

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

Datasheet - production data

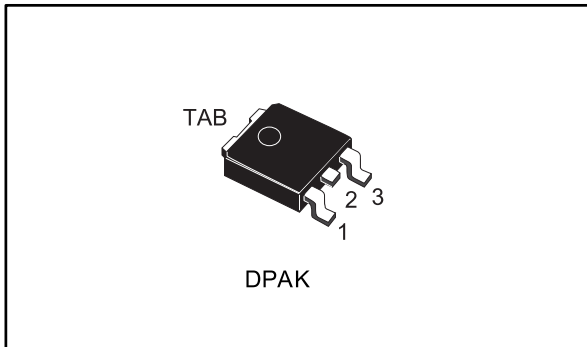
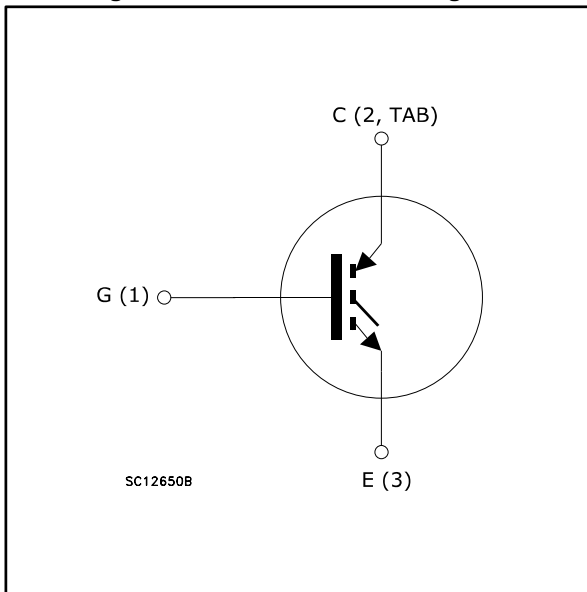


Figure 1: Internal schematic diagram



Features

Order code	V_{CES}	$V_{CE(sat) max}$ @ 25°C	I_c @ 100°C
STGD7NC60HT4	600 V	< 2.5 V	14 A

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

Applications

- Switching applications

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
STGD7NC60HT4	GD7NC60H	DPAK	Tape and reel

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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	70	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	1.78	°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	100	°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	-	
C_{res}	Reverse transfer capacitance			17	-	
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	-	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	
$t_{r(on)}$	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)

