ACT85611 Datasheet Brief

Please refer to the ACT85611 Product Page for more information. Click here for a link to request the full datasheet.

BENEFITS and FEATURES

- **HIGH PERFORMANCE POWER LOSS PROTECTION**
  - Wide 2.7 to 14V Operating Input Range
  - 20V Max Input Withstanding Voltage
  - Programmable 5.5V to 31V Boost Storage Voltage
  - 8A Synchronous Buck With 100% Duty Cycle Mode
  - Inrush Current Control
  - Programmable 10A Input Current Limit
  - Adjustable Start-Up Slew Rate
  - Configurable Power Failure Levels
  - Programmable up to 2.25MHz Buck Operating Frequency for Small Inductor Size
  - Undetectable Transition from Input Supply to Capacitor Bank Power
  - Compatible with Many Types of Storage Caps: Super Caps, Electrolytic, Tantalum, POSCAP, etc.
  - Storage Capacitor Health Monitoring
  - Early Storage Capacitor Failure Detection
  - Storage Capacitance Measurement
  - eFuse, Boost, and Buck UV/OV/OC Protection

- **High Efficiency PMIC with Integrated FETs**
  - 4 High Voltage DC-DC Buck Converters
  - Integrated Synchronous Power Stage
  - Up to 96% Efficiency
  - Optimized Single Stage Conversion from Vin = 12V to Vout = 0.6V
  - Excellent Dynamic Response
  - Proprietary COT Control Algorithm
  - Small Inductor Sizes
  - Fast Transient Response
  - 1 High Voltage Nonsynchronous Boost Regulator
  - 1 LDO with Programmable Output Voltage
  - 400 kHz – 1.9MHz Configurable Frequency Range
  - Near Constant Frequency
  - Sensorless Over Current Protection (OCP)
  - Output UV and OV Detection
  - Optimized for Ceramic Output Capacitors

- **SYSTEM CONTROL AND INTERFACE**
  - Dedicated Power Loss Indicator Pin (PLI)
  - 6 Programmable General Purpose I/Os
  - I2C Serial Interface with Password Protection
  - ADC Monitoring of Critical Signals
  - Independent On & Off Sequencing Control
  - Reset/Power Good Output
  - Configurable Rails On/Off though I2C/GPIO
  - Input Power, UV, and OV Monitoring
  - Configurable Interrupts to Inform Host of Faults/Status Change
  - Thermal Alert and Protection

- **SYSTEM MANAGEMENT**
  - Versatile GPIO Functions
  - Watchdog Supervision
  - Interrupt Function Available
  - I^2C Safety bits to Enhance Immunity against Spurious I^2C Transactions.
  - Thermal Enhanced FCQFN Package

APPLICATIONS

- Solid State Drives
- Industrial Applications
- Backup Power
- Hot Plug Devices

GENERAL DESCRIPTION

The ACT85611 is a highly integrated, highly configurable multiple output power management IC (PMIC) with built-in power loss protection (PLP). There are four high efficiency Buck regulators that can supply 3 x 4A and 1 x 2A output current. The output voltage can go as low as 0.6V. In addition, there is a 12V boost converter plus a Buck converter to provide the IC's bias power and to power the internal gate drivers for maximum efficiency.

The power loss protection (PLP) provides backup storage power in the event of an input power failure. A built-in Boost converter provides high voltage energy storage to minimize storage capacitor size requirements. The built-in Buck converter regulates the storage voltage to a fixed output voltage during Supplement mode. The ACT85611 contains internal, back-to-back eFuse FETs to provide bi-directional input to output isolation. The IC also provides hot swap and inrush current control.

The ACT85611 features a programmable storage capacitor voltage to optimize the storage capacitor sizing and system run time. The internal ADC and health monitoring provide an extra layer of protection and improve system reliability and early capacitor failure notification. It checks the storage capacitor health and notifies the user when the energy in the storage caps is not sufficient for backup power. The built-in ADC also measures the input voltage, output voltage, storage voltage, eFuse current, and die temperature. The built-in synchronous Buck converter maximizes energy transfer from the storage caps to the system.

The high voltage step-down regulators use a proprietary control architecture that is based on a constant on-time (COT) topology. It is designed for high efficiency, has programmable switching frequency options, is suitable for high conversion ratios to support output voltages as low as 0.6V, and can operate at very low duty cycles as required in low output voltage applications.

