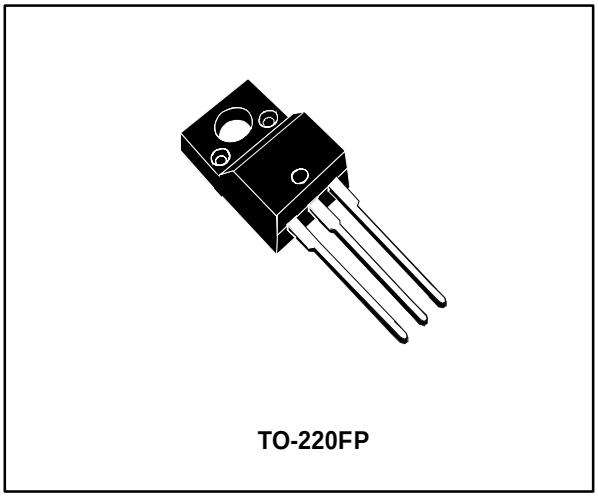
STF140N8F7

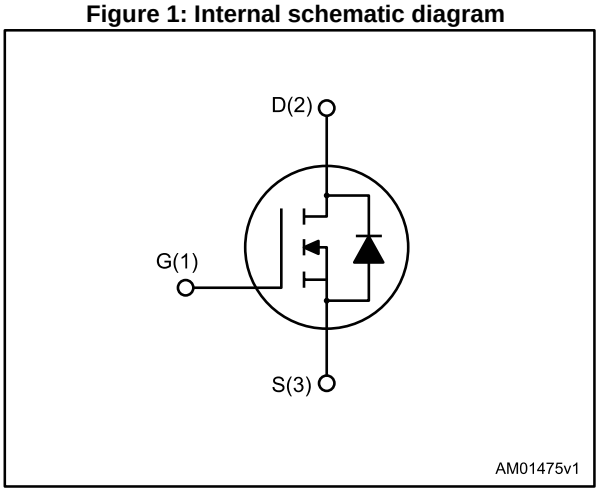
N-channel 80 V, 3.5 mΩ typ., 64 A STripFET™ F7 Power MOSFET in a TO-220FP package

Datasheet - production data



TO-220FP

Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STF140N8F7	80 V	4.3 mΩ	64 A	35 W

- Among the lowest $R_{DS(on)}$ on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1: Device summary

Order code	Marking	Package	Packaging
STF140N8F7	140N8F7	TO-220FP	Tube

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	80	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (continuous) at T_C = 25 °C	64 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	45(1)	A
I_{DM}(2)	Drain current (pulsed)	256	A
P_{TOT}	Total dissipation at T_C = 25 °C	35	W
E_{AS}(3)	Single pulse avalanche energy	515	mJ
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, T_C = 25 °C)	2.5	kV
T_j	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature		

Notes:

(1)Limited by package.

(2)Pulse width is limited by safe operating area.

(3)Starting Tj =25 °C, Id = 18.5 A, Vdd = 50 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	4.29	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/W

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 4: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0, I_D = 250 µA	80			V
I_{DSS}	Zero gate voltage Drain current	V_{GS} = 0, V_{DS} = 80 V			1	µA
		V_{GS} = 0, V_{DS} = 80 V, T_J=125 °C			10	µA
I_{GSS}	Gate-source leakage current	V_{DS} = 0, V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 32 A		3.5	4.3	mΩ

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0, V_{DS} = 40 V, f = 1 MHz	-	6340	-	pF
C_{oss}	Output capacitance		-	1195	-	pF
C_{rss}	Reverse transfer capacitance		-	105	-	pF
Q_g	Total gate charge	V_{DD} = 40 V, I_D = 64 A, V_{GS} = 10 V	-	96	-	nC
Q_{gs}	Gate-source charge		-	30	-	nC
Q_{gd}	Gate-drain charge		-	26	-	nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 40 V, I_D = 45 A R_G = 4.7 Ω, V_{GS} = 10 V	-	26	-	ns
t_r	Rise time		-	51	-	ns
$t_{d(off)}$	Turn-off-delay time		-	82	-	ns
t_f	Fall time		-	44	-	ns

