

WT6653P
USB Power Delivery and
Fast Charge Controller

Product Spec.

Rev. 0.90

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1. General Description

The WT6653P is a highly integrated USB Power Delivery (USB PD) controller that supports USB PD 3.0 Programmable Power Supply (PPS) specification, Universal Fast Charging Specification for mobile devices (UFCS) and Qualcomm® Quick Charge™ 4 or Quick Charge 4+ technologies. It is designed for USB Type-C® power source applications such as power adapters, wall chargers, car chargers, power strip, power bank, and etc.

The WT6653P minimizes external components by integrating USB PD baseband PHY, UFCS 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. Wide operation voltage range (3V to 24V) supports USB PD 3.0 Programmable Power Supply specification. One-Time-Programmable ROM is provided for program code and user configuration data.

2. Features

- USB Type-C and USB-PD
 - Supports USB PD 3.0 including Programmable Power Supply (PPS)
 - Programmable USB Type-C pull-up Rp
 - Integrated VCONN power and switch for reading E-marked cable
- Supports USB BC1.2 DCP
- Support Quick Charge 2.0, 3.0, 4/4+, 5
- Support UFCS
- Supports Fast Charge Protocol (FCP) and Smart Charge Protocol (SCP)
- Built-in shunt regulator
 - Programmable constant voltage control
 - Programmable constant current 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)
- 10-bit ADC for voltage and current monitoring
- MCU
 - Turbo 8051 compatible MCU
 - 12K bytes One-Time-Programmable (OTP) ROM and 12K byte Mask ROM
- Driver for NMOS load switch
- Built-in discharge MOS transistor
- High voltage CC1, CC2, D+ and D- pins
- Internal RC oscillator
- Internal capless VDD regulator
- General purpose I/Os
- Supports power saving mode
- Operating voltage range: 3V ~ 24V (30V tolerant)
- Operating temperature range: -20°C ~ +105°C
- Green Package: 16-pin QFN, 14-pin SOP and 10-pin SOP

Applications:

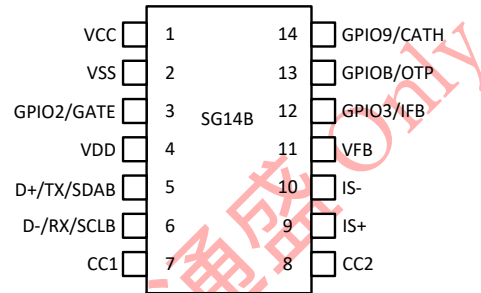
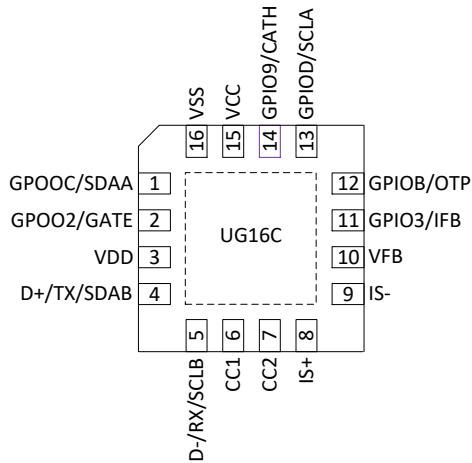
USB Type-C with USB Power Delivery power adapters, wall chargers, car chargers, power strip, and etc.

