MPQ9361

Industrial Grade, High Performance Regulated Charge Pump

The Future of Analog IC Technology

DESCRIPTION

The MPQ9361 is a high performance, regulated charge pump converter. Its input voltage ranges from 2.8V to Vout. The output voltage is regulated to a fixed 5V. No external inductor is required for simplicity and compactness. Internal soft-start circuit effectively reduces the in-rush current both while start-up and mode change.

The MPQ9361 is available in a compact TSOT23-6 package

FEATURES

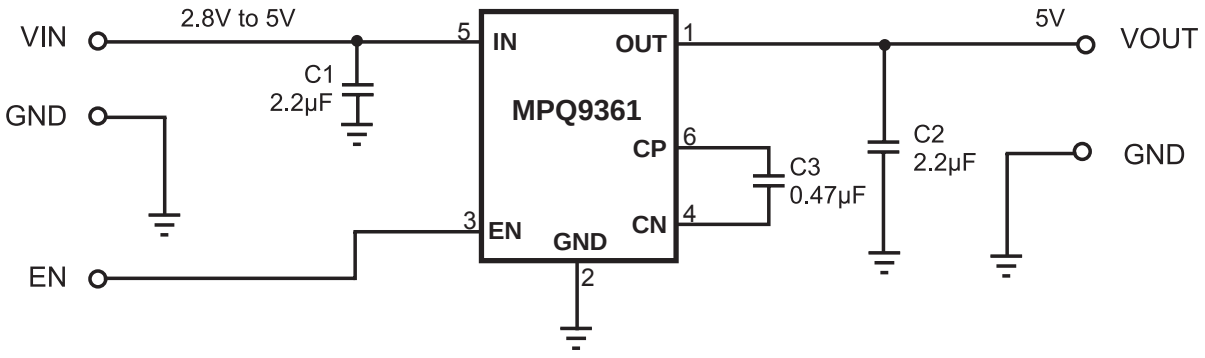
- Guaranteed Industrial Temp Range Limits
- Input Voltage Range: 2.8V to 5V
- Internal Soft-Start
- Output Maximum Current up to 110mA
- Fixed 5V Output Voltage with 30mV Ripple
- 2X Charge Pump
- Fixed 1.35MHz Switching Frequency
- Over Current Protection
- Short Circuit Protection
- In-rush Current limit
- TSOT23-6 package and Lead (pb)-Free

APPLICATIONS

- Cell phone, Smart phone, LED backlight
- PDA or hand Held Computer
- Camera Flash White LED
- LCD Display Supply
- TV-Remote Control

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TYPICAL APPLICATION



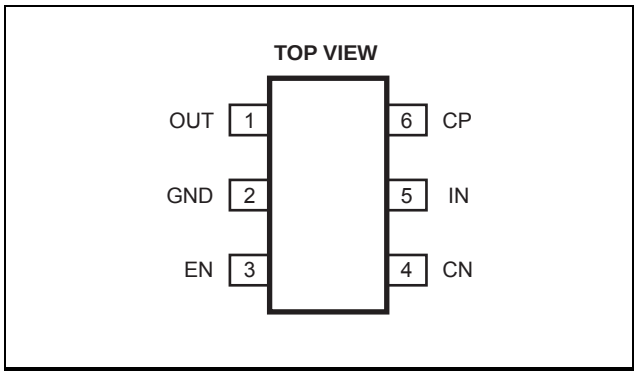
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ORDERING INFORMATION

Part Number*	Package	Top Marking	Free Air Temperature (T_A)
MPQ9361DJ	TSOT23-6	U2	-40°C to +85°C

***** For Tape & Reel, add suffix –Z (e.g. MP MPQ9361DJ–Z);
For RoHS compliant packaging, add suffix –LF (e.g. MPQ9361DJ–LF–Z)

PACKAGE REFERENCE



ABSOLUTE MAXIMUM RATINGS (1)

