

# BQ25185 具有电源路径、出厂模式和电池跟踪 VINDPM 的单节电池、1A 独立线性电池充电器

## 1 特性

- 1A 线性电池充电器
  - 3.0V 至 18V 输入电压工作范围
  - 可耐受 25V 的输入电压
  - 通过外部电阻器实现可编程操作：
    - ILIM/VSET 将电池稳压电压设置为 3.6V、3.65V、4.02V、4.1V、4.2V、4.35V 或 4.4V
    - ILIM/VSET 将输入电流限制设置为 100mA、500mA 或 1100mA
    - ISSET 用于设置 5mA 至 1A 的充电电流
  - 支持锂离子、锂聚合物电池和磷酸铁锂化学物质
  - 115mΩ 电池 FET 导通电阻
  - 高达 3.125A 的放电电流，支持高系统负载
- 电源路径管理，用于系统供电和电池充电
  - 稳定系统电压 (SYS) 为 4.5V
  - 可配置的输入电流限制
  - 支持 USB 挂起模式
  - 适用于高阻抗输入源的电池跟踪输入电压动态电源管理 (VINDPM)
  - 动态电源路径管理可以对通过弱适配器充电进行优化
- 超低静态电流
  - 仅电池模式下为 4μA
  - 睡眠模式下输入适配器 I<sub>q</sub> 为 30μA
  - 出厂模式下电池放电电流为 3.2μA
- 集成故障保护
  - 输入过压保护 (VIN\_OVP)
  - 电池欠压保护 (BUVLO)
  - 电池短路保护 (BATSC)
  - 电池过流保护 (BATOCP)
  - 输入电流限制保护 (ILIM)
  - 热调节 (TREG) 和热关断 (TSHUT)
  - 电池热故障保护 (TS)
  - 安全计时器故障
  - ISSET 和 ILIM/VSET 引脚短路/开路保护。

## 2 应用

- TWS 耳机和充电盒
- 智能眼镜、AR 和 VR
- 智能手表和其他可穿戴设备
- 零售自动化和支付
- 楼宇自动化

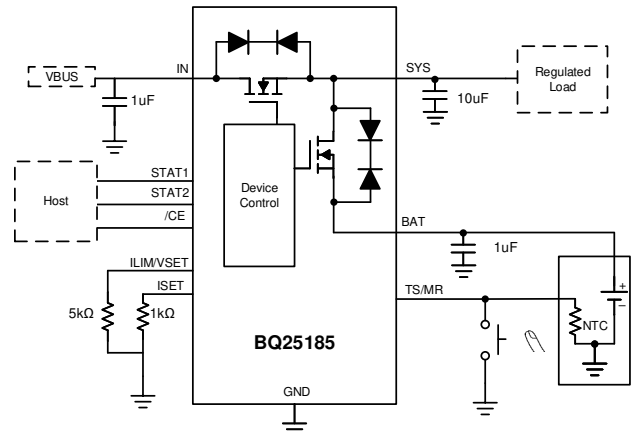
## 3 说明

BQ25185 是一款线性电池充电器 IC，主要用于实现小尺寸解决方案和低静态电流以延长电池寿命。该器件采用无引线、小尺寸封装，带有散热焊盘，可提供良好的热性能。该器件可支持高达 1A 的充电电流和高达 3.125 A 的系统负载电流。

### 封装信息

器件型号	封装 <sup>(1)</sup>	封装尺寸 <sup>(2)</sup>	封装尺寸 (标称值)
BQ25185	DLH ( WSON , 10 )	2.2mm × 2.0mm	2.2mm x 2.0mm

- 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。
- 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。



简化版原理图



## Table of Contents

<b>1 特性</b> .....	<b>1</b>	8.3 Feature Description.....	<b>14</b>
<b>2 应用</b> .....	<b>1</b>	8.4 Device Functional Modes.....	<b>19</b>
<b>3 说明</b> .....	<b>1</b>	<b>9 Application and Implementation</b> .....	<b>20</b>
<b>4 Revision History</b> .....	<b>2</b>	9.1 Application Information.....	<b>20</b>
<b>5 说明 (续)</b> .....	<b>3</b>	9.2 Typical Application.....	<b>20</b>
<b>6 Pin Configuration and Functions</b> .....	<b>4</b>	9.3 Power Supply Recommendations.....	<b>22</b>
<b>7 Specifications</b> .....	<b>5</b>	9.4 Layout.....	<b>23</b>
7.1 Absolute Maximum Ratings.....	<b>5</b>	<b>10 Device and Documentation Support</b> .....	<b>24</b>
7.2 ESD Ratings.....	<b>5</b>	10.1 Device Support.....	<b>24</b>
7.3 Thermal Information.....	<b>5</b>	10.2 接收文档更新通知.....	<b>24</b>
7.4 Recommended Operating Conditions.....	<b>5</b>	10.3 支持资源.....	<b>24</b>
7.5 Electrical Characteristics.....	<b>6</b>	10.4 Trademarks.....	<b>24</b>
7.6 Timing Requirements.....	<b>8</b>	10.5 静电放电警告.....	<b>24</b>
7.7 Typical Characteristics.....	<b>9</b>	10.6 术语表.....	<b>24</b>
<b>8 Detailed Description</b> .....	<b>10</b>	<b>11 Mechanical, Packaging, and Orderable Information</b> .....	<b>25</b>
8.1 Overview.....	<b>10</b>		
8.2 Functional Block Diagram.....	<b>14</b>		

## 4 Revision History

注：以前版本的页码可能与当前版本的页码不同

DATE	REVISION	NOTES
October 2023	*	Initial Release

## 5 说明 ( 续 )

该器件采用标准锂离子或磷酸铁锂充电曲线分三个阶段对电池进行充电：预充电、恒流和恒压。通过热调节提供最大充电电流，同时管理器件温度。该充电器还针对电池间充电进行了优化，具有 3V 的最低输入电压，并且可以承受 25V 的绝对最大线路瞬变。该器件集成了单按钮输入，用于减小解决方案的总尺寸。

## 6 Pin Configuration and Functions

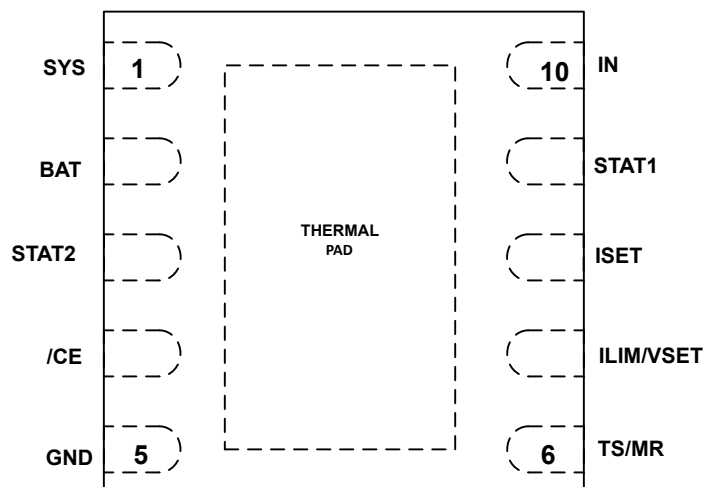


图 6-1. DLH Package 10-Pin (top view)

表 6-1. Pin Functions

Pin		I/O <sup>(1)</sup>	Description
Name	NO.		
IN	10	P	DC input power supply. IN is connected to the external DC supply. Bypass IN to GND with at least 1 uF of capacitance using a ceramic capacitor.
SYS	1	P	Regulated system output. Connect at least 10uF ceramic capacitor (at least 1uF of ceramic capacitance with DC bias de-rating) from SYS to GND as close to the SYS and GND pins as possible.
BAT	2	P	Battery connection. Connect to the positive terminal of the battery. Bypass BAT to GND with at least 1uF of ceramic capacitance.
GND	5	-	Ground connection. Connect to the ground plane of the circuit.
ILIM/VSET	7	I/O	Input current limit and battery regulation voltage program input. Refer to <a href="#">ILIM/VSET Control</a>
ISET	8	I/O	Fast charge current program input. We recommend an RC for small charge current values. Prefer to work only with one resistor.
STAT1	9	O	Open drain status output. Can be pulled up to 1- 20kohm resistor. Typical pull up voltage = 1.8V, Max pull up voltage = 5V. Refer to the Status Pins section for more details.
TS/MR	6	I/O	Manual reset input/ NTC thermistor pin. TS/MR is a general purpose input that must be held low for greater than $t_{LPRESS}$ to go into Factory mode. TS/MR may be driven by a momentary push-button or a MOS switch. The TS/MR pin can also have an NTC thermistor connected on to it. Refer to <a href="#">External NTC Monitoring Section (TS)</a> section.
$\overline{CE}$	4	I	Charge enable active-low input. Connect $\overline{CE}$ to a high logic level to disable charging. Connect to a low logic level to enable charging.
STAT2	3	O	Open drain status output. Can be pulled up to 1- 20kohm resistor. Typical pull up voltage = 1.8V, Max pull up voltage = 5V. Refer to the Status Pins section for more details.

(1) I = Input, O = Output, I/O = Input or Output, G = Ground, P = Power.

