Single D-type Flip-Flop with Reset; Positive-Edge Trigger

General Description

The ET74HC1G175 is a low-power, low-voltage single positive edge triggered D-type flip-flop with individual data (D) input, clock (CP) input, master reset ($\overline{MR}$) input, and Q output.

The master reset ($\overline{MR}$) is an asynchronous active LOW input and operates independently of the clock input. Information on the data input is transferred to the Q output on the LOW-to-HIGH transition of the clock pulse. The D input must be stable one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

The inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device in a mixed 3.3V and 5V environment.

This device is fully specified for partial power-down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing the damaging back-flow current through the device when it is powered down.

Schmitt trigger action at all inputs makes the circuit highly tolerant of slower input rise and fall times.

Features

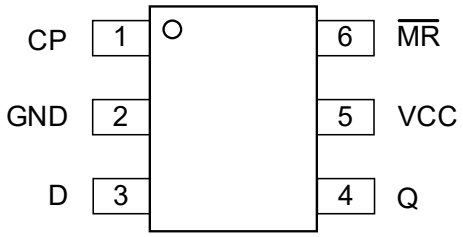
- Designed for 2V to 6V V_{CC} Operation
- Over-voltage Tolerant Inputs Accept Voltages to 6V
- High Noise Immunity
- ±5.2mA Balanced Output Sink and Source Capability
- CMOS Low Power Consumption
- I_{OFF} Circuitry Provides Partial Power-down Mode Operation
- Direct Interface with TTL Levels
- Multiple Package Options
- ESD Protection Complies with JESD22 Standard
  -- HBM: ±4000V Pass (JEDEC JS-001)
  -- CDM: ±1500V Pass (JEDEC JS-002)
- Latch-up Performance Exceeds ±200mA per JEDEC JESD78F
- Part No. and Package Information

Part No.	Package	Packing Option	MSL
ET74HC1G175	SC70-6 (1.3mm × 2.1mm)	Tape and Reel, 3K/Reel	1
ET74HC1G175T	SOT23-6 (1.6mm × 2.9mm)	Tape and Reel, 3K/Reel	3

Applications

- Server
- LED Display Screen
- Network Switches
- Telecommunications Infrastructure
- Motor Driver
- I/O Extender

Pin Configuration



SC70-6/SOT23-6

Figure1. Pin Configuration

Pin Function

SC70-6/SOT23-6

Pin No.	Pin Name	Pin Function
1	CP	Clock Input (Low-to-High, Edge-Triggered)
2	GND	Ground
3	D	Data Input
4	Q	Flip-Flop Output
5	VCC	Supply Voltage
6	$\overline{MR}$	Master Reset Input (Active LOW)

Functional Diagram

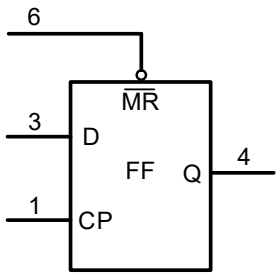


Figure2. Logic Symbol

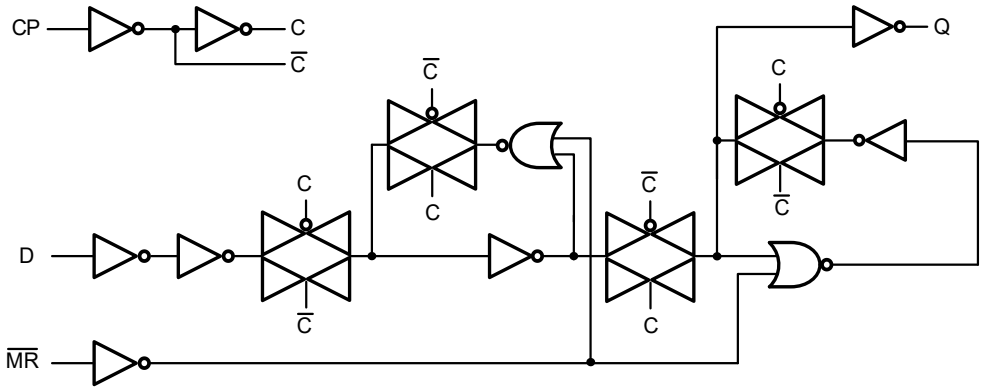


Figure3. Logic Diagram

Function Table

H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition;
L = LOW voltage level; l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;
↑ = LOW-to-HIGH CP transition; X = don't care.

