

N-channel 40 V, 2.1 mΩ typ., 120 A STripFET™ F6 Power MOSFET in a TO-220 package

Datasheet - production data

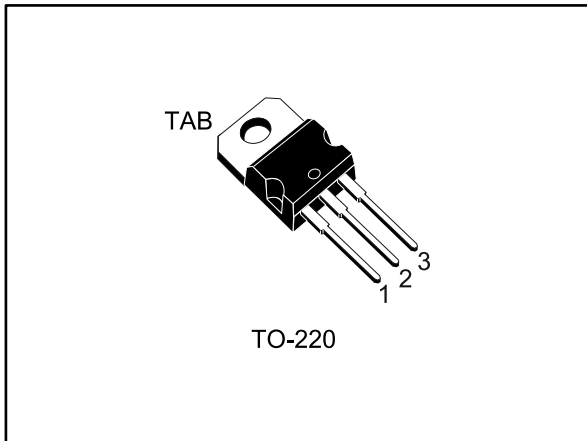
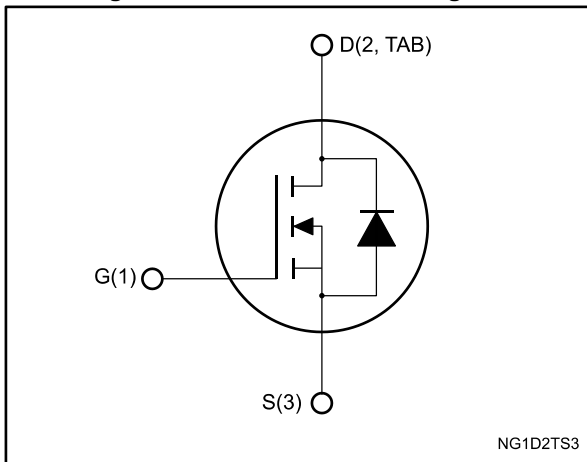


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STP180N4F6	40 V	2.7 mΩ	120 A	190 W

- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

Applications

- Switching applications
- Power tools

Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R_{DS(on)} in all packages.

Table 1: Device summary

Order code	Marking	Package	Packing
STP180N4F6	180N4F6	TO-220	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	40	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$	120	A
	Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$	120	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	480	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$	190	W
T_{stg}	Storage temperature range	-55 to 175	$^\circ\text{C}$
T_j	Operating junction temperature range		

Notes:

(1) Limited by package.

(2) Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.78	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-amb	62.5	

2 Electrical characteristics

($T_{\text{case}} = 25\text{ °C}$ unless otherwise specified)

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	40			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 40\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 40\text{ V}$, $T_{\text{case}} = 125\text{ °C}^{(1)}$			100	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 20\text{ V}$			± 100	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	3		4.5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 60\text{ A}$		2.1	2.7	m Ω

Notes:

⁽¹⁾Defined by design, not subject to production test.

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	7735	-	μF
C_{oss}	Output capacitance		-	745	-	
C_{rss}	Reverse transfer capacitance		-	560	-	
Q_{g}	Total gate charge	$V_{\text{DD}} = 20\text{ V}$, $I_{\text{D}} = 120\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Test circuit for gate charge behavior")	-	130	-	nC
Q_{gs}	Gate-source charge		-	36	-	
Q_{gd}	Gate-drain charge		-	42	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 20\text{ V}$, $I_{\text{D}} = 60\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	24	-	ns
t_{r}	Rise time		-	150	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	106	-	
t_{f}	Fall time		-	57	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		120	A
$I_{SDM}^{(2)}$	Source-drain current (pulsed)		-		480	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 120\text{ A}$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 120\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 32\text{ V}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	36		ns
Q_{rr}	Reverse recovery charge		-	40		nC
I_{RRM}	Reverse recovery current		-	2.3		A

Notes:

(1) Limited by package.

