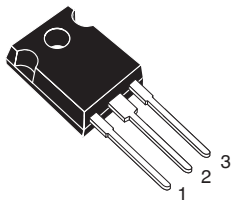
STW57N65M5, STWA57N65M5

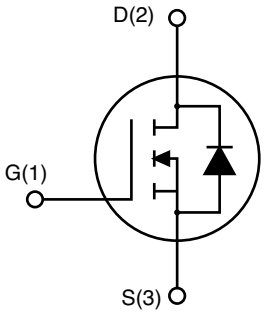
N-channel 650 V, 0.056 Ω typ., 42 A MDmesh™ V Power MOSFETs in TO-247 and TO-247 long leads packages

Datasheet - production data



TO-247
TO-247 long leads

Figure 1. Internal schematic diagram



AM01475v1

Features

Order codes	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max	I_D
STW57N65M5	710 V	0.063 Ω	42 A
STWA57N65M5			

- Worldwide best $R_{DS(on)}$*area amongst the silicon based devices
- Higher V_{DSS} rating, high dv/dt capability
- Excellent switching performance
- Easy to drive, 100% avalanche tested

Applications

- Switching applications

Description

These devices are N-channel MDmesh™ V Power MOSFETs based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

Table 1. Device summary

Order codes	Marking	Packages	Packaging
STW57N65M5	57N65M5	TO-247	Tube
STWA57N65M5		TO-247 long leads	

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	42	A
I_D	Drain current (continuous) at T_C = 100 °C	26.5	A
I_{DM} (1)	Drain current (pulsed)	168	A
P_{TOT}	Total dissipation at T_C = 25 °C	250	W
I_{AR}	Max current during repetitive or single pulse avalanche (pulse width limited by T_{JMAX})	11	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25°C, I_D = I_{AR}, V_{DD} = 50V)	960	mJ
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
dv/dt (3)	MOSFET dv/dt ruggedness	50	V/ns
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Max. operating junction temperature	150	°C

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 42$ A, di/dt $\leq$ 400 A/μs, $V_{DS(peak)} < V_{(BR)DSS}$, V_{DD} = 400 V
3. $V_{DS} \leq 520$ V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.50	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	50	°C/W

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	650			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 650 V V_{DS} = 650 V, T_C=125 °C			1 100	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 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 = 21 A		0.056	0.063	Ω

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	-	4200	-	pF
C_{oss}	Output capacitance		-	115		pF
C_{rss}	Reverse transfer capacitance		-	9		pF
$C_{o(er)}$(1)	Equivalent output capacitance energy related	V_{GS} = 0, V_{DS} = 0 to 520 V	-	93	-	pF
$C_{o(tr)}$(2)	Equivalent output capacitance time related		-	303	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D=0	-	1.3	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 21 A, V_{GS} = 10 V (see *Figure 17* and *20*)	-	98	-	nC
Q_{gs}	Gate-source charge		-	23		nC
Q_{gd}	Gate-drain charge		-	40		nC

1. $C_{o(er)}$ 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}
2. $C_{o(tr)}$ 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}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(V)}$	Voltage delay time	V_{DD} = 400 V, I_D = 28 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 17* and *20*)	-	73	-	ns
$t_{r(V)}$	Voltage rise time		-	15	-	ns
$t_{f(i)}$	Current fall time		-	12	-	ns
$t_{c(off)}$	Crossing time		-	19	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		42 168	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 42 A, V_{GS} = 0	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 42 A, di/dt = 100 A/µs V_{DD} = 100 V (see *Figure 17*)	-	418		ns
Q_{rr}	Reverse recovery charge		-	8		µC
I_{RRM}	Reverse recovery current		-	40		A
t_{rr}	Reverse recovery time	I_{SD} = 42 A, di/dt = 100 A/µs V_{DD} = 100 V, T_j = 150 °C (see *Figure 17*)	-	528		ns
Q_{rr}	Reverse recovery charge		-	12		µC
I_{RRM}	Reverse recovery current		-	44		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 2. Safe operating area

