AMICCOM

A7700

<Preliminary>

2.4GHz RF Front End

Document Title

A7700 Data Sheet, 2.4GHz RF Front End with PA and LNA

Revision History

Rev. No.	History	Issue Date	Remark
0.0	Initial issue.	May, 2009	Objective
0.1	Change package from QFN3X3 12pin to QFN3X3 16 pin. Change mode control pin to TXSW, RXSW.	Sep., 2009	Preliminary
0.2	Change pin7 (VDD_BA) and pin 12 (BGS) to NC.	Mar., 2010	Preliminary

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1. Typical Application

- 2400 ~ 2483.5MHz ISM Band System
- IEEE 802.15.4 and Zigbee System
- Wireless metering and building automation

- Wireless Audio/Video System
- Industry control
- 2.4GHz Helicopter and airplane radio controller

2. General Description

A7700 is a high performance and low cost 2.4GHz RF front end by CMOS technology. It integrates PA (up to 19dBm output power), LNA (gain up to 11 dB), RF switch as well as matching network so that only a few external components are needed. A7700 consists of two stages PA to provide extended link budget (distance) of larger TX output power and LNA for higher RX sensitivity in a wireless system. A7700 also has a very low sleep current (0.2 uA) for not only portable consumer electronic device but wireless sensor applications (IEEE 802.15.4) in the 2.4 GHz ISM band. All features are integrated in a small QFN-16 3X3mm package. Overall, A7700 is a range extender for all existing AMICCOM's 2.4GHz TRX to provide users the total solutions of 2.4GHz high power module design including PCB layout, matching network and performance optimization.

3. Feature

- Small size (QFN 3X3, 16 pins).
- Support 2400 ~ 2483.5MHz ISM band.
- Wide range operation 2.0V ~ 3.6V.
- TX output power 17.9dBm when Pin = 0dBm.
- PA and LNA current adjustable by bias resistor on BG pin.
- LNA high/low gain mode adjustable by HGM pin.
- Few external components.
  - ◆ Integrate two stages PA.
  - ◆ Integrate LNA.
  - ◆ Integrate RF switch.
  - ◆ Integrate Inductors.
  - ◆ Integrate matching network.
- 6.8 dB LNA noise figure in high gain mode.
- Low Sleep current 0.2 uA.
- RX current 4.3 mA @ high gain mode.
- TX current 97 mA @ 17.9 dBm output power when Pin = 0dBm @ Vdd = 3.3V.
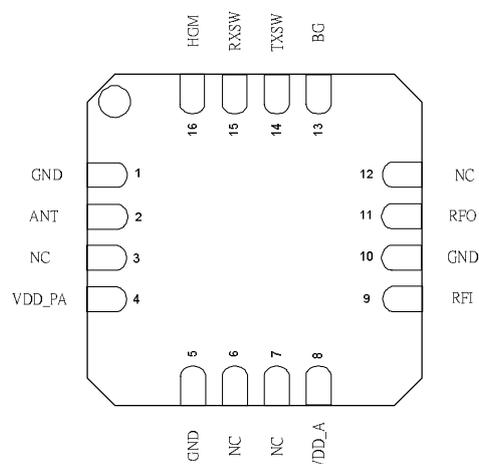
4. PIN Configuration

Figure 4.1 A7700 QFN-16 3X3 Package Top View

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5. PIN Description (I: Input, O: Output, I/O: Input or Output, G: Ground, D: Digital)

Pin No.	Symbol	I/O	Function Description
1	GND	G	Ground.
2	ANT	I/O	Antenna port. Connect to antenna matching network.
3	NC		No connection.
4	VDD_PA	I	Power amplifier supply voltage input.
5	GND	G	Ground.
6	NC		No connection.
7	NC		No connection.
8	VDD_A	I	Analog supply voltage input.
9	RFI	I	TX RF input.
10	GND	G	Ground.
11	RFO	O	RX RF output.
12	NC		No connection.
13	BG	O	Band-gap output. Connect to bias resistor.
14	TXSW	DI	TX select. See below table.
15	RXSW	DI	RX select. See below table.
16	HGM	DI	LNA gain setting. Low→ LNA low gain mode, High→ LNA high gain mode.
	Back side plate	G	Ground. **Back side plate shall be well-solder to ground; otherwise, it will impact RF performance.**

