GL6251

250mA ULTRA - LOW DROPOUT POSITIVE VOLTAGE REGULATOR

Description

GL6251 combines high accuracy with very low power consumption, and provides high output current even when the application requires extremely low input-output voltage differential.

GL6251 includes a precision voltage reference, an error correction circuit, over-temperature protection, and a current limited output driver. Fast transient response to load variations provides excellent stability under dynamic load conditions.

Gl6251 comes in SOT-23 (150mW), SOT-89 (500mW) and TO-92 packages.

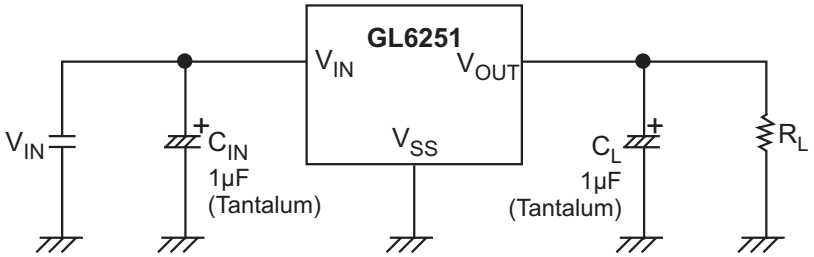
Features

- **Maximum output current 250mA (within maximum power dissipation)**
- **Output Voltage: from 1.5V to 6.0V in 0.1V increments**
- **Output Voltage 2%**
- **CMOS low power consumption, typically 1.0uA at Vout=5.0V**
- **Input Stability typically 0.2%/V**
- **Ultra-low dropout Voltage 0.38V @ Iout=200mA at Vout=5.0V**
- **Small input/ output differential 0.4V at 160mA (Vout=3.3V)**
- **SOT-23 (150mW) , SOT-89 (500mW) and TO-92 packages**

Application

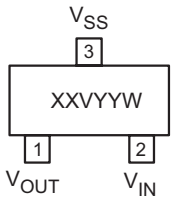
Palmtops
Portable Cameras
Video Recorders
Battery Powered Equipment
Reference Voltage Sources

TYPICAL APPLICATION CIRCUITS

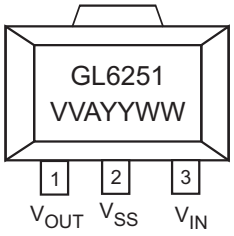


MARKING INFORMATION & PIN CONFIGURATIONS(TOP VIEW)

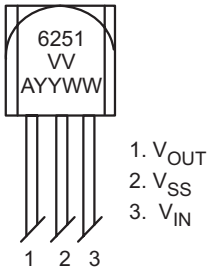
SOT-23



SOT-89



TO-92



XX = Marking Code(51 = GL6251)
V = Voltage Code
VV = Voltage Suffix (18=1.8V ,50=5.0V)
A = Assembly Location
YY = Year
WW, W = Weekly

ORDERING INFORMATION (Green Package Products are available now!)

Ordering Number	Output Voltage	Voltage Code	Package	Shipping
GL6251-1.5T92B	1.5V		TO-92	1,000 Units/ ESD Bag
GL6251-1.5T92RL	1.5V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-1.5ST23R	1.5V	C	SOT-23	3,000 Units/ Tape and Reel
GL6251-1.5ST89R	1.5V		SOT-89	1,000 Units/ Tape and Reel
GL6251-1.8T92B	1.8V		TO-92	1,000 Units/ ESD Bag
GL6251-1.8T92RL	1.8V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-1.8ST23R	1.8V	E	SOT-23	3,000 Units/ Tape and Reel
GL6251-1.8ST89R	1.8V		SOT-89	1,000 Units/ Tape and Reel
GL6251-2.5T92B	2.5V		TO-92	1,000 Units/ ESD Bag
GL6251-2.5T92RL	2.5V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-2.5ST23R	2.5V	G	SOT-23	3,000 Units/ Tape and Reel
GL6251-2.5ST89R	2.5V		SOT-89	1,000 Units/ Tape and Reel
GL6251-2.7T92B	2.7V		TO-92	1,000 Units/ ESD Bag
GL6251-2.7T92RL	2.7V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-2.7ST23R	2.7V	T	SOT-23	3,000 Units/ Tape and Reel
GL6251-2.7ST89R	2.7V		SOT-89	1,000 Units/ Tape and Reel
GL6251-2.8T92B	2.8V		TO-92	1,000 Units/ ESD Bag
GL6251-2.8T92RL	2.8V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-2.8ST23R	2.8V	H	SOT-23	3,000 Units/ Tape and Reel
GL6251-2.8ST89R	2.8V		SOT-89	1,000 Units/ Tape and Reel
GL6251-2.85T92B	2.85V		TO-92	1,000 Units/ ESD Bag
GL6251-2.85T92RL	2.85V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-2.85ST23R	2.85V	I	SOT-23	3,000 Units/ Tape and Reel
GL6251-2.85ST89R	2.85V		SOT-89	1,000 Units/ Tape and Reel
GL6251-3.0T92B	3.0V		TO-92	1,000 Units/ ESD Bag
GL6251-3.0T92RL	3.0V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-3.0ST23R	3.0V	J	SOT-23	3,000 Units/ Tape and Reel
GL6251-3.0ST89R	3.0V		SOT-89	1,000 Units/ Tape and Reel

