STGP35HF60W

35 A, 600 V Ultrafast IGBT

Datasheet — production data

Features

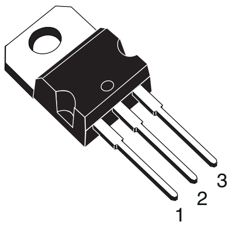
- Improved E_{off} at elevated temperature
- Minimal tail current
- Low conduction losses

Applications

- Welding
- High frequency converters
- Power factor correction

Description

This Ultrafast IGBT is developed using a new planar technology to yield a device with tighter switching energy variation (E_{off}) versus temperature. The suffix "W" denotes a subset of products designed for high switching frequency operation (over 100 kHz).



TO-220

Figure 1. Internal schematic diagram

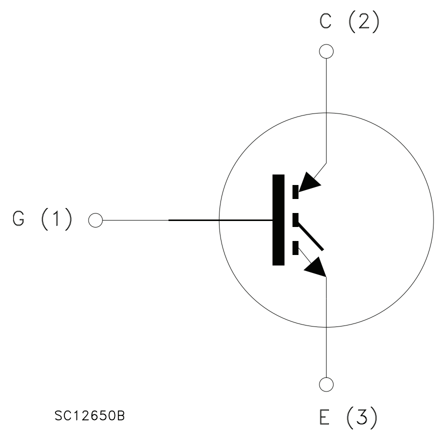


Table 1. Device summary

Order codes	Markings	Packages	Packaging
STGP35HF60W	GP35HF60W	TO-220	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)	Continuous collector current at T_C = 25 °C	60	A
I_C (1)	Continuous collector current at T_C = 100 °C	35	A
I_{CP} (2)	Pulsed collector current	150	A
I_{CL} (3)	Turn-off latching current	80	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total dissipation at T_C = 25 °C	200	W
T_{stg}	Storage temperature	– 55 to 150	°C
T_j	Operating junction temperature		

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. Pulse width limited by maximum junction temperature and turn-off within RBSOA
3. V_{CLAMP} = 80% (V_{CES}), V_{GE} = 15 V, R_G = 10 Ω, T_J = 150 °C

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	0.63	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	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= 20 A			2.5	V
		V_{GE} = 15V, I_C = 20 A,T_J= 125 °C		1.65		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	3.75		5.75	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 600 V V_{CE} = 600 V, T_J = 125 °C			250 1	µA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ±20 V			± 100	nA

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	-	2400 235 50	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 400 V, I_C = 20 A, V_{GE} = 15 V, *(see Figure 16)*	-	140 13 52	-	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} = 400 V, I_C = 20 A R_G = 10 Ω, V_{GE} = 15 V, *(see Figure 15)*	-	30 15 1650	-	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} = 400 V, I_C = 20 A R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C *(see Figure 15)*	-	30 15 1600	-	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} = 400 V, I_C = 20 A, R_{GE} = 10 Ω, V_{GE} = 15 V *(see Figure 15)*	-	30 175 40	-	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} = 400 V, I_C = 20 A, R_{GE} = 10 Ω, V_{GE} =15 V, T_J = 125 °C *(see Figure 15)*	-	50 225 70	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}(1) E_{off} E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 400 V, I_C = 20 A R_G = 10 Ω, V_{GE} = 15 V, *(see Figure 17)*	-	290 185 475		µJ µJ µJ
E_{on}(1) E_{off} E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 400 V, I_C = 20 A R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C *(see Figure 17)*	-	420 350 770	530	µJ µJ µJ

1. Eon is the tun-on losses when a typical diode is used in the test circuit in Figure 17. If the IGBT is offered in a package with a co-pak diode, the co-pack diode is used as external diode. IGBTs and diode are at the same temperature (25 °C and 125 °C). Eon include diode recovery energy.

