Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Trench gate field-stop IGBT M series, 650 V, 15 A low-loss

Datasheet - production data

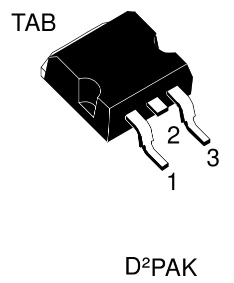
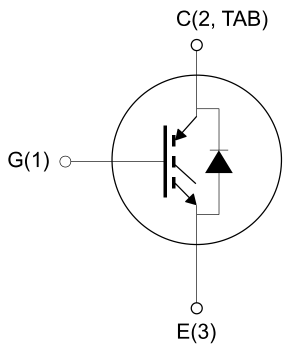


Figure 1: Internal schematic diagram



Features

- 6 µs of short-circuit withstand time
- $V_{CE(sat)}$ = 1.55 V (typ.) @ I_C = 15 A
- Tight parameter distribution
- Safer paralleling
- Low thermal resistance
- Soft and very fast recovery antiparallel diode

Applications

- Motor control
- UPS
- PFC

Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the M series IGBTs, which represent an optimal balance between inverter system performance and efficiency where low-loss and short-circuit functionality are essential. Furthermore, the positive $V_{CE(sat)}$ temperature coefficient and tight parameter distribution result in safer paralleling operation.

Table 1: Device summary

Order code	Marking	Package	Packing
STGB15M65DF2	G15M65DF2	D²PAK	Tape and reel

Contents

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	30	A
	Continuous collector current at T_C = 100 °C	15	
I_{CP} (1)	Pulsed collector current	60	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Continuous forward current at T_C = 25 °C	30	A
	Continuous forward current at T_C = 100 °C	15	
I_{FP} (1)	Pulsed forward current	60	A
P_{TOT}	Total dissipation at T_C = 25 °C	136	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range	- 55 to 175	°C

Notes:

(1)Pulse width limited by maximum junction temperature.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	1.1	°C/W
R_{thJC}	Thermal resistance junction-case diode	2.08	
R_{thJA}	Thermal resistance junction-ambient	62.5	

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 = 2 mA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 15 A		1.55	2.0	V
		V_{GE} = 15 V, I_C = 15 A, T_J = 125 °C		1.9		
		V_{GE} = 15 V, I_C = 15 A, T_J = 175 °C		2.1		
V_F	Forward on-voltage	I_F = 15 A		1.7		V
		I_F = 15 A, T_J = 125 °C		1.5		
		I_F = 15 A, T_J = 175 °C		1.4		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 500 µA	5	6	7	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 650 V			25	µA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			±250	µA

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 V	-	1250	-	pF
C_{oes}	Output capacitance		-	80	-	
C_{res}	Reverse transfer capacitance		-	25	-	
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 15 A, V_{GE} = 15 V (see *Figure 30: " Gate charge test circuit"*)	-	45	-	nC
Q_{ge}	Gate-emitter charge		-	11	-	
Q_{gc}	Gate-collector charge		-	15	-	

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 V, I_C = 15 A, V_{GE} = 15 V, R_G = 12 Ω (see *Figure 29: " Test circuit for inductive load switching"*)		24	-	ns
t_r	Current rise time			7.8	-	ns
$(di/dt)_{on}$	Turn-on current slope			1570	-	A/µs
$t_{d(off)}$	Turn-off-delay time			93	-	ns
t_f	Current fall time			106	-	ns
E_{on} (1)	Turn-on switching energy			0.09	-	mJ
E_{off} (2)	Turn-off switching energy			0.45	-	mJ
E_{ts}	Total switching energy			0.54	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 15 A, V_{GE} = 15 V, R_G = 12 Ω, T_J = 175 °C (see *Figure 29: " Test circuit for inductive load switching"*)		24.8	-	ns
t_r	Current rise time			9.2	-	ns
$(di/dt)_{on}$	Turn-on current slope			1300	-	A/µs
$t_{d(off)}$	Turn-off-delay time			96	-	ns
t_f	Current fall time			169	-	ns
E_{on}	Turn-on switching energy			0.22	-	mJ
E_{off}	Turn-off switching energy			0.61	-	mJ
E_{ts}	Total switching energy			0.83	-	mJ
t_{sc}	Short-circuit withstand time	V_{CC} ≤ 400 V, V_{GE} = 15 V, T_{Jstart} = 150 °C	6		-	µs
		V_{CC} ≤ 400 V, V_{GE} = 13 V, T_{Jstart} = 150 °C	10			

Notes:

(1)Including the reverse recovery of the diode.

