



ON Semiconductor®

# FSUSB42 — Low-Power, Two-Port, High-Speed, USB2.0 (480Mbps) UART Switch

## Features

- Low On Capacitance: 3.7 pF Typical
- Low On Resistance: 3.9 Ω Typical
- Low Power Consumption: 1 μA Maximum
  - 15 μA Maximum I<sub>CC</sub>T over an Expanded Voltage Range (V<sub>IN</sub>=1.8 V, V<sub>CC</sub>=4.4 V)
- Wide -3 db Bandwidth: > 720 MHz
- Packaged in:
  - 10-Lead UMLP (1.4 x 1.8 mm)
  - 10-Lead MSOP
- 8 kV ESD Rating, >16 kV Power / GND ESD Rating
- Over-Voltage Tolerance (OVT) on all USB Ports Up to 5.25 V without External Components

## Applications

- Cell phone, PDA, Digital Camera, and Notebook
- LCD Monitor, TV, and Set-Top Box

## Description

The FSUSB42 is a bi-directional, low-power, two-port, high-speed, USB2.0 switch. Configured as a double-pole, double-throw switch (DPDT) switch, it is optimized for switching between any combination of high-speed (480 Mbps) or Full-Speed (12 Mbps) sources.

The FSUSB42 is compatible with the requirements of USB2.0 and features an extremely low on capacitance (C<sub>ON</sub>) of 3.7 pF. The wide bandwidth of this device (720 MHz) exceeds the bandwidth needed to pass the third harmonic, resulting in signals with minimum edge and phase distortion. Superior channel-to-channel crosstalk also minimizes interference.

The FSUSB42 contains special circuitry on the switch I/O pins for applications where the V<sub>CC</sub> supply is powered-off (V<sub>CC</sub>=0 V), which allows the device to withstand an over-voltage condition. This device is designed to minimize current consumption even when the control voltage applied to the SEL pin is lower than the supply voltage (V<sub>CC</sub>). This feature is especially valuable to ultra-portable applications, such as cell phones, allowing for direct interface with the general-purpose I/Os of the baseband processor. Other applications include switching and connector sharing in portable cell phones, PDAs, digital cameras, printers, and notebook computers.

## Ordering Information

Part Number	Top Mark	Operating Temperature Range	Package
FSUSB42UMX	HE	-40 to +85°C	10-Lead, Quad, Ultrathin Molded Leadless Package (UMLP), 1.4 x 1.8 mm
FSUSB42MUX	FSUSB42	-40 to +85°C	10-Lead, Molded Small-Outline Package (MSOP) JEDEC MO-187, 3.0 mm Wide

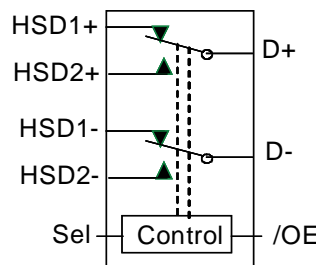


Figure 1. Analog Symbol

## Pin Assignments

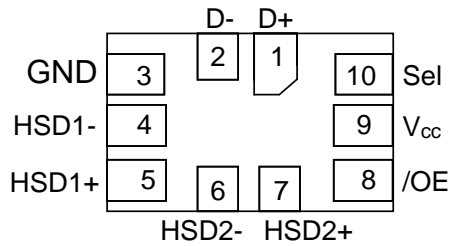


Figure 2. 10-Lead UMLP (Top-Through View)

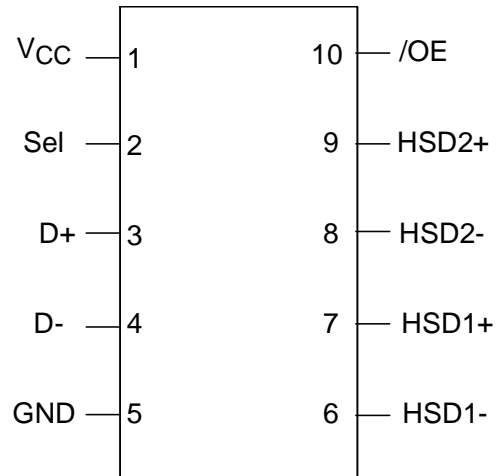


Figure 3. 10-Lead MSOP (Top-Through View)

