



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





STB32N65M5, STF32N65M5, STI32N65M5 STP32N65M5, STW32N65M5

N-channel 650 V, 0.095 Ω , 24 A, MDmesh™ V Power MOSFET
in D²PAK, I²PAK, TO-220FP, TO-220, TO-247

Features

Order codes	V _{DSS} @ T _{Jmax}	R _{DS(on)} max	I _D
STB32N65M5	710 V	< 0.119 Ω	24 A
STF32N65M5	710 V	< 0.119 Ω	24 A ⁽¹⁾
STI32N65M5	710 V	< 0.119 Ω	24 A
STP32N65M5	710 V	< 0.119 Ω	24 A
STW32N65M5	710 V	< 0.119 Ω	24 A

1. Limited only by maximum temperature allowed

- Worldwide best R_{DS(on)}* area
- 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	Package	Packaging
STB32N65M5	32N65M5	D ² PAK	Tape and reel
STF32N65M5	32N65M5	TO-220FP	Tube
STI32N65M5	32N65M5	I ² PAK	Tube
STP32N65M5	32N65M5	TO-220	Tube
STW32N65M5	32N65M5	TO-247	Tube

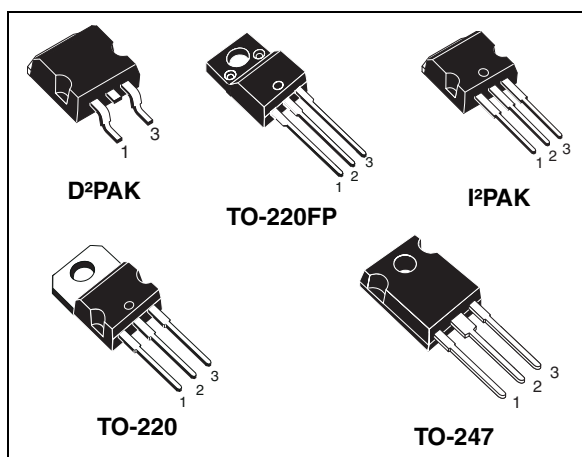
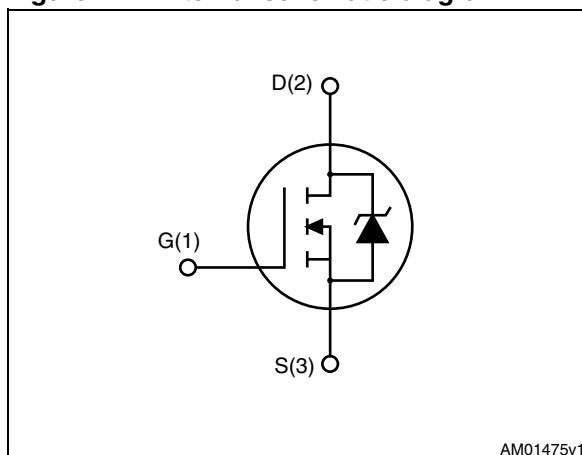


Figure 1. Internal schematic diagram



AM01475v1

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
2.1	Electrical characteristics (curves)	6
3	Test circuits	9
4	Package mechanical data	10
5	Packaging mechanical data	19
6	Revision history	21

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, D ² PAK TO-247, I ² PAK	TO-220FP	
V _{GS}	Gate- source voltage	± 25		V
I _D	Drain current (continuous) at T _C = 25 °C	24	24 ⁽¹⁾	A
I _D	Drain current (continuous) at T _C = 100 °C	15	15 ⁽¹⁾	A
I _{DM} ⁽²⁾	Drain current (pulsed)	96	96 ⁽¹⁾	A
P _{TOT}	Total dissipation at T _C = 25 °C	150	35	W
I _{AR}	Max current during repetitive or single pulse avalanche (pulse width limited by T _{JMAX})	8		A
E _{AS}	Single pulse avalanche energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	650		mJ
dv/dt ⁽³⁾	Peak diode recovery voltage slope	15		V/ns
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T _C =25 °C)	2500		V
T _{stg}	Storage temperature	- 55 to 150		°C
T _j	Max. operating junction temperature	150		°C

- Limited only by maximum temperature allowed
- Pulse width limited by safe operating area
- I_{SD} ≤ 24 A, di/dt = 400 A/μs, peak V_{DS} < V_{(BR)DSS}

Table 3. Thermal data

Symbol	Parameter	Value					Unit
		D ² PAK	TO-220FP	I ² PAK	TO-220	TO-247	
R _{thj-case}	Thermal resistance junction-case max	0.83	3.6	0.83			°C/W
R _{thj-amb}	Thermal resistance junction-ambient max		62.5		50		°C/W
R _{thj-pcb}	Thermal resistance junction-pcb max	30					°C/W
T _l	Maximum lead temperature for soldering purpose		300				°C

2 Electrical characteristics

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

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}, V_{GS} = 0$	650			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}, T_C = 125\text{ °C}$			1 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}, I_D = 12\text{ A}$		0.095	0.119	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	3320	-	pF
C_{oss}	Output capacitance			75		pF
C_{rss}	Reverse transfer capacitance			5		pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{GS} = 0, V_{DS} = 0\text{ to }520\text{ V}$	-	210	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related	$V_{GS} = 0, V_{DS} = 0\text{ to }520\text{ V}$	-	70	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz open drain}$	-	2	-	Ω
Q_g	Total gate charge	$V_{DD} = 520\text{ V}, I_D = 12\text{ A},$ $V_{GS} = 10\text{ V}$ (see Figure 20)	-	72	-	nC
Q_{gs}	Gate-source charge			17		nC
Q_{gd}	Gate-drain charge			29		nC

- $C_{oss\text{ eq.}}$ 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}
- $C_{oss\text{ eq.}}$ 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
$t_{d(off)}$	Turn-off delay time	$V_{DD} = 400\text{ V}$, $I_D = 15\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 21)		53		ns
t_r	Rise time			12		ns
t_c	Cross time			29		ns
t_f	Fall time			16		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		24	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				96	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 24\text{ A}$, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 24\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 21)	-	375		ns
Q_{rr}	Reverse recovery charge			6		μC
I_{RRM}	Reverse recovery current			33		A
t_{rr}	Reverse recovery time	$I_{SD} = 24\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 21)	-	440		ns
Q_{rr}	Reverse recovery charge			8		μC
I_{RRM}	Reverse recovery current			36		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 for TO-220, D²PAK, I²PAK

