FUJITSU SEMICONDUCTOR
DATA SHEET

DS06-70105-1E

Semicustom
Bi-CMOS

ASTRO-NT
(for RF front-end LSI-Based on PLL, Analog Macro)

MB15G000 Series

■ DESCRIPTION

The ASTRO-NT* is a new technology to correspond to the demand of high performance RF LSI. The technology stands on a macro concept and create a custom LSI ideal for use in high frequency front-end circuit such as VCO, amplifier, mixer and I/Q modulator devices.

The chip can be built by combining macros, in accordance with user's demand function and characteristic. FUJITSU prepares standard RF macros. They are well finished in design and layout to fulfil good performance by function that a master slice method can not achive. It is possible to modify RF macro in response to user's demand.

This LSI series uses FUJITSU's latest BiCMOS process technology for low current consumption. In addition, many types of packages are available that makes it possible to find a proper size package for different circuit integration levels.

ASTRO-NT is ideal for applications with RF or IF signal, particularly mobile communication devices operating such as PDC, PHS, GSM, DCS, PCS and so on.

* Advanced Standard macro base Technology of PLL with RF system On LSI-New Technology

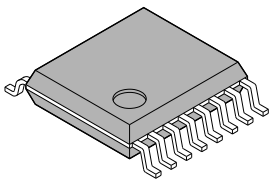
■ FEATURES

- High operating frequency: to 3.0 GHz (max)
- Supply voltage: 2.5 to 5.5 V
- Standard RF macro
- Low power consumption
- Package line up – Many types of package are available.
  SSOP-16, SSOP-20, SSOP-24P, SSOP-34, BCC-16, LQFP-48P, LQFP-64P,
- Operating temperature: –40 to +85°C
- Fujitsu's latest BiCMOS process technology

MB15G000 Series

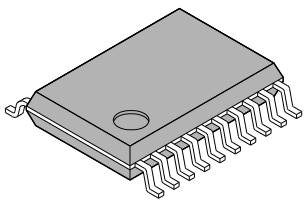
■ PACKAGES

16-pin Plastic SSOP



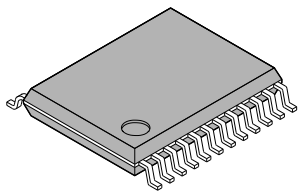
(FPT-16P-M05)

20-pin Plastic SSOP



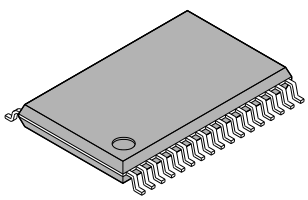
(FPT-20P-M03)

24-pin Plastic SSOP



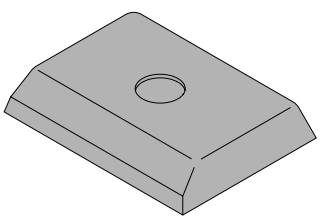
(FPT-24P-M03)

34-pin Plastic SSOP



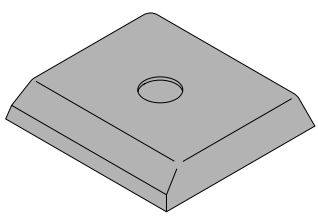
(FPT-34P-M03)

16-pad Plastic BCC



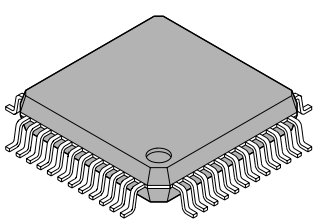
(LCC-16P-M02)

16-pad Plastic BCC



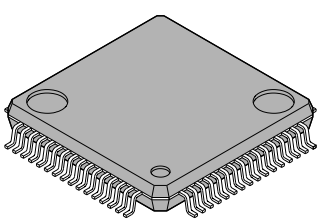
(LCC-16P-M03)

48-pin Plastic LQFP



(FPT-48P-M05)

64-pin Plastic LQFP



(FPT-64P-M03)

■ MACRO DESCRIPTIONS

1. Prescaler

Divides the reference frequency by any given value and outputs the resulting frequency. Choice of two -modulus or fixed output mode.

