2.25-MHz 300-mA Step-Down Converter in DDC/TSOT23 Package

Check for Samples: TPS62242-Q1

FEATURES

- **Qualified for Automotive Applications**
- **AEC-Q100 Qualified With the Following Results:**
  - **Device Temperature Grade 2**
  - **Device HBM ESD Classification Level H2**
  - **Device CDM ESD Classification Level C3B**
- **High Efficiency – Greater than 94%**
- **Output Current up to 300 mA**
- **V_{IN} Range From 2 V to 6 V**
- **2.25-MHz Fixed-Frequency Operation**
- **Power-Save Mode at Light Load Currents**
- **Output Voltage Accuracy in PWM Mode ±1.5%**
- **Adjustable Output Voltage from 0.6 V to V_{IN}**
- **Typical 15 µA Quiescent Current**
- **100% Duty Cycle for Lowest Dropout**
- **Available in a TSOT23 Package**
- **Allows < 1-mm Solution Height**

APPLICATIONS

- **Automotive Applications**
- **Bluetooth™ Headset**
- **Cell Phones, Smart-Phones**
- **WLAN**
- **Low-Power DSP Supply**
- **Portable Media Players**

DESCRIPTION

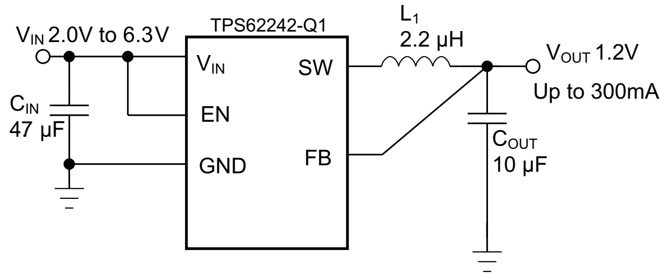
The TPS62242-Q1 device is a high-efficiency synchronous step-down dc-dc converter optimized for battery-powered portable applications. It provides up to 300 mA of output current from a single Li-Ion cell and is ideal to power portable applications like mobile phones and other portable equipment.

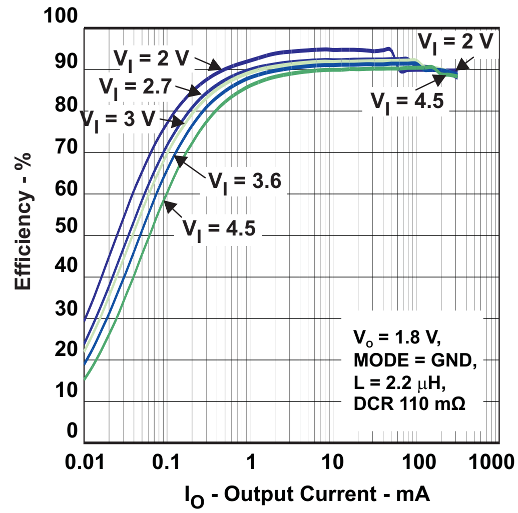
With an input voltage range of 2 V to 6 V, the device supports applications powered by Li-Ion batteries with extended voltage range, two- and three-cell alkaline, 3.3-V and 5-V input voltage rails.

The TPS62242-Q1 operates at 2.25-MHz fixed switching frequency and enters the power-save mode of operation at light load currents to maintain high efficiency over the entire load current range.

The power-save mode is optimized for low output-voltage ripple. In the shutdown mode, the current consumption is reduced to less than 1 µA. TPS62242-Q1 allows the use of small inductors and capacitors to achieve a small solution size.

The TPS62242-Q1 is available in a 5-pin TSOT23 package.


VIN 2.0V to 6.3V
TPS62242-Q1
L1
2.2 µH
VOUT 1.2V
Up to 300mA
VIN
SW
EN
GND
FB
CIN
47 µF
COUT
10 µF


VI = 2 V
VI = 2.7
VI = 3 V
VI = 3.6
VI = 4.5
VI = 2 V
VI = 4.5
Vo = 1.8 V,
MODE = GND,
L = 2.2 µH,
DCR 110 mΩ
Efficiency - %
IO - Output Current - mA

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ORDERING INFORMATION(1)

T_A	PACKAGE		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 115°C	TSOT23-5 – DDC	Reel of 3000	TPS62242QDDCRQ1	SAW

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)(1)

			VALUE	UNIT
V_I	Input voltage range(2)		–0.3 to 7	V
	Voltage range at EN		–0.3 to V_{IN} +0.3, ≤7	V
	Voltage on SW		–0.3 to 7	V
	Peak output current		Internally limited	A
	ESD rating(3)	Human Body Model (HBM) AEC-Q100 Classification Level H2	2	kV
		Charged Device Model (CDM) AEC-Q100 Classification Level C3B	750	V
T_J	Maximum operating junction temperature		–40 to 150	°C
T_{stg}	Storage temperature range		-65 to 150	°C

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute–maximum–rated conditions for extended periods may affect device reliability.
(2) All voltage values are with respect to network ground terminal.
(3) The human body model is a 100-pF capacitor discharged through a 1.5 kΩ resistor into each pin. The machine model is a 200-pF capacitor discharged directly into each pin.

DISSIPATION RATINGS

PACKAGE	$R_{\theta JA}$	POWER RATING FOR T_A ≤ 25°C	DERATING FACTOR ABOVE T_A = 25°C
DDC	250°C/W	400 mW	4 mW/°C

RECOMMENDED OPERATING CONDITIONS

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

		MIN	NOM	MAX	UNIT
V_I	Supply voltage, VIN	2		6	V
	Output voltage range for adjustable voltage	0.6		VIN	V
T_A	Operating ambient temperature	–40		115	°C
T_J	Operating junction temperature	–40		125	°C

ELECTRICAL CHARACTERISTICS

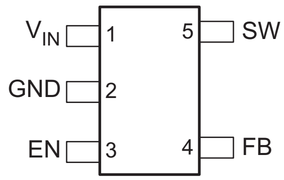
Over full operating ambient temperature range, typical values are at T_A = 25°C. Unless otherwise noted, specifications apply for condition V_{IN} = EN = 3.6V. External components C_{IN} = 4,7µF 0603, C_{OUT} = 10µF 0603, L = 2.2µH, refer to parameter measurement information.

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY							
V_{IN}	Input voltage range			2		6	V
I_{OUT}	Output current		2.3 V ≤ V_{IN} ≤ 6 V			300	mA
			2 V ≤ V_{IN} ≤ 2.3 V			150	
I_Q	Operating quiescent current		I_{OUT} = 0 mA. PFM mode enabled, device not switching		15		µA
			I_{OUT} = 0 mA. PFM mode enabled, device switching, V_{OUT} = 1.8 V, (1)		18.5		
			I_{OUT} = 0 mA, switching with no load , PWM operation , V_{OUT} = 1.8 V, V_{IN} = 3 V		3.8		mA
I_{SD}	Shutdown current		EN = GND		0.1	1	µA
			T_A = 115°C			5	µA
UVLO	Undervoltage lockout threshold		Falling		1.85		V
			Rising		1.95		
ENABLE, MODE							
V_{IH}	High level input voltage, EN		2 V ≤ V_{IN} ≤ 6 V	1		V_{IN}	V
V_{IL}	Low level input voltage, EN		2 V ≤ V_{IN} ≤ 6 V	0		0.4	V
			T_A = 115°C			0.35	V
I_{IN}	Input bias current, EN		EN		0.01	1	µA
POWER SWITCH							
$R_{DS(on)}$	High side MOSFET on-resistance		V_{IN} = V_{GS} = 3.6 V, T_A = 25°C		240	480	mΩ
	Low side MOSFET on-resistance				180	380	
I_{LIMF}	Forward current limit MOSFET high-side and low side		VIN = VGS = 3.6 V, T_A= 25°C	0.56	0.7	0.84	A
			T_A = –40°C to 115°C	0.54		0.95	
TSD	Thermal shutdown		Increasing junction temperature	135	150	165	°C
	Thermal shutdown hysteresis		Decreasing junction temperature	12	14	16	°C
OSCILLATOR							
f_{SW}	Oscillator frequency		2 V ≤ V_{IN} ≤ 6 V	2	2.25	2.5	MHz
OUTPUT							
V_{OUT}	Output voltage				1.2		V
V_{ref}	Reference voltage		T_A = 25°C	0.594	600	0.606	mV
V_{FB}	Feedback voltage		PWM operation, 2 V ≤ V_{IN} ≤ 6 V, in fixed output voltage versions V_{FB} = V_{OUT}, See (2)	–1.5%	0%	1.5%	
			T_A = 115°C	–1.5%		2.5%	
	Feedback voltage PFM mode		Device in PFM mode		0%		
	Load regulation				-0.5		%/A
$t_{Start\ Up}$	Start-up Time		Time from active EN to reach 95% of V_{OUT} nominal		500		µs
t_{Ramp}	V_{OUT} ramp UP time		Time to ramp from 5% to 95% of V_{OUT}		250		µs
I_{lkg}	Leakage current into SW pin		V_{IN} = 3.6 V, V_{IN} = V_{OUT} = V_{SW}, EN = GND, (3)		0.1	1	µA
			T_A = 115°C			10	

