Application Note

3-A DC/DC Buck Converter Selection Guide of Mid-Range VIN

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ABSTRACT

Texas Instruments has broad products for power management designs. For middle-range input voltage (1.6 V - 30 V), 3 A output step-down DC/DC applications, TI provides many great hero products. To help users improve their decision and select a part designed for their applications, this application note introduces TI advanced features of buck converters, then compares TI latest parts specifications.

Table of Contents

List of Tables

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1 Introduction

Middle-range input voltage (1.6 V - 30 V) power rails are common in industrial, automotive communication, personal electronics and enterprise markets. The step-down design to convert the middle-range input voltage into a lower output voltage like 5 Vout/3.3 Vout/1.8 Vout are widely used in electrical applications.

In this article, latest TI mid-Vin 3 A buck parts are compared. Each part has its advantages and can be an excellent choice than other parts in a special application. When users select a mid-Vin 3 A buck, this article provides the guidance to help them make a decision.

2 Features Description

This section describes some advanced features of TI buck converters.

2.1 Light Load Operation

Three operation modes of light load are mentioned in this application note.

Power Save Mode (PSM) can decrease the device switching frequency to improve efficiency at light load.

Out-of-Audio (OOA) mode is a unique control feature that keeps the switching frequency above audible frequency (20 Hz-20 KHz) with minimum reduction in efficiency, which prevents audio noise generation from the output capacitors and inductor. The *Understanding OOA™ Operation* application note describes the OOA details.

Forced Continuous Conduction Mode (FCCM) allows the inductor current to become negative in light load, the switching frequency is maintained, achieve small ripple at light load.

Table 2-1 lists the comparison between PSM, OOA, and FCCM mode.

Table 2-1. Comparison Between PSM, OOA, and FCCM Mode

Light Load Mode	PSM	OOA	FCCM
fsw	Low	Middle	High
Vout Ripple	Large	Middle	Small
Light Load Efficiency	High	Middle	Low
Suitable Applications	Require high light-load efficiency	Require high efficiency without audible noise in light load	Require almost fixed fsw and small Vout ripple across whole loading range

2.2 Low Iq

For some applications using batteries for input, to achieve longer battery life, they often require a very low quiescent current (Iq) and high efficiency at both full and light loads. Because most of the device lifetime is spent in low-power states, quiescent currents, subsystem shutdown currents, and high efficiency are very important, as these standby currents can have significant impacts on overall battery life.

TPS62xxx series converters are mainly low Iq devices with less than 30 uA quiescent current and high light-load efficiency. They are mostly using DCS-control™ mode.

2.3 Low Noise

The TPS62912 and TPS62913 devices are a family of high-efficiency, low-noise and low-ripple synchronous buck converters. The devices are designed for noise sensitive applications that can normally use an LDO for post regulation such as AFEs, high-speed ADCs, Clock and Jitter Cleaner, Serializer, De-serializer, and Radar applications. The device operates at a fixed switching frequency of 2.2 MHz or 1 MHz, and can be synchronized to an external clock. To further reduce the output voltage ripple, the device integrates loop compensation to operate with an optional second-stage ferrite bead L-C filter. This allows an output voltage ripple below 10 µVRMS. Low-frequency noise levels, similar to a low-noise LDO, are achieved by filtering the internal voltage reference with a capacitor connected to the NR/SS pin.

2.4 Large Duty Operation

In the applications where Vout is close to Vin, large duty is needed to support normal regulation. Due to minimum off-time limit, if switching frequency does not change, the maximum duty-cycle is fixed. Large Duty Operation extends the high-side FET on-time, thus decreasing switching frequency and allowing large duty cycles to be maintained. The *Large Duty Cycle Operation With the TPS568230* application note describes the details.

Some parts support 100% duty-cycle mode, high-side FET is continuously switched on as long as the BOOT capacitor voltage is higher than preset UVLO threshold.

2.5 BST Cap Integrated

TPS563252/7 integrate the BST capacitor, helps users to save one BST cap component, but also makes the layout easy, improves thermal performance. The *TPS56X242/7 Optimize SOT563 Package Pin Out* application brief describes the details.

