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^{o} 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

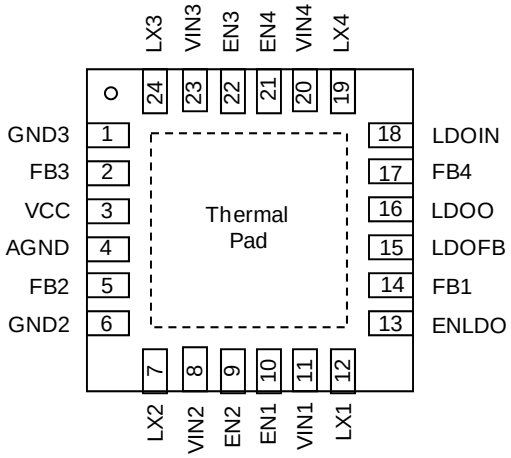
- **Smart Phone**
- **TV Dongle**
- **OTT**

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, (θ_{JA})
QFN4X4-24 . . . . . 52°C/W
Continuous Power Dissipation (T_A=25°C)
QFN4X4-24 . . . . . .2.4W
Thermal Resistance Junction to Case, (θ_{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

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.

Electrical characteristics

(VIN_X=3.6V, VCC=3.6V, T_A=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.

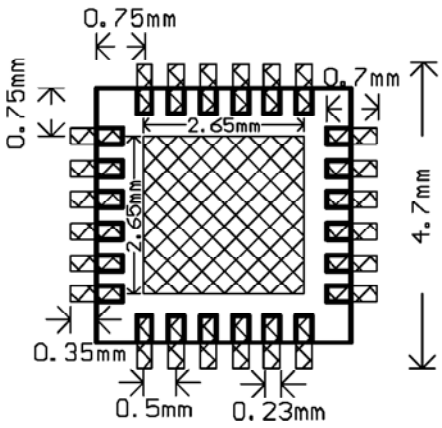
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
GENERAL						
VIN Operating Voltage	V_{INx}		2.7	---	5.5	V
VCC Operating Voltage for PMU	V_{VCC_PMU}		2.7	---	5.5	V
VCC Over Voltage threshold	V_{VCC_OVLO}		5.8	6.0	---	V
PMU Stand-by Supply Current	I_{VCC_LDO}	Only LDO is active, Io=0A	---	65	80	µA
	I_{VCC_DC}	Only DC1 is active, Io=0A	---	60	80	uA
	I_{VCC_ALL}	DC1~DC4 are active, Io=0A	---	120	150	uA
PMU Non-switching Supply Current	$I_{VCC\_DC\_NOSW}$	Only DC1 is active (non switching)	---	40	55	uA
	$I_{VCC\_ALL\_NOSW}$	DC1~DC4 are active (non switching)	---	55	80	uA
PMU Shutdown Current	I_{PMU_SD}	PMU shutdown.	---	0.1	1	µA
ENABLE CONTROL						
Enable Pin Input High Threshold	V_{ENx-H}	DCDC1~DCDC4	1.4	---	---	V
Enable Pin Input Low Threshold	V_{ENx-L}	DCDC1~DCDC4	---	---	0.5	V
OSCILLATOR						
Frequency	F_{OSC}	DCDC1~DCDC4	1.2	1.5	1.8	MHz
CH1 DC/DC Buck Converter						
Soft-Start Internal	SS_CH1		---	1.3	---	mS
FB regulation voltage accuracy	V_{FB1}		0.588	0.6	0.612	V
Maximum Duty Cycle	D_{max1}		---	100	---	%
VIN Leakage Current	I_{VIN1_LK}	V_{LX1}=0V, VIN1=5.0V	---	1	5	µA
LX Leakage Current	I_{LX1_LK}	V_{LX1}=5.0V	---	1	5	µA
Switch ON Resistance	Ron1-N		---	76	---	mΩ
	Ron1-P		---	100	---	
Peak Current Limit	I_{LIM_CH1}		4.5	5	---	A
Under Voltage Protection Threshold	$\%V_{UVP\_CH1}$	$\%V_{UVP\_CH1}=VFB_{UVP1}/VFB1$	---	87.5	---	%