## 7 Specifications

### 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
Input Voltage	IN	-0.3	25	V
Voltage	All other pins	-0.3	5.5	V
Input Current (DC)	IN		1.1	A
SYS Discharge Current(DC)	SYS		3.125	A
Output Sink Current	STAT1, STAT2		20	mA
T <sub>J</sub>	Junction temperature	-40	150	°C
T <sub>stg</sub>	Storage temperature	-65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Rating* 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 Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### 7.2 ESD Ratings

			VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001, all pins <sup>(1)</sup>	±2500	V
		Charged device model (CDM), per ANSI/ESDA/ JEDEC JS-002, all pins <sup>(2)</sup>	±1500	

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.  
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 7.3 Thermal Information

THERMAL METRIC <sup>(1)</sup>		BQ25185	UNIT
		DLH	
		10	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance (JEDEC <sup>(1)</sup> )	68.3	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	77.2	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	34.7	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	2.0	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	34.7	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case (bottom) thermal resistance	10.7	°C/W

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

### 7.4 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
VBAT	Battery Voltage Range	2.2		4.6	V
VIN	Input Voltage Range	2.7		5.5	V
IIN	Input Current Range (IN to SYS)			1.1	A
IBAT	Battery Discharge Current (BAT to SYS)			3.125	A

## 7.4 Recommended Operating Conditions (续)

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

		MIN	NOM	MAX	UNIT
TJ	Operating Junction Temperature Range	-40		125	°C

## 7.5 Electrical Characteristics

VIN = 5V, VBAT = 3.6V. -40°C < TJ < 125°C unless otherwise noted. Typical data at TJ = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>INPUT CURRENTS</b>						
I <sub>Q_IN</sub>	Input supply quiescent current	VBAT = 3.6V, VIN = 5V, Charge enabled, ICHG = 0mA, SYSREG = 4.5V		0.75	1	mA
I <sub>SLEEP_IN</sub>	SLEEP input current	VIN = 3.6V, VBAT = 3.7V		30		μA
I <sub>Q_BAT</sub>	Battery quiescent current	V <sub>IN</sub> < V <sub>UVLO</sub> , VBAT = 3.6V, 0°C < TJ < 85°C		4	5	μA
I <sub>BAT_FACT</sub>	Battery discharge current in Factory Mode	VBAT = 3.6 V, 0°C < TJ < 85°C		3.2	5	μA
<b>POWER-PATH MANAGEMENT AND INPUT</b>						
V <sub>IN_OP</sub>	Input voltage operating range		3.6		18	V
V <sub>IN_UVLOZ</sub>	Exit IN undervoltage lock-out	IN rising			3	V
V <sub>IN_UVLO</sub>	Enter IN undervoltage lock-out	IN falling			2.7	V
V <sub>IN_LOWV</sub>	IN voltage to start charging	IN rising		3	3.15	V
V <sub>IN_LOWVZ</sub>	IN voltage to stop charging	IN falling		2.95	3.1	V
V <sub>IN_PORZ</sub>	IN voltage threshold to enter Factory Mode	IN falling	1.09	1.3	1.66	V
V <sub>SLEEPZ</sub>	Exit sleep mode threshold	IN rising, VIN - VBAT, VBAT= 4V, VINDPM_ACTIVE = 1	122	152	188	mV
V <sub>SLEEPZ</sub>	Exit sleep mode threshold	IN rising, VIN - VBAT, VBAT= 4V, VINDPM_ACTIVE = 0	168	208	262	mV
V <sub>SLEEP</sub>	Enter sleep mode threshold	IN falling, VIN - VBAT, VBAT= 4V, VINDPM_ACTIVE = 1		82		mV
V <sub>SLEEP</sub>	Enter sleep mode threshold	IN falling, VIN - VBAT, VBAT= 4V, VINDPM_ACTIVE = 0		82		mV
V <sub>SLEEP</sub>	Enter sleep mode threshold	IN falling, VIN - VBAT, VBAT = 4V		82		mV
V <sub>SLEEPZ</sub>	Exit sleep mode threshold	IN rising, VIN - VBAT, VBAT = 4V	168	208	262	mV
V <sub>IN_OVP</sub>	VIN overvoltage rising threshold	IN rising	18	18.5	19	V
V <sub>IN_OVP_HYS</sub>	IN overvoltage hysteresis	IN falling		500		mV
I <sub>BAT_OCP</sub>	BATOCP (Reverse OCP only)	VBAT = 4V		3.13		A
I <sub>BAT_OCPACC</sub>	Battery OCP Accuracy	IBAT= 3.125 A, TJ = 27C			18	%
VBSUP1	Enter supplement mode threshold	VBAT = 3.6V, VBAT > V <sub>BUVLO</sub> , V <sub>SYS</sub> < VBAT-VBSUP1		40		mV
VBSUP2	Exit supplement mode threshold	V <sub>BAT</sub> > V <sub>BUVLO</sub> , V <sub>SYS</sub> > VBAT-VBSUP2		20		mV
ILIM	Input Current Limit	VIN = 5V, ILIM=100 mA	80	90	98	mA
		VIN = 5V, ILIM=500 mA	450	475	498	mA
		VIN = 5V, ILIM=1050mA	995	1050	1100	mA
V <sub>INDPM</sub>	Input voltage threshold when input current is reduced			VBAT + V <sub>INDPM_T RACK</sub>		V
V <sub>INDPM_TRACK</sub>	Input voltage threshold offset for when input current is reduced and when VBAT > 3.5 V	VINDPM target = VBAT + V <sub>INDPM_TRACK</sub>		330		mV

## 7.5 Electrical Characteristics (续)

VIN = 5V, VBAT = 3.6V. -40°C < TJ < 125°C unless otherwise noted. Typical data at TJ = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V <sub>DPPM</sub>	SYS voltage threshold when charge current is reduced	VBAT = 3.6V, V <sub>SYST</sub> = V <sub>DPPM</sub> + VBAT before charge current is reduced.		0.1		V
V <sub>SYST_REG</sub>	SYS Regulation Voltage	VIN = 5V, VBATREG ≤ 4.3 V		4.5		V
V <sub>SYST_REG_ACC</sub>	SYS Regulation Accuracy	VIN = 5V, VBAT = 3.6V, R <sub>SYST</sub> = 100 ohm	-2		2	%
V <sub>MINSYST</sub>	Minimum SYS voltage when in battery tracking mode	VBAT < 3.6V		3.8		V
R <sub>SYST_PD</sub>	SYS pull down resistance	V <sub>SYST</sub> = 3.6V		20		Ω
V <sub>SYST_SHORT</sub>	Voltage threshold for detecting SYS_SHORT condition has occurred	200mV hysteresis		1.6		V
<b>BATTERY CHARGER</b>						
R <sub>ON_BAT</sub>	Battery FET on-resistance	VBAT = 4.5V, IBAT = 400 mA		115	140	mΩ
R <sub>ON_IN</sub>	Input FET on-resistance	IN = 5V, IIN = 1A		330	470	mΩ
V <sub>REG_RANGE</sub>	Typical BAT charge voltage regulation range		3.6		4.4	V
V <sub>REG_ACC</sub>	BAT charge voltage accuracy, summary for all settings	All VBATREG settings, typical measurement at VBATREG = 4.2V	-0.5		0.5	%
I <sub>CHG_RANGE</sub>	Typical charge current regulation range	V <sub>BAT</sub> > V <sub>LOWV</sub>	5		1000	mA
V <sub>ISET</sub>	ISET pin voltage when in regulation	IBAT = ICHG		1		V
K <sub>ISET</sub>	Charge current setting factor, I <sub>CHG</sub> = K <sub>ISET</sub> / R <sub>ISET</sub>	10mA < ICHG < 1000mA	285	300	315	AΩ
I <sub>CHG_ACC</sub>	Charge current accuracy	VIN = 5V, Fastcharge ≥ 40mA	-10		10	%
I <sub>CHG</sub>	Charge current accuracy at 800 mA	R <sub>ISET</sub> = 375Ω, OUT = 3.8V	720	800	880	mA
	Charge current accuracy at 500 mA	R <sub>ISET</sub> = 600Ω, OUT = 3.8V	450	500	550	mA
	Charge current accuracy at 150 mA	R <sub>ISET</sub> = 2.0kΩ, OUT = 3.8V	135	150	165	mA
	Charge current accuracy at 10 mA	R <sub>ISET</sub> = 30kΩ, OUT = 3.8V	9	10	11	mA
I <sub>PRECHG</sub>	Typical pre-charge current, as percentage of ICHG	V <sub>OUT</sub> < V <sub>LOWV</sub>		20		%
I <sub>PRECHG_ACC</sub>	Precharge current accuracy	Fastcharge current ≥ 40mA	-10		10	%
I <sub>PRECHG_ACC</sub>	Precharge current accuracy at ICHG = 800 mA	R <sub>ISET</sub> = 375Ω, OUT = 2.5V	144	160	176	mA
I <sub>PRECHG_ACC</sub>	Precharge current accuracy at ICHG = 500 mA	R <sub>ISET</sub> = 600Ω, OUT = 2.5V	90	100	110	mA
I <sub>PRECHG_ACC</sub>	Precharge current accuracy at ICHG = 150 mA	R <sub>ISET</sub> = 2.0kΩ, OUT = 2.5V	26.5	30	34.5	mA
I <sub>PRECHG_ACC</sub>	Precharge current accuracy at ICHG = 10 mA	R <sub>ISET</sub> = 30kΩ, OUT = 2.5V	1.6	2	2.4	mA
I <sub>TERM</sub>	Typical termination current, as percentage of ICHG	V <sub>OUT</sub> = VBATREG		10		%
I <sub>TERM_ACC</sub>	Termination current accuracy	IBAT = 3mA (ICHG = 30mA) TJ = 25°C	-10		10	%
V <sub>LOWV</sub>	Pre-charge to fast-charge transition threshold	VBAT rising	2.9	3	3.1	V
V <sub>LOWV_HYS</sub>	Battery LOWV hysteresis			100		mV
V <sub>BUVLO</sub>	Battery UVLO, VBAT falling			3		V
V <sub>BUVLO_HYS</sub>	Battery UVLO hysteresis, VBAT rising	VIN = 5V	110	150	190	mV
V <sub>BUVLO_HYS</sub>	Battery UVLO hysteresis, VBAT rising	VIN = 0V	90	150	210	mV
V <sub>RCH</sub>	Battery Recharge Threshold	VIN = 5V, Charge Enabled, VBAT falling from VBATREG		100		mV

