WT6633Q Automotive-Grade USB Power Delivery and Qualcomm® Quick Charge™ 4/4+/5 Controller

Product Spec.

Rev. 1.01

May 2022

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1. General Description

The WT6633Q is a highly integrated USB Power Delivery (USB PD) controller that supports USB PD 3.0 Programmable Power Supply (PPS) specification and Qualcomm® Quick Charge™ 4, Quick Charge 4+, and Quick Charge 5 technologies. With AEC-Q100 qualification for automotive-grade performance, the WT6633Q is designed for automotive USB Type-C® power source applications such as charging ports and infotainment ports in cars.

The WT6633Q 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. 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, Quick Charge 4 and Quick Charge 4+ (backward compatible Quick Charge 3.0 and Quick Charge 2.0)
- Supports Fast Charge Protocol and Smart Charge Protocol
- 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)
- CC1/CC2/D+/D- Pins Over Voltage Protection
- 10-bit ADC for voltage and current monitoring
- MCU
  - Turbo 8051 compatible MCU
  - 16K 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: 3V ~ 24V (30V tolerant)
- Green Package: 16-pin QFN, 14-pin SOP AEC-Q100 Grade 1 Qualified (-40℃ to +125℃)

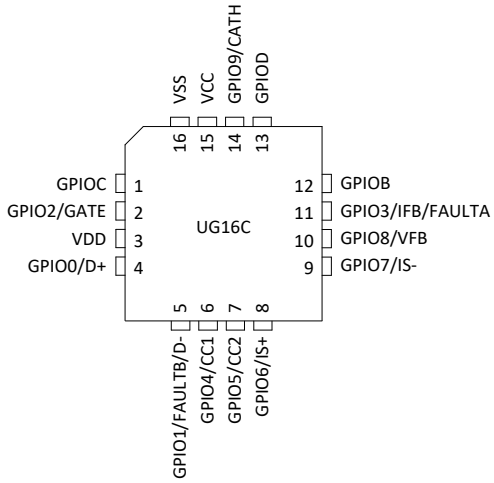
Applications:

Automotive USB Type-C with USB Power Delivery power.

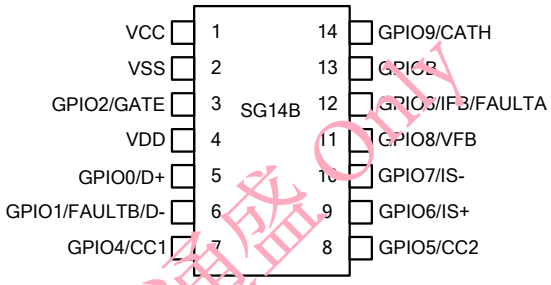
3. Pin Configuration

3.1 Package

16-pin QFN



14-pin SOP



3.2 Pin Description

Pin Number		Pin Name	Function	I/O Voltage	Type		Description
QFN 16C	SOP 14B				Input	Output	
15	1	VCC	VCC	HV	-	-	Positive power supply
			DISC		-	OD	Discharge
16	2	VSS	VSS	-	-	-	Ground
1		GPIOC	GPIOC	HV	TTL	OD	Serial purpose I/O
			OTPA		AN	-	Temperature sensing pin
			ADC9		AN	-	ADC input
			P07		TTL	OD	8051 port I/O
2	3	GPIO2	GPIO2	HV	TTL	OD	General purpose I/O
			GATE		-	PP	Blocking MOS Control
			ADC12		AN	-	ADC input
3	4	VDD	VDD	LV	-	AN	4.8V regulator
4	5	GPIO0	GPIO0	HV	TTL	OD	General purpose I/O
			D+		AN	-	D+ for B.C. with USB device side
			ADC6		AN	-	ADC input
			TX		TTL	OD	UART transmitter
			SDAB		TTL	OD	I^2C SDA B path
			P00		TTL	OD	8051 port I/O