Electrical characteristics (Continued)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
CH2 DC/DC Buck Converter						
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	µA
LX Leakage Current	I_{LX2_LK}	V_{LX2}=5.0V	---	1	5	µA
Switch ON Resistance	Ron2-N		---	76	---	mΩ
	Ron2-P		---	100	---	
Peak Current Limit	I_{LIM_CH2}		4.5	5	---	A
Under Voltage Protection Threshold	$\%V_{UVP\_CH2}$	$\%V_{UVP\_CH2}=VFB_{UVP2}/VFB2$	---	87.5	---	%
CH3 DC/DC Buck Converter						
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	µA
LX Leakage Current	I_{LX3_LK}	V_{LX3}=5.0V	---	1	5	µA
Switch ON Resistance	Ron3-N		---	88	---	mΩ
	Ron3-P		---	100	---	
Peak Current Limit	I_{LIM_CH3}		4.5	5	---	A
Under Voltage Protection Threshold	$\%V_{UVP\_CH3}$	$\%V_{UVP\_CH3}=VFB_{UVP3}/VFB3$	---	87.5	---	%
CH4 DC/DC Buck Converter						
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	µA
LX Leakage Current	I_{LX4_LK}	V_{LX4}=5.0V	---	1	5	µA
Switch ON Resistance	Ron4-N		---	88	---	mΩ
	Ron4-P		---	100	---	
Peak Current Limit	I_{LIM_CH4}		4.5	5	---	A
Under Voltage Protection Threshold	$\%V_{UVP\_CH4}$	$\%V_{UVP\_CH4}=VFB_{UVP4}/VFB4$	---	87.5	---	%
LDO						
Input voltage range	V_{LDOIN}		2.7	---	5.5	V
Soft-Start Internal	SS_{LDO}		---	1.3	---	mS
FB regulation voltage accuracy	VFBLDO		0.588	0.6	0.612	V
LDO Input Current	I_{LDOIN}	Io=0mA	---	---	32	µA
Dropout Voltage	V_{DOLDO}	Io=600mA	---	400	---	mV
Output current limit	I_{LIMLDO}	LDOIN>LDOO+1.0V		900		mA
LDO Load Regulation	%LD	LDOIN>LDOO+1.0V, Io=10mA~600mA	---	---	1	%
Short Circuit Protection threshold	V_{SCPLDO}	V(FB_LDO)	---	0.1	---	V
Ripple Rejection	PSRR	f=10Hz~3kHz, Io=100mA	---	65	---	dB
Protection						
UVP Protection Fault Delay	T_{D_Fault}	DCDC1~DCDC4	---	90	---	mS
Thermal Shutdown Detect	T_{SD}		---	150	---	°C
Thermal Shutdown Hysteresis	ΔT_{SD}		---	20	---	°C

