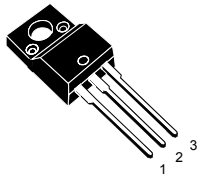
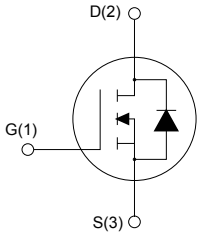
N-channel 800 V, 0.95 Ω typ., 6.5 A MDmesh Power MOSFET in a TO-220FP package



TO-220FP



AM01475v1_noZen_noTab

Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STF7NM80	800 V	1.05 Ω	6.5 A

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Applications

- Switching applications

Description

This N-channel Power MOSFET is developed using STMicroelectronics' revolutionary MDmesh technology, which associates the multiple drain process with the company's PowerMESH horizontal layout. This device offers extremely low on-resistance, high dv/dt, and excellent avalanche characteristics. Using STMicroelectronics's proprietary strip technique, this Power MOSFET boasts an overall dynamic performance that is superior to similar products on the market.

Product status link
STF7NM80

Product summary	
Order code	STF7NM80
Marking	F7NM80
Package	TO-220FP
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	800	V
V_{GS}	Gate-source voltage	±30	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	6.5	A
	Drain current (continuous) at T_C = 100 °C	4	
I_{DM}(1)(2)	Drain current (pulsed)	26	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
T_{stg}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		°C

1. *This value is limited by maximum junction temperature.*
2. *Pulse width is limited by safe operating area.*

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_{AS}	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_{AS}, V_{DD} = 50 V)	240	mJ

2 Electrical characteristics

T_C = 25 °C unless otherwise specified.

Table 4. On/off states

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0 V	800			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 800 V			10	µA
		V_{GS} = 0 V, V_{DS} = 800 V, T_C = 125 °C(1)			100	
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, V_{GS} = ±30 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 3.25 A		0.95	1.05	Ω

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

Table 5. Dynamic

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	620	-	pF
C_{oss}	Output capacitance		-	460	-	pF
C_{rss}	Reverse transfer capacitance		-	15	-	pF
R_g	Gate input resistance	f = 1 MHz open drain	-	7	-	Ω
Q_g	Total gate charge	V_{DD} = 640 V, I_D = 6.5 A, V_{GS} = 0 to 10 V (see Figure 13. Test circuit for gate charge behavior)	-	18	-	nC
Q_{gs}	Gate-source charge		-	4	-	nC
Q_{gd}	Gate-drain charge		-	11	-	nC

Table 6. Switching times

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 400 V, I_D = 3.25 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	20	-	ns
t_r	Rise time		-	8	-	ns
$t_{d(off)}$	Turn-off delay time		-	35	-	ns
t_f	Fall time		-	10	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		6.5	A
I_{SDM}(1)	Source-drain current (pulsed)		-		26	A
V_{SD}(2)	Forward on voltage	I_{SD} = 6.5 A, V_{GS} = 0 V	-		1.3	V
t_{rr}	Reverse recovery time	I_{SD} = 6.5 A, di/dt = 100 V	-	460		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 50 V (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	4		µC
I_{RRM}	Reverse recovery current		-	17		A
t_{rr}	Reverse recovery time	I_{SD} = 6.5 A, di/dt = 100 A/µs	-	680		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 50 V (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	6		µC
I_{RRM}	Reverse recovery current		-	17		A

