Precision 0.600V Low Voltage FGA™ References

The ISL21032 FGA™ voltage references are very high precision analog voltage references specifically designed to meet the rigorous performance requirements of high current, low voltage VRM and POL modules.

Fabricated in Intersil's proprietary Floating Gate Analog technology, these references and feature guaranteed performance over the -40°C to 130°C operating temperature range.

Additional features include guaranteed absolute accuracy as low as ±0.5% over the operating temperature range of -40°C to +130°C. Long-term stability is 10ppm/√1,000Hrs.

The absolute accuracy and thermal performance of the ISL21032 family are ideal fit for the next generation of high current, low voltage VRM and POL modules.

Ordering Information

PART NUMBER	V_{OUT} OPTION (V)	GRADE	TEMP. RANGE (°C)	PACKAGE
ISL21032BPH306Z (Note)	0.6	±0.5%@ ΔT_A = 170°C	-40 to 130	3 Ld SOT-23 (Pb-free)
ISL21032BPH306Z-TK (Note)	0.6	±0.5%@ ΔT_A = 170°C	-40 to 130	3 Ld SOT-23 (Pb-free) T&R
ISL21032CPH306Z (Note)	0.6	±0.75% @ ΔT_A = 170°C	-40 to 130	3 Ld SOT-23 (Pb-free)
ISL21032CPH306Z-TK (Note)	0.6	±0.75% @ ΔT_A = 170°C	-40 to 130	3 Ld SOT-23 (Pb-free) T&R
ISL21032DPH306Z (Note)	0.6	±1.0%@ ΔT_A = 170°C	-40 to 130	3 Ld SOT-23 (Pb-free)
ISL21032DPH306Z-TK (Note)	0.6	±1.0%@ ΔT_A = 170°C	-40 to 130	3 Ld SOT-23 (Pb-free) T&R

NOTE: Intersil Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

Features

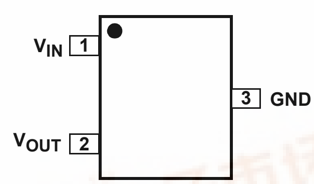
- Reference Voltage 0.6V
- Initial Accuracy Options @ 25°C . . . . ±1.0mV, ±2.5mV, & ±5.0mV
- Absolute Accuracy Options Over Operating Temp Range . . ±0.5% (±3.0mV), ±0.75% (±4.5mV), & ±1.0% (±6.0mV)
- Supply Voltage Range . . . . 2.7V to 5.5V
- Low Quiescent Current . . . . 12µA typ
- Long Term Stability. . . . . 10ppm/√1,000Hrs.
- Thermal Hysteresis . . . . 100ppm @ ΔT_A = 170°C
- Source & Sink Current 7mA
- ESD Protection. . . . . 5kV (Human Body Model)
- Standard 3 Ld SOT-23 Packaging
- Extended Temperature Range . . . . -40°C to 130°C
- Pb-Free Plus Anneal Available (RoHS Compliant)

Applications

- Low Voltage, High Current VRM & POL Modules
- Accurate Reference for Low Voltage DC/DC Converters

Pinout

ISL21032
(3 LD SOT-23)
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge; follow proper IC Handling Procedures.

Absolute Maximum Ratings

Storage Temperature Range . . . . -65°C to + 150°C
Max Voltage V_{IN} to Gnd. . . . . -0.5V to +6.5V
Max Voltage V_{OUT} to Gnd*:
ISL21032, V_{OUT} = 0.6V. . . . . -0.5V to +1.6V
Voltage on "DNC" Pins. . . No Connections Permitted to These Pins.

ESD Ratings

MIL-STD 883, Method 3015. . . . . .5kV
ESD Rating (Machine Model) 500V

Thermal Information

Thermal Resistance θ_{JA} (°C/W)
3 Ld SOT-23 Package 400
Storage Temperature . . . . -65°C to +150°C
Lead Temperature, Soldering* . . . . +225°C
*Note: Maximum Duration = 10s

CAUTION: Absolute Maximum Ratings are limits which may result in impaired reliability and/or permanent damage to the device. These are stress ratings provided for information only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification are not implied.