Operating Mode	Input			Output
	$\overline{MR}$	CP	D	Q
Reset (Clear)	L	X	X	L
Load '1'	H	↑	h	H
Load '0'	H	↑	l	L

Absolute Maximum Ratings

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage (VCC Pin)		-0.5 to 6.5	V
I_{IK}	DC Input Diode Current, V_I < GND		-50	mA
V_I	DC Input Voltage (1)		-0.5 ≤ V_I ≤ 6.5	V
I_{OK}	DC Output Diode Current, V_O < GND		±50	mA
V_O	DC Output Voltage Output in Higher or Low State		-0.5 to V_{CC} + 0.5	V
I_O	DC Output Sink Current, V_O = 0V to V_{CC}		±50	mA
I_{CC}	DC Supply Current per Supply Pin		100	mA
I_{GND}	DC Ground Current per Supply Pin		-100	mA
T_J	Max Junction Temperature		150	°C
T_{STG}	Storage Temperature Range		-65 to 150	°C
V_{ESD}	ESD Classification	Human Body Model (2)	±4000	V
		Charged Device Model (3)	±1500	
I_{LU}	Max Latch Up Current Above V_{CC} and GND at 125°C (4)		±200	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Note1: I_O absolute maximum rating must be observed.

Note2: HBM tested per JEDEC JS-001;

Note3: CDM tested per JEDEC JS-002;

Note4: Latch up Current Maximum Rating tested per JEDEC JESD78F.

Recommended Operating Conditions

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage Operating		2	6	V
V_I	DC Input Voltage		0	V_{CC}	V
V_O	DC Output Voltage (High or Low State)		0	V_{CC}	V
T_A	Operating Temperature Range		-40	125	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2.0V		625	ns/V
		V_{CC} = 4.5V		139	
		V_{CC} = 6.0V		83	

Electrical Characteristics

DC Electrical Characteristics

Symbol	Parameter	Condition	V_{CC}(V)	T_A = 25°C			-40°C ≤ T_A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High-Level Input Voltage		2.0	1.5	1.2		1.5		V
			4.5	3.15	2.4		3.15		
			6.0	4.2	3.2		4.2		
V_{IL}	Low-Level Input Voltage		2.0		0.8	0.5		0.5	V
			4.5		2.1	1.35		1.35	
			6.0		2.8	1.8		1.8	
V_{OH}	High-Level Output Voltage	I_{OH} = -20uA	2.0	1.9	2.0		1.9		V
		I_{OH} = -20uA	4.5	4.4	4.5		4.4		
		I_{OH} = -20uA	6.0	5.9	6.0		4.4		
		I_{OH} = -4.0mA	4.5	3.84	4.32		3.7		
		I_{OH} = -5.2mA	6.0	5.34	5.81		5.2		
V_{OL}	Low-Level Output Voltage	I_{OL} = 20uA	2.0		0	0.1		0.1	V
		I_{OL} = 20uA	4.5		0	0.1		0.1	
		I_{OL} = 20uA	6.0		0	0.1		0.1	
		I_{OL} = 4.0mA	4.5		0.15	0.33		0.4	
		I_{OL} = 5.2mA	6.0		0.16	0.33		0.4	
I_I	Input Leakage Current	V_I = 6.0V or GND	6.0			0.1		2.0	uA
I_{CC}	Quiescent Supply Current	Per Pin: V_I = 6.0V or GND; I_O = 0mA	6.0			1.0		40	uA

AC Electrical Characteristics

Voltages are referenced to GND (ground = 0V); for test circuit see Figure6.

