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FAST Products	

FAST 74F283

4-Bit Binary Full Adder With Fast Carry

FEATURES

- High speed 4-bit binary addition
- Cascadable in 4-bit increments
- Fast internal carry look-ahead

DESCRIPTION

The 74F283 adds two 4-bit binary words (A_n plus B_n) plus the incoming carry. The binary sum appears on the sum outputs (Σ_0 - Σ_3) and the outgoing carry (C_{OUT}) according to the equation:

$$C_{IN} + 2^0(A_0 + B_0) + 2^1(A_1 + B_1) + 2^2(A_2 + B_2) + 2^3(A_3 + B_3)$$

$$= \Sigma_0 + 2\Sigma_1 + 4\Sigma_2 + 8\Sigma_3 + 16C_{OUT}$$

where (+) = plus

Due to the symmetry of the binary add function, the 'F283 can be used with either all active-High operands (positive logic) or with all active-Low operands (negative logic). See Function Table. In case of all active-Low operands (negative

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F283	6.5ns	40mA

ORDERING INFORMATION

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$; $T_A = 0^\circ C$ to $+70^\circ C$
16-Pin Plastic DIP	N74F283N
16-Pin Plastic SO	N74F283D

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74F(U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
$A_0 - A_3$	A operand inputs	1.0/2.0	20 μ A/1.2mA
$B_0 - B_3$	B operand inputs	1.0/2.0	20 μ A/1.2mA
C_{IN}	Carry input	1.0/1.0	20 μ A/0.6mA
C_{OUT}	Carry output	50/33	1.0mA/20mA
$\Sigma_0 - \Sigma_3$	Sum outputs	50/33	1.0mA/20mA

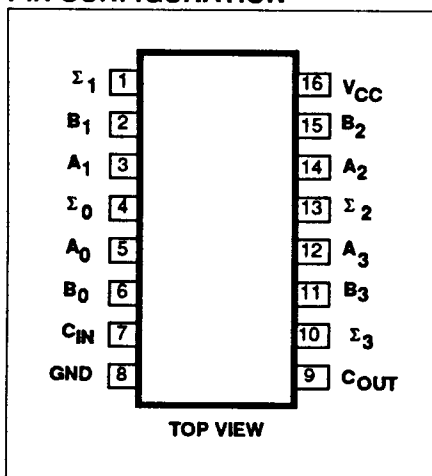
NOTE:

One (1.0) FAST Unit Load is defined as: 20 μ A in the High state and 0.6mA in the Low state.

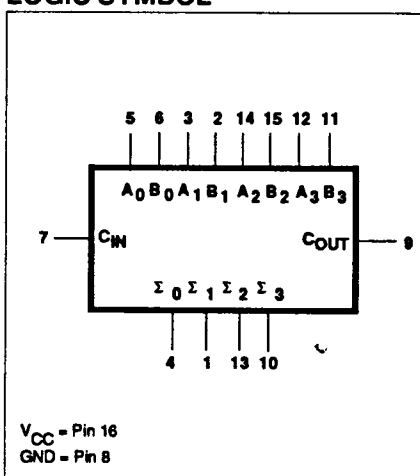
logic) the results $\Sigma_1 - \Sigma_4$ and C_{OUT} should be interpreted also as active-Low. With active-High inputs, C_{IN} cannot be left open; it must be held Low when no "carry

in" is intended. Interchanging inputs of equal weight does not affect the operation, thus A_0, B_0, C_{IN} can arbitrarily be assigned to pins 5, 6, 7, etc.

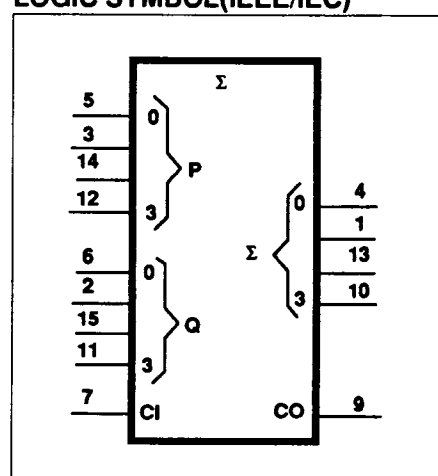
PIN CONFIGURATION



LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



4-Bit Adder

FAST 74F283

Due to pin limitations, the intermediate carries of the 'F283 are not brought out for use as inputs or outputs. However, other means can be used to effectively insert a carry into, or bring a carry out from, an intermediate stage.

