

Full Bridge Power Amplifier

FEATURES

- Dual Power Operational Amplifiers
- $\pm 2A$ Output Current Guaranteed
- Precision Current Sense Amplifier
- Two Supply Monitoring Inputs
- Parking Function and Under-Voltage Lockout
- Safe Operating Area Protection
- 3V to 35V Operation

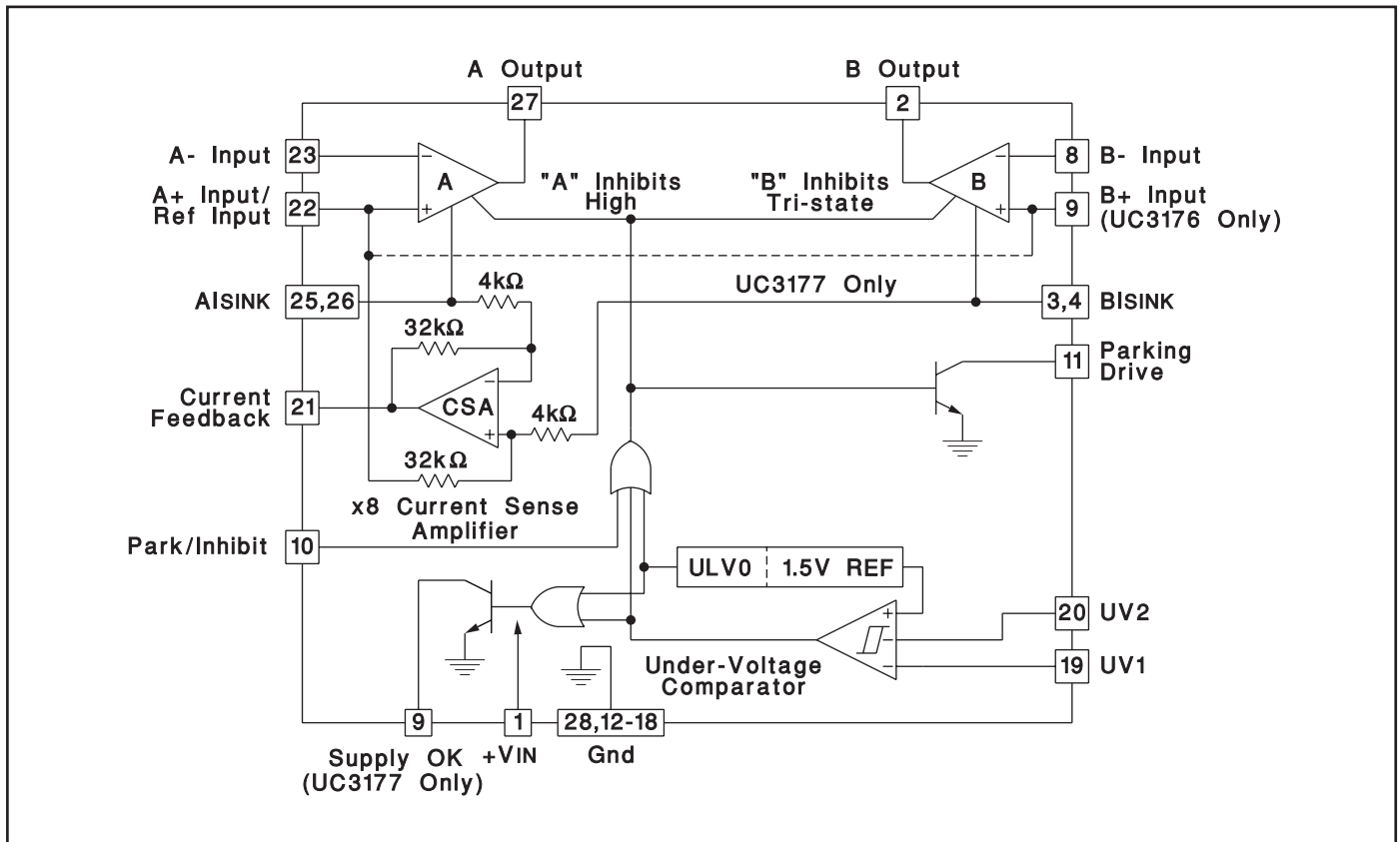
DESCRIPTION

The UC3176/7 family of full bridge power amplifiers is rated for a continuous output current of 2A. Intended for use in demanding servo applications such as disk head positioning, the onboard current sense amplifier can be used to obtain precision control of load current, or where voltage mode drive is required, a standard voltage feedback scheme can be used. Output stage protection includes foldback current limiting and thermal shutdown, resulting in a very rugged device.

Auxiliary functions on this device include a dual input under-voltage comparator that can be programmed to respond to low voltage conditions on two independent supplies. In response to an under-voltage condition the power Op-Amps are inhibited and a high current, 100mA, open collector drive output is activated. A separate Park/Inhibit command input.

