



STGB10HF60KD STGF10HF60KD, STGP10HF60KD

10 A - 600 V - short-circuit rugged IGBT

Features

- Low on-voltage drop ($V_{CE(sat)}$)
- Operating junction temperature up to 175 °C
- Low C_{res} / C_{ies} ratio (no cross conduction susceptibility)
- Tight parameter distribution
- Ultrafast soft-recovery antiparallel diode
- Short-circuit rugged

Applications

- Motor drives
- High frequency inverters
- SMPS and PFC in both hard switch and resonant topologies

Description

This device utilizes the advanced PowerMESH™ process for the IGBT and the Turbo 2 Ultrafast high voltage technology for the diode. The combination results in a very good trade-off between conduction losses and switching behavior rendering the product ideal for diverse high voltage applications operating at high frequencies.

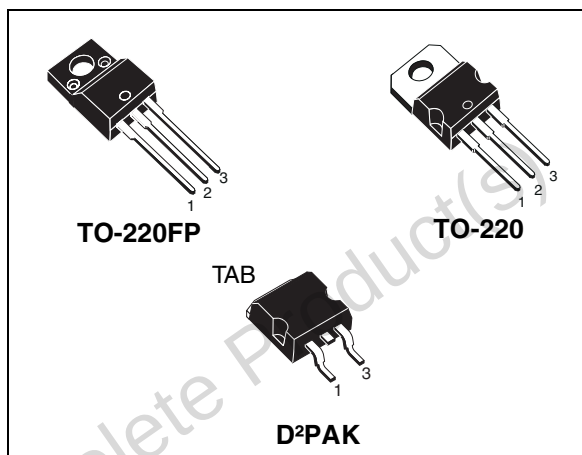


Figure 1. Internal schematic diagram

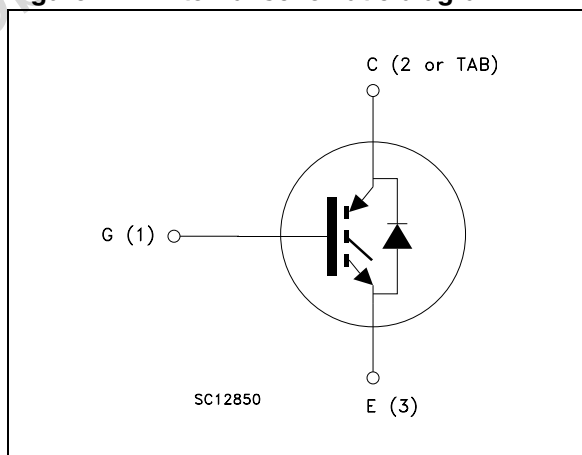


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB10HF60KDT4	GB10HF60KD	D²PAK	Tape and reel
STGF10HF60KD	GF10HF60KD	TO-220FP	Tube
STGP10HF60KD	GP10HF60KD	TO-220	Tube

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Obsolete Product(s) - Obsolete Product(s)



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK, TO-220	TO-220FP	
V _{CES}	Collector-emitter voltage (V _{GE} = 0)	600		V
I _C ⁽¹⁾	Collector current (continuous) at T _C = 25 °C	20	9	A
I _C ⁽¹⁾	Collector current (continuous) at T _C = 100 °C	10	6	A
I _{CL} ⁽²⁾	Turn-off latching current	TBD		A
I _{CP} ⁽³⁾	Pulsed collector current	TBD		A
V _{GE}	Gate-emitter voltage	±20		V
I _F	Diode RMS forward current at T _C = 25 °C	10		A
I _{FSM}	Surge non repetitive forward current t _p = 10 ms sinusoidal	20		A
V _{ISO}	Isolations withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T _C = 25 °C)	-	2500	V
P _{TOT}	Total dissipation at T _C = 25 °C	80	30	W
t _{scw}	Short-circuit withstand time, V _{CE} = 0.5V _{(BR)CES} , T _C = 125 °C, R _G = 10 Ω, V _{GE} = 12 V	5		μs
T _j	Operating junction temperature	- 40 to 175		°C

