1.0uA Ultra Low Current Consumption and Low Dropout CMOS Voltage Regulators

General Description

The SWLD2340 series are positive voltage regulators with ultra low current consumption, low dropout voltage, high-accuracy output voltage and 250mA output current, developed in CMOS technology.

Output capacitor as small as 0.1uF can be used. The SWLD240 series operate with an ultra low current consumption, only 1uA typical current is consumed to prolong the battery used time.

The built-in low on-resistance transistor realizes low dropout voltage and a large output current. A built-in over-current protection circuit prevents the load current from exceeding the current capacity of the output transistor. Reverse leakage current is 0.2uA(TYP) when $V_{OUT}>V_{IN}$.

Compared with voltage regulators using a conventional CMOS technology, more types of capacitors, including small input an output capacitors, can be used with the SWLD2340 series. The SWLD2340 series feature ultra low current consumption and come in small packages, making them most suitable for portable equipment.

Features

- 1.7V to 7.5V Input Voltage Range
- High Output Voltage Accuracy
- Low Dropout Voltage
- Ultra Low Current Consumption:1.0uA(TYP)
- 250mA Nominal Output Current
- Output Capacitor: Ceramic Capacitor of 0.1uF or Higher can be used
- Fixed Outputs of 1.2V, 1.5V, 1.8V, 2.5V, 2.8V 3.0V, 3.3V, 3.6V, 4.0V, 4.2V, 5.0V
- Low Reverse Leakage Current when $V_{OUT}>V_{IN}$
- Built-In Over-Temperature Protection
- Built-In Over-Current Protection Circuit
- Supports 1.8V Logic for EN Pin
- Operating Temperature Range: -40'C to +85'C

Applications

- Cellular Telephones
- Cordless Telephones
- Wearable Device
- Smart Phone
- Palmtop Computers
- Electronic Planners
- Portable Equipment

Available in Green

- UTDFN-1X1-4AL Package
- SOT-23-5 Package

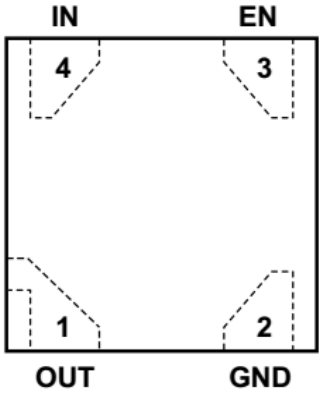
UTDFN-1X1-4L

SOT-23-5

Figure 1. Package Type of SWLD2340

Pin Configuration

UTDFN-1X1-4AL Package



SOT-23-5 Package

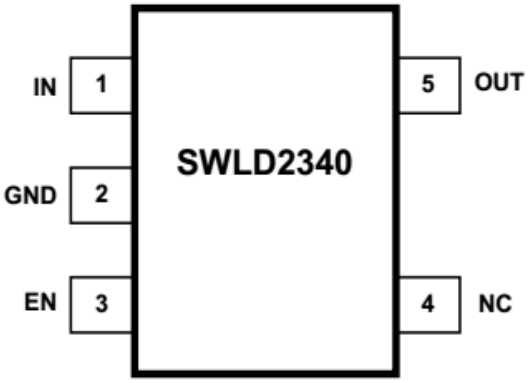
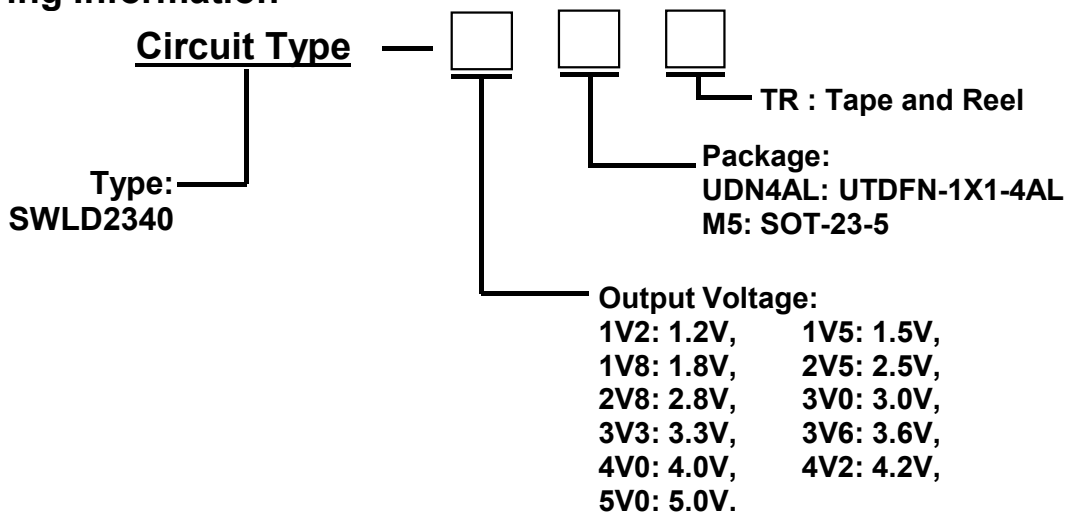


