90mΩ、1.5A带标志位高侧电源开关

UM9711S *SOT23-5*
UM9711S8 *SOP8*
UM9711AS8 *SOP8*

描述

UM9711/UM9711A 是一款低电压、单N沟道MOSFET的高侧电源开关，专为自供电(self-powered) 和总线供电 (bus- powered) 的通用串行总线 (USB) 应用优化。

UM9711/UM9711A 内含一个电荷泵电路来驱动内部 MOSFET 开关，开关的90mΩ低导通电阻($R_{DS(ON)}$)符合USB的压降要求。UM9711 具有一个 $\overline{FLG}$ 标志位，该引脚为N沟道开漏MOSFET输出，该标志输出用于向本地USB控制器指示故障情况，需要说明的是，UM9711A不具备这种功能。

其他功能还包括用于限制插入时浪涌电流的软启动功能、用来防止高电流负载造成严重失效的热关断功能、确保设备在没有有效输入电压时保持关闭状态的欠压锁定 (UVLO) 功能。最大电流在双端口模式下通常限制为2.5A，符合USB电源要求；静态电流低至40μA，使该器件成为便携式电池供电设备的理想选择。UM9711采用SOT23-5和SOP8封装，占用最小电路板空间并使用最小尺寸组件，而UM9711A仅采用SOP8封装。

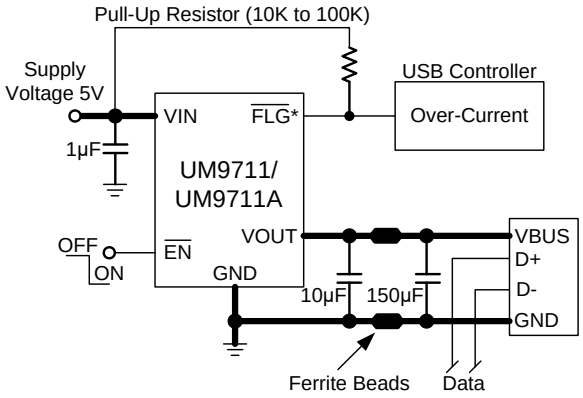
应用

- USB 总线/自供电集线器
- USB 外设
- ACPI电源分配
- PC 卡热插拔
- 笔记本电脑、主板、桌面计算机
- 电池供电装置
- 热插拔电源
- 电池充电器电路

特性

- 符合 USB 规范
- 内置 N-MOSFET，典型 $R_{DS(ON)}$: 90mΩ
- 输出可以被强制高于输入 (关断状态)
- 低输入电流：
  开关开启状态，典型值：40μA
  开关关闭状态，典型值：0.1μA
- 保证 1.5A 连续负载电流
- 宽输入电压范围：2.5V至5.5V
- 开路漏极故障标志输出
  (UM9711S, UM9711S8)
- 热插拔应用 (软启动)
- 欠压锁定 (UVLO) 典型值 1.7V
- 限流保护
- 热关断
- 反向电流阻断 (无体二极管)

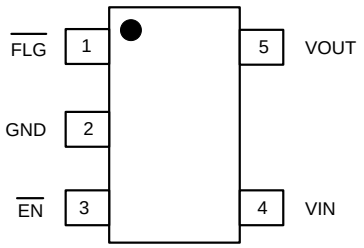
Typical Application Circuit



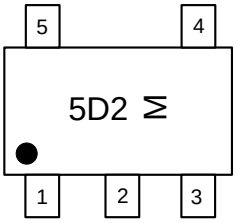
*Only for UM9711S/UM9711S8.