Symbol	Parameter	Conditions	T_A = 25°C			-40°C ≤ T_A ≤ 125°C		Unit
			Min	Typ[5]	Max	Min	Max	
t_{pd}	Propagation Delay	CP to Q; See Figure4						ns
		V_{CC} = 2V, C_L = 50pF		6.2	11		12.5	
		V_{CC} = 4.5V, C_L = 50pF		2.9	4.4		5.1	
		V_{CC} = 5V, C_L = 15pF		2.7	3.5		4.1	
		V_{CC} = 6V, C_L = 50pF		2.8	3.7		4.4	
		$\overline{MR}$ to Q; See Figure5						
		V_{CC} = 2V, C_L = 50pF		6.0	11.1		12.2	
		V_{CC} = 4.5V, C_L = 50pF		2.8	4.4		5.1	
		V_{CC} = 5V, C_L = 15pF		2.6	3.6		4.0	
		V_{CC} = 6V, C_L = 50pF		2.7	3.7		4.2	
t_W	Pulse Width	CP H or L; See Figure4						ns
		V_{CC} = 2V	6.2			6.2		
		V_{CC} = 4.5V to 6V	2.0			2.0		
		$\overline{MR}$ Low; See Figure5						
		V_{CC} = 2V	6.2			6.2		
		V_{CC} = 4.5V to 6V	2.0			2.0		
t_{rec}	Recovery Time	$\overline{MR}$; See Figure5						ns
		V_{CC} = 2V	1.9			1.9		
		V_{CC} = 4.5V to 6V	1.0			1.0		
t_{su}	Set-up Time	D to CP; See Figure4						ns
		V_{CC} = 2V	2.9			2.9		
		V_{CC} = 4.5V to 6V	1.1			1.1		
t_h	Hold time	D to CP; See Figure4						ns
		V_{CC} = 2V	1.5			1.5		
		V_{CC} = 4.5V to 6V	1.0			1.0		
f_{max}	Maximum Frequency	D; See Figure4						MHz
		V_{CC} = 2V	80			80		
		V_{CC} = 4.5V to 6V	200			200		

Note5: All typical values are measured at corresponding V_{CC} and T_A = 25°C.

Capacitance Characteristics

Symbol	Parameter	Condition	Typ	Unit
C_{IN}	Input Capacitance	V_{CC} = 5.5V, V_I = 0V or V_{CC}	4.5	pF
C_{PD}	Power Dissipation Capacitance (6)	10MHz, V_{CC} = 3.3V, V_I = 0V or V_{CC}	19	pF

Note6: C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:

f_i = Input Frequency in MHz;

f_o = Output Frequency in MHz;

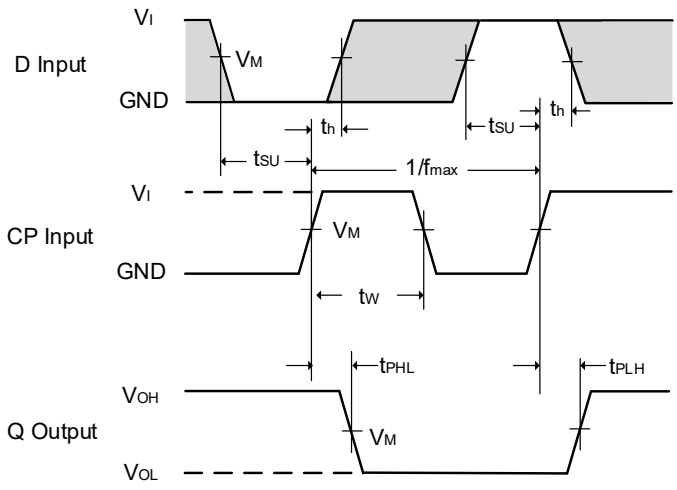
C_L = Output Load capacitance in pF;

V_{CC} = Supply Voltage in V;

N = Number of Inputs Switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = Sum of Outputs.

Test Waveform

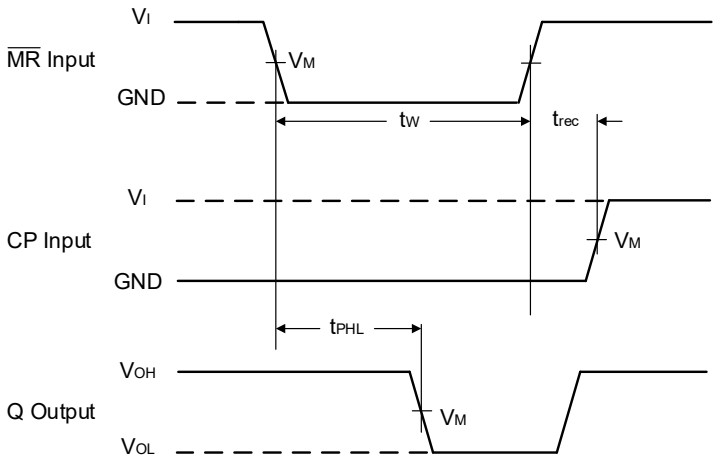


Measurement points are given in Table1.