Supply Input Voltage.....-0.3V to +6.0V
All Other Pins.....-0.3V to +6.0V
Storage Temperature..... -65°C to +150°C
Continuous Power Dissipation (T_A = +25°C) (2)
..... 0.64W
Junction Temperature.....+150°C
Lead Temperature .....+260°C

Recommended Operating Conditions (3)

Supply Voltage V_{IN} .....2.8V to 5.0V
Output Voltage V_{OUT}..... 5.0V
Operating Junct. Temp (T_J)..... -40°C to +125°C

Thermal Resistance (4)	θ_{JA}	θ_{JC}
TSOT23-6	195	25 °C/W

Notes:

1) Exceeding these ratings may damage the device.
2) The maximum allowable power dissipation is a function of the maximum junction temperature T_J(MAX), the junction-to-ambient thermal resistance θ_{JA}, and the ambient temperature T_A. The maximum allowable continuous power dissipation at any ambient temperature is calculated by P_D(MAX)=(T_J(MAX)-T_A)/θ_{JA}. Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.
3) The device is not guaranteed to function outside of its operating conditions.
4) Measured on JESD51-7 4-layer board.

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ELECTRICAL CHARACTERISTICS

V_{IN}=3.7V, C_{IN}=C_{OUT}=2.2uF, C_P=0.22µF, T_A=-40°C to +85°C. Typical values are at T_A=25°C, unless otherwise noted.

Parameter	Symbol	Condition		Min	Typ	Max	Units
Input Supply Voltage	V_{IN}			2.8		5	V
Output Voltage	V_{OUT}	V_{IN}>3.2V, I_{OUT}<110mA	T_A =25°C	4.8	5	5.2	V
			-40°C ≤ T_A ≤ +85°C	4.6	5	5.2	
Quiescent Current	I_Q	I_{OUT}=0			2	4	mA
Maximum Output Current	I_O	V_{IN}>3.2V		110			mA
Over Current Protection	I_{OCP}	V_{OUT}=5V		250	350	500	mA
Short Circuit Protection	I_{SHORT}	T_A =25°C			60	90	mA
		-40°C ≤ T_A ≤ +85°C			60	150	
Output Ripple		I_{OUT}=60mA			30		mV
Shut Down Current	I_{SHDN}	V_{IN}=4.5V, V_{EN}<0.4V			0.1	1	µA
Operation Frequency	F_{OSC}			1.1	1.35	1.6	MHz
Enable Voltage, High	V_{EN} (HIGH)				1.5		V
Enable Voltage, Low	V_{EN} (LOW)				0.4		V
Enable Pin Leakage	I_{EN}	V_{EN}=5V			0.2	1	µA

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PIN FUNCTIONS

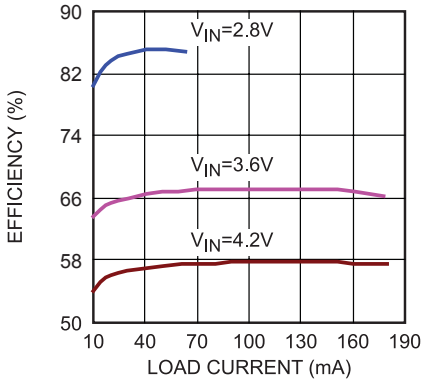
Pin #	Name	Description
1	OUT	Output Voltage. Decoupled with a 2.2µF ceramic capacitor for a load current less than 60mA. For a load current greater than 60mA, use 10µF decoupling capacitor.
2	GND	Ground.
3	EN	Device Enable: A logic high input (V_{EN}>1.5V) turns on the regulator. A logic low input (V_{EN}>0.4V)
4	CN	Flying Capacitor Negative Terminal.
5	IN	Input.
6	CP	Flying Capacitor Positive Terminal.

