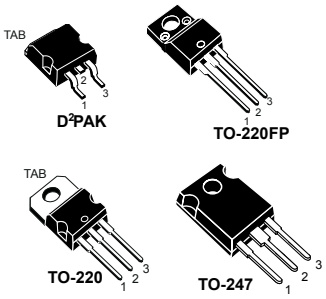
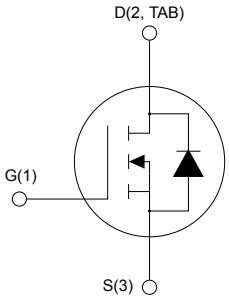
STB34NM60ND, STF34NM60ND
STP34NM60ND, STW34NM60ND

Datasheet

N-channel 600 V, 97 mΩ typ., 29 A FDmesh II Power MOSFET in a D²PAK, TO-220FP, TO-220 and TO-247 packages





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Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STB34NM60ND	600 V	110 mΩ	29 A
STF34NM60ND			
STP34NM60ND			
STW34NM60ND			

- Fast-recovery body diode
- Low gate charge and input capacitance
- Low on-resistance $R_{DS(on)}$
- 100% avalanche tested
- High dv/dt ruggedness

Applications

- Switching applications

Description

These FDmesh II Power MOSFET with fast-recovery body diode are produced using MDmesh II technology. Utilizing a new strip-layout vertical structure, these devices feature low on-resistance and superior switching performance. They are ideal for bridge topologies and ZVS phase-shift converters.

STPOWER

Product status links
STB34NM60ND
STF34NM60ND
STP34NM60ND
STW34NM60ND

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D^2PAK TO-220 TO-247	TO-220FP	
V_{DS}	Drain-source voltage	600		V
V_{GS}	Gate-source voltage	±25		V
I_D	Drain current (continuous) at T_C = 25 °C	29	29(1)	A
	Drain current (continuous) at T_C = 100 °C	18	18(1)	
I_{DM}(2)	Drain current (pulsed)	116		A
P_{TOT}	Total power dissipation at T_C = 25 °C	190	40	W
dv/dt(3)	Peak diode recovery voltage slope	40		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_{stg}	Storage temperature range	-55 to 150		°C
T_J	Maximum operating junction temperature	150		

1. *Limited by maximum junction temperature.*
2. *Pulse width is limited by safe operating area.*
3. *I_{SD} ≤ 29 A, di/dt ≤ 600 A/µs, V_{DD} = 480 V, V_{DS} (peak) < $V_{(BR)DSS}$.*

Table 2. Thermal data

Symbol	Parameter	Value				Unit
		D^2PAK	TO-220	TO-247	TO-220FP	
R_{thJC}	Thermal resistance, junction-to-case	0.66			3.1	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	30(1)	62.5	50	62.5	°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.)	7	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	110	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	I_D = 1 mA, V_{GS} = 0 V	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	
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 = 14.5 A	-	97	110	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} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	2785	-	pF
C_{oss}	Output capacitance		-	168	-	pF
C_{rss}	Reverse transfer capacitance		-	5	-	pF
$C_{oss\ eq.}$(1)	Equivalent capacitance time related	V_{DS} = 0 to 480 V, V_{GS} = 0 V	-	438	-	pF
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 29 A, V_{GS} = 0 to 10 V (see the Figure 18. Test circuit for gate charge behavior)	-	80.4	-	nC
Q_{gs}	Gate-source charge		-	16	-	nC
Q_{gd}	Gate-drain charge		-	41.4	-	nC
R_g	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	2.87	-	Ω

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 = 14.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see the Figure 17. Test circuit for resistive load switching times and Figure 22. Switching time waveform)	-	30	-	ns
t_r	Rise time		-	53.4	-	ns
$t_{d(off)}$	Turn-off delay time		-	111	-	ns
t_f	Fall time		-	61.8	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	29	A
I_{SDM}(1)	Source-drain current (pulsed)		-	-	116	A
V_{SD}(2)	Forward on voltage	I_{SD} = 29 A, V_{GS} = 0 V	-	-	1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 29 A, di/dt = 100 A/µs,	-	175	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V	-	1.4	-	µC
I_{RRM}	Reverse recovery current	(see the Figure 19. Test circuit for inductive load switching and diode recovery times)	-	16	-	A
t_{rr}	Reverse recovery time	I_{SD} = 29 A, di/dt = 100 A/µs,	-	255	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_J = 150 °C	-	2.6	-	µC
I_{RRM}	Reverse recovery current	(see the Figure 19. Test circuit for inductive load switching and diode recovery times)	-	20	-	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 and TO-220

