RICOH

R1518x Series

AEC-Q100 Grade 1 Compliant

1 A 36V Input Low Supply Current LDO for Automotive Applications

NO.EC-329-141222

OUTLINE

R1518x is a CMOS-based LDO that specifically designed for automotive applications featuring 1 A output current and 36 V input voltage. In addition to a conventional regulator circuit, R1518x consists of a constant slope circuit as a soft-start function, a fold-back protection circuit, a short current limit circuit, and a thermal shutdown circuit. Besides the low supply current by CMOS, the operating temperature is −40°C to 125°C and the maximum input voltage is 36 V, the R1518x is very suitable for power source of car accessories.

R1518x is available in R1518xxxxB/D/E/F with the internally fixed output voltage, and R1518xxxxD/F with the auto-discharge function at standby.

R1518J001C can adjust the output voltage with an external resistor. R1518xxxxB/C/D internally fixes the soft-start time at 120 µs (Typ). R1518Jxx1E/F can adjust the soft-start time with an external capacitor.

R1518x is available in two packages for ultra high wattage: HSOP-6J and TO-252-5-P2.

FEATURES

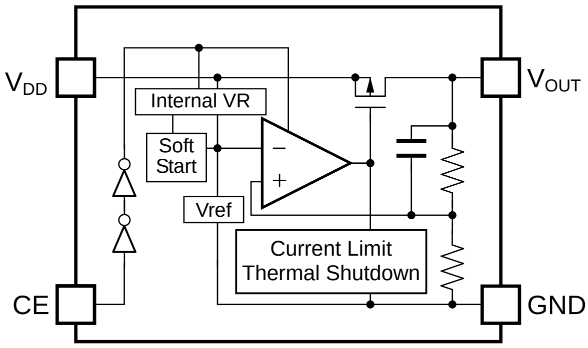
- Input Voltage Range (Maximum Rating) ·············· 3.5 V to 36.0 V (50.0V)
- Operating Temperature range ··························· –40°C to 125°C
- Supply Current··· Typ. 18 µA
- Standby Current·· Typ. 0.1 µA
- Dropout Voltage ·· Typ. 0.7 V (I_{OUT} = 1 A, V_{OUT} = 5.0 V)
- Output Voltage Accuracy································· ±0.8% (V_{OUT} ≤ 5.0 V)
- Temperature-Drift Coefficient of Output Voltage····· Typ. ±60 ppm/°C (−40°C ≤ Ta ≤ 125°C)
- Line Regulation··· Typ. 0.01%/V
- Packages ·· HSOP-6J, TO-252-5-P2
- Output Voltage Range ···································· R1518xxxxB/D/E/F: 2.5 V/2.8 V/3.0 V/3.3 V/3.4 V/5.0 V/ 6.0 V/8.0 V/8.5 V/9.0 V
  *Contact Ricoh sales representatives for other voltages.
  R1518J001C: Adjustable from 2.5 V to 12.0 V with external resistor
  Feedback Voltage: 2.5 V
- Built-in Short Current Limit Circuit ······················ Typ. 150 mA
- Built-in Fold-Back Protection Circuit···················· Min. 1.1 A
- Built-in Thermal Shutdown Circuit ······················ Typ. 160°C
- Built-in Soft-start Circuit ·································· R1518xxxxB/C/D: Typ.120 µs
  R1518Jxx1E/F: Time adjustable
- Ceramic Capacitors can be used ······················· R1518xxxxB/D/E/F: 0.1 µF or more
  R1518J001C: 1.0 µF or more

APPLICATIONS

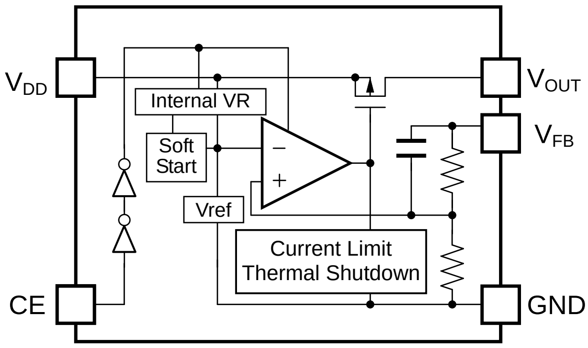
- Power source for car accessories including car audio equipment, car navigation system, and ETC system.
- Power source for control units including EV inverter and charge control.

BLOCK DIAGRAMS

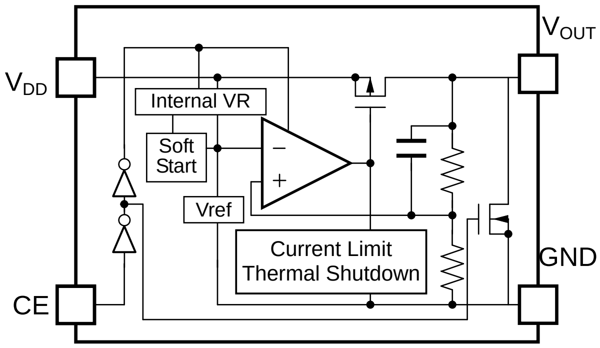
R1518xxxxB



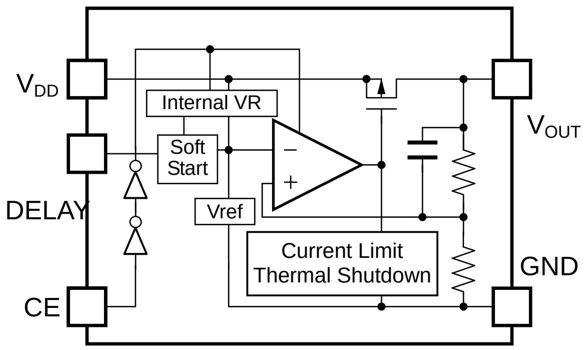
R1518J001C



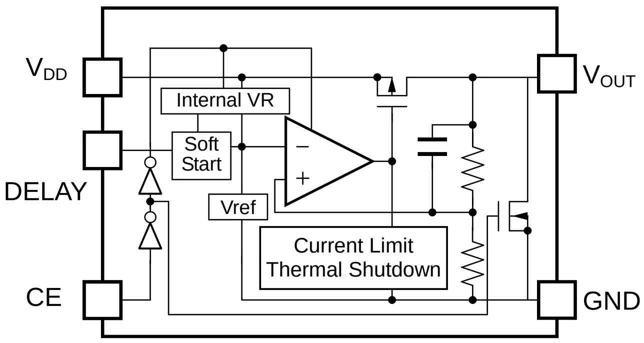
R1518xxxxD



R1518Jxx1E



R1518Jxx1F



SELECTION GUIDE

The output voltage, version, and package type for this device can be selected at the user's request.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1518Sxx2∗-E2-#E	HSOP-6J	1,000 pcs	Yes	Yes
R1518Jxx1∗-T1-#E	TO-252-5-P2	3,000 pcs	Yes	Yes

xx: Specify the set output voltage (V_{SET})
2.5 V (25) / 2.8 V (28) / 3.0 V (30) / 3.3 V (33) / 3.4 V (34) / 5.0 V (50) / 6.0 V (60) / 8.0 V (80) / 8.5 V (85) / 9.0 V (90)
Note: Contact Ricoh sales representatives for other voltages.
Adjustable output voltage setting type is fixed to (00)
Note: R1518J001C-T1-#E only support

∗ : Specify the version with desired functions
B: No auto-discharge function
C: No auto-discharge function / Adjustable output voltage setting
D: Auto-discharge function
E: No auto-discharge function / Adjustable soft-start time setting
F: Auto-discharge function / Adjustable soft-start time setting

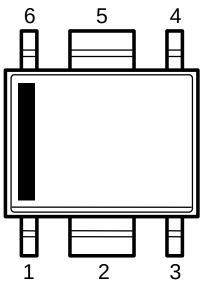
Note: R1518Sxx2∗-E2-#E can provide R1518Sxx2B/D only.

: Specify Automotive Class Code

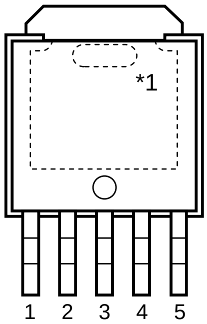
	Operating Temperature Range	Guaranteed Specs Temperature Range	Screening
A	−40°C to 125°C	25°C	High temperature
K	−40°C to 125°C	−40°C to 125°C	High and low temperature

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

PIN DESCRIPTION



HSOP-6J



TO-252-5-P2

HSOP-6J

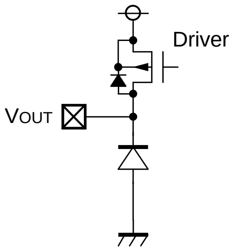
Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	GND	Ground Pin
3	GND	Ground Pin
4	CE	Chip Enable Pin, Active-high
5	GND	Ground Pin
6	V_{OUT}	Output Pin

TO-252-5-P2

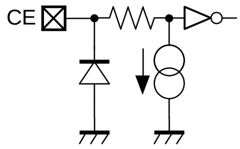
Pin No.	Symbol	Description	
1	V_{DD}	Input Pin	
2	NC	No Connection	R1518Jxx1B/D
	V_{FB}	Feedback Pin	R1518J001C
	DELAY	Adjustable Soft-start Time Pin	R1518Jxx1E/F
3	GND	Ground Pin	
4	CE	Chip Enable Pin, Active-high	
5	V_{OUT}	Output Pin	

[*1] The tab on the bottom of the package enhances thermal performance and is electrically connected to GND (substrate level). The tab is recommended to connect to the ground plane on the board. Otherwise it may be left floating.

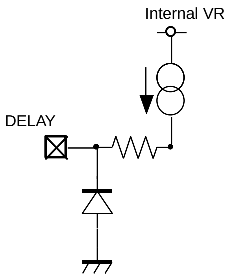
PIN EQUIVALENT CIRCUIT DIAGRAMS



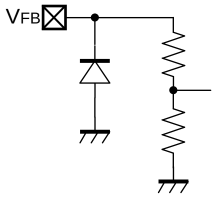
V_{OUT} Pin



CE Pin



DELAY Pin
(R1518Jxx1E/F)



V_{FB} Pin
(R1518J001C)

ABSOLUTE MAXMUM RATINGS

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage		−0.3 to 50	V
V_{IN}	Peak Input Voltage*2		60	V
V_{CE}	Input Voltage (CE Pin)		−0.3 to 50	V
V_{FB}	Input Voltage (V_{FB} Pin)		−0.3 to 50	V
V_{OUT}	Output Voltage		−0.3 to V_{IN} + 0.3 ≤ 50	V
P_D	Power Dissipation (HSOP-6J)*3	Standard Land Pattern	2100	mW
		Ultra High Wattage Land Pattern	3400	
	Power Dissipation (TO-252-5-P2)*3	Standard Land Pattern	2350	
		Ultra High Wattage Land Pattern	4800	
Tj	Junction Temperature		−40 to 150	°C
Tstg	Storage Temperature Range		−55 to 150	°C

*2 Duration time = 200 ms
*3 Refer to *PACKAGE INFORMATION* for detailed information.

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 CONDITION

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	3.5 to 36	V
Ta	Operating Temperature Range	−40 to 125	°C

RECOMMENDED OPERATING CONDITION
All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating condition. The semiconductor devices cannot operate normally over the recommended operating condition, 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 condition.

ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{SET}$ + 1.0 V, I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 0.1 μF, unless otherwise noted.

The specifications surrounded by □ are guaranteed by design engineering at -40°C ≤ Ta ≤ 125°C.

R1518xxxxB/D (-AE) (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{SET} ≤ 5.0 V	×0.992		×1.008	V
			V_{SET} > 5.0 V	×0.99		×1.01	V
		−40°C ≤ Ta ≤ 125°C	V_{SET} ≤ 5.0 V	×0.982		×1.018	V
			V_{SET} > 5.0 V	×0.98		×1.02	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	$V_{IN} = V_{SET}$ + 2.0 V 1mA ≤ I_{OUT} ≤ 250 mA		−15	3	25	mV
		$V_{IN} = V_{SET}$ + 2.0 V 1mA ≤ I_{OUT} ≤ 1 A		−60	10	60	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 1 A		Refer to the *Product-specific Electrical Characteristics*			
I_{SS}	Supply Current	I_{OUT} = 0 mA			18	36	μA
Istandby	Standby Current	V_{CE} = 0 V			0.1	2.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	V_{SET} + 0.5 V ≤ V_{IN} ≤ 36 V, if V_{IN} ≤ 3.5 V			0.01	0.02	%/V
I_{LIM}	Output Current Limit	$V_{IN} = V_{SET}$ +2.0 V		1.1	1.8	2.5	A
I_{SC}	Short Current Limit	V_{OUT} = 0 V		110	180	250	mA
I_{PD}	CE Pull-down Current	V_{CE} = 5 V			0.2	0.6	μA
		V_{CE} = 36 V			0.5	1.3	μA
t_{D1}	Soft-start Time 1				120		μs
V_{CEH}	CE Input Voltage "H"			2.2		3.6	V
V_{CEL}	CE Input Voltage "L"			0		1.0	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature		150	160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature		125	135		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (R1518xxxxD)	V_{IN} = 14.0 V, V_{CE} = 0 V		1.0	3.2	5.0	kΩ

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj ≈ Ta = 25°C) except for Soft-start Time 1.

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V_{IN} = V_{SET} + 1.0 V, I_{OUT} = 1 mA, C_{IN} = 0.1 μF, C_{OUT} = 1.0 μF, unless otherwise noted.

The specifications surrounded by [ ] are guaranteed by design engineering at -40°C ≤ Ta ≤ 125°C.

R1518J001C (-AE) (Ta = 25°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{FB}	Feedback Voltage	Ta = 25°C	2.480		2.520	V
		−40°C ≤ Ta ≤ 125°C	[2.455]		[2.545]	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN} = V_{SET} +2.0 V 1mA ≤ I_{OUT} ≤ 250 mA	[−10]	3	[10]	mV
		V_{IN} = V_{SET} +2.0 V 1 mA ≤ I_{OUT} ≤ 1 A	[−25]	5	[35]	mV
V_{DIF}	Dropout Voltage	V_{SET} = V_{FB}, I_{OUT} = 1 A		1.0	1.8	V
I_{SS}	Supply Current	I_{OUT} = 0 mA		18	[36]	μA
Istandby	Standby Current	V_{CE} = 0 V		0.1	[2.0]	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	V_{SET} = V_{FB}, 3.5 V ≤ V_{IN} ≤ 36 V		0.01	[0.02]	%/V
I_{LIM}	Output Current Limit	V_{IN} = V_{SET} +2.0 V	[1.1]	1.8	[2.5]	A
I_{SC}	Short Current Limit	V_{OUT} = V_{FB} = 0 V	[110]	180	[250]	mA
I_{PD}	CE Pull-down Current	V_{CE} = 5 V		0.2	[0.6]	μA
		V_{CE} = 36 V		0.5	[1.3]	μA
t_{D1}	Soft-start Time 1			120		μs
V_{CEH}	CE Input Voltage "H"		[2.2]		[36]	V
V_{CEL}	CE Input Voltage "L"		[0]		[1.0]	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature	[150]	160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature	[125]	135		°C

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj ≈ Ta = 25°C) except for Soft-start Time 1.

V_{IN} = V_{SET} + 1.0 V, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 0.1 μF, unless otherwise noted.

The specifications surrounded by ☐ are guaranteed by design engineering at -40°C ≤ Ta ≤ 125°C.