(1) See the parameter measurement information.
(2) for V_{IN} = V_O + 0.6
(3) In fixed output voltage versions, the internal resistor divider network is disconnected from FB pin.

PIN ASSIGNMENTS

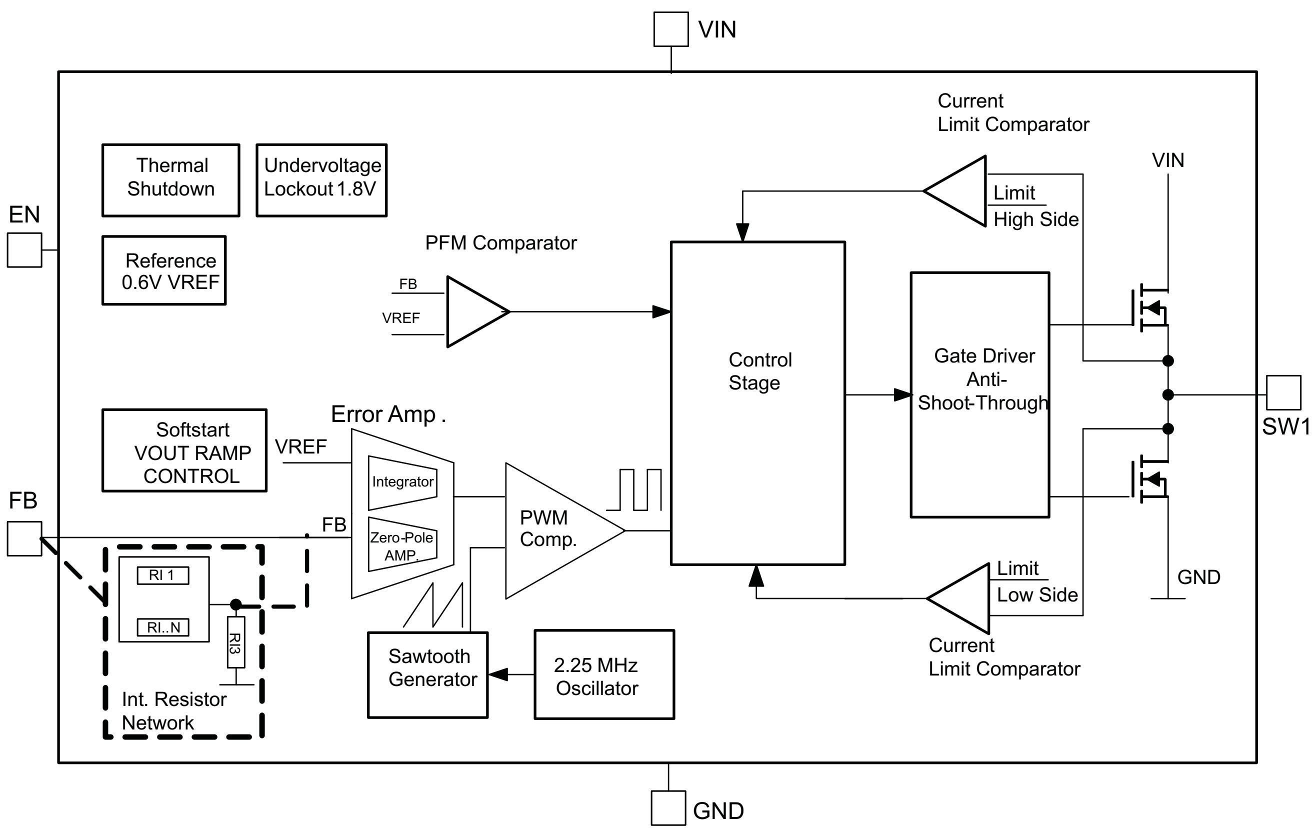
DDC PACKAGE
(TOP VIEW)



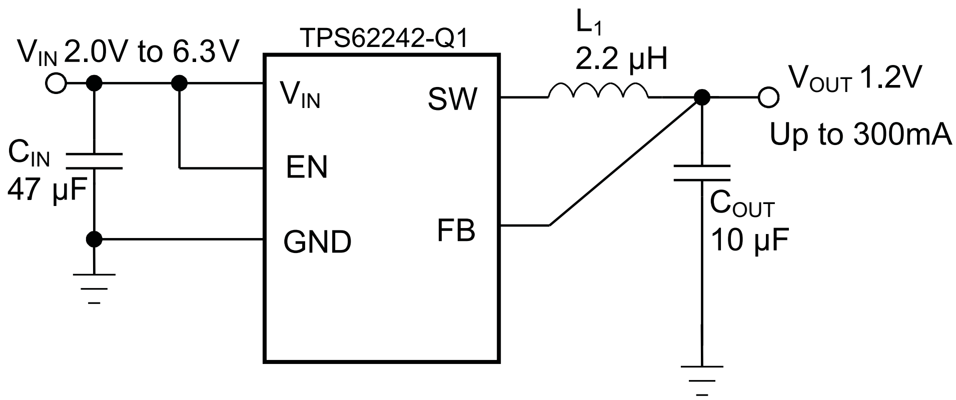
TERMINAL FUNCTIONS

TERMINAL		I/O	DESCRIPTION
NAME	NO.		
V_{IN}	1	PWR	V_{IN} power supply pin.
GND	2	PWR	GND supply pin
EN	3	I	This is the enable pin of the device. Pulling this pin to low forces the device into shutdown mode. Pulling this pin to high enables the device. This pin must be terminated.
SW	5	OUT	This is the switch pin and is connected to the internal MOSFET switches. Connect the inductor to this terminal.
FB	4	I	Feedback Pin for the internal regulation loop. Connect the external resistor divider to this pin. In case of fixed output voltage option, connect this pin directly to the output capacitor.