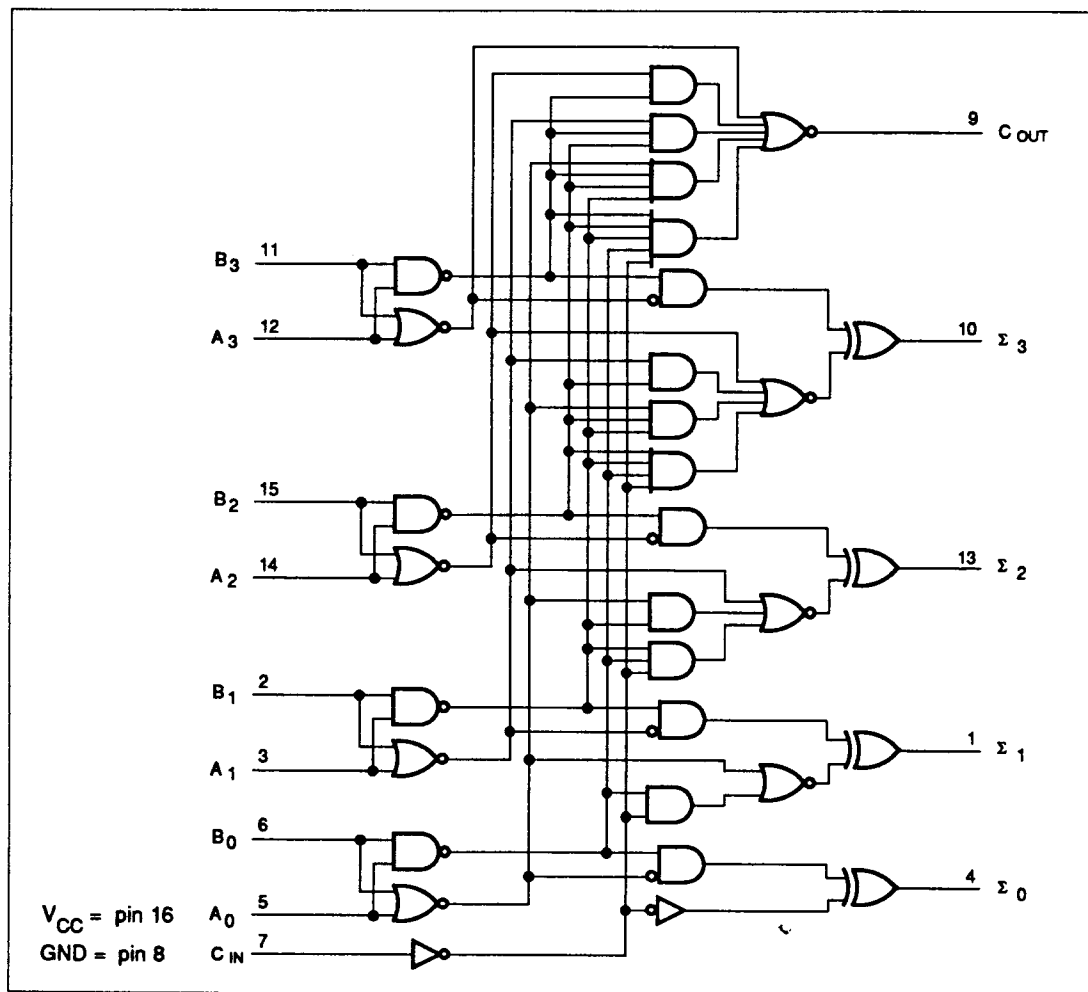
Figure a shows how to make a 3-bit adder. Tying the operand inputs of the fourth adder (A_3, B_3) Low makes Σ_3 dependent only on, and equal to, the carry from the third adder. Using somewhat the same

principle, Figure b shows a way of dividing the 'F283 into a 2-bit and a 1-bit adder. The third stage adder (A_2, B_2, Σ_2) is used as means of getting a carry (C_{10}) signal into the fourth stage adder (via A_2 and B_2) and bringing out the carry from the second stage on Σ_2 . Note that as long as A_2 and B_2 are the same, whether High or Low, they do not influence Σ_2 . Similarly, when A_2 and B_2 are the same, the carry into the third stage does not influence the

carry out of the third stage.

