STGB20NC60V, STGP20NC60V, STGW20NC60V

30 A - 600 V - very fast IGBT

TO-247

D²PAK

TO-220

Features

- High frequency operation up to 50 kHz
- Lower C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)
- High current capability

Applications

- High frequency inverters
- UPS, motor drivers
- HF, SMPS and PFC in both hard switch and resonant topologies

Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.

Figure 1. Internal schematic diagram

Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB20NC60V	GB20NC60V	D²PAK	Tape and reel
STGP20NC60V	GP20NC60V	TO-220	Tube
STGW20NC60V	GW20NC60V	TO-247	Tube

Contents

1   Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600	V
I_C [1]	Collector current (continuous) at 25 °C	60	A
I_C [1]	Collector current (continuous) at 100 °C	30	A
I_{CL} [2]	Turn-off latching current	100	A
I_{CP} [3]	Pulsed collector current	100	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total dissipation at T_C = 25 °C	200	W
T_j	Operating junction temperature	− 55 to 150	°C

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

2. Vclamp = 80%(V_{CES}), T_j =150 °C, R_G=10 Ω, V_{GE}=15 V

3. Pulse width limited by max junction temperature allowed

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		TO-247	**TO-220 D²PAK**	
$R_{thj-case}$	Thermal resistance junction-case max	0.62		°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	62.5	°C/W

2   Electrical characteristics

(T_{CASE}=25°C unless otherwise specified)

Table 4. Static electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}=15 V, I_C= 20 A V_{GE}=15 V, I_C= 20 A,T_C= 125 °C		1.8 1.7	2.5	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	3.75		5.75	V
I_{CES}	Collector-emitter cut-off current (V_{GE} = 0)	V_{CE} = 600 V V_{CE} = 600 V, Tc=125 °C			10 1	µA mA
I_{GES}	Gate-emitter cut-off current (V_{CE} = 0)	V_{GE} = ±20 V			± 100	nA
g_{fs} [1]	Forward transconductance	V_{CE} = 15 V, I_C= 20 A		15		S

1.   Pulse duration = 300 µs, duty cycle 1.5%

Table 5. Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}=0	-	2200	-	pF
C_{oes}	Output capacitance		-	225	-	pF
C_{res}	Reverse transfer capacitance		-	50	-	pF
Q_g	Total gate charge	V_{CE} = 390 V, I_C = 20 A, V_{GE} = 15 V, *(see Figure 17)*	-	100	-	nC
Q_{ge}	Gate-emitter charge		-	16	-	nC
Q_{gc}	Gate-collector charge		-	45	-	nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 20 A R_G= 3.3 Ω, V_{GE}= 15 V, *(see Figure 16)*	-	31	-	ns
t_r	Current rise time		-	11	-	ns
(di/dt)on	Turn-on current slope		-	1600	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 20 A R_G= 3.3 Ω, V_{GE}= 15 V, T_C= 125 °C *(see Figure 16)*	-	31	-	ns
t_r	Current rise time		-	11.5	-	ns
(di/dt)on	Turn-on current slope		-	1500	-	A/µs
$t_{r(Voff)}$	Off voltage rise time	V_{cc} = 390 V, I_C = 20 A, R_G = 3.3 Ω, V_{GE} = 15 V *(see Figure 18)*	-	28	-	ns
$t_{d(off)}$	Turn-off delay time		-	100	-	ns
t_f	Current fall time		-	75	-	ns
$t_{r(Voff)}$	Off voltage rise time	V_{cc} = 390 V, I_C = 20 A, R_G=3.3 Ω, V_{GE} =15 V, T_C=125 °C *(see Figure 18)*	-	66	-	ns
$t_{d(off)}$	Turn-off delay time		-	150	-	ns
t_f	Current fall time		-	130	-	ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching losses	V_{CC} = 390 V, I_C = 20 A R_G= 3.3 Ω, V_{GE}= 15 V, *(see Figure 18)*	-	220	-	µJ
E_{off}[1]	Turn-off switching losses		-	330	-	µJ
E_{ts}	Total switching losses		-	550	-	µJ
E_{on}	Turn-on switching losses	V_{CC} = 390 V, I_C = 20 A R_G= 3.3 Ω, V_{GE}= 15 V, T_C= 125 °C *(see Figure 18)*	-	450	-	µJ
E_{off}[1]	Turn-off switching losses		-	770	-	µJ
E_{ts}	Total switching losses		-	1220	-	µJ

1. Turn-off losses include also the tail of the collector current.

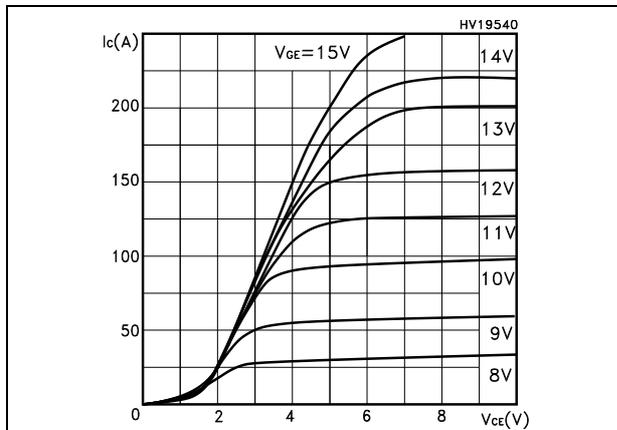## 2.1 Electrical characteristics (curves)