FUNCTIONAL BLOCK DIAGRAM



PARAMETER MEASUREMENT INFORMATION



TYPICAL CHARACTERISTICS

Table 1. Table of Graphs

		FIGURE
Efficiency	vs Output current, Power Save Mode	Figure 1
	vs Output current, Forced PWM Mode	
	vs Output current	
	vs Output current	
Output voltage accuracy	vs Output current, T_A = 25°C	Figure 3
	vs Output current, T_A = –40°C	Figure 4
	vs Output current, T_A = 85°C	Figure 5
	vs Output current, T_A = 25°C	
	vs Output current, T_A = 85°C	
	vs Output current, T_A = –40°C	
Startup timing		Figure 6
Typical operation	PWM Mode with V_O = 1.8V	Figure 7
	PFM Mode with V_O = 1.8V	Figure 8
	PFM Mode Ripple	Figure 9
PFM load transient	1 mA to 50 mA with V_O = 1.8V	Figure 10
	20 mA to 200 mA with V_O = 1.8V	Figure 11
	50 mA to 200 mA with V_O = 1.8V	
PFM line transient	I_O = 50 mA, 3.6V to 4.2V	Figure 12
	I_O= 250 mA, 3.6V to 4.2V	Figure 13
Mode transition	PFM to PWM	Figure 14
	PWM to PFM	Figure 15
Shutdown Current into VIN	vs Input Voltage, (T_A = 85°C, T_A = 25°C, T_A = -40°C)	Figure 16
Quiescent Current	vs Input Voltage, (T_A = 85°C, T_A = 25°C, T_A = -40°C)	Figure 17
Static Drain-Source On-State Resistance	vs Input Voltage, (T_A = 85°C, T_A = 25°C, T_A = -40°C)	Figure 18
		Figure 19

EFFICIENCY (Power Save Mode)
vs
OUTPUT CURRENT

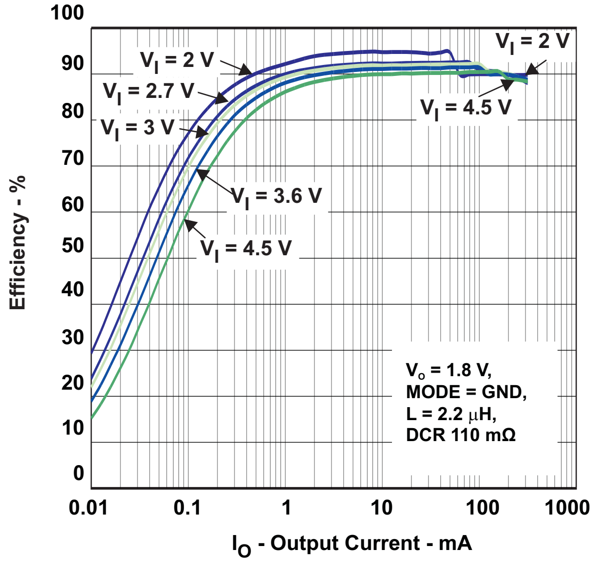


Figure 1.

EFFICIENCY
vs
OUTPUT CURRENT

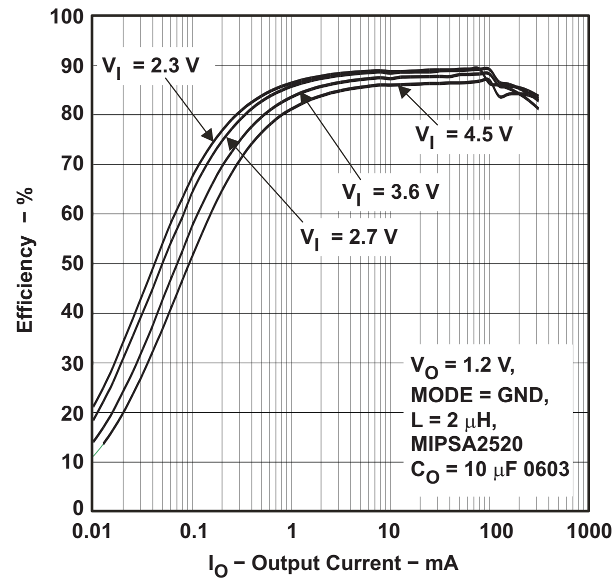


Figure 2.

OUTPUT VOLTAGE ACCURACY
vs
OUTPUT CURRENT

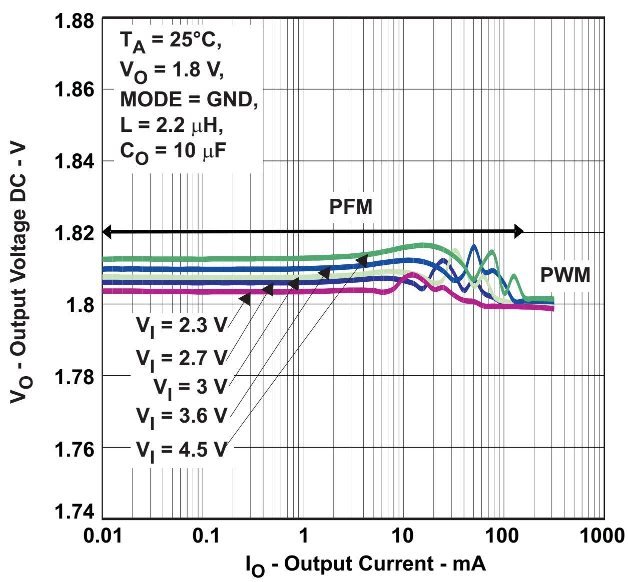


Figure 3.

OUTPUT VOLTAGE ACCURACY
vs
OUTPUT CURRENT

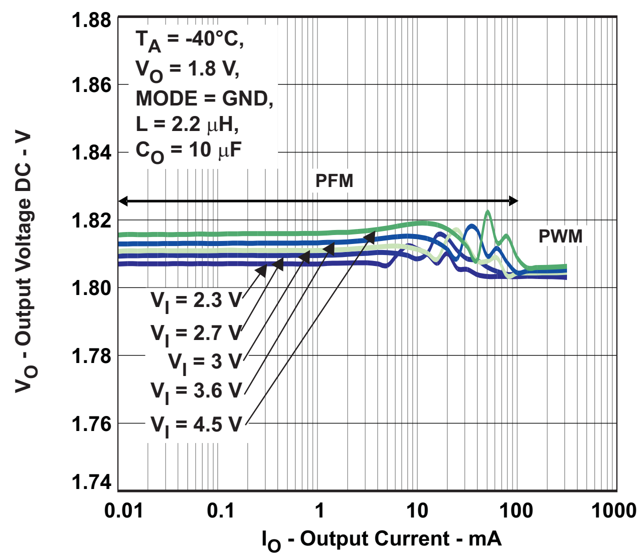


Figure 4.

OUTPUT VOLTAGE ACCURACY
vs
OUTPUT CURRENT

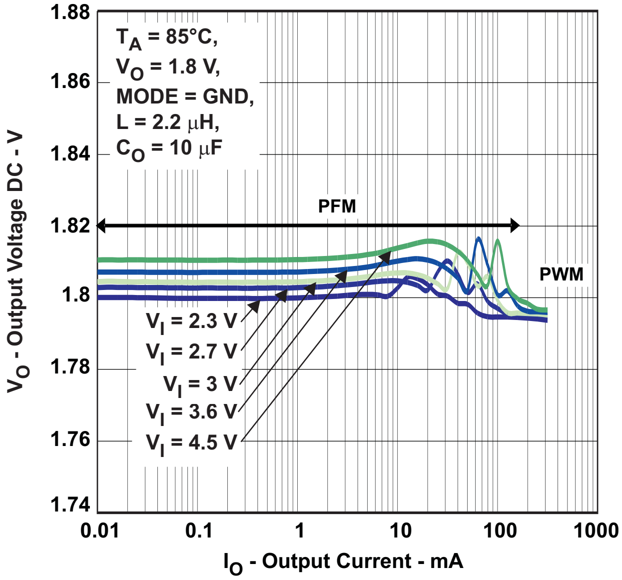


Figure 5.

STARTUP TIMING

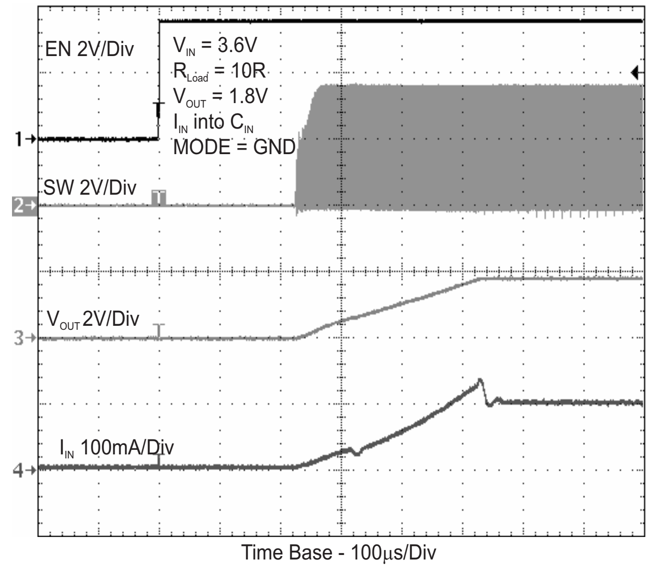


Figure 6.

