AP66200QFVBW
EVB User Guide

DESCRIPTION

The AP66200Q is an adjustable switching frequency, internally compensated, synchronous DC-DC Buck converter with a default internal frequency of 500kHz. The device fully integrates an 185mΩ high-side power MOSFET and an 80mΩ low-side power MOSFET to provide highly efficient step-down DC-DC conversion.

The AP66200Q enables continuous load current of up to 2A with as high as 95% efficiency. The device features current mode control operation, enabling easy loop stabilization, and supports a wide range of output capacitive loads.

With its high level of integration and minimal need for external components, the AP66200Q simplifies board layout and reduces space requirements. This makes it ideal for distributed power architectures.

The AP66200Q is available in the standard Green U-QFN4040-16/SWP (Type UXB) package.

FEATURES

- Qualified for Automotive Applications
- AEC-Q100 Qualified with the Following Results
  - Device Temperature Grade 1: -40°C to +125°C T_A
  - Device HBM ESD Classification Level H1C
  - Device CDM ESD Classification Level C3B
- V_{IN} 3.8 to 60V
- 2A Continuous Output Current
- V_{OUT} Adjustable from 0.8V to 50V
- Enhanced Efficiency Mode with Bias
- Adjustable Switching Frequency. 500kHz Default Frequency
- Start-up with Pre-biased Output
- External Soft-Start with Tracking – Sequential, Ratiometric, or Absolute. Default Internal Soft-Start of 2ms
- Enable Pin with 5% tolerance
- Soft Discharge
- ±5% Power Good Detection with Internal Pull-up Resistor
- Overvoltage Protection & Undervoltage Protection
- Overcurrent Protection (OCP) with Hiccup
- Thermal Protection
- **Totally Lead-Free & Fully RoHS Compliant**
- **Halogen and Antimony Free. “Green” Device**

APPLICATIONS

- General Purpose Point-of-load DC-DC Power Conversion
- Automotive Infotainments
- Telecommunication Systems
- Distributed Power Systems
- Home Audio Devices
- Consumer Electronics
- Network Systems
- FPGA, DSP and ASIC Supplies

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
V_{IN}	Supply Voltage	-0.3 to +72	V
V_{SW}	Switch Node Voltage	-1.0 to V_{IN} +0.3 (DC)	V
V_{SW}	Switch Node Voltage	-2.5 to V_{IN} +2 (ns)	V
V_{EN}	Enable/UVLO Voltage	-0.3V to +72	V
V_{BST}	Bootstrap Voltage	V_{SW} -0.3 to V_{SW} +6.0	V
V_{BIAS}	Bias Voltage	-0.3 to +18	V
V_{CC}	VCC Voltage	-0.3V to +6.0	V
V_{FB}	Feedback Voltage	-0.3V to +6.0	V
V_{FS}	Frequency Adjust	-0.3V to +6.0	V
V_{PG}	Power Good Voltage	-0.3V to +6.0	V
$V_{SS/TR}$	Soft-start / Tracking	-0.3V to +6.0	V
V_{MSYNC}	Synchronization and MODE	-0.3V to +6.0	V
T_{ST}	Storage Temperature	-65 to +150	°C
T_J	Junction Temperature	+150	°C
T_L	Lead Temperature	+300	°C
ESD Susceptibility			
HBM	Human Body Model	±2500	V
CDM	Charged Device Model	±1500	V

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{IN}	Supply Voltage	3.8	60	V
V_{BIAS}	Supply Voltage	3.8	15	V
T_A	Operating Ambient Temperature Range	-40	+125	°C
T_J	Operating Junction Temperature Range	-40	+150	°C

ORDERING INFORMATION

Part Number	Package Code	Package	Identification Code	Tape and Reel	
				Quantity	Part Number Suffix
AP66200QFVBW-13	FVBW	U-QFN4040-16	F2Q	3000	-13

