

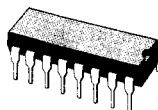


PCM LINE TRANSCEIVER

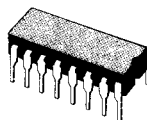
- NMOS TECHNOLOGY
- OPERATES FROM + 5 V SUPPLY
- DIGITAL TECHNOLOGY THROUGHOUT
- EXTRACTS DISTANT CLOCK TRANSMITTED BY A PCM TRUNK
- CAN HANDLE PEAK TO PEAK JITTER AMPLITUDE UP TO 0.25 BIT FOR AN 8-BIT PERIOD
- INTEGRATED TRANSMIT AND RECEIVE AMPLIFIERS
- TTL-COMPATIBLE INPUT/OUTPUT

DESCRIPTION

The EF73321 provides the interface between a 2.048 or 1.544 Mbits/s PCM trunk and the switching equipment. The receiving side amplifies and reshapes the bipolar signals from a receive transformer and extracts from the signals the distant clock HD. On the transmitting side it calibrates pulses in terms of duration and amplitude by means of transistor circuits directly coupled to a transmit transformer.



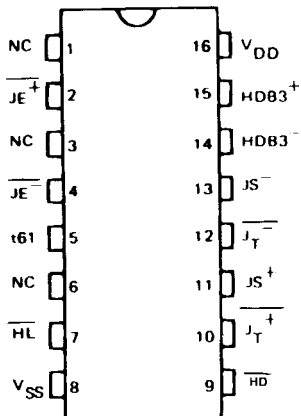
DIP16
Plastic



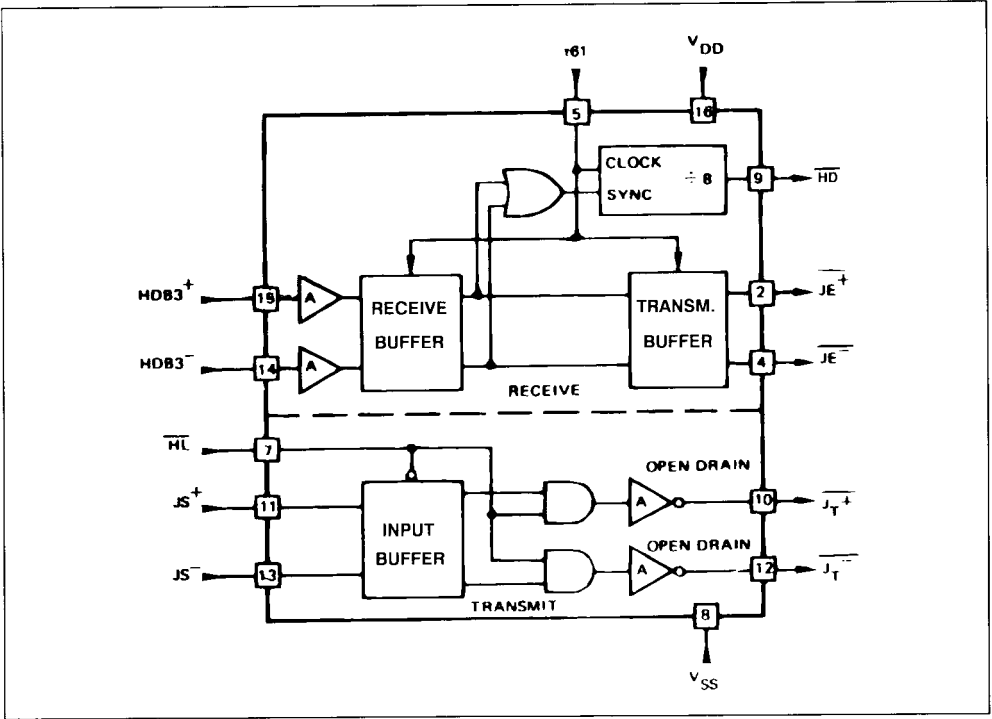
DIP16
Ceramic

ORDER CODE : EF73321P
EF73321C

PIN CONNECTIONS



BLOCK DIAGRAM



PIN DESCRIPTION

POWER SUPPLY

N°	Name	Type	Function	Description
8	V _{SS}	S	Supply	Ground
16	V _{DD}	S		+ 5 V ± 5 %

RECEIVE

N°	Name	Type	Function	Description
5	t61	I	–	16384 kHz or 12352 kHz Clock. Synchronises outputs JE+, JE– and HD.
15 14	HDB3+ HDB3–	I I	Data Input	Bipolar signals in HDB3 code received from the receive transformer. The amplitude of these signals is between – 5 V and + 5 V. Each positive pulse on HDB3+ (HDB3–) resynchronises the circuit clock and is reconstituted in calibrated form on output JE+ (JE–). Negative pulses have no effect on the circuit as the inputs are protected.
2 4	JE+ JE–	O O	Data Output	Received HDB3 signals are resynchronised with HD and calibrated in terms of amplitude (TTL compatible levels).
9	HD	O	Distant Clock Output	The distant clock recovered from the signal on HDB3+, HDB3–. The nominal frequency is 2048 kHz or 1544 kHz in the absence of jitter.

