MIC5396/7/8/9

Low-Power Dual 300 mA LDO

Features

- 2.5V to 5.5V Input Voltage Range
- Independent Power Inputs
- Output Voltage Range from 1V to 3.3V
- Two 300 mA Outputs
- High Output Accuracy (±2%)
- Low Quiescent Current (37 µA typ. per LDO)
- Stable with 1 µF Ceramic Output Capacitors
- Low Dropout Voltage (160 mV at 300 mA)
- Independent Enable Pins
- Internal Enable Pull-Down (MIC5398, MIC5399)
- Output Discharge Circuit (MIC5397, MIC5399)
- Thermal Shutdown Protection
- Current Limit Protection
- 8-Lead 1.6 mm × 1.2 mm Extra Thin DFN Package

Applications

- Smartphones
- DSC, GPS, PMP and PDAs
- Medical Devices
- Portable Electronics

General Description

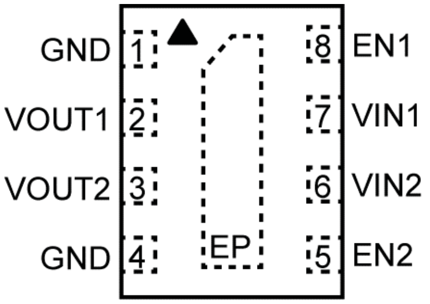
The MIC5396, MIC5397, MIC5398, and MIC5399 are advanced dual LDOs ideal for powering general purpose portable devices. The MIC5396/7/8/9 provide two high performance, independent 300 mA LDOs in a single package. This makes it possible to improve system efficiency by providing two independent supply inputs that can be optimized for each individual LDO. The MIC5396/7/8/9 also feature a wide output voltage range down to 1.0V.

Its full feature set and low dropout voltage make it ideal for battery-powered applications. The MIC5396/7/8/9 offer 2% accuracy, low dropout voltage (160 mV at 300 mA), and low ground current (typically 42 µA per LDO at full load). The MIC5396/7/8/9 can also be put into a zero off mode current state, drawing virtually no current when disabled.

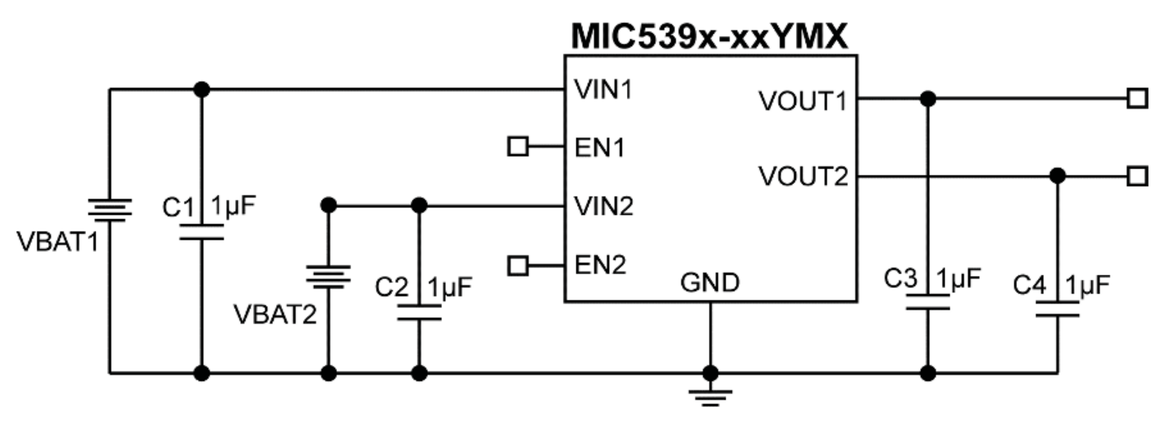
When the MIC5397 or MIC5399 are disabled, an internal resistive load is automatically applied to the output to discharge the output capacitor. In addition, the MIC5398 and MIC5399 offer an internal enable pull-down resistor to ensure that the output is disabled when the enable is in tri-state mode. These LDOs also offer fast transient response and high PSRR while consuming a minimum operating current. The family is available in a tiny 8-lead, 1.6 mm x 1.2 mm leadless Extra Thin DFN package.

Package Type

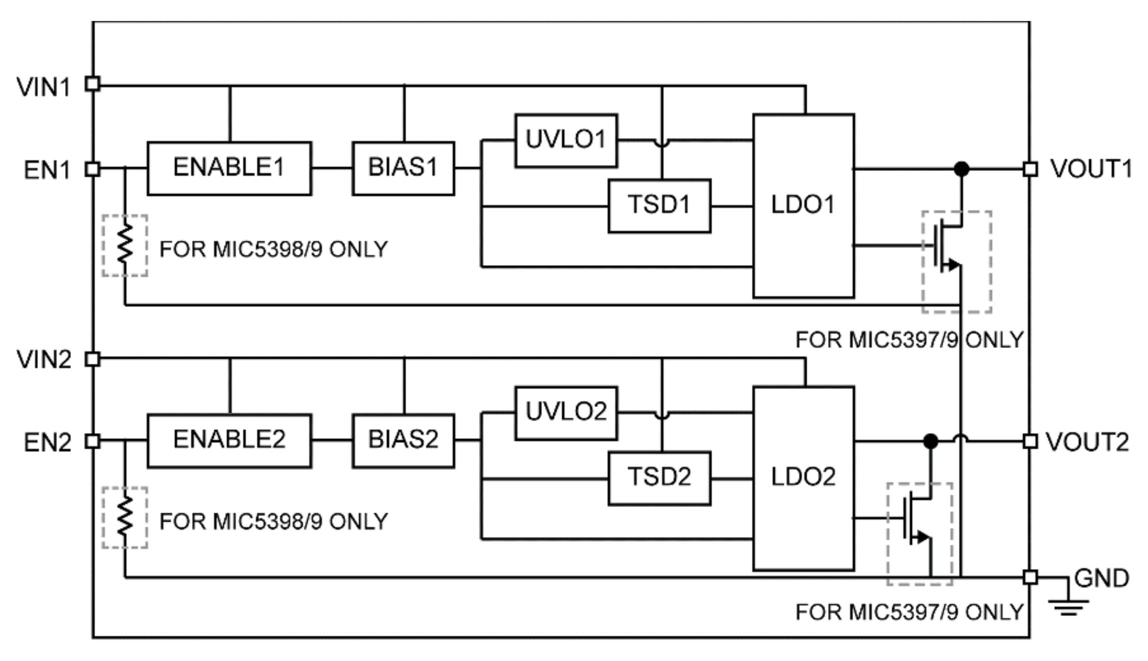
MIC5396/7/8/9
UDFN 8L, X2DFN 8L
(Top View)



Typical Application Schematic



Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings(†)

Supply Voltage (V_{IN1}, V_{IN2})	–0.3V to +6V
Enable Voltage (V_{EN1}, V_{EN2})	–0.3V to V_{IN}
Power Dissipation (P_D) Note 1	Internally Limited
ESD Rating Note 2	3 kV

Operating Ratings(‡)

Supply Voltage (V_{IN1}, V_{IN2})	+2.5V to +5.5V
Enable Voltage (V_{EN1}, V_{EN2})	0V to V_{IN}

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: Devices are ESD sensitive. Handling precautions are recommended. Human body model, 1.5 kΩ in series with 100 pF.

† **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.