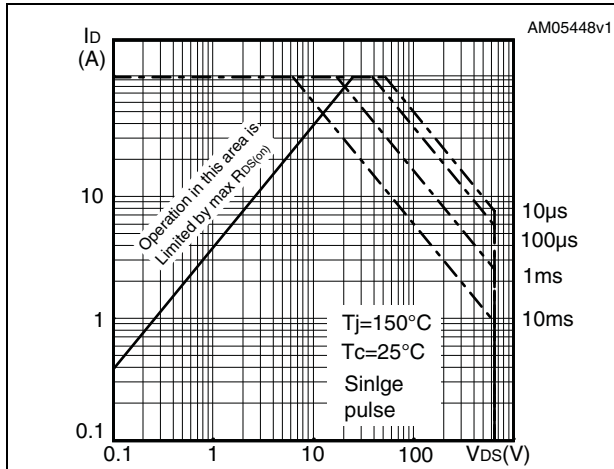


Figure 3. Thermal impedance for TO-220, D²PAK, I²PAK

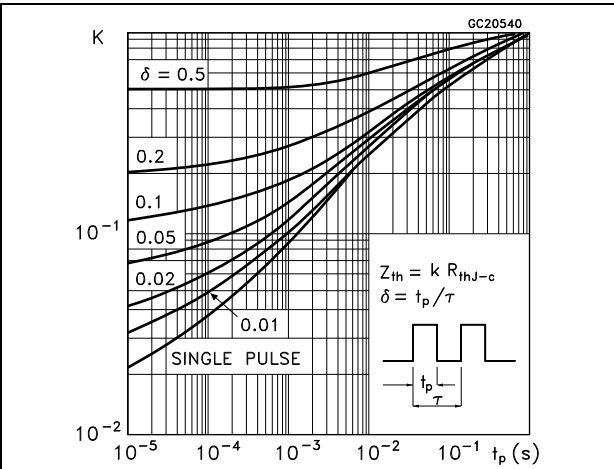


Figure 4. Safe operating area for TO-220FP

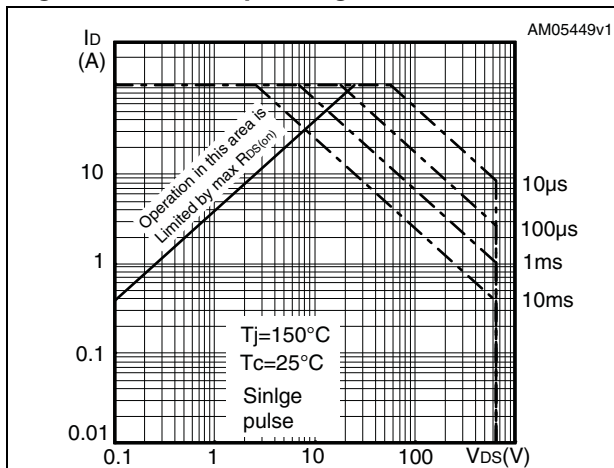


Figure 5. Thermal impedance for TO-220FP

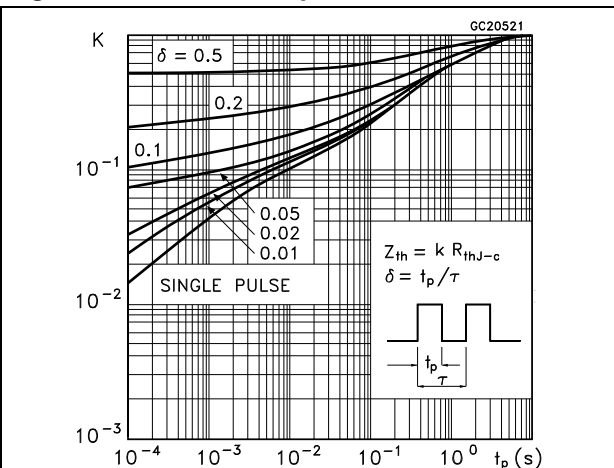


Figure 6. Safe operating area for TO-247

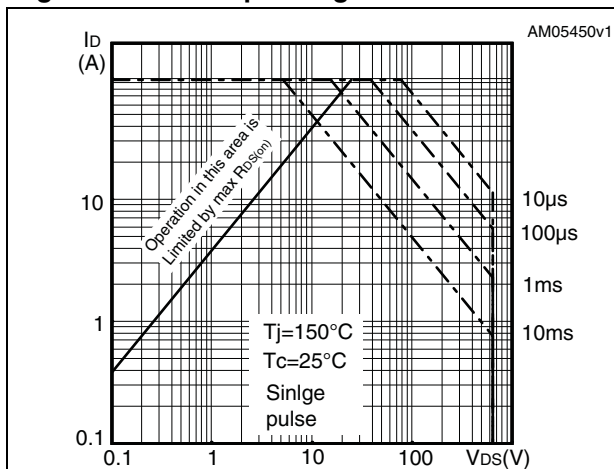


Figure 7. Thermal impedance for TO-247

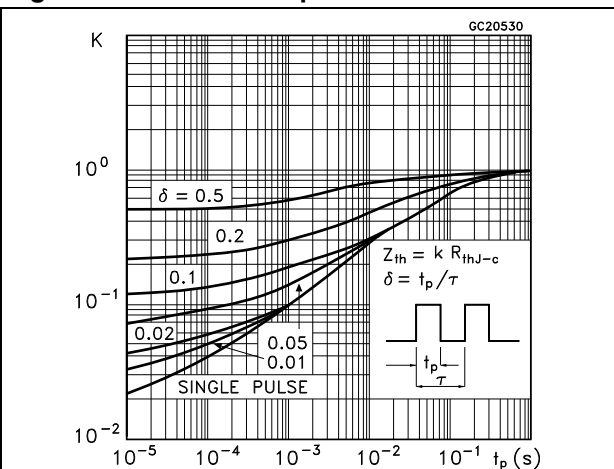


Figure 8. Output characteristics

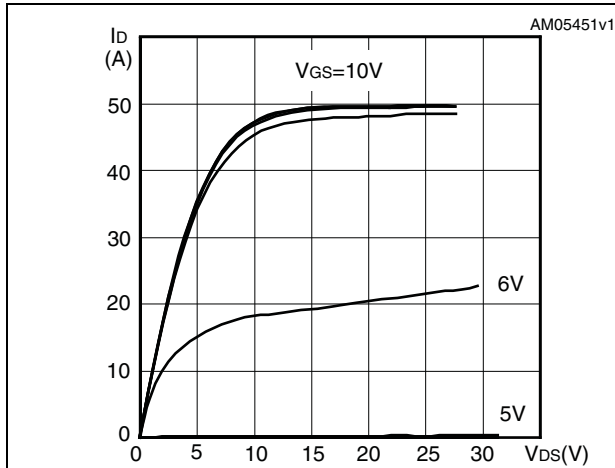


Figure 9. Transfer characteristics

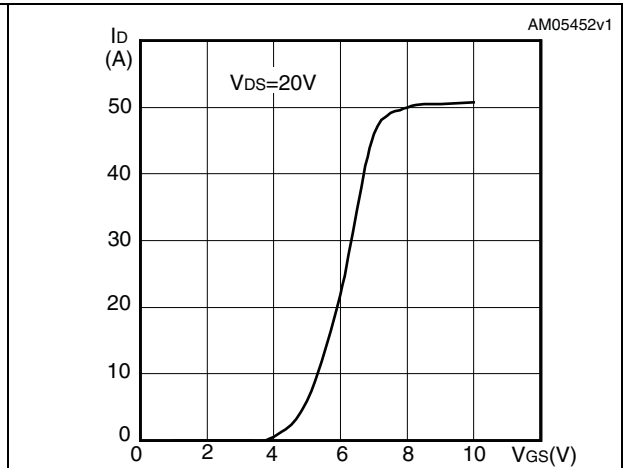


Figure 10. Gate charge vs gate-source voltage

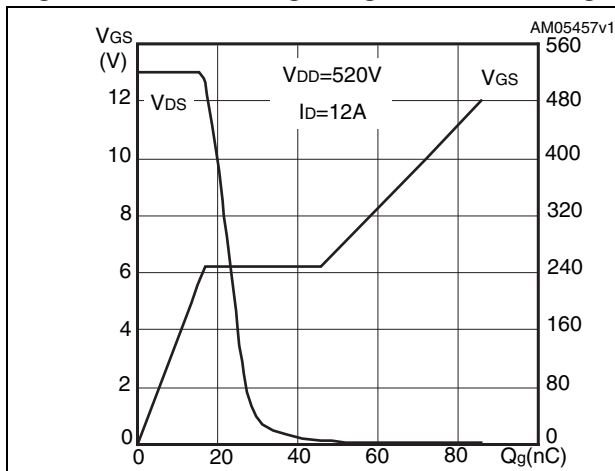


Figure 11. Static drain-source on resistance

