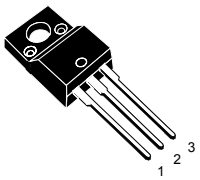
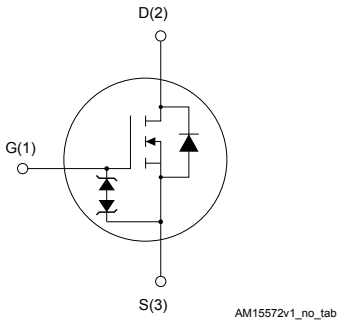
STF5N105K5

Datasheet

N-channel 1050 V, 2.9 Ω typ., 3 A MDmesh K5 Power MOSFET in a TO-220FP package



TO-220FP



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STF5N105K5	1050 V	3.5 Ω	3 A

- Ultra-low gate charge
- Very low FoM (figure of merit)
- Zener-protected
- 100% avalanche tested

Applications

- Switching applications

Description

This very high voltage N-channel Power MOSFET is designed using MDmesh K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.

Product status link
STF5N105K5

Product summary	
Order code	STF5N105K5
Marking	5N105K5
Package	TO-220FP
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	±30	V
I_D	Drain current (continuous) at T_C = 25 °C	3	A
	Drain current (continuous) at T_C = 100 °C	2	
I_{DM}(1)	Drain current (pulsed)	12	A
P_{TOT}	Total power dissipation at T_C = 25 °C	25	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_C = 25 °C)	2.5	kV
dv/dt(2)	Peak diode recovery voltage slope	4.5	V/ns
dv/dt(3)	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		°C

1. *Pulse width is limited by safe operating area.*
2. *I_{SD} ≤ 3 A, di/dt = 100 A/µs, V_{DS} (peak) < $V_{(BR)DSS}$.*
3. *V_{DS} ≤ 840 V*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	5	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	62.5	°C/W

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_J max.)	1	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	85	mJ

2 Electrical characteristics

T_C = 25 °C unless otherwise specified.

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	1050	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 1050 V	-	-	1	µA
		V_{GS} = 0 V, V_{DS} = 1050 V, T_C = 125 °C(1)	-	-	50	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V	-	-	±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 100 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 1.5 A	-	2.9	3.5	Ω

1. *Specified by design, not tested in production.*

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	210	-	pF
C_{oss}	Output capacitance		-	16	-	pF
C_{rss}	Reverse transfer capacitance		-	0.5	-	pF
$C_{o(tr)}$(1)	Equivalent output capacitance time related	V_{DS} = 0 to 840 V, V_{GS} = 0 V	-	26	-	pF
$C_{o(er)}$(2)	Equivalent output capacitance energy related		-	10	-	pF
R_g	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	9	-	Ω
Q_g	Total gate charge	V_{DD} = 840 V, I_D = 3 A, V_{GS} = 10 V (see the Figure 15. Test circuit for gate charge behavior)	-	12.5	-	nC
Q_{gs}	Gate-source charge		-	2	-	nC
Q_{gd}	Gate-drain charge		-	9.5	-	nC

1. *$C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.*
2. *$C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.*

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 525 V, I_D = 1.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see the Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	15.5	-	ns
t_r	Rise time		-	8.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	31	-	ns
t_f	Fall time		-	24	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	3	A
I_{SDM}[1]	Source-drain current (pulsed)		-	-	12	A
V_{SD}[2]	Forward on voltage	V_{GS} = 0 V, I_{SD} = 3 A	-	-	1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 3 A, di/dt = 100 A/µs, V_{DD} = 60 V (see the Figure 16. Test circuit for inductive load switching and diode recovery times)	-	400	-	ns
Q_{rr}	Reverse recovery charge		-	2.3	-	µC
I_{RRM}	Reverse recovery current		-	12	-	A
t_{rr}	Reverse recovery time	I_{SD} = 3 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_J = 150 °C (see the Figure 16. Test circuit for inductive load switching and diode recovery times)	-	560	-	ns
Q_{rr}	Reverse recovery charge		-	3.1	-	µC
I_{RRM}	Reverse recovery current		-	11	-	A

