STF35N65DM2

N-channel 650 V, 0.093 Ω typ., 32 A MDmesh™ DM2 Power MOSFET in a TO-220FP package

Datasheet - production data

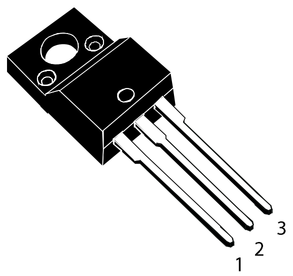
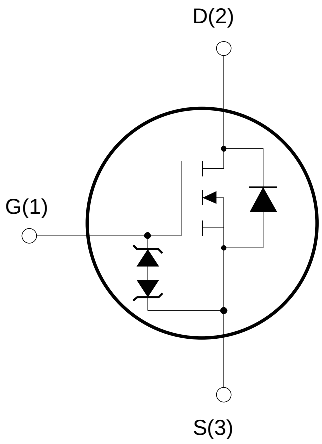


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STF35N65DM2	650 V	0.110 Ω	32 A	40 W

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

Applications

- Switching applications

Description

This high voltage N-channel Power MOSFET is part of the MDmesh™ DM2 fast recovery diode series. It offers very low recovery charge (Q_{rr}) and time (t_{rr}) combined with low $R_{DS(on)}$, rendering it suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Table 1: Device summary

Order code	Marking	Package	Packing
STF35N65DM2	35N65DM2	TO-220FP	Tube

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	±25	V
I_D	Drain current (continuous) at T_{case} = 25 °C	32	A
	Drain current (continuous) at T_{case} = 100 °C	20	
I_{DM}(1)	Drain current (pulsed)	90	A
P_{TOT}	Total dissipation at T_{case} = 25 °C	40	W
dv/dt(2)	Peak diode recovery voltage slope	50	V/ns
dv/dt(3)	MOSFET dv/dt ruggedness	50	
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_{stg}	Storage temperature range	-55 to 150	°C
T_j	Operating junction temperature range		

Notes:

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

(2)I_{SD} ≤ 32 A, di/dt=900 A/µs, V_{DS} peak < $V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$

(3)V_{DS} ≤ 520 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	3.1	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive	4	A
E_{AS}(1)	Single pulse avalanche energy	1150	mJ

Notes:

(1)Starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V.

2 Electrical characteristics

(T_{case} = 25 °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 V, I_D = 1 mA	650			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 650 V			1	µA
		V_{GS} = 0 V, V_{DS} = 650 V, T_{case} = 125 °C(1)			100	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±5	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 16 A		0.093	0.110	Ω

Notes:

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

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	2540	-	pF
C_{oss}	Output capacitance		-	115	-	
C_{rss}	Reverse transfer capacitance		-	2.5	-	
$C_{oss\ eq.}$(1)	Equivalent output capacitance	V_{DS} = 0 to 520 V, V_{GS} = 0 V	-	204	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	4.2	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 32 A, V_{GS} = 0 to 10 V (see *Figure 15: "Test circuit for gate charge behavior"*)	-	56.3	-	nC
Q_{gs}	Gate-source charge		-	12.7	-	
Q_{gd}	Gate-drain charge		-	27.6	-	

Notes:

(1)$C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}.

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 325 V, I_D = 16 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 14: "Test circuit for resistive load switching times"* and *Figure 19: "Switching time waveform"*)	-	23.4	-	ns
t_r	Rise time		-	23	-	
$t_{d(off)}$	Turn-off delay time		-	72	-	
t_f	Fall time		-	10.4	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		32	A
I_{SDM}[(1)]	Source-drain current (pulsed)		-		90	A
V_{SD}[(2)]	Forward on voltage	V_{GS} = 0 V, I_{SD} = 32 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 32 A, di/dt = 100 A/µs, V_{DD} = 60 V (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	100		ns
Q_{rr}	Reverse recovery charge		-	0.42		µC
I_{RRM}	Reverse recovery current		-	8.4		A
t_{rr}	Reverse recovery time	I_{SD} = 32 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	205		ns
Q_{rr}	Reverse recovery charge		-	1.8		µC
I_{RRM}	Reverse recovery current		-	17.6		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

