LM284x SIMPLE SWITCHER® 4.5V 至 42V 输入、0.1/0.3/0.6A 输出降压直流/直流稳压器，采用超薄 SOT 封装

1 特性

- 4.5V 至 42V 输入电压
- 100mA、300mA 和 600mA 输出电流选项
- 0.765V 反馈引脚电压
- 550kHz (X) 或 1.25MHz (Y) 开关频率
- 低关断 I_Q：16μA 典型值
- 短路保护
- 内部补偿
- 软启动电路
- 小型总体解决方案尺寸（SOT-6L 封装）
- 使用 LM2840（或 LM2841/42）并借助 WEBENCH® 电源设计器进行定制设计

2 应用

- 电池供电类设备
- 工业分布式电源 应用
- 便携式媒体播放器
- 便携式手持仪器

3 说明

LM284x SIMPLE SWITCHER™器件是 PWM 直流/直流降压稳压器。该器件具有 4.5V 至 42V 的输入范围，适合各种 应用（例如，从非稳压源进行电源调节）。它们具有低 R_{DSON}（典型值 0.9Ω）内部开关，可实现最大效率（典型值 85%）。此外，它们还具有 550kHz（X 选项）和 1.25MHz（Y 选项）的固定工作频率，可在保证低输出电压纹波的同时支持小型外部组件。可通过结合使用关断 ($\overline{SHDN}$) 引脚和外部 RC 电路来执行软启动，从而方便用户根据特定应用调整软启动时间。

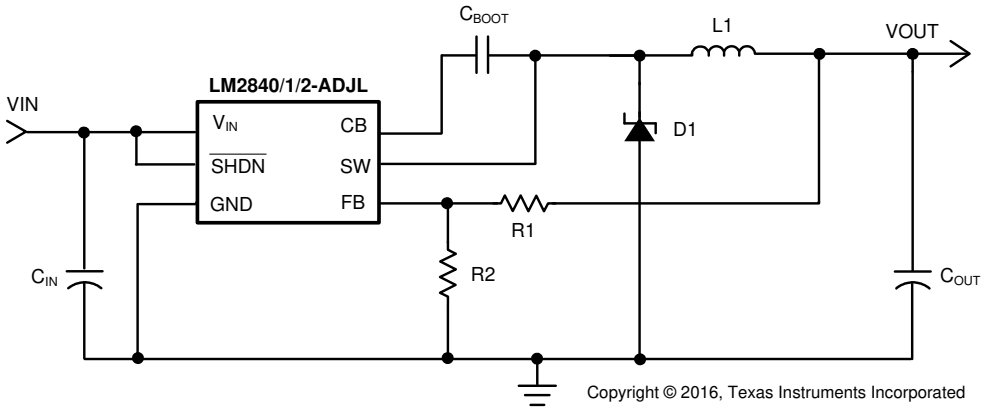
经过优化后，LM2840 的负载电流高达 100mA，LM2841 的负载电流高达 300mA，LM2842 的负载电流则高达 600mA。它们都具有 0.765V 的标称反馈电压。

此器件还提供其他 特性 包括：热关断、V_{IN} 欠压锁定和栅极驱动欠压锁定。LM284x 都采用低厚度 SOT-6L 封装。

器件信息(1)

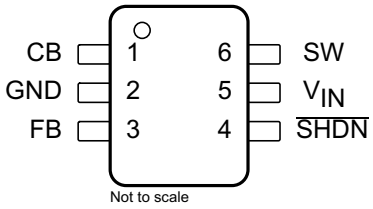
器件型号	封装	封装尺寸（标称值）
LM2840、LM2841、LM2842	SOT (6)	1.60mm x 2.90mm

典型应用电路



5 Pin Configuration and Functions

DDC Package
6-Pin SOT
Top View



Not to scale

Pin Functions

PIN		I/O	DESCRIPTION
NO.	NAME		
1	CB	I	SW FET gate bias voltage. Connect C_{BOOT} capacitor between CB and SW.
2	GND	—	Ground connection
3	FB	I	Feedback pin: Set feedback voltage divider ratio with $V_{OUT} = V_{FB}$ (1 + (R1 / R2)). Resistors must be from 100 Ω to 10 kΩ to avoid input bias errors.
4	$\overline{SHDN}$	I	Logic level shutdown input. Pull to GND to disable the device and pull high to enable the device. If this function is not used tie to V_{IN} . DO NOT ALLOW TO FLOAT.
5	V_{IN}	I	Power input voltage pin: 4.5-V to 42-V normal operating range.
6	SW	O	Power FET output: Connect to inductor, diode, and C_{BOOT} capacitor.

