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Accuracies of the AD590

The following tables contain maximum errors by grade for applications involving limited temperature spans. The tables reflect the worst case nonlinearities of the AD590, which invariably occur at the ends of the specified temperature range. The "trims" in each table refer to the error correction circuits on pages 4 and 5 of the AD590 data sheet (Figures 4 and 7a). All accuracies given below are ±°C. For example, ±1°C accuracy is required over the +25°C to +75°C range, then trimming a J grade device using the circuit of Figure 4 on the AD590 data sheet will result in a sensor of the required accuracy and range.

M GRADE

Number Of Trims	Temperature Span (°C)	Lowest Temperature In Span (°C)							
		–55	–25	0	+25	+50	+75	+100	+125
None	10	0.6	0.5	0.6	0.6	0.7	0.7	0.7	0.9
None	25	0.8	0.8	0.7	0.7	0.8	0.8	1.0	1.1
None	50	1.0	0.9	0.8	0.9	0.9	1.1	1.2	—
None	100	1.3	1.4	1.3	1.4	1.5	—	—	—
None	150	1.5	1.6	1.6	—	—	—	—	—
None	205	1.7	—	—	—	—	—	—	—
One	10	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2
One	25	0.4	0.3	0.2	0.2	0.2	0.2	0.3	0.4
One	50	0.5	0.4	0.3	0.3	0.3	0.4	0.5	—
One	100	0.8	0.8	0.7	0.7	0.8	—	—	—
One	150	0.9	0.9	0.9	—	—	—	—	—
One	205	1.0	—	—	—	—	—	—	—
Two	10	0.1	*	*	*	*	*	*	0.1
Two	25	0.1	*	*	*	*	*	*	0.1
Two	50	0.2	*	*	*	*	*	0.2	—
Two	100	0.2	0.1	*	0.1	0.2	—	—	—
Two	150	0.3	0.2	0.3	—	—	—	—	—
Two	205	0.3	—	—	—	—	—	—	—

*Below ±0.05°C

L GRADE

Number Of Trims	Temperature Span (°C)	Lowest Temperature In Span (°C)							
		–55	–25	0	+25	+50	+75	+100	+125
None	10	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.6
None	25	1.3	1.3	1.3	1.4	1.5	1.6	1.7	1.9
None	50	1.9	1.8	1.7	1.8	1.9	2.1	2.4	—
None	100	2.4	2.4	2.4	2.4	2.7	—	—	—
None	150	2.7	2.6	2.8	—	—	—	—	—
None	205	3.0	—	—	—	—	—	—	—
One	10	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2
One	25	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.5
One	50	1.0	0.8	0.6	0.6	0.6	0.8	1.0	—
One	100	1.3	1.2	1.1	1.1	1.3	—	—	—
One	150	1.4	1.3	1.4	—	—	—	—	—
One	205	1.6	—	—	—	—	—	—	—
Two	10	0.1	*	*	*	*	*	*	0.1
Two	25	0.1	*	*	*	*	*	*	0.1
Two	50	0.2	*	*	*	*	*	0.2	—
Two	100	0.3	0.2	0.1	0.2	0.3	—	—	—
Two	150	0.3	0.2	0.3	—	—	—	—	—
Two	205	0.4	—	—	—	—	—	—	—

*Below ±0.05°C

K GRADE

Number Of Trims	Temperature Span (°C)	Lowest Temperature In Span (°C)							
		–55	–25	0	+25	+50	+75	+100	+125
None	10	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.6
None	25	2.6	2.7	2.8	3.0	3.2	3.5	3.8	4.2
None	50	3.8	3.5	3.4	3.6	3.8	4.3	5.1	—
None	100	4.2	4.3	4.4	4.6	5.1	—	—	—
None	150	4.8	4.8	5.3	—	—	—	—	—
None	205	5.5	—	—	—	—	—	—	—
One	10	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2
One	25	0.6	0.4	0.3	0.3	0.3	0.4	0.5	0.6
One	50	1.2	1.0	0.7	0.7	0.7	1.0	1.2	—
One	100	1.5	1.4	1.3	1.3	1.5	—	—	—
One	150	1.7	1.5	1.7	—	—	—	—	—
One	205	2.0	—	—	—	—	—	—	—
Two	10	0.1	*	*	*	*	*	*	0.1
Two	25	0.2	0.1	*	*	*	*	0.1	0.2
Two	50	0.3	0.1	*	*	*	0.1	0.2	—
Two	100	0.5	0.3	0.2	0.3	0.7	—	—	—
Two	150	0.6	0.5	0.7	—	—	—	—	—
Two	205	0.8	—	—	—	—	—	—	—