2.6 Voltage Identification Control

Some devices in the table apply the Voltage Identification control (VID) control, such as TPS62134X, using the logic pin input or I2C interface to achieve dynamic output change and meet processor's adaptive voltage requirements.

2.7 Synchronizable to an External Clock

Some parts have SYNC-pin. The switching frequency of the device can be synchronized to an external clock applied to the SYNC-pin.

2.8 Frequency Spread Spectrum

Some parts (like TPS62933x) supports frequency spread spectrum, which helps with lowering down EMI noise. The purpose of spread spectrum is to eliminate peak emissions at specific frequencies by spreading emissions across a wider range of frequencies than a part with fixed frequency operation.

2.9 -EP -ET, and -Q1

Some of TI parts have suffix like -ET, -EP, and Q1.

-ET means enhanced temperature, the device will support larger junction temperature range than non -ET part. This applicatio note *Extended Temperature DC/DC Switching Regulator Solutions* introduces TI ET products

-EP means enhanced product, which belongs to TI HiRel Enhanced Product.

-Q1 means automotive grade parts.

2.10 Voltage Margining

Voltage margining is the process of dynamically testing a load circuit over its supply voltage range. This feature allows evaluation of product performance at the limits of the power supply voltage. The testing is usually implemented by forcing the power supply to ±5% of its nominal output voltage and then making sure that the end-equipment still passes its final acceptance test.

The application note *Voltage Margining Using the TPS62130* describes this feature in detail.

3 Control Modes Description

For the selection of devices, control mode is one important aspect which determines load transient performance, switching frequency accuracy and output accuracy.

Among 3 A converters in TI portfolio, the control modes can be easily divided into two categories: PCM/ACM/AECM and D-CAP2™/D-CAP3™/DCS. PCM, ACM and AECM are all fixed frequency control mode, whose advantages are frequency predictable, smaller jitter, easily SYNC to external clock and stack with another buck. D-CAP2™,D-CAP3™, and DCS control are all COT (Constant On Time) control mode, whose advantages are fast transient reponse, no need for loop compensation and small solution size.

3.1 PCM/ACM

Peak current mode (PCM) and internally compensated advanced current mode (ACM) are two commonly used control modes in TI fixed frequency buck regulators portfolio.

Fixed frequency control modes can provide better switching frequency accuracy, which can offer low EMI / noise via true fixed frequency, but at the cost of a slower transient response compared with D-CAP™ control mode with adaptive constant on time (COT) control method.

Peak current mode control with a fixed-frequency modulator requires Type II compensation circuitry to achieve acceptable bandwidth and phase margins for stability, increasing design complexity, size and cost.

Internally compensated advanced current mode (ACM) is a control topology proposed by TI based on PCM control scheme. It addresses a major challenge of PCM – especially in high frequency operation – is the minimum on time required to properly sense the current information to overcome large noise compared to the small sensed signal. Furthermore, it could achieve larger signal-to-noise ratio to achieve multi-megahertz switching frequency and could offer better load transient performance with internal compensation.

3.2 D-CAP2™/D-CAP3™

The term D-CAP means the current information is Direct connection to the output CAPacitor. TI's first D-CAP™ controller, the TPS51116, was realized by combining a controller with a constant on-time modulator. Today, TI has a family of products featuring various modulators and next-generation forms of the original D-CAP™ control.

The first generation D-CAP™ requires large ESR at the output bulk cap to stabilize the loop. D-CAP2™ doesn't have this requirement, supports the output ceramic capacitors with internal phase compensation. An internal inductor ripple current "emulator" circuit is used to generate a sufficient ramp for D-CAP2™ control to compare the output voltage vs. the reference voltage to determine whether to turn the PWM on or not.

D-CAP3™ also supports the output ceramic capacitors with internal phase compensation. D-CAP3™ mode improves the output voltage set-point accuracy by implementing specialized circuits to remove the half time ramp magnitude.

3.3 AECM

AECM(Advanced Emulated Current Mode) control is based topology that combines the advantages of peak current mode control and D-CAP2 control, providing fast transient response with true fixed switching frequency. Its control loop is using an emulated current to improve its transient response performance. AECM can support both PSM and FCCM under light load condition.

