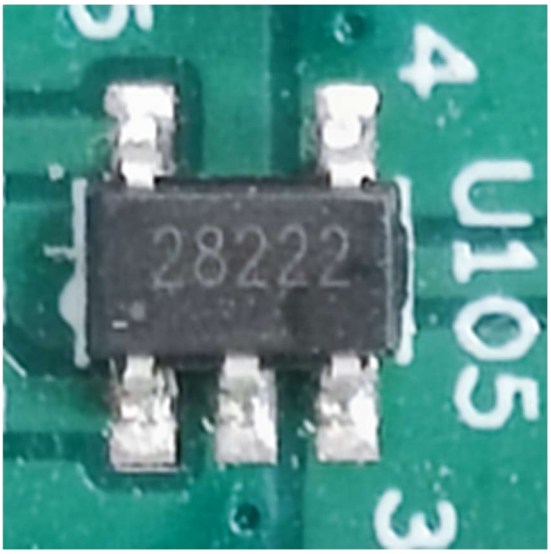


設計驗證
工程課
2025 -01- 14
發行
紘緯科技開發股份有限公司

承　　認　　書

SPECIFICATION FOR APPROVAL

DATE : 2024/12/10

客戶名稱 CUSTOMER NAME	鈺緯科技開發股份有限公司 DIVA LABORATORIES, LTD.
品牌 (MODEL NO.)	Global Mixed-mode Technology
品名(PART NAME)	IC (G2822T11U,SOT23-5,2A,SMD,GMT)
料號 (PART NO.)	G2822T11U / (3AG2822T01Y)(A0553)
承　認　書 APPROVED BY	審核(FAE) / 製作人

設計驗證 工程課 2025-01-14 發行 鈺緯科技開發股份有限公司

林 113.12.10 啓人

吳 2024.12.10 慶軍

樵屋國際股份有限公司
CHIEFTRON INTERNATIONAL CORP.

TEL: 886-2-26961696
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台北縣汐止市新台五路一段106號B棟12樓
12F, B Building, No. 106, Hsin Tai Wu Rd.,
Sec.1, Hsi Chih City, Taipei Hsien, Taiwan, R.O.C.

G2822

1MHz, 3A Synchronous Step-Down Regulator

Features

- **High Efficiency: Up to 95%**
- **50μA Operating Quiescent Current**
- **<1μA Shutdown Current**
- **Internal Soft Start Function**
  Output Current :
  G2822T11U: 2A Continuous, 3A Peak
  G2822TB1U: 2A Continuous, 3A Peak
  G2822RC1U: 3A Continuous
- **2.7V to 6.5V Input Voltage Range**
- **1MHz Switching Frequency**
- **No Schottky Diode Required**
- **100% Duty Cycle in Dropout Operation**
- **0.6V Reference Allows Low Output Voltages**
- **Over Temperature Protection**
- **VIN Over Voltage Protection**
- **Hiccup Short-Circuit Protection**
- **Output Discharge**
- **RoHS Compliant**

General Description

The G2822 is a high efficiency monolithic synchronous buck regulator using a constant frequency, current mode architecture. Supply current during operation is only 50μA and drops to <1μA in shutdown. The 2.7V to 6.5V input voltage range makes the G2822 ideally suited for single Li-Ion battery-powered applications. 100% duty cycle provides low dropout operation, extending battery run time in portable systems. Switching frequency is internally set at 1MHz, allowing the use of small surface mount inductors and capacitors. The internal synchronous switch increase efficiency and eliminates the need for an external Schottky diode. Built-in soft start function eliminates in-rush current that could damage the system.

Applications

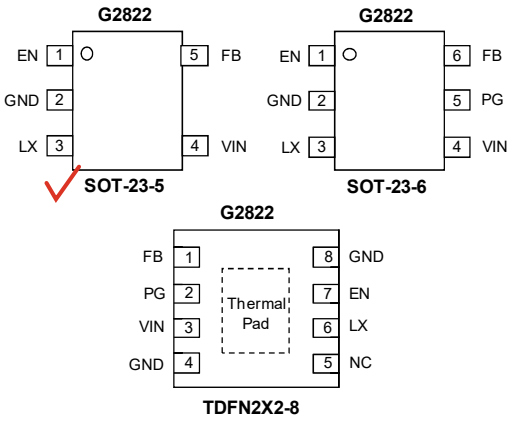
- **Cellular Telephones**
- **Personal Information Appliances**
- **Microprocessors and DSP Core Supplies**
- **Wireless and DSL Modems**
- **Digital Still and Video Cameras**
- **MP3 Players**
- **Portable Instruments**

Ordering Information

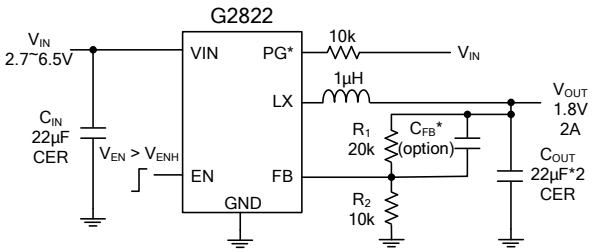
ORDER NUMBER	MARKING	OUTPUT VOLTAGE	TEMP. RANGE	PACKAGE (Green)
G2822T11U	2822x	Adjustable	-40°C to +85°C	SOT-23-5
G2822TB1U	2822x	Adjustable	-40°C to +85°C	SOT-23-6
G2822RC1U	2822	Adjustable	-40°C to +85°C	TDFN2X2-8

Note: T1: SOT-23-5 TB: SOT-23-6 RC: TDFN2X2-8
1: Bonding Code
U: Tape & Reel
Green : Lead Free / Halogen Free