The devices are operational over a 3V to 35V supply range. Internal under-voltage lockout provides predictable power-up and power-down characteristics.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)

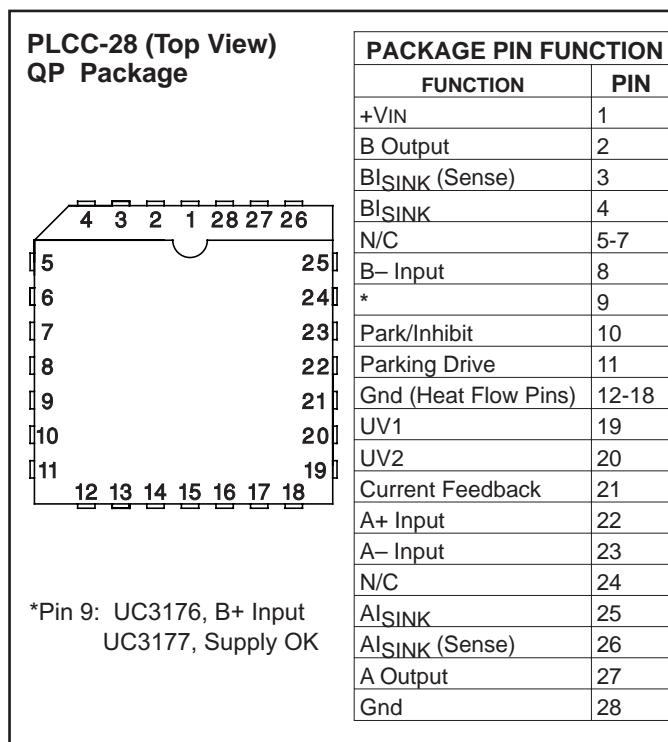
| | |
|--|---------------------------|
| Input Supply voltage, (+V _{IN}) | 40V |
| Park/Inhibit, UV1 and UV2 inputs (zener clamped) | |
| Maximum forced voltage | -0.3V to 10V |
| Maximum forced current | ±10mA |
| Other Input Voltages | -0.3V to +V _{IN} |
| A _{SINK} and B _{SINK} Voltages | -0.3V to 6V |
| Open Collector Output Voltages | 40V |
| A and B Output Currents (Continuous) | |
| Source | Internally Limited |
| Sink | 2.5A |
| Total Supply Current (Continuous) | 4A |
| Parking Drive Output Current (Continuous) | 200mA |
| Supply OK Output Current, UC3177 (Continuous) | 30mA |
| Operating Junction Temperature | -55°C to +150°C |
| Power Dissipation at TC = +75°C | |
| QP package | 4W |
| Storage Temperature | -65°C to +150°C |

THERMAL DATA

QP package:

| | |
|---|--------|
| Thermal Resistance Junction to Leads, θ_{JL} | 15°C/W |
| Thermal Resistance Junction to Ambient, θ_{JA} | 50°C/W |
| Thermal Resistance Junction to C _{OSC} , θ_{JC} | 30°C/W |