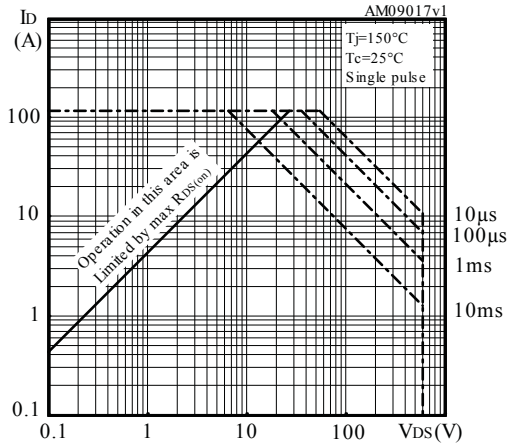


Figure 2. Normalized transient thermal impedance for D²PAK and TO-220

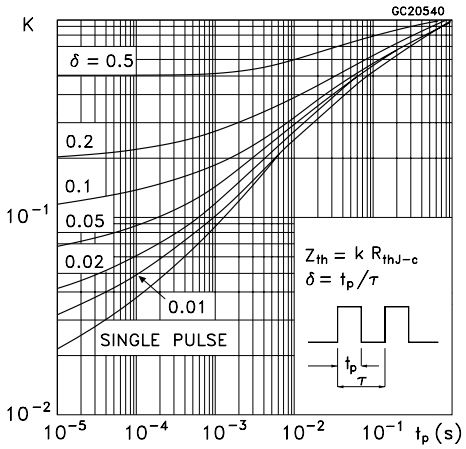


Figure 3. Safe operating area for TO-220FP

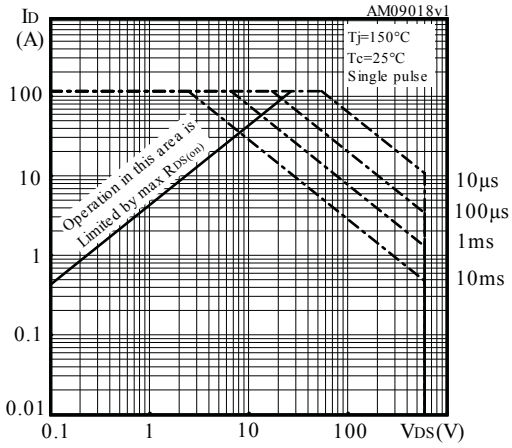


Figure 4. Normalized transient thermal impedance for TO-220FP

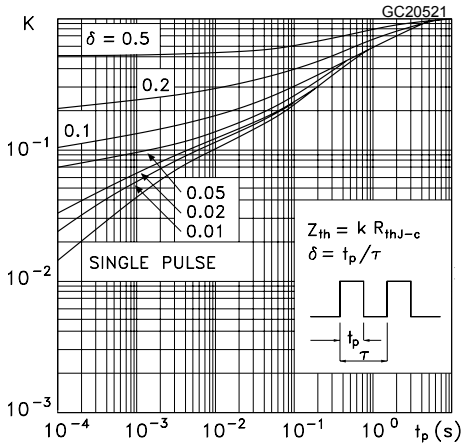


Figure 5. Safe operating area for TO-247

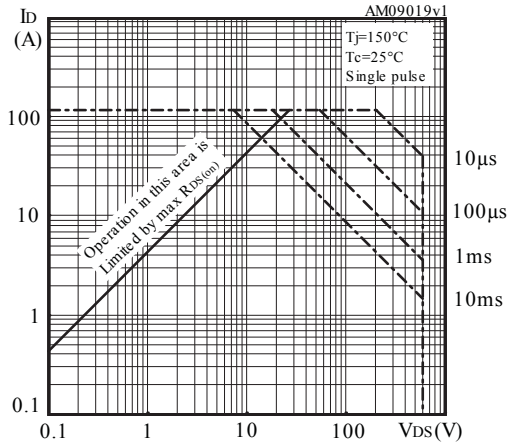


Figure 6. Normalized transient thermal impedance for TO-247

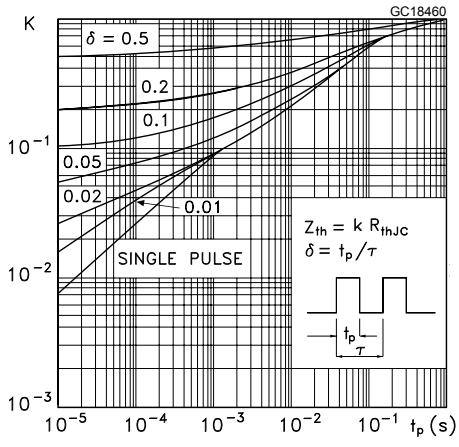


Figure 7. Typical output characteristics

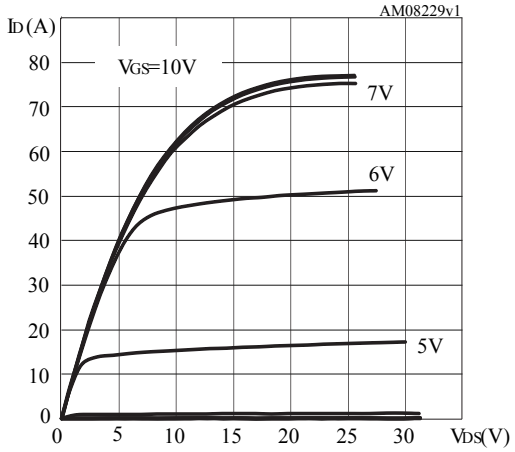


Figure 8. Typical transfer characteristics

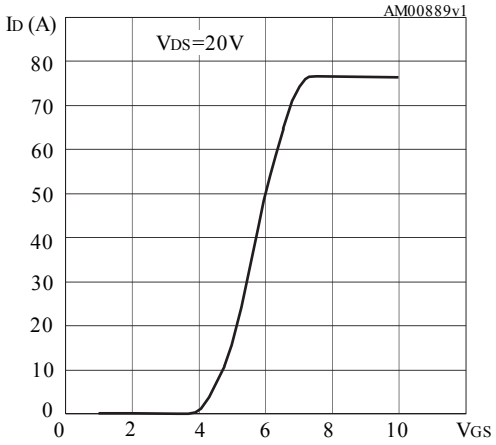


Figure 9. Typical gate charge characteristics