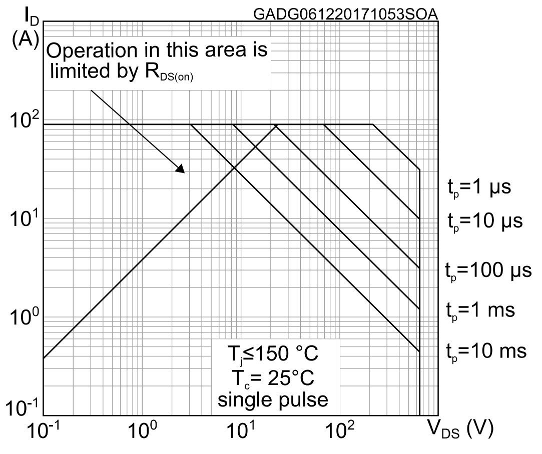


Figure 3: Thermal impedance

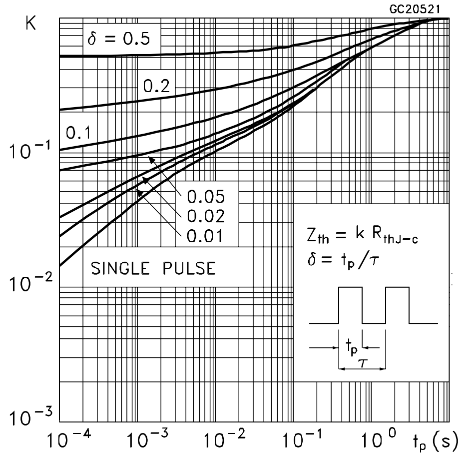


Figure 4: Output characteristics

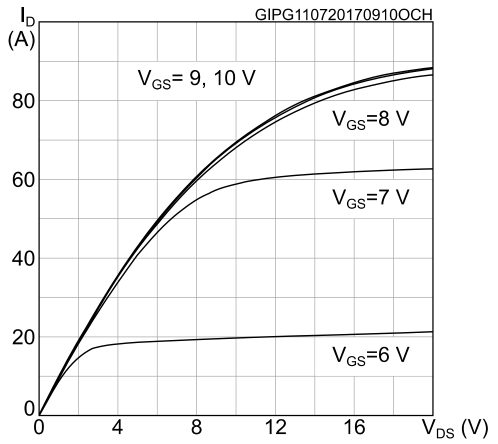


Figure 5: Transfer characteristics

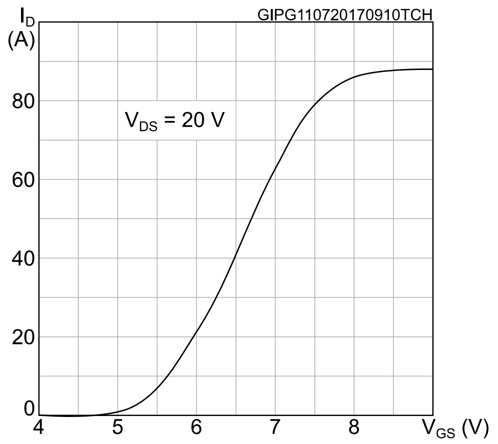


Figure 6: Gate charge vs gate-source voltage

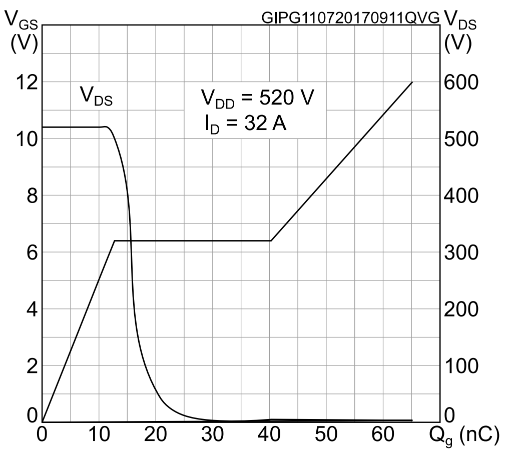


Figure 7: Static drain-source on-resistance

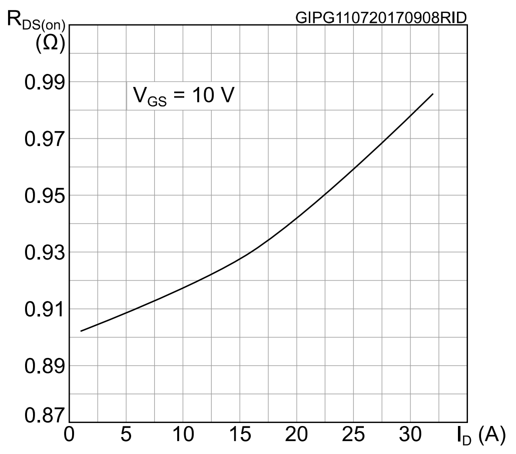


Figure 8: Capacitance variations

