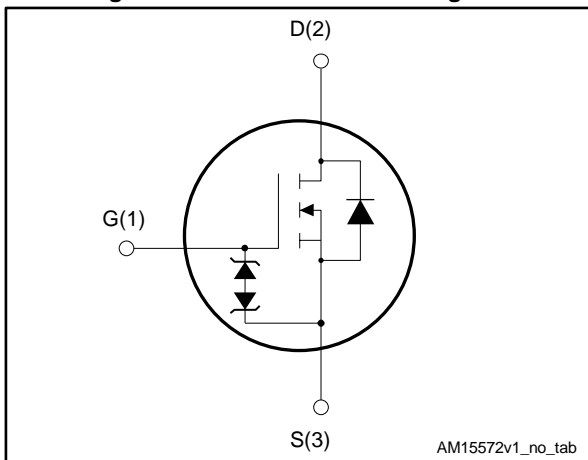


N-channel 650 V, 0.093 Ω typ., 32 A MDmesh™ DM2 Power MOSFET in a TO-220FP package

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	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves).....	6
3	Test circuits	8
4	Package information	9
	4.1 TO-220FP package information	10
5	Revision history	12

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

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

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$	650			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 650\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 650\text{ V}$, $T_{\text{case}} = 125\text{ °C}^{(1)}$			100	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 25\text{ V}$			± 5	μA
$V_{\text{GS(th)}}$	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	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 16\text{ A}$		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	$V_{\text{DS}} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	2540	-	pF
C_{oss}	Output capacitance		-	115	-	
C_{riss}	Reverse transfer capacitance		-	2.5	-	
$C_{\text{oss eq.}}^{(1)}$	Equivalent output capacitance	$V_{\text{DS}} = 0\text{ to }520\text{ V}$, $V_{\text{GS}} = 0\text{ V}$	-	204	-	pF
R_{G}	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_{\text{D}} = 0\text{ A}$	-	4.2	-	Ω
Q_{g}	Total gate charge	$V_{\text{DD}} = 520\text{ V}$, $I_{\text{D}} = 32\text{ A}$, $V_{\text{GS}} = 0$ 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⁾ $C_{\text{oss eq.}}$ 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
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 325\text{ V}$, $I_{\text{D}} = 16\text{ A}$, $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Test circuit for resistive load switching times" and Figure 19: "Switching time waveform")	-	23.4	-	ns
t_{r}	Rise time		-	23	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	72	-	
t_{f}	Fall time		-	10.4	-	