Figure 2. Output characteristics
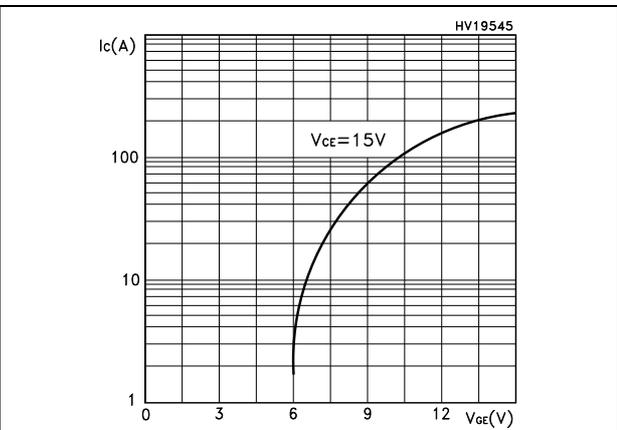

Figure 3. Transfer characteristics

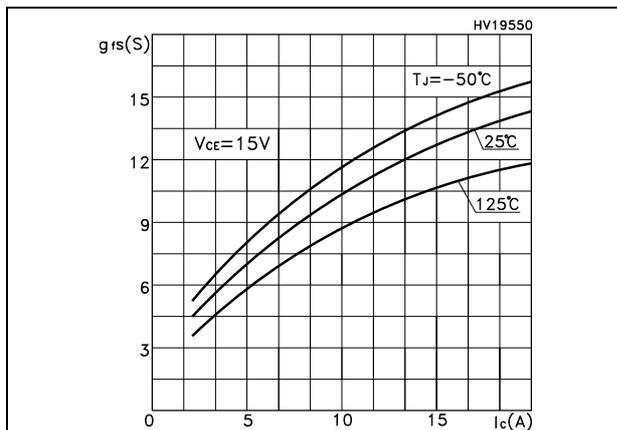**Figure 4. Transconductance**

Figure 5. Collector-emitter on voltage vs temperature
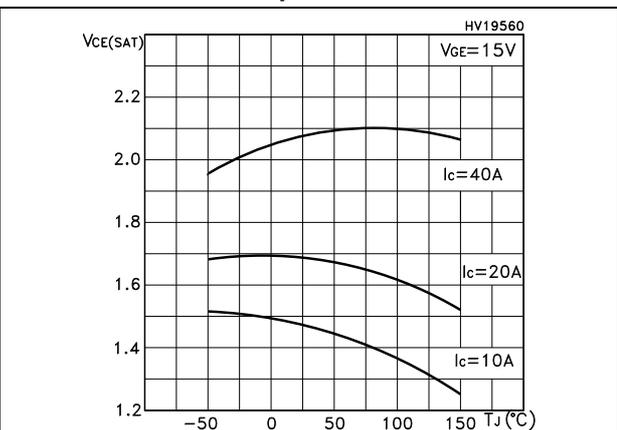

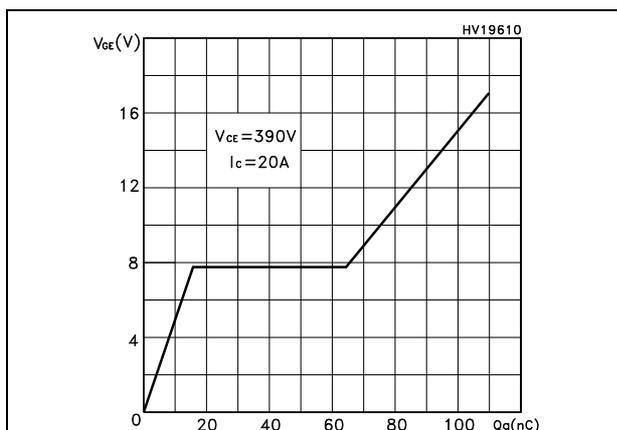**Figure 6. Gate charge vs gate-source voltage**
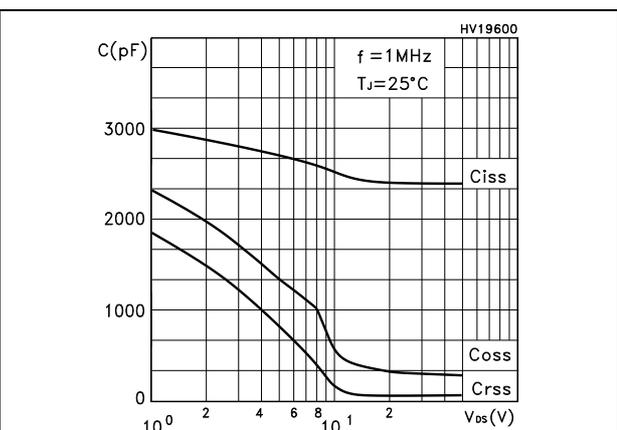