For more information, you can refer to the section 7.3.1 of *TPS563211* data sheet .

3.4 DCS™

DCS-Control™ means Direct Control with Seamless transition into power-save mode. It's another type of constant on-time control. This topology incorporates the advantages of the voltage-mode, current-mode, and hysteretic control topologies while providing a clean entry into power-save mode.

The DCS-Control topology fundamentally is a hysteretic topology. It uses FB pin for the comparison with internal reference voltage and provides precise output-voltage regulation. In the meanwhile, it has VOS pin, which is connected directly to the output voltage, to provide the fast hysteretic response. Like D-CAP™ control, an internal on-time timer is included to set a relatively fixed frequency. See *High-efficiency, low-ripple DCS-Control™ offers seamless PWM/power-save transitions* analog design journal for detailed description of DCS control mode.

3.5 Control Modes Comparison

Table 3-1 shows a brief comparison of the control modes.

Table 3-1. Comparison of Control Modes

	ACM	PCM	AECM	D-CAP2™	D-CAP3™	DCS
DC Accuracy	Good	Good	Good	½ ripple DC offset	Good	Good
Compensation	Internal	External/Internal	Internal	Internal	Internal	Internal
Frequency Accuracy	Good	Good	Good	Good at Steady State	Good at Steady State	Good at Steady State
Predictable EMI Freq	Best	Best	Best	Good	Good	Good at Duty<60%
Transient	Good	Good	Good	Best	Best	Best
Stackable	Yes	Yes	N/A	N/A	N/A	N/A
Sync Method	Edge Trigger	Edge Trigger	No	No	No	No
Noise susceptibility(Jitter)	Best	Good	Good	Good	Good	Good

4 Specifications Comparison

Table 4-1 shows key feature comparison of 1.6 V≤ Vin ≤ 20 V, 3 A buck converters.