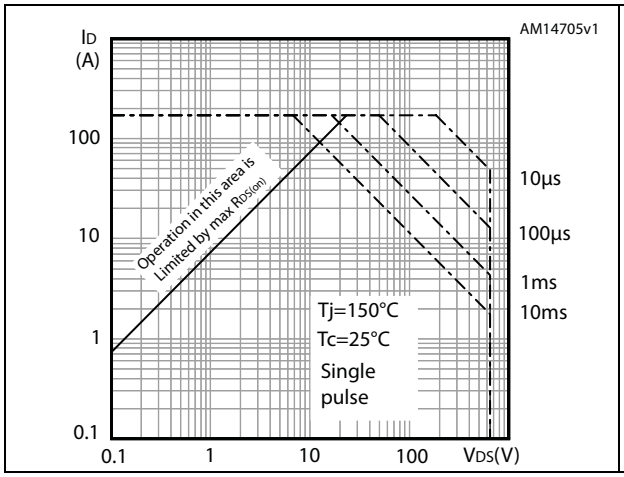


Figure 3. Thermal impedance

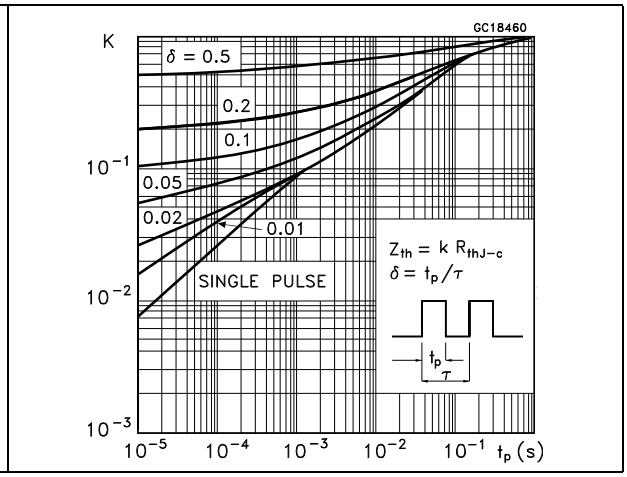


Figure 4. Output characteristics

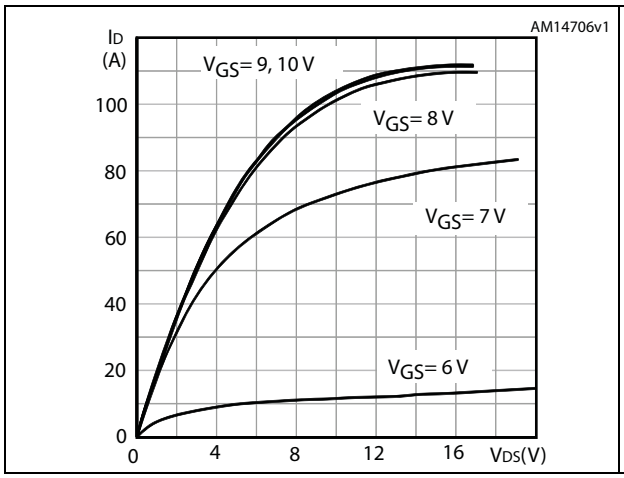


Figure 5. Transfer characteristics

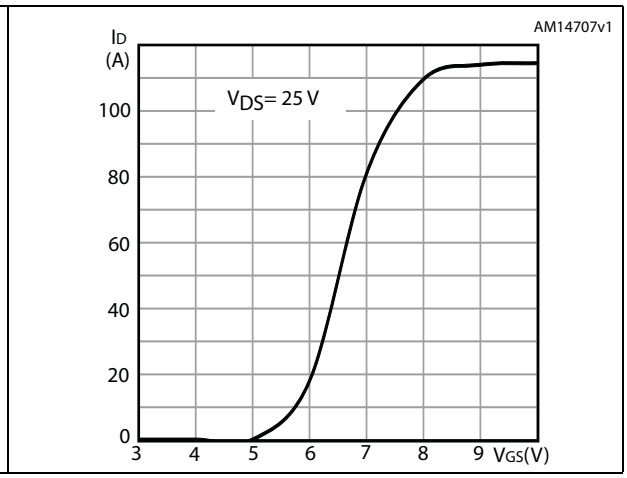


Figure 6. Gate charge vs gate-source voltage

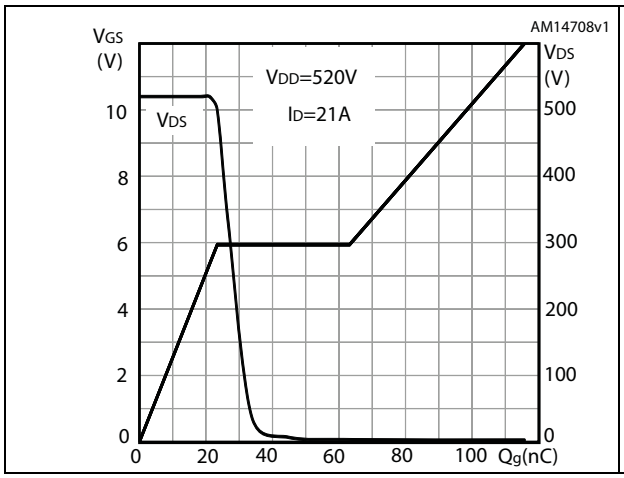


