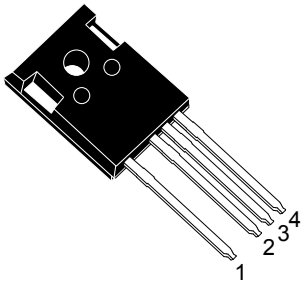
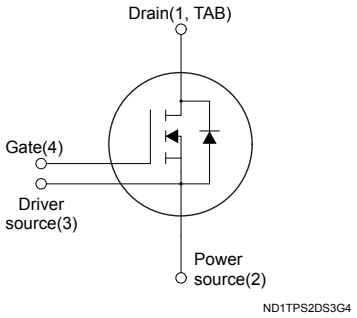
SCTWA50N120-4

Datasheet

Silicon carbide Power MOSFET 1200 V, 52 mΩ typ., 65 A in an HiP247-4 package



HiP247-4



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
SCTWA50N120-4	1200 V	69 mΩ	65 A

- Very fast and robust intrinsic body diode
- Low capacitances
- Source sensing pin for increased efficiency
- Very high operating junction temperature capability (T_J = 200 °C)

Applications

- High voltage DC-DC converters
- Battery charges
- Power supply for servers
- Solar inverters
- Motor control

Description

This silicon carbide Power MOSFET is produced exploiting the advanced, innovative properties of wide bandgap materials. This results in unsurpassed on-resistance per unit area and very good switching performance almost independent of temperature. The outstanding thermal properties of the SiC material allow designers to use an industry-standard outline with significantly improved thermal capability. These features render the device perfectly suitable for high-efficiency and high power density applications.

Product status link
SCTWA50N120-4

Product summary	
Order code	SCTWA50N120-4
Marking	SCTWA50N120
Package	HiP247-4
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	1200	V
V_{GS}	Gate-source voltage	-10 to 25	V
I_D	Drain current (continuous) at T_C = 25 °C	65	A
	Drain current (continuous) at T_C = 100 °C	50	
I_{DM} (1)	Drain current (pulsed)	130	A
P_{TOT}	Total power dissipation at T_C = 25 °C	318	W
T_{stg}	Storage temperature range	-55 to 200	°C
T_J	Operating junction temperature range		°C

1. *Pulse width limited by safe operating area.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.55	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	40	°C/W

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified).

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero gate voltage drain current	V_{DS} = 1200 V, V_{GS} = 0 V			5	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = -10 to 22 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 1 mA	1.8	3.0	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 20 V, I_D = 40 A		52	69	mΩ
		V_{GS} = 20 V, I_D = 40 A, T_J = 150 °C		59		
		V_{GS} = 20 V, I_D = 40 A, T_J = 200 °C		70		

Table 4. Dynamic, based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 400 V, f = 1 MHz, V_{GS} = 0 V	-	1900	-	pF
C_{oss}	Output capacitance		-	170	-	pF
C_{rss}	Reverse transfer capacitance		-	30	-	pF
Q_g	Total gate charge	V_{DD} = 800 V, I_D = 40 A, V_{GS} = 0 to 20 V	-	122	-	nC
Q_{gs}	Gate-source charge		-	19	-	nC
Q_{gd}	Gate-drain charge		-	35	-	nC
R_g	Gate input resistance	f = 1 MHz open drain	-	1.9	-	Ω

Table 5. Switching energy (inductive load), based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 40 A, R_G = 2.2 Ω, V_{GS} = -5 to 20 V	-	530	-	µJ
E_{off}	Turn-off switching energy		-	310	-	µJ
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 40 A, R_G = 2.2 Ω, V_{GS} = -5 to 20 V, T_J = 150 °C	-	670	-	µJ
E_{off}	Turn-off switching energy		-	334	-	µJ

