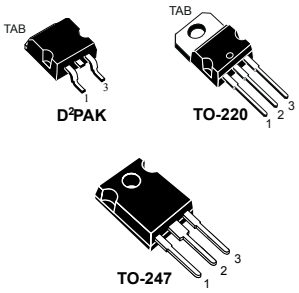
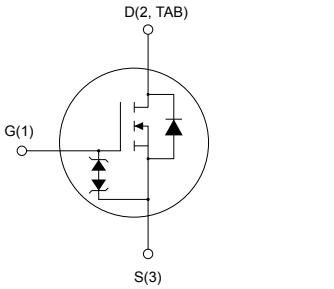
STB24N60DM2, STP24N60DM2, STW24N60DM2

Datasheet

N-channel 600 V, 175 mΩ typ., 18 A MDmesh DM2 Power MOSFETs in a D²PAK, TO-220 and TO-247 packages





Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STB24N60DM2	600 V	200 mΩ	18 A
STP24N60DM2			
STW24N60DM2			

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

Applications

- Switching applications

Description

These high-voltage N-channel Power MOSFET are part of the MDmesh DM2 fast-recovery diode series. They offer very low recovery charge (Q_{rr}) and time (t_{rr}) combined with low $R_{DS(on)}$, rendering them suitable for the most demanding high-efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Product status link
STB24N60DM2
STP24N60DM2
STW24N60DM2

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	±25	V
I_D	Drain current (continuous) at T_C = 25 °C	18	A
	Drain current (continuous) at T_C = 100 °C	11	
I_{DM}(1)	Drain current (pulsed)	72	A
P_{TOT}	Total power dissipation at T_C = 25 °C	150	W
dv/dt(2)	Peak diode recovery voltage slope	40	V/ns
dv/dt(3)	MOSFET dv/dt ruggedness	50	V/ns
T_{stg}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		°C

1. *Pulse width is limited by safe operating area.*
2. *I_{SD} ≤ 18 A, di/dt ≤ 400 A/µs, V_{DS} (peak) < $V_{(BR)DSS}$, V_{DD} = 400 V.*
3. *V_{DS} ≤ 480 V.*

Table 2. Thermal data

Symbol	Parameter	Value			Unit
		D^2PAK	TO-220	TO-247	
R_{thJC}	Thermal resistance, junction-to-case	0.83			°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	30(1)	62.5	50	°C/W

1. *When mounted on a standard 1 inch^2 area of FR-4 PCB with 2-oz copper.*

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max.)	3.5	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	180	mJ

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	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	-	-	1.5	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_C = 125 °C(1)	-	-	100	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V	-	-	±10	µA
$V_{GS(th)}$	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 = 9 A	-	175	200	mΩ

1. *Specified by design, not tested in production.*

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	-	1055	-	pF
C_{oss}	Output capacitance		-	56	-	pF
C_{rss}	Reverse transfer capacitance		-	2.4	-	pF
$C_{oss\ eq.}$(1)	Equivalent output capacitance	V_{GS} = 0 V, V_{DS} = 0 to 480 V	-	259	-	pF
R_g	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	7	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 18 A, V_{GS} = 0 to 10 V (see the Figure 16. Test circuit for gate charge behavior)	-	29	-	nC
Q_{gs}	Gate-source charge		-	6	-	nC
Q_{gd}	Gate-drain charge		-	12	-	nC

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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 9 A, R_G = 4.7 Ω, V_{GS} = 10 V (see the Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform)	-	15	-	ns
t_r	Rise time		-	8.7	-	ns
$t_{d(off)}$	Turn-off delay time		-	60	-	ns
t_f	Fall time		-	15	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	18	A
I_{SDM}(1)	Source-drain current (pulsed)		-	-	72	A
V_{SD}(2)	Forward on voltage	I_{SD} = 18 A, V_{GS} = 0 V	-	-	1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 18 A, di/dt = 100 A/µs,	-	155	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V	-	0.956	-	µC
I_{RRM}	Reverse recovery current	(see the Figure 17. Test circuit for inductive load switching and diode recovery times)	-	12.5	-	A
t_{rr}	Reverse recovery time	I_{SD} = 18 A, di/dt = 100 A/µs,	-	200	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_J = 150 °C	-	1.45	-	µC
I_{RRM}	Reverse recovery current	(see the Figure 17. Test circuit for inductive load switching and diode recovery times)	-	13	-	A

1. *Pulse width is 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 and TO-220