(2)Including 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 = 15 A, V_R = 400 V, V_{GE} = 15 V (see Figure 29: " Test circuit for inductive load switching") di/dt = 1000 A/µs	-	142	-	ns
Q_{rr}	Reverse recovery charge		-	525	-	nC
I_{rrm}	Reverse recovery current		-	13.4	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	790	-	A/µs
E_{rr}	Reverse recovery energy		-	64	-	µJ
t_{rr}	Reverse recovery time	I_F = 15 A, V_R = 400 V, V_{GE} = 15 V, T_J = 175 °C (see Figure 29: " Test circuit for inductive load switching") di/dt = 1000 A/µs	-	241	-	ns
Q_{rr}	Reverse recovery charge		-	1690	-	nC
I_{rrm}	Reverse recovery current		-	20	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	420	-	A/µs
E_{rr}	Reverse recovery energy		-	176	-	µJ

2.1 Electrical characteristics (curves)

Figure 2: Power dissipation vs. case temperature

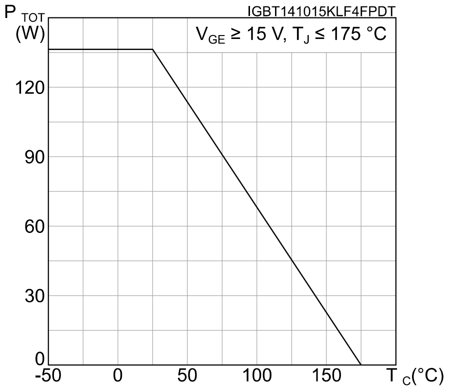


Figure 3: Collector current vs. case temperature

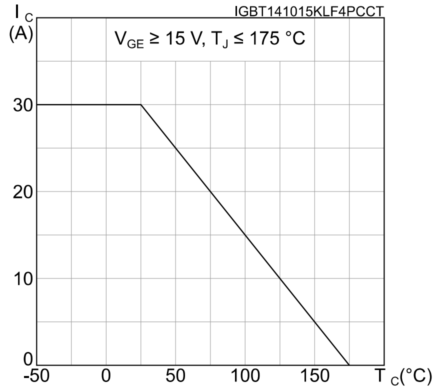


Figure 4: Output characteristics (T_J = 25 °C)

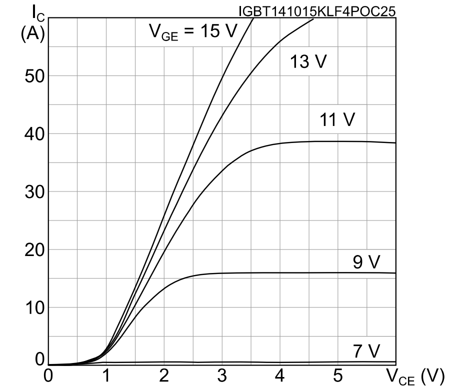


Figure 5: Output characteristics (T_J = 175 °C)

