

## Description

The GM6251's combine high accuracy with very low power consumption, providing high output current even when the application requires extremely low input-output voltage differential.

The GM6251's include 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.

The GM6251's come in SOT-25 (150mW), SOT-89 (500mW) and TO-92 packages.

## Features

- ◆ Maximum output current 250mA (within maximum power dissipation)
- ◆ Output voltage: from 1.8 V to 6.0V in 0.1V increments
- ◆ Output voltage  $\pm 2\%$
- ◆ CMOS low power consumption, typically 1.0 $\mu$ A at  $V_{OUT} = 5.0V$
- ◆ Input stability typically 0.2%/V
- ◆ Ultra-low dropout voltage 0.38V @  $I_{OUT} = 200mA$  at  $V_{OUT} = 5.0V$
- ◆ Small input/ output differential: 0.4V at 160mA ( $V_{OUT} = 3.3V$ )
- ◆ SOT-25 (150mW), SOT-89 (500mW) and TO-92 packages

## Application

**Palmtops**

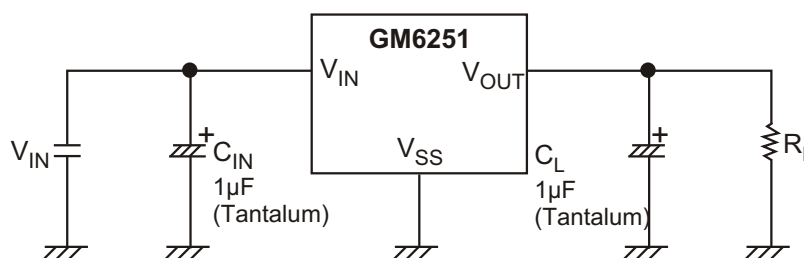
**Portable Cameras**

**Video Recorders**

**Battery Powered Equipment**

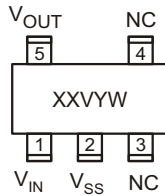
**Reference Voltage Sources**

## TYPICAL APPLICATION CIRCUITS

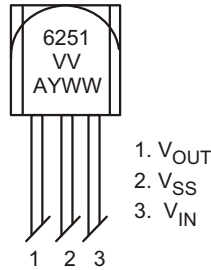


**◆ MARKING INFORMATION & PIN CONFIGURATIONS(TOP VIEW)**

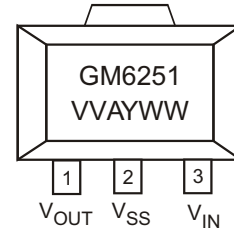
**SOT-25(SOT-23-5)**



**TO-92**



**SOT-89**



XX = Specific Device Code(FA = GM6251)  
 V = Voltage Code  
 VV = Voltage Suffix (18=1.8V ,50=5.0V)  
 A = Assembly Location  
 Y = Year  
 WW, W= Work Week

**◆ ORDERING INFORMATION**

Ordering Number	Output Voltage	Voltage Code	Package	Shipping
GM6251-1.8T92B	1.8V		TO-92	1,000 Units/ ESD Bag
GM6251-1.8T92RL	1.8V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-1.8ST25R	1.8V	E	SOT-25	3,000 Units/ Tape and Reel
GM6251-1.8ST89R	1.8V		SOT-89	1,000 Units/ Tape and Reel
GM6251-2.5T92B	2.5V		TO-92	1,000 Units/ ESD Bag
GM6251-2.5T92RL	2.5V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-2.5ST25R	2.5V	G	SOT-25	3,000 Units/ Tape and Reel
GM6251-2.5ST89R	2.5V		SOT-89	1,000 Units/ Tape and Reel
GM6251-2.7T92B	2.7V		TO-92	1,000 Units/ ESD Bag
GM6251-2.7T92RL	2.7V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-2.7ST25R	2.7V	T	SOT-25	3,000 Units/ Tape and Reel
GM6251-2.7ST89R	2.7V		SOT-89	1,000 Units/ Tape and Reel
GM6251-2.8T92B	2.8V		TO-92	1,000 Units/ ESD Bag
GM6251-2.8T92RL	2.8V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-2.8ST25R	2.8V	H	SOT-25	3,000 Units/ Tape and Reel
GM6251-2.8ST89R	2.8V		SOT-89	1,000 Units/ Tape and Reel
GM6251-3.0T92B	3.0V		TO-92	1,000 Units/ ESD Bag
GM6251-3.0T92RL	3.0V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-3.0ST25R	3.0V	J	SOT-25	3,000 Units/ Tape and Reel
GM6251-3.0ST89R	3.0V		SOT-89	1,000 Units/ Tape and Reel

\* For detail Ordering Number identification, please see last page.