Figure c shows a method of implementing a 5-input encoder where the inputs are equally weighted. The outputs Σ_0, Σ_1 and Σ_2 present a binary number equal to the number of inputs $I_0 - I_4$ that are true. Figure d shows one method of implementing a 5-input majority gate. When three or more of the inputs $I_0 - I_4$ are true, the output M_4 is true.

LOGIC DIAGRAM



FUNCTION TABLE

PINS	C_{IN}	A_0	A_1	A_2	A_3	B_0	B_1	B_2	B_3	Σ_0	Σ_1	Σ_2	Σ_3	C_{OUT}
Logic levels	L	L	H	L	H	H	L	L	H	H	H	L	L	H
Active High	0	0	1	0	1	1	0	0	1	1	1	0	0	1
Active Low	1	1	0	1	0	0	1	1	0	0	0	1	1	0

H = High voltage level

L = Low voltage level

Example:

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1001
1010
10011
(10+9=19)
(carry+5+6=12)

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4-Bit Adder

FAST 74F283

APPLICATIONS

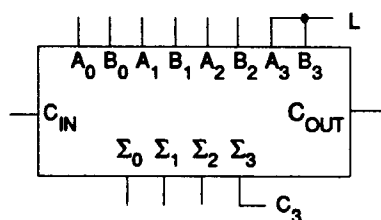


Figure a 3-bit adder

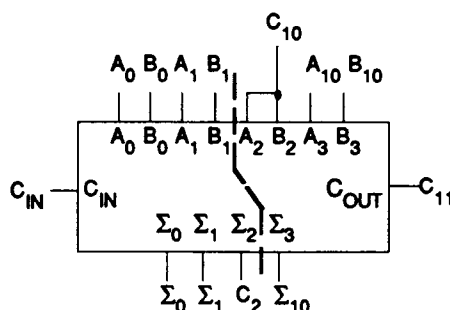


Figure b 2-bit and 1-bit adder

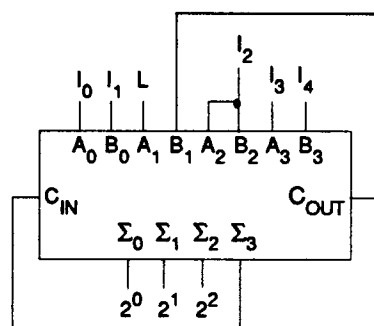


Figure c 5-input Encoder

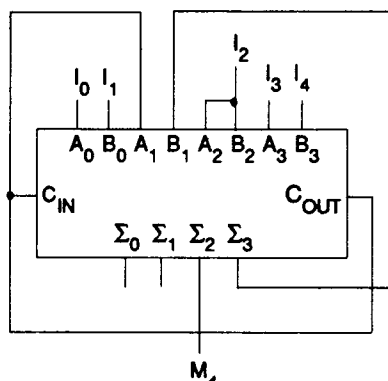


Figure d 5-input majority Gate

ABSOLUTE MAXIMUM RATINGS (Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	-0.5 to +7.0	V
V_{IN}	Input voltage	-0.5 to +7.0	V
I_{IN}	Input current	-30 to +5	mA
V_{OUT}	Voltage applied to output in High output state	-0.5 to + V_{CC}	V
I_{OUT}	Current applied to output in Low output state	40	mA
T_A	Operating free-air temperature range	0 to +70	°C
T_{STG}	Storage temperature	-65 to +150	°C

4-Bit Adder

FAST 74F283

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		Min	Nom	Max	
V_{CC}	Supply voltage	4.5	5.0	5.5	V
V_{IH}	High-level input voltage	2.0			V
V_{IL}	Low-level input voltage			0.8	V
I_{IK}	Input clamp current			-18	mA
I_{OH}	High-level output current			-1	mA
I_{OL}	Low-level output current			20	mA
T_A	Operating free-air temperature range	0		70	°C

DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS ¹	LIMITS			UNIT
			Min	Typ ²	Max	
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}$ $V_{IH} = \text{MIN}, I_{OH} = \text{MAX}$	$\pm 10\%V_{CC}$	2.5		V
			$\pm 5\%V_{CC}$	2.7	3.4	V
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}$ $V_{IH} = \text{MIN}, I_{OL} = \text{MAX}$	$\pm 10\%V_{CC}$		0.30	0.50
			$\pm 5\%V_{CC}$		0.30	0.50
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = I_{IK}$		-0.73	-1.2	V
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7.0\text{V}$			100	μA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7\text{V}$			20	μA
I_{IL}	Low-level input current	C_{IN} only A_n, B_n			-0.6	mA
					-1.2	mA
I_{OS}	Short circuit output current ³	$V_{CC} = \text{MAX}$	-60		-150	mA
I_{CC}	Supply current (total) ⁴	$V_{CC} = \text{MAX}$		40	55	mA

