

## 4+1 channels PMIC

### Features

- 2.7V ~ 5.5V Input Voltage Operation.
- 95% Efficient DC/DC Converter
- Independent Enable Control
- Built-in 4-ch synchronous buck converter, and 1-ch LDO
- Bucks can be set to lower quiescent current at low load.
- 180° Phase Shifted architecture
- Fixed 1.5MHz switching frequency
- Built-In Short Circuit Protection (SCP), Under Voltage Protection (UVP), and cycle-by cycle current limit for DC/DC Converters.
- Built-In Thermal Shutdown Function.
- Built-In VCC OVP Function.
- QFN4X4-24 Package.

### General Description

The G2257 provide a complete power supply solution for handsets or data card. It contains four dc/dc converters, and one 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 1.5MHz to optimize size, cost, and efficiency. All Synchronous converters are enabled by individual EN pin control and operate at pulse skipping mode at light load.

The G2257 is available in QFN4X4-24 package.

### Applications

- Smart Phone
- TV Dongle
- OTT

### Ordering Information

| ORDER NUMBER | MARKING | TEMP. RANGE | PACKAGE (Green) |
|--------------|---------|-------------|-----------------|
| G2257Q51U    | 2257    | -40°C~+85°C | QFN4X4-24       |

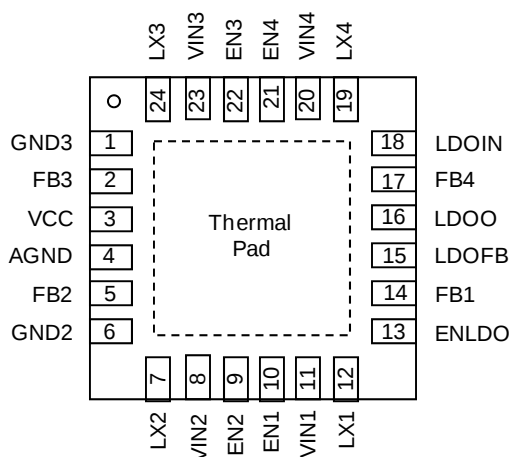
Note: Q5: QFN4X4-24

1: Bonding code

U: Tape & Reel

Green : Lead Free / Halogen Free.

### Pin Configuration



#### G2257 QFN4X4-24

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

## Absolute Maximum Ratings

Input Voltage (VIN1, VIN2, VIN3, VIN4, VCC)  
 ..... -0.3V to +6.3V  
 LX Pin Voltage (LX1, LX2, LX3, LX4)  
 ..... -0.3V to +6.3V  
 All Other Pins Voltage. .... -0.3V to +6.3V  
 Thermal Resistance Junction to Ambient, ( $\theta_{JA}$ )  
 QFN4X4-24 ..... 52°C/W  
 Continuous Power Dissipation ( $T_A=25^\circ\text{C}$ )  
 QFN4X4-24 ..... 2.4W  
 Thermal Resistance Junction to Case, ( $\theta_{JC}$ )  
 QFN4X4-24. .... 28°C/W

Temperature operating Range ( $T_A$ ) . . . . -40°C to 85°C  
 Maximum Junction Temperature ( $T_{Jmax}$ ) . . . . +150°C  
 Lead Temperature (Soldering, 10 sec). . . . 260°C  
 Storage Temperature Range ( $T_S$ ) . . . -65°C to +150°C  
 EDS Susceptibility (Human Body Mode) . . . . . 2kV  
 EDS Susceptibility (Machine Mode) . . . . . 200V

## Recommended Operating Conditions

Input Voltage (VIN1, VIN2, VIN3, VIN4, VCC)  
 ..... +2.7V to +5.5V  
 Junction Temperature Range ( $T_J$ ) . . . -40°C to +125°C

- 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.

## Electrical characteristics

(VIN<sub>x</sub>=3.6V, VCC=3.6V, T<sub>A</sub>=25°C)

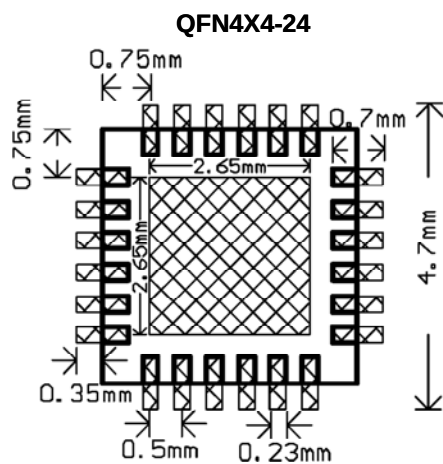
The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

| PARAMETER                          | SYMBOL                    | CONDITIONS                                                    | MIN   | TYP  | MAX   | UNIT |
|------------------------------------|---------------------------|---------------------------------------------------------------|-------|------|-------|------|
| <b>GENERAL</b>                     |                           |                                                               |       |      |       |      |
| VIN Operating Voltage              | V <sub>INx</sub>          |                                                               | 2.7   | ---  | 5.5   | V    |
| VCC Operating Voltage for PMU      | V <sub>VCC_PMU</sub>      |                                                               | 2.7   | ---  | 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_LDO</sub>      | Only LDO is active, I <sub>o</sub> =0A                        | ---   | 65   | 80    | μA   |
|                                    | I <sub>VCC_DC</sub>       | Only DC1 is active, I <sub>o</sub> =0A                        | ---   | 60   | 80    | uA   |
|                                    | I <sub>VCC_ALL</sub>      | DC1~DC4 are active, I <sub>o</sub> =0A                        | ---   | 120  | 150   | uA   |
| PMU Non-switching Supply Current   | I <sub>VCC_DC_NOSW</sub>  | Only DC1 is active (non switching)                            | ---   | 40   | 55    | uA   |
|                                    | I <sub>VCC_ALL_NOSW</sub> | DC1~DC4 are active (non switching)                            | ---   | 55   | 80    | uA   |
| PMU Shutdown Current               | I <sub>PMU_SD</sub>       | PMU shutdown.                                                 | ---   | 0.1  | 1     | μA   |
| <b>ENABLE CONTROL</b>              |                           |                                                               |       |      |       |      |
| Enable Pin Input High Threshold    | V <sub>ENx-H</sub>        | DCDC1~DCDC4                                                   | 1.4   | ---  | ---   | V    |
| Enable Pin Input Low Threshold     | V <sub>ENx-L</sub>        | DCDC1~DCDC4                                                   | ---   | ---  | 0.5   | V    |
| <b>OSCILLATOR</b>                  |                           |                                                               |       |      |       |      |
| Frequency                          | F <sub>OSC</sub>          | DCDC1~DCDC4                                                   | 1.2   | 1.5  | 1.8   | MHz  |
| <b>CH1 DC/DC Buck Converter</b>    |                           |                                                               |       |      |       |      |
| Soft-Start Internal                | SS_CH1                    |                                                               | ---   | 1.3  | ---   | mS   |
| FB regulation voltage accuracy     | V <sub>FB1</sub>          |                                                               | 0.588 | 0.6  | 0.612 | V    |
| Maximum Duty Cycle                 | D <sub>max1</sub>         |                                                               | ---   | 100  | ---   | %    |
| VIN Leakage Current                | I <sub>VIN1_LK</sub>      | V <sub>LX1</sub> =0V, VIN1=5.0V                               | ---   | 1    | 5     | μA   |
| LX Leakage Current                 | I <sub>LX1_LK</sub>       | V <sub>LX1</sub> =5.0V                                        | ---   | 1    | 5     | μA   |
| Switch ON Resistance               | R <sub>on1-N</sub>        |                                                               | ---   | 76   | ---   | mΩ   |
|                                    | R <sub>on1-P</sub>        |                                                               | ---   | 100  | ---   |      |
| Peak Current Limit                 | I <sub>LIM_CH1</sub>      |                                                               | 4.5   | 5    | ---   | A    |
| Under Voltage Protection Threshold | %V <sub>UVP_CH1</sub>     | %V <sub>UVP_CH1</sub> =V <sub>FB_UVP1</sub> /V <sub>FB1</sub> | ---   | 87.5 | ---   | %    |

