1 A 36V Input Low Supply Current LDO

NO.EA−329−230124

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 105°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.
The output voltage of R1518x001C can be set with an external resistor, and the setting range is from 2.5V to Max 20V.R1518xxxxB/C/D internally fixes the soft-start time at 120 μs (Typ). R1518xxxxE/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 rang ······························ –40°C to 105°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)
- Line Regulation·· Typ. 0.01%/V
- Packages ·· HSOP-6J, TO-252-5-P2
- Output Voltage Range ···································· R1518xxxxB/D/E/F:
  2.5V/3.3V/3.4V/5.0V/6.0V/8.5V/9.0V
  R1518x001C: Adjustable from 2.5 V to 20.0 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. 1A
- Built-in Thermal Shutdown Circuit ························ Typ. 160°C
- Built-in Soft-start Circuit ···································· Typ.120 μs
  R1518xxxxE/F: Adjustable Time Setting with
  External Capacitors.
- Ceramic Capacitors can be used ························ R1518xxxxB/D/E/F: 0.1 μF or more
  R1518x001C: 1.0 μF or more

APPLICATIONS

- Power source for home appliances such as refrigerators, rice cookers, electric water warmers.
- Power source for notebook PCs, digital TVs, telephones, private LAN systems.
- Power source for office equipment such as copiers, printers, facsimiles, scanners, and projectors

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
R1518Sxx1∗-E2-FE	HSOP-6J	1,000 pcs	Yes	Yes
R1518Jxx1∗-T1-FE	TO-252-5-P2	3,000 pcs	Yes	Yes

xx: Specify the set output voltage (V_{SET})
2.5 V (25) / 3.3 V (33) / 3.4 V (34) / 5.0 V (50) / 6.0 V (60) / 8.5 V (85) / 9.0 V (90)

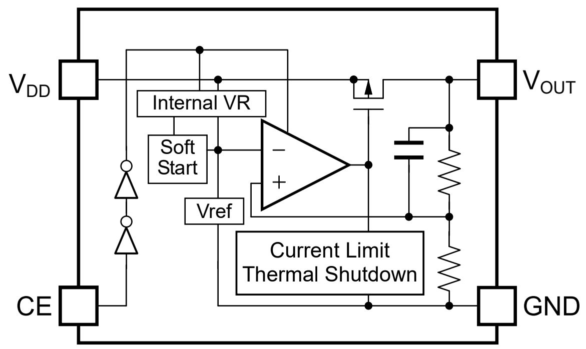
Adjustable output voltage setting type is fixed to (00)
Note: R1518x001C-T1-#E only support

∗ : 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

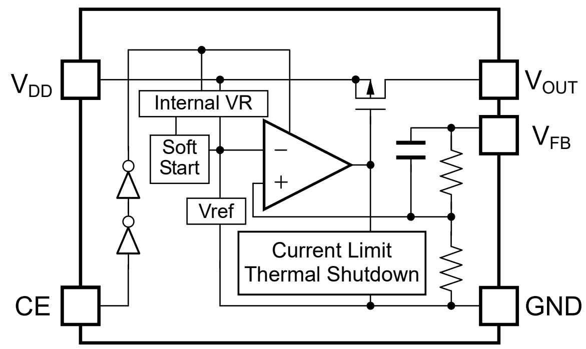
Auto-Discharge function quickly lowers the output voltage to 0 V by releasing the electrical charge in the external capacitor when the chip enable signal is switched from the active mode to the standby mode.

BLOCK DIAGRAMS

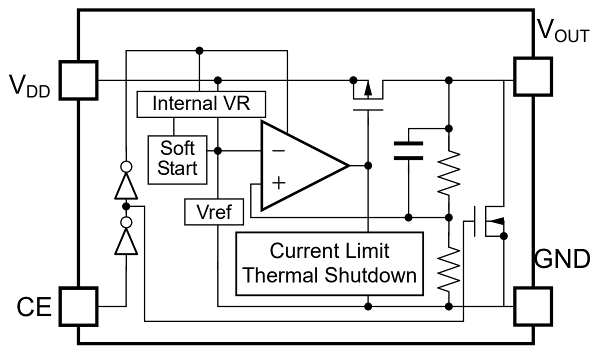
R1518xxxxB



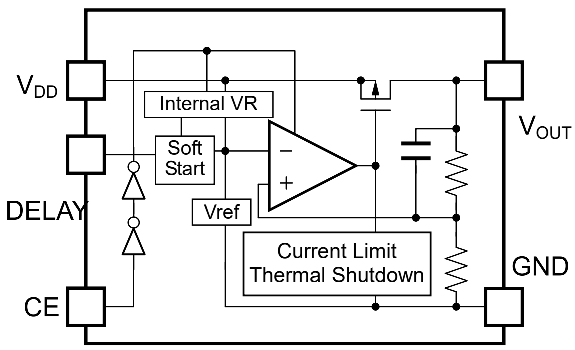
R1518x001C



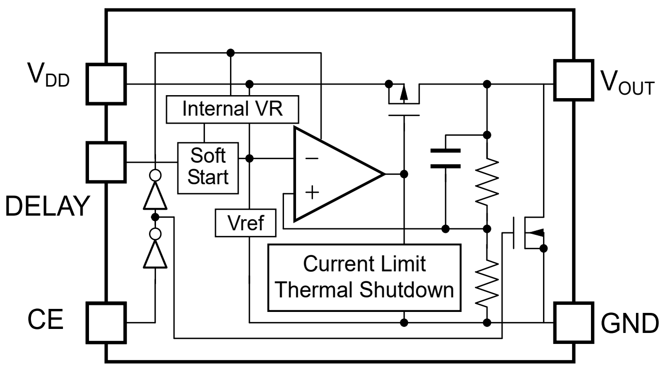
R1518xxxxD



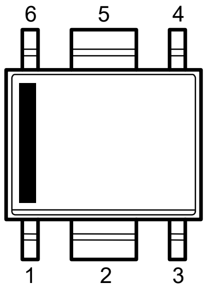
R1518xxxxE



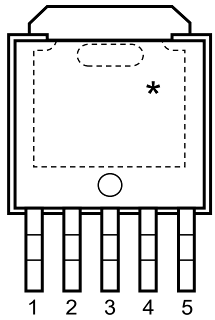
R1518xxxxF



PIN DESCRIPTION



HSOP-6J



TO-252-5-P2

HSOP-6J

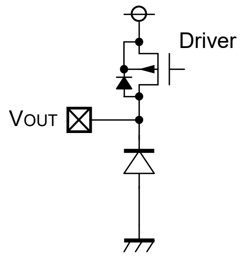
Pin No.	Symbol	Description	
1	VDD	Input Pin	
2	GND	Ground Pin	
3	NC	No Connection	R1518SxxxB/D
	VFB	Feedback Pin	R1518S001C
	DELAY	Adjustable Soft-start Time Pin	R1518SxxxE/F
4	CE	Chip Enable Pin, Active-high	
5	GND	Ground Pin	
6	VOUT	Output Pin	

TO-252-5-P2

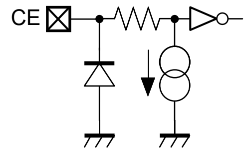
Pin No.	Symbol	Description	
1	VDD	Input Pin	
2	NC	No Connection	R1518Jxx1B/D
	VFB	Feedback Pin	R1518J001C
	DELAY	Adjustable Soft-start Time Pin	R1518Jxx1E/F
3	GND	Ground Pin	
4	CE	Chip Enable Pin, Active-high	
5	VOUT	Output Pin	

* 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.

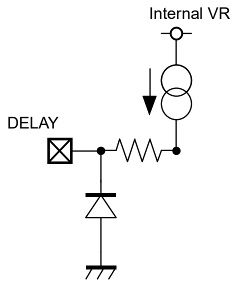
PIN EQUIVALENT CIRCUIT DIAGRAMS



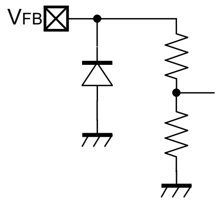
V_{OUT} Pin



CE Pin



DELAY Pin
(R1518xxxxE/F)



V_{FB} Pin
(R1518x001C)

ABSOLUTE MAXMUM RATINGS

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage		−0.3 to 50	V
V_{IN}	Peak Input Voltage (1)		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 (2) (JEDEC STD.51-7)	HSOP-6J	2700	mW
		TO-252-5-P2	3800	
Tj	Junction Temperature Range		−40 to 125	°C
Tstg	Storage Temperature Range		−55 to 125	°C

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the 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.

RECCOMENDED OPERATING CONDITIONS

Recommended Operating Conditions

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage	3.5 to 36	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 ratings 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) Duration time = 200 ms
(2) Refer to POWER DISSIPATION for detailed information

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 $\boxed{\quad}$ are guaranteed by design engineering at -40°C ≤ Ta ≤ 105°C.

R1518xxxxB/D (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 ≤ 105°C	V_{SET} ≤ 5.0 V	$\boxed{\times 0.982}$		$\boxed{\times 1.018}$	V
			V_{SET} > 5.0 V	$\boxed{\times 0.98}$		$\boxed{\times 1.02}$	V
ΔV_{OUT} /ΔI_{OUT}	Load Regulation	$V_{IN} = V_{SET} + 2.0$ V, 1mA ≤ I_{OUT} ≤ 250 mA		$\boxed{-15}$	3	$\boxed{25}$	mV
		$V_{IN} = V_{SET} + 2.0$ V, 1mA ≤ I_{OUT} ≤ 1 A		$\boxed{-60}$	10	$\boxed{60}$	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	$\boxed{36}$	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, Under the condition of V_{IN} ≥ 3.5 V			0.01	$\boxed{0.02}$	%/V
ΔV_{OUT} /ΔTa	Output Voltage Temperature Coefficient	−40°C ≤ Ta ≤ 105°C			±60		ppm /°C
I_{LIM}	Output Current Limit	$V_{IN} = V_{SET}$ +2.0 V		$\boxed{1}$			A
I_{SC}	Short Current Limit	V_{IN} =5.0 V, V_{OUT} = 0 V			150		mA
I_{PD}	CE Pull-down Current	V_{CE} = 5.0 V			0.2	$\boxed{0.6}$	µA
		V_{CE} = 36 V			0.5	$\boxed{1.3}$	µA
t_{D1}	Soft-start Time 1				120		µs
V_{CEH}	CE Input Voltage "H"			$\boxed{2.2}$			V
V_{CEL}	CE Input Voltage "L"					$\boxed{1.0}$	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature			160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature			135		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (R1518xxxxD)	V_{IN} = 14.0 V, V_{CE} = 0 V			3.2		kΩ

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

V_{IN} = V_{FB} (= 2.5 V) + 1.0 V = 3.5 V, I_{OUT} = 1 mA, C_{IN} = 0.1 μF, COUT = 1.0 μF unless otherwise noted.

The specifications surrounded by $\boxed{}$ are guaranteed by design engineering at -40°C ≤ Ta ≤ 105°C.

R1518x001C (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 ≤ 105°C	$\boxed{2.455}$		$\boxed{2.545}$	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN} = 4.5 V, 1mA ≤ I_{OUT} ≤ 250 mA	$\boxed{-10}$	3	$\boxed{10}$	mV
		V_{IN} = 4.5 V, 1 mA ≤ I_{OUT} ≤ 1 A	$\boxed{-25}$	5	$\boxed{35}$	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 1 A		1.0	$\boxed{1.8}$	V
I_{SS}	Supply Current	I_{OUT} = 0 mA		18	$\boxed{36}$	μA
Istandby	Standby Current	V_{CE} = 0 V		0.1	2.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	3.5 V ≤ V_{IN} ≤ 36 V		0.01	$\boxed{0.02}$	%/V
$\Delta V_{OUT}/\Delta Ta$	Output Voltage Temperature Coefficient	−40°C ≤ Ta ≤ 105°C		±60		ppm/°C
I_{LIM}	Output Current Limit	V_{IN} = 4.5 V	$\boxed{1}$			A
I_{SC}	Short Current Limit	V_{CE} = 5.0 V, V_{OUT} = V_{FB} = 0 V		150		mA
I_{PD}	CE Pull-down Current	V_{CE} = 5.0 V		0.2	$\boxed{0.6}$	μA
		V_{CE} = 36 V		0.5	$\boxed{1.3}$	μA
t_{D1}	Soft-start Time 1			120		μs
V_{CEH}	CE Input Voltage "H"		$\boxed{2.2}$			V
V_{CEL}	CE Input Voltage "L"				$\boxed{1.0}$	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature		160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature		135		°C

V_{OUT} = V_{FB} = 2.5 V (excluding short circuit current)
All test items listed under Electrical Characteristics are done under the pulse load condition (Tj ≈ Ta = 25°C) except for Output Voltage Temperature coefficient and 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 $\boxed{}$ are guaranteed by design engineering at -40°C ≤ Ta ≤ 105°C.

