General Description

The MAX4736 is a low on-resistance, low-voltage, dual single-pole/double throw (SPDT) analog switch that operates from a single 1.6V to 4.2V supply. This device has fast switching speeds ($t_{ON} = 25ns$, $t_{OFF} = 20ns$ max), handles rail-to-rail analog signals, and consumes less than 4µW of quiescent power. The MAX4736 has break-before-make switching.

When powered from a 3V supply, the MAX4736 features low 0.6Ω on-resistance (R_{ON}), with 0.1Ω R_{ON} matching and 0.05Ω R_{ON} flatness. The digital logic input is 1.8V CMOS compatible when using a single 3V supply.

The MAX4736 has one normally open (NO) switch and one normally closed (NC) switch, and is available in 12pin TQFN-EP (3mm x 3mm), 10-pin µMAX and 10 pin µDFN (2mm x 2mm) packages.

Applications

Power Routina

Battery-Powered Systems Audio and Video Signal Routing

Low-Voltage Data-Acquisition Systems

Communications Circuits

PCMCIA Cards

Cellular Phones

Modems

Hard Drives

Features

- Low Ron 0.6Ω (3V Supply) 1.5Ω (1.8V Supply)
- 0.1Ω max R_{ON} Flatness (3V Supply)
- Single-Supply Operation Down to 1.6V
- Available in TQFN, µDFN and µMAX Packages

///XI//

- 1.8V CMOS Logic Compatible (3V Supply)
- Fast Switching: ton = 25ns, torr = 20ns

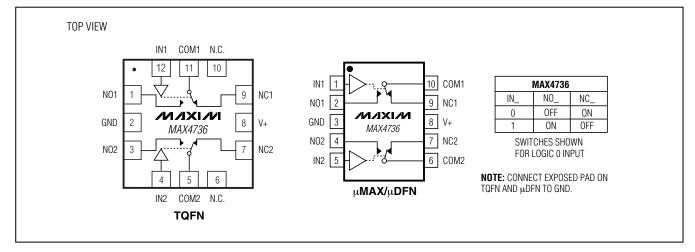
Ordering Information

PART	PIN-PACKAGE	PKG CODE
MAX4736EUB	10 µMAX	U10-2
MAX4736ETC	12 Thin QFN-EP*	T1233-1
MAX4736ELB	10 µDFN	L1022-1

Note: All devices operate over the -40°C to +55°C operating temperature range.

*EP = Exposed pad.

Pin Configurations/Functional Diagrams/Truth Table



M/XI/M

Maxim Integrated Products 1

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

MAX4736

ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to GND.)

V+, IN	0.3V to +4.6V
COM_, NO_, NC_ (Note 1)	0.3V to (V+ + 0.3V)
Continuous Current COM_, NO_, NC	±300mA
Continuous Current (all other pins)	±20mA
Peak Current COM_, NO_, NC_	
(pulsed at 1ms 10% duty cycle)	±500mA

Continuous Power Dissipation ($T_A = +70^{\circ}C$)
10-Pin µDFN (derate 5.3mW/°C above +70°C)423.7mW
10-Pin µMAX (derate 5.6mW/°C above +70°C)
12-Pin TQFN-EP (derate 14.7mW/°C above +70°C)1176mW
Operating Temperature Range40°C to +85°C
Maximum Junction Temperature+150°C
Storage Temperature Range65°C to +150°C
Lead Temperature (soldering, 10s)+300°C

Note 1: Signals on COM_, NO_, or NC_ exceeding V+ or GND are clamped by internal diodes. Limit forward current to maximum current rating.