Table 7: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		64	A
I_{SDM} (1)	Source-drain current (pulsed)		-		256	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0, I_{SD} = 64 A	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 64 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C	-	58		ns
Q_{rr}	Reverse recovery charge		-	92		nC
I_{RRM}	Reverse recovery current		-	3.2		A

Notes:

(1)Pulse width is limited by safe operating area

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

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

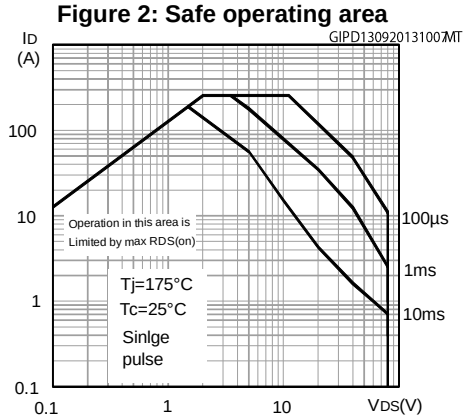


Figure 3: Thermal impedance

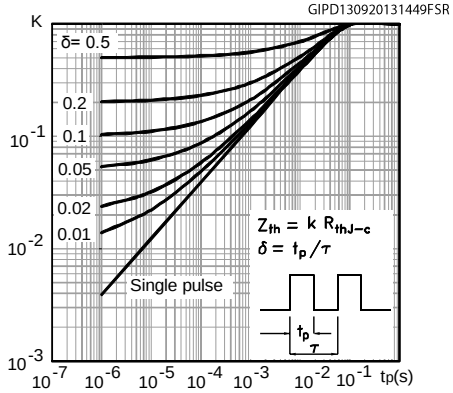


Figure 4: Output characteristics

