MCP1252/3

Low Noise, Positive-Regulated Charge Pump

Features

- Inductorless, Buck/Boost, DC/DC Converter
- Low Power: 80 µA (Typical)
- High Output Voltage Accuracy:
  - ±2.5% (V_{OUT} Fixed)
- 120 mA Output Current
- Wide Operating Temperature Range:
  - -40°C to +85°C
- Thermal Shutdown and Short-Circuit Protection
- Uses Small Ceramic Capacitors
- Switching Frequency:
  - MCP1252: 650 kHz
  - MCP1253: 1 MHz
- Low Power Shutdown Mode: 0.1 µA (Typical)
- Shutdown Input Compatible with 1.8V Logic
- V_{IN} Range: 2.0V to 5.5V
- Selectable Output Voltage (3.3V or 5.0V) or Adjustable Output Voltage
- Space-saving, 8-Lead MSOP
- Soft-Start Circuitry to Minimize In-Rush Current

Applications

- White LED Backlighting
- Color Display Bias
- Local 3V-to-5V Conversions
- Flash Memory Supply Voltage
- SIM Interface Supply for GSM Phones
- Smart Card Readers
- PCMCIA Local 5V Supplies

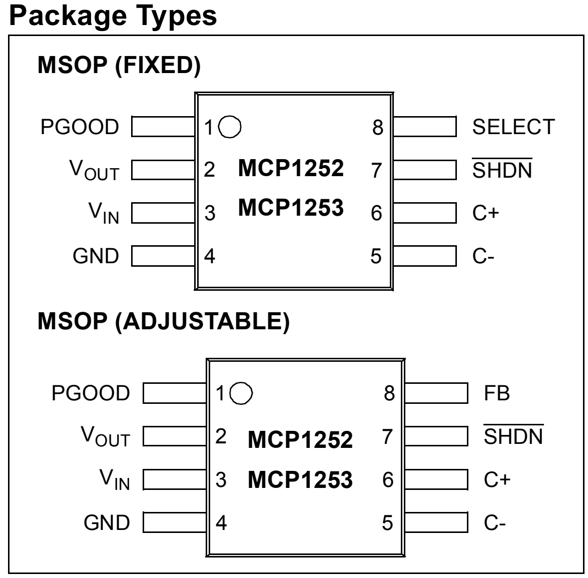
Description

The MCP1252/3 are inductorless, positive-regulated charge pump DC/DC converters. The devices generate a regulated fixed (3.3V or 5.0V) or adjustable output voltage. They are specifically designed for applications requiring low noise and high efficiency and are able to deliver up to 120 mA output current. The devices allow the input voltage to be lower or higher than the output voltage, by automatically switching between buck/boost operation.

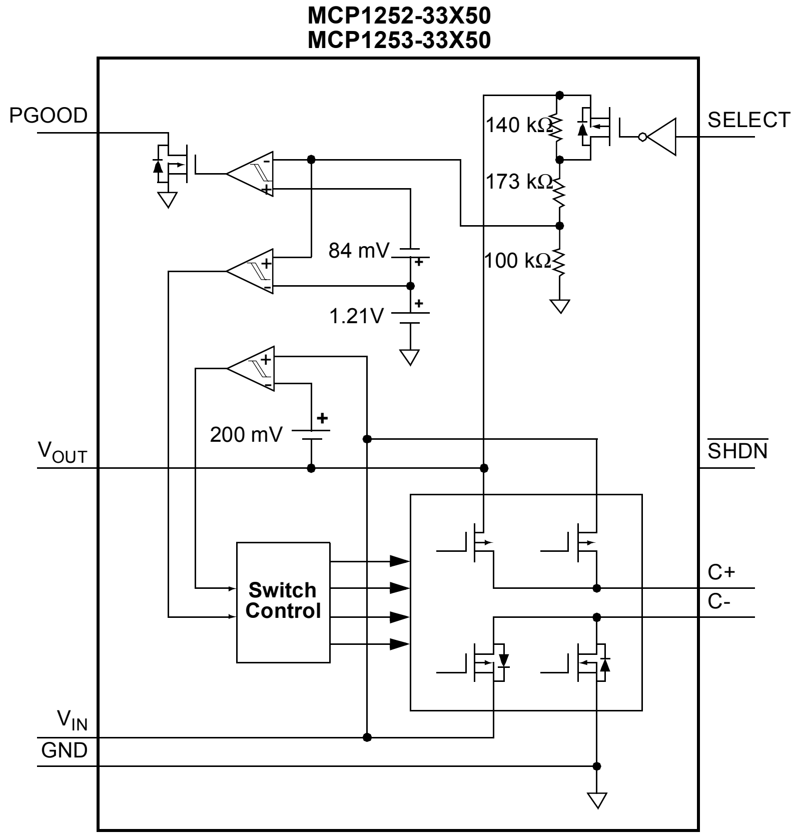
The MCP1252 has a switching frequency of 650 kHz, avoiding interference with sensitive IF bands. The MCP1253 has a switching frequency of 1 MHz and allows the use of smaller capacitors than the MCP1252, thus saving board space and cost.

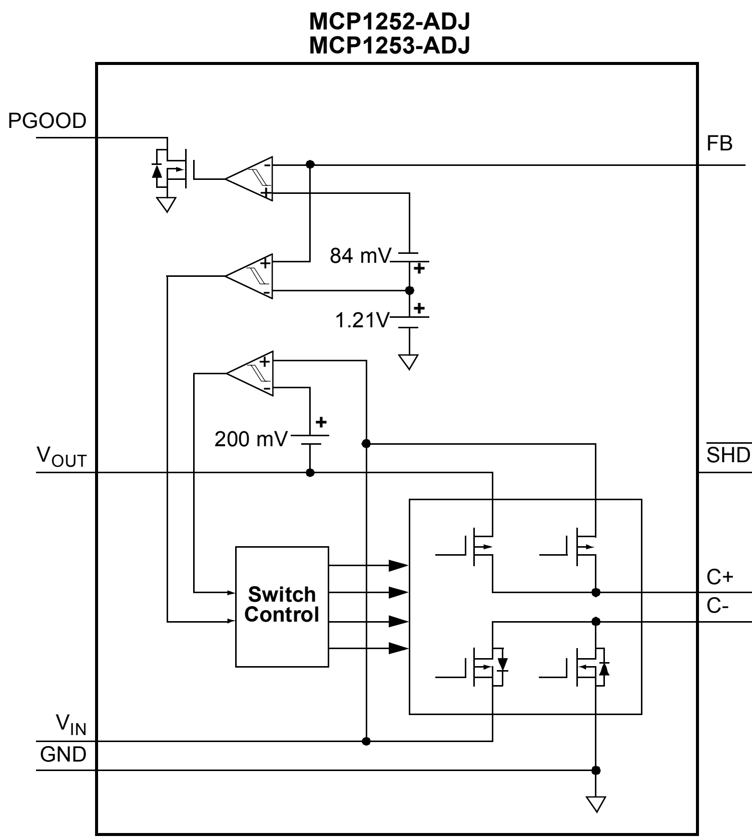
Both devices feature a power-good output that can be used to detect out-of-regulation conditions. Extremely low supply current and low external parts count (three capacitors) make these devices ideal for small, battery-powered applications. A shutdown mode is also provided for further power reduction. The MCP1252 and MCP1253 feature thermal and short-circuit protection and are offered in space-saving, 8-lead, MSOP packages.