1. *Pulse width 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

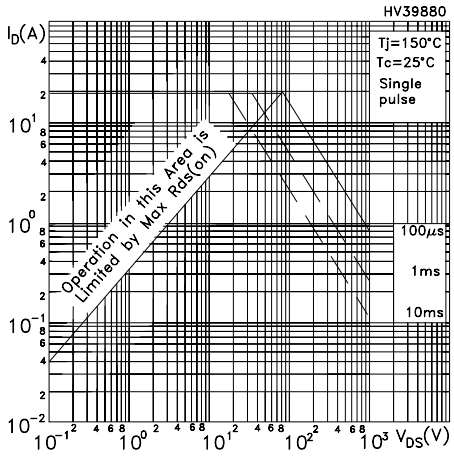


Figure 2. Thermal impedance

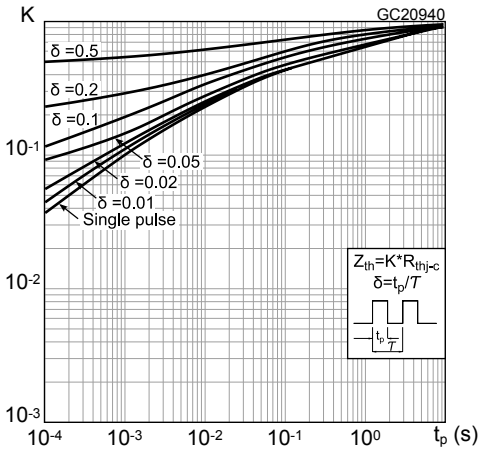


Figure 3. Output characterisics

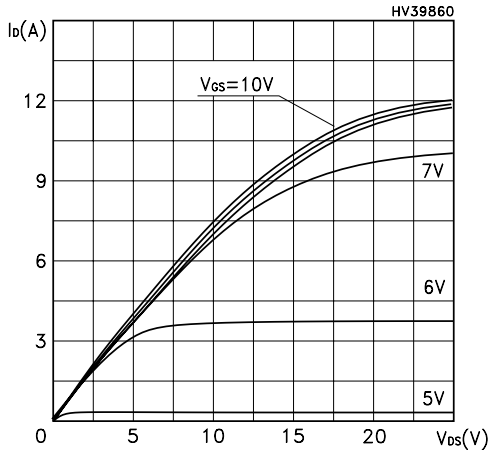


Figure 4. Transfer characteristics

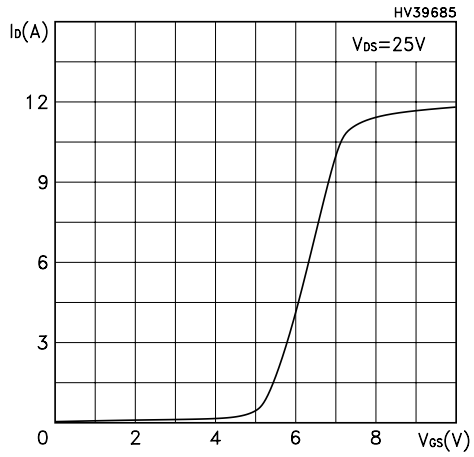


Figure 5. Static drain-source on-resistance

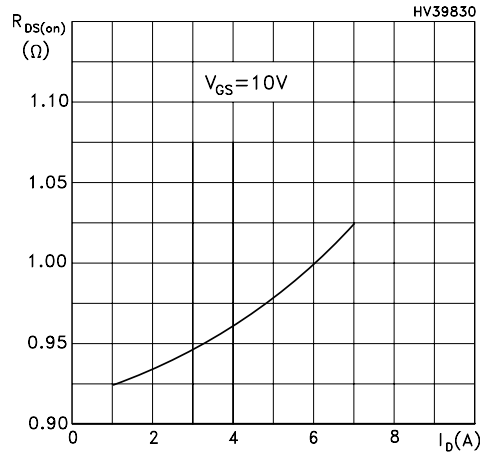


Figure 6. Gate charge vs gate-source voltage