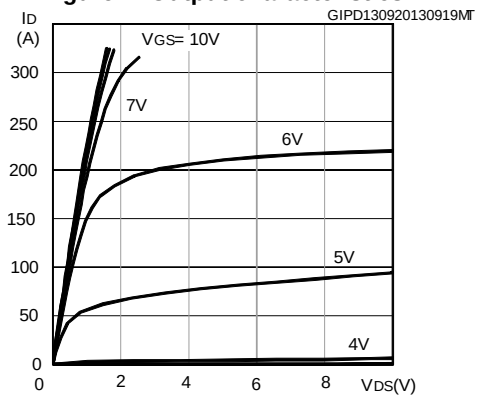


Figure 5: Transfer characteristics

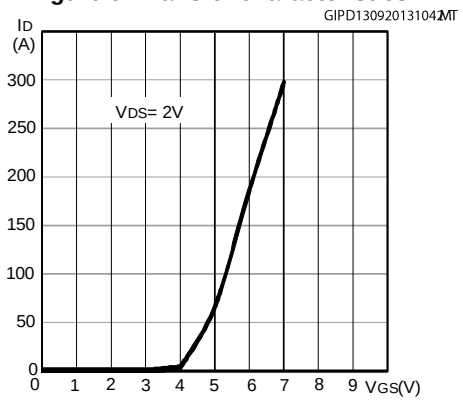


Figure 6: Normalized V(BR)DSS vs. temperature

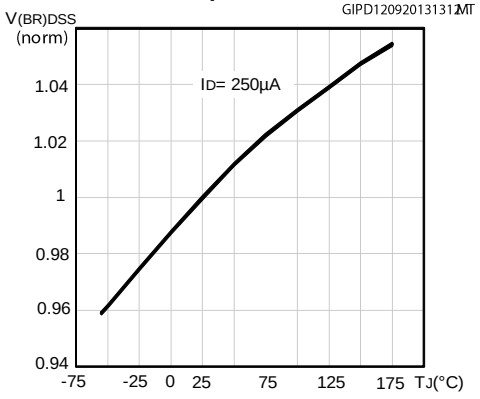


Figure 7: Static drain-source on resistance

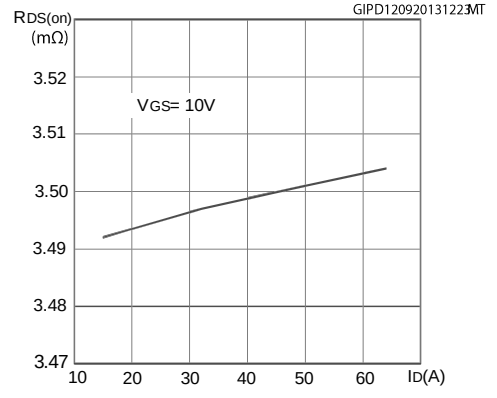


Figure 8: Gate charge vs. gate-source voltage

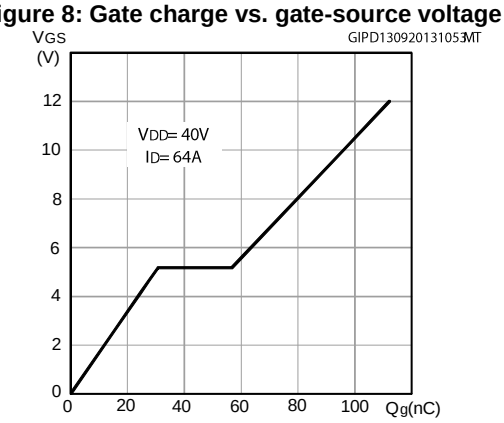


Figure 9: Capacitance variations

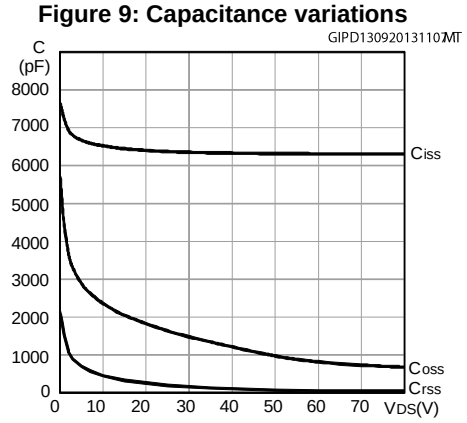


Figure 10: Normalized gate threshold voltage vs. temperature

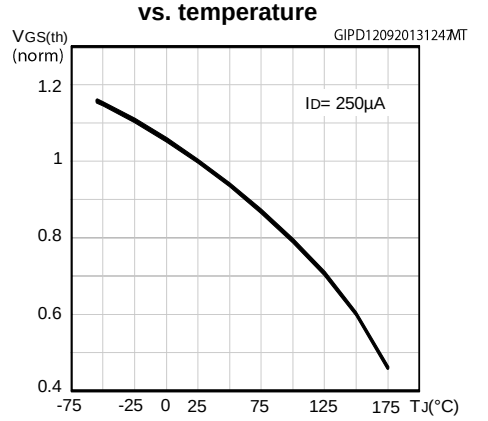


Figure 11: Normalized on resistance vs. temperature

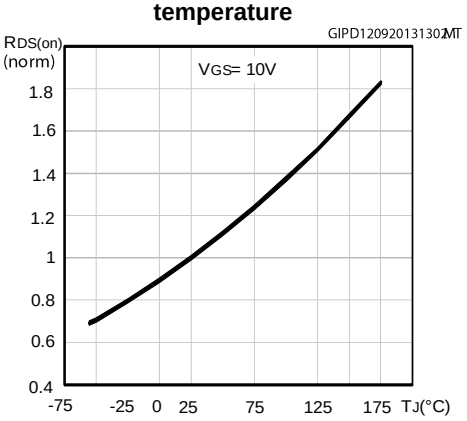
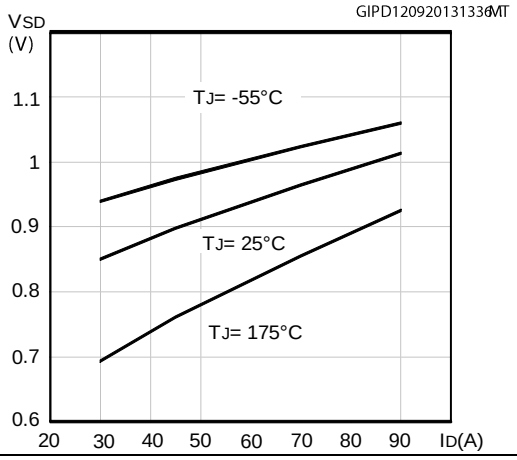