The proprietary control architecture allows the regulators to work at near constant frequency at a given operating point, which is determined by the input and output voltage. As load is varied, the regulator operates at a near constant frequency while operating in continuous conduction mode. The frequency is selectable to accommodate a variety of inductor values and sizes. When load current is reduced, frequency is automatically scaled back to maintain high efficiency in discontinuous mode (DCM) operation. This functionality enables the converter to achieve high efficiencies even at very light loads.

The buck converter output inductors can be optimized for different applications. Proper inductor selection can optimize transient response or efficiency targets. Based on these criteria, a suitable switching frequency can also be selected to optimize these parameters. Careful analysis of operating points - input and output voltage ratio and load profiles, such as typical operating currents where efficiency is most important, peak switching currents, inductor current ripple and the desired dynamic response should all be considered while selecting inductors and switching frequency. All switching converters are internally compensated for stable operation using Qorvo proprietary circuitry. This allows the PMIC to work across a wide range of inductor values and switching frequencies while allowing the end user to balance requirements such as efficiency, dynamic load transient response, inductor form factors and current ratings, peak inductor current ripple and output voltage ripple.

The ACT85611 also contains a Boost regulator. It operates from a wide input voltage range of 2.5V to 13.2V and provides a programmable output voltage range of 10.8V to 13.2V.

The fixed output Buck regulator, Buck VCC, provides the ACT85611 bias power to the IC's internal circuitry and gate drivers. Bias power is applied to the VCC pin. The regulator provides up to 100mA of output current which can be used to power external circuitry or LDOs. When the system level input voltage, VBUS, is 3.3V or 5V, Buck VCC is not needed and the VCC pin can be directly tied to VBUS.

The ACT86510's integrated LDO can support 300mA output current to power external circuitry.

ACT85611 provides an I^2C bus interface to allow MCU control and monitoring. Its integrated voltage supervi-

sors monitor the input voltage, output voltage, and storage voltage. It contains six configurable GPIOs that can be programmed to implement a variety of system functions. They can be programmed to generate interrupt as an interrupt request pin (nIRQ pin), to control and sequence external regulators, to enable or disable internal regulators, as input lines to control entry or exit from low power state, and other such system related functions. GPIOs can also be used to perform dynamic voltage scaling or DVS for the buck regulators or control the external DC-DC regulator voltages. This function allows the user to scale the regulators' outputs between different output voltages to optimize system level power consumption during low power modes.

The ACT85611 includes an I²C a safety feature to eliminate accidentally changing register values. The I²C block requires a register passcode before I²C transactions are accepted to change register values.

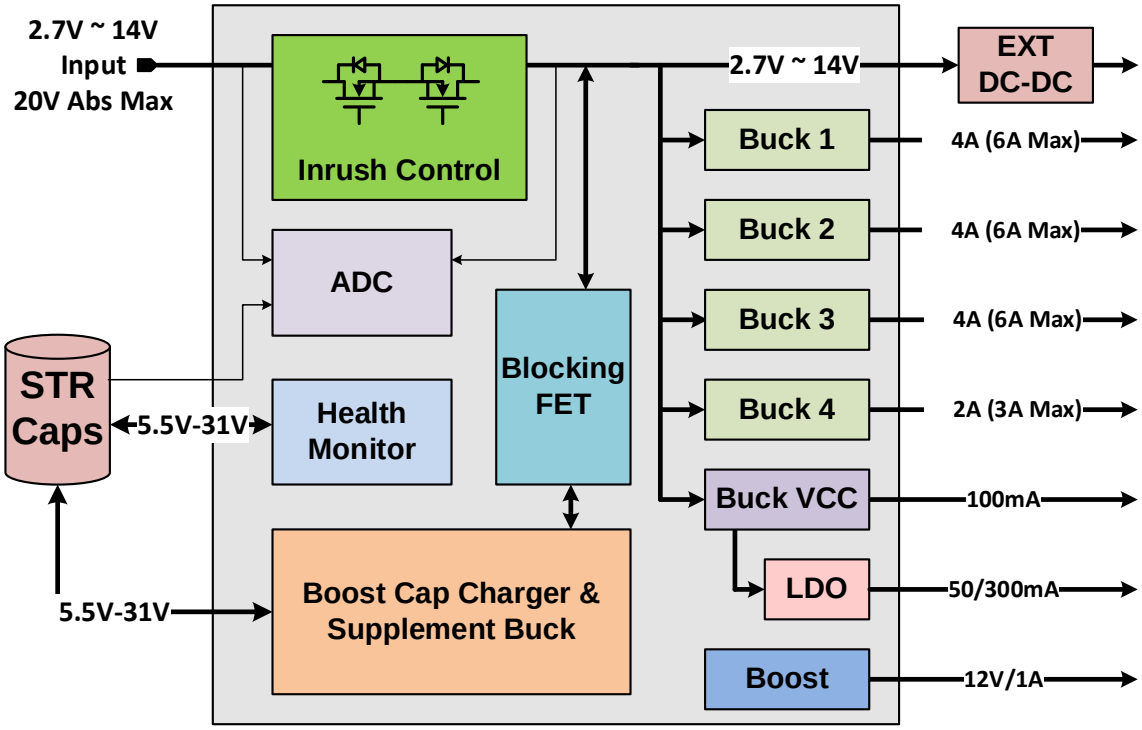
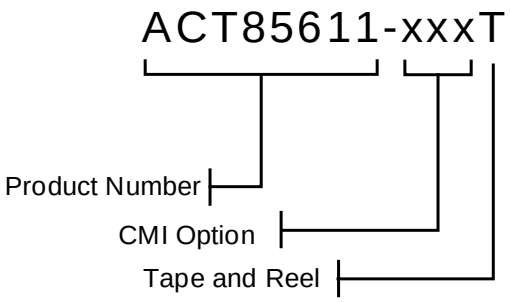


