STGB30H60DFB, STGP30H60DFB

Trench gate field-stop IGBT, HB series 600 V, 30 A high speed

Datasheet - production data

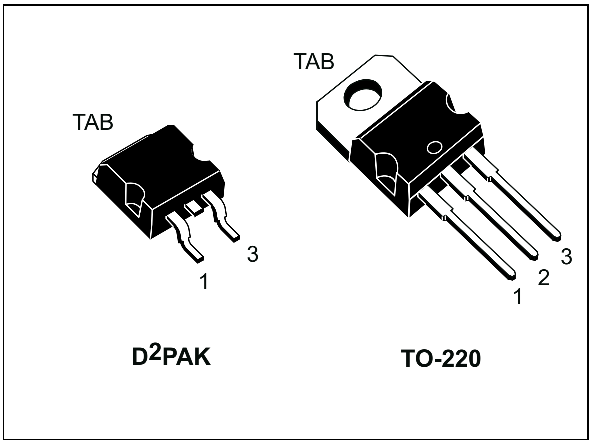
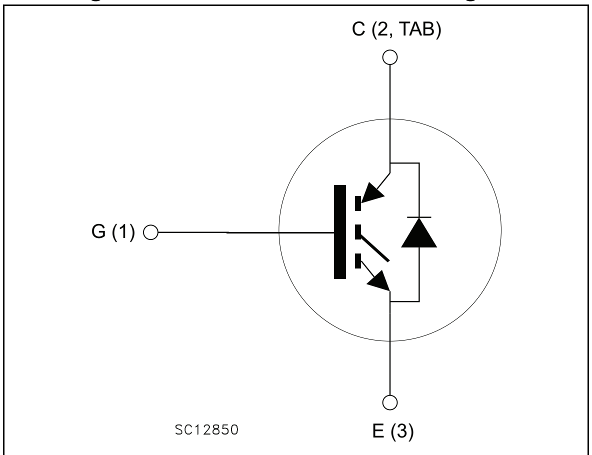


Figure 1. Internal schematic diagram



Features

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

Applications

- Photovoltaic inverters
- High frequency converters

Description

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

Table 1. Device summary

Order code	Marking	Package	Packaging
STGB30H60DFB	GB30H60DFB	D2PAK	Tape and reel
STGP30H60DFB	GP30H60DFB	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	Continuous collector current at T_C = 25 °C	60	A
I_C	Continuous collector current at T_C = 100 °C	30	A
I_{CP}[(1)]	Pulsed collector current	120	A
I_F	Continuous forward current at T_C = 25 °C	60	A
I_F	Continuous forward current at T_C = 100 °C	30	A
I_{FP}[(1)]	Pulsed forward current	120	A
V_{GE}	Gate-emitter voltage	±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	- 55 to 175	°C

1. Pulse width limited by maximum junction temperature.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	0.58	°C/W
R_{thJC}	Thermal resistance junction-case diode	2.08	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

T_J = 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)	I_C = 2 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 30 A		1.55	2	V
		V_{GE} = 15 V, I_C = 30 A T_J = 125 °C		1.65		
		V_{GE} = 15 V, I_C = 30 A T_J = 175 °C		1.75		
V_F	Forward on-voltage	I_F = 30 A		2	2.6	V
		I_F = 30 A; T_J = 125 °C		1.7		
		I_F = 30 A; T_J = 175 °C		1.6		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	5	6	7	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 600 V			25	µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ± 20 V			250	nA

Table 5. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0	-	3659	-	pF
C_{oes}	Output capacitance		-	101	-	pF
C_{res}	Reverse transfer capacitance		-	76	-	pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 30 A, V_{GE} = 15 V, see *Figure 29*	-	149	-	nC
Q_{ge}	Gate-emitter charge		-	25	-	nC
Q_{gc}	Gate-collector charge		-	62	-	nC

Table 6. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 30 A, R_G = 10 Ω, V_{GE} = 15 V, see *Figure 28*	-	37	-	ns
t_r	Current rise time		-	14.6	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1643	-	A/µs
$t_{d(off)}$	Turn-off delay time			146	-	ns
t_f	Current fall time		-	23	-	ns
E_{on}	Turn-on switching losses		-	383	-	µJ
E_{off} (1)	Turn-off switching losses		-	293	-	µJ
E_{ts}	Total switching losses		-	676	-	µJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 30 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 175 °C, see *Figure 28*	-	35	-	ns
t_r	Current rise time		-	16.1	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1496	-	A/µs
$t_{d(off)}$	Turn-off delay time		-	158	-	ns
t_f	Current fall time		-	65	-	ns
E_{on}	Turn-on switching losses		-	794	-	µJ
E_{off} (1)	Turn-off switching losses		-	572	-	µJ
E_{ts}	Total switching losses		-	1366	-	µJ

1. Turn-off losses include also the tail of the collector current.

Table 7. Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	I_F = 30 A, V_R = 400 V, di/dt=1000 A/µs, V_{GE} = 15 V, (see *Figure 28*)	-	53	-	ns
Q_{rr}	Reverse recovery charge		-	384	-	nC
I_{rrm}	Reverse recovery current		-	14.5	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	788	-	A/µs
E_{rr}	Reverse recovery energy		-	104	-	µJ
t_{rr}	Reverse recovery time	I_F = 30 A, V_R = 400 V, di/dt=1000 A/µs, V_{GE} = 15 V, T_J = 175 °C, (see *Figure 28*)	-	104	-	ns
Q_{rr}	Reverse recovery charge		-	1352	-	nC
I_{rrm}	Reverse recovery current		-	26	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	310	-	A/µs
E_{rr}	Reverse recovery energy		-	407	-	µJ

2.1 Electrical characteristics (curve)

Figure 2. Power dissipation vs. case temperature

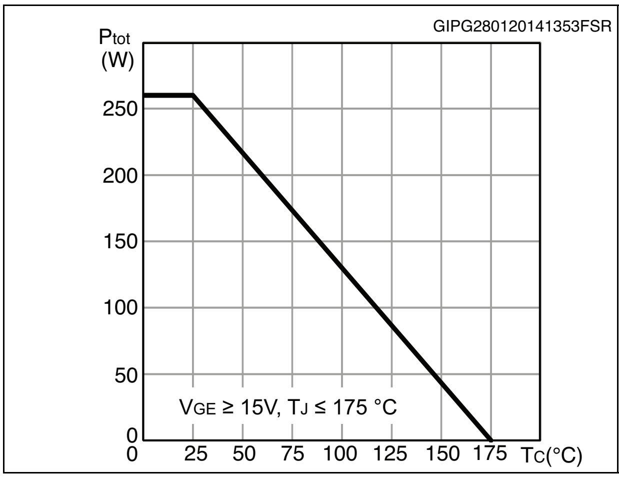


Figure 3. Collector current vs. case temperature

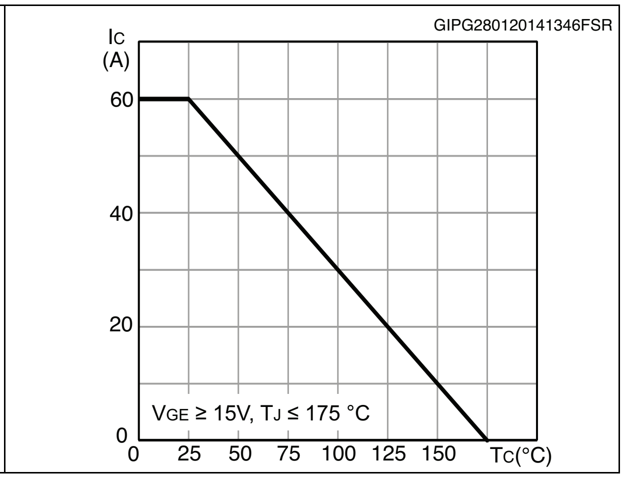


Figure 4. Output characteristics (T_J = 25°C)