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 1. Safe operating area

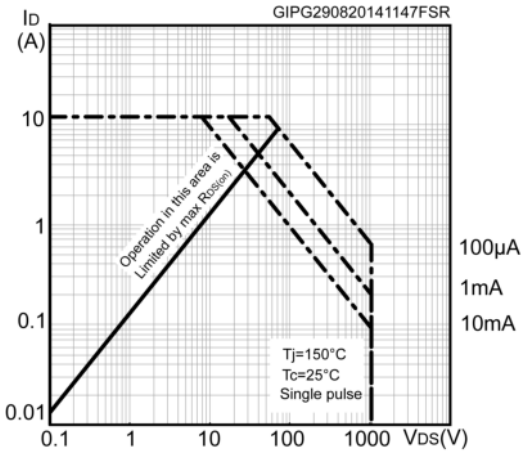


Figure 2. Normalized transient thermal impedance

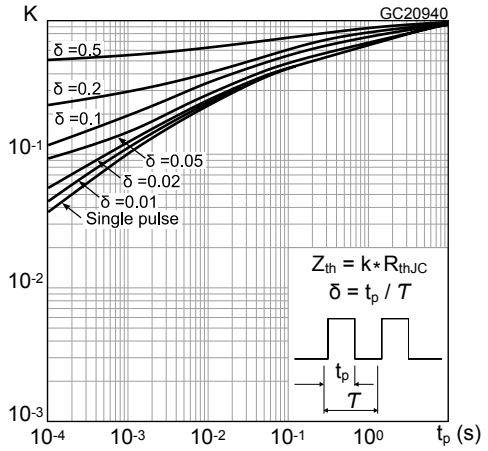


Figure 3. Typical output characteristics

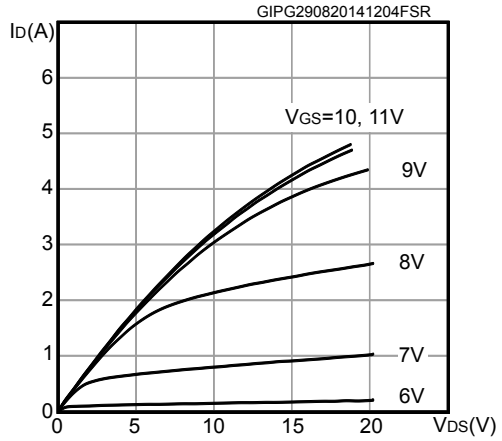


Figure 4. Typical transfer characteristics

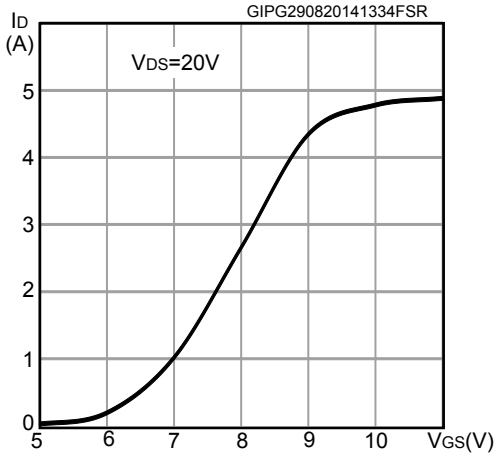


Figure 5. Typical gate charge characteristics

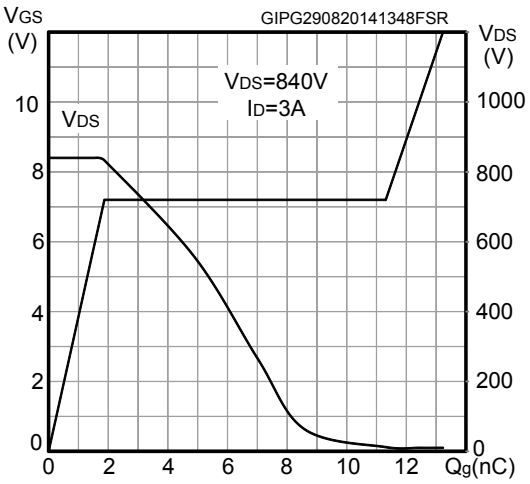