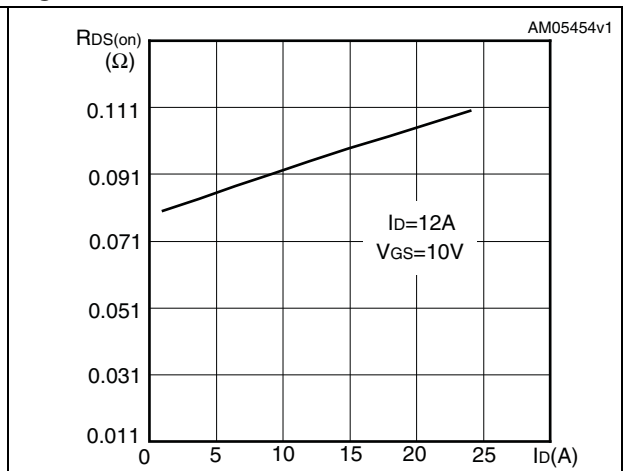


Figure 12. Capacitance variations

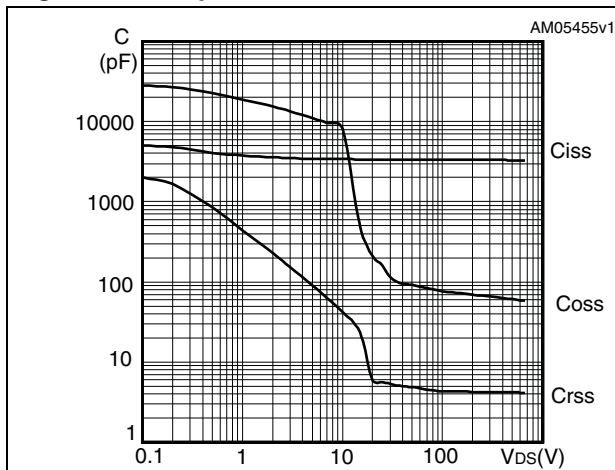


Figure 13. Output capacitance stored energy

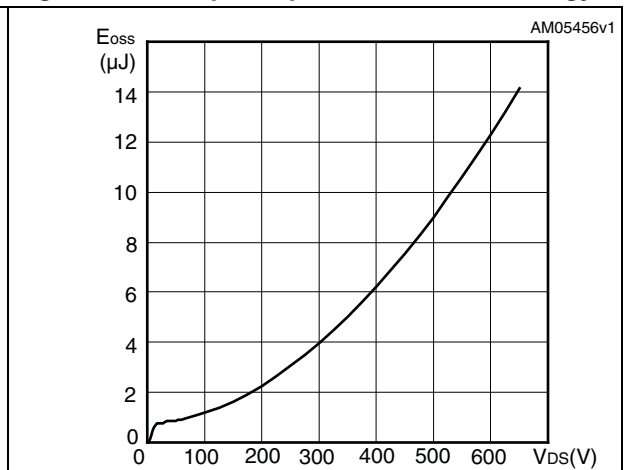


Figure 14. Normalized gate threshold voltage vs temperature

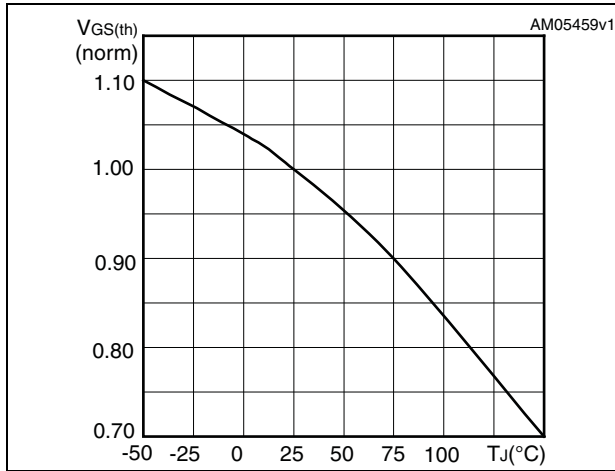


Figure 15. Normalized on resistance vs temperature

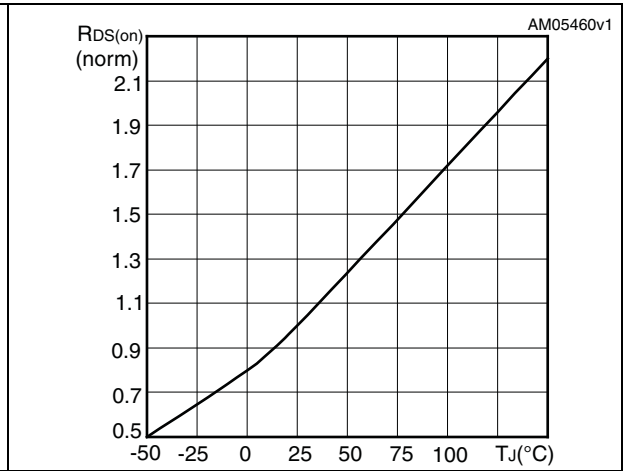


Figure 16. Source-drain diode forward characteristics

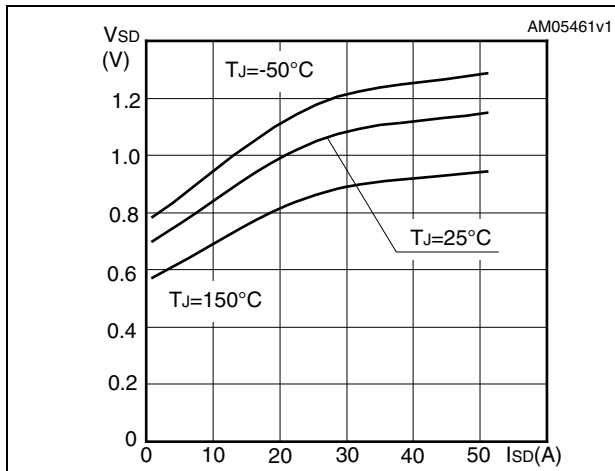


Figure 17. Normalized BV_{DSS} vs temperature

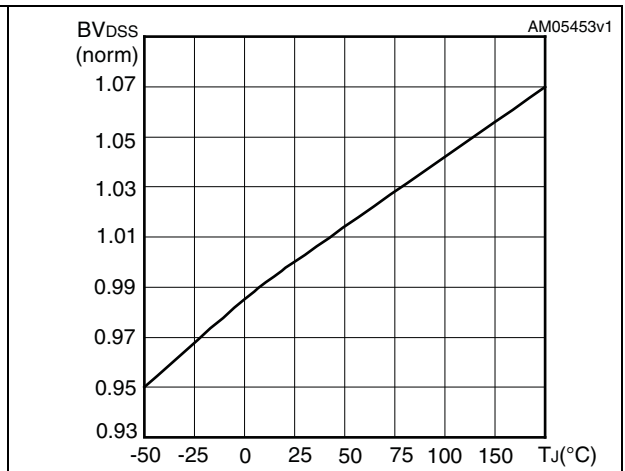
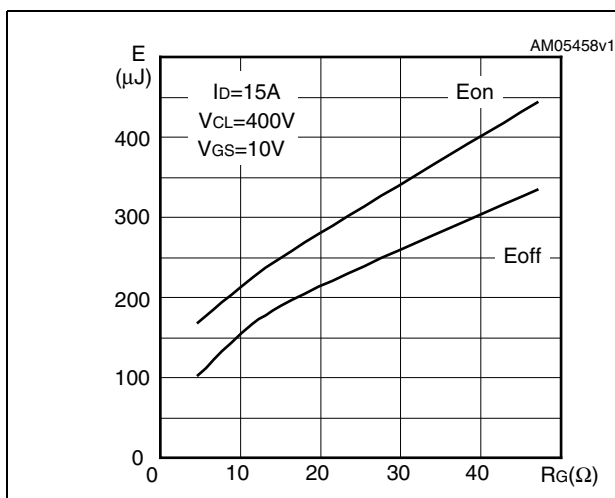


Figure 18. Switching losses vs gate resistance (1)



1. Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 19. Switching times test circuit for resistive load