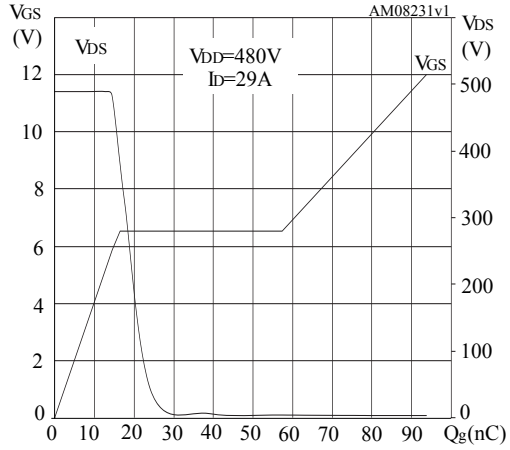


Figure 10. Typical capacitance characteristics

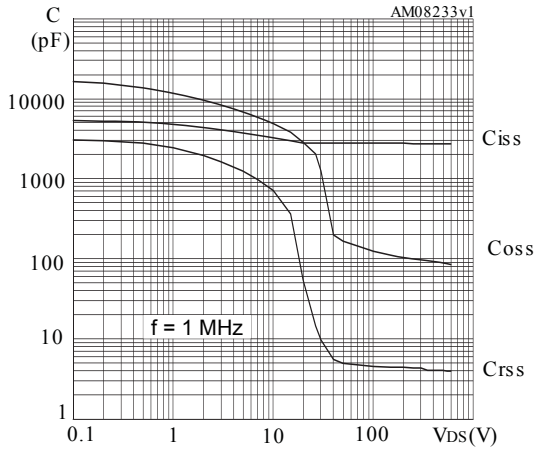


Figure 11. Typical drain-source on-resistance

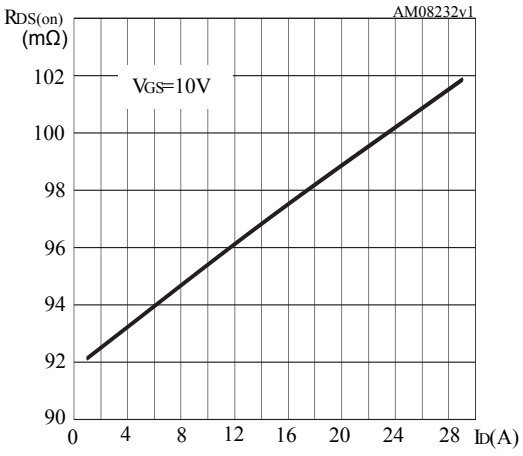


Figure 12. Normalized breakdown voltage vs temperature

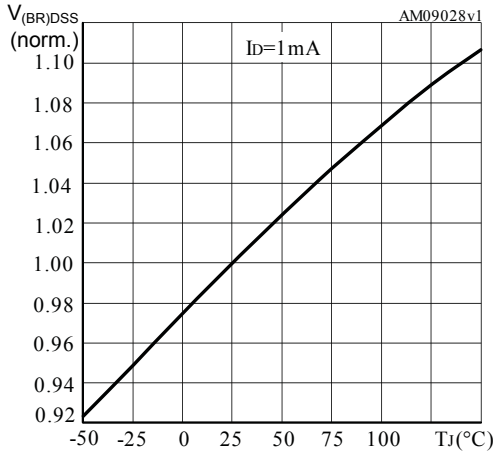


Figure 13. Normalized gate threshold vs temperature

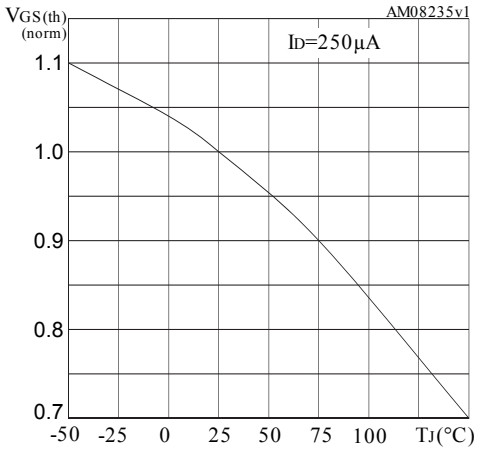


Figure 14. Normalized on-resistance vs temperature

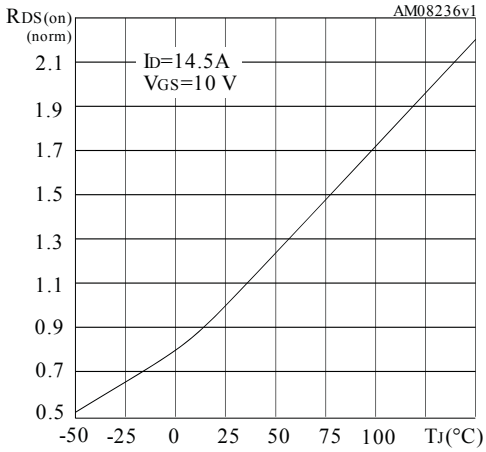


Figure 15. Typical output capacitance stored energy

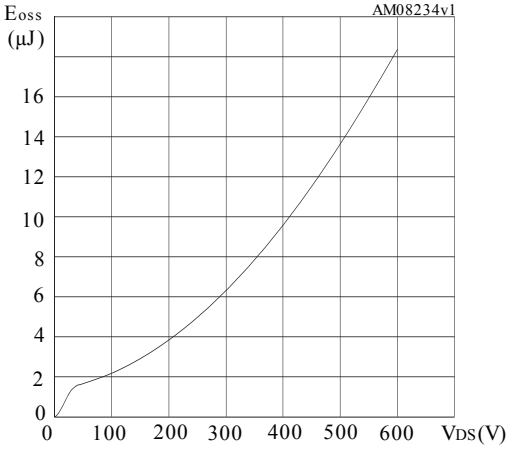
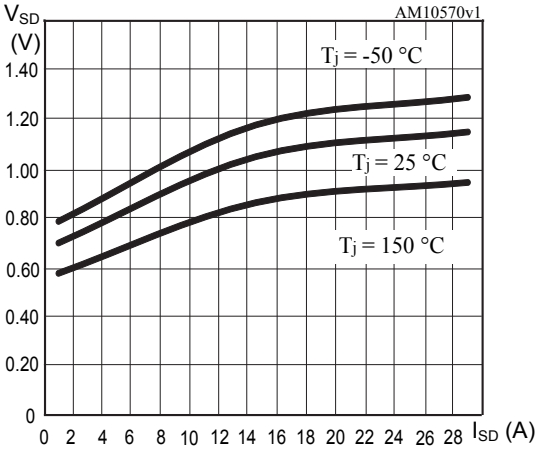


Figure 16. Typical reverse diode forward characteristics



3 Test circuits

Figure 17. Test circuit for resistive load switching times