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

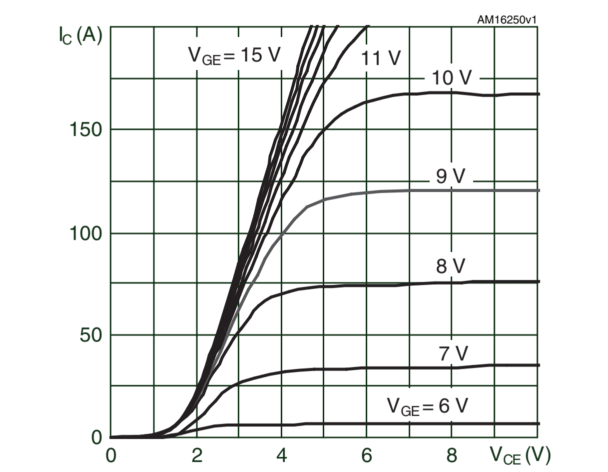


Figure 3. Transfer characteristics

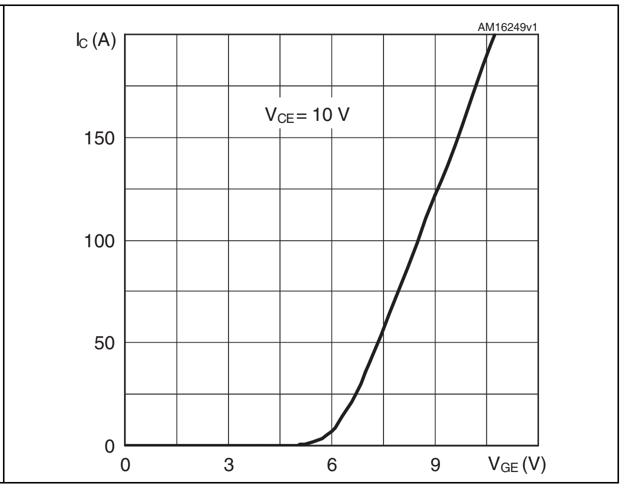


Figure 4. Normalized $V_{CE(sat)}$ vs. I_C

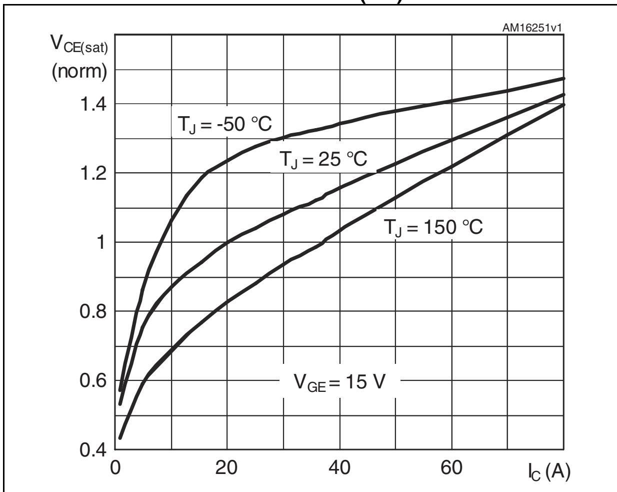


Figure 5. Normalized $V_{CE(sat)}$ vs. temperature

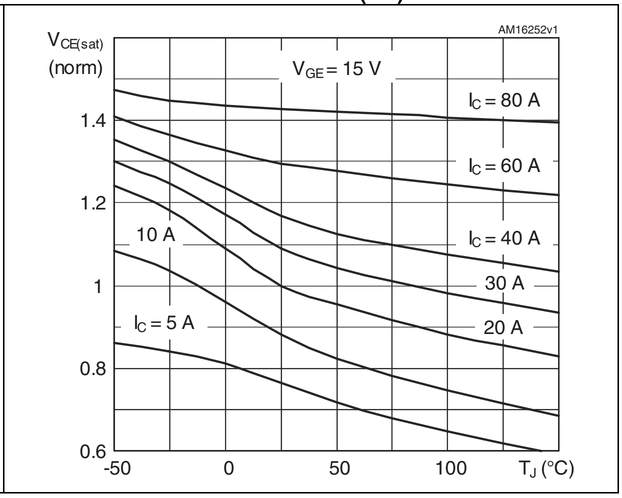


Figure 6. Normalized breakdown voltage vs. temperature

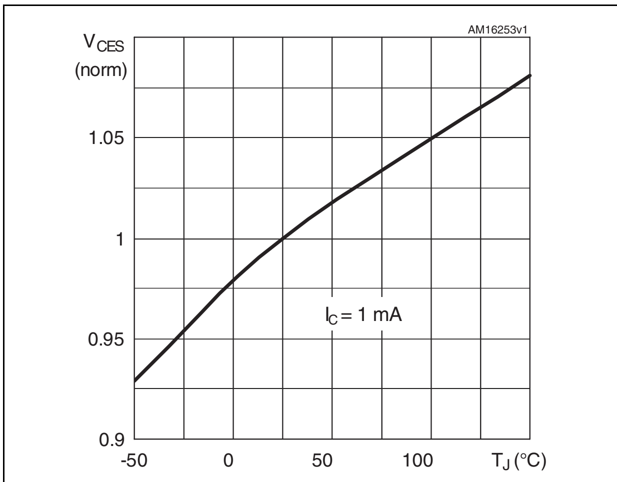


Figure 7. Normalized gate threshold voltage vs. temperature

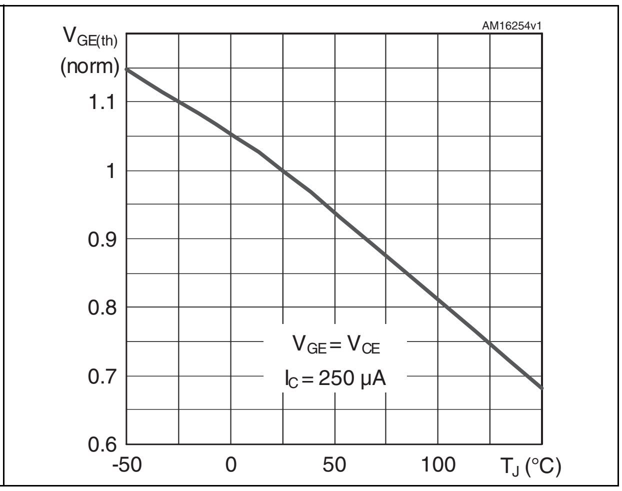


Figure 8. Gate charge vs. gate-emitter voltage

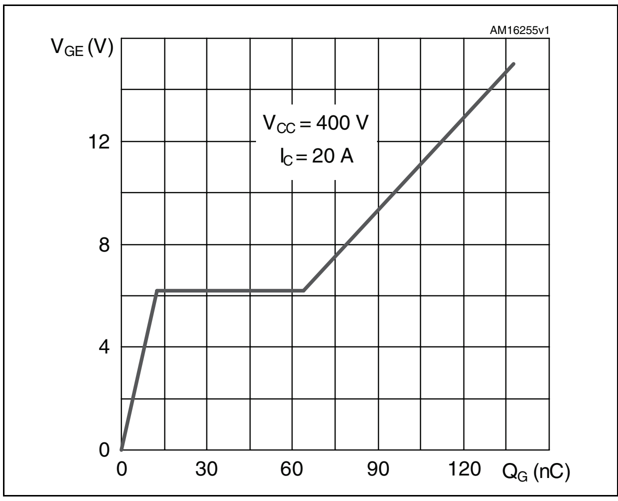


Figure 9. Capacitance variations