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% of V_{CES}, T_j = 175 °C, R_G = 10 Ω, V_{GE} = 15 V

3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		D ² PAK TO-220	TO-220FP	
R _{thj-case}	Thermal resistance junction-case IGBT	1.8	5	°C/W
R _{thj-case}	Thermal resistance junction-case diode	4	7	°C/W
R _{thj-amb}	Thermal resistance junction-ambient	62.5	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 ($V_{GE} = 0$)	$I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$, $T_j = 150\text{ °C}$		2 1.6		V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	4.5		6.5	V
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$, $T_j = 150\text{ °C}$			± 100	nA
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600\text{ V}$ $V_{CE} = 600\text{ V}$, $T_j = 150\text{ °C}$			150 1	μA mA
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 15\text{ V}$, $I_C = 5\text{ A}$		3		S

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	TBD	-	pF
C_{oes}	Output capacitance			TBD		pF
C_{res}	Reverse transfer capacitance			TBD		pF
Q_g	Total gate charge	$V_{CE} = 390\text{ V}$, $I_C = 5\text{ A}$, $V_{GE} = 15\text{ V}$ (see Figure 3)	-	TBD	-	nC
Q_{ge}	Gate-emitter charge			TBD		nC
Q_{gc}	Gate-collector charge			TBD		nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 5\text{ A}$		TBD		ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, (see Figure 2)	-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope			TBD		A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 5\text{ A}$		TBD		ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 2)	-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope			TBD		A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 5\text{ A}$, $R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 2)	-	TBD	-	ns
$t_{d(off)}$	Turn-off delay time			TBD		ns
t_f	Current fall time			TBD		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 5\text{ A}$, $R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see Figure 2)	-	TBD	-	ns
$t_{d(off)}$	Turn-off delay time			TBD		ns
t_f	Current fall time			TBD		ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 390\text{ V}$, $I_C = 5\text{ A}$		TBD		μ J
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, (see Figure 2)	-	TBD	-	μ J
E_{ts}	Total switching losses			TBD		μ J
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 390\text{ V}$, $I_C = 5\text{ A}$		TBD		μ J
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 2)	-	TBD	-	μ J
E_{ts}	Total switching losses			TBD		μ J

1. E_{on} is the turn-on losses when a typical diode is used in the test circuit. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs and diode are at the same temperature (25°C and 125°C)

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	$I_F = 5\text{ A}$ $I_F = 5\text{ A}$, $T_j = 150\text{ }^\circ\text{C}$	-	2.1 1.8	2.4	V V
t_{rr}	Reverse recovery time	$I_F = 5\text{ A}$, $V_R = 40\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 5)	-	24 17 1.5		ns nC A
Q_{rr}	Reverse recovery charge					
I_{rrm}	Reverse recovery current					
t_{rr}	Reverse recovery time	$I_F = 5\text{ A}$, $V_R = 40\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 5)	-	TBD TBD TBD		ns nC A
Q_{rr}	Reverse recovery charge					
I_{rrm}	Reverse recovery current					