Table 8: Source-drain diode

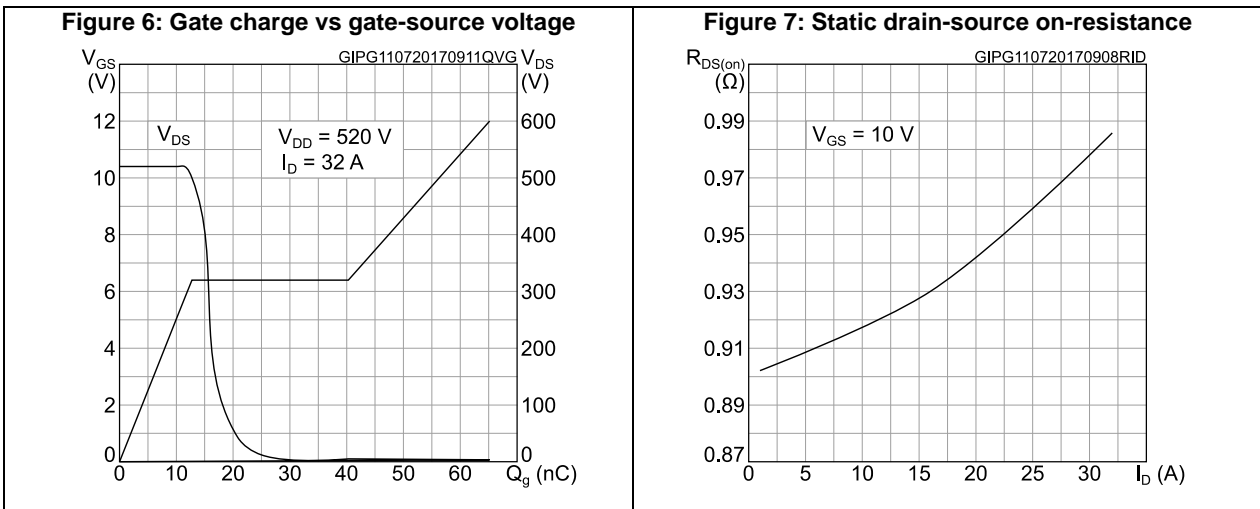
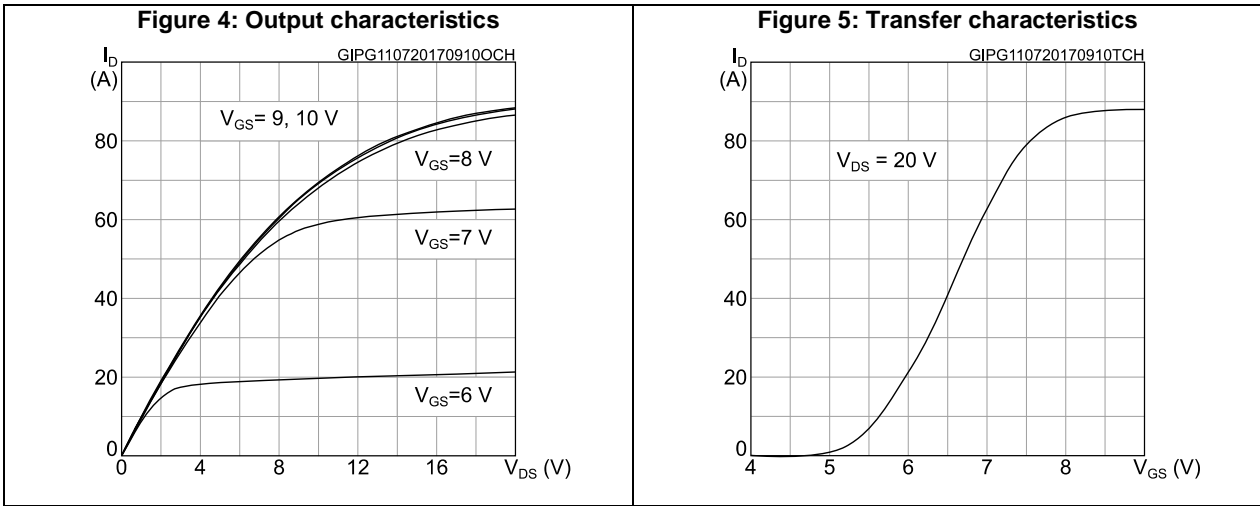
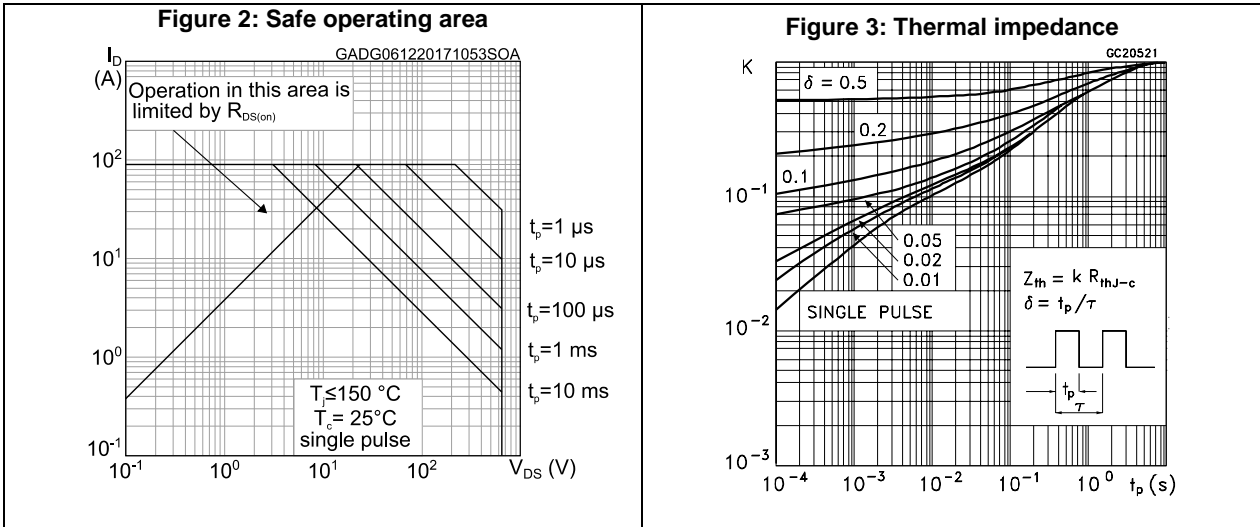
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		32	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		90	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 32\text{ A}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 32\text{ A}$, $di/dt = 100\text{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

