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
    - Type-C Source
    - Support USB PD2.0/PD3.1 SPR&EPR 36V
    - PD with EPR USB-IF TID: 9627
    - 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
  - ✧ Support UFCS
    - ctf. no 0302347161322ROM-UFCS00054
  - ✧ 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 with minimum step of 12.5mA
  - ✧ Integrated low side current sense amplifier
  - ✧ Cable drop compensation
- **Support multiple modes of voltage control**
  - ✧ 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
- **Operating voltage range: 3V~40V**
- **Package**
  - ✧ QFN24

2. Description

The IP2756 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 SPR & EPR36V, 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 IP2756 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.

Contents

4. Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Revision V1.00 (March 2023)

Changes from Revision V1.00 (March 2023) to Revision V1.01 (July 2023) Page

- Update PD with EPR USB-IF TID......1
- Update the note of typical application schematic of control of optocoupler......4
- Update the note of typical application schematic of control of I2C......5

Changes from Revision V1.01 (July 2023) to Revision V1.02 (August 2023) Page

- Update UFCS Certificate......1

5. Typical Application Schematic

- **Control of optocoupler**

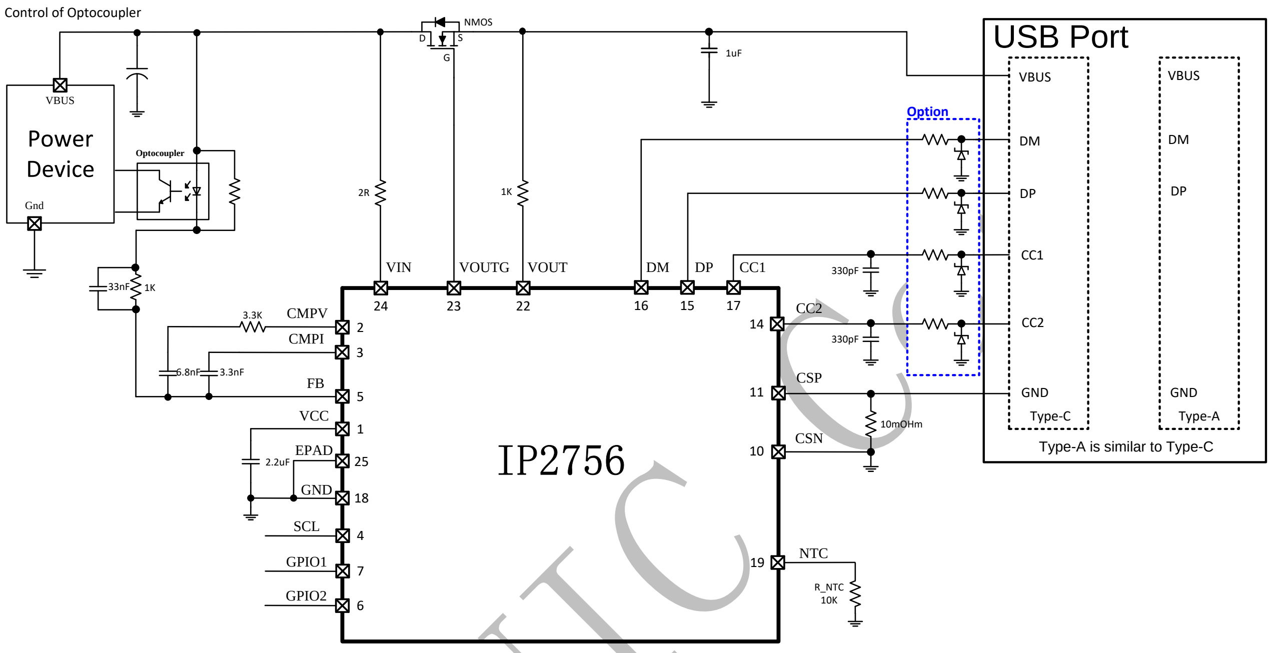


Figure 5-1. Typical application schematic of control of optocoupler

Note：

1). Vdss⩾30V NMOS (SPR) or ⩾40V NMOS (EPR) 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;

4). It is recommended to use 1k for 20V(SPR) or 510R for 28V(EPR) between VOUT and VBUS;

