90mΩ, 1.5A High-Side Power Switches with Flag

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

General Description

The UM9711/UM9711A is a low voltage, single N-MOSFET high-side power switch, optimized for self-powered and bus-powered Universal Serial Bus (USB) applications. The UM9711/UM9711A is equipped with a charge pump circuitry to drive the internal MOSFET switch; the switch's low $R_{DS(ON)}$, 90mΩ, meets USB voltage drop requirements. The UM9711 provides a $\overline{FLG}$ signal pin which is an N-Channel open drain MOSFET output. The flag output is available to indicate fault conditions to the local USB controller. The UM9711A doesn't have such function.

Additional features include soft-start to limit inrush current during plug-in, thermal shutdown to prevent catastrophic switch failure from high-current loads, under-voltage lockout (UVLO) to ensure that the device remains off unless there is a valid input voltage present. The maximum current is limited to typically 2.5A in dual ports in accordance with the USB power requirements, lower quiescent current as 40μA making this device ideal for portable battery-operated equipment. The UM9711 is available in SOT23-5 and SOP8 packages requiring minimum board space and smallest components while the UM9711A is available in SOP8 package.

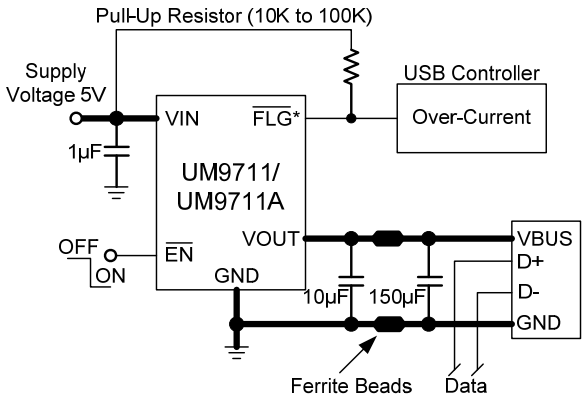
Applications

- USB Bus/Self-Powered Hubs
- USB Peripherals
- ACPI Power Distribution
- PC Card Hot Swap
- Notebook, Motherboard PCs
- Battery-Powered Equipment
- Hot-Plug Power Supplies
- Battery-Charger Circuits

Features

- Compliant to USB Specifications
- Built-in N-MOSFET, Typical $R_{DS(ON)}$: 90mΩ
- Output can be Forced Higher than Input (Off-State)
- Low Supply Current:
  40μA Typical at Switch on State
  0.1μA Typical at Switch off State
- Guaranteed 1.5A Continuous Load Current
- Wide Input Voltage Range: 2.5V to 5.5V
- Open-Drain Fault Flag Output (UM9711S, UM9711S8)
- Hot Plug-in Application (Soft-Start)
- 1.7V Typical Under-Voltage Lockout (UVLO)
- Current Limiting Protection
- Thermal Shutdown Protection
- Reverse Current Flow Blocking (No Body Diode)

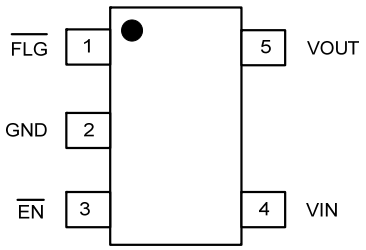
Typical Application Circuit



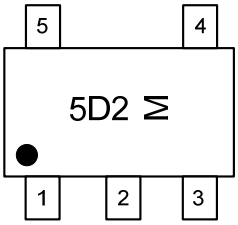
*Only for UM9711S/UM9711S8.

Pin Configurations

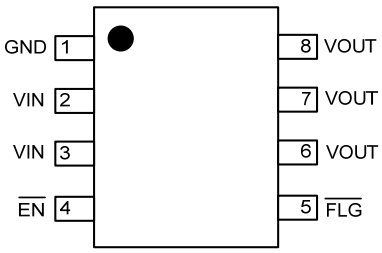
Top View



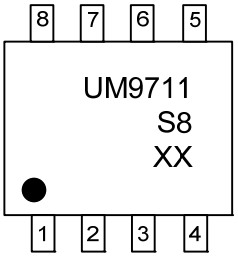
UM9711S



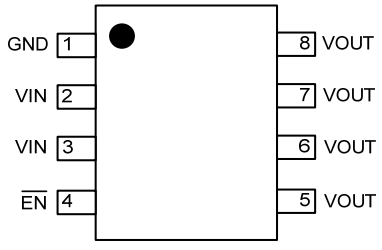
M: Month Code
UM9711S
SOT23-5



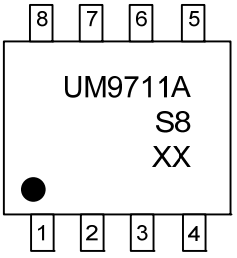
UM9711S8



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	°C
T_J	Operating Junction Temperature		+125	°C
T_{STG}	Storage Temperature Range		-40 to +150	°C
T_L	Maximum Lead Temperature for Soldering 10 Seconds		+260	°C

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.

