

N-channel 60 V, 0.0057 Ω typ., 90 A STripFET™ F6 Power MOSFET in a TO-220 package

Datasheet - production data

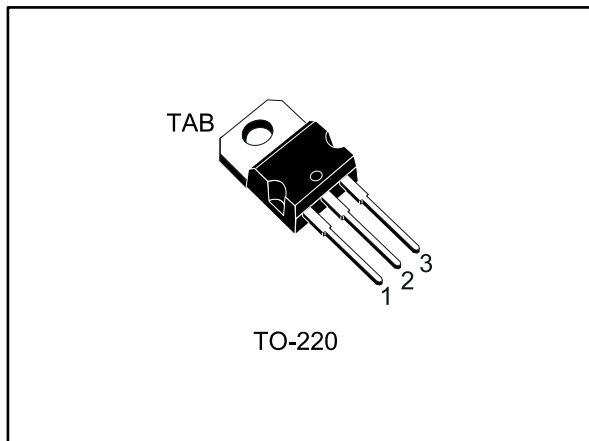
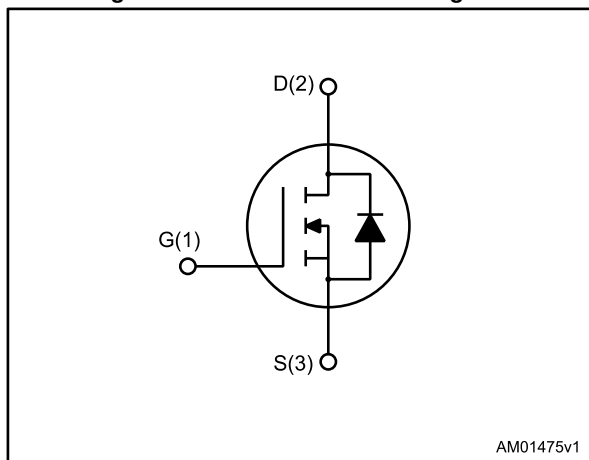


Figure 1: Internal schematic diagram



Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STP90N6F6	60 V	0.0063 Ω	90 A	136 W

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

Applications

- Switching applications

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.

Features

Table 1: Device summary

Order code	Marking	Package	Packaging
STP90N6F6	90N6F6	TO-220	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	90	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	70	A
$I_{DM}^{(1)}$	Drain current (pulsed)	360	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	136	W
T_{stg}	Storage temperature	- 55 to 175	$^{\circ}\text{C}$
T_j	Max. operating junction temperature	175	$^{\circ}\text{C}$

Notes:

⁽¹⁾ Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max.	1.1	$^{\circ}\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max.	62.5	$^{\circ}\text{C/W}$

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	45	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AV}$, $V_{DD} = 43\text{ V}$)	152	mJ

2 Electrical characteristics

($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified).

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	60			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$			10	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$, $T_j = 125\text{ }^{\circ}\text{C}$			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 45\text{ A}$		0.0057	0.0063	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ISS}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	4295	-	pF
C_{OSS}	Output capacitance		-	292	-	pF
C_{RSS}	Reverse transfer capacitance		-	190	-	pF
Q_g	Total gate charge	$V_{DD} = 30\text{ V}$, $I_D = 90\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Gate charge test circuit")	-	74.9	-	nC
Q_{gs}	Gate-source charge		-	19	-	nC
Q_{gd}	Gate-drain charge		-	18.3	-	nC
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	2.2	-	Ω

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}$, $I_D = 45\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13: "Switching times test circuit for resistive load" and Figure 18: "Switching time waveform")	-	22	-	ns
t_r	Rise time		-	42	-	ns
$t_{d(off)}$	Turn-off-delay time		-	73	-	ns
t_f	Fall time		-	16	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 90\text{ A}$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 90\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 48\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	49		ns
Q_{rr}	Reverse recovery charge		-	8.5		μC
I_{RRM}	Reverse recovery current		-	0.3		A

Notes:

⁽¹⁾ Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

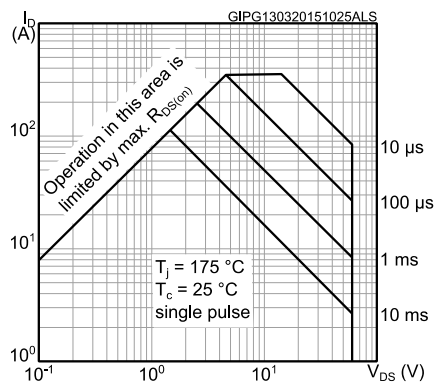


Figure 3: Thermal impedance

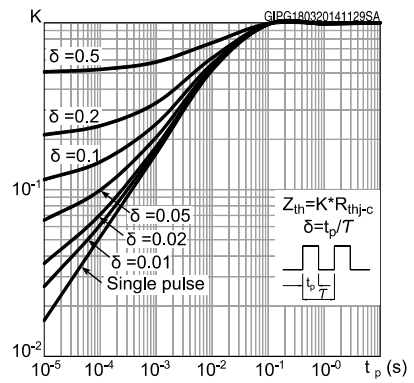


Figure 4: Output characteristics

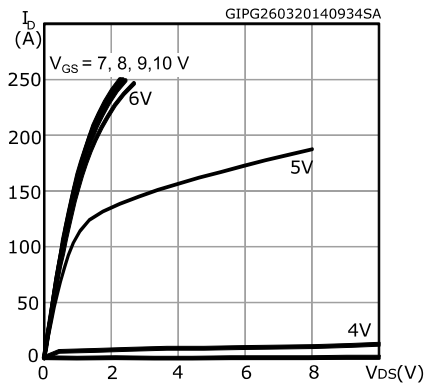


Figure 5: Transfer characteristics

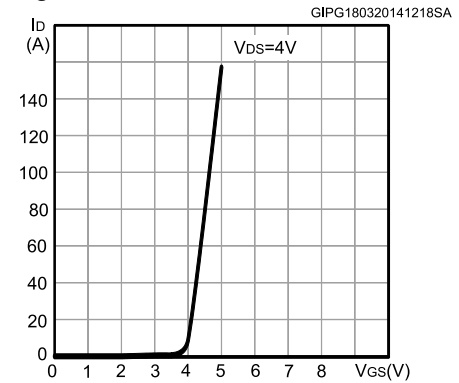


Figure 6: Normalized gate threshold voltage vs. temperature

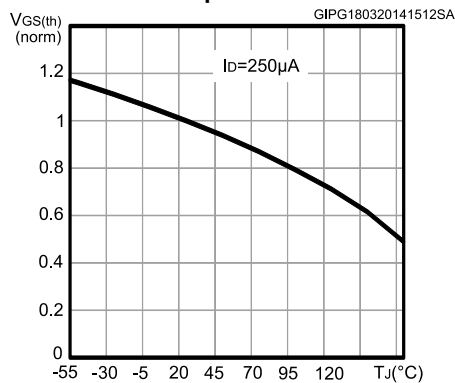


Figure 7: Normalized V(BR)DSS vs. temperature

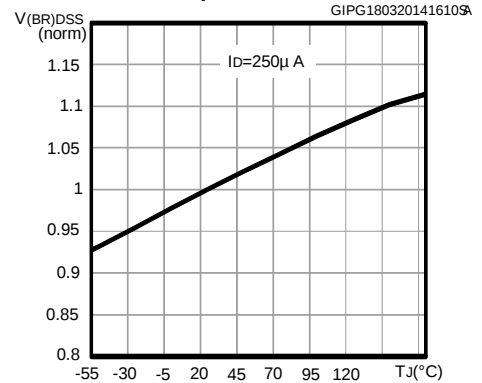


