

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

Datasheet - obsolete product

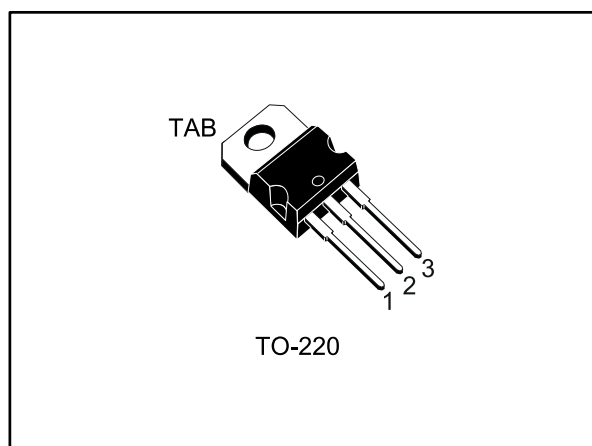
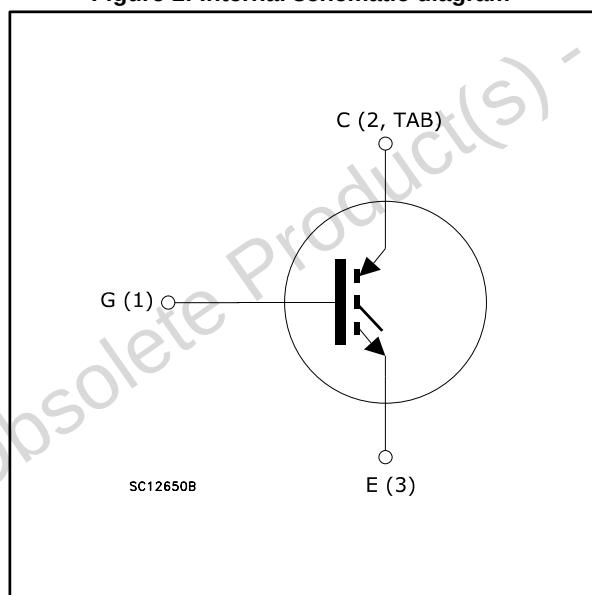


Figure 1: Internal schematic diagram



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.....	3
2	Electrical characteristics	4
2.1	Electrical characteristics (curves).....	6
3	Test circuits	9
4	Package information	10
4.1	TO-220 type A package information.....	11
5	Revision history.....	13

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 width limited by maximum junction temperature.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R _{thj-case}	Thermal resistance junction-case max	1.56	°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	62.5	°C/W

2 Electrical characteristics

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

Table 4: Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$		1.85	2.5	V
		$V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$, $T_J = 125\text{ °C}$		1.7		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	3.75		5.75	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$			10	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_C = 125\text{ °C}$ ⁽¹⁾			1	mA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 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	$V_{CE} = 15\text{ V}$, $I_C = 7\text{ A}$		4.30		S
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$		720		pF
C_{oes}	Output capacitance			81		pF
C_{res}	Reverse transfer capacitance			17		pF
Q_g	Total gate charge	$V_{CE} = 390\text{ V}$, $I_C = 7\text{ A}$, $V_{GE} = 15\text{ V}$ (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	$V_{clamp} = 480\text{ V}$, $T_J = 150\text{ °C}$, $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$	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	$V_{CC} = 390 \text{ V}$, $I_C = 7 \text{ A}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \Omega$ (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/ μ s
$t_{r(off)}$	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	μ J
$E_{off(2)}$	Turn-off switching energy		-	115	150	μ J
E_{ts}	Total switching energy		-	210	275	μ J
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 390 \text{ V}$, $I_C = 7 \text{ A}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \Omega$ $T_J = 125 \text{ }^\circ\text{C}$ (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/ μ s
$t_{r(off)}$	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		μ J
$E_{off(2)}$	Turn-off switching energy		-	215		μ J
E_{ts}	Total switching energy		-	355		μ J