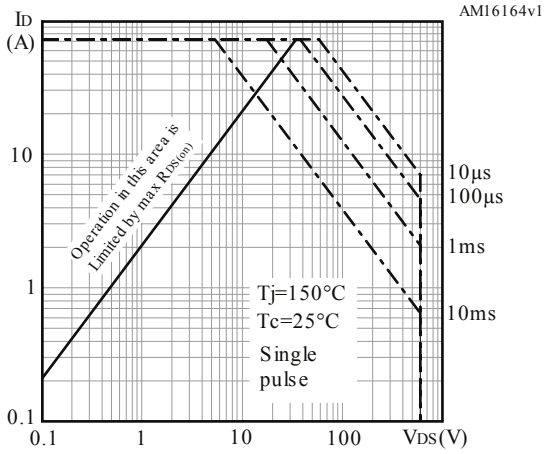


Figure 2. Thermal impedance for D²PAK and TO-220

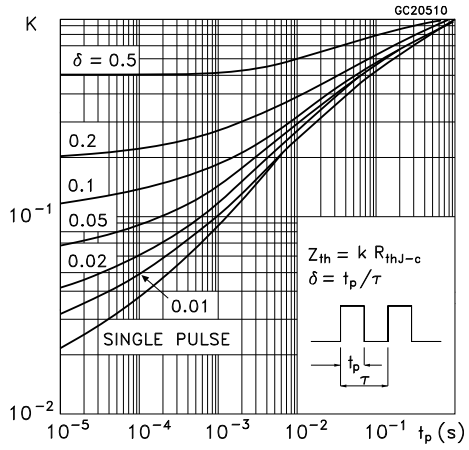


Figure 3. Safe operating area for TO-247

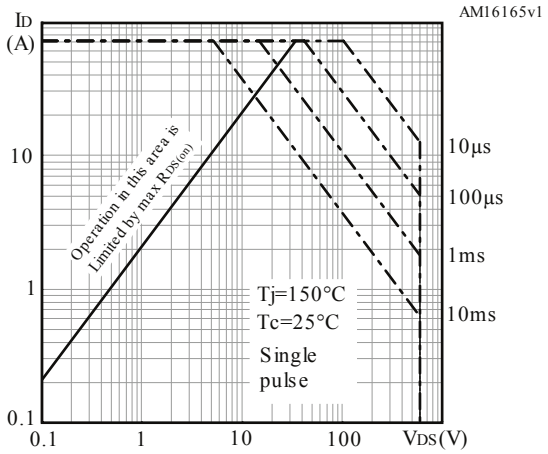


Figure 4. Thermal impedance for TO-247

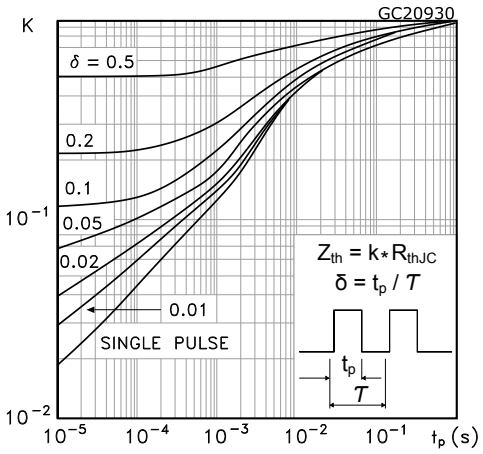


Figure 5. Output characteristics

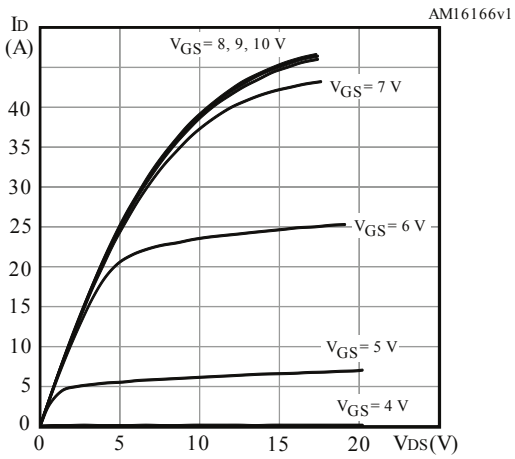


Figure 6. Transfer characteristics

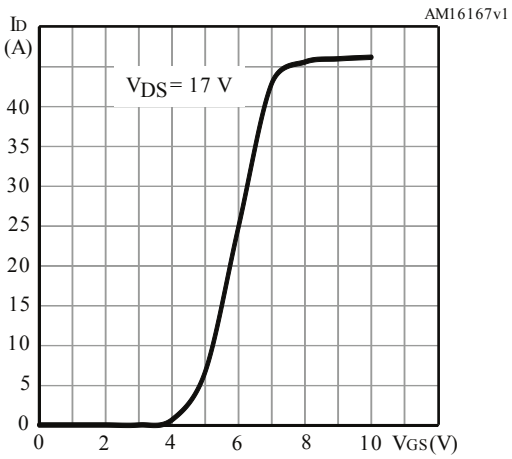


Figure 7. Gate charge vs gate-source voltage

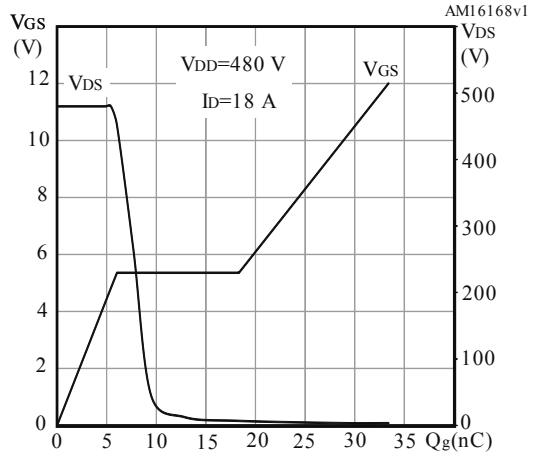