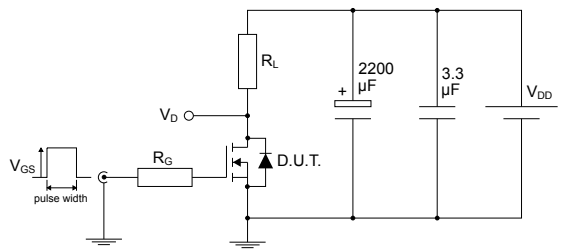


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Figure 18. Test circuit for gate charge behavior

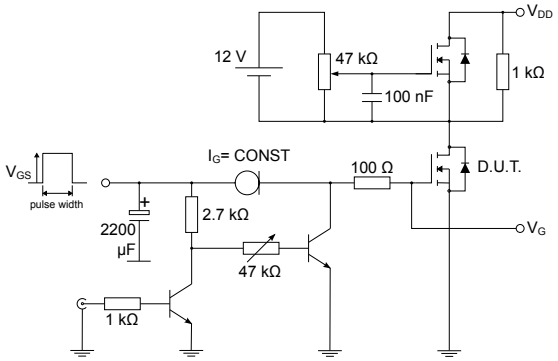

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Figure 19. Test circuit for inductive load switching and diode recovery times

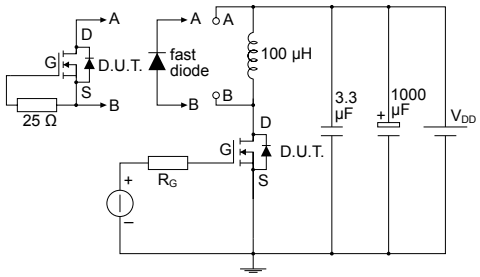

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Figure 20. Unclamped inductive load test circuit

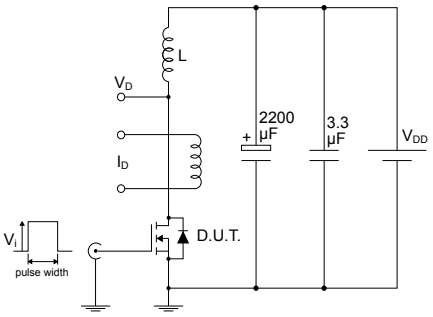

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Figure 21. Unclamped inductive waveform

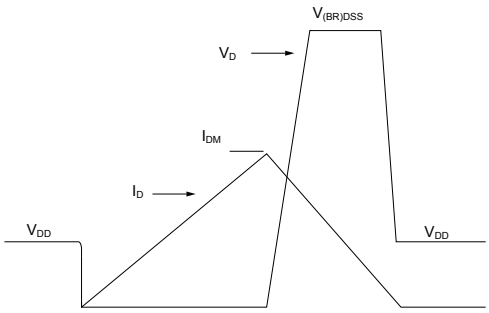

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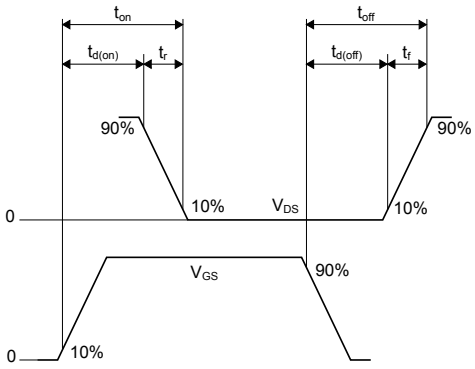
Figure 22. Switching time waveform



