Universal Serial Bus transceiver PDIUSBP11

FEATURES

- Utilizes digital inputs and outputs to transmit and receive USB cable data
- Supports 12Mbit/s "Full Speed" and 1.5Mbit/s "Low Speed" serial data transmission
- Compatible with the VHDL "Serial Interface Engine" from USB developer's conference
- Available in SO, 14 pin package
- Hysteresis on D+, D–, V_{MO} inputs

DESCRIPTION

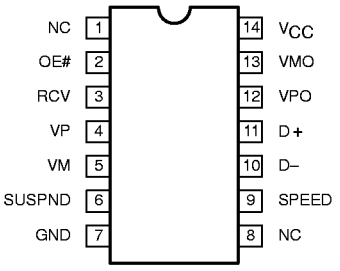
The PDIUSBP11 is a one chip generic USB transceiver. It is designed to allow 5.0V or 3.3V programmable and standard logic to interface with the physical layer of the Universal Serial Bus. It is capable of transmitting and receiving serial data at both full speed (12Mbit/s) and low speed (1.5Mbit/s) data rates. The outputs from the serial interface engine (inputs VPO and VMO on the PDIUSBP11) are driven by the host. The gated inputs (outputs VP and VM on the PDIUSBP11) are to be decoded by the host.

Implementation of the Serial Interface Engine along with the USB transceiver allow the designer to make flexible USB compatible devices with widely available logic components.

ORDERING INFORMATION

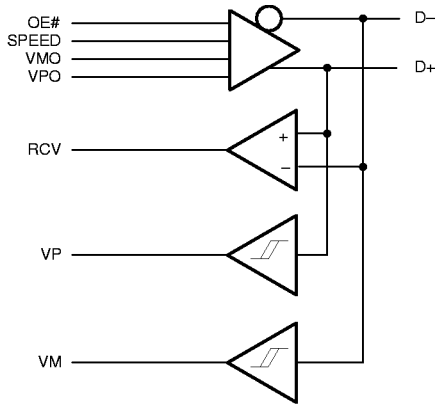
PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
14-pin plastic SO	0°C to +70°C	PDIUSBP11 D	PDIUSBP11 D	SOT108-1
14-pin plastic SSOP	0°C to +70°C	PDIUSBP11 DB	PDIUSBP11 DB	SOT337-1
14-pin plastic TSSOP	0°C to +70°C	PDIUSBP11 PW	PDUSBP11 PW DH	SOT402-1

PIN CONFIGURATION



SV00142

FUNCTIONAL DIAGRAM



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PIN DESCRIPTION

PIN No.	PIN SYMBOL	I/O	NAME AND FUNCTION
3	RCV	O	Receive data. CMOS level output for USB differential input
2	OE#	I	Output Enable. Active LOW, enables the transceiver to transmit data on the bus. When not active the transceiver is in receive mode
12, 13	VPO, VMO	I	Inputs to differential driver. (Outputs from SIE). **VPO VMO RESULT** **0 0 SE0** **0 1 Logic "0"** **1 0 Logic "1"** **1 1 Undefined**
4, 5	VP, VM	O	Gated version of D– and D+. Outputs are logic "0" and logic "1". Used to detect single ended zero (SE0#), error conditions, and interconnect speed. (Inputs to SIE). **VP VM RESULT** **0 0 SE0** **0 1 Low Speed** **1 0 Full Speed** **1 1 Error**
11, 10	D+, D–	I/O	Data+, Data–. Differential data bus conforming to the Universal Serial Bus standard.
6	SUSPND	I	Suspend. Enables a low power state while the USB bus is inactive. While the suspnd pin is active it will drive the RCV pin to a logic "0" state.
9	SPEED	I	Edge rate control. Logic "1" operates at edge rates for "full speed". Logic "0" operates edge rates for "low speed".
14	V_{CC}		3.0V to 3.6V power supply
7	GND		Ground reference

