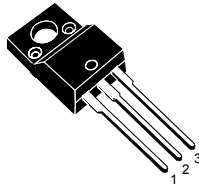
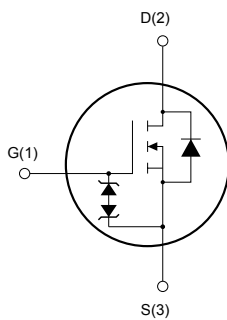


## N-channel 800 V, 0.400 $\Omega$ typ., 12 A MDmesh™ K5 Power MOSFET in a TO-220FP ultra narrow leads package



TO-220FP  
ultra narrow leads



AM15572v1\_no\_tab



### Features

Order code	$V_{DS}$	$R_{DS(on)}$ max.	$I_D$
STFU14N80K5	800 V	0.445 $\Omega$	12 A

- Industry's lowest  $R_{DS(on)}$  x area
- Industry's best FoM (figure of merit)
- Ultra-low gate charge
- 100% avalanche tested
- Zener-protected

### 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

[STFU14N80K5](#)

#### Product summary

<b>Order code</b>	STFU14N80K5
<b>Marking</b>	14N80K5
<b>Package</b>	TO-220FP ultra narrow leads
<b>Packing</b>	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 30$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	12	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	7.4	A
$I_D^{(2)}$	Drain current (pulsed)	48	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	30	W
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t=1\text{ s}$ ; $T_C=25\text{ }^\circ\text{C}$ )	2500	V
$dv/dt^{(3)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(4)}$	MOSFET $dv/dt$ ruggedness	50	
$T_{stg}$	Storage temperature range	- 55 to 150	$^\circ\text{C}$
$T_J$	Operating junction temperature range		

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area.
3.  $I_{SD} \leq 12\text{ A}$ ,  $di/dt = 100\text{ A}/\mu\text{s}$ ;  $V_{DS}(\text{peak}) < V_{(BR)DSS}$ ,  $V_{DD} = 640\text{ V}$
4.  $V_{DS} \leq 640\text{ V}$

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	4.2	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	$^\circ\text{C}/\text{W}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax}$ )	4	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	270	mJ

## 2 Electrical characteristics

$T_C = 25\text{ °C}$  unless otherwise specified.

**Table 4. On/off-state**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	800			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}, V_{DS} = 800\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}, V_{DS} = 800\text{ V}$ $T_C = 125\text{ °C}^{(1)}$			50	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}$		0.400	0.445	$\Omega$

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

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	620	-	pF
$C_{oss}$	Output capacitance		-	60	-	pF
$C_{rss}$	Reverse transfer capacitance		-	0.8	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ to }640\text{ V}, V_{GS} = 0\text{ V}$	-	107	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	39	-	pF
$R_g$	Intrinsic gate resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$	-	6.5	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 640\text{ V}, I_D = 12\text{ A}$	-	22	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 0\text{ to }10\text{ V}$	-	4.3	-	nC
$Q_{gd}$	Gate-drain charge	(see Figure 15. Test circuit for gate charge behavior)	-	16.5	-	nC

1. Time related is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$
2. Energy related is defined as a constant equivalent capacitance giving the same stored energy as  $C_{oss}$  when  $V_{DS}$  increases 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	$V_{DD} = 400\text{ V}, I_D = 6\text{ A}, R_G = 4.7\text{ }\Omega$	-	12.5	-	ns
$t_r$	Rise time		$V_{GS} = 10\text{ V}$	-	8	-
$t_{d(off)}$	Turn-off delay time	see ( Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	33	-	ns
$t_f$	Fall time		-	10	-	ns

**Table 7. Source-drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		48	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12\text{ A}, V_{GS} = 0\text{ V}$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 60\text{ V}$	-	365		ns
$Q_{rr}$	Reverse recovery charge	(see )Figure 16. Test circuit for inductive load switching and diode recovery times	-	4.77		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	26		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 60\text{ V}, T_j = 150\text{ }^\circ\text{C}$	-	485		ns
$Q_{rr}$	Reverse recovery charge	(see )Figure 16. Test circuit for inductive load switching and diode recovery times	-	5.85		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	24		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

**Table 8. Gate-source Zener diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	$I_{GS} = \pm 1\text{ mA}, I_D = 0\text{ A}$	30	-	-	V

The built-in back-to-back Zener diodes are specifically designed to enhance the ESD performance of the device. The Zener voltage facilitates efficient and cost-effective device integrity protection, thus eliminating the need for additional external componentry.