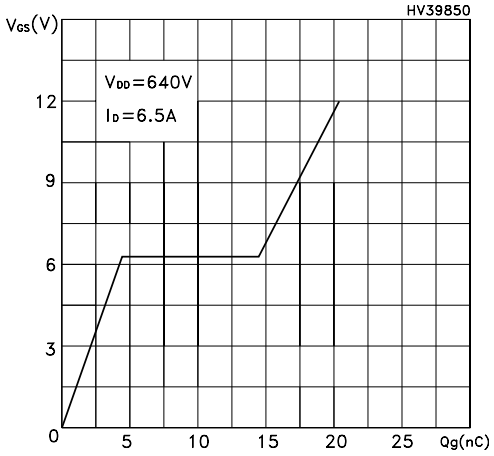


Figure 7. Capacitance variations

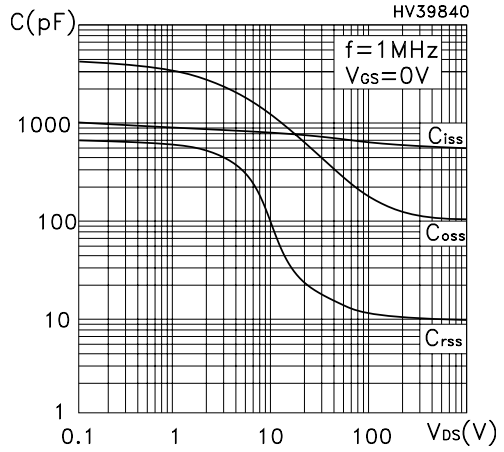


Figure 8. Normalized gate threshold voltage vs temperature

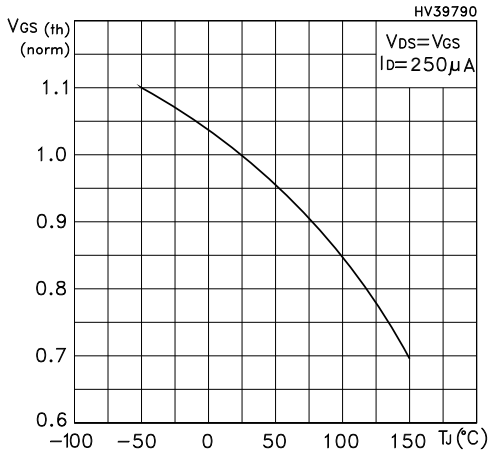


Figure 9. Normalized on-resistance vs temperature

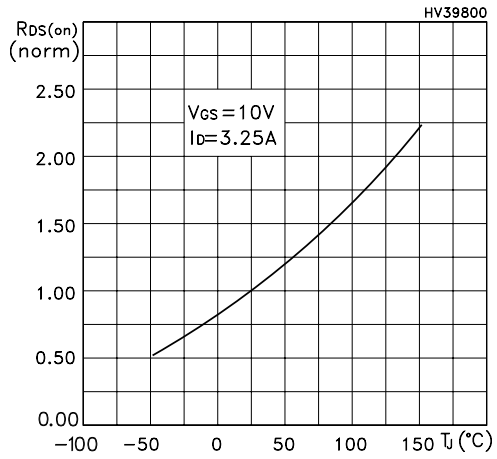


Figure 10. Source-drain diode forward characteristics

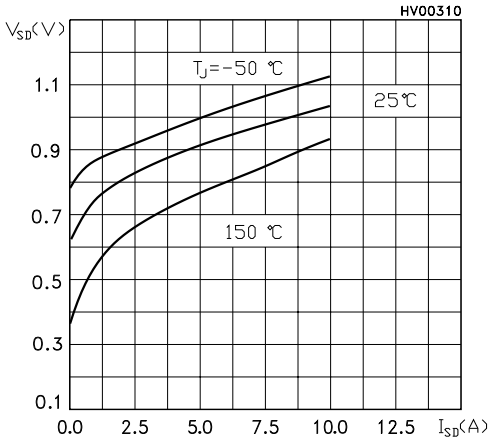
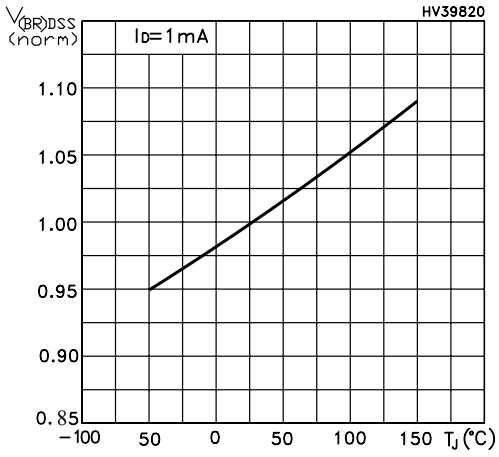
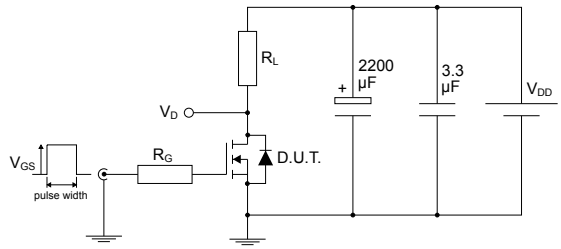


