

Product Overview

The NSREF30xx is a family of precision, low power, low dropout, series voltage references available in the tiny 3-pin SOT23 package. The NSREF30xx's small size and low power consumption make it ideal for portable and battery-powered applications. The NSREF30xx does not require a load capacitor, but is stable with any capacitive load and can sink or source up to ± 10 mA of output current. Unloaded, the NSREF30xx can operate on supplies down to 1 mV above the output voltage. All models are specified for the wide temperature range of -40°C to $+125^{\circ}\text{C}$.

Key Features

- Low Dropout: 1mV
- Output Noise: 22uVpp of NSREF3025
- High Output Current: ± 10 mA
- High Accuracy: 0.2% Maximum
- Do not require a load capacitor to be stable
- Excellent Specified Drift Performance:
35 ppm/°C (Maximum) from -40°C to $+125^{\circ}\text{C}$

Applications

- Data Acquisition Systems
- Medical Equipment
- Hand-Held Test Equipment

Device Information

Part Number	Package	Body Size
NSREF30xx	SOT23-3L	2.9 mm $\times$ 1.3 mm

INDEX

1. PIN CONFIGURATION AND FUNCTIONS.....	3
2. ABSOLUTE MAXIMUM RATINGS	3
3. RECOMMENDED OPERATING CONDITIONS	3
4. ESD RATINGS	4
5. THERMAL INFORMATION.....	4
6. DEVICE COMPARISON TABLE.....	4
7. SPECIFICATIONS.....	5
7.1. ELECTRICAL CHARACTERISTICS.....	5
ELECTRICAL CHARACTERISTICS(CONTINUED).....	6
7.2. TYPICAL PERFORMANCE CHARACTERISTICS	7
8. APPLICATION INFORMATION.....	10
9. PACKAGE INFORMATION	11
10. ORDERING INFORMATION	12
11. TAPE AND REEL INFORMATION	13

1. Pin Configuration and Functions

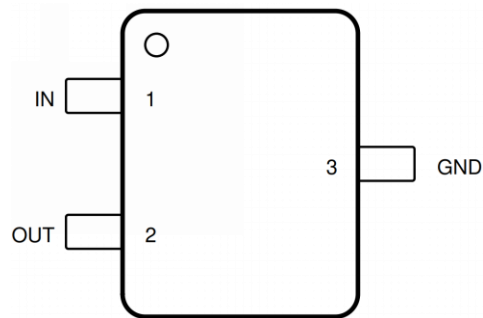


Figure 1.1 NSREF30xx Package

Table 1.1 NSREF30xx Pin Configuration and Description

NSREF30xx PIN NO.	Symbol	Function
1	IN	Input supply voltage
2	OUT	Reference output voltage
3	GND	Ground

2. Absolute Maximum Ratings

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Supply voltage				6.5	V	
Output short circuit			Continuous			
Operating Temperature		-40		125	°C	
Junction temperature				150	°C	
Storage temperature, Tstg		-65		150	°C	

3. Recommended Operating Conditions

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Input voltage	V_{IN}	1.8		5.5	V	NSREF3012 Only
		$V_{REF} + 0.05$		5.5		Except NSREF3012
Load current	I_{LOAD}	-10		10	mA	
Operating temperature	T_A	-40		+125	°C	

4. ESD Ratings

Parameters	Symbol	Value	Unit
V(ESD) Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±8000	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±2000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5. Thermal Information

Parameters	Symbol	SOT23-3L	Unit
Junction-to-ambient thermal resistance	θ_{JA}	297.3	°C/W
Junction-to-case(top) thermal resistance	$\theta_{JC (top)}$	128.5	°C/W
Junction-to-board thermal resistance	θ_{JB}	91.7	°C/W