CONNECTION DIAGRAM

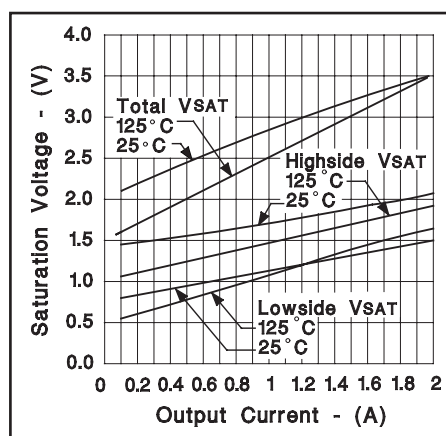


ELECTRICAL CHARACTERISTICS: Unless otherwise stated, specifications hold for T_A = 0 to 70°C, +V_{IN} = 12V, T_A = T_J.

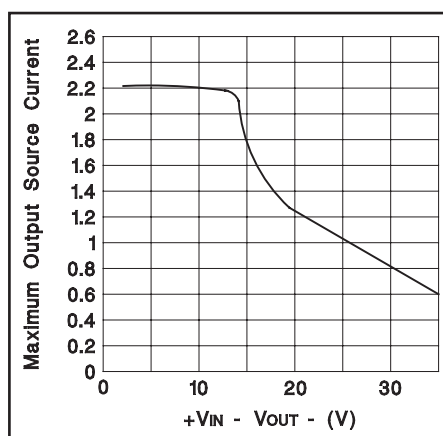
| PARAMETER | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|--|------|------|------|-------|
| Input Supply | | | | | |
| Supply Current | +V _{IN} = 12V | | 18 | 25 | mA |
| | +V _{IN} = 35V | | 21 | 30 | mA |
| UVOL Threshold | +V _{IN} low to high | | 2.8 | 3.0 | V |
| | Threshold Hysteresis | | 220 | 300 | mV |
| Power, Amplifier, A and B | | | | | |
| Input Offset Voltage | V _{CM} = 6V, V _{OUT} = 6V | | | 8 | mV |
| Input Bias Current | V _{CM} = 6V, Except A+ Input | -500 | -100 | | nA |
| Input Bias Current at A+/Reference Input | (A+/REF - B _{SINK}) / 36kΩ; T _J = 25°C | 23 | 28 | 35 | μA/V |
| Input Offset Current B Amp (UC3176 Only) | V _{CM} = 6V | | | 200 | nA |
| CMRR | V _{CM} = 1 to 33V, +V _{IN} = 35V, V _{OUT} = 6V | 70 | 100 | | dB |
| PSRR | +V _{IN} = 5 to 35V, V _{CM} = 2.5V | 70 | 100 | | dB |
| Large Signal Voltage Gain | V _{OUT} = 3V, w/I _{OUT} = 1A to V _{OUT} = 9V, w/I _{OUT} = -1A | 1.5 | 4 | | V/mV |
| Thermal Feedback | +V _{IN} = 20V, Pd = 20W at opposite output | | 25 | 200 | μV/W |
| Saturation Voltage | I _{OUT} = -2A, High Side, T _J = 25° | | 1.9 | | V |
| | C _I _{OUT} = 2A, Low Side, T _J = 25°C | | 1.6 | | V |
| | Total V _{SAT} at 2A, T _J = 25°C | | 3.5 | 3.7 | V |
| Unity Gain Bandwidth | | | 1 | | MHz |
| Slew Rate | | | 1 | | V/μs |
| Differential I _{OUT} Sense Error Current in Bridge Configuration | I _{OUT} (A) = -I _{OUT} (B), I _{OUT} / - / A _{SINK} - B _{SINK} / | | | | |
| | I _{OUT} ≤ 200mA | | 3.0 | 6.0 | mA |
| | I _{OUT} ≤ 2A | | 5.0 | 10 | mA |
| High Side Current Limiting | =V _{IN} - V _{OUT} < 12V | | -2.7 | -2.0 | A |

ELECTRICAL CHARACTERISTICS: Unless otherwise stated, specifications hold for $T_A = 0$ to 70°C , $+V_{IN} = 12\text{V}$, $T_A = T_J$.