Pin Configurations

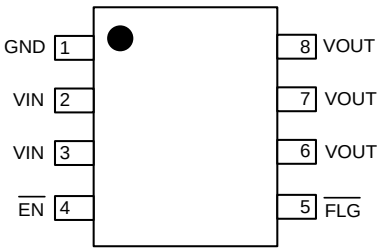
Top View



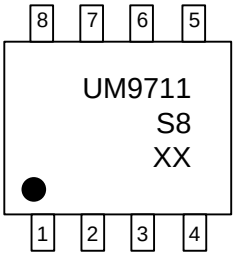
UM9711S



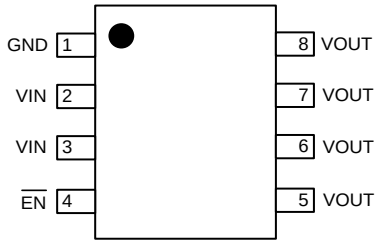
M: Month Code
UM9711S
SOT23-5



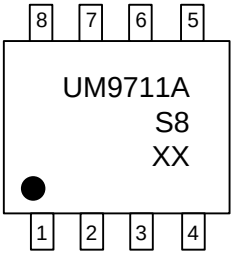
UM9711S8



XX: Week Code
UM9711S8
SOP8



UM9711AS8



XX: Week Code
UM9711AS8
SOP8

Pin Description

Pin Number			Symbol	Function
UM9711S (SOT23-5)	UM9711S8 (SOP8)	UM9711AS8 (SOP8)		
1	5	-	$\overline{FLG}$	Open-Drain Fault Flag Output
2	1	1	GND	Ground
3	4	4	$\overline{EN}$	Chip Enable (Active Low)
4	2,3	2,3	VIN	Power Input Voltage
5	6,7,8	5,6,7,8	VOUT	Output Voltage

Ordering Information

Part Number	Packaging Type	Marking Code	Shipping Qty
UM9711S	SOT23-5	5D2	3000pcs/7Inch Tape & Reel
UM9711S8	SOP8	UM9711S8	2500pcs/13Inch Tape & Reel
UM9711AS8		UM9711AS8	

Absolute Maximum Ratings (Note 1)

Symbol	Parameter		Value	Unit
V_{IN}	Supply Voltage on VIN		-0.3 to +6.5	V
$V_{\overline{EN}}$	Voltages on Pin $\overline{EN}$		-0.3 to +6.5	V
$V_{\overline{FLG}}$	Flag Voltage (UM9711S, UM9711S8)		6.5	V
P_D	Continuous Power Dissipation	SOT23-5	400	mW
		SOP8	625	mW
T_A	Operating Ambient Temperature		-40 to +85	℃
T_J	Operating Junction Temperature		+125	℃
T_{STG}	Storage Temperature Range		-40 to +150	℃
T_L	Maximum Lead Temperature for Soldering 10 Seconds		+260	℃

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. 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 remain possibility to affect device reliability.

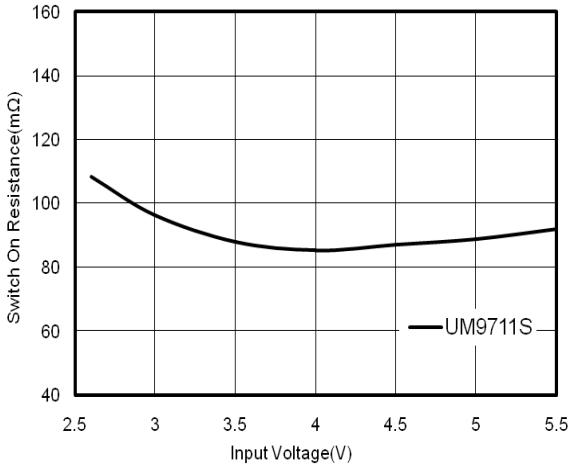
Electrical Characteristics

(V_{IN}=5V, C_{IN}=C_{OUT}=1μF, T_A=25℃, unless otherwise specified)

