Fast Charging Controller IC for USB Interfaces

TypeC/PD2.0/PD3.1, QC5/QC4+/QC3+/QC3.0/QC2.0, FCP, SCP, AFC, SFCP, MTK PE+ 2.0/1.1, UFCS, Apple, BC1.2

1. Features

- **Support Charging standards including**
  - ✧ USB Type-C and USB Power Delivery
    - Support USB PD2.0/PD3.1/PPS/EPR 28V
    - Type-C Source
    - Integrated VCONN power and switch for reading E-Marker cable
  - ✧ Support QC5/QC4+/QC3+/QC3.0/QC2.0
    - Compatible with Class B
  - ✧ Support FCP/SCP
  - ✧ Support AFC
  - ✧ Support SFCP
  - ✧ Support MTK PE+ 2.0/1.1
    - PE+ 2.0: 5~20V (0.5V/step)
    - PE+ 1.1: 5V, 7V, 9V, 12V
  - ✧ Support UFCS
  - ✧ Support BC1.2, Apple 2.4A, SAMSUNG 2.0A
- **Independent built-in shunt regulator**
  - ✧ Programmable constant voltage control with minimum step of 10mV
  - ✧ Programmable constant current control
  - ✧ Integrated low side current sense amplifier
  - ✧ Cable drop compensation
- **Support multiple modes of voltage control**
  - ✧ Control of PWM controller feedback
  - ✧ Control of optocoupler
  - ✧ Control of I2C
- **Power management**
  - ✧ Integrated NMOS driver and support VDS detecting
  - ✧ Integrated Bleeder
  - ✧ Support power saving mode
- **Programmable fault protections**
  - ✧ Over Voltage Protection (OVP)
  - ✧ Under Voltage Protection (UVP)
  - ✧ Over Current Protection (OCP)
  - ✧ Over Temperature Protection (OTP)
  - ✧ DP/DM/CC1/CC2 over voltage protection
- **Package**
  - ✧ QFN24

2. Description

The IP2736 is a highly integrated fast charging controller dedicated for USB interfaces which supports many kinds of charging standards includes Type-C Source, PD2.0/PD3.1/PPS/EPR28V,HVDCP QC5/QC4+/QC3+/QC3.0/QC2.0 (Quick Charge), FCP (Hisilicon® Fast Charge Protocol), SCP (Super Fast Charge), AFC (Samsung® Adaptive Fast Charge), SFCP, MTK PE+ 2.0/1.1 (MediaTek Pump Express Plus 2.0/1.1), UFCS (Universal Fast Charging for Mobile Devices), BC1.2, Apple 2.4A, SAMSUNG 2.0A.

The IP2736 supports automatically detecting the connected device and switching standards type to respond to the fast charging requirements.

3. Applications

- ✧ USB power output ports for AC adapter, power bank, car charger, etc.
- ✧ Power supply for smart phones, tablets, netbooks, digital cameras, etc.