2. PLL

- **Phase comparator**

The phase comparator has a phase detection range of –2π to +2π, and is designed to eliminate blind spots in phase comparison by output of a margin-of-error signal to the charge pump even when the phase difference is zero. Phase comparator characteristics can also be tuned to the polarity of VCO.

- **Counters**

The divide ratios of the comparator-side counter and reference-side counter can be either programmable or fixed.

- **Charge pump**

The “H” level output voltage from the charge pump is determined by power supply voltage. Charge pump characteristics for the sending and receiving systems can be optimized for each specific application.

For example, when FM modulation is applied directly to the VCO signal, charge pump characteristic can be adjusted for lower speeds in order to reduce the sensitivity of the synthesizer loop so that output does not track the modulation.

- **High speed lock-up circuit**

This circuit is specially designed for faster lock-up speeds.

- **Intermittent operation control circuit**

This on-chip power-saving function reduces circuit current flow in standby status, enabling devices to operate with less power demand. A special circuit is built in to prevent excessive error signal from increasing lock-up delay during the transition from power-saving mode to operating mode.

- **List of standard macros (Preliminary)**

<table>
<tr><th>Type</th><th>V_{CC}</th><th>I_{CC}</th><th>Operating frequency</th><th>Prescaler divide ratio (M)</th><th>Comparator counter divide ratio (N)</th><th>Swallow counter divide ratio (A)</th><th>Reference counter divide ratio (R)</th></tr>
<tr><td>PLL1</td><td rowspan="4">3 V</td><td>1.0 mA*</td><td>0.5 GHz</td><td>8/9, 16/17</td><td rowspan="4">16 to 2047</td><td rowspan="4">0 to 127</td><td rowspan="4">8 to 16383</td></tr>
<tr><td>PLL2</td><td>2.0 mA*</td><td>1.2 GHz</td><td rowspan="3">32/33, 64/65</td></tr>
<tr><td>PLL3</td><td>3.0 mA*</td><td>2.0 GHz</td></tr>
<tr><td>PLL4</td><td>3.5 mA*</td><td>2.5 GHz</td></tr>
</table>

Crystal oscillator input frequency: Up to 32 MHz

Standby mode current demand: 10 μA(Max.)

* : Target spec.

Note: Refer to macro specification book.

3. RF Analog Macro List (Preliminary)

Circuit	Function		Voltage	Current	Application example
QMOD/QDEM	900 MHz QMOD + AGC		3.0 V	29.5 mA	PDC
	1.9 GHz Doubler + MOD + UpCONV (IF = 233 MHz)+AGC			28.5 mA	PHS
	0.9, 1.9 GHz Doubler + MOD UpCONV IF = 300 to 450 MHz			27.0 mA	GSM/DCS,PCS
	130 MHz Shifter QMOD			8.0 mA	CDMA
	85 MHz Shifter + QDEM			8.2 mA	CDMA
2nd Mixer	L_O = 250 MHz, IF = 10.8 MHz 2nd Mixer			3.7 mA	PHS
	L_O = 130 MHz, IF = 450 kHz 2nd Mixer			2.6 mA	PDC
	400 MHz IFAMP + 2ndMIX			5.0 mA	GSM/DCS,PCS
Buf AMP/VCO	1.2 to 1.6 GHz Local Buffer AMP			5.0 mA	GSM/DCS,PCS
	400 MHz VCO + VCO Buffer			5.0 mA	GSM/DCS,PCS
	260 MHz VCO (Tx)			3.5 mA	CDMA
	170 MHz VCO (Rx)			3.5 mA	CDMA
Lim AMP/RSSI	450 kHz LimAMP/RSSI			2.3 mA	PDC
	10.8 MHz LimAMP/RSSI 10.8 MHz LimAMP/RSSI			2.3 mA	PHS
1st Mixer	L_O = 718 MHz, IF = 130 MHz 1st Mixer			4.5 mA	PDC
Offset Mixer	L_O = 718 MHz, RF = 850 MHz Tx-Mixer			6.0 mA	PDC
RF AMP	850 MHz RF-AMP			2.5 mA	PDC
AGC AMP	130 MHz AGC	Gp = 40 dB	3.6 V	19 mA	CDMA
		Gp = –55 dB		4.9 mA	

Note: Circuit format and other details can be adjusted to meet customer requirements.
Refer to macro specification book.