TRANSMIT

N°	Name	Type	Function	Description
7	HL	I	Clock	Local clock, nominal frequency 2048 kHz or 1544 kHz.
11 13	JS+ JS–	I I	Data Input	The data is recognised on the falling edge of HL.
10 12	JT+ JT–	O O	Data Output	These open drain outputs are connected to the windings of the transmit transformer. Recognition of a "1" on JS+ (JS–) grounds the winding of the transformer connected to JT+ (JT–) for the duration of "1" level of HL. These outputs are protected against short-circuits by current limiting internal to the circuit.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DD}	Supply Voltage	$-0.3\text{ V} \leq V_{DD} \leq 7\text{ V}$	V
V _i	Input Voltage Range (except inputs HDB3 + and HDB3 –)	$-0.3\text{ V} \leq V_i \leq V_{DD} + 0.3\text{ V}$	V
P	Maximum Power	P _{max} = 250 mW in 0 °C to 70 °C Range	mW
T _{sig}	Storage Temperature Range	$-55\text{ °C to }+150\text{ °C}$	°C

FUNCTIONAL DESCRIPTION

RECEIVE PATH

The PCM Line Transceiver receives directly from the receive transformer on inputs HDB3 + and HDB3- data in HDB3 code. It synchronizes this data by means of the clock on input t61 and converts it to voltage pulses of calibrated duration on outputs $\overline{JE+}$ and $\overline{JE-}$. To be recognized correctly by this circuit the received data must satisfy minimum and maximum duration conditions (Refer to timing diagrams).

Distant clock HD is provided by a counter which divides by 8 the frequency of the clock t61. This counter is resynchronized with the data of the PCM trunk on each positive-going edge at HDB3+ or HDB3-. The period of HD may vary by 0.25 bit within a period of 8 bits without degradation of the phase relationships between $\overline{JE+}$, $\overline{JE-}$ and HD (Cf. fig.1). If the variation occurs in an interval exceeding 4 bits but

less than 8 bits the phase relationships between $\overline{JE+}$, $\overline{JE-}$ and HD are modified (Cf. fig. 2 and fig. 3).

In all cases outputs $\overline{JE+}$ and $\overline{JE-}$ remain stable on either side of the falling edge of HL so as to be sampled correctly by the EF7333.

TRANSMIT PATH

The signals JS+ and JS- to transmit are sampled on the falling edge of clock signal HL and calibrated by the duration for which this signal is high.

Open drain outputs $\overline{JT+}$ and $\overline{JT-}$ drive the primary windings of the transmit transformer directly. They are protected against overcurrents occurring should the secondary windings of this transformer be short-circuited, in which case the primary behaves as a very low resistance connecting the output to supply rail V_{DD} .

RECEIVE TIMING DIAGRAM

Figure 1 : External Signals with Jitter < 0.25 Bit within 8-Bit Period.

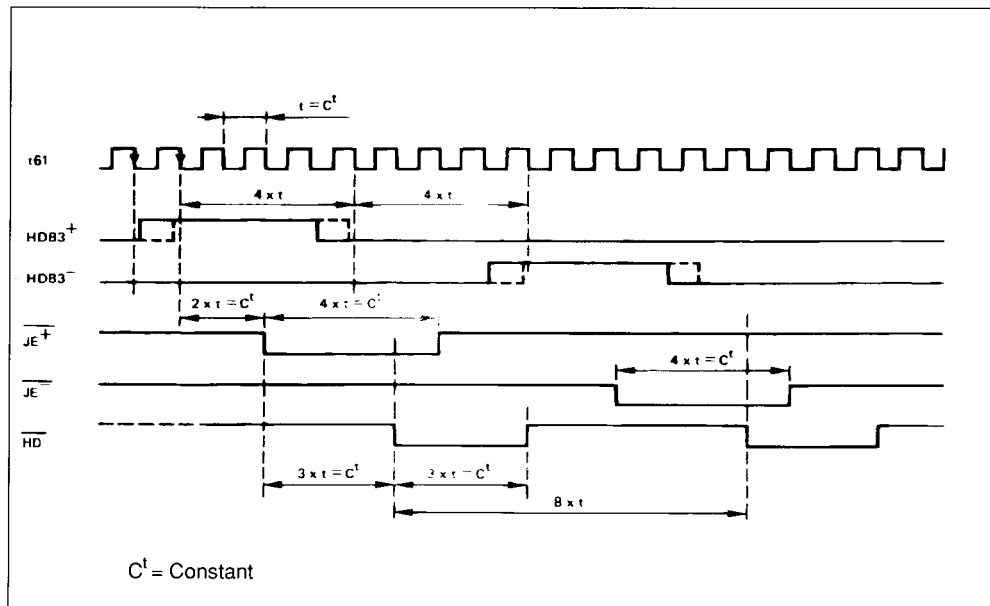


Figure 2 : External Signals with HDB3⁺ and HDB3⁻ Signal Period $6 \times t$.