Table 4-1. 1.6 V ≤ Vin ≤ 20 V, 3 A Buck Converters Comparison

Part Number	Vin Range	ABS Vin	Vref (full temp range)	Vout Range	HS/LS FETs Rds_on	Fsw	PG/SS Pin	Light Load Operation	OC Limit	Control Mode	Package	Other Features
TPS563203 ***NEW***	4.2-17 V	18 V	0.6V±2%	0.6-7 V	110/60 mΩ	600 kHz	No	PSM	3.9 A	D-CAP3™	SOT563-6, **1.6x1.6**	Large duty operation;
TPS563206 ***NEW***	4.2-17 V	18 V	0.6V±2%	0.6-7 V	110/60 mΩ	600 kHz	No	FCCM	3.9 A	D-CAP3™	SOT563-6, **1.6x1.6**	Large duty operation;
TPS563252 ***NEW***	**3**-17 V	18 V	0.6V±1.5%	0.6-**10 V**	55/24.3 mΩ	1.2 MHz	No SS	PSM	4.1 A	D-CAP3™	SOT563-6, **1.6x1.6**	BST cap integrated; Large duty operation;
TPS563257 ***NEW***	**3**-17 V	18 V	0.6V±1.5%	0.6-**10 V**	55/24.3 mΩ	1.2 MHz	No SS	FCCM	4.1 A	D-CAP3™	SOT563-6, **1.6x1.6**	BST cap integrated; Large duty operation;
TPSM863252 ***NEW***	**3**-17 V	18 V	0.6V±1.5%	0.6-**10 V**	55/24 mΩ	1.2 MHz	No SS	PSM	4.1 A	D-CAP3™	QFN-7, 4x3.3	Power module (L integrated) of TPS563252
TPSM863257 ***NEW***	**3**-17 V	18 V	0.6V±1.5%	0.6-5.5 V	55/24 mΩ	1.2 MHz	No SS	FCCM	4.1 A	D-CAP3™	QFN-7, 4x3.3	Power module (L integrated) of TPS563257
TPS563211	4.2-**18** V	20 V	0.6V±1.5%	0.6-7 V	66/33 mΩ	600 kHz	Selectable PG or SS	PSM/FCCM	4 A	AECM	SOT583-8, **1.6x2.1**	Large duty operation;
TPS563212	4.2-**18** V	20 V	0.6V±1.5%	0.6-7 V	66/33 mΩ	1.2 MHz	Selectable PG or SS	PSM/FCCM	4 A	AECM	SOT583-8, **1.6x2.1**	Large duty operation;
TPS563231	4.5-17 V	19 V	0.6V±2%(25℃)	0.6-7 V	95/55 mΩ	600 kHz	No	PSM	3.9 A	D-CAP3™	SOT563-6, **1.6x1.6**	
TPS563240	4.5-17 V	19 V	0.6V±2%	0.6-7 V	70/30 mΩ	1.4 MHz	No	PSM	3.9 A	D-CAP3™	SOT236-6, 1.6x2.9	
TPS563249	4.5-17 V	19 V	0.6V±2%	0.6-7 V	70/30 mΩ	1.4 MHz	No	FCCM	3.9 A	D-CAP3™	SOT236-6, 1.6x2.9	
TPS563202	4.3-17 V	19 V	0.806V±2%(25℃)	0.806-7 V	95/57 mΩ	580 kHz	No	PSM	4.4 A	D-CAP2™	SOT563-6, **1.6x1.6**	
TPS563207	4.3-17 V	19 V	0.806V±2%(25℃)	0.806-7 V	95/57 mΩ	580 kHz	No	FCCM	4.4 A	D-CAP2™	SOT563-6, **1.6x1.6**	
TPS563202S	4.3-17 V	19 V	0.806V±1.5%(25℃)	0.806-7 V	95/57 mΩ	580 kHz	No	PSM	4.4 A	D-CAP2™	SOT563-6, **1.6x1.6**	
TPS563207S	4.3-17 V	19 V	0.806V±1.5%(25℃)	0.806-7 V	95/57 mΩ	580 kHz	No	FCCM	4.4 A	D-CAP2™	SOT563-6, **1.6x1.6**	
TPS563201	4.5-17 V	19 V	0.768V±2%(25℃)	0.76-7 V	95/57 mΩ	580 kHz	No	PSM	4.2 A	D-CAP2™	SOT236-6, 1.6x2.9	

Table 4-1. 1.6 V ≤ Vin ≤ 20 V, 3 A Buck Converters Comparison (continued)