R1518Jxx1E/F (-AE) (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{SET} ≤ 5.0 V	×0.992		×1.008	V
			V_{SET} > 5.0 V	×0.99		×1.01	V
		−40°C ≤ Ta ≤ 125°C	V_{SET} ≤ 5.0 V	×0.982		×1.018	V
			V_{SET} > 5.0 V	×0.98		×1.02	V
ΔV_{OUT} /ΔI_{OUT}	Load Regulation	V_{IN} = V_{SET} +2.0 V 1 mA ≤ I_{OUT} ≤ 250 mA		−15	3	25	mV
		V_{IN} = V_{SET} +2.0 V 1 mA ≤ I_{OUT} ≤ 1 A		−60	10	60	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 1 A		Refer to the *Product-specific Electrical Characteristics*			
I_{SS}	Supply Current	I_{OUT} = 0 mA			18	36	μA
Istandby	Standby Current	V_{CE} = 0 V			0.1	2.0	μA
ΔV_{OUT} /ΔV_{IN}	Line Regulation	V_{SET} +0.5 V ≤ V_{IN} ≤ 36 V, if V_{IN} ≤ 3.5 V			0.01	0.02	%/V
I_{LIM}	Output Current Limit	V_{IN} = V_{SET} +2.0 V		1.1	1.8	2.5	A
I_{SC}	Short Current Limit	V_{OUT} = 0 V		110	180	250	mA
I_{PD}	CE Pull-down Current	V_{CE} = 5 V			0.2	0.6	μA
		V_{CE} = 36 V			0.5	1.3	μA
I_{DELAY}	DELAY Current	DELAY = GND		1.5	2.5	3.5	μA
t_{D1}	Soft-start Time 1	DELAY = OPEN			26		μs
t_{D2}	Soft-start Time 2	DELAY = 0.001 μF		210	290	415	μs
V_{CEH}	CE Input Voltage "H"			2.2		36	V
V_{CEL}	CE Input Voltage "L"			0		1.0	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature		150	160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature		125	135		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (R1518Jxx1F)	V_{IN} = 14.0 V, V_{CE} = 0 V		1.0	3.2	5.0	kΩ

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj ≈ Ta = 25°C) except for Soft-start Time 1 and Soft-start Time 2.

The specifications surrounded by [ ] are guaranteed by design engineering at -40°C ≤ Ta ≤ 125°C.

R1518Jxx1B/D/E/F (-AE), R1518Sxx2B/D (-AE) Product-specific Electrical Characteristics (Ta = 25°C)

Product Name	V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 125°C)			V_{DIF} [V]	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
R1518x25xx	2.480	2.500	2.520	2.455	2.500	2.545	1.00	1.80
R1518x28xx	2.778	2.800	2.822	2.750	2.800	2.850		
R1518x30xx	2.976	3.000	3.024	2.946	3.000	3.054		
R1518x33xx	3.274	3.300	3.326	3.241	3.300	3.359	0.90	1.60
R1518x34xx	3.373	3.400	3.427	3.339	3.400	3.461		
R1518x50xx	4.960	5.000	5.040	4.910	5.000	5.090	0.70	1.30
R1518x60xx	5.940	6.000	6.060	5.880	6.000	6.120		
R1518x80xx	7.920	8.000	8.080	7.840	8.000	8.160		
R1518x85xx	8.415	8.500	8.585	8.330	8.500	8.670	0.65	1.10
R1518x90xx	8.910	9.000	9.090	8.820	9.000	9.180		

$V_{IN} = V_{SET} + 1.0$ V, $I_{OUT} = 1$ mA, $C_{IN} = C_{OUT} = 0.1$ μF, unless otherwise noted.

R1518xxxxB/D (-KE) (−40 ≤ Ta ≤ 125°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{SET} ≤ 5.0 V	×0.992		×1.008	V
			V_{SET} > 5.0 V	×0.99		×1.01	V
		−40°C ≤ Ta ≤ 125°C	V_{SET} ≤ 5.0 V	×0.982		×1.018	V
			V_{SET} > 5.0 V	×0.98		×1.02	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	$V_{IN} = V_{SET}$ +2.0 V 1 mA ≤ I_{OUT} ≤ 250 mA		−15	3	25	mV
		$V_{IN} = V_{SET}$ +2.0 V 1 mA ≤ I_{OUT} ≤ 1 A		−60	10	60	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 1 A		Refer to the *Product-specific Electrical Characteristics*			
I_{SS}	Supply Current	I_{OUT} = 0 mA			18	36	μA
Istandby	Standby Current	V_{CE} = 0 V			0.1	2.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	V_{SET} +0.5 V ≤ V_{IN} ≤ 36 V, if V_{IN} ≤ 3.5 V			0.01	0.02	%/V
I_{LIM}	Output Current Limit	$V_{IN} = V_{SET}$ +2.0 V		1.1	1.8	2.5	A
I_{SC}	Short Current Limit	V_{OUT} = 0 V		110	180	250	mA
I_{PD}	CE Pull-down Current	V_{CE} = 5 V			0.2	0.6	μA
		V_{CE} = 36 V			0.5	1.3	μA
V_{CEH}	CE Input Voltage "H"			2.2		36	V
V_{CEL}	CE Input Voltage "L"			0		1.0	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature		150	160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature		125	135		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (R1518xxxxD)	V_{IN} = 14.0 V, V_{CE} = 0 V		1.0	3.2	5.0	kΩ

V_{IN} = V_{SET} +1.0 V, I_{OUT} = 1 mA, C_{IN} = 0.1 μF, C_{OUT} = 1.0 μF, unless otherwise noted.

R1518J001C (-KE) (−40 ≤ Ta ≤ 125°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{FB}	Feedback Voltage	Ta = 25°C	2.480		2.520	V
		−40°C ≤ Ta ≤ 125°C	2.455		2.545	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN} = V_{SET} + 2.0 V 1 mA ≤ I_{OUT} ≤ 250 mA	−10	3	10	mV
		V_{IN} = V_{SET} + 2.0 V 1mA ≤ I_{OUT} ≤ 1 A	−25	5	35	mV
V_{DIF}	Dropout Voltage	V_{SET} = V_{FB}, I_{OUT} = 1 A		1.0	1.8	V
I_{SS}	Supply Current	I_{OUT} = 0 mA		18	36	μA
Istandby	Standby Current	V_{CE} = 0 V		0.1	2.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	V_{SET} = V_{FB}, 3.5 V ≤ V_{IN} ≤ 36 V		0.01	0.02	%/V
I_{LIM}	Output Current Limit	V_{IN} = V_{SET} + 2.0 V	1.1	1.8	2.5	A
I_{SC}	Short Current Limit	V_{OUT} = V_{FB} = 0 V	110	180	250	mA
I_{PD}	CE Pull-down Current	V_{CE} = 5 V		0.2	0.6	μA
		V_{CE} = 36 V		0.5	1.3	μA
V_{CEH}	CE Input Voltage "H"		2.2		36	V
V_{CEL}	CE Input Voltage "L"		0		1.0	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature	150	160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature	125	135		°C

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V_{IN} = V_{SET} +1.0 V, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 0.1 μF, unless otherwise noted.

R1518Jxx1E/F (-KE) (−40 ≤ Ta ≤ 125°C)

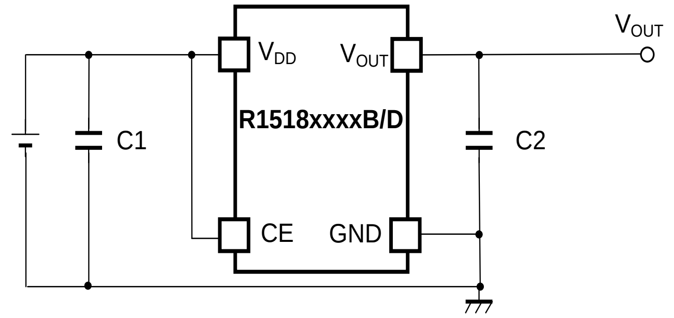
Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{SET} ≤ 5.0 V	×0.992		×1.008	V
			V_{SET} > 5.0 V	×0.99		×1.01	V
		−40°C ≤ Ta ≤ 125°C	V_{SET} ≤ 5.0 V	×0.982		×1.018	V
			V_{SET} > 5.0 V	×0.98		×1.02	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN} = V_{SET} + 2.0 V 1 mA ≤ I_{OUT} ≤ 250 mA		−15	3	25	mV
		V_{IN} = V_{SET} + 2.0 V 1 mA ≤ I_{OUT} ≤ 1 A		−60	10	60	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 1 A		Refer to the *Product-specific Electrical Characteristics*			
I_{SS}	Supply Current	I_{OUT} = 0 mA			18	36	μA
Istandby	Standby Current	V_{CE} = 0 V			0.1	2.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	V_{SET} + 0.5 V ≤ V_{IN} ≤ 36 V, if V_{IN} ≤ 3.5 V			0.01	0.02	%/V
V_{IN}	Input Voltage			3.5		36	V
I_{LIM}	Output Current Limit	V_{IN} = V_{SET} + 2.0 V		1.1	1.8	2.5	A
I_{SC}	Short Current Limit	V_{OUT} = 0 V		110	180	250	mA
I_{PD}	CE Pull-down Current	V_{CE} = 5 V			0.2	0.6	μA
		V_{CE} = 36 V			0.5	1.3	μA
I_{DELAY}	DELAY Current	DELAY = GND		1.5	2.5	3.5	μA
V_{CEH}	CE Input Voltage "H"			2.2		36	V
V_{CEL}	CE Input Voltage "L"			0		1.0	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature		150	160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature		125	135		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (R1518Jxx1F)	V_{IN} = 14.0 V, V_{CE} = 0 V		1.0	3.2	5.0	kΩ

R1518Jxx1B/D/E/F (-KE), R1518Sxx2B/D (-KE) Product-specific Electrical Characteristics

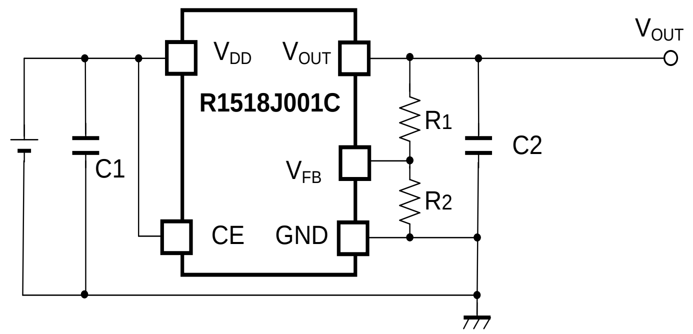
(−40 ≤ Ta ≤ 125°C)

Product Name	V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 125°C)			V_{DIF} [V]	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
R1518x25xx	2.480	2.500	2.520	2.455	2.500	2.545	1.00	1.80
R1518x28xx	2.778	2.800	2.822	2.750	2.800	2.850		
R1518x30xx	2.976	3.000	3.024	2.946	3.000	3.054		
R1518x33xx	3.274	3.300	3.326	3.241	3.300	3.359	0.90	1.60
R1518x34xx	3.373	3.400	3.427	3.339	3.400	3.461		
R1518x50xx	4.960	5.000	5.040	4.910	5.000	5.090	0.70	1.30
R1518x60xx	5.940	6.000	6.060	5.880	6.000	6.120		
R1518x80xx	7.920	8.000	8.080	7.840	8.000	8.160		
R1518x85xx	8.415	8.500	8.585	8.330	8.500	8.670	0.65	1.10
R1518x90xx	8.910	9.000	9.090	8.820	9.000	9.180		

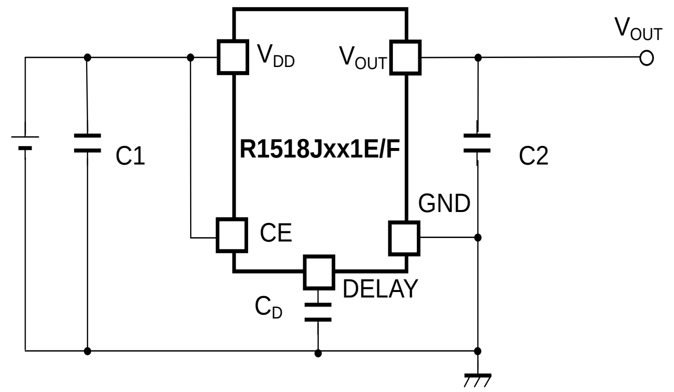
TYPICAL APPLICATION



R1518xxxxB/D Typical Application



R1518J001C Typical Application



R1518Jxx1E/F Typical Application

External Components：

Symbol	Description
R1518xxxxB//D/E/F	
C1	0.1µF (Ceramic)
C2	0.1µF (Ceramic)
R1518J001C	
C1	0.1µF (Ceramic)
C2	1.0µF (Ceramic)

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TECHNICAL NOTES

Phase Compensation

In LDO regulators, phase compensation is provided to secure stable operation even when the load current is varied. For this purpose, use 0.1 µF or more (R1518xxxxB/D/E/F), 1.0 µF or more (R1518J001C) of the capacitor C2. When using a tantalum type capacitor and the ESR (Equivalent Series Resistance) value is large, the output might be unstable. Evaluate the circuit including consideration of frequency characteristics.

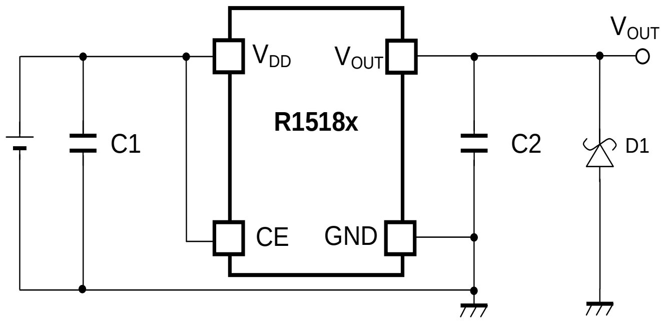
For the externally adjustable output voltage type (R1518J001C), use 10 kΩ or lower resistance R2.

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 0.1 µF or more of the capacitor C1 between the V_{DD} and GND, and as close as possible to the pins.

In addition, connect the capacitor C2 between V_{OUT} and GND, and as close as possible to the pins.

TYPICAL APPLICATION FOR IC CHIP BREAKDOWN PROVENTION



When a sudden surge of electrical current travels along the V_{OUT} 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 V_{OUT} pin and GND has the effect of preventing damage to them.

OPERATION DESCRIPTION

Thermal Shutdown Function

Thermal shutdown function is included in this device. If the junction temperature is more than or equal to 160°C (Typ.), the operation of the regulator would stop. After that, when the junction temperature is less than or equal to 135°C (Typ.), the operation of the regulator would restart. Unless the cause of rising temperature is removed, the regulator repeats on and off, and output waveform would be like consecutive pulses.

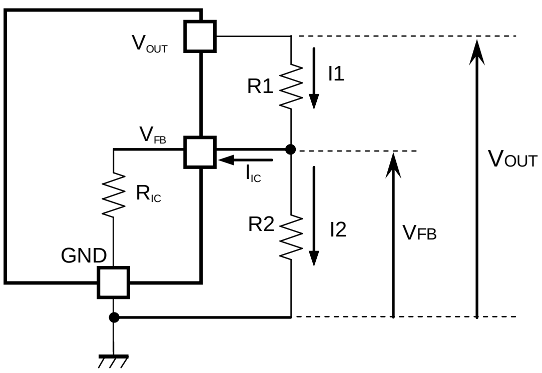
Adjustable Output Voltage Setting (R1518J001C)

The output voltage of R1518J001C can be adjusted by using the external divider resistors (R1, R2). By using the following equation, the output voltage (V_{OUT}) can be determined. The voltage which is fixed inside the IC is described as V_{FB}.

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

Recommended Range: $2.5\text{ V} \leq V_{OUT} \leq 12.0\text{ V}$

$V_{FB} = 2.5\text{ V}$



Output Voltage Adjustment Using External Divider Resistors (R1, R2)

R_{IC} of the R1518J001C is approximately Typ. 1.35 MΩ (Ta=25°C, guaranteed by design engineering). For better accuracy, setting R1 << R_{IC} reduces errors. The resistance value for R2 should be set to 10 kΩ or lower. It is easily affected by noises when setting the value of R1 and R2 larger, which makes the impedance of V_{FB} pin larger.

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.

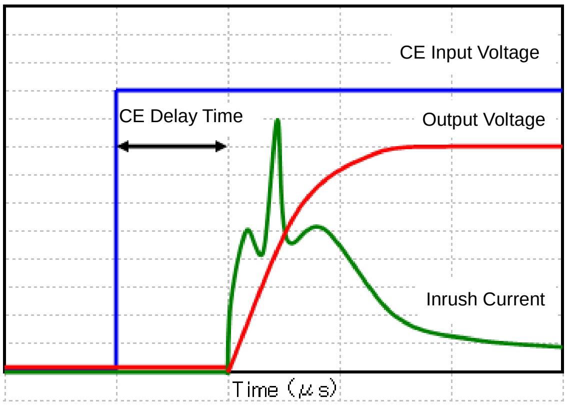
Soft-start Function

R1518x is equipped with a constant slope circuit, which achieves a soft-start function. This circuit allows the output voltage to start up gradually when the CE is turned on. The constant slope circuit minimizes the inrush current at the start-up and also prevents the overshoot of the output voltage. For R1518xxxxB/C/D, the capacitor to create the start-up slope is built in this device that does not require any external components. The start-up time and the start-up slope angle are fixed inside the device. As for R1518Jxx1E/F, the soft-start time is adjustable by inserting the external capacitor to DELAY pin. By using the following equation, the relation between the soft-start time t_D [s] and DELAY pin capacitor C_D [F] is determined.