For guaranteed specifications and test conditions, see Electrical Characteristics.

The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Electrical Specifications (VOUT = 0.600V)

Operating Conditions: V_{IN} = 3.0V, I_{OUT} = 0mA, C_{OUT} = 0.001µF, T_A = -40 to +130°C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OUT}	Output Voltage			0.600		V
VOA	V_{OUT} Accuracy @ T_A = 25°C	ISL21032B06	-1.0		+1.0	mV
		ISL21032C06	-2.5		+2.5	mV
		ISL21032D06	-5.0		+5.0	mV
VOA	V_{OUT} Accuracy Over Op Temp Range (-40° < T_A < 130°C)	ISL21032B06	-3.0		+3.0	mV
		ISL21032C06	-4.5		+4.5	mV
		ISL21032D06	-6.0		+6.0	mV
VIN	Input Voltage Range		2.7		5.5	V
IIN	Supply Current			12	25	µA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	+2.7V ≤ V_{IN} ≤ +5.5V		50	200	µV/V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	Sourcing: 0mA ≤ ISOURCE ≤ 7mA		20	70	µV/mA
		Sinking: -7mA ≤ ISINK ≤ 0mA		20	70	µV/mA
$\Delta V_{OUT}/\Delta t$	Long Term Stability (Note 3)	T_A = 25°C		10		ppm/ √1kHrs
$\Delta V_{OUT}/\Delta TA$	Thermal Hysteresis (Note 1)	ΔT_A = 170°C		100		ppm
ISC	Short Circuit Current (Note 2)	T_A = 25°C, V_{OUT} tied to Gnd		50	80	mA
VN	Output Voltage Noise	0.1Hz ≤ f ≤ 10Hz		30		µVp-p

NOTES:

1. Thermal Hysteresis is the change in V_{OUT} measured @ T_A = 25°C after temperature cycling over a specified range, ΔT_A. V_{OUT} is read initially at T_A = 25°C for the device under test. The device is temperature cycled and a second V_{OUT} measurement is taken at 25°C. The difference between the initial V_{OUT} reading and the second VOUT reading is then expressed in ppm. For ΔT_A = 170°C, the device under is cycled from +25°C to +130°C to -40°C to +25°C.
2. Guaranteed by device characterization and/or correlation to other device tests.
3. FGA™ voltage reference long term drift is a logarithmic characteristic. Changes that occur after the first few hundred hours of operation are significantly smaller with time, asymptotically approaching zero beyond 2000 hours. Because of this decreasing characteristic, long-term drift is specified in ppm/√1kHr.

Typical Performance Curves, ISL21032 Low Voltage Output Reference

V_{IN} = 3.0V, I_{OUT} = 0mA, T_A = 25°C Unless Otherwise Specified

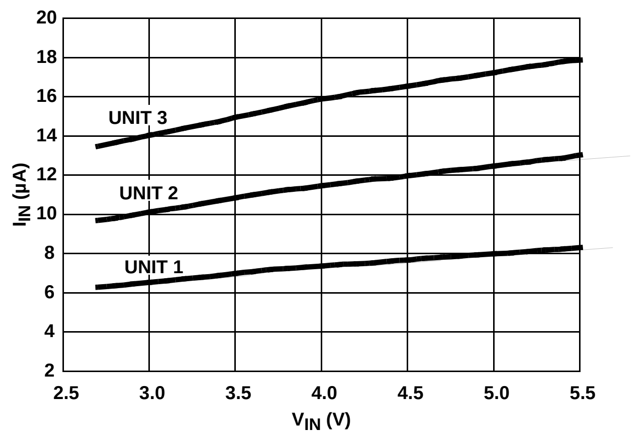


FIGURE 1. I_{IN} vs V_{IN} (3 REPRESENTATIVE UNITS)

