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STGP7NC60H

N-channel PowerMESH™ 600 V, 14 A very fast IGBT

Datasheet - obsolete product

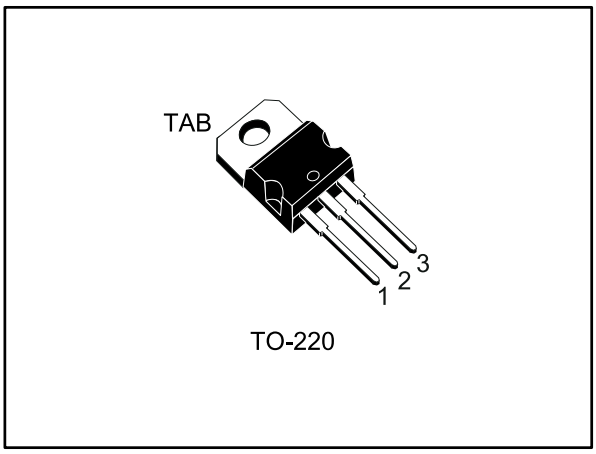
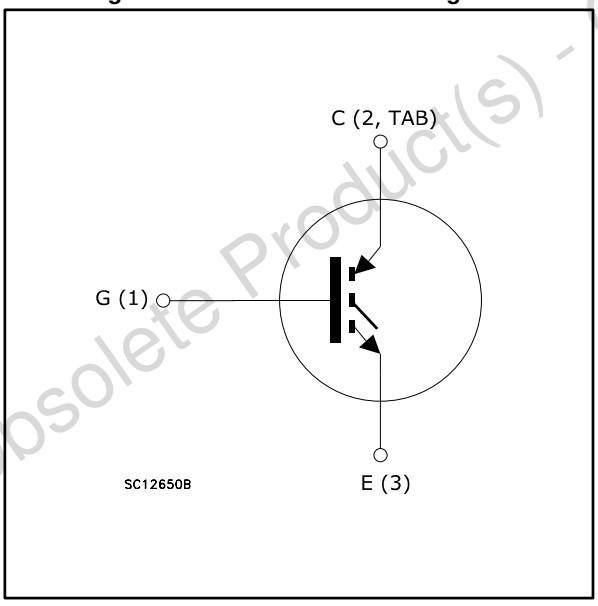


Figure 1: Internal schematic diagram



Features

Order code	V_{CES}	$V_{CE(sat)}$ max @ 25°C	I_C @ 100°C
STGP7NC60H	600 V	< 2.5 V	14 A

- Low on-voltage drop ($V_{CE(sat)}$)
- High frequency operation up to 70 kHz

Applications

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

Description

This device is a very fast IGBT developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. This device is well-suited for resonant or soft-switching applications.

Table 1: Device summary

Order code	Marking	Package	Packing
STGP7NC60H	GP7NC60H	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
V_{GE}	Gate-emitter voltage	±20	V
I_C	Continuous collector current at T_C = 25 °C (1)	25	A
	Continuous collector current at T_C = 100 °C (1)	14	A
I_{CM}(2)	Collector current (pulsed)	50	A
P_{TOT}	Continuous forward current at T_C = 25 °C	80	W
T_{stg}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range		

Notes:

(1)Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_{J(max)} \times I_C(T_C))}$$

(2)Pulse widht limited by maximum junction temperature.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.56	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	62.5	°C/W

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	V_{GE} = 0 V, I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 7 A		1.85	2.5	V
		V_{GE} = 15 V, I_C = 7 A, T_J = 125 °C		1.7		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 600 V			10	µA
		V_{GE} = 0 V, V_{CE} = 600 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
g_{fs} (1)	Forward transconductance	V_{CE}= 15 V, I_C = 7 A		4.30		S
C_{ies}	Input capacitance	V_{CE}= 25 V, f = 1 MHz, V_{GE} = 0 V		720		pF
C_{oes}	Output capacitance			81		pF
C_{res}	Reverse transfer capacitance			17		pF
Q_g	Total gate charge	V_{CE} = 390 V, I_C = 7 A, V_{GE} = 15 V (see *Figure 18: "Gate charge test circuit"*)		35	48	nC
Q_{ge}	Gate-emitter charge			7		
Q_{gc}	Gate-collector charge			16		
I_{CL}	Turn-off SOA minimum current	V_{clamp} = 480 V, T_j = 150 °C, R_G = 10 Ω, V_{GE} = 15 V	50			A