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN.	MAX.	
V_{CC}	DC supply voltage		3.0	3.6	V
V_I	DC Input voltage range		0	5.5	V
$V_{I/O}$	DC input range for I/O's		0	V_{CC}	V
V_O	DC output voltage range		0	V_{CC}	V
T_{amb}	Operating ambient temperature range in free air	See DC and AC characteristics for individual device	0	+70	°C

ABSOLUTE MAXIMUM RATINGS[1, 2]

In accordance with the Absolute Maximum Rating System (IEC 134) Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V_{CC}	DC supply voltage		–0.5	+6.5	V
I_{IK}	DC input diode current	$V_I < 0$	–	–50	mA
V_I	DC input voltage	Note 3	–0.5	+5.5	V
$V_{I/O}$	DC input voltage range for I/O's		–0.5	V_{CC} +0.5	V
I_{OK}	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	–	± 50	mA
V_O	DC output voltage	Note 3	–0.5	V_{CC} +0.5	V
I_O	DC output source or sink current for VP/VM, RCV pins	V_O = 0 to V_{CC}	–	± 15	mA
I_O	DC output source or sink current for D+/D– pins	V_O = 0 to V_{CC}	–	± 50	mA
I_{GND}, I_{CC}	DC V_{CC} or GND current		–	± 100	mA
T_{stg}	Storage temperature range		–60	+150	°C
P_{tot}	Power dissipation per package				mW

NOTES:

1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
3. The input and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.

DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions
Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = 0°C to +70°C			
			MIN	TYP[1]	MAX	
V_{IH}	HIGH level input	V_{CC} = 3.0V to 3.6V[3]	2.0			V
V_{IL}	LOW level input	V_{CC} = 3.0V to 3.6V[3]			0.8	V
R_D H	Output impedance (HIGH state)	Note 2	28	34	43	Ω
R_D L	Output impedance (LOW state)	Note 2	28	35	51	Ω
V_{OH}	HIGH level output[3]	V_{CC} = 3.0V; I_O = 6mA	2.2	2.7		V
		V_{CC} = 3.0V; I_O = 4mA	2.4			
		V_{CC} = 3.0V; I_O = 100µA	2.8	–		
V_{OL}	LOW level output[3]	V_{CC} = 3.0V; I_O = 6mA		0.3	0.8	V
		V_{CC} = 3.0V; I_O = 4mA			0.5	
		V_{CC} = 3.0V; I_O = 100µA		–	0.2	
I_{CCQ}	Quiescent supply current	V_{CC} = 3.6V; V_I = V_{CC} or GND; I_O = 0		330	600	µA
I_{CCS}	Supply current in Suspend	V_{CC} = 3.6V; V_I = V_{CC} or GND; I_O = 0		–	65	µA
I_{CCFS}	Active supply current (Full Speed)	V_{CC} = 3.3V		10	30	mA
I_{CCLS}	Active supply current (Low Speed)	V_{CC} = 3.3V		2	25	mA
I_I	Input leakage current	V_{CC} = 3.6V; V_I = 5.5V or GND; not for I/O pins		±0.1	±5	µA
I_{OZ}	3-State output OFF-state current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} or GND [2]			±10	µA

NOTES:
1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
2. This value includes an external resistor of 24Ω ±1%. See "Load D+ and D–" diagram for testing details.
3. All signals except D+ and D–.

AC CHARACTERISTICS

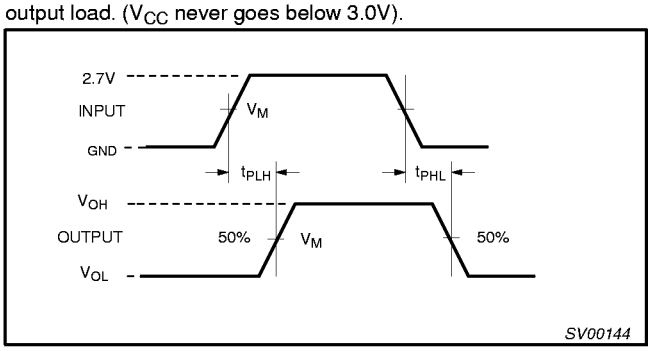
GND = 0V, t_R = t_F = 3.0ns, C_L = 50pF, R_L = 500Ω, V_{CC} = 3.3V