R1518xxxxE/F (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 ≤ 105°C	V_{SET} ≤ 5.0 V	$\boxed{\times 0.982}$		$\boxed{\times 1.018}$	V
			V_{SET} > 5.0 V	$\boxed{\times 0.98}$		$\boxed{\times 1.02}$	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	$V_{IN} = V_{SET}$ +2.0 V, 1 mA ≤ I_{OUT} ≤ 250 mA		$\boxed{-15}$	3	$\boxed{25}$	mV
		$V_{IN} = V_{SET}$ +2.0 V, 1 mA ≤ I_{OUT} ≤ 1 A		$\boxed{-60}$	10	$\boxed{60}$	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	$\boxed{36}$	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, Under the condition of V_{IN} ≥ 3.5 V			0.01	$\boxed{0.02}$	%/V
$\Delta V_{OUT}/\Delta Ta$	Output Voltage Temperature Coefficient	−40°C ≤ Ta ≤ 105°C			±60		ppm/°C
I_{LIM}	Output Current Limit	$V_{IN} = V_{SET}$ +2.0 V		$\boxed{1}$			A
I_{SC}	Short Current Limit	V_{IN} = 5.0 V, V_{OUT} = 0 V			150		mA
I_{PD}	CE Pull-down Current	V_{CE} = 5.0 V			0.2	$\boxed{0.6}$	µA
		V_{CE} = 36 V			0.5	$\boxed{1.3}$	µA
I_{DELAY}	DELAY Current	DELAY = GND		$\boxed{1.5}$	2.5	$\boxed{3.5}$	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"			$\boxed{2.2}$			V
V_{CEL}	CE Input Voltage "L"					$\boxed{1.0}$	V
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature			160		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature			135		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (R1518xxx1F)	V_{IN} = 14.0 V, V_{CE} = 0 V			3.2		kΩ

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

The specifications surrounded by ☐ are guaranteed by design engineering at -40°C ≤ Ta ≤ 105°C.

R1518xxxxB/D/E/F Product-specific Electrical Characteristics (Ta = 25°C)

Product Name	V_{OUT} [V] (Ta = 25°C)			V_{OUT} [V] (−40°C ≤ Ta ≤ 105°C)			V_{DIF} [V]	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
R1518x251x	2.480	2.500	2.520	$\boxed{2.455}$	2.500	$\boxed{2.545}$	1.00	$\boxed{1.80}$
R1518x331x	3.274	3.300	3.326	$\boxed{3.241}$	3.300	$\boxed{3.359}$	0.90	$\boxed{1.60}$
R1518x341x	3.373	3.400	3.427	$\boxed{3.339}$	3.400	$\boxed{3.461}$		
R1518x501x	4.960	5.000	5.040	$\boxed{4.910}$	5.000	$\boxed{5.090}$	0.70	$\boxed{1.30}$
R1518x601x	5.940	6.000	6.060	$\boxed{5.880}$	6.000	$\boxed{6.120}$		
R1518x851x	8.415	8.500	8.585	$\boxed{8.330}$	8.500	$\boxed{8.670}$	0.65	$\boxed{1.10}$
R1518x901x	8.910	9.000	9.090	$\boxed{8.820}$	9.000	$\boxed{9.180}$	0.65	$\boxed{1.10}$

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.

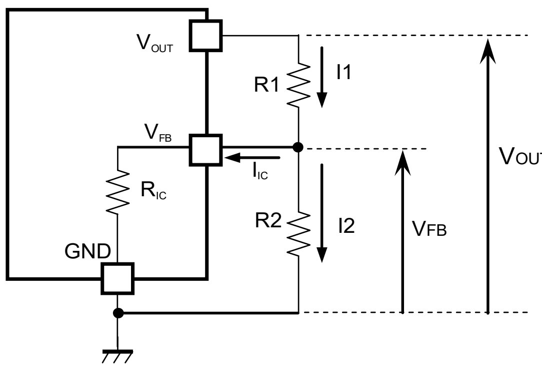
Adjustable Output Voltage Setting (R1518x001C)

The output voltage of R1518x001C 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}.

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

Recommended Range: $2.5\text{ V} \le V_{OUT} \le 20.0\text{ V}$

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



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

R_{IC} of the R1518x001C 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 R1518xxxxE/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.

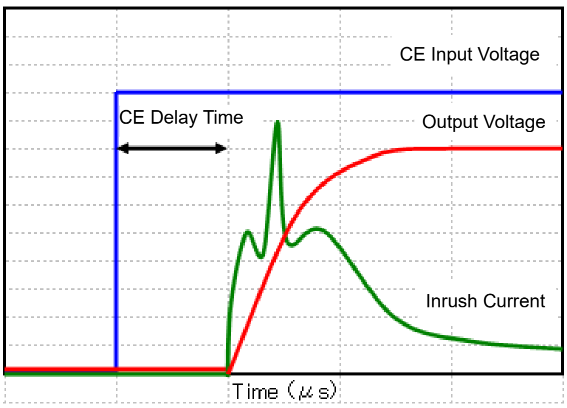
$$t_D = ((C_D + 90 \times 10^{-12}) / I_{DELAY}) \times 0.73$$

When the capacitor C_D of R1518xxxxE/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.

The capacity (C_D) of the DELAY pin is discharged when V_{IN} is input and CE = L. If the C_D is restarted without being discharged, the soft start time may be shorter than the set time.

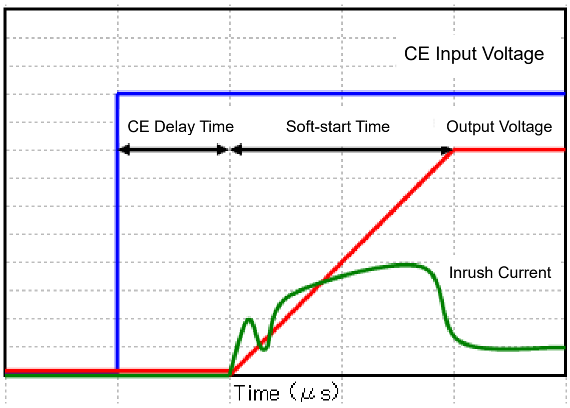
Conventional Inrush Current Limit Circuit

(Diagrammatic sketch)



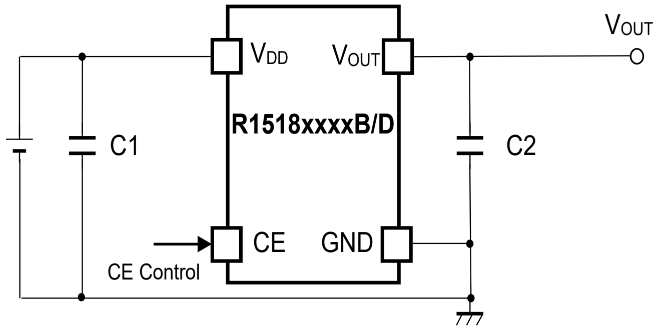
Constant Slope Circuit

(Diagrammatic sketch)

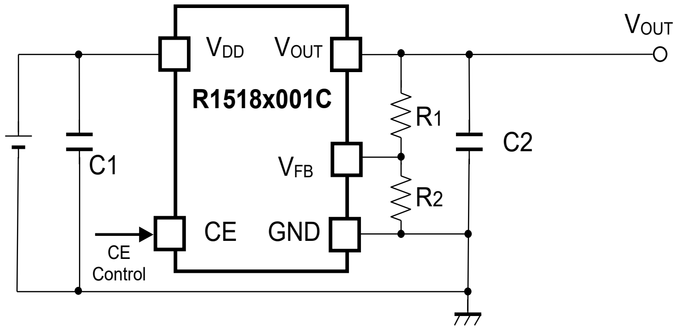


APPLICATION INFORMATION

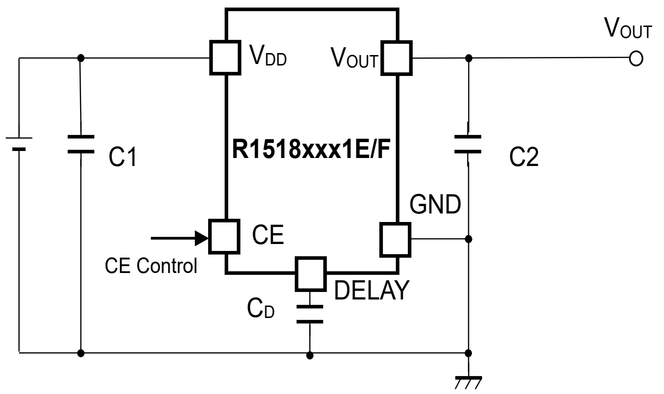
TYPICAL APPLICATION



R1518xxxxB/D Typical Application



R1518x001C Typical Application



R1518xxx1E/F Typical Application

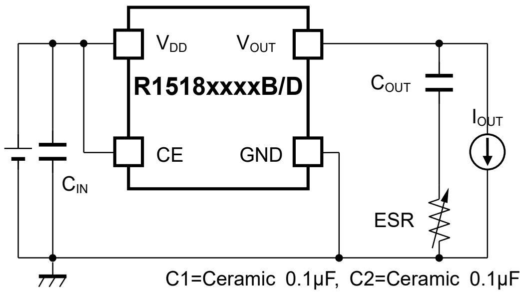
External Components：

Symbol	Description
R1518xxxxB/D/E/F	
C1 (C_{IN})	0.1μF (Ceramic)
C2 (C_{OUT})	0.1μF (Ceramic)
R1518x001C	
C1 (C_{IN})	0.1μF (Ceramic)
C2 (C_{OUT})	1.0μF (Ceramic)

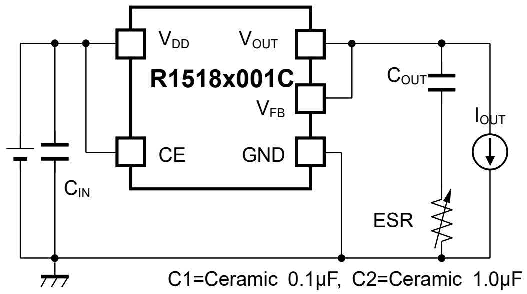
ESR vs. Output Current

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.

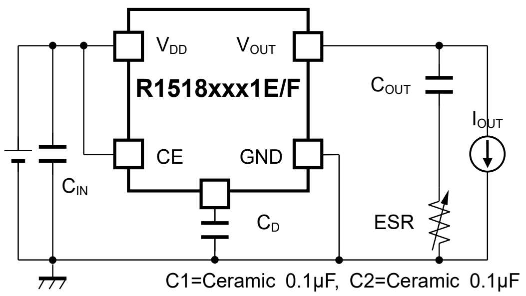
R1518xxxxB/D Test Circuit



R1518x001C Test Circuit



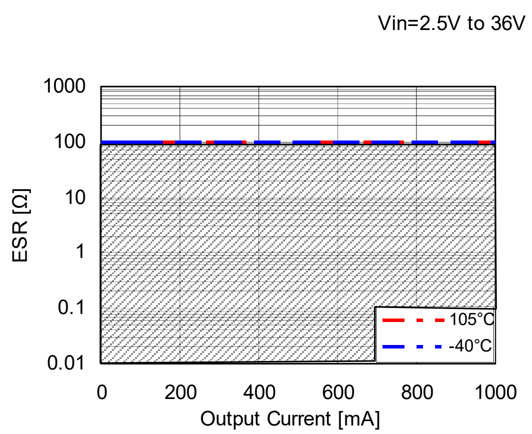
R1518xxxxE/F Test Circuit



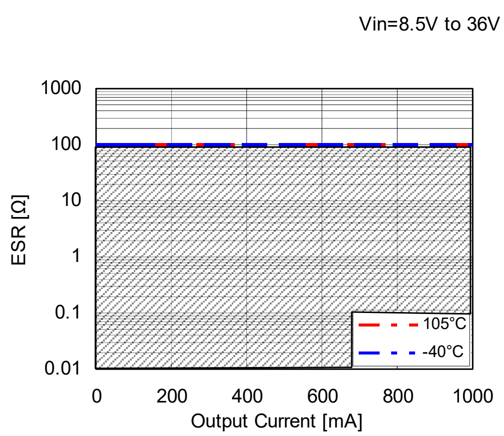
Measurement conditions

Frequency Band: 10 Hz to 2 MHz
Measurement Temperature: −40°C to 105°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



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 (R1518x001C) 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 (R1518x001C), 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.

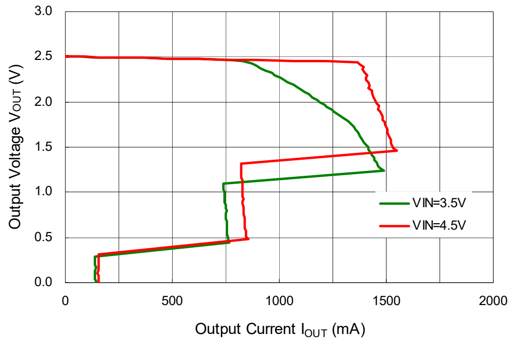
In addition, connect the capacitor C2 between V_{OUT} and GND, and as close as possible to the pins.

