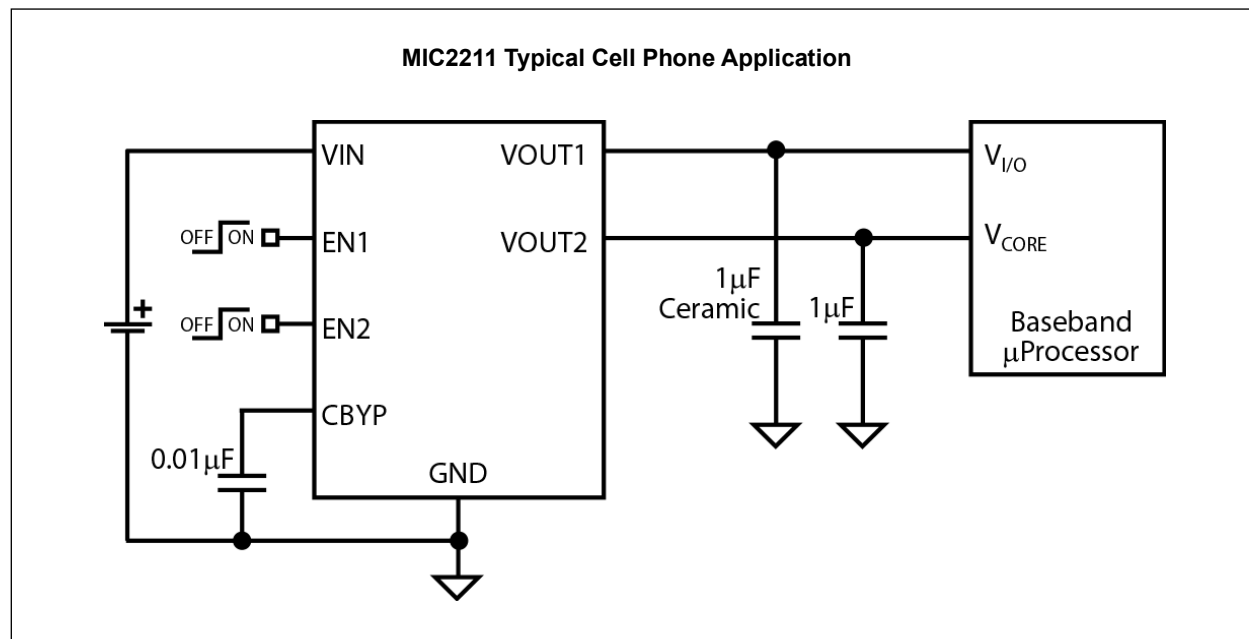


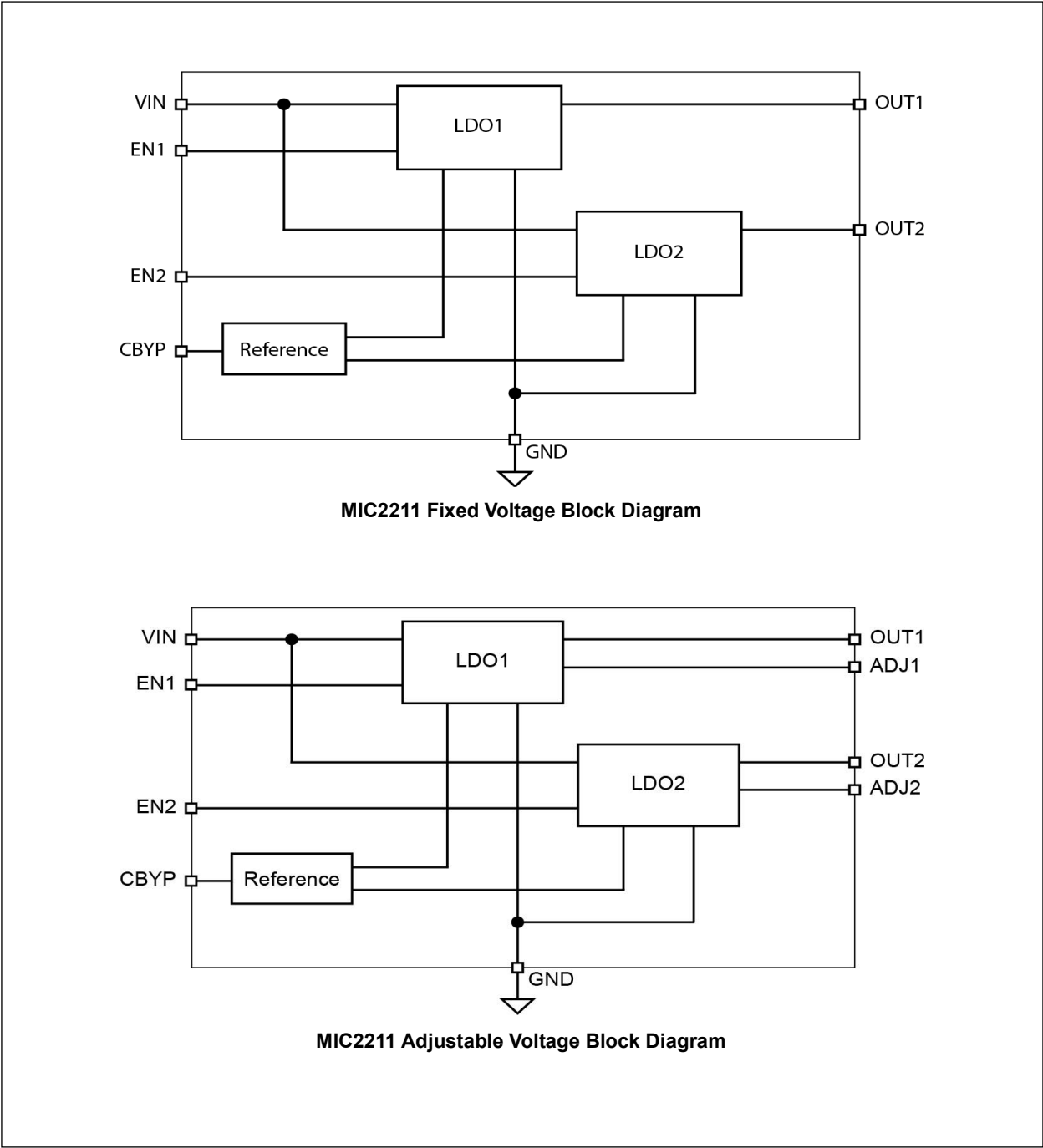


MIC2211

Typical Application Circuits



Functional Block Diagram



MIC2211

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Input Voltage (V_{IN})	0V to 7.0V
Enable Input Voltage (V_{EN})	0V to 7.0V
Power Dissipation (P_D), Note 1	Internally Limited

