

## 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/PPS/EPR 28V
    - PD with PPS USB-IF TID: 10162
    - 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 0302247161585R0M-UFCS00009
  - ✧ 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 IP2736U 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 IP2736U 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.

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## 4. Revision History

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

### Revision V1.00 (September 2022)

#### Changes from Revision V1.00 (September 2022) to Revision V1.01 (October 2023) Page

- Update PD with PPS USB-IF TID.....1

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## 5. Typical Application Schematic

- Control of PWM controller feedback

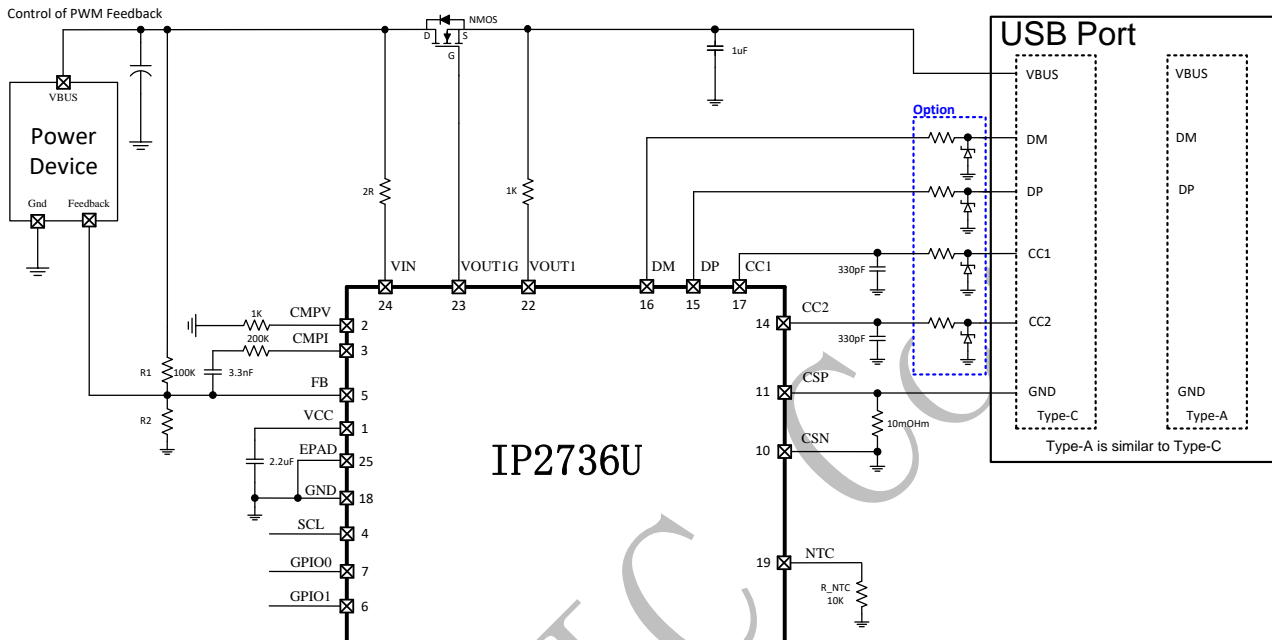


Figure 5-1. Typical application schematic of control of PWM controller feedback

**Note:**

- 100kΩ(1%) R1 is recommended,  $R2 = (V_{fb} * R1) / (5 - V_{fb})$ ;
- $V_{dss} \geq 30V$  NMOS is recommended;
- 10kΩ(B=3380K) NTC is recommended;
- The compensation capacitor and compensation resistor of CMPV/CMPI are adjustable refer to the power device;