Figure 7. Capacitance variations

Figure 8. Normalized gate threshold voltage vs temperature
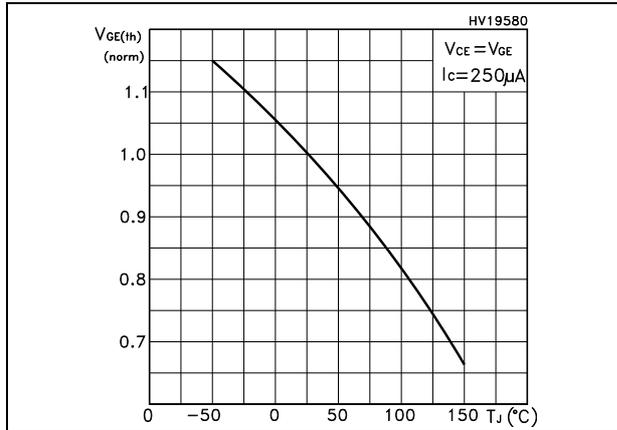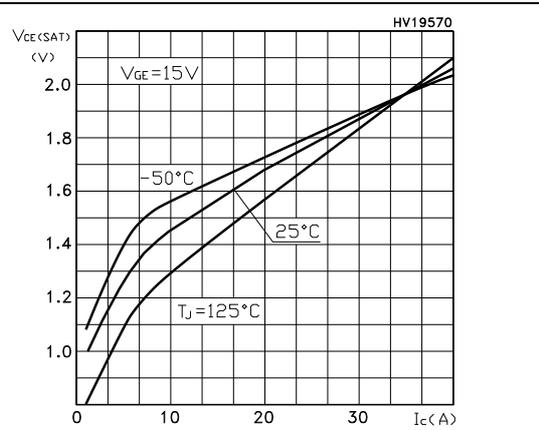

Figure 9. Collector-emitter on voltage vs collector current
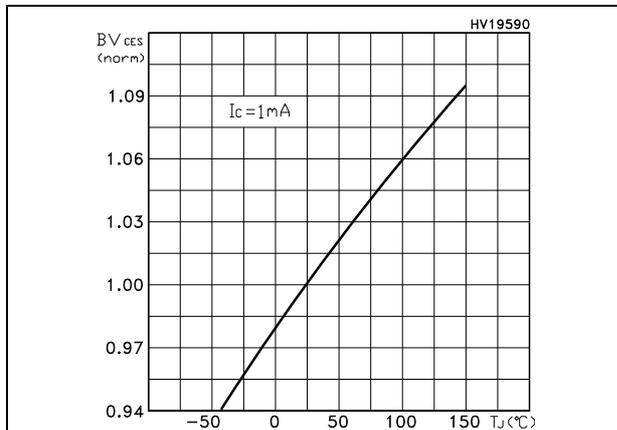

Figure 10. Normalized breakdown voltage vs temperature

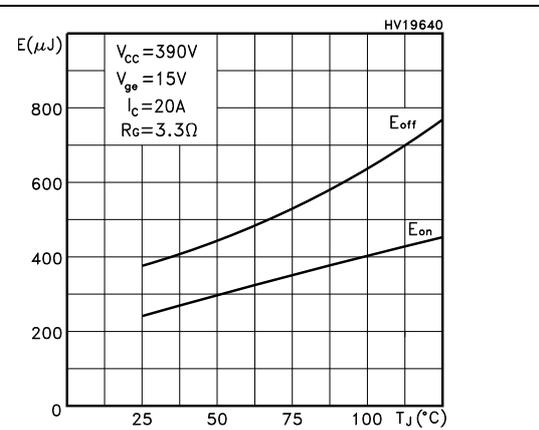**Figure 11. Switching losses vs temperature**

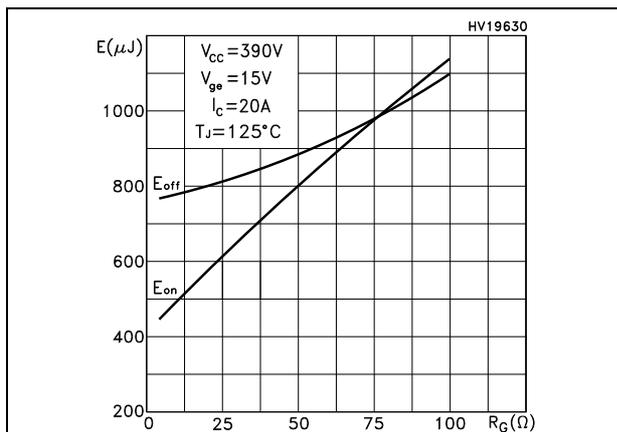**Figure 12. Switching losses vs gate resistance**

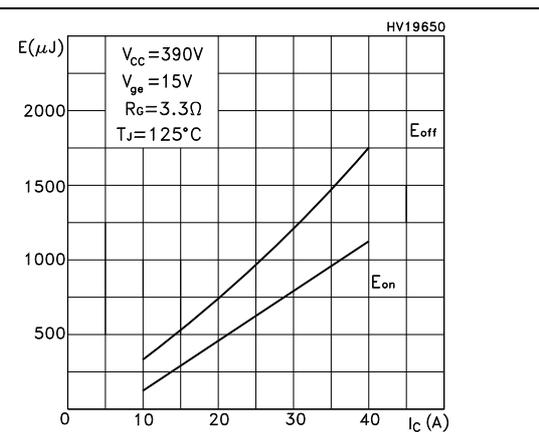**Figure 13. Switching losses vs collector current**