SYMBOL	PARAMETER	TEST CONDITIONS	WAVEFORMS	LIMITS					UNIT
				T_{amb} = 25°C			T_{amb} = 0°C to +70°C		
				MIN	TYP	MAX	MIN	MAX	
tp_{LH}	VMO/VPO to D+/D– Full Speed		1	0		12	0	15	ns
tp_{HL}				0		12	0	15	
t_{rise}	Rise and Fall Times Full Speed		2	4		20	4	20	ns
t_{fall}				4		20	4	20	
tp_{LH}	VMO/VPO to D+/D– Low Speed		1	30		300	30	300	ns
tp_{HL}				30		300	30	300	
t_{rise}	Rise and Fall Times Low Speed		2	75		300	75	300	ns
t_{fall}				75		200	75	200	
tp_{LH}	D+/D– to RCV		3			16		16	ns
tp_{HL}						16		20	
tp_{LH}	D+/D– to VP/VM		1			8		8	ns
tp_{HL}						8		12	
tp_{HZ}	OE# to D+/D– RL = 500Ω		4			12		12	ns
tp_{ZH}						12		15	
tp_{LZ}						10		10	
tp_{ZL}						10		15	
t_{su}	Setup for SPEED		5	0					ns
V_{cr}	Crossover point	Note 1	3	1.3		2.0	1.3	2.0	V

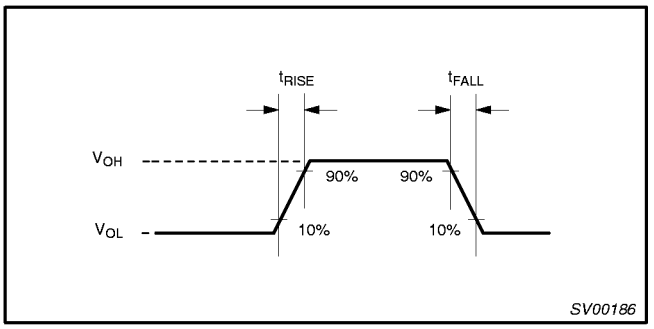
NOTE:
1. The crossover point is in the range of 1.3V to 2.5V for the low speed mode with a 50pF capacitance. In the low-speed mode with a 100pF or greater capacitance, the crossover point is in the range of 1.3V to 2.0V.

AC WAVEFORMS

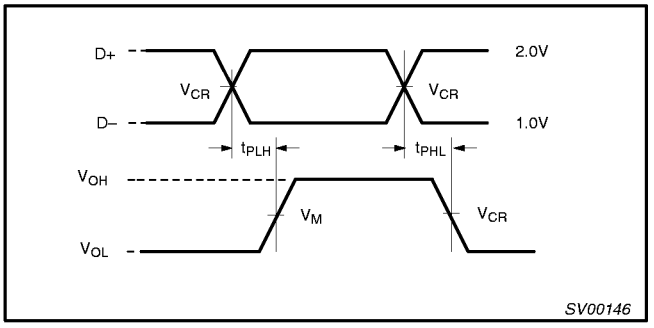
V_M = 1.5V
$V_X = V_{OL}$ +0.3V
$V_Y = V_{OH}$ –0.3V
V_{OL} and V_{OH} are the typical output voltage drops that occur with the output load. (V_{CC} never goes below 3.0V).



