STGB19NC60KDT4, STGF19NC60KD, STGP19NC60KD

20 A, 600 V short-circuit rugged IGBT

Datasheet - production data

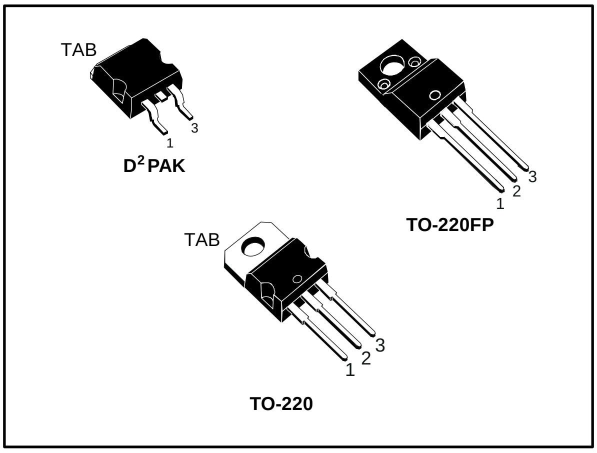
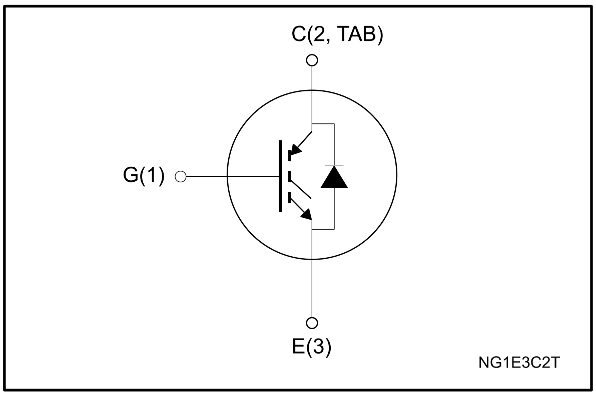


Figure 1: Internal schematic diagram



Features

- Low on voltage drop ($V_{CE(sat)}$)
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)
- Short-circuit withstand time 10 µs
- IGBT co-packaged with ultrafast free-wheeling diode

Applications

- High frequency inverters
- Motor drives

Description

These devices are very fast IGBTs developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior.

Table 1: Device summary

Order code	Marking	Package	Packing
STGB19NC60KDT4	GB19NC60KD	D²PAK	Tape and reel
STGF19NC60KD	GF19NC60KD	TO-220FP	Tube
STGP19NC60KD	GP19NC60KD	TO-220	

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D²PAK, TO-220	TO-220FP	
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	600		V
I_C(1)	Continuous collector current at T_C = 25 °C	35	16	A
	Continuous collector current at T_C = 100 °C	20	10	A
I_{CL}(2)	Turn-off latching current	75		A
I_{CP}(3)	Pulsed collector current	75		A
V_{GE}	Gate-emitter voltage	±20		V
I_F	Diode RMS forward current at T_C= 25 °C	20		A
I_{FSM}	Surge non repetitive forward current t_p= 10 ms sinusoidal	50		A
P_{TOT}	Total dissipation at T_C = 25 °C	125	32	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat-sink (t=1 s; T_C= 25 °C)		2500	V
t_{scw}	Short-circuit withstand time V_{CE} = 300 V, T_j = 125 °C, R_G = 10 Ω, V_{GE} = 12 V	10		µs
T_{stg}	Storage temperature range	- 55 to 150		°C
T_J	Operating junction temperature range			

Notes:

(1)Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

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

(3)Pulse width limited by maximum junction temperature.

Table 3: Thermal data

Symbol	Parameter	Value		Unit
		D²PAK, TO-220	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case IGBT	1	3.9	°C/W
$R_{thj-case}$	Thermal resistance junction-case diode	3	5.6	
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5		

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 4: Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	I_C = 1 mA, V_{GE} = 0 V	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} =15 V, I_C = 12 A		2.0	2.75	V
		V_{GE} = 15 V, I_C = 12 A, T_C= 125 °C		1.65		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	4.5		6.5	V
I_{CES}	Collector cut-off current	V_{CE} = 600 V, V_{GE} = 0 V			150	µA
		V_{CE}=600 V, V_{GE} = 0 V, T_C= 125 °C (1)			1	mA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			±100	nA

Notes:

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

Table 5: Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE}= 25 V, f = 1 MHz, V_{GE} = 0 V	-	1170	-	pF
C_{oes}	Output capacitance		-	127	-	
C_{res}	Reverse transfer capacitance		-	28	-	
Q_g	Total gate charge	V_{CE} = 480 V, I_C = 12 A, V_{GE} = 0 to 15 V (see *Figure 20: " Gate charge test circuit"*)	-	55	-	nC
Q_{ge}	Gate-emitter charge		-	11	-	
Q_{gc}	Gate-collector charge		-	26	-	

Table 6: Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 480 V, I_C = 12 A, R_G = 10 Ω, V_{GE} = 15 V (see *Figure 19: " Test circuit for inductive load switching"* and *Figure 21: " Switching waveform"*)	-	30	-	ns
t_r	Current rise time		-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1450	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 480 V, I_C = 12 A, R_G = 10 Ω, V_{GE} = 15 V, T_C=125 °C (see *Figure 19: " Test circuit for inductive load switching"* and *Figure 21: " Switching waveform"*)	-	30	-	ns
t_r	Current rise time		-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1380	-	A/µs
$t_{r(Voff)}$	Off voltage rise time	V_{CC} = 480 V, I_C = 12 A, R_G = 10 Ω, V_{GE} = 15 V (see *Figure 19: " Test circuit for inductive load switching"* and *Figure 21: " Switching waveform"*)	-	35	-	ns
$t_{d(off)}$	Turn-off delay time		-	105	-	ns
t_f	Current fall time		-	85	-	ns
$t_{r(Voff)}$	Off voltage rise time	V_{CC} = 480 V, I_C = 12 A, R_G = 10 Ω, V_{GE} = 15 V, T_C=125 °C (see *Figure 19: " Test circuit for inductive load switching"* and *Figure 21: " Switching waveform"*)	-	65	-	ns
$t_{d(off)}$	Turn-off delay time		-	145	-	ns
t_f	Current fall time		-	125	-	ns

Table 7: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}(1)	Turn-on switching energy	V_{CC} = 480 V, I_C = 12 A, R_G = 10 Ω , V_{GE} = 15 V (see *Figure 19: " Test circuit for inductive load switching"*)	-	165	-	µJ
E_{off}(2)	Turn-off switching energy		-	255	-	µJ
E_{ts}	Total switching energy		-	420	-	µJ
E_{on}(1)	Turn-on switching energy	V_{CC} = 480 V, I_C = 12 A, R_G = 10 Ω , V_{GE} = 15 V, T_C=125 °C (see *Figure 19: " Test circuit for inductive load switching"*)	-	250	-	µJ
E_{off}(2)	Turn-off switching energy		-	445	-	µJ
E_{ts}	Total switching energy		-	695	-	µJ

Notes:

(1)Including the reverse recovery of the diode.

(2)Including the tail of the collector current.

