

8 bit 30/50 MSPS Flash A/D Converter

Evaluation Board Available — CXA1016PPCB/CXA1016KPCB
CXA1056PPCB/CXA1056KPCB

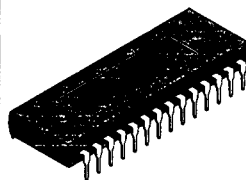
Description

CXA1016P/CXA1016K/CXA1056P/CXA1056K are 8 bit high-speed A/D converter ICs for various applications. They can be used widely for various purposes which require high-speed A/D conversions.

CXA1016P/CXA1056P are assembled in the plastic DIP packages and CXA1016K/CXA1056K are in the ceramic lead-less chip carriers.

28 pin DIP (Plastic)

44 pin LCC (Ceramic)



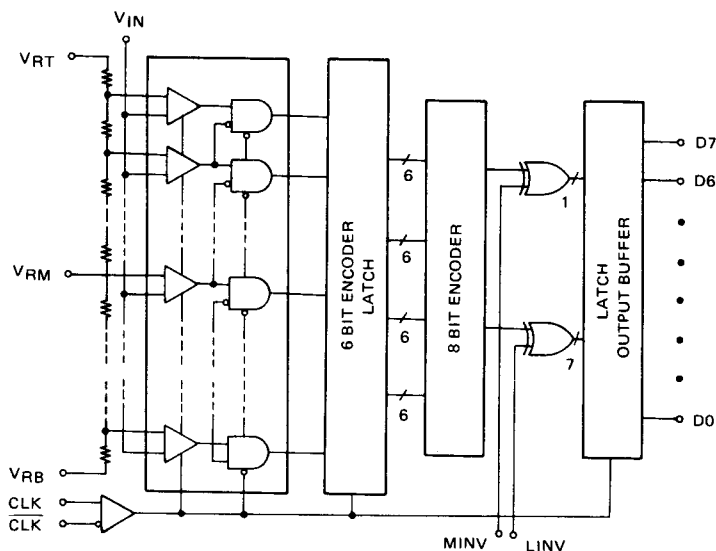
Features (CXA1016P/CXA1016K)

- Resolution 8 bits $\pm 1/2$ LSB
- High-speed operation Maximum conversion Rate 30 MSPS
- Wide analog input bandwidth 30MHz (-3 dB)
- Low input capacitance 35 pF (typ)
- Low power consumption 420 mW (typ)

Features (CXA1056P/CXA1056K)

- Resolution 8 bits $\pm 1/2$ LSB
- High-speed operation Maximum conversion Rate 50 MSPS
- Wide analog input bandwidth 50MHz (-3 dB)
- Low input capacitance 35 pF (typ)
- Low power consumption 550 mW (typ)

Block Diagram



Absolute Maximum Ratings (Ta=25°C)

• Supply voltage	V _{EE}	0 to -7	V
• Analog input voltage	V _{IN}	0.5 to V _{EE}	V
• Reference input voltage	V _{RT} , V _{RB} , V _{RM}	0.5 to V _{EE}	V
	V _{RT} -V _{RB}	2.5	V
• Digital input voltage	CLK, $\overline{\text{CLK}}$, MINV, LINV	0.5 to -4	V
• VRM pin input current	I _{VRM}	-3 to +3	mA
• Digital output current	ID ₀ to ID ₇	0 to -10	mA
• Operating temperature	T _a	-20 to +100	°C (CXA1016P/CXA1056P)
	T _c	-25 to +125	°C (CXA1016K/CXA1056K)*1
• Storage temperature	T _{stg}	-55 to +150	°C
• Allowable power dissipation	P _D	1.48	W (CXA1016P/CXA1056P)
		1.08	W (CXA1016K/CXA1056K)

*1 Heat sinking is required above 100°C (CXA1016K)/86°C (CXA1056K).