6 Specifications

6.1 Absolute Maximum Ratings

See (1)(2)

	MIN	MAX	UNIT
V_{IN}	–0.3	45	V
$\overline{SHDN}$	–0.3	(V_{IN} + 0.3 V) < 45	V
SW voltage	–0.3	45	V
CB voltage above SW voltage		7	V
FB voltage	–0.3	5	V
Power dissipation(3)	Internally Limited		
Maximum junction temperature		150	°C
Storage temperature, T_{stg}	–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The maximum allowable power dissipation is a function of the maximum junction temperature, T_J(MAX), the junction-to-ambient thermal resistance, $R_{\theta JA}$, and the ambient temperature, T_A. The maximum allowable power dissipation at any ambient temperature is calculated using: P_D (MAX) = ($T_{J(MAX)}$ − T_A) / $R_{\theta JA}$. Exceeding the maximum allowable power dissipation causes excessive die temperature, and the regulator goes into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage. Thermal shutdown engages at T_J=175°C (typical) and disengages at T_J= 155°C (typical).

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Operating junction temperature(1)	–40	125	°C
Input voltage V_{IN}	4.5	42	V
SW voltage		42	V

(1) All limits specified at room temperature (T_A = 25°C) unless otherwise specified. All room temperature limits are 100% production tested. All limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).

6.4 Thermal Information

THERMAL METRIC(1)		LM284x DDC (SOT) 6 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance(2)(3)	121	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	94	°C/W

(1) The package thermal impedance is calculated in accordance to JESD 51-7.
(2) Thermal Resistances were simulated on a 4-layer, JEDEC board

6.5 Electrical Characteristics

Specifications are for T_J = 25°C unless otherwise specified. Minimum and Maximum limits are specified through test, design, or statistical correlation. Typical values represent the most likely parametric norm at T_J = 25°C, and are provided for reference purposes only. Unless otherwise stated the following conditions apply: V_{IN} = 12 V.[1][2][3]

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
I_Q	Quiescent current	$\overline{SHDN}$ = 0 V			16		µA
			T_J = −40°C to 125°C			40	
		Device ON, not switching			1.3		mA
			T_J = −40°C to 125°C			1.75	
		Device ON, no load			1.35		
			T_J = −40°C to 125°C			1.85	
R_{DSON}	Switch ON resistance	See [4]			0.9		Ω
			T_J = −40°C to 125°C			1.6	
I_{LSW}	Switch leakage current	V_{IN} = 42 V			0		µA
			T_J = −40°C to 125°C			0.5	
I_{CL}	Switch current limit	LM2840[5]			525		mA
			T_J = −40°C to 125°C			900	
		LM2841[5]			525		mA
			T_J = −40°C to 125°C			900	
		LM2842[5]			1.15		A
			T_J = −40°C to 125°C			1.7	
I_{FB}	Feedback pin bias current	LM284[0,1,2][6]			0.1		µA
			T_J = −40°C to 125°C			1	
V_{FB}	FB Pin reference voltage				0.765		V
			T_J = −40°C to 125°C	0.747		0.782	
$t_{ON(min)}$	Minimum ON-time	See [7]			100		ns
			T_J = −40°C to 125°C			150	
$t_{OFF(min)}$	Minimum OFF-time	X option			110		ns
			T_J = −40°C to 125°C			370	
		Y option			104		ns
			T_J = −40°C to 125°C			200	
f_{SW}	Switching frequency	X option, V_{FB} = 0.5 V			550		kHz
			T_J = −40°C to 125°C	325		750	
		X option, V_{FB} = 0 V			140		
		Y option, V_{FB} = 0.5 V			1.25		MHz
			T_J = −40°C to 125°C	0.95		1.5	
		Y option, V_{FB} = 0 V			0.35		
D_{MAX}	Maximum duty cycle	X option			94%		
			T_J = −40°C to 125°C	88%			
		Y option			87%		
			T_J = −40°C to 125°C	81%			