Operation Mode	Pin 14 (TXSW)	Pin 15 (RXSW)
Inhibited	0	0
TX	0	1
RX	1	0
Sleep	1	1

6. Block Diagram
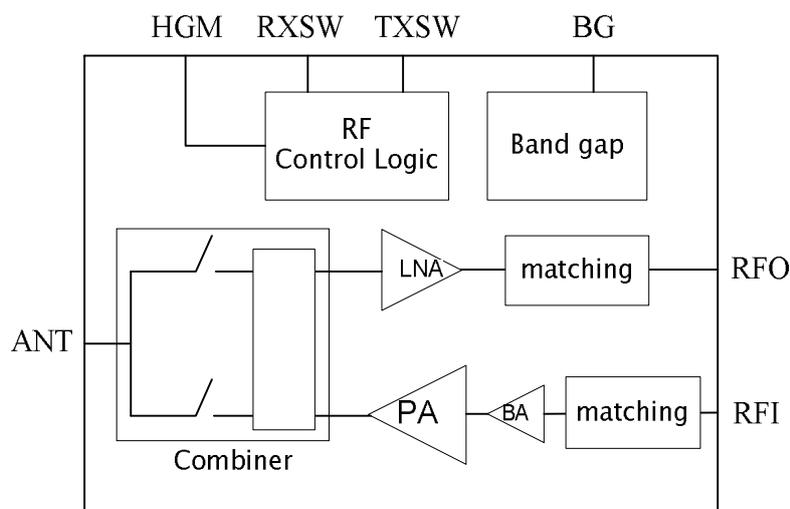
Figure 6.1 A7700 Block Diagram

7. Absolution Maximum Rating

Parameter	With respect to	Rating	Unit
Supply voltage range (VDD)	GND	-0.3 ~ 3.9	V
Digital I/O pins range	GND	-0.3 ~ VDD+0.3, max 3.9	V
Voltage on the analog pins range	GND	-0.3 ~ VDD+0.3, max 3.9	V
Maximum input RF level		10	dBm
Storage Temperature range		-55 ~ 125	°C
ESD	HBM	± 2KV *	V
	MM	± 100	V

*Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

*Device is ESD sensitive. Use appropriate ESD precautions. HBM (Human Body Mode) is tested under MIL-STD-883F Method 3015.7. MM (Machine Mode) is tested under JEDEC EIA/JESD22-A115-A.

*Device is Moisture Sensitivity Level III (MSL 3).
* Except Pin 2 and pin 4 are ± 1.75KV, other pins are ± 2KV.

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8. Electrical Specifications

(Ta=25℃, VDD=3.3V, unless otherwise noted. Measured on MD7700-G01 reference design with matching circuit.)

Parameter	Description	Minimum	Typical	Maximum	Unit
General					
Operating Temperature		-40		85	°C
Operating frequency range		2400		2483.5	
Supply Voltage (VDD)		2.0	3.3	3.6	V
Current Consumption	Sleep Mode		0.2		uA
	TX Mode (Pin=0dBm, Pout =17.9dBm)		97		mA
	RX Mode (HGM=1, high gain)		4.3		mA
	RX Mode (HGM=0, low gain)		1.3		mA
Transmitter					
Gain			19.2		dB
Maximum output power			19		dBm
Output P1dB			16.8		dBm
Output power variation (Pin = 0dBm)	Over frequency 2400M~2483MHz		0.5		dB
	Over voltage 2.0V ~ 3.6V		3		dB
2nd harmonic power	Pin = 0dBm[1]		-25		dBm
Input return loss	RFI pin 9		-14		dB
Receiver					
Gain	HGM=1		11		dB
	HGM=0		1		dB
Noise Figure	HGM=1		6.8		dB
Input P1dB	HGM=1		-4.5		dBm
Input return loss	HGM=1		-11		dB
Output return loss	RFO pin 11 and HGM=1		-14		dB
Digital IO DC characteristics					
High Level Input Voltage (V_{IH})		0.8*VDD		VDD	V
Low Level Input Voltage (V_{IL})		0		0.2*VDD	V
High Level Output Voltage (V_{OH})	@I_{OH}= -0.5mA	VDD-0.4		VDD	V
Low Level Output Voltage (V_{OL})	@I_{OL}= 0.5mA	0		0.4	V