The shaded areas indicate when the input is permitted to change for predictable output performance.

V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Figure4. The clock input (CP) to output (Q) propagation delays, the clock pulse width, D to CP set-up,CP to D hold times, and the maximum clock pulse frequency



Measurement points are given in Table1.

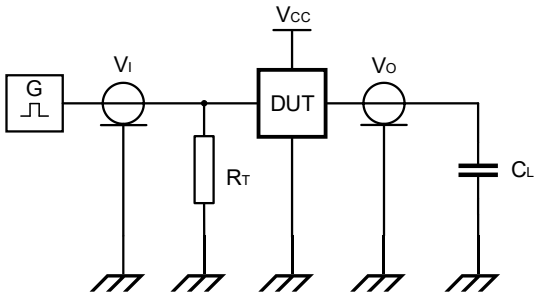
V_{OL} and V_{OH} are typical output voltage drops that occur with the output load.

Figure5. The master reset ($\overline{MR}$) input to output (Q) propagation delays, the master reset pulse widths, and the $\overline{MR}$ to CP recovery time

Table1.Measurement Points

Supply Voltage	Input	Output
V_{CC}	V_M	V_M
2V to 5.5V	0.5 × V_{CC}	0.5 × V_{CC}

Test Circuit



Measurement points are given in Dynamic Characteristics.

Definitions test circuit:

C_L = Load capacitance including jig and probe capacitance;

R_T = Termination resistance should be equal to output impedance Z_O of the pulse generator;