4. Typical Application Schematic

- **Control of PWM controller feedback**

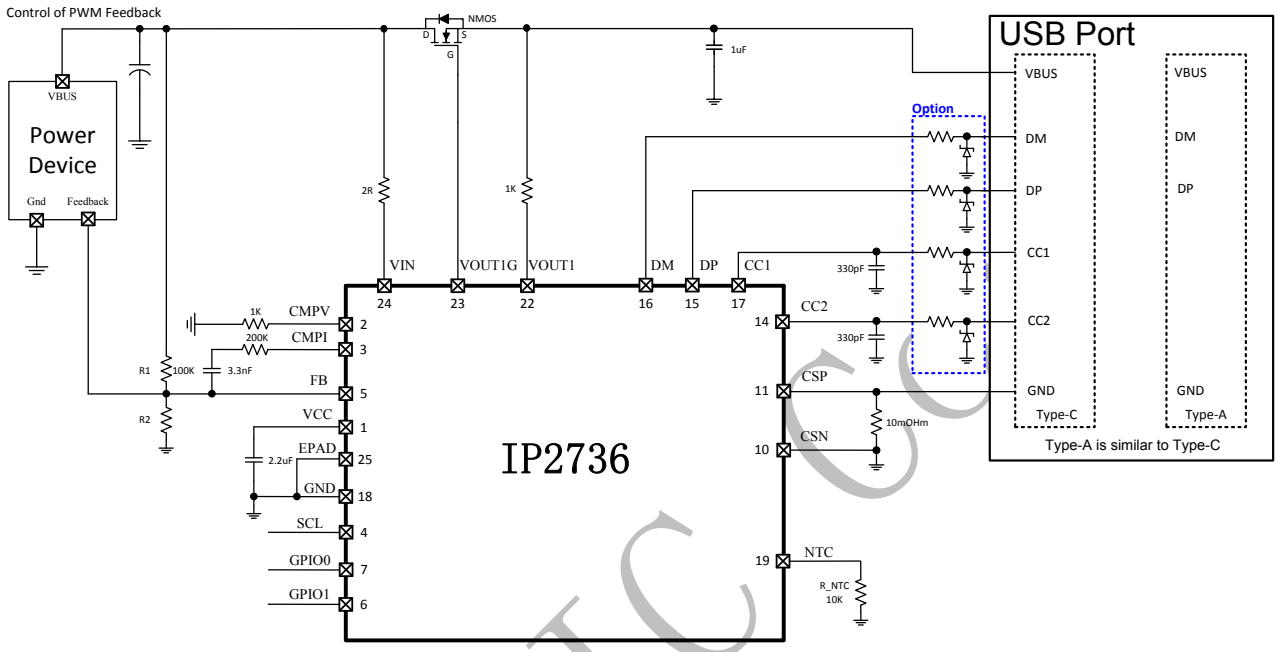


Figure 4-1. Typical application schematic of control of PWM controller feedback

Note：

1). 100kOhm(1%) R1 is recommended，R2=(Vfb*R1)/(5-Vfb);

2). Vdss≥30V NMOS is recommended;

3). 10kOhm(B=3380K) NTC is recommended;

4). The compensation capacitor and compensation resistor of CMPV/CMPI are adjustable refer to the power device;