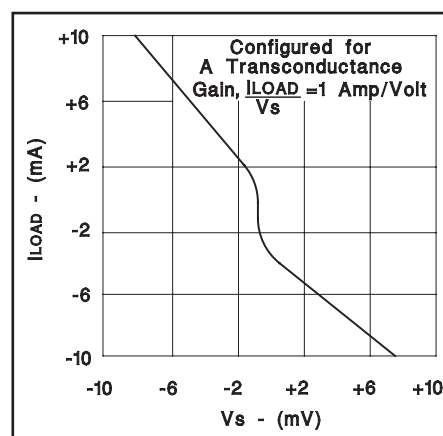
| PARAMETER | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|-----------------------------------|---|-------|-------|------|------------------|
| Current Sense Amplifier | | | | | |
| Input Offset Voltage | $V_{CM} = 0\text{V}$, A+ / REF at 6V | | | 3 | mV |
| | REF = 2V to 20V, $+V_{IN} = 35$, change with REF Input voltage | | | 600 | $\mu\text{V/V}$ |
| Thermal Gradient Sensitivity | $+V_{IN} = 20\text{V}$, REF = 10V Pd = 20W @ A or B Output | | 5.0 | 75.0 | $\mu\text{V/W}$ |
| PSRR | REF = 2.5V, $+V_{IN} = 5$ to 35V | 70 | 100 | | dB |
| Gain | $ A_{SINK-B} _{SINK} / \leq 0.5\text{V}$ | 7.8 | 8.0 | 8.1 | V/V |
| Slew Rate | | | 2 | | V/ μS |
| 3dB Bandwidth | | | 1 | | MHz |
| MAX Output Current | $I_{SOURCE} = +V_{IN} - V_{OUT} = 0.5\text{V}$ | 2.5 | 3.5 | | mA |
| Output Saturation Voltage | $I_{SOURCE} = 1.5\text{mA}$, High Side | | 0.15 | 0.30 | V |
| | $I_{SINK} = 5\text{mA}$, Low Side | | 1.4 | 1.85 | V |
| Under-Voltage Comparator | | | | | |
| Threshold Voltage | Low to High, other input at 5V | 1.44 | 1.50 | 1.56 | V |
| | Threshold Hysteresis | 50 | 70 | 80 | mV |
| Input Current | Input = 2V, other input at 5V | -2.00 | -0.05 | | μA |
| Supply OK V_{SAT} (UC3177 Only) | $I_{OUT} = 5\text{mA}$ | | | 0.45 | V |
| Supply OK Leakage (UC3177 Only) | $V_{OUT} = 35\text{V}$ | | | 5 | μA |
| Park/Inhibit | | | | | |
| Park/Inhibit Th'l'd | | 1.1 | 1.3 | 1.7 | V |
| Park/Inhibit Input Current | At threshold | | 60 | 100 | μA |
| Parking Drive Saturation Voltage | $I_{OUT} = 100\text{mA}$ | | 0.3 | 0.7 | V |
| Parking Drive Leakage | $V_{OUT} = 35\text{V}$ | | | 15 | μA |
| Thermal Shutdown | | | | | |
| Shutdown Temperature | | | 165 | | $^\circ\text{C}$ |



Output saturation voltage vs. current.

