STB36N60M6

N-channel 600 V, 85 mΩ typ., 30 A MDmesh™ M6 Power MOSFET in a D²PAK package

Datasheet - production data

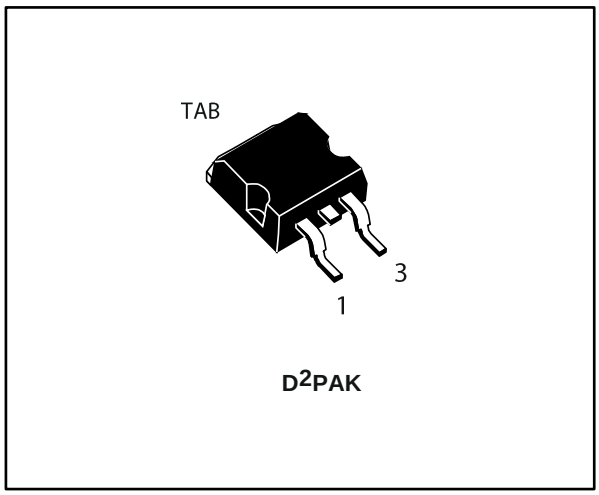
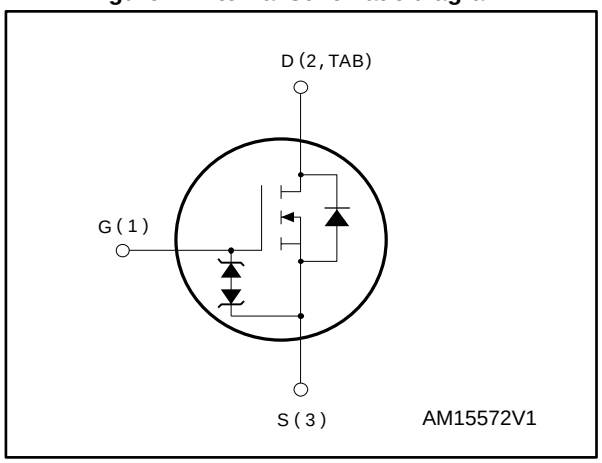


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STB36N60M6	600 V	99 mΩ	30 A

- Reduced switching losses
- Lower $R_{DS(on)}$ x area vs previous generation
- Low gate input resistance
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

The new MDmesh™ M6 technology incorporates the most recent advancements to the well-known and consolidated MDmesh family of SJ MOSFETs. STMicroelectronics builds on the previous generation of MDmesh devices through its new M6 technology, which combines excellent $R_{DS(on)}$ * area improvement with one of the most effective switching behaviors available, as well as a user-friendly experience for maximum end-application efficiency.

Table 1: Device summary

Order code	Marking	Package	Packing
STB36N60M6	36N60M6	D²PAK	Tape and reel

This is information on a product in full production.

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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	30	A
I_D	Drain current (continuous) at T_C = 100 °C	19	A
I_D(1)	Drain current (pulsed)	102	A
P_{TOT}	Total dissipation at T_C = 25 °C	208	W
dv/dt(2)	Peak diode recovery voltage slope	15	V/ns
dv/dt(3)	MOSFET dv/dt ruggedness	50	
T_J	Operating junction temperature range	-55 to 150	°C
T_{stg}	Storage temperature range		

Notes:

(1)Pulse width limited by safe operating area.

(2)I_{SD} ≤ 30 A, di/dt = 400 A/µs; $V_{DS\ peak}$ < $V_{(BR)DSS}$, V_{DD} = 400 V

(3)V_{DS} ≤ 480 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.6	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb(1)	30	

Notes:

(1)When mounted on 1 inch² FR-4, 2 Oz copper board.

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax.}$)	5	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	750	mJ

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 5: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS}= 0 V, I_D = 1 mA	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)			100	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±5	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3.25	4	4.75	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 15 A		85	99	mΩ

Notes:

(1)Defined by design, not subject to production test.

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	1960	-	pF
C_{oss}	Output capacitance		-	93	-	pF
C_{rss}	Reverse transfer capacitance		-	6	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 480 V, V_{GS} = 0 V	-	332	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	1.6	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 30 A, V_{GS} = 0 to 10 V, (See *Figure 15: "Test circuit for gate charge behavior"*)	-	44.3	-	nC
Q_{gs}	Gate-source charge		-	10.1	-	nC
Q_{gd}	Gate-drain charge		-	25	-	nC

Notes:

(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 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 15 A, R_G = 4.7 Ω, V_{GS} = 10 V (See *Figure 14: "Test circuit for resistive load switching times"* and *Figure 19: "Switching time waveform"*)	-	15.2	-	ns
t_r	Rise time		-	5.3	-	ns
$t_{d(off)}$	Turn-off delay time		-	50.2	-	ns
t_f	Fall time		-	7.3	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		30	A
I_{SDM}(1)	Source-drain current (pulsed)		-		102	A
V_{SD}(2)	Forward on voltage	I_{SD} = 30 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 30 A, di/dt = 100 A/µs, V_{DD} = 60 V, (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	340		ns
Q_{rr}	Reverse recovery charge		-	5.3		µC
I_{RRM}	Reverse recovery current		-	31		A
t_{rr}	Reverse recovery time	I_{SD} = 30 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	430		ns
Q_{rr}	Reverse recovery charge		-	7.7		µC
I_{RRM}	Reverse recovery current		-	36		A

Notes:

(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

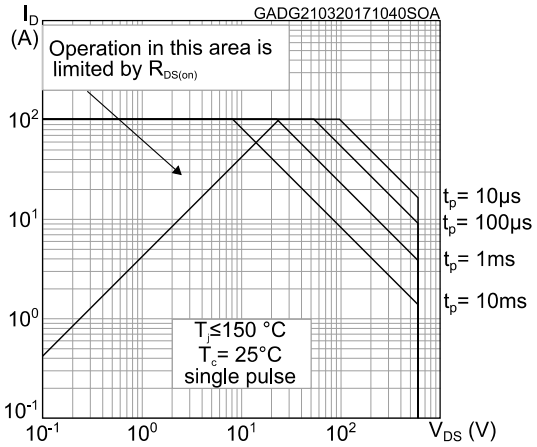


Figure 3: Thermal impedance

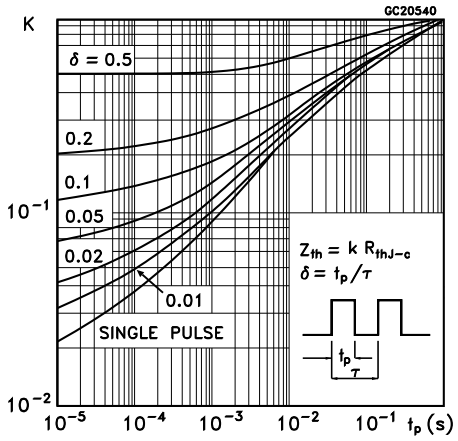


Figure 4: Output characteristics

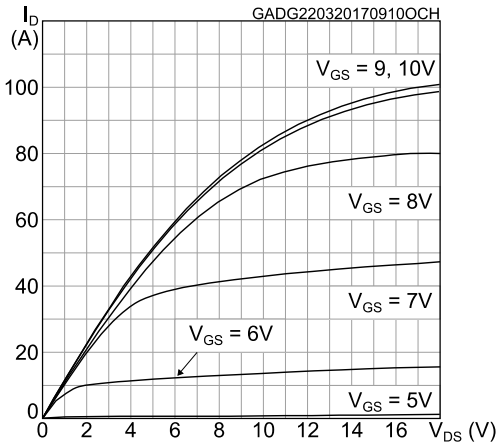


Figure 5: Transfer characteristics

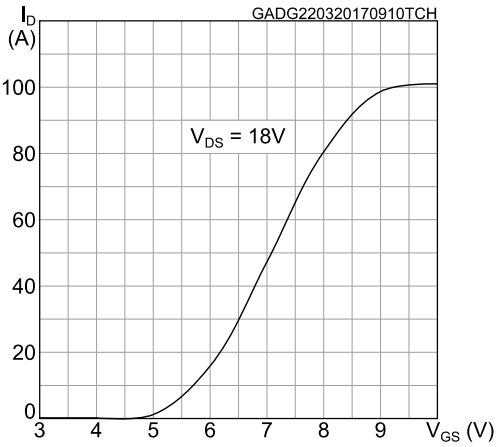


Figure 6: Normalized VBR(DSS)vs temperature

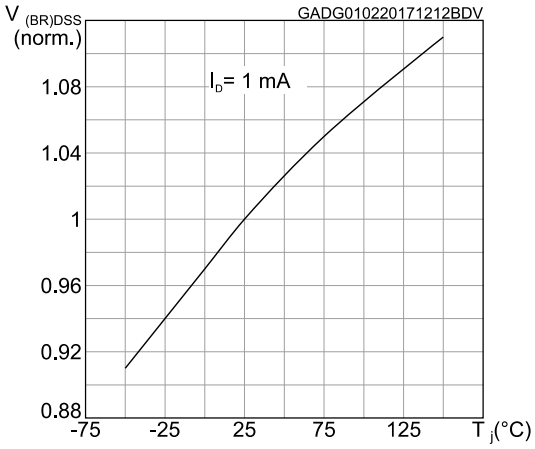


Figure 7: Static drain-source on-resistance

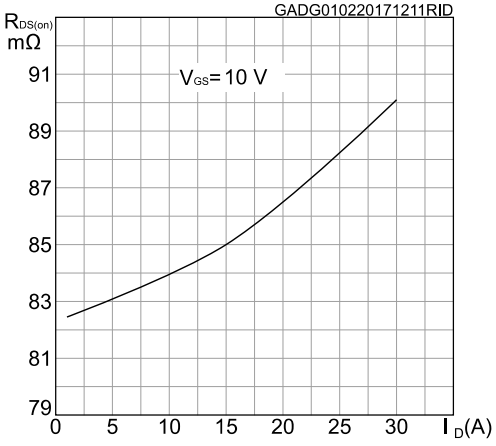