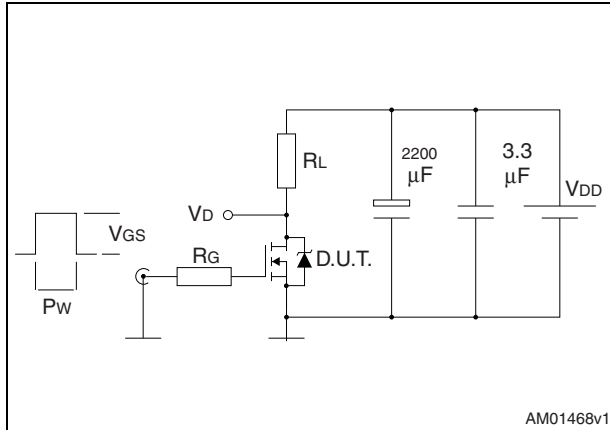


Figure 20. Gate charge test circuit

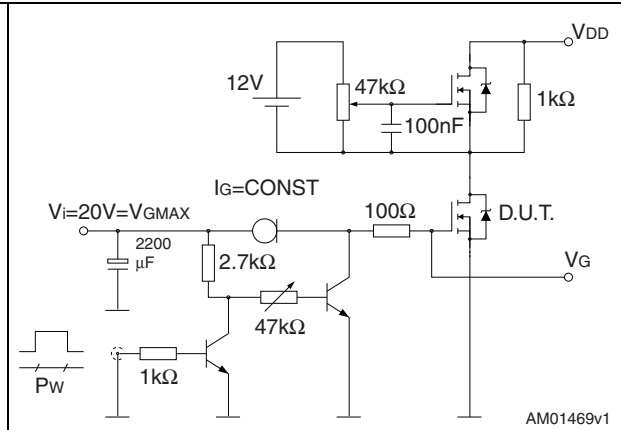


Figure 21. Test circuit for inductive load switching and diode recovery times

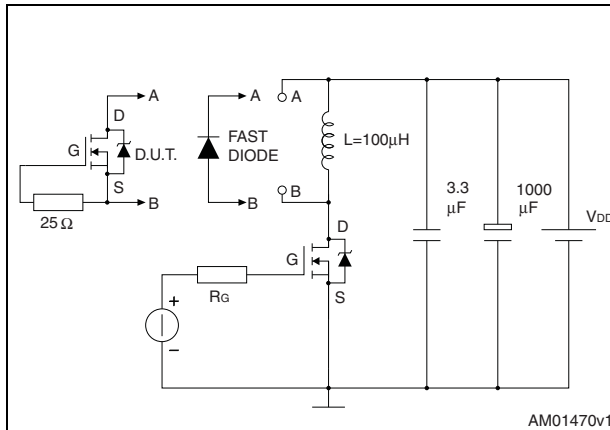


Figure 22. Unclamped inductive load test circuit

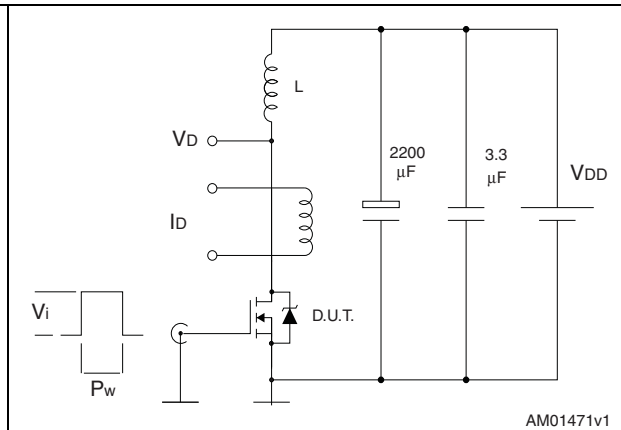


Figure 23. Unclamped inductive waveform