(2) Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

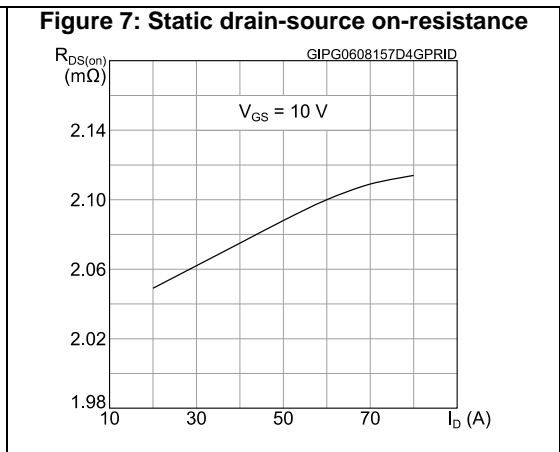
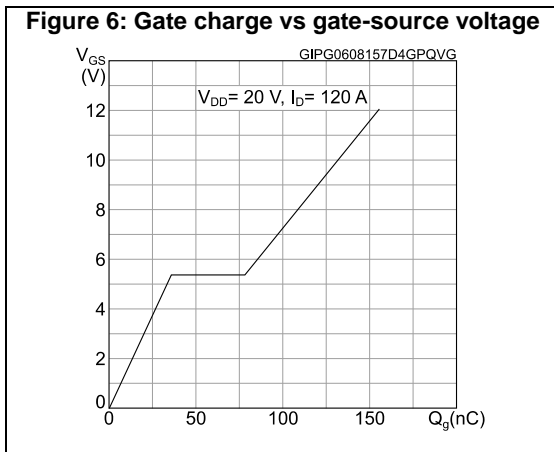
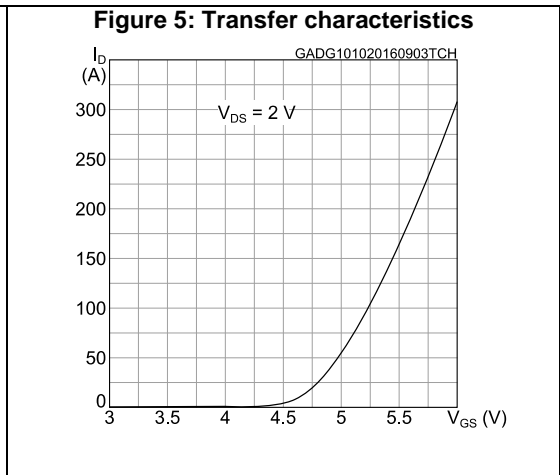
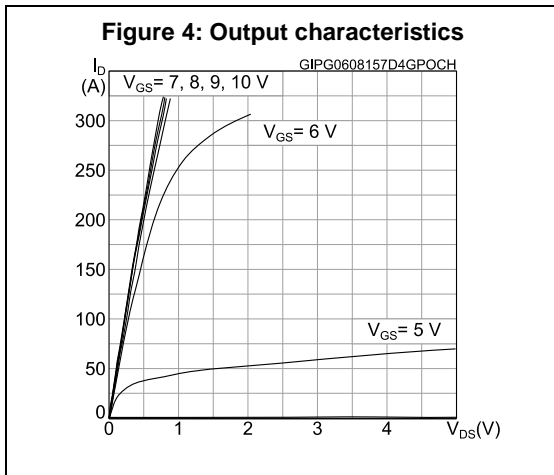
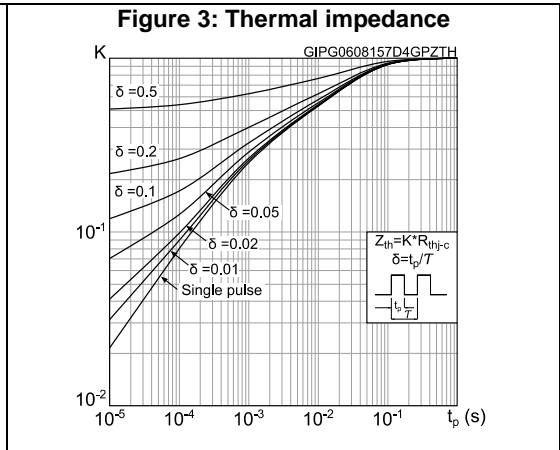
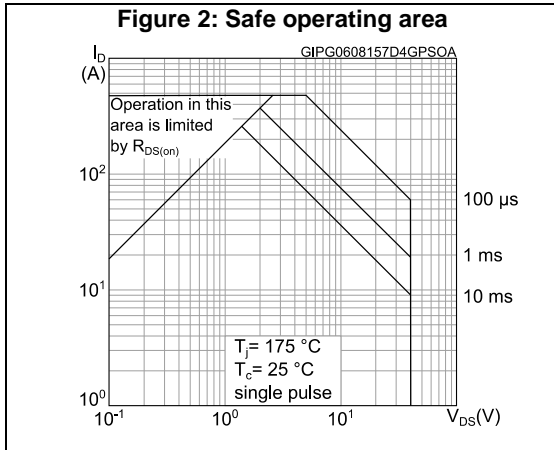


