

Micropower, High-Performance Dual 300 mA ULDO™

Features

- 2.3V to 5.5V Input Voltage Range
- 300 mA Output Current per LDO
- Very Low Quiescent Current: 25 μ A per LDO
- POR Output with Programmable Delay on LDO2
- High PSRR: >65 dB on Each LDO
- Stable with 1 μ F Ceramic Output Capacitors
- Tiny 8-Pin 2 mm x 2 mm UDFN Package
- Ultra-Low Dropout Voltage: 120 mV @ 300 mA
- Low Output Voltage Noise: 50 μ V_{RMS}
- Current-Limit and Thermal Shutdown Protection

Applications

- Camera Phones
- Mobile Phones
- PDAs
- GPS Receivers
- Portable Devices

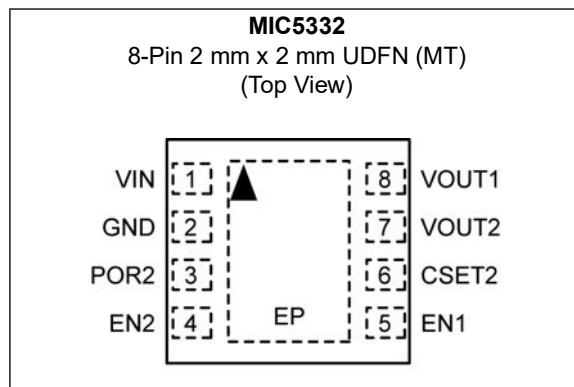
General Description

The MIC5332 is a tiny, dual LDO with low quiescent current that is ideal for power-sensitive applications. The MIC5332 integrates two high-performance 300 mA LDOs and a power-on-reset (POR) generator into a 2 mm x 2 mm UDFN package. This solution occupies the same PC board area of a single SOT-23 package.

The MIC5332 is designed to reject input noise and provide low output noise with fast transient response so as to respond to any load change quickly, even though it is a low quiescent current part. This combination of PSRR, low noise and transient response, along with low power consumption makes for a very high performance, yet general purpose product.

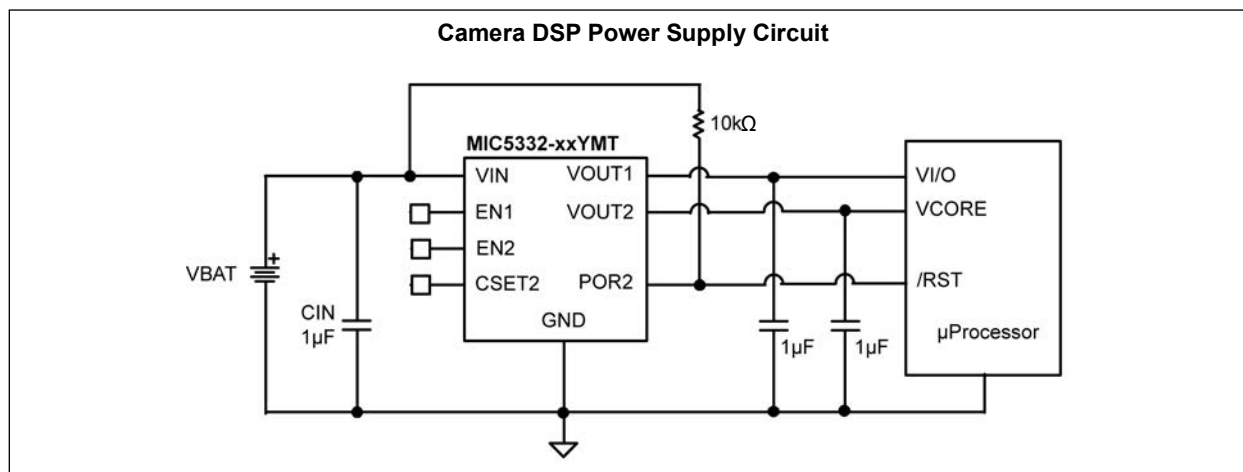
The MIC5332 is a μ Cap design, operating with very small ceramic output capacitors, which reduces required board space and component cost. It is available in fixed output voltages in a tiny 8-pin 2 mm x 2 mm UDFN leadless package.