Table 8: Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	I_F=12 A	-	1.9	-	V
		I_F=12 A, T_C=125 °C	-	1.6	-	V
t_{rr}	Reverse recovery time	I_F=12 A, V_R=40 V, di/dt=100 A/µs (see *Figure 22: " Diode reverse recovery waveform"*)	-	31	-	ns
Q_{rr}	Reverse recovery charge		-	30	-	nC
I_{rrm}	Reverse recovery current		-	2	-	A
t_{rr}	Reverse recovery time	I_F=12 A, V_R=40 V, T_C=125 °C, di/dt=100 A/µs (see *Figure 22: " Diode reverse recovery waveform"*)	-	50	-	ns
Q_{rr}	Reverse recovery charge		-	70	-	nC
I_{rrm}	Reverse recovery current		-	4	-	A

2.1 Electrical characteristics (curves)

Figure 2: Output characteristics

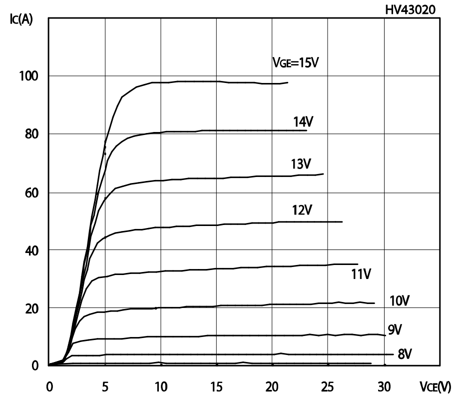


Figure 3: Transfer characteristics

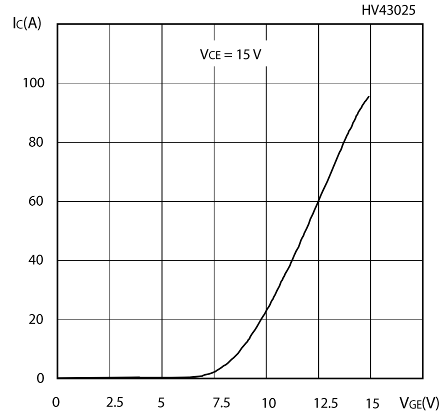


Figure 4: Collector-emitter on voltage vs temperature

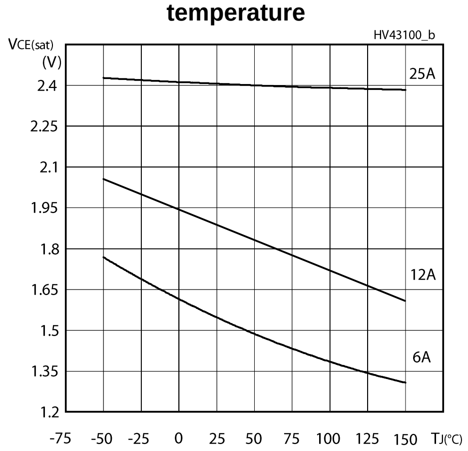


Figure 5: Gate charge vs gate-source voltage

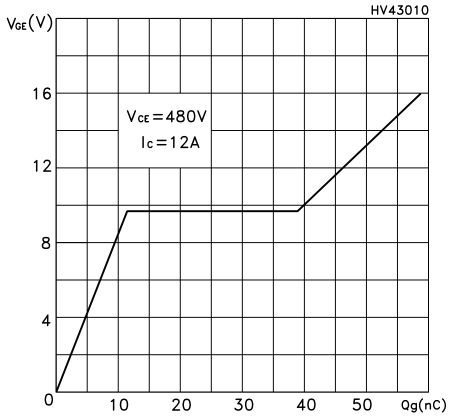


Figure 6: Capacitance variations

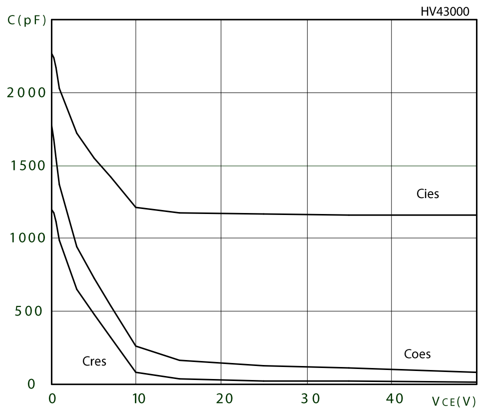