Figure 8: Capacitance variations

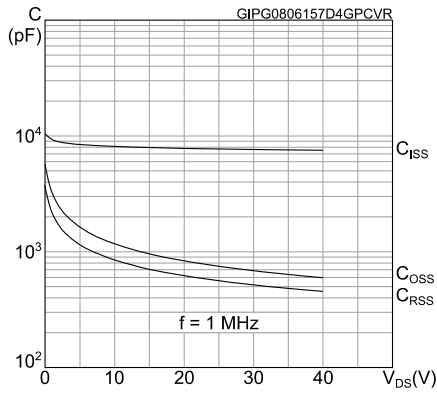


Figure 9: Normalized gate threshold voltage vs temperature

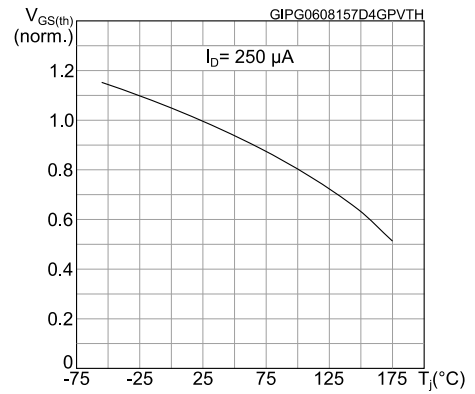


Figure 10: Normalized on-resistance vs temperature

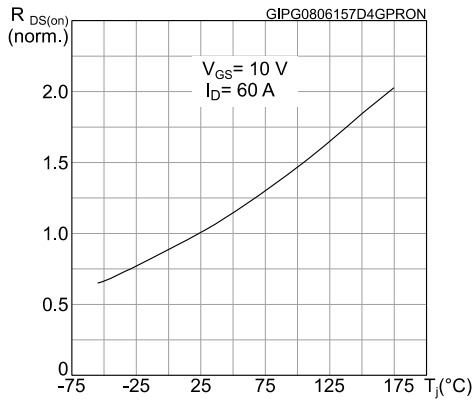


Figure 11: Normalized V_{(BR)DSS} vs temperature

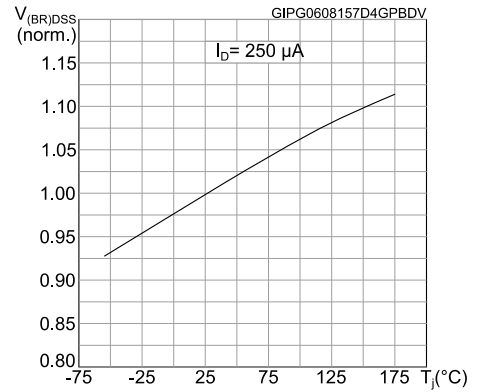
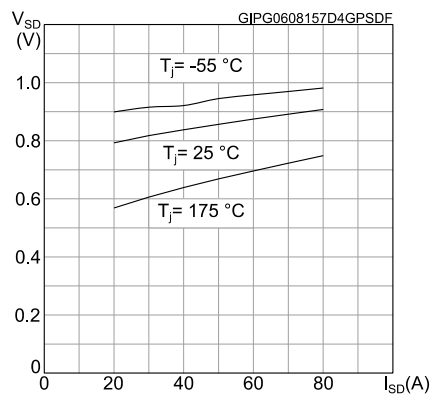
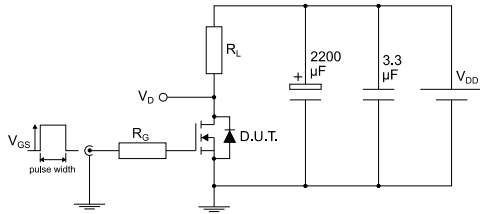


Figure 12: Source-drain diode forward characteristics



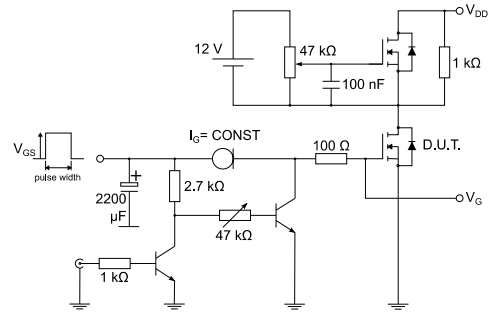
3 Test circuits

Figure 13: Test circuit for resistive load switching times



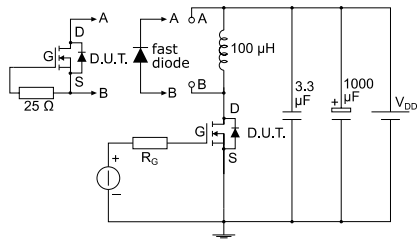