## 7.5 Electrical Characteristics (续)

VIN = 5V, VBAT = 3.6V. -40°C < TJ < 125°C unless otherwise noted. Typical data at TJ = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V <sub>BATSC</sub>	Short on battery threshold for trickle charge, VBAT rising		1.6	1.8	2.0	V
V <sub>BATSC_HYS</sub>	Battery short circuit voltage hysteresis			200		mV
I <sub>BATSC</sub>	Trickle Charge Current	VBAT < V <sub>BATSC</sub>		7		mA
R <sub>ISET_SHORT</sub>	Resistor value considered short	R <sub>ISET</sub> below this range at startup, charger does not initiate charge, power cycle or /CE toggle to reset			264	Ω
<b>TEMPERATURE REGULATION AND TEMPERATURE SHUTDOWN</b>						
T <sub>REG</sub>	Typical junction temperature regulation			100		°C
T <sub>SHUT_RISING</sub>	Thermal shutdown rising threshold	Temperature increasing		150		°C
T <sub>SHUT_FALLING</sub>	Thermal shutdown falling threshold	Temperature decreasing		135		°C
<b>BATTERY NTC MONITOR</b>						
V <sub>HOT_ENTRY</sub>	High Temperature trip point	Battery Charging, V <sub>TS/MR</sub> falling	0.1050	0.1150	0.1250	V
V <sub>COLD_ENTRY</sub>	Low Temperature trip point	Battery Charging, V <sub>TS/MR</sub> rising	0.9575	1.0075	1.0575	V
V <sub>HOT_EXIT</sub>	Hysteresis on high trip point	Battery Charging, V <sub>TS/MR</sub> rising from V <sub>HOT_ENTRY</sub>	0.1250	0.1350	0.1450	V
V <sub>COLD_EXIT</sub>	Hysteresis on low trip point	Battery Charging, V <sub>TS/MR</sub> falling from V <sub>COLD_ENTRY</sub>	0.7775	0.8200	0.8600	V
<b>PUSH BUTTON TIMERS AND THRESHOLDS</b>						
I <sub>TSMR</sub>	Adapter present		36.5	38	39.5	μA
V <sub>TSMR</sub>	TSMR voltage to detect a button press event, adapter present				90	mV
t <sub>LPRESS</sub>	Long Press timer. Time from button press detection to long press action.			10		s
<b>BATTERY CHARGING TIMERS</b>						
t <sub>MAXCHG</sub>	Charge safety timer			720		min
t <sub>PRECHG</sub>	Precharge safety timer			0.25 * t <sub>MAXCHG</sub>		
<b>LOGIC PINS</b>						
V <sub>IL</sub>	Input low threshold level	VPULLUP = 1.8V, /CE pin			0.4	V
V <sub>IH</sub>	Input high threshold level	VPULLUP = 1.8V, /CE pin	1.3			V
V <sub>OL</sub>	Output low threshold level	IL = 5mA, sink current, VPULLUP = 3.3V, STAT1, STAT2 pins			0.4	V
I <sub>LKG</sub>	High-Level leakage current	VPULLUP = 3.3V, STAT1, STAT2 pins			1	μA

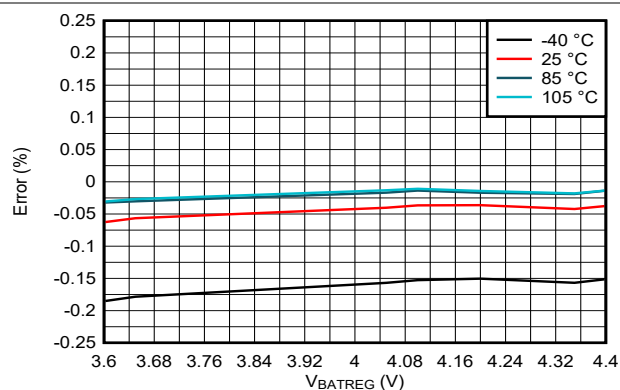
## 7.6 Timing Requirements

		MIN	NOM	MAX	UNIT
<b>INPUT</b>					
t <sub>VIN_OVPZ_DGL</sub>	VIN_OVP deglitch, VIN falling		30		ms
<b>BATTERY CHARGER</b>					
t <sub>REC_SC</sub>	Recovery time, BATOCP during Discharge Mode		250		ms
t <sub>RETRY_SC</sub>	Retry window for SYS or BAT short circuit recovery(BATOCP)		2		s
t <sub>BUVLO</sub>	Deglitch time to disconnect the BATFET when VBAT < V <sub>BUVLO</sub> setting		60		μs

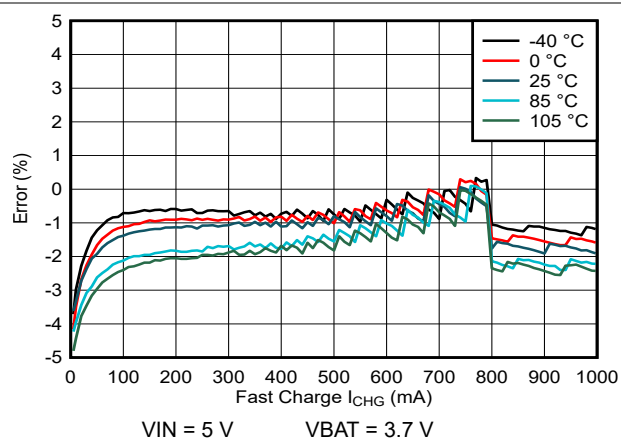


## 7.7 Typical Characteristics

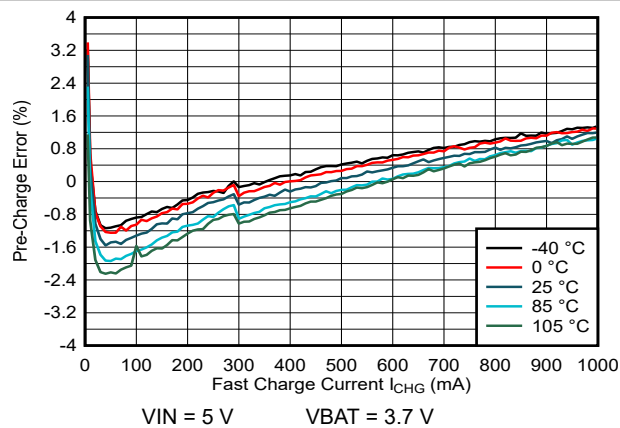
VIN = 5 V, CIN = 2.2  $\mu$ F, COUT = 10  $\mu$ F, CBAT = 1  $\mu$ F (unless otherwise specified)



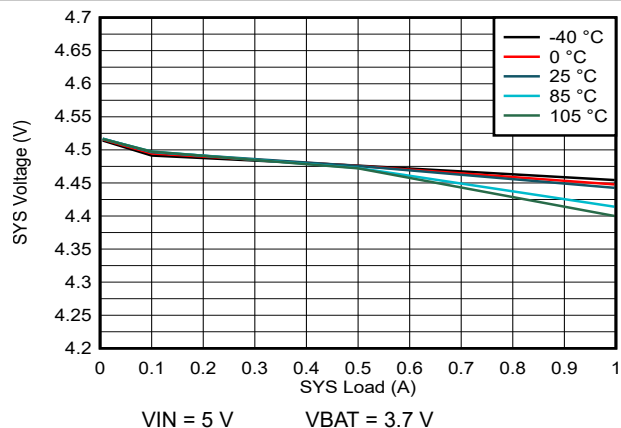
**图 7-1. Battery Regulation Voltage Accuracy vs. VBATREG Setting**



**图 7-2. Charge Current Accuracy vs. ICHARGE Setting**



**图 7-3. Precharge Accuracy vs Battery Voltage**



**图 7-4. SYS Load Regulation**

## 8 Detailed Description

### 8.1 Overview

The BQ25185 integrates a linear charger that allows the battery to be charged with a resistor configurable charge current of up to 1 A. In addition to the charge current, other charging parameters can be programmed through external resistors such as battery regulation voltage and input current limit.

The power path allows the system to be powered from a regulated output, SYS, even when the battery is empty or charging, by drawing power from IN pin. It also prioritizes the system load in SYS, reducing the charging current, if necessary, in order support the load when input power is limited. If the input supply is removed and the battery voltage level is above  $V_{BUVLO}$ , SYS will automatically and seamlessly switch to battery power.

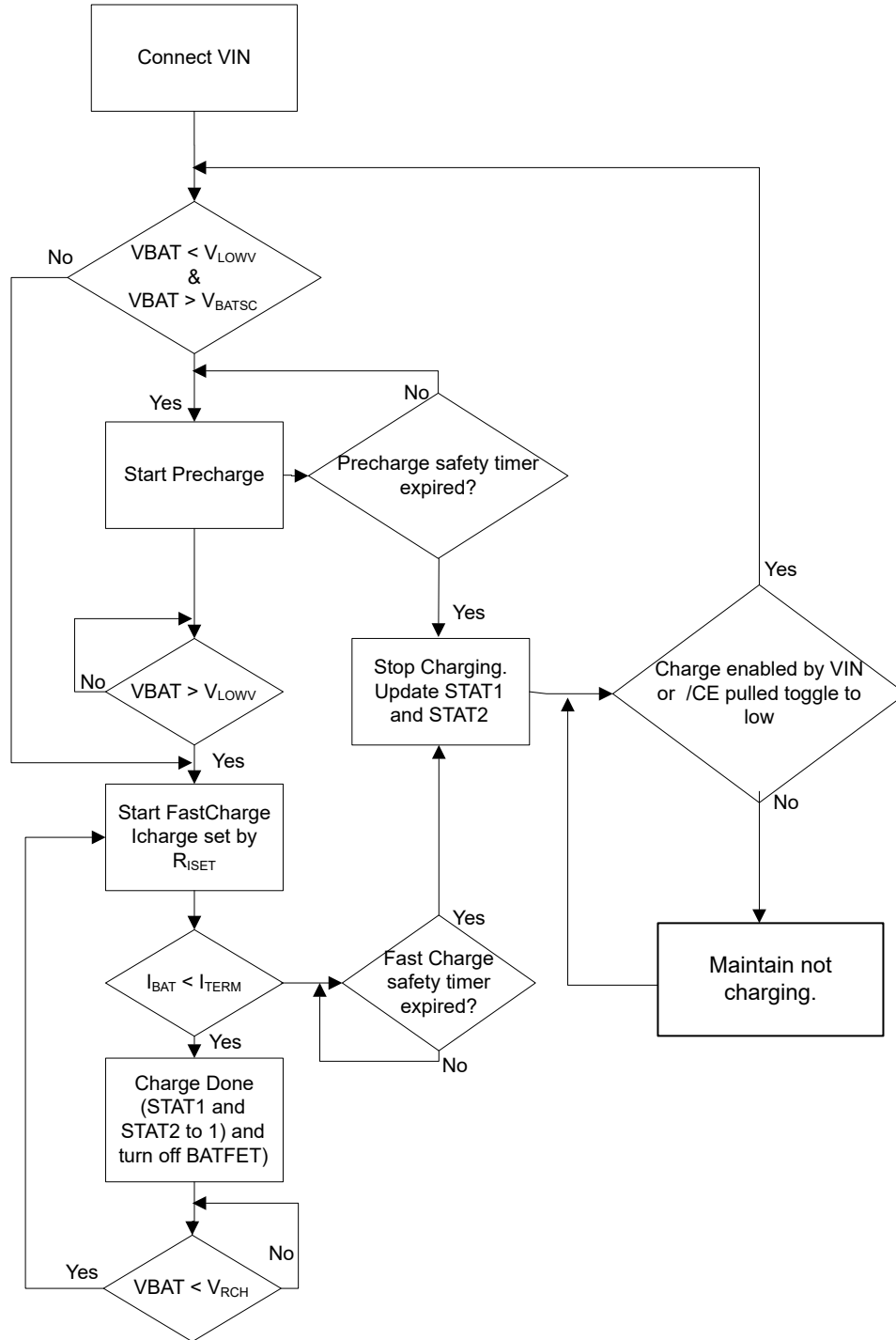
Charging is done through the internal battery MOSFET. There are several loops that influence the charge current: constant current loop (CC), constant voltage loop (CV), input current limit, thermal regulation, VDPPM, and VINDPM. During the charging process, all loops are enabled and the one that is dominant takes control.

