

## 4+2CH PMU for Wearable / Sports-CAM & IP-CAM Application

## Features

- **2.8V ~ 5.5V Input Voltage Operation.**
- **95% Efficient DC/DC Converter**
- **Built-in 4-ch synchronous buck converter, 1-ch power switch, and 1-ch low quiescent current LDO for RTC.**
- **Bucks can be set to lower quiescent current at low load.**
- **Low Power consumption (Sleep Mode) < 20μA.**
- **1.5/ 3MHz switching frequency.**
- **Built-In Power ON/OFF Sequence for PMU.**
- **Built-In Short Circuit Protection (SCP), Under Voltage Protection (UVP), and cycle-by cycle current limit for DC/DC Converters.**
- **Real Time Clock**
- **Built-In Thermal Shutdown Function.**
- **Built-In VCC OVP Function.**
- **TQFN4x4-28 Package.**

## General Description

The G2225A provide a complete power supply solution for wearable / sports-cam & IP-CAM application. It contains four dc/dc converters, one power switch and one low quiescent current LDO to power each critical blocks of the system, and is optimized for maximum battery life, featuring a low ground current when in standby mode operation. All channels DC/DC converters operate at selectable frequency of 1.5/3.0MHz to optimize size, cost, and efficiency. All Synchronous converters operate at pulse skipping mode at light load.

The G2225A is available in TQFN4x4-28 package.

## Applications

- Wearable/Sports camera
- IP camera
- DSC

## Ordering Information

| ORDER<br>NUMBER | MARKING | TEMP.<br>RANGE | PACKAGE<br>(Green) |
|-----------------|---------|----------------|--------------------|
| G2225ARV1U      | 2225A   | -40°C~+105°C   | TQFN4x4-28         |

Note: RV:TQFN4X4-28

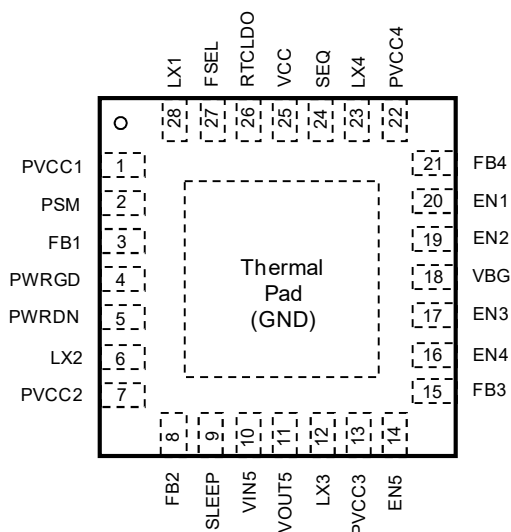
1: Bonding code

U: Tape & Reel

Green : Lead Free / Halogen Free.

## Pin Configuration

### Top View



**G2225A TQFN4X4-28**

**Note:** Recommend connecting the Thermal Pad to the round for excellent power dissipation.

## Absolute Maximum Ratings

VCC, PVCC1, PVCC2, PVCC3, PVCC4, VIN5  
 ..... -0.3V to +6.3V  
 FB1, FB2, FB3, FB4, VOUT5, RTCOUT  
 ..... -0.3V to +6.3V  
 LX1, LX2, LX3, LX4. .... -0.3V to +6.3V  
 EN1, EN2, EN3, EN4, EN5, SLEEP, PSM, SEQ, VBG,  
 PWRGD, FSEL, PWR-DOWN . . . . -0.3V to +6.3V  
 Thermal Resistance Junction to Ambient, ( $\theta_{JA}$ )  
 TQFN4X4-28 . . . . . 32°C/W  
 Continuous Power Dissipation ( $T_A=25^\circ\text{C}$ )  
 TQFN4X4-28 . . . . . 4300mW

Thermal Resistance Junction to Case, ( $\theta_{JC}$ )  
 TQFN4X4-28 . . . . . 15°C/W  
 Operating Ambient Temperature . . . . -40°C to 105°C  
 Storage Temperature Range. . . . . -55°C to +150°C  
 Reflow Temperature (soldering, 10 sec) . . . . 260°C  
 ESD (HBM) . . . . . 2kV  
 ESD (MM) . . . . . 200V

1. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. Device is ESD sensitive. Handling precaution recommended. The Human Body model is a 100pF capacitor discharged through a 1.5K $\Omega$  resistor into each pin.

## Electrical characteristics

(VCC=PVCC1=PVCC2=PVCC3=PVCC4=3.7, VIN5=1.2V, LDOINx=3.7V,  $T_A=25^\circ\text{C}$ )

The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

| PARAMETER                                  | SYMBOL                | CONDITIONS                                                   | MIN   | TYP   | MAX   | UNIT          |
|--------------------------------------------|-----------------------|--------------------------------------------------------------|-------|-------|-------|---------------|
| <b>GENERAL</b>                             |                       |                                                              |       |       |       |               |
| VCC minimum Startup Voltage                | V <sub>VCC_ST</sub>   |                                                              | ---   | ---   | 2.6   | V             |
| VCC Operating Voltage for PMU              | V <sub>VCC_PMU</sub>  |                                                              | 2.8   | ---   | 5.5   | V             |
| VCC Over Voltage threshold                 | V <sub>VCC_OVLO</sub> |                                                              | 5.8   | 6.0   | ---   | V             |
| PMU Stand-by Supply Current                | I <sub>VCC</sub>      | ALL converters off.                                          | ---   | 80    | 100   | $\mu\text{A}$ |
|                                            |                       | ALL DCDC enter ECO mode, and without loading current.        | ---   | 150   | 250   | $\mu\text{A}$ |
| PMU Shutdown Current                       | I <sub>PMU_SD</sub>   | PMU shutdown.                                                | ---   | 10    | ---   | $\mu\text{A}$ |
| Quiescent current for each DC/DC converter | I <sub>Q_DCDC</sub>   | DCDC1~DCDC4 in ECO mode                                      | ---   | 5     | ---   | $\mu\text{A}$ |
| VBG Accuracy                               | V <sub>VBG</sub>      |                                                              | 1.218 | 1.234 | 1.25  | V             |
| PMU Enable Delay Time                      | TD_EN                 | Delay from EN to first DCDC startup                          | 2.1   | 2.9   | 3.9   | ms            |
| <b>OSCILLATOR</b>                          |                       |                                                              |       |       |       |               |
| Frequency                                  | F <sub>OSC</sub>      | FSEL connect to VCC or GND                                   | 2.6   | 3.0   | 3.4   | MHz           |
|                                            | F <sub>OSC</sub>      | R <sub>FSEL</sub> =120k $\Omega$ or 20k $\Omega$ .           | 1.3   | 1.5   | 1.7   | MHz           |
| <b>CH1 DC/DC Buck Converter</b>            |                       |                                                              |       |       |       |               |
| Soft-Start Internal                        | SS_CH1                |                                                              | ---   | 2.4   | ---   | ms            |
| FB regulation voltage accuracy             | V <sub>FB1</sub>      |                                                              | 0.788 | 0.8   | 0.812 | V             |
| Maximum Duty Cycle                         | D <sub>max1</sub>     |                                                              | ---   | 100   | ---   | %             |
| PVCC Leakage Current                       | I <sub>PVCC1_LK</sub> | V <sub>LX1</sub> =0V, PVCC1=5.0V                             | ---   | 1     | 5     | $\mu\text{A}$ |
| LX Leakage Current                         | I <sub>LX1_LK</sub>   | V <sub>LX1</sub> =5.0V                                       | ---   | 1     | 5     | $\mu\text{A}$ |
| Switch ON Resistance                       | R <sub>on1-N</sub>    |                                                              | ---   | 90    | ---   | m $\Omega$    |
|                                            | R <sub>on1-P</sub>    |                                                              | ---   | 150   | ---   |               |
| Peak Current Limit                         | I <sub>LIM_CH1</sub>  |                                                              | ---   | 4.4   | ---   | A             |
| Under Voltage Protection Threshold         | %V <sub>UVP_CH1</sub> | %V <sub>UVP_CH1</sub> =V <sub>FB</sub> UVP1/V <sub>FB1</sub> | ---   | 87.5  | ---   | %             |

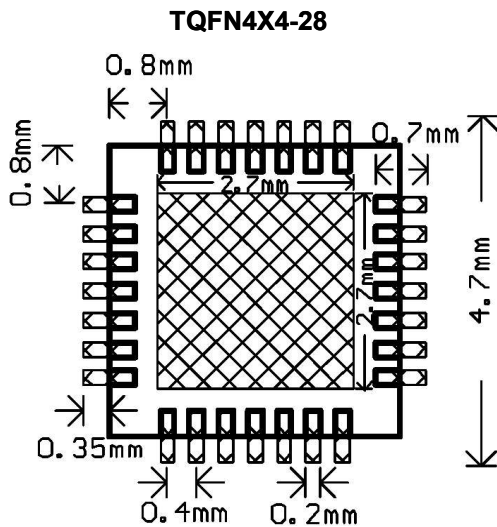
**Electrical characteristics (Continued)**