- EPR28V control IP6550 feedback

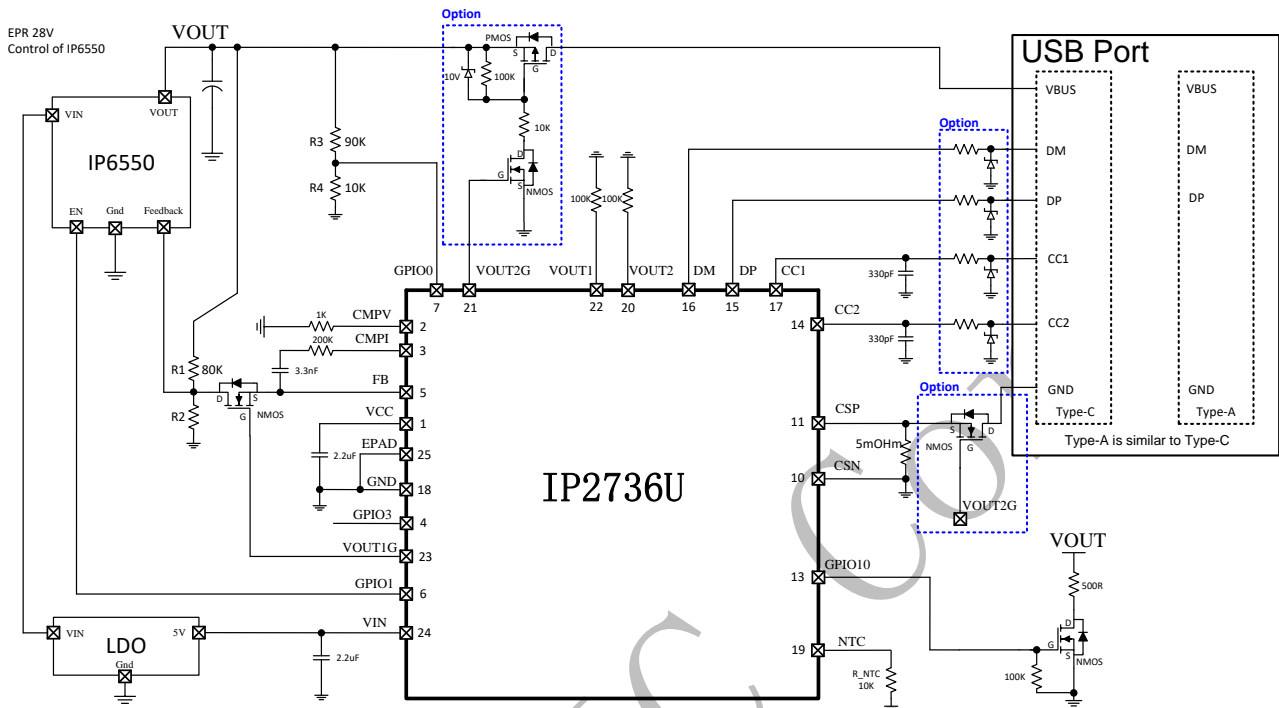


Figure 5-2. Typical application schematic of EPR28V control of IP6550 feedback

**Note:**

- 1). EPR28V dedicated;
- 2). 80kOhm(0.1%/1%) R1 is recommended,  $R2=(V_{fb} \cdot R1)/(5-V_{fb})$ ;
- 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).  $V_{dss} \geq 30V$  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

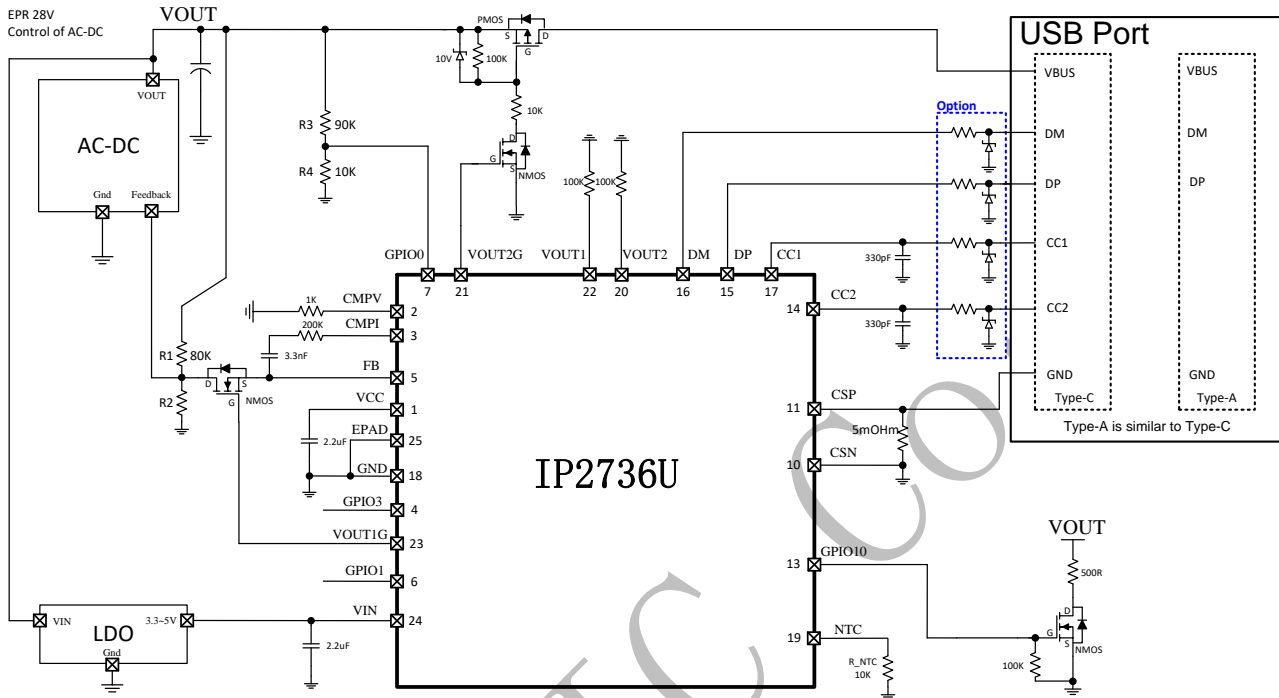


Figure 5-3. Typical application schematic of EPR28V control of AC-DC feedback

**Note:**

- 1). EPR28V dedicated;
- 2). 80kOhm(0.1%/1%) R1 is recommended,  $R2=(V_{fb} * R1)/(5 - V_{fb})$ ;
- 3). 90kOhm(0.1%/1%) R3 and 10kOhm(0.1%/1%) R4 is recommended;
- 4).  $V_{dss} \geq 30V$  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;