◆ **ORDERING INFORMATION** (Continued)

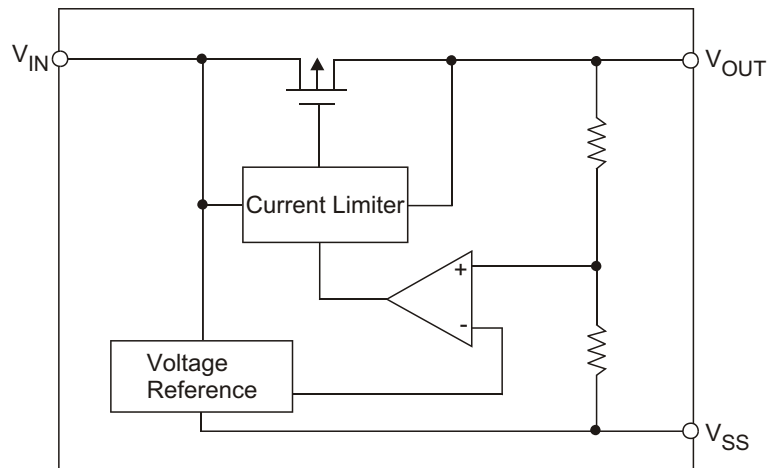
Ordering Number	Output Voltage	Voltage Code	Package	Shipping
GM6251-3.2T92B	3.2V		TO-92	1,000 Units/ ESD Bag
GM6251-3.2T92RL	3.2V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-3.2ST25R	3.2V	U	SOT-25	3,000 Units/ Tape and Reel
GM6251-3.2ST89R	3.2V		SOT-89	1,000 Units/ Tape and Reel
GM6251-3.3T92B	3.3V		TO-92	1,000 Units/ ESD Bag
GM6251-3.3T92RL	3.3V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-3.3ST25R	3.3V	K	SOT-25	3,000 Units/ Tape and Reel
GM6251-3.3ST89R	3.3V		SOT-89	1,000 Units/ Tape and Reel
GM6251-3.5T92B	3.5V		TO-92	1,000 Units/ ESD Bag
GM6251-3.5T92RL	3.5V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-3.5ST25R	3.5V	V	SOT-25	3,000 Units/ Tape and Reel
GM6251-3.5ST89R	3.5V		SOT-89	1,000 Units/ Tape and Reel
GM6251-3.6T92B	3.6V		TO-92	1,000 Units/ ESD Bag
GM6251-3.6T92RL	3.6V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-3.6ST25R	3.6V	L	SOT-25	3,000 Units/ Tape and Reel
GM6251-3.6ST89R	3.6V		SOT-89	1,000 Units/ Tape and Reel
GM6251-4.0T92B	4.0V		TO-92	1,000 Units/ ESD Bag
GM6251-4.0T92RL	4.0V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-4.0ST25R	4.0V	M	SOT-25	3,000 Units/ Tape and Reel
GM6251-4.0ST89R	4.0V		SOT-89	1,000 Units/ Tape and Reel
GM6251-4.4T92B	4.4V		TO-92	1,000 Units/ ESD Bag
GM6251-4.4T92RL	4.4V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-4.4ST25R	4.4V	W	SOT-25	3,000 Units/ Tape and Reel
GM6251-4.4ST89R	4.4V		SOT-89	1,000 Units/ Tape and Reel
GM6251-4.5T92B	4.5V		TO-92	1,000 Units/ ESD Bag
GM6251-4.5T92RL	4.5V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-4.5ST25R	4.5V	N	SOT-25	3,000 Units/ Tape and Reel
GM6251-4.5ST89R	4.5V		SOT-89	1,000 Units/ Tape and Reel
GM6251-5.0T92B	5.0V		TO-92	1,000 Units/ ESD Bag
GM6251-5.0T92RL	5.0V		TO-92	2,000 Units/ Ammo Pack (Tape)
GM6251-5.0ST25R	5.0V	Q	SOT-25	3,000 Units/ Tape and Reel
GM6251-5.0ST89R	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 Voltage	$V_{OUT}$	$V_{SS} - 0.3 \sim V_{IN} + 0.3$	V
Output Current	$I_{OUT}$	500	mA
Continuous Total Power Dissipation (SOT - 89)	$P_D$	500	mW
Operating Ambient Temperature	$T_{opr}$	-30 ~ +80	°C
Storage Temperature	$T_{stg}$	-40 ~ +125	°C