Figure 8: Gate charge vs gate-source voltage

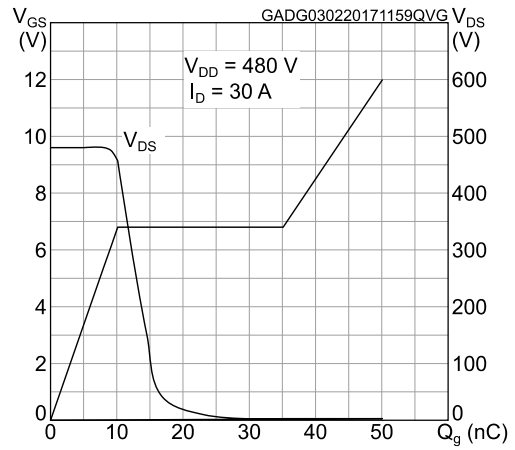


Figure 9: Capacitance variations

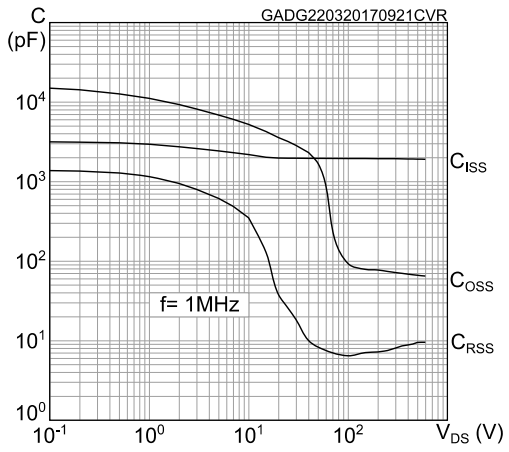


Figure 10: Normalized gate threshold voltage vs temperature

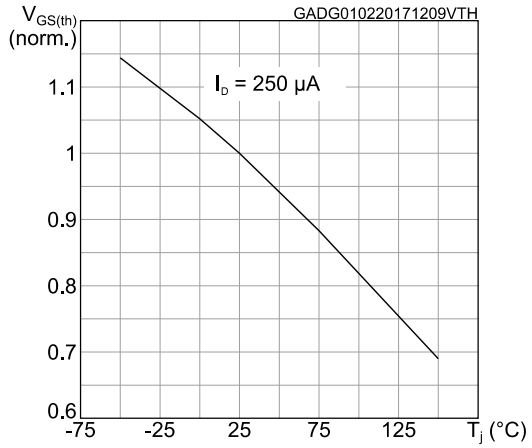


Figure 11: Normalized on-resistance vs temperature

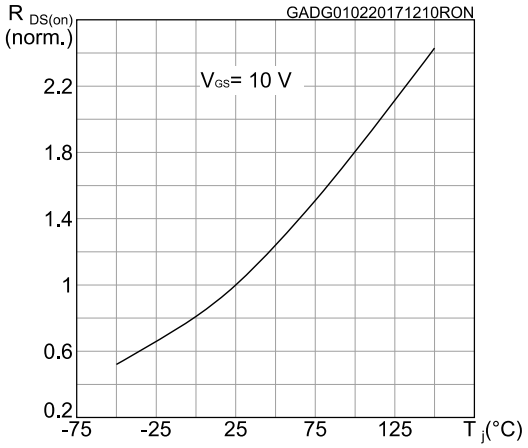


Figure 12: Source-drain diode forward characteristics

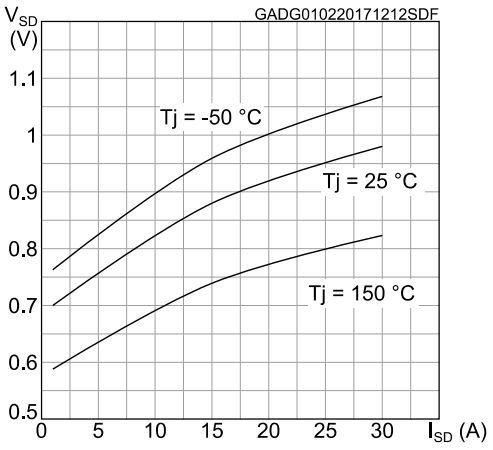
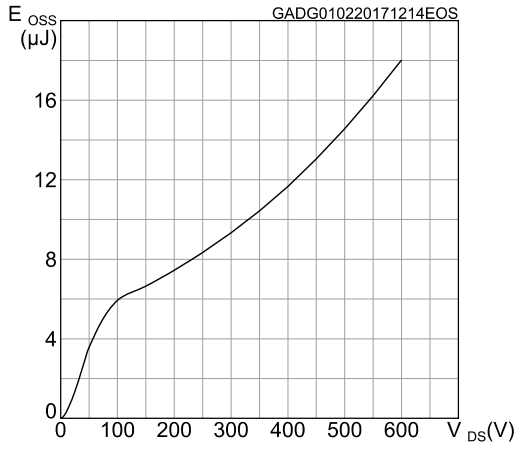