Table 6. Reverse SiC diode characteristics, based on HiP247 package option

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V_{SD}	Diode forward voltage	I_F = 20 A, V_{GS} = 0 V	-	3.5	-	V
t_{rr}	Reverse recovery time	I_F = 40 A, di/dt = 2000 A/µs, V_{DD} = 800 V	-	55		ns
Q_{rr}	Reverse recovery charge		-	230	-	nC
I_{RRM}	Reverse recovery current		-	14	-	A

2.1 Electrical characteristics (curves), based on HiP247 package option

Figure 1. Safe operating area

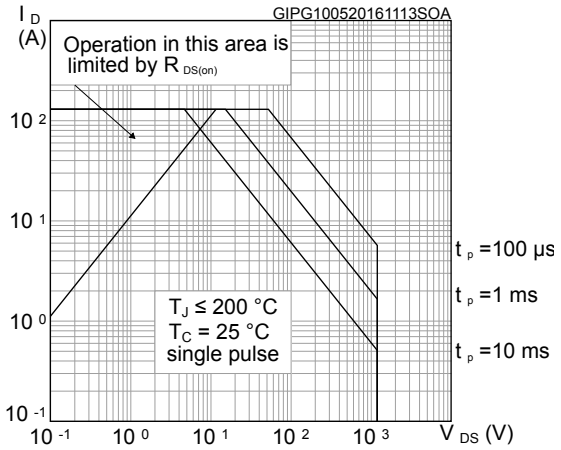


Figure 2. Thermal impedance

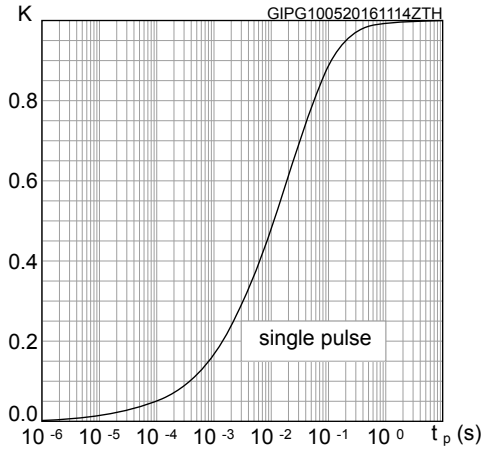


Figure 3. Output characteristics (T_J = 25 °C)

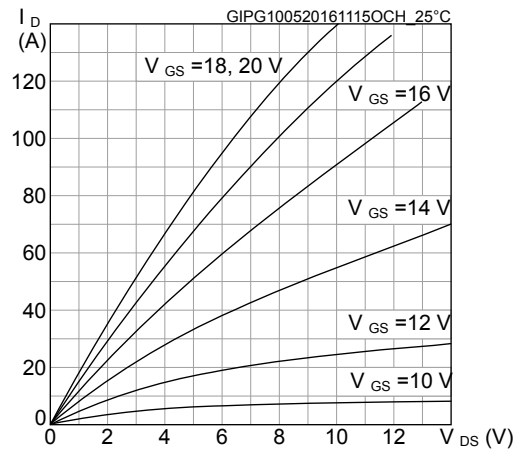


Figure 4. Output characteristics (T_J = 150 °C)

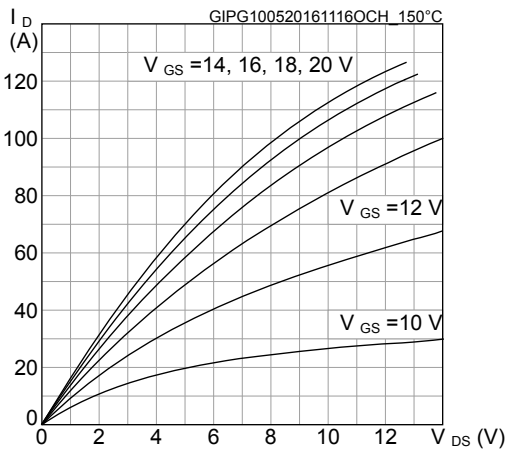


Figure 5. Output characteristics (T_J = 200 °C)

