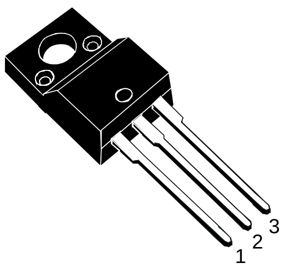
STFU13N60M2

life.augmented

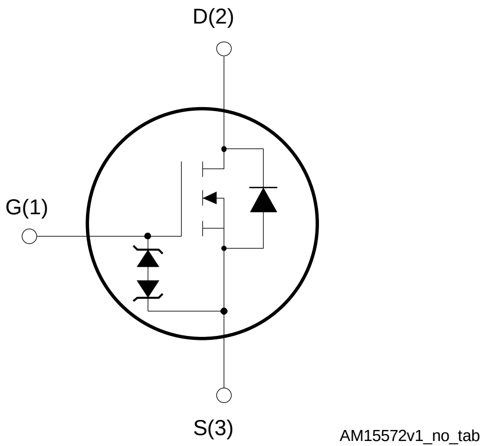
N-channel 600 V, 0.35 Ω typ., 11 A MDmesh™ M2 Power MOSFET in a TO-220FP ultra narrow leads package

Datasheet - production data



TO-220FP
ultra narrow leads

Figure 1: Internal schematic diagram



Features

Order code	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max	I_D
STFU13N60M2	650 V	0.38 Ω	11 A

- Extremely low gate charge
- Lower $R_{DS(on)}$ x area vs previous generation
- Low gate input resistance
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using MDmesh™ M2 technology. Thanks to its strip layout and an improved vertical structure, the device exhibits low on-resistance and optimized switching characteristics, rendering it suitable for the most demanding high efficiency converters.

Table 1: Device summary

Order code	Marking	Package	Packaging
STFU13N60M2	13N60M2	TO-220FP ultra narrow leads	Tube

This is information on a product in full production.

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_C = 25 °C	11[(1)]	A
I_D	Drain current (continuous) at T_C = 100 °C	7	A
I_{DM}[(2)]	Drain current (pulsed)	44	A
P_{TOT}	Total 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)	2500	V
dv/dt [(3)]	Peak diode recovery voltage slope	15	V/ns
dv/dt [(4)]	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature	- 55 to 150	°C
T_j	Max. operating junction temperature		

Notes:

[(1)]Limited by maximum junction temperature.

[(2)]Pulse width limited by safe operating area.

[(3)]I_{SD} ≤ 11 A, di/dt ≤ 400 A/µs; V_{DSpeak} < $V_{(BR)DSS}$, V_{DD} = 400 V

[(4)]V_{DS} ≤ 480 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	5	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	°C/W

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	2.8	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25°C, I_D = I_{AR}; V_{DD} = 50 V)	125	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 5: On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0 V	600			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 600 V			1	µA
		V_{DS} = 600 V, T_C = 125 °C			100	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 5.5 A		0.35	0.38	Ω

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	-	580	-	pF
C_{oss}	Output capacitance		-	32	-	pF
C_{rss}	Reverse transfer capacitance		-	1.1	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 480 V, V_{GS} = 0 V	-	120	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	6.6	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 11 A, V_{GS} = 10 V (see *Figure 15: "Test circuit for gate charge behavior"*)	-	17	-	nC
Q_{gs}	Gate-source charge		-	2.5	-	nC
Q_{gd}	Gate-drain charge		-	9	-	nC

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} = 300 V, I_D = 5.5 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"*)	-	11	-	ns
t_r	Rise time		-	10	-	ns
$t_{d(off)}$	Turn-off delay time		-	41	-	ns
t_f	Fall time		-	9.5	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		11	A
I_{SDM}[(1)]	Source-drain current (pulsed)		-		44	A
V_{SD}[(2)]	Forward on voltage	I_{SD} = 11 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 11 A, di/dt = 100 A/µs, V_{DD} = 60 V (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	297		ns
Q_{rr}	Reverse recovery charge		-	2.8		µC
I_{RRM}	Reverse recovery current		-	18.5		A
t_{rr}	Reverse recovery time	I_{SD} = 11 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"*)	-	394		ns
Q_{rr}	Reverse recovery charge		-	3.8		µC
I_{RRM}	Reverse recovery current		-	19		A