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—Single 3V Supply

(V+ = 2.7V to 4.2V, V_{IH} = 1.4V, V_{IL} = 0.5V, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are at V+ = 3.0V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	Тд	MIN	ТҮР	МАХ	UNITS
ANALOG SWITCH							
Analog Signal Range	V _{COM} _, V _{NO} _, V _{NC} _			0		V+	V
On Registeries (Note 4)	Devi	V + = 2.7V, $I_{COML} = 100mA;$	+25°C		0.6	0.8	Ω
On-Resistance (Note 4)	Ron	$V_{NO_}$ or $V_{NC_}$ = 1.5V	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$			1	52
On-Resistance Match Between Channels	ADavi	$V_{+} = 2.7V,$	+25°C		0.1	0.2	Ω
(Notes 4, 5)	ΔR _{ON}	$I_{COML} = 100$ mA; V _{NO_} or V _{NC_} = 1.5V	T _{MIN} to T _{MAX}		0.3		52
On-Resistance Flatness	Development	$V_{+} = 2.7V,$	+25°C		0.05	0.1	
(Note 6)	RFLAT(ON)	I _{COM} = 100mA; V _{NO} or V _{NC} = 1V, 1.5V, 2V	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$		0.2		Ω
NO_ or NC_ Off-Leakage	I _{NO_} (OFF),	V+ = 3.6V,	+25°C	-1	±0.002	+1	
Current (Note 10)	INC_(OFF)	V _{COM} = 0.3V, 3.3V; V _{NO} or V _{NC} = 3.3V, 0.3V	T _{MIN} to T _{MAX}	-5		+5	nA
COM_ On-Leakage Current		V+ = 3.6V, V _{COM} _ = 0.3V, 3.3V;	+25°C	-2	±0.002	+2	
(Note 10)	ICOM_(ON)	$V_{NO_{-}}$ or $V_{NC_{-}} = 0.3V$, 3.3V, or floating	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$	-10		+10	nA

ELECTRICAL CHARACTERISTICS—Single 3V Supply (continued)

(V+ = 2.7V to 4.2V, V_{IH} = 1.4V, V_{IL} = 0.5V, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are at V+ = 3.0V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	ТҮР	MAX	UNITS
SWITCH DYNAMIC CHARACTE	ERISTICS						
Turn-On Time	ton	$V_{NO_{-}}, V_{NC_{-}} = 1.5V;$ $R_{L} = 50\Omega, C_{L} = 35pF,$	+25°C		20	25	ns
	-011	Figure 1	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$			30	
Turn-Off Time	tOFF	$V_{NO_{-}}, V_{NC_{-}} = 1.5V;$ RL = 50 Ω , CL = 35pF,	+25°C		15	20	ns
		Figure 1	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$			25	
Break-Before-Make (Note 7)	t _{BBM}	$V_{NO_{-}}, V_{NC_{-}} = 1.5V;$ $R_{L} = 50\Omega, C_{L} = 35pF,$	+25°C		5		ns
		Figure 2	T_{MIN} to T_{MAX}	1			
Charge Injection	Q	$V_{GEN} = 0$, $R_{GEN} = 0$, $C_L = 1.0$ nF, Figure 3	+25°C		60		рС
NO_ or NC_ Off-Capacitance	COFF	f = 1MHz, Figure 4	+25°C		33		pF
COM_ Off-Capacitance	CCOM(OFF)	f = 1MHz, Figure 4	+25°C		60		pF
COM_ On-Capacitance	C _{COM(ON)}	f = 1MHz, Figure 4	+25°C		85		pF
-3dB On-Channel Bandwidth	BW	Signal = 0, R _{IN} = R _{OUT} = 50Ω, C _L = 5pF, Figure 5			130		MHz
Off-Isolation (Note 8)	VISO	$ f = 1 MHz, V_{COM} = 1 V_{P-P}, R_L = 50 \Omega, C_L = 5 pF, Figure 5 $	+25°C		-52		dB
Crosstalk (Note 9)	V _{CT}	$ f = 1 MHz, V_{COM_} = 1 V_{P-P}, R_L = 50 \Omega, C_L = 5 pF, Figure 5 $	+25°C		-78		dB
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, $V_{COM_{-}}$ = 2V _{P-P} , R _L = 32 Ω	+25°C		0.018		%
LOGIC INPUT (A_, IN_)							
Input Logic High	VIH			1.4			V
Input Logic Low	VIL					0.5	V
Input Leakage Current	I _{IN}	V _{IN_} = 0 or 3.6V		-1	+0.005	+1	μA
POWER SUPPLY							•
Power-Supply Range	V+			1.6		3.6	V
Positive Supply Current	l+	$V_{+} = 3.6V, V_{IN_{-}} = 0 \text{ or } V_{+},$ all channels on or off			0.006	1	μA