Figure 8. Capacitance variations

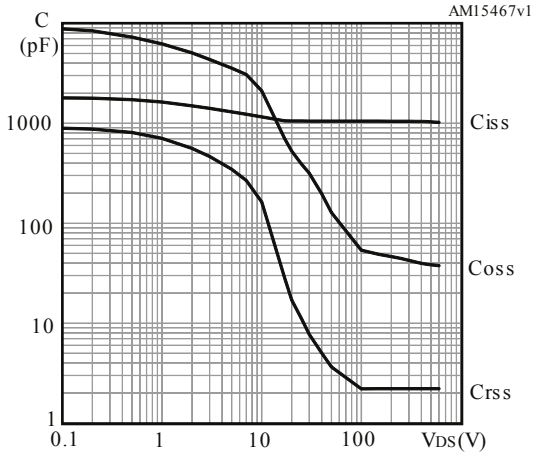


Figure 9. Static drain-source on resistance

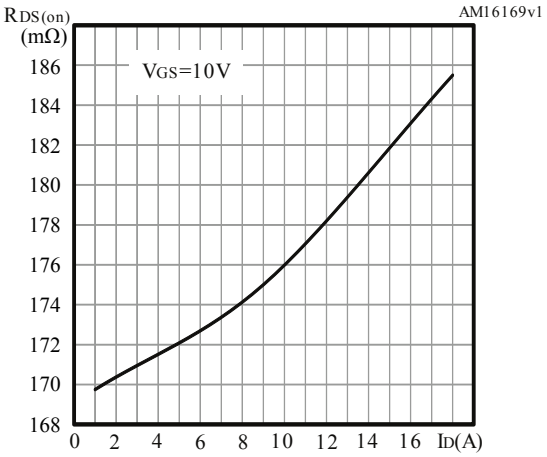


Figure 10. Output capacitance stored energy

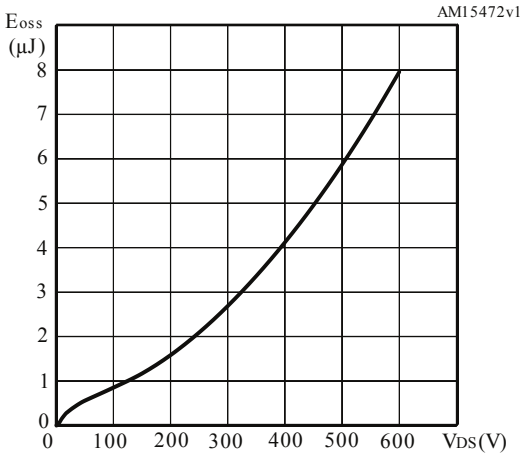


Figure 11. Normalized gate threshold voltage vs temperature

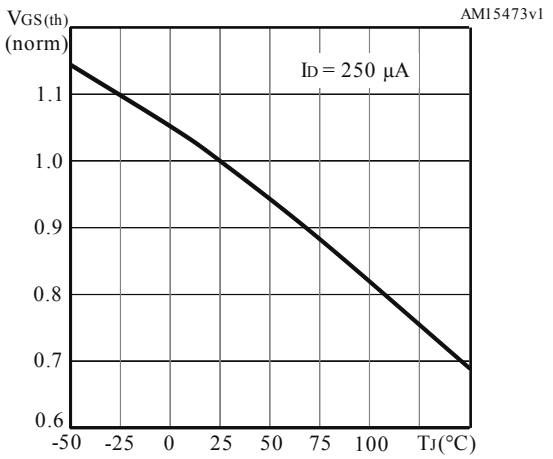


Figure 12. Normalized on resistance vs temperature

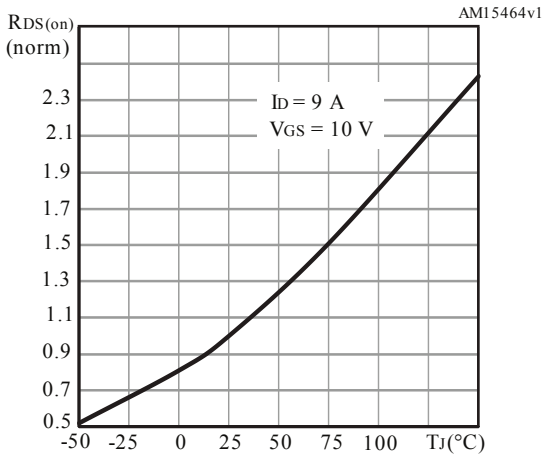


Figure 13. Typical reverse diode forward characteristics

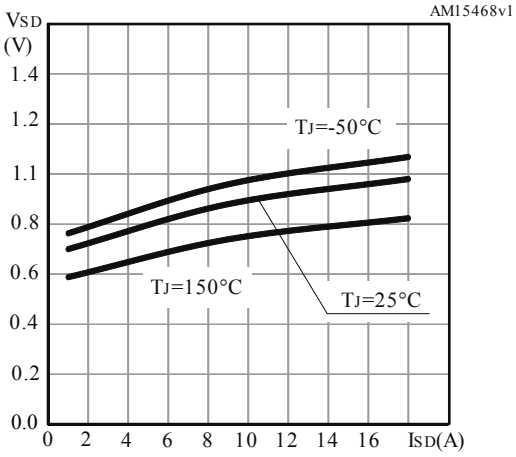
