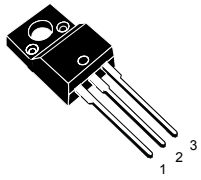
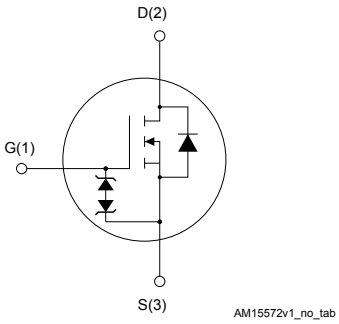
STF12NK60Z

Datasheet

N-channel 600 V, 530 mΩ typ., 10 A SuperMESH Power MOSFET in a TO-220FP package



TO-220FP



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STF12NK60Z	600 V	640 mΩ	10 A

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Zener-protected

Applications

- Switching applications

Description

This high-voltage device is a Zener-protected N-channel Power MOSFET developed using the SuperMESH technology by STMicroelectronics, an optimization of the well-established PowerMESH. In addition to a significant reduction in on-resistance, this device is designed to ensure a high level of dv/dt capability for the most demanding applications.

Product status link
STF12NK60Z

Product summary	
Order code	STF12NK60Z
Marking	F12NK60Z
Package	TO-220FP
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	±30	V
I_D	Drain current (continuous) at T_C = 25 °C	10	A
	Drain current (continuous) at T_C = 100 °C	6.3	
I_{DM}(1)	Drain current (pulsed)	40	A
P_{TOT}	Total power dissipation at T_C = 25 °C	35	W
ESD	Gate-source human body model (R = 1.5 kΩ, C = 100 pF)	2.5	kV
dv/dt(2)	Peak diode recovery voltage slope	4.5	V/ns
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	Maximum operating junction temperature	150	

1. *Pulse width is limited by safe operating area.*
2. *I_{SD} ≤ 10 A, di/dt ≤ 200 A/µs, V_{DD} = 480 V.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	3.6	°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 not-repetitive (pulse width limited by T_J max.)	10	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	260	mJ

2 Electrical characteristics

T_C = 25 °C unless otherwise specified.

Table 4. 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, V_{DS} = 600 V	-	-	1	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_C = 125 °C(1)	-	-	50	
I_{GSS}	Gate-body leakage current	V_{GS} = ±20 V, V_{DS} = 0 V	-	-	±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 100 µA	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 5 A	-	530	640	mΩ

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} = 25 V, f = 1 MHz, V_{GS} = 0 V	-	1740	-	pF
C_{oss}	Output capacitance		-	195	-	pF
C_{rss}	Reverse transfer capacitance		-	49	-	pF
$C_{oss\ eq.}$(1)	Equivalent output capacitance	V_{GS} = 0 V, V_{DS} = 0 to 480 V	-	101	-	pF
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 10 A, V_{GS} = 0 to 10 V (see the Figure 14. Test circuit for gate charge behavior)	-	59	-	nC
Q_{gs}	Gate-source charge		-	10	-	nC
Q_{gd}	Gate-drain charge		-	32	-	nC

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 6. Switching times

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see the Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	22.5	-	ns
t_r	Rise time		-	18.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	55	-	ns
t_f	Fall time		-	31.5	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	10	A
I_{SDM}(1)	Source-drain current (pulsed)		-	-	40	A
V_{SD}(2)	Forward on voltage	I_{SD} = 10 A, V_{GS} = 0 V	-	-	1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 10 A, di/dt = 100 A/µs,	-	358	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 50 V	-	3	-	µC
I_{RRM}	Reverse recovery current	(see the Figure 15. Test circuit for inductive load switching and diode recovery times)	-	17	-	A
t_{rr}	Reverse recovery time	I_{SD} = 10 A, di/dt = 100 A/µs,	-	460	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 50 V, T_J = 150 °C	-	4.2	-	µC
I_{RRM}	Reverse recovery current	(see the Figure 15. Test circuit for inductive load switching and diode recovery times)	-	18.2	-	A

1. *Pulse width is limited by safe operating area.*
2. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%.*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