* For detail ordering number identification, please see last page.

◆ ORDERING INFORMATION (Green Package Products are available now!)

Ordering Number	Output Voltage	Voltage Code	Package	Shipping
GL6251-3.2T92B	3.2V		TO-92	1,000 Units/ ESD Bag
GL6251-3.2T92RL	3.2V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-3.2ST23R	3.2V	U	SOT-23	3,000 Units/ Tape and Reel
GL6251-3.2ST89R	3.2V		SOT-89	1,000 Units/ Tape and Reel
GL6251-3.3T92B	3.3V		TO-92	1,000 Units/ ESD Bag
GL6251-3.3T92RL	3.3V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-3.3ST23R	3.3V	K	SOT-23	3,000 Units/ Tape and Reel
GL6251-3.3ST89R	3.3V		SOT-89	1,000 Units/ Tape and Reel
GL6251-3.5T92B	3.5V		TO-92	1,000 Units/ ESD Bag
GL6251-3.5T92RL	3.5V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-3.5ST23R	3.5V	V	SOT-23	3,000 Units/ Tape and Reel
GL6251-3.5ST89R	3.5V		SOT-89	1,000 Units/ Tape and Reel
GL6251-3.6T92B	3.6V		TO-92	1,000 Units/ ESD Bag
GL6251-3.6T92RL	3.6V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-3.6ST23R	3.6V	L	SOT-23	3,000 Units/ Tape and Reel
GL6251-3.6ST89R	3.6V		SOT-89	1,000 Units/ Tape and Reel
GL6251-4.0T92B	4.0V		TO-92	1,000 Units/ ESD Bag
GL6251-4.0T92RL	4.0V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-4.0ST23R	4.0V	M	SOT-23	3,000 Units/ Tape and Reel
GL6251-4.0ST89R	4.0V		SOT-89	1,000 Units/ Tape and Reel
GL6251-4.4T92B	4.4V		TO-92	1,000 Units/ ESD Bag
GL6251-4.4T92RL	4.4V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-4.4ST23R	4.4V	W	SOT-23	3,000 Units/ Tape and Reel
GL6251-4.4ST89R	4.4V		SOT-89	1,000 Units/ Tape and Reel
GL6251-4.5T92B	4.5V		TO-92	1,000 Units/ ESD Bag
GL6251-4.5T92RL	4.5V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-4.5ST23R	4.5V	N	SOT-23	3,000 Units/ Tape and Reel
GL6251-4.5ST89R	4.5V		SOT-89	1,000 Units/ Tape and Reel
GL6251-5.0T92B	5.0V		TO-92	1,000 Units/ ESD Bag
GL6251-5.0T92RL	5.0V		TO-92	2,000 Units/ Ammo Pack (Tape)
GL6251-5.0ST23R	5.0V	Q	SOT-23	3,000 Units/ Tape and Reel
GL6251-5.0ST89R	5.0V		SOT-89	1,000 Units/ Tape and Reel

* For detail ordering number identification, please see last page.