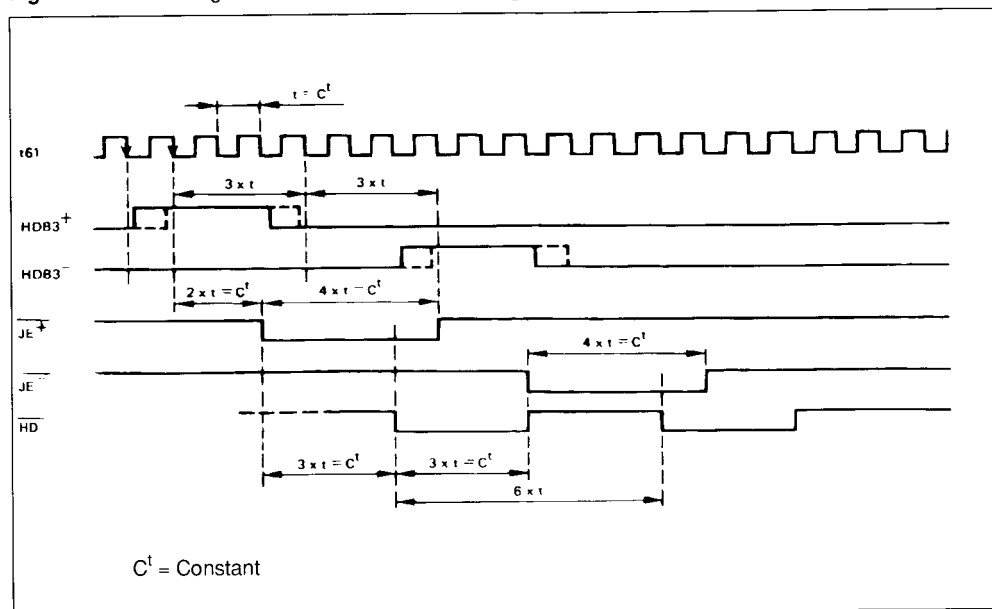
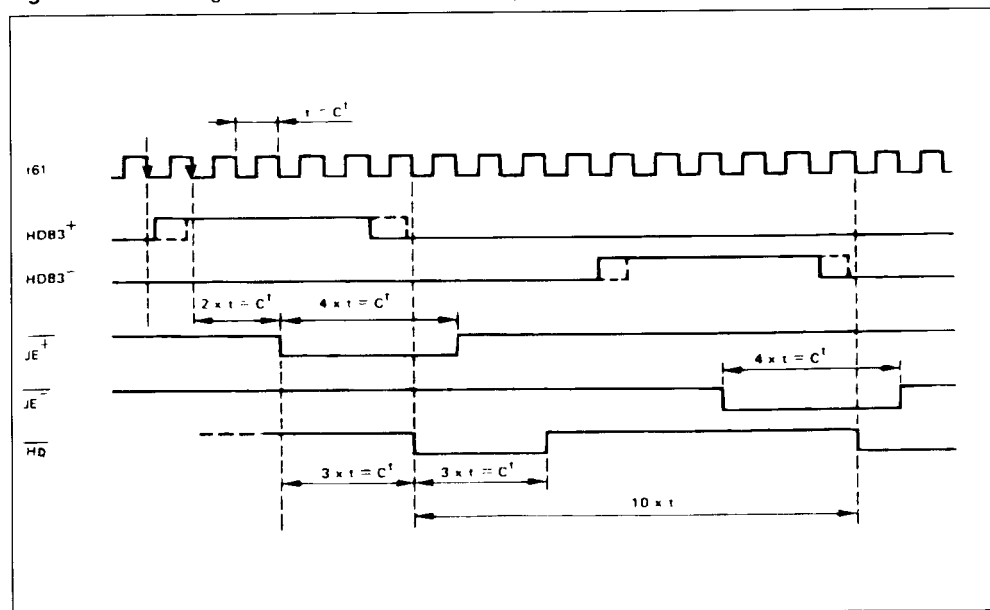


Figure 3 : External Signals with HDB3⁺ and HDB3⁻ Signal Period $10 \times t$.



TRANSMIT

Figure 4 .

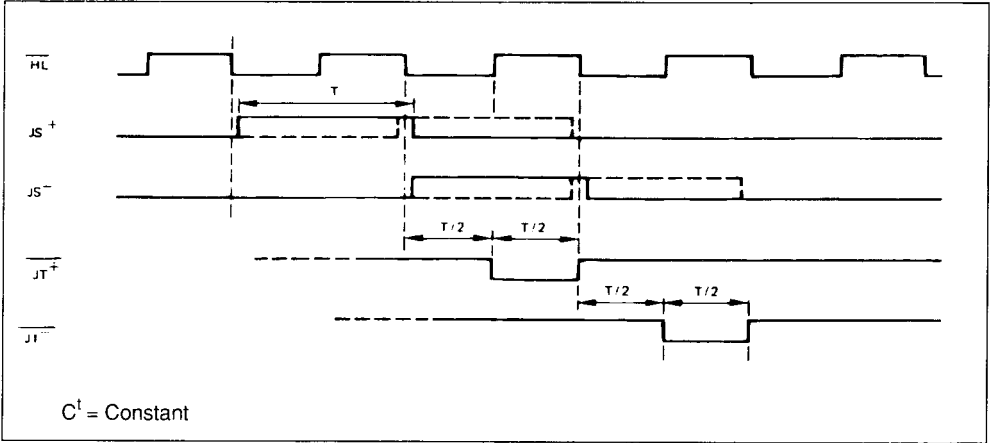
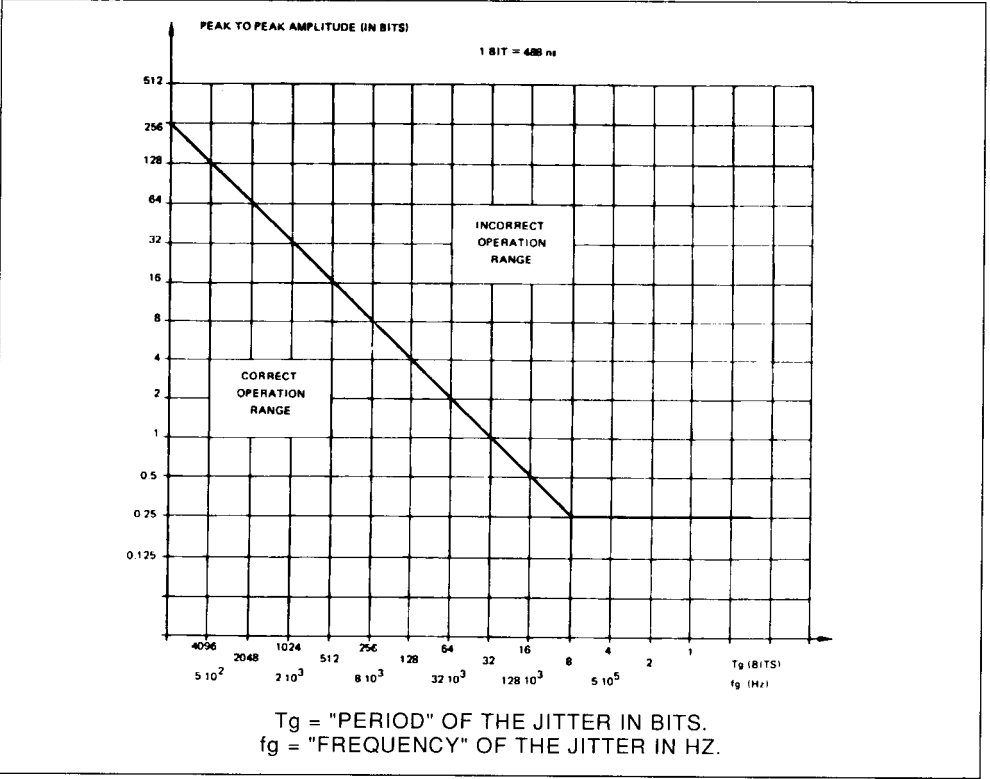


