Absolute Maximum Ratings

IN to GND ....-0.3V to +13V
OUT to GND ....-0.3V to the lower of +6V and (V_{IN} + 0.3V)
Output to GND Short-Circuit Duration........................Continuous
Continuous Power Dissipation (T_A = +70°C)
5-Pin SOT23 (derate 7.1mW/°C above +70°C)...........571mW
8-Pin SO (derate 5.9mW/°C above +70°C)..............470.6mW
Operating Temperature Range ....-40°C to +85°C
Storage Temperature Range ....-65°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics—MAX6029_21 (V_{OUT} = 2.048V)

(V_{IN} = 2.5V, I_{OUT} = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
OUTPUT						
Output Voltage	V_{OUT}	T_A = +25°C	2.0449	2.0480	2.0511	V
Output Voltage Temperature Coefficient	TCV_{OUT}	(Notes 2, 3)			30	ppm/°C
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.5V to 12.6V		27	200	µV/V
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4mA		0.22	0.7	µV/µA
		I_{OUT} = 0 to -1mA		2.4	5.5	
Output Short-Circuit Current	I_{SC}			60		mA
Long-Term Stability	ΔV_{OUT}/time	1000 hours at +25°C		150		ppm
Thermal Hysteresis		(Note 4)		140		ppm
DYNAMIC CHARACTERISTICS						
Noise Voltage	e_{OUT}	f = 0.1Hz to 10Hz		30		$µV_{P-P}$
		f = 10Hz to 1kHz		115		$µV_{RMS}$
Ripple Rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.5V ±200mV, f = 120Hz		43		dB
Turn-On Settling Time	t_R	To V_{OUT} = 0.1% of final value		450		µs
INPUT						
Supply Voltage Range	V_{IN}		2.5		12.6	V
Supply Current	I_{IN}				5.25	µA
Change in Supply Current	I_{IN}/V_{IN}	V_{IN} = 2.5V to 12.6V			1.5	µA/V

Electrical Characteristics—MAX6029_25 (V_{OUT} = 2.500V)

(V_{IN} = 2.7V, I_{OUT} = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
OUTPUT							
Output Voltage	V_{OUT}	T_A = +25°C	MAX6029EUK	2.4963	2.5000	2.5038	V
			MAX6029ESA	2.495	2.500	2.505	
Output Voltage Temperature Coefficient	TCV_{OUT}	(Notes 2, 3)				30	ppm/°C
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.7V to 12.6V			30	230	µV/V
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4mA			0.1	0.6	µV/µA
		I_{OUT} = 0 to -1mA			2.5	6.2	
Dropout Voltage (Note 5)	V_{IN} - V_{OUT}	I_{OUT} = 0				100	mV
		I_{OUT} = 4mA				200	
Output Short-Circuit Current	I_{SC}				60		mA
Long-Term Stability	ΔV_{OUT}/time	1000 hours at +25°C			150		ppm
Thermal Hysteresis		(Note 4)			140		ppm
DYNAMIC CHARACTERISTICS							
Noise Voltage	e_{OUT}	f = 0.1Hz to 10Hz			39		μV_{P-P}
		f = 10Hz to 1kHz			137		μV_{RMS}
Ripple Rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 2.7V ±200mV, f = 120Hz			34		dB
Turn-On Settling Time	t_R	To V_{OUT} = 0.1% of final value			700		ms
INPUT							
Supply Voltage Range	V_{IN}			2.7		12.6	V
Supply Current	I_{IN}					5.75	µA
Change in Supply Current	I_{IN}/V_{IN}	V_{IN} = 2.7V to 12.6V				1.5	µA/V

Electrical Characteristics—MAX6029_30 (V_{OUT} = 3.000V)

(V_{IN} = 3.2V, I_{OUT} = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
OUTPUT						
Output Voltage	V_{OUT}	T_A = +25°C	2.9955	3.0000	3.0045	V
Output Voltage Temperature Coefficient	TCV_{OUT}	(Notes 2, 3)			30	ppm/°C
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.2V to 12.6V		15	250	µV/V
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4mA		0.1	0.6	µV/µA
		I_{OUT} = 0 to -1mA		2.4	6.5	
Dropout Voltage (Note 5)	V_{IN} - V_{OUT}	I_{OUT} = 0			100	mV
		I_{OUT} = 4mA			200	
Output Short-Circuit Current	I_{SC}			60		mA
Long-Term Stability	ΔV_{OUT}/time	1000 hours at +25°C		150		ppm
Thermal Hysteresis		(Note 4)		140		ppm
DYNAMIC CHARACTERISTICS						
Noise Voltage	e_{OUT}	f = 0.1Hz to 10Hz		39		μV_{P-P}
		f = 10Hz to 1kHz		161		μV_{RMS}
Ripple Rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.2V ±200mV, f = 120Hz		37		dB
Turn-On Settling Time	t_R	To V_{OUT} = 0.1% of final value		775		µs
INPUT						
Supply Voltage Range	V_{IN}		3.2		12.6	V
Supply Current	I_{IN}				6.75	µA
Change in Supply Current	I_{IN}/V_{IN}	V_{IN} = 3.2V to 12.6V			1.5	µA/V

Electrical Characteristics—MAX6029_33 (V_{OUT} = 3.000V)