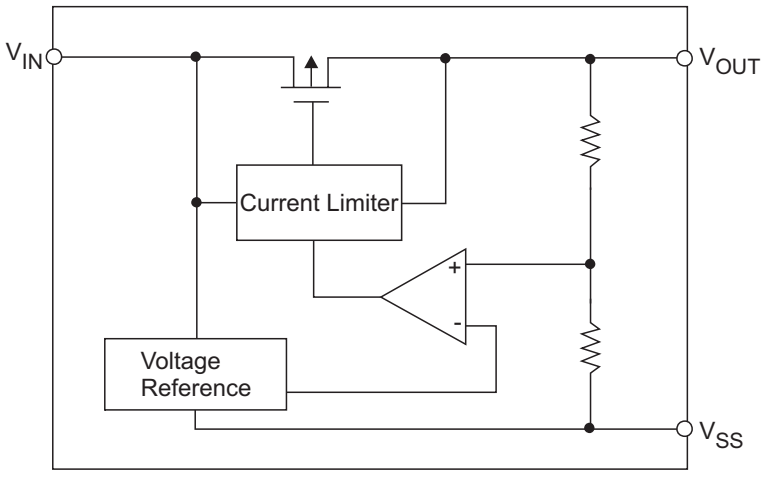
◆ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	12	V
Output Current		I_{OUT}	300	mA
Output Voltage		V_{OUT}	V_{SS} - 0.3 ~ V_{IN} + 0.3	V
Continuous Total Power Dissipation	SOT - 23	P_D	150	mW
	SOT - 89		500	
	TO - 92		300	
Operating Ambient Temperature		T_{opr}	-30 ~ +80	°C
Storage Temperature		T_{stg}	-40 ~ +125	°C
Peak Reflow Temperature			260	°C

◆ Thermal Information

PARAMETER		Maximum	Unit
Thermal Resistance $R_{\theta jc}$	SOT-89	100	°C / W
Thermal Resistance $R_{\theta ja}$		300	°C / W

◆ BLOCK DIAGRAM



◆ ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Circuit
Output Voltage	GL6250-1.5V	$V_{OUT}(E)$ (Note 2)	I_{OUT}=40mA, V_{IN} >V_{Drop}+V_{OUT}	1.470	1.500	1.530	V	1
	GL6250-1.8V			1.760	1.800	1.840		
	GL6250-2.5V			2.450	2.500	2.550		
	GL6250-2.7V			2.650	2.700	2.760		
	GL6250-2.8V			2.740	2.800	2.860		
	GL6250-3.0V			2.940	3.000	3.060		
	GL6250-3.2V			3.136	3.200	3.264		
	GL6250-3.3V			3.240	3.300	3.370		
	GL6250-3.5V			3.430	3.500	3.570		
	GL6250-3.6V			3.530	3.600	3.670		
	GL6250-4.0V			3.920	4.000	4.080		
	GL6250-4.4V			4.312	4.400	4.488		
	GL6250-4.5V			4.410	4.500	4.590		
	GL6250-5.0V			4.900	5.000	5.100		
Maximum Output Current	GL6250-1.5V	I_{OUT} max	V_{IN}=3.0V, V_{OUT}(E) ≥1.35V	250			mA	1
	GL6250-1.8V		V_{IN}=3.0V, V_{OUT}(E) ≥1.62V					
	GL6250-2.5V		V_{IN}=4.0V, V_{OUT}(E) ≥ 2.3V					
	GL6250-2.7V		V_{IN}=4.0V, V_{OUT}(E) ≥2.43V					
	GL6250-2.8V		V_{IN}=4.0V, V_{OUT}(E) ≥2.52V					
	GL6250-3.0V		V_{IN}=4.0V, V_{OUT}(E) ≥ 2.7V					
	GL6250-3.2V		V_{IN}=4.0V, V_{OUT}(E) ≥2.88V					
	GL6250-3.3V		V_{IN}=4.0V, V_{OUT}(E) ≥2.97V					
	GL6250-3.5V		V_{IN}=5.0V, V_{OUT}(E) ≥3.15V					
	GL6250-3.6V		V_{IN}=5.0V, V_{OUT}(E) ≥3.24V					
	GL6250-4.0V		V_{IN}=5.0V, V_{OUT}(E) ≥ 3.6V					
	GL6250-4.4V		V_{IN}=6.0V, V_{OUT}(E) ≥3.96V					
	GL6250-4.5V		V_{IN}=6.0V, V_{OUT}(E) ≥4.05V					
	GL6250-5.0V		V_{IN}=6.0V, V_{OUT}(E) ≥ 4.5V					

