

## Trench gate field-stop IGBT, HB series 650 V, 30 A high speed in a D<sup>2</sup>PAK package

Datasheet - production data

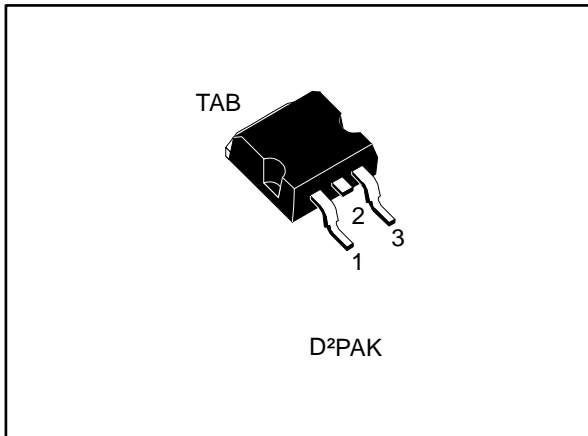


Figure 1: Internal schematic diagram

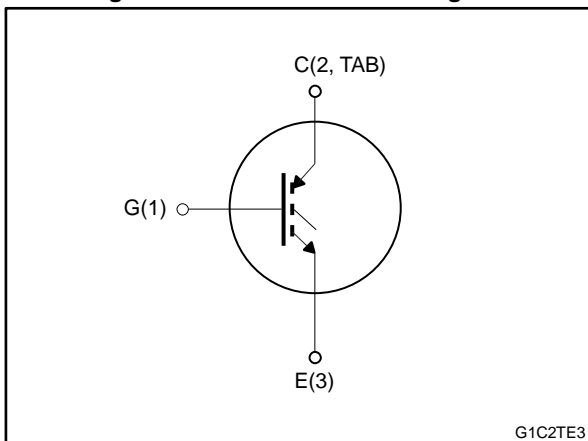


Table 1: Device summary

Order code	Marking	Package	Packing
STGB30H65FB	GB30H65FB	D <sup>2</sup> PAK	Tape and reel

### Features

- Maximum junction temperature:  $T_J = 175\text{ °C}$
- High speed switching series
- Minimized tail current
- $V_{CE(sat)} = 1.55\text{ V (typ.) @ } I_C = 30\text{ A}$
- Safe paralleling
- Tight parameter distribution
- Low thermal resistance

### Applications

- Photovoltaic inverters
- High frequency converters

### Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the new HB series of IGBTs, which represents an optimum compromise between conduction and switching loss to maximize the efficiency of any frequency converter. Furthermore, the slightly positive  $V_{CE(sat)}$  temperature coefficient and very tight parameter distribution result in safer paralleling operation.

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0$ V)	650	V
$I_C$	Continuous collector current at $T_C = 25$ °C	60	A
	Continuous collector current at $T_C = 100$ °C	30	
$I_{CP}^{(1)}$	Pulsed collector current	120	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$P_{TOT}$	Total dissipation at $T_C = 25$ °C	260	W
$T_{STG}$	Storage temperature range	- 55 to 150	°C
$T_J$	Operating junction temperature range	- 55 to 175	

**Notes:**

<sup>(1)</sup>Pulse width limited by maximum junction temperature.

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case	0.58	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	62.5	

## 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	$V_{GE} = 0\text{ V}$ , $I_C = 2\text{ mA}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$		1.55	2	V
		$V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$ , $T_J = 125\text{ °C}$		1.65		
		$V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$ , $T_J = 175\text{ °C}$		1.75		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$ , $I_C = 1\text{ mA}$	5	6	7	V
$I_{CES}$	Collector cut-off current	$V_{GE} = 0\text{ V}$ , $V_{CE} = 650\text{ V}$			25	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$			$\pm 250$	nA

**Table 5: Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0\text{ V}$	-	3659	-	pF
$C_{oes}$	Output capacitance		-	101	-	
$C_{res}$	Reverse transfer capacitance		-	76	-	
$Q_g$	Total gate charge	$V_{CC} = 520\text{ V}$ , $I_C = 30\text{ A}$ , $V_{GE} = 0\text{ to }15\text{ V}$ (see <a href="#">Figure 23: "Gate charge test circuit"</a> )	-	149	-	nC
$Q_{ge}$	Gate-emitter charge		-	25	-	
$Q_{gc}$	Gate-collector charge		-	62	-	

Table 6: IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$ , $I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$ , $R_G = 10\ \Omega$ (see <a href="#">Figure 22: "Test circuit for inductive load switching"</a> )	-	37	-	ns
$t_r$	Current rise time		-	14.6	-	
$(di/dt)_{on}$	Turn-on current slope		-	1643	-	A/ $\mu$ s
$t_{d(off)}$	Turn-off-delay time		-	146	-	ns
$t_f$	Current fall time		-	23	-	
$E_{on}^{(1)}$	Turn-on switching energy		-	151	-	$\mu$ J
$E_{off}^{(2)}$	Turn-off switching energy		-	293	-	
$E_{ts}$	Total switching energy		-	444	-	
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$ , $I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$ , $R_G = 10\ \Omega$ , $T_J = 175\text{ }^\circ\text{C}$ (see <a href="#">Figure 22: "Test circuit for inductive load switching"</a> )	-	35	-	ns
$t_r$	Current rise time		-	16.1	-	
$(di/dt)_{on}$	Turn-on current slope		-	1496	-	A/ $\mu$ s
$t_{d(off)}$	Turn-off-delay time		-	158	-	ns
$t_f$	Current fall time		-	65	-	
$E_{on}^{(1)}$	Turn-on switching energy		-	175	-	$\mu$ J
$E_{off}^{(2)}$	Turn-off switching energy		-	572	-	
$E_{ts}$	Total switching energy		-	747	-	

**Notes:**

(1) Including the reverse recovery of the diode. Turn-on times and energy have been measured applying as freewheeling an external SiC diode STPSC206W.