ELECTRICAL CHARACTERISTICS

Electrical Characteristics: $V_{IN1} = V_{EN1} = V_{OUT1}$ + 1V, $V_{IN2} = V_{EN2} = V_{OUT2}$ + 1V, $I_{OUT1} = I_{OUT2}$ = 100 µA; $C_{IN1} = C_{IN2} = C_{OUT1} = C_{OUT2}$ = 1 µF; T_A = +25°C. **Bold** values are valid for –40°C to +125°C, unless noted. (**Note 1**).

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Voltage Accuracy	V_{OUT}	–2.0	—	+2.0	%	Variation from nominal V_{OUT}
		–3.0	—	**+3.0**		
Line Regulation	—	—	0.02	**0.3**	%/V	$V_{IN} = V_{OUT}$ +1V to 5.5V, I_{OUT} = 100 µA
Load Regulation	—	—	8	40	mV	I_{OUT} = 100 µA to 300 mA
Dropout Voltage	V_{DO}	—	80	**190**	mV	I_{OUT} = 150 mA
		—	160	**380**		I_{OUT} = 300 mA
Ground Pin Current	I_{GND}	—	37	**55**	µA	V_{EN1} = High; V_{EN2} = Low; I_{OUT2} = 0 mA
		—	37	**55**		V_{EN1} = Low; V_{EN2} = High; I_{OUT1} = 0 mA
		—	74	**110**		$V_{EN1} = V_{EN2}$ = High; $I_{OUT1} = I_{OUT2}$ = 0 mA
Ground Pin Current	I_{GND}	—	42	**65**	µA	V_{EN1} = High; V_{EN2} = Low; I_{OUT1} = 300 mA
		—	42	**65**		V_{EN1} = Low; V_{EN2} = High; I_{OUT2} = 300 mA
		—	84	**130**		$V_{EN1} = V_{EN2}$ = High; $I_{OUT1} = I_{OUT2}$ = 300 mA

Note 1: Specification for packaged product only.

ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Characteristics: $V_{IN1} = V_{EN1} = V_{OUT1} + 1V$, $V_{IN2} = V_{EN2} = V_{OUT2} + 1V$, $I_{OUT1} = I_{OUT2} = 100\ \mu A$; $C_{IN1} = C_{IN2} = C_{OUT1} = C_{OUT2} = 1\ \mu F$; $T_A = +25°C$. **Bold** values are valid for –40°C to +125°C, unless noted. (**Note 1**).

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Shutdown Current	I_{SHDN}	—	0.05	1	µA	$V_{EN1} = V_{EN2} = 0V$
Ripple Rejection	PSRR	—	60	—	dB	f = 1 kHz; $C_{OUT} = 1\ \mu F$
Current Limit	I_{LIM}	400	630	900	mA	$V_{OUT} = 0V$
Output Voltage Noise	e_N	—	93	—	μV_{RMS}	$C_{OUT} = 1\mu F$, 10 Hz to 100 kHz
Auto-Discharge NFET Resistance	$R_{DS(ON)}$	—	25	—	Ω	MIC5397, MIC5399 Only; $V_{EN1} = V_{EN2} = 0V$; $V_{IN} = 3.6V$; $I_{OUT} = -3\ mA$
Enable Inputs (EN1/EN2)						
Enable Pull-Down Resistor	$R_{PULL-DN}$	—	4	—	MΩ	MIC5398, MIC5399
Enable Input Voltage	V_{EN-LOW}	—	—	**0.2**	V	Logic Low
	$V_{EN-HIGH}$	**1.2**	—	—		Logic High
Enable Input Current MIC5396, MIC5397	I_{EN}	—	0.01	**1**	µA	$V_{EN} = 0V$
		—	0.01	**1**		$V_{EN} = 5.5V$
Enable Input Current MIC5398, MIC5399	I_{EN}	—	0.01	**1**	µA	$V_{EN} = 0V$
		—	1.4	2		$V_{EN} = 5.5V$
Turn-On Time	t_{ON}	—	50	**125**	µs	$C_{OUT} = 1\ \mu F$

Note 1: Specification for packaged product only.

TEMPERATURE SPECIFICATIONS

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Temperature Range	T_J	–40	—	+125	°C	Note 1
Storage Temperature Range	T_S	–65	—	+150	°C	—
Lead Temperature	—	—	—	260	°C	Soldering, 10 sec.
Package Thermal Resistances						
Thermal Resistance, UDFN-8	θ_{JA}	—	172.6	—	°C/W	—
Thermal Resistance, Extra Thin DFN-8						

Note 1: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +125°C rating. Sustained junction temperatures above +125°C can impact the device reliability.

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.