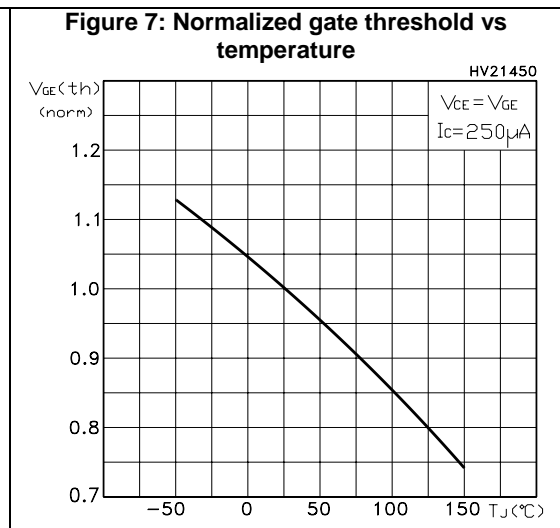
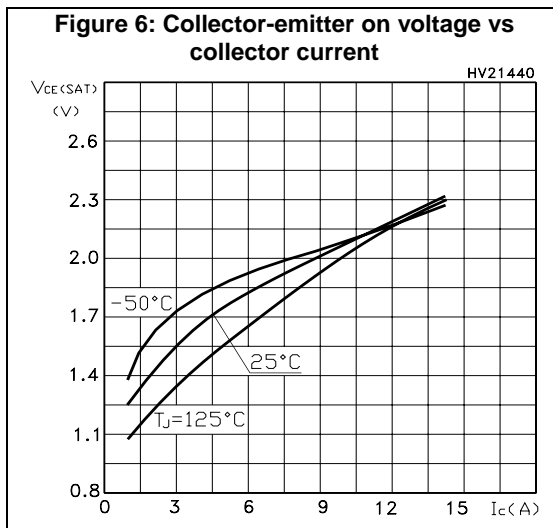
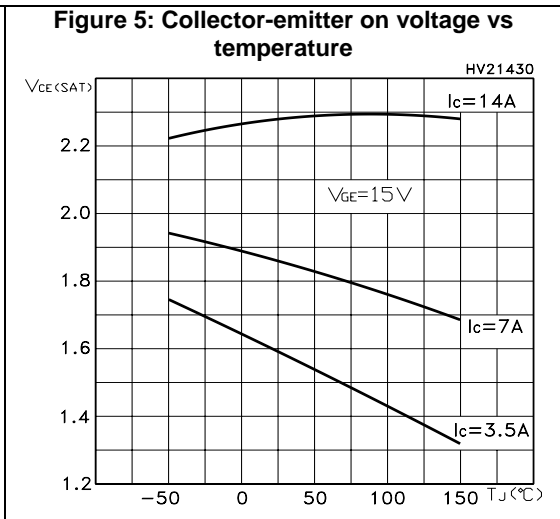
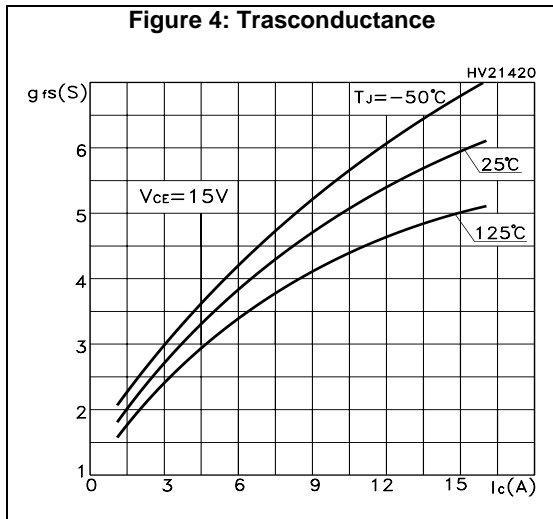
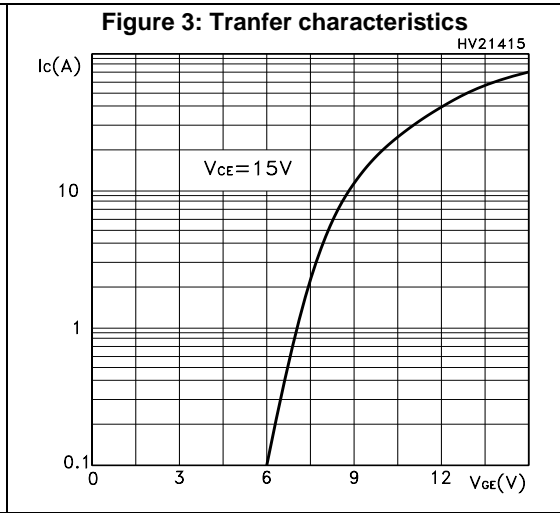
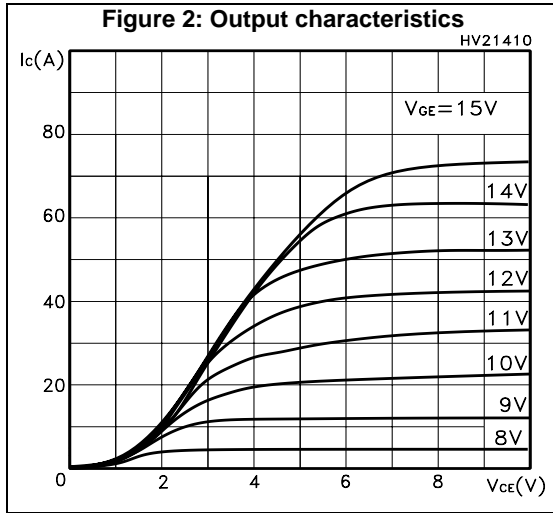