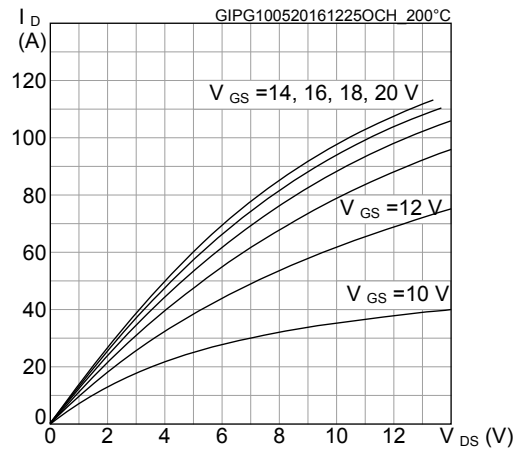


Figure 6. Transfer characteristics

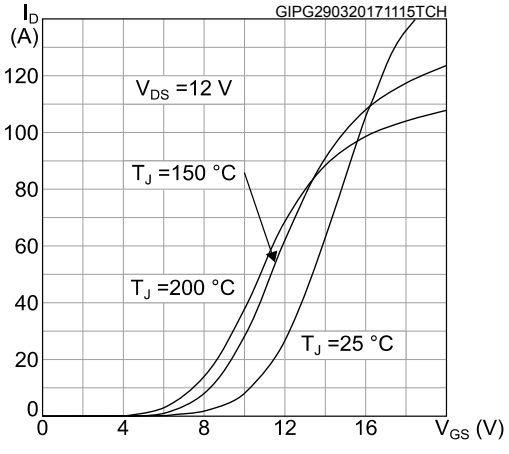


Figure 7. Total power dissipation

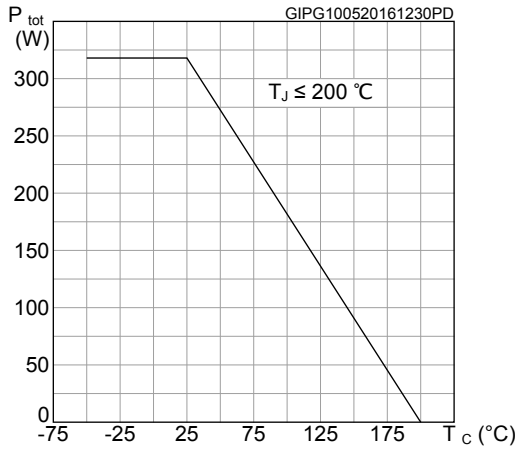


Figure 8. Gate charge vs gate-source voltage

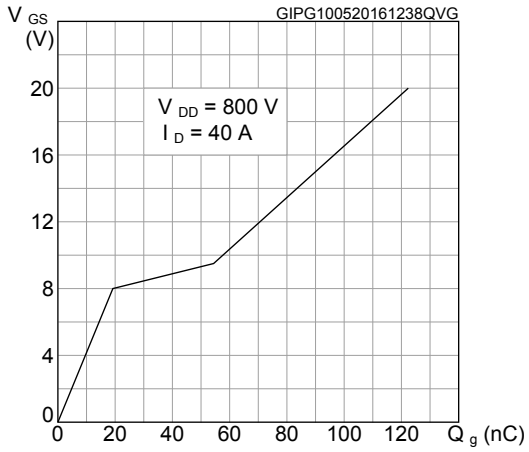


Figure 9. Capacitance variations

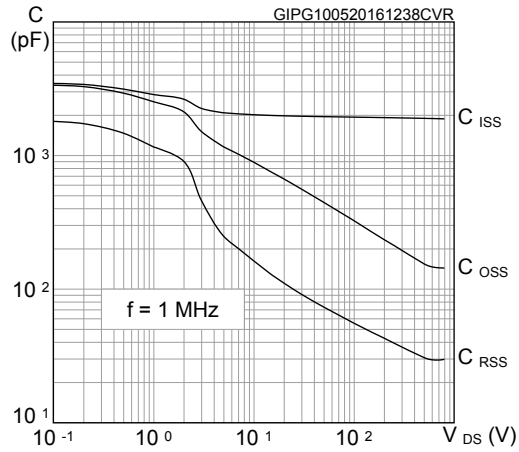