Figure 8: Static drain-source on-resistance

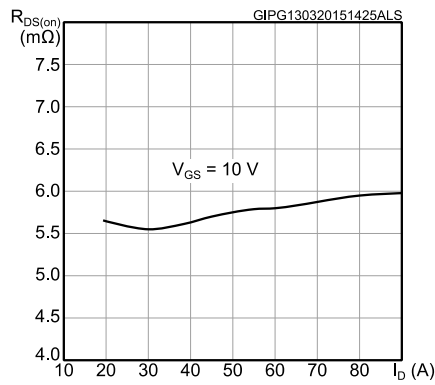


Figure 9: Normalized on-resistance vs. temperature

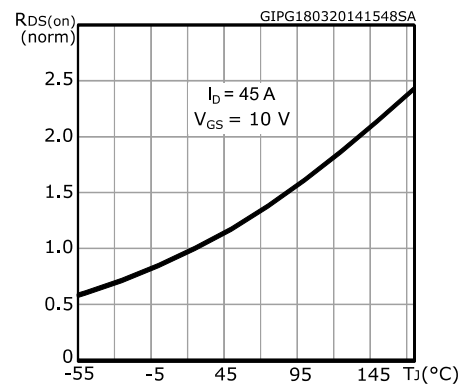


Figure 10: Gate charge vs. gate-source voltage

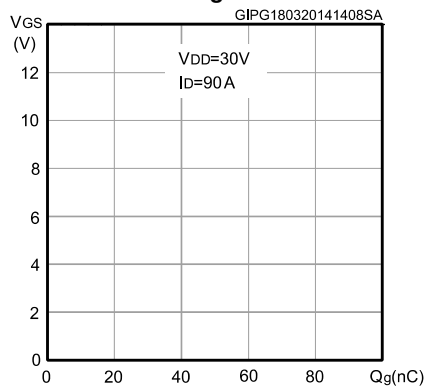


Figure 11: Capacitance variations

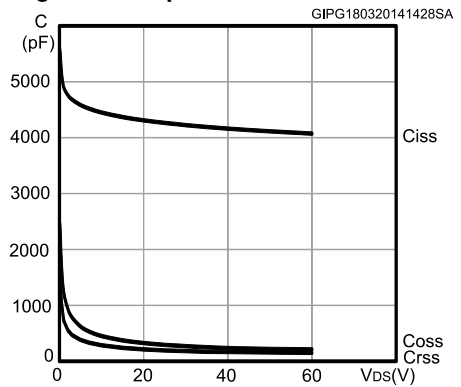
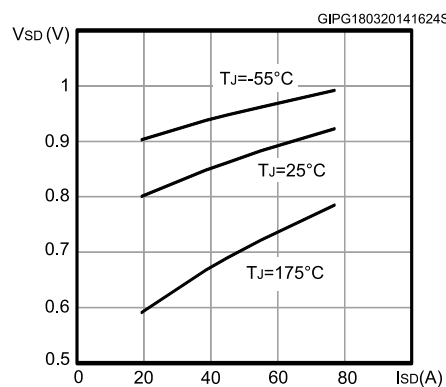


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Switching times test circuit for resistive load