| PARAMETER                          | SYMBOL                | CONDITIONS                                        | MIN   | TYP  | MAX   | UNIT |
|------------------------------------|-----------------------|---------------------------------------------------|-------|------|-------|------|
| <b>CH2 DC/DC Buck Converter</b>    |                       |                                                   |       |      |       |      |
| Soft-Start Internal                | SS_CH2                |                                                   | ---   | 2.4  | ---   | mS   |
| FB regulation voltage accuracy     | VFB2                  |                                                   | 0.788 | 0.8  | 0.812 | V    |
| Maximum Duty Cycle                 | D <sub>max2</sub>     |                                                   | ---   | 100  | ---   | %    |
| PVCC Leakage Current               | I <sub>PVCC2_LK</sub> | V <sub>LX2</sub> =0V, PVCC2=5.0V                  | ---   | 1    | 5     | μA   |
| LX Leakage Current                 | I <sub>LX2_LK</sub>   | V <sub>LX2</sub> =5.0V                            | ---   | 1    | 5     | μA   |
| Switch ON Resistance               | Ron2-N                |                                                   | ---   | 200  | ---   | mΩ   |
|                                    | Ron2-P                |                                                   | ---   | 250  | ---   |      |
| Peak Current Limit                 | I <sub>LIM_CH2</sub>  |                                                   | ---   | 2.5  | ---   | A    |
| Under Voltage Protection Threshold | %V <sub>UVP_CH2</sub> | %V <sub>UVP_CH2</sub> =VFB <sub>UVP2</sub> /VFB2  | ---   | 87.5 | ---   | %    |
| <b>CH3 DC/DC Buck Converter</b>    |                       |                                                   |       |      |       |      |
| Soft-Start Internal                | SS_CH3                |                                                   | ---   | 2.4  | ---   | mS   |
| FB regulation voltage accuracy     | VFB3                  |                                                   | 0.788 | 0.8  | 0.812 | V    |
| Maximum Duty Cycle                 | D <sub>max3</sub>     |                                                   | ---   | 100  | ---   | %    |
| PVCC Leakage Current               | I <sub>PVCC3_LK</sub> | V <sub>LX3</sub> =0V, PVCC3=5.0V                  | ---   | 1    | 5     | μA   |
| LX Leakage Current                 | I <sub>LX3_LK</sub>   | V <sub>LX3</sub> =5.0V                            | ---   | 1    | 5     | μA   |
| Switch ON Resistance               | Ron3-N                |                                                   | ---   | 200  | ---   | mΩ   |
|                                    | Ron3-P                |                                                   | ---   | 150  | ---   |      |
| Peak Current Limit                 | I <sub>LIM_CH3</sub>  |                                                   | ---   | 3.1  | ---   | A    |
| Under Voltage Protection Threshold | %V <sub>UVP_CH3</sub> | %V <sub>UVP_CH3</sub> =VFB <sub>UVP3</sub> /VFB3  | ---   | 87.5 | ---   | %    |
| <b>CH4 DC/DC Buck Converter</b>    |                       |                                                   |       |      |       |      |
| Soft-Start Internal                | SS_CH4                |                                                   | ---   | 2.4  | ---   | mS   |
| FB regulation voltage accuracy     | VFB4                  |                                                   | 0.788 | 0.8  | 0.812 | V    |
| Maximum Duty Cycle                 | D <sub>max4</sub>     |                                                   | ---   | 100  | ---   | %    |
| PVCC Leakage Current               | I <sub>PVCC4_LK</sub> | V <sub>LX4</sub> =0V, PVCC4=5.0V                  | ---   | 1    | 5     | μA   |
| LX Leakage Current                 | I <sub>LX4_LK</sub>   | V <sub>LX4</sub> =5.0V                            | ---   | 1    | 5     | μA   |
| Switch ON Resistance               | Ron4-N                |                                                   | ---   | 200  | ---   | mΩ   |
|                                    | Ron4-P                |                                                   | ---   | 250  | ---   |      |
| Peak Current Limit                 | I <sub>LIM_CH4</sub>  |                                                   | ---   | 2.5  | ---   | A    |
| Under Voltage Protection Threshold | %V <sub>UVP_CH4</sub> | %V <sub>UVP_CH4</sub> =VFB <sub>UVP4</sub> /VFB4  | ---   | 87.5 | ---   | %    |
| <b>CH5 Power Switch</b>            |                       |                                                   |       |      |       |      |
| Input voltage range (N-Switch)     | V <sub>VIN5-N</sub>   | RFSEL=20kΩ or FSEL=GND                            | 1.0   | 1.8  | VCC-1 | V    |
| Input voltage range (P-Switch)     | V <sub>VIN5-P</sub>   | RFSEL=120kΩ or FSEL=VCC                           | 2.2   | 3.0  | VCC   | V    |
| Shutdown Current                   | I <sub>SD_SW5</sub>   | CH5 shutdown                                      | ---   | ---  | 1     | μA   |
| Quiescent Current                  | I <sub>Q_SW5</sub>    | CH5 enable                                        | ---   | 30   | ---   | μA   |
| Switch ON Resistance               | Ronsw5-N              | V <sub>VIN5</sub> =1.2V, I <sub>SWO5</sub> =100mA | ---   | 350  | ---   | mΩ   |
|                                    | Ronsw5-P              | V <sub>VIN5</sub> =3.0V, I <sub>SWO5</sub> =100mA | ---   | 350  | ---   | mΩ   |
| Soft-Start Internal                | SS <sub>SW5</sub>     |                                                   | ---   | 2.4  | ---   | mS   |
| Output current limit               | I <sub>LIMSW1</sub>   |                                                   | ---   | 400  | ---   | mA   |
| Short Circuit Protection Threshold | V <sub>SCP_SW5</sub>  |                                                   | ---   | 0.75 | ---   | V    |
| Discharge Resistance               | D <sub>DIS_SW5</sub>  |                                                   | ---   | 30   | ---   | Ω    |

## Electrical characteristics (Continued)

| PARAMETER                                              | SYMBOL            | CONDITIONS                           | MIN | TYP | MAX  | UNIT        |
|--------------------------------------------------------|-------------------|--------------------------------------|-----|-----|------|-------------|
| <b>RTCLDO</b>                                          |                   |                                      |     |     |      |             |
| Input voltage range                                    | $V_{VINRTC}$      | VCC                                  | 2.5 | --- | 5.5  | V           |
| Standby current                                        | $I_{Q1\_RTC}$     | $V_{VCC}=3.7V$                       | --- | 5   | 8    | $\mu A$     |
| Output voltage                                         | $V_{RTCO}$        | $I_o=0.1mA$                          | --- | 1.8 | ---  | V           |
| Dropout Voltage                                        | $V_{DO1\_RTC}$    | $I_o=50mA$                           | --- | --- | 1500 | mV          |
| Maximum Output Current                                 |                   | $V_{VCC}=4.2V$ , $RTCO=95\%*V_{SET}$ | 60  | --- | 200  | mA          |
| Soft-Start Interval                                    | $SS_{RTCLDO}$     |                                      | --- | 500 | ---  | $\mu S$     |
| <b>Protection</b>                                      |                   |                                      |     |     |      |             |
| UVP Protection Fault Delay                             | $T_{D\_Fault}$    | DCDC1~DCDC4                          | 128 | --- | ---  | mS          |
| Thermal Shutdown Detect                                | $T_{SD}$          |                                      | --- | 150 | ---  | $^{\circ}C$ |
| Thermal Shutdown Hysteresis                            | $\Delta T_{SD}$   |                                      | --- | 20  | ---  | $^{\circ}C$ |
| <b>Control Signal</b>                                  |                   |                                      |     |     |      |             |
| Logic-Input Threshold<br>(EN1~5, PSM, SLEEP, PWR-DOWN) | $V_{TH}$          | High threshold                       | 1.4 | --- | ---  | V           |
|                                                        | $V_{TL}$          | Low threshold                        | --- | --- | 0.5  | V           |
| Internal pull high resistance<br>(PWR-DOWN)            | $R_{PULLH}$       |                                      | --- | 100 | ---  | $k\Omega$   |
| EN1~5 sink current                                     | $I_{EN1-5\_SINK}$ | EN1~5=5V                             | --- | 5   | 10   | $\mu A$     |
| Open-Drain Output Low Voltage<br>(PWRGD)               | $V_{ODLOW}$       | $I_{SINK}=5mA$ , $V_{VCC}=3.7V$      | --- | --- | 100  | mV          |
| Open-Drain Output Leakage Current<br>(PWRGD)           | $I_{LK\_OD}$      | $V_{OD}=5V$                          | --- | --- | 1    | $\mu A$     |
| PWRGD Delay Time                                       | $T_{DLY\_PWRGD}$  |                                      | 10  | --- | ---  | mS          |

## Minimum Footprint PCB Layout Section

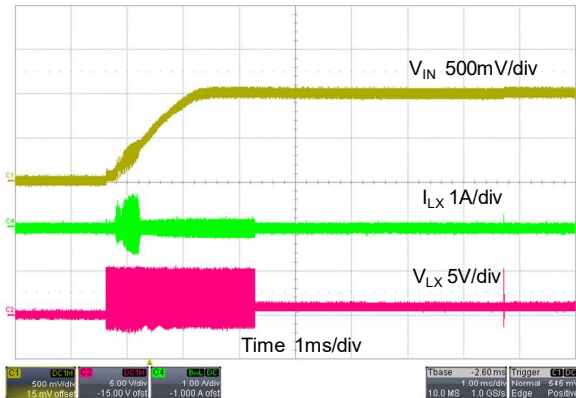


**Typical Performance Characteristics**

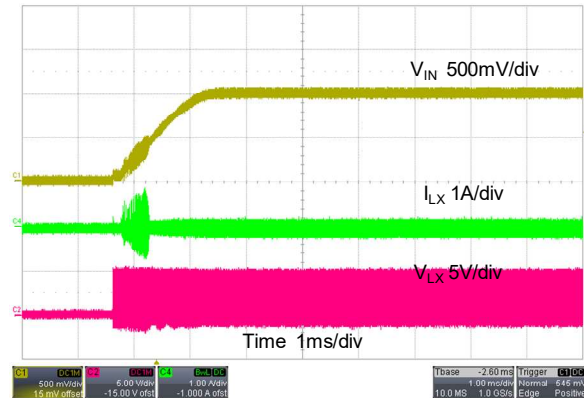
(Fsw=1.5MHz, L=2.2μH, TA=25°C, unless otherwise noted.)

**1. start up**

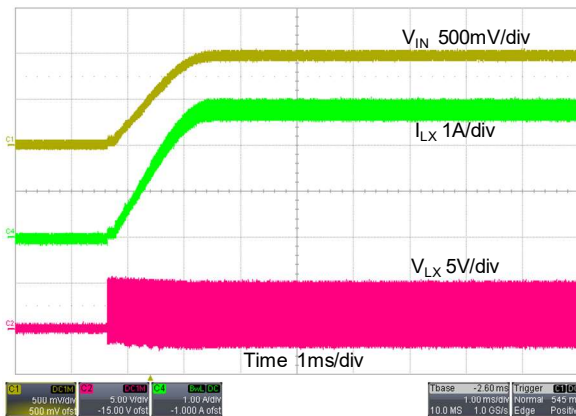
CH1 VIN=3.6V, Vout=1.0V, NO Load (PSM)



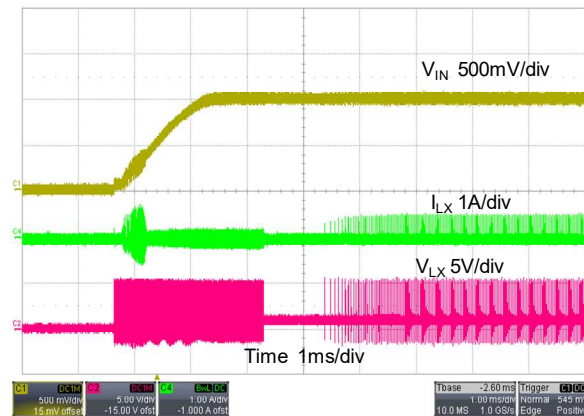
CH1 VIN=3.6V, Vout=1.0V, NO Load (PWM)



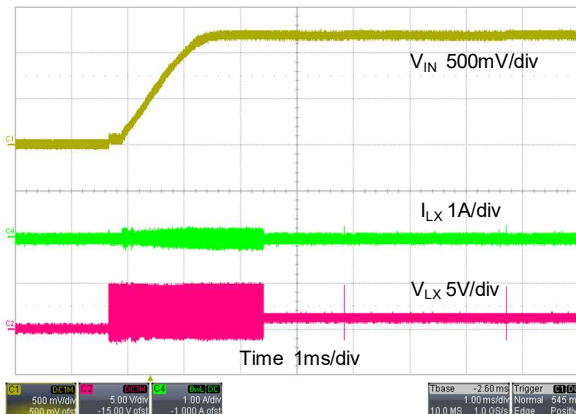
CH1 VIN=3.6V, Vout=1.0V, Iout=2.9A



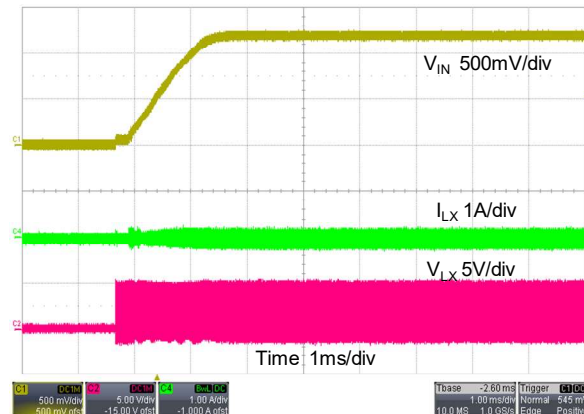
CH1 VIN=3.6V, Vout=1.0V, Iout=30mA (PSM)



