

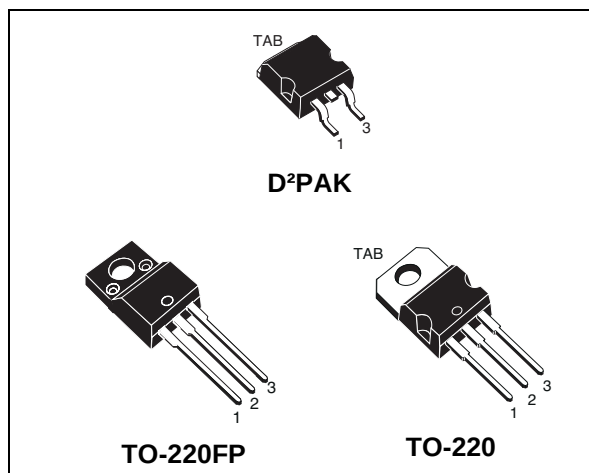
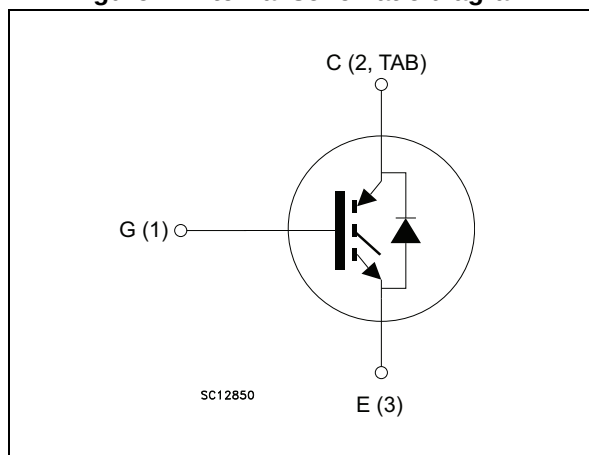


Figure 1. Internal schematic diagram



Features

- High speed switching
- Tight parameters distribution
- Safe paralleling
- Low thermal resistance
- Short-circuit rated
- Ultrafast soft recovery antiparallel diode

Applications

- Motor control
- UPS, PFC

Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. This IGBT series offers the optimum compromise between conduction and switching losses, maximizing the efficiency of very high frequency converters. Furthermore, a positive $V_{CE(sat)}$ temperature coefficient and very tight parameter distribution result in easier paralleling operation.

Table 1. Device summary

Order codes	Marking	Packages	Packaging
STGB15H60DF	GB15H60DF	D²PAK	Tape and reel
STGF15H60DF	GF15H60DF	TO-220FP	Tube
STGP15H60DF	GP15H60DF	TO-220	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
3	Test circuits	7
4	Package mechanical data	8
5	Packaging mechanical data	14
6	Revision history	16

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	TO-220 D ² PAK	TO-220FP	Unit
V _{CES}	Collector-emitter voltage (V _{GE} = 0)	600		V
I _C	Continuous collector current at T _C = 25 °C	30	30 ⁽¹⁾	A
	Continuous collector current at T _C = 100 °C	15	15 ⁽¹⁾	A
I _{CP} ⁽²⁾	Pulsed collector current	60	60 ⁽¹⁾	A
V _{GE}	Gate-emitter voltage	±20		V
I _F	Continuous forward current T _C = 25 °C	30	30 ⁽¹⁾	A
	Continuous forward current at T _C = 100 °C	15	15 ⁽¹⁾	
I _{FP} ⁽²⁾	Pulsed forward current	60	60 ⁽¹⁾	A
P _{TOT}	Total dissipation at T _C = 25 °C	115	30	W
T _{STG}	Storage temperature range	- 55 to 150		°C
T _J	Operating junction temperature	- 55 to 175		

1. Limited by maximum junction temperature.
2. Pulse width limited by maximum junction temperature.

Table 3. Thermal data

Symbol	Parameter	TO-220 D ² PAK	TO-220FP	Unit
R_{thJC}	Thermal resistance junction-case IGBT	1.3	5	°C/W
R_{thJC}	Thermal resistance junction-case diode	2.78	6.25	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5		°C/W

2 Electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 2\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 15\text{ A}$		1.6	2.0	V
		$V_{GE} = 15\text{ V}$, $I_C = 15\text{ A}$ $T_J = 125\text{ °C}$		1.75		
		$V_{GE} = 15\text{ V}$, $I_C = 15\text{ A}$ $T_J = 175\text{ °C}$		1.8		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	5.0	6.0	7.0	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600\text{ V}$			25	μA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$			250	nA

