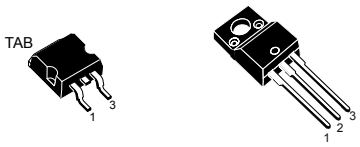
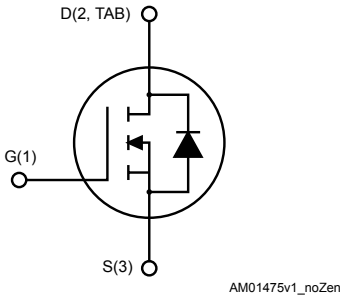
N-channel 550 V, 0.150 Ω typ., 16 A MDmesh™ M5 Power MOSFETs in a D²PAK and TO-220FP packages



D²PAK TO-220FP



Features

Order code	V_{DS} @ $T_{jmax.}$	$R_{DS(on)}$max.	Package
STB18N55M5	600 V	0.192 Ω	D²PAK
STF18N55M5			TO-220FP

- 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 link
STB18N55M5
STF18N55M5

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D²PAK	TO-220FP	
V_{GS}	Gate-source voltage	±25		V
I_D	Drain current (continuous) at T_C = 25 °C	16		A
I_D	Drain current (continuous) at T_C = 100 °C	10		A
I_{DM} (1)	Drain current (pulsed)	64		A
P_{TOT}	Total dissipation at T_C = 25 °C	110	25	W
dv/dt (2)	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)	2.5		kV
T_j	Operating junction temperature range	-55 to 150		°C
T_{stg}	Storage temperature range			

1. *Pulse width limited by safe operating area.*
2. *I_{SD} ≤ 16 A, di/dt ≤ 400 A/µs; $V_{DS\ peak}$ < $V_{(BR)DSS}$, V_{DD} = 340 V.*

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		D²PAK	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.14	5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		62.5	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	30		°C/W

1. *When mounted on an 1-inch² FR-4, 2oz Cu board.*

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j Max)	4	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	210	mJ

2 Electrical characteristics

(T_{CASE} = 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	550			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 550 V			1	µA
		V_{GS} = 0 V, V_{DS} = 550 V, T_C = 125 °C(1)			100	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, 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 = 8 A		0.150	0.192	Ω

1. *Defined by design, not subject to production test.*

Table 5. Dynamic

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	1260	-	pF
C_{oss}	Output capacitance			42		
C_{rss}	Reverse transfer capacitance			3.6		
$C_{o(tr)}$ (1)	Equivalent capacitance time related	V_{DS} = 0 to 440 V, V_{GS} = 0 V	-	103	-	pF
$C_{o(er)}$ (2)	Equivalent capacitance energy related		-	35	-	pF
Rg	Gate input resistance	f = 1 MHz open drain	-	2.8	-	Ω
Q_g	Total gate charge	V_{DD} = 440 V, I_D = 8 A, V_{GS} = 0 to 10 V (see Figure 18. Test circuit for gate charge behavior)	-	31	-	nC
Q_{gs}	Gate-source charge			8.3		
Q_{gd}	Gate-drain charge			14.2		

1. *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}.*
2. *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 condition	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	V_{DD} = 400 V, I_D = 10.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 19. Test circuit for inductive load switching and diode recovery times and Figure 22. Switching time waveform)	-	37	-	ns
$t_{r(v)}$	Voltage rise time			7		
$t_{c(off)}$	Crossing time			10.3		
$t_{f(i)}$	Current fall time			8.3		

Table 7. Source drain diode

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		16	A
I_{SDM} (1)	Source-drain current (pulsed)				64	
V_{SD} (2)	Forward on voltage	I_{SD} = 16 A, V_{GS} = 0 V	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 16 A, di/dt = 100 A/µs V_{DD} = 100 V (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	244		ns
Q_{rr}	Reverse recovery charge			2.8		µC
I_{RRM}	Reverse recovery current			23		A
t_{rr}	Reverse recovery time	I_{SD} = 16 A, di/dt = 100 A/µs V_{DD} = 100 V, Tj = 150 °C (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	295		ns
Q_{rr}	Reverse recovery charge			3.7		µC
I_{RRM}	Reverse recovery current			25		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