CH2 VIN=3.6V, Vout=1.2V, NO load (PSM)



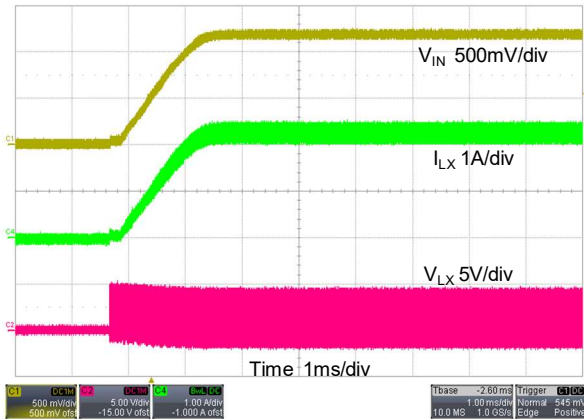
CH2 VIN=3.6V, Vout=1.2V, NO load (PWM)



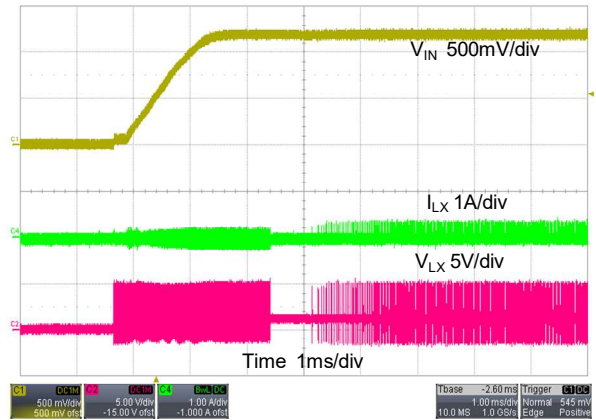
**Typical Performance Characteristics (continued)**

**1. start up**

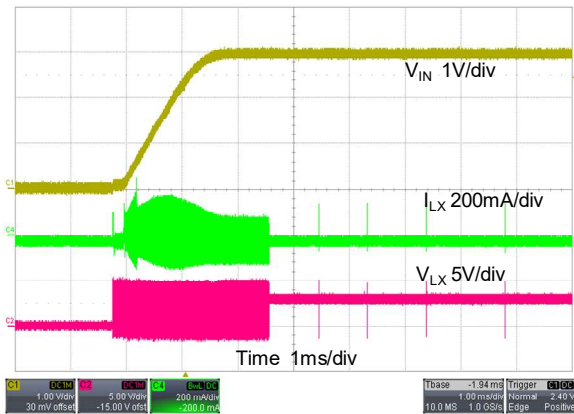
CH2 VIN=3.6V, Vout=1.2V, Iout=2A



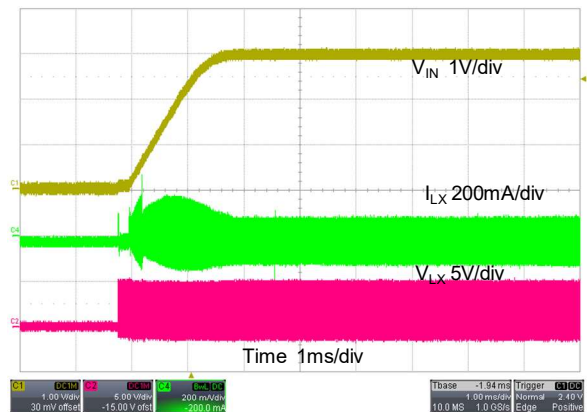
CH2 VIN=3.6V, Vout=1.2V, Iout=30mA



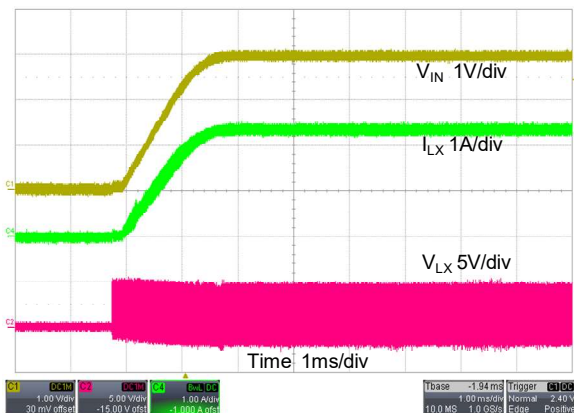
CH3 VIN=3.6V, Vout=3V, NO load (PSM)



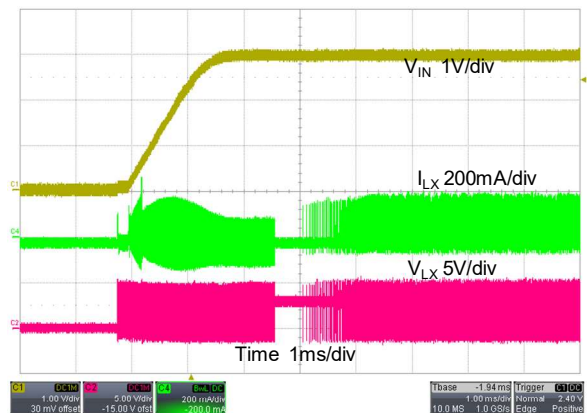
CH3 VIN=3.6V, Vout=3V, NO load (PWM)



CH3 VIN=3.6V, Vout=3V, Iout=2.3A



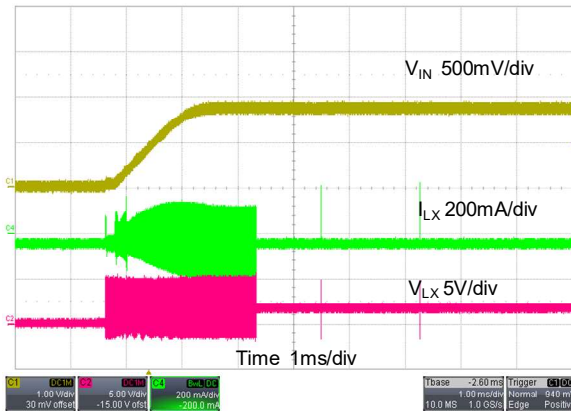
CH3 VIN=3.6V, Vout=3V, Iout=30mA (PSM)



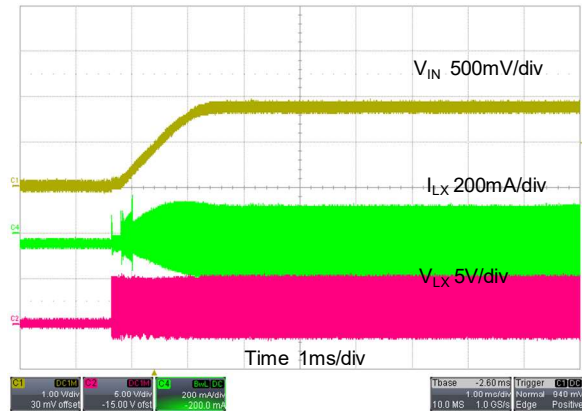
**Typical Performance Characteristics (continued)**

**1. start up**

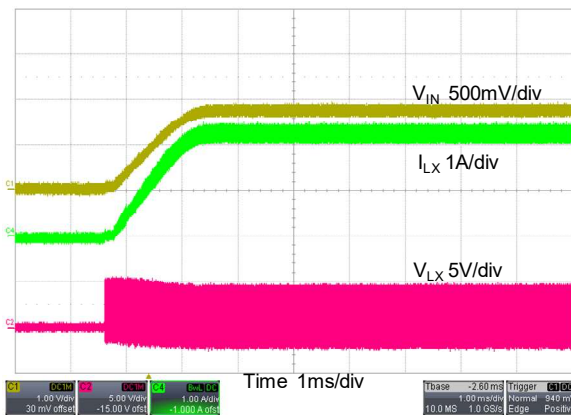
**CH4 VIN=3.6V, Vout=1.8V, NO load (PSM)**



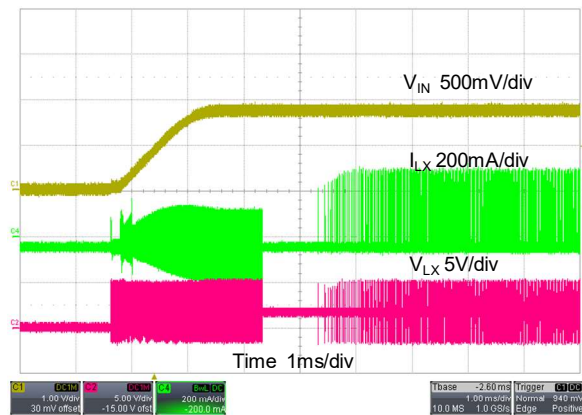
**CH4 VIN=3.6V, Vout=1.8V, NO load (PWM)**



**CH4 VIN=3.6V, Vout=1.8V, Iout=2A**



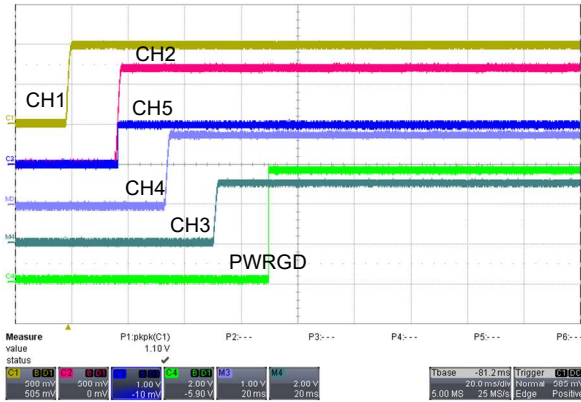
**CH4 VIN=3.6V, Vout=1.8V, Iout=30mA**



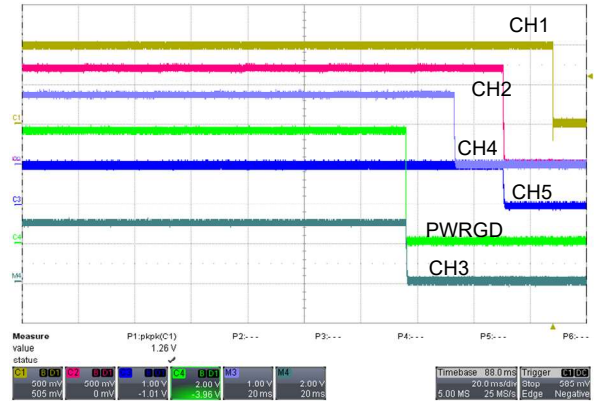
**Typical Performance Characteristics (continued)**