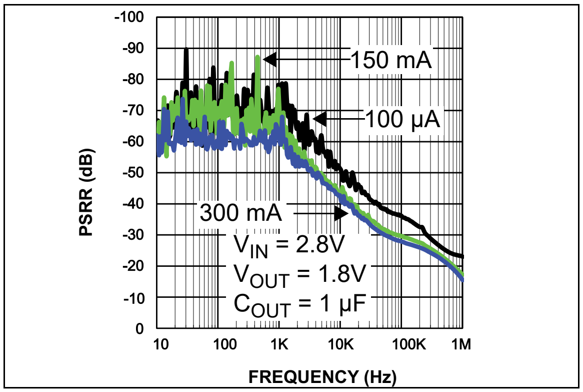


FIGURE 2-1: *Power Supply Rejection Ratio.*

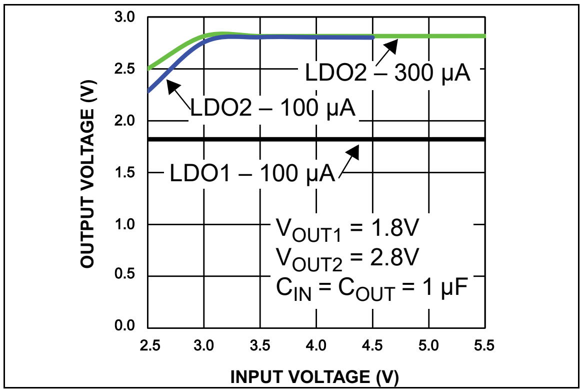


FIGURE 2-2: *Output Voltage vs. Input Voltage.*

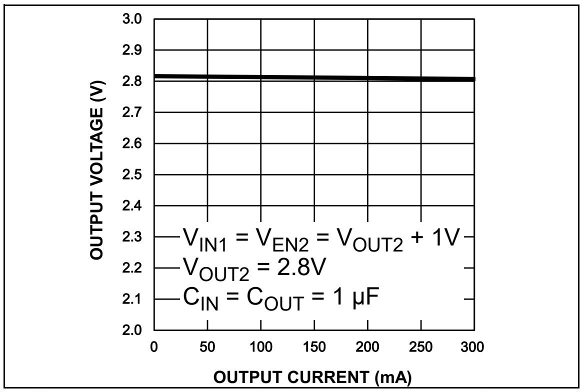


FIGURE 2-3: *Output Voltage vs. Output Current.*

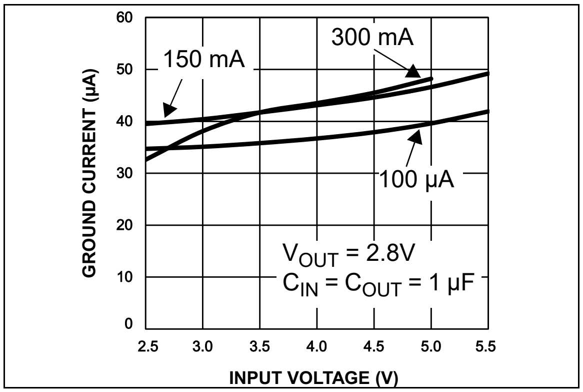


FIGURE 2-4: *Ground Current vs. Input Voltage.*

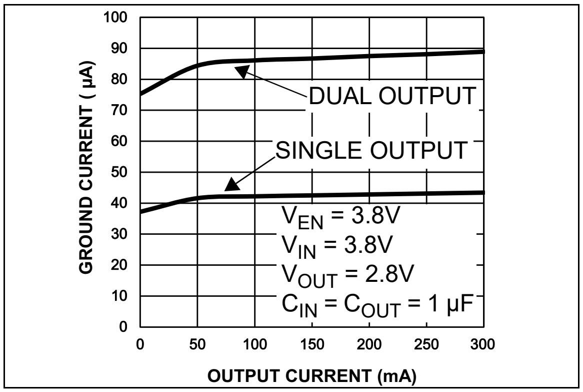


FIGURE 2-5: *Ground Current vs. Output Current.*

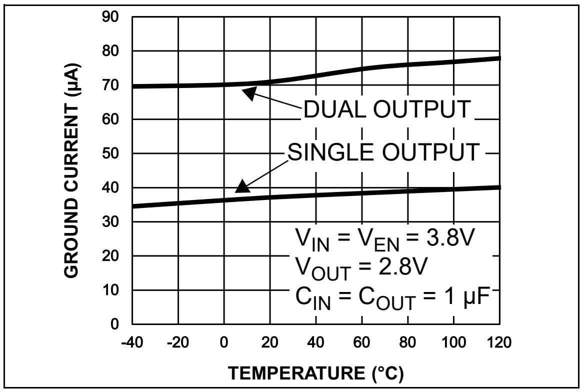


FIGURE 2-6: *Ground Current vs. Temperature.*

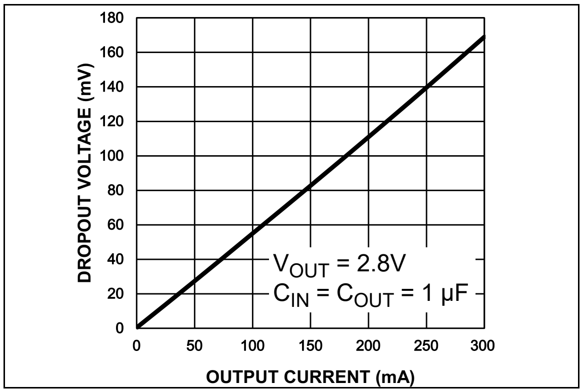


FIGURE 2-7: *Dropout Voltage vs. Output Current.*

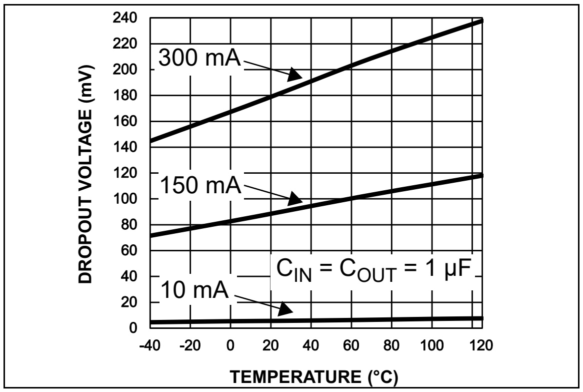


FIGURE 2-8: *Dropout Voltage vs. Temperature.*

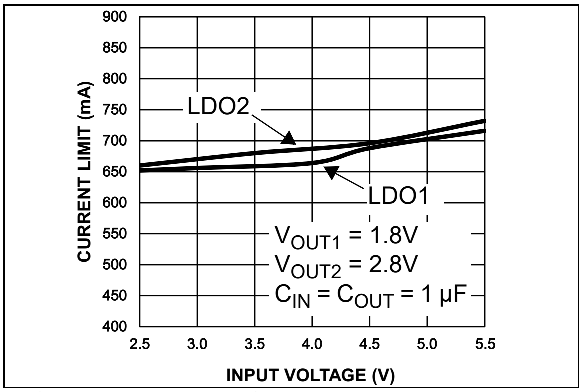


FIGURE 2-9: *Current Limit vs. Input Voltage.*

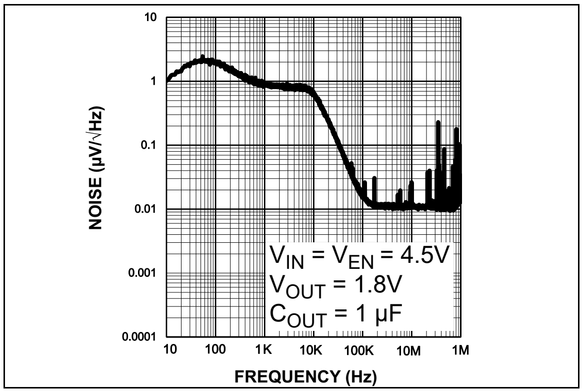


FIGURE 2-10: *Output Noise Spectral Density.*

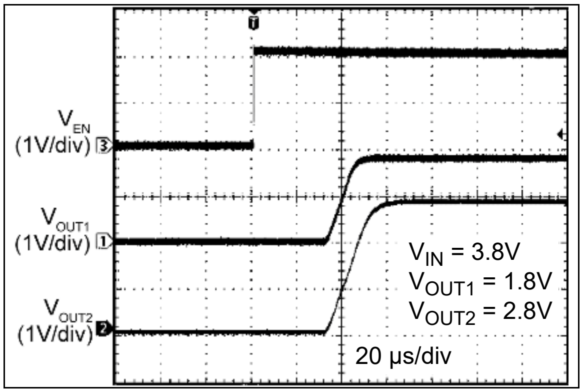


FIGURE 2-11: *Turn-On Time.*

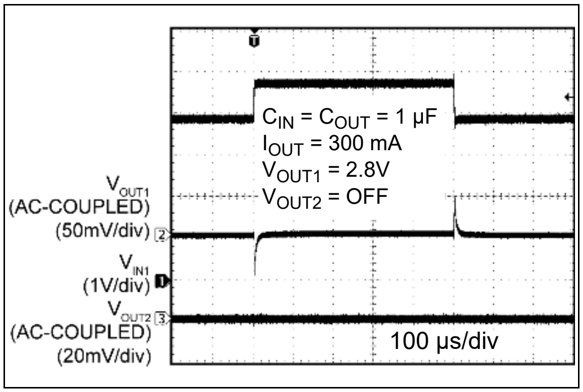


FIGURE 2-12: *Line Transient V_{IN1}.*

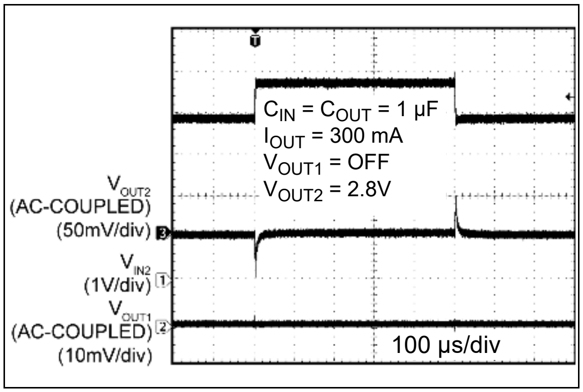


FIGURE 2-13: *Line Transient* V_{IN2}.