- **EPR28V control IP6550 feedback**

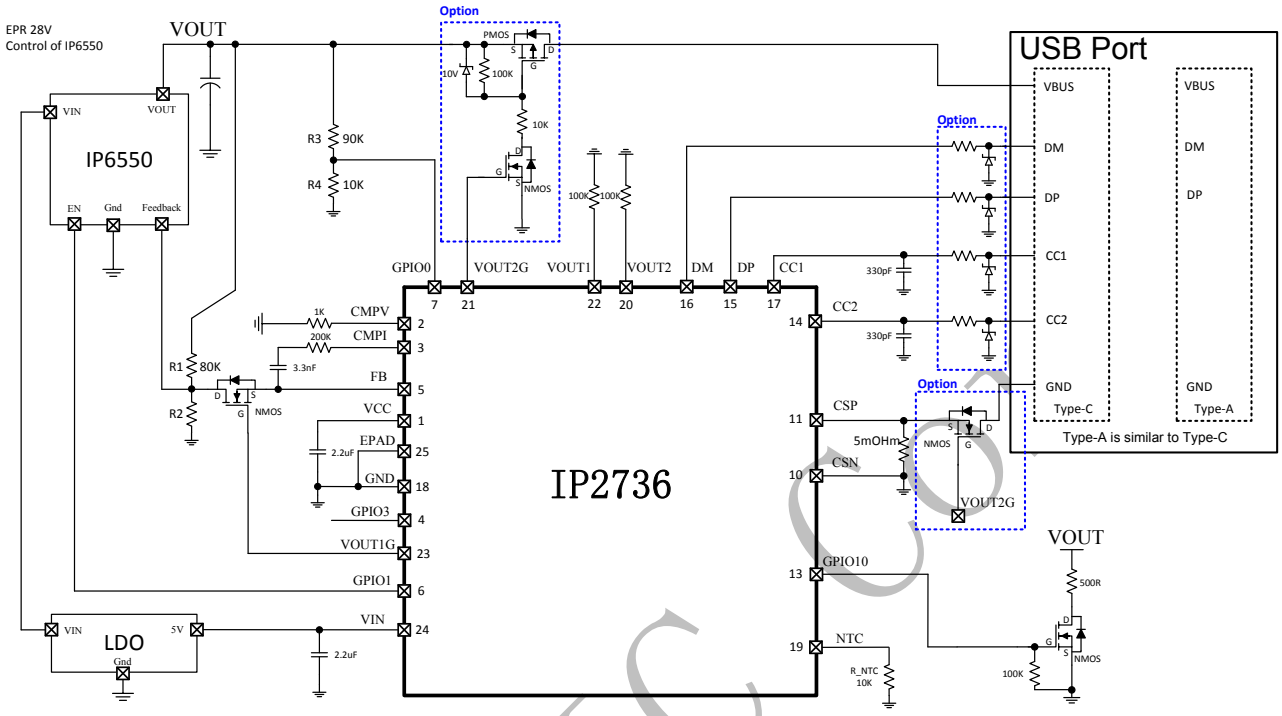


Figure 4-2. Typical application schematic of EPR28V control of IP6550 feedback

Note：

1). EPR28V dedicated;

2). 80kOhm(0.1%/1%) R1 is recommended，R2=(Vfb*R1)/(5-Vfb);

3). 90kOhm(0.1%/1%) R3 and 10kOhm(0.1%/1%) R4 is recommended;

4). PMOS driver can be PMOS(power path) or NMOS(ground path). Another path need to be short circuit

5). Vdss≥30V MOS is recommended;

6). 10kOhm(B=3380K) R_NTC is recommended;

7). The compensation capacitor and compensation resistor of CMPV/CMPI are adjustable refer to the power device;

- **EPR28V control AC-DC feedback**

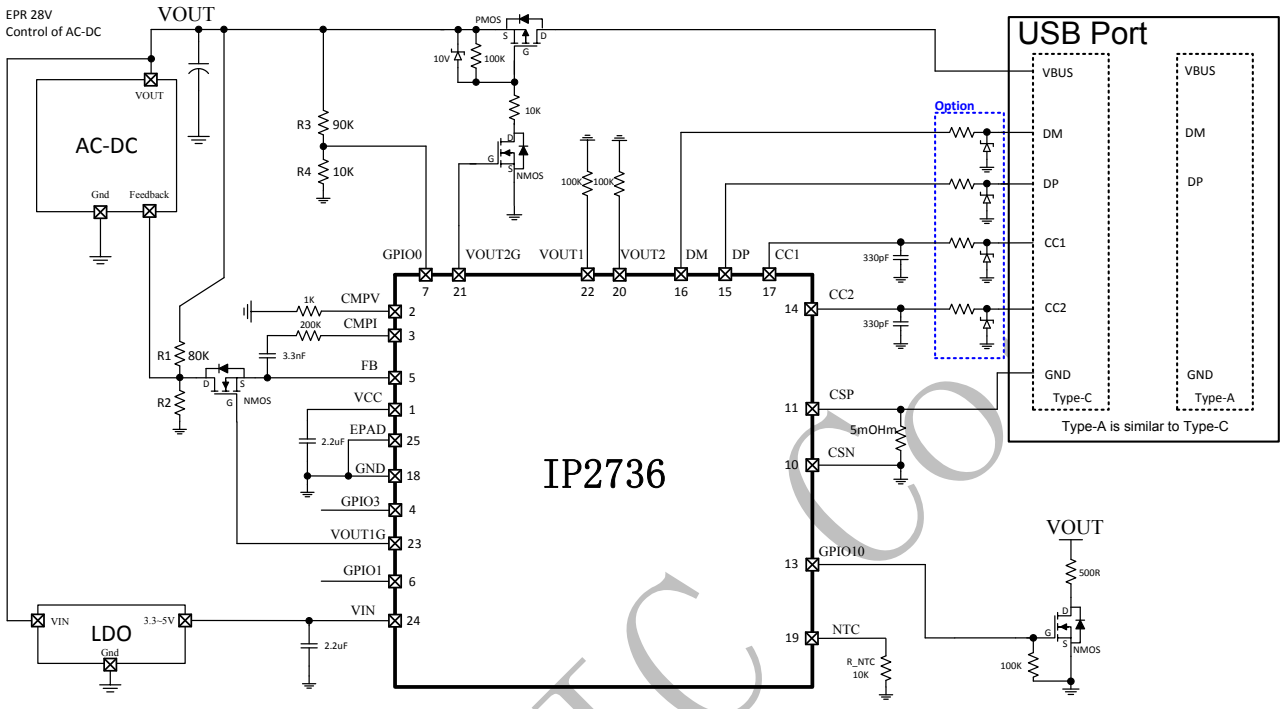


Figure 4-3. Typical application schematic of EPR28V control of AC-DC feedback

Note：

1). EPR28V dedicated;