## Pin Definitions

UMLP Pin#	MSOP Pin#	Name	Description
1	3	D+	Common USB Data Bus
2	4	D-	Common USB Data Bus
3	5	GND	Ground
4	6	HSD1-	Multiplexed Source Input 1
5	7	HSD1+	Multiplexed Source Input 1
6	8	HSD2-	Multiplexed Source Input 2
7	9	HSD2+	Multiplexed Source Input 2
8	10	/OE	Sw itch Enable
9	1	Vcc	Supply Voltage
10	2	Sel	Sw itch Select

## Truth Table

SEL	/OE	Function
X	HIGH	Disconnect
LOW	LOW	D+= HSD1+, D-= HSD1-
HIGH	LOW	D+= HSD2+, D-= HSD2-

### Notes:

1.  $LOW \leq V_{IL}$ .
2.  $HIGH \geq V_{IH}$ .
3. X=Don't Care.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
V <sub>CC</sub>	Supply Voltage	-0.5	5.6	V
V <sub>CNTRL</sub>	DC Input Voltage (S, /OE) <sup>(4)</sup>	-0.5	V <sub>CC</sub>	V
V <sub>SW</sub>	DC Switch I/O Voltage <sup>(4)</sup> (V <sub>CC</sub> =0V)	-0.50	5.25	V
I <sub>IK</sub>	DC Input Diode Current	-50		mA
I <sub>OUT</sub>	DC Output Current		100	mA
T <sub>STG</sub>	Storage Temperature	-65	+150	°C
MSL	Moisture Sensitivity Level (JEDEC J-STD-020A)		1	Level
ESD	Human Body Model, JEDEC: JESD22-A114	All Pins	7	kV
		I/O to GND	8	
		Power to GND	16	
		D+/D-	9	
	IEC 61000-4-2 System on USB Connector Pins D+ & D-	Air Discharge	15	
		Contact	8	
	Charged Device Model, JEDEC: JESD22-C101	2		

**Note:**

4. The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. ON Semiconductor does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
V <sub>CC</sub>	Supply Voltage	2.4	4.4	V
V <sub>CNTRL</sub>	Control Input Voltage (S, /OE) <sup>(5)</sup>	0	V <sub>CC</sub>	V
V <sub>SW</sub>	Switch I/O Voltage	-0.5	4.5	V
T <sub>A</sub>	Operating Temperature	-40	+85	°C

**Note:**

5. The control input must be held HIGH or LOW and it must not float.

## DC Electrical Characteristics

All typical value are at  $T_A=25^{\circ}\text{C}$  unless otherw ise specified.

Symbol	Parameter	Condition	$V_{CC}$ (V)	$T_A=-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$			Unit
				Min.	Typ.	Max.	
$V_{IK}$	Clamp Diode Voltage	$I_N=-18\text{mA}$	3.0			-1.2	V
$V_{IH}$	Input Voltage High		2.4 to 3.6	1.3			V
			4.3	1.7			
$V_{IL}$	Input Voltage Low		2.4 to 3.6			0.5	V
			4.3			0.7	
$I_{IN}$	Control Input Leakage	$V_{SW}=0$ to $V_{CC}$	0 to 4.3	-1		1	$\mu\text{A}$
$I_{OZ}$	Off State Leakage	$0 \leq D_n, \text{HSD}1_n, \text{HSD}2_n \leq 3.6\text{ V}$	4.3	-2		2	$\mu\text{A}$
$I_{OFF}$	Power-Off Leakage Current (All I/O Ports)	$V_{SW}=0\text{ V}$ to $4.3\text{ V}$ , $V_{CC}=0\text{ V}$ Figure 5	0	-2		2	$\mu\text{A}$
$R_{ON}$	HS Switch On Resistance <sup>(6)</sup>	$V_{SW}=0.4\text{ V}$ , $I_{ON}=-8\text{ mA}$ Figure 4	2.4		4.5	7.5	$\Omega$
			3.0		3.9	6.5	
$\Delta R_{ON}$	HS Delta $R_{ON}$ <sup>(7)</sup>	$V_{SW}=0.4\text{ V}$ , $I_{ON}=-8\text{ mA}$	3.0		0.65		$\Omega$
$I_{CC}$	Quiescent Supply Current	$V_{CNTRL}=0$ or $V_{CC}$ , $I_{OUT}=0$	4.3			1	$\mu\text{A}$
$I_{CCT}$	Increase in $I_{CC}$ Current per Control Voltage and $V_{CC}$	$V_{CNTRL}=2.6\text{ V}$ , $V_{CC}=4.3\text{ V}$	4.3			10	$\mu\text{A}$
		$V_{CNTRL}=1.8\text{ V}$ , $V_{CC}=4.3\text{ V}$	4.3			15	$\mu\text{A}$