(2) Including the tail of the collector current.

2.1 Electrical characteristics (curves)

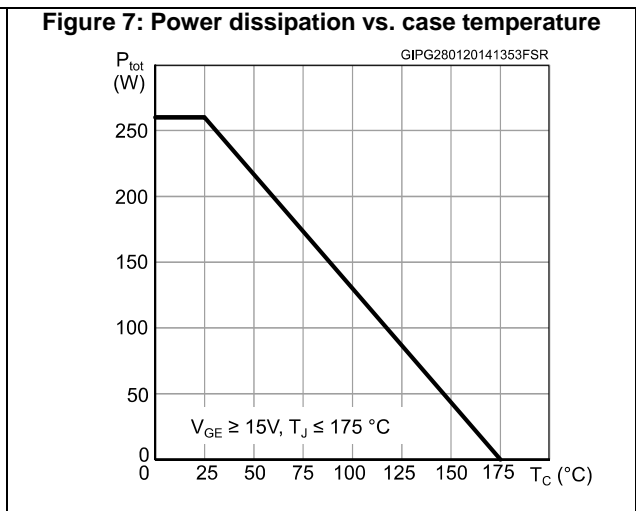
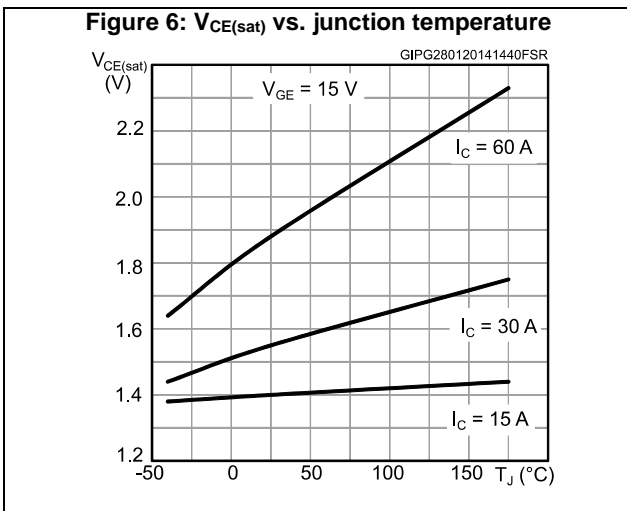
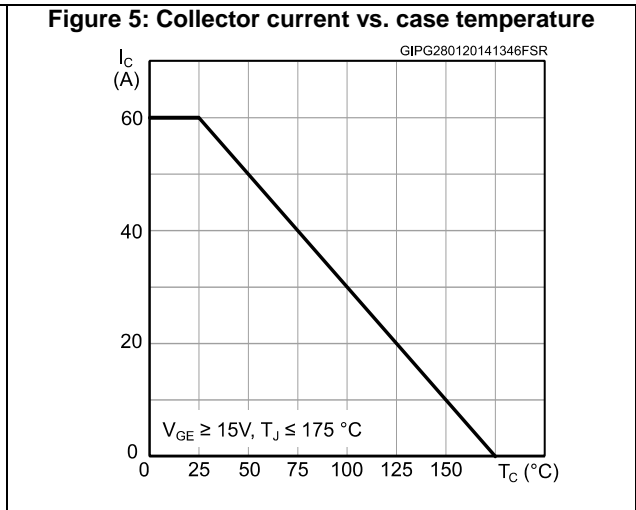
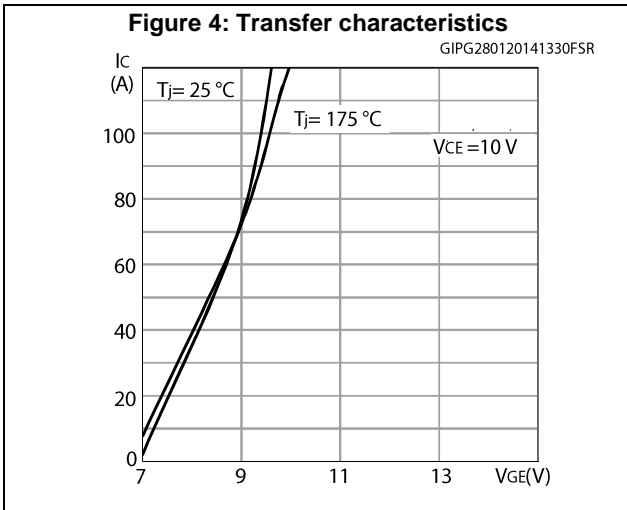
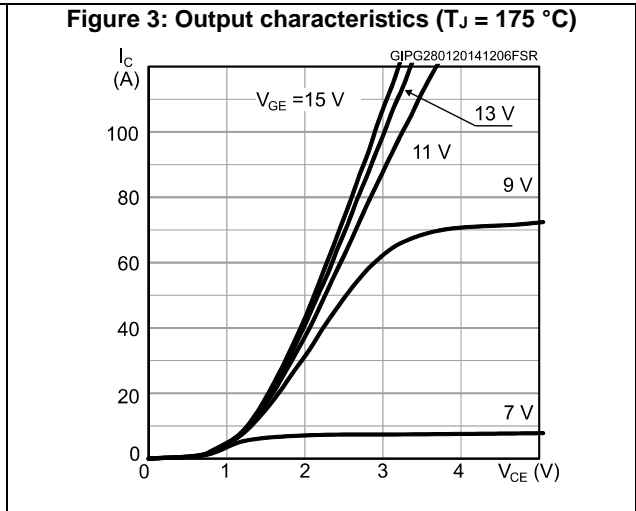
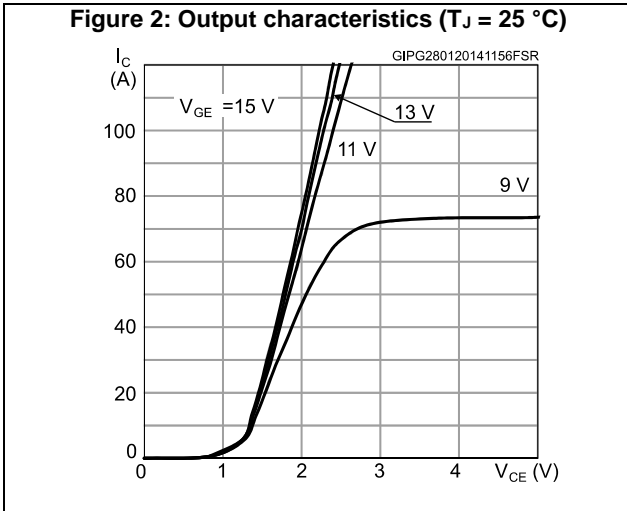