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min.	Max.	
Power supply voltage *	V_{CC}	–0.5	6.0	V
Input voltage *	V_{IN}	–0.5	V_{CC} + 0.5	V
Output current	I_{out}	–10	10	mA
Storage temperature	T_{stg}	–55	+125	°C

* : Voltage values are based on GND = 0 V

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Power supply voltage *1	V_{CC} *2	2.5	—	5.5	V
	GND	—	0	—	V
Operating temperature	T_a	–40	—	+85	°C

*1: Voltage values are based on GND = 0 V
*2: The range of operating voltage should be defined depends on circuit configuration.

WARNING: Recommended operating conditions are normal operating ranges for the semiconductor device. All the device's electrical characteristics are warranted when operated within these ranges.

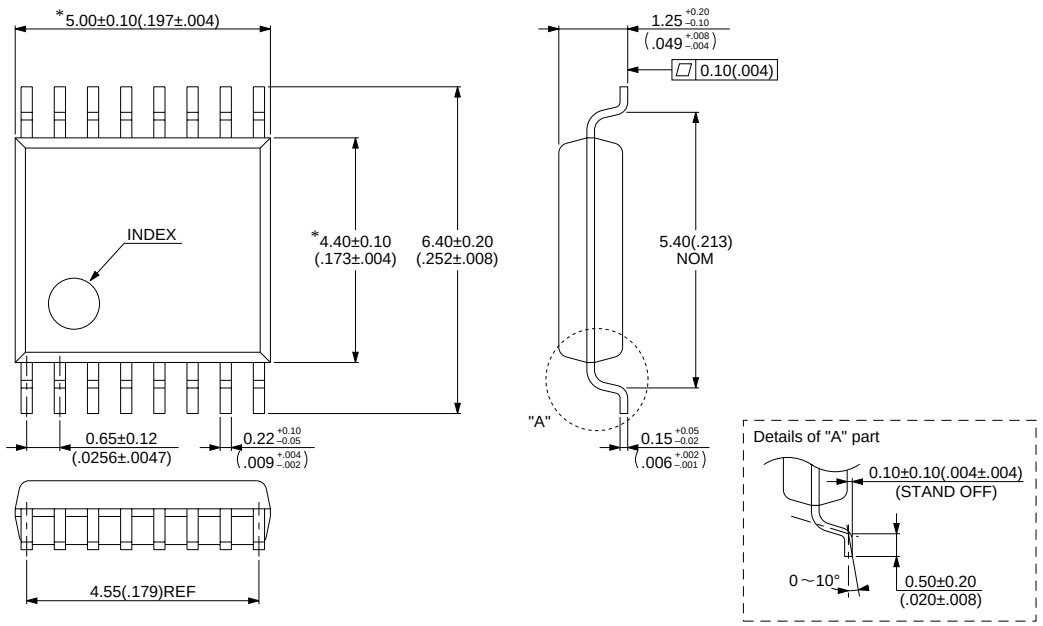
Always use semiconductor devices within the recommended operating conditions. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representative beforehand.