6. Device Comparison Table

PART NUMBER	VOLTAGE (V)
NSREF3012	1.25
NSREF3020	2.048
NSREF3025	2.5
NSREF3030	3.0
NSREF3033	3.3
NSREF3040	4.096

7. Specifications

7.1. Electrical Characteristics

Ta = 25°C, V_{IN} = 5V and I_{LAOD} = 0mA (Unless otherwise noted)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
NSREF3012						
Output voltage	V _{OUT}	1.2475	1.25	1.2525	V	
Quiescent current	I _Q		138	153	uA	
Output voltage noise			9		uV _{pp}	f = 0.1Hz to 10Hz
Line regulation			27	90	ppm/V	1.8 ≤ V _{IN} ≤ 5.5V
Turn-on settling time			100		us	To 0.1% with C _L = 0μF
NSREF3020						
Output voltage	V _{OUT}	2.044	2.048	2.052	V	
Quiescent current	I _Q		139	158	uA	
Output voltage noise			19		uV _{pp}	f = 0.1Hz to 10Hz
Line regulation			12	57	ppm/V	V _{out} +0.05V ≤ V _{IN} ≤ 5.5V
Turn-on settling time			250		us	To 0.1% with C _L = 0μF
NSREF3025						
Output voltage	V _{OUT}	2.495	2.50	2.505	V	
Quiescent current	I _Q		140	155	uA	
Output voltage noise			22		uV _{pp}	f = 0.1Hz to 10Hz
Line regulation			14	68	ppm/V	V _{out} +0.05V ≤ V _{IN} ≤ 5.5V
Turn-on settling time			380		us	To 0.1% with C _L = 0μF
NSREF3030						
Output voltage	V _{OUT}	2.994	3.0	3.006	V	
Quiescent current	I _Q		141	155	uA	
Output voltage noise			28		uV _{pp}	f = 0.1Hz to 10Hz
Line regulation			18	82	ppm/V	V _{out} +0.05V ≤ V _{IN} ≤ 5.5V
Turn-on settling time			450		us	To 0.1% with C _L = 0μF
NSREF3033						
Output voltage	V _{OUT}	3.294	3.30	3.306	V	
Quiescent current	I _Q		143	159	uA	
Output voltage noise			30		uV _{pp}	f = 0.1Hz to 10Hz

Electrical Characteristics(continued)Ta = 25°C, V_{IN} = 5V and I_{LOAD} = 0mA (Unless otherwise noted)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Line regulation			25	100	ppm/V	V _{out} +0.05V ≤ V _{IN} ≤ 5.5V
Turn-on settling time			550		us	To 0.1% with C _L = 0μF
NSREF3040						
Output voltage	V _{OUT}	4.088	4.096	4.104	V	
Quiescent current	I _Q		145	163	uA	
Output voltage noise			33		uV _{pp}	f = 0.1Hz to 10Hz
Line regulation			58	167	ppm/V	V _{out} +0.05V ≤ V _{IN} ≤ 5.5V
Turn-on settling time			680		us	To 0.1% with C _L = 0μF
NSREF30xx (NSREF3012, NSREF3020, NSREF3025, NSREF3030, NSREF3033, NSREF3040)						
Supply Voltage	V _S	1.8		5.5	V	NSREF3012
		V _{OUT} +50mV		5.5	V	Except NSREF3012
Temperature drift	dV _{OUT} /dT		10	35	ppm/°C	T _A = -40°C to 125°C
Thermal Hysteresis			100		ppm	
Load regulation	ΔV _{O(ΔIL)}		5	10	uV/mA	0mA < I _{LOAD} < 10mA, V _{IN} = V _{REF} + 250mV ⁽¹⁾
			25	40		-10mA < I _{LOAD} < 0mA, V _{IN} = V _{REF} + 100mV ⁽¹⁾
Dropout voltage	V _{IN} - V _{OUT}		1		mV	
Output current	I _{LOAD}	-10		+10	mA	
Short-circuit current	I _{SC}		40		mA	Sourcing
			48			Sinking

(1) Minimum supply voltage for the NSREF3012 is 1.8 V.

7.2. Typical Performance Characteristics

$T_a = 25^\circ\text{C}$, $V_{IN} = 5\text{V}$ and $I_{LOAD} = 0\text{mA}$ (Unless otherwise noted)

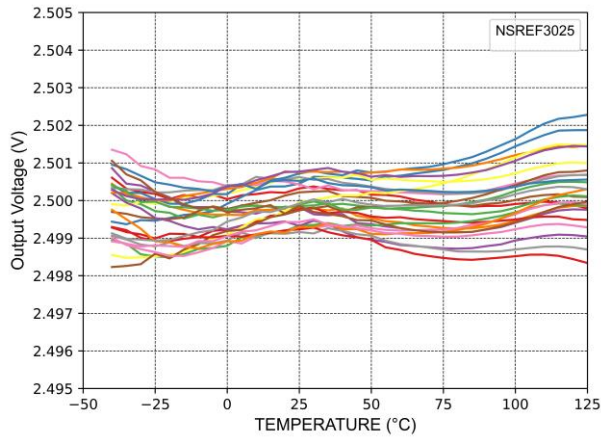


Figure 7-1 Output Voltage vs Temperature (-40°C to 125°C)

