GS2019

7V, 500mA Balanced Performance LDO

GENERAL DESCRIPTION

The GS2019 Seriesare a group of voltage regulator swith high accuracy, high speed, low drop-out, high ripple rejection and fast discharge function.

The current limiter's fold-back circuit operates as a short circuit protection as well as the output current limiter for the output pin.

Output voltage is selectable from 1.2V to 5.0V which fixed by laser trimming technologies, Step=100mV.

The GS2019 Series is available in SOT23, SOT23-3L, SOT23-5L and DFN1x1-4L packages.

FEATURES

- Output Accuracy: ±1%
- Low Quiescent Current:40uA
- Low Dropout Voltage:120mV@100mA/3.3V
- High PSRR: 80dB@1KHz,10mA
- Output Current: 500mA
- Excellent Lineand Load Regulation
- Operating Voltage Range:from 1.8V to7.0V
- Output Voltage Range:from 1.2V to5.0V
- Over-Temperature Protection
- Current Limiting Protection
- Output Short-Circuit Protection
- Available in SOT23, SOT23-3L, SOT23-5L and DFN1x1-4L Packages

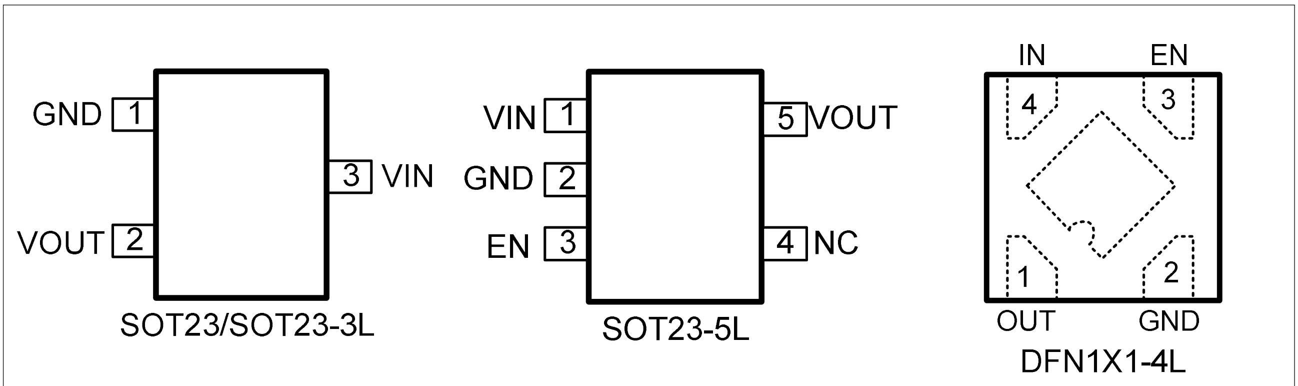
APPLICATIONS

- Battery-Powered Devices
- Reference Voltage Sources
- Other Low Voltage Power Suppliers

PIN DESCRIPTION:

PIN No				SYMBOL	DESCRIPTTION
SOT23	SOT23-3L	SOT23-5L	DFN1×1-4L		
3	3	1	4	VIN	Power Supply Input
1	1	2	2, E-PAD	GND	Ground
--	--	3	3	EN	Chip Enable
--	--	4	--	NC	Not Connected
2	2	5	1	VOUT	Output

PIN ASSIGNMENT

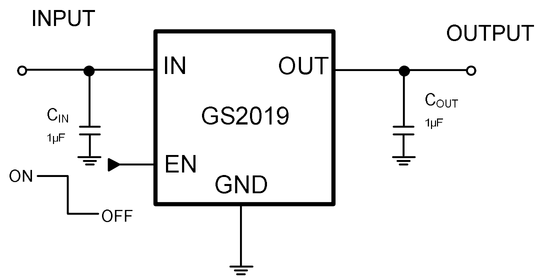


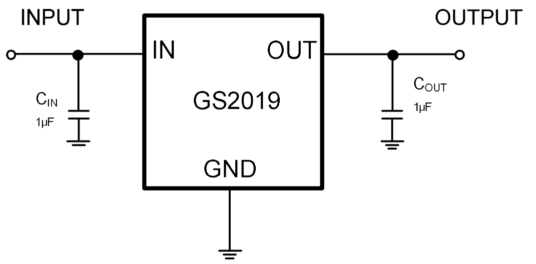
Order Information

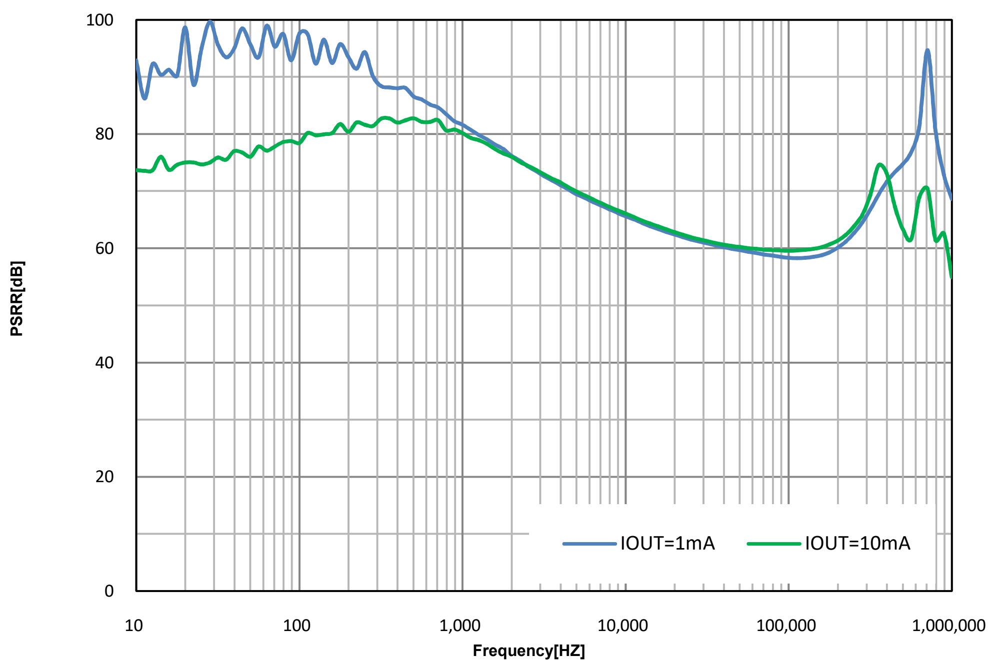
Model	PIN-Package	Ordering Number	Packing Option
GS2019	SOT23/SOT23-3L	GS2019-XXTR3	3000pcs/Reel
	SOT23-5L	GS2019-XXTR5	3000pcs/Reel
	DFN1*1-4L	GS2019-XXFR4	10000pcs/Reel

Note:“XX”represents the type of voltage value.