TYPICAL OPERATION
vs
PWM MODE

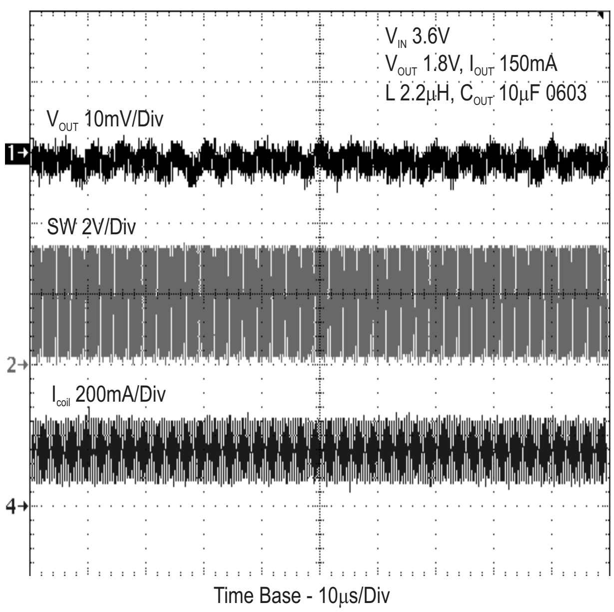


Figure 7.

TYPICAL OPERATION
vs
PFM MODE

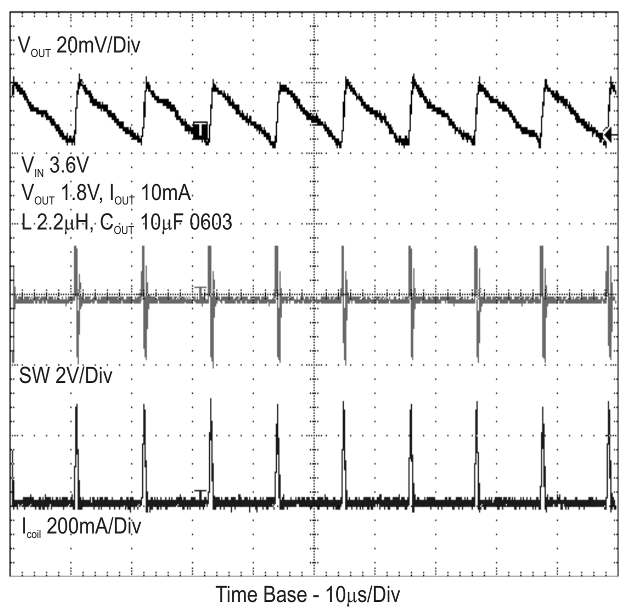


Figure 8.

PFM MODE RIPPLE

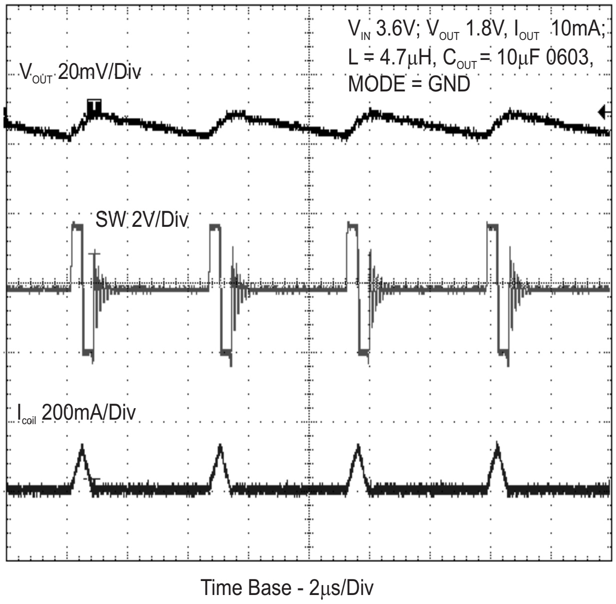


Figure 9.

PFM LOAD TRANSIENT

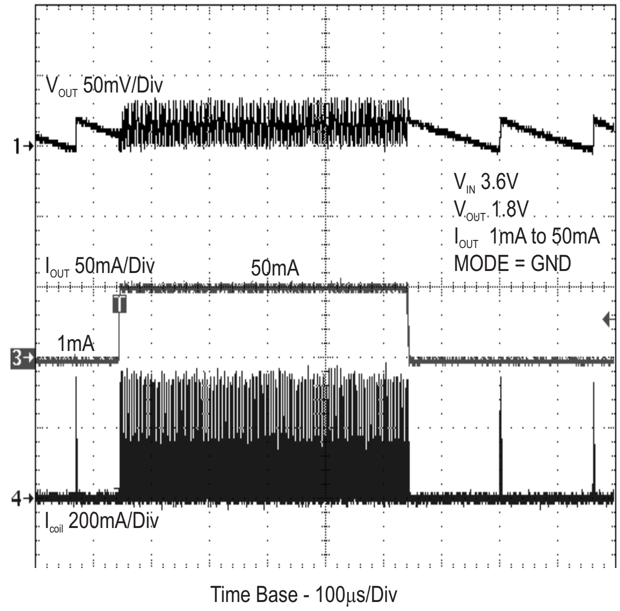


Figure 10.

PFM LOAD TRANSIENT

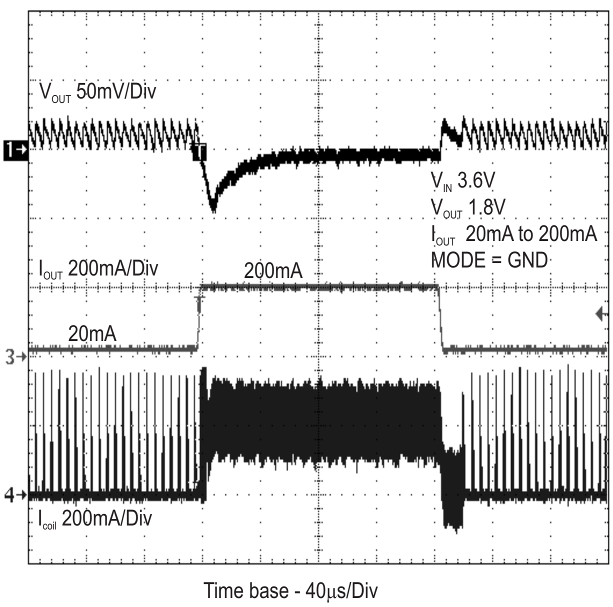


Figure 11.

PFM LINE TRANSIENT

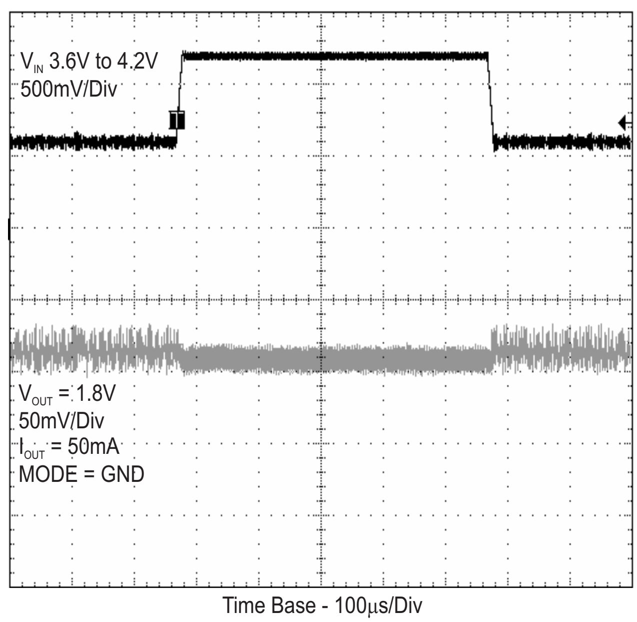


Figure 12.

