74HC245; 74HCT245

Octal bus tranceiver; 3-state

Product data sheet

1. General description

The 74HC245; 74HCT245 is a high-speed Si-gate CMOS device and is pin compatible with Low-Power Schottky TTL (LSTTL).

The 74HC245; 74HCT245 is an octal transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. The 74HC245; 74HCT245 features an output enable input ($\overline{OE}$) for easy cascading and a send/receive input (DIR) for direction control. $\overline{OE}$ controls the outputs so that the buses are effectively isolated.

The 74HC245; 74HCT245 is similar to the 74HC640; 74HCT640 but has true (non-inverting) outputs.

2. Features

- Octal bidirectional bus interface
- Non-inverting 3-state outputs
- Multiple package options
- Complies with JEDEC standard no. 7A
- ESD protection:
  - HBM EIA/JESD22-A114-B exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V
- Specified from –40 °C to +85 °C and from –40 °C to +125 °C

3. Quick reference data

Table 1: Quick reference data

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Type 74HC245							
t_{PHL}, t_{PLH}	propagation delay An to Bn or Bn to An	C_L = 15 pF; V_{CC} = 5 V		-	7	-	ns
C_I	input capacitance			-	3.5	-	pF
$C_{I/O}$	input/output capacitance			-	10	-	pF
C_{PD}	power dissipation capacitance per transceiver	V_I = GND to V_{CC}	[1]	-	30	-	pF
Type 74HCT245							
t_{PHL}, t_{PLH}	propagation delay An to Bn or Bn to An	C_L = 15 pF; V_{CC} = 5 V		-	10	-	ns

PHILIPS

Table 1: Quick reference data *...continued*

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_I	input capacitance			-	3.5	-	pF
$C_{I/O}$	input/output capacitance			-	10	-	pF
C_{PD}	power dissipation capacitance per transceiver	V_I = GND to V_{CC} − 1.5 V	[1]	-	30	-	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in µW):
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in V;
N = number of inputs switching;
$\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

4. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC245N	–40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HC245D	–40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HC245PW	–40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HC245DB	–40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HC245BQ	–40 °C to +125 °C	DHVQFN20	plastic dual-in-line compatible thermal enhanced very thin quad flat package no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1
74HCT245N	–40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HCT245D	–40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HCT245PW	–40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HCT245DB	–40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HCT245BQ	–40 °C to +125 °C	DHVQFN20	plastic dual-in-line compatible thermal enhanced very thin quad flat package no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1

Table 3: Pin description *...continued*

Symbol	Pin	Description
B1	17	data input/output
B0	18	data input/output
$\overline{OE}$	19	output enable input (active LOW)
V_{CC}	20	supply voltage

7. Functional description

7.1 Function table

Table 4: Function table [1]

Input		Input/output	
$\overline{OE}$	DIR	An	Bn
L	L	A = B	input
L	H	input	B = A
H	X	Z	Z

[1] H = HIGH voltage level;
L = LOW voltage level;
X = don't care;
Z = high-impedance OFF-state.

8. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		–0.5	+7	V
I_{IK}	input diode current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	±20	mA
I_{OK}	output diode current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	-	±20	mA
I_O	output source or sink current	$V_O = -0.5$ V to $V_{CC} + 0.5$ V	-	±35	mA
I_{CC}, I_{GND}	V_{CC} or GND current		-	±70	mA
T_{stg}	storage temperature		–65	+150	°C
P_{tot}	total power dissipation		[1]		
	DIP20 package		-	750	mW
	SO20, SSOP20, TSSOP20 and DHVQFN20 packages		-	500	mW

[1] For DIP20 packages: above 70 °C, P_{tot} derates linearly with 12 mW/K.
For SO20 packages: above 70 °C, P_{tot} derates linearly with 8 mW/K.
For SSOP20 and TSSOP20 packages: above 60 °C, P_{tot} derates linearly with 5.5 mW/K.
For DHVQFN20 packages: above 60 °C, P_{tot} derates linearly with 4.5 mW/K.

9. Recommended operating conditions

Table 6: Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Type 74HC245						
V_{CC}	supply voltage		2.0	5.0	6.0	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
t_r, t_f	input rise and fall times	V_{CC} = 2.0 V	-	-	1000	ns
		V_{CC} = 4.5 V	-	6.0	500	ns
		V_{CC} = 6.0 V	-	-	400	ns
T_{amb}	ambient temperature		–40	-	+125	°C
Type 74HCT245						
V_{CC}	supply voltage		4.5	5.0	5.5	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
t_r, t_f	input rise and fall times	V_{CC} = 4.5 V	-	6.0	500	ns
T_{amb}	ambient temperature		–40	-	+125	°C