Figure 8: Forward bias safe operating area

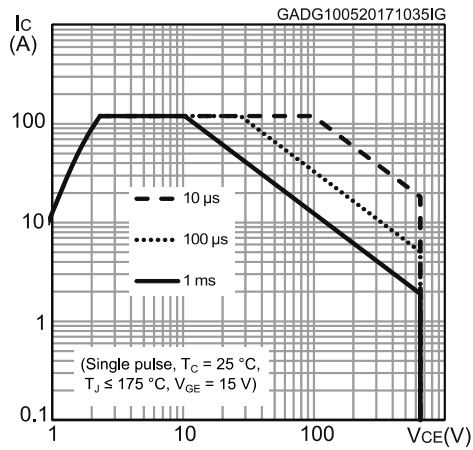


Figure 9: Collector current vs. switching frequency

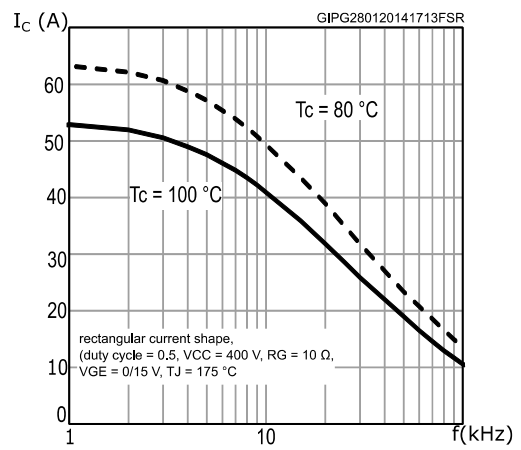


Figure 10: Normalized  $V_{GE(th)}$  vs. junction temperature

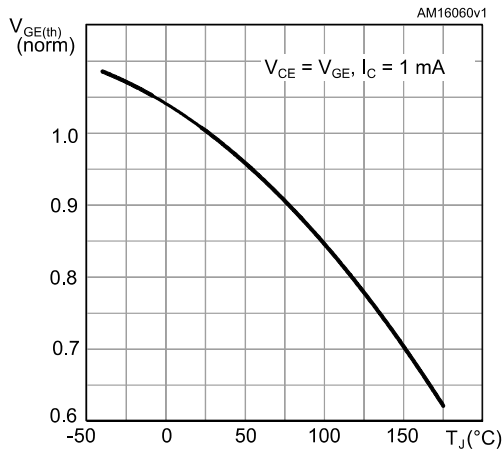


Figure 11: Normalized  $V_{(BR)CES}$  vs. junction temperature

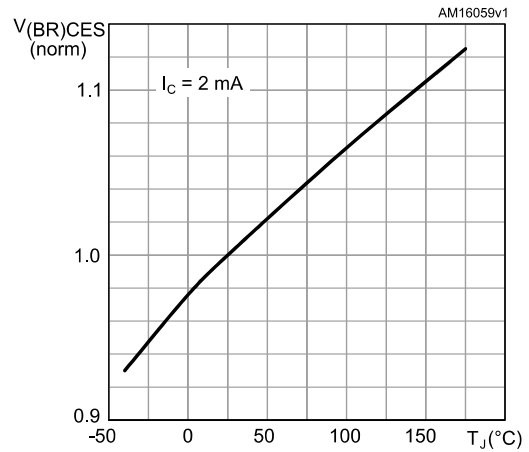


Figure 12: Switching energy vs. temperature

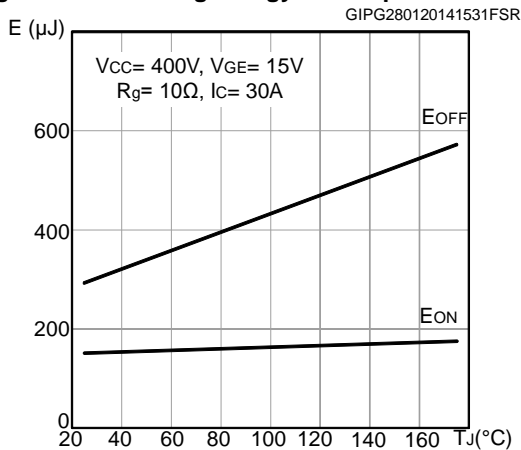
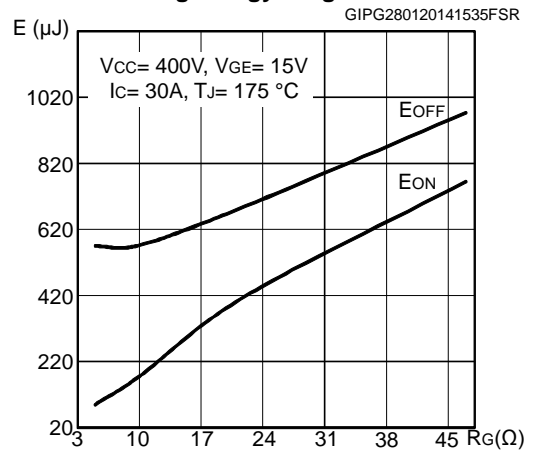