PFM LINE TRANSIENT

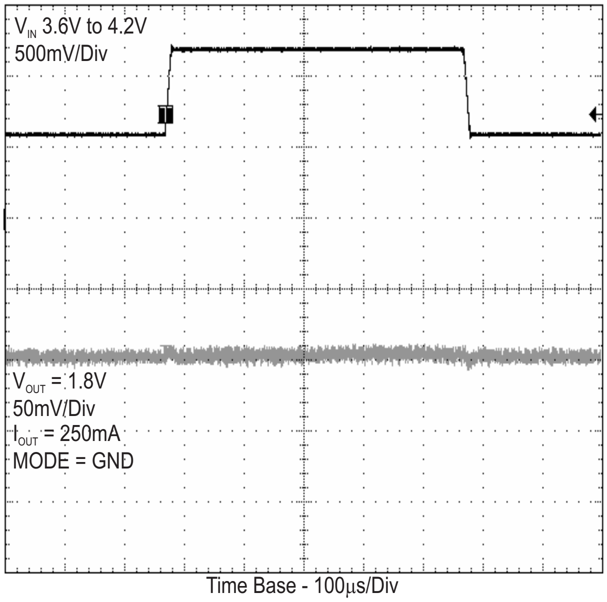


Figure 13.

MODE TRANSITION PFM to PWM

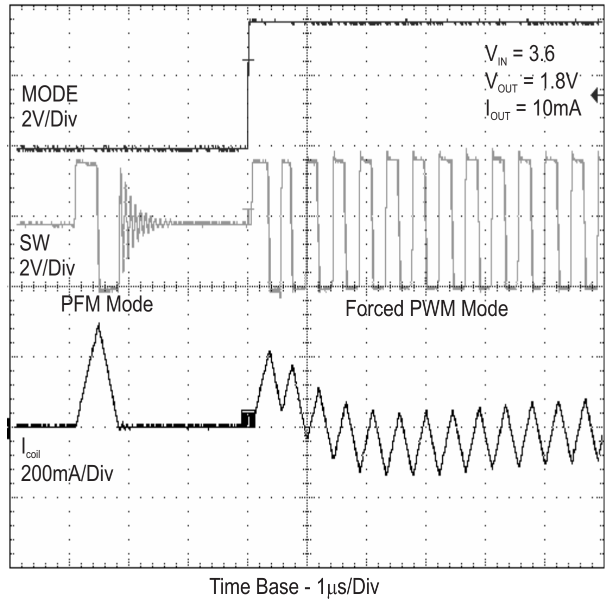


Figure 14.

MODE TRANSITION PWM to PFM

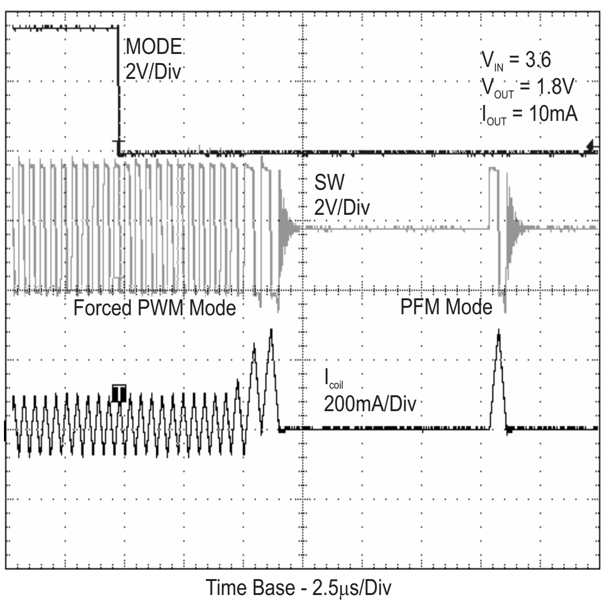


Figure 15.

SHUTDOWN CURRENT INTO VIN vs INPUT VOLTAGE

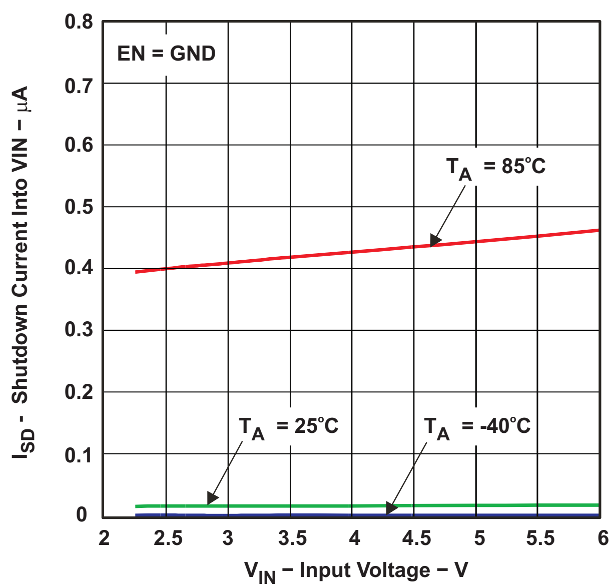


Figure 16.

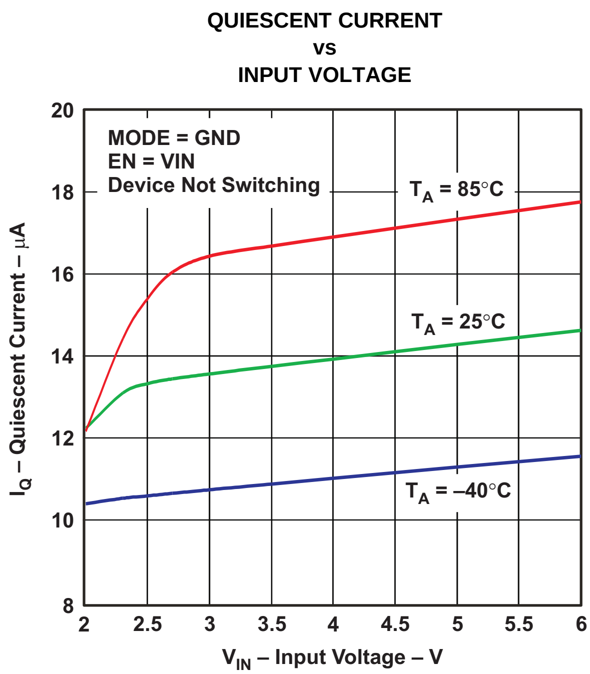


Figure 17.

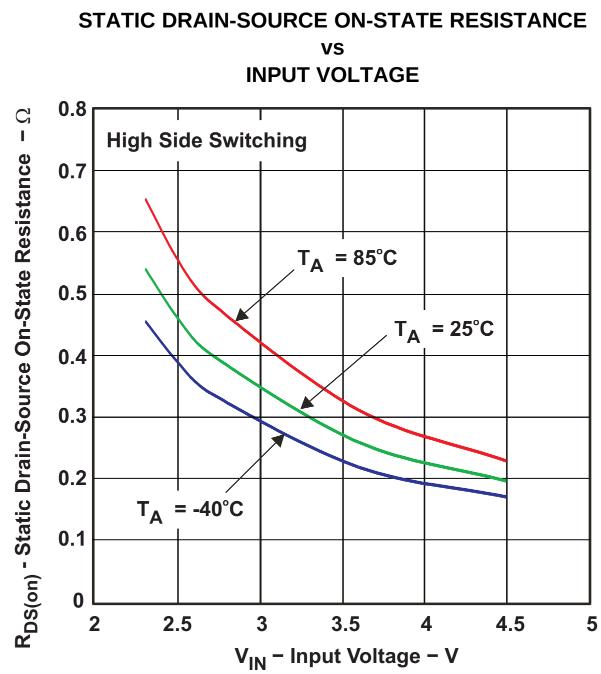


Figure 18.