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	2100	-	pF
C_{oes}	Output capacitance		-	80	-	pF
C_{res}	Reverse transfer capacitance		-	50	-	pF
Q_g	Total gate charge	$V_{CC} = 400\text{ V}$, $I_C = 15\text{ A}$, $V_{GE} = 15\text{ V}$	-	80	-	nC
Q_{ge}	Gate-emitter charge		-	TBD	-	nC
Q_{gc}	Gate-collector charge		-	TBD	-	nC

Table 6. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$, $I_C = 15\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD	-	ns
t_r	Current rise time		-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	TBD	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$, $I_C = 15\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	TBD	-	ns
t_r	Current rise time		-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	TBD	-	A/ μ s
$t_{r(Voff)}$	Off voltage rise time	$V_{CE} = 400\text{ V}$, $I_C = 15\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD	-	ns
$t_{d(off)}$	Turn-off delay time		-	TBD	-	ns
t_f	Current fall time		-	TBD	-	ns
$t_{r(Voff)}$	Off voltage rise time	$V_{CE} = 400\text{ V}$, $I_C = 15\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	TBD	-	ns
$t_{d(off)}$	Turn-off delay time		-	TBD	-	ns
t_f	Current fall time		-	TBD	-	ns
t_{sc}	Short-circuit withstand time	$V_{CC} \leq 360\text{ V}$, $V_{GE} = 15\text{ V}$	-	TBD	-	μ s

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CE} = 400\text{ V}$, $I_C = 15\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD	-	μ J
$E_{off}^{(2)}$	Turn-off switching losses		-	TBD	-	μ J
E_{ts}	Total switching losses		-	TBD	-	μ J
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CE} = 400\text{ V}$, $I_C = 15\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	TBD	-	μ J
$E_{off}^{(2)}$	Turn-off switching losses		-	TBD	-	μ J
E_{ts}	Total switching losses		-	TBD	-	μ J

1. Energy losses include reverse recovery of the diode.
2. Turn-off losses include also the tail of the collector current.

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 15\text{ A}$ $I_F = 15\text{ A}$, $T_J = 175\text{ °C}$	-	1.8 1.3	2.2	V V
t_{rr}	Reverse recovery time	$V_r = 60\text{ V}$; $I_F = 15\text{ A}$; $di_F/dt = 100\text{ A / }\mu\text{s}$	-	TBD		ns
Q_{rr}	Reverse recovery charge		-	TBD		nC
I_{rrm}	Reverse recovery current		-	TBD		A
t_{rr}	Reverse recovery time	$V_r = 60\text{ V}$; $I_F = 15\text{ A}$; $di_F/dt = 100\text{ A / }\mu\text{s}$ $T_J = 175\text{ °C}$	-	TBD		ns
Q_{rr}	Reverse recovery charge		-	TBD		nC
I_{rrm}	Reverse recovery current		-	TBD		A