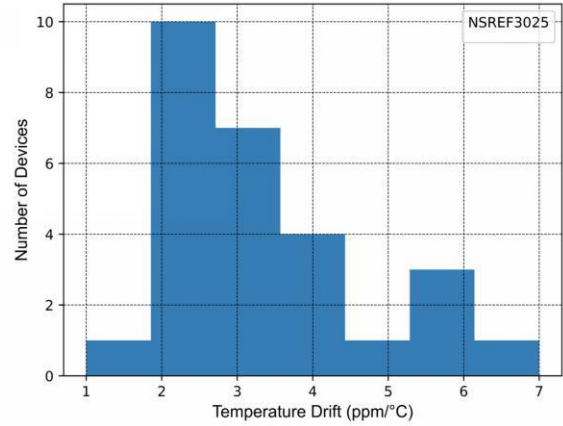


Figure 7-2 Temperature Drift Histogram

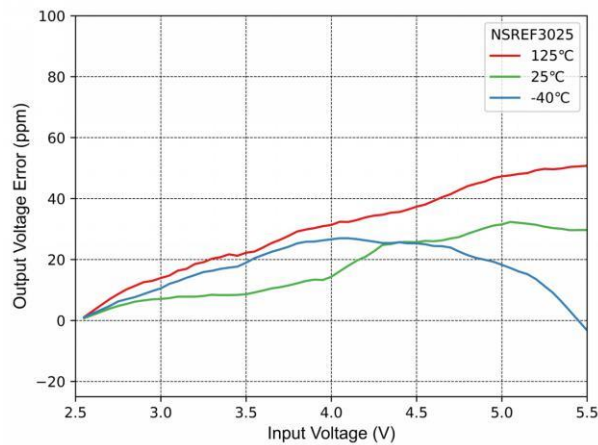


Figure 7-3 Output Voltage Error vs Input Voltage

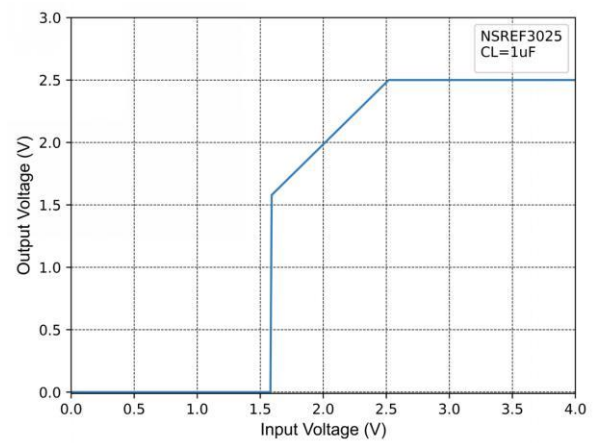


Figure 7-4 Output Voltage vs. Input Voltage

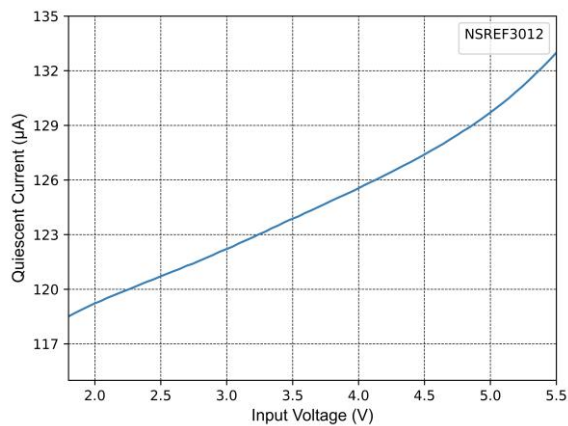


Figure 7-5 Quiescent Current vs Input Voltage