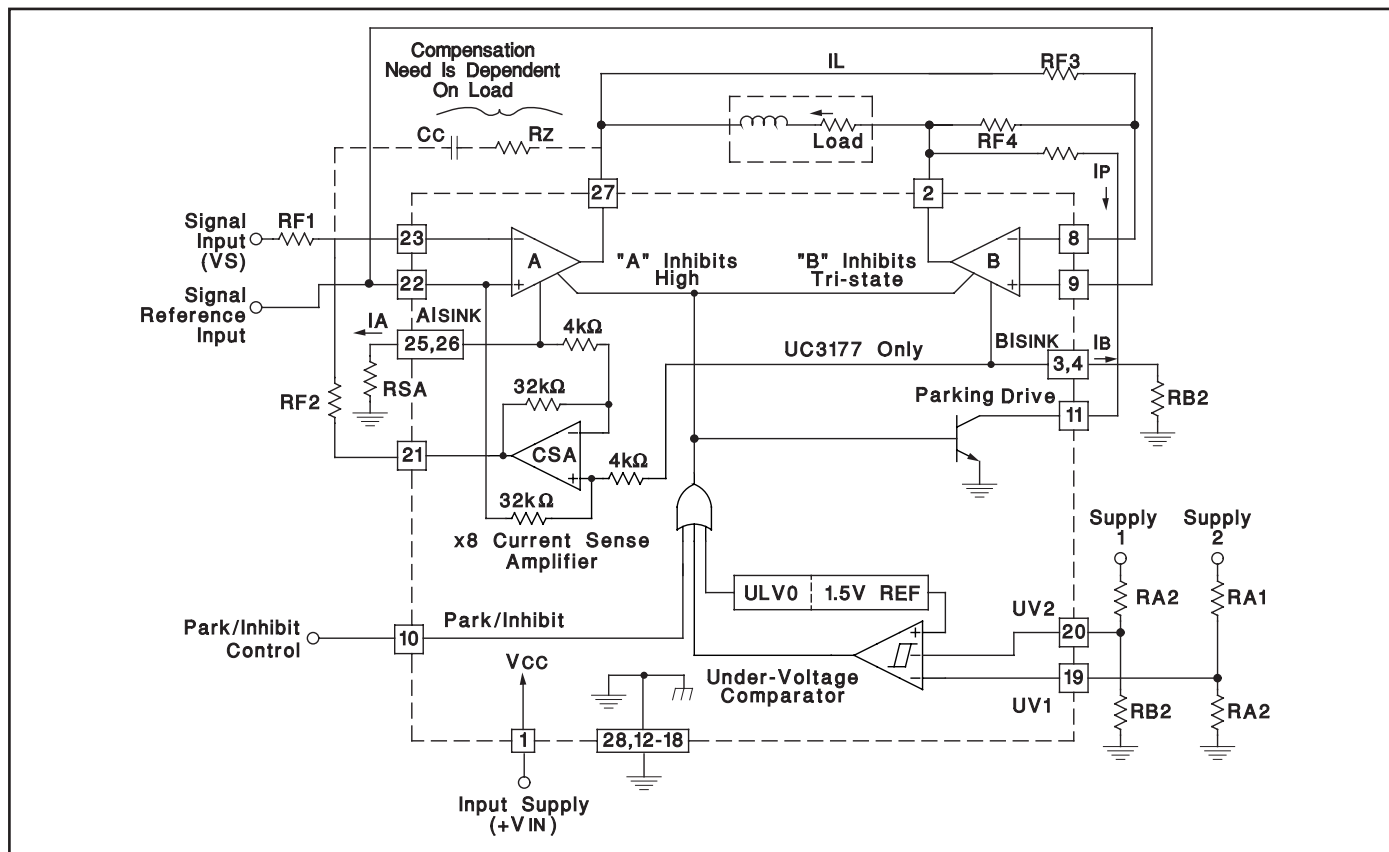


Maximum source current vs. $+V_{IN} - V_{OUT}$.

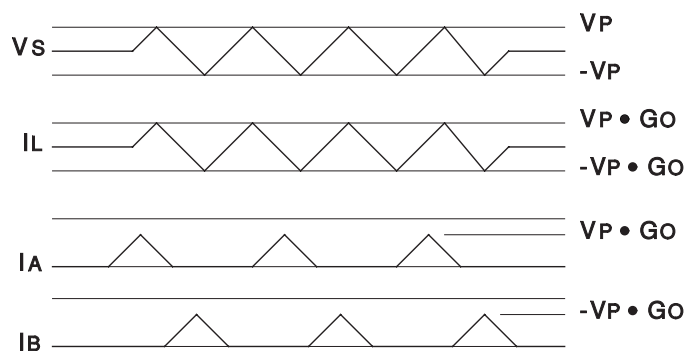


Crossover current error characteristic.

