-8 package for a dual input type. Both packages are equipped with two LDOs which can achieve high-density mounting.

FEATURES

- Input Voltage Range (Maximum Rating) .... 1.4 V to 5.25 V (6.0 V)
- Operating Temperature Range .... –40°C to 105°C
- Supply Current.. Typ. 50 μA x 2 (VR1 & VR2)
- Standby Current... Typ. 0.1 μA x 2 (VR1 & VR2)
- Output Voltage Range .... 0.8 V to 3.7 V (0.1 V step)
- Output Voltage Accuracy .... ±1.0% (V_{SET} > 2.0 V, Ta = 25°C)
- Temperature-Drift Coefficient of Output Voltage..................... Typ. ±80 ppm/°C
- Dropout Voltage .... Typ. 0.25 V (I_{OUT} = 300 mA, V_{SET} = 2.5 V)
- Ripple Rejection.. Typ. 75 dB (f = 1 kHz)
- Line Regulation... Typ. 0.02%/V
- Output Noise.. Typ. 75 μVrms (BW = 10 Hz to 100 kHz)
- Short-current Limit Circuit.. Typ. 60 mA
- Overcurrent Protection Circuit
- Ceramic Capacitor Compatible.. 1.0 μF or more
- Packages DFN2020-8, SOT-23-6

APPLICATIONS

- Power source for car accessories including car audio equipment, car navigation system, and ETC system.

SELECTION GUIDE

The set output voltage, the package, and the auto-discharge function [1] are user-selectable options.

Selection Guide

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP154L5xx∗-TR-#	DFN2020-8	3,000 pcs	Yes	Yes
RP154N0xx∗-TR-#E	SOT-23-6	3,000 pcs	Yes	Yes

5xx: The combination of set output voltage for each channel can be designated by serial numbers (from 501). The set output voltage for each channel can be set in the range from 0.8 V to 3.7 V in 0.1 V step.

0xx: The combination of set output voltage for each channel can be designated by serial numbers (from 001). The set output voltage for each channel can be set in the range from 0.8 V to 3.7 V in 0.1 V step.

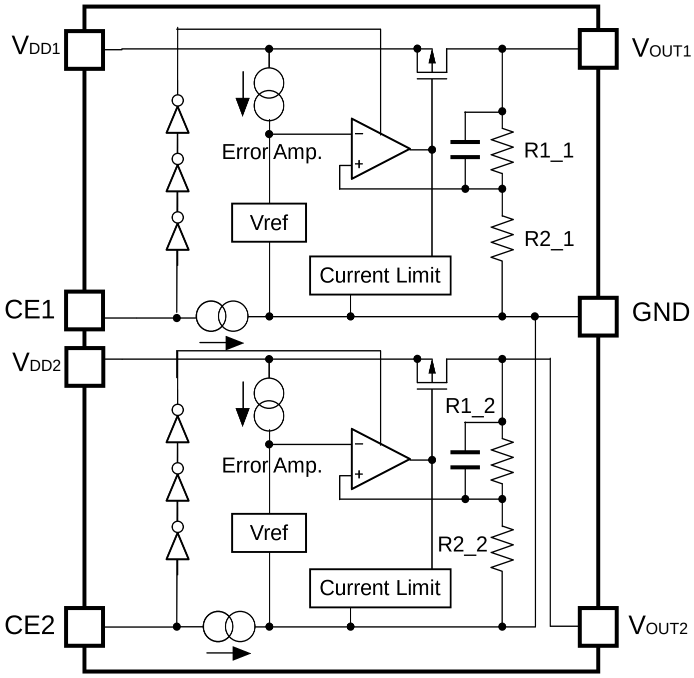
∗: The auto-discharge function at off state are options as follows.
(A) Auto-discharge function not included, Active-high
(B) Auto-discharge function included, Active-high

#: Quality Class

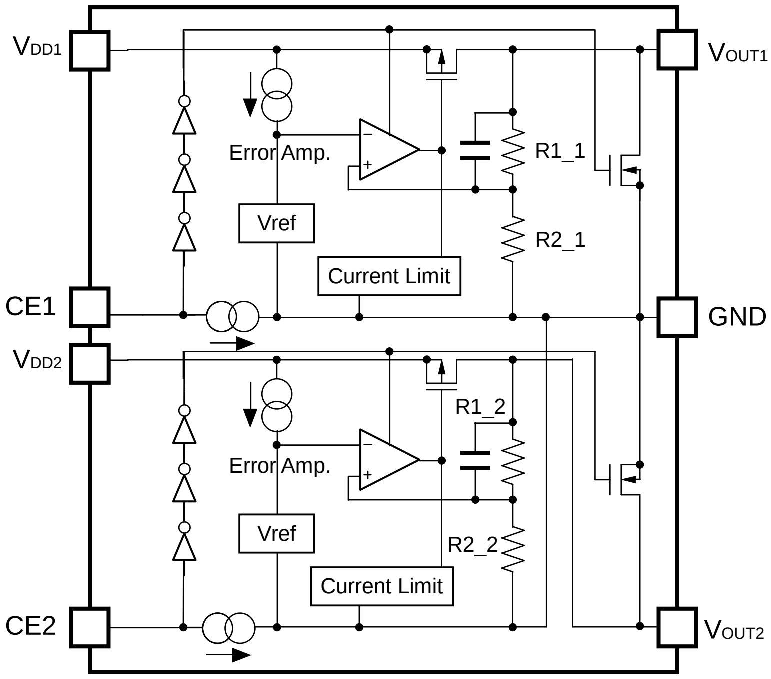
#	Operating Temperature Range	Test Temperature
A	−40°C to 105°C	25°C, High

[1] Auto-discharge function quickly lowers the output voltage to 0 V by releasing the electrical charge accumulated in the external capacitor when the chip enable signal is switched from the active mode to the standby mode.

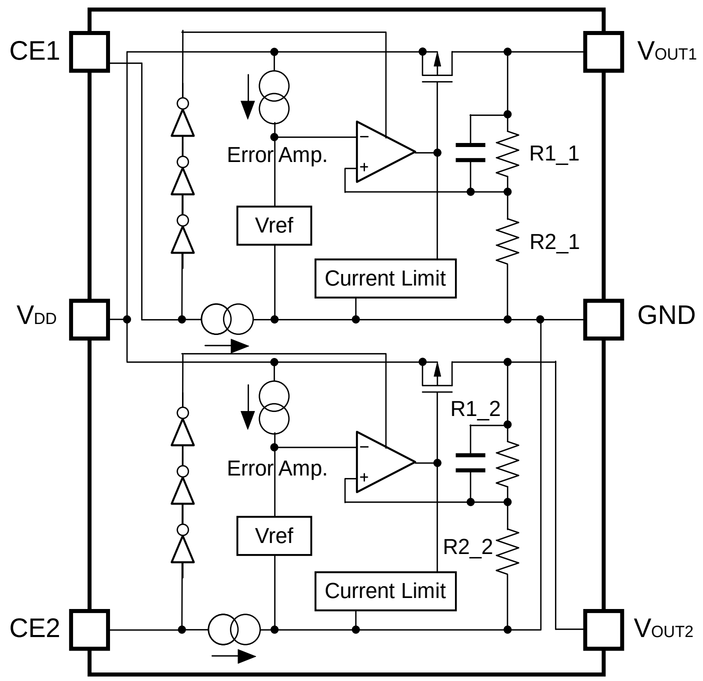
BLOCK DIAGRAMS



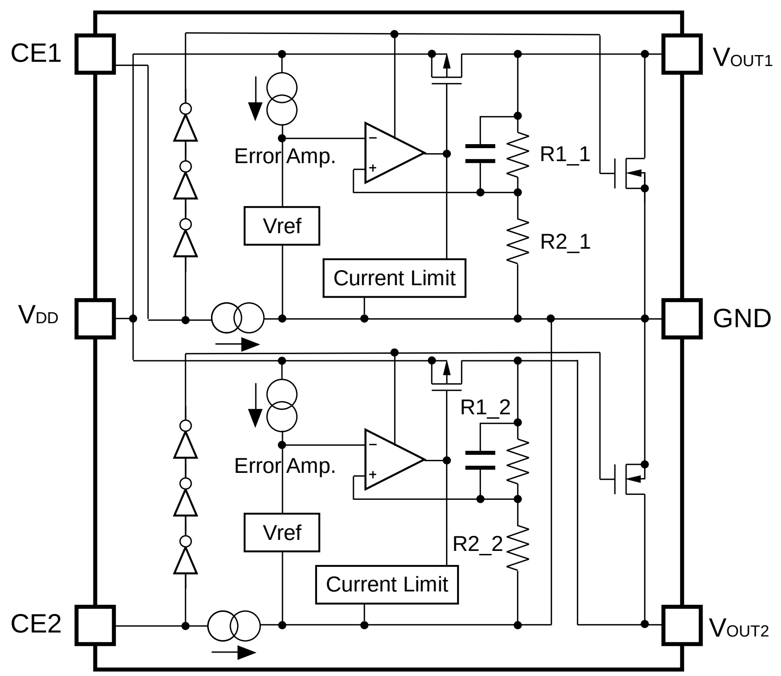
RP154LxxxA Block Diagram



RP154LxxxB Block Diagram

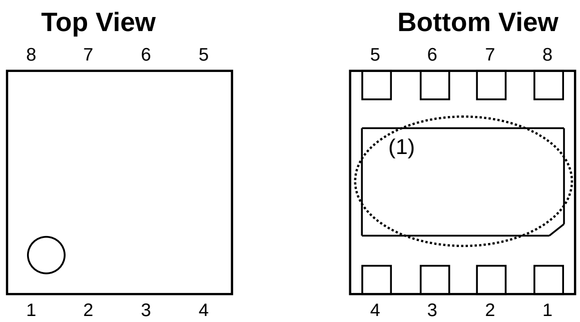


RP154NxxxA Block Diagram

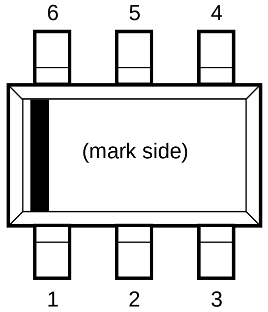


RP154NxxxB Block Diagram

PIN DESCRIPTIONS



DFN2020-8 Pin Configuration



SOT-23-6 Pin Configuration

DFN2020-8 Pin Description

Pin No.	Symbol	Description
1	GND	Ground Pin[2]
2	VOUT1	Output Pin 1
3	VOUT2	Output Pin 2
4	GND	Ground Pin[2]
5	CE2	Chip Enable Pin 2, Active-high
6	VDD2	Input Pin 2
7	VDD1	Input Pin 1
8	CE1	Chip Enable Pin 1, Active-high

SOT-23-6 Pin Description

Pin No.	Symbol	Description
1	CE1	Chip Enable Pin 1, Active-high
2	VDD	Input Pin
3	CE2	Chip Enable Pin 2, Active-high
4	VOUT2	Output Pin 2
5	GND	Ground Pin
6	VOUT1	Output Pin 1

(1) Tab is GND level. (They are connected to the reverse side of this IC).The tab is better to be connected to the GND, but leaving it open is also acceptable.
(2) The GND pin must be wired together when it is mounted on board.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage		6.0	V
V_{CE}	Input Voltage (CE Pin)		−0.3 to 6.0	V
V_{OUT1}, V_{OUT2}	Output Voltage		−0.3 to V_{IN} + 0.3	V
I_{OUT1}, I_{OUT2}	Output Current		400	mA
P_D	Power Dissipation[1] (JEDEC STD. 51-7 Test Land Pattern)	DFN2020-8	3100	mW
		SOT-23-6	830	
Tj	Junction Temperature Range		−40 to 150	°C
Tstg	Storage Temperature Range		−55 to 150	°C

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage 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 CONDITIONS

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	1.4 to 5.25	V
Ta	Operating Temperature Range	−40 to 105	°C

RECOMMENDED OPERATING CONDITIONS

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

[1] Refer to *POWER DISSIPATION* for detailed information.

ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{SET} + 1.0$ V ($V_{SET} > 1.5$ V), $V_{IN} = 2.5$ V ($V_{SET} \leq 1.5$ V), $I_{OUT} = 1$ mA, $C_{IN} = C_{OUT} = 1.0$ µF, unless otherwise noted, V_{SET} is Set Output Voltage.

The specification in ☐ is checked and guaranteed by design engineering at –40°C ≤ Ta ≤ 105°C.