Operating Ratings ‡

Supply Input Voltage (V_{IN})	+2.25V to +5.5V
Enable Input Voltage (V_{EN})	0V to V_{IN}

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

ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{OUT} + 1.0V$ for higher output of the regulator pair; $C_{OUT} = 1.0 \mu F$, $I_{OUT} = 100 \mu A$; $T_J = 25^\circ C$, bold values indicate $-40^\circ C \leq T_J \leq +125^\circ C$, unless noted. (Note 1)						
Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Output Voltage Accuracy	V_O	-1.0	—	+1.0	%	Variation from nominal V_{OUT}
		-2.0	—	+2.0		
Output Voltage Temperature Coefficient	$\Delta V_O / \Delta T$	—	40	—	ppm/C	—
Line Regulation (Note 2)	$\Delta V_{OUT} / (V_{OUT} \times \Delta V_{IN})$	-0.3	0.02	0.3	%/V	$V_{IN} = V_{OUT} + 1V$ to 5.5V
		-0.6	—	0.6		
Load Regulation	$\Delta V_{OUT} / V_{OUT}$	—	0.2	1.0	%	$I_{OUT} = 100 \mu A$ to 150 mA (Regulator 1 and 2)
		—	—	1.5		$I_{OUT} = 100 \mu A$ to 300 mA (Regulator 2)
Dropout Voltage (Note 3)	$V_{IN} - V_{OUT}$	—	120	190	mV	$I_{OUT} = 150$ mA (Regulator 1 and 2)
		—	—	250		$I_{OUT} = 300$ mA (Regulator 2)
		—	240	340		
		—	—	420		
Ground Pin Current	I_{GND}	—	48	65	μA	$I_{OUT1} = I_{OUT2} = 0 \mu A$
		—	—	80		$I_{OUT1} = 150$ mA, $I_{OUT2} = 300$ mA
		—	60	—		

Note 1: Specification for packaged product only.

2: Minimum input for line regulation test is set to $V_{OUT} + 1V$ relative to the highest output voltage.

3: Dropout voltage is defined as the input-to-output differential at which the output voltage drops 2% below its nominal value measured at 1V differential. For outputs below 2.25V, dropout voltage is the input-to-output voltage differential with the minimum input voltage 2.25V. Minimum input operating voltage is 2.25V.

ELECTRICAL CHARACTERISTICS (CONTINUED)

$V_{IN} = V_{OUT} + 1.0V$ for higher output of the regulator pair; $C_{OUT} = 1.0 \mu F$, $I_{OUT} = 100 \mu A$; $T_J = 25^\circ C$, **bold** values indicate $-40^\circ C \leq T_J \leq +125^\circ C$, unless noted. (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Ground Pin Current in Shutdown	I_{GND_SHDN}	—	—	2.0	μA	$V_{EN} \leq 0.4V$
Ripple Rejection	PSRR	—	60	—	dB	$f = 1 \text{ kHz}$; $C_{OUT} = 1.0 \mu F$ ceramic; $C_{BYP} = 10 \text{ nF}$
		—	40	—		$f = 20 \text{ kHz}$; $C_{OUT} = 1.0 \mu F$ ceramic; $C_{BYP} = 10 \text{ nF}$
Current Limit	I_{LIM}	150	280	460	mA	$V_{OUT} = 0V$ (Regulator 1)
		300	450	700		$V_{OUT} = 0V$ (Regulator 2)
Output Voltage Noise	e_n	—	30	—	μV_{rms}	$C_{OUT} = 1 \mu F$, $C_{BYP} = 0.01 \mu F$, 10 Hz to 100 kHz
Enable Input						
Enable Input Voltage	V_{EN}	—	—	0.6	V	Logic Low (Regulator Shutdown)
		1.8	—	—	V	Logic Low (Regulator Enabled)
Enable Input Current	I_{EN}	−1	0.01	+1	μA	$V_{IL} < 0.6V$ (Regulator Shutdown)
		−1	0.01	+1	μA	$V_{IH} > 1.8V$ (Regulator Enabled)

- Note 1:** Specification for packaged product only.
- 2:** Minimum input for line regulation test is set to $V_{OUT} + 1V$ relative to the highest output voltage.
- 3:** Dropout voltage is defined as the input-to-output differential at which the output voltage drops 2% below its nominal value measured at 1V differential. For outputs below 2.25V, dropout voltage is the input-to-output voltage differential with the minimum input voltage 2.25V. Minimum input operating voltage is 2.25V.

TEMPERATURE SPECIFICATIONS

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Junction Temperature Range	T_J	−40	—	+125	$^\circ C$	—
Storage Temperature Range	T_s	−65	—	+150	$^\circ C$	—
Lead Temperature	—	—	+260	—	$^\circ C$	Soldering, 5 seconds
Package Thermal Resistance						
10-Lead 3 mm × 3 mm VDFN	θ_{JA}	—	+60	—	$^\circ C/W$	—

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.

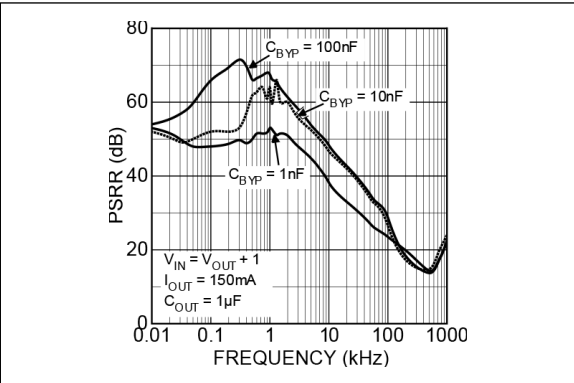


FIGURE 2-1: PSRR Output 1.