Note 1: 2nd harmonic and 3rd harmonic power can be reduced below regulation limit by external ceramic filter. See BOM List of reference design for details.
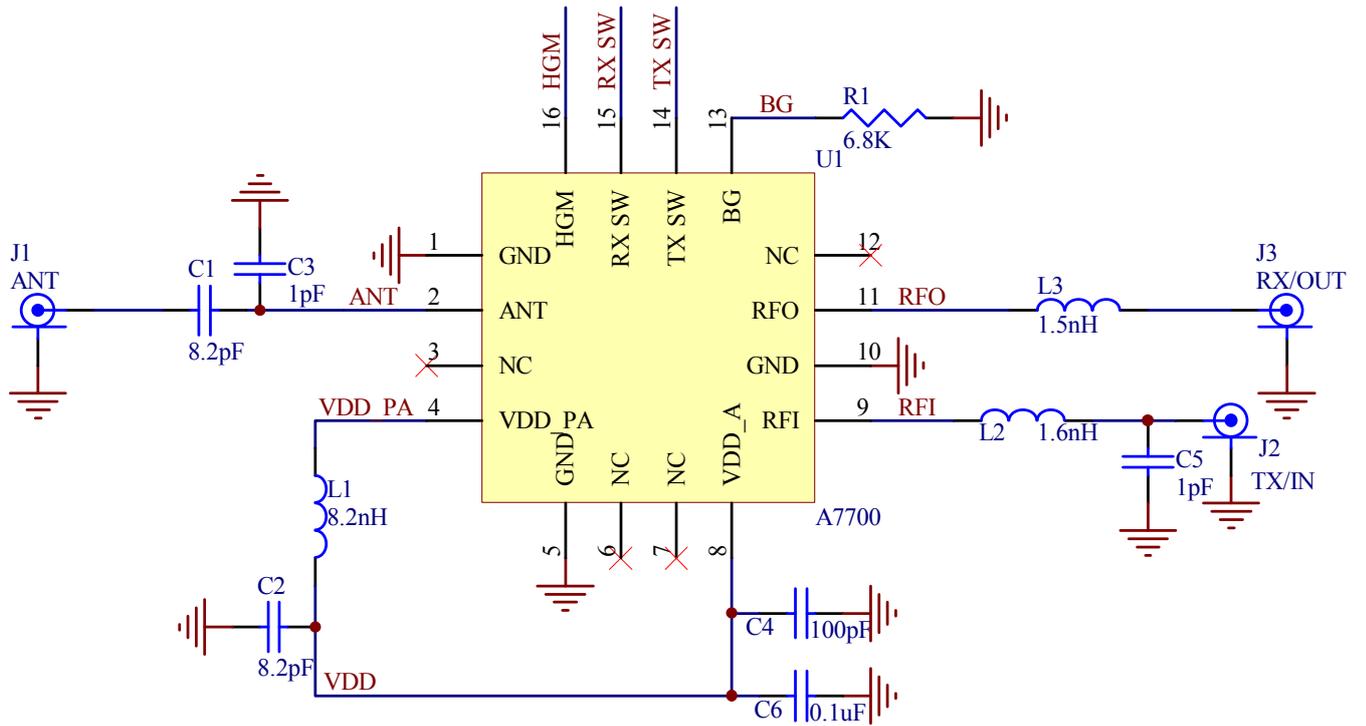
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9. Application Circuit