Recommended Operating Conditions (CXA1016P/CXA1016K)

		Min.	Typ.	Max.	Unit
• Supply voltage	A _{V_{EE}} , D _{V_{EE}}	-5.7	-5.2	-5.0	V
	A _{V_{EE}} -D _{V_{EE}}	-0.05	0	0.05	V
	A _{GND} -D _{GND}	-0.05	0	0.05	V
• Reference input voltage	V _{RT}	-0.1	0	0.1	V
	V _{RB}	-2.2	-2	-1.8	V
• Analog input voltage	V _{IN}		V _{RB}	V _{RT}	
• Clock pulse width	T _{pw1}	25			ns
	T _{pw0}	8			ns

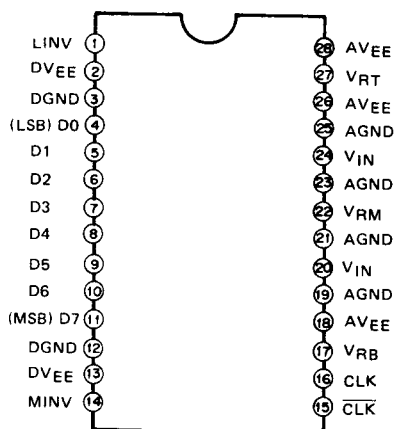
Recommended Operating Conditions (CXA1056P/CXA1056K)

		Min.	Typ.	Max.	Unit
• Supply voltage	A _{V_{EE}} , D _{V_{EE}}	-5.7	-5.2	-5.0	V
	A _{V_{EE}} -D _{V_{EE}}	-0.05	0	0.05	V
	A _{GND} -D _{GND}	-0.05	0	0.05	V
• Reference input voltage	V _{RT}	-0.1	0	0.1	V
	V _{RB}	-2.2	-2	-1.8	V
• Analog input voltage	V _{IN}		V _{RB}	V _{RT}	
• Clock pulse width	T _{pw1}	15			ns
	T _{pw0}	5			ns

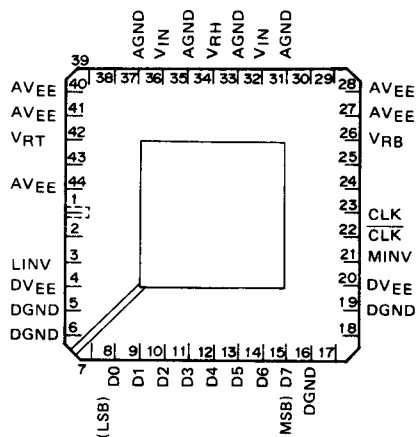
Pin Configuration (Top View)

The pin numbers without indication are empty pins. (not connected)

CXA1016P/CXA1056P



CXA1016K/CXA1056K



Pin Description

Symbol	Function
AVEE	Analog VEE, -5.2V (typ). Coupled with $\sim 6\Omega$ between DVEE.
LINV	Input pin for output polarity inversion of D ₀ (LSB)~D ₆ . (See the code table)
DVEE	Digital VEE, -5.2V (typ).
DGND	Digital GND, which is separated from the Analog GND.
D ₀ ~D ₇	Digital data output pin, ECL level. D ₀ : LSB~D ₇ : MSB. Pull-down resistors are necessary externally.
MINV	Input pin for output polarity inversion of D ₇ (MSB) (See the code table). ECL level. "0" level is held when it is released.
CLK	Inverse clock input pin, ECL level.
CLK	Clock input pin, ECL level.
V _{RB}	Reference voltage (bottom), -2V (typ).
AGND	Analog GND
V _{IN}	Analog input, input range is V _{RT} ~V _{RB}
V _{RM}	Middle point of the reference voltage, it can be used as a linearity correction pin.
V _{RT}	Reference voltage (top), 0V (typ).
	Empty pins (not connected), 2 and 19 are used to be grounded to DGND, the others are used to be grounded to AGND.

Output Coding

MINV LINV	0 0	0 1	1 0	1 1
0V	111 ... 11	100 ... 00	011 ... 11	000 ... 00
.	111 ... 10	100 ... 01	011 ... 10	000 ... 01
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
V _{IN}	100 ... 00	111 ... 11	000 ... 00	011 ... 11
.	011 ... 11	000 ... 00	111 ... 11	100 ... 00
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	000 ... 01	011 ... 10	100 ... 01	111 ... 10
-2V	000 ... 00	011 ... 11	100 ... 00	111 ... 11

1: V_{IH}, V_{OH}0: V_{IL}, V_{OL}

Electrical Characteristics (CXA1016P/CXA1016K)