- **Control of I2C**

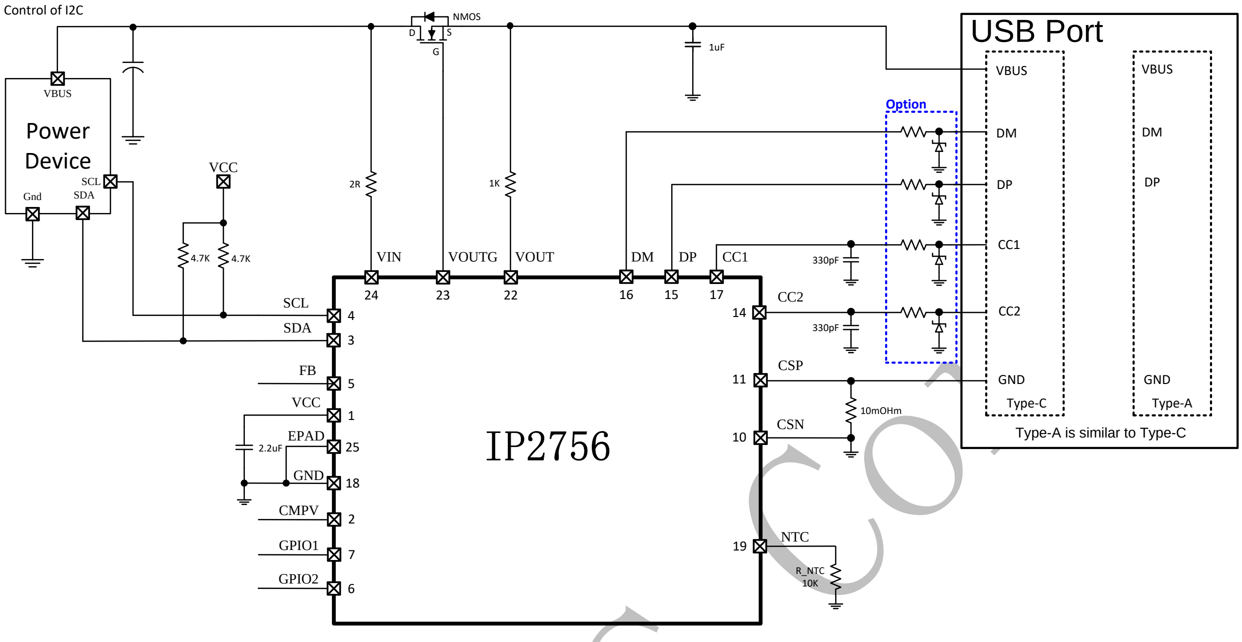


Figure 5-2. Typical application schematic of control of I2C

Note：

1). Vdss⩾30V NMOS (SPR) or ⩾40V NMOS (EPR) is recommended;

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

3). It is recommended to use 1k for 20V(SPR) or 510R for 28V(EPR) between VOUT and VBUS;