◆ ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Circuit
Load Stability	GL6250-1.5V	ΔV_{OUT}	V_{IN}=2.5V, 1mA≤ I_{OUT}≤ 60mA		45	90	mV	1
	GL6250-1.8V		V_{IN}=2.8V, 1mA≤ I_{OUT}≤ 60mA		45	90		
	GL6250-2.5V		V_{IN}=3.5V, 1mA≤ I_{OUT}≤ 80mA		45	90		
	GL6250-2.7V		V_{IN}=3.7V, 1mA ≤ I_{OUT}≤ 80mA		45	90		
	GL6250-2.8V		V_{IN}=3.8V, 1mA ≤ I_{OUT}≤ 80mA		45	90		
	GL6250-3.0V		V_{IN}=4.0V, 1mA ≤ I_{OUT}≤ 80mA		45	90		
	GL6250-3.2V		V_{IN}=4.2V, 1mA ≤ I_{OUT}≤ 80mA		45	90		
	GL6250-3.3V		V_{IN}=4.3V, 1mA ≤ I_{OUT} ≤ 100mA		45	90		
	GL6250-3.5V		V_{IN}=4.5V, 1mA ≤ I_{OUT} ≤ 100mA		45	90		
	GL6250-3.6V		V_{IN}=4.6V, 1mA ≤ I_{OUT} ≤ 100mA		45	90		
	GL6250-4.0V		V_{IN}=5.0V, 1mA ≤ I_{OUT} ≤ 100mA		40	80		
	GL6250-4.4V		V_{IN}=5.4V, 1mA ≤ I_{OUT} ≤ 100mA		40	80		
	GL6250-4.5V		V_{IN}=4.5V, 1mA ≤ I_{OUT} ≤ 100mA		40	80		
	GL6250-5.0V		V_{IN}=6.0V, 1mA ≤ I_{OUT} ≤ 100mA		40	80		
Dropout Voltage V_{OUT} > 2.5V			I_O=160mA		400	700	mV	1
for 2.0V < V_{OUT} ≤ 2.5V					550	850		
for V_{OUT} ≤ 2.0V					900	1300		
Supply Current	GL6250-1.5V	I_{SS}	V_{IN} = 2.5V		32	50	μA	2
	GL6250-1.8V		V_{IN} = 2.8V					
	GL6250-2.5V		V_{IN} = 3.5V					
	GL6250-2.7V		V_{IN} = 3.7V					
	GL6250-2.8V		V_{IN} = 3.8V					
	GL6250-3.0V		V_{IN} = 4.0V					
	GL6250-3.2V		V_{IN} = 4.2V					
	GL6250-3.3V		V_{IN} = 4.3V					
	GL6250-3.5V		V_{IN} = 4.5V					
	GL6250-3.6V		V_{IN} = 4.6V					
	GL6250-4.0V		V_{IN} = 5.0V					
	GL6250-4.4V		V_{IN} = 5.4V					
	GL6250-4.5V		V_{IN} = 5.5V					
	GL6250-5.0V		V_{IN} = 6.0V					
Output Current Limit					300		mA	-

◆ ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Circuit
Input Stability	GL6251-1.8V	$\frac{\Delta V_{OUT}}{\Delta VIN \bullet V_{OUT}}$	I_{OUT} = 40mA 2.8V ≤ V_{IN} ≤ 10.0V		0.2	0.3	%/ V	1
	GL6251-2.5V		I_{OUT} = 40mA 3.5V ≤ V_{IN} ≤ 10.0V					
	GL6251-2.7V		I_{OUT} = 40mA 3.7V ≤ V_{IN} ≤ 10.0V					
	GL6251-2.8V		I_{OUT} = 40mA 3.8V ≤ V_{IN} ≤ 10.0V					
	GL6251-3.0V		I_{OUT} = 40mA 4.0V ≤ V_{IN} ≤ 10.0V					
	GL6251-3.2V		I_{OUT} = 40mA 4.2V ≤ V_{IN} ≤ 10.0V					
	GL6251-3.3V		I_{OUT} = 40mA 4.3V ≤ V_{IN} ≤ 10.0V					
	GL6251-3.5V		I_{OUT} = 40mA 4.5V ≤ V_{IN} ≤ 10.0V					
	GL6251-3.6V		I_{OUT} = 40mA 4.6V ≤ V_{IN} ≤ 10.0V					
	GL6251-4.0V		I_{OUT} = 40mA 5.0V ≤ V_{IN} ≤ 10.0V					
	GL6251-4.4V		I_{OUT} = 40mA 5.4V ≤ V_{IN} ≤ 10.0V					
	GL6251-4.5V		I_{OUT} = 40mA 5.5V ≤ V_{IN} ≤ 10.0V					
	GL6251-5.0V		I_{OUT} = 40mA 6.0V ≤ V_{IN} ≤ 10.0V					
Input Voltage		V_{IN}				10	V	-
Output Voltage Temperature Characteristics		$\frac{\Delta V_{OUT}}{\Delta Topr \bullet V_{OUT}}$	I_{OUT} = 10mA -30°C ≤ Topr ≤ 80°C		±100		ppm/°C	1