(Ta=25°C, VEE=-5.2V, VRT=0V, VRB=-2V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Maximum Conversion Rate	Fc	VIN=0 to -2V, fin=1 kHz, ramp	30			MSPS
Supply Current	IEE			-75	-100	mA
Analog Input Capacitance	CIN	VIN=-1V+0.07 Vrms		35	40	pF
Analog Input Bias Current	IIN	VIN=-1V		60	90	μA
Reference Resistor	Rr (VRT~VRB)		70	80	100	Ω
Offset Voltage	VRT		7	9	11	mV
	VRB		15	17	19	mV
Digital Input Voltage	VIH		-1.0	-0.9	-0.7	V
	VIL		-1.9	-1.75	-1.6	V
Digital Input Current	IiH	VIH=-0.9V	0		0.4	mA
	IiL	VIL=-1.75V	-0.05		0.35	mA
Digital Output Voltage	VOH	RL=620Ω ~ VEE	-1.0			V
	VOL				-1.6	V
Output Data Delay	Td	RL=620Ω ~ VEE		4.0	5.0	ns
Non-linearity Error		Fc = 30 MSPS, VIN=0 to -2V, fin=1 kHz, ramp			±1/2	LSB
Differential Non-linearity Error		Fc = 30 MSPS			±1/2	LSB
Differential Gain	DG	NTSC 40 IRE mod. ramp, Fc = 30 MSPS			1.5.	%
Differential Phase	DP				0.5	deg.
Aperture Jitter	Taj			45		ps
Sampling Delay	Tsd		6.3	6.8	7.3	ns
Full scale input BW (-3dB)	BWf	*1		30		MHz

*1 Source impedance = 50 Ω

Without a buffer amplifier driving A/D input

Electrical Characteristics (CXA1056P/CXA1056K)

(Ta=25°C, VEE=-5.2V, VRT=0V, VRB=-2V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Maximum Conversion Rate	Fc	VIN=0 to -2V, fin=1 kHz, ramp	50			MSPS
Supply Current	IEE			-95	-120	mA
Analog Input Capacitance	CIN	VIN=-1V+0.07 Vrms		35	40	pF
Analog Input Bias Current	IIN	VIN=-1V		75	115	μA
Reference Resistor	Rr (VRT~VRB)		70	80	100	Ω
Offset Voltage	VRT		7	9	11	mV
	VRB		15	17	19	mV
Digital Input Voltage	VIH		-1.0	-0.9	-0.7	V
	VIL		-1.9	-1.75	-1.6	V
Digital Input Current	IiH	VIH=-0.9V	0		0.4	mA
	IiL	VIL=-1.75V	-0.05		0.35	mA
Digital Output Voltage	VOH	Rℓ=620Ω ~ VEE	-1.0			V
	VOL				-1.6	V
Output Data Delay	Td	Rℓ=620Ω ~ VEE		4.0	5.0	ns
Non-linearity Error		Fc = 50 MSPS, VIN=0 to -2V, fin=1 kHz, ramp			±1/2	LSB
Differential Non-linearity Error		Fc = 50 MSPS			±1/2	LSB
Differential Gain	DG	NTSC 40 IRE mod. ramp, Fc = 50 MSPS			1.5	%
Differential Phase	DP				0.5	deg.
Aperture Jitter	Taj			30		ps
Sampling Delay	Tsd		5.4	5.7	6.0	ns
Full scale input BW (-3dB)	BWF	*1		50		MHz

*1 Source impedance = 50 Ω

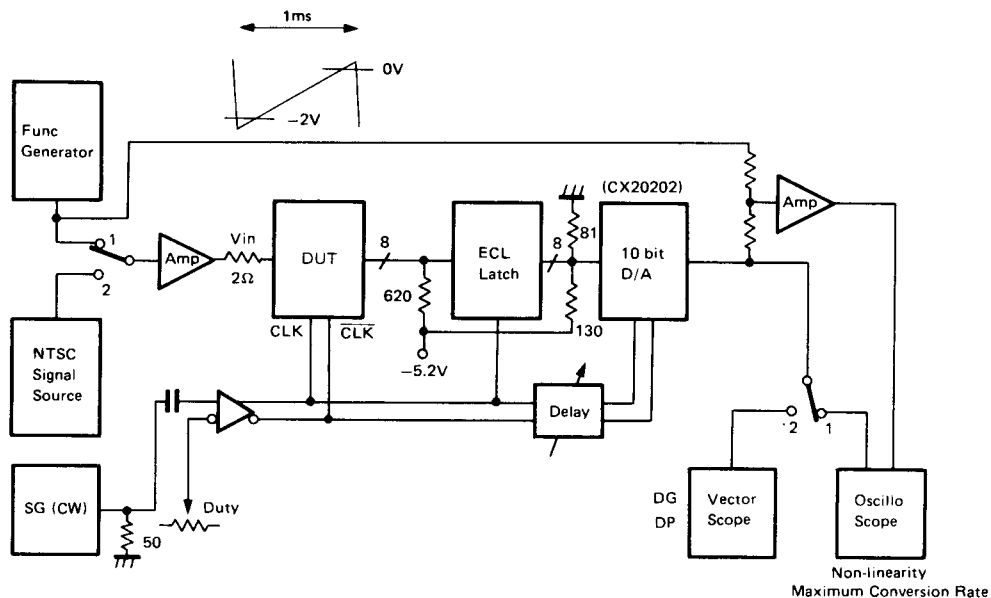
Without a buffer amplifier driving A/D input