6. Pin Assignment

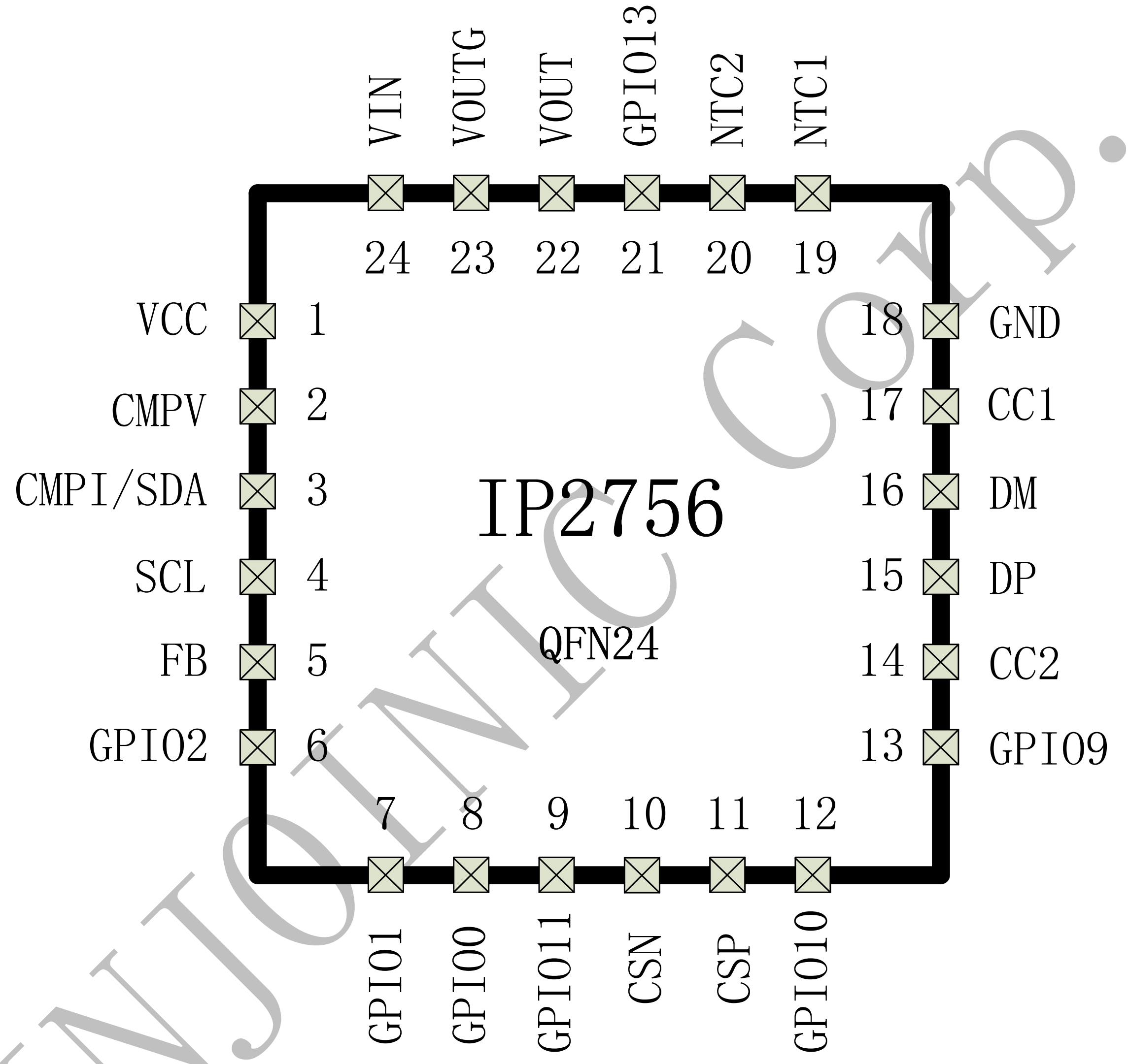


Figure 6-1. Pin Assignment (Top view)

Table 6-1. 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 4
5	FB	Loop feedback driver
6	GPIO2	General purpose I/O 2, can be configured as ADC
7	GPIO1	General purpose I/O 1, can be configured as ADC
8	GPIO0	General purpose I/O 0, can be configured as ADC
9	GPIO11	General purpose I/O 11, can be configured as ADC
10	CSN	Negative input of current sense amplifier
11	CSP	Positive input of current sense amplifier
12	GPIO10	General purpose I/O 10, can be configured as UART_TX
13	GPIO9	General purpose I/O 9, can be configured as UART_RX
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	NTC1	NTC Resistor input for temperature sense, built-in current source
20	NTC2	NTC Resistor input for temperature sense, built-in current source
21	GPIO13	General purpose I/O 13
22	VOUT	Path detect of load switch
23	VOUTG	Gate driver of load switch
24	VIN	Positive power supply
25	EPAD	Connect to ground

7. Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
VIN Input Voltage Range	VIN	-0.3 ~ 45	**V**
VOUT Input Voltage Range	VOUT	-0.3 ~ 45	**V**
VOUTG Input Voltage Range	VOUTG	-0.3 ~ 45	**V**
DP, DM Input Voltage Range	V_{DP}, V_{DM}	-0.3 ~ 33	**V**
CC1, CC2 Input Voltage Range	V_{CC1}, V_{CC2}	-0.3 ~ 33	**V**
FB Input Voltage Range	V_{FB}	-0.3 ~ 45	**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**
DP, DM, CC1, CC2 Human Body Model (HBM)	ESD	6	**KV**
Other Pins Human Body Model (HBM)	ESD	2	**KV**
Moisture Sensitivity Level (MSL)	MSL	3	**Level**

***** 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.

8. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Input Voltage	VIN	3		40	V
Ambient Temperature	T_A	-20		115	℃