Figure 7: Normalized gate threshold voltage vs temperature

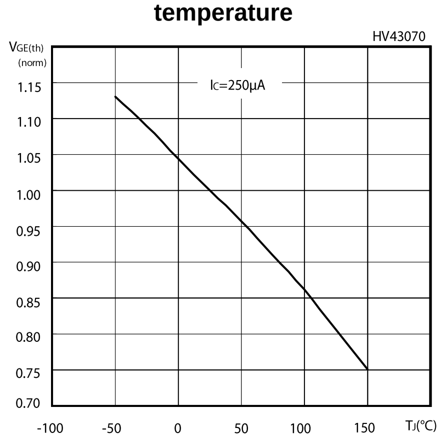


Figure 8: Collector-emitter on voltage vs collector current

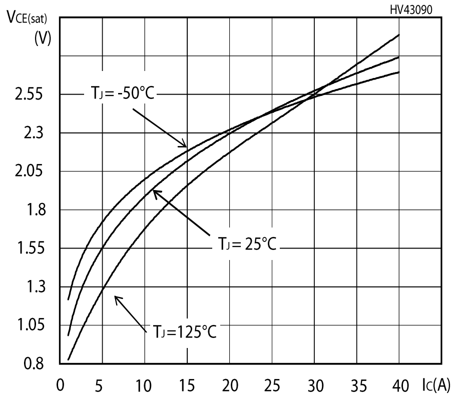


Figure 9: Normalized breakdown voltage vs temperature

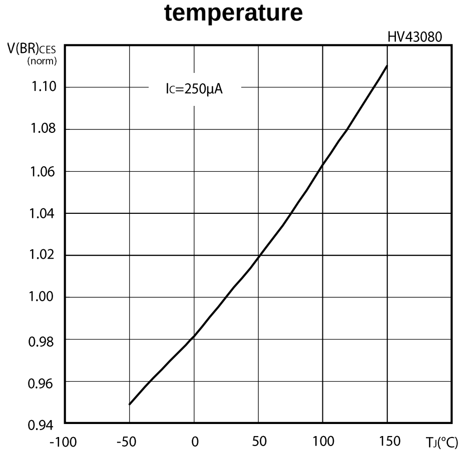


Figure 10: Switching energy vs temperature

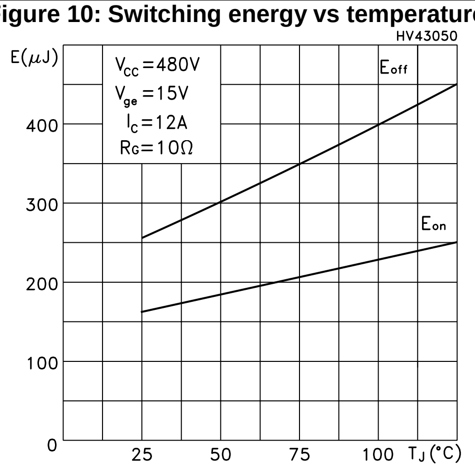


Figure 11: Switching energy vs. gate resistance

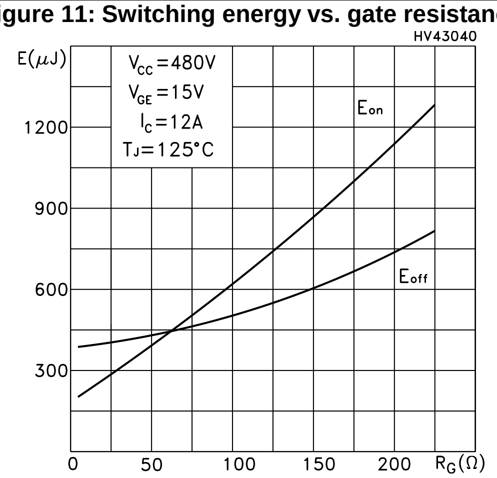


Figure 12: Switching energy vs collector current

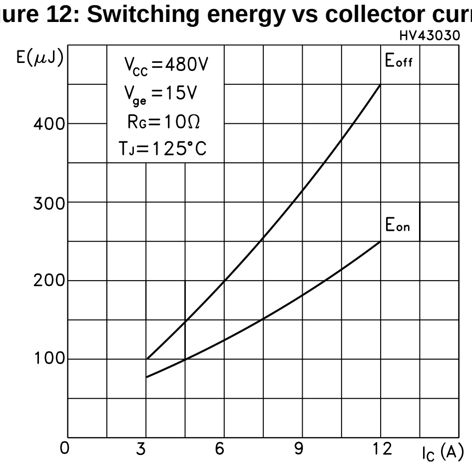


Figure 13: Turn-off SOA

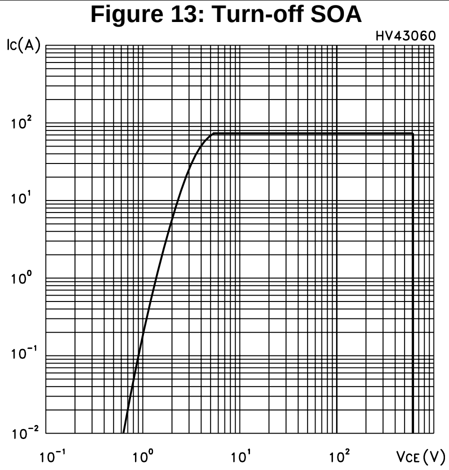


Figure 14: Emitter-collector diode characteristics

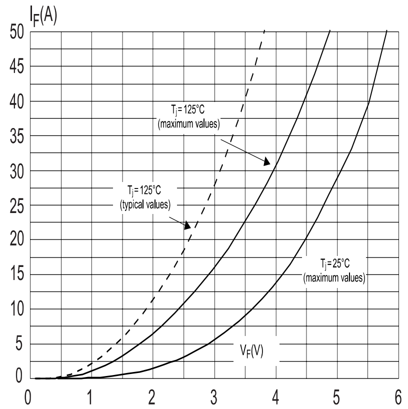


Figure 15: Thermal impedance for TO-220, D²PAK

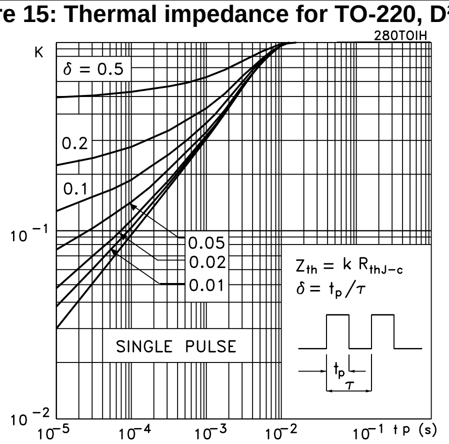


Figure 16: Thermal impedance for TO-220FP

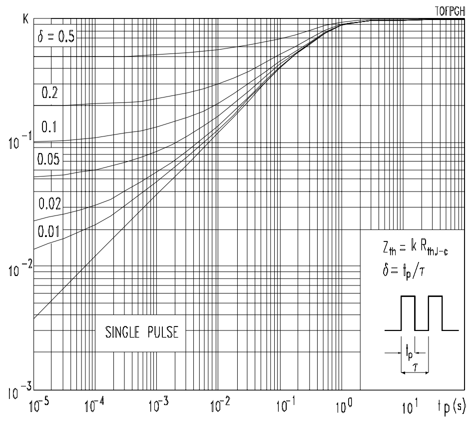


Figure 17: Maximum DC collector current vs T_{CASE} for TO-220FP

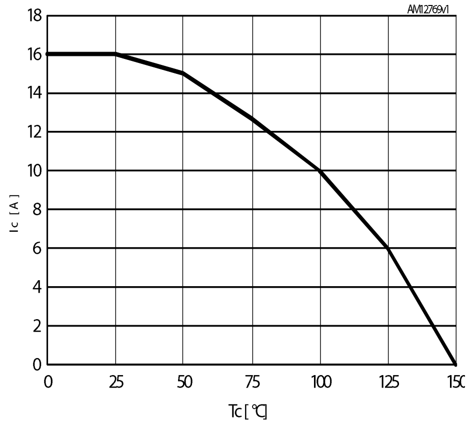
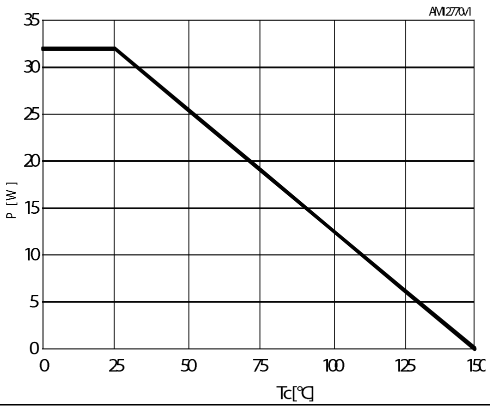