(V_{IN} = 3.5V, I_{OUT} = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
OUTPUT						
Output Voltage	V_{OUT}	T_A = +25°C	3.2951	3.3000	3.3050	V
Output Voltage Temperature Coefficient	TCV_{OUT}	(Notes 2, 3)			30	ppm/°C
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.5V to 12.6V		30	270	µV/V
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4mA		0.1	0.6	µV/µA
		I_{OUT} = 0 to -1mA		2.4	7	
Dropout Voltage (Note 5)	V_{IN} - V_{OUT}	I_{OUT} = 0			100	mV
		I_{OUT} = 4mA			200	
Output Short-Circuit Current	I_{SC}			60		mA
Long-Term Stability	ΔV_{OUT}/time	1000 hours at +25°C		150		ppm
Thermal Hysteresis		(Note 4)		140		ppm
DYNAMIC CHARACTERISTICS						
Noise Voltage	e_{OUT}	f = 0.1Hz to 10Hz		56		μV_{P-P}
		f = 10Hz to 1kHz		174		μV_{RMS}
Ripple Rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 3.5V ±200mV, f = 120Hz		38		dB
Turn-On Settling Time	t_R	To V_{OUT} = 0.1% of final value		1		ms
INPUT						
Supply Voltage Range	V_{IN}		3.5		12.6	V
Supply Current	I_{IN}				7.25	µA
Change in Supply Current	I_{IN}/V_{IN}	V_{IN} = 3.5V to 12.6V			1.5	µA/V

Electrical Characteristics—MAX6029_41 (V_{OUT} = 4.096V)

(V_{IN} = 4.3V, I_{OUT} = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
OUTPUT							
Output Voltage	V_{OUT}	T_A = +25°C	MAX6029EUK	4.0899	4.0960	4.1021	V
			MAX6029ESA	4.088	4.096	4.104	
Output Voltage Temperature Coefficient	TCV_{OUT}	(Notes 2, 3)				30	ppm/°C
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 4.3V to 12.6V			30	310	µV/V
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4mA			0.1	0.6	µV/µA
		I_{OUT} = 0 to -1mA			2.5	8.5	
Dropout Voltage (Note 5)	V_{IN} - V_{OUT}	I_{OUT} = 0				100	mV
		I_{OUT} = 4mA				200	
Output Short-Circuit Current	I_{SC}				60		mA
Long-Term Stability	ΔV_{OUT}/time	1000 hours at +25°C			150		ppm
Thermal Hysteresis		(Note 4)			140		ppm
DYNAMIC CHARACTERISTICS							
Noise Voltage	e_{OUT}	f = 0.1Hz to 10Hz			72		μV_{P-P}
		f = 10Hz to 1kHz			210		μV_{RMS}
Ripple Rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 4.3V ±200mV, f = 120Hz			36		dB
Turn-On Settling Time	t_R	To V_{OUT} = 0.1% of final value			1.2		ms
INPUT							
Supply Voltage Range	V_{IN}			4.3		12.6	V
Supply Current	I_{IN}					8.75	µA
Change in Supply Current	I_{IN}/V_{IN}	V_{IN} = 4.3V to 12.6V				1.5	µA/V

Electrical Characteristics—MAX6029_50 (V_{OUT} = 5.000V)

(V_{IN} = 5.2V, I_{OUT} = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

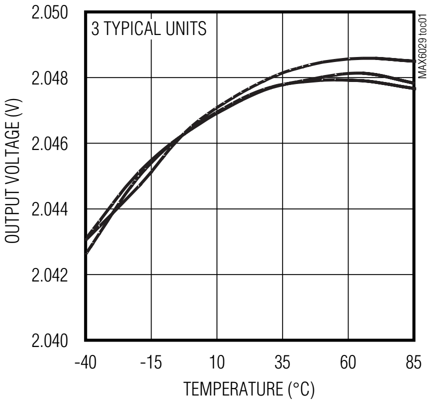
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
OUTPUT						
Output Voltage	V_{OUT}	T_A = +25°C	4.9925	5.0000	5.0075	V
Output Voltage Temperature Coefficient	TCV_{OUT}	(Notes 2, 3)			30	ppm/°C
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 5.2V to 12.6V		34	375	µV/V
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	I_{OUT} = 0 to 4mA		0.3	0.8	µV/µA
		I_{OUT} = 0 to -1mA		3.3	9	
Dropout Voltage (Note 5)	V_{IN} - V_{OUT}	I_{OUT} = 0			100	mV
		I_{OUT} = 4mA			200	
Output Short-Circuit Current	I_{SC}			60		mA
Long-Term Stability	ΔV_{OUT}/time	1000 hours at +25°C		150		ppm
Thermal Hysteresis		(Note 4)		140		ppm
DYNAMIC CHARACTERISTICS						
Noise Voltage	e_{OUT}	f = 0.1Hz to 10Hz		90		$µV_{P-P}$
		f = 10Hz to 1kHz		245		$µV_{RMS}$
Ripple Rejection	$\Delta V_{OUT}/\Delta V_{IN}$	V_{IN} = 5.2V ±200mV, f = 120Hz		38		dB
Turn-On Settling Time	t_R	To V_{OUT} = 0.1% of final value		1.4		ms
INPUT						
Supply Voltage Range	V_{IN}		5.2		12.6	V
Supply Current	I_{IN}				10.5	µA
Change in Supply Current	I_{IN}/V_{IN}	V_{IN} = 5.2V to 12.6V			1.5	µA/V

Note 1: MAX6029 is 100% production tested at T_A = +25°C and is guaranteed by design for T_A = T_{MIN} to T_{MAX} as specified.
Note 2: Temperature coefficient is defined by box method: $(V_{MAX} - V_{MIN})/(\Delta T \times V_{+25°C})$.
Note 3: Not production tested. Guaranteed by design.
Note 4: Thermal hysteresis is defined as the change in T_A = +25°C output voltage before and after temperature cycling of the device (from T_A = T_{MIN} to T_{MAX}). Initial measurement at T_A = +25°C is followed by temperature cycling the device to T_A = +85°C then to T_A = -40°C and another measurement at T_A = +25°C is compared to the original measurement at T_A = +25°C.
Note 5: Dropout voltage is the minimum input voltage at which V_{OUT} changes by 0.1% from V_{OUT} at rated V_{IN} and is guaranteed by Load Regulation Test.