Pin Configuration



Typical Application Circuit



Absolute Maximum Ratings

VIN to GND . . . . . -0.3V to +7V
EN, VFB to GND. . . . . -0.3V to (VIN + 0.3V)
LX to GND . . . . . -0.3V to (VIN + 0.3V)
LX to GND . . . . . -3V to (VIN + 3V) for <20ns
Thermal Resistance Junction to Ambient, (θ_{JA})
SOT-23-5. . . . . 250°C/W(1)
SOT-23-6. . . . . 240°C/W(1)
TDFN2X2-8 . . . . . 127°C/W(2)
Continuous Power Dissipation (T_A = +25°C)
SOT-23-5. . . . . .0.52W(1)
SOT-23-6. . . . . .0.52W(1)
TDFN2X2-8 . . . . . .1.0W(2)

Thermal Resistance Junction to Case, (θ_{JC})
SOT-23-5. . . . . .60°C/W
SOT-23-6. . . . . .60°C/W
TDFN2X2-8 . . . . . .63°C/W
Operating Temperature Range . . . . . -40°C to 85°C
Maximum Junction Temperature . . . . . 150°C
Storage Temperature Range . . . . . -65°C to 165°C
Reflow Temperature (soldeing,10 sec) . . . . . .260°C

Note:
(1) : Please refer to Minimum Footprint PCB Layout Section.
(2): Please refer to 1in^2 of 1oz PCB Layout Section.

Electrical Characteristics

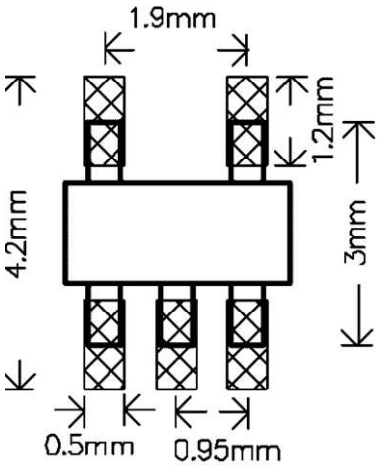
(V_{IN}=5V, V_{OUT} =1.8V, L=1µH, C_{OUT} =22µFx2, T_A =25°C)

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.

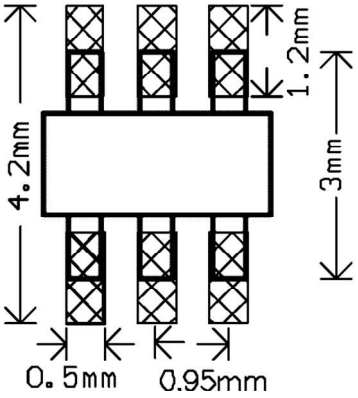
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Input Voltage Range	V_{IN}		2.7	---	6.5	V
Quiescent Current	I_Q	I_{OUT}=0, V_{FB}=V_{REF}×105%	---	50	---	µA
Shutdown Current	I_{SHDN}	EN=0	---	0.1	1	µA
Feedback Reference Voltage	V_{REF}		0.594	0.6	0.606	V
PFET RON	$R_{DS(ON),P}$		---	80	---	mΩ
NFET RON	$R_{DS(ON),N}$		---	60	---	mΩ
PFET Current Limit	I_{LIM}		4.0	5.0	6.0	A
EN Rising Threshold	V_{ENH}		1.5	---	---	V
EN Falling Threshold	V_{ENL}		---	---	0.4	V
Input UVLO Threshold	V_{UVLO}		---	---	2.65	V
UVLO Hysteresis	V_{HYS}		---	0.2	---	V
Oscillator Frequency	F_{OSC}	I_{OUT}=500mA	---	1	---	MHz
Short Circuit Protection Threshold	V_{SCP}		---	0.1	---	V
Min ON Time			---	75	---	ns
Max Duty Cycle			100	---	---	%
Soft Start Time	T_{SS}		---	1	---	ms
Output Discharge Switch On Resistance	R_{DISCH}		---	50	---	Ω
Thermal Shutdown Temperature	T_{SD}		---	150	---	°C
VIN Over Voltage Protection	V_{OVP}	VIN Rising	---	7.2	---	V
OVP Hysteresis	V_{OVHYS}		---	0.4	---	V
Line Regulation		I_{OUT} = 1A, V_{IN} = 2.7V to 6.5V	---	0.05	---	%/V
Load Regulation		I_{OUT} = 0.5A to 3A	---	0.2	---	%/A