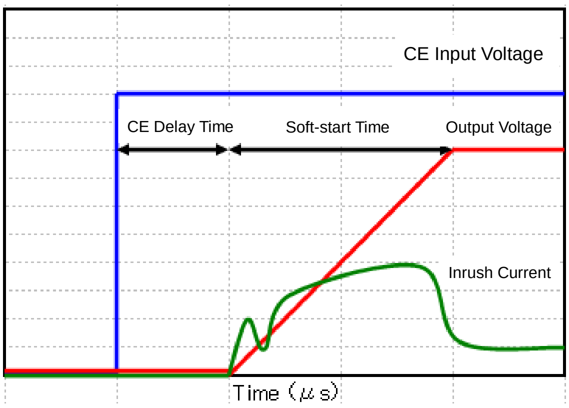
$$t_D = ((C_D + 90 \times 10^{-12}) / I_{DELAY}) \times 0.73$$

When the capacitor C_D of R1518Jxx1E/F is not used, use the DELAY pin as OPEN. At that time, $C_D = 0$ in the above equation, therefore the start-up time is about 26 µs. However, be sure to consider approximately 50 µs of CE delay time.

Conventional Inrush Current Limit Circuit
(Diagrammatic sketch)



Constant Slope Circuit
(Diagrammatic sketch)



PACKAGE INFORMATION

POWER DISSIPATION (HSOP-6J)

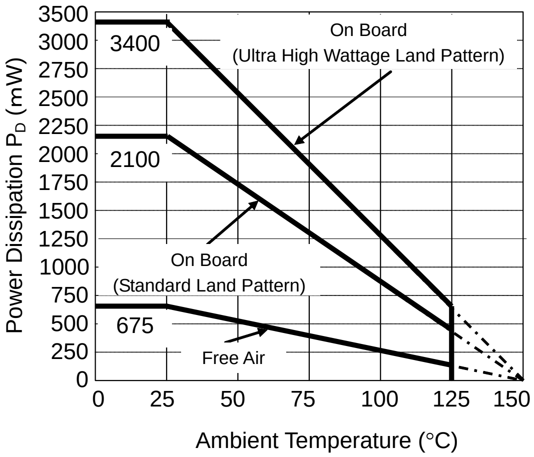
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

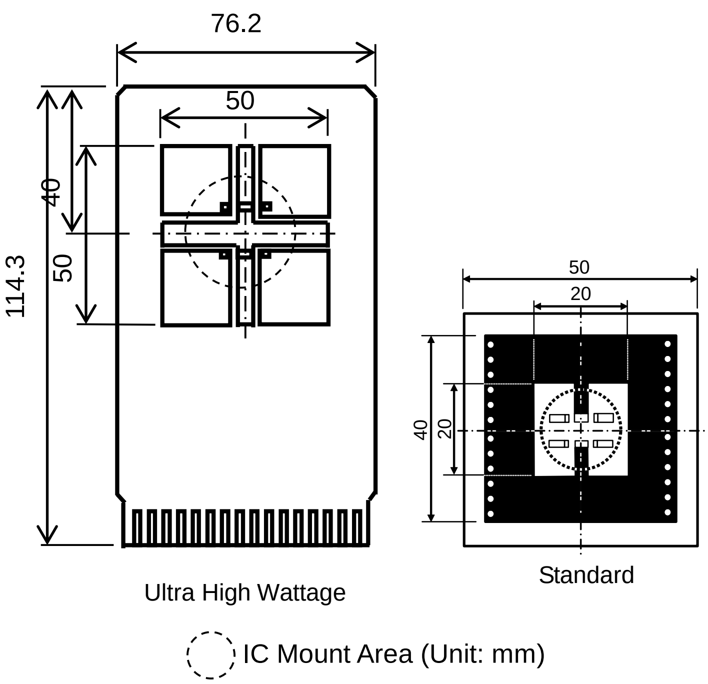
	Ultra High Wattage Land Pattern	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0 m/s)	Mounting on Board (Wind velocity=0 m/s)
Board Material	Glass cloth epoxy plastic (Four-layers)	Glass cloth epoxy plastic (Double layers)
Board Dimensions	76.2 mm x 114.3 mm x 0.8 mm	50 mm x 50 mm x 1.6 mm
Copper Ratio	96%	50%
Through-hole	ϕ0.3 mm x 28 pcs	ϕ0.5 mm x 24 pcs

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

	Ultra High Wattage Land Pattern	Standard Land Pattern	Free Air
Power Dissipation	3400 mW	2100 mW	675 mW
Thermal Resistance	37°C/W	59°C/W	185°C/W



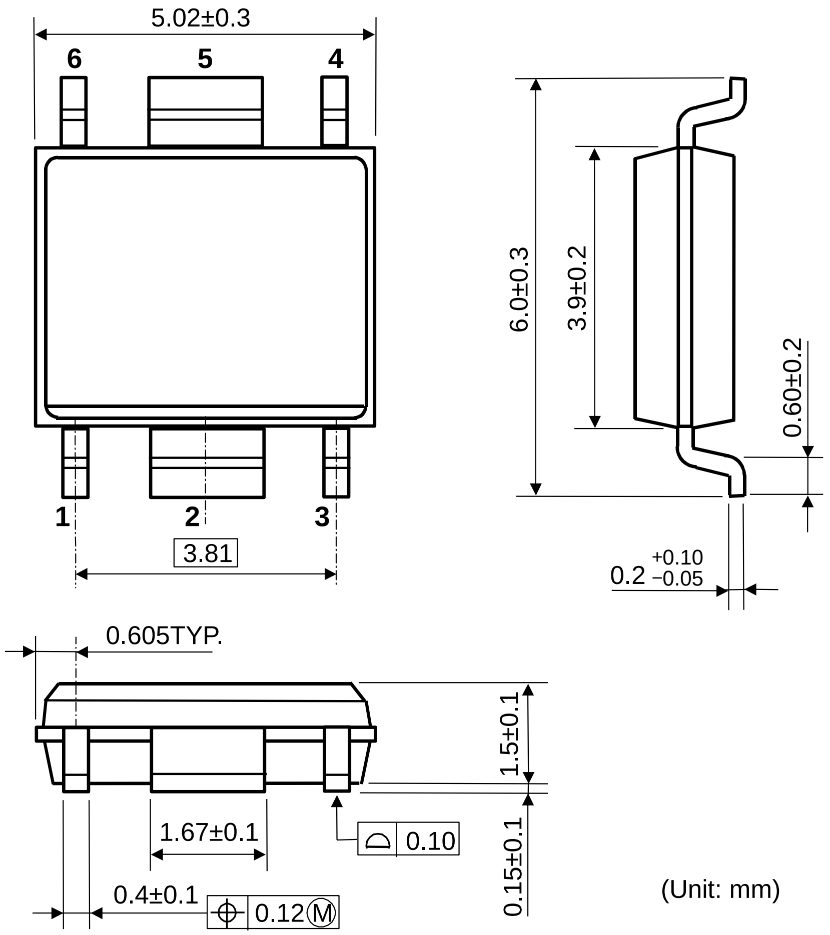
Power Dissipation



Power Dissipation vs. Ambience Temperature

Measurement Board Pattern

PACKAGE DIMENSIONS (HSOP-6J)

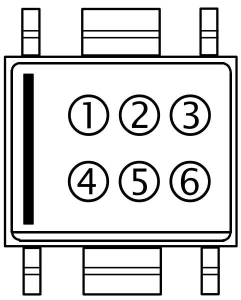


HSOP-6J Package Dimensions

MARK SPECIFICATION (HSOP-6J)

①②③④: Product Code … **Refer to “*R1518S MARK SPECIFICATION TABLE (HSOP-6J)*”**

⑤⑥: Lot Number … Alphanumeric Serial Number



HSOP-6J Mark Specification

R1518S MARK SPECIFICATION TABLE (HSOP-6J)

R1518Sxx2B

Product Name	①②③④	V_{SET}
R1518S252B	**W 6 2 5**	2.5 V
R1518S282B	**W 6 2 8**	2.8 V
R1518S302B	**W 6 3 0**	3.0 V
R1518S332B	**W 6 3 3**	3.3 V
R1518S342B	**W 6 3 4**	3.4 V
R1518S502B	**W 6 5 0**	5.0 V
R1518S602B	**W 6 6 0**	6.0 V
R1518S802B	**W 6 8 0**	8.0 V
R1518S852B	**W 6 8 5**	8.5 V
R1518S902B	**W 6 9 0**	9.0 V

R1518Sxx2D

Product Name	①②③④	V_{SET}
R1518S252D	**W 7 2 5**	2.5 V
R1518S282D	**W 7 2 8**	2.8 V
R1518S302D	**W 7 3 0**	3.0 V
R1518S332D	**W 7 3 3**	3.3 V
R1518S342D	**W 7 3 4**	3.4 V
R1518S502D	**W 7 5 0**	5.0 V
R1518S602D	**W 7 6 0**	6.0 V
R1518S802D	**W 7 8 0**	8.0 V
R1518S852D	**W 7 8 5**	8.5 V
R1518S902D	**W 7 9 0**	9.0 V

POWER DISSIPATION (TO-252-5-P2)

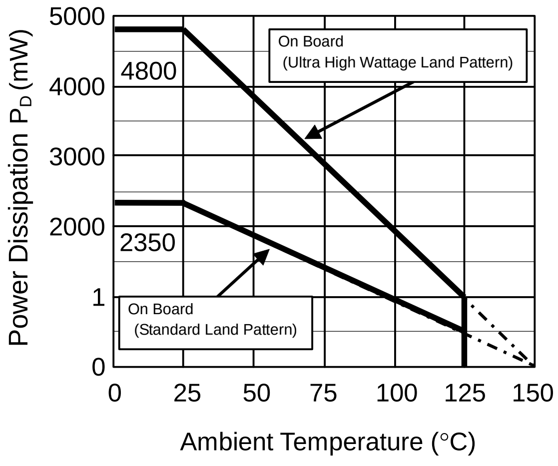
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

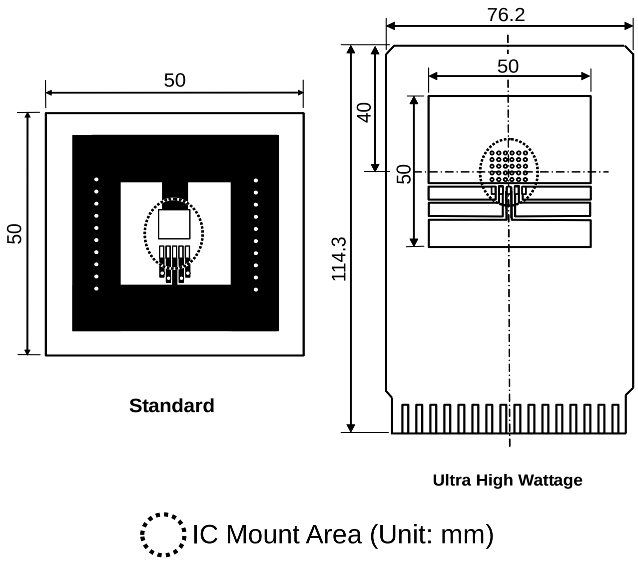
	Ultra High Wattage Land Pattern	Standard Land Pattern
Environment	Mounting on board (Wind velocity 0 m/s)	
Board Material	Glass cloth epoxy plastic (Four-layers)	Glass cloth epoxy plastic (Double layers)
Board Dimensions	76.2 mm x 114.3 mm x 0.8 mm	50 mm x 50 mm x 1.6 mm
Copper Ratio	Top, Back side: Approx. 96%, 2nd, 3rd: 100%	Top side: Approx. 50%, Back side: Approx. 50%
Through - hole	ϕ 0.4 mm x 30 pcs	ϕ 0.5 mm x 24 pcs

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

	Ultra High Wattage Land Pattern	Standard Land Pattern
Power Dissipation	4800 mW	2350 mW
Thermal Resistance	θja= (150-25°C)/4.8 W = 26°C/W	θja=(150-25°C)/2.35 W= 53°C/W
	θjc= 7°C/W	θjc= 17°C/W



Power Dissipation



Power Dissipation vs. Ambience Temperature

Measurement Board Pattern

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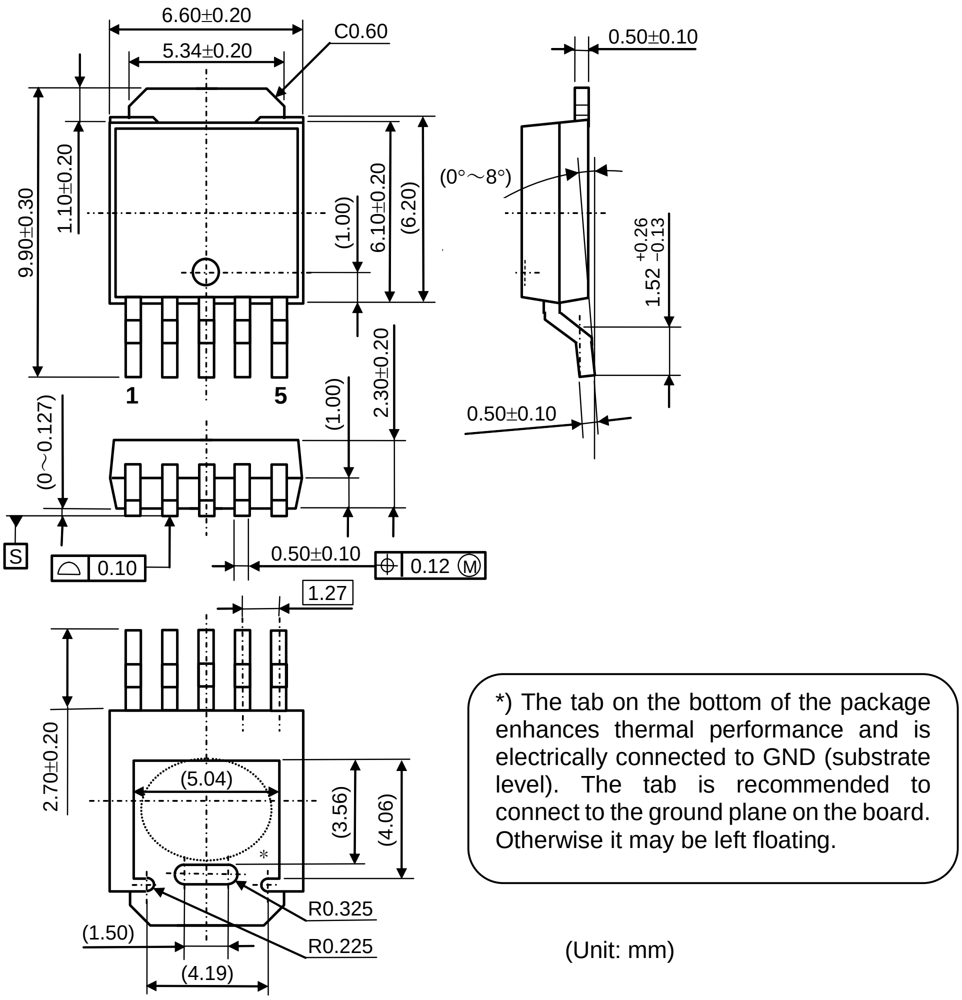
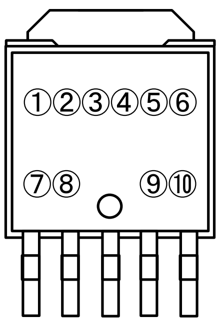
PACKAGE DIMENSIONS (TO-252-5-P2)



TO-252-5-P2 Package Dimensions

MARK SPECIFICATION (TO-252-5-P2)

①②③④⑤⑥⑦⑧: Product Code … **Refer to "*R1518J MARK SPECIFICATION TABLE (TO-252-5-P2)*"**
⑨⑩: Lot Number … Alphanumeric Serial Number



TO-252-5-P2 Mark Specification

R1518J MARK SPECIFICATION TABLE (TO-252-5-P2)

