TEXAS INSTRUMENTS
AMC1300
SBAS895D – MAY 2018 – REVISED MAY 2022

# AMC1300 Precision, ±250-mV Input, Reinforced Isolated Amplifier

## 1 Features

- ±250-mV input voltage range optimized for current measurement using shunt resistors
- Fixed gain: 8.2
- Low DC errors:
  - AMC1300B:
    - Offset error: ±0.2 mV (maximum)
    - Offset drift: ±0.9 µV/°C (maximum)
    - Gain error: ±0.3% (maximum)
    - Gain drift: ±30 ppm/°C (maximum)
  - AMC1300:
    - Offset error: ±2 mV (maximum)
    - Offset drift: ±4 µV/°C (maximum)
    - Gain error: ±1% (maximum)
    - Gain drift: ±50 ppm/°C (typical)
  - Nonlinearity: 0.03% (maximum)
- 3.3-V operation on high-side (AMC1300B)
- High CMTI: 100 kV/µs (minimum) (AMC1300B)
- Low EMI, meets CISPR-11 and CISPR-25 standards
- System-level diagnostic features
- Safety-related certifications:
  - 7071-$V_{PK}$ reinforced isolation per DIN VDE V 0884-11: 2017-01
  - 5000-$V_{RMS}$ isolation for 1 minute per UL1577

## 2 Applications

- Shunt-resistor-based current sensing in:
  - Motor drives
  - Frequency inverters
  - Uninterruptible power supplies

## 3 Description

The AMC1300 is a precision, isolated amplifier with an output separated from the input circuitry by an isolation barrier that is highly resistant to magnetic interference. This barrier is certified to provide reinforced galvanic isolation of up to 5 $kV_{RMS}$ according to VDE V 0884-11 and UL1577. Used in conjunction with isolated power supplies, this isolated amplifier separates parts of the system that operate on different common-mode voltage levels and protects lower-voltage parts from damage.

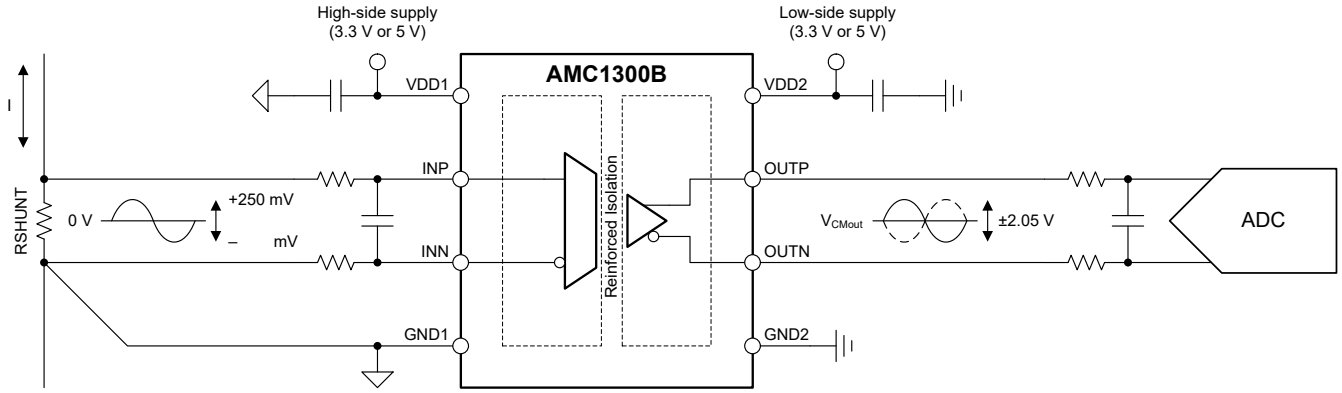
The input of the AMC1300 is optimized for direct connection to shunt resistors or other low voltage-level signal sources. The excellent performance of the device supports accurate current control resulting in system-level power savings and, especially in motor control applications, lower torque ripple. The integrated common-mode overvoltage and missing high-side supply voltage detection features of the AMC1300 simplify system-level design and diagnostics.

The AMC1300 is offered with two performance grade options: the AMC1300B is specified over the extended industrial temperature range of –55°C to +125°C, and the AMC1300 for operation at –40°C to +125°C.

**Device Information**(1)

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| AMC1300 | SOIC (8) | 5.85 mm × 7.50 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.




**Simplified Schematic**

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## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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| • Changed CDM ESD standard from JESD22-C101 to ANSI/ESDA/JEDEC JS-002 | 5 |
| • Changed $T_A$ (max) for AMC1300 from 105 °C to 125 °C. | 5 |
| • Updated VDE standard references is *Safety-Related Certifications* table | 8 |

| Changes from Revision B (April 2020) to Revision C (June 2021) | Page |
|---|---|
| • Changed *Features* section | 1 |
| • Changed several figures throughout document (editorial changes only) | 1 |
| • Changed $TCV_{OS}$, $TCE_G$, and CMTI values in AMC1300B column of *Device Comparison Table* | 3 |
| • Changed $C_{IO}$ from ~1 pF to ~1.5 pF | 7 |
| • Changed $V_{CMov}$ hysteresis from 95 mV to 60 mV | 9 |
| • Changed $TCV_{OS}$ (AMC1300B) from ±3 to ±0.9 µV/°C and typical value from ±1 to ±0.1 µV/°C | 9 |
| • Changed $TCE_G$ (AMC1300B) from ±50 to ±30 ppm/°C and typical value from ±15 to ±5 ppm/°C | 9 |
| • Changed SNR (min), $f_{IN}$ = 1 kHz from 80 dB to 81.5 dB | 9 |
| • Added $V_{CLIPout}$ specification | 9 |
| • Changed $V_{FAILSAFE}$ from * / –2.6 V / –2.5 V to –2.63 V / –2.57 V / –2.53 V (min / typ /max) | 9 |
| • Changed output short-circuit current from ±13 mA to 14 mA (sourcing or sinking) | 9 |
| • Changed CMTI (AMC1300B) min from 75 to 100 kV/µs and typ from 140 to 150 kV/µs | 9 |
| • Changed $VDD1_{UV}$ from 1.75 V / 2.53 V / 2.7 V to 2.4 V / 2.6 V / 2.8 V (min / typ / max) | 9 |
| • Changed *Analog Input* section | 20 |
| • Changed *Analog Output* section | 22 |
| • Changed *Detailed Design Procedure* section | 24 |
| • Added *Shunt Resistor Sizing* section | 24 |
| • Added *Input Filter Design* section | 24 |
| • Added *Differential to Single-Ended Output Conversion* section | 25 |
| • Changed *Application Curves* section | 26 |
| • Added layout recommendations to *What To Do and What Not To Do* section | 26 |

## 5 Device Comparison Table

| PARAMETER | | AMC1300B | AMC1300 |
|---|---|---|---|
| High-side supply voltage, VDD1 | | 3.0 V to 5.5 V | 4.5 V to 5.5 V |
| Specified ambient temperature, $T_A$ | | –55°C to +125°C | –40°C to +125°C |
| Input offset voltage, $V_{OS}$ | 4.5 V ≤ VDD1 ≤ 5.5 V | ±0.2 mV | ±2 mV |
| | 3.0 V ≤ VDD1 ≤ 4.5 V | | Not applicable |
| Input offset drift, $TCV_{OS}$ | | ±0.9 µV/°C (max) | ±4 µV/°C (max) |
| Gain error, $E_G$ | | ±0.3% | ±1% |
| Gain error drift, $TCE_G$ | | ±5 ppm/°C (typ), ±30 ppm/°C (max) | ±50 ppm/°C (typ) |
| Common-mode transient immunity, CMTI | | 100 kV/µs (min), 150 kV/µs (typ) | 15 kV/µs (min), 30 kV/µs (typ) |
| Output bandwidth, BW | | 250 kHz (min), 310 kHz (typ) | 170 kHz (min), 230 kHz (typ) |
| INP, INN to OUTP, OUTN signal delay (50% – 90%) | | 3 µs (max) | 3.4 µs (max) |

# 6 Pin Configuration and Functions

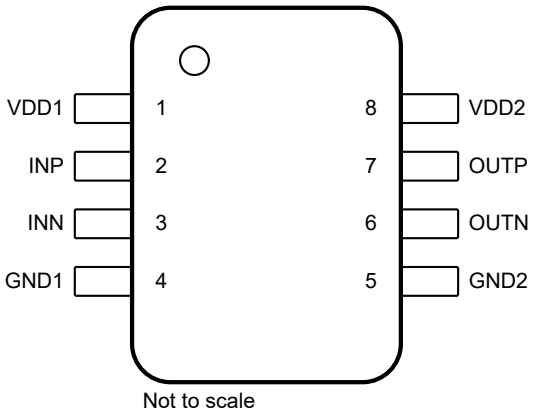



**Figure 6-1. DWV Package, 8-Pin SOIC, Top View**

**Table 6-1. Pin Functions**

| PIN | | TYPE | DESCRIPTION |
|---|---|---|---|
| NO. | NAME | | |
| 1 | VDD1 | High-side power | High-side power supply.(1) |
| 2 | INP | Analog input | Noninverting analog input. Either INP or INN must have a DC current path to GND1 to define the common-mode input voltage.(2) |
| 3 | INN | Analog input | Inverting analog input. Either INP or INN must have a DC current path to GND1 to define the common-mode input voltage.(2) |
| 4 | GND1 | High-side ground | High-side analog ground. |
| 5 | GND2 | Low-side ground | Low-side analog ground. |
| 6 | OUTN | Analog output | Inverting analog output. |
| 7 | OUTP | Analog output | Noninverting analog output. |
| 8 | VDD2 | Low-side power | Low-side power supply.(1) |

(1) See the *Power Supply Recommendations* section for power-supply decoupling recommendations.
(2) See the *Layout* section for details.

# 7 Specifications

## 7.1 Absolute Maximum Ratings

over operating ambient temperature range (unless otherwise noted)(1)

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Power-supply voltage | High-side VDD1 to GND1 | –0.3 | 6.5 | V |
| | Low-side VDD2 to GND2 | –0.3 | 6.5 | |
| Analog input voltage | INP, INN | GND1 – 6 | VDD1 + 0.5 | V |
| Output voltage | OUTP, OUTN | GND2 – 0.5 | VDD2 + 0.5 | V |
| Input current | Continuous, any pin except power-supply pins | –10 | 10 | mA |
| Temperature | Junction, $T_J$ | | 150 | °C |
| | Storage, $T_{stg}$ | –65 | 150 | °C |

(1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime

## 7.2 ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 (1) | ±2000 | V |
| | | Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002 (2) | ±1000 | |

(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.

## 7.3 Recommended Operating Conditions

over operating ambient temperature range (unless otherwise noted)

| | | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|---|
| **POWER SUPPLY** | | | | | | |
| | High-side power supply | VDD1 to GND1, AMC1300 | 4.5 | 5 | 5.5 | V |
| | | VDD1 to GND1, AMC1300B | 3 | 5 | 5.5 | |
| | Low-side power supply | VDD2 to GND2 | 3 | 3.3 | 5.5 | V |
| **ANALOG INPUT** | | | | | | |
| $V_{Clipping}$ | Differential input voltage before clipping output | $V_{IN} = V_{INP} - V_{INN}$ | | ±320 | | mV |
| $V_{FSR}$ | Specified linear differential full-scale voltage | $V_{IN} = V_{INP} - V_{INN}$ | –250 | | 250 | mV |
| | Absolute common-mode input voltage(1) | $(V_{INP}+V_{INN}) / 2$ to GND1 | –2 | | VDD1 | V |
| $V_{CM}$ | Operating common-mode input voltage | $(V_{INP}+V_{INN}) / 2$ to GND1 | –0.16 | | VDD1 – 2.1 | V |
| **TEMPERTURE RANGE** | | | | | | |
| $T_A$ | Specified ambient temperature | AMC1300 | –40 | | 125 | °C |
| | | AMC1300B | –55 | | 125 | °C |

(1) Steady-state voltage supported by the device in case of a system failure. See specified common-mode input voltage VCM for normal operation. Observe analog input voltage range as specified in Absolute Maximum Ratings.

## 7.4 Thermal Information

| THERMAL METRIC(1) | | AMC1300x DWV (SOIC) 8 PINS | UNIT |
|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 85.4 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 26.8 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 43.5 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 4.8 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 41.2 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | °C/W |

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report.