APPLICATION AND OPERATION INFORMATION



WAVEFORMS FOR ABOVE APPLICATION



DESIGN EQUATIONS

$$\text{Transconductance } (G_O) = \frac{I_L}{V_S} = \frac{R_{F2}}{R_{F1}} \times \left(\frac{1}{8R_S} \right)$$

with: $R_{SA} = R_{SB}$ and $R_{F3} = R_{F4}$

$$\text{Parking Current } (I_P) = \frac{V_{IN} - 1.5}{R_P + R_L}$$

where: R_L = load resistance

Under-Voltage Thresholds, at Supplies
 High to Low Threshold, $(V_{LH}) = 1.425 (R_A + R_B)/R_B$
 Low to High Threshold, $(V_{HL}) = 1.5 (R_A + R_B)/R_B$

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|---------|
| UC3176QP | LIFEBUY | PLCC | FN | 28 | 37 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR | 0 to 70 | UC3176QP | |
| UC3176QPTR | LIFEBUY | PLCC | FN | 28 | 750 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR | 0 to 70 | UC3176QP | |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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FN 28

GENERIC PACKAGE VIEW

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4040005-3/C

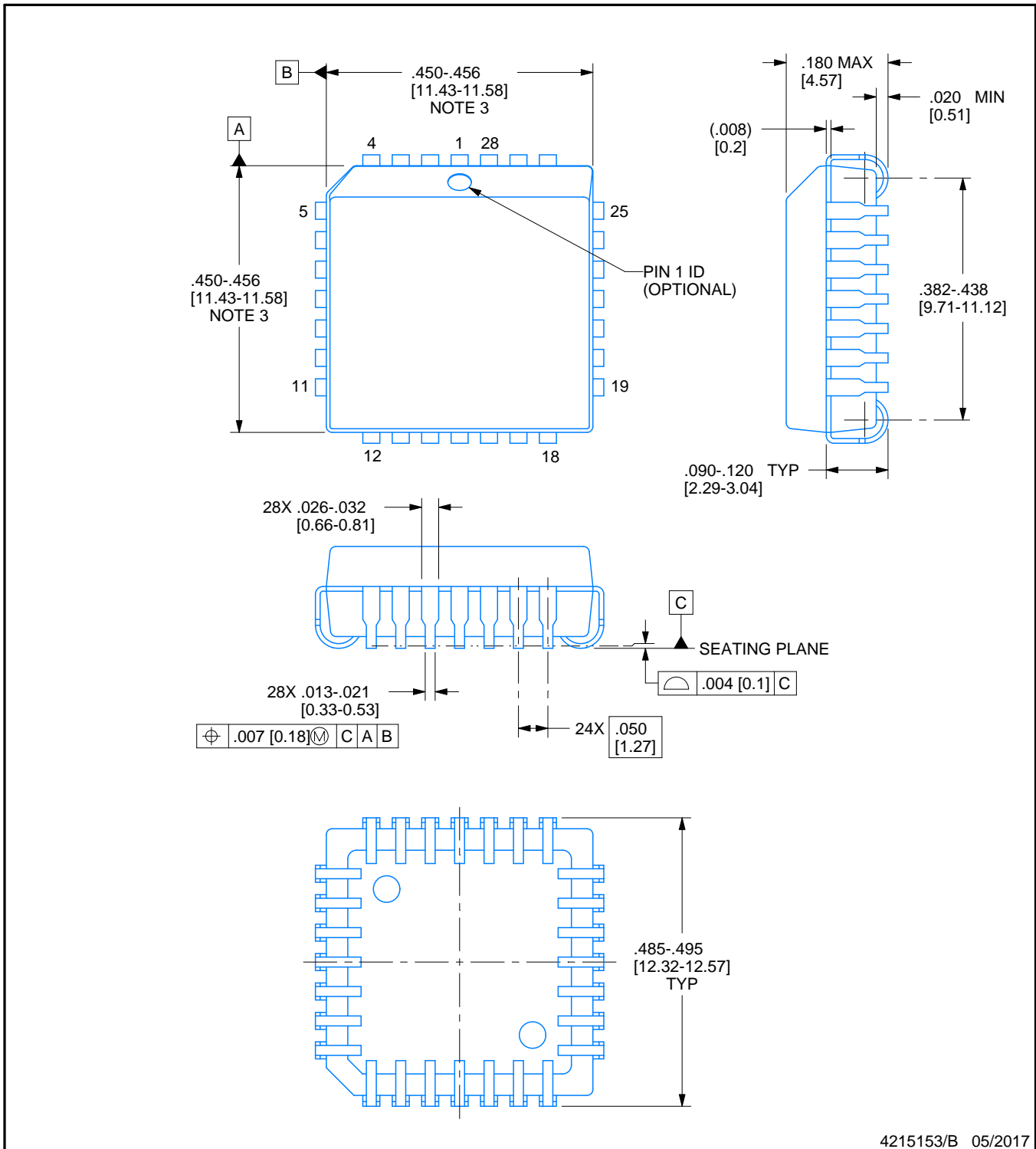


PACKAGE OUTLINE

FN0028A

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



4215153/B 05/2017

NOTES:

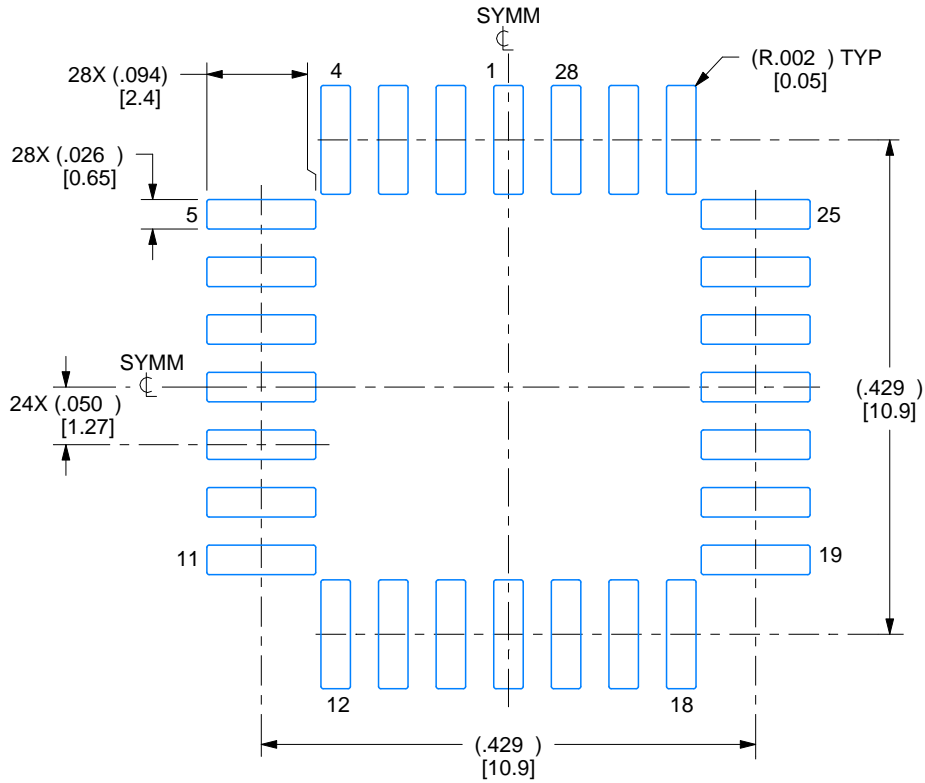
1. All linear dimensions are in inches. Any dimensions in brackets are in millimeters. Any dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Dimension does not include mold protrusion. Maximum allowable mold protrusion .01 in [0.25 mm] per side.
4. Reference JEDEC registration MS-018.