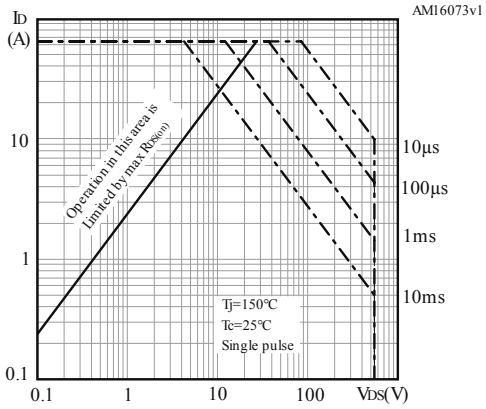


Figure 2. Thermal impedance for D²PAK

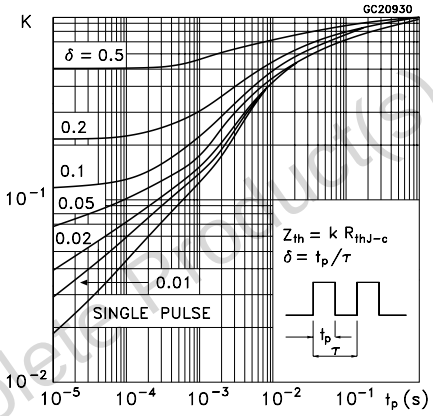


Figure 4. Safe operating area for TO-220FP

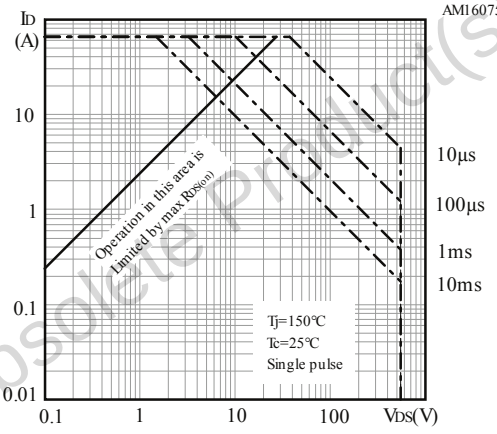


Figure 5. Thermal impedance for TO-220FP

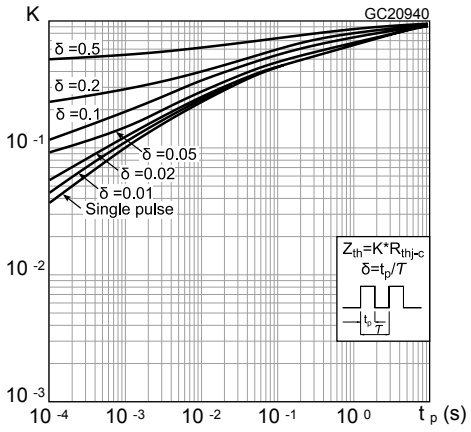


Figure 6. Output characterisics

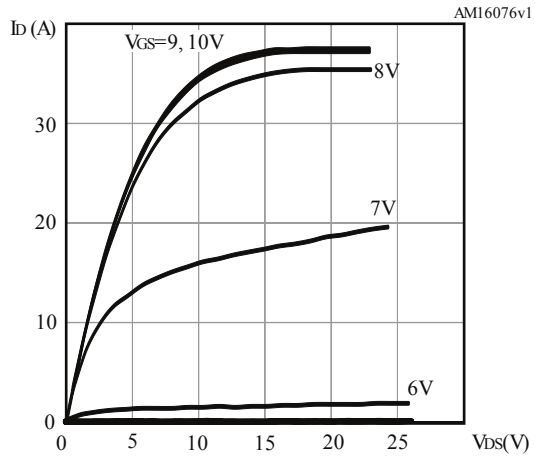


Figure 7. Transfer characteristics

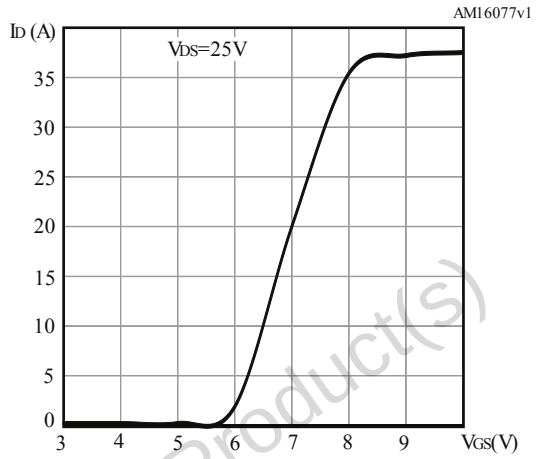