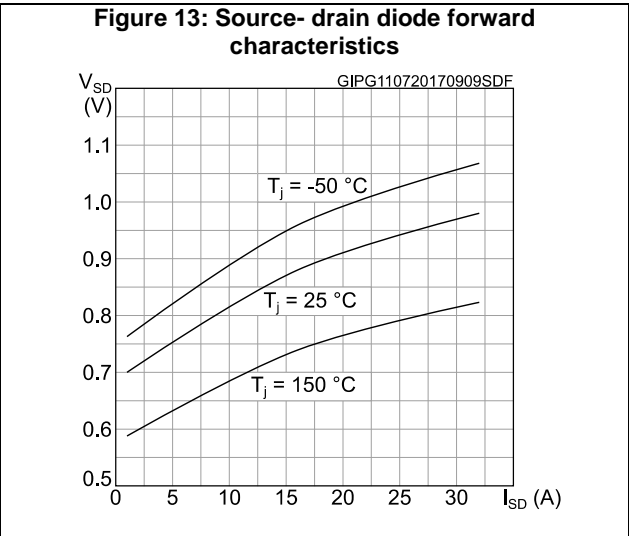
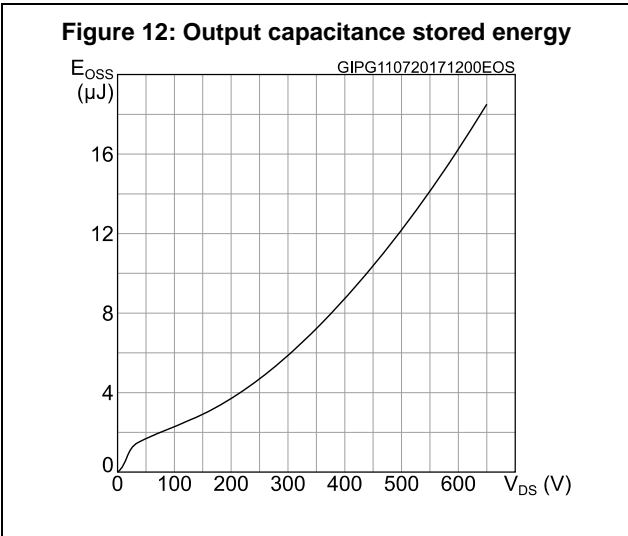
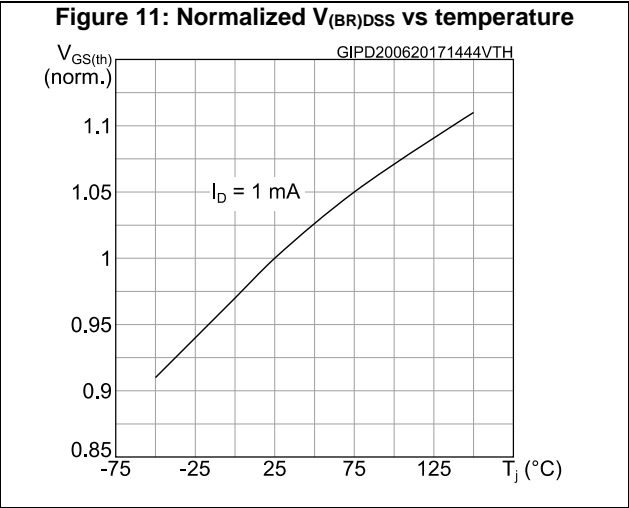
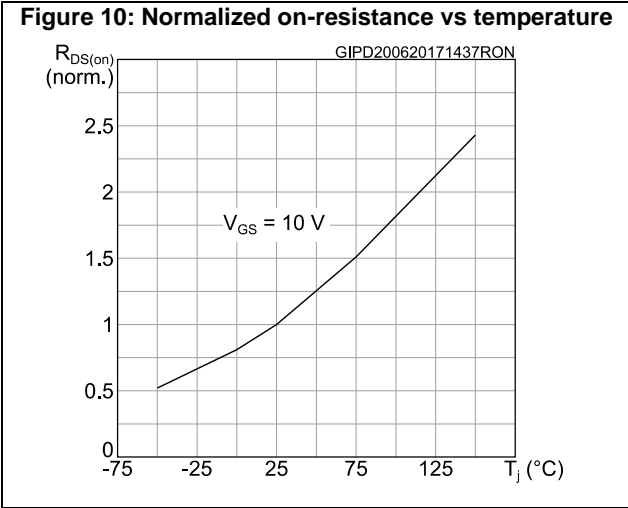
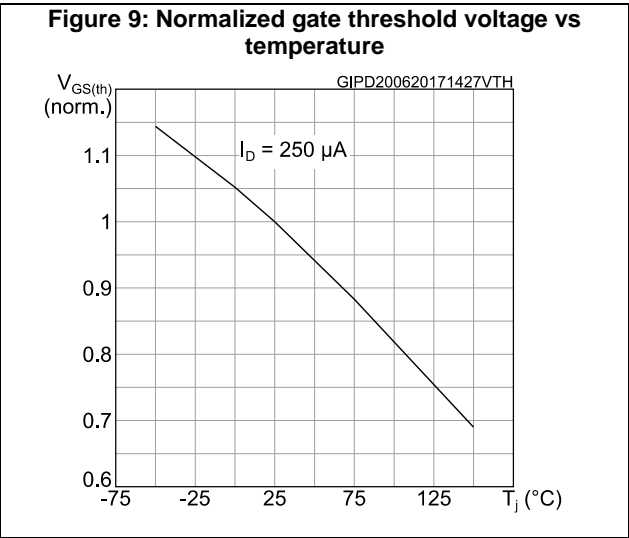
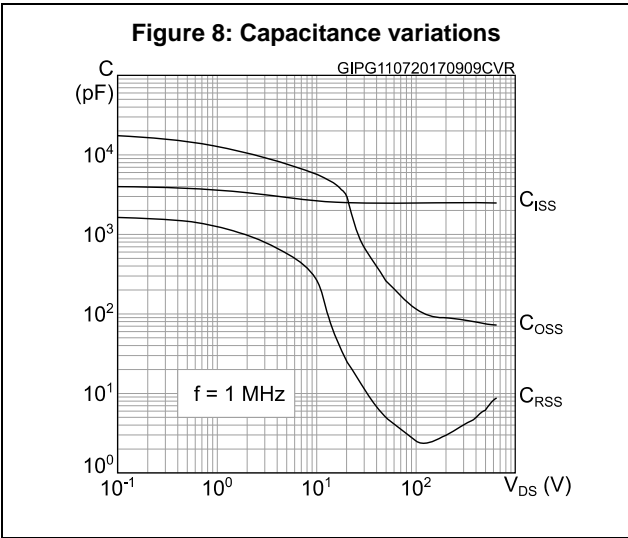
Notes:

(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)





3 Test circuits

Figure 14: Test circuit for resistive load switching times



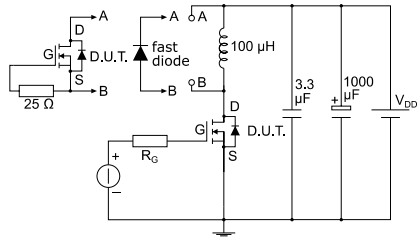
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Figure 15: Test circuit for gate charge behavior



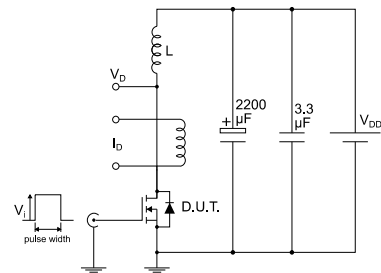
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Figure 16: Test circuit for inductive load switching and diode recovery times



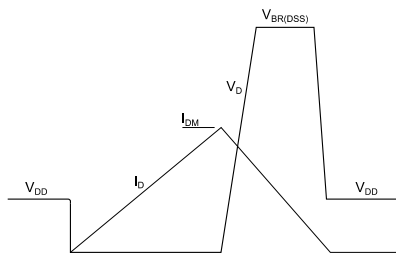
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Figure 17: Unclamped inductive load test circuit



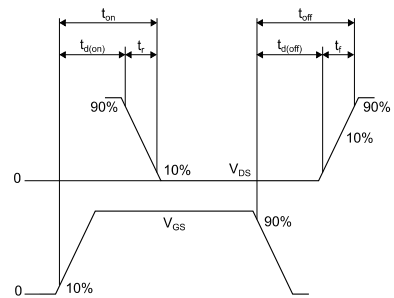
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Figure 18: Unclamped inductive waveform



