7V, 3A Power Switch with Charging Port Controller and Status Display

1 Features

- 35mΩ Robust internal power switch with 18V high breakdown voltage to resist huge instant current and voltage spike at output hard short accident
- Automatic USB charger Identification, Support Apple® Devices fast charging. (Apple® 2.4A mode) , Samsung® Devices fast charging and BC1.2 & YD/T 1591-2009 charging spec
- Very reliable to resist all kinds of output short conditions
- Programmable accurate current limit with external resistor
- ±5% Current Limit Accuracy
- Secondary fast-turn-off to cut off internal power switch during output short protection
- Output soft start to avoid in-rush current at power up
- Low quiescent current at no load condition
- Automatic detection of load plug-in and plug-out
- Over temperature shutdown and auto-restart
- RoHS Compliant and Halogen Free
- Reliable Small size flip-chip TSOT23-6 Pb-Free package

2 Applications

- Patch board
- Portable charging device
- Wall-Adapter, Power Plugs, Outlets
- Power Bank
- Car Charger
- USB Power Output Ports

3 Description

PL5802B is a one channel high performance power switch with USB-dedicated charging port (DCP) controller. A 35mΩ high breakdown voltage NMOS is integrated inside to provide a reliable performance in all kinds of output short accidents. PL5802B integrated a charging port controller which can automatically detect Apple® Devices fast charging, Samsung® Devices and general BC1.2 & YD/T 1591-2009 charging spec.

PL5802B can be used in applications such as car chargers, wall adapters, especially the applications with multiple USB charging Ports.

PL5802B is packaged in tiny flip-chip TSOT23-6. It is very easy to be placed close to USB charging port.
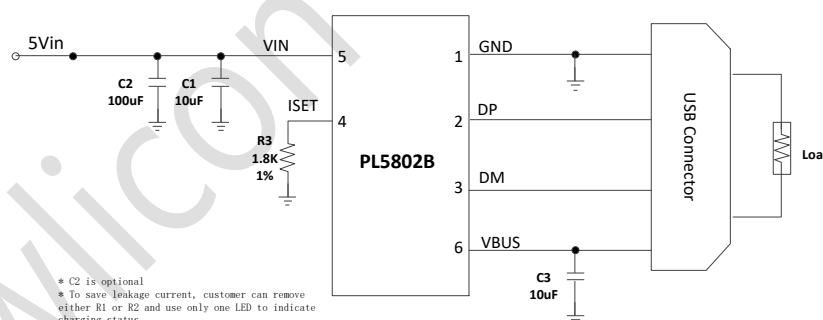
4 Typical Application Schematic

Fig. 1 Schematic
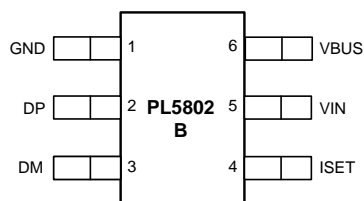
5 Pin Configuration and Functions

Fig. 2 Pin-Function (TSOT23-6)

PL5802B Pin Function

Pin		Description
Number	**Name**	
1	GND	Ground.
2	DP	USB D+ data line.
3	DM	USB D- data line.
4	ISET	Connect a resistor between this pin and GND pin to set the current limit. Use 1.8K resistor to set the current limit to be around 3.4A.
5	VIN	Power Input. VIN supplies the power to the IC. Supply VIN with a 4V to 7V power source. Bypass VIN to GND with a large capacitor and at a ceramic capacitor to eliminate noise on the input to the IC. Put the capacitors close to VIN and GND pins.
6	VBUS	Output pin.

6 Device Marking Information

Part Number	Order Information	Package	Package Qty	Top Marking
PL5802B	**PL5802BITS06**	**TSOT23-6**	**3000**	**B2YMD**

PL5802B: Part Number
B2: PL5802B
YMD: Package Date

7 Specifications

7.1 Absolute Maximum Ratings(Note1)

	PARAMETER	MIN	MAX	Unit
Input Voltages	V_{IN} to GND	-0.3	7.5	V
	V_{ISET} to GND	-0.3	7.5	
	V_{DPM} to GND	-0.3	7.5	
Output Voltages	V_{BUS} to GND	-0.3	7.5	V