TYPICAL CHARACTERISTICS

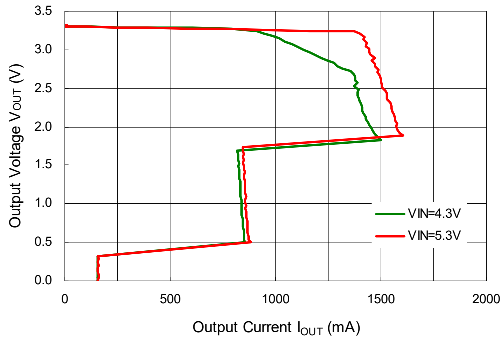
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

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

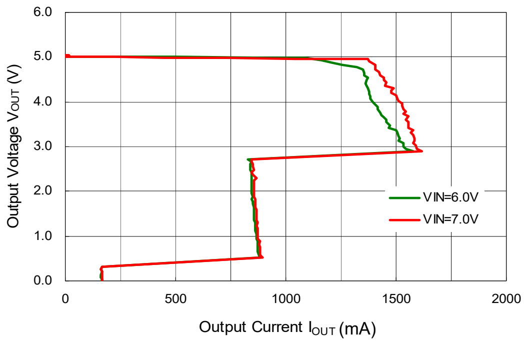
R1518x25xx, R1518x001C



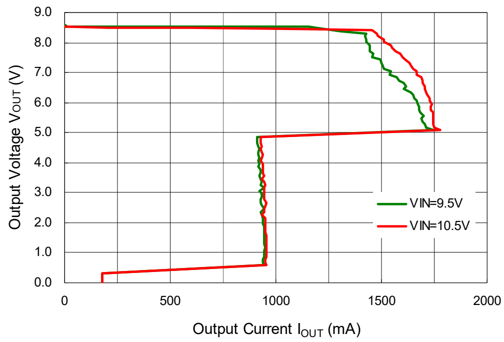
R1518x33xx



R1518x50xx

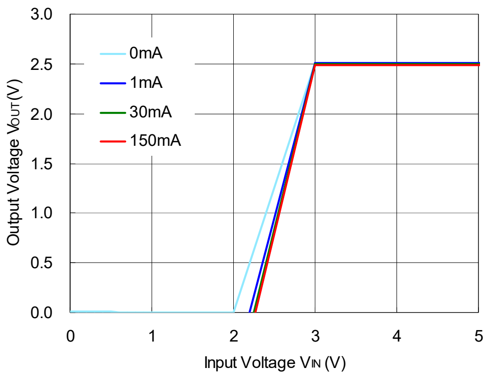


R1518x85xx

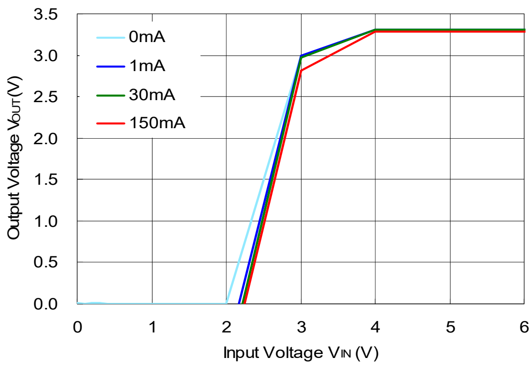


2) Output Voltage vs. Input Voltage (Ta = 25°C)