Figure 18: Maximum power dissipation vs T_{CASE} for TO-220FP



3 Test circuits

Figure 19: Test circuit for inductive load switching

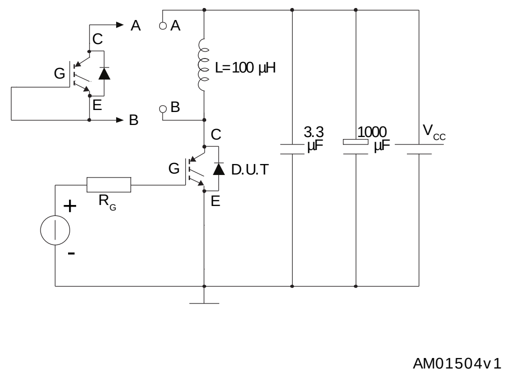


Figure 20: Gate charge test circuit

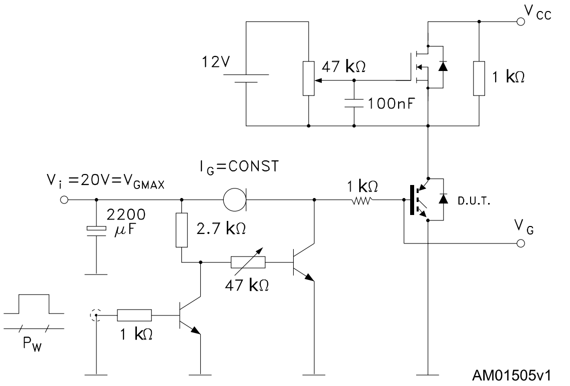


Figure 21: Switching waveform

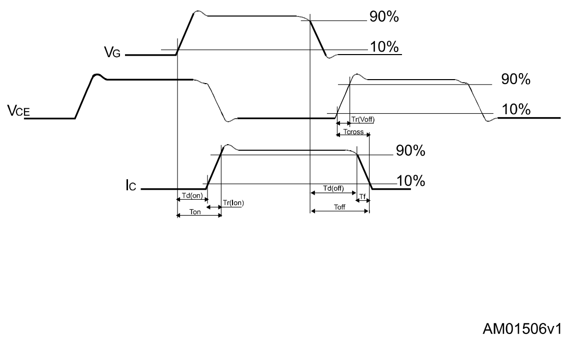
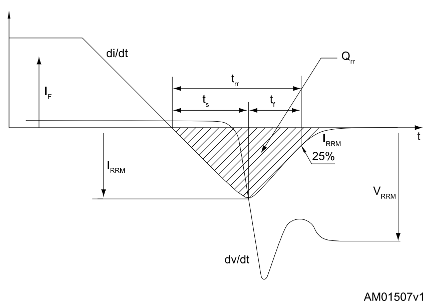


Figure 22: Diode reverse recovery waveform



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

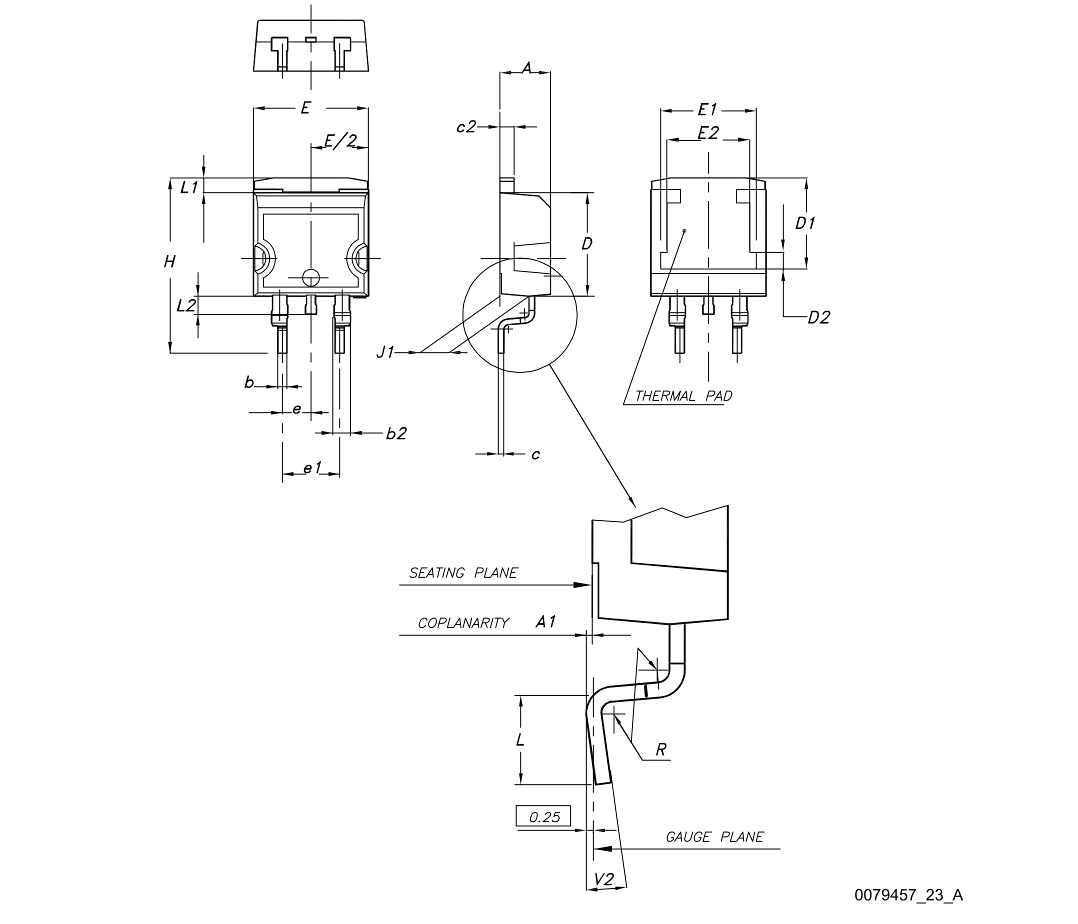
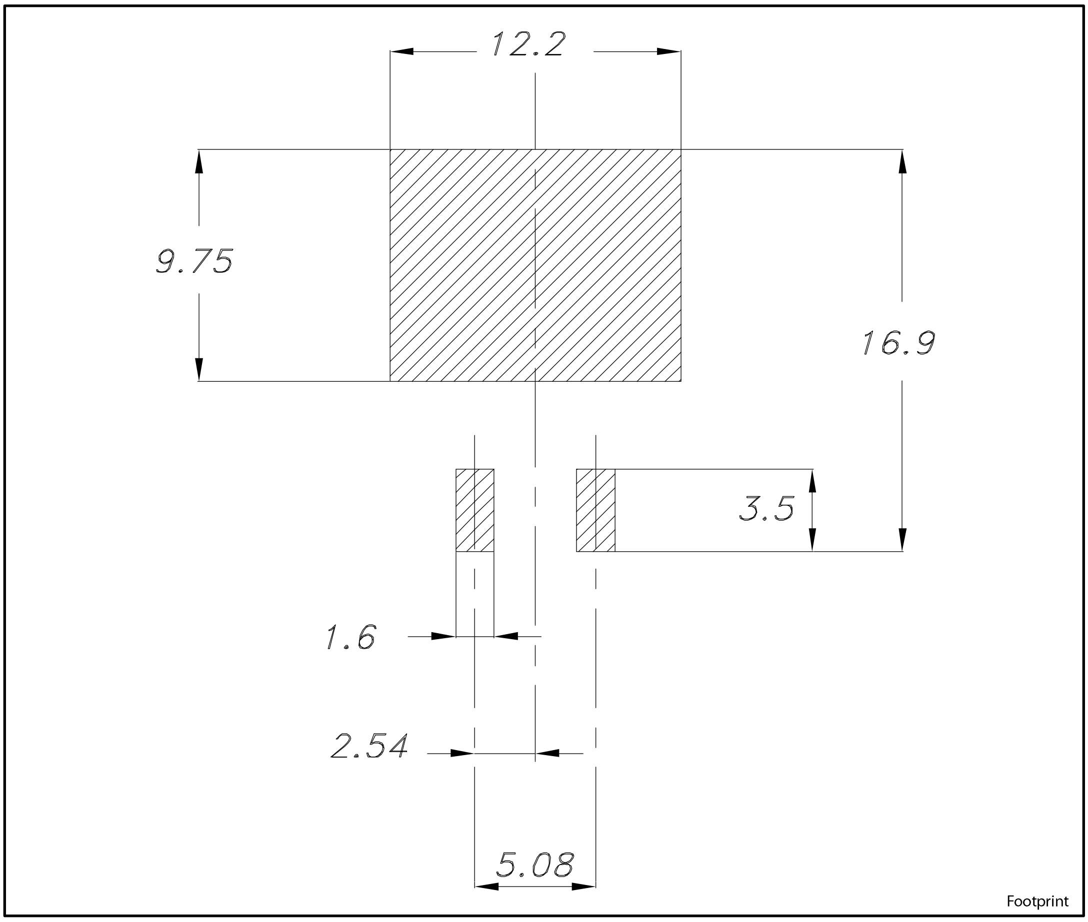


