

## Features

- Low Quiescent Current  
~4uA (Typ.)
- 3.8V to 24V Operation
- $\pm 2\%$  Initial Voltage Accuracy
- Available in 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 4.0V, 4.4V, 5.0V, 12V and 13V
- Internal Over Temperature Protection
- SOT-23-3, MSOT-23, SOT-23-5, SOT-353, TSOT-23-5, SOT-89-3, SOT-223, TO-252, PSOP-8 and TDFN4-1x1.2 package
- Green Product (RoHS, Lead-Free, Halogen-Free Compliant)

## Applications

- Portable/battery powered equipments
- Electronic sensors
- Microcontroller power
- Real time clock backup power

## Typical Application

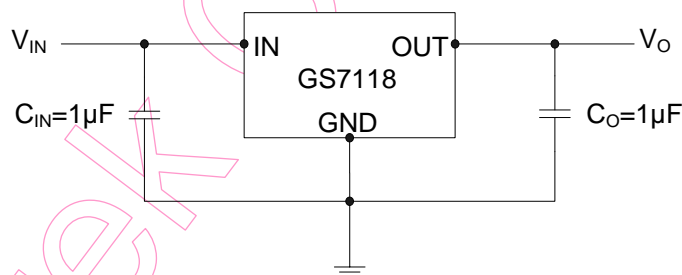


Figure.1 Typical Application of GS7118

## General Description

The GS7118 is a three terminal voltage regulator works in a wide operation range from 3.8V to 24V with a ~ 4uA (typical case) quiescent current. GS7118 includes essential features for the applications of portable devices with high voltage batteries, especially for supplying the always-on, keep-alive power circuitries.

**Function Block Diagram**

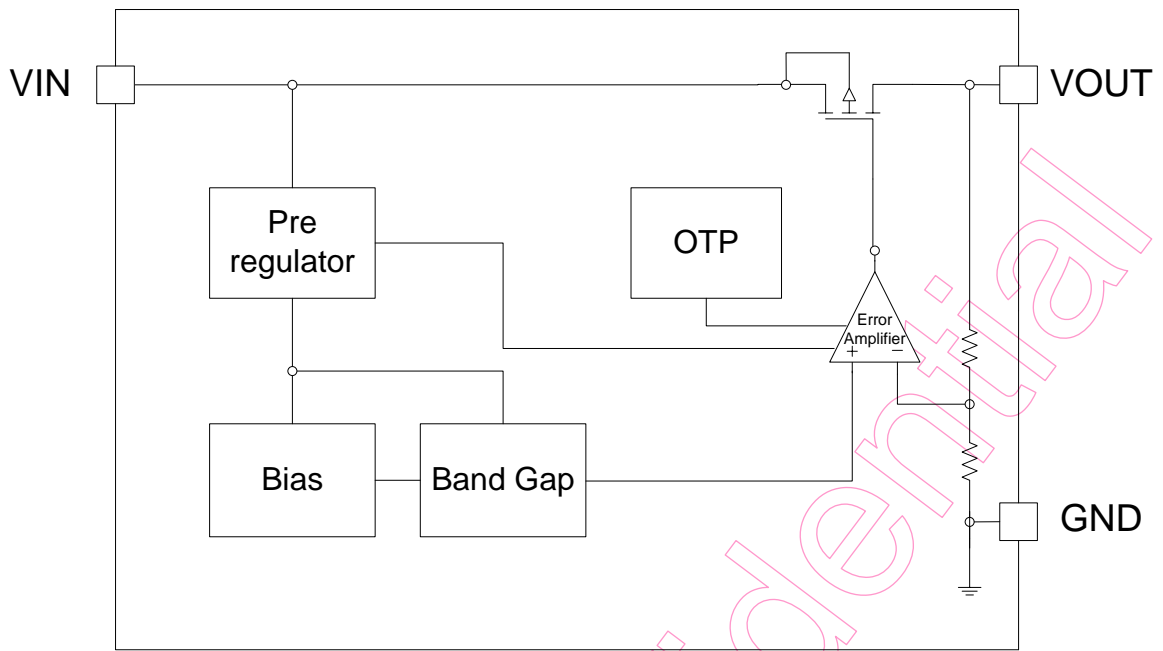


Figure.2 Function Block Diagram

**Pin Configuration**

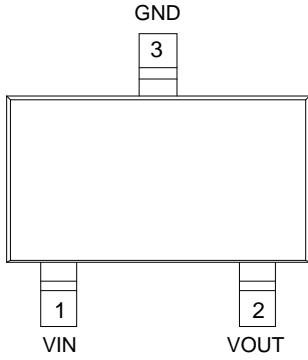


Figure 3a SOT-23-3 / MSOT-23

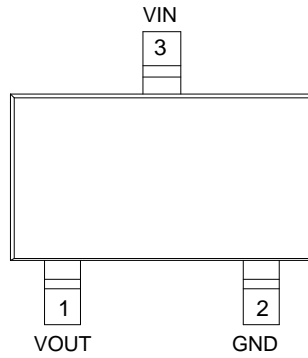


Figure 3b SOT-23\*

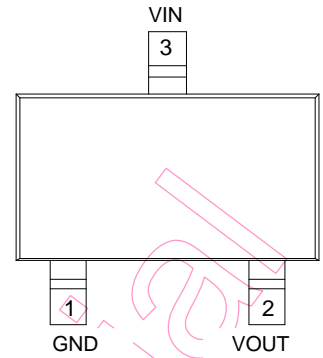


Figure 3c SOT-23-3+ Package

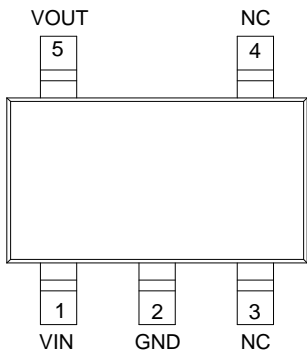


Figure 3d TSOT23-5 / SOT-23-5

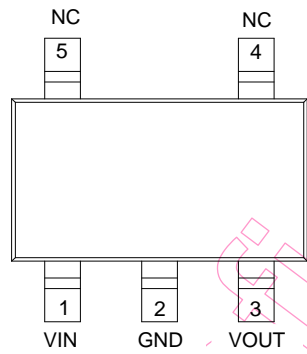


Figure 3e SOT-353

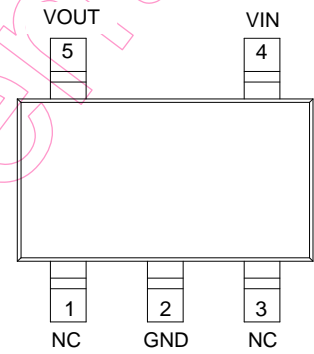


Figure 3f SOT-353\*

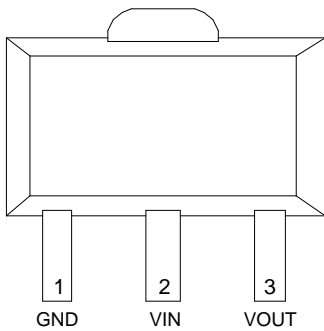


Figure 3g SOT-89-3 Package

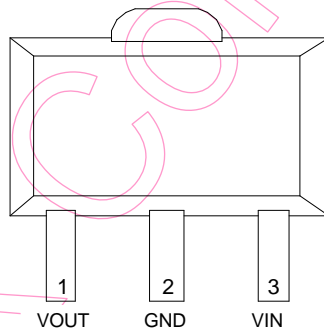


Figure 3h SOT-89-3\*

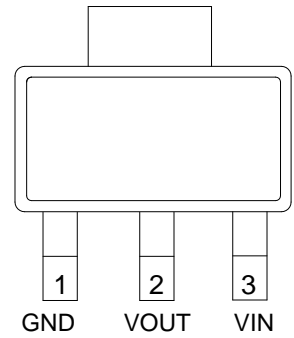


Figure 3i SOT-223

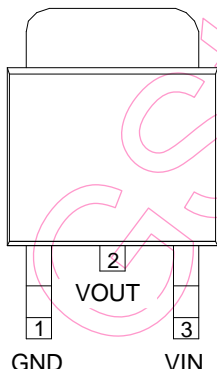


Figure 3j TO-252

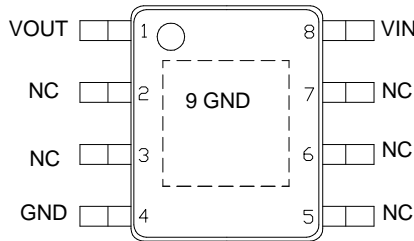


Figure 3k PSOP-8

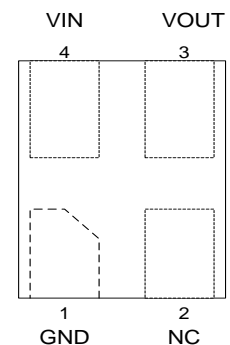


Figure 3l TDFN4-1x1.2

## Pin Descriptions

No										Name	I/O type	Description
SOT-23-3/ MSOT-23/	SOT-23-5/ TSOT-23-5	SOT-23-3 <sup>+</sup>	SOT-353	SOT-353*	SOT-89-3	SOT-89-3*/ SOT-23*	PSOP-8	SOT-223/ TO-252	TDFN4- 1x1.2			
1	1	3	1	4	2	3	8	3	4	VIN	I	Input pin
2	5	2	3	5	3	1	1	2	3	VOUT	O	Output pin
3	2	1	2	2	1	2	4,9	1	1	GND	O	Ground pin
	3、4		4、5	1、3			2、3、5~7		2	NC		