- Control of optocoupler

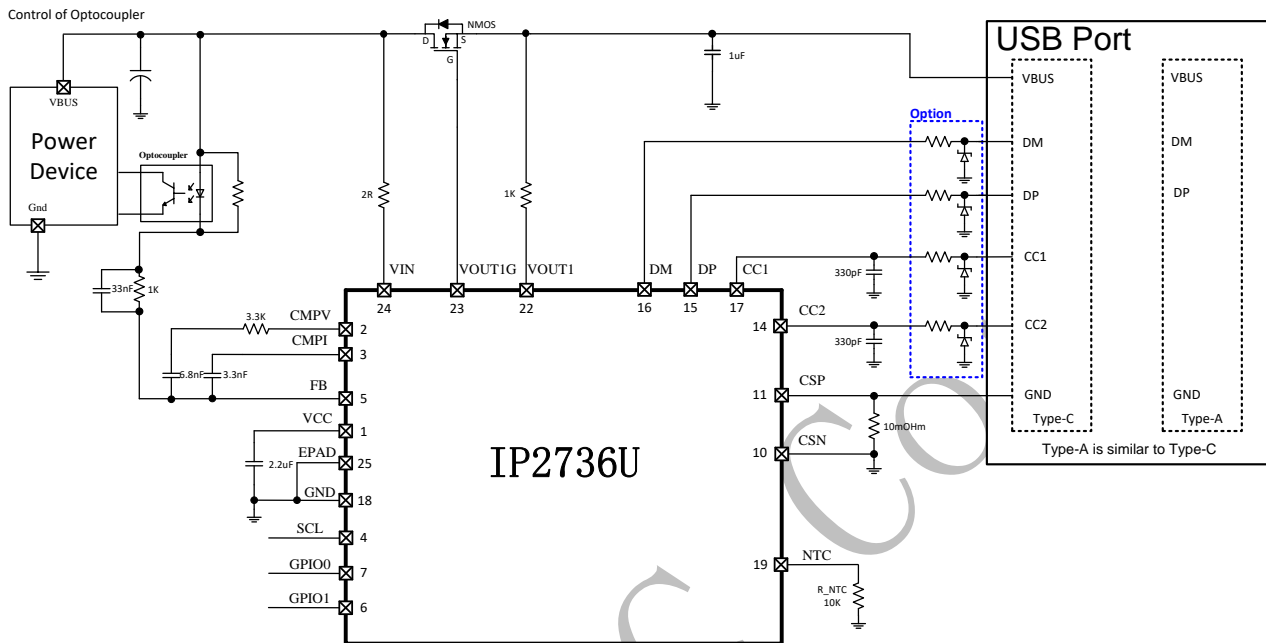


Figure 5-4. Typical application schematic of control of optocoupler

**Note:**

- 1).  $V_{dss} \geq 30V$  NMOS is recommended;
- 2).  $10k\Omega$  ( $B=3380K$ ) NTC is recommended;
- 3). The compensation capacitor and compensation resistor of CMPV/CMPI are adjustable refer to the power device;