Minimum Footprint PCB Layout Section

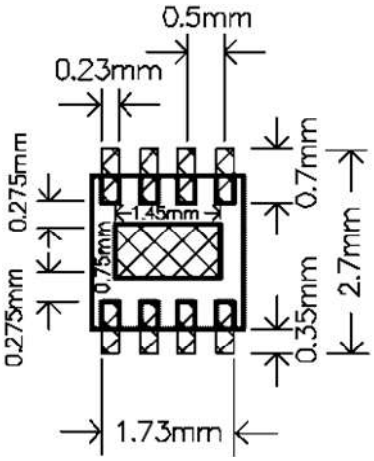
SOT-23-5



SOT-23-6

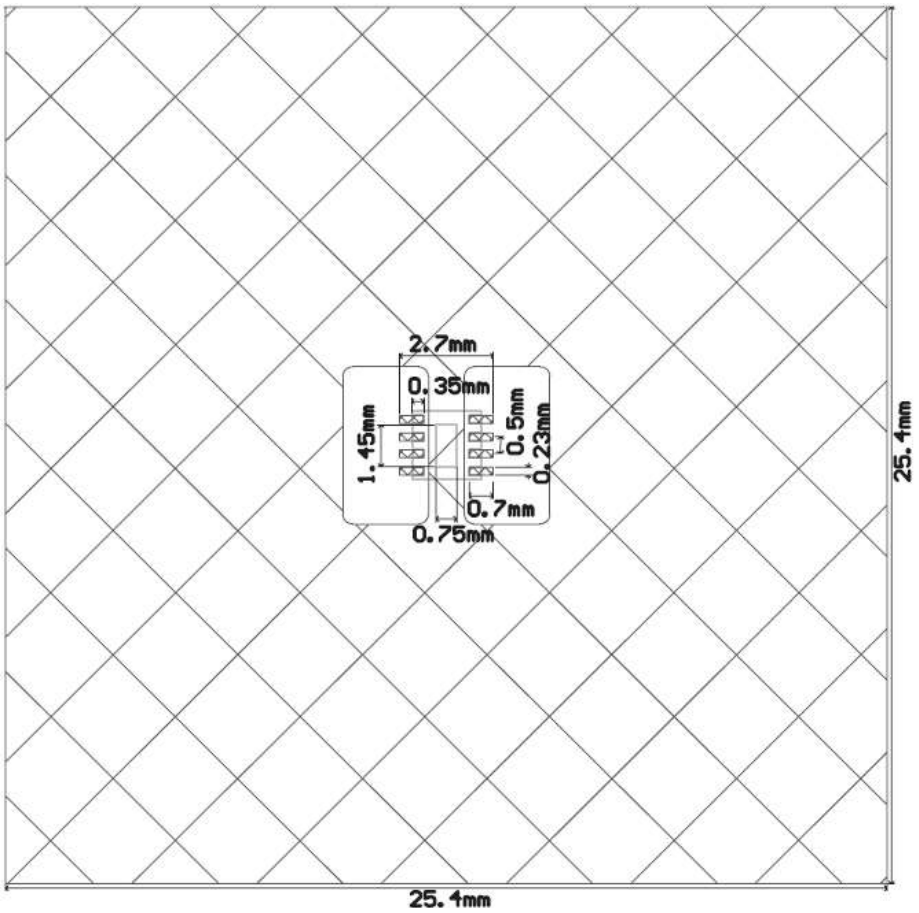


TDFN2X2-8



1in^2 of 1oz PCB Layout Section

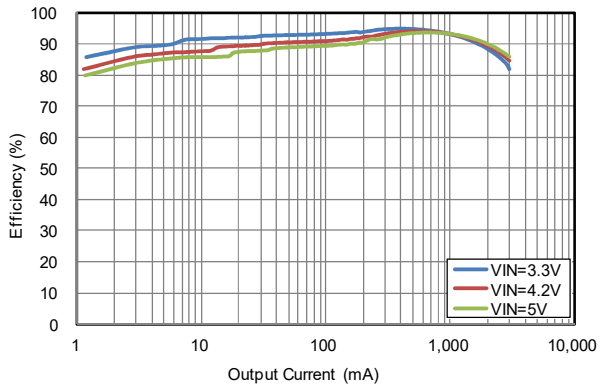
TDFN2X2-8



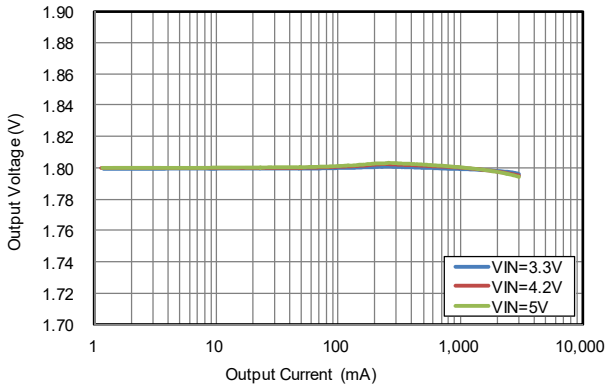
Typical Performance Characteristics

(V_{OUT} =1.8V, L=1μH, C_{OUT} =22μFx2, T_A =25°C)

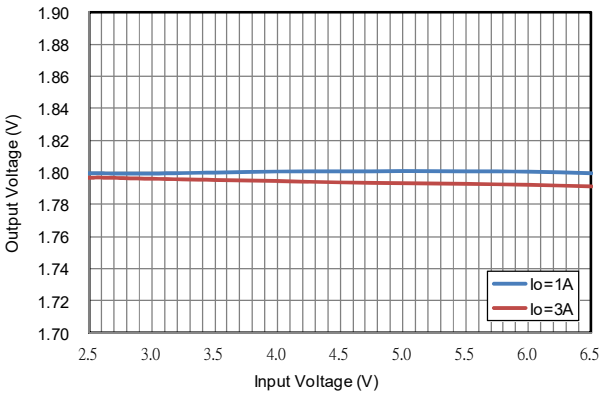
Efficiency vs. Output Currrent (V_{OUT}=1.8V)