Note: 1. V_{OUT}(T) = Specified Output Voltage
2. V_{OUT}(E) = Effective Output Voltage (the output voltage when"V_{OUT}(T) + 1.0V" is provided at the V_{IN} pin while maintaining a certain I_{OUT} value)

* Output Voltage from 1.8V to 6.0V in 0.1V increments ate available

DIRECTIONS FOR USAGE

Notes on Usage

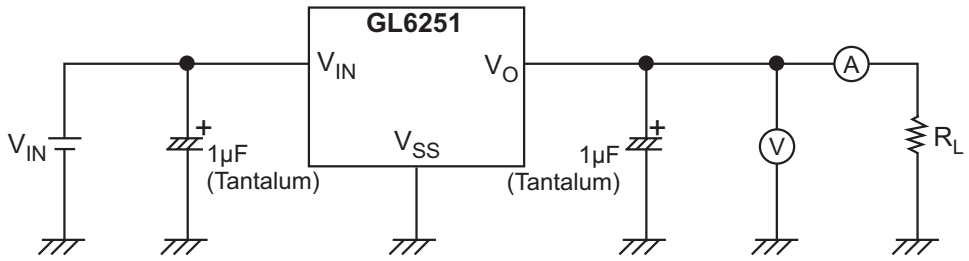
1. Please use this IC within the stipulated absolute maximum ratings as the IC is liable to malfunction outside of such parameters.

2. There is a possibility theat, oscillation may occur as result of the impedance present between the power supply and IC's input. Where impedance is 10W or more, please use a capacitor (Cin) of least 1uF.With a large output current, operations can be stabilized by increasing capacitor size (Cin). If Cin is small and capacitor size (CL) is increased, there is a possibility of oscillation due to input impedance. In such cases, operations can be stabilized by either increasing the size of Cin or decreasing the size of CL.

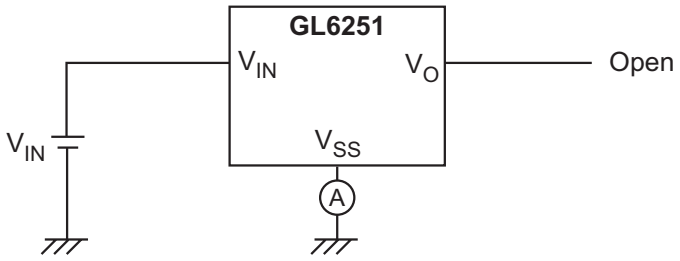
3. Please ensure the output current (Iout) is less than Pd (Vin - Vout) and does not exceed the stipulated continuous total power dissipation value (Pd) for the package.

TEST CIRCUIT

Circuit 1



Circuit 2



CALCULATING POWER DISSIPATION

The GL6250 series precision linear regulators include thermal shutdown and current limit circuitry to protect the devices. However, high power regulators normally operate at high junction temperatures so it is important to calculate the power dissipation and junction temperatures accurately to be sure that you use and adequate heat sink.

The thermal characteristics of an IC depend four factors:

1. Maximum Ambient Temperature T_A(°C)
2. Power Dissipation P_D (Watts)
3. Maximum Junction Temperature T_J(°C)
4. Thermal Resistance Junction to ambient R_{QJA}(°C/W)

These relationship of these four factors is expressed by equation (1): $\mathbf{T_J = T_A + P_D \, X \, R_{QJA}}$

Maximum ambient temperature and power dissipation are determined by the design while the maximum junction temperature and thermal resistance depend on the manufacturer and the package type.