3 Test circuits

Figure 2. Test circuit for inductive load switching

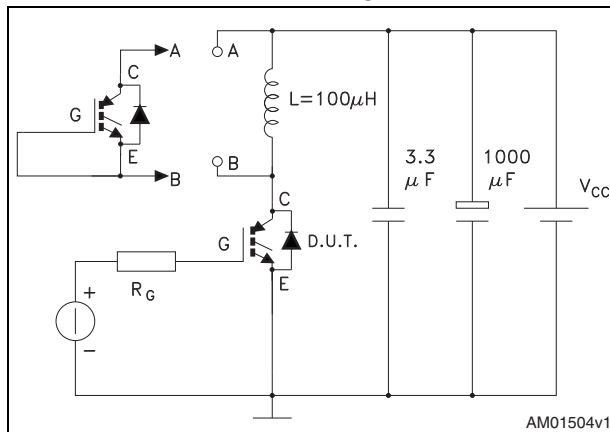


Figure 3. Gate charge test circuit

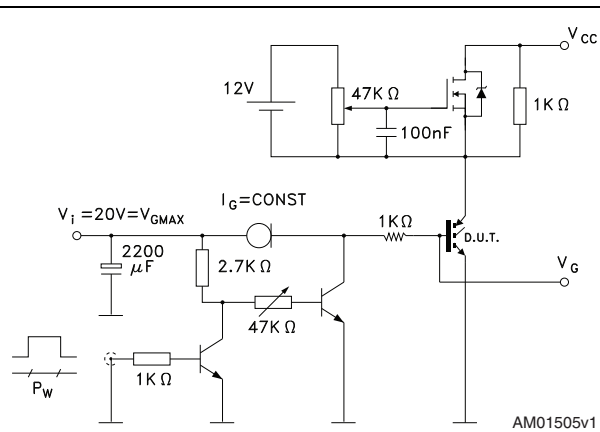


Figure 4. Switching waveform

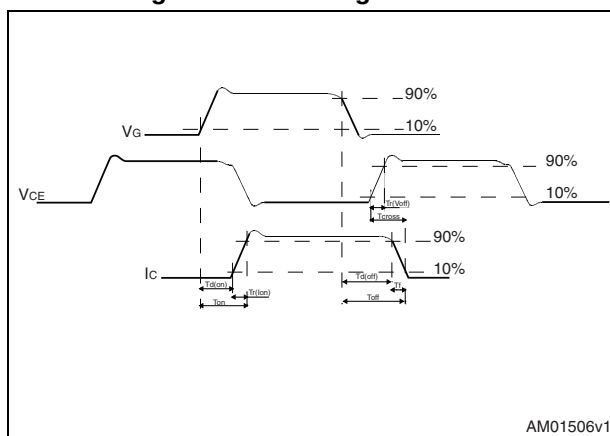
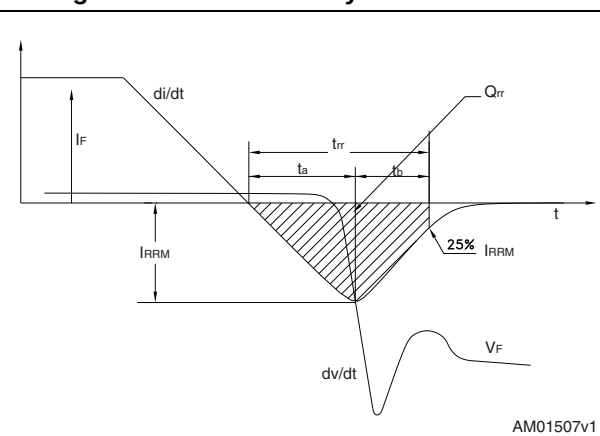