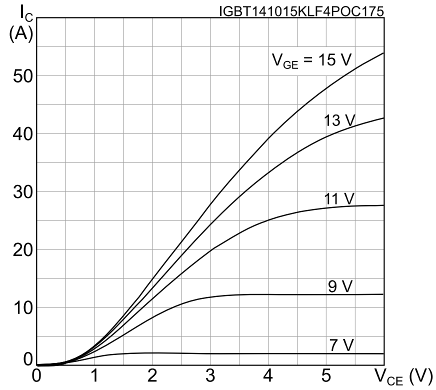


Figure 6: $V_{CE(sat)}$ vs. junction temperature

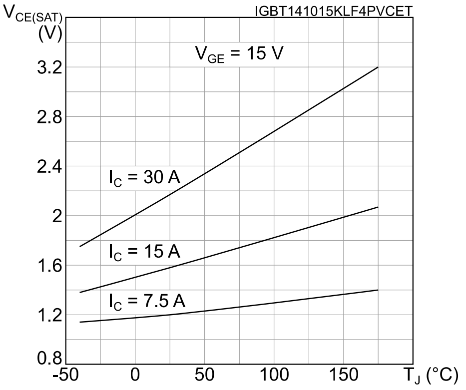


Figure 7: $V_{CE(sat)}$ vs. collector current

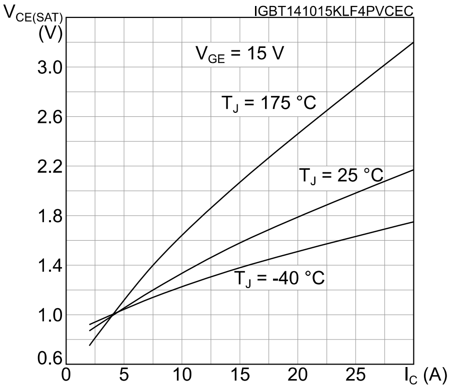


Figure 8: Collector current vs. switching frequency

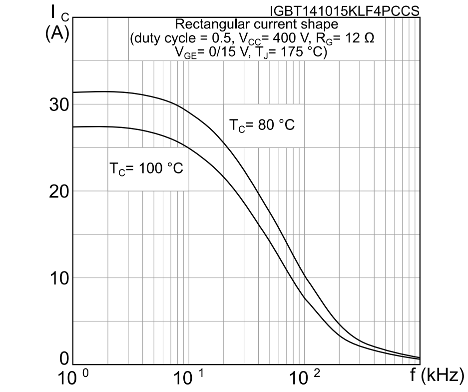


Figure 9: Forward bias safe operating area

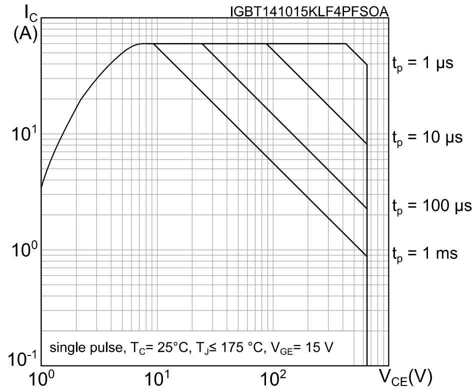


Figure 10: Transfer characteristics

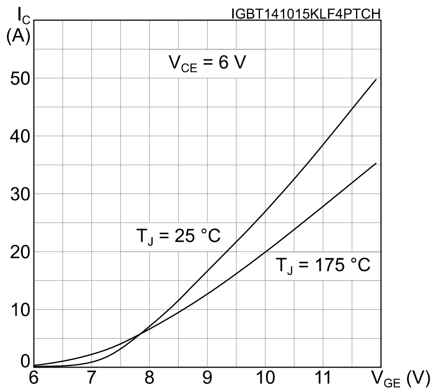


Figure 11: Diode V_F vs. forward current

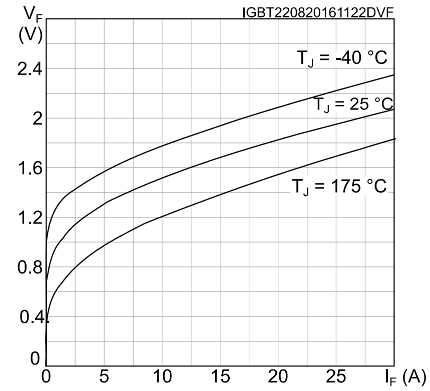


Figure 12: Normalized $V_{GE(th)}$ vs. junction temperature

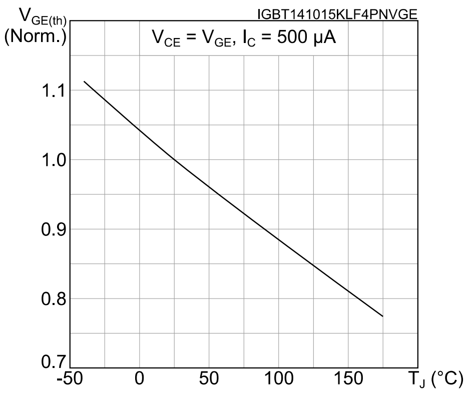


Figure 13: Normalized $V_{(BR)CES}$ vs. junction temperature