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

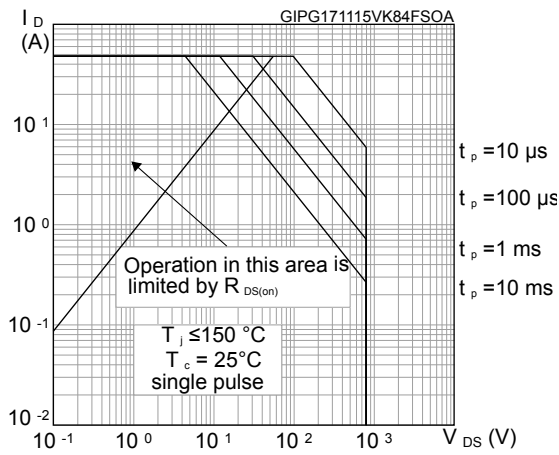


Figure 2. Thermal impedance

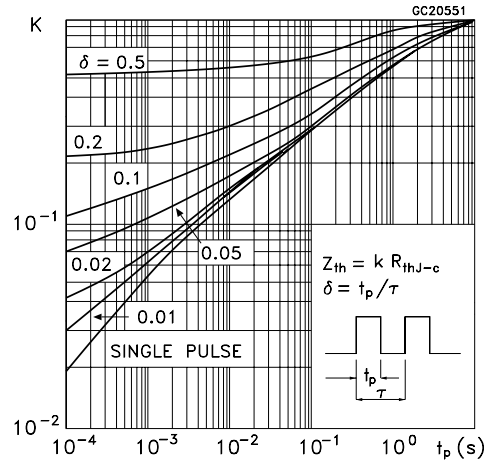


Figure 3. Output characteristics

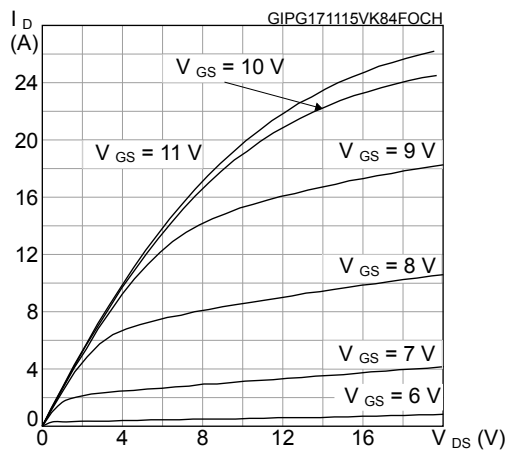
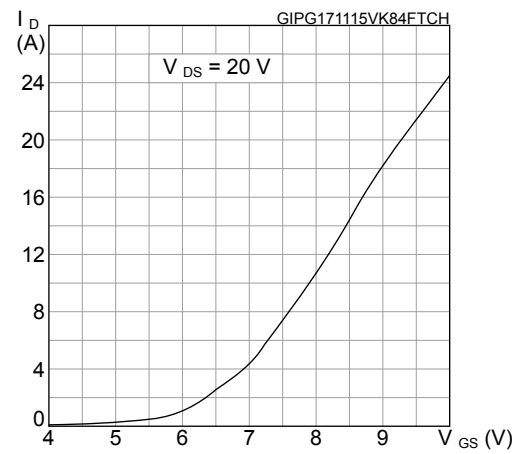
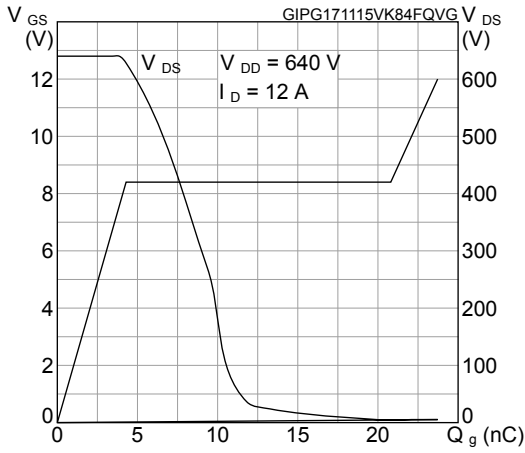