10. Static characteristics

Table 7: Static characteristics type 74HC245

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	1.2	-	V
		V_{CC} = 4.5 V	3.15	2.4	-	V
		V_{CC} = 6.0 V	4.2	3.2	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	0.8	0.5	V
		V_{CC} = 4.5 V	-	2.1	1.35	V
		V_{CC} = 6.0 V	-	2.8	1.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}				
		I_O = –20 μA; V_{CC} = 2.0 V	1.9	2.0	-	V
		I_O = –20 μA; V_{CC} = 4.5 V	4.4	4.5	-	V
		I_O = –20 μA; V_{CC} = 6.0 V	5.9	6.0	-	V
		I_O = –6.0 mA; V_{CC} = 4.5 V	3.98	4.32	-	V
		I_O = –7.8 mA; V_{CC} = 6.0 V	5.48	5.81	-	V

Table 7: Static characteristics type 74HC245 *…continued*

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	-	0.5	V
		V_{CC} = 4.5 V	-	-	1.35	V
		V_{CC} = 6.0 V	-	-	1.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}		-		
		I_O = –20 μA; V_{CC} = 2.0 V	1.9	-	-	V
		I_O = –20 μA; V_{CC} = 4.5 V	4.4	-	-	V
		I_O = –20 μA; V_{CC} = 6.0 V	5.9	-	-	V
		I_O = –6.0 mA; V_{CC} = 4.5 V	3.7	-	-	V
		I_O = –7.8 mA; V_{CC} = 6.0 V	5.2	-	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}		-		
		I_O = 20 μA; V_{CC} = 2.0 V	-	-	0.1	V
		I_O = 20 μA; V_{CC} = 4.5 V	-	-	0.1	V
		I_O = 20 μA; V_{CC} = 6.0 V	-	-	0.1	V
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	-	0.4	V
		I_O = 7.8 mA; V_{CC} = 6.0 V	-	-	0.4	V
I_{LI}	input leakage current	V_I = V_{CC} or GND; V_{CC} = 6.0 V	-	-	±1.0	μA
I_{OZ}	OFF-state output current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} or GND; V_{CC} = 6.0 V	-	-	±10.0	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 6.0 V	-	-	160	μA

Table 8: Static characteristics type 74HCT245

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	1.6	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	1.2	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}; V_{CC} = 4.5 V				
		I_O = –20 μA	4.4	4.5	-	V
		I_O = –6 mA	3.98	4.32	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}; V_{CC} = 4.5 V				
		I_O = 20 μA	-	0	0.1	V
		I_O = 6.0 mA	-	0.15	0.26	V
I_{LI}	input leakage current	V_I = V_{CC} or GND; V_{CC} = 5.5 V	-	-	±0.1	μA
I_{OZ}	OFF-state output current	V_I = V_{IH} or V_{IL}; V_{CC} = 5.5 V; V_O = V_{CC} or GND per input pin; other inputs at V_{CC} or GND; I_O = 0 A	-	-	±0.5	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	8.0	μA

Table 8: Static characteristics type 74HCT245 *…continued*

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
ΔI_{CC}	additional quiescent supply current per input pin	$V_I = V_{CC} - 2.1$ V; other inputs at $V_I = V_{CC}$ or GND; V_{CC} = 4.5 V to 5.5 V; I_O = 0 A				
	An or Bn inputs		-	40	144	µA
	$\overline{OE}$ input		-	150	540	µA
	DIR input		-	90	324	µA
C_I	input capacitance		-	3.5	-	pF
$C_{I/O}$	input/output capacitance		-	10	-	pF
T_{amb} = –40 °C to +85 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = –20 µA	4.4	-	-	V
		I_O = –6 mA	3.84	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = 20 µA	-	-	0.1	V
		I_O = 6.0 mA	-	-	0.33	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	±1.0	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 5.5 V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; I_O = 0 A	-	-	±5.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	80	µA
ΔI_{CC}	additional quiescent supply current per input pin	$V_I = V_{CC} - 2.1$ V; other inputs at $V_I = V_{CC}$ or GND; V_{CC} = 4.5 V to 5.5 V; I_O = 0 A				
	An or Bn inputs		-	-	180	µA
	$\overline{OE}$ input		-	-	675	µA
	DIR input		-	-	405	µA
T_{amb} = –40 °C to +125 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = –20 µA	4.4	-	-	V
		I_O = –6 mA	3.7	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = 20 µA	-	-	0.1	V
		I_O = 6.0 mA	-	-	0.4	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	±1.0	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 5.5 V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; I_O = 0 A	-	-	±10	µA

Table 8: Static characteristics type 74HCT245 *…continued*

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	160	µA
ΔI_{CC}	additional quiescent supply current per input pin	$V_I = V_{CC} - 2.1$ V; other inputs at $V_I = V_{CC}$ or GND; $V_{CC} = 4.5$ V to 5.5 V; $I_O = 0$ A				
	An or Bn inputs		-	-	196	µA
	$\overline{OE}$ input		-	-	735	µA
	DIR input		-	-	441	µA