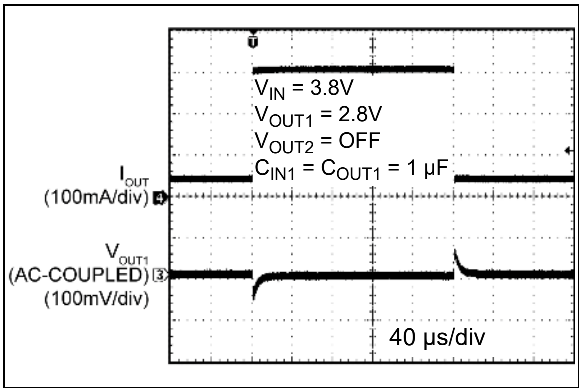


FIGURE 2-14: *Load Transient* V_{OUT1}.

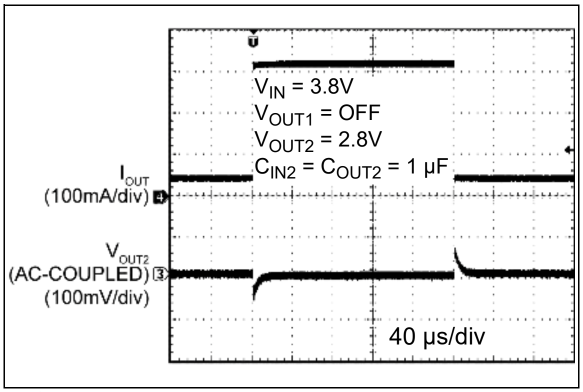


FIGURE 2-15: *Load Transient* V_{OUT2}.

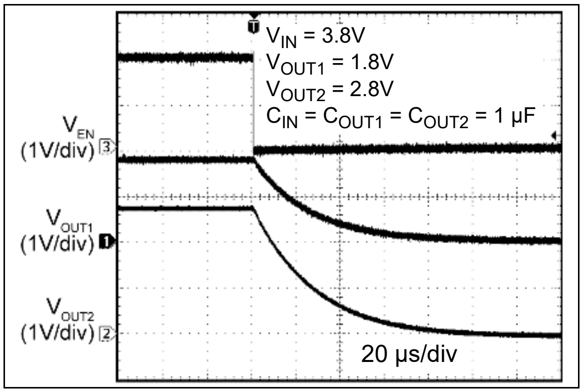


FIGURE 2-16: *Turn-Off Time.*

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, 4	GND	Ground.
2	VOUT1	Output regulator 1. Connect a capacitor to ground.
3	VOUT2	Output regulator 2. Connect a capacitor to ground.
5	EN2	Enable input for regulator 2: Active-high input. Logic high = On; Logic low = Off. MIC5396/7 Do not leave floating. MIC5398/9 internal pull-down resistor, tri-state = Off.
6	VIN2	Input voltage supply for regulator 2. Connect a capacitor to ground.
7	VIN1	Input voltage supply for regulator 1. Connect a capacitor to ground.
8	EN1	Enable input for regulator 1: Active-high input. Logic high = On; Logic low = Off. MIC5396/7 Do not leave floating. MIC5398/9 internal pull-down resistor, tri-state = Off.
EP	ePad	Exposed heat sink pad. Connect to ground.

4.0 APPLICATION INFORMATION

MIC5396/7/8/9 are dual 300 mA LDOs in a tiny 8-lead 1.2 mm x 1.6 mm Extra Thin DFN package. The MIC5397 and MIC5399 include an auto-discharge circuit for each LDO output, which is activated when the output is disabled. The MIC5398 and MIC5399 have an internal pull-down resistor on the enable pin to ensure that the output is disabled if the control signal is tri-stated. The MIC5396/7/8/9 regulators are fully protected from damage due to fault conditions using linear current limiting and thermal shutdown. These devices are not suitable for RF transmitter systems.

4.1 Input Capacitor

The MIC5396/7/8/9 are high-performance, high-bandwidth devices. An input capacitor of 1 µF capacitor is required from the input to ground to provide stability. Low-ESR ceramic capacitors provide optimal performance at a minimum of space. Additional high-frequency capacitors, such as small valued NPO dielectric type capacitors, help filter out high-frequency noise and are 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 MIC5396/7/8/9 require 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 MIC5396/7/8/9 will remain stable and in regulation with no load.

4.4 Enable/Shutdown

The MIC5396/7/8/9 come with two active-high enable pins that allow each regulator to be disabled independently. Forcing the enable pin low disables the regulator and sends it into an off mode current state drawing virtually zero current. When disabled, the MIC5397 and MIC5399 switch an internal 25Ω load on the regulator output to discharge the external capacitor.

Forcing the enable pin high enables the output voltage. The MIC5396 and MIC5397 active-high enable pin uses CMOS technology and cannot be left floating. A floating enable pin may cause an indeterminate state on the output. The MIC5398 and MIC5399 have an internal pull-down resistor on the enable pin to disable the output when the enable pin is floating.

4.5 Thermal Considerations

The MIC5396/7/8/9 are designed to provide two 300 mA continuous current outputs in a very small package. Maximum operating temperature can be calculated based on the output currents and the voltage drop across the part. For example, if the input voltage is 3.6V, V_{OUT1} = 3.3V, V_{OUT2} = 2.8V, each with an output current of 300 mA. The actual power dissipation of the regulator circuit can be determined using Equation 4-1:

EQUATION 4-1:

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

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 the calculation in Equation 4-2:

EQUATION 4-2:

$$P_D = (3.6V - 3.3V)300mA + (3.6V - 2.8V)300mA$$

$$P_D = 0.33W$$

To determine the maximum ambient operating temperature of the package, use the junction-to-ambient thermal resistance of the device and the following basic formula in Equation 4-3:

EQUATION 4-3:

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

Where:

$T_{J(MAX)}$ = 125°C

θ_{JA} = 172.6°C/W

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 172.6°C/W.

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

For example, when operating a 3.3V/2.8V application with an input voltage of 3.6V and 300 mA at each output with a minimum footprint layout, the maximum ambient operating temperature T_A can be determined as follows:

EQUATION 4-4:

$$0.33W = (125°C - TA)/(172.6°C/\mathrm{W})$$

$$T_A = 68.04°C$$

Therefore, a MIC5396-SMYMX application with 300 mA at each output current can accept an ambient operating temperature of 68.04°C in a 1.6 mm x 1.2 mm Extra Thin DFN package. For a full discussion of heat sinking and thermal effects of voltage regulators, refer to the "Regulator Thermals" section of Designing with Low-Dropout Voltage Regulators handbook.