R1518Jxx1B

Product Name	①②③④⑤⑥⑦⑧	V_{SET}
R1518J251B	L 1 J 2 5 1 B	2.5 V
R1518J281B	L 1 J 2 8 1 B	2.8 V
R1518J301B	L 1 J 3 0 1 B	3.0 V
R1518J331B	L 1 J 3 3 1 B	3.3 V
R1518J341B	L 1 J 3 4 1 B	3.4 V
R1518J501B	L 1 J 5 0 1 B	5.0 V
R1518J601B	L 1 J 6 0 1 B	6.0 V
R1518J801B	L 1 J 8 0 1 B	8.0 V
R1518J851B	L 1 J 8 5 1 B	8.5 V
R1518J901B	L 1 J 9 0 1 B	9.0 V

R1518J001C (Adjustable Output Voltage Setting Type)

Product Name	①②③④⑤⑥⑦⑧	V_{SET}
R1518J001C	L 2 J 0 0 1 C	-

R1518Jxx1D

Product Name	①②③④⑤⑥⑦⑧	V_{SET}
R1518J251D	L 3 J 2 5 1 D	2.5 V
R1518J281D	L 3 J 2 8 1 D	2.8 V
R1518J301D	L 3 J 3 0 1 D	3.0 V
R1518J331D	L 3 J 3 3 1 D	3.3 V
R1518J341D	L 3 J 3 4 1 D	3.4 V
R1518J501D	L 3 J 5 0 1 D	5.0 V
R1518J601D	L 3 J 6 0 1 D	6.0 V
R1518J801D	L 3 J 8 0 1 D	8.0 V
R1518J851D	L 3 J 8 5 1 D	8.5 V
R1518J901D	L 3 J 9 0 1 D	9.0 V

R1518Jxx1E

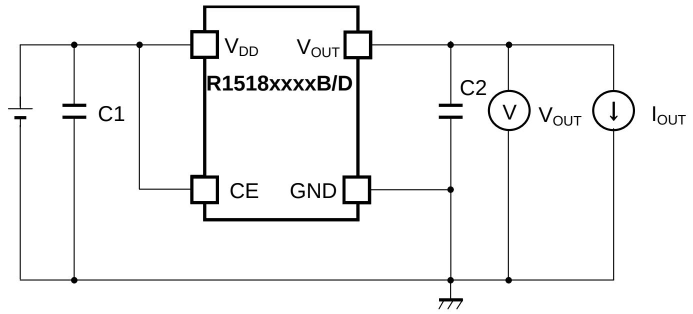
Product Name	①②③④⑤⑥⑦⑧	V_{SET}
R1518J251E	L 4 J 2 5 1 E	2.5 V
R1518J281E	L 4 J 2 8 1 E	2.8 V
R1518J301E	L 4 J 3 0 1 E	3.0 V
R1518J331E	L 4 J 3 3 1 E	3.3 V
R1518J341E	L 4 J 3 4 1 E	3.4 V
R1518J501E	L 4 J 5 0 1 E	5.0 V
R1518J601E	L 4 J 6 0 1 E	6.0 V
R1518J801E	L 4 J 8 0 1 E	8.0 V
R1518J851E	L 4 J 8 5 1 E	8.5 V
R1518J901E	L 4 J 9 0 1 E	9.0 V

R1518Jxx1F

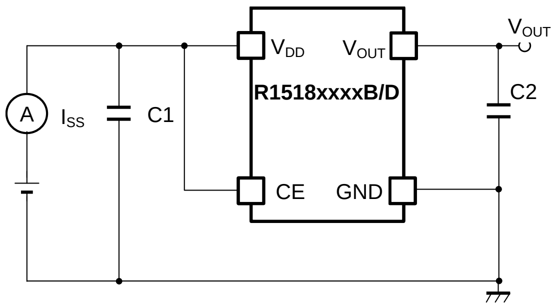
Product Name	①②③④⑤⑥⑦⑧	V_{SET}
R1518J251F	L 5 J 2 5 1 F	2.5 V
R1518J281F	L 5 J 2 8 1 F	2.8 V
R1518J301F	L 5 J 3 0 1 F	3.0 V
R1518J331F	L 5 J 3 3 1 F	3.3 V
R1518J341F	L 5 J 3 4 1 F	3.4 V
R1518J501F	L 5 J 5 0 1 F	5.0 V
R1518J601F	L 5 J 6 0 1 F	6.0 V
R1518J801F	L 5 J 8 0 1 F	8.0 V
R1518J851F	L 5 J 8 5 1 F	8.5 V
R1518J901F	L 5 J 9 0 1 F	9.0 V

TEST CIRCUITS

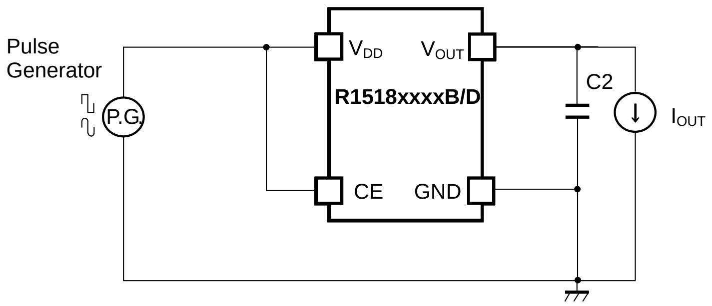
Soft-start: Internally Fixed Type (R1518xxxxB/D)



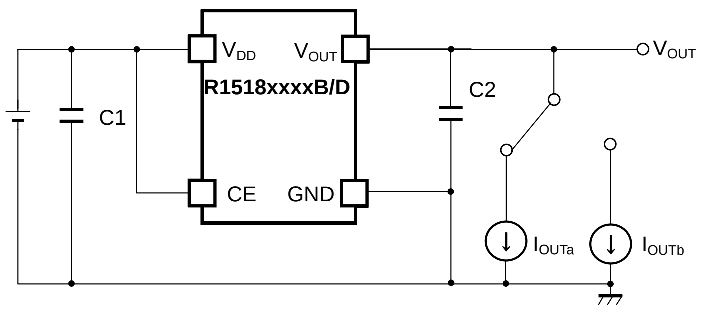
R1518xxxxB/D Basic Test Circuit



R1518xxxxB/D Supply Current Test Circuit

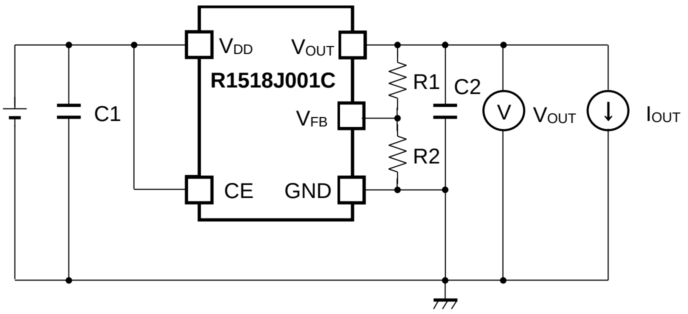


R1518xxxxB/D Ripple Rejection Test Circuit

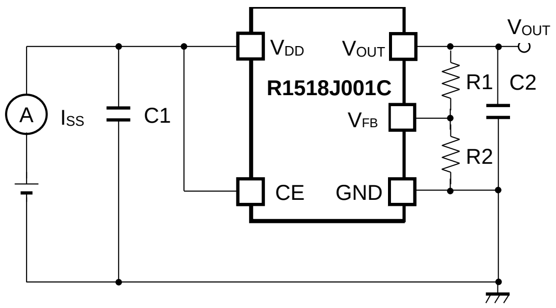


R1518xxxxB/D Load Transient Response Test Circuit

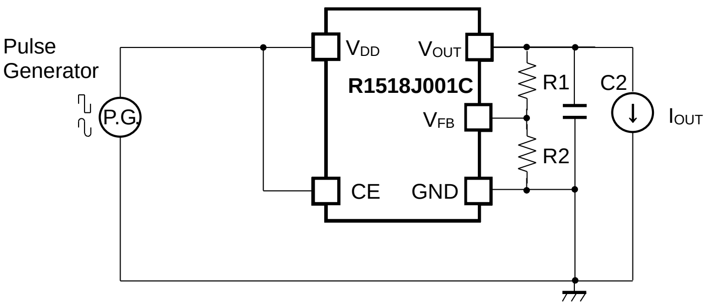
Adjustable Output Voltage Setting Type (R1518J001C)



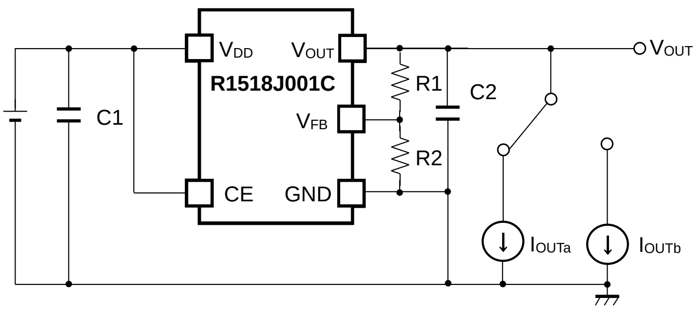
R1518J001C Basic Test Circuit



R1518J001C Supply Current Test Circuit



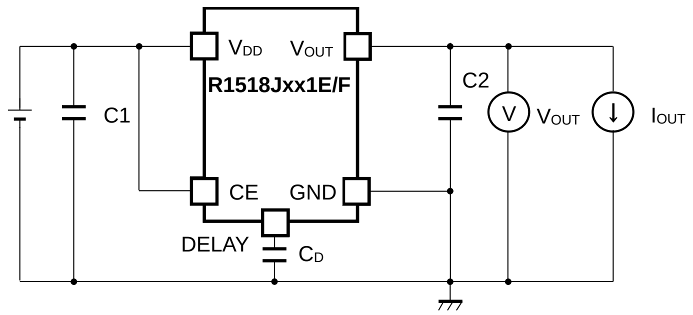
R1518J001C Ripple Rejection Test Circuit



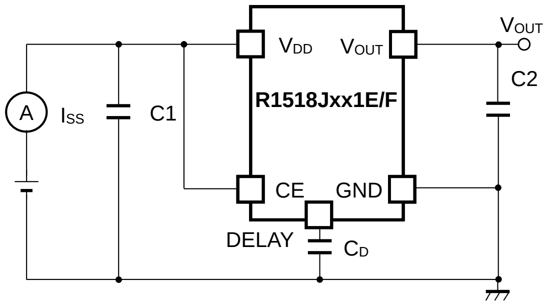
R1518J001C Load Transient Response Test Circuit

Note: Refer to *Adjustable Output Voltage Setting* for R1 and R2.

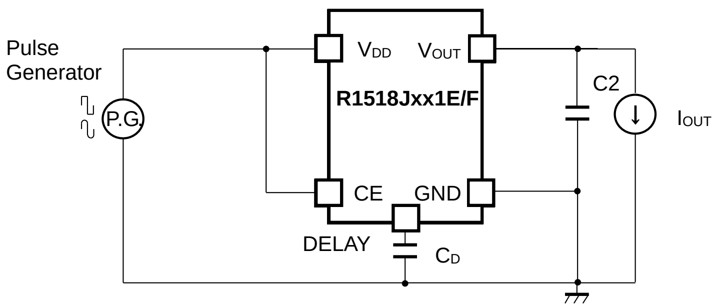
Adjustable Soft-start Setting Type (R1518Jxx1E/F)



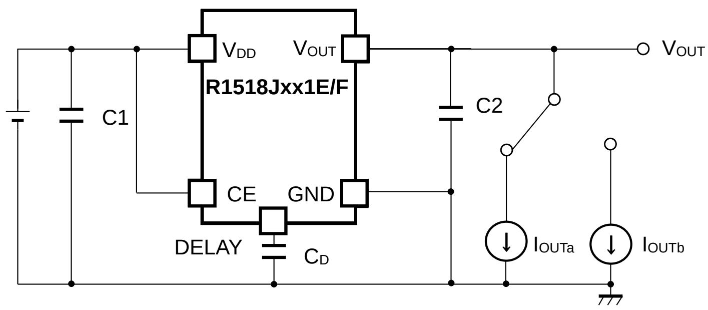
R1518Jxx1E/F Basic Test Circuit



R1518Jxx1E/F Supply Current Test Circuit



R1518Jxx1E/F Ripple Rejection Test Circuit



R1518Jxx1E/F Load Transient Response Test Circuit

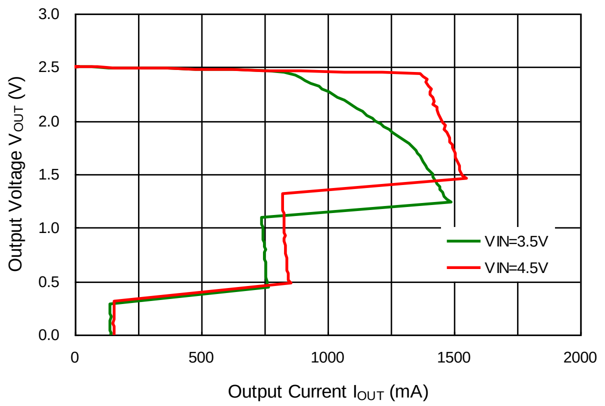
Note: Refer to *Soft-start Function* for detailed information on C_D.

TYPICAL CHARACTERISTICS

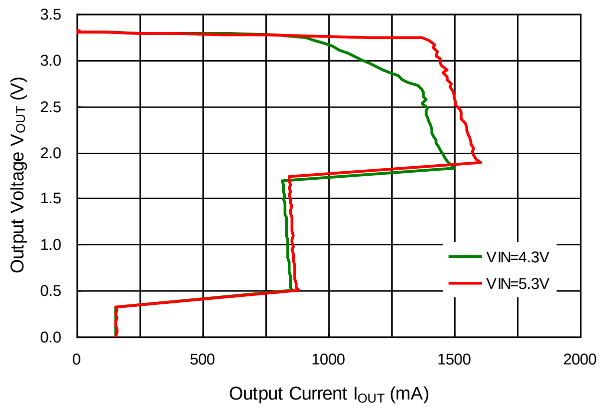
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

1) Output Voltage vs. Output Current (Ta = 25°C)

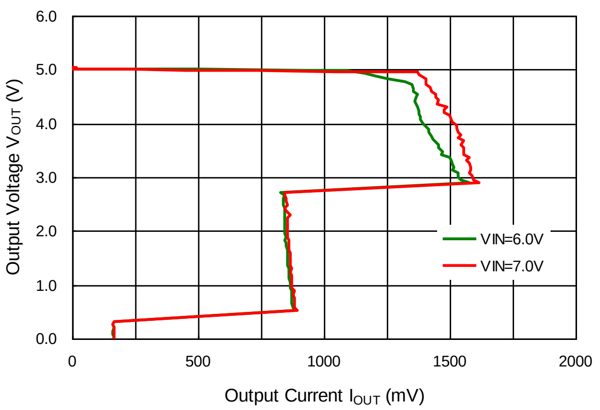
R1518x25xx, R1518J001C



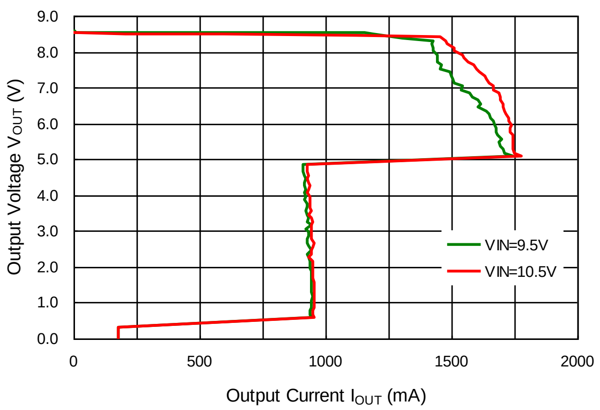
R1518x33xx



R1518x50xx

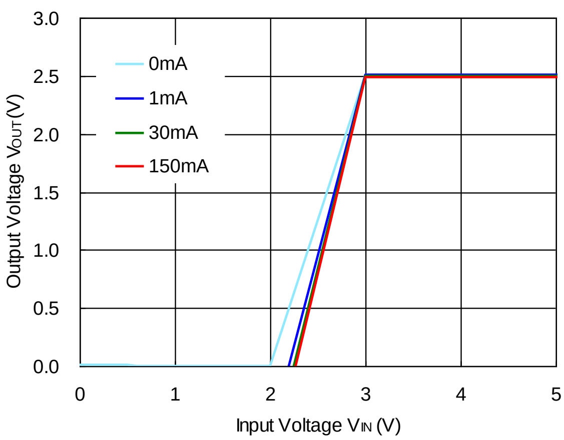


R1518x85xx

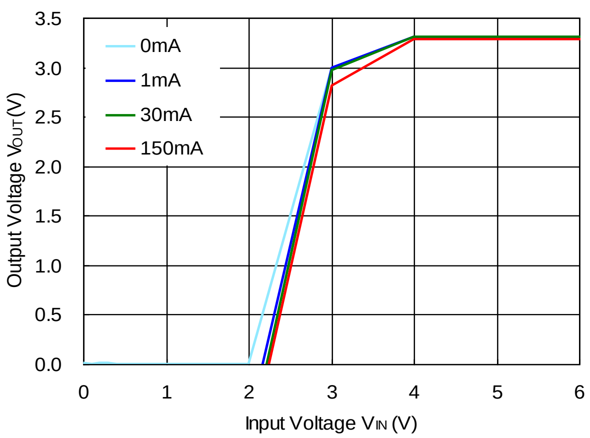


2) Output Voltage vs. Input Voltage (Ta = 25°C)