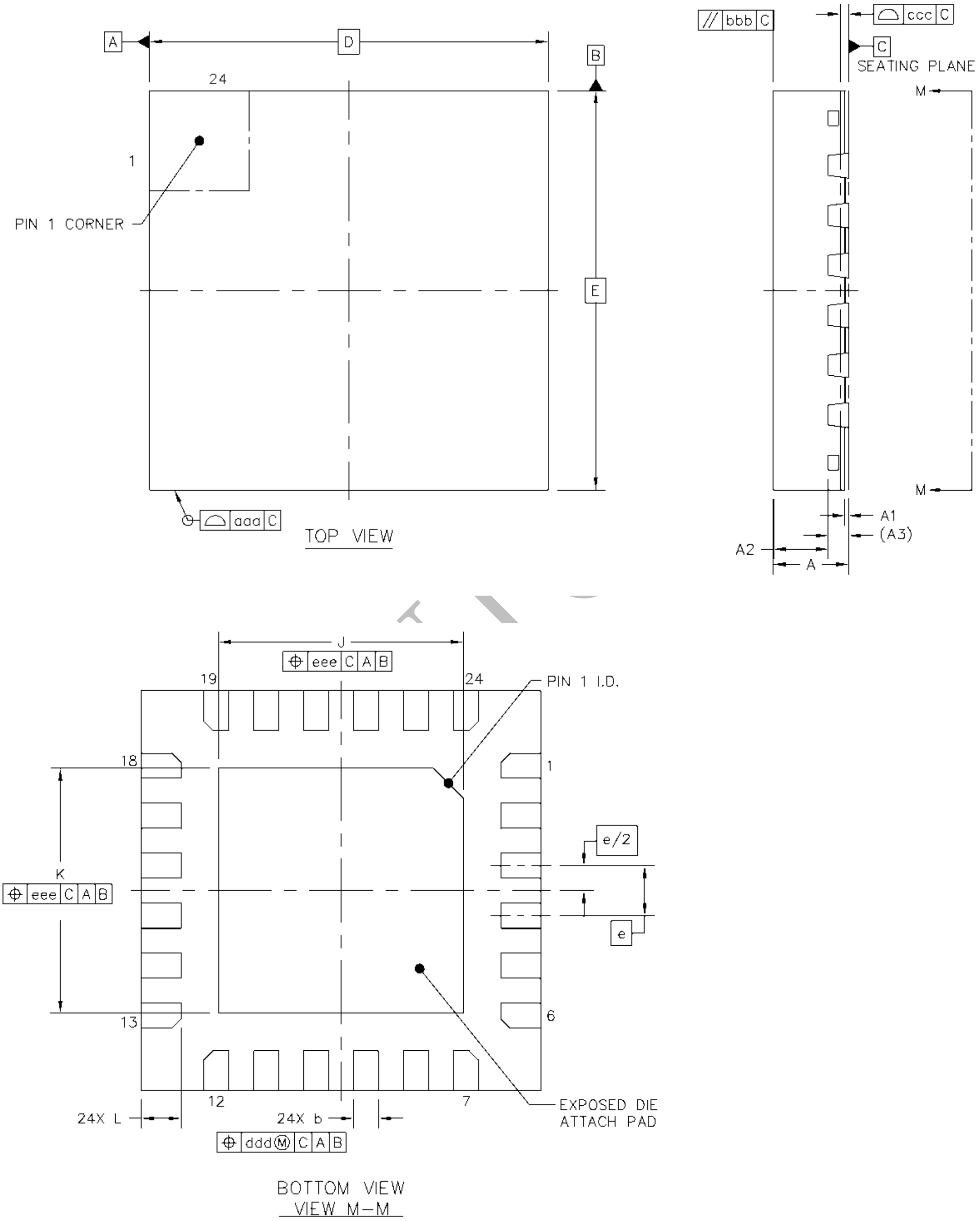
Devices' performance cannot be guaranteed when working beyond those Recommended Operating Conditions.