7.2 Handling Ratings

PARAMETER	DEFINITION	MIN	MAX	UNIT
T_{ST}	Storage Temperature Range	-55	135	°C
T_J	Junction Temperature		+135	°C
T_L	Lead Temperature		+260	°C
V_{ESD}	HBM Human body model		5	kV
	MM Machine model		600	V

7.3 Recommended Operating Conditions (Note 2)

	PARAMETER	MIN	MAX	Unit
Input Voltages	V_{IN} to GND	4	7.5	V
	V_{ISET}	-0.3	7.5	
	$V_{DP/DM}$ to GND	-0.3	7.5	
Output Current	I_{OUT}	0	3.0	A
Temperature	Operating junction temperature range, T_J	-40	+125	°C

7.4 Thermal Information(Note 3)

Symbol	Description	TSOT23-6	Unit
θ_{JA}	Junction to ambient thermal resistance	110	°C/W
θ_{JC}	Junction to case thermal resistance	65	

Notes:
1) Exceeding these ratings may damage the device.
2) The device function is not guaranteed outside of the recommended operating conditions.
3) Measured on approximately 1" square of 1 oz copper.

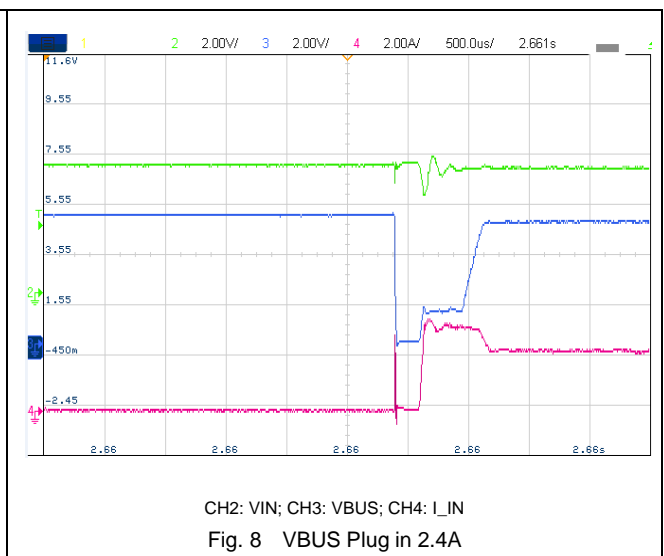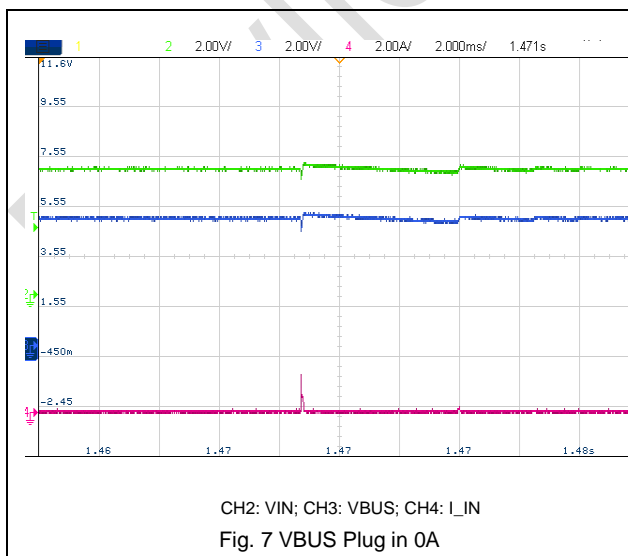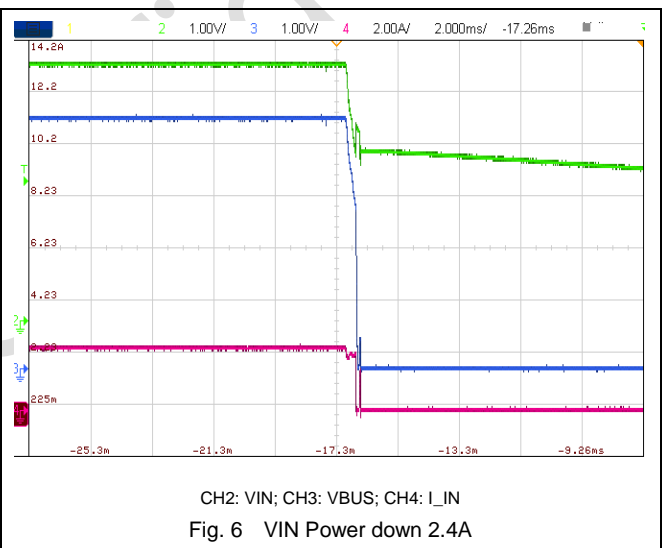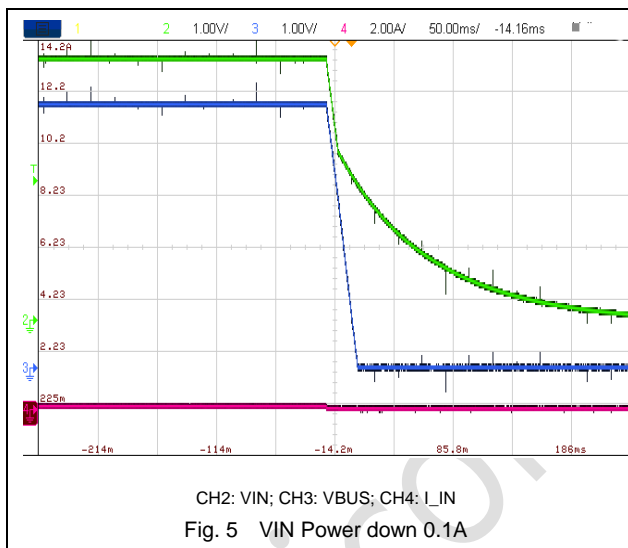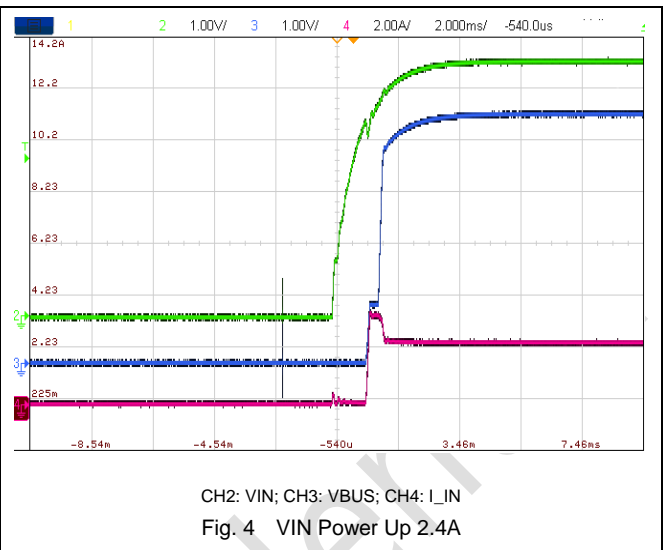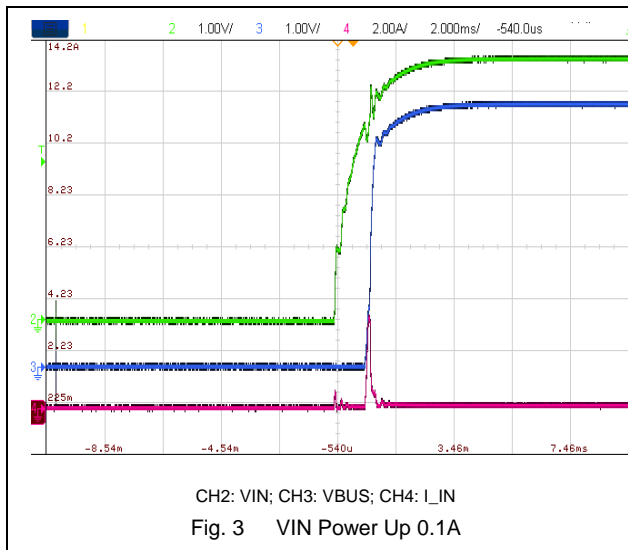## 7.5 Electrical Characteristics (Typical at VIN = 5V, T_J =25°C, unless otherwise noted.)
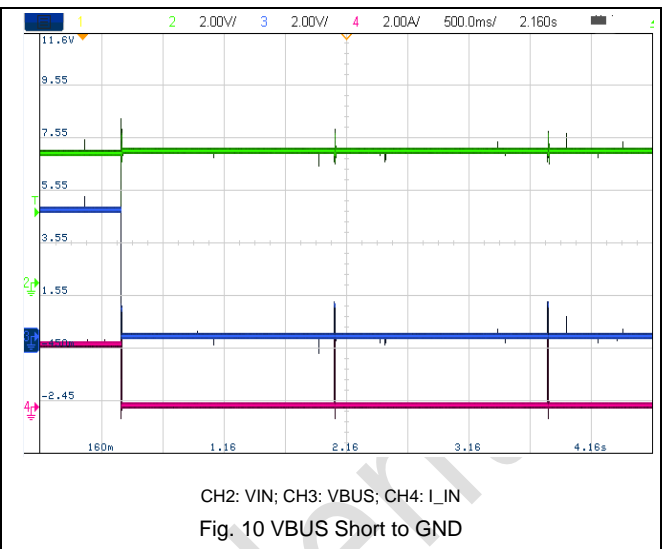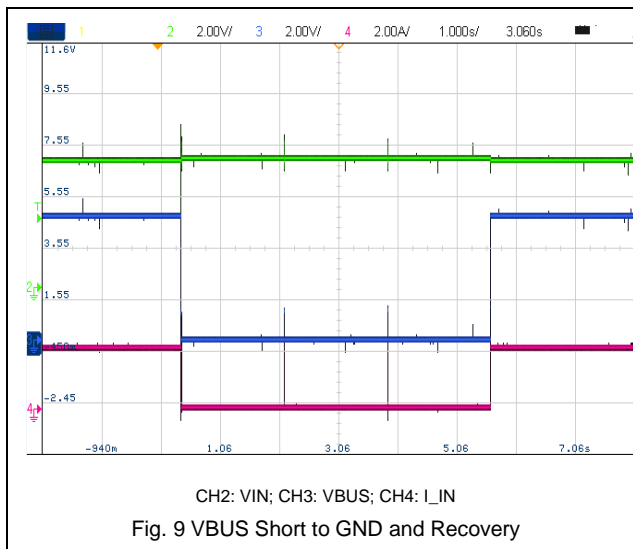
SYMBOL	PARAMETER	CONDITION	MIN	TYP	MAX	UNIT
SUPPLY VOLTAGE (VIN)						
V_{IN}	Input Voltage		4		7	V
I_{BUS}	V_{BUS} Supply Current	I_{OUT} =0A		180		uA
$R_{(DS)ON}$	Switch On resistance	I_{OUT}=0.5A		35		mΩ
I_{LIM}	Current Limit	R_{ISET}=1.8k		3.4		A
V_{IN_UVLO}	Input UVLO Threshold			3.8		V
V_{IN_HYS}	Input UVLO Threshold Hysteresis			500		mV
T_{RISE}	Soft Start Rise Time			800		us
Samsung Mode						
DP_1.2V/DM_1.2V line output voltage				1.2		V
DP_1.2V/DM_1.2V line output Impedance				100		kΩ
Apple® Mode						
DP_2.7V/DM_2.7V line output voltage				2.7		V
DP_2.7V/DM_2.7V line output Impedance				30		kΩ
BC1.2 Mode						
R_{bc1p2}	D+ to D- short resistance in DCP mode			10		Ω
Out Load Sense						
T_{SD}	Thermal Shutdown Threshold[Note 4]			135		°C
T_{HYS}	Thermal Shutdown Hysteresis[Note 4]			20		°C