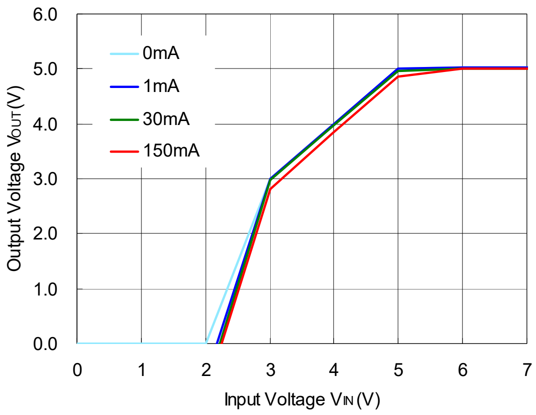
R1518x25xx



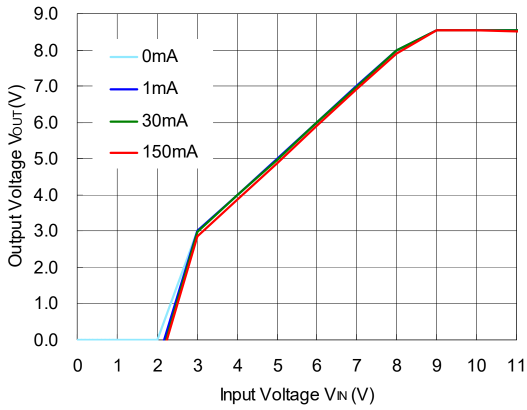
R1518x33xx



R1518x50xx

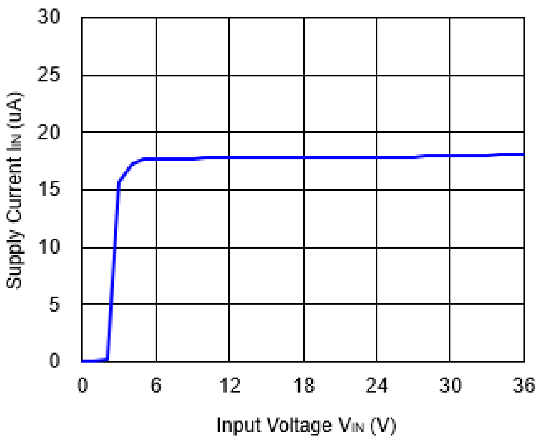


R1518x85xx

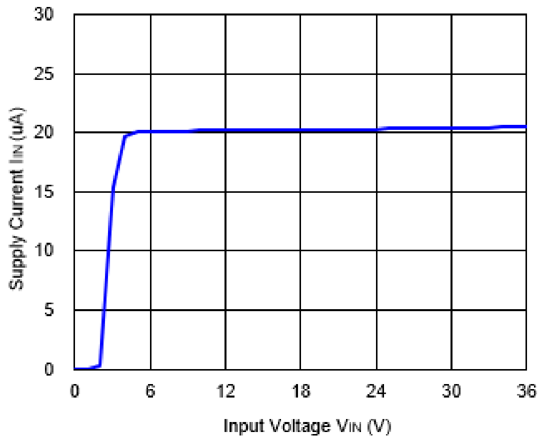


3) Supply Current vs. Input Voltage （ I_{OUT} = 0 mA ）

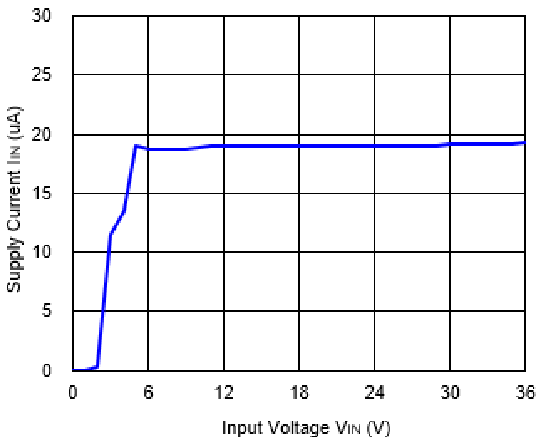
R1518x25xx, R1518x001C



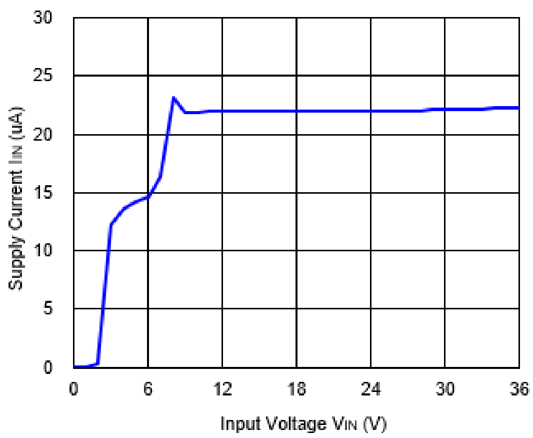
R1518x33xx



R1518x50xx

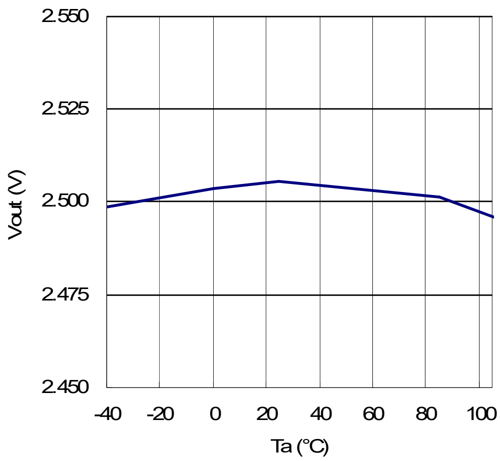


R1518x85xx

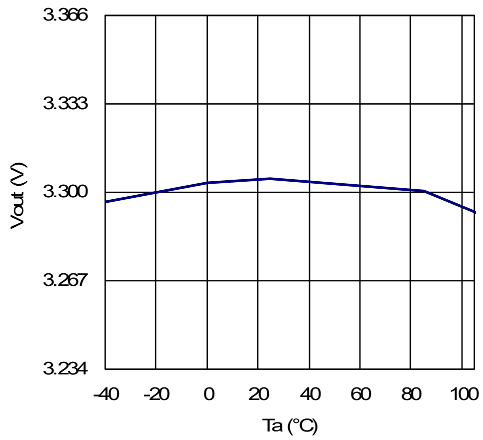


4) Output Voltage vs. Operating Temperature

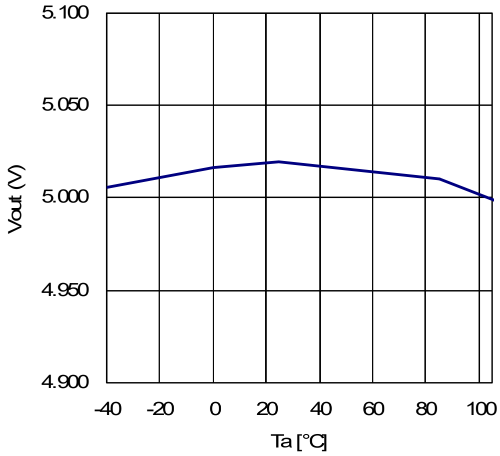
R1518x25xx, R1518x001C



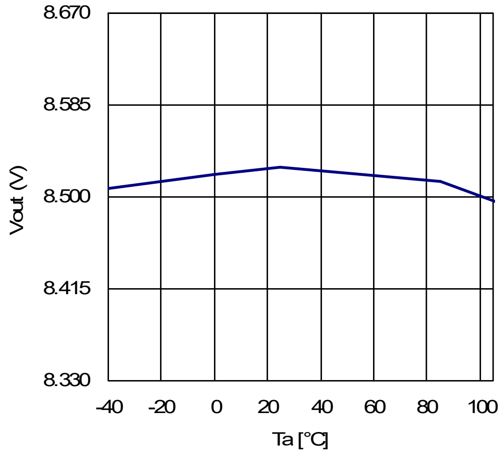
R1518x33xx



R1518x50xx

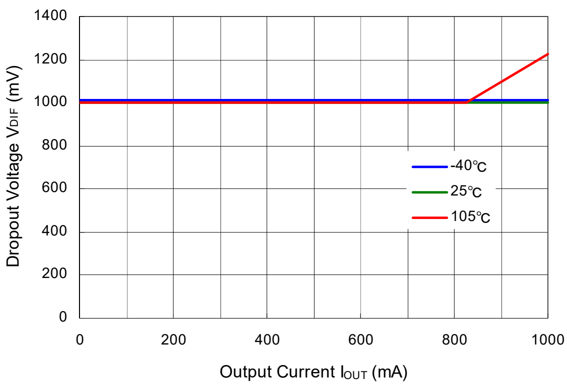


R1518x85xx

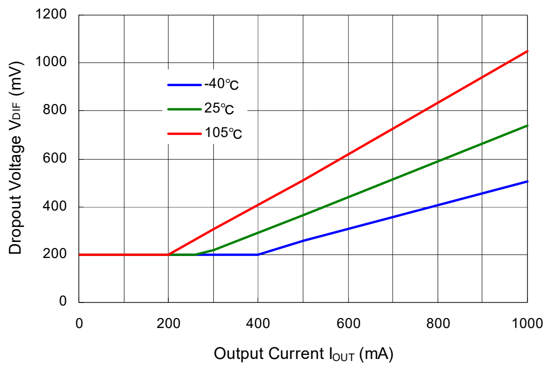


5) Dropout Voltage vs. Output Current

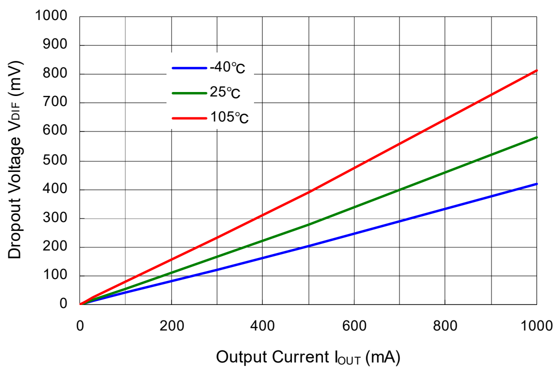
R1518x25xx, R1518x001C



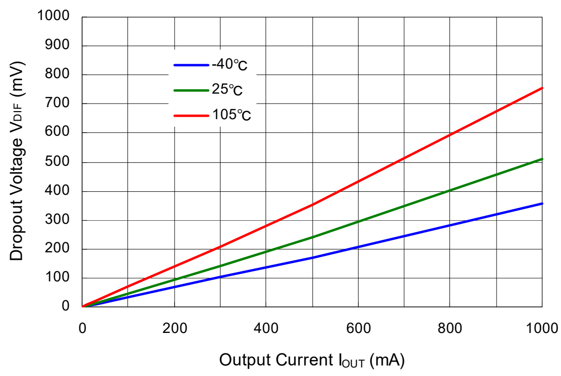
R1518x33xx



R1518x50xx

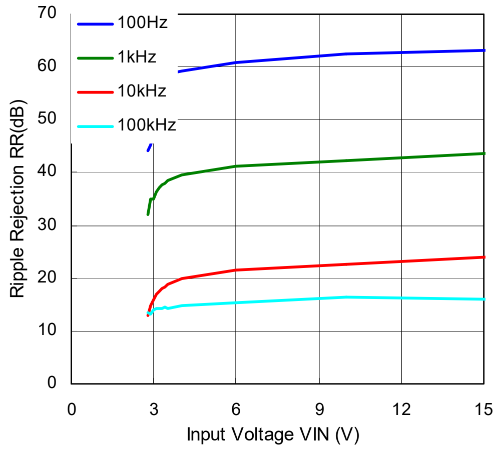


R1518x85xx

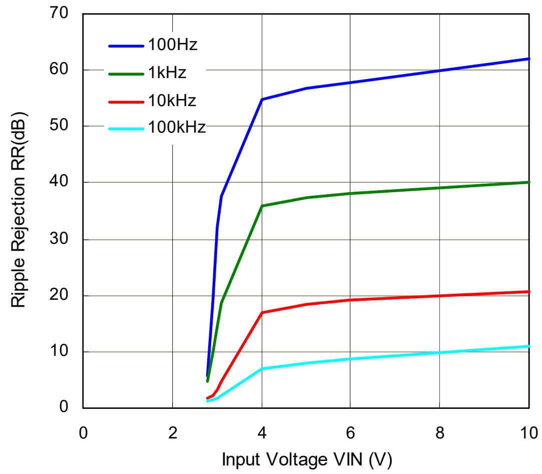


6) Ripple Rejection vs. Input Voltage (Ta = 25°C, Ripple = 0.2 Vpp)

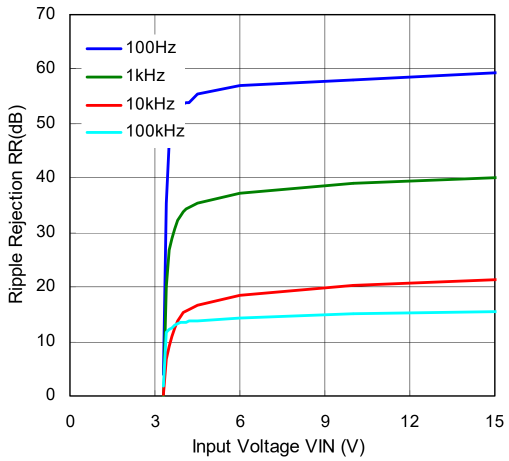
R1518x25xx, R1518x001C (I_{OUT} = 1 mA)



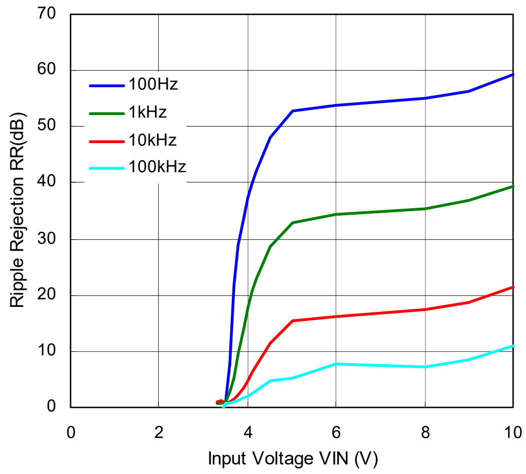
R1518x25xx, R1518x001C (I_{OUT} = 300 mA)



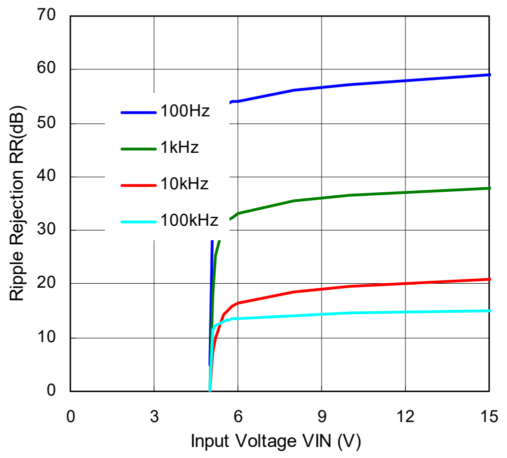
R1518x33xx (I_{OUT} = 1 mA)



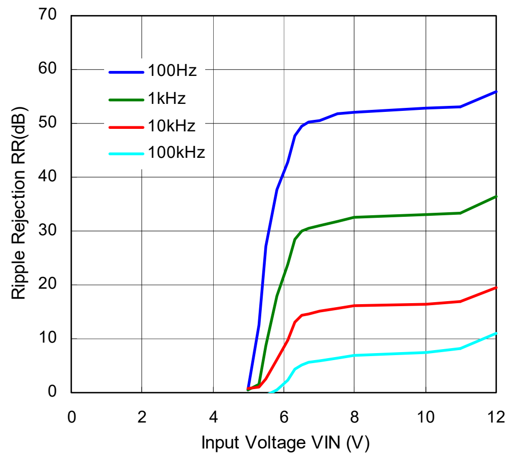
R1518x33xx (I_{OUT} = 300 mA)



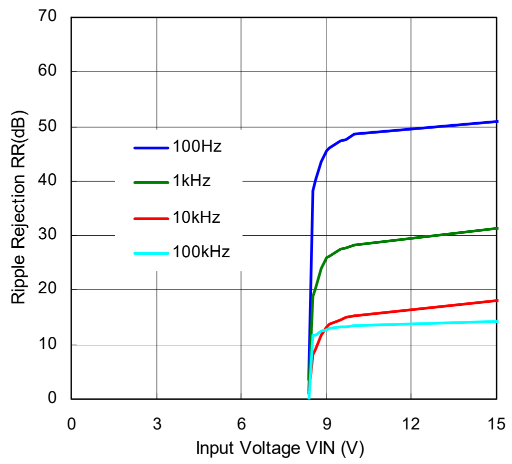
R1518x50xx (I_{OUT} = 1 mA)



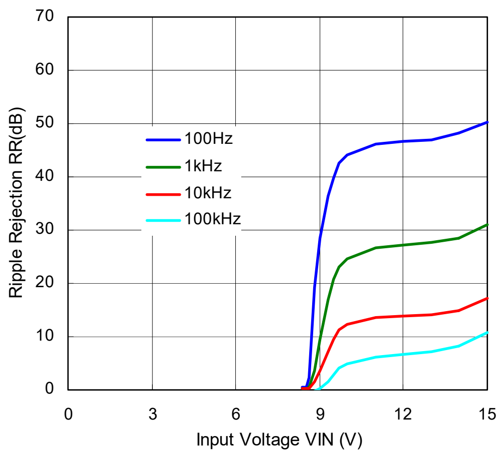
R1518x50xx (I_{OUT} = 300 mA)



R1518x85xx (I_{OUT} = 1 mA)

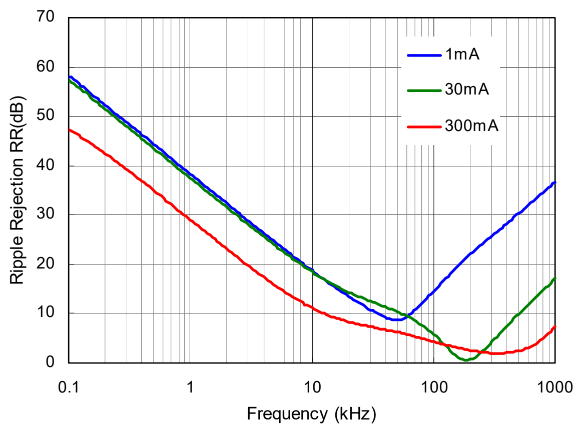


R1518x85xx (I_{OUT} = 300 mA)

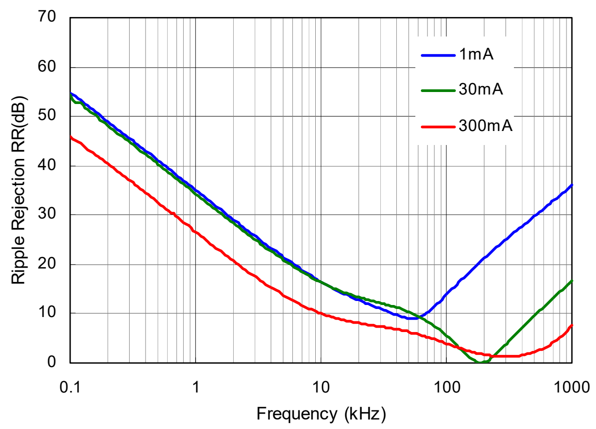


7) Ripple Rejection vs. Frequency (Ta = 25°C, Ripple = 0.2 Vpp)

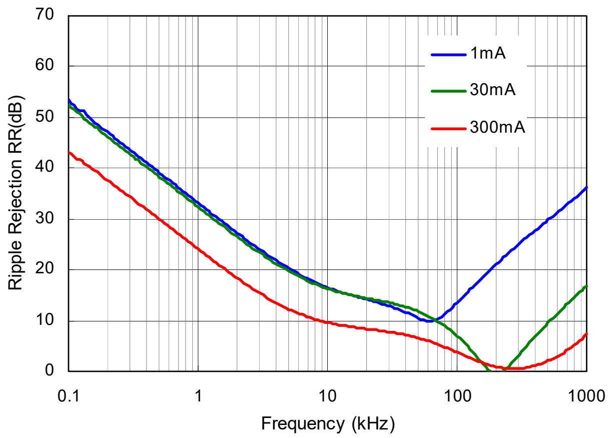
R1518x25xx, R1518x001C



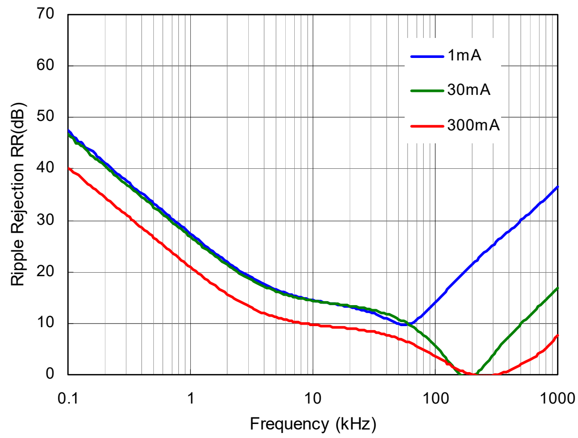
R1518x33xx



R1518x50xx

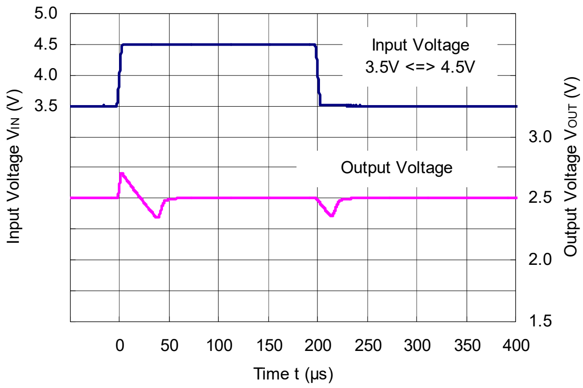


R1518x85xx

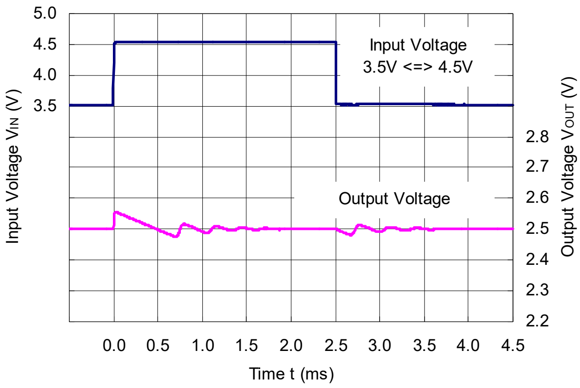


8) Input Transient Response (Ta = 25°C, I_{OUT} = 1 mA, tr = tf = 5 µs)