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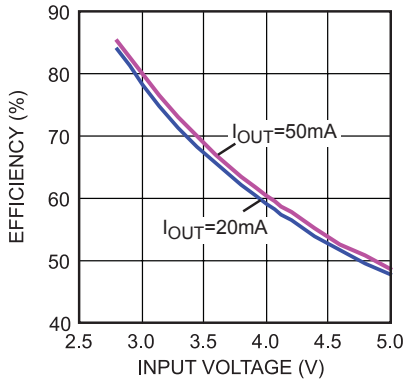
TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN}=3.7V, V_{OUT}=5V, C1=C2=2.2µF, C3=0.47µF. T_A=25ºC, unless otherwise noted.

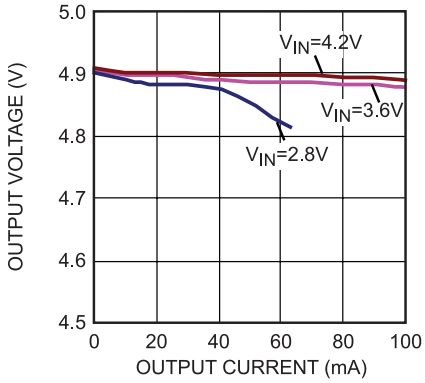
Efficiency vs. Load Current



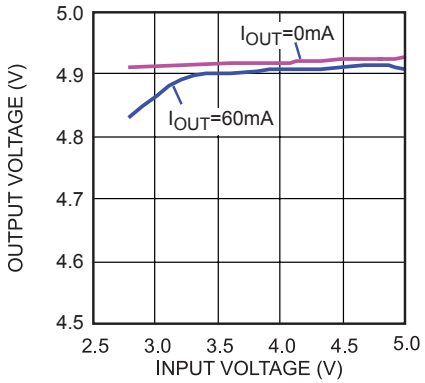
Efficiency vs. Input Voltage



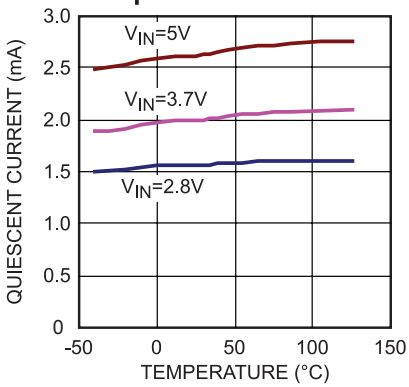
Load regulation



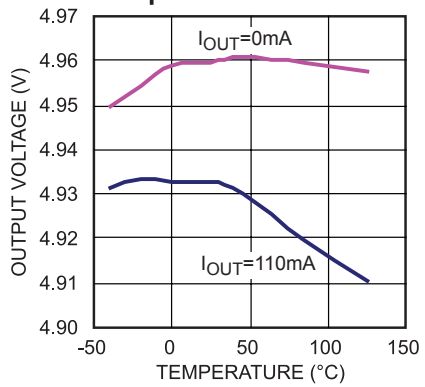
Line Regulation



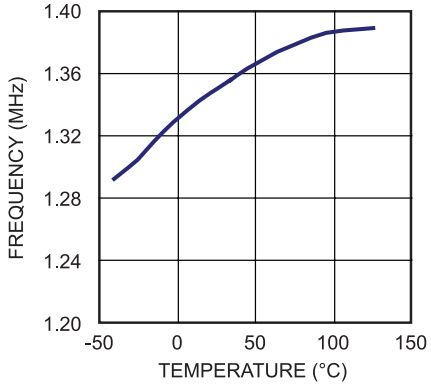
Quiescent Current vs. Temperature



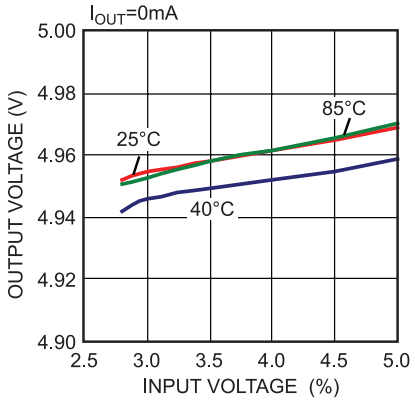
Output Voltage vs. Temperature



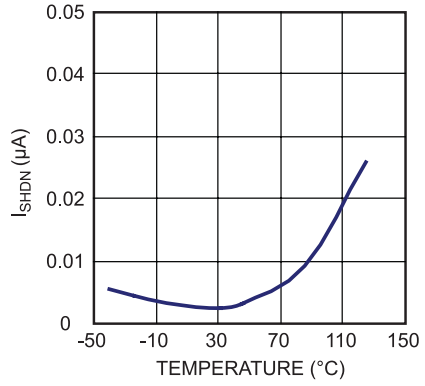
Frequency vs. Temperature



Line Regulation vs. Temperature



Shut Down Current vs. Temperature



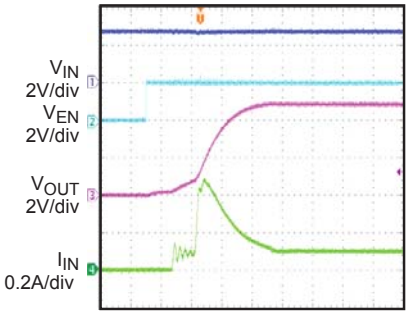
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TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN}=3.7V, V_{OUT}=5V, C1=C2=2.2µF, C3=0.47µF. T_A=25ºC, unless otherwise noted. (*continued*)