## 7.5 Power Ratings

| PARAMETER | | TEST CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $P_D$ | Maximum power dissipation (both sides) | VDD1 = VDD2 = 5.5 V | 99 | mW |
| | | VDD1 = VDD2 = 3.6 V, AMC1300B only | 57 | |
| $P_{D1}$ | Maximum power dissipation (high-side) | VDD1 = 5.5 V | 54 | mW |
| | | VDD1 = 3.6 V, AMC1300B only | 31 | |
| $P_{D2}$ | Maximum power dissipation (low-side) | VDD2 = 5.5 V | 45 | mW |
| | | VDD2 = 3.6 V | 26 | |

## 7.6 Insulation Specifications

over operating ambient temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| **GENERAL** | | | | |
| CLR | External clearance(1) | Shortest terminal-to-terminal distance through air | ≥ 8.5 | mm |
| CPG | External Creepage(1) | Shortest terminal-to-terminal distance across the package surface | ≥ 8.5 | mm |
| DTI | Distance through the insulation | Minimum internal gap (internal clearance) of the double isolation (2 x 0.0105 mm) | ≥ 0.021 | mm |
| CTI | Comparative tracking index | DIN EN 60112 (VDE 0303-11); IEC 60112 | ≥ 600 | V |
| | Material Group | According to IEC 60664-1 | I | |
| | Overvoltage category | Rated mains voltage ≤ 600 $V_{RMS}$ | I-IV | |
| | | Rated mains voltage ≤ 1000 $V_{RMS}$ | I-III | |
| **DIN VDE 0884-11 (VDE V 0884-11): 2017-01** | | | | |
| $V_{IORM}$ | Maximum repetitive peak isolation voltage | AC voltage (bipolar) | 2121 | $V_{PK}$ |
| $V_{IOWM}$ | Maximum isolation working voltage | AC voltage (sine wave); time-dependent dielectric breakdown (TDDB) test; see Figure 4 | 1500 | $V_{RMS}$ |
| | | DC voltage | 2121 | $V_{DC}$ |
| $V_{IOTM}$ | Maximum transient isolation voltage | $V_{TEST} = V_{IOTM}$, t = 60 s (qualification test) | 7071 | $V_{PK}$ |
| | | $V_{TEST} = V_{IOTM}$, t = 1 s (100% production test) | 8485 | $V_{PK}$ |
| $V_{IOSM}$ | Maximum surge isolation voltage(2) | Test method per IEC 60065, 1.2/50 µs waveform, $V_{TEST} = 1.6 \times V_{IOSM} = 12800\ V_{PK}$ (qualification) | 8000 | $V_{PK}$ |
| $q_{pd}$ | Apparent charge(3) | Method a: After I/O safety test subgroup 2/3, $V_{ini} = V_{IOTM}$, $t_{ini}$ = 60 s; $V_{pd(m)} = 1.2 \times V_{IORM} = 2545\ V_{PK}$, $t_m$ = 10 s | ≤ 5 | pC |
| | | Method a: After environmental tests subgroup 1, $V_{ini} = V_{IOTM}$, $t_{ini}$ = 60 s; $V_{pd(m)} = 1.6 \times V_{IORM} = 3394\ V_{PK}$, $t_m$ = 10 s | ≤ 5 | |
| | | Method b1: At routine test (100% production) and preconditioning (type test), $V_{ini} = V_{IOTM}$, $t_{ini}$ = 1 s; $V_{pd(m)} = 1.875 \times V_{IORM} = 3977\ V_{PK}$, $t_m$ = 1 s | ≤ 5 | |
| $C_{IO}$ | Barrier capacitance, input to output(4) | $V_{IO}$ = 0.4 × sin (2 πft), f = 1 MHz | ~1.5 | pF |
| $R_{IO}$ | Insulation resistance, input to output(4) | $V_{IO}$ = 500 V, $T_A$ = 25°C | > $10^{12}$ | Ω |
| | | $V_{IO}$ = 500 V, 100°C ≤ $T_A$ ≤ 125°C | > $10^{11}$ | |
| | | $V_{IO}$ = 500 V at $T_S$ = 150°C | > $10^9$ | |
| | Pollution degree | | 2 | |
| | Climatic category | | 55/125/21 | |
| **UL 1577** | | | | |
| $V_{ISO}$ | Withstand isolation voltage | $V_{TEST} = V_{ISO} = 5000\ V_{RMS}$, t = 60 s (qualification), $V_{TEST} = 1.2 \times V_{ISO} = 6000\ V_{RMS}$, t = 1 s (100% production) | 5000 | $V_{RMS}$ |

(1) Creepage and clearance requirements should be applied according to the specific equipment isolation standards of an application. Careshould be taken to maintain the creepage and clearance distance of a board design to ensure that the mounting pads of the isolator onthe printed-circuit board do not reduce this distance. Creepage and clearance on a printed-circuit board become equal in certain cases.Techniques such as inserting grooves, ribs, or both on a printed-circuit board are used to help increase these specifications.
(2) Testing is carried out in air or oil to determine the intrinsic surge immunity of the isolation barrier.
(3) Apparent charge is electrical discharge caused by a partial discharge (pd).
(4) All pins on each side of the barrier tied together creating a two-pin device.

## 7.7 Safety-Related Certifications

| VDE | UL |
|---|---|
| Certified according to<br>DIN VDE V 0884-11 (VDE V 0884-11): 2017-01,<br>DIN EN 62368-1: 2016-05,<br>EN 62368-1: 2014, and IEC 62368-1: 2014 | Recognized under 1577 component recognition and<br>CSA component acceptance NO 5 programs |
| Reinforced insulation | Single protection |
| Certificate number: 40040142 | Certificate number: E181974 |

## 7.8 Safety Limiting Values

Safety limiting(1) intends to minimize potential damage to the isolation barrier upon failure of input or output circuitry. A failure of the I/O can allow low resistance to ground or the supply and, without current limiting, dissipate sufficient power to over-heat the die and damage the isolation barrier potentially leading to secondary system failures.

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $I_S$ | Safety input, output, or supply current | $R_{\theta JA}$ = 85.4°C/W, VDDx = 5.5 V,<br>$T_J$ = 150°C, $T_A$ = 25°C | | | 266 | mA |
| $I_S$ | Safety input, output, or supply current | $R_{\theta JA}$ = 85.4°C/W, VDDx = 3.6 V,<br>$T_J$ = 150°C, $T_A$ = 25°C | | | 407 | mA |
| $P_S$ | Safety input, output, or total power | $R_{\theta JA}$ = 85.4°C/W, $T_J$ = 150°C, $T_A$ = 25°C | | | 1464 | mW |
| $T_S$ | Maximum safety temperature | | | | 150 | °C |

(1) The maximum safety temperature, $T_S$, has the same value as the maximum junction temperature, $T_J$, specified for the device. The $I_S$ and $P_S$ parameters represent the safety current and safety power, respectively. Do not exceed the maximum limits of $I_S$ and $P_S$. These limits vary with the ambient temperature, $T_A$.
The junction-to-air thermal resistance, $R_{\theta JA}$, in the Thermal Information table is that of a device installed on a high-K test board for leaded surface-mount packages. Use these equations to calculate the value for each parameter:
$T_J = T_A + R_{\theta JA} \times P$, where P is the power dissipated in the device.
$T_{J(max)} = T_S = T_A + R_{\theta JA} \times P_S$, where $T_{J(max)}$ is the maximum junction temperature.
$P_S = I_S \times VDD_{max}$, where $VDD_{max}$ is the maximum supply voltage for high-side and low-side.

## 7.9 Electrical Characteristics

minimum and maximum specifications of the AMC1300 apply from $T_A$ = – 40°C to+105°C, VDD1 = 4.5 V to 5.5 V, VDD2 = 3.0 V to 5.5 V, INP = – 250 mV to + 250 mV, and INN = GND1; minimum and maximum specifications of the AMC1300B apply fromTA = – 55°C to+125°C, VDD1 = 3.0 V to 5.5 V, VDD2 = 3.0 V to 5.5 V, INP = – 250 mV to + 250 mV, and INN = GND1; typical specifications are at TA = 25°C, VDD1 = 5 V, and VDD2 = 3.3 V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **ANALOG INPUT** | | | | | | |
| $V_{CMov}$ | Common-mode overvoltage detection level | ($V_{INP}$+$V_{INN}$) / 2 to GND1 | VDD1 – 2 | | | V |
| | Hysteresis of common-mode overvoltage detection level | | | 60 | | mV |
| $V_{OS}$ | Input offset voltage(1) (2) | AMC1300, initial, at $T_A$ = 25°C, $V_{INP}$ = $V_{INN}$ = GND1 | –2 | ±0.01 | 2 | mV |
| | | AMC1300B, initial, at $T_A$ = 25°C, $V_{INP}$ = $V_{INN}$ = GND1, 4.5 V ≤ VDD1 ≤ 5.5 V | –0.2 | ±0.01 | 0.2 | |
| | | AMC1300B, initial, at $T_A$ = 25°C, $V_{INP}$ = $V_{INN}$ = GND1, 3.0 V ≤ VDD1 ≤ 5.5 V | –0.2 | ±0.01 | 0.2 | |
| $TCV_{OS}$ | Input offset drift(1) (2) (4) | AMC1300 | –4 | ±1.3 | 4 | uV/°C |
| | | AMC1300B | –0.9 | ±0.1 | 0.9 | |
| CMRR | Common-mode rejection ratio | $f_{IN}$ = 0 Hz, $V_{CM\ min}$ ≤ $_{VC}$M ≤ $_{VCM\ max}$ | | –100 | | dB |
| | | $f_{IN}$ = 10 kHz, $V_{CM\ min}$ ≤ $_{VC}$M ≤ $_{VCM\ max}$ | | –98 | | |
| $R_{IN}$ | Single-ended input resistance | INN = GND1 | | 19 | | kΩ |
| $R_{IND}$ | Differential input resistance | | | 22 | | |
| $I_{IB}$ | Input bias current | INP = INN = GND1; IIB = (IIBP+IIBN) / 2 | –41 | –30 | –24 | uA |
| $I_{IO}$ | Input offset current | IIO = IIBP - IIBN | | ±5 | | nA |
| $C_{IN}$ | Single-ended input capacitance | INN = GND1, $f_{IN}$ = 275 kHz | | 2 | | pF |
| $C_{IND}$ | Differential input capacitance | $f_{IN}$ = 275 kHz | | 1 | | |
| **ANALOG OUTPUT** | | | | | | |
| | Nominal gain | | | 8.2 | | |
| $E_G$ | Gain error(1) | AMC1300, initial, at $T_A$ = 25°C | –1% | 0.4% | 1% | |
| | | AMC1300B, initial, at $T_A$ = 25°C | –0.3% | ±0.05% | 0.3% | |
| $TCE_G$ | Gain error drift(1) (5) | AMC1300 | | ±50 | | ppm/°C |
| | | AMC1300B | –30 | ±5 | 30 | |
| | Nonlinearity(1) | | –0.03 | ±0.01 | 0.03 | % |
| THD | Total harmonic distortion(3) | $f_{IN}$ = 10 kHz | | –85 | | dB |
| | Output noise | INP = INN = GND1, $f_{IN}$ = 0 Hz, BW = 100 kHz brickwall filter | | 230 | | $\mu V_{RMS}$ |
| SNR | Signal-to-noise ratio | $f_{IN}$ = 1 kHz, BW = 10 kHz | 81.5 | 85 | | dB |
| | | $f_{IN}$ = 10 kHz, BW = 100 kHz | | 72 | | |
| PSRR | Power-supply rejection ratio(2) | PSRR vs VDD1, at DC | | –103 | | dB |
| | | PSRR vs VDD1, 100-mV and 10-kHz ripple | | –96 | | |
| | | PSRR vs VDD2, at DC | | –106 | | |
| | | PSRR vs VDD2, 100-mV and 10-kHz ripple | | –86 | | |
| $V_{CMout}$ | Common-mode output voltage | | 1.39 | 1.44 | 1.49 | V |
| $V_{CLIPout}$ | Clipping differential output voltage | $V_{OUT}$ = ($V_{OUTP}$ – $V_{OUTN}$); \|$V_{IN}$\| = \|$V_{INP}$ – $V_{INN}$\| > \|$V_{Clipping}$\| | –2.52 | ±2.49 | 2.52 | V |
| $V_{FAILSAFE}$ | Failsafe differential output voltage | $V_{CM}$ ≥ $_{VCMov}$, or VDD1 missing | –2.63 | –2.57 | –2.53 | V |

## 7.9 Electrical Characteristics (continued)

minimum and maximum specifications of the AMC1300 apply from $T_A$ = – 40°C to+105°C, VDD1 = 4.5 V to 5.5 V, VDD2 = 3.0 V to 5.5 V, INP = – 250 mV to + 250 mV, and INN = GND1; minimum and maximum specifications of the AMC1300B apply fromTA = – 55°C to+125°C, VDD1 = 3.0 V to 5.5 V, VDD2 = 3.0 V to 5.5 V, INP = – 250 mV to + 250 mV, and INN = GND1; typical specifications are at TA = 25°C, VDD1 = 5 V, and VDD2 = 3.3 V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $BW_{OUT}$ | Output bandwidth | AMC1300 | 170 | 230 | | kHz |
| | | AMC1300B | 250 | 310 | | |
| $R_{OUT}$ | Output resistance | On OUTP or OUTN | | < 0.2 | | Ω |
| | Output short-circuit current | On OUTP or OUTN, sourcing or sinking, INN = INP = GND1, outputs shorted to either GND2 or VDD2 | | 14 | | mA |
| CMTI | Common-mode transient immunity | \|GND1 – GND2\| = 1 kV, AMC1300 | 15 | 30 | | kV/µs |
| | | \|GND1 – GND2\| = 1 kV, AMC1300B | 100 | 150 | | |
| **POWER SUPPLY** | | | | | | |
| $VDD1_{UV}$ | VDD1 undervoltage detection threshold voltage | VDD1 falling | 2.4 | 2.6 | 2.8 | V |
| IDD1 | High-side supply current | AMC1300B only, 3.0 V ≤ VDD1 ≤ 3.6 V | | 6.3 | 8.5 | mA |
| | | 4.5 V ≤ VDD1 ≤ 5.5 V | | 7.2 | 9.8 | |
| IDD2 | Low-side supply current | 3.0 V ≤ VDD2 ≤ 3.6 V | | 5.3 | 7.2 | mA |
| | | 4.5 V ≤ VDD2 ≤ 5.5 V | | 5.9 | 8.1 | |

(1) The typical value includes one standard deviation ("sigma") at nominal operating conditions.
(2) This parameter is input referred.
(3) THD is the ratio of the rms sum of the amplitues of first five higher harmonics to the amplitude of the fundamental.
(4) Offset error temperature drift is calculated using the box method, as described by the following equation:
$TCV_{OS} = (Value_{MAX} - Value_{MIN}) / TempRange$
(5) Gain error temperature drift is calculated using the box method, as described by the following equation:
$TCE_G\ (ppm) = (Value_{MAX} - Value_{MIN}) / (Value_{(T=25°C)} \times TempRange) \times 10^6$