**2. Power on sequence**

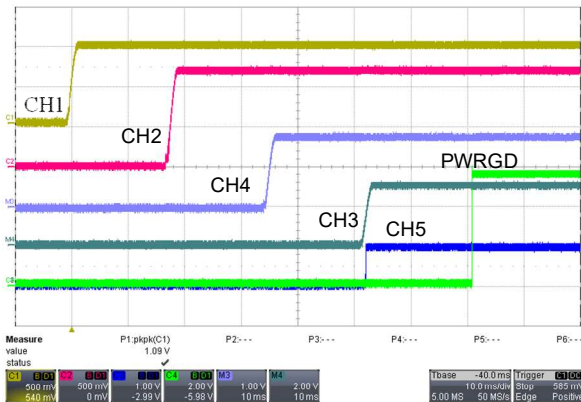
VIN=3.6V, Rseq=12k, EN1=high



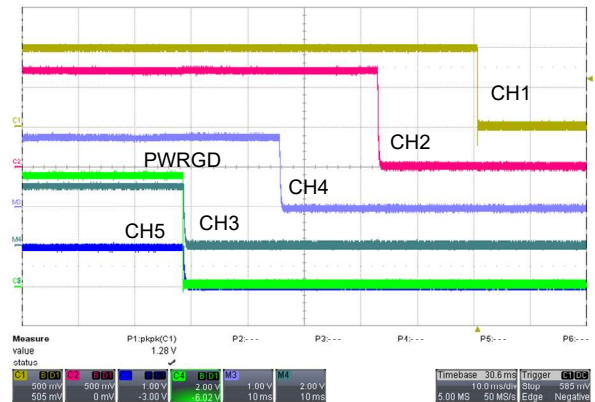
VIN=3.6V, Rseq=12k, EN1=low



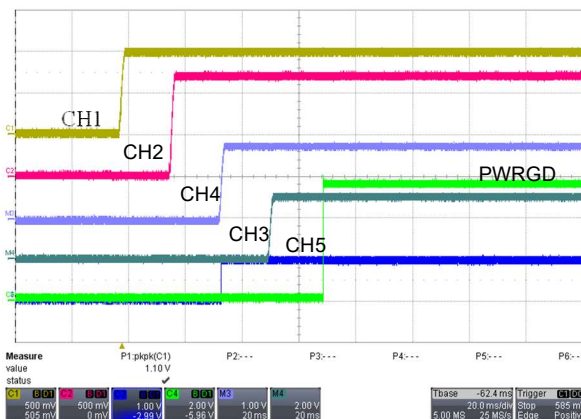
VIN=3.6V, Rseq=30k, EN1=high



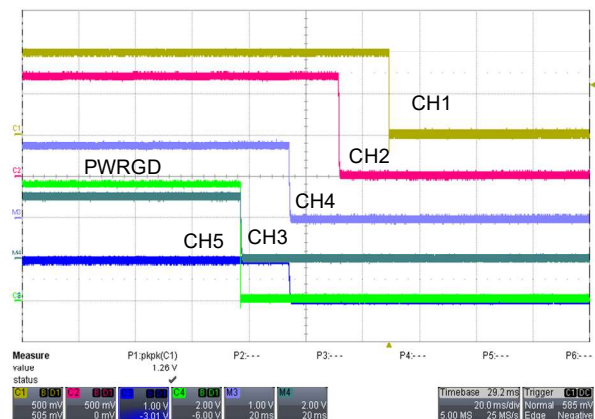
VIN=3.6V, Rseq=30k, EN1=low



VIN=3.6V, Rseq=60k, EN1=high



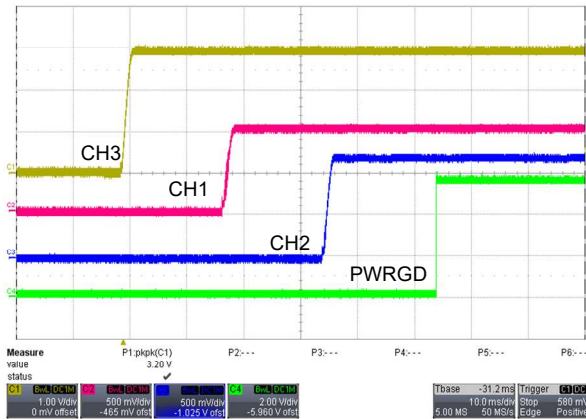
VIN=3.6V, Rseq=60k, EN1=low



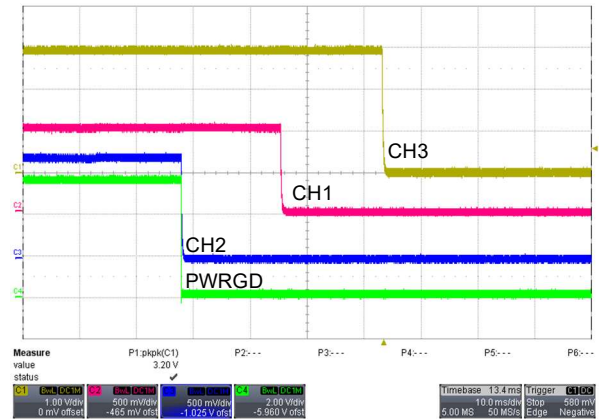
Typical Performance Characteristics (continued)

2. Power on sequence

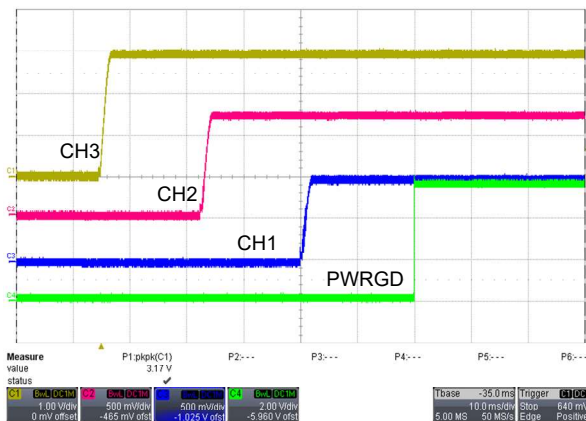
VIN=3.6V, Rseq=120k, EN1=high



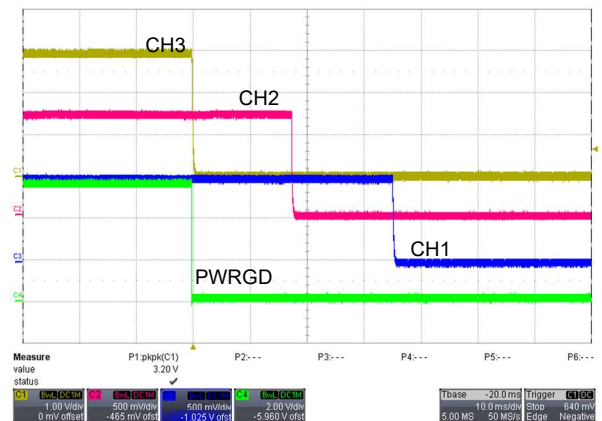
VIN=3.6V, Rseq=120k, EN1=low



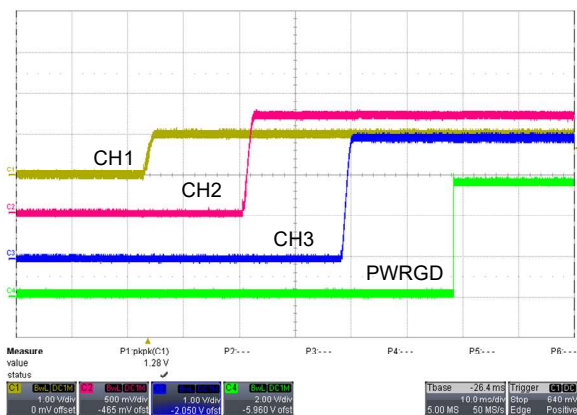
VIN=3.6V, Rseq=300k, EN1=high



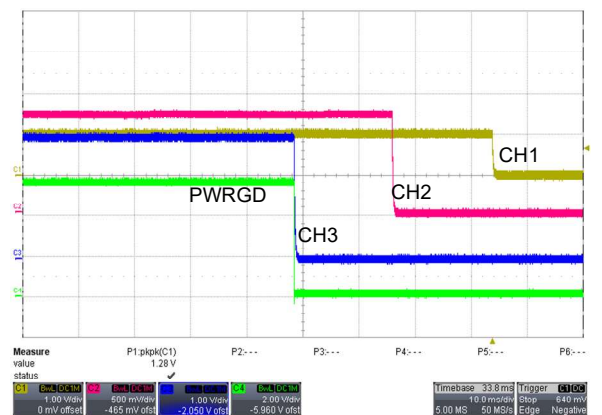
VIN=3.6V, Rseq=300k, EN1=low



VIN=3.6V, Rseq=Vcc, EN1=high



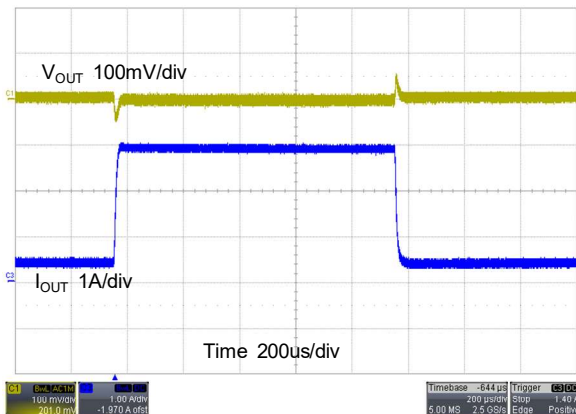
VIN=3.6V, Rseq=Vcc, EN1=low



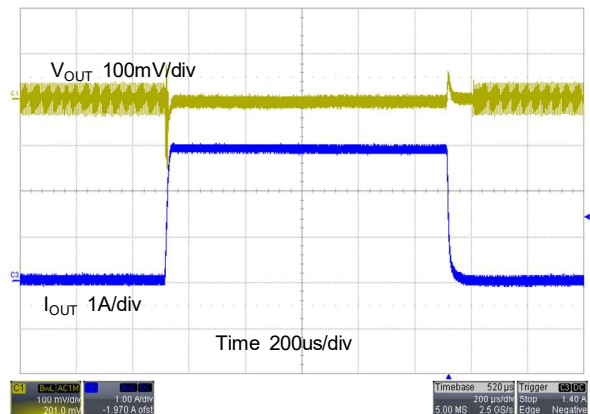
Typical Performance Characteristics (continued)

3. Load transient

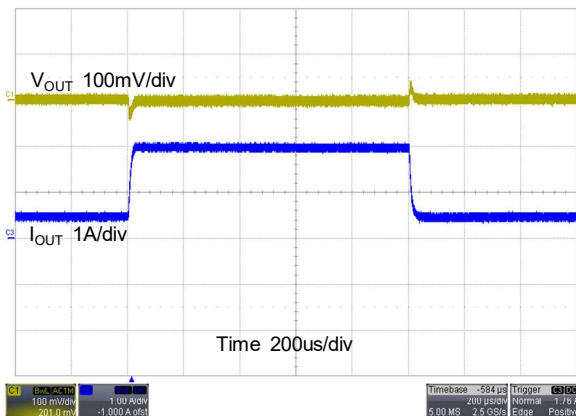
CH1, Fsw=1.5MHz, Iout=500mA~3A, VIN=4.2V



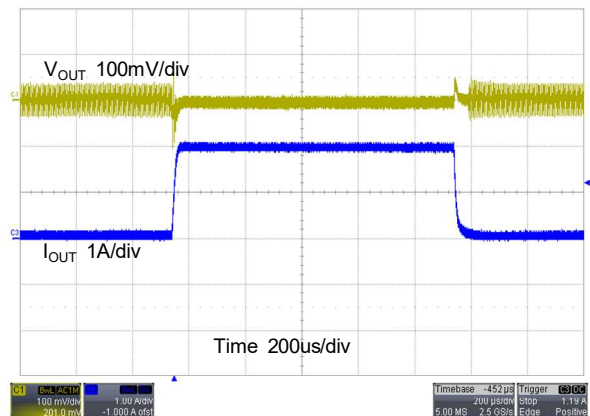
CH1, Fsw=1.5MHz, Iout=100mA~3A, VIN=4.2V