5.0 TYPICAL APPLICATION SCHEMATIC

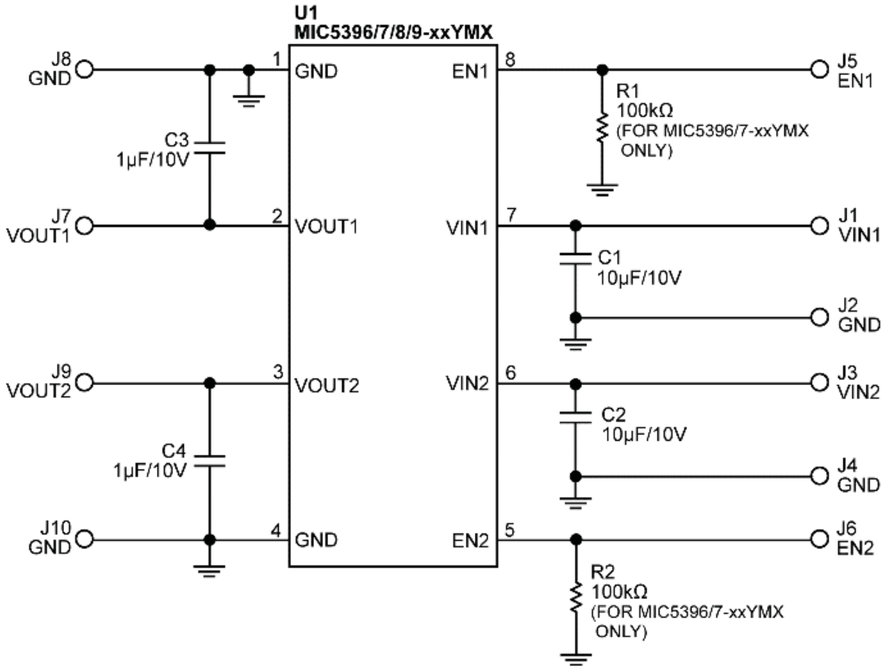


FIGURE 5-1: MIC5396/7/8/9-x.xYMX Typical Application Schematic.

TABLE 5-1: BILL OF MATERIALS

Item	Part Number	Manufacturer	Description	Qty.
C1, C2	C1608X5R0J106K	TDK	Capacitor, 1 µF Ceramic, 10V, X5R, Size 0402	2
C1, C2	C1005X5R1A105K	TDK	Capacitor, 1 µF Ceramic, 10V, X5R, Size 0402	2
C1, C2	CR0603100KFKEA	Vishay	Resistor, 100 kΩ, 1/16W, Size 0603	2
U1	**MIC5396/7/8/9-xxYMX**	**Microchip**	**Dual, 300 mA LDO, Size 1.2mm × 1.6mm Extra Thin DFN**	**1**

6.0 PCB LAYOUT RECOMMENDATIONS

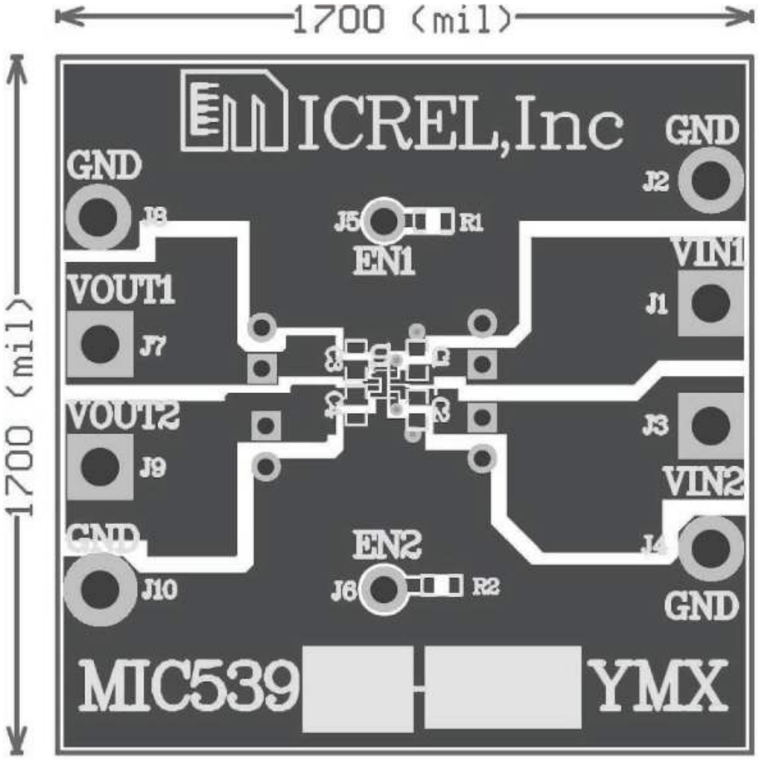


FIGURE 6-1: Top Layer.

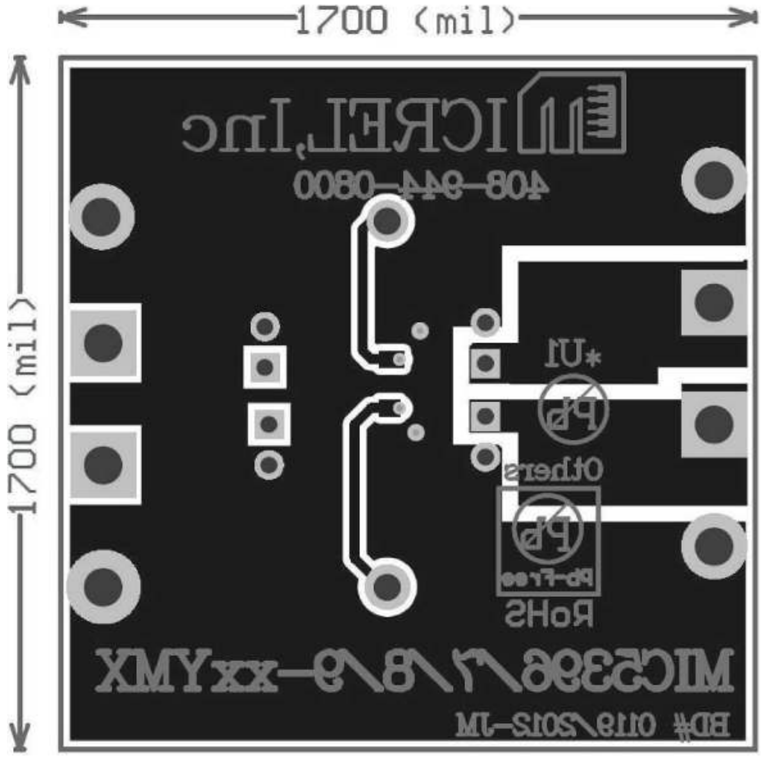
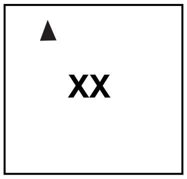


FIGURE 6-2: Bottom Layer.

7.0 PACKAGING INFORMATION

7.1 Package Marking Information

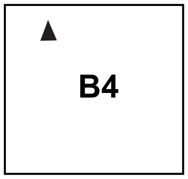
8-Lead UDFN



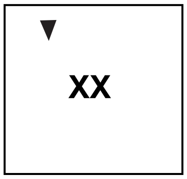
Part Number	Output Voltage	Code
MIC5396-P4YMT	3.0V/1.2V	B4
MIC5397-GPYMT	1.8V/3.0V	D6
MIC5399-GMYMT	1.8V/2.8V	H4
MIC5399-MMYMT	2.8V/2.8V	L8
MIC5399-SMYMT	3.3V/2.8V	L9

Note: The content of this table applies to 8-Lead UDFN.