Figure 2. Pin Configuration of SWLD2340 (Top View)

Pin Function Table

UTDFN-1X1-4AL	SOT-23-5	NAME	Function
1	5	OUT	Output Voltage Pin.
2	2	GND	Ground Pin.
3	3	EN	Enable Pin. This pin has an internal pull-down resistor. A logic low reduces the supply current to less than 1uA. Connect to logic "High" for normal operation.
4	1	IN	Input Voltage Pin.
-	4	NC	Not Connected.

Ordering Information



Ordering Code

Part Number	VOUT(V)	Marking ID note1	Temperature Range	Package	Package Type
SWLD2340-1V2UDN4ALTR	1.2V	C6XX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-1V5UDN4ALTR	1.5V	C7XX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-1V8UDN4ALTR	1.8V	69XX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-2V5UDN4ALTR	2.5V	C8XX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-2V8UDN4ALTR	2.8V	6AXX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-3V0UDN4ALTR	3.0V	C9XX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-3V3UDN4ALTR	3.3V	6BXX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-3V6UDN4ALTR	3.6V	CAXX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-4V0UDN4ALTR	4.0V	CBXX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-4V2UDN4ALTR	4.2V	CCXX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-5V0UDN4ALTR	5.0V	CDXX	-40'C to +85'C	UTDFN-1X1-4AL	10000pcs/TR
SWLD2340-1V2M5TR	1.2V	MBEXX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-1V5M5TR	1.5V	MC5XX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-1V8M5TR	1.8V	M65XX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-2V5M5TR	2.5V	MBDXX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-2V8M5TR	2.8V	M66XX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-3V0M5TR	3.0V	GPAXX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-3V3M5TR	3.3V	M67XX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-3V6M5TR	3.6V	MBFXX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-4V0M5TR	4.0V	MC0XX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-4V2M5TR	4.2V	MC1XX	-40'C to +85'C	SOT-23-5	3000pcs/TR
SWLD2340-5V0M5TR	5.0V	M2FXX	-40'C to +85'C	SOT-23-5	3000pcs/TR

Note 1. XX=Date Code.