VR1/VR2 Electrical Characteristics (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	$V_{SET} > 2.0$ V	x0.99		x1.01	V
			$V_{SET} \leq 2.0$ V	−20		20	mV
		−40°C ≤ Ta ≤ 105°C	$V_{SET} > 2.0$ V	x0.964		x1.03	V
			$V_{SET} \leq 2.0$ V	−72		60	mV
I_{LIM}	Output Current Limit			300			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	1 mA ≤ I_{OUT} ≤ 300 mA			15	40	mV
V_{DIF}	Dropout Voltage	Refer to *Dropout Voltage by Set Output Voltage*.					
I_{SS}	Supply Current	$I_{OUT} = 0$ mA			50	90	µA
Istandby	Standby Current	$V_{CE} = 0$ V			0.1	4.5	µA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	$V_{SET} + 0.5$ V ≤ V_{IN} ≤ 5.25 V (V_{IN} ≥ 1.4 V)			0.02	0.10	%/V
I_{SC}	Short Current	$V_{OUT} = 0$ V			60	120	mA
I_{PD}	CE Pull-down Current				0.3	0.6	µA
V_{CEH}	CE Input Voltage "H"			1.0			V
V_{CEL}	CE Input Voltage "L"					0.4	V
R_{LOW}	Low Output Nch Tr. ON Resistance (of B version)	$V_{IN} = 4.0$ V, $V_{CE} = 0$ V			50		Ω

Dropout Voltage by Set Output Voltage (Ta = 25°C)

Set Output Voltage V_{SET} (V)	Dropout Voltage V_{DIF} (V)		
	Condition	Typ.	Max.
$V_{SET} = 0.8$	$I_{OUT} = 300$ mA	0.56	0.74
$V_{SET} = 0.9$		0.51	0.67
1.0 ≤ V_{SET} < 1.2		0.46	0.61
1.2 ≤ V_{SET} < 1.4		0.39	0.52
1.4 ≤ V_{SET} < 1.7		0.35	0.46
1.7 ≤ V_{SET} < 2.1		0.30	0.41
2.1 ≤ V_{SET} < 2.5		0.26	0.36
2.5 ≤ V_{SET} < 3.0		0.25	0.32
3.0 ≤ V_{SET} ≤ 3.7		0.22	0.31

RP154L5xxx Product-specific Electrical Characteristics

Product Name	VR1								VR2							
	V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]		V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
RP154L502x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154L504x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154L505x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52
RP154L506x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154L510x	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154L513x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154L514x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31
RP154L518x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154L521x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154L524x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154L525x	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154L533x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154L536x	0.980	1.000	1.020	0.928	1.000	1.060	0.46	0.61	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154L537x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154L539x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154L552x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154L554x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52
RP154L561x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154L562x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154L563x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46
RP154L564x	1.080	1.100	1.120	1.028	1.100	1.160	0.46	0.61	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154L565x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154L566x	0.780	0.800	0.820	0.728	0.800	0.860	0.56	0.74	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154L567x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154L568x	1.280	1.300	1.320	1.228	1.300	1.360	0.39	0.52	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154L569x	1.680	1.700	1.720	1.628	1.700	1.760	0.30	0.41	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46
RP154L570x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	1.280	1.300	1.320	1.228	1.300	1.360	0.39	0.52
RP154L571x	1.080	1.100	1.120	1.028	1.100	1.160	0.46	0.61	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31

RP154N0xxx Product-specific Electrical Characteristics

Product Name	VR1								VR2							
	V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]		V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
RP154N001x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154N002x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154N003x	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154N004x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N005x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52
RP154N006x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N007x	2.822	2.850	2.878	2.748	2.850	2.935	0.25	0.32	2.822	2.850	2.878	2.748	2.850	2.935	0.25	0.32
RP154N008x	2.822	2.850	2.878	2.748	2.850	2.935	0.25	0.32	2.574	2.600	2.626	2.507	2.600	2.678	0.25	0.32
RP154N009x	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154N010x	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N011x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46
RP154N012x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	2.574	2.600	2.626	2.507	2.600	2.678	0.25	0.32
RP154N013x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154N014x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31
RP154N015x	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154N016x	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154N017x	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154N018x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N019x	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46	2.574	2.600	2.626	2.507	2.600	2.678	0.25	0.32
RP154N020x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N021x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154N022x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52
RP154N023x	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154N024x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154N025x	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31

RP154N0xxx Product-specific Electrical Characteristics

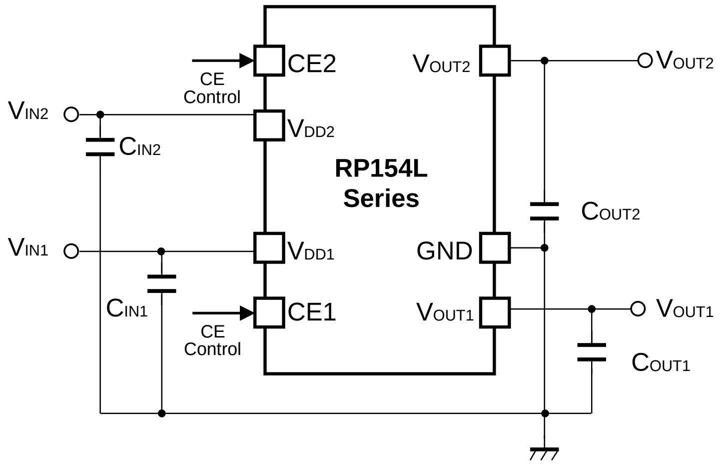
Product Name	VR1								VR2							
	V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]		V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
RP154N026x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N027x	2.277	2.300	2.323	2.218	2.300	2.369	0.26	0.36	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32
RP154N028x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	0.980	1.000	1.020	0.928	1.000	1.060	0.46	0.61
RP154N029x	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46
RP154N030x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154N031x	2.624	2.650	2.676	2.555	2.650	2.729	0.25	0.32	2.822	2.850	2.878	2.748	2.850	2.935	0.25	0.32
RP154N032x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	2.822	2.850	2.878	2.748	2.850	2.935	0.25	0.32
RP154N033x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154N034x	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N035x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	2.673	2.700	2.727	2.603	2.700	2.781	0.25	0.32
RP154N036x	0.980	1.000	1.020	0.928	1.000	1.060	0.46	0.61	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N037x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154N038x	1.680	1.700	1.720	1.628	1.700	1.760	0.30	0.41	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N039x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154N040x	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N041x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.673	2.700	2.727	2.603	2.700	2.781	0.25	0.32
RP154N042x	2.673	2.700	2.727	2.603	2.700	2.781	0.25	0.32	2.673	2.700	2.727	2.603	2.700	2.781	0.25	0.32
RP154N043x	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154N044x	1.680	1.700	1.720	1.628	1.700	1.760	0.30	0.41	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154N045x	1.730	1.750	1.770	1.678	1.750	1.810	0.30	0.41	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154N046x	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N047x	1.730	1.750	1.770	1.678	1.750	1.810	0.30	0.41	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N048x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N049x	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N050x	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31

RP154N0xxx Product-specific Electrical Characteristics

Product Name	VR1								VR2							
	V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]		V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			ΔV_{DIF} [V]	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
RP154N051x	3.564	3.600	3.636	3.471	3.600	3.708	0.22	0.31	3.564	3.600	3.636	3.471	3.600	3.708	0.22	0.31
RP154N052x	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154N053x	2.822	2.850	2.878	2.748	2.850	2.935	0.25	0.32	3.069	3.100	3.131	2.989	3.100	3.193	0.22	0.31
RP154N054x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52
RP154N055x	3.663	3.700	3.737	3.567	3.700	3.811	0.22	0.31	3.663	3.700	3.737	3.567	3.700	3.811	0.22	0.31
RP154N056x	1.080	1.100	1.120	1.028	1.100	1.160	0.46	0.61	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N057x	1.080	1.100	1.120	1.028	1.100	1.160	0.46	0.61	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52
RP154N058x	0.980	1.000	1.020	0.928	1.000	1.060	0.46	0.61	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31
RP154N059x	0.880	0.900	0.920	0.828	0.900	0.960	0.51	0.67	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N060x	0.880	0.900	0.920	0.828	0.900	0.960	0.51	0.67	0.880	0.900	0.920	0.828	0.900	0.960	0.51	0.67
RP154N061x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	2.970	3.000	3.030	2.892	3.000	3.090	0.22	0.31
RP154N062x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154N063x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46
RP154N064x	1.080	1.100	1.120	1.028	1.100	1.160	0.46	0.61	2.871	2.900	2.929	2.796	2.900	2.987	0.25	0.32
RP154N065x	2.772	2.800	2.828	2.700	2.800	2.884	0.25	0.32	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154N066x	0.780	0.800	0.820	0.728	0.800	0.860	0.56	0.74	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N067x	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31	2.475	2.500	2.525	2.410	2.500	2.575	0.25	0.32
RP154N068x	1.280	1.300	1.320	1.228	1.300	1.360	0.39	0.52	1.780	1.800	1.820	1.728	1.800	1.860	0.30	0.41
RP154N069x	1.680	1.700	1.720	1.628	1.700	1.760	0.30	0.41	1.480	1.500	1.520	1.428	1.500	1.560	0.35	0.46
RP154N070x	1.180	1.200	1.220	1.128	1.200	1.260	0.39	0.52	1.280	1.300	1.320	1.228	1.300	1.360	0.39	0.52
RP154N071x	1.080	1.100	1.120	1.028	1.100	1.160	0.46	0.61	3.267	3.300	3.333	3.182	3.300	3.399	0.22	0.31

APPLICATION INFORMATION

Typical Application Circuit

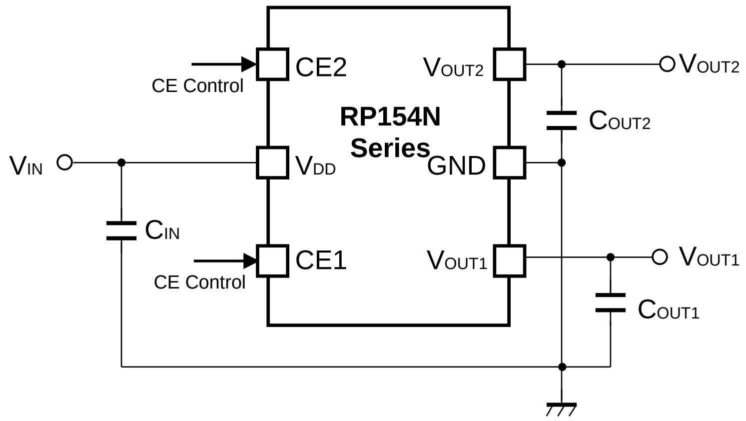


$C_{IN1} = C_{IN2} = C_{OUT1} = C_{OUT2}$ = Ceramic 1.0 µF

RP154LxxxA/B Typical Application Circuit

External Components

Symbol	Description
C_{OUT1}, C_{OUT2}	Ceramic Capacitor, 1.0 µF, TDK: CGA3E1X7R1C105K080AC



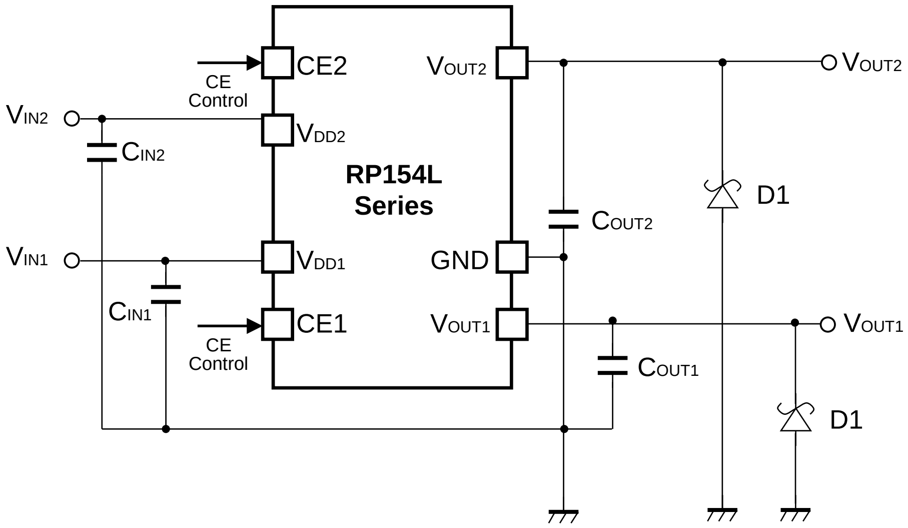
$C_{IN} = C_{OUT1} = C_{OUT2}$ = Ceramic 1.0 µF

RP154NxxxA/B Typical Application Circuit

External Components

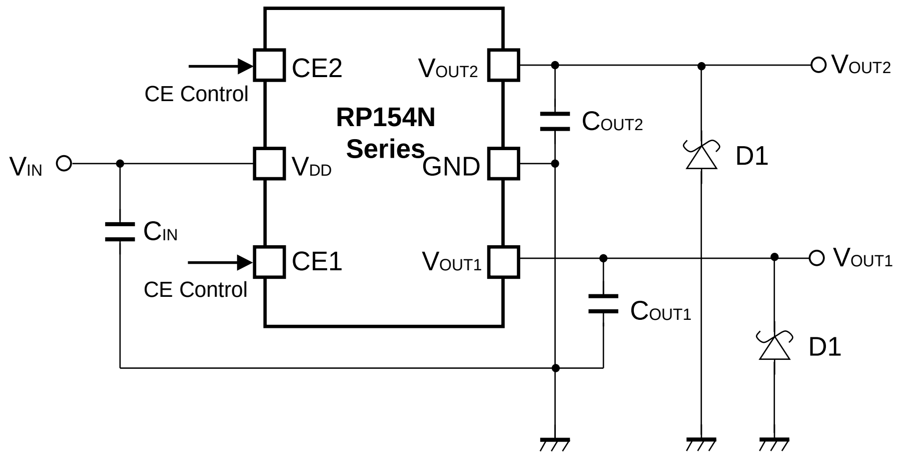
Symbol	Description
C_{OUT1}, C_{OUT2}	Ceramic Capacitor, 1.0 µF, TDK: CGA3E1X7R1C105K080AC

Typical Application Circuit for IC Chip Breakdown Prevention



$C_{IN1} = C_{IN2} = C_{OUT1} = C_{OUT2}$ = Ceramic 1.0 μF

RP154LxxxA/B Typical Application Circuit for IC Chip Breakdown Prevention



$C_{IN} = C_{OUT1} = C_{OUT2}$ = Ceramic 1.0 μF

RP154NxxxA/B Typical Application Circuit for IC Chip Breakdown Prevention

When a sudden surge of electrical current travels along the VOUT pin and GND due to a short-circuit, electrical resonance of a circuit involving an output capacitor (C2) and a short circuit inductor generates a negative voltage and may damage the device or the load devices. Connecting a schottky diode (D1) between the VOUT pin and GND has the effect of preventing damage to them.