Pin Number		Pin Name	Function	I/O Voltage	Type		Description
QFN 16C	SOP 14B				Input	Output	
5	6	GPIO1	GPIO1	LV	TTL	OD	General purpose I/O
			D-		AN	-	D- for B.C. with USB device side
			FAULTB		TTL	OD	Fault indication. Outputs low when OVP/OCP
			ADC7		AN	-	ADC input
			RX		TTL	-	UART receiver
			SCLB		TTL	OD	I^2C SCL B path
			P01		TTL	OD	8051 port I/O
6	7	GPIO4	GPIO4	HV	TTL	-	General purpose Input
			CC1		CC	PP	USB Type-C Configuration Channel
			ADC4		AN	-	ADC input
7	8	GPIO5	GPIO5	HV	TTL	-	General purpose Input
			CC2		CC	PP	USB Type-C Configuration Channel
			OTPC		AN	-	Temperature sensing pin
			ADC5		AN	-	ADC input
8	9	GPIO6	GPIO6	LV	TTL	OD	General purpose I/O
			IS+		AN	-	Positive input of current sensing amplifier
			SCLA		TTL	OD	I^2C SCL A path
9	10	GPIO7	GPIO7	LV	TTL	OD	General purpose I/O
			IS-		AN	-	Negative input of current sensing amplifier.
			SDAA		TTL	OD	I^2C SDA A path
10	11	GPIO8	GPIO8	LV	TTL	OD	General purpose I/O.
			VFB		AN	-	Feedback of shunt regulator
			P04		TTL	OD	8051 port I/O
11	12	GPIO3	GPIO3	HV	TTL	OD	General purpose I/O. Open drain output.
			IFB		AN	-	Feedback of shunt regulator
			FAULTA		TTL	OD	Fault indication. Output low when OVP/OCP.
			ADC3		AN	-	ADC input
			P03		TTL	OD	8051 port I/O
12	13	GPIOB	GPIOB	HV	TTL	OD	General purpose I/O.
			OTPB		AN	-	Temperature sensing pin
			ADC8		AN	-	ADC input
			P06		TTL	OD	8051 port I/O
13		GPIOD	GPIOD	HV	TTL	OD	General purpose I/O
			OTPD		AN	-	Temperature sensing pin
			ADC10		AN	-	ADC input
			P02		TTL	OD	8051 port I/O
14	14	GPIO9	GPIO9	HV	TTL	OD	General purpose I/O.
			CATH		-	AN	Cathode of shunt regulator
			P05		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

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter		Min.	Max.	Units
Supply voltage VCC pin		–0.3	30	V
I/O voltage	GPIO0, GPIO3, GPIO4, GPIO5, GPIO9, GPIOB, GPIOC, GPIOD	–0.3	VCC + 0.3 (Max. 30V)	V
	GPIO2	–0.3	37	V
	GPIO1, GPIO6, GPIO7, GPIO8	–0.3	VDD + 0.3V	V
Output voltage	VDD	-0.3	6	V
Operating temperature		-40	125	°C
Storage temperature		-55	150	°C
ESD	HBM	±2K	-	V
	CDM	±500	-	V

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 Device-Level Specification

All device-level specifications including "recommended operating conditions", "DC characteristics" and "AC characteristics" will be added in a future version of general version data sheet.

4.3 Thermal Information

16-pin QFN

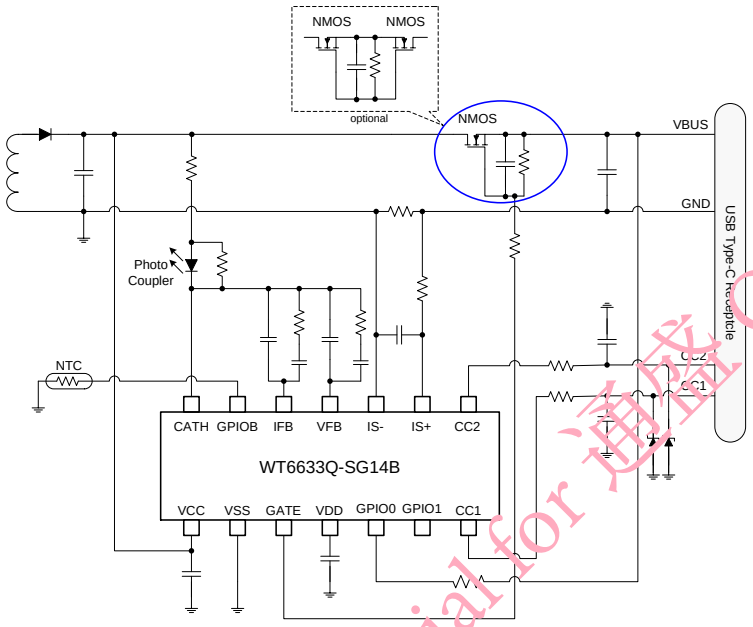
Symbol	Parameter	Value	Units
θ_{JA}	Thermal Resistance (Junction to Air)	44	°C /W
θ_{JC}	Thermal Resistance (Junction to Case)	7.3	°C /W
T_{JMAX}	Maximum Junction Temperature	125	°C