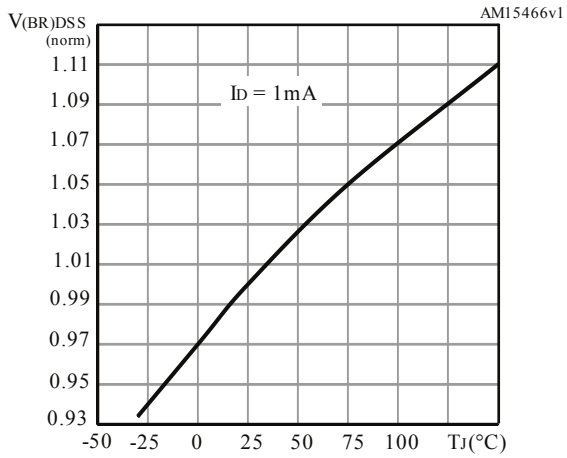
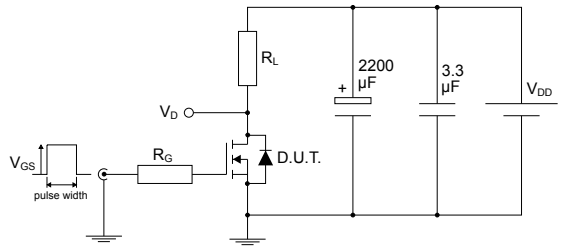


Figure 14. Normalized $V_{(BR)DSS}$ vs temperature



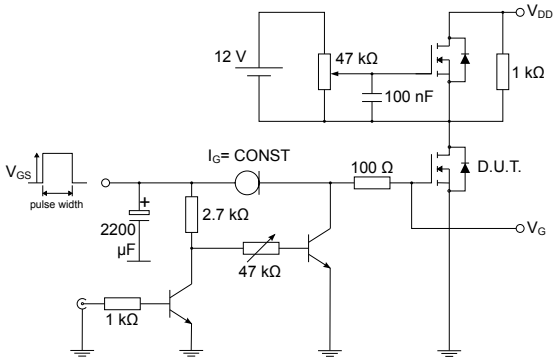
3 Test circuits

Figure 15. Test circuit for resistive load switching times



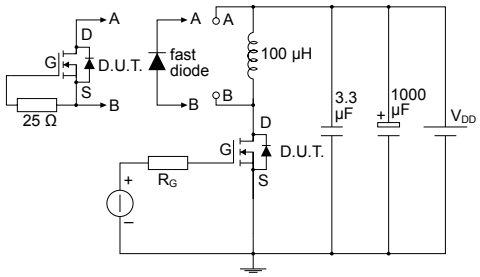
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Figure 16. Test circuit for gate charge behavior



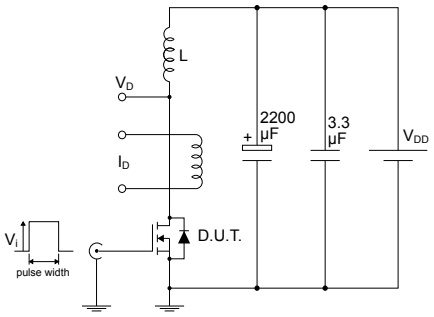
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Figure 17. Test circuit for inductive load switching and diode recovery times