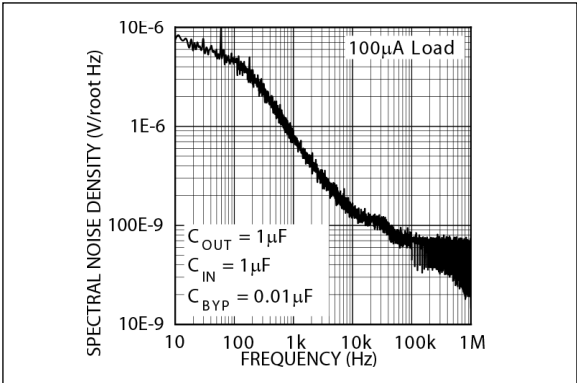


FIGURE 2-4: Special Noise Density Output 2.

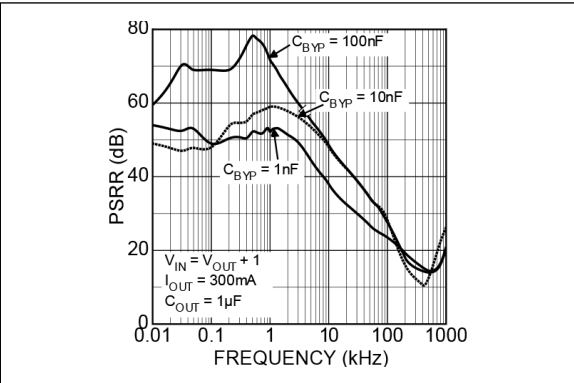


FIGURE 2-2: PSRR Output 2.

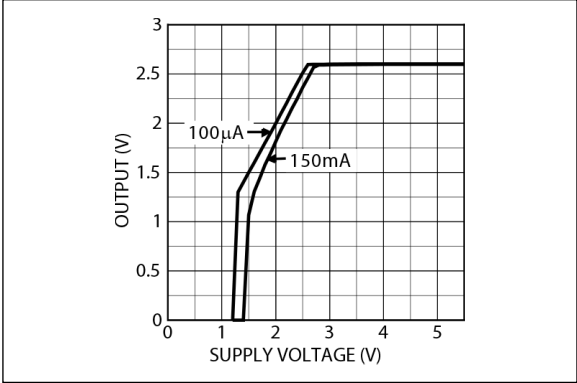


FIGURE 2-5: Dropout Characteristics Output 1.

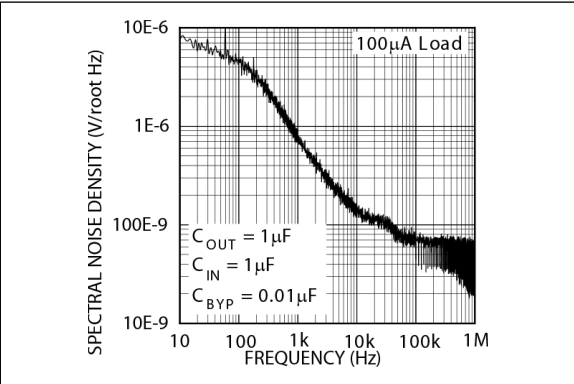


FIGURE 2-3: Special Noise Density Output 1.

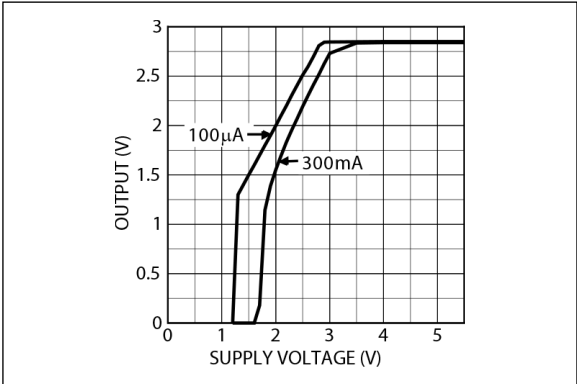


FIGURE 2-6: Dropout Characteristics Output 2.

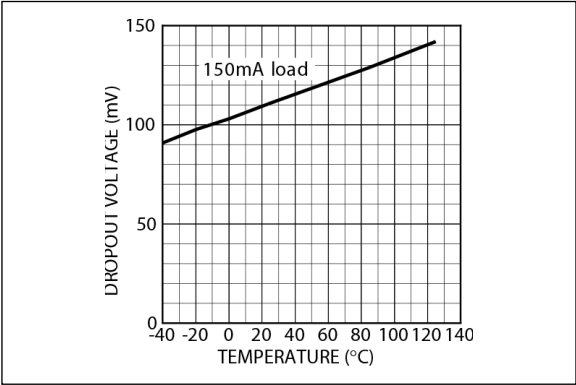


FIGURE 2-7: Dropout Voltage Output 1.

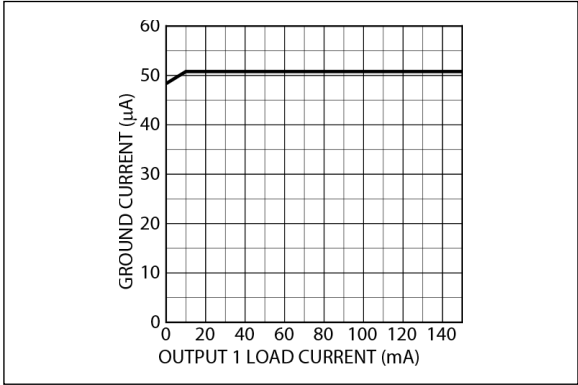


FIGURE 2-10: Ground Current vs. Output 1 Current.

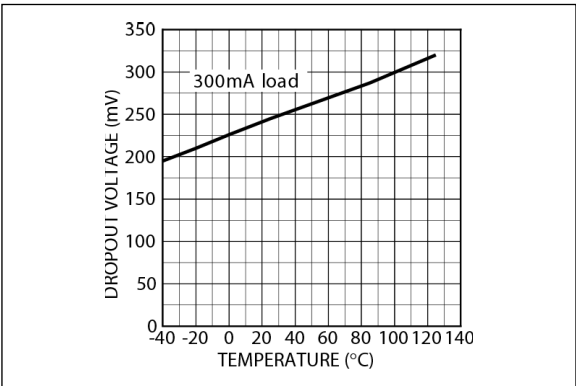


FIGURE 2-8: Dropout Voltage Output 2.