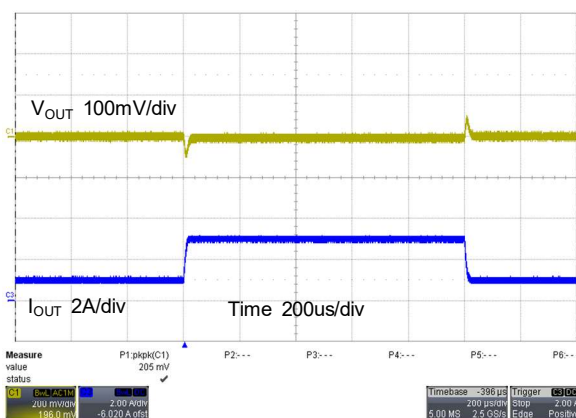
CH2, Fsw=1.5MHz, Iout=500mA~2A, VIN=4.2V



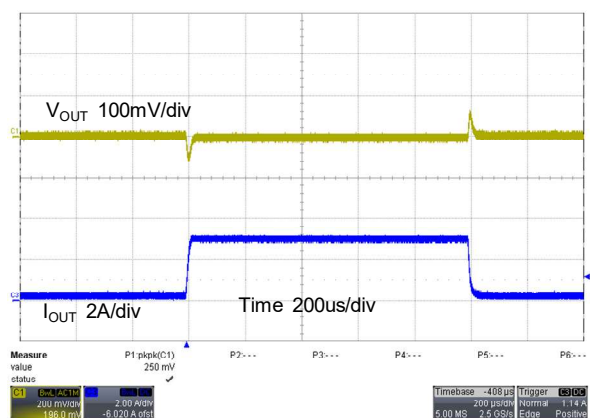
CH2, Fsw=1.5MHz, Iout=100mA~2A, VIN=4.2V



CH3, Fsw=1.5MHz, Iout=500mA~3A, VIN=4.2V



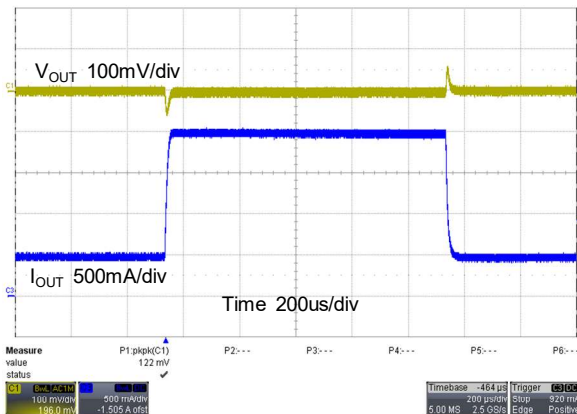
CH3, Fsw=1.5MHz, Iout=100mA~3A, VIN=4.2V



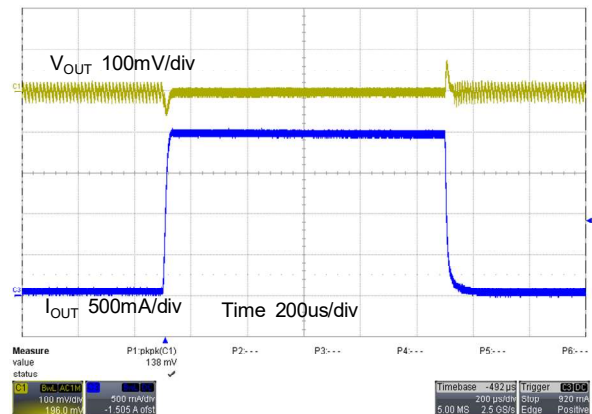
**Typical Performance Characteristics (continued)**

