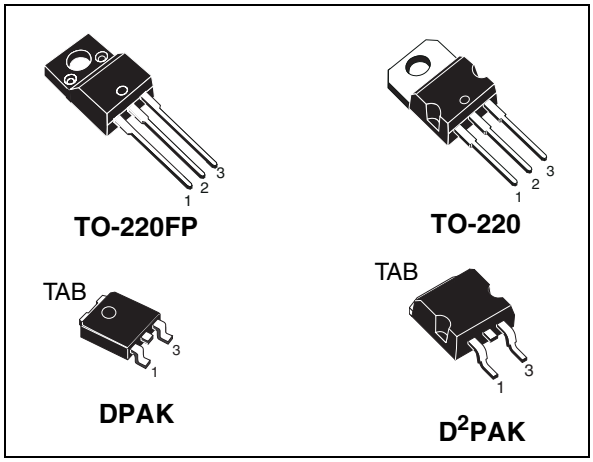
STGB10HF60KD, STGD10HF60KD
STGF10HF60KD, STGP10HF60KD

10 A - 600 V - short-circuit rugged IGBT

Preliminary data

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 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

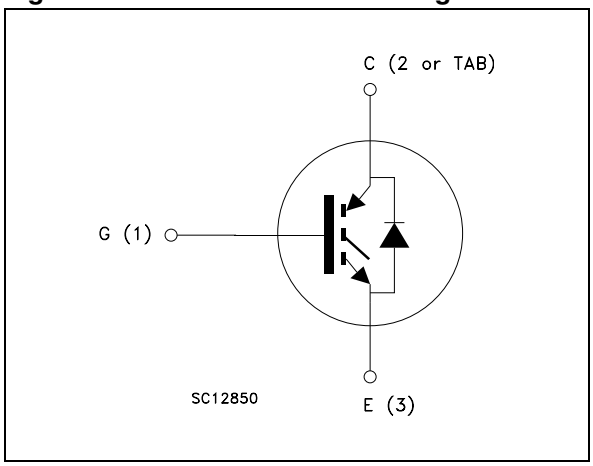


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB10HF60KDT4	GB10HF60KD	D^2PAK	Tape and reel
STGD10HF60KDT4	GD10HF60KD	DPAK	Tube
STGF10HF60KD	GF10HF60KD	TO-220FP	Tube
STGP10HF60KD	GP10HF60KD	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		D^2PAK TO-220	DPAK	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} = 0.5$V_{(BR)CES}$, 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. Vclamp = 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^2PAK TO-220	DPAK	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	1.8	1.9	5	°C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case diode	4	4.5	7	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	100	62.5	°C/W

2 Electrical characteristics

(T_j = 25 °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 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 5 A V_{GE}= 15 V, I_C= 5 A, T_j = 150 °C		2 1.6		V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	4.5		6.5	V
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE}= ±20 V, T_j = 150 °C			±100	nA
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE}= 600 V V_{CE}= 600 V, T_j = 150 °C			150 1	µA mA
g_{fs} (1)	Forward transconductance	V_{CE} = 15 V , I_C = 5 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} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}= 0	-	TBD TBD TBD	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 390 V, I_C = 5 A, V_{GE} = 15 V *(see Figure 3)*	-	TBD TBD TBD	-	nC nC nC

Table 6. Switching on/off (inductive load)

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

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 5 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 2)*	-	TBD TBD TBD	-	µJ µJ µJ
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 5 A R_G= 10 Ω, V_{GE}= 15 V, T_j = 150 °C *(see Figure 2)*	-	TBD TBD TBD	-	µJ µJ µJ

1. Eon 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 A I_F = 5 A, T_j = 150 °C	-	2.1 1.8	2.4	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 5 A, V_R = 40 V, di/dt = 100 A/µs *(see Figure 5)*	-	24 17 1.5		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 5 A, V_R = 40 V, T_j = 150 °C, di/dt = 100 A/µs *(see Figure 5)*	-	TBD TBD TBD		ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

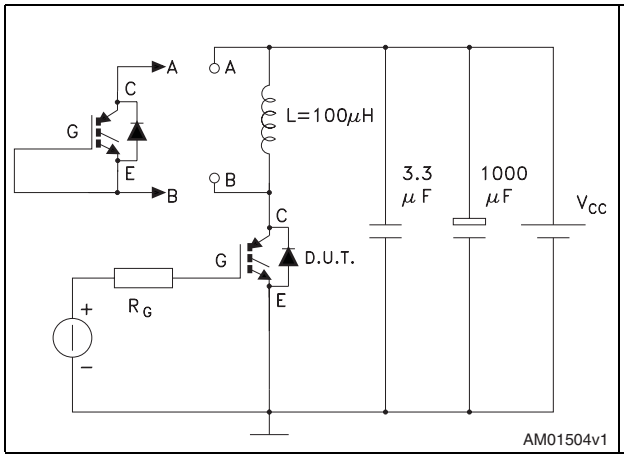


Figure 3. Gate charge test circuit

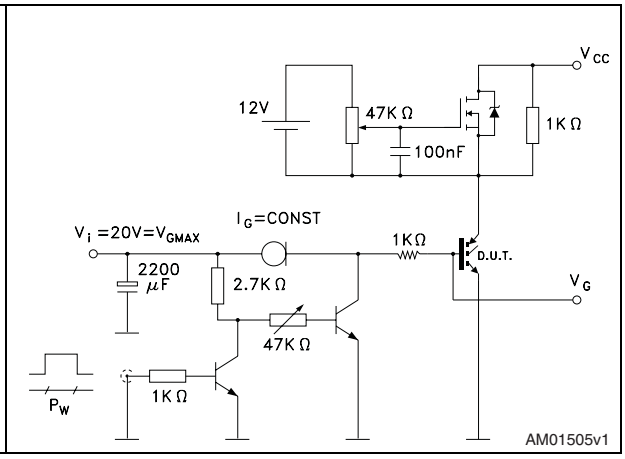


Figure 4. Switching waveforms

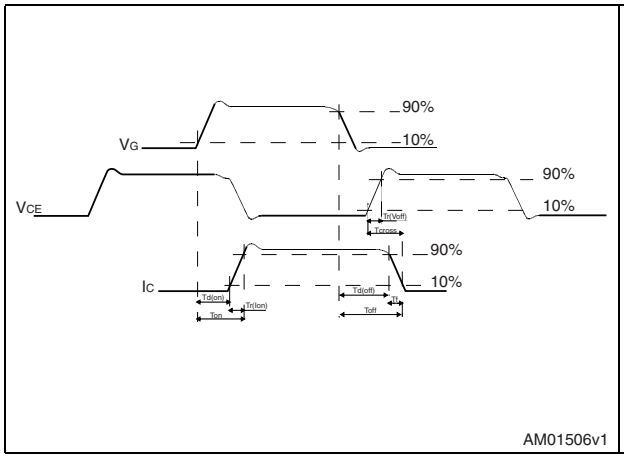
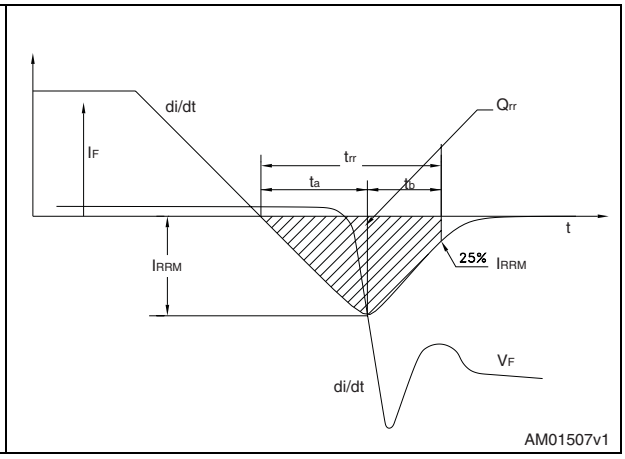


Figure 5. Diode recovery times waveform

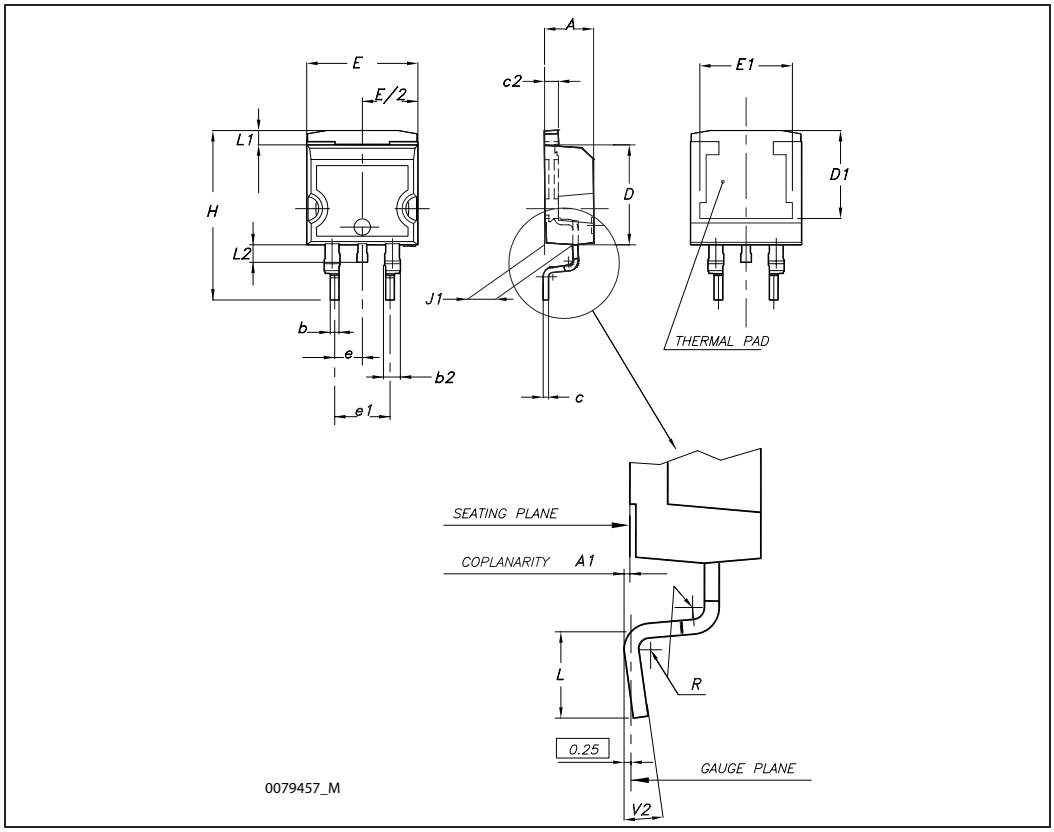


4 Package mechanical data

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.

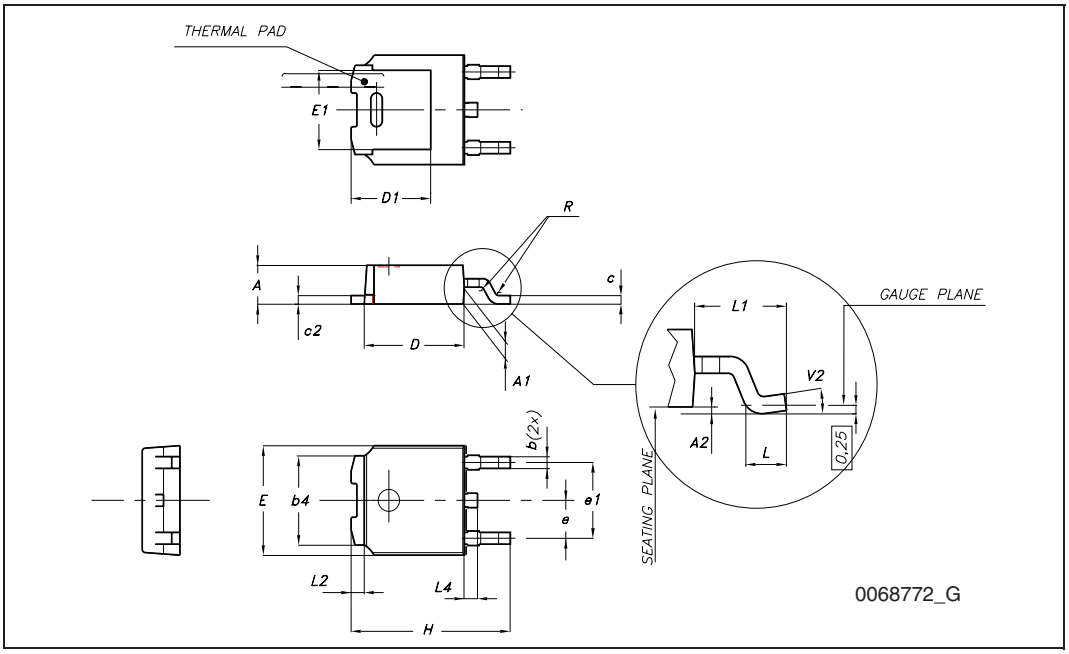
D²PAK (TO-263) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°



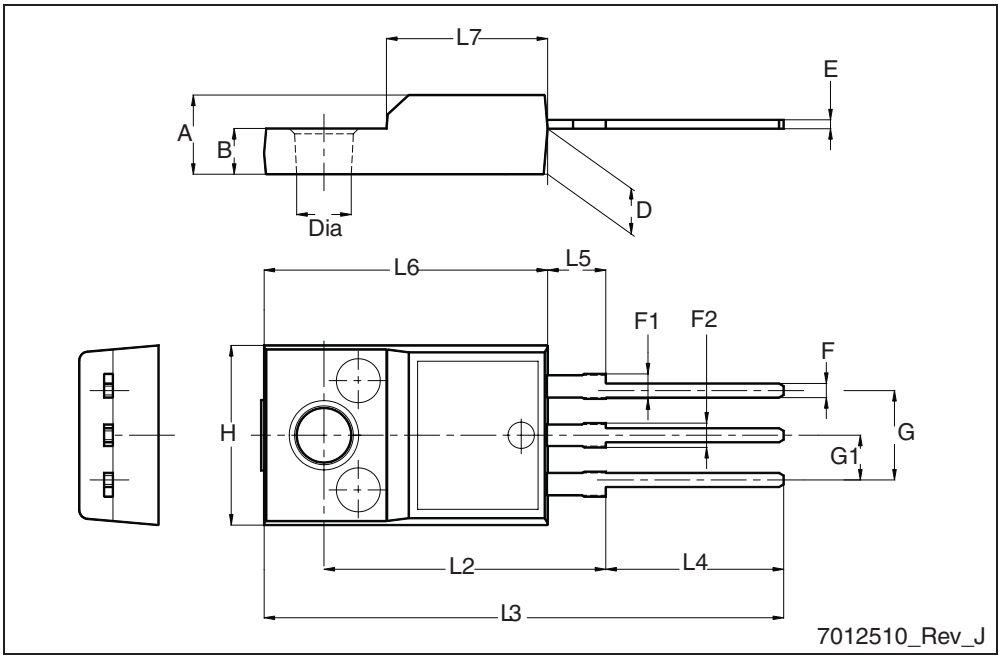
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °



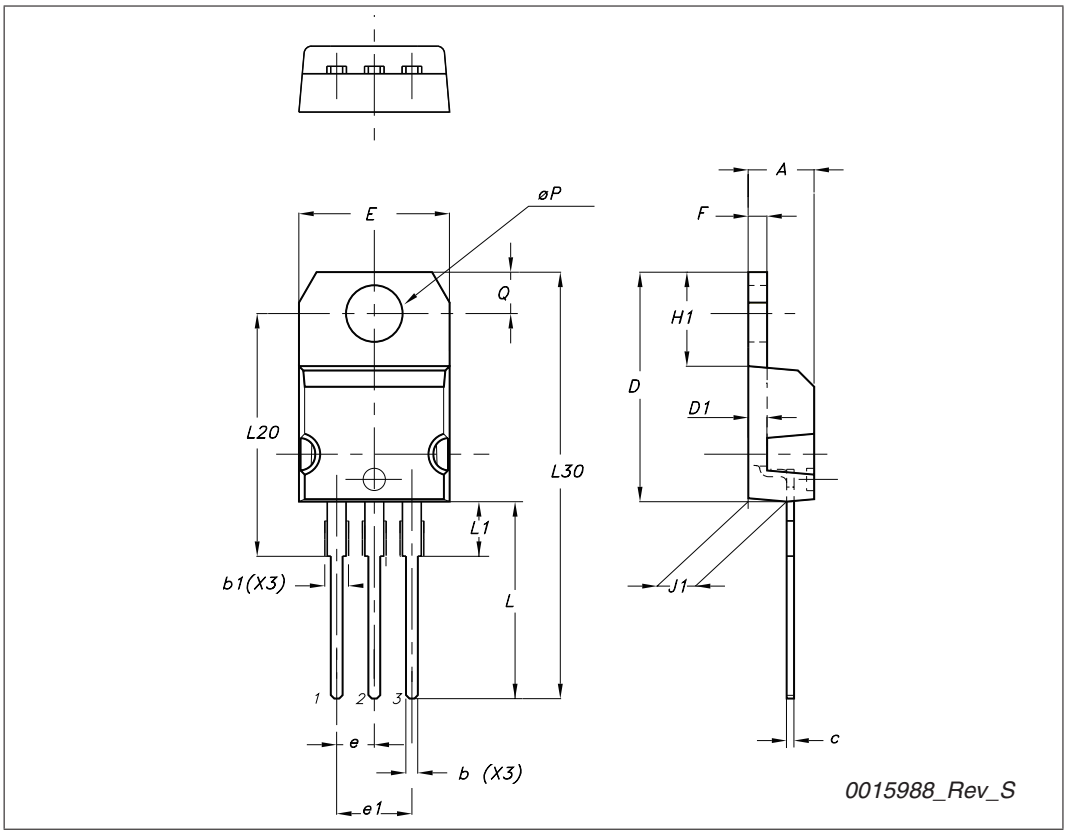
TO-220FP mechanical data

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		1.5
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



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	
∅P	3.75		3.85
Q	2.65		2.95



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
18-Aug-2009	1	Initial release

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