Figure 8. Gate charge vs gate-source voltage

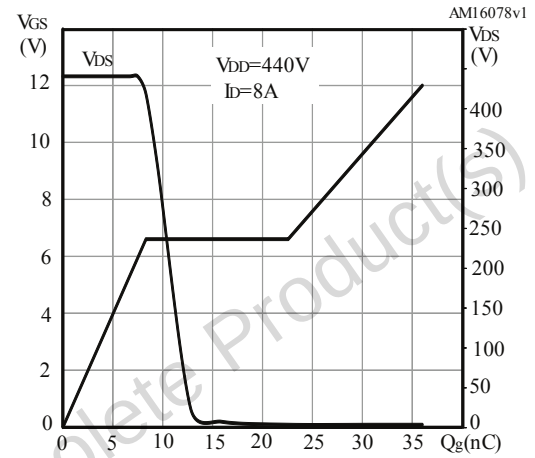


Figure 9. Static drain-source on resistance

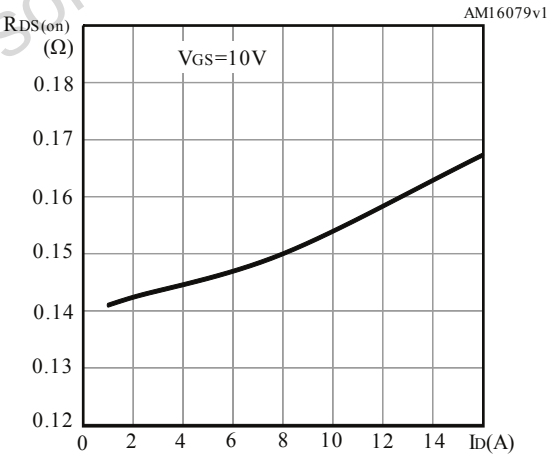


Figure 10. Capacitance variations

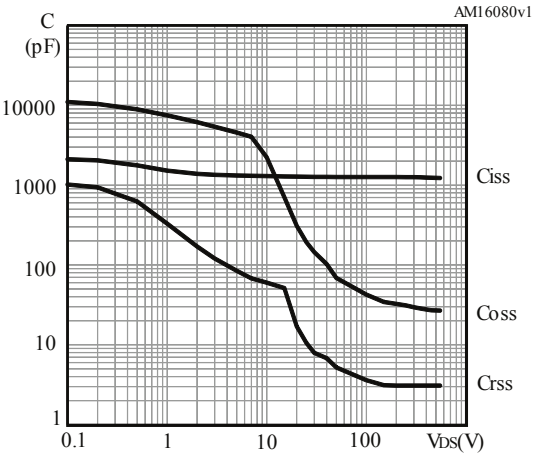


Figure 11. Output capacitance stored energy

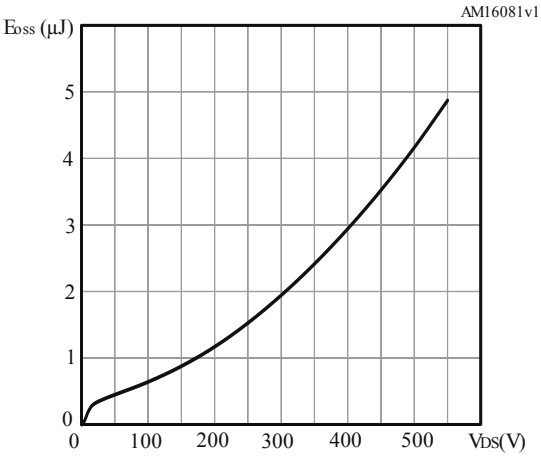


Figure 12. Normalized on-resistance vs temperature

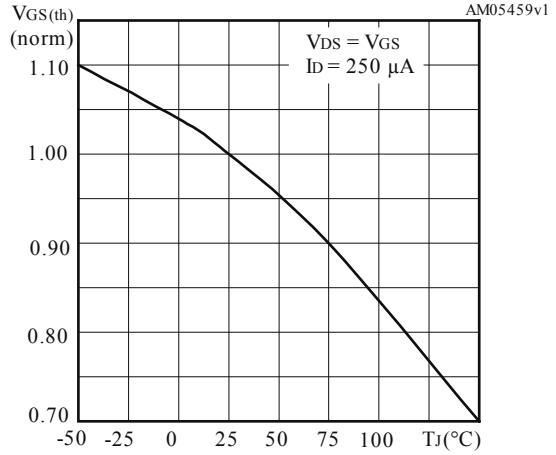


Figure 13. Normalized gate threshold voltage vs temperature