Notes:

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

Table 6: IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 7 A, V_{GE} = 15 V, R_G = 10 Ω (see *Figure 16: "Ic vs frequency"* and *Figure 17: "Test circuit for inductive load switching"*)	-	18.5		ns
$t_{r(on)}$	Turn-on rise time		-	8.5		ns
$di/dt_{(on)}$	Turn-on current slope		-	1060		A/µs
$t_{r(off)}$	Turn-off rise time		-	27		ns
$t_{d(off)}$	Turn-off delay time		-	72		ns
t_f	Fall time		-	60		ns
E_{on} (1)	Turn-on switching energy		-	95	125	µJ
E_{off} (2)	Turn-off switching energy		-	115	150	µJ
E_{ts}	Total switching energy		-	210	275	µJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 390 V, I_C = 7 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 125 °C (see *Figure 17: "Test circuit for inductive load switching"*)	-	18.5		ns
$t_{r(on)}$	Turn-on rise time		-	7		ns
$di/dt_{(on)}$	Turn-on current slope		-	1000		A/µs
$t_{r(off)}$	Turn-off rise time		-	56		ns
$t_{d(off)}$	Turn-off delay time		-	116		ns
t_f	Fall time		-	105		ns
E_{on} (1)	Turn-on switching energy		-	140		µJ
E_{off} (2)	Turn-off switching energy		-	215		µJ
E_{ts}	Total switching energy		-	355		µJ

Notes:

(1)Including the reverse recovery of the diode.

(2)Including the tail of the collector current.