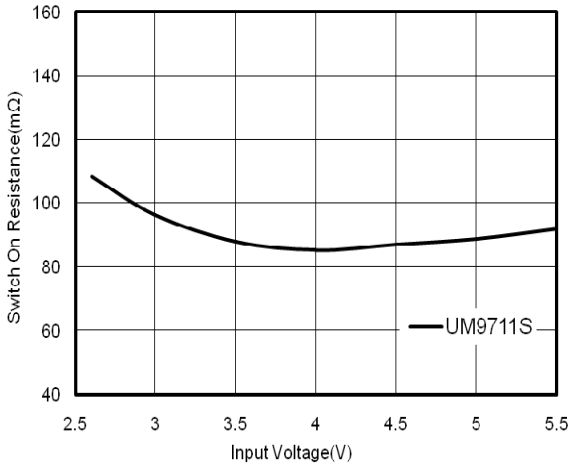
Electrical Characteristics

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

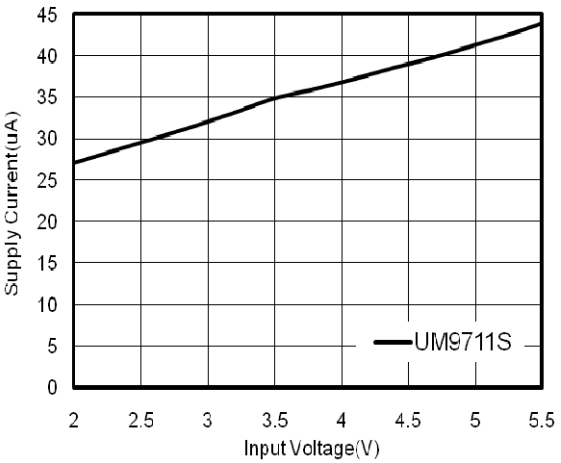
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage Range		2.5		5.5	V
$R_{DS(ON)}$	Switch on Resistance	V_{IN}=5V, I_{OUT}=1A		90	110	mΩ
I_{SW_ON}	Switch on Supply Current	Switch On, V_{OUT}=Open		40	60	μA
I_{SW_OFF}	Switch off Supply Current	Switch Off, V_{OUT}=Open		0.1	1	μA
I_{LEAK}	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
$\triangle V_{UVLO}$	Under-Voltage Hysteresis	V_{IN} Decreasing (I_{LOAD}=10mA)		0.1		V
T_{SD}	Thermal Shutdown Protection			140		°C
$\triangle T_{SD}$	Thermal Shutdown Hysteresis			20		°C

Typical Operating Characteristics

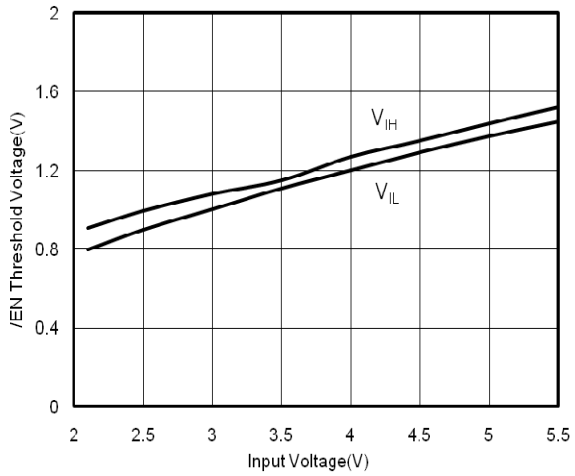
Switch on Resistance vs. Input Voltage
I_{OUT}=1A, C_{IN}=C_{OUT}=1μF



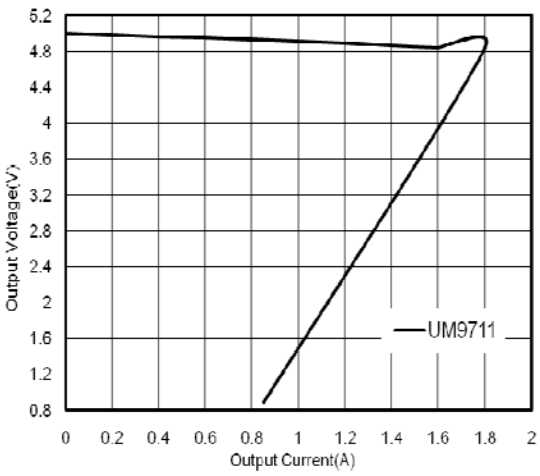
Supply Current vs. Input Voltage
R_L=open, V_{EN}=0V, C_{IN}=C_{OUT}=1μF