Figure 5 : EF73321 Operating Range as a Function of Jitter Period and Frequency.

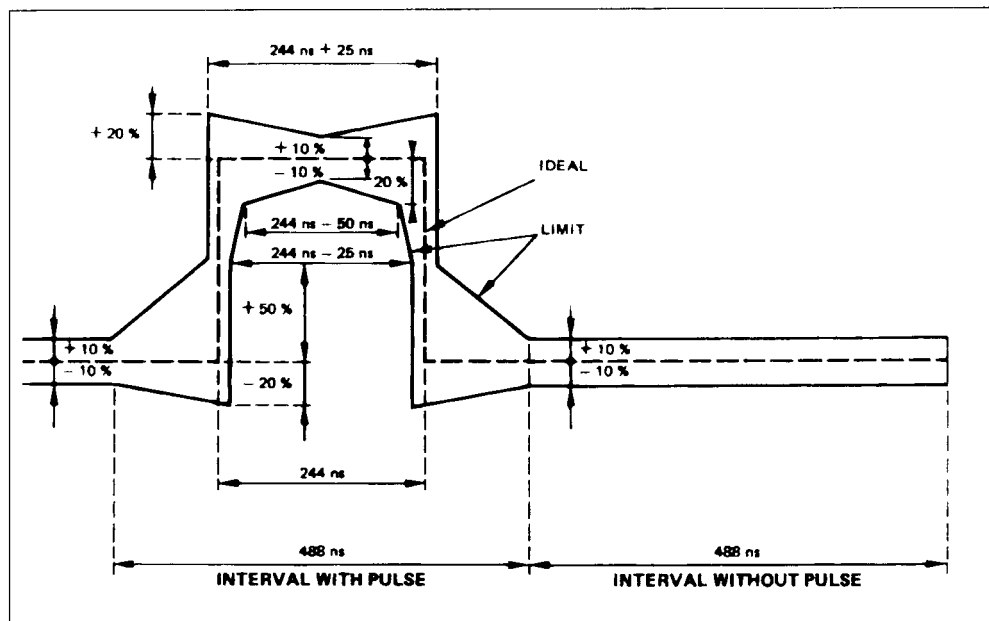


TRANSMIT PATH

Pulse limiting curves for 2 048 kbit/s CEPT PCM trunk.

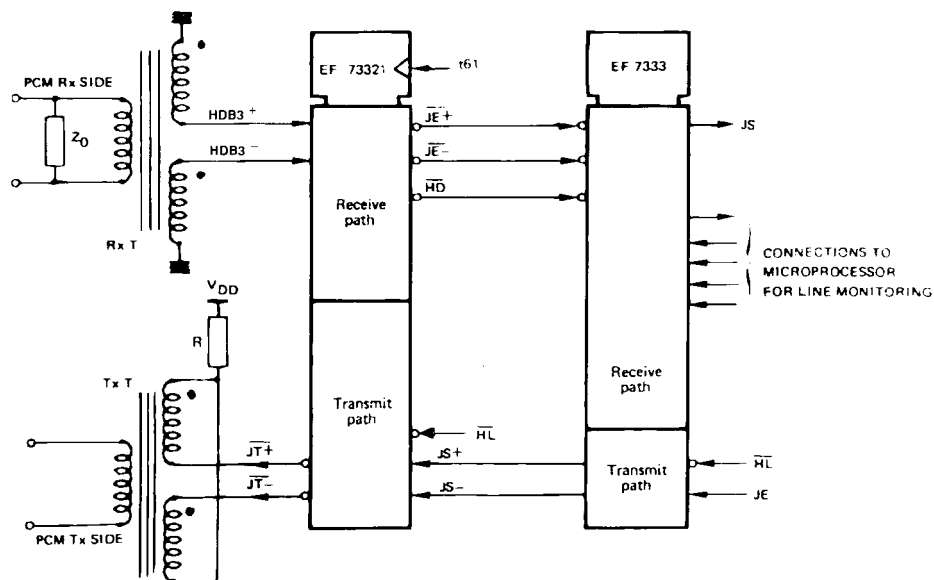
The limiting curves below are for a resistive load of $120\ \Omega$ connected across the secondary winding of the transmit transformer.

Figure 6 .



TYPICAL APPLICATION

Using EF7333 and EF73321 in a 2048 kHz PCM line for Data transmission/reception and frame monitoring.



t61 : 16384 Khz CLOCK

Rx T : LINE RECEIVE TRANSFORMER

Tx T : LINE TRANSMIT TRANSFORMER

HL : LOCAL 2048 Khz CLOCK

Note : EF73321 layout considerations : for correct operation of transmission drivers a 100 nF decoupling capacitor must be connected between VDD and VSS and located as close as possible to the supply pins.