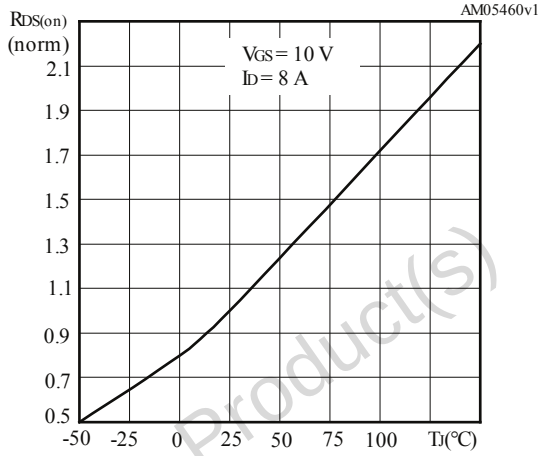


Figure 14. Drain-source diode forward characteristics

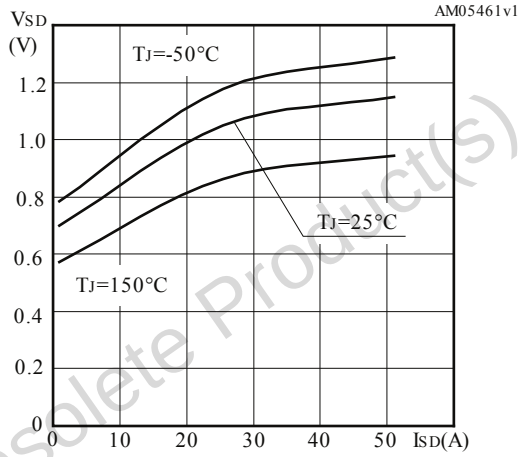


Figure 15. Normalized $V_{(BR)DSS}$ vs temperature

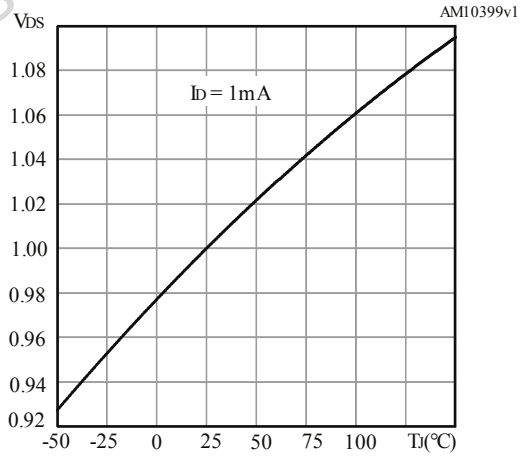
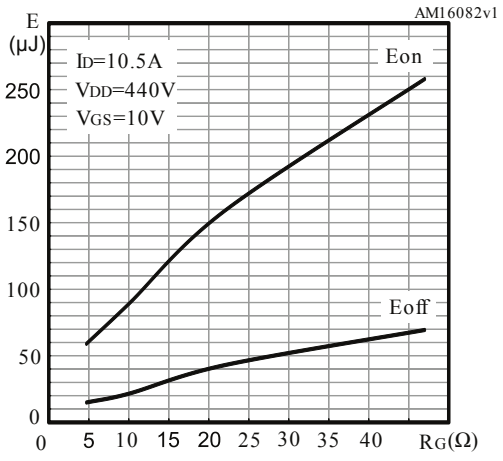


Figure 16. Switching energy vs gate resistance



* Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 17. Test circuit for resistive load switching times