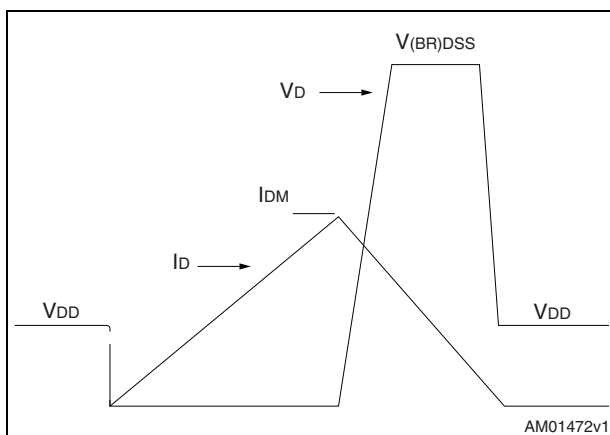
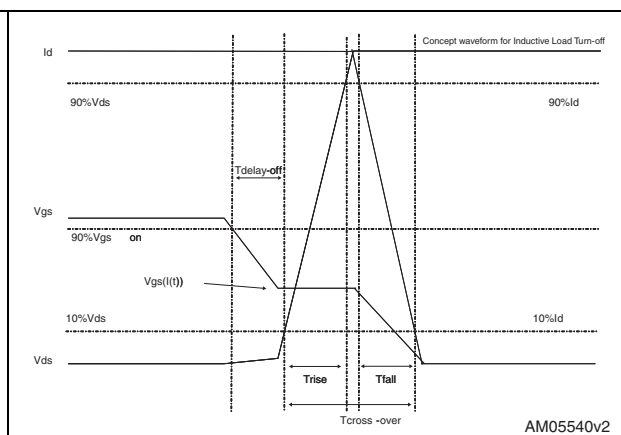


Figure 24. Switching time waveform



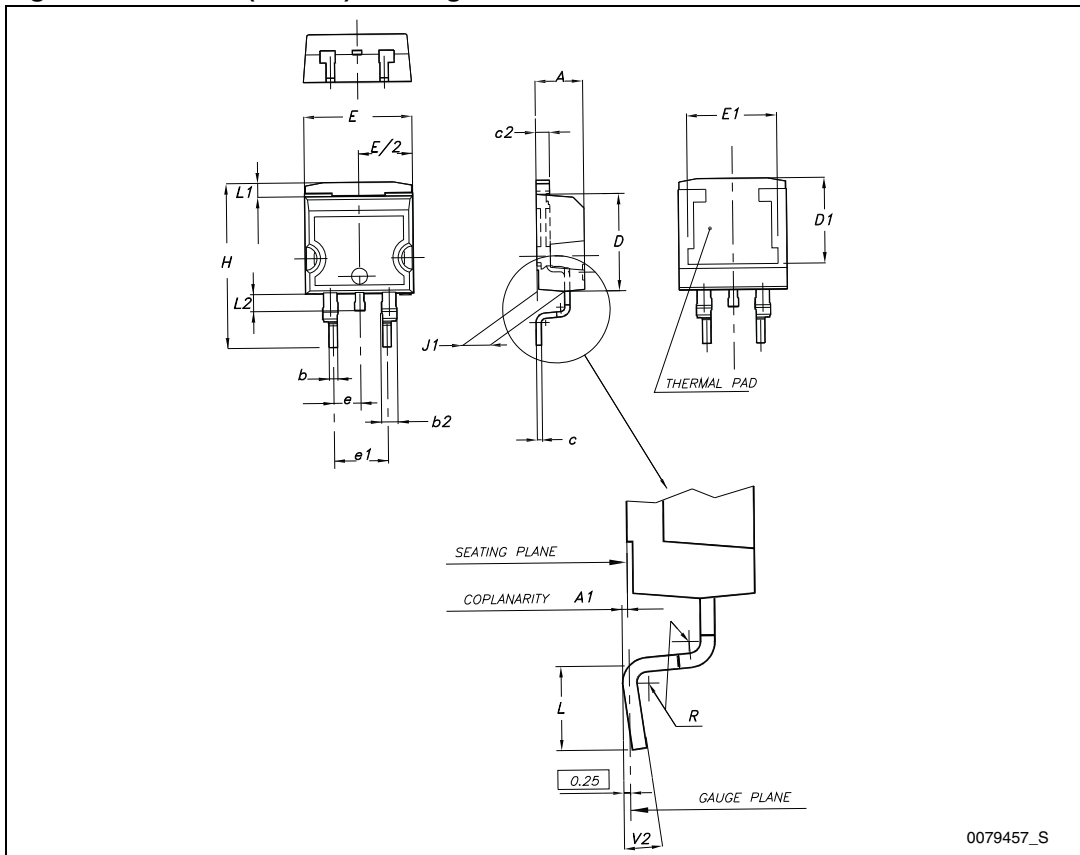
4 Package mechanical data

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. D²PAK (TO-263) mechanical data

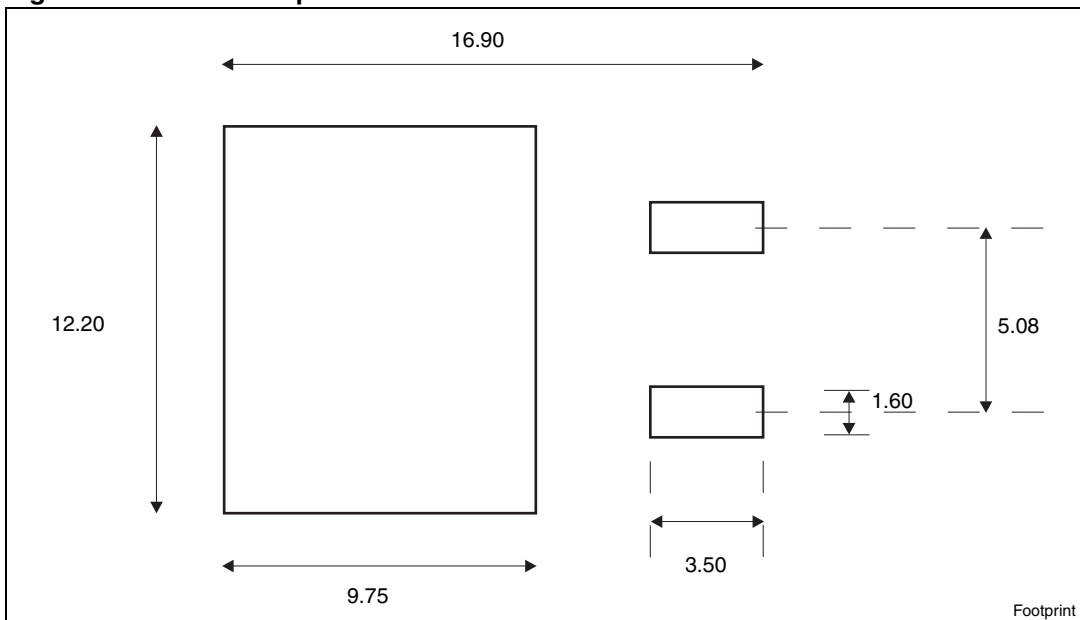
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 25. D²PAK (TO-263) drawing



