

PMBus® Command Set Comparison of DC/DC Buck Converters TPS544B28, TPS544E27, TPS546E25, and TPS546D24S



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Introduction

Power Management Bus (PMBus) provides a standardized digital interface for configuring, controlling, and monitoring power management devices. Through support for programmable operating parameters, telemetry reporting, and fault handling, PMBus enables greater system visibility and flexibility than traditional analog-only solutions. This application brief examines and compares the PMBus command sets of four buck converter devices. While the devices share a common PMBus foundation, they differ in command support, telemetry functionality, and advanced feature implementation. Understanding these differences can simplify system integration and aid in selecting the most appropriate device for specific applications.

Device Feature Overview

Table 1 summarizes the key parametric performance specifications across each device which will provide a baseline comparison of electrical, product size, and feature set specifications.

Table 1. Device Specifications Comparison

Parameter	TPS544B28	TPS544E27	TPS546E25	TPS546D24S
Input Voltage	2.7 - 16V	2.7 - 18V	2.7 - 18V	2.95 - 18V
Output Voltage	0.4 - 5.5V	0.25 - 5.5V	0.4 - 5.5V	0.25 - 5.5V
Output Current	20A	40A	50A	40A
Control Architecture	D-CAP4	D-CAP+	D-CAP4	Average current mode control
Feedback Accuracy (-40°C < TJ < 125°C)	+/- 1.25%	+/- 1%	+/- 0.85%	+/- 1%
Package	3mm x 3mm 19-pin QFN	5mm x 6mm 37-pin QFN	6mm x 5mm 37-pin QFN	7mm x 5mm x 1.5mm 40-pin QFN
Junction Temperature	-40°C - 150°C	-40°C - 125°C	-40°C - 125°C	-40°C - 150°C
Switching Frequency	500kHz - 1.4MHz	400kHz - 2MHz	400kHz - 2MHz	225kHz - 1.5MHz
MOSFET On-Resistance	8.4mΩ/3.3mΩ	2.6mΩ/1mΩ	2.6mΩ/1mΩ	4.5mΩ/0.9mΩ
External VCC Bias Support	3.1 - 4.3V	4.7 - 5.5V	4.7 - 5.3V	3.9 - 5.3V
Stackable?	No	No	Yes, 4x	Yes, 4x
M(Iout) telemetry accuracy (Full Load)	+/- 7.5% (10A - 20A)	+/- 6% (30A - 50A)	+/- 8% (30A - 50A)	+/- 4A (40A)
M(Vout) telemetry accuracy	+/- 2% (400mV - 5.5V)	+/- 1.4% (>= 1.2V) +/- 2% (< 750mV)	+/- 2% (500mV - 3.3V)	+/- 2% (250mV - 6V)
M(Tsns) telemetry accuracy	+/- 4°C	+/- 4°C	+/- 4°C	+/- 3°C

Table 1. Device Specifications Comparison (continued)

Parameter	TPS544B28	TPS544E27	TPS546E25	TPS546D24S
Alternate Versions	TPS544A28 (12A), TPS544628 (6A)	TPS544C27 (35A), TPS544B27 (20A)	TPS546C25 (35A), TPS546B25 (25A)	TPS546B24S (20A), TPS546A24S (10A)

Condensed PMBus Command Set Comparison

The four buck-converter families evaluated in this brief each target a different balance of footprint, efficiency, current capability, and digital-interface fullness, which is reflected in the extent of their PMBus command sets. Each device family includes variants with different current ratings or package sizes (for example, the TPS544B27 version of the E27 series), but these maintain identical PMBus command sets and are therefore not separately detailed in this comparison.

To simplify evaluation of digital interface complexity, PMBus commands are grouped into functional categories such as configuration, monitoring, fault management, and control. [Table 2](#) provides a high-level comparison of command group availability across devices. Support is indicated as + (basic), ++ (expanded), and +++ (most comprehensive) based on scope of commands implemented within each functional category. Security features are rated separately according to the standard PMBus security specification (Level 0–Level 2).

Table 2. PMBus Command Category Comparison

Command Category	TPS544B28	TPS544E27	TPS546E25	TPS546D24S
Vout Configuration	+	++	++	+++
Stackable Configuration	X	X	++	+++
Calibration	X	++	++	+++
Vout Faults/Warnings	+	+++	+++	+++
Iout Faults/Warnings	+	++	++	+++
Temperature Faults/Warnings	X	+++	+++	+++
Vin Faults/Warnings	X	++	++	+++
Simulate Faults	X	X	X	+++
Timing Configuration	+	++	++	+++
Power Warning	X	+++	X	X
Security Features	Level 0*	Level 2	Level 0	Level 0
Status Registers	+	+++	+++	+++
Telemetry	+	+++	+++	+++
Device/MFR Info	+	++	++	+++
VR13 and VR14.Cloud Registers	X	+++	X	X
Operation and Configurability	+	++	++	+++

Note

*Registers marked with an asterisk are manufacturer-specific implementations and may vary in behavior across devices. Refer to device datasheets for details.

