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MIC22405YML EV

Evaluation Board

**4A Integrated Switch High-Efficiency
Synchronous Buck Regulator with
Frequency Programmable upto 4MHz**

General Description

The Micrel MIC22405 is a high-efficiency, 4A, integrated switch, synchronous buck (step-down) regulator. The MIC22405 achieves more than 95% efficiency and switches at 1MHz. The ultra-high speed control loop keeps the output voltage within regulation even under extreme transient load swings commonly found in FPGAs and low-voltage ASICs. The output voltage is pre-bias safe and is adjustable down to 0.7V.

The MIC22405 offers a full range of sequencing and tracking options. The Enable/Delay (EN/DLY) and Power Good (PG) inputs allow versatile turn-on and turn-off sequencing across multiple devices. The Ramp Control™ (RC) input allows start-up voltage tracking, either directly or ratio-metrically.

The MIC22405 is available in a 20-pin 3mm x 4mm MLF® with a junction operating range from -40°C to +125°C.

Data sheets and support documentation are found on the Micrel web site: www.micrel.com.

Requirements

The MIC22405YML EV requires a power supply of 2.9V to 5.5V, and a test load. Ensure that the power supply can provide the wattage required for the chosen test load. The load can be active (electronic load) or passive (resistor). Additionally, monitor the Power Good output (PG) with a multimeter or an oscilloscope if desired.

Precautions

There is no reverse input protection on this board. While connecting supplies and signals ensure that correct polarities are observed.

Getting Started

1. V_{IN} Supplies

Connect the V_{IN} supply (2.9V to 5.5V) across the VIN and GND terminals. Monitor V_{IN} at the VIN and GND terminals with a voltmeter.

2. Enable/SHDN Inputs

The enable input EN is internally pulled up with a 1 μ A current source. When external on/off control is desired install Q1 and R5, and connect a logic level control signal to the SHDN input. When SHDN is high the output is off, and when SHDN is low the output is on.

3. Monitor Outputs

Monitor the output V_{OUT} with a scope or DVM connected across the VOUT and GND terminals.

4. Output Load

Connect a load across the VOUT and GND terminals. Use an active or passive load.

5. Turn On the Power

Turn on the power supply and verify that $V_{OUT} = 1.8V$.

Ordering Information

| Part Number | Description |
|----------------|--------------------------------------|
| MIC22405YML EV | Evaluation Board for the MIC22405YML |

Ramp Control is a trademark of Micrel, Inc.

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Evaluation Board Features

Enable/Delay (EN/DLY)

Enable/Delay allows delayed turn on of the MIC22405. Install a capacitor in location C4 to increase the start-up delay of the MIC22405.

Shutdown Input (SHDN)

SHDN allows enable/disable of the MIC22405 with an external logic signal. To activate the shutdown feature install components into the locations labeled Q1 and R5 (component recommendations are listed in the Bill of Materials later in this document). With the components installed, force SHDN high to disable the MIC22405, and low to allow the MIC22405 to operate normally.

Ramp Control (RC)

Ramp control allows slowing the slew rate of the MIC22405 output. Increase the value of capacitor C6 to reduce the slew rate.