0079457_S

Figure 26. D²PAK footprint^(a)



a. All dimensions are in millimeters

Table 9. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 27. TO-220FP drawing

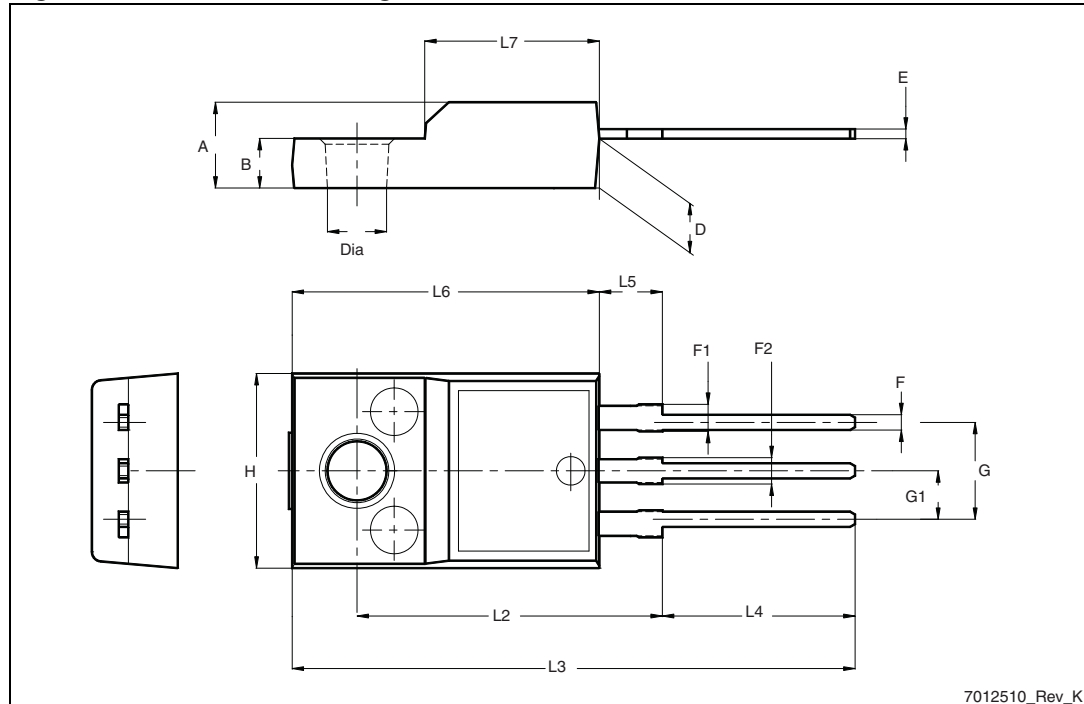
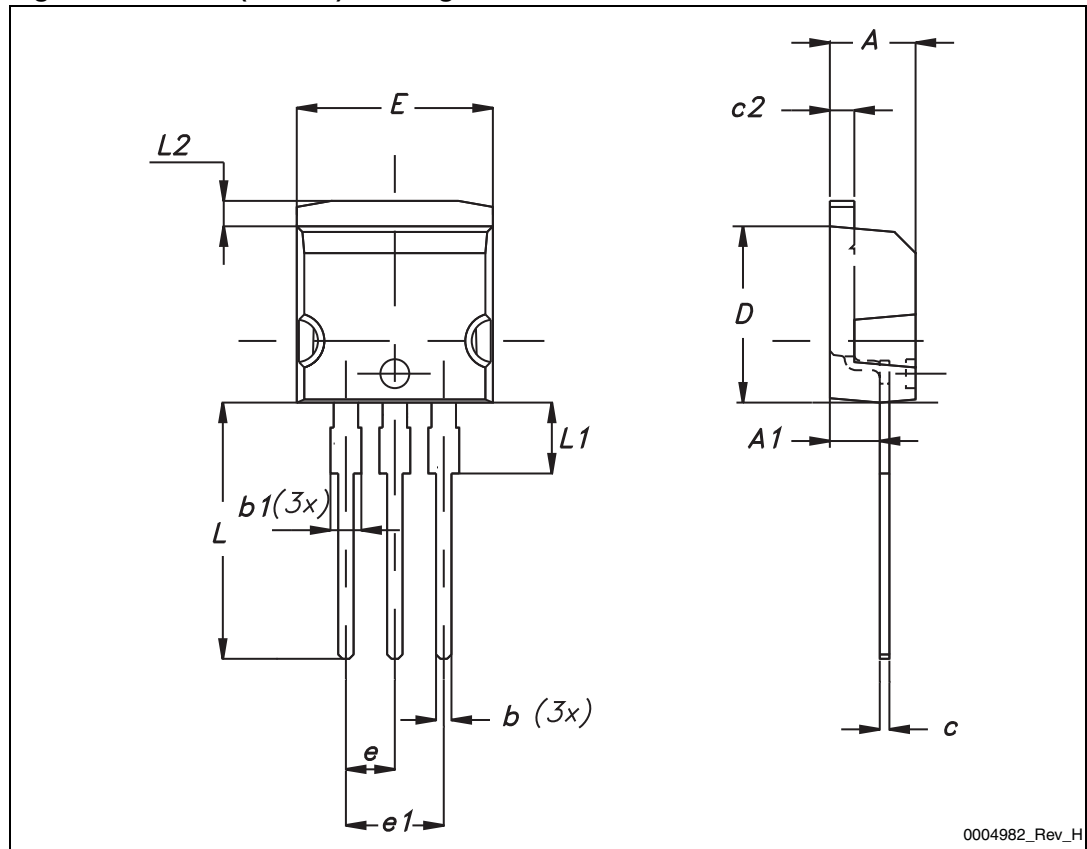


Table 10. I²PAK (TO-262) mechanical data

DIM.	mm.		
	min.	typ	max.
A	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
e	2.40		2.70
e1	4.95		5.15
E	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

Figure 28. I²PAK (TO-262) drawing



0004982_Rev_H

Table 11. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 29. TO-220 type A drawing