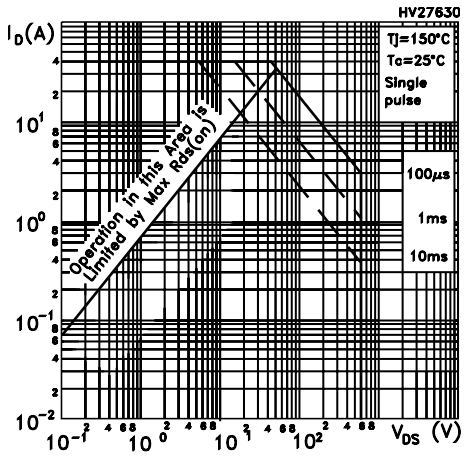


Figure 2. Normalized transient thermal impedance

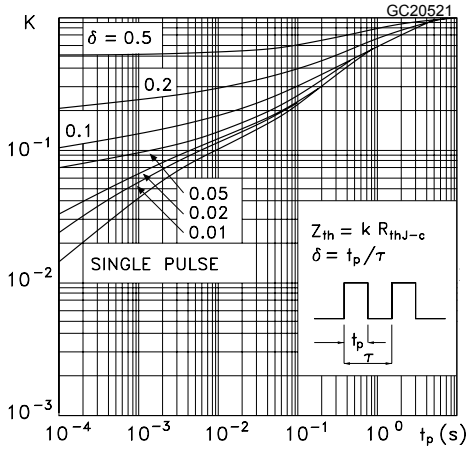


Figure 3. Typical output characteristics

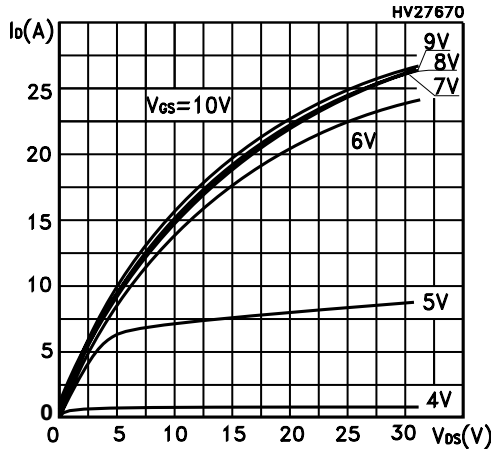


Figure 4. Typical transfer characteristics

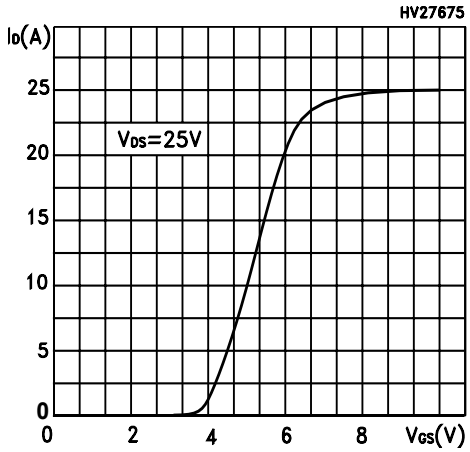


Figure 5. Typical gate charge characteristics

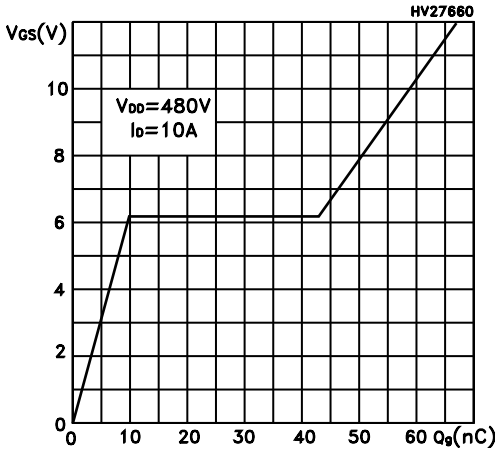


Figure 6. Typical drain-source on-resistance

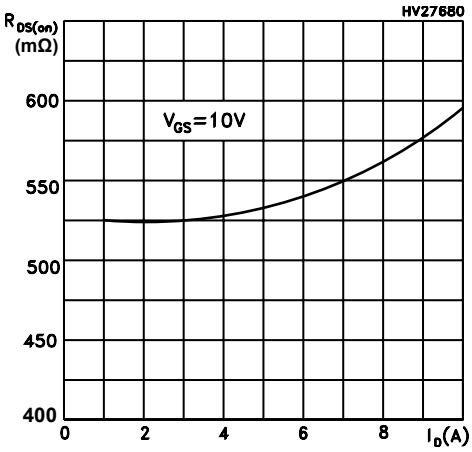


Figure 7. Typical capacitance characteristics