2.2 Electrical characteristics (curves)

Figure 2: Output characteristics

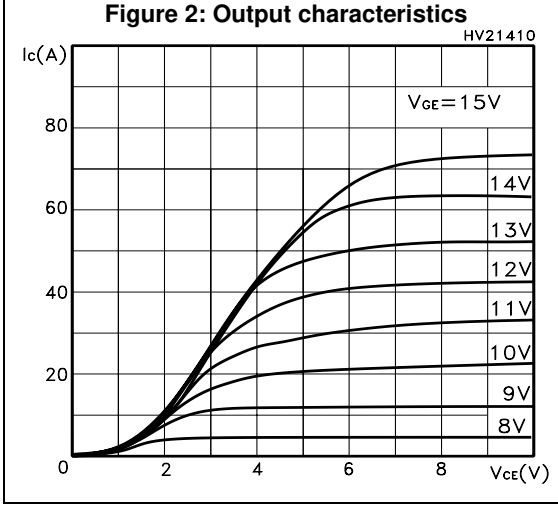


Figure 3: Tranfer characteristics

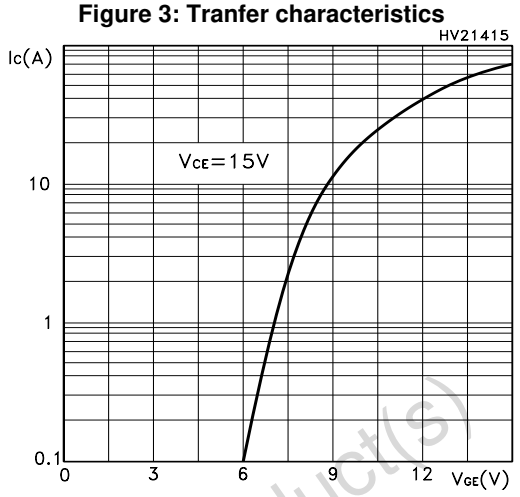


Figure 4: Trasconductance

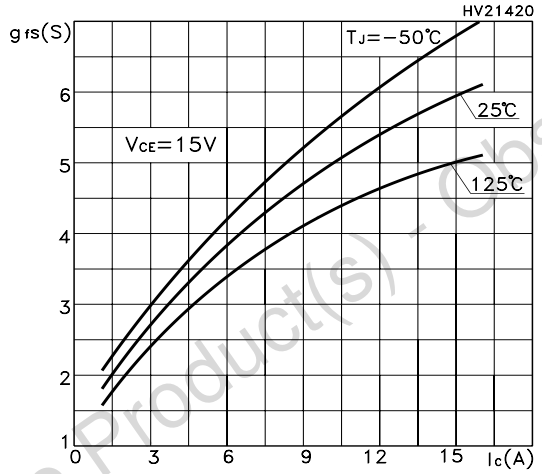


Figure 5: Collector-emitter on voltage vs temperature

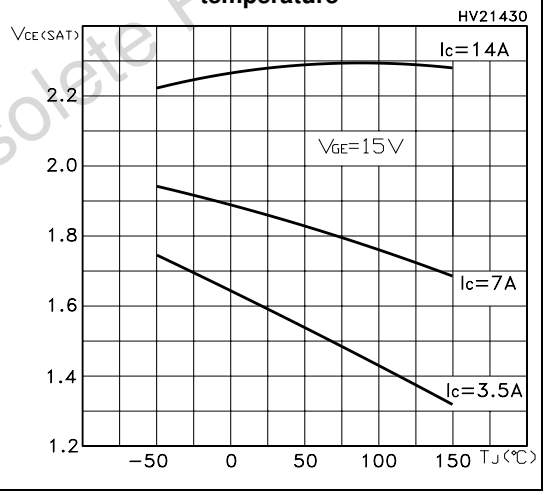


Figure 6: Collector-emitter on voltage vs collector current

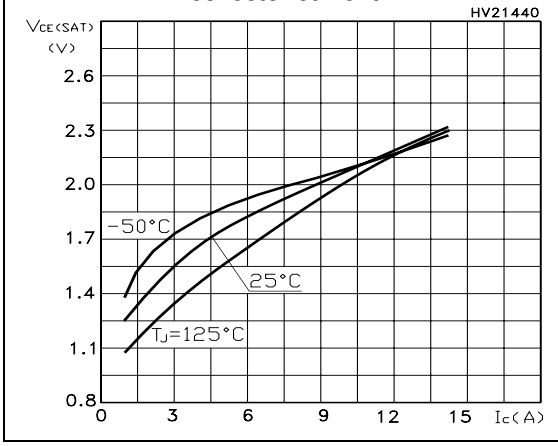


Figure 7: Normalized gate threshold vs temperature

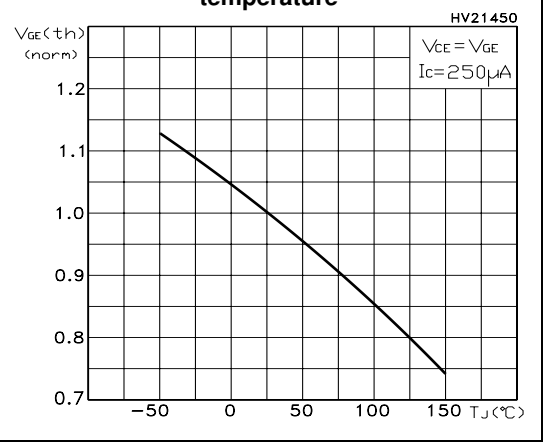