Figure 13: Output capacitance stored energy



3 Test circuits

Figure 14: Test circuit for resistive load switching times

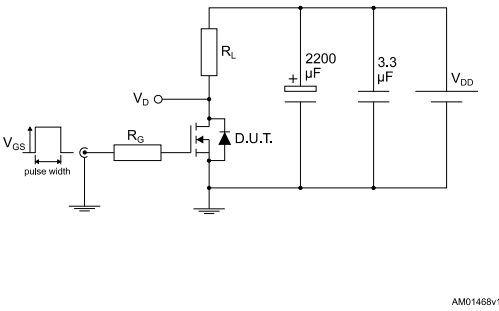


Figure 15: Test circuit for gate charge behavior

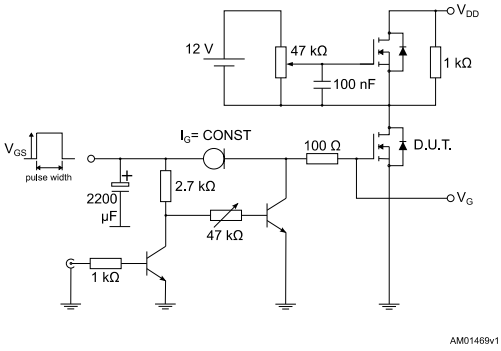


Figure 16: Test circuit for inductive load switching and diode recovery times

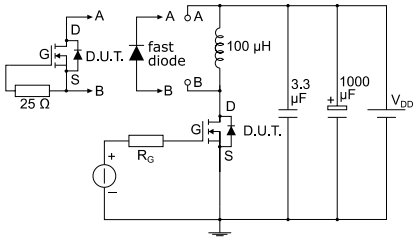


Figure 17: Unclamped inductive load test circuit

