

WT6631P

USB Power Delivery Controller

Product Spec.

Rev. 1.02

August 2020

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1. General Description

The WT6631P is a highly integrated USB Power Delivery (PD) controller that supports USB PD 3.0 specification. It is designed for USB Type-C[®] power source applications such as power adapters, wall chargers, car chargers, power banks, and etc.

The WT6631P minimizes external components by integrating USB PD baseband PHY, USB Type-C detection, shunt regulator, voltage and current monitors, NMOS load switch driver and an 8-bit MCU to allow small form factor and low BOM cost. The WT6631P supports 5V to 20V USB PD 3.0 specification. One-Time-Programmable ROM is provided for program code and user configuration data.

The WT6631P is certified by USB Implementers Forum (USB-IF) for USB Type-C PD (TID: 1090014).

2. Features

- USB Type-C and USB-PD
 - Supports USB PD 3.0 baseband communication
 - Programmable USB Type-C pull-up Rp
- Built-in shunt regulator
 - Programmable constant voltage control
 - Integrated low side current sense amplifier
 - Cable drop compensation
- Programmable fault protections
 - Over Voltage Protection (OVP)
 - Under Voltage Protection (UVP)
 - Over Current Protection (OCP)
 - Over Temperature Protection (OTP)
 - Short Circuit Protection (SCP)
- 10-bit ADC for voltage and current monitoring
- MCU
 - Turbo 8051 compatible MCU
 - 12K bytes One-Time-Programmable ROM
- Driver for NMOS load switch
- Built-in discharge MOS transistor
- Internal RC oscillator
- Internal VDD regulator
- General purpose I/Os
- Supports power saving mode
- Operating voltage range: 4V to 24V (30V tolerant)
- Operating temperature range: -20°C to +105°C
- Package: 16-pin QFN, 14-pin SOP, 10-pin SOP and 8-pin SOP

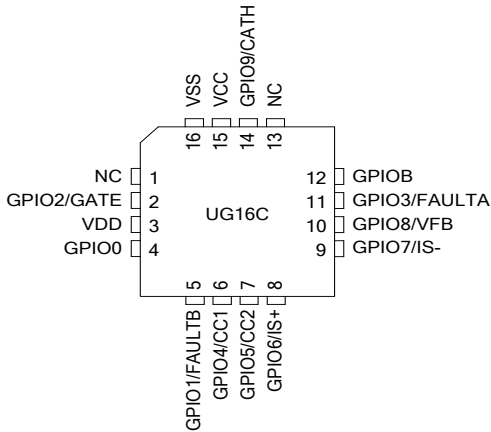
Applications:

USB Type-C with USB Power Delivery power adapters, wall chargers, car chargers, power banks, and etc.

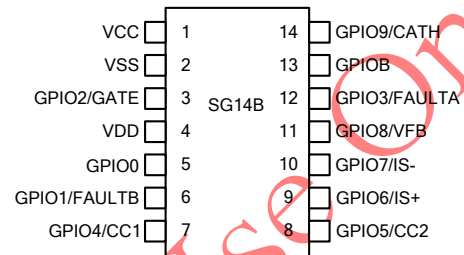
3. Pin Configuration

3.1 Package Types

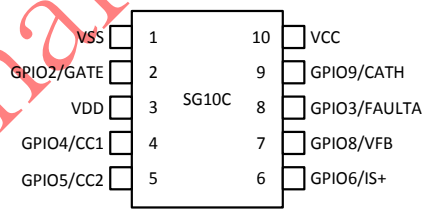
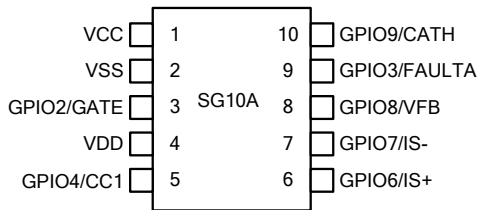
16-pin QFN