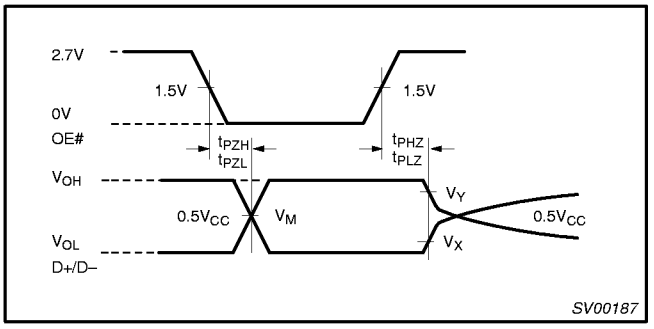
Waveform 1. D+/D– to VP/VM or VPO/VMO to D+/D–



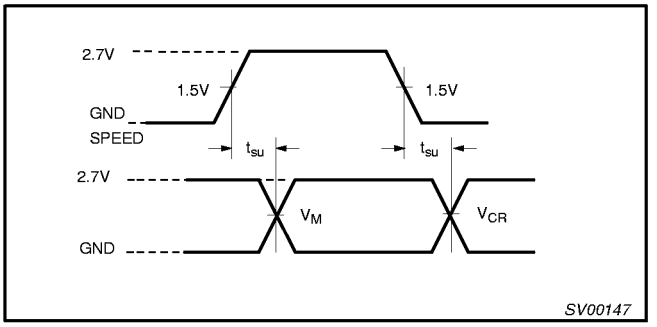
Waveform 2. Rise and Fall Times



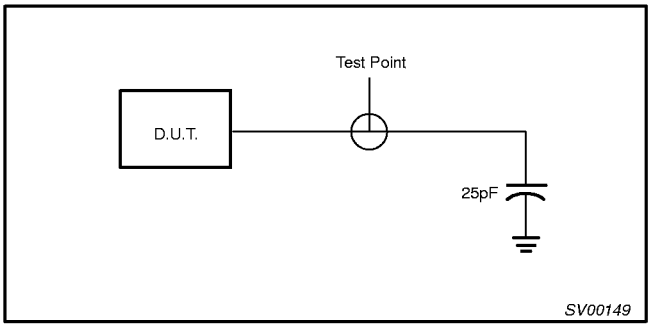
Waveform 3. D+/D– to RCV



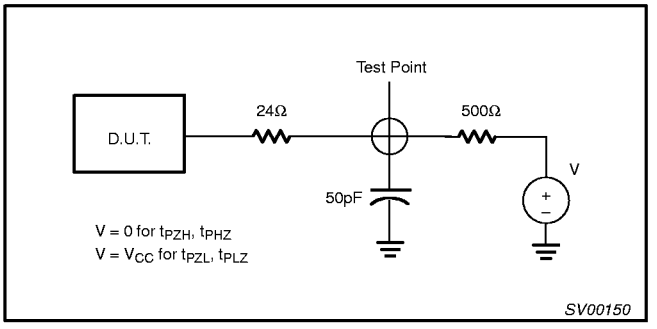
Waveform 4. OE# to D+/D–



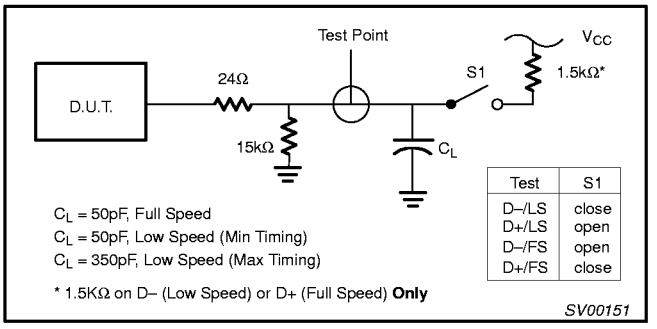
Waveform 5. Setup for Speed



Load for VM/VP and RCV

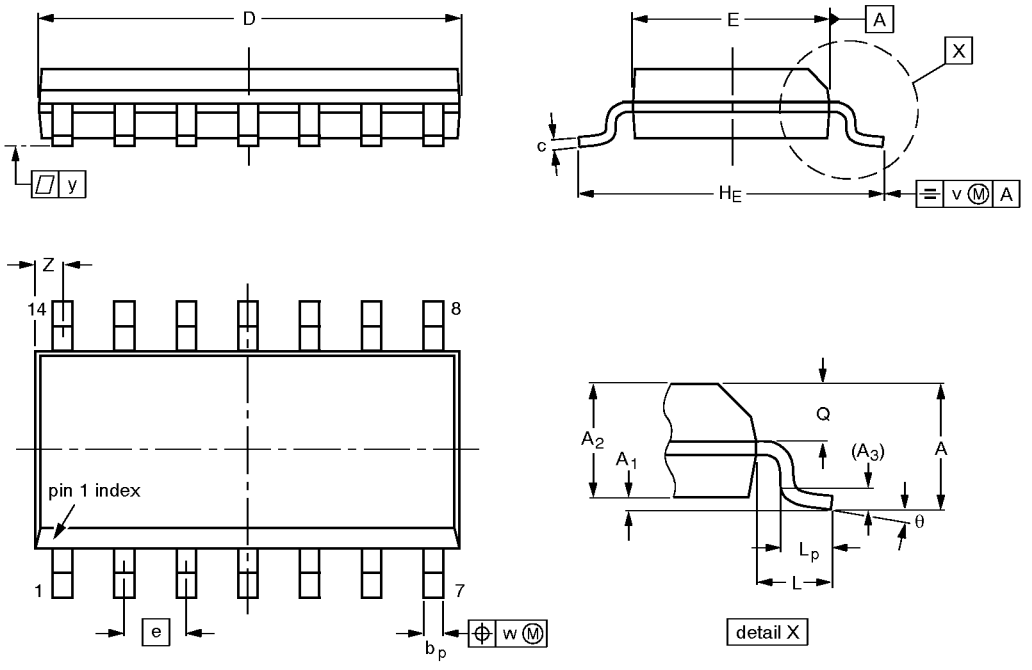


