

Features

- Low Dropout 1 mV
- High Accuracy 2%
- High Output Current 25 mA
- Low IQ Maximum of 50 μ A
- Low Temperature Drift: Maximum of 100 ppm/ $^{\circ}$ C
- Package appearance SOT-23

Applications

- Battery-Powered Equipment
- Data Acquisition Systems
- Precision Audio Components
- Instrumentation
- Process Control

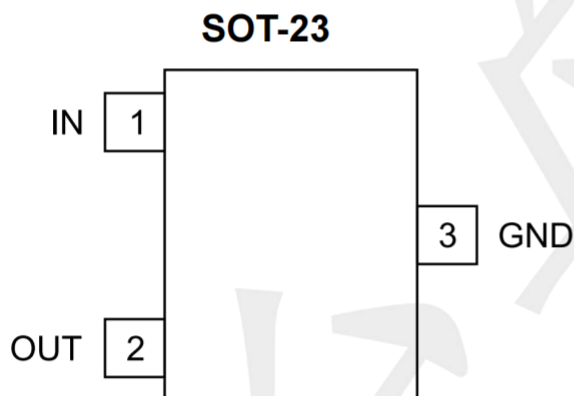
General Description

The is a precision, low-power, low-voltage dropout voltage reference family available in a tiny 3-pin SOT-23 package.

The small size and low power consumption (50 μ A maximum) of the make it ideal for portable and battery-powered applications. The does not require a load capacitor, but it is stable with any capacitive load.

Unloaded, the can be operated with supplies within 1 mV of output voltage. All models are specified for the wide temperature range, -40° C to 125° C.

Pin Configuration



Functions

NO.	NAME	DESCRIPTION
1	IN	Input supply voltage
2	OUT	Reference output voltage
3	GND	Ground

Device Comparison Table

PRODUCT	VOLTAGE (V)
TPREF2912S3	1.25V
TPREF2920S3	2.048V
TPREF2925S3	2.5V
TPREF2930S3	3.0V
TPREF2933S3	3.3V
TPREF2940S3	4.096V

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Supply voltage, V+ to V–	--	7	V
Output short circuit ⁽²⁾	Continuous		°C
Lead temperature (soldering, 10 s)	--	300	°C
Operating temperature	-40	125	°C
Junction temperature	--	150	°C
Storage temperature, T _{stg}	-65	150	°C

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

Note 2, Short-circuit to ground.

ESD Ratings

	VALUE	UNIT
V _(ESD) Electrostatic discharge	Human-body model (HBM)	±4000
	Charged-device model (CDM)	±1500

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
V _{IN} Input voltage	1.8	5.5	V
I _{LOAD} Load current	--	25	mA
T _A Operating temperature	-40	125	°C
R _{θJA} Junction-to-ambient thermal resistance	297.3		°C/W
R _{θJB} Junction-to-board thermal resistance	91.7		°C/W
R _{θJC} Junction-to-case (top) thermal resistance	128.5		°C/W

Electrical Characteristics

(At $T_A = 25^\circ\text{C}$, $I_{\text{LOAD}} = 0 \text{ mA}$, $V_{\text{IN}} = 5 \text{ V}$, unless otherwise noted.)