14-pin SOP

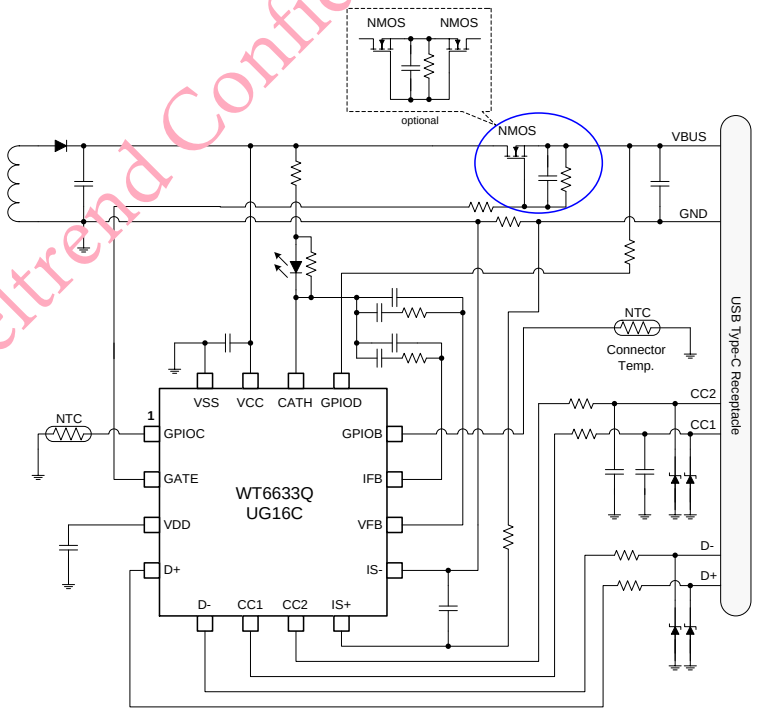
Symbol	Parameter	Value	Units
θ_{JA}	Thermal Resistance (Junction to Air)	90	°C /W
θ_{JC}	Thermal Resistance (Junction to Case)	37	°C /W
T_{JMAX}	Maximum Junction Temperature	125	°C

5. Application Information

5.1 USB PD 3.0 Power Adapter with PPS



5.2 QC4 Charger

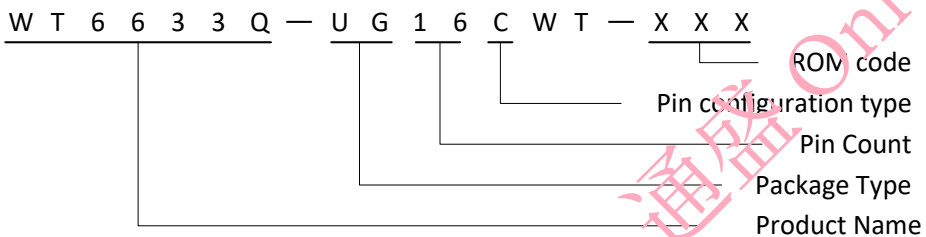


6. Ordering Information

Package Type	Package Outline	Part Number	Ordering Number	Note
16-pin QFN	4mm x 4mm	WT6633Q	WT6633Q-UG16CWT-XXX	
14-pin SOP	150 mil		WT6633Q-SG14BWT-XXX	

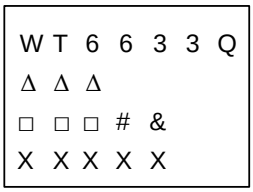
Note: suffix number number-XXX for difference Firmware code, please refer to Firmware control list.