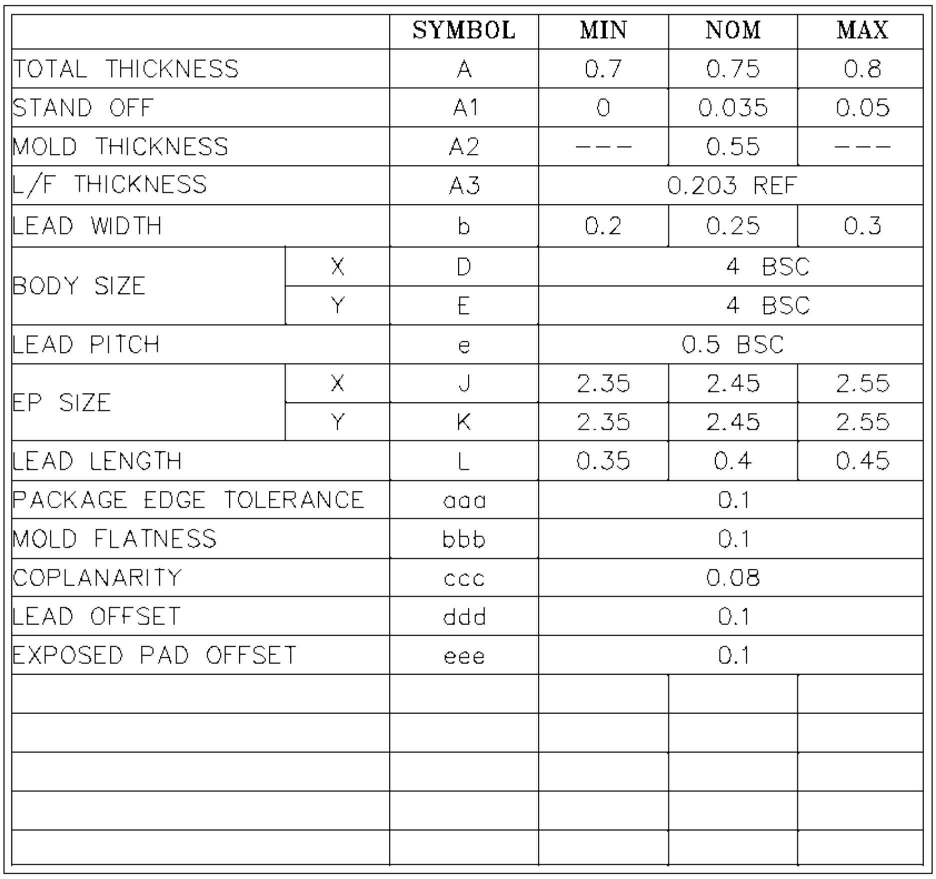
9. Electrical Characteristics

Unless otherwise specified, T A =25℃

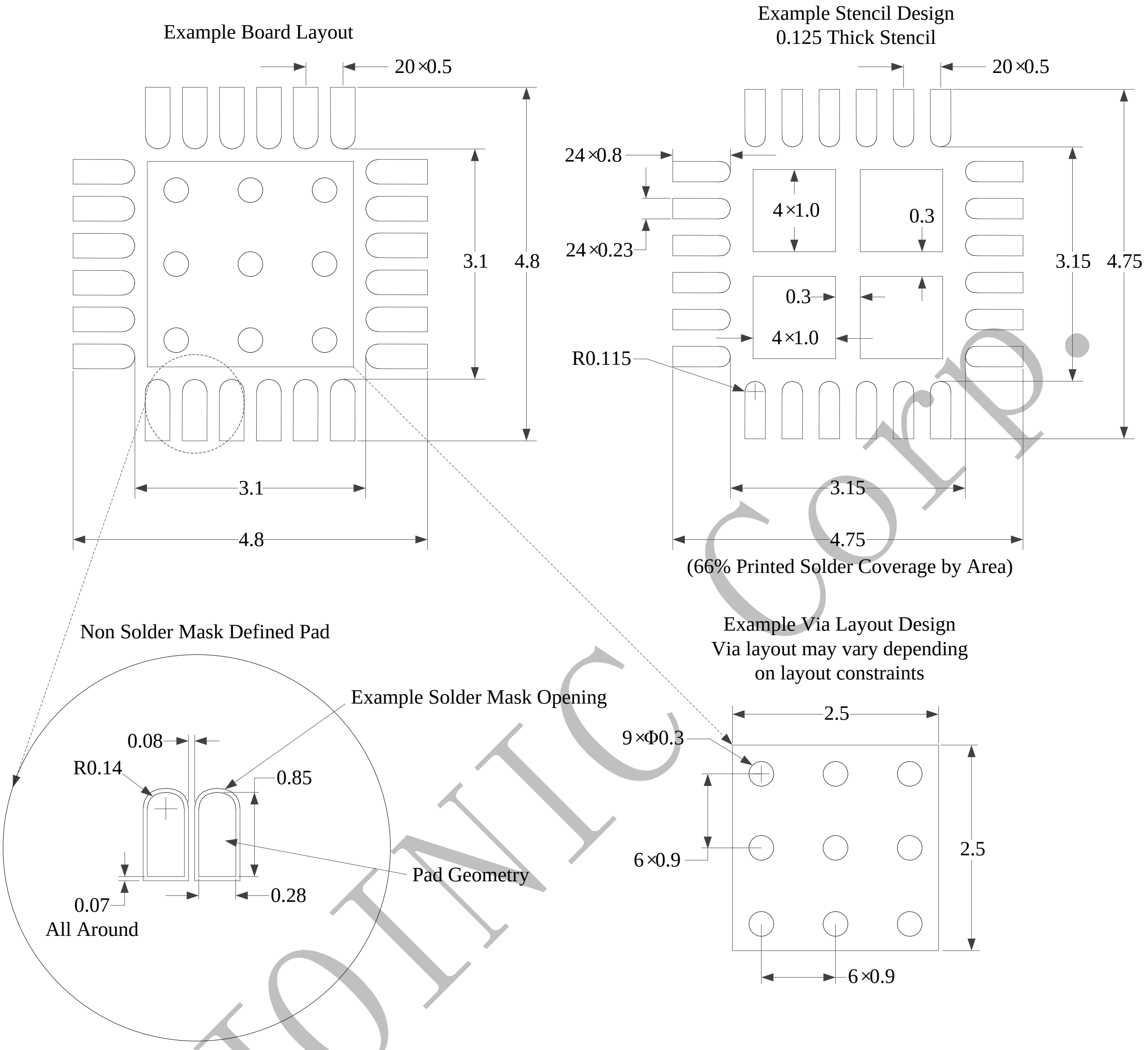
Parameter	Symbol	Test Conditions	Min.	Typ.	Max	Unit
Input Voltage	VIN	Supplied directly	3		40	V
Input UVLO Threshold	UVLO	VIN Falling	2.5		2.9	V
VCC	VCC			3.2		V
TYPE-C						
Rp_default	Default USB			80		μA
Rp_1.5A	1.5 A @ 5 V			180		μA
Rp_3.0A	3.0 A @ 5 V			330		μA
HVDCP (QC2.0&QC3.0&QC3+)						
Data 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 configurable)		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
I2C						
F_{I2C}	Bit rate		100		400	KHz