Figure 1: ACT85611 Blocks

ORDERING INFORMATION

PART NUMBER	V_{IN}	V_{STR}	$V_{Sup-plement}$	V_{OUT1}	V_{OUT2}	V_{OUT3}	V_{OUT4}	V_{Vcc}	LDO
ACT85611-101T	12V	28V	4.3V	0.8V	1.2V	2.5V	1.8V	5.0V	2.5V
ACT85611-108T	12V	28V	7.5V	3.3V	3.3V	1.2V	0.8V	5.0V	3.3V
ACT85611-110T	12V	28V	5V	0.84V	1.2V	2.5V	1.8V	5.0V	3.3V



Note 1: Standard product options are identified in this table. Contact factory for custom options, minimum order quantity required.

Note 2: “xxx” represents the CMI (Code Matrix Index) option The CMI identifies the IC’s default register settings.

PIN CONFIGURATION

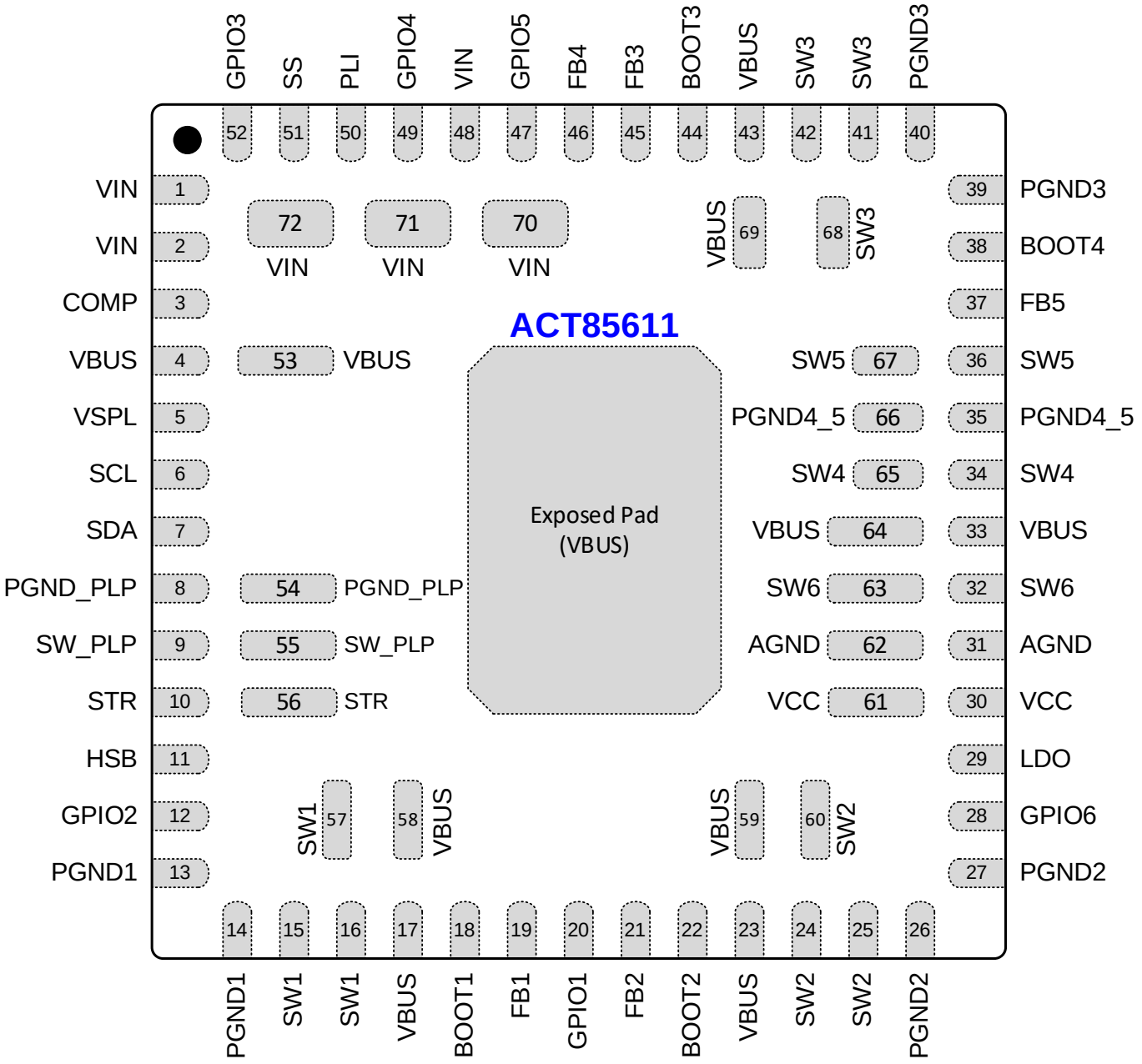


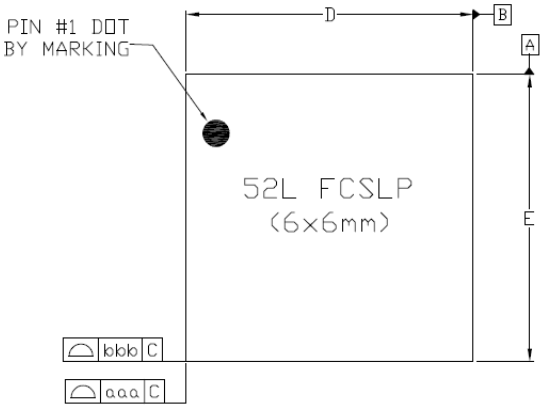
Figure 3: Pin Configuration – Top View – QFN6x6-52

PIN DESCRIPTIONS

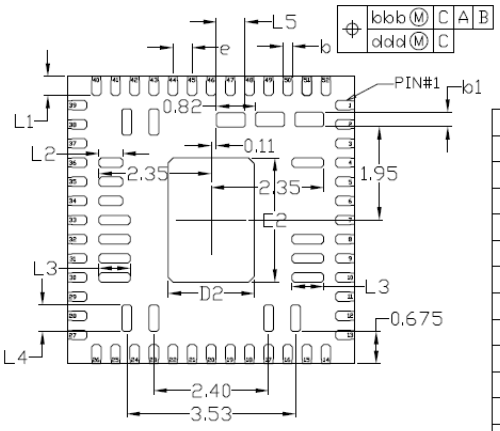
PIN	NAME	DESCRIPTION
1, 2, 48, 70, 71, 72	VIN	Power Supply Input. Input to the eFuse. Connect a 0.1µF capacitor between VIN and PGND as close to the IC as possible.
3	COMP	Compensation input pin for the supplement Buck converter.
4, 17, 23, 33, 43, 53, 58, 59, 64, 69	VBUS	Output for bypass mode, in-rush, and eFuse functionality. VBUS is also the input voltage bus for the downstream regulators.
5	VSPL	Supplement Buck circuit output and Boost circuit input pin. It is isolated from VBUS with the internal blocking FET. Place the inductor between VSPL and SW_PLP.
6	SCL	I^2C Clock Input. Needs an external pull up resistor.
