STB42N65M5, STF42N65M5, STI42N65M5 STP42N65M5, STW42N65M5

Datasheet

N-channel 650 V, 70 mΩ typ., 33 A, MDmesh M5 Power MOSFETs in D²PAK, TO-220FP, I²PAK, TO-220 and TO-247 packages

D²PAK   TO-220FP   I²PAK   TO-220   TO-247

AM01475v1_noZen

Features

Order codes	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max.	I_D	Package
STB42N65M5				D²PAK
STF42N65M5				TO-220FP
STI42N65M5	710 V	79 mΩ	33 A	I²PAK
STP42N65M5				TO-220
STW42N65M5				TO-247
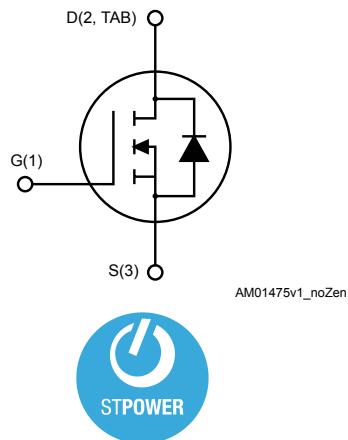
- Extremely low $R_{DS(on)}$
- Low gate charge and input capacitance
- Excellent switching performance
- 100% avalanche tested

Applications

- Switching applications

Description

These devices are N-channel Power MOSFETs based on the MDmesh M5 innovative vertical process technology combined with the well-known PowerMESH horizontal layout. The resulting products offer extremely low on-resistance, making them particularly suitable for applications requiring high power and superior efficiency.

Product status
STB42N65M5
STF42N65M5
STI42N65M5
STP42N65M5
STW42N65M5

DS6033 - Rev 4 - May 2019
For further information contact your local STMicroelectronics sales office.
www.st.com

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D²PAK, I²PAK, TO-220, TO-247	TO-220FP	
V_{GS}	Gate-source voltage	±25		V
I_D	Drain current (continuous) at T_C = 25 °C	33	33[1]	A
	Drain current (continuous) at T_C = 100 °C	20.8	20.8 [1]	A
I_{DM}[2]	Drain current (pulsed)	132	132	A
P_{TOT}	Total power dissipation at T_C = 25 °C	190	40	W
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_j	Operating junction temperature range	-55 to 150		°C
T_{stg}	Storage temperature range			

1. *Limited by maximum junction temperature.*
2. *Pulse width limited by safe operating area.*
3. *$I_{SD} ≤ 33$ A, di/dt ≤ 400 A/μs, V_{DD} = 400 V, $V_{DS(peak)} < V_{(BR)DSS}$.*

Table 2. Thermal data

Symbol	Parameter	Value					Unit
		D²PAK	I²PAK	TO-220	TO-247	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case	0.66				3.1	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient			62.5	50	62.5	°C/W
$R_{thj-pcb}$ [1]	Thermal resistance junction-pcb	30					°C/W

1. *When mounted on an 1 inch² FR-4, 2 Oz copper board.*

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive (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} = 50 V)	950	mJ

2 Electrical characteristics

(T_{CASE} = 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	650			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 650 V			1	µA
		V_{GS} = 0 V, V_{DS} = 650 V, T_C = 125 °C [1]			100	µA
I_{GSS}	Gate body leakage current	V_{GS} = ±25 V, V_{DS}= 0 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 = 16.5 A		70	79	mΩ

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 V, f = 1 MHz, V_{GS} = 0 V	-	4650	-	pF
C_{oss}	Output capacitance			110		
C_{rss}	Reverse transfer capacitance			3.2		
$C_{o(tr)}$ [1]	Equivalent capacitance time related	V_{DS} = 0 to 520 V, V_{GS} = 0 V	-	100	-	pF
$C_{o(er)}$ [2]	Equivalent capacitance energy related			285	-	
R_g	Gate input resistance	f = 1 MHz, I_D = 0 A	-	1.1	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 33 A, V_{GS} = 0 to 10 V (see Figure 20. Test circuit for gate charge behavior)	-	98	-	nC
Q_{gs}	Gate-source charge			28	-	
Q_{gd}	Gate-drain charge			39		

1. *$C_{o(tr)}$ 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}.*

2. *$C_{o(er)}$ 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}.*

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	V_{DD} = 400 V, I_D = 20 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 21. Test circuit for inductive load switching and diode recovery times and Figure 24. Switching time waveform)	-	52	-	ns
$t_{r(v)}$	Voltage rise time			8.4		
$t_{f(i)}$	Current fall time			8.7		
$t_{c(off)}$	Crossing time			14		

Table 7. Source-drain diode
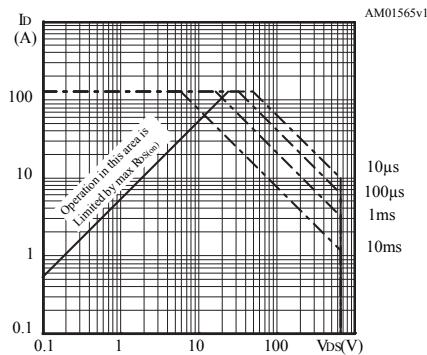
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		33	A
I_{SDM}[1]	Source-drain current (pulsed)				132	
V_{SD}[2]	Forward on voltage	I_{SD} = 33 A, V_{GS} = 0 V	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 33 A, di/dt = 100 A/µs		400		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 100 V	-	7		µC
I_{RRM}	Reverse recovery current	(see Figure 21. Test circuit for inductive load switching and diode recovery times)		35		A
t_{rr}	Reverse recovery time	I_{SD} = 33 A, di/dt = 100 A/µs		532		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 100 V, T_j = 150 °C	-	10		µC
I_{RRM}	Reverse recovery current	(see Figure 21. Test circuit for inductive load switching and diode recovery times)		38		A