Table 9: D²PAK (TO-263) type A package mechanical data

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 24: D²PAK (TO-263) type A recommended footprint (dimensions are in mm)



4.2 D²PAK (TO-263) type B package information

Figure 25: D²PAK (TO-263) type B package outline

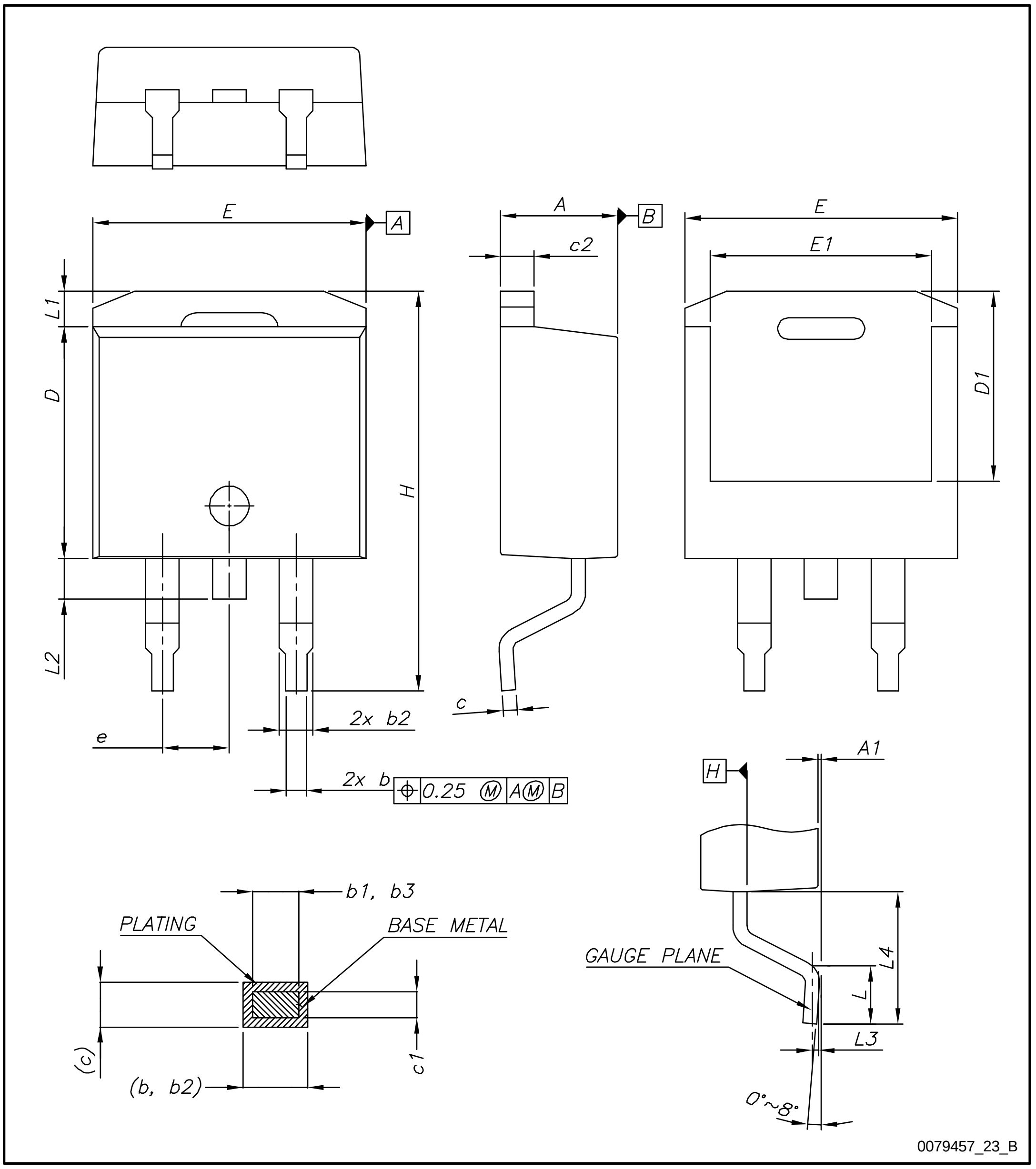
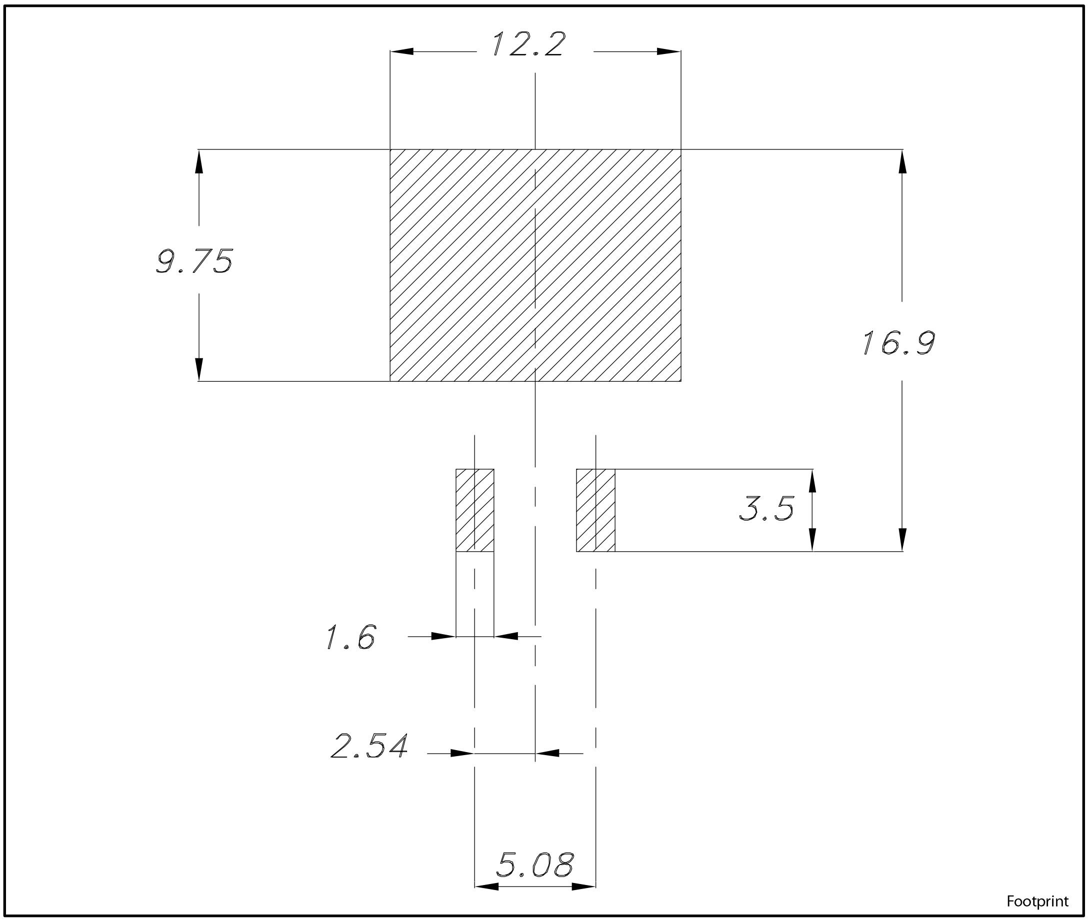