TYPICAL APPLICATION CIRCUIT







V_{OUT}=3.3V, V_{IN}=4.3V, V_{PP}=0.2V,C_{IN}=non, C_{OUT}=1uF

ABSOLUTE MAXIMUM RATINGS(Note 1):

Symbol	Item		Rating	Unit
V_{IN}	Supply Voltage		-0.3~8.0	V
V_{EN}	EN pin Voltage		-0.3~ 8.0	V
V_{OUT}	VOUT pin Voltage		-0.3~ (V_{IN}+0.3)	V
$V_{(ESD)}$	ESD Susceptibility, Human-body model[2]		+/-2000	V
PD	Maximum Power Dissipation	SOT23	285	mW
		SOT23-3/5L	450	
		DFN1x1-4L	350	
PTR	Package Thermal Resistance Θ_{JA}	SOT23	350	℃/W
		SOT23-3/5L	220	
		DFN1x1-4L	280	
T_J	Junction Temperature Range		-40~150	℃
T_{STG}	Storage Temperature Range		-40~150	℃
T_{SOLDER}	Lead Temperature (Soldering, 10 Sec)		260	℃

Note:

1. Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability

2. per ANSI/ESDA/JEDEC JS-001

ELECTRICAL CHARACTERISTICS:

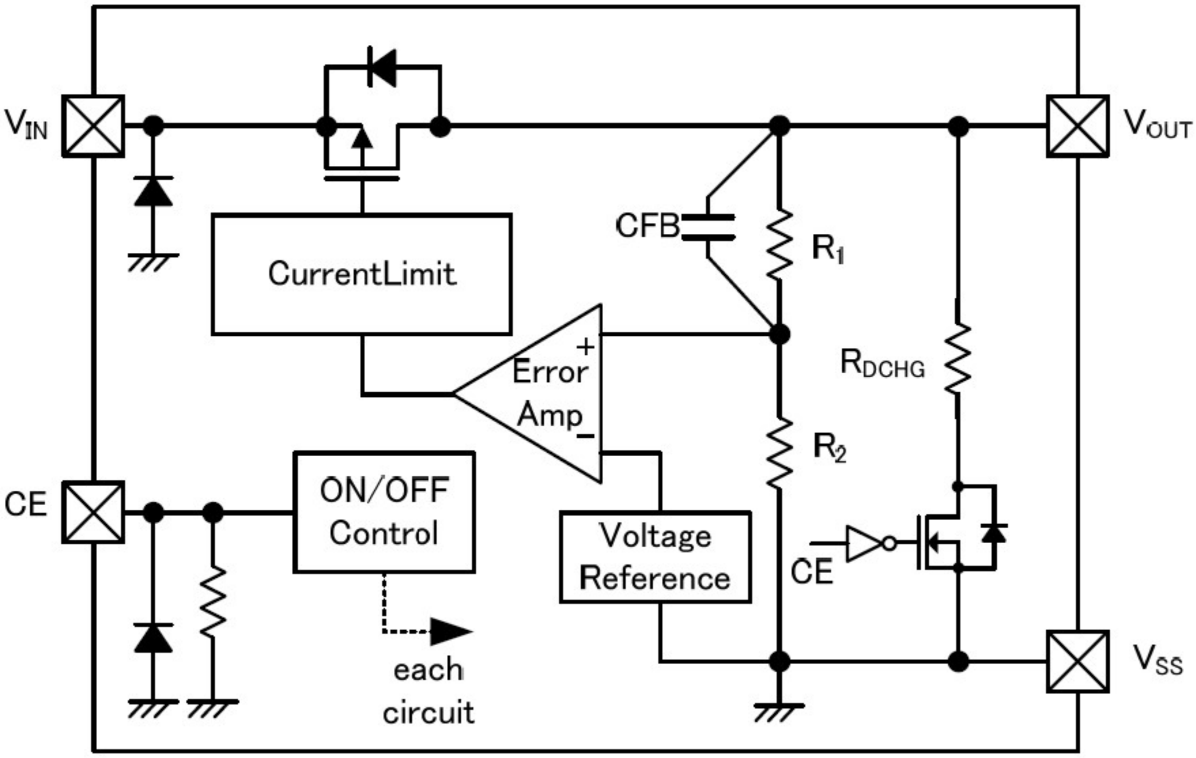
(V_{IN}=V_{OUT}+1V, Vout =3.3V, C_{IN}=C_{OUT}=1uF,T_A =25℃, unless otherwise specified.)

Symbol	Parameter	Conditions		MIN	TYP	MAX	Units
V_{IN}	Input Voltage			1.8		7.0	V
V_{OUT}	Output Accuracy	I_{OUT}= 1mA		-1.0		+1.0	%
I_{LIM}	Current Limit(1)	V_{IN}=4.3V, V_{OUT} =3.3V		520	650		mA
I_Q	Quiescent Current	V_{IN}=V_{EN}=V_{OUT}+1V, No Load			40	60	μA
I_{SHD}	Shutdown Current	V_{IN}=7.0V, V_{EN}=0V				0.1	μA
V_{DROP}	Dropout Voltage(2)	I_{OUT}=100mA, V_{OUT}=3.3V			120		mV
		I_{OUT}=300mA, V_{OUT}=3.3V			380		
		I_{OUT}=500mA, V_{OUT}=3.3V			700		
S_{LINE}	Line Regulation	V_{IN}= V_{OUT}+1V to7.0V, I_{OUT}=1mA			0.05	0.1	%/V
S_{LOAD}	Load Regulation	1mA≤I_{OUT}≤500mA			0.001	0.01	%/mA
I_{SHORT}	Short Current	V_{OUT}=0V			100		mA
V_{ENH}	EN High Voltage	V_{IN}=1.8Vto7.0V, I_{OUT}=1mA		1.5			V
V_{ENL}	EN Low Voltage					0.4	V
T_{STR}	Startup Time	From V_{EN} 'L'→'H' to 95%*V_{OUT}, C_{OUT}=1uF, No Load			60		μs
PSRR	Power Supply Rejection Ratio	C_{IN}=None,V_{OUT}=3.3 V, I_{OUT}=10mA	f=217Hz		81		dB
			f=1KHz		80		
			f=10KHz		66		
T_{SD}	Thermal Shut Down	Temperature rising			155		℃
$\triangle T_{SD}$	TSD Hysteresis	Temperature falling			20		℃
$R_{DISCHRG}$	R_{ON} of Discharge MOSFET	V_{EN}=0V			80		Ω

Notes:

1. Guaranteed by design
2. The dropout voltage is defined as V_{IN} - V_{OUT}, when V_{OUT}=95%*$V_{OUT(NOM)}$

SIMPLIFIED BLOCK DIAGRAM:



DETAIL OPERATION DESCRIPTION:

The GS2019 Series is alow noise, high PSRR, low drop-out voltage regulator. It consists of a current limiter circuit, a driver transistor, a precision voltage reference and an error correction circuit, and is compatible with low ESR ceramic capacitors. The current limiter's fold-back circuit operates as a short circuit protection as well as the output current limiter.