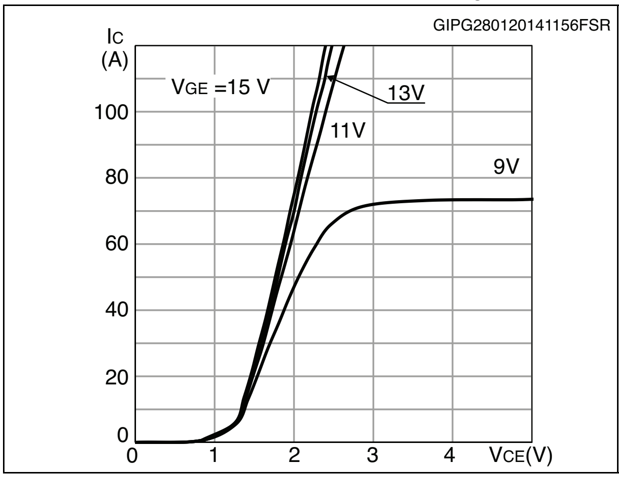


Figure 5. Output characteristics (T_J = 175°C)

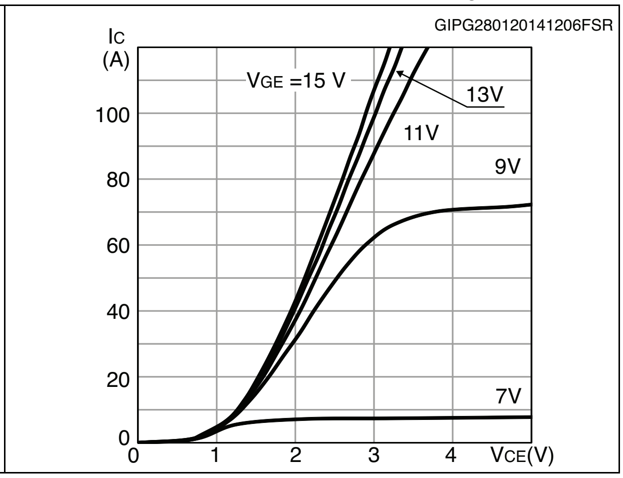


Figure 6. $V_{CE(sat)}$ vs. junction temperature

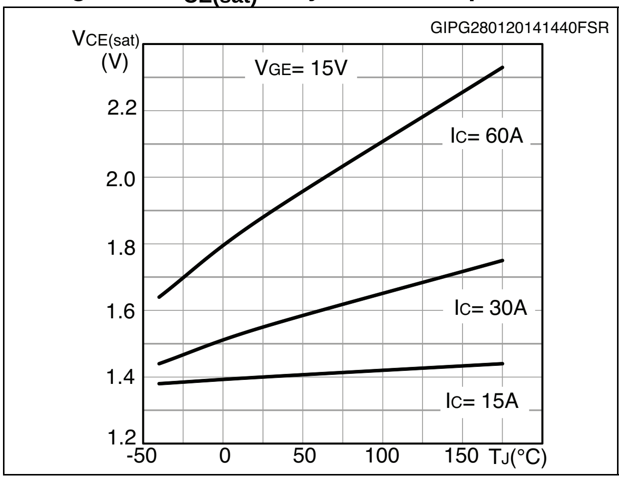


Figure 7. $V_{CE(sat)}$ vs. collector current

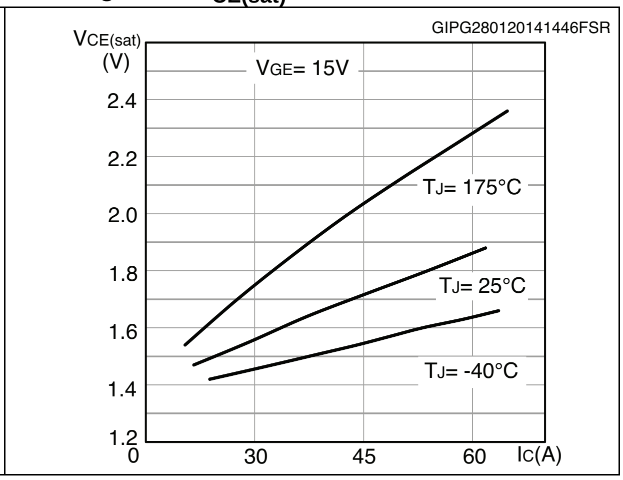


Figure 8. Collector current vs. switching frequency

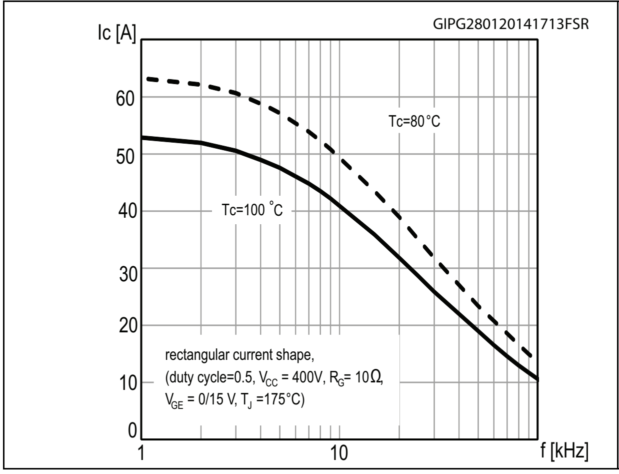


Figure 9. Forward bias safe operating area

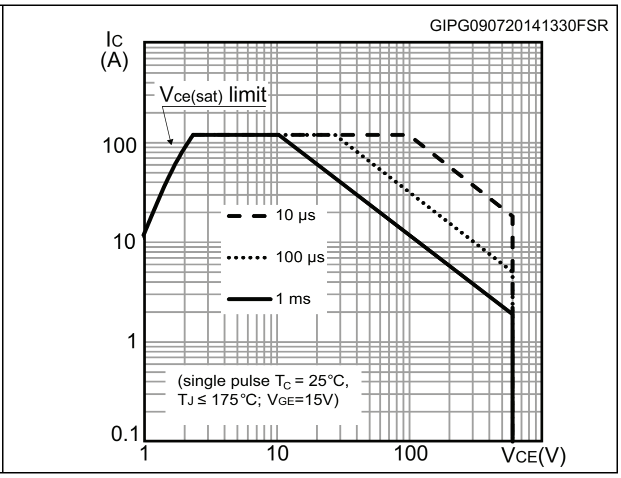


Figure 10. Transfer characteristics