## Ordering Information

**GS7118PP-XXX- R**



No	Item	Contents
1	Package	ST:SOT-23-3 S1:SOT-23-3* S2:SOT-23-3 <sup>+</sup> SR:MSOT-23 T5:TSOT-23-5 S5:SOT-23-5 C5:SOT-353 C7:SOT-353* S9:SOT-89-3 S3:SOT-89-3* SP:PSOP-8 T3:SOT-223 O5:TO-252 TD:TDFN4-1x1.2
2	Output Voltage	1P5: 1.5V, 1P8:1.8V, 2P5: 2.5V,2P8:2.8V, 3P0:3.0V, 3P3: 3.3V, 4P0: 4.0V, 4P4: 4.4V, 5P0: 5.0V, 012:12V, 013:13V
3	Shipping	R: Tape & Reel

Example: GS7118 SOT-23-3 2.5V Tape & Reel ordering information is "GS7118ST-2P5-R"

**Absolute Maximum Rating** (Note 1)

Parameter	Symbol	Limits	Units
VIN to GND	$V_{IN}$	$-0.3 < V_{IN} < 24$	V
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_SOT-23-3}$	400	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_MSOT-23}$	380	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_TSOT-23-5}$	400	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_SOT-23-5}$	400	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_SOT-353}$	300	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_SOT-89-3}$	571	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_PSOP-8}$	1333	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_SOT-223}$	741	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_TO-252}$	1471	mW
Package Power Dissipation at $T_A \leq 25^\circ\text{C}$	$P_{D\_TDFN4-1x1.2}$	360	mW
Storage Temperature	$T_{STG}$	- 65 ~ 150	$^\circ\text{C}$
Lead Temperature (Soldering) 10S	$T_{LEAD}$	260	$^\circ\text{C}$
ESD (Human Body Mode) (Note 2)	$V_{ESD\_HBM}$	2K	V
ESD (Machine Mode) (Note 2)	$V_{ESD\_MM}$	200	V

**Thermal Information** (Note 3)

Parameter	Symbol	Limits	Units
Thermal Resistance Junction to Ambient	$\theta_{JA\_SOT-23-3}$	250	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_MSOT-23}$	263	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_TSOT-23-5}$	250	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_SOT-23-5}$	250	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_SOT-353}$	333	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_SOT-89-3}$	182	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_PSOP-8}$	75	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_SOT-223}$	135	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_TO-252}$	68	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient	$\theta_{JA\_TDFN4-1x1.2}$	278	$^\circ\text{C/W}$

## Recommend Operating Condition (Note 4)

Parameter	Symbol	Limits	Units
V <sub>IN</sub> to GND	V <sub>IN</sub>	3.8 to 24	V
Junction Temperature	T <sub>J</sub>	- 40 ~ 125	°C
Operating Temperature Range	T <sub>A</sub>	-40 ~ 85	°C

## Electrical Characteristics

(C<sub>IN</sub>=1μF, C<sub>OUT</sub>=1μF, V<sub>IN</sub>=MAX{V<sub>O(NOM)</sub>+1V, 4.3V}, T<sub>A</sub> = 25°C, I<sub>OUT</sub>=1mA, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Input Voltage	V <sub>IN</sub>	I <sub>O</sub> =20mA, V <sub>O(NOM)</sub> =3.3V	3.8		24	V
		I <sub>O</sub> =50mA, V <sub>O(NOM)</sub> =3.3V	4.3		24	
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =MAX{V <sub>O(NOM)</sub> +1V, 4.3V}	2.9	3.9	7.0	μA
		V <sub>IN</sub> =24V	2.9	4.0	7.0	
Output Voltage accuracy	V <sub>O</sub>		-2		2	%
Dropout Voltage (Note 5)	V <sub>DROP</sub>	I <sub>O</sub> =50mA, V <sub>O(NOM)</sub> =5.0V	0.46	0.56	0.70	V
Load Regulation	ΔV <sub>OUT</sub>	1mA<I <sub>O</sub> <50mA			0.15	%/mA
Line Regulation	ΔV <sub>OUT</sub>	V <sub>IN</sub> =MAX{V <sub>O(NOM)</sub> +1V, 4.3V} to 24V			0.3	%/V
Power supply rejection	PSRR	V <sub>RIPPLE</sub> =0.1V, I <sub>O</sub> =20mA, f=120Hz		50		dB
Output noise voltage	eN	BW from 200Hz to 100kHz, I <sub>O</sub> =10mA		170		μV <sub>RMS</sub>
Thermal shutdown	OTP			170		°C
Return temperature	OTH			140		°C
Maximum output current	I <sub>OMAX</sub>	V <sub>IN</sub> ≥5V, V <sub>OUT</sub> <0.2V	120	160	200	mA

**Note 1.** Stresses listed as the above “Absolute Maximum Ratings” may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

**Note 2.** Devices are ESD sensitive. Handling precaution recommended.

**Note 3.** θ<sub>JA</sub> is measured in the natural convection at T<sub>A</sub>=25°C on a high effective thermal conductivity test board (4 Layers, 2S2P) of JEDEC 51-7 thermal measurement standard.

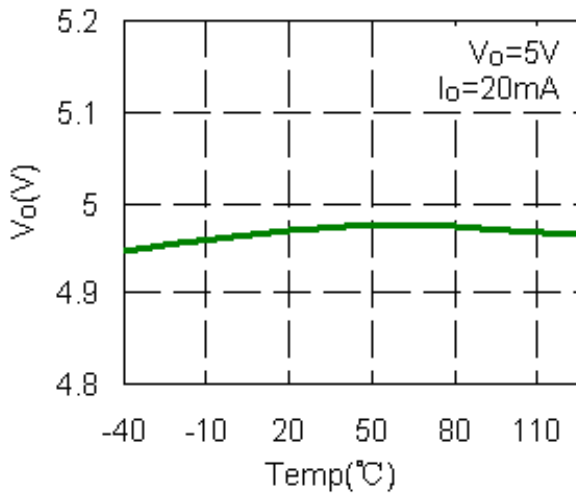
**Note 4.** The device is not guaranteed to function outside its operating conditions.

**Note 5.** The dropout voltage is defined as V<sub>IN</sub> - V<sub>OUT</sub>, which is measured when V<sub>OUT</sub> is 98%\*V<sub>OUT</sub>.

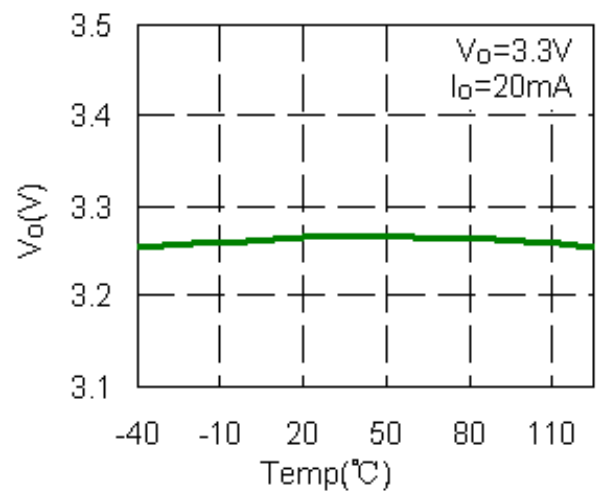
## Typical Characteristics

( $V_{IN} = \text{MAX}\{V_{O(NOM)} + 1V, 4.3V\}$ ,  $I_{OUT} = 1mA$ ,  $C_{IN} = 1\mu F$ ,  $C_{OUT} = 1\mu F$ ,  $T_A = 25^\circ C$  unless otherwise specified)