## 7.10 Switching Characteristics

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

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $t_r$ | Output signal rise time | | | 1.3 | | µs |
| $t_f$ | Output signal fall time | | | 1.3 | | µs |
| | $V_{INx}$ to $V_{OUTx}$ signal delay (50% - 10%) | AMC1300, unfiltered output | | 1.5 | 2.2 | µs |
| | | AMC1300B, unfiltered output | | 1 | 1.5 | |
| | $V_{INx}$ to $V_{OUTx}$ signal delay (50% - 50%) | AMC1300, unfiltered output | | 2 | 2.7 | µs |
| | | AMC1300B, unfiltered output | | 1.6 | 2.1 | |
| | $V_{INx}$ to $V_{OUTx}$ signal delay (50% - 90%) | AMC1300, unfiltered output | | 2.7 | 3.4 | µs |
| | | AMC1300B, unfiltered output | | 2.5 | 3 | |
| $t_{AS}$ | Analog settling time | VDD1 step to 3.0 V with VDD2 ≥ 3.0 V, to $V_{OUTP}$, $V_{OUTN}$ valid, 0.1% settling | | 500 | | µs |

## 7.11 Timing Diagram

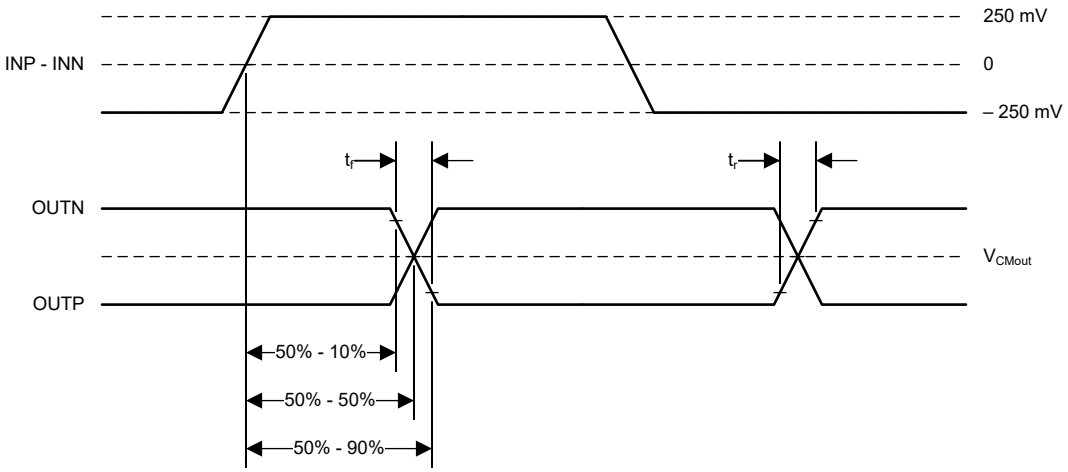



**Figure 7-1. Rise, Fall, and Delay Time Waveforms**

## 7.12 Insulation Characteristics Curves

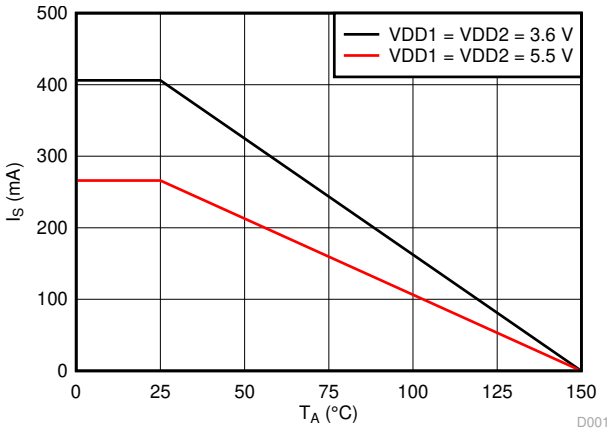



**Figure 7-2. Thermal Derating Curve for Safety-Limiting Current per VDE**

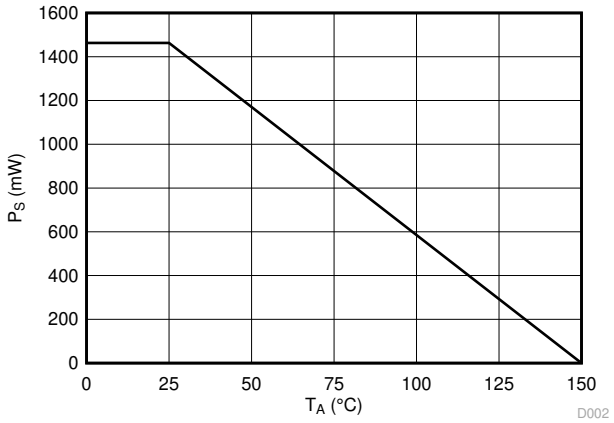
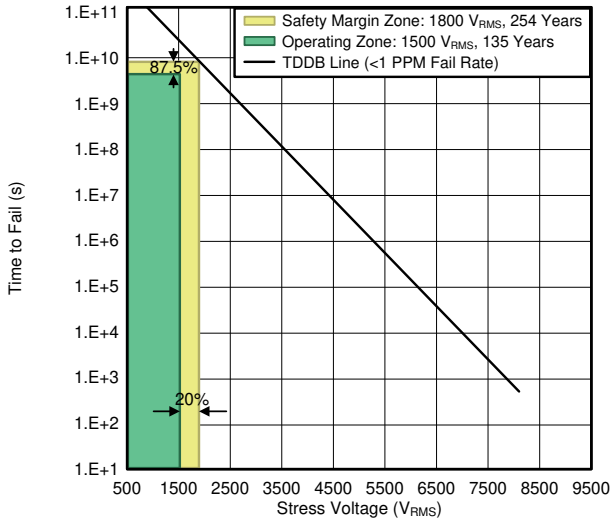



**Figure 7-3. Thermal Derating Curve for Safety-Limiting Power per VDE**




$T_A$ up to 150°C, stress-voltage frequency = 60 Hz, isolation working voltage = 1500 $V_{RMS}$, operating lifetime = 135 year

**Figure 7-4. Reinforced Isolation Capacitor Lifetime Projection**

## 7.13 Typical Characteristics

at VDD1 = 5 V, VDD2 = 3.3 V, VINP = –250 mV to 250 mV, VINN = 0 V, and $f_{IN}$ = 10 kHz (unless otherwise noted)

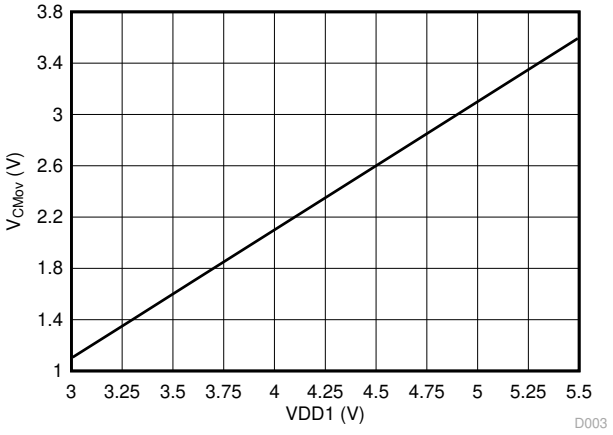
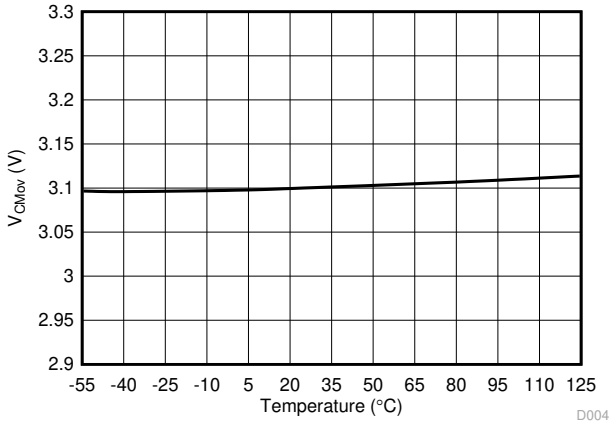
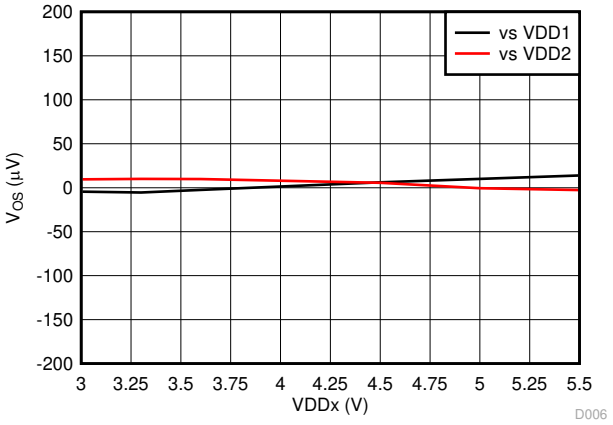



**Figure 7-5. Common-Mode Overvoltage Detection Level vs High-Side Supply Voltage**



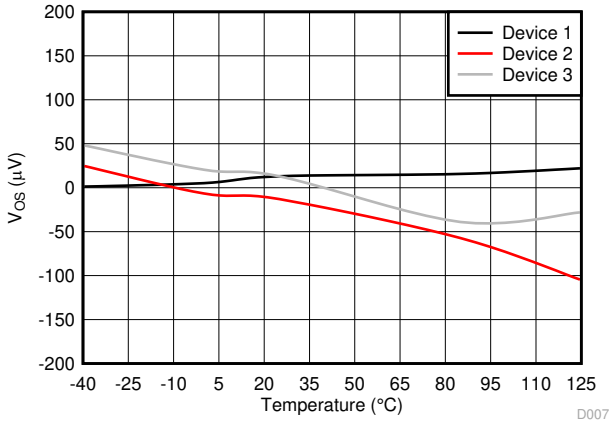

$-55°C \le T_A < -40°C$ for AMC1300B only

**Figure 7-6. Common-Mode Overvoltage Detection Level vs Temperature**



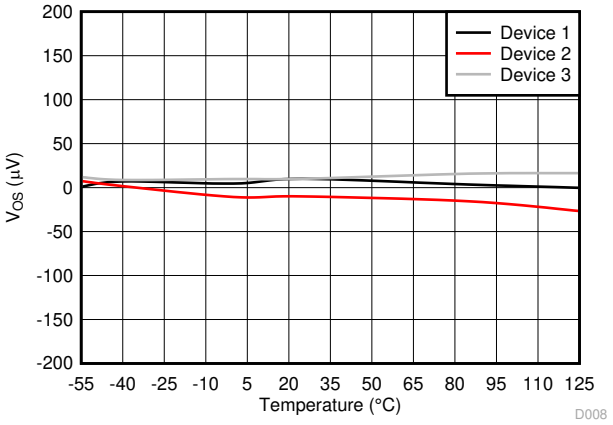

3 V ≤ VDD1 < 4.5 V for AMC1300B only

**Figure 7-7. Input Offset Voltage vs Supply Voltage**




AMC1300

**Figure 7-8. Input Offset Voltage vs Temperature**




AMC1300B

**Figure 7-9. Input Offset Voltage vs Temperature**

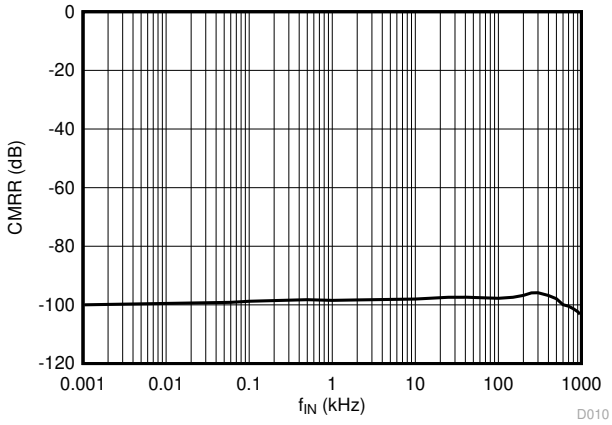
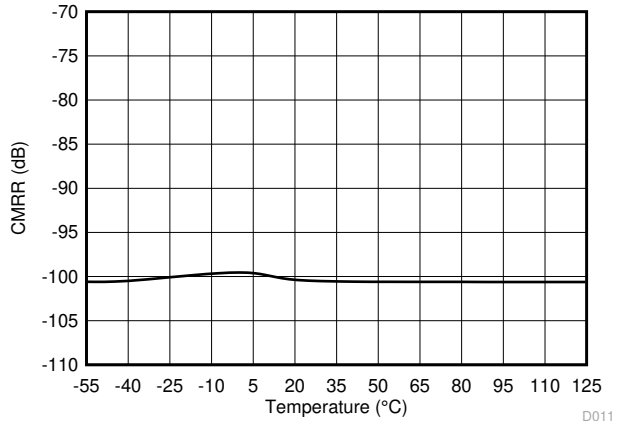



**Figure 7-10. Common-Mode Rejection Ratio vs Input Frequency**

## 7.13 Typical Characteristics (continued)

at VDD1 = 5 V, VDD2 = 3.3 V, VINP = –250 mV to 250 mV, VINN = 0 V, and $f_{IN}$ = 10 kHz (unless otherwise noted)




–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-11. Common-Mode Rejection Ratio vs Temperature**