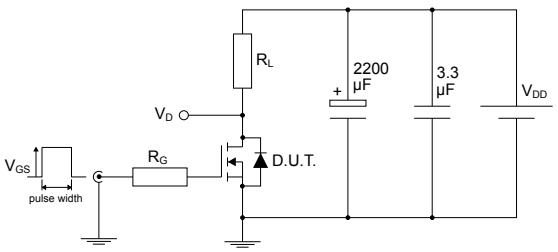


Figure 18. Test circuit for gate charge behavior

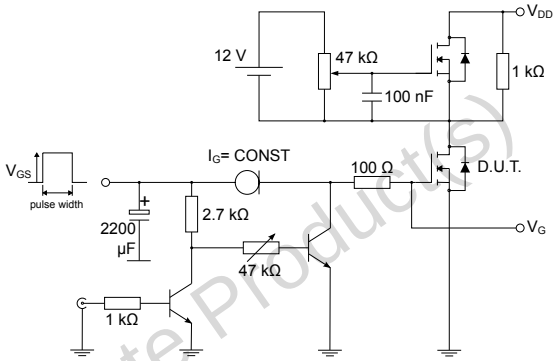


Figure 19. Test circuit for inductive load switching and diode recovery times

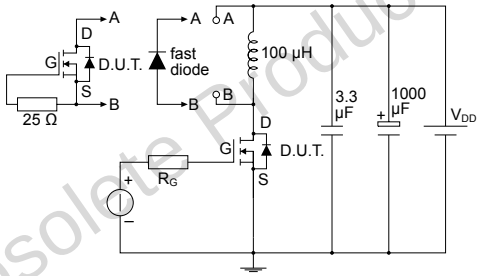


Figure 20. Unclamped inductive load test circuit

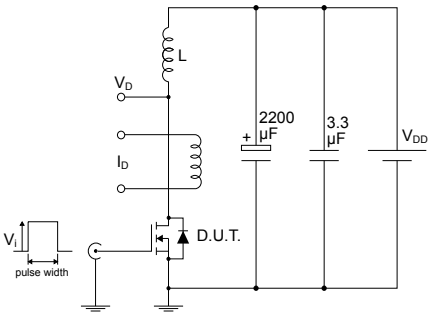


Figure 21. Unclamped inductive waveform

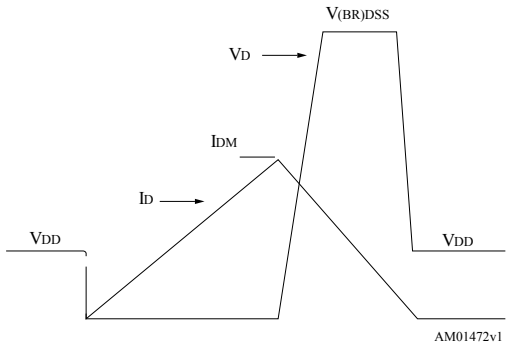
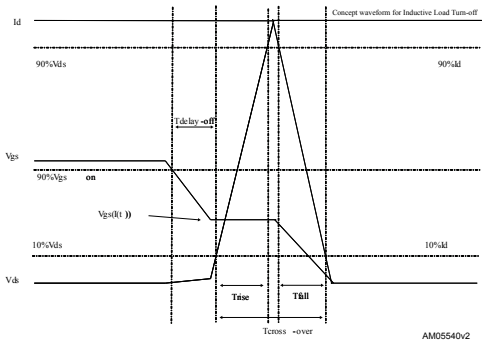


Figure 22. Switching time waveform



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 (TO-263) type A package information