The device supports multiple battery chemistries for single-cell applications, through adjustable battery regulation voltage regulation ( $V_{BATREG}$ ) and charge current ( $I_{CHG}$ ) options.

#### 8.1.1 Battery Charging Process

When a valid input source is connected ( $V_{IN} > V_{INDPM}$  and  $V_{BAT} + V_{SLEEP} < V_{IN} < V_{IN\_OVP}$ ), the state of the  $\overline{CE}$  pin and the TS/MR pin determines whether a charge cycle is initiated. When the  $\overline{CE}$  pin is set to disable charging,  $V_{HOT} < V_{TS/MR} < V_{COLD}$  and a valid input source is connected, the battery FET is turned off, preventing any kind of charging of the battery. Note that supplement behavior is independent of the  $\overline{CE}$  pin. The device will be able to charge a battery as long as VIN voltage is higher than the  $V_{INDPM}$  threshold. This threshold is present as the VIN can be considered "powergood" with a very low battery voltage or a 0-V battery.

The following figure illustrates a typical charge cycle.



**图 8-1. Charger Flow Diagram**

### 8.1.1.1 Trickle Charge

In order to prevent damage to the battery, the device will charge the battery at a much lower current level known as trickle charge ( $I_{BATSC}$ ) when the battery voltage (VBAT) is below the  $V_{BATSC}$  threshold. During trickle charge, the device still counts against the precharge safety timer. Rather trickle charge and precharge are counting against the same duration of 25% of the fast charge timer.

### 8.1.1.2 Pre-Charge

When battery voltage is above the  $V_{BATSC}$  but lower than  $V_{LOWV}$  threshold, the battery is charged with the pre-charge current ( $I_{PRECHG}$ ). Pre-charge current is 2x the termination current (Section 8.1.1.5 Termination). As a result, the pre-charge current is 20 % of the fast charge current ( $I_{CHG}$ ).

When the battery voltage reaches the precharge to fast charge transition threshold ( $V_{LOWV}$ ), the device charges the battery at the fast charge current. If the device does not exit pre-charge within 25% of the fast charge safety timer, the device will stop charging. For more information on safety timers, see Section 8.3.7.7. Safety Timer.

### 8.1.1.3 Fast Charge

The charger has two main control loops that control charging when  $V_{BAT} > V_{LOWV}$ : the Constant Current (CC) and Constant Voltage (CV) loops. When the CC loop is dominant, typically when  $V_{BAT} < V_{BATREG} - V_{RCH}$ , the battery is charged at the maximum charge current level  $I_{CHG}$ , unless there is a TS fault condition, VINDPM is active, thermal regulation or DPPM is active. (See respective sections for details on these modes of operation). Once the battery voltage approaches the  $V_{BATREG}$  level, the CV loops becomes more dominant and the charging current starts tapering off as shown in Typical Charging Profile of a Battery. Once the charging current reaches the termination current ( $I_{TERM}$ ) the charge is done, then the STAT1 and STAT2 pins change to indicate a charge complete.

### 8.1.1.4 ISET Pin Detection

After valid VIN is plugged in and  $\overline{CE}$  pin is pulled LOW, the device checks the resistor on the ISET pin for shortcircuit ( $R_{ISET} < R_{ISET\_SHORT}$ ). If the condition is detected, charger remains in the FAULT state until the input or  $\overline{CE}$  pin are toggled. If the ISET pin is open-circuit, the charger will charge with very low charging current in the order of 1.5 mA. This pin is monitored while charging, and changes in  $R_{ISET}$  while the charger is operating will immediately translate to changes in charge current. An external pull-down resistor ( $\pm 1\%$  or better recommended to minimize charge current error) from ISET pin to GND sets the charge current as:

$$I_{CHG} = (K_{ISET}) / (R_{ISET}) \quad (1)$$

- $I_{CHG}$  is the desired fast charge current
- $K_{ISET}$  is a gain factor found in the electrical specification (typically 300 A $\Omega$ )
- $R_{ISET}$  is the pull-down resistor from ISET pin to GND

For charge currents below 50 mA, an extra RC circuit using a 50 pF capacitance is recommended on ISET to achieve more stable current signal. The ISET pin can also be used to monitor device current when the device is not in ICHG regulation. The voltage on the ISET pin is proportional to the device charging current. To measure the charge current when the device is charging, the following formula can be used:

$$I_{CHG} = (K_{ISET} V_{ISET}) / (R_{ISET}) \quad (2)$$

- $V_{ISET}$  is the measured voltage at the ISET pin in volts.
- $I_{CHG}$  is the calculated measured charge current

### 8.1.1.5 Termination

As the device CV loop becomes more dominate than the CC loop in fast charge operation, the charge current will taper and approach the  $I_{TERM}$  threshold. The device terminates at 10 % of  $I_{CHG}$ .

Once the  $I_{TERM}$  threshold is met during the CV phase, the device automatically terminates charge current by disabling the BATFET (disconnects the battery from SYS) to enter high impedance mode. If there is a regulation loop such as VINDPM, DPPM, or a thermal regulation loop that affects the charge current while the CV loop is tapering the charge current, termination will not occur. Charge current will continue to taper due to the active current affecting regulation loops and CV but the device will not terminate the charge current.

Termination only occurs when the CV loop is operating without any other regulation loops in effect that could reduce the charge current further. Post termination, the battery FET is disabled and the device monitors the BAT pin voltage. If the BAT pin voltage has dropped lower than the battery regulation voltage ( $V_{BATREG}$ ) by the recharge threshold ( $V_{RCH}$ ), a new charge cycle is started and safety timers are reset.

During charging or even when charge done, a higher SYS load will be supported through the supplement operation.

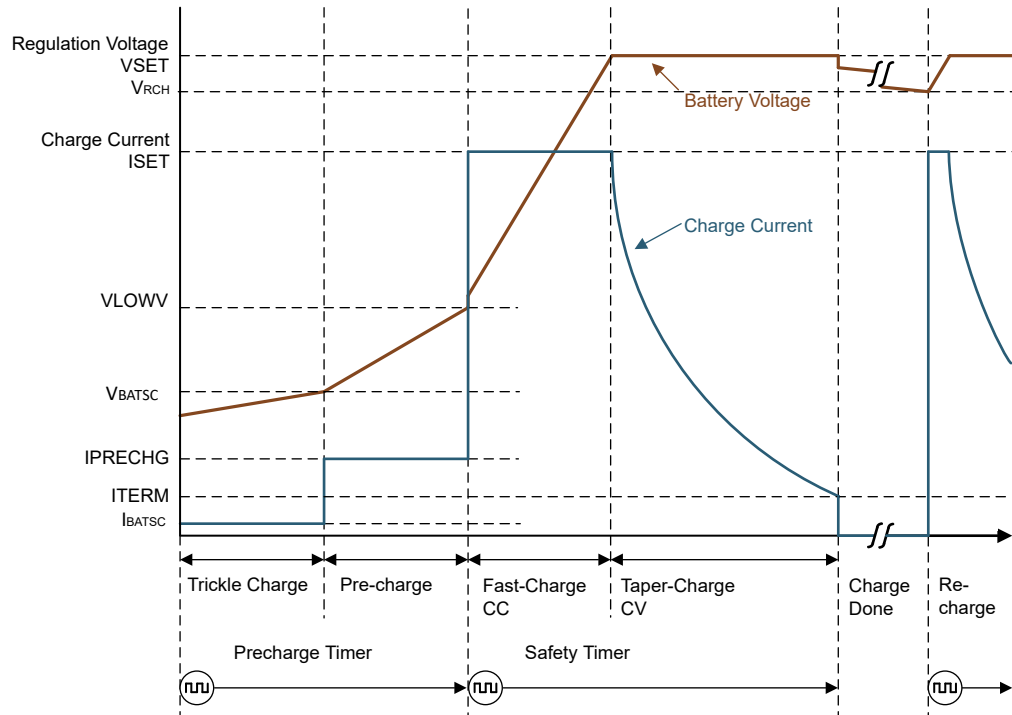
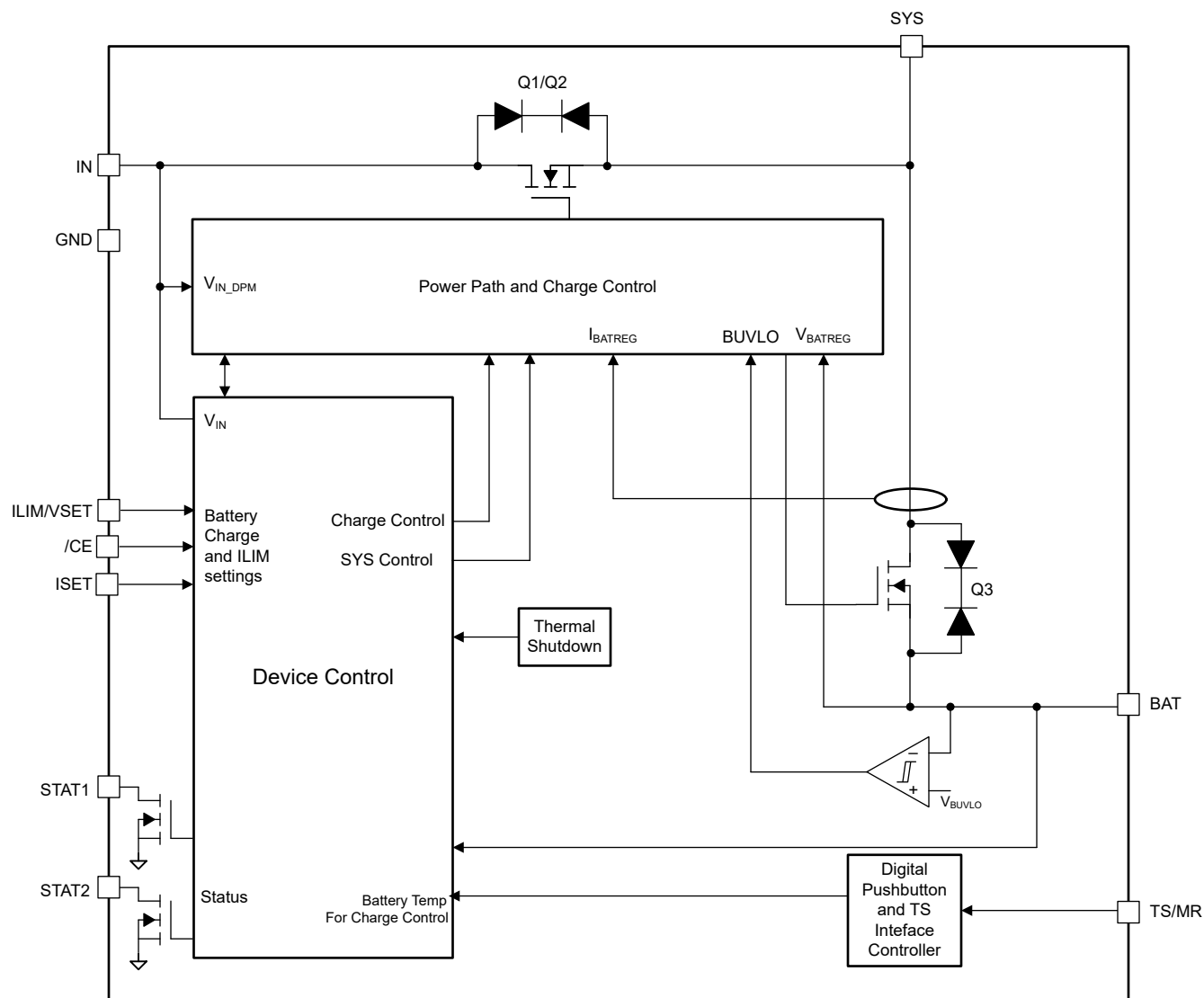