MB15G000 Series

■ PACKAGE DIMENSIONS

16-pin Plastic SSOP
(FPT-16P-M05)



Dimensions in mm (inches)

20-pin Plastic SSOP
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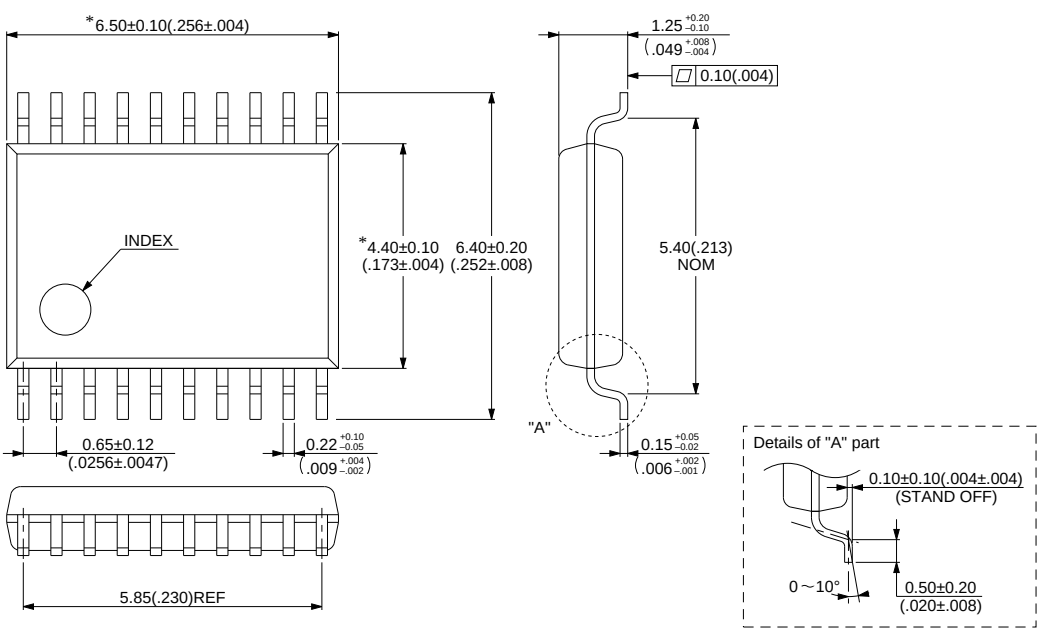

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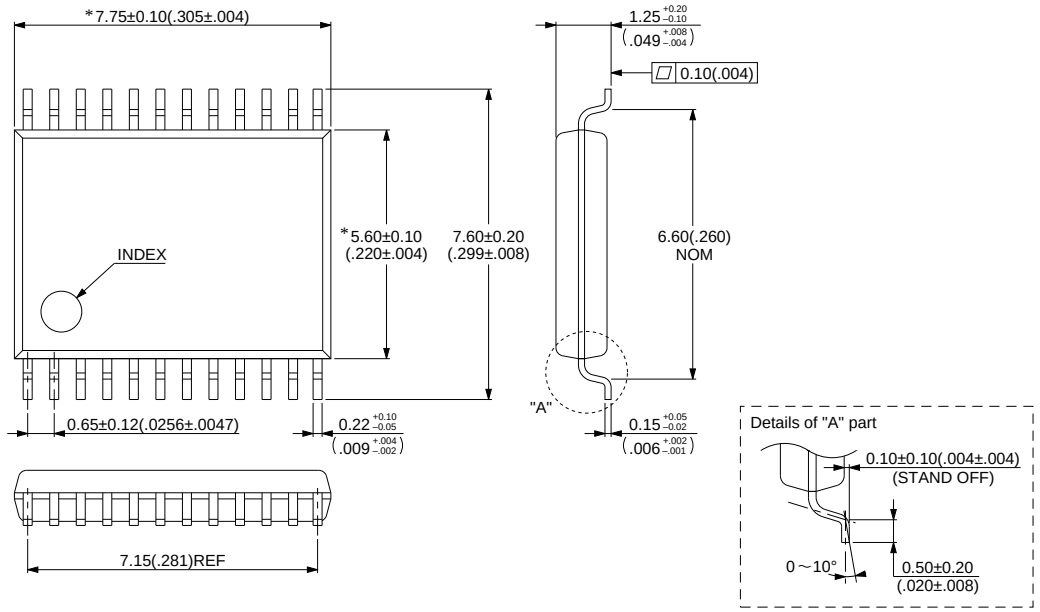