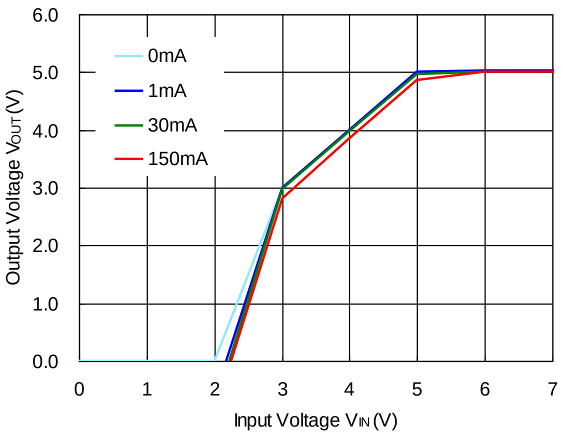
R1518x25xx



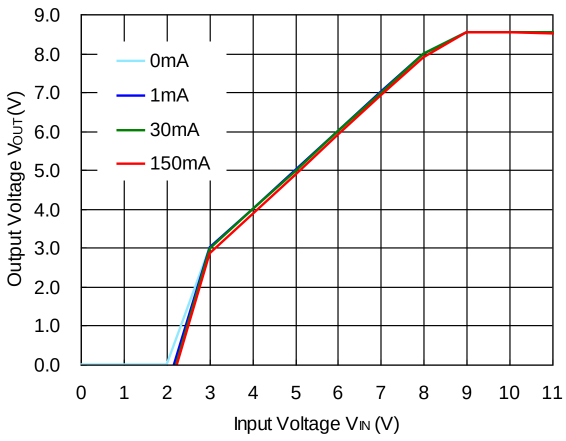
R1518x33xx



R1518x50xx

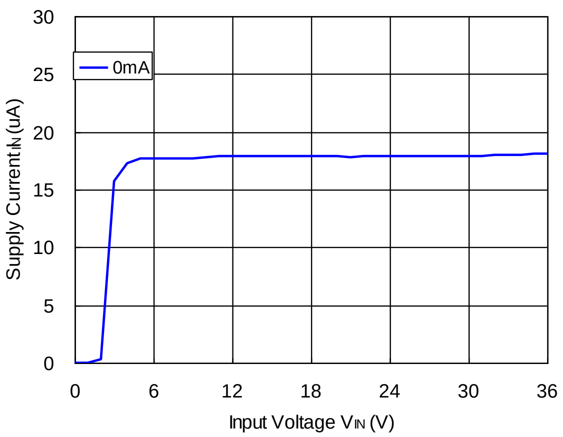


R1518x85xx

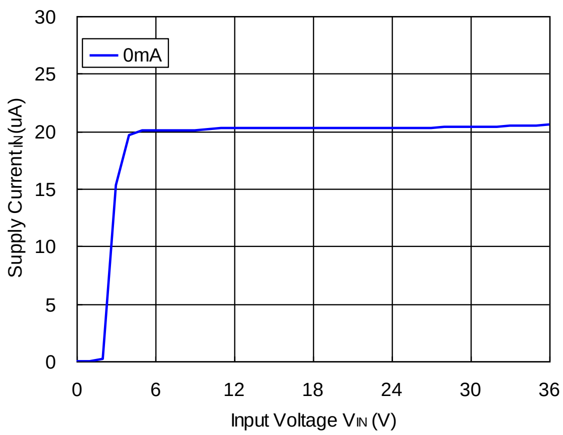


3) Supply Current vs. Input Voltage

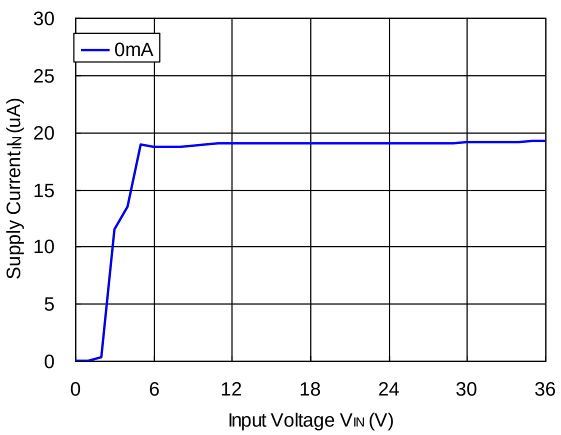
R1518x25xx, R1518J001C



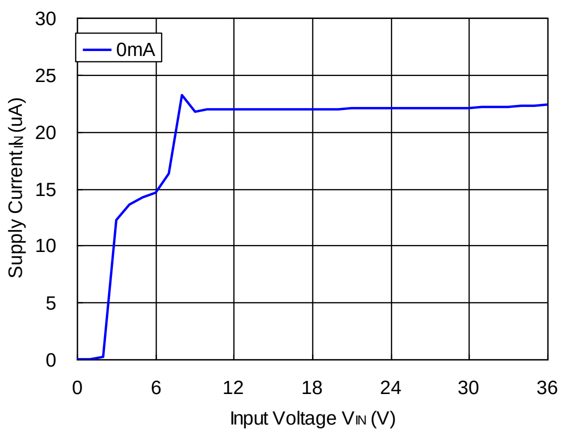
R1518x33xx



R1518x50xx

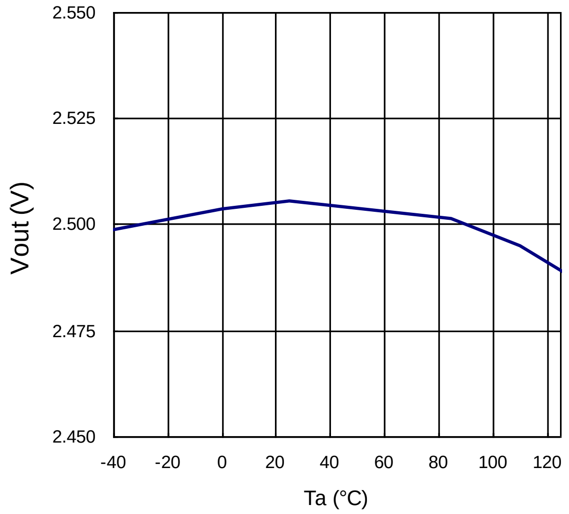


R1518x85xx

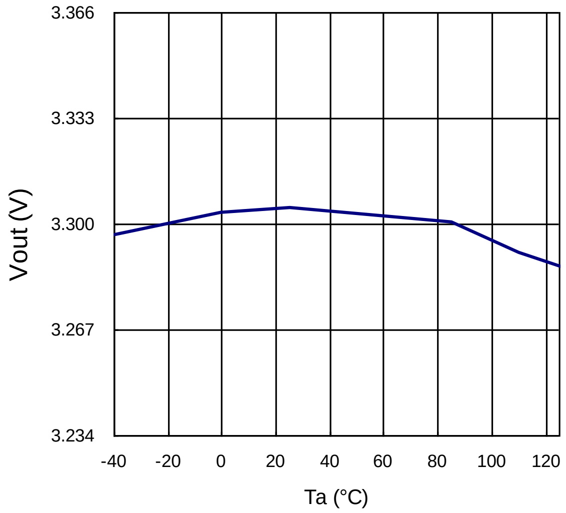


4) Output Voltage vs. Operating Temperature

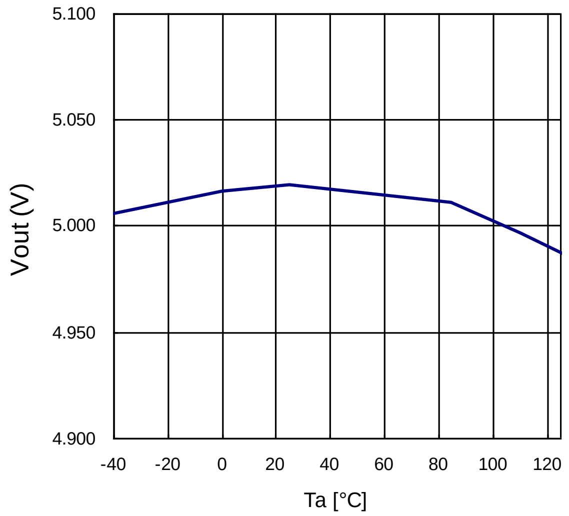
R1518x25xx, R1518J001C



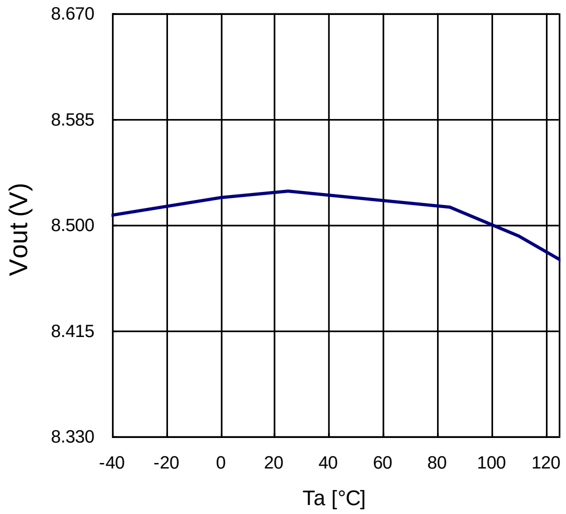
R1518x33xx



R1518x50xx

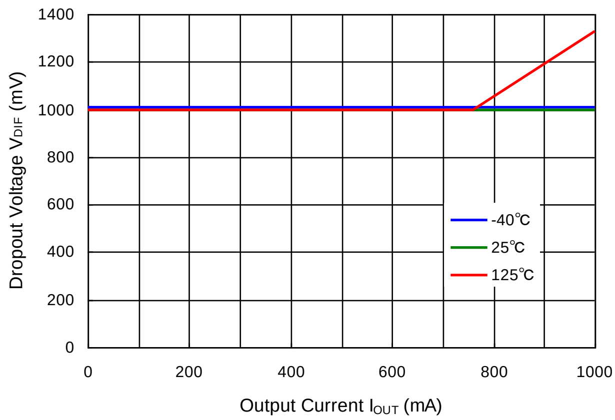


R1518x85xx

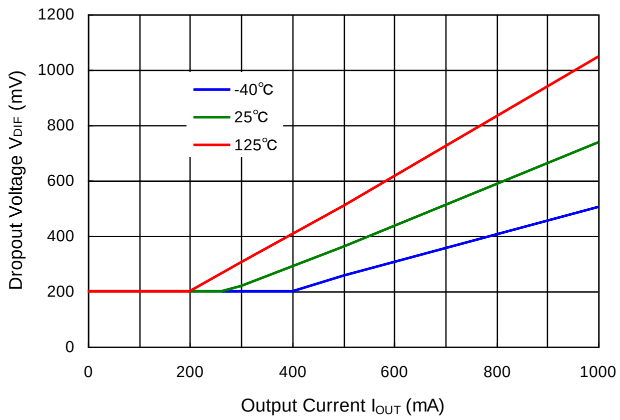


5) Dropout Voltage vs. Output Current

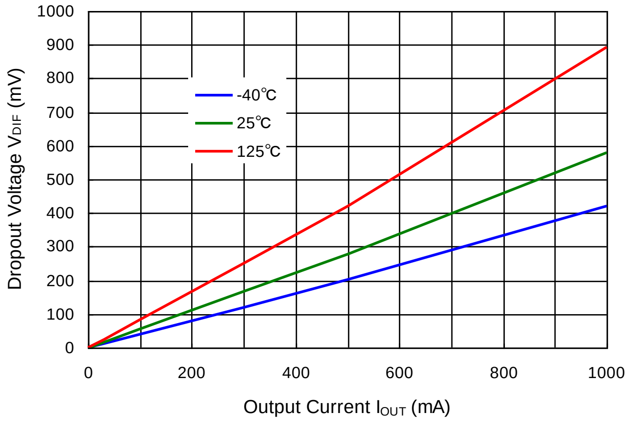
R1518x25xx, R1518J001C



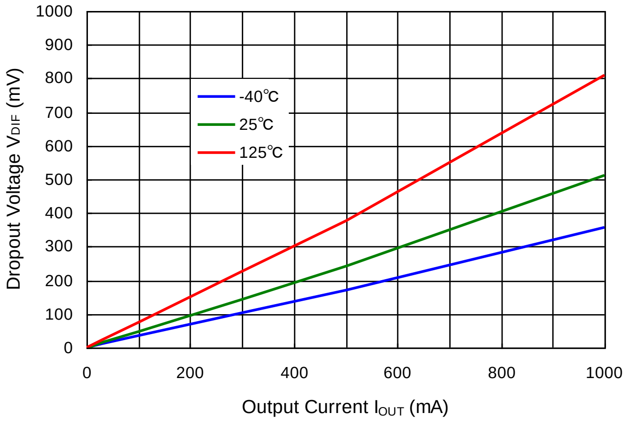
R1518x33xx



R1518x50xx

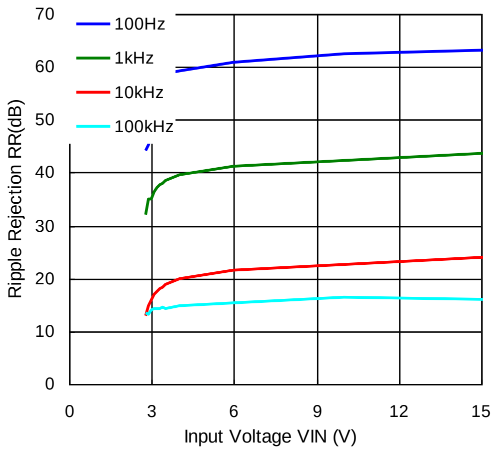


R1518x85xx

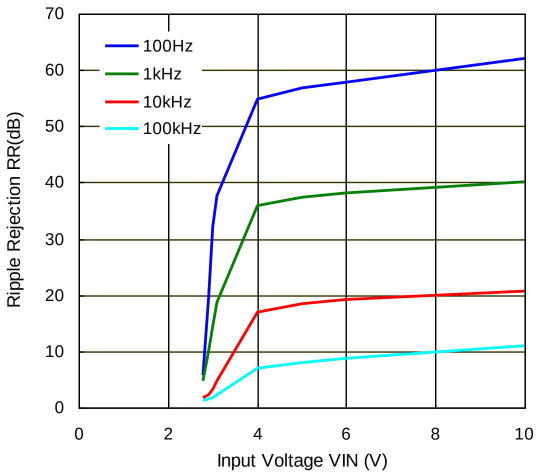


6) Ripple Rejection vs. Input Voltage (Ta = 25°C, Ripple = 0.5 Vpp)

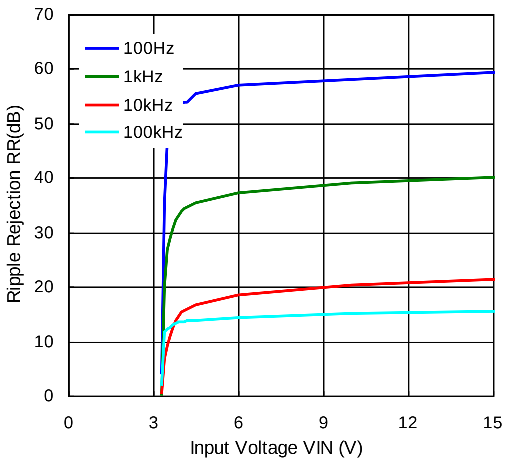
R1518x25xx, R1518J001C (I_{OUT} = 1 mA)