**3. Load transient**

CH4, Fsw=1.5MHz, Iout=500mA~2A, VIN=4.2V

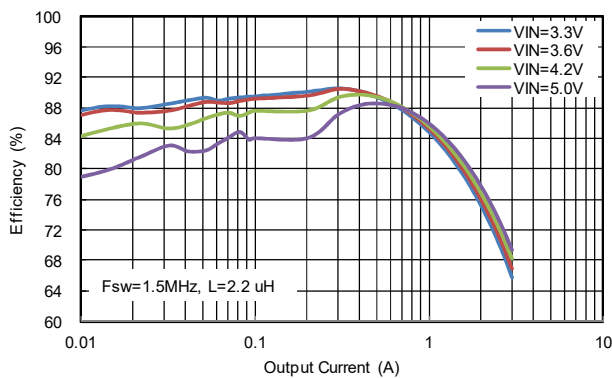


CH4, Fsw=1.5MHz, Iout=100mA~2A, VIN=4.2V

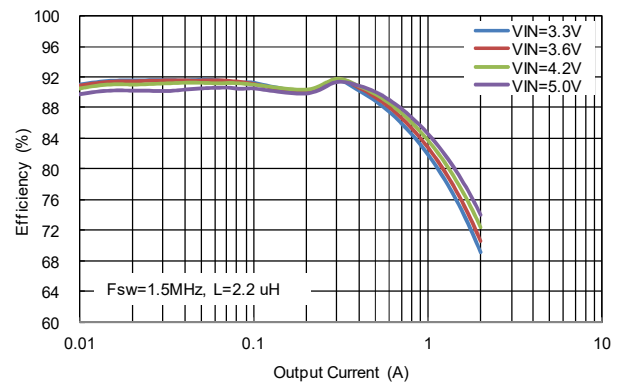


**4. Efficiency**

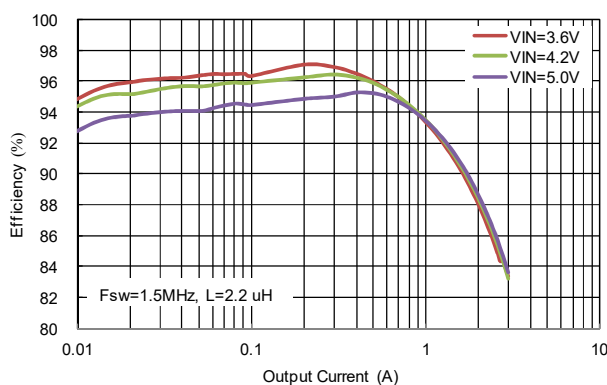
CH1, Fsw=1.5MHz, Iout=0~3A, Vout=1V



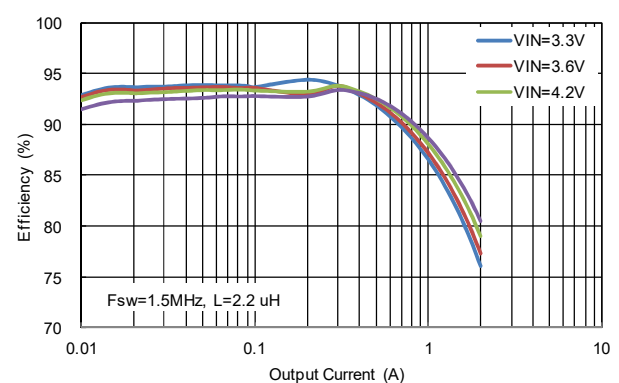
CH2, Fsw=1.5MHz, Iout=0~2A, Vout=1.2V



CH3, Fsw=1.5MHz, Iout=0~3A, Vout=3V



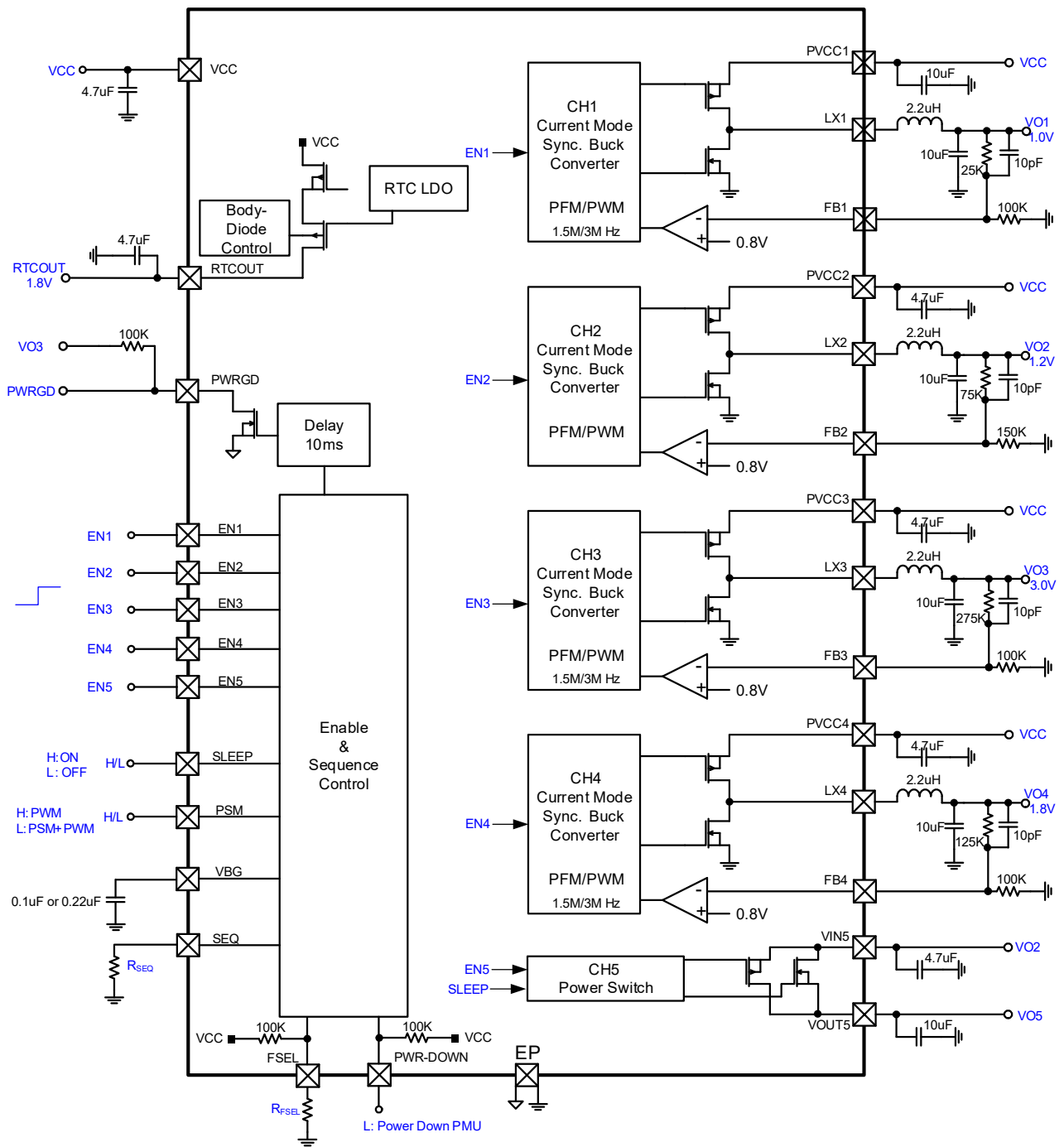
CH4, Fsw=1.5MHz, Iout=0~2A, Vout=1.8V



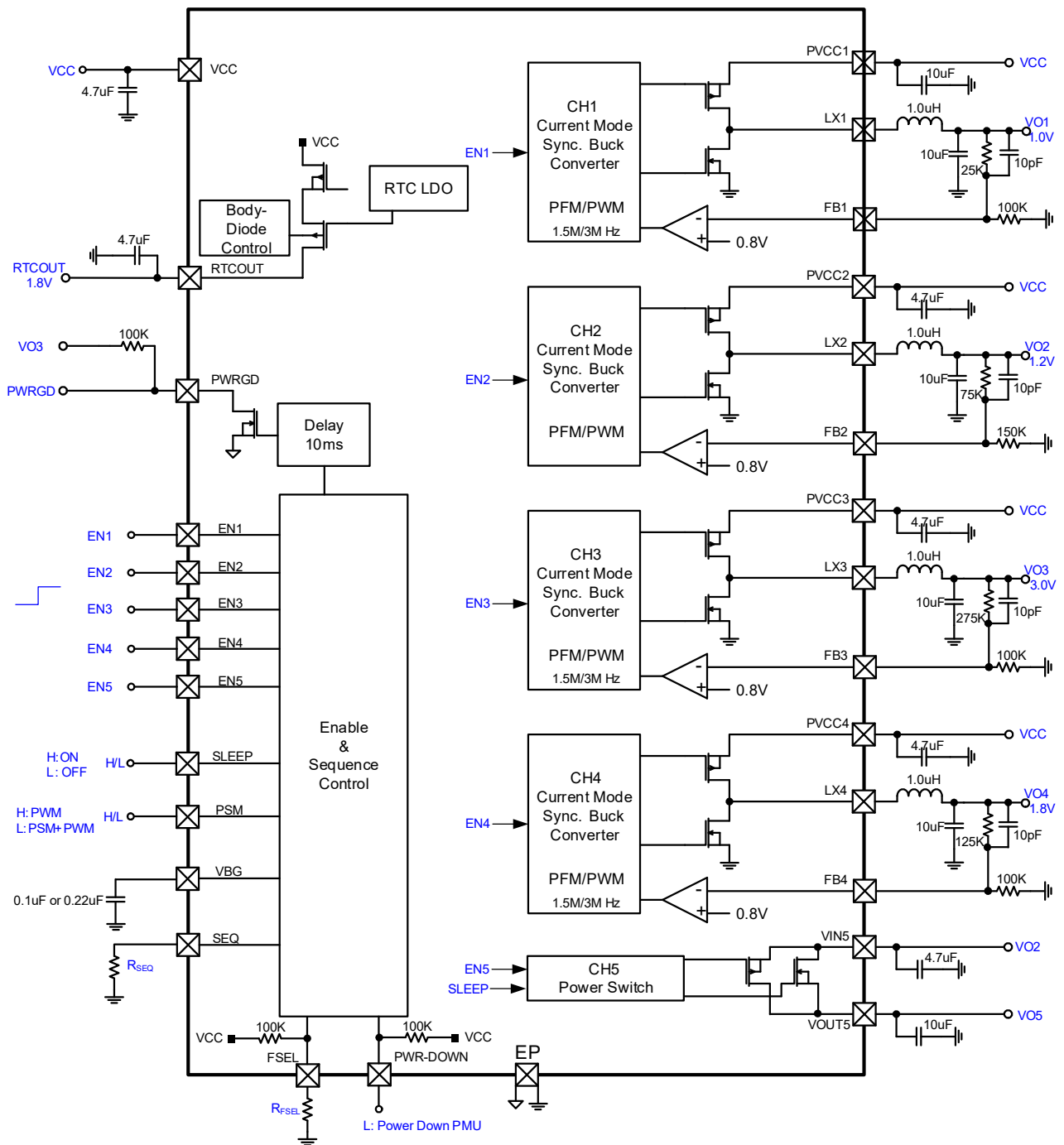
## Pin Description

| Pin No | Pin Name | Function                                                                                                                                                                                              |
|--------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | PVCC1    | Power Input of DCDC1 Buck Converter.                                                                                                                                                                  |
| 2      | PSM      | Setting the operating mode of DC/DC1~4.                                                                                                                                                               |
| 3      | FB1      | Sensing Input of DCDC1 Buck Converter's feedback voltage.                                                                                                                                             |
| 4      | PWRGD    | Indicator of PMU power on/off with open drain output.                                                                                                                                                 |
| 5      | PWRDN    | Power down pin of G2225A                                                                                                                                                                              |
| 6      | LX2      | Inductor switch node of DCDC2 Buck Converter.                                                                                                                                                         |
| 7      | PVCC2    | Power Input of DCDC2 Buck Converter.                                                                                                                                                                  |
| 8      | FB2      | Sensing Input of DCDC2 Buck Converter's output voltage.                                                                                                                                               |
| 9      | SLEEP    | Control the operation status of PMU.                                                                                                                                                                  |
| 10     | VIN5     | Power Input of Power Switch (CH5)                                                                                                                                                                     |
| 11     | VOU5     | Power Output of Power Switch (CH5)                                                                                                                                                                    |
| 12     | LX3      | Inductor switch node of DCDC3 Buck Converter.                                                                                                                                                         |
| 13     | PVCC3    | Power Input of DCDC3 Buck Converter.                                                                                                                                                                  |
| 14     | EN5      | Power on/off signal of Power Switch (CH5).                                                                                                                                                            |
| 15     | FB3      | Sensing Input of DCDC3 Buck Converter's output voltage.                                                                                                                                               |
| 16     | EN4      | Power on/off signal of DCDC4.                                                                                                                                                                         |
| 17     | EN3      | Power on/off signal of DCDC3.                                                                                                                                                                         |
| 18     | VBG      | 1.21V Reference Voltage Output. Bypass this pin to ground with a 0.1 $\mu$ F or 0.22 $\mu$ F ceramic capacitor. It is recommended that the capacitance value should not be greater than 0.22 $\mu$ F. |
| 19     | EN2      | Power on/off signal of DCDC2.                                                                                                                                                                         |
| 20     | EN1      | Power on/off signal of DCDC1.                                                                                                                                                                         |
| 21     | FB4      | Sensing Input of DCDC4 Buck Converter's output voltage.                                                                                                                                               |
| 22     | PVCC4    | Power Input of DCDC4 Buck Converter.                                                                                                                                                                  |
| 23     | LX4      | Inductor switch node of DCDC4 Buck Converter.                                                                                                                                                         |
| 24     | SEQ      | Setting the Power on/off timing sequence.                                                                                                                                                             |
| 25     | VCC      | IC Power Supply Input pin. Bypass with a 10 $\mu$ F or greater ceramic capacitor.                                                                                                                     |
| 26     | RTCLDO   | RTC LDO Output.                                                                                                                                                                                       |
| 27     | FSEL     | Setting the DC/DC switching frequency and the Power MOS type (p/n) for CH5                                                                                                                            |
| 28     | LX1      | Inductor switch node of DCDC1 Buck Converter.                                                                                                                                                         |
| EP     | GND      | Power Ground of DCDC1~4 Buck Converters and Digital/Analog ground. The Exposed Pad must be soldered to a large PCB and connected to GND for maximum power dissipation.                                |

**Block Diagram & Application circuit (1.5MHz)**



**Block Diagram & Application circuit (3.0MHz)**



## Function Description

### PMU

The G2225A includes four DC/DC Converters, one Power Switch, and one LDO to generate a multiple-output power-supply system.

|        | Topology                      | FB voltage | V <sub>OUT</sub> range                             | Current rating | ON/OFF Control                               |
|--------|-------------------------------|------------|----------------------------------------------------|----------------|----------------------------------------------|
| DCDC1  | 1.5/3MHz Sync. Buck Converter | 0.8V       | Set the V <sub>OUT1</sub> range from 0.8V to 1.5V. | 3.5A           | Controlled by EN1~EN5                        |
| DCDC2  | 1.5/3MHz Sync. Buck Converter | 0.8V       | Set the V <sub>OUT2</sub> range from 1.0V to 3.0V  | 2.0A           |                                              |
| DCDC3  | 1.5/3MHz Sync. Buck Converter | 0.8V       | Set the V <sub>OUT3</sub> range from 2.8V to 3.4V. | 2.5A           |                                              |
| DCDC4  | 1.5/3MHz Sync. Buck Converter | 0.8V       | Set the V <sub>OUT4</sub> range from 1.0V to 3.0V. | 2.0A           |                                              |
| SW5    | P/NMOS Switch                 | -          | 0.8V to VCC                                        | 300mA          | Always On if PWRDN=1<br>Shut down if PWRDN=0 |
| RTCLDO | PMOS LDO                      | -          | 1.8V                                               | 50mA           |                                              |

## Detail Pin Description

### PWRGD

| PWRGD         | Operation mode |
|---------------|----------------|
| Power Good    | High           |
| No Power Good | Low            |

### FSEL

| FSEL           | Switch Frequency | P/NMOS for CH5 |
|----------------|------------------|----------------|
| Short to VCC   | 3MHz             | PMOS           |
| 120K $\Omega$  | 1.5MHz           | PMOS           |
| 20K $\Omega$   | 1.5MHz           | NMOS           |
| Connect to GND | 3MHz             | NMOS           |

### PSM

| PSM  | Operation mode |
|------|----------------|
| High | PWM            |
| Low  | PSM+PWM        |

### SLEEP (SEQ=12K $\Omega$ Only)

| SLEEP | EN1  | CH2       | Other Channels |
|-------|------|-----------|----------------|
| Low   | Low  | Shutdown  | Shutdown       |
| Low   | High | Operation | Operation      |
| High  | Low  | Operation | Shutdown       |
| High  | High | Operation | Operation      |

### SLEEP (SEQ=30K $\Omega$ Only)

| SLEEP | EN1  | CH3       | Other Channels |
|-------|------|-----------|----------------|
| Low   | Low  | Shutdown  | Shutdown       |
| Low   | High | Operation | Operation      |
| High  | Low  | Operation | Shutdown       |
| High  | High | Operation | Operation      |

### SLEEP (SEQ=60K $\Omega$ Only)

| SLEEP | EN1  | CH4       | Other Channels |
|-------|------|-----------|----------------|
| Low   | Low  | Shutdown  | Shutdown       |
| Low   | High | Operation | Operation      |
| High  | Low  | Operation | Shutdown       |
| High  | High | Operation | Operation      |

## PMU Power ON/OFF Initiation

The following conditions are available to turn on the PMU of G2225A:

- EN1 is high when R\_SEQ is connected a resistor to GND.
- One of EN1~EN4 is high when R\_SEQ is shorted to VCC.

## PMU Power ON/OFF Sequence

When the power on condition is met, these four DC/DC converters and Power Switch (CH5) start up in sequence set by R\_SEQ pin. The open-drain output PWRGD is high with 10ms time delay from start up sequence is finished (or all CH1~4 turn ON when R\_SEQ is shorted to VCC). When power off, all channels start the power off sequence. The detail sequence setting and timing are shown below.