Figure 8: Normalized breakdown voltage vs temperature

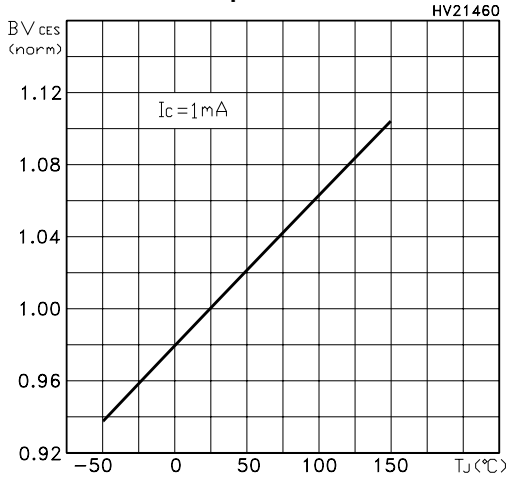


Figure 9: Gate charge vs gate-emitter voltage

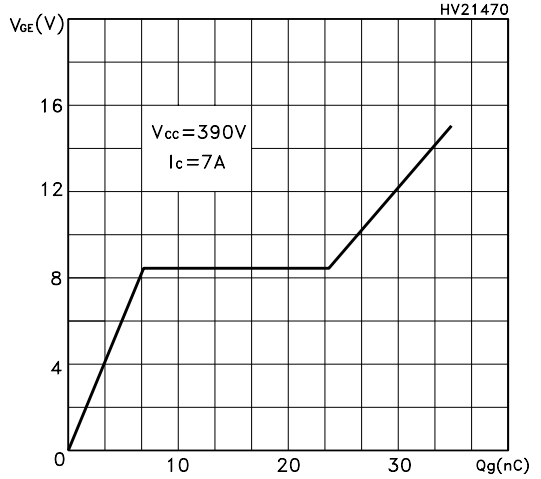


Figure 10: Capacitance variations