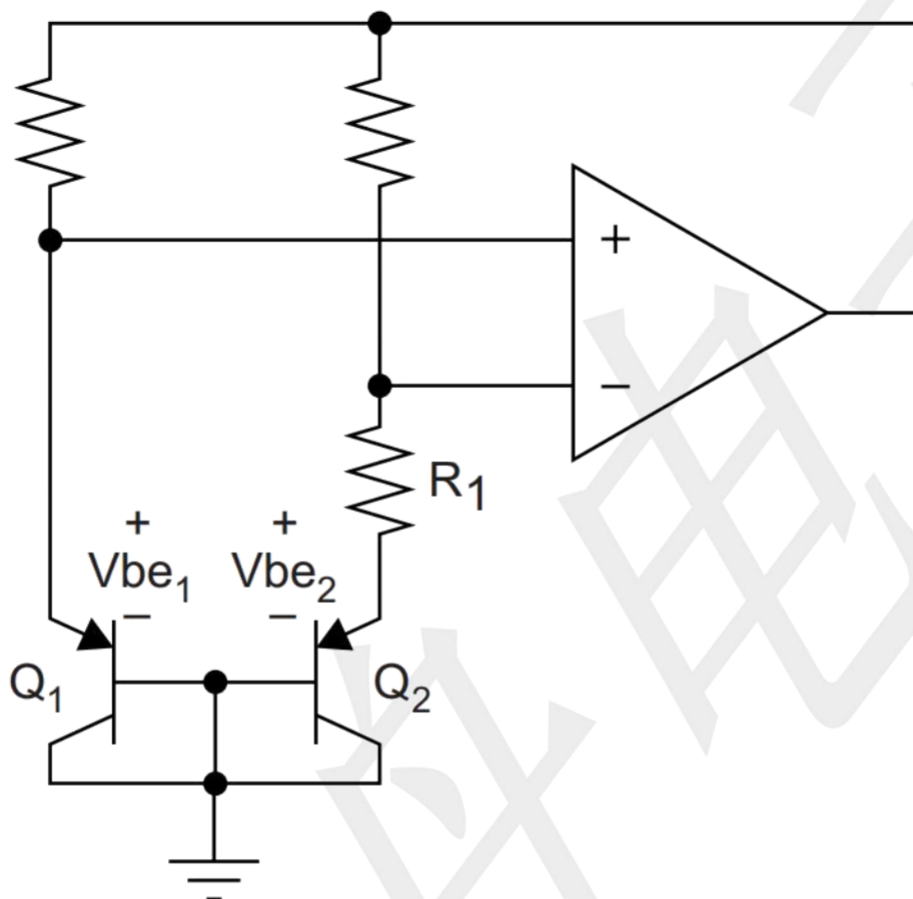
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
TPREF2912S3						
V_{OUT}	Output voltage		1.225	1.25	1.275	V
Initial accuracy			2%			
Output voltage noise		$f = 0.1 \text{ Hz to } 10 \text{ Hz}$,	14			μV_{PP}
Voltage noise		$f = 10 \text{ Hz to } 10 \text{ kHz}$	42			μV_{rms}
Line regulation		$1.8 \text{ V} \leq V_{\text{IN}} \leq 5.5 \text{ V}$	--	60	190	$\mu\text{V/V}$
TPREF2920S3						
V_{OUT}	Output voltage		2.007	2.048	2.089	V
Initial accuracy			2%			
Output voltage noise		$f = 0.1 \text{ Hz to } 10 \text{ Hz}$,	23			μV_{PP}
Voltage noise		$f = 10 \text{ Hz to } 10 \text{ kHz}$	65			μV_{rms}
Line regulation		$V_{\text{REF}} + 50 \text{ mV} \leq V_{\text{IN}} \leq 5.5 \text{ V}$	--	110	290	$\mu\text{V/V}$
TPREF2925S3						
V_{OUT}	Output voltage		2.45	2.5	2.55	V
Initial accuracy			2%			
Output voltage noise		$f = 0.1 \text{ Hz to } 10 \text{ Hz}$	28			μV_{PP}
Voltage noise		$f = 10 \text{ Hz to } 10 \text{ kHz}$	80			μV_{rms}
Line regulation		$V_{\text{REF}} + 50 \text{ mV} \leq V_{\text{IN}} \leq 5.5 \text{ V}$	--	120	325	$\mu\text{V/V}$
TPREF2930S3						
V_{OUT}	Output voltage		2.94	3	3.06	V
Initial accuracy			2%			
Output voltage noise		$f = 0.1 \text{ Hz to } 10 \text{ Hz}$,	33			μV_{PP}
Voltage noise		$f = 10 \text{ Hz to } 10 \text{ kHz}$	94			μV_{rms}
Line regulation		$V_{\text{REF}} + 50 \text{ mV} \leq V_{\text{IN}} \leq 5.5 \text{ V}$	--	120	375	$\mu\text{V/V}$
TPREF2933S3						
V_{OUT}	Output voltage		3.234	3.3	3.366	V
Initial accuracy			2%			
Output voltage noise		$f = 0.1 \text{ Hz to } 10 \text{ Hz}$,	36			μV_{PP}
Voltage noise		$f = 10 \text{ Hz to } 10 \text{ kHz}$	105			μV_{rms}
Line regulation		$V_{\text{REF}} + 50 \text{ mV} \leq V_{\text{IN}} \leq 5.5 \text{ V}$	--	130	400	$\mu\text{V/V}$