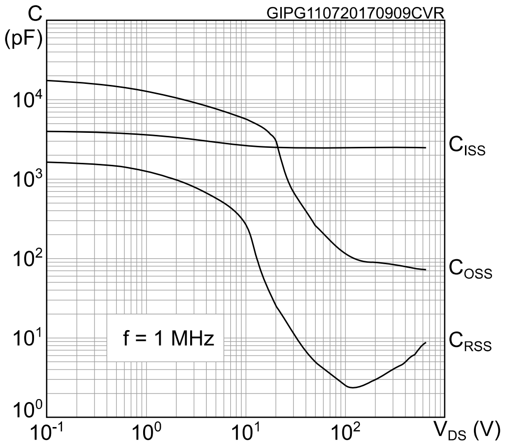


Figure 9: Normalized gate threshold voltage vs temperature

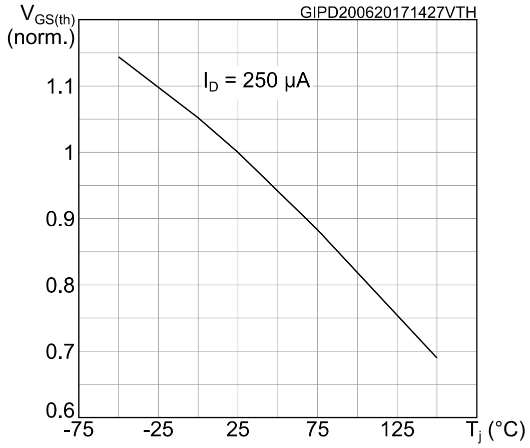


Figure 10: Normalized on-resistance vs temperature

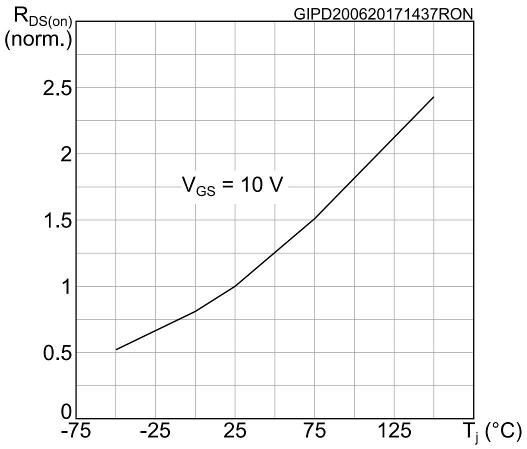


Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

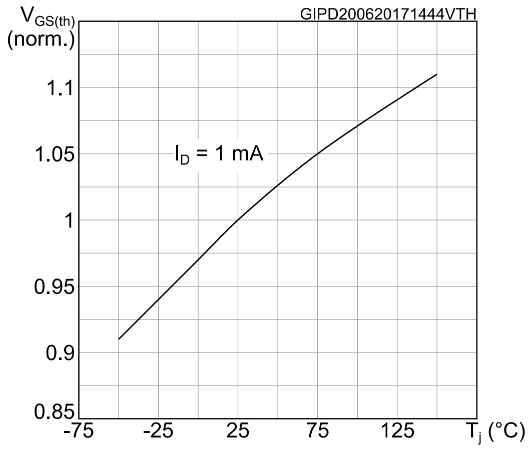


Figure 12: Output capacitance stored energy

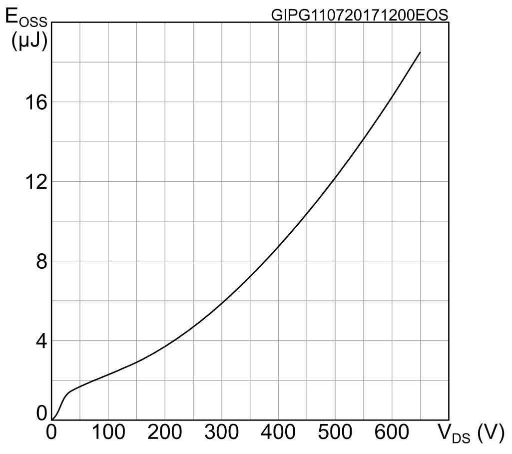
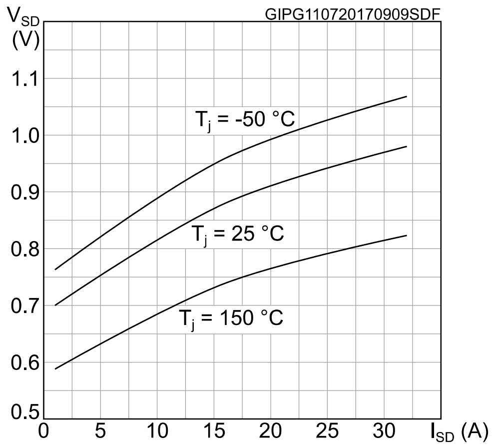