EVALUATION BOARD

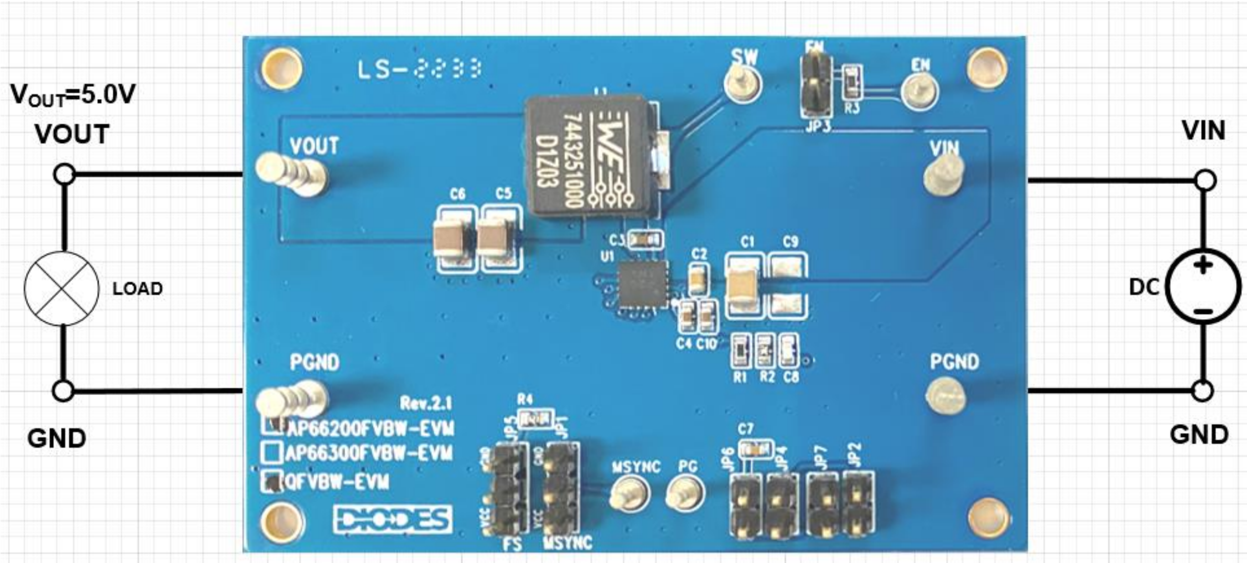

Figure 1. AP66200QFVBW-EVM

QUICK START GUIDE

The AP66200Q EVM board has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP66200Q, follow the procedure below:

1. Insert jumpers to configure the EVM board setting as described in the Application Information sections of the device datasheet.
2. Use jumper JP3 (100KΩ to VIN) set device enabled.
3. Remove jumpers JP3 and connect external voltage source on EN pin directly.
4. Use jumper JP5 to set FS to default 500KHz (VCC) or 2.5MHz (GND).
5. Use jumper JP1 to set MSYNC to forced PWM (VCC) or PFM (GND) operation.
6. Remove jumper JP1 and force an external clock source on MSYNC pin for synchronization with positive edge trigger and PWM.
7. Use jumper JP6 for default external soft start (C7) of 2ms.
8. Remove jumper JP6 and use jumper JP7 (VCC) for internal soft start of 1.7ms.
9. Use jumper JP4 to connect BIAS pin to PGND.
10. Use jumper JP2 to connect BIAS pin to VOUT.
11. Remove JP2 and JP4 and connect an external voltage source on BIAS pin (<15V).
12. Connect a 12V power supply between the VIN and PGND terminals. Make sure the power supply is turned off.
13. Connect an adjustable current or resistive load to the VOUT and PGND terminals.
14. Turn on the power supply. Do not turn on the power supply until all connections are completed and fully checked.
15. The EVM board should now power up with a 5V output voltage.
16. Increase the load current and observe the output voltage change.
17. Check for the stable operation of the SW and VOUT signal on the oscilloscope.
18. Measure the switching frequency on SW probe jack in the EVM board.
19. Measure the output ripple on the VOUT probe jack in the EVM board.

MEASUREMENT/PERFORMANCE GUIDELINES:

1. When measuring the output voltage ripple, maintain the shortest possible ground lengths on the oscilloscope probe. Long ground leads can erroneously inject high frequency noise into the measured ripple.