Package Types

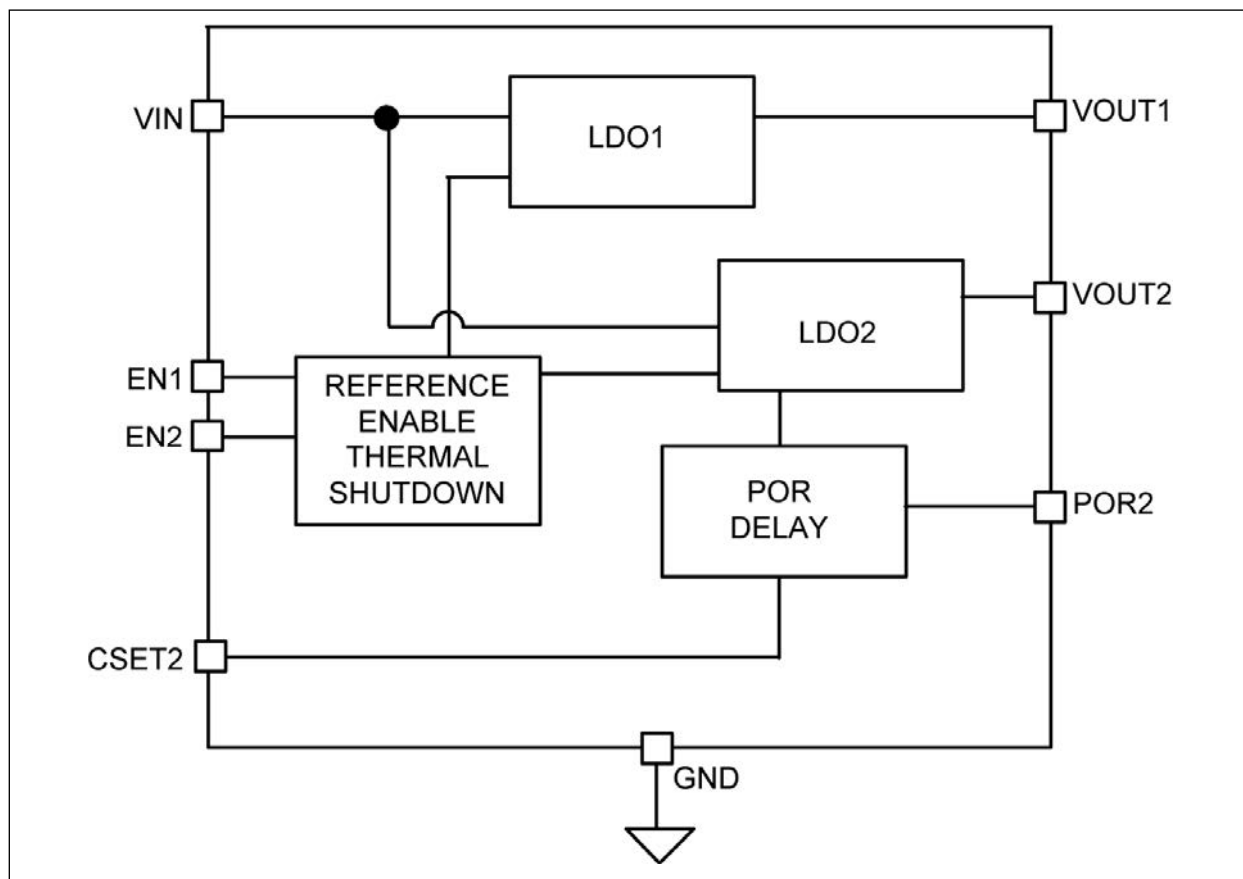


MIC5332

Typical Application Circuit



Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage (V_{IN})	0V to +6V
Enable Input Voltage (V_{EN1} , V_{EN2})	0V to V_{IN}
POR2 Voltage (V_{POR2})	0V to +6V
Power Dissipation (Note 1)	Internally Limited
ESD Rating (Note 2)	2 kV

Operating Ratings ‡

Supply Voltage (V_{IN})	+2.3V to +5.5V
Enable Input Voltage (V_{EN1} , V_{EN2})	0V to V_{IN}
POR2 Voltage (V_{POR2})	0V to +5.5V

† **Notice:** Stresses above those listed under “Absolute 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 sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

‡ **Notice:** The device is not guaranteed to function outside its operating ratings.

Note 1: The maximum allowable power dissipation of any T_A (ambient temperature) is $P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature and the regulator will go into thermal shutdown.

2: Device is ESD sensitive. Handling precautions are recommended. Human body model, 1.5 k Ω in series with 100 pF.

ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{EN1} = V_{EN2} = V_{OUT} + 1.0V$, higher of the two regulator outputs; $I_{OUT1} = I_{OUT2} = 100 \mu A$;
 $C_{OUT1} = C_{OUT2} = 1 \mu F$; $T_J = +25^\circ C$, **bold** values valid for $-40^\circ C \leq T_J \leq +125^\circ C$, unless noted. [Note 1](#)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Voltage Accuracy	V_{OUT}	-1.0	—	1.0	%	Variation from nominal V_{OUT}
		-2.0	—	2.0		Variation from nominal V_{OUT} ; -40°C to +125°C
Line Regulation	$\Delta V_{OUT}/(V_{OUT} \times \Delta V_{IN})$	—	0.02	0.3	%/V	$V_{IN} = V_{OUT} + 1V$ to 5.5V; $I_{OUT} = 100 \mu A$
		—	—	0.6		
Load Regulation	$\Delta V_{OUT}/V_{OUT}$	—	0.2	0.5	%	$I_{OUT} = 100 \mu A$ to 300 mA
Dropout Voltage	V_{DO}	—	20	40	mV	$I_{OUT} = 50$ mA
		—	120	240		$I_{OUT} = 300$ mA
Ground Current	I_{GND}	—	25	50	μA	$V_{EN1} = \text{High}$; $V_{EN2} = \text{Low}$; $I_{OUT} = 100 \mu A$ to 300 mA
		—	25	50		$V_{EN1} = \text{Low}$; $V_{EN2} = \text{High}$; $I_{OUT} = 100 \mu A$ to 300 mA
		—	40	75		$V_{EN1} = V_{EN2} = \text{High}$; $I_{OUT1} = 300$ mA, $I_{OUT2} = 300$ mA
Ground Current in Shutdown	I_{SHDN}	—	0.01	1.0	μA	$V_{EN1} = V_{EN2} \leq 0.2V$
Ripple Rejection	PSRR	—	65	—	dB	$f = 1$ kHz; $C_{OUT} = 2.2 \mu F$
		—	45	—		$f = 20$ kHz; $C_{OUT} = 2.2 \mu F$
Current Limit	I_{LIM}	350	550	800	mA	$V_{OUT} = 0V$
Output Voltage Noise	e_n	—	50	—	μV_{RMS}	$C_{OUT} = 1 \mu F$, 10 Hz to 100 kHz

MIC5332

ELECTRICAL CHARACTERISTICS (CONTINUED)