Figure 7. Static drain-source on-resistance

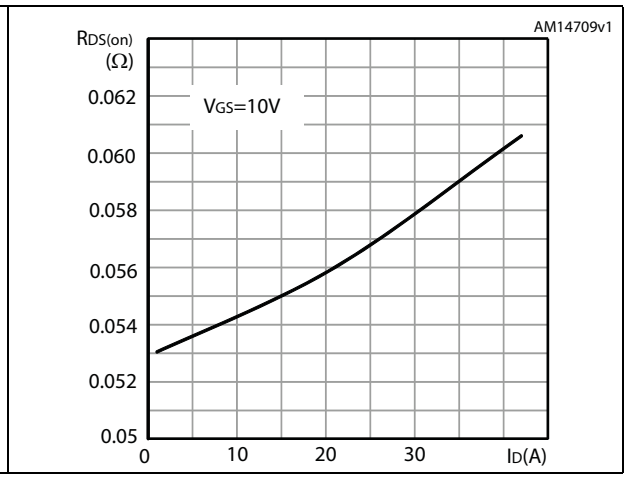


Figure 8. Capacitance variations

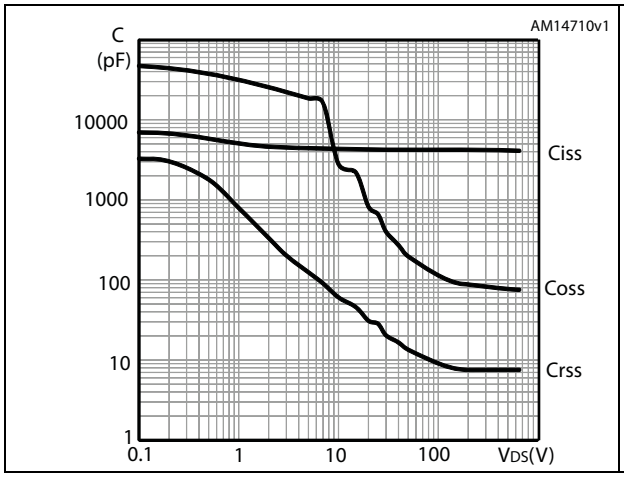


Figure 9. Output capacitance stored energy

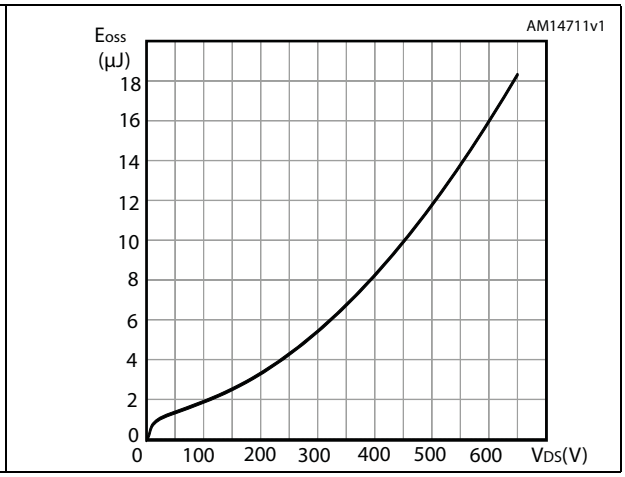


Figure 10. Normalized gate threshold voltage vs temperature