**Electrical characteristics (Continued)**

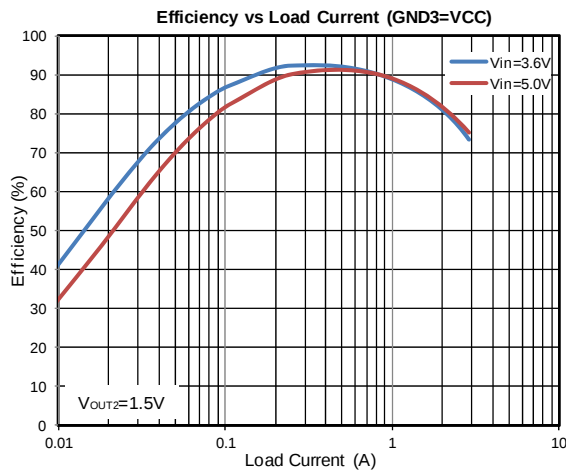
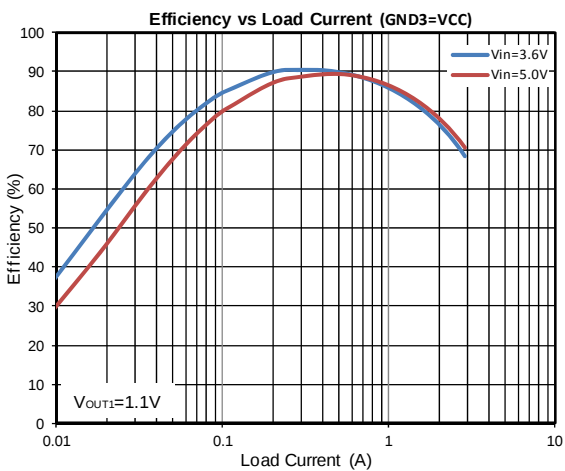
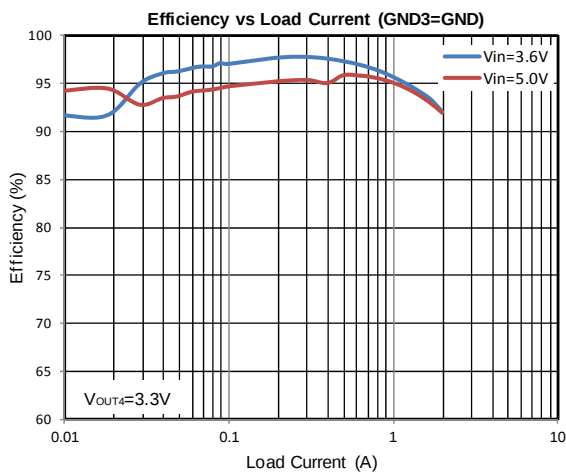
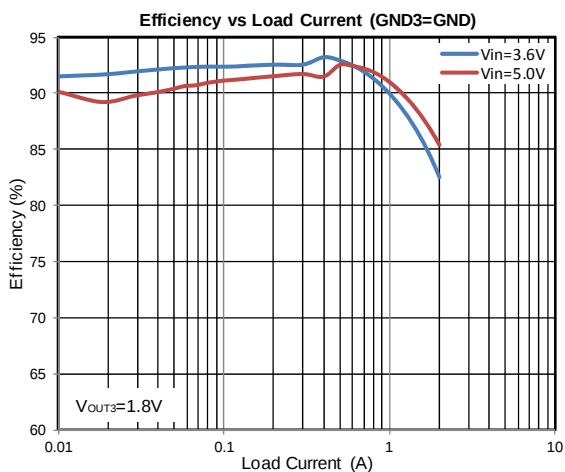
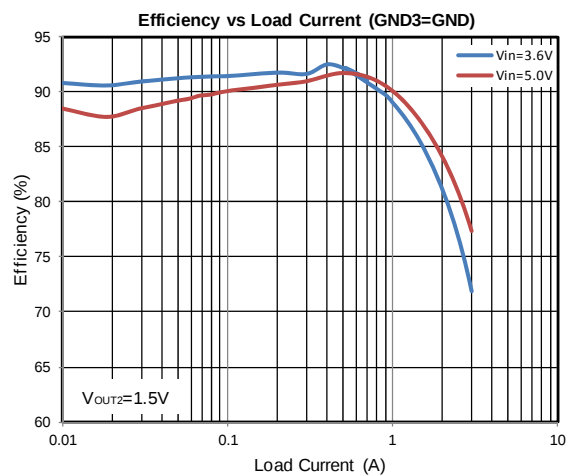
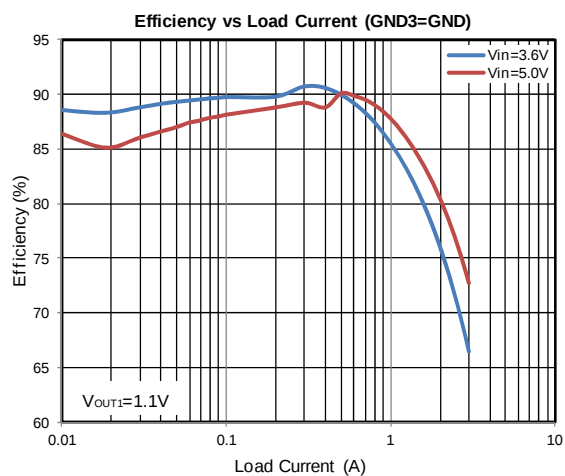
| PARAMETER                          | SYMBOL           | CONDITIONS                            | MIN   | TYP  | MAX   | UNIT        |
|------------------------------------|------------------|---------------------------------------|-------|------|-------|-------------|
| <b>CH2 DC/DC Buck Converter</b>    |                  |                                       |       |      |       |             |
| Soft-Start Internal                | SS_CH2           |                                       | ---   | 1.3  | ---   | mS          |
| FB regulation voltage accuracy     | $V_{FB2}$        |                                       | 0.588 | 0.6  | 0.612 | V           |
| Maximum Duty Cycle                 | $D_{max2}$       |                                       | ---   | 100  | ---   | %           |
| VIN Leakage Current                | $I_{VIN2\_LK}$   | $V_{LX2}=0V, VIN2=5.0V$               | ---   | 1    | 5     | $\mu A$     |
| LX Leakage Current                 | $I_{LX2\_LK}$    | $V_{LX2}=5.0V$                        | ---   | 1    | 5     | $\mu A$     |
| Switch ON Resistance               | Ron2-N           |                                       | ---   | 76   | ---   | m $\Omega$  |
|                                    | Ron2-P           |                                       | ---   | 100  | ---   |             |
| Peak Current Limit                 | $I_{LIM\_CH2}$   |                                       | 4.5   | 5    | ---   | A           |
| Under Voltage Protection Threshold | $\%V_{UVP\_CH2}$ | $\%V_{UVP\_CH2}=V_{FB\_UVP2}/V_{FB2}$ | ---   | 87.5 | ---   | %           |
| <b>CH3 DC/DC Buck Converter</b>    |                  |                                       |       |      |       |             |
| Soft-Start Internal                | SS_CH3           |                                       | ---   | 1.3  | ---   | mS          |
| FB regulation voltage accuracy     | $V_{FB3}$        |                                       | 0.588 | 0.6  | 0.612 | V           |
| Maximum Duty Cycle                 | $D_{max3}$       |                                       | ---   | 100  | ---   | %           |
| VIN Leakage Current                | $I_{VIN3\_LK}$   | $V_{LX3}=0V, VIN3=5.0V$               | ---   | 1    | 5     | $\mu A$     |
| LX Leakage Current                 | $I_{LX3\_LK}$    | $V_{LX3}=5.0V$                        | ---   | 1    | 5     | $\mu A$     |
| Switch ON Resistance               | Ron3-N           |                                       | ---   | 88   | ---   | m $\Omega$  |
|                                    | Ron3-P           |                                       | ---   | 100  | ---   |             |
| Peak Current Limit                 | $I_{LIM\_CH3}$   |                                       | 4.5   | 5    | ---   | A           |
| Under Voltage Protection Threshold | $\%V_{UVP\_CH3}$ | $\%V_{UVP\_CH3}=V_{FB\_UVP3}/V_{FB3}$ | ---   | 87.5 | ---   | %           |