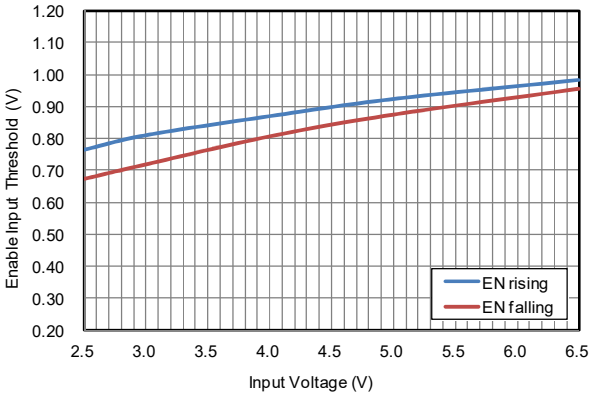
Output Voltage vs. Output Current



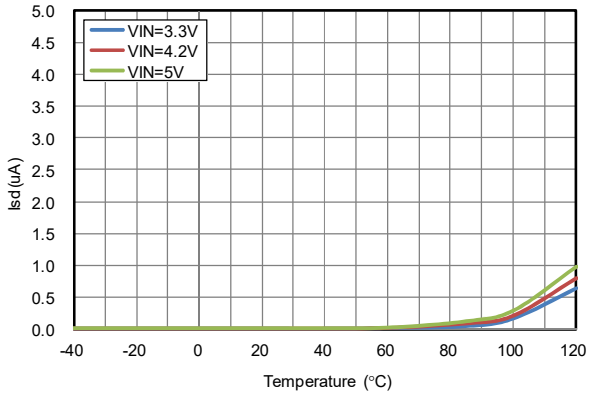
Output Voltage vs. Iutput Voltage



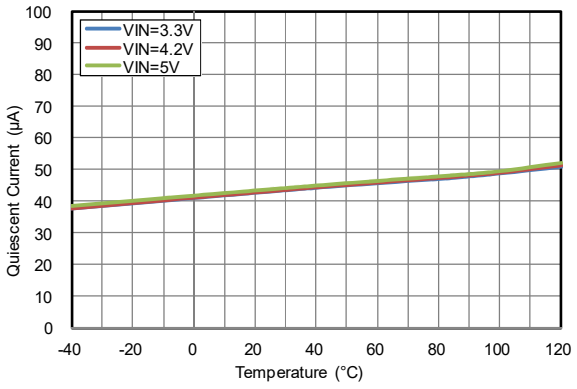
Enable input Voltage vs. Input Voltage



Shutdown Current vs. Temperature

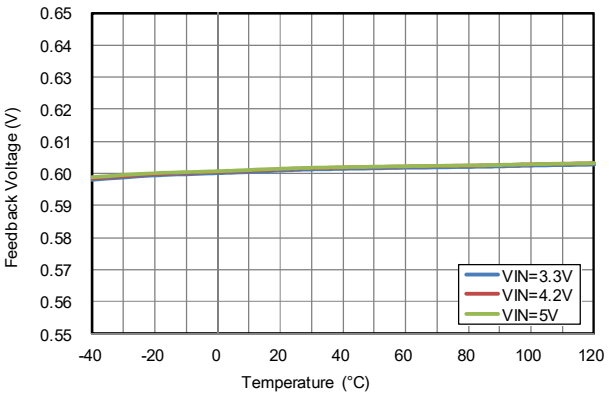


Quiescent Current vs. Temperature

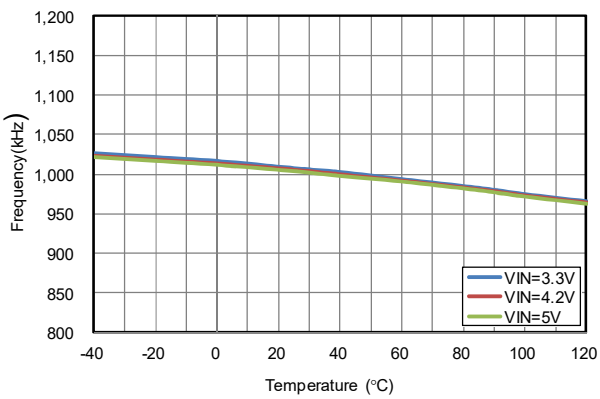


Typical Performance Characteristics (continued)

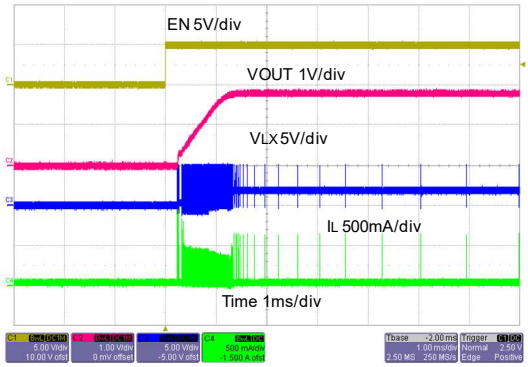
Feedback Voltage vs. Temperature



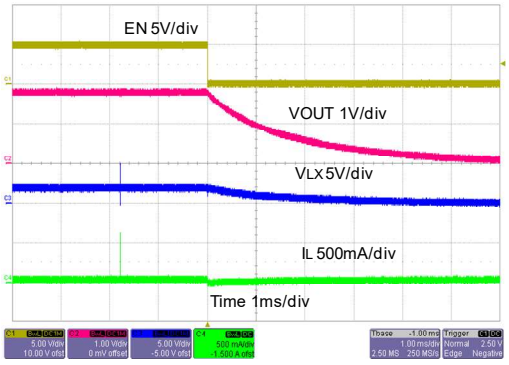
Switching frequency vs. Temperature



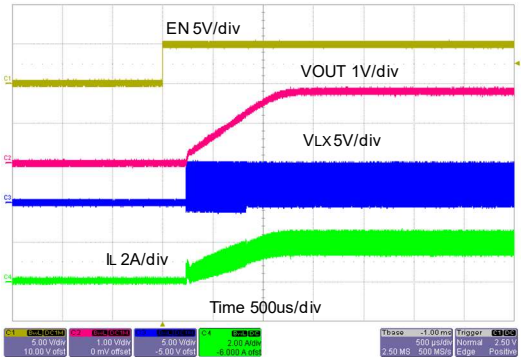
Power On from EN (I_O=0A)



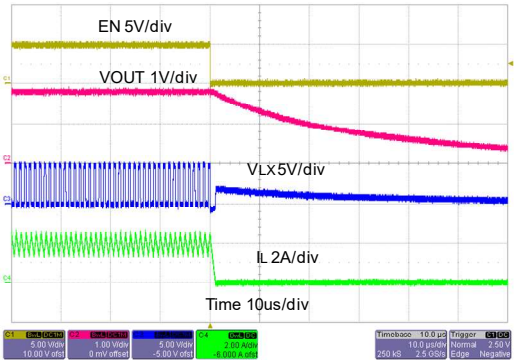
Power Off from EN (I_O=0A)



Power On from EN (I_O=2A)

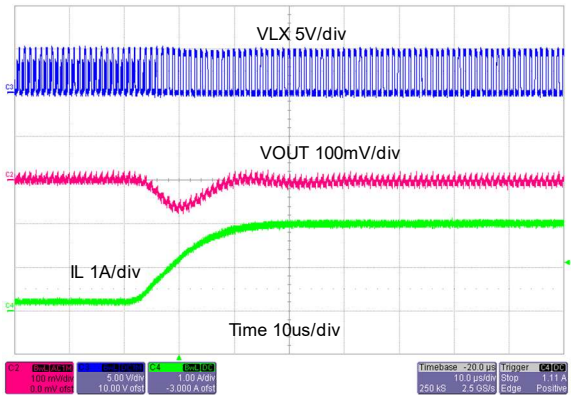


Power Off from EN (I_O=2A)