Example:



Top Marking

16-pin QFN Top Marking



△ ROM Code

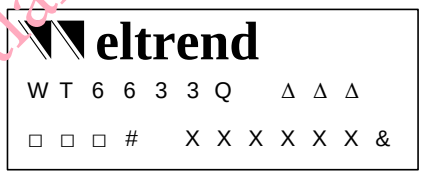
□ Date Code

FW Version Code

& Pin configuration type

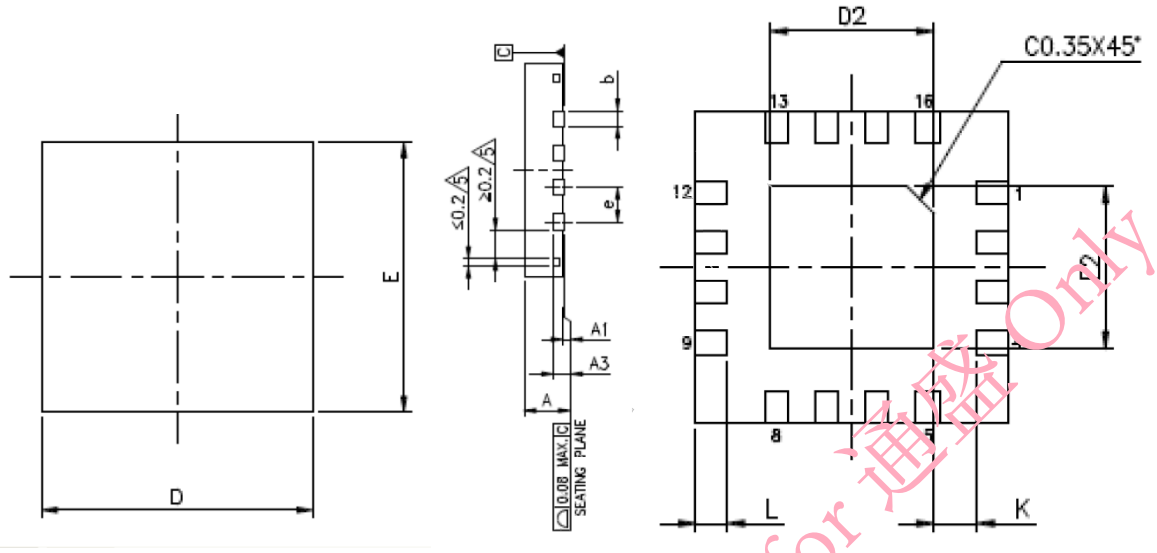
X Production Tracking code

14-pin SOP Top Marking



7. Package Dimension

16-pin QFN



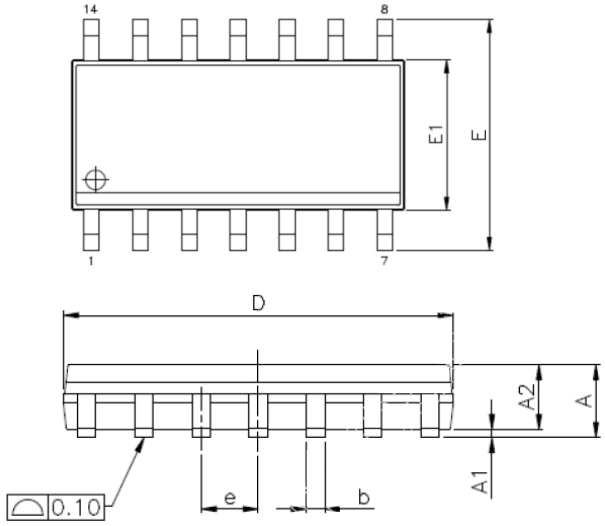
All dimensions shown in mm

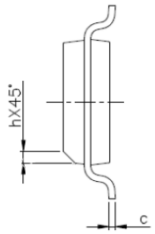
SYMBOL	MIN	NOR	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.20	
b	0.25	0.30	0.35
D	3.90	4.00	4.10
E	3.90	4.00	4.10
e		0.65	
K	0.20	-	-
L	0.30	-	0.50
D2	2.00	-	2.80
E2	2.00	-	2.80

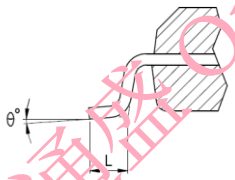
Note:

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.

8. Revision History

Version	History	Date
1.00	Initial issue	2022/04/21
1.01	Update Features description	2022/05/31

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