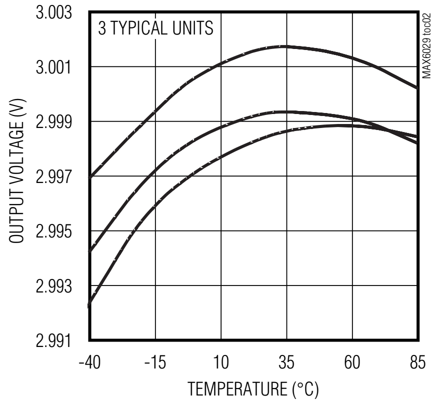
Typical Operating Characteristics

(V_{IN} = 2.5V for MAX6029EUK21, V_{IN} = 3.2V for MAX6029EUK30, and V_{IN} = 5.2V for MAX6029EUK50, I_{OUT} = 0, T_A = +25°C, unless otherwise noted.)

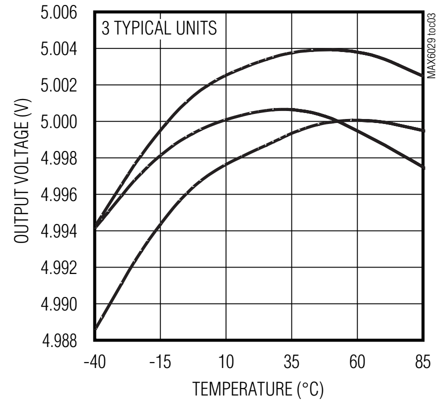
OUTPUT VOLTAGE vs. TEMPERATURE (V_{OUT} = 2.048V)



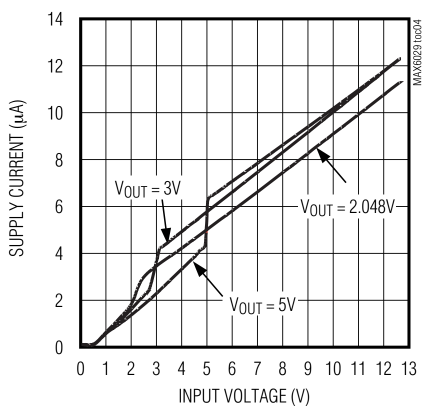
OUTPUT VOLTAGE vs. TEMPERATURE (V_{OUT} = 3V)



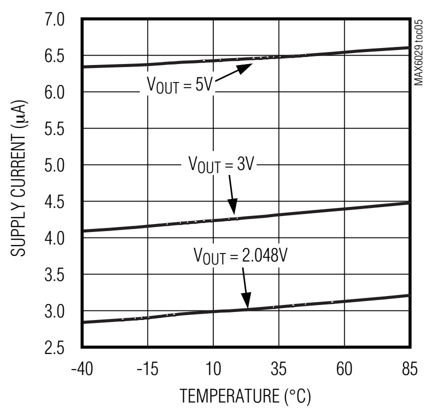
OUTPUT VOLTAGE vs. TEMPERATURE (V_{OUT} = 5V)



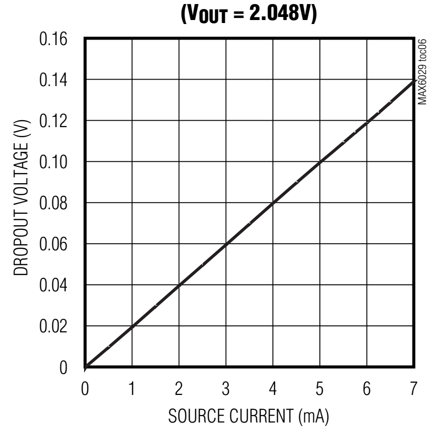
SUPPLY CURRENT vs. INPUT VOLTAGE



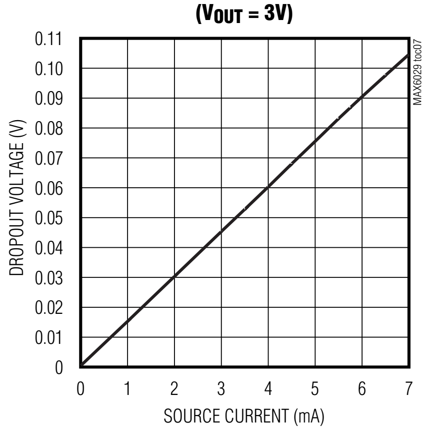
SUPPLY CURRENT vs. TEMPERATURE



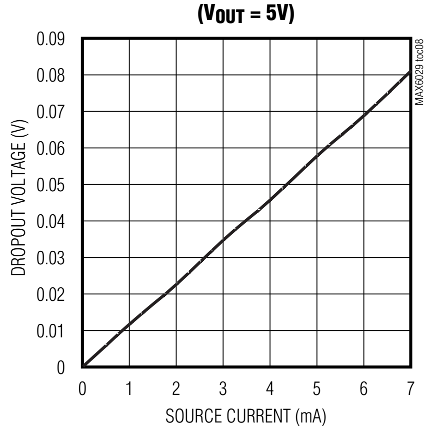
DROPOUT VOLTAGE vs. SOURCE CURRENT (V_{OUT} = 2.048V)



