

N-channel 1700 V, 7 Ω typ., 2.6 A PowerMESH™ Power MOSFET in a TO-3PF package

Datasheet - production data

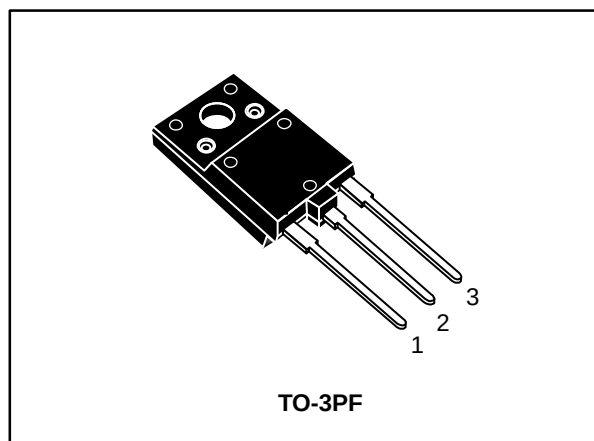
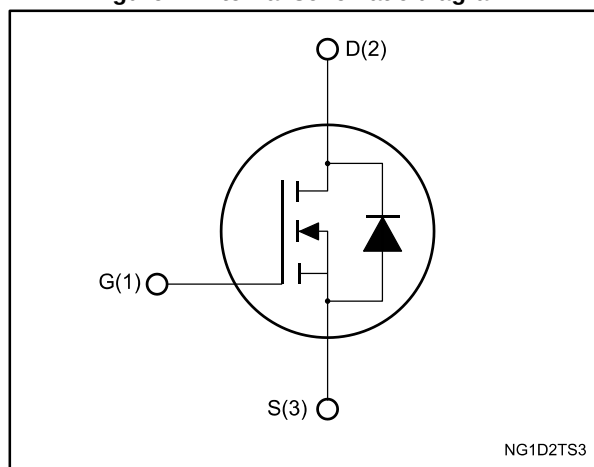


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STFW3N170	1700 V	13 Ω	2.6 A	63 W

- Intrinsic capacitances and Q₉ minimized
- TO-3PF for higher creepage between leads
- High speed switching
- 100% avalanche tested

Applications

- Switching applications

Description

This Power MOSFET is designed using the STMicroelectronics consolidated strip-layout-based MESH OVERLAY™ process. The result is a product that matches or improves on the performance of comparable standard parts from other manufacturers.

Table 1: Device summary

Order code	Marking	Package	Packing
STFW3N170	3N170	TO-3PF	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	1700	V
V_{GS}	Gate-source voltage	± 30	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ }^{\circ}\text{C}$	2.6	A
	Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$	1.6	
I_{DM}	Drain current (pulsed)	10.4	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$	63	W
I_{AR}	Avalanche current, repetitive or not repetitive	0.8	A
$E_{AS}^{(2)}$	Single pulse avalanche energy	2	mJ
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ }^{\circ}\text{C}$)	3.5	kV
T_{stg}	Storage temperature	-55 to 150	$^{\circ}\text{C}$
T_j	Operating junction temperature		

Notes:

⁽¹⁾ Limited by maximum junction temperature.

⁽²⁾ starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2	$^{\circ}\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	50	

2 Electrical characteristics

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

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$	1700			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 1700\text{ V}$			10	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 1700\text{ V}$, $T_{\text{case}} = 125\text{ }^{\circ}\text{C}$			500	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 30\text{ V}$			± 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	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 1.3\text{ A}$		7	13	Ω