10. Abbreviations

HBM   Human Body Mode
HGM   High Gain Mode
ESD   Electro-Static Discharge
LNA   Low Noise Amplifier
PA   Power Amplifier
RX   Receiver
TRX   Transceiver
TX   Transmitter

11. Ordering Information

Part No.	Package	Units Per Reel / Tray
A77C00AQFI/Q	QFN16L, Pb Free, Tape & Reel, -40℃～85℃	3K
A77C00AQFI	QFN16L, Pb Free, Tray, -40℃～85℃	490EA

![AMICCOM logo]

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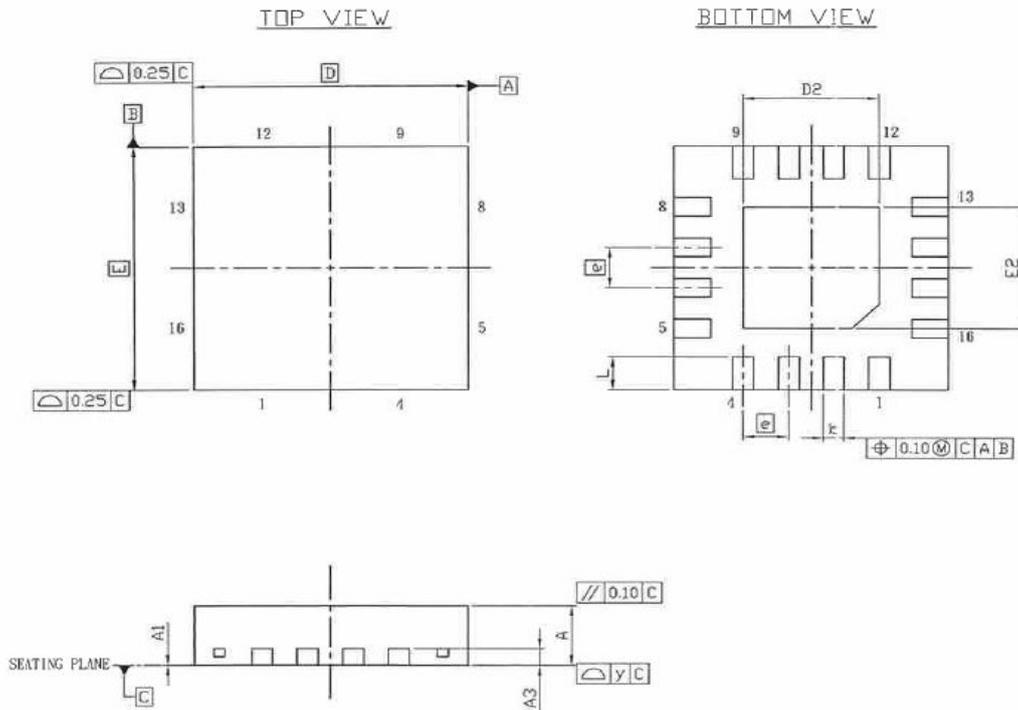
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12. Package Information

QFN 16L (3 X 3 X 0.8mm) Outline Dimensions   unit: mil/mm

| SYMBOL	Dimension(mm)			Dimension(mil)		
	Min	Nom	Max	Min	Nom	Max
A	0.7	0.75	0.8	27.56	29.53	31.5
A1	0	0.02	0.05	0	0.79	1.97
A3		0.203			7.99	
b	0.18	0.23	0.3	7.09	9.06	11.81
D	2.9	3	3.1	114.17	118.11	122.05
D2	1.4	1.6	1.8	55.12	62.99	70.87
E	2.9	3	3.1	114.17	118.11	122.05
E2	1.4	1.6	1.8	55.12	62.99	70.87
e		0.5			19.69	
L	0.3	0.4	0.5	11.81	15.75	19.69
y		0.08			3.15	