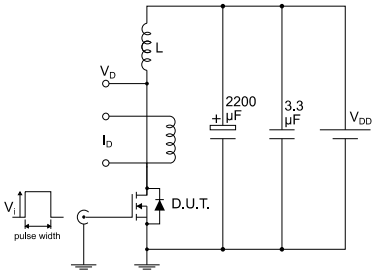


Figure 18: Unclamped inductive waveform

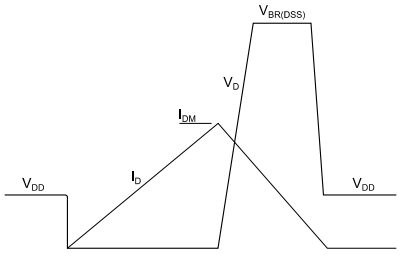
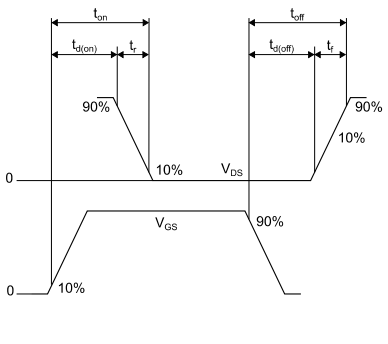


Figure 19: Switching time waveform



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 type A package information

Figure 20: D²PAK (TO-263) type A package outline

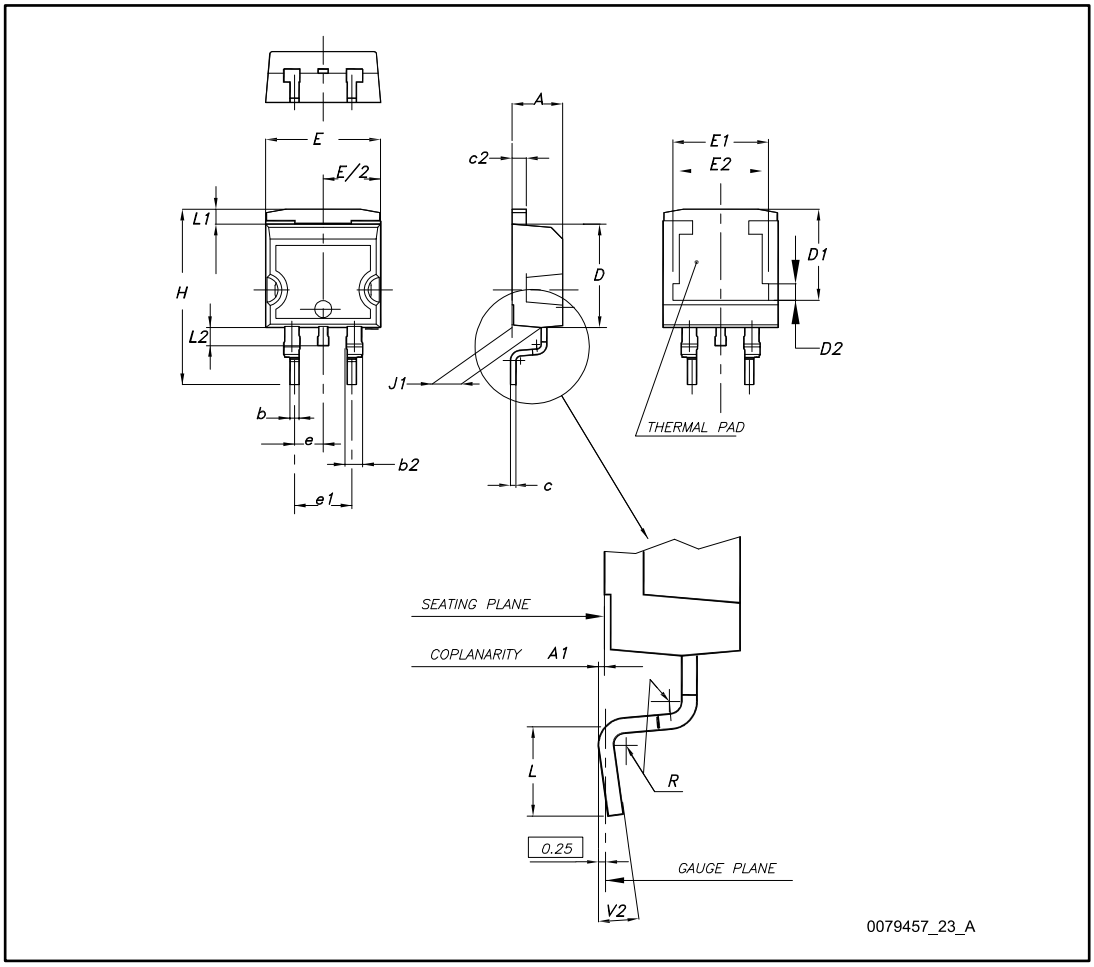
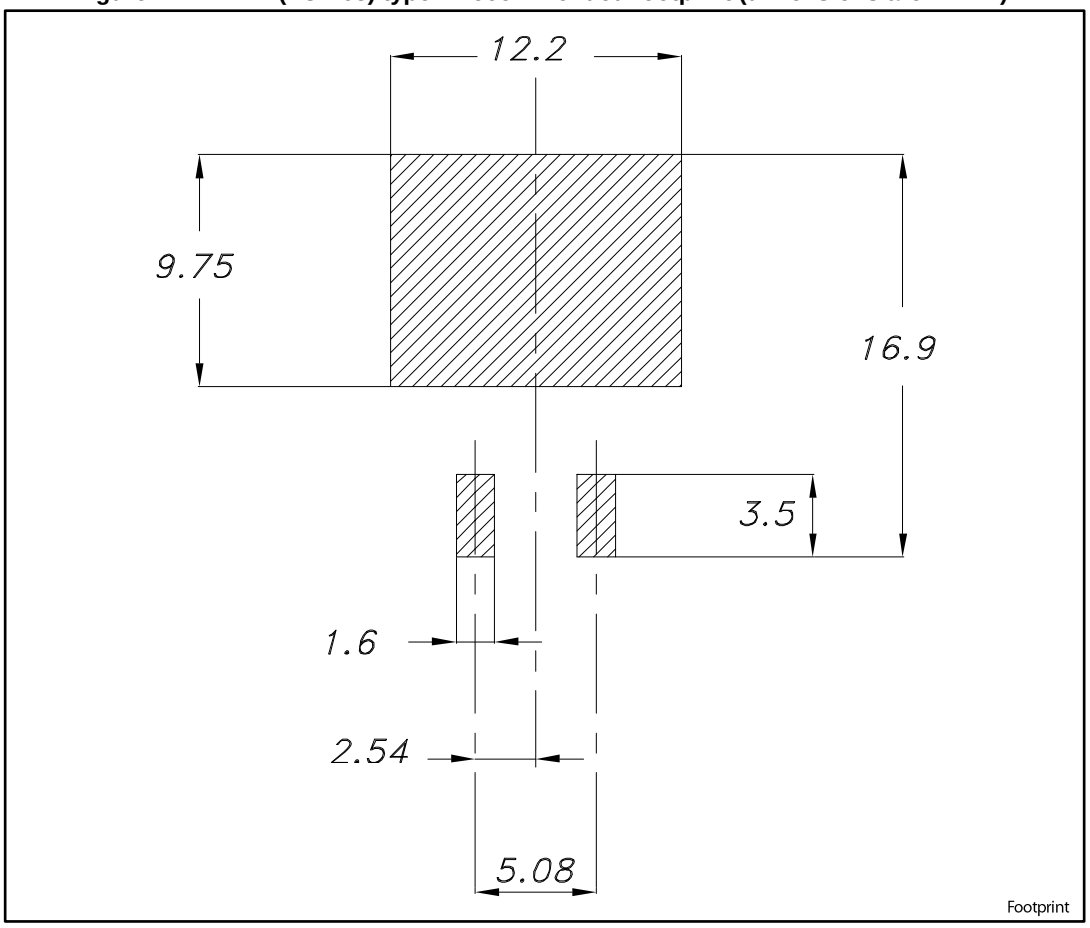