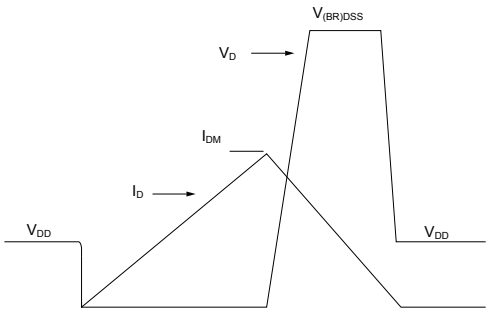
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Figure 18. Unclamped inductive load test circuit



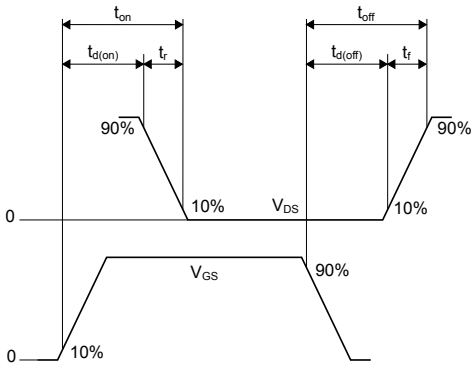
AM01471v1

Figure 19. Unclamped inductive waveform



AM01472v1

Figure 20. Switching time waveform



AM01473v1

4 Package information

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 21. **D²PAK (TO-263) type A package outline**

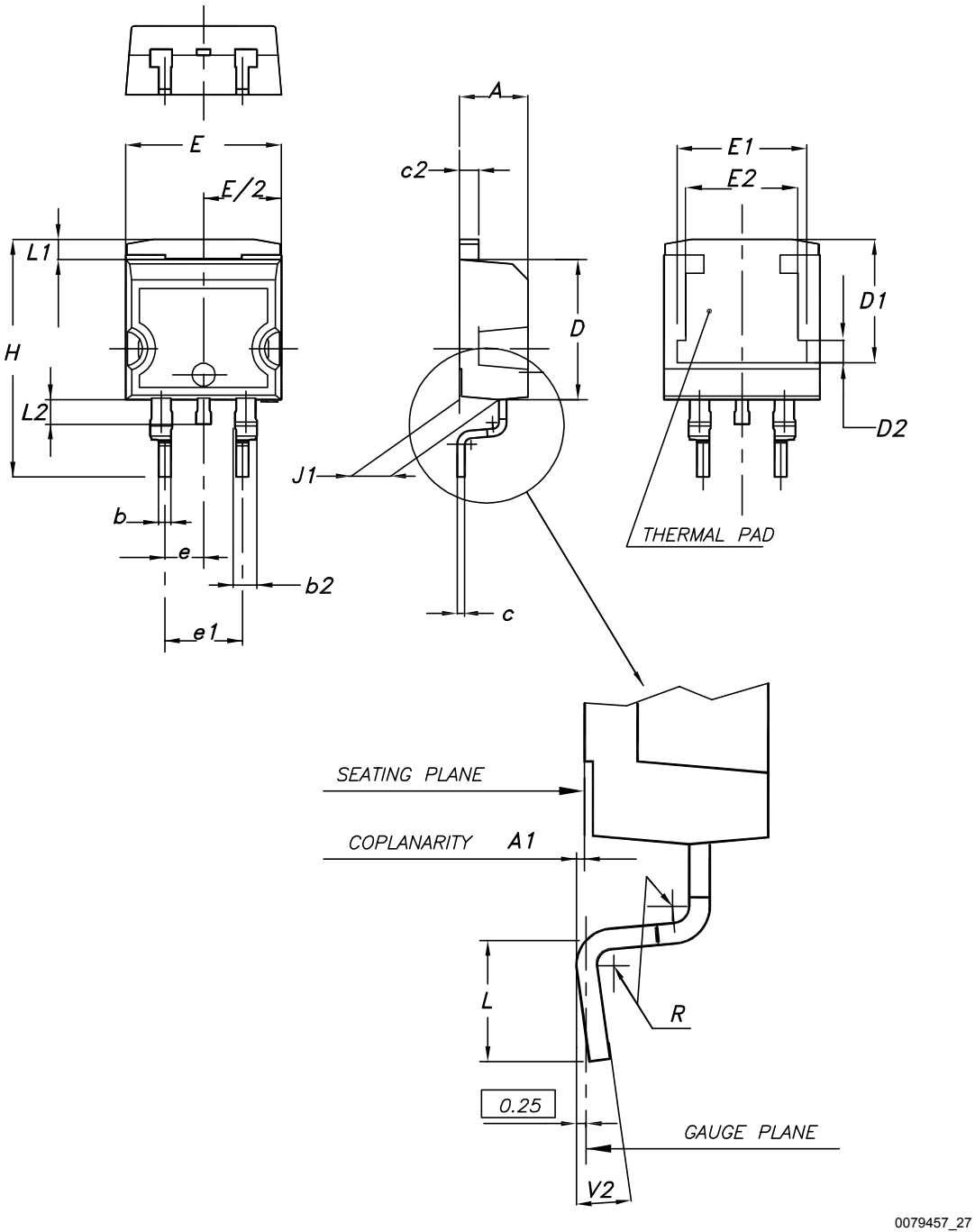
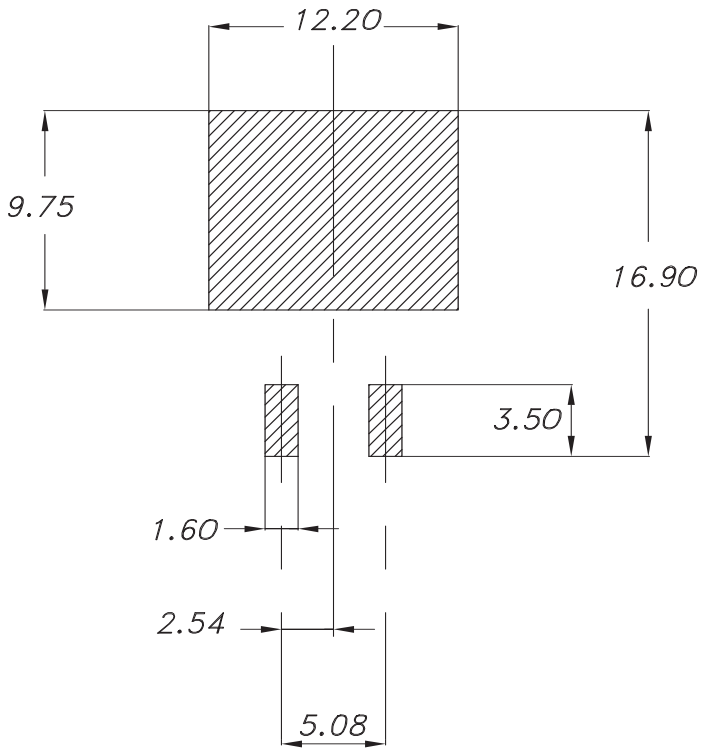