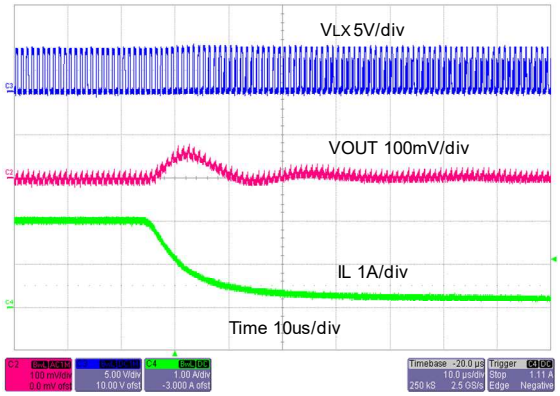


Typical Performance Characteristics (continued)

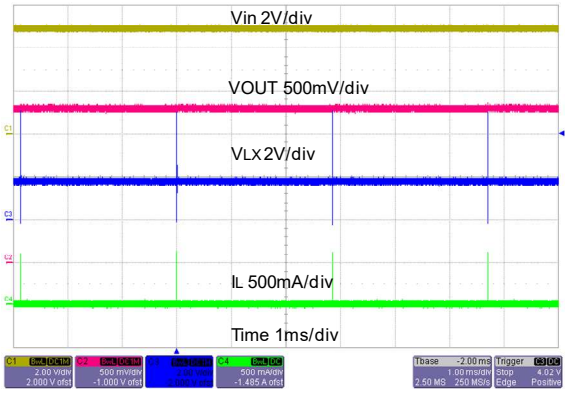
Load Transient Response (0.2A to 2A)



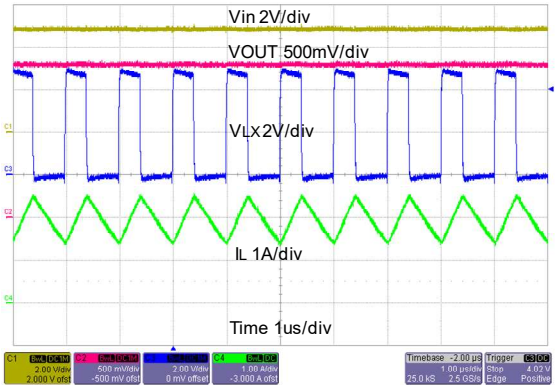
Load Transient Response (2A to 0.2A)



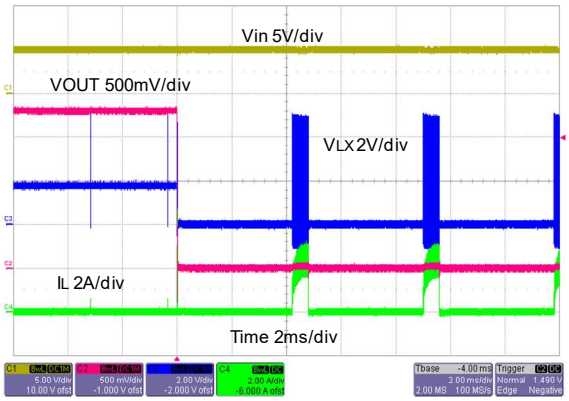
Steady State Operation (I_O=0A)



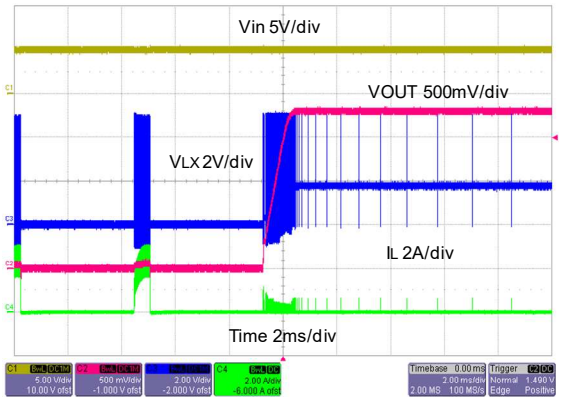
Steady State Operation (I_O=2A)



Short Circuit Waveform (Output short)



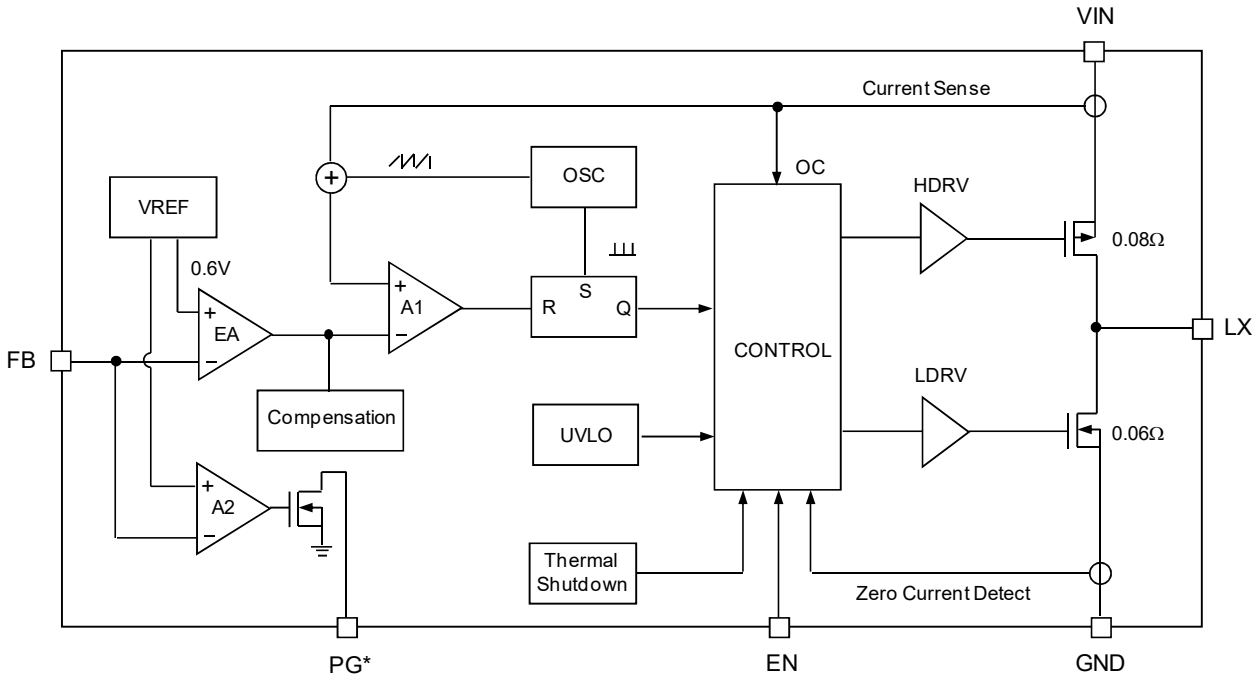
Short Circuit Waveform (Recovery)