Figure 23. D²PAK (TO-263) type A package outline

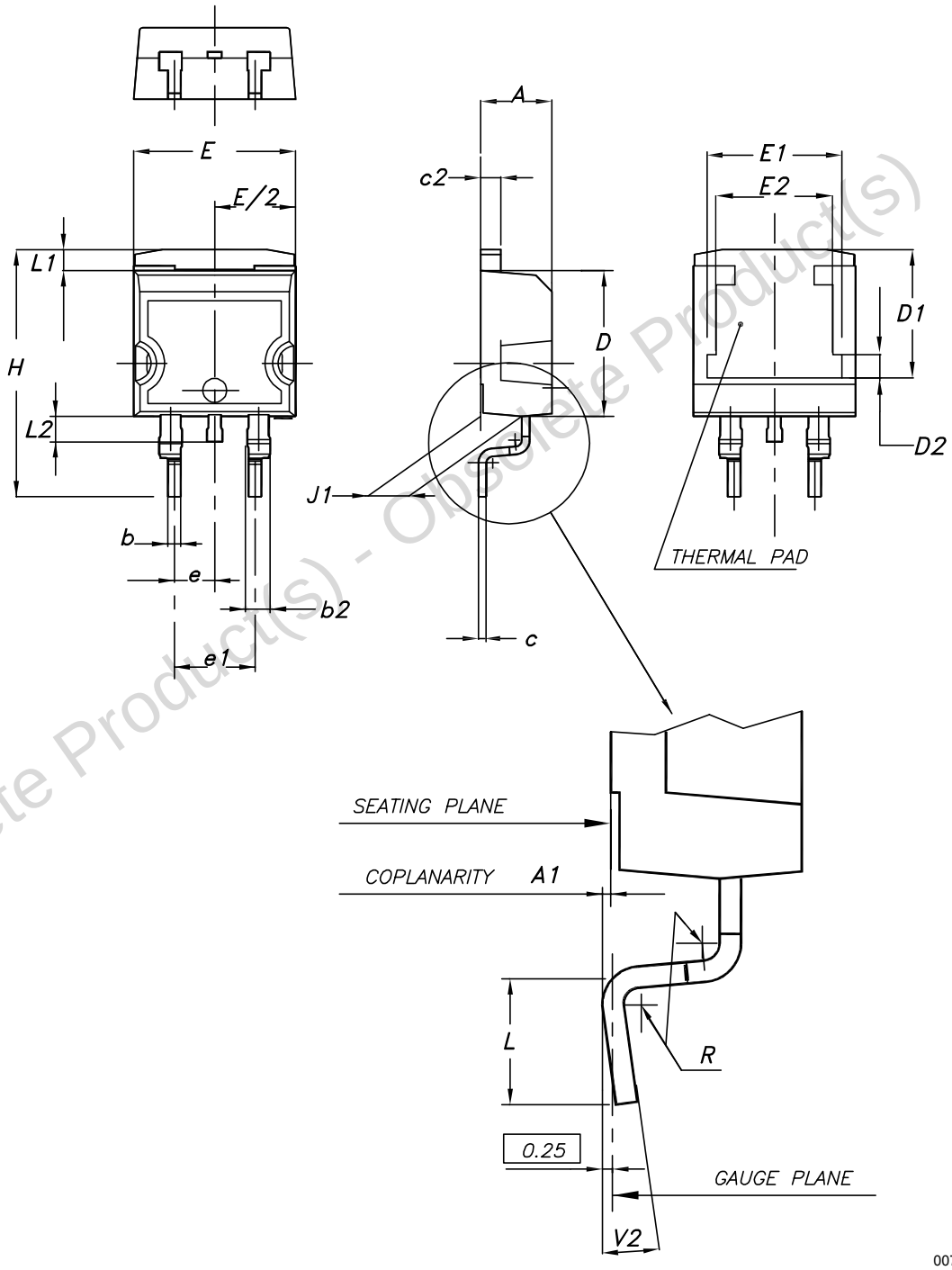
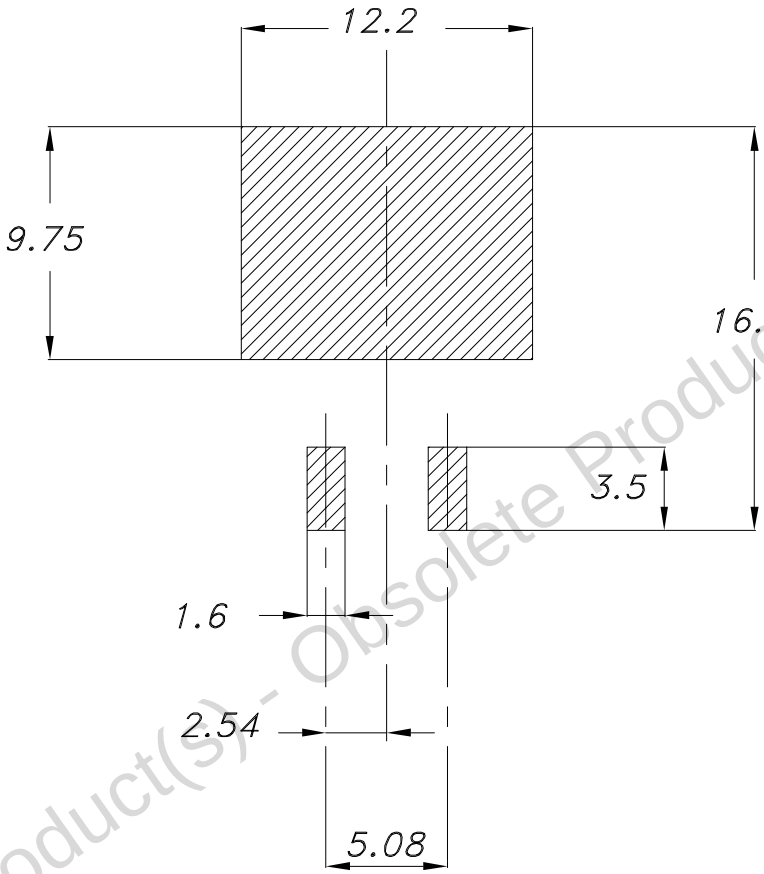


Table 8. D²PAK (TO-263) type A package mechanical data

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	8.30	8.50	8.70
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 24. D²PAK (TO-263) recommended footprint (dimensions are in mm)