EVALUATION BOARD SCHEMATIC

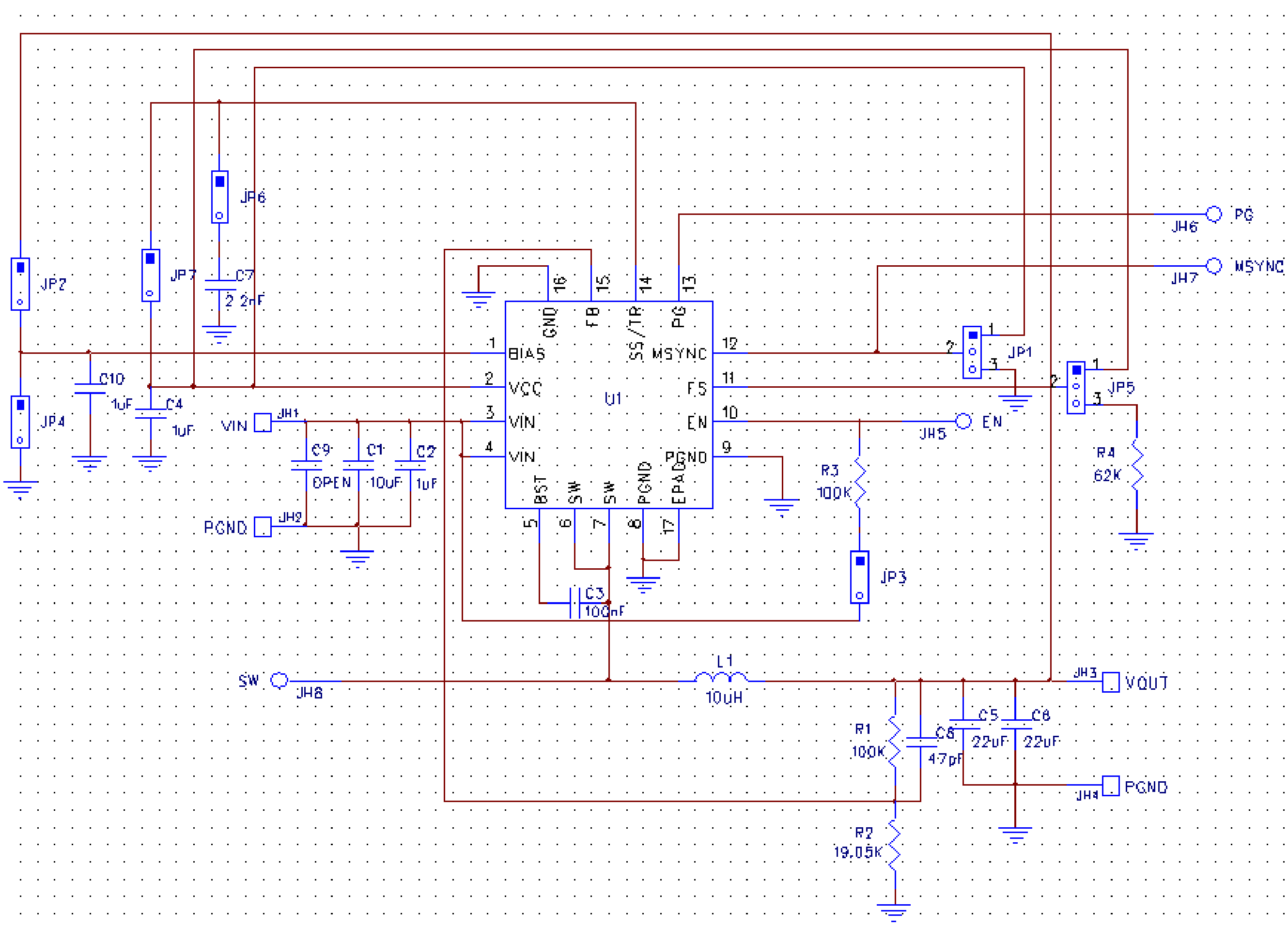

Figure 2. AP66200QFVBW-EVM Schematic

PCB LAYOUT

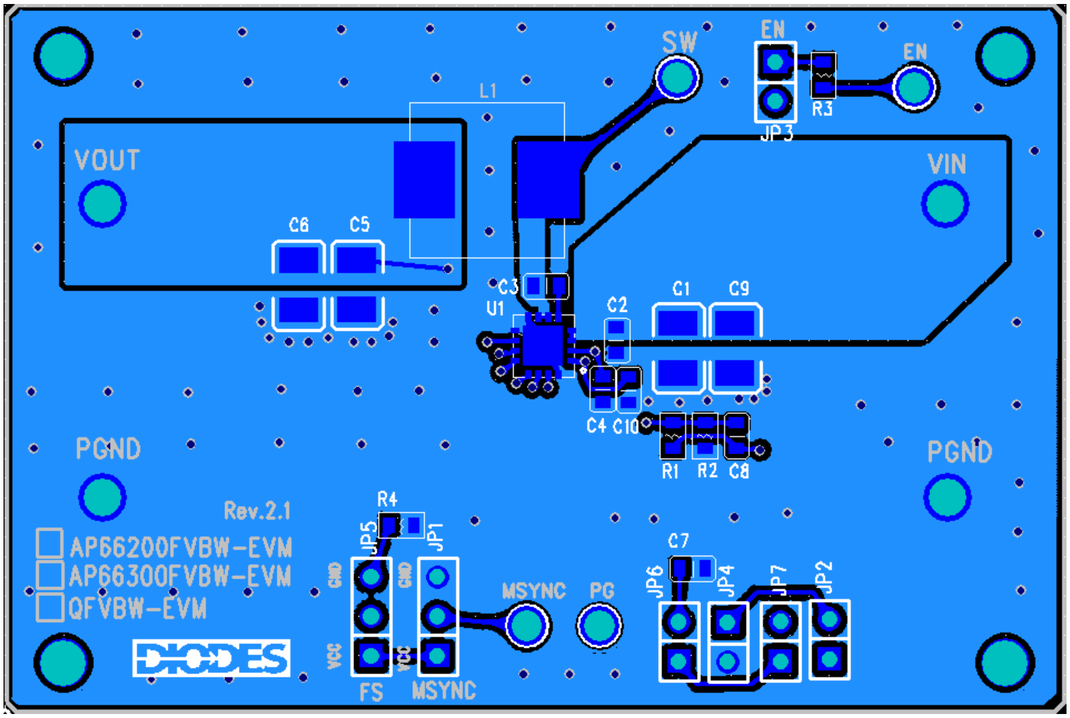

Figure 3. AP66200QFVBW-EVM – Top Layer

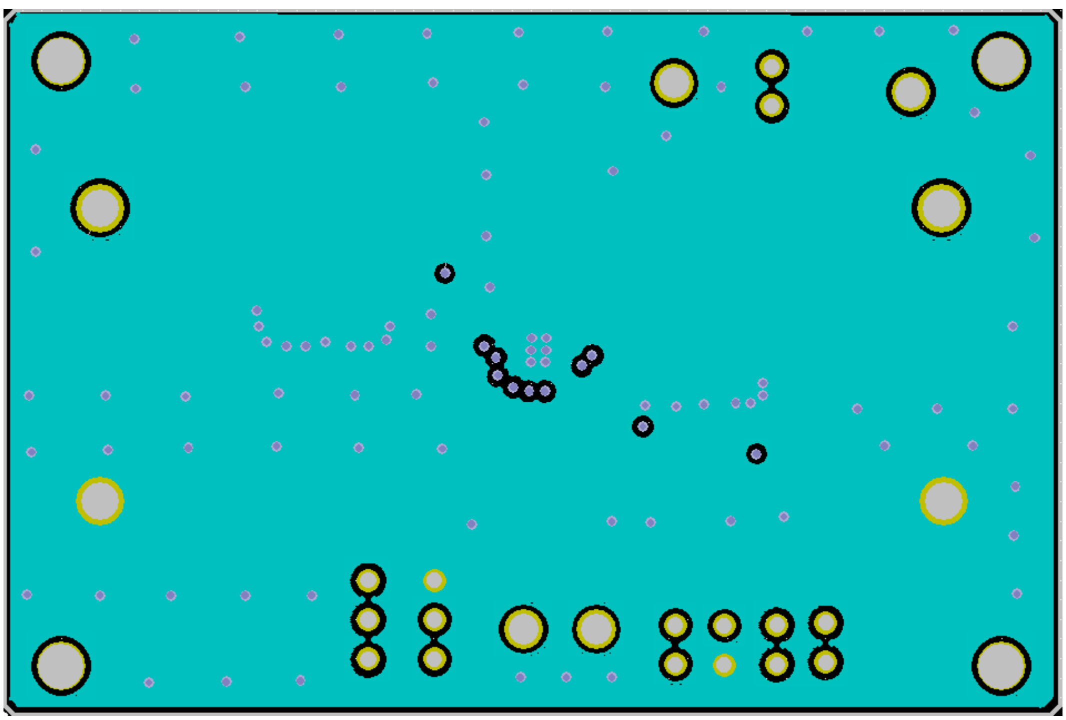

Figure 4. AP66200QFVBW-EVM – Layer 2

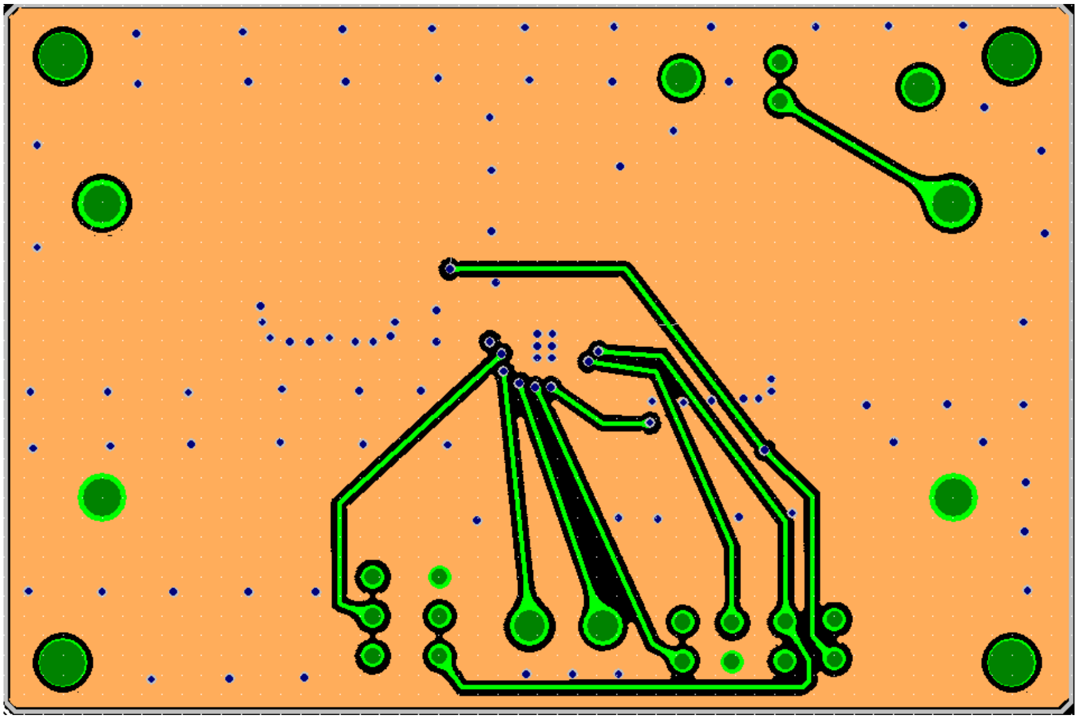

Figure 5. AP66200QFVBW-EVM – Layer 3

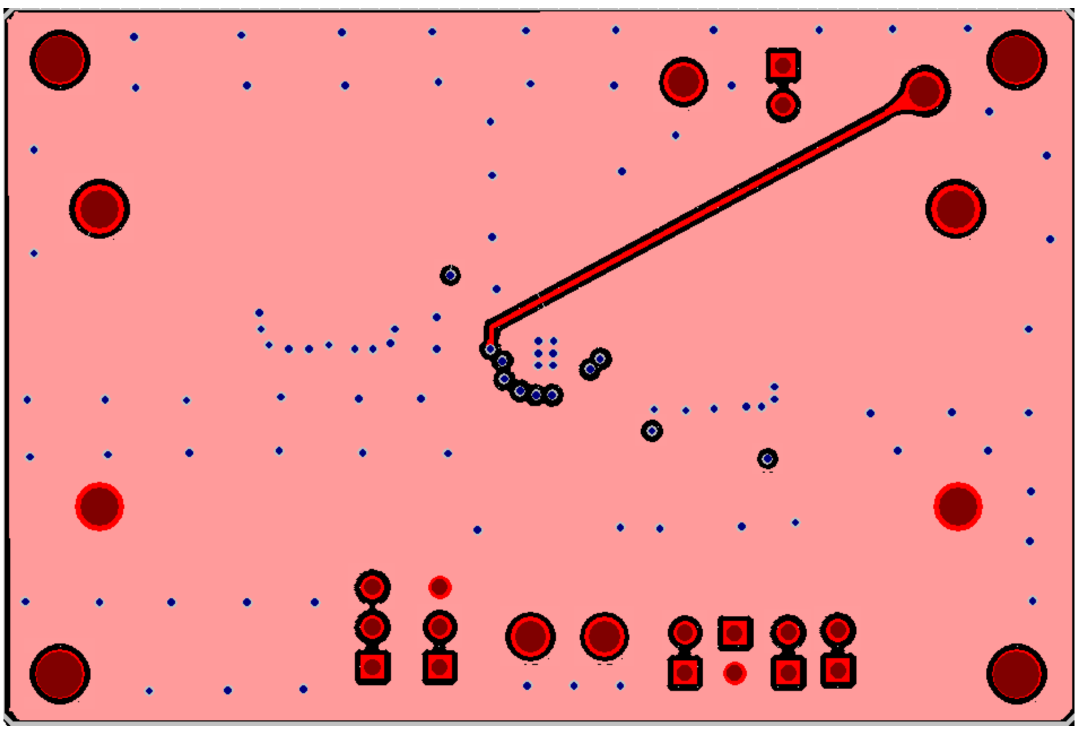