$V_{IN} = V_{EN1} = V_{EN2} = V_{OUT} + 1.0V$, higher of the two regulator outputs; $I_{OUT1} = I_{OUT2} = 100 \mu A$;
 $C_{OUT1} = C_{OUT2} = 1 \mu F$; $T_J = +25^\circ C$, **bold** values valid for $-40^\circ C \leq T_J \leq +125^\circ C$, unless noted. [Note 1](#)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Enable Inputs (EN1/EN2)						
Enable Input Voltage	V _{EN}	—	—	0.2	V	Logic Low
		1.2	—	—		Logic High
Enable Input Current	I _{EN}	—	0.01	1.0	μA	V _{IL} ≤ 0.2V
		—	0.01	1.0		V _{IH} ≥ 1.2V
Turn-On Time						
Turn-On Time (LDO1 & LDO2)	t _{ON}	—	140	500	μs	C _{OUT} = 1 μF (Enable of First LDO)
		—	110	500		C _{OUT} = 1 μF (Enable of Second LDO after First LDO Enabled)
POR2 Output (LDO2 Only)						
Threshold Voltage	V _{TH}	88	—	—	%	Low Threshold, % of V _{OUT2} (POR2 ON)
		—	—	98		High Threshold, % of V _{OUT2} (POR2 OFF)
POR2 Output Logic Low Voltage	V _{OL}	—	0.02	0.1	V	I _L = 250 μA
POR2 Leakage Current	I _{POR2}	−1.0	0.01	1.0	μA	POR OFF
CSET2 Input						
CSET2 Pin Current Source		0.8	1.4	2	μA	V _{CSET2} = 0V
CSET2 Pin Threshold Votlage		1.21	1.25	1.29	V	POR2 = High

Note 1: Specification for packaged product only.

TEMPERATURE SPECIFICATIONS

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Temperature Range	T_J	-40	—	+125	$^\circ C$	—
Storage Temperature Range	T_S	-65	—	+150	$^\circ C$	—
Lead Temperature	T_{LEAD}	—	—	+260	$^\circ C$	Soldering, 10 sec.
Package Thermal Resistances						
Thermal Resistance, 8-Ld UDFN	θ_{JA}	—	90	—	$^\circ C/W$	—

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.

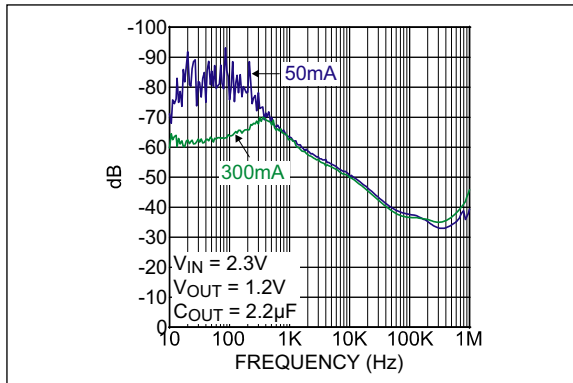


FIGURE 2-1: Power Supply Rejection Ratio.

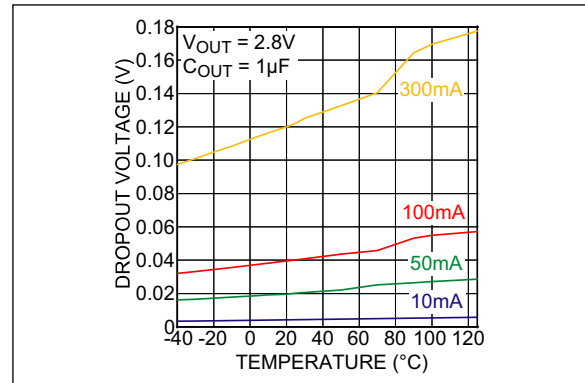


FIGURE 2-4: Dropout Voltage vs. Temperature.

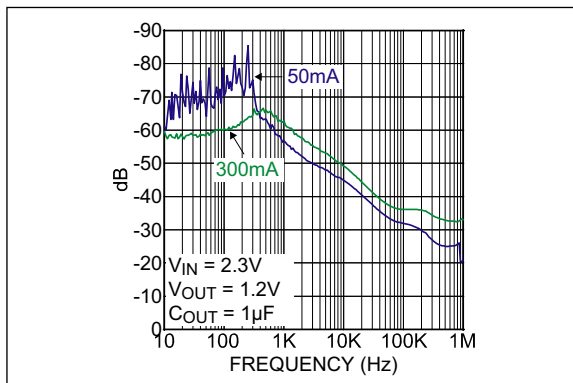


FIGURE 2-2: Power Supply Rejection Ratio.

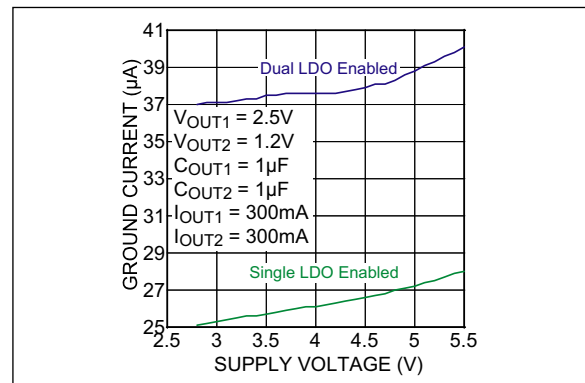


FIGURE 2-5: Ground Current vs. Supply Voltage.