1. *Pulse width limited by safe operating area.*

2. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%.*
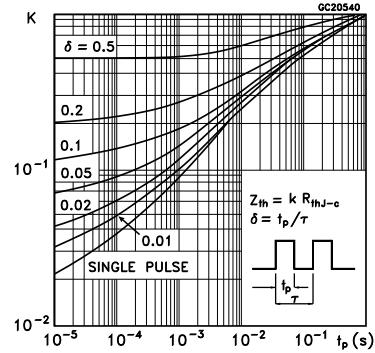
2.1 Electrical characteristics (curves)
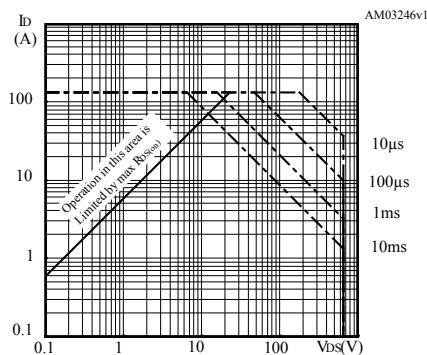
Figure 1. Safe operating area for D²PAK, I²PAK, TO-220
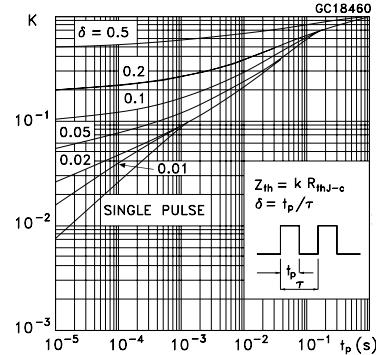
Figure 2. Thermal impedance for D²PAK, I²PAK, TO-220
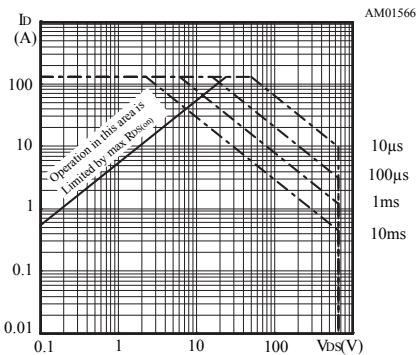
Figure 3. Safe operating area for TO-247
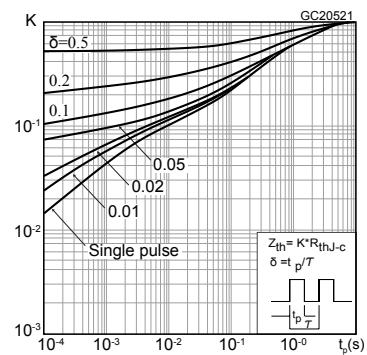
Figure 4. Thermal impedance for TO-247
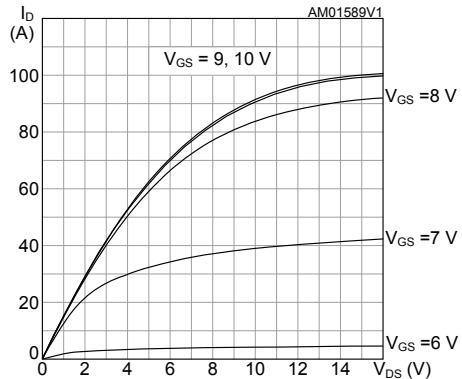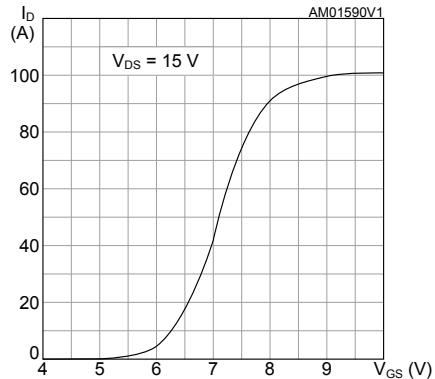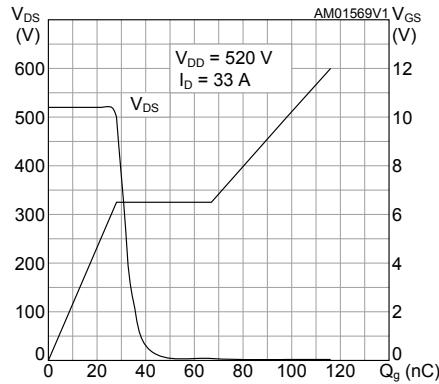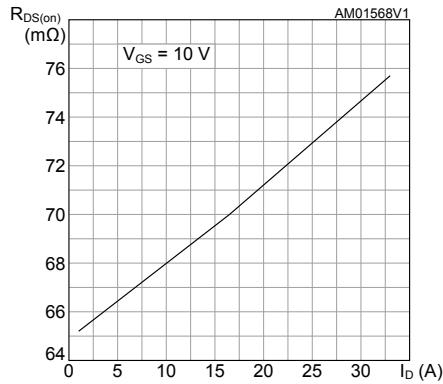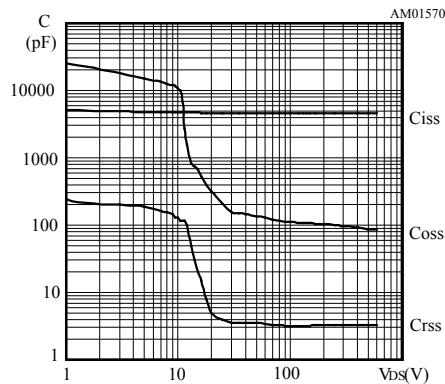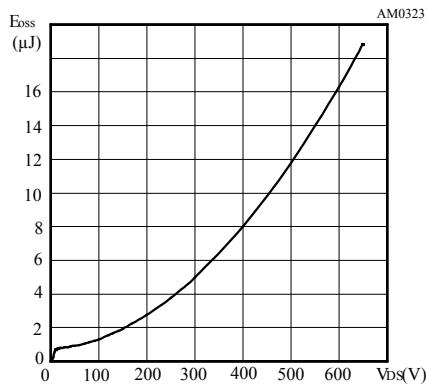
Figure 5. Safe operating area for TO-220FP
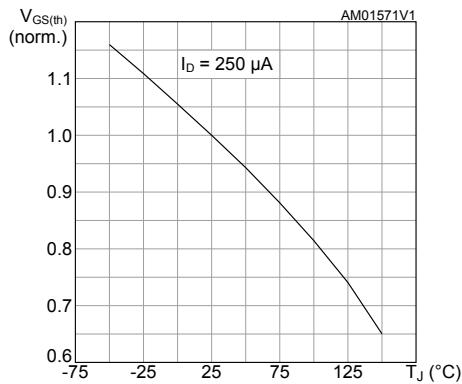
Figure 6. Thermal impedance for TO-220FP
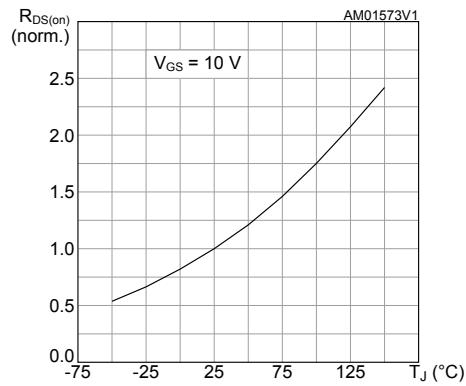
**Figure 7. Output characteristics**