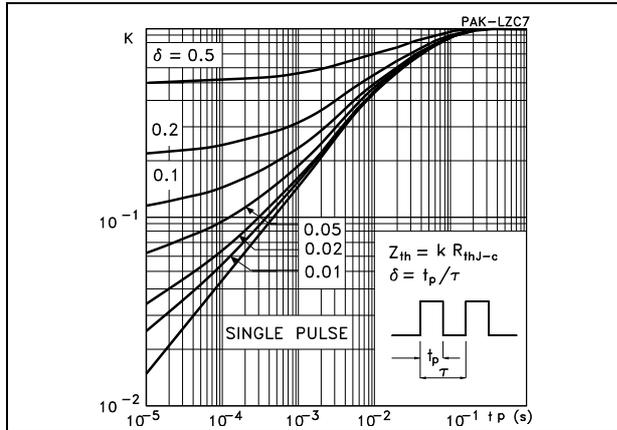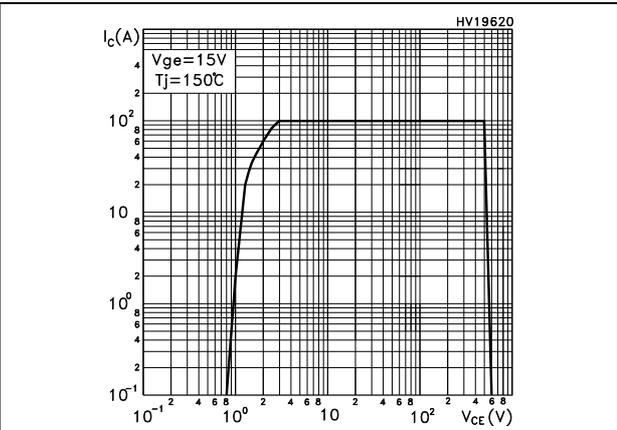**Figure 14. Thermal impedance**

Figure 15. Turn-off SOA

3 Test circuits

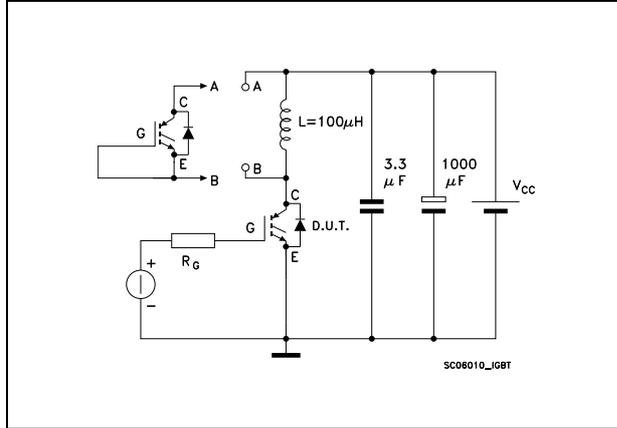**Figure 16. Test circuit for inductive load switching**

Figure 17. Gate charge test circuit
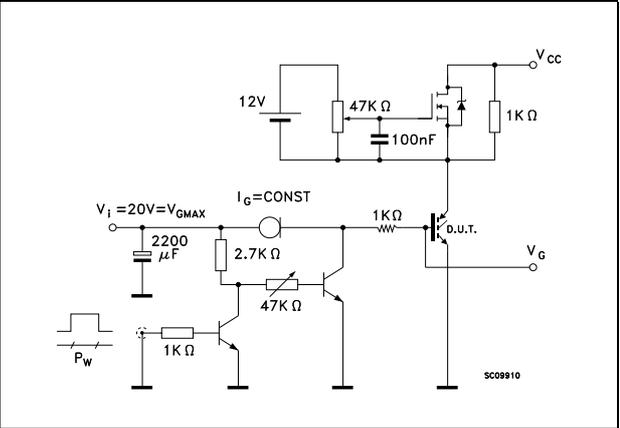
Figure 18. Switching waveform
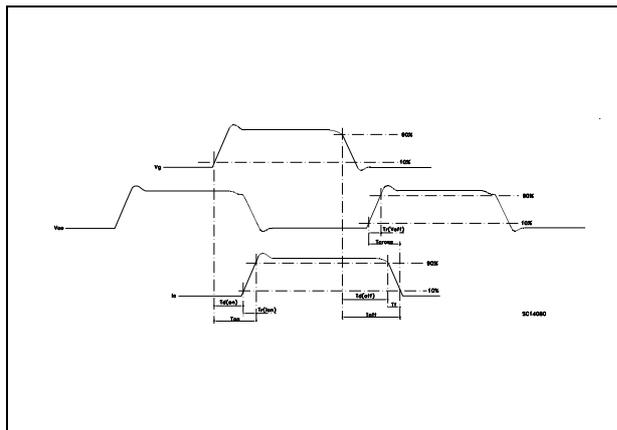
4 Package information

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 19. D²PAK (TO-263) type A package outline