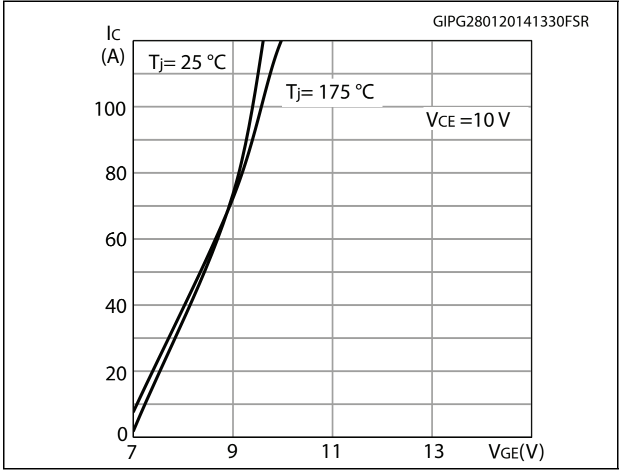


Figure 11. Diode V_F vs. forward current

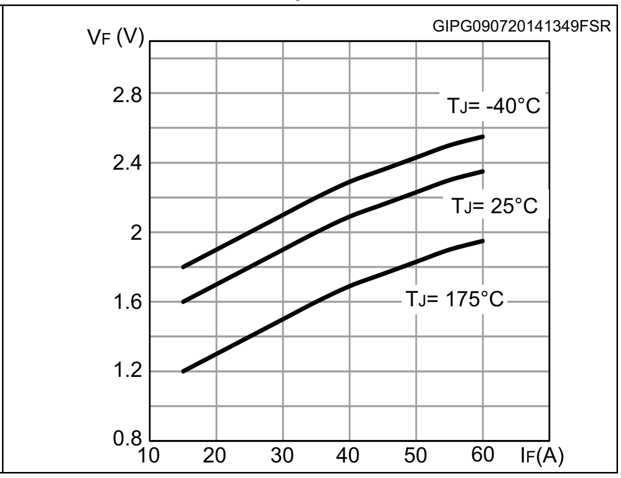


Figure 12. Normalized $V_{GE(th)}$ vs junction temperature

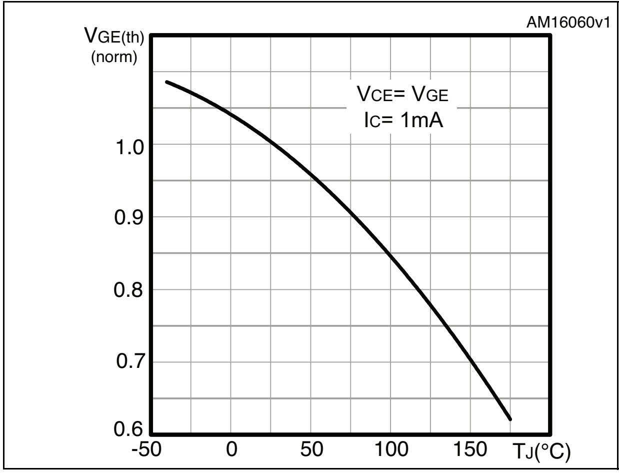


Figure 13. Normalized $V_{(BR)CES}$ vs. junction temperature

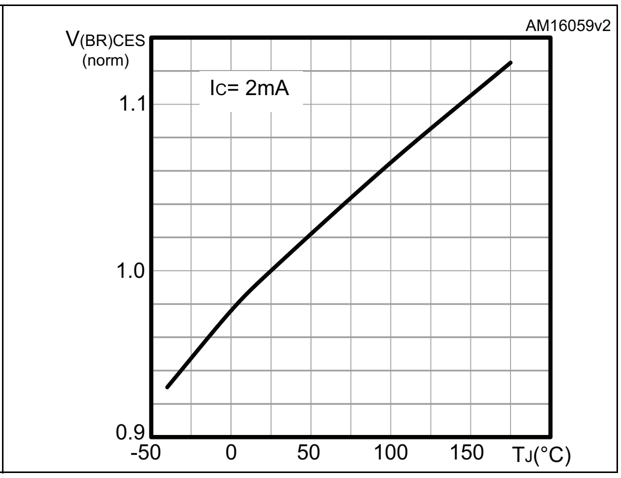


Figure 14. Capacitance variation

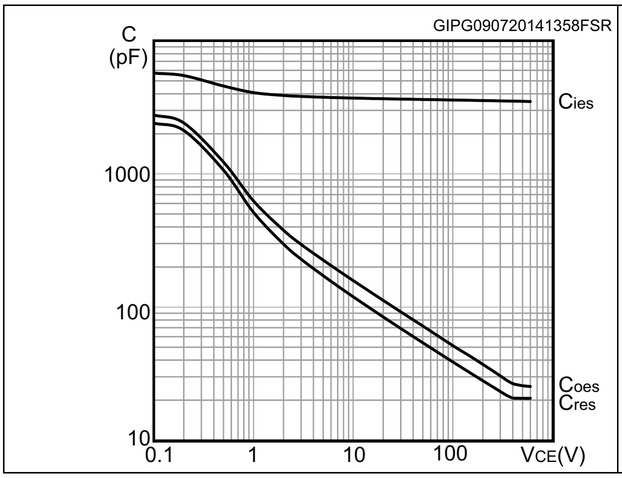


Figure 15. Gate charge vs. gate-emitter voltage

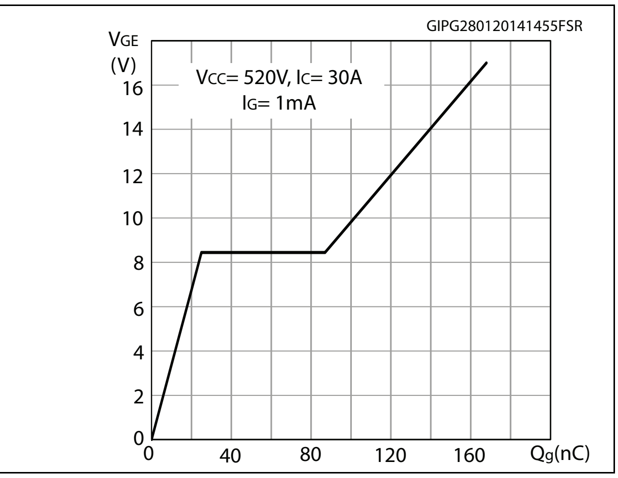