Note:
4) Guaranteed by design, not tested in production.

8 Typical Characteristics

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 3   VIN Power Up 0.1A

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 4   VIN Power Up 2.4A

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 5   VIN Power down 0.1A

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 6   VIN Power down 2.4A

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 7 VBUS Plug in 0A

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 8   VBUS Plug in 2.4A

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 9 VBUS Short to GND and Recovery

CH2: VIN; CH3: VBUS; CH4: I_IN

Fig. 10 VBUS Short to GND

9 Detailed Description

9.1 Overview

PL5802B is a one channel high performance power switch with USB-dedicated charging port (DCP) controller. A 35mΩ high breakdown voltage NMOS is integrated inside to provide a reliable performance in all kinds of output short accidents. PL5802B integrated a charging port controller which can automatically detect Apple® Devices fast charging, Samsung® Devices and general BC1.2 & YD/T 1591-2009 charging spec.

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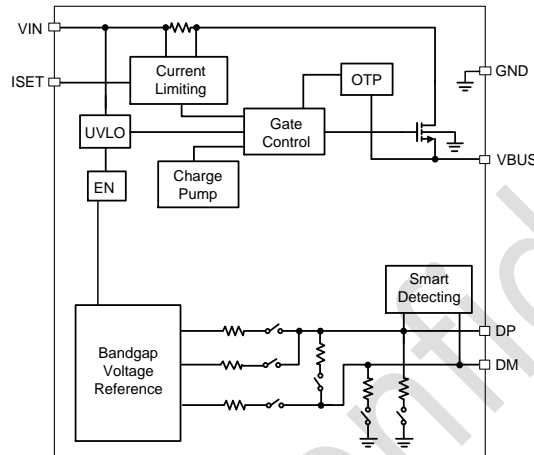
9.2 Functional Block Diagram

Fig. 11 PL5802B Diagram

9.3 Identification principle

A dedicated charging port (DCP) is a downstream port on a device that outputs power through a USB connector, which generally allows portable devices to fast charge at their maximum rated current. A USB charger is a device with a DCP, such as a wall adapter or car power adapter. A DCP is identified by the electrical characteristics of its data lines.

PL5802B integrated a charging port controller which can automatically detect Apple® Devices fast charging, Samsung® Devices and general BC1.2 & YD/T 1591-2009 charging spec.

9.4 Current Limit

PL5802B power-distribution switch is intended for applications where heavy capacitive loads and short circuits are likely to happen. PL5802B can limit the output current to protect the power supply from over current or short circuit. It goes into hiccup mode with Over-Temperature-Protection on and off during an overload condition. Hiccup mode operation can reduce the output short circuit current down to several milli-amperes.

In PL5802B, the current limit can be set by ISET pin. The current limit value can be calculated using the following equation:

$$I_{SET} = \frac{800}{0.13*RISET} \tag{1}$$

RISET is the resistor value on ISET pin.

9.5 Thermal Protection

PL5802B provides thermal protection from the thermal-sensing circuit that monitors the operating temperature of the power switch. The device operates in constant-current mode during an over current condition. When the die temperature exceeds OTP threshold, PL5802B will turn off power switch. Power switch will not be turned on until the device has cooled down. PL5802B continues to cycle off and on until the fault is finally removed.

10 Application and Implementation

10.1 Input and Output Capacitance

Input and output capacitance improves the performance of this device; the actual capacitance must be optimized for particular application. For all applications, Powlicon recommends placing a 4.7μF or greater ceramic bypass capacitor between VIN and GND. Additional input capacitance such as a 470uF electrolytic capacitor may be needed on the input to absorb voltage spike when the input power supply is plugged in. This is especially important during bench testing where long, inductive cables are used to connect the evaluation board to the bench power supply.

Powlicon recommends placing at least a 4.7μF ceramic capacitor or higher-value ceramic capacitor on the output pin when large transient currents are expected on the output to reduce the undershoot, which is caused by the inductance of the output power bus. Energy stored in the inductance drives the V_{BUS} voltage down and potentially negative.

11 PCB Layout

11.1 Layout Guidelines

1. PL5802B placement.

Place PL5802B near the USB output connector and it is better to add at least 10μF filter capacitor at V_{BUS} pin.