### ◆ BLOCK DIAGRAM



◆ **ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Circuit	
Output Voltage	GM6251-1.8V	$V_{\text{OUT(E)}}^{(\text{Note 2})}$	$I_{\text{OUT}}=40\text{mA},$ $V_{\text{IN}} > V_{\text{Drop}} + V_{\text{OUT}}$	1.764	1.800	1.836	V	1
	GM6251-2.5V			2.450	2.500	2.550		
	GM6251-2.7V			2.646	2.700	2.754		
	GM6251-2.8V			2.744	2.800	2.856		
	GM6251-3.0V			2.940	3.000	3.060		
	GM6251-3.2V			3.136	3.200	3.264		
	GM6251-3.3V			3.234	3.300	3.366		
	GM6251-3.5V			3.430	3.500	3.570		
	GM6251-3.6V			3.528	3.600	3.672		
	GM6251-4.0V			3.920	4.000	4.080		
	GM6251-4.4V			4.312	4.400	4.488		
	GM6251-4.5V			4.410	4.500	4.590		
	GM6251-5.0V			4.900	5.000	5.100		
Maximum Output Current	GM6251-1.8V	$I_{\text{OUT max}}$	250			mA	1	
	GM6251-2.5V							$V_{\text{IN}}=3.0\text{V}, V_{\text{OUT(E)}} \geq 1.62\text{V}$
	GM6251-2.7V							$V_{\text{IN}}=4.0\text{V}, V_{\text{OUT(E)}} \geq 2.3\text{V}$
	GM6251-2.8V							$V_{\text{IN}}=4.0\text{V}, V_{\text{OUT(E)}} \geq 2.43\text{V}$
	GM6251-3.0V							$V_{\text{IN}}=4.0\text{V}, V_{\text{OUT(E)}} \geq 2.52\text{V}$
	GM6251-3.2V							$V_{\text{IN}}=4.0\text{V}, V_{\text{OUT(E)}} \geq 2.7\text{V}$
	GM6251-3.3V							$V_{\text{IN}}=4.0\text{V}, V_{\text{OUT(E)}} \geq 2.88\text{V}$
	GM6251-3.5V							$V_{\text{IN}}=4.0\text{V}, V_{\text{OUT(E)}} \geq 2.97\text{V}$
	GM6251-3.6V							$V_{\text{IN}}=5.0\text{V}, V_{\text{OUT(E)}} \geq 3.15\text{V}$
	GM6251-4.0V							$V_{\text{IN}}=5.0\text{V}, V_{\text{OUT(E)}} \geq 3.24\text{V}$
	GM6251-4.4V							$V_{\text{IN}}=5.0\text{V}, V_{\text{OUT(E)}} \geq 3.6\text{V}$
	GM6251-4.5V							$V_{\text{IN}}=6.0\text{V}, V_{\text{OUT(E)}} \geq 3.96\text{V}$
	GM6251-5.0V							$V_{\text{IN}}=6.0\text{V}, V_{\text{OUT(E)}} \geq 4.05\text{V}$

◆ ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Circuit
Load Stability	GM6251-1.8V	$V_{OUT}$	$V_{IN}=2.8\text{V}, 1\text{mA} \leq I_{OUT} \leq 60\text{mA}$		45	90	mV	1
	GM6251-2.5V		$V_{IN}=3.5\text{V}, 1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		45	90		
	GM6251-2.7V		$V_{IN}=3.7\text{V}, 1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		45	90		
	GM6251-2.8V		$V_{IN}=3.8\text{V}, 1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		45	90		
	GM6251-3.0V		$V_{IN}=4.0\text{V}, 1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		45	90		
	GM6251-3.2V		$V_{IN}=4.2\text{V}, 1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		45	90		
	GM6251-3.3V		$V_{IN}=4.3\text{V}, 1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		45	90		
	GM6251-3.5V		$V_{IN}=4.5\text{V}, 1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		45	90		
	GM6251-3.6V		$V_{IN}=4.6\text{V}, 1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		45	90		
	GM6251-4.0V		$V_{IN}=5.0\text{V}, 1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		40	80		
	GM6251-4.4V		$V_{IN}=5.4\text{V}, 1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		40	80		
	GM6251-4.5V		$V_{IN}=5.5\text{V}, 1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		40	80		
	GM6251-5.0V		$V_{IN}=6.0\text{V}, 1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		40	80		
Input - Output Voltage Differential (Note 3)	GM6251-1.8V	Vdif1	$I_{OUT} = 60\text{mA}$		180	360	mV	1
		Vdif2	$I_{OUT} = 160\text{mA}$		900	1300		
	GM6251-2.5V	Vdif1	$I_{OUT} = 80\text{mA}$		180	360		
		Vdif2	$I_{OUT} = 160\text{mA}$		550	850		
	GM6251-2.7V	Vdif1	$I_{OUT} = 80\text{mA}$		180	360		
		Vdif2	$I_{OUT} = 160\text{mA}$		400	700		
	GM6251-2.8V	Vdif1	$I_{OUT} = 80\text{mA}$		180	360		
		Vdif2	$I_{OUT} = 160\text{mA}$		400	700		
	GM6251-3.0V	Vdif1	$I_{OUT} = 80\text{mA}$		180	360		
		Vdif2	$I_{OUT} = 160\text{mA}$		400	700		
	GM6251-3.2V	Vdif1	$I_{OUT} = 80\text{mA}$		180	360		
		Vdif2	$I_{OUT} = 160\text{mA}$		400	700		
	GM6251-3.3V	Vdif1	$I_{OUT} = 100\text{mA}$		170	330		
		Vdif2	$I_{OUT} = 200\text{mA}$		400	630		
	GM6251-3.5V	Vdif1	$I_{OUT} = 100\text{mA}$		120	300		
		Vdif2	$I_{OUT} = 200\text{mA}$		380	600		
	GM6251-3.6V	Vdif1	$I_{OUT} = 100\text{mA}$		120	300		
		Vdif2	$I_{OUT} = 200\text{mA}$		380	600		
	GM6251-4.0V	Vdif1	$I_{OUT} = 100\text{mA}$		170	330		
		Vdif2	$I_{OUT} = 200\text{mA}$		400	630		
GM6251-4.4V	Vdif1	$I_{OUT} = 100\text{mA}$		120	300			
	Vdif2	$I_{OUT} = 200\text{mA}$		380	600			
GM6251-4.5V	Vdif1	$I_{OUT} = 100\text{mA}$		120	300			
	Vdif2	$I_{OUT} = 200\text{mA}$		380	600			
GM6251-5.0V	Vdif1	$I_{OUT} = 100\text{mA}$		120	300			
	Vdif2	$I_{OUT} = 200\text{mA}$		380	600			

