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Total Solution of MCU

ATOM130

4-bit Microcontrollers with Reduced 8051 Architecture

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1 ATOM130 Overview

1.1 General Description

ATOM130 is a 4-bit reduced 8051 Microcontroller.

ATOM130 has 17 or 13 programmable I/O ports, Watchdog timer, POR (Power-On Reset), built-in I.R. LED Driver, and LVD (Low Voltage Detector) as peripherals.

ATOM130 operates over the extended -20℃ to +70℃ temperature range, and is available in the 20-pin SOP/TSSOP, 16-pin SOP/TSSOP package.

1.2 Features

- CPU
  - ✓ 4-bit reduced 8051 architecture
  - ✓ Continuous program addressing, not paged.
  - ✓ 51 instructions including push, pop and logic inst.
  - ✓ Instruction cycle : $F_{SYS}/6$
  - ✓ Multi-level subroutine nesting with RAM based stack.
- Program Memory (MTP)
  - ✓ 4K Bytes (4,096 X 8 bits)
  - ✓ Multi-programmable by 1K Bytes, 2K Bytes or 4K Bytes
  - ✓ ISP (In System Programming) of MTP
- Data RAM : 48 nibbles (including stack)
- I/O Ports
  - ✓ P0 : 4-bit parallel input
  - ✓ P1 : 2-bit parallel input, 2-bit parallel I/O
  - ✓ P2 : 4-bit parallel I/O, Bit-selectable output
  - ✓ P3 : 2-bit parallel I/O, Bit-selectable output
  - ✓ P4 : 3-bit Parallel/bit-selectable Output

- REM output (Remote control transmitter)
  - ✓ Built-in Transistor for I.R. LED Drive
  - ✓ I_{OL}= 250 mA (Max.) at V_{DD} = 3V and V_O = 0.3V
- Carrier Pulse Generation : 8 types
- Built-in Oscillator
  - ✓ Internal Precision Oscillator: 3.64MHz (Typ. ±1%)
- Built-in Reset
  - ✓ Power-on Reset, Power-fail Reset
  - ✓ WDT (Watch-Dog Timer) Reset
  - ✓ Clock switching reset
- Power Management
  - ✓ Power-down (stop) mode
  - ✓ Release stop by input changes
- Power Consumption
  - ✓ Stop mode : 1 uA (Max.) at 3.0V
  - ✓ Normal mode : 400 uA (Typ.) at 2.0V, F_{OSC} = 4 MHz
- Operating frequency vs. voltage
  - ✓ Max. F_{SYS} = 4 MHz (1.8 V ≤ V_{DD} ≤ 3.6V)
- Operating temperature : -20 °C ~ 70 °C
- ESD protection
  - ✓ HBM : 2,000V (JESD22-A114E)
  - ✓ MM : 200V (JESD22-A115-A)
  - ✓ CDM : 800V (JESD22-C101-C)
- Latch-up protection up to ±200mA
- Package
  - ✓ 20-pin TSSOP
  - ✓ 20-pin SOP (JEDEC)
  - ✓ 16-pin TSSOP
  - ✓ 16-pin SOP (Narrow Type)

