Quad 2-input EXCLUSIVE-OR gate

74AC86
74ACT86

FEATURES

- 74AC86 has CMOS-compatible inputs
- Meets or exceeds JEDEC standard standard for 74AC(T)XX family
- Superior ground bounce noise immunity
- Output source/sink 24mA

DESCRIPTION

The 74AC/T86 provides the 2-input EXCLUSIVE-OR function..

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYPICAL			UNIT
			AC		ACT	
			V_{CC} = 3.3V	V_{CC} = 5.0V	V_{CC} = 5.0V	
t_{PHL}/t_{PLH}	Propagation delay nA, nB to nY	C_L = 50pF	3.4	2.7	3.5	ns
C_I	Input capacitance		4.5			pF
C_{PD}	Power dissipation capacitance per gate	V_I = GND to V_{CC}[1]	26		28	pF

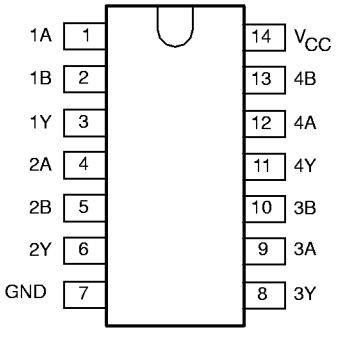
NOTE:

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

ORDERING AND PACKAGE INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DRAWING NUMBER
14-Pin Plastic SO	–40°C to +85°C	74AC86D 74ACT86D	74AC86D 74ACT86D	SOT108-1
14-Pin Plastic SSOP Type II	–40°C to +85°C	74AC86DB 74ACT86DB	74AC86DB 74ACT86DB	SOT337-1
14-Pin Plastic TSSOP Type I	–40°C to +85°C	74AC86PW 74ACT86PW	74AC86PW DH 74ACT86PW DH	SOT402-1

PIN CONFIGURATION



PIN DESCRIPTION

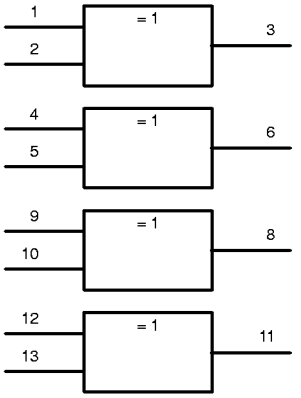
PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 4, 9, 12	1A to 4A	Data inputs
2, 5, 10, 13	1B to 4B	
3, 6, 8, 11	1Y to 4Y	Data outputs
7	GND	Ground (0 V)
14	V_{CC}	Positive supply voltage

FUNCTION TABLE

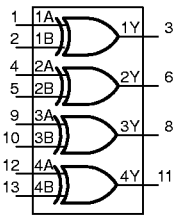
INPUTS		OUTPUT
nA	nB	nY
L	L	L
L	H	H
H	L	H
H	H	L

H = HIGH voltage level
L = LOW voltage level

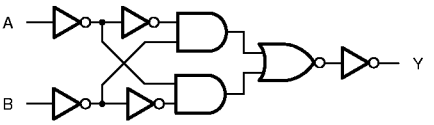
LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



LOGIC DIAGRAM



RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V_{CC}	DC supply voltage for 'AC	2.0	6.0	V
V_{CC}	DC supply voltage for 'ACT	4.5	5.5	V
V_{IN}	DC input voltage range	0	V_{CC}	V
V_O	DC output voltage range	0	V_{CC}	V
T_{amb}	Operating in free-air temperature range	–40	+85	°C
$\Delta V/\Delta t$	Minimum input edge rate — AC devices V_{IN} from 30% to 70% of V_{CC} V_{CC} @ 3.3V, 4.5V, 5.5V	125		mV/ns
	— ACT devices V_{IN} from 0.8V to 2.0V V_{CC} @ 4.5V, 5.5V	125		