(1) All limits specified at room temperature (T_A = 25°C) unless otherwise noted. Room temperature limits are production tested. Limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. Limits are used to calculate Average Outgoing Quality Level (AOQL).
(2) Typical numbers are at 25°C and represent the most likely norm.
(3) The part numbers in this table represent both the Q1 and non-Q1 versions of the respective parts.
(4) Includes the bond wires, R_{DSON} from V_{IN} pin to SW pin.
(5) Current limit at 0% duty cycle. May be lower at higher duty cycle or input voltages below 6 V.
(6) Bias currents flow into pin.
(7) Minimum ON-time specified by design and simulation.

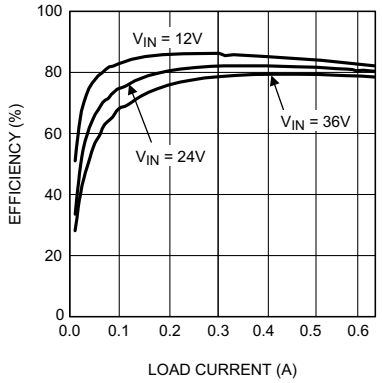
Electrical Characteristics (continued)

Specifications are for T_J = 25°C unless otherwise specified. Minimum and Maximum limits are specified through test, design, or statistical correlation. Typical values represent the most likely parametric norm at T_J = 25°C, and are provided for reference purposes only. Unless otherwise stated the following conditions apply: V_{IN} = 12 V.[1][2][3]

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{UVP}	Undervoltage lockout thresholds	On threshold			3.7		V
			T_J = −40°C to 125°C	4.4			
		Off threshold			3.5		
			T_J = −40°C to 125°C			3.25	
$V_{\overline{SHDN}}$	Shutdown threshold	Device ON			1		V
			T_J = −40°C to 125°C	2.3			
		Device OFF			0.9		
			T_J = −40°C to 125°C			0.3	
$I_{\overline{SHDN}}$	Shutdown pin input bias current	$V_{\overline{SHDN}}$ = 2.3 V[6]			0.05		µA
			T_J = −40°C to 125°C			1.5	
		$V_{\overline{SHDN}}$ = 0 V			0.02		
			T_J = −40°C to 125°C			1.5	

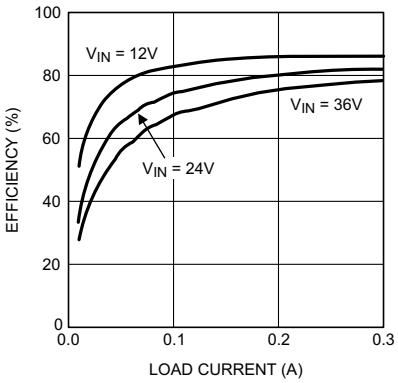
6.6 Typical Characteristics

The part numbers in this section represent both the Q1 and non-Q1 versions of the respective parts.