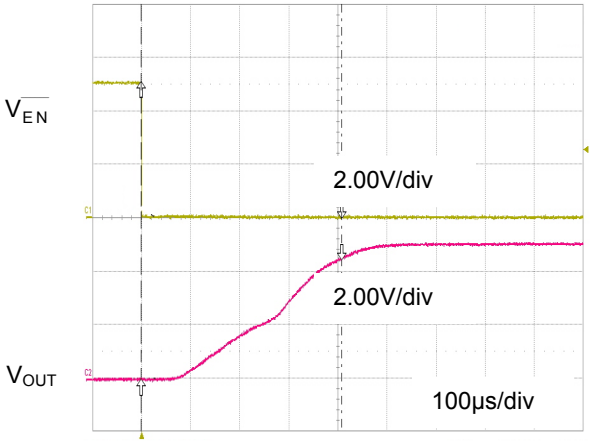
$\overline{EN}$ Pin Threshold Voltage vs. Input Voltage
I_{LOAD}=100mA, C_{IN}=C_{OUT}=1μF



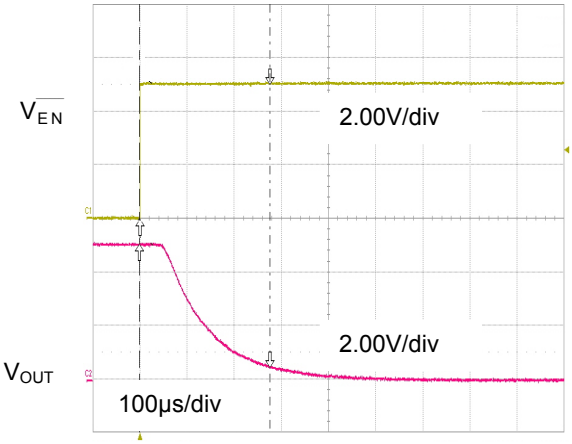
Output Voltage vs. Output Current
V_{IN}=5V, C_{IN}=C_{OUT}=1μF



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°C 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°C. The power switch will auto-recover when the IC is cooling down. The thermal hysteresis temperature is about 20°C.

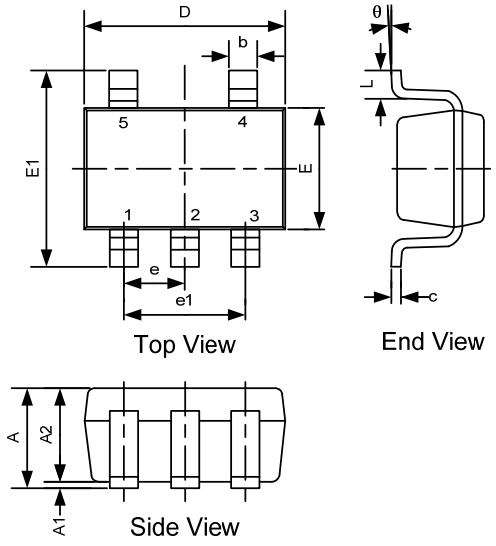
Supply Filter/Bypass Capacitor

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

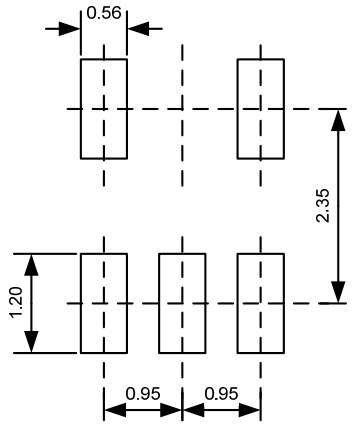
UM9711S SOT23-5

Outline Drawing



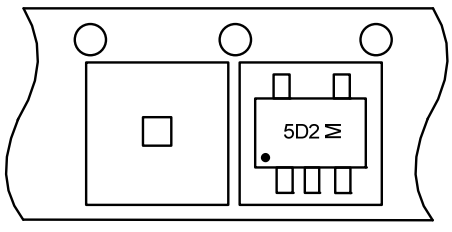
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.013	1.15	1.40	0.040	0.045	0.055
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2	1.00	1.10	1.30	0.039	0.043	0.051
b	0.30	-	0.50	0.012	-	0.020
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.82	-	3.10	0.111	-	0.122
E	1.50	1.60	1.70	0.059	0.063	0.067
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