1.3 Applications

- Remote Controller

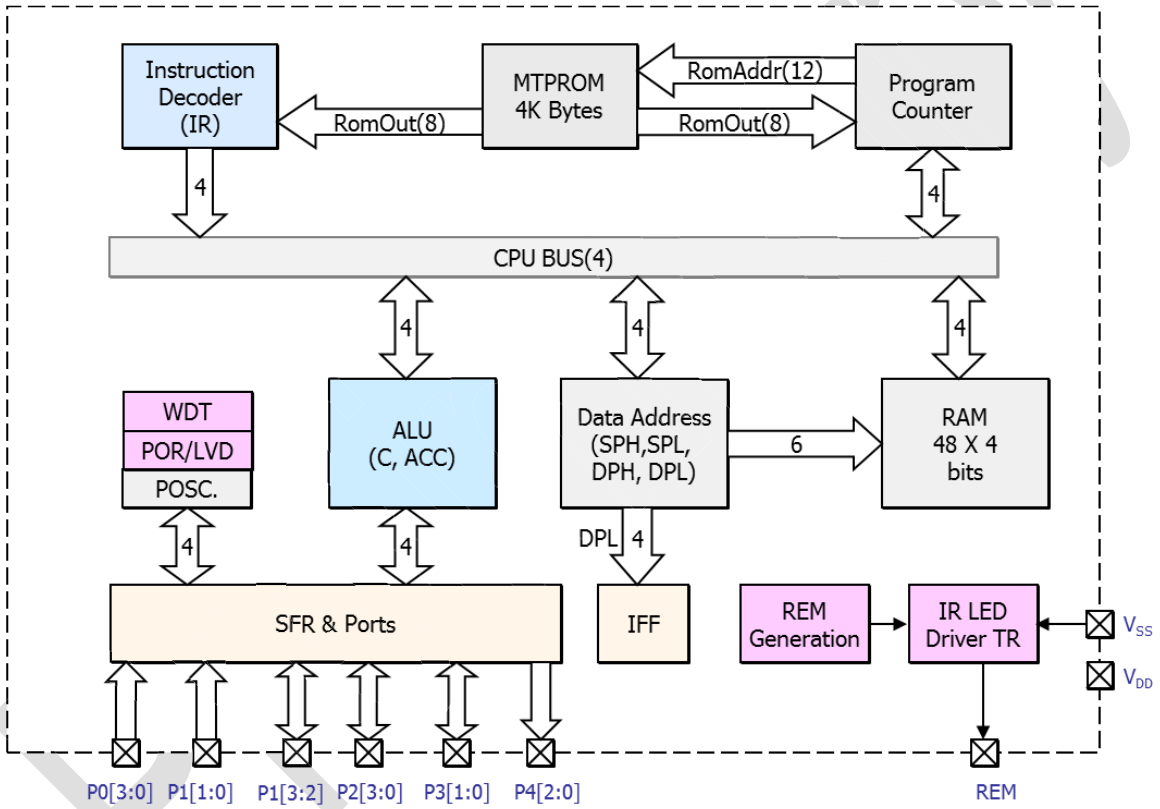
1.4 Product Family Guide

Product	Mask-ROM [Byte]	MTPROM [Byte]	RAM [Nibble]	I/O Pins	Package	Other Peripherals
ATOM130	**-**	**4k**	**48**	**17** **17** **13** **13**	20-TSSOP 20-SOP 16-TSSOP 16-SOP	WDT ISP LVD POR I.R. LED Driver

2 Block Diagram

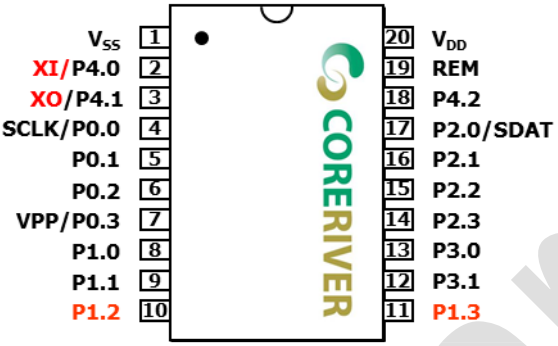
Figure shows the block diagram of ***ATOM130***. Programs reside in the internal program memory (Embedded Flash Memory). Data are read from or written to data memory (SRAM) or special function registers (SFRs).

The internal registers of ***ATOM130*** are configured as part of the on-chip RAM: therefore each register has an address.

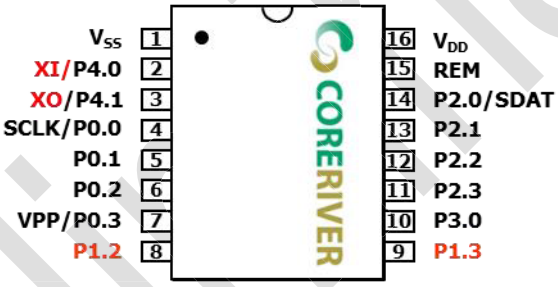


3 Pin Configuration

[20-SOP/20-TSSOP]



[16-SOP/16-TSSOP]