Figure 13: Source- drain diode forward characteristics



3 Test circuits

Figure 14: Test circuit for resistive load switching times

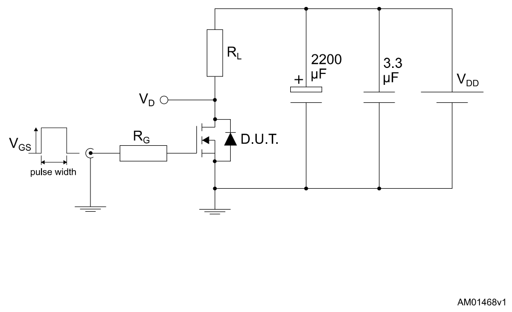


Figure 15: Test circuit for gate charge behavior

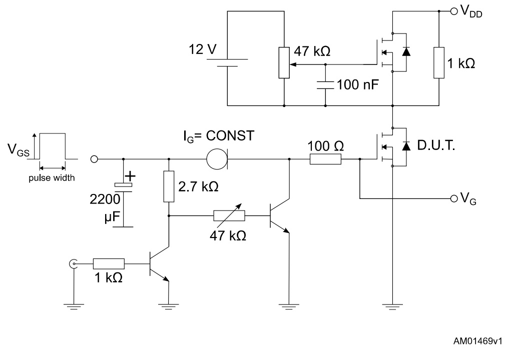


Figure 16: Test circuit for inductive load switching and diode recovery times

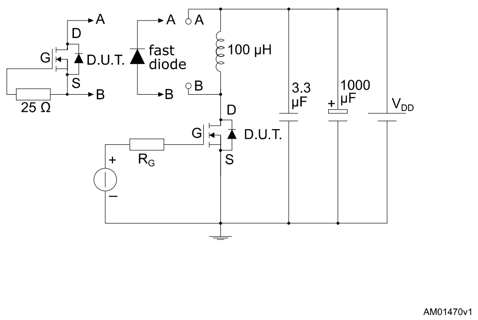


Figure 17: Unclamped inductive load test circuit

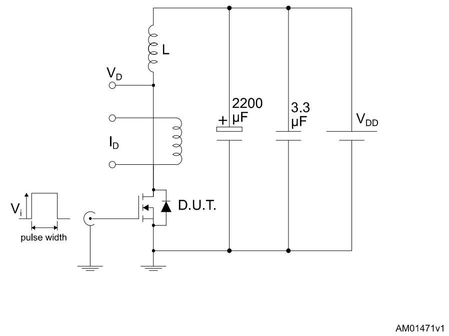


Figure 18: Unclamped inductive waveform

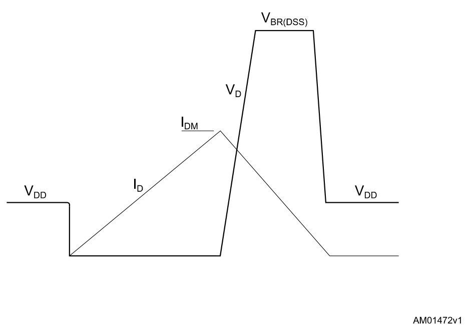
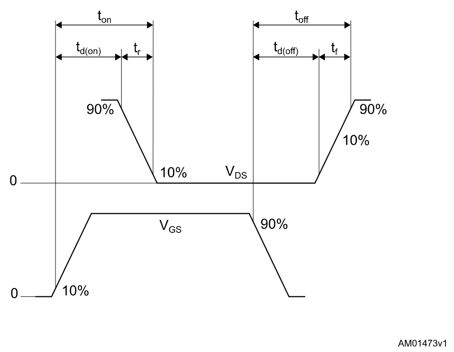