**Figure 8. Transfer characteristics**

Figure 9. Gate charge vs gate-source voltage

Figure 10. Static drain-source on-resistance

Figure 11. Capacitance variations

Figure 12. Output capacitance stored energy
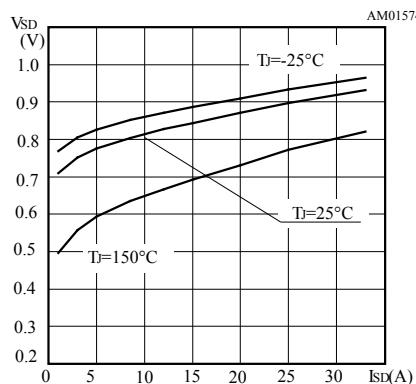
**Figure 13. Normalized gate threshold voltage vs temperature**
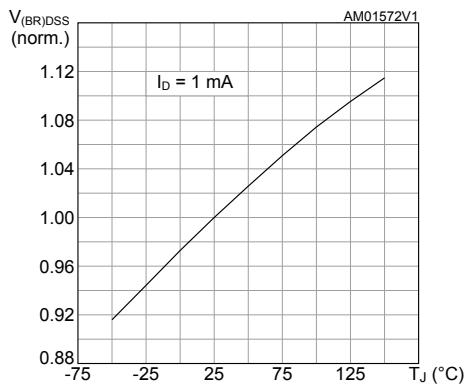
Figure 14. Normalized on-resistance vs temperature
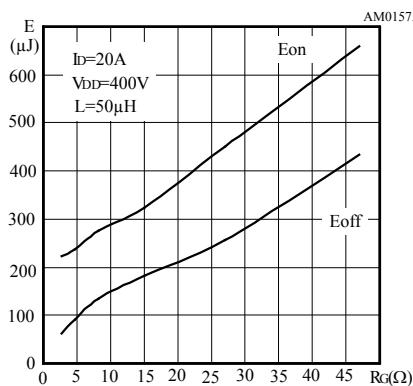
Figure 15. Source-drain diode forward characteristics

Figure 16. Normalized V$_{(BR)DSS}$ vs temperature

Figure 17. Switching energy vs gate resistance
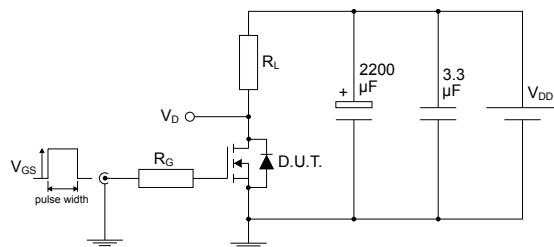
Note: E$_{on}$ including reverse recovery of a SiC diode.
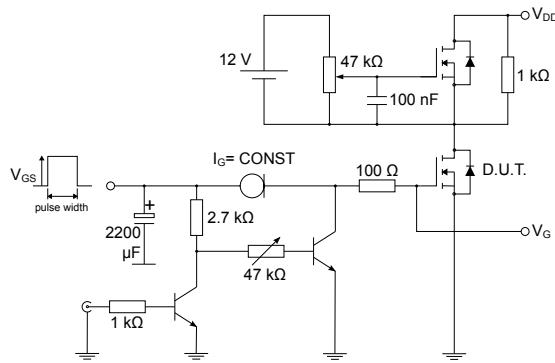
3 Test circuits