NOTES:

- 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 $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$.
- Not more than one output should be shorted at a time. For testing I_{OS} , the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.
- I_{CC} should be measured with all outputs open and the following conditions:
 Condition 1: all inputs grounded
 Condition 2: all B inputs Low, other inputs at 4.5V
 Condition 3: all inputs at 4.5V

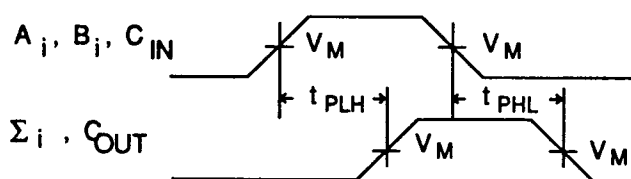
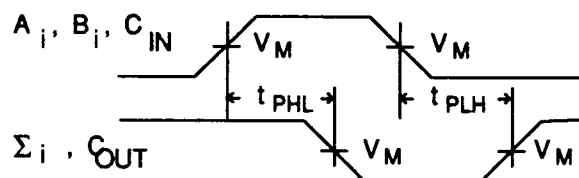
4-Bit Adder

FAST 74F283

AC ELECTRICAL CHARACTERISTICS

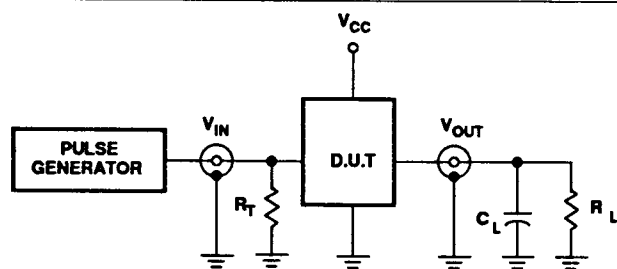
SYMBOL	PARAMETER	TEST CONDITION	LIMITS						UNIT
			$T_A = +25^{\circ}\text{C}$ $V_{CC} = 5\text{V}$ $C_L = 50\text{pF}$ $R_L = 500\Omega$			$T_A = 0^{\circ}\text{C to } +70^{\circ}\text{C}$ $V_{CC} = 5\text{V} \pm 10\%$ $C_L = 50\text{pF}$ $R_L = 500\Omega$			
			Min	Typ	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation delay C_{IN} to Σ_i	Waveform 1, 2	3.5 4.0	7.0 7.0	9.5 9.5	3.0 3.5	10.5 10.5	ns	
t_{PLH} t_{PHL}	Propagation delay A_i or B_i to Σ_i	Waveform 1, 2	3.5 3.5	7.0 7.0	9.5 9.5	2.5 3.5	10.5 10.5	ns	
t_{PLH} t_{PHL}	Propagation delay C_{IN} to C_{OUT}	Waveform 2	3.5 3.0	5.7 5.4	7.5 7.0	3.5 2.5	8.5 8.0	ns	
t_{PLH} t_{PHL}	Propagation delay A_i or B_i to C_{OUT}	Waveform 1, 2	3.5 2.5	5.7 5.3	7.5 7.0	3.0 2.5	8.5 8.0	ns	

AC WAVEFORMS


 Waveform 1. Propagation Delay
Operands and Carry inputs to Outputs

 Waveform 2. Propagation Delay
Operands and Carry inputs to Outputs

 NOTE: For all waveforms, $V_M = 1.5\text{V}$

TEST CIRCUIT AND WAVEFORMS

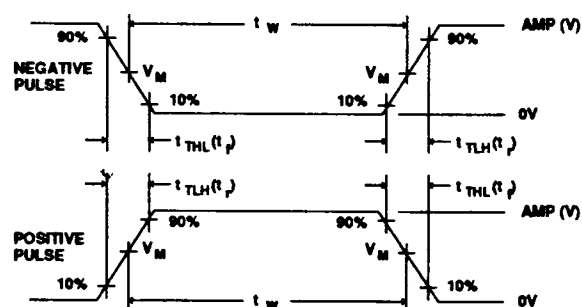


Test Circuit For Totem-Pole Outputs

DEFINITIONS

 R_L = Load resistor; see AC CHARACTERISTICS for value.