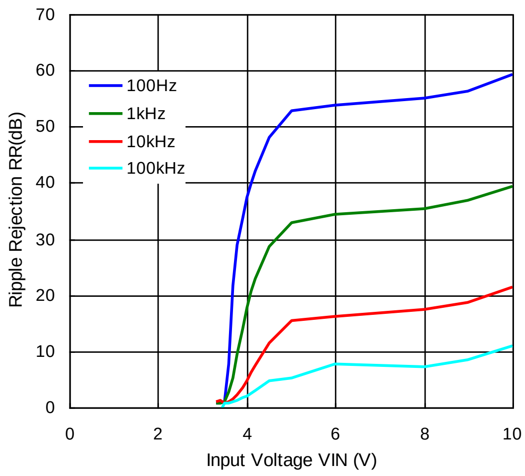
R1518x25xx, R1518J001C (I_{OUT} = 300 mA)



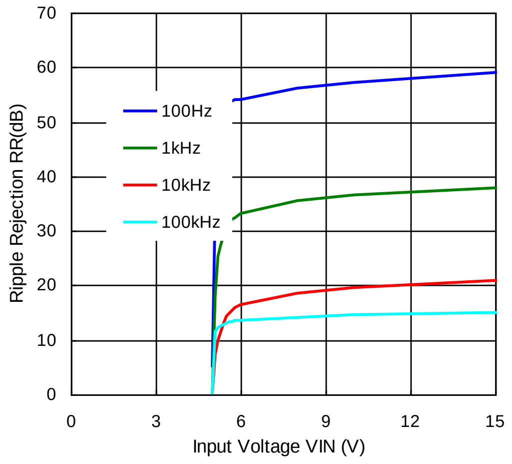
R1518x33xx (I_{OUT} = 1 mA)



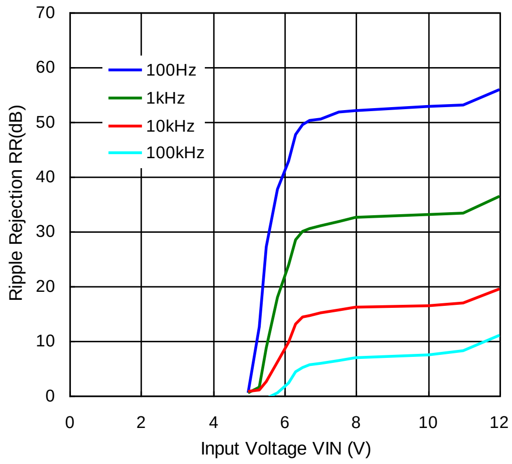
R1518x33xx (I_{OUT} = 300 mA)



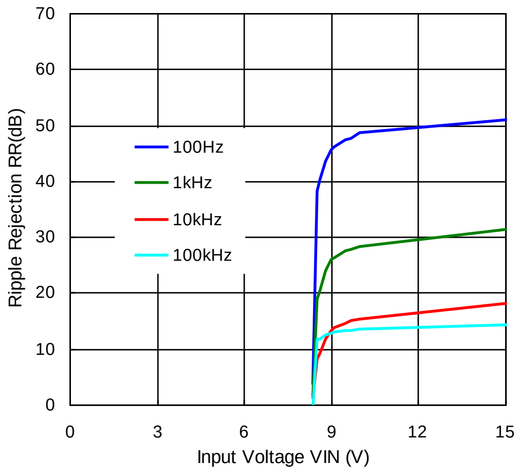
R1518x50xx (I_{OUT} = 1 mA)



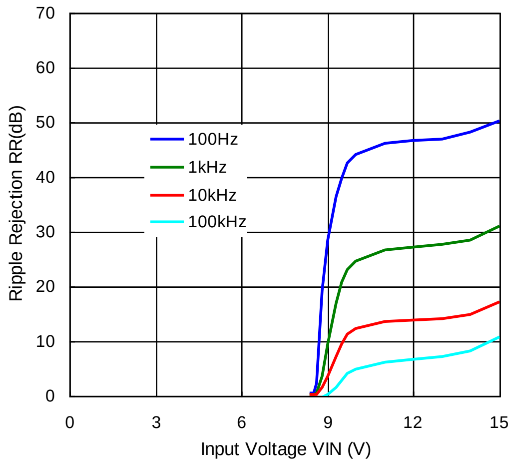
R1518x50xx (I_{OUT} = 300 mA)



R1518x85xx (I_{OUT} = 1 mA)

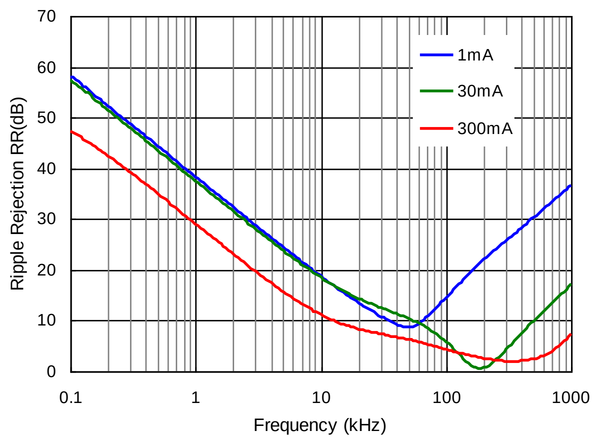


R1518x85xx (I_{OUT} = 300 mA)

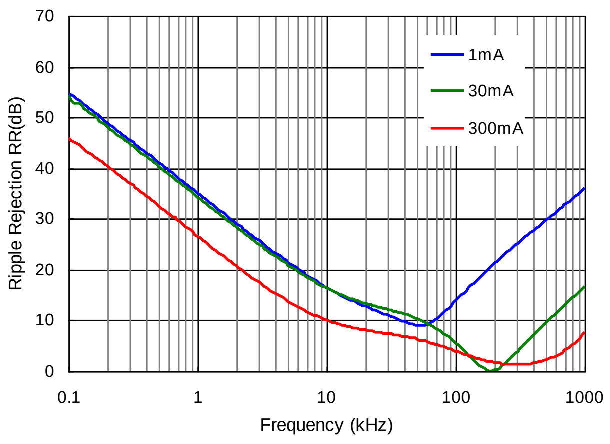


7) Ripple Rejection vs. Frequency (Ta = 25°C, Ripple = 0.5 Vpp)

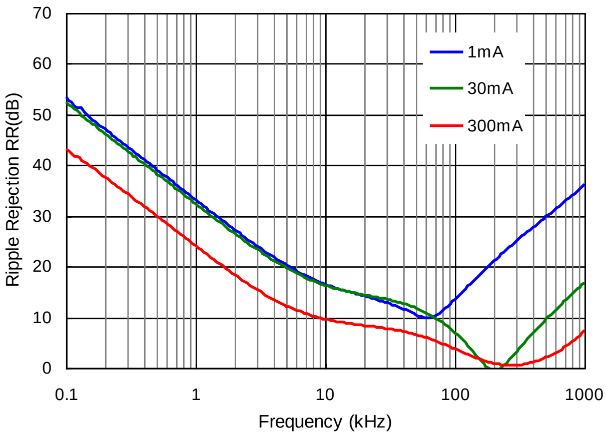
R1518x25xx, R1518J001C



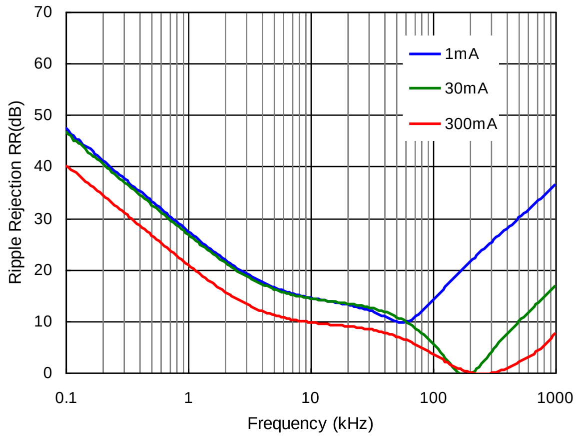
R1518x33xx



R1518x50xx

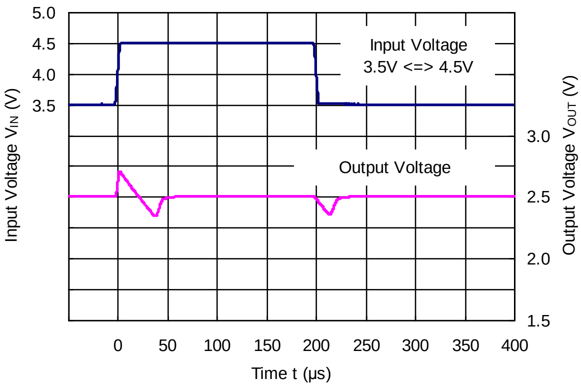


R1518x85xx

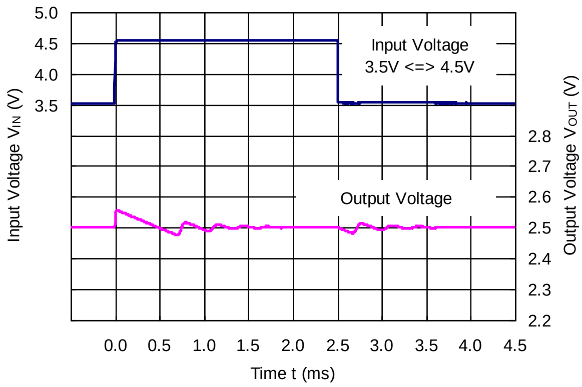


8) Input Transient Response (Ta = 25°C, I_{OUT} = 1 mA, tr = tf = 5 μs)

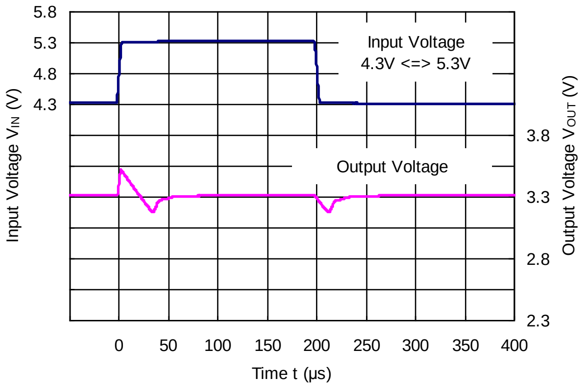
R1518x25xx, R1518J001C (C2 = 0.1 μF)



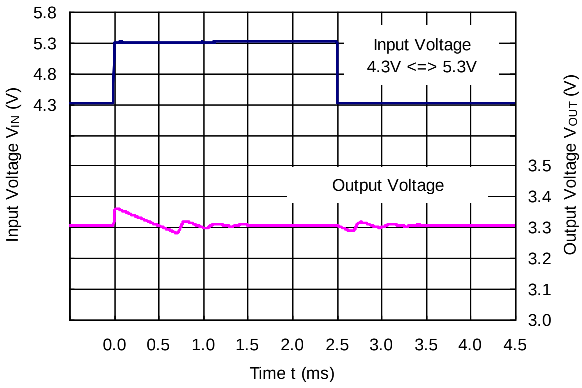
R1518x25xx, R1518J001C (C2 = 10 μF)



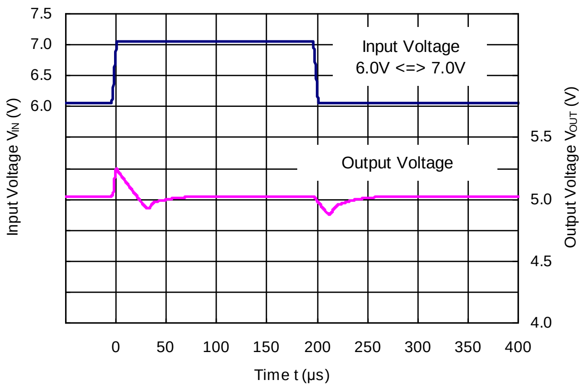
R1518x33xx (C2 = 0.1 μF)



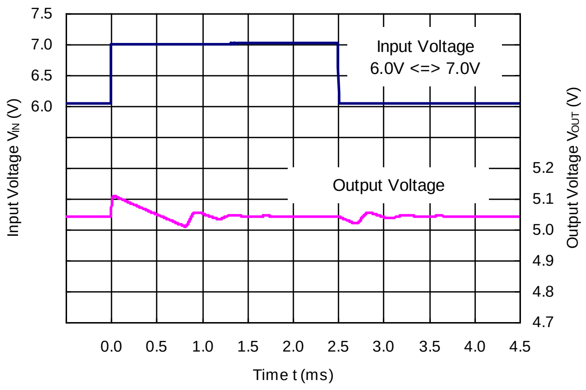
R1518x33xx (C2 = 10 μF)



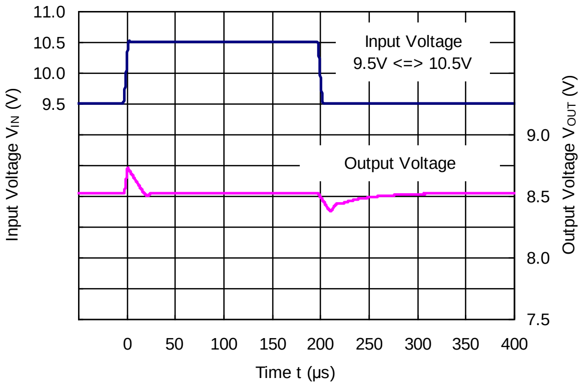
R1518x50xx (C2 = 0.1 µF)



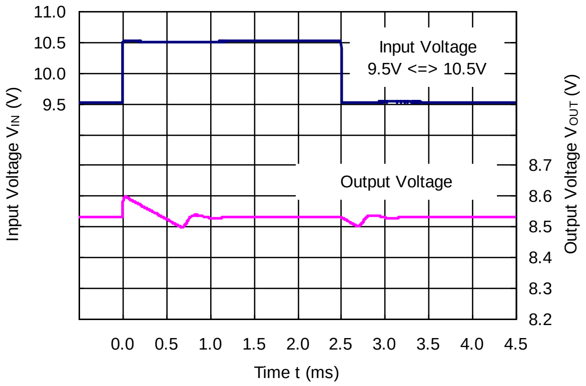
R1518x50xx (C2 = 10 µF)



R1518x85xx (C2 = 0.1 µF)

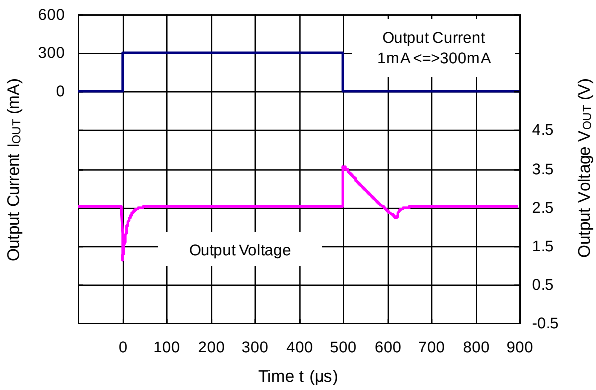


R1518x85xx (C2 = 10 µF)

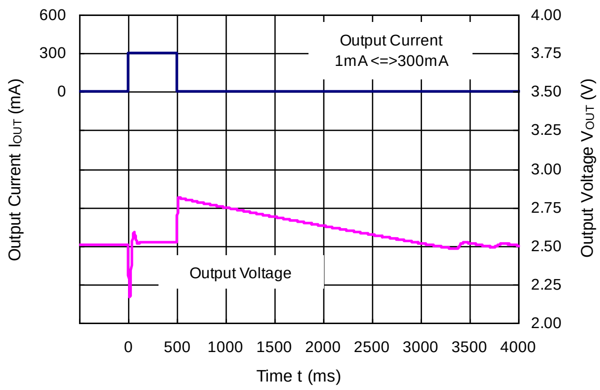


9) Load Transient Response (Ta = 25°C, $V_{IN} = V_{OUT} + 1.0$ V, tr = tf = 0.5 µs)