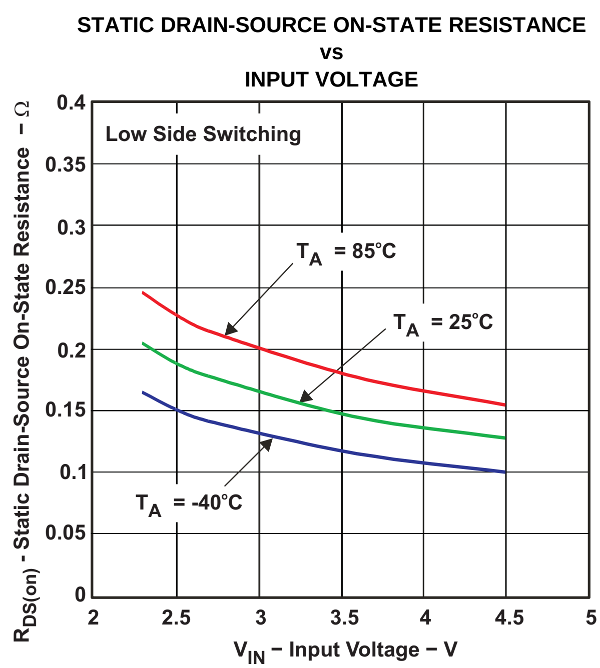


Figure 19.

DETAILED DESCRIPTION

OPERATION

The TPS62242-Q1 step down converter operates with typically 2.25MHz fixed frequency pulse width modulation (PWM) at moderate to heavy load currents. At light load currents, the converter can automatically enter Power Save Mode and operates then in PFM mode.

During PWM operation, the converter uses a unique fast response voltage mode control scheme with input voltage feed-forward to achieve good line and load regulation, allowing the use of small ceramic input and output capacitors. At the beginning of each clock cycle initiated by the clock signal, the High Side MOSFET switch is turned on. The current then flows from the input capacitor via the High Side MOSFET switch through the inductor to the output capacitor and load. During this phase, the current ramps up until the PWM comparator trips and the control logic turns off the switch. The current limit comparator also turns off the switch if the current limit of the High Side MOSFET switch is exceeded. After a dead time preventing shoot through current, the Low Side MOSFET rectifier is turned on and the inductor current ramps down. The current then flows from the inductor to the output capacitor and to the load. It returns back to the inductor through the Low Side MOSFET rectifier.

The next cycle is initiated by the clock signal again turning off the Low Side MOSFET rectifier and turning on the High Side MOSFET switch.

POWER SAVE MODE

The Power Save Mode is enabled. If the load current decreases, the converter will enter Power Save Mode operation automatically. During Power Save Mode, the converter skips switching and operates with reduced frequency in PFM mode with a minimum quiescent current to maintain high efficiency.

The transition from PWM mode to PFM mode occurs once the inductor current in the Low Side MOSFET switch becomes zero, which indicates discontinuous conduction mode.

During the Power Save Mode, the output voltage is monitored with a PFM comparator. As the output voltage falls below the PFM comparator threshold of V_{OUT} nominal, the device starts a PFM current pulse. The High Side MOSFET switch will turn on, and the inductor current ramps up. After the On-time expires, the switch is turned off and the Low Side MOSFET switch is turned on until the inductor current becomes zero.

The converter effectively delivers a current to the output capacitor and the load. If the load is below the delivered current, the output voltage will rise. If the output voltage is equal to or greater than the PFM comparator threshold, the device stops switching and enters a sleep mode with typical 15-µA current consumption.

If the output voltage is still below the PFM comparator threshold, a sequence of further PFM current pulses are generated until the PFM comparator threshold is reached. The converter starts switching again once the output voltage drops below the PFM comparator threshold.

With a fast single-threshold comparator, the output voltage ripple during PFM mode operation can be kept to a minimum. The PFM Pulse is time controlled, allowing the user to modify the charge transferred to the output capacitor by the value of the inductor. The resulting PFM output voltage ripple and PFM frequency both depend on the size of the output capacitor and the inductor value. Increasing output capacitor values and inductor values will minimize the output ripple. The PFM frequency decreases with smaller inductor values and increases with larger values.

If the output current cannot be supported in PFM mode, the device exits PFM mode and enters PWM mode.

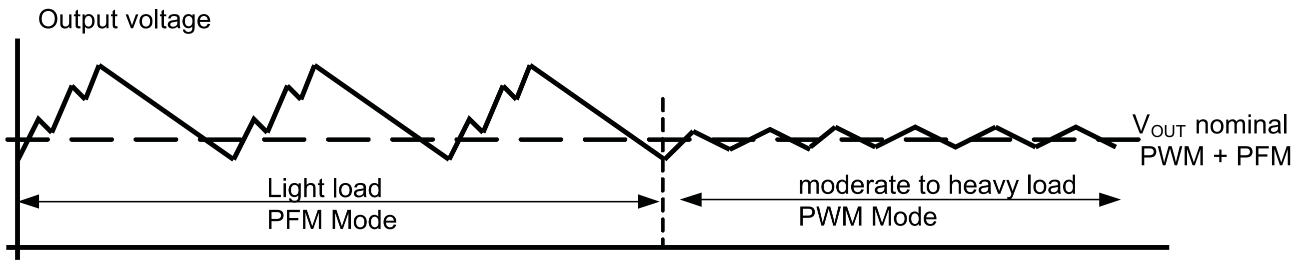


Figure 20. Power Save Mode

100% Duty Cycle Low Dropout Operation

The device starts to enter 100% duty cycle mode once the input voltage comes close to the nominal output voltage. In order to maintain the output voltage, the High Side MOSFET switch is turned on 100% for one or more cycles.

With further decreasing V_{IN} the High Side MOSFET switch is turned on completely. In this case the converter offers a low input-to-output voltage difference. This is particularly useful in battery-powered applications to achieve longest operation time by taking full advantage of the entire battery voltage range.

The minimum input voltage to maintain regulation depends on the load current and output voltage, and can be calculated as:

$$V_{IN}min = V_{O}max + I_{O}max \times ®_{DSo(n)}max + R_{L})$$

With:

$I_{O}max$ = maximum output current plus inductor ripple current
$R_{DS(on)}max$ = maximum P-channel switch $R_{DS(on)}$.
R_{L} = DC resistance of the inductor
$V_{O}max$ = nominal output voltage plus maximum output voltage tolerance

UNDERVOLTAGE LOCKOUT

The undervoltage lockout circuit prevents the device from malfunctioning at low input voltages and from excessive discharge of the battery and disables the output stage of the converter. The undervoltage lockout threshold is typically 1.85V with falling V_{IN}.

ENABLE

The device is enabled by setting the EN pin to high. During the start up time $t_{Start\ Up}$, the internal circuits are settled and the soft start circuit is activated. The EN input can be used to control power sequencing in a system with various dc/dc converters. The EN pin can be connected to the output of another converter, to drive the EN pin high and getting a sequencing of supply rails. With EN pin = GND, the device enters shutdown mode in which all circuits are disabled. In fixed output voltage versions, the internal resistor divider network is then disconnected from FB pin.

SOFT START

The TPS62242-Q1 has an internal soft start circuit that controls the ramp up of the output voltage. The output voltage ramps up from 5% to 95% of its nominal value within typical 250µs. This limits the inrush current in the converter during ramp up and prevents possible input voltage drops when a battery or high impedance power source is used. The soft start circuit is enabled within the start up time, $t_{Start\ up}$.

SHORT-CIRCUIT PROTECTION

The High Side and Low Side MOSFET switches are short-circuit protected with maximum switch current equal to I_{LIMF}. The current in the switches is monitored by current limit comparators. Once the current in the High Side MOSFET switch exceeds the threshold of it's current limit comparator, it turns off and the Low Side MOSFET switch is activated to ramp down the current in the inductor and High Side MOSFET switch. The High Side MOSFET switch can only turn on again, once the current in the Low Side MOSFET switch has decreased below the threshold of its current limit comparator.