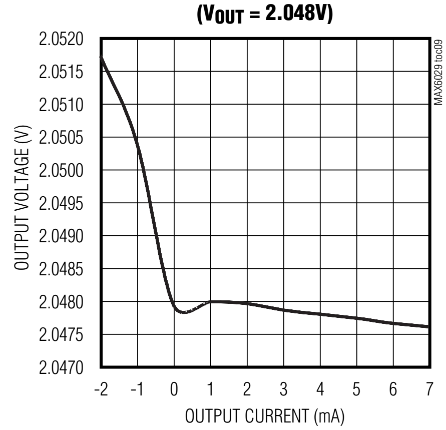
DROPOUT VOLTAGE vs. SOURCE CURRENT (V_{OUT} = 3V)



DROPOUT VOLTAGE vs. SOURCE CURRENT (V_{OUT} = 5V)



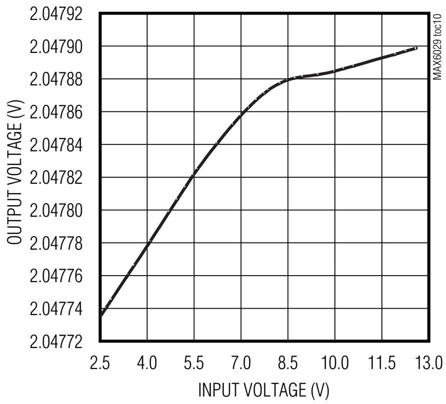
LOAD REGULATION (V_{OUT} = 2.048V)



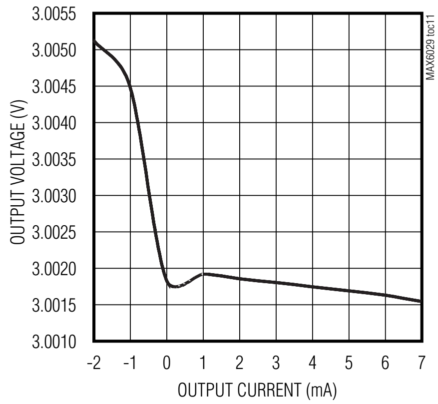
Typical Operating Characteristics (continued)

(V_{IN} = 2.5V for MAX6029EUK21, V_{IN} = 3.2V for MAX6029EUK30, and V_{IN} = 5.2V for MAX6029EUK50, I_{OUT} = 0, T_A = +25°C, unless otherwise noted.)

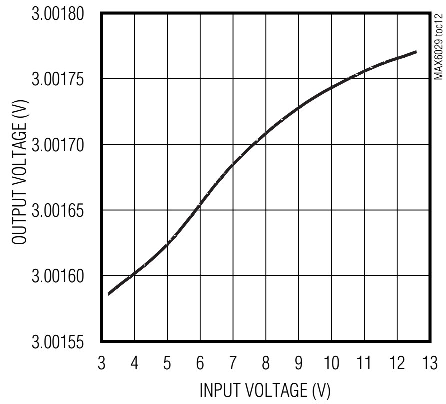
LINE REGULATION (V_{OUT} = 2.048V)



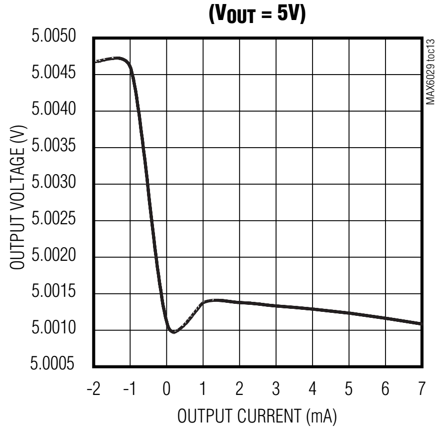
LOAD REGULATION (V_{OUT} = 3V)



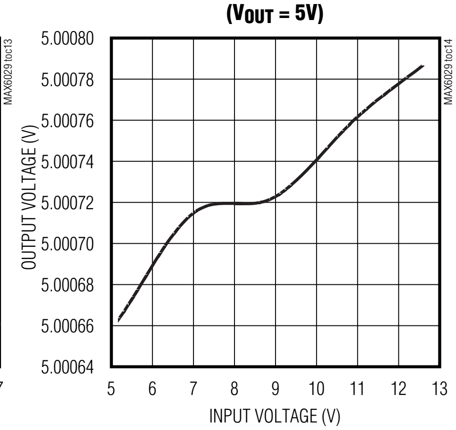
LINE REGULATION (V_{OUT} = 3V)



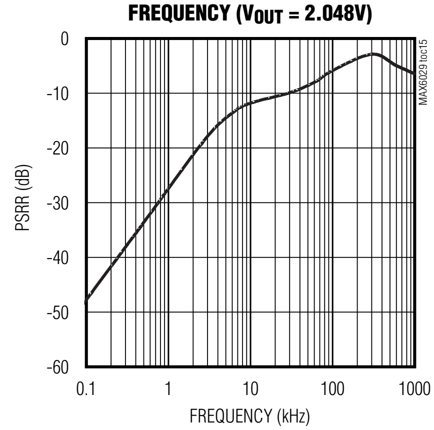
LOAD REGULATION (V_{OUT} = 5V)