◆ ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Circuit
Supply Current	GM6251-1.8V	$I_{SS}$	$V_{IN} = 2.8\text{V}$		1.0	2.9	$\mu\text{A}$	2
	GM6251-2.5V		$V_{IN} = 3.5\text{V}$					
	GM6251-2.7V		$V_{IN} = 3.7\text{V}$					
	GM6251-2.8V		$V_{IN} = 3.8\text{V}$					
	GM6251-3.0V		$V_{IN} = 4.0\text{V}$					
	GM6251-3.2V		$V_{IN} = 4.2\text{V}$					
	GM6251-3.3V		$V_{IN} = 4.3\text{V}$					
	GM6251-3.5V		$V_{IN} = 4.5\text{V}$					
	GM6251-3.6V		$V_{IN} = 4.6\text{V}$					
	GM6251-4.0V		$V_{IN} = 5.0\text{V}$					
	GM6251-4.4V		$V_{IN} = 5.4\text{V}$					
	GM6251-4.5V		$V_{IN} = 5.5\text{V}$					
	GM6251-5.0V		$V_{IN} = 6.0\text{V}$					
Output Current Limit					500		$\text{mA}$	-
Input Stability	GM6251-1.8V	$\frac{V_{OUT}}{V_{IN} \cdot V_{OUT}}$	$I_{OUT} = 40\text{mA}$ $2.8\text{V} \leq V_{IN} \leq 10.0\text{V}$		0.2	0.3	$\%/V$	1
	GM6251-2.5V		$I_{OUT} = 40\text{mA}$ $3.5\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-2.7V		$I_{OUT} = 40\text{mA}$ $3.7\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-2.8V		$I_{OUT} = 40\text{mA}$ $3.8\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-3.0V		$I_{OUT} = 40\text{mA}$ $4.0\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-3.2V		$I_{OUT} = 40\text{mA}$ $4.2\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-3.3V		$I_{OUT} = 40\text{mA}$ $4.3\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-3.5V		$I_{OUT} = 40\text{mA}$ $4.5\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-3.6V		$I_{OUT} = 40\text{mA}$ $4.6\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-4.0V		$I_{OUT} = 40\text{mA}$ $5.0\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-4.4V		$I_{OUT} = 40\text{mA}$ $5.4\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-4.5V		$I_{OUT} = 40\text{mA}$ $5.5\text{V} \leq V_{IN} \leq 10.0\text{V}$					
	GM6251-5.0V		$I_{OUT} = 40\text{mA}$ $6.0\text{V} \leq V_{IN} \leq 10.0\text{V}$					
Input Voltage		$V_{IN}$				10	$\text{V}$	-
Output Voltage Temperature Characteristics		$\frac{V_{OUT}}{T_{opr} \cdot V_{OUT}}$	$I_{OUT} = 10\text{mA}$ $-30^\circ\text{C} \leq T_{opr} \leq 80^\circ\text{C}$		$\pm 100$		$\text{ppm}/^\circ\text{C}$	1

**Note:** 1.  $V_{OUT}(T)$  = Specified Output Voltage

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

3.  $V_{dif} = \{V_{IN1}(\text{Note 4}) - V_{OUT}(E)\}$

4.  $V_{IN1}$  = The input voltage at the time 98% of  $V_{OUT}(E)$  is output (input voltage has been gradually reduced).