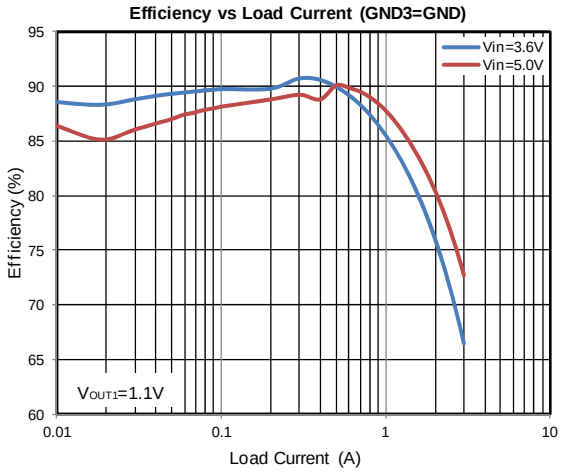
Minimum Footprint PCB Layout Section

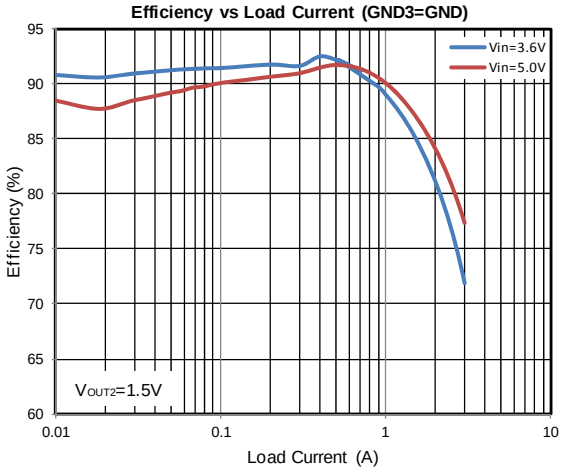
QFN4X4-24

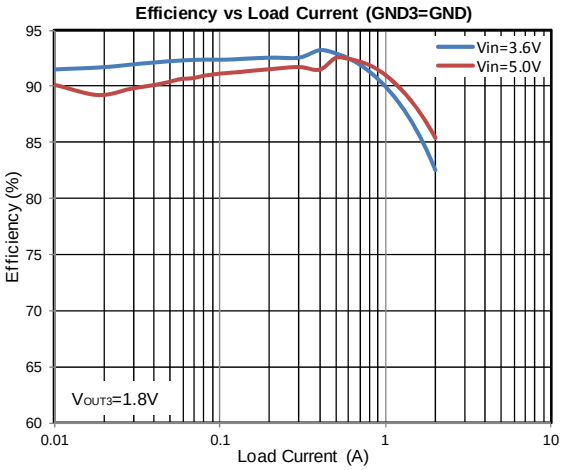


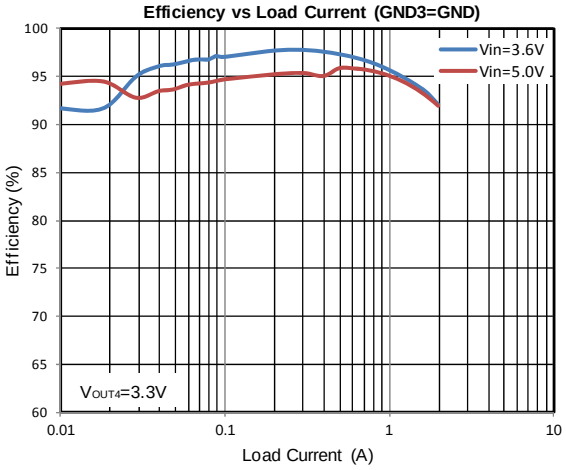
Typical Performance Characteristics

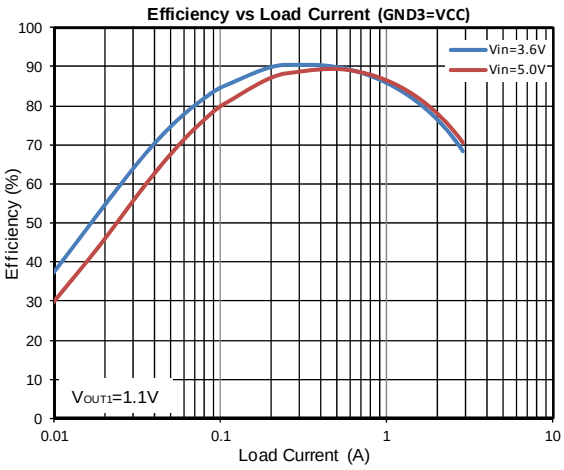
(V_{IN1}~V_{IN4}=5V, V_{CC}=5V, V_{OUT1}=1.1V, V_{OUT2}=1.5V, V_{OUT3}=1.8V, V_{OUT4}=3.3V, L1~L4=1μH, T_A=25°C, unless otherwise noted.)