Figure 16. Switching loss vs collector current

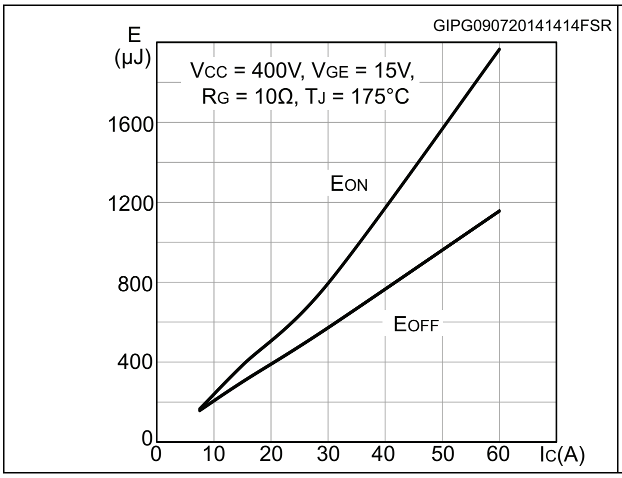


Figure 17. Switching loss vs gate resistance

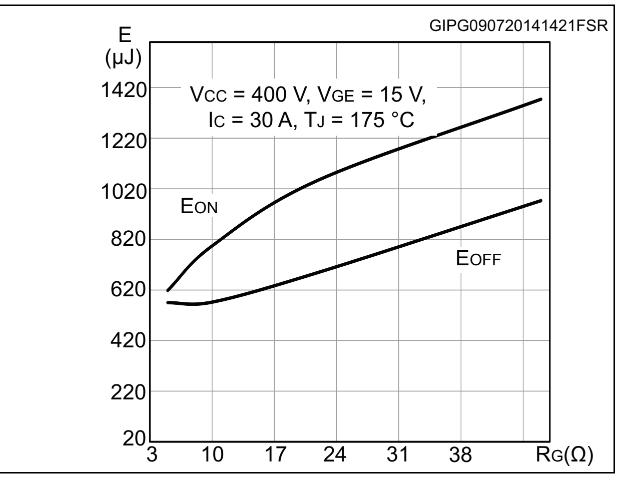


Figure 18. Switching loss vs temperature

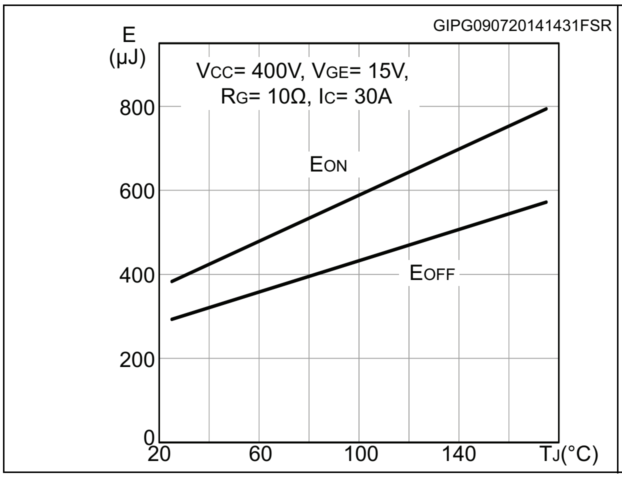


Figure 19. Switching loss vs collector-emitter voltage

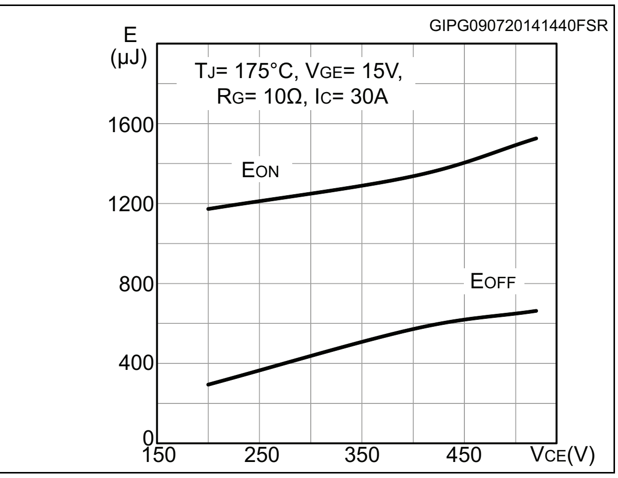


Figure 20. Switching times vs. collector current

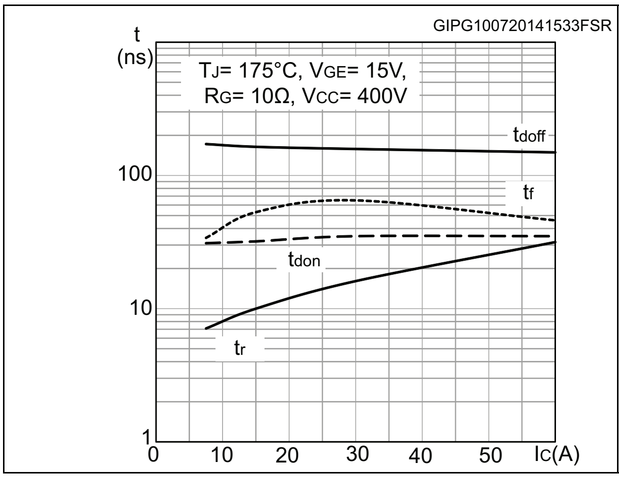


Figure 21. Switching times vs. gate resistance

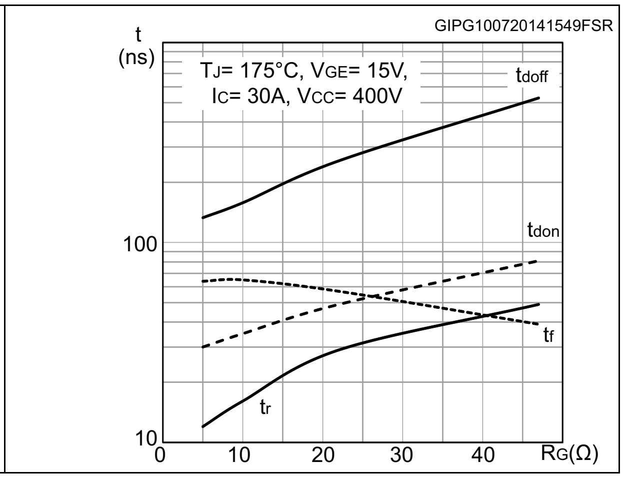