Figure 8: Normalized breakdown voltage vs temperature

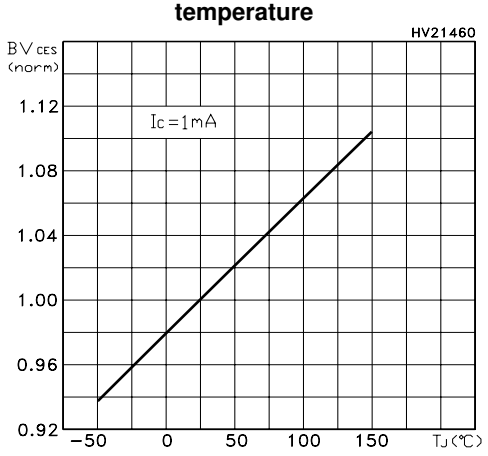


Figure 9: Gate charge vs gate-emitter voltage

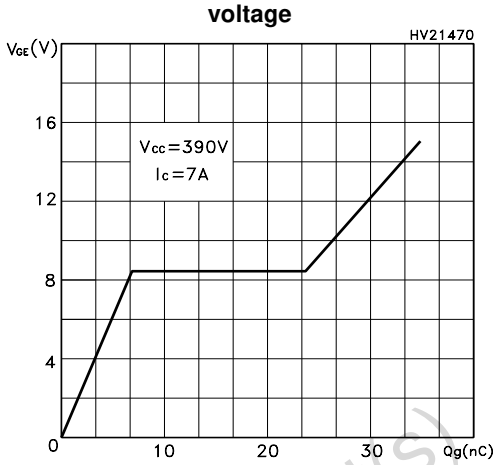


Figure 10: Capacitance variations

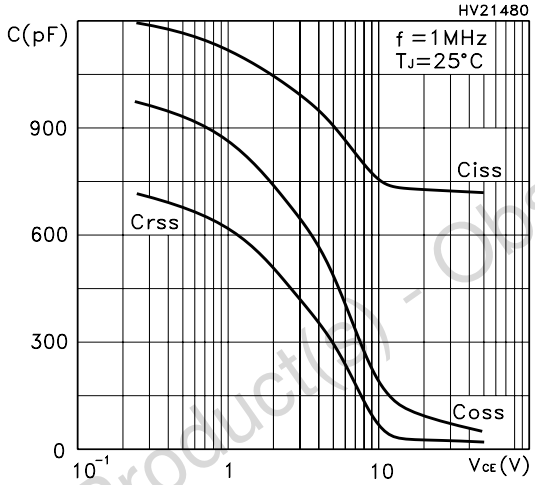


Figure 11: Total switching energy vs temperature

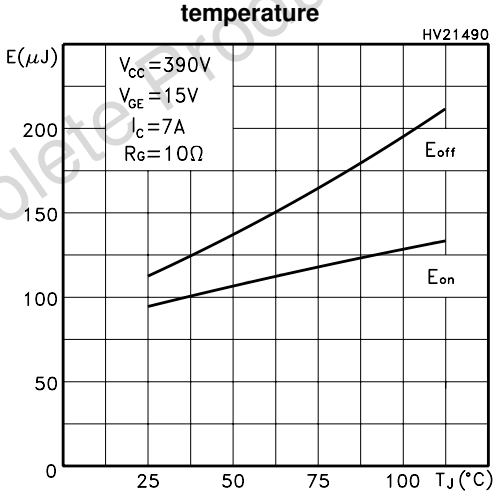


Figure 12: Total switching energy vs gate resistance

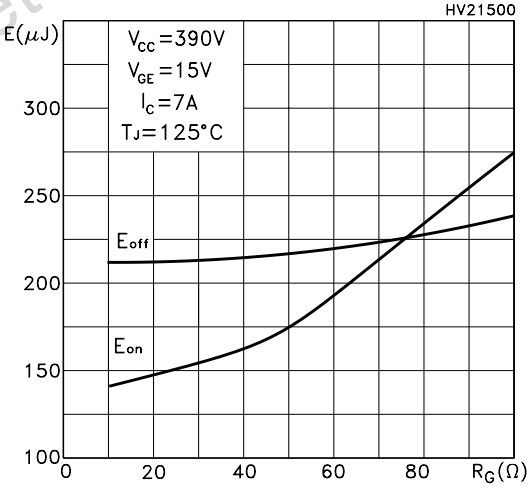


Figure 13: Total switching energy vs collector current

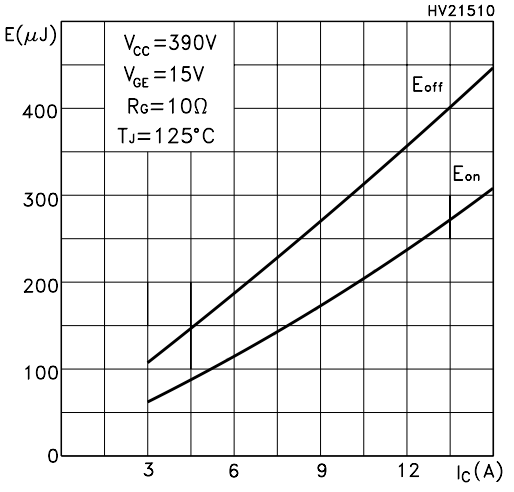