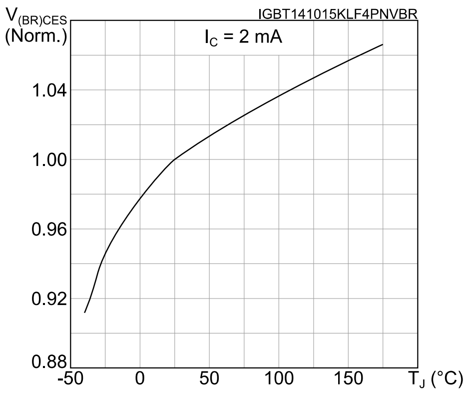


Figure 14: Capacitance variations

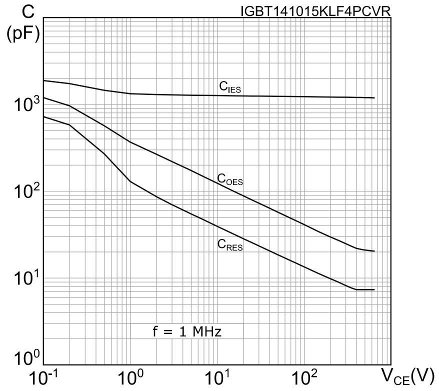


Figure 15: Gate charge vs. gate-emitter voltage

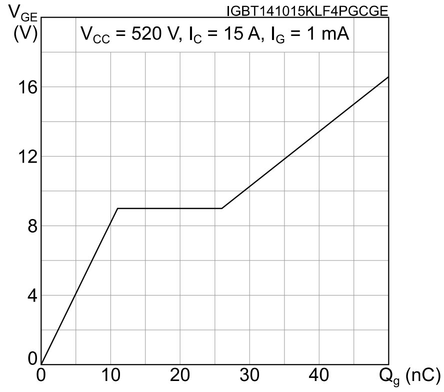


Figure 16: Switching energy vs. collector current

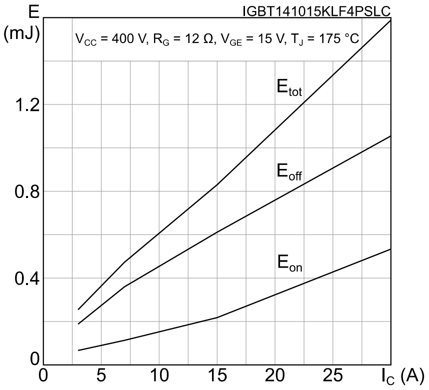


Figure 17: Switching energy vs. gate resistance

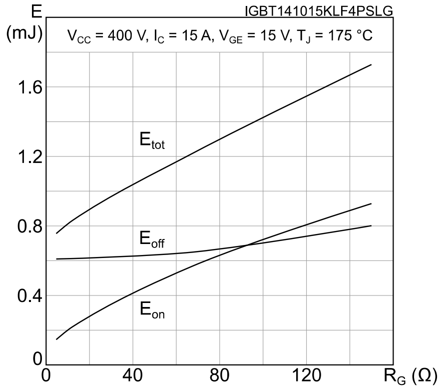


Figure 18: Switching energy vs. temperature

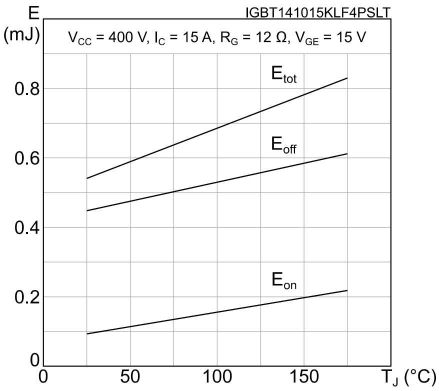


Figure 19: Switching energy vs. collector emitter voltage

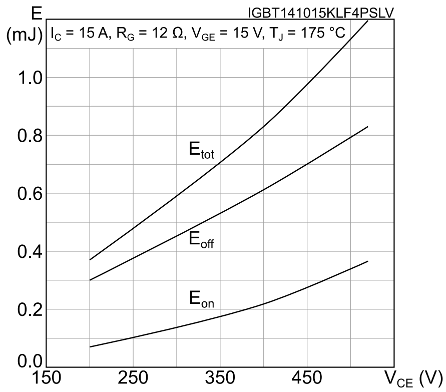


Figure 20: Short-circuit time and current vs. V_{GE}

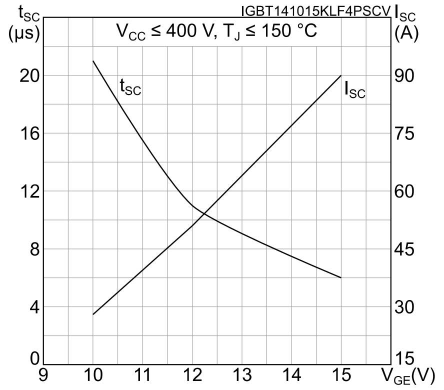