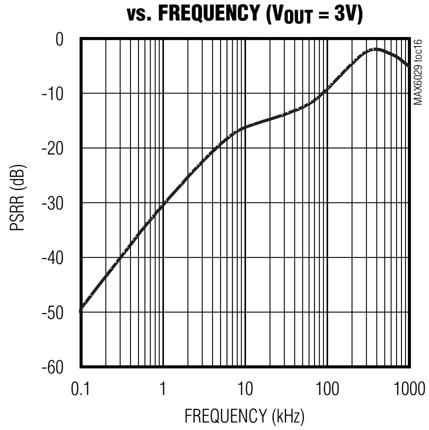
LINE REGULATION (V_{OUT} = 5V)



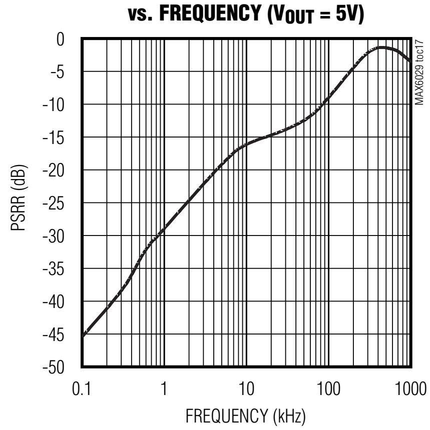
POWER-SUPPLY REJECTION RATIO vs. FREQUENCY (V_{OUT} = 2.048V)



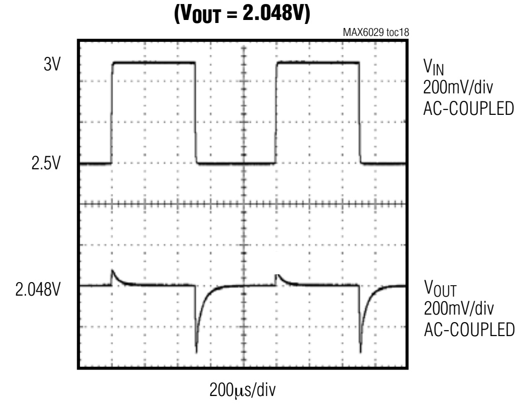
POWER-SUPPLY REJECTION RATIO vs. FREQUENCY (V_{OUT} = 3V)



POWER-SUPPLY REJECTION RATIO vs. FREQUENCY (V_{OUT} = 5V)



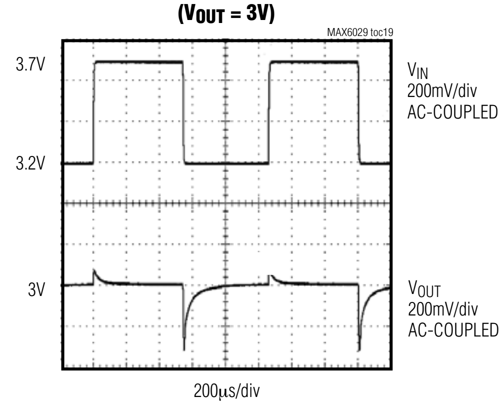
LINE-TRANSIENT RESPONSE (V_{OUT} = 2.048V)



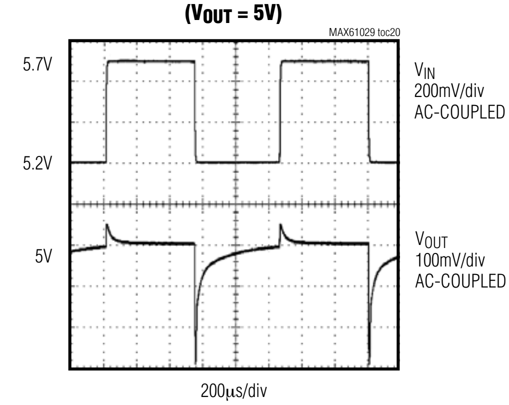
Typical Operating Characteristics (continued)

(V_{IN} = 2.5V for MAX6029EUK21, V_{IN} = 3.2V for MAX6029EUK30, and V_{IN} = 5.2V for MAX6029EUK50, I_{OUT} = 0, T_A = +25°C, unless otherwise noted.)

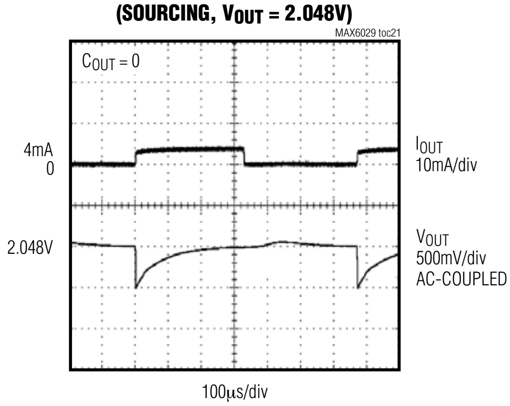
LINE-TRANSIENT RESPONSE (V_{OUT} = 3V)



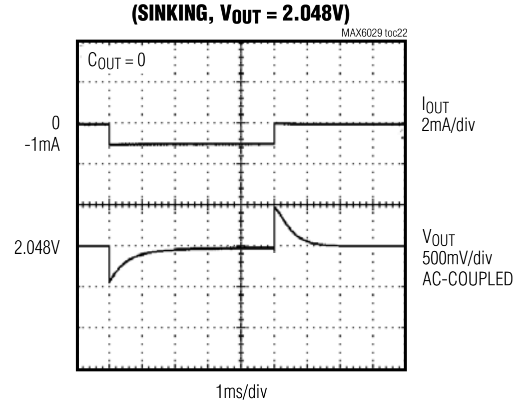
LINE-TRANSIENT RESPONSE (V_{OUT} = 5V)