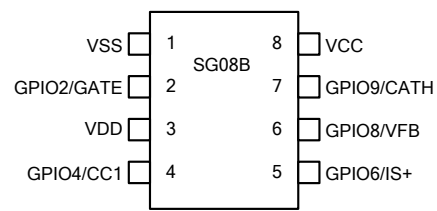
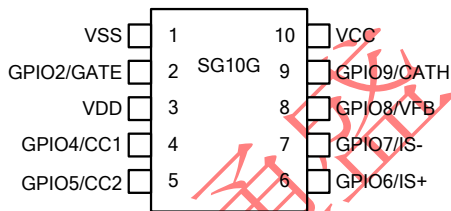
14-pin SOP



10-pin SOP/8-pin SOP



Note: GPIO7 bonding to VSS (pin1)



Note: GPIO7 bonding to VSS (pin1)

3.2 Pin Description

Pin Number						Pin Name	Function	I/O Voltage	Type		Description
QFN	SOP								Input	Output	
16C	14B	10A	10C	10G	08B						
15	1	1	10	10	8	VCC	VCC	HV	-	-	Positive power supply
16	2	2	1	1	1	VSS	VSS	-	-	-	Ground
2	3	3	2	2	2	GPIO2	GPIO2	HV	TTL	OD	General purpose I/O.
							GATE		-	PP	Gate driver of load switch
							ADC2		AN	-	ADC input
3	4	4	3	3	3	VDD	VDD	LV	-	AN	4.8V regulator
4	5					GPIO0	GPIO0	HV	TTL	OD	General purpose I/O.
							OTPA		AN	-	Temperature sensing pin
							ADC6		AN	-	ADC input
							TX		TTL	OD	UART transmitter
							SDAB		TTL	OD	I ² C SDA path B
							P00		TTL	OD	8051 port I/O
							T2CAPA		TTL	OD	T2CAP A path input
5	6					GPIO1	GPIO1	HV	TTL	OD	General purpose I/O.
							FAULTB		TTL	OD	Fault indication. Active low.
							ADC7		AN	-	ADC input
							RX		TTL	-	UART receiver
							SCLB		TTL	OD	I ² C SCL path B
							P01		TTL	OD	8051 port I/O
							T2CAPB		TTL	OD	T2CAP B path input
6	7	5	4	4	4	GPIO4	GPIO4	HV	TTL	-	General purpose I/O
							CC1		CC	PP	USB Type-C Configuration Channel
							ADC4		AN	-	ADC input
7	8		5	5		GPIO5	GPIO5	HV	TTL	-	General purpose I/O
							CC2		CC	PP	USB Type-C Configuration Channel
							OTPC		AN	-	Temperature sensing pin
							ADC5		AN	-	ADC input
8	9	6	6	6	5	GPIO6	GPIO6	LV	TTL	OD	General purpose I/O.
							IS+		AN	-	Positive input of current sense amplifier.
							SCLA		TTL	OD	I ² C SCL path A
9	10	7	1	7	1	GPIO7	GPIO7	LV	TTL	OD	General purpose I/O.
							IS-		AN	-	Negative input of current sense amplifier.
							SDAA		TTL	OD	I ² C SDA path A
10	11	8	7	8	6	GPIO8	GPIO8	LV	TTL	OD	General purpose I/O.
							VFB		AN	-	Feedback of constant voltage loop
							P04		TTL	OD	8051 port I/O

Pin Number						Pin Name	Function	I/O Voltage	Type		Description						
QFN	SOP								Input	Output							
16C	14B	10A	10C	10G	08B												
11	12	9	8			GPIO3	GPIO3	HV	TTL	OD	General purpose I/O. Open drain output.						
									TTL	OD	Fault indication. Active low.						
									AN	-	Temperature sensing pin						
												ADC3			AN	-	ADC input
												P03			TTL	OD	8051 port I/O
12	13					GPIOB	GPIOB	HV	TTL	OD	General purpose I/O.						
									AN	-	Temperature sensing pin						
									TTL	OD	8051 port I/O						
14	14	10	9	9	7	GPIO9	GPIO9	HV	TTL	OD	General purpose I/O.						
									-	AN	Cathode of shunt regulator						
									TTL	OD	8051 port I/O						

Legend: HV=High Voltage (max. 30V), LV=Low voltage (max. 5.5V), OD=Open Drain, PP=Push Pull, AN=analog, TTL= TTL compatible input, CC= USB PD baseband input.