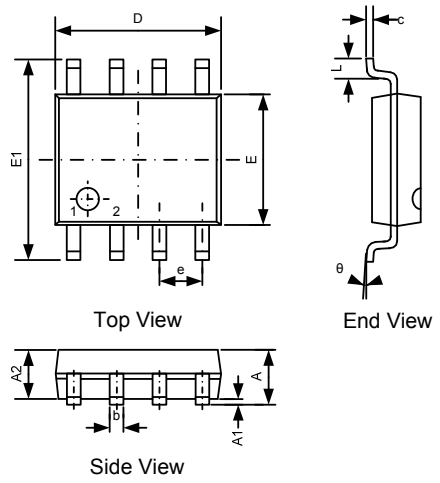
NOTES:
1. Compound dimension: 2.92×1.60;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



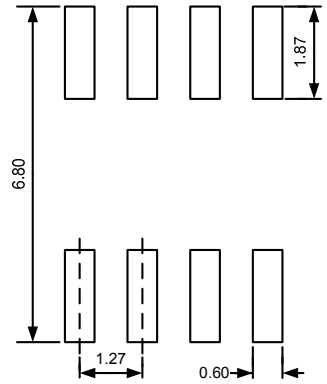
UM9711S8 SOP8

Outline Drawing



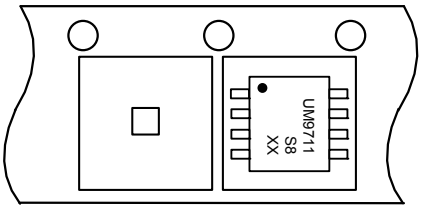
Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.35	1.55	1.75	0.053	0.061	0.069
A1	0.10	-	0.25	0.004	-	0.010
A2	1.25	-	1.65	0.049	-	0.065
b	0.30	-	0.51	0.012	-	0.020
c	0.15	-	0.25	0.006	-	0.010
D	4.70	4.90	5.10	0.185	0.193	0.200
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	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



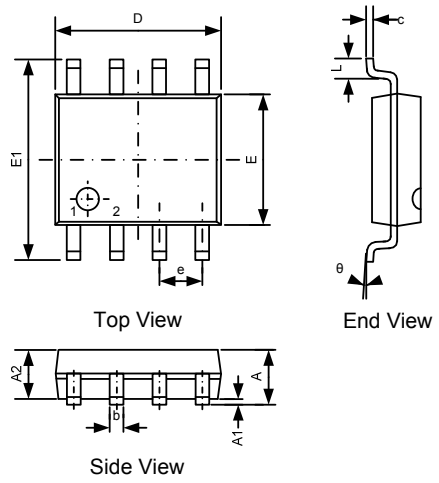
NOTES:
1. Compound dimension: 4.90×3.90;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



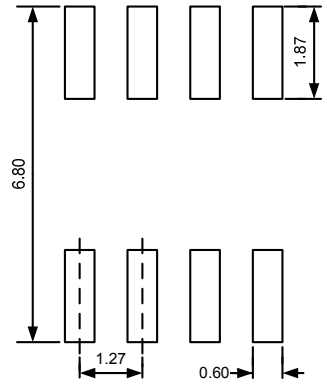
UM9711AS8 SOP8

Outline Drawing



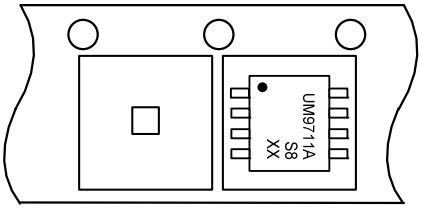
Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.35	1.55	1.75	0.053	0.061	0.069
A1	0.10	-	0.25	0.004	-	0.010
A2	1.25	-	1.65	0.049	-	0.065
b	0.30	-	0.51	0.012	-	0.020
c	0.15	-	0.25	0.006	-	0.010
D	4.70	4.90	5.10	0.185	0.193	0.200
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	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:
1. Compound dimension: 4.90×3.90;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



GREEN COMPLIANCE

Union Semiconductor is committed to environmental excellence in all aspects of its operations including meeting or exceeding regulatory requirements with respect to the use of hazardous substances. Numerous successful programs have been implemented to reduce the use of hazardous substances and/or emissions.
All Union components are compliant with the RoHS directive, which helps to support customers in their compliance with environmental directives. For more green compliance information, please visit:
http://www.union-ic.com/index.aspx?cat_code=RoHSDeclaration

IMPORTANT NOTICE

The information in this document has been carefully reviewed and is believed to be accurate. Nonetheless, this document is subject to change without notice. Union assumes no responsibility for any inaccuracies that may be contained in this document, and makes no commitment to update or to keep current the contained information, or to notify a person or organization of any update. Union reserves the right to make changes, at any time, in order to improve reliability, function or design and to attempt to supply the best product possible.

Union Semiconductor, Inc
Add: Unit 606, No.570 Shengxia Road, Shanghai 201210
Tel: 021-51093966
Fax: 021-51026018
Website: www.union-ic.com