Notes:

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300 µs, duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

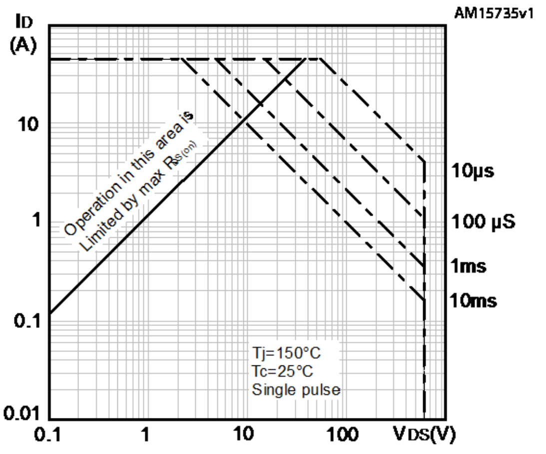


Figure 3: Thermal impedance

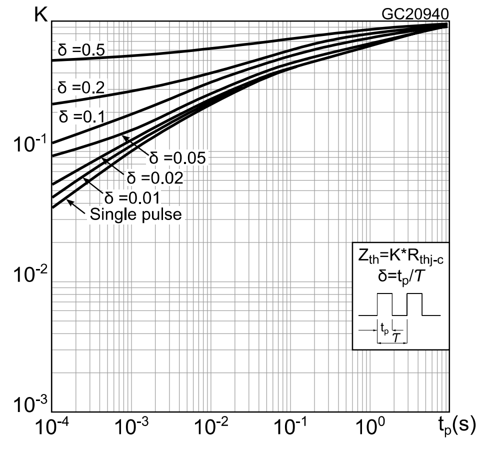


Figure 4: Output characteristics

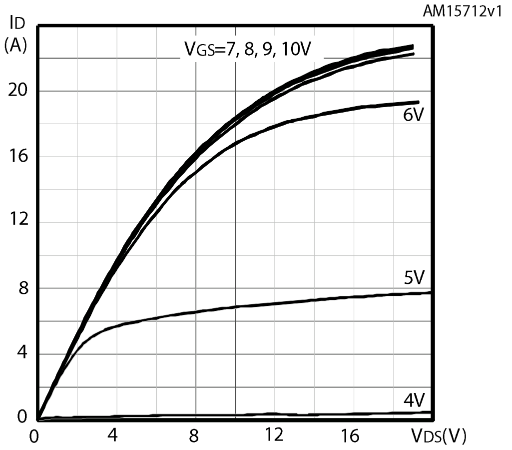


Figure 5: Transfer characteristics