Figure 10. Switching energy vs drain current

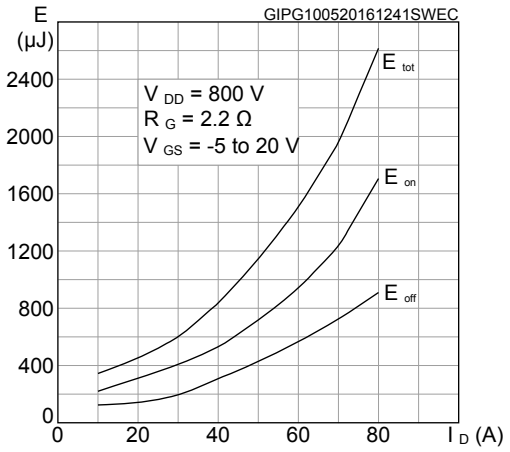


Figure 11. Switching energy vs junction temperature

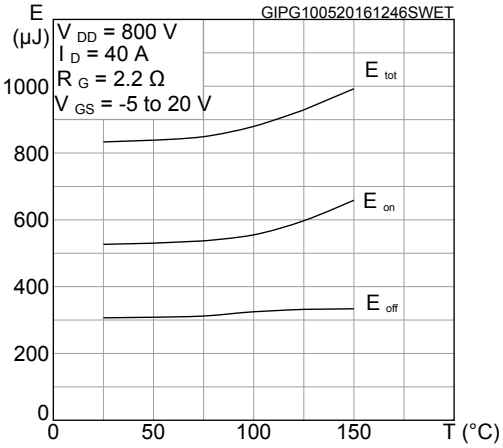


Figure 12. Normalized $V_{(BR)DSS}$ vs temperature

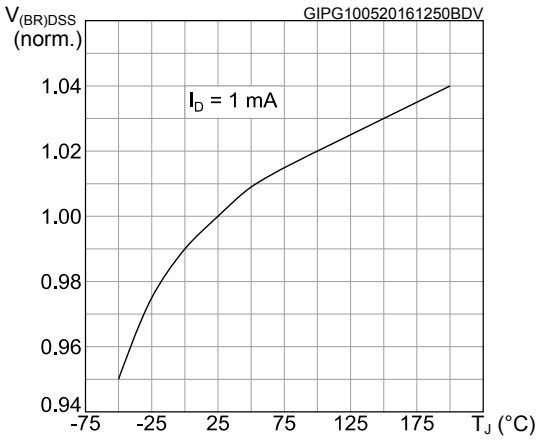


Figure 13. Normalized gate threshold voltage vs temperature

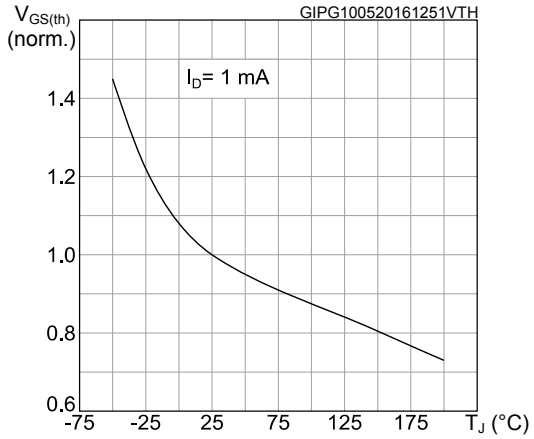