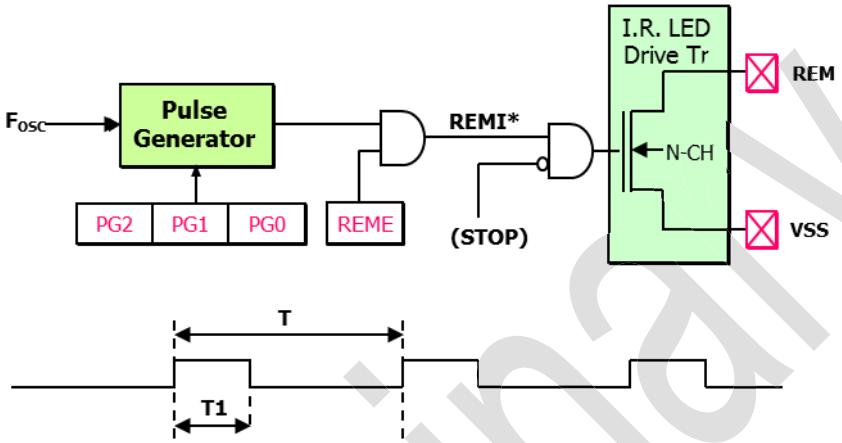
20-pin & 16-pin Package Diagram

4 Pin Description

Symbol	Direction	Description	Remark
V_{DD}	Power	Power Supply	
V_{SS}	Power	Ground	
REM	Output	Output for IR LED drive Transistor. The transistor is n-channel device.	
P4[2:0]	Output	Parallel open-drain Output port. If configured, P4[1:0] is used as XTAL oscillator PADs.	P4.0 : XI P4.1 : XO
P0[3:0]	Input	Parallel Input port with internal pull-up TR. The STOP mode is released by "L" input of each pin. P0[0] and P0[3] are also used for ISP of OTP memory.	P0.0 : SCLK P0.3 : VPP
P1[1:0]	Input	Parallel Input port with internal pull-up TR. The STOP mode is released by "L" input of each pin.	
P1[3:2]	Input/Output	Parallel Input/Output port. Schmitt Trigger input and open-drain output with internal pull-up TR. The STOP mode is released by "L" input of each pin while the port register contains “H”.	
P2[3:0]	Input/Output	Parallel Input/Output port. Each bit can be individually set or cleared. Schmitt Trigger input and open-drain output with internal pull-up TR. P2[0] is also used for ISP of OTP memory.	P2.0 : SDAT
P3[1:0]	Input/Output	Parallel Input/Output port. Each bit can be individually set or cleared. Schmitt Trigger input and open-drain output with internal pull-up TR.	

5 Carrier frequency generation

The ***ATOM130*** family can drive an IR LED for remote controller application. It supports 7 carrier frequencies for data transmission. The REMC register is used for control of the IR LED driver and the carrier frequency.



IR LED driver control

The IR LED driver is a n-channel MOS transistor. The REM ouput is the inverse of the REMI* signal. The IR LED is turned on when REMI* is high.

REME	PG2	PG1	PG0	Transmission Control (REMI)	Carrier Frequency (F_{osc} = 3.64 MHz)
0	X	X	X	0 (Disable)	
1	0	0	0	1/T = F_{osc}/96, T1/T = 1/3	37.92 KHz
1	0	0	1	1/T = F_{osc}/64, T1/T = 1/2	56.88 KHz
1	0	1	0	1/T = F_{osc}/101, T1/T = 34/101	36.04 KHz
1	0	1	1	1 (No carrier)	
1	1	0	0	1/T = F_{osc}/96, T1/T = 1/2	37.92 KHz
1	1	0	1	1/T = F_{osc}/65, T1/T = 22/65	56.00 KHz
1	1	1	0	1/T = F_{osc}/87, T1/T = 1/3	41.84 KHz
1	1	1	1	1/T = F_{osc}/91, T1/T = 31/91	40.00KHz

Carrier frequency selection

6 Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{DD}	DC supply voltage	-0.3 to 3.6V	V
V_{IN}	DC input voltage	-0.3 to V_{DD} + 0.3	V
V_{OUT}	DC output Voltage	-0.3 to V_{DD} + 0.3	V
I_{OL}	DC output low current	One I/O pin active: 20	mA
		All I/O pins active: 100	mA
T_{STG}	Storage temperature	-55 to 125	°C
T_{SOL}	Soldering temperature	260 for 10 seconds	°C