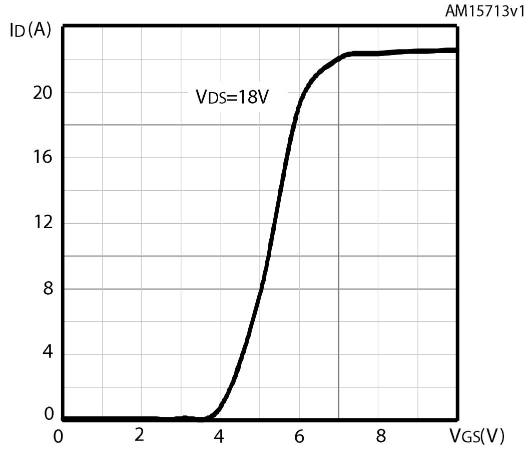


Figure 6: Normalized V(BR)DSS vs temperature

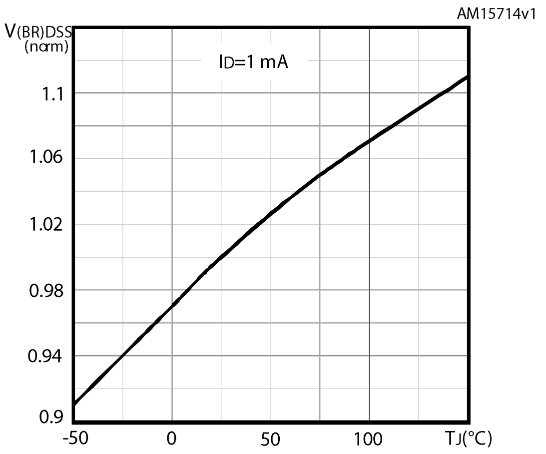


Figure 7: Static drain-source on-resistance

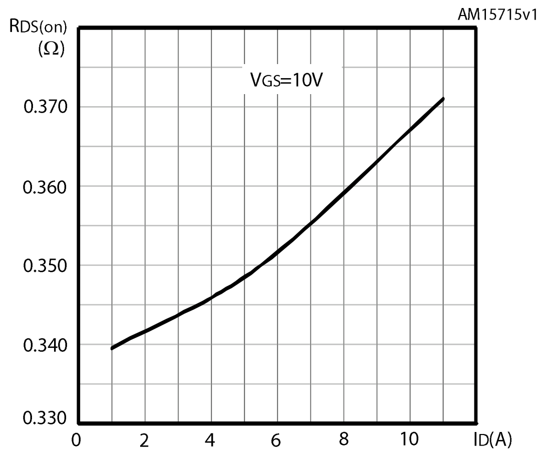


Figure 8: Gate charge vs gate-source voltage

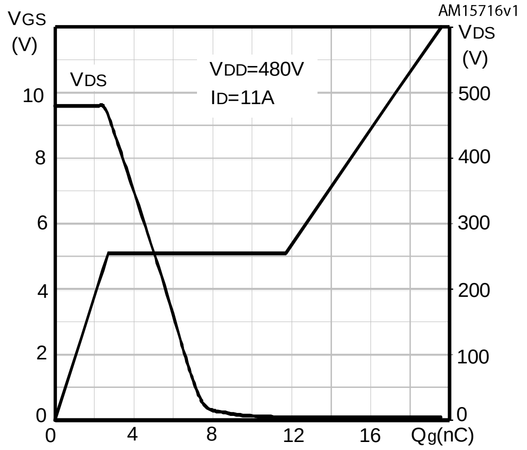


Figure 9: Capacitance variations

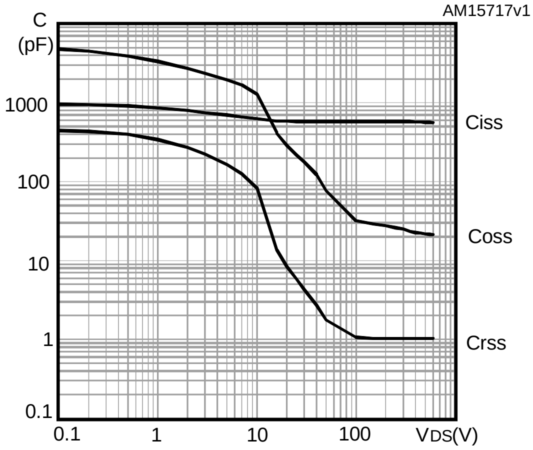