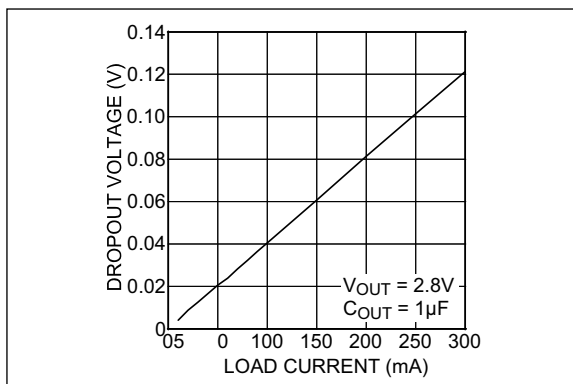


FIGURE 2-3: Dropout Voltage vs. Load Current.

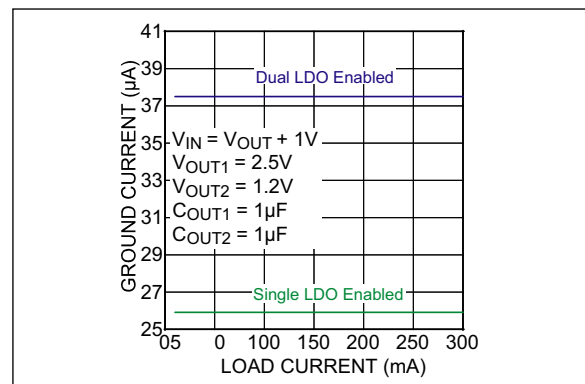


FIGURE 2-6: Ground Current vs. Load Current.

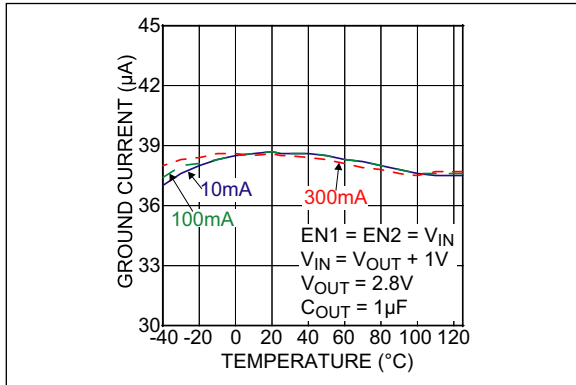


FIGURE 2-7: Ground Current vs. Temperature.

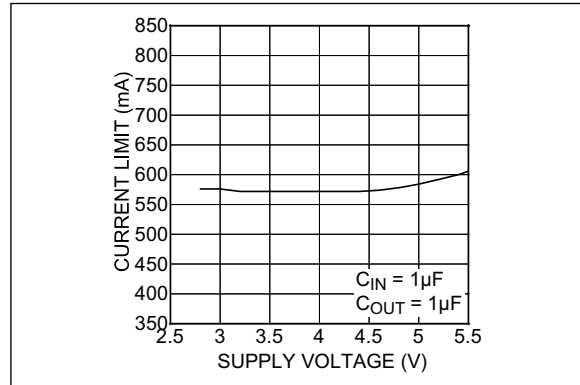


FIGURE 2-10: Current Limit vs. Supply Voltage.

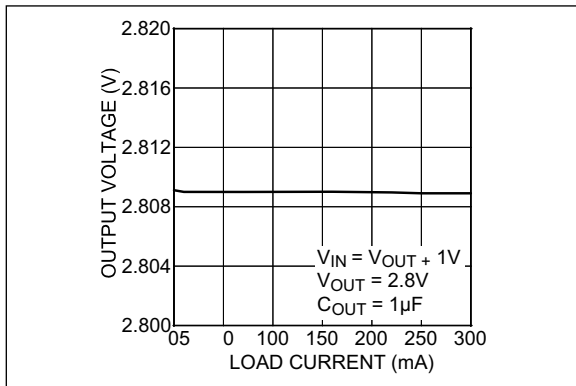


FIGURE 2-8: Output Voltage vs. Load Current.

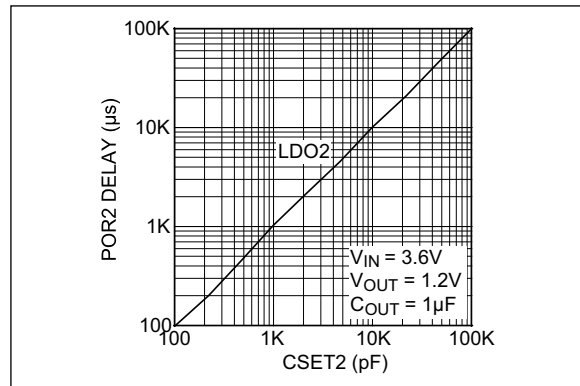


FIGURE 2-11: POR2 Delay vs. CSET2.

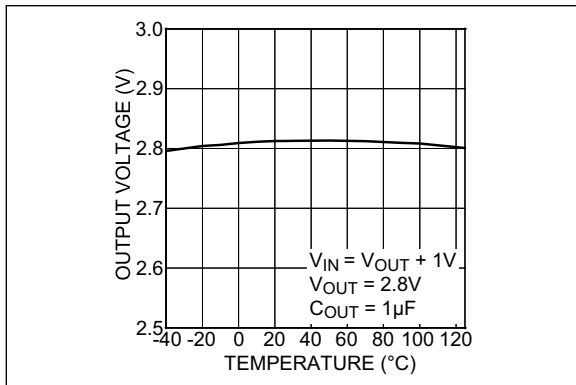


FIGURE 2-9: Output Voltage vs. Temperature.