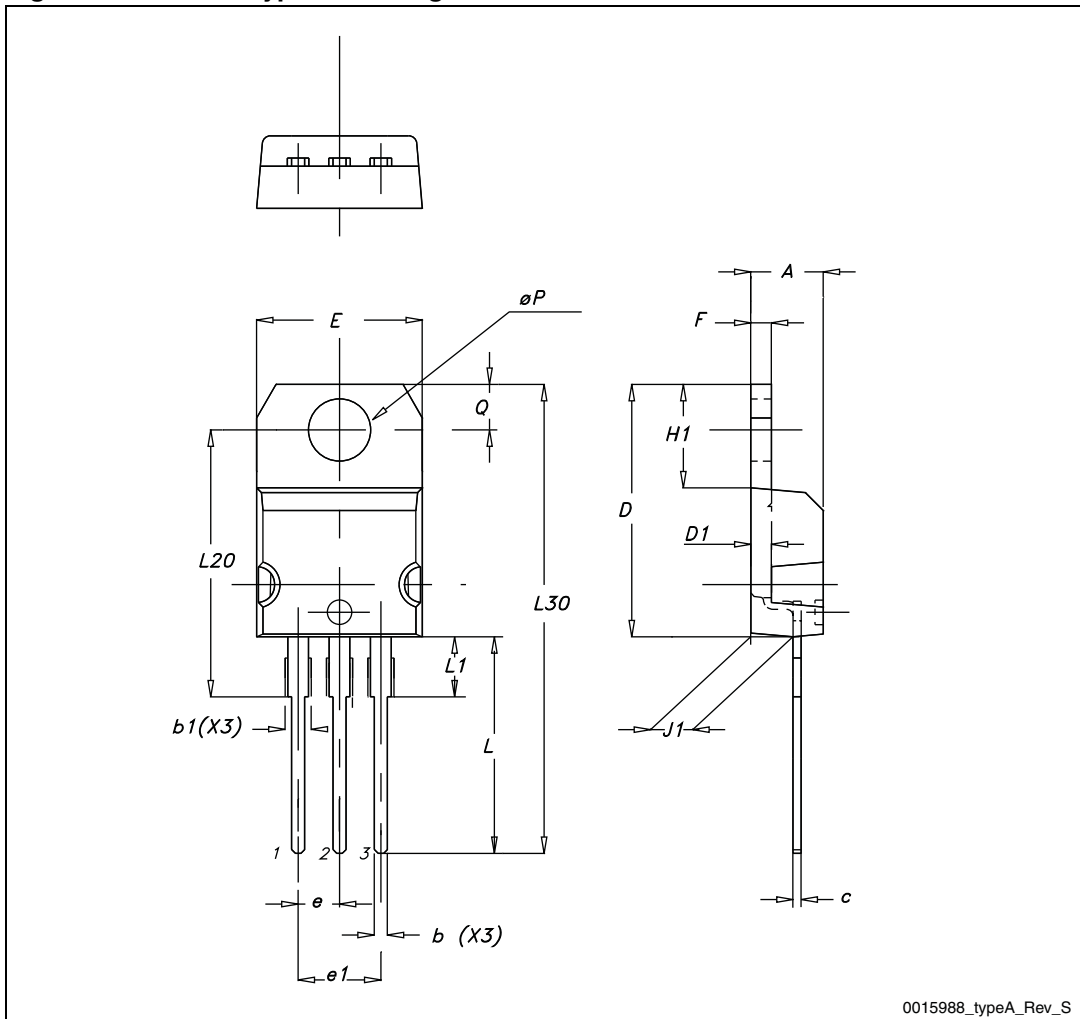
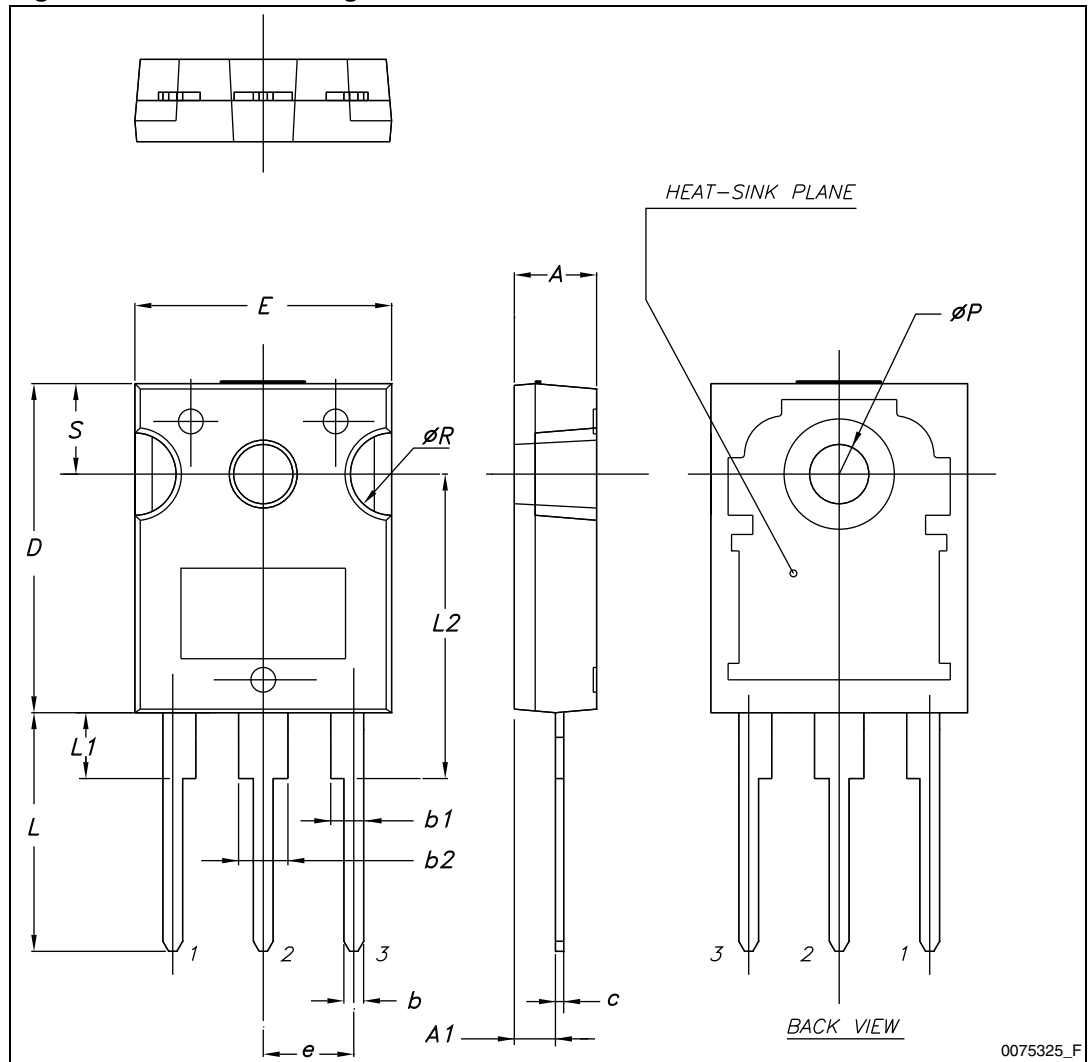


Table 12. TO-247 mechanical data

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		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S		5.50	