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	1100	-	pF
C_{oss}	Output capacitance		-	50	-	
C_{rss}	Reverse transfer capacitance		-	7	-	
R_{G}	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_{\text{D}} = 0\text{ A}$	-	3.6	-	Ω
Q_{g}	Total gate charge	$V_{\text{DD}} = 1360\text{ V}$, $I_{\text{D}} = 2.6\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 15: "Gate charge test circuit")	-	44	-	nC
Q_{gs}	Gate-source charge		-	7	-	
Q_{gd}	Gate-drain charge		-	25	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 850\text{ V}$, $I_{\text{D}} = 1.3\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Switching times test circuit for resistive load" and Figure 19: "Switching time waveform")	-	25	-	ns
t_{r}	Rise time		-	9	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	51	-	
t_{f}	Fall time		-	53	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current	$T_J = 25\text{ }^{\circ}\text{C}$	-		2.6	A
I_{SDM}	Source-drain current (pulsed)		-		10.4	
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 2.6\text{ A}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 2.6\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	1.58		μs
Q_{rr}	Reverse recovery charge		-	6		μC
I_{RRM}	Reverse recovery current		-	7.9		A
t_{rr}	Reverse recovery time	$I_{SD} = 2.6\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	2.12		μs
Q_{rr}	Reverse recovery charge		-	8.8		μC
I_{RRM}	Reverse recovery current		-	8.3		A

Notes:

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

2.1 Electrical characteristics (curves)

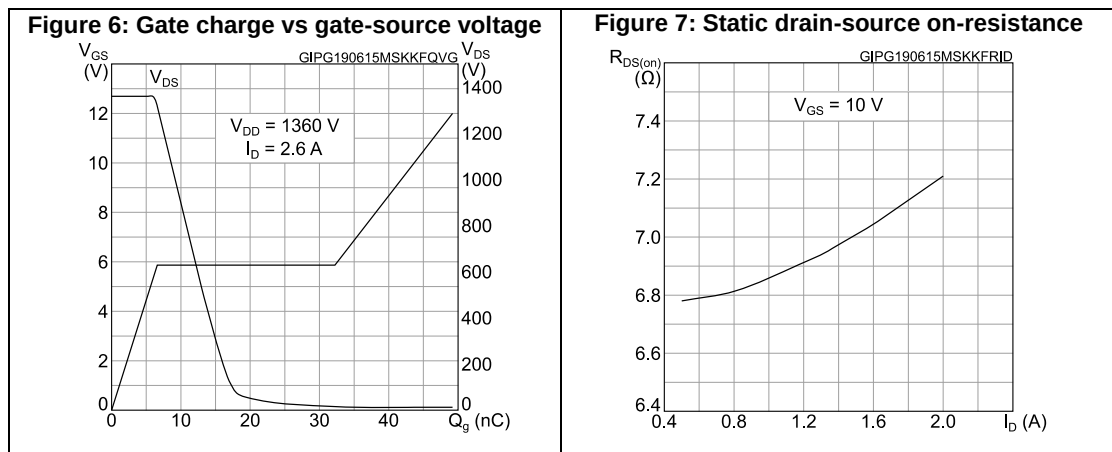
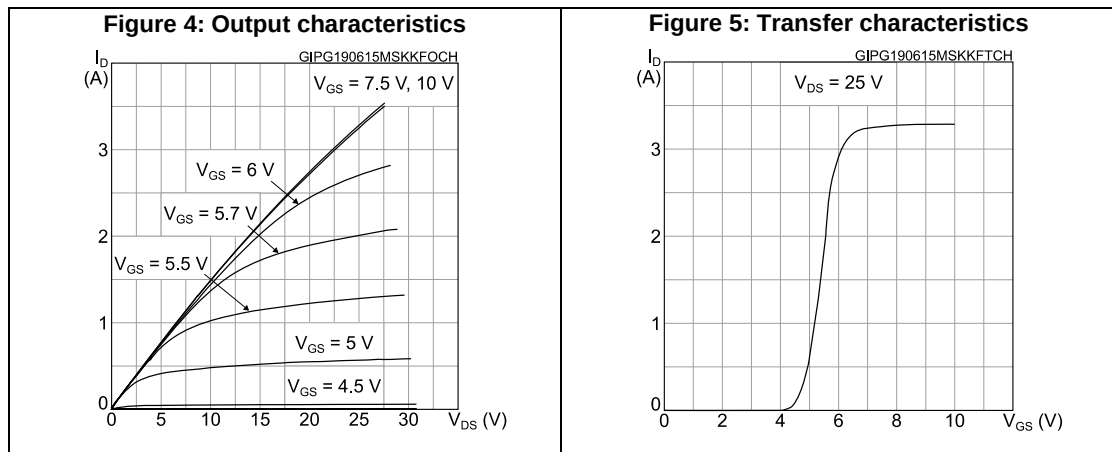
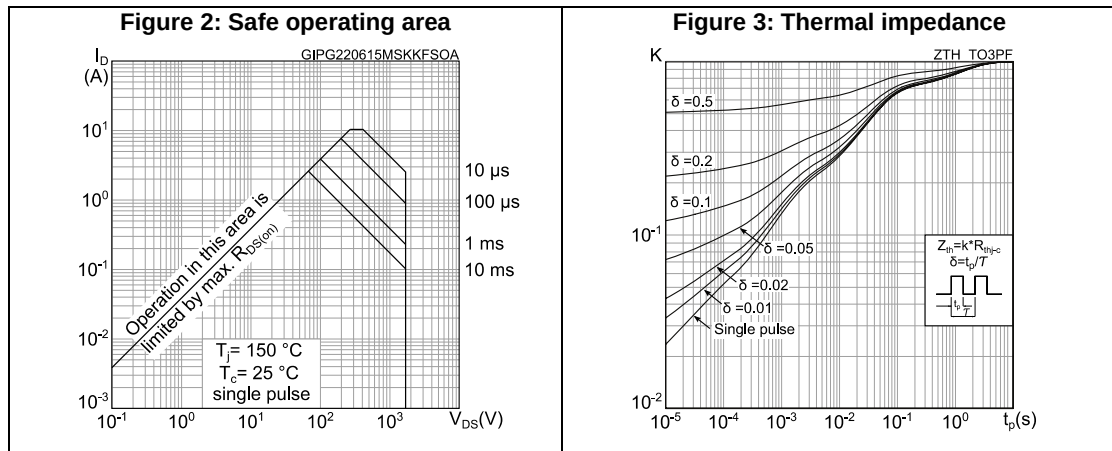