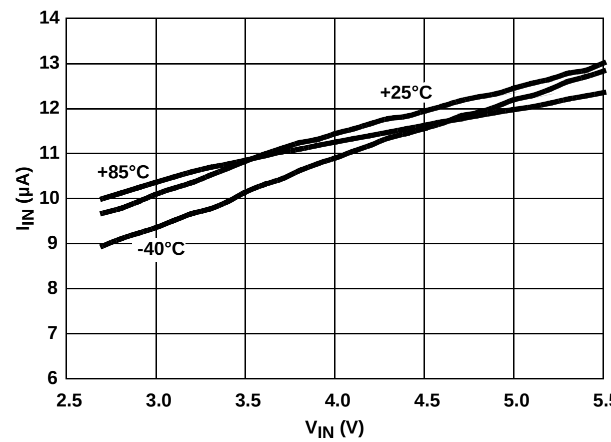


FIGURE 2. I_{IN} vs V_{IN} - 3 TEMPS

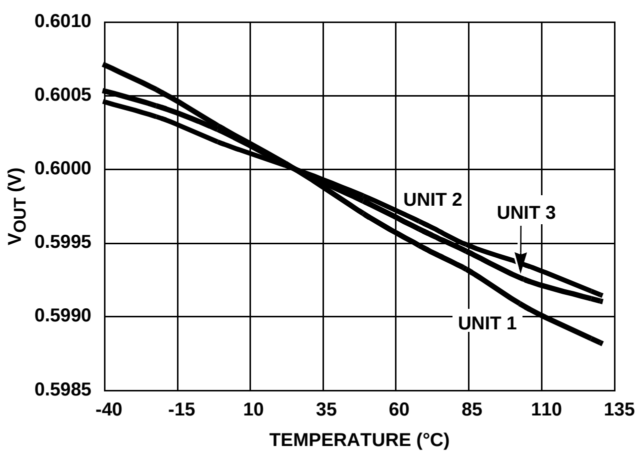


FIGURE 3. V_{OUT} vs TEMP

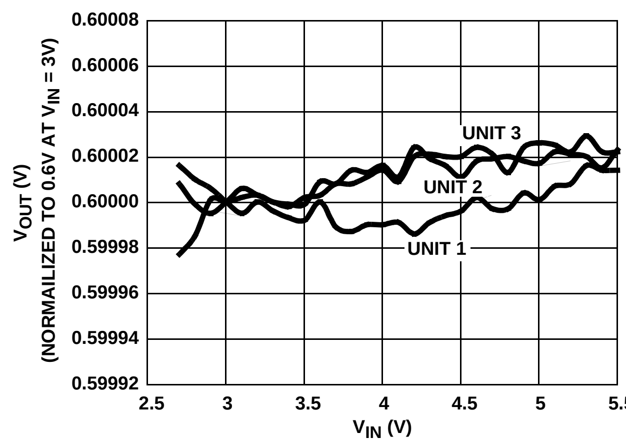


FIGURE 4. LINE REGULATION

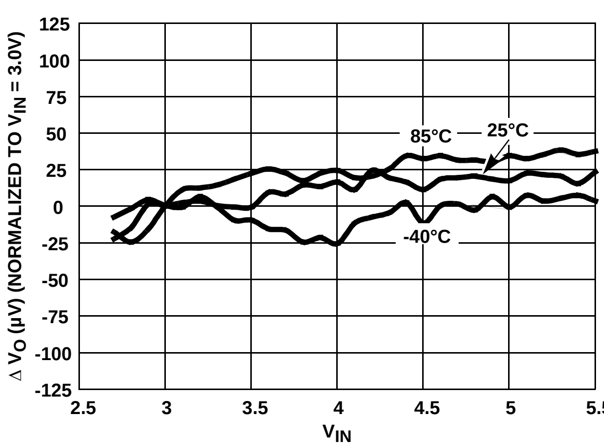


FIGURE 5. LINE REGULATION - 3 TEMPS

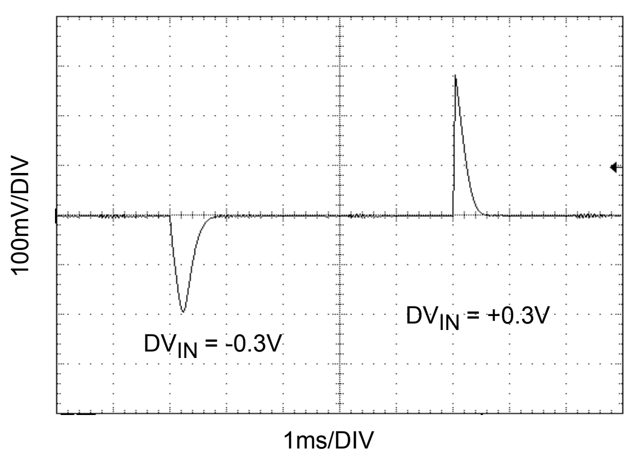


FIGURE 6. LINE TRANSIENT RESPONSE, C_L = 0nF

Typical Performance Curves, ISL21032 Low Voltage Output Reference

V_{IN} = 3.0V, I_{OUT} = 0mA, T_A = 25°C Unless Otherwise Specified **(Continued)**