THERMAL SHUTDOWN

As soon as the junction temperature, T_J, exceeds TBD(typical) the device goes into thermal shutdown. In this mode, the High Side and Low Side MOSFETs are turned off. The device continues its operation when the junctiontemperature falls below the thermal shutdown hysteresis.

APPLICATION INFORMATION

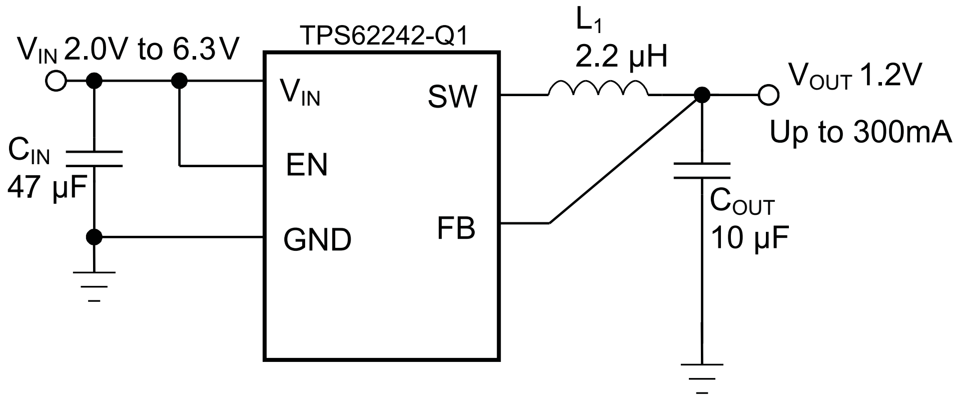


Figure 21. Fixed 1.2 V

OUTPUT FILTER DESIGN (INDUCTOR AND OUTPUT CAPACITOR)

The TPS62242-Q1 is designed to operate with inductors in the range of 1.5μH to 4.7μH and with output capacitors in the range of 4.7μF to 22μF. The part is optimized for operation with a 2.2μH inductor and 10μF output capacitor.

Larger or smaller inductor values can be used to optimize the performance of the device for specific operation conditions. For stable operation, the L and C values of the output filter may not fall below 1μH effective Inductance and 3.5μF effective capacitance. Selecting larger capacitors is less critical because the corner frequency of the L-C filter moves to lower frequencies with fewer stability problems.

Inductor Selection

The inductor value has a direct effect on the ripple current. The selected inductor must be rated for its dc resistance and saturation current. The inductor ripple current (ΔI_L) decreases with higher inductance and increases with higher V_I or V_O.

The inductor selection also has an impact on the output voltage ripple in the PFM mode. Higher inductor values will lead to lower output voltage ripple and higher PFM frequency, and lower inductor values will lead to a higher output voltage ripple but lower PFM frequency.

Equation 1 calculates the maximum inductor current in PWM mode under static load conditions. The saturation current of the inductor should be rated higher than the maximum inductor current as calculated with Equation 2. This is recommended because during heavy load transients the inductor current will rise above the calculated value.

$$\Delta I_L = Vout \times \frac{1 - \frac{Vout}{Vin}}{L \times f} \tag{1}$$

$$I_{Lmax} = I_{outmax} + \frac{\Delta I_L}{2} \tag{2}$$

With:

- f = Switching Frequency (2.25 MHz typical)
- L = Inductor Value
- ΔI_L = Peak to Peak inductor ripple current
- I_{Lmax} = Maximum Inductor current

A more conservative approach is to select the inductor current rating just for the maximum switch current limit I_{LIMF} of the converter.

Accepting larger values of ripple current allows the use of low inductance values, but results in higher output voltage ripple, greater core losses, and lower output current capability.

The total losses of the coil have a strong impact on the efficiency of the dc/dc conversion and consist of both the losses in the dc resistance ($R_{(DC)}$) and the following frequency-dependent components:

- The losses in the core material (magnetic hysteresis loss, especially at high switching frequencies)
- Additional losses in the conductor from the skin effect (current displacement at high frequencies)
- Magnetic field losses of the neighboring windings (proximity effect)
- Radiation losses

Table 2. List of Inductors

DIMENSIONS [mm³]	INDUCTANCE µH	INDUCTOR TYPE	SUPPLIER
2.5 × 2.0 × 1.0	2.0	MIPS2520D2R2	FDK
2.5 × 2.0 × 1.2	2.0	MIPSA2520D2R2	FDK
2.5x2.0x1.0	2.2	KSLI-252010AG2R2	Hitachi Metals
2.5x2.0x1.2	2.2	LQM2HPN2R2MJ0L	Murata
3 × 3 × 1.4	2.2	LPS3015	Coilcraft

Output Capacitor Selection

The advanced fast-response voltage mode control scheme of the TPS62242-Q1 allows the use of tiny ceramic capacitors. Ceramic capacitors with low ESR values have the lowest output voltage ripple and are recommended. The output capacitor requires either an X7R or X5R dielectric. Y5V and Z5U dielectric capacitors, aside from their wide variation in capacitance over temperature, become resistive at high frequencies.

At nominal load current, the device operates in PWM mode and the RMS ripple current is calculated as:

$$I_{RMSCout} = Vout \times \frac{1 - \frac{Vout}{Vin}}{L \times f} \times \frac{1}{2 \times \sqrt{3}} \tag{3}$$

At nominal load current, the device operates in PWM mode and the overall output voltage ripple is the sum of the voltage spike caused by the output capacitor ESR plus the voltage ripple caused by charging and discharging the output capacitor:

$$\Delta Vout = Vout \times \frac{1 - \frac{Vout}{Vin}}{L \times f} \times \left(\frac{1}{8 \times Cout \times f} + ESR\right) \tag{4}$$

At light load currents, the converter operates in Power Save Mode and the output voltage ripple depends on the output capacitor and inductor value. Larger output capacitor and inductor values minimize the voltage ripple in PFM mode and tighten dc output accuracy in PFM mode.

Input Capacitor Selection

The buck converter has a natural pulsating input current; therefore, a low ESR input capacitor is required for best input voltage filtering, and minimizing the interference with other circuits caused by high input voltage spikes. For most applications, a 4.7-µF to 10-µF ceramic capacitor is recommended. Because ceramic capacitors lose up to 80% of their initial capacitance at 5V, it is recommended that a 10-µF input capacitor be used for input voltages greater than 4.5V. The input capacitor can be increased without any limit for better input voltage filtering.

Take care when using only small ceramic input capacitors. When a ceramic capacitor is used at the input, and the power is being supplied through long wires, such as from a wall adapter, a load step at the output, or VIN step on the input, can induce ringing at the VIN pin. The ringing can couple to the output and be mistaken as loop instability, or could even damage the part by exceeding the maximum ratings

Table 3. List of Capacitors

CAPACITANCE	TYPE	SIZE	SUPPLIER
4.7µF	GRM188R60J475K	0603: 1.6x0.8x0.8mm³	Murata
10µF	GRM188R60J106M69D	0603: 1.6x0.8x0.8mm³	Murata

LAYOUT CONSIDERATIONS

As for all switching power supplies, the layout is an important step in the design. Proper function of the device demands careful attention to PCB layout. Care must be taken in board layout to get the specified performance. If the layout is not carefully done, the regulator could show poor line and/or load regulation, and additional stability issues as well as EMI problems. It is critical to provide a low inductance, impedance ground path. Therefore, use wide and short traces for the main current paths. The input capacitor should be placed as close as possible to the IC pins as well as the inductor and output capacitor.

Connect the GND pin of the device to the PowerPAD™ land of the PCB and use this pad as a star point. Use a common Power GND node and a different node for the Signal GND to minimize the effects of ground noise. Connect these ground nodes together to the PowerPAD land (star point) underneath the IC. Keep the common path to the GND pin, which returns the small signal components, and the high current of the output capacitors as short as possible to avoid ground noise. The FB line should be connected right to the output capacitor and routed away from noisy components and traces (for example, the SW line).