TECHNICAL NOTES

Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use capacitors (1.0 μF or more) for C_{OUT1} and C_{OUT2} with good frequency characteristics and ESR (Equivalent Series Resistance).

Note: If additional ceramic capacitors are connected with parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB. If the tantalum capacitor is used and its ESR (equivalent series resistance) is too large, the output may be unstable, therefore, fully evaluation is necessary.

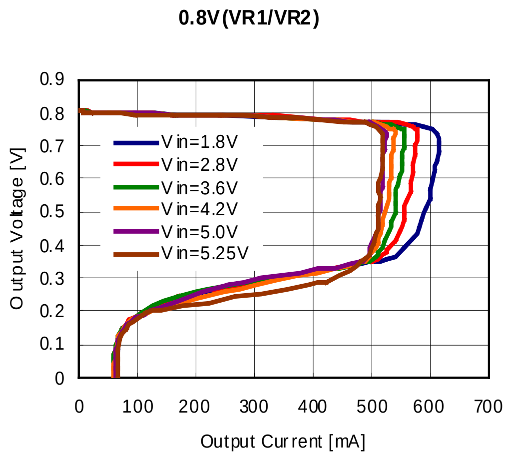
PCB Layout

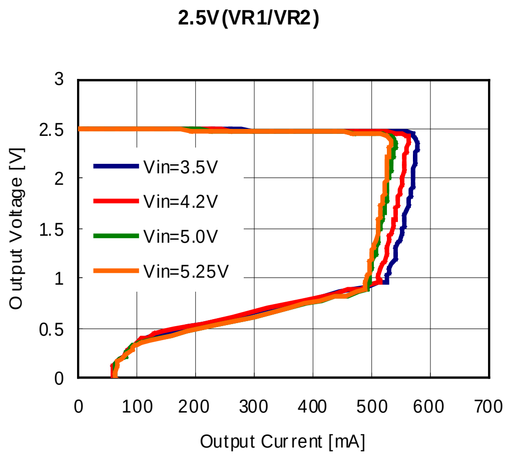
Make VDD and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect capacitors with a capacitance value as much as 1.0 μF or more between VDD and GND pin, and as close as possible to the pins (C_{IN1}/C_{IN2}).
Set external components, especially the output capacitors, as close as possible to the ICs, and make wiring as short as possible (C_{OUT1}/C_{OUT2}).

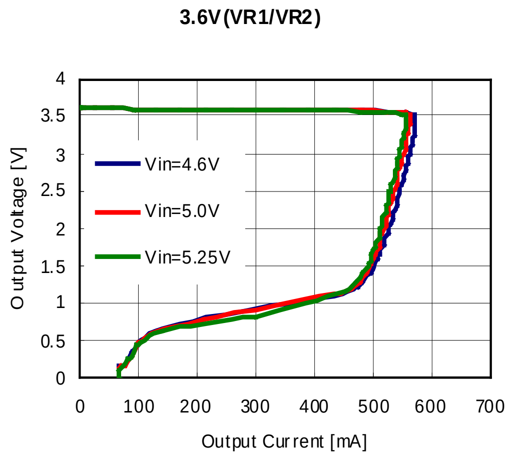
TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

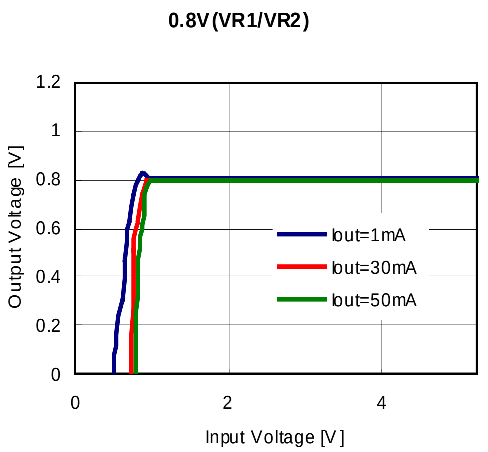
1) Output Voltage vs. Output Current (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF, Ta = 25°C)

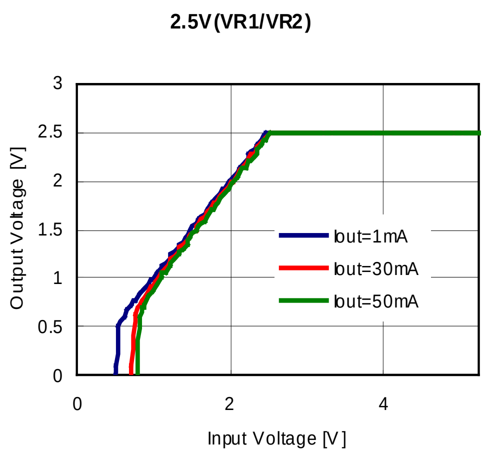


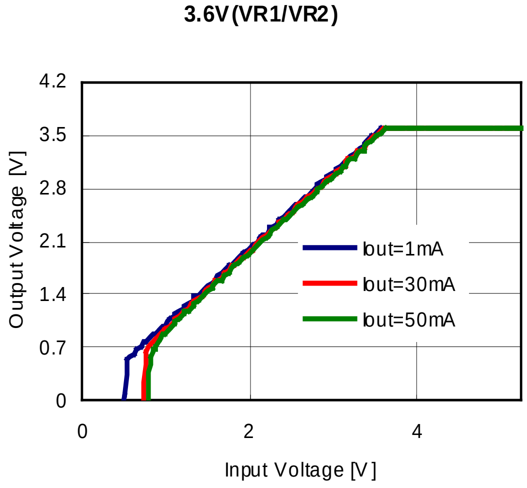




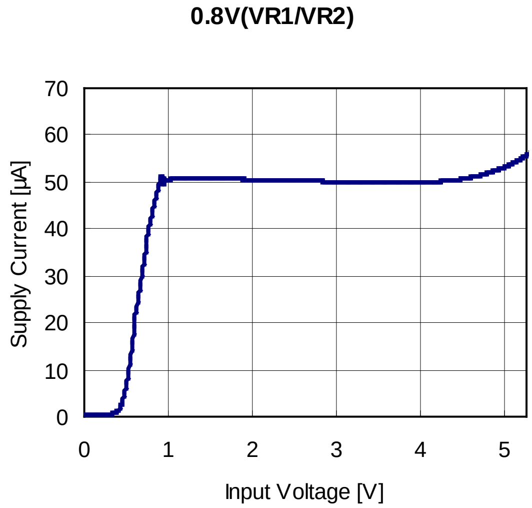
2) Output Voltage vs. Input Voltage (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF, Ta = 25°C)

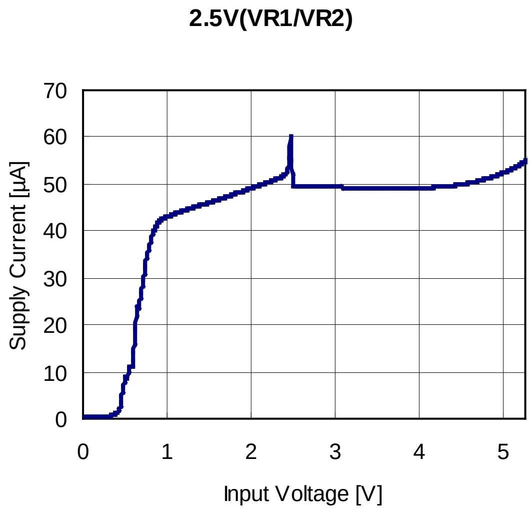


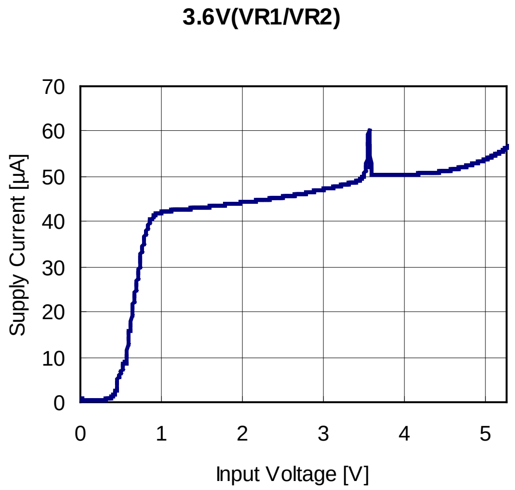




3) Supply Current vs. Input Voltage (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF, Ta = 25°C)

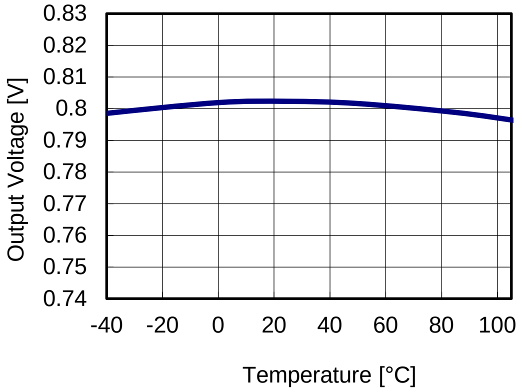




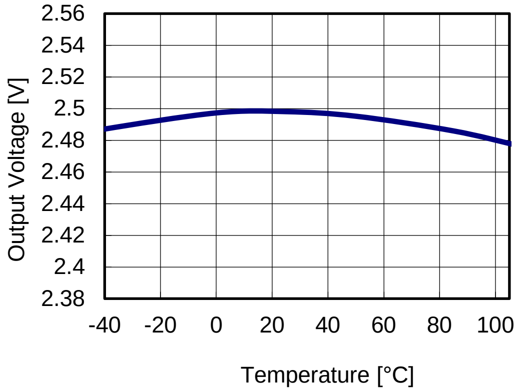


4) Output Voltage vs. Temperature (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF, I_{OUT} = 5 mA)

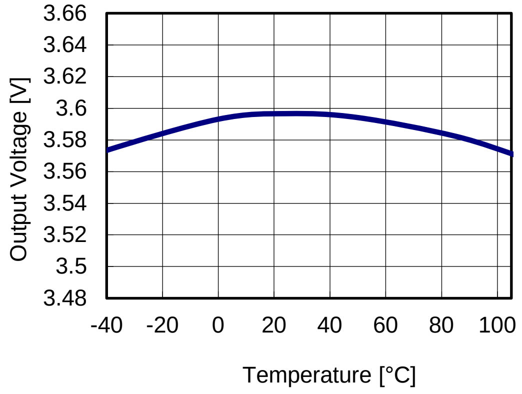
0.8V (VR1/VR2)



2.5V (VR1/VR2)

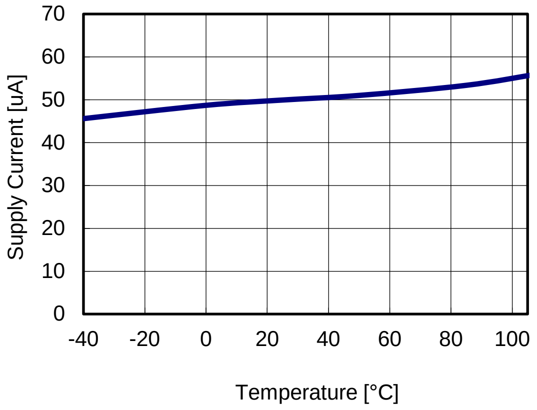


3.6V (VR1/VR2)

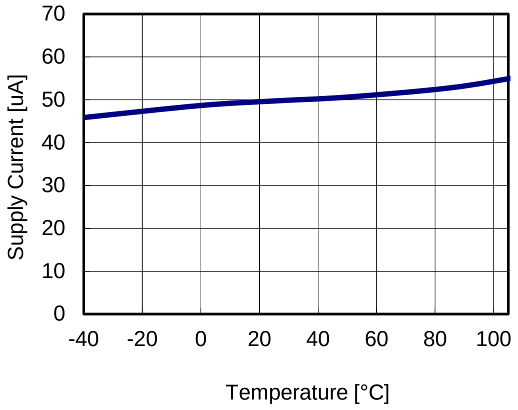


5) Supply Current vs. Temperature (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF)

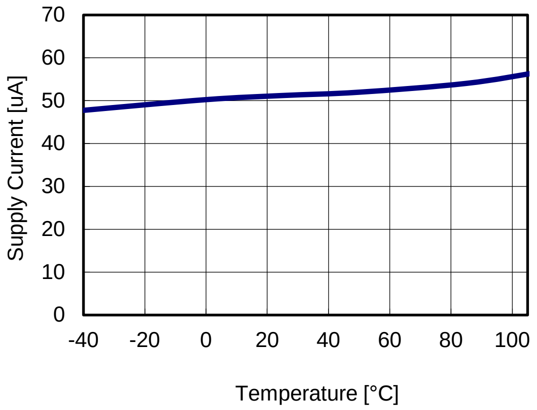
0.8V (VR1/VR2)



2.5V (VR1/VR2)