Footprint

4.2 D²PAK packing information

Figure 25. D²PAK tape outline

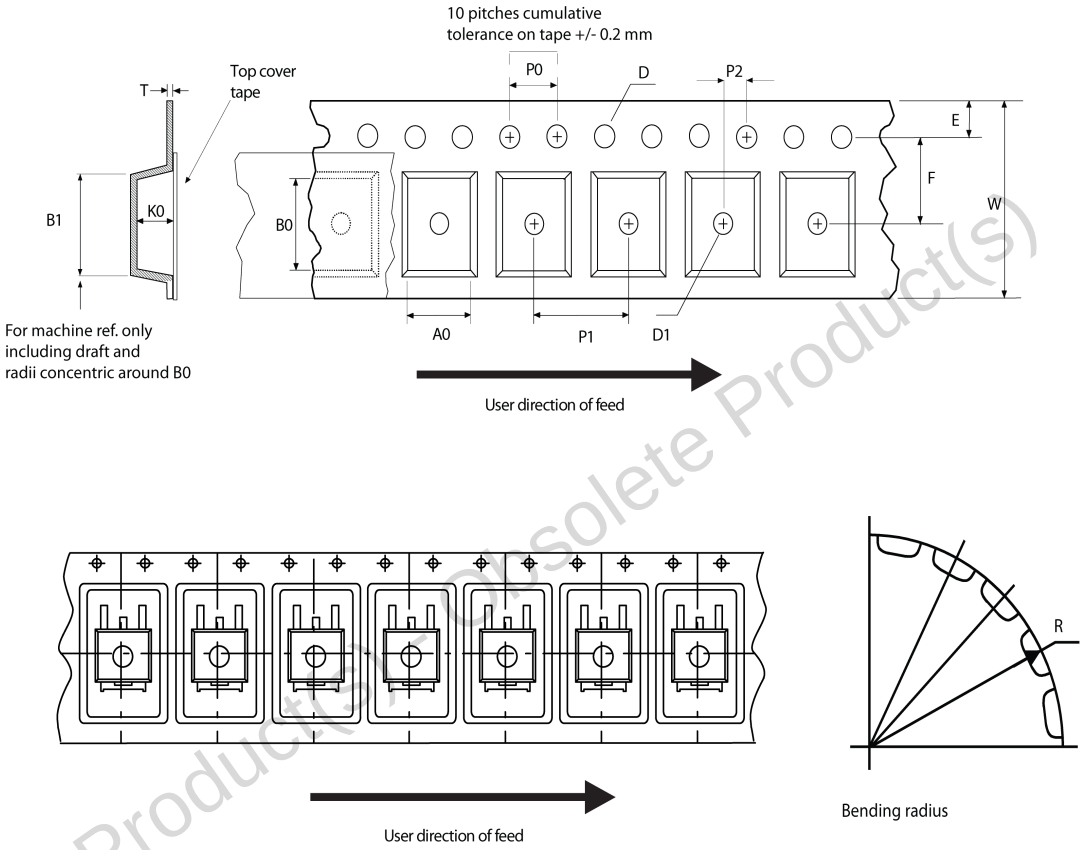


Figure 26. **D²PAK reel outline**

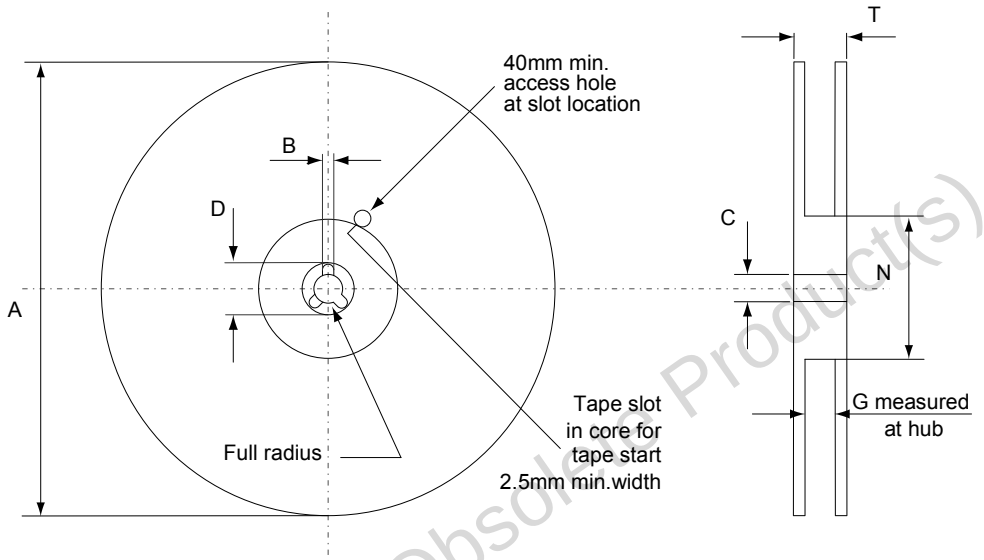


Table 9. **D²PAK tape and reel mechanical data**

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 27. **TO-220FP package outline**