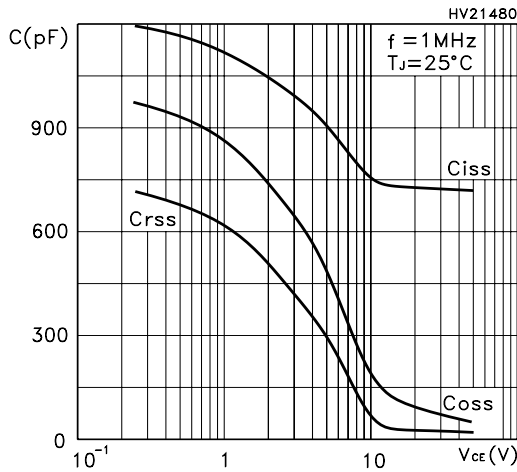


Figure 11: Total switching energy vs temperature

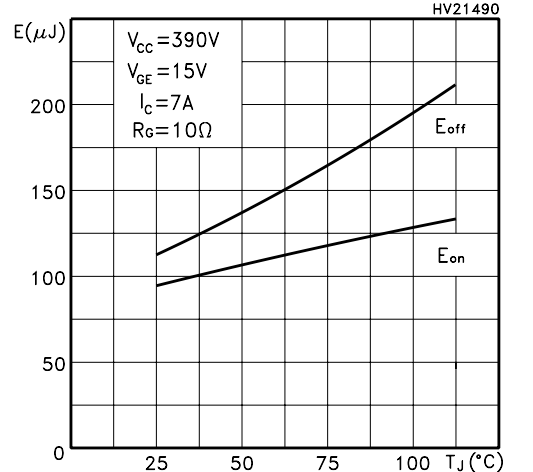


Figure 12: Total switching energy vs gate resistance

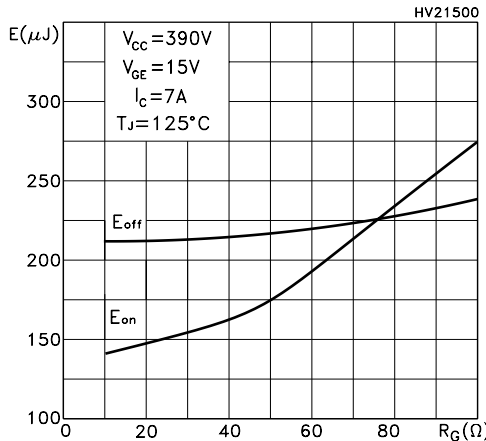