Part Number	Vin Range	ABS Vin	Vref (full temp range)	Vout Range	HS/LS FETs Rds_on	Fsw	PG/SS Pin	Light Load Operation	OC Limit	Control Mode	Package	Other Features
TPS563208	4.5-17 V	19 V	0.768V±2%(25 ℃)	0.76-7 V	95/57 mΩ	580 kHz	No	FCCM	4.2 A	D-CAP2™	SOT236-6, 1.6x2.9	
TPS563210A	4.5-17 V	19 V	0.765V±1.8%	0.76-7 V	68/39mΩ	650 kHz	**Yes**	PSM	4.2 A	D-CAP2™	SOT238-8, 1.6x2.9	
TPS563219A	4.5-17 V	19 V	0.765V±1.8%	0.76-7 V	68/39mΩ	650 kHz	**Yes**	FCCM	4.2 A	D-CAP2™	SOT238-8, 1.6x2.9	
TPS563200	4.5-17 V	19 V	0.765V±1%(25 ℃)	0.76-7 V	68/39 mΩ	650 kHz	No	PSM	4.2 A	D-CAP2™	SOT236-6, 1.6x2.9	
TPS563209	4.5-17 V	19 V	0.765V±1%(25 ℃)	0.76-7 V	68/39 mΩ	650 kHz	No	FCCM	4.2 A	D-CAP2™	SOT236-6, 1.6x2.9	
TPS54328	4.5-**18** V	20 V	0.765V±2%(25 ℃)	0.76-7 V	100/70 mΩ	700 kHz	No PG	PSM	4.2 A	D-CAP2™	SOP-8, 4.89x3.9; SON-10 3x3	
TPS54327	4.5-**18** V	20 V	0.765V±2%(25 ℃)	0.76-7 V	100/70mΩ	700 kHz	No PG	FCCM	4.2 A	D-CAP2™	SOP-8, 4.89x3.9; SON-10 3x3	
TPS54325	w/o bias: 4.5-**18** V; w/ bias: **2-18**V	20 V	0.765V±1.8%	0.76-5.5 V	120/70 mΩ	700 kHz	Yes	FCCM	4.1 A	D-CAP2™	SOP-14 5x4.4	
TPS54325-Q1	w/o bias: 4.5-**18** V; w/ bias: **2-18**V	20 V	0.765V±1.8%	0.76-5.5 V	120/70 mΩ	700 kHz	Yes	FCCM	4.1 A	D-CAP2™	SOP-14 5x4.4	Auto version of TPS54325
TPS54326	w/o bias: 4.5-**18** V; w/ bias: **2-18**V	20 V	0.765V±1.8%	0.76-5.5 V	120/70 mΩ	700 kHz	Yes	PSM	4.1 A	D-CAP2™	SOP-14 5x4.4; QFN-16 3x3	
TPS53312*	w/o bias: 4.5-**18** V; w/ bias: **2-18**V	20 V	0.765V±1.8%	0.76-5.5 V	120/70 mΩ	700 kHz	Yes	PSM	4.1 A	D-CAP2™	QFN-16 3x3	
TPS62913 ***NEW***	3-17 V	18 V	0.8V±**1%**	0.8-5.5 V	57/20mΩ	1M/2.2MHz	Yes	FCCM	4.2 A	PCM	QFN-10 2x2	Low noise low ripple; Spread spectrum modulation; Sync to external clock; 100% Duty Cycle
TPSM82913 ***NEW***	3-17 V	18 V	0.8V±**1%**	0.8-5.5 V	57/20mΩ	1M/2.2MHz	Yes	FCCM	4.2 A	PCM	QFN-28 4.5x5.5	Power module(L integrated) of TPS62913
TPSM82913E ***NEW***	3-17 V	18 V	0.8V±**1%**	0.8-5.5 V	57/20mΩ	1M/2.2MHz	Yes	FCCM	4.2 A	PCM	QFN-28 4.5x5.5	ET version of TPSM82913

Table 4-1. 1.6 V ≤ Vin ≤ 20 V, 3 A Buck Converters Comparison (continued)

Part Number	Vin Range	ABS Vin	Vref (full temp range)	Vout Range	HS/LS FETs Rds_on	Fsw	PG/SS Pin	Light Load Operation	OC Limit	Control Mode	Package	Other Features
TPS62903	3-17 V	18 V	0.6V±**0.9%**	**0.4**-5.5 V	62/22mΩ	1M/2.5MHz	Yes	PSM/FCCM	4.4 A	DCS™	QFN-9 1.5x2	Low Iq; BST cap integrated; 100% Duty Cycle; Setable Vout; AEE™
TPS62903-Q1 ***NEW***	3-18 V	19.5 V	0.6V±**0.9%**	**0.4**-5.5 V	62/22mΩ	1M/2.5MHz	Yes	PSM/FCCM	4.4 A	DCS™	QFN-9 2.2x2	Auto version of TPS62903
TPS62993-Q1 ***NEW***	3-10 V	12 V	0.6V±1.5%	**0.4**-5.5 V	62/22mΩ	1M/2.5MHz	Yes	PSM/FCCM	4.3 A	DCS™	QFN-9 2.2x2	Low Iq; Auto -grade; BST cap integrated; 100% Duty Cycle; Setable Vout; AEE™;
TPS62130	3-17 V	20 V	0.8V±1.8%	0.9-6 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Low Iq; 100% Duty Cycle; Voltage margining;
TPS62130A	3-17 V	20 V	0.8V±1.8%	0.9-6 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Different PG logic version of TPS62130
TPS62131	3-17 V	20 V	0.8V±1.8%	1.8 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Fixed Vout version of TPS62130
TPS62132	3-17 V	20 V	0.8V±1.8%	3.3 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Fixed Vout version of TPS62130
TPS62133	3-17 V	20 V	0.8V±1.8%	5.0 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Fixed Vout version of TPS62130
TPS62130A-Q1	3-17 V	20 V	0.8V±1.8%	0.9-6 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Auto version of TPS62130A
TPS62133A-Q1	3-17 V	20 V	0.8V±1.8%	5.0 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Auto version of TPS62133A
TPS6213013A-Q1	3-17 V	20 V	0.8V±1.8%	1.3 V	90/40mΩ	1.25M/2.5MHz	Yes	PSM	4.2 A	DCS™	QFN-16 3x3	Fixed Vout version of TPS62130A
TPS82130	3-17 V	20 V	0.8V±1.8%	0.9-6 V	90/40mΩ	2 MHz	Yes	PSM	4.2 A	DCS™	SIL-8 3x2.8	Power module (L integrated) of TPS62130