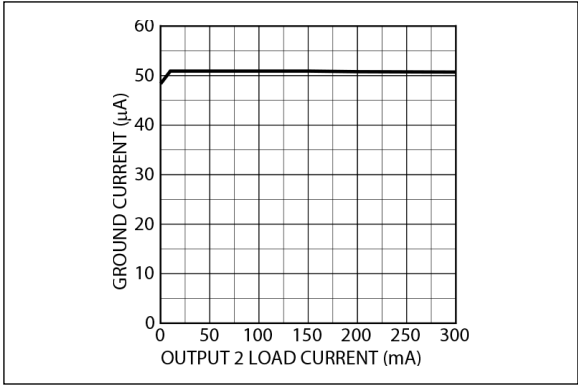


FIGURE 2-11: Ground Current vs. Output 2 Current.

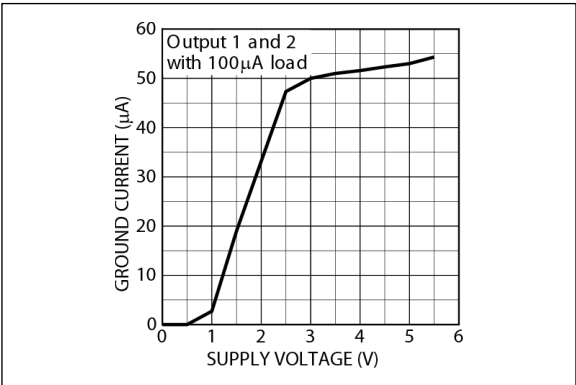


FIGURE 2-9: Ground Current vs. Supply Voltage.

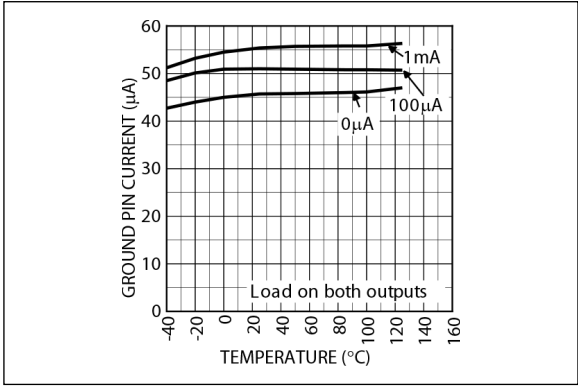


FIGURE 2-12: Ground Pin Current.

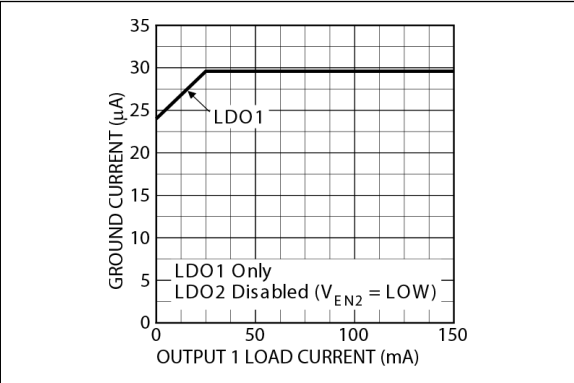


FIGURE 2-13: Ground Current vs. Output Current.

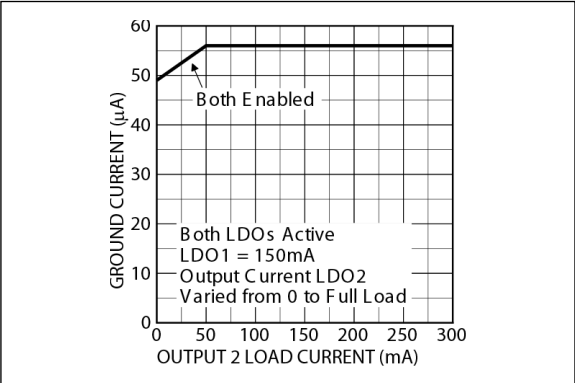


FIGURE 2-16: Ground Current vs. Output Current.

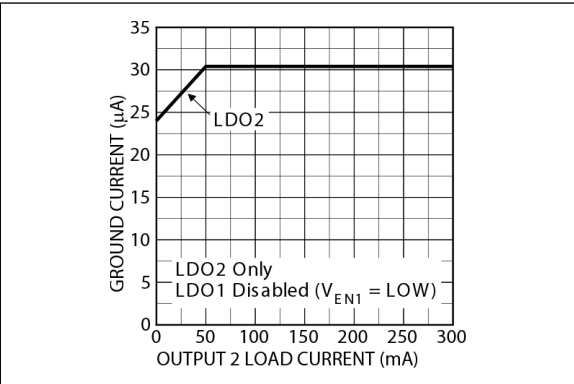


FIGURE 2-14: Ground Current vs. Output Current.

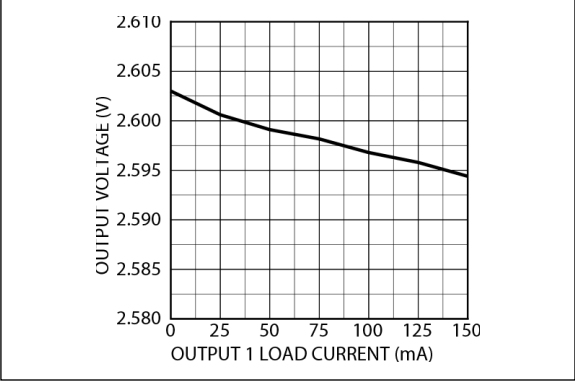


FIGURE 2-17: Output Voltage vs. Load Current.

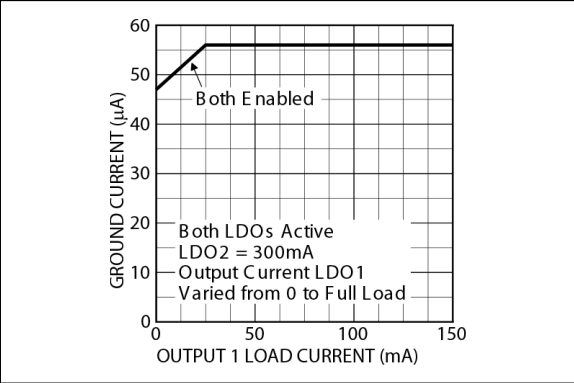


FIGURE 2-15: Ground Current vs. Output Current.