Figure 6. Typical drain-source on-resistance

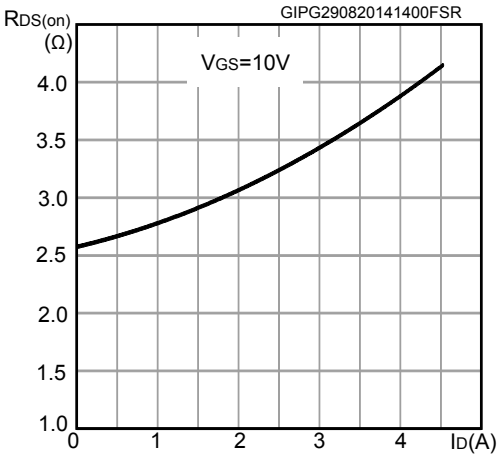


Figure 7. Typical capacitance characteristics

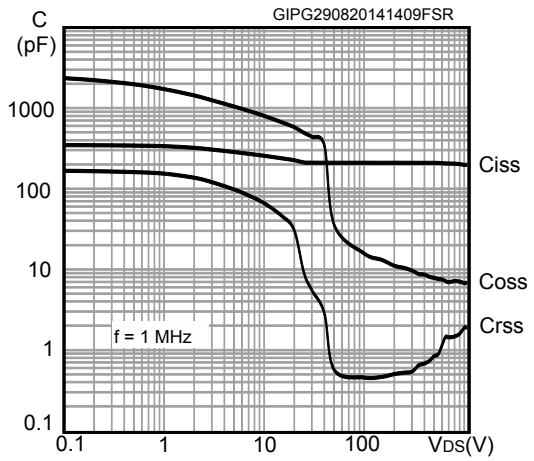


Figure 8. Normalized gate threshold vs temperature

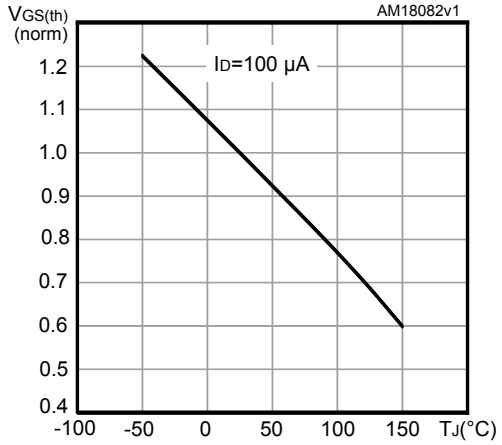


Figure 9. Normalized on-resistance vs temperature

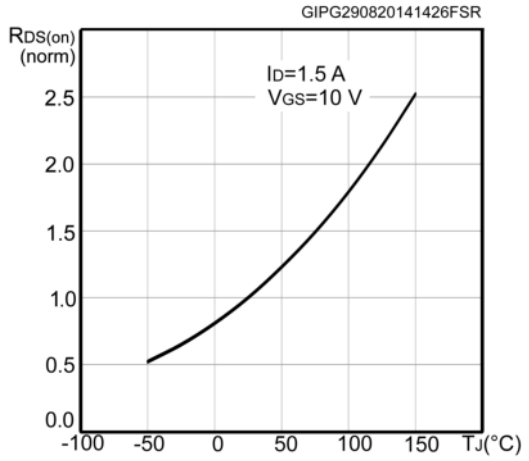


Figure 10. Normalized breakdown voltage vs temperature

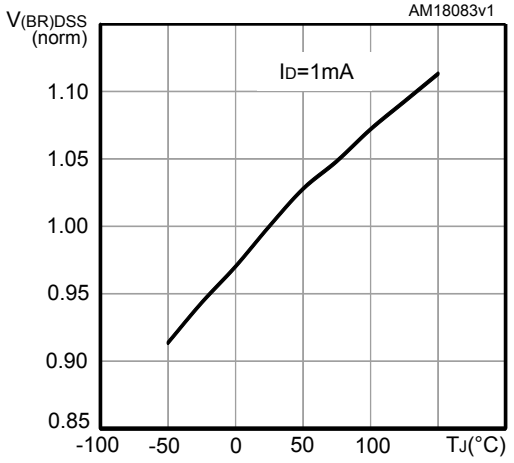


Figure 11. Maximum avalanche energy vs starting T_J