Package Types



Functional Block Diagram





1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Power Supply Voltage, V_{IN} 6.0V
Voltage on Any Pin w.r.t. GND .... -0.3V to (V_{IN} + 0.3V)
Output Short Circuit Duration ....continuous
Storage Temperature Range.........................-65°C to +150°C
Ambient Temperature with Power Applied ....-55°C to +125°C
Junction Temperature ....+150°C
ESD Ratings:
Human Body Model (1.5 kΩ in Series with 100 pF ......≥ 4 kV
Machine Body Model (200 pF, No Series Resistance ≥ 400V

†Notice: Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

PIN FUNCTION TABLE

Name	Function
PGOOD	Open-Drain Power GOOD Output
V_{OUT}	Regulated Output Voltage
V_{IN}	Power Supply Input
GND	Ground Terminal
C-	Flying Capacitor Negative Terminal
C+	Flying Capacitor Positive Terminal
$\overline{SHDN}$	Shutdown Mode, Active-Low Input
SELECT	Output Voltage Select Pin. (MCP1252-33X50, MCP1253-33X50)
FB	Feedback Input Pin for Adjustable Output (MCP1252-ADJ, MCP1253-ADJ)

ELECTRICAL CHARACTERISTICS

Electrical Specifications: Unless otherwise specified, all limits are specified for T_A = -40°C to +85°C, $\overline{SHDN}$ = V_{IN}, C_{IN} = C_{OUT} = 10 µF, C_{FLY} = 1 µF, I_{OUT} = 10 mA. Typical values are for T_A = +25°C.

Parameters	Sym	Min	Typ	Max	Units	Conditions
Selectable Output - MCP1252-33X50, MCP1253-33X50: SELECT = V_{IN}, V_{OUT} = 3.3V						
Supply Voltage	V_{IN}	2.1	—	5.5	V	
Output Voltage Accuracy	V_{OUT}	-2.5	+/-0.5	+2.5	%	2.3V ≤ V_{IN} < 2.5V, I_{OUT} ≤ 80 mA 2.5V ≤ V_{IN} ≤ 5.5V, I_{OUT} ≤ 120 mA
Output Current	I_{OUT}	80 120	100 150	—	mA mA	2.3V ≤ V_{IN} < 2.5V 2.5V ≤ V_{IN} ≤ 5.5V
SELECT Logic Input Voltage High	V_{IH}	1.4	—	—	V	MCP1252-33X50, MCP1253-33X50
Selectable Output - MCP1252-33X50, MCP1253-33X50: SELECT = GND, V_{OUT} = 5.0V						
Supply Voltage	V_{IN}	2.7	—	5.5	V	
Output Voltage Accuracy	V_{OUT}	-2.5	+/-0.5	+2.5	%	2.7V ≤ V_{IN} < 3.0V, I_{OUT} ≤ 40 mA 3.0V ≤ V_{IN} ≤ 5.5V, I_{OUT} ≤ 120 mA
Output Current	I_{OUT}	40 120	80 150	—	mA mA	2.7V ≤ V_{IN} < 3.0V 3.0V ≤ V_{IN} ≤ 5.5V
SELECT Logic Input Voltage Low	V_{IL}	—	—	0.4	V	MCP1252-33X50, MCP1253-33X50
Adjustable Output - MCP1252-ADJ, MCP1253-ADJ						
Supply Voltage	V_{IN}	2.0	—	5.5	V	
Output Voltage Adjustment Range	V_{OUT}	1.5	—	5.5	V	$V_{OUT(MAX)}$ < 2 x V_{IN}
FB Regulation Voltage	V_{FB}	1.18	1.21	1.24	V	MCP1252-ADJ, MCP1253-ADJ
ALL DEVICES						
Supply Current	I_{DD}	—	60	120	µA	No load
Output Short-Circuit Current	I_{SC}	—	200	—	mA	V_{OUT} = GND, foldback current
Shutdown Current	I_{SHDN}	—	0.1	2.0	µA	$\overline{SHDN}$ = 0V
Power Efficiency	η	—	81 68	—	% %	V_{IN} = 3.0V, V_{OUT} = 5V V_{IN} = 3.6V, V_{OUT} = 5V I_{OUT} =120 mA
$\overline{SHDN}$ Logic Input Voltage Low	V_{IL}	—	—	0.4	V	
$\overline{SHDN}$ Logic Input Voltage High	V_{IH}	1.4	—	—	V	
PGOOD Threshold Voltage	V_{TH}	—	$0.93V_{OUT}$	—	V	
PGOOD Hysteresis	V_{HYS}	—	$0.04V_{OUT}$	—	V	

AC CHARACTERISTICS

Electrical Specifications: Unless otherwise specified, all limits are specified for T_A = -40°C to +85°C, V_{IN} = 2.7V to 5.5V, SELECT = GND, $\overline{SHDN}$ = V_{IN}, C_{IN} = C_{OUT} = 10 µF, C_{FLY} = 1 µF, I_{OUT} = 10 mA. Typical values are for T_A = +25°C.

Parameters	Sym	Min	Typ	Max	Units	Conditions
Internal Oscillator Frequency	F_{OSC}	520 800	650 1000	780 1200	kHz kHz	MCP1252 MCP1253
Ripple Voltage	V_{RIP}	—	50 45	—	mV_{p-p} mV_{p-p}	MCP1252 MCP1253
V_{OUT} Wake-Up Time From Shutdown	T_{WKUP}	—	200 300	—	µsec µsec	SELECT = V_{IN} SELECT = GND V_{IN} = 3.6V, I_{OUT} = 10 mA, $\overline{SHDN}$ = $V_{IH(MIN)}$, V_{OUT} from 0 to 90% Nominal Regulated Output Voltage

TEMPERATURE SPECIFICATIONS

Parameters	Symbol	Min	Typ	Max	Units	Conditions
Temperature Ranges:						
Specified Temperature Range	T_A	-40	—	+85	°C	
Maximum Operating Junction Temperature	T_J	—	—	+125	°C	
Storage Temperature Range	T_A	-65	—	+150	°C	
Thermal Package Resistances:						
Thermal Resistance, 8 Pin MSOP	θ_{JA}	—	206	—	°C/W	Single-Layer SEMI G42-88 Board, Natural Convection

2.0 TYPICAL PERFORMANCE CURVES

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

Note: Unless otherwise indicated, V_{IN} = 3.6V, T_A = 25°C, C_{IN} = C_{OUT} = 10 µF, C_{FLY} = 1 µF, all capacitors X7R ceramic.