Key Configuration Commands

Certain configuration commands play a particularly important role during system design and optimization. [Table 3](#) compares the PMBus programmability and resolution of key operating parameters across the four devices, including output voltage, switching frequency, and current limits.

Table 3. Key Parameters Comparison

Parameter	TPS544B28	TPS544E27	TPS546E25	TPS546D24S
VOUT_COMMAND	0.35V – 5.5V 0.976mV resolution	0.25V – 5.5V 1.953mV resolution	0.25V – 5.5V 1.953mV resolution	0.25V – 5.5V 1.95mV resolution
FREQUENCY_SWITCH	500kHz, 600kHz, 800kHz, 1000kHz, 1200kHz, 1400 kHz	500kHz, 600kHz, 800kHz, 1000kHz, 1200kHz, 1500kHz, 1800kHz, 2000kHz	400kHz, 600kHz, 800kHz, 1000kHz, 1200kHz, 1400kHz, 1800kHz, 2000kHz	225kHz, 275kHz, 325kHz, 375kHz, 450kHz, 550kHz, 650kHz, 750kHz, 900kHz, 1100kHz, 1300kHz, 1500kHz
IOUT_OC_FAULT_LIMIT	4A, 7A, 10A, 13A, 15A, 18A, 21A	10A, 12A, 15A, 18A, 20A, 25A, 30A, 31A, 37A, 40A, 43A, 50A	12.5A, 15A, 18.75A, 23.75A, 26.25A, 30A, 35A, 37.5A, 40A, 48.75A, 50A, 55A, 60A	8A to 62A in 2A steps

Device PMBus Capability Overviews

While the TPS544B28 device offers a smaller PMBus command set than the other devices evaluated in this brief, its streamlined feature set aligns well with many general-purpose power applications where board space, efficiency, and design simplicity are key considerations. As a 3mm x 3mm, 20A device, TPS544B28 is particularly well suited for low-current, high-density designs, providing essential digital power management capabilities without the complexity associated with more feature-rich solutions.

The most valuable PMBus features in practical applications are telemetry, fault reporting, and configurability. Integrated telemetry allows for monitoring of key operating parameters such as output voltage, output current, and device temperature without requiring additional external sensing components. Built-in fault reporting for conditions such as overcurrent and overtemperature events simplifies system diagnostics and can significantly reduce debugging time during development and field operation. In addition, support for internal compensation adjustment provides flexibility across a wider range of applications and BOM selections, allowing designers to optimize performance while accommodating components from multiple vendors. The ability to quickly configure parameters such as output voltage further simplifies system bring-up and design reuse. Together, these capabilities provide the functionality most customers require while maintaining a compact, efficient solution that supports a focus on increasing power density and overall system efficiency.

The TPS544E27 device expands on the capabilities of the lower current solution by supporting higher output current, a larger package, and enhanced PMBus functionality. A key differentiator is its support for PMBus 1.5 security features, making it well suited for applications that require secure communication and improved system integrity while maintaining a straightforward implementation.

In addition to output telemetry and fault reporting, the device provides telemetry for input voltage, input current, and input power and provides fault monitoring for input voltage. This expansion of telemetry and fault management PMBus commands enables greater visibility into overall power system performance, faster fault diagnosis, and more effective system management. The device also supports SVID communication which further expands its flexibility in processor-powered systems requiring dynamic voltage control. Another feature that is unique to the TPS544E27 device is its DC Load Line capability. DC Load Line compensation automatically adjusts output voltage based on load current, improving voltage stability under transient conditions. With its combination of higher current capability, enhanced telemetry, built-in PMBus security, and SVID communication capability, this device is a strong choice for applications requiring greater functionality without the complexity of a full-featured digital power solution.

The TPS546E25 device targets higher-power applications by pushing the current capability up to 50A and introducing stackable operation for up to four interleaved devices. This device provides a balanced solution for systems that require scalable power solutions while maintaining a familiar PMBus interface. It retains the telemetry, fault reporting, and configuration features customers rely on while adding greater configuration flexibility and enhanced protection features, including dedicated low-voltage overcurrent fault detection for improved short-circuit handling. These capabilities make it well suited for high-current, performance-oriented applications.