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

## ◆ DIRECTIONS FOR USE

### Notes on Use

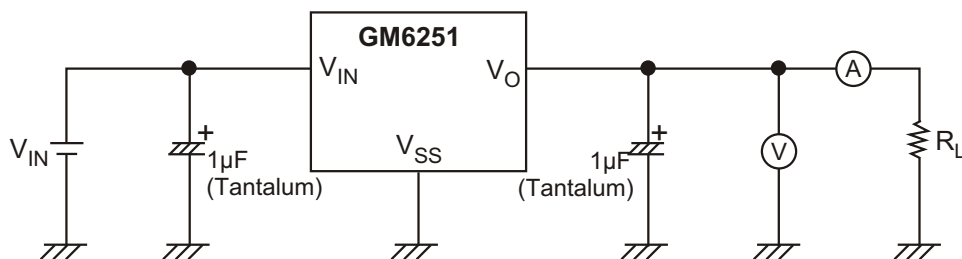
1. Please use this IC within the stipulated absolute maximum ratings as the IC is liable to malfunction outside of such parameters.
2. There is a possibility that oscillation may occur as a result of the impedance present between the power supply and the IC's input. Where impedance is 10W or more, please use a capacitor ( $C_{IN}$ ) of at least 1μF.

With a large output current, operations can be stabilised by increasing capacitor size ( $C_{IN}$ ). If  $C_{IN}$  is small and capacitor size ( $C_L$ ) is increased, there is a possibility of oscillation due to input impedance. In such cases, operations can be stabilised by either increasing the size of  $C_{IN}$  or decreasing the size of  $C_L$ .

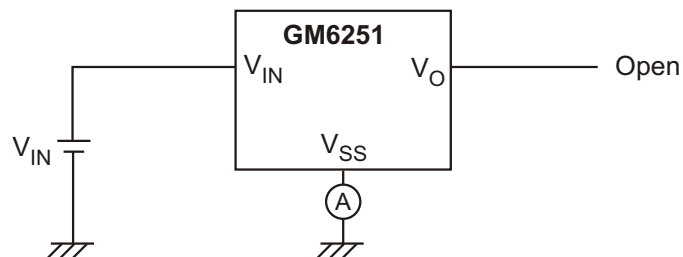
3. Please ensure that output current ( $I_{OUT}$ ) is less than  $Pd \div (V_{IN} - V_{OUT})$  and does not exceed the stipulated continuous total power dissipation value ( $Pd$ ) for the package.