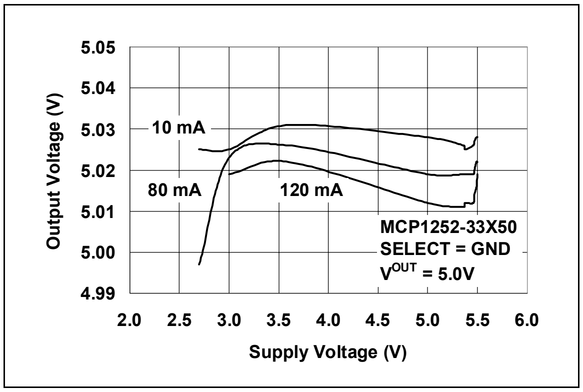


FIGURE 2-1: *Output Voltage vs. Supply Voltage (MCP1252-33X50).*

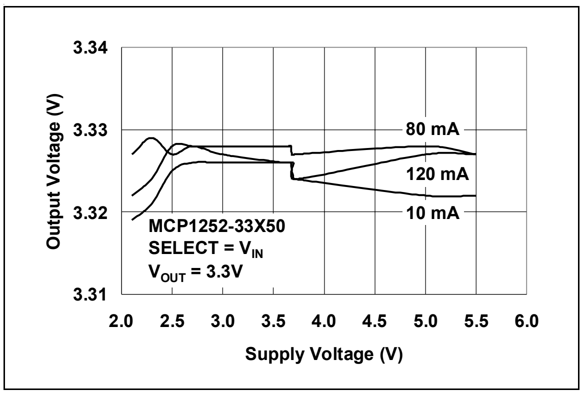


FIGURE 2-2: *Output Voltage vs. Supply Voltage (MCP1252-33X50).*

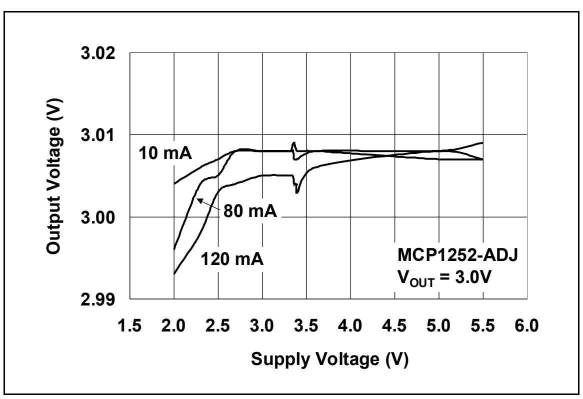


FIGURE 2-3: *Output Voltage vs. Supply Voltage (MCP1252-ADJ).*

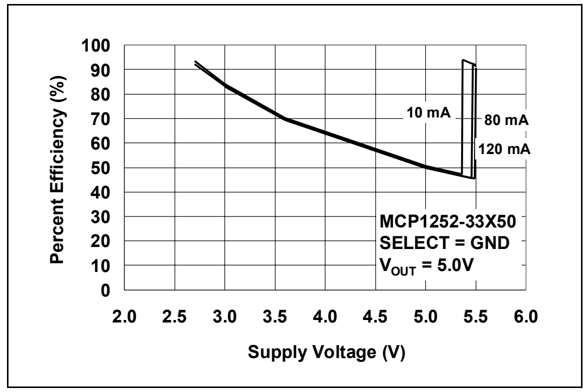


FIGURE 2-4: *Percent Efficiency vs. Supply Voltage (MCP1252-33X50).*

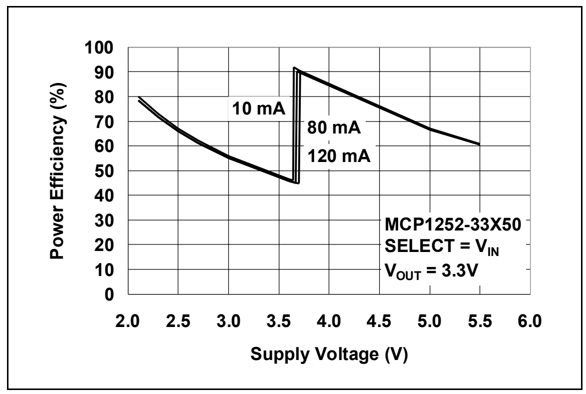


FIGURE 2-5: *Power Efficiency vs. Supply Voltage (MCP1252-33X50).*

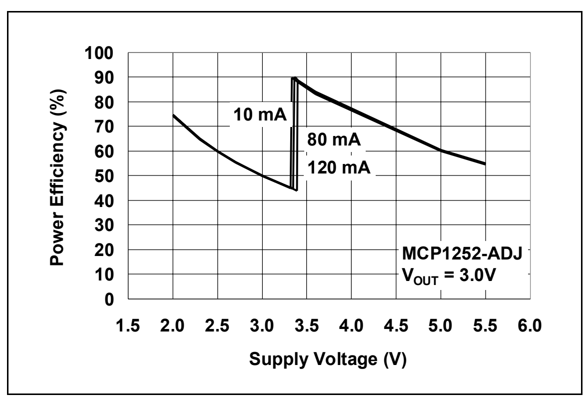


FIGURE 2-6: *Power Efficiency vs. Supply Voltage (MCP1252-ADJ).*

Note: Unless otherwise indicated, V_{IN} = 3.6V, T_A = 25°C, C_{IN} = C_{OUT} = 10 mF, C_{FLY} = 1 mF, all capacitors X7R ceramic.