图 8-2. Typical Charging Profile of a Battery

## 8.2 Functional Block Diagram



## 8.3 Feature Description

### 8.3.1 Input Voltage Based Dynamic Power Management (VINDPM)

The VINDPM loop prevents the input voltage from collapsing to a point where charging would be interrupted. This is done by reducing the current drawn by charger enough to keep the input voltage above the VINDPM threshold ( $V_{INDPM}$ ).

During the normal charging process, if the input power source is not able to support the programmed or default charging current and System load, the supply voltage decreases. Once the supply drops to the  $V_{INDPM}$  threshold, the input DPM current and voltage loops will reduce the input current through the blocking FETs to prevent the further drop of the supply.

The VINDPM threshold is typically 300 mV above  $V_{BAT}$ . If the device is not operating in battery tracking VINDPM due to battery voltage, it will regulate the input to 3.6 V. Additionally, termination is disabled when VINDPM is active.

### 8.3.2 Dynamic Power Path Management Mode (DPPM)

With a valid input source connected, the power-path management circuitry monitors the input voltage and current continuously. The current into IN is shared at SYS between charging the battery and powering the system load at SYS. If the sum of the charging and load currents exceeds the preset maximum input current, the input DPM loop reduces input current. If SYS drops below the DPPM voltage threshold, the charging current is reduced by the DPPM loop through the BATFET. If SYS falls below the supplement mode threshold after BATFET charging current is reduced to zero, the part will enter supplement mode. SYS voltage is maintained above battery voltage when the DPPM loop is in control. Battery termination is disabled when the DPPM loop is active.

The VDPPM threshold is typically 100 mV above VBAT.

### 8.3.3 Battery Supplement Mode

While in DPPM mode, if the charging current falls to zero and the system load current increases beyond the programmed input current limit, the voltage at SYS reduces further. When the SYS voltage drops below the battery voltage to  $V_{BSUP1}$ , the battery supplements the system load. The battery stops supplementing the system load when the voltage on the SYS pin rises within the battery voltage to  $V_{BSUP2}$ . During supplement mode, the battery supplement current is not regulated, however, the BATOCP protection circuit is active. Battery termination is disabled while in supplement mode. Battery voltage has to be higher than battery undervoltage lockout threshold ( $V_{BUVLO}$ ) to be able to supplement the system.

### 8.3.4 Sleep Mode

The device enters the low-power sleep mode if  $V_{IN}$  falls below the sleep-mode entry threshold and  $V_{IN}$  is higher than the undervoltage lockout threshold. In sleep mode, the input is isolated from the battery. This feature prevents draining the battery during the absence of  $V_{IN}$ . Once  $V_{IN} > V_{BAT} + V_{SLEEP}$  and  $V_{IN}$  exceeds the VINDPM threshold, the device initiates a new charge cycle.

### 8.3.5 SYS Regulation

The BQ25185 includes a SYS voltage regulation loop. By regulating the SYS voltage the device prevents downstream devices connected to SYS from being exposed to voltages as high as  $V_{IN\_OVP}$ . SYS regulation is only active when  $V_{IN} > V_{UVLO}$ ,  $V_{IN} > V_{BAT} + V_{SLEEP}$  and  $V_{IN} < V_{IN\_OVP}$ .

For the BQ25185, if the ILIM/VSET is configured for a VBATREG setting higher than 4.3 V, the device regulates the SYS voltage in battery tracking mode. As battery voltage increases,  $V_{SYS}$  is regulated to 225 mV above the battery. If the battery is less than 3.6 V, the  $V_{SYS}$  will be regulated to  $V_{MINSYS}$ . This regulation occurs to ensure proper termination of the battery even if VDDPM is active.

### 8.3.6 ILIM/VSET Control

The input current limit can be controlled the external programmable resistor as indicated below.

The ILIM/VSET pin will be checked in the following conditions:

- Valid adapter present on  $V_{IN}$  ( $V_{IN}$  is considered power good)
- Charge Enable pin state is changed to enable.
  - Toggle the /CE pin when the TS/MR pin is not pressed to avoid charging during pin detection.
- TS/MR push button is not pressed.

If an Open is detected on the ILIM/VSET pin- the device will disable charging but regulate the SYS pin and limit the ILIM current to 500mA.

If a Short is detected on the ILIM/VSET pin, the device will stay in battery only mode.

**表 8-1. ILIM and VBATREG Resistor Map**

RESISTOR (kOhm)	CURRENT LIMIT	V <sub>BATREG</sub> (V)	V <sub>LowV</sub> (V)
> 180	Charge Disabled, ILIM 500		
130	ILIM500	4.1	3.0
100	ILIM1100		
75	ILIM500	4.4	
56	ILIM1100		
43	ILIM500	4.35	
33	ILIM1100		
24	ILIM100	4.2	
18	ILIM500		
13	ILIM1100		
9.1	ILIM500	4.05	
6.8	ILIM1100		
5.1	ILIM1100	3.65	2.0
3.6	ILIM500	3.6	
2.4	ILIM1100		
<1.5	Battery Only Mode		

### 8.3.7 Protection Mechanisms

#### 8.3.7.1 Input Overvoltage Protection

The input overvoltage protection protects the device and downstream components connected to SYS, and BAT against damage from overvoltage on the input supply. When  $V_{IN} > V_{IN\_OVP}$ , a VIN overvoltage condition is determined to exist. During the VIN overvoltage condition, the device turns the battery discharge FET on, the STAT1 and STAT2 pins update to reflect a recoverable fault (STAT1 = LOW, STAT2 = HIGH). Once the VIN overvoltage condition is removed, the STAT1 and STAT2 pins update to normal operation once the startup routine has finished due to a power good VIN detection. Thereafter VIN powergood condition is determined if  $V_{IN} > V_{BAT} + V_{SLEEP}$ .

#### 8.3.7.2 Battery Undervoltage Lockout

To prevent deep discharge of the battery, the device integrates a battery undervoltage lockout feature that disengages the BAT to SYS path when voltage at the battery drops below the BUVLO voltage.

#### 8.3.7.3 Battery Overcurrent Protection

In order to protect the device from overcurrent and prevent excessive battery discharge current, the device detects if the current on the battery FET exceeds IBAT\_OCP. If the BATOCP limit is reached, the battery discharge FET is turned off and the device starts operating in hiccup mode, re-enabling the BATFET  $t_{REC\_SC}$  (250 ms) after being turned OFF by the over current condition. If the overcurrent condition is triggered upon retry for 4 to 7 consecutive times in a 2-s window, the BATFET shall then remain off until valid VIN is connected ( $V_{IN} = V_{IN\_POWERGOOD}$ ). If the overcurrent condition and hiccup operation occurs while in supplement mode where VIN is already present, VIN must be toggled in order for BATFET to be enabled and start another detection cycle.

#### 8.3.7.4 System Overvoltage Protection

The system overvoltage protection is to prevent the SYS from overshooting to a high voltage due to the input supply. The SYS\_OVP will momentarily disconnect the blocking FETs and re-engage when the thresholds have dropped to less than SYS\_OVP\_FALLING threshold.



SYS\_OVP\_RISING threshold is 104 to 106% of target SYS voltage and SYS\_OVP\_FALLING threshold is 101.5 to 103.5% of the target SYS voltage.

### 8.3.7.5 System Short Protection

System short protection kicks in when the following conditions are met - the adapter connected the device turns ON the input FET for 5 ms and it detects the SYS pin to be shorted (voltage on SYS  $< V_{SYS\_SHORT}$ ). In this scenario, the device will turn OFF the input FET for 200  $\mu$ s and turn it back ON for 5 ms for SYS to rise above the  $V_{SYSSHORT}$  threshold. If after 10 tries, the voltage at SYS does not rise above the  $V_{SYSSHORT}$  threshold, the device will disable both the input and BATFET paths and wait on adapter insertion before turning the paths ON again. A 2s timer is implemented to refresh the retry counter. After 2s, the device will check for system short again repeating the 10 attempts if there is a system short.

### 8.3.7.6 Thermal Protection and Thermal Regulation

During operation, to protect the device from damage due to overheating, the junction temperature of the die,  $T_J$ , is monitored. When  $T_J$  reaches  $T_{SHUT\_RISING}$  the device stops charging operation and VSYS is shutdown. If in the case where  $T_J > T_{SHUT\_RISING}$  prior to power being applied to the device (either battery or adapter), the input FET or BATFET will not turn ON, regardless of TSMR pin. Thereafter if temperature falls below  $T_{SHUT\_FALLING}$  the device will automatically power up if VIN is present or if in Battery Only mode.