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Figure 14: Test circuit for gate charge behavior



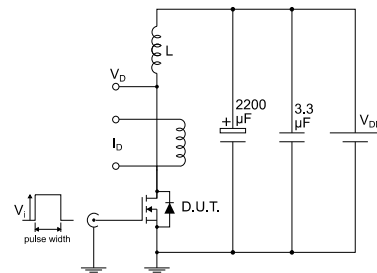
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Figure 15: Test circuit for inductive load switching and diode recovery times



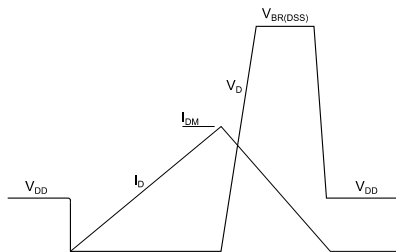
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Figure 16: Unclamped inductive load test circuit



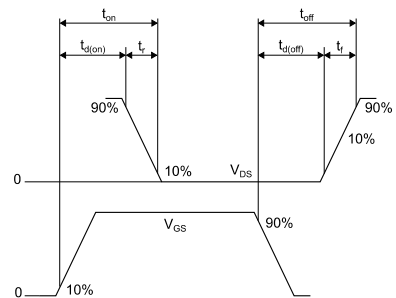
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Figure 17: Unclamped inductive waveform



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Figure 18: Switching time waveform



AM01473v1

4 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.

