

# SN54136, SN54LS136, SN74136, SN74LS136 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES WITH OPEN-COLLECTOR OUTPUTS

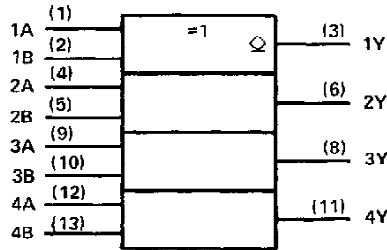
DECEMBER 1972 - REVISED MARCH 1988

FUNCTION TABLE

INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

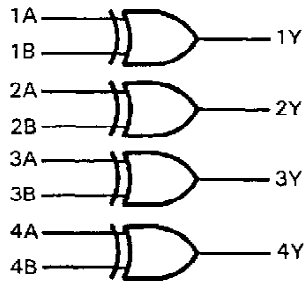
H = high level, L = low level

logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

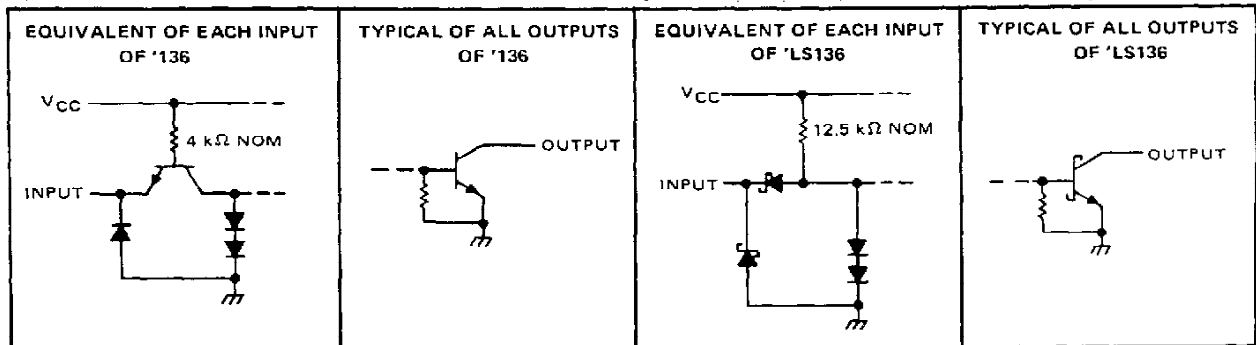
logic diagram (each gate)



positive logic

$$Y = A \oplus B = \bar{A} \cdot B + A \cdot \bar{B}$$

schematics of inputs and outputs



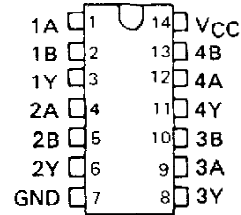
Resistor values shown are nominal.

SN54136, SN54LS136 . . . J OR W PACKAGE

SN74136 . . . N PACKAGE

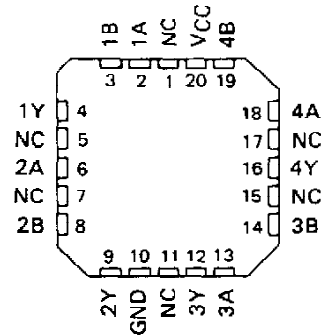
SN74LS136 . . . D OR N PACKAGE

(TOP VIEW)



SN54LS136 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

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# SN54136, SN74136 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES WITH OPEN-COLLECTOR OUTPUTS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN54136	-55°C to 125°C
SN74136	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

### recommended operating conditions

	SN54136			SN74136			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$	4.5	5	5.5	4.75	5	5.25	V
High-level input voltage, $V_{IH}$	2			2			V
Low-level input voltage, $V_{IL}$			0.8			0.8	V
High-level output voltage, $V_{OH}$			5.5			5.5	V
Low-level output current, $I_{OL}$			16			16	mA
Operating free-air temperature, $T_A$	-55		125	0		70	°C

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>†</sup>	SN54136			SN74136			UNIT	
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX		
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -8 \text{ mA}$			-1.5			-1.5	V	
$I_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = 0.8 \text{ V}$ , $V_{OH} = 5.5 \text{ V}$						0.25	mA	
	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = 0.7 \text{ V}$ , $V_{OH} = 5.5 \text{ V}$			0.25					
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 16 \text{ mA}$			0.2	0.4		0.2	0.4	V
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1			1	mA	
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			40			40	$\mu\text{A}$	
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$			-1.6			-1.6	mA	
$I_{CC}$	$V_{CC} = \text{MAX}$ , See Note 2			30	43		30	50	mA

<sup>†</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

<sup>‡</sup> All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

NOTE 2:  $I_{CC}$  is measured with one input of each gate at 4.5 V, the other inputs grounded, and the outputs open.

### switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER <sup>¶</sup>	FROM (INPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT	
		Other input low	Other input high					
$t_{PLH}$	A or B	Other input low	$C_L = 15 \text{ pF}$ , $R_L = 400 \Omega$ , See Note 3			12	18	ns
$t_{PHL}$						39	50	
$t_{PLH}$	A or B	Other input high	See Note 3			14	22	ns
$t_{PHL}$						42	55	

<sup>¶</sup>  $t_{PLH}$  propagation delay time, low-to-high-level output

$t_{PHL}$  propagation delay time, high-to-low-level output

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



# SN54LS136, SN74LS136

## QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES WITH OPEN-COLLECTOR OUTPUTS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range: SN54LS136	-55°C to 125°C
SN74LS136	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54LS136			SN74LS136			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$	4.5	5	5.5	4.75	5	5.25	V
High-level output voltage, $V_{OH}$	5.5			5.5			V
Low-level output current, $I_{OL}$	4			8			mA
Operating free-air temperature, $T_A$	-55	125		0	70		°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54LS136		SN74LS136		UNIT	
		MIN	TYP‡	MAX	MIN		TYP‡
$V_{IH}$ High-level input voltage		2		2		V	
$V_{IL}$ Low-level input voltage		0.7		0.8		V	
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$	-1.5		-1.5		V	
$I_{OH}$ High-level output current	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, V_{OH} = 5.5 \text{ V}$	100		100		μA	
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}$	$I_{OL} = 4 \text{ mA}$	0.25	0.4	0.25	0.4	V
		$I_{OL} = 8 \text{ mA}$			0.35	0.5	
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$	0.2		0.2		mA	
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$	40		40		μA	
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$	-0.8		-0.8		mA	
$I_{CC}$ Supply current	$V_{CC} = \text{MAX}, \text{ See Note 2}$	6.1	10	6.1	10	mA	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

NOTE 2:  $I_{CC}$  is measured with one input of each gate at 4.5 V, the other inputs grounded, and the outputs open.

switching characteristics,  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$

PARAMETER‡	FROM (INPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
$t_{PLH}$	A or B	Other input low	$C_L = 15 \text{ pF}, R_L = 2 \text{ k}\Omega,$ (See Note 3)	18	30	ns	
$t_{PHL}$				18	30		
$t_{PLH}$	A or B	Other input high	(See Note 3)	18	30	ns	
$t_{PHL}$				18	30		

‡  $t_{PLH}$  propagation delay time, low-to-high-level output

‡  $t_{PHL}$  propagation delay time, high-to-low-level output

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



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