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

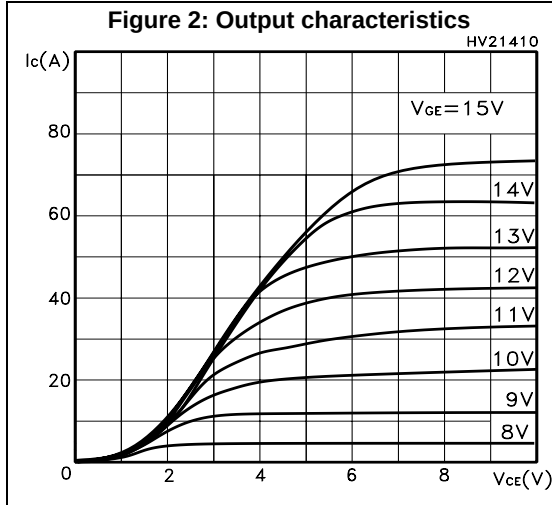


Figure 3: Transfer characteristics

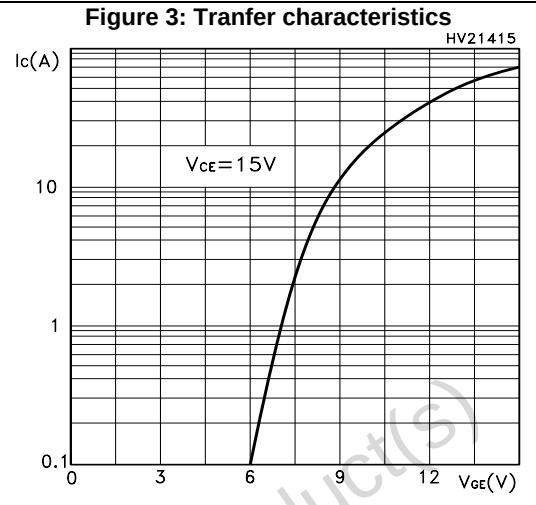


Figure 4: Transconductance

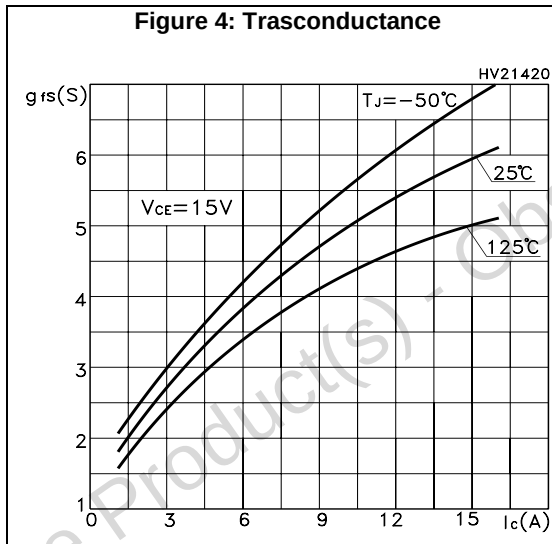


Figure 5: Collector-emitter on voltage vs temperature

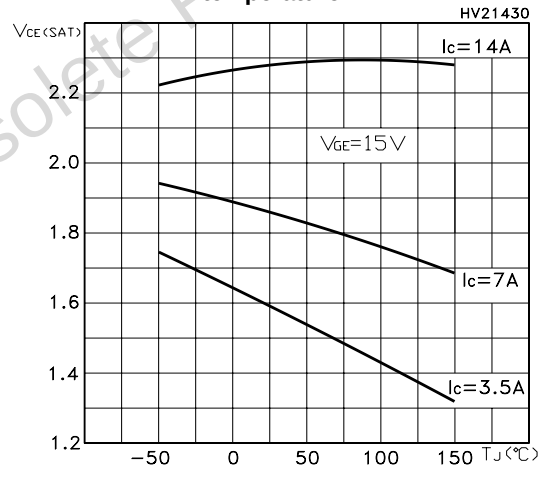


Figure 6: Collector-emitter on voltage vs collector current

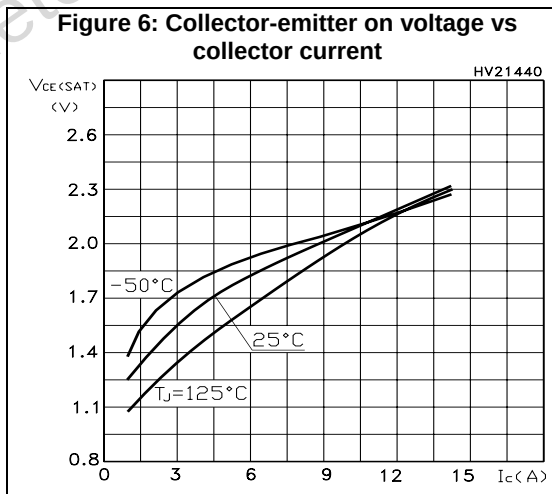


Figure 7: Normalized gate threshold vs temperature

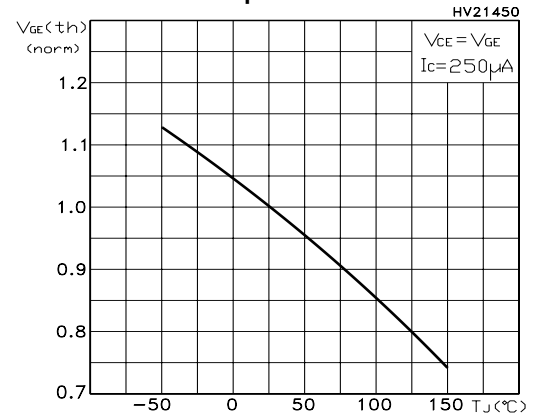