3. Pin Configuration

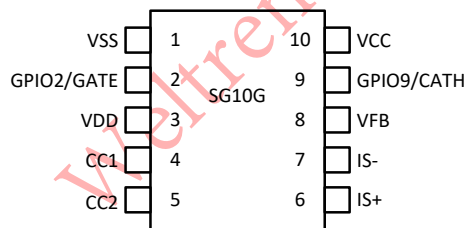
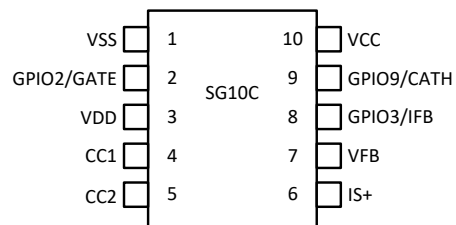
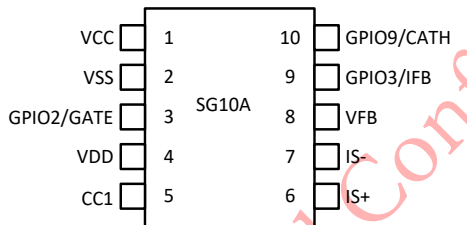
3.1 Package

16-pin QFN (4mmx4mm)

SOP-14 pin (150mil)



10-pin SOP (150mil)



3.2 Pin Description

Pin Number					Pin Name	Function	I/O Voltage	Type		Description
QFN	SOP							Input	Output	
16C	14B	10A	10C	10G						
15	1	1	10	10	VCC	VCC	HV	-	-	Positive power supply
15	1	1	10	10	DISC	DISC	HV	-	OD	Discharge
16	2	2	1	1	VSS	VSS	-	-	-	Ground
1					GPIOC	GPIOC	LV	TTL	OD	Serial purpose I/O.
						OTPA		AN	-	Temperature sensing pin
						ADC7		AN	-	ADC input
						SDAA		TTL	OD	I ² C SDA A path
						P04		TTL	OD	8051 port I/O
2	3	3	2	2	GPIO2	GPIO2	HV	TTL	OD	General purpose I/O.
						GATE		-	PP	Blocking MOS Control
						ADC3		AN	-	ADC input
						P02		TTL	OD	8051 port I/O
3	4	4	3	3	VDD	VDD	LV	-	AN	4.8V regulator
4	5				D+	D+	HV ²	AN	-	D+ for B.C. with USB device side
						ADC2		AN	-	ADC input
						TX		TTL	OD	UFCS transmitter
						TXC		TTL	OD	UART transmitter C path
						SDAB		TTL	OD	I ² C SDA B path
						P00		TTL	OD	8051 port I/O
5	6				D-	D-	HV ²	AN	-	D- for B.C. with USB device side
						FCP		AN	PP	FCP/SCP interface
						RX		TTL	-	UFCS receiver
						RXC		TTL	-	UART receiver C path
						SCLB		TTL	OD	I ² C SCL B path
						P01		TTL	OD	8051 port I/O
6	7	5	4	4	CC1	CC1	HV ²	CC	PP	USB Type-C Configuration Channel
						ADC4		AN	-	ADC input
						TRXA		TTL	OD	UART transmitter/receiver A path
7	8		5	5	CC2	CC2	HV ²	CC	PP	USB Type-C Configuration Channel
						OTPC		AN	-	Temperature sensing pin
						ADC5		AN	-	ADC input
						TRXB		TTL	OD	UART transmitter/receiver B path
8	9	6	6	6	GPIO6	GPIO6	LV	TTL	OD	General purpose I/O.
						IS+		AN	-	Positive input of current sensing amplifier.
9	10	7	1	7	IS-	IS-	LV	AN	-	Negative input of current sensing amplifier.
10	11	8	7	8	VFB	VFB	HV ²	AN	-	Feedback of shunt regulator