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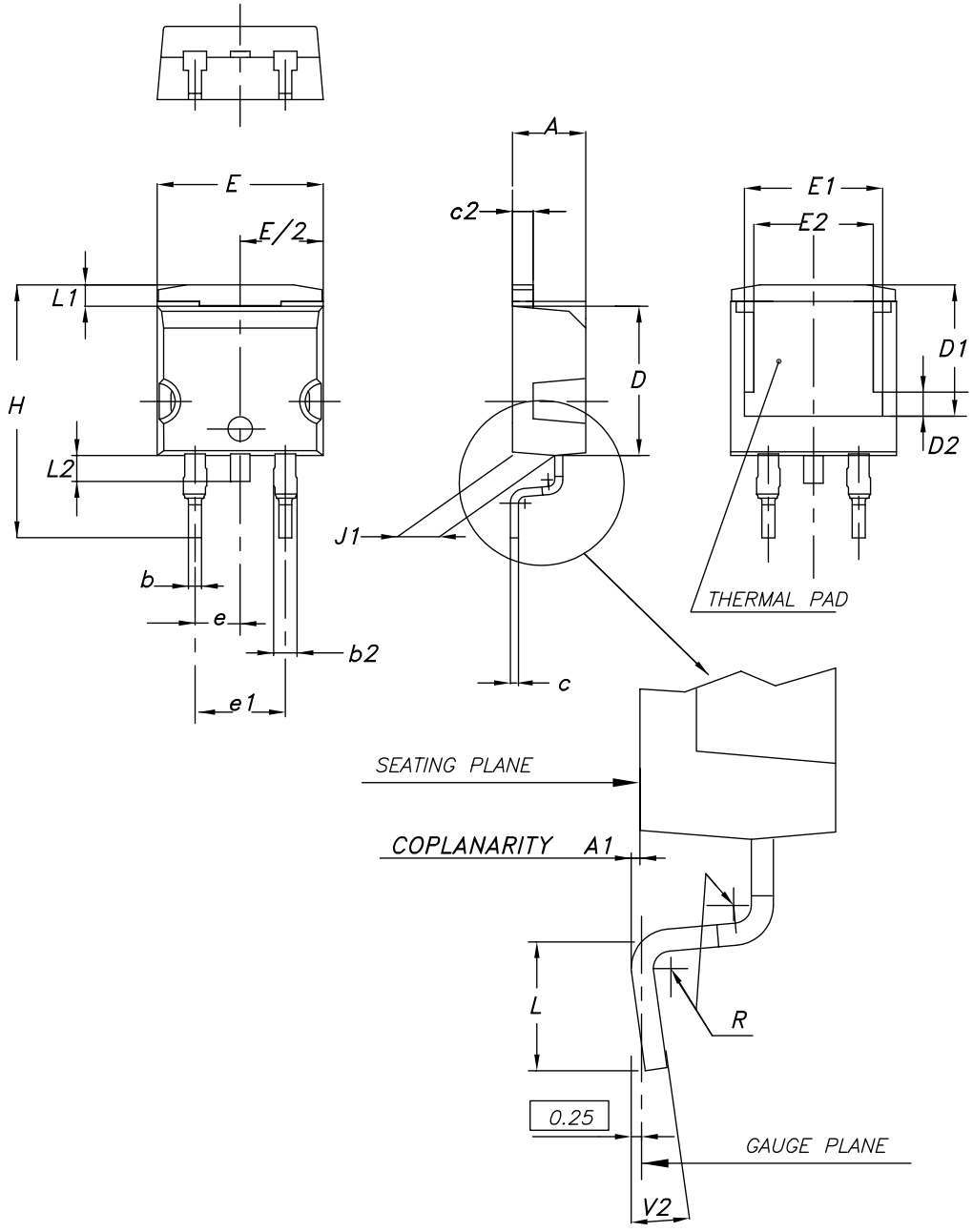
4 Package information