| <b>CH4 DC/DC Buck Converter</b>    |                  |                                       |       |      |       |             |
| Soft-Start Internal                | SS_CH4           |                                       | ---   | 1.3  | ---   | mS          |
| FB regulation voltage accuracy     | $V_{FB4}$        |                                       | 0.588 | 0.6  | 0.612 | V           |
| Maximum Duty Cycle                 | $D_{max4}$       |                                       | ---   | 100  | ---   | %           |
| VIN Leakage Current                | $I_{VIN4\_LK}$   | $V_{LX1}=0V, VIN4=5.0V$               | ---   | 1    | 5     | $\mu A$     |
| LX Leakage Current                 | $I_{LX4\_LK}$    | $V_{LX4}=5.0V$                        | ---   | 1    | 5     | $\mu A$     |
| Switch ON Resistance               | Ron4-N           |                                       | ---   | 88   | ---   | m $\Omega$  |
|                                    | Ron4-P           |                                       | ---   | 100  | ---   |             |
| Peak Current Limit                 | $I_{LIM\_CH4}$   |                                       | 4.5   | 5    | ---   | A           |
| Under Voltage Protection Threshold | $\%V_{UVP\_CH4}$ | $\%V_{UVP\_CH4}=V_{FB\_UVP4}/V_{FB4}$ | ---   | 87.5 | ---   | %           |
| <b>LDO</b>                         |                  |                                       |       |      |       |             |
| Input voltage range                | $V_{LDOIN}$      |                                       | 2.7   | ---  | 5.5   | V           |
| Soft-Start Internal                | SS_LDO           |                                       | ---   | 1.3  | ---   | mS          |
| FB regulation voltage accuracy     | $V_{FBLDO}$      |                                       | 0.588 | 0.6  | 0.612 | V           |
| LDO Input Current                  | $I_{LDOIN}$      | $I_o=0mA$                             | ---   | ---  | 32    | $\mu A$     |
| Dropout Voltage                    | $V_{DOLDO}$      | $I_o=600mA$                           | ---   | 400  | ---   | mV          |
| Output current limit               | $I_{LIMLDO}$     | $LDOIN>LDOO+1.0V$                     |       | 900  |       | mA          |
| LDO Load Regulation                | $\%LD$           | $LDOIN>LDOO+1.0V, I_o=10mA\sim600mA$  | ---   | ---  | 1     | %           |
| Short Circuit Protection threshold | $V_{SCPLDO}$     | $V(FB\_LDO)$                          | ---   | 0.1  | ---   | V           |
| Ripple Rejection                   | PSRR             | $f=10Hz\sim3kHz, I_o=100mA$           | ---   | 65   | ---   | dB          |
| <b>Protection</b>                  |                  |                                       |       |      |       |             |
| UVP Protection Fault Delay         | $T_{D\_Fault}$   | DCDC1~DCDC4                           | ---   | 90   | ---   | mS          |
| Thermal Shutdown Detect            | $T_{SD}$         |                                       | ---   | 150  | ---   | $^{\circ}C$ |
| Thermal Shutdown Hysteresis        | $\Delta T_{SD}$  |                                       | ---   | 20   | ---   | $^{\circ}C$ |