- Control of I2C

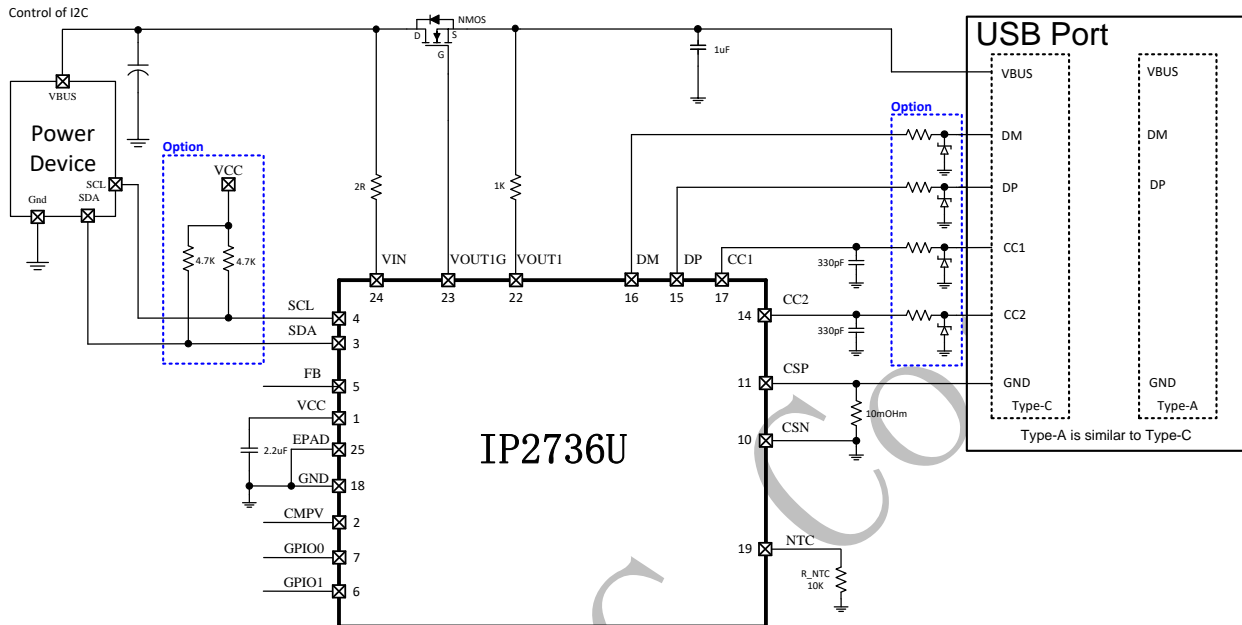


Figure 5-5. Typical application schematic of control of I2C

**Note:**

- 1). The external pull-up resistor is Optional which can be replace by 3kOhm internal pull-up resistor;
- 2).  $V_{dss} \geq 30V$  NMOS is recommended;
- 3). 10kOhm(B=3380K) NTC is recommended;



## 6. Pin Assignment

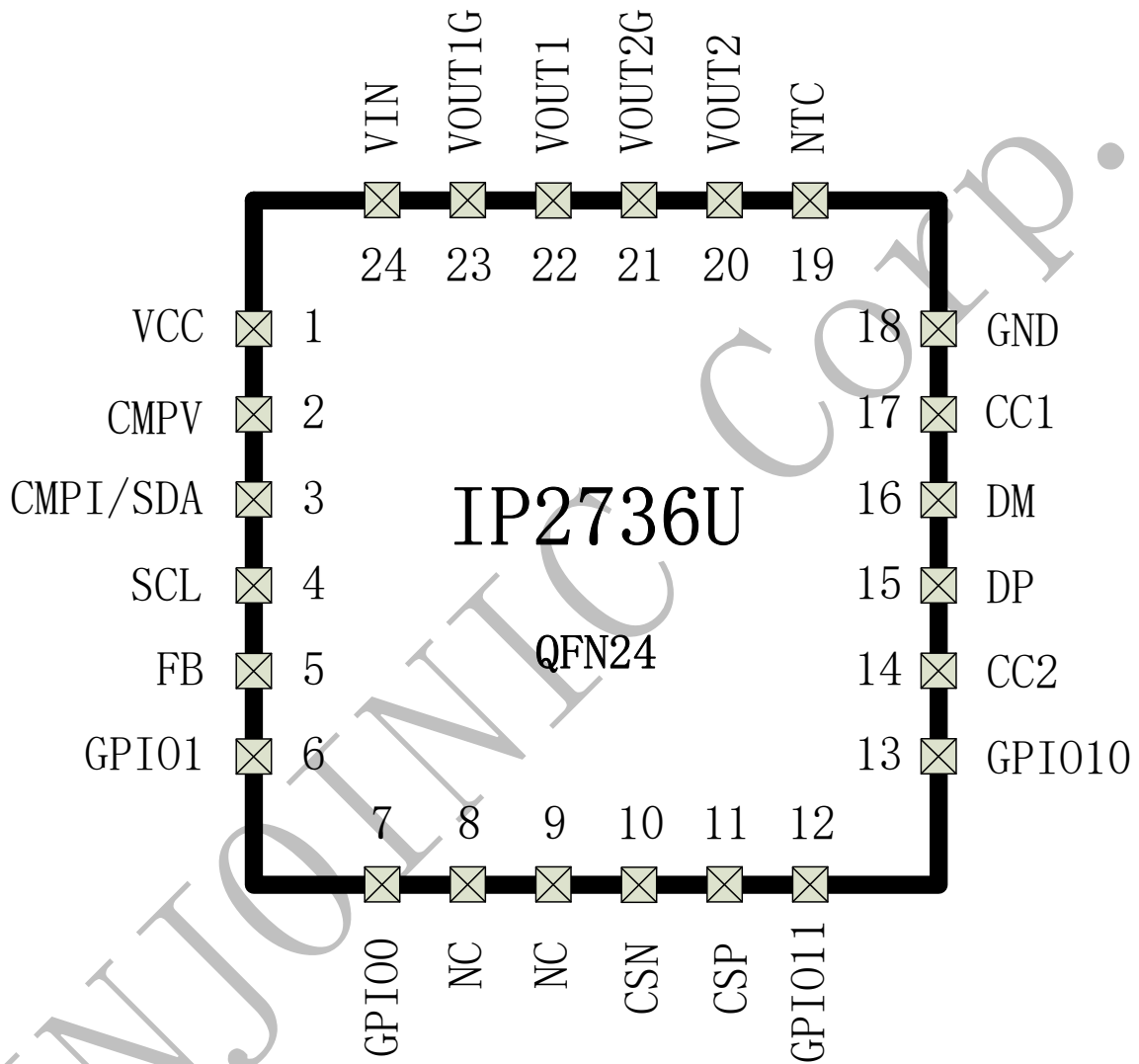


Figure 6-1. Pin Assignment (Top view)