Pin Descriptions

PIN			NAME	FUNCTION
SOT-23-5	SOT-23-6	TDFN2X2-8		
1	1	7	EN	Enable Control Pin (Active high, do not leave EN pin floating)
2	2	4,8	GND	Ground Pin
3	3	6	LX	Switch Pin
4	4	3	VIN	Input Supply Pin
5	6	1	FB	Feedback Pin
-	5	2	PG	Power Good. When V_{OUT} is within 10% of regulation point, the output is open drain
-		5	NC	No Connection

Block Diagram



* For SOT-23-6 & TDFN2X2-8

Function Description

Normal Operation

The G2822 uses a constant frequency, current mode step-down architecture. Both high/low-side switches are internal. During normal operation, the internal high-side (PMOS) switch is turned on each cycle when the oscillator sets the SR latch, and turned off when the comparator (A1) resets the SR latch.The peak inductor current at which comparator (A1) resets the SR latch, is controlled by the output of error amplifier EA. While the high-side switch is off, the low-side switch is turned on until either the inductor current starts to reverse or the beginning of the next switching cycle.

Dropout Operation

As the input supply voltage decreases to a value approaching the output voltage, the duty cycle increases toward the maximum on-time. Further reduction of the supply voltage forces the high-side switch to remain on for more than one cycle until it reaches 100% duty cycle. The output voltage is dropped from the input supply for the voltage which across the high-side switch.

Over Temperature Protection

The G2822 has an integrated over-temperature protection circuit that monitors the device junction temperature, and stop switching if the junction temperature over 150°C. When the junction temperature cools down to 130°C, the device will restart.

Soft-Start

During normal power-up, as the input voltage exceeds UVLO threshold, the soft-start circuitry will slowly ramp up the output voltage. This feature prevents supply inrush current and output voltage overshoots during startup conditions.

Over Current Protection

Cycle-by-cycle peak inductor current limit is used to protect embedded switch from damage. The typical peak current limit is 4.0A. If the current through high-side FET over the current limit threshold, high-side FET is turned off immediately. Hence the maximum output current (the average of inductor current) is also restricted.

Short-circuit Protection

Short-circuit protection will activate once the feedback voltage falls below 0.1V. The operating frequency is folded back to 50% of the normal frequency to prevent inductor current runaway. Also, hiccup-mode is adopted to further reduce power dissipation during short-circuit fault condition. When short circuit status is released, the output voltage will automatically recover and ramp up to the setting voltage.

Application Information

Inductor Selection

For most applications, the value of the inductor will fall in the range of 1μH to 4.7μH. Its value is chosen based on the desired ripple current. Large value inductors lower ripple current and small value inductors result in higher ripple currents. Higher V_{IN} or V_{OUT} also increase the ripple current ΔI_L:

$$\Delta I_L = \frac{1}{fL} V_{OUT}\left(1 - \frac{V_{OUT}}{V_{IN}}\right)$$

Where f=switching frequency, L=inductance. A reasonable inductor current ripple is usually set as 1/2 to 1/5 of maximum out current.

The DC current rating of the inductor should be at least equal to the maximum load current plus half the ripple current to prevent core saturation. For better efficiency, choose a low DCR inductor.

Capacitor Selection

In continuous mode, the source current of the top MOSFET is a square wave of duty cycle V_{OUT}/V_{IN}. To prevent large voltage transients, a low ESR input capacitor sized for maximum RMS current must be used. The maximum RMS capacitor current is given by:

$$C_{IN} \text{ requires } I_{RMS} \cong I_{OMAX} \frac{\sqrt{V_{OUT}(V_{IN} - V_{OUT})}}{V_{IN}}$$

This formula has a maximum at $V_{IN}=2V_{OUT}$, where $I_{RMS}=I_{OUT}/2$. This simple worst case condition is commonly used for design because even significant deviations do not offer much relief.

The selection of C_{OUT} is driven by the required effective series resistance (ESR). Typically, once the ESR requirement for C_{OUT} has been met, the RMS current rating generally far exceeds the $I_{RIPPLE(P-P)}$ requirement. The output ripple ΔV_{OUT} is determined by:

$$\Delta V_{OUT} \cong \Delta I_L \left(ESR + \frac{1}{8fC_{OUT}}\right)$$

For a fixed output voltage, the output ripple is highest at maximum input voltage since ΔI_L increases with input voltage.

Nowadays, higher value, lower cost ceramic capacitors are becoming available in smaller case sizes. Their high ripple current, high voltage rating and low ESR make them ideal for switching regulator applications. Because the G2822's control loop does not depend on the output capacitor's ESR for stable opera-

tion, ceramic capacitors can be used freely to achieve very low output ripple and small circuit size.

When choosing the input and output ceramic capacitors, choose the X5R or X7R dielectric formulations. These dielectrics have the best temperature and voltage characteristics of all the ceramics for given value and size.