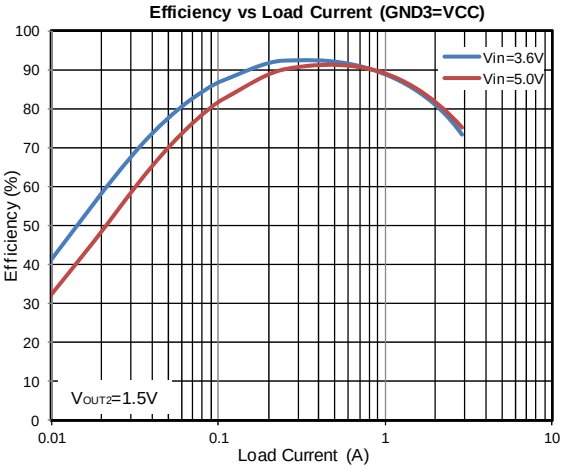




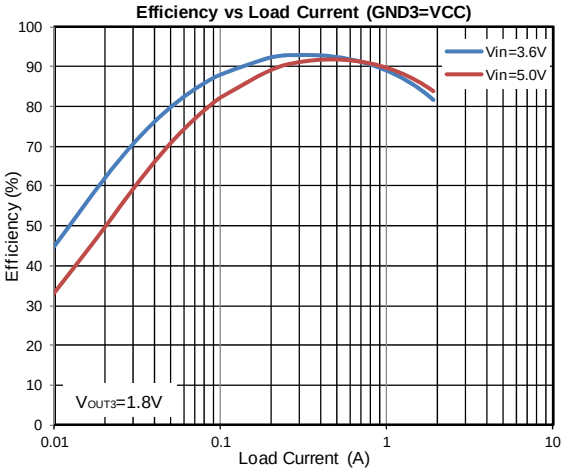


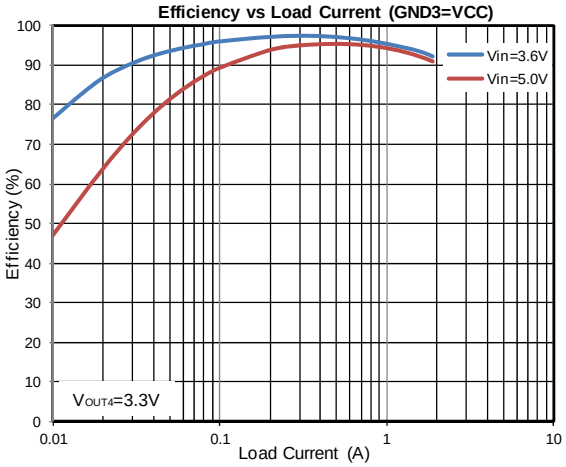


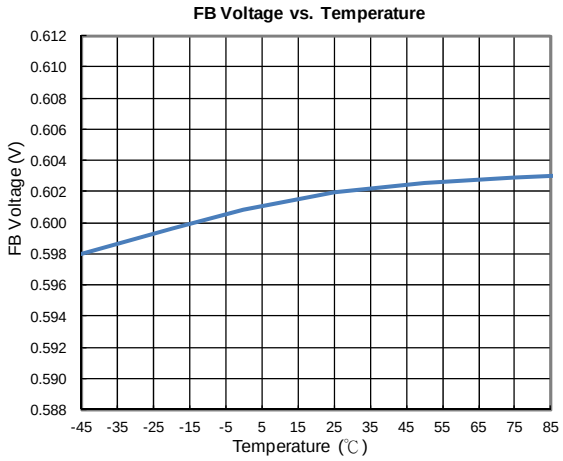


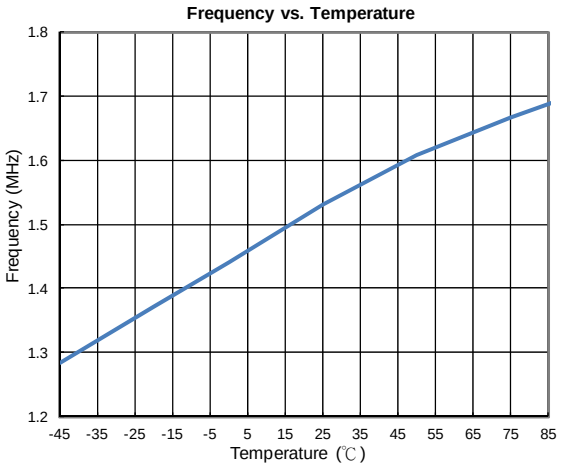


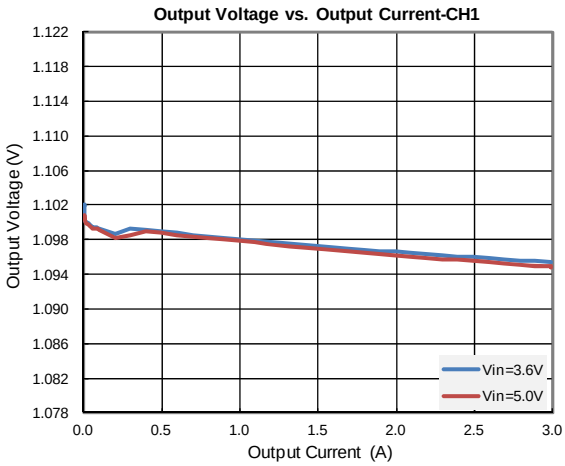
Typical Performance Characteristics (continued)

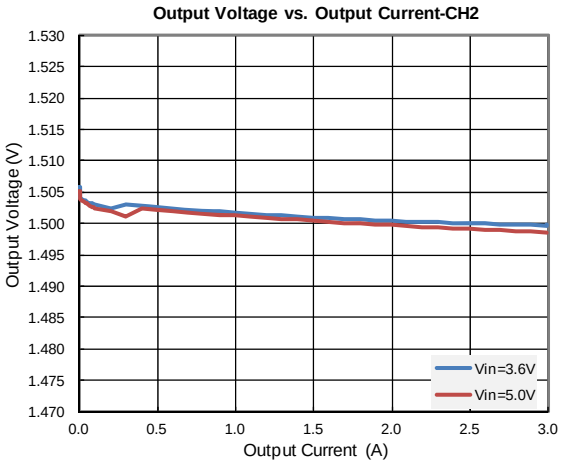




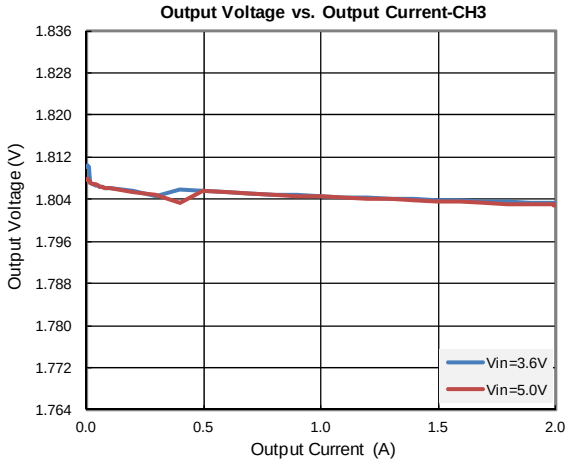


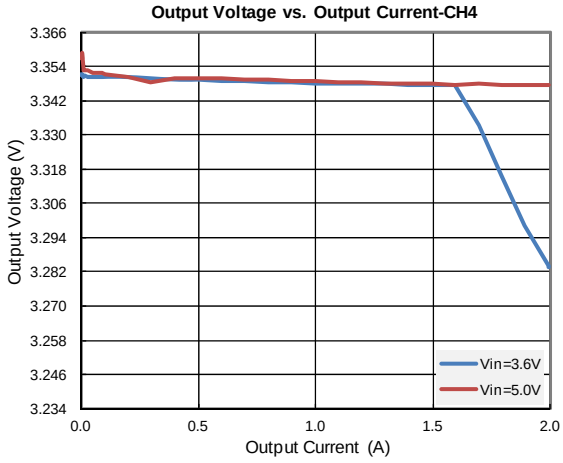






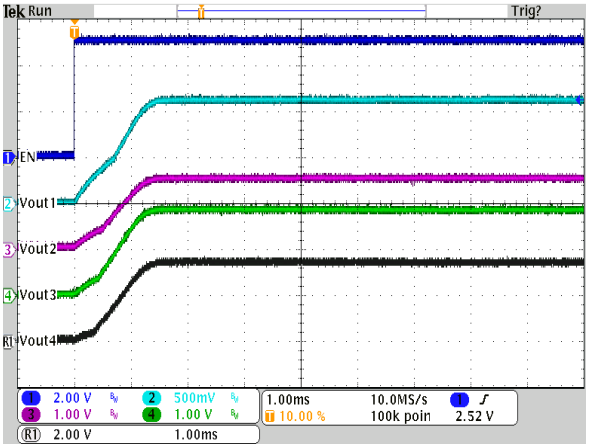
Typical Performance Characteristics (continued)



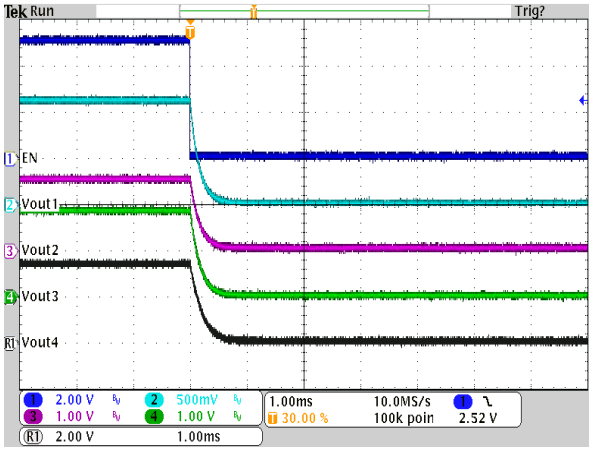


Typical Performance Characteristics (continued)