Figure 13: Switching energy vs. gate resistance



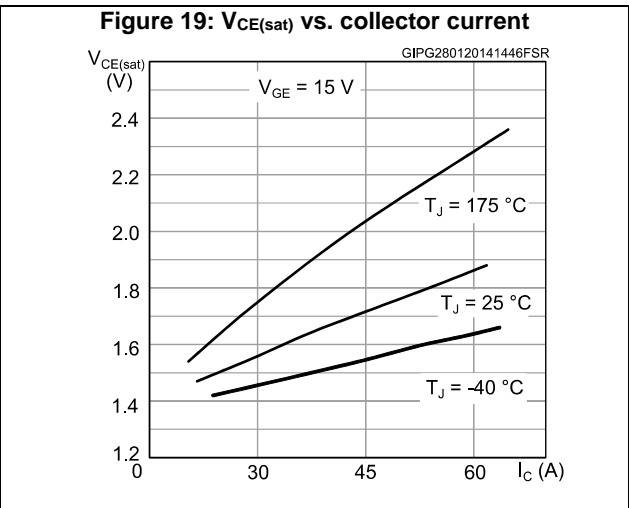
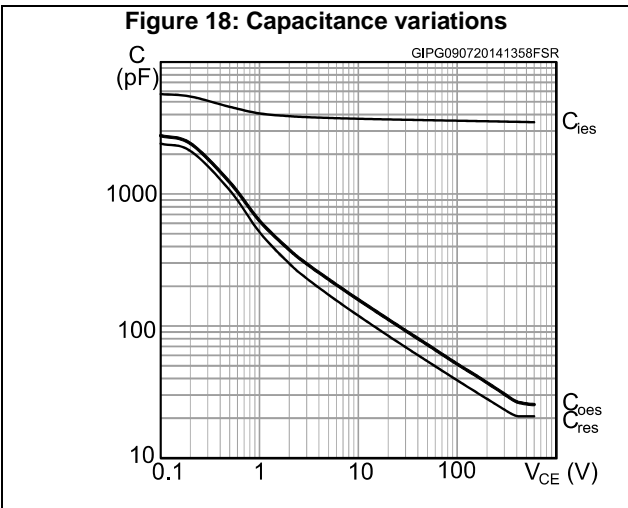
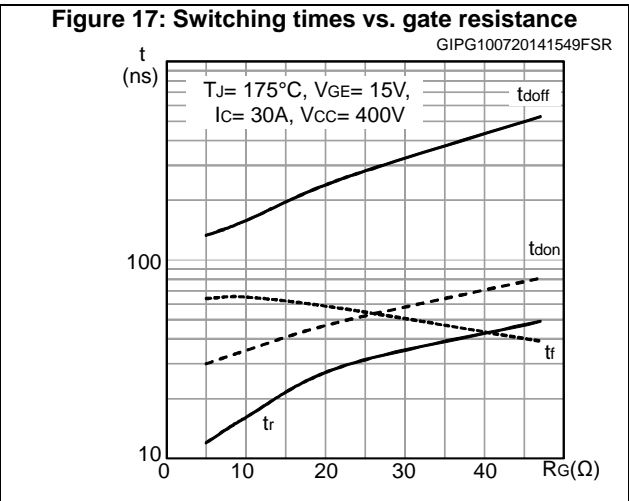
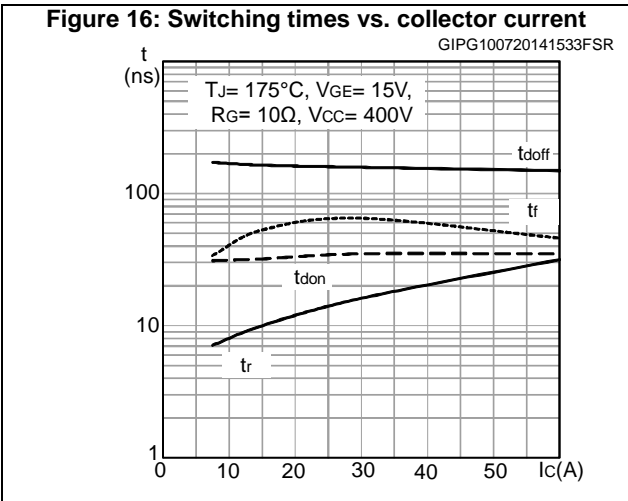
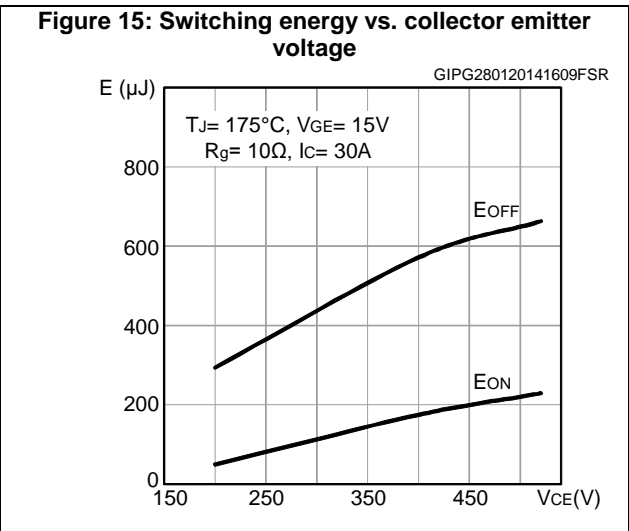