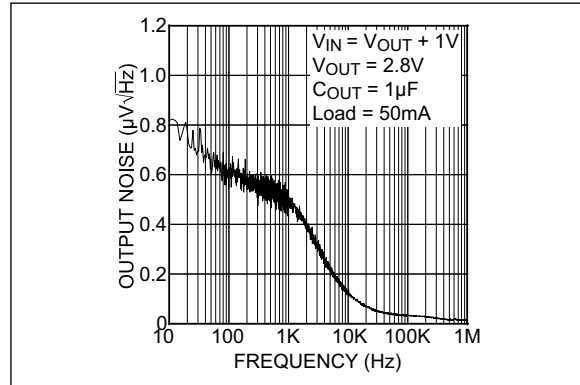


FIGURE 2-12: Output Noise Spectral Density.

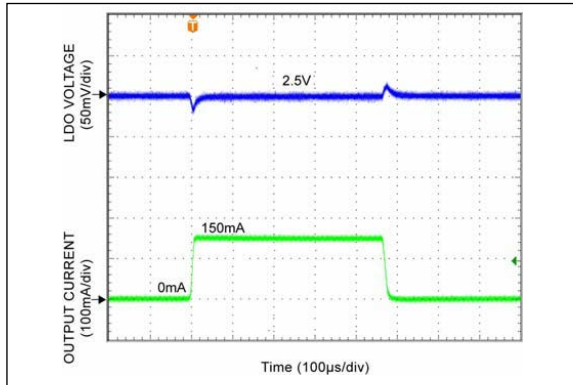


FIGURE 2-13: Load Transient (0 mA to 150 mA).

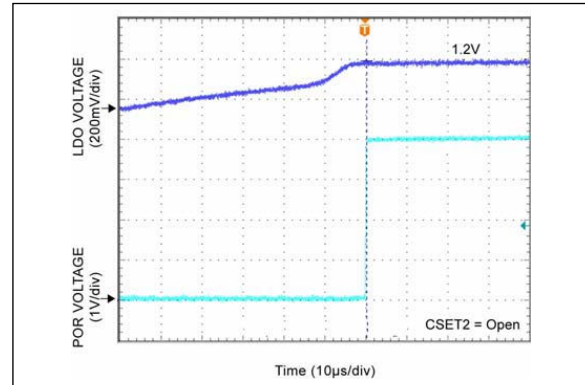


FIGURE 2-16: POR2 Signal (Low-High).

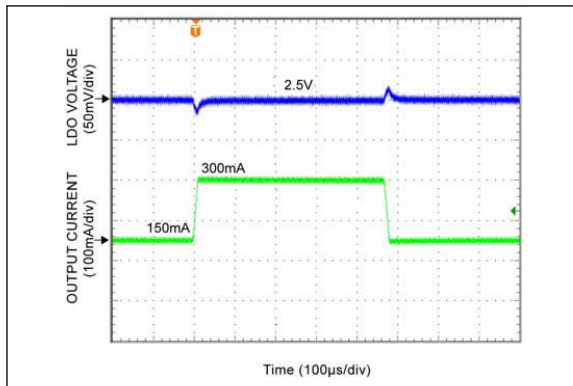


FIGURE 2-14: Load Transient (150 mA to 300 mA)

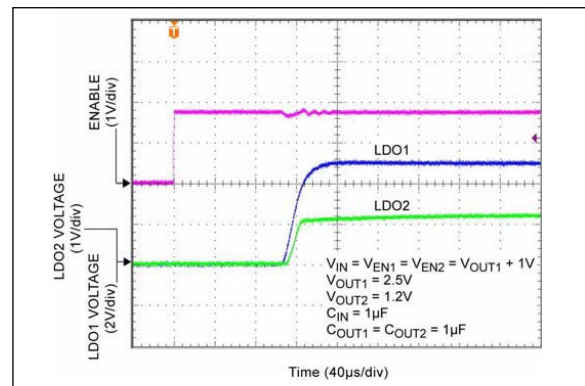


FIGURE 2-17: Enable Turn-On.

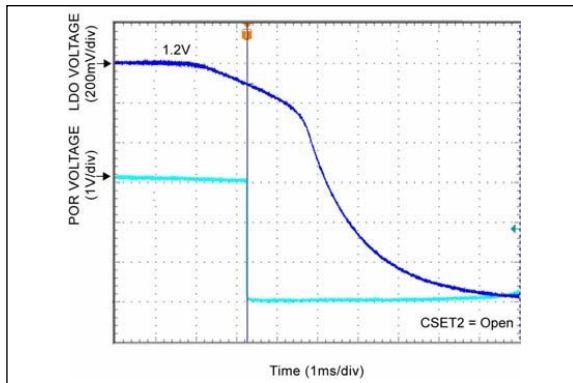


FIGURE 2-15: POR2 Signal (High-Low).

3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 3-1](#).

TABLE 3-1: PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	VIN	Supply Input.
2	GND	Ground.
3	POR2	Power-On Reset Output (Regulator 2): Open-drain output. Active low indicates an output undervoltage condition on Regulator 2 when the device is enabled.
4	EN2	Enable Input (Regulator 2): Active High Input. Logic High = On; Logic Low = Off. Do not leave floating.
5	EN1	Enable Input (Regulator 1): Active High Input. Logic High = On; Logic Low = Off. Do not leave floating.
6	CSET2	Delay Set Input (Regulator 2): Connect external capacitor to GND to set the internal delay for the POR2 output. When left open, there is no delay. This pin cannot be grounded.
7	VOUT2	Regulator Output: LDO2.
8	VOUT1	Regulator Output: LDO1.
EP	ePAD	Exposed Heat Sink Pad. Connect to GND for best thermal performance.