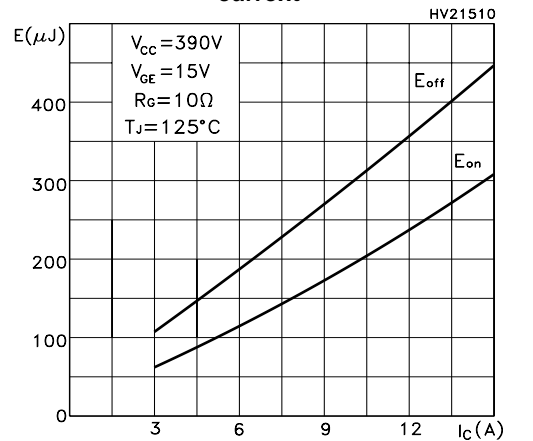
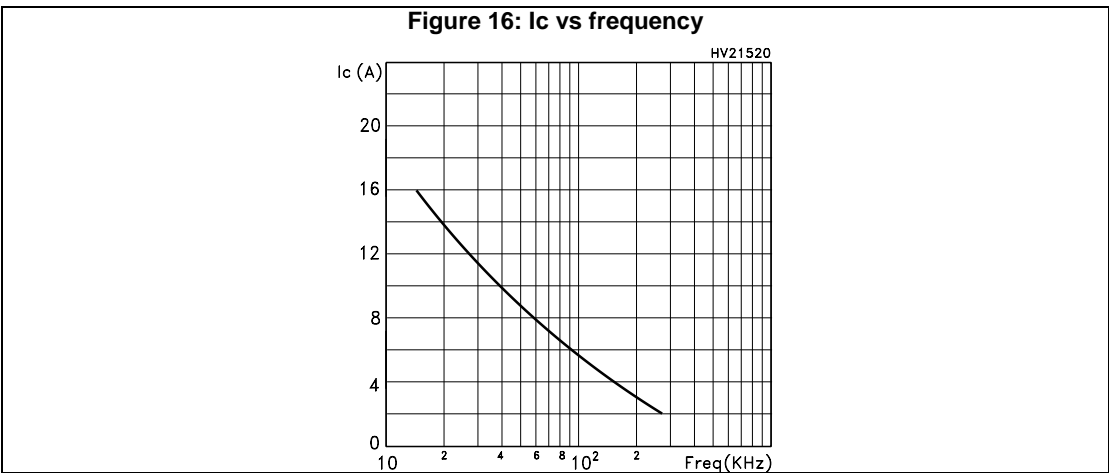
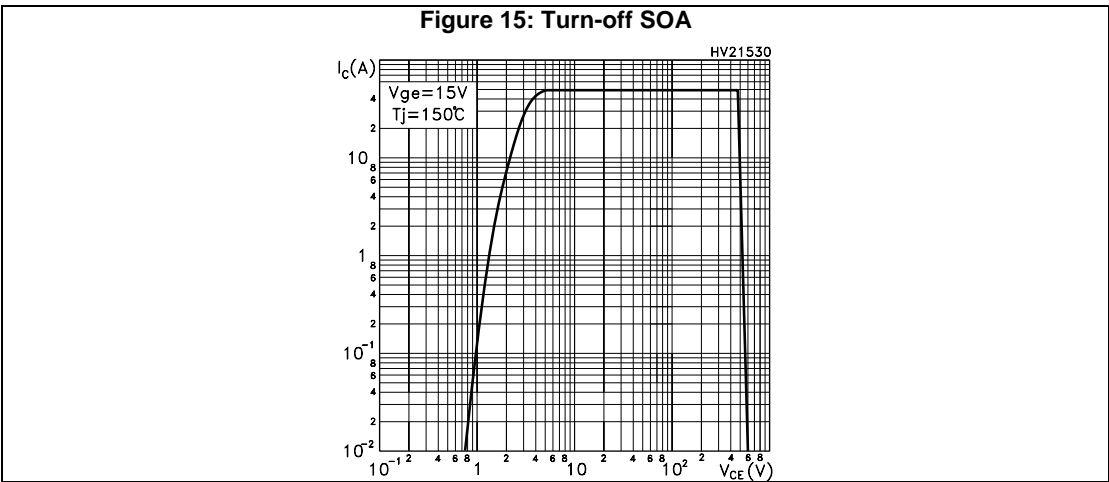
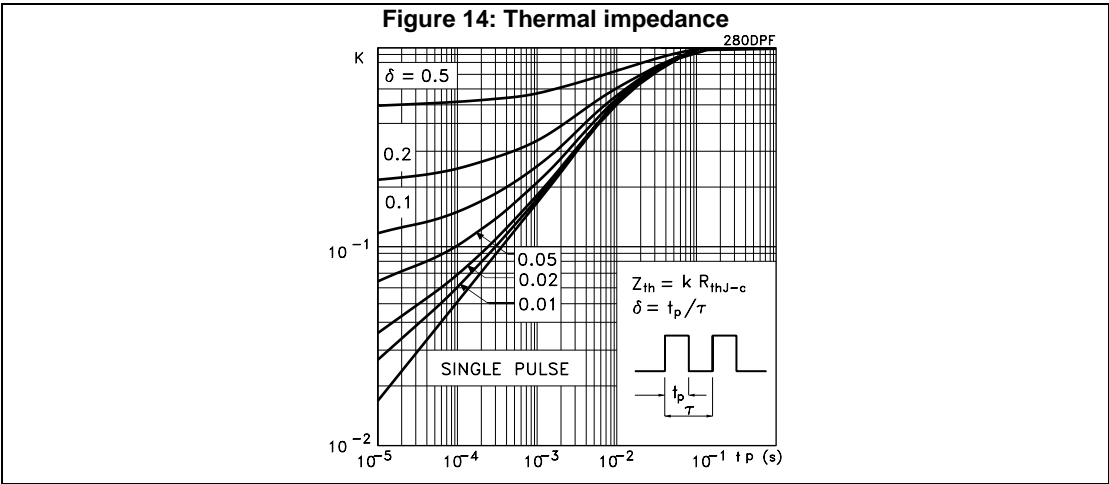
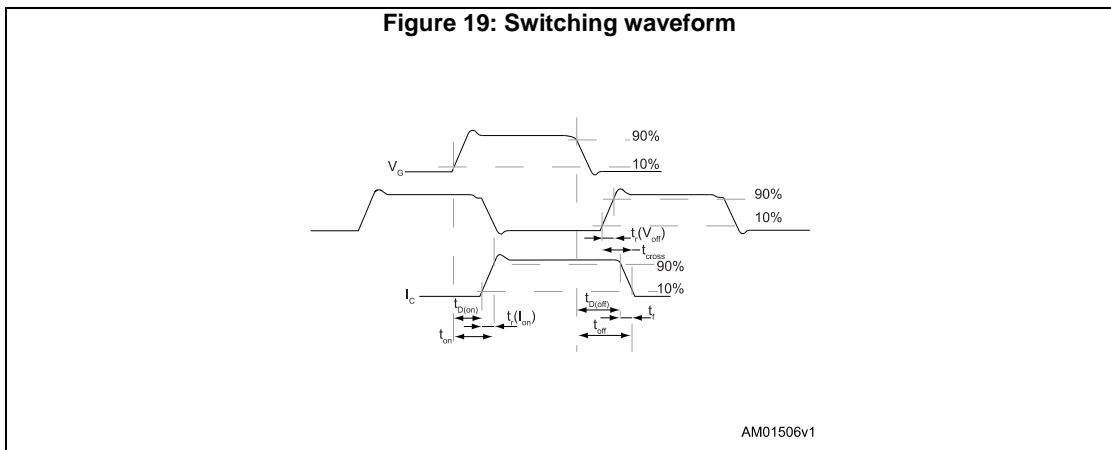
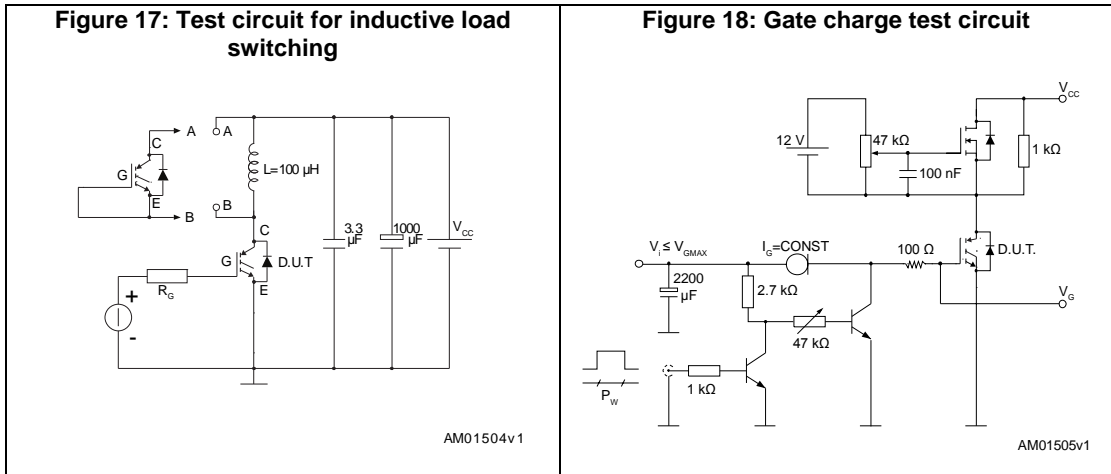