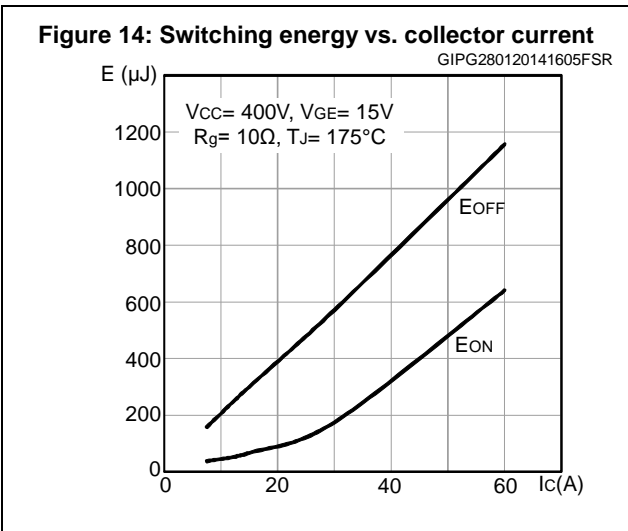




Figure 20: Gate charge vs. gate-emitter voltage

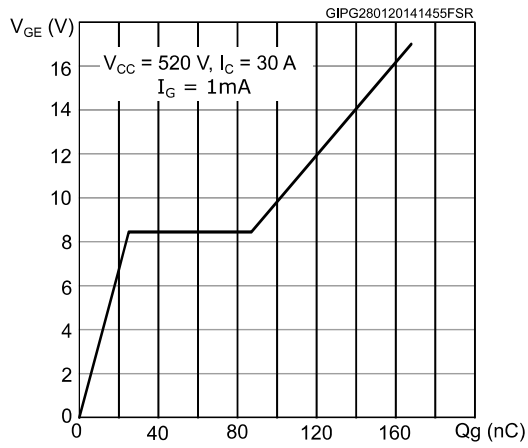
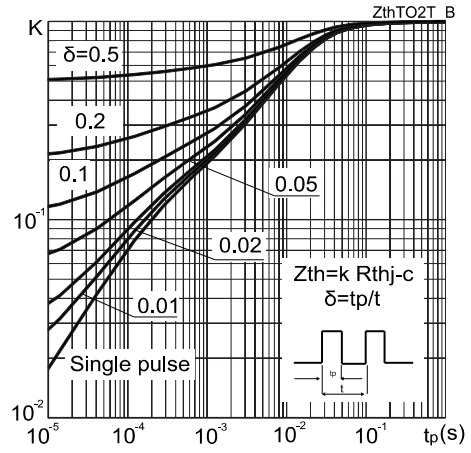
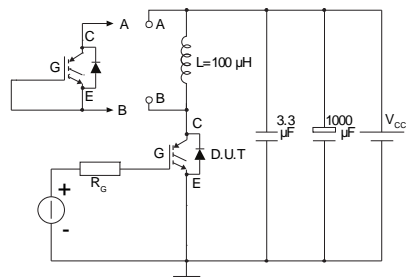