Current Limiting and Short-Circuit Protection

The current limit circuitry prevents damage to the MOSFET switch and the hub downstream port but can deliver load current up to the current limit threshold of typically 700mA through the switch.When a heavy load or short circuit is applied to an enabled switch, a large transient current may flow until the currentlimit circuitry responds. Once this current limit threshold isexceeded the device enters constant current mode until the thermal shutdown occurs or the fault is removed.

TYPICAL OPERATING CHARACTERISTICS:

（Tested under T_A =25°C, unless otherwise specified）

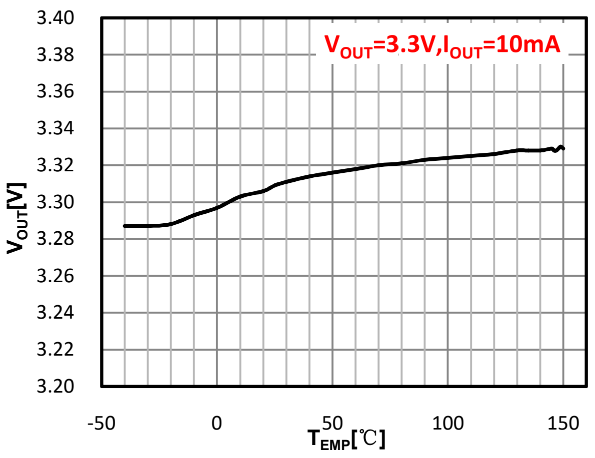


Figure 1. V_{OUT} vs Temperature

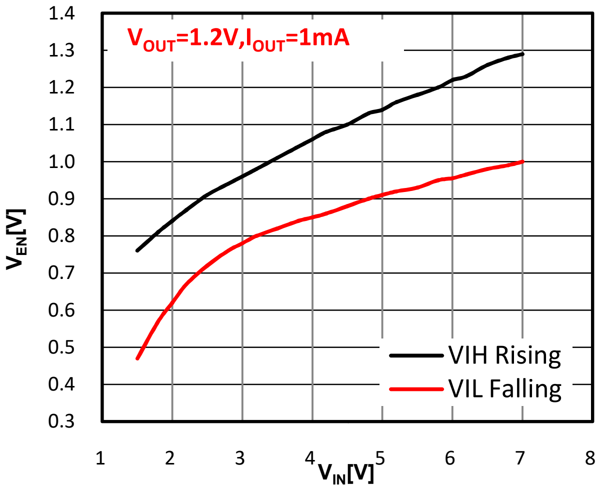


Figure 2. V_{EN} vs V_{IN}

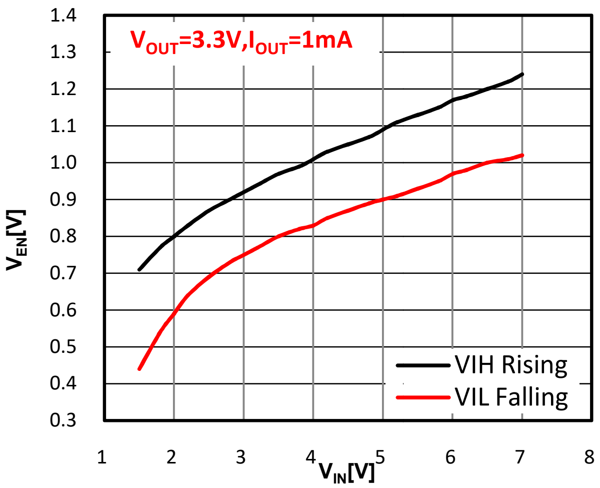


Figure 3. V_{EN} vs V_{IN}

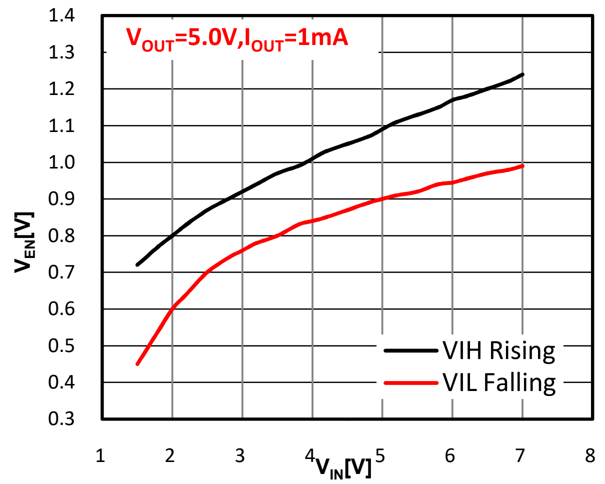


Figure 4. V_{EN} vs V_{IN}

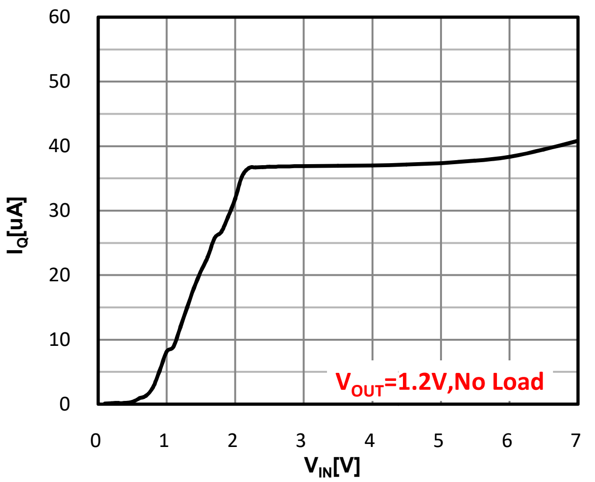


Figure 5. I_Q VS V_{IN}

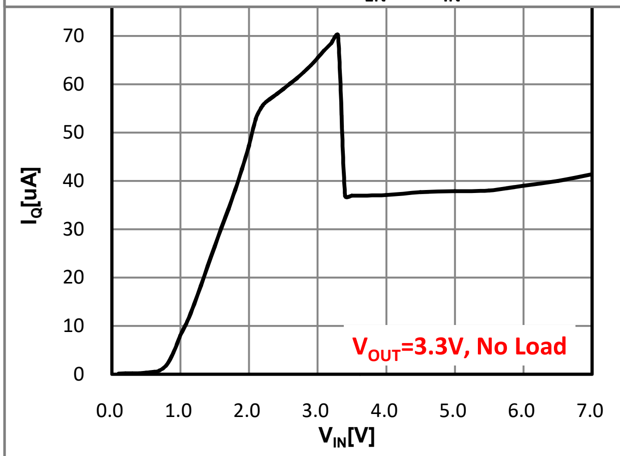


Figure 6. I_Q VS V_{IN}

TYPICAL OPERATING CHARACTERISTICS:

(Tested under T_A =25°C, unless otherwise specified)