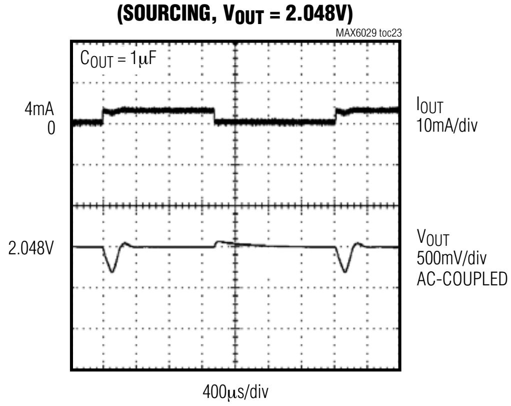
LOAD-TRANSIENT RESPONSE (SOURCING, V_{OUT} = 2.048V)



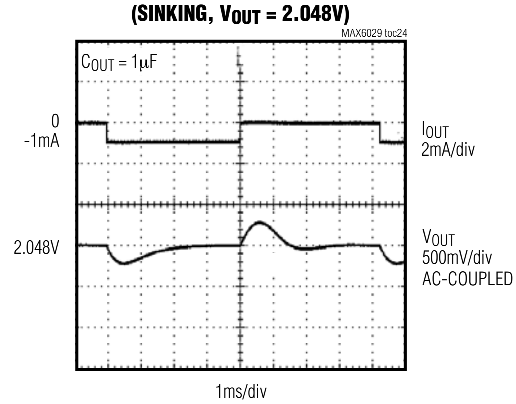
LOAD-TRANSIENT RESPONSE (SINKING, V_{OUT} = 2.048V)



LOAD-TRANSIENT RESPONSE (SOURCING, V_{OUT} = 2.048V)



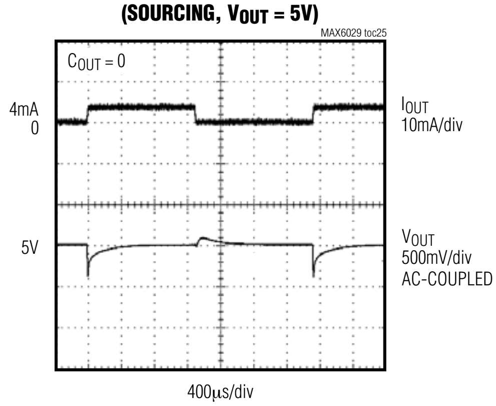
LOAD-TRANSIENT RESPONSE (SINKING, V_{OUT} = 2.048V)



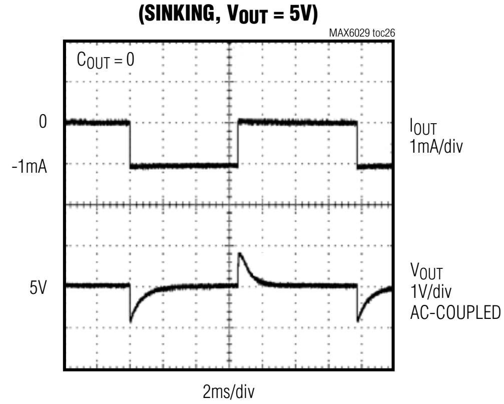
Typical Operating Characteristics (continued)

(V_{IN} = 2.5V for MAX6029EUK21, V_{IN} = 3.2V for MAX6029EUK30, and V_{IN} = 5.2V for MAX6029EUK50, I_{OUT} = 0, T_A = +25°C, unless otherwise noted.)

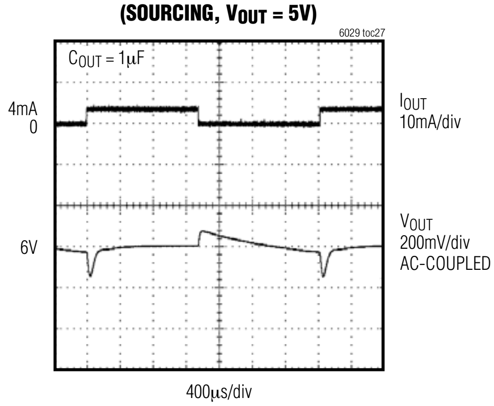
LOAD-TRANSIENT RESPONSE (SOURCING, V_{OUT} = 5V)



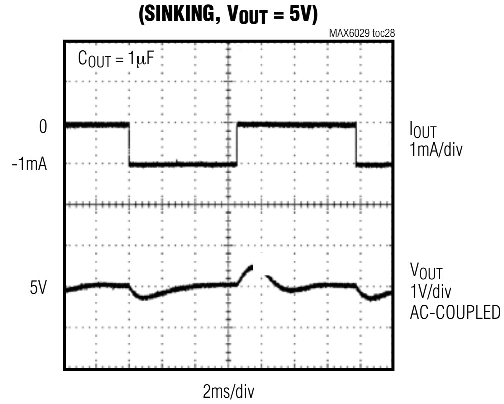
LOAD-TRANSIENT RESPONSE (SINKING, V_{OUT} = 5V)