Figure 21: Switching times vs. collector current

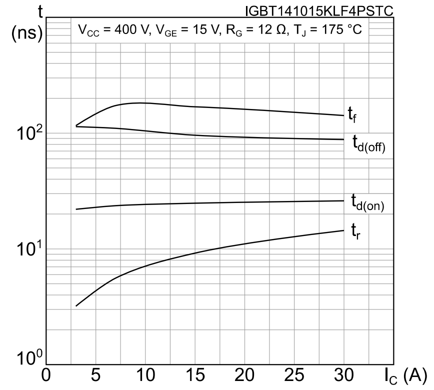


Figure 22: Switching times vs. gate resistance

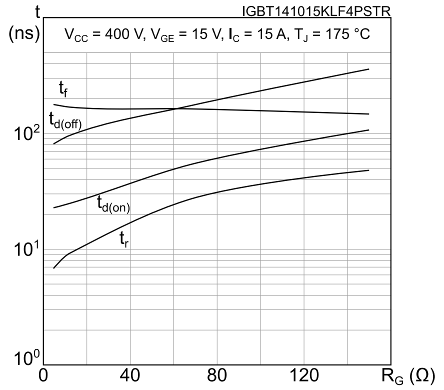


Figure 23: Reverse recovery current vs. diode current slope

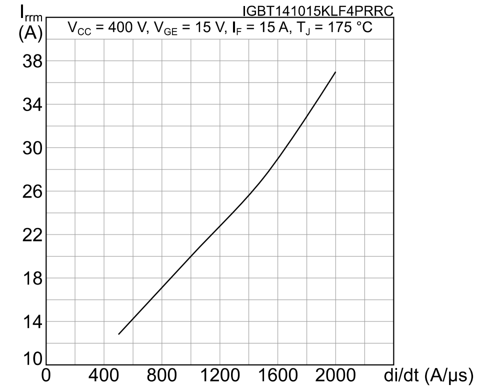


Figure 24: Reverse recovery time vs. diode current slope

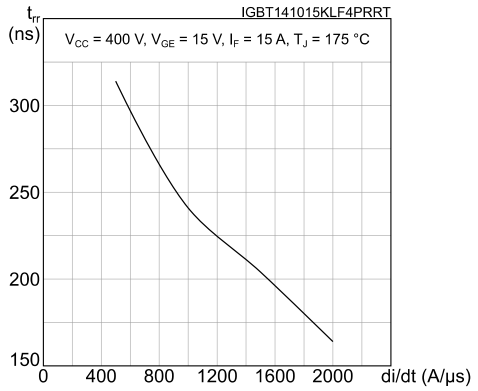


Figure 25: Reverse recovery charge vs. diode current slope

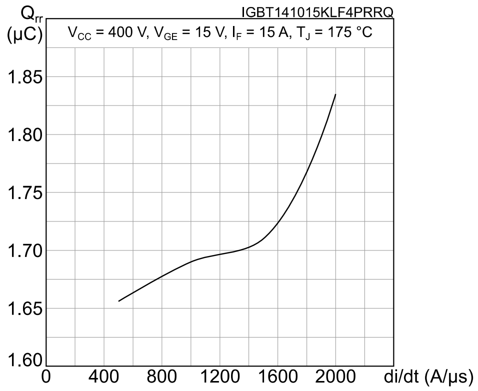


Figure 26: Reverse recovery energy vs. diode current slope

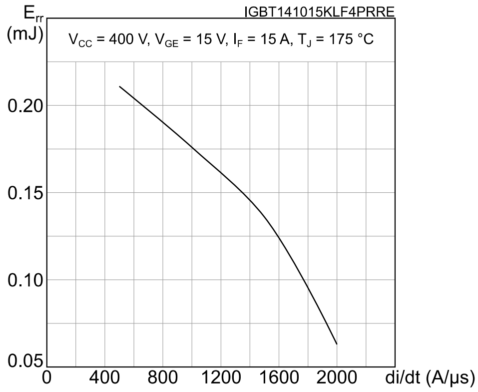


Figure 27: Thermal impedance for IGBT

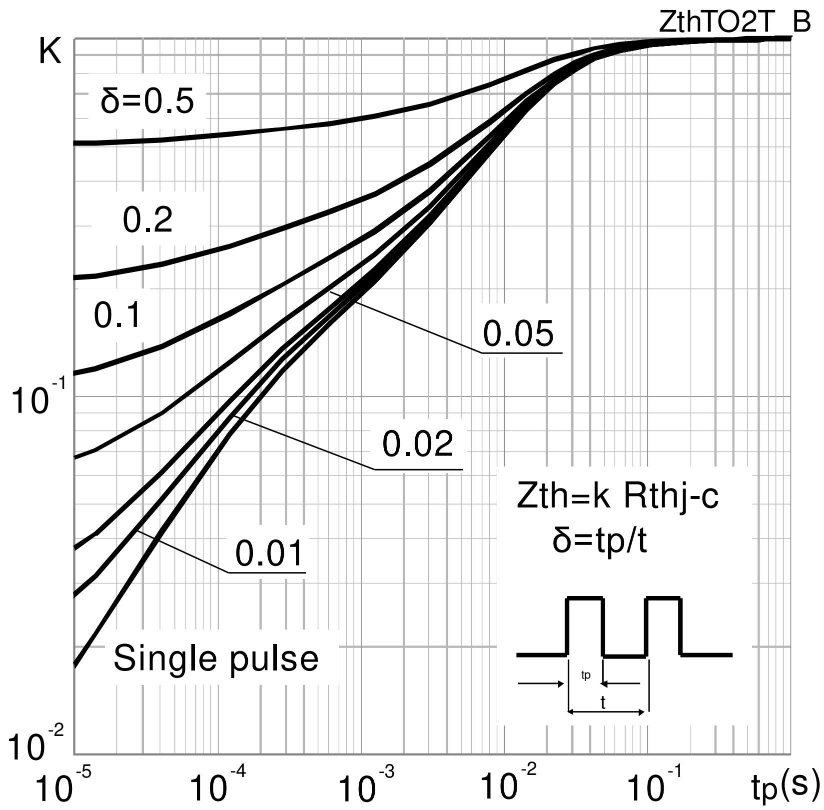
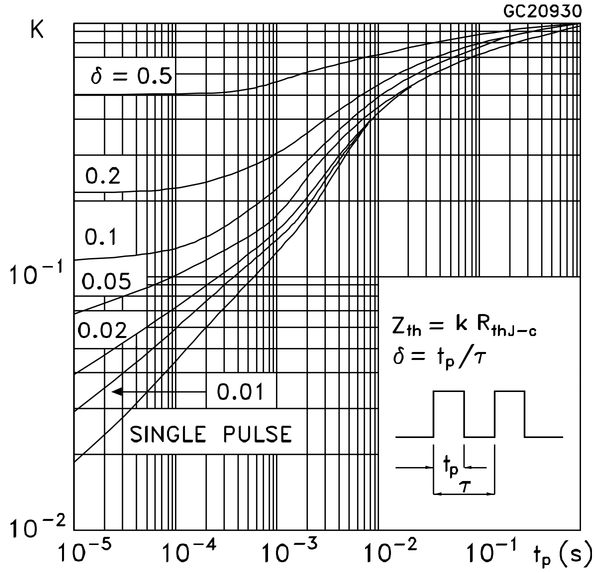