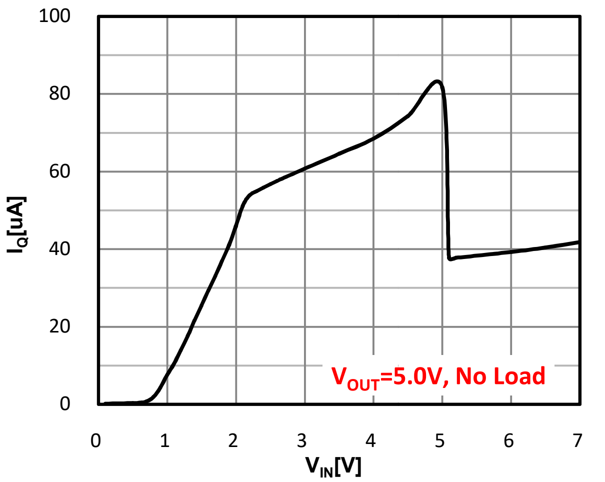


Figure 7. I_Q VS V_{IN}

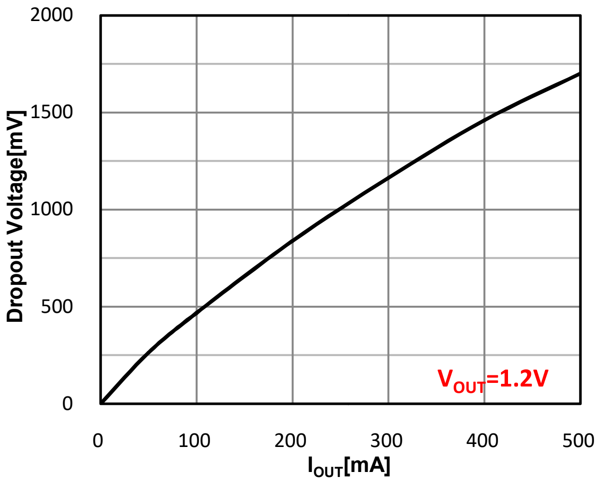


Figure 8. Dropout Voltage VS I_{OUT}

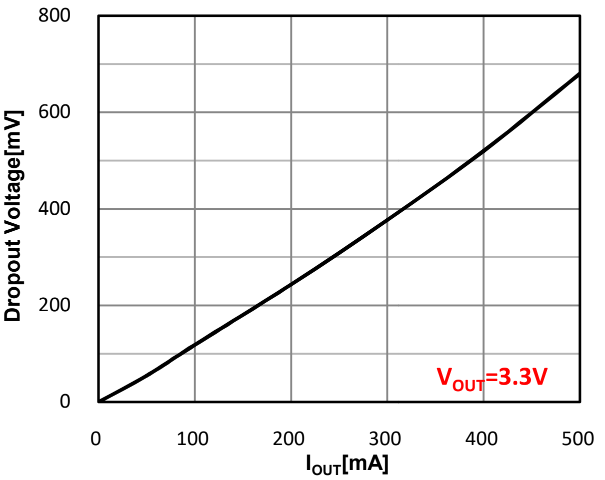


Figure 9. Dropout Voltage VS I_{OUT}

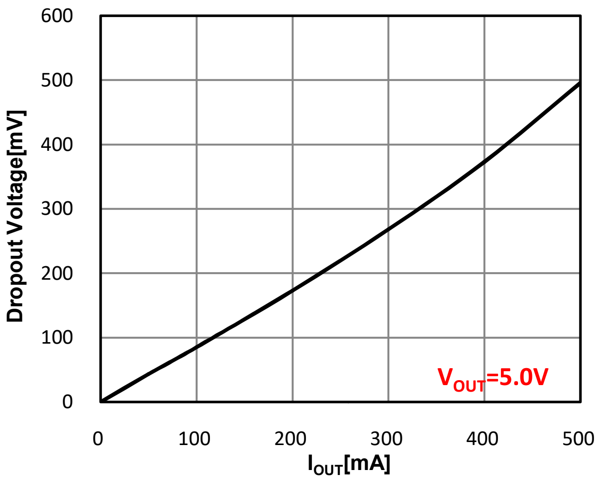


Figure 10. Dropout Voltage VS I_{OUT}

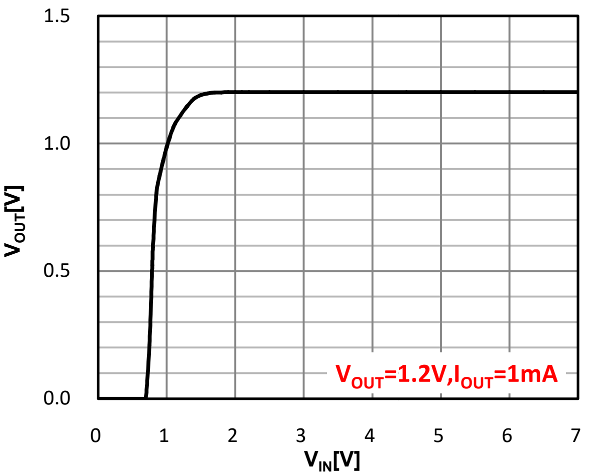


Figure 11. V_{OUT} vs V_{IN}

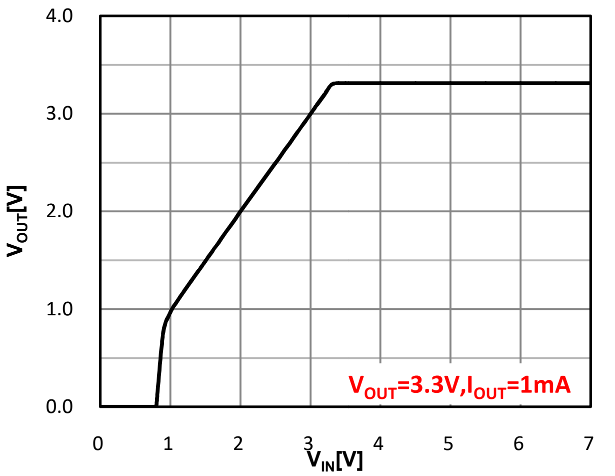


Figure 12. V_{OUT} vs V_{IN}

TYPICAL OPERATING CHARACTERISTICS:

（Tested under T_A =25°C, unless otherwise specified）

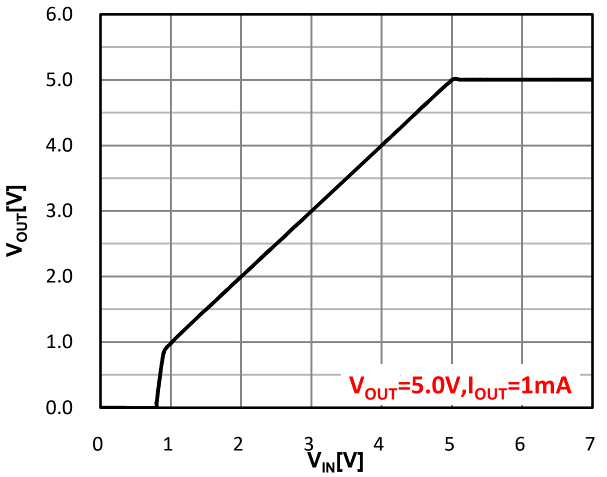


Figure 13. V_{OUT} vs V_{IN}

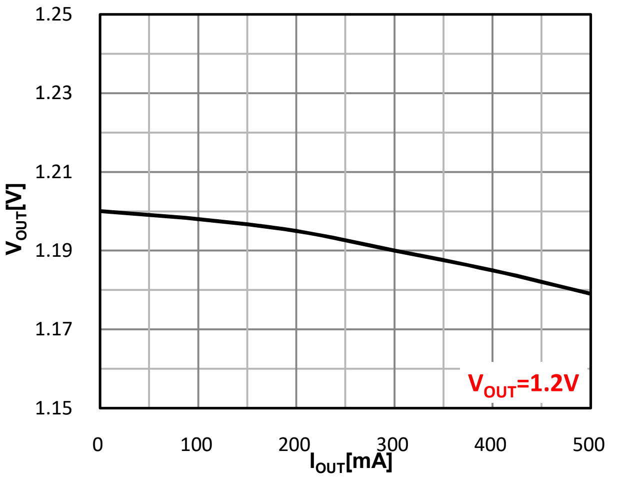


Figure 14. Load Regulation

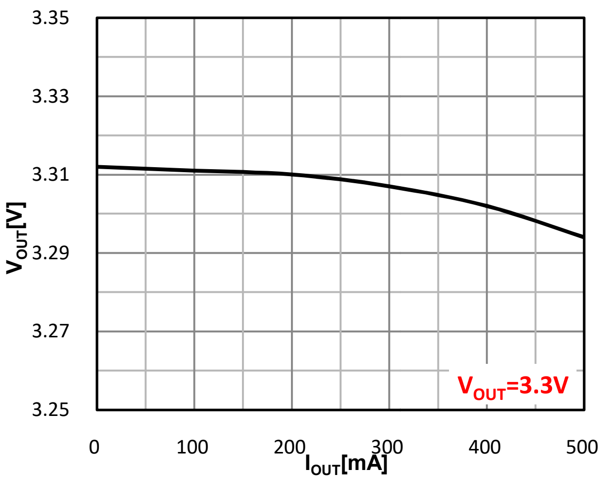


Figure 15. Load Regulation

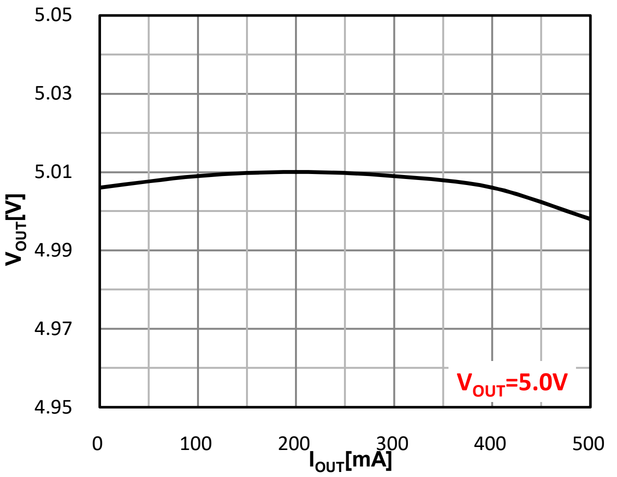
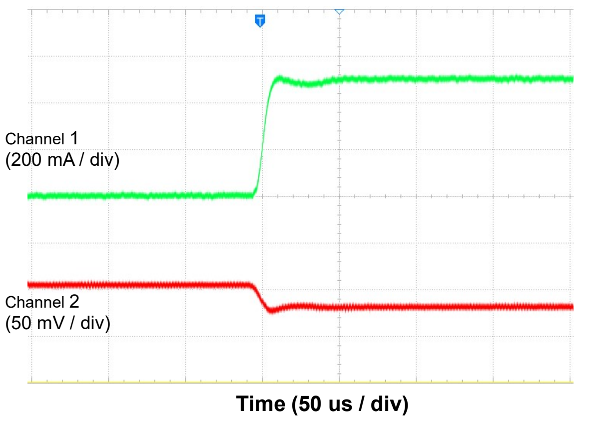
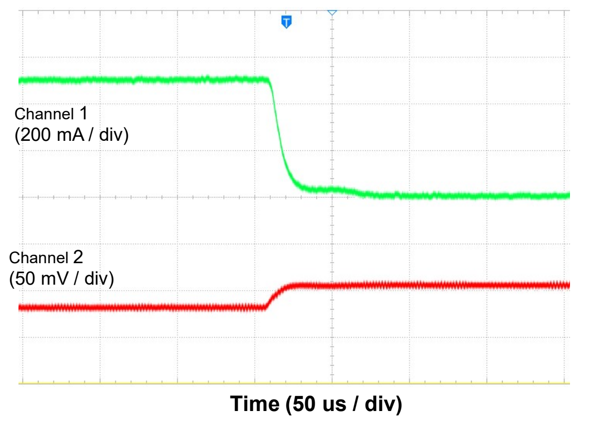


Figure 16. Load Regulation



Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=3.0V, V_{OUT}=1.2V

Figure 17. Load Transient (1 mA to 500 mA)

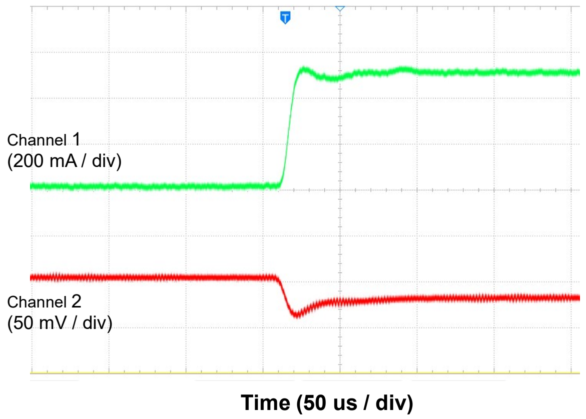


Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=3.0V, V_{OUT}=1.2V

Figure 18. Load Transient (500 mA to 1 mA)

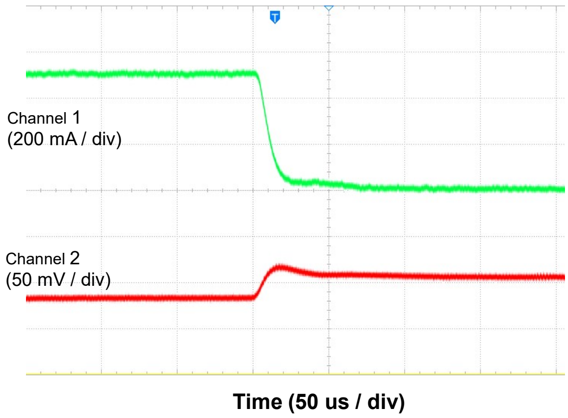
TYPICAL OPERATING CHARACTERISTICS:

（Tested under T_A =25°C, unless otherwise specified）



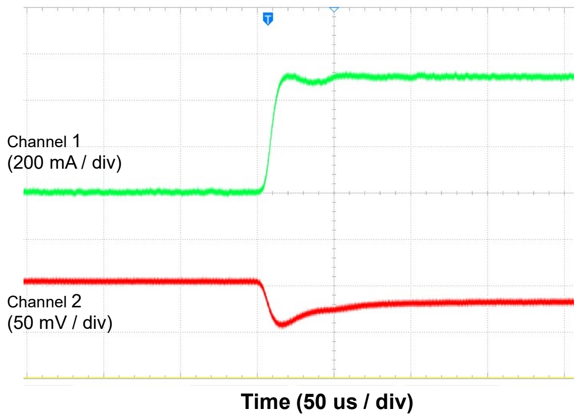
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=4.3V, V_{OUT}=3.3V

Figure 19. Load Transient (1 mA to 500 mA)



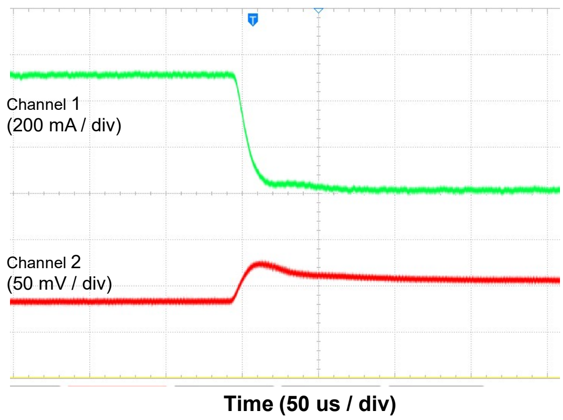
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=4.3V, V_{OUT}=3.3V

Figure 20. Load Transient (500 mA to 1 mA)



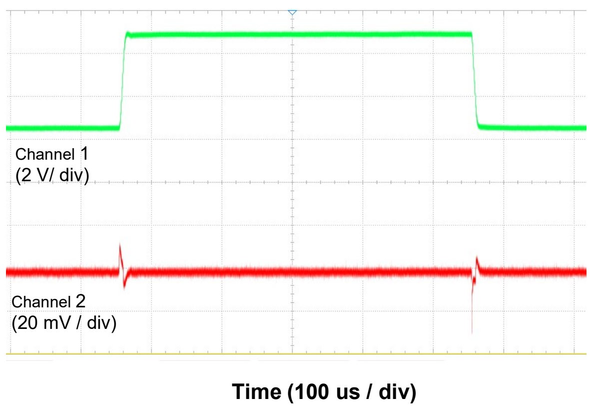
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=6.0V, V_{OUT}=5.0V

Figure 21. Load Transient (1 mA to 500 mA)



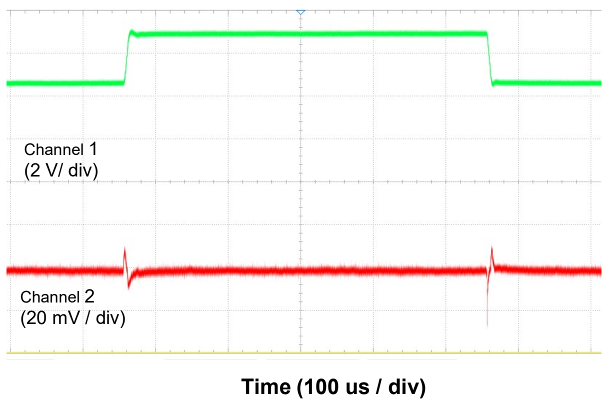
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=6.0V, V_{OUT}=5.0V

Figure 22. Load Transient (500 mA to 1 mA)



Channel 1 = V_{IN}, channel 2 =V_{OUT}, V_{IN}=2.2V→7.0V,
Tr=Tf=5us, V_{OUT}=1.2V, I_{OUT}=10mA

Figure 23. Line Transient

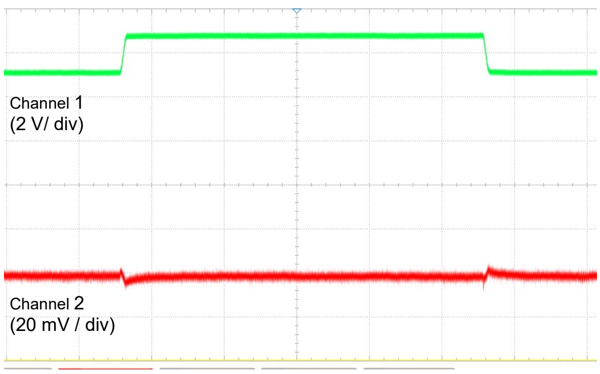


Channel 1 = V_{IN}, channel 2 =V_{OUT}, V_{IN}=4.3V→7.0V,
Tr=Tf=5us, V_{OUT}=3.3V, I_{OUT}=10mA

Figure 24. Line Transient

TYPICAL OPERATING CHARACTERISTICS:

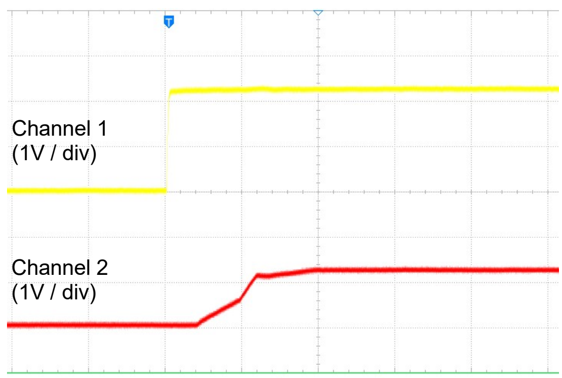
（Tested under T_A =25°C, unless otherwise specified）



Time (50 us / div)

Channel 1 = V_{IN}, channel 2 =V_{OUT}, V_{IN}=5.5V→7.0V, Tr=Tf=5us, V_{OUT}=5.0V, I_{OUT}=10mA

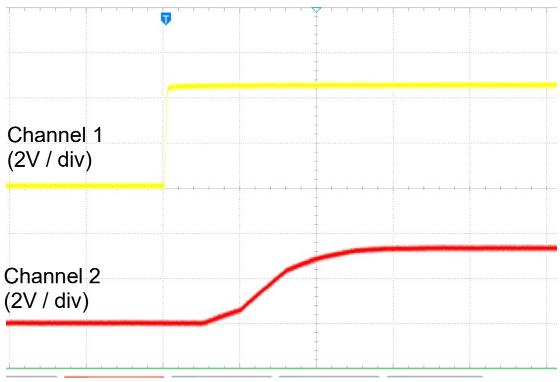
Figure 25. Line Transient



Time (20 us / div)