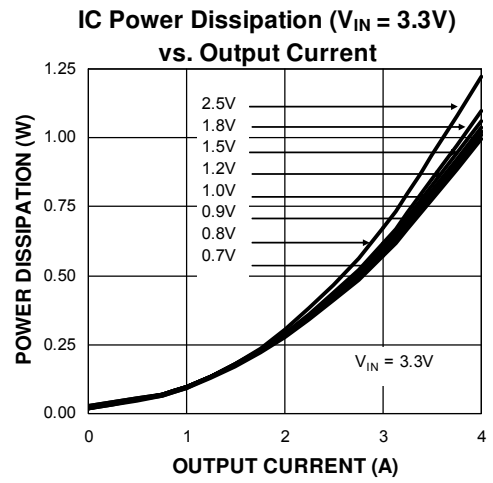
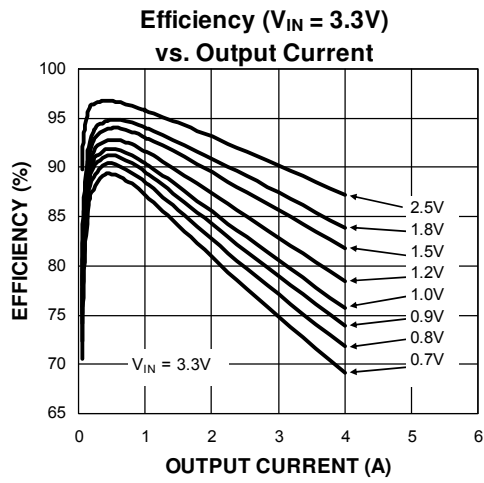
Power Good Output (PG)

Open drain output PG pulls low when the output voltage of the MIC22405 is out of specification. PG is pulled up to V_{IN} by a 47.5k Ω resistor.