### Notes:

6. Measured by the voltage drop between HSDn and Dn pins at the indicated current through the switch. On resistance is determined by the lower of the voltage on the two (HSDn or Dn ports).
7. Guaranteed by characterization.

## AC Electrical Characteristics

All typical value are for  $V_{CC}=3.3\text{ V}$  at  $T_A=25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Condition	$V_{CC}$ (V)	$T_A=-40^\circ\text{C to }+85^\circ\text{C}$			Unit
				Min.	Typ.	Max.	
$t_{ON}$	Turn-On Time S, /OE to Output	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW}=0.8\ \text{V}$ , Figure 6, Figure 7	2.4		24	40	ns
			3.0 to 3.6		13	30	
$t_{OFF}$	Turn-Off Time S, /OE to Output	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW}=0.8\ \text{V}$ , Figure 6, Figure 7	2.4		15	35	ns
			3.0 to 3.6		12	25	
$t_{PD}$	Propagation Delay <sup>8</sup>	$C_L=5\ \text{pF}$ , $R_L=50\ \Omega$ , Figure 6, Figure 8	3.3		0.25		ns
$t_{BBM}$	Break-Before-Make	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW1}=V_{SW2}=0.8\ \text{V}$ , Figure 10	2.4	2.0		10	ns
			3.0 to 3.6	2.0		6.5	
$O_{IRR}$	Off Isolation	$R_L=50\ \Omega$ , $f=240\ \text{MHz}$ , Figure 12	3.0 to 3.6		-30		dB
Xtalk	Non-Adjacent Channel Crosstalk	$R_L=50\ \Omega$ , $f=240\ \text{MHz}$ , Figure 13	3.0 to 3.6		-45		dB
BW	-3db Bandwidth	$R_L=50\ \Omega$ , $C_L=0\ \text{pF}$ , Figure 11	3.0 to 3.6		720		MHz
		$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , Figure 11			550		MHz

**Note:**

8. Guaranteed by characterization.

## USB High-Speed-Related AC Electrical Characteristics

All typical value are for  $V_{CC}=3.3\text{ V}$  at  $T_A=25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Condition	$V_{CC}$ (V)	$T_A=-40^\circ\text{C to }+85^\circ\text{C}$			Unit
				Min.	Typ.	Max.	
$t_{SK(P)}$	Skew of Opposite Transitions of the Same Output <sup>(9)</sup>	$C_L=5\ \text{pF}$ , $R_L=50\ \Omega$ , Figure 9			20		ps
$t_J$	Total Jitter <sup>(9)</sup>	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $t_R=t_F=500\ \text{ps}$ (10-90%) at 480 Mbps (PRBS= $2^{15}-1$ )			200		ps