Figure 10: Normalized gate threshold voltage vs temperature

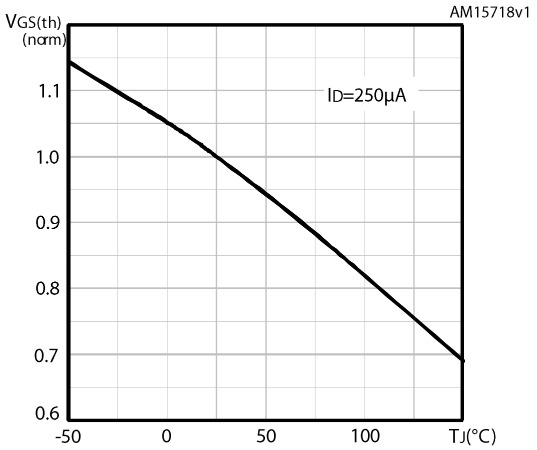


Figure 11: Normalized on-resistance vs temperature

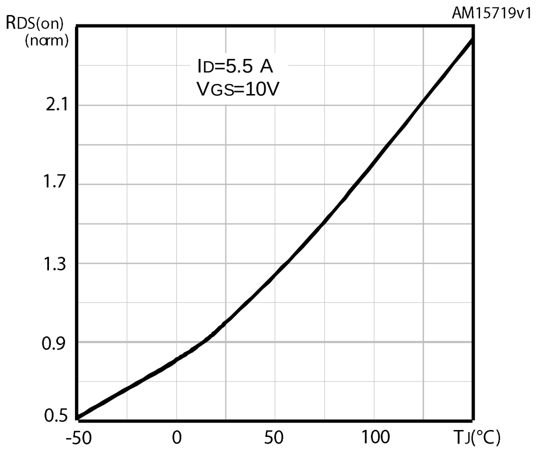


Figure 12: Source-drain diode forward characteristics

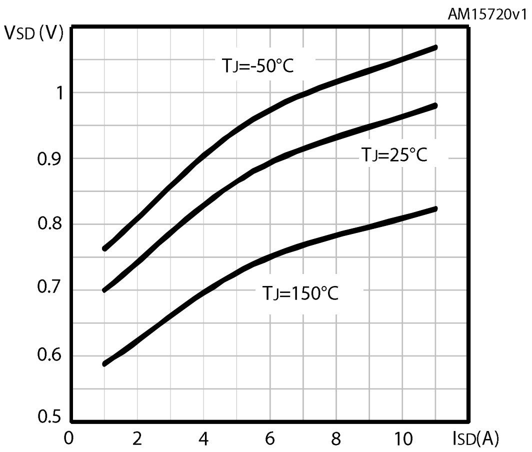
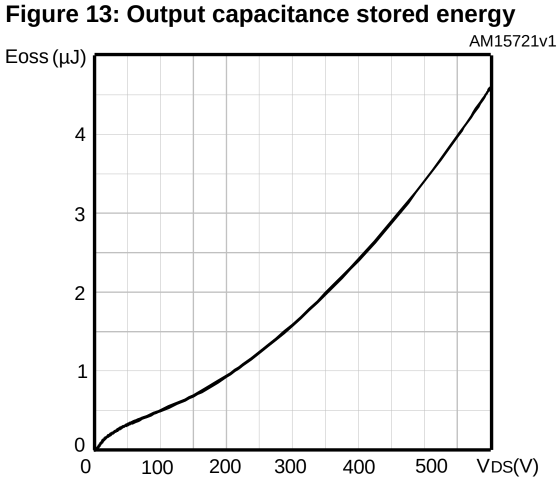