**Figure 19. Test circuit for resistive load switching times**
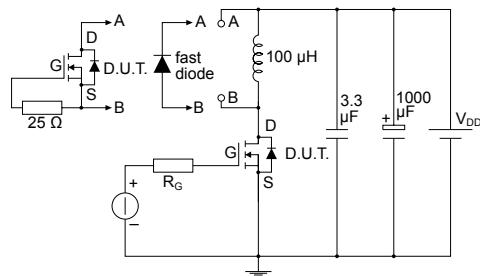
AM01468v1

Figure 20. Test circuit for gate charge behavior
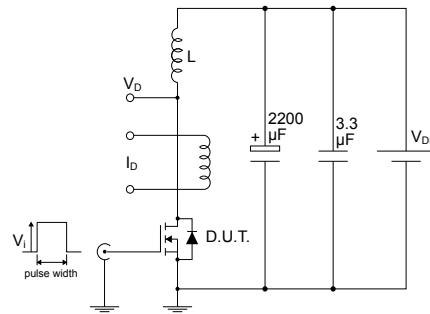
AM01469v1

Figure 21. Test circuit for inductive load switching and diode recovery times
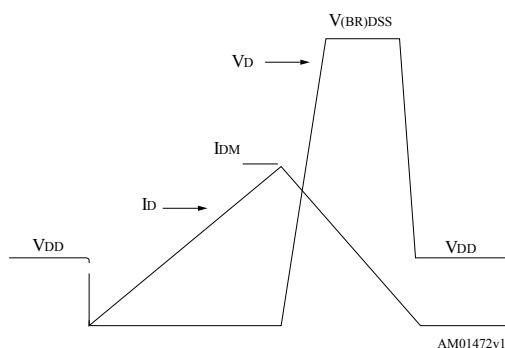
AM01470v1

Figure 22. Unclamped inductive load test circuit
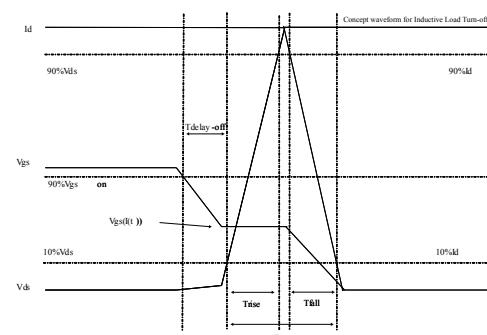
AM01471v1