ELECTRICAL CHARACTERISTICS—Single 1.8V Supply

 $(V + = 1.8V, V_{IH} = 1.0V, V_{IL} = 0.4V, T_A = T_{MIN}$ to T_{MAX} , unless otherwise specified. Typical values are at $T_A = +25^{\circ}C$.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	ТҮР	МАХ	UNITS
ANALOG SWITCH			•				·
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}			0		V+	V
On-Resistance	Ron	$I_{COM} = 10$ mA; V _{NO} or V _{NC} = 1V	+25°C T _{MIN} to T _{MAX}		1.5	2	Ω
SWITCH DYNAMIC CHARACTE	RISTICS		I MIN TO I MAX			0	<u>I</u>
Turn-On Time	tou	V_{NO} or V_{NC} = 1V; RI = 50 Ω , CI = 35pF,	+25°C		25	30	
rum-On nime	ton	$R_L = 50\Omega, C_L = 35pF,$ Figure 1	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$			35	ns
Turn-Off Time	to ==	$V_{NO_{-}}$ or $V_{NC_{-}} = 1V$; $R_{L} = 50\Omega$, $C_{L} = 35pF$,	+25°C		18	25	
	toff	HL = 5002, CL = 35pF, Figure 1	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$			28	ns
Proof Defere Make (Note 7)		V_{NO} or V_{NC} = 1V;	+25°C		7		
Break-Before-Make (Note 7)	^t BBM	$R_L = 50\Omega$, $C_L = 35pF$, Figure 2	$T_{\mbox{MIN}}$ to $T_{\mbox{MAX}}$	1			ns
Charge Injection	Q	$V_{GEN} = 0$, $R_{GEN} = 0$, $C_L = 1nF$, Figure 3	+25°C		35		рС
Off-Isolation (Note 8)	VISO	$ f = 1MHz, V_{NO_{-}} = V_{NC_{-}} $ = 1V _{P-P} , R _L = 50 Ω , C _L = 5pF, Figure 5	+25°C		-52		dB
Crosstalk (Note 9)	V _{CT}	$ f = 1 MHz, V_{COM} = 1 V_{P,P}, \\ R_L = 50 \Omega, C_L = 5 pF, Figure 5 $	+25°C		-78		dB
LOGIC INPUT (IN_)	•		•				
Input Logic High	VIH			1			V
Input Logic Low	VIL					0.4	V
Input Leakage Current	l _{IN}	$V_{IN_{}} = 0 \text{ or } 3.6V$				1	μA

Note 2: The algebraic convention, where the most negative value is a minimum and the most positive value is a maximum, is used in this data sheet.

Note 3: -40°C specifications are guaranteed by design.

Note 4: R_{ON} and ΔR_{ON} matching specifications for QFN packaged parts are guaranteed by design.

Note 5: $\Delta R_{ON} = R_{ON}(MAX) - R_{ON}(MIN)$.

Note 6: Flatness is defined as the difference between the maximum and the minimum value of on-resistance as measured over the specified analog signal ranges.

Note 7: Guaranteed by design.

Note 8: Off-Isolation = $20\log_{10}(V_{COM_{-}}/V_{NO_{-}})$, $V_{COM_{-}}$ = output, $V_{NO_{-}}$ = input to OFF switch.

Note 9: Between two switches.

Note 10: Leakage parameters are 100% tested at hot temperature and guaranteed by correlation at room.

Note 11: Devices are guaranteed to 1 million cycles of operation. (Cycle = switch on → switch off → switch on)

Note 12: The minimum load resistance is 8Ω .