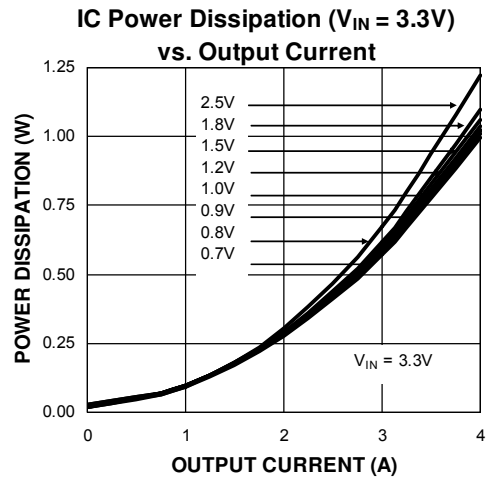
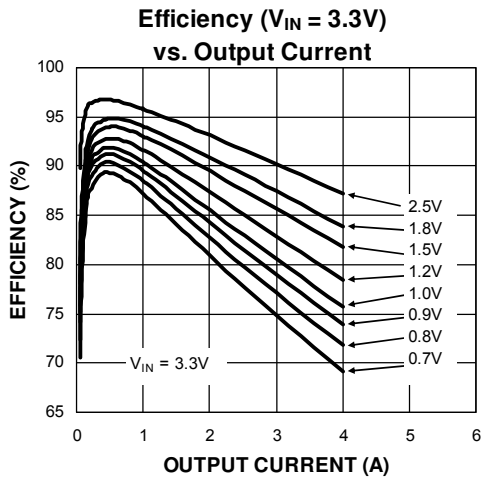
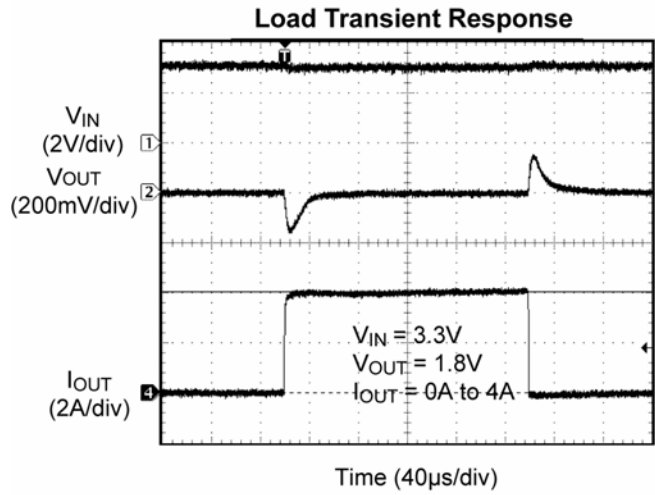
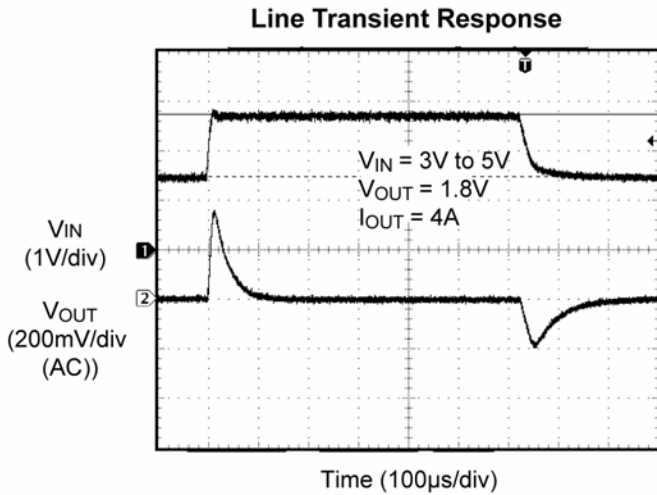
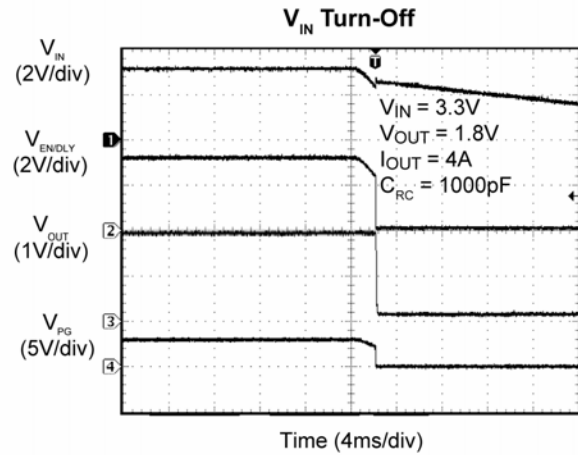
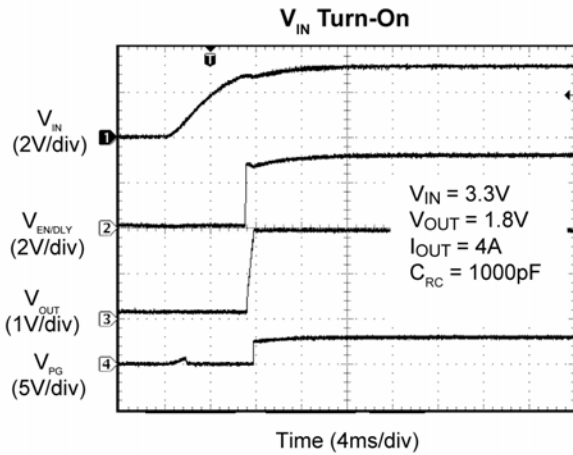
Switch Voltage (V_{SW})