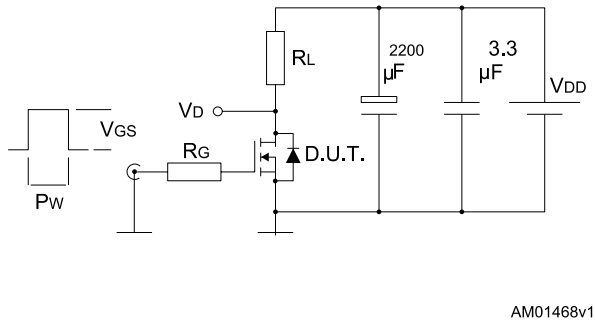


Figure 14: Gate charge test circuit

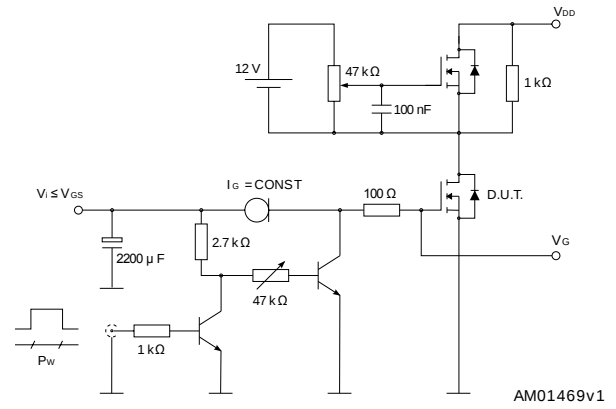


Figure 15: Test circuit for inductive load switching and diode recovery times

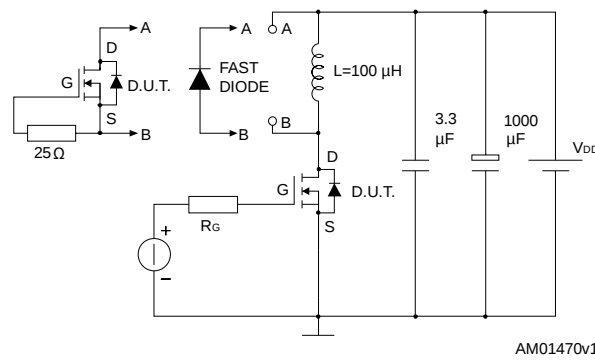


Figure 16: Unclamped inductive load test circuit

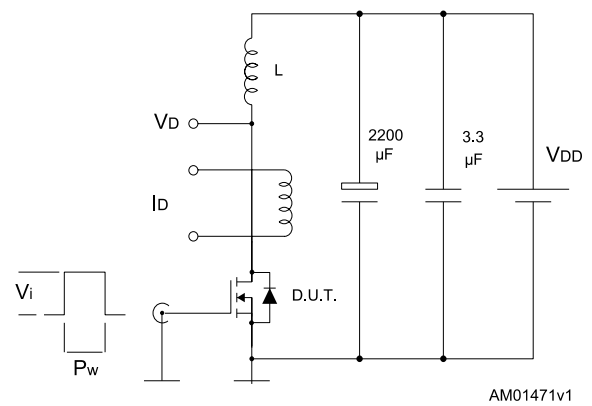


Figure 17: Unclamped inductive waveform

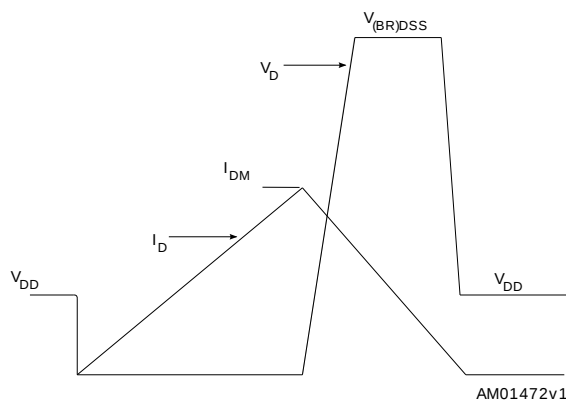
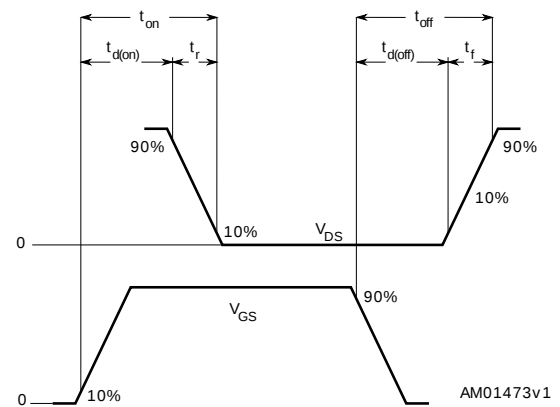