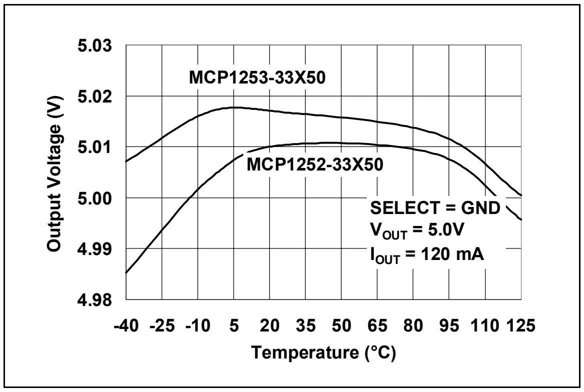


FIGURE 2-7: *Output Voltage vs. Temperature (MCP1252-33X50, MCP1253-33X50).*

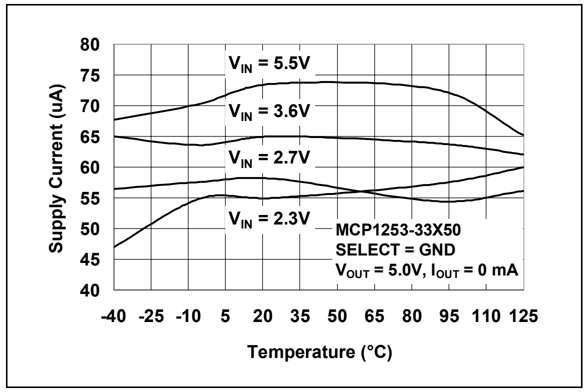


FIGURE 2-10: *Quiescent Current vs. Temperature (MCP1253-33X50).*

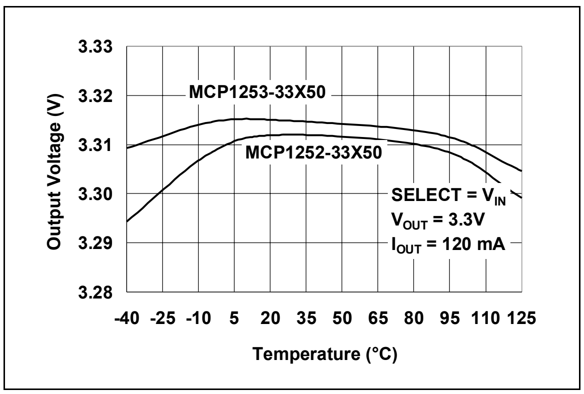


FIGURE 2-8: *Output Voltage vs. Temperature (MCP1252-33X50, MCP1253-33X50).*

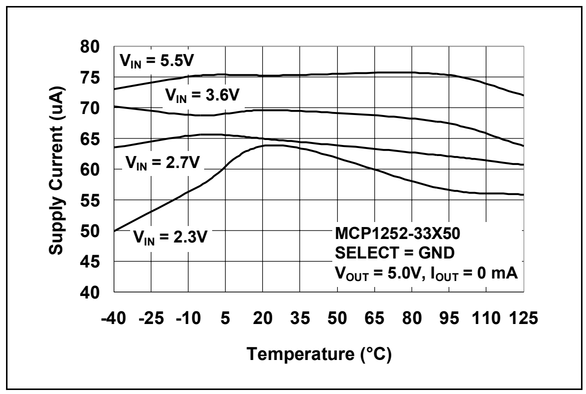


FIGURE 2-11: *Quiescent Current vs. Temperature (MCP1252-33X50).*

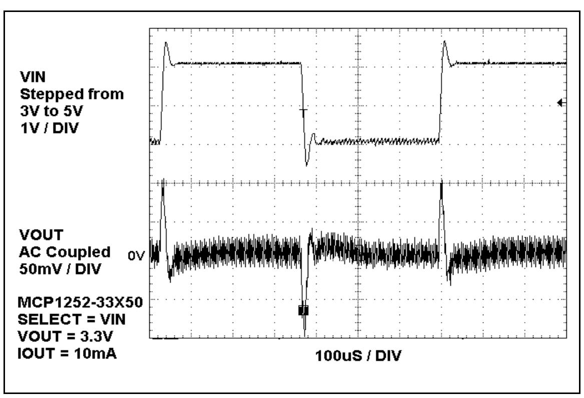


FIGURE 2-9: *Line Transient Response.*

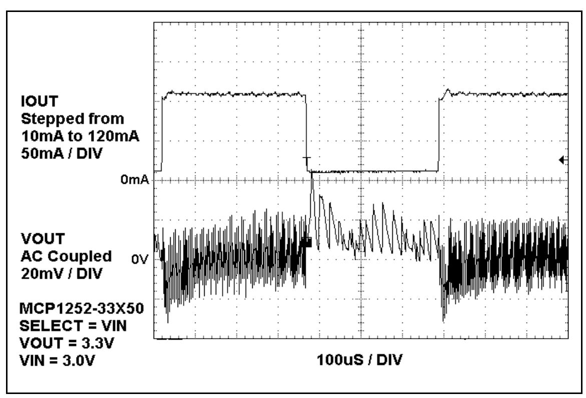


FIGURE 2-12: *Load Transient Response.*

Note: Unless otherwise indicated, V_{IN} = 3.6V, T_A = 25°C, C_{IN} = C_{OUT} = 10mF, C_{FLY} = 1mF, all capacitors X7R ceramic.

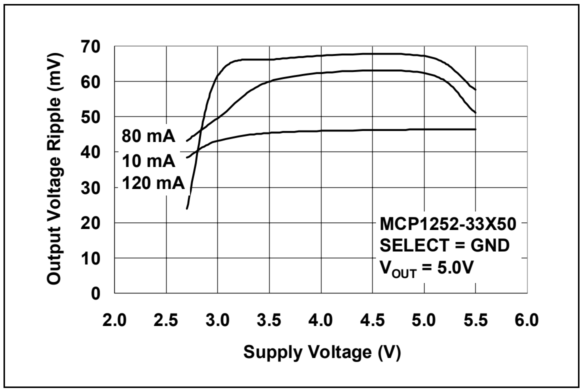


FIGURE 2-13: *Output Voltage Ripple vs. Supply Voltage (MCP1252-33X50).*

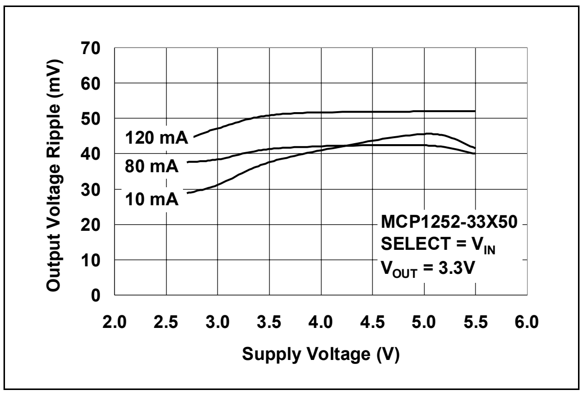


FIGURE 2-14: *Output Voltage Ripple vs. Supply Voltage (MCP1252-33X50).*

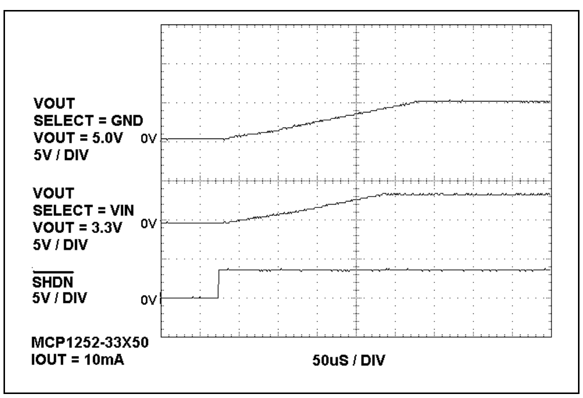


FIGURE 2-15: *Start-Up (MCP1252-33X50).*

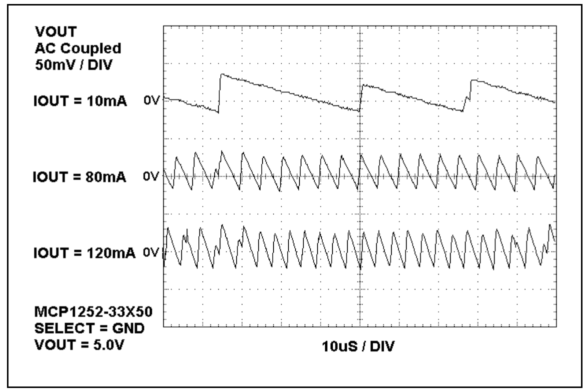


FIGURE 2-16: *Output Voltage Ripple vs. Time.*

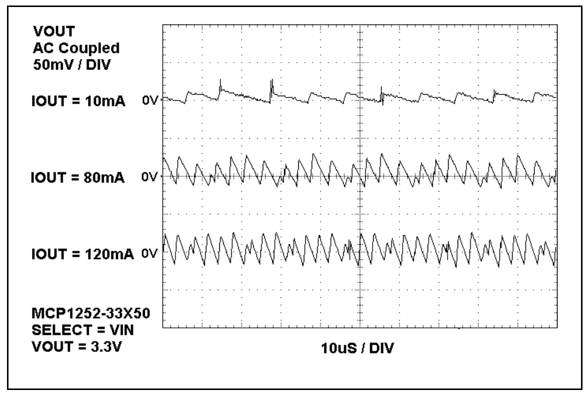


FIGURE 2-17: *Output Voltage Ripple vs. Time.*

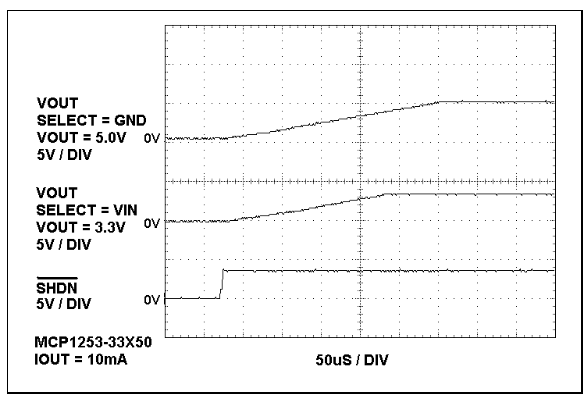


FIGURE 2-18: *Start-Up (MCP1253-33X50).*

3.0 PIN FUNCTIONS

TABLE 3-1: PIN FUNCTION TABLE

Pin No.	Name	Function
1	PGOOD	Open-Drain Power GOOD Output
2	V_{OUT}	Regulated Output Voltage
3	V_{IN}	Power Supply Input
4	GND	Ground Terminal
5	C-	Flying Capacitor Negative Terminal
6	C+	Flying Capacitor Positive Terminal
7	$\overline{SHDN}$	Shutdown Mode, Active-Low Input
8	SELECT	Output Voltage Select Pin. (MCP1252-33X50, MCP1253-33X50)
	FB	Feedback Input Pin for Adjustable Output (MCP1252-ADJ, MCP1253-ADJ)