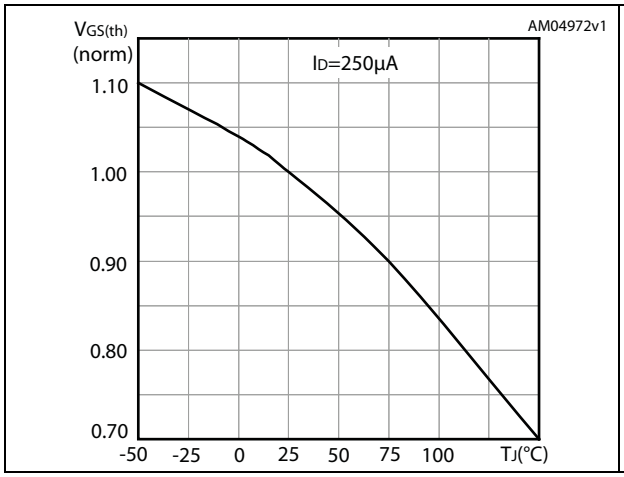


Figure 11. Normalized on-resistance vs temperature

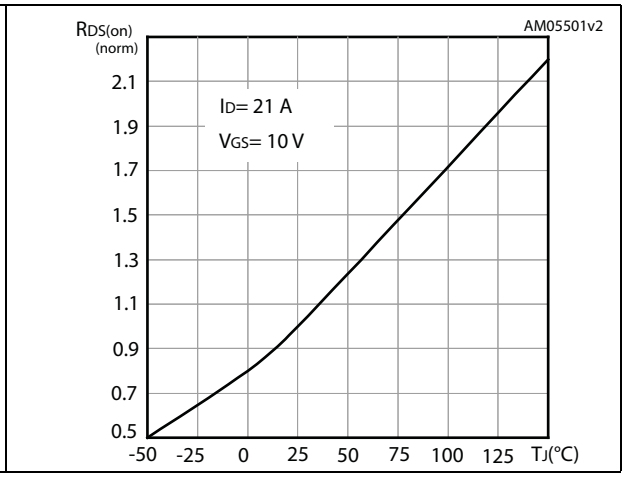


Figure 12. Source-drain diode forward characteristics

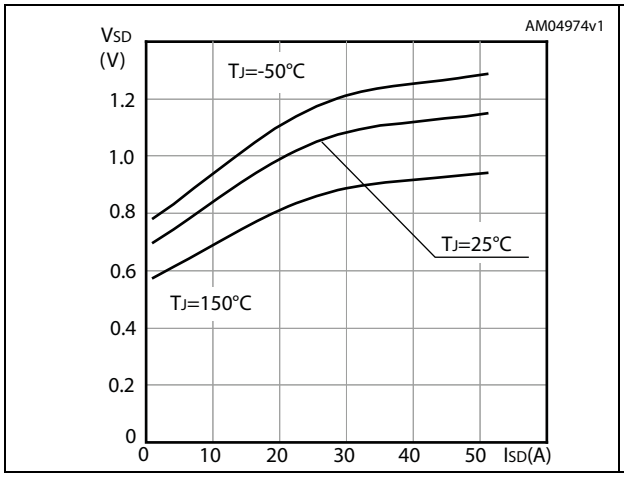


Figure 13. Normalized V_{DS} vs temperature

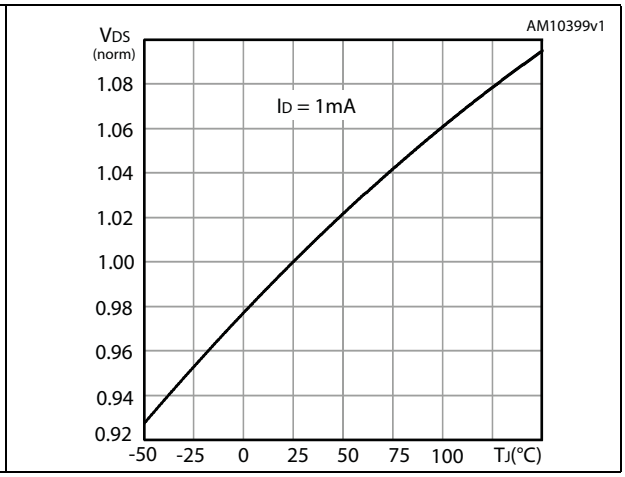
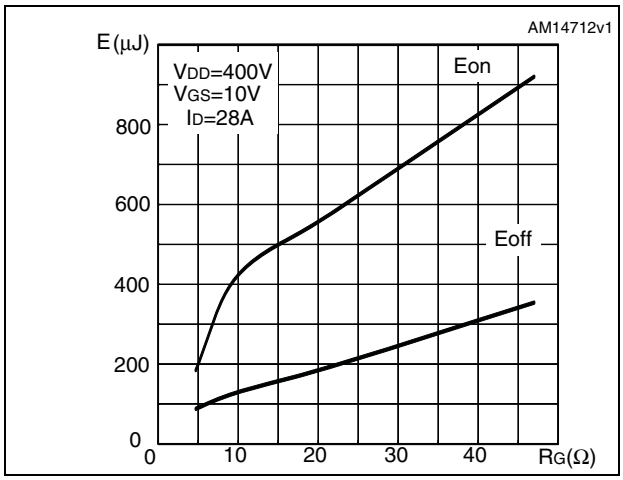