Figure 13: Total switching energy vs collector current





3 Test circuits



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 DPAK (TO-252) type A2 package information

Figure 20: DPAK (TO-252) type A2 package outline

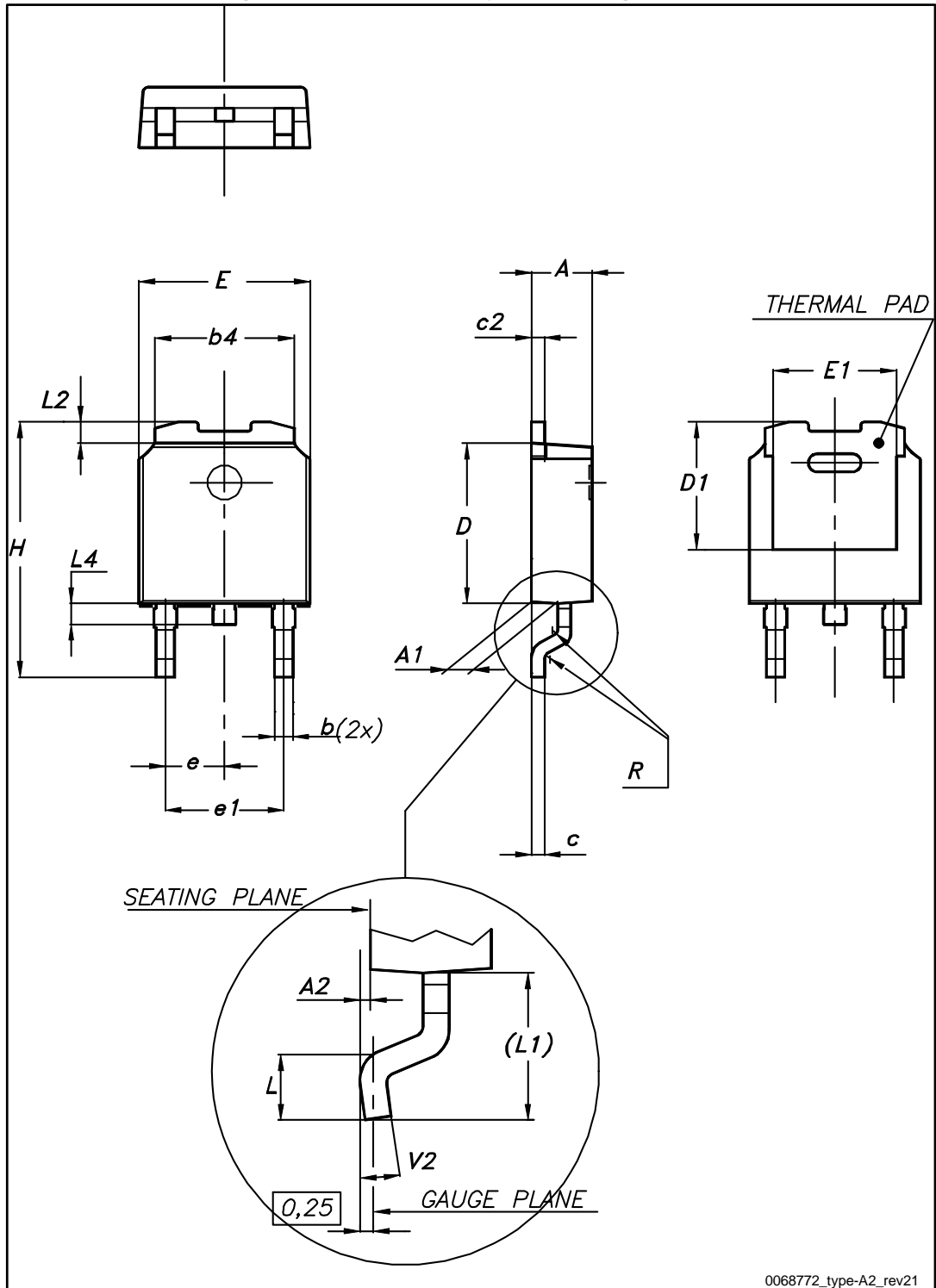
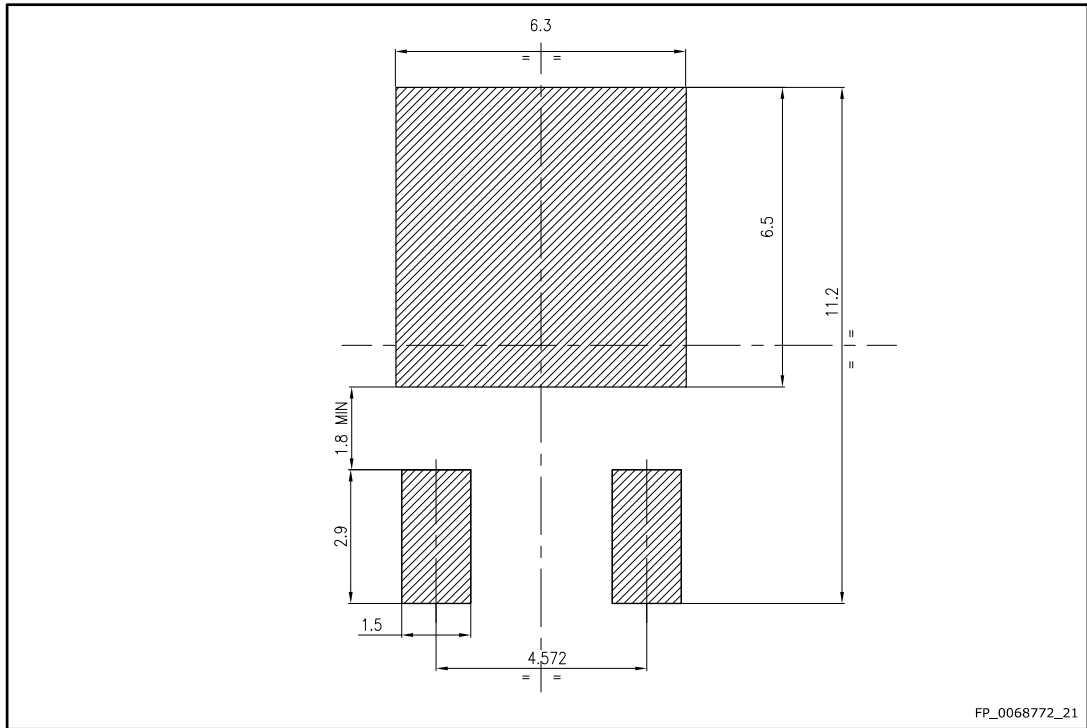