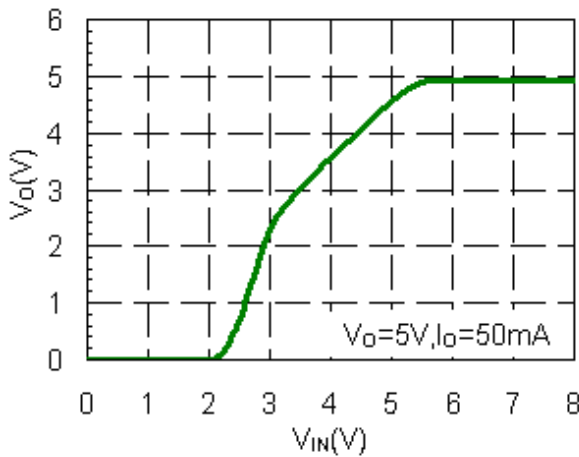
Output Voltage vs. Temperature



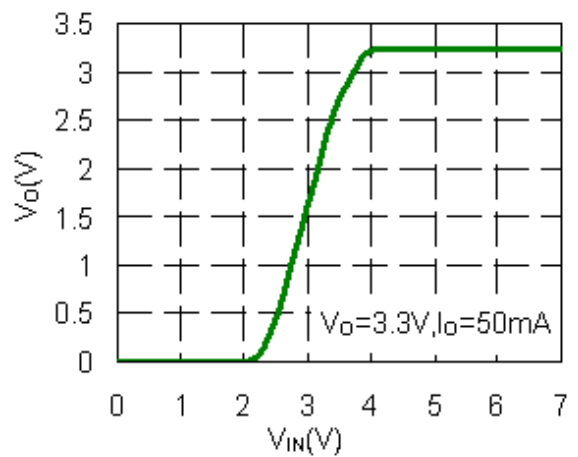
Output Voltage vs. Temperature



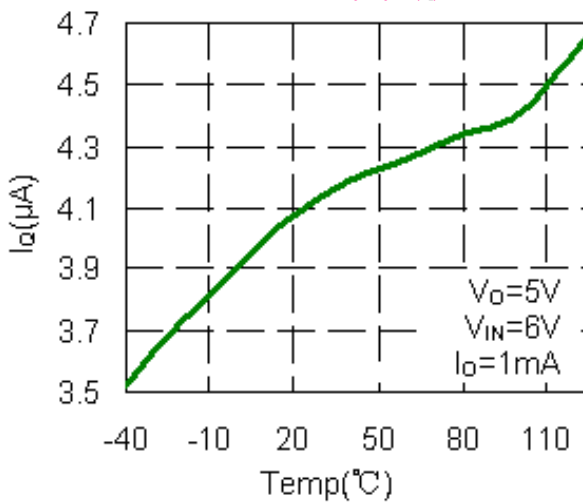
Output Voltage vs. Input Voltage



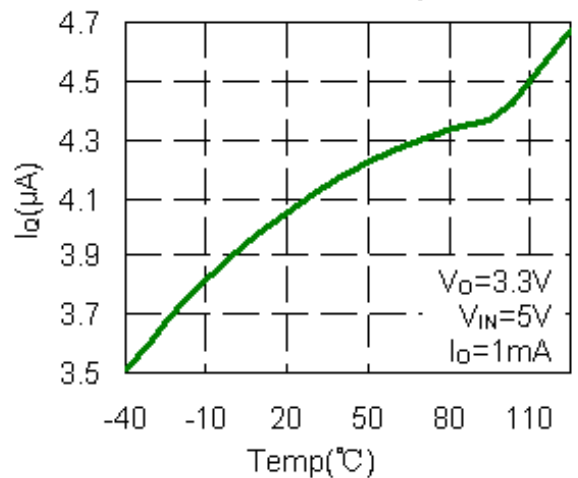
Output Voltage vs. Input Voltage



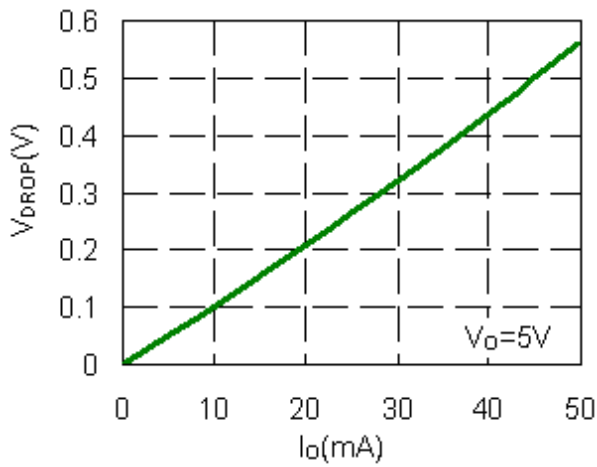
Quiescent Current vs. Temperature



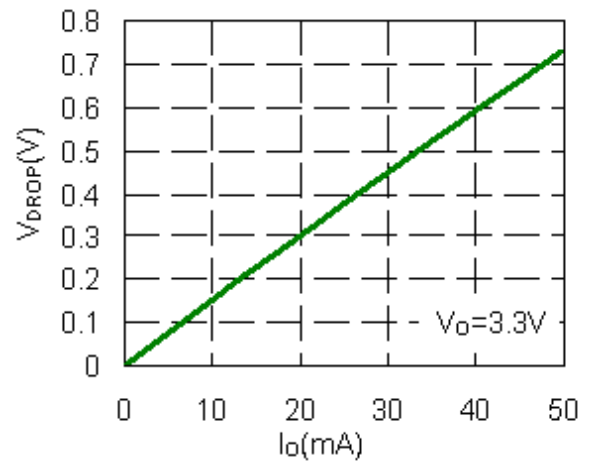
Quiescent Current vs. Temperature



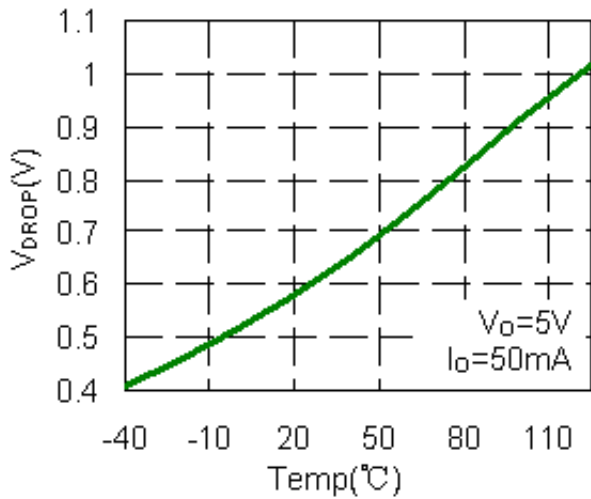
**Dropout Voltage vs. Output Current**



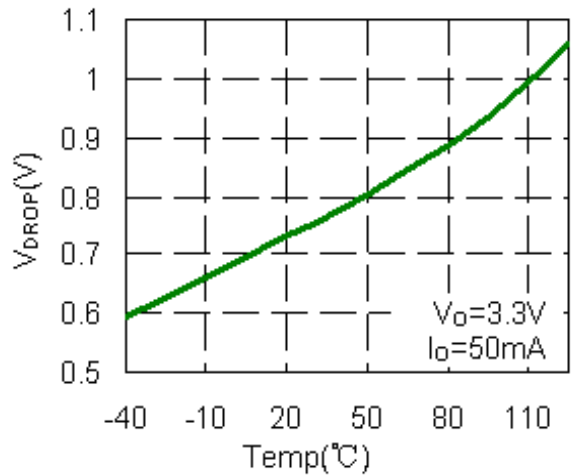
**Dropout Voltage vs. Output Current**



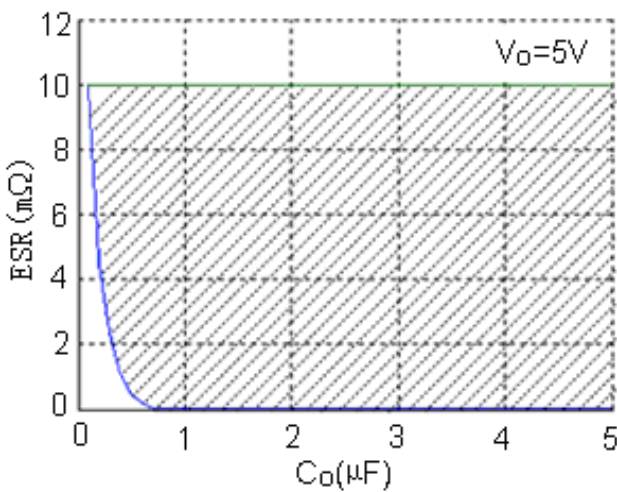