Figure 8: Capacitance variations

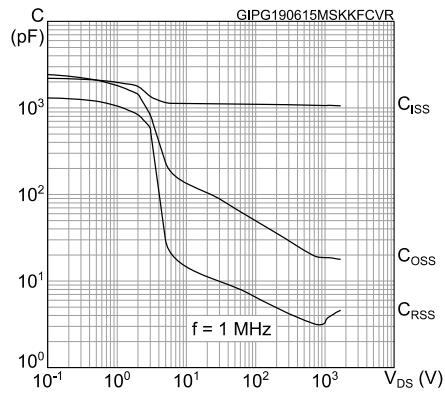


Figure 9: Normalized gate threshold voltage vs temperature

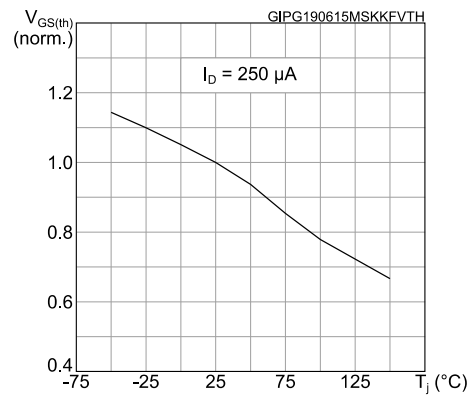


Figure 10: Normalized on-resistance vs temperature

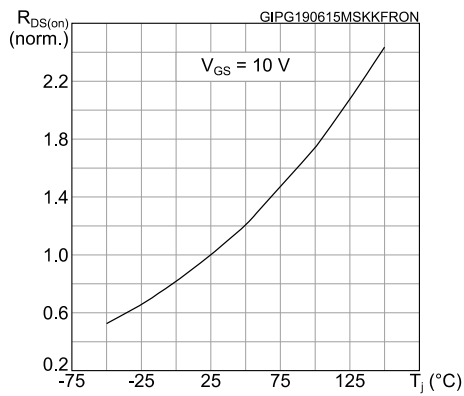


Figure 11: Normalized V(BR)DSS vs temperature

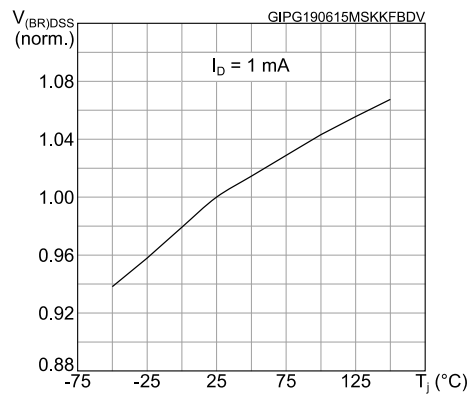


Figure 12: Output capacitance stored energy

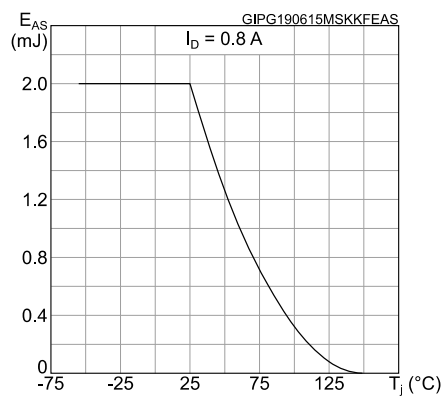
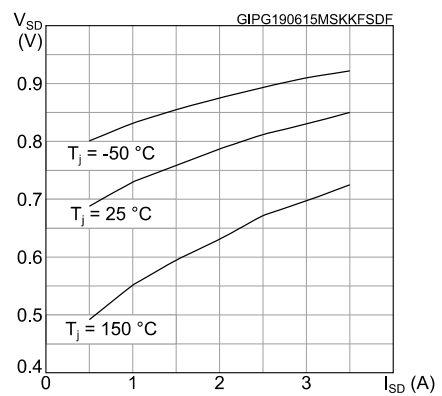
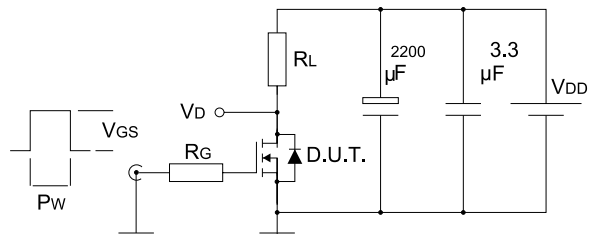