 C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

 R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

 $V_M = 1.5\text{V}$

Input Pulse Definition

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	$t_{TLH}(t_p)$	$t_{THL}(t_p)$
74F	3.0V	1MHz	500ns	2.5ns	2.5ns

VI. COMMERCIAL PRODUCT SPECIAL PROCESSING T-90-20

SUPR II LEVEL B PRICING ADDERS

SUPR II LEVEL B

Signetics Upgraded Product Reliability (SUPR) program is designed to provide customers whose systems require an infant mortality level less than that of our non-burned-in products (which is typically below 1000 PPM).

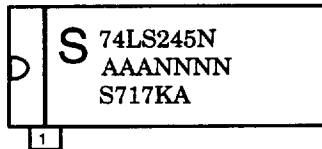
DEVICE AVAILABILITY

Products available for Level B processing are identified in the Price Book with a "B" suffix to the basic part number.

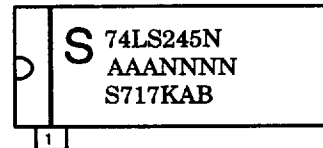
PRODUCT FAMILY	SUGGESTED RESALE ADDERS		
	1-99	100-999	OVER 1000
LIN	.14	.14	.11
LOG (TTL)			
(SSl)	.12	.10	.08
(MSl)	.16	.14	.11
(OCT)	.16	.14	.11
(CTM)	.16	.14	.11
LOG (ECL)			
(SSl)	.25	.23	.20
(MSl)	.25	.23	.20
LOG (LSI)	Consult Factory for Pricing		
(RAM)			
MIC (8X)			
PLD	Consult Factory for Pricing		
MCG	Consult Factory for Pricing		
DAT	Not Available		
MIC			

MARKING FORMAT EXAMPLES

Standard (no Burn-In) Products (Dual-in-line)



SUPR II (Burned-In) Products (Dual-in-line)



NOTE: The "B" in the 7th position on the 3rd line, when present, is the SUPR II Burn-In indicator.

TAPE AND REEL PACKAGING

SPECIFICATIONS

Tape and Reel specifications conform to Electronic Industries Association (EIA) Proposed Specification #EIA-481-A using 13 inch reels. Current incremental quantities reflect the quantities per reel. As more customers are able to handle a larger quantity per reel, this quantity will be increased.

DEVICE AVAILABILITY

Products available in tape and reel packaging are identified in the Price Book with a "T" suffix to the basic part number and are only offered as a product for sale by the reel. Return of product is limited to full reels with unbroken quality seals.

TAPE AND REEL PRICING ADDERS

PRODUCT FAMILY	SUGGESTED RESALE ADDER
MCG	.07
LIN	.07
LOG	.07
DAT MIC	PACKAGE A28 = .20 A44 = .25 A52 = .30 A68 = .40 A84 = .45 D24 = .17

VII. PACKING QUANTITY INFORMATION

T-90-20

CERAMIC DUAL IN-LINE (CERDIP)

PACKAGE CODE	PIN COUNT	QUANTITIES	
		DEVICES PER TUBE	DEVICES PER BOX
F/FE, BPA, PA	8-pin (300-mil)	48	1920
F, BCA, CA	14-pin (300-mil)	25	1000
F, BEA, EA	16-pin (300-mil)	25	1000
F, BVA, MVA	18-pin (300-mil)	21	840
F/FA, BRA, RA	20-pin (300-mil)	20	800
F, BWA, WA	22-pin (400-mil)	17	544
F/FA/F6, BJA, JA	24-pin (600-mil)	15	360
F/FA/F3/F24, BLA, LA	24-pin (300-mil)	15	600
F, BXA, XA	24-pin (400-mil)	15	480
F/FA/F28, BXA, XA	28-pin (600-mil)	13	312
FA	32-pin (600-mil)	11	264
F/FA/F40, BQA, MQA, QA	40-pin (600-mil)	9	216

CERPAC

PACKAGE CODE	PIN COUNT	QUANTITIES	
		DEVICES PER TUBE	
BDA/DA/W	14-pin	145	
BFA/FA/W	16-pin	145	
BXA/BYA/W	18-pin	100	
BSA/SA/W/WB	20-pin	100	
BKA/KA/W	24-pin	120	
BYA/YA/W	28-pin	50	