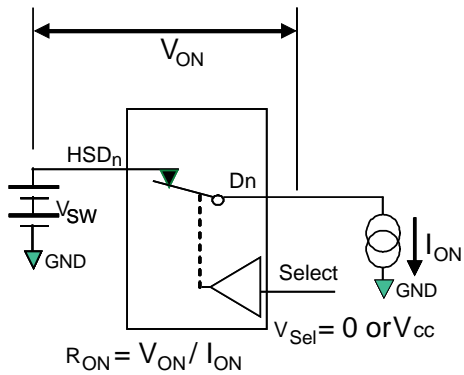
**Note:**

9. Guaranteed by characterization.

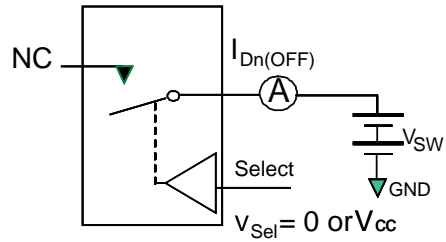
## Capacitance

Symbol	Parameter	Condition	$T_A=-40^\circ\text{C to }+85^\circ\text{C}$			Unit
			Min.	Typ.	Max.	
$C_{IN}$	Control Pin Input Capacitance	$V_{CC}=0\ \text{V}$		1.5		pF
$C_{ON}$	D+/D- On Capacitance	$V_{CC}=3.3\ \text{V}$ , /OE=0 V, $f=240\ \text{MHz}$ , Figure 15		3.7		
$C_{OFF}$	D1n, D2n Off Capacitance	$V_{CC}$ and /OE=3.3 V, Figure 14		2.0		

### Test Diagrams

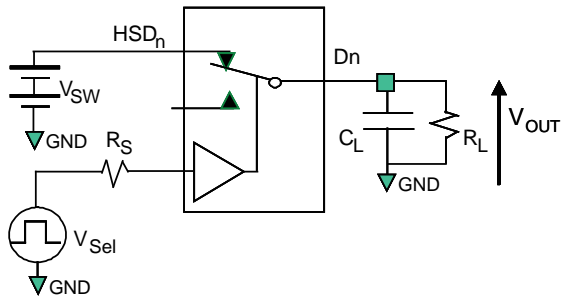


**Figure 4. On Resistance**



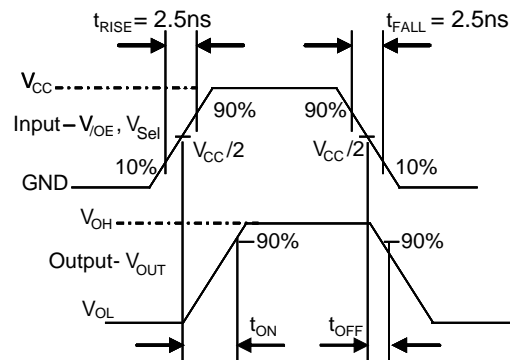
\*\*Each switch port is tested separately

**Figure 5. Off Leakage**

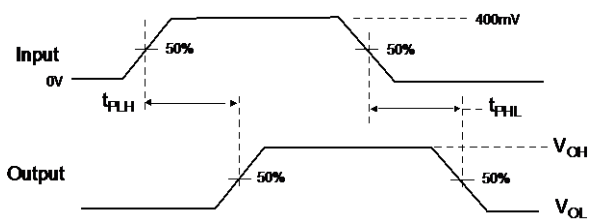


$R_L$ ,  $R_S$ , and  $C_L$  are functions of the application environment (see AC Tables for specific values)  
 $C_L$  includes test fixture and stray capacitance.