3.1 Open-Drain Power Good Output (PGOOD)

PGOOD is a high-impedance when the output voltage is in regulation. A logic-low is asserted when the output falls 7% (typical) below the nominal value. The PGOOD output remains low until V_{OUT} is within 3% (typical) of its nominal value. On start-up, this pin indicates when the output voltage reaches its final value. PGOOD is high-impedance when $\overline{SHDN}$ is low.

3.2 Regulated Output Voltage (V_{OUT})

Bypass to GND with a filter capacitor.

3.3 Power Supply Input (V_{IN})

It is recommended that V_{IN} be tied to a ceramic bypass capacitor.

3.4 Ground (GND)

It is recommended that the ground pin be tied to a ground plane for best performance.

3.5 Flying Capacitor Negative Terminal (C-)

The charge pump capacitor (flying capacitor) is used to transfer charge from the input supply to the regulated output.

It is recommended that a low ESR (equivalent series resistance) capacitor be used.

3.6 Flying Capacitor Positive Terminal (C+)

The charge pump capacitor (flying capacitor) is used to transfer charge from the input supply to the regulated output.

Proper orientation is imperative when using a polarized capacitor.

3.7 Shutdown Input ($\overline{SHDN}$)

A logic-low signal applied to $\overline{SHDN}$ disables the device. A logic-high signal applied to this pin allows normal operation.

3.8 Select (SELECT) Input or Feedback (FB) Input

MCP1252-33X50, MCP1253-33X50:
SELECT: Select Input Pin.

Connect SELECT to V_{IN} for 3.3V fixed output. Connect SELECT to GND for a 5.0V fixed output.

MCP1252-ADJ, MCP1253-ADJ:
FB: Feedback Pin.

A resistor divider connected to this pin determines the adjustable V_{OUT} value (1.5V to 5.5V).

4.0 DEVICE OVERVIEW

4.1 Theory of Operation

The MCP1252 and MCP1253 family of devices employ a switched capacitor charge pump to buck or boost an input supply voltage (V_{IN}) to a regulated output voltage. Referring to the Functional Block Diagram and Figure 4-1, the devices perform conversion and regulation in three phases. When the devices are not in shutdown mode and a steady-state condition has been reached, the three phases are continuously cycled through. The first phase transfers charge from the input to the flying capacitor (C_{FLY}) connected to pins C+ and C-. This phase always occurs for half of the internal oscillator period. During this phase, switches S_1 and S_2 are closed.

Once the first phase is complete, all switches are opened and the second phase (idle phase) is entered. The device compares the internal or external feedback voltage with an internal reference. If the feedback voltage is below the regulation point, the device transitions to the third phase.

The third phase transfers energy from the flying capacitor to the output capacitor connected to V_{OUT} and the load. If regulation is maintained, the device returns to the idle phase. If the charge transfer occurs for half the internal oscillator period, more charge is needed in the flying capacitor and the device transitions back to the first phase.

The regulation control is hysteretic, otherwise referred to as a bang-bang control. The output is regulated around a fixed reference with some hysteresis. As a result, typically 50 mV of peak-to-peak ripple will be observed at the output independent of load current. The frequency of the output ripple, however, will be influenced heavily by the load current and output capacitance. The maximum frequency that will be observed is equal to the internal oscillator frequency.

The devices automatically transition between buck or boost operation. This provides a low-cost, compact and simple solution for step-down/step-up DC/DC conversion. This is especially true for battery-operated applications that require a fixed output above or below the input.

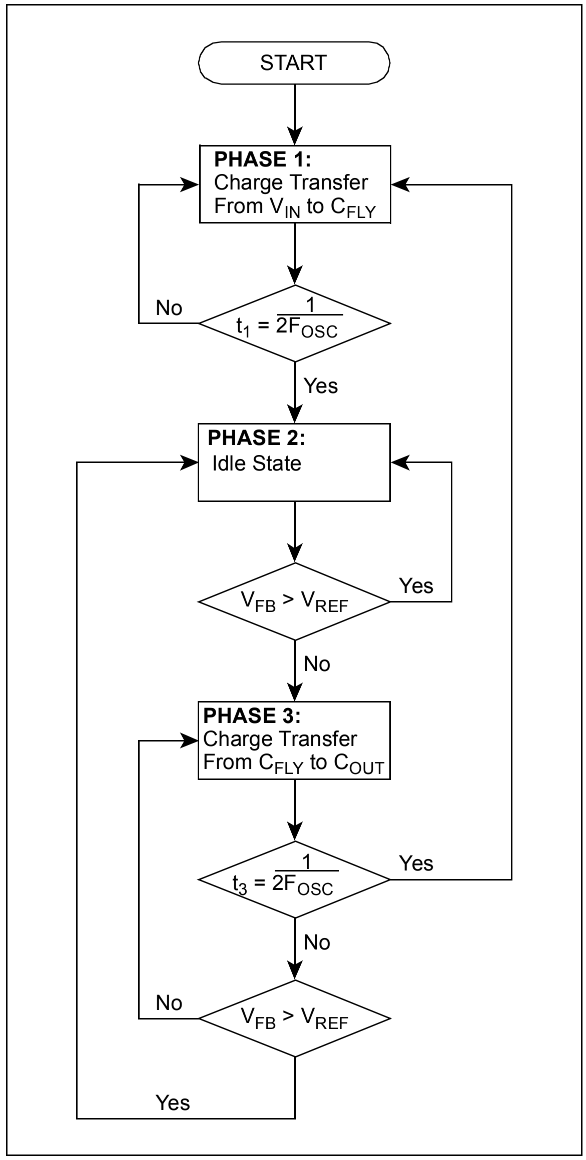


FIGURE 4-1: *Flow Algorithm.*

4.2 Power Efficiency

The power efficiency, η, is determined by the mode of operation. In boost mode, the efficiency is approximately half of a linear regulator. In buck mode, the efficiency is approximately equal to that of a linear regulator. The following formulas can be used to approximate the power efficiency with any significant amount of output current. At light loads, the quiescent current of the device must be taken into consideration.

EQUATION

$$\eta_{BOOST} = \frac{P_{OUT}}{P_{IN}} = \frac{V_{OUT} \times I_{OUT}}{V_{IN} \times 2 \times I_{OUT}} = \frac{V_{OUT}}{V_{IN} \times 2}$$

$$\eta_{BUCK} = \frac{P_{OUT}}{P_{IN}} = \frac{V_{OUT} \times I_{OUT}}{V_{IN} \times I_{OUT}} = \frac{V_{OUT}}{V_{IN}}$$

4.3 Shutdown Mode

Driving $\overline{SHDN}$ low places the MCP1252 or MCP1253 in a low power shutdown mode. This disables the charge pump switches, oscillator and control logic, reducing the quiescent current to 0.1 µA (typical). The PGOOD output is in a high-impedance state during shutdown.