13. Top Marking Information

- Part No.   : **A77C00AQFI**
- Pin Count   : **16**
- Package Type : **QFN**
- Dimension   : **3*3 mm**
- Mark Method : **Laser Mark**
- Character Type : **Arial**
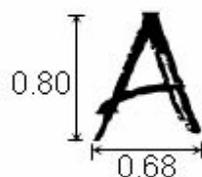
❖ TOP MARKING LAYOUT:
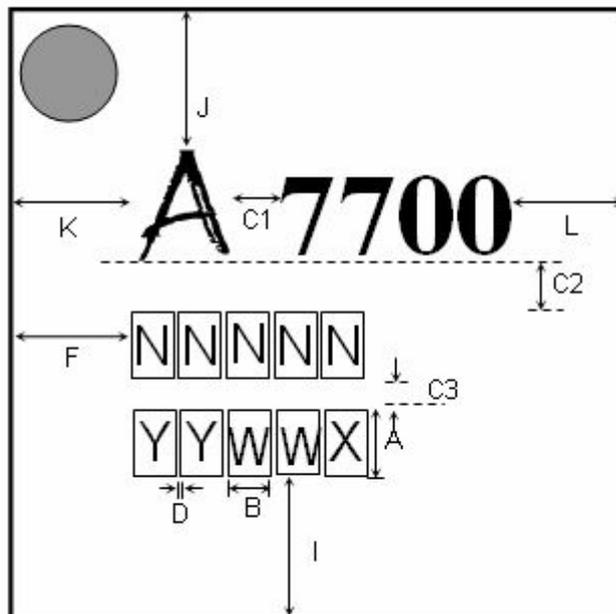
❖ CHARACTER SIZE : (Unit in mm)

A : 0.55
B : 0.30
C1 : 0.25   C2 : 0.3   C3 : 0.2
D : 0.03
A1 : 0.75
B2 : 0.7

I=J
F=K=L

YYWW	: DATECODE
X	: PKG HOUSE ID
NNNNN	: LOT NO. (The last 5 characters, no decimals)

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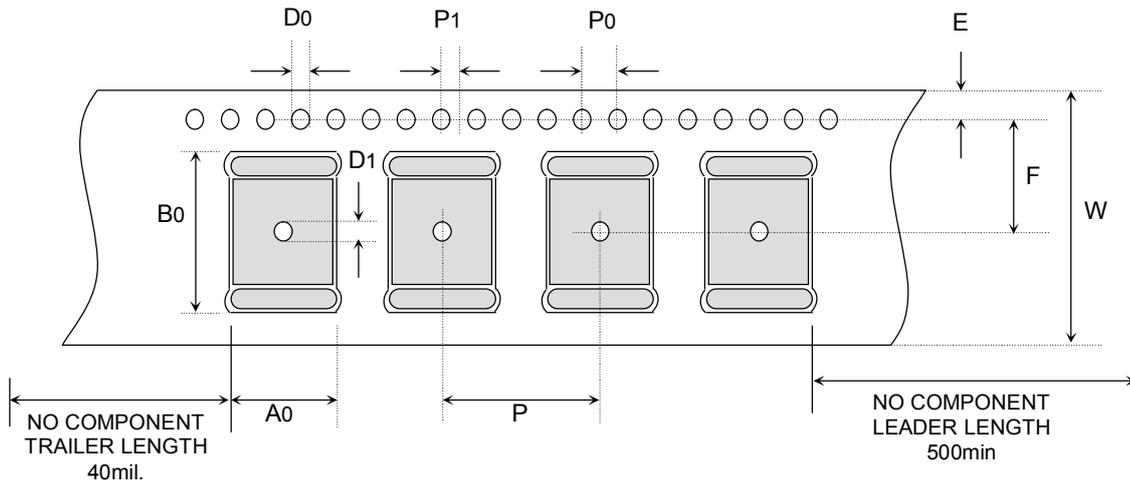
14. Reflow Profile

LEAD FREE (GREEN) PROFILE :