7 Recommended Operating Conditions

Symbol	Parameter	Rating	Unit
V_{DD}	DC supply voltage	1.8 to 3.6	V
T_A	Industrial temperature range	-20 to 70	°C

8 DC Characteristics

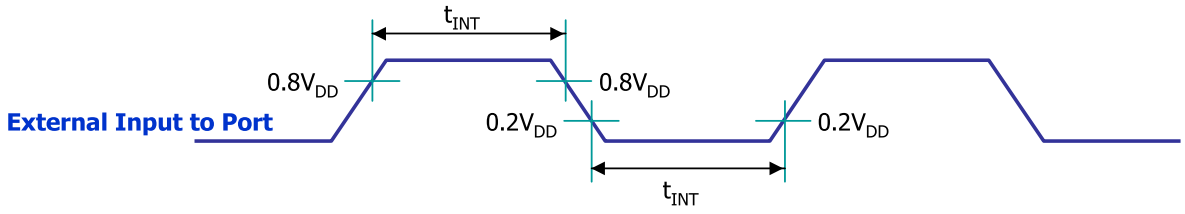
(T_A= -20°C ~ +70°C, V_{DD}=1.8V ~ 3.6V unless otherwise specified)

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Input low voltage	V_{IL1}	P0, P1, P2, P3	V_{DD}=1.8V~3.6V	-0.3	-	0.2V_{DD}	V
Input high voltage	V_{IH1}	P0, P1, P2, P3	V_{DD}=1.8V~3.6V	0.8V_{DD}	-	V_{DD}+0.3	V
Input high leakage current	I_{IH}	All pins except XI, XO	V_{IN} = V_{DD}	-1	-	+1	uA
Output low voltage	V_{OL}	P1,P2,P3,P4	I_{OL}=8mA @V_{DD}=3V	-	-	0.3V_{DD}	V
Output low voltage	V_{OL2}	REM	I_{OL}=250mA @V_{DD}=3V	-	-	0.4	V
Output high voltage	V_{OHP}	Pull-up current	I_{OHP}= -50uA @V_{DD}=3V	0.7V_{DD}	-	-	V
Pin capacitance	C_{IO}	All	V_{DD} = 5V	-	10	-	pF

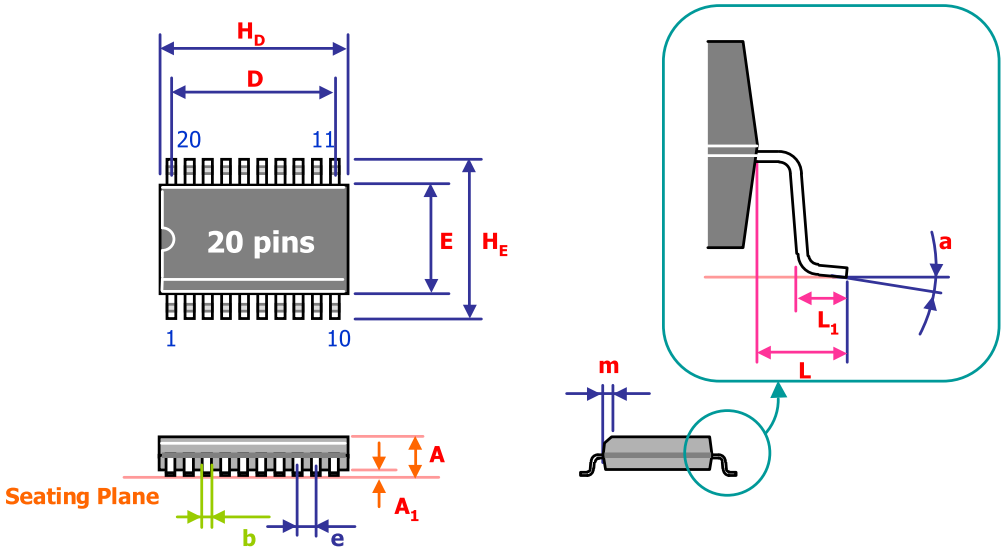
9 AC Characteristics

(T_A=-20°C ~ +70°C unless otherwise specified)