Figure 14. Switching losses vs gate resistance (1)



1. Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 15. Switching times test circuit for resistive load

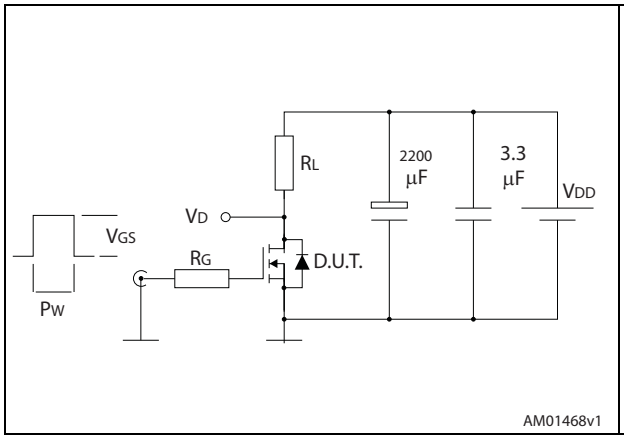


Figure 16. Gate charge test circuit

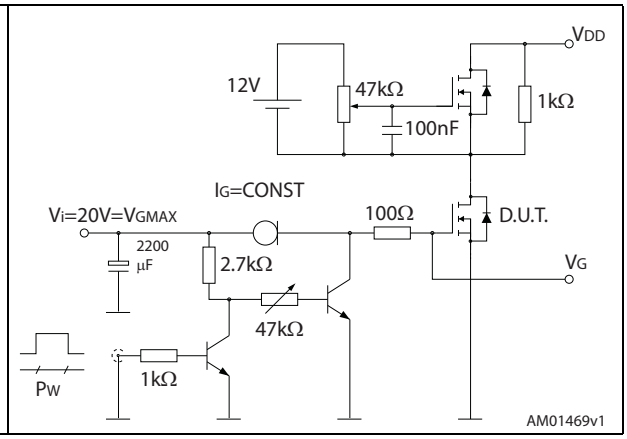


Figure 17. Test circuit for inductive load switching and diode recovery times

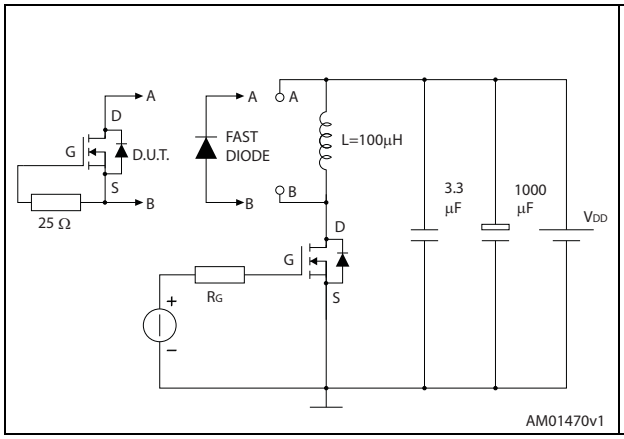


Figure 18. Unclamped inductive load test circuit

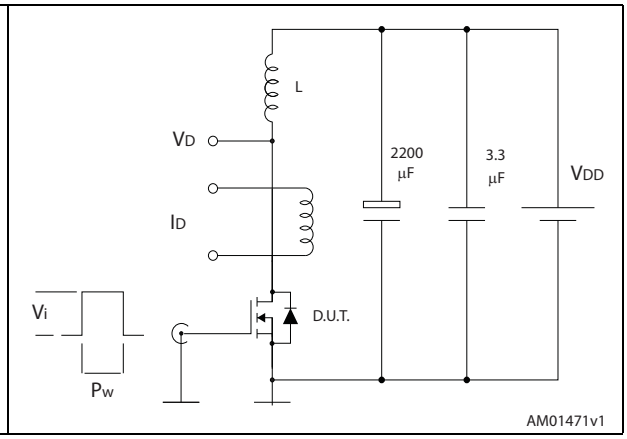


Figure 19. Unclamped inductive waveform

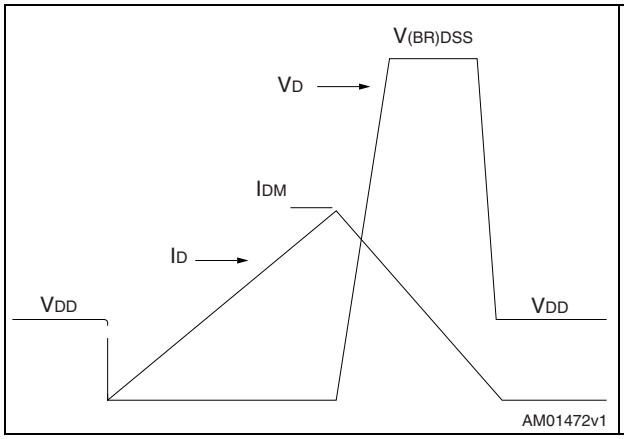
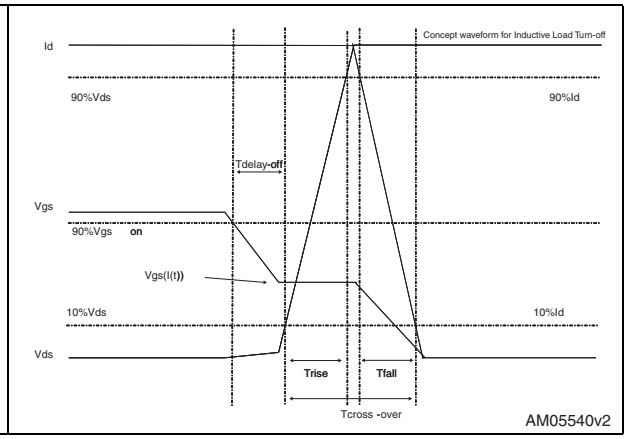


Figure 20. Switching time waveform



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.