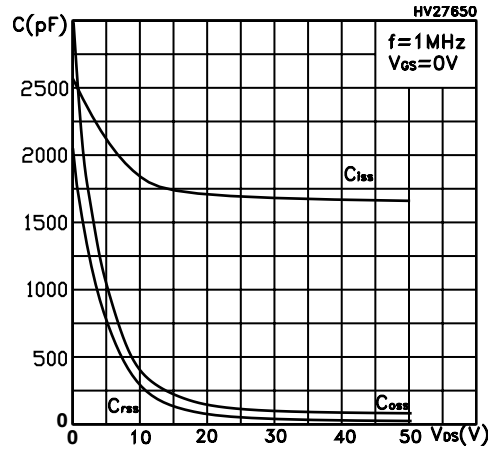


Figure 8. Normalized gate threshold vs temperature

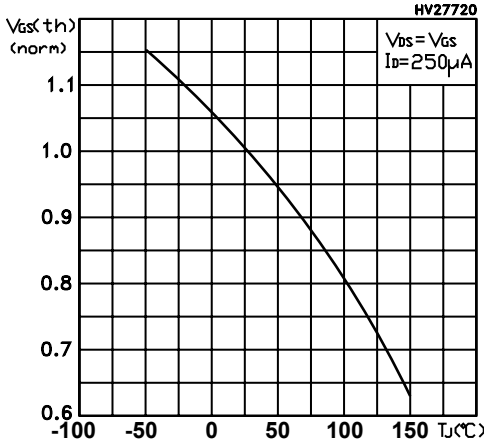


Figure 9. Normalized on-resistance vs temperature

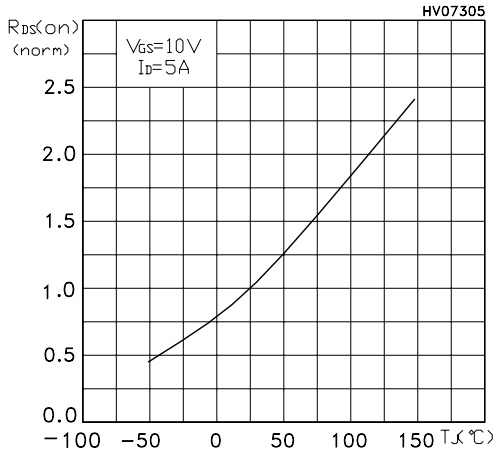


Figure 10. Normalized breakdown voltage vs temperature

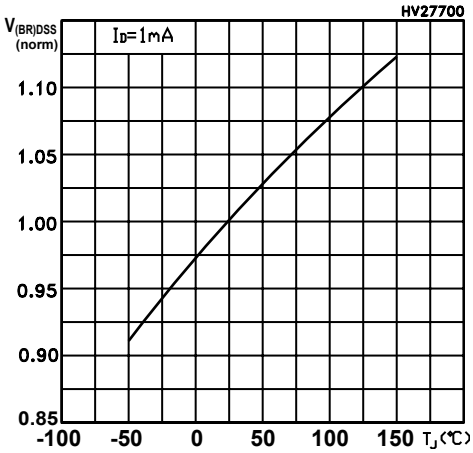


Figure 11. Maximum avalanche energy vs temperature

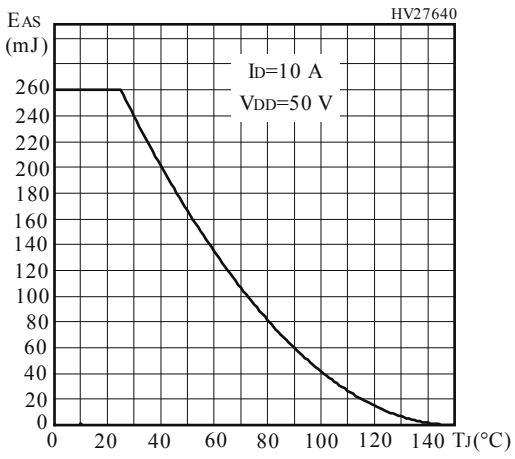
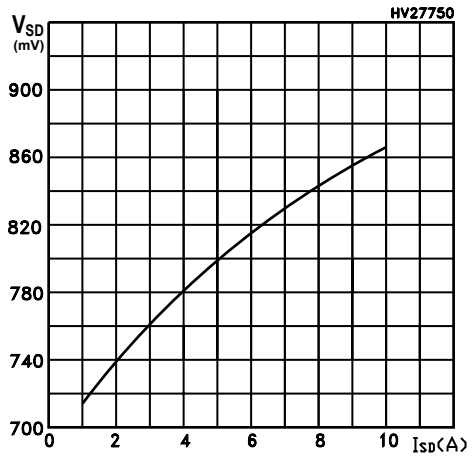
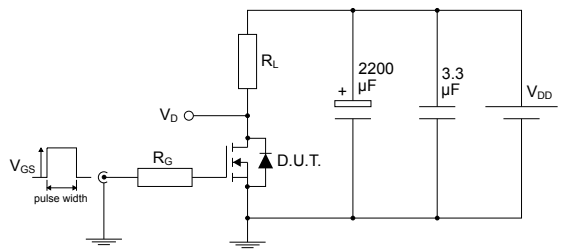


