HT6P20B2T3/D2T3/F2T3
2^{24} Encoder with ASK Transmitter

Features

- Complete UHF transmitter
- Frequency range 300MHz to 450MHz
- ASK modulation
- Output Power to 10dBm
- Low external part count
- Low voltage operation (down to 2.0V)
- 2^{24} maximum address and data codes
- Data active: D0~D4

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Security systems
- Cordless telephones
- Other remote control systems

General Description

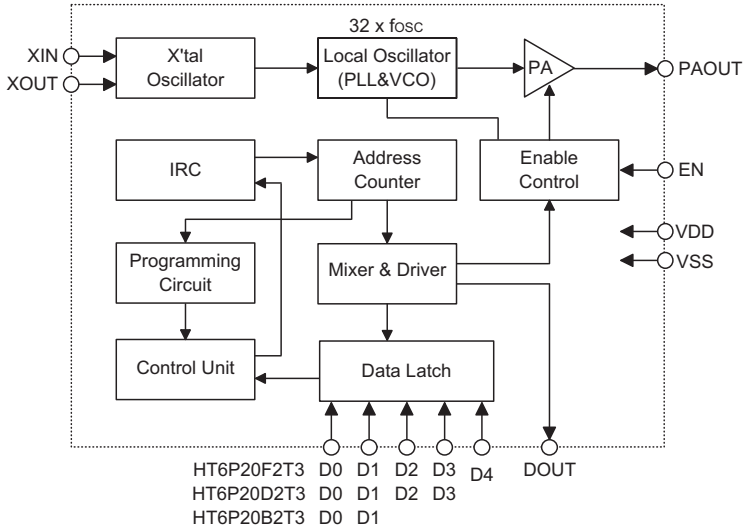
The HT6P20x2T3 is a CMOS LSI encoder designed for remote control system applications. It encodes 24 bits of information and then serially transmits it via the PAOUT pin upon receipt of transmission enable (DATA pins: D0~D4) signals. In addition, the device offers various packaging for flexible combination of address/data so as to meet the needs of various applications. Its address/data is transmitted together with the anti-code bits using an RF transmission medium upon receipt of a trigger signal.

The device is a high performance, easy to use, single chip ASK Transmitter IC for remote wireless applications in the 300 to 450MHz frequency band. This transmitter IC is a true ″data-in, antenna-out″ monolithic device and offers high performance in terms of power delivery and operating temperature. Regarding power, the device is capable of delivering up to 10 dBm into a 50Ω load, which enables a small form factor transmitter to operate near the maximum limit of transmission regulations. As for temperature, the device can operate from –40°C to 85°C whose range is wider than SAW operation range. Being easy to use, the device only needs a reference frequency (RF carrier frequency divided by 32 times) generated from a crystal with a few additional external parts to create a complete versatile transmitter. The device operates with ASK/OOK (Amplitude Shift Keying/On-Off Keyed) UHF receiver types from wide-band super-regenerative radios to narrow-band, high performance super-heterodyne receivers.

Selection Table

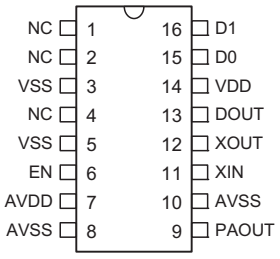
Part No.	VDD	Addr. No.	Data No.	Trig.	Frequency Band	RF Type	Package
HT6P20B2T3	2.0V~3.6V	22	2	Data	300MHz~450MHz	ASK TX	16NSOP
HT6P20D2T3	2.0V~3.6V	20	4	Data	300MHz~450MHz	ASK TX	16NSOP
HT6P20F2T3	2.0V~3.6V	19	5	Data	300MHz~450MHz	ASK TX	16NSOP

Block Diagram

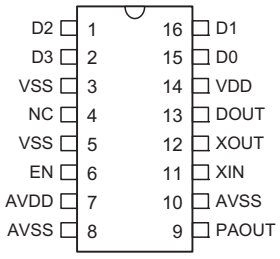


Note: Address/Data setups are available in various combinations, for details refer to the functional description.