260℃ Max

255+ 5℃ / -0℃

10±1sec

220℃

80 sec

Re-flow Zone

150℃

Temperature ℃

Pre-heating Zone
60~120 sec

50~80 sec

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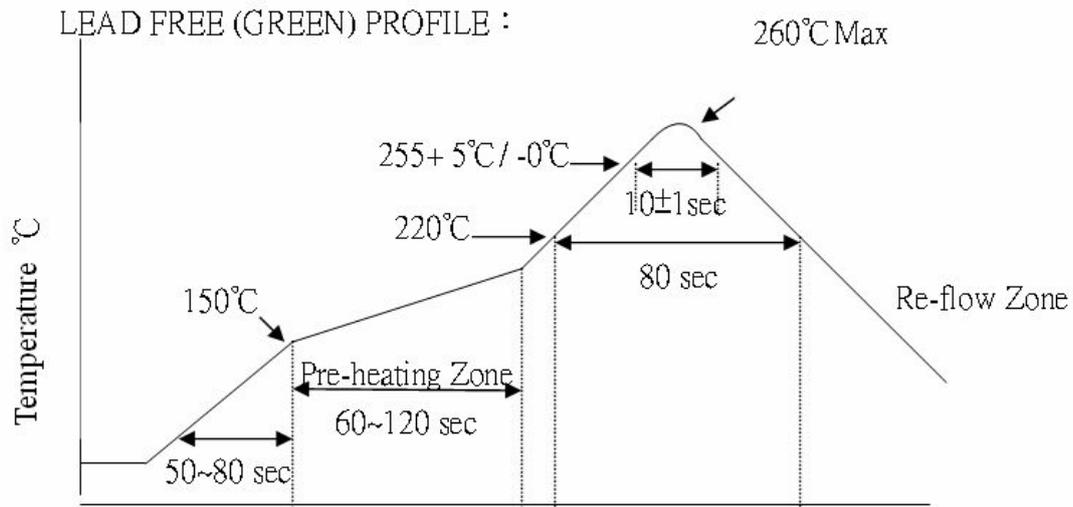
15. Tape Reel Information

Cover / Carrier Tape Dimension

11 EA IC   **60cm±4cm**

TYPE	P	A0	B0	P0	P1	D0	D1	E	F	W
12 QFN 3*3	4	3.2	3.2	4.0	2.0	1.5	-	1.75	1.9	8
20 QFN 4*4	8	4.35	4.35	4.0	2.0	1.5	1.5	1.75	5.5	12
24 QFN 4*4	8	4.4	4.4	4.0	2.0	1.5	1.5	1.75	5.5	12
32 QFN 5*5	8	5.25	5.25	4.0	2.0	1.5	1.5	1.75	5.5	12
48 QFN 7*7	12	7.25	7.25	4.0	2.0	1.5	1.5	1.75	7.5	16
DFN-10	4	3.2	3.2	4.0	2.0	1.5	-	1.75	1.9	8
20 SSOP	12	8.2	7.5	4.0	2.0	1.5	1.5	1.75	7.5	16
24 SSOP	12	8.2	8.8	4.0	2.0	1.5	1.5	1.75	7.5	16
28 SSOP (150mil)	8	6	10	4.0	2.0	1.5	1.5	1.75	7.5	16
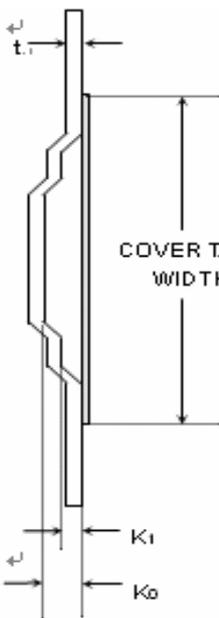
TYPE	K0	K1	t
12 QFN (3X3)	0.75	-	0.25
20 QFN (4X4)	1.1	-	0.3
24 QFN (4X4)	1.4	-	0.3
32 QFN (5X5)	1.1	-	0.3
48 QFN (7X7)	1.1	-	0.3
DFN-10	0.75	-	0.25
20 SSOP	2.5	-	0.3
24 SSOP	2.1	-	0.3
28 SSOP (150mil)	2.5	-	0.3