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 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

## 7. 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 <sub>DP</sub> , V <sub>DM</sub>	-0.3 ~ 30	V
CC1, CC2 Input Voltage Range	V <sub>CC1</sub> , V <sub>CC2</sub>	-0.3 ~ 30	V
FB Input Voltage Range	V <sub>FB</sub>	-0.3 ~ 30	V
Other Pins Input Voltage Range		-0.3 ~ 6	V
Junction Temperature Range	T <sub>J</sub>	-40 ~ 150	°C
Storage Temperature Range	T <sub>stg</sub>	-60 ~ 150	°C
Lead Temperature Range (Soldering, 10sec)	T <sub>s</sub>	260	°C
Ambient Temperature	T <sub>A</sub>	-40~120	°C
Package Thermal Resistance	θ <sub>JA</sub>	90	°C/W
Package Thermal Resistance	θ <sub>JC</sub>	39	°C/W
Human Body Model (HBM)	ESD	4	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		25	V
Ambient Temperature	T <sub>A</sub>	-20		115	°C

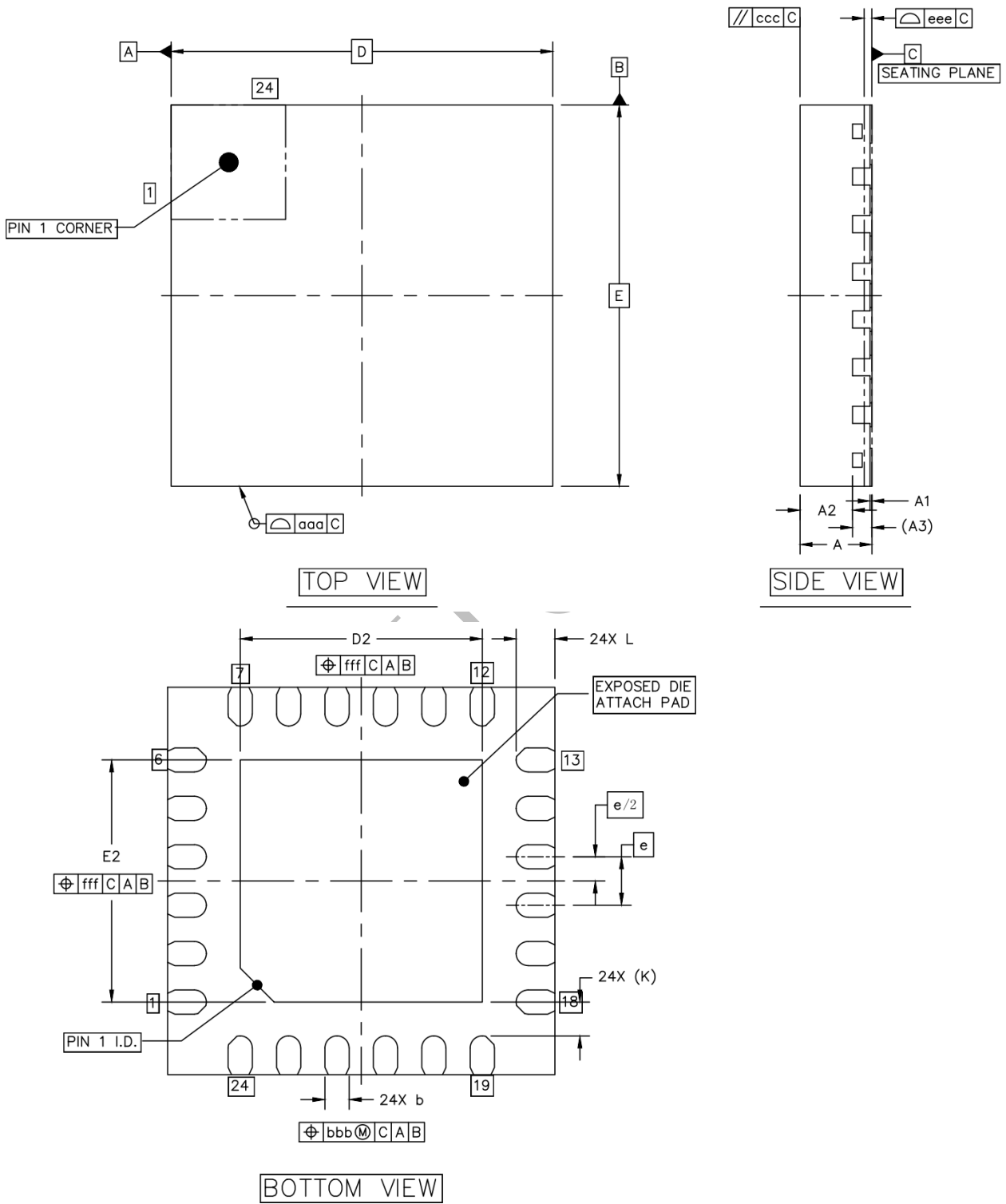
\* Devices' performance cannot be guaranteed when working beyond those Recommended Operating Conditions.