2). 80kOhm(0.1%/1%) R1 is recommended，R2=(Vfb*R1)/(5-Vfb);

3). 90kOhm(0.1%/1%) R3 and 10kOhm(0.1%/1%) R4 is recommended;

4). Vdss≥30V MOS is recommended;

5). 10kOhm(B=3380K) R_NTC is recommended;

6). The compensation capacitor and compensation resistor of CMPV/CMPI are adjustable refer to the power device;

7). If system is going to work under 5V, it is recommended that 3.3VLDO be used;

- **Drive control optocoupler**

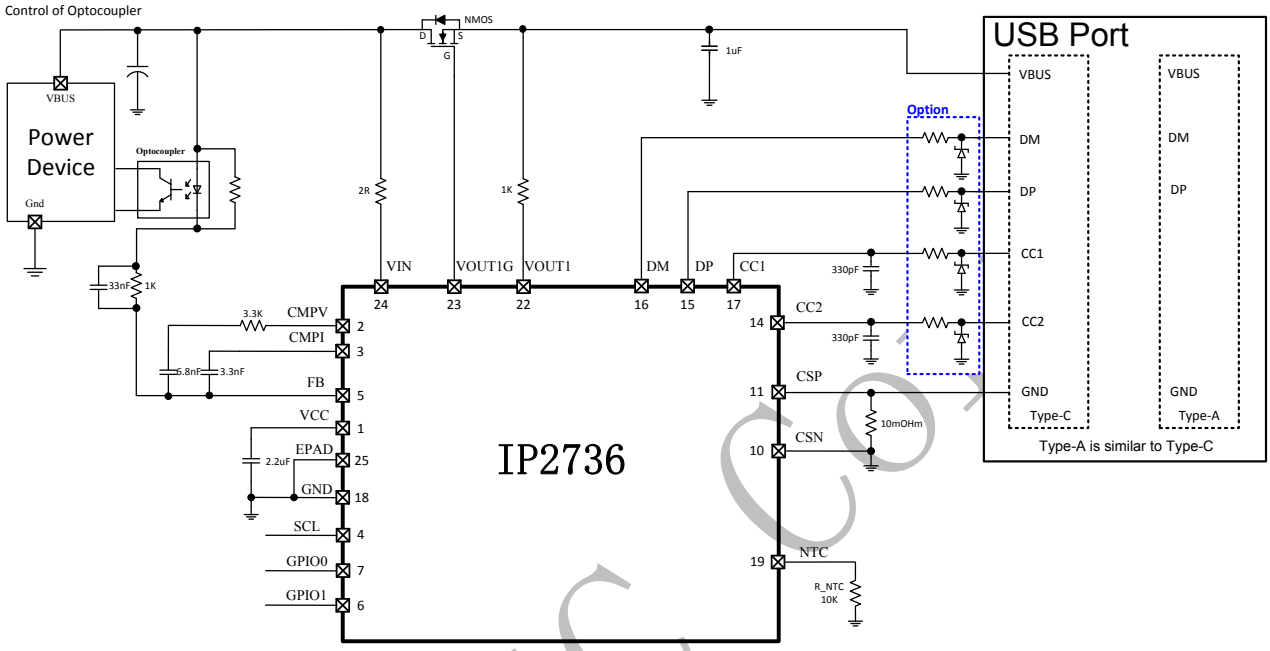


Figure 4-4. Typical application schematic of control of optocoupler

Note：

1). Vdss≥30V NMOS is recommended;

2). 10kOhm(B=3380K) NTC is recommended;

3). The compensation capacitor and compensation resistor of CMPV/CMPI are adjustable refer to the power device;