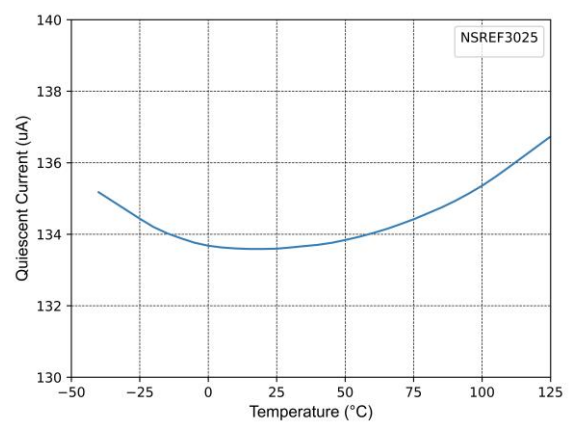


Figure 7-6 Quiescent Current vs Temperature (-40°C to 125°C)

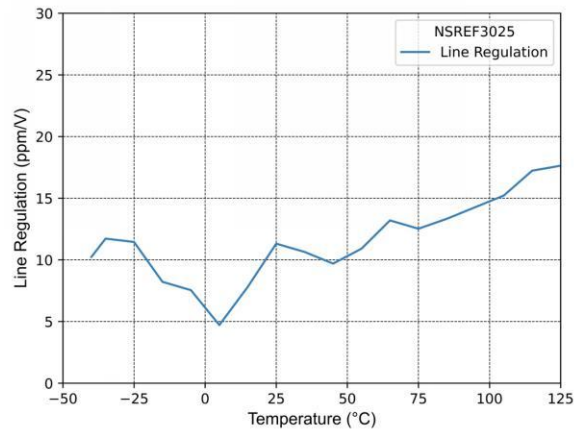


Figure 7-7 Line Regulation vs Temperature (-40°C to 125°C)

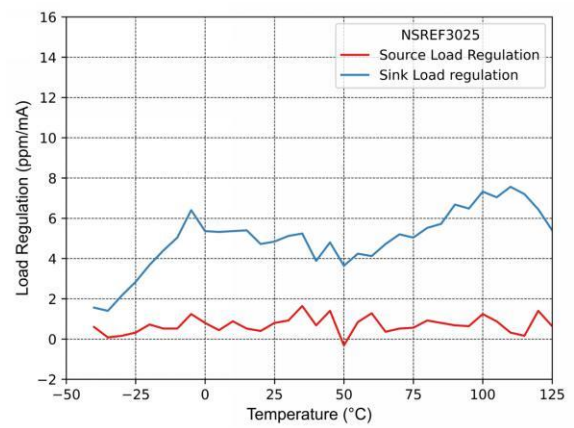


Figure 7-8 Load Regulation vs Temperature (-40°C to 125°C)