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 A2 package information

Figure 23. **D²PAK (TO-263) type A2 package outline**

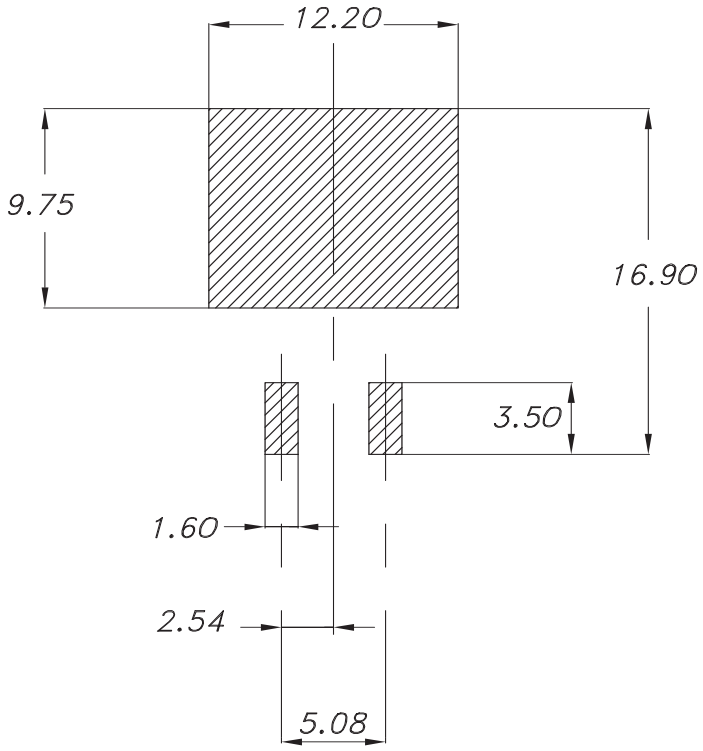


0079457_A2_27

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

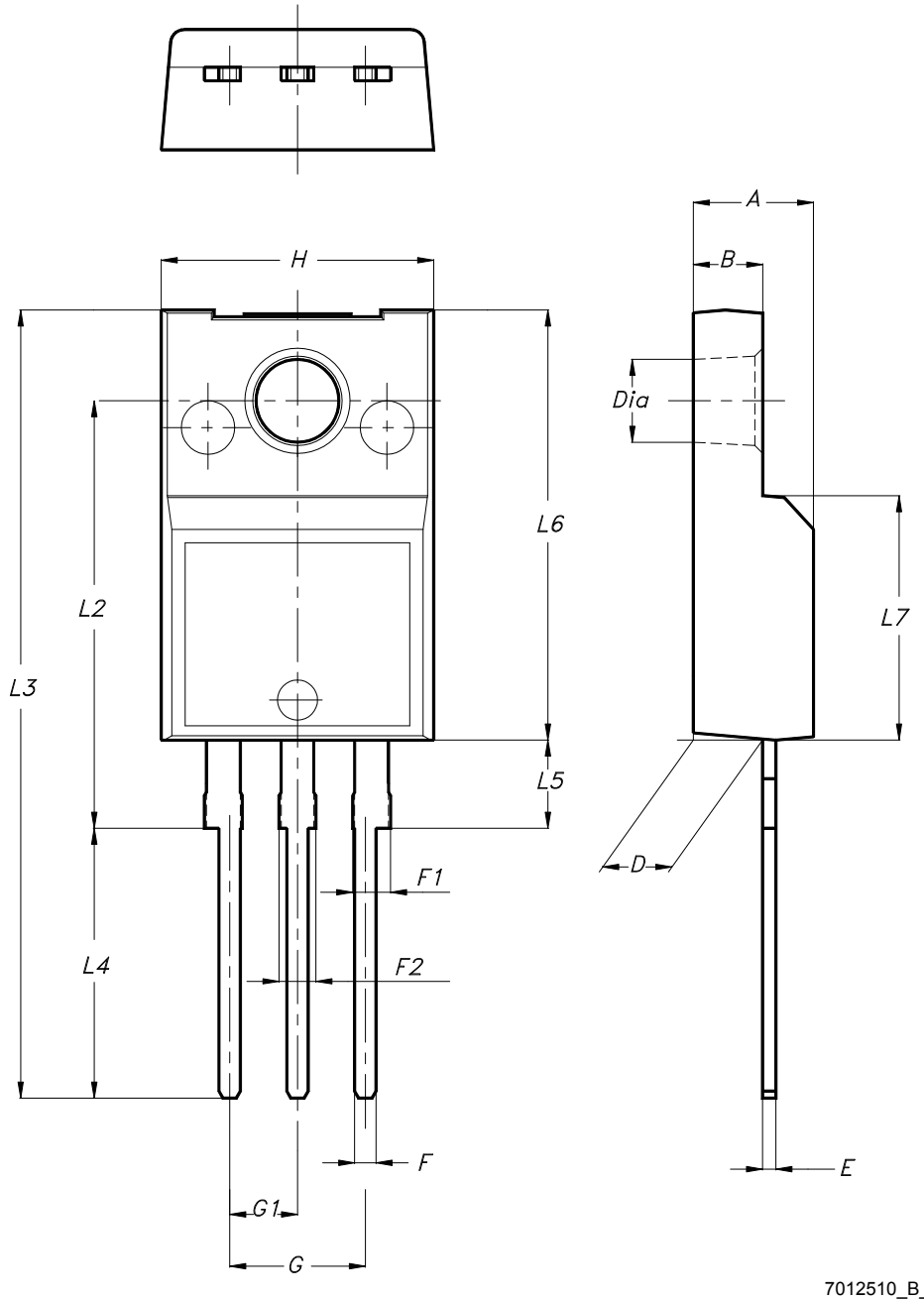
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.70	8.90	9.10
E2	7.30	7.50	7.70
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 24. **D²PAK (TO-263) recommended footprint (dimensions are in mm)**



4.2 TO-220FP type B package information

Figure 25. **TO-220FP type B package outline**



7012510_B_rev.14

Table 9. **TO-220FP type B package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