Figure 13: Output capacitance stored energy



3 Test circuit

Figure 14: Test circuit for resistive load switching times

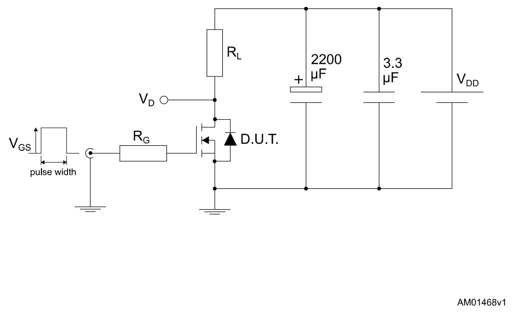


Figure 15: Test circuit for gate charge behavior

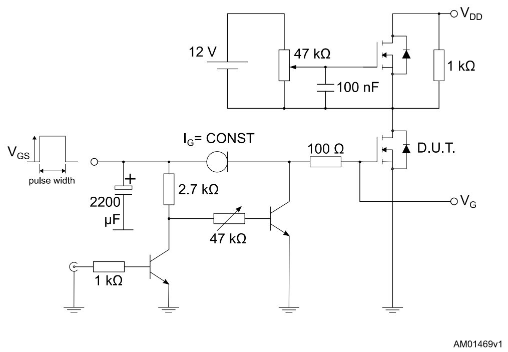


Figure 16: Test circuit for inductive load switching and diode recovery times

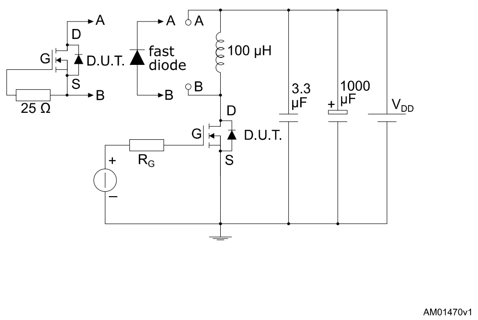


Figure 17: Unclamped inductive load test circuit

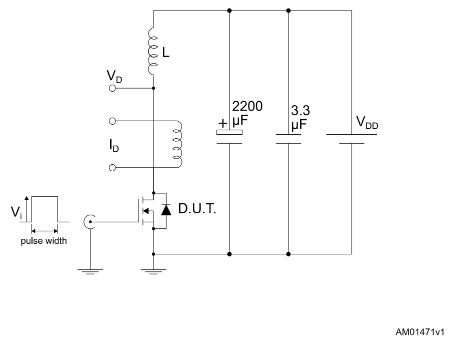


Figure 18: Unclamped inductive waveform

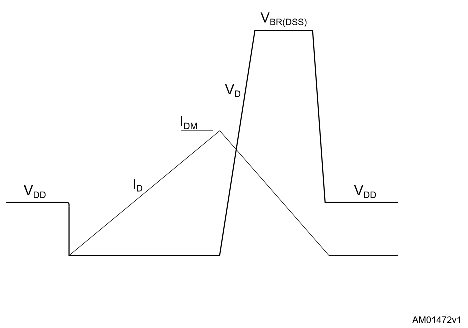
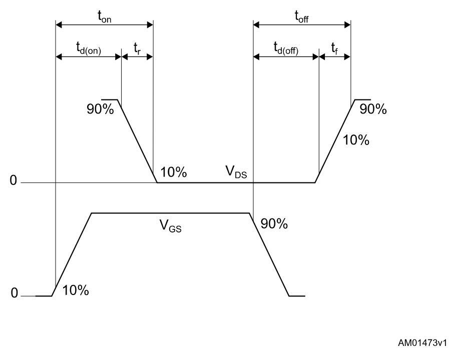