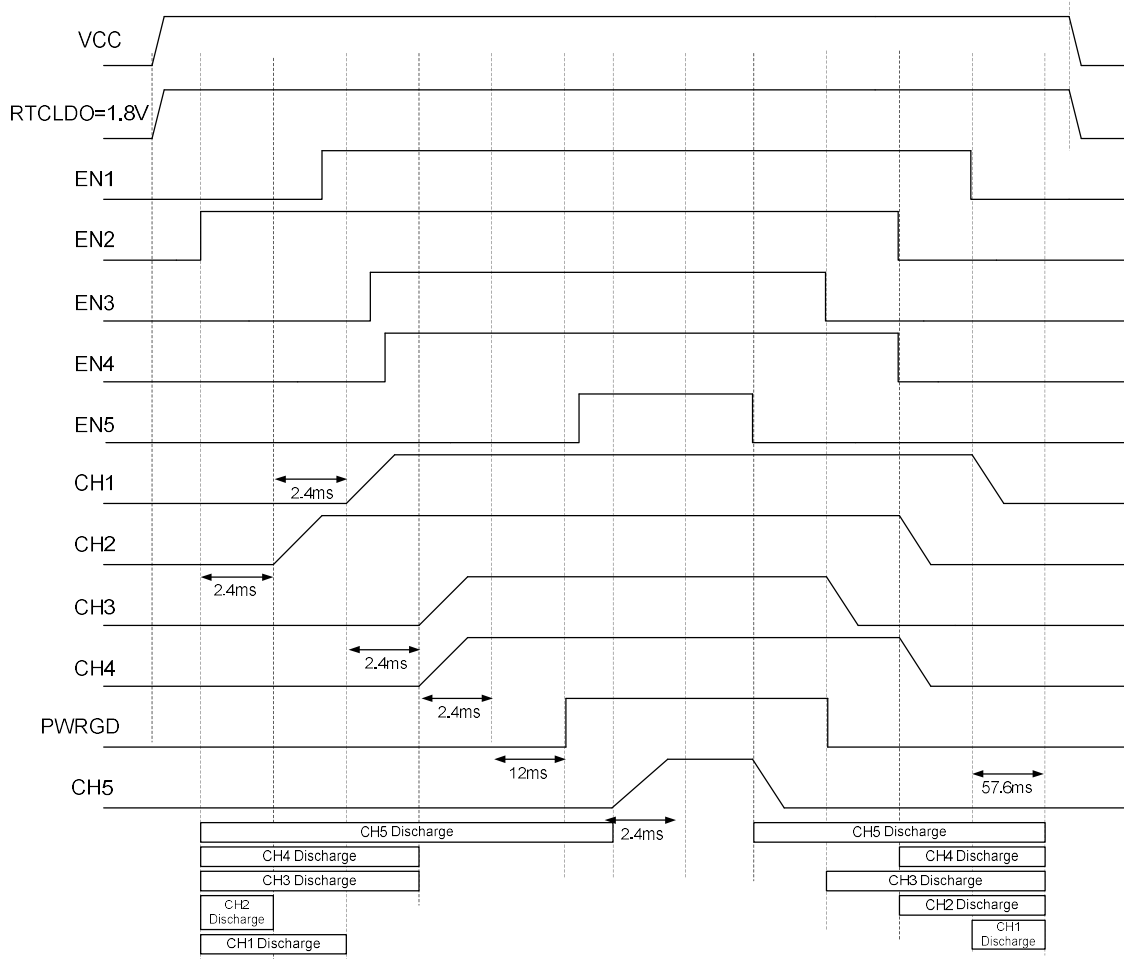
### Power on/off timing sequence setting:

| R_SEQ        | Status    | EN Control       | Sequence                                                                                              | Note                                                  |
|--------------|-----------|------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Short to GND | Power-on  | One of EN1~3=H   | All Channel Independent<br>(One of CH1~3 has to be enabled first before CH4 and/or CH5 being enabled) | PWRGD is high after 10ms delay from all CH1~4 are ON. |
|              | Power-off | All of EN1~3=L   | Operation                                                                                             | PWRGD is low if one of CH1~4 is OFF.                  |
| 12KΩ         | Power-on  | EN1=H, EN2/3/4=0 | CH1→CH2/5→CH4→CH3→PWRGD                                                                               | Support SLEEP Mode (Self-Refresh)                     |
|              | Power-off | EN1=L            | PWRGD→CH3→CH4→CH2/5→CH1                                                                               | Support SLEEP Mode (Self-Refresh)                     |
| 30KΩ         | Power-on  | EN1=H, EN2/3/4=0 | CH1→CH2→CH4→CH3/5→PWRGD                                                                               | Support SLEEP Mode (BT Wake-up)                       |
|              | Power-off | EN1=L            | PWRGD→CH3/5→CH4→CH2→CH1                                                                               | Support SLEEP Mode (BT Wake-up)                       |
| 60KΩ         | Power-on  | EN1=H, EN2/3/4=0 | CH1→CH2→CH4/5→CH3→PWRGD                                                                               | Support SLEEP MODE (BT Wake-up)                       |
|              | Power-off | EN1=L            | PWRGD→CH3→CH4/5→CH2→CH1                                                                               | Support SLEEP MODE (BT Wake-up)                       |
| 120KΩ        | Power-on  | EN1=H, EN2/3=0   | CH3→CH1→CH2→PWRGD                                                                                     | CH4/5 Independent Control ON/OFF                      |
|              | Power-off | EN1=L            | PWRGD→CH2→CH1→CH3                                                                                     | CH4/5 Independent Control ON/OFF                      |
| 300KΩ        | Power-on  | EN1=H, EN2/3=0   | CH3→CH2→CH1→PWRGD                                                                                     | CH4/5 Independent Control ON/OFF                      |
|              | Power-off | EN1=L            | PWRGD→CH3→CH2→CH1                                                                                     | CH4/5 Independent Control ON/OFF                      |
| Short to VCC | Power-on  | EN1=H, EN2/3=0   | CH1→CH2→CH3→PWRGD                                                                                     | CH4/5 Independent Control ON/OFF                      |
|              | Power-off | EN1=L            | PWRGD→CH3→CH2→CH1                                                                                     | CH4/5 Independent Control ON/OFF                      |

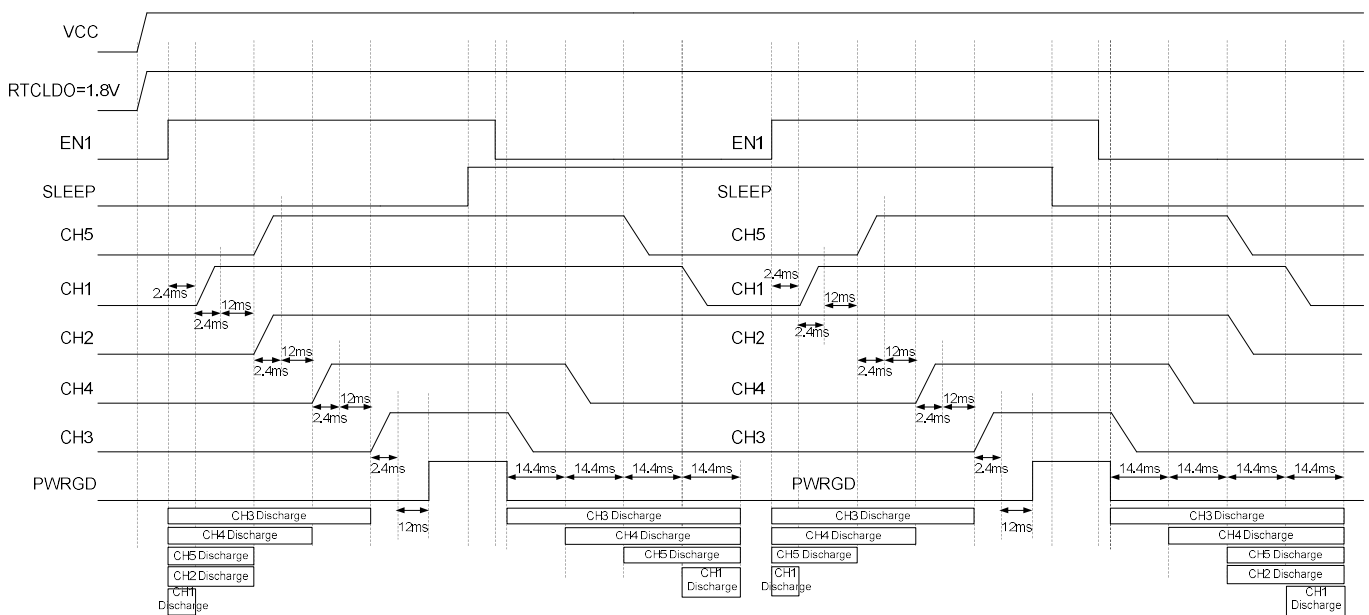
\*If CH5 is in the sequence, connect VIN5 to VCC or the channel output that established with/before CH5 (even if VOUT5 is not in use).