EXAMPLE BOARD LAYOUT

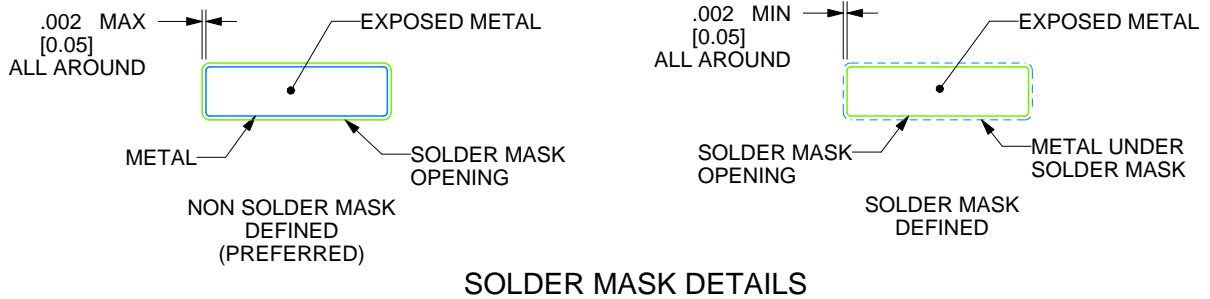
FN0028A

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



4215153/B 05/2017

NOTES: (continued)

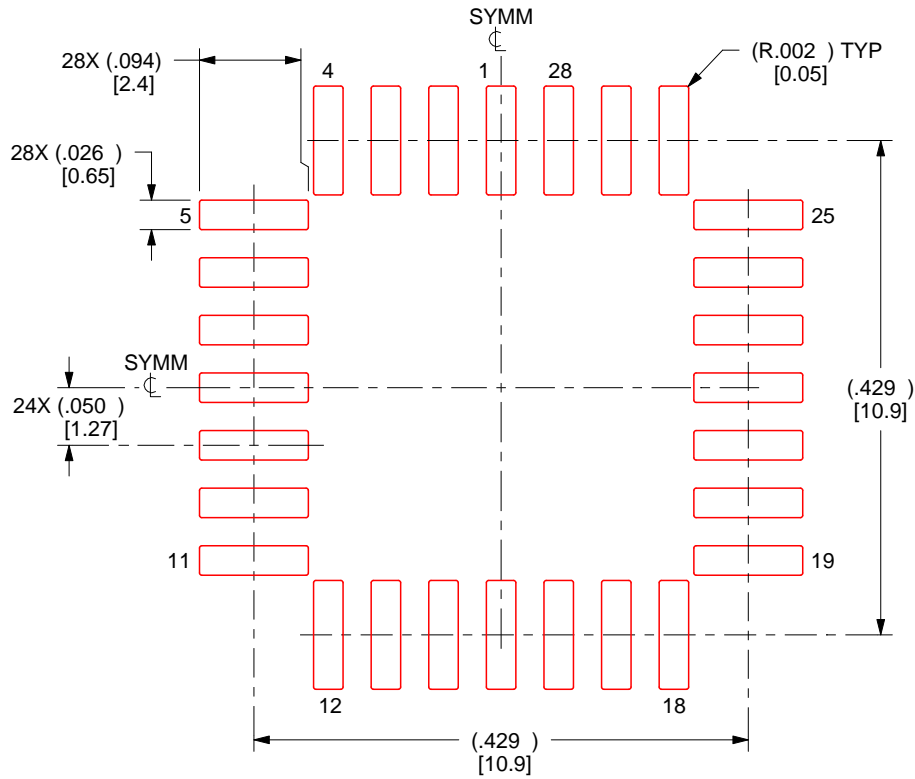
- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

FN0028A

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



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

4215153/B 05/2017

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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