STATIC ELECTRICAL CHARACTERISTICS

Ambient Temperature Range : 0 °C to + 70 °C - Typical Values at + 25 °C

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{DD}	Positive Power Supply	4.75	5	5.25	V
I_{DD}	Supply Current	—	20	40	mA
	Stray Capacitance between one Input and Ground (outputs loaded with $C_L = 25$ pF)	—	5	10	pF

INPUTS

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Voltage at Input HDB3+ / HDB3- When Low When High	- 5 2.2	— —	0.6 5	V V
	Resistance at Input HDB3+ / HDB3- (inverse voltage $V_I = - 5$ V)	—	10	—	k Ω
	Voltage at input JS+ / JS- / HL When Low When High	- 0.3 2.2	— —	0.6 V_{DD}	V V
	Voltage at Input t61 When Low When High	0 2.6	— —	0.6 V_{DD}	V V

OUTPUTS

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Voltage at Output HD / JE+ / JE- When Low ($I_{OL} = 0.4$ mA) When High ($I_{OH} = - 40$ μ A)	0 2.6	— —	0.4 V_{DD}	V V
	Voltage at Output $\overline{JT+} / \overline{JT-}$ when Low ($R_L = 175$ Ω to V_{DD})	250	450	750	mV
	Current at Output $\overline{JT+} / \overline{JT-}$ when High Impedance ($V_{OH} = 12$ V)	—	—	100	μ A
	Current at Output $\overline{JT+} / \overline{JT-}$ (output current protection)	—	—	35	mA

DYNAMIC CHARACTERISTICSTypical values at + 25 °C (0 °C < T_A < + 70 °C).**CLOCKS**

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Clock t61 (fig. 8)	—	12352	—	kHz
t_{PL}	when Low	—	16384	16500	kHz
t_{PH}	when High	20	—	—	ns
	Clock HL (fig. 10)	—	1544	—	kHz
t_{THL}	Fall Time	—	2048	2200	kHz
t_{TLH}	Rise Time	—	—	30	ns
		—	—	30	ns

INPUTS

Symbol	Parameter	Min.	Typ.	Max.	Unit
t_H t_L	Inputs HDB3+/HDB3- (fig. 9) Min. Pulse Duration Max. Pulse Duration	t		$4 \times t$	ns
t_{set-up} t_{hold}	Inputs JS+/JS- (fig. 10) Set up Time Hold Time	20 30			ns

OUTPUTS

Symbol	Parameter	Min.	Typ.	Max.	Unit
t_{set-up} t_{hold} t_{THL} t_{TLH}	Outputs $\overline{JE+}/\overline{JE-}$ Relative to \overline{Hd} ($C_L = 25 \text{ pF}$, fig. 11) Set up Time Hold Time Fall Time Rise Time	150 30	$3 \times t$ t 15 20		ns
t_{WM}	Outputs $\overline{JT+}/\overline{JT-}$ ($R_L = 175 \Omega = \text{to } V_{DD}$, fig. 12) Pulse Duration ($C_L = 25 \text{ pF}$) $\overline{HL} = 2048 \text{ kHz}$	219	244	269	ns

Figure 8.

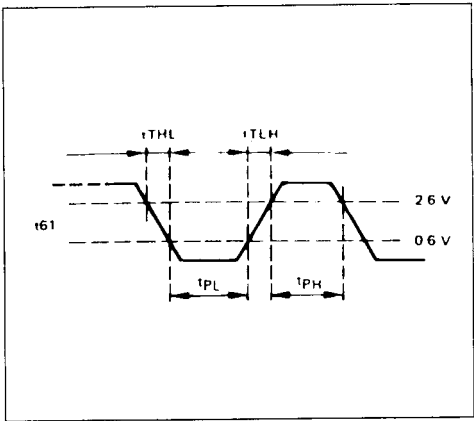


Figure 9.

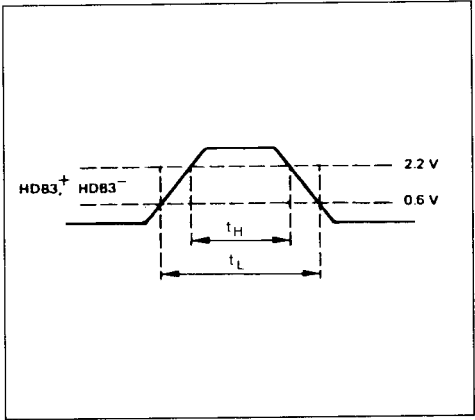


Figure 10.

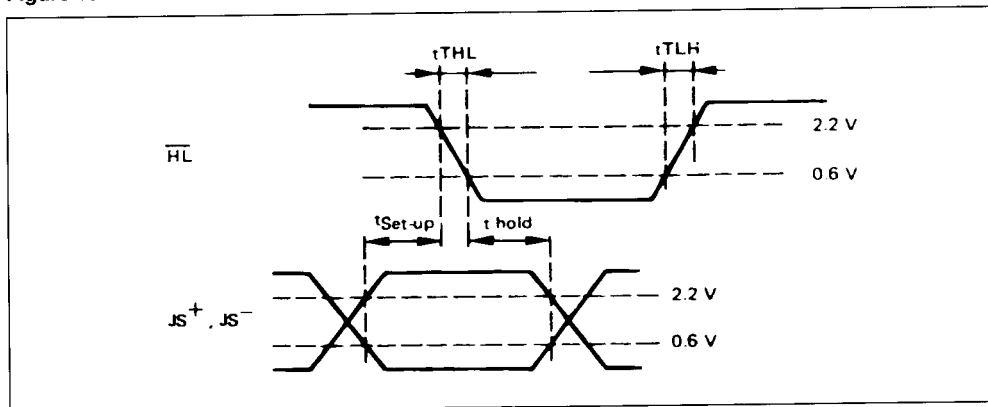


Figure 11.