4.3 TO-220 type A package information

Figure 26. **TO-220 type A package outline**

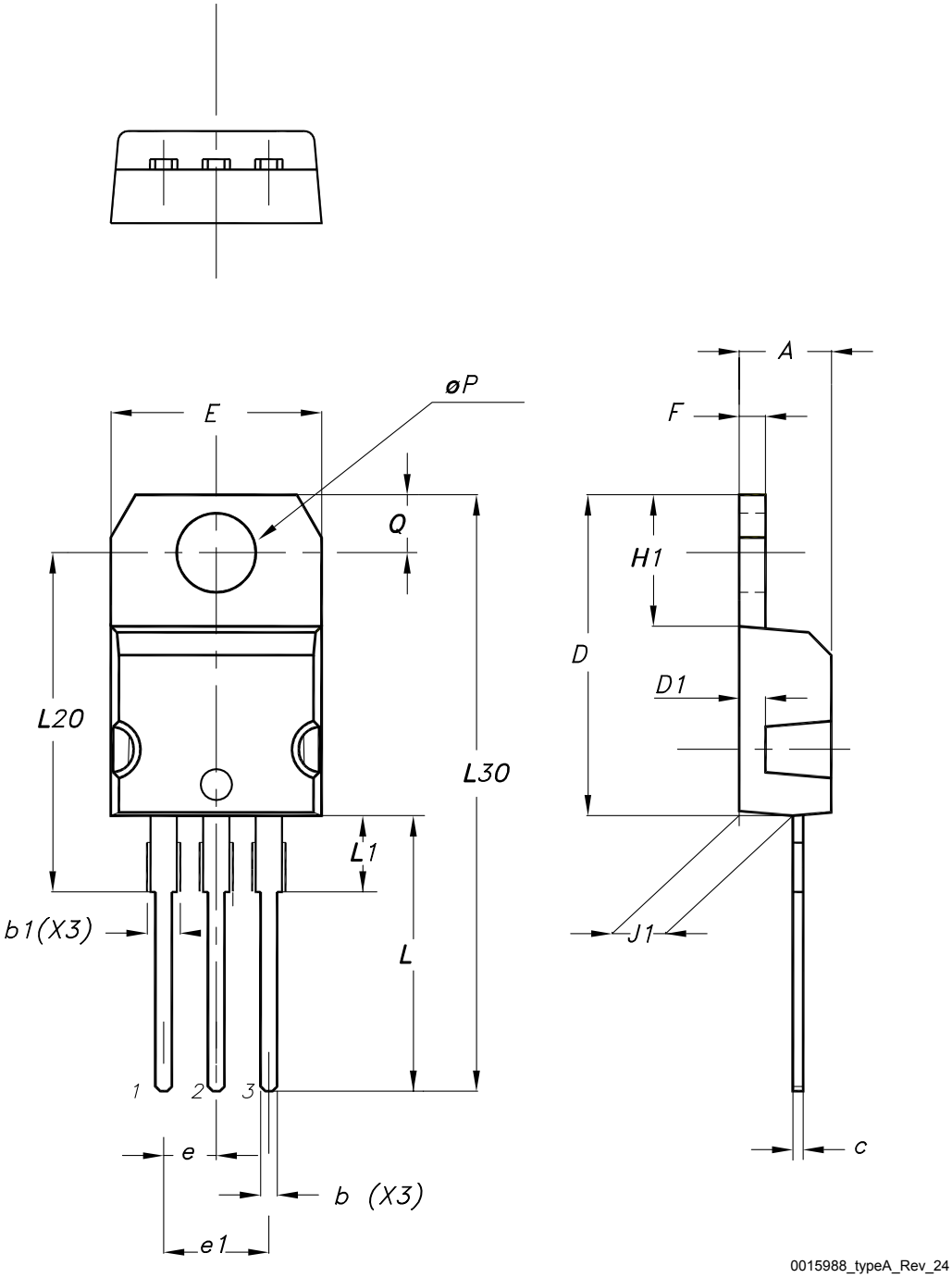
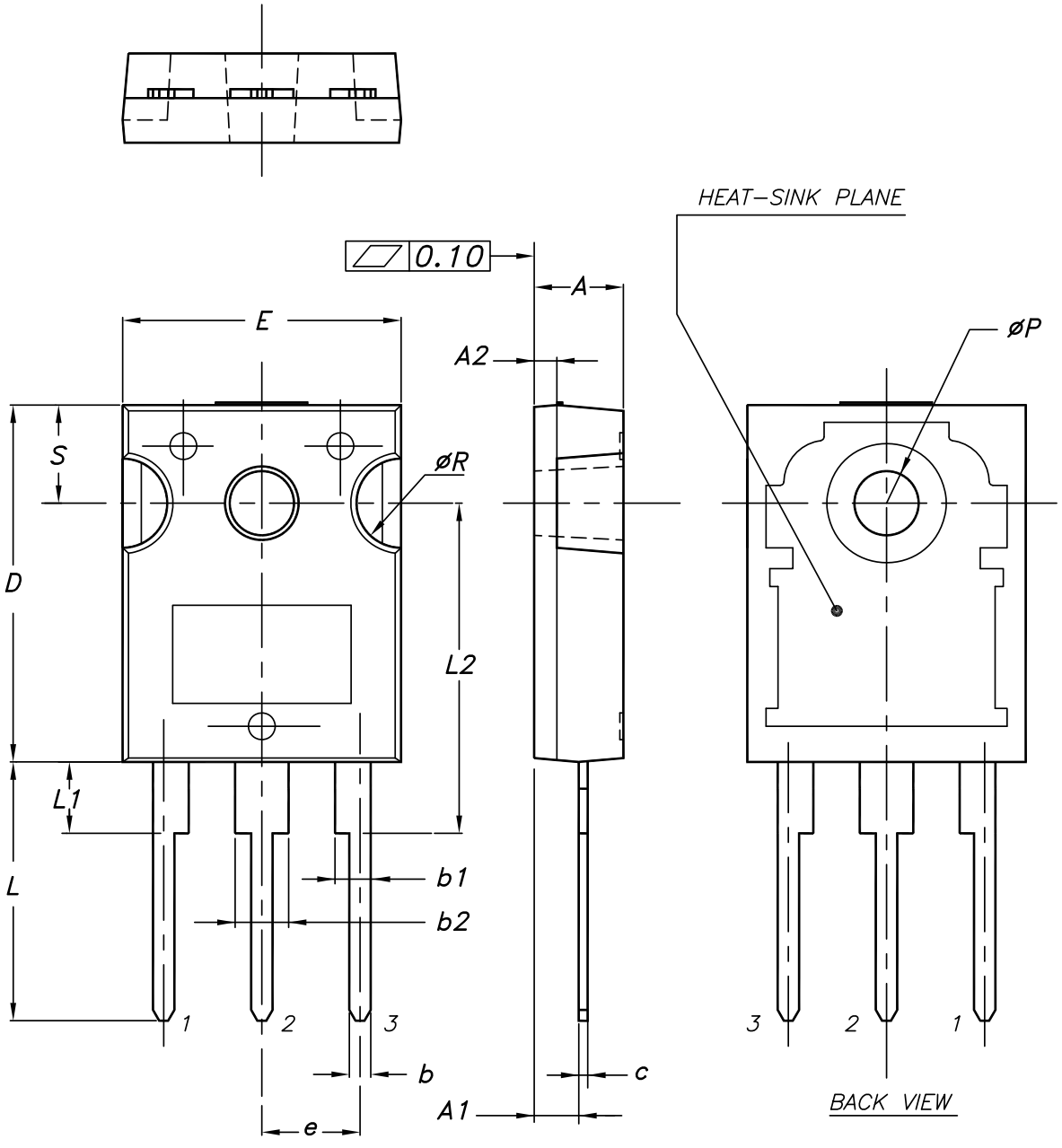