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Operating Frequency (Internal Clock)	F_{OSC}		1.8V ≤V_{DD}≤3.6V	3.64 -2%	3.64	3.64 +2%	MHz
System Frequency	F_{SYS}		1.8V ≤V_{DD}≤3.6V	1/8	-	1	F_{OSC}
External Input Width	t_{INT}	P0, P1, P2, P3	1.8V ≤V_{DD}≤3.6V	12	-	-	F_{SYS}



10 20-pin TSSOP Package Dimension

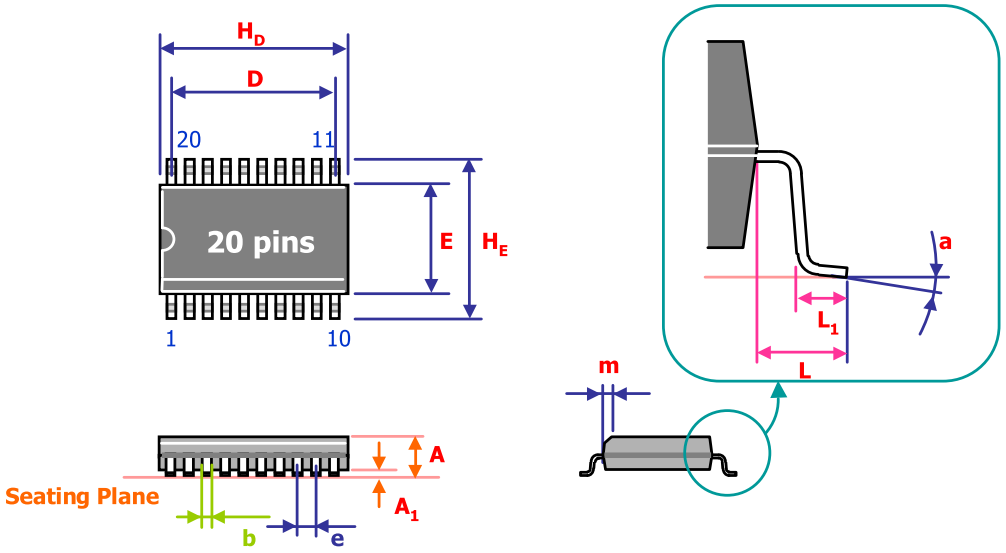


Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A			0.043			1.1
A_1	0.001		0.006	0.020		0.150
b	0.007		0.012	0.190		0.300
D		0.234			5.850	
E	0.169	0.174	0.177	4.300	4.400	4.500
H_D	0.252	0.254	0.259	6.400	6.500	6.600
H_E	0.246	0.252	0.258	6.250	6.400	6.550
L	0.038	0.039	0.040	0.975	1.000	1.025
L_1	0.020	0.024	0.028	0.500	0.600	0.700
a	1°	-	7°	1°	-	7°
e	0.026 BSC			0.65 BSC		

Notes:

1. **Dimension D & E include mold mismatch and are determined at the mold parting line.**
2. **General appearance spec. should be based on final visual inspection spec.**