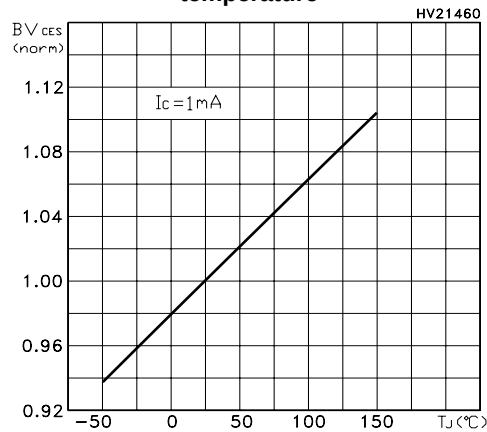
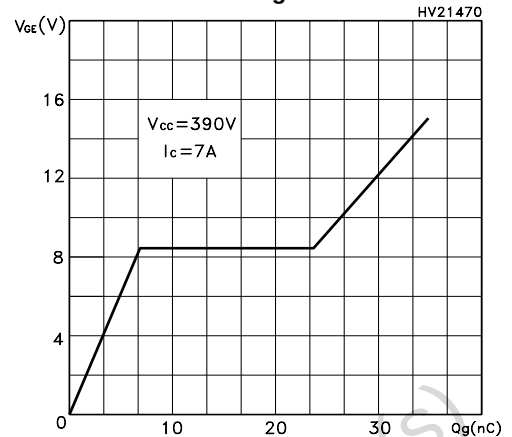
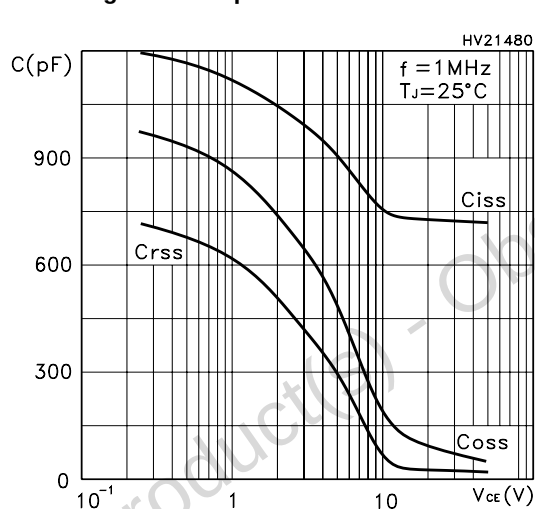
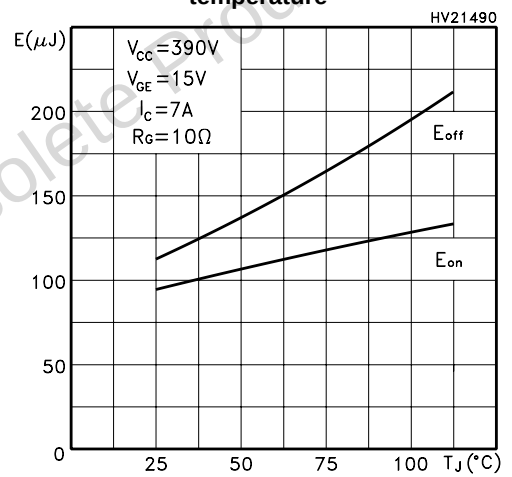
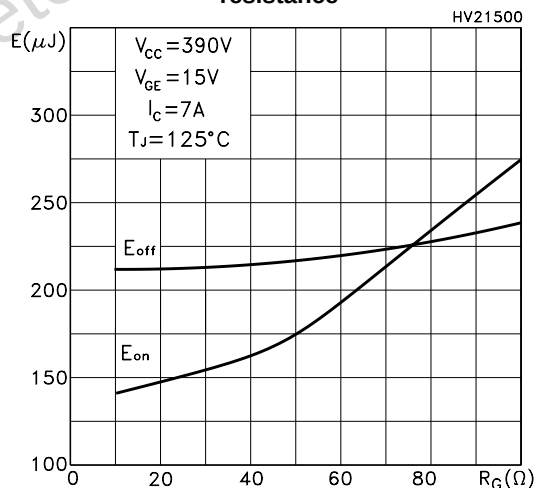
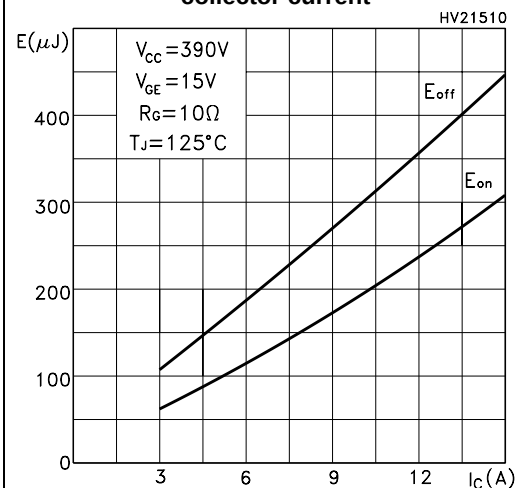
Figure 8: Normalized breakdown voltage vs temperature**Figure 9: Gate charge vs gate-emitter voltage****Figure 10: Capacitance variations****Figure 11: Total switching energy vs temperature****Figure 12: Total switching energy vs gate resistance****Figure 13: Total switching energy vs collector current**