Figure 6. AP66200QFVBW-EVM – Bottom Layer

BILL OF MATERIALS for AP66200QFVBW-EVM

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer P/N
1	C1	10µF	Ceramic Capacitor, 100V	1210	Murata	GRM32EC72A106KE05L
1	C2	1µF	Ceramic Capacitor, 100V, X5R, 20%	0805	Murata	GRJ21BC72A105KE11L
1	C3	100nF	Ceramic Capacitor,50 V, X7R, 10%	0603	TDK	CGA3E2X7R1H104KTOY ON
2	C4, C10	1µF	Ceramic Capacitor,25 V, X7R, 10%	0603	Taiyo Yuden	963-TMK107B7105KA-T
2	C5, C6	22µF	Ceramic Capacitor, 25V, X5R	1210	Taiyo Yuden	TMK325BJ226MM-T
1	C7	2.2nF	Ceramic Capacitor,25 V, X7R, 10%	0603	AVX	06033C222KAT2A
1	C8	47pF	Ceramic Capacitor, 100V, X7R, 20%	0603	Kemet	C0603C470K1RACTU
2	R1, R3	100K Ω	Film Resistor	0603	Panasonic	ERJ-3EKF1003V
1	R2	19.1K Ω	Film Resistor	0603	Yageo	AC0603FR-0719K1L
1	R4	62KΩ	Film Resistor	0603	Yageo	AC0603FR-1362KL
1	L1	10µH	DCR=16.3m Ω, Isat=7.2A	10.5x10.5x4.7 mm	Wurth Electronics	7443251000
5	JP2, 3, 4, 6, 7		PCB Header, 40 POS	1X2	3M	2340-6111TG
2	JP1, 5		PCB Header, 40 POS	1X3	3M	2340-6111TG
4	PG, MSYNC, SW, EN		PCB Turret Terminal, 0.082"	0.082"	Keystone Electronics	1573-2
4	VIN, VOUT, PGNDx2		PCB Turret Terminal, 0.094"X1/16	0.082"	Keystone Electronics	1598-2
1	AP66200Q		IC	U-QFN4040-16	Diodes Incorporated (Diodes)	AP66200QFVBW