PERFORMANCE CHARACTERISTICS FOR GL6251 - 3.0

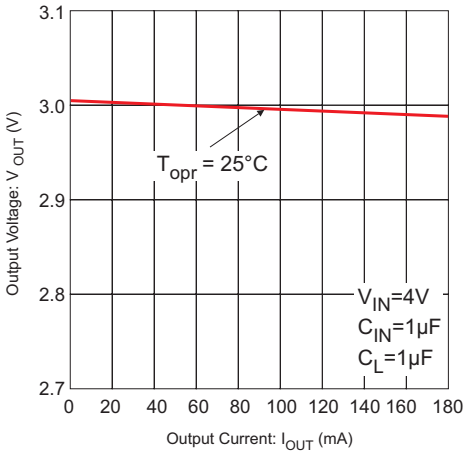


Figure 1: Output Voltage vs. Output Current

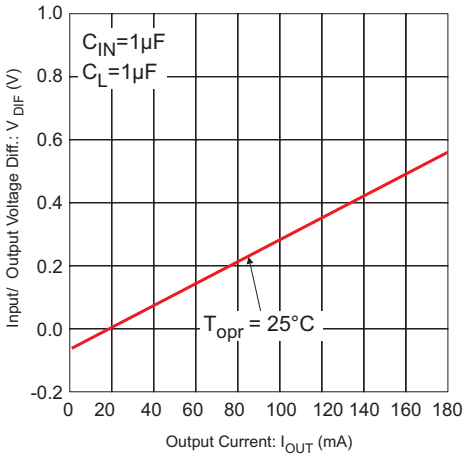


Figure 2: Input/ Output Voltage differential vs. Output Current

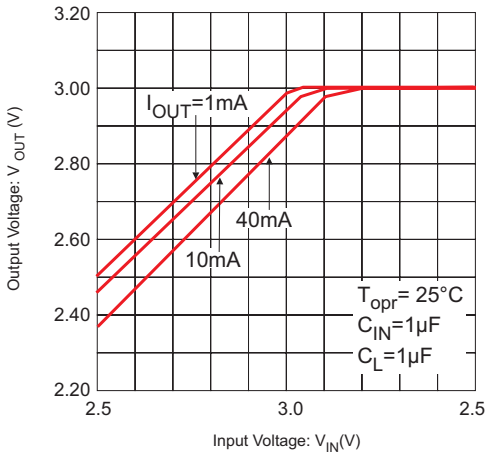


Figure 3: Output Voltage vs. Input voltage

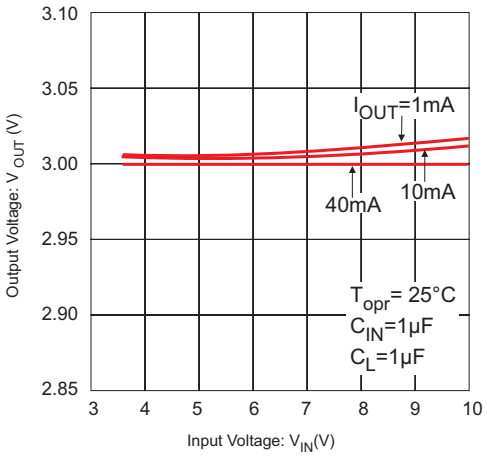


Figure 4: Output Voltage vs. Input voltage

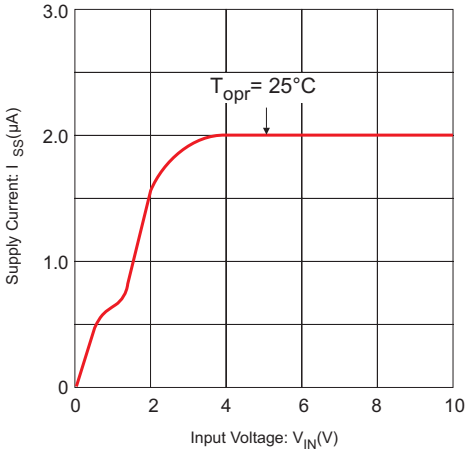


