

MediaTek MT7681 Datasheet

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1 Introduction

1.1 General Description

The MT7681 is a highly integrated Wi-Fi System on Chip (SoC), which supports IEEE802.11b/g/n single stream, GPIO and PWM for intelligent control and UART/SPI interfaces for device communication.

The MT7681 integrates a power amplifier, low noise amplifier and RF switch to reduce the module size and simplify RF design in the final product. It also integrates a power management unit for a single 3.3V power source.

A 32-bit RISC MCU is embedded in the MT7681 to run 802.11b/g/n drivers, wireless supplicant, TCP/IP protocol stack and networking applications. It also helps provide Wi-Fi station and softAP operation modes.

These features make the MT7681 a cost effective chipset for use in embedded devices that need to enable Wi-Fi-based networking services with minimal design effort.

All these features are available in a compact 40 pin, 5mm x 5mm QFN package.

1.2 Features

The key features of the MT7681 are:

- Single stream IEEE 802.11b/g/n
- 32-bit RISC microprocessor host MCU
- Embedded IEEE 802.11b/g/n drivers, wireless supplicant and TCP/IP stack
- Highly integrated RF PA, LNA and RF switch
- Integrated high efficiency switching regulator for single 3.3V power source
- Security support for WPA personal (WPA-PSK), WPA2 personal (WPA2-PSK) and WPA/WPA2 personal
- Operation in station or softAP modes
- Rich I/O interfaces: UART, SPI, PWM and GPIO
- All functions integrated in a compact 5mm x 5mm QFN40L package

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1.3 Applications

The MT7681 is ideal for use in devices for these applications:

- Home automation
- Smart plugs
- Lighting
- Metering
- Remote control
- Consumer network devices

1.4 Block Diagram

Figure 1 shows the block diagram of the MT7681.

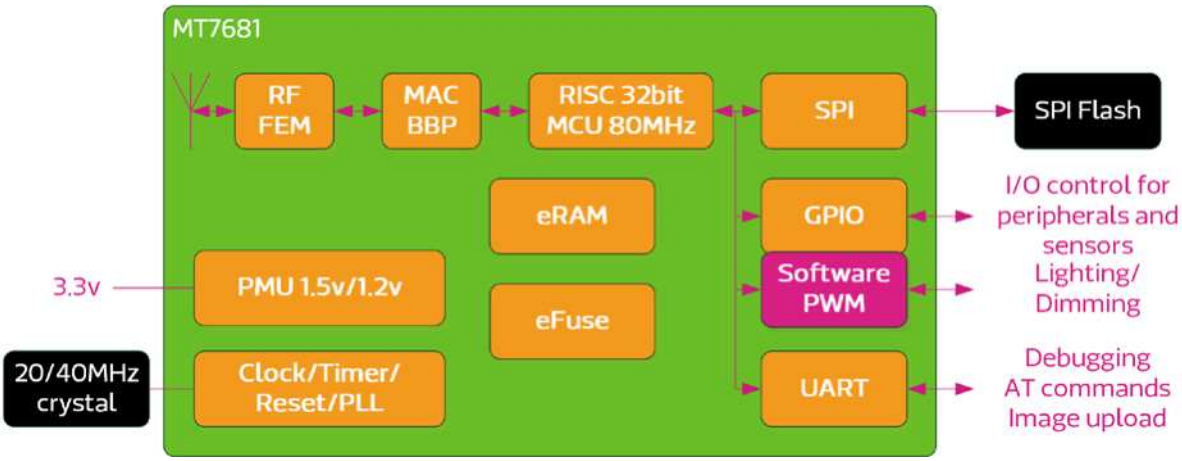


Figure 1 MT7681 block diagram

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2 Product Descriptions

This section provides details of the MT7681, including:

- Pin layout
- Pin descriptions
- Strapping options
- Package information
- Ordering information
- Top markings

2.1 Pin Layout

Figure 2 shows a top view of the pin layout for the MT7681. These pins are described in detail in section 2.2, “PIN Description”.

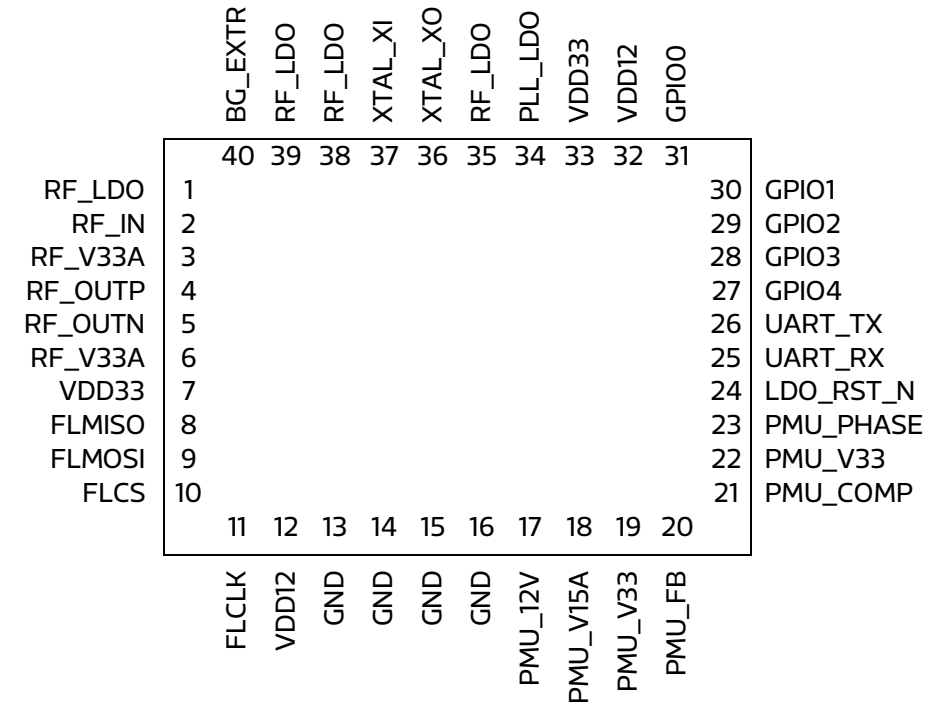


Figure 2 Top view of MT7681 QFN pin-out

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2.2 Pin Descriptions

Table 1 provides descriptions of the pins on the MT7681.

QFN40	Pin Name	Pin description	Default PU/PD	I/O	Supply domain
Reset and clocks					
24	LDO_RST_N	External system reset for active low	N/A	Input	VDD33
37	XTAL_XI	Crystal or external clock input	N/A	Input	
36	XTAL_XO	Crystal output	N/A	Input	
UART interface					
25	UART_RX	UART Rx	N/A		VDD33
26	UART_TX	UART Tx	N/A		VDD33
FLASH interface					
8	FLMISO	External memory data input	PD	Input	VDD33
9	FLMOSI	External memory data output	PD	Output	VDD33
10	FLCS	External chip select	PU	Output	VDD33
11	FLCLK	External clock	PU	Output	VDD33
Programmable I/O					
30	GPIO0	Programmable input/output	PD	In/out	VDD33
31	GPIO1	Programmable input/output	PD	In/out	VDD33
29	GPIO2	Programmable input/output	PD	In/out	VDD33
28	GPIO3	Programmable input/output	PD	In/out	VDD33
27	GPIO4	Programmable input/output	PD	In/out	VDD33
WIFI radio interface					
40	BG_EXTR	RF BG reference	N/A		
2	RF_IN	RF auxiliary Rx input	N/A		
4	RF_OUTP	RF port	N/A		
5	RF_OUTN	RF port	N/A		
PMU					
17	PMU_12V	PMU 1.2V output	N/A	Output	
18	PMU_V15A	PMU 1.5V input	N/A	Input	
19, 22	PMU_V33	PMU 3.3V power supply	N/A	Input	
20	PMU_FB	PMU control	N/A		
21	PMU_COMP	PMU control	N/A		
23	PMU_PHASE	PMU control	N/A		
Power supplies					
7, 33	VDD33	Digital I/O power supply	N/A	Input	
12, 32	VDD12	Digital core power supply	N/A	Input	

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QFN40	Pin Name	Pin description	Default PU/PD	I/O	Supply domain
3, 6	RF_V33A	RF 3.3V power supply	N/A	Input	
1, 35, 38, 39	RF_LDO	RF power supply	N/A	Input	
34	PLL_LDO	PLL power supply	N/A	Input	
E-PAD	DVSS	Digital ground	N/A		

Table 1 MT7681 pin descriptions

2.3 Strapping option

Table 2 shows the strapping options for the MT7681.

QFN40	Pin Name	Pin description	Default PU/PD
8	FLMISO	XTAL_20_SEL XTAL is 20MHz: Pull up XTAL is 40MHz: Pull down	PD
27	GPIO4	EXT_EE_SEL: Pull down	PD
25	UART_RX	CHIP_MODE[2]: Pull down	PD
11	FLCLK	CHIP_MODE[1]: Pull up	PD
9	FLMOSI	CHIP_MODE[0]: Pull down	PU

Table 2 Strapping option for the MT7681

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2.4 Package Information

This section provides details of the QNF packaging offered on the MT7681, including the package drawings in Figure 3 and the drawing annotations in Figure 4.

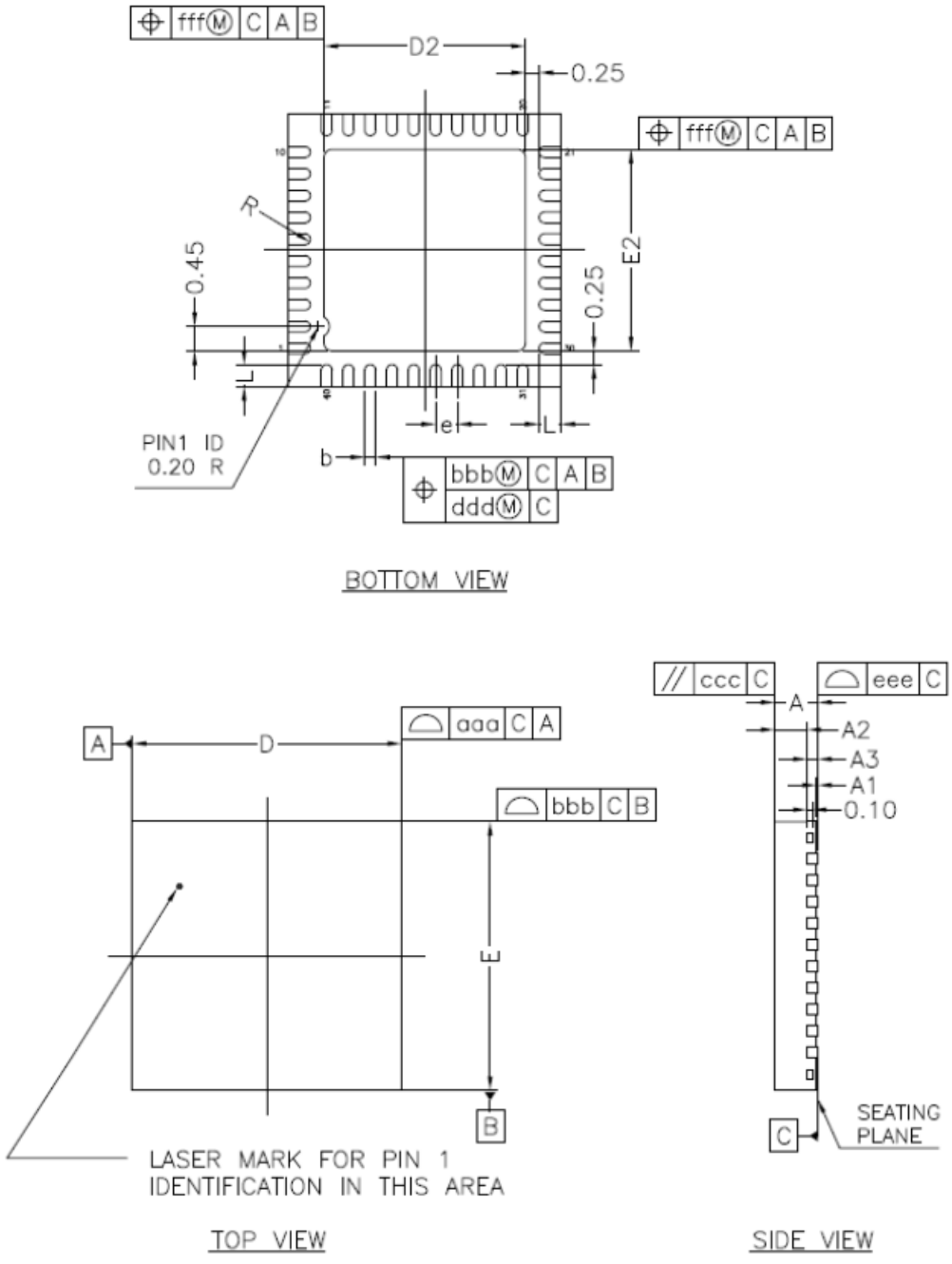


Figure 3 MT7681 package outline drawing

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* CONTROLLING DIMENSION : MM

SYMBOL	MILLIMETER			INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	---	---	0.80	---	---	0.031
A1	---	---	0.05	---	---	0.002
A2	---	0.53	0.58	---	0.021	0.023
A3	0.20 REF.			0.008 REF.		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	5.00 bsc			0.197 bsc		
D2	3.55	3.70	3.85	0.140	0.146	0.152
E	5.00 bsc			0.197 bsc		
E2	3.55	3.70	3.85	0.140	0.146	0.152
L	0.30	0.40	0.50	0.012	0.016	0.020
e	0.40 bsc			0.016 bsc		
R	0.075	---	---	0.003	---	---
TOLERANCES OF FORM AND POSITION						
aaa	0.10			0.004		
bbb	0.07			0.003		
ccc	0.10			0.004		
ddd	0.05			0.002		
eee	0.08			0.003		
fff	0.10			0.004		

NOTES :

1.ALL DIMENSIONS ARE IN MILLIMETERS.

2.DIE THICKNESS ALLOWABLE IS 0.305 mm MAXIMUM(.012 INCHES MAXIMUM)

3.DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M. -1994.

4.THE PIN #1 IDENTIFIER MUST BE PLACED ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR OTHER FEATURE OF PACKAGE BODY.

5.EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

6.PACKAGE WARPAGE MAX 0.08 mm.

7.APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.

8.APPLIED ONLY TO TERMINALS.

Figure 4 MT7681 package outline drawing annotations

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2.5 Ordering Information

Table 3 shows the ordering information for the MT7681.

Part number	MT7681N
Package	5mm x 5mm x 0.8 mm 40-QFN
Operational temperature range	-10 to 70°C

Table 3 MT7681 ordering information

2.6 Top Marking Information

Figure 5 shows the top marking displayed on a MT7681 chip.



Figure 5 Top marking on an MT7681 chip

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3 Electrical And Thermal Characteristics

This section provides details of the electrical and thermal characteristics of the MT7681, including:

- Maximum and minimum ratings
- Recommended operating ranges
- DC characteristics
- Thermal characteristics
- Current consumption

3.1 Maximum And Minimum Ratings

Table 4 shows the maximum and minimum ratings for the MT7681.

Symbol	Parameters	Minimum rating	Maximum rating	Unit
VDD33	3.3V Supply Voltage	-0.3	3.6	V
VDD12	1.2V Supply Voltage	-0.3	1.5	V
VDD15	1.5V Supply Voltage	-0.3	1.8	V
T_{STG}	Storage Temperature	-40	+125	°C
VESD	ESD protection (HBM)		2000	V

Table 4 Maximum and minimum ratings

3.2 Recommended Operating Ranges

Table 5 shows the recommended operating ranges for the MT7681.

Symbol	Rating	Minimum	Typical	Maximum	Unit
VDD33	3.3V Supply Voltage	2.97	3.3	3.63	V
VDD12	1.2V Supply Voltage	1.14	1.2	1.26	V
VDD15	1.5V Supply Voltage	1.425	1.5	1.575	V
$T_{AMBIENT}$	Ambient Temperature	-10	-	70	°C

Table 5 Recommended operating ranges

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3.3 DC Characteristics

Table 6 describes the DC characteristics of the MT7681.

Symbol	Parameter	Conditions	Minimum	Maximum	Unit
V_{IL}	Input Low Voltage	LVTTL	-0.28	0.6	V
V_{IH}	Input High Voltage		2.0	3.63	V
V_{T-}	Schmitt Trigger Negative Transition Threshold Voltage	LVTTL	0.68	1.36	V
V_{T+}	Schmitt Trigger Positive Transition Threshold Voltage		1.36	1.7	V
V_{OL}	Output Low Voltage	$\|I_{OL}\|$ = 1.6~14 mA	-0.28	0.4	V
V_{OH}	Output High Voltage	$\|I_{OH}\|$ = 1.6~14 mA	2.4	VDD33+0.33	V
R_{PU}	Input Pull-Up Resistance	PU=high, PD=low	40	190	KΩ
R_{PD}	Input Pull-Down Resistance	PU=low, PD=high	40	190	KΩ

Table 6 DC characteristics

3.4 Thermal Characteristics

Table 7 shows the thermal characteristics of the MT7681.

Symbol	Description	Performance	
		Typical	Unit
T_J	Maximum Junction Temperature (Plastic Package)	125	°C
Θ_{JA}	Junction to ambient temperature thermal resistance[1][2]	48.11	°C/W
Θ_{JC}	Junction to case temperature thermal resistance	TBD	°C/W
Ψ_{Jt}	Junction to the package thermal resistance[3]	3.23	°C/W

Notes:

[1] Air flow condition: Natural convection, 0.5m/s.

[2] PCB dimension 21mm x 11mm. 4-layer.

[3] 5mm x 5mm QFN40L package

Table 7 Thermal characteristics

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3.5 Current Consumption

Table 8 shows the current consumption for the Wi-Fi features of the MT7681.

Description	Performance	
	Typical	Unit
Sleep mode	1.1	mA
RX Active, HT40, MCS7	151	mA
RX Power saving, DTIM=1	15	mA
RX Listen	6	mA
TX HT40, MCS7 @15dBm	210	mA
TX CCK, 11Mbps @19dBm	242	mA

Note: All results measured at the antenna port with VDD33 at 3.3V

Table 8 WLAN 2.4GHz current consumption

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4 Cautions



ESD CAUTION

MT7681 is an ESD (electrostatic discharge) sensitive device and may be damaged by ESD or spike voltage. Although MT7681 has built-in ESD protection circuitry, please handle with care to avoid permanent damage or performance degradation.

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