**Dropout Voltage vs. Temperature**



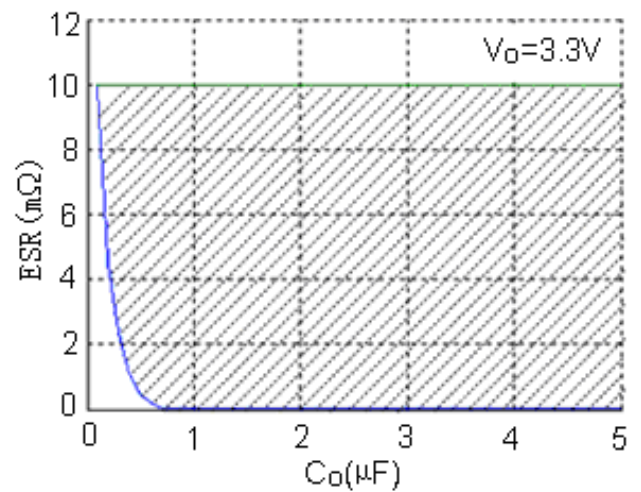
**Dropout Voltage vs. Temperature**



**Stability**

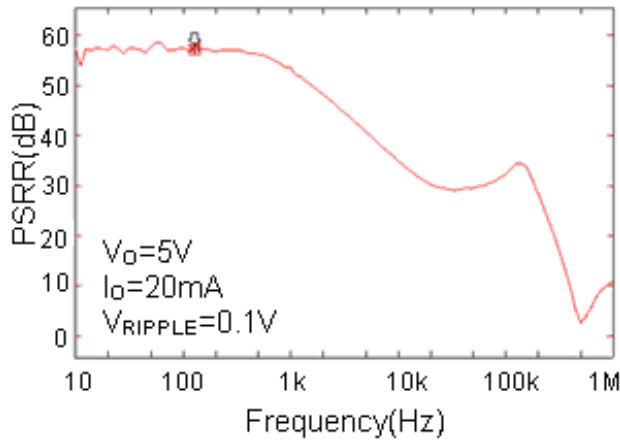


**Stability**

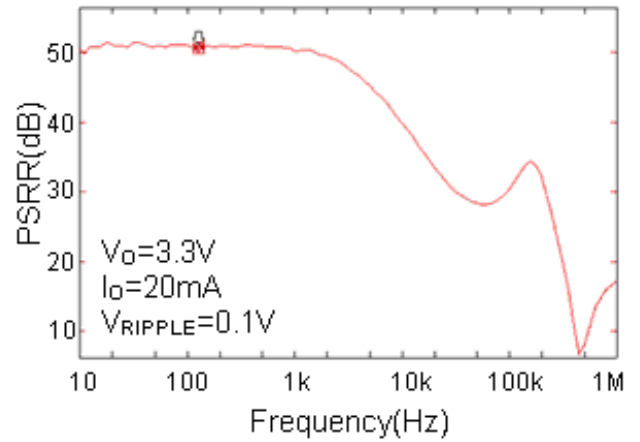




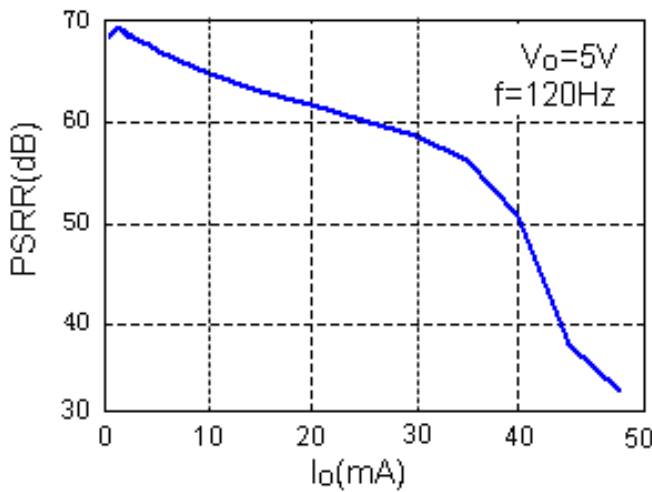
**PSRR vs. Frequency**



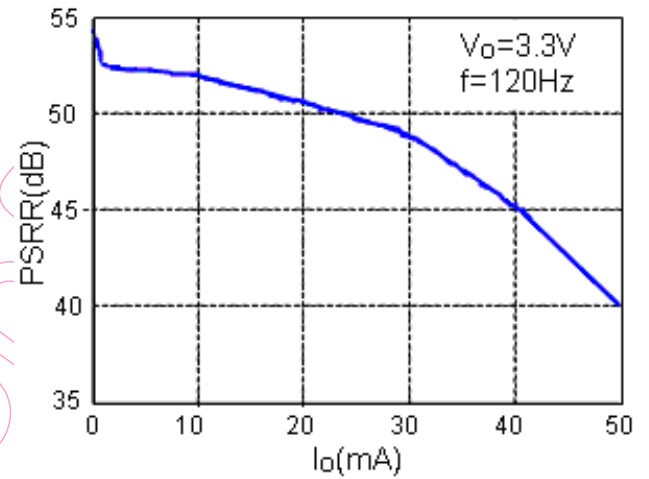
**PSRR vs. Frequency**



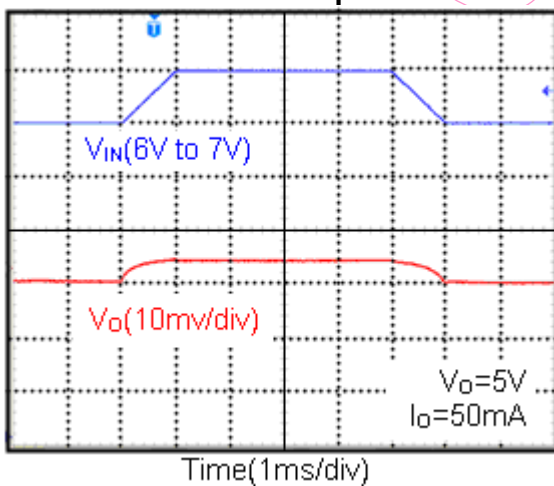
**PSRR vs. Output Current**



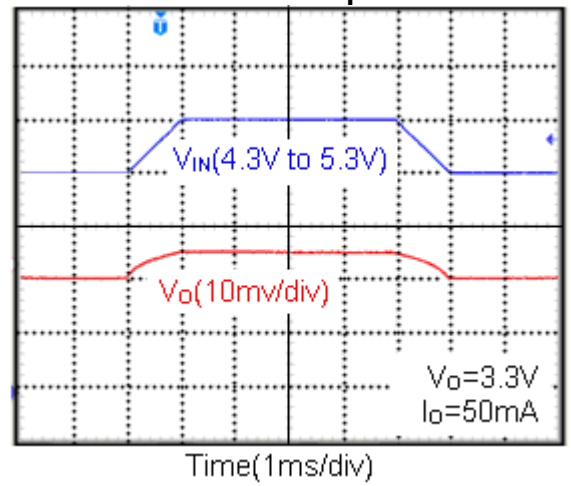
**PSRR vs. Output Current**



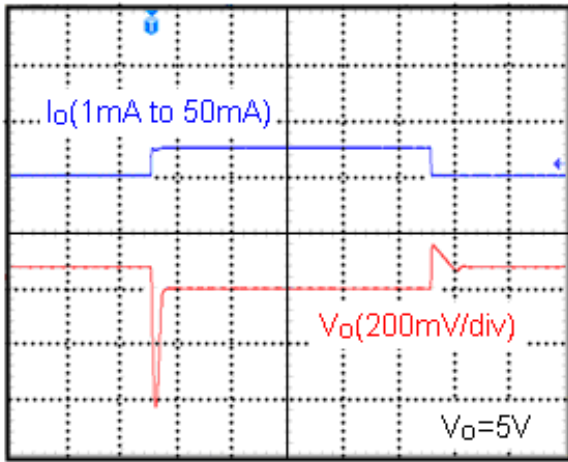
**Line Transient Response**



**Line Transient Response**

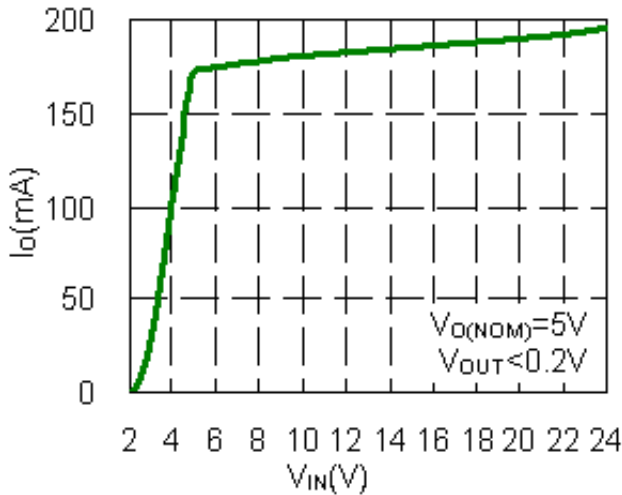


Load Transient Response

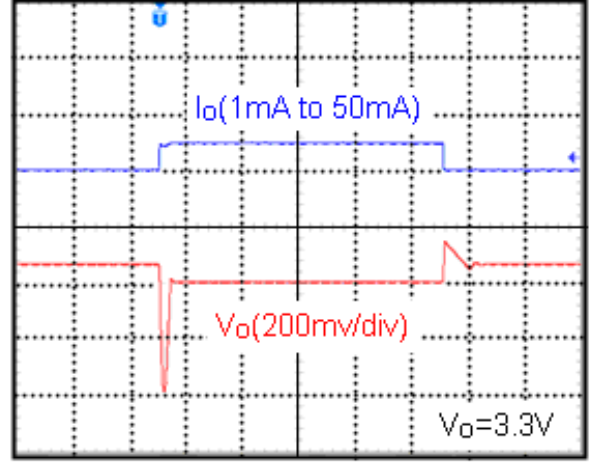


Time(200µs/div)