Figure 14: Thermal impedance

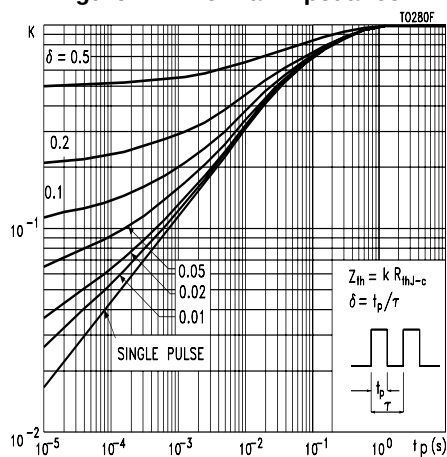


Figure 15: Turn-off SOA

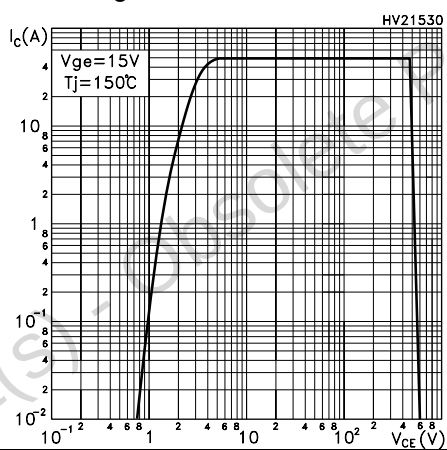
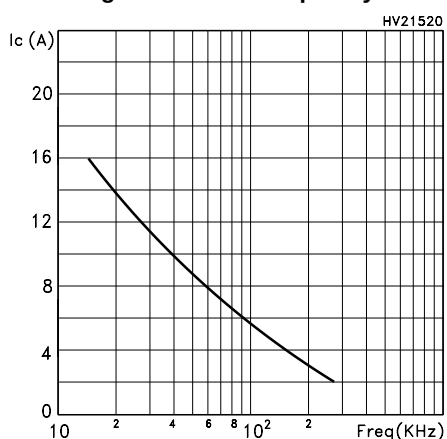
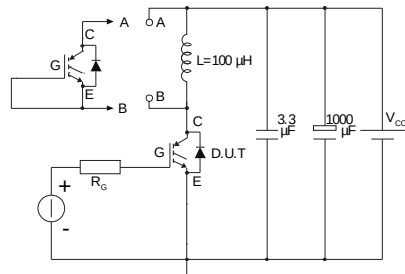


Figure 16: Ic vs frequency



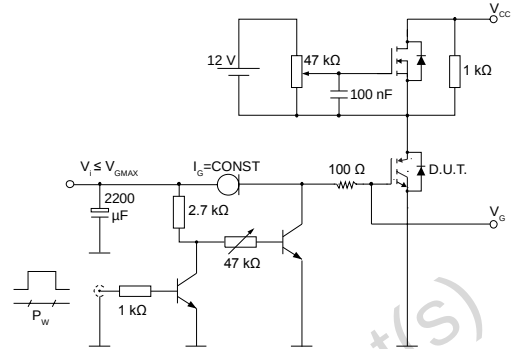
3 Test circuits

Figure 17: Test circuit for inductive load switching



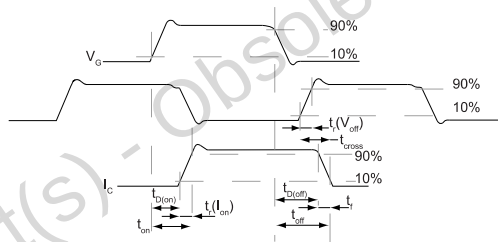
AM01504v1

Figure 18: Gate charge test circuit



AM01505v1

Figure 19: Switching waveform



AM01506v1

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.

Obsolete Product(s) - Obsolete Product(s)

4.1 TO-220 type A package information

Figure 20: TO-220 type A package outline

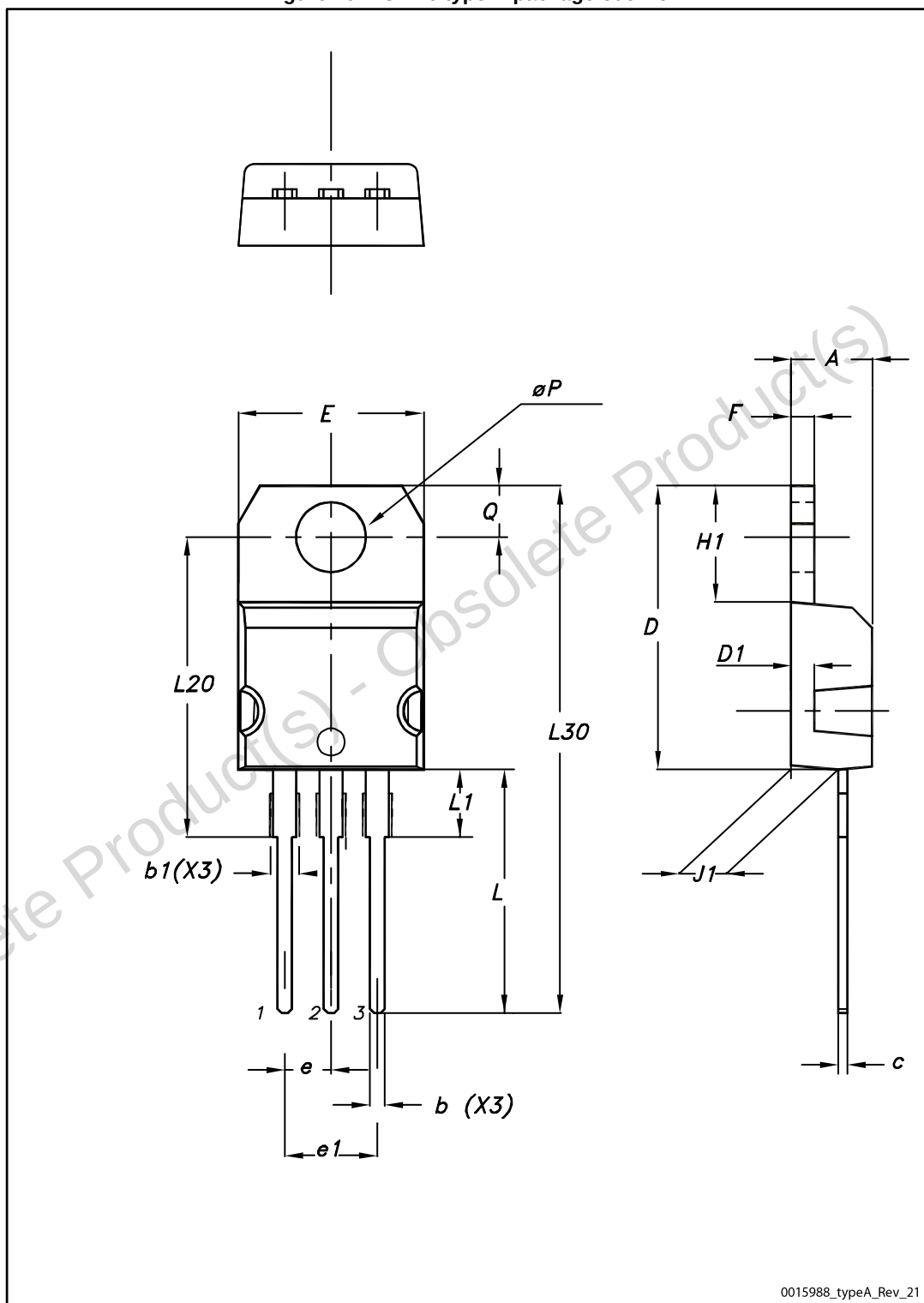


Table 7: TO-220 type A mechanical data

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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