For 通盛 Internal Use Only

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter		Min.	Max.	Units
Supply voltage VCC pin		-0.3	30	V
I/O voltage	GPIO0, GPIO1, GPIO3, GPIO4, GPIO5, GPIO9, GPIOB	-0.3	VCC + 0.3 (Max. 30V)	V
	GPIO2	-0.3	37	V
	GPIO6, GPIO7, GPIO8	-0.3	VDD + 0.3	V
Output voltage	VDD	-0.3	6	V
Operating temperature		-40	125	°C
Storage temperature		-55	150	°C

NOTE: Maximum ratings applied to the device are individual stress limit value. Stresses above those listed may cause permanent damage and reliability may be affected. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

4.2 Recommended Operating Conditions

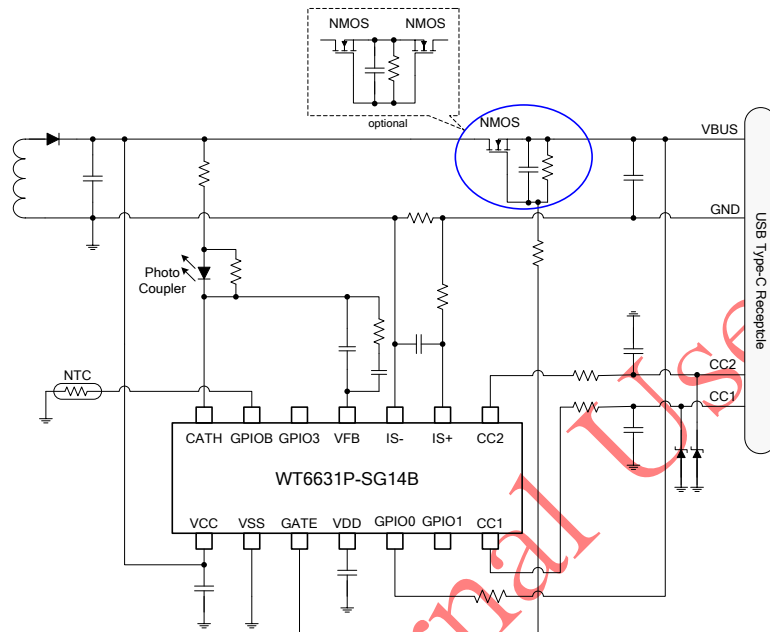
Parameter		Condition	Min.	Typ.	Max.	Units
V _{CC_OPR}	Operating voltage		4		24	V
V _{IO_HV}	GPIO0, GPIO3, GPIO4, GPIO5, GPIO9, GPIOB		0		V _{CC_OPR} + 0.3	V
V _{GATE_HV}	GPIO2 pin		0		V _{CC_OPR} + 8.5	V
V _{IO_LV}	GPIO1, GPIO6, GPIO7, GPIO8		0		V _{O_LDO} + 0.3	V
V _{O_LDO}	VDD pin		4.465	4.7	4.935	V
T _{OPR}	Operating Temperature		-20		105	°C

4.3 Thermal Resistance

Package	Parameter		Min.	Typ.	Max.	Units
16-pin QFN	θ_{JA}	Thermal Resistance (Junction to Air)		47		°C/W
	θ_{JC}	Thermal Resistance (Junction to Case)		4.5		°C/W
	T_{JMAX}	Maximum Junction Temperature		125		°C
14-pin SOP	θ_{JA}	Thermal Resistance (Junction to Air)		90		°C/W
	θ_{JC}	Thermal Resistance (Junction to Case)		37		°C/W
	T_{JMAX}	Maximum Junction Temperature		125		°C
10-pin SOP	θ_{JA}	Thermal Resistance (Junction to Air)		88		°C/W
	θ_{JC}	Thermal Resistance (Junction to Case)		37		°C/W
	T_{JMAX}	Maximum Junction Temperature		125		°C
8-pin SOP	θ_{JA}	Thermal Resistance (Junction to Air)		150		°C/W
	θ_{JC}	Thermal Resistance (Junction to Case)		39		°C/W
	T_{JMAX}	Maximum Junction Temperature		125		°C