Figure 14. Normalized on-resistance vs temperature

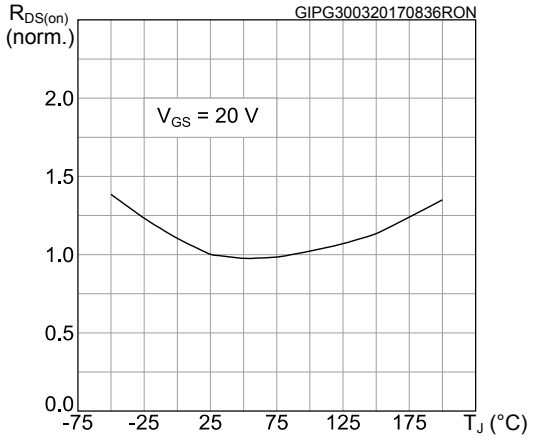


Figure 15. Reverse conduction characteristics (T_J = -50 °C)

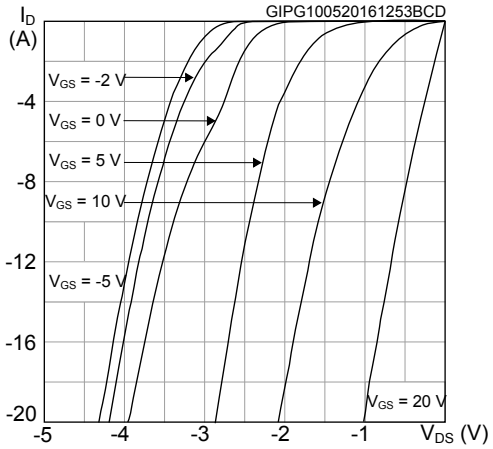


Figure 16. Reverse conduction characteristics (T_J = 25 °C)

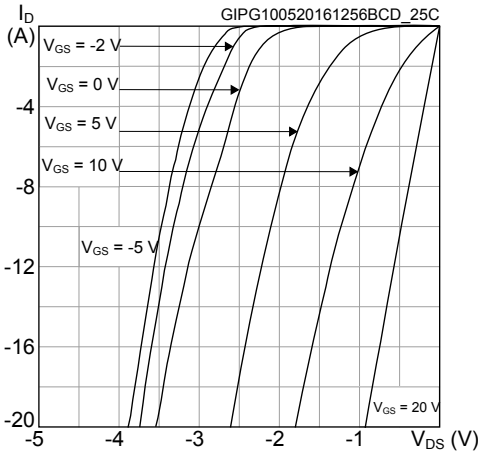
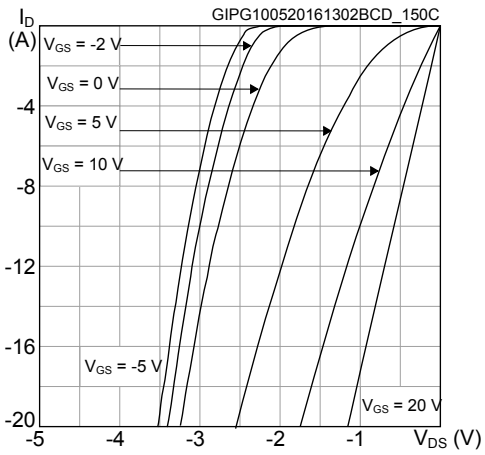


Figure 17. Reverse conduction characteristics (T_J = 150 °C)