Figure 23. Unclamped inductive waveform

AM01472v1

Figure 24. Switching time waveform

AM05540v2
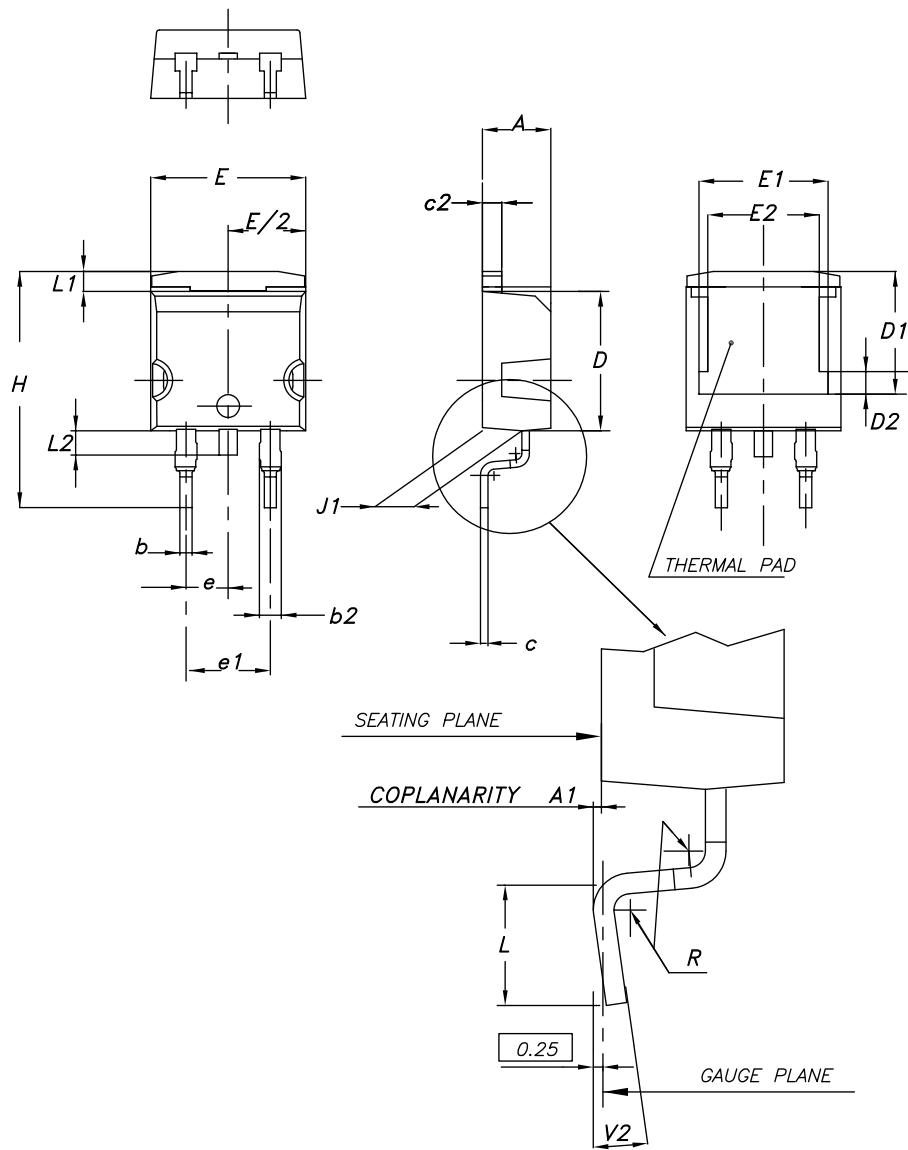
4 Package information

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 D²PAK (TO-263) type A2 package information
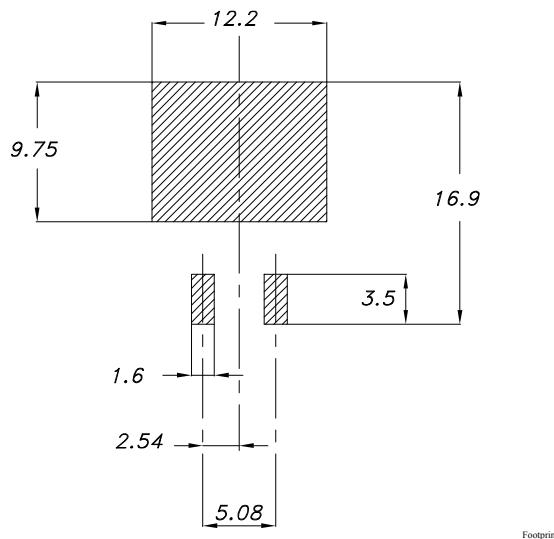
Figure 25. D²PAK (TO-263) type A2 package outline

0079457_A2_26
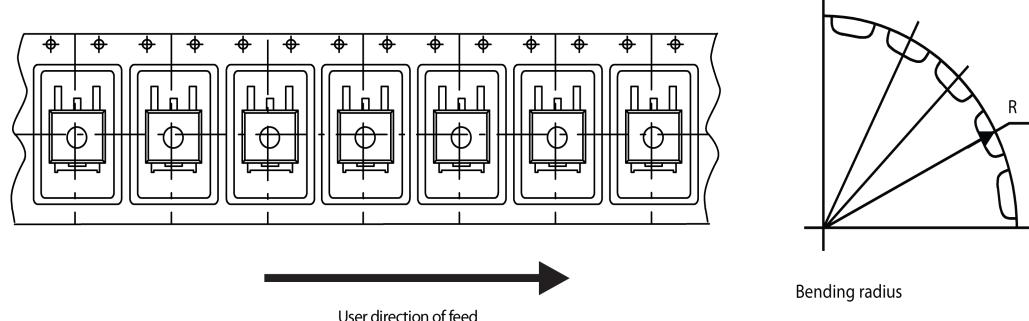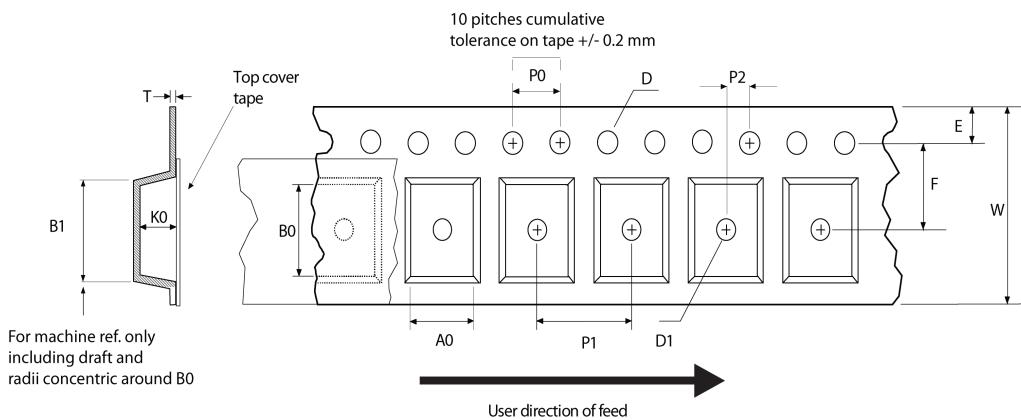
Table 8. D²PAK (TO-263) type A2 package mechanical data

| 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	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.70	8.90	9.10
E2	7.30	7.50	7.70
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°
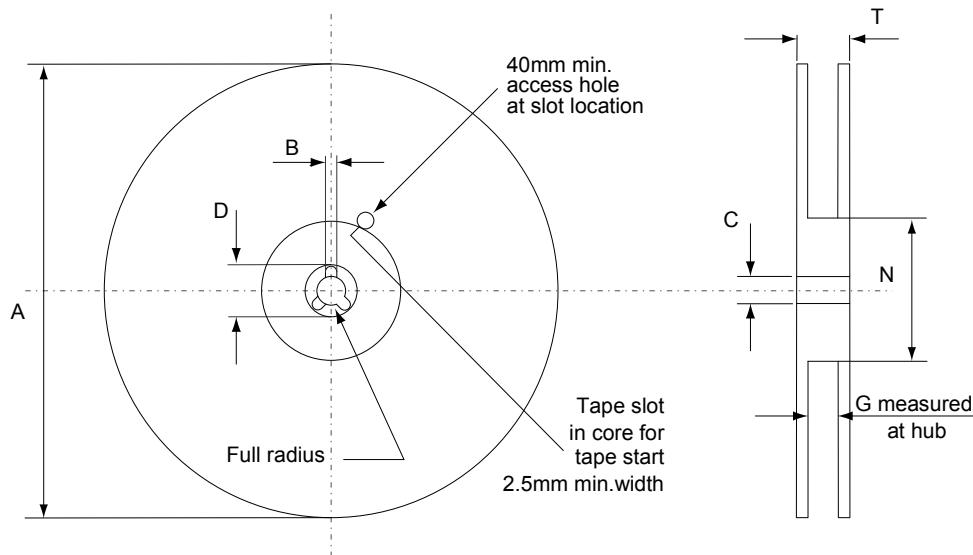
Figure 26. D²PAK (TO-263) recommended footprint (dimensions are in mm)