## 9. Electrical Characteristics

Unless otherwise specified, T<sub>A</sub> = 25 °C

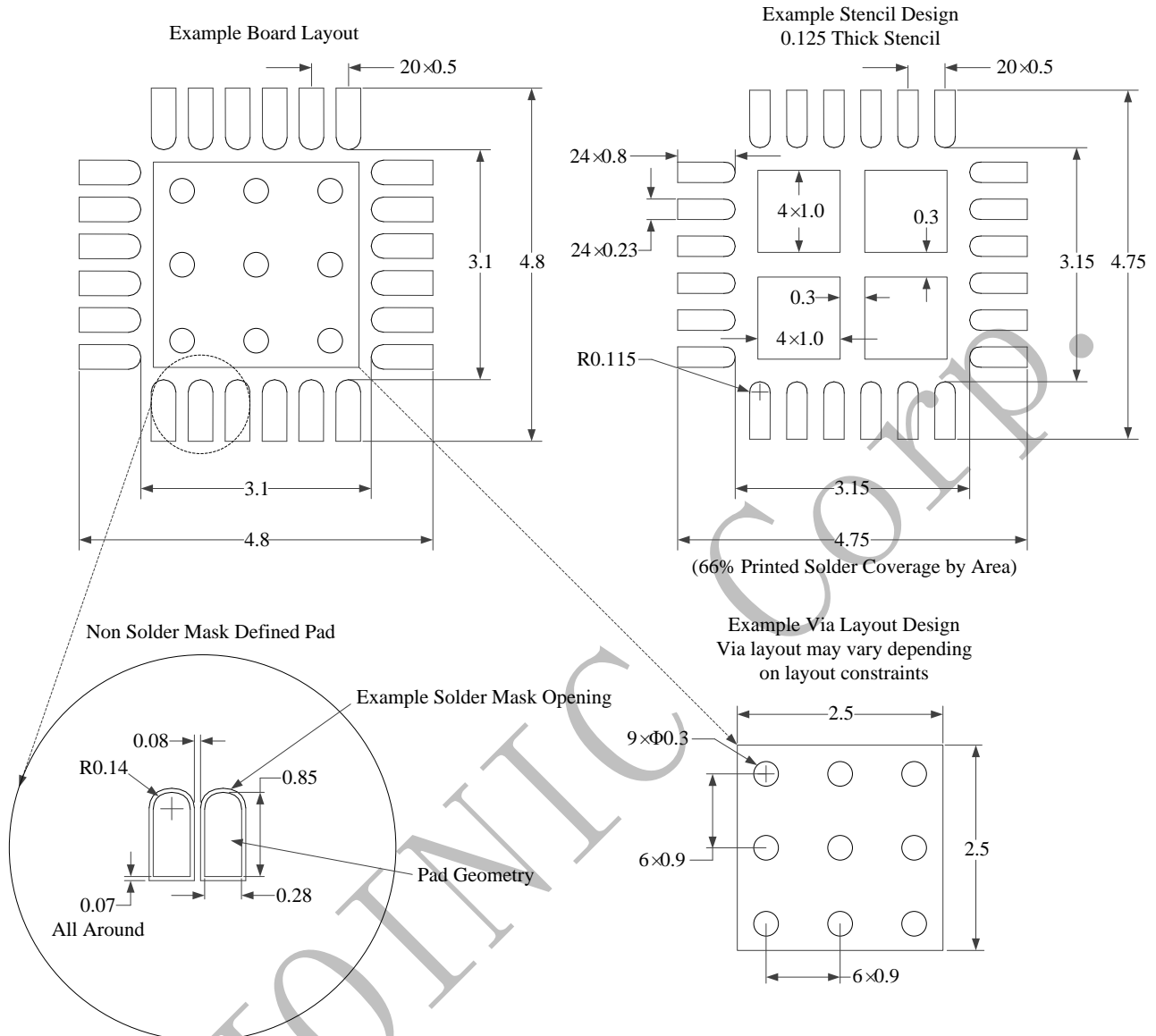
Parameter	Symbol	Test Conditions	Min.	Typ.	Max	Unit
Input Voltage	V <sub>IN</sub>	Supplied directly	3		25	V
Input UVLO Threshold	UVLO	VIN Falling	2.5		2.9	V
VCC	VCC			3.2		V
<b>TYPE-C</b>						
R <sub>p_default</sub>	Default USB			80		μA
R <sub>p_1.5A</sub>	1.5 A @ 5 V			180		μA
R <sub>p_3.0A</sub>	3.0 A @ 5 V			330		μA
<b>HVDCP (QC2.0&amp;QC3.0&amp;QC3+)</b>						
Data Detect Voltage Threshold	V <sub>DATA_REF</sub>		0.25	0.325	0.4	V
DP High Glitch Filter Time	T <sub>GLITCH(BC)_DP_H</sub>		1000	1250	1500	ms
DM Low Glitch Filter Time	T <sub>GLITCH(BC)_DM_L</sub>			2		ms
Output Voltage Glitch Filter Time	T <sub>GLITCH(V)_CHANGE</sub>		20	40	60	ms
Continuous Mode Glitch Filter Time	T <sub>GLITCH_CONT_CHANGE</sub>		100		200	us
DM Pull-down Resistance	R <sub>DM_DOWN</sub>	VDP=0.6V		20		kOhm
DP Pull-down Resistance	R <sub>DAT_LKG</sub>	VDP=0.6V		768(+ 300 configurable)		kOhm
<b>GPIO</b>						
V <sub>IH</sub>	Input high voltage		0.7VCC			V
V <sub>IL</sub>	Input low voltage				0.3VCC	V
V <sub>OH</sub>	Output high voltage			VCC		V
V <sub>OL</sub>	Output low voltage			GND		V
R <sub>pu</sub>	Pull-up resistor			3		k
R <sub>pd</sub>	Pull-down resistor			20		k
<b>I2C</b>						
F <sub>I2C</sub>	Bit rate		100		400	KHz