Figure 14: Thermal impedance

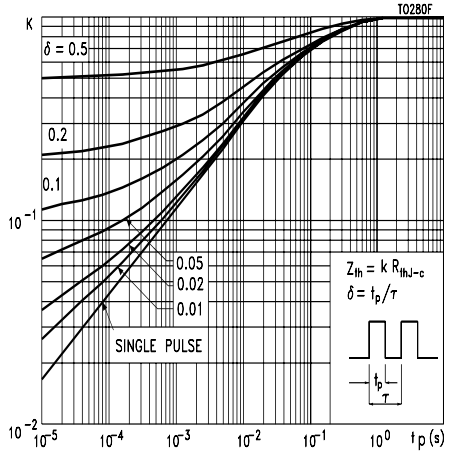


Figure 15: Turn-off SOA

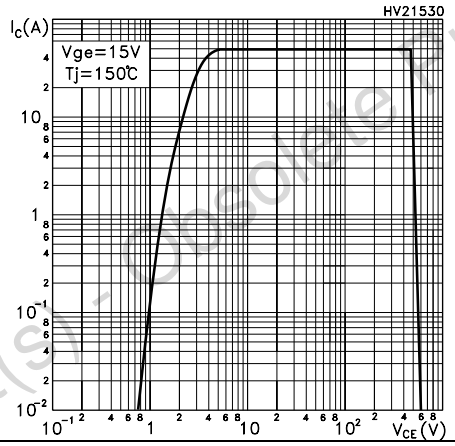
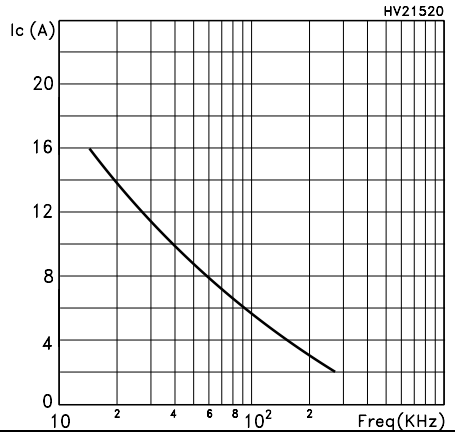


Figure 16: Ic vs frequency



3 Test circuits

Figure 17: Test circuit for inductive load switching

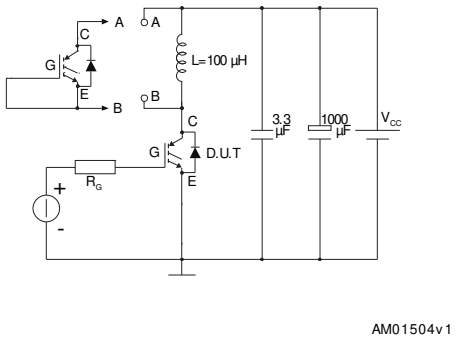


Figure 18: Gate charge test circuit

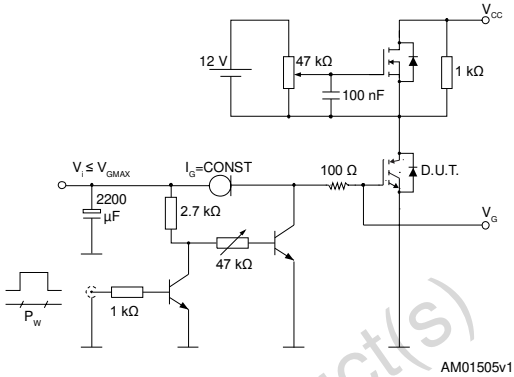
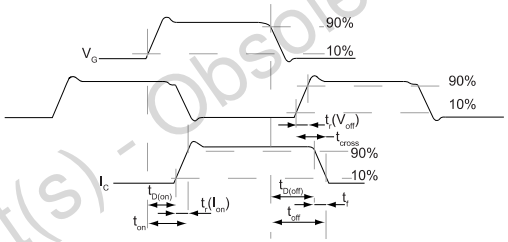


Figure 19: Switching waveform



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 TO-220 type A package information