Figure 22. Reverse recovery current vs. diode current slope

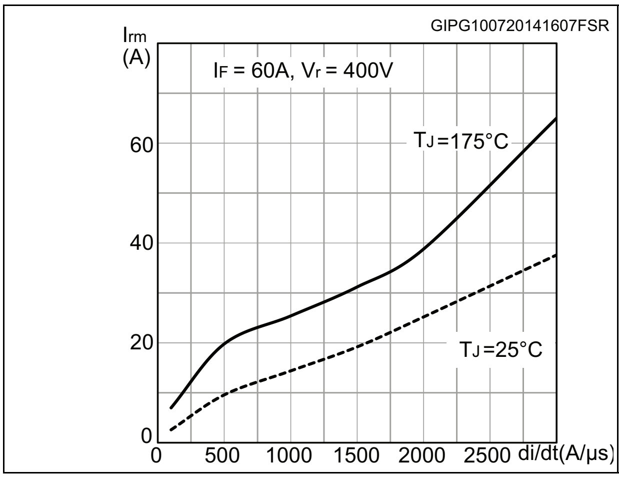


Figure 23. Reverse recovery time vs. diode current slope

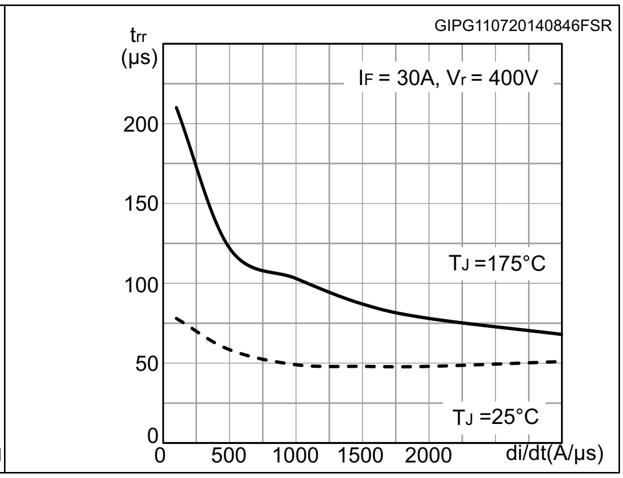


Figure 24. Reverse recovery charge vs. diode current slope

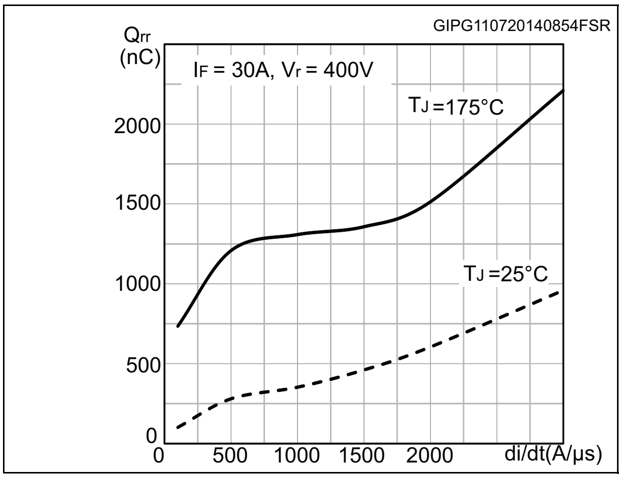


Figure 25. Reverse recovery energy vs. diode current slope

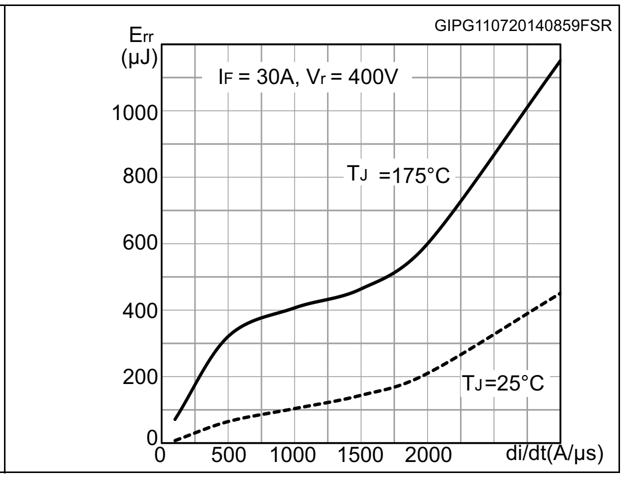


Figure 26. Thermal impedance for IGBT

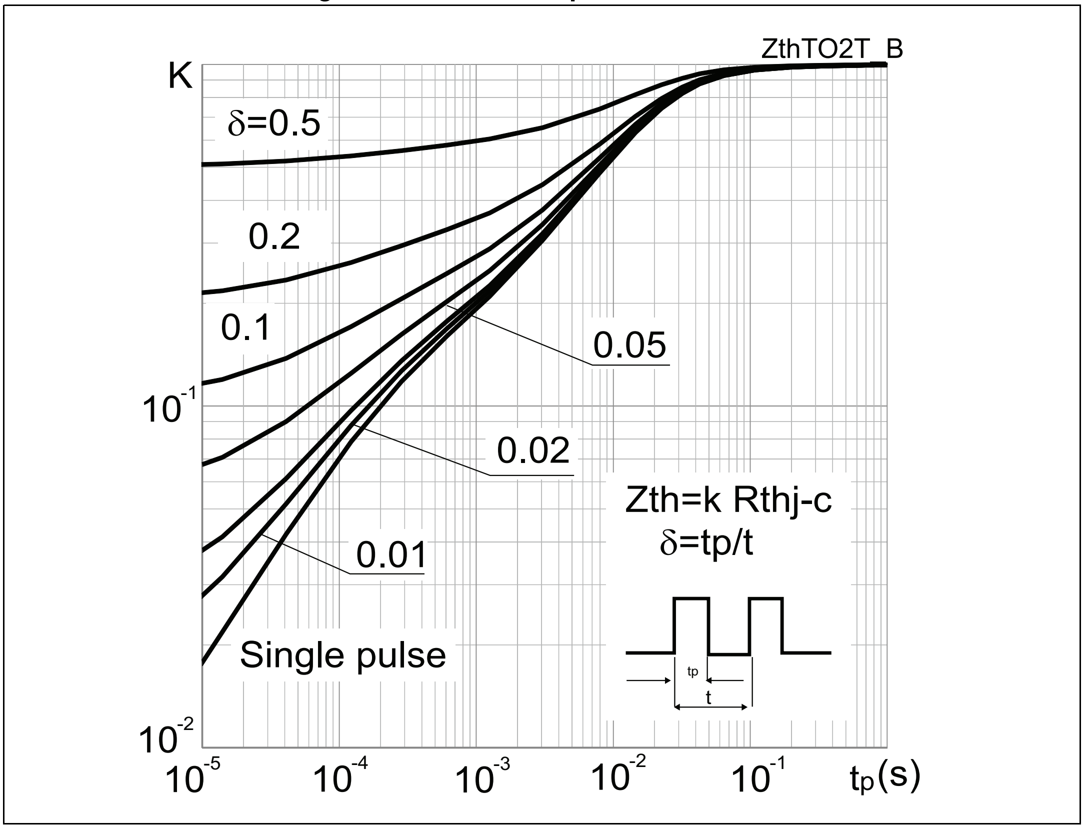
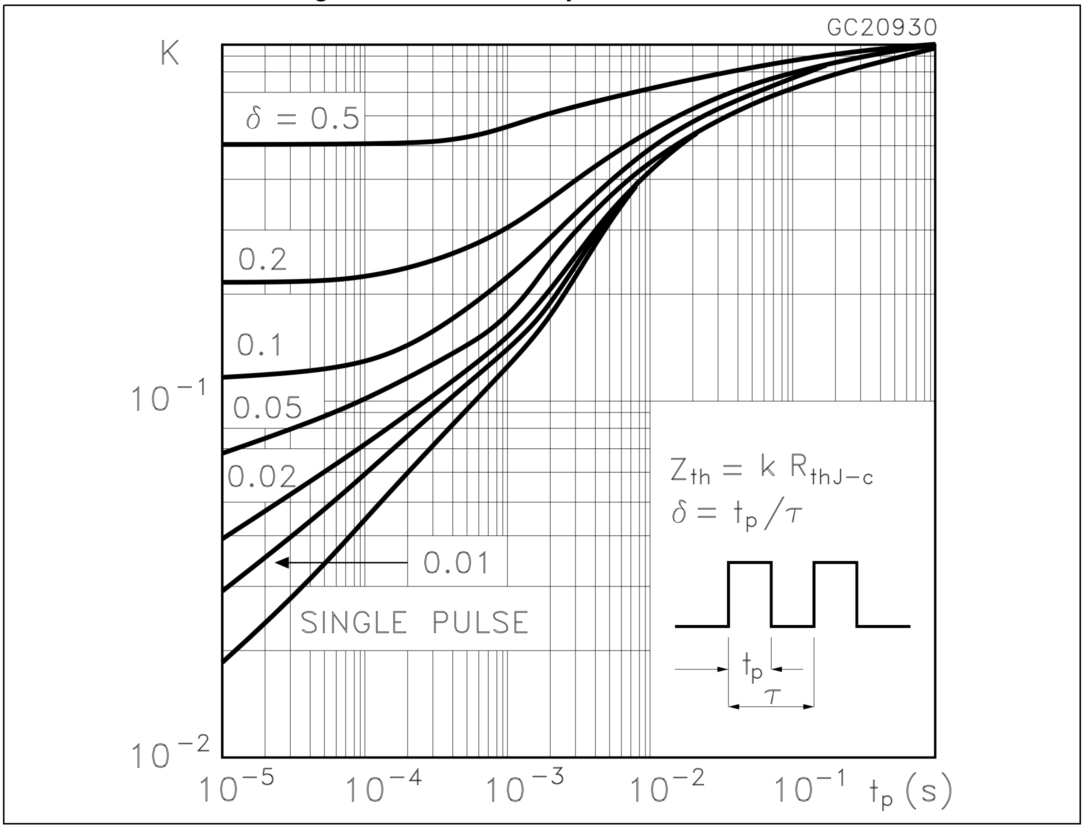