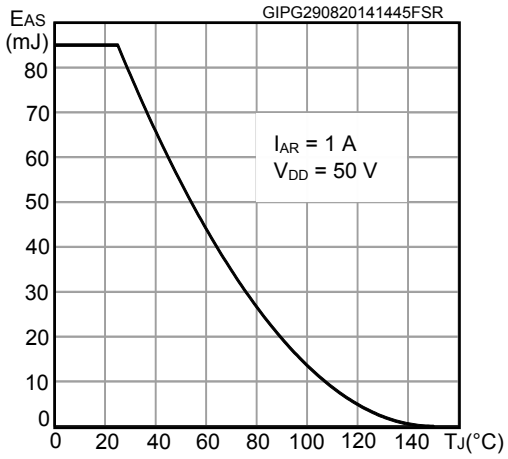


Figure 12. Source-drain diode forward characteristics

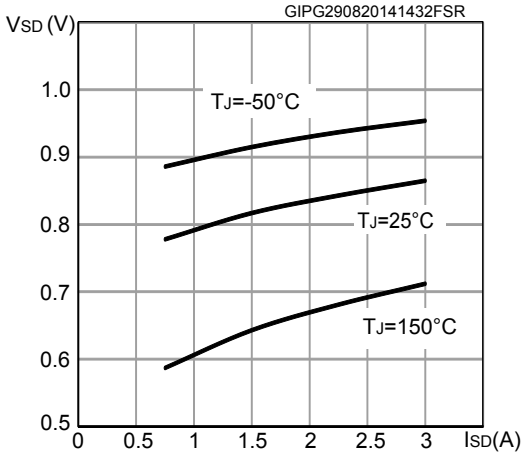
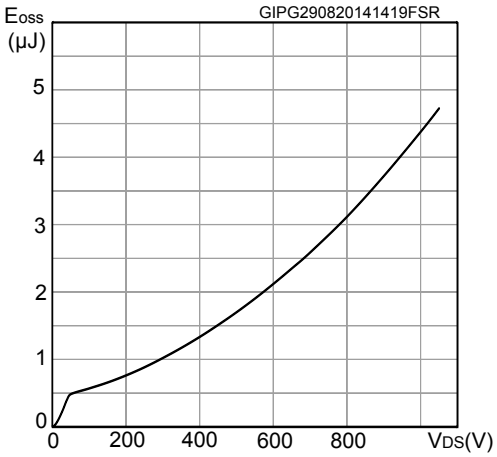


Figure 13. Typical output capacitance stored energy



3 Test circuits

Figure 14. Test circuit for resistive load switching times

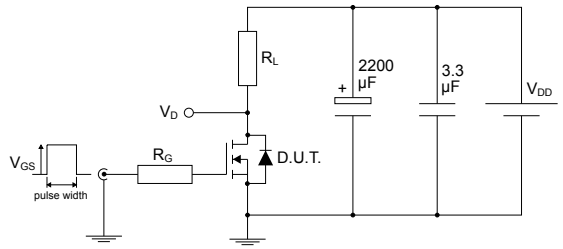


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Figure 15. Test circuit for gate charge behavior