Figure6. Test circuit for measuring switching times

Layout Guide

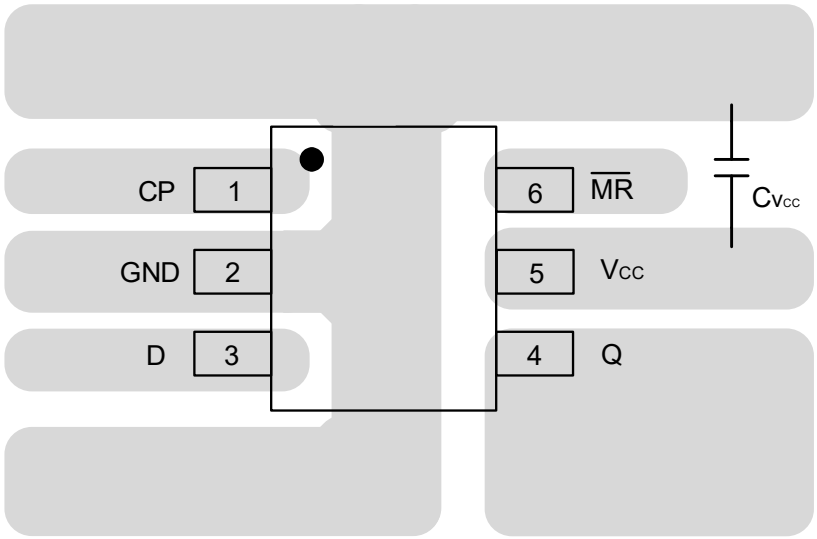
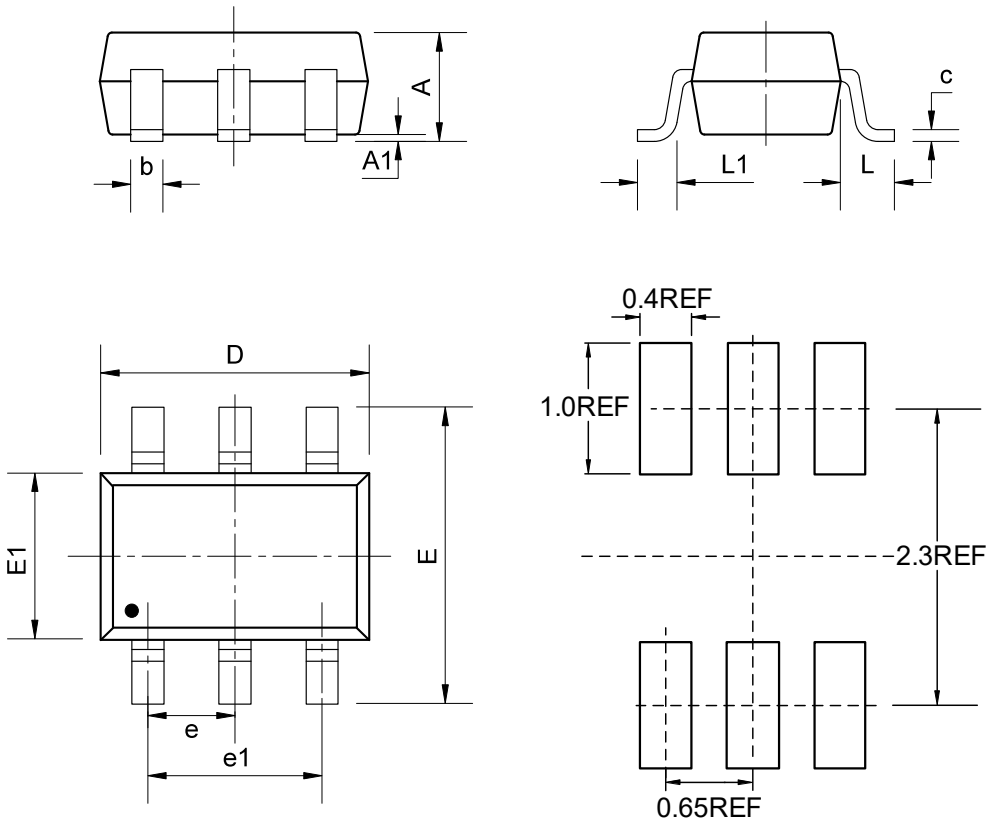


Figure7. Layout Guide

Package Dimension

SC70-6 (1.3mm × 2.1mm)