*Below ±0.05°C

J GRADE

Number Of Trims	Temperature Span (°C)	Lowest Temperature In Span (°C)							
		–55	–25	0	+25	+50	+75	+100	+125
None	10	4.2	4.6	5.0	5.4	5.8	6.2	6.6	7.2
None	25	5.0	5.2	5.5	5.9	6.0	6.9	7.5	8.0
None	50	6.5	6.5	6.4	6.9	7.3	8.2	9.0	—
None	100	7.7	8.0	8.3	8.7	9.4	—	—	—
None	150	9.2	9.5	9.6	—	—	—	—	—
None	205	10.0	—	—	—	—	—	—	—
One	10	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3
One	25	0.9	0.6	0.5	0.5	0.5	0.6	0.8	0.9
One	50	1.9	1.5	1.0	1.0	1.0	1.5	1.9	—
One	100	2.3	2.2	2.0	2.0	2.3	—	—	—
One	150	2.5	2.4	2.5	—	—	—	—	—
One	205	3.0	—	—	—	—	—	—	—
Two	10	0.1	*	*	*	*	*	*	0.1
Two	25	0.2	0.1	*	*	*	*	0.1	0.2
Two	50	0.4	0.2	0.1	*	*	0.1	0.2	*
Two	100	0.7	0.5	0.3	0.7	1.0	—	—	—
Two	150	1.0	0.7	1.2	—	—	—	—	—
Two	205	1.5	—	—	—	—	—	—	—

*Below ±0.05°C

I GRADE

Number Of Trims	Temperature Span (°C)	Lowest Temperature In Span (°C)							
		–55	–25	0	+25	+50	+75	+100	+125
None	10	8.4	9.2	10.0	10.8	11.6	12.4	13.2	14.4
None	25	10.0	10.4	11.0	11.8	12.0	13.8	15.0	16.0
None	50	13.0	13.0	12.8	13.8	14.6	16.4	18.0	—
None	100	15.2	16.0	16.6	17.4	18.8	—	—	—
None	150	18.4	19.0	19.2	—	—	—	—	—
None	205	20.0	—	—	—	—	—	—	—
One	10	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.6
One	25	1.8	1.2	1.0	1.0	1.0	1.2	1.6	1.8
One	50	3.8	3.0	2.0	2.0	2.0	3.0	3.8	—
One	100	4.8	4.5	4.2	4.2	5.0	—	—	—
One	150	5.5	4.8	5.5	—	—	—	—	—
One	205	5.8	—	—	—	—	—	—	—
Two	10	0.3	0.2	0.1	*	*	0.1	0.2	0.3
Two	25	0.5	0.3	0.2	*	0.1	0.2	0.3	0.5
Two	50	1.2	0.6	0.4	0.2	0.2	0.3	0.7	—
Two	100	1.8	1.4	1.0	2.0	2.5	—	—	—
Two	150	2.6	2.0	2.8	—	—	—	—	—
Two	205	3.0	—	—	—	—	—	—	—

*Below ±0.05°C

NOTES

1. All accuracies excluding the 205°C span are guaranteed, not tested; the 205°C span accuracies are tested for by testing each device at –55°C, +25°C, +125°C and +150°C.
2. All one-trim accuracies excluding the 205°C span assume that the trim is made at the midpoint in the span; the 205°C span assumes a trim at +25°C.
3. All two-trim accuracies excluding the 205°C span assume that the trims are made at the endpoints of the span; the 205°C span assumes that trims are made at approximately 0°C and +140°C.
4. All accuracies exclude:
   a. Trim error in calibration technique used;
   b. Repeatability error;
   c. Long-term drift errors.

In precision applications, the actual errors encountered are usually dependent upon sources of error that are often overlooked in error budgets.

A) *Trim Error* is usually the largest error source. This error arises from such sources as:

   1. Poor thermal coupling between the device to be calibrated and the reference sensor;
   2. Reference sensor errors;
   3. Device to be calibrated is not permitted to thermally settle;
   4. θ_{CA} is radically different for the trim and the application.

B) *Repeatability Errors* arise from a strain hysteresis of the package. The magnitude of this error is solely a function of the magnitude of the temperature span over which the device is used. For example, thermal shocks between 0°C and 100°C will result in an extremely low hysteresis, for a repeatability error of less than ±0.05°C. When the thermal shocks are widened to –55°C and +150°C, the device will typically exhibit a repeatability of ±0.05°C, with ±0.10°C maximum being guaranteed.

C) *Long-Term Drift Errors* are related to the average operating temperature and the magnitude of the thermal shocks experienced by the device. Extended use of the device at temperatures above 100°C typically results in a long term drift of ±0.03°C; the guaranteed maximum is ±0.10°C. Operating temperatures below 100°C induce no measurable drifts in the device. In addition to operating temperature, the severity of the thermal shocks incurred will determine the absolute stability of the device. For thermal shock spans of less than 100°C, the drift is difficult to measure (< 0.03°C). However, for 200°C spans the device may drift by as much as ±0.10°C after 20 such shocks. If severe, quick shocks are necessary in the application of the device, simulated life tests are recommended for a thorough evaluation of the error introduced by such shocks.

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