## 10. Package



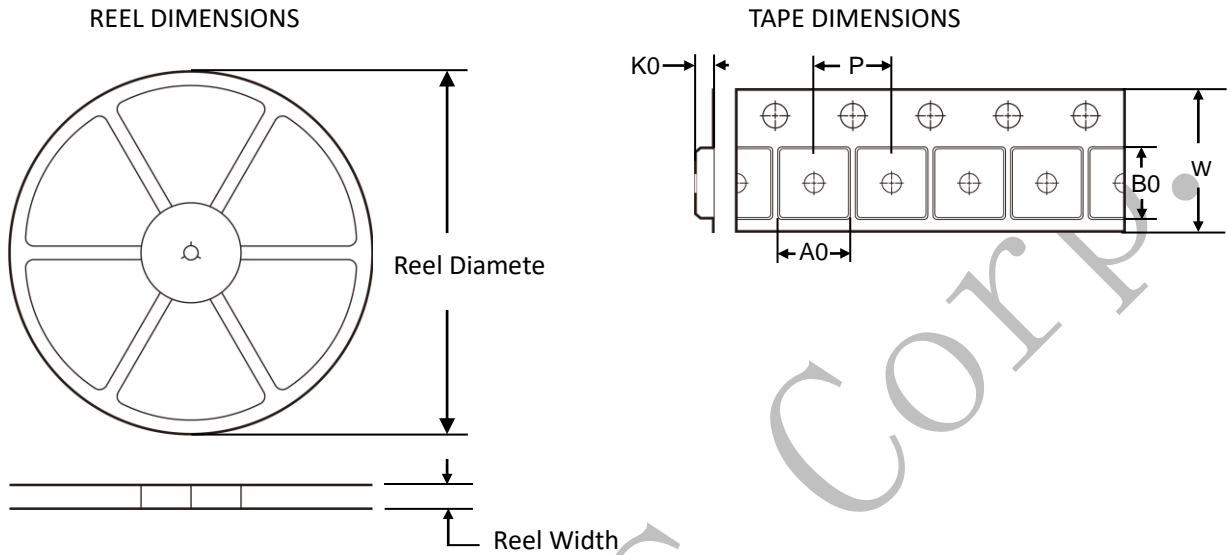
		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3	0.203 REF		
LEAD WIDTH		b	0.2	0.25	0.3
BODY SIZE	X	D	3.9	4 BSC	4.1
	Y	E	3.9	4 BSC	4.1
LEAD PITCH		e	0.5 BSC		
EP SIZE	X	D2	2.4	2.5	2.6
	Y	E2	2.4	2.5	2.6
LEAD LENGTH		L	0.35	0.4	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		

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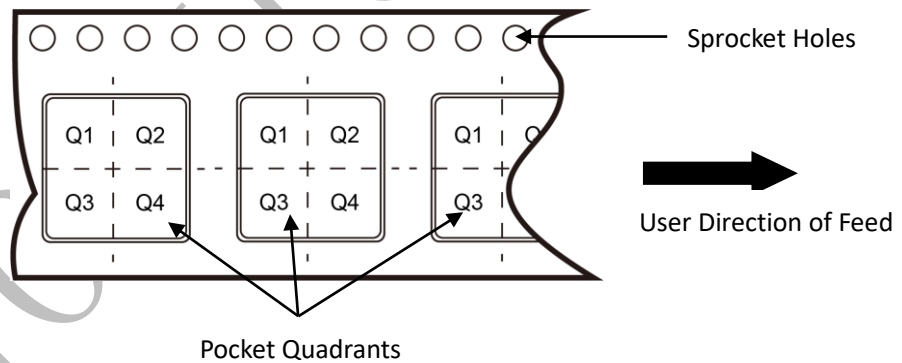


- NOTES: 1. All linear dimensions are in millimeters.  
2. This drawing is subject to change without notice.  
3. Customers should contact their board fabrication site for recommended solder mask tolerances and via tenting recommendations for vias placed in the thermal pad.