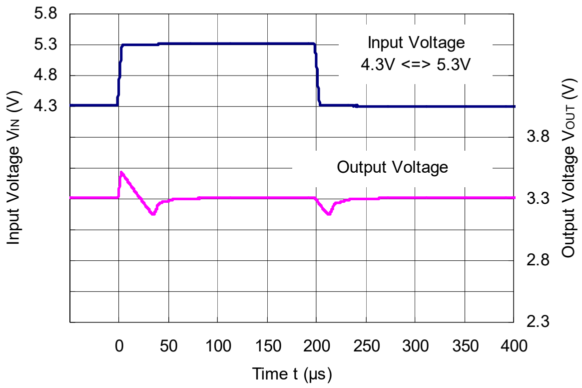
R1518x25xx, R1518x001C (C2 = 0.1 µF)



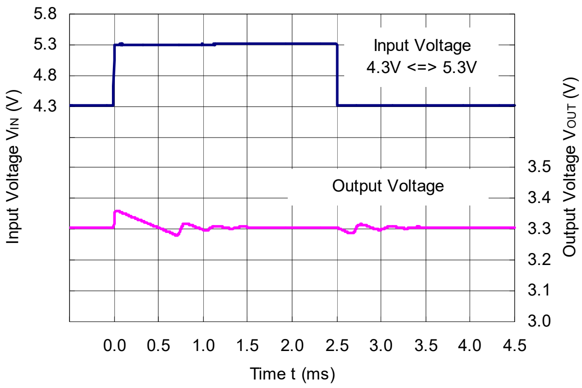
R1518x25xx, R1518x001C (C2 = 10 µF)



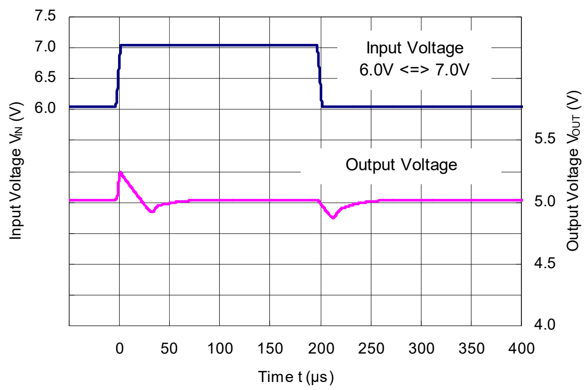
R1518x33xx (C2 = 0.1 µF)



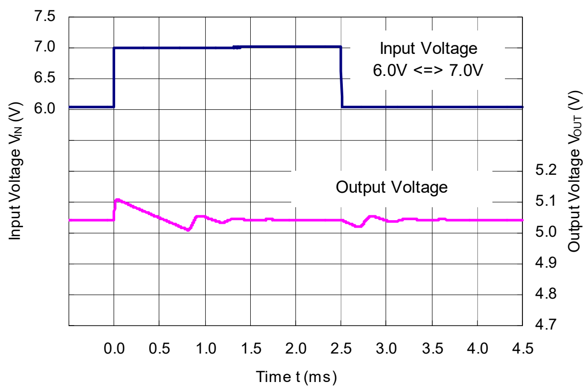
R1518x33xx (C2 = 10 µF)



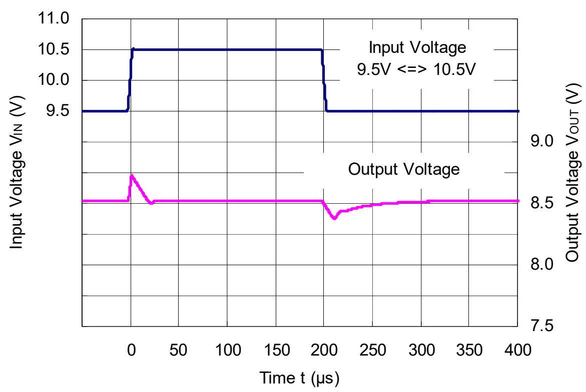
R1518x50xx (C2 = 0.1 μF)



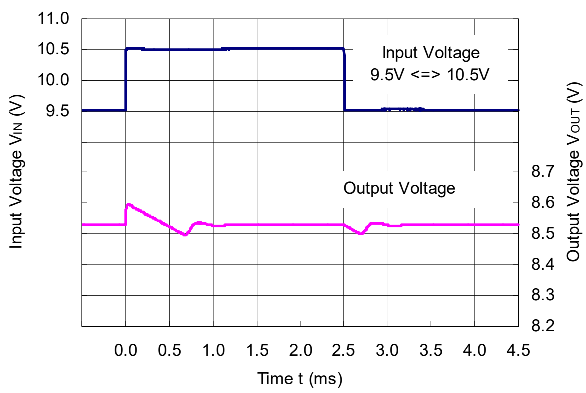
R1518x50xx (C2 = 10 μF)



R1518x85xx (C2 = 0.1 μF)

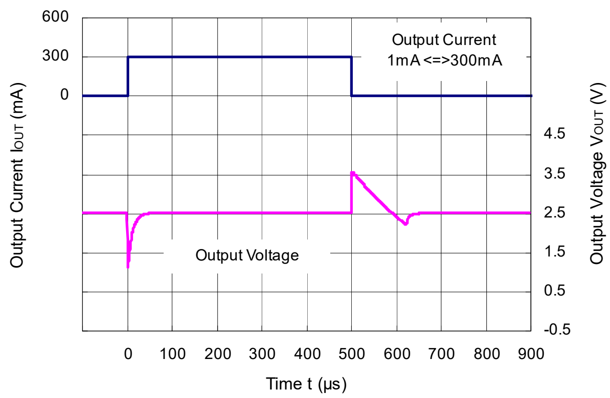


R1518x85xx (C2 = 10 μF)

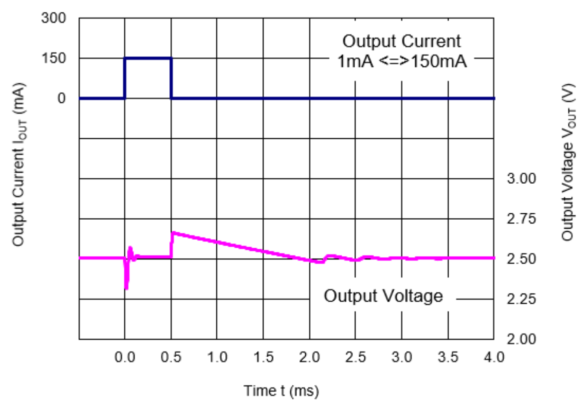


9) Load Transient Response (Ta = 25°C, V_{IN} = V_{OUT} + 1.0 V, tr = tf = 0.5 μs)

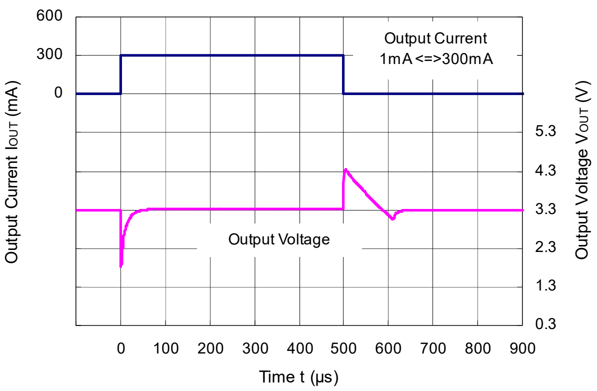
R1518x25xx, R1518x001C (C2 = 0.1 μF)



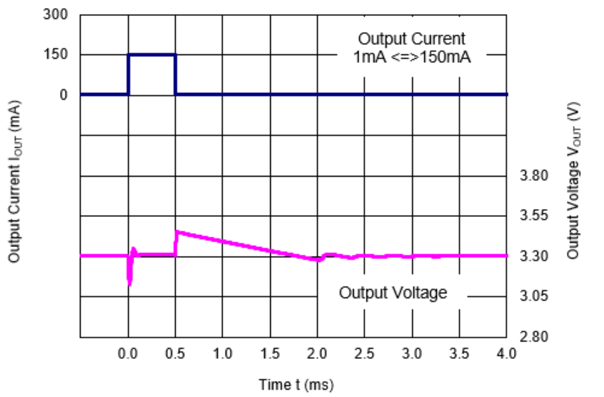
R1518x25xx, R1518x001C (C2 = 10 μF)



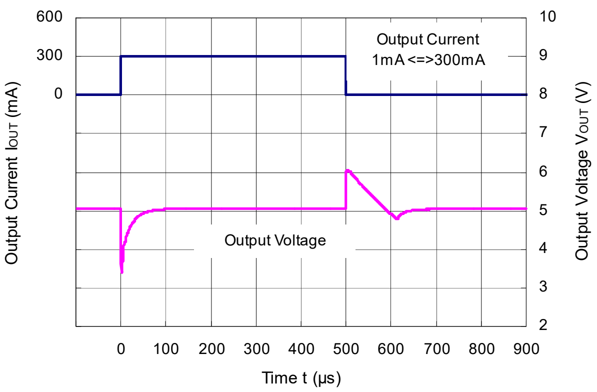
R1518x33xx (C2 = 0.1 μF)



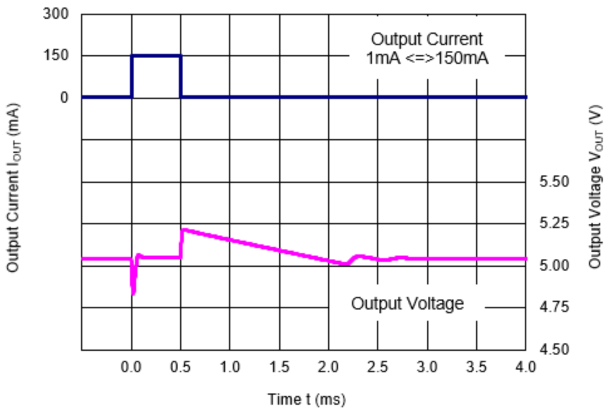
R1518x33xx (C2 = 10 μF)



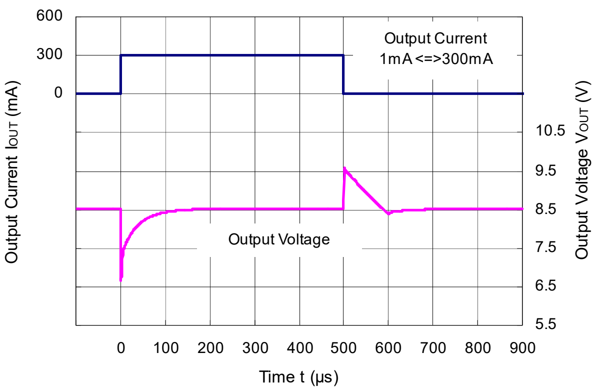
R1518x50xx (C2 = 0.1 μF)



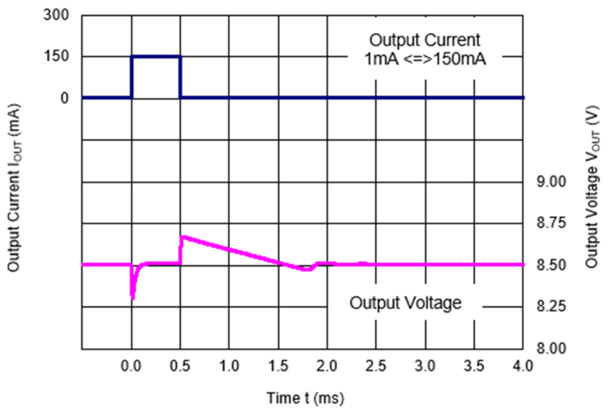
R1518x50xx (C2 = 10 μF)



R1518x85xx (C2 = 0.1 μF)

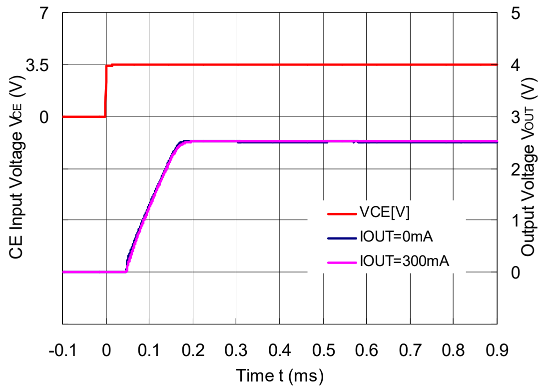


R1518x85xx (C2 = 10 μF)