Electrical Characteristics (continued)

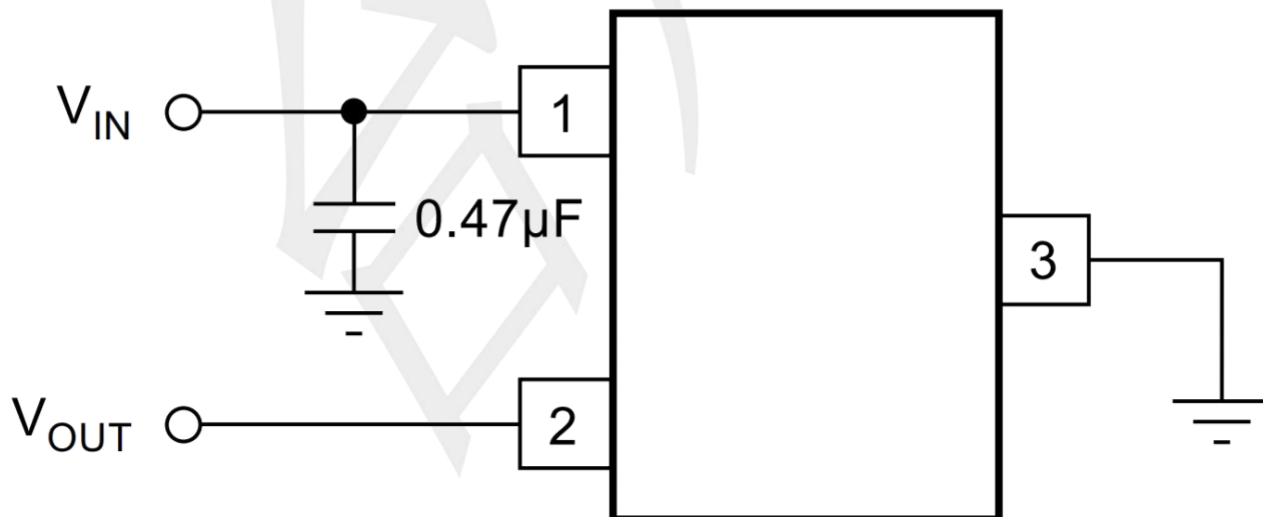
(At $T_A = 25^\circ\text{C}$, $I_{\text{LOAD}} = 0\text{ mA}$, $V_{\text{IN}} = 5\text{ V}$, unless otherwise noted.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
TPREF2940S3						
V _{OUT}	Output voltage		4.014	4.096	4.178	V
Initial accuracy			2%			
Output voltage noise		f = 0.1 Hz to 10 Hz,	45			μV _{PP}
Voltage noise		f = 10 Hz to 10 kHz	128			μV _{rms}
Line regulation		V _{REF} + 50 mV ≤ V _{IN} ≤ 5.5 V	--	160	410	μV/V
TPREF2912S3, TPREF2920S3, TPREF2925S3, TPREF2930S3, TPREF2933S3, TPREF2940S3						
dV _{OUT} /dT	Output voltage temperature drift	-40°C ≤ T _A ≤ 125°C	--	35	100	ppm/°C
I _{LOAD}	Output current		25			mA
Long-term stability		0 to 1000H	24			ppm
		1000 to 2000H	15			ppm
dV _{OUT} /dI _{LOAD} Load regulation		0 mA < I _{LOAD} < 25 mA, V _{IN} = V _{REF} + 500 mV ⁽³⁾	--	3	100	μV/mA
dT	Thermal Hysteresis		--	25	100	ppm
V _{IN} – V _{OUT}	Dropout voltage		--	1	50	mV
I _{SC}	Short-circuit current		45			mA
Turnon settling time		to 0.1% at V _{IN} = 5 V with C _L = 0	120			μs
POWER SUPPLY						
V _S	Voltage	I _L = 0	V _{REF} + 0.001	--	5.5	V
	Voltage over temperature	-40°C ≤ T _A ≤ 125°C	V _{REF} + 0.05	--	5.5	
I _Q	Quiescent current		--	42	50	μA
	Quiescent current over temperature	-40°C ≤ T _A ≤ 125°C	59			
TEMPERATURE RANGE						
Specified range			-40	--	125	°C
Operating range			-40	--	125	°C
Storage range			-65	--	150	°C