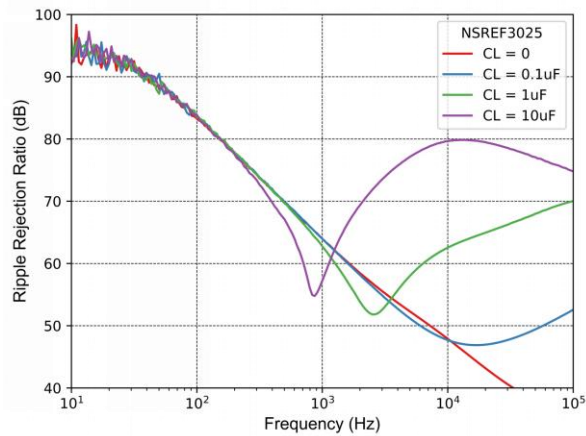


Figure 7-9 Ripple Rejection Ratio vs. Frequency

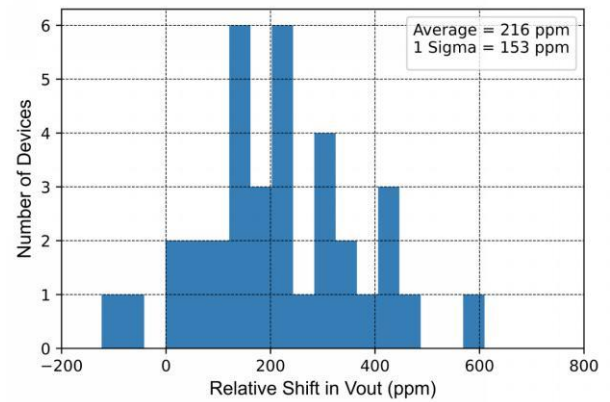


Figure 7-10 Solder Heat Reflow Shift Histogram

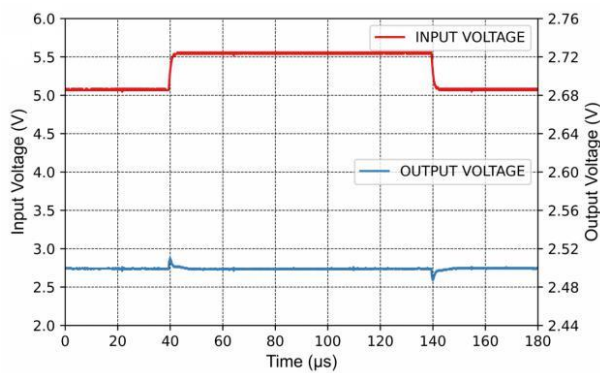


Figure 7-11 Line Transient Response (CL=0)

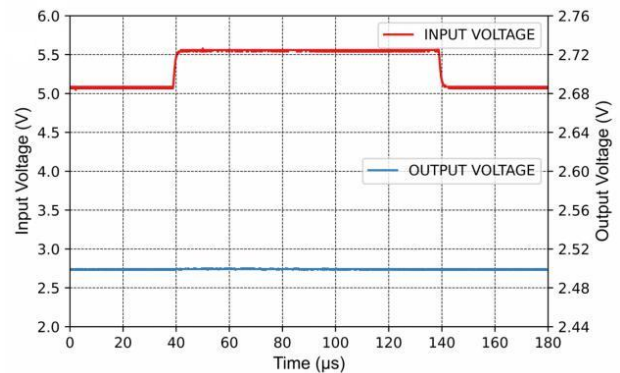


Figure 7-12 Line Transient Response (CL=1uF)

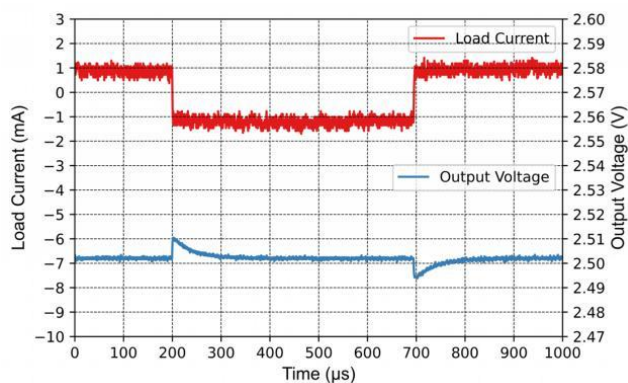


Figure 7-13 Load Transient Response $\pm 1\text{mA}$ ($\text{CL}=0$)

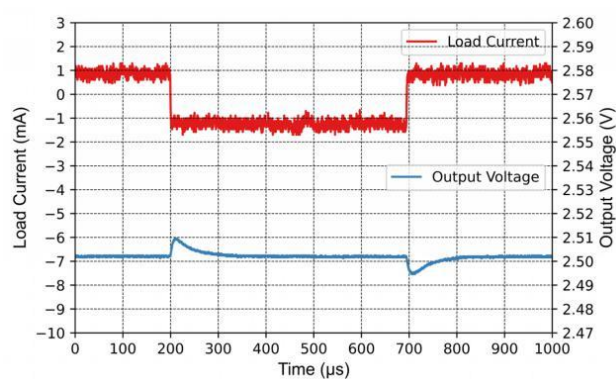


Figure 7-14 Load Transient Response $\pm 1\text{mA}$ ($\text{CL}=1\mu\text{F}$)

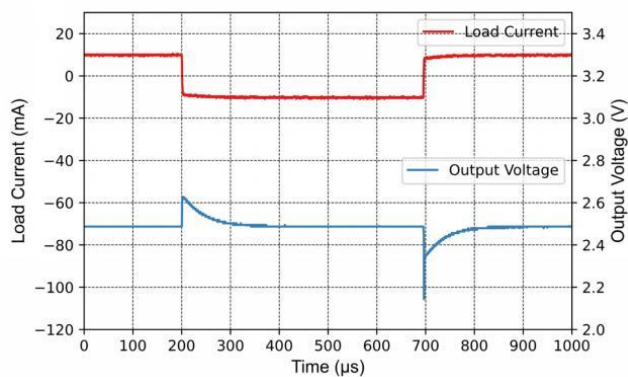


Figure 7-15 Load Transient Response $\pm 10\text{mA}$ ($\text{CL}=0$)