ABSOLUTE MAXIMUM RATINGS[1]

in accordance with the Absolute Maximum Rating System (IEC134)
Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		–0.5 to +7.0	V
I_{IK}	DC input diode current	V_{IN} = –0.5V	–20	mA
		V_{IN} = V_{CC} + 0.5V	+20	
V_{IN}	DC input voltage		–0.5 to V_{CC} +0.5	V
I_{OK}	DC output diode current	V_O = –0.5V	–20	mA
		V_O = V_{CC} + 0.5V	+20	
V_O	DC output voltage		–0.5 to V_{CC} +0.5	V
I_O	DC output source or sink current		±50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current per output		±50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current		±200	mA
T_{stg}	Storage temperature range		–65 to +150	°C
P_{TOT}	Power dissipation per package – plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	 above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	 500 500	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.

DC CHARACTERISTICS FOR THE AC FAMILY

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

SYMBOL	PARAMETER	TEST CONDITIONS	V_{CC} (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V_{IH}	HIGH level Input voltage	V_{OUT} = 0.1V or (V_{CC} – 0.1V)	3.0	2.1	1.5		V
			4.5	3.15	2.25		
			5.5	3.85	2.75		
V_{IL}	LOW level Input voltage	V_{OUT} = 0.1V or (V_{CC} – 0.1V)	3.0		1.5	0.9	V
			4.5		2.25	1.35	
			5.5		2.75	1.65	
V_{OH}	HIGH level output voltage	I_{OUT} = –50 μA	3.0	2.9	2.99		V
			4.5	4.4	4.49		
			5.5	5.4	5.49		
		V_{IN} = V_{IL} or V_{IH}, I_{OH} = –12mA[1]	3.0	2.46			
		V_{IN} = V_{IL} or V_{IH}, I_{OH} = –24mA[1]	4.5	3.76			
		V_{IN} = V_{IL} or V_{IH}, I_{OH} = –24mA[1]	5.5	4.76			
V_{OL}	LOW level output voltage	I_{OUT} = 50 μA	3.0		0.01	0.1	V
			4.5		0.01	0.1	
			5.5		0.01	0.1	
		V_{IN} = V_{IL} or V_{IH}, I_{OL} = 12mA[1]	3.0			0.44	
		V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24mA[1]	4.5			0.44	
		V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24mA[1]	5.5			0.44	
I_{IN}	Input leakage current	V_{IN} = V_{CC}, GND	5.5			±1.0	μA
I_{OLD}	Dynamic output current[2]	V_{OLD} = 1.65V max	5.5	75			mA
I_{OHD}	Dynamic output current[2]	V_{OHD} = 3.85V min	5.5			–75	mA
I_{CC}	Quiescent supply current	V_{IN} = V_{CC} or GND	5.5			40	μA

NOTES:

1. All outputs loaded
2. Maximum test duration 2.0 ms; one output loaded at a time

DC CHARACTERISTICS FOR THE ACT FAMILY

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

SYMBOL	PARAMETER	TEST CONDITIONS	V_{CC} (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V_{IH}	HIGH level Input voltage	V_{OUT} = 0.1V or (V_{CC} – 0.1V)	4.5	2.0	1.5		V
			5.5	2.0	1.5		
V_{IL}	LOW level Input voltage	V_{OUT} = 0.1V or (V_{CC} – 0.1V)	4.5		1.5	0.8	V
			5.5		1.5	0.8	
V_{OH}	HIGH level output voltage	I_{OUT} = –50 μA	4.5	4.4	4.49		V
			5.5	5.4	5.49		
		V_{IN} = V_{IL} or V_{IH}, I_{OH} = –24mA[1]	4.5	3.76			
		V_{IN} = V_{IL} or V_{IH}, I_{OH} = –24mA[1]	5.5	4.76			
V_{OL}	LOW level output voltage	I_{OUT} = 50 μA	4.5		0.01	0.1	V
			5.5		0.01	0.1	
		V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24mA[1]	4.5			0.44	
		V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24mA[1]	5.5			0.44	
I_{IN}	Input leakage current	V_{IN} = V_{CC}, GND	5.5			±1.0	μA
ΔI_{CC}	Additional quiescent supply current per input pin	V_{IN} = V_{CC} – 2.1V Other inputs at V_{CC} or GND; I_{OUT} = 0	5.5			1.5	mA
I_{OLD}	Dynamic output current[2]	V_{OLD} = 1.65V max	5.5	75			mA
I_{OHD}	Dynamic output current[2]	V_{OHD} = 3.85V min	5.5			–75	mA
I_{CC}	Quiescent supply current	V_{IN} = V_{CC} or GND	5.5			40	μA