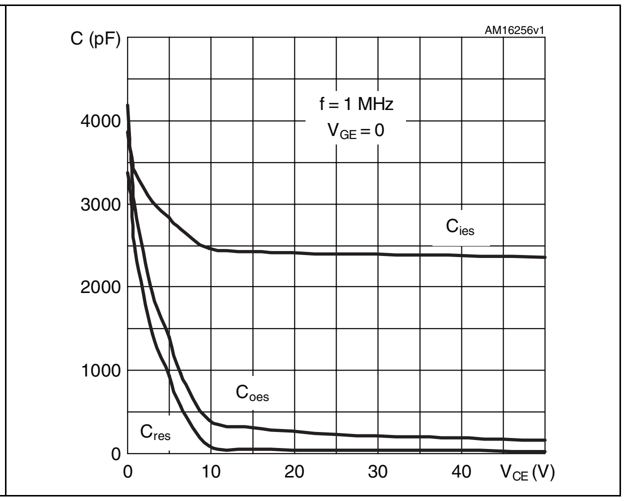


Figure 10. Switching losses vs. temperature

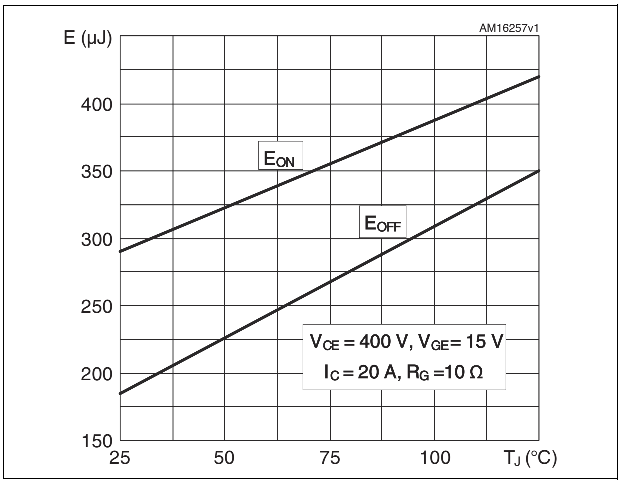


Figure 11. Switching losses vs. gate resistance

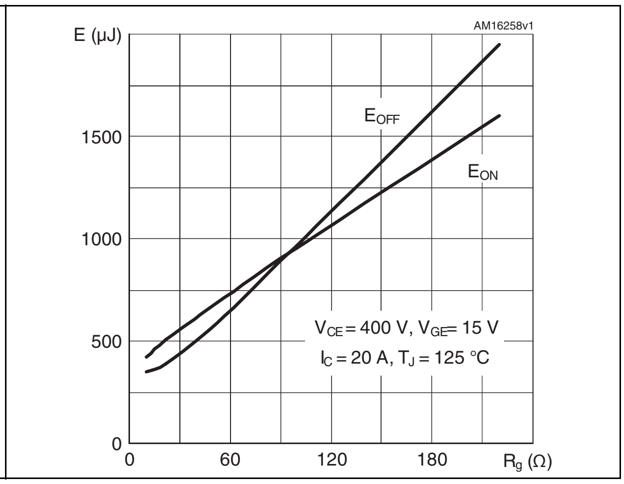


Figure 12. Switching losses vs. collector current

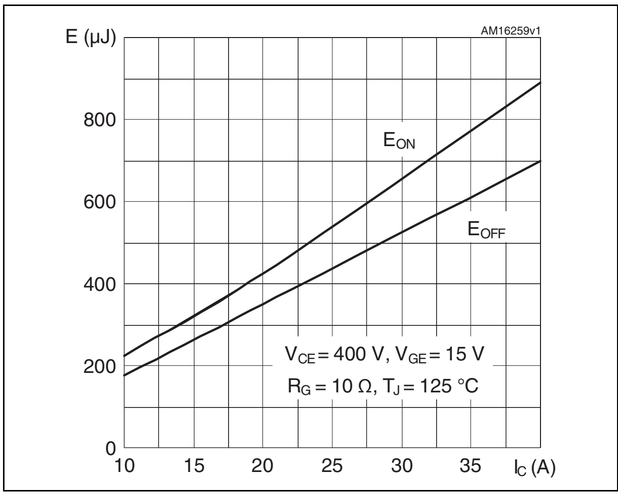


Figure 13. Turn-off SOA

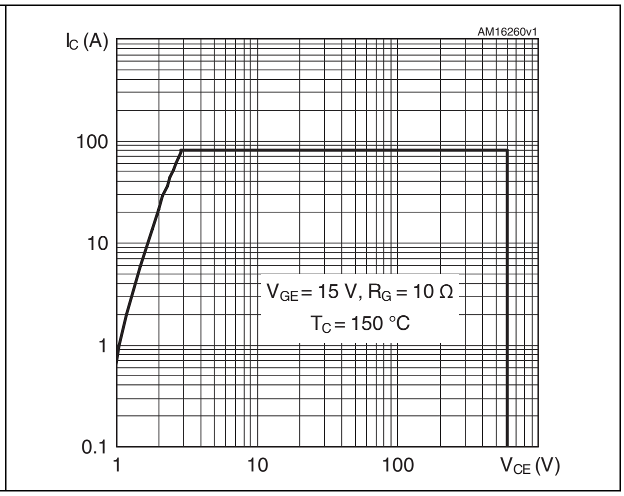
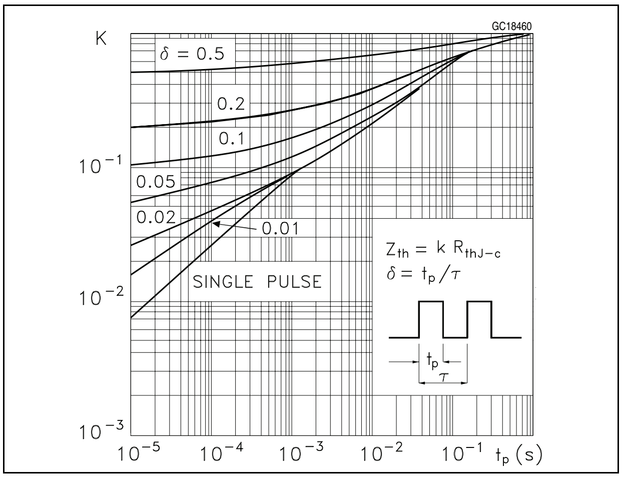


Figure 14. Thermal impedance



3 Test circuits

Figure 15. Test circuit for inductive load switching

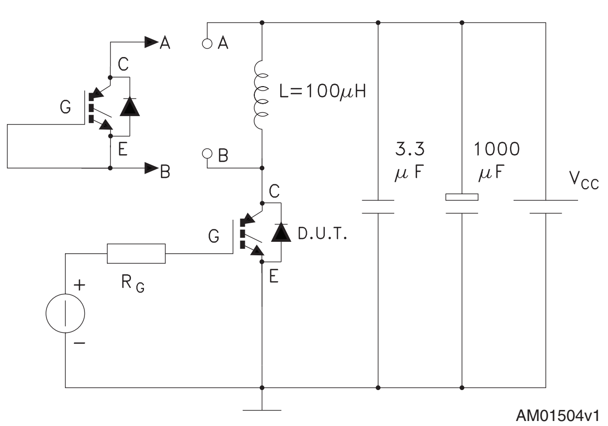


Figure 16. Gate charge test circuit

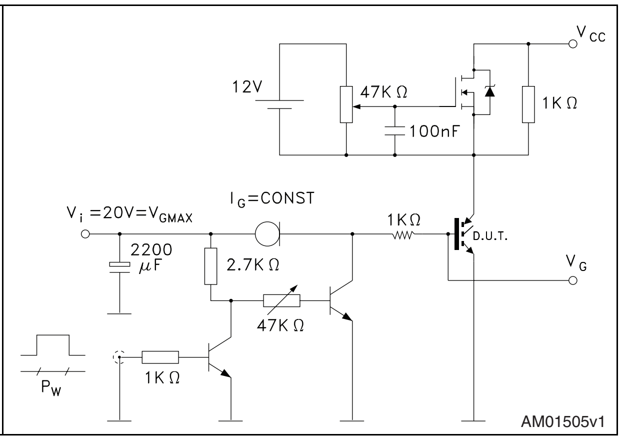
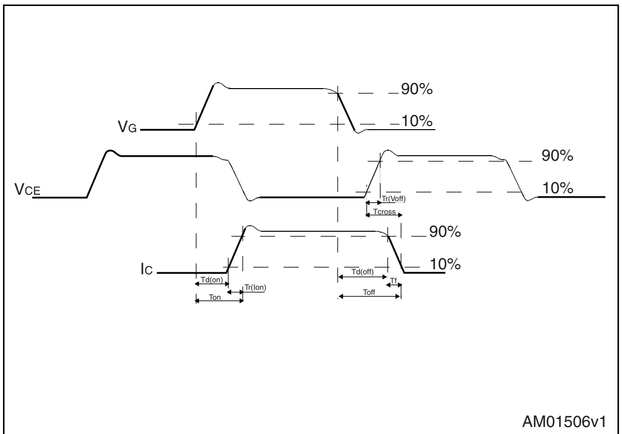