5. Example of Application

5.1 USB PD 3.0 Power Adapter



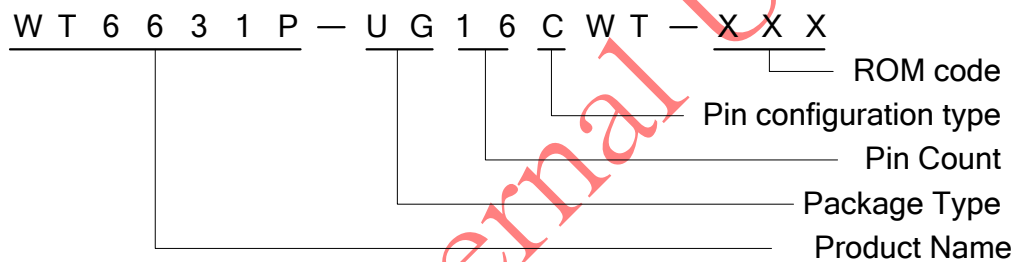
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6. Ordering Information

Package Type	Package Outline	Part Number	Ordering Number	Note
16-pin QFN	4mm x 4mm	WT6631P	WT6631P-UG16CWT-XXX	-
14-pin SOP	150 mil		WT6631P-SG14BWT-XXX	-
10-pin SOP			WT6631P-SG10AWT-XXX	-
			WT6631P-SG10CWT-XXX	-
			WT6631P-SG10GWT-XXX	-
8-pin SOP			WT6631P-SG08BWT-XXX	-

Note: suffix number number-XXX for difference Firmware code, please refer to Firmware control list.

Example:



Top Marking

16-pin QFN Top Marking

W T 6 6 3 1 P
Δ Δ Δ
□ □ □ # &
X X X X X

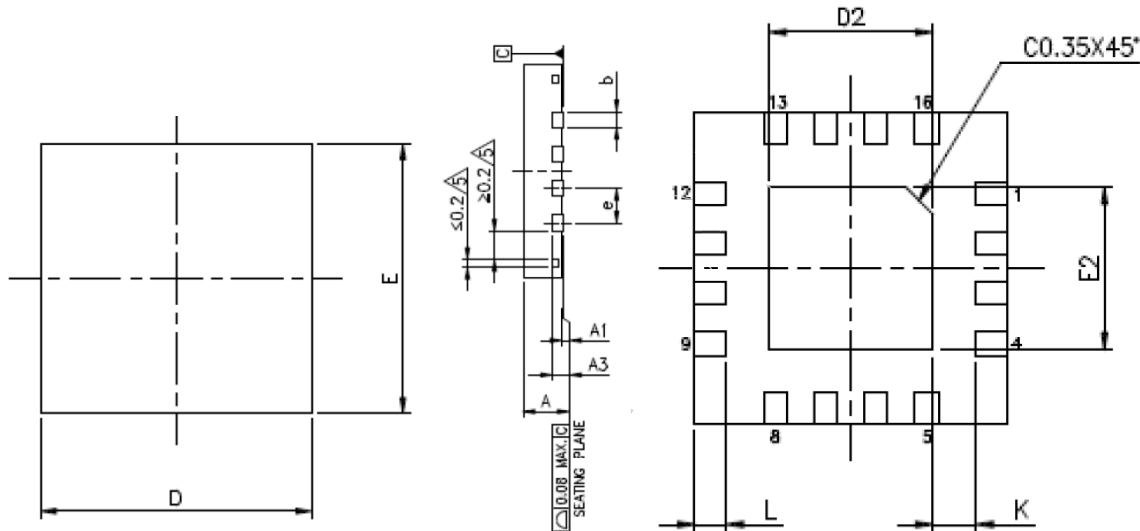
- Δ ROM Code
- Date Code
- # FW Version Code
- & Pin configuration type
- X Production Tracking code