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Switching times test circuit for resistive load

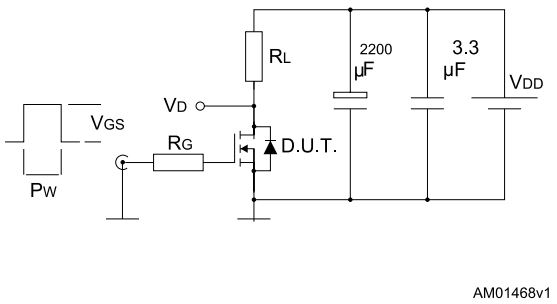


Figure 14: Gate charge test circuit

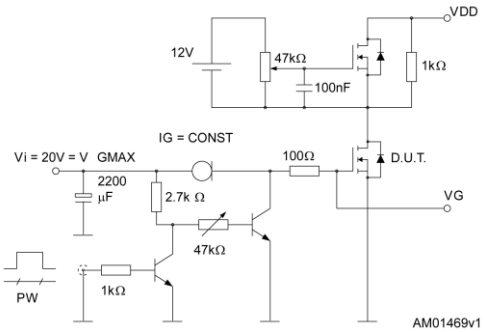


Figure 15: Test circuit for inductive load switching and diode recovery times

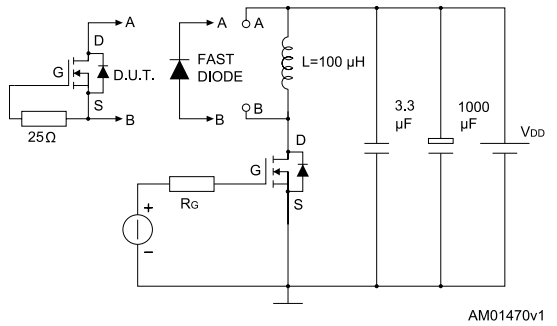


Figure 16: Unclamped inductive load test circuit

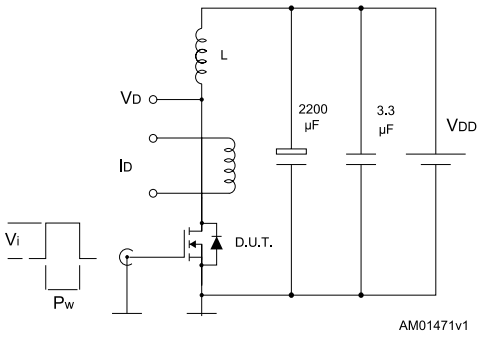


Figure 17: Unclamped inductive waveform

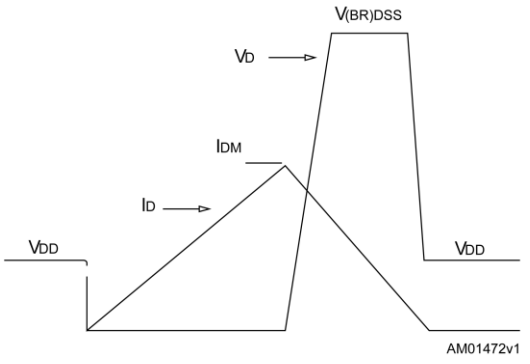
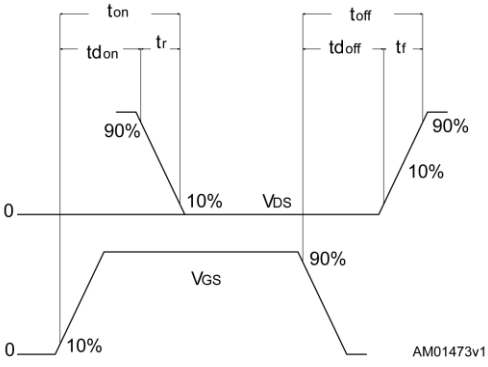