Short Circuit Current

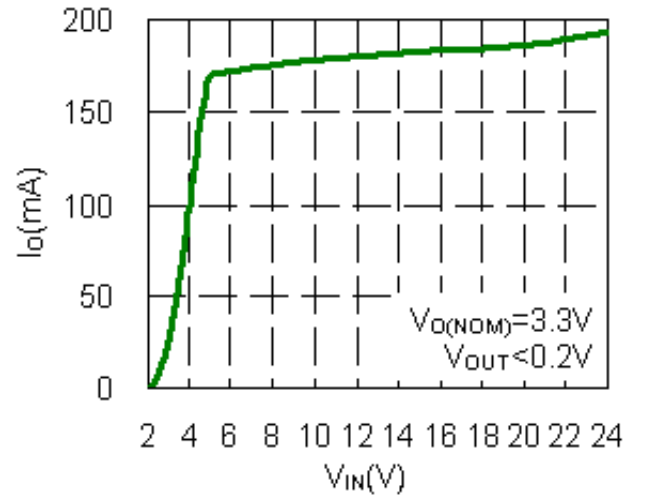


Load Transient Response

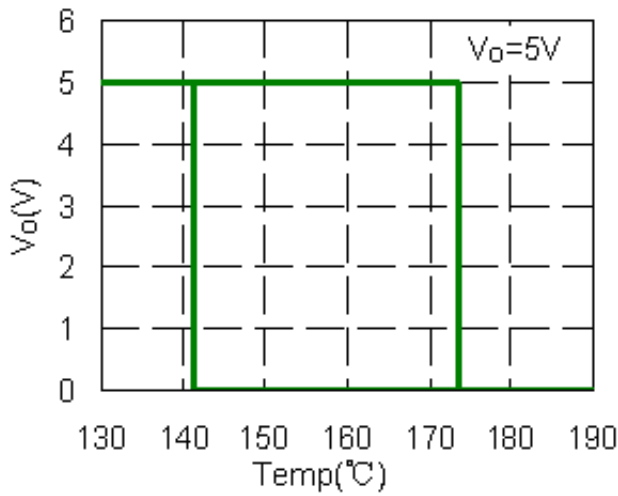


Time(200µs/div)

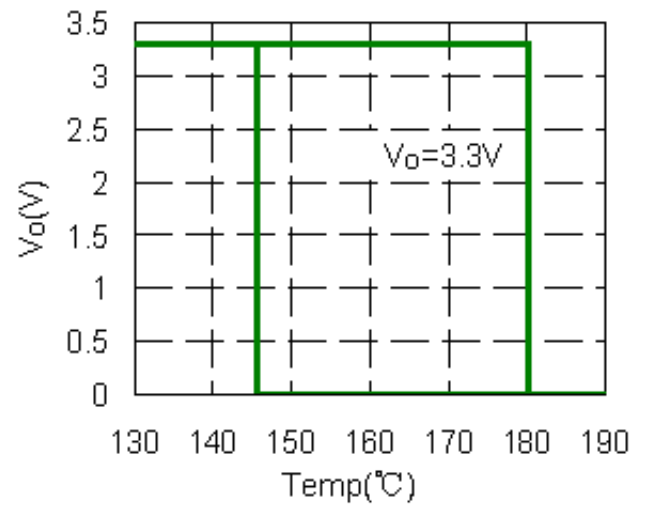
Short Circuit Current



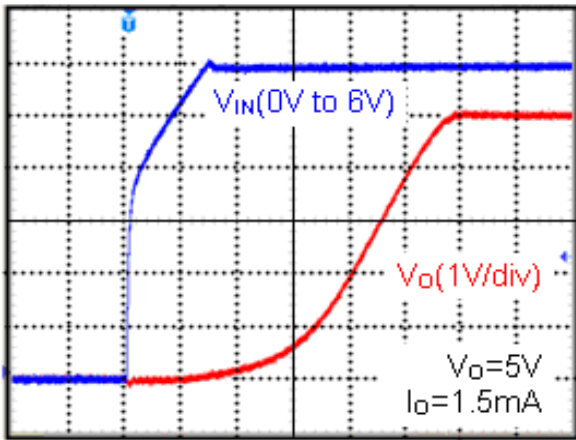
Thermal Protection



Thermal Protection

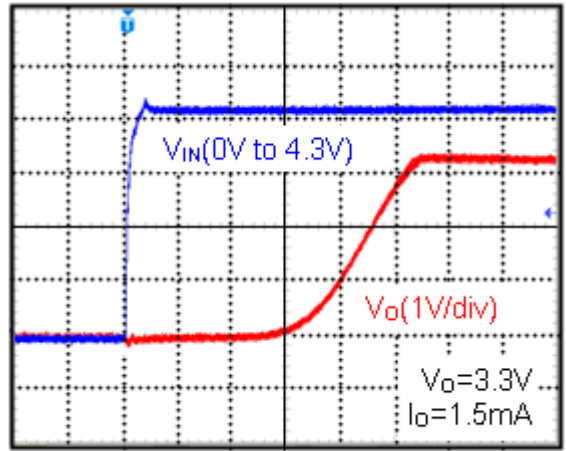


Power On from VIN



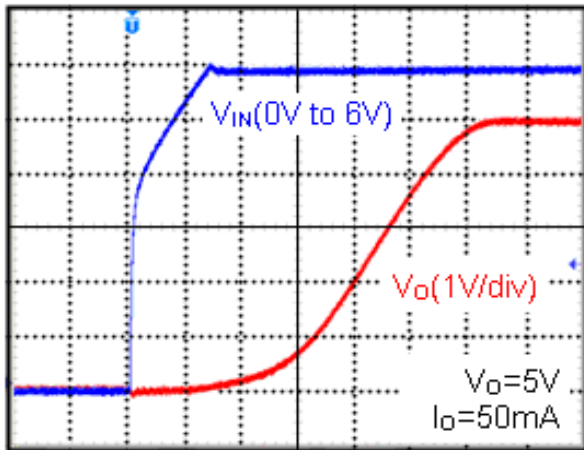
Time(40µs/div)

Power On from VIN



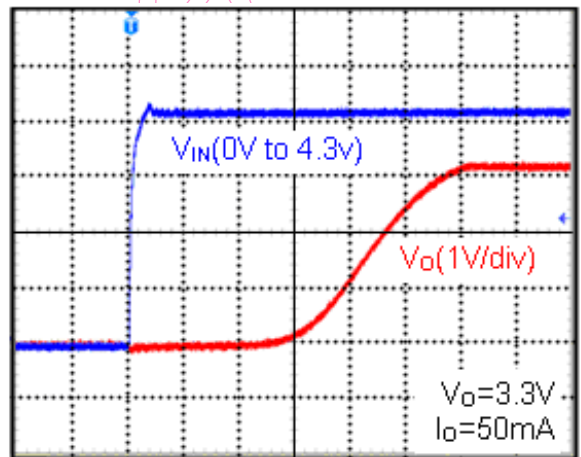
Time(40µs/div)

Power On from VIN



Time(40µs/div)

Power On from VIN



Time(40µs/div)

## Application Information

### Thermal Considerations

Although internal thermal limiting function is integrated in GS7118, continuously keeping the junction near the thermal shutdown temperature may possibly affect device reliability. For continuous operation, it is highly recommended to keep the junction temperature below the maximum operation junction temperature 125°C for maximum reliability. The power dissipation definition in device is:

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where  $T_{J(MAX)}$  is the maximum operation junction temperature 125°C,  $T_A$  is the ambient temperature and the  $\theta_{JA}$  is the junction to ambient thermal resistance.