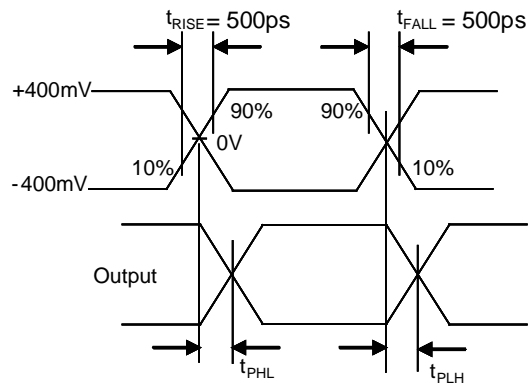
**Figure 6. AC Test Circuit Load**



**Figure 7. Turn-On / Turn-Off Waveforms**

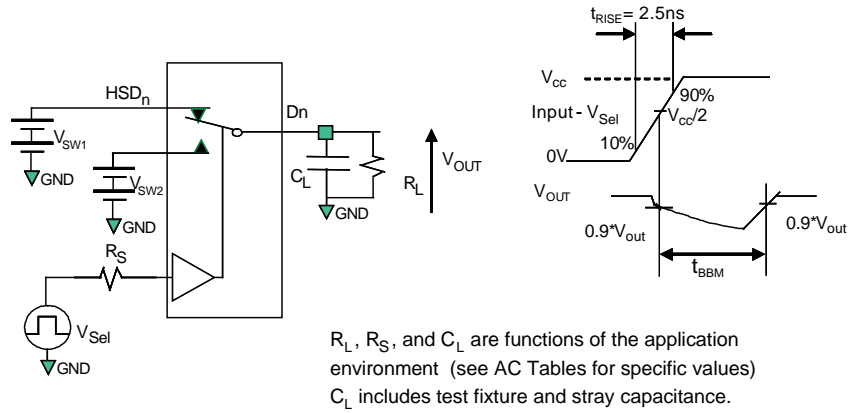


**Figure 8. Propagation Delay ( $t_{rTF} = 500$  ps)**

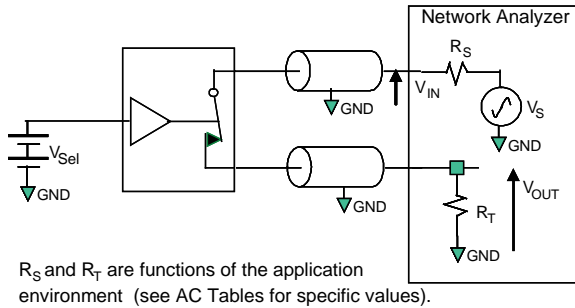


**Figure 9. Intra-Pair Skew Test  $t_{sK(P)}$**

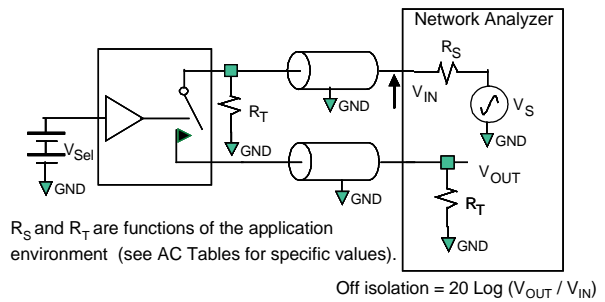
**Test Diagrams (Continued)**



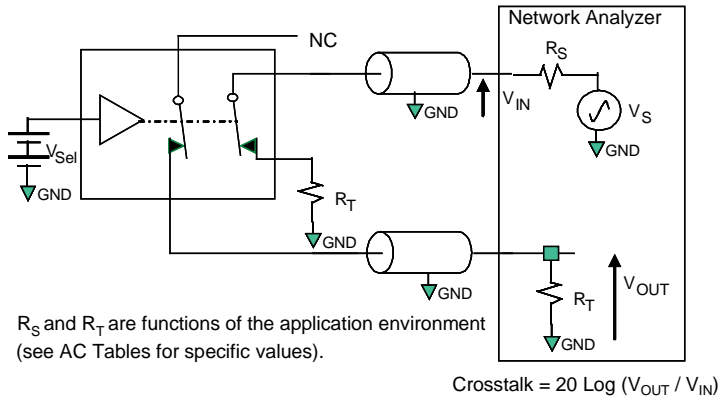
**Figure 10. Break-Before-Make Interval Timing**