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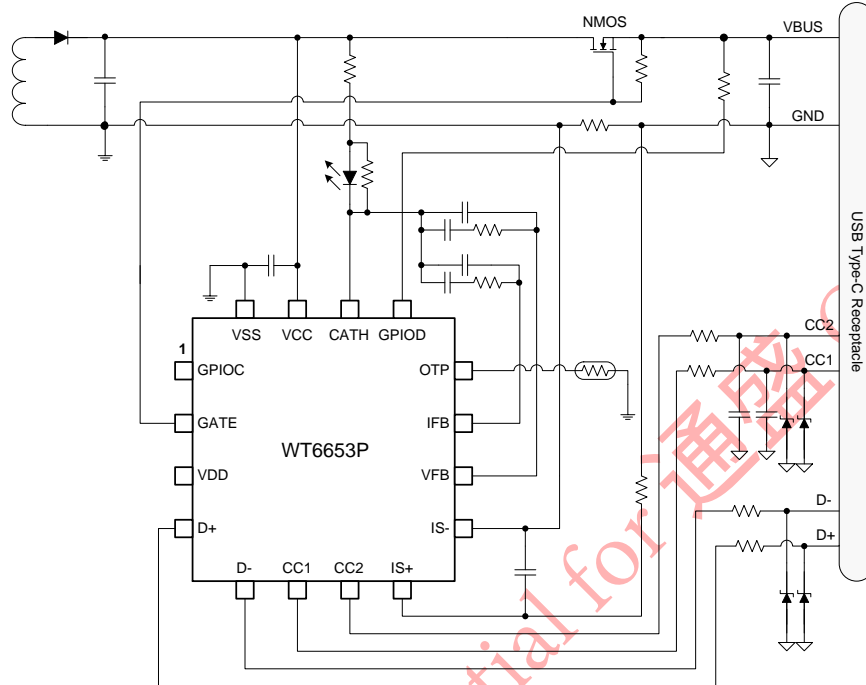
Pin Number					Pin Name	Function	I/O Voltage	Type		Description
QFN	SOP							Input	Output	
16C	14B	10A	10C	10G						
11	12	9	8		GPIO3	GPIO3	HV ²	TTL	OD	General purpose I/O. Open drain output.
						IFB		AN	-	Feedback of shunt regulator
12	13				GPIOB	GPIOB	LV	TTL	OD	General purpose I/O.
						OTPB		AN	-	Temperature sensing pin
						ADC6		AN	-	ADC input
						P03		TTL	OD	8051 port I/O
13					GPIOD	GPIOD	HV ²	TTL	OD	General purpose I/O
						ADC8		AN	-	ADC input
						SCLA		TTL	OD	I ² C SCL A path
						P05		TTL	OD	8051 port I/O
3	3	10	9	9	GPIO9	GPIO9	HV ²	TTL	OD	General purpose I/O.
						CATH		-	AN	Cathode of shunt regulator

*(1) Lend: HV = High Voltage (Max. 30V), HV² = High Voltage 2 (Max. 26V), HV³ = High Voltage 3 (Max. 26V), LV = Low voltage (Max. 5.5V), OD = Open Drain, PP = Push Pull, AN = analog, TTL = TTL compatible input, CC = USB PD baseband input.

*(2) HV³ pins (D+, D- pins) voltage 7V to 26V, the time must be < 100ms.

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4. Application Information



5. Electrical Characteristics

5.1 Absolute Maximum Ratings

Parameter		Min.	Max.	Units
Supply voltage VCC pin		-0.3	30	V
I/O voltage	HV pins: GPIO2	-0.3	VCC + 0.3 (Max. 30V)	V
	HV ² pins: CC1, CC2, VFB, GPIO3, GPIO9	-0.3	26	V
	HV ³ pins: D+, D-	-0.3	26	V
	GPIO6, GPIO7, GPIOB, GPIOC	-0.3	VDD + 0.3V	V
Output voltage	VDD	-0.3	6	V
Operating temperature		-40	125	°C
Storage temperature		-55	150	°C

NOTES:

- (1) 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.
- (2) When HV³ pins (D+, D- pins) voltage 7V to 26V, the time must be < 100ms.