For recommended operating conditions specification of GS7118, where  $T_{J(MAX)}$  is the maximum junction temperature of the die (125°C) and  $T_A$  is the maximum ambient temperature. The junction to ambient thermal resistance ( $\theta_{JA}$  is layout dependent) for SOT-23-3 package is 250°C/W, MSOT-23 package is 263°C/W and SOT-323 package is 333°C/W on standard JEDEC 51-3 thermal test board. The maximum power dissipation at  $T_A = 25^\circ\text{C}$  can be calculated by following formula:

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 250 = 400\text{mW} \\ (\text{SOT-23-3})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 263 = 380\text{mW} \\ (\text{MSOT-23})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 333 = 300\text{mW} \\ (\text{SOT-353})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 250 = 400\text{mW} \\ (\text{TSOT-23-5})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 250 = 400\text{mW} \\ (\text{SOT-23-5})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 182 = 571\text{mW} \\ (\text{SOT-89-3})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 75 = 1333\text{mW} \\ (\text{PSOP-8})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 135 = 741\text{mW} \\ (\text{SOT-223})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 68 = 1471\text{mW} \\ (\text{TO-252})$$

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 278 = 360\text{mW} \\ (\text{TDFN4-1x1.2})$$

The maximum power dissipation depends on operating ambient temperature or fixed  $T_{J(MAX)}$  and thermal resistance  $\theta_{JA}$ . For GS7118 packages, the Figure 4. of derating curves allows the designer to see the effect of rising ambient temperature on the maximum power allowed.

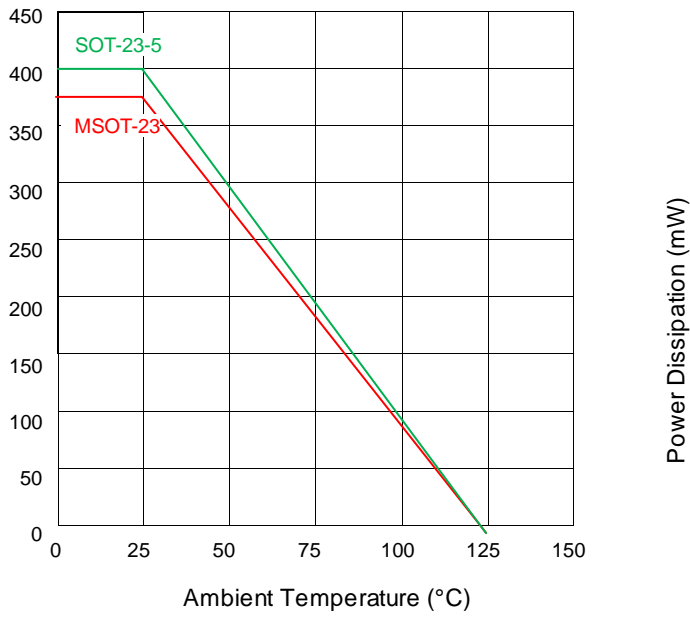
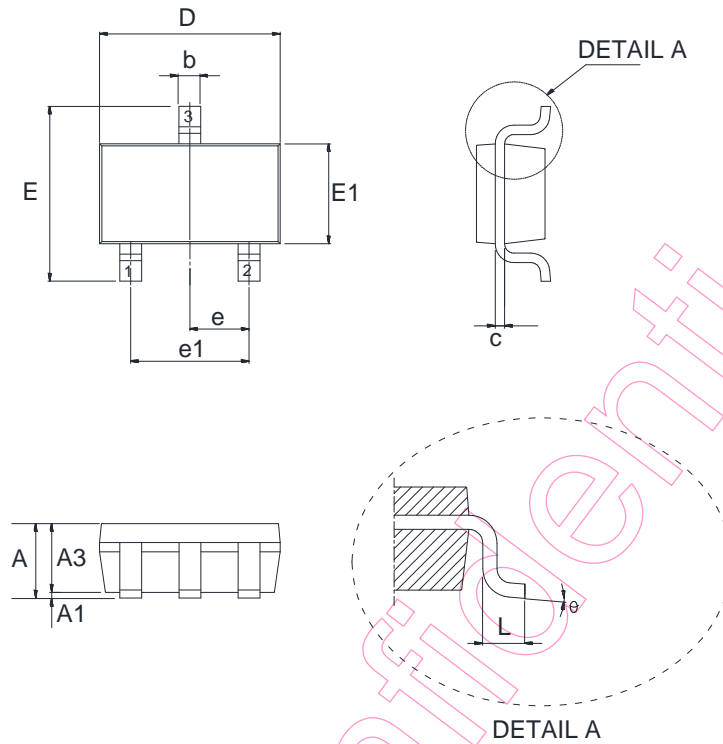


Figure 4 Derating Curve for Packages

GStek Confidential

## Package Dimensions, SOT-23

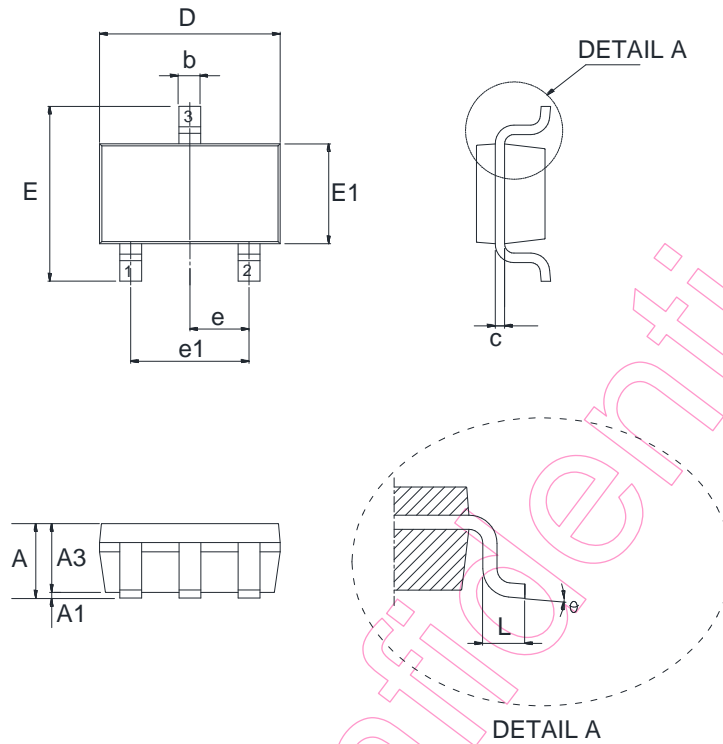


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.90	1.45
A1	0.00	0.15
A3	0.90	1.30
b	0.30	0.50
c	0.08	0.25
e	0.95 REF.	
e1	1.90 REF.	
D	2.90 REF.	
E	2.80 REF.	
E1	1.60 REF.	
L	0.30	0.60
θ	0°	8°

**Note:**

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.

## Package Dimensions, MSOT-23

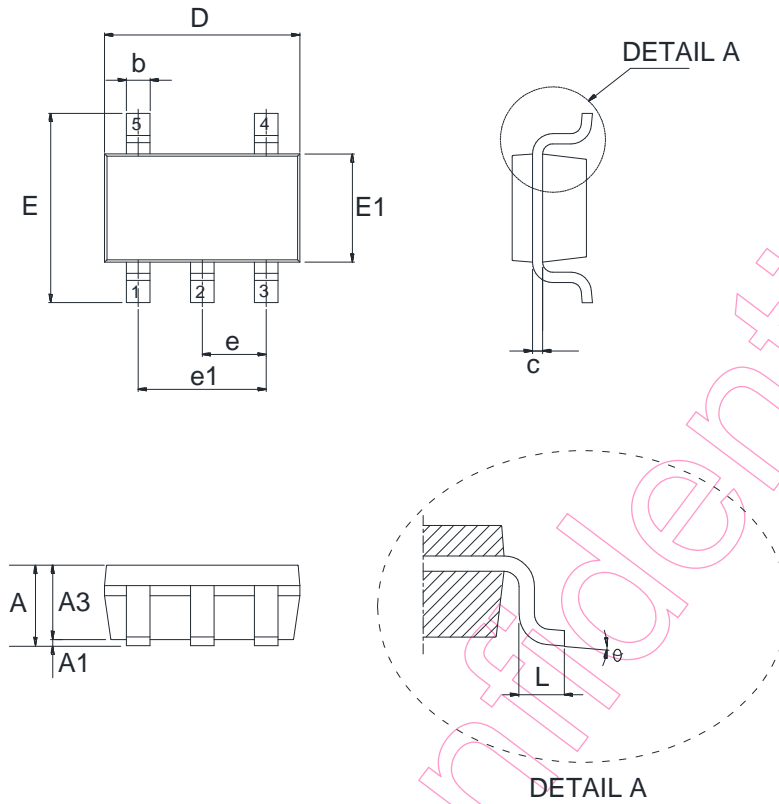


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.90	1.15
A1	0.00	0.10
A2	0.90	1.05
b	0.30	0.50
c	0.08	0.15
e	0.95 REF.	
e1	1.90 REF.	
D	2.90 REF.	
E	2.40 REF.	
E1	1.30 REF.	
L	0.30	0.50
θ	0°	8°

**Note:**

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.