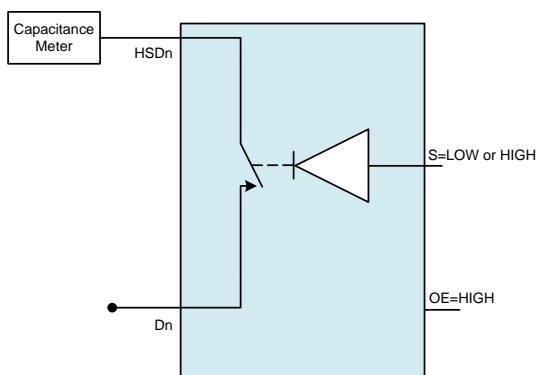
**Figure 11. Bandwidth**



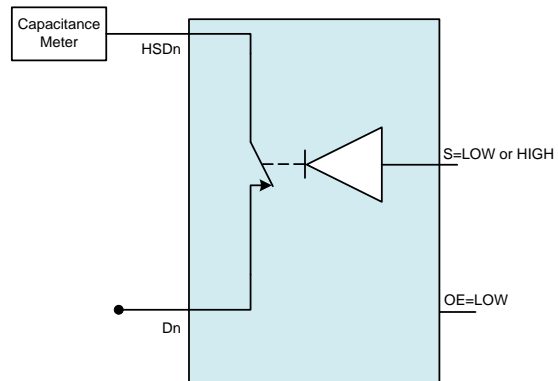
**Figure 12. Channel Off Isolation**



**Figure 13. Non-Adjacent Channel-to-Channel Crosstalk**

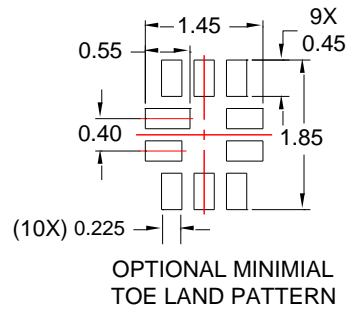
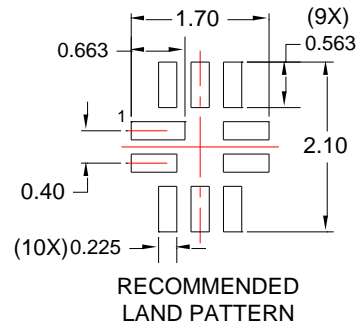
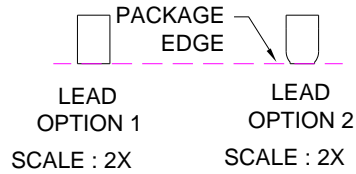
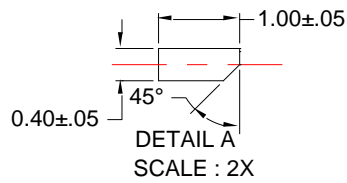
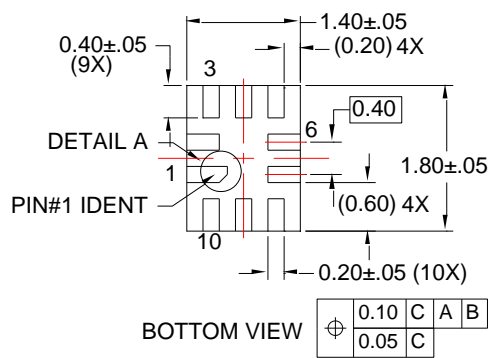
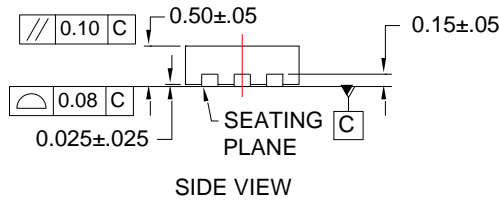
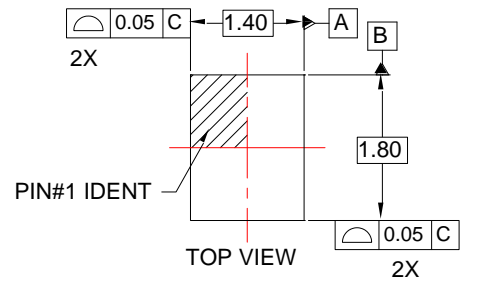