Test point V_{SW} is provided to monitor the internal switching node. V_{SW} is isolated from the switch node by 49.9 Ω resistor R7.

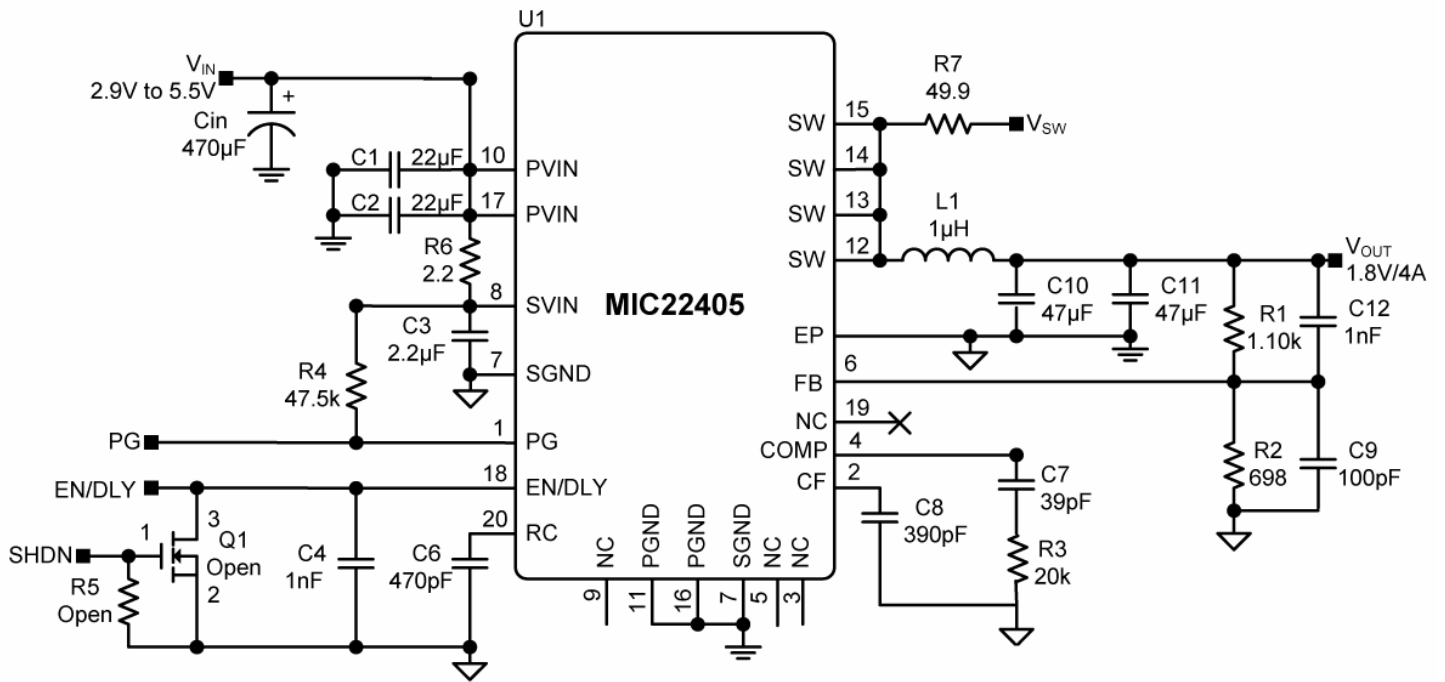
Typical Characteristics



Functional Characteristics



Evaluation Board Schematic



Bill of Materials

| Item | Part Number | Manufacturer | Description | Qty. |
|---------|--------------------|-----------------------|---|------|
| C1, C2 | 08056D226MAT | AVX ⁽¹⁾ | Capacitor, 22µF, 6.3V, X5R, Size 0805 | 2 |
| | C2012X5R0J226M | TDK ⁽²⁾ | | |
| | GRM21BR60J226ME39L | Murata ⁽³⁾ | | |
| C3 | 06036D225MAT2A | AVX ⁽²⁾ | 2.2µF/6.3V, Ceramic Capacitor, X5R, Size 0603 | 1 |
| | GRM188R60J225M | Murata ⁽³⁾ | | |
| | C1608X5R0J225M | TDK ⁽¹⁾ | | |
| C4, C12 | GRM188R71H102KA01D | Murata ⁽³⁾ | Capacitor, 1nF, 50V, X7R, Size 0603 | 2 |
| | C1608C0G1H102J | TDK ⁽²⁾ | | |
| | 06035C102KAT2A | AVX ⁽¹⁾ | | |
| C6 | GRM188R71H471KA01D | Murata ⁽³⁾ | Capacitor, 470pF, 50V, X7R, Size 0603 | 1 |
| | C1608X7RH471K | TDK ⁽²⁾ | | |
| | 06035C471KAT2A | AVX ⁽¹⁾ | | |
| C7 | GRM188R71H390JA01 | Murata ⁽³⁾ | Capacitor, 39pF, 50V, Size 0603 | 1 |
| | C1608COG1H390J | TDK ⁽²⁾ | | |
| | 06035A390JAT2A | AVX ⁽¹⁾ | | |
| C8 | GRM188R71H391JA01 | Murata ⁽³⁾ | Capacitor, 390pF, 50V, Size 0603 | 1 |
| | 1608COG1H391J | TDK ⁽²⁾ | | |
| | 06035A391JAT2A | AVX ⁽¹⁾ | | |