2. V_{IN} pin bypass capacitance.

Place 10μF bypass capacitor near VIN pin and make the PCB trace between VIN pin and this capacitor as short as possible. Another 470uF electrolytic capacitor may be needed to absorb input voltage spike caused by input plug-in and plug-out.
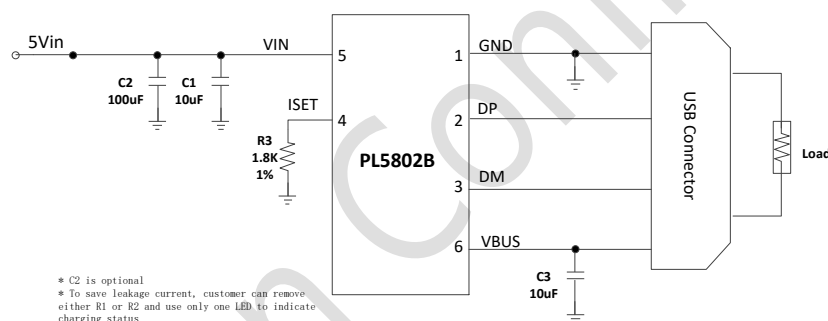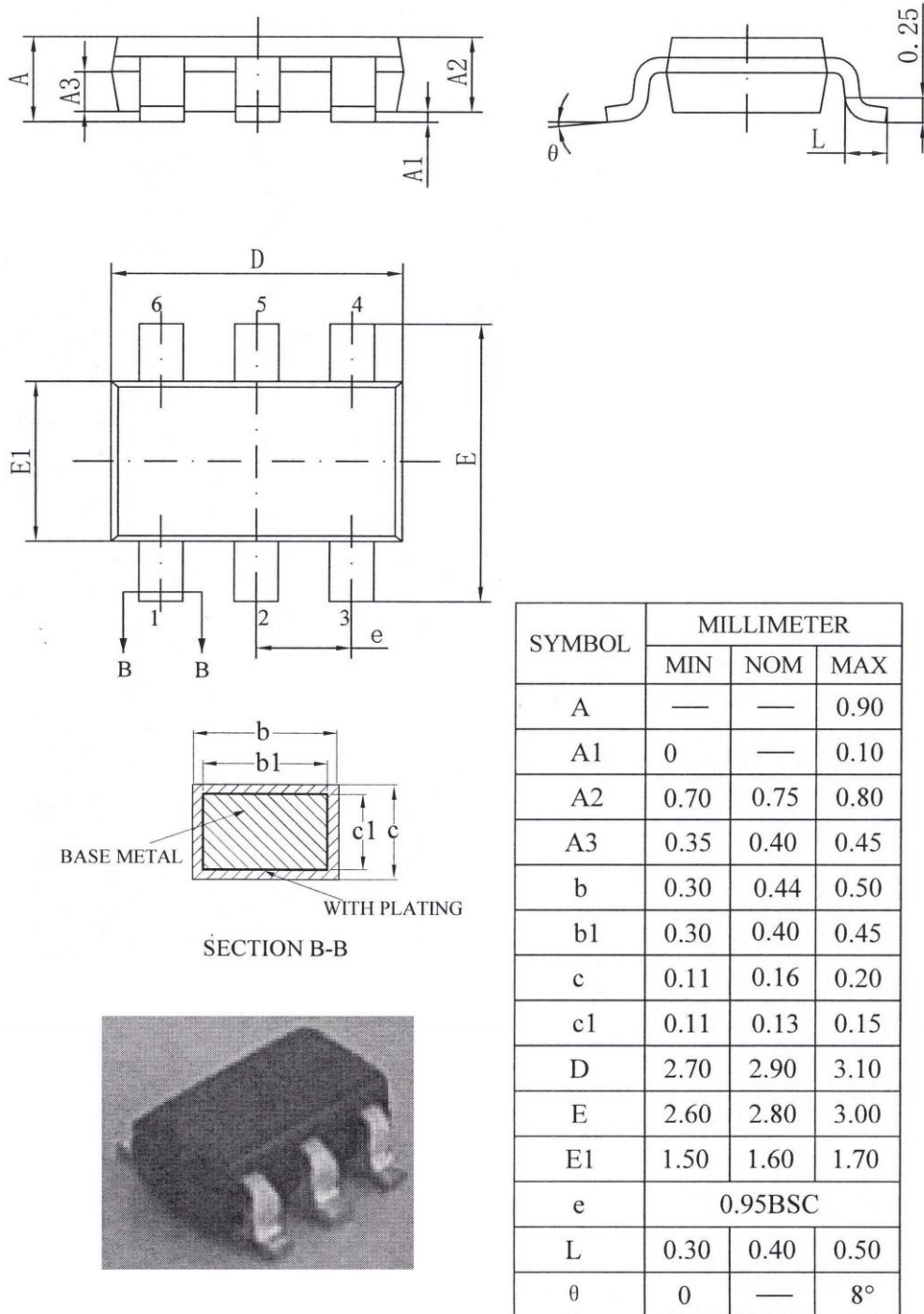
11.2 Layout Example

Fig. 12 Schematic

12 Packaging Information

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	0.90
A1	0	—	0.10
A2	0.70	0.75	0.80
A3	0.35	0.40	0.45
b	0.30	0.44	0.50
b1	0.30	0.40	0.45
c	0.11	0.16	0.20
c1	0.11	0.13	0.15
D	2.70	2.90	3.10
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
L	0.30	0.40	0.50
θ	0	—	8°

IMPORTANT NOTICE