Figure 30. TO-247 drawing



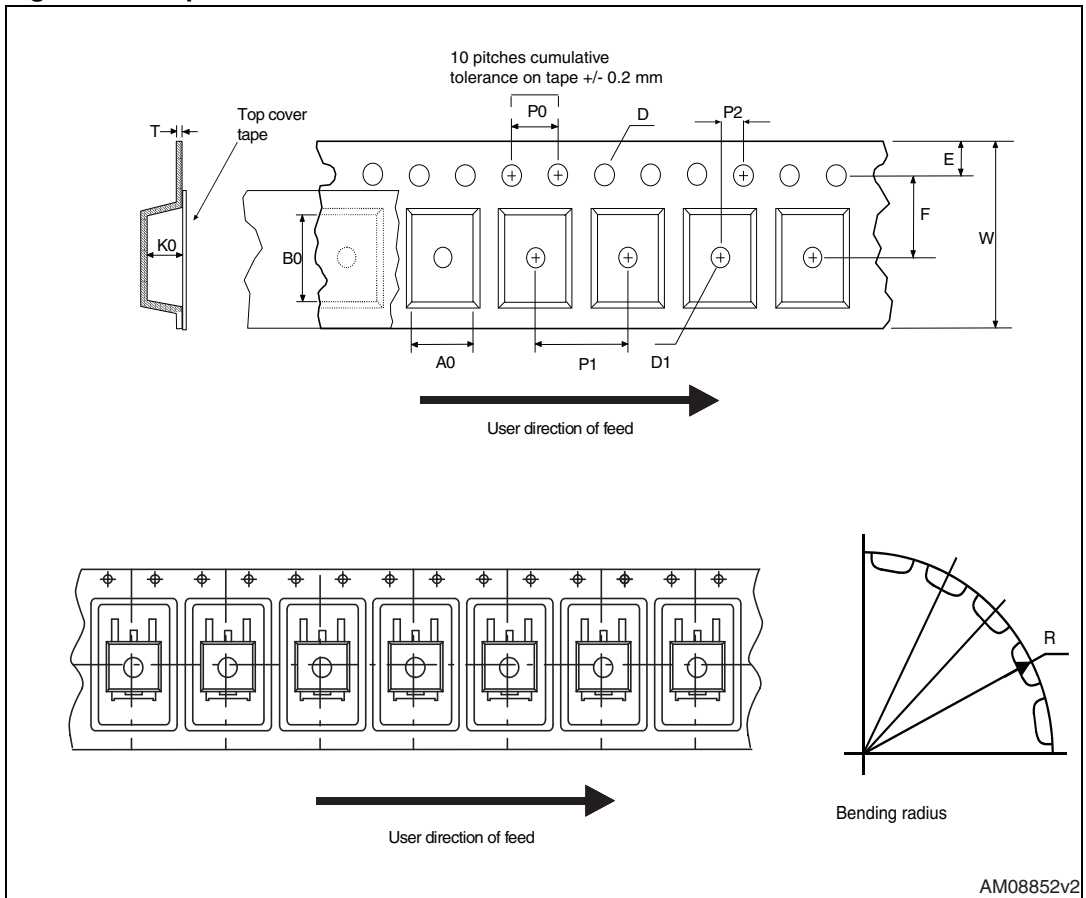
0075325_F

5 Packaging mechanical data

Table 13. D²PAK (TO-263) tape and reel mechanical data

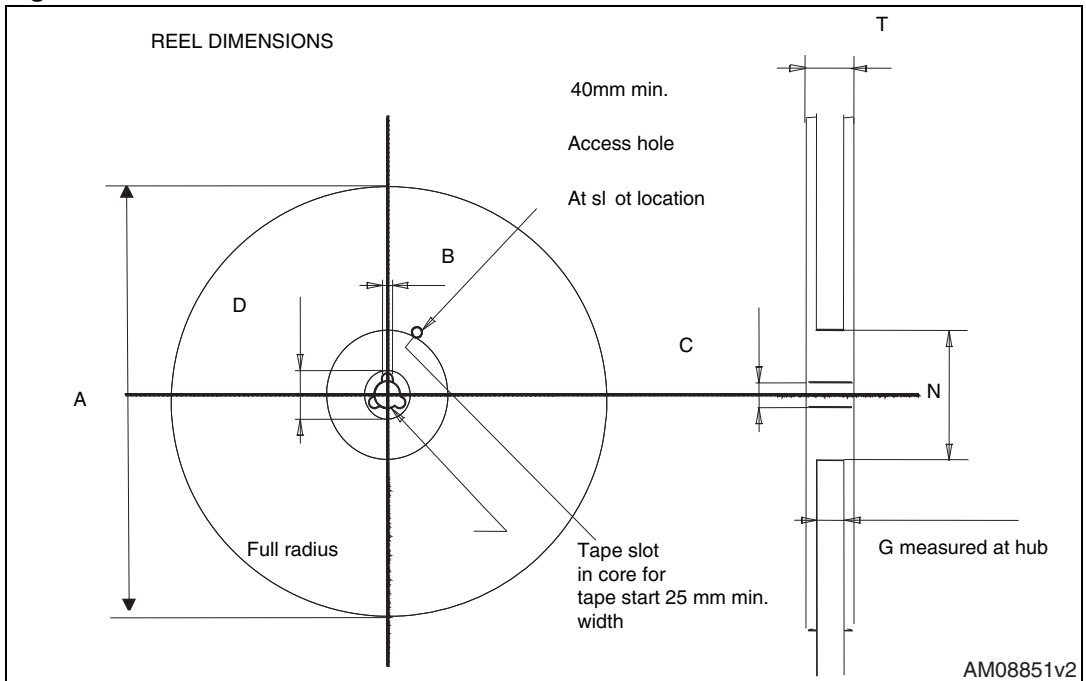
Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1		Base qty	1000
P2	1.9	2.1		Bulk qty	1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 31. Tape



AM08852v2

Figure 32. Reel



AM08851v2

6 Revision history

Table 14. Document revision history

Date	Revision	Changes
16-Jan-2009	1	First release
01-Sep-2009	2	Document status promoted from preliminary data to datasheet.
30-Sep-2009	3	Corrected V_{GS} value on Table 2: Absolute maximum ratings
06-Oct-2011	4	<p>$C_{o(er)}$ and $C_{o(tr)}$ values changed in Table 5: Dynamic Table 6: Switching times parameters updates Figure 24: Switching time waveform has been corrected Minor text changes Section 4: Package mechanical data has been modified. Added:</p> <ul style="list-style-type: none"> – Table 8: D²PAK (TO-263) mechanical data, Figure 25: D²PAK (TO-263) drawing and Figure 26: D²PAK footprint; – Table 9: TO-220FP mechanical data, and Figure 27: TO-220FP drawing; – Table 10: I²PAK (TO-262) mechanical data, and Figure 28: I²PAK (TO-262) drawing; – Table 11: TO-220 type A mechanical data, and Figure 29: TO-220 type A drawing; – Table 12: TO-247 mechanical data, and Figure 30: TO-247 drawing; <p>Section 5: Packaging mechanical data has been modified. Added:</p> <ul style="list-style-type: none"> – Table 13: D²PAK (TO-263) tape and reel mechanical data, Figure 31: Tape and Figure 32: Reel;

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.

UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

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.

© 2011 STMicroelectronics - All rights reserved

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