Figure 17. Switching waveform



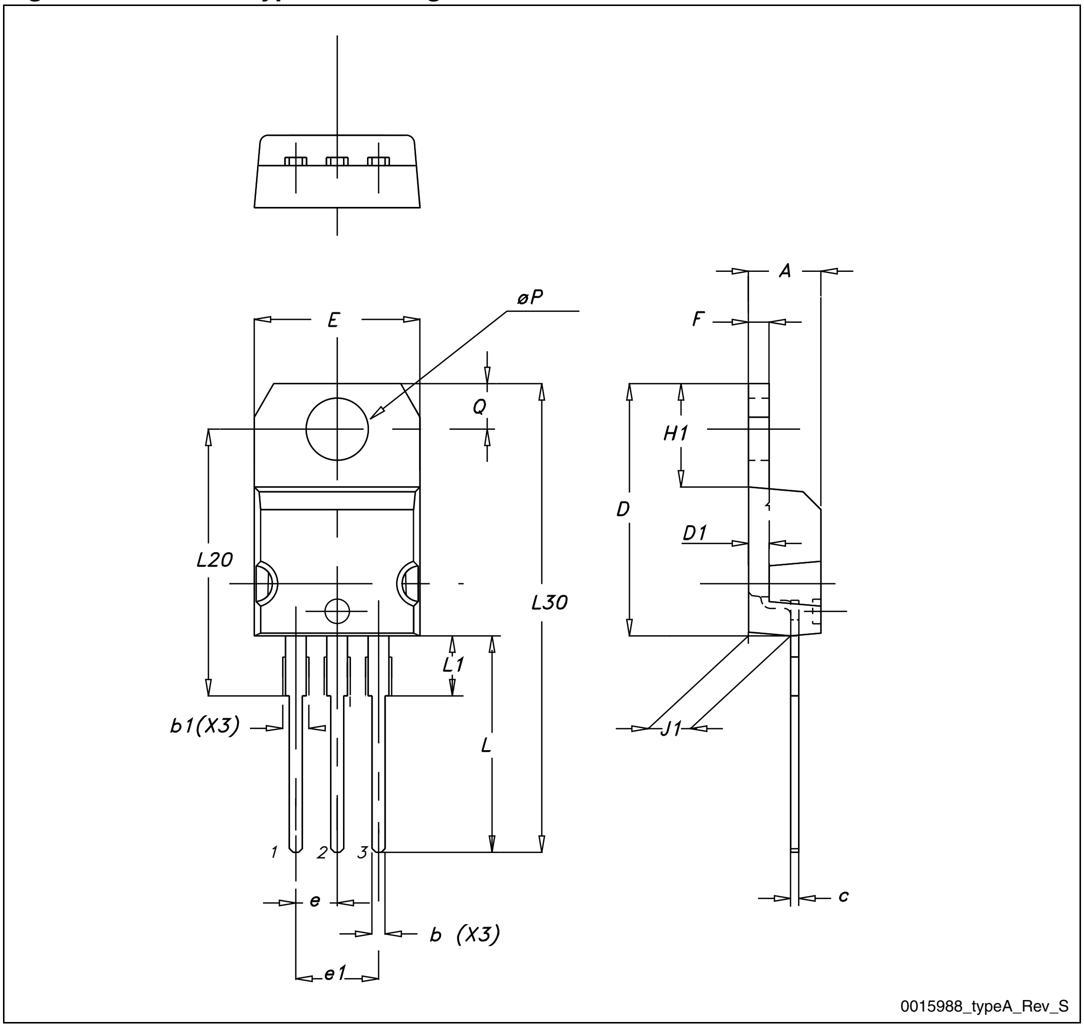
4 Package mechanical data

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 8. 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

Figure 18. TO-220 type A drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
06-Nov-2012	1	Initial release.