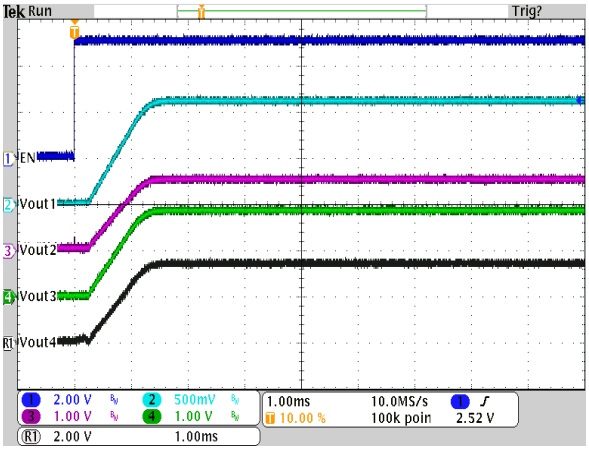
EN On Waveform-0A



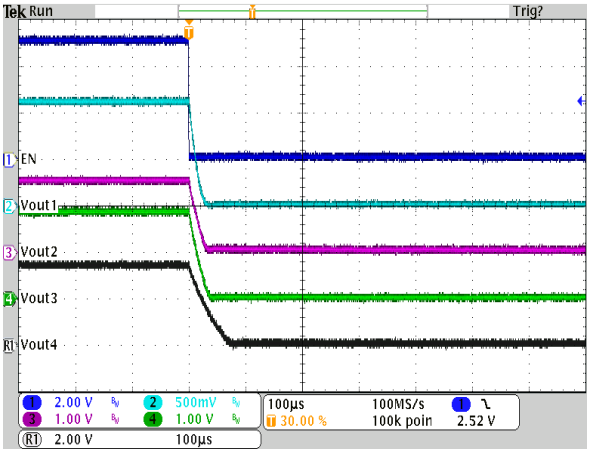
EN Off Waveform-0A



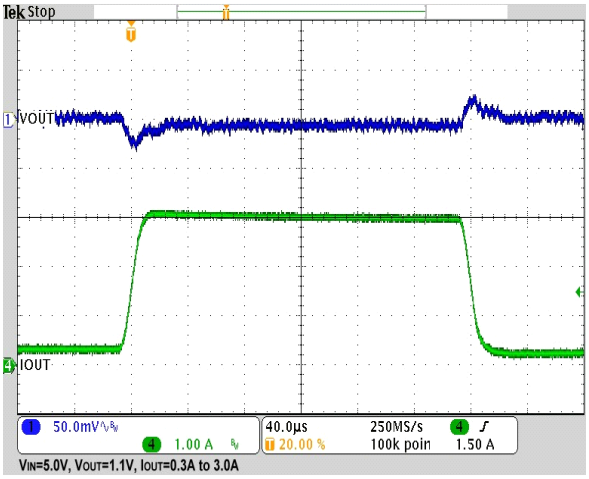
EN On Waveform-1A



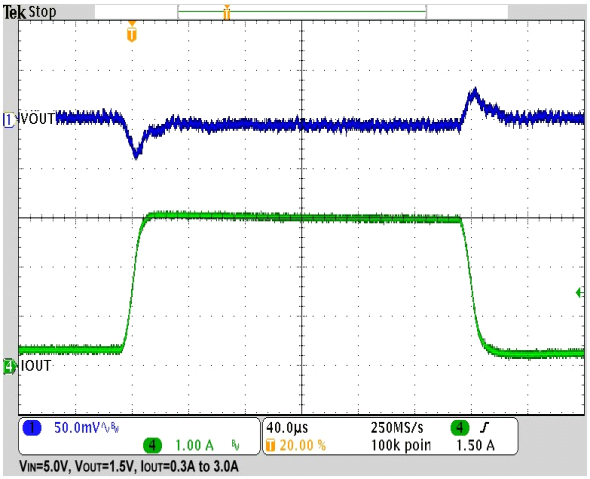
EN Off Waveform-1A



Load Transient-CH1

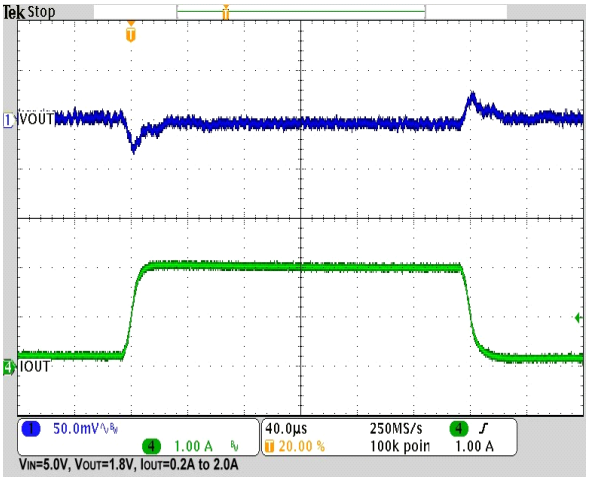


Load Transient-CH2

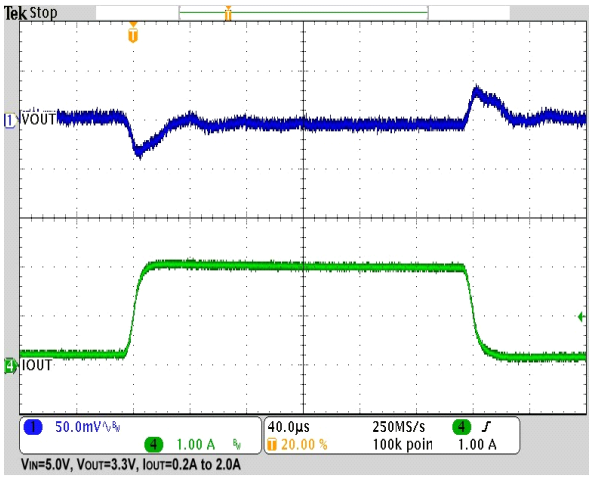


Typical Performance Characteristics (continued)