Example



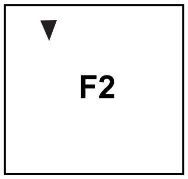
8-Lead X2DFN



Part Number	Output Voltage	Code
MIC5396-GMYMX	1.8V/2.8V	F2
MIC5397-GPYMX	1.8V/3.0V	D4
MIC5398-P4YMX	3.0V/1.2V	E5
MIC5399-GMYMX	1.8V/2.8V	H1
MIC5399-MMYMX	2.8V/2.8V	H7
MIC5399-SGYMX	3.3V/1.8V	H5
MIC5399-SMYMX	3.3V/2.8V	H6
MIC5399-SSYMX	3.3V/3.3V	H4

Note: The content of this table applies to 8-Lead X2DFN.

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
	ⓔ3	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (ⓔ3) 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).

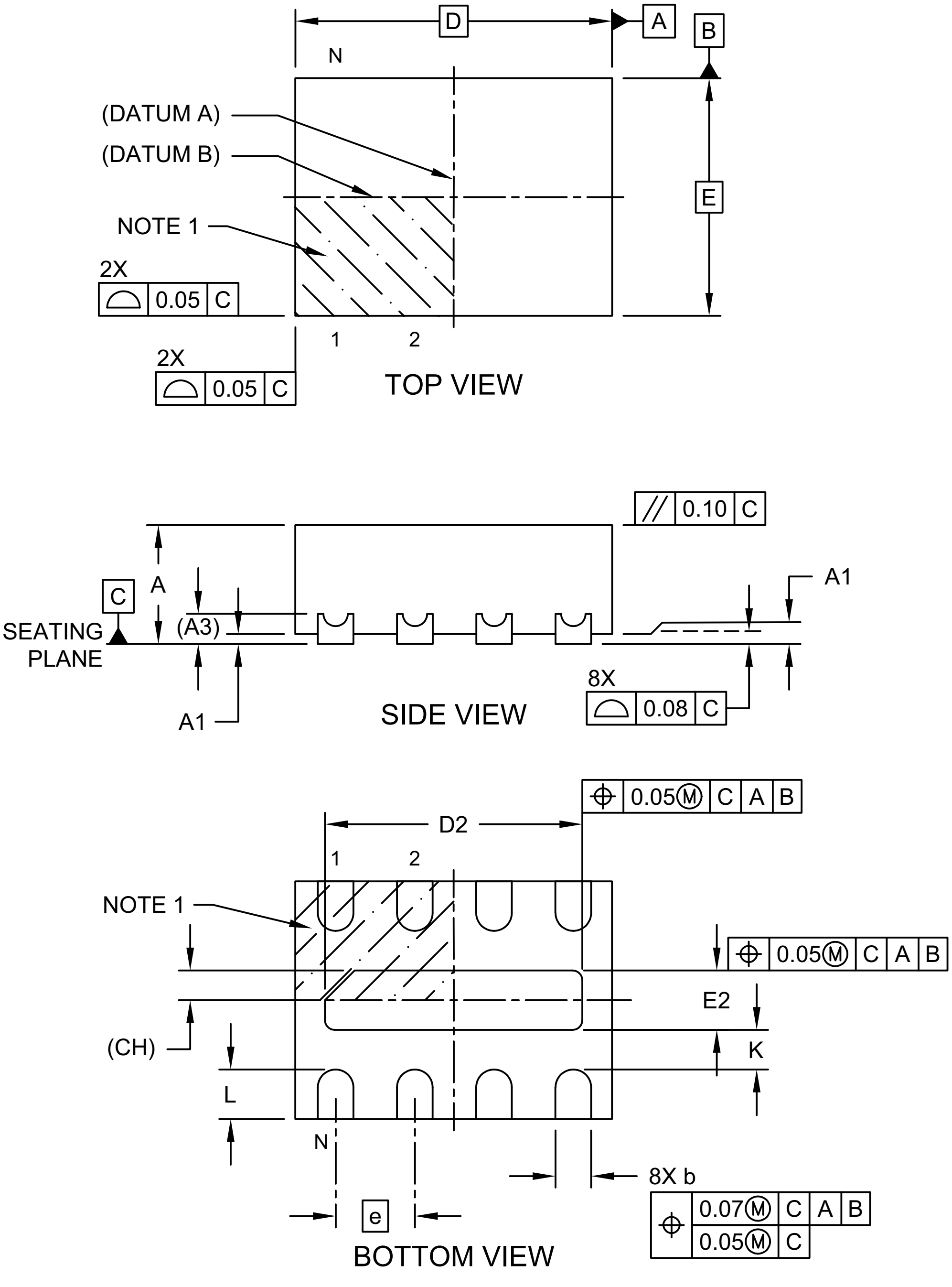
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

Underbar (_) symbol may not be to scale.

8-Lead Ultra Thin DFN Package Outline and Recommended Land Pattern

8-Lead Ultra Thin Dual Flat, No Lead Package (HJA) - 1.6 x 1.2 x 0.6 mm Body [UDFN] Micrel Legacy Package TMLF1216D-08L

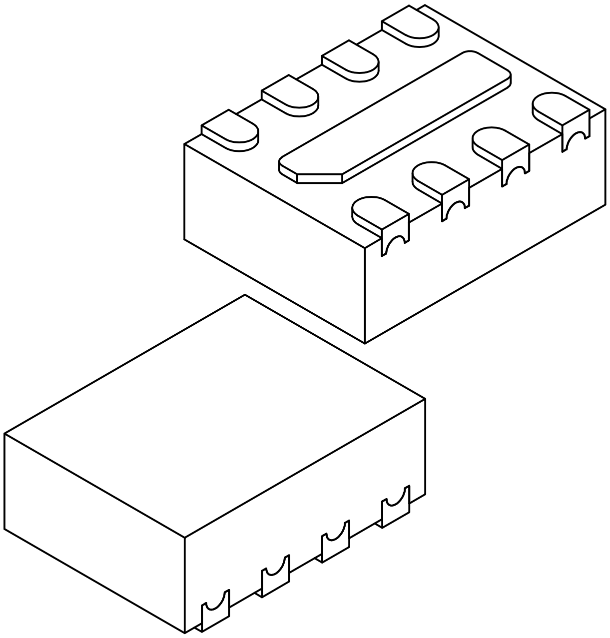
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-1153 Rev A Sheet 1 of 2

8-Lead Ultra Thin Dual Flat, No Lead Package (HJA) - 1.6 x 1.2 x 0.6 mm Body [UDFN] Micrel Legacy Package TMLF1216D-08L

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	0.40 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	1.60 BSC		
Exposed Pad Length	D2	1.25	1.30	1.35
Overall Width	E	1.20 BSC		
Exposed Pad Width	E2	0.25	0.30	0.35
Exposed Pad Index Chamfer	CH	0.15 REF		
Terminal Width	b	0.13	0.18	0.23
Terminal Length	L	0.20	0.25	0.30
Terminal-to-Exposed-Pad	K	0.20	–	–