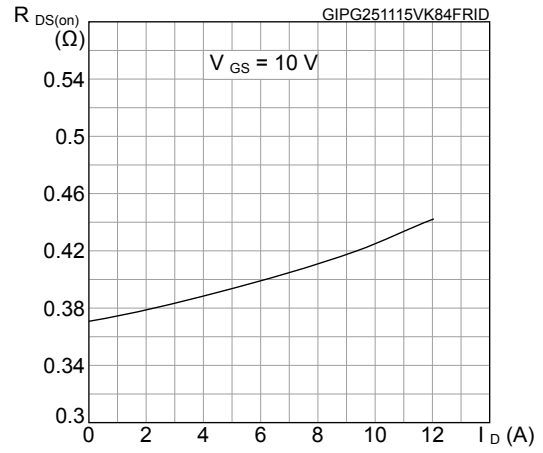
Figure 4. Transfer characteristics



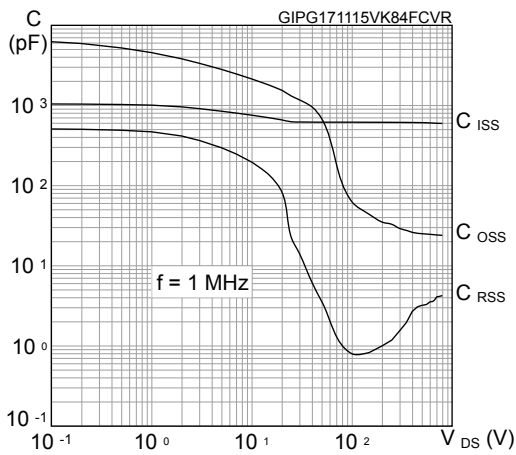
**Figure 5. Gate charge vs gate-source voltage**



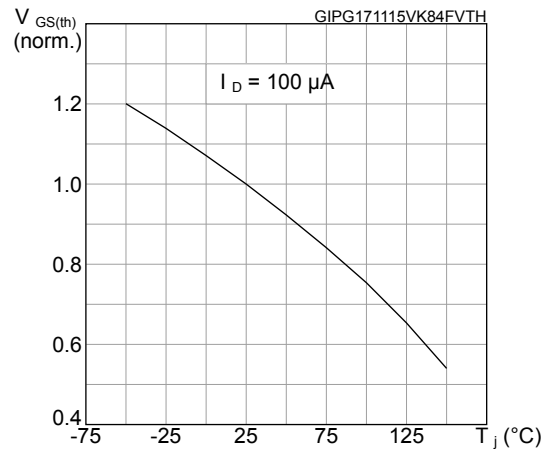
**Figure 6. Static drain-source on-resistance**