4.2 D²PAK packing information

Figure 27. D²PAK tape outline

AM08852v1

Figure 28. D²PAK reel outline
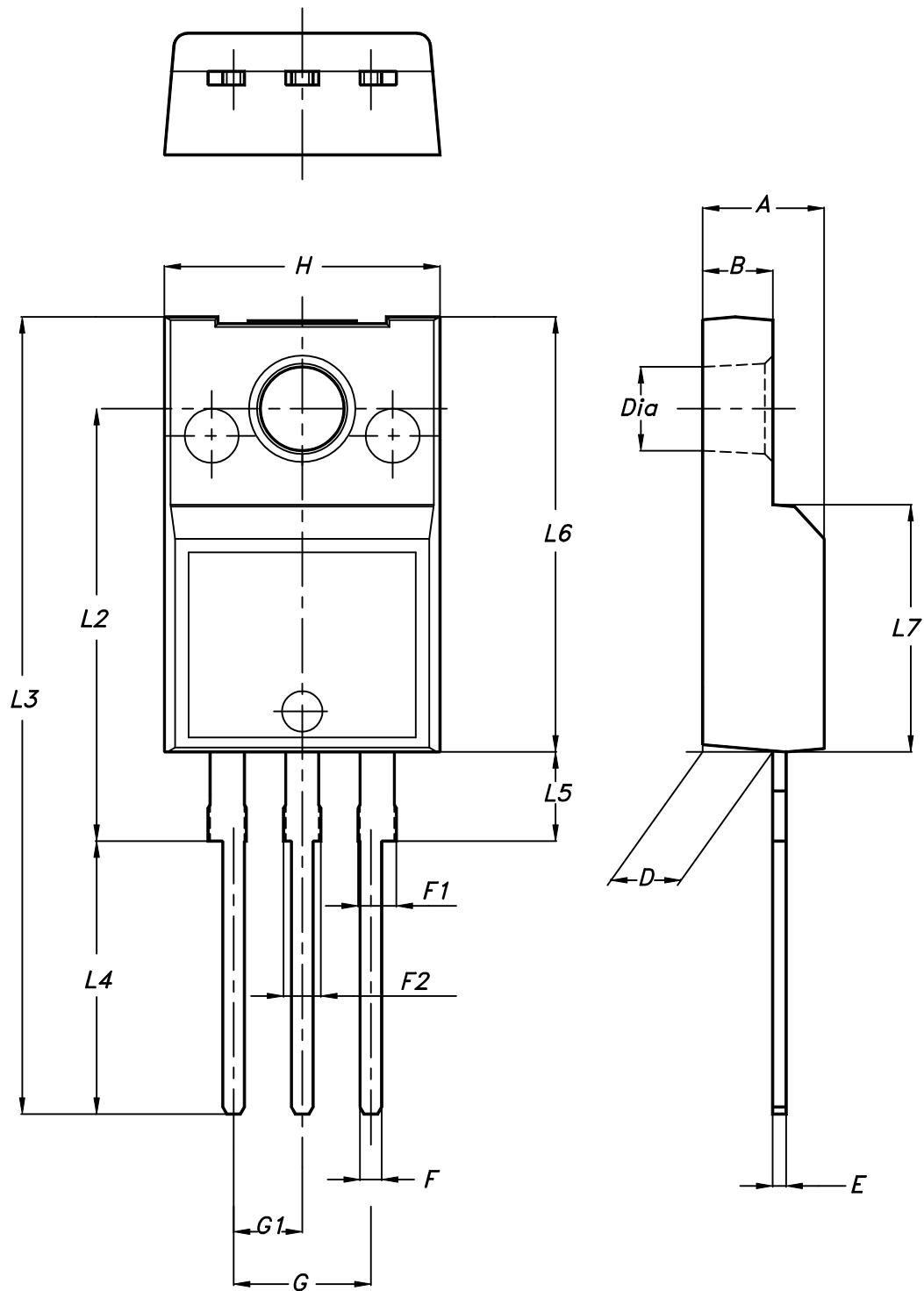
AM06038v1

Table 9. D²PAK 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 quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