Functional Block Diagram



Typical Connections for Operating



Typical Operating Characteristics

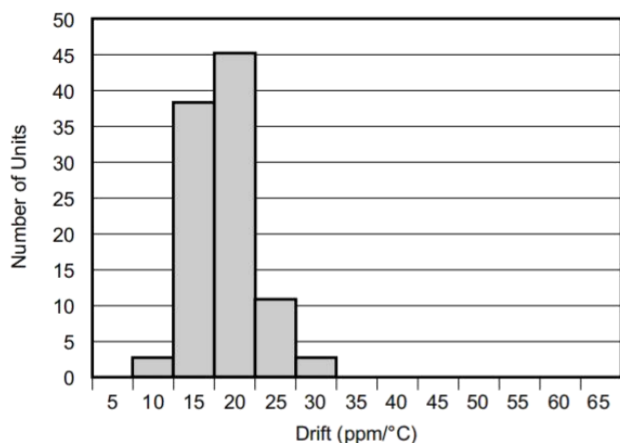


Figure 1. Temperature Drift (0°C to 70°C)

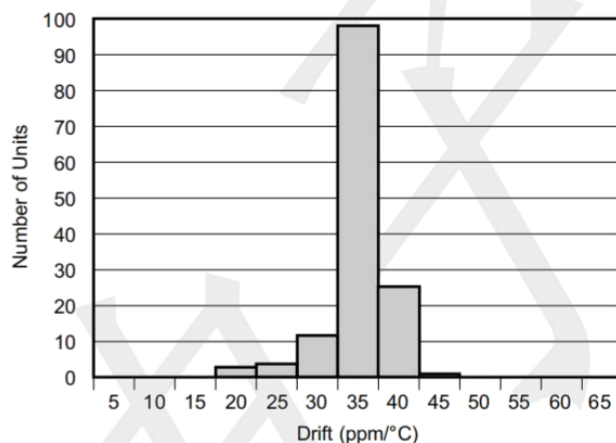


Figure 2. Temperature Drift (-40°C to 125°C)