10.Package


A
D
B
24
1
PIN 1 CORNER
E
aaa C
TOP VIEW
// bbb C
ccc C
C
SEATING PLANE
M
M
A1
(A3)
A2
A
J
eee C A B
19
24
PIN 1 I.D.
18
1
e/2
K
eee C A B
e
13
6
12
7
24X L
24X b
ddd M C A B
EXPOSED DIE ATTACH PAD
BOTTOM VIEW
VIEW M–M



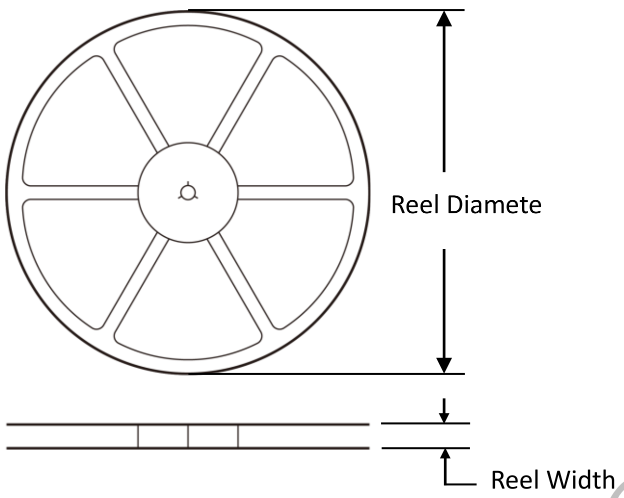
		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.035	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3	0.203 REF		
LEAD WIDTH		b	0.2	0.25	0.3
BODY SIZE	X	D	4 BSC		
	Y	E	4 BSC		
LEAD PITCH		e	0.5 BSC		
EP SIZE	X	J	2.35	2.45	2.55
	Y	K	2.35	2.45	2.55
LEAD LENGTH		L	0.35	0.4	0.45
PACKAGE EDGE TOLERANCE		aaa	0.1		
MOLD FLATNESS		bbb	0.1		
COPLANARITY		ccc	0.08		
LEAD OFFSET		ddd	0.1		
EXPOSED PAD OFFSET		eee	0.1		



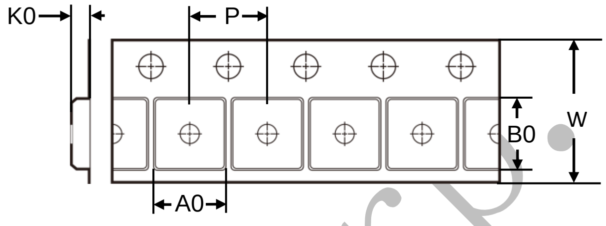
NOTES: 1. All linear dimensions are in millimeters.
2. This drawing is subject to change without notice.
3. Customers should contact their board fabrication site for recommended solder mask tolerances and via tenting recommendations for vias placed in the thermal pad.