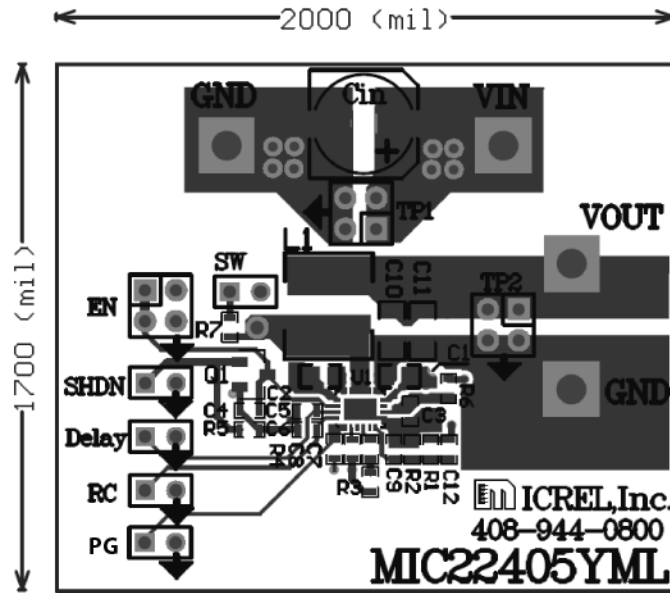
Bill of Materials (Continued)

| Item | Part Number | Manufacturer | Description | Qty. |
|----------|--------------------------------|-----------------------------|---|----------|
| C9 | GRM188R71H101JA01 | Murata ⁽³⁾ | Capacitor, 100pF, 50V, Size 0603 | 1 |
| | C1608COG1H101J | TDK ⁽²⁾ | | |
| | 06035A101JT2A | AVX ⁽¹⁾ | | |
| C10, C11 | GRM31CR60J476ME19 | Murata ⁽³⁾ | Capacitor, 47µF, 6.3V, X5R, Size 1206 | 2 |
| | C3216X5R0J476M | TDK ⁽²⁾ | | |
| | 12066D476MAT2A | AVX ⁽¹⁾ | | |
| Cin | B41125A3477M | Epcos | 470µF, 10V, Electrolytic, 8x10-case | |
| L1 | FP3-1R0-R(7.2x6.7x3mm) | Cooper ⁽⁵⁾ | Inductor, 1µH, 6.26A | 1 |
| | CDRH8D28NP-1R0NC (8x6x3mm) | Sumida ⁽⁶⁾ | Inductor, 1µH, 8A | 1 |
| | SPM6530T-1R0M120 (7x6.5x3mm) | TDK ⁽²⁾ | Inductor, 1µH, 12A | 1 |
| R1 | CRCW06031101FKEYE3 | Vishay ⁽⁴⁾ | Resistor, 1.1k, 1%, Size 0603 | 1 |
| R2 | CRCW06036980FKEYE3 | Vishay ⁽⁴⁾ | Resistor, 698Ω, 1%, Size 0603 | 1 |
| R3 | CRCW06032002FKEYE3 | Vishay ⁽⁴⁾ | Resistor, 20k, 1%, Size 0603 | 1 |
| R4 | CRCW06034752FKEYE3 | Vishay ⁽⁴⁾ | Resistor, 47.5k, 1%, Size 0603 | 1 |
| R5 | (Open) CRCW06031003FKEYE3 | Vishay ⁽⁴⁾ | Resistor, 100k, 1%, Size 0603 | 1 |
| R6 | CRCW06032R20FKEA | Vishay ⁽⁴⁾ | Resistor, 2.2Ω, 1%, Size 0603 | 1 |
| R7 | CRCW060349R9FKEA | Vishay ⁽⁴⁾ | Resistor, 49.9Ω, 1%, Size 0603 | 1 |
| Q1 | 2N7002E | Vishay ⁽⁴⁾ | Open | 1 |
| U1 | MIC22405YML | Micrel⁽⁷⁾ | Integrated 4A Synchronous Buck Regulator | 1 |