**Package Dimensions, SOT-353(SC-75)**



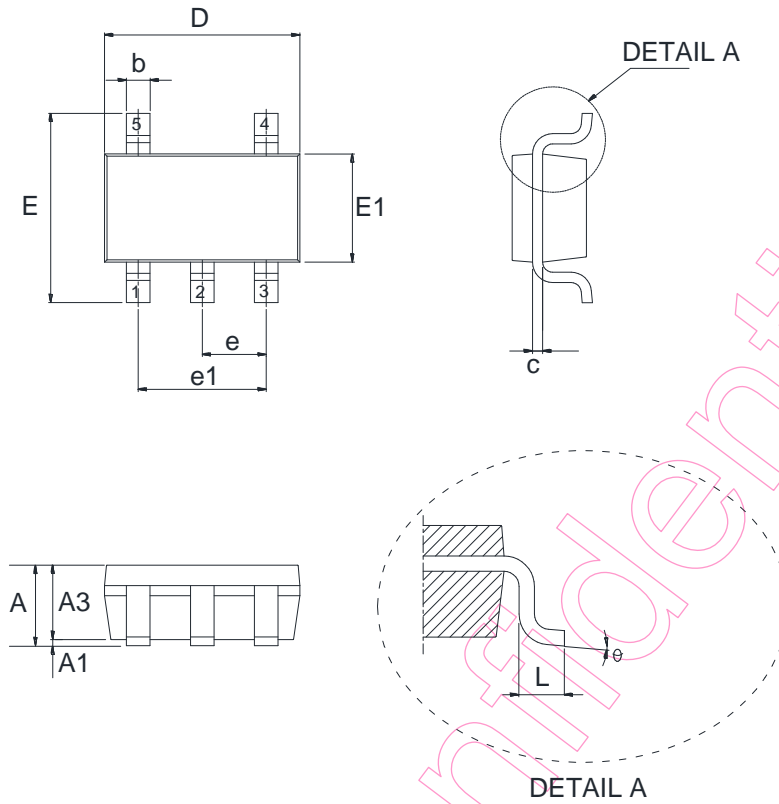
Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.85	1.10
A1	0.00	0.10
A3	0.80	1.00
b	0.15	0.35
c	0.08	0.15
e	0.65 REF.	
e1	1.30 REF.	
D	2.00	2.20
E	2.15	2.45
E1	1.15	1.35
L	0.26	0.46
θ	0°	8°

**Note:**

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.



## Package Dimensions, SOT-23-5

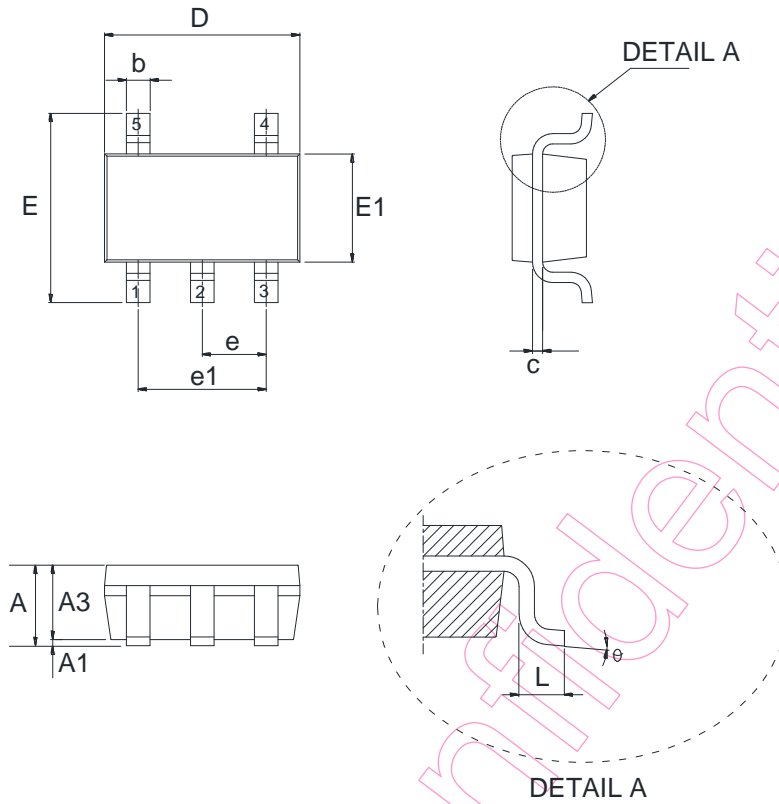


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.90	1.45
A1	0.00	0.15
A3	0.90	1.30
b	0.30	0.50
c	0.08	0.25
e	0.95 REF.	
e1	1.90 REF.	
D	2.90 REF.	
E	2.80 REF.	
E1	1.60 REF.	
L	0.30	0.60
$\theta$	0°	8°

**Note**

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.

## Package Dimensions, TSOT-23-5

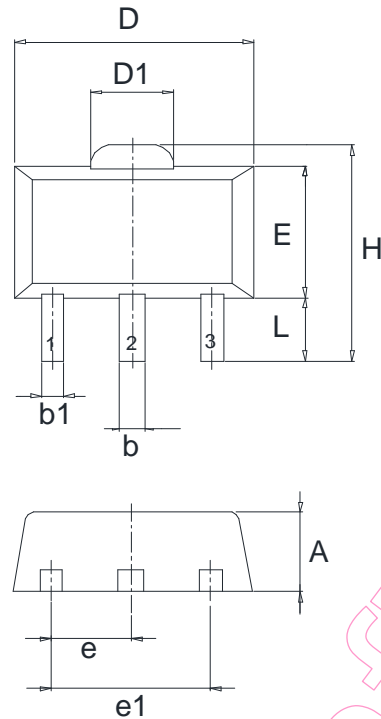


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.70	0.90
A1	0.00	0.10
A3	0.70	0.80
b	0.35	0.50
c	0.08	0.20
e	0.95 REF.	
e1	1.90 REF.	
D	2.80	3.02
E	2.60	2.95
E1	1.50	1.70
L	0.30	0.60
θ	0°	8°

**Note**

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.

## Package Dimensions, SOT-89-3

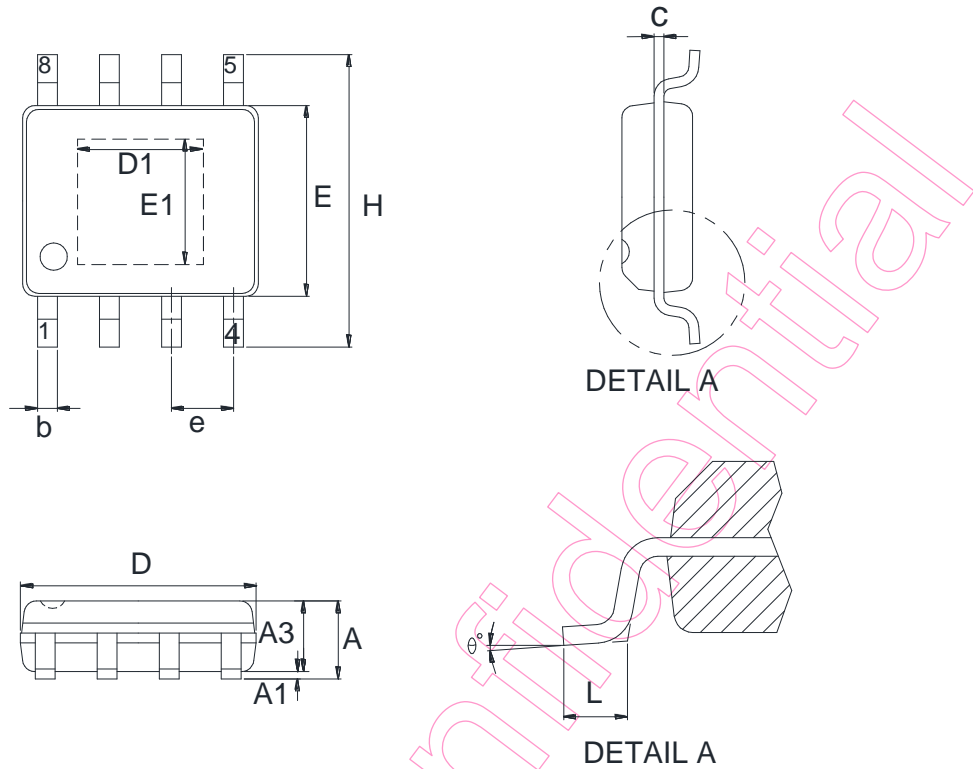


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	1.40	1.60
b	0.40	0.58
b1	0.32	0.52
c	0.35	0.44
e	1.50 REF.	
e1	3.00 REF.	
D	4.40	4.60
D1	1.60 REF.	
E	2.29	2.60
H	3.94	4.25
L	0.80	1.20

### Note

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.