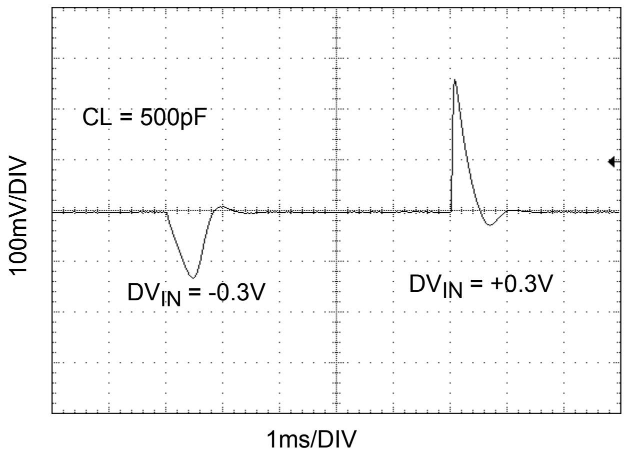


FIGURE 7. LINE TRANSIENT RESPONSE, C_L = 1nF

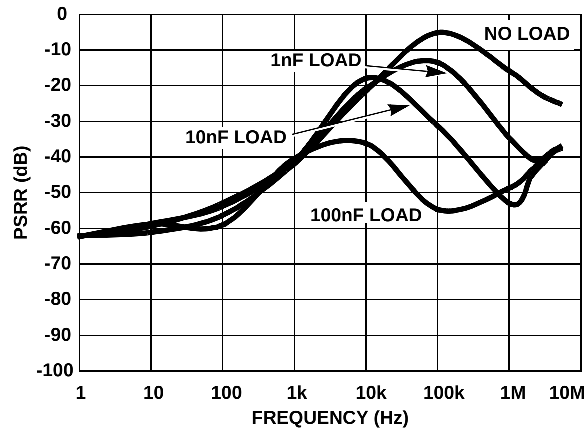


FIGURE 8. PSRR vs f vs C_L

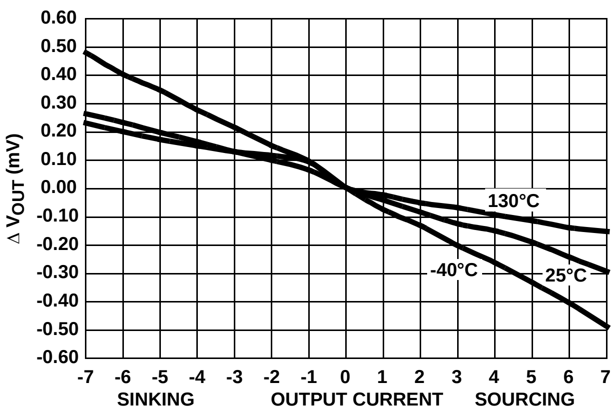


FIGURE 9. LOAD REGULATION vs TEMP

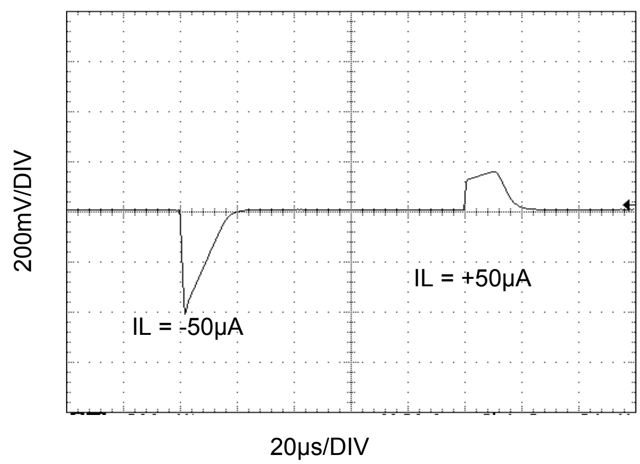


FIGURE 10. LOAD TRANSIENT RESPONSE @ I_L = 50µA, C_L = 1nF