3 Test circuits

Figure 2. Test circuit for inductive load switching

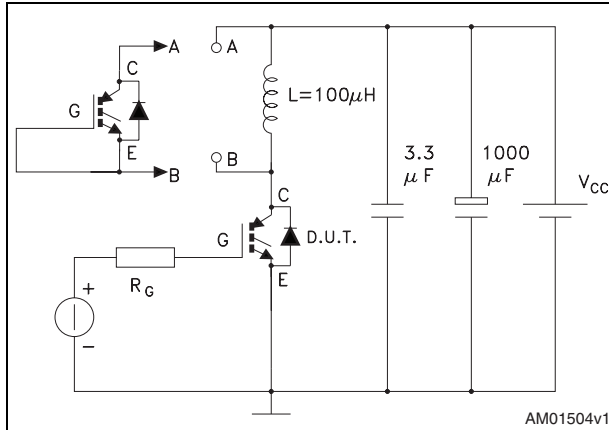


Figure 3. Gate charge test circuit

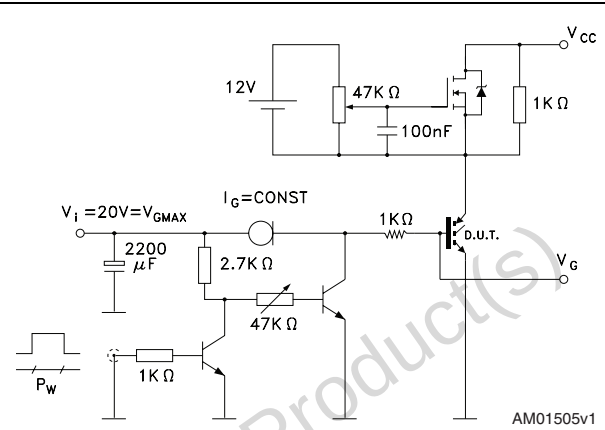


Figure 4. Switching waveforms

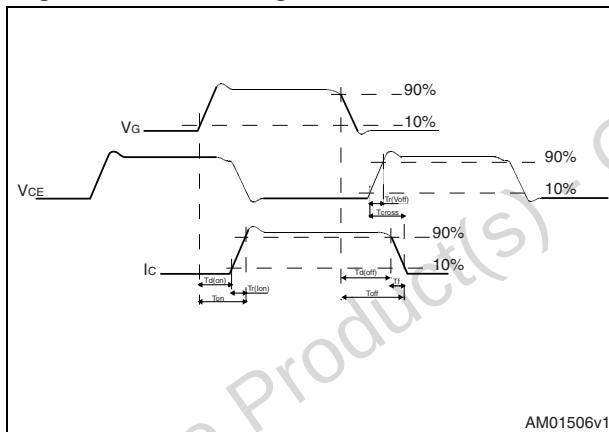
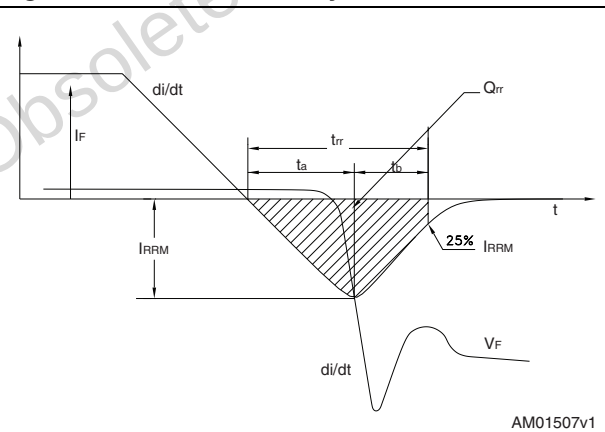


Figure 5. Diode recovery times waveform



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 (TO-263) 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°