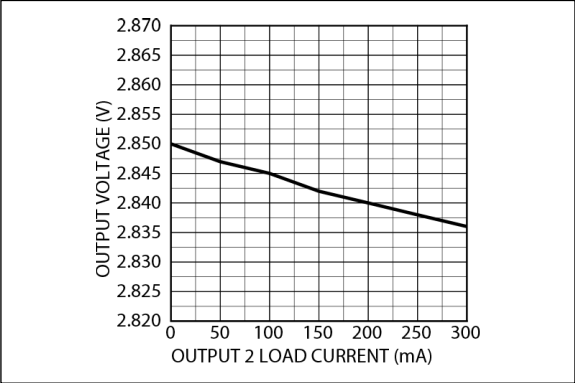


FIGURE 2-18: Output Voltage vs. Load Current.

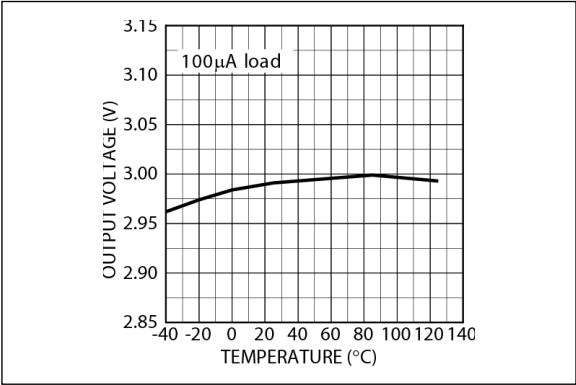


FIGURE 2-19: Output Voltage 1 vs. Temperature.

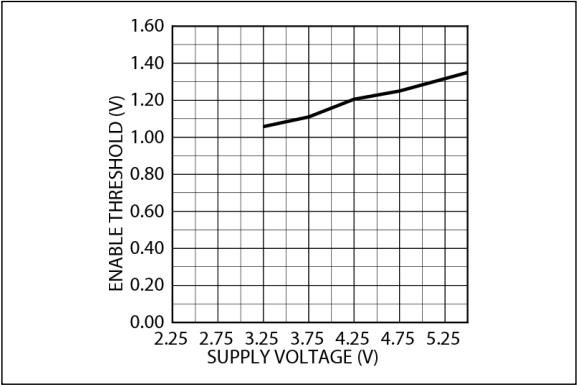


FIGURE 2-21: Enable Voltage Threshold vs. Supply Voltage.

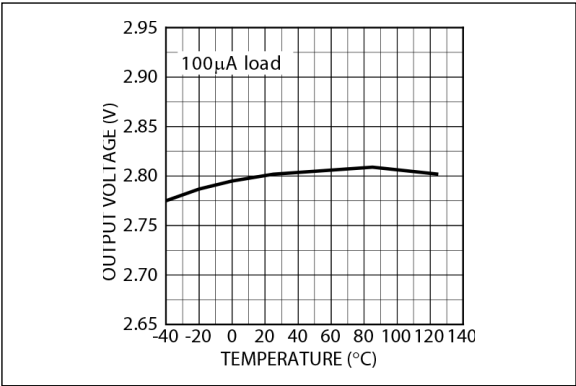


FIGURE 2-20: Output Voltage 2 vs. Temperature.

3.0 TYPICAL FUNCTIONAL CHARACTERISTICS

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.

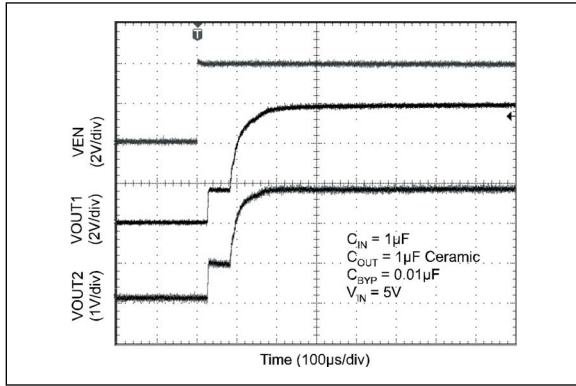


FIGURE 3-1: Enable Characteristics.

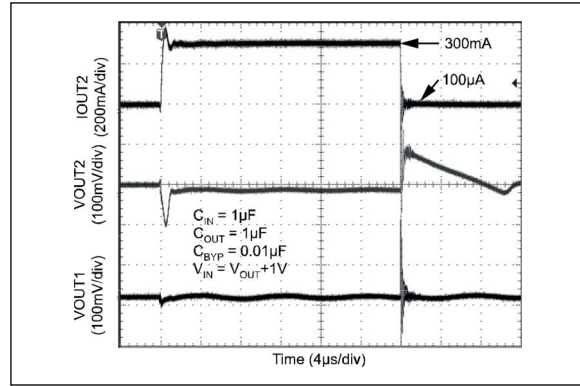


FIGURE 3-3: Load Transient Response (LDO 2).

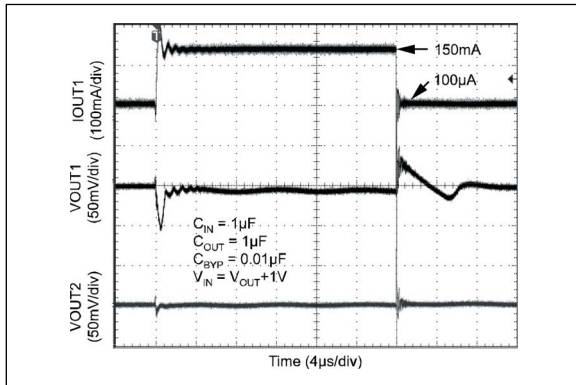


FIGURE 3-2: Load Transient Response (LDO 1).

4.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 4-1](#).

TABLE 4-1: PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	VIN	Supply input: (VIN1 and VIN2 are internally tied together.)
2	EN1	Enable input to regulator 1: Enables regulator 1 output. Active high input. High = ON, Low = OFF. Do not leave floating.
3	EN2	Enable input to regulator 2: Enables regulator 2 output. Active high input. High = ON, Low = OFF. Do not leave floating.
4	CBYP	Reference bypass: Connect external 0.01 μ F to GND to reduce output noise. May be left open.
5, 7, 8	NC	No connection.
6	GND	Ground: Connect externally to Exposed Pad.
9	VOUT2	Output of regulator 2: 300 mA output current.
10	VOUT1	Output of regulator 1: 150 mA output current.
EP	GND	Ground: Internally connected to the Exposed Pad. Connect externally to pin 6.