**Figure 14. Channel Off Capacitance**



**Figure 15. Channel On Capacitance**

## Physical Dimensions



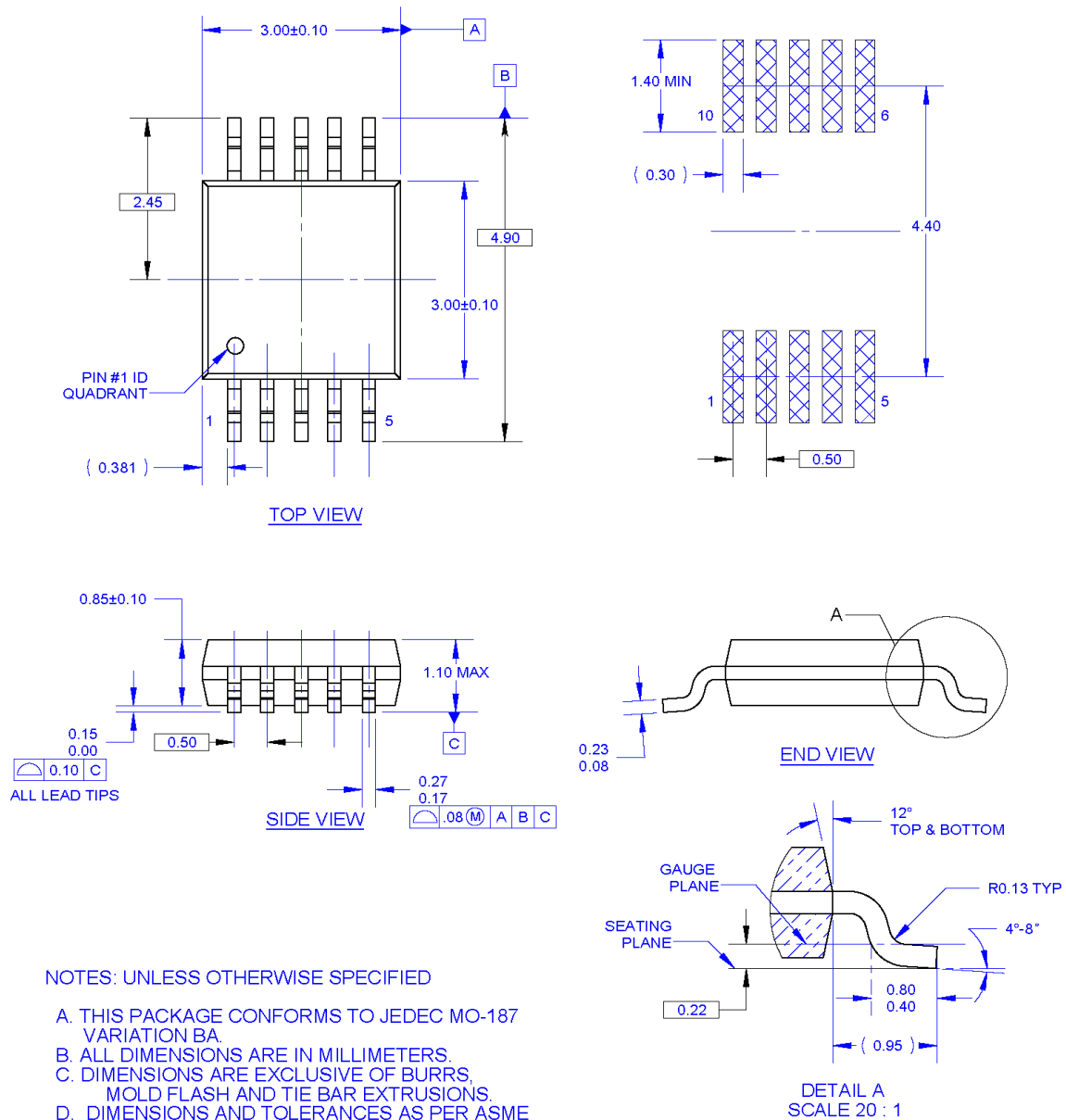
### NOTES:

- A. PACKAGE DOES NOT CONFORM TO ANY JEDEC STANDARD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
- E. DRAWING FILENAME: MKT-UMLP10Arev6.

Figure 16. 10-Lead, Ultrathin Molded Leadless Package (UMLP)



Physical Dimensions (Continued)



NOTES: UNLESS OTHERWISE SPECIFIED

- A. THIS PACKAGE CONFORMS TO JEDEC MO-187 VARIATION BA.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES AS PER ASME Y14.5-1994.
- E. LAND PATTERN AS PER IPC7351#SOP50P490X110-10AN
- F. FILE NAME: MKT-MUA10AREV3

Figure 17. 10-Lead, Molded Small Outline Package (MSOP)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

**PUBLICATION ORDERING INFORMATION**

**LITERATURE FULFILLMENT:**

Literature Distribution Center for ON Semiconductor  
 19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
 USA/Canada.

**Europe, Middle East and Africa Technical Support:**  
 Phone: 421 33 790 2910

**Japan Customer Focus Center**  
 Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local  
 Sales Representative

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А