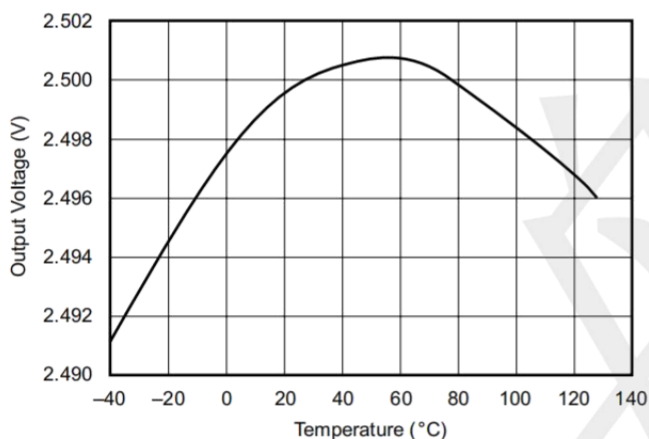


Figure 3. Output Voltage vs Temperature

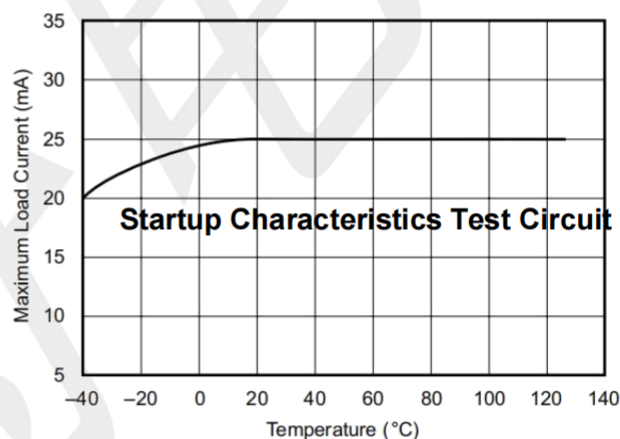


Figure 4. Maximum Load Current vs Temperature

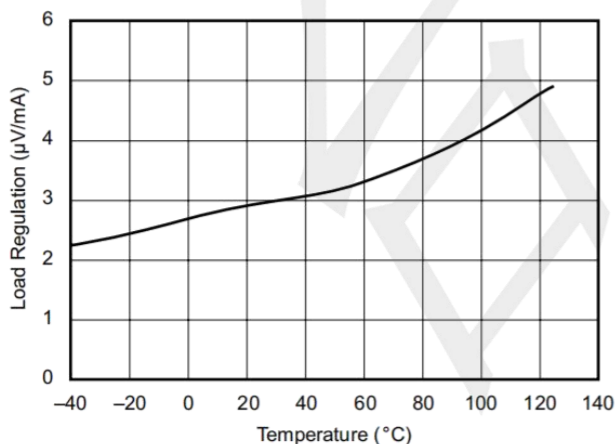


Figure 5. Load Regulation vs Temperature

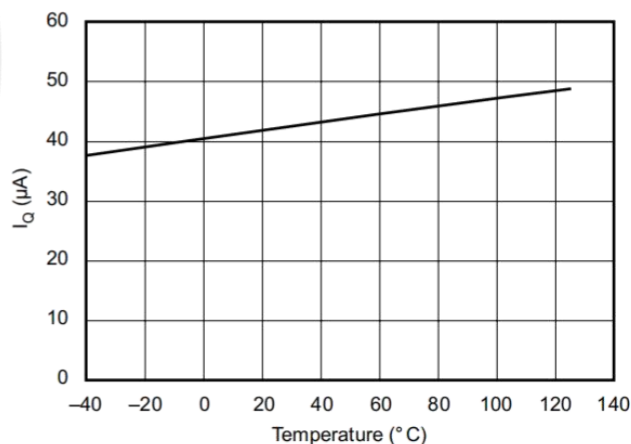


Figure 6. Quiescent Current vs Temperature

Typical Operating Characteristics

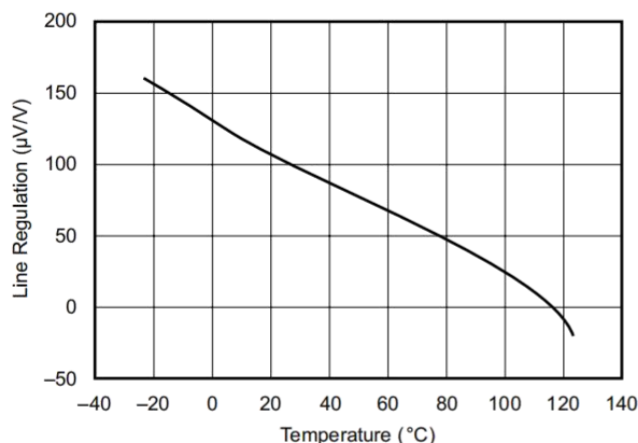