4.0 APPLICATION INFORMATION

MIC5332 is a 300 mA dual LDO with an integrated power-on-reset (POR) for the second regulator. The MIC5332 regulator is fully protected from damage due to fault conditions, offering linear current limiting and thermal shutdown.

4.1 Input Capacitor

The MIC5332 is a high-performance, high-bandwidth device. Therefore, it required a well-bypassed input supply for optimal performance. A 1 μF capacitor is required from the input to ground to provide stability. Low-ESR ceramic capacitors provide optimal performance at minimum of space. Additional high-frequency capacitors, such as small-valued NPO dielectric-type capacitors, help filter out high-frequency noise and are a good practice in any RF-based circuit. X5R or X7R dielectrics are recommended for the input capacitor. Y5V dielectrics lose most of their capacitance over temperature and are, therefore, not recommended.

4.2 Output Capacitor

The MIC5332 requires an output capacitor of 1 μF or greater to maintain stability. The design is optimized for use with low-ESR ceramic chip capacitors. High-ESR capacitors may cause high frequency oscillation. The output capacitor can be increased, but performance has been optimized for a 1 μF ceramic output capacitor and does not improve significantly with larger capacitance.

X7R/X5R dielectric-type ceramic capacitors are recommended because of their temperature performance. X7R-type capacitors change capacitance by 15% over their operating temperature range and are the most stable type of ceramic capacitors. Z5U and Y5V dielectric capacitors change value by as much as 50% and 60%, respectively, over their operating temperature ranges. To use a ceramic chip capacitor with Y5V dielectric, the value must be much higher than an X7R ceramic capacitor to ensure the same minimum capacitance over the equivalent operating temperature range.

4.3 No-Load Stability

Unlike many other voltage regulators, the MIC5332 will remain stable and in regulation with no load. This is especially important in CMOS RAM keep-alive applications.

4.4 Enable/Shutdown

The MIC5332 comes with dual active-high enable pins that allow each regulator to be disabled independently. Forcing the enable pin low disables the regulator and sends it into a “zero” off-mode current state. In this

state, current consumed by the regulator goes to nearly zero. Forcing the enable pin high enables the output voltage. The active-high enable pin uses CMOS technology and the enable pin cannot be left floating; a floating enable pin may cause an indeterminate state on the output.

4.5 Power-On-Reset

The second regulator has a power-on-reset status pin (POR2). This pin is an open-drain output. When LDO2 is enabled, an active-low POR2 indicates an undervoltage condition on V_{OUT2} .

The POR2 status signal can be programmed for a delay of one second per μF by placing a capacitor from the CSET2 pin to ground. Zero delay is added by leaving the CSET2 pin open circuit.

4.6 Thermal Considerations

The MIC5332 is designed to provide 300 mA of continuous current for both outputs in a very small package. Maximum ambient operating temperature can be calculated based upon the output current and the voltage drop across the part. For example, if the input voltage is 3.6V, the output voltage is 3.0V for V_{OUT1} , 2.8V for V_{OUT2} , and the output current equals 300 mA. The actual power dissipation of the regulator circuit can be determined using the following equation:

EQUATION 4-1:

$$P_D = (V_{IN} - V_{OUT1}) \times I_{OUT1} + (V_{IN} - V_{OUT2}) \times I_{OUT2} + V_{IN} \times I_{GND}$$

Because this device is CMOS and the ground current is typically <100 μA over the load range, the power dissipation contributed by the ground current is <1% and can be ignored for this calculation.

EQUATION 4-2:

$$P_D = (3.6V - 3.0V) \times 300mA + (3.6V - 2.8V) \times 300mA$$

$$P_D = 0.42W$$

To determine the maximum ambient operating temperature of the package, use the junction-to-ambient thermal resistance of the device and the following basic equation:

EQUATION 4-3:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{\theta_{JA}}$$

The maximum junction temperature of the die is 125°C and the package thermal resistance is 90°C/W.

MIC5332

Substituting P_D for $P_{D(MAX)}$ and solving for the ambient operating temperature will give the maximum operating conditions for the regulator circuit. The junction-to-ambient thermal resistance for the minimum footprint is 90°C/W .

The maximum power dissipation must not be exceeded for proper operation.

For example, when operating the MIC5332-PMYMT at an input voltage of 3.6V and 300 mA loads at each output with a minimum footprint layout, the maximum ambient operating temperature (T_A) can be determined as follows:

EQUATION 4-4:

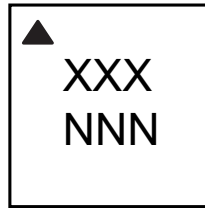
$$0.42\text{ W} = \frac{125^{\circ}\text{C} - T_A}{90^{\circ}\text{C/W}}$$
$$T_A = 87.2^{\circ}\text{C}$$

Therefore, a 3.0V/2.8V application with 300 mA at each output current can accept an ambient operating temperature of 87°C in a 2 mm x 2 mm UDFN package. For a full discussion of heat sinking and thermal effects on voltage regulators, refer to the “Regulator Thermals” section of Microchip’s [Designing with Low-Dropout Voltage Regulators](#) handbook.