Figure 21: Thermal impedance



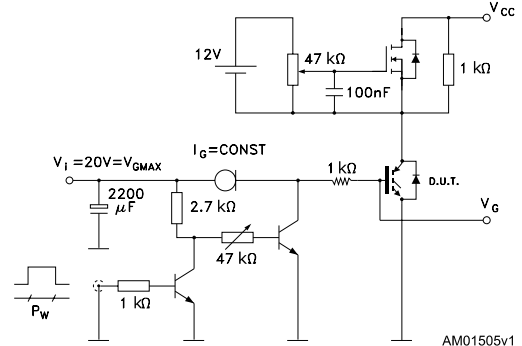
### 3 Test circuits

**Figure 22: Test circuit for inductive load switching**



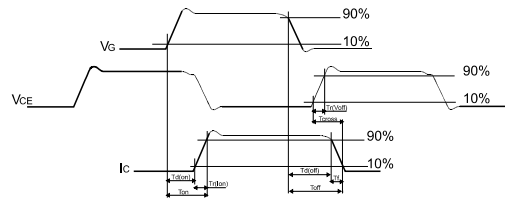
AM01504v1

**Figure 23: Gate charge test circuit**



AM01505v1

**Figure 24: 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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 D<sup>2</sup>PAK package information

Figure 25: D<sup>2</sup>PAK (TO-263) type A package outline

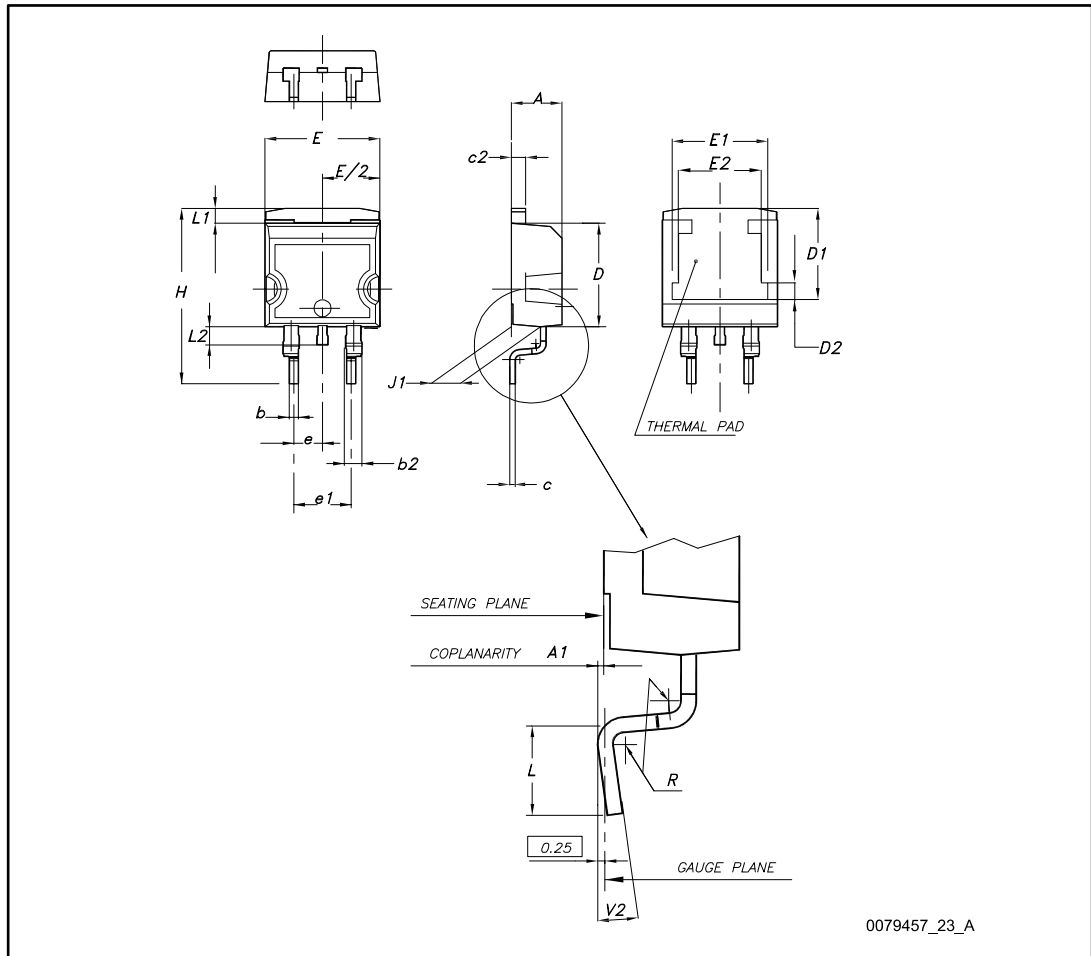
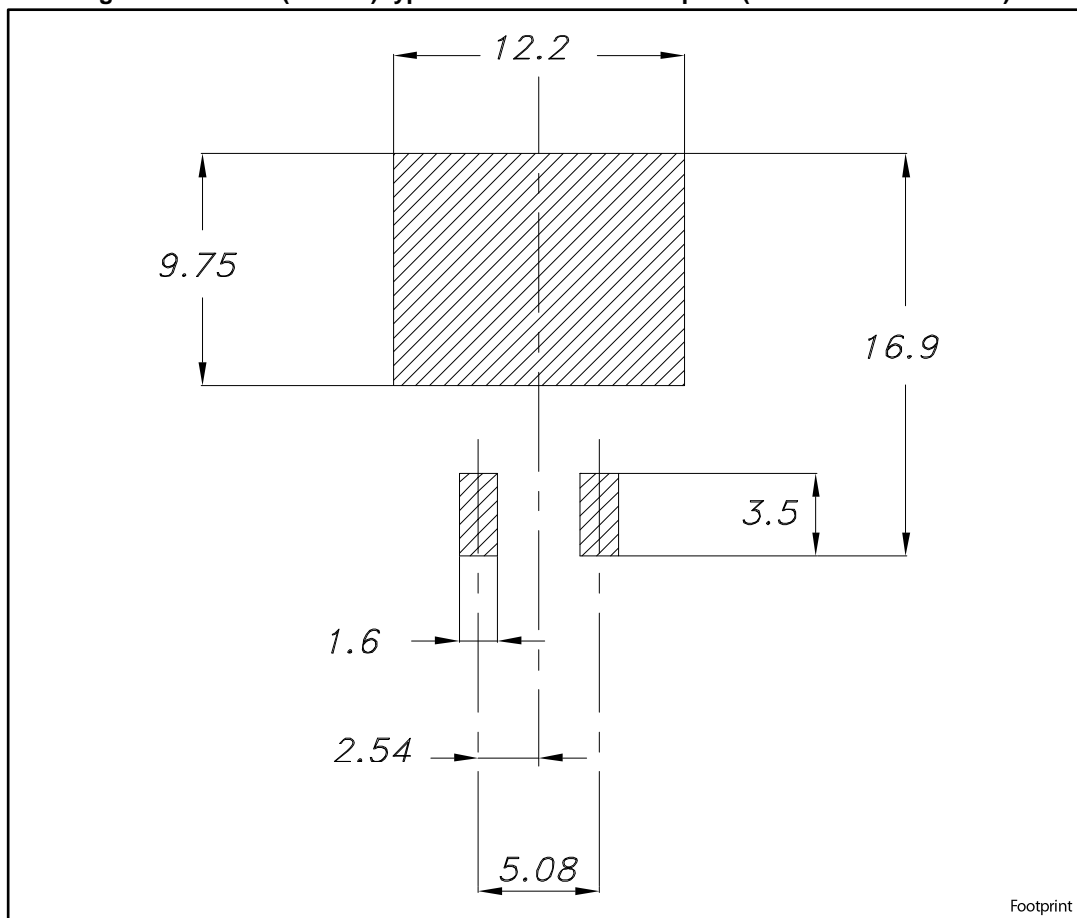