Table 8. TO-247 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

Figure 21. TO-247 drawing

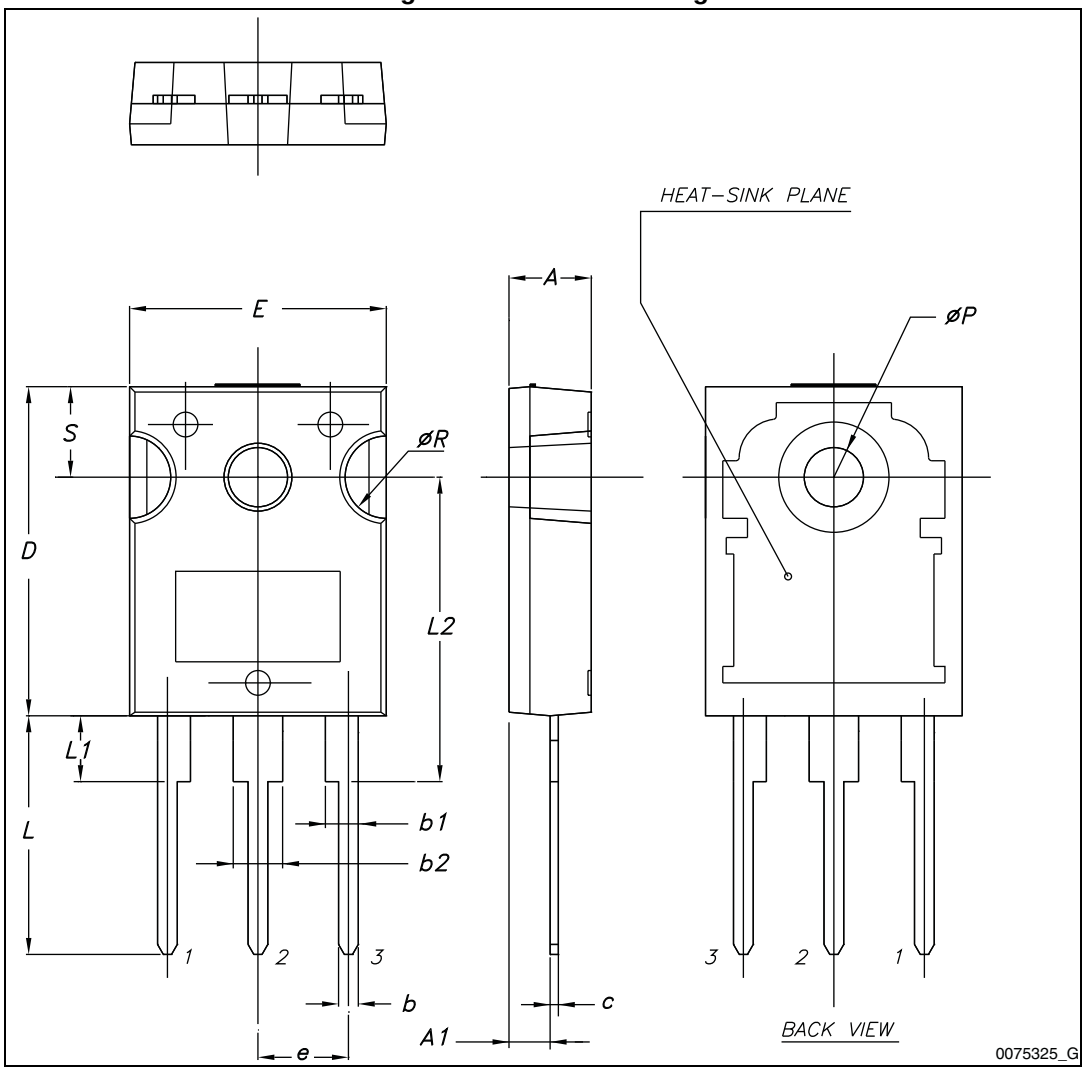
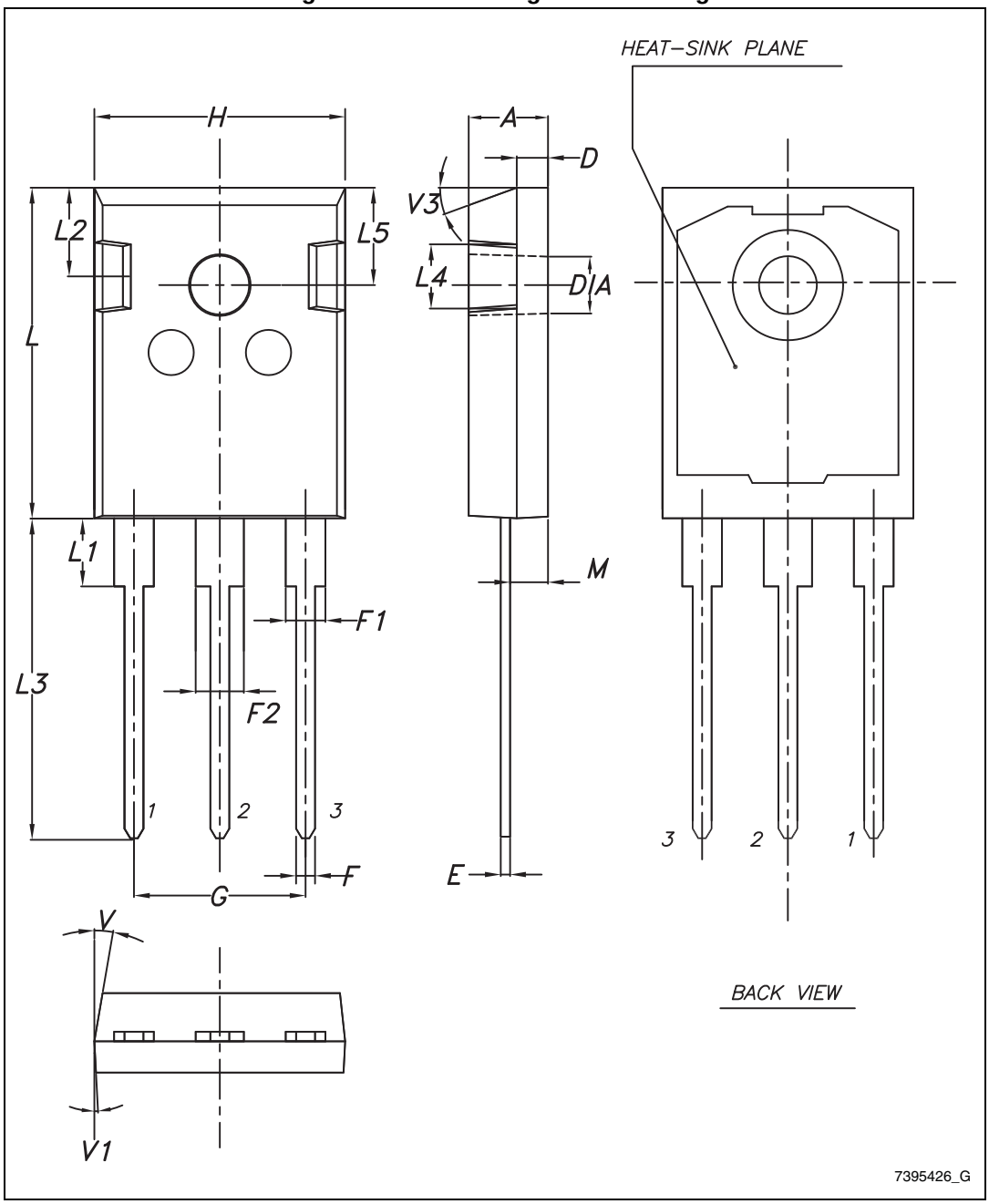