Table 4-1. 1.6 V ≤ Vin ≤ 20 V, 3 A Buck Converters Comparison (continued)

Part Number	Vin Range	ABS Vin	Vref (full temp range)	Vout Range	HS/LS FETs Rds_on	Fsw	PG/SS Pin	Light Load Operation	OC Limit	Control Mode	Package	Other Features
TPS62134A/B/C/D	3-17 V	20 V	±1%	0.7-1.05 V	90/40mΩ	1 MHz	Yes	PSM	4.4 A	DCS™	QFN-16 3x3	Low Iq; VID control; Single-ended remote sense
TPS543320 ***NEW***	4-18 V	20 V	0.5V±**0.5%**	**0.5**-7 V	**25/13.9mΩ**	500K/ 750K/1M/1.5M/ 2.2MHz	Selectable SS-time	FCCM	Adjustable	ACM	QFN-14 2.5*3	Sync to external clock;
TPS54320	w/o bias: 4.5-17 V; w/ bias: 1.6-17V	20 V	0.8V±**1%**	0.8-**15** V	57/50mΩ	200K-1.2MHz	Yes	FCCM	5.8 A	PCM	QFN-14 3.5*3.5	100% Duty Cycle;
TPS54350	4.5-**20** V	21.5 V	0.891V**±1%**	0.9-**12** V	100/mΩ (External LS FET)	250K-700KHz	No SS	FCCM	4.5 A	PCM	SOP-16 5x4.4	Sync to external clock;
TPS54350-EP	4.5-**20** V	21.5 V	0.891V±**1%**	0.9-**12** V	100/mΩ (External LS FET)	250K-700KHz	No SS	FCCM	4.5 A	PCM	SOP-16 5x4.4	-EP version of TPS54350
TPS54352/3/4/5/6/7	4.5-**20** V	21.5 V	**±**2%	1.2/1.5/1.8/2.5/ 3.3/5 V	100/mΩ (External LS FET)	250K-700KHz	No SS	FCCM	4.5 A	PCM	SOP-16 5x4.4	Sync to external clock;
TPS65283 **(3.5/2.5A)**	4.5-18 V	20 V	0.6V±2%	0.6-9 V	100/65; 140/95mΩ	200K-2MHz	No SS	FCCM	5/3.75A	PCM	QFN-24 4x4	Dual channel; Sync to external clock; Load switch intergrated;
TPS65283-1 **(3.5/2.5A)**	4.5-18 V	20 V	0.6V±2%	0.6-9 V	100/65; 140/95mΩ	200K-2MHz	No SS	PSM	5/3.75A	PCM	QFN-24 4x4	Dual channel; Sync to external clock; Load switch intergrated;
TPS65281 **(3/3A)**	4.5-18 V	18V	0.8V±2%	0.6-9 V	90/70mΩ	300K-1.4MHz	Yes	FCCM	4A (Latch)	PCM	QFN-16 4x4	Dual channel; Load switch intergrated;
TPS65821-1 **(3/3A)**	4.5-18 V	18V	0.8V±2%	0.6-9 V	90/70mΩ	300K-1.4MHz	Yes	FCCM	4A (Non-latch)	PCM	QFN-16 4x4	Dual channel; Load switch intergrated;