4.3 TO-220FP package information
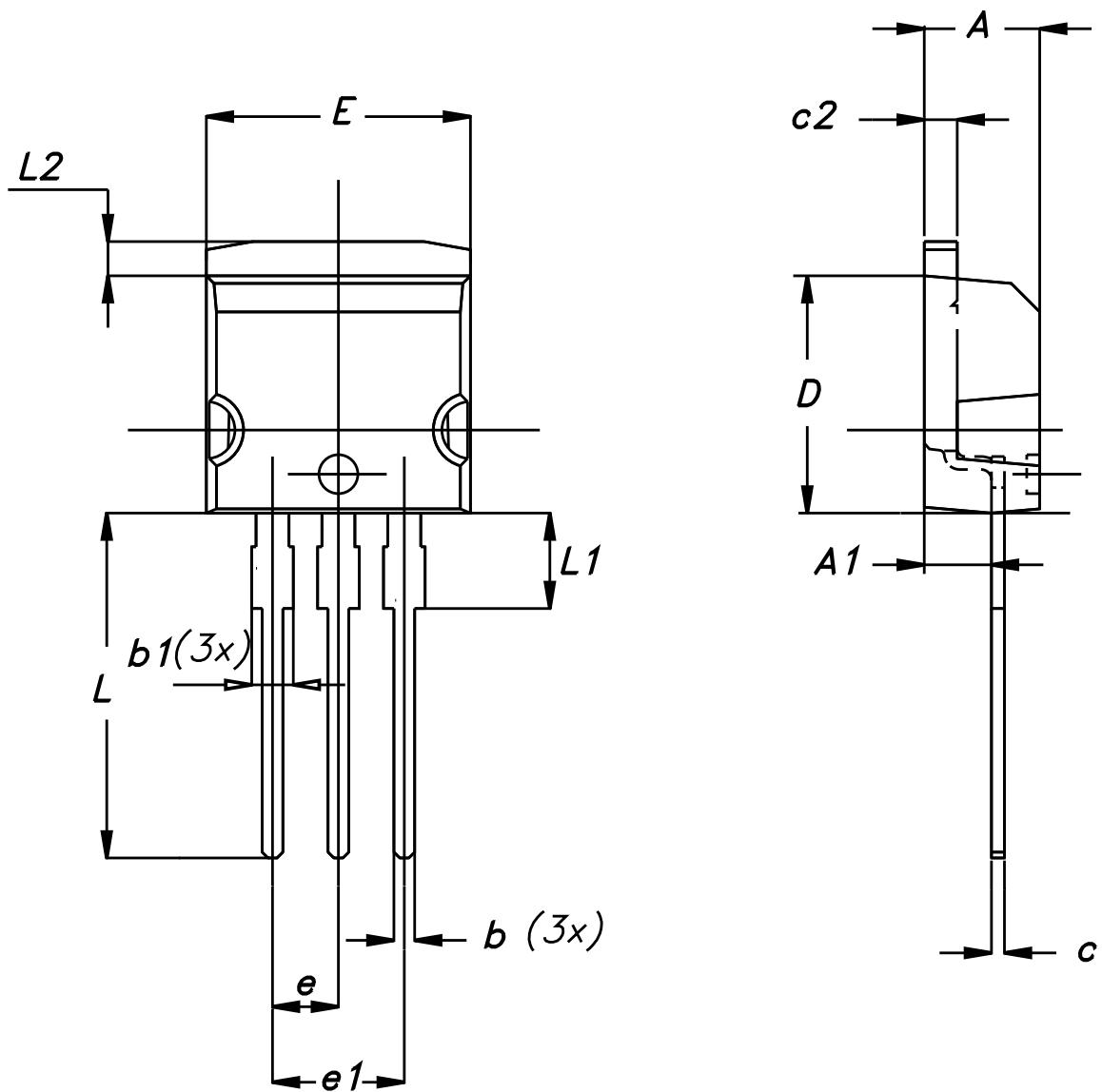
Figure 29. TO-220FP package outline

7012510_Rev_12_B

Table 10. TO-220FP package 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

4.4 I²PAK package information

Figure 30. I²PAK package outline
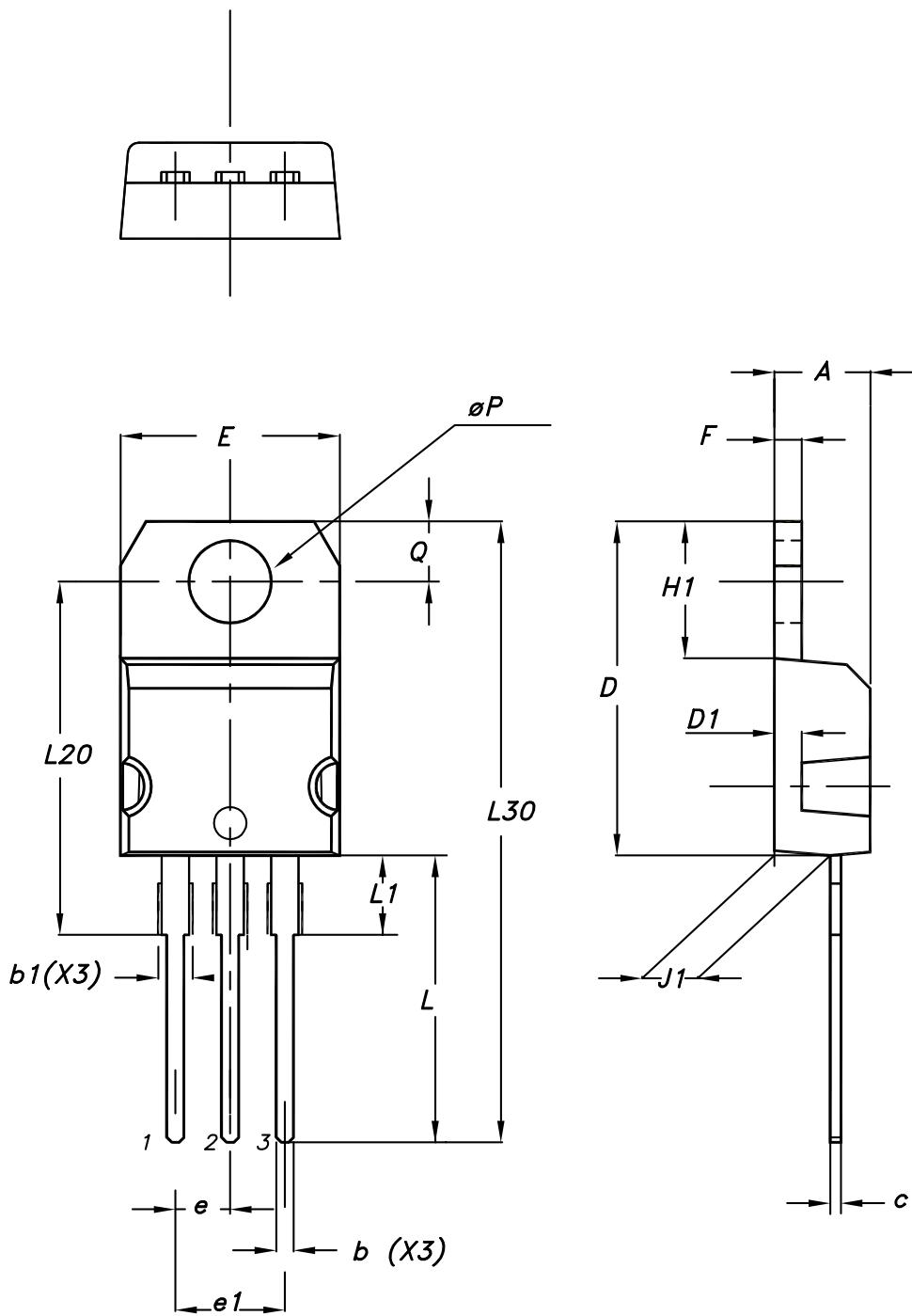
0004982_Rev_H