Figure 28: Thermal impedance for diode



3 Test circuits

Figure 29: Test circuit for inductive load switching

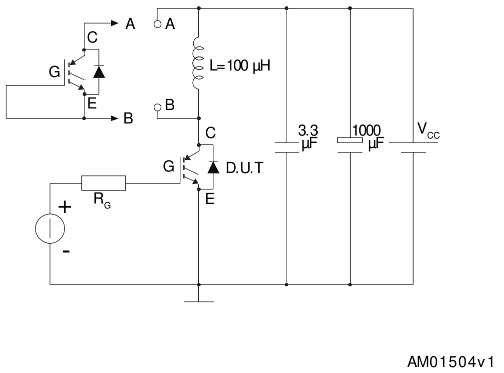


Figure 30: Gate charge test circuit

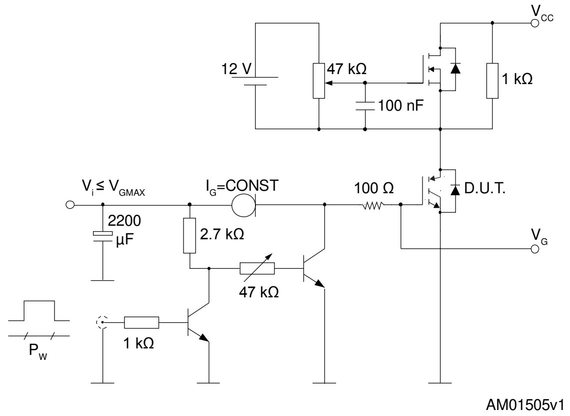


Figure 31: Switching waveform

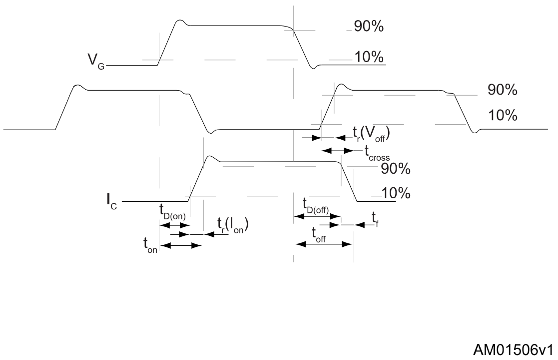
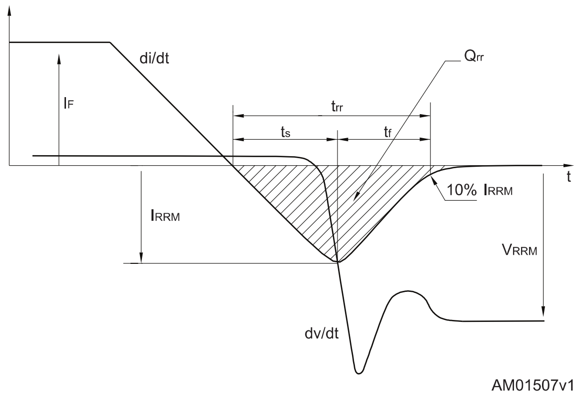


Figure 32: Diode reverse recovery waveform



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 D²PAK (TO-263) type A package information