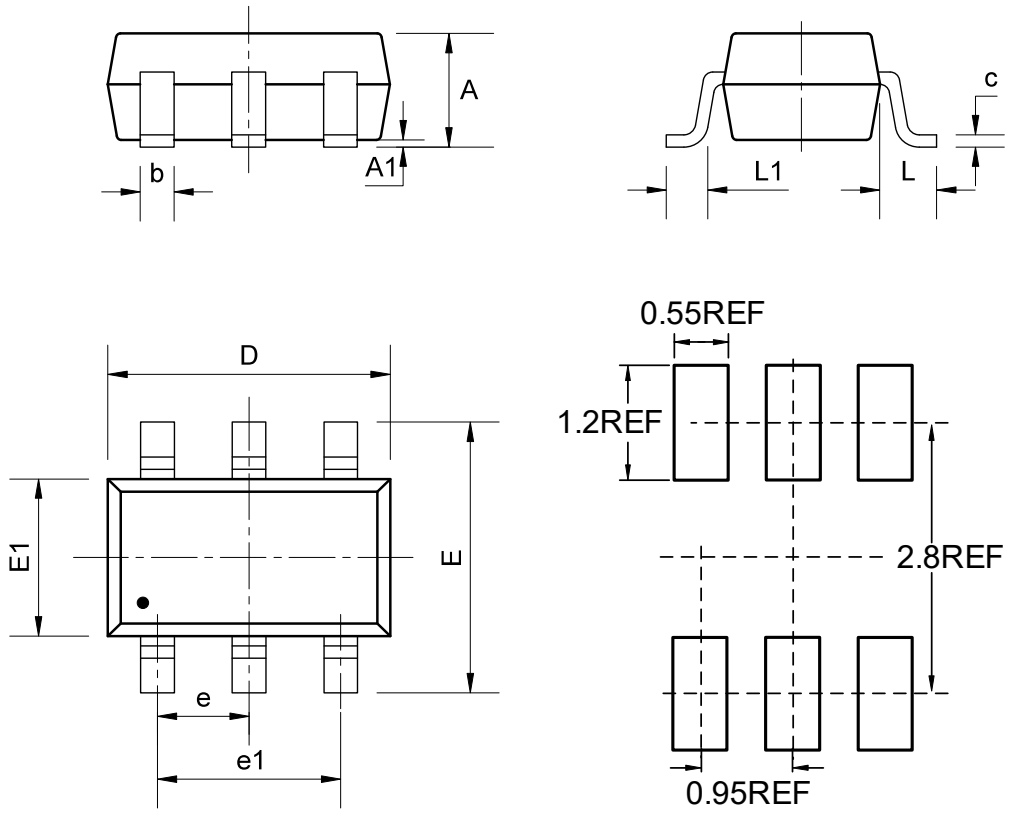


COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	-	-	1.10
A1	0.00	-	0.15
b	0.15	-	0.35
c	0.08	-	0.20
D	2.00	2.10	2.30
e	0.65BSC		
e1	1.30BSC		
E	2.15	2.30	2.50
E1	1.15	1.30	1.45
L	0.50REF		
L1	0.33REF		

SOT23-6 (1.6mm × 2.9mm)



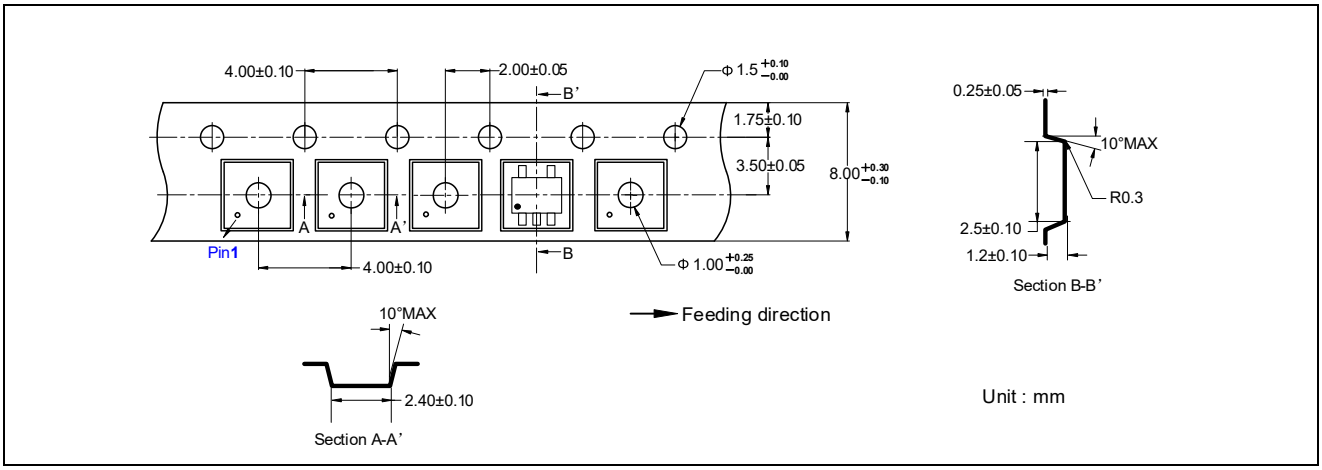
COMMON DIMENSIONS

(Unit: mm)