14-pin/10-pin/8-pin SOP Top Marking

eltrend
W T 6 6 3 1 P Δ Δ Δ
□ □ □ # X X X X X &

7. Package Dimension

16-PIN QFN



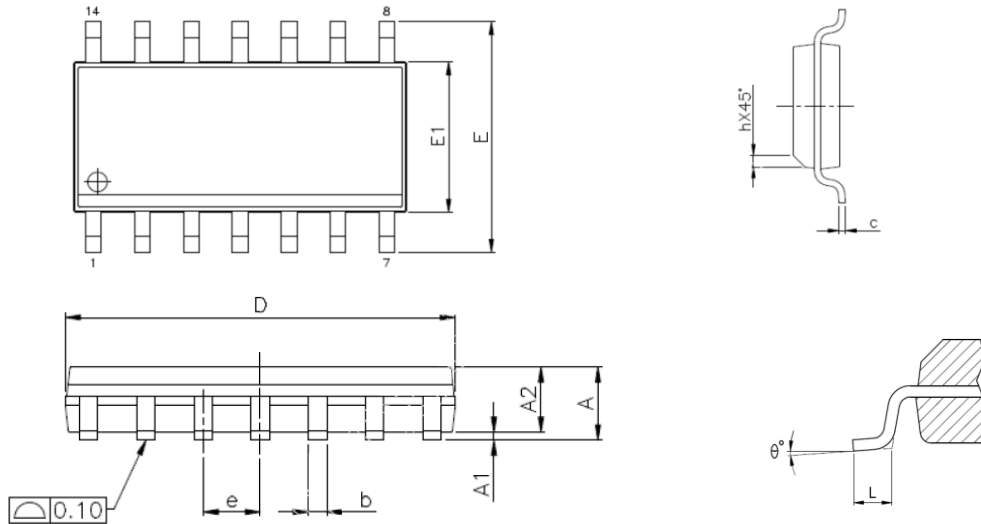
All dimensions shown in mm

SYMBOL	MIN	NOR	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.20		
b	0.25	0.30	0.35
D	3.90	4.00	4.10
E	3.90	4.00	4.10
e	0.65		
K	0.20	-	-
L	0.30	-	0.50
D2	2.00	-	2.80
E2	2.00	-	2.80

NOTE:

1. Dimension "b" applies to metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip. If the terminal has the optional radius on the other end of the terminal, the dimension "b" should not be measured in that radius area.

14-PIN SOP



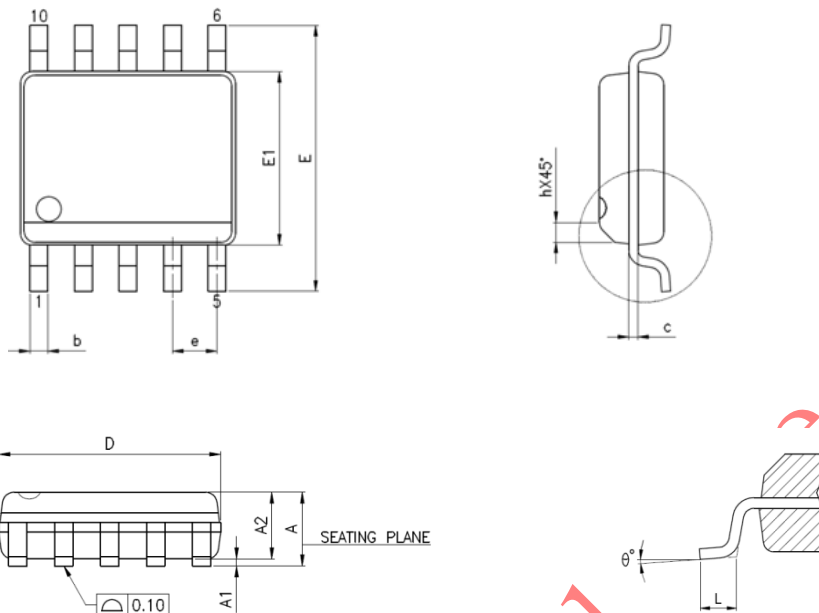
All dimensions shown in mm

SYMBOL	MIN.	MAX.
A	-	1.75
A1	0.10	0.25
A2	1.25	-
b	0.31	0.51
c	0.10	0.25
D	8.55	8.75
E	5.8	6.2
E1	3.8	4.0
e	1.27 BSC	
L	0.40	1.27
h	0.25	0.50
θ°	0	8

NOTES:

1. Dimension "D" does not include mold flash, protrusions or gate burrs mold flash. Protrusions or gate burrs shall not exceed 0.15mm.
2. Dimension "E1" does not include inter-lead flash, or protrusions. Inter-lead flash and protrusions shall not exceed 0.25mm per side.