7	SDA	I^2C Data Input and Output. Needs an external pull up resistor.
8, 54	PGND_PLP	PLP Power Ground. Connect to large ground plane on PCB
9, 55	SW_PLP	Power loss protection Buck switching node. This is the boost converter switch node and the buck converter switch node. Place the inductor between VSPL and SW_PLP.
10, 56	STR	Storage Capacitor Input. Connect the storage capacitors to STR. STR requires a minimum capacitor of 100µF to PGND.
11	HSB	High Side Bias, Boot strap pin. This provides power to the internal high-side MOSFET gate driver circuitry. Connect a 22nF-220nF capacitor from HSB pin to SW_PLP pin.
12	GPIO2	GPIO2 Pin
13, 14	PGND1	Buck1 Power Ground. Connect to large ground plane on PCB
15, 16, 57	SW1	Switch pin for HV Buck1 regulator
18	BOOT1	Boot strap voltage for HV Buck1 regulator. Connect a 22nF-220nF capacitor between BOOT1 and SW_B1.
19	FB1	Output and feedback pin for HV Buck1 regulator
20	GPIO1	GPIO1 Pin
21	FB2	Output and feedback pin for HV Buck2 regulator
22	BOOT2	Boot strap voltage for HV Buck2 regulator. Connect a 22nF-220nF capacitor between BOOT2 and SW_B2.
24, 25, 60	SW2	Switch pin for HV Buck2 regulator
26, 27	PGND2	Buck2 Power Ground. Connect to large ground plane on PCB
28	GPIO6	GPIO6 Pin
29	LDO	LDO output pin. Place 1uF or large ceramic between this pin and AGND.
30, 61	VCC	Output and feedback pin for VCC Buck regulator