5.2 Recommended Operating Conditions

Parameter		Condition	Min.	Typ.	Max.	Units
VCC_OPR	Operating voltage		3		24	V
T_OPR	Operating Temperature		-20		105	°C

5.3 Thermal Resistance

16-pin QFN

Parameter		Condition	Value	Units
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

Parameter		Condition	Value	Units
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

Parameter		Condition	Value	Units
θ_{JA}	Thermal Resistance (Junction to Air)	Power dissipation at 1.5W	35.09	°C /W
θ_{JC}	Thermal Resistance (Junction to Case)	Power dissipation at 1.5W	22.36	°C /W
T_{JMAX}	Maximum Junction Temperature		125	°C

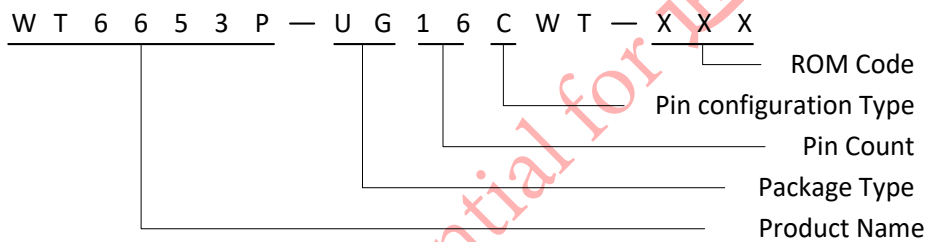
Note: The package is mounted to a 4 layer (2s2p) test board consistent with JE5D51-7 standard test board of the customer. The ambient temperature is set to 25°C.

6. Ordering Information

Package Type	Package Outline	Part Number	Ordering Number	Note
16-pin QFN	4mm x 4mm	WT6653P	WT6653P-UG16CWT-XXX	-
14-pin SOP	150 mil		WT6653P-SG14BWT-XXX	-
10-pin SOP			WT6653P-SG10AWT-XXX	-
			WT6653P-SG10CWT-XXX	-
			WT6653P-SG10GWT-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 5 3 P
△ △ △
□ □ □ # &
X X X X X

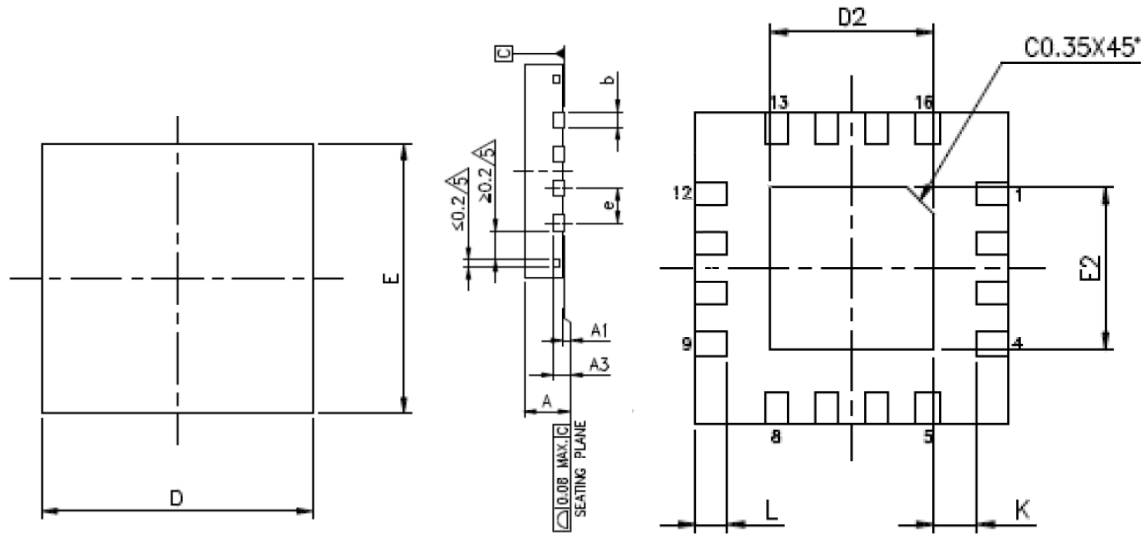
- △ ROM Code
- Date Code
- X Production Tracking code
- # FW Version Code
- & Pin configuration type