Figure 33: D²PAK (TO-263) type A package outline

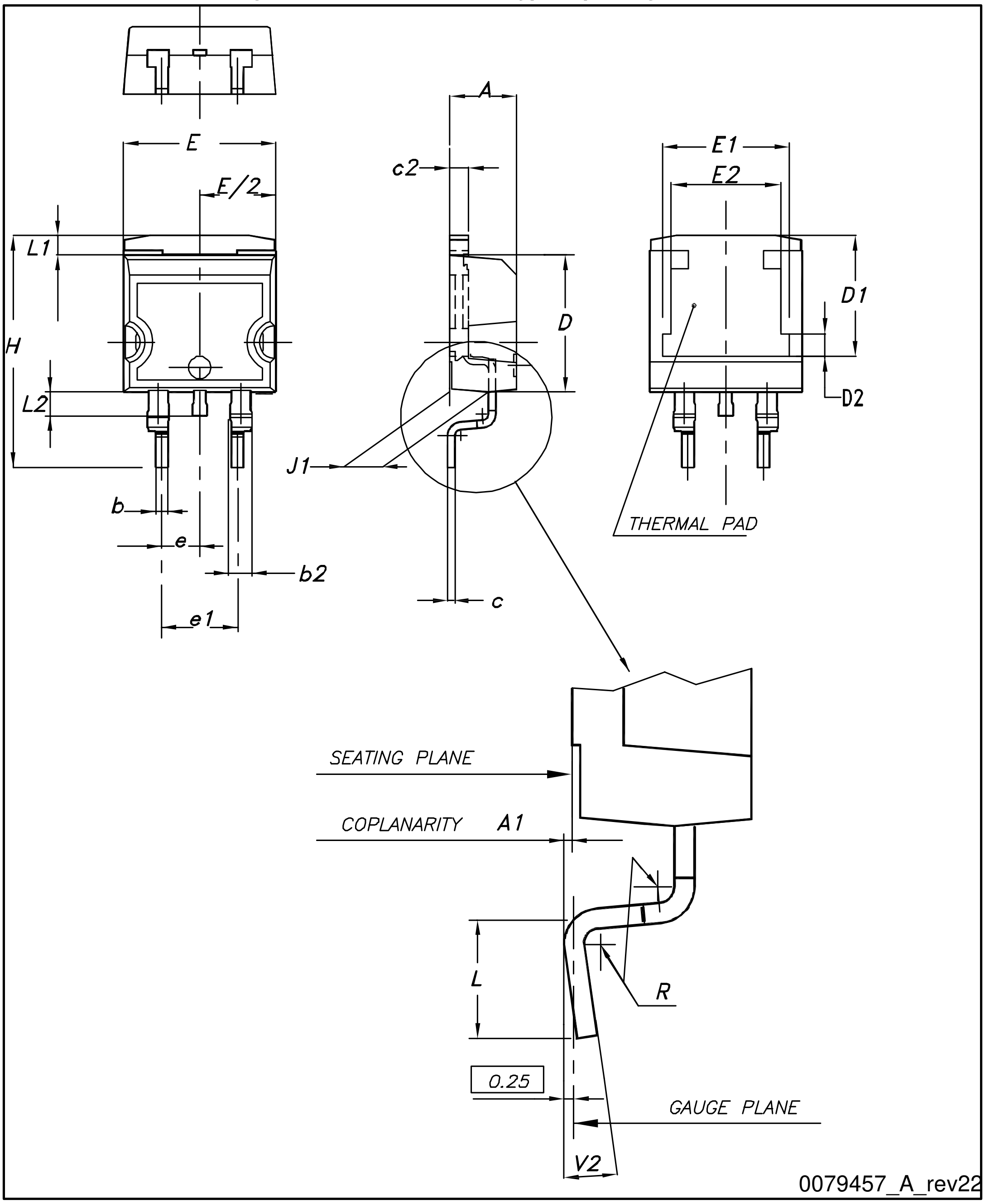
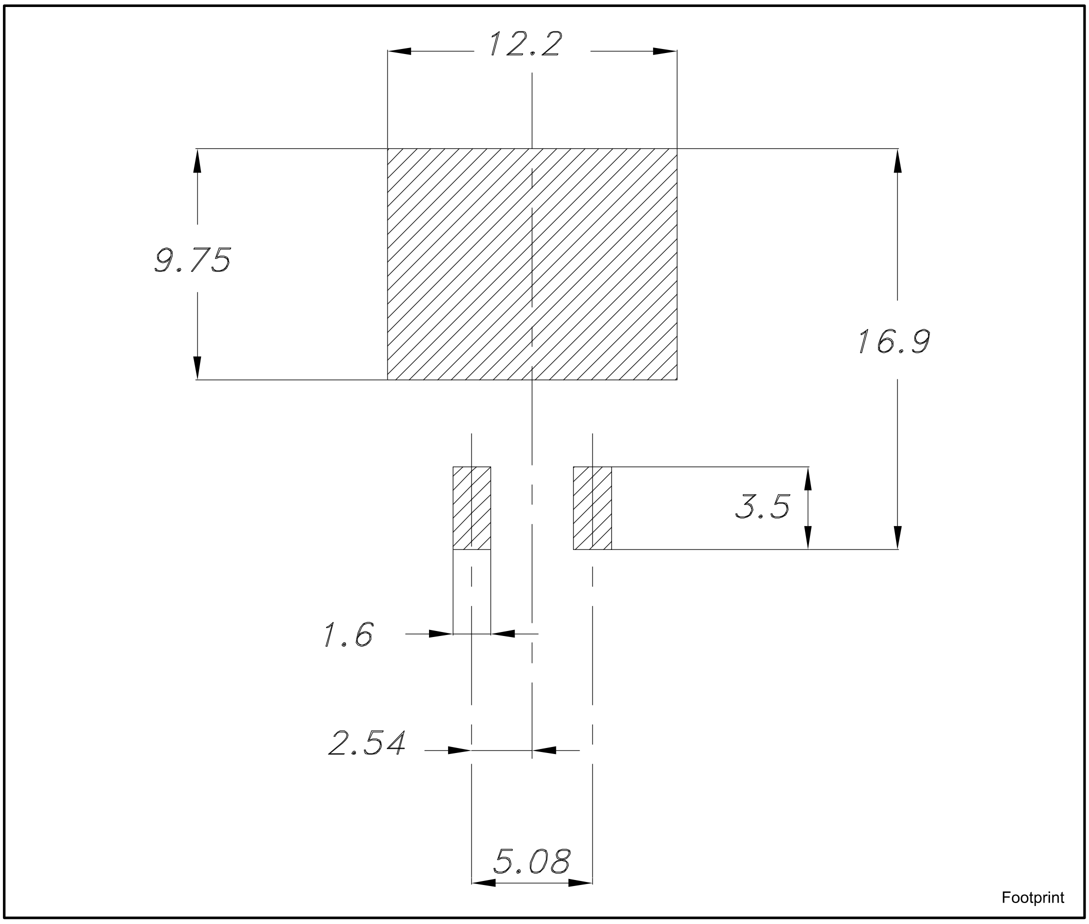


Table 8: D²PAK (TO-263) type A package mechanical data

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		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 34: D²PAK (TO-263) recommended footprint (dimensions are in mm)