0079457_A_rev22
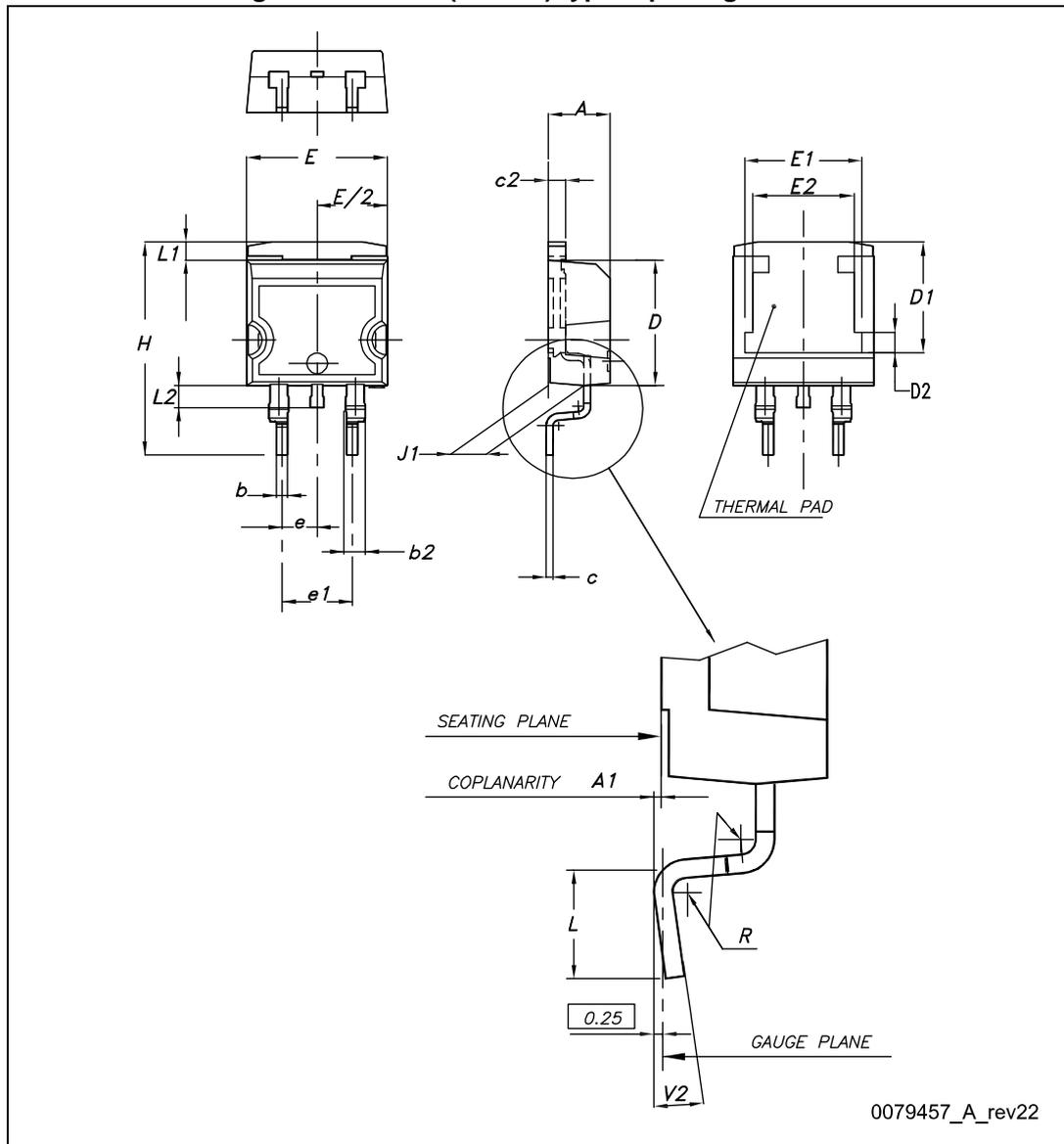
Table 8. D²PAK (TO-263) type A mechanical data

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		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		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 20. D²PAK recommended footprint[a]

Footprint

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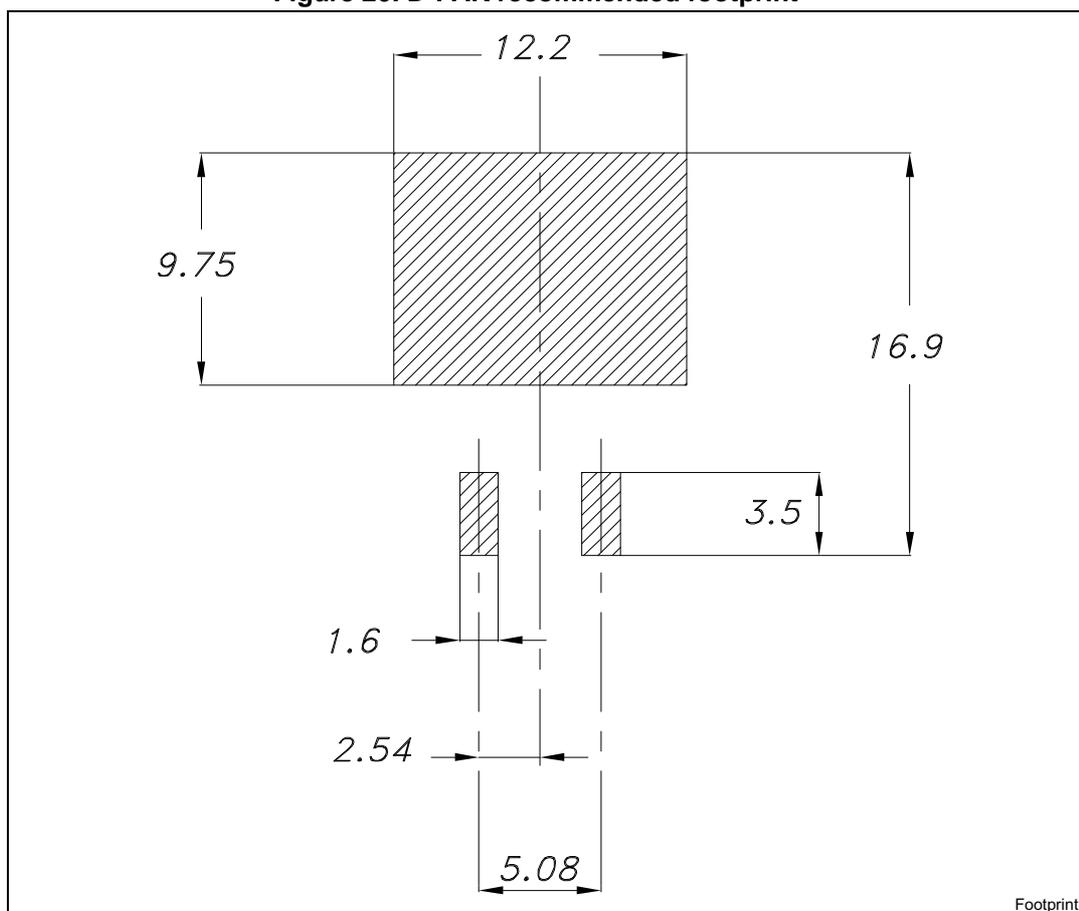
a. All dimension are in millimeters