Table 10: D²PAK (TO-263) type B mechanical data

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 26: D^2PAK (TO-263) type B recommended footprint (dimensions are in mm)



4.3 D²PAK type A packing information

Figure 27: D²PAK type A tape outline

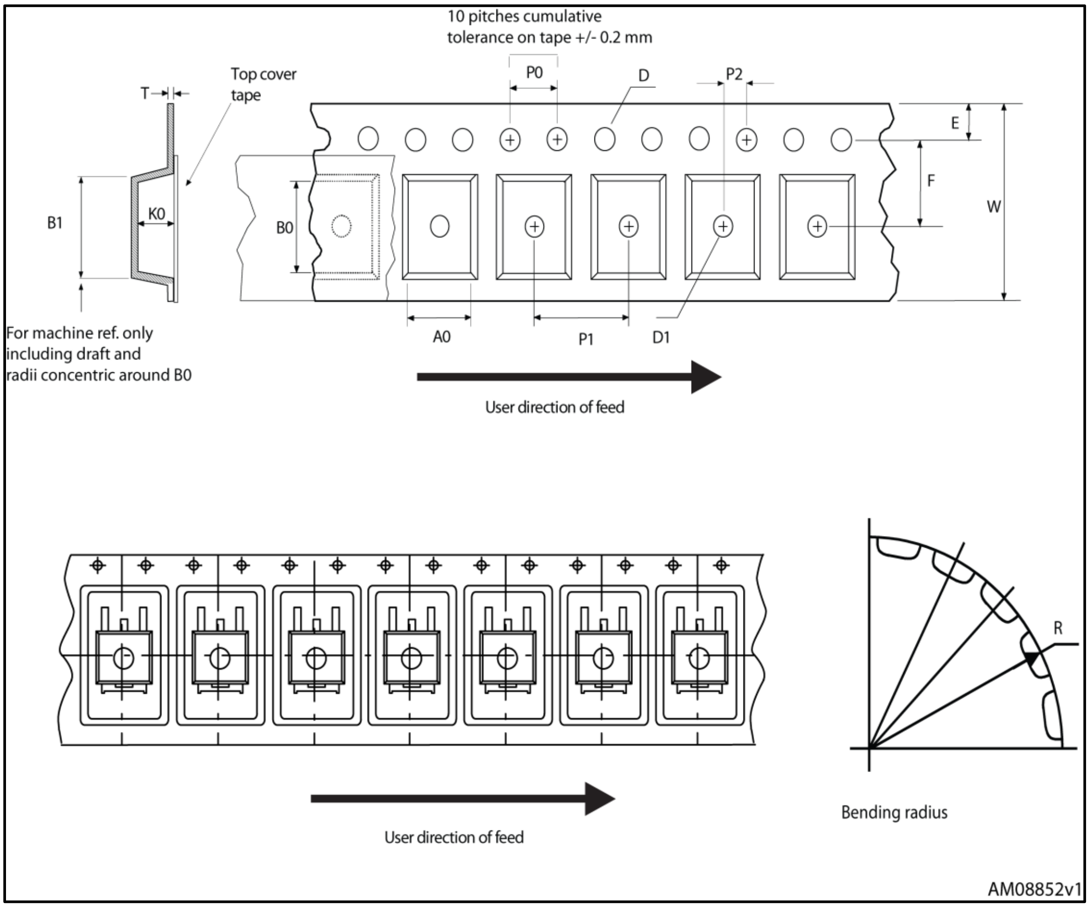


Figure 28: D²PAK type A reel outline

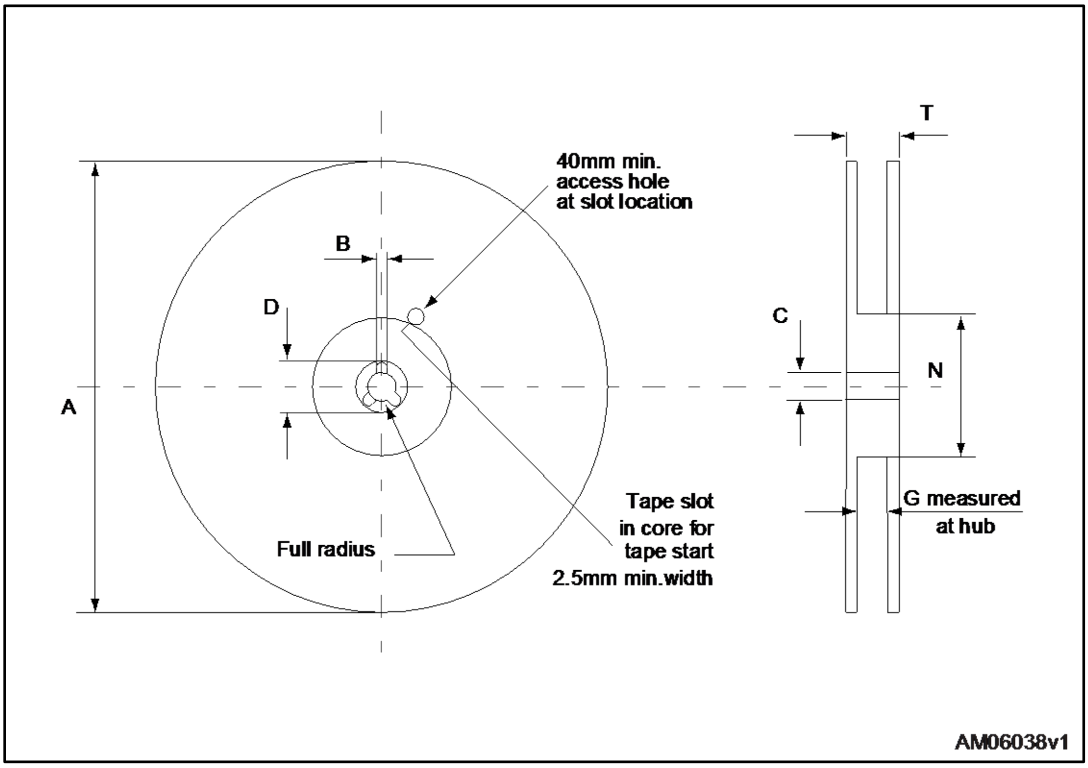


Table 11: D²PAK type A tape and reel mechanical data

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 29: D²PAK type B tape outline