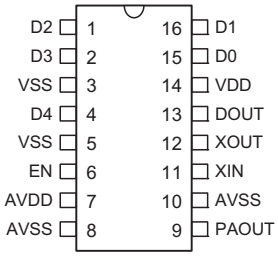
Pin Assignment



HT6P20B2T3
16 NSOP-A



HT6P20D2T3
16 NSOP-B

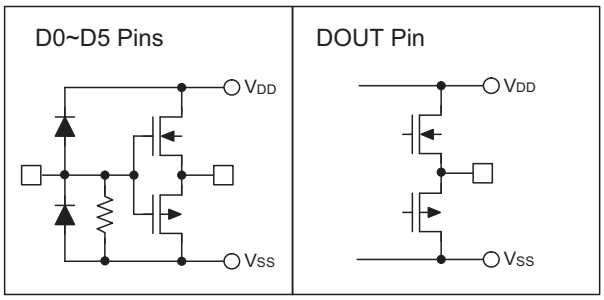


HT6P20F2T3
16 NSOP-C

Pin Description

Pin Name	I/O	Internal Connection	Description
NC	—	—	No connection for HT6P20B2T3/HT6P20D2T3
D0~D1	I	CMOS in Pull-high	Data input and transmission enable - active low. Can be externally set to VSS or left open.
D2~D3	I	CMOS in Pull-high	Data input and transmission enable - active low. Can be externally set to VSS or left open for the HT6P20D2T3.
D4	I	CMOS in Pull-high	Data input and transmission enable - active low. Can be externally set to VSS or left open for the HT6P20F2T3.
EN	I	RF enable pin	RF enable - active high; When set low, the RF is enabled by the data input.
VDD	—	—	Positive power supply
AVDD	—	—	RF positive power supply
VSS	—	—	Negative power supply, ground
AVSS	—	—	RF negative power supply, ground
PAOUT	O	Power amplify output	L/C matching circuit
XIN	O	Crystal Fs input	Crystal value is 9.84375MHz at 315MHz and 13.56MHz at 433.92MHz
XOUT	I	Crystal Fs output	
DOUT	O	CMOS OUT	Data serial transmission output

Approximate Internal Connection Circuits



Absolute Maximum Ratings

Supply Voltage ..... V_{SS}−0.3V to V_{SS}+3.6V
Storage Temperature ..... −50°C to 125°C
Input Voltage ..... V_{SS}−0.3V to V_{DD}+0.3V
Operating Temperature ..... −40°C to 85°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Electrical Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operating Voltage	—	—	2	—	3.6	V
V_{IH}	"H" Input Voltage	—	—	$0.8V_{DD}$	—	V_{DD}	V
V_{IL}	"L" Input Voltage	—	—	0	—	$0.2V_{DD}$	V
t_{DW}	Bit Time Width	3.0V	—	—	1.2	—	ms

Ta=25°C, Freq. X'tal OSC=13.560MHz, EN=VDD. Bold values indicate –20°C to +70°C unless otherwise noted. 1kbps data rate 50% duty cycle. RL 50Ω load (matched).

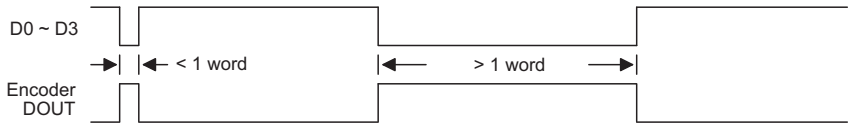
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
I_I	Data High Current	3V	@315MHz, POUT=+10dBm, @433.92MHz	—	12.5	—	mA
I_O	Data Low Current	3V	@315MHz, 433.92MHz	—	3.0	—	mA
I_{STB}	EN Low & DIN Low Current	3V		—	1	—	μA
RF and Crystal							
	Output Power Level	3.5V	@315MHz	—	9	—	dBm
			@433.92MHz	—	9	—	dBm
	Harmonics Output for 315MHz	3V	@630MHz, 2nd harm	—	–48	—	dBc
			@945MHz, 3rd harm	—	–60	—	dBc
	Harmonics Output for 433.92MHz	3V	@867.84MHz, 2nd harm	—	–45	—	dBc
			@1301.76MHz, 3rd harm	—	–55	—	dBc
	Extinction Ratio for ASK 10Kbps	3V	—	—	70	—	dBc
	Data Rate	3V	—	10	—	—	kbps
	Occupied Bandwidth	3V	@315MHz	—	<700	—	kHz
			@433.92MHz	—	<1000	—	kHz
	315MHz Single Side Band Phase Noise	3V	@100kHz from Carrier	—	–78	—	dBc/Hz
			@1000kHz from Carrier	—	–77	—	dBc/Hz
	433.92MHz Single Side Band Phase Noise	3V	@100kHz from Carrier	—	–78	—	dBc/Hz
			@1000kHz from Carrier	—	–76	—	dBc/Hz
	XTLIN, XTLOUT	3V	Pin capacitance	—	2	—	pF
	External Capacitance	3V	See application circuit C3, C4 @315MHz @433.92MHz	—	 15 18	—	pF
	Output Blanking	3V	Standby transition from low to high	—	500	—	μs