TABLE 4-2: VOLTAGE CODES

Voltage	Code
Adj.	A
1.5	F
1.6	W
1.8	G
1.85	D
1.9	Y
2.0	H
2.1	E
2.5	J
2.6	K
2.65	I

TABLE 4-2: VOLTAGE CODES

Voltage	Code
2.7	L
2.8	M
2.850	N
2.9	O
3.0	P
3.1	Q
3.2	R
3.3	S
3.4	T
3.5	U
3.6	V

5.0 FUNCTIONAL DESCRIPTION

The MIC2211 is a high performance, low quiescent current, power management IC consisting of two μ Cap low dropout regulators. The first regulator is capable of sourcing 150 mA at output voltages from 1.25V to 5V; the second regulator is capable of sourcing 300mA of current at output voltages from 1.25V to 5V.

5.1 Enable 1 and 2

The enable inputs allow for logic control of both output voltages with individual enable inputs. The enable input is active high, requiring 1.8V for guaranteed operation. The enable input is CMOS logic and cannot be left floating.

5.2 Input Capacitor

Good bypassing is recommended from input to ground to help improve AC performance. A 1 μ F capacitor or greater located close to the IC is recommended.

5.3 Bypass Capacitor

The internal reference voltage of the MIC2211 can be bypassed with a capacitor to ground to reduce output noise and increase Power Supply Rejection Ratio (PSRR). A quick-start feature allows for quick turn-on of the output voltage regardless of the size of the capacitor. The recommended nominal bypass capacitor is 0.01 μ F, but it can be increased without limit.

5.4 Output Capacitor

Each regulator output requires a 1 μ F ceramic output capacitor for stability. The output capacitor value can be increased to improve transient response, but performance has been optimized for a 1 μ F ceramic type output capacitor.

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.

6.0 ADJUSTABLE REGULATOR DESIGN

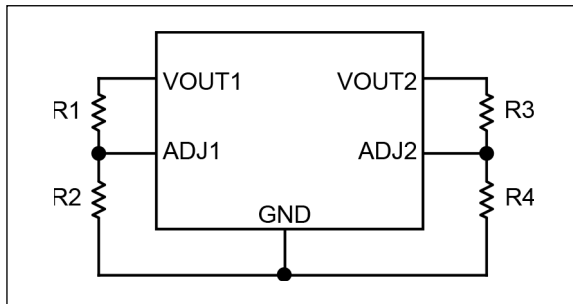


FIGURE 6-1: MIC2211 Adjustable Regulator Design.

The MIC2211 allows the programming of the output voltages 1 and 2 anywhere between 1.25V and 5.5V, the maximum operating rating of the part. Two resistors are required for each output. Appropriate resistor values are required to prevent the low quiescent current performance being compromised. Resistor values recommended are between 100 kΩ and 500 kΩ. The resistor values are calculated using the equation below.

EQUATION 6-1:

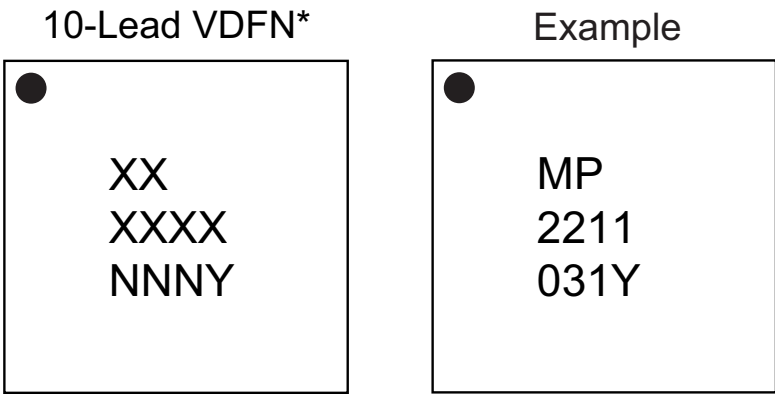
$$R1 = R2 \times \left(\frac{V_{OUT1}}{1.250} - 1 \right)$$

$$R3 = R4 \times \left(\frac{V_{OUT2}}{1.250} - 1 \right)$$

Where V_{OUT1} and V_{OUT2} are each the desired output voltage for their respective outputs. Calculate separately for each output.