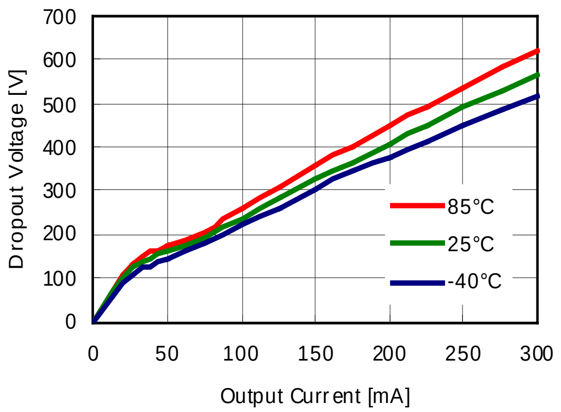


3.6V (VR1/VR2)

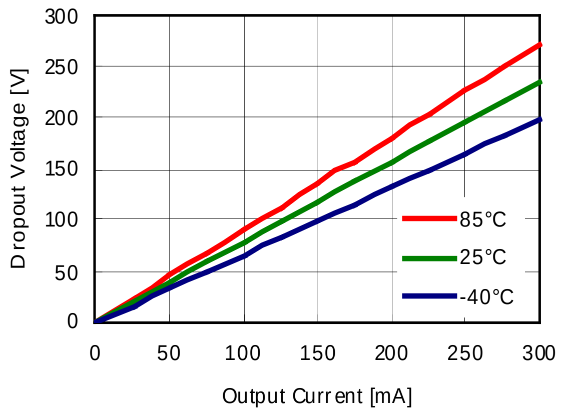


6) Dropout Voltage vs. Output Current (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF)

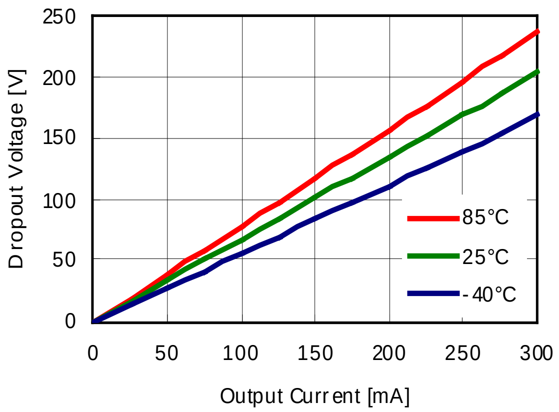
0.8V (VR1/VR2)



2.5V (VR1/VR2)

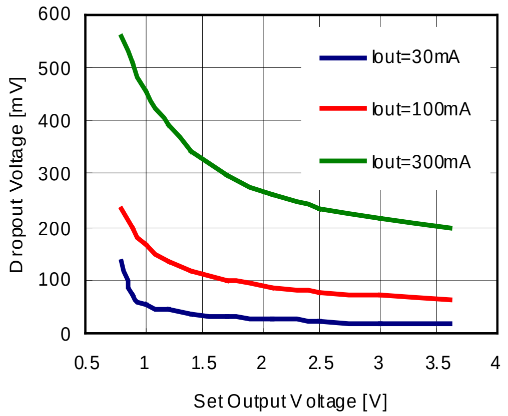


3.6V (VR1/VR2)



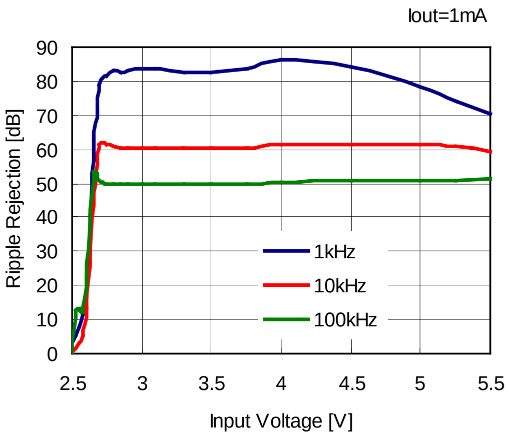
7) Dropout Voltage vs. Set Output Voltage

(VR1/VR2)

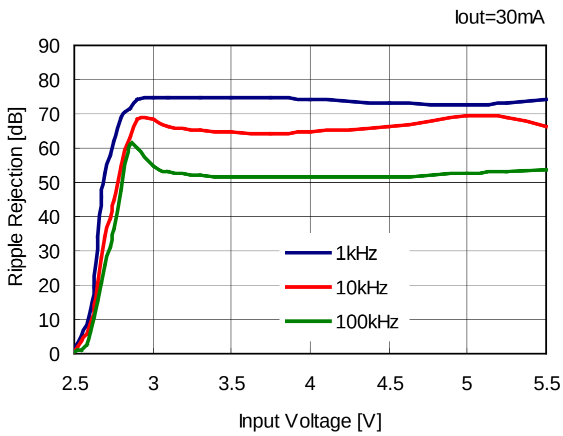


8) Ripple Rejection vs. Input Voltage (C_{IN} = none, C_{OUT1} = C_{OUT2} = 1.0 µF, Ripple = 0.2 Vp-p, Ta = 25°C)

2.5V(VR1/VR2)

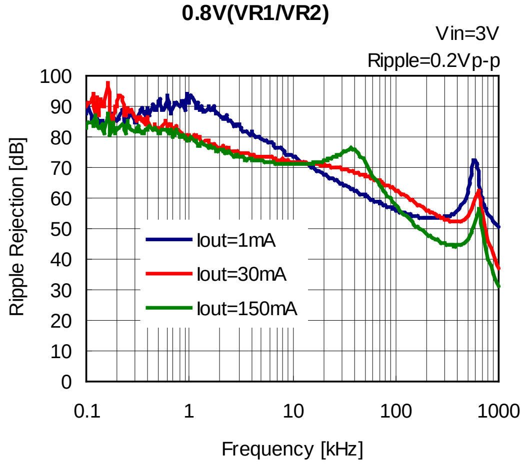


2.5V(VR1/VR2)

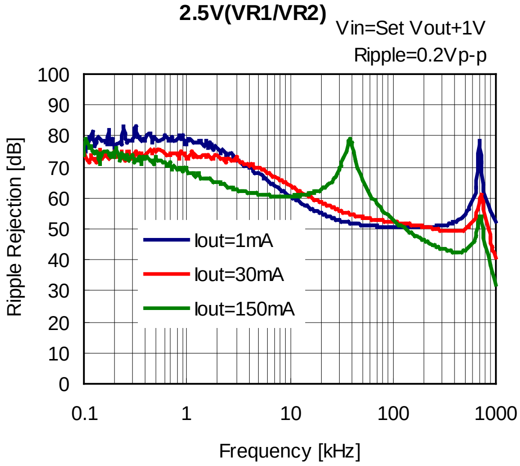


9) Ripple Rejection vs. Frequency (C_{IN} = none, C_{OUT1} = C_{OUT2} = 1.0 µF, Ta = 25°C)

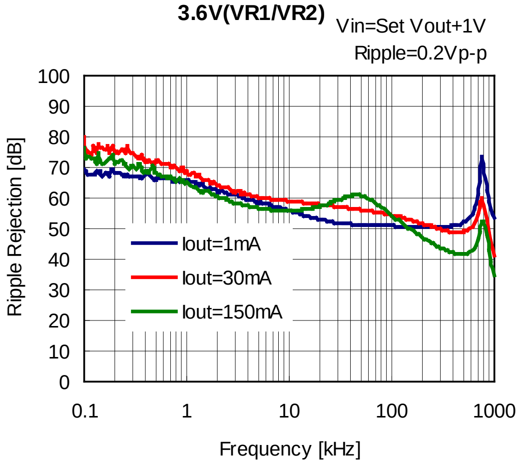
0.8V(VR1/VR2)



2.5V(VR1/VR2)

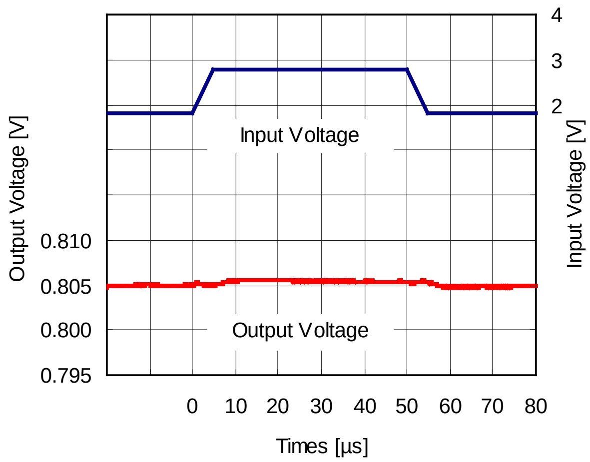


3.6V(VR1/VR2)

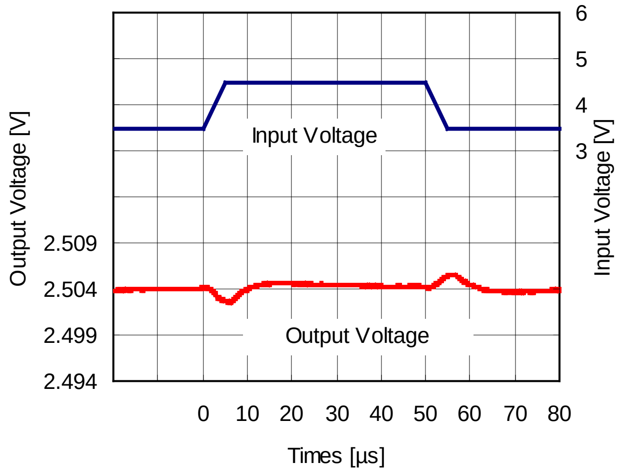


10) Input Transient Response (C_{IN} = none, C_{OUT1} = C_{OUT2} = 1.0 µF, tr = tf = 5 µs, Ta = 25°C)

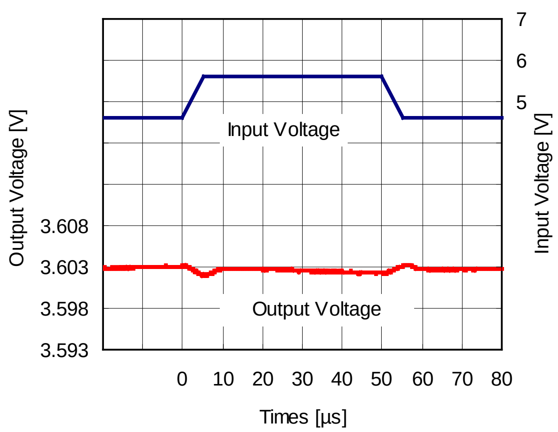
0.8V(VR1/VR2)



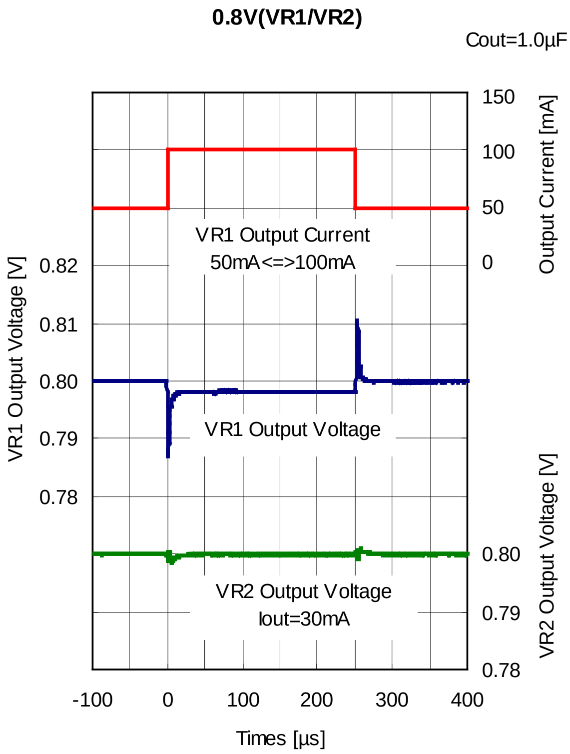
2.5V(VR1/VR2)

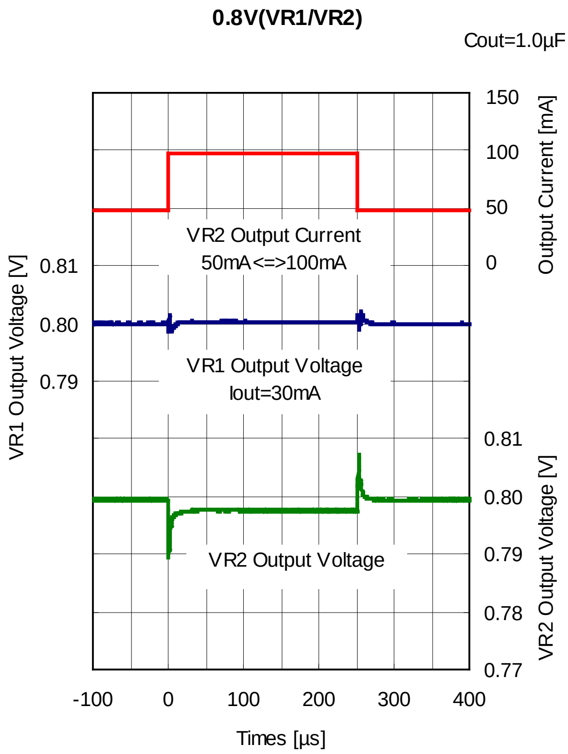


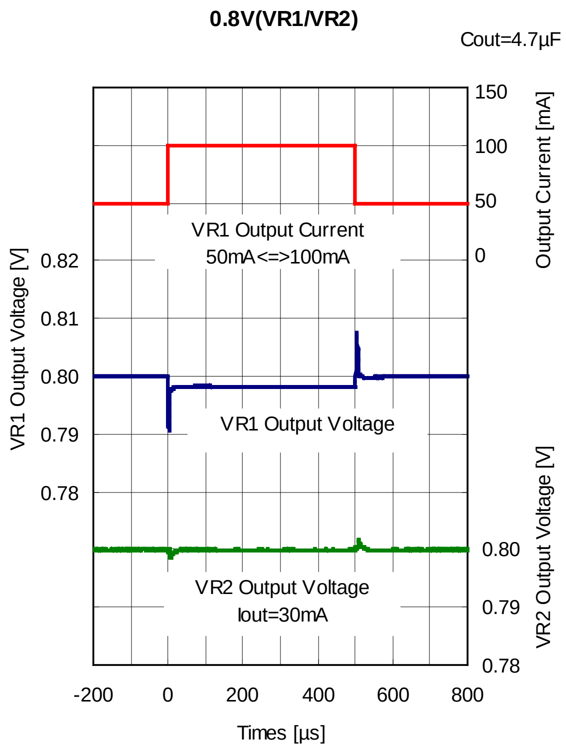
3.6V(VR1/VR2)