## ◆ TEST CIRCUIT

Circuit 1



Circuit 2





◆ PERFORMANCE CHARACTERISTICS FOR GM6251 - 3.0

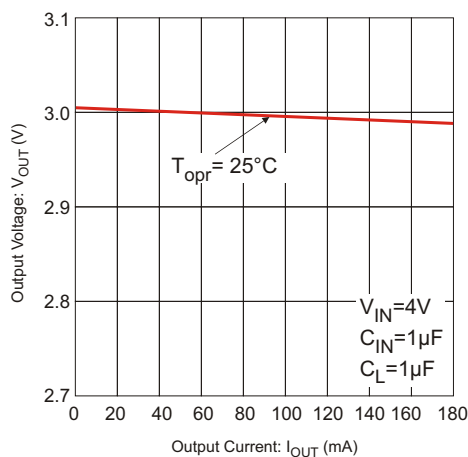


Figure 1: Output Voltage vs. Output Current

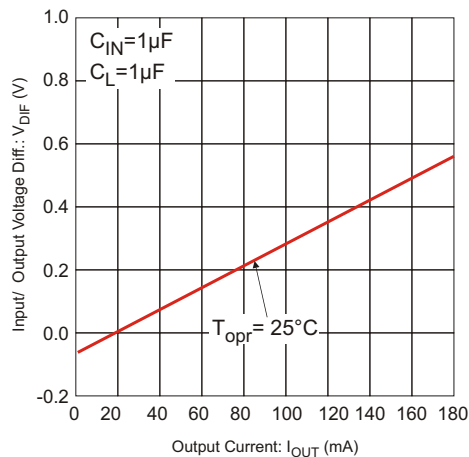


Figure 2: Input/ Output Voltage differential vs. Output Current

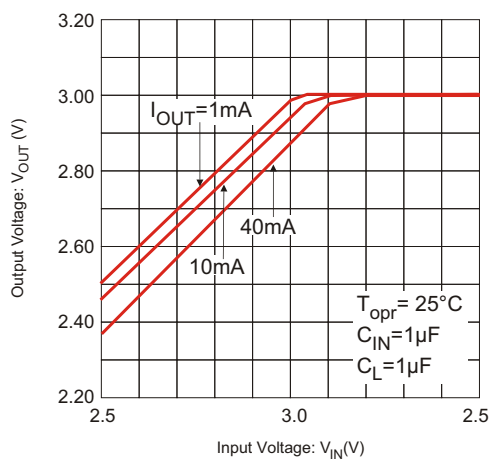


Figure 3: Output Voltage vs. Input voltage

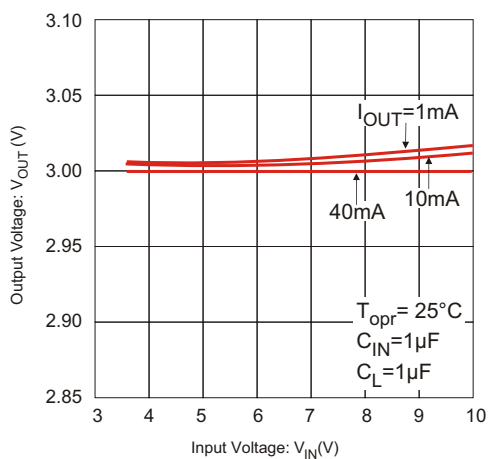


Figure 4: Output Voltage vs. Input voltage