Figure 7. Line Regulation vs Temperature

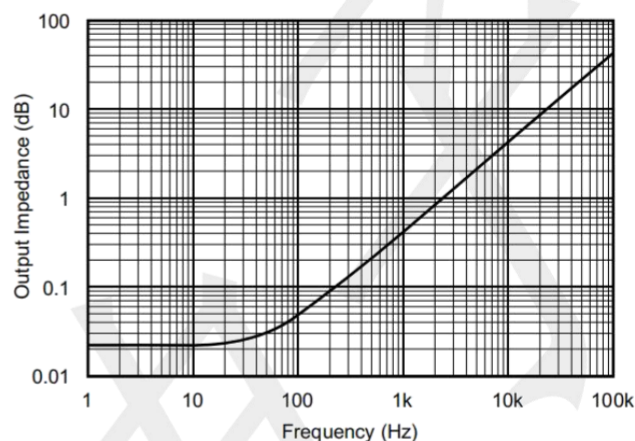


Figure 8. Output Impedance vs Frequency

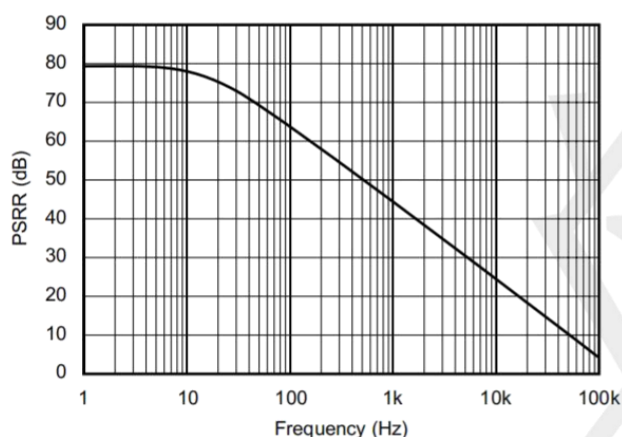


Figure 9. Power-Supply Rejection Ratio vs Frequency

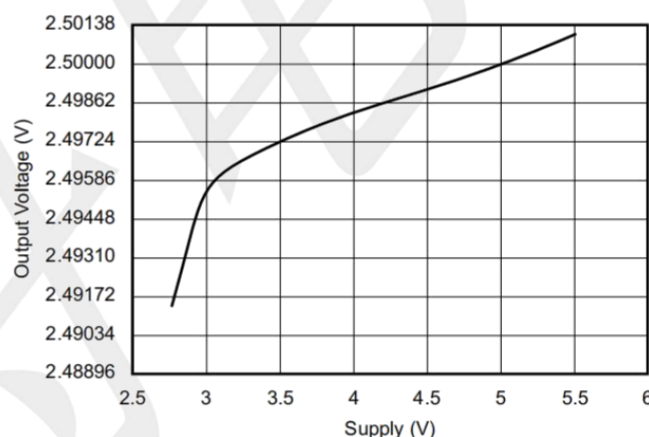


Figure 10. Output Voltage vs Supply Voltage (No Load)

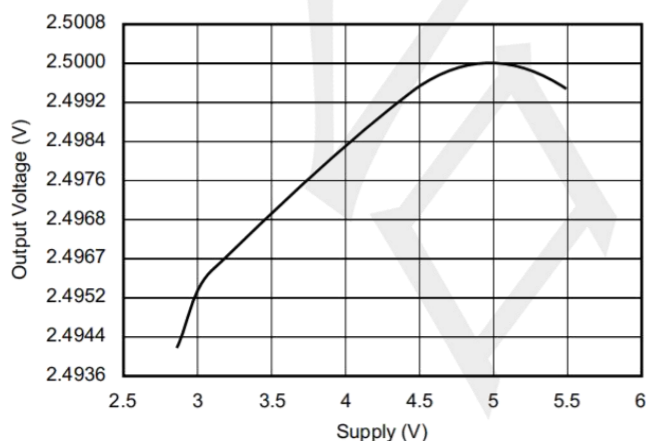


Figure 11. Output Voltage vs Supply Voltage ($I_{LOAD} = 25\text{ mA}$)