Electrical Characteristics Test Circuit

Maximum Conversion Frequency Test Circuit

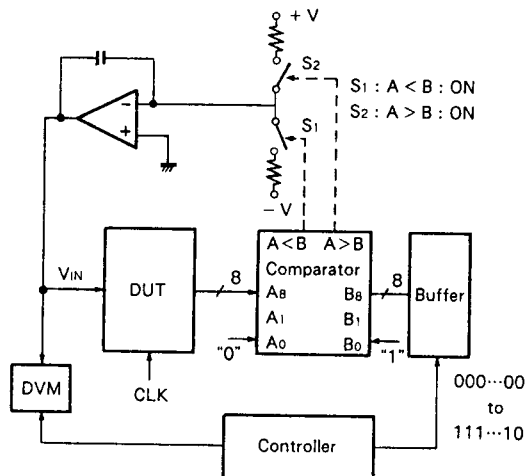
Differential Gain Error Test Circuit

Differential Phase Error Test Circuit



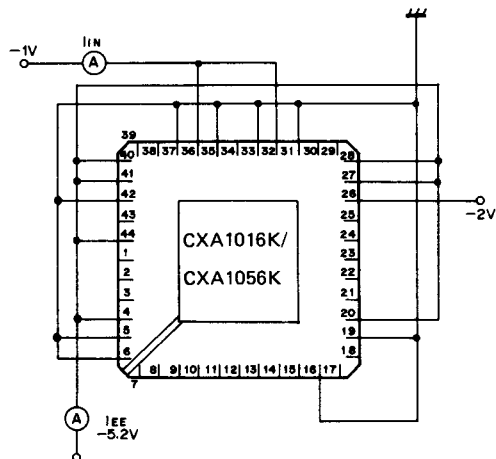
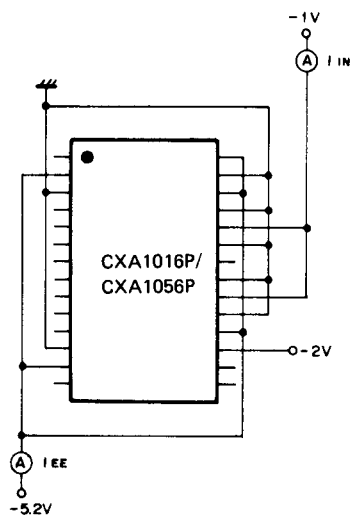
Differential Non-linearity Test Circuit