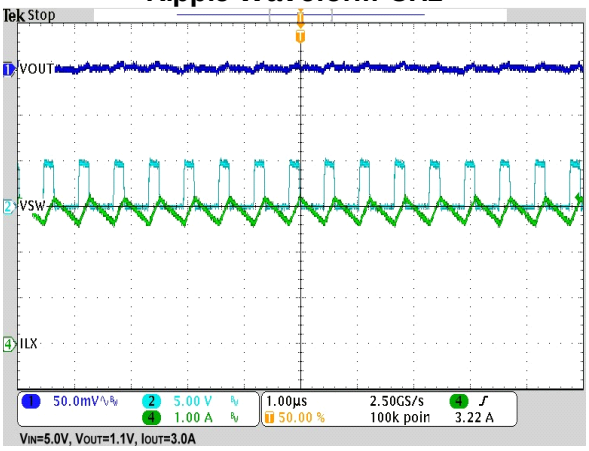
Load Transient-CH3



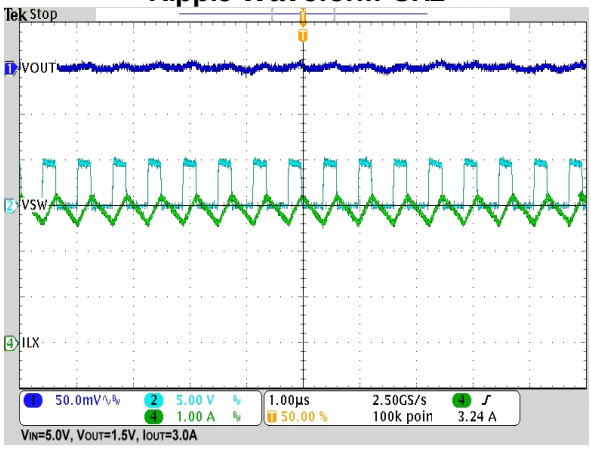
Load Transient-CH4



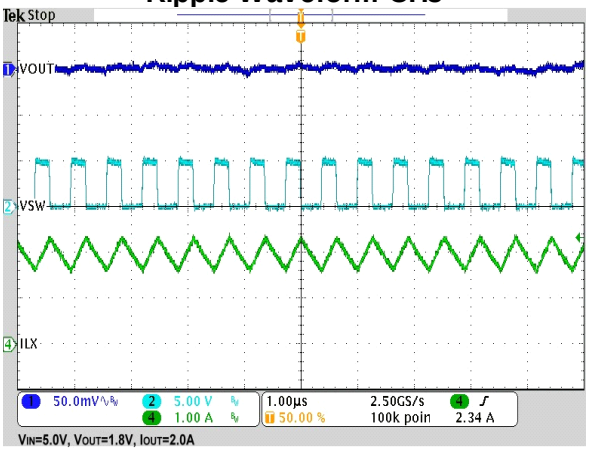
Ripple Waveform-CH1



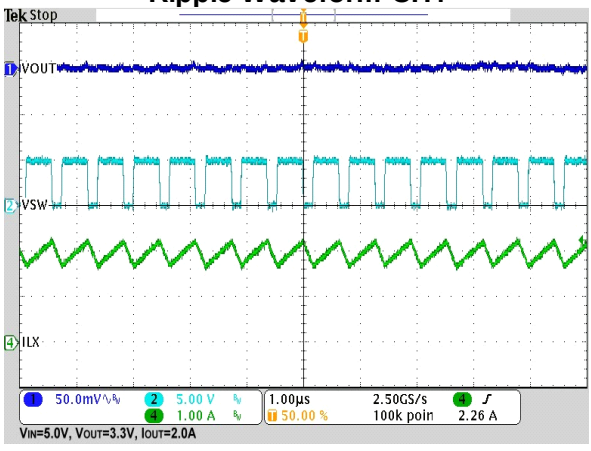
Ripple Waveform-CH2



Ripple Waveform-CH3

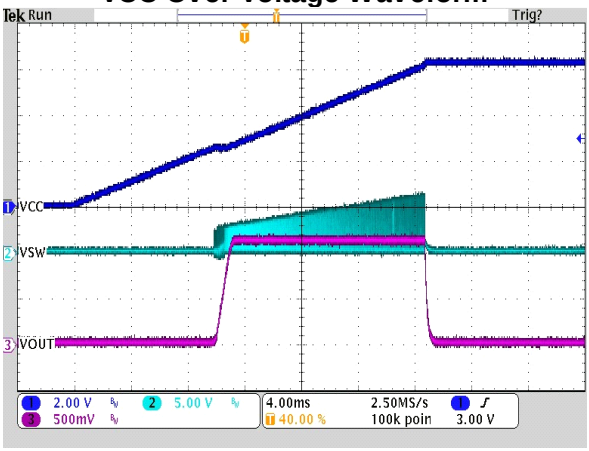


Ripple Waveform-CH4

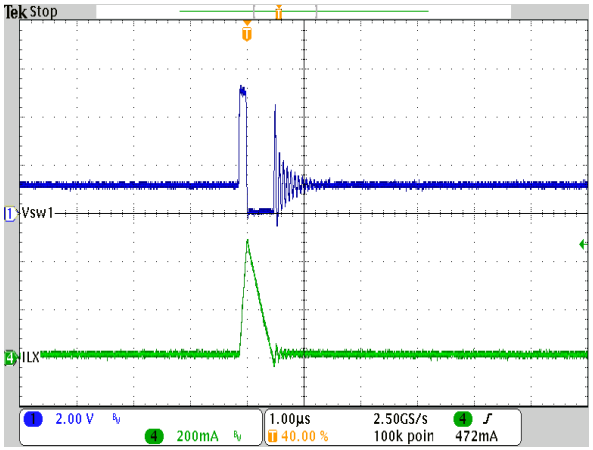


Typical Performance Characteristics (continued)

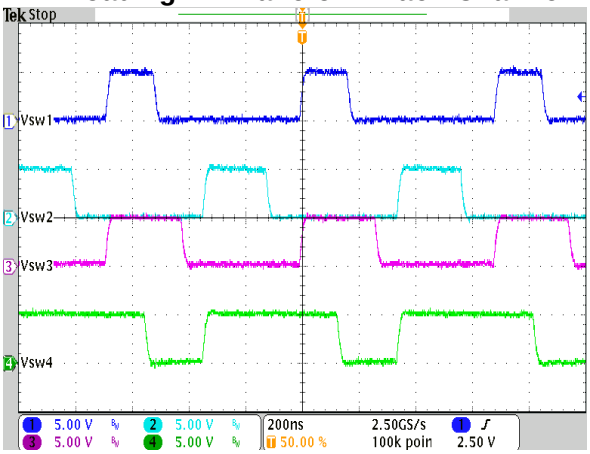
VCC Over Voltage Waveform



NO Load LX Waveform