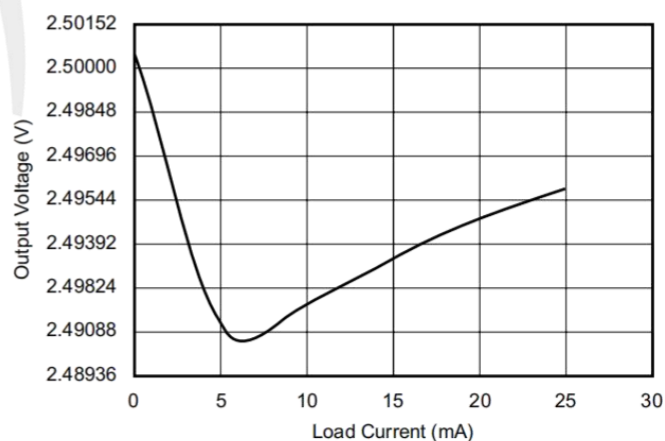


Figure 12. Output Voltage vs Load Current

Typical Operating Characteristics

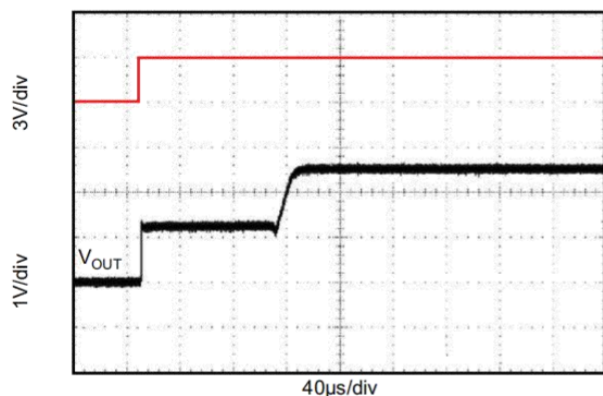


Figure 13. Step Response, $C_L = 0$, 3-V Start-Up

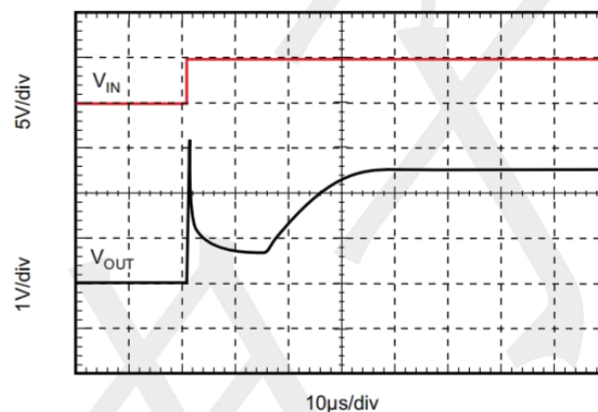


Figure 14. Step Response, $C_L = 0$, 5-V Start-Up

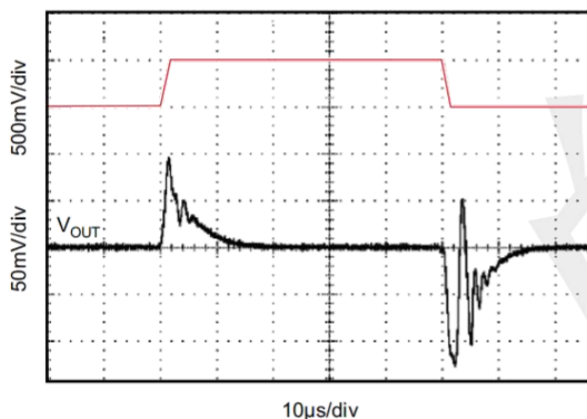


Figure 15. Line Transient Response

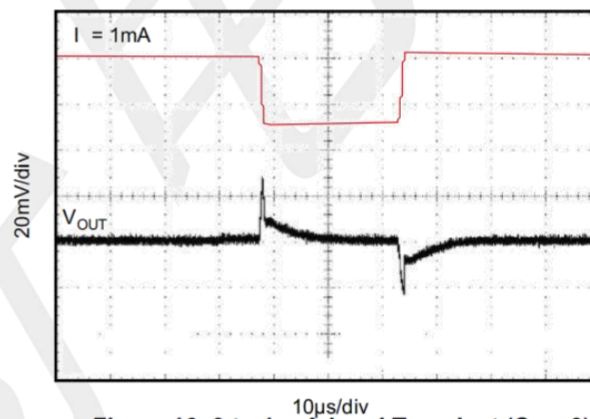


Figure 16. 0 to 1-mA Load Transient ($C_L = 0$)

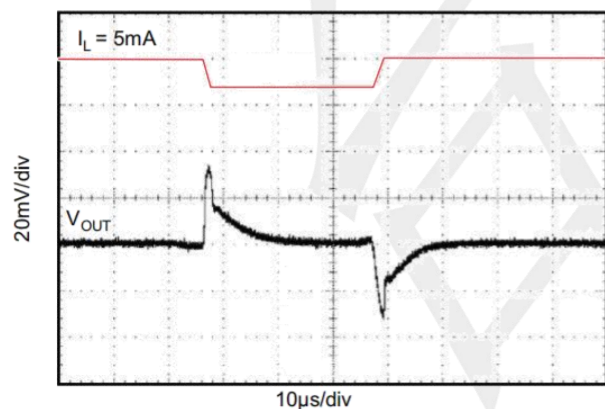


Figure 17. 0 to 5-mA Load Transient ($C_L = 0$)