Figure 18: Switching time waveform



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

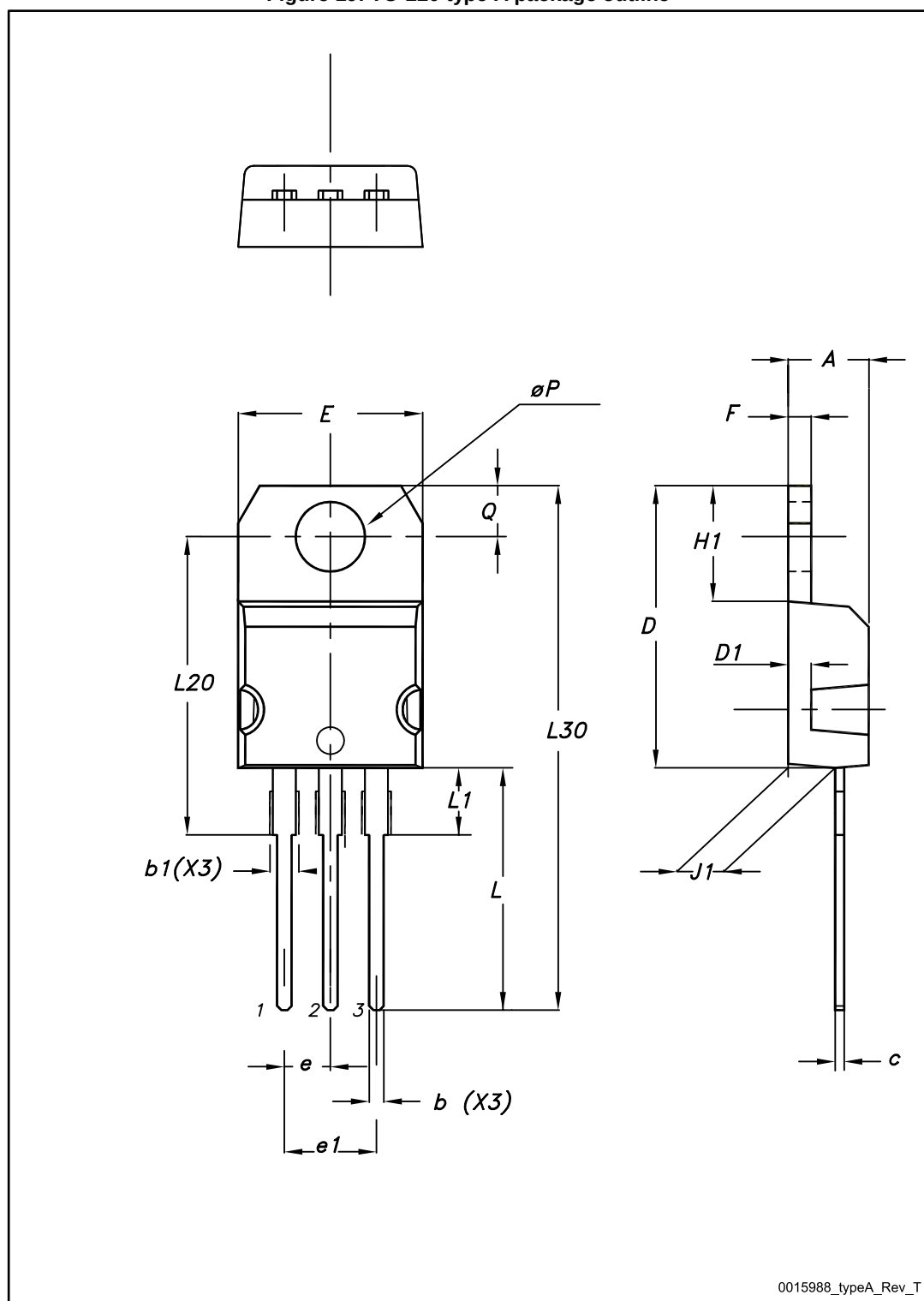


Table 9: TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
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 10: Document revision history

Date	Revision	Changes
03-Sep-2013	1	Initial release.
03-Apr-2014	2	Document status promoted from preliminary to production data. Updated new section curves. Minor text changes.
13-Mar-2015	3	Minor text edits throughout document On cover page: updated title description, features table and description In section 1 Electrical ratings: renamed and updated Table 5 "Static" (was On/off states), Table 6 "Dynamic", Table 7 "Switching times", Table 8 "Source-drain diode" In section 2 Electrical characteristics: updated Table 2 "Absolute maximum ratings" and Table 4 "Avalanche characteristics"; updated Section 2.1 Electrical characteristics (curves)

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