Block Diagram

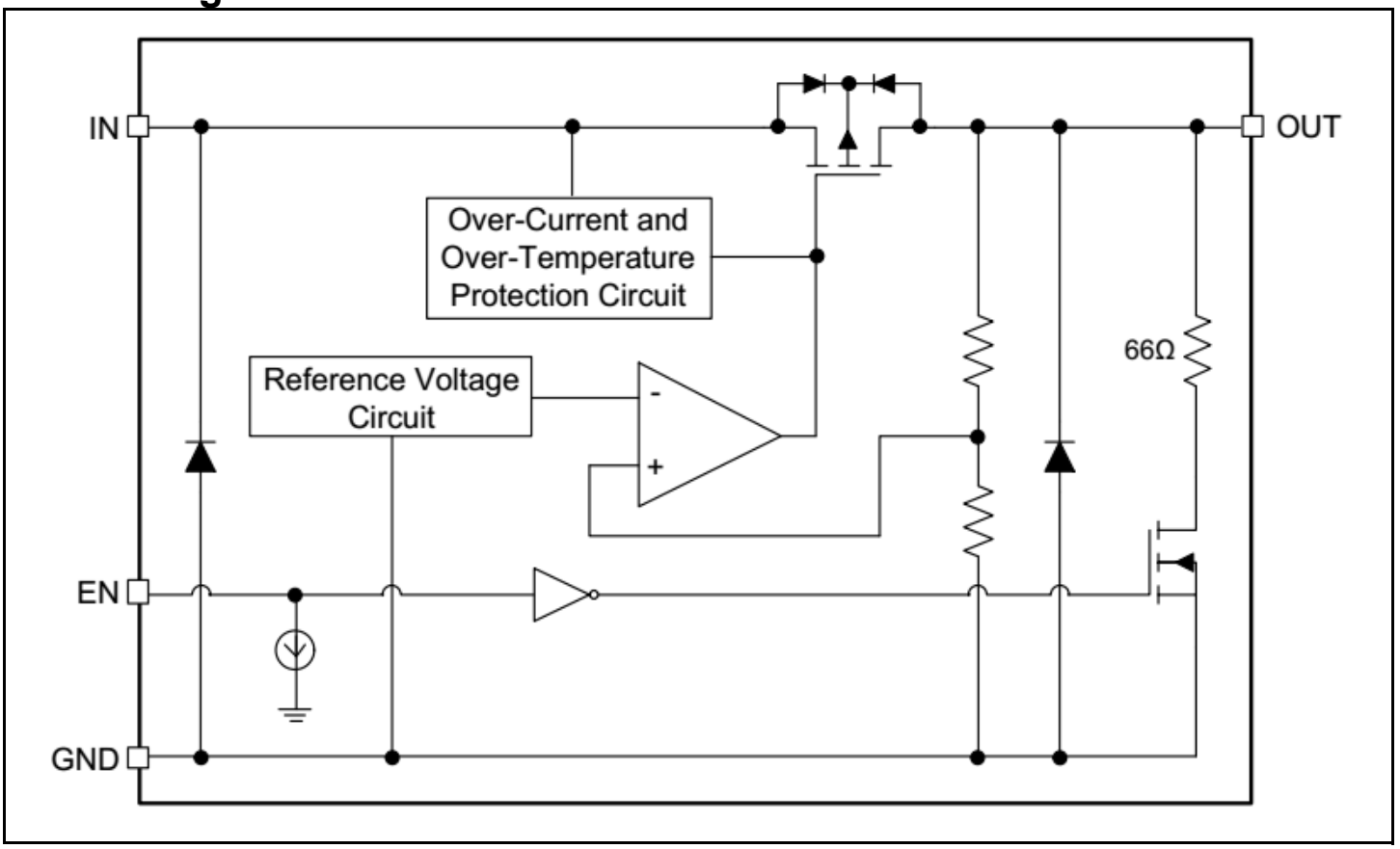


Figure 3. Block Diagram of SWLD2340

Standard Circuit

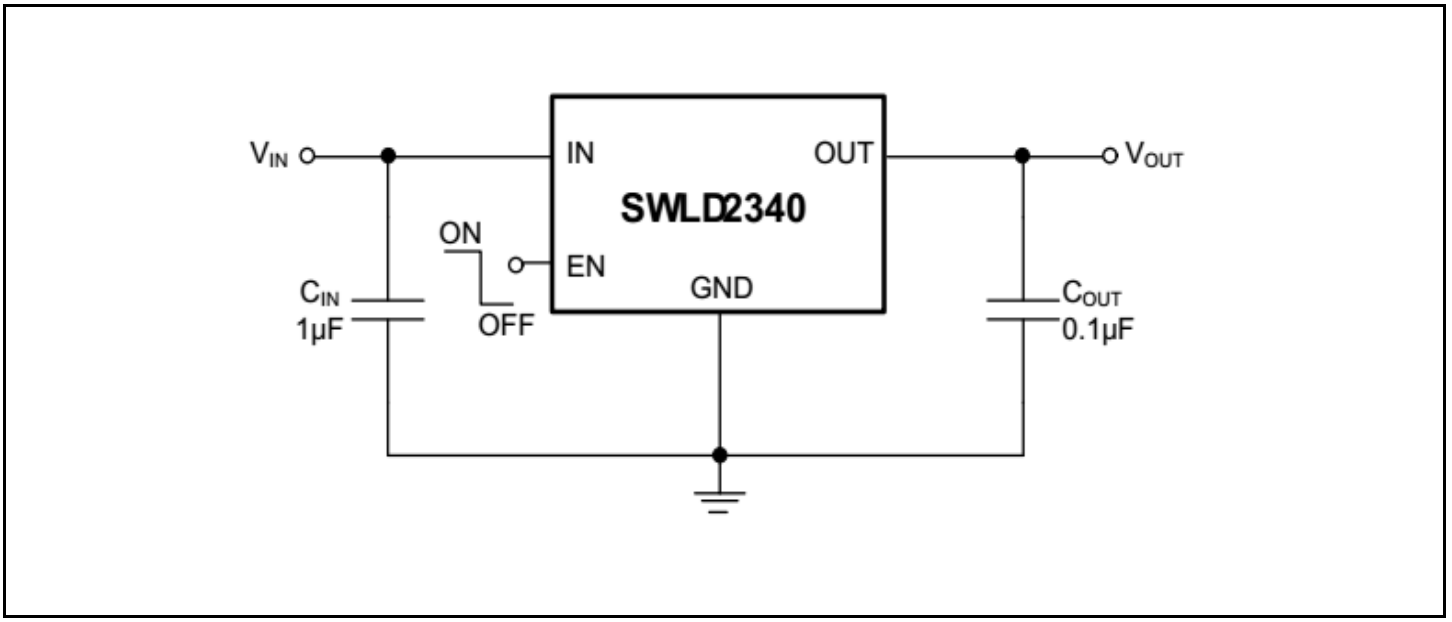


Figure 4. Standard Circuit of SWLD2340

Absolute Maximum Ratings Note 1

Parameter		Symbol	Value	Unit
Supply Voltage, IN to GND		V_{IN}	-0.3 to 8	V
Output Short-Circuit Duration		V_{OSCD}	Infinite	-
Supply Voltage from EN to GND		V_{EN}	-0.3 to 6	V
Difference Voltage from OUT to GND		V_{OUT}	-0.3 to 6	V
Power Dissipation at TA=25'C	UTDFN-1X1-4AL	P_D	400	mW
	SOT-23-5		390	
Thermal Resistance at T_A=+25'C	UTDFN-1X1-4AL	θ_{JA}	238	'C/W
	SOT-23-5	θ_{JA}	207	'C/W
Storage Temperature Range		T_{STG}	-65 to +150	'C
Junction Temperature		T_J	+150	'C
Lead Temperature (Soldering, 10s)		T_{LEAD}	+260	'C
Human Body Model ESD Protection		ESD HBM	4000	V
Machine Model ESD Protection		ESD MM	400	V

Note 1: Stresses above those listed under"Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Value	Unit
Operating Voltage Range	V_{IN}	1.7 to 7.5	V
Operating Temperature Range	T_{OPTR}	-40 to 85	'C

Electrical Characteristics

(V_{IN}=$V_{OUT(NOMINAL)}$+1V, Full=-40'C to 85'C, typical values are at T_A=+25'C, unless otherwise noted.)