- **Control of I2C**

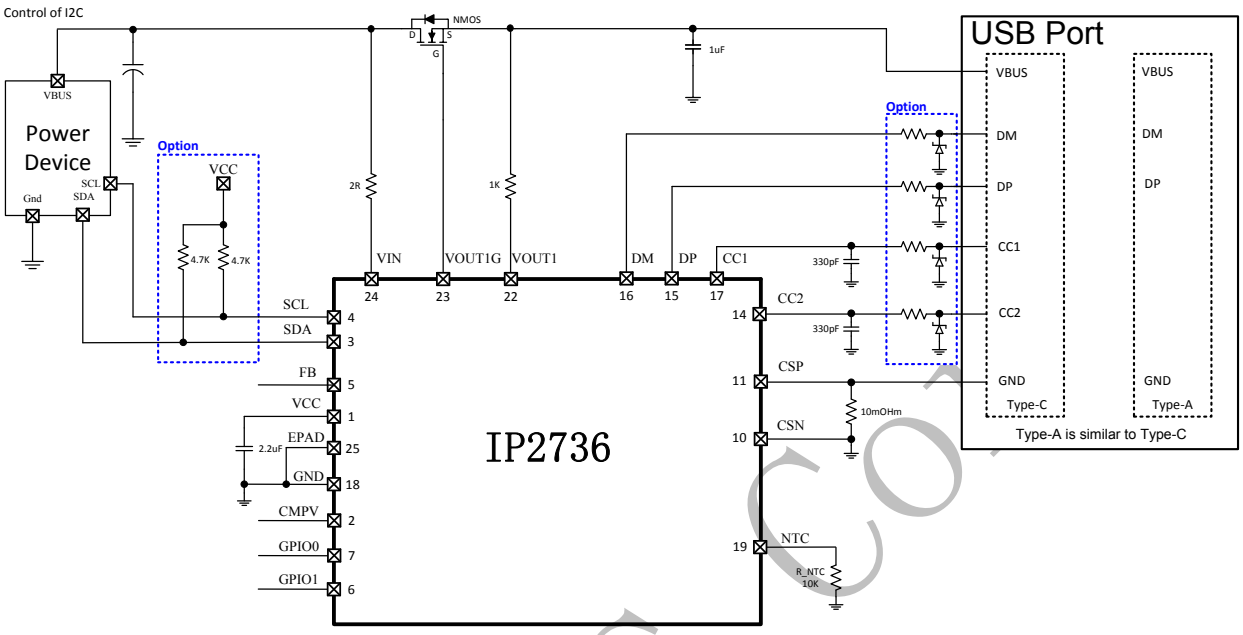


Figure 4-5. Typical application schematic of control of I2C

Note：

1). The external pull-up resistor is Optional which can be replace by 3kOhm internal pull-up resistor;

2). Vdss≥30V NMOS is recommended;

3). 10kOhm(B=3380K) NTC is recommended;