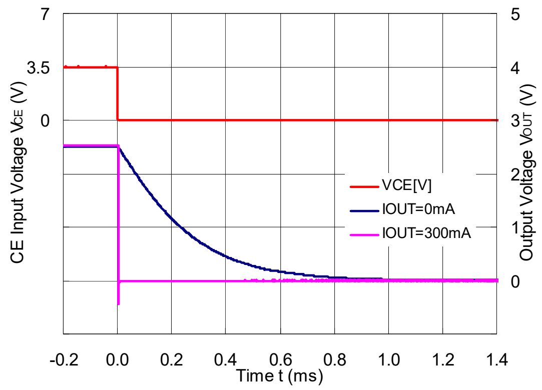


10) CE Transient Response (Ta = 25°C)

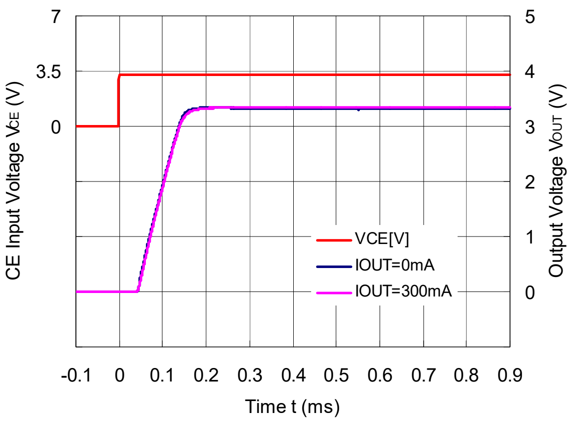
R1518x25xB/D, R1518x001C (C2 = 0.1 μF)



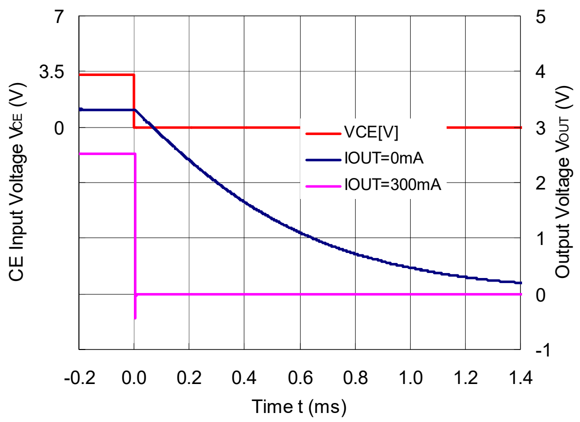
R1518x25xD (C2 = 0.1 μF)



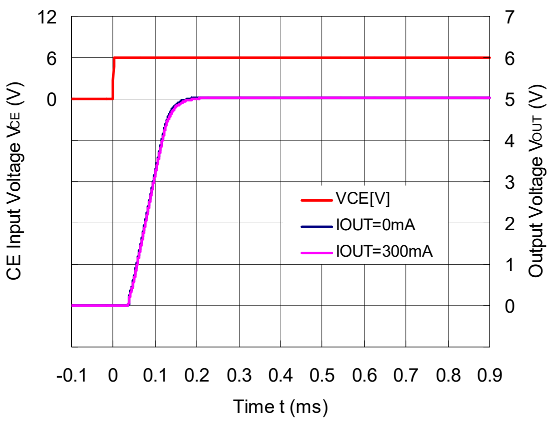
R1518x33xB/D (C2 = 0.1 μF)



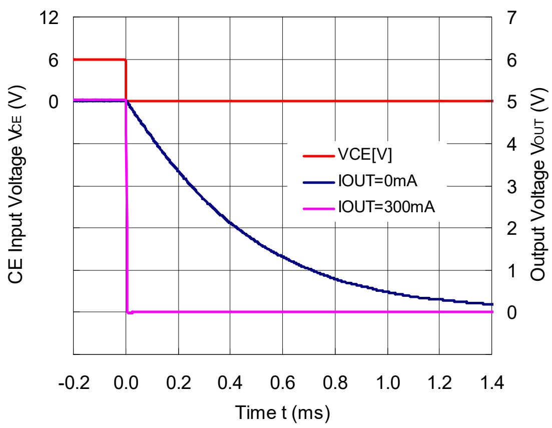
R1518x33xD (C2 = 0.1 μF)



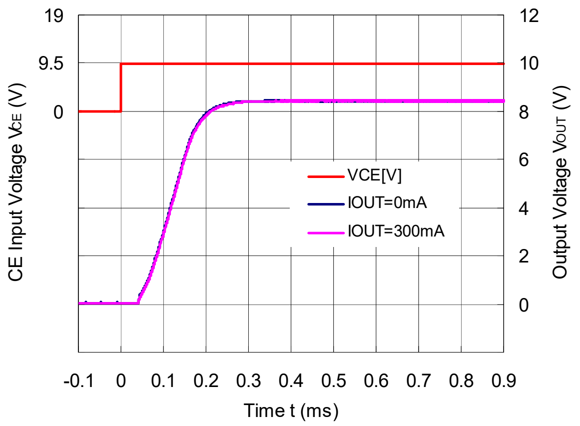
R1518x50xB/D (C2 = 0.1 μF)



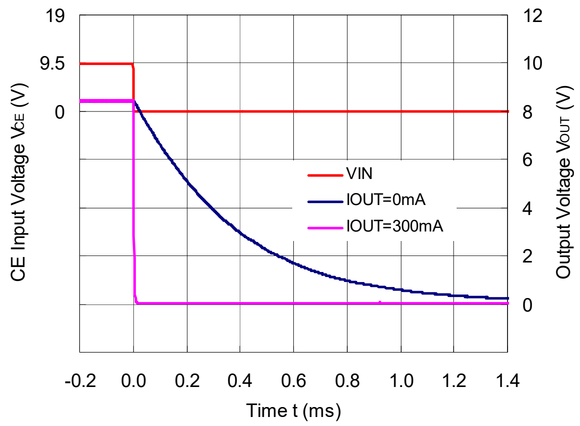
R1518x50xD (C2 = 0.1 μF)



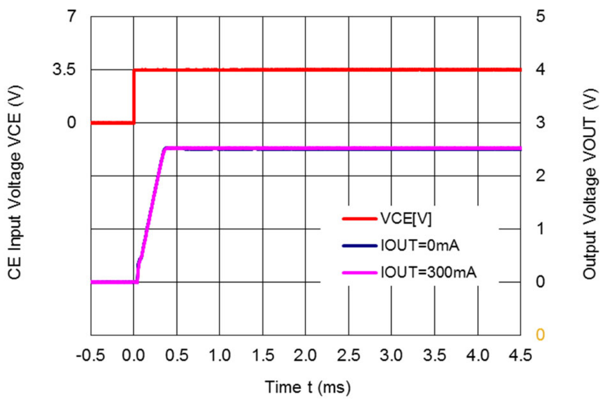
R1518x85xB/D (C2 = 0.1 μF)



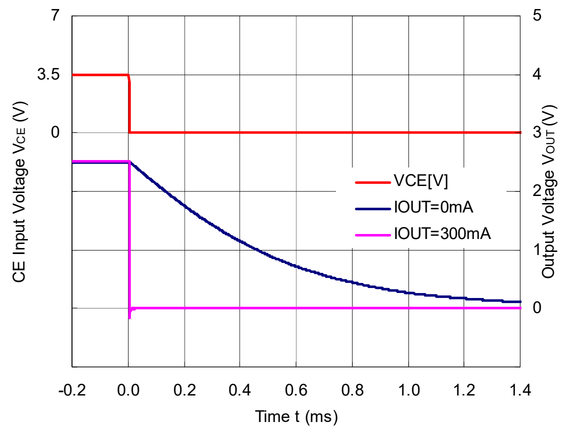
R1518x85xD (C2 = 0.1 μF)



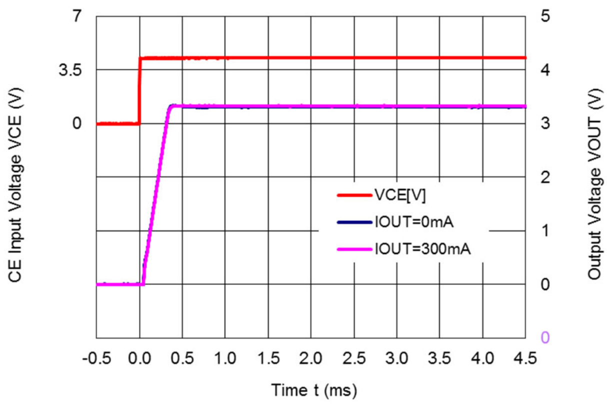
R1518x25xE/F (C2 = 0.1 μF, C_D = 1 nF)



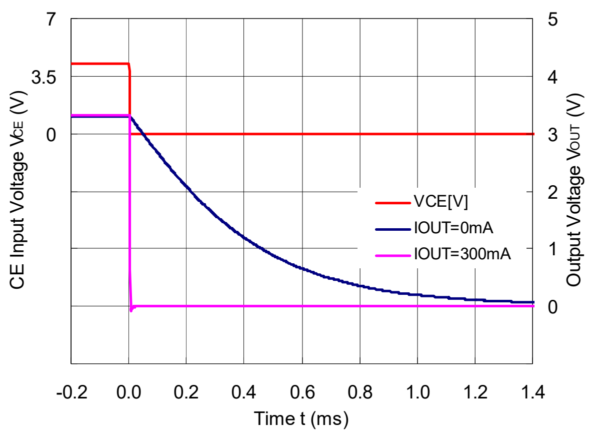
R1518x25xF (C2 = 0.1 μF, C_D = 1 nF)



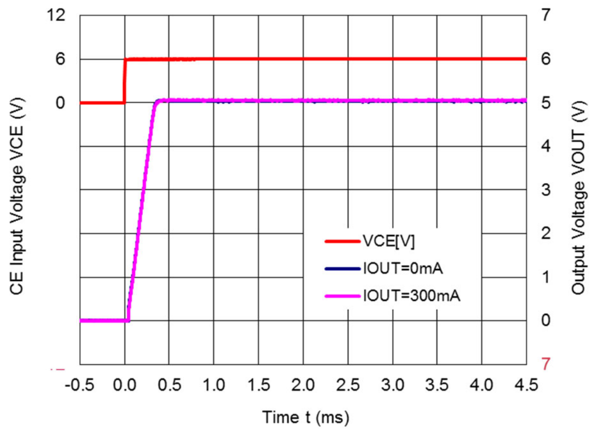
R1518x33xE/F (C2 = 0.1 μF, C_D = 1 nF)



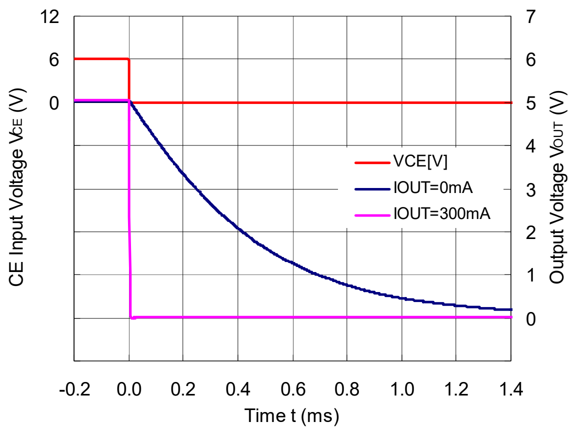
R1518x33xF (C2 = 0.1 μF, C_D = 1 nF)



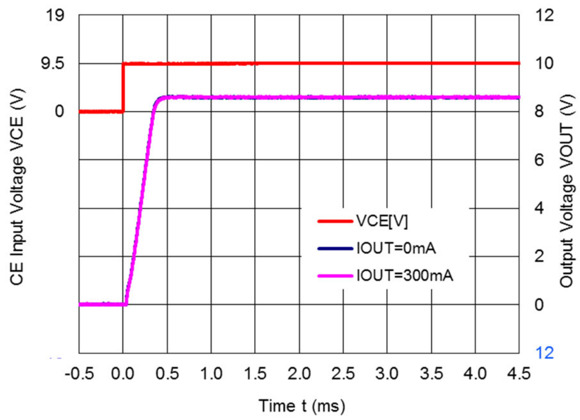
R1518x50xE/F (C2 = 0.1 μF, C_D = 1 nF)



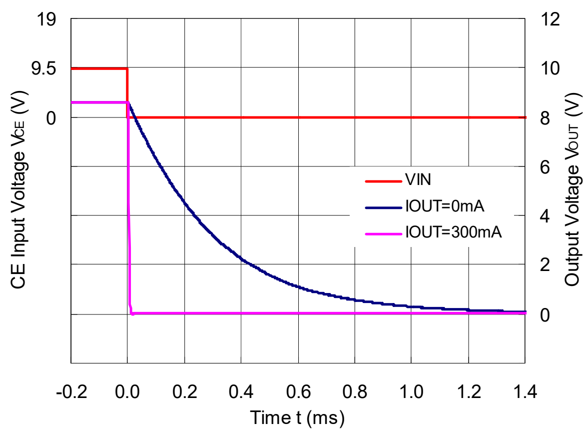
R1518x50xF (C2 = 0.1 μF, C_D = 1 nF)