14-pin/10-pin SOP Top Marking


W T 6 6 5 3 P △ △ △
□ □ □ # X X X X X &

7. Package Dimension

16-PIN QFN



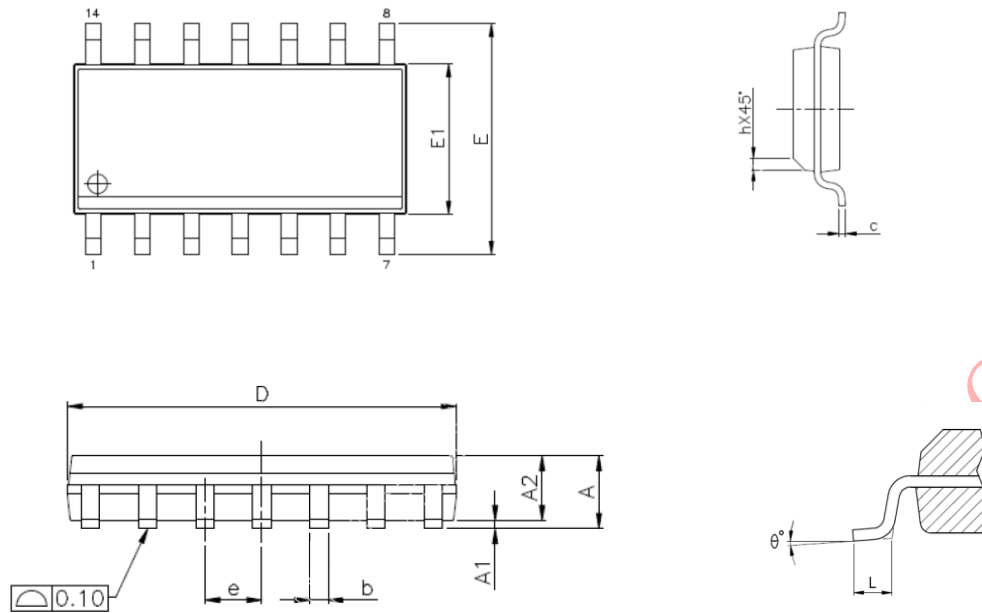
All dimensions shown in mm

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



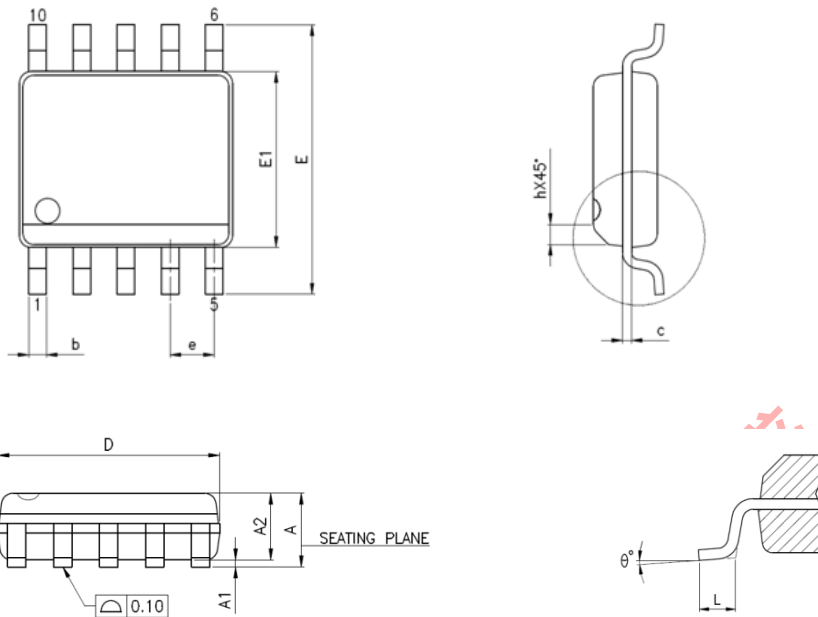
All dimensions shown in mm

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. Revision History

Version	History	Date
0.90	Preliminary	2022/03/10

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