11. Dynamic characteristics

Table 9: Dynamic characteristics type 74HC245

GND = 0 V; test circuit see Figure 7.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = 25 °C							
t_{PHL}, t_{PLH}	propagation delay An to Bn or Bn to An	see Figure 5					
		V_{CC} = 2.0 V		-	25	90	ns
		V_{CC} = 4.5 V		-	9	18	ns
		V_{CC} = 5.0 V; C_L = 15 pF		-	7	-	ns
		V_{CC} = 6.0 V		-	7	15	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	see Figure 6					
		V_{CC} = 2.0 V		-	30	150	ns
		V_{CC} = 4.5 V		-	11	30	ns
		V_{CC} = 6.0 V		-	9	26	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	see Figure 6					
		V_{CC} = 2.0 V		-	41	150	ns
		V_{CC} = 4.5 V		-	15	30	ns
		V_{CC} = 6.0 V		-	12	26	ns
t_{THL}, t_{TLH}	output transition time	see Figure 5					
		V_{CC} = 2.0 V		-	14	60	ns
		V_{CC} = 4.5 V		-	5	12	ns
		V_{CC} = 6.0 V		-	4	10	ns
C_{PD}	power dissipation capacitance per transceiver	V_I = GND to V_{CC}	[1]	-	30	-	pF
T_{amb} = −40 °C to +85 °C							
t_{PHL}, t_{PLH}	propagation delay An to Bn or Bn to An	see Figure 5					
		V_{CC} = 2.0 V		-	-	115	ns
		V_{CC} = 4.5 V		-	-	23	ns
		V_{CC} = 6.0 V		-	-	20	ns

Table 10: Dynamic characteristics type 74HCT245

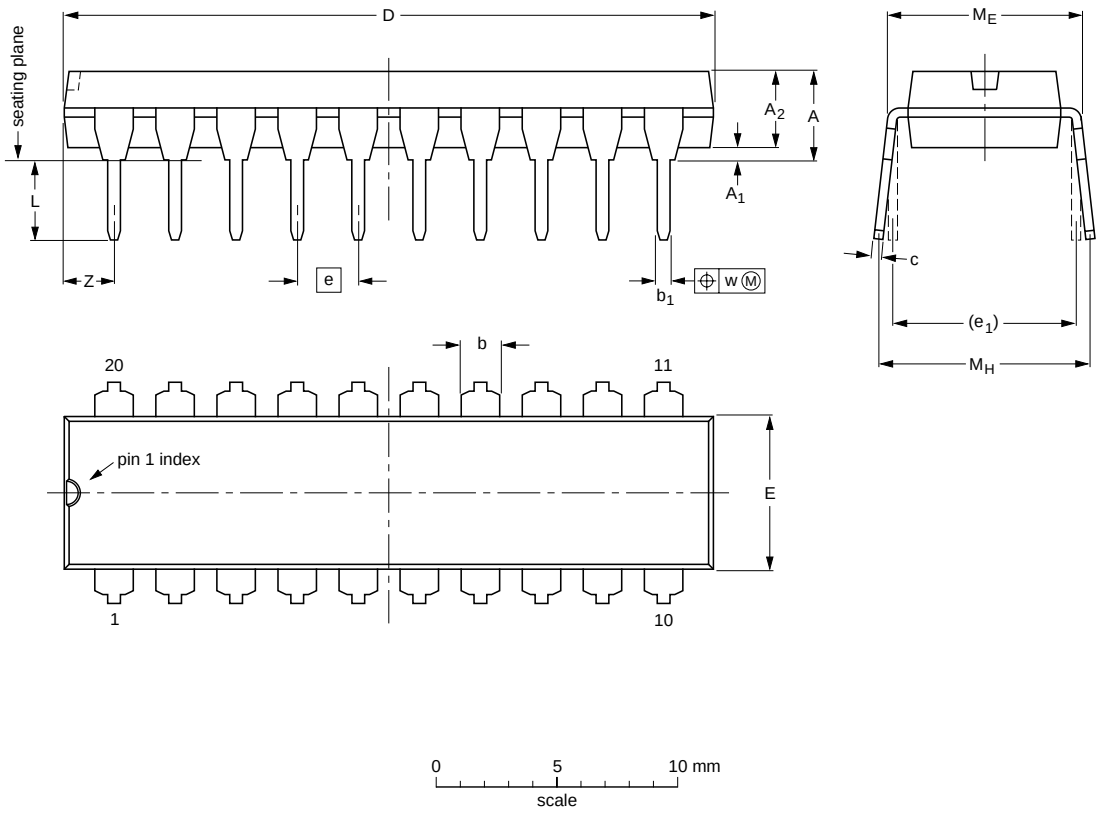
GND = 0 V; test circuit see Figure 7.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = 25 °C							
t_{PHL}, t_{PLH}	propagation delay An to Bn or Bn to An	see Figure 5					
		V_{CC} = 4.5 V		-	12	22	ns
		V_{CC} = 5.0 V; C_L = 15 pF		-	10	-	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	V_{CC} = 4.5 V; see Figure 6		-	16	30	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	V_{CC} = 4.5 V; see Figure 6		-	16	30	ns
t_{THL}, t_{TLH}	output transition time	V_{CC} = 4.5 V; see Figure 5		-	5	12	ns
C_{PD}	power dissipation capacitance per transceiver	V_I = GND to V_{CC} – 1.5 V	[1]	-	30	-	pF
T_{amb} = –40 °C to +85 °C							
t_{PHL}, t_{PLH}	propagation delay An to Bn or Bn to An	V_{CC} = 4.5 V; see Figure 5		-	-	28	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	V_{CC} = 4.5 V; see Figure 6		-	-	38	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	V_{CC} = 4.5 V; see Figure 6		-	-	38	ns
t_{THL}, t_{TLH}	output transition time	V_{CC} = 4.5 V; see Figure 5		-	-	15	ns
T_{amb} = –40 °C to +125 °C							
t_{PHL}, t_{PLH}	propagation delay An to Bn or Bn to An	V_{CC} = 4.5 V; see Figure 5		-	-	33	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	V_{CC} = 4.5 V; see Figure 6		-	-	45	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to An or $\overline{OE}$ to Bn	V_{CC} = 4.5 V; see Figure 6		-	-	45	ns
t_{THL}, t_{TLH}	output transition time	V_{CC} = 4.5 V; see Figure 5		-	-	18	ns