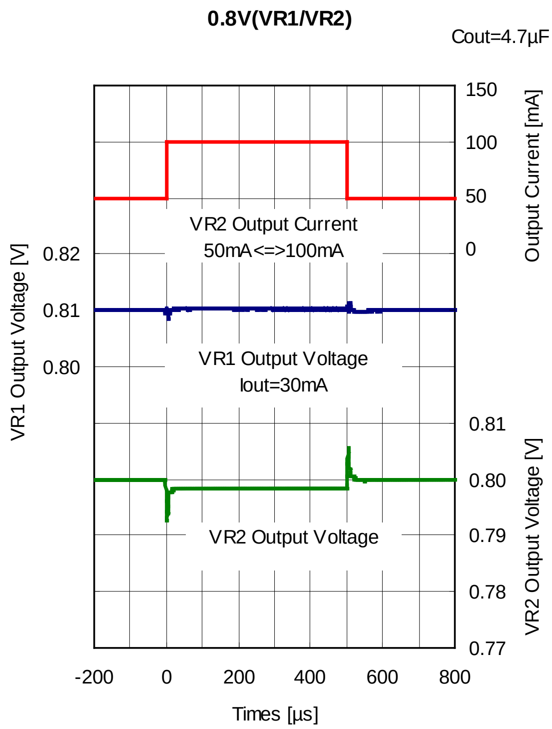


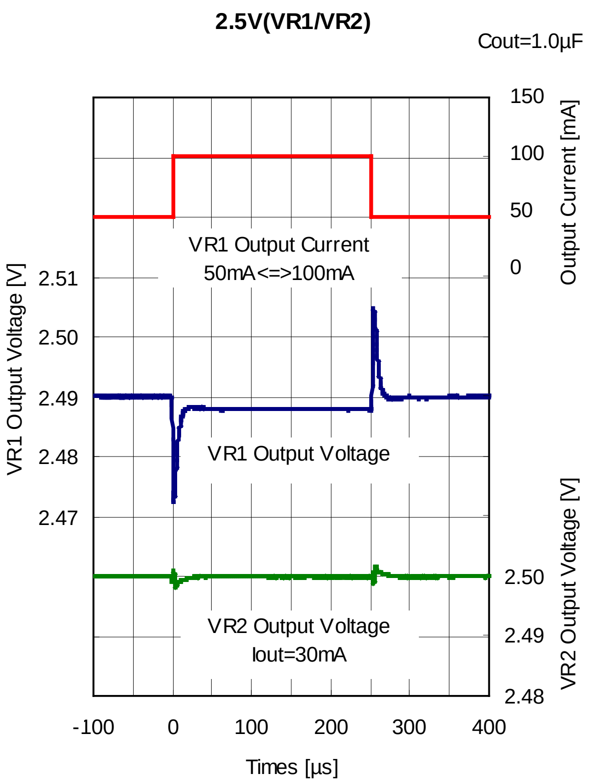
11) Load Transient Response (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF, tr = tf = 0.5 µs, Ta = 25°C)

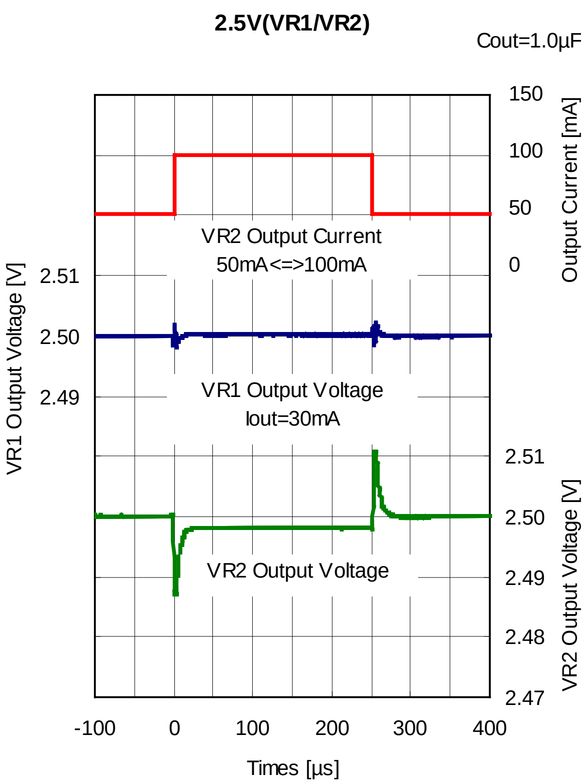


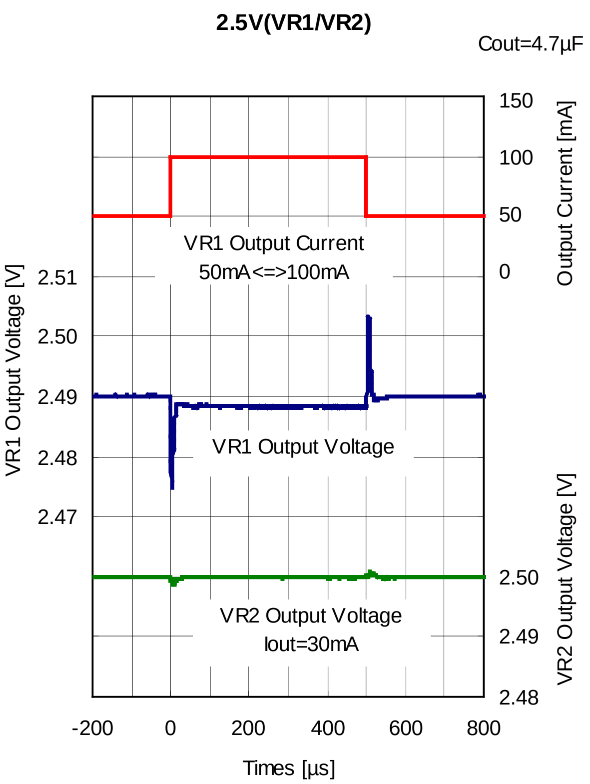


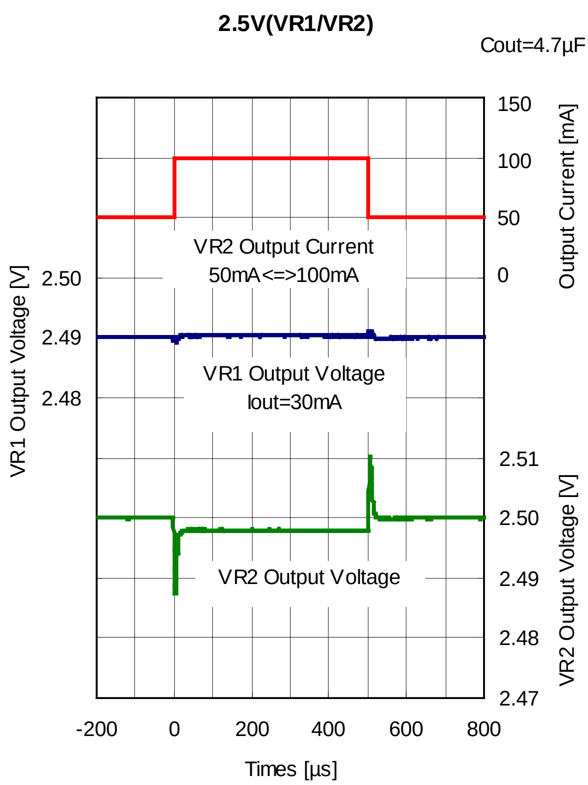


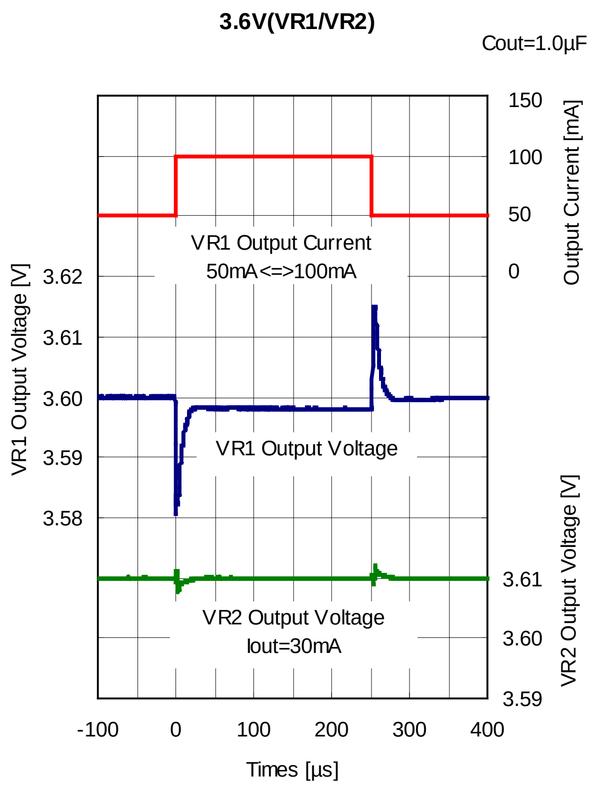


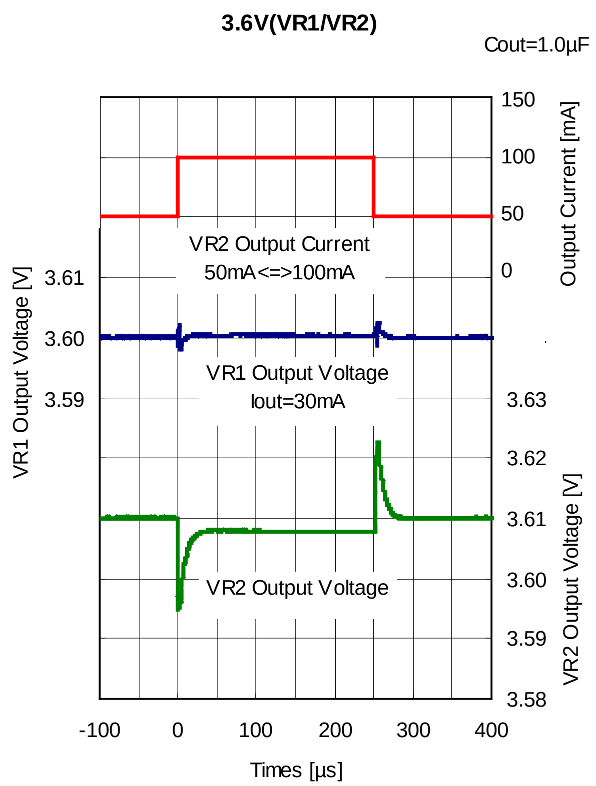

2.5V(VR1/VR2)
Cout=1.0μF
VR1 Output Current
50mA<=>100mA
VR1 Output Voltage
VR2 Output Voltage
Iout=30mA
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]

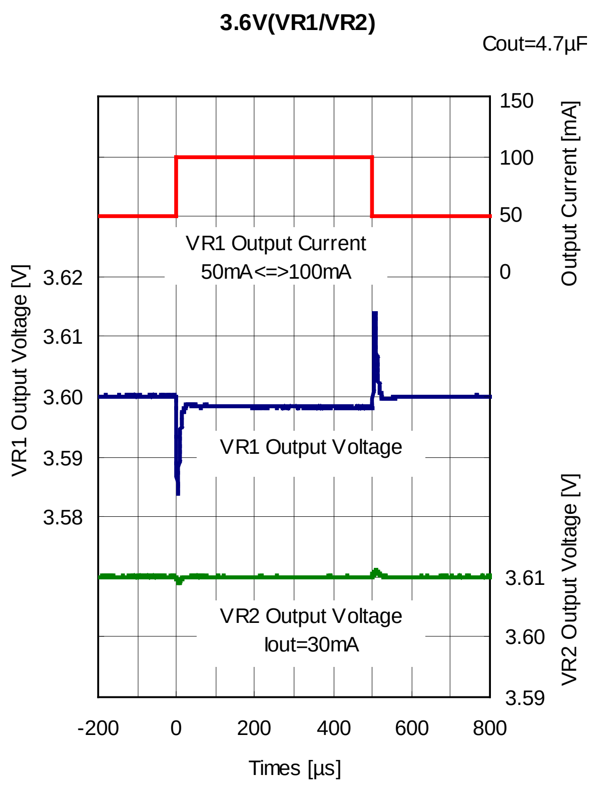

2.5V(VR1/VR2)
Cout=1.0μF
VR2 Output Current
50mA<=>100mA
VR1 Output Voltage
Iout=30mA
VR2 Output Voltage
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]