1A Loading LX Waveform-Each Channel



Pin Description

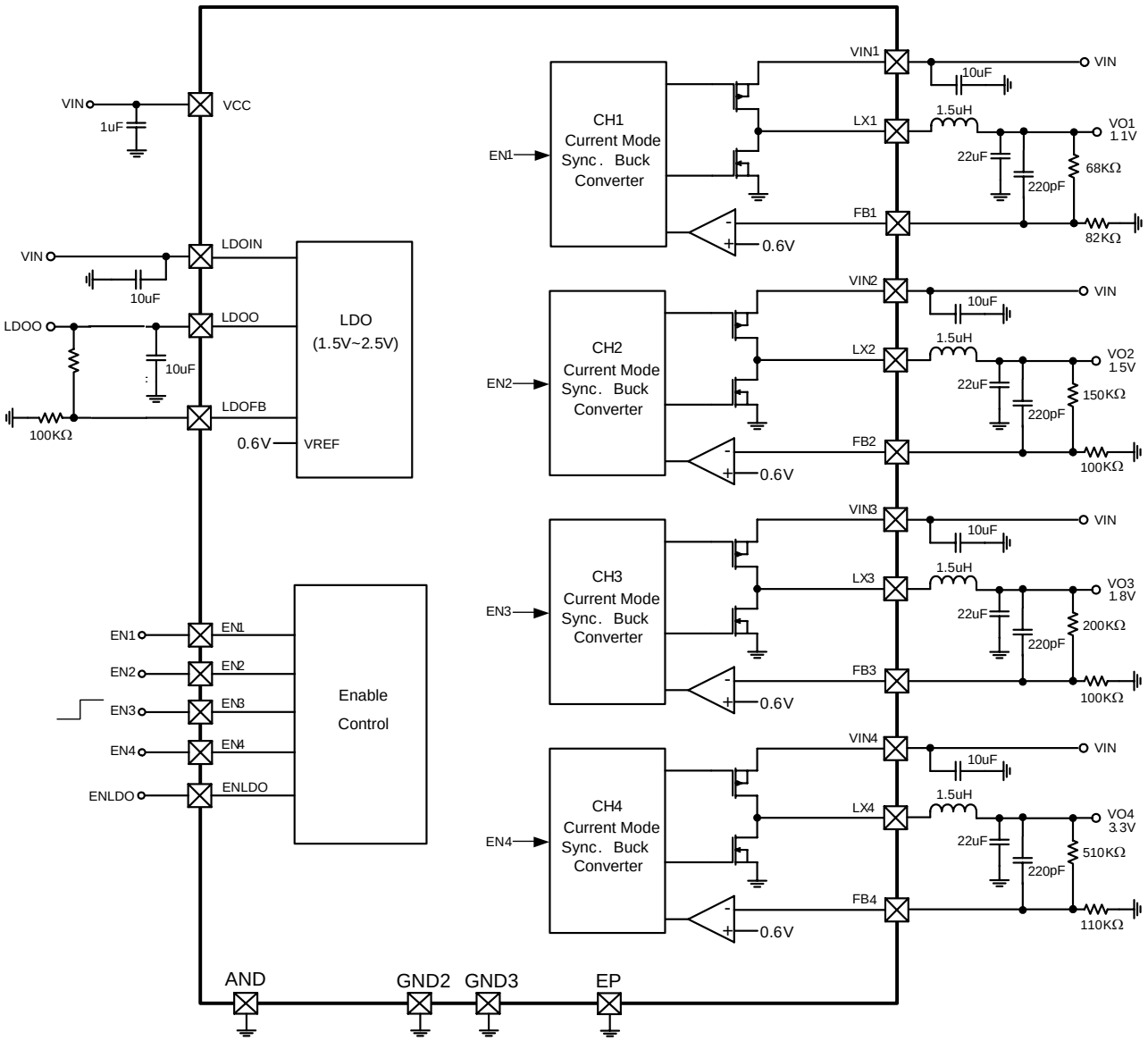
Pin No	Pin Name	Function
1	GND3	Power ground pin of CH3
2	FB3	Feedback input of CH3. Connect to output voltage with a resistor divider.
3	VCC	Input supply pin for internal control circuit.
4	AGND	Analog ground pin.
5	FB2	Feedback input of CH2. Connect to output voltage with a resistor divider.
6	GND2	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_{OUT}	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 Arichitecture