Channel 1 = En, channel 2 =V_{OUT}, V_{OUT}=1.2V, No Load

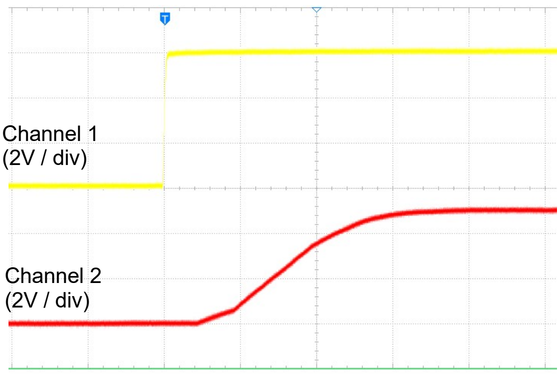
Figure 26. Power-Up with Enable



Time (20 us / div)

Channel 1 = En, channel 2 =V_{OUT}, V_{OUT}=3.3V, No Load

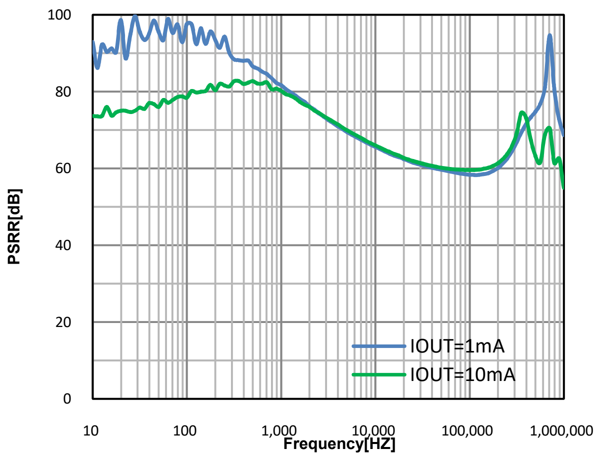
Figure 27. Power-Up with Enable



Time (20 us / div)

Channel 1 = En, channel 2 =V_{OUT}, V_{OUT}=5.0V, No Load

Figure 28. Power-Up with Enable



V_{OUT}=3.3V, V_{IN}=4.3V, V_{PP}=0.2V,C_{IN}=non, C_{OUT}=1uF

Figure 29. PSRR vs Frequency

APPLICATION INFORMATION:

- **Input Capacitor Selection**

Like any low-dropout regulator, the external capacitors used with the GS2019 Series must be carefully selected for regulator stability and performance. Using a capacitor whose value is >=1μF on the GS2019 Series input and the amount of capacitance canbe increased without limit.An at least 10uF input capacitor is needed if input ripple voltage V_{PP}>1V.The input capacitor must be located a distance less than 0.5 inch from the input pin of the IC and returned to a clean analog ground.Any good quality ceramic or tantalum canbe used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response.

- **Output Capacitor Selection**

The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application.The GS2019 Series is designed specifically to work with low ESR ceramic output capacitorin space-saving and performance consideration. Using a ceramic capacitor whose value is at least 1μF on the GS2019 Series output ensures stability. An appropriate output capacitor can reduce noise and improve load transient response and PSRR. The output capacitor should be located not more than 0.5 inch from theVOUT pin of the GS2019 Series and returned to aclean analog ground.

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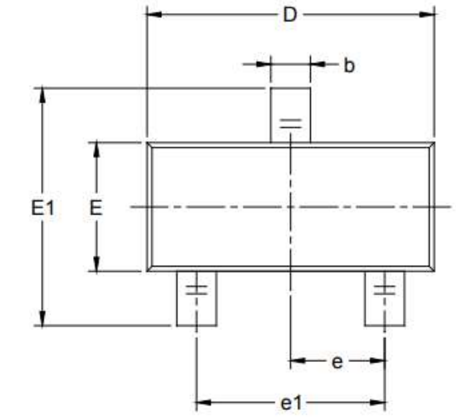
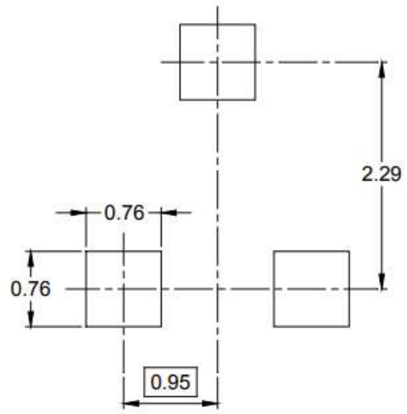
- **Layout considerations**

To improve ac performance such as PSRR,output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for VIN and VOUT, with each ground plane connected only at the GND pin of the device.

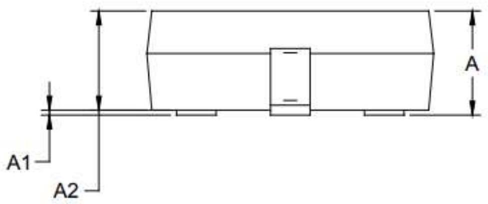
PACKAGE OUTLINE：

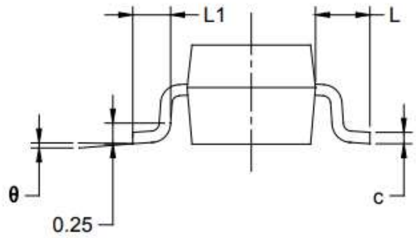
SOT23 Package





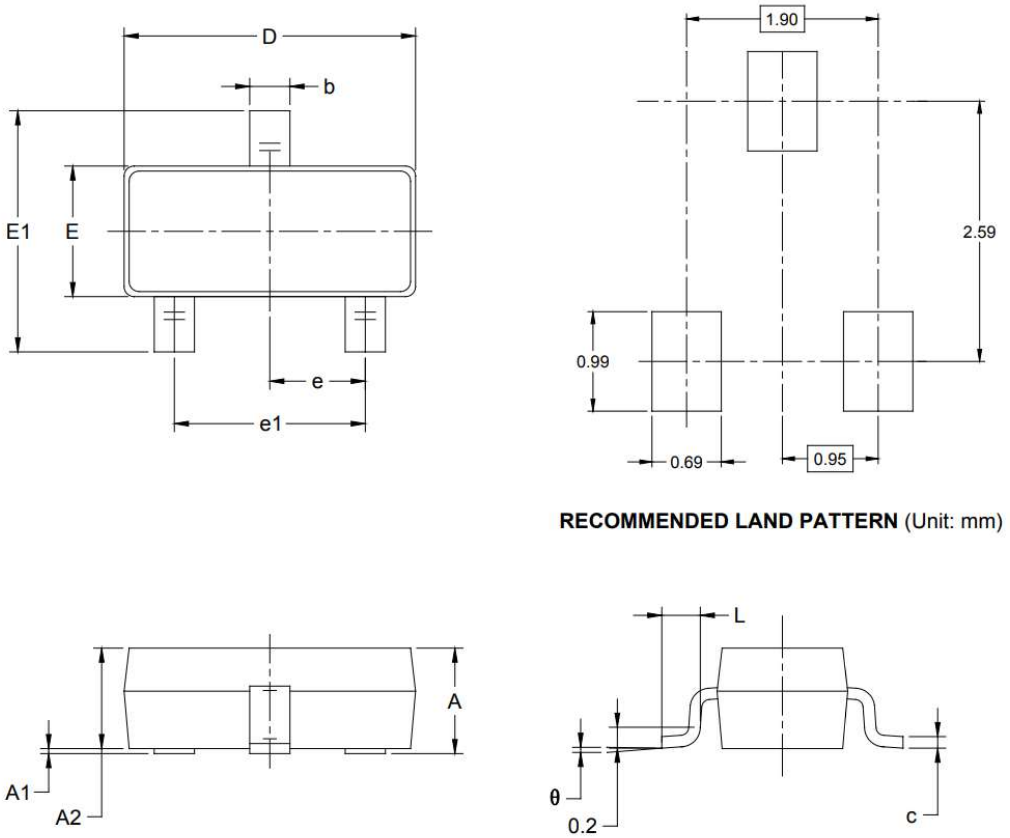
RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