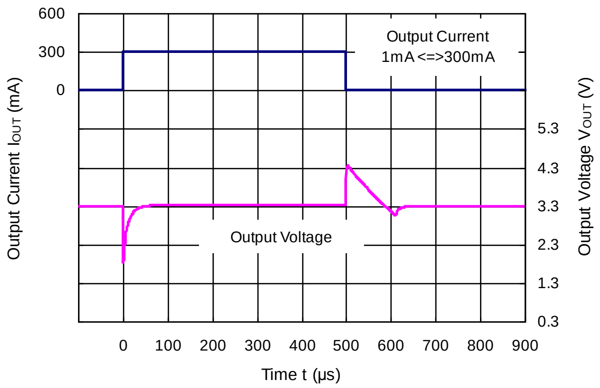
R1518x25xx, R1518J001C (C2 = 0.1 µF)



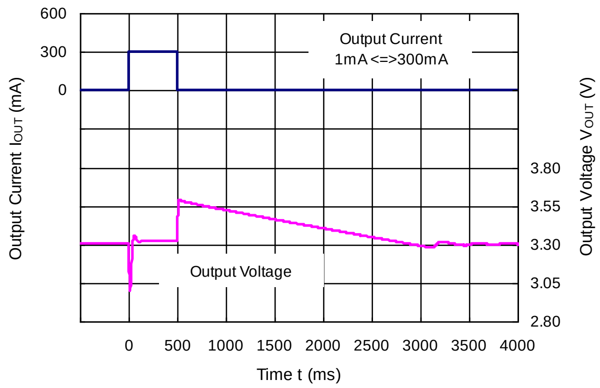
R1518x25xx, R1518J001C (C2 = 10 µF)



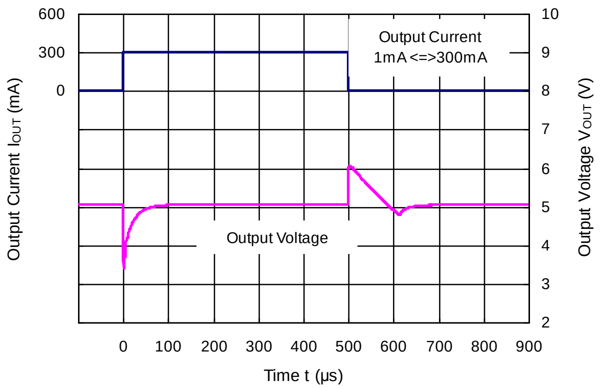
R1518x33xx (C2 = 0.1 μF)



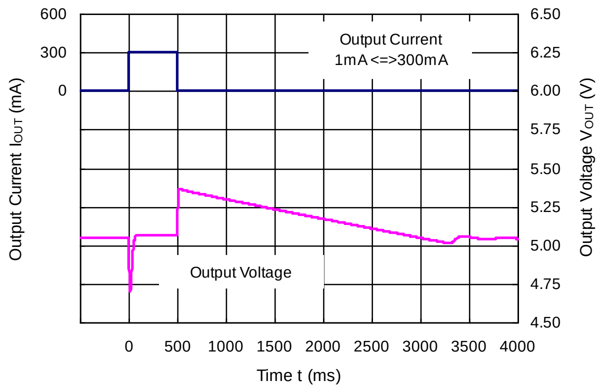
R1518x33xx (C2 = 10 μF)



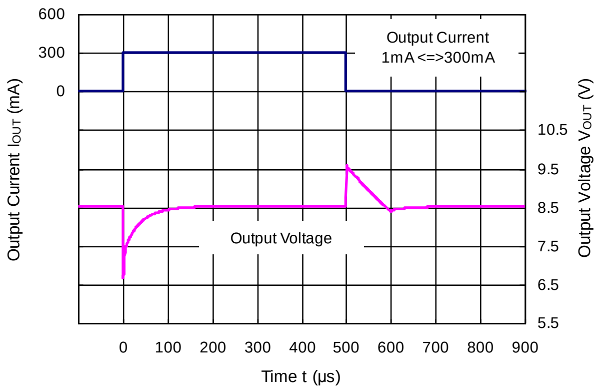
R1518x50xx (C2 = 0.1 μF)



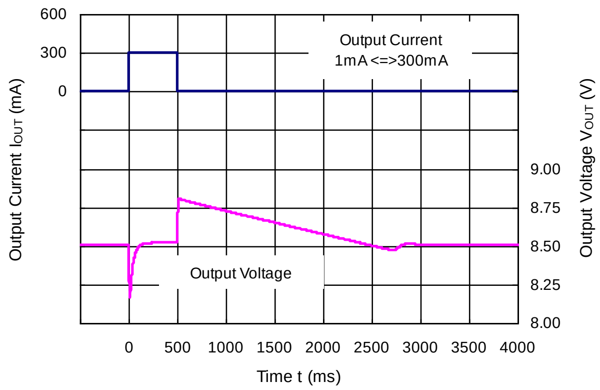
R1518x50xx (C2 = 10 μF)



R1518x85xx (C2 = 0.1 μF)

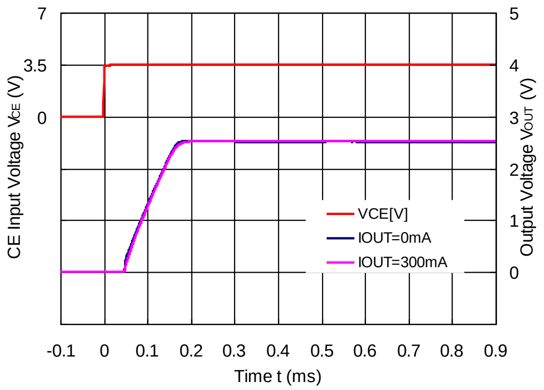


R1518x85xx (C2 = 10 μF)

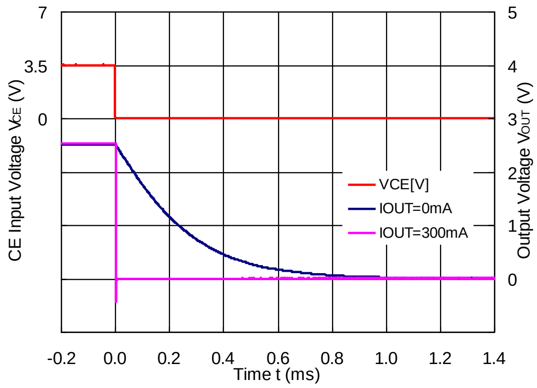


10) CE Transient Response (Ta = 25°C, I_{OUT} = 1 mA)

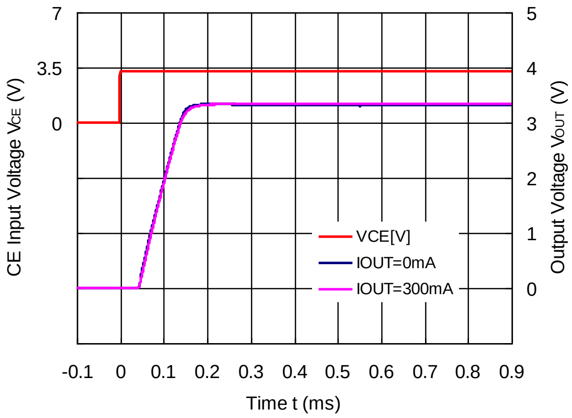
R1518x25xB/D, R1518J001C (C2 = 0.1 μF)



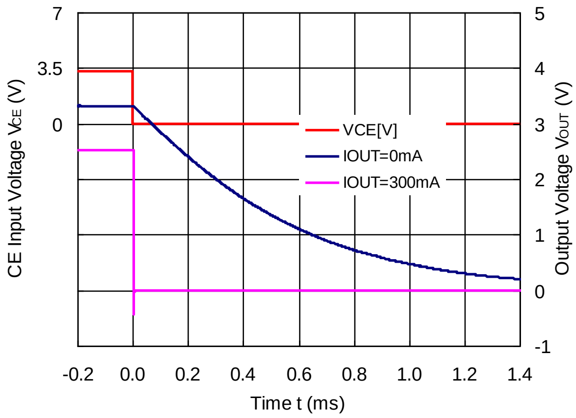
R1518x25xB/D (C2 = 0.1 μF)



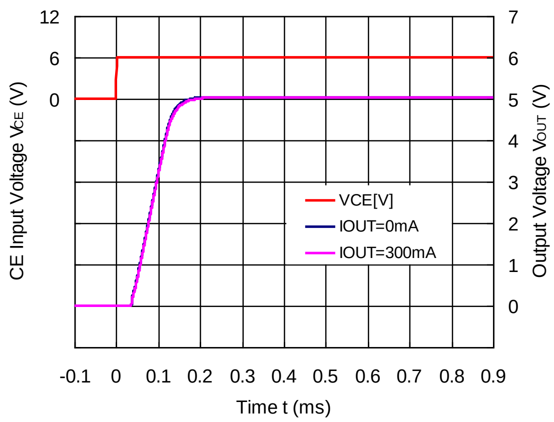
R1518x33xB/D (C2 = 0.1 μF)



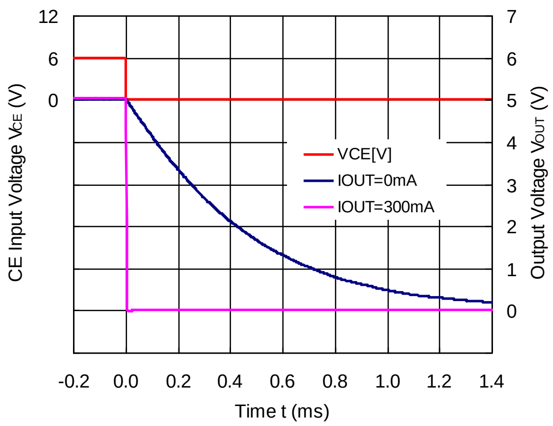
R1518x33xB/D (C2 = 0.1 μF)



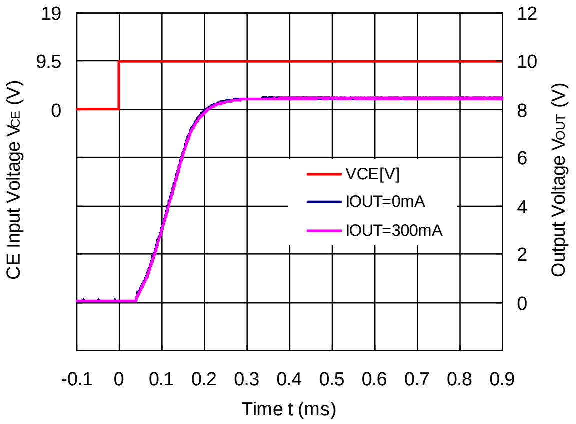
R1518x50xB/D (C2 = 0.1 μF)



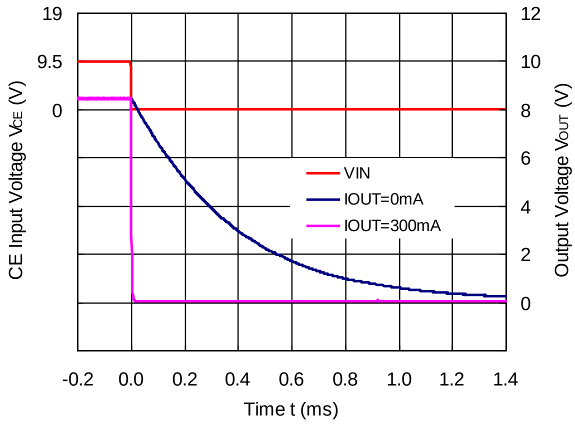
R1518x50xB/D (C2 = 0.1 μF)



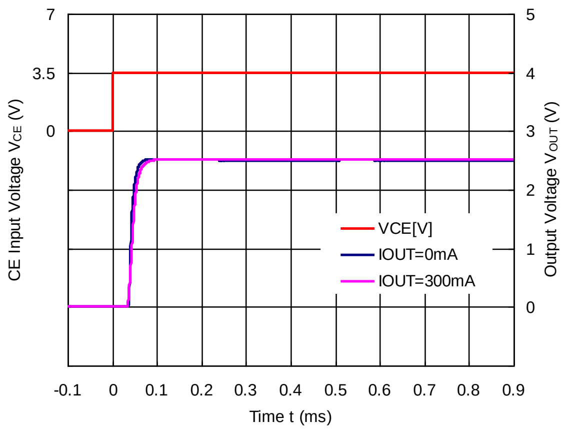
R1518x85xB/D (C2 = 0.1 μF)



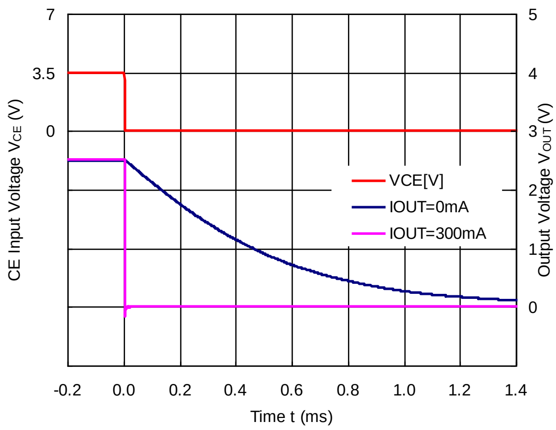
R1518x85xB/D (C2 = 0.1 μF)



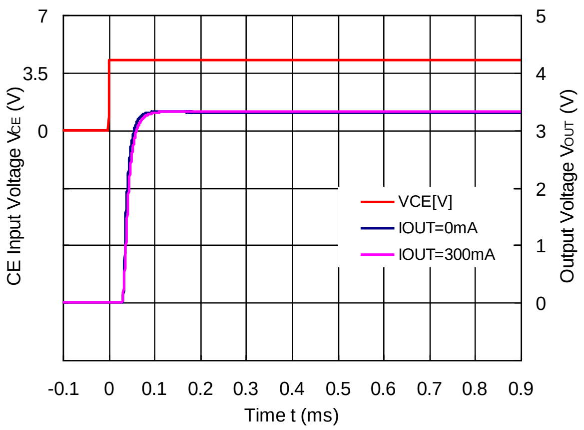
R1518J251E/F (C2 = 0.1 μF, C_D = 1 nF)



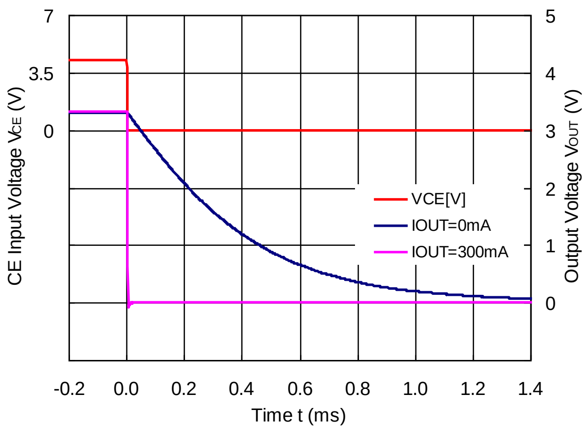
R1518J251E/F (C2 = 0.1 μF, C_D = 1 nF)



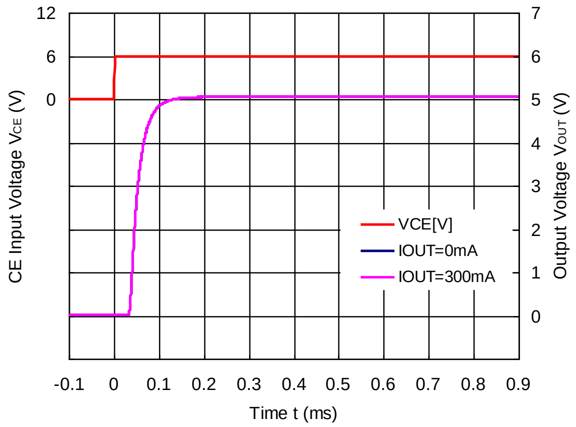
R1518J331E/F (C2 = 0.1 μF, C_D = 1 nF)



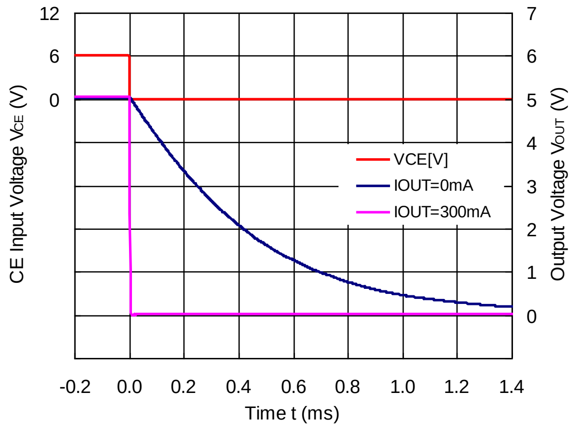
R1518J331E/F (C2 = 0.1 μF, C_D = 1 nF)