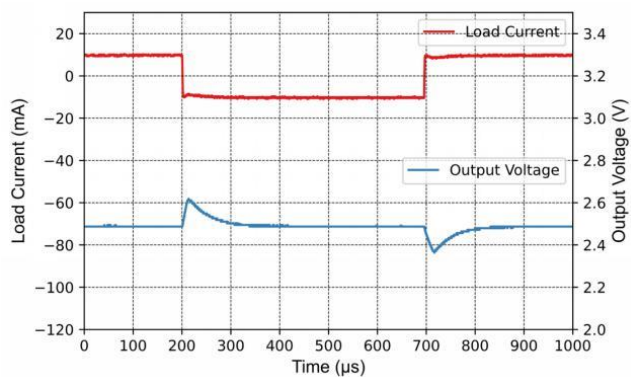


Figure 7-16 Load Transient Response $\pm 10\text{mA}$ ($\text{CL}=1\mu\text{F}$)

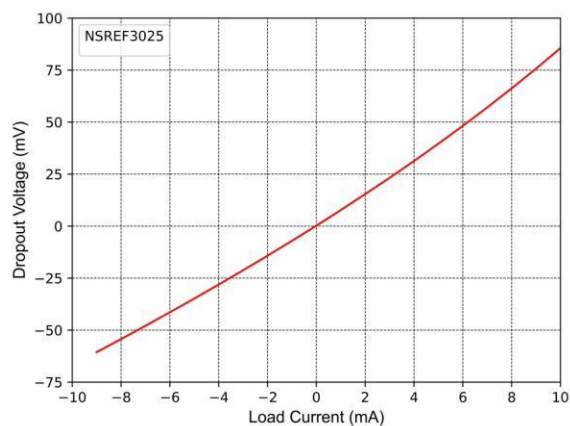


Figure 7-17 Dropout Voltage vs Load Current

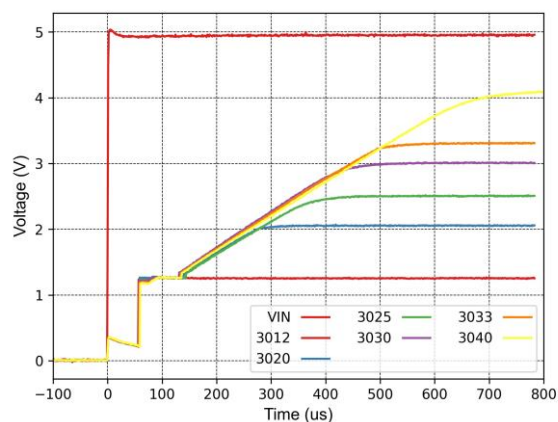


Figure 7-18 Step Response

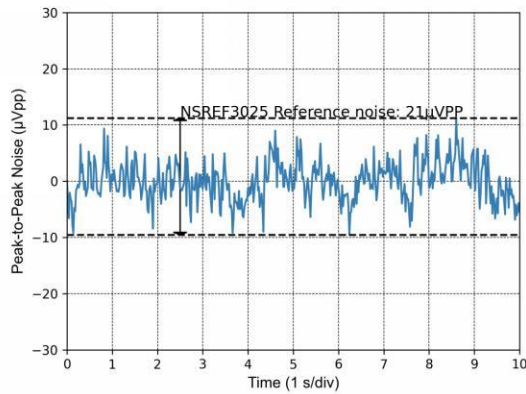


Figure 7-19 0.1Hz to 10Hz Voltage Noise

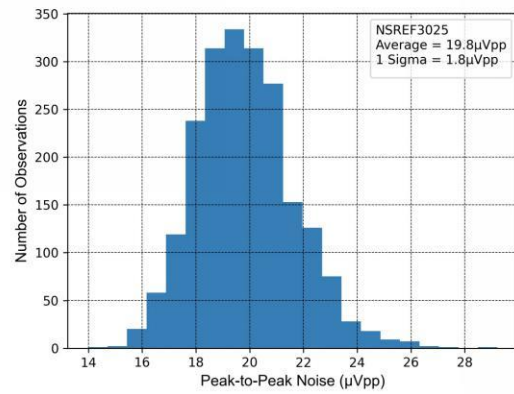


Figure 7-20 0.1Hz to 10Hz Noise Histogram

8. Application Information

The NSREF30xx does not require any output capacitance for frequency stability, and the optimum output capacitance for most applications is $1\mu\text{F}$, although larger values work as well. Connect a supply bypass capacitor of $0.1\mu\text{F}$ capacitor to reduce high frequency supply noise.