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34-pin Plastic SSOP
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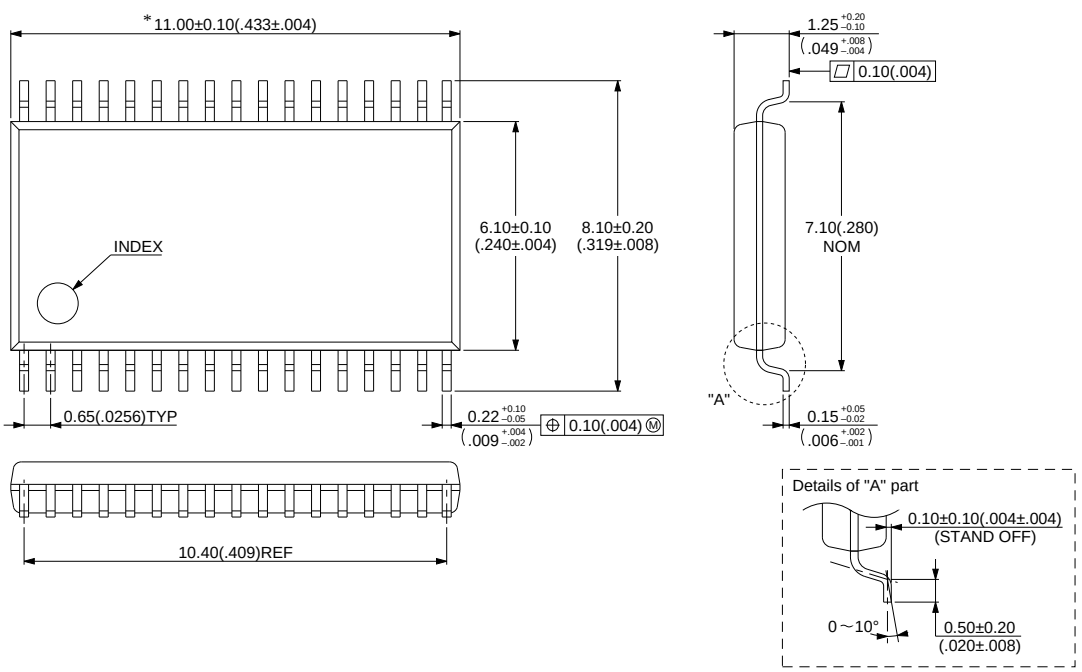
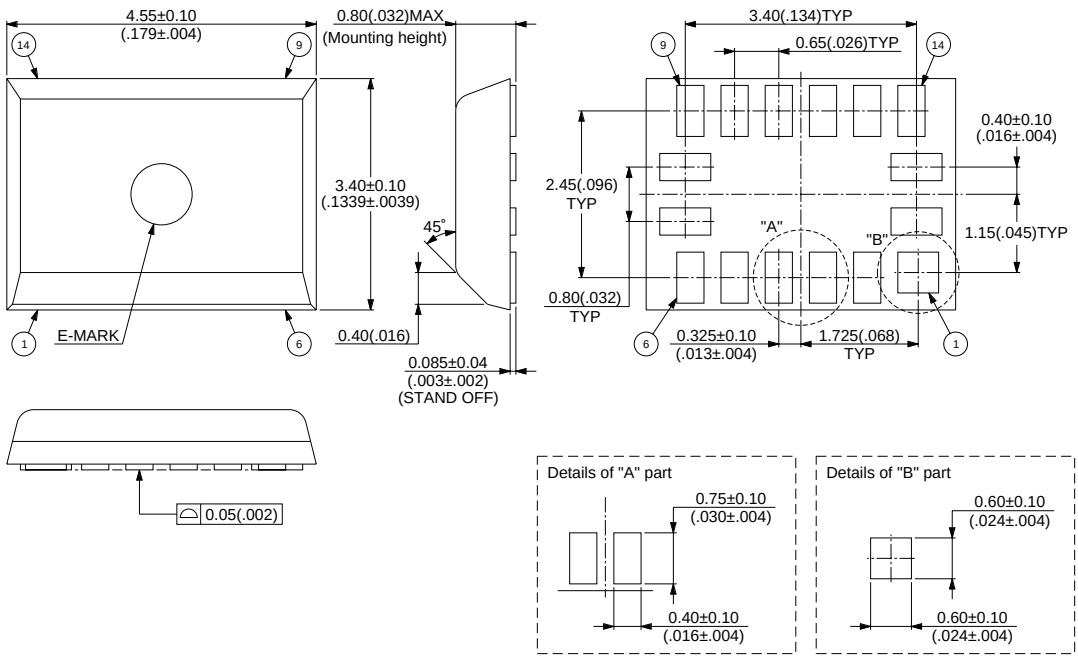