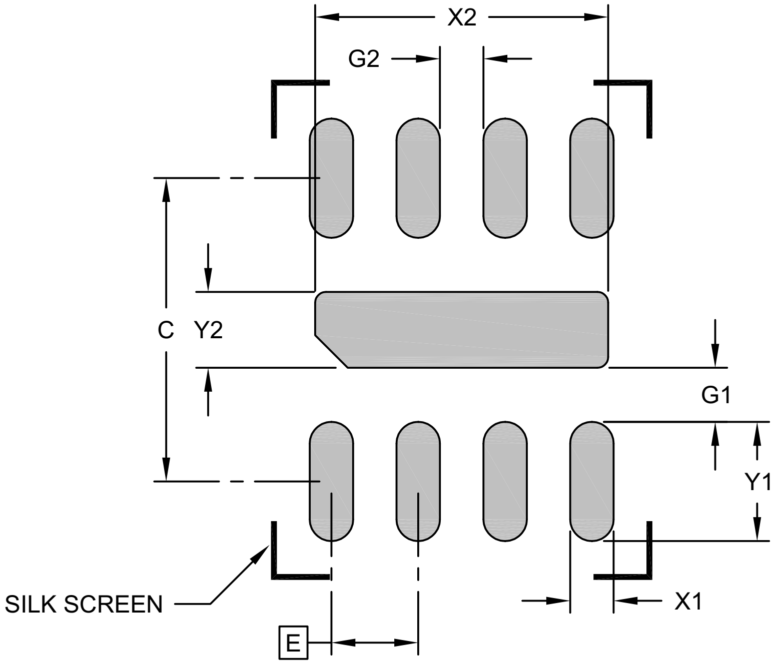
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. 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 C04-1153 Rev A Sheet 2 of 2

8-Lead Ultra Thin Dual Flat, No Lead Package (HJA) - 1.6 x 1.2 x 0.6 mm Body [UDFN] Micrel Legacy Package TMLF1216D-08L

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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		0.40 BSC	
Center Pad Width	X2			1.35
Center Pad Length	Y2			0.35
Contact Pad Spacing	C		1.40	
Contact Pad Width (X8)	X1			0.20
Contact Pad Length (X8)	Y1			0.55
Contact Pad to Center Pad (X8)	G1	0.25		
Contact Pad to Contact Pad (X6)	G2	0.20		

Notes:

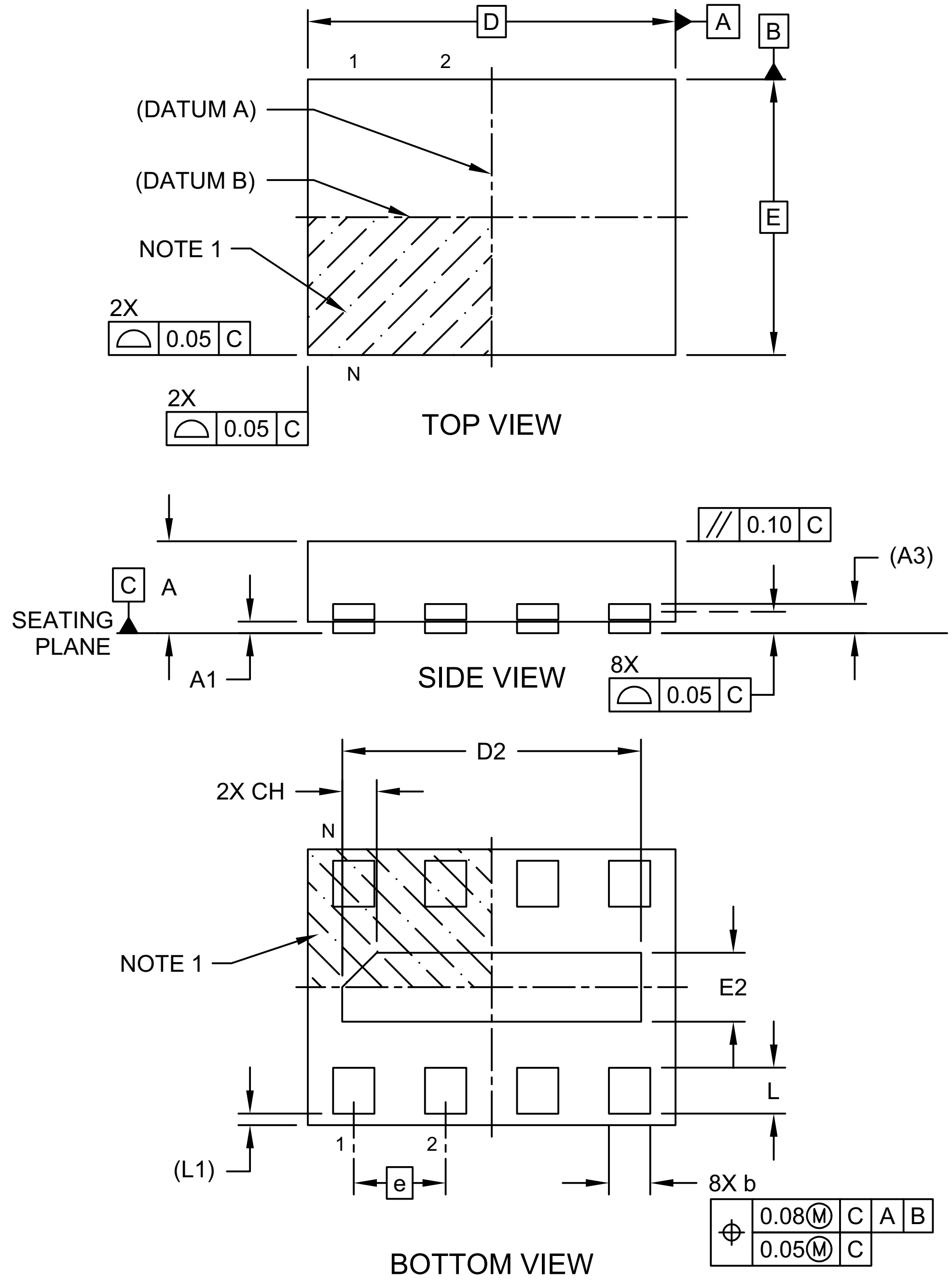
1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-3153 Rev A

8-Lead Extremely Thin DFN Package Outline and Recommended Land Pattern

8-Lead Extremely Thin Plastic Dual Flat, No Lead Package (K7A) - 1.6x1.2 mm Body [X2DFN]; Micrel Legacy XTDFN1216-08L

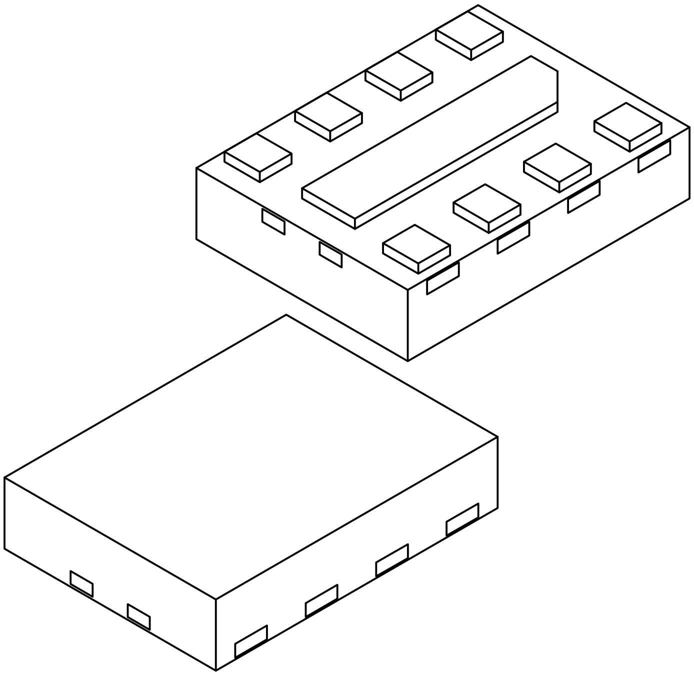
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-01260 Rev B Sheet 1 of 2