Figure 5: Supply Current vs. Input Voltage

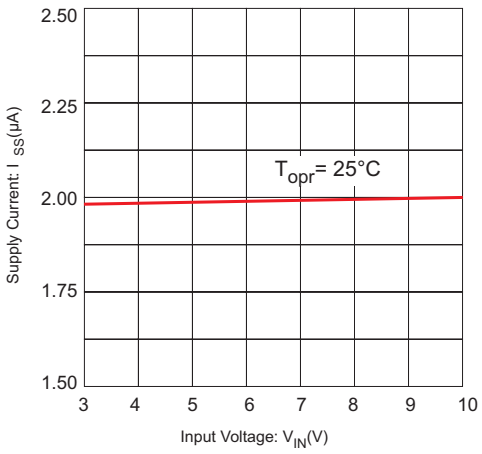


Figure 6: Supply Current vs. Input Voltage

PERFORMANCE CHARACTERISTICS FOR GL6251- 3.0

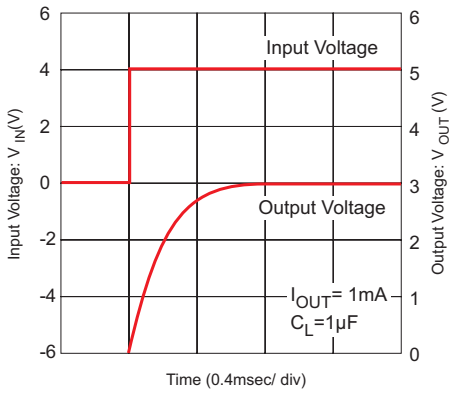


Figure 7: Input Transient Response 1

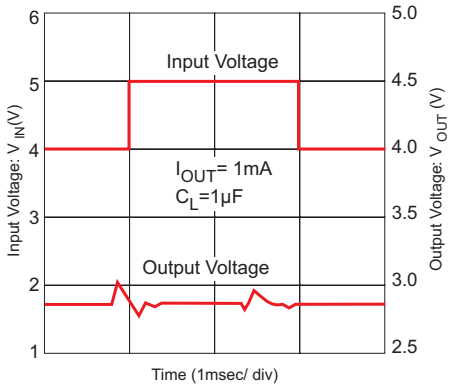


Figure 8: Input Transient Response 2

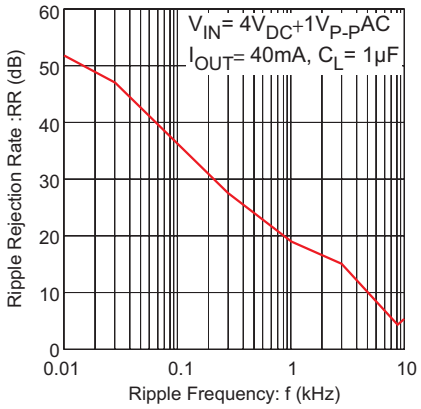
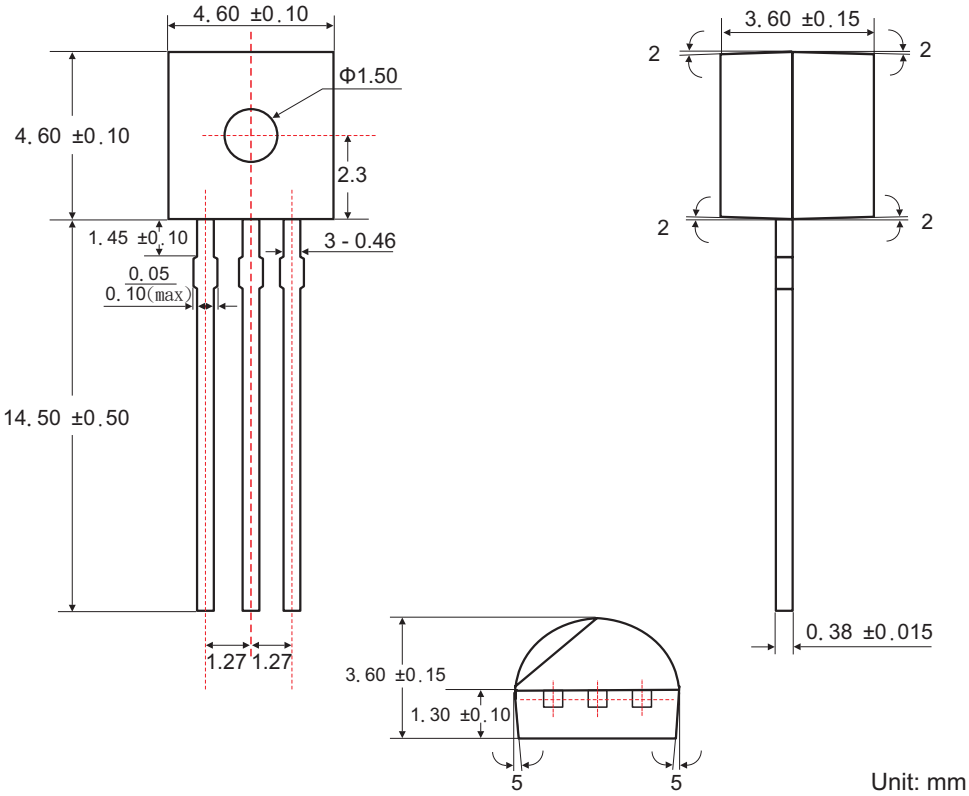