Table 10. **TO-220 type A package mechanical data**

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

4.4 TO-247 package information

Figure 27. **TO-247 package outline**



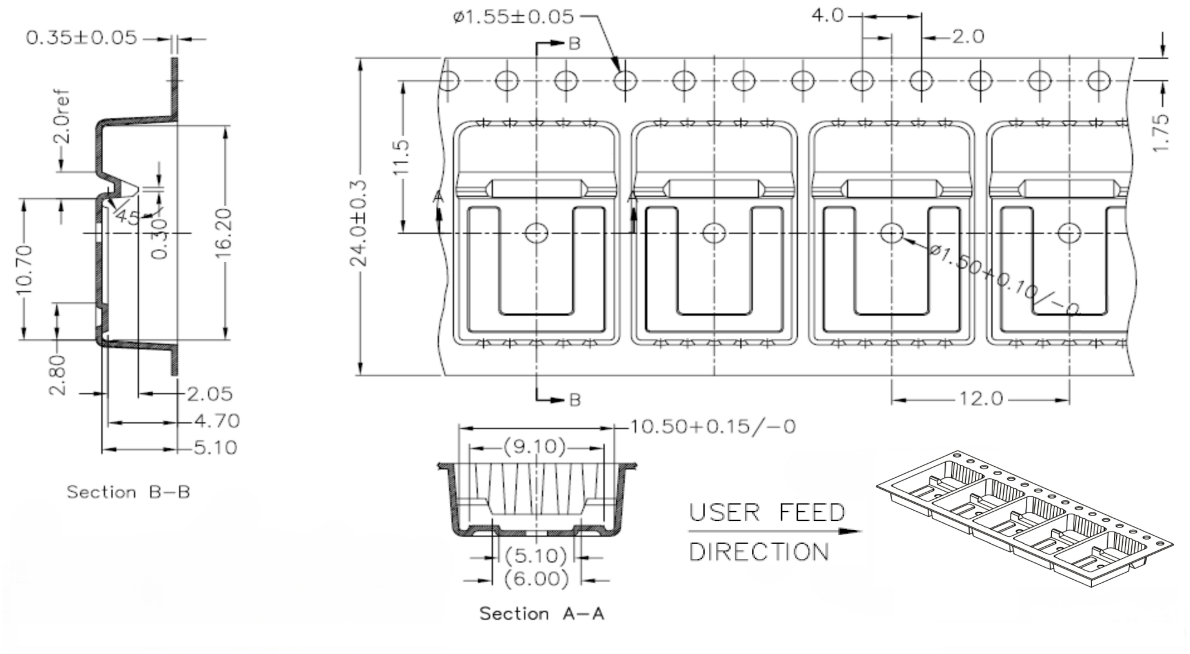
0075325_11

Table 11. **TO-247 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
A2		1.27	
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

4.5 D²PAK packing information

Figure 28. **D²PAK tape drawing (dimensions are in mm)**



5 Ordering information

Table 12. **Order codes**

Order codes	Marking	Package	Packing
STB34NM60ND	34NM60ND	D²PAK	Tape and reel
STF34NM60ND		TO-220FP	Tube
STP34NM60ND		TO-220	
STW34NM60ND		TO-247	

Revision history

Table 13. **Document revision history**

Date	Revision	Changes
04-Nov-2010	1	First release.
18-Apr-2011	2	Corrected E_{AS} value in *Table 4: Avalanche characteristics*.
14-Sep-2011	3	Added order code in D2PAK and TO-220FP. Updated *Table 1: Device summary*, *Table 2: Absolute maximum ratings* and *Table 3: Thermal data*. Updated *Section 4: Package mechanical data*. Added *Section 5: Packaging mechanical data*. Minor text changes.
29-Dec-2011	4	Updated description in cover page.
01-Oct-2012	5	Updated title on the cover page. Updated figures *10*, *11*, *16* and *17*. Updated *Section 4: Package mechanical data*. Minor text changes.
02-Oct-2013	6	Modified: E_{AS} in *Table 4*, $C_{oss\ eq.}$ typical value in *Table 6*, *Figure 13*. Modified: *Figure 18*, *19*, *20* and *21*. Minor text changes.
02-Feb-2026	7	Updated Section 4: Package information. Minor text changes.

Contents