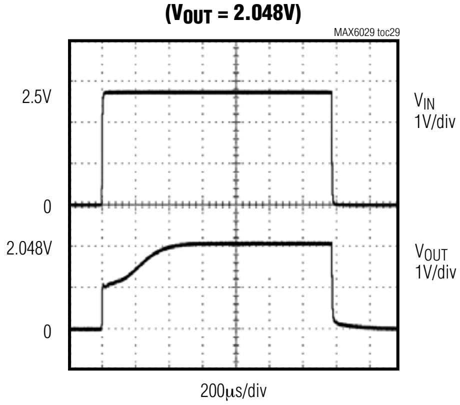
LOAD-TRANSIENT RESPONSE (SOURCING, V_{OUT} = 5V)



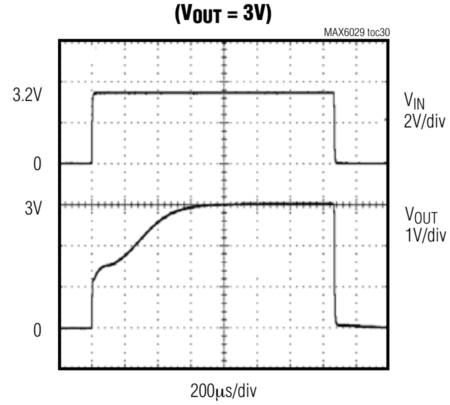
LOAD-TRANSIENT RESPONSE (SINKING, V_{OUT} = 5V)



TURN-ON TRANSIENT (V_{OUT} = 2.048V)



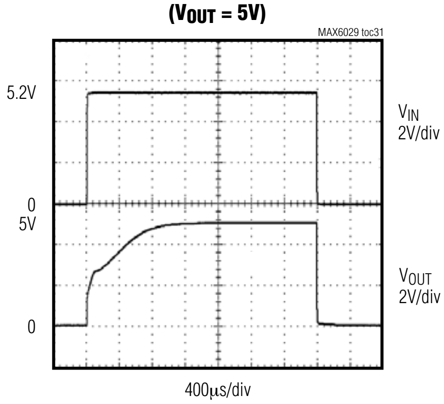
TURN-ON TRANSIENT (V_{OUT} = 3V)



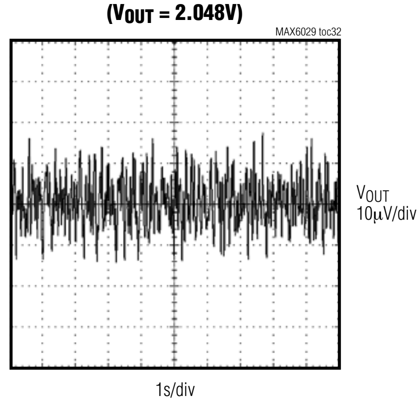
Typical Operating Characteristics (continued)

(V_{IN} = 2.5V for MAX6029EUK21, V_{IN} = 3.2V for MAX6029EUK30, and V_{IN} = 5.2V for MAX6029EUK50, I_{OUT} = 0, T_A = +25°C, unless otherwise noted.)

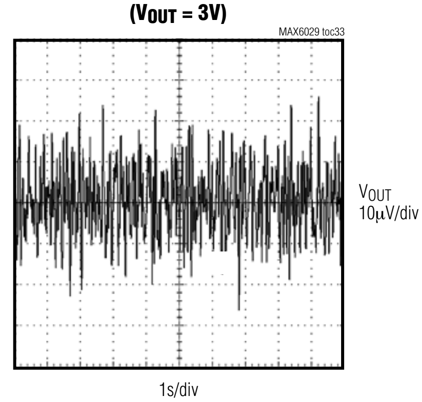
TURN-ON TRANSIENT
(V_{OUT} = 5V)



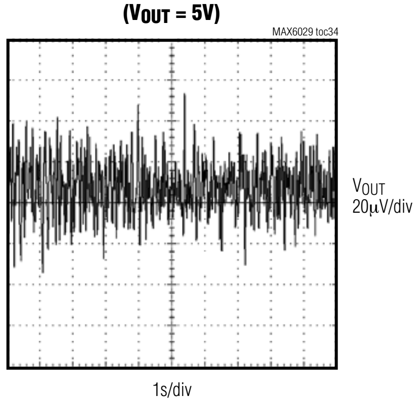
0.1Hz TO 10Hz OUTPUT NOISE
(V_{OUT} = 2.048V)



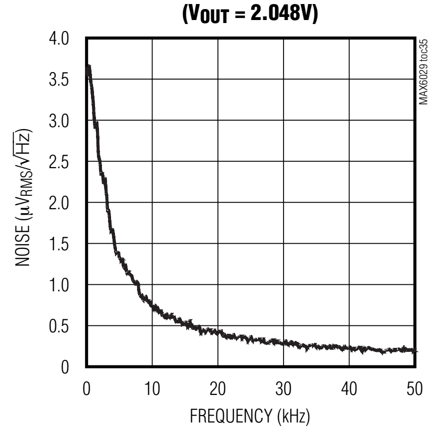
0.1Hz TO 10Hz OUTPUT NOISE
(V_{OUT} = 3V)



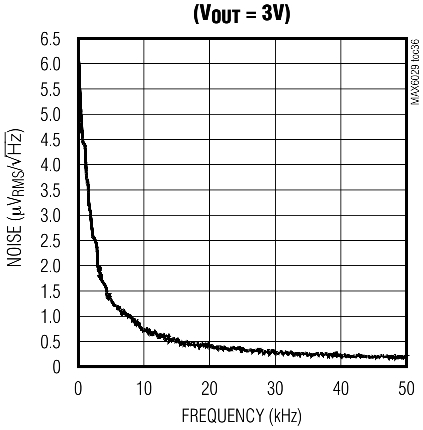
0.1Hz TO 10Hz OUTPUT NOISE
(V_{OUT} = 5V)