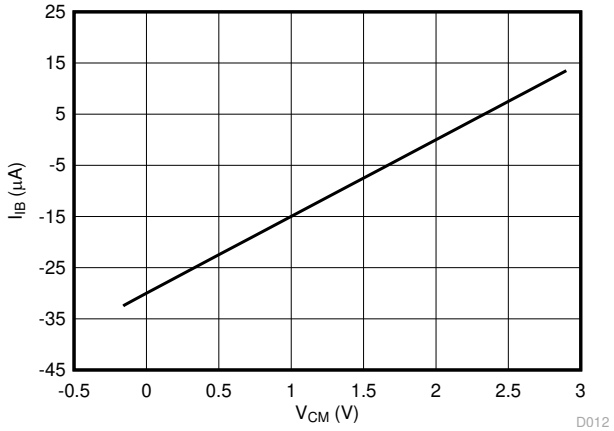



**Figure 7-12. Input Bias Current vs Common-Mode Input Voltage**

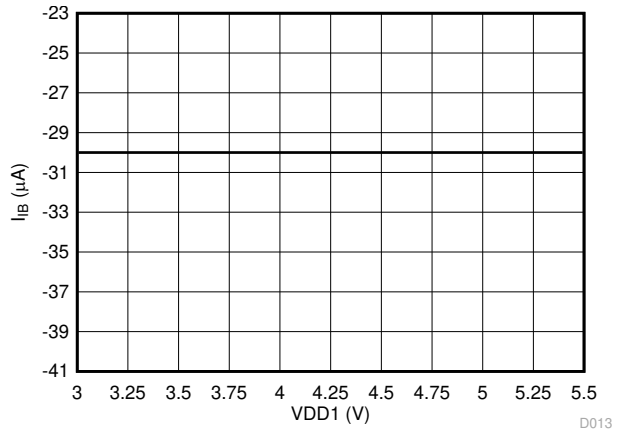
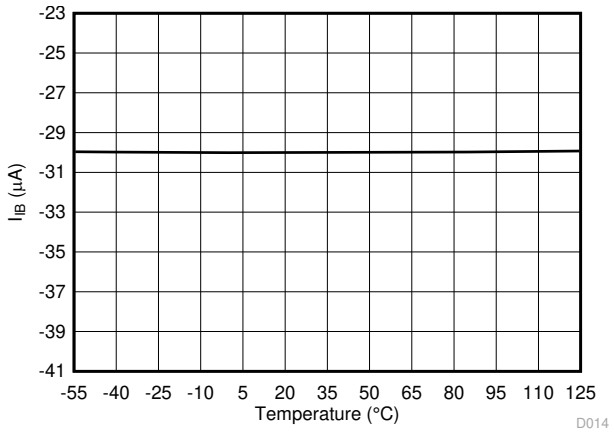



**Figure 7-13. Input Bias Current vs High-Side Supply Voltage**




–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-14. Input Bias Current vs Temperature**

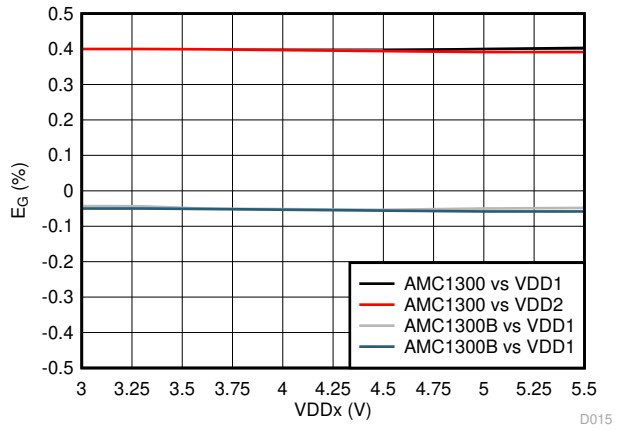
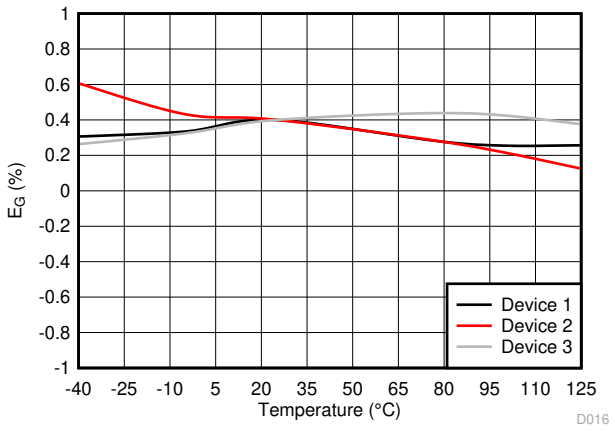



**Figure 7-15. Gain Error vs Supply Voltage**




AMC1300

**Figure 7-16. Gain Error vs Temperature**

## 7.13 Typical Characteristics (continued)

at VDD1 = 5 V, VDD2 = 3.3 V, VINP = –250 mV to 250 mV, VINN = 0 V, and $f_{IN}$ = 10 kHz (unless otherwise noted)

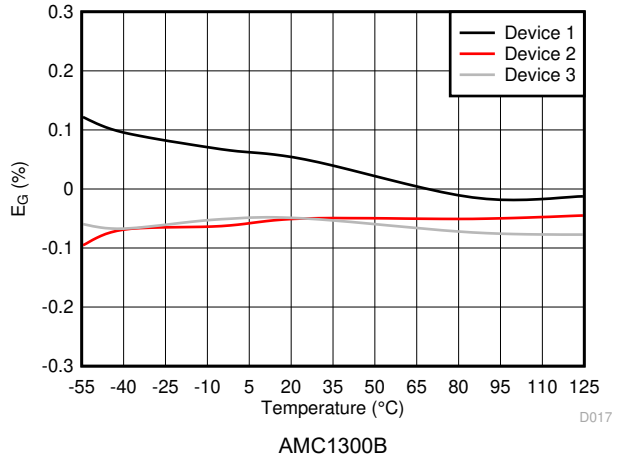



**Figure 7-17. Gain Error vs Temperature**

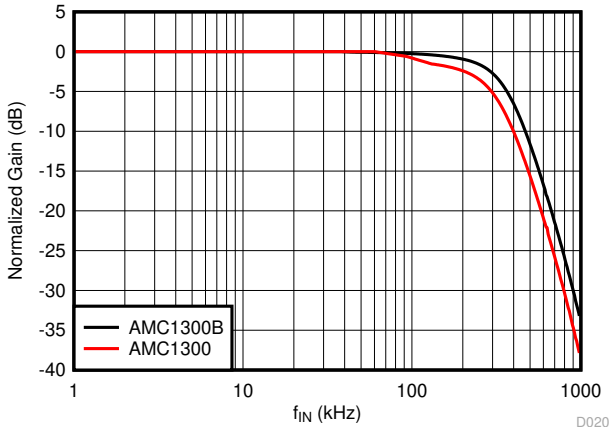



**Figure 7-18. Normalized Gain vs Input Frequency**

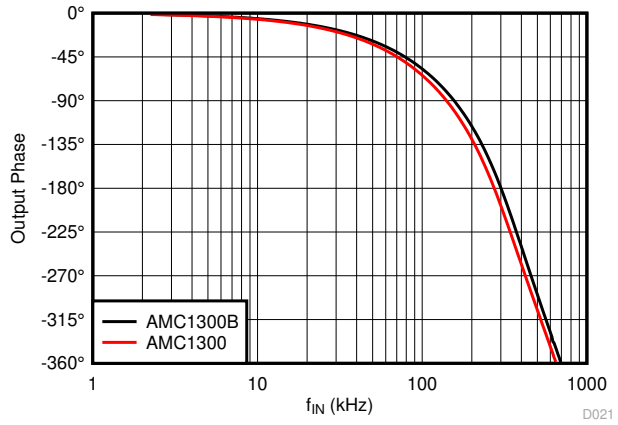



**Figure 7-19. Output Phase vs Input Frequency**

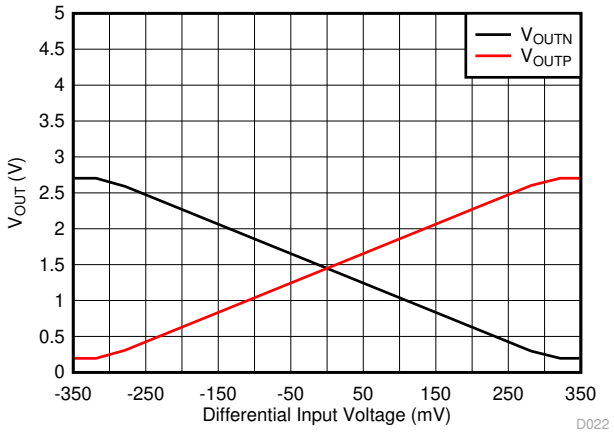



**Figure 7-20. Output Voltage vs Input Voltage**

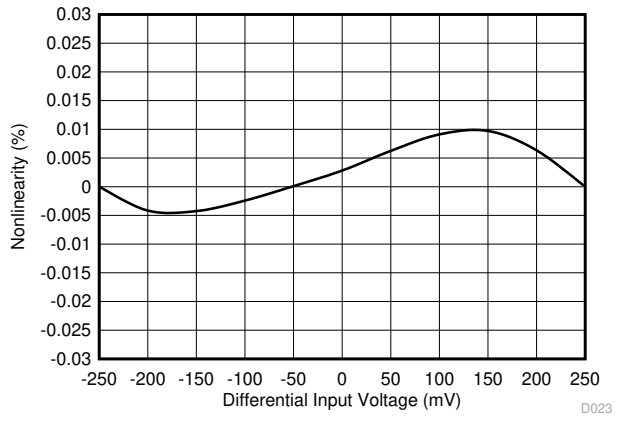



**Figure 7-21. Nonlinearity vs Input Voltage**

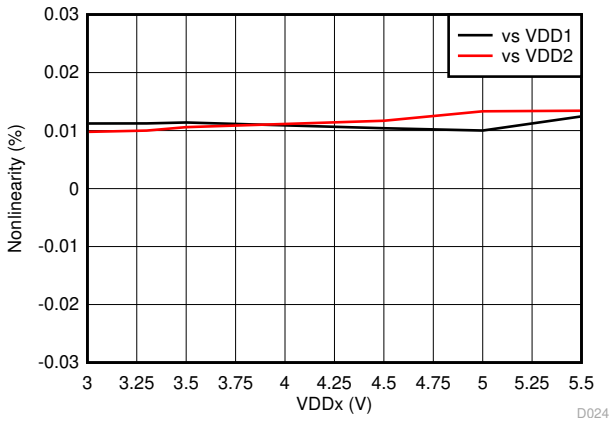
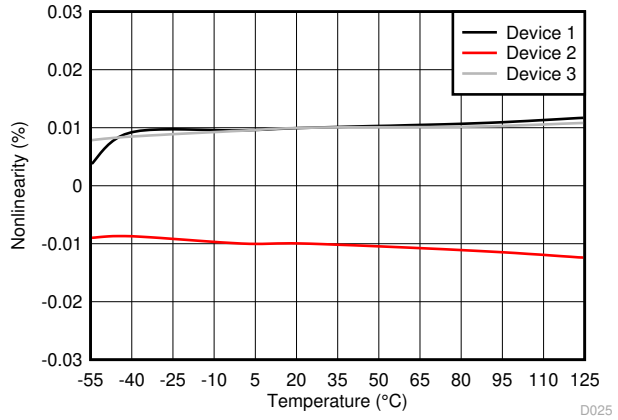



**Figure 7-22. Nonlinearity vs Supply Voltage**

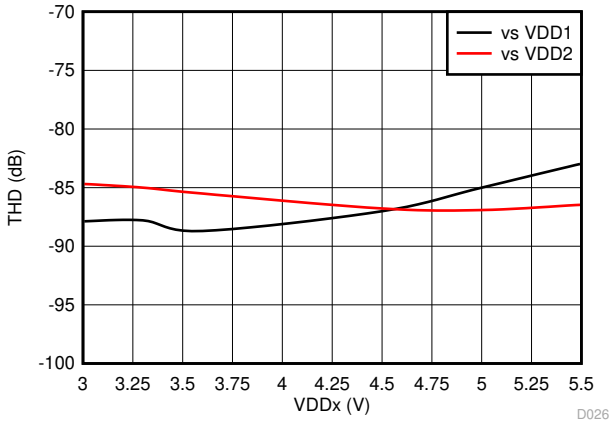
## 7.13 Typical Characteristics (continued)

at VDD1 = 5 V, VDD2 = 3.3 V, VINP = –250 mV to 250 mV, VINN = 0 V, and $f_{IN}$ = 10 kHz (unless otherwise noted)



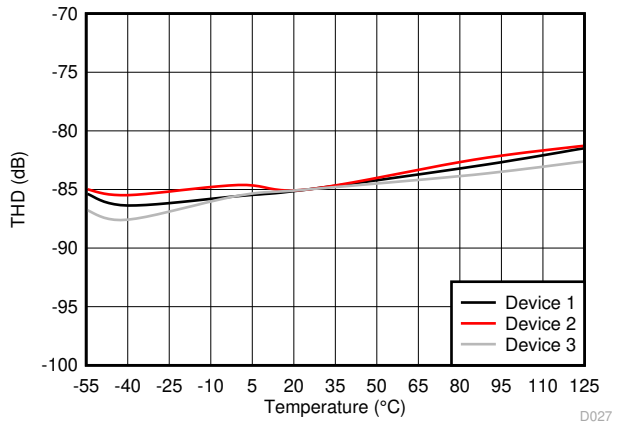

–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-23. Nonlinearity vs Temperature**




3 V ≤ VDD1 < 4.5 V for AMC1300B only

**Figure 7-24. Total Harmonic Distortion vs Supply Voltage**




–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-25. Total Harmonic Distortion vs Temperature**