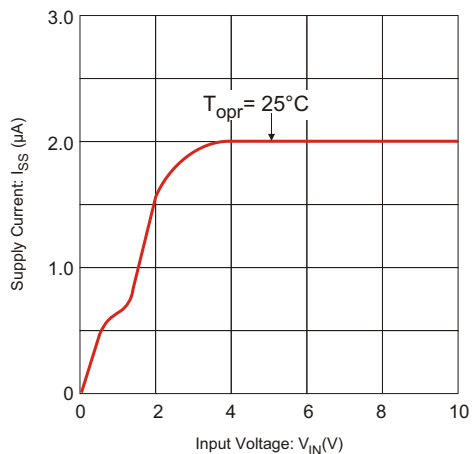


Figure 5: Supply Current vs. Input Voltage

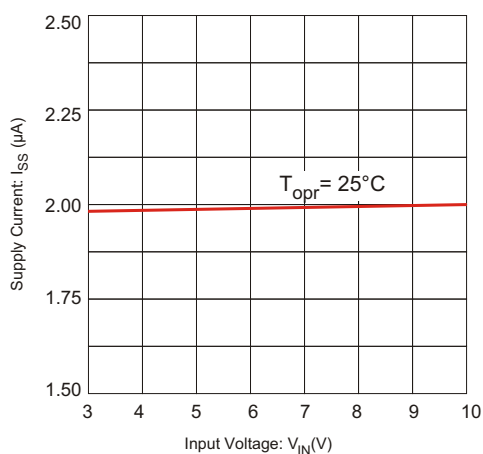


Figure 6: Supply Current vs. Input Voltage

◆ PERFORMANCE CHARACTERISTICS FOR GM6251-3.0

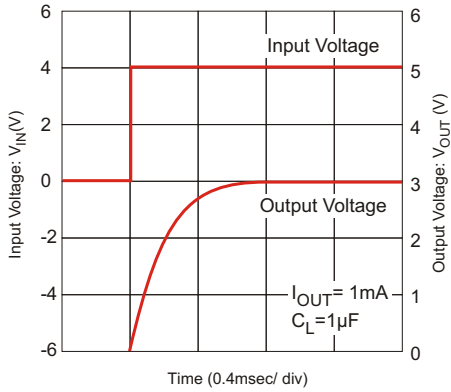


Figure 7: Input Transient Response 1

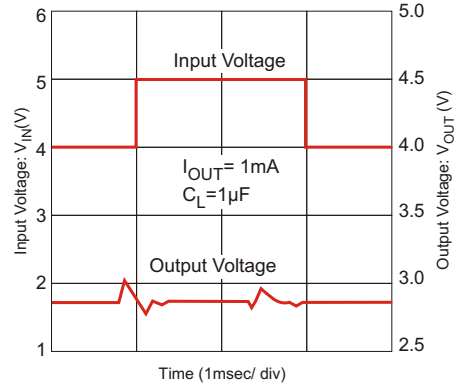


Figure 8: Input Transient Response 2

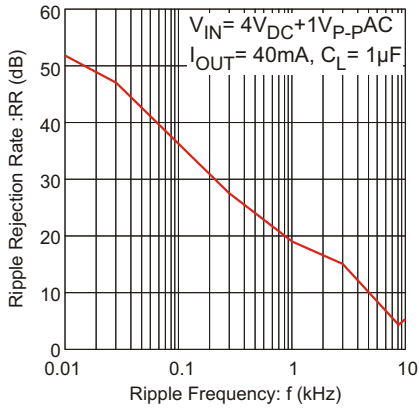
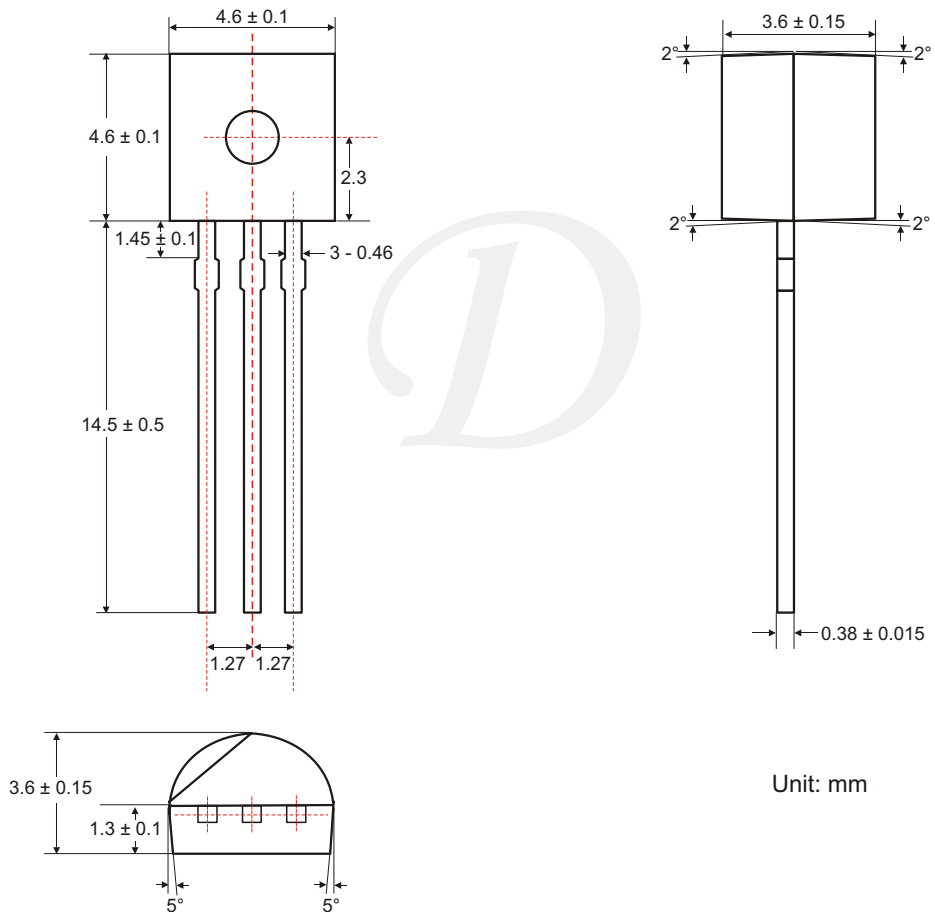