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
	ASK to RF Out Response Time	3V	Delta between ASK input transition from Low To High to RF output transition from low to high	—	1	—	μs
	CREF Clock Output Frequency	3V	@315MHz (f_{osc}=9.84MHz)	—	150	—	Hz
			@433.92MHz (f_{osc}=13.56MHz)	—	207	—	Hz

Functional Description

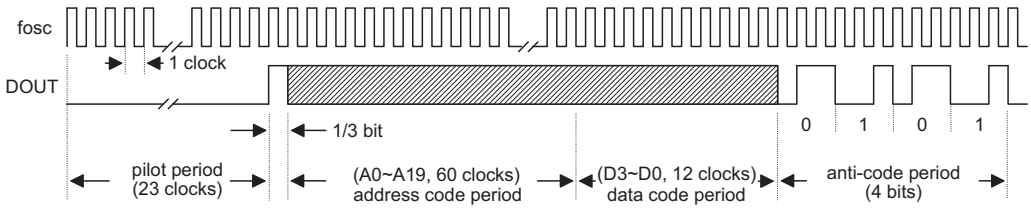
Normal Operation

The devices encode and transmits address/data to a decoder upon receipt of a trigger signal. The address codes of the device are always transmitted as long as power (VDD) is supplied. The transmission function of the device is enabled by the D0~D1 pins (active low). The following diagram shows the transmission timing:



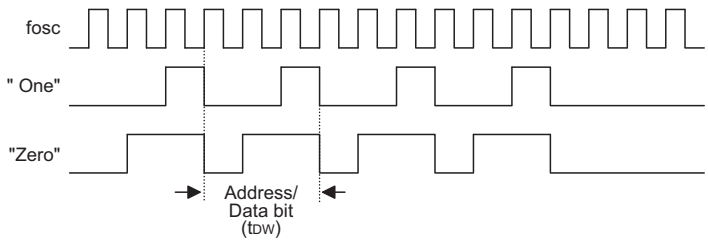
Transmission Timing

A Complete code word of the HT6P20D2T3 consists of 3 periods as shown below.



A Complete Code Word for the HT6P20D2T3

The device detects the logic state of the internal programmed address and the external data pins, and then transmits the detected information during the code period. Each address/data bit can be set to one of the following two logic states:

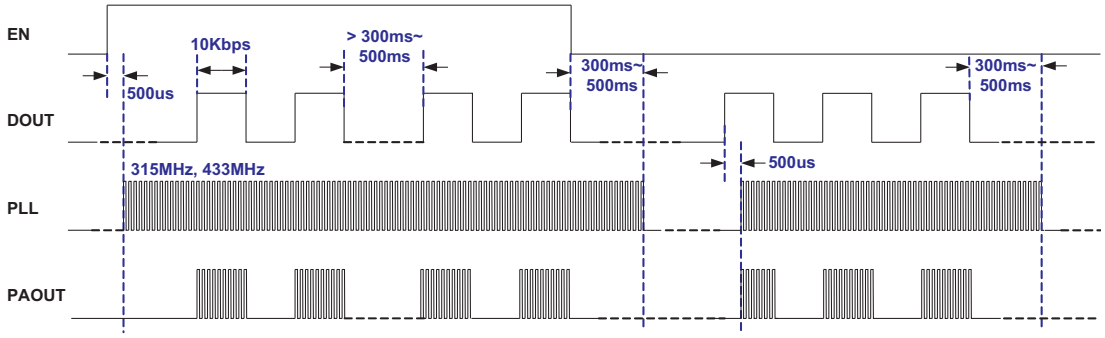


Code Word

A group of code bits is called a code word. A code word consists of one Synchronous bit followed by address/data bits. Refer to the diagram below:

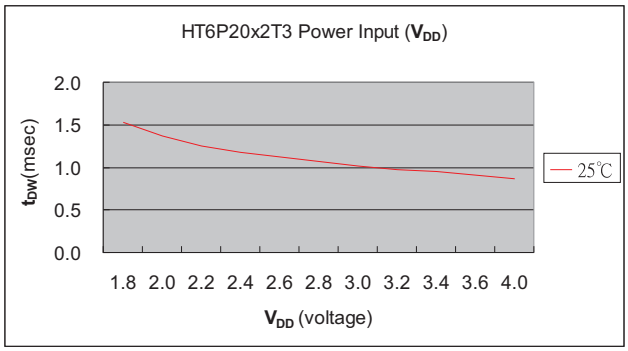
HT6P20B2T3			
Synchronous Bit	A0~A21	D1~D0	0101
HT6P20D2T3			
Synchronous Bit	A0~A19	D3~D0	0101
HT6P20F2T3			
Synchronous Bit	A0~A18	D4~D0	0101

Timing Diagram

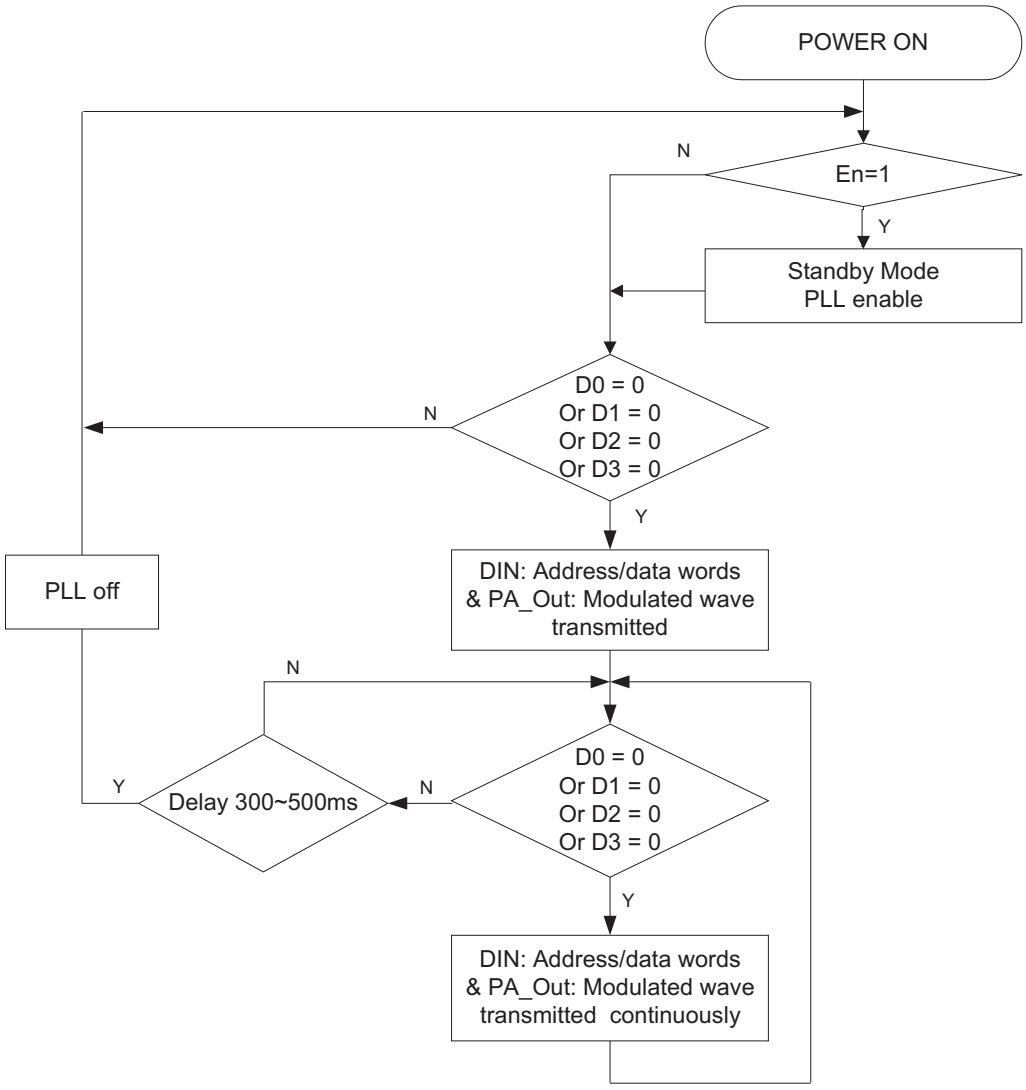


V_{DD} vs. t_{DW}

V_{DD}	t_{DW} (ms)
2.0	1.37
2.2	1.26
2.4	1.18
2.6	1.12
2.8	1.07
3.0	1.02
3.2	0.98
3.4	0.95
3.6	0.91