 $(T_A = +25^{\circ}C, unless otherwise noted.)$ **ON/OFF-LEAKAGE CURRENT ON-RESISTANCE** vs. V_{COM} AND TEMPERATURE **ON-RESISTANCE vs. VCOM** vs. TEMPERATURE 2.5 10,000 2.0 $1.8V, T_A = -40^{\circ}C$ 1.8 1.8V, T_A = = 1.6V +25°C ON, V + = 3.0V2.0 1.6 OFF, V+ = 3.0V 1.8V, T_A = +85°C 1.4 V+ = 3.0V, T_A = +85°C 1.5 1.2 $R_{ON}(\Omega)$ Ron (Ω) V+ = 1.8V 1.0 $V_{+} = 2.5V$ 1.0 0.8 OFF, V+ = 1.8V $V_{+} = 3.0V$ ON, V+ = 1.8V 0.6 10 0.5 0.4 V+ = 3.0V, T_A = +25°C 0.2 $V_{+} = 3.6V$ $V + = 3.0V, T_A = -40^{\circ}C$ 0 1 0 0 2 3 -40 -15 10 60 85 1 0 0.5 1.0 1.5 2.0 2.5 3.0 35 Δ TEMPERATURE (°C) V_{COM} (V) V_{COM} (V) LOGIC-LEVEL THRESHOLD **SUPPLY CURRENT vs. SUPPLY CHARGE INJECTION vs. VCOM VOLTAGE AND TEMPERATURE** vs. SUPPLY VOLTAGE 1.2 70 1000 60 100 1.1 T₄ = +85°C ≣ 50 SUPPLY CURRENT (nA) 10 $T_A = +25^{\circ}C$ 1.0 40 THRESHOLD (V) 0.9 Q (pC) 1 30 V+ = 3.0V RISING $T_A = -40^{\circ}C$ 20 0.1 0.8 FALLING 10 0.01 $V_{+} = 1.8V$ 0.7 0 0.001 0.6 -10 -20 0.0001 0.5 0 0.5 1.0 1.5 2.0 2.5 3.0 0 0.4 0.8 1.2 1.6 2.0 2.4 2.8 3.2 3.6 1.6 2.0 2.4 2.8 3.2 3.6 SUPPLY VOLTAGE (V) SUPPLY VOLTAGE (V) V_{COM} (V) TURN-ON/OFF TIME **TURN-ON/OFF TIMES** vs. SUPPLY VOLTAGE vs. TEMPERATURE 30 30 $t_{ON}, V_{+} = 1.8V$ 25 25 tом 20 20 t_{OFF}, V+ = 1.8V ton/torF (ns) ton/torr (ns) toFF t_{ON}, V+ = 3.0V 15 15 t_{OFF}, V+ = 3.0V 10 10 5 5 0 0

Typical Operating Characteristics

1.6

2.0

2.4

SUPPLY VOLTAGE (V)

2.8

3.2

3.6

-40

-15

10

TEMPERATURE (°C)

35

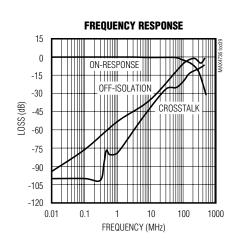
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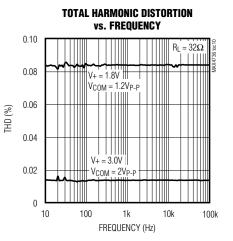
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MAX4736

Typical Operating Characteristics (continued)

 $(T_A = +25^{\circ}C, \text{ unless otherwise noted.})$





Pin Description

PI	N	NAME	FUNCTION
µMAX/µDFN	TQFN		FUNCTION
1	12	IN1	Digital Control Input Switch 1
2	1	NO1	Analog Switch 1—Normally Open Terminal
3	2	GND	Ground
4	3	NO2	Analog Switch 2—Normally Open Terminal
5	4	IN2	Digital Control Input Switch 2
6	5	COM2	Analog Switch 2—Common Terminal
7	7	NC2	Analog Switch 2—Normally Closed Terminal
8	8	V+	Positive-Supply Voltage Input
9	9	NC1	Analog Switch 1—Normally Closed Terminal
10	11	COM1	Analog Switch 1—Common Terminal
	6, 10	N.C.	No Connection
	EP	EP	Exposed Pad. Connect to ground.