5. Pin Assignment

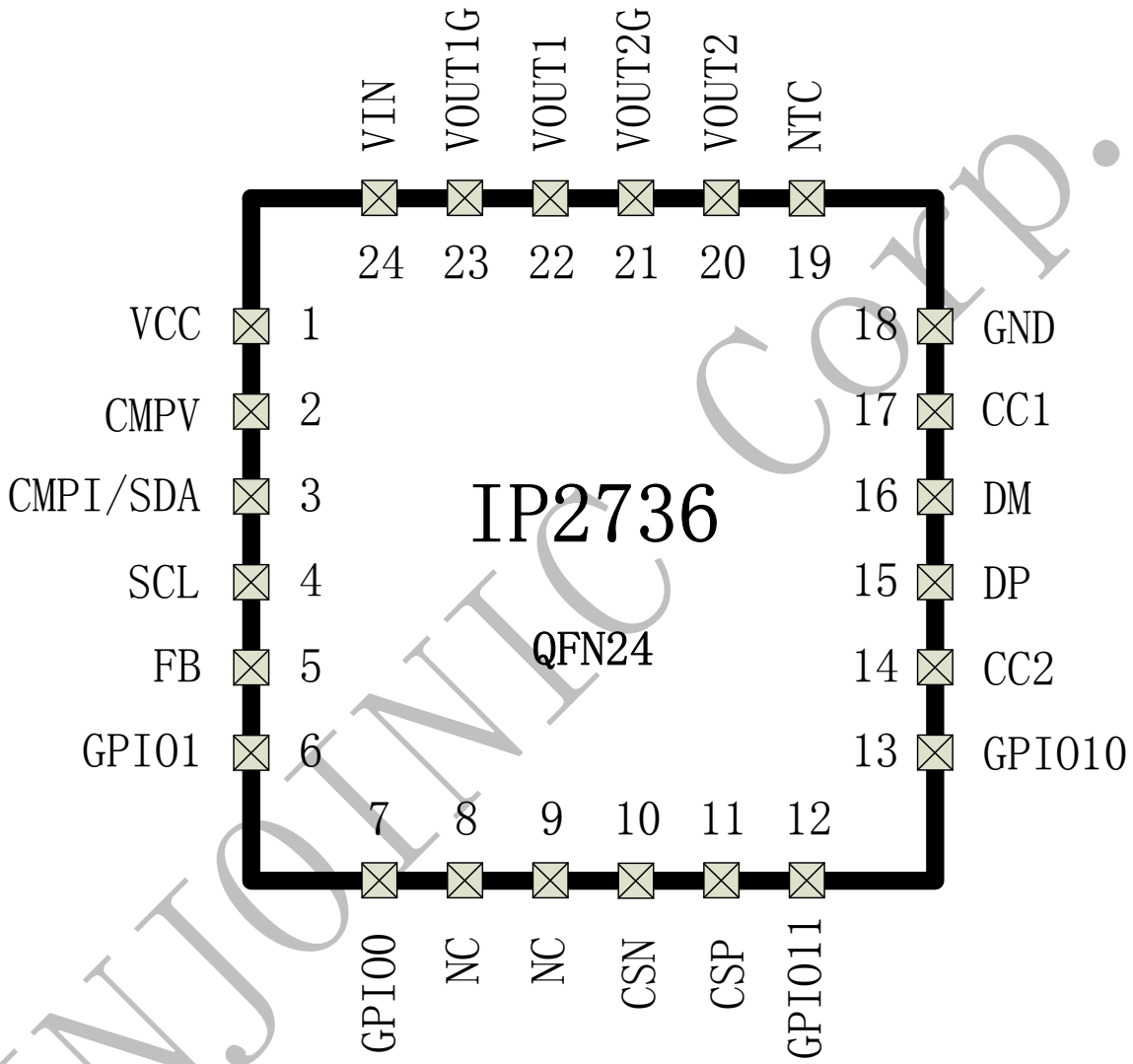


Figure 5-1. Pin Assignment (Top view)

Table 5-1. Pin Description

Pin No.	Pin name	Pin description
1	VCC	Internal power supply output, it is recommended that an external capacitance 2.2uF be used
2	CMPV	Loop compensation of voltage
3	CMPI/SDA	Loop compensation of current / I2C data
4	SCL	I2C clock, can be configured as general purpose I/O 3
5	FB	Loop feedback driver
6	GPIO1	General purpose I/O 1, can be configured as ADC
7	GPIO0	General purpose I/O 0, can be configured as ADC
8	NC	Normal close
9	NC	Normal close
10	CSN	Negative input of current sense amplifier
11	CSP	Positive input of current sense amplifier
12	GPIO11	General purpose I/O 11
13	GPIO10	General purpose I/O 10
14	CC2	Type-C Configuration Channel2
15	DP	USB DP, can be configured as UART_TX/UART_RX/GPIO
16	DM	USB DM, can be configured as UART_TX/UART_RX/GPIO
17	CC1	Type-C Configuration Channel1
18	GND	Ground
19	NTC	NTC Resistor input for temperature sense, built-in current source
20	VOUT2	Path detect of load switch 2
21	VOUT2G	Gate driver of load switch 2 (NMOS)
22	VOUT1	Path detect of load switch 1
23	VOUT1G	Gate driver of load switch 1 (NMOS)
24	VIN	Positive power supply
25	EPAD	Connect to ground

6. Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
VIN Input Voltage Range	VIN	-0.3 ~ 30	**V**
VOUT Input Voltage Range	VOUT	-0.3 ~ 30	**V**
VOUTG Input Voltage Range	VOUTG	-0.3 ~ 30	**V**
DP, DM Input Voltage Range	V_{DP}, V_{DM}	-0.3 ~ 30	**V**
CC1, CC2 Input Voltage Range	V_{CC1}, V_{CC2}	-0.3 ~ 30	**V**
FB Input Voltage Range	V_{FB}	-0.3 ~ 30	**V**
Other Pins Input Voltage Range		-0.3 ~ 6	**V**
Junction Temperature Range	T_J	-40 ~ 150	℃
Storage Temperature Range	Tstg	-60 ~ 150	℃
Lead Temperature Range (Soldering, 10sec)	Ts	260	℃
Ambient Temperature	T_A	-40~120	℃
Package Thermal Resistance	θ_{JA}	90	**℃/W**
Package Thermal Resistance	θ_{JC}	39	**℃/W**
Human Body Model (HBM)	ESD	4	**KV**

***** Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to Absolute Maximum Rated conditions for extended periods may affect device reliability.

***** Voltages are referenced to GND unless otherwise noted.

7. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Input Voltage	VIN	3		25	V
Ambient Temperature	T_A	-20		115	℃

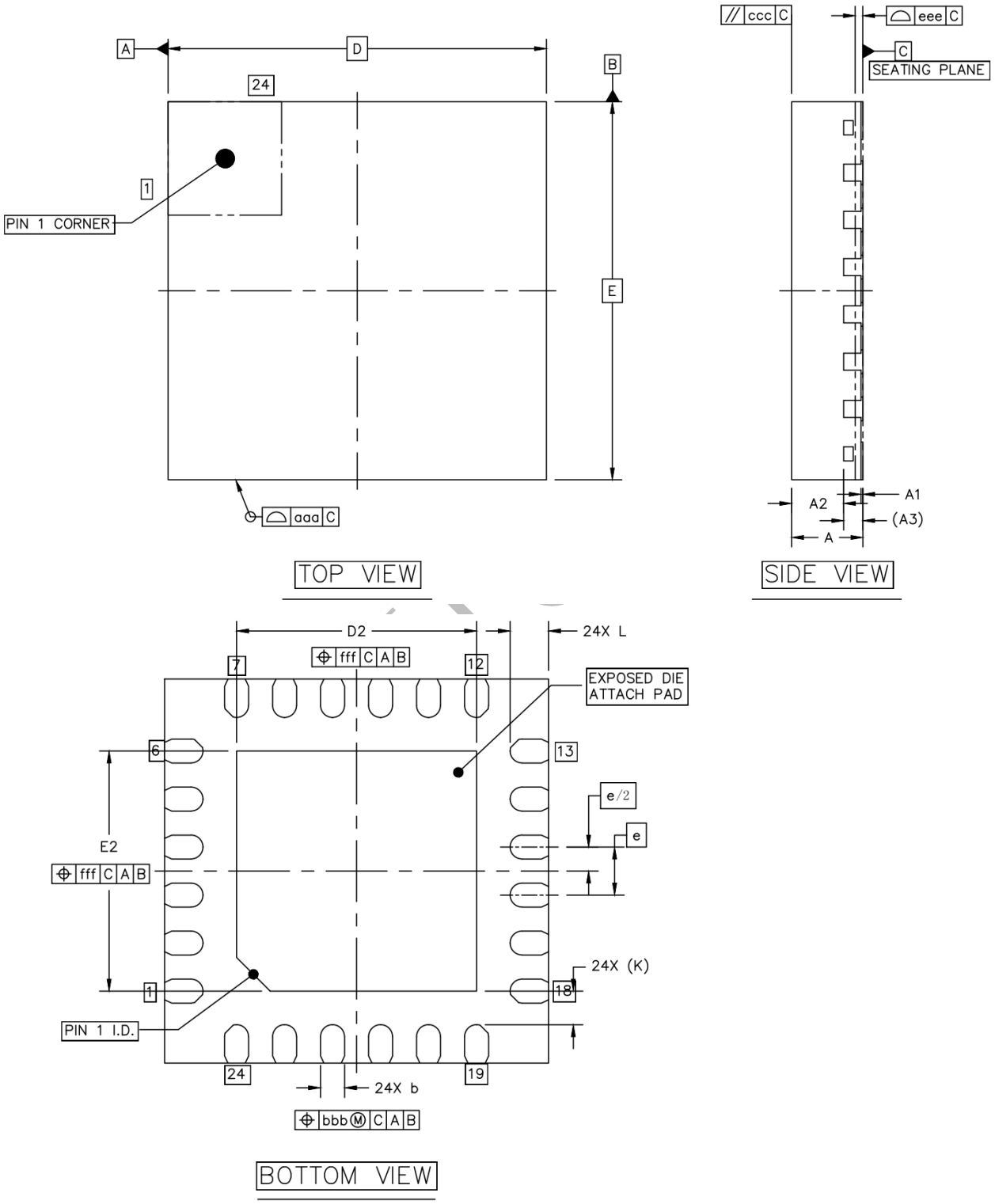
***** Devices' performance cannot be guaranteed when working beyond those Recommended Operating Conditions.