Table 11. I²PAK package 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

4.5 TO-220 type A package information

Figure 31. TO-220 type A package outline

0015988_typeA_Rev_22
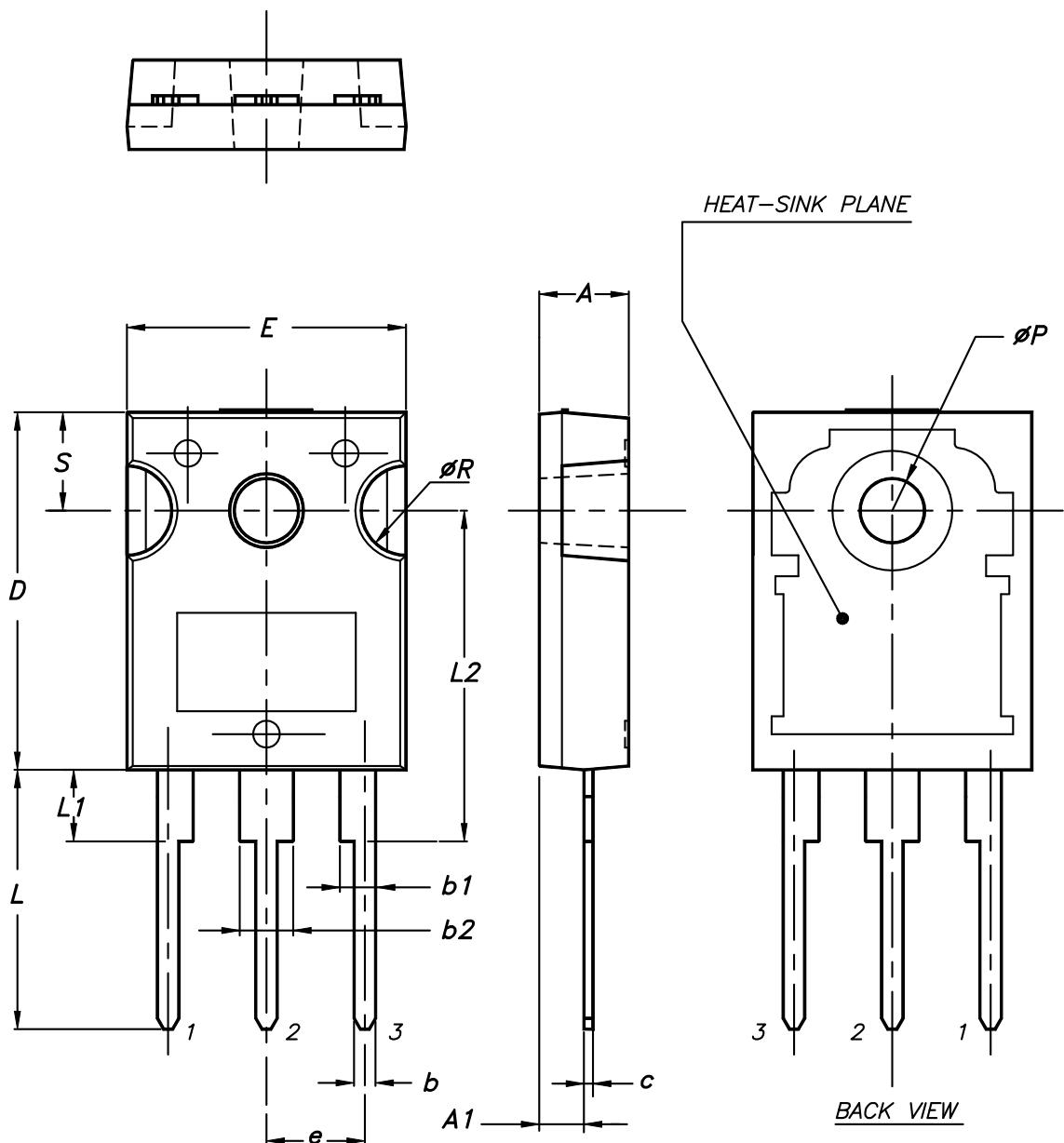
Table 12. TO-220 type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

4.6 TO-247 package information

0075325_9

Table 13. TO-247 package 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	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

5   Ordering information

Table 14. **Order codes**

Order code	Marking	Package	Packing
STB42N65M5	42N65M5	D²PAK	Tape and reel
STF42N65M5		TO-220FP	Tube
STI42N65M5		I²PAK	
STP42N65M5		TO-220	
STW42N65M5		TO-247	

Revision history

Table 15. **Document revision history**

Date	Version	Changes
16-Jan-2009	1	First release.
15-May-2009	2	Updated *figures 9*, *10*, *11* and *17*
12-Jun-2009	3	*Figure 15* has been updated
02-May-2019	4	Modified features and description on cover page. Updated Section 4 Package information. Minor text changes.

Contents

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. For additional information about ST trademarks, please 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.

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 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 DMN1006UCA6-7