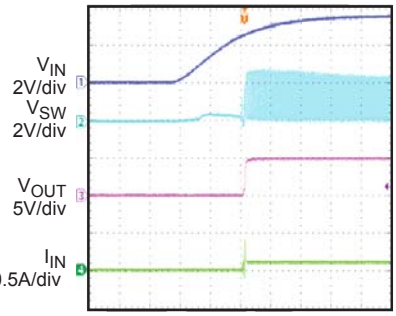
Inrush Current

V_{IN}=2.8V, I_{OUT}=64mA
with resistor load



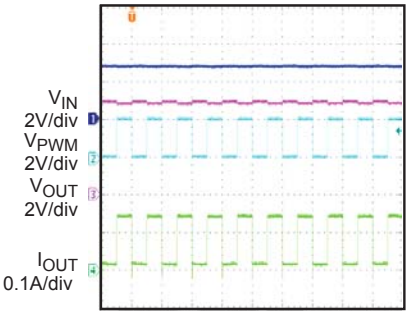
Inrush Current

V_{GN}=V_{IN}=3.6V, I_{OUT}=64mA
with resistor load



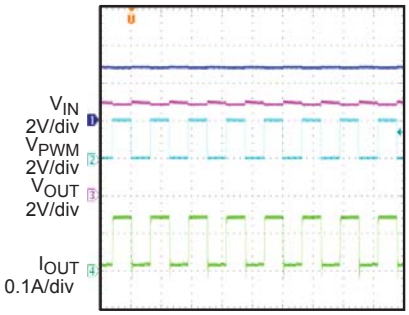
Load PWM Dimming Operation

V_{EN}=V_{IN}=2.8V, F_{PWM}=100HZ



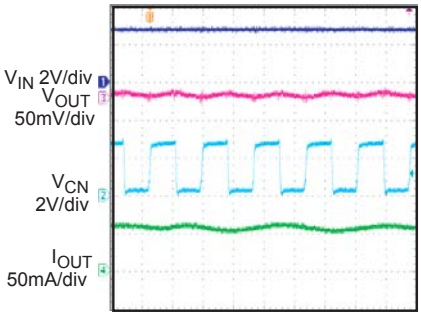
Load PWM Dimming Operation

V_{EN}=V_{IN}=2.8V, F_{PWM}=2KHZ



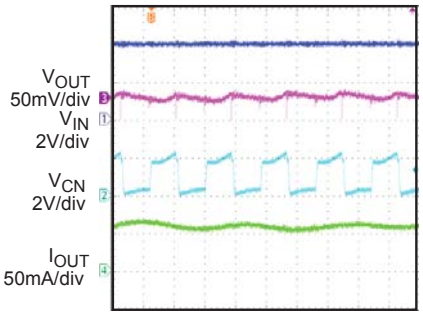
Normal Load Ripple

V_{EN}=V_{IN}=2.8V, V_{OUT}=5V, I_{OUT}=60mA