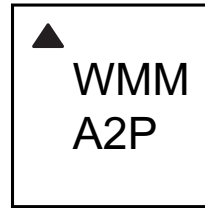
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

8-Lead UDFN*



Example

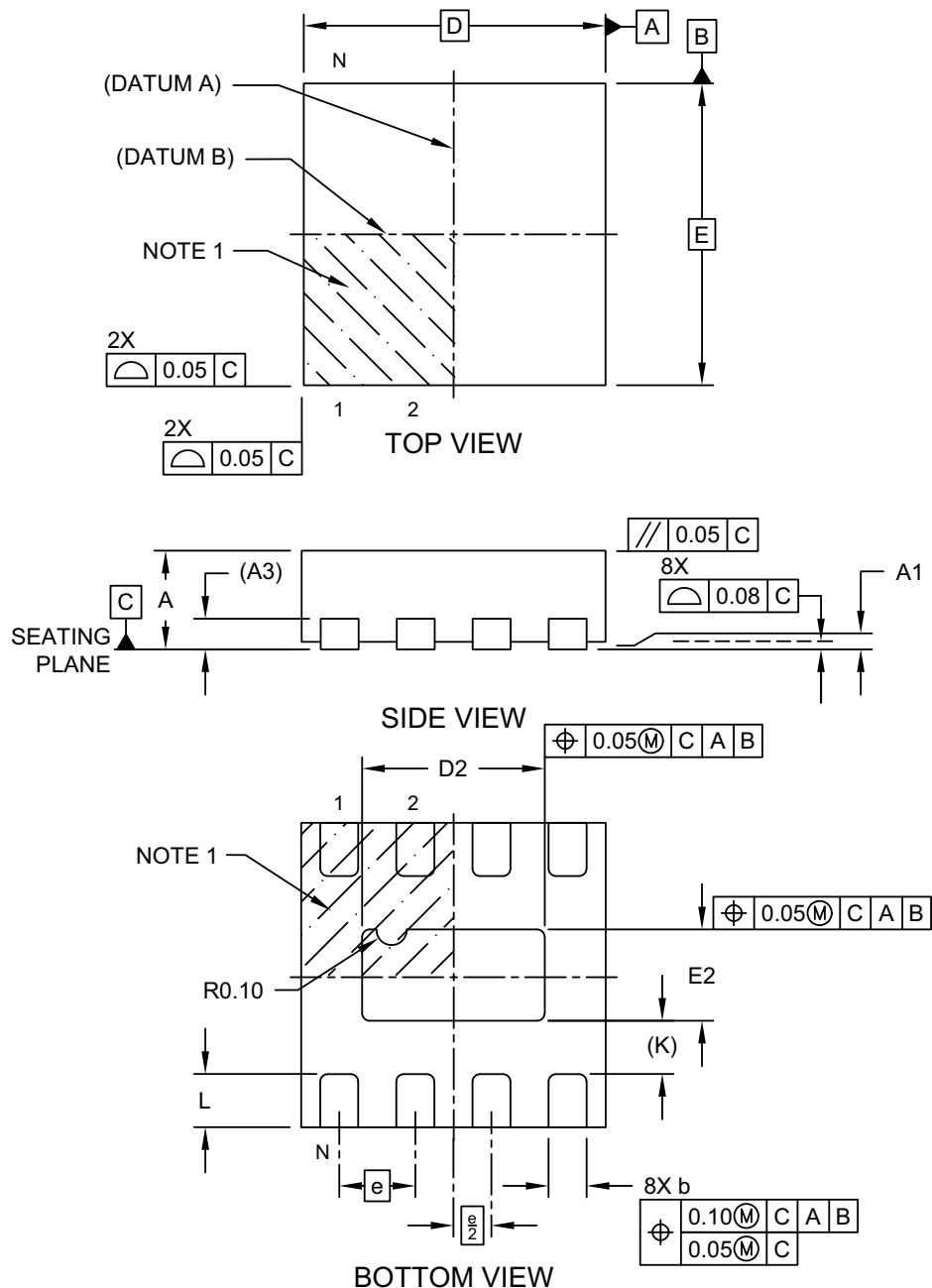


Legend:	XX...X	Product code or customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.
	•, ▲, ▼	Pin one index is identified by a dot, delta up, or delta down (triangle mark).
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. Package may or may not include the corporate logo.	
	Underbar (_) and/or Overbar (¯) symbol may not be to scale.	

Note: If the full seven-character YYWWNNN code cannot fit on the package, the following truncated codes are used based on the available marking space:
 6 Characters = YWWNNN; 5 Characters = WWNNN; 4 Characters = WNNN; 3 Characters = NNN;
 2 Characters = NN; 1 Character = N

8-Lead Ultra Thin Plastic Dual Flat, No Lead Package (HYA) - 2x2 mm Body [UDFN] With 1.2x0.6 mm Exposed Pad

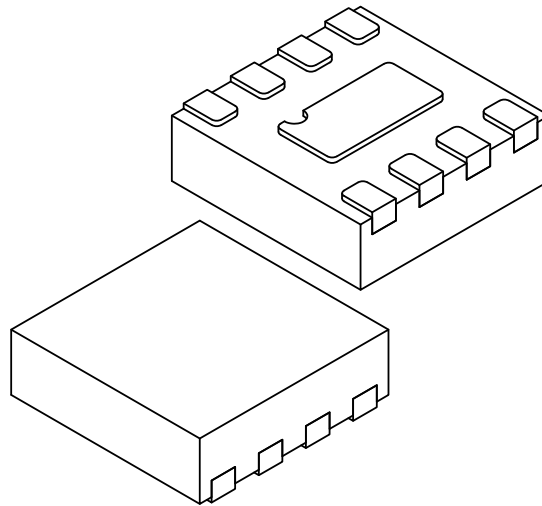
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packageing>



Microchip Technology Drawing C04-1158-HYA Rev C Sheet 1 of 2

8-Lead Ultra Thin Plastic Dual Flat, No Lead Package (HYA) - 2x2 mm Body [UDFN] With 1.2x0.6 mm Exposed Pad