Parameter	Symbol	Conditions		Min	Type	Max	Unit
Input Voltage	V_{IN}	V_{CM}=0.3V		1.7	-	7.5	V
Output Voltage Accuracy note1		I_{OUT}=0.1mA		-2.0	-	2.0	%
Maximum Output Current note1	I_{OUT}			-	250	-	mA
Current Limit note1	I_{LIM}			-	440	-	mA
Supply Pin Current	I_Q	No load		-	1.0	-	uA
Dropout Voltage note2	V_{DROP}	I_{OUT}=100mA	V_{OUT}=2.8V	-	0.11	-	mV
			V_{OUT}=3.3V	-	0.09	-	
			V_{OUT}=5.0V	-	0.06	-	
Line Regulation note1	ΔV_{LNR}	V_{IN}=V_{OUT}+1V to 7.5V,	I_{OUT}=100uA	-	0.001	-	%/V
			I_{OUT}=30mA	-	0.004	-	
Load Regulation	ΔV_{OUT}	I_{OUT}=100uA to 250mA		-	0.3	-	mV
Short Current Limit	I_{SHORT}	V_{OUT} = 0V		-	86	-	mA
Reverse Leakage Current	I_{RL}	V_{IN}=1.7V, V_{OUT} =5.5V		-	0.2	-	uA
Power Supply Rejection Ratio	PSRR	I_{OUT}=30mA C_{OUT}=0.1uF, ΔV_{RIPPLE}=0.2V_{P-P}	f=217Hz	-	68	-	dB
			f=1KHz	-	57	-	
Output Voltage Temperature Coefficient note3	ΔV_{OVTC}	I_{OUT} = 1mA		-	18	-	ppm/'C
SHUTDOWN							
EN Input Threshold	V_{IH}	V_{IN}=1.7V to 7.5V		1.7	-	-	V
	V_{IL}			-	-	0.2	
EN Input Bias Current	I_{BH}	V_{EN}=5.5V		-	36	-	nA
	I_{BL}	V_{EN}=0V		-	0.2	-	
Shutdown Supply Current	I_{SHDN}	V_{EN}=0V		-	0.8	-	uA
Output Discharge Resistance	R_{DISCH}	V_{EN}=0V, V_{OUT}=0.5V		-	66	-	Ω
Thermal Shutdown Temperature	T_{SHDN}			-	140	-	'C
Thermal Shutdown Hysteresis	ΔT_{SHDN}			-	15	-	'C

note 1.Max Output Current is affected by the PCB layout, attention should be paid to the dropout voltage when VIN<VOUT+VDROP

2. The dropout voltage is characterized when V_{OUT} falls 5% below $V_{OUT(NOMAL)}$.

3. Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.

APPLICATION INFORMATION

Typical Application Circuit

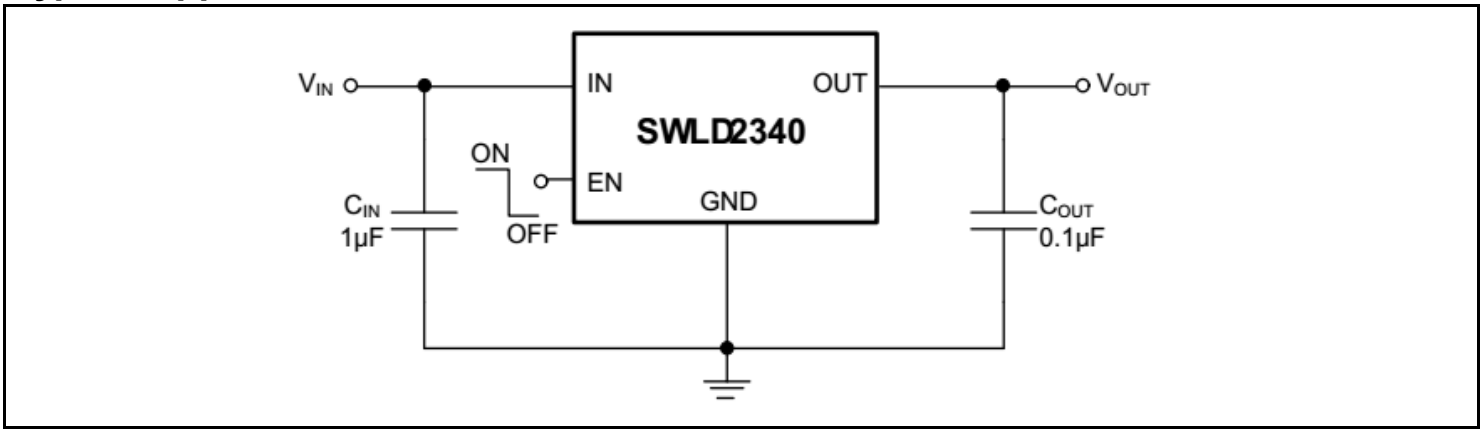


Figure 5. Typical Application Circuit of SWLD2340

Condition of Application

Input Capacitor (C_{IN}): 1uF or higher

Output Capacitor (C_{OUT}): 0.1uF or higher

Caution:Generaally regulator may oscillate depending on the selection of external components Confirm that no oscillation occurs in the application for which the above capacitors are used.