7.0 PACKAGING INFORMATION

7.1 Package Marking Information

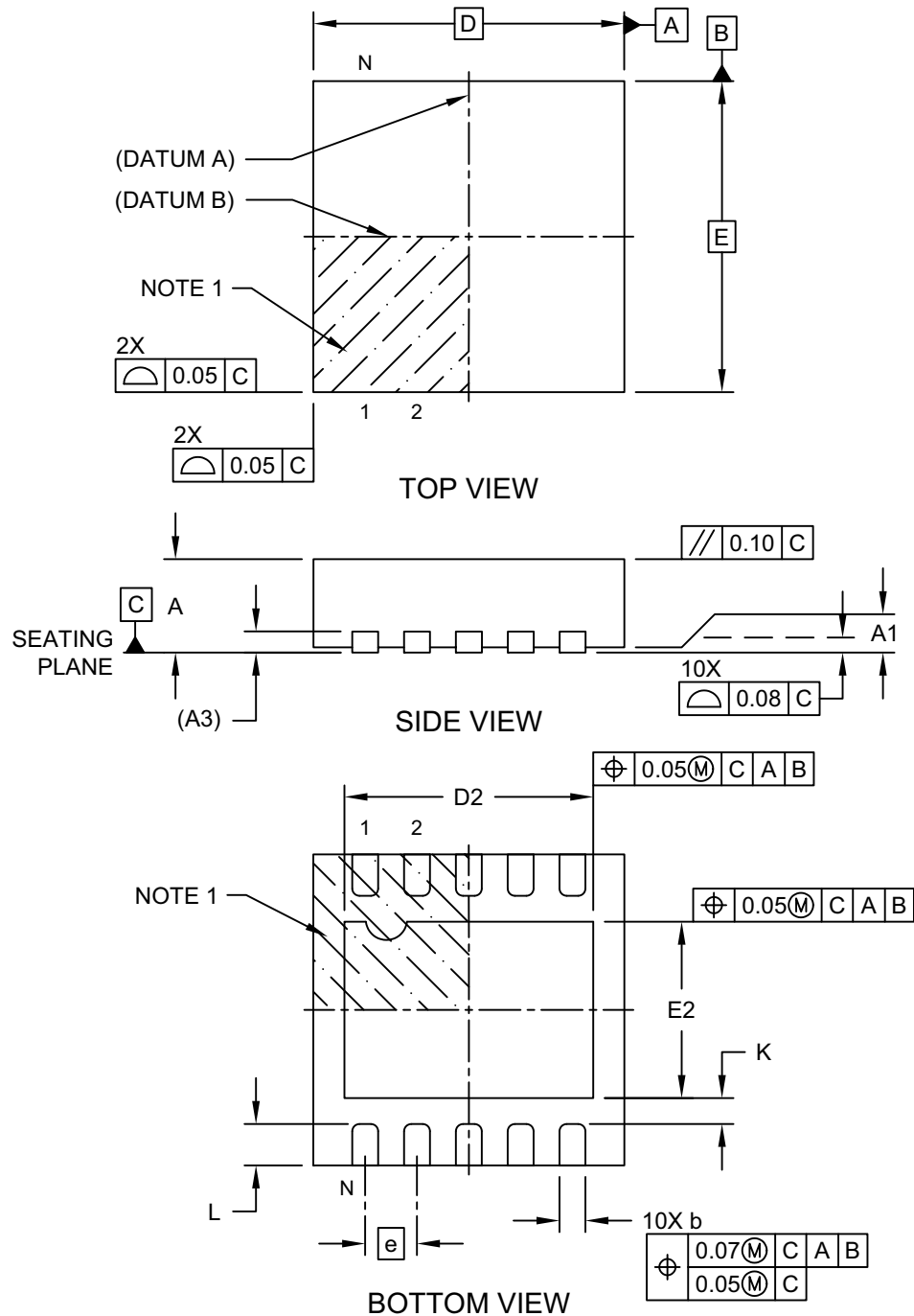


PACKAGE MARKING DRAWING SYMBOLS LEGEND

Symbol	Definition
XX . . . X	Product code or customer-specific information. (Note 1, Note 2)
YYWW	Date code, where YY is the last 2 digits of calendar year and WW is the work week (i.e., week of January 1 is week 01). (Note 3)
M	Month of assembly (if applicable). January is represented by “A” and each month thereafter follows the order of the alphabet through “L” for December.
NNN	Alphanumeric traceability code. (Note 3, Note 4)
ⓔ3	Pb-free JEDEC designator for Matte Tin (Sn).
*	Indicates this package is Pb-free. The Pb-free JEDEC designator (the symbol in the row above this one) 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 1: If the full Microchip part number cannot fit on one line, it will be carried over to the next line, limiting the number of available characters for customer-specific information. The package may or may not include the corporate logo. 2: Any underbar (_) and/or overbar (¯) symbols shown in a package marking drawing may not be to scale. 3: If the full date code (YYWW) and the alphanumeric traceability code (NNN)—usually marked together on the last or only line of a package marking as the seven-character YYWWNNN—cannot fit on the package together, the codes will be truncated based on the number of available character spaces, as follows: 6 characters = YWWNNN; 5 characters = WWNNN; 4 characters = WNNN; 3 characters = NNN; 2 characters = NN; 1 character = N. 4: Some products might have a “Y” symbol at the end of the last or only line in a package marking, usually at the end of the alphanumeric traceability code (NNN or truncated versions), to indicate the product is Pb-free.	

10-Lead 3 mm × 3 mm VDFN [JFA] Package Outline and Recommended Land Pattern

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

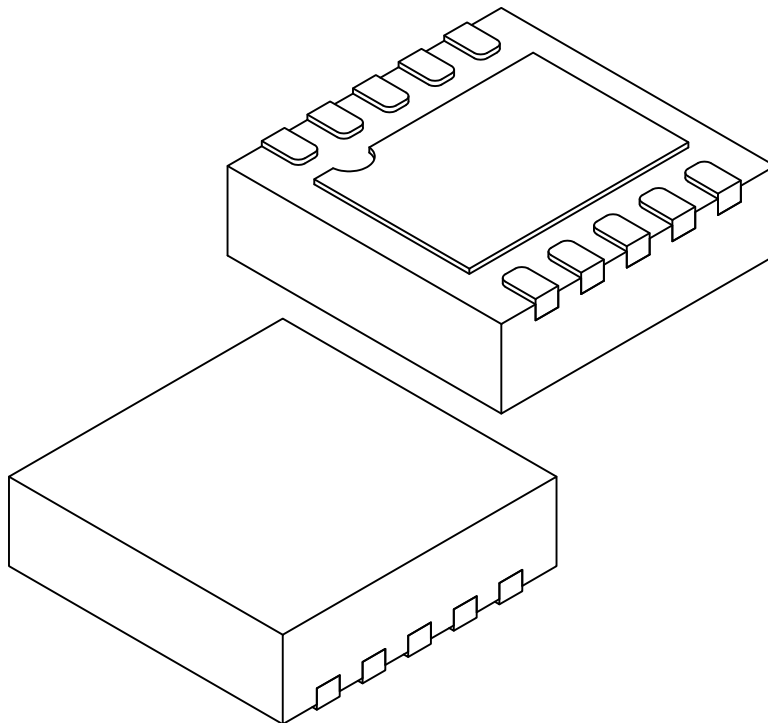


Microchip Technology Drawing C04-1019-JFA Rev B Sheet 1 of 2

MIC2211

10-Lead 3 mm × 3 mm VDFN [JFA] Package Outline and Recommended Land Pattern

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		10		
Pitch	e		0.50 BSC		
Overall Height	A		0.80	0.90	1.00
Standoff	A1		0.00	0.02	0.05
Terminal Thickness	A3		0.203 REF		
Overall Length	D		3.00 BSC		
Exposed Pad Length	D2		2.35	2.40	2.45
Overall Width	E		3.00 BSC		
Exposed Pad Width	E2		1.65	1.70	1.75
Terminal Width	b		0.17	0.22	0.27
Terminal Length	L		0.35	0.40	0.45
Terminal-to-Exposed-Pad	K		0.25	—	—