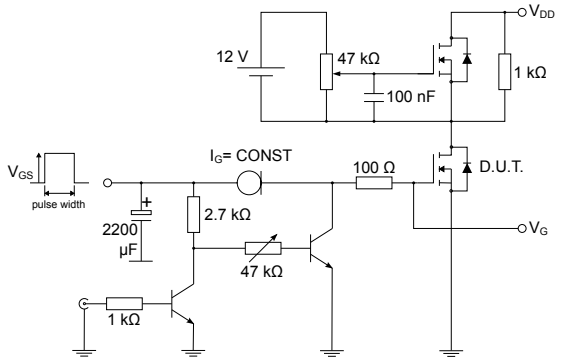

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Figure 16. Test circuit for inductive load switching and diode recovery times

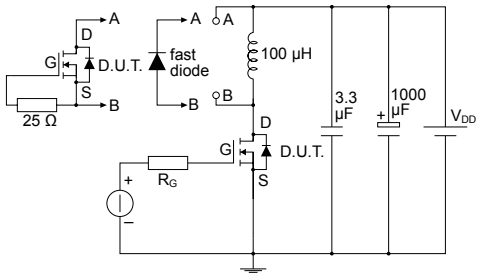

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Figure 17. Unclamped inductive load test circuit

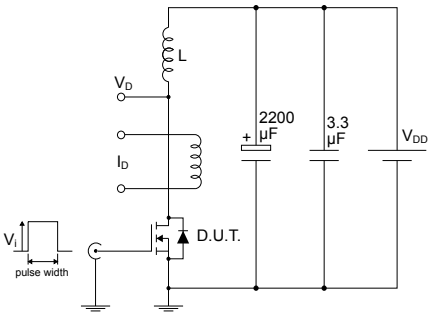

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Figure 18. Unclamped inductive waveform

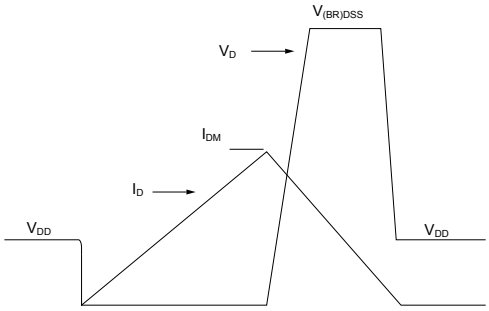

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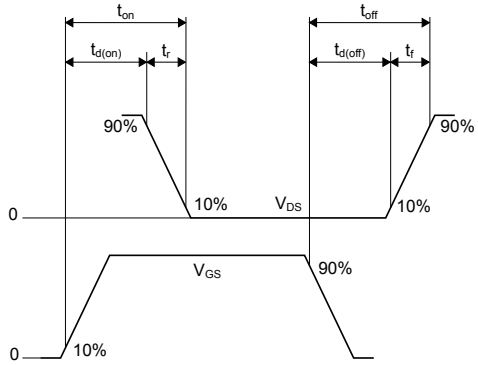
Figure 19. Switching time waveform