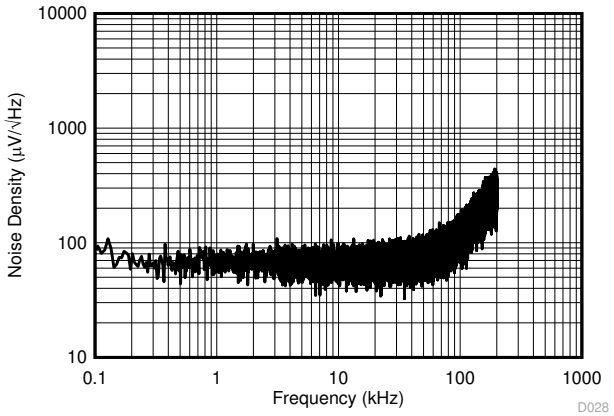



**Figure 7-26. Input-Referred Noise Density vs Frequency**

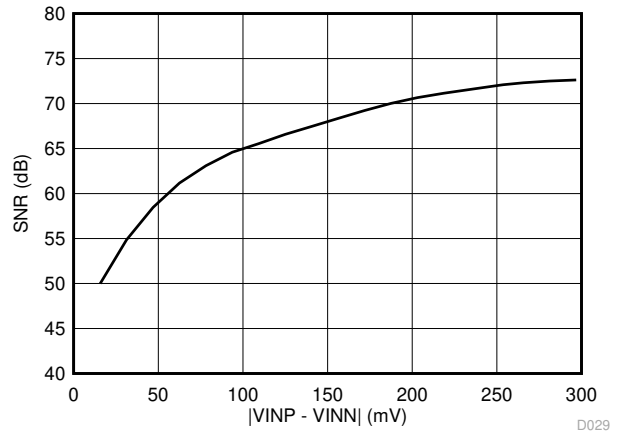
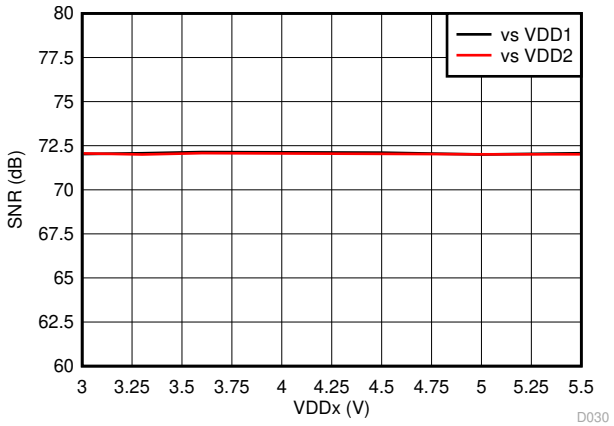



**Figure 7-27. Signal-to-Noise Ratio vs Input Voltage**

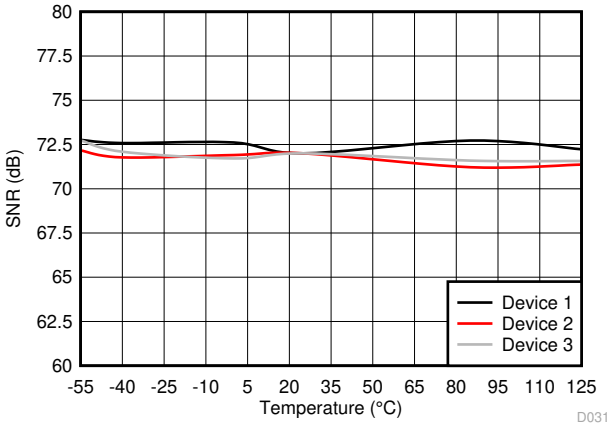



3 V ≤ VDD1 < 4.5 V for AMC1300B only

**Figure 7-28. Signal-to-Noise Ratio vs Supply Voltage**

## 7.13 Typical Characteristics (continued)

at VDD1 = 5 V, VDD2 = 3.3 V, VINP = –250 mV to 250 mV, VINN = 0 V, and $f_{IN}$ = 10 kHz (unless otherwise noted)




–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-29. Signal-to-Noise Ratio vs Temperature**

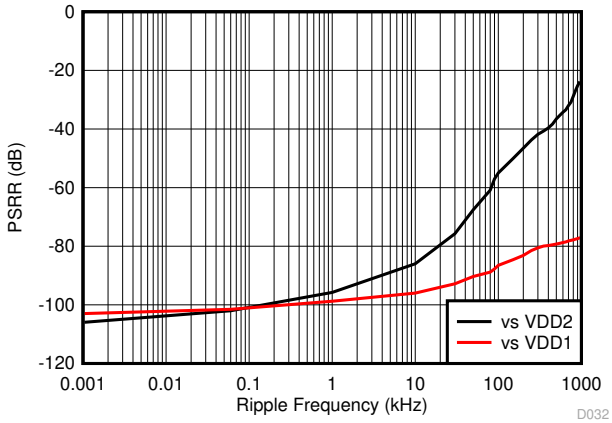



**Figure 7-30. Power-Supply Rejection Ratio vs Ripple Frequency**

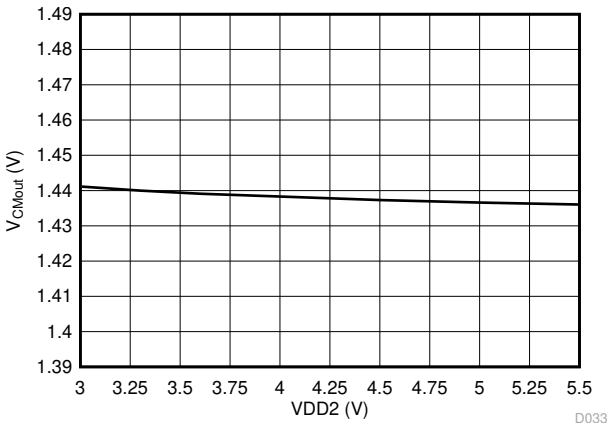
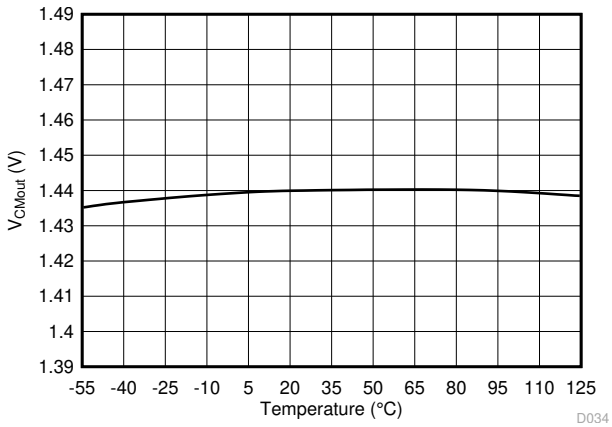



**Figure 7-31. Output Common-Mode Voltage vs Low-Side Supply Voltage**




–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-32. Output Common-Mode Voltage vs Temperature**

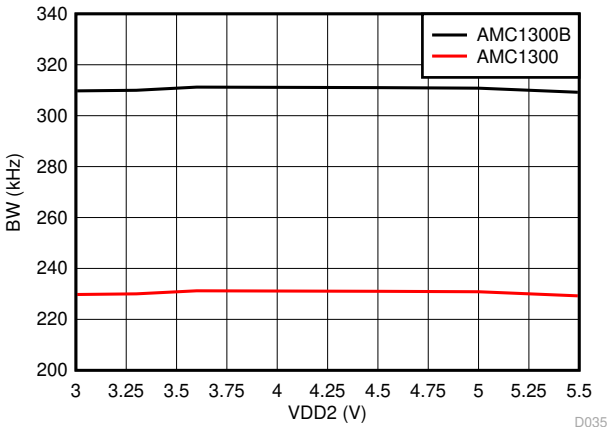



**Figure 7-33. Output Bandwidth vs Low-Side Supply Voltage**

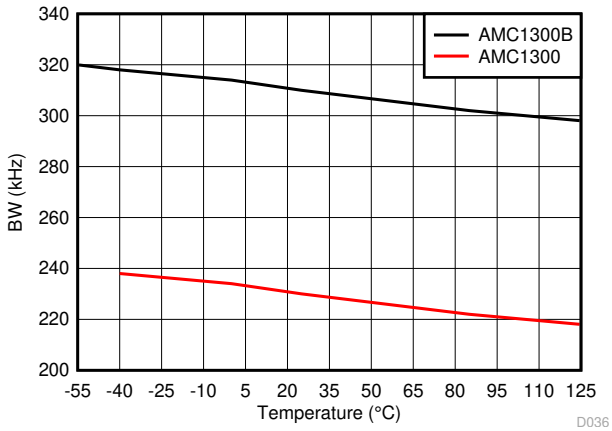
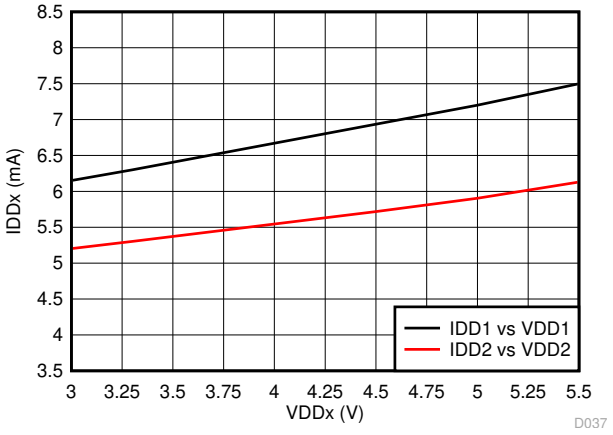



**Figure 7-34. Output Bandwidth vs Temperature**

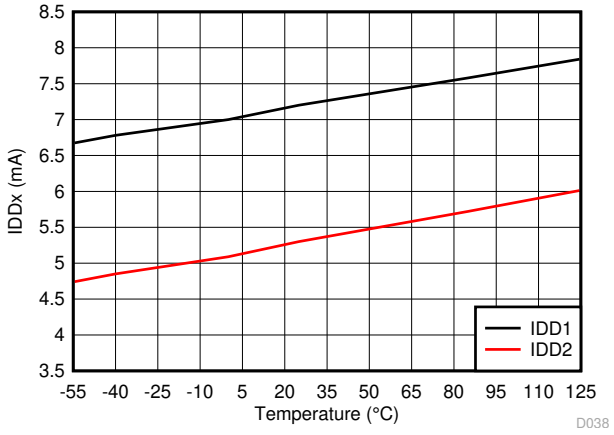
## 7.13 Typical Characteristics (continued)

at VDD1 = 5 V, VDD2 = 3.3 V, VINP = –250 mV to 250 mV, VINN = 0 V, and $f_{IN}$ = 10 kHz (unless otherwise noted)




3 V ≤ VDD1 < 4.5 V for AMC1300B only

**Figure 7-35. Supply Current vs Supply Voltage**




–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-36. Supply Current vs Temperature**

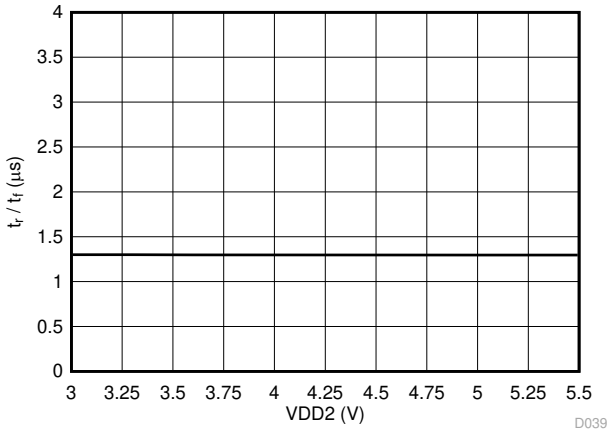
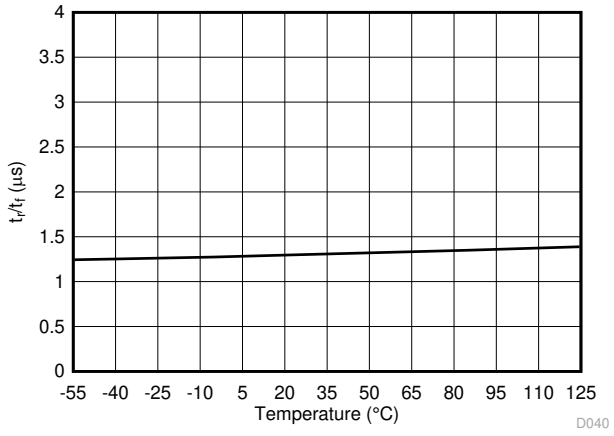
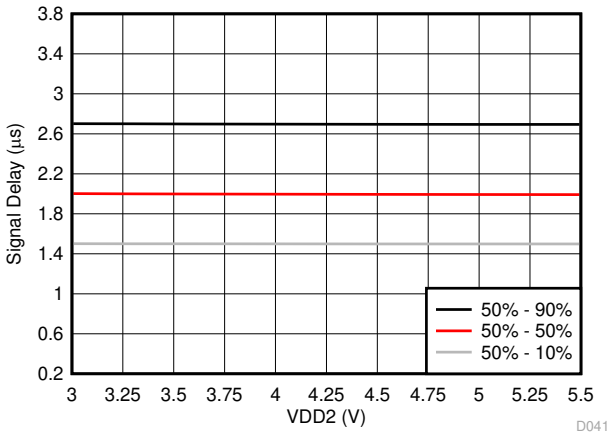