Selection of Input and Output Capacitors

The SWLD2340 series require an output capacitor (C_{OUT}) between the OUT pin and GND pin for phase compensation.

Operation is stable with a ceramic capacitor of 0.1uF or higher in the entire temperature range. When using an OS capacitor, a tantalum capacitor, or an aluminum electrolytic capacitor, the capacitance must be 0.1uF or higher.

The value of the output overshoot or undershoot transient response varies depending on the value of the output capacitor.

The required capacitance of the input capacitor (CIN) differs depending on the application.

The recommended value for an application is CIN>=1uF, COUT>+0.1uF; however, when selecting these capacitors, perform sufficient evaluation, including evaluation of temperature characteristics, on the actual device.

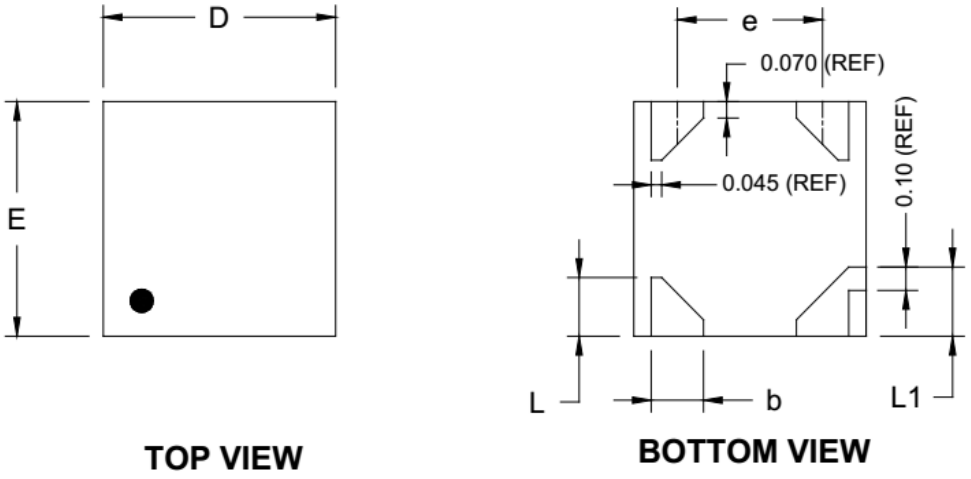
The SWLD2340 series enable use of a low equivalent series resistance capacitor, such as a ceramic capacitor, for the output-side capacitor (C_{OUT}).

Over-Current Protection Circuit

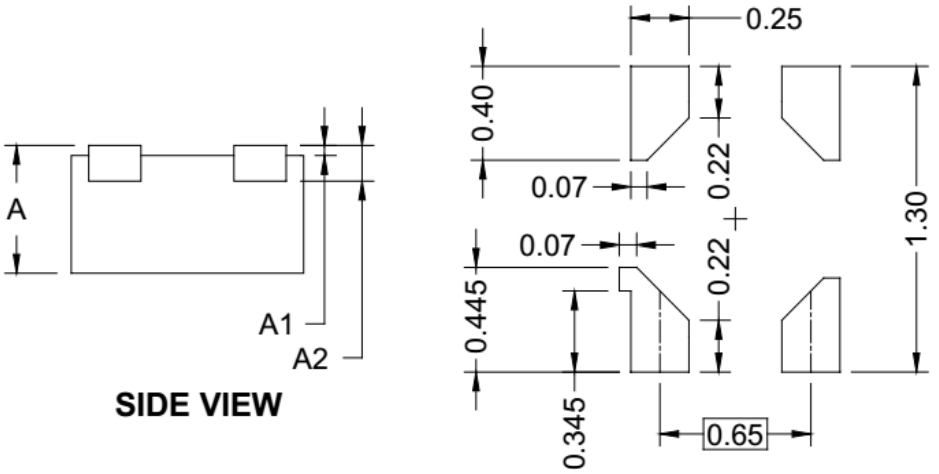
The SWLD2340 series include an over-current protection circuit having the characteristics shown in the table of Electrical Characteristics, in order to protect the output transistor against an excessive output current and short circuiting between the OUT and GND pins. The current when the output pin is short-circuited (I_{SHORT}) is internally set at approximately 86mA(TYP), and the normal value is restored for the output voltage, if the short circuit condition is released.