4.2 TO-220 type A package information

Figure 21. TO-220 type A package outline

0015988_typeA_Rev_T
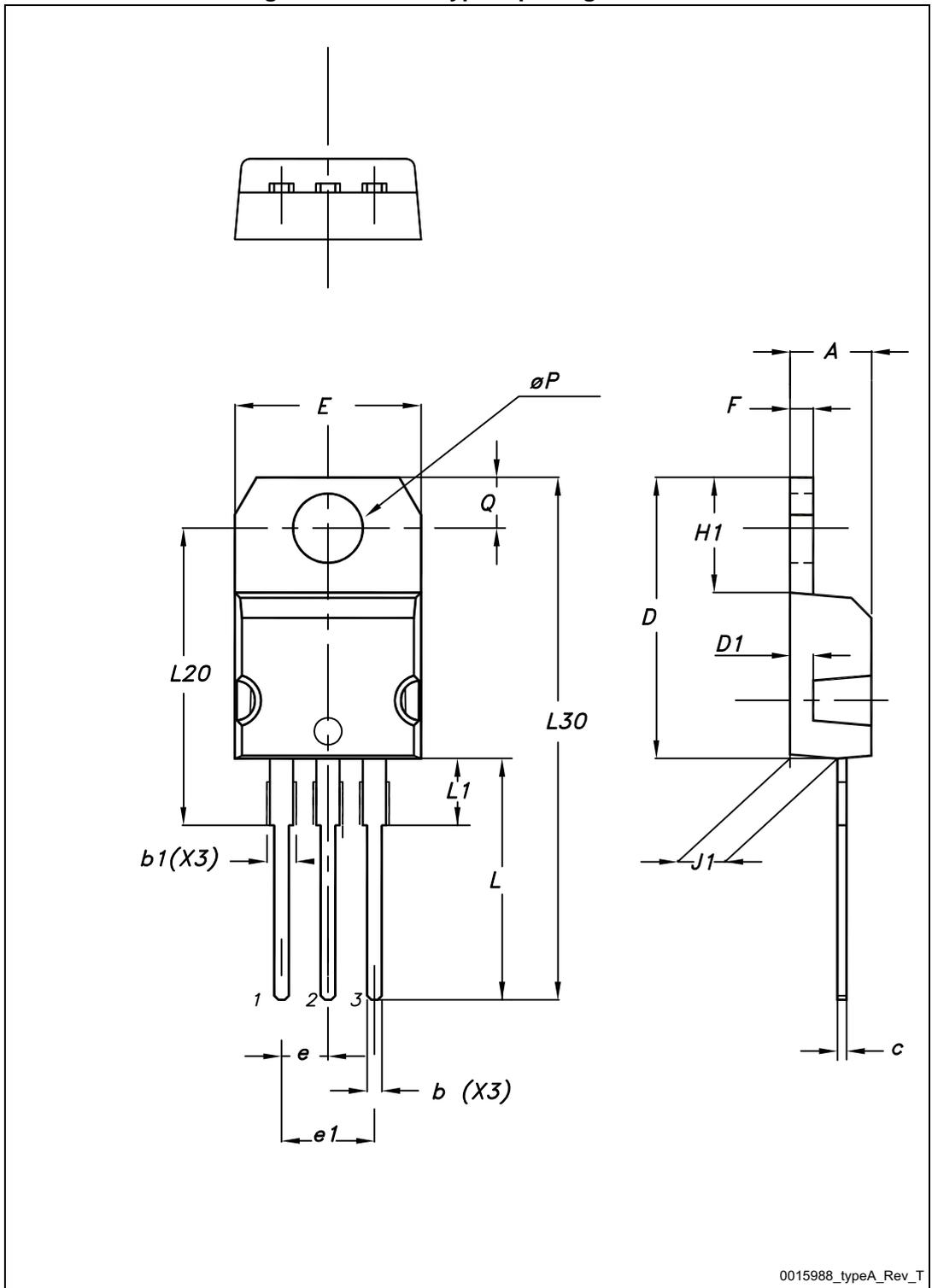
Table 9. TO-220 type A package mechanical data