TPS546D24S is a 40A, current control mode device with stackable operation of up to four interleaved devices for scalable power delivery. It offers the most comprehensive PMBus implementation of the devices in this brief, providing the largest set of configuration, fault, and warning registers making it an ideal device for moderate-power systems requiring scalable power delivery and extensive fault management and diagnostics.

Comprehensive List of PMBus Commands/Capabilities for Each Device

[Table 4](#) lists a comprehensive comparison of supported PMBus commands for each device. This detailed view highlights differences in telemetry depth, configurability, and feature support.

Table 4. Complete Command Set Comparison

Command Category	PMBus Command	TPS544B28	TPS544E27	TPS546E25	TPS546D24S
Vout Configuration	VOUT_MODE	✓	✓	✓	✓ ^N
	VOUT_COMMAND	✓	✓	✓	✓ ^N
	VOUT_TRIM		✓ ^N	✓ ^N	✓ ^N
	VOUT_MAX		✓	✓ ^N	✓ ^N
	VOUT_MARGIN_HIGH	✓	✓ ^N	✓ ^N	✓ ^N
	VOUT_MARGIN_LOW	✓		✓ ^N	✓ ^N
	VOUT_TRANSITION_RATE	✓	✓ ^N	✓ ^N	✓ ^N
	VOUT_DROOP		✓		
	VOUT_SCALE_LOOP	✓	✓ ^N	✓ ^N	✓ ^N
	VOUT_SCALE_MONITOR			✓ ^N	
	VOUT_MIN			✓ ^N	✓ ^N
	VBOOT*	✓ ^N			
	VBOOT_OFFSET_1*		✓ ^N	✓ ^N	
	VBOOT_DCLL*		✓ ^N		
Stackable Configuration	INTERLEAVE				✓ ^N
	PHASE			✓	✓
	P2_PLUS_WRITE			✓	
	P2_PLUS_READ			✓	
	STACK_CONFIG			✓	
Calibration	IOUT_CAL_GAIN				✓ ^N
	IOUT_CAL_OFFSET			✓ ^N	✓ ^N
	IIN_CAL*		✓ ^N		
	IMON_CAL*		✓ ^N	✓ ^N	
	MFR_SPECIFIC_00 (TELEMETRY CONFIG)				✓ ^N
Vout Faults/Warnings	VOUT_OV_FAULT_LIMIT		✓ ^N	✓ ^N	✓ ^N
	VOUT_OV_FAULT_RESPONSE	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	VOUT_OV_WARN_LIMIT		✓ ^N	✓ ^N	✓ ^N
	VOUT_UV_WARN_LIMIT		✓ ^N	✓ ^N	✓ ^N
	VOUT_UV_FAULT_LIMIT		✓ ^N	✓ ^N	✓ ^N
	VOUT_UV_FAULT_RESPONSE	✓ ^N	✓ ^N	✓ ^N	✓ ^N
Iout Faults/Warnings	IOUT_OC_FAULT_LIMIT	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	IOUT_OC_FAULT_RESPONSE		✓		✓ ^N
	IOUT_OC_LV_FAULT_LIMIT			✓	
	IOUT_OC_LV_FAULT_RESPONSE			✓	
	IOUT_OC_WARN_LIMIT		✓ ^N	✓ ^N	✓ ^N

Table 4. Complete Command Set Comparison (continued)