3 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

3.1 HiP247-4 package information

Figure 18. HiP247-4 package outline

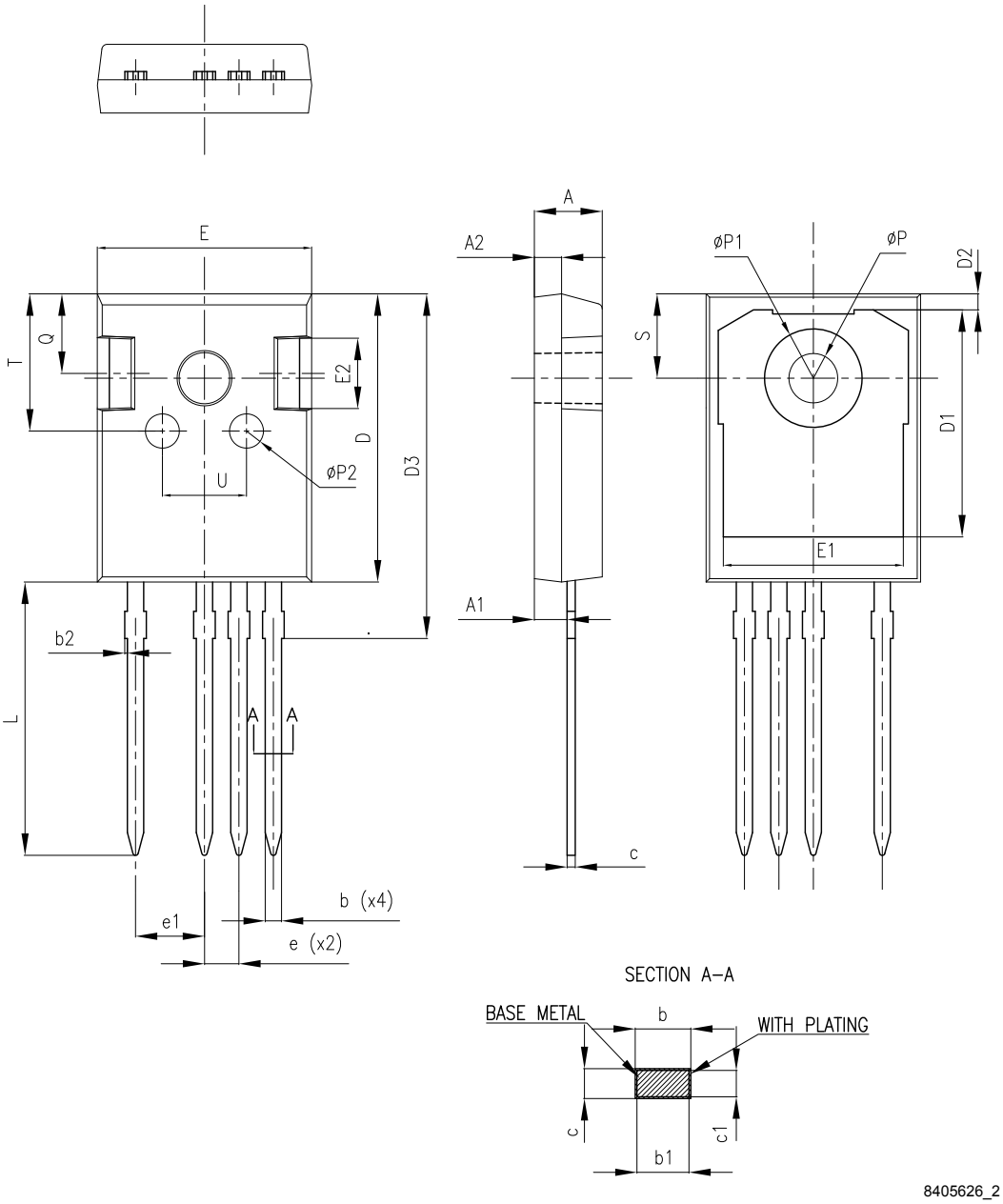


Table 7. **HiP247-4 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16		1.29
b1	1.15	1.20	1.25
b2	0		0.20
c	0.59		0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
D3	24.97	25.12	25.27
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
P	3.50	3.60	3.70
P1			7.40
P2	2.40	2.50	2.60
Q	5.60		6.00
S		6.15	
T	9.80		10.20
U	6.00		6.40

Revision history

Table 8. **Document revision history**

Date	Version	Changes
10-Dec-2020	1	First release.

Contents

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