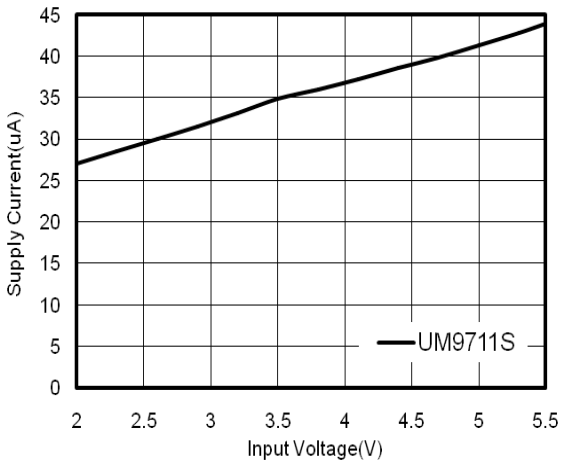
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage Range		2.5		5.5	V
$R_{DS(ON)}$	Switch on Resistance	V_{IN}=5V, I_{OUT}=1A		90	110	mΩ
I_{SW_ON}	Switch on Supply Current	Switch On, V_{OUT}=Open		40	60	μA
I_{SW_OFF}	Switch off Supply Current	Switch Off, V_{OUT}=Open		0.1	1	μA
I_{LEAK}	Output Leakage Current	$V_{\overline{EN}}$ =5V, R_{LOAD}=0Ω		2.5	10	μA
V_{IH}	$\overline{EN}$ Threshold Logic-High Voltage	V_{IN}=2V to 5.5V, Switch Off	1.7			V
V_{IL}	$\overline{EN}$ Threshold Logic-Low Voltage	V_{IN}=2V to 5.5V, Switch On			0.8	V
$I_{\overline{EN}}$	$\overline{EN}$ Input Current	$V_{\overline{EN}}$=0V to 5.5V		0.01	1.0	μA
t_{ON_RISE}	Output Turn-On Rise Time	10% to 90% of V_{OUT} Rising (R_{LOAD}=82Ω)		400		μs
I_{LIM}	Current Limit	Current Ramp (<0.1A/ms) on V_{OUT}	1.6	2.5	3.2	A
I_{SC_FB}	Short Circuit Fold-Back Current (Hysteresis)	V_{OUT}=0V, Measured Prior to Thermal Shutdown		1.0		A
$R_{\overline{FLG}}$	FLAG Output Resistance	I_{SINK}= 1mA		100	400	Ω
$I_{\overline{FLG}\_OFF}$	FLAG Off Current	$V_{\overline{FLG}}$ = 5V		0.01	1	μA
t_D	FLAG Delay Time	From Fault Condition to $\overline{FLG}$ Assertion	5	12	20	ms
V_{UVLO}	Under-Voltage Lockout	V_{IN} Increasing (I_{LOAD}=10mA)	1.3	1.7		V
△ V_{UVLO}	Under-Voltage Hysteresis	V_{IN} Decreasing (I_{LOAD}=10mA)		0.1		V
T_{SD}	Thermal Shutdown Protection			140		℃
△ T_{SD}	Thermal Shutdown Hysteresis			20		℃

Typical Operating Characteristics

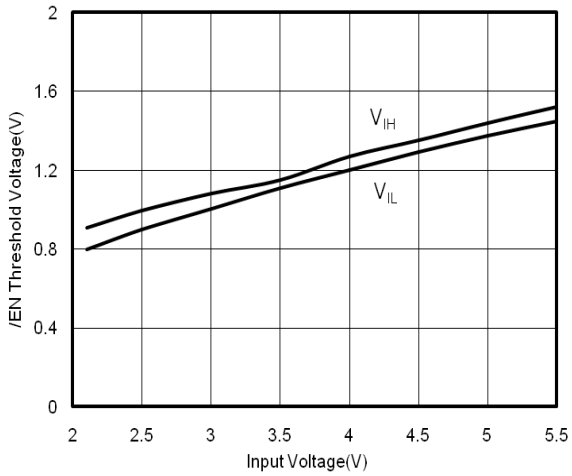
Switch on Resistance vs. Input Voltage
I_{OUT}=1A, C_{IN}=C_{OUT}=1μF



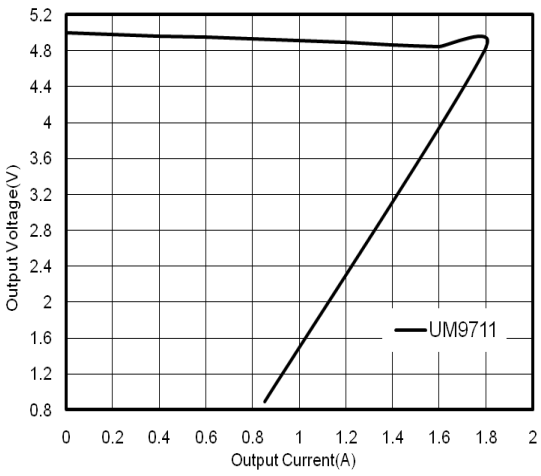
Supply Current vs. Input Voltage
R_L=open, V_{EN}=0V, C_{IN}=C_{OUT}=1μF