**Minimum Footprint PCB Layout Section**

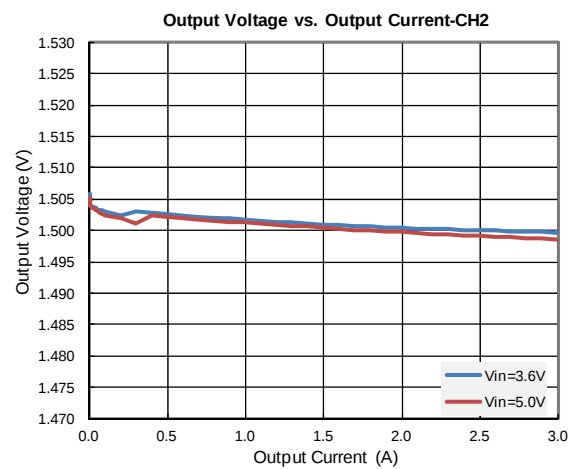
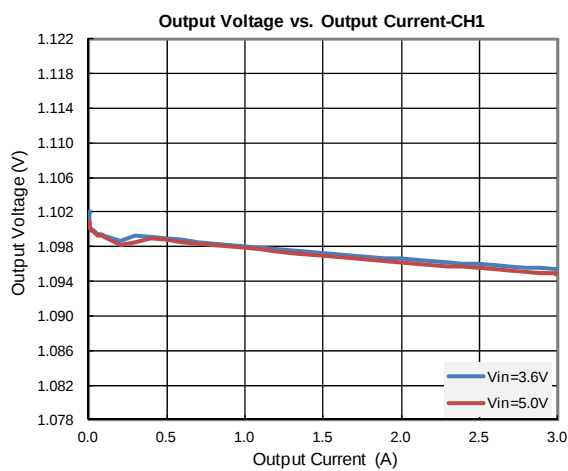
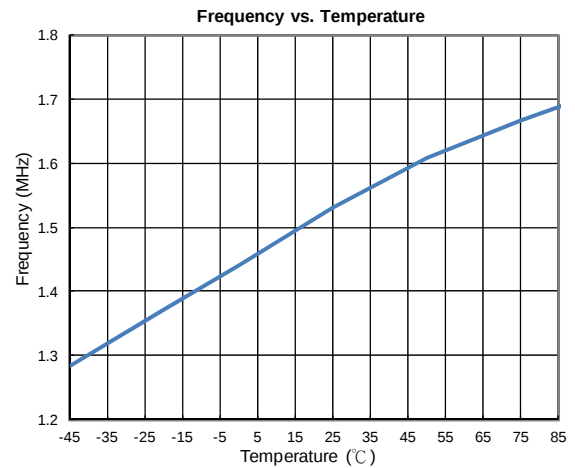
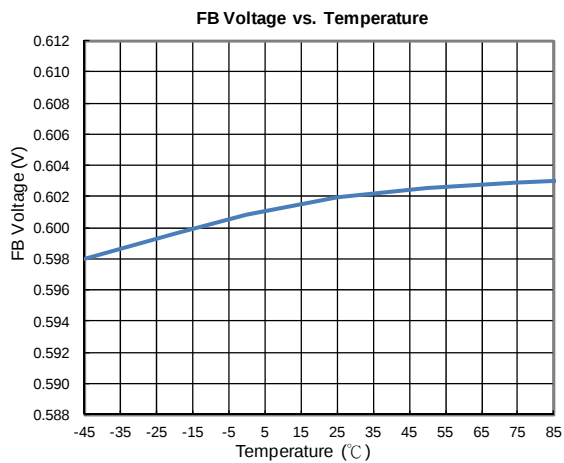
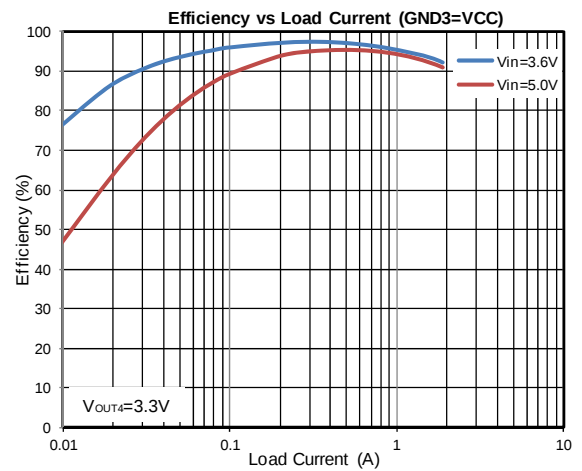
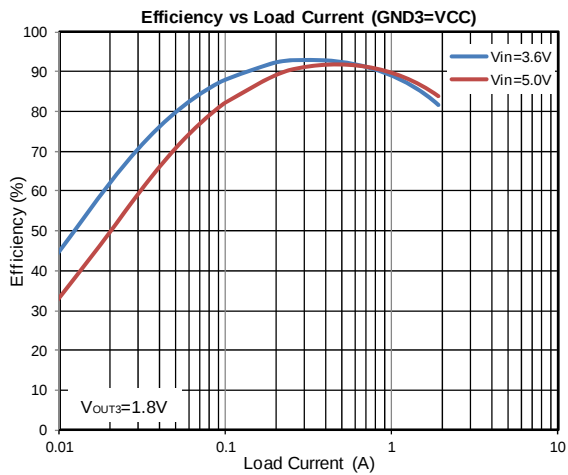


## Typical Performance Characteristics

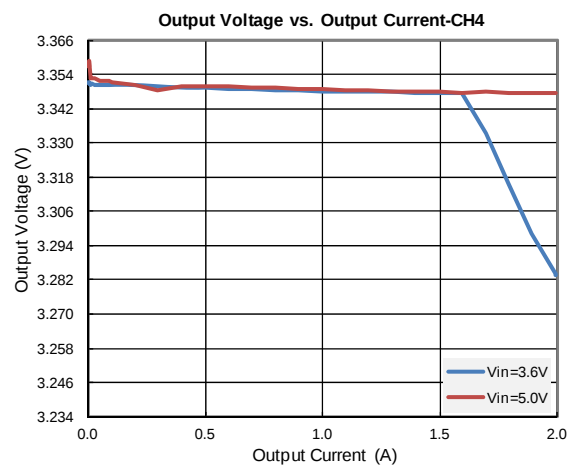
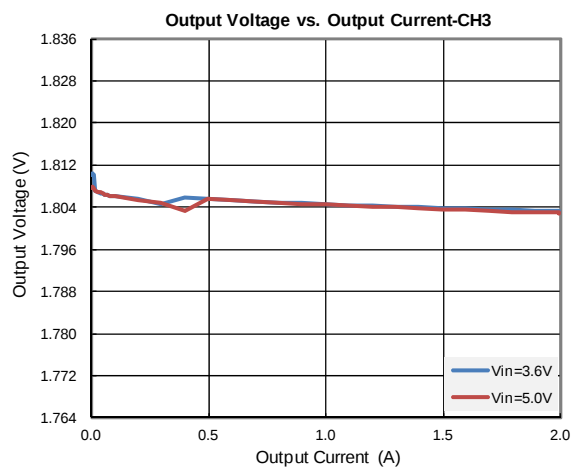
( $V_{IN1} \sim V_{IN4} = 5V$ ,  $V_{CC} = 5V$ ,  $V_{OUT1} = 1.1V$ ,  $V_{OUT2} = 1.5V$ ,  $V_{OUT3} = 1.8V$ ,  $V_{OUT4} = 3.3V$ ,  $L1 \sim L4 = 1\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.)