Figure 27. Thermal impedance for diode



3 Test circuits

Figure 28. Test circuit for inductive load switching

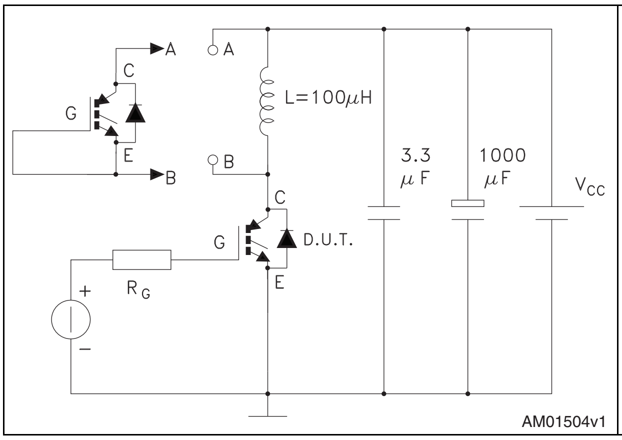


Figure 29. Gate charge test

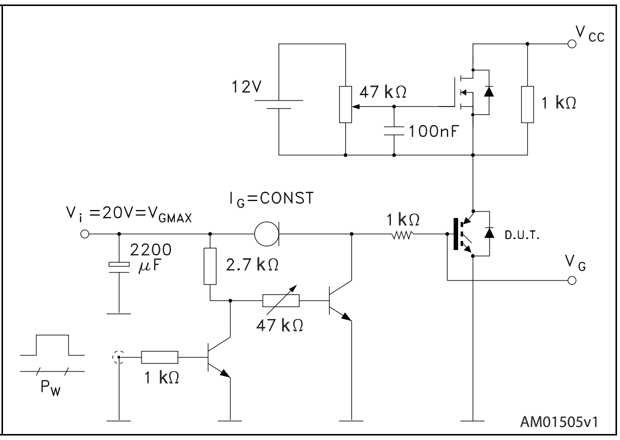


Figure 30. Switching waveform

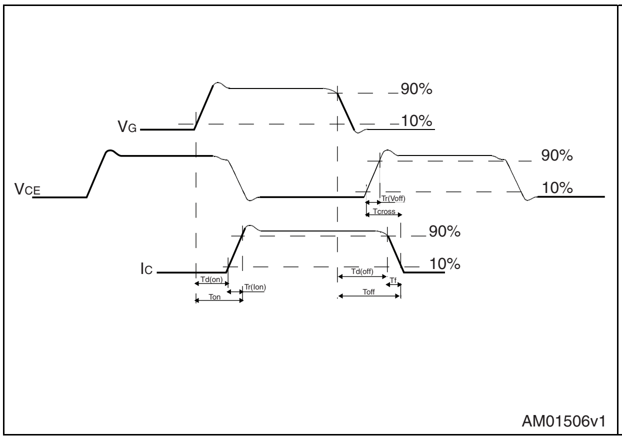
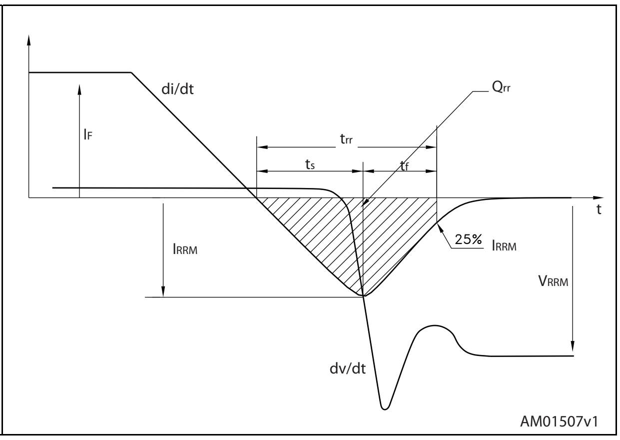


Figure 31. Diode reverse recovery waveform



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.