COVER TAPE WIDTH
8
9.2
9.2
9.2
13.3
8
13.3
13.3
12.5

Unit : mm

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REEL DIMENSIONS
UNIT IN mm

TYPE	G	N	T	M	D	K	L	R
12 QFN(3X3) 20 QFN(4X4) 24 QFN(4X4) 32 QFN(5X5) DFN-10	12.8+0.6/-0.4	100 REF	18.2(MAX)	1.75±0.25	13.0+0.5/-0.2	2.0±0.5	330＋ 0.00/-1.0	20.2
48 QFN(7X7)	16.8+0.6/-0.4	100 REF	22.2(MAX)	1.75±0.25	13.0+0.5/-0.2	2.0±0.5	330＋ 0.00/-1.0	20.2
28 SSOP (150mil)	20.4+0.6/-0.4	100 REF	25(MAX)	1.75±0.25	13.0+0.5/-0.2	2.0±0.5	330＋ 0.00/-1.0	20.2
20 SSOP 24 SSOP	16.4+2.0/-0.0	100 REF	22.4(MAX)	1.75±0.25	13.0+0.2/-0.2	1.9±0.4	330＋ 0.00/-1.0	20.2
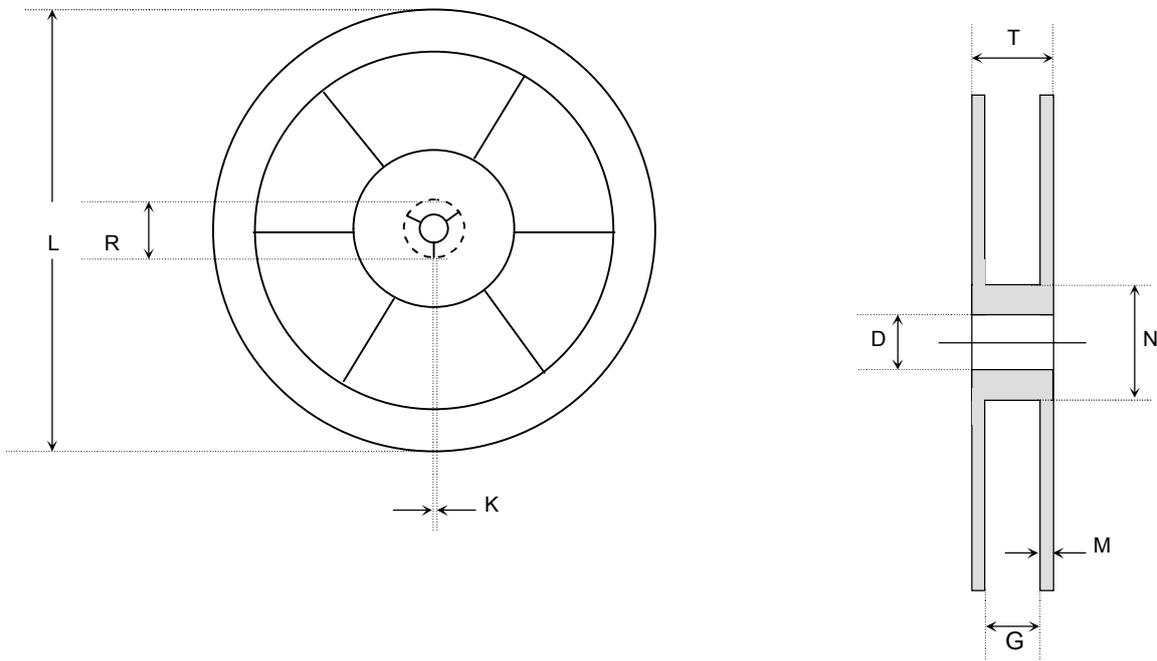
16. Product Status

Data Sheet Identification	Product Status	Definition
Objective	Planned or Under Development	This data sheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	Engineering Samples and First Production	This data sheet contains preliminary data, and supplementary data will be published at a later date. AMICCOM reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
No Identification	Noted Full Production	This data sheet contains the final specifications. AMICCOM reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Obsolete	Not In Production	This data sheet contains specifications on a product that has been discontinued by AMICCOM. The data sheet is printed for reference information only.

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