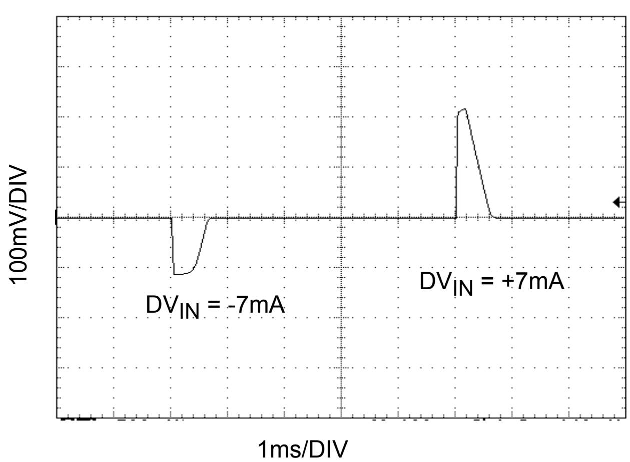


FIGURE 11. LOAD TRANSIENT RESPONSE @ I_L = 7mA, C_L = 1nF

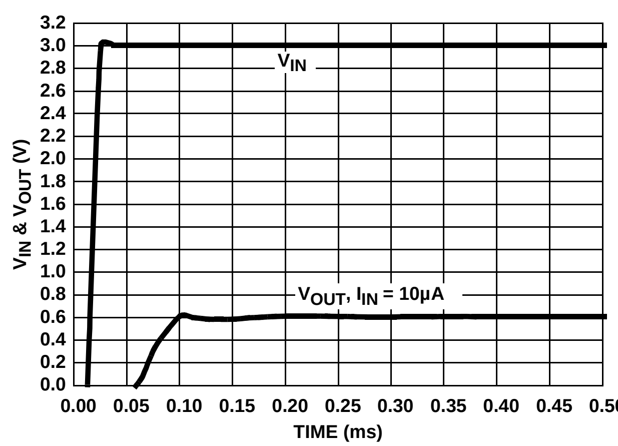


FIGURE 12. TURN-ON TIME @ T_A = 25°C

Typical Performance Curves, ISL21032 Low Voltage Output Reference

V_{IN} = 3.0V, I_{OUT} = 0mA, T_A = 25°C Unless Otherwise Specified **(Continued)**