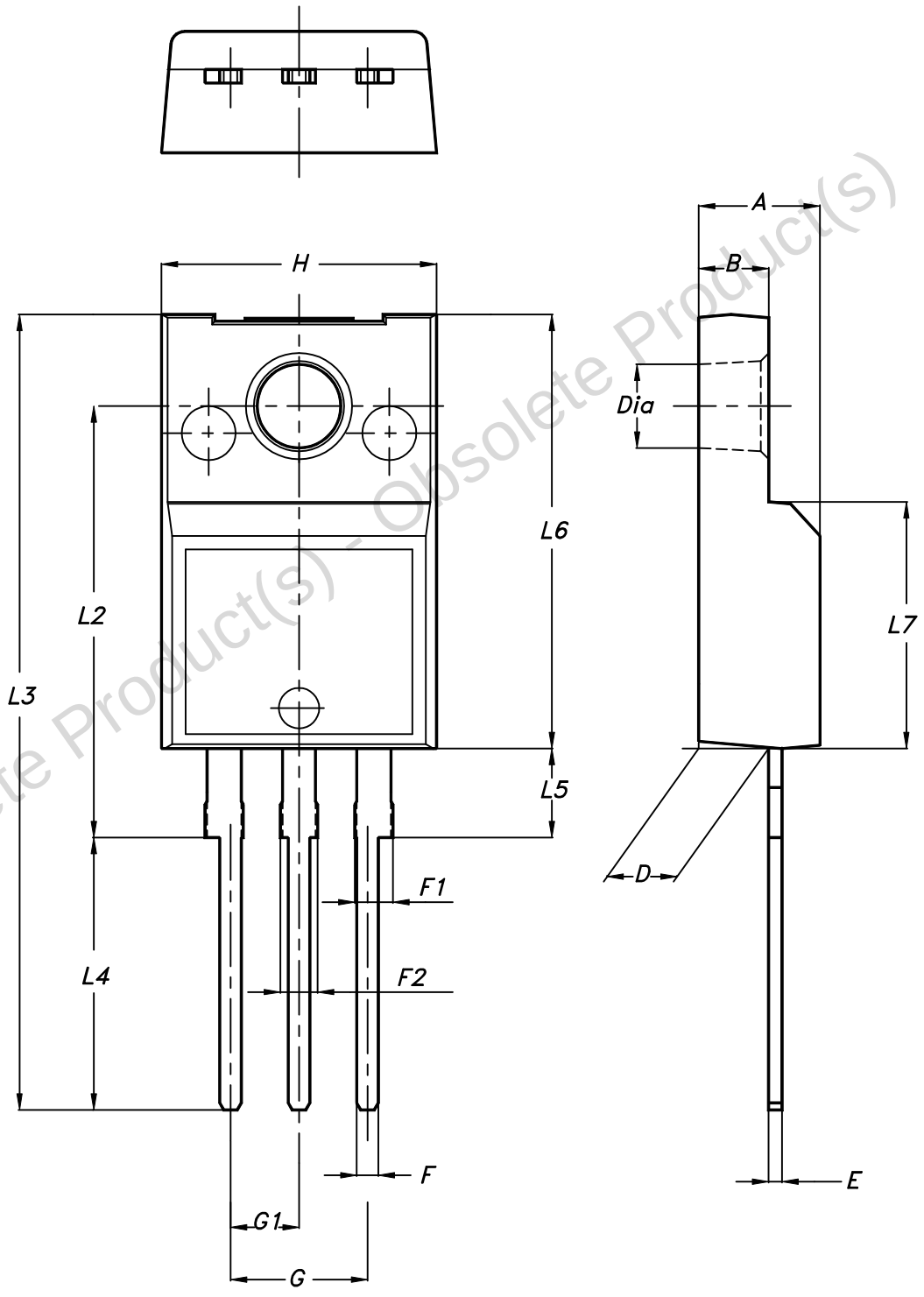


Table 10. **TO-220FP package mechanical data**

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

5 Ordering information

Table 11. **Order codes**

Order code	Marking	Package	Packing
STB18N55M5	18N55M5	D^2PAK	Tape and reel
STF18N55M5		TO-220FP	Tube

Revision history

Table 12. **Document revision history**

Date	Version	Changes
27-Aug-2018	1	First release. Part numbers previously included in datasheet DocID17078.

Contents