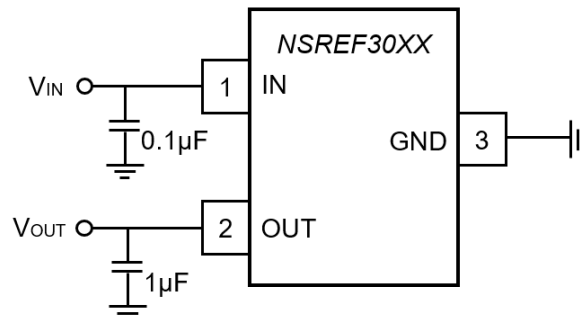


Figure 8.1 Typical Connections for Operating NSREF30xx

9. Package Information

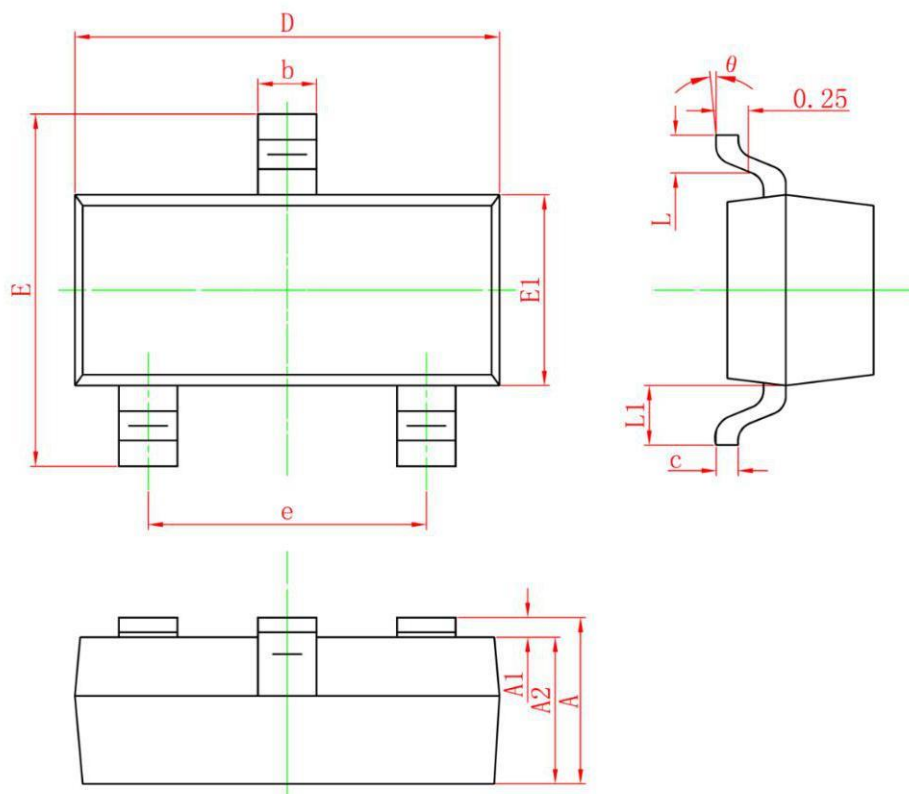


Figure 9.1 SOT23-3L Package Shape and Dimension in millimeters and (inches)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.15Max.		0.045Max.	
A1	0.000	0.100	0.000	0.004
A2	0.900	1.100	0.035	0.043
b	0.300	0.500	0.012	0.020
C	0.132	0.202	0.005	0.008
D	2.800	3.000	0.110	0.118
E	2.250	2.550	0.089	0.100
E1	1.200	1.400	0.047	0.055
e	1.800	2.000	0.071	0.079
L	0.300	0.500	0.012	0.020
L1	0.550 REF.		0.022 REF.	
θ	0°	8°	0°	8°