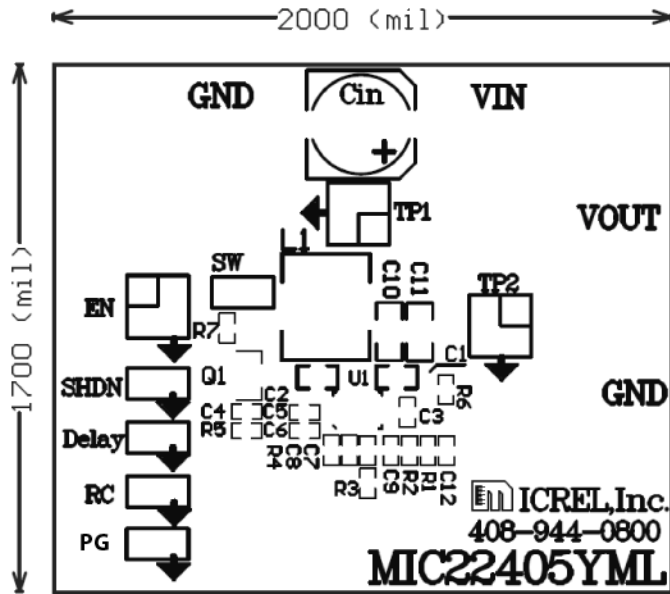
Notes:

1. AVX: www.avx.com
2. TDK: www.tdk.com
3. Murata: www.murata.com
4. Vishay: www.vishay.com
5. Cooper Bussmann: www.cooperet.com
6. Sumida: www.sumida.com
7. **Micrel, Inc.:** www.micrel.com