Output Voltage Programming

In the adjustable version of G2822, the output voltage is set by a resistive divider according to the following formula:

$$V_{OUT} = \mathbf{0.6} \bullet \left(\mathbf{1} + \frac{R\mathbf{1}}{R\mathbf{2}} \right) \text{ Volt.}$$

Parameters Suggestion Table

V_{OUT}(V)	R1(KΩ)	R2(KΩ)	L(μH)	C_{OUT}(μF)
3.3	45	10	1	22x2
2.5	31.6	10	1	22x2
1.8	20	10	1	22x2
1.2	10	10	1	22x2
1.05	7.5	10	1	22x2

* If R2 is larger than 100k, a 10~22pF ceramic cap in parallel with R1 is recommended.

Efficiency Considerations

Although all dissipative elements in the circuit produce losses, one major source usually account for most of the losses in G2822 circuits: I^2R losses. The I^2R loss dominates the efficiency loss at medium to high load currents. To minimize the power consumption from feedback resistors, a value of between 10k and 1M for both R1 and R2 is recommended.

The I^2R losses are calculated from the resistances of the internal switches, R_{SW}, and external inductor R_L. In continuous mode, the average output current flowing through inductor L is "chopped" between the main switch and the synchronous switch. Thus the series resistance looking into the LX pin is a function of both top and bottom MOSFET $R_{DS(ON)}$ and the duty cycle (D) as follows:

$$R_{SW} = (R_{DS(ON)TOP})(D)+(R_{DS(ON)BOTTOM})(1-D)$$

The $R_{DS(ON)}$ for both the top and bottom MOSFETs can be obtained from Electrical Characteristics table. Thus, to obtained I^2R losses, simply add R_{SW} to R_L and multiply the result by the square of the average output current.

Other losses including C_{IN} and C_{OUT} ESR dissipative losses and inductor core losses generally account for less than 2% total additional loss.

Checking Transient Response

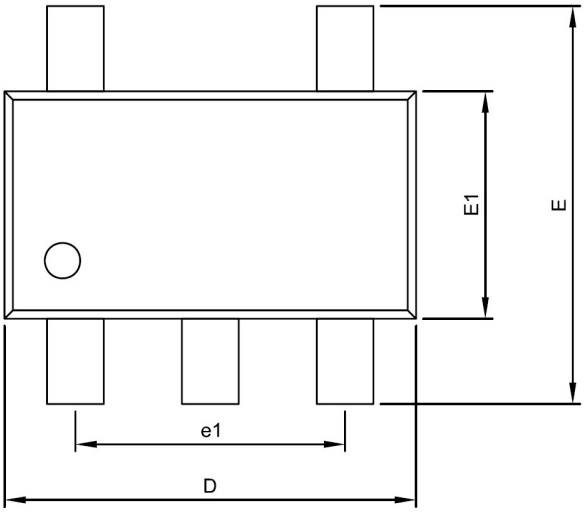
The regulator loop response can be checked by looking at the load transient response. Switching regulators take several cycles to respond to a step in load current. When a load step occurs, V_{OUT} immediately shifts by an amount equal to (ΔI_{LOAD}•ESR), where ESR is the effective series resistance of C_{OUT}. ΔI_{LOAD} also begins to charge or discharge C_{OUT}, which generates a feedback error signal. The regulator loop then acts to return V_{OUT} to its steady-state value. During this recovery time V_{OUT} can be monitored for overshoot or ringing that would indicate a stability problem. For large load transient step applications, a 10~22pF ceramic cap in parallel with R1 is recommended.

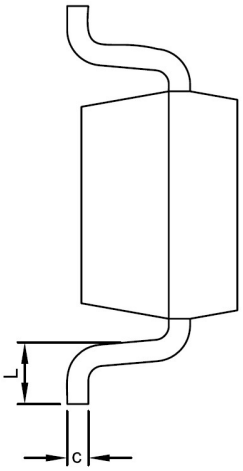
Thermal considerations

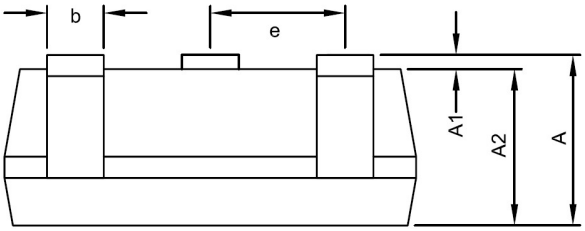
In most application the G2822 does not dissipate much heat due to its high efficiency. But, in applications where the G2822 is running at high ambient temperature with low supply voltage and high duty cycles, such as in dropout, the heat dissipated may exceed the maximum junction temperature of the part. If the junction temperature reaches approximately 150°C, both power switches will be turned off and the LX node will become high impedance.

Assume power dissipation on G2822 P_D=0.1W, ambient temperature T_A=70°C, thermal resistance of junction to ambient θ_{JA}=250°C/W, then temperature junction $T_J = T_A + \theta_{JA} * P_D$ = 95°C.