Figure 20: TO-220 type A package outline

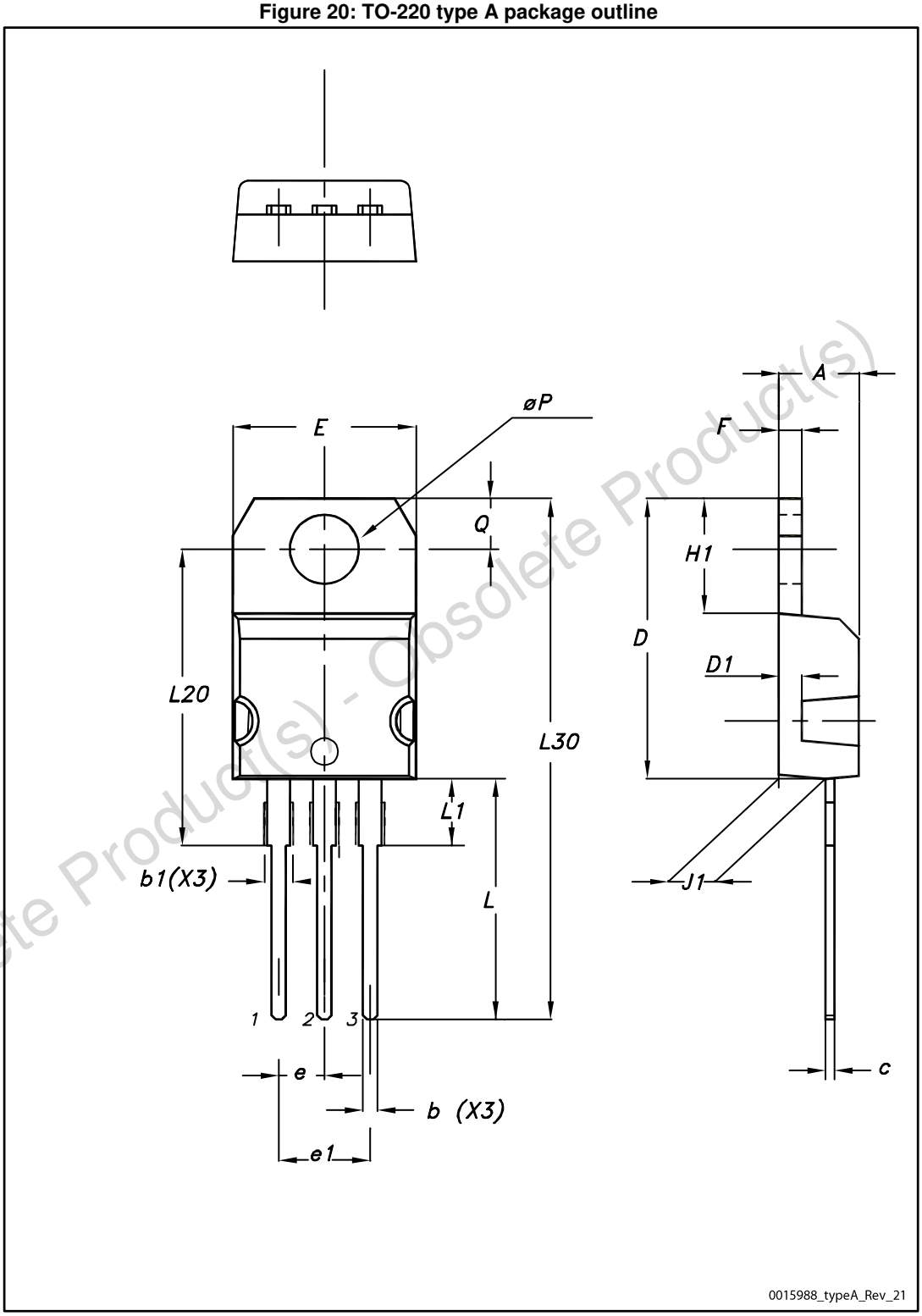


Table 7: TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
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 8: Document revision history

Date	Revision	Changes
20-Aug-2004	1	New datasheet.
09-Jun-2005	2	Modified title
04-Jul-2016	3	The part number STGD7NC60HT4 has been moved to a separate datasheet. Modified: title, features and description. Modified: *Table 2: "Absolute maximum ratings"*, *Table 3: "Thermal data"*, *Table 4: "Static characteristics"*, *Table 5: "Dynamic characteristics"* and *Table 6: "IGBT switching characteristics (inductive load)"* Updated: *Section 5.1: "TO-220 type A package information"*. Minor text changes.

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