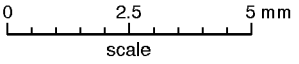
Load for Enable and Disable Times



Load for D+/D–

SO14: plastic small outline package; 14 leads; body width 3.9 mm SOT108-1





DIMENSIONS (inch dimensions are derived from the original mm dimensions)

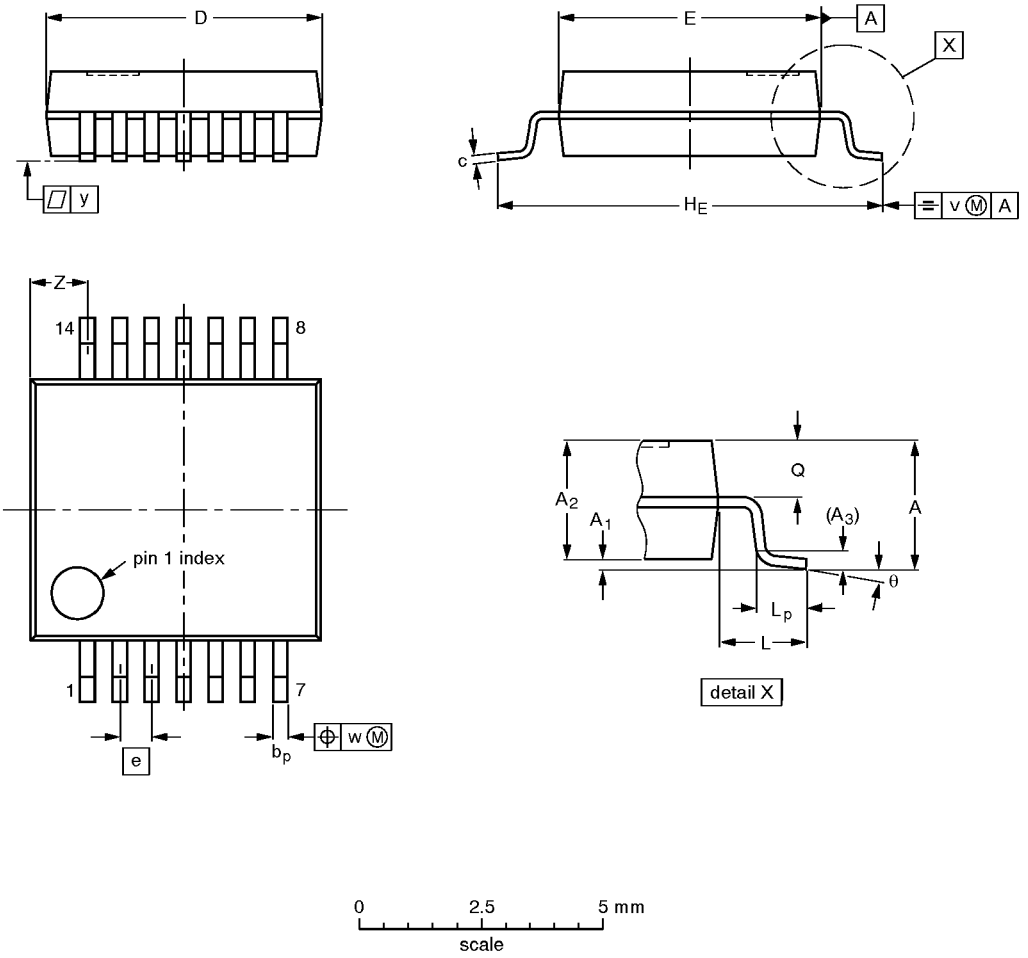
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.35 0.34	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT108-1	076E06S	MS-012AB				~~91-08-13~~ 95-01-23