Typical Performance Characteristics

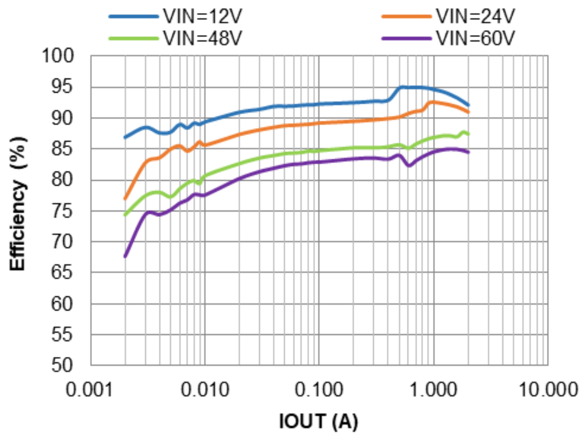

Figure 7. PFM Efficiency vs. IOUT, VOUT=5V, L=10µH

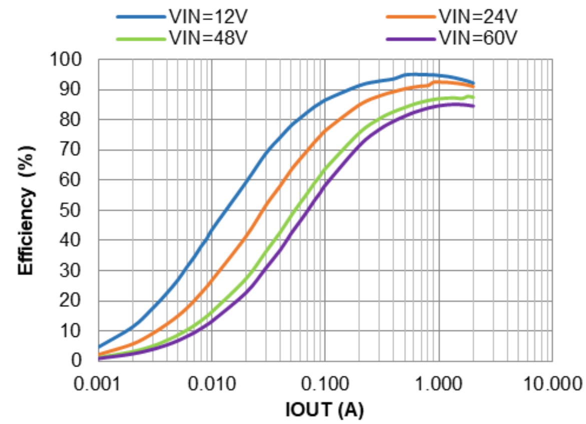

Figure 8. PWM Efficiency vs. IOUT, VOUT=5V, L=10µH

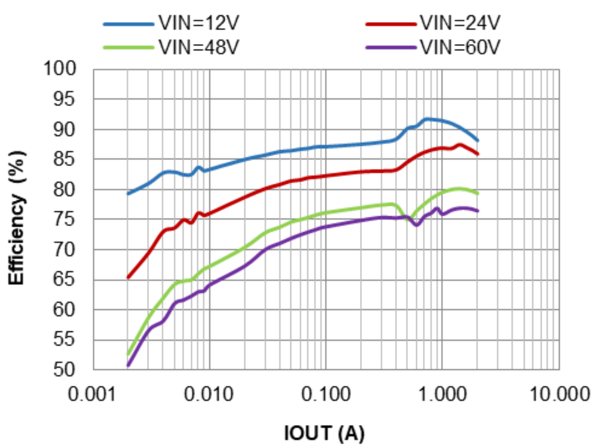

Figure 9. PFM Efficiency vs. IOUT, VOUT=3.3V, L=8.2µH

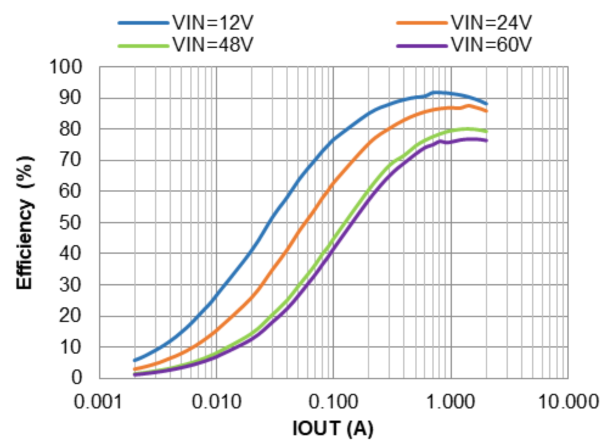

Figure 10. PWM Efficiency vs. IOUT, VOUT=3.3V, L=8.2µH

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