NOTES:

1. All outputs loaded
2. Maximum test duration 2.0ms, one output loaded at a time

AC CHARACTERISTICS FOR 74AC86

GND = 0V; $t_r = t_f \leq 2.5$ns; $C_L = 50$pF; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V_{CC}[1]	LIMITS					UNIT	WAVEFORM
			T_{amb} = +25°C			T_{amb} = –40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t_{PLH}	Propagation delay nA, nB to nY	3.3 5.0	2.0 1.5	3.7 2.9	11.0 7.5	1.5 1.0	12.5 8.5	ns	1, 2
t_{PHL}	Propagation delay nA, nB to nY	3.3 5.0	2.0 1.5	3.1 2.5	11.0 7.5	1.5 1.0	12.5 8.5	ns	

NOTE:

1. Voltage range 3.3V is $V_{CC} = 3.3V \pm 0.3V$
   Voltage range 5.0V is $V_{CC} = 5.0V \pm 0.5V$

AC CHARACTERISTICS FOR 74ACT86

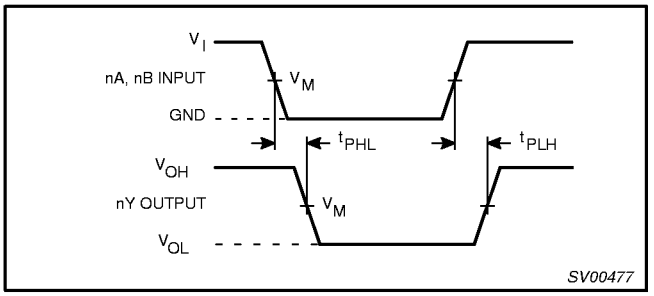
GND = 0V; $t_r = t_f \leq 2.5$ns; $C_L = 50$pF; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V_{CC}[1]	LIMITS					UNIT	WAVEFORM
			T_{amb} = +25°C			T_{amb} = –40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t_{PLH}	Propagation delay nA, nB to nY	5.0	2.0	3.7	9.0	1.5	10.0	ns	1, 2
t_{PHL}	Propagation delay nA, nB to nY	5.0	2.0	3.3	9.0	1.5	10.0	ns	

NOTE:

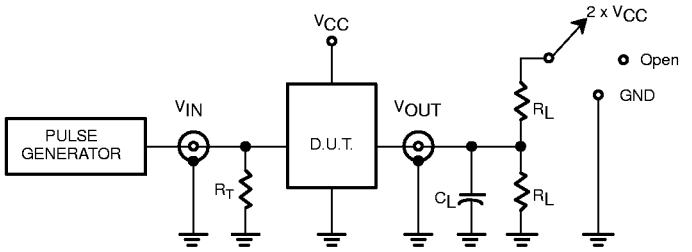
1. Voltage range 5.0V is $V_{CC} = 5.0V \pm 0.5V$

AC WAVEFORMS



Waveform 1. Inputs (nA, nB) to output (nY) propagation delays

TEST CIRCUIT



Test Circuit for 3-State Outputs

SWITCH POSITION

TEST	SWITCH
t_{PLH}/t_{PHL}	Open

FAMILY	V_{IN} Input Requirements	V_m Input	V_m Output
AC	GND to V_{CC}	50% V_{CC}	50% V_{CC}
ACT	GND to 3.0V	1.5V	50% V_{CC}