**Figure 7-37. Output Rise and Fall Time vs Low-Side Supply**



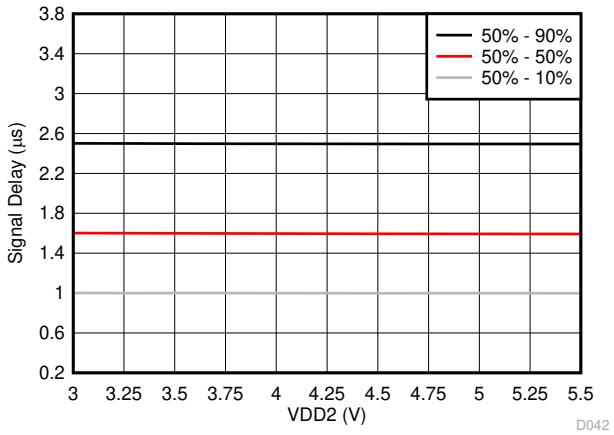

–55°C ≤ $T_A$ < –40°C for AMC1300B only

**Figure 7-38. Output Rise and Fall Time vs Temperature**




AMC1300

**Figure 7-39. $V_{IN}$ to $V_{OUT}$ Signal Delay vs Low-Side Supply Voltage**

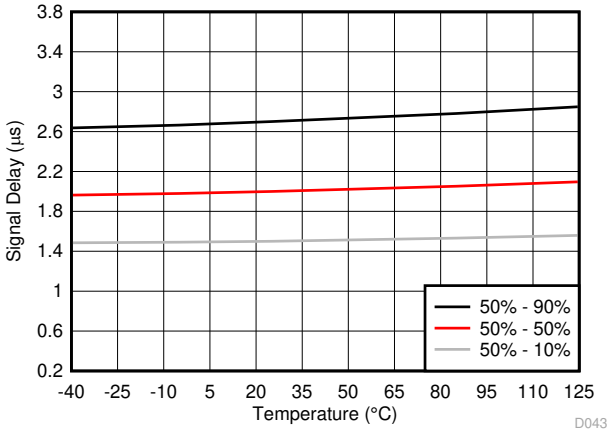



AMC1300B

**Figure 7-40. $V_{IN}$ to $V_{OUT}$ Signal Delay vs Low-Side Supply Voltage**

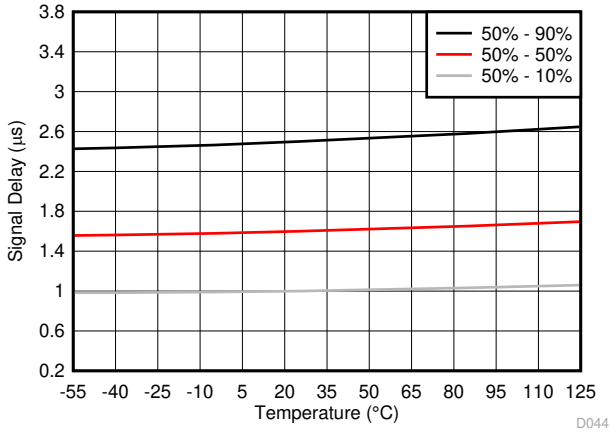
## 7.13 Typical Characteristics (continued)

at VDD1 = 5 V, VDD2 = 3.3 V, VINP = –250 mV to 250 mV, VINN = 0 V, and $f_{IN}$ = 10 kHz (unless otherwise noted)




AMC1300

**Figure 7-41. $V_{IN}$ to $V_{OUT}$ Signal Delay vs Temperature**




AMC1300B

**Figure 7-42. $V_{IN}$ to $V_{OUT}$ Signal Delay vs Temperature**

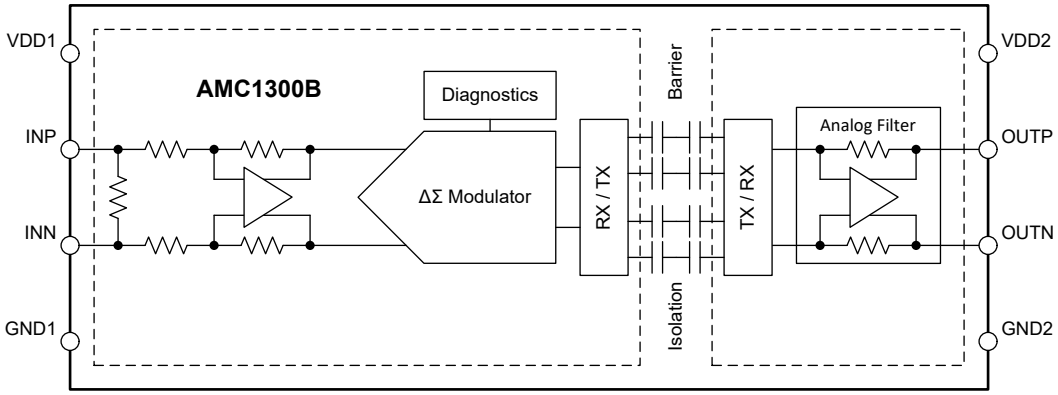
# 8 Detailed Description

## 8.1 Overview

The AMC1300 is a fully differential, precision, isolated amplifier. The input stage of the device consists of a fully differential amplifier that drives a second-order, delta-sigma (ΔΣ) modulator. The modulator converts the analog input signal into a digital bitstream that is transferred across the isolation barrier that separates the high-side from the low-side. On the low-side, the received bitstream is processed by a fourth-order analog filter that outputs a differential signal at the OUTP and OUTN pins that is proportional to the input signal.

The $SiO_2$-based, capacitive isolation barrier supports a high level of magnetic field immunity, as described in the *ISO72x Digital Isolator Magnetic-Field Immunity* application report. The digital modulation used in the AMC1300 to transmit data across the isolation barrier, and the isolation barrier characteristics itself, result in high reliability and common-mode transient immunity.

## 8.2 Functional Block Diagram




## 8.3 Feature Description

### 8.3.1 Analog Input

The differential amplifier input stage of the AMC1300 feeds a second-order, switched-capacitor, feed-forward ΔΣ modulator. The gain of the differential amplifier is set by internal precision resistors with a differential input impedance of $R_{IND}$. The modulator converts the analog input signal into a bitstream that is transferred across the isolation barrier, as described in the *Isolation Channel Signal Transmission* section.

There are two restrictions on the analog input signals INP and INN. First, if the input voltages $V_{INP}$ or $V_{INN}$ exceed the range specified in the *Absolute Maximum Ratings* table, the input currents must be limited to the absolute maximum value, because the electrostatic discharge (ESD) protection turns on. In addition, the linearity and parametric performance of the device are ensured only when the analog input voltage remains within the linear full-scale range ($V_{FSR}$) and within the common-mode input voltage range ($V_{CM}$) as specified in the *Recommended Operating Conditions* table.

### 8.3.2 Isolation Channel Signal Transmission

The AMC1300 uses an on-off keying (OOK) modulation scheme, as shown in Figure 8-1, to transmit the modulator output bitstream across the $SiO_2$-based isolation barrier. The transmit driver (TX) shown in the *Functional Block Diagram* transmits an internally generated, high-frequency carrier across the isolation barrier to represent a digital *one* and does not send a signal to represent a digital *zero*. The nominal frequency of the carrier used inside the AMC1300 is 480 MHz.

The receiver (RX) on the other side of the isolation barrier recovers and demodulates the signal and provides the input to the fourth-order analog filter. The AMC1300 transmission channel is optimized to achieve the highest level of common-mode transient immunity (CMTI) and lowest level of radiated emissions caused by the high-frequency carrier and RX/TX buffer switching.

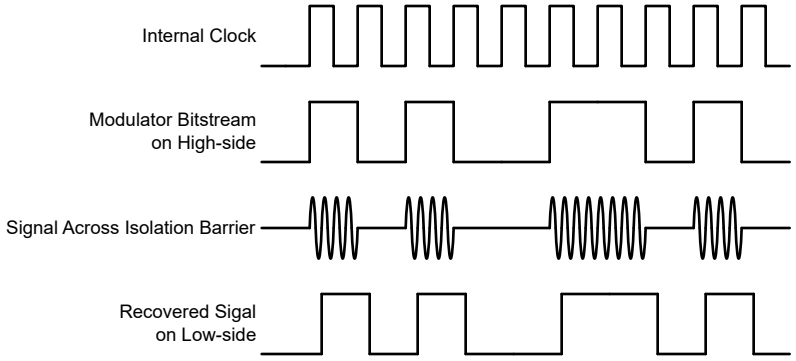



**Figure 8-1. OOK-Based Modulation Scheme**

### 8.3.3 Analog Output

The AMC1300 offers a differential analog output comprised of the OUTP and OUTN pins. For differential input voltages ($V_{INP}$ – $V_{INN}$) in the range from –250 mV to +250 mV, the device provides a linear response with a nominal gain of 8.2. For example, for a differential input voltage of 250 mV, the differential output voltage ($V_{OUTP}$ – $V_{OUTN}$) is 2.05 V. At zero input (INP shorted to INN), both pins output the same common-mode output voltage $V_{CMout}$, as specified in the *Electrical Characteristics* table. For absolute differential input voltages greater than 250 mV but less than 320 mV, the differential output voltage continues to increase in magnitude but with reduced linearity performance. The outputs saturate at a differential output voltage of $V_{CLIPout}$, as shown in Figure 8-2, if the differential input voltage exceeds the $V_{Clipping}$ value.

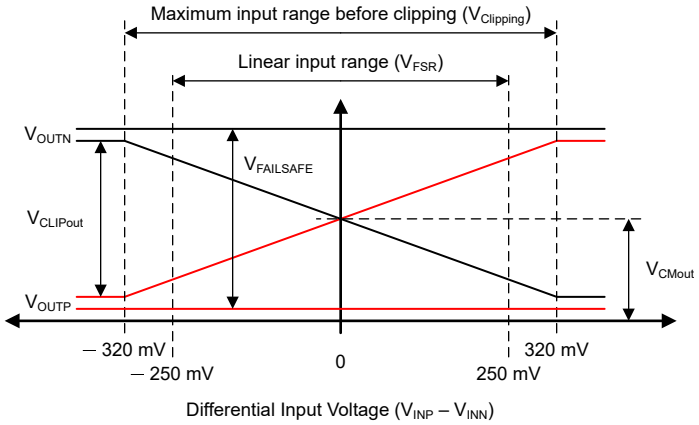



**Figure 8-2. Output Behavior of the AMC1300**

The AMC1300 offers a fail-safe feature that simplifies diagnostics on system level. Figure 8-2 shows the fail-safe potential that is a negative differential output voltage that does not occur under normal operating conditions. The fail-safe output is active in two cases:

- When the high-side supply is missing or below the $VDD1_{UV}$ threshold
- When the common-mode input voltage, that is $V_{CM}$ = ($V_{INP}$ + $V_{INN}$) / 2, exceeds the common-mode overvoltage detection level $V_{CMov}$

Use the maximum $V_{FAILSAFE}$ voltage specified in the *Electrical Characteristics* table as a reference value for fail-safe detection on system level.

## 8.4 Device Functional Modes

The AMC1300 is operational when the power supplies VDD1 and VDD2 are applied, as specified in the *Recommended Operating Conditions* table.

# 9 Application and Implementation

**Note**

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

## 9.1 Application Information

The low analog input voltage range, excellent accuracy, and low temperature drift make the AMC1300 a high-performance solution for industrial applications where shunt-based current sensing in the presence of high common-mode voltage levels is required.

## 9.2 Typical Application

The AMC1300 is ideally suited for shunt-based current sensing applications where accurate current monitoring is required in the presence of high common-mode voltages.

Figure 9-1 shows the AMC1300 in a typical application. The load current flowing through an external shunt resistor RSHUNT produces a voltage drop that is sensed by the AMC1300. The AMC1300 digitizes the analog input signal on the high-side, transfers the data across the isolation barrier to the low-side, reconstructs the analog signal, and presents that signal as a differential voltage on the output pins.

The differential input, differential output, and the high common-mode transient immunity (CMTI) of the AMC1300 ensure reliable and accurate operation even in high-noise environments.

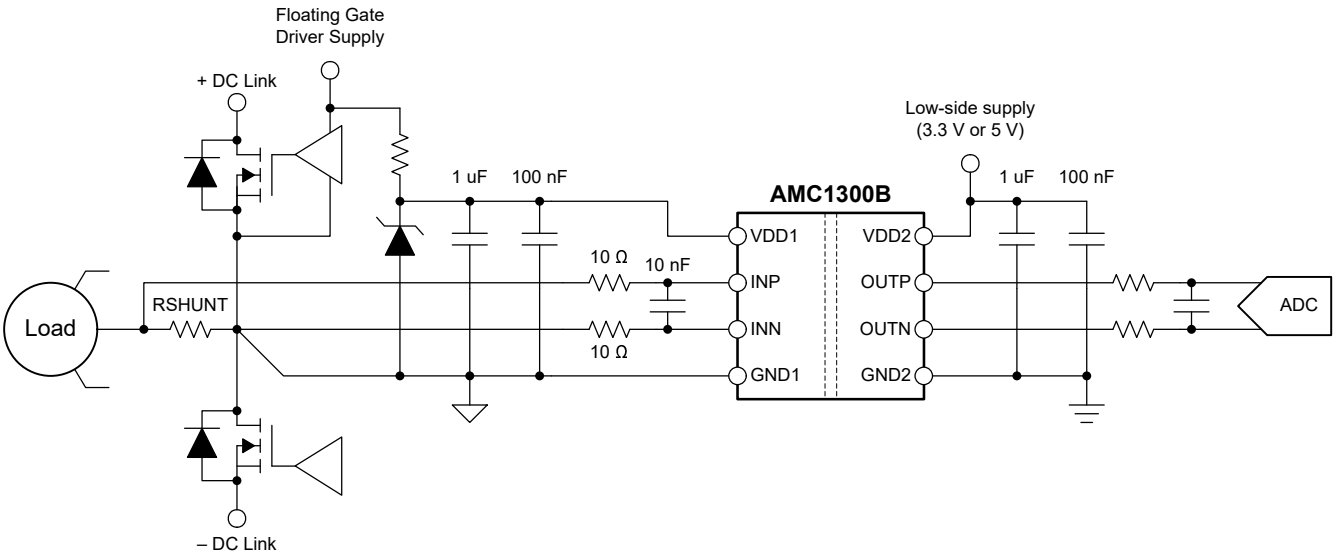



**Figure 9-1. Using the AMC1300 for Current Sensing in a Typical Application**

### 9.2.1 Design Requirements

Table 9-1 lists the parameters for this typical application.