## Power ON/OFF Sequence Timing Diagram:

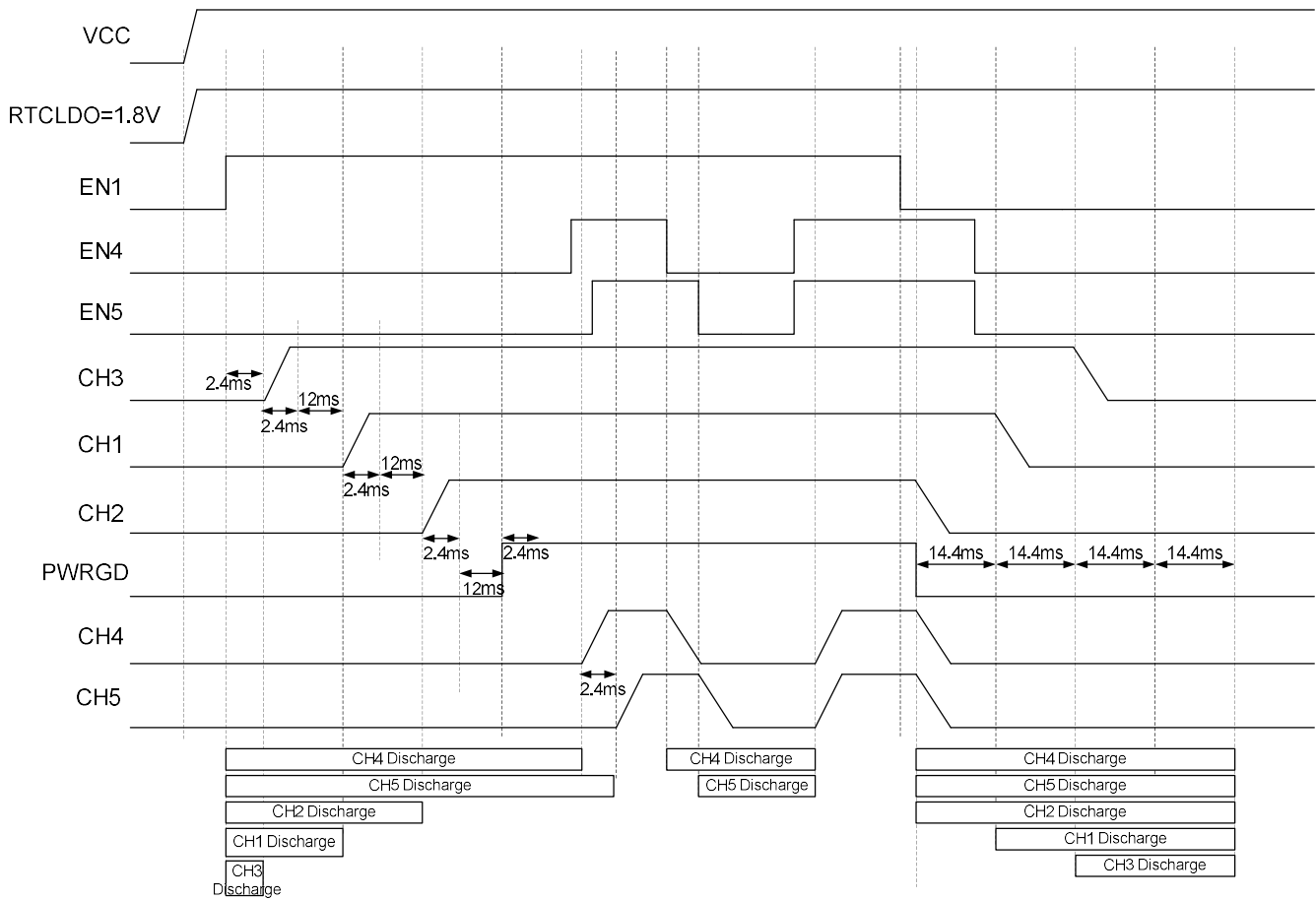
### 1. R\_SEQ short to GND



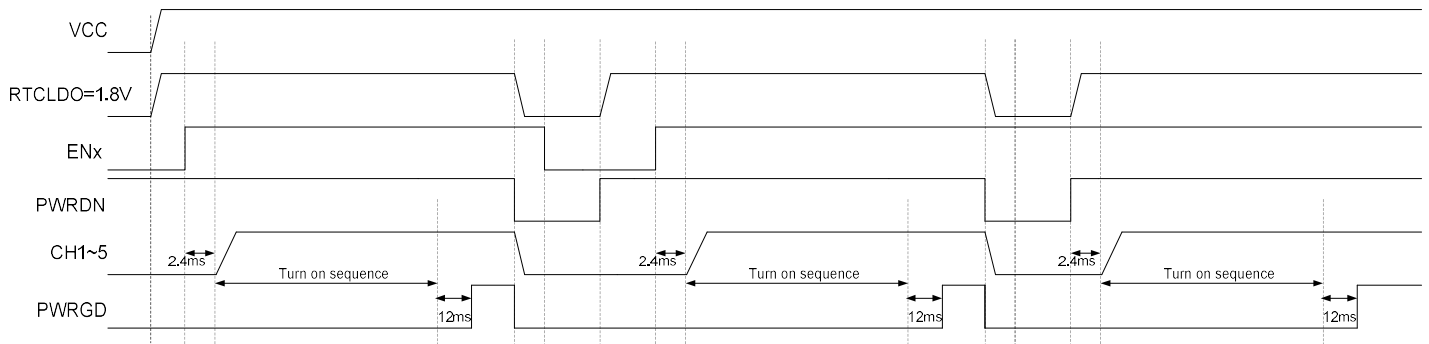
### 2. R\_SEQ=12kΩ



**3. R\_SEQ=120kΩ**



**4. PWRDN timing**

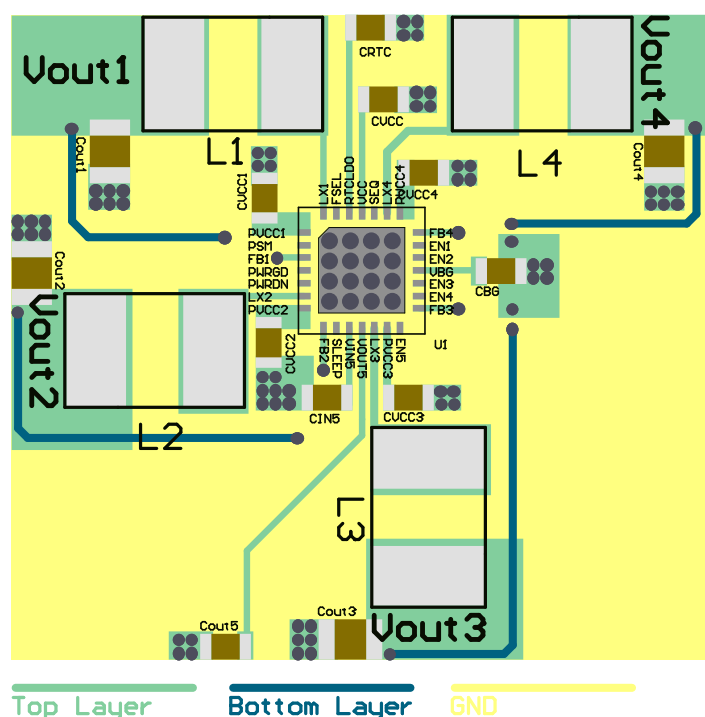


## PMU Fault Protection

G2225A PMU provides VCC over voltage protection, over-current protection, under-voltage protection, short-circuit protection, and thermal shutdown protection to achieve complete protection.

|                        | Protection type | Threshold             | Protection methods                | Reset Method                                     |
|------------------------|-----------------|-----------------------|-----------------------------------|--------------------------------------------------|
| <b>VCC</b>             | UVLO            | VCC<2.34V             | IC shutdown                       | Reset by the power-on/off initiation conditions  |
|                        | OVP             | VCC>6.15V             | IC shutdown                       | Reset by the power-on/off initiation conditions  |
| <b>DCDC1</b><br>Buck   | Current Limit   | PMOS current>4.4A     | PMOS Off, NMOS on                 | Automatic Reset at next cycle                    |
|                        | UVP             | FB1,3<0.7V            | IC shutdown if period above 128ms | Reset by the power- on/off initiation conditions |
| <b>DCDC3</b><br>Buck   | Current Limit   | PMOS current>3.1A     | PMOS Off, NMOS on                 | Automatic Reset at next cycle                    |
|                        | UVP             | FB1,3<0.7V            | IC shutdown if period above 128ms | Reset by the power- on/off initiation conditions |
| <b>DCDC2,4</b><br>Buck | Current Limit   | PMOS current>2.5A     | PMOS Off, NMOS on                 | Automatic Reset at next cycle                    |
|                        | UVP             | FB2,4 <0.7V           | IC shutdown if period above 128ms | Reset by the power- on/off initiation conditions |
| <b>Power Switch 5</b>  | Current Limit   | P/NMOS current>400mA  |                                   | P/NMOS current<400mA                             |
|                        | SCP             | VOUT5<0.7V            | P/NMOS Off                        | Reset by the power- on/off initiation conditions |
| <b>Thermal</b>         | TSD             | Junction Temp. >150°C | IC shutdown                       | Reset by the power- on/off initiation conditions |

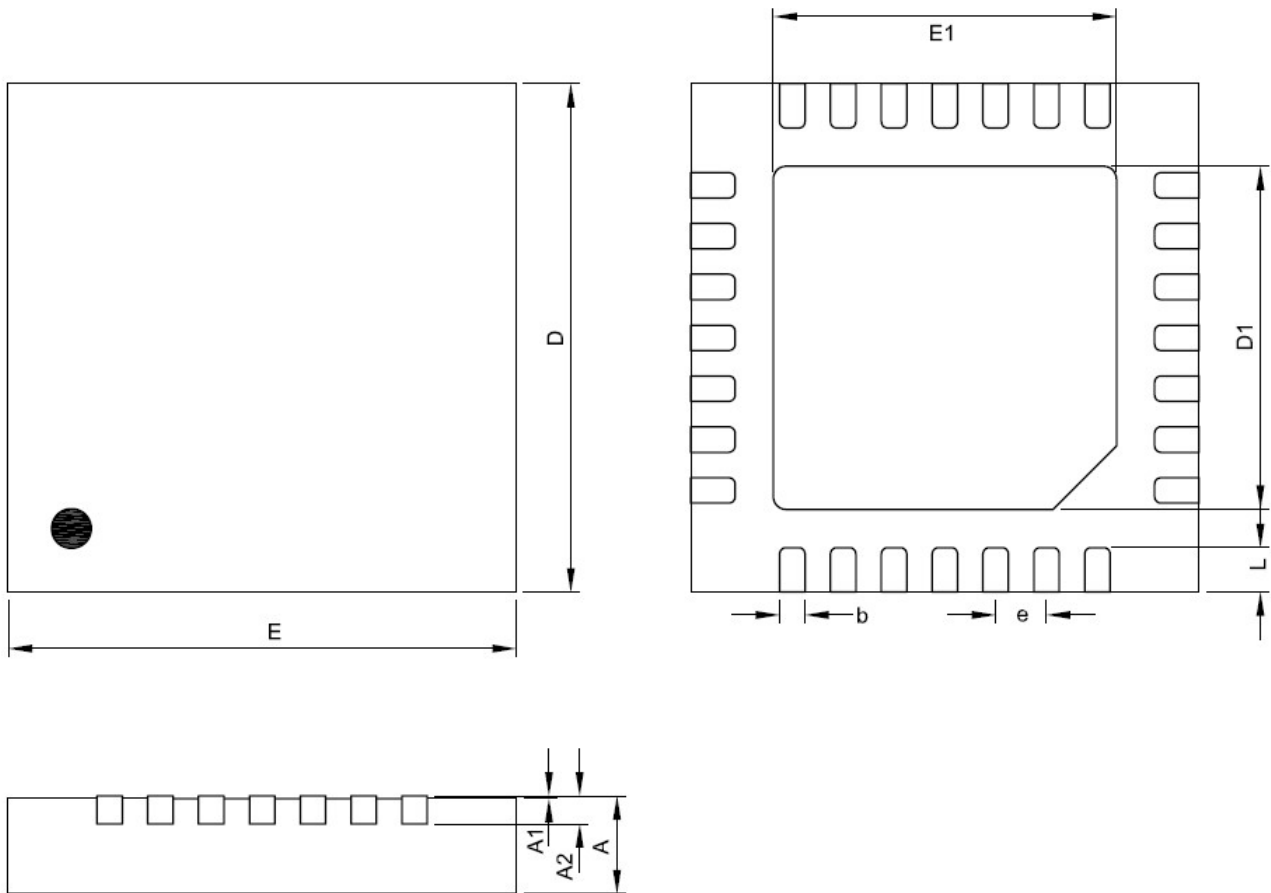
## PCB Layout Guideline



1. Place the CVCCx as close to the PVCCx pin as possible.
2. Keep the traces for the CVCCx, inductor and the COUTx, short, direct and wide.
3. Keep the Feed-back path away from switching high current paths, and place the FB voltage divider circuit as close to VOUTx pin as possibly.

\*Note: x represents the channel number.

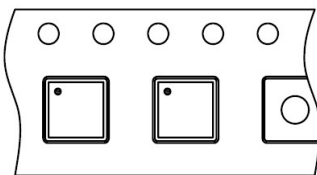
**Package Information**



**TQFN4X4-28 Package**

| Symbol | DIMENSION IN MM |      |      | DIMENSION IN INCH |        |        |
|--------|-----------------|------|------|-------------------|--------|--------|
|        | MIN.            | NOM. | MAX. | MIN.              | NOM.   | MAX.   |
| A      | 0.70            | 0.75 | 0.80 | 0.0276            | 0.0295 | 0.0315 |
| A1     | 0.00            | ---  | 0.05 | 0.0000            | ---    | 0.0020 |
| A2     | 0.20 REF        |      |      | 0.0079 REF        |        |        |
| D      | 3.95            | 4.00 | 4.05 | 0.1555            | 0.1575 | 0.1594 |
| E      | 3.95            | 4.00 | 4.05 | 0.1555            | 0.1575 | 0.1594 |
| D1     | 2.55            | 2.65 | 2.75 | 0.1004            | 0.1043 | 0.1083 |
| E1     | 2.55            | 2.65 | 2.75 | 0.1004            | 0.1043 | 0.1083 |
| b      | 0.15            | 0.20 | 0.25 | 0.0059            | 0.0079 | 0.0098 |
| e      | 0.40 BSC        |      |      | 0.0157 BSC        |        |        |
| L      | 0.30            | 0.40 | 0.45 | 0.0118            | 0.0157 | 0.0177 |

**Taping Specification**



Feed Direction

GMT Inc. does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and GMT Inc. reserves the right at any time without notice to change said circuitry and specifications.

| PACKAGE    | Q'TY/REEL |
|------------|-----------|
| TQFN4X4-28 | 3,000 ea  |