Table 9: D²PAK (TO-263) type A package mechanical data

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	8.50	8.70	8.90
E2	6.85	7.05	7.25
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 21: D²PAK (TO-263) type A recommended footprint (dimensions are in mm)



4.2 D²PAK (TO-263) type B package information

Figure 22: D²PAK (TO-263) type B package outline

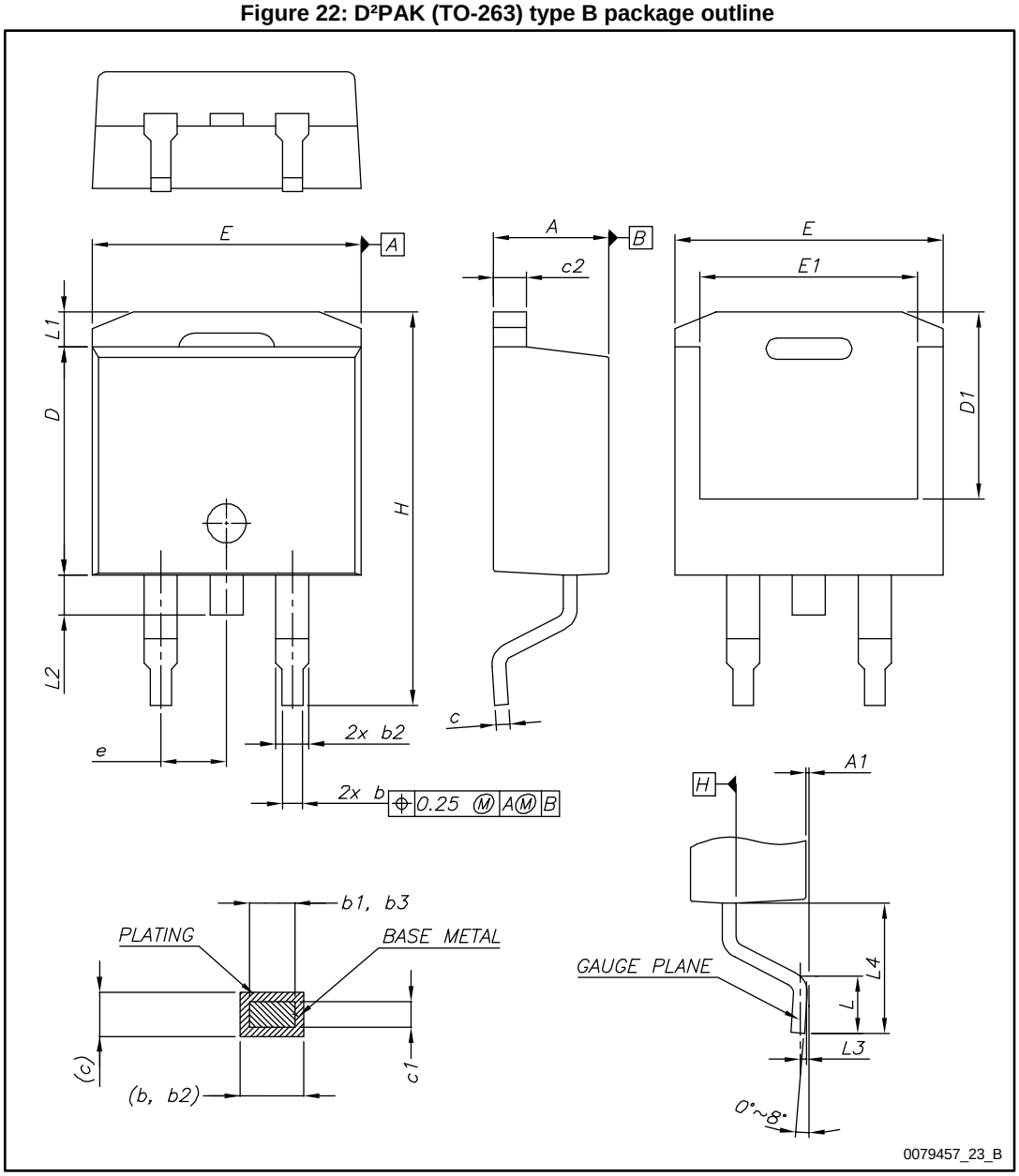
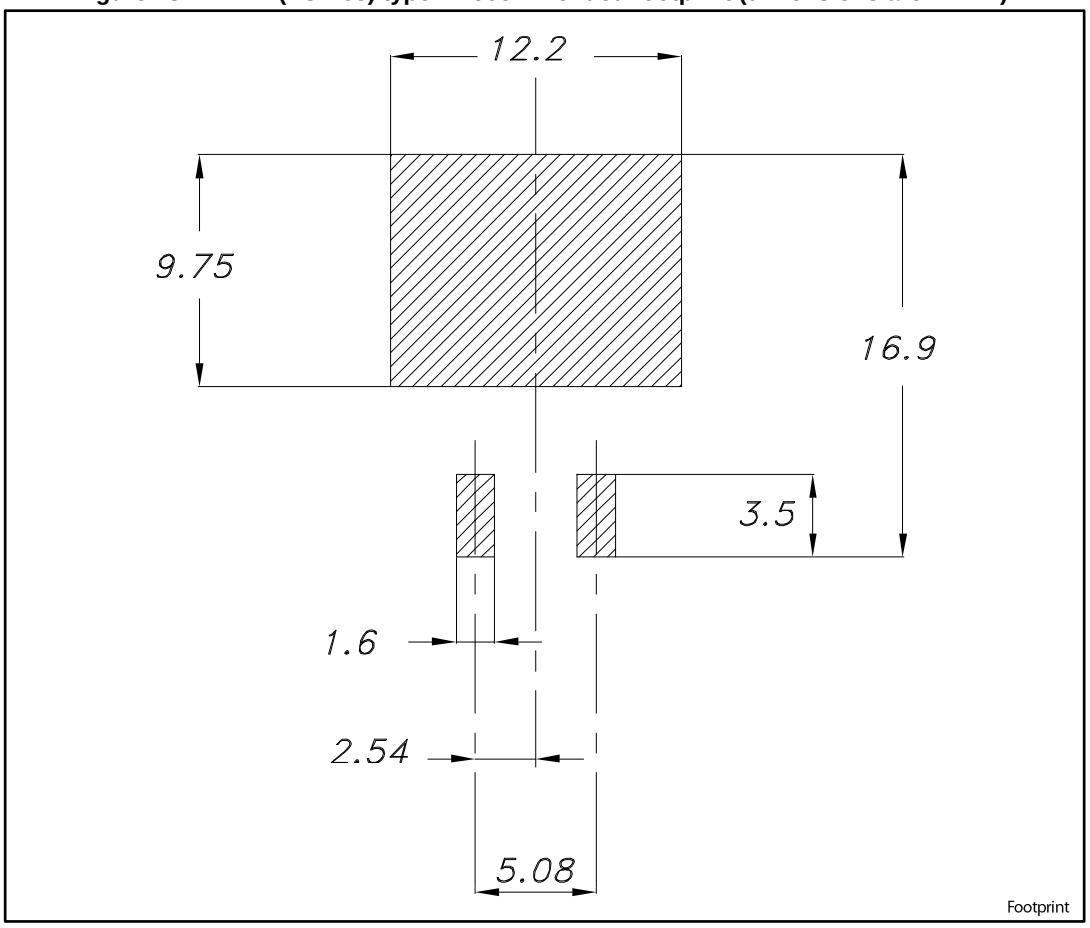


Table 10: D²PAK (TO-263) type B mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.36		4.56
A1	0		0.25
b	0.70		0.90
b1	0.51		0.89
b2	1.17		1.37
b3	1.36		1.46
c	0.38		0.694
c1	0.38		0.534
c2	1.19		1.34
D	8.60		9.00
D1	6.90		7.50
E	10.15		10.55
E1	8.10		8.70
e	2.54 BSC		
H	15.00		15.60
L	1.90		2.50
L1			1.65
L2			1.78
L3		0.25	
L4	4.78		5.28

Figure 23: D²PAK (TO-263) type B recommended footprint (dimensions are in mm)