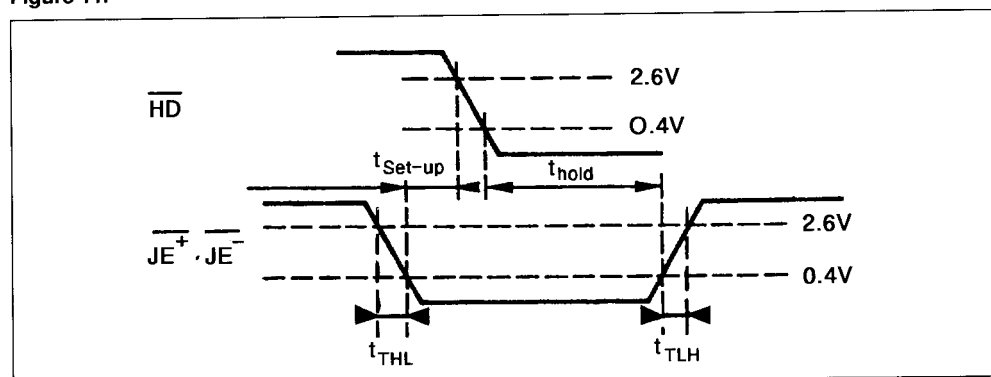
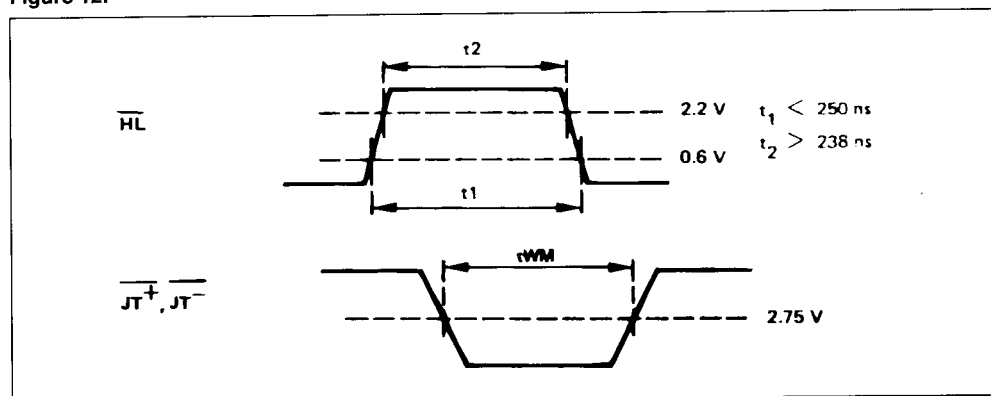


Figure 12.

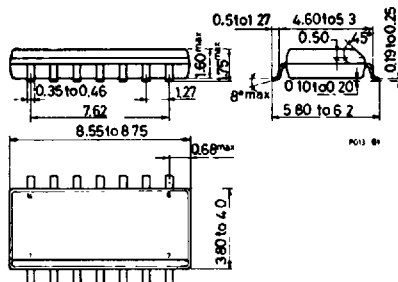
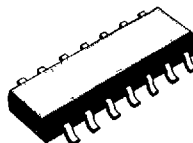
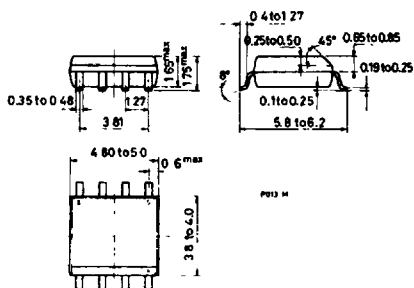
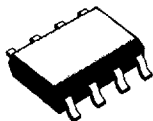
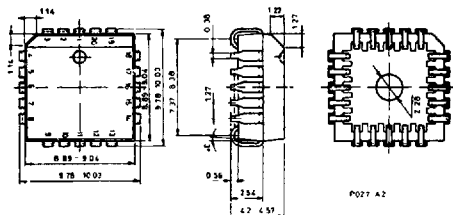
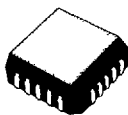
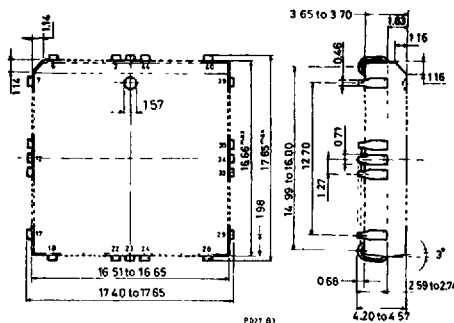
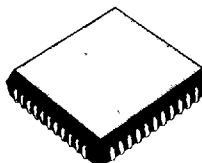


SO-8J

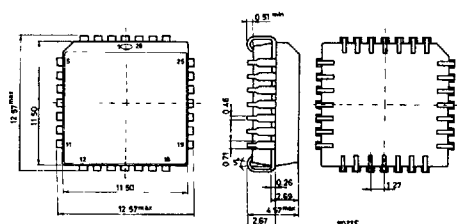
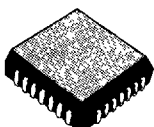
SO-14J