Typical Performance Characteristics (continued)

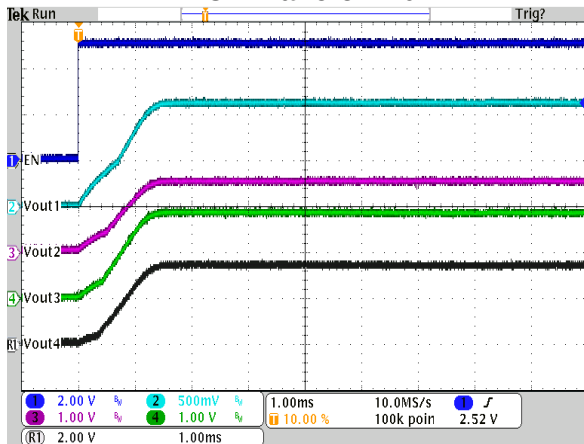


Typical Performance Characteristics (continued)

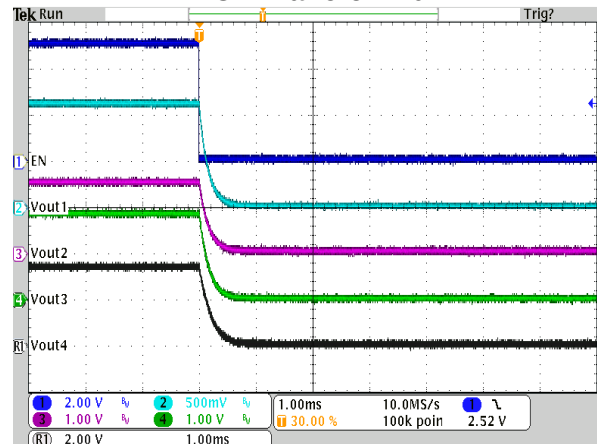


Typical Performance Characteristics (continued)

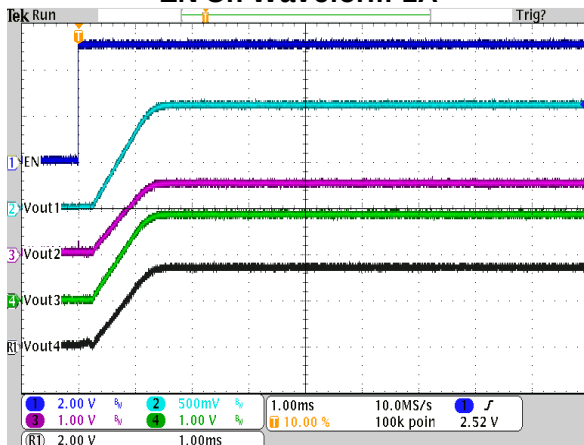
EN On Waveform-0A



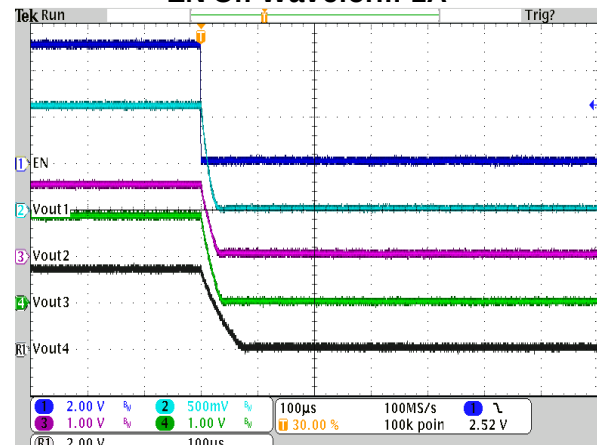
EN Off Waveform-0A



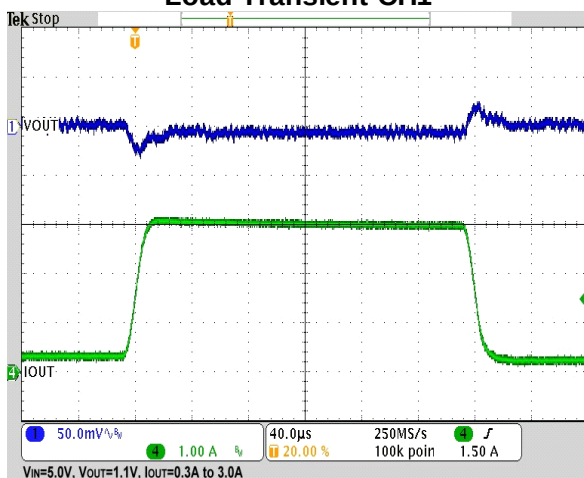
EN On Waveform-1A



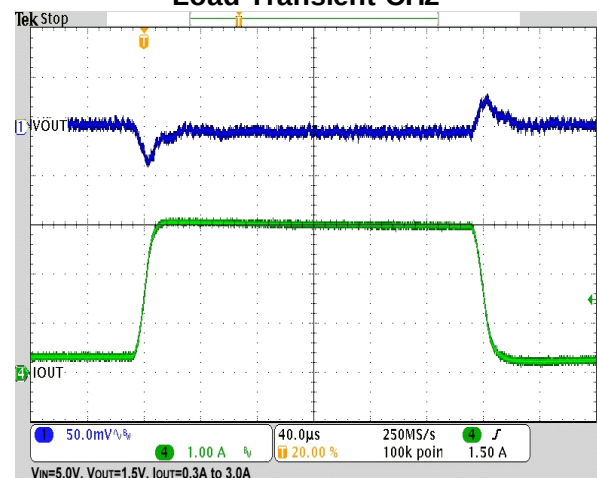
EN Off Waveform-1A



Load Transient-CH1

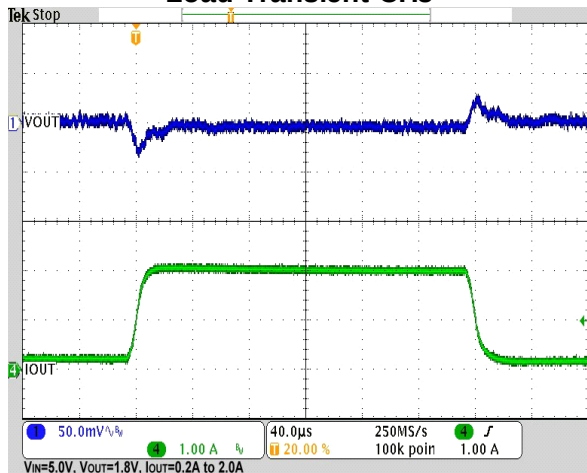


Load Transient-CH2

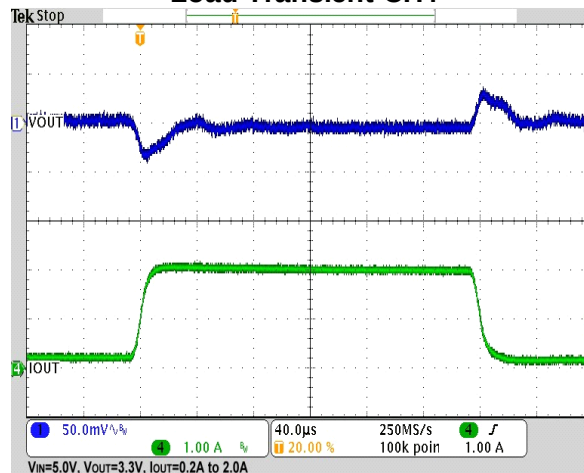


Typical Performance Characteristics (continued)