4.3 D2PAK type A packing information

Figure 24: D2PAK type A tape outline

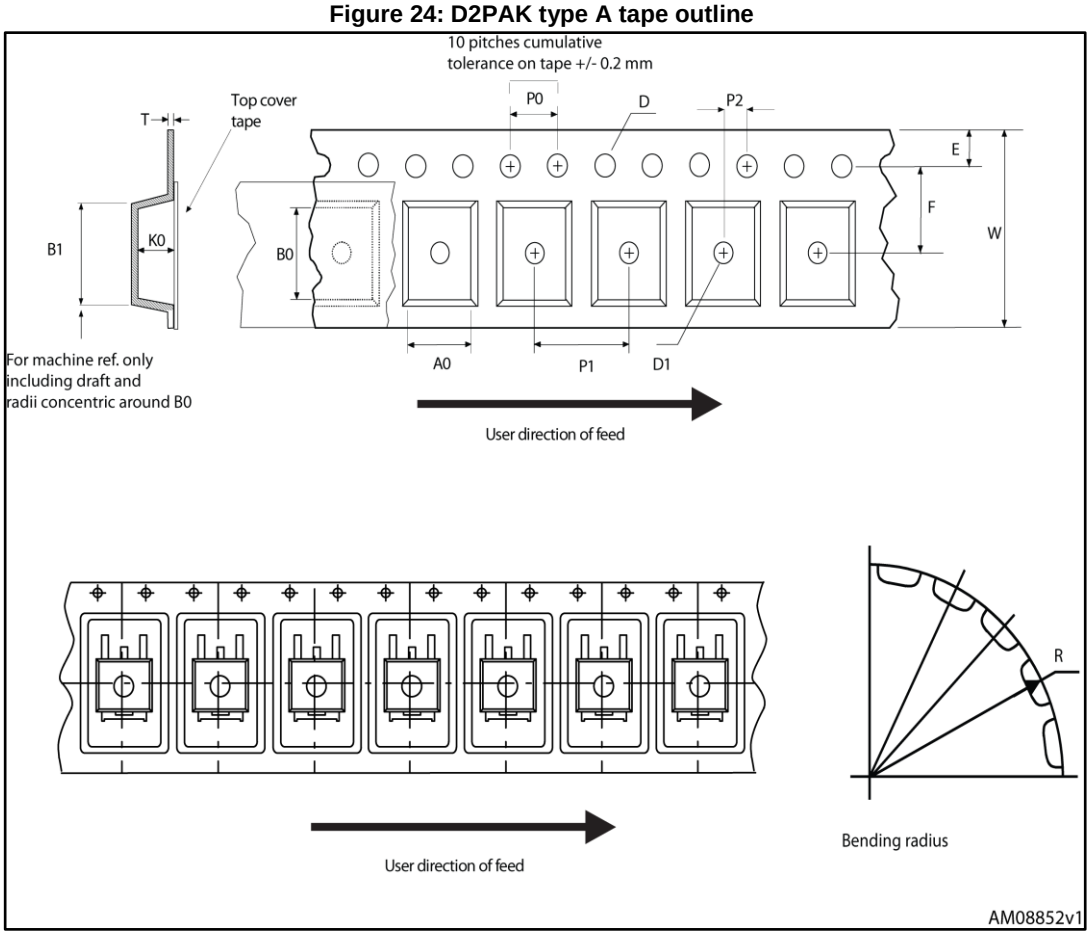


Figure 25: D2PAK type A reel outline

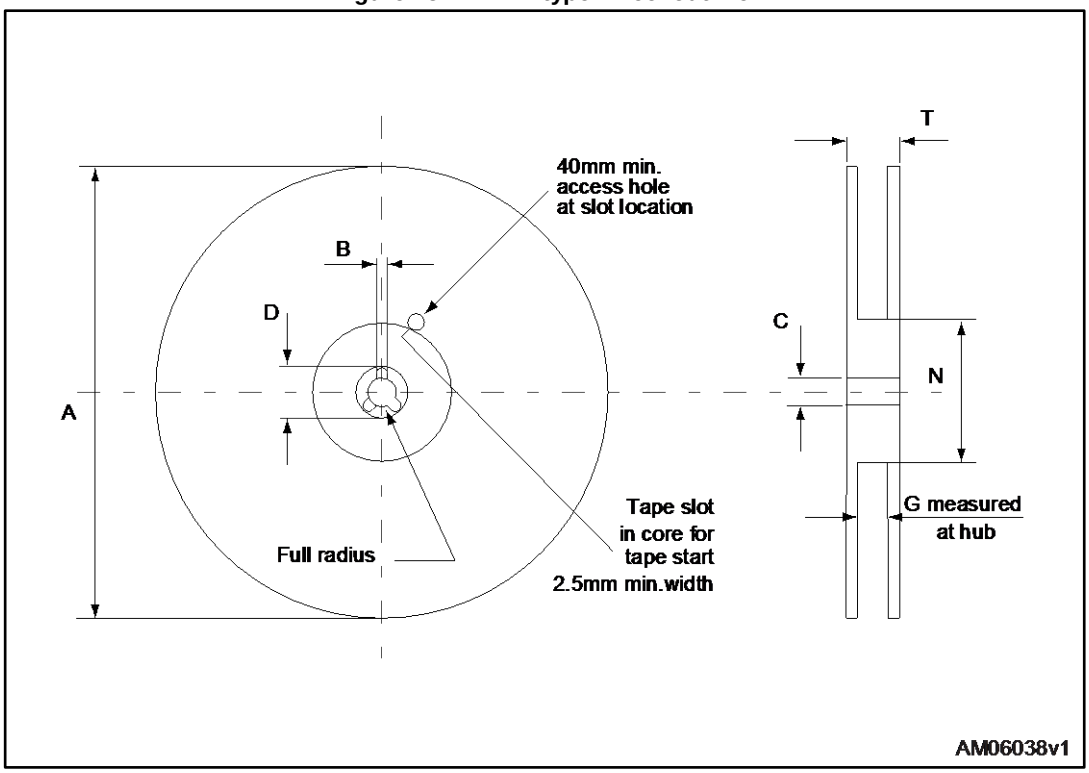


Table 11: D²PAK type A tape and reel mechanical data

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			

4.4 D²PAK type B packing information

Figure 26: D2PAK type B tape outline

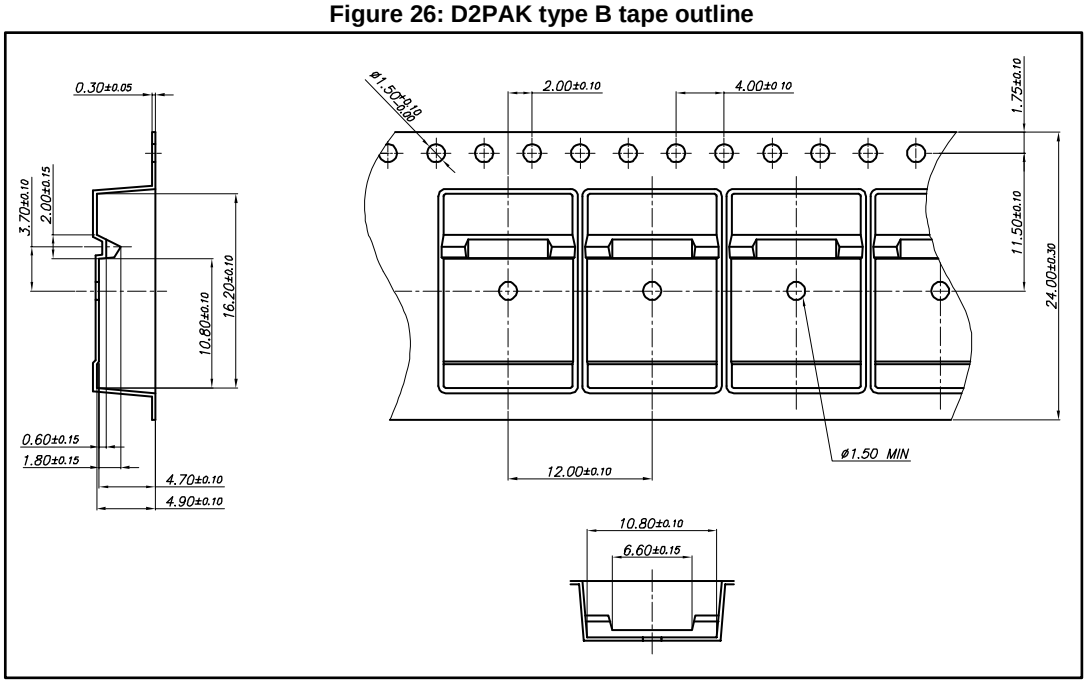


Figure 27: D2PAK type B reel outline

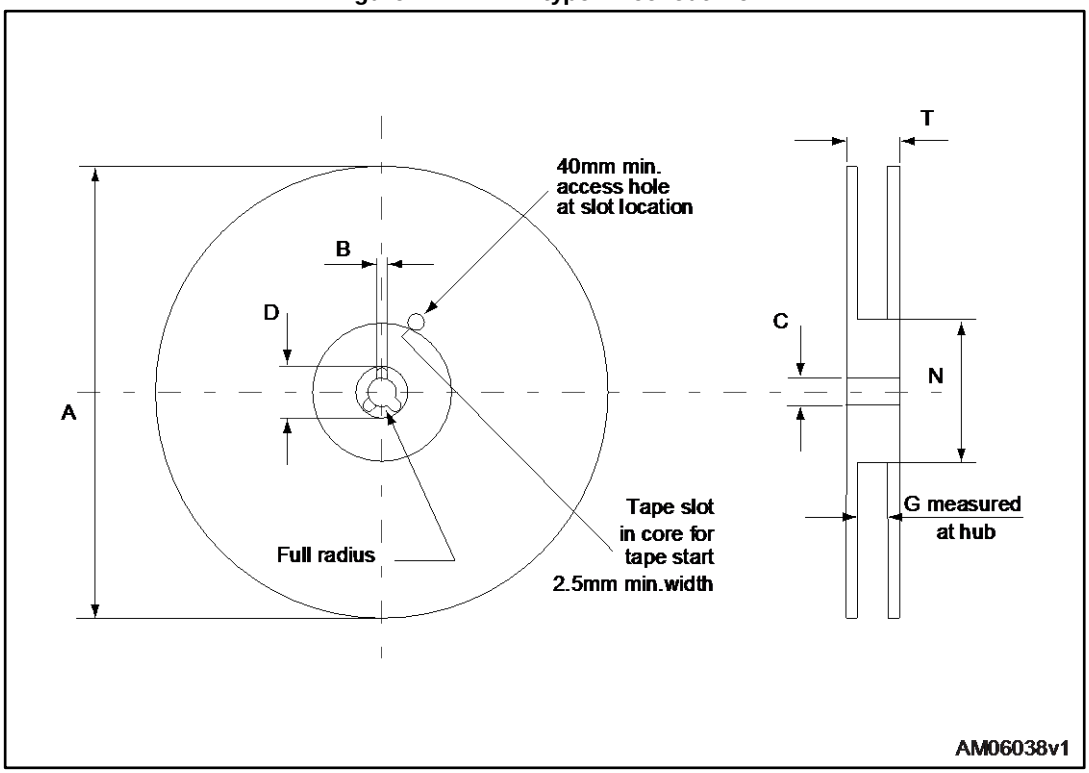


Table 12: D²PAK type B reel mechanical data

Dim.	mm	
	Min.	Max.
A		330
B	1.5	
C	12.8	13.2
D	20.2	
G	24.4	26.4
N	100	
T		30.4

5 Revision history

Table 13: Document revision history

Date	Revision	Changes
08-Jan-2015	1	Initial release.
07-Apr-2016	2	Updated *Table 2: "Absolute maximum ratings"*, *Table 6: "Dynamic"*, *Table 7: "Switching times"* and *Table 8: "Source-drain diode"*.
06-Feb-2017	3	Updated title, the table of features in cover page, *Section 1: "Electrical ratings"* and *Section 2: "Electrical characteristics"*. Added *Section 2.1: "Electrical characteristics (curves)"*. Added *Section 4.2: "D²PAK (TO-263) type B package information"* and *Section 4.4: "D²PAK type B packing information"*. Minor text changes.
21-Mar-2017	4	Updated document status from preliminary to production data. Updated *Table 2: "Absolute maximum ratings"*, *Table 6: "Dynamic"* and *Table 8: "Source-drain diode"*. Updated *Figure 2: "Safe operating area"*, *Figure 4: "Output characteristics"*, *Figure 5: "Transfer characteristics"* and *Figure 9: "Capacitance variations"*.

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