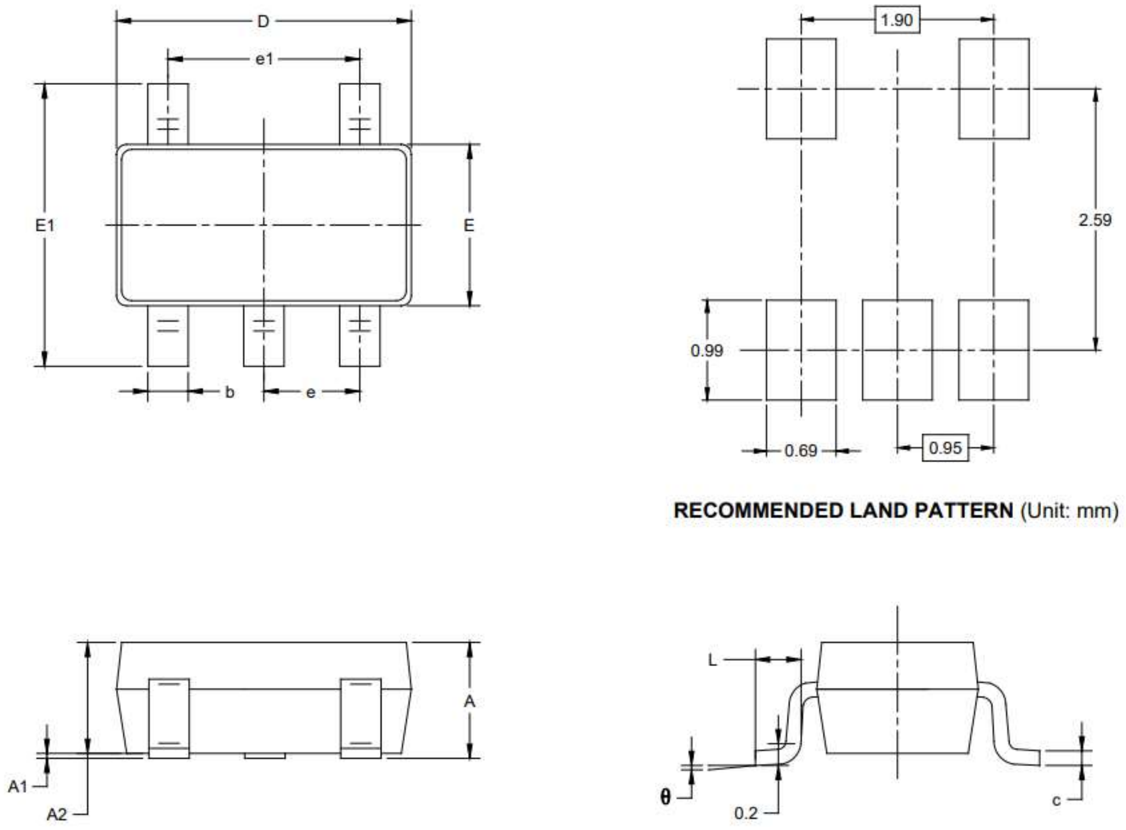
SOT23-3L Package



RECOMMENDED LAND PATTERN (Unit: mm)

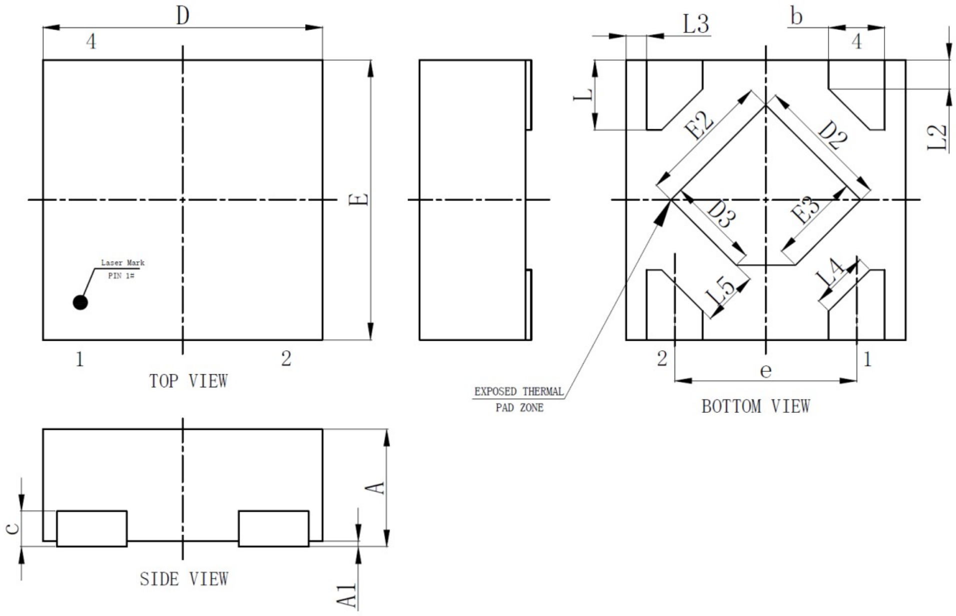
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT23-5L Package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

DFN1x1-4L Package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0. 35	-	0. 40
A1	0. 00	0.02	0. 05
b	0. 15	0. 20	0. 25
c	0. 127REF		
D	0. 95	1. 00	1. 05
D2	0. 38	0. 48	0. 58
D3	0. 23	0. 33	0. 43
e	0. 65BSC		
E	0. 95	1. 00	1. 05
E2	0. 38	0. 48	0. 58
E3	0. 23	0. 33	0. 43
L	0. 20	0.25	0. 30
L2	0.103REF		
L3	0.075REF		
L4	0.208REF		
L5	0.200REF		