4.4 PGOOD Output

The PGOOD output is an open-drain output that sinks current when the regulator output voltage falls below $0.93V_{OUT}$ (typical). The output voltage can either be fixed when the selectable output device is chosen (MCP1252-33X50, MCP1253-33X50) or adjustable from an external resistive divider when the adjustable device is chosen (MCP1252-ADJ, MCP1253-ADJ). If the regulator output voltage falls below $0.93V_{OUT}$ (typical) for less than 200 µsec and then recovers, glitch-immunity circuits prevent the PGOOD signal from transitioning low. A 10 kΩ to 1 MΩ pull-up resistor from PGOOD to V_{OUT} may be used to provide a logic output. Connect PGOOD to GND or leave unconnected if not used.

4.5 Soft-Start and Short-Circuit Protection

The MCP1252 and MCP1253 features foldback short-circuit protection. This circuitry provides an internal soft-start function by limiting in-rush current during startup and also limits the output current to 200 mA (typical) if the output is shorted to GND. The internal soft-start circuitry requires approximately 300 µsec, typical with a 5V output, from either initial power-up or release from shutdown for the output voltage to be in regulation.

4.6 Thermal Shutdown

The MCP1252 and MCP1253 feature thermal shutdown with temperature hysteresis. When the die temperature exceeds 160°C, typically, the device shuts down. When the die cools by 15°C, typically, the device automatically turns back on. If high die temperature is caused by output overload and the load is not removed, the device will turn on and off, resulting in a pulse output.

5.0 APPLICATIONS

The MCP1252 and MCP1253 are inductorless, positive regulated, charge pump DC/DC converters. A typical circuit configuration for the fixed output version is depicted in Figure 5-1. The adjustable version is depicted in Figure 5-2.

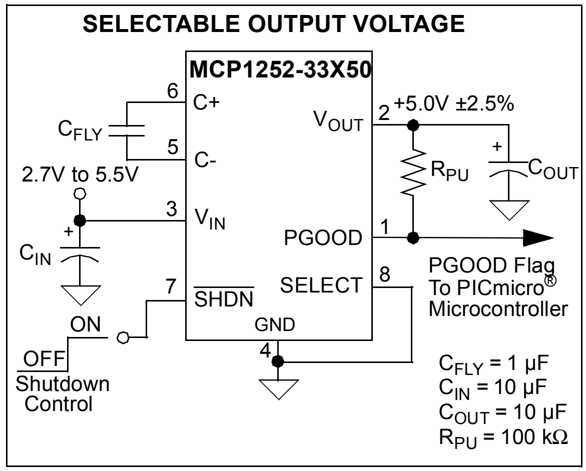


FIGURE 5-1: *Typical Circuit Configuration for Fixed Output Device.*

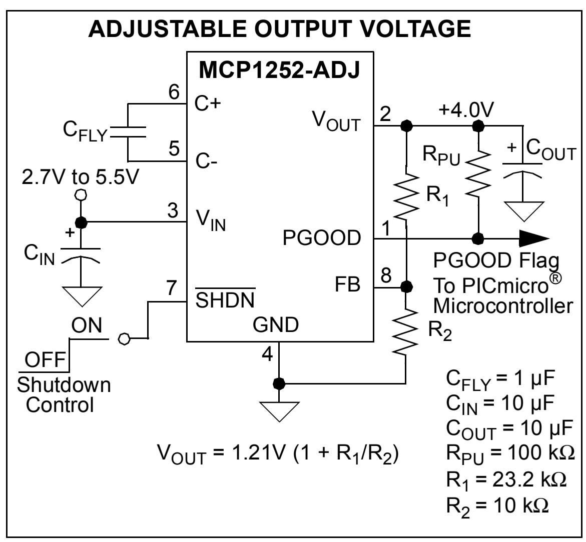


FIGURE 5-2: *Typical Circuit Configuration for Adjustable Output Device.*

5.1 Capacitor Selection

The style and value of capacitors used with the MCP1252 and MCP1253 family of devices determine several important parameters such as output voltage ripple and charge pump strength. To minimize noise and ripple, it is recommended that low ESR (0.1 Ω) capacitors be used for both C_{IN} and C_{OUT}. These capacitors should be either ceramic or tantalum and should be 10 µF or higher. Aluminum capacitors are not recommended because of their high ESR.

If the source impedance to V_{IN} is very low, up to several megahertz, C_{IN} may not be required. Alternatively, a somewhat smaller value of C_{IN} may be substituted for the recommended 10 µF, but will not be as effective in preventing ripple on the V_{IN} pin.

The value of C_{OUT} controls the amount of output voltage ripple present on V_{OUT}. Increasing the size of C_{OUT} will reduce output ripple at the expense of a slower turn-on time from shutdown and a higher in-rush current.

The flying capacitor (C_{FLY}) controls the strength of the charge pump. In order to achieve the maximum rated output current (120 mA), it is necessary to have at least 1 µF of capacitance for the flying capacitor. A smaller flying capacitor delivers less charge per clock cycle to the output capacitor, resulting in lower output ripple. The output ripple is reduced at the expense of maximum output current and efficiency.

5.2 Output Voltage Setting

The MCP1252-33X50 and MCP1253-33X50 feedback controllers select between an internally-set, regulated output voltage (3.3V or 5.0V). Connect SELECT to GND for a regulated 5.0V output and connect SELECT to V_{IN} for a regulated 3.3V output.

The MCP1252-ADJ and MCP1253-ADJ utilize an external resistor divider that allows the output voltage to be adjusted between 1.5V and 5.5V. For an adjustable output, connect a resistor between V_{OUT} and FB (R_1) and another resistor between FB and GND (R_2). In the following equation, choose R_2 to be less than or equal to 30 kΩ and calculate R_1 from the following formula:

EQUATION

$$R_1 = R_2[(V_{OUT}/V_{FB}) - 1]$$

and

EQUATION

$$V_{OUT} = V_{FB}(1 + R_1/R_2)$$

where:

V_{OUT} is the desired output voltage from 1.5V to 5.5V

V_{FB} is the internal regulation voltage, nominally 1.21V

Note that the tolerance of the external resistors will have an effect on the accuracy of the output voltage. For optimum results, it is recommended that the external resistors have a tolerance no larger than 1%.

5.3 Recommended Layout

The MCP1252 and MCP1253 family of devices transfer charge at high switching frequencies, producing fast, high peak, transient currents. As a result, any stray inductance in the component layout will produce unwanted noise in the system. Proper board layout techniques are required to ensure optimum performance. Figure 5-3 depicts the recommended board layout. The input capacitor connected between V_{IN} and GND, and the output capacitor connected between V_{OUT} and GND, are 10 µF ceramic, X7R dielectric, in 1206 packages. The flying capacitor connected between C+ and C- is a 1 µF ceramic, X7R dielectric in a 0805 package. The layout is scaled 3:1.