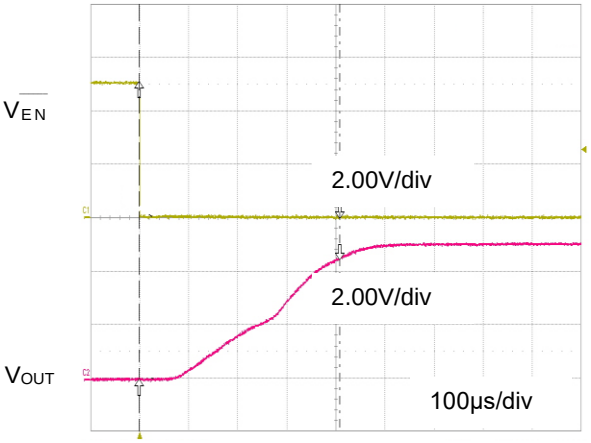
$\overline{EN}$ Pin Threshold Voltage vs. Input Voltage
I_{LOAD}=100mA, C_{IN}=C_{OUT}=1μF



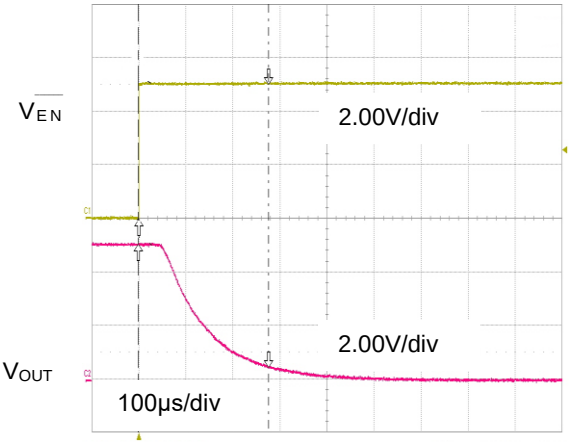
Output Voltage vs. Output Current
V_{IN}=5V, C_{IN}=C_{OUT}=1μF



Turn-On Response
V_{IN}=5V, R_L=82Ω, C_{IN}=C_{OUT}=1μF(UM9711S)



Turn-Off Response
V_{IN}=5V, R_L=82Ω, C_{IN}=C_{OUT}=1μF(UM9711S)



Function Description

Reverse Current Protection

The UM9711/UM9711A prevents reverse current flow if V_{OUT} is externally forced to a higher voltage than V_{IN} when the output is disabled ($V_{\overline{EN}}$>1.7V).

Soft Start for Hot Plug-In Applications

In order to eliminate the upstream voltage droop caused by the large inrush current during hot-plug events, the "soft-start" feature effectively isolates the power source from extremely large capacitive loads, satisfying the USB voltage droop requirements.

Fault Flag (UM9711S, UM9711S8)

The UM9711 provides a $\overline{FLG}$ signal pin which is an N-Channel open drain MOSFET output. This open drain output goes low when V_{OUT}<V_{IN}−1V, current limit or the die temperature exceeds 130℃ approximately. The $\overline{FLG}$ output is capable of sinking a 10mA load to typically 200mV above ground. The $\overline{FLG}$ pin requires a pull-up resistor; this resistor should be large in value to reduce energy drain. A 100kΩ pull-up resistor works well for most applications. In the case of an over-current condition, $\overline{FLG}$ will be asserted only after the flag response delay time, t_D, has elapsed. This ensures that $\overline{FLG}$ is asserted only upon valid over-current conditions and that erroneous error reporting is eliminated.

For example, false over-current conditions may occur during hot-plug events when extremely large capacitive loads are connected and causes a high transient inrush current that exceeds the current limit threshold. The $\overline{FLG}$ response delay time t_D is typically 12ms.