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Figure 19: Switching time waveform



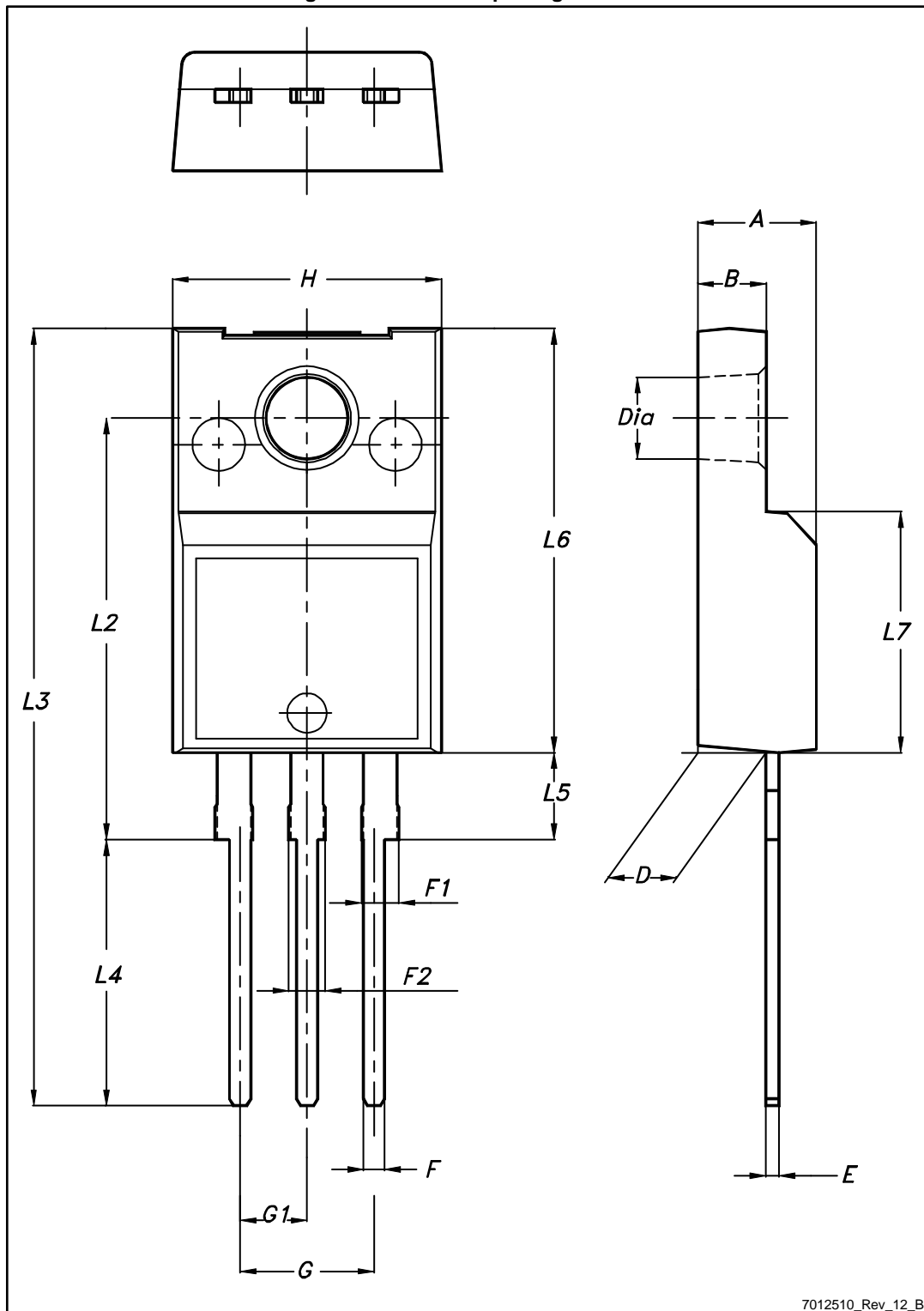
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4 Package information

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



7012510_Rev_12_B

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 <i>Table 2: "Absolute maximum ratings"</i> and <i>Table 8: "Source-drain diode"</i> . Updated <i>Figure 2: "Safe operating area"</i> . Minor text changes.

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