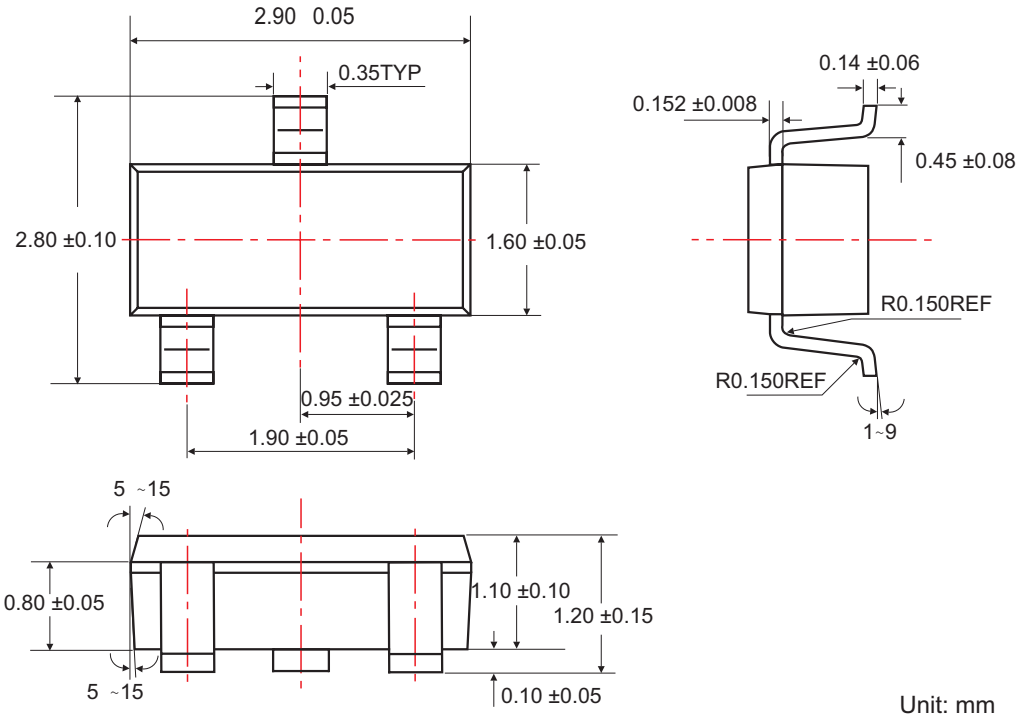
Figure 9: Ripple Rejection Rate

TO-92 PACKAGE OUTLINE DIMENSIONS



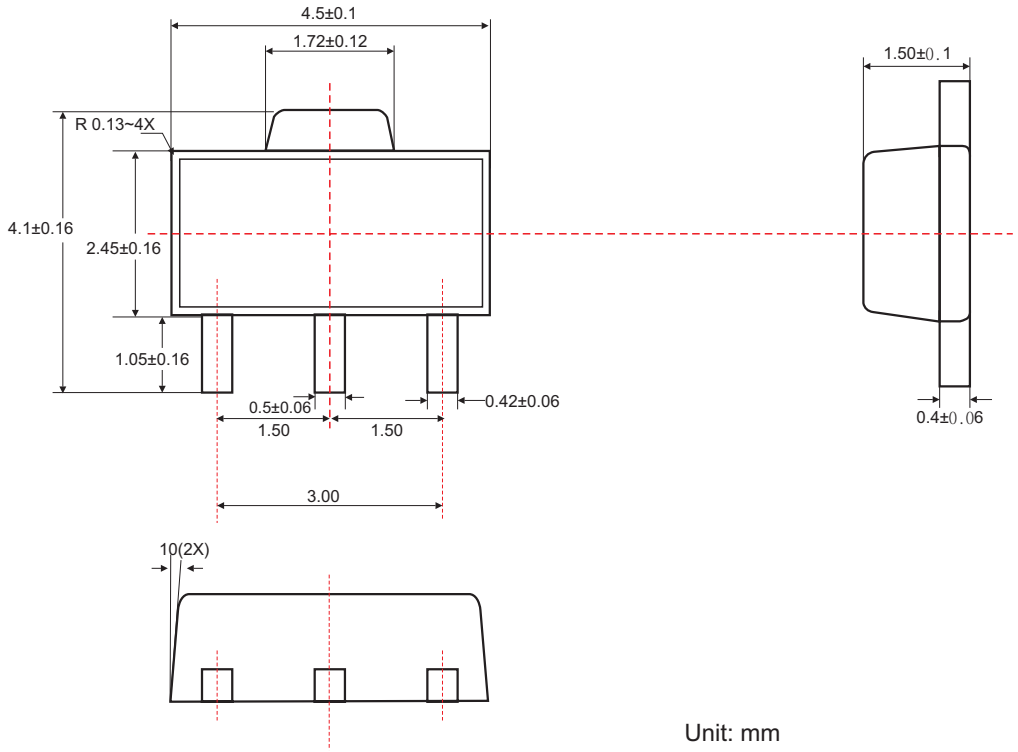
Unit: mm

SOT-23 PACKAGE OUTLINE DIMENSIONS



Unit: mm

SOT-89 PACKAGE OUTLINE DIMENSIONS



Unit: mm

◆ ORDERING NUMBER