Figure 19: Switching time waveform



4 Package 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 20: TO-220FP ultra narrow leads package outline

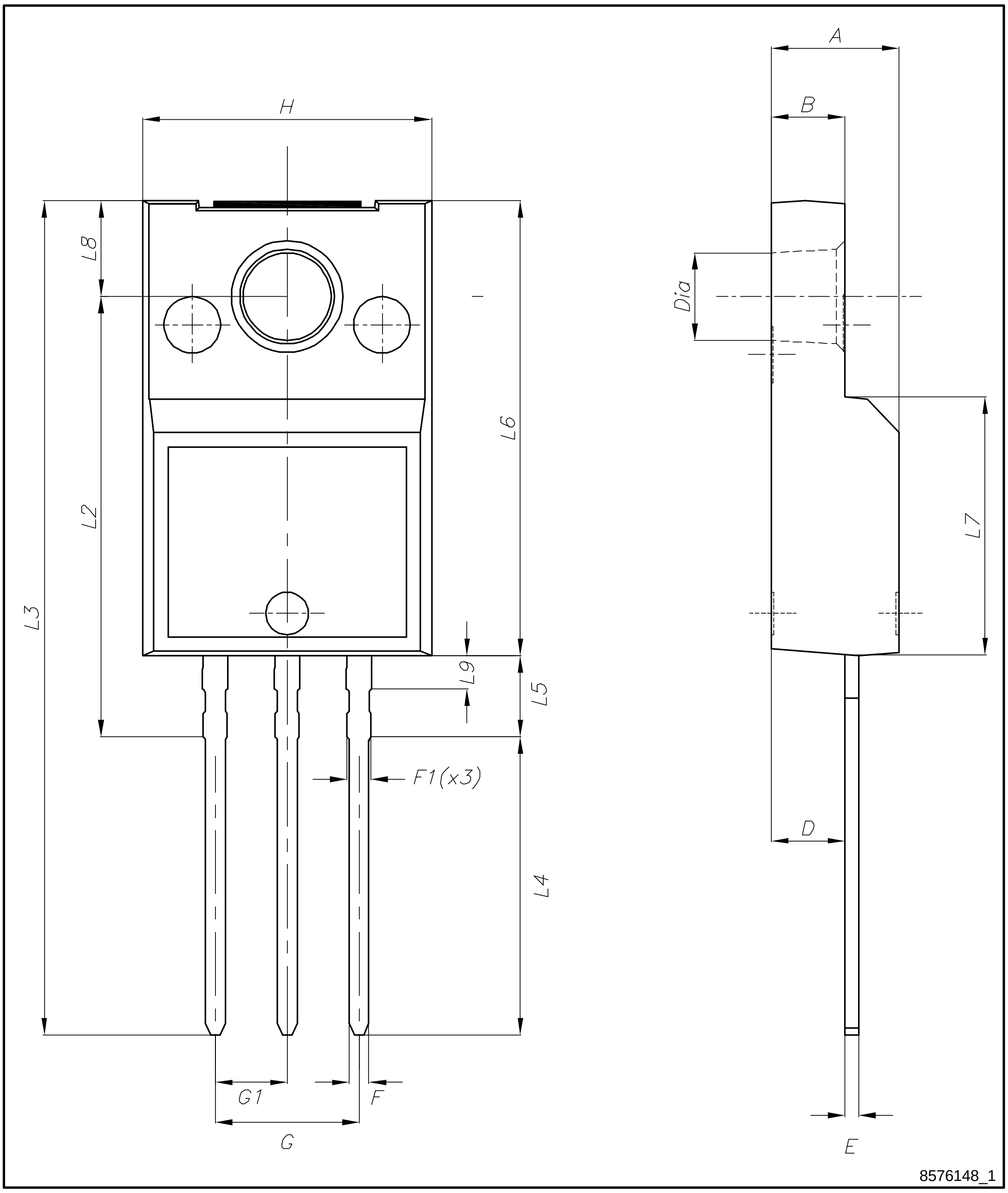


Table 9: TO-220FP ultra narrow leads mechanical data

Dim.	mm		
	Min.	**Typ.**	**Max.**
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.60
F	0.65		0.75
F1	-		0.90
G	4.95		5.20
G1	2.40	2.54	2.70
H	10.00		10.40
L2	15.10		15.90
L3	28.50		30.50
L4	10.20		11.00
L5	2.50		3.10
L6	15.60		16.40
L7	9.00		9.30
L8	3.20		3.60
L9	-		1.30
Dia.	3.00		3.20

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
09-Mar-2015	1	Initial release
15-Sep-2015	2	Document status changed from preliminary to production data.