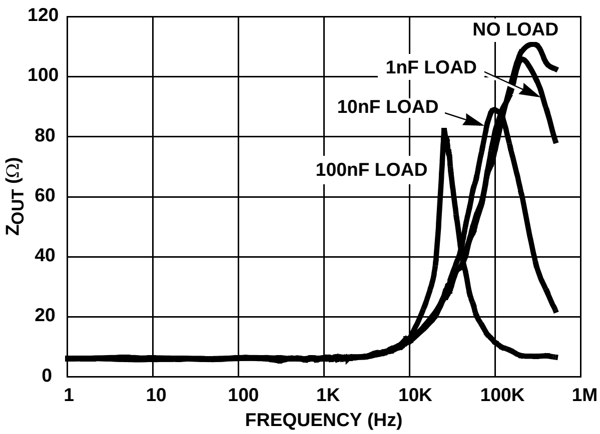


FIGURE 13. Z_{OUT} vs f vs C_L

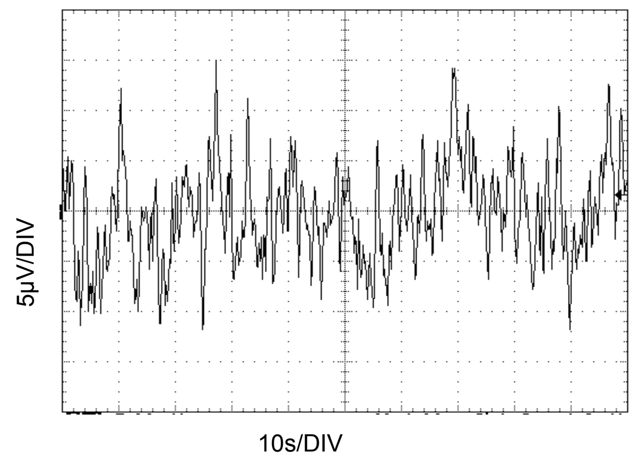


FIGURE 14. V_{OUT} NOISE

FGA Technology

The ISL21032 series of voltage references use the floating gate technology to create references with very low drift and supply current. Essentially the charge stored on a floating gate cell is set precisely in manufacturing. The reference voltage output itself is a buffered version of the floating gate voltage. The resulting reference device has excellent characteristics which are unique in the industry: very low temperature drift, high initial accuracy, and almost zero supply current. Also, the reference voltage itself is not limited by voltage bandgaps or zener settings, so a wide range of reference voltages can be programmed (standard voltage settings are provided, but customer-specific voltages are available).

The process used for these reference devices is a floating gate CMOS process, and the amplifier circuitry uses CMOS transistors for amplifier and output transistor circuitry. While providing excellent accuracy, there are limitations in output noise level and load regulation due to the MOS device characteristics. These limitations are addressed with circuit techniques discussed in other sections.

Board Mounting Considerations

For applications requiring the highest accuracy, board mounting location should be reviewed. Placing the device in areas subject to slight twisting can cause degradation of the accuracy of the reference voltage due to die stresses. It is normally best to place the device near the edge of a board, or the shortest side, as the axis of bending is most limited at that location. Obviously mounting the device on flexprint or extremely thin PC material will likewise cause loss of reference accuracy.

Noise Performance and Reduction

The output noise voltage in a 0.1Hz to 10Hz bandwidth is typically 30µV_{P-P}. The noise measurement is made with a bandpass filter made of a 1 pole high-pass filter with a corner frequency at 0.1Hz and a 2-pole low-pass filter with a corner frequency at 12.6Hz to create a filter with a 9.9Hz bandwidth. Wideband noise is reduced by adding capacitor to the output, but the value should be limited to 1nF or less to insure stability.

Temperature Drift

The limits stated for output accuracy over temperature are governed by the method of measurement. For the -40°C to 130°C temperature range, measurements are made at 25°C and the two extremes. This measurement method combined with the fact that FGA references have a fairly linear temperature drift characteristic insures that the limits stated will not be exceeded over the temperature range.