**Package Dimensions, PSOP-8(B)**

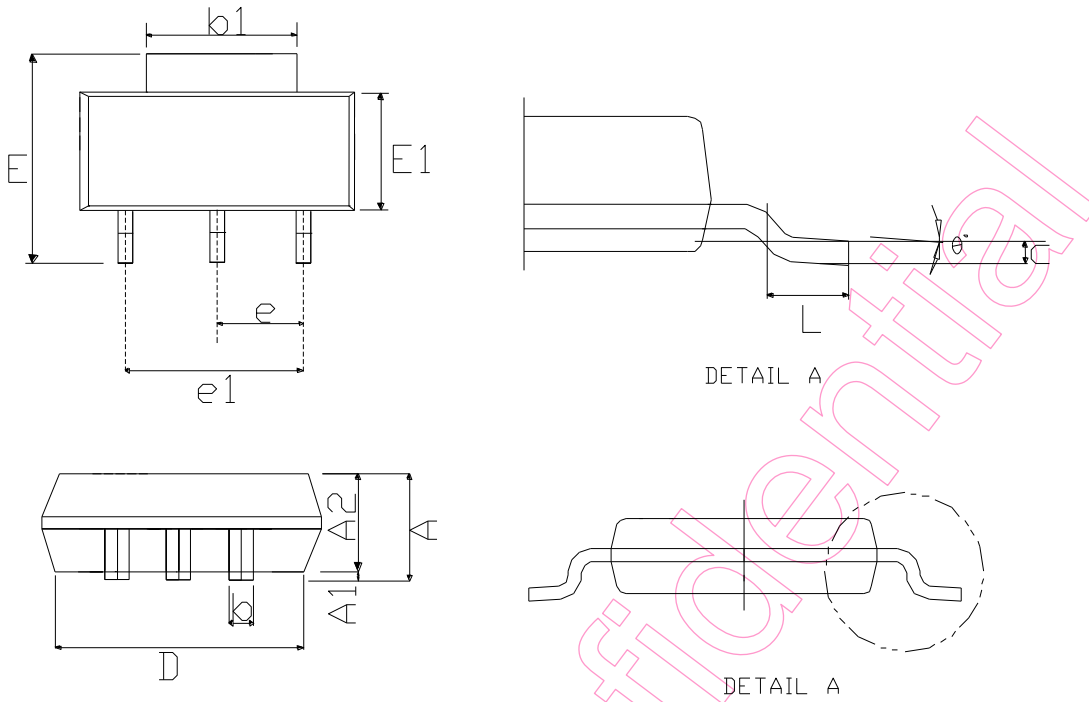


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	1.30	1.80
A1		0.15
A3	1.25	-
b	0.31	0.51
c	0.17	0.25
e	1.27 REF.	
D	4.70	5.10
E	3.80	4.00
D1	3.1 REF.	
E1	2.3 REF.	
H	5.80	6.20
L	0.40	1.27
θ	0°	8°

Note

1. Min.: Minimum dimension specified.
2. Max.: Maximum dimension specified.
3. REF.: Reference. Normal/Regular dimension specified for reference.

## Package Dimensions, SOT-223

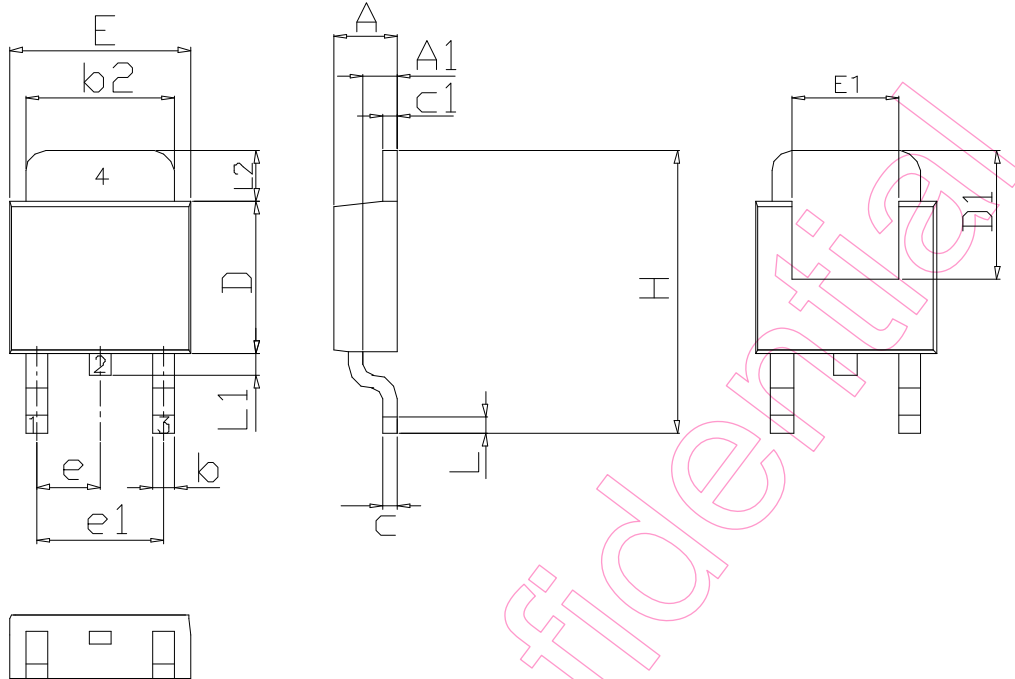


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	-	1.80
A1	0.02	0.10
A2	1.60 REF.	
b	0.60	0.81
b1	2.90	3.10
D	6.30	6.70
c	0.25	0.35
E	6.75	7.30
E1	3.30	3.70
e	2.30 REF.	
e1	4.60 REF.	
L	1.75 REF.	
θ	0°	8°

### Note

1. Min.: Minimum dimension specified.
2. Max.: Maximum dimension specified.
3. REF.: Reference. Normal/Regular dimension specified for reference.

## Package Dimensions, TO-252

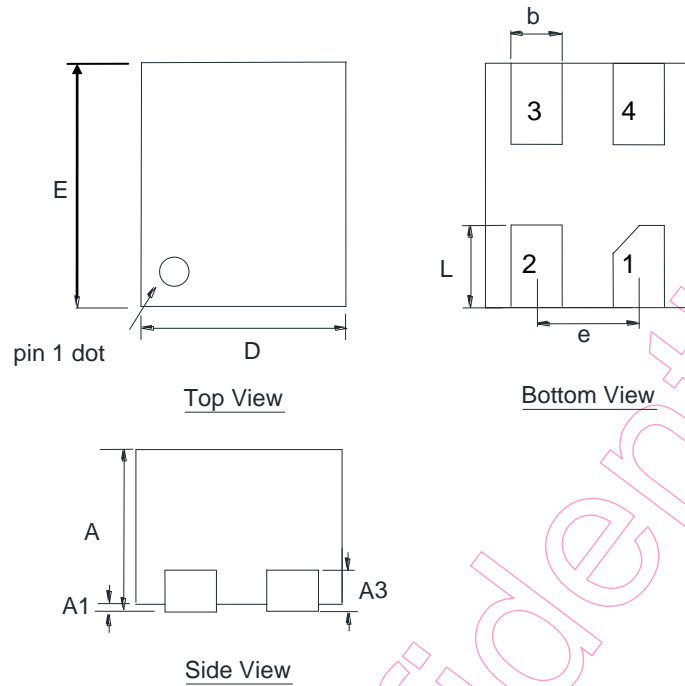


Symbol	Dimensions in Millimeters	
	Min.	Max.
A	2.19	2.43
A1	0.89	1.50
b	0.50	0.90
b2	5.20	5.50
c	0.35	0.65
c1	0.35	0.65
D	5.40	6.20
E	6.35	6.80
D1	4.57	-
E1	3.80	-
e	2.28 REF.	
e1	3.96	5.18
H	8.90	10.40
L	0.50	-
L1	0.60	1.20
L2	1.35	2.03

### Note

1. Min.: Minimum dimension specified.
2. Max.: Maximum dimension specified.
3. REF.: Reference. Normal/Regular dimension specified for reference

## Package Dimensions, TDFN4-1x1.2



Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.70	0.80
A1	0.00	0.05
A3	0.195	0.205
D	0.95	1.05
E	1.15	1.25
b	0.20	0.30
e	0.50 REF.	
L	0.35	0.45

### Note

1. Min.: Minimum dimension specified.
2. Max.: Maximum dimension specified.
3. REF.: Reference. Normal/Regular dimension specified for reference.

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