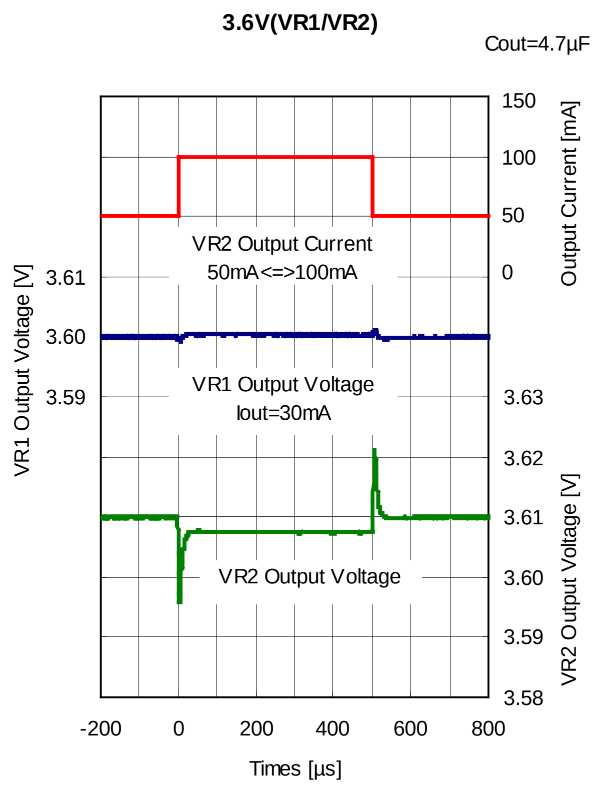

2.5V(VR1/VR2)
Cout=4.7μF
VR1 Output Current
50mA<=>100mA
VR1 Output Voltage
VR2 Output Voltage
Iout=30mA
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]


2.5V(VR1/VR2)
Cout=4.7μF
VR2 Output Current
50mA<=>100mA
VR1 Output Voltage
Iout=30mA
VR2 Output Voltage
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]


3.6V(VR1/VR2)
Cout=1.0μF
VR1 Output Current
50mA<=>100mA
VR1 Output Voltage
VR2 Output Voltage
Iout=30mA
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]

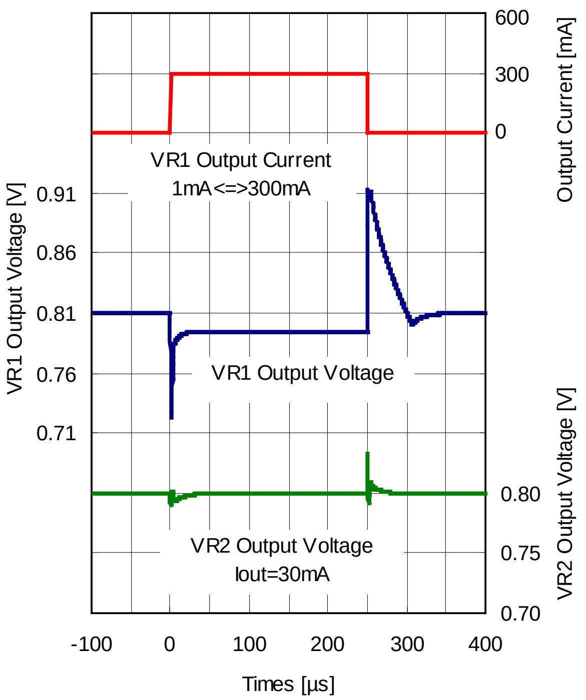

3.6V(VR1/VR2)
Cout=1.0μF
VR2 Output Current
50mA<=>100mA
VR1 Output Voltage
Iout=30mA
VR2 Output Voltage
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]


3.6V(VR1/VR2)
Cout=4.7μF
VR1 Output Current
50mA<=>100mA
VR1 Output Voltage
VR2 Output Voltage
Iout=30mA
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]


3.6V(VR1/VR2)
Cout=4.7μF
VR2 Output Current
50mA<=>100mA
VR1 Output Voltage
Iout=30mA
VR2 Output Voltage
VR1 Output Voltage [V]
Output Current [mA]
VR2 Output Voltage [V]
Times [μs]

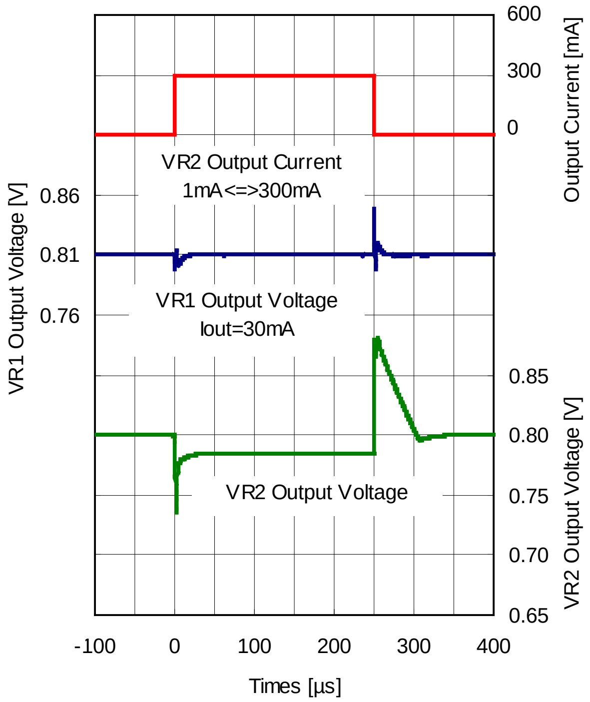
0.8V(VR1/VR2)

Cout=1.0µF



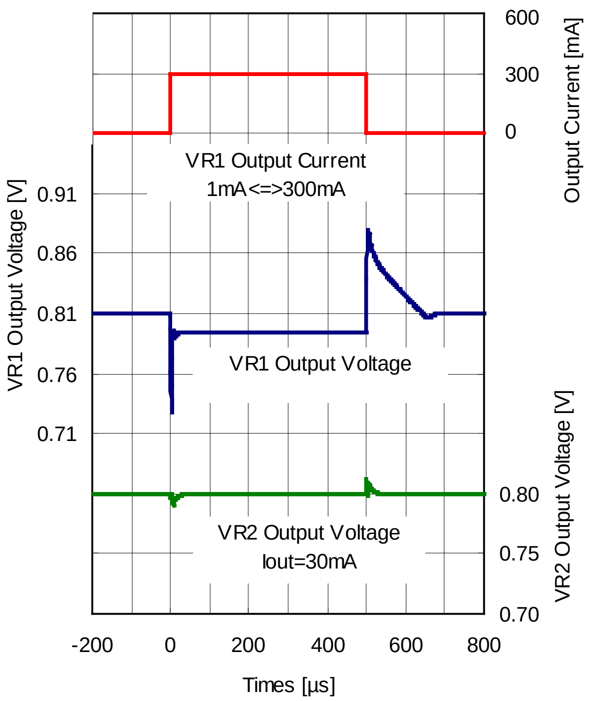
0.8V(VR1/VR2)

Cout=1.0µF



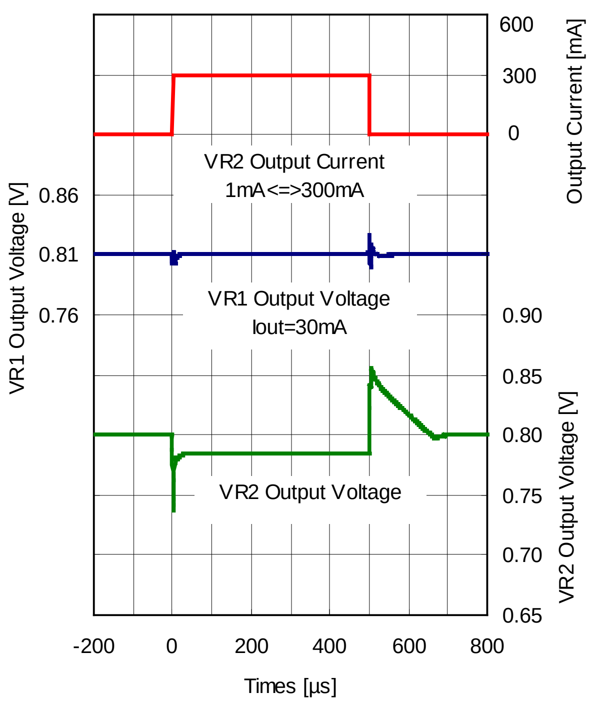
0.8V(VR1/VR2)

Cout=4.7µF



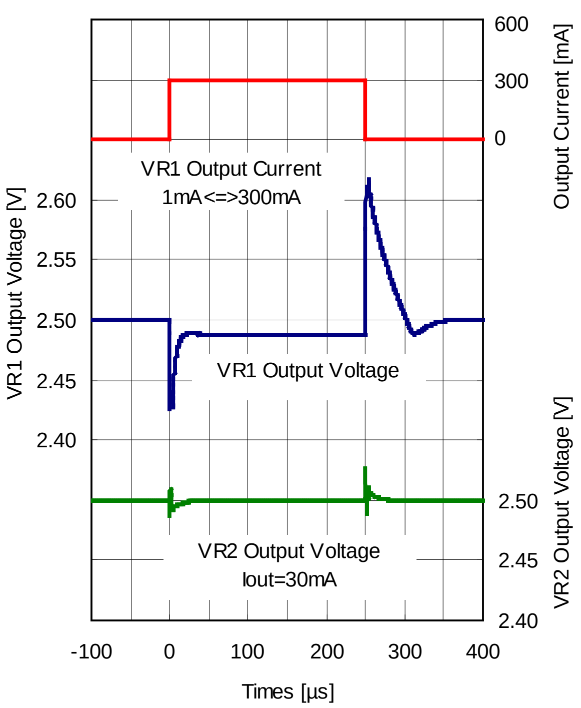
0.8V(VR1/VR2)

Cout=4.7µF



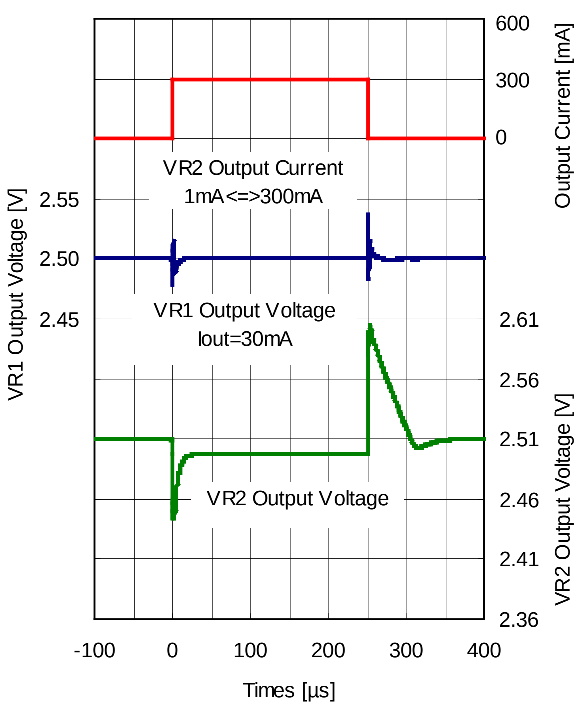
2.5V(VR1/VR2)

Cout=1.0µF



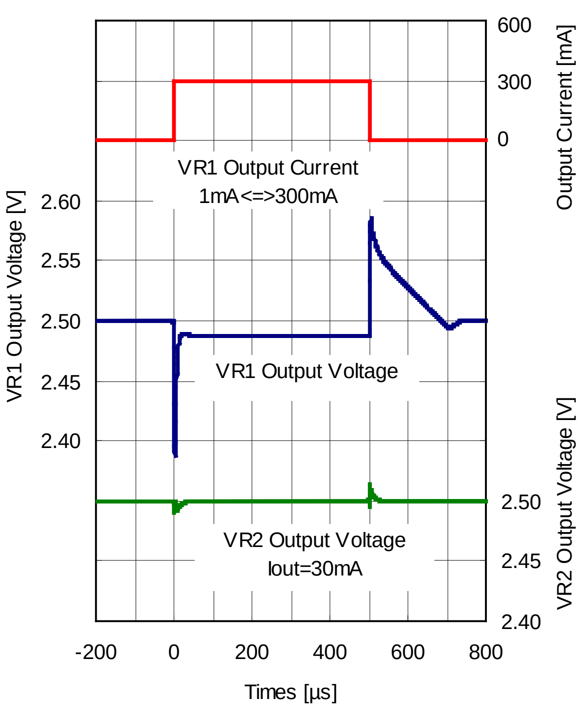
2.5V(VR1/VR2)