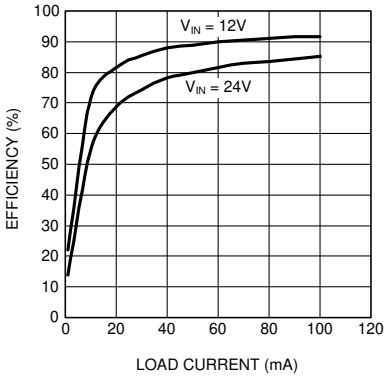
LM2842X V_{OUT} = 3.3 V

Figure 1. Efficiency vs Load Current



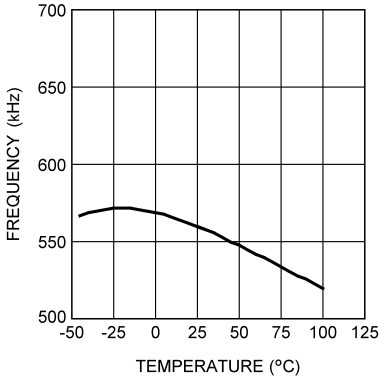
LM2841X V_{OUT} = 3.3 V

Figure 2. Efficiency vs Load Current



LM2840X V_{OUT} = 8 V

Figure 3. Efficiency vs Load Current



X option

Figure 4. Switching Frequency vs Temperature

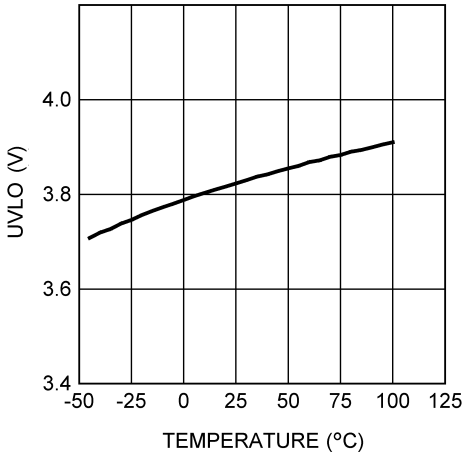
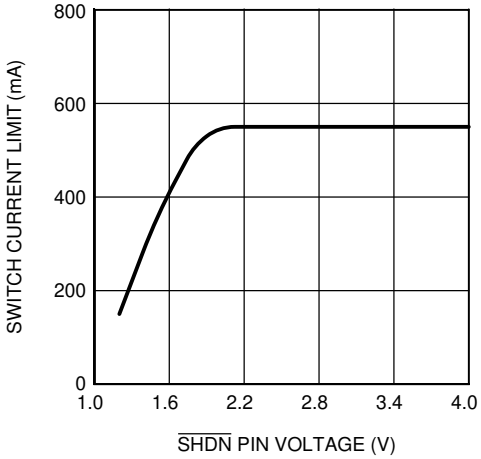


Figure 5. Input UVLO Voltage vs Temperature



Soft-Start Implementation LM284[0,1]

Figure 6. Switch Current Limit vs $\overline{\text{SHDN}}$ Pin Voltage

Typical Characteristics (continued)

The part numbers in this section represent both the Q1 and non-Q1 versions of the respective parts.

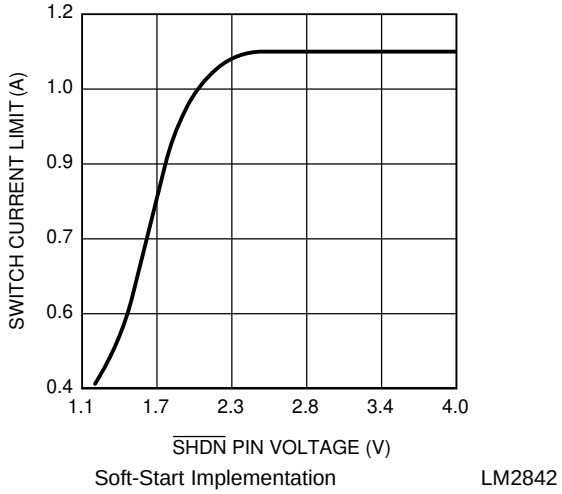


Figure 7. Switch Current Limit vs $\overline{\text{SHDN}}$ Pin Voltage

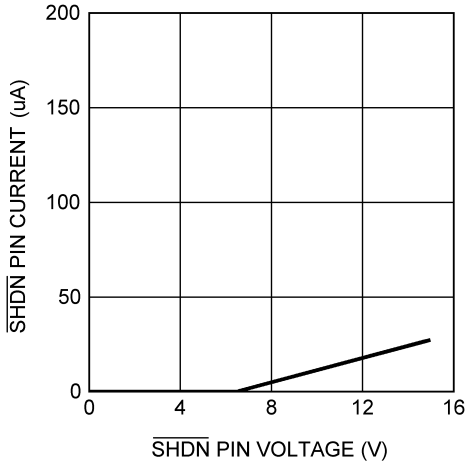


Figure 8. $\overline{\text{SHDN}}$ Pin Current vs $\overline{\text{SHDN}}$ Pin Voltage