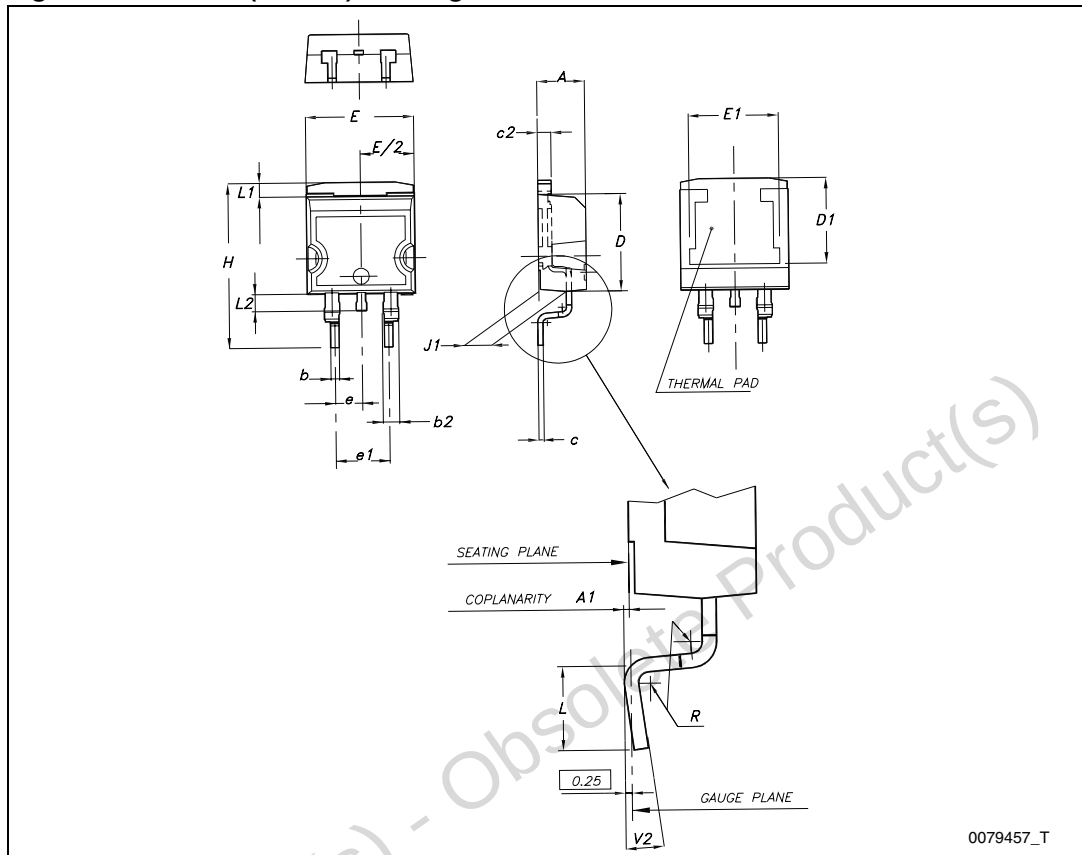
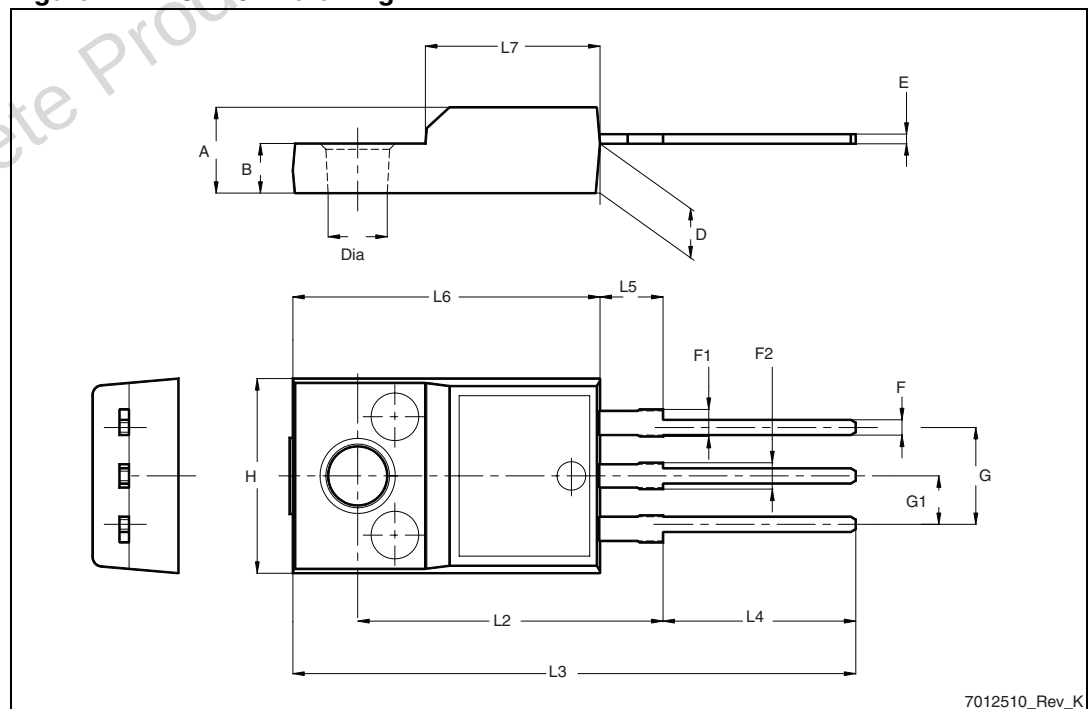
Figure 6. D²PAK (TO-263) drawing