Table 7: D<sup>2</sup>PAK (TO-263) type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.50	8.70	8.90
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 26: D<sup>2</sup>PAK (TO-263) type A recommended footprint (dimensions are in mm)



### 4.2 D<sup>2</sup>PAK packing information

Figure 27: D<sup>2</sup>PAK type A tape outline

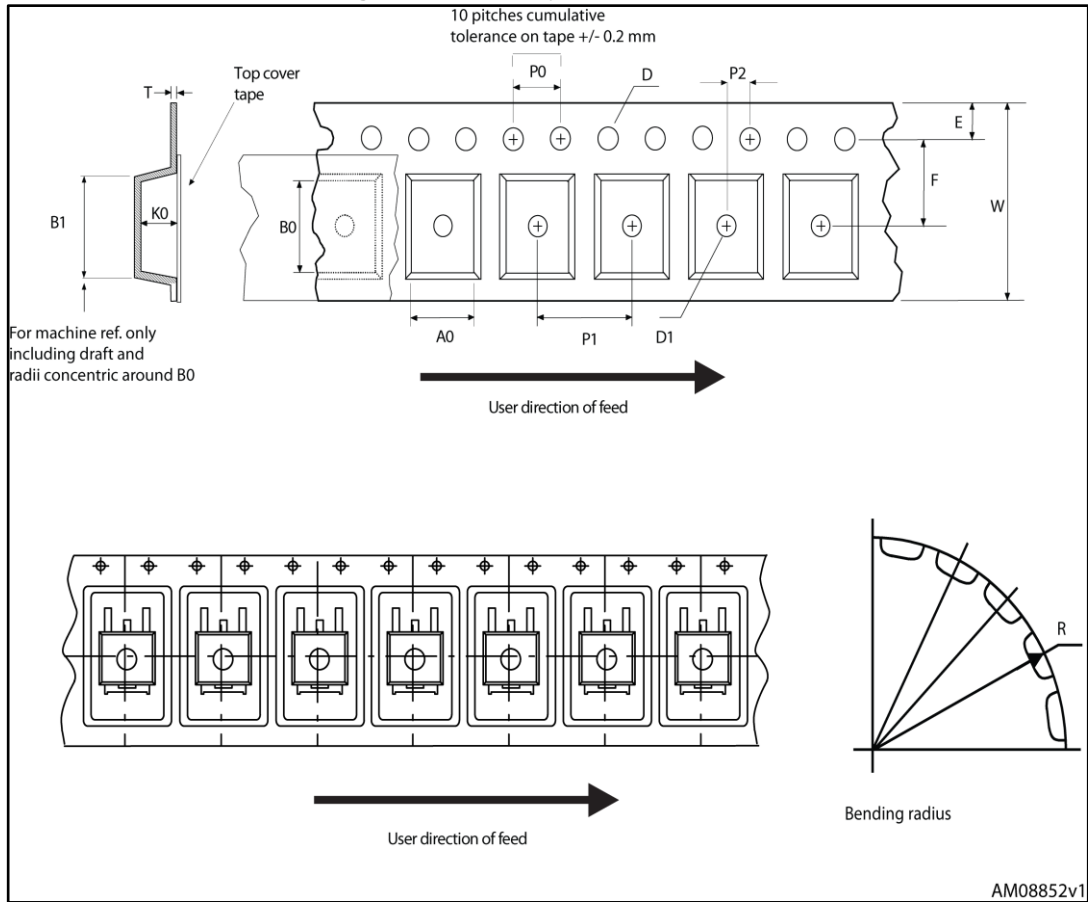


Figure 28: D<sup>2</sup>PAK type A reel outline

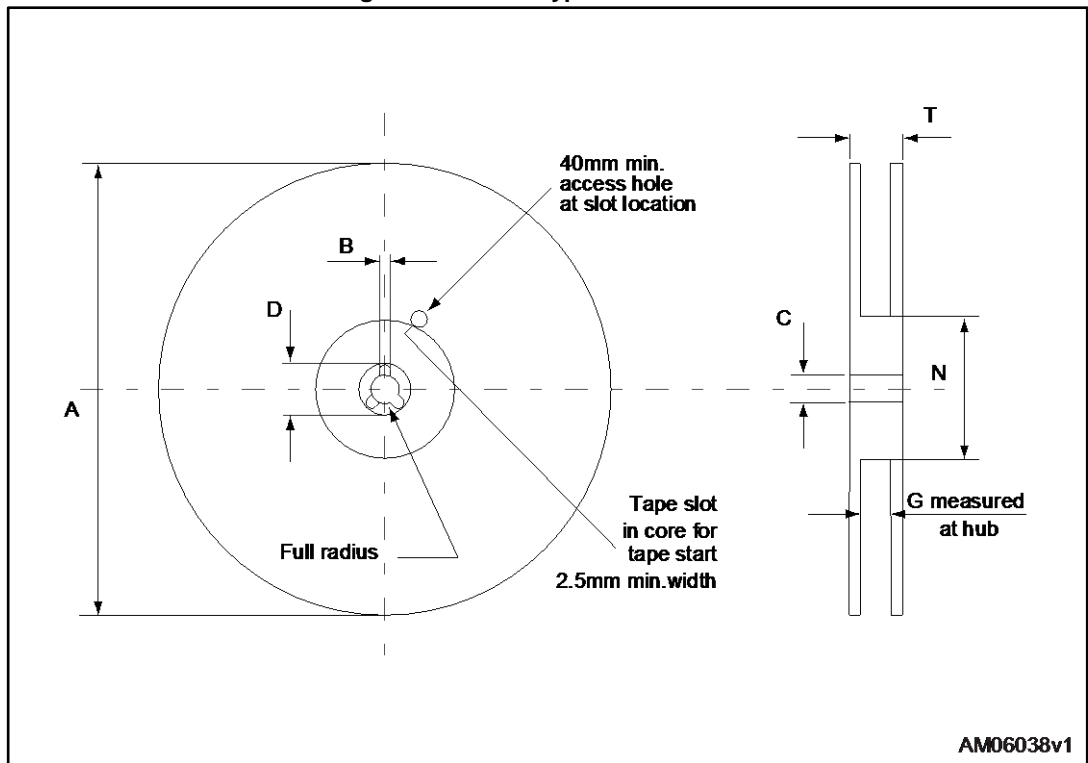


Table 8: D<sup>2</sup>PAK type A tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

## 5 Revision history

**Table 9: Document revision history**

Date	Revision	Changes
11-May-2017	1	Initial release.
29-May-2017	2	Document status promoted from preliminary to production data.



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[IGW30N60H3FKSA1](#) [STGWA8M120DF3](#) [IGW08T120FKSA1](#) [IGW75N60H3FKSA1](#) [HGTG40N60B3](#) [FGH60N60SMD\\_F085](#)  
[FGH75T65UPD](#) [STGWA15H120F2](#) [IKA10N60TXKSA1](#) [IHW20N120R5XKSA1](#) [RJH60D2DPP-M0#T2](#) [IKP20N60TXKSA1](#)  
[IHW20N65R5XKSA1](#) [IDW40E65D2FKSA1](#)