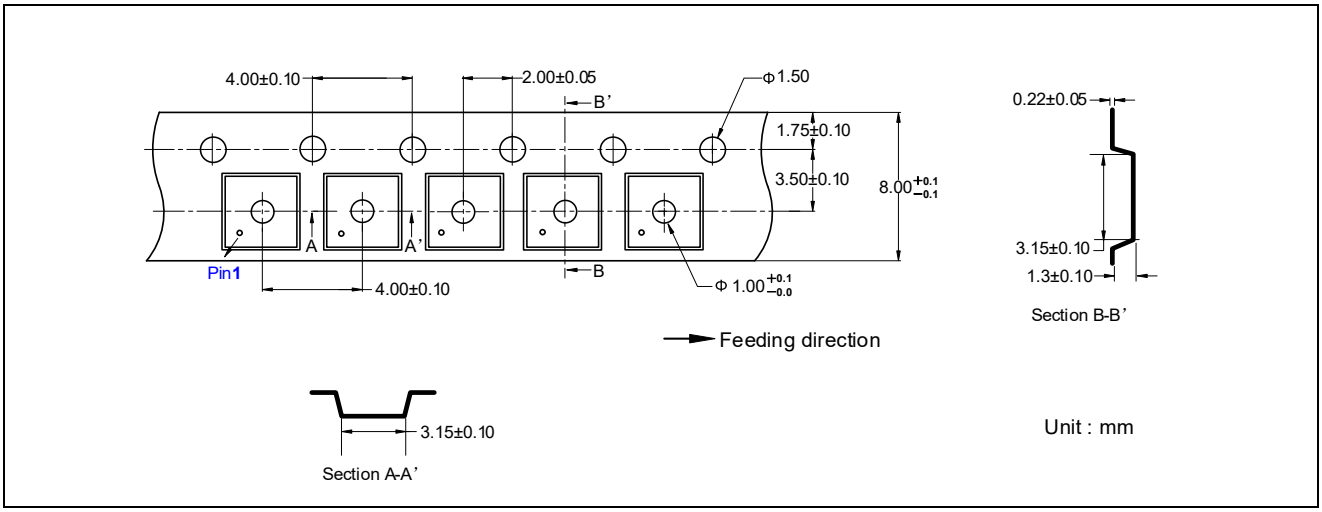
SYMBOL	MIN	NOM	MAX
A	-	-	1.45
A1	0.00	-	0.15
b	0.28	0.35	0.50
c	0.08	0.15	0.22
D	2.75	2.9	3.05
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
E	2.60	2.80	3.00
E1	1.45	1.6	1.75
L	0.60REF		
L1	0.30	0.45	0.60

Tape Information

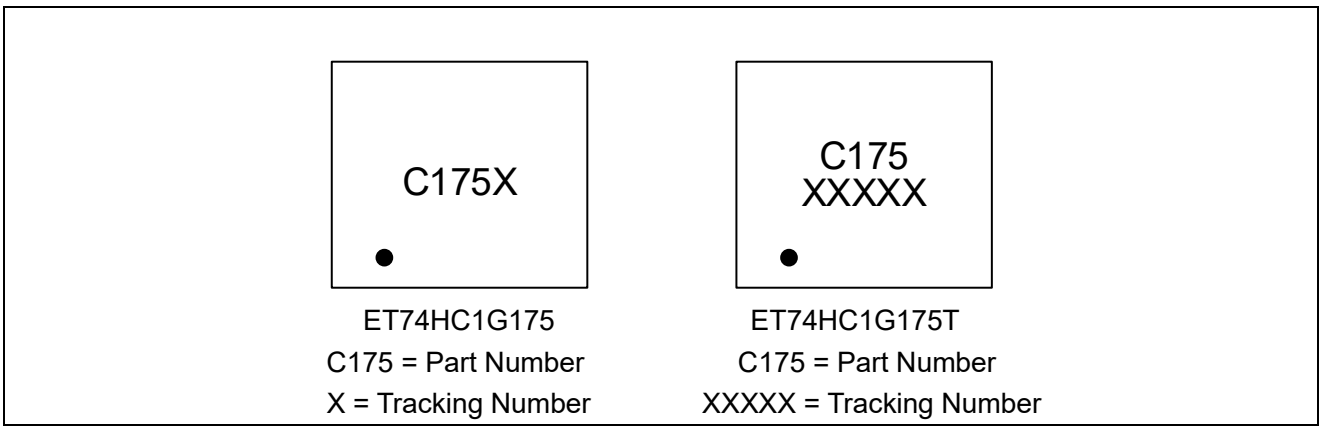
SC70-6 (1.3mm × 2.1mm)



SOT23-6 (1.6mm × 2.9mm)



Marking Information



ET74HC1G175
C175 = Part Number
X = Tracking Number

ET74HC1G175T
C175 = Part Number
XXXXX = Tracking Number

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2026-05-08	Official Version	Xu tao	Yang xiaoxu	Liu jiaying