4.1 D²PAK, STGB30H60DFB

Figure 32. D²PAK (TO-263) drawing

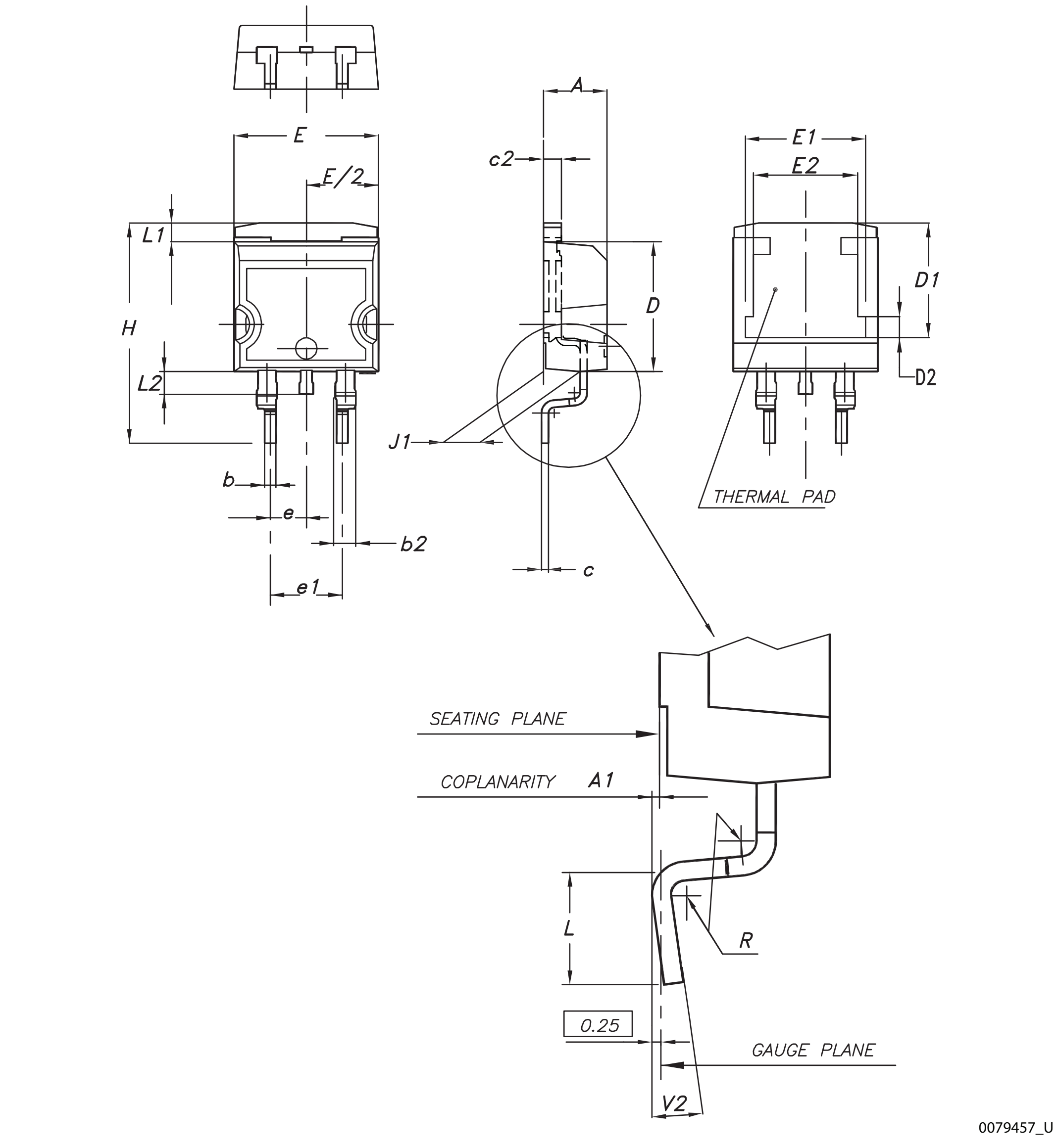
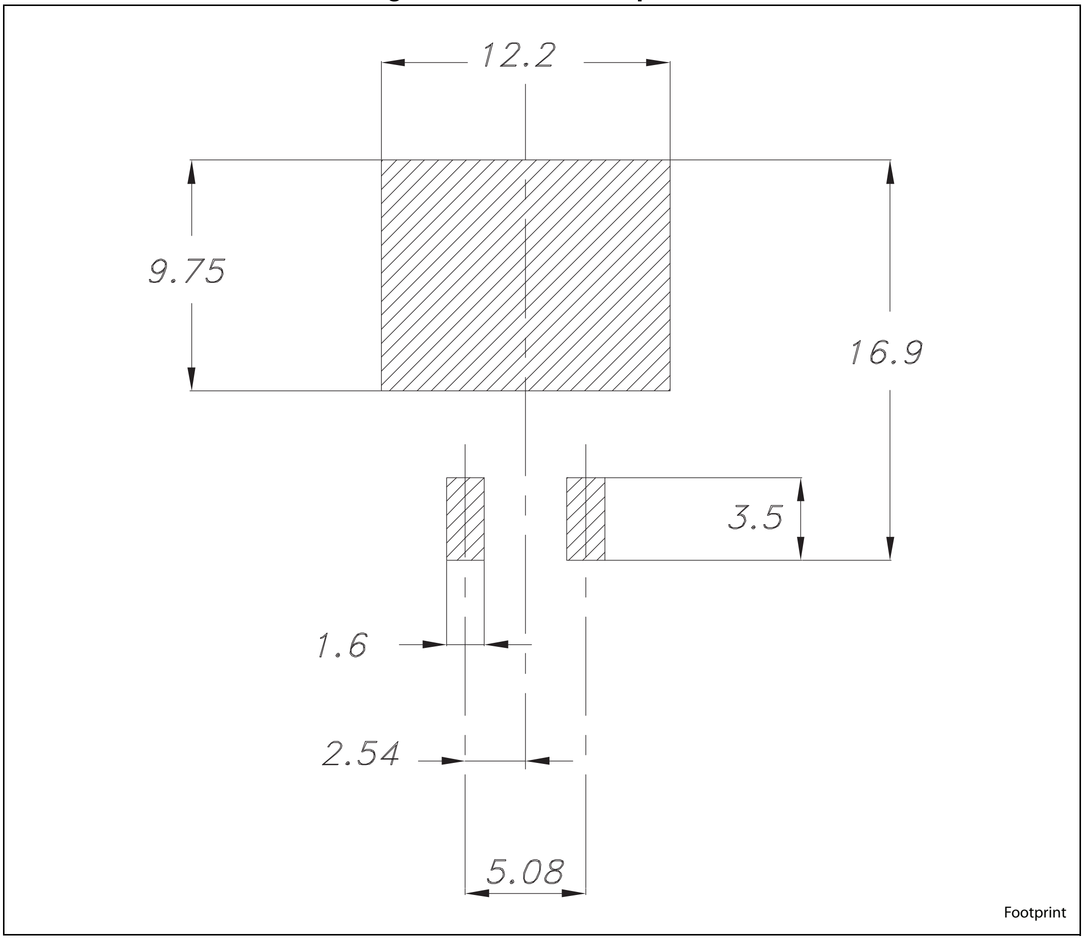


Table 8. D²PAK (TO-263) mechanical data

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		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		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 33. D²PAK footprint[a]