Under-Voltage Lockout

Under-voltage lockout (UVLO) prevents the MOSFET switch from turning on until input voltage exceeds approximately 1.7V. If input voltage drops below approximately 1.6V, UVLO turns off the MOSFET switch, $\overline{FLG}$ will be asserted accordingly. Under-voltage detection functions only when the switch is enabled.

Current Limiting and Short-Circuit Protection

The current limit circuitry prevents damage to the MOSFET switch and the hub downstream port but can deliver load current up to the current limit threshold of typically 2.5A through the switch of UM9711/UM9711A. When a heavy load or short circuit is applied to an enabled switch, a large transient current may flow until the current limit circuitry responds. Once this current limit threshold is exceeded the device enters constant current mode until the thermal shutdown occurs or the fault is removed.

Thermal Shutdown

Thermal shutdown is employed to protect the device from damage if the die temperature exceeds approximately 130℃. The power switch will auto-recover when the IC is cooling down. The thermal hysteresis temperature is about 20℃.

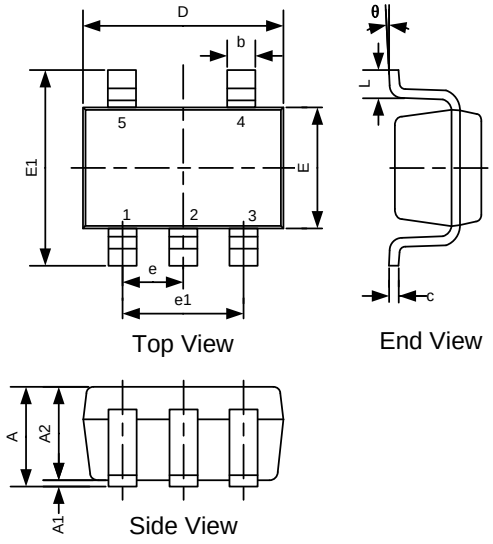
Supply Filter/Bypass Capacitor

A 1μF low-ESR ceramic capacitor from V_{IN} to GND, located at the device is strongly recommended to prevent the input voltage drooping during hot-plug events. However, higher capacitor values will further reduce the voltage droop on the input. Furthermore, without the bypass capacitor, an output short may cause sufficient ringing on the input (from source lead inductance) to destroy the internal control circuitry. The input transient must not exceed 6.5V of the absolute maximum supply voltage even for a short duration.

Package Information

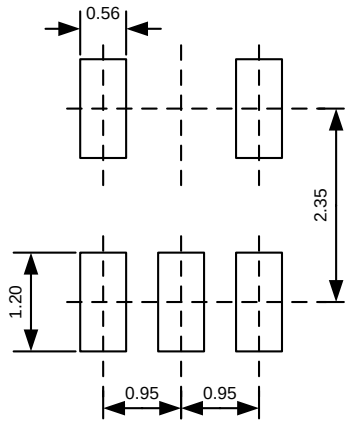
UM9711S SOT23-5

Outline Drawing



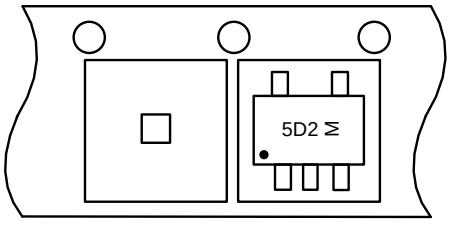
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.013	1.15	1.40	0.040	0.045	0.055
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2	1.00	1.10	1.30	0.039	0.043	0.051
b	0.30	-	0.50	0.012	-	0.020
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.82	-	3.10	0.111	-	0.122
E	1.50	1.60	1.70	0.059	0.063	0.067
E1	2.60	2.80	3.00	0.102	0.110	0.118
e	0.95REF			0.037REF		
e1	1.90REF			0.075REF		
L	0.30	-	0.60	0.012	-	0.024
θ	0 °	-	8 °	0 °	-	8 °