8. Electrical Characteristics

Unless otherwise specified, T A =25℃

Parameter	Symbol	Test Conditions	Min.	Typ.	Max	Unit
Input Voltage	VIN	Supplied directly	3		25	V
Input UVLO Threshold	UVLO	VIN Falling	2.5		2.9	V
VCC	VCC			3.2		V
TYPE-C						
Rp_default	Default USB			80		μA
Rp_1.5A	1.5 A @ 5 V			180		μA
Rp_3.0A	3.0 A @ 5 V			330		μA
HVDCP (QC2.0&QC3.0&QC3+)						
Data Detect Voltage Threshold	V_{DATA_REF}		0.25	0.325	0.4	V
DP High Glitch Filter Time	$T_{GLITCH(BC)\_DP\_H}$		1000	1250	1500	ms
DM Low Glitch Filter Time	$T_{GLITCH(BC)\_DM\_L}$			2		ms
Output Voltage Glitch Filter Time	$T_{GLITCH(V)\_CHANGE}$		20	40	60	ms
Continuous Mode Glitch Filter Time	$T_{GLITCH\_CONT\_CHANGE}$		100		200	us
DM Pull-down Resistance	R_{DM_DOWN}	VDP=0.6V		20		kOhm
DP Pull-down Resistance	R_{DAT_LKG}	VDP=0.6V		768(+ 300 configur-able)		kOhm
GPIO						
VIH	Input high voltage		0.7VCC			V
VIL	Input low voltage				0.3VCC	V
VOH	Output high voltage			VCC		V
VOL	Output low voltage			GND		V
Rpu	Pull-up resistor			3		k
Rpd	Pull-down resistor			20		k
I2C						
F_{I2C}	Bit rate		100		400	KHz

9. Package



		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.2	0.25	0.3
BODY SIZE	X	D		4 BSC	
	Y	E		4 BSC	
LEAD PITCH		e		0.5 BSC	
EP SIZE	X	D2	2.4	2.5	2.6
	Y	E2	2.4	2.5	2.6
LEAD LENGTH		L	0.35	0.4	0.45
LEAD TIP TO EXPOSED PAD EDGE		K		0.35 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.08	
LEAD OFFSET		bbb		0.1	
EXPOSED PAD OFFSET		fff		0.1	

10. IMPORTANT NOTICE

INJOINIC TECHNOLOGY and its subsidiaries reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to INJOINIC TECHNOLOGY's terms and conditions of sale supplied at the time of order acknowledgment.

INJOINIC TECHNOLOGY assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using INJOINIC TECHNOLOGY's components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of INJOINIC TECHNOLOGY's components in its applications, notwithstanding any applications-related information or support that may be provided by INJOINIC TECHNOLOGY. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify INJOINIC TECHNOLOGY and its representatives against any damages arising out of the use of any INJOINIC TECHNOLOGY's components in safety-critical applications.

Reproduction of significant portions of INJOINIC TECHNOLOGY's information in INJOINIC TECHNOLOGY's data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. INJOINIC TECHNOLOGY is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

INJOINIC TECHNOLOGY will update this document from time to time. The actual parameters of the product may vary due to different models or other items. This document voids all express and any implied warranties.

Resale of INJOINIC TECHNOLOGY's components or services with statements different from or beyond the parameters stated by INJOINIC TECHNOLOGY for that component or service voids all express and any implied warranties for the associated INJOINIC TECHNOLOGY's component or service and is an unfair and deceptive business practice. INJOINIC TECHNOLOGY is not responsible or liable for any such statements.