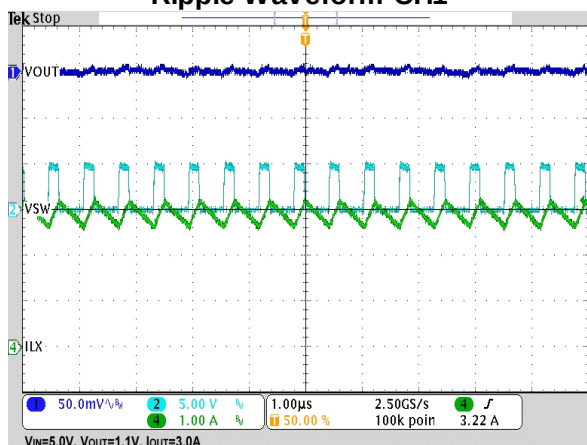
Load Transient-CH3



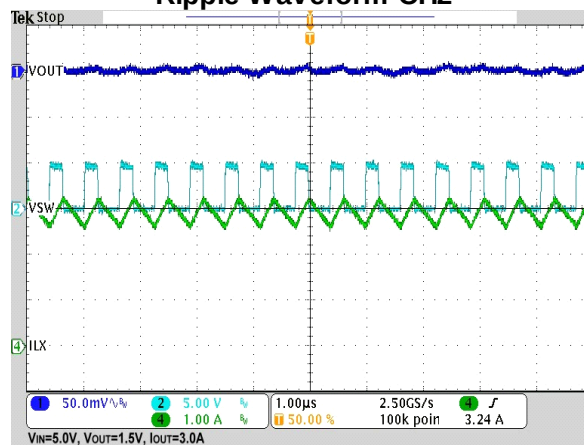
Load Transient-CH4



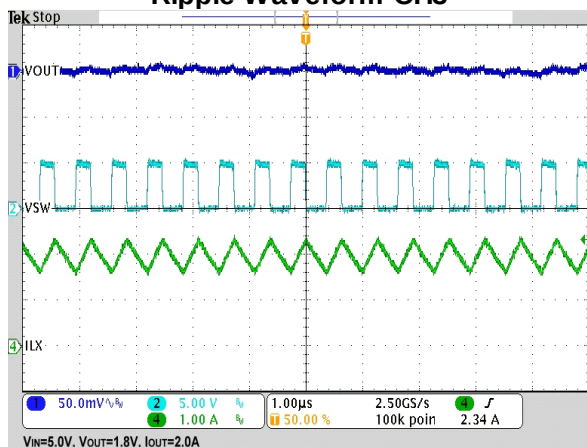
Ripple Waveform-CH1



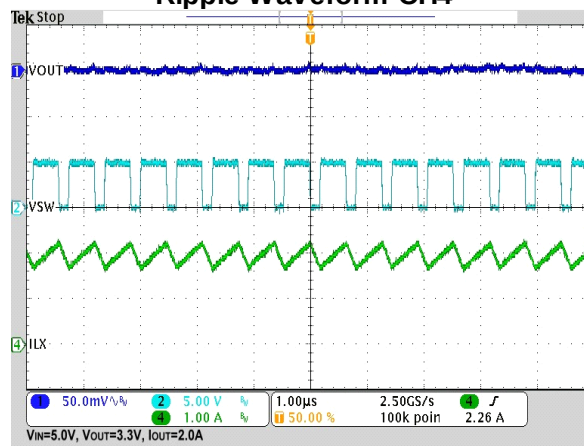
Ripple Waveform-CH2



Ripple Waveform-CH3

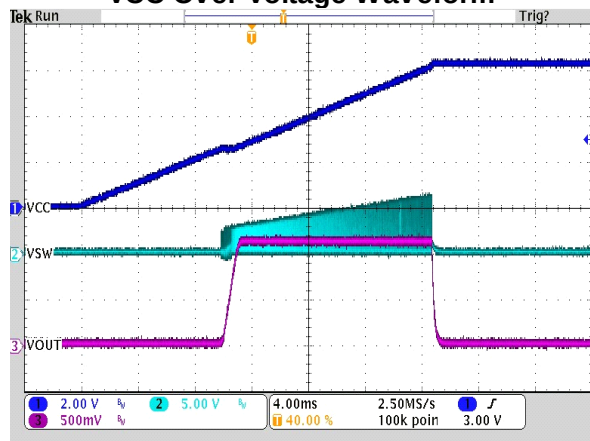


Ripple Waveform-CH4

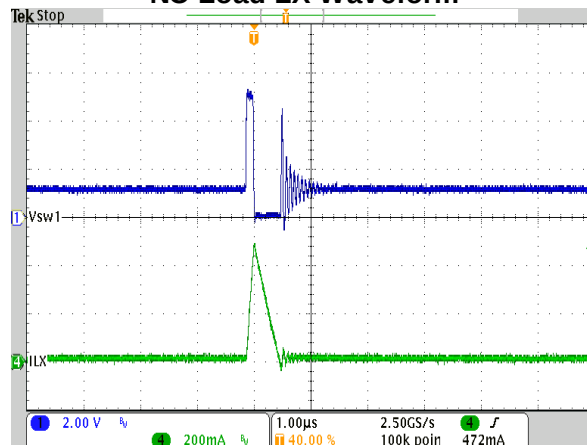


Typical Performance Characteristics (continued)