11 20-pin SOP Package Dimension

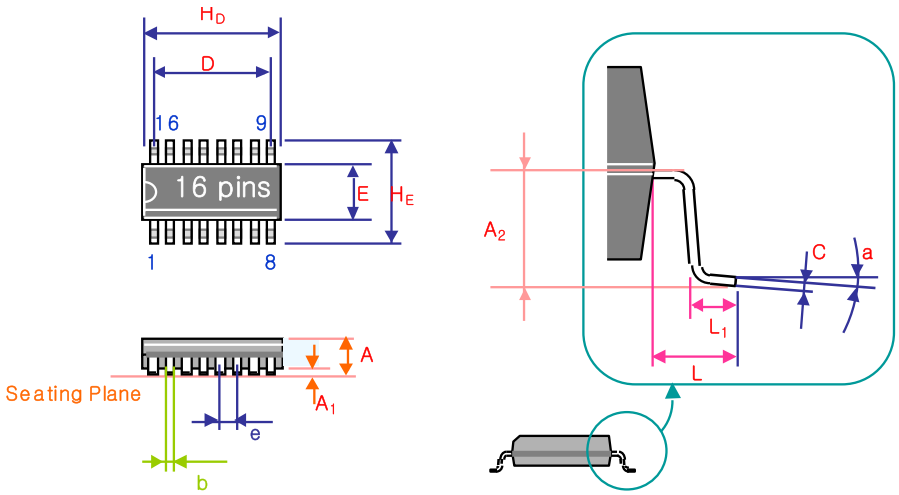


Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	0.106	-	-	2.7
A_1	0.004	-	-	0.1	-	-
b	0.013	0.016	0.020	0.324	0.4	0.51
E	0.264	0.295	0.324	6.71	7.5	8.23
H_D	0.495	0.504	0.512	12.57	12.8	13
H_E	0.394	0.406	0.419	10.0	10.3	10.643
L	0.016	-	0.052	0.406	-	1.32
a	0°	-	8°	0°	-	8°
e	0.050 BSC			1.27 BSC		

Notes:

1. **Dimension D & E include mold mismatch and are determined at the mold parting line.**
2. **General appearance spec. should be based on final visual inspection spec.**

12 16-pin TSSOP Package Dimension

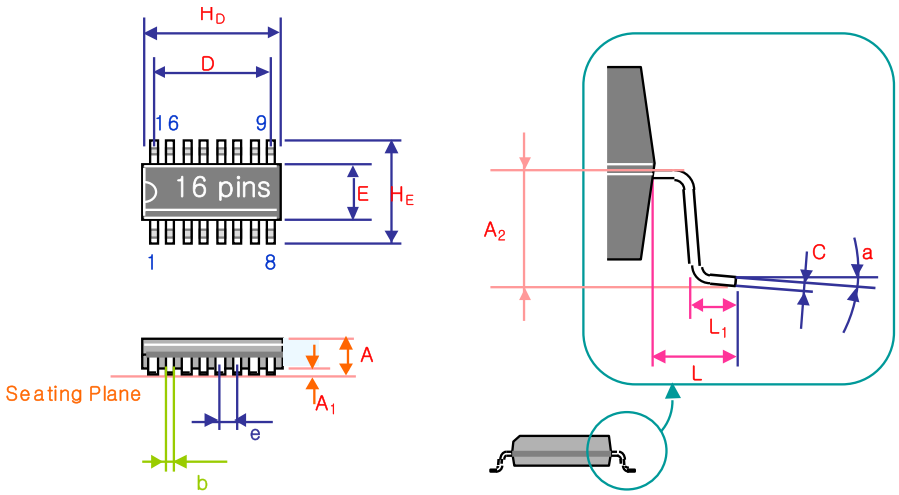


Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.037	0.039	0.041	0.95	1.00	1.05
A_1	0.015	0.017	0.019	0.3865	0.4365	0.4865
A_2	0.026	0.028	0.030	0.65	0.7	0.75
b	0.008	0.009	0.009	0.20	0.22	0.24
C	0.004	0.006	0.008	0.09	0.145	0.20
D	0.176	0.179	0.182	4.47	4.55	4.63
E	0.171	0.173	0.175	4.35	4.4	4.45
H_D	0.200	0.202	0.204	5.077	5.127	5.177
H_E	0.248	0.252	0.256	6.30	6.40	6.50
L	0.033	0.037	0.041	0.85	0.95	1.05
L_1	0.020	0.024	0.028	0.50	0.60	0.70
a	1°	3°	5°	1°	3°	5°
e	0.026 BSC			0.65 BSC		

Notes:

1. **Dimension D & E include mold mismatch and are determined at the mold parting line.**
2. **General appearance spec. should be based on final visual inspection spec.**

13 16-pin SOP Package Dimension



Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.093	0.099	0.104	2.35	2.45	2.65
A_1	0.004	0.008	0.012	0.10	0.20	0.30
b	0.014	0.016	0.019	0.35	0.42	0.49
D	-	.350	-	-	8.89	-
E	0.150	0.153	0.157	3.80	3.90	4.00
H_D	0.398	0.405	0.413	10.10	10.29	10.50
H_E	0.234	0.239	0.244	5.95	6.07	6.20
L	0.038	0.043	0.048	0.97	1.08	1.2
L_1	0.022	0.027	0.032	0.58	0.70	0.82
a	0°	-	8°	0°	-	8°
e	0.050 BSC			1.27 BSC		

Notes:

1. **Dimension D & E include mold mismatch and are determined at the mold parting line.**
2. **General appearance spec. should be based on final visual inspection spec.**