Cout=1.0µF



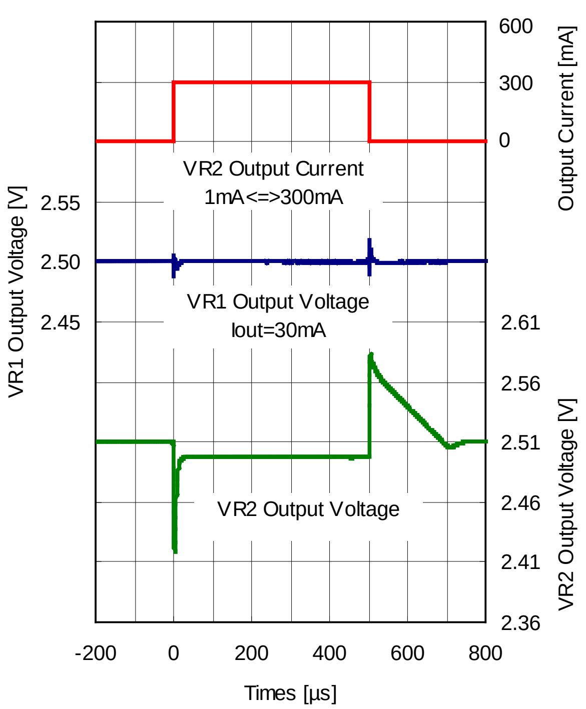
2.5V(VR1/VR2)

Cout=4.7µF



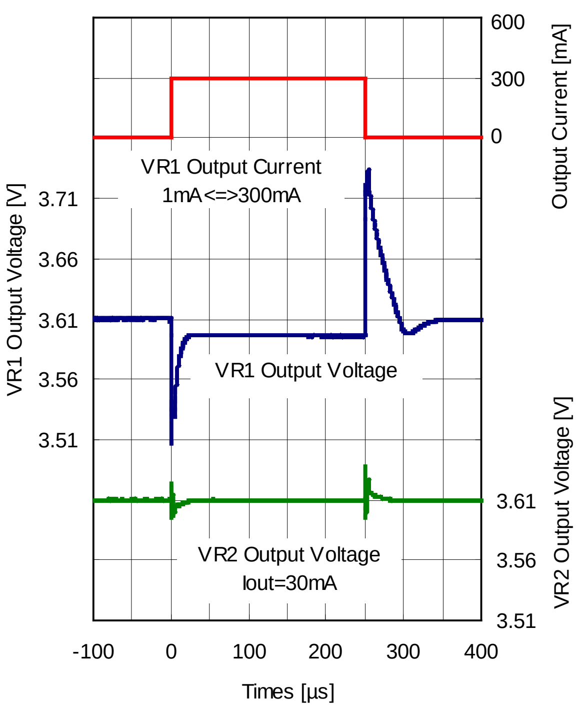
2.5V(VR1/VR2)

Cout=4.7µF



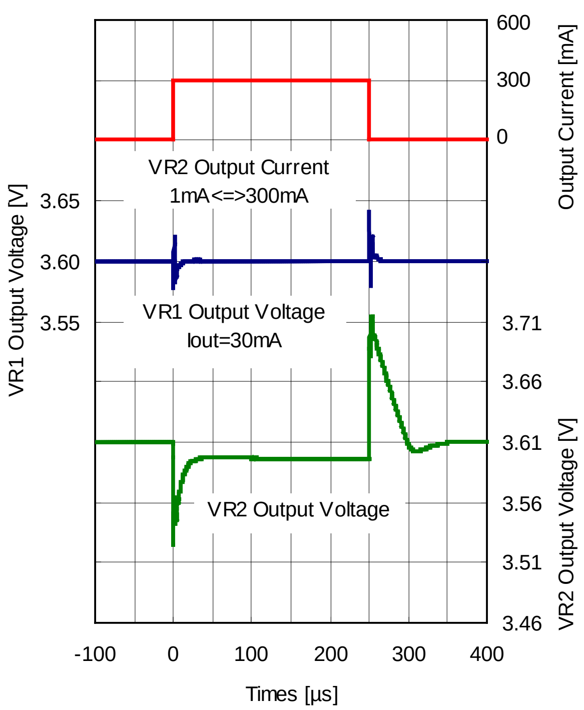
3.6V(VR1/VR2)

Cout=1.0µF



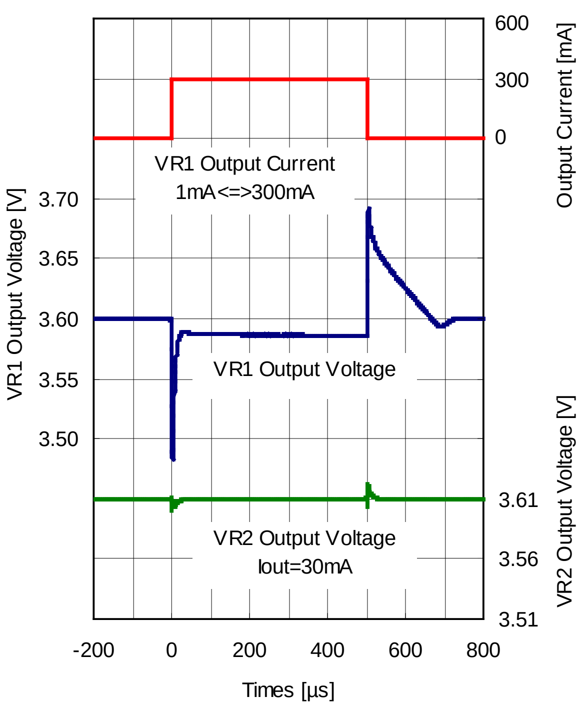
3.6V(VR1/VR2)

Cout=1.0µF



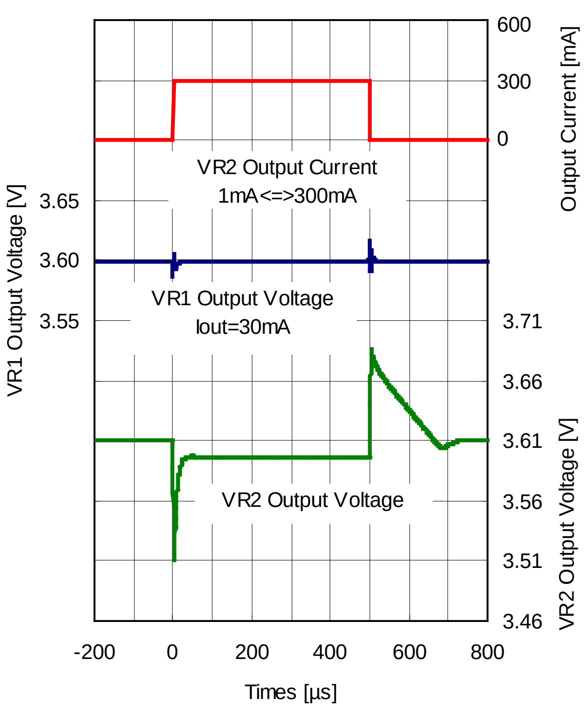
3.6V(VR1/VR2)

Cout=4.7µF



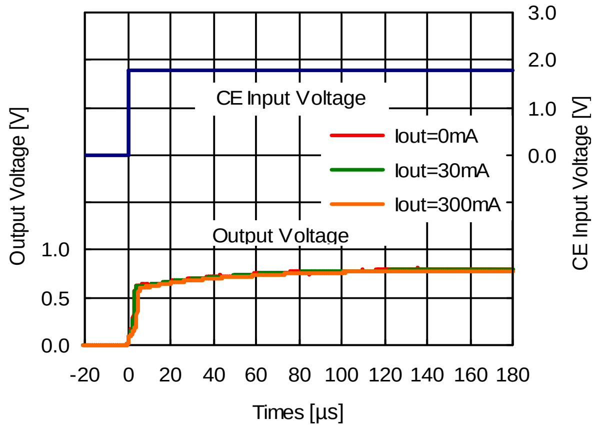
3.6V(VR1/VR2)

Cout=4.7µF

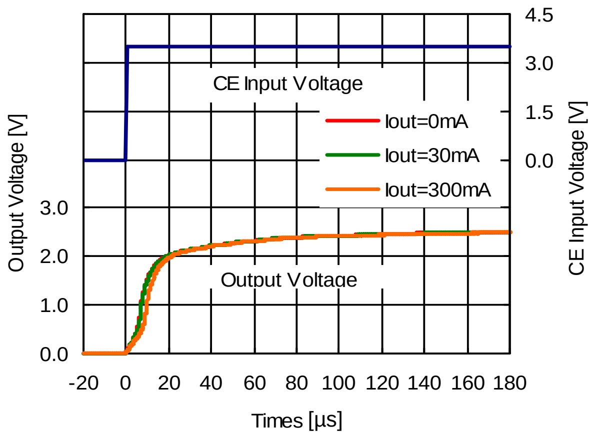


12) Turn On Speed with CE pin (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF, Ta = 25°C)

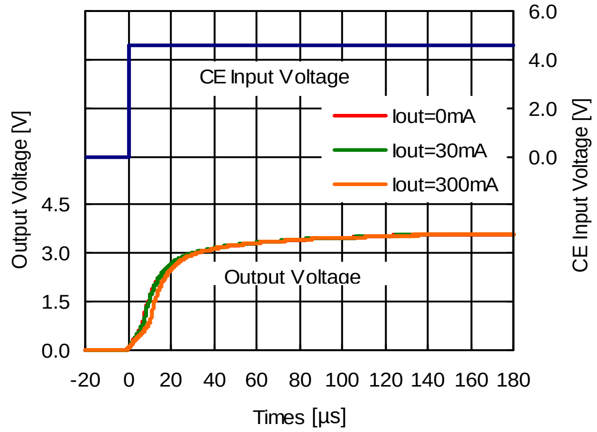
0.8V(VR1/VR2)



2.5V(VR1/VR2)

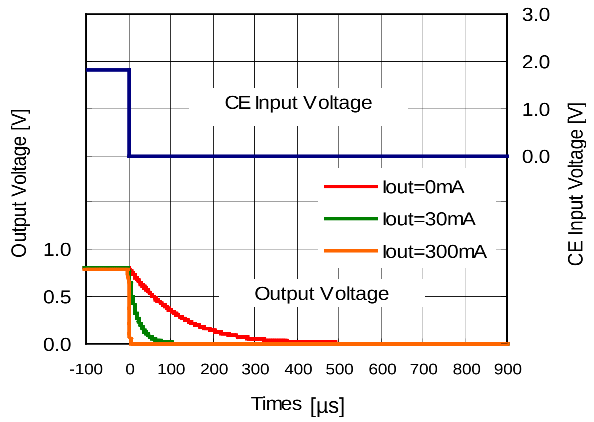


3.6V(VR1/VR2)

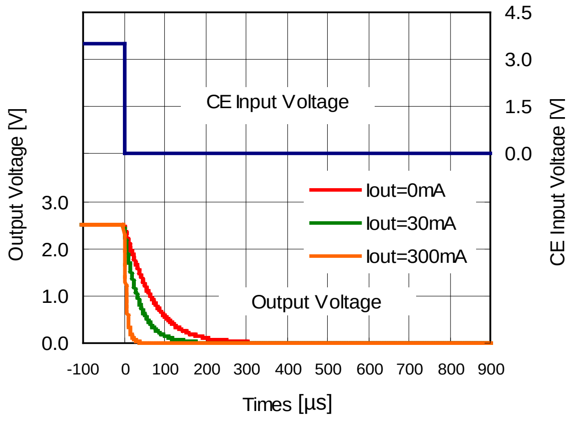


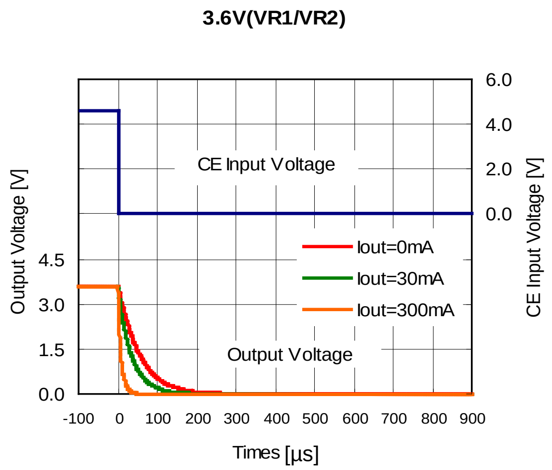
13) Turn Off Speed with CE pin (RP154xxxxB) (C_{IN} = 1.0 µF, C_{OUT1} = C_{OUT2} = 1.0 µF, Ta = 25°C)

0.8V(VR1/VR2)

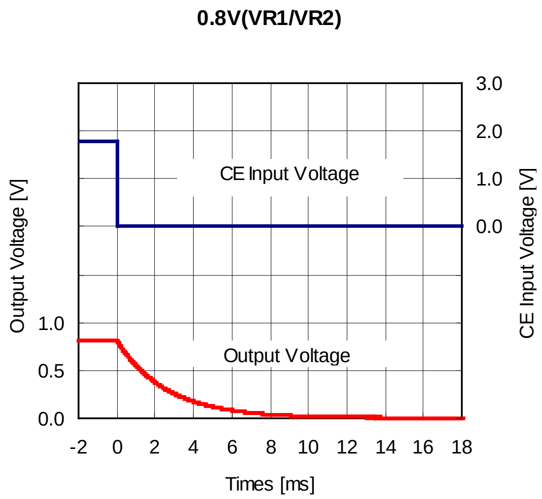


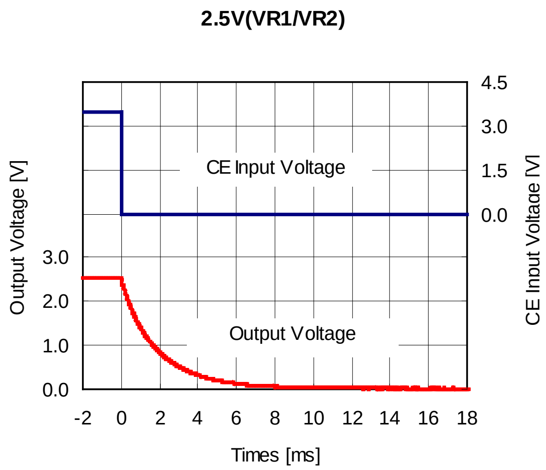
2.5V(VR1/VR2)

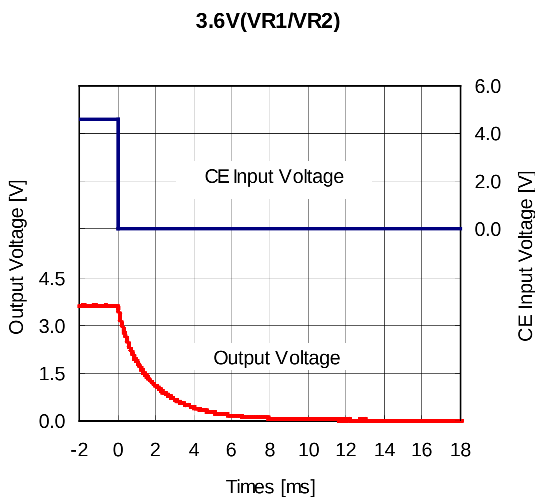




14) Turn Off Speed with CE pin (RP154xxxxA) (C_{IN} = 1.0 μF, C_{OUT1} = C_{OUT2} = 1.0 μF, I_{OUT} = 0 mA, Ta = 25°C)







ESR vs. Output Current

When using these ICs, consider the following points:

The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below.