Figure 19: Switching time waveform



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-220FP package information

Figure 20: TO-220FP package outline

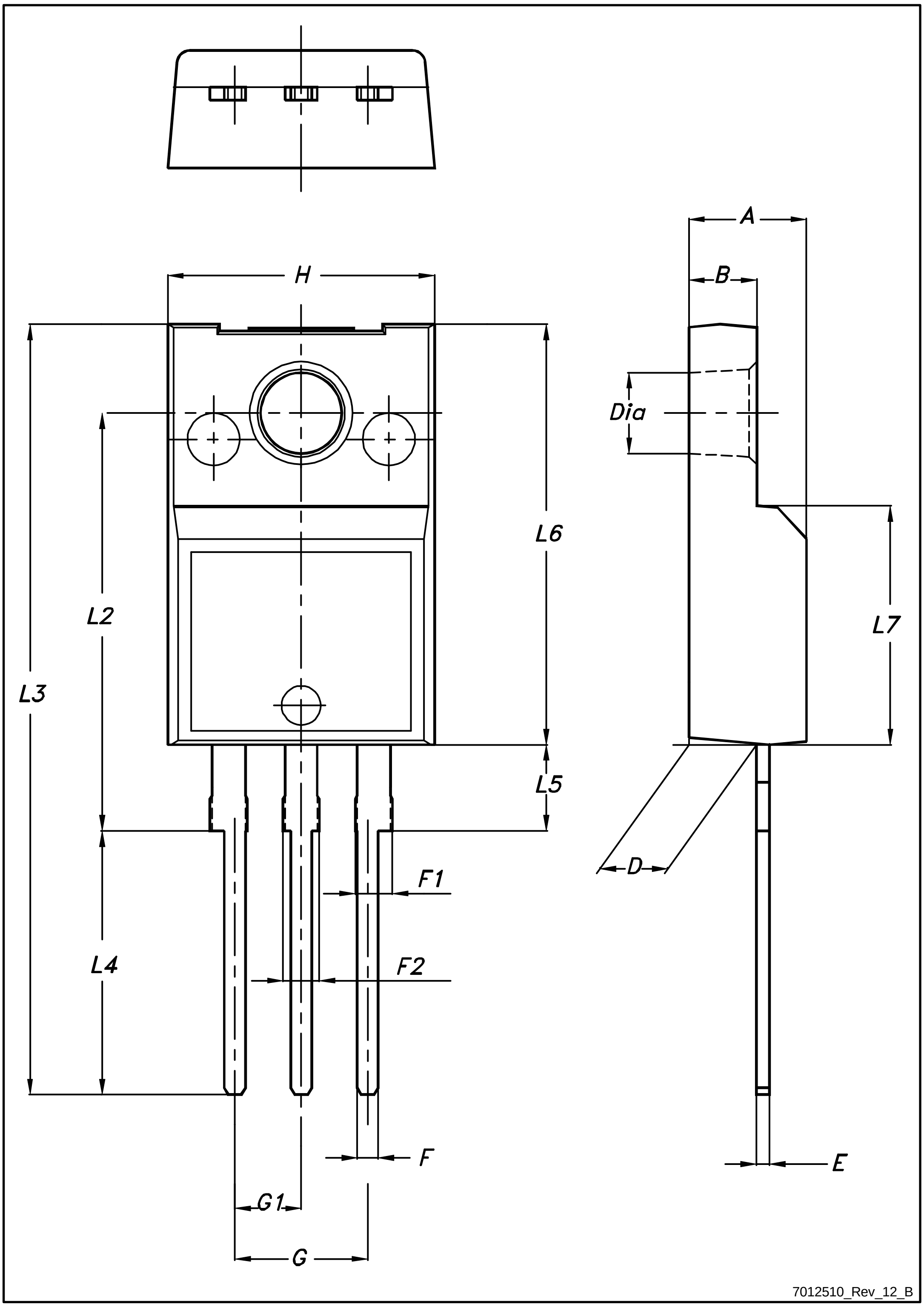


Table 9: TO-220FP package mechanical data

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 10: Document revision history

Date	Revision	Changes
21-Jul-2017	1	Initial release
04-Dec-2017	2	Document status changed from preliminary to production data. Updated *Table 2: "Absolute maximum ratings"* and *Table 8: "Source-drain diode"*. Updated *Figure 2: "Safe operating area"*. Minor text changes.