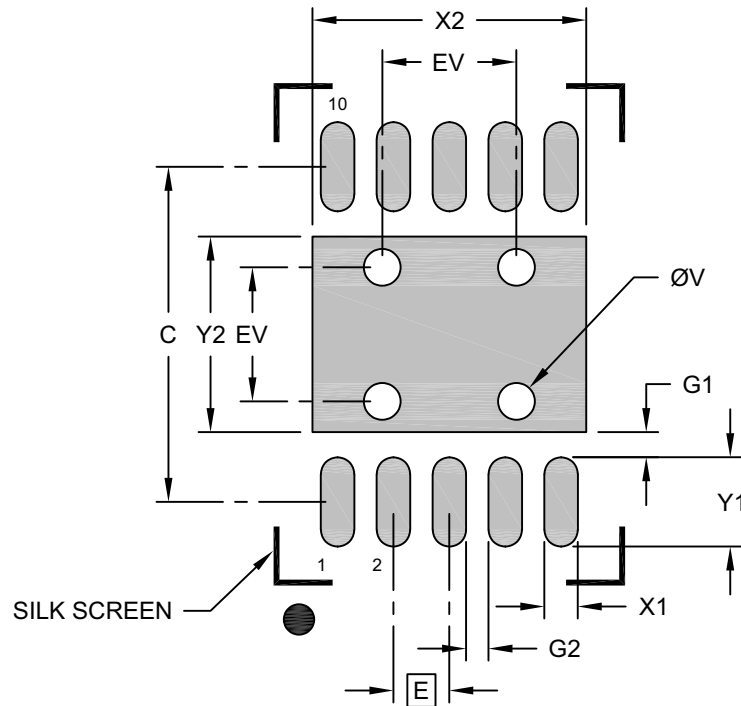
Notes:

- 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 C04-1019-JFA Rev B Sheet 2 of 2

10-Lead 3 mm × 3 mm VDFN [JFA] Package Outline and Recommended Land Pattern

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	0.50 BSC		
Optional Center Pad Width	X2			2.45
Optional Center Pad Length	Y2			1.75
Contact Pad Spacing	C		3.00	
Contact Pad Width (Xnn)	X1			0.30
Contact Pad Length (Xnn)	Y1			0.80
Contact Pad to Center Pad (Xnn)	G1	0.23		
Contact Pad to Contact Pad (Xnn)	G2	0.20		
Thermal Via Diameter	V		0.33	
Thermal Via Pitch	EV		1.20	

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 C04-3019-JFA Rev B

MIC2211

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (April 2025)

- Converted Micrel document MIC2211 to Microchip data sheet DS20006935A.
- Minor text changes throughout.

MIC2211

NOTES:

PRODUCT IDENTIFICATION SYSTEM

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

Part #	-X	X	X	XX	-XX
Device	Output Voltage 1	Output Voltage 2	Junction Temp. Range	Package	Media Type
Device: MIC2211 Dual μ Cap LDO					
Output Voltage 1:	F	=	1.5V		
	W	=	1.6V		
	G	=	1.8V		
	Y	=	1.9V		
	H	=	2.0V		
	J	=	2.5V		
	K	=	2.6V		
	L	=	2.7V		
	M	=	2.8V		
	N	=	2.85V		
	O	=	2.9V		
	P	=	3.0V		
	S	=	3.3V		
V	=	3.6V			
A	=	Adjustable			
Output Voltage 2:	F	=	1.5V		
	W	=	1.6V		
	G	=	1.8V		
	Y	=	1.9V		
	J	=	2.5V		
	K	=	2.6V		
	L	=	2.7V		
	M	=	2.8V		
	N	=	2.85V		
	O	=	2.9V		
	P	=	3.0V		
	Q	=	3.1V		
	S	=	3.3V		
V	=	3.6V			
A	=	Adjustable			
Junction Temp. Range:	Y	=	-40°C to +125°C		
Package:	ML	=	10-Lead 3 mm $\times$ 3 mm VDFN		
Media Type:	-TR	=	5000/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 options.

Examples:

a) **MIC2211-WOYML-TR**
MIC2211 Dual μ Cap LDO, 1.6V Output Voltage 1, 2.9V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

b) **MIC2211-KNYML-TR**
MIC2211 Dual μ Cap LDO, 2.6V Output Voltage 1, 2.85V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

c) **MIC2211-OFYML-TR**
MIC2211 Dual μ Cap LDO, 2.9V Output Voltage 1, 1.5V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

d) **MIC2211-LGYML-TR**
MIC2211 Dual μ Cap LDO, 2.7V Output Voltage 1, 1.8V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

e) **MIC2211-YMYML-TR**
MIC2211 Dual μ Cap LDO, 1.9V Output Voltage 1, 2.8V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

f) **MIC2211-VVYML-TR**
MIC2211 Dual μ Cap LDO, 3.6V Output Voltage 1, 3.6V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

g) **MIC2211-NSYML-TR**
MIC2211 Dual μ Cap LDO, 2.85V Output Voltage 1, 3.3V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

h) **MIC2211-HPYML-TR**
MIC2211 Dual μ Cap LDO, 2.0V Output Voltage 1, 3.0V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

i) **MIC2211-AAYML-TR**
MIC2211 Dual μ Cap LDO, Adjustable Output Voltage 1, Adjustable Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

Examples:

- MIC2211-WOYML-TR**
MIC2211 Dual μ Cap LDO, 1.6V Output Voltage 1, 2.9V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-KNYML-TR**
MIC2211 Dual μ Cap LDO, 2.6V Output Voltage 1, 2.85V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-OFYML-TR**
MIC2211 Dual μ Cap LDO, 2.9V Output Voltage 1, 1.5V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-LGYML-TR**
MIC2211 Dual μ Cap LDO, 2.7V Output Voltage 1, 1.8V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-YMYML-TR**
MIC2211 Dual μ Cap LDO, 1.9V Output Voltage 1, 2.8V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-VVYML-TR**
MIC2211 Dual μ Cap LDO, 3.6V Output Voltage 1, 3.6V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-NSYML-TR**
MIC2211 Dual μ Cap LDO, 2.85V Output Voltage 1, 3.3V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-HPYML-TR**
MIC2211 Dual μ Cap LDO, 2.0V Output Voltage 1, 3.0V Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel
- MIC2211-AAYML-TR**
MIC2211 Dual μ Cap LDO, Adjustable Output Voltage 1, Adjustable Output Voltage 2, -40°C to +125°C, 10-Lead 3 mm $\times$ 3 mm VDFN, 5000/Reel

MIC2211

NOTES:

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