8-Lead Extremely Thin Plastic Dual Flat, No Lead Package (K7A) - 1.6x1.2 mm Body [X2DFN]; Micrel Legacy XTDFN1216-08L

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		0.40 BSC	
Overall Height	A	0.30	0.35	0.40
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3		0.127 REF	
Overall Length	D		1.60 BSC	
Exposed Pad Length	D2	1.25	1.30	1.35
Overall Width	E		1.20 BSC	
Exposed Pad Width	E2	0.25	0.30	0.35
Terminal Width	b	0.13	0.18	0.23
Terminal Length	L	0.15	0.20	0.25
Terminal Pullback	L1		0.05 REF	
Exposed Pad Corner Chamfer	CH	0.10	0.15	0.20

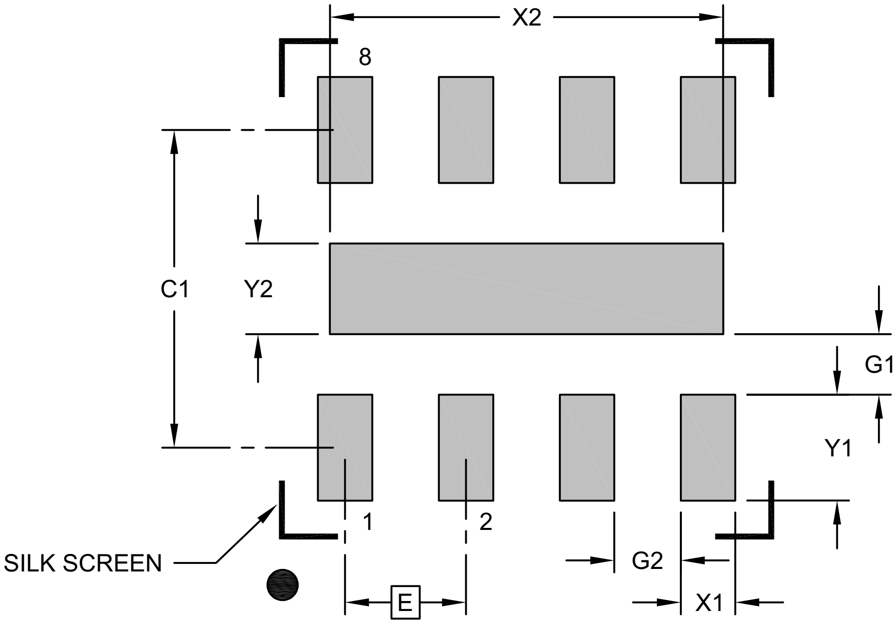
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. 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 C04-01260 Rev B Sheet 2 of 2

8-Lead Extremely Thin Plastic Dual Flat, No Lead Package (K7A) - 1.6x1.2 mm Body [X2DFN]; Micrel Legacy XTDFN1216-08L

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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.40 BSC		
Optional Center Pad Width	X2			1.30
Optional Center Pad Length	Y2			0.30
Contact Pad Spacing	C1		1.05	
Contact Pad Width (X20)	X1			0.18
Contact Pad Length (X20)	Y1			0.35
Contact Pad to Center Pad (X8)	G1	0.20		
Contact Pad to Contact Pad (X6)	G2	0.22		

Notes:

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

Microchip Technology Drawing C04-03260 Rev B

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (October 2019)

- Converted Micrel document MIC5396/7/8/9 to Microchip data sheet DS20006264A.
- Minor text changes throughout.
- Added Symbols column in the **Section 1.0 "Electrical Characteristics"** table.
- Updated Section 4.0, Application Information with adding this new sentence: These devices are not suitable for RF transmitter systems.
- Changed I_{OUT} = 300 mA from 500 mA in Figure 2-12 and Figure 2-13.

Revision B (January 2020)

- Updates to the Product Identification System in the Examples table and in the voltage option segment.

Revision C (April 2022)

- Part variants table and latest drawings were added to **Section 7.0 "Packaging Information"**.
- **Section "Product Identification System"** was updated to more accurately describe the part.
- Minor layout and aesthetic changes throughout.
- Minor grammatical 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.

PART NO.	-XX	X	XX	-XX
Device	**Voltage Option**	**Junction Temperature Range**	**Package**	**Media Type**

Device:
MIC5396: Low-Power Dual 300 mA LDO
MIC5397: Low-Power Dual 300 mA LDO with Output Discharge Circuit
MIC5398: Low-Power Dual 300 mA LDO with Internal Enable Pull-Down
MIC5399: Low-Power Dual 300 mA LDO with Output Discharge Circuit and Internal Enable Pull-Down

Voltage Option
GM = 1.8V/2.8V (MIC5396)
GP = 1.8V/3.0V (MIC5397)
P4 = 3.0V/1.2V (MIC5398)
SS = 3.3V/3.3V (MIC5399)
SM = 3.3V/2.8V (MIC5399)
SG = 3.3V/1.8V (MIC5399)
MM = 2.8V/2.8V (MIC5399)

Junction Temperature Range:
Y = –40°C to +125°C (RoHS Compliant)

Package:
MT = 8-Lead 1.6 mm x 1.2 mm Thin DFN (Pb-Free)
MX = 8-Lead 1.6 mm x 1.2 mm Extra Thin DFN (Pb-Free)

Media Type:
T5 = 500/Reel
TR = 5,000/Reel

Examples:

a) MIC5396-P4YMT-T5:	Low-Power Dual 300 mA LDO, 3.0V/1.2V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm UDFN, 500/Reel
b) MIC5396-P4YMT-TR:	Low-Power Dual 300 mA LDO, 3.0V/1.2V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm X2DFN, 5,000/Reel
c) MIC5397-GPYMT-T5:	Low-Power Dual 300 mA LDO with Output Discharge Circuit, 1.8V/3.0V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm UDFN, 500/Reel
d) MIC5397-GPYMX-TR:	Low-Power Dual 300 mA LDO with Output Discharge Circuit, 1.8V/3.0V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm X2DFN, 5,000/Reel
e) MIC5398-P4YMX-T5:	Low-Power Dual 300 mA LDO with Internal Enable Pull-Down, 3.0V/1.2V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm X2DFN, 500/Reel
f) MIC5398-P4YMX-TR:	Low-Power Dual 300 mA LDO with Internal Enable Pull-Down, 3.0V/1.2V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm X2DFN, 5,000/Reel
g) MIC5399-GMYMX-T5:	Low-Power Dual 300 mA LDO with Output Discharge Circuit and Internal Enable Pull-Down, 1.8V/2.8V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm X2DFN, 500/Reel
h) MIC5399-MMYMT-TR:	Low-Power Dual 300 mA LDO with Output Discharge Circuit and Internal Enable Pull-Down, 2.8V/2.8V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm UDFN, 5,000/Reel
i) MIC5399-SMYMT-T5:	Low-Power Dual 300 mA LDO with Output Discharge Circuit and Internal Enable Pull-Down, 3.3V/2.8V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm UDFN, 500/Reel
j) MIC5399-SSYMX-TR:	Low-Power Dual 300 mA LDO with Output Discharge Circuit and Internal Enable Pull-Down, 3.3V/3.3V, –40°C to +125°C, 8-Lead 1.6 mm x 1.2 mm X2DFN, 5,000/Reel

Note 1: 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.

NOTES:

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