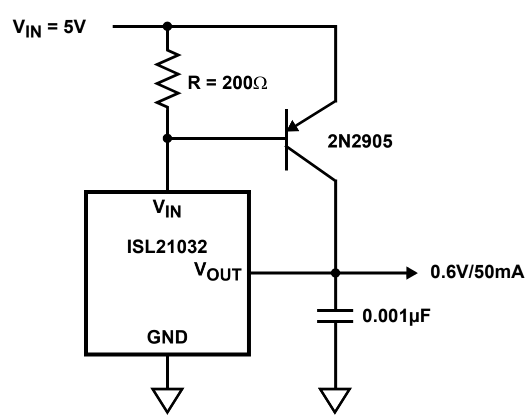
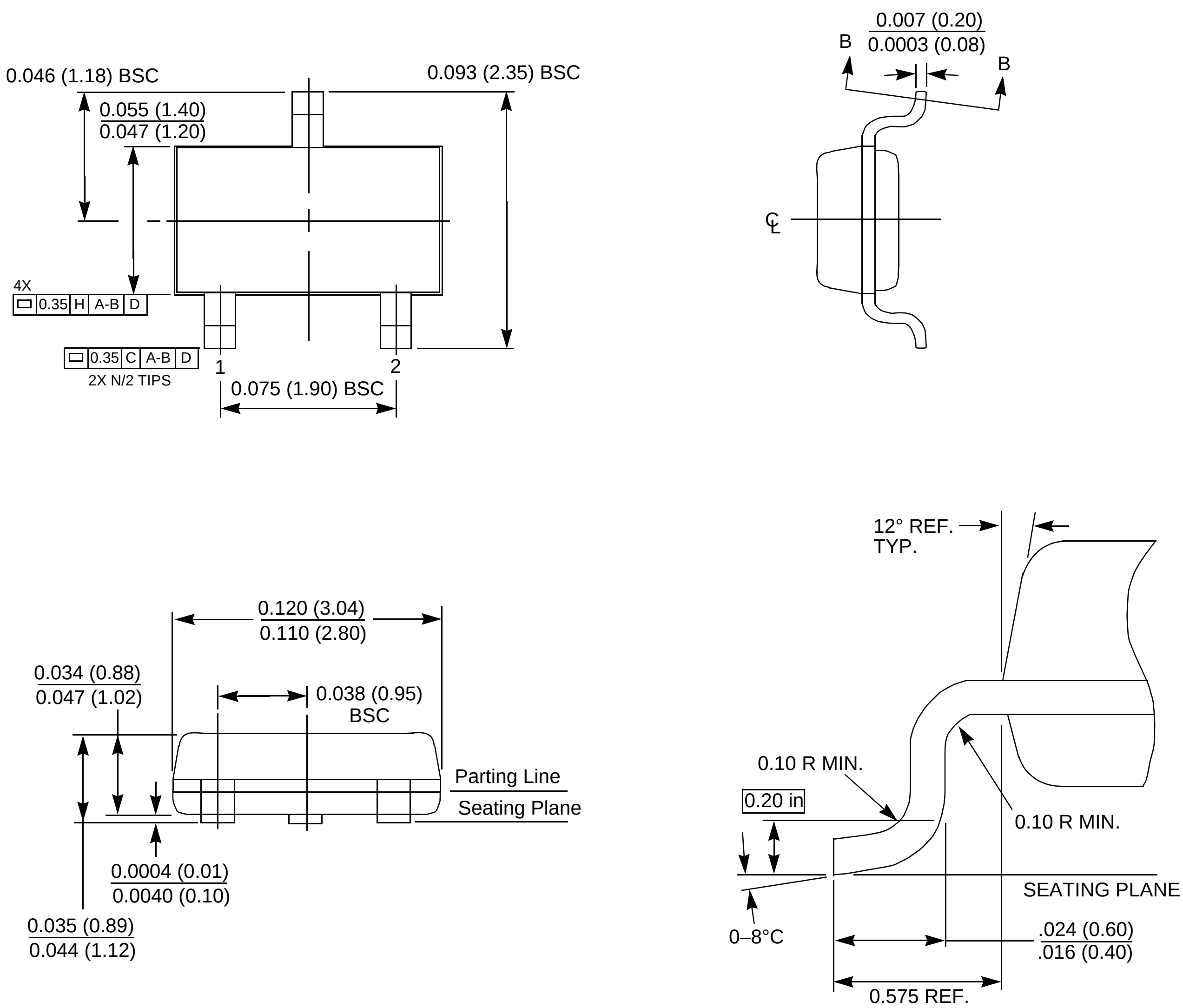


FIGURE 15. PRECISION LOW NOISE, LOW DRIFT, 0.6V, 50mA REFERENCE

Packaging Information

3-Lead, SOT23, Package Code H3



NOTES**:**

1. All dimensions in inches (in parentheses in millimeters).
2. Package dimensions exclude molding flash.
3. Die and die paddle is facing down towards seating plane.
4. This part is compliant with JEDEC Specification TO-236AB.
5. Dimensioning and tolerances per ASME, Y14.5M-1994.