Figure 12. Typical reverse diode forward characteristics



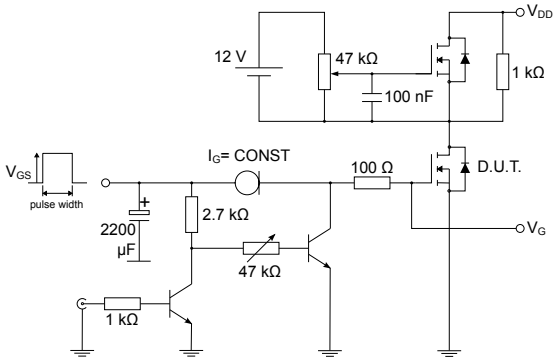
3 Test circuits

Figure 13. Test circuit for resistive load switching times



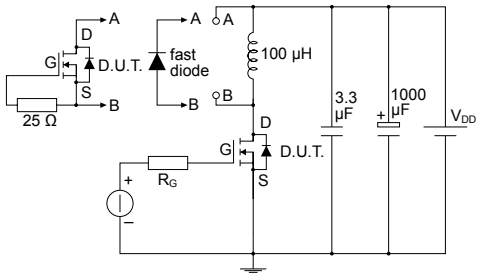
AM01468v1

Figure 14. Test circuit for gate charge behavior



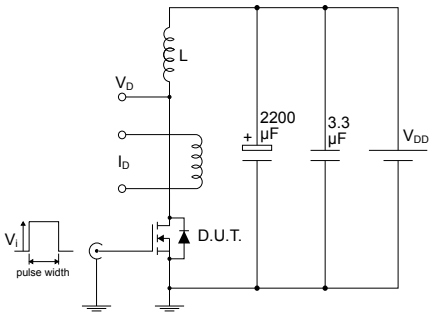
AM01469v1

Figure 15. Test circuit for inductive load switching and diode recovery times



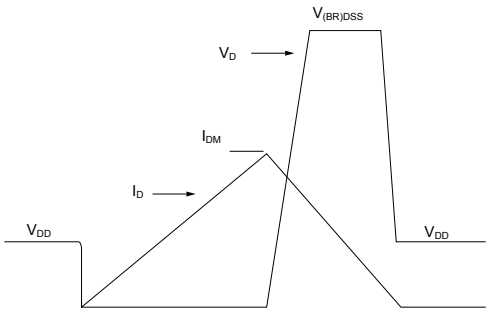
AM01470v1

Figure 16. Unclamped inductive load test circuit



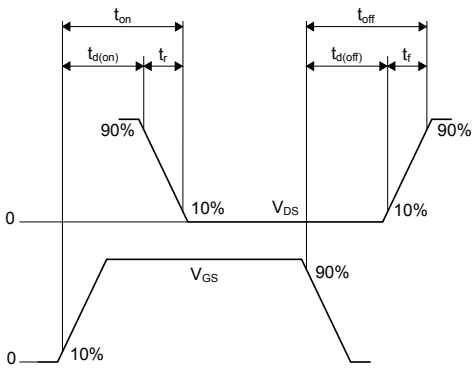
AM01471v1

Figure 17. Unclamped inductive waveform



AM01472v1

Figure 18. Switching time waveform



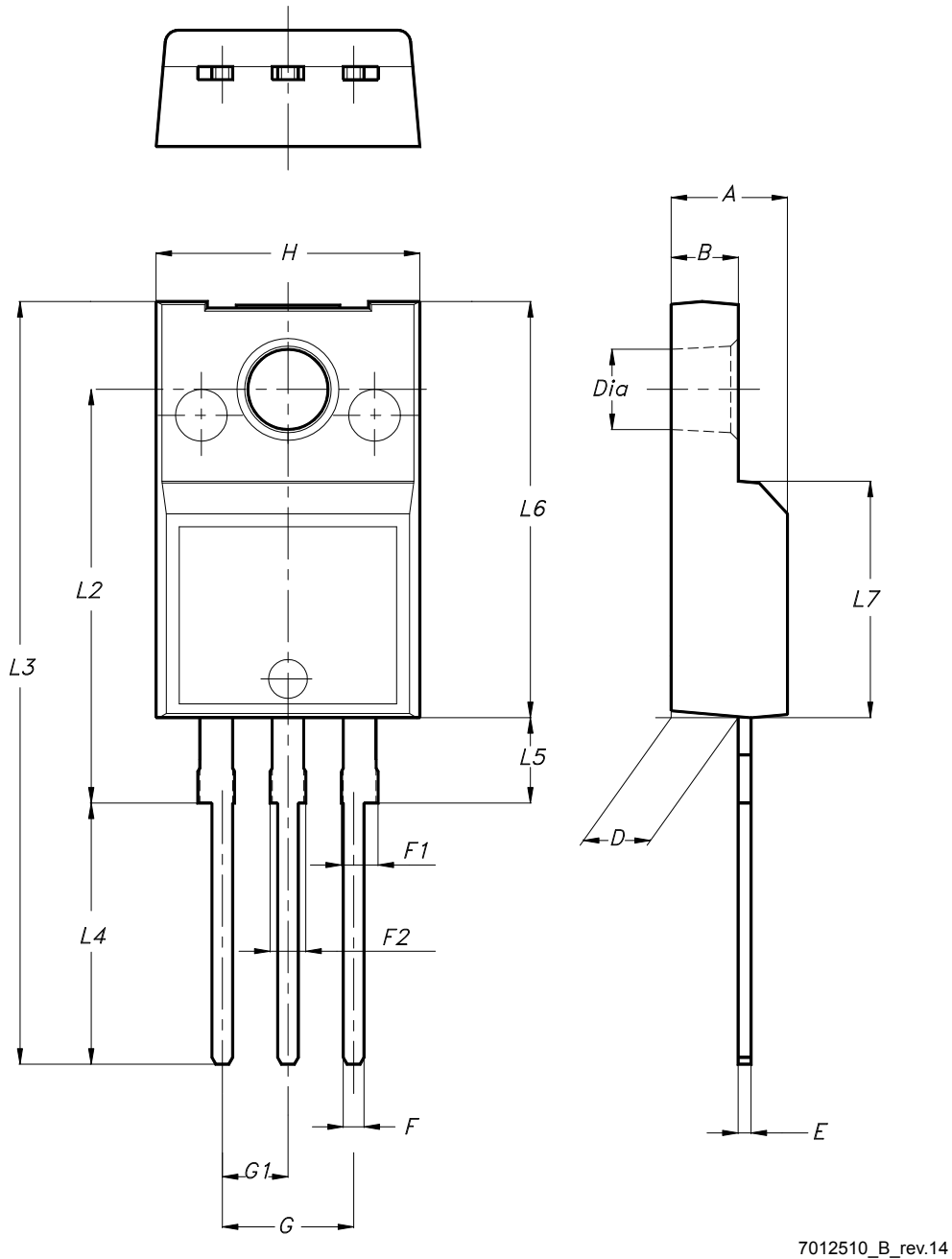
AM01473v1

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 19. TO-220FP type B package outline



7012510_B_rev.14

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
12-Apr-2004	1	First release.
06-Sep-2005	2	Inserted ecopack indication.
13-Sep-2005	3	Final version.
05-Sep-2006	4	The document has been reformatted.
26-Apr-2007	5	The document has been updated on *Section 1: Electrical ratings*.
25-Jan-2008	6	Modified: dv/dt value on *Table 2: Absolute maximum ratings*.
13-Oct-2009	7	Added new package, mechanical data: TO-247.
11-Feb-2026	8	Removed order code STP12NK60Z and STW12NK60Z. 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** 7
4 **Package information** 8
4.1 TO-220FP type B package information 8
Revision history 10

IMPORTANT NOTICE – 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.

In the event of any conflict between the provisions of this document and the provisions of any contractual arrangement in force between the purchasers and ST, the provisions of such contractual arrangement shall prevail.

The 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 acknowledgment.

The 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 the 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.

If the purchasers identify an ST product that meets their functional and performance requirements but that is not designated for the purchasers' market segment, the purchasers shall contact ST for more information.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. 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.

© 2026 STMicroelectronics – All rights reserved