## 11. Tape and Reel Information



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE IS Q1

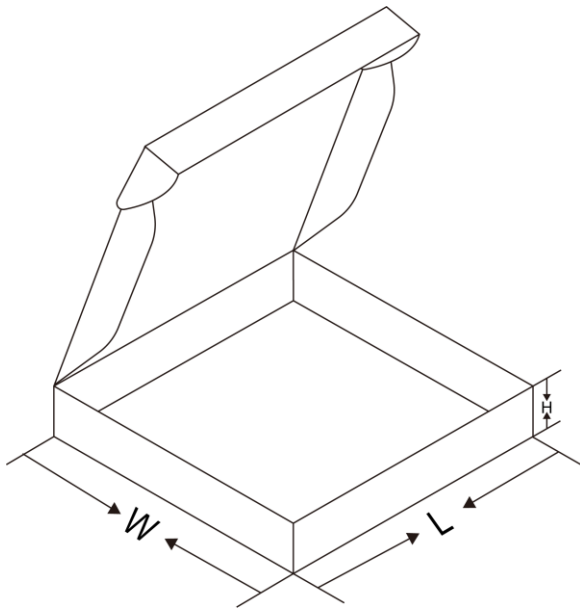


\*所有尺寸为标准尺寸

Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P (mm)	W (mm)	Pin1 Quadrant
IP2736U	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

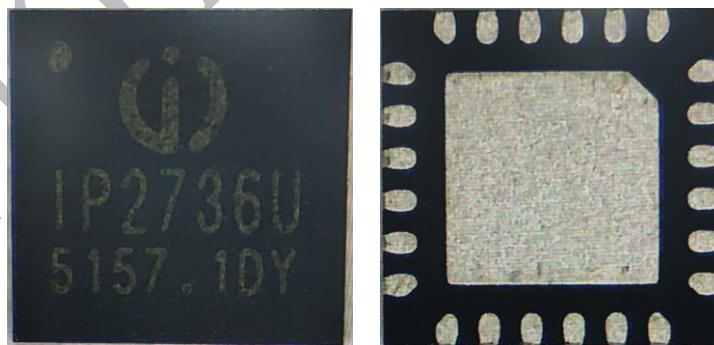
## 12. Marking Specification



说明:

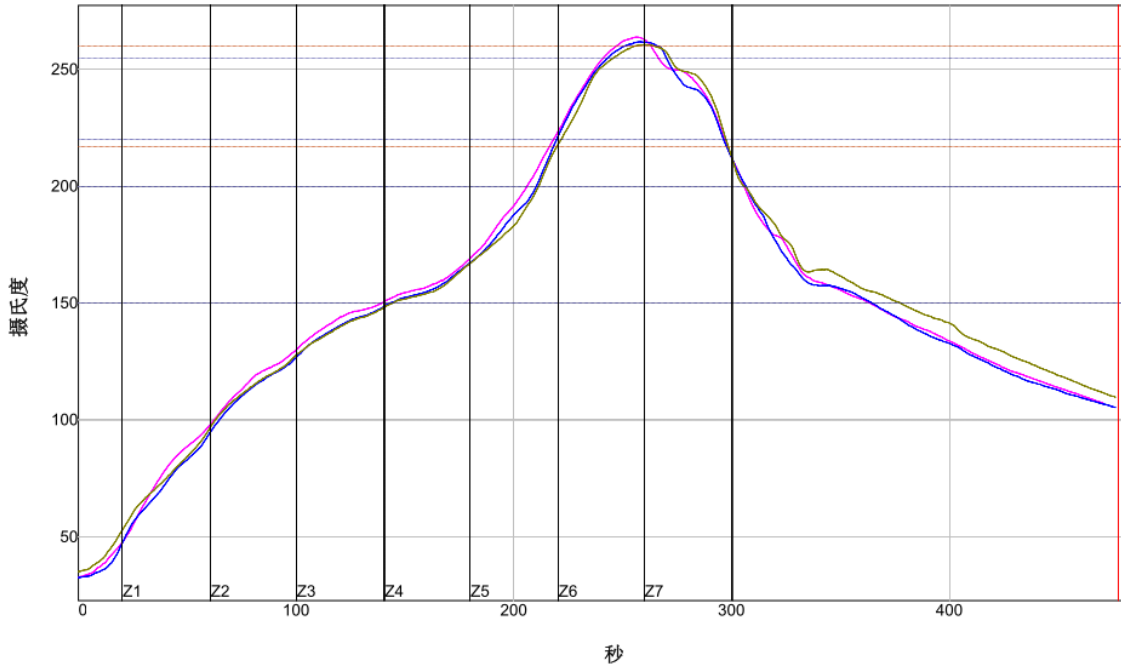
- 1、  ——英集芯标志
- 2、 IP2736U ——产品型号
- 3、 XXXXXXXXX ——生产批号
- 4、  ——Pin 1脚位置标识

## 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:

统计数名称	最低界限	最高界限	单位
锡膏: 260			
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

## 15. IMPORTANT NOTICE

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