Mechanical Dimensions

PKG : UTDFN-1X1-4AL (UDN4AL) **Unit: mm (inch)**



TOP VIEW **BOTTOM VIEW**



SIDE VIEW

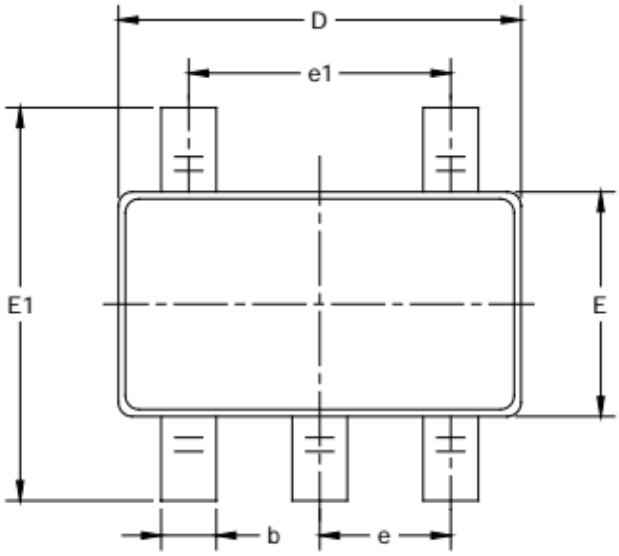
RECOMMENDED LAND PATTERN (Unit: mm)

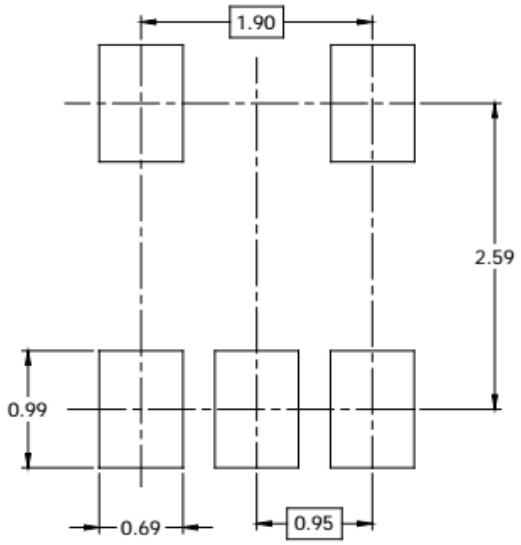
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.500	0.550	0.600
A1	0.000		0.050
A2	0.152 REF		
e	0.625 BSC		
D	0.950	1.000	1.050
E	0.950	1.000	1.050
b	0.175	0.225	0.275
L	0.200	0.250	0.300
L1	0.245	0.295	0.345

Mechanical Dimensions(Con.)

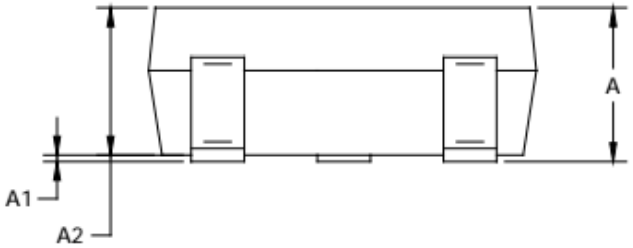
PKG:SOT-23-5 (M5)

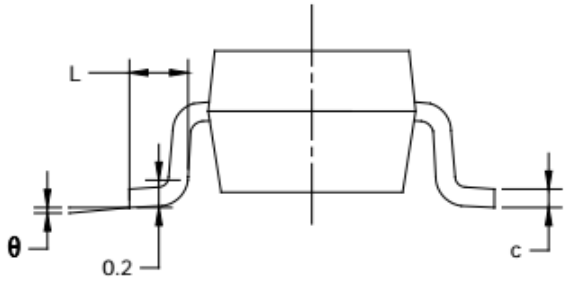
Unit: mm (inch)





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°