Dimensions in mm (inches)

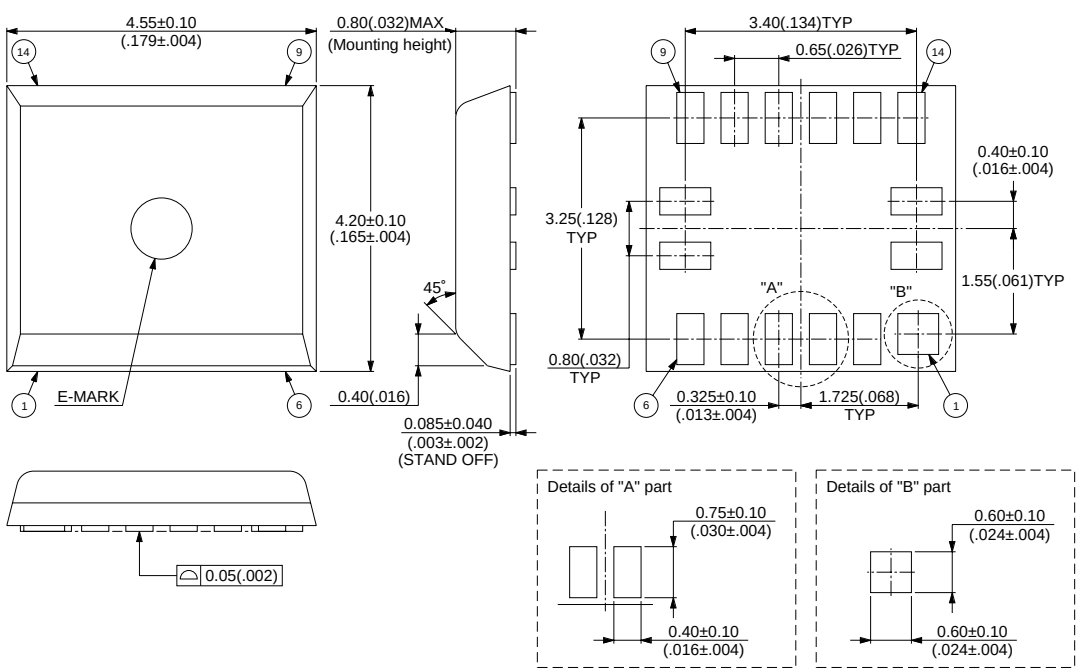
MB15G000 Series

16-pad Plastic BCC
(LCC-16P-M02)



Dimensions in mm (inches)

16-pad Plastic BCC
(LCC-16P-M03)