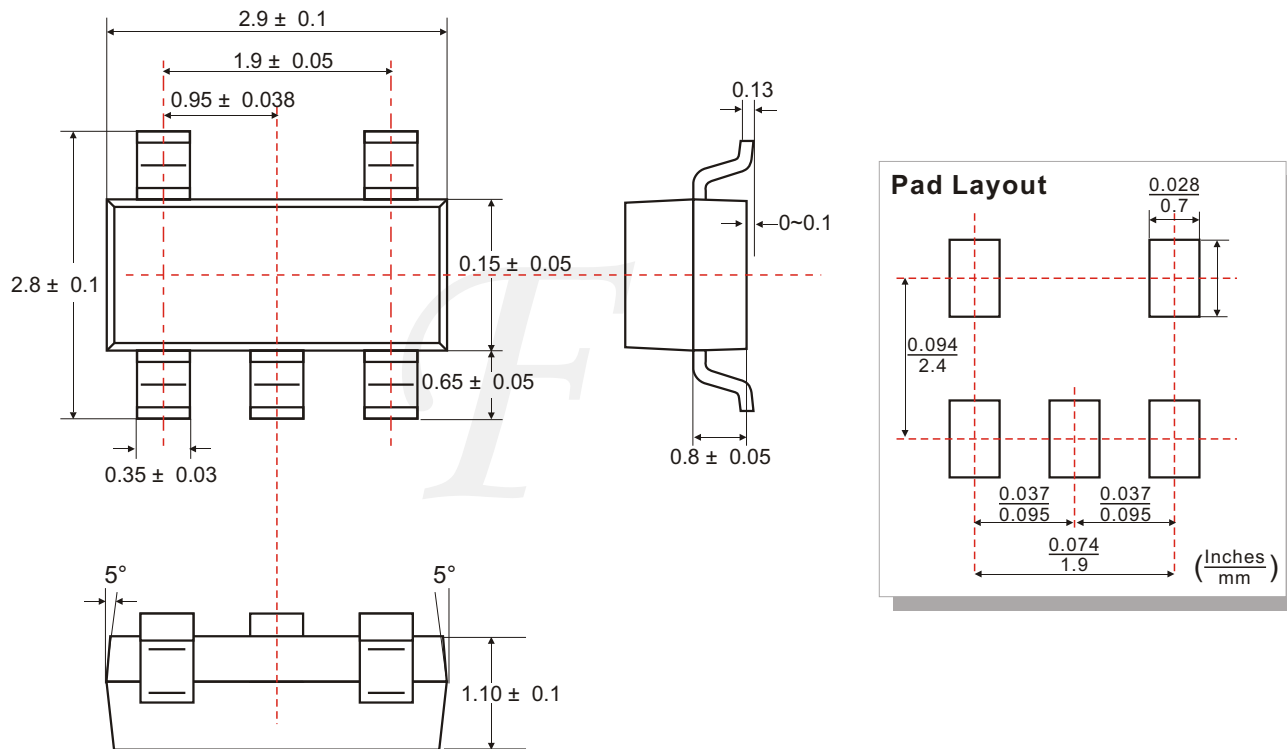
Figure 9: Ripple Rejection Rate

◆ TO-92 PACKAGE OUTLINE DIMENSIONS

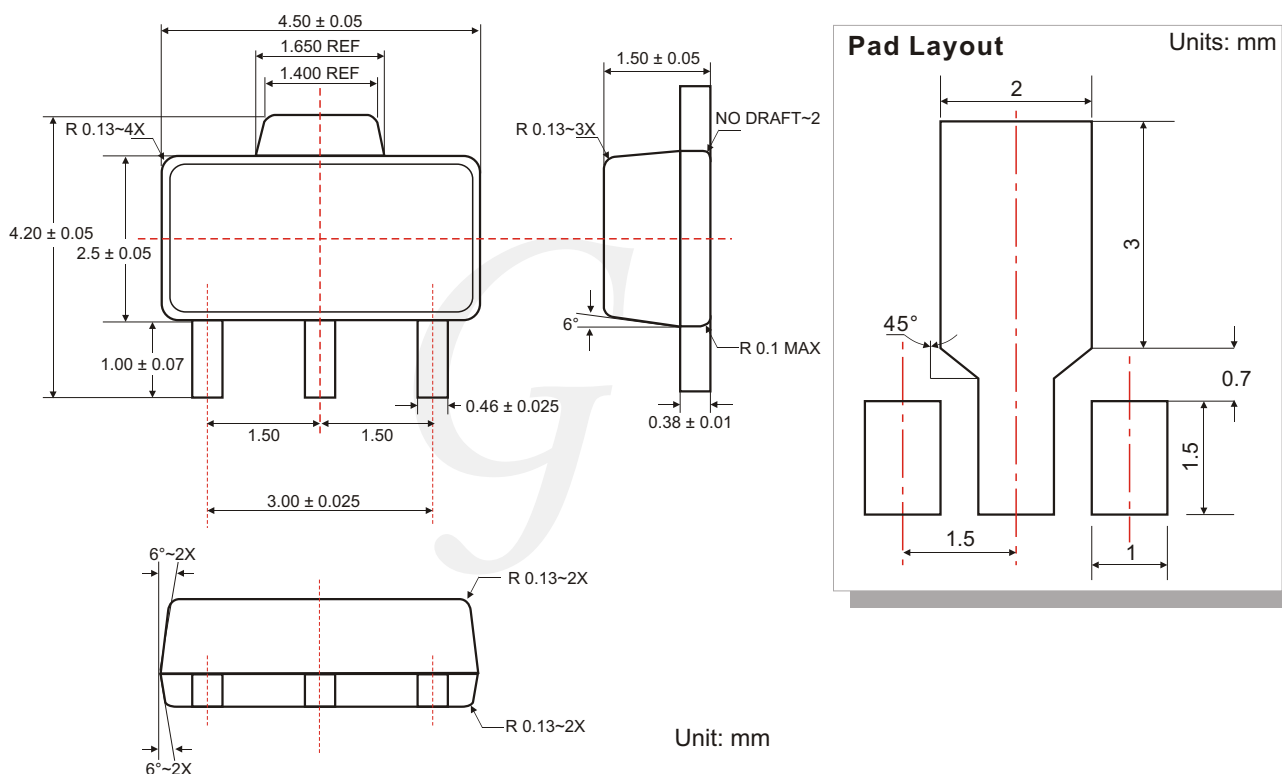


Unit: mm

◆ SOT-25(SOT-23-5) PACKAGE OUTLINE DIMENSIONS



◆ SOT-89 PACKAGE OUTLINE DIMENSIONS



◆ ORDERING NUMBER