Table 8. D²PAK (TO-263) type A package mechanical data

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 22. D²PAK (TO-263) recommended footprint (dimensions are in mm)



4.2 TO-220 type A package information

Figure 23. **TO-220 type A package outline**

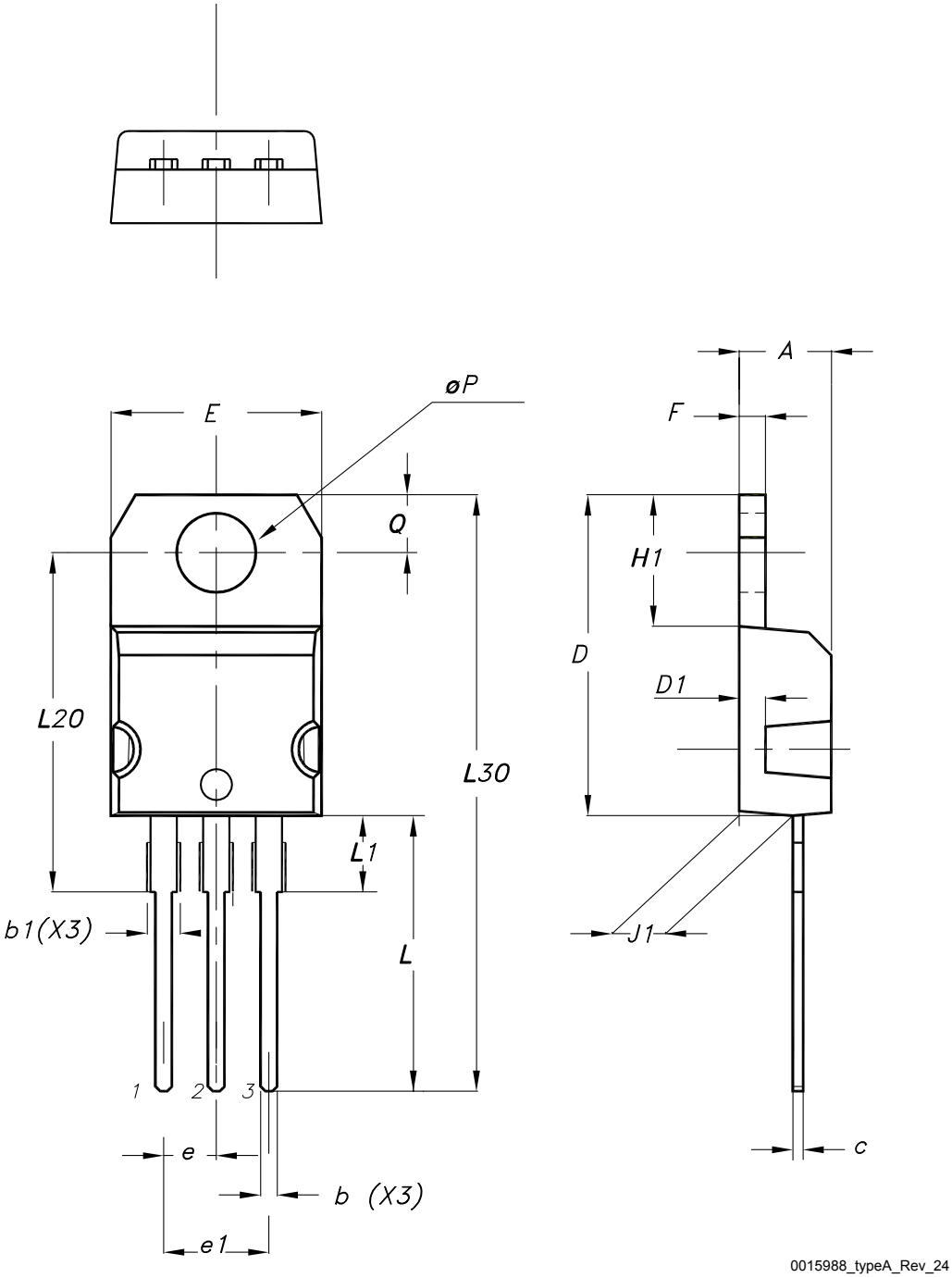
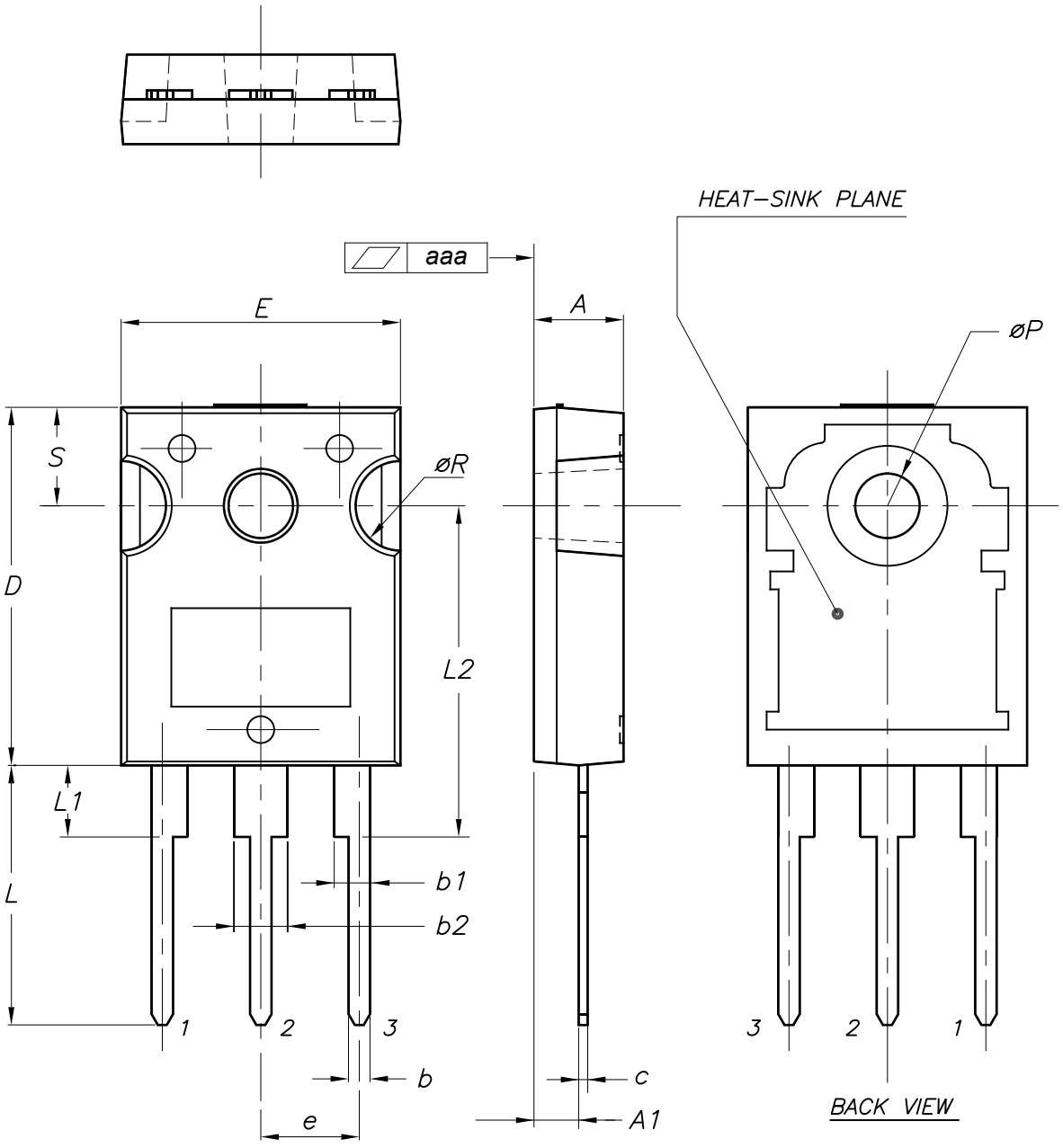