4.1 TO-220 type A package information

Figure 19: TO-220 type A package outline

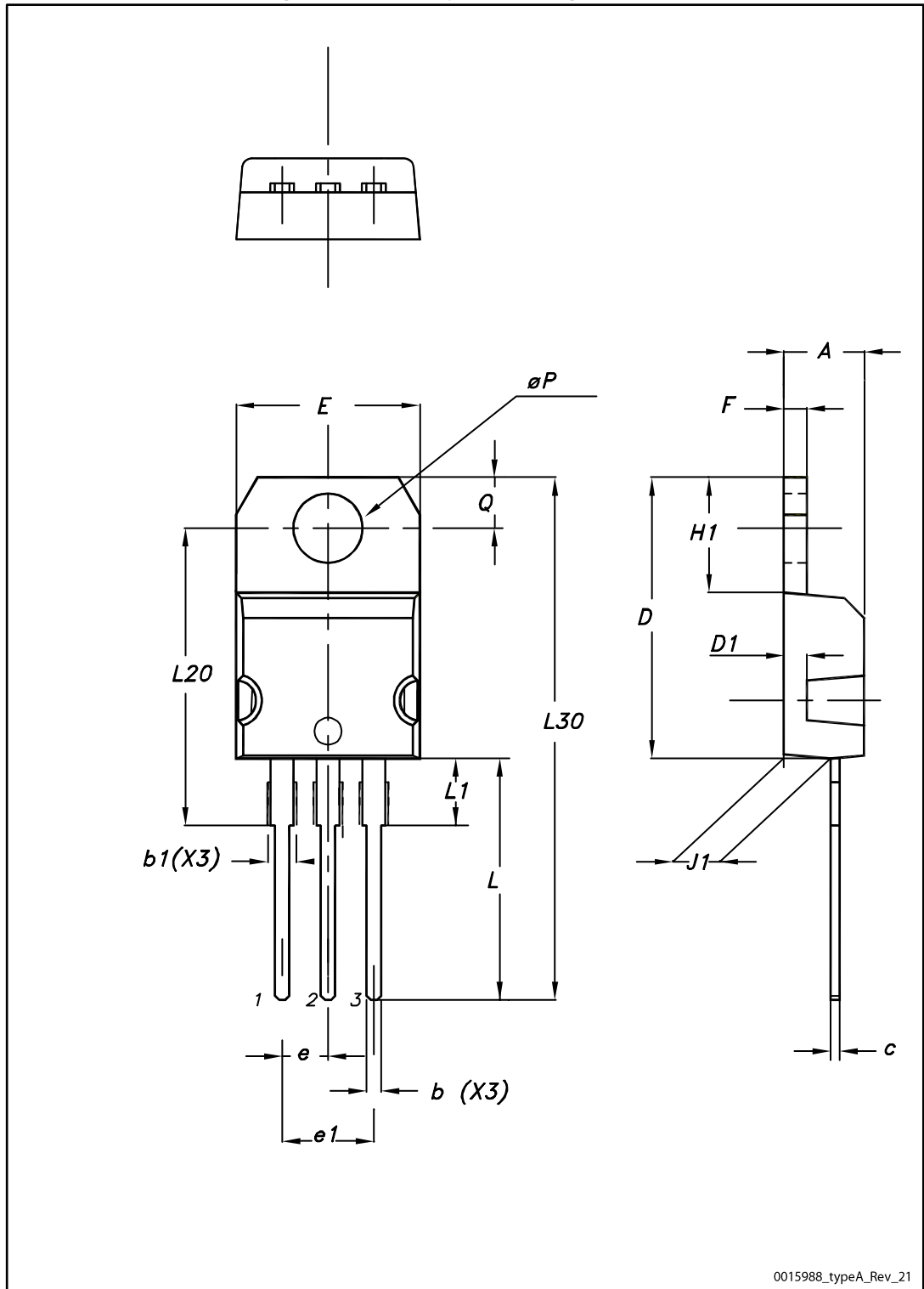


Table 8: TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
07-Aug-2015	1	First release.
11-Oct-2016	2	Datasheet promoted from preliminary to production data. Changed Figure 5: "Transfer characteristics" . Minor text changes.

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