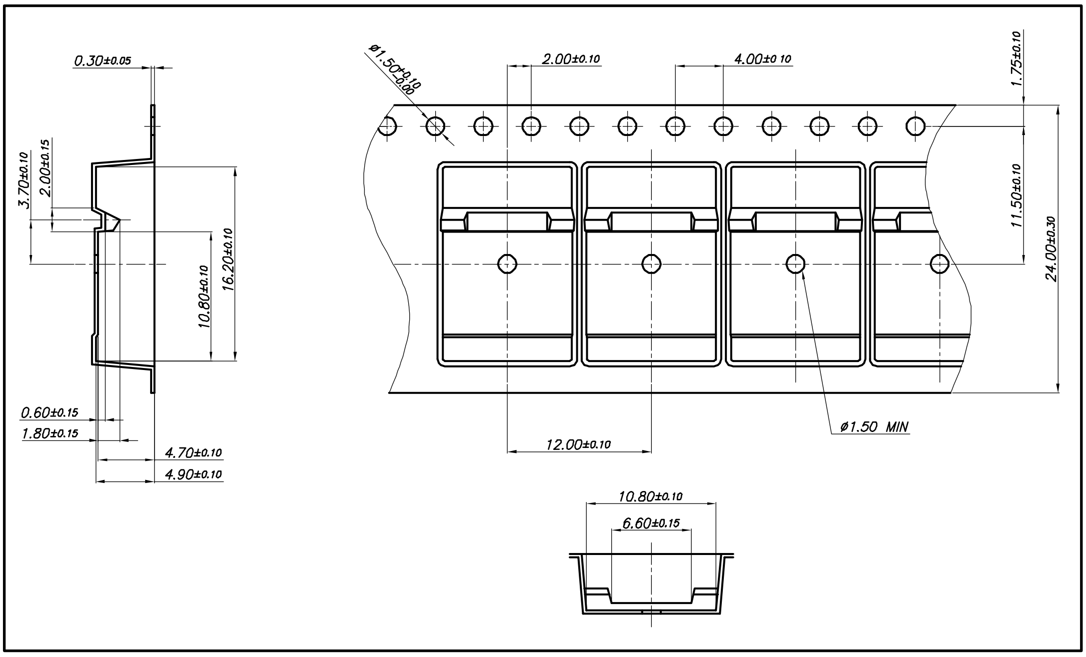


Figure 30: D²PAK type B reel outline

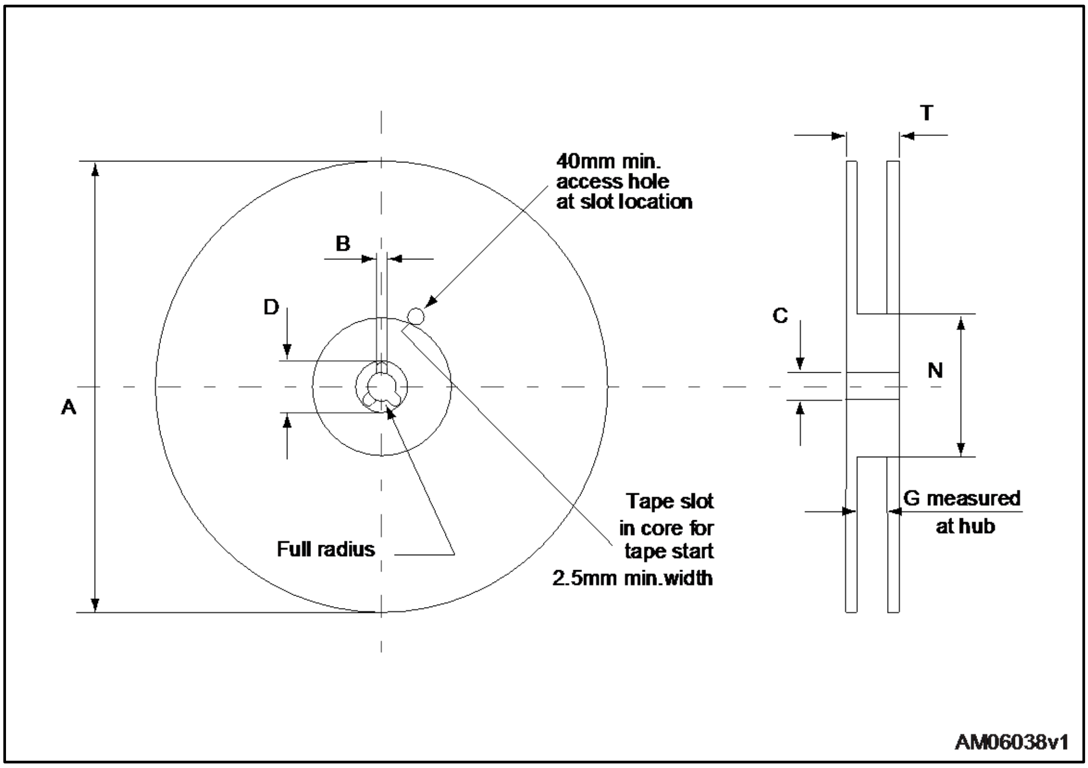


Table 12: D^2PAK type B reel mechanical data

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

4.5 TO-220FP package information

Figure 31: TO-220FP package outline

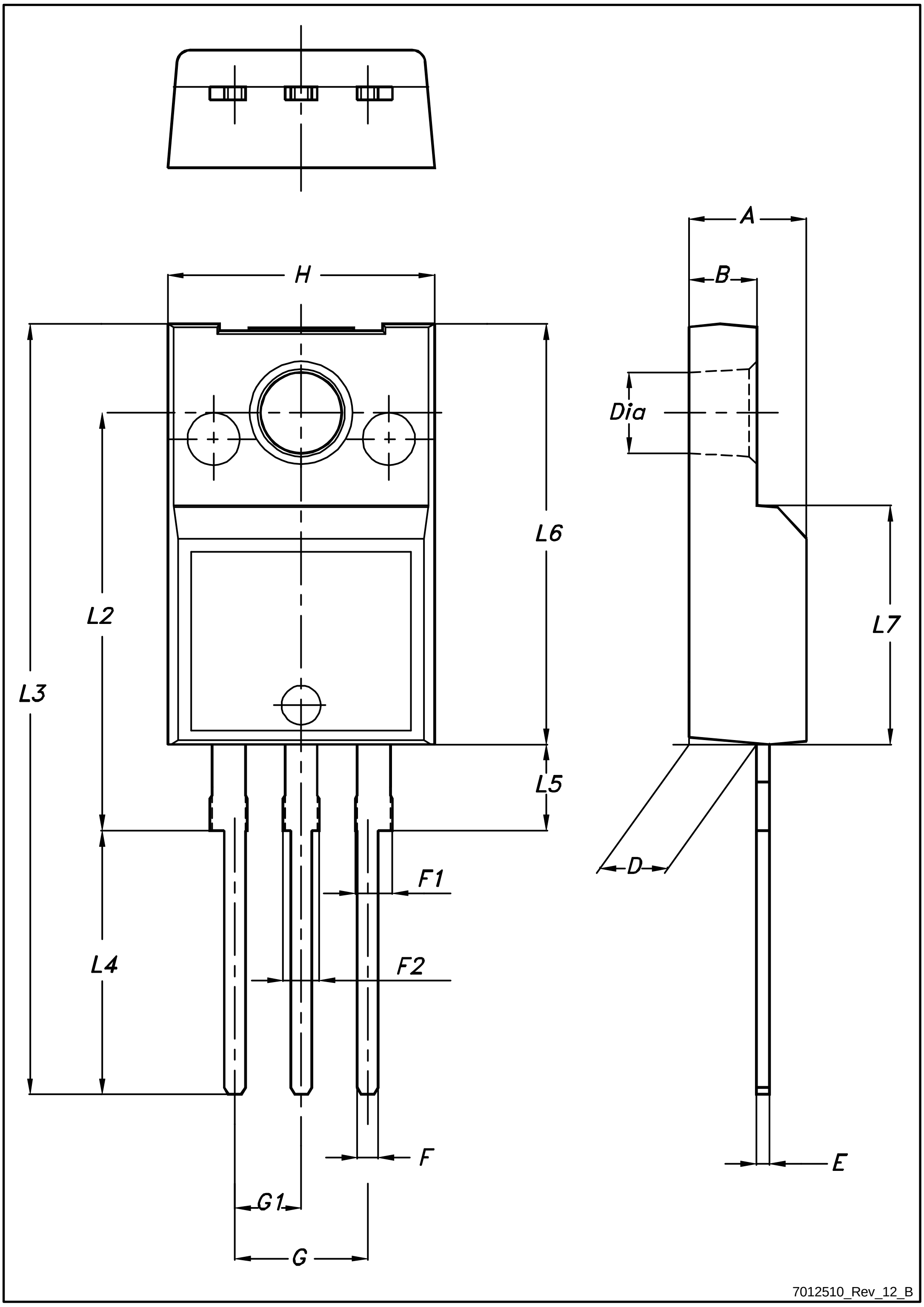


Table 13: TO-220FP package mechanical data

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

4.6 TO-220 type A package information

Figure 32: TO-220 type A package outline

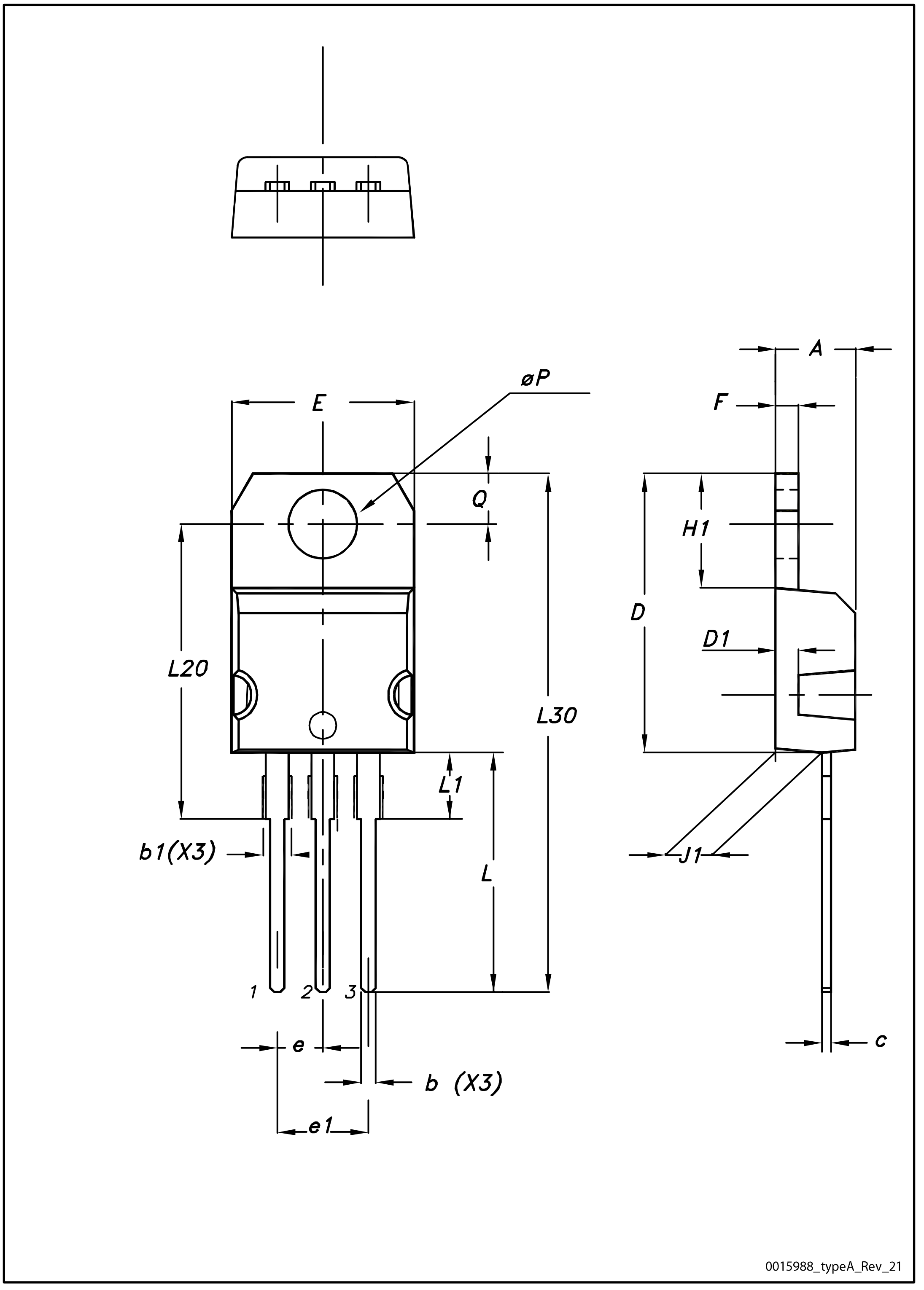


Table 14: TO-220 type A package mechanical data

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

5 Revision history

Table 15: Document revision history

Date	Revision	Changes
08-May-2008	1	Initial release
28-May-2008	2	– Value on Table 3: Thermal resistance has been changed. – Inserted Figure 16: Thermal impedance for TO-220, D²PAK and Figure 17: Thermal impedance for TO-220FP
31-Jul-2012	3	Added: Figure 18 and Figure 19 on page 8.
17-Jul-2017	4	Modified internal schematic diagram on cover page Modified *Table 2: "Absolute maximum ratings"*, *Table 3: "Thermal data"*, and *Table 4: "Static characteristics"*. Modified *Figure 3: "Transfer characteristics"*, *Figure 4: "Collector-emitter on voltage vs temperature"* and *Figure 8: "Collector-emitter on voltage vs collector current"*. Updated *Section 4: "Package information"*. Minor text changes.

Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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