Figure 5. Diode recovery time waveform



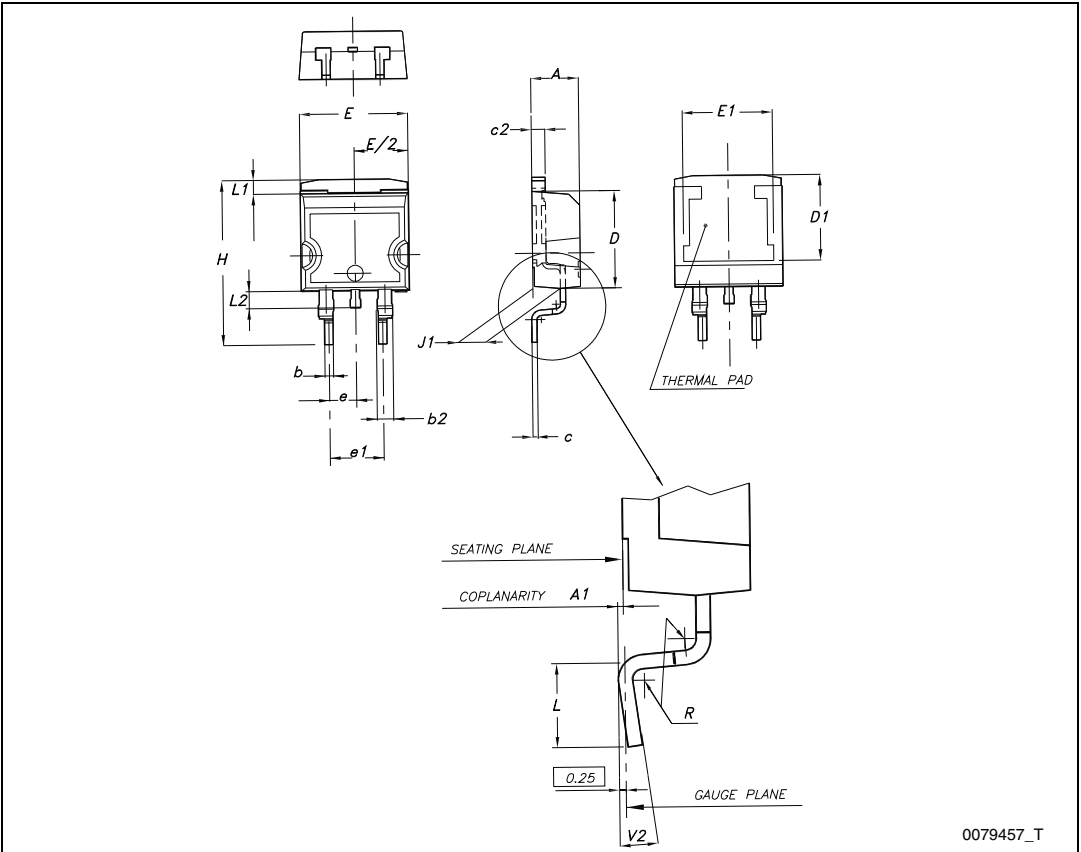
4 Package mechanical data

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.

Table 9. D²PAK mechanical data

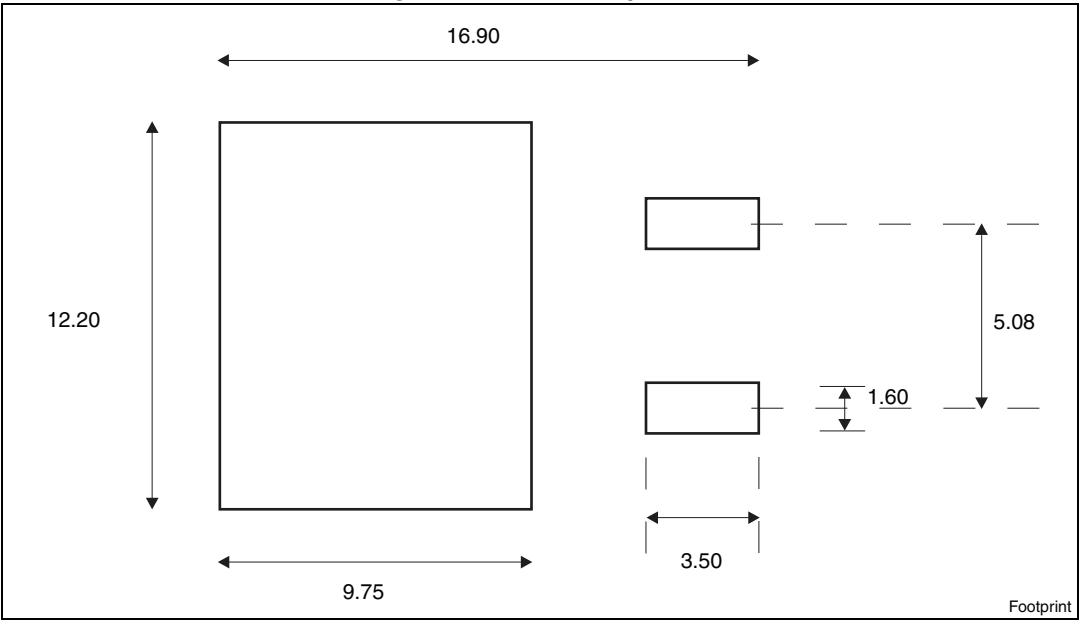
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 6. D²PAK drawing



0079457_T

Figure 7. D²PAK footprint^(a)