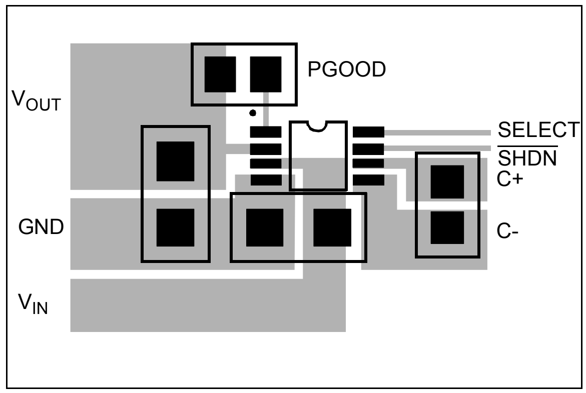
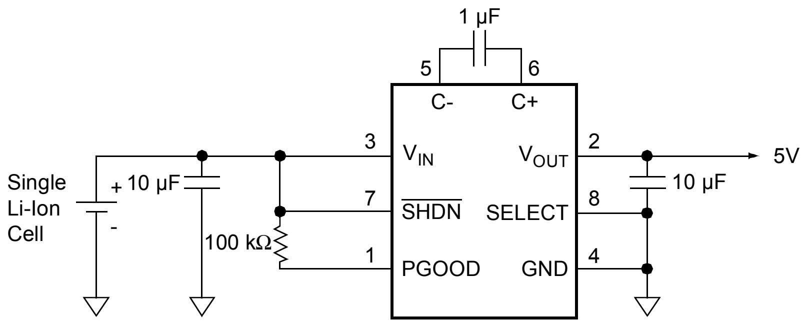


FIGURE 5-3: Recommended Printed Circuit Board Layout.

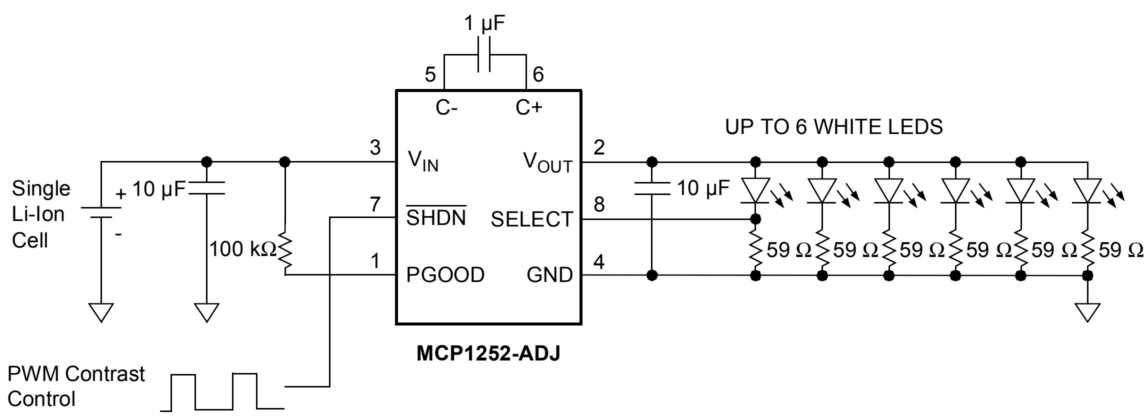
6.0 TYPICAL APPLICATION CIRCUITS

Single Cell Lithium-Ion Battery To 5V Converter



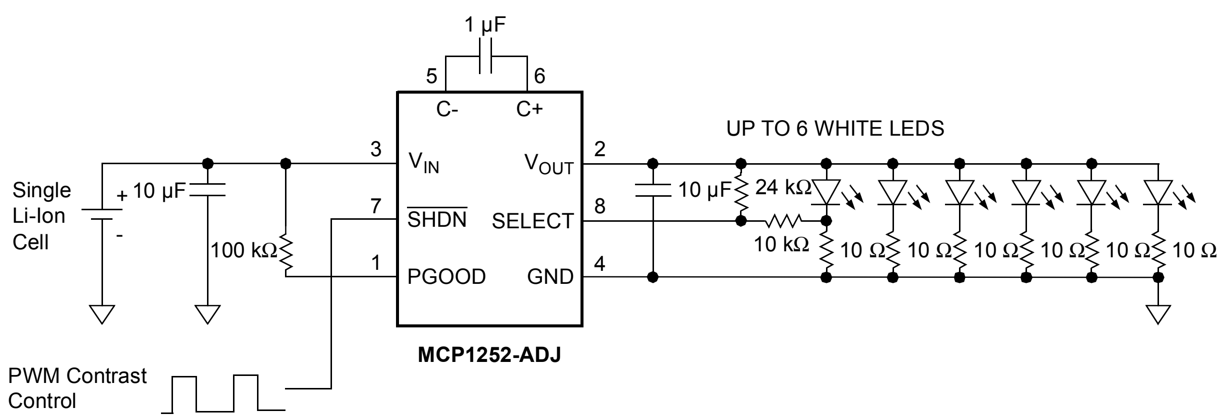
MCP1252-33X50

White LED Bias



MCP1252-ADJ

Alternative White LED Bias

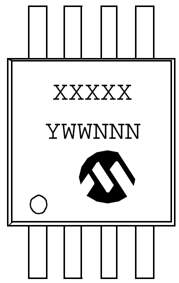


MCP1252-ADJ

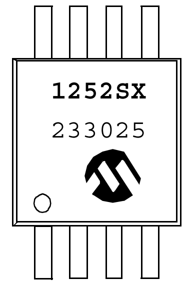
7.0 PACKAGING INFORMATION

7.1 Package Marking

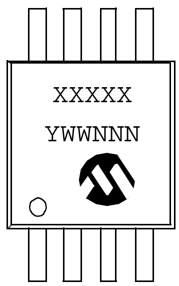
8-Lead MSOP (Fixed)



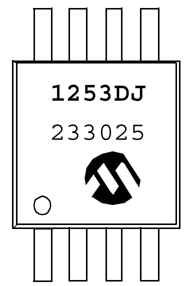
Example:



8-Lead MSOP (Adjustable)



Example:

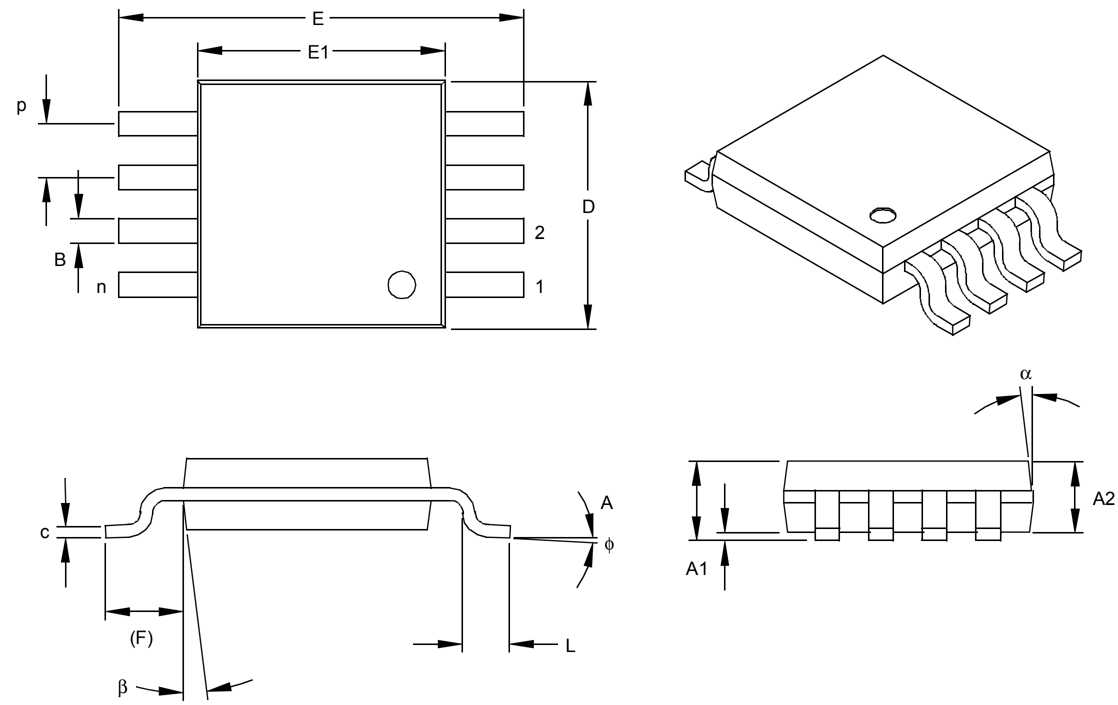


Legend:	XX...X	Customer specific information*
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line thus limiting the number of available characters for customer specific information.

* Standard OTP marking consists of Microchip part number, year code, week code, and traceability code.

8-Lead Plastic Micro Small Outline Package (MS) (MSOP)



Units		INCHES			MILLIMETERS*		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8				8
Pitch	p		.026			0.65	
Overall Height	A			.044			1.18
Molded Package Thickness	A2	.030	.034	.038	0.76	0.86	0.97
Standoff §	A1	.002		.006	0.05		0.15
Overall Width	E	.184	.193	.200	4.67	4.90	.5.08
Molded Package Width	E1	.114	.118	.122	2.90	3.00	3.10
Overall Length	D	.114	.118	.122	2.90	3.00	3.10
Foot Length	L	.016	.022	.028	0.40	0.55	0.70
Footprint (Reference)	F	.035	.037	.039	0.90	0.95	1.00
Foot Angle	φ	0		6	0		6
Lead Thickness	c	.004	.006	.008	0.10	0.15	0.20
Lead Width	B	.010	.012	.016	0.25	0.30	0.40
Mold Draft Angle Top	α		7			7	
Mold Draft Angle Bottom	β		7			7	

*Controlling Parameter
§ Significant Characteristic

Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

Drawing No. C04-111

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

PART NO.	X	/XX
Device	Temperature Range	Package

Device:	MCP1252: Low Noise, Positive-Regulated Charge Pump MCP1252T: Low Noise, Positive-Regulated Charge Pump (Tape and Reel) MCP1253: Low Noise, Positive-Regulated Charge Pump MCP1253T: Low Noise, Positive-Regulated Charge Pump (Tape and Reel)
Temperature Range:	I = -40°C to +85°C
Package:	MS = Plastic Micro Small Outline (MSOP), 8-lead

Examples:

a) MCP1252-33X50I/MS: Low Noise, Positive-Regulated Charge Pump, Fixed Output
b) MCP1252-ADJI/MS: Low Noise, Positive-Regulated Charge Pump, Adjustable Output
c) MCP1252T-33X50I/MS: Tape and Reel, Low Noise, Positive-Regulated Charge Pump, Fixed Output

a) MCP1253-33X50I/MS: Low Noise, Positive-Regulated Charge Pump, Fixed Output
b) MCP1253-ADJI/MS: Low Noise, Positive-Regulated Charge Pump, Adjustable Output
c) MCP1253T-ADJI/MS: Tape and Reel, Low Noise, Positive-Regulated Charge Pump, Adjustable Output

Sales and Support

Data Sheets
Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site (www.microchip.com)

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

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- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
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Corporate Office
2355 West Chandler Blvd.
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Web Address: http://www.microchip.com

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Chandler, AZ 85224-6199
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Dallas
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Detroit
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32255 Northwestern Highway, Suite 190
Farmington Hills, MI 48334
Tel: 248-538-2250 Fax: 248-538-2260

Kokomo
2767 S. Albright Road
Kokomo, Indiana 46902
Tel: 765-864-8360 Fax: 765-864-8387

Los Angeles
18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

San Jose
Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7950 Fax: 408-436-7955

Toronto
6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1X5, Canada
Tel: 905-673-0699 Fax: 905-673-6509

ASIA/PACIFIC

Australia
Microchip Technology Australia Pty Ltd
Suite 22, 41 Rawson Street
Epping 2121, NSW
Australia
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

China - Beijing
Microchip Technology Consulting (Shanghai) Co., Ltd., Beijing Liaison Office
Unit 915
Bei Hai Wan Tai Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Chengdu
Microchip Technology Consulting (Shanghai) Co., Ltd., Chengdu Liaison Office
Rm. 2401-2402, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-86766200 Fax: 86-28-86766599

China - Fuzhou
Microchip Technology Consulting (Shanghai) Co., Ltd., Fuzhou Liaison Office
Unit 28F, World Trade Plaza
No. 71 Wusi Road
Fuzhou 350001, China
Tel: 86-591-7503506 Fax: 86-591-7503521

China - Shanghai
Microchip Technology Consulting (Shanghai) Co., Ltd.
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xia Road
Shanghai, 200051
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

China - Shenzhen
Microchip Technology Consulting (Shanghai) Co., Ltd., Shenzhen Liaison Office
Rm. 15-16, 13/F, Shenzhen Kerry Centre,
Renminnan Lu
Shenzhen 518001, China
Tel: 86-755-82350361 Fax: 86-755-82366086

China - Hong Kong SAR
Microchip Technology Hongkong Ltd.
Unit 901-6, Tower 2, Metroplaza
223 Hing Fong Road
Kwai Fong, N.T., Hong Kong
Tel: 852-2401-1200 Fax: 852-2401-3431

India
Microchip Technology Inc.
India Liaison Office
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaugnessey Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan
Microchip Technology Japan K.K.
Benex S-1 6F
3-18-20, Shinyokohama
Kohoku-Ku, Yokohama-shi
Kanagawa, 222-0033, Japan
Tel: 81-45-471- 6166 Fax: 81-45-471-6122

Korea
Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku
Seoul, Korea 135-882
Tel: 82-2-554-7200 Fax: 82-2-558-5934

Singapore
Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-6334-8870 Fax: 65-6334-8850

Taiwan
Microchip Technology (Barbados) Inc.,
Taiwan Branch
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

EUROPE

Austria
Microchip Technology Austria GmbH
Durisolstrasse 2
A-4600 Wels
Austria
Tel: 43-7242-2244-399
Fax: 43-7242-2244-393

Denmark
Microchip Technology Nordic ApS
Regus Business Centre
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Ballerup DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

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Parc d'Activite du Moulin de Massy
43 Rue du Saule Trapu
Batiment A - ler Etage
91300 Massy, France
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

Germany
Microchip Technology GmbH
Steinheilstrasse 10
D-85737 Ismaning, Germany
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

Italy
Microchip Technology SRL
Centro Direzionale Colleoni
Palazzo Taurus 1 V. Le Colleoni 1
20041 Agrate Brianza
Milan, Italy
Tel: 39-039-65791-1 Fax: 39-039-6899883

United Kingdom
Microchip Ltd.
505 Eskdale Road
Winnersh Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44 118 921 5869 Fax: 44-118 921-5820

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