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
TPS62242QDDCRQ1	ACTIVE	SOT	DDC	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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OTHER QUALIFIED VERSIONS OF TPS62242-Q1 :

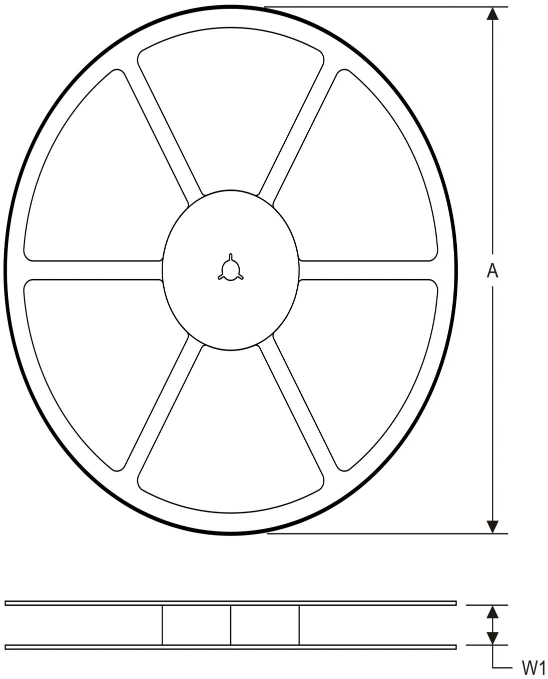
- Catalog: TPS62242

NOTE: Qualified Version Definitions:

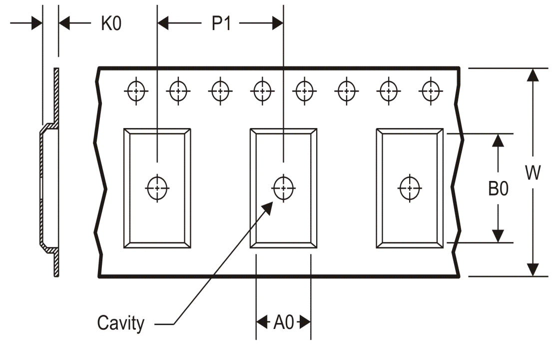
- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



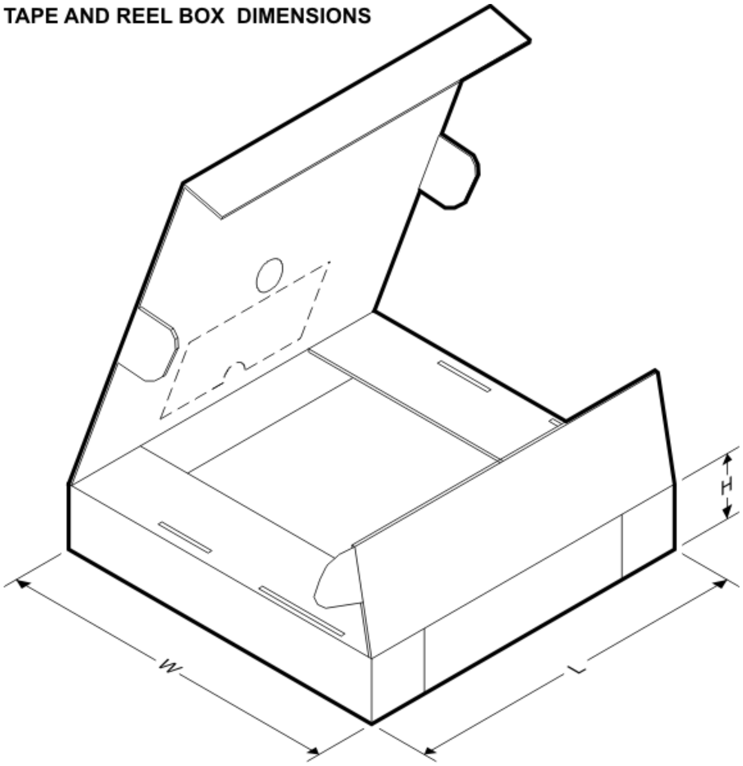
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS62242QDDCRQ1	SOT	DDC	5	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

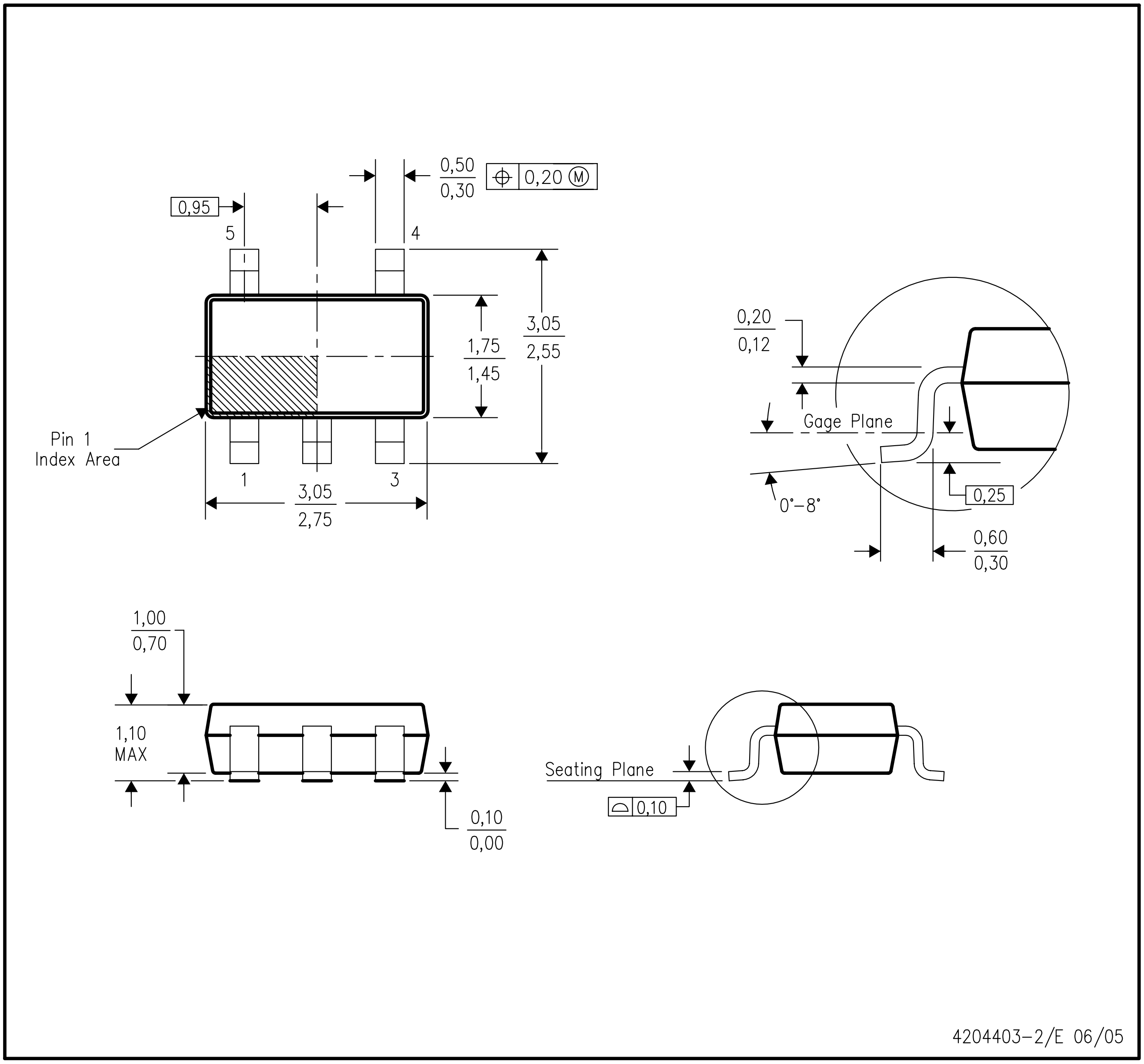
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS62242QDDCRQ1	SOT	DDC	5	3000	203.0	203.0	35.0

DDC (R–PDSO–G5) PLASTIC SMALL–OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO–193 variation AB (5 pin).

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