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48-pin Plastic LQFP
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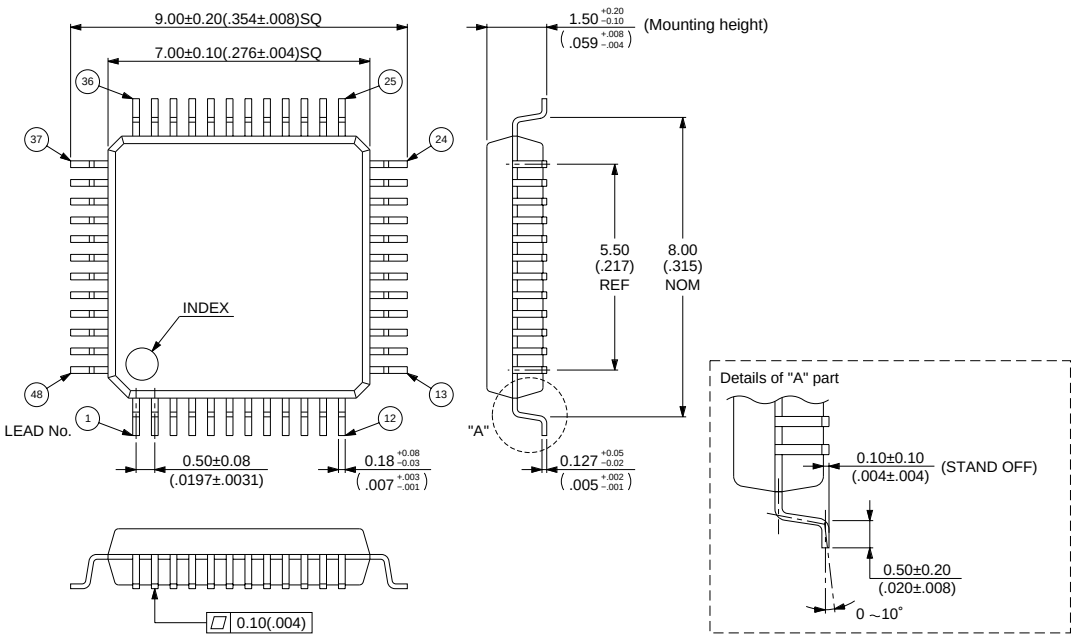
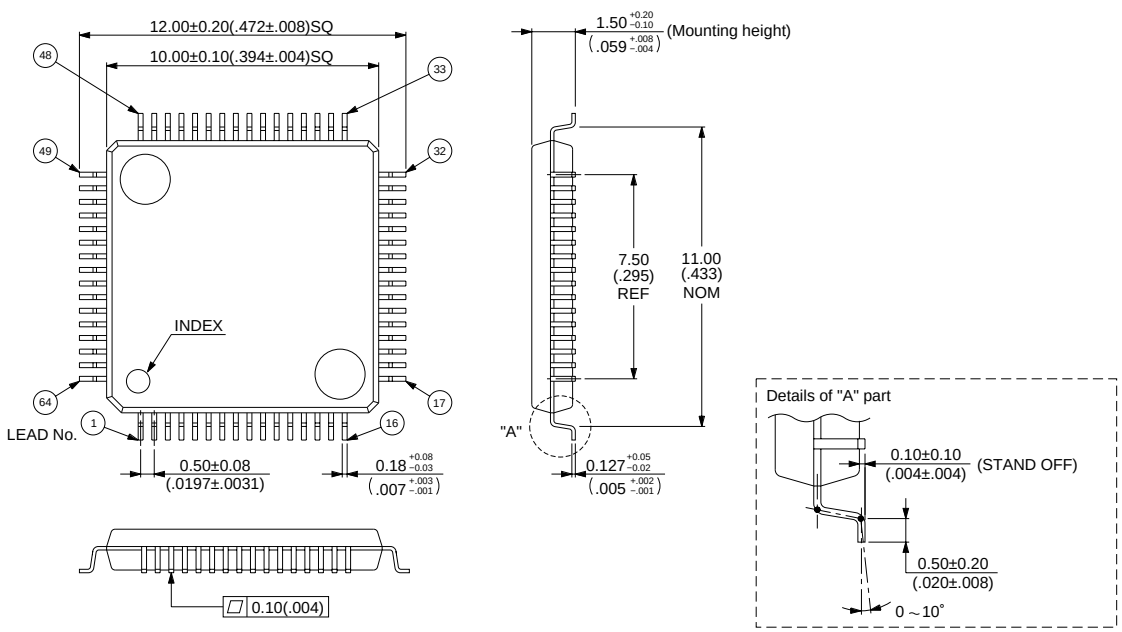


Dimensions in mm (inches)

64-pin Plastic LQFP
(FPT-64P-M03)



Dimensions in mm (inches)

MB15G000 Series

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