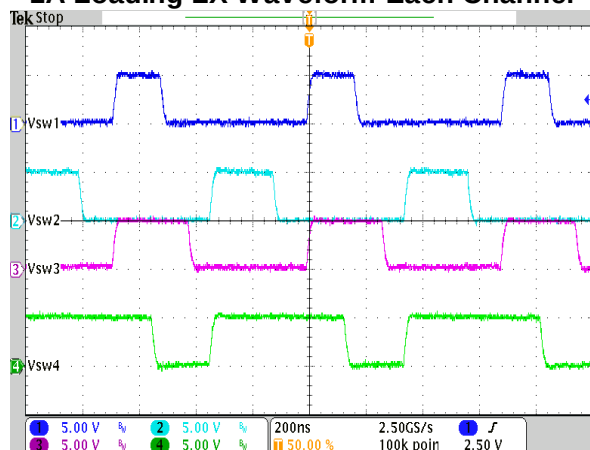
VCC Over Voltage Waveform



NO Load LX Waveform



1A Loading LX Waveform-Each Channel



**Pin Description**

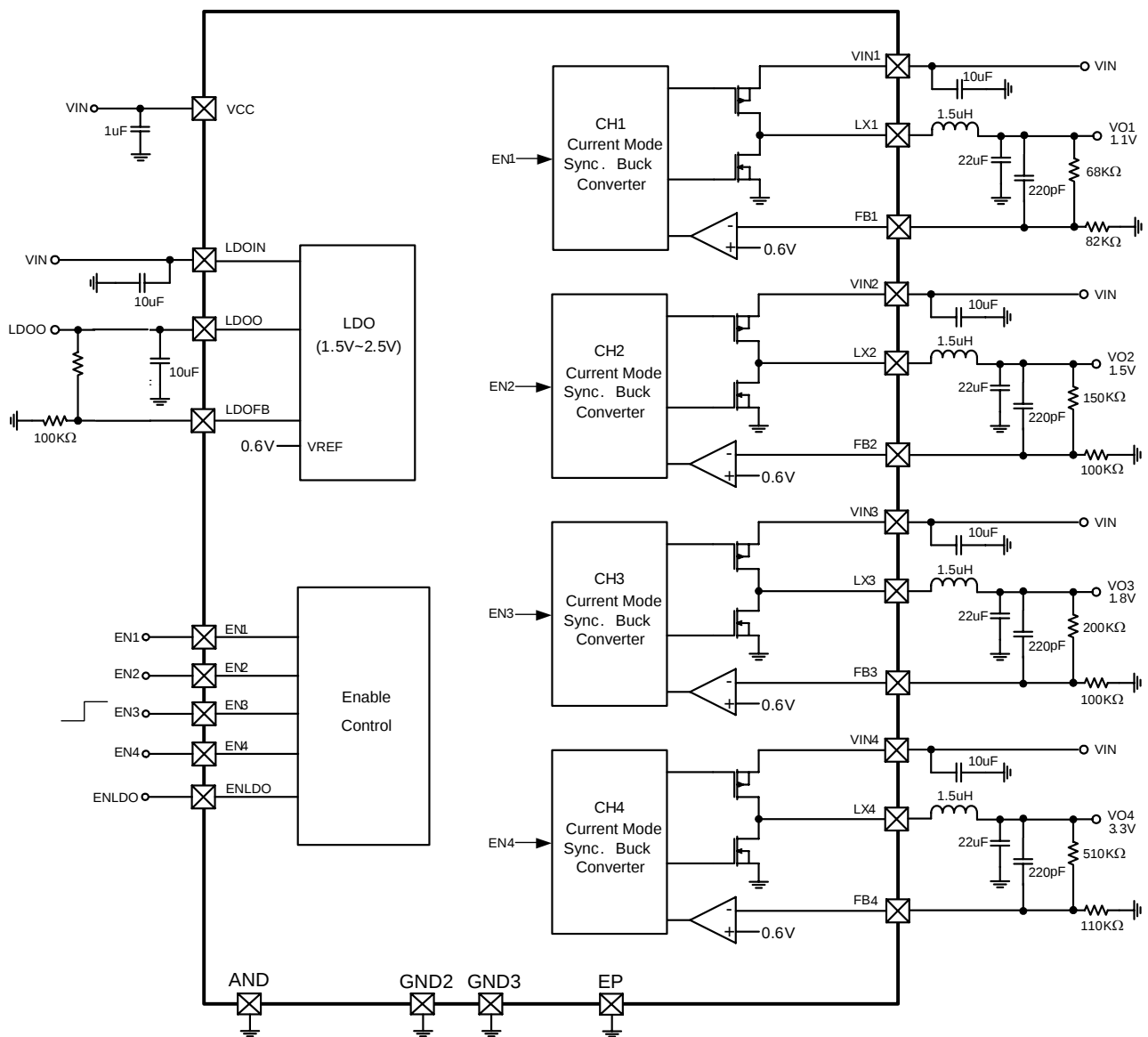
| Pin No | Pin Name    | Function                                                                                                       |
|--------|-------------|----------------------------------------------------------------------------------------------------------------|
| 1      | GND3        | Power ground pin of CH3                                                                                        |
| 2      | FB3         | Feedback input of CH3. Connect to output voltage with a resistor divider.                                      |
| 3      | VCC         | Input supply pin for internal control circuit.                                                                 |
| 4      | AGND        | Analog ground pin.                                                                                             |
| 5      | FB2         | Feedback input of CH2. Connect to output voltage with a resistor divider.                                      |
| 6      | GND2        | Power ground pin of CH2.                                                                                       |
| 7      | LX2         | Internal MOSFET switching output of CH2.                                                                       |
| 8      | VIN2        | Power input pin of CH2.                                                                                        |
| 9      | EN2         | CH2 turns on/turns off control input. Don't leave this pin floating.                                           |
| 10     | EN1         | CH1 turns on/turns off control input. Don't leave this pin floating.                                           |
| 11     | VIN1        | Power input pin of CH1.                                                                                        |
| 12     | LX1         | Internal MOSFET switching output of CH1.                                                                       |
| 13     | ENLDO       | LDO turns on/turns off control input. Don't leave this pin floating.                                           |
| 14     | FB1         | Feedback input of CH1. Connect to output voltage with a resistor divider.                                      |
| 15     | LDOFB       | FB input of LDO. Connect to output voltage with a resistor divider.                                            |
| 16     | LDOO        | Output of LDO.                                                                                                 |
| 17     | FB4         | Feedback input of CH4. Connect to output voltage with a resistor divider.                                      |
| 18     | LDOIN       | Power input of LDO.                                                                                            |
| 19     | LX4         | Internal MOSFET switching output of CH4.                                                                       |
| 20     | VIN4        | Power input pin of CH4.                                                                                        |
| 21     | EN4         | CH4 turns on/turns off control input. Don't leave this pin floating.                                           |
| 22     | EN3         | CH3 turns on/turns off control input. Don't leave this pin floating.                                           |
| 23     | VIN3        | Power input pin of CH3.                                                                                        |
| 24     | LX3         | Internal MOSFET switching output of CH3.                                                                       |
| 25     | Exposed Pad | The Exposed Pad must be soldered to a large PCB copper plane and connected to GND for appropriate dissipation. |

**NOTE:**

IF GND3=VCC: Setting DCDC1~DCDC4 operating in PWM Mode.

IF GND3=GND: Setting DCDC1~DCDC4 operating in PSM+PWM Mode.