Detailed Description

The MAX4736 is a low 0.8Ω max (at V+ = 2.7V) onresistance, low-voltage, dual SPDT analog switch that operates from a 1.6V to 4.2V single supply. CMOS switch construction allows switching analog signals that range from GND to V+.

When powered from a 2.7V supply, the 0.8 $\!\Omega$ max R_ON allows high continuous currents to be switched in a variety of applications.

Applications Information

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings; stresses beyond the listed ratings can cause permanent damage to the devices. Always sequence V+ on first, followed by NO_, NC_, or COM_.

Although it is not required, power-supply bypassing improves noise margin and prevents switching noise propagation from the V+ supply to other components. A 0.1μ F capacitor, connected from V+ to GND, is adequate for most applications.

Logic Inputs

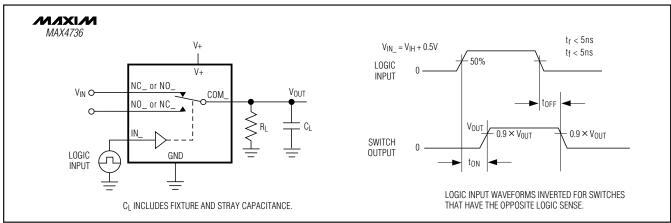
The MAX4736 logic inputs can be driven up to 3.6V, regardless of the supply voltage. For example, with a 1.8V supply, IN_ can be driven low to GND and high to 3.6V. Driving IN_ rail-to-rail minimizes power consumption.

Analog Signal Levels

Analog signals that range over the entire supply voltage (V+ to GND) can be passed with very little change in onresistance (see *Typical Operating Characteristics*). The switches are bidirectional, so the NO_, NC_, and COM_ pins can be used as either inputs or outputs.

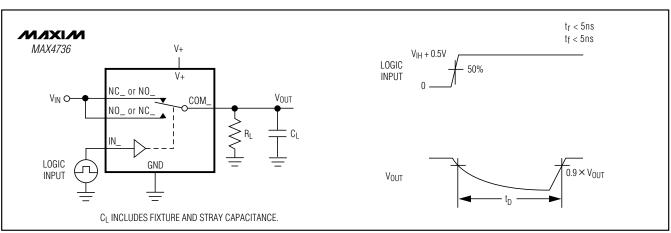
Layout

High-speed switches require proper layout and design procedures for optimum performance. Reduce stray inductance and capacitance by keeping traces short and wide. Ensure that bypass capacitors are as close to the device as possible. Use large ground planes where possible.



Test Circuits/Timing Diagrams

Figure 1. Switching Time



Test Circuits/Timing Diagrams (continued)