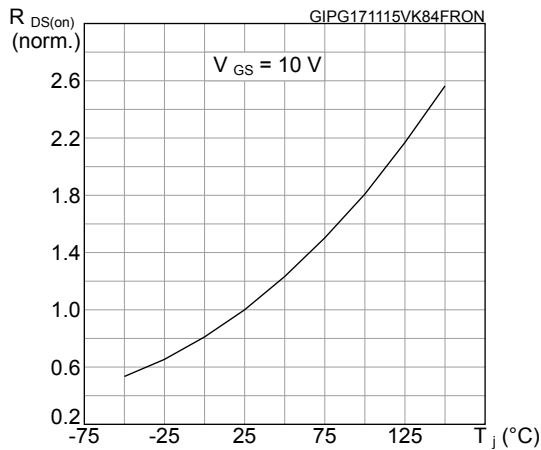
**Figure 7. Capacitance variations**



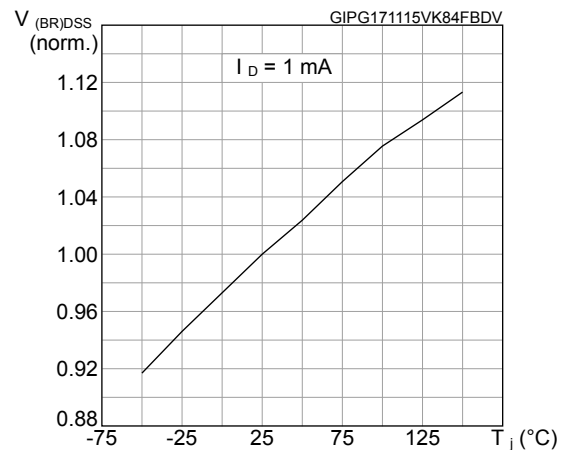
**Figure 8. Normalized gate threshold voltage vs temperature**



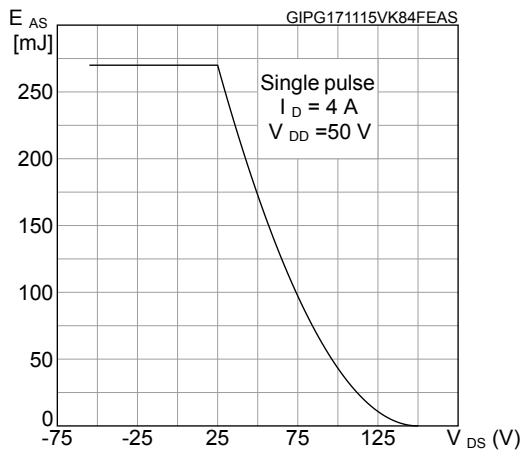
**Figure 9. Normalized on-resistance vs temperature**



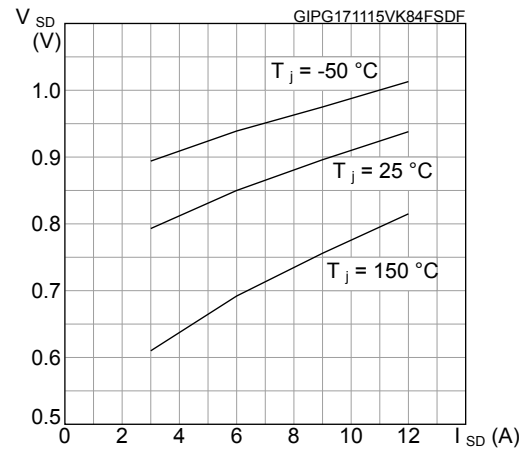
**Figure 10. Normalized V\_(BR)DSS vs temperature**



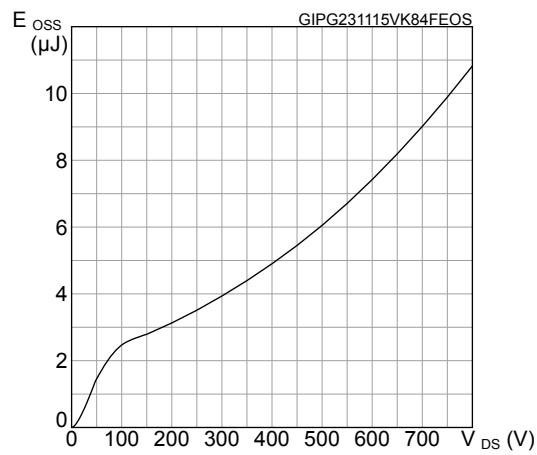
**Figure 11. Maximum avalanche energy vs starting  $T_J$**