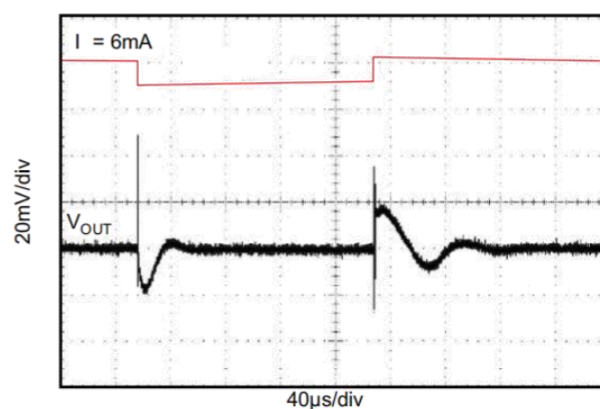
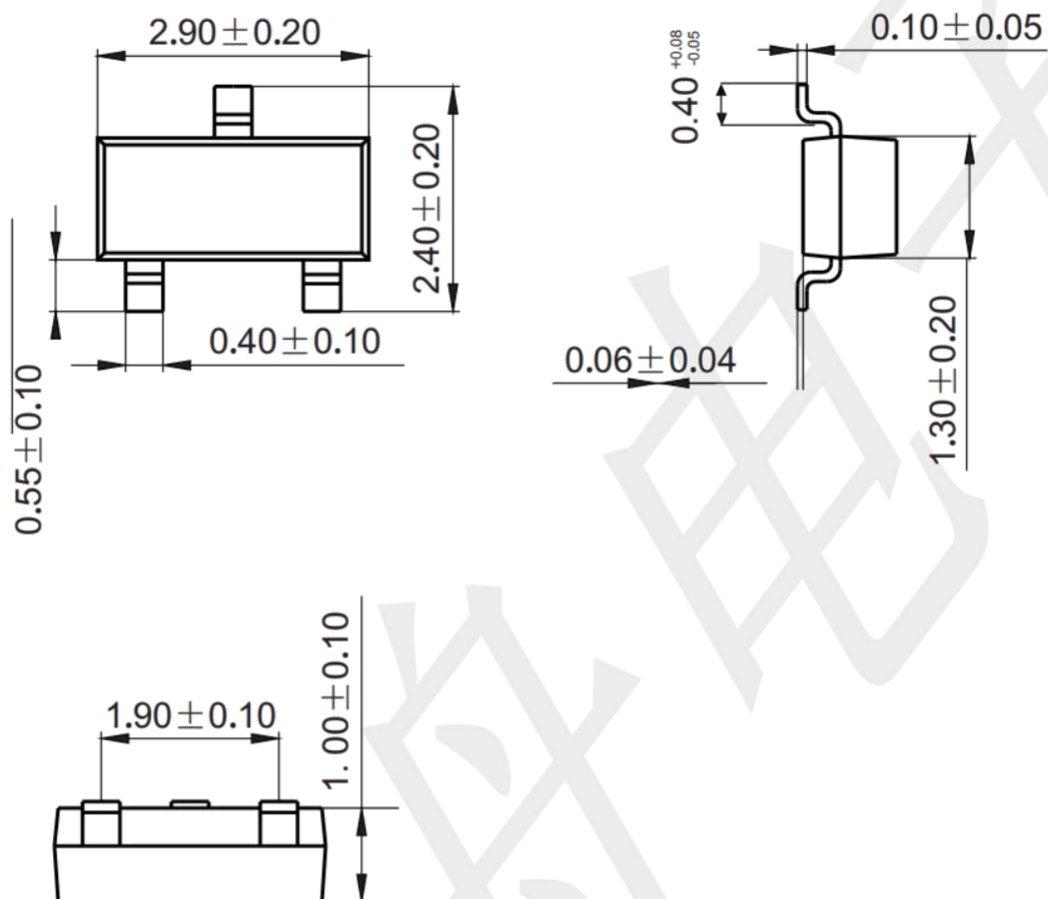


Figure 18. 1 to 6-mA Load Transient ($C_L = 1 \mu F$)

Package Outline Dimensions (unit: mm)

SOT-23



Mounting Pad Layout (unit: mm)