During the charging process, to prevent overheating in the device, the device monitors the junction temperature of the die and reduces the charging current once  $T_J$  reaches the thermal regulation threshold ( $T_{REG}$ ). If the charge current is reduced to 0, the battery supplies the current needed to supply the SYS output.

To ensure that the system power dissipation is under the limit of the device. The power dissipated by the device can be calculated using the following equation:

$P_{DISS} = P_{SYS} + P_{BAT}$  Where:

$$P_{SYS} = (V_{IN} - V_{SYS}) * I_{IN}$$

$$P_{BAT} = (V_{SYS} - V_{BAT}) * I_{BAT}$$

The die junction temperature,  $T_J$ , can be estimated based on the expected board performance using the following equation:

$$T_J = T_A + \theta_{JA} * P_{DISS}$$

The  $\theta_{JA}$  is largely driven by the board layout, board layers, copper thickness and the layout. For more information about traditional and new thermal metrics, see the [IC Package Thermal Metrics Application Report](#). Under typical conditions, the time spent in this state is very short.

### 8.3.7.7 Safety Timer

At the beginning of each charge cycle mode (Precharge or Fast Charge), the device starts the respective mode safety timer. If charging has not terminated before the programmed safety time,  $t_{MAXCHG}$  expires or the device does not exit the precharge mode before  $t_{PRECHG}$  expires, charging is disabled. The precharge safety timer,  $t_{PRECHG}$ , is 25% of  $t_{MAXCHG}$ . When a safety timer fault occurs for the device, the STATx pins update to show a non-recoverable fault. The /CE pin or the input power must be toggled in order to clear the safety timer.

### 8.3.8 Pushbutton Wake and Reset Input

The pushbutton function implemented through TS/MR pin has two main functions. First, it serves as a means to wake the device from ultra-low power modes like Factory mode. Second, it serves as a mean to get device into Factory mode after detecting a long button press.

#### 8.3.8.1 Pushbutton Long Button Press Function - Factory mode

The device will perform factory mode entry when the pushbutton is pressed (TS/MR is held low) for a time  $t_{LPRESS}$  while a valid input is present, then removing VIN once the duration is met. Factory Mode is a low  $I_Q$  state

that turns off the SYS regulation to minimize battery consumption. Toggling the /CE pin will restart the timer for the long press button when VIN is present.

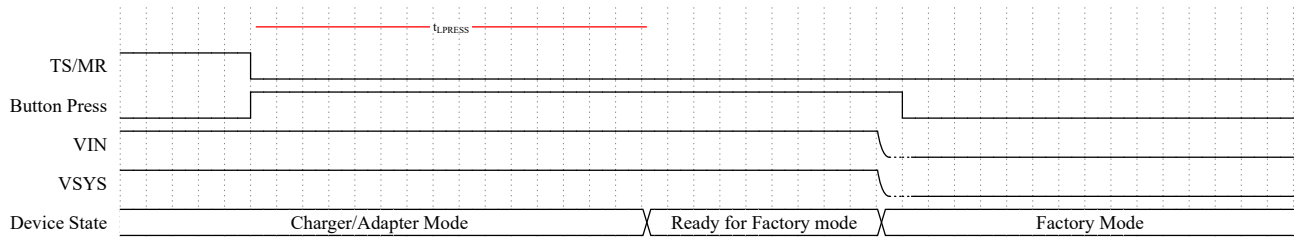


图 8-3. Enter Factory Mode

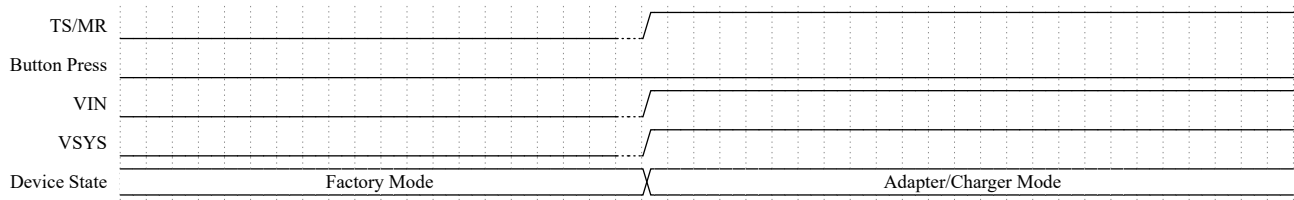


图 8-4. Exit Factory Mode - VIN Insertion

To wake up the device from factory mode, insert a valid VIN. The TS/MR push button cannot be used to wake from Factory Mode.

### 8.3.9 External NTC Monitoring (TS)

#### 8.3.9.1 TS Biasing and Function

The device is configured to a simpler HOT/COLD function only. Two temperature thresholds are monitored: the cold battery threshold, and the hot battery threshold. These temperatures correspond to the  $V_{COLD}$  and  $V_{HOT}$  thresholds in the Electrical Characteristics table. Charging and safety timers are suspended when  $V_{TS} < V_{HOT}$  or  $V_{TS} > V_{COLD}$ .

For devices where the TS function is not needed, tie a 10-k $\Omega$  resistor to the TS/MR pin.

There is an active voltage clamp present on this device which will prevent the voltage on TS/MR pin from rising above the  $V_{TS\_CLAMP}$  threshold. This will particularly be ON when the TS/MR pin is floating.

When the button is detected as a “press” during the charging process, charging will be momentarily suspended till the button is high again. When charging is disabled in any of the TS faults, the trickle charging is also disabled.

#### 8.3.10 Status Pins

The device has two open drain configuration status pins (STAT1 and STAT2) which can be externally pulled up and either be connected to an LED or an IO pin of an MCU to be able to inform the host or the user on the charger status.

When there is no battery present, the device will charge the capacitor on the BAT pin and toggle between charging done, charge completed. So STAT1 pin will be stable where as STAT2 pin will toggle between HIGH and LOW.

表 8-2. Status Pins State Table

CHARGING STATE	STAT1 PIN STATE	STAT2 PIN STATE
Charge completed, charger in sleep mode or charge disabled (including $V_{BAT} > V_{RCH}$ )	HIGH	HIGH

**表 8-2. Status Pins State Table (续)**

CHARGING STATE	STAT1 PIN STATE	STAT2 PIN STATE
Normal Charge in progress (including automatic recharge)	HIGH	LOW
Recoverable fault (VIN_OVP, TS HOT, TS COLD, TSHUT, System Short protection)	LOW	HIGH
Non-recoverable or latch-off fault (ILIM/ISET pin short, BATOCP, Safety TMR_EXP for charging)	LOW	LOW

## 8.4 Device Functional Modes

The BQ25185 has three main modes of operation: Charger/Adapter Mode (when a supply is connected to IN), Battery Mode (when only battery is connected), and Factory Mode (when battery only but VSYS is turned off). The table below summarizes the functions that are active for each operation mode.

FUNCTION	CHARGER/ADAPTER MODE	BATTERY MODE	FACTORY MODE
Input Overvoltage	Yes	Yes	No
Input Undervoltage	Yes	Yes	Yes
Battery Overcurrent	Yes	Yes	Yes
Input DPM	Yes	No	Yes
Dynamic Power Path Management	Yes	No	No
BATFET	Yes	Yes	No
TS Measurement	Yes	No	No
Battery Charging	Yes	No	No
Input Current Limit	Yes (Selected by $R_{ILIM/VSET}$ )	No	No
Pushbutton Input	Yes	No	No
Status Pin	Yes	Yes	No

## 9 Application and Implementation

### 备注

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

### 9.1 Application Information

A typical application of the BQ25185 consists of the device configured as a standalone single cell Li-ion battery charger and power path manager or battery applications such as smart-watches and wireless headsets. A battery thermistor may be connected to the TS pin to allow the device to monitor the battery temperature and control charging as desired.

The system designer may connect the TS/MR pin input to a push-button to send interrupts to the host as a button is pressed or to allow the application end user to reset the system.

### 9.2 Typical Application

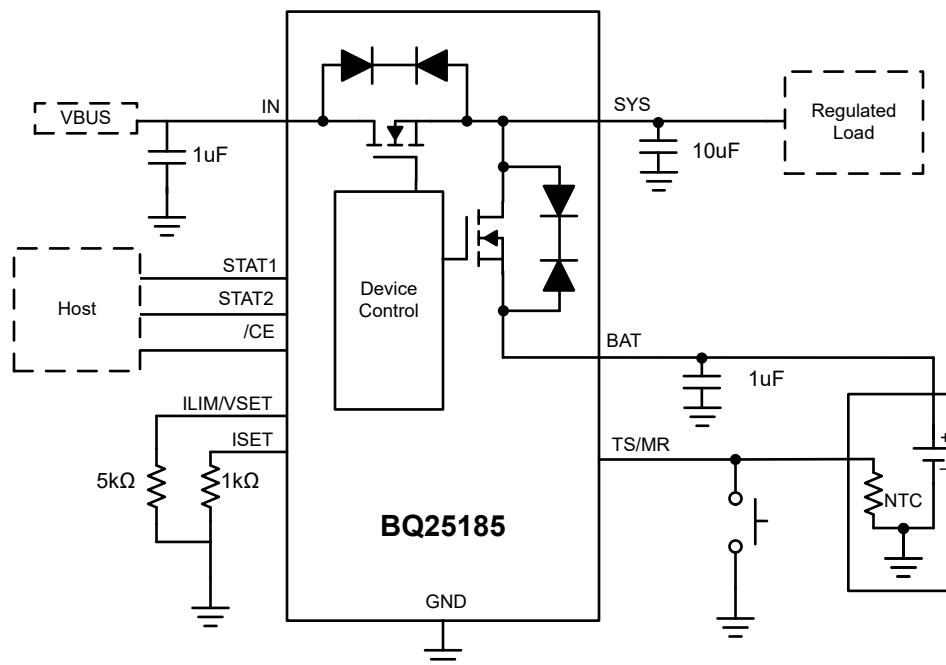


图 9-1. Typical Application

#### 9.2.1 Design Requirements

The design requirements for the following design example are shown in 表 9-1.

表 9-1. Design Parameters

PARAMETER	VALUE
IN Supply Voltage	5 V
Battery Regulation Voltage	4.2 V
Fast Charge Current	300 mA
Input Current Limit	500 mA

## 9.2.2 Detailed Design Procedure

### 9.2.2.1 Input Current and Battery Regulation Voltage - ILIM/VSET

To configure the device for 4.2 V  $V_{BATREG}$  and an input current limit of 500 mA, the  $R_{ILIM/VSET}$  resistor is set to 18 k $\Omega$ . The resistor value is found in the [ILIM Control](#) section.