**Table 9-1. Design Requirements**

| PARAMETER | VALUE |
|---|---|
| High-side supply voltage | 3.3 V or 5 V |
| Low-side supply voltage | 3.3 V or 5 V |
| Voltage drop across RSHUNT for a linear response | ± 250 mV (maximum) |
| Signal delay (50% VIN to 90% OUTP, OUTN) | 3 µs (maximum) |

### 9.2.2 Detailed Design Procedure

In Figure 9-1, the high-side power supply (VDD1) for the AMC1300 is derived from the floating power supply of the upper gate driver.

The floating ground reference (GND1) is derived from the end of the shunt resistor that is connected to the negative input of the AMC1300 (INN). If a four-pin shunt is used, the inputs of the AMC1300 are connected to the inner leads and GND1 is connected to the outer lead on the INN-side of the shunt. To minimize offset and improve accuracy, route the ground connection as a separate trace that connects directly to the shunt resistor rather than shorting GND1 to INN directly at the input to the device. See the *Layout* section for more details.

#### *9.2.2.1 Shunt Resistor Sizing*

Use Ohm's Law to calculate the voltage drop across the shunt resistor ($V_{SHUNT}$) for the desired measured current: $V_{SHUNT} = I \times RSHUNT$.

Consider the following two restrictions when selecting the value of the shunt resistor, RSHUNT:

- The voltage drop caused by the nominal current range must not exceed the recommended differential input voltage range for a linear response: $|V_{SHUNT}| \leq |V_{FSR}|$
- The voltage drop caused by the maximum allowed overcurrent must not exceed the input voltage that causes a clipping output: $|V_{SHUNT}| \leq |V_{Clipping}|$

#### *9.2.2.2 Input Filter Design*

TI recommends placing an RC filter in front of the isolated amplifier to improve signal-to-noise performance of the signal path. Design the input filter such that:

- The cutoff frequency of the filter is at least one order of magnitude lower than the sampling frequency (20 MHz) of the ΔΣ modulator
- The input bias current does not generate significant voltage drop across the DC impedance of the input filter
- The impedances measured from the analog inputs are equal

For most applications, the structure shown in Figure 9-2 achieves excellent performance.

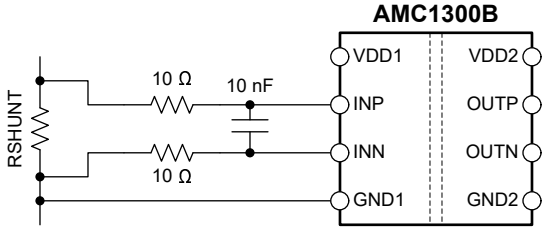



**Figure 9-2. Differential Input Filter**

#### 9.2.2.3 Differential-to-Single-Ended Output Conversion

Figure 9-3 shows an example of a TLV6001-based signal conversion and filter circuit for systems using single-ended-input ADCs to convert the analog output voltage into digital. With R1 = R2 = R3 = R4, the output voltage equals ($V_{OUTP}$ – $V_{OUTN}$) + $V_{REF}$. Tailor the bandwidth of this filter stage to the bandwidth requirement of the system. For most applications, R1 = R2 = R3 = R4 = 3.3 kΩ and C1 = C2 = 330 pF yields good performance.

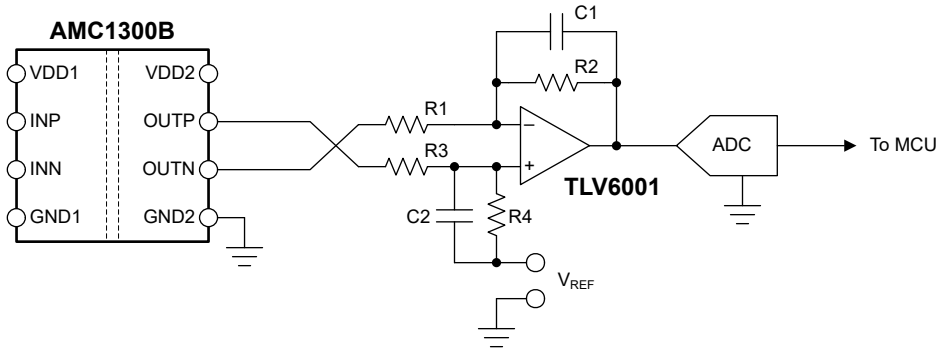



**Figure 9-3. Connecting the AMC1300 Output to a Single-Ended Input ADC**

For more information on the general procedure to design the filtering and driving stages of SAR ADCs, see the *18-Bit, 1MSPS Data Acquisition Block (DAQ) Optimized for Lowest Distortion and Noise* and *18-Bit Data Acquisition Block (DAQ) Optimized for Lowest Power* reference guides, available for download at www.ti.com.

### 9.2.3 Application Curves

One important aspect of power-stage design is the effective detection of an overcurrent condition to protect the switching devices and passive components from damage. To power off the system quickly in the event of an overcurrent condition, a low delay caused by the isolated amplifier is required. Figure 9-4 shows the typical full-scale step response of the AMC1300.

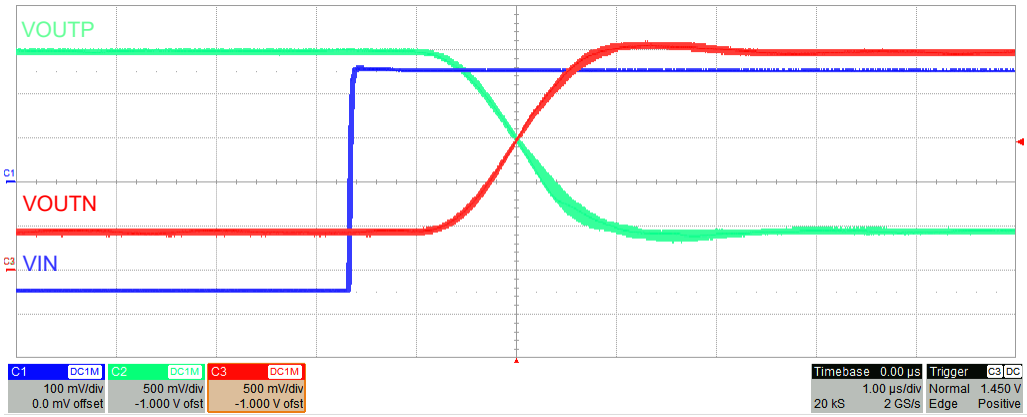



**Figure 9-4. Step Response of the AMC1300**

## 9.3 What To Do and What Not To Do

Do not leave the inputs of the AMC1300 unconnected (floating) when the device is powered up. If the device inputs are left floating, the input bias current may drive the inputs to a positive value that exceeds the operating common-mode input voltage and the device outputs the fail-safe voltage as described in the *Analog Output* section.

Connect the high-side ground (GND1) to INN, either by a hard short or through a resistive path. A DC current path between INN and GND1 is required to define the input common-mode voltage. Do not exceed the input common-mode range specified in the *Recommended Operating Conditions* table. For best accuracy, route the ground connection as a separate trace that connects directly to the shunt resistor rather than shorting GND1 to INN directly at the input to the device. See the *Layout* section for more details.

## 10 Power Supply Recommendations

The AMC1300 does not require any specific power up sequencing. The high-side power-supply (VDD1) is decoupled with a low-ESR, 100-nF capacitor (C1) parallel to a low-ESR, 1-µF capacitor (C2). The low-side power supply (VDD2) is equally decoupled with a low-ESR, 100-nF capacitor (C3) parallel to a low-ESR, 1-µF capacitor (C4). Place all four capacitors (C1, C2, C3, and C4) as close to the device as possible.

The ground reference for the high-side (GND1) is derived from the end of the shunt resistor, which is connected to the negative input (INN) of the device. For best DC accuracy, use a separate trace (as shown in Figure 10-1) to make this connection instead of shorting GND1 to INN directly at the device input. If a four-terminal shunt is used, the device inputs are connected to the inner leads and GND1 is connected to the outer lead on the INN-side of the shunt.

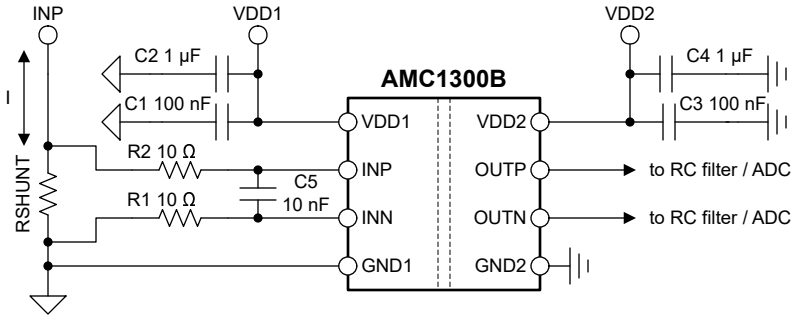



**Figure 10-1. Decoupling of the AMC1300**

Capacitors must provide adequate effective capacitance under the applicable DC bias conditions they experience in the application. Multilayer ceramic capacitors (MLCCs) typically exhibit only a fraction of their nominal capacitance under real-world conditions and this factor must be taken into consideration when selecting these capacitors. This problem is especially acute in low-profile capacitors, in which the dielectric field strength is higher than in taller components. Reputable capacitor manufacturers provide capacitance versus DC bias curves that greatly simplify component selection.

# 11 Layout

## 11.1 Layout Guidelines

Figure 11-1 shows a layout recommendation with the critical placement of the decoupling capacitors (as close as possible to the AMC1300 supply pins) and placement of the other components required by the device. For best performance, place the shunt resistor close to the INP and INN inputs of the AMC1300 and keep the layout of both connections symmetrical.

## 11.2 Layout Example

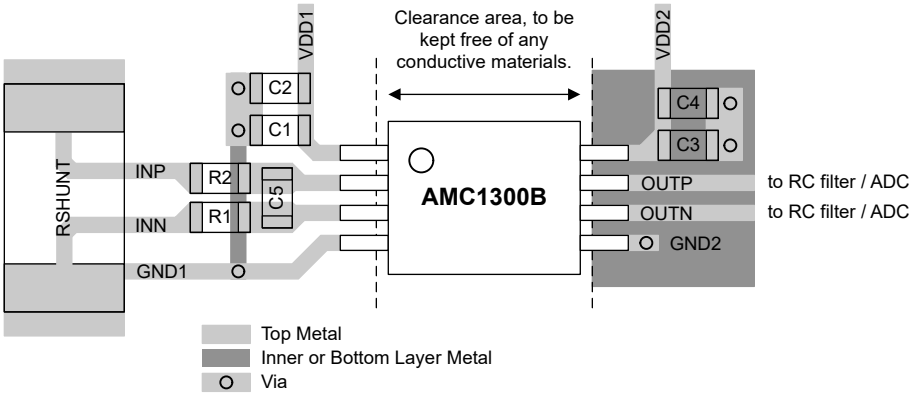



**Figure 11-1. Recommended Layout of the AMC1300**

# 12 Device and Documentation Support

## 12.1 Documentation Support

### 12.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *Isolation Glossary* application report
- Texas Instruments, *Semiconductor and IC Package Thermal Metrics* application report
- Texas Instruments, *ISO72x Digital Isolator Magnetic-Field Immunity* application report
- Texas Instruments, *TLV600x Low-Power, Rail-to-Rail In/Out, 1-MHz Operational Amplifier for Cost-Sensitive Systems* data sheet
- Texas Instruments, *18-Bit, 1-MSPS Data Acquisition Block (DAQ) Optimized for Lowest Distortion and Noise* reference guide
- Texas Instruments, *18-Bit, 1-MSPS Data Acquisition Block (DAQ) Optimized for Lowest Power* reference guide
- Texas Instruments, *Isolated Amplifier Voltage Sensing Excel Calculator* design tool

## 12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

## 12.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

## 12.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

## 12.5 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 12.6 Glossary

| | |
|---|---|
| TI Glossary | This glossary lists and explains terms, acronyms, and definitions. |

# 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| AMC1300BDWV | Active | Production | SOIC (DWV) \| 8 | 64 \| TUBE | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300BDWV.A | Active | Production | SOIC (DWV) \| 8 | 64 \| TUBE | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300BDWV.B | Active | Production | SOIC (DWV) \| 8 | 64 \| TUBE | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300BDWVG4.A | Active | Production | SOIC (DWV) \| 8 | 64 \| TUBE | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300BDWVG4.B | Active | Production | SOIC (DWV) \| 8 | 64 \| TUBE | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300BDWVR | Active | Production | SOIC (DWV) \| 8 | 1000 \| LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300BDWVR.A | Active | Production | SOIC (DWV) \| 8 | 1000 \| LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300BDWVR.B | Active | Production | SOIC (DWV) \| 8 | 1000 \| LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300B |
| AMC1300DWV | Active | Production | SOIC (DWV) \| 8 | 64 \| TUBE | Yes | NIPDAU | Level-3-260C-168 HR | -40 to 125 | AMC1300 |
| AMC1300DWV.B | Active | Production | SOIC (DWV) \| 8 | 64 \| TUBE | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300 |
| AMC1300DWVR | Active | Production | SOIC (DWV) \| 8 | 1000 \| LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -40 to 125 | AMC1300 |
| AMC1300DWVR.A | Active | Production | SOIC (DWV) \| 8 | 1000 \| LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300 |
| AMC1300DWVR.B | Active | Production | SOIC (DWV) \| 8 | 1000 \| LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -55 to 125 | AMC1300 |