Command Category	PMBus Command	TPS544B28	TPS544E27	TPS546E25	TPS546D24S
Temperature Faults/Warnings	OT_FAULT_LIMIT		✓ ^N	✓ ^N	✓ ^N
	OT_FAULT_RESPONSE		✓ ^N	✓ ^N	✓ ^N
	OT_WARN_LIMIT		✓ ^N	✓ ^N	✓ ^N
Vin Faults/Warnings	VIN_OV_FAULT_LIMIT		✓ ^N	✓ ^N	✓ ^N
	VIN_OV_FAULT_RESPONSE				✓ ^N
	VIN_UV_WARN_LIMIT				✓ ^N
	VIN_ON		✓ ^N	✓ ^N	✓ ^N
	VIN_OFF		✓ ^N	✓ ^N	✓ ^N
Simulate Faults	MFR_SPECIFIC_33 (SIMULATE FAULTS)				✓
Timing Configuration	TON_DELAY	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	TON_RISE	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	TON_MAX_FAULT_LIMIT				✓ ^N
	TON_MAX_FAULT_LIMIT				✓ ^N
	TOFF_DELAY	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	TOFF_FALL	✓	✓ ^N	✓ ^N	✓ ^N
Power Warning	PIN_OP_WARN_LIMIT		✓ ^N		
Security Features	WRITE_PROTECT	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	EXTENDED_WRITE_PROTECT*		✓ ^N	✓ ^N	✓ ^N
	PASSKEY	✓ ^{N*}	✓ ^N	✓ ^N	✓ ^N
	SECURITY_BYTE		✓ ^N		
	SECURITY_BLOCK		✓ ^N		
	SECURITY_AUTO_INCREMENT		✓ ^N		
Status Registers	CLEAR_FAULTS	✓	✓	✓	✓
	SMBALERT_MASK		✓ ^N	✓ ^N	✓ ^N
	STATUS_BYTE	✓	✓	✓	✓
	STATUS_WORD	✓	✓	✓	✓
	STATUS_VOUT		✓	✓	✓
	STATUS_IOUT		✓	✓	✓
	STATUS_INPUT		✓	✓	✓
	STATUS_TEMPERATURE		✓	✓	✓
	STATUS_CML	✓	✓	✓	✓
	STATUS_OTHER		✓	✓	✓
	STATUS_MFR_SPECIFIC	✓	✓	✓	✓
	STATUS_PULSE_CATCHER*		✓		
	MFR_SPECIFIC_12 (STATUS_PHASE)				✓
	STATUS_ALL*			✓	✓
Telemetry	READ_VIN		✓	✓	✓
	READ_IIN		✓		
	READ_VOUT	✓	✓	✓	✓
	READ_IOUT	✓	✓	✓	✓
	READ_TEMP1	✓	✓	✓	✓
	READ_PIN		✓		
	READ_TELEMETRY*			✓	✓

Table 4. Complete Command Set Comparison (continued)

Command Category	PMBus Command	TPS544B28	TPS544E27	TPS546E25	TPS546D24S
Device/MFR Info	CAPABILITY	✓	✓	✓	✓
	PMBUS_REVISION	✓	✓	✓	✓
	MFR_ID	✓	✓	✓	✓ ^N
	MFR_MODEL	✓	✓ ^N	✓ ^N	✓ ^N
	MFR_REVISION	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	MFR_SERIAL				✓ ^N
	IC_DEVICE_ID	✓	✓	✓	✓
	IC_DEVICE_REV	✓	✓	✓	✓
	DIE_ID*		✓ ^N		
	FUSION_ID0*	✓	✓	✓	✓
	FUSION_ID1*	✓	✓	✓	✓
VR13 and VR14.Cloud Registers	SVID_IMAX*		✓ ^N		
	SVID_EXT_CAPABILITY_VIDOMAX*		✓ ^N		
	SVID_ADDR_CFG_USER*		✓ ^N		
	SVID_STATUS_1_2*		✓		
	CAPABILITY_SVID*		✓		
	VID_SETTING*		✓		
	NVM_PATCH_SPACE*		✓ ^N		
	ADV_TEL_BYTE*		✓ ^N		
	VENDOR_ID*		✓		
	CLOUD_OPTIONS*		✓ ^N		
Operation and Configuration	OPERATION	✓	✓	✓	✓
	ON_OFF_CONFIG	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	STORE_USER_ALL	✓	✓	✓	✓
	RESTORE_USER_ALL	✓	✓	✓	✓
	SYS_CFG_USER1*	✓ ^N	✓ ^N	✓ ^N	
	PMBUS_ADDR*		✓ ^N	✓ ^N	✓ ^N
	PIN_DETECT_OVERRIDE*			✓ ^N	✓ ^N
	COMP*	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	NVM_CHECKSUM	✓		✓	✓
	FREQUENCY_SWITCH	✓ ^N	✓ ^N	✓ ^N	✓ ^N
	USER_DATA_05 (POWER_STAGE_CONFIG)				✓ ^N
	MFR_SPECIFIC_19 (PGOOD_CONFIG)				✓ ^N
	MFR_SPECIFIC_20 (SYNC_CONFIG)				✓ ^N
	MFR_SPECIFIC_28 (STACK_CONFIG)				✓ ^N
	MFR_SPECIFIC_29 (MISC_OPTIONS)				✓ ^N

Note

- *Registers marked with an asterisk are manufacturer-specific implementations and may vary in behavior across devices. Refer to device datasheets for details.
- ^N indicates NVM configurability.

Conclusion

Device selection should prioritize the target application's specific requirements. While the PMBus command sets share a common foundation, each device is optimized for a different balance of current capability, monitoring, configurability, security, and scalability. High-current, security-sensitive, or diagnostics-heavy systems warrant the expanded PMBus feature set of the TPS544E27 or TPS546D24S. Compact, cost-sensitive designs benefit from TPS544B28's streamlined approach. Understanding these capability differences enables designers to select the device that best meets their application needs while avoiding unnecessary complexity.

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