4.2 D²PAK packing information

Figure 35: Tape outline

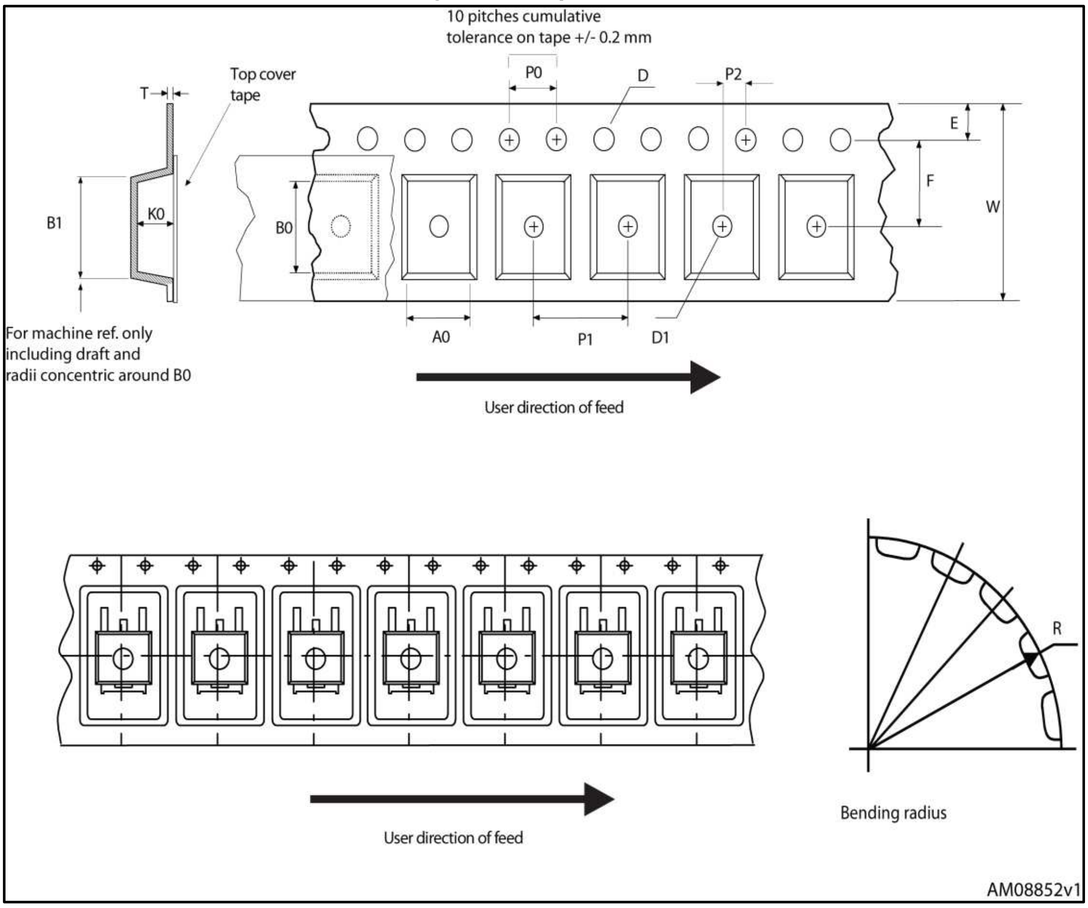


Figure 36: Reel outline

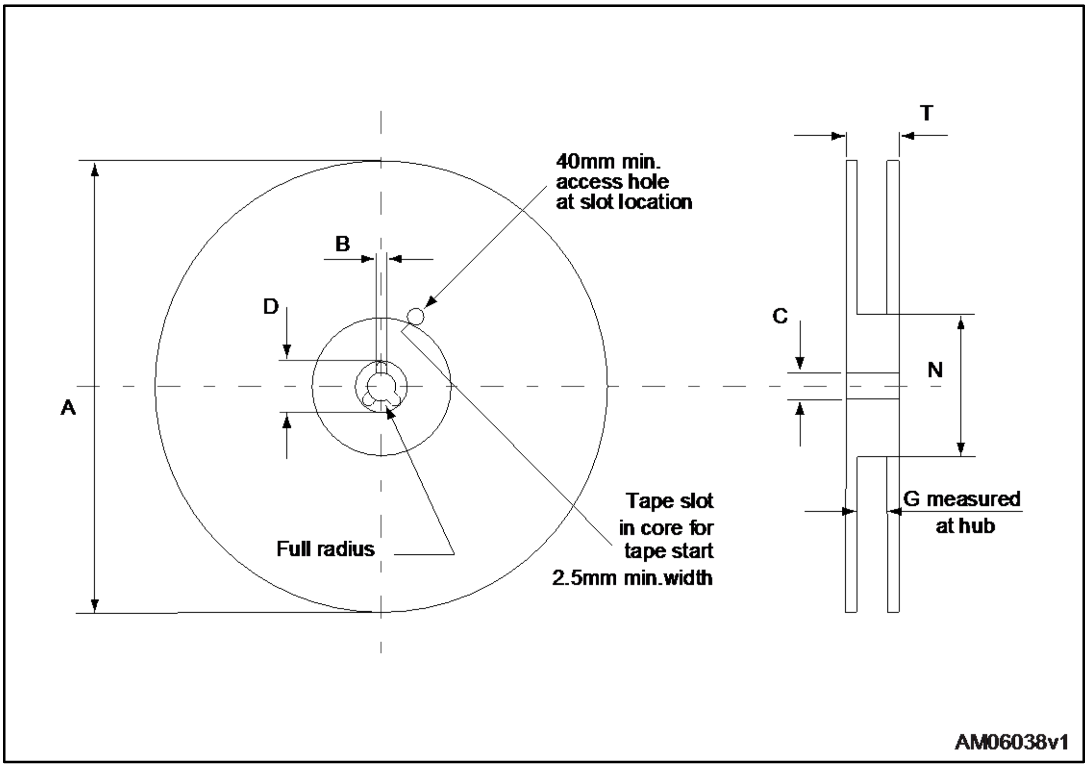


Table 9: D²PAK tape and reