Low-Power WAN Module GL6509

General Features

- General Purpose LoRa module for sensor integration
- Different versions to support AT commands, ModBus, and generic GPIO and I²C and UART interfaces
- Compact form factor: 15 x 39 x 2.75 mm
- Castellation SMT edge for easy PCB mounting
- Optional version with pin header for quick prototyping
- Separate versions for 915 MHz and for 868 MHz
- High receiver sensitivity: down to -137.5 dBm
- Industrial grade

Operational

- Single operating voltage at 3.3V
- Temperature range: -40°C to +85°C
- Low-power consumption

This LPWAN Module GL6509 is a general purpose SMT module for sensor integration. Sensor vendors can speed up their LPWAN integration by embedding this module in their designs. This module will take care of the LPWAN communication with our LPWAN AP and cloud services. There are different integration options: the sensor design can integrate this SMT module via AT command set treating this module as a LPWAN modem; the interface can be via Modbus interface; and the entire sensor be controlled by the MCU of the module through GPIO or I²C or UART.

This GL6509 Module complies with the LoRaWAN Class A protocol specifications. It integrates RF, a Low-Power Long Range transceiver and an application MCU. Together with the integration to our LPWAN gateway and back-end cloud service, making this a total IOT network solution.

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1 MODULE OVERVIEW

The GL6509 module is based on LoRa technology to provide low power long range communication using spread spectrum. This provides very high receive sensitivity enabling communication with high interference immunity.

Using LoRa modulation, depending on the spreading factor (SF), GL6509 can achieve system receiver sensitivity of -137.5 dBm.

TABLE 1-1: RECEIVER SENSITIVITY OF SYSTEM WITH 125 KHz MODE(UPLINK WITH SX1257)

SF	Data rate (bit/sec)	Sensitivity (dBm)
7	5469	-130.0
8	3125	-132.5
9	1758	-135.0
10	977	-137.5

TABLE 1-2: RECEIVER SENSITIVITY OF MODULE WITH 125 KHz MODE(DOWNLINK)

SF	Data rate (bit/sec)	Sensitivity (dBm)
7	5469	-125.0
8	3125	-128.0
9	1758	-131.0
10	977	-134.0

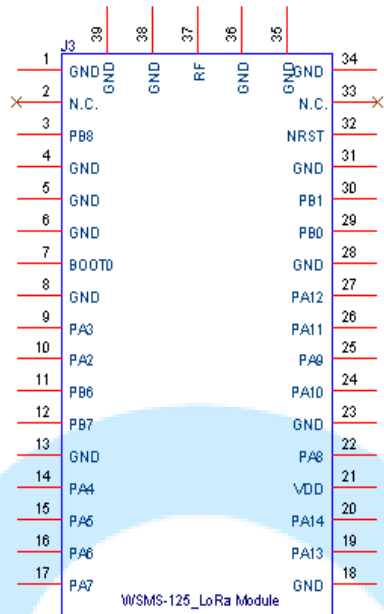**FIGURE 1-1: GL6509 SMT PIN DIAGRAM(Top View)**

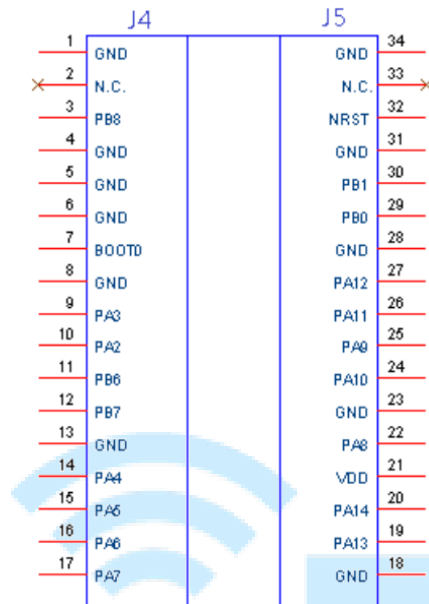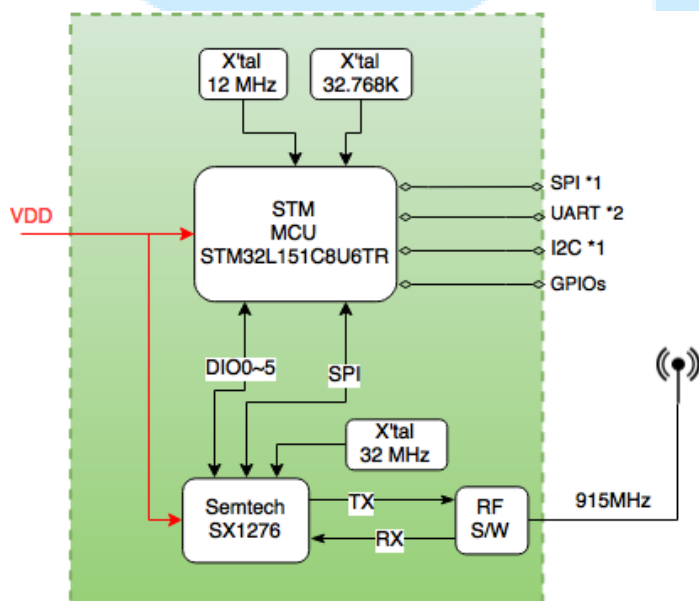**FIGURE 1-2: GL6509 PIN HEADER PIN DIAGRAM(Top View)**

FIGURE 1-3: GL6509 BLOCK DIAGRAM

TABLE 1-2: SMT PIN DESCRIPTION

Pin	Name	Type	Description
1	GND	Power	System Ground
2	N.C.	---	Not Connected
3	PB8	Input/Output	GPIO_1
4	GND	Power	System Ground
5	GND	Power	System Ground
6	GND	Power	System Ground
7	BOOT0	Input	Reserved for debug. Not Connected.
8	GND	Power	System Ground
9	PA3	Input/Output	GPIO_2
10	PA2	Input/Output	GPIO_3
11	PB6	Input/Output	GPIO_4
12	PB7	Input/Output	GPIO_5
13	GND	Power	System Ground
14	PA4	Input/Output	GPIO_6
15	PA5	Input/Output	GPIO_7
16	PA6	Input/Output	GPIO_8
17	PA7	Input/Output	GPIO_9
18	GND	Power	System Ground
19	PA13	Input / Output	SWDIO (Debug Port)
20	PA14	Input	SWCLK (Debug Port)
21	VDD	Power	Positive supply
22	PA8	Input/Output	GPIO_10
23	GND	Power	System Ground
24	PA10	Input	Communication USART1 Transmit (RX)
25	PA9	Output	Communication USART1 Receive (TX)

26	PA11	Input/Output	GPIO_11
27	PA12	Input/Output	GPIO_12
28	GND	Power	Supply Ground
29	PB0	Input/Output	GPIO_13
30	PB1	Input/Output	GPIO_14
31	GND	Power	System Ground
32	NRST	Input	MCU Reset
33	N.C.	---	Not Connected
34	GND	Power	Supply Ground
35	GND	Power	Supply Ground
36	GND	Power	Supply Ground
37	RF	RF Analog	RF RX/TX pin
38	GND	Power	Supply Ground
39	GND	Power	Supply Ground

2 GENERAL SPECIFICATIONS

Table 2-1 provides the general specifications for the module. Table 2-2, Table 2-3 and Table 2-4 provide the electrical characteristics, current consumption and output power of Tx power setting.

TABLE 2-1: GENERAL SPECIFICATIONS

Specifications	
Frequency Band	902 ~ 928MHz
Modulation Method	LoRa® Technology modulation
Maximum Over-the-Air Data Rate	5469 bps
RF connection	UFL Connector
Interface	UART (reserve for UART*1, I2C*1, SPI*1)
Sensitivity at 10 % BER	-137.5 dBm @ Lora Modulation, BW = 125K, SF = 10
RF TX Power	Adjustable, up to 19 dBm on 915MHz band
Temperature	-40°C to + 85°C(Operating) 40°C to + 125°C(Storage)
Humidity	10% ~ 90% non-condensing

TABLE 2-2: ELECTRICAL CHARACTERISTICS

Parameter	Min.	Typ.	Max.	Units
Supply Voltage, VDD	2.5	---	3.6	V
Voltage on any pin with respect to VSS (except VDD)	-0.3	---	VDD + 0.3	V
Output current sunk by any I/O and control pin	---	---	25	mA
Output current sourced by any I/O and control pin	---	---	-25	mA
Input low level voltage, VIL	---	---	0.3VDD	V
Input high level voltage, VIH	0.7VDD	---	---	V
Output low level voltage for an I/O pin, VOL	---	---	1.3	V
Output high level voltage for an I/O pin, VOH	VDD-1.3	---	---	V
RF Input Level	---	---	+10	dBm

TABLE 2-3: CURRENT CONSUMPTION

| Mode	Typical current at 3V (mA)
Standby	20
Receive	30
Deep Sleep	0.0043

TABLE 2-4: OUTPUT POWER OF TX POWER SETTING (BW=125KHZ)

Band	TX Power index	Output Power(dBm)	Current Consumption @ VDD = 3.3V(mA)
915 MHz	2	2.3	48
	3	3.27	50
	4	4.4	52
	5	5.41	54
	6	6.52	56
	7	7.65	58
	8	8.63	60
	9	9.65	62
	10	10.76	66
	11	11.73	69
	12	12.76	73
	13	13.75	77
	14	14.74	81
	15	15.65	87
	16	16.51	95
	17	17.29	105
	18	17.83	113
	19	18.54	123
	20	19.15	135

3 TYPICAL HARDWARE CONNECTIONS

Figure 3-1 shows the typical hardware connections where GL6509 is connected as a modem.

FIGURE 3-1: HARDWARE CONNECTIONS
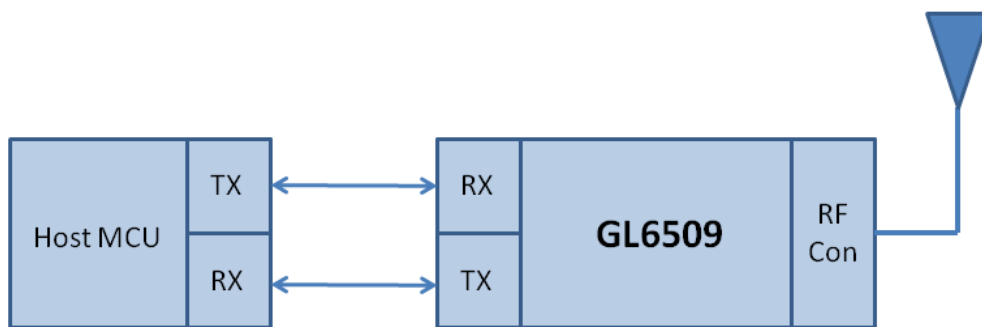
1.1 3.1 INTERFACE TO HOST MCU

A typical application of GL6509 is to use the UART connection to communicate with a host controller. In this application, the GL6509 is treated as a LoRa modem.

TABLE 3-1: DEFAULT UART SETTINGS

Specification	Description
Baud Rate	9600 bps
Data Length	8 bits
Parity Bit	No
Stop Bits	1 bit
Hardware Flow Control	No

1.2 3.2 GPIO AND INTERRUPT PINS

The GL6509 has 14 GPIO pins.

1.3 3.3 ANTENNA CONNECTIONS

There are two versions of antenna connectivity: one via the U.FL connector and the other via the SMT pin (RF Pin 37).

1.4 3.4 POWER PIN

It is recommended that all the power related pins are connected.

1.5 3.5 BOOT PIN

This general purpose input pin is used to boot the GL6509 module. This is reserved for debug purpose. Not Connected.
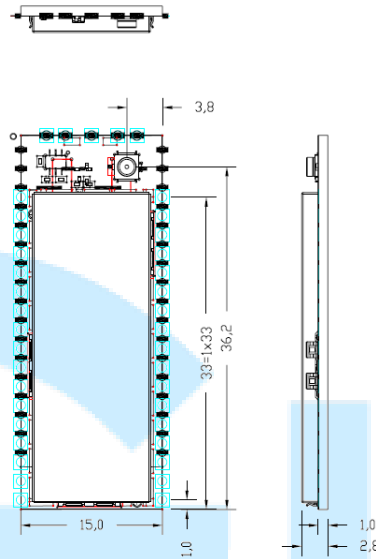
1.6 3.6 RESET PIN

This input pin is for reset of the module's MCU. Low active.
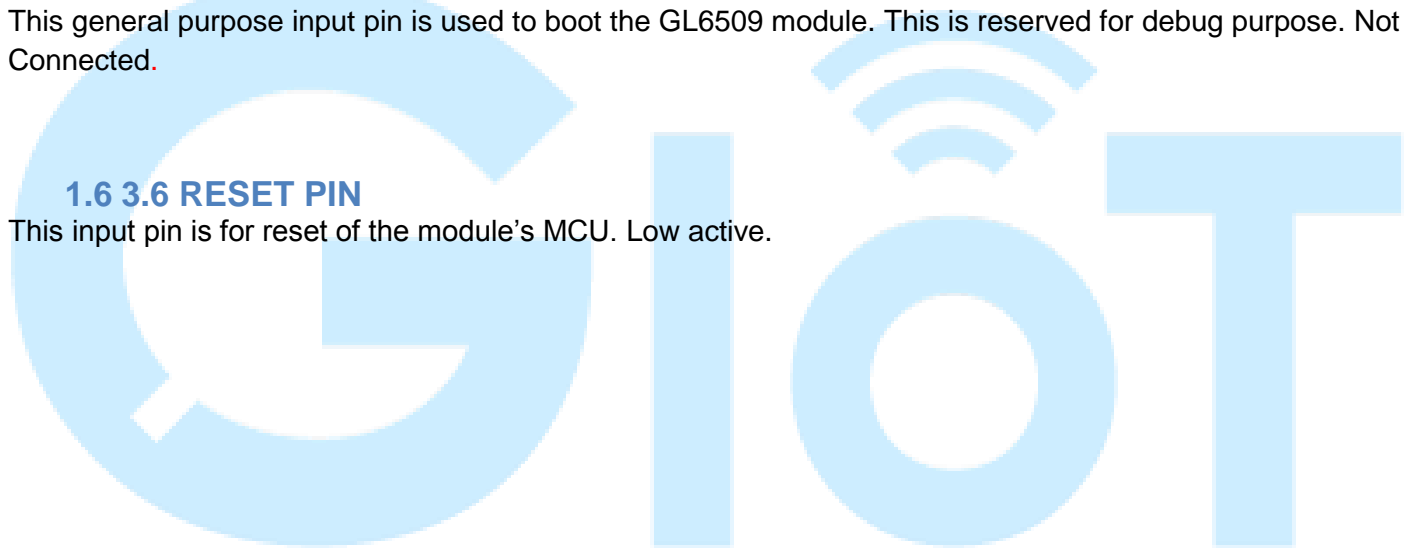
4 PHYSICAL DIMENSIONS

Figures 4-1 and 4-2 show the physical dimensions for both the SMT and the PIN Header mounted versions. Figure 4-3 shows the module PCB footprint, Figure 4-4 shows the module PIN Header type Pin Number.

FIGURE 4-1: GL6509 SMT DIMENSIONS

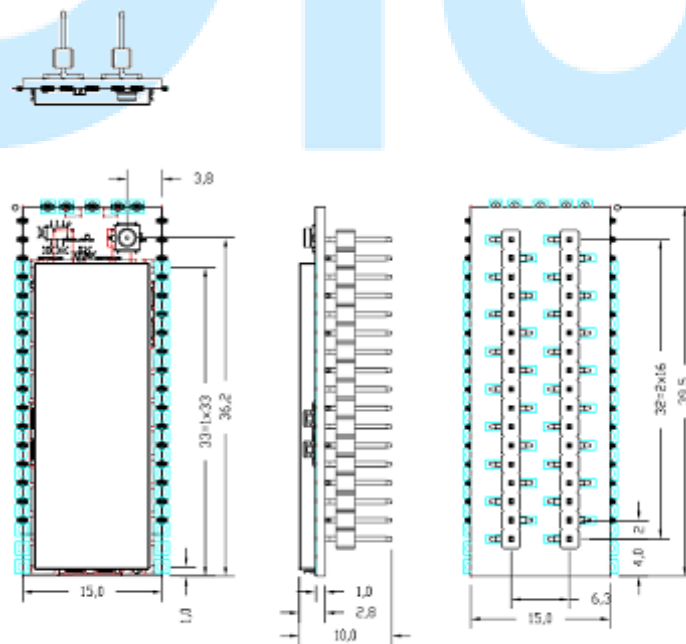**FIGURE 4-2: GL6509 PIN HEADER VERSION DIMENSIONS**

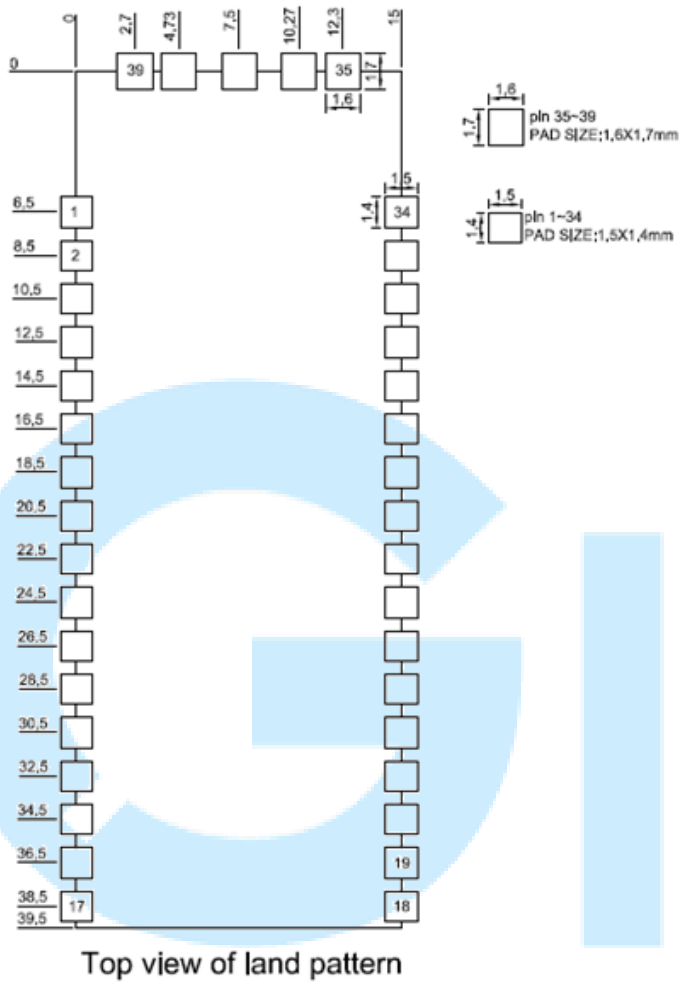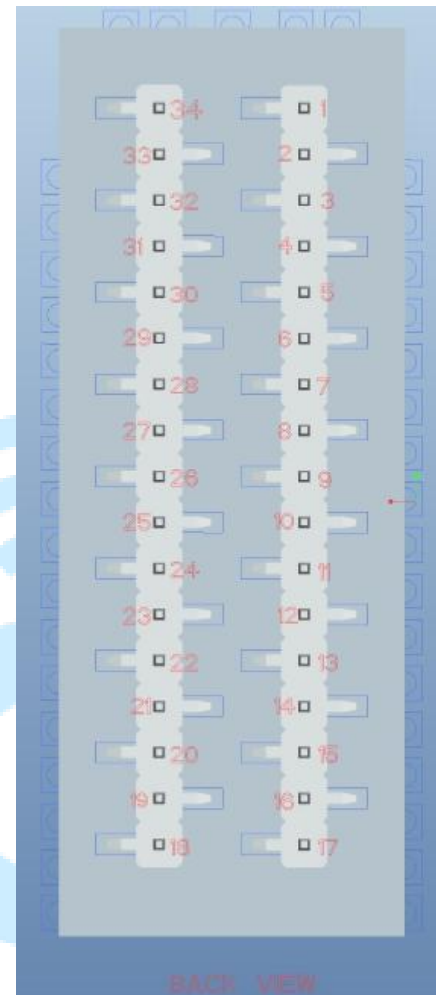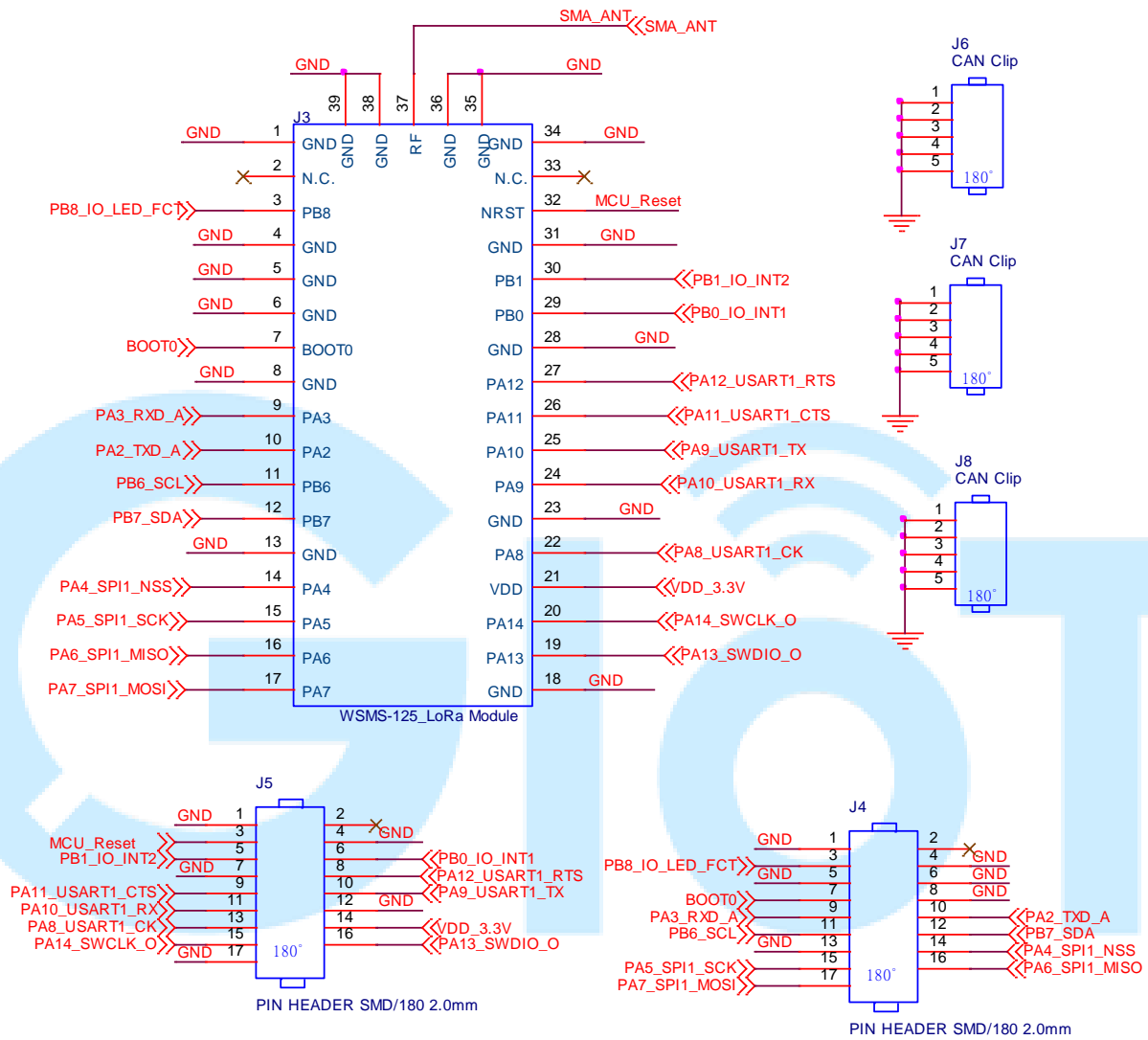**FIGURE 4-3: GL6509 SMT Type Recommend PCB Footprint.**

FIGURE 4-4: GL6509 PIN Header Type Pin Number (Bottom view).

Top view of land pattern

BACK VIEW

5 APPLICATION INFORMATION

PRODUCT IDENTIFICATION SYSTEM

G L 6 5 0 9 _ A _ M _ U

GL6509: for Gemtek LoRa module model name

A: for AT Commands; M: for ModBus; P: Programming

M: SMT; P: Pin Header

A: Antenna; T: Trace; U: U.FL