Table 7: DPAK (TO-252) type A2 mechanical data

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	4.95	5.10	5.25
E	6.40		6.60
E1	5.10	5.20	5.30
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 21: DPAK (TO-252) recommended footprint (dimensions are in mm)



4.2 DPAK (TO-252) packing information

Figure 22: DPAK (TO-252) tape outline

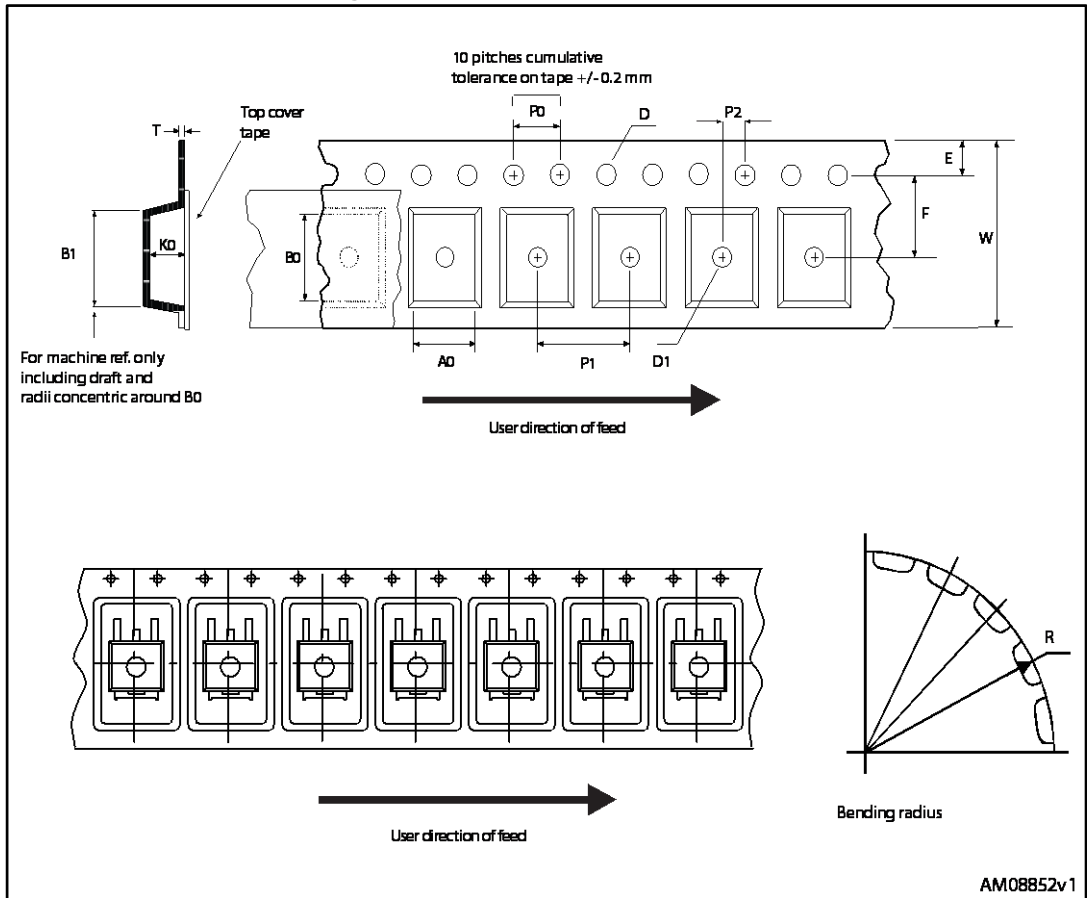


Figure 23: DPAK (TO-252) reel outline

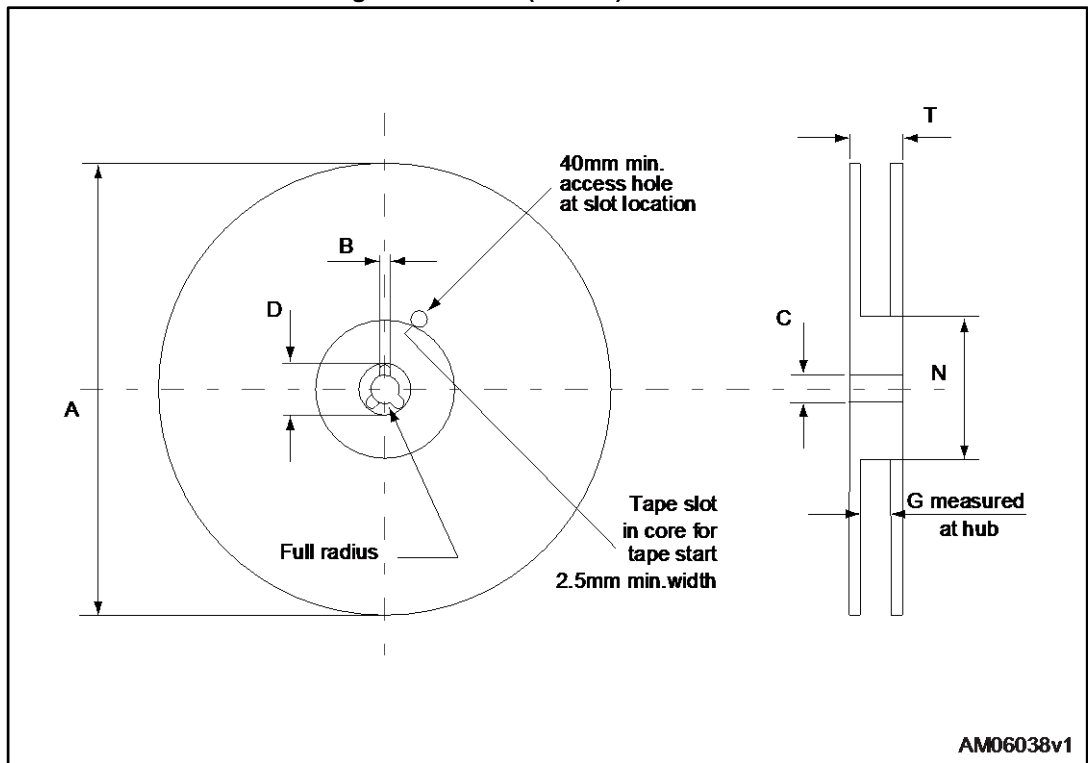


Table 8: DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
11-Jul-2016	1	First release. Part number previously included in datasheet DocID10855.

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