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature



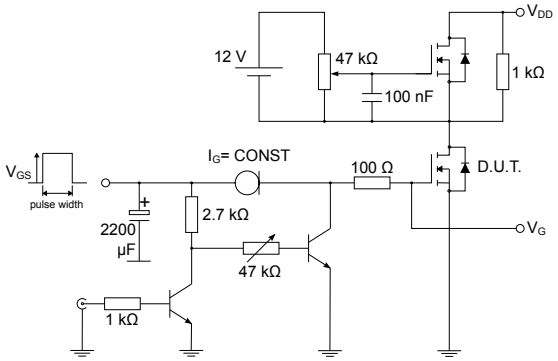
3 Test circuits

Figure 12. Test circuit for resistive load switching times



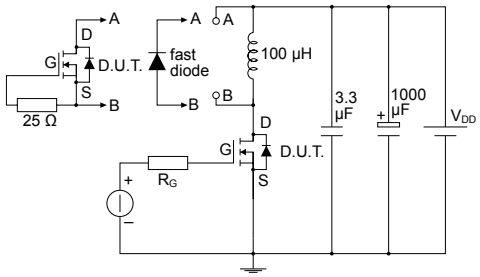
AM01468v1

Figure 13. Test circuit for gate charge behavior



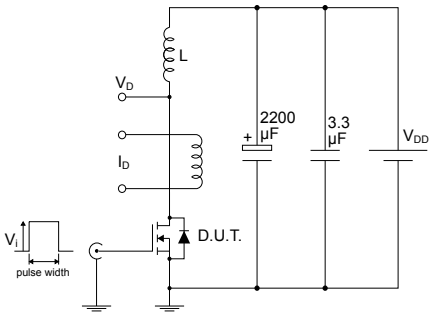
AM01469v1

Figure 14. Test circuit for inductive load switching and diode recovery times



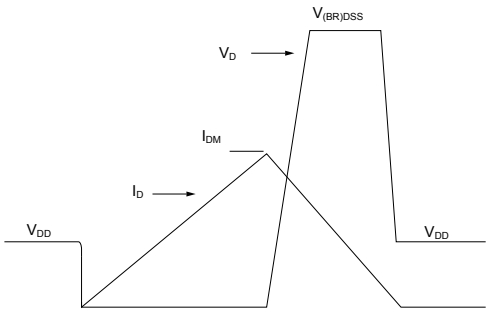
AM01470v1

Figure 15. Unclamped inductive load test circuit



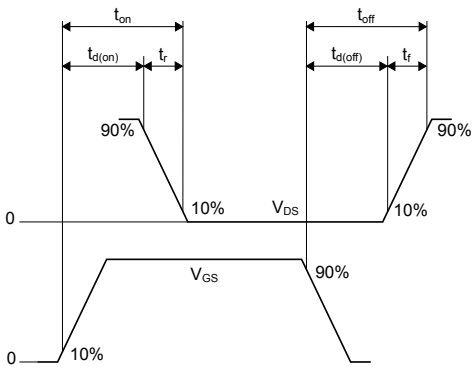
AM01471v1

Figure 16. Unclamped inductive waveform



AM01472v1

Figure 17. 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. ECOPACK is an ST trademark.