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4 Package information

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 type B package information

Figure 20. TO-220FP type B package outline

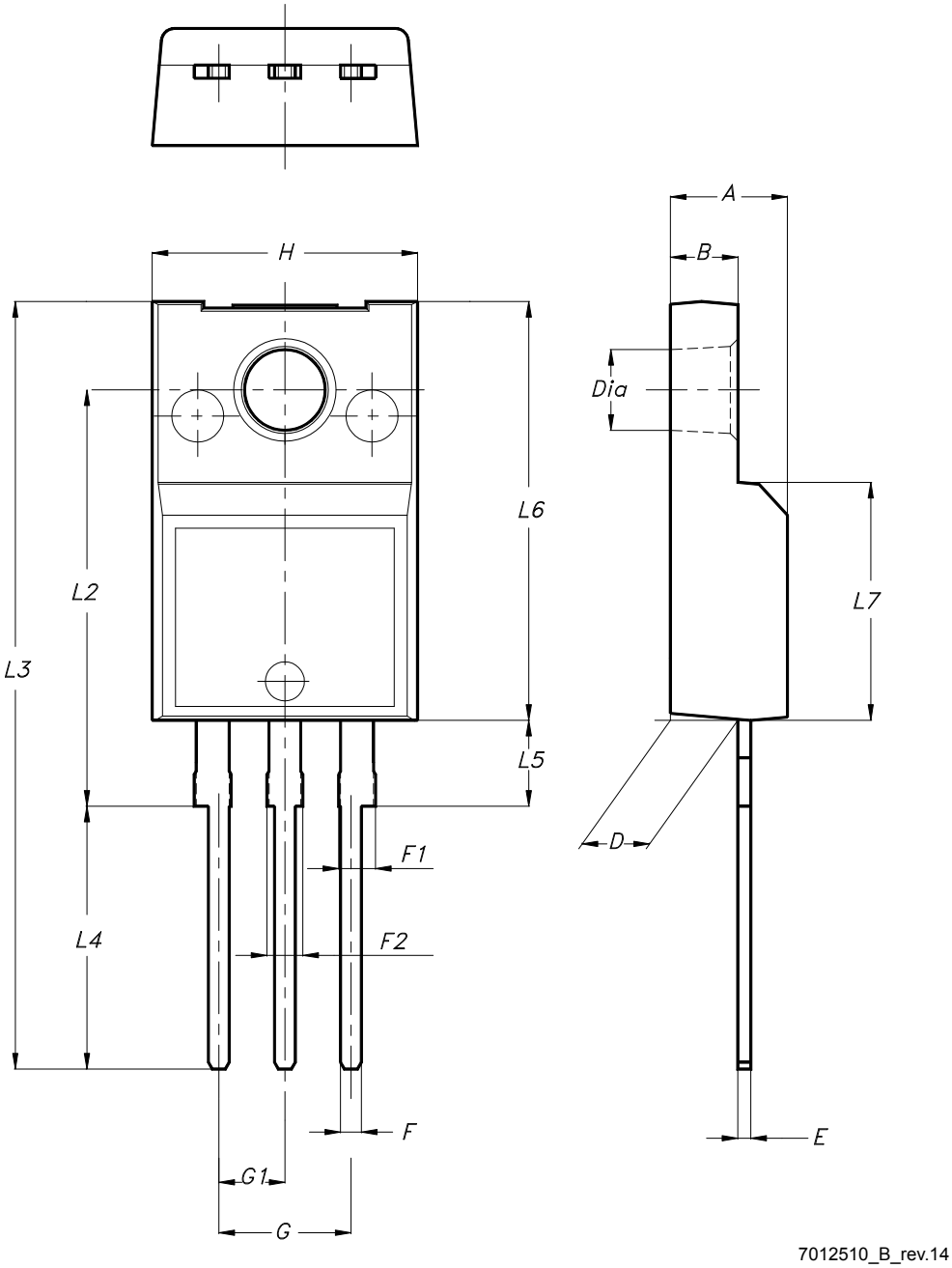

Table 8. **TO-220FP type B package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

Revision history

Table 9. Document revision history

Date	Revision	Changes
17-Jul-2014	1	First release.
01-Sep-2014	2	Document status promoted from preliminary to production data. Inserted *Section 3.1: "Electrical characteristics (curves)".* Minor text changes.
02-Sep-2014	3	Updated title in cover page.
03-Oct-2014	4	Updated: *Figure 3: "Thermal impedance", Figure 6: "Gate charge vs gate-source voltage"* and *Figure 8: "Capacitance variations"*
15-Oct-2014	5	Updated *Table 2: "Absolute maximum ratings"*
11-May-2026	6	Updated Section 4: Package information. Minor text changes.

Contents

1 Electrical ratings 2

2 Electrical characteristics 3

2.1 Electrical characteristics (curves) 5

3 Test circuits 8

4 Package information 9

4.1 TO-220FP type B package information 9

Revision history 11

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