Figure 13: Source- drain diode forward characteristics



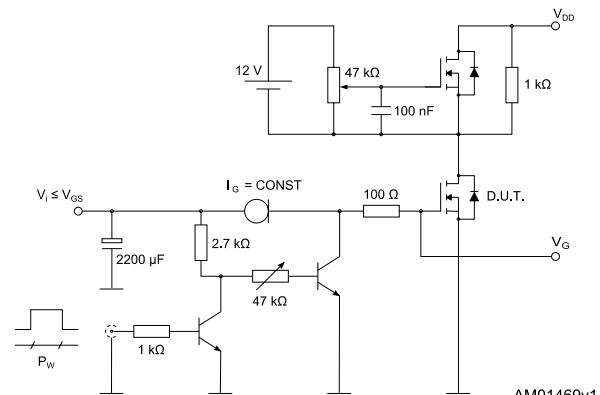
3 Test circuits

Figure 14: Switching times test circuit for resistive load



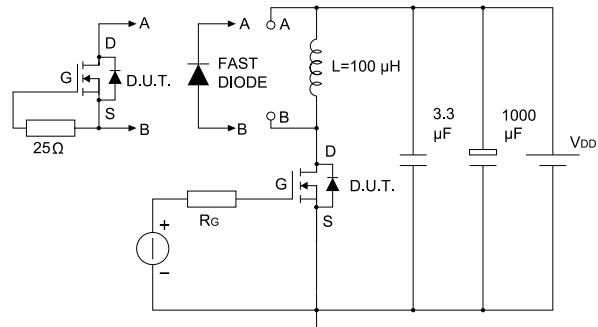
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Figure 15: Gate charge test circuit



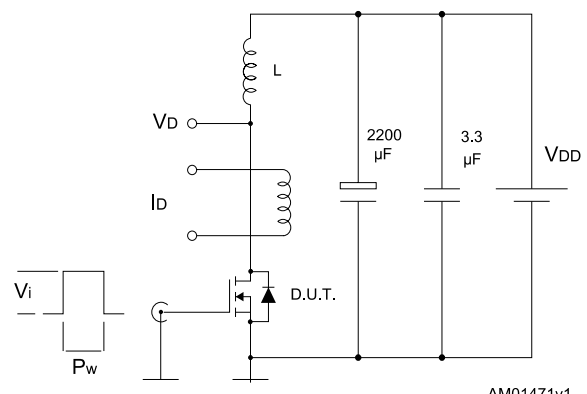
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Figure 16: Test circuit for inductive load switching and diode recovery times



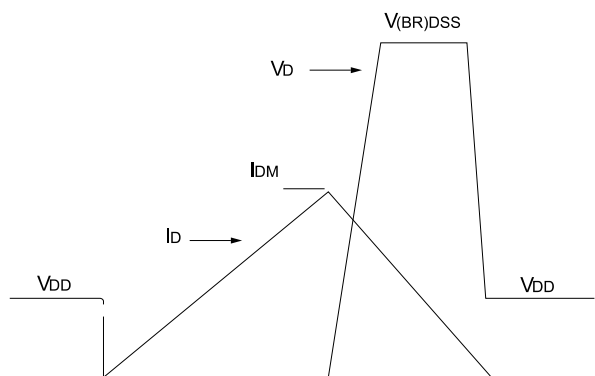
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Figure 17: Unclamped inductive load test circuit



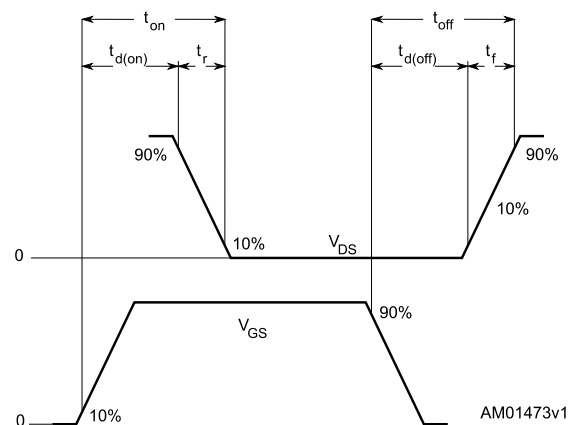
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Figure 18: Unclamped inductive waveform



AM01472v1

Figure 19: 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-3PF package information