Normal Load Ripple

V_{IN}=V_{EN}=4V, I_{OUT}=60mA



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OPERATION

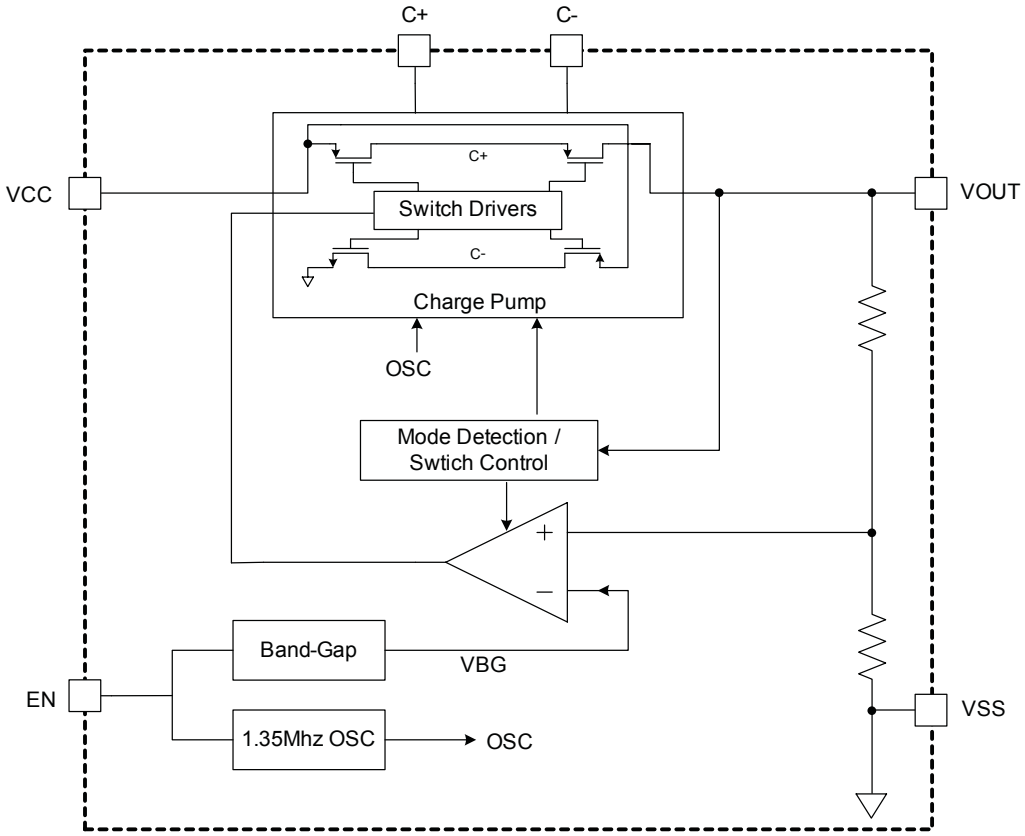


Figure 1— Functional Block Diagram

The MPQ9361 uses a switched capacitor charge pump to boost an input voltage to a regulated output voltage. Regulation is achieved by sensing the charge pump output voltage through an internal resistor divider network. A switched doubling circuit is enabled when the divided output drops below a preset trip point controlled by an internal comparator.