Integral Non-linearity Test Circuit

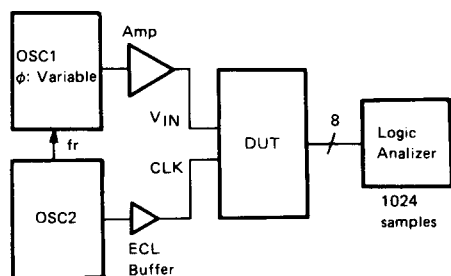


Power Supply Current Test Circuit

Analog Input Bias Current Test Circuit



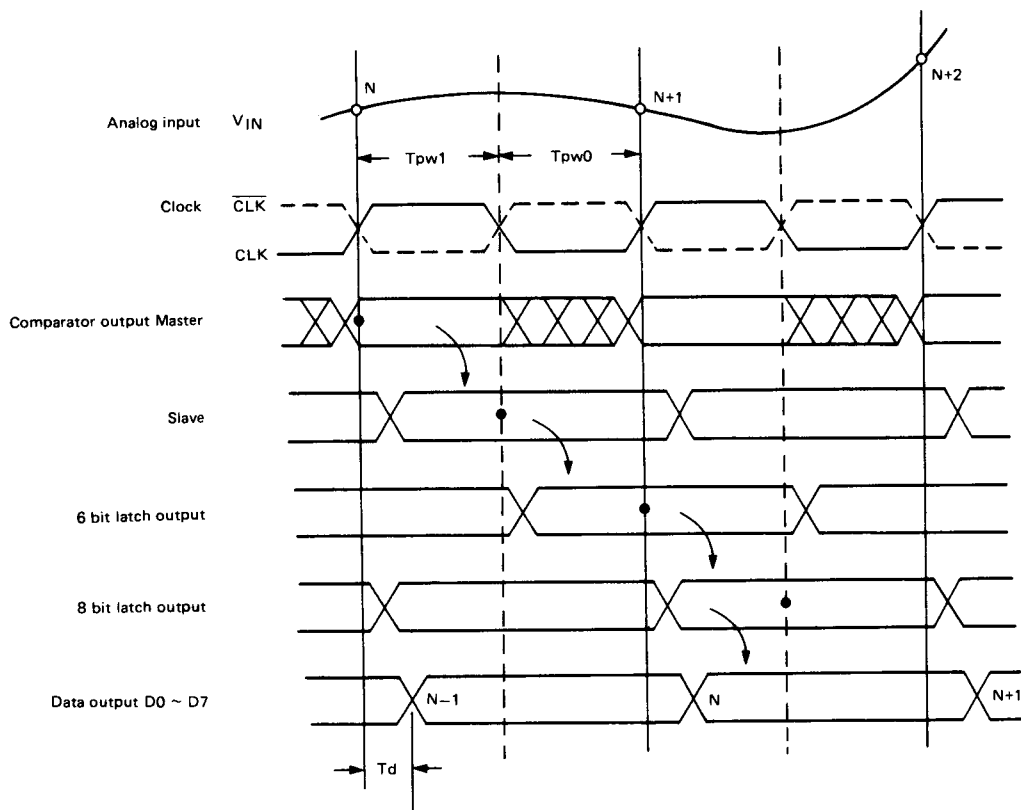
Aperture Jitter Test Circuit



Description of Function (See the block diagram and timing chart.)

1. The reference voltage, which is obtained by dividing equally the voltage across V_{RT} to V_{RB} into 256 by the reference resistor ladder, is applied to the respective $\oplus$ (positive) input sides of 256 clocked comparators. An analog input is applied to the $\ominus$ (negative) input sides of all the 256 clocked comparators from the V_{IN} pin.
2. When the state of CLK is in Low, the master (front stage) of the comparator compares the respective reference voltage and the analog input voltage which is ever-changing.
3. When the CLK moves from Low into Hi, each master latches the state immediately prior to the above simultaneously, and as a result, it provides conditions of "11 1100 . . 0" in sequence from the V_{RT} side to the V_{RB} side.
4. The output of the master is ANDed between the respective adjacent outputs, and "1" stands only when neighboring 2 outputs become "10", and the all other outputs become "0".
5. The result of the AND is latched when CLK moves from Hi into Low. Output of the slave is divided into 4 blocks and each block has 32 clocked comparators, and they are coded into binary codes of 6 bits respectively by the transistor matrix circuit.
6. The 6 bit codes are further coded into 8 bit codes by the transistor matrix circuit after they are respectively latched, and they are then output into the ECL level by the output buffer after being 8 bit latched. The output data is delayed 1 clock from the data sampling point and appears at the output pin.
7. Two polarity inversion inputs such as MINV and LINV are fed externally to the output buffer, and each of them selects output polarity of MSB and other polarity than MSB respectively.