Evaluation Board PCB Layout

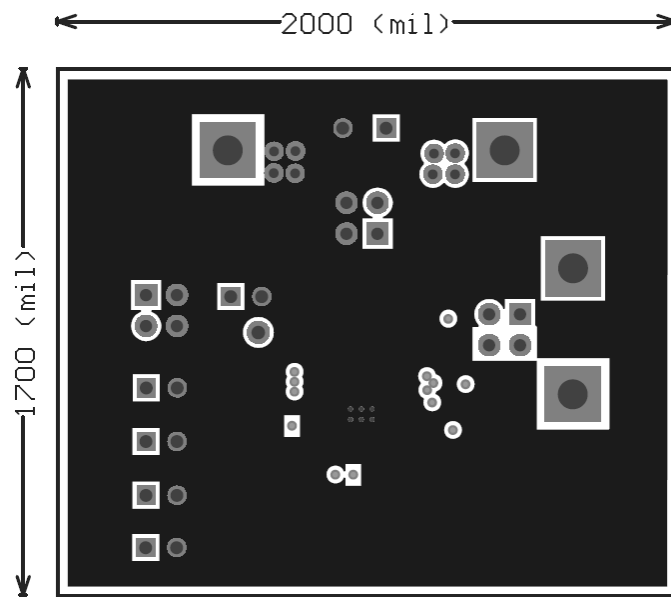


MIC22405 Evaluation Board Top Layer

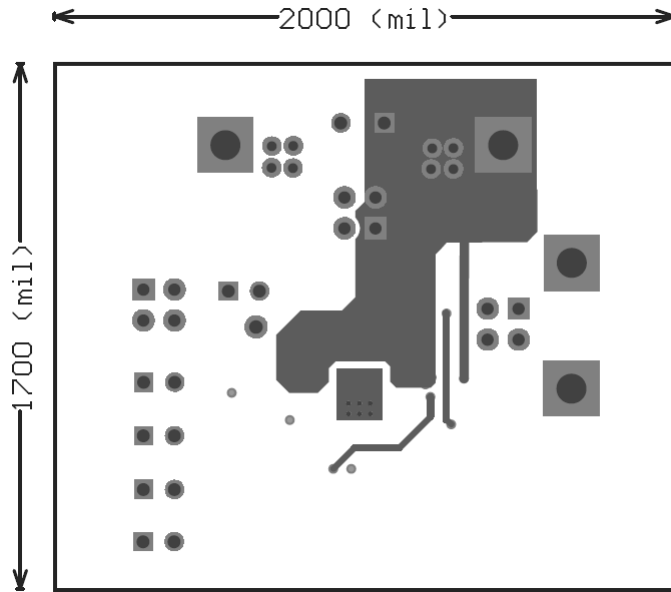


MIC22405 Evaluation Board Top Silk

Evaluation Board PCB Layout (Continued)

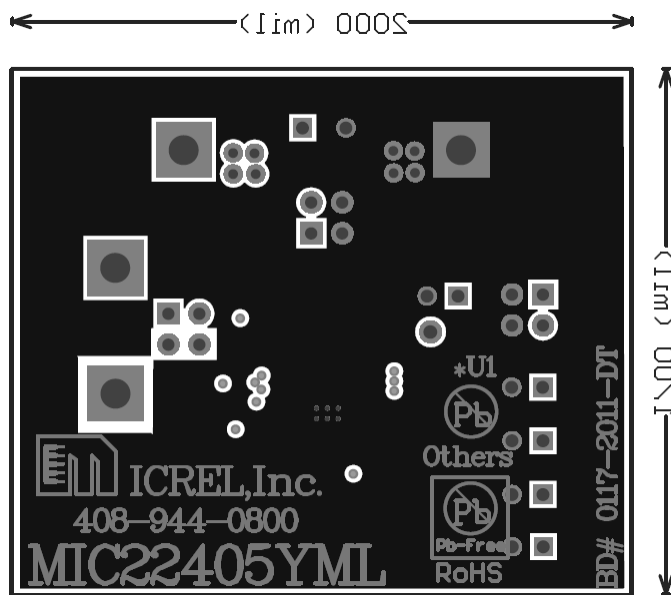


MIC22405 Evaluation Board Mid-Layer 1 (Ground Plane)

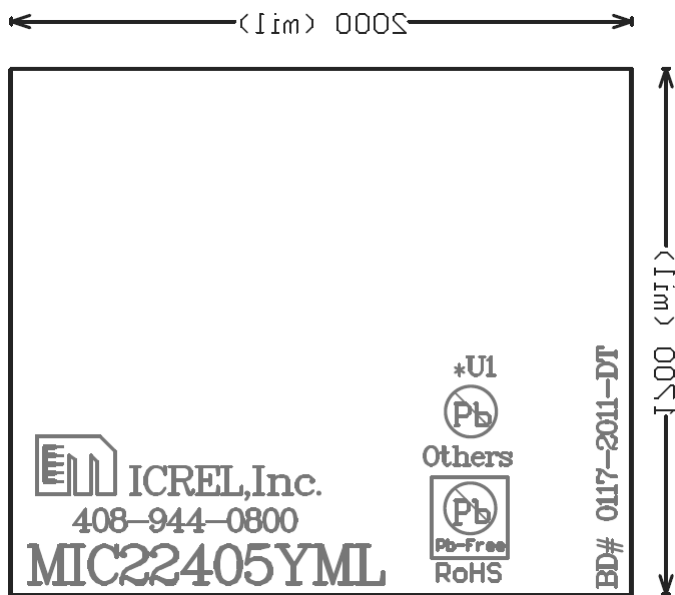


MIC22405 Evaluation Board Mid-Layer 2

Evaluation Board PCB Layout (Continued)



MIC22405 Evaluation Board Bottom Layer



MIC22405 Evaluation Board Bottom Silk

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