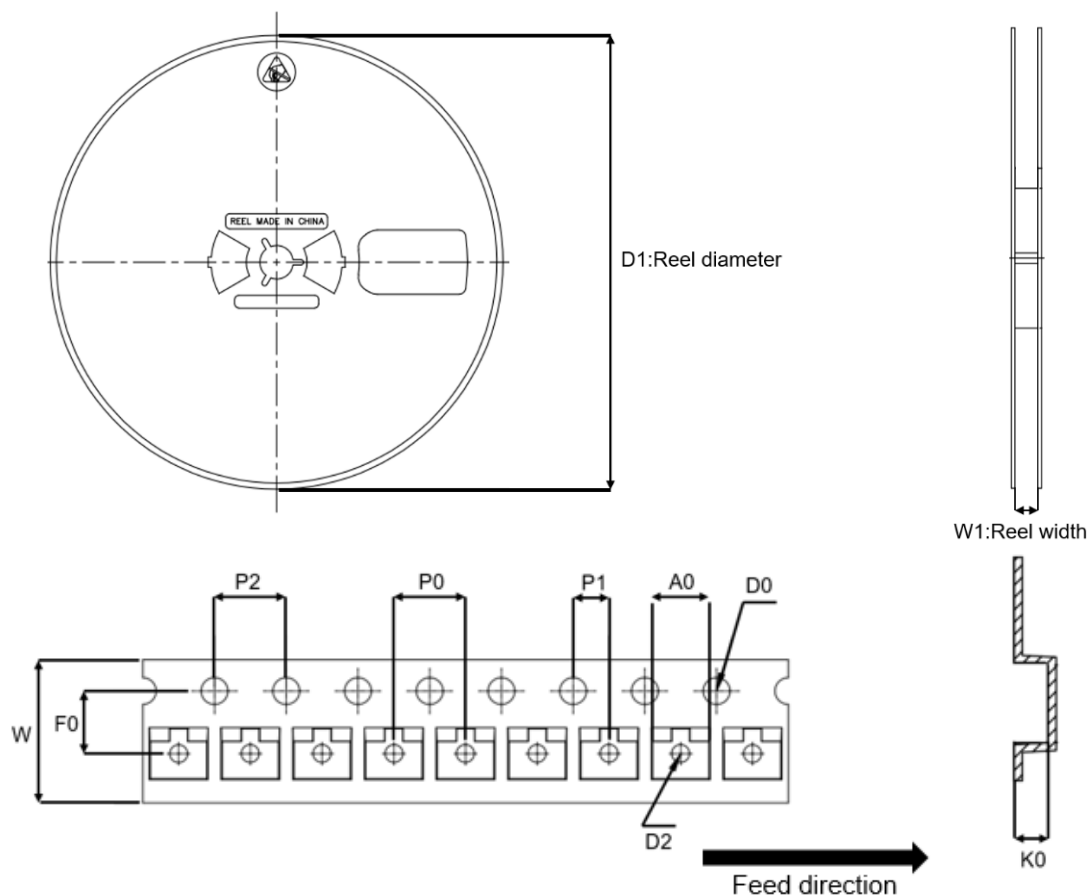
10. Ordering Information

Type	Unit	Marking	Description
NSREF3012-DSTR	3000ea/Reel	3012	SOT23-3L package, Reel
NSREF3020-DSTR	3000ea/Reel	3020	SOT23-3L package, Reel
NSREF3025-DSTR	3000ea/Reel	3025	SOT23-3L package, Reel
NSREF3030-DSTR	3000ea/Reel	3030	SOT23-3L package, Reel
NSREF3033-DSTR	3000ea/Reel	3033	SOT23-3L package, Reel
NSREF3040-DSTR	3000ea/Reel	3040	SOT23-3L package, Reel

NOTE: All packages are RoHS-compliant with peak reflow temperatures of 260 °C according to the JEDEC industry standard classifications and peak solder temperatures.

Moisture Sensitivity Level: 1

11. Tape and Reel Information



Device	Package	D1 (mm)	W1 (mm)	A0 (mm)	D0 (mm)	D2 (mm)	F0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)
NSREF30xx	SOT23-3L	178.0	9.5	3.15	1.5	1.0	3.5	1.22	4.0	2.0	4.0	8.0

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