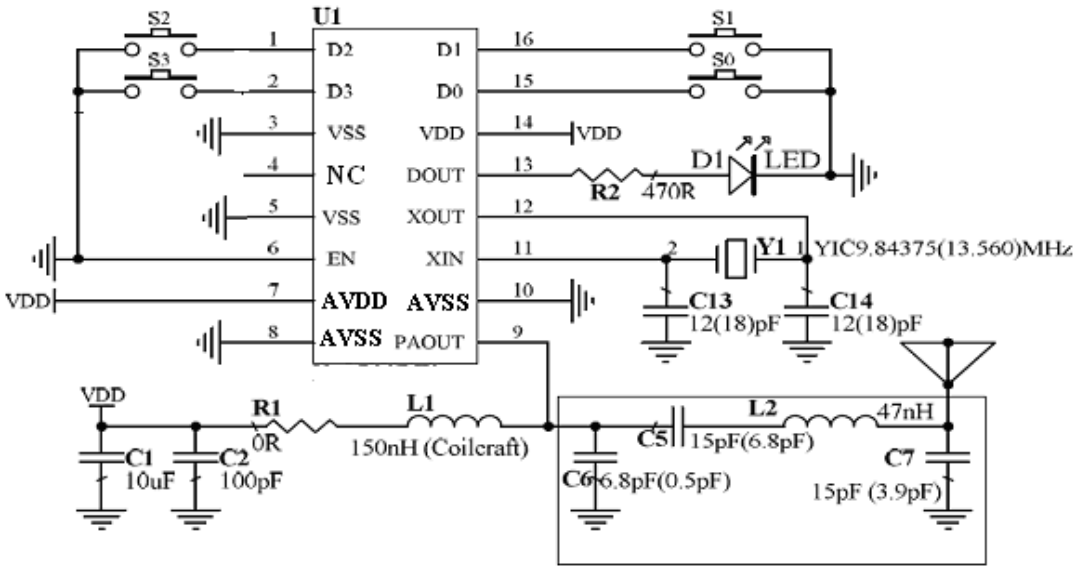


Flowchart for HT6P20D2T3



Application Circuits

HT6P20D2T3_315(433)MHz TX



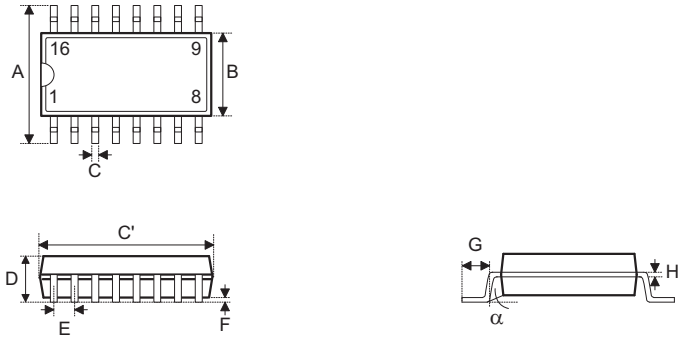
This part can be omitted if harmonic noise can be ignored.

Note: The values contained within brackets are for the 433.92MHz case. For example, for the 433.92MHz application, the crystal Y1 is 13.56MHz