Table 4-1. 1.6 V ≤ Vin ≤ 20 V, 3 A Buck Converters Comparison (continued)

Part Number	Vin Range	ABS Vin	Vref (full temp range)	Vout Range	HS/LS FETs Rds_on	Fsw	PG/SS Pin	Light Load Operation	OC Limit	Control Mode	Package	Other Features
TPS65273V **(3.5/3.5A)**	4.5-18 V	20 V	0.6V±**1%**	0.68-1.95 V	31/23mΩ	200K-1.6MHz	No PG	PSM/FCCM	5A each	PCM	SOP-32 6.1x11; QFN-36 6x6	Dual channel; I2C interface; Programmable slew rate; Current sharing; Sync to external clock
TPS542941 **(2/3A)**	4.5-18 V	20 V	0.765V±1%(25 ℃)	0.76-7V	150/100mΩ	700 KHz	No SS	PSM	3.9/4.7A	D-CAP2™	SOP-16 4.4x5; QFN-16 4x4	Dual channel;
TPS542951 **(2/3A)**	4.5-18 V	20 V	0.765V±1%(25 ℃)	0.76-7V	150/100mΩ	700 KHz	No PG	PSM	3.9/4.7A	D-CAP2™	SOP-16 4.4x5; QFN-16 4x4	Dual channel;
TPS54394 **(3/3A)**	4.5-18 V	20 V	0.765V±1%(25 ℃)	0.76-7V	90/60mΩ	700 KHz	No SS	PSM	4.7A each	D-CAP2™	SOP-16 4.4x5; QFN-16 4x4	Dual channel;
TPS54395 **(3/3A)**	4.5-18 V	20 V	0.765V±1%(25 ℃)	0.76-7V	90/60mΩ	700 KHz	No PG	PSM	4.7A each	D-CAP2™	SOP-16 4.4x5; QFN-16 4x4	Dual channel;

Table 4-2 shows key feature comparison of 3.5 V≤ Vin ≤ 30 V, 3 A buck converters.

Table 4-2. 3.5 V ≤ Vin ≤ 30 V 3 A Buck Converters Comparison

Part Number	Vin Range	ABS Vin	Vref (full temp range)	Vout Range	HS/LS FETs Rds_on	Fsw	PG/SS Pin	Light Load Operation	OC Limit	Control Mode	Package	Other Features
TPS62933 NEW	3.8-**30** V	32 V	0.8V±2%	0.8-22 V	76/32 mΩ	200K-2.2MHz	No PG	PSM	3.8 A	PCM	SOT583-8 **1.6x2.1**	Large duty operation; Low Iq; Frequency spread spectrum
TPS62933P NEW	3.8-**30** V	32 V	0.8V±2%	0.8-22 V	76/32 mΩ	200K-2.2MHz	No SS	PSM	3.8 A	PCM	SOT583-8 **1.6x2.1**	Large duty operation; Low Iq; Frequency spread spectrum
TPS62933O NEW	3.8-**30** V	32 V	0.8V±2%	0.8-22 V	76/32 mΩ	200K-2.2MHz	No SS	OOA	3.8 A	PCM	SOT583-8 **1.6x2.1**	Large duty operation; Low Iq; Frequency spread spectrum
TPS62933F NEW	3.8-**30** V	32 V	0.8V±2%	0.8-22 V	76/32 mΩ	200K-2.2MHz	No PG	FCCM	3.8 A	PCM	SOT583-8 **1.6x2.1**	Large duty operation; Low Iq;
TPS563300 NEW	3.8-**30** V	32 V	0.8V±2%	0.8-22 V	76/32 mΩ	500 KHz	No	PSM	3.8 A	PCM	SOT583-8 **1.6x2.1**	Large duty operation; Low Iq; Frequency spread spectrum
TPS56339	4.5-24 V	26 V	0.802V±2.5%	0.8-16 V	70/35 mΩ	500 KHz	No	PSM	3.6 A	AECM	SOT236-6 1.6x2.9	Large duty operation;
TPS54302	4.5-28 V	30 V	0.596V±2.5%	0.6-25 V	85/40 mΩ	400 KHz	No	PSM	4 A	PCM	SOT236-6 1.6x2.9	Frequency spread spectrum ; 100% duty cycle
TPS54308	4.5-28 V	30 V	0.596V±2.5%	0.6-25 V	85/40 mΩ	350 KHz	No	FCCM	4 A	PCM	SOT236-6 1.6x2.9	100% duty cycle
TPS54335A	4.5-28 V	30 V	0.8V±1.5%	0.8-24 V	128/84 mΩ	50K-1.5MHz	No	PSM	4.7 A	PCM	SO-8 4.89x3.9; SON-10 3x3	
TPS54335-1A	4.5-28 V	30 V	0.8V±1.5%	0.8-24 V	128/84 mΩ	50K-1.5MHz	No	PSM	4.7 A	PCM	SON-10 3x3 (narrow heat-pad)	
TPS54336A	4.5-28 V	30 V	0.8V±1.5%	0.8-24 V	128/84 mΩ	340KHz	No PG	PSM	4.7 A	PCM	SO-8 4.89x3.9; SON-10 3x3	
TPS54334	4.2-28V	30 V	0.8V±1.5%	0.8-24 V	128/84 mΩ	570 kHz	No SS	PSM	4.7 A	PCM	SO-8 4.89x3.9; SON-10 3x3	
TPS54331	3.5-28 V	30 V	0.8V±3.5%	0.8-25 V	80/ mΩ, External LS diode	570 kHz	No PG	PSM	5.8 A	PCM	SO-8 4.89x3.9; SOIC-8 4.89x3.9;	