**Block Diagram & Application circuit**



## Function Description

### PMU

The G2257 includes four DC/DC Converters, and one LDO to generate a multiple-output power-supply system.

|       | Topology                    | FB voltage | V <sub>OUT</sub> | Current rating | ON/OFF Control                     |
|-------|-----------------------------|------------|------------------|----------------|------------------------------------|
| DCDC1 | 1.5MHz Sync. Buck Converter | 0.6V       | 1.1V.            | 3A             | Individually Controlled by EN1~EN4 |
| DCDC2 | 1.5MHz Sync. Buck Converter | 0.6V       | 1.5V.            | 3A             |                                    |
| DCDC3 | 1.5MHz Sync. Buck Converter | 0.6V       | 1.8V.            | 2A             |                                    |
| DCDC4 | 1.5MHz Sync. Buck Converter | 0.6V       | 3.3V.            | 2A             |                                    |
| LDO   | PMOS LDO                    | 0.6V       | 1.5V~2.5V        | 600mA          | ENLDO                              |

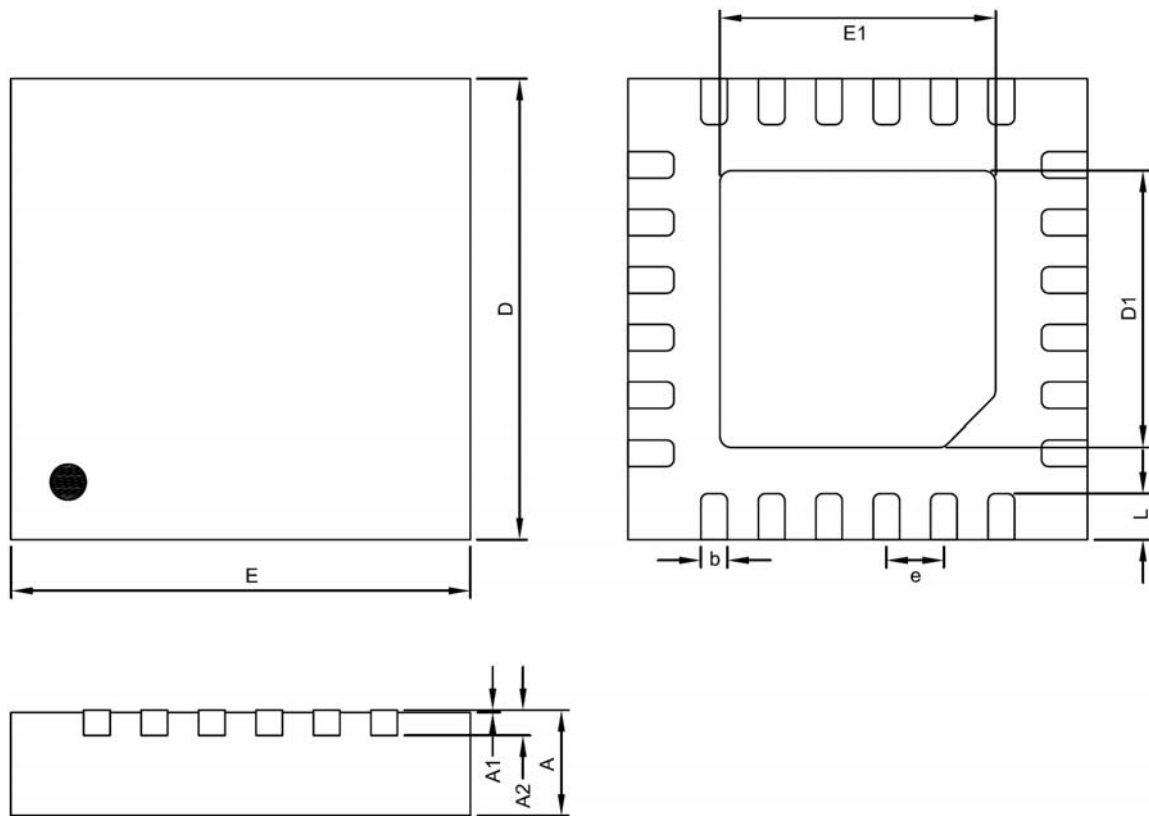
### 180° Phases Shifted Architecture

G2257 applies 180° phase shifted architecture. DCDC1 and DCDC3 operate at the same phase, and DCDC2 and DCDC4 are 180° out of phase.

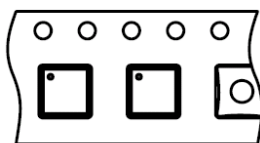
### PMU Fault Protection

G2257 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                                     |
|------------|-----------------|----------------------------------|----------------------------------|--------------------------------------------------|
| VCC        | OVP             | VCC>5.8V                         | IC shutdown                      | Reset by the power-on/off initiation conditions  |
| DCDC1 Buck | Current Limit   | pMOS current>5A                  | pMOS Off, nMOS on                | Automatic Reset at next cycle                    |
|            | UVP             | VOUT1<87.5%*VOUT <sub>SET</sub>  | IC shutdown if period above 90ms | Reset by the power- on/off initiation conditions |
| DCDC2 Buck | Current Limit   | pMOS current>5A                  | pMOS Off, nMOS on                | Automatic Reset at next cycle                    |
|            | UVP             | VOUT2<87.5%*VOUT <sub>SET</sub>  | IC shutdown if period above 90ms | Reset by the power- on/off initiation conditions |
| DCDC3 Buck | Current Limit   | pMOS current>5A                  | pMOS Off, nMOS on                | Automatic Reset at next cycle                    |
|            | UVP             | VOUT3<87.5%*VOUT <sub>SET</sub>  | IC shutdown if period above 90ms | Reset by the power- on/off initiation conditions |
| DCDC4 Buck | Current Limit   | pMOS current>5A                  | pMOS Off, nMOS on                | Automatic Reset at next cycle                    |
|            | UVP             | VOUT4<87.5%*VOUT <sub>SET</sub>  | IC shutdown if period above 90ms | Reset by the power- on/off initiation conditions |
| LDO        | Current Limit   | pMOS current>900mA               |                                  | PMOS current<900mA                               |
|            | UVP             | VOUTX<12.5%*VOUTX <sub>SET</sub> | pMOS Off                         | Reset by the power- on/off initiation conditions |
| Thermal    | TSD             | Junction Temp. >150°C            | IC shutdown                      | Reset by the power- on/off initiation conditions |

**Package Information**

**QFN4X4-24 Package**

| Symbol | DIMENSION IN MM |      |      | DIMENSION IN INCH |        |        |
|--------|-----------------|------|------|-------------------|--------|--------|
|        | MIN.            | NOM. | MAX. | MIN.              | NOM.   | MAX.   |
| A      | 0.80            | 0.90 | 1.00 | 0.0315            | 0.0354 | 0.0394 |
| 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     | 2.50            | 2.65 | 2.80 | 0.0984            | 0.1043 | 0.1102 |
| E1     | 2.50            | 2.65 | 2.80 | 0.0984            | 0.1043 | 0.1102 |
| b      | 0.18            | 0.23 | 0.30 | 0.0071            | 0.0091 | 0.0118 |
| e      | 0.50 BSC        |      |      | 0.0197 BSC        |        |        |
| L      | 0.35            | 0.40 | 0.45 | 0.0138            | 0.0157 | 0.0177 |

**Taping Specification**


Feed Direction

| PACKAGE   | Q'TY/REEL |
|-----------|-----------|
| QFN4X4-24 | 3,000 ea  |

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