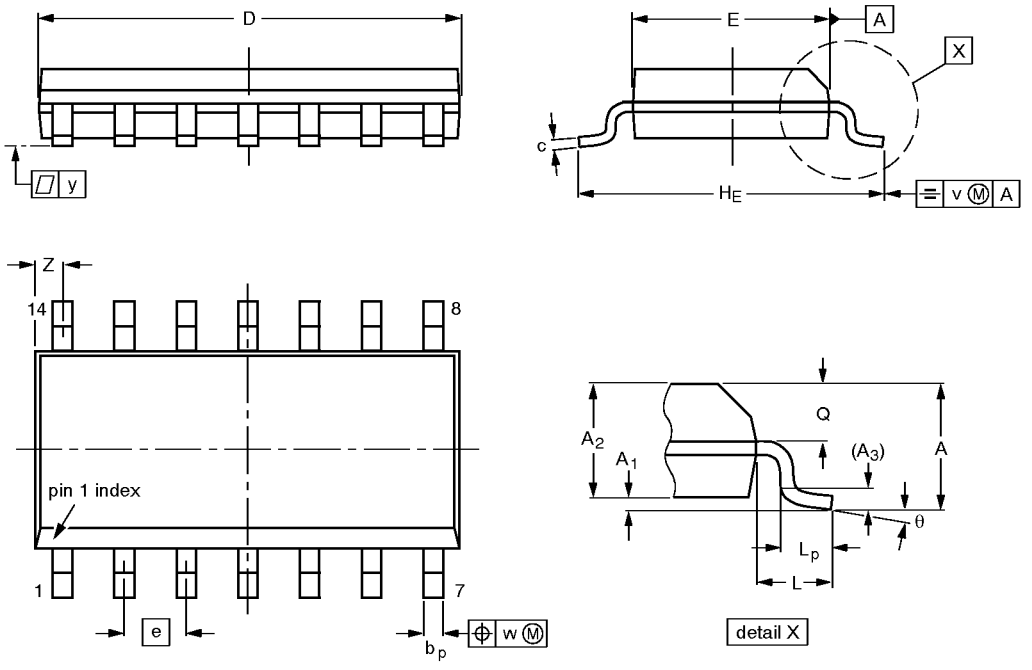
SV00802

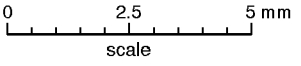
Waveform 2. Load circuitry for switching times

DEFINITIONS

R_L = Load resistor; see AC Characteristics for value
C_L = Load capacitance; see AC Characteristics
Termination resistance should be equal to Z_{OUT} of pulse generators