### 9.2.2.2 Fast Charge Current- ISET

To configure the device for 300 mA of fast charge current, the  $R_{ISET}$  resistor is set to 1 k $\Omega$ . The resistor value is calculated based on the equations found in [ISET Pin Detection](#).

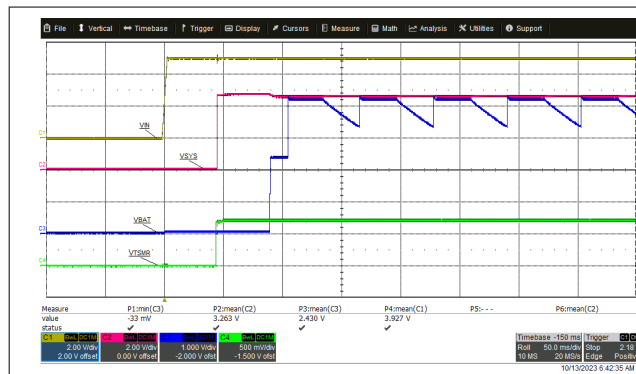
### 9.2.2.3 Recommended Passive Components

Low ESR ceramic capacitors such as X7R or X5R are preferred for input decoupling capacitors and should be placed as close as possible to the supply and ground pins for the IC. Due to the voltage derating of the capacitors, it is recommended that 25-V rated capacitors are used for the IN and SYS pins which can normally operate at 5 V. After derating the minimum capacitance must be higher than 1  $\mu$ F.

		MIN	NOM	MAX	UNIT
$C_{SYS}$	Capacitance on SYS pin	1	10	100	$\mu$ F
$C_{BAT}$	Capacitance on BAT pin	1	1	-	$\mu$ F
$C_{IN}$	Capacitance on IN pin ( $t_{VIN\_PRESENT} > 25$ ms)	1			$\mu$ F

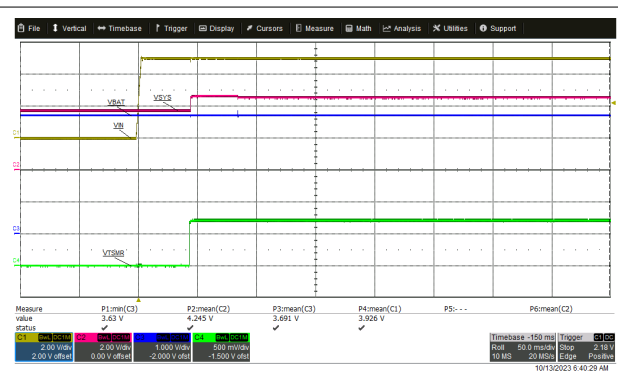
## 9.2.3 Application Curves

$C_{IN} = 1 \mu$ F,  $C_{OUT} = 10 \mu$ F,  $V_{IN} = 5$  V,  $V_{OUT} = 3.7$  V,  $I_{CHG} = 100$  mA (unless otherwise specified)



$V_{IN} = 5$  V  $V_{BAT} = \text{Floating}$

**图 9-2. Power Up with IN Supply Insertion with No Battery**



$V_{IN} = 5$  V  $V_{BAT} = 3.7$  V

**图 9-3. Power Up with IN Supply Insertion with Battery**

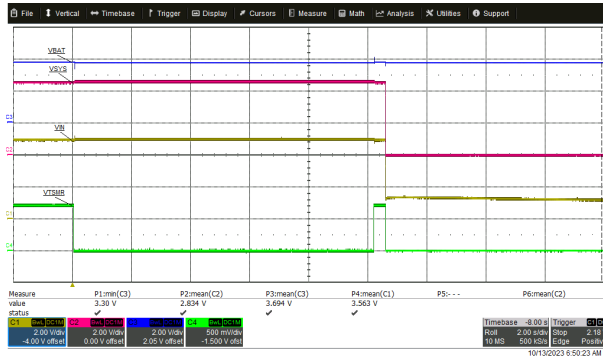


图 9-4. Enter Factory Mode

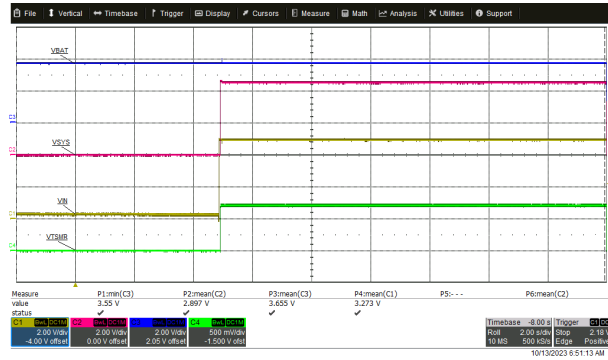


图 9-5. Wake up from Factory Mode with Adapter Insertion

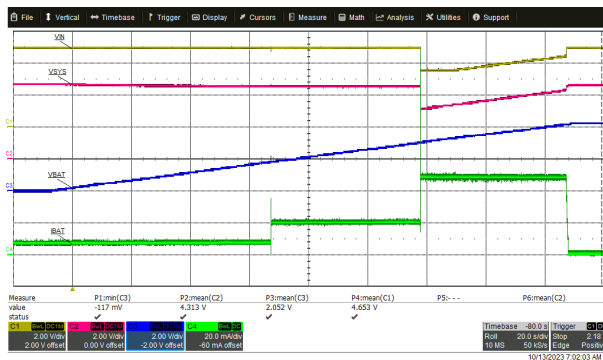


图 9-6. Battery Tracking VINDPM

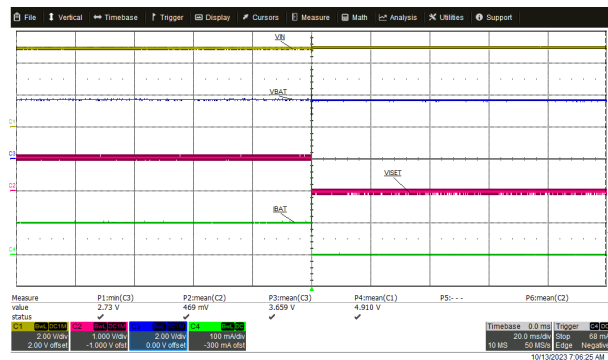


图 9-7. ISET Short Protection

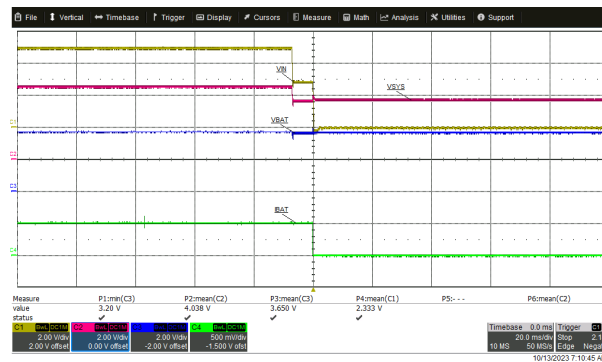


图 9-8. VIN Power Down with VBAT Present

### 9.3 Power Supply Recommendations

The BQ25185 requires the adapter or IN supply to be between 3.3 V and 18 V. The battery voltage must be higher than 3.15 V or  $V_{BATUVLO}$  to ensure proper operation.

## 9.4 Layout

### 9.4.1 Layout Guidelines

- To obtain optimal performance, the decoupling capacitor from IN to GND, the capacitor from SYS to GND, and the BAT to GND capacitor should be placed as close as possible to the device.
- A solid ground plane should be used that is tied to the GND pin and thermal pad
- The pushbutton GND should be connected as close to the device as possible
- The high current charge paths into IN, SYS, and BAT must be sized appropriately for the maximum charge current in order to avoid voltage drops in these traces

### 9.4.2 Layout Example

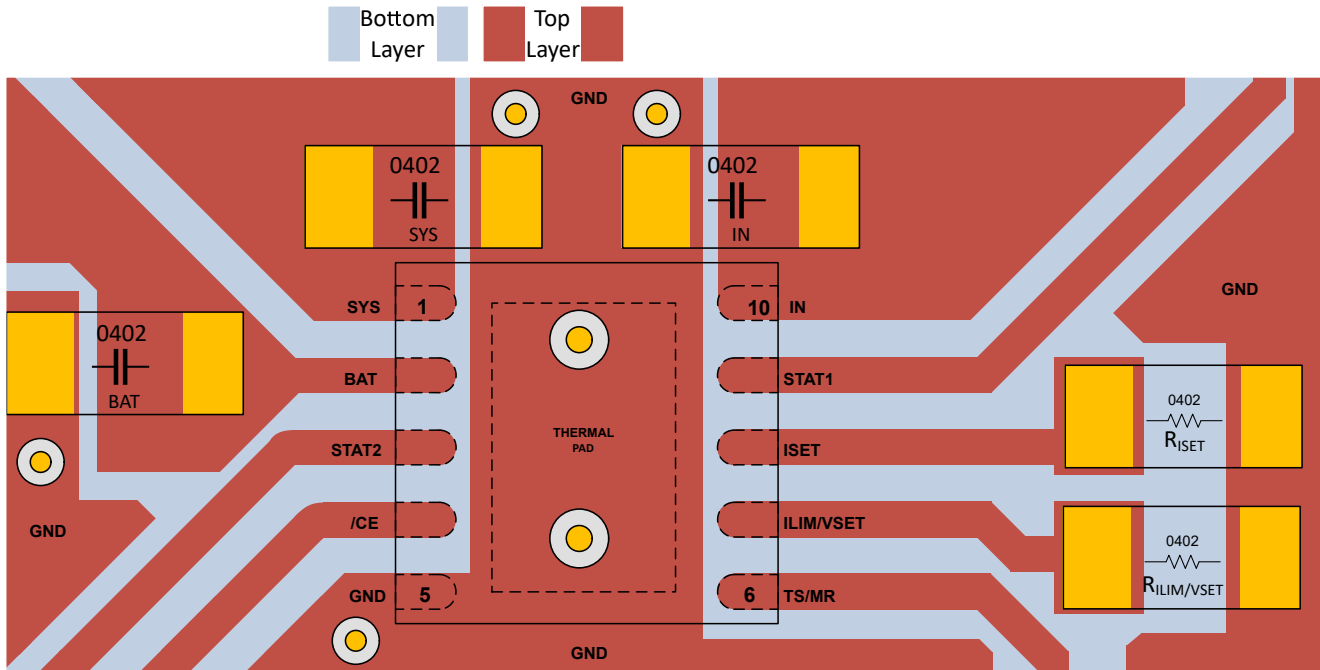


图 9-9. Board Layout Example

## 10 Device and Documentation Support

### 10.1 Device Support

#### 10.1.1 第三方产品免责声明

TI 发布的与第三方产品或服务有关的信息，不能构成与此类产品或服务或保修的适用性有关的认可，不能构成此类产品或服务单独或与任何 TI 产品或服务一起的表示或认可。