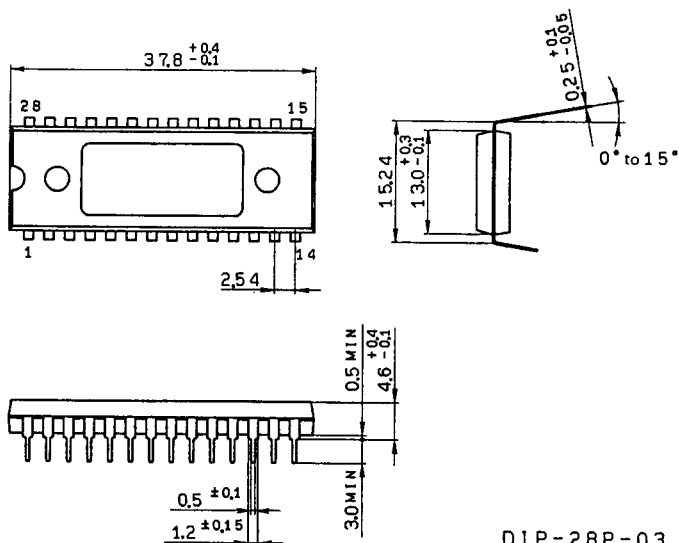
Timing Chart



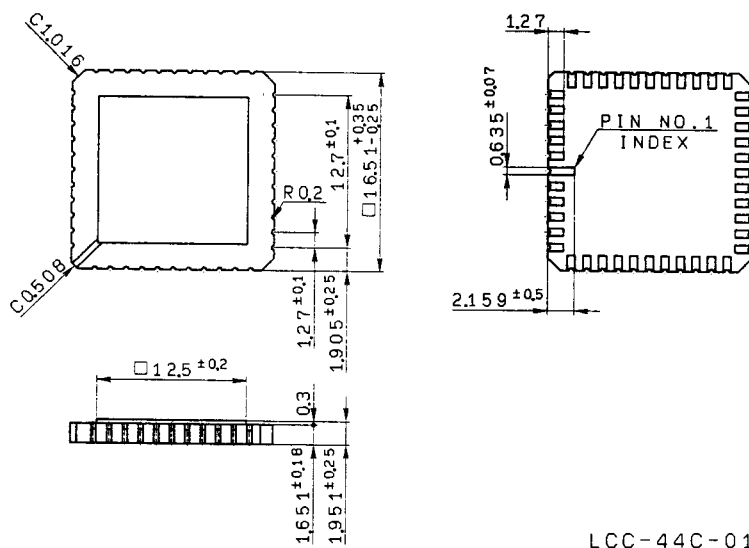
*See page 54 for T_{pw1} and T_{pw0} .

Package Outline Unit: mm

CXA1016P/CXA1056P 28 pin DIP (Plastic)



CXA1016K/CXA1056K 44 pin LCC (Ceramic)



Sony Package Product Name

T-90-20

Type	Package name		Package	Features			
	Symbol	Description		Material*	Lead pitch	Lead shape	Lead pull out direction
Inserted	Standard	DIP	DUAL IN LINE PACKAGE	P C	2.54mm (100MIL)	Through Hole Lead	2-direction
		SIP	SINGLE IN LINE PACKAGE	P	2.54mm (100MIL)	Through Hole Lead	1-direction
		ZIP	ZIG ZAG IN LINE PACKAGE	P	2.54mm (100MIL) Zig Zag inline	Through Hole Lead	1-direction
		PGA	PIN GRID ARRAY	C	2.54mm (100MIL)	Through Hole Lead	4-direction
		PIGGY BACK	PIGGY BACK	C	2.54mm (100MIL)	Through Hole Lead	2-direction
	Shrink	SDIP	SHRINK DUAL IN LINE PACKAGE	P	1.778mm (70MIL)	Through Hole Lead	2-direction
Surface mounted	Standard flat package	QFP	QUAD FLAT PACKAGE	P	1.0mm 0.8mm	Gull-Wing	4-direction
		SOP	SMALL OUTLINE PACKAGE	P	1.27mm (50MIL)	Gull-Wing	2-direction
	Shrink flat package	VQFP	VERY SMALL QUAD FLAT PACKAGE	P	0.5mm	Gull-Wing	4-direction
		VSOP	VERY SMALL OUTLINE PACKAGE	P	0.65mm	Gull Wing	2-direction
	Standard chip carrier	PLCC	PLASTIC LEADED CHIP CARRIER	P	1.27mm (50MIL)	J-bend	4-direction
		LCC	LEAD LESS CHIP CARRIER	C	1.27mm (50MIL)	Lead less	Package side
	Shrink chip carrier	SPLCC (PLCC)	SHRINK PLASTIC LEADED CHIP CARRIER	P	1.27mm Max. (50MIL Max.)	J-bend	4-direction
	Standard 2-direction chip carrier	SOJ	SMALL OUTLINE J-LEAD PACKAGE	P	1.27mm (50MIL)	J-bend	2-direction

*P.....Plastic, C.....Ceramic