31, 62	AGND	Analog Ground. Kelvin connect AGND to the PGND plane.
32, 63	SW6	Switch pin for VCC Buck regulator
34, 65	SW4	Switch pin for HV Buck4 regulator
35, 66	PGND4_5	Buck4 and Boost Power Ground. Connect to large ground plane on PCB
36, 67	SW5	Switch pin for Boost regulator
37	FB5	Output and feedback pin for Boost regulator
38	BOOT4	Boot strap voltage for HV Buck4 regulator. Connect a 22nF-220nF capacitor between BOOT4 and SW_B4.
39, 40	PGND3	Buck3 Power Ground. Connect to large ground plane on PCB
41, 42, 68	SW3	Switch pin for HV Buck3 regulator
44	BOOT3	Boot strap voltage for HV Buck3 regulator. Connect a 22nF-220nF capacitor between BOOT3 and SW_B3.
45	FB3	Output and feedback pin for HV Buck3 regulator
46	FB4	Output and feedback pin for HV Buck4 regulator
47	GPIO5	GPIO5 Pin
49	GPIO4	GPIO4 Pin
50	PLI	Power Loss Indicator Open-Drain Output for VIN. PLI goes high when the eFuse is turned on and goes low when the IC enters supplement mode. PLI is referenced to AGND.
51	SS	Soft Start Input. Place a capacitor from SS to VSS to control the eFuse start-up voltage slew rate.
52	GPIO3	GPIO3 Pin
Exposed Pad	VBUS	Tie to top layer VBUS plane. All VBUS pins should be directly connected to the exposed pad on the top layer.

QFN-52 PACKAGE OUTLINE AND DIMENSIONS

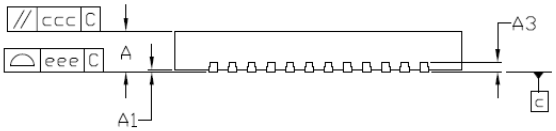


TOP VIEW



BOTTOM VIEW

Dimensional Ref.			
REF.	Min.	Nom.	Max.
A	0.800	0.850	0.900
A1	---	---	0.050
A3	0.203 Ref.		
D	5.950	6.000	6.050
E	5.950	6.000	6.050
D2	1.750	1.800	1.850
E2	2.550	2.600	2.650
b	0.150	0.200	0.250
b1	0.250	0.300	0.350
e	0.400 BSC		
L1	0.350	0.400	0.450
L2	0.450	0.500	0.550
L3	0.610	0.660	0.710
L4	0.500	0.550	0.600
L5	0.550	0.600	0.650
Tol. of Form&Position			
aaa	0.10		
bbb	0.10		
ccc	0.10		
ddd	0.05		
eee	0.08		



SIDE VIEW

Notes

1. All DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER JEDEC MO-220.

Product Compliance

This part complies with RoHS directive 2011/65/EU as amended by (EU) 2015/863.

This part also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- SVHC Free
- PFOS Free
- Antimony Free
- TBBP-A (C15H12Br402) Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com **Tel: 1-844-890-8163**

Email: customer.support@qorvo.com

For technical questions and application information:

Email: appsupport@qorvo.com

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