R1518x851E/F (C2 = 0.1 μF, C_D = 1 nF)

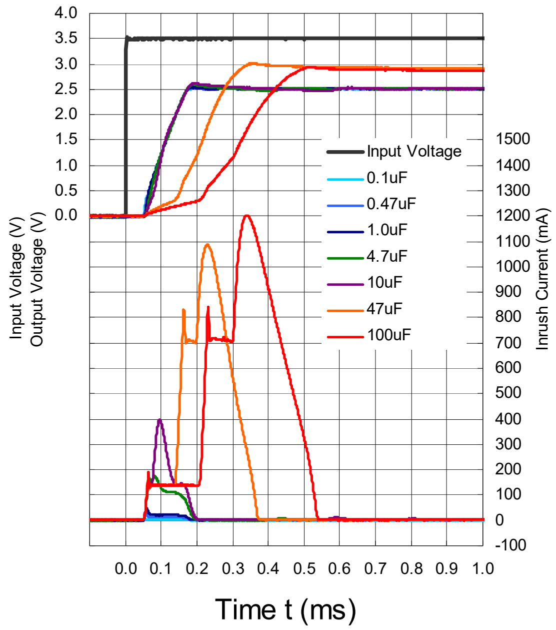


R1518x851F (C2 = 0.1 μF, CD = 1 nF)

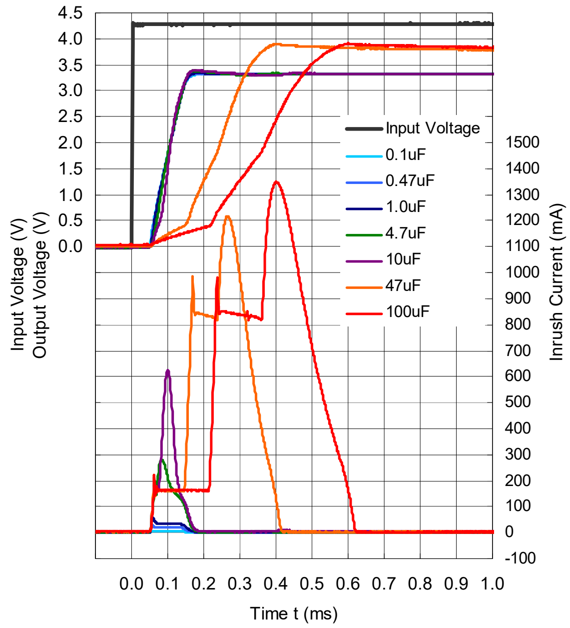


11) Inrush Current Prevention Circuit (Ta = 25°C, I_{OUT} = 1 mA)

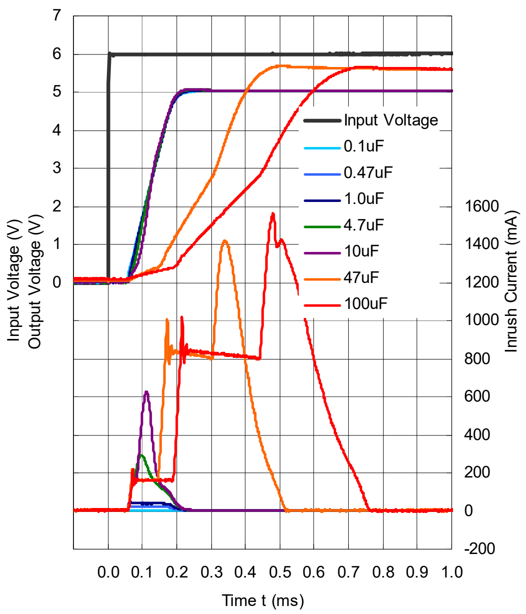
R1518x25xB/D, R1518x001C



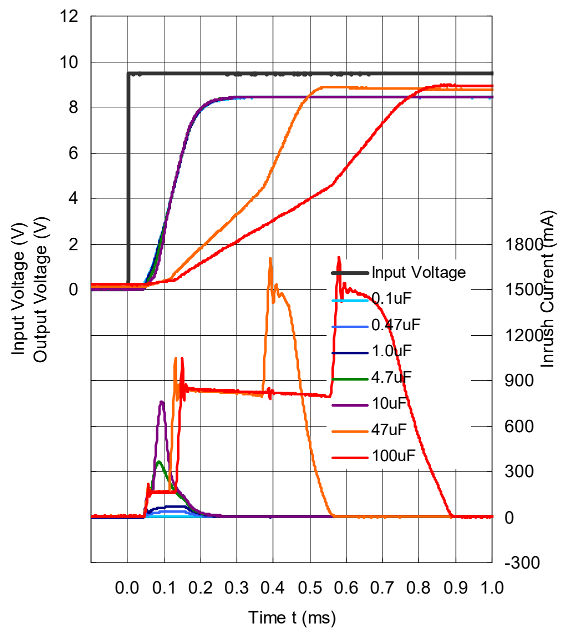
R1518x33xB/D



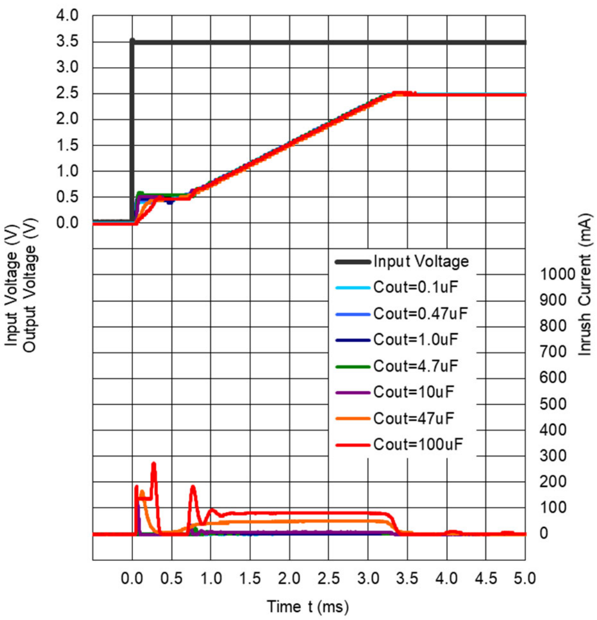
R1518x50xB/D



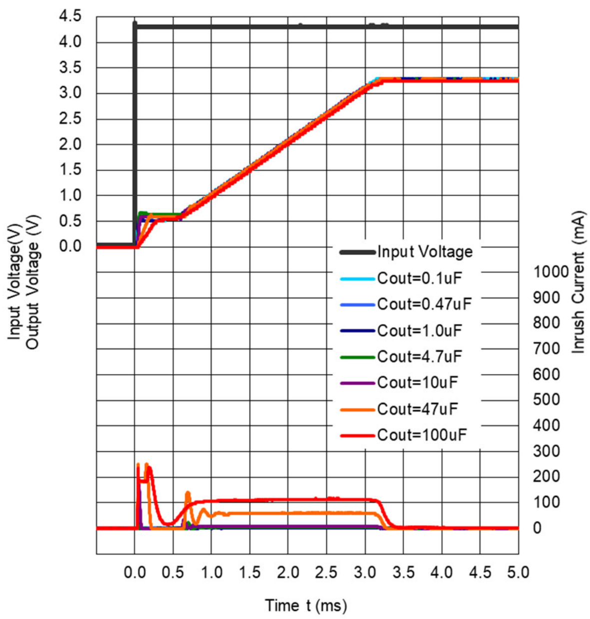
R1518x85xB/D



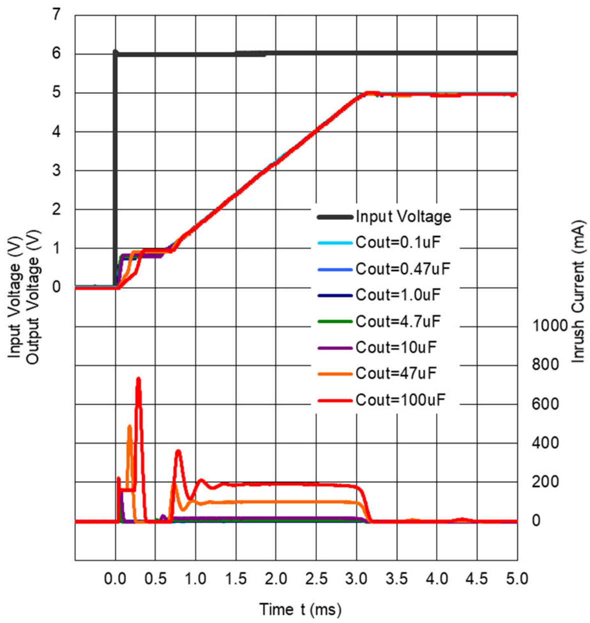
R1518x25xE/F (C_D = 10 nF)



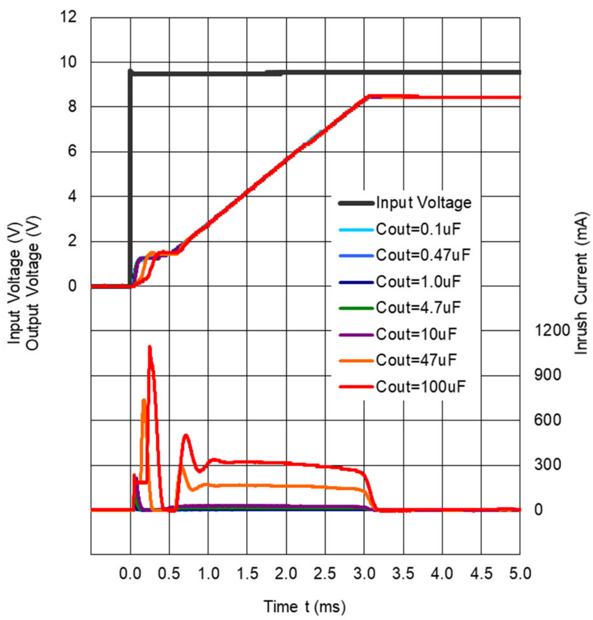
R1518x33xE/F (C_D = 10 nF)



R1518x50xE/F (C_D = 10 nF)



R1518x85xE/F (C_D = 10 nF)



PD-HSOP-6J-(105125150)-JE-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

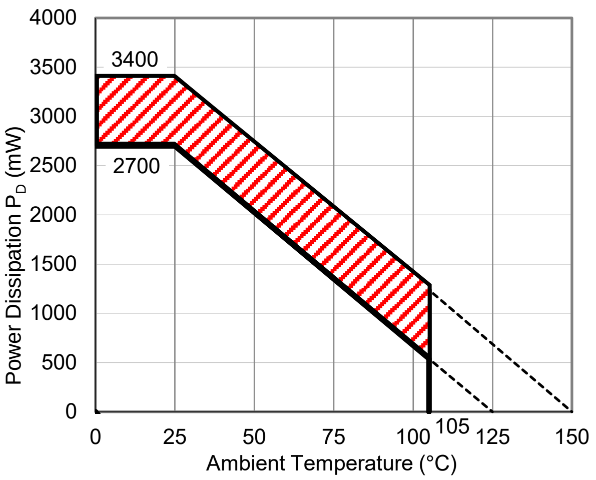
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 28 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

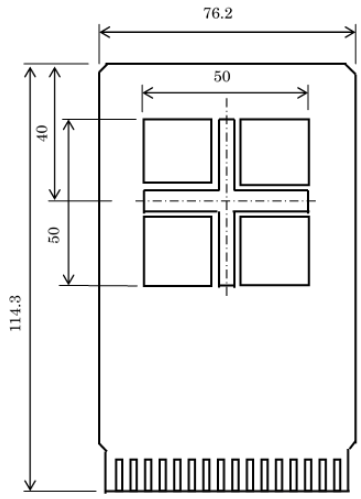
Item	Measurement Result
Power Dissipation	2700 mW
Thermal Resistance (θja)	θja = 37°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 7°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