a. All dimension are in millimeters

4.2 TO-220, STGP30H60DFB

Figure 34. TO-220 type A drawing

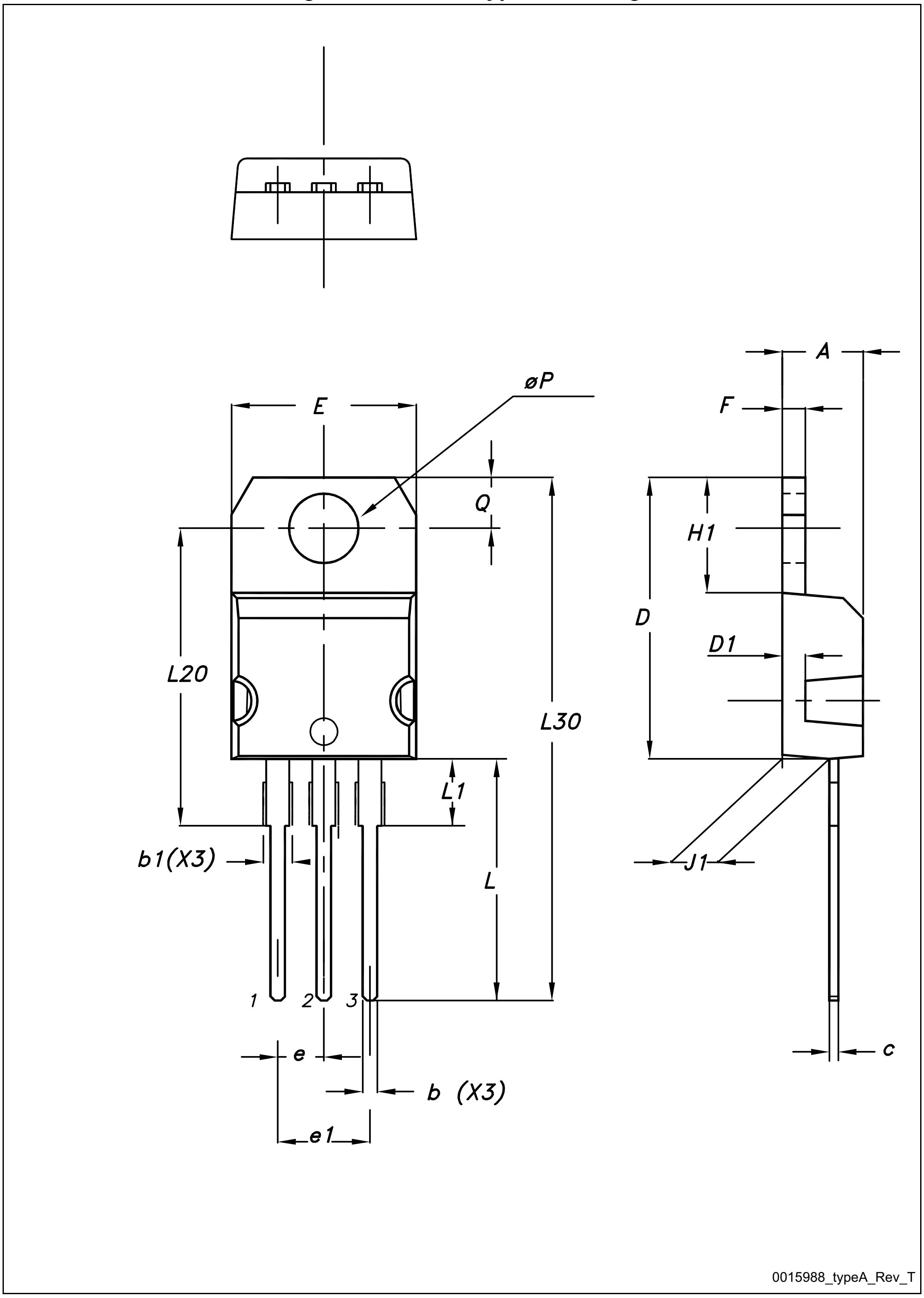


Table 9. TO-220 type A mechanical data

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	
øP	3.75		3.85
Q	2.65		2.95

5 Packaging mechanical data

Figure 35. Tape

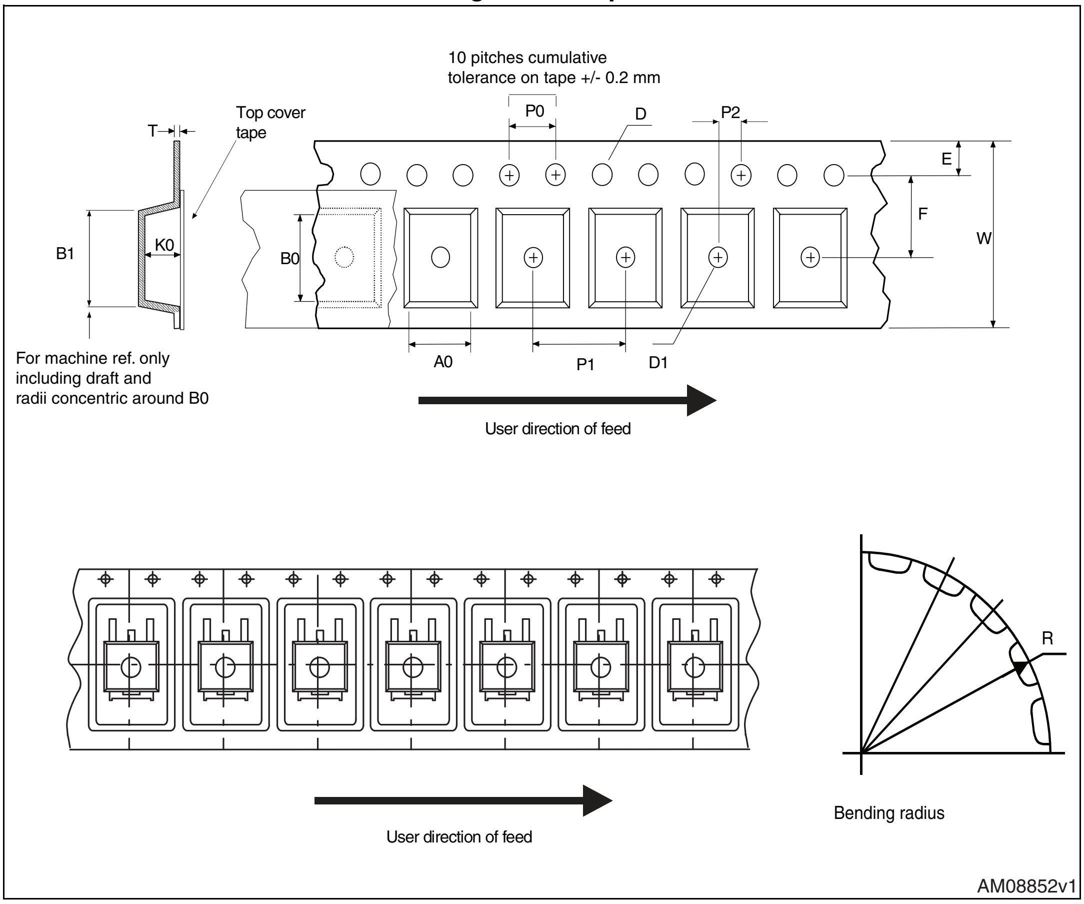


Figure 36. Reel

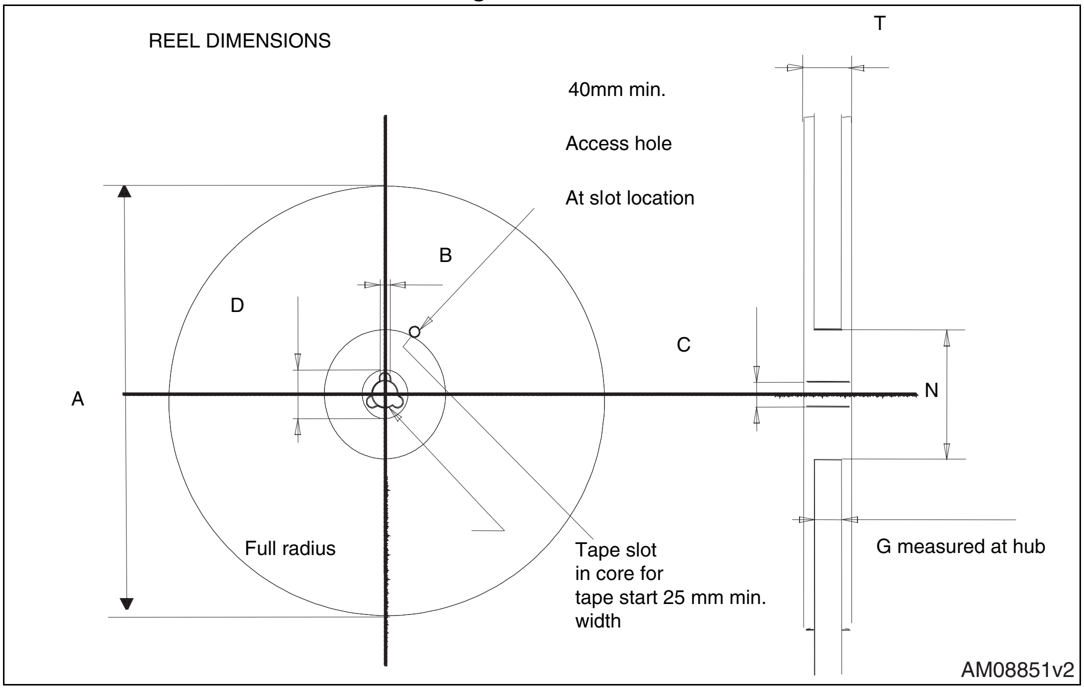


Table 10. D²PAK (TO-263) tape and reel mechanical data

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 qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

6 Revision history

Table 11. Document revision history

Date	Revision	Changes
07-Aug-2014	1	Initial release.