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in µW):
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in V;
N = number of inputs switching;
$\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

13. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil) **SOT146-1**



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

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2
inches	0.17	0.02	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

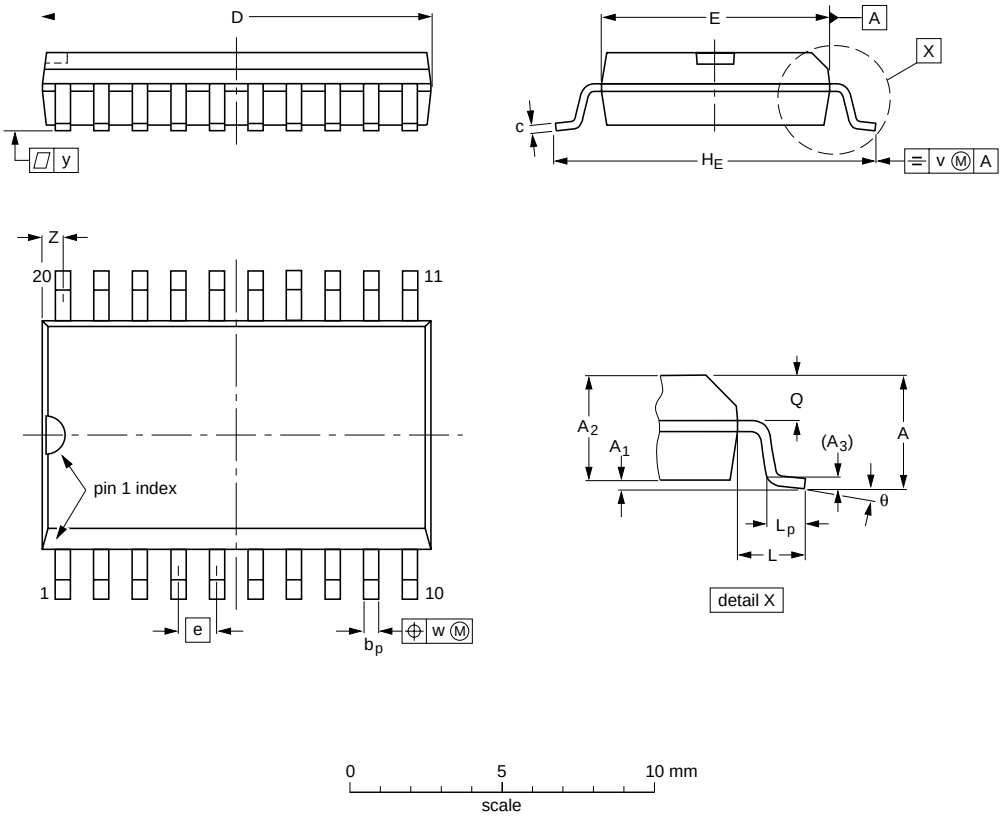
Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	
	IEC	JEDEC	JEITA			
SOT146-1		MS-001	SC-603			

Fig 8. Package outline SOT146-1 (DIP20)

SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



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	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				

Fig 9. Package outline SOT163-1 (SO20)