11.Tape and Reel Information

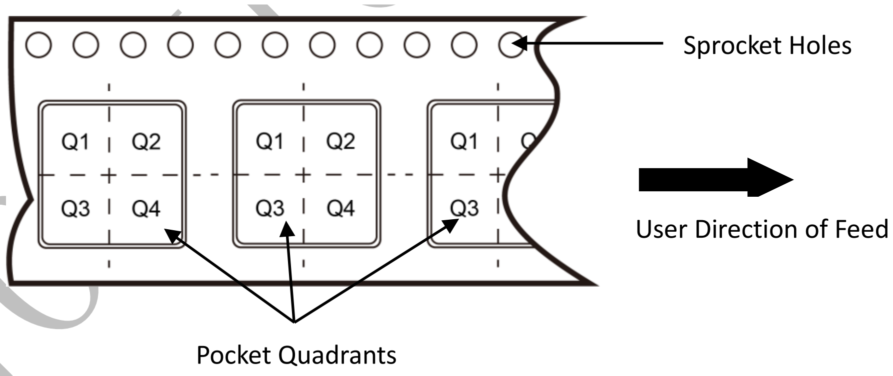
REEL DIMENSIONS



TAPE DIMENSIONS



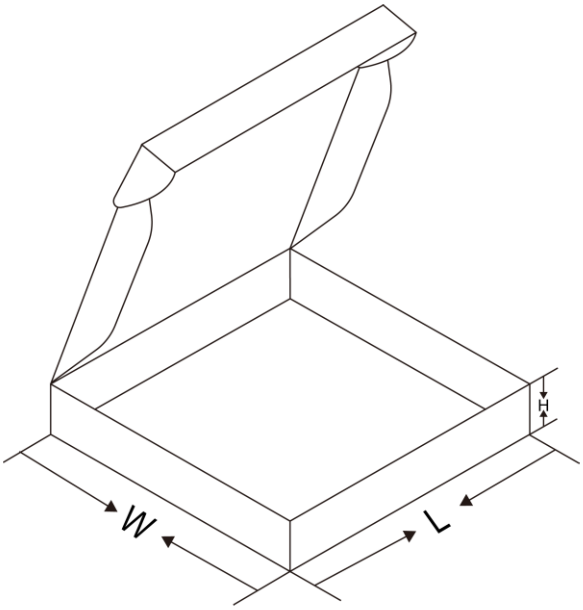
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE IS Q1



*所有尺寸为标准尺寸

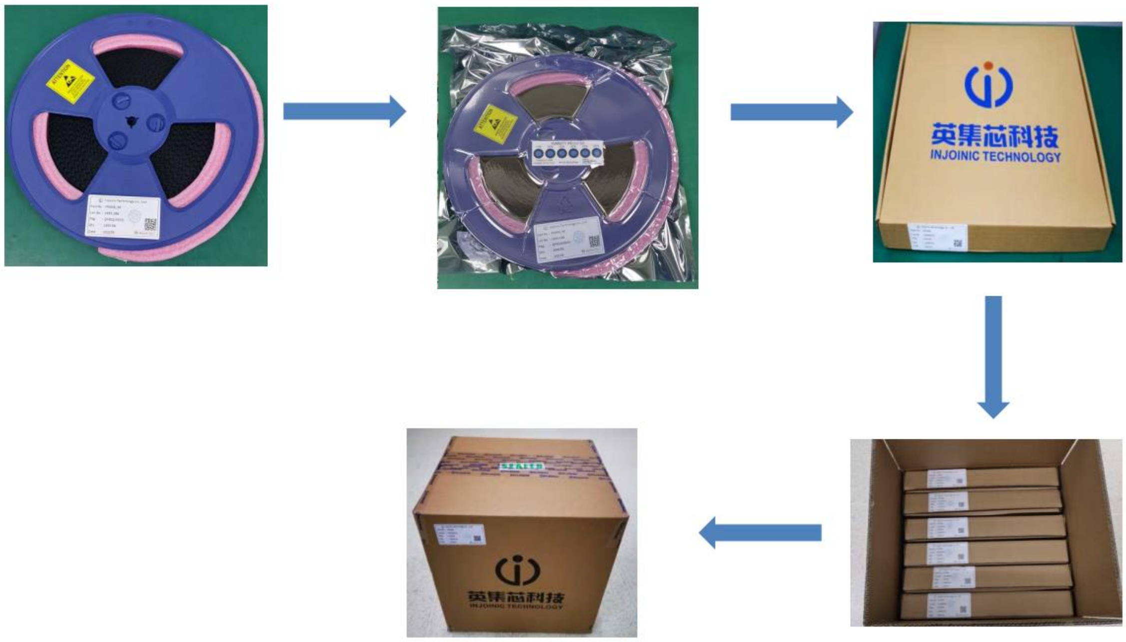
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P (mm)	W (mm)	Pin1 Quadrant
IP2756	QFN24	24	5000	330	12.5	4.45 ± 0.10	4.50 ± 0.10	1.20 ± 0.10	8.0 ±0.1	12 ±0.3	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Package Type	PCS /Tape Reel	Tape Reel /Inner box	PCS /Inner box	Inner box /Carton	PCS /Carton	W (mm)	L (mm)	H (mm)
QFN24	5000	2	10000	6	60000	360	360	50