10-PIN SOP



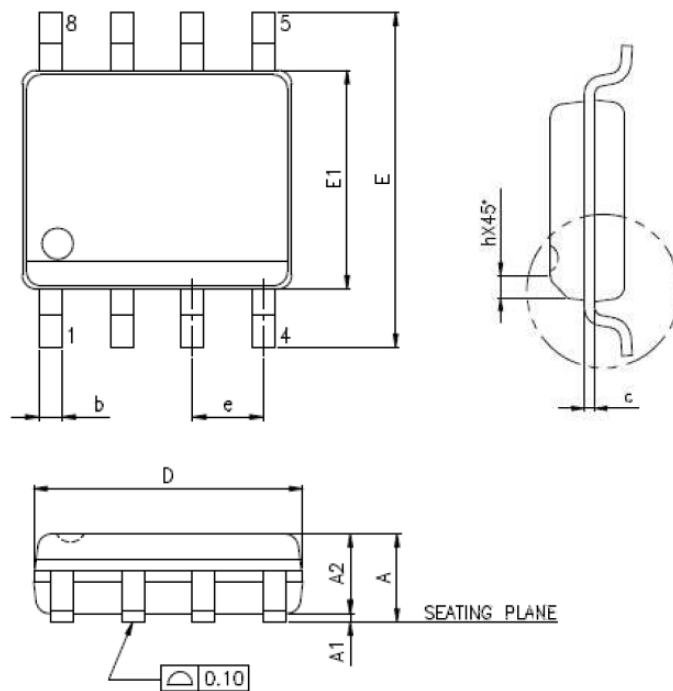
All dimensions shown in mm

SYMBOL	MIN.	MAX.
A	-	1.75
A1	0.10	0.25
A2	1.25	-
b	0.30	0.45
c	0.10	0.25
D	4.80	4.95
E	6.00 BSC	
E1	3.80	4.00
e	1.0 BSC	
L	0.40	1.27
h	0.25	0.50
θ°	0	8

Notes:

1. Dimension "D" does not include mold flash, protrusions or gate burrs mold flash. Protrusions or gate burrs shall not exceed 0.15mm.
2. Dimension "E1" does not include inter-lead flash, or protrusions. Inter-lead flash and protrusions shall not exceed 0.25mm per side.

8-PIN SOP



All dimensions shown in mm

SYMBOL	MIN.	MAX.
A	-	1.75
A1	0.10	0.25
A2	1.25	-
b	0.31	0.51
c	0.10	0.25
D	4.80	4.95
E	6.00 BSC	
E1	3.80	4.00
e	1.27 BSC	
L	0.40	1.27
h	0.25	0.50
θ°	0	8

Notes:

1. Dimension "D" does not include mold flash, protrusions or gate burrs mold flash. Protrusions or gate burrs shall not exceed 0.15mm.
2. Dimension "E1" does not include inter-lead flash, or protrusions. Inter-lead flash and protrusions shall not exceed 0.25mm per side.

8. Revision History

Version	History	Date
0.80	Preliminary	2018/08/01
0.90	Add 8-pin SOP package (SG08B), update Pin Configuration, Ordering Information and package dimension for SG08B package.	2018/10/15
0.91	Modify ADC and OTP channels	2019/01/30
1.00	<ol style="list-style-type: none"> 1. Update Feature description for add "SCP" 2. Update 3.1. package types, add note for SG10C and SG08B 3. Modify 4.2. pin description <ol style="list-style-type: none"> a. Modify GPIO0, GPIO1 and GPIO2 multi-functions. b. Modify SG08B GPIO9 pin number. c. Modify GPIO1 I/O Voltage. 4. Update I/O Voltage for GPIO1 (section 4.1) 5. Update 4.2 V_{O_LDO} Specification. 	2019/02/11
1.01	Update 4.2 V _{O_LDO} Specification.	2020/02/14
1.02	Update General Description (section 1)	2020/08/27