Figure 2. Break-Before-Make Interval

MAX4736

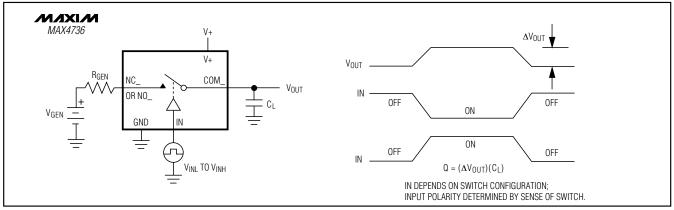


Figure 3. Charge Injection

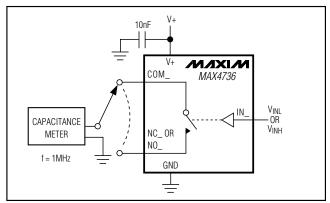


Figure 4. Channel Off/On-Capacitance

Chip Information

TRANSISTOR COUNT: 379 PROCESS: CMOS

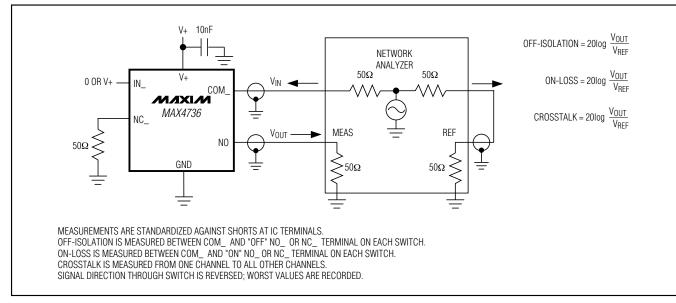
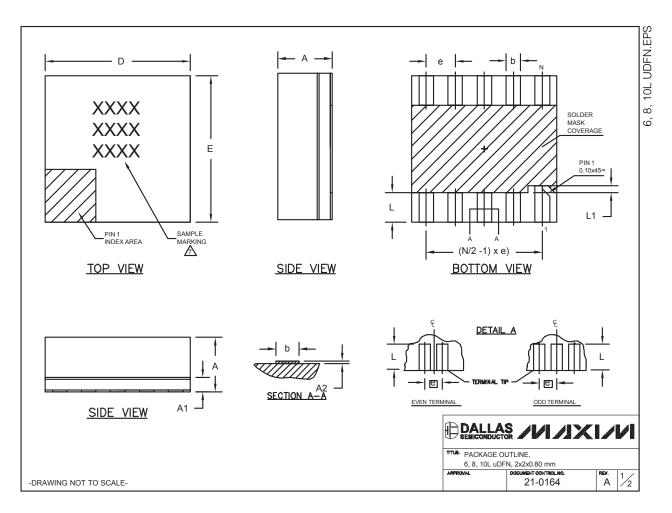


Figure 5. On-Loss, Off-Isolation, and Crosstalk

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to www.maxim-ic.com/packages.)

COMM	ON DIMENS	IONS	
SYMBOL	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.15	0.20	0.25
A2	0.020	0.025	0.035
D	1.95	2.00	2.05
E	1.95	2.00	2.05
L	0.30	0.40	0.50
L1		0.10 REF.	

PACKAGE VARI	ATIONS			
PKG. CODE	N	е	b	(N/2 -1) x e
L622-1	6	0.65 BSC	0.30±0.05	1.30 REF.
L822-1	8	0.50 BSC	0.25±0.05	1.50 REF.
L1022-1	10	0.40 BSC	0.20±0.03	1.60 REF.

NOTES:

- ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
 COPLANARITY SHALL NOT EXCEED 0.08mm.
 WARPAGE SHALL NOT EXCEED 0.10mm.

- 4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).

- 5. "N" IS THE TOTAL NUMBER OF LEADS. 6. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY. AMARKING IS FOR PACKAGE DRIENTATION REFERENCE ONLY.