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	8		
Pitch	e	0.50 BSC		
Overall Height	A	0.50	0.55	0.60
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3	0.152 REF		
Overall Length	D	2.00 BSC		
Exposed Pad Length	D2	1.10	1.20	1.30
Overall Width	E	2.00 BSC		
Exposed Pad Width	E2	0.50	0.60	0.70
Terminal Width	b	0.20	0.25	0.30
Terminal Length	L	0.30	0.35	0.40
Terminal-to-Exposed-Pad	K	0.35 REF		

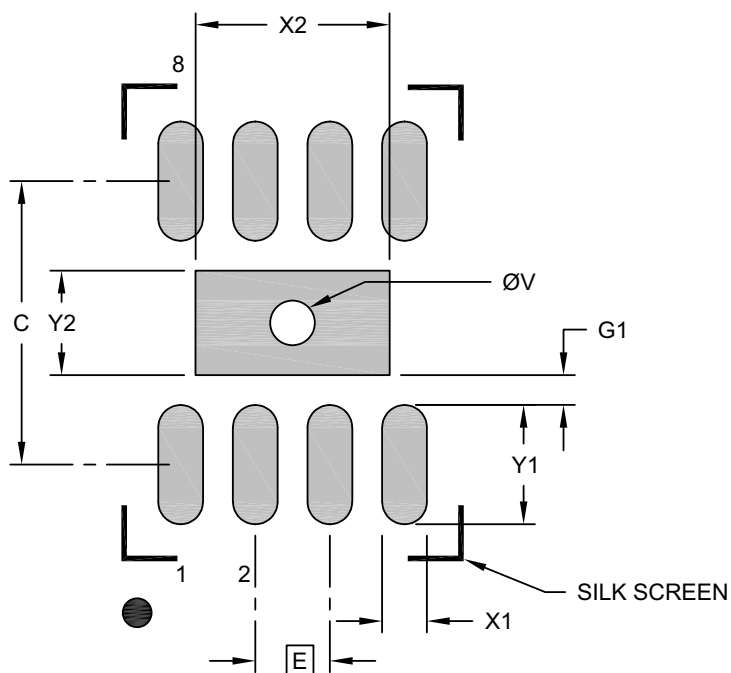
Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M
 - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 - REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1158-HYA Rev C Sheet 2 of 2

8-Lead Very Thin Plastic Dual Flat, No Lead Package (HYA) - 2x2 mm Body [UDFN] Micrel Legacy Package

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Optional Center Pad Width	X2			1.30
Optional Center Pad Length	Y2			0.70
Contact Pad Spacing	C		1.90	
Contact Pad Width (X8)	X1			0.30
Contact Pad Length (X8)	Y1			0.80
Contact Pad to Center Pad (X8)	G1	0.20		
Thermal Via Diameter	V		0.30	

Notes:

- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-3158-HYA Rev. C

APPENDIX A: REVISION HISTORY

Revision A (March 2026)

- Converted Micrel document MIC5332 to Microchip data sheet DS20007052A.
- Minor text changes throughout.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

<u>Part Number</u>	<u>-XX</u>	<u>X</u>	<u>XX</u>	<u>-XX</u>
Device	Voltage	Temperature Range	Package	Media Type
Device:	MIC5332:	Micropower, High-Performance Dual 300 mA ULDO		
	G4	=	1.8V/1.2V	
	J4	=	2.5V/1.2V	
	MM	=	2.8V/2.8V	
	MN	=	2.8V/2.85V	
Voltage:	NN	=	2.85V/2.85V	
	PM	=	3.0V/2.8V	
	PN	=	3.0V/2.85V	
	PP	=	3.0V/3.0V	
	SS	=	3.3V/3.3V	
Temperature Range:	Y	=	-40°C to +125°C	
Package:	MT	=	8-Lead 2 mm x 2 mm UDFN	
Media Type:	TR	=	5,000/Reel	

Examples:

a) MIC5332-G4YMT-TR:
MIC5332, 1.8V/1.2V Voltage, -40°C to +125°C Temp. Range, 8-Lead UDFN, 5,000/Reel

b) MIC5332-MMYMT-TR:
MIC5332, 2.8V/2.8V Voltage, -40°C to +125°C Temp. Range, 8-Lead UDFN, 5,000/Reel

c) MIC5332-PMYMT-TR:
MIC5332, 3.0V/2.8V Voltage, -40°C to +125°C Temp. Range, 8-Lead UDFN, 5,000/Reel

d) MIC5332-SSYMT-TR:
MIC5332, 3.3V/3.3V Voltage, -40°C to +125°C Temp. Range, 8-Lead UDFN, 5,000/Reel

Note: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

MARKING CODES

Part Number	Marking	Voltage	Package
MIC5332-G4YMT	WG4	1.8V/1.2V	8-Lead 2 mm x 2 mm UDFN
MIC5332-J4YMT	WJ4	2.5V/1.2V	8-Lead 2 mm x 2 mm UDFN
MIC5332-MMYMT	WMM	2.8V/2.8V	8-Lead 2 mm x 2 mm UDFN
MIC5332-MNYMT	WMN	2.8V/2.85V	8-Lead 2 mm x 2 mm UDFN
MIC5332-NNYMT	WNN	2.85V/2.85V	8-Lead 2 mm x 2 mm UDFN
MIC5332-PMYMT	WPM	3.0V/2.8V	8-Lead 2 mm x 2 mm UDFN
MIC5332-PNYMT	WPN	3.0V/2.85V	8-Lead 2 mm x 2 mm UDFN
MIC5332-PPYMT	WPP	3.0V/3.0V	8-Lead 2 mm x 2 mm UDFN
MIC5332-SSYMT	WSS	3.3V/3.3V	8-Lead 2 mm x 2 mm UDFN

NOTES:

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