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





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

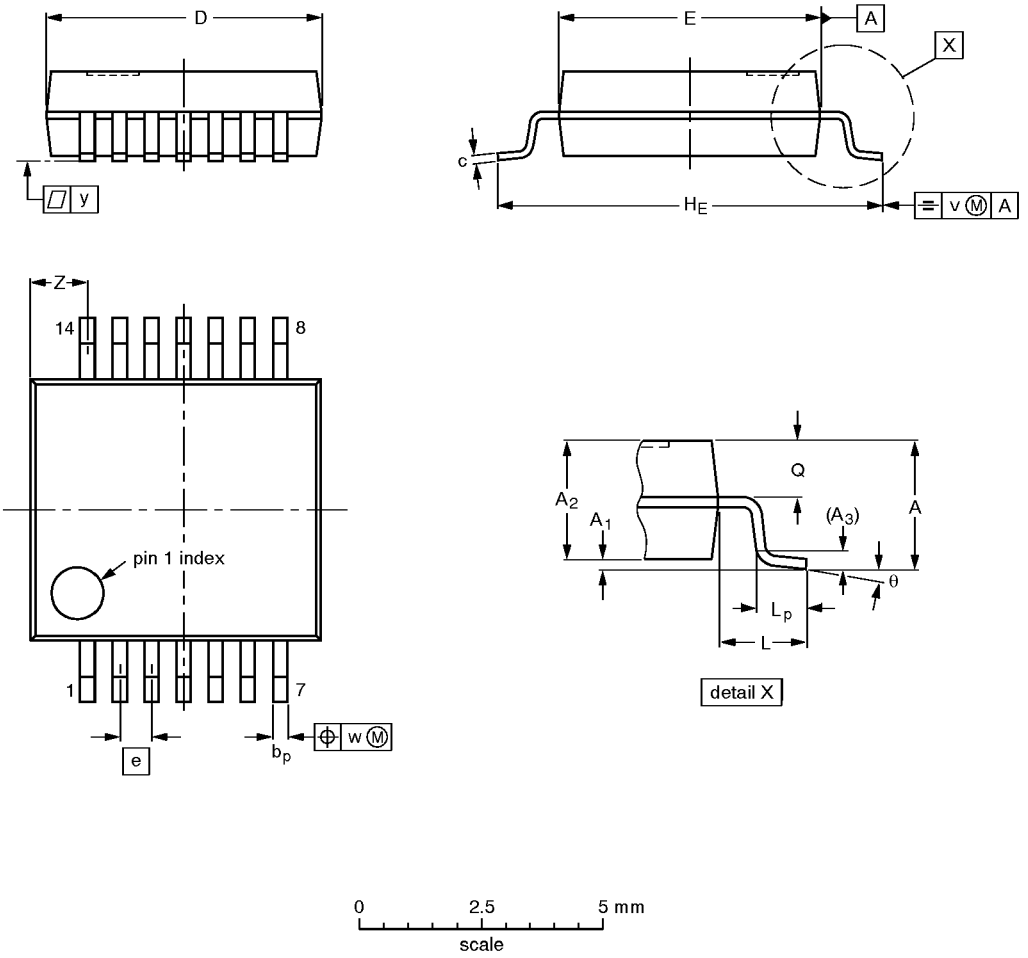
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.35 0.34	0.16 0.15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

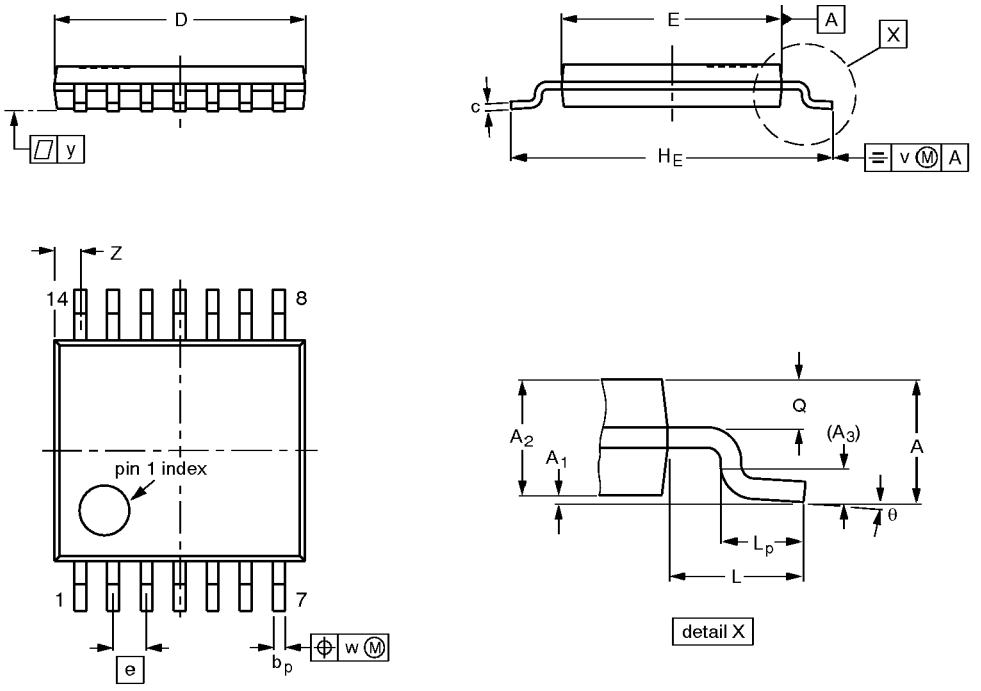
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

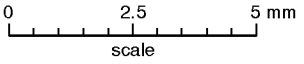
Note

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