T-90-20

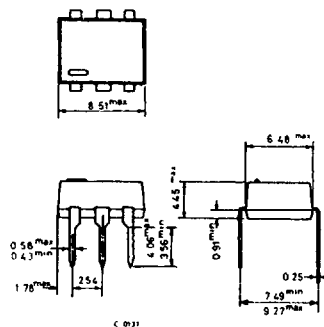
S G S-THOMSON

**PLCC20****PLCC44**

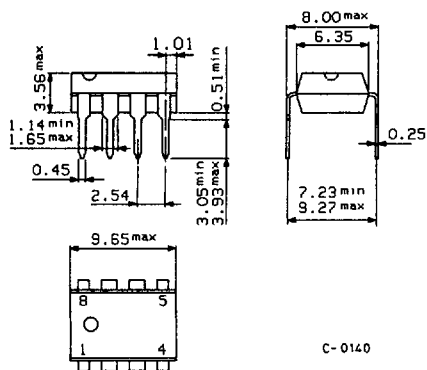
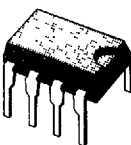
PLCC-28 Plastic Chip Carrier



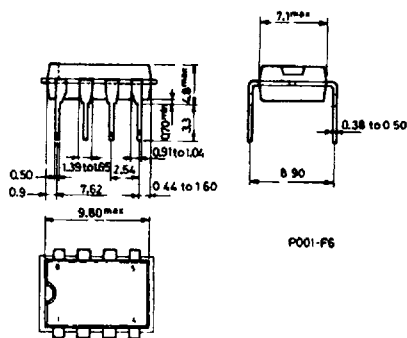
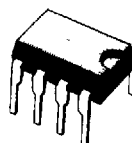
DIP-6



Minidip A Plastic

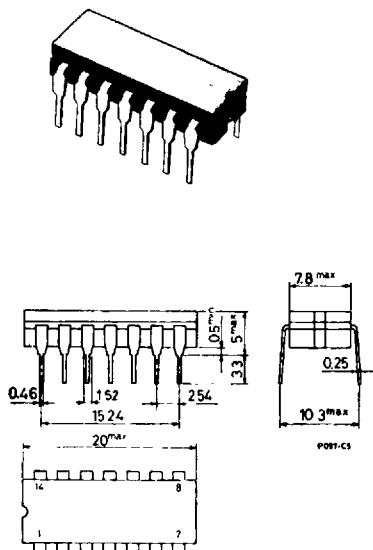


8 lead Plastic Minidip

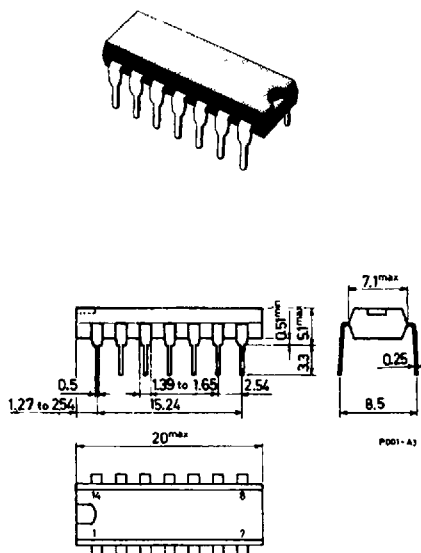


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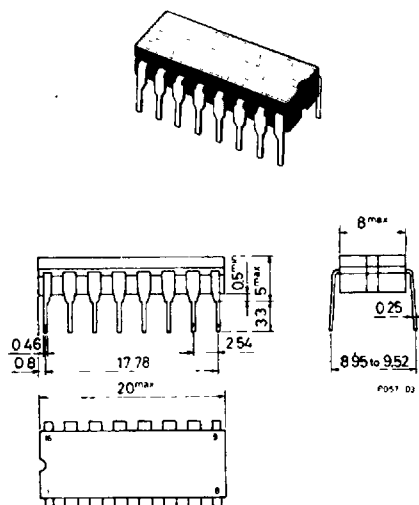
14 lead Ceramic Dip



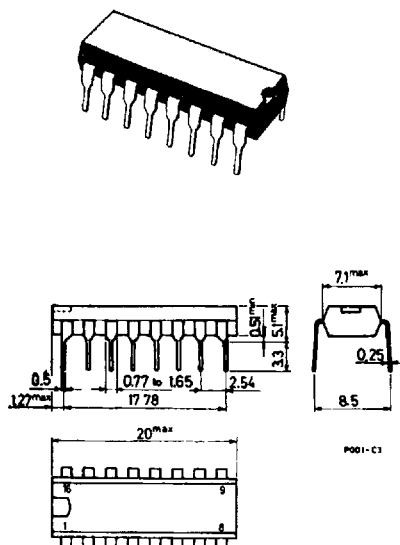
14 lead Plastic Dip



16 lead Ceramic Dip



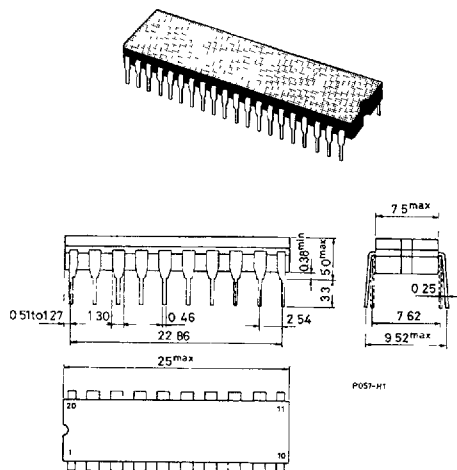
16 lead Plastic Dip (0.25)