The conditions when the white noise level is under 40 µV (Avg.) are marked as the hatched area in the graph.

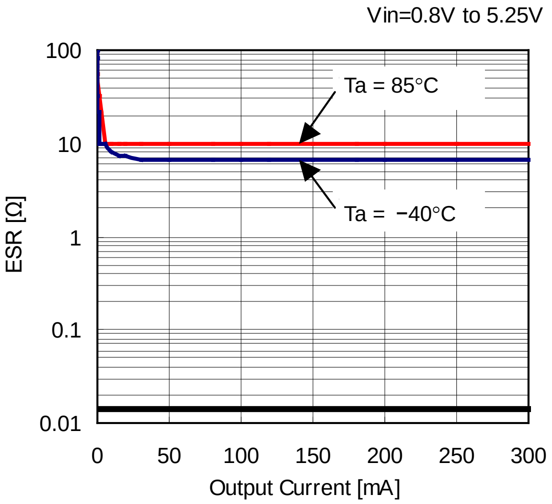
Measurement conditions

Frequency Band: 10 Hz to 2 MHz

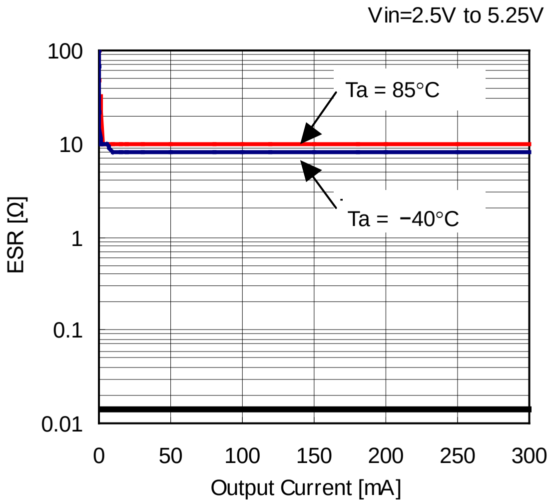
Temperature: −40°C to 85°C

C_{IN}, C_{OUT1}, C_{OUT2}: 1.0 µF

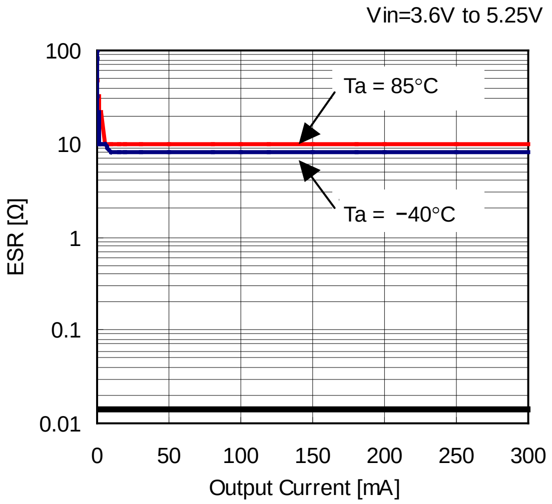
0.8V(VR1/VR2)



2.5V(VR1/VR2)



3.6V(VR1/VR2)



Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

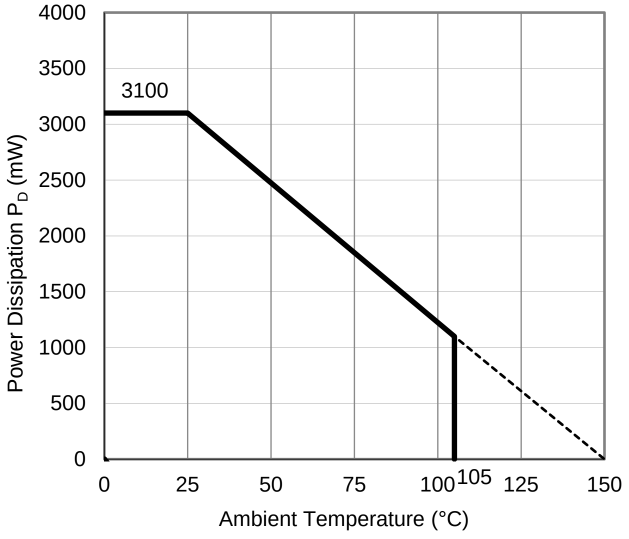
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 23 pcs

Measurement Result (Ta = 25°C, Tjmax = 150°C)

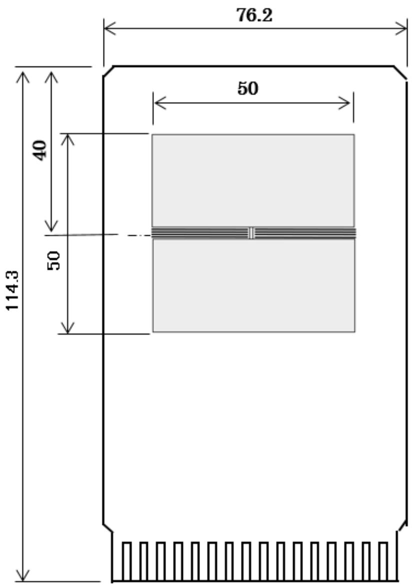
Item	Measurement Result
Power Dissipation	3100 mW
Thermal Resistance (θja)	θja = 40°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 12°C/W

θja: Junction-to-Ambient Thermal Resistance

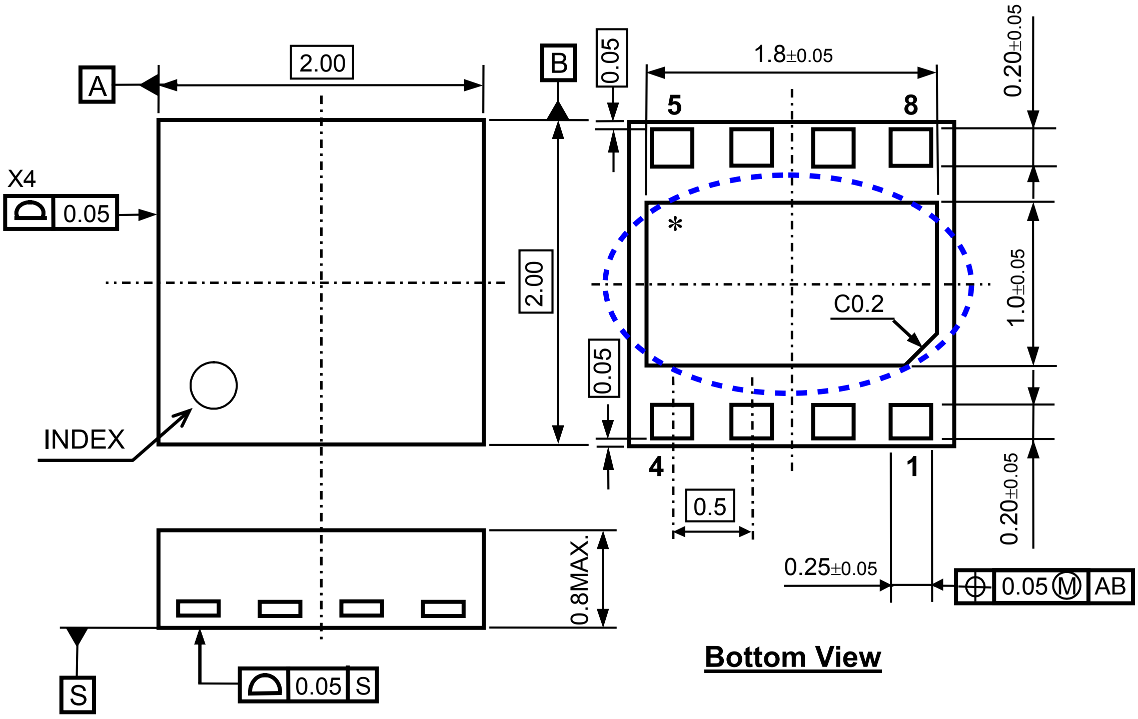
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



DFN2020-8 Package Dimensions (Unit: mm)

* The tab on the bottom of the package is substrate level (GND). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating.

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

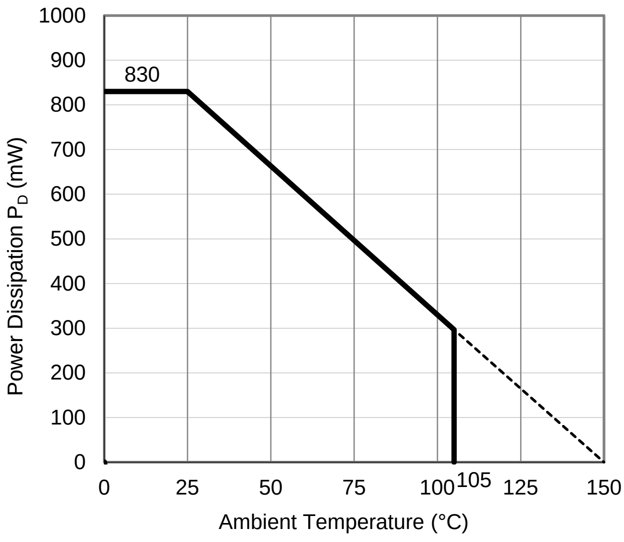
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 7 pcs

Measurement Result (Ta = 25°C, Tjmax = 150°C)

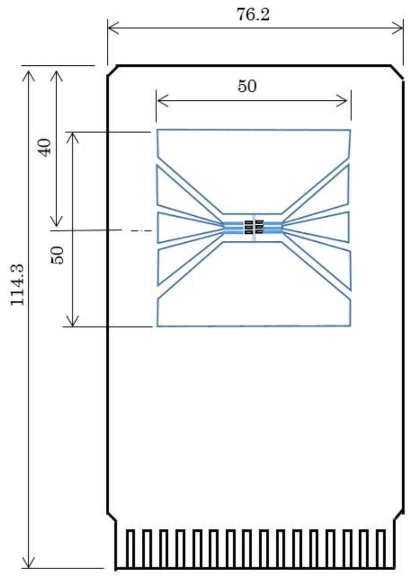
Item	Measurement Result
Power Dissipation	830 mW
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter

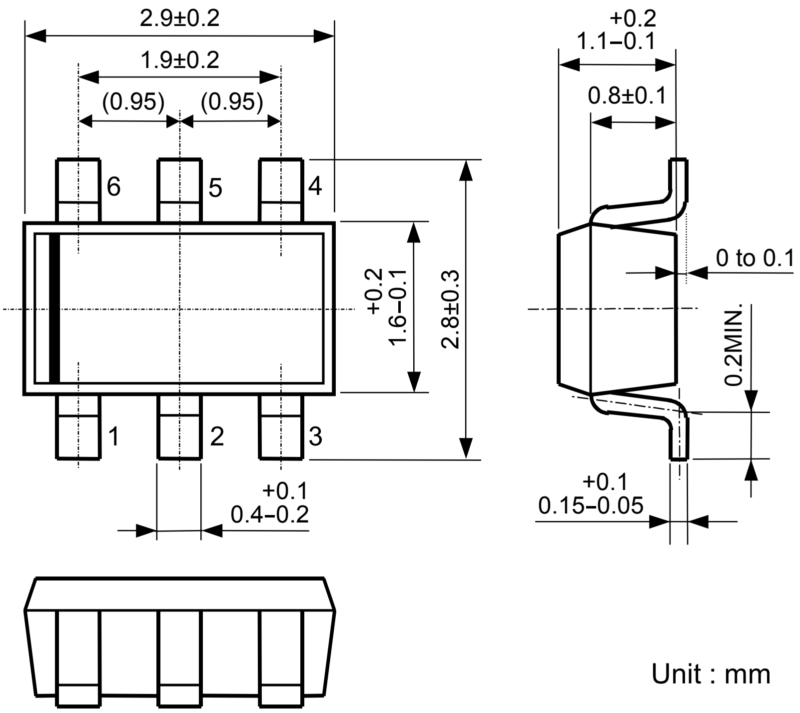


Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

Ver. A



SOT-23-6 Package Dimensions

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7. Anti-radiation design is not implemented in the products described in this document.
8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
10. There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or our distributor before attempting to use AOI.
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