CERQUAD

PACKAGE CODE	PIN COUNT	QUANTITIES	
		DEVICES PER TRAY	DEVICES PER BOX
KA/K44	44-pin	6	6
KA/K68	68-pin	4	4
KA	84-pin	42	210

LEADLESS CHIP CARRIER

PACKAGE CODE	PIN COUNT	QUANTITIES	
		DEVICES PER TUBE	
B2A/2A/GA	20-pin	55	
B3A/3A/GA/GC1	28-pin	43	
YA/YA/GC2	32-pin	35	
BUA/MXA/MUA/UA/XA/GA/GC	44-pin	27	
BZA/BUA/UA/ZA/GA/GC	68-pin	19	

QUANTITIES SHOWN IN GRAY REQUIRE PURCHASE TO BE MADE IN EXACT MULTIPLES OF THAT QUANTITY.

VII. PACKING QUANTITY INFORMATION

T-90-20

PLASTIC DUAL IN-LINE

PACKAGE CODE	PIN COUNT	QUANTITIES	
		DEVICES PER TUBE	DEVICES PER BOX
N/N8	8-pin (300-mil)	50	2000
N/N14/N16	14- 16-pin (300-mil)	25	1000
N	18-pin (300-mil)	20	800
N/N20	20-pin (300-mil)	18	720
N	22-pin (400-mil)	17	544
N/N6	24-pin (600-mil)	15	360
N/N3/N24	24-pin (300-mil)	15	600
N/N24	24-pin (400-mil)	15	480
N/N28	28-pin (600-mil)	13	312
N/N3	28-pin (300-mil)	13	520
N	32-pin (600-mil)	11	264
N/N40	40-pin (600-mil)	9	216
NB (Shrink)	42-pin (600-mil)	12	288
N/N48	48-pin (600-mil)	7	168
N	50-pin (900-mil)	7	112
N/N64	64-pin (900-mil)	5	80

PLASTIC LEADED CHIP CARRIER (PLCC)

PACKAGE CODE	PIN COUNT	QUANTITIES		
		DEVICES PER TUBE	DEVICES PER BOX	DEVICES PER REEL
A	20-pin	46	3680	1000
A/A28	28-pin	37	2368	750
A	32-pin	31	2232	750
A/A44	44-pin	26	1248	500
A/A52	52-pin	23	1012	500
A/A68	68-pin	18	648	250
A/A84	84-pin	15	420	250

QUANTITIES SHOWN IN GRAY REQUIRE PURCHASE TO BE MADE IN EXACT MULTIPLES OF THAT QUANTITY.

VII. PACKING QUANTITY INFORMATION

T-90-20

PLASTIC SMALL OUTLINE (SO)

PACKAGE CODE	PIN COUNT	QUANTITIES		
		DEVICES PER TUBE	DEVICES PER BOX	DEVICES PER REEL
D/D8	8-pin (150-mil)	100	10000	2500
D	8-pin (300-mil)	64	2560	1000 - 13" 700 - 7"
D/D14	14-pin (150-mil)	57	5700	2500
D	16-pin (150-mil)	50	5000	2500
D	16-pin (300-mil)	48	1920	1000
DK(SSOP)	20-pin (170-mil)	75	6750	2500
D	20-pin (300-mil)	38	1520	1000
D/D24	24-pin (300-mil)	32	1280	1000
D	28-pin (300-mil)	27	1080	1000
D	40-pin (VSO-40)	31	1240	1000 - 13" 300 - 7"
D	56-pin (VSO-56)	22	616	1000

QUAD FLAT PACK*

PACKAGE CODE	PIN COUNT	QUANTITIES	
		DEVICES PER TRAY	DEVICES PER BOX
B/B44	44-pin	50	500
B/B44	44-pin	96	480
B	52-pin	119	595
B	80-pin	66	330
B	100-pin	50	250
B	120-pin	24	120
B	120-pin (Philips source)	30	150

- * Quad Flat Pack parts require dry pack handling according to EIA Standard - 583.
These parts are identified in part list section with DRY PACK in the Cross Ref Part No field.

QUANTITIES SHOWN IN GRAY REQUIRE PURCHASE TO BE MADE IN EXACT MULTIPLES OF THAT QUANTITY.