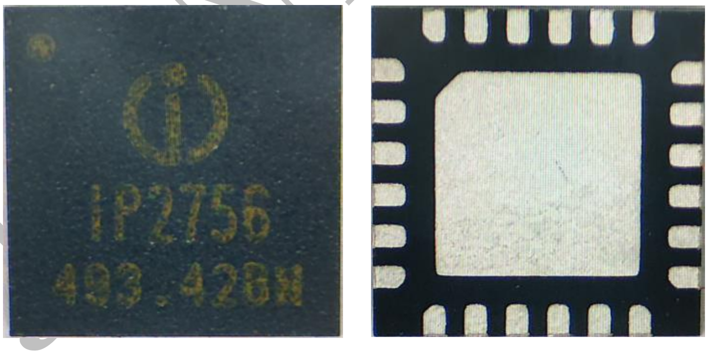
外箱尺寸:385*345*380mm

内盒尺寸:360*360*50mm

12.Marking Specification

说明：
1、 ——英集芯标志
2、IP2756 ——产品型号
3、XXXXXXXX——生产批号
4、 ● ——Pin 1脚位置标识

13.Picture of Material Object

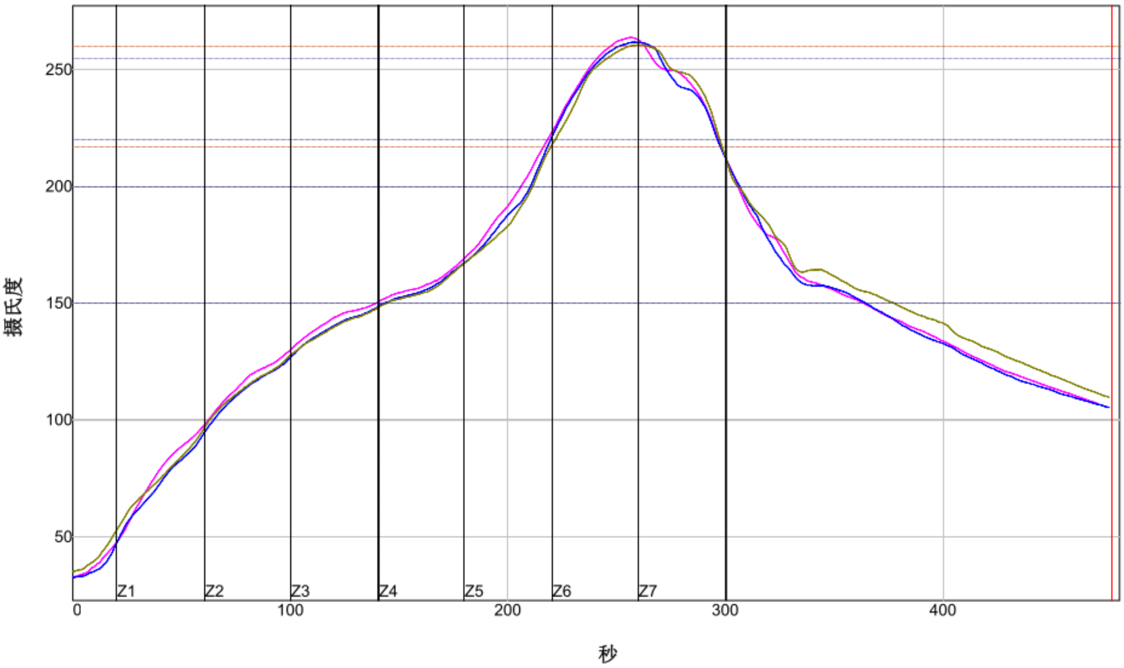


14.Solder Instruction

温度设置 (摄氏度)

温区	1	2	3	4	5	6	7
上温区	130	140	160	160	200	320	265
下温区	130	140	160	160	200	320	265

传送带速度 (公分/分): 39.0



PWI= 75%	最高上升斜率		预热150至200C		最高温度		总共 时间 /217C		斜率1 (217-260C)		预热220至255C-(2)		总共 时间 /260C-2		距峰值5C区域时间	
🟪 VP 1	1.69	-31%	66.21	-59%	263.87	18%	80.99	-70%	1.70	-30%	22.81	-36%	15.90	-30%	18.13	-75%
🟦 VP 2	1.99	-1%	66.91	-54%	261.84	-9%	78.97	-73%	1.87	-13%	23.44	-33%	15.74	-31%	23.64	-31%
🟫 VP 3	1.83	-17%	66.61	-56%	260.76	-23%	78.19	-74%	1.88	-12%	23.97	-30%	9.37	-66%	23.95	-28%
🟫 温差	0.30		0.70		3.11		2.80		0.18		1.16		6.53		5.82	

制程界限:

锡膏: 260

统计数名称	最低界限	最高界限	单位
最高温度上升斜率 (目标=2.0) (计算斜率的时间距离= 20 秒)	1.0	3.0	度/秒
斜率1 (目标=2.0) 介于 217.0 和 260.0 (计算斜率的时间距离= 10 秒)	1.0	3.0	度/秒
预热时间150-200摄氏度	60	90	秒
预热时间220-255摄氏度-(2)	10	50	秒
最高温度	255	270	度 摄氏度
在217摄氏度以上时间	60	200	秒
在260摄氏度以上时间-(2)	3	40	秒
距峰值5C区域时间	15	40	秒

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