Figure 18: Switching time waveform



4 Package mechanical data

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-220FP package information

Figure 19: TO-220FP package outline

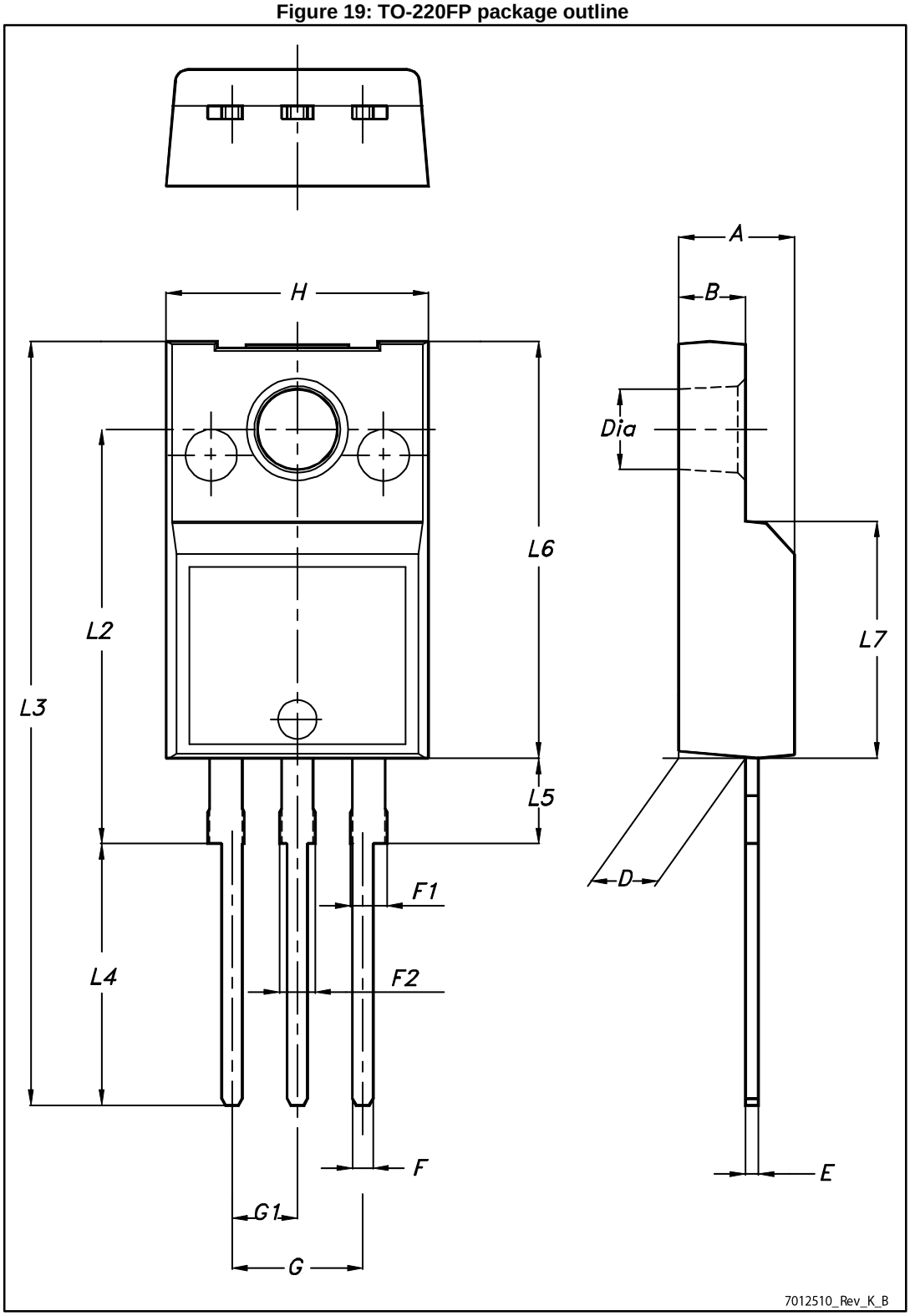


Table 8: TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
18-Sep-2013	1	First release.
22-Aug-2014	2	• The part numbers STH140N8F7-2 and STP140N8F7 have been moved to a separate datasheet. • Modified: not found • Minor text changes
10-Oct-2014	3	• Updated *Figure 3: "Thermal impedance"*

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