**Figure 12. Source-drain diode forward characteristics**



**Figure 13. Maximum avalanche energy vs starting  $T_J$**



### 3 Test circuits

**Figure 14. Test circuit for resistive load switching times**


AM01468v1

**Figure 15. Test circuit for gate charge behavior**


AM01469v1

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


AM01470v1

**Figure 17. Unclamped inductive load test circuit**


AM01471v1

**Figure 18. Unclamped inductive waveform**


AM01472v1

**Figure 19. Switching time waveform**


AM01473v1

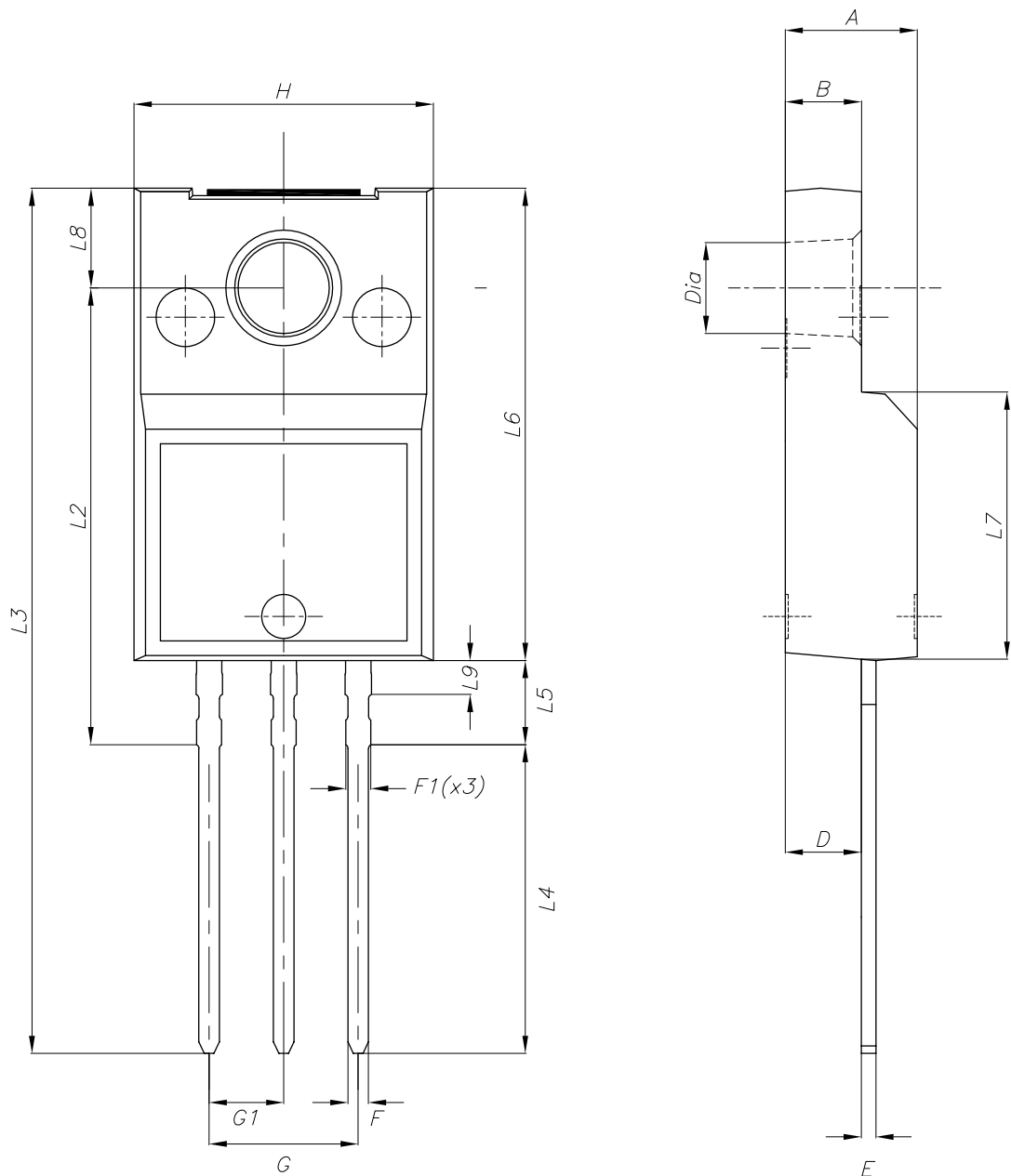


## 4 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 TO-220FP ultra narrow leads package information

Figure 20. TO-220FP ultra narrow leads package outline



8576148\_2

**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

## Revision history

**Table 10. Document revision history**

Date	Revision	Changes
10-Jan-2019	1	First release.

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2019 STMicroelectronics – All rights reserved