Dim.	mm		
	Min.	**Typ.**	**Max.**
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

4.3 TO-247 package information

Figure 22. TO-247 package outline
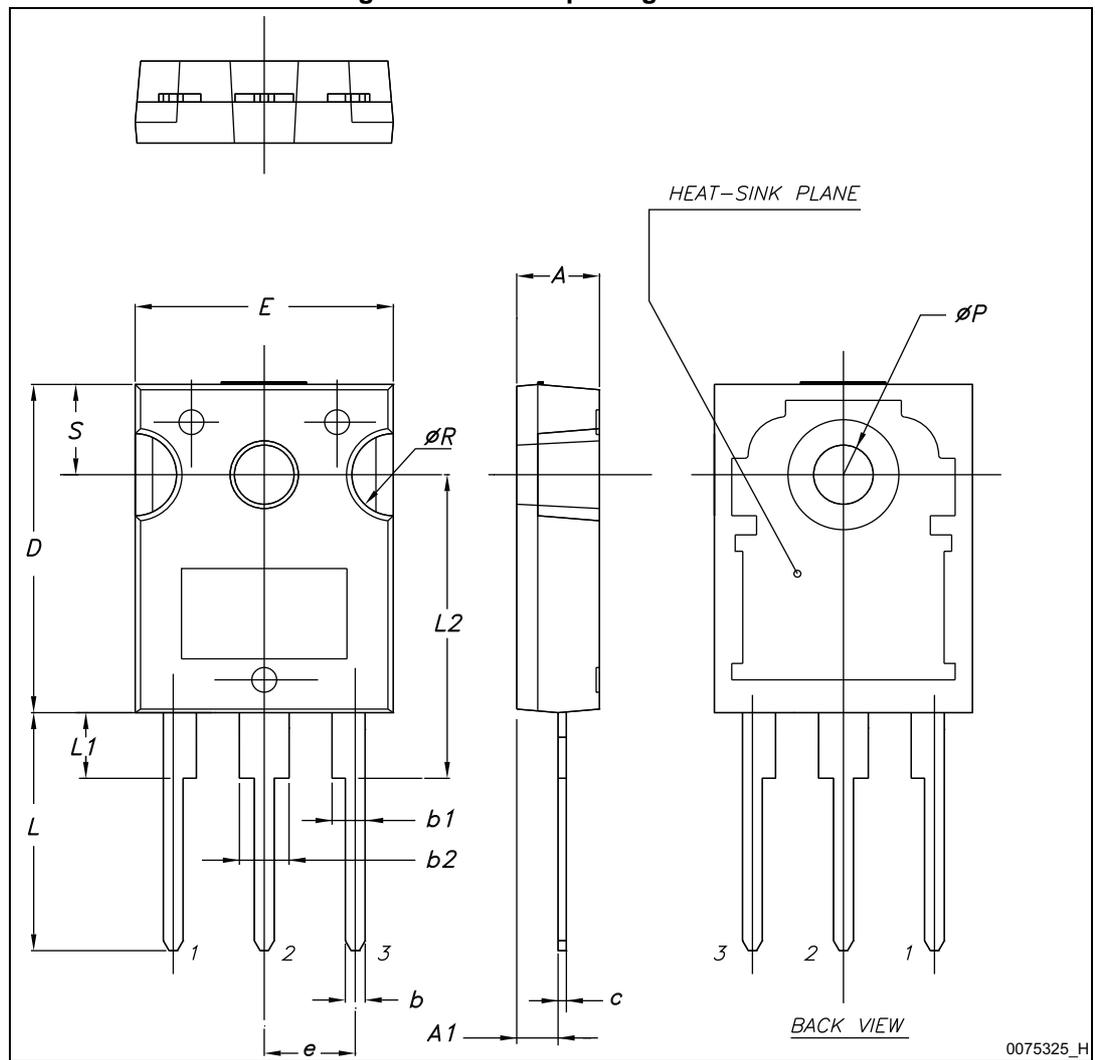
Table 10. TO-247 package mechanical data

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	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