Land Pattern



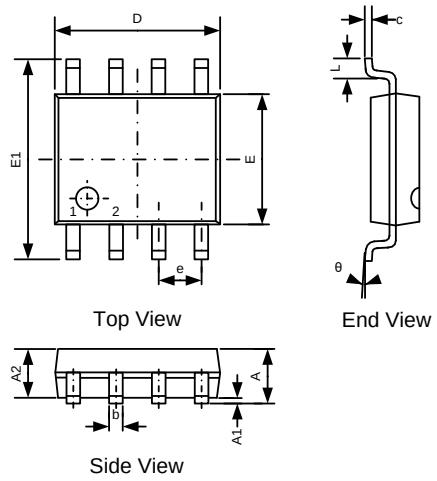
NOTES:
1. Compound dimension: 2.92×1.60;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



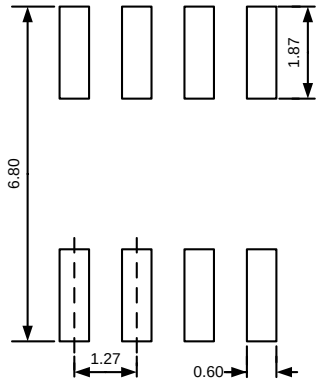
UM9711S8 SOP8

Outline Drawing



Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.35	1.55	1.75	0.053	0.061	0.069
A1	0.10	-	0.25	0.004	-	0.010
A2	1.25	-	1.65	0.049	-	0.065
b	0.30	-	0.51	0.012	-	0.020
c	0.15	-	0.25	0.006	-	0.010
D	4.70	4.90	5.10	0.185	0.193	0.200
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	6.20	0.228	0.236	0.244
e	1.27BSC			0.050 BSC		
L	0.40	-	1.27	0.016	-	0.050
θ	0 °	-	8 °	0 °	-	8 °

Land Pattern



NOTES:
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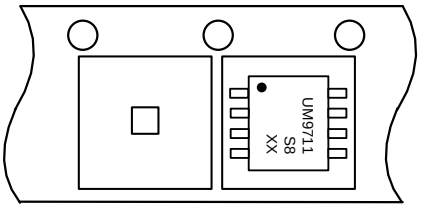
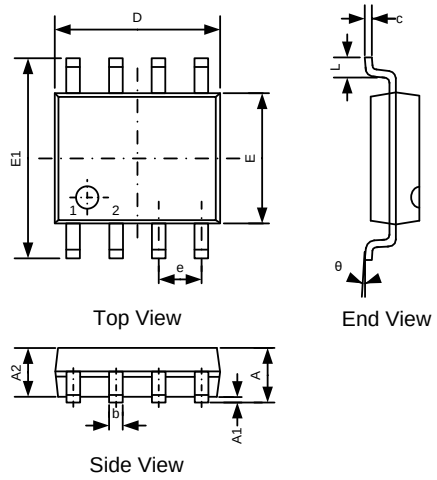
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



UM9711AS8 SOP8

Outline Drawing



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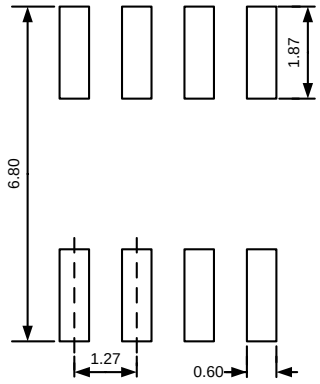
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.35	1.55	1.75	0.053	0.061	0.069
A1	0.10	-	0.25	0.004	-	0.010
A2	1.25	-	1.65	0.049	-	0.065
b	0.30	-	0.51	0.012	-	0.020
c	0.15	-	0.25	0.006	-	0.010
D	4.70	4.90	5.10	0.185	0.193	0.200
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	6.20	0.228	0.236	0.244
e	1.27BSC			0.050 BSC		
L	0.40	-	1.27	0.016	-	0.050
θ	0 °	-	8 °	0 °	-	8 °

Land Pattern



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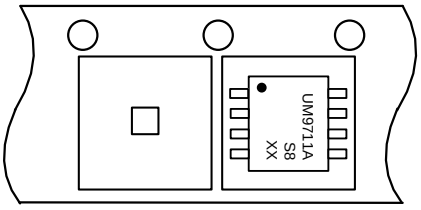

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