Table 4-2. 3.5 V ≤ Vin ≤ 30 V 3 A Buck Converters Comparison (continued)

Part Number	Vin Range	ABS Vin	Vref (full temp range)	Vout Range	HS/LS FETs Rds_on	Fsw	PG/SS Pin	Light Load Operation	OC Limit	Control Mode	Package	Other Features
TPS54332 **(3.5A)**	3.5-28 V	30 V	0.8V±3.5%	0.8-25 V	80/ mΩ, External LS diode	1 MHz	No PG	PSM	6.5 A	PCM	SO-8 4.89x3.9;	
TPS54339	4.5-23 V	25 V	0.765±2.1% (25℃)	0.76-7 V	140/70 mΩ	600 kHz	No PG	FCCM	4.1 A	DCAP2™	SO-8 4.89x3.9;	
TPS54339E	4.5-23 V	25 V	0.765±2.1% (25℃)	0.76-7 V	140/70 mΩ	600 kHz	No PG	PSM	4.1 A	DCAP2™	SO-8 4.89x3.9;	
TPS54386 **(3/3A)**	4.5-28 V	30 V	0.8±1.5%	0.8-90%Vin	85/ mΩ, External LS diode	630 kHz	No	FCCM	Adjustable	PCM	SOP-14 4.4x5	Dual channel
TPS54383 **(3/3A)**	4.5-28 V	30 V	0.8±1.5%	0.8-90%Vin	85/ mΩ, External LS diode	310 kHz	No	FCCM	Adjustable	PCM	SOP-14 4.4x5	Dual channel
TPS55386 **(3/3A)**	4.5-28 V	30 V	0.8±1.75%	0.8-90%Vin	85/ mΩ, External LS diode	630 kHz	No	FCCM	Adjustable	PCM	SOP-16 4.4x5	Dual channel
TPS55383 **(3/3A)**	4.5-28 V	30 V	0.8±1.75%	0.8-90%Vin	85/ mΩ, External LS diode	310 kHz	No	FCCM	Adjustable	PCM	SOP-16 4.4x5	Dual channel

PG: Power Good.

SS: Soft-start.

OC: Overcurrent.

*: Contact TI local sales team for device more information.

5 References

- Texas Instruments, *TPS56X242/7 Optimize SOT563 Package Pin Out*, application brief.
- Texas Instruments, *Large Duty Cycle Operation With the TPS568230*, application note.
- Texas Instruments, *Understanding OOA™ Operation*, application note.
- Texas Instruments, *Extended Temperature DC/DC Switching Regulator Solutions*, application note.

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