a. All dimension are in millimeters

Table 10. TO-220FP 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

Figure 8. TO-220FP drawing

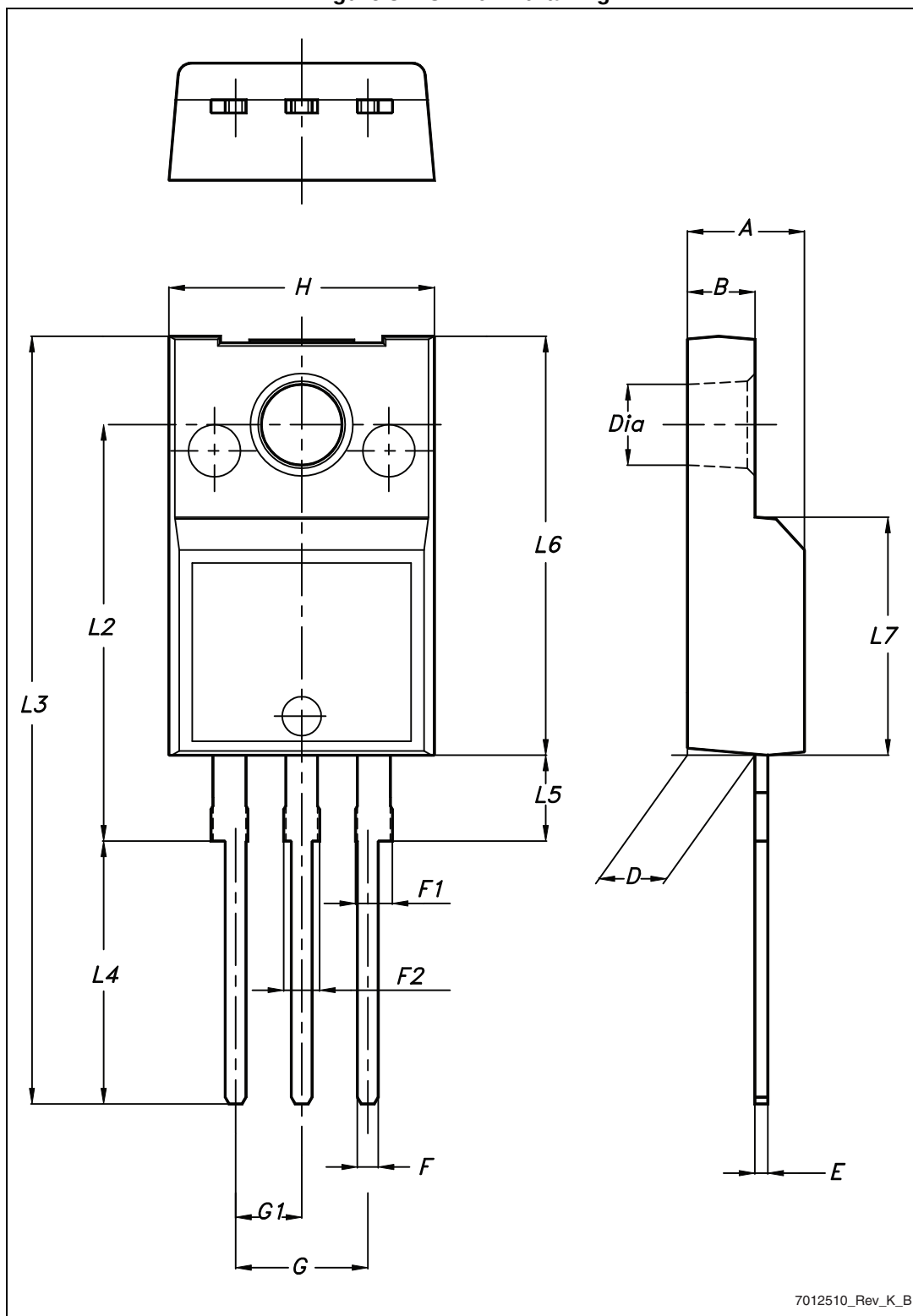
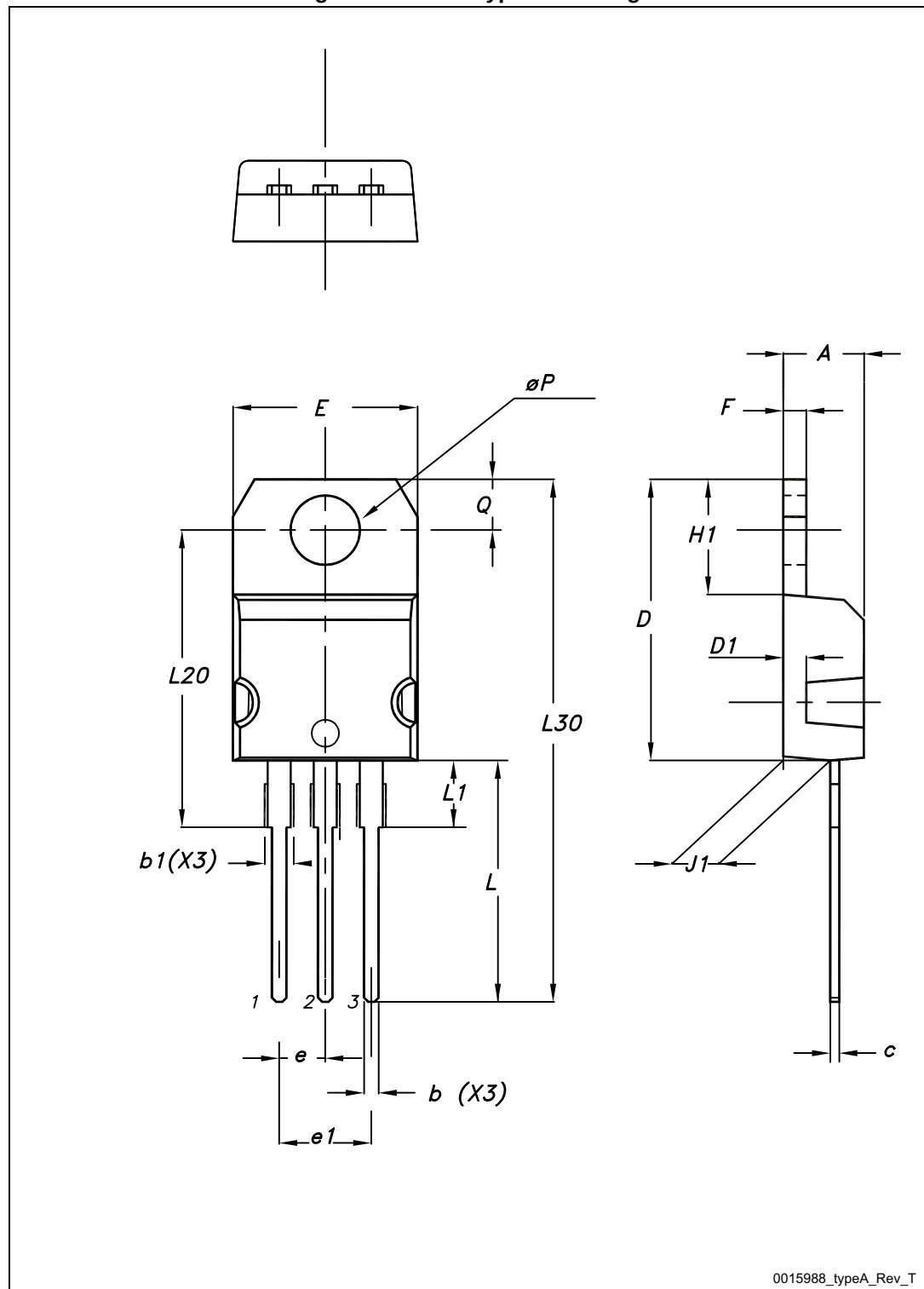