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 7. TO-220FP drawing

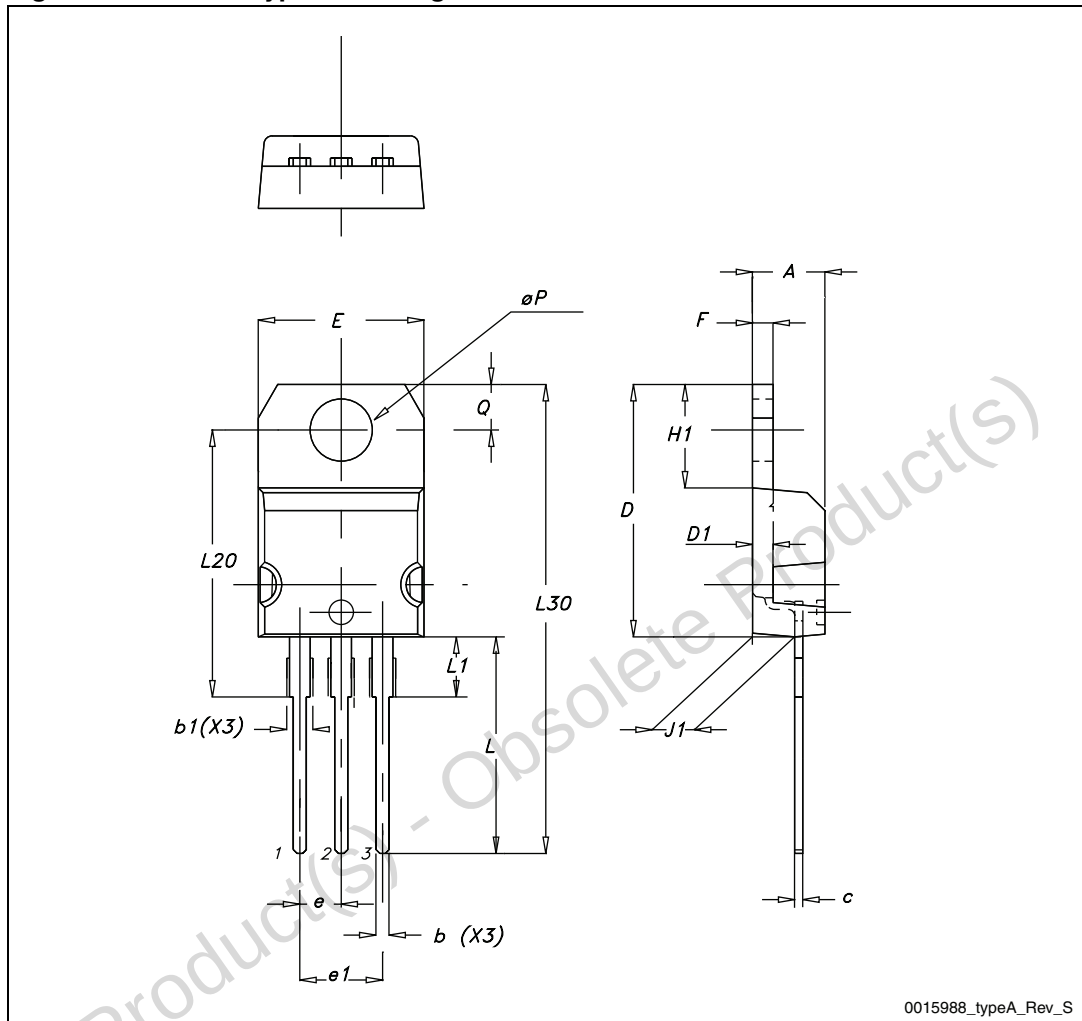


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Table 11. TO-220 type A mechanical data

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 8. TO-220 type A drawing



5 Revision history

Table 12. Document revision history

Date	Revision	Changes
18-Aug-2009	1	Initial release.
23-Feb-2012	2	The part number STGD10HF60KD has been moved to a separate datasheet. Document promoted from preliminary data to full datasheet - Modified Description text on the coverpage.

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