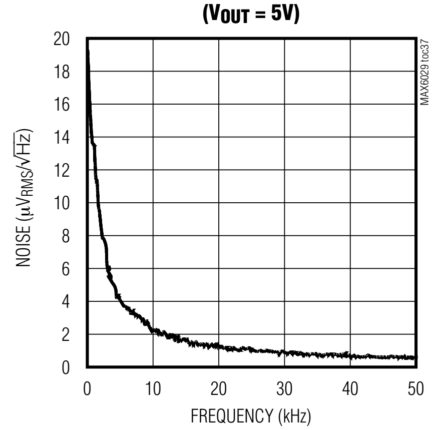
NOISE vs. FREQUENCY
(V_{OUT} = 2.048V)



NOISE vs. FREQUENCY
(V_{OUT} = 3V)



NOISE vs. FREQUENCY
(V_{OUT} = 5V)



Pin Description

PIN		NAME	FUNCTION
SOT23	SO		
1	2	IN	Positive Voltage Supply
2	4	GND	Ground
3, 4	1, 3, 5, 7, 8	N.C.	No Connection. Leave unconnected or connect to ground.
5	6	OUT	Reference Output

Applications Information

Input Bypassing

The MAX6029 does not require an input bypass capacitor. For improved transient performance, bypass the input to ground with a 0.1µF ceramic capacitor. Place the capacitor as close to IN as possible.

Load Capacitance

The MAX6029 does not require an output capacitor for stability. The MAX6029 is stable driving capacitive loads from 0 to 100pF and 0.1µF to 10µF when sourcing current and from 0 to 0.4µF when sinking current. In applications where the load or the supply can experience step changes, an output capacitor reduces the amount of overshoot (undershoot) and improves the circuit's transient response. Many applications do not require an external capacitor, and the MAX6029 offers a significant advantage in applications where board space is critical.

Supply Current

The quiescent supply current of the series-mode MAX6029 is very small, 5.25µA (max), and is very stable against changes in the supply voltage with only 1.5µA/V (max) variation with supply voltage. The MAX6029 family draws load current from the input voltage source only when required, so supply current is not wasted and efficiency is maximized at all input voltages. This improved efficiency reduces power dissipation and extends battery life.

Output Thermal Hysteresis

Output thermal hysteresis is the change of the output voltage at T_A = +25°C before and after the device is cycled over its entire operating temperature range. Hysteresis is caused by differential package stress appearing across the device.

Temperature Coefficient vs. Operating Temperature Range for a 1LSB Maximum Error

In a data converter application, the reference voltage of the converter must stay within a certain limit to keep the error in the data converter smaller than the resolution limit through the operating temperature range. Figure 1 shows the maximum allowable reference voltage temperature coefficient to keep the conversion error to less than 1 LSB, as a function of the operating temperature range (T_{MAX} - T_{MIN}) with the converter resolution as a parameter. The graph assumes the reference-voltage temperature coefficient as the only parameter affecting accuracy. In reality, the absolute static accuracy of a data converter is dependent on the combination of many parameters such as integral nonlinearity, differential nonlinearity, offset error, gain error, as well as voltage reference changes.

Turn-On Time

These devices turn on and settle to within 0.1% of their final value in less than 1ms. The turn-on time increases when heavily loaded and operating close to dropout.

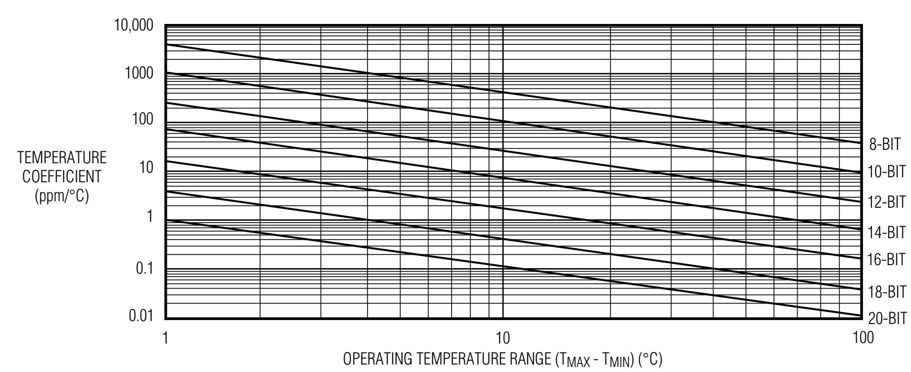
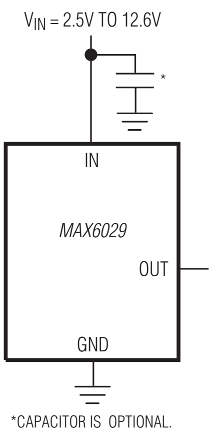


Figure 1. Temperature Coefficient vs. Operating Temperature Range for a 1 LSB Maximum Error

Typical Operating Circuit



Chip Information

PROCESS: BiCMOS

Package Information

For the latest package outline information and land patterns (footprints), go to **www.maximintegrated.com/packages**. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
5 SOT23	U5+1	**21-0057**	**90-0174**
8 SO	S8+2	**21-0041**	**90-0096**

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/03	Initial release	—
1	8/06	Added SO package	1, 2, 14, 15
2	11/06	Updated voltage output limits	3, 6
3	1/09	Added lead-free notation to *Ordering Information*	1