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

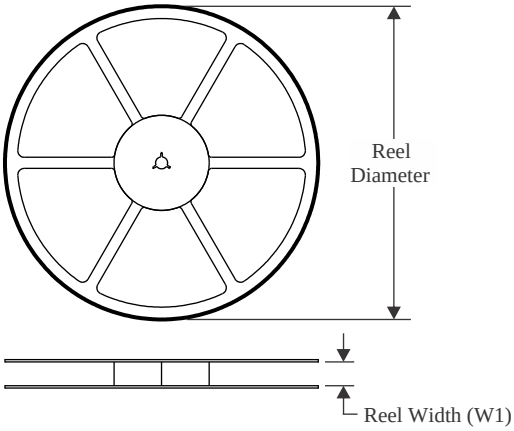
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

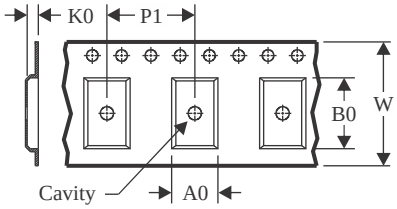
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

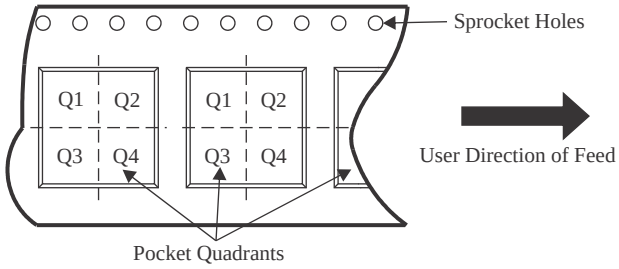



**TAPE DIMENSIONS**




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

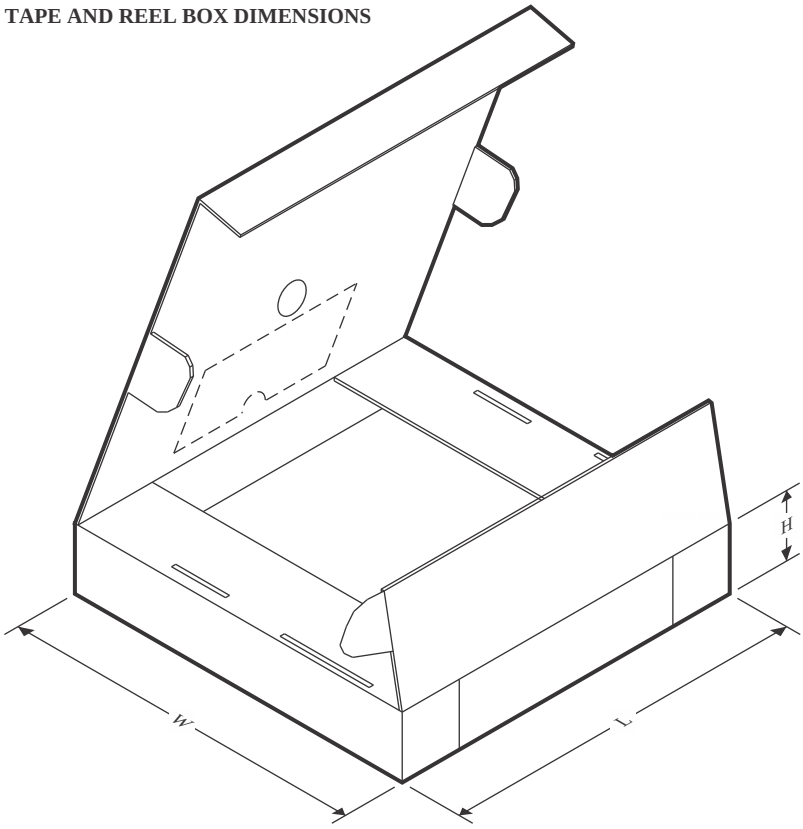
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AMC1300BDWVR | SOIC | DWV | 8 | 1000 | 330.0 | 16.4 | 12.15 | 6.2 | 3.05 | 16.0 | 16.0 | Q1 |
| AMC1300DWVR | SOIC | DWV | 8 | 1000 | 330.0 | 16.4 | 12.15 | 6.2 | 3.05 | 16.0 | 16.0 | Q1 |

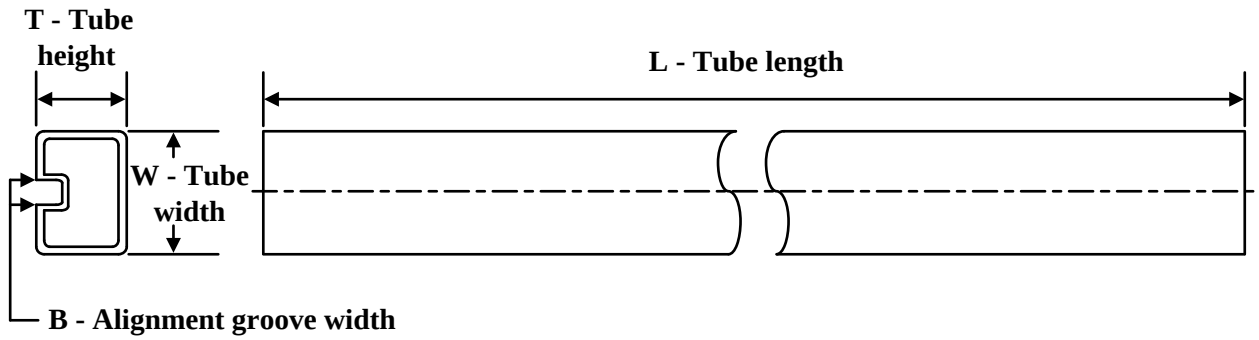
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

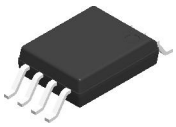
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| AMC1300BDWVR | SOIC | DWV | 8 | 1000 | 356.0 | 356.0 | 35.0 |
| AMC1300DWVR | SOIC | DWV | 8 | 1000 | 356.0 | 356.0 | 35.0 |

## TUBE




*All dimensions are nominal

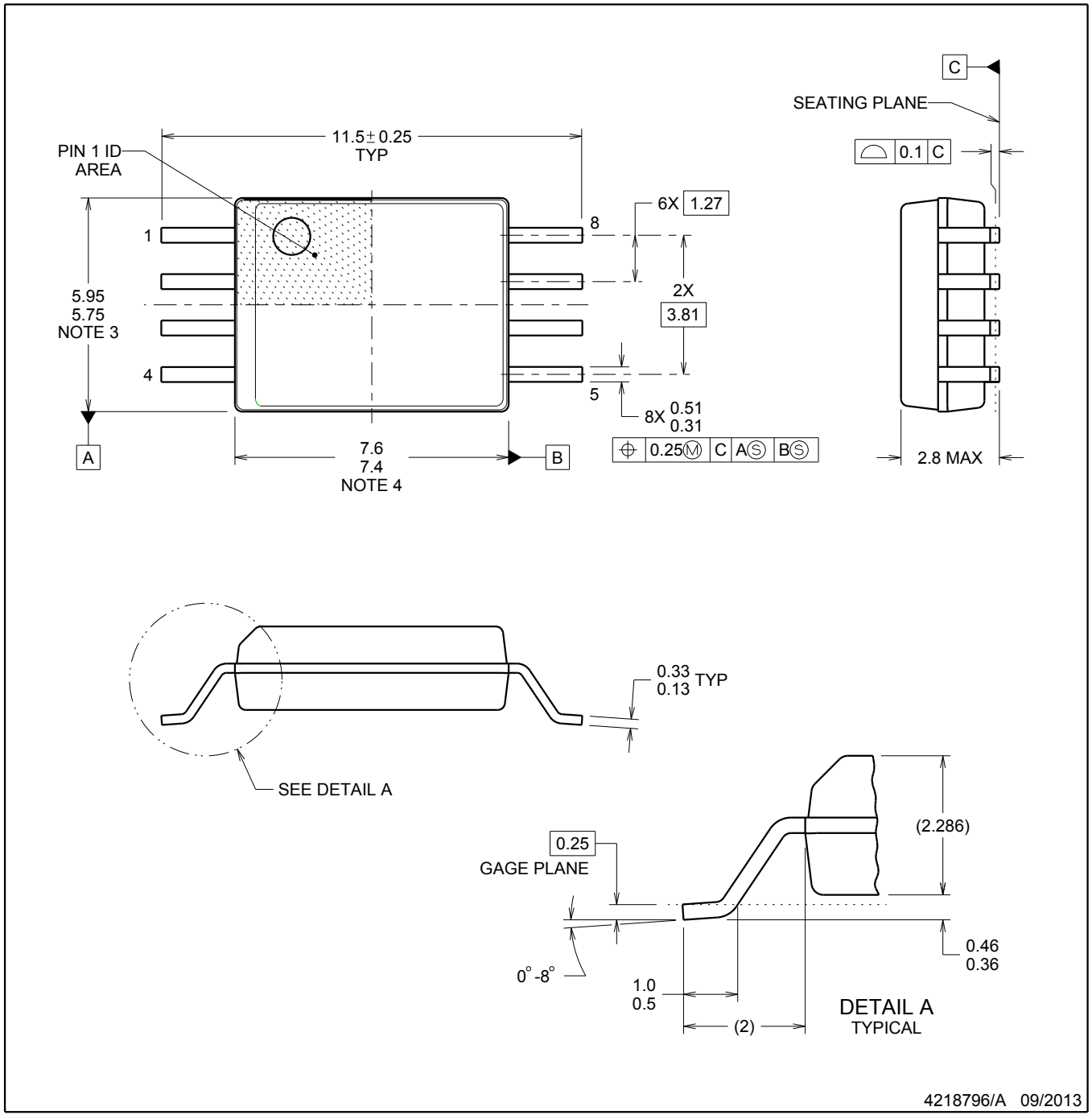
| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|---|---|---|---|---|---|---|---|---|
| AMC1300BDWV | DWV | SOIC | 8 | 64 | 505.46 | 13.94 | 4826 | 6.6 |
| AMC1300BDWV.A | DWV | SOIC | 8 | 64 | 505.46 | 13.94 | 4826 | 6.6 |
| AMC1300BDWV.B | DWV | SOIC | 8 | 64 | 505.46 | 13.94 | 4826 | 6.6 |
| AMC1300BDWVG4.A | DWV | SOIC | 8 | 64 | 505.46 | 13.94 | 4826 | 6.6 |
| AMC1300BDWVG4.B | DWV | SOIC | 8 | 64 | 505.46 | 13.94 | 4826 | 6.6 |
| AMC1300DWV | DWV | SOIC | 8 | 64 | 505.46 | 13.94 | 4826 | 6.6 |
| AMC1300DWV.B | DWV | SOIC | 8 | 64 | 505.46 | 13.94 | 4826 | 6.6 |



# DWV0008A

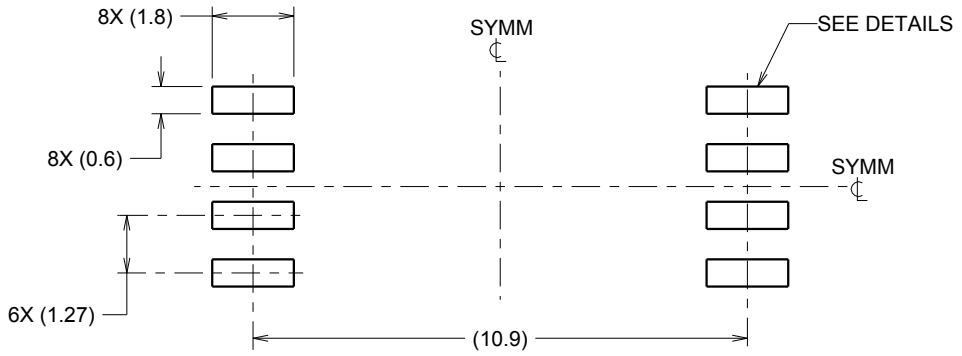
## SOIC - 2.8 mm max height

SOIC

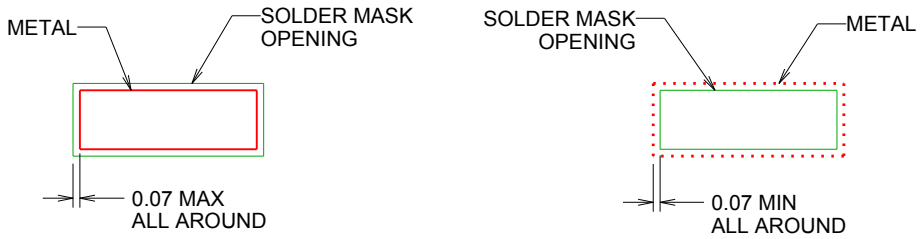



NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.




LAND PATTERN EXAMPLE
9.1 mm NOMINAL CLEARANCE/CREEPAGE
SCALE:6X




SOLDER MASK DETAILS

4218796/A 09/2013

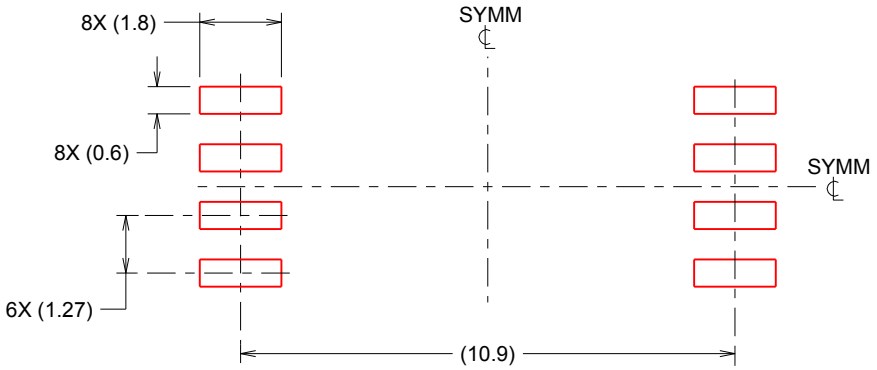
NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

DWV0008A

SOIC - 2.8 mm max height

SOIC




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4218796/A 09/2013

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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