-DRAWING NOT TO SCALE-



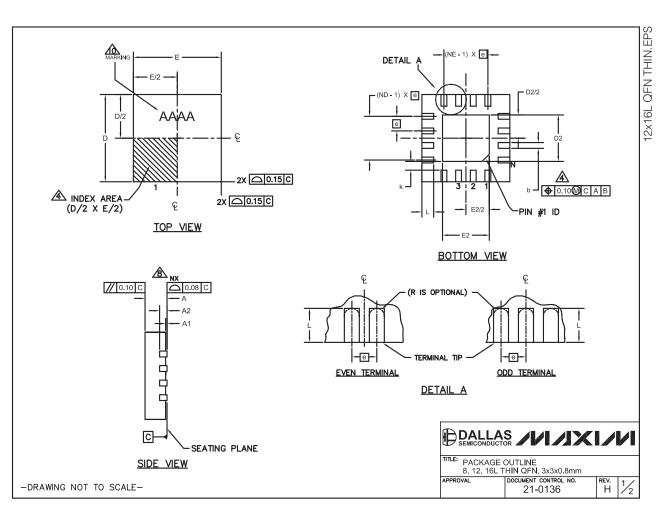
A 2/2

ntus:	PACKAGE OU	JTLINE,
		N, 2x2x0.80 mm
APPRO	VAL	DOCUMENT CONTROL NO
		21-0164

MAX4736

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



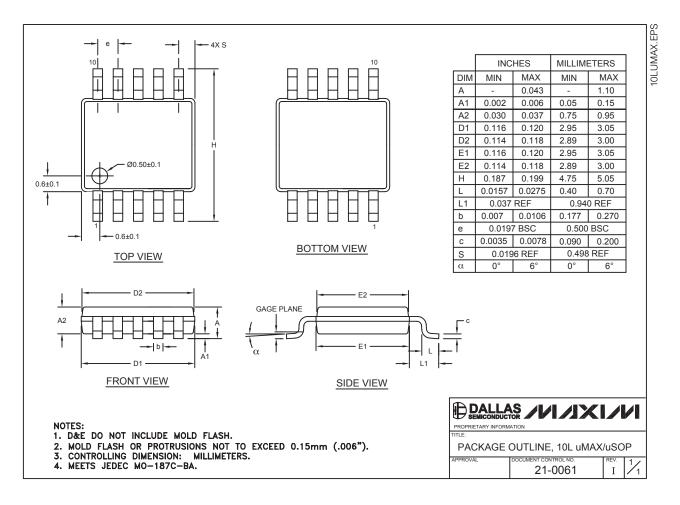
Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

EFF. MIN. NOM. MAX. MIN. NOM. MAX. MIN. NOM. MAX. MIN. NOM. MAX. 0.70 0.75 0.80 0.75 0.80 0.85 0.70 0.85 0.80 0.85 0.80 <td< th=""><th>PKG</th><th></th><th>8L 3x3</th><th></th><th>1</th><th>2L 3x3</th><th></th><th>1</th><th>6L 3x3</th><th></th><th></th><th></th><th>EXF</th><th>POSE</th><th></th><th>) VAR</th><th>RIATIC</th><th>NS</th><th></th></td<>	PKG		8L 3x3		1	2L 3x3		1	6L 3x3				EXF	POSE) VAR	RIATIC	NS	
b 0.25 0.30 0.35 0.20 0.25 0.30 0.20 0.25 0.30 D 2.90 3.00 3.10 2.90 3.00 3.10 2.90 3.00 3.10 2.90 3.00 3.10 2.90 3.00 3.10 2.90 3.00 3.10 2.90 3.00 3.10 2.90 3.00 3.10 e 0.65 BSC. 0.50 BSC. 0.55 0.30 0.40 0.50 ND 2 3 4 10 0.55 0.50 0.02 0.55 1.10 1.25 0.95 1.10 1.26 0.35 x 45° WEED-1 T1633-1 0.95 1.10 1.25 0.95 1.10 1.25 0.35 x 45° WEED-2 T1633-2 0.95 1.10 1.25 0.95 1.10 1.25 0.35 x 45° WEED-2 T1633-4 0.95 0.20 0.55 0.20	REF.						_		_		PKG.		D2			E2		DINUD	
D 2.90 3.00 3.10 2.90 3.10 1.25 0.95 1.10 1.26 0.35 x 45° WEED-2 11633-1 0.95 0.20 0.05 0.020 0.05 0.20 </td <td></td> <td>CODES</td> <td>MIN.</td> <td>NOM.</td> <td>MAX.</td> <td>MIN.</td> <td>NOM.</td> <td>MAX.</td> <td>PINID</td> <td>JEDEC</td>											CODES	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	PINID	JEDEC
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Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



Revision History

Pages changed at Rev 2: 1, 6, 10-14

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14

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AT'S NEW PROD		UTIONS	DESIGN APPNOTES SUPPORT		COMPANY MEMBER:
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uMAX;10 pin;3 x 3mm Dwg: 21-0061I (PDF) Use pkgcode/variation: U10+2*

MAX4736EUB+

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MAX4736EUB+T	uMAX;10 pin;3 x 3mm Dwg: 21-00611 (PDF) Use pkgcode/variation: U10+2*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX4736EUB-T	uMAX;10 pin;3 x 3mm Dwg: 21-00611 (PDF) Use pkgcode/variation: U10-2*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX4736EUB	uMAX;10 pin;3 x 3mm Dwg: 21-00611 (PDF) Use pkgcode/variation: U10-2*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
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