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm SOT337-1



DIMENSIONS (mm are the original dimensions)

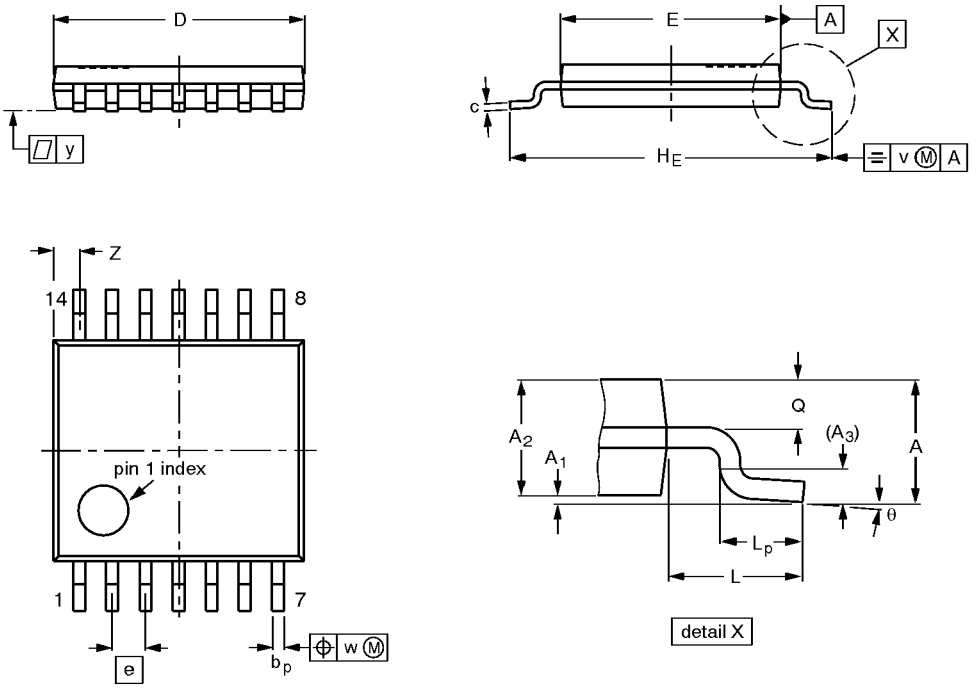
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

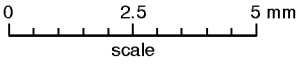
Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT337-1		MO-150AB				~~95-02-04~~ 96-01-18

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm **SOT402-1**





DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT402-1		MO-153				~~94-07-12~~ 95-04-04