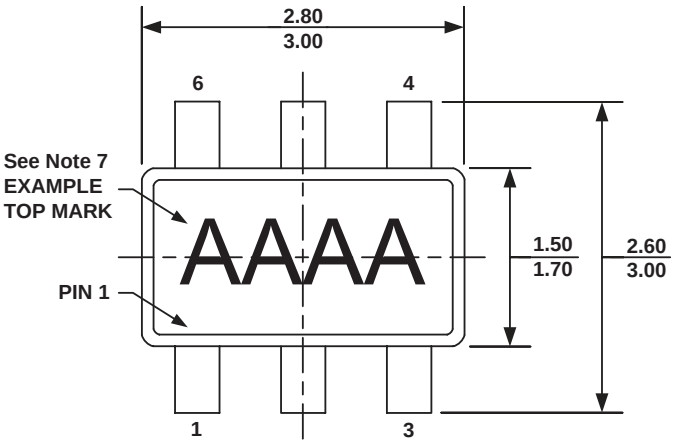
The switching signal, which drives the charge pump, is created by an integrated oscillator within the control circuit block. The fixed charge pump switching frequency is approximately 1.35MHz.

The MPQ9361 has complete output short-circuit and thermal protection to safeguard the device under extreme operating conditions. An internal thermal protection circuit senses die temperature and will shut down the device if the internal junction temperature exceeds approximately 145°C. The charge pump will remain disabled until the fault condition is relieved.

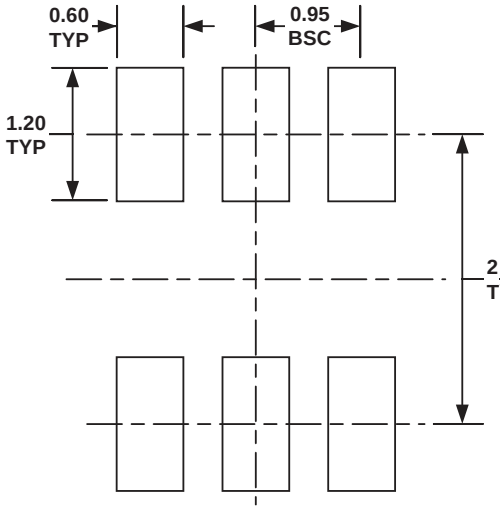
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PACKAGE INFORMATION

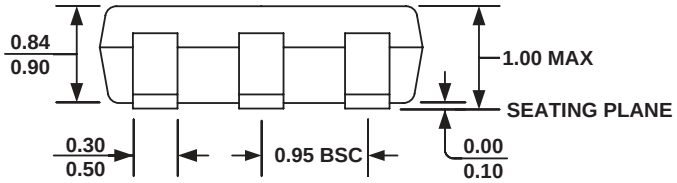
TSOT23-6



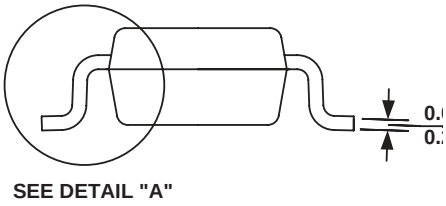
TOP VIEW



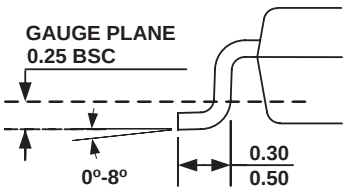
RECOMMENDED LAND PATTERN



FRONT VIEW



SIDE VIEW



DETAIL A

NOTE:

1) ALL DIMENSIONS ARE IN MILLIMETERS.
2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH PROTRUSION OR GATE BURR.
3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FL OR PROTRUSION.
4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FOI SHALL BE 0.10 MILLIMETERS MAX.
5) DRAWING CONFORMS TO JEDEC MO-193, VARIATION
6) DRAWING IS NOT TO SCALE.
7) PIN 1 IS LOWER LEFT PIN WHEN READING TOP MARK LEFT TO RIGHT, (SEE EXAMPLE TOP MARK)

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