Table 11. TO-220 type A mechanical data

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

Figure 9. TO-220 type A drawing



5 Packaging mechanical data

Table 12. 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 qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 10. Tape

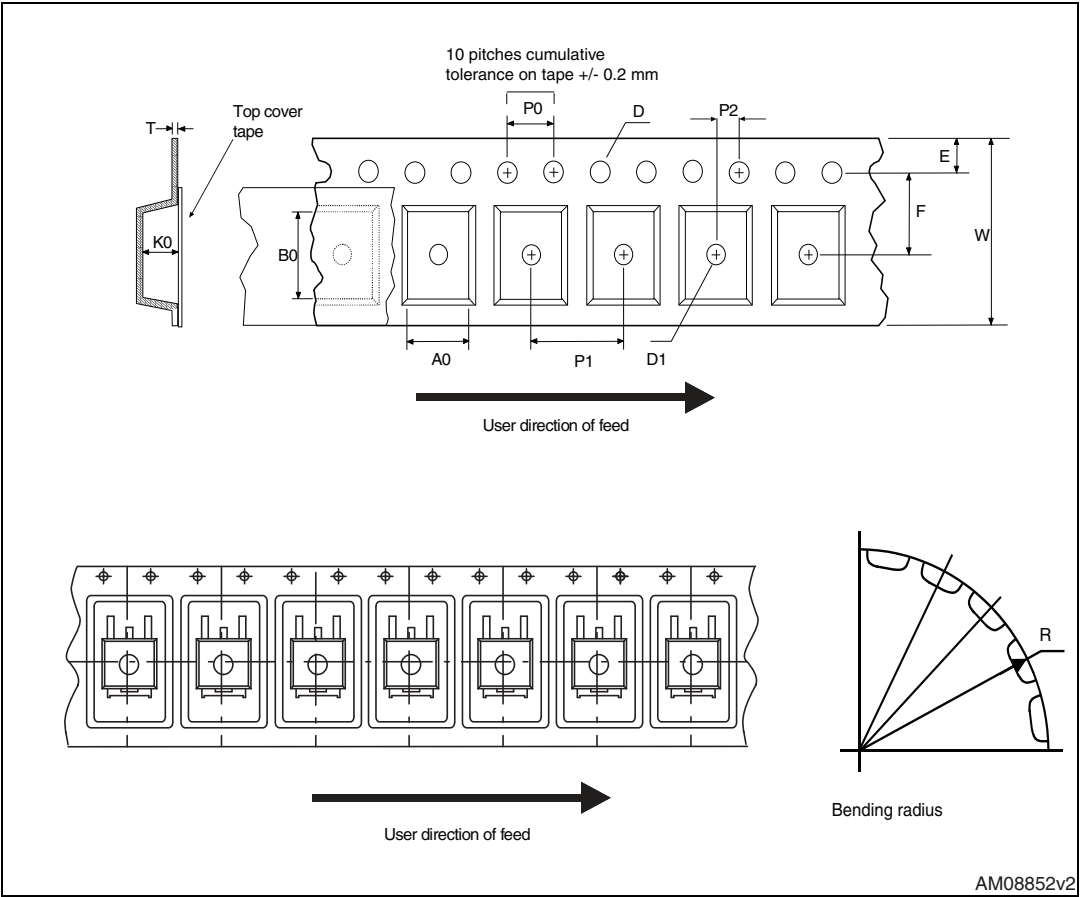
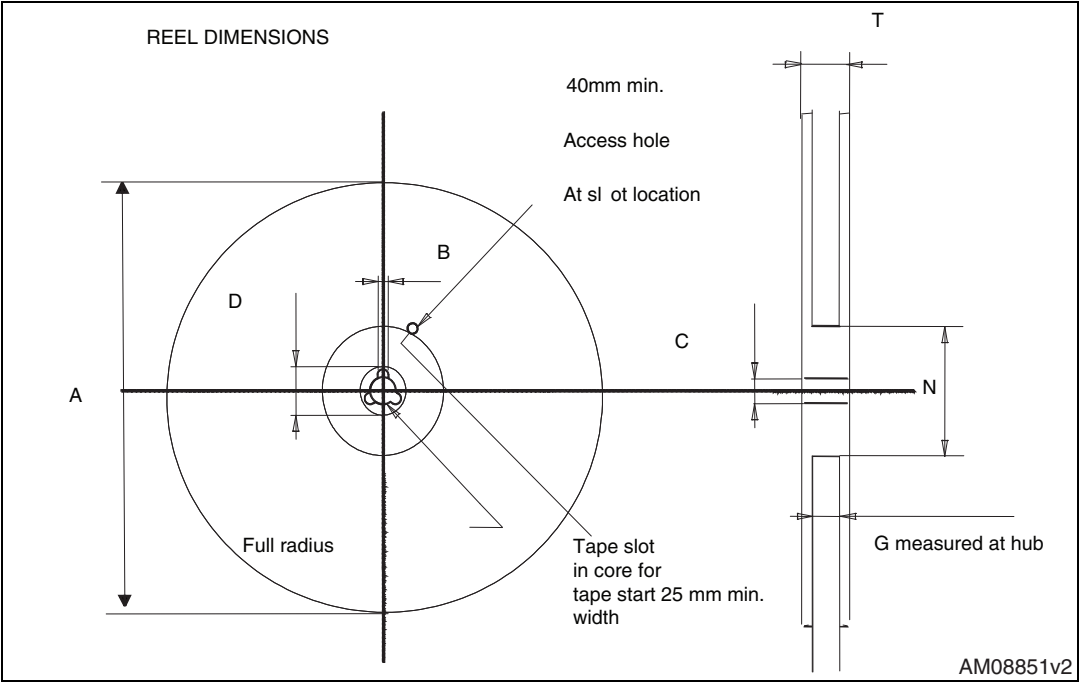


Figure 11. Reel



6 Revision history

Table 13. Document revision history

Date	Revision	Changes
12-Aug-2013	1	Initial release.

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