4.1 TO-220FP type B package information

Figure 18. TO-220FP type B package outline

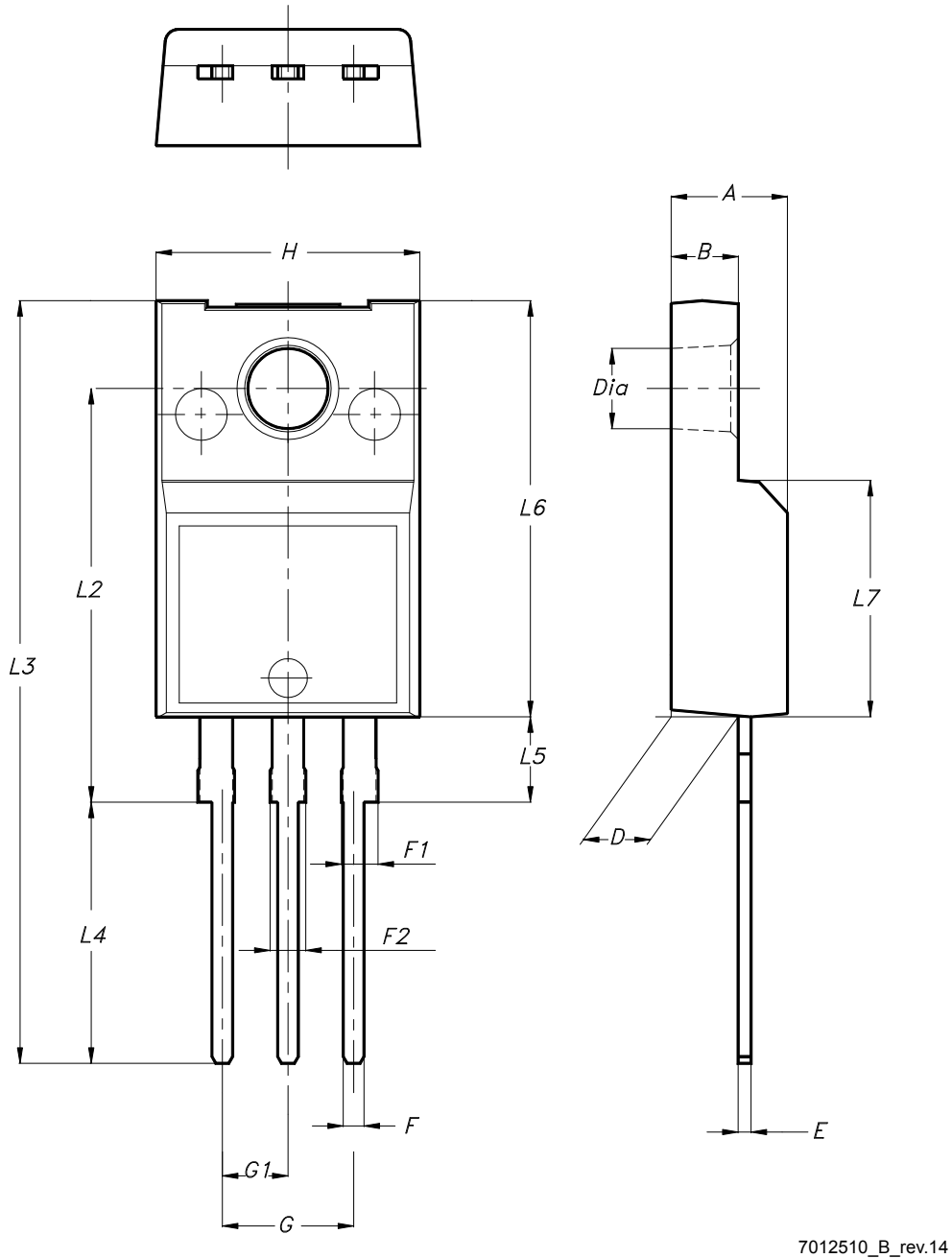


Table 8. **TO-220FP type B package mechanical data**

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
30-May-2023	1	First release. The part number STF7NM80 was previously inserted in the DS4854.

Contents