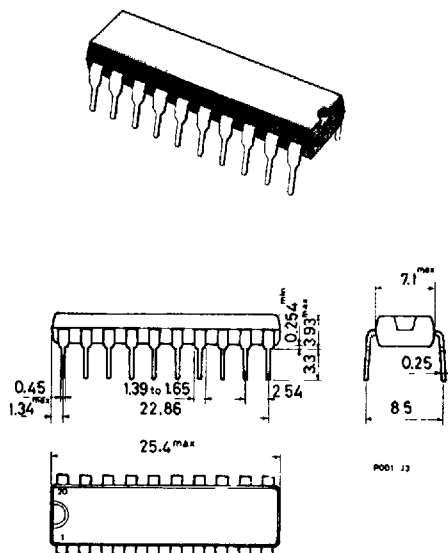
PACKAGES

S G S-THOMSON

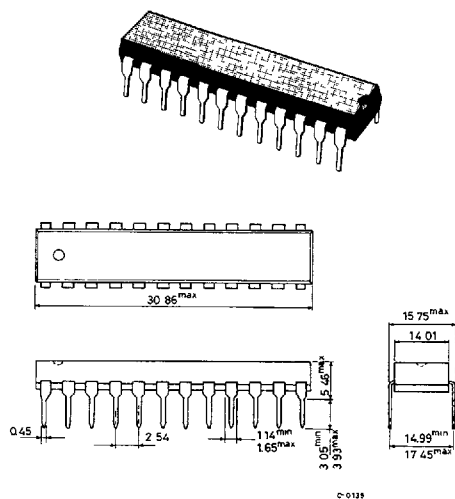
DIP-20 Ceramic



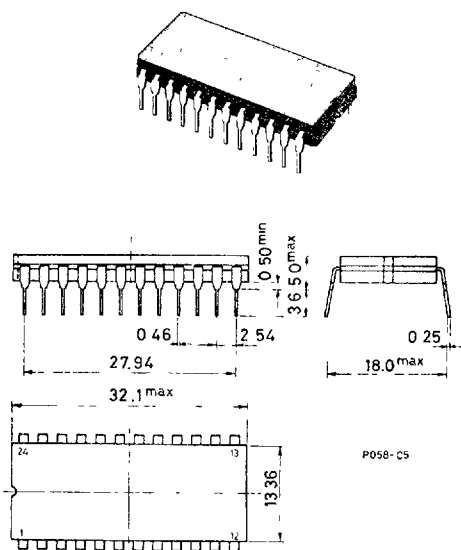
20 lead Plastic Dip (0.25)



DIP-24 Plastic

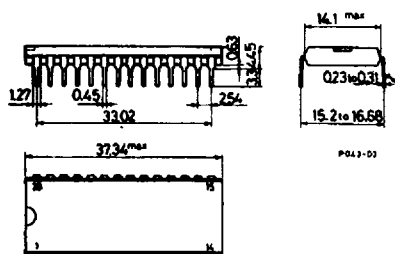
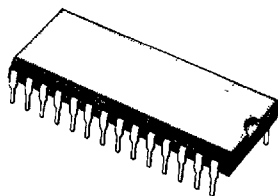


DIP-24 Ceramic (0.25)

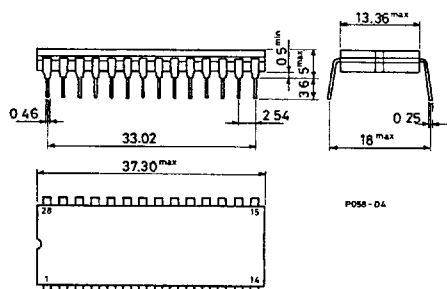
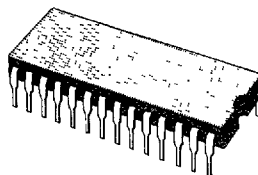


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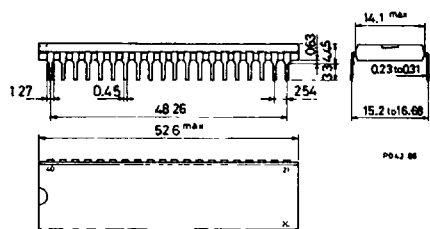
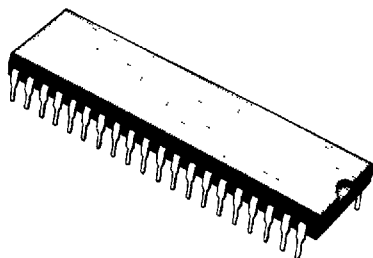
28 lead Plastic Dip



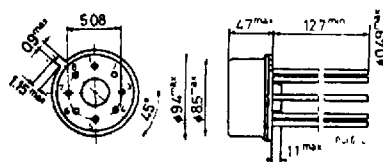
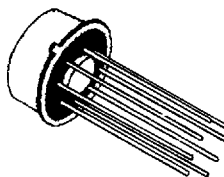
DIP-28 Ceramic (0.25)



40 lead Plastic Dip



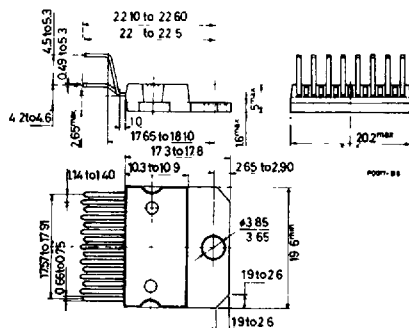
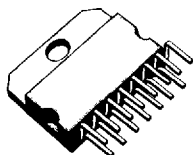
TO-99



PACKAGES

S G S-THOMSON

MULTIWATT-15



FLEXIWATT-15