Application Circuit for 315M/433.92MHz Tx

Package Information

16-pin NSOP (150mil) Outline Dimensions

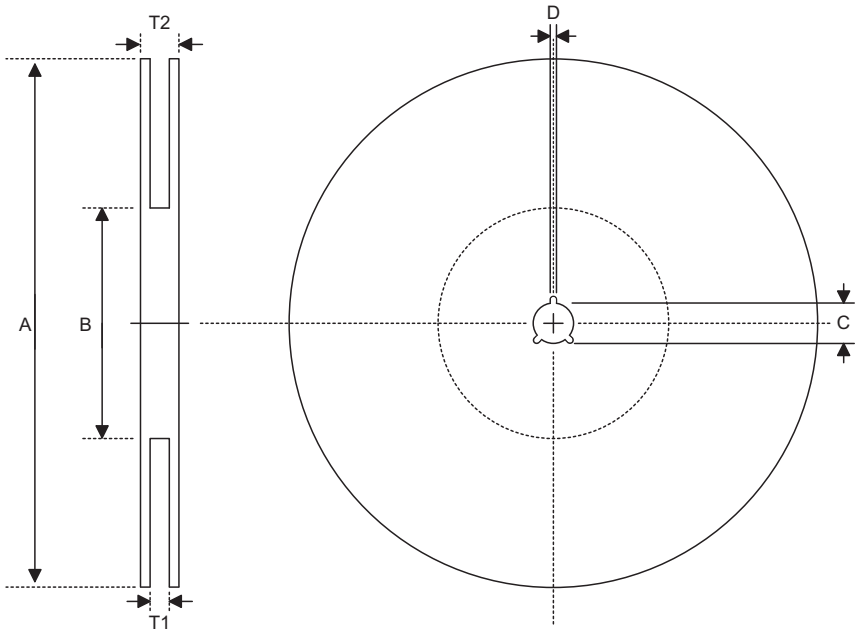


MS-012

Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.228	—	0.244
B	0.150	—	0.157
C	0.012	—	0.020
C′	0.386	—	0.402
D	—	—	0.069
E	—	0.050	—
F	0.004	—	0.010
G	0.016	—	0.050
H	0.007	—	0.010
α	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	5.79	—	6.20
B	3.81	—	3.99
C	0.30	—	0.51
C′	9.80	—	10.21
D	—	—	1.75
E	—	1.27	—
F	0.10	—	0.25
G	0.41	—	1.27
H	0.18	—	0.25
α	0°	—	8°

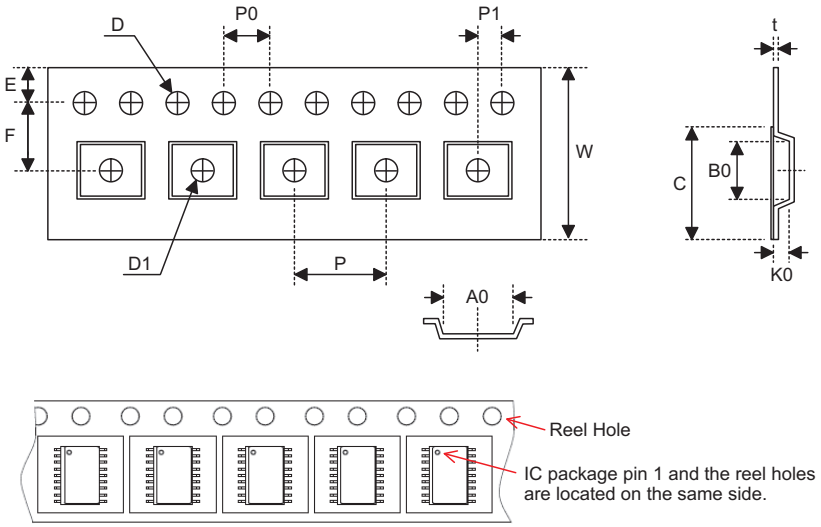
Reel Dimensions



SOP 16N (150mil)

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	330.0±1.0
B	Reel Inner Diameter	100.0±1.5
C	Spindle Hole Diameter	13.0 $^{+0.5/-0.2}$
D	Key Slit Width	2.0±0.5
T1	Space Between Flange	16.8 $^{+0.3/-0.2}$
T2	Reel Thickness	22.2±0.2

Carrier Tape Dimensions



SOP 16N (150mil)

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	16.0±0.3
P	Cavity Pitch	8.0±0.1
E	Perforation Position	1.75±0.1
F	Cavity to Perforation (Width Direction)	7.5±0.1
D	Perforation Diameter	$1.55^{+0.10/-0.00}$
D1	Cavity Hole Diameter	$1.50^{+0.25/-0.00}$
P0	Perforation Pitch	4.0±0.1
P1	Cavity to Perforation (Length Direction)	2.0±0.1
A0	Cavity Length	6.5±0.1
B0	Cavity Width	10.3±0.1
K0	Cavity Depth	2.1±0.1
t	Carrier Tape Thickness	0.30±0.05
C	Cover Tape Width	13.3±0.1

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