Figure 20: TO-3PF package outline

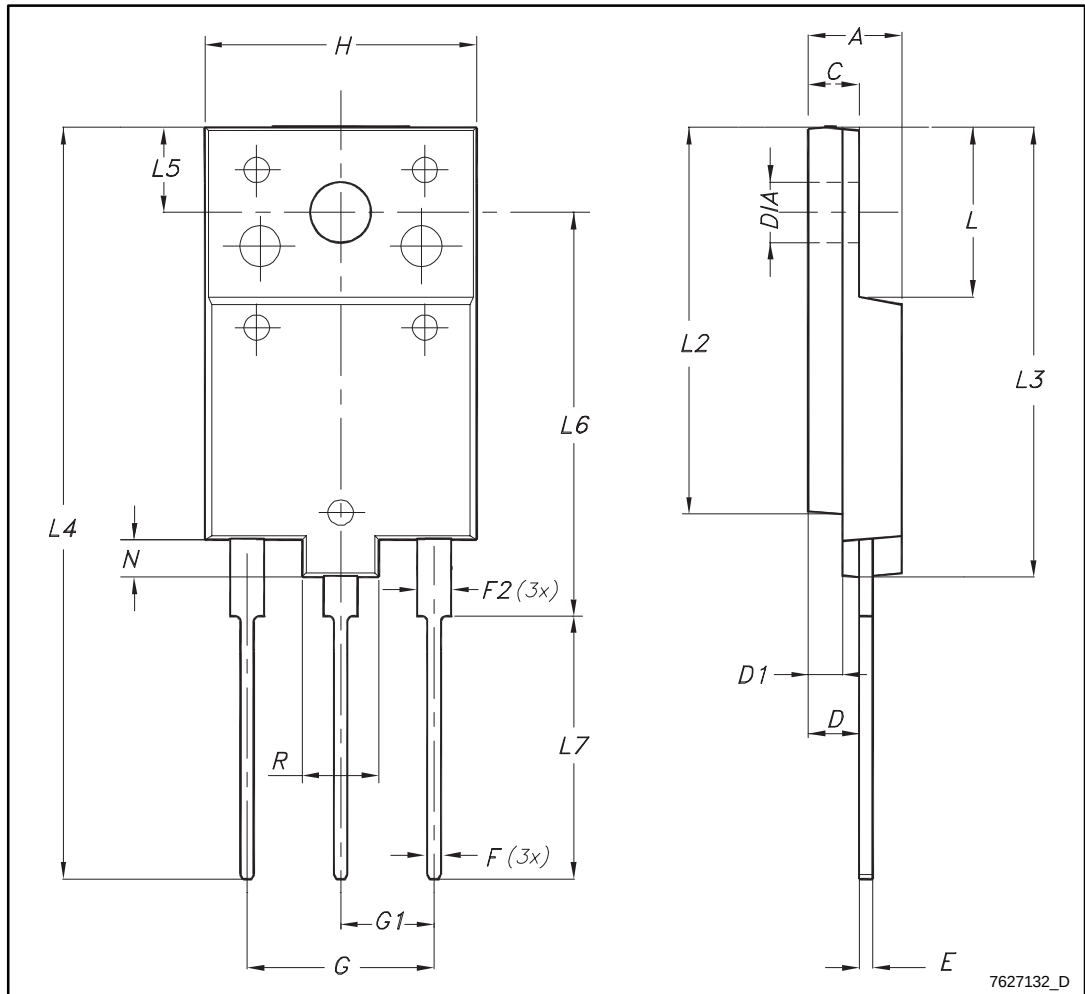


Table 8: TO-3PF mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
17-Jan-2013	1	First release.
22-Jun-2015	2	Text and formatting changes throughout document. Part number STW3N170 has been moved to a separate document. In section Electrical ratings: - updated Table Absolute maximum ratings In section Electrical characteristics: - renamed Table Static (was On/off states) - updated Table Dynamic - updated Table Switching times - updated Table Source-drain diode Added section Electrical characteristics (curves) In section Package information: - updated section name (was Package mechanical data) - updated TO-3PF package information
16-Sep-2015	3	In section <i>Electrical ratings</i> : - updated table <i>Absolute maximum ratings</i> In section <i>Electrical characteristics</i> : - updated table <i>Dynamic</i> In section <i>Electrical characteristics (curves)</i> : - updated figures <i>Thermal impedance</i> and <i>Output capacitance stored energy</i>

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9