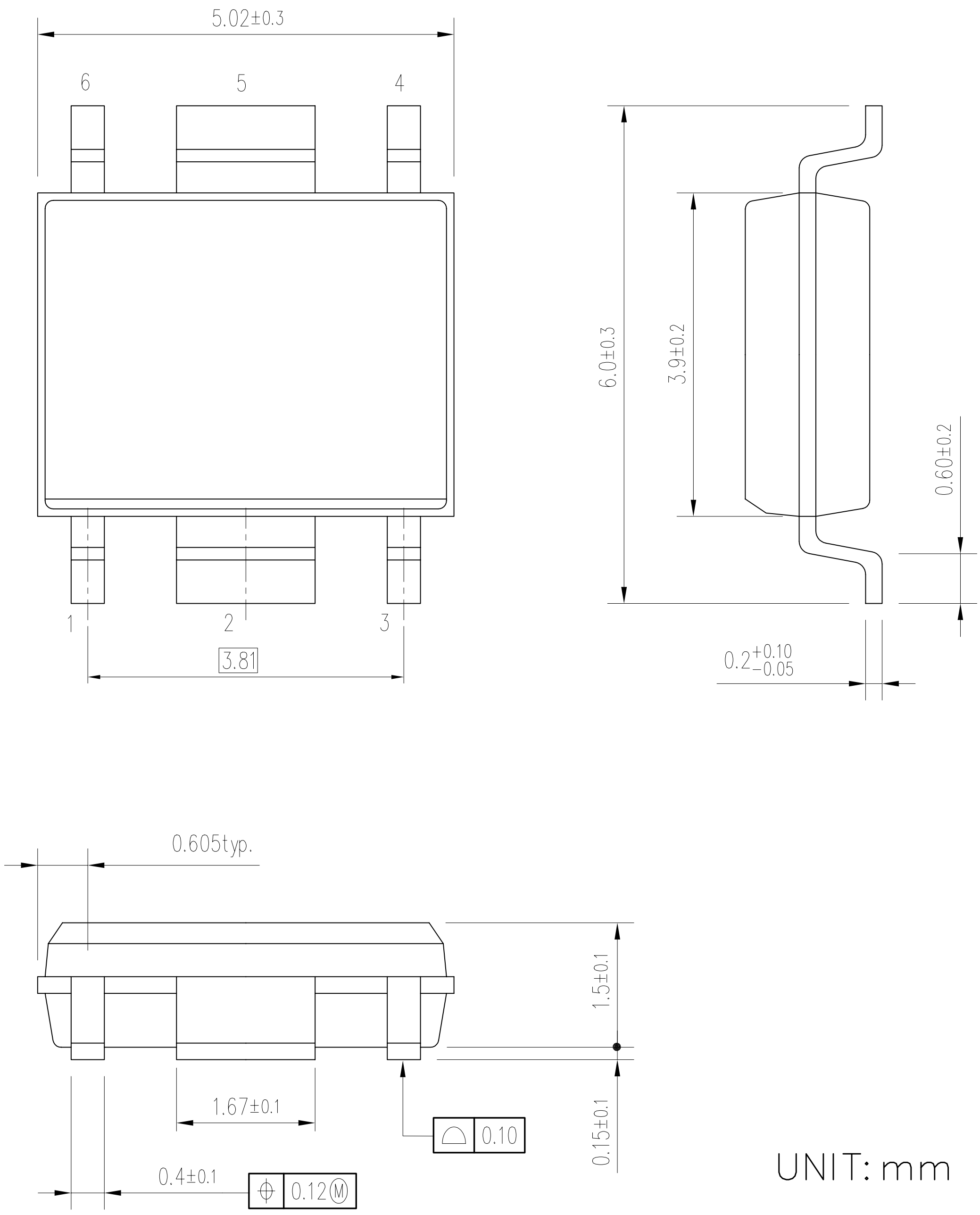
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at Tjmax = 125°C and Tjmax = 150°C. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

Total Hours of Use	Total Years of Use (4 hours/day)
13,000 hours	9 years

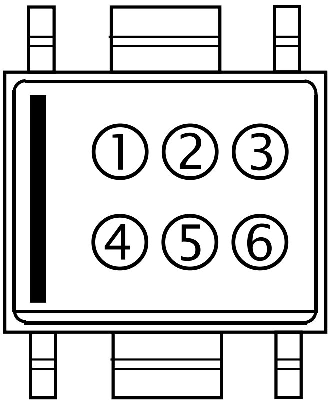


HSOP-6J Package Dimensions

MK-R1518S-JAEA-B

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

⑤⑥: Lot Number … Alphanumeric Serial Number



HSOP-6J Part Markings

NOTICE
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.

MK-R1518S-JAEA-B

R1518S MARK SPECIFICATION TABLE (HSOP-6J)

R1518Sxx1B

Product Name	①②③④	V_{SET}
R1518S251B	**W 1 2 5**	2.5 V
R1518S331B	**W 1 3 3**	3.3 V
R1518S341B	**W 1 3 4**	3.4 V
R1518S501B	**W 1 5 0**	5.0 V
R1518S601B	**W 1 6 0**	6.0 V
R1518S851B	**W 1 8 5**	8.5 V
R1518S901B	**W 1 9 0**	9.0 V

R1518S001C

Product Name	①②③④	V_{SET}
R1518S001C	**W 2 0 1**	-

R1518Sxx1D

Product Name	①②③④	V_{SET}
R1518S251D	**W 3 2 5**	2.5 V
R1518S331D	**W 3 3 3**	3.3 V
R1518S341D	**W 3 3 4**	3.4 V
R1518S501D	**W 3 5 0**	5.0 V
R1518S601D	**W 3 6 0**	6.0 V
R1518S851D	**W 3 8 5**	8.5 V
R1518S901D	**W 3 9 0**	9.0 V

R1518Sxx1E

Product Name	①②③④	V_{SET}
R1518S251E	**W 4 2 5**	2.5 V
R1518S331E	**W 4 3 3**	3.3 V
R1518S341E	**W 4 3 4**	3.4 V
R1518S501E	**W 4 5 0**	5.0 V
R1518S601E	**W 4 6 0**	6.0 V
R1518S851E	**W 4 8 5**	8.5 V
R1518S901E	**W 4 9 0**	9.0 V

R1518Sxx1F

Product Name	①②③④	V_{SET}
R1518S251F	**W 5 2 5**	2.5 V
R1518S331F	**W 5 3 3**	3.3 V
R1518S341F	**W 5 3 4**	3.4 V
R1518S501F	**W 5 5 0**	5.0 V
R1518S601F	**W 5 6 0**	6.0 V
R1518S851F	**W 5 8 5**	8.5 V
R1518S901F	**W 5 9 0**	9.0 V

PD-TO-252-5-P2-(105125150)-JE-B

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

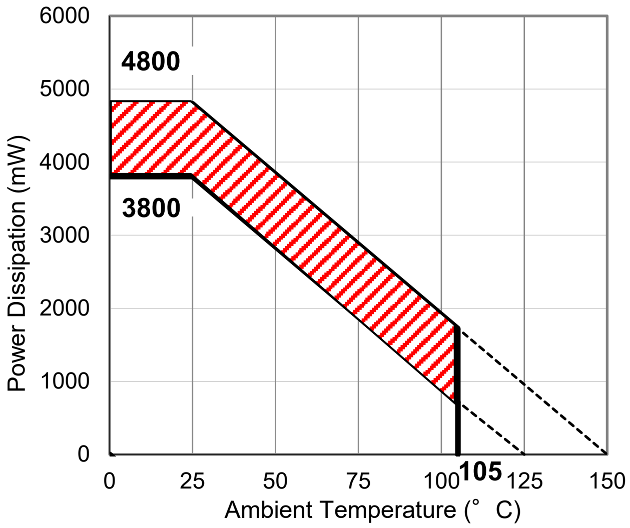
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Approx.95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 21 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

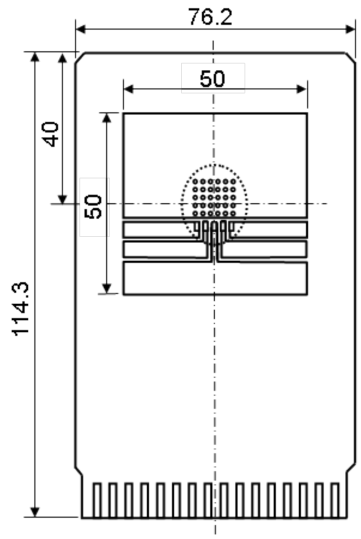
Item	Measurement Result
Power Dissipation	3800 mW
Thermal Resistance (θja)	θja = 26°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 7°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature

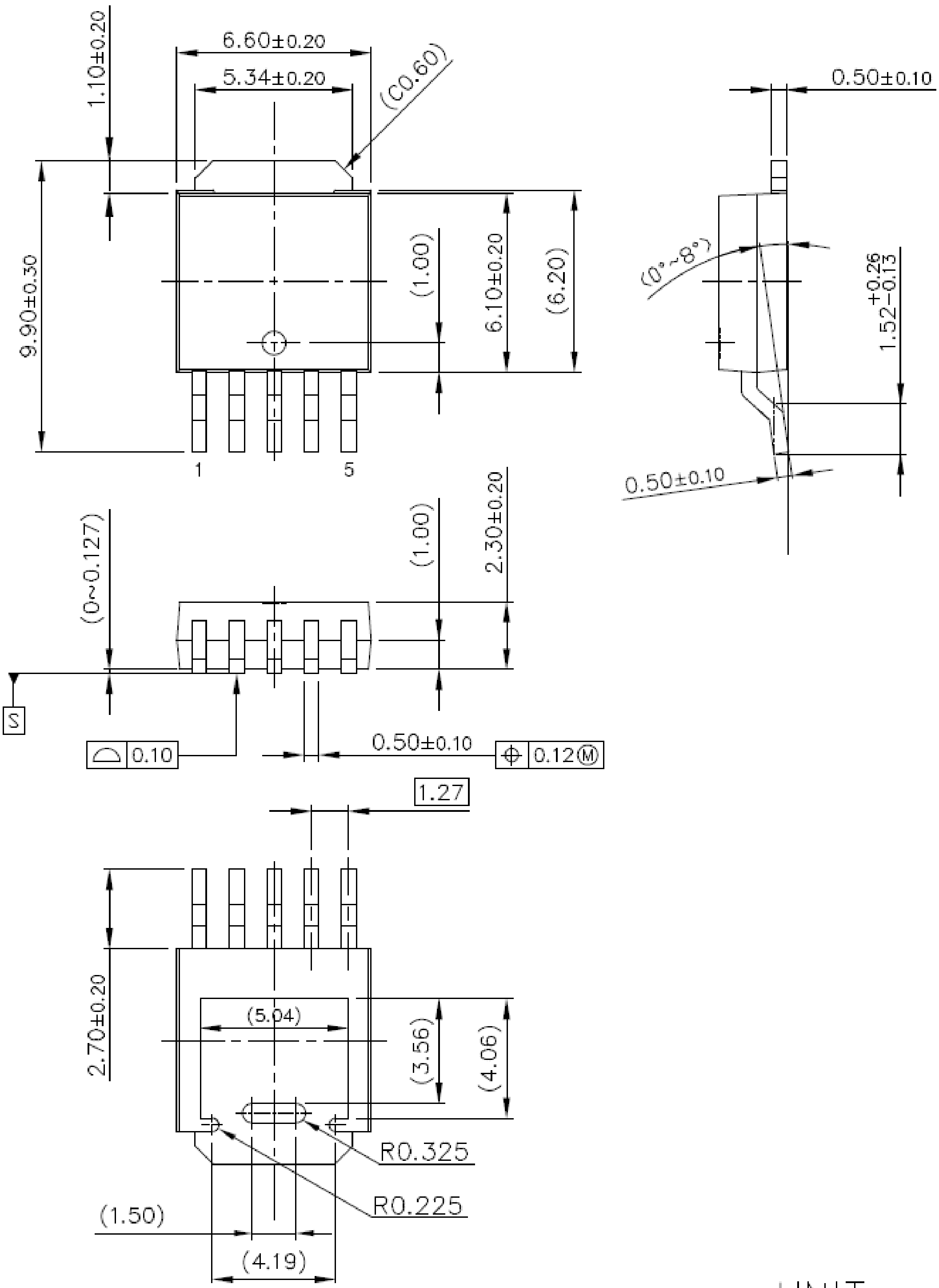


Measurement Board Pattern

The above graph shows the power dissipation of the package at Tjmax = 125°C and Tjmax = 150°C. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

Total Hours of Use	Total Years of Use (4 hours/day)
13,000 hours	9 years

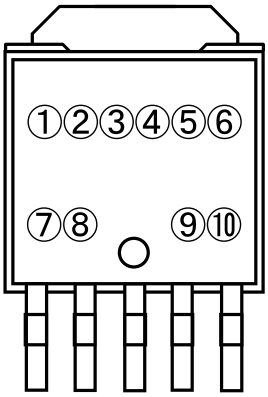
DM-TO-252-5-P2-JE-C



UNIT: mm

MK-R1518J-JAEA-B

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



TO-252-5-P2 Part Markings

NOTICE
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.

MK-R1518J-JAEA-B

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

Note: ⑧Underbar indicates a blank

R1518Jxx1B

Product Name	①②③④⑤⑥⑦⑧	V_{SET}
R1518J251B	**L 1 J 2 5 1 B _**	2.5 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
R1518J851B	**L 1 J 8 5 1 B _**	8.5 V
R1518J901B	**L 1 J 9 0 1 B _**	9.0 V

R1518J001C

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
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
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
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
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
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
R1518J851F	**L 5 J 8 5 1 F _**	8.5 V
R1518J901F	**L 5 J 9 0 1 F _**	9.0 V

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8. Quality Warranty

    8-1. Quality Warranty Period

    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.

    8-2. Quality Warranty Remedies

    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.

    8-3. Remedies after Quality Warranty Period

    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
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