Package Information





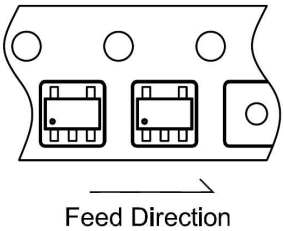


設計驗證
工程課
2025 -01- 14
發行
致新科技開發股份有限公司

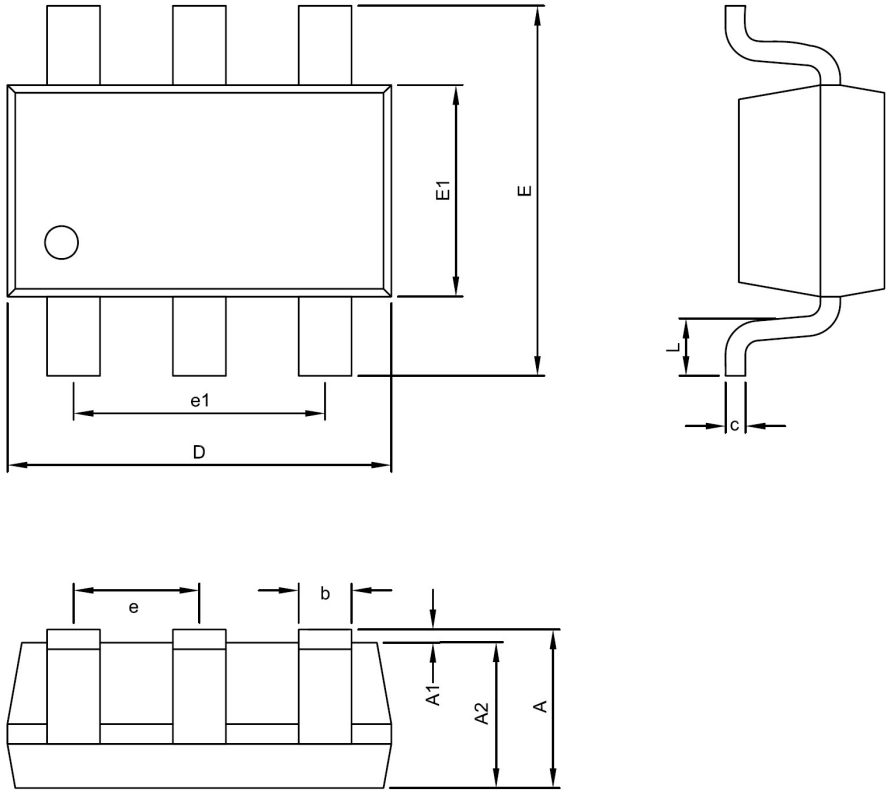
SOT-23-5 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.10	1.45	0.037	0.043	0.057
A1	0.00	- - -	0.15	0.000	- - -	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



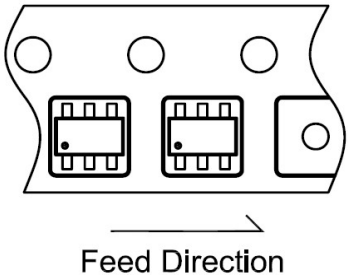
PACKAGE	Q'TY/REEL
SOT-23-5	3,000 ea



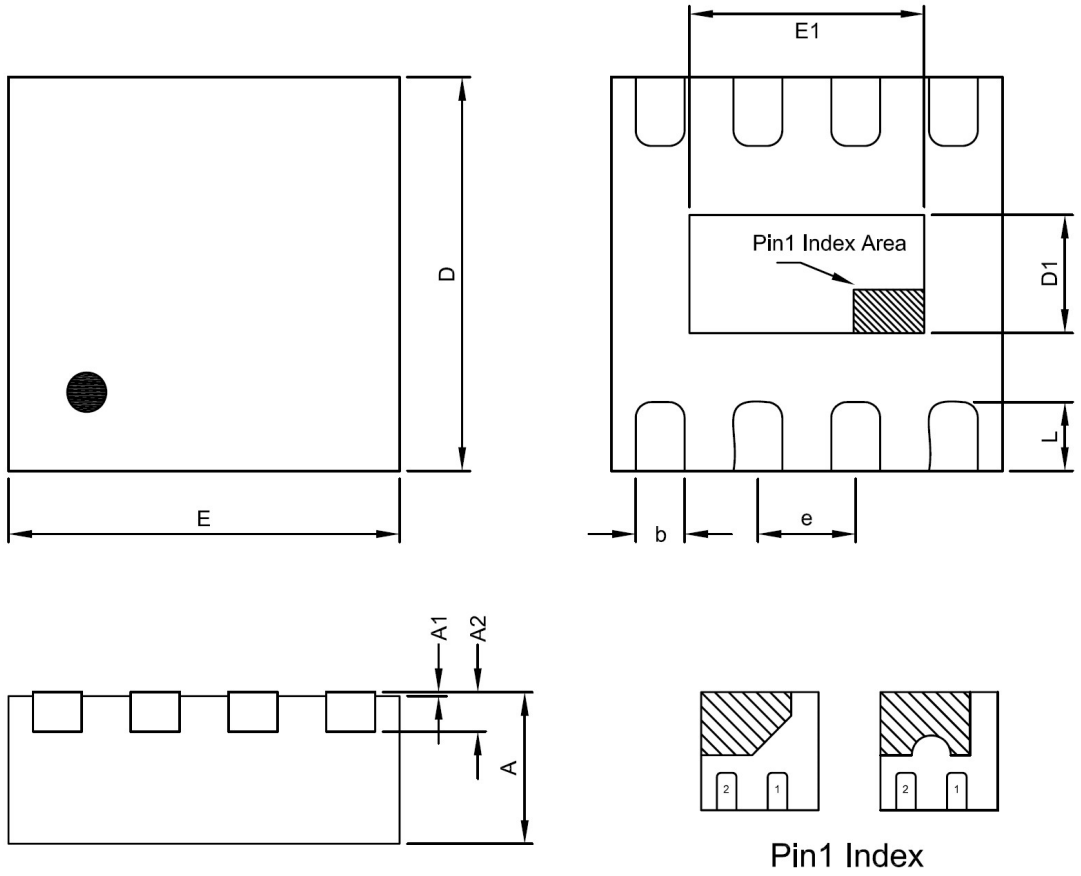
SOT-23-6 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.10	1.45	0.037	0.043	0.057
A1	0.00	- - -	0.15	0.000	- - -	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



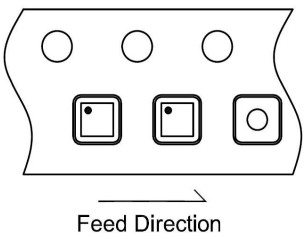
PACKAGE	Q'TY/REEL
SOT-23-6	3,000 ea



TDFN2X2-8 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	1.95	2.00	2.05	0.0768	0.0787	0.0807
E	1.95	2.00	2.05	0.0768	0.0787	0.0807
D1	0.55	0.75	0.95	0.0217	0.0295	0.0374
E1	1.15	1.40	1.65	0.0453	0.0551	0.0650
b	0.15	0.23	0.30	0.0059	0.0091	0.0118
e	0.50 BSC			0.0197 BSC		
L	0.30	0.35	0.40	0.0118	0.0138	0.0157

Taping Specification



PACKAGE	Q'TY/REEL
TDFN2X2-8	3,000 ea

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