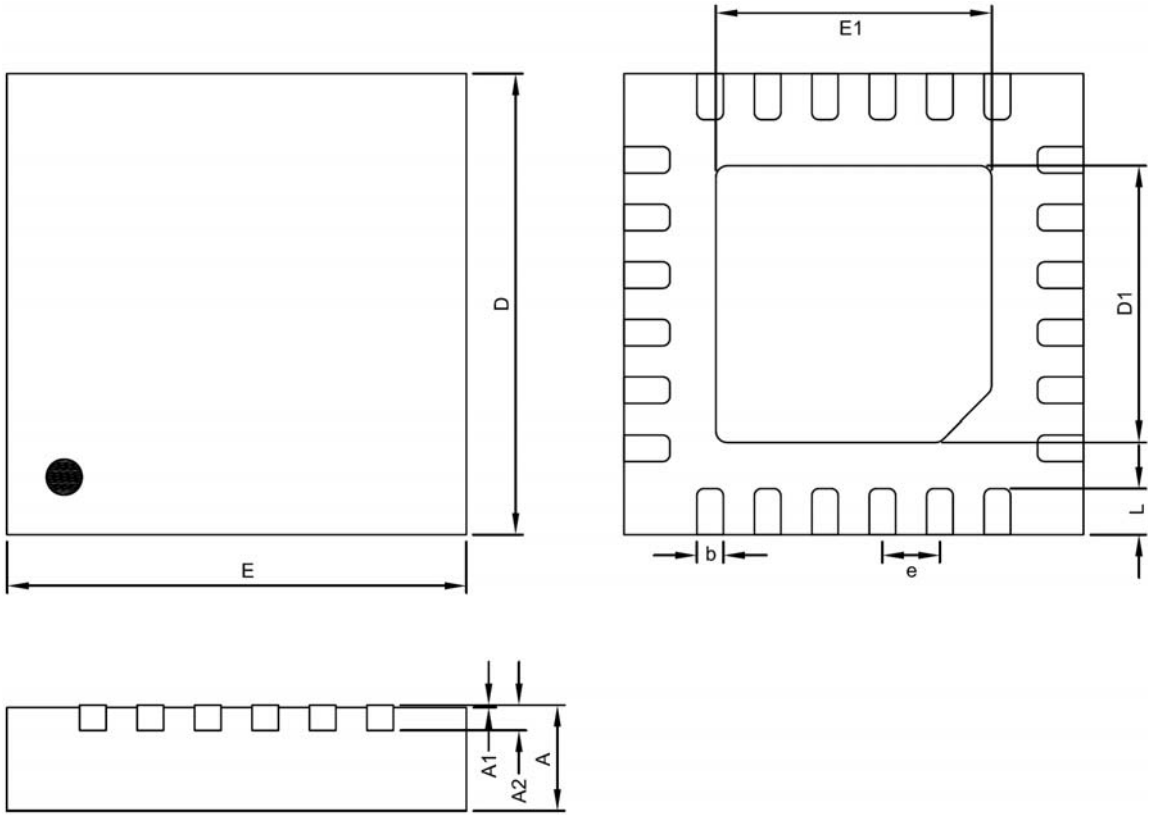
G2257 applies 180° phase shifted architecture. DCDC1 and DCDC3 operate at the same phase, and DCDC2 and DCDC4 are 180° out of phase.

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%*$VOUT_{SET}$	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%*$VOUT_{SET}$	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%*$VOUT_{SET}$	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%*$VOUT_{SET}$	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%*$VOUTX_{SET}$	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

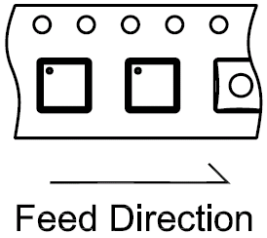
Package Information



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



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