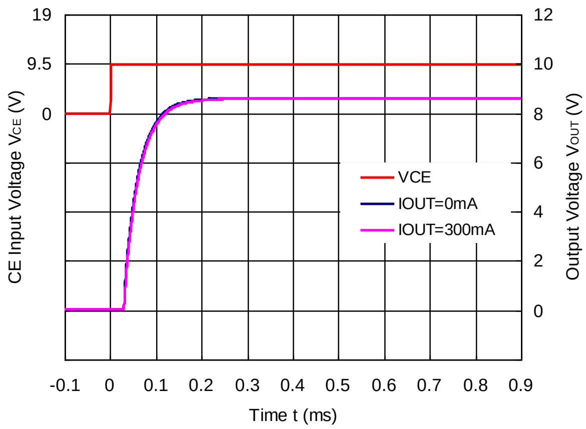
R1518J501E/F (C2 = 0.1 μF, C_D = 1 nF)



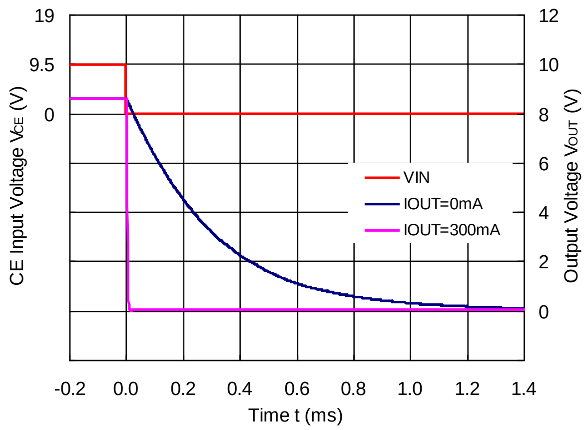
R1518J501E/F (C2 = 0.1 μF, C_D = 1 nF)



R1518J851E/F (C2 = 0.1 μF, C_D = 1 nF)

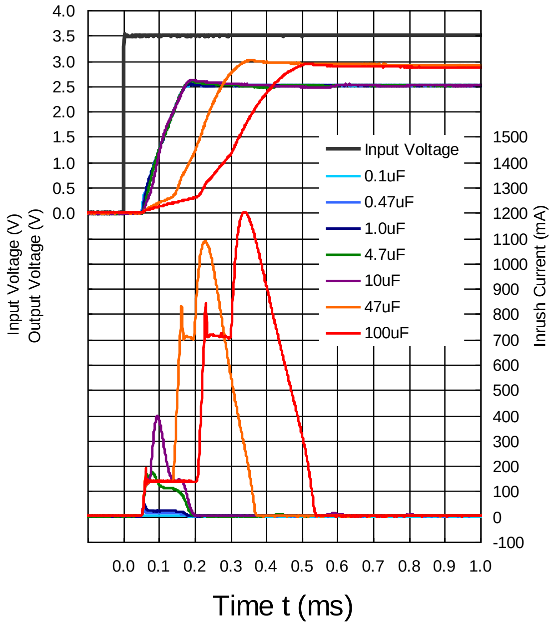


R1518J851E/F (C2 = 0.1 μF, CD = 1 nF)

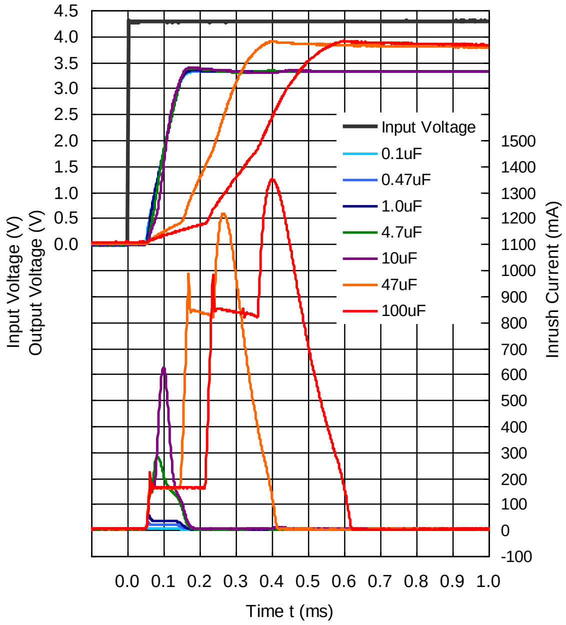


11) Inrush Current Prevention Circuit (Ta = 25°C, I_{OUT} = 1 mA)

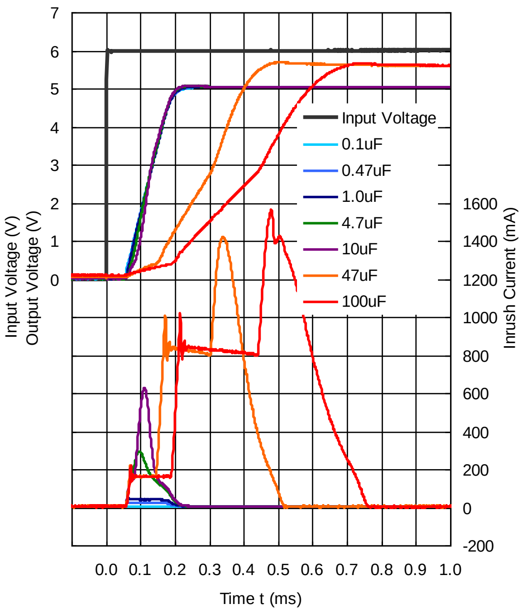
R1518x25xB/D, R1518J001C



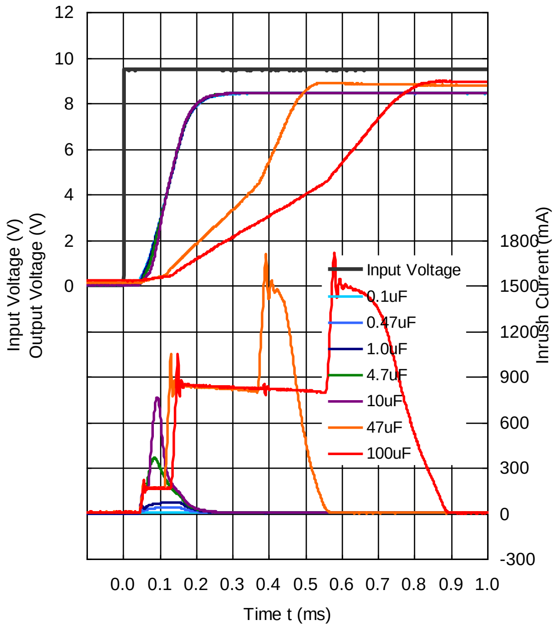
R1518x33xB/D



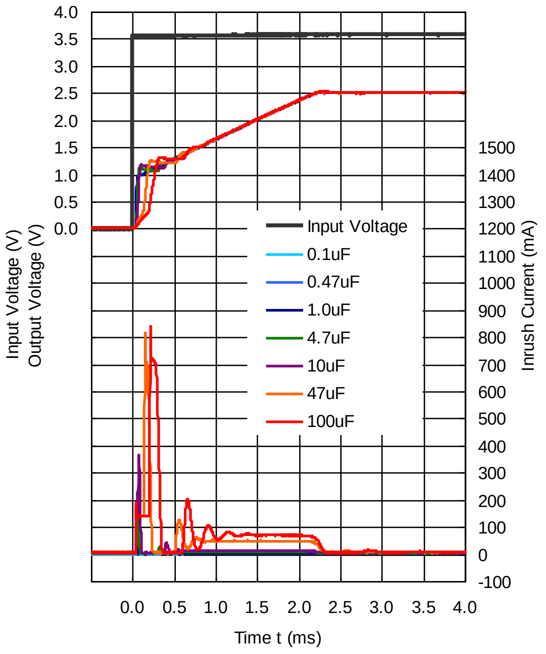
R1518x50xB/D



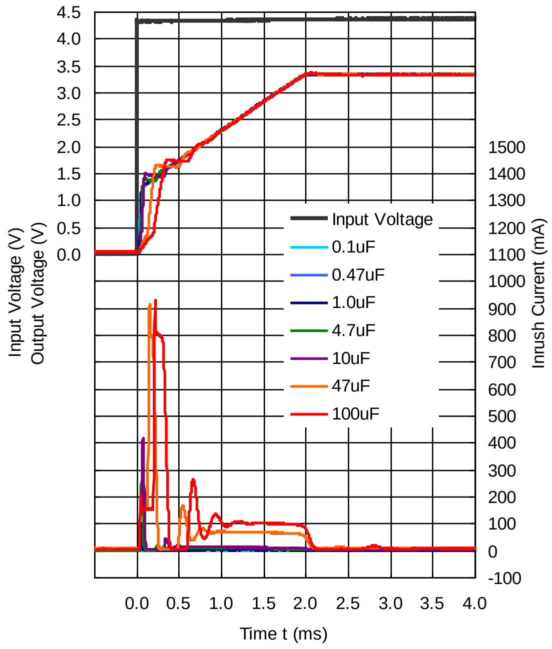
R1518x85xB/D



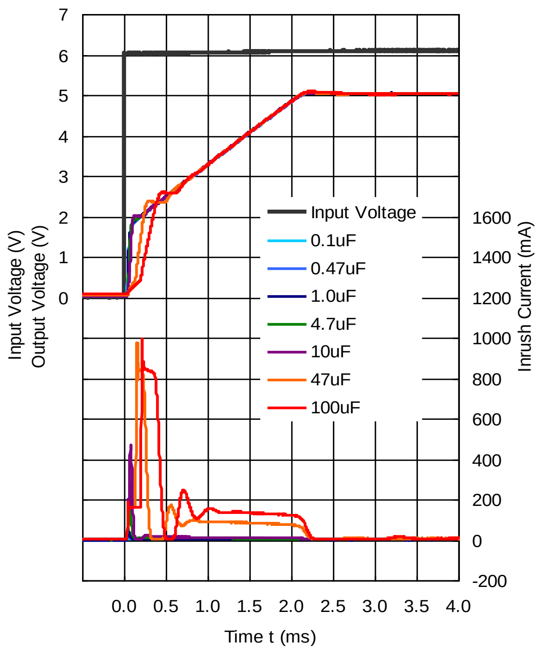
R1518J251E/F (C_D = 10 nF)



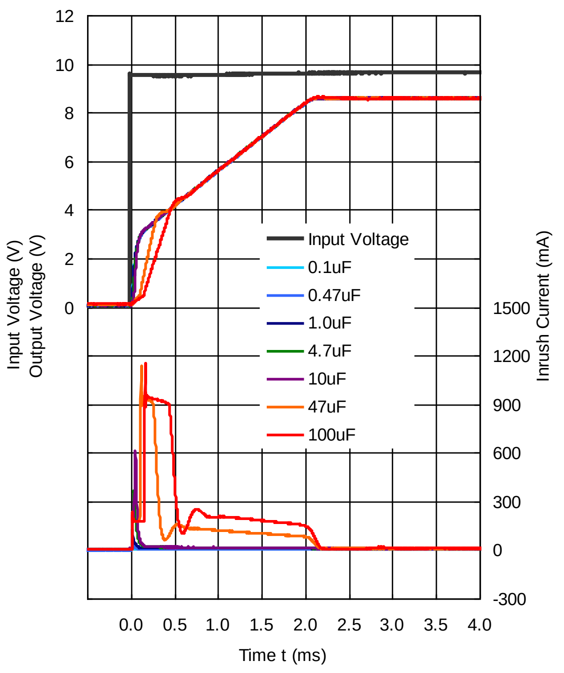
R1518J331E/F (C_D = 10 nF)



R1518J501E/F (C_D = 10 nF)



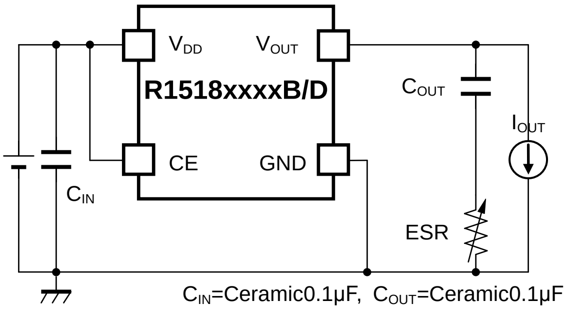
R1518J851E/F (C_D = 10 nF)



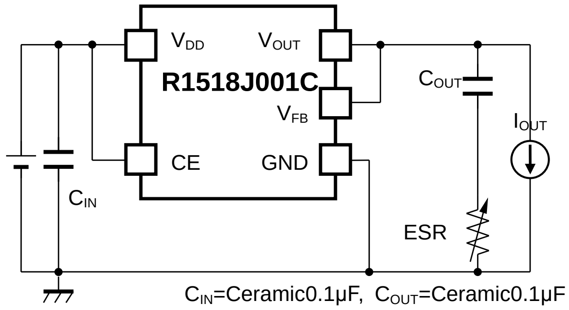
ESR vs. Output Current

It is recommended that a ceramic type capacitor be used for this device. 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.

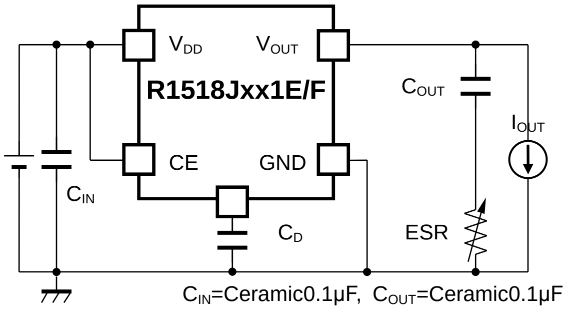
R1518xxxxB/D Test Circuit



R1518J001C Test Circuit



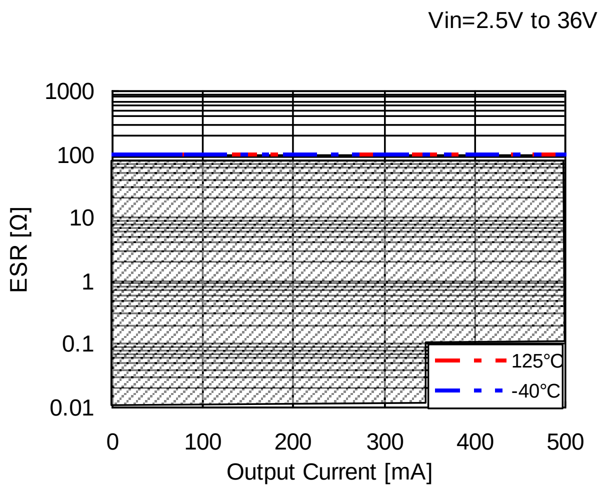
R1518Jxx1E/F Test Circuit



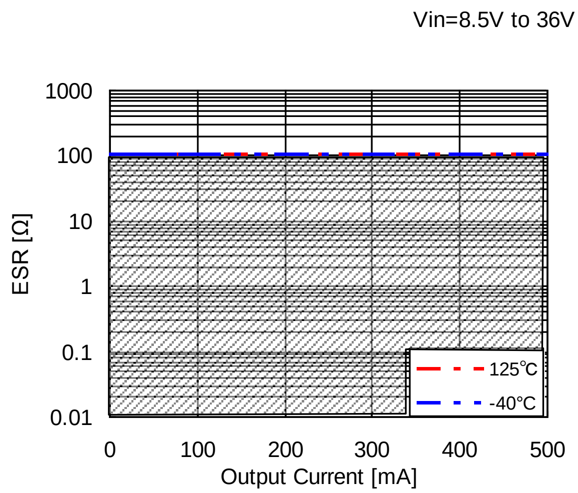
Measurement conditions

Frequency Band: 10 Hz to 2 MHz
Measurement Temperature: −40°C to 125°C
Hatched area: Noise level is 40 μV (average) or below
Capacitor: C1 = Ceramic 0.1 μF, C2 = 0.1 μF

R1518x25xx Output Current I_{OUT} vs. ESR



R1518x85xx Output Current I_{OUT} vs. ESR



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