#### 10.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://ti.com) 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

#### 10.3 支持资源

TI E2E™ [中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的[使用条款](#)。

#### 10.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

#### 10.5 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

#### 10.6 术语表

##### TI 术语表

本术语表列出并解释了术语、首字母缩略词和定义。



## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
BQ25185DLHR	Active	Production	WSO (DLH)   10	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	B185

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

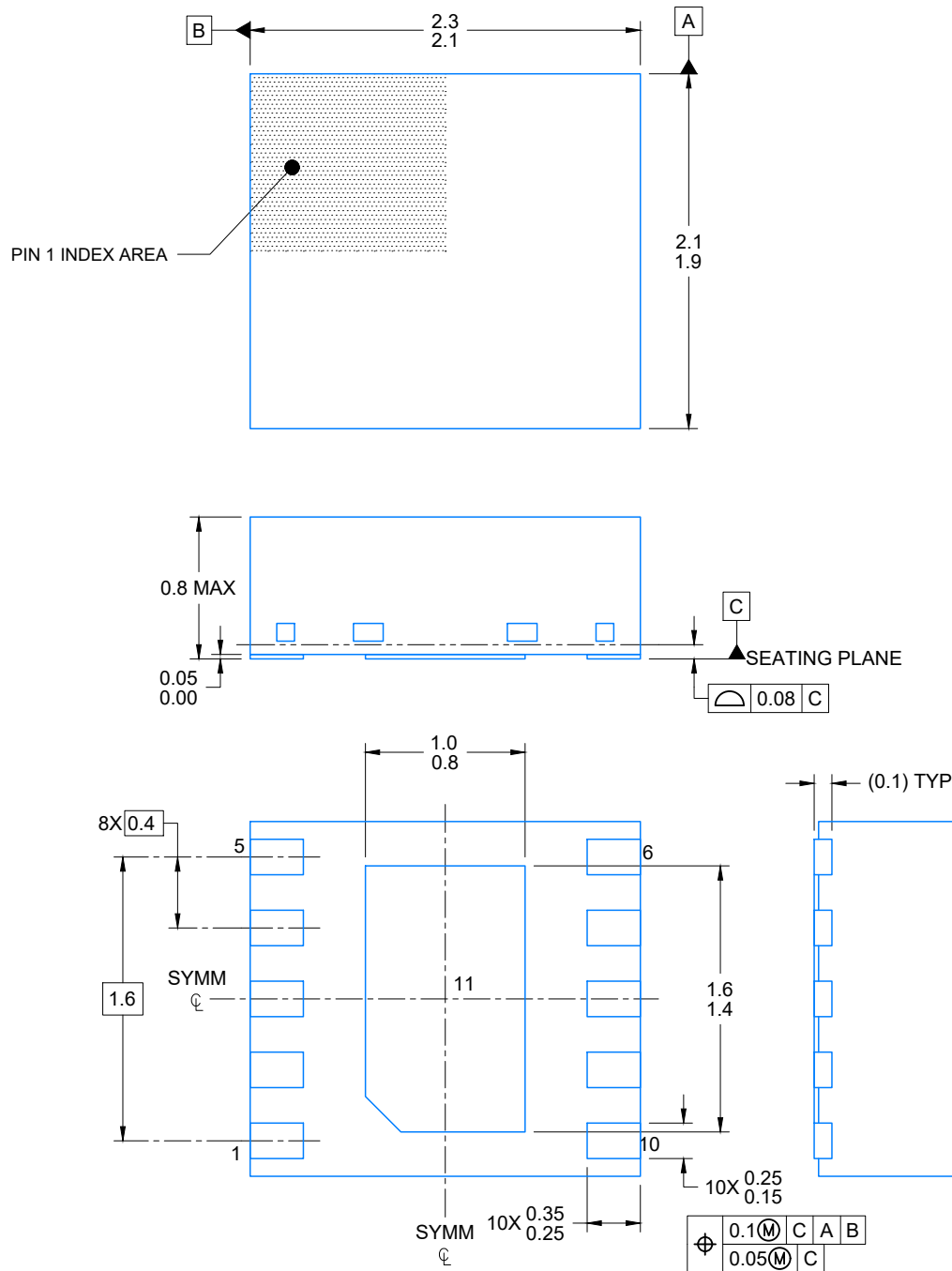
<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

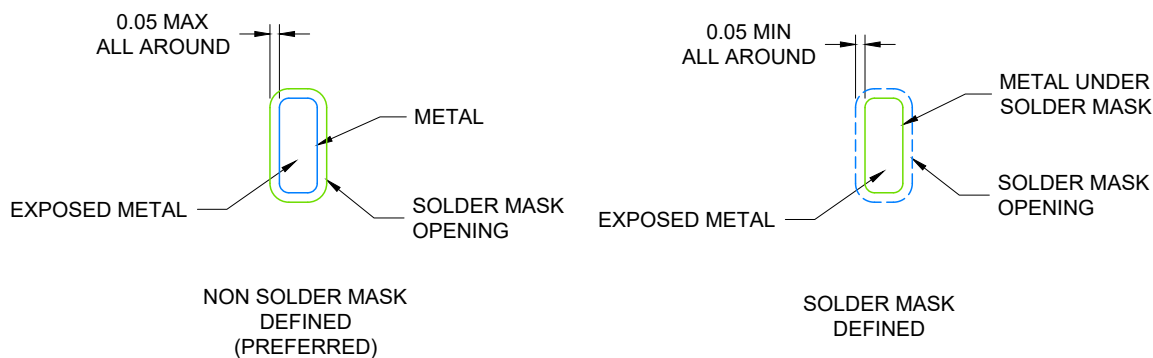
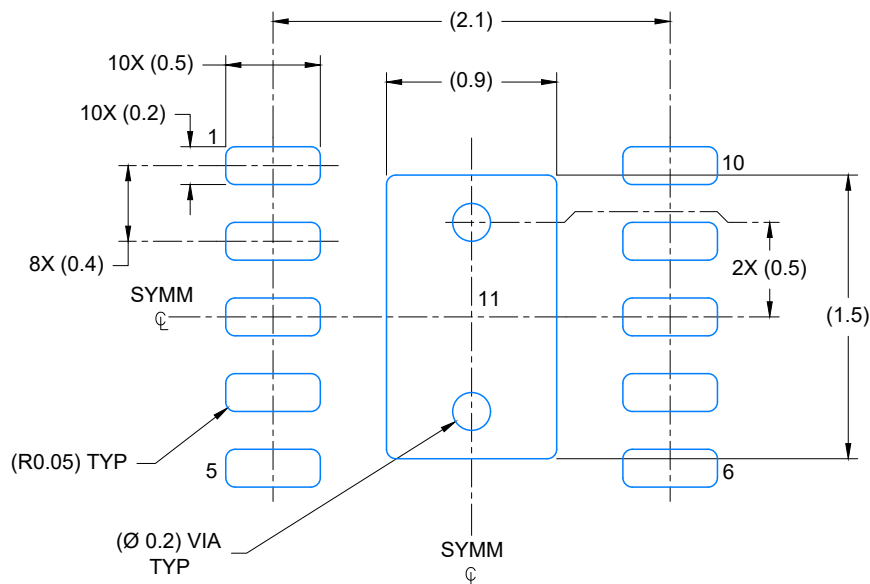
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.



4226298/A 10/2020

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.



4226298/A 10/2020

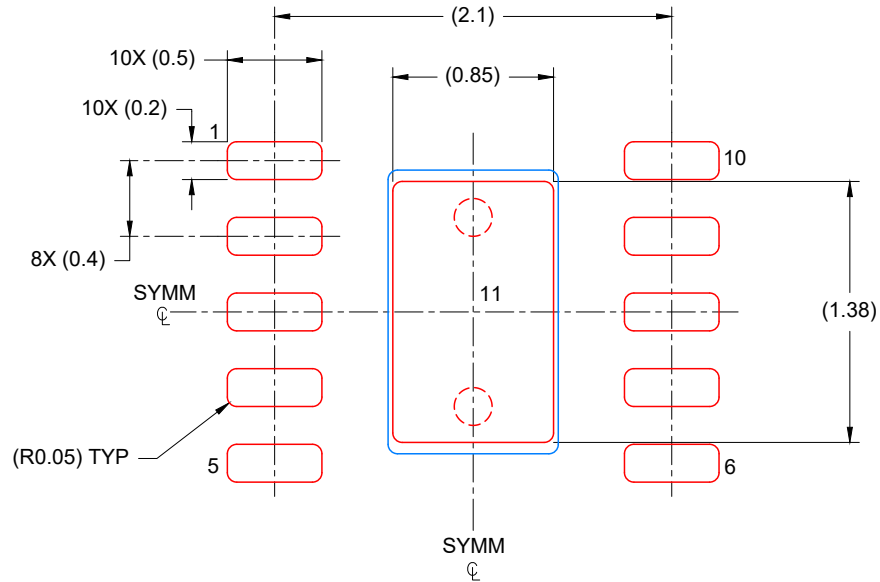
## NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

**DLH0010A**

**WSN - 0.8 mm max height**

PLASTIC QUAD FLATPACK- NO LEAD



## SOLDER PASTE EXAMPLE BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD  
88% PRINTED COVERAGE BY AREA  
SCALE: 25X

4226298/A 10/2020

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

## 重要通知和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做任何明示或暗示的担保，包括但不限于对适销性、某特定用途方面的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他功能安全、信息安全、监管或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的相关应用。严禁以其他方式对这些资源进行复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。您应全额赔偿因在这些资源的使用中对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，TI 对此概不负责。

TI 提供的产品受 [TI 的销售条款](#) 或 [ti.com](#) 上其他适用条款/TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

邮寄地址：Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
版权所有 © 2025，德州仪器 (TI) 公司