Table 9. TO-247 long leads mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90		5.15
D	1.85		2.10
E	0.55		0.67
F	1.07		1.32
F1	1.90		2.38
F2	2.87		3.38
G	10.90 BSC		
H	15.77		16.02
L	20.82		21.07
L1	4.16		4.47
L2	5.49		5.74
L3	20.05		20.30
L4	3.68		3.93
L5	6.04		6.29
M	2.25		2.55
V		10°	
V1		3°	
V3		20°	
Dia.	3.55		3.66

Figure 22. TO-247 long leads drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
17-Dec-2012	1	First release.
13-Dec-2013	2	– Modified: *Figure 1* – Added: MOSFET dv/dt ruggedness parameter in *Table 2* and *note 3* – Modified: test conditions $C_{o(er)}$ and $C_{o(tr)}$ in *Table 5* – Updated: the entire *Section 2.1: Electrical characteristics (curves)* except *Figure 14: Switching losses vs gate resistance* – Updated: *Section 4: Package mechanical data* – Minor text changes

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST’s terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST’S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER’S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR “AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL” INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.
Information in this document supersedes and replaces all information previously supplied.
The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for MOSFET ***category:***

Click to view products by STMicroelectronics ***manufacturer:***

Other Similar products are found below :

614233C 648584F IRFD120 JANTX2N5237 FCA20N60_F109 FDZ595PZ 2SK2545(Q,T) 405094E 423220D TPCC8103,L1Q(CM MIC4420CM-TR VN1206L SBVS138LT1G 614234A 715780A NTNS3166NZT5G SSM6J414TU,LF(T 751625C BUK954R8-60E DMN3404LQ-7 NTE6400 SQJ402EP-T1-GE3 2SK2614(TE16L1,Q) 2N7002KW-FAI DMN1017UCP3-7 EFC2J004NUZTDG ECH8691-TL-W FCAB21350L1 P85W28HP2F-7071 DMN1053UCP4-7 NTE221 NTE2384 NTE2903 NTE2941 NTE2945 NTE2946 NTE2960 NTE2967 NTE2969 NTE2976 NTE455 NTE6400A NTE2910 NTE2916 NTE2956 NTE2911 DMN2080UCB4-7 TK10A80W,S4X(S SSM6P69NU,LF DMP22D4UFO-7B