5 Packing information

Figure 23. Tape
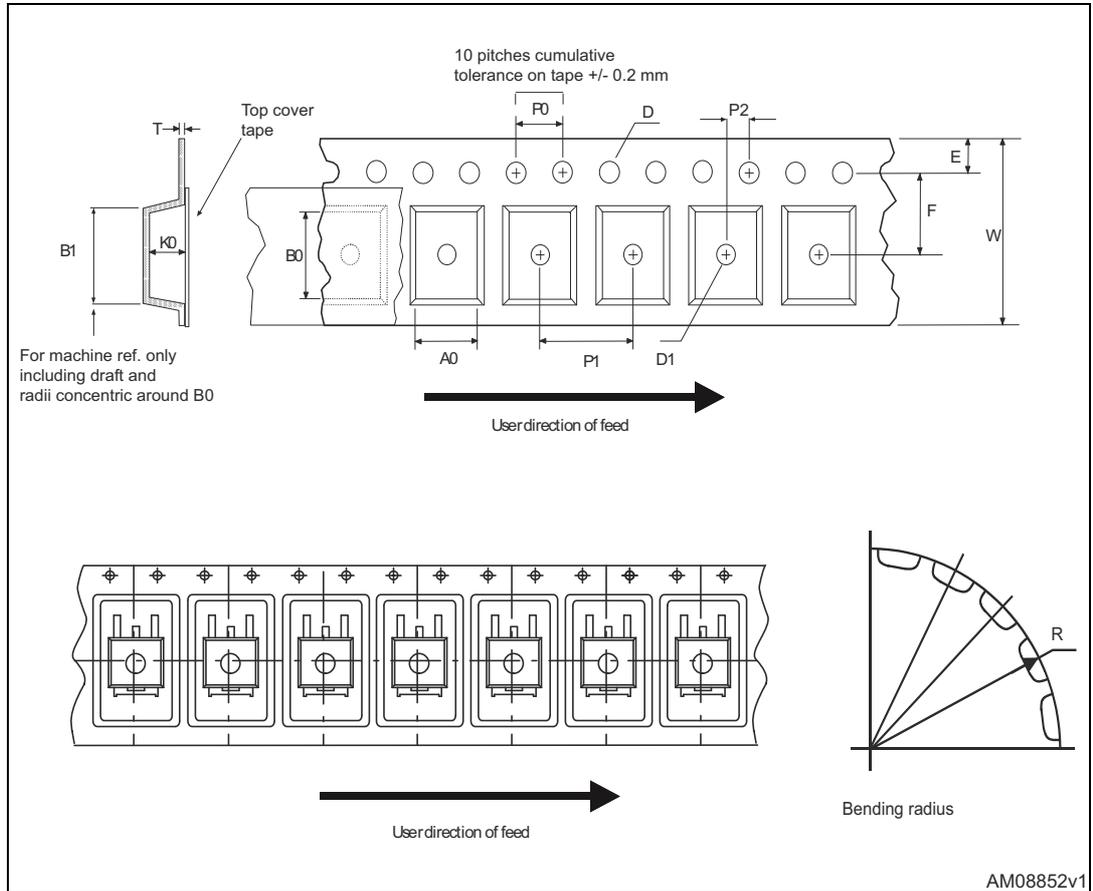
Figure 24. Reel
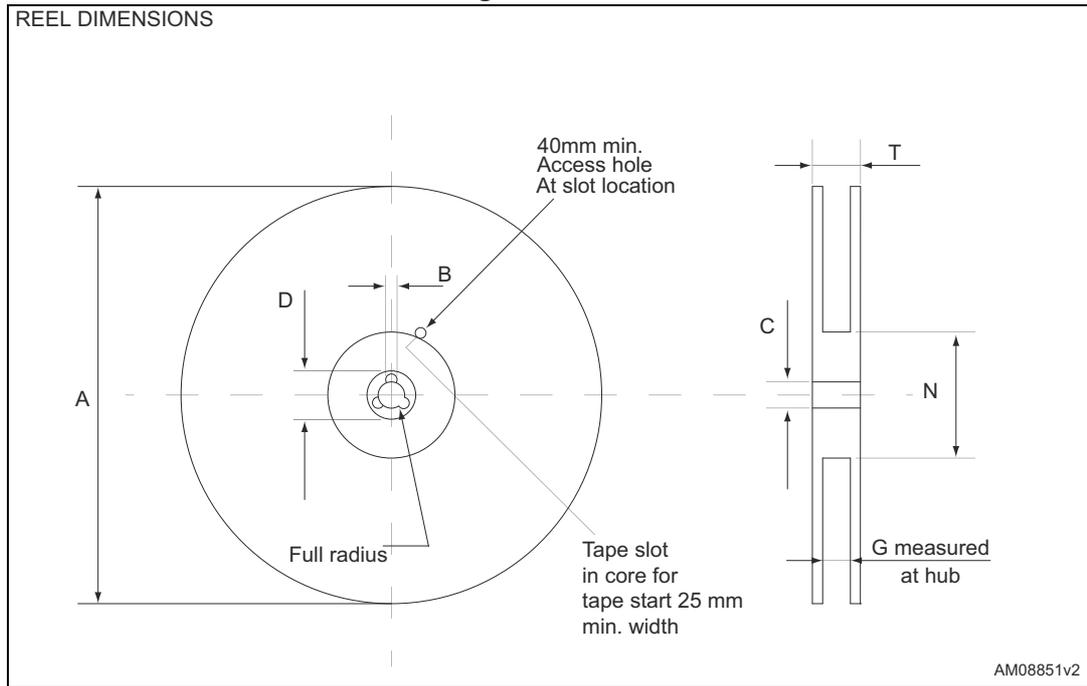
Table 11. D²PAK (TO-263) tape and reel mechanical data

Dim.	Tape mm		Dim.	Reel 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 qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

6 Revision history

Table 12. Document revision history

Date	Revision	Changes
07-Jun-2004	4	Stylesheet update. No content change
14-May-2008	5	Inserted D²PAK
18-Jun-2015	6	Updated *Table 1: Device summary*. Updated *Section 4: Package information* and *Section 5: Packing information*.

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