Table 9. **TO-220 type A package mechanical data**

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
Slug flatness		0.03	0.10

4.3 TO-247 package information

Figure 24. **TO-247 package outline**



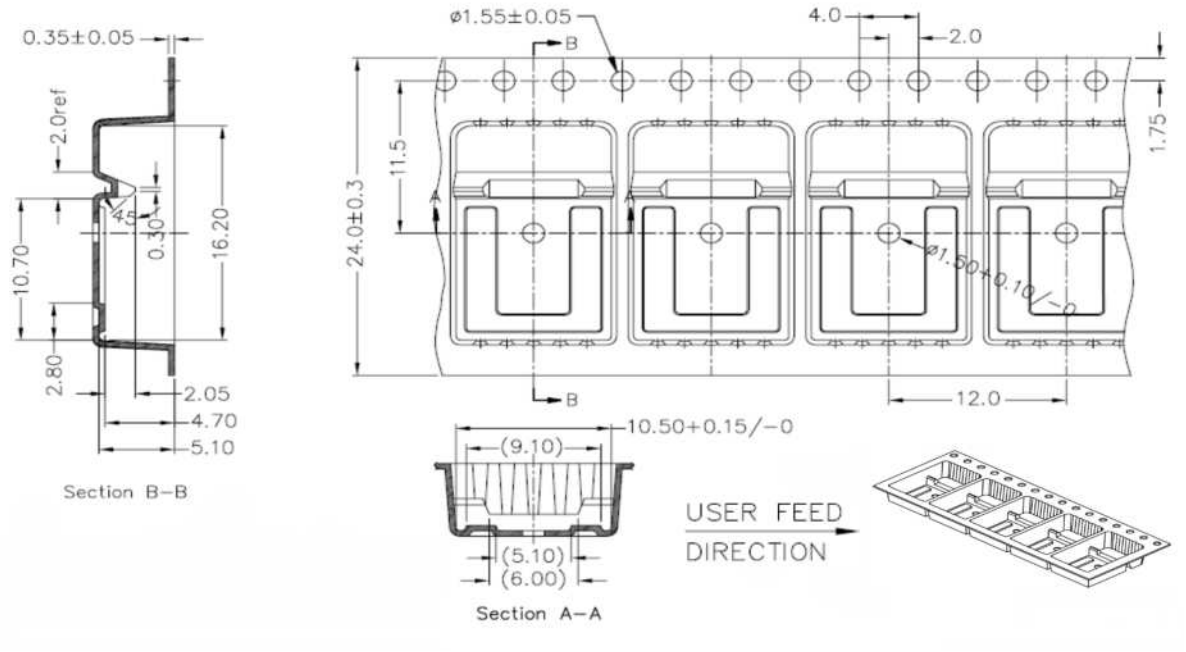
0075325_10

Table 10. **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
aaa		0.04	0.10

4.4 D²PAK packing information

Figure 25. **D²PAK tape drawing (dimensions are in mm)**



DM01095771_2

5 Ordering information

Table 11. **Order codes**

Order codes	Marking	Package	Packing
STB24N60DM2	24N60DM2	D²PAK	Tape and reel
STP24N60DM2		TO-220	Tube
STW24N60DM2		TO-247	

Revision history

Table 12. **Document revision history**

Date	Version	Changes
12-Nov-2013	1	First release.
17-Jan-2014	2	Document status promoted from preliminary data to production data. Modified: dv/dt (peak diode recovery voltage slope) value in *Table 2*. Modified: IAR value in *Table 4*. Modified: IDSS and $V_{GS(th)}$ values in *Table 5*. Minor text changes.
03-Mar-2014	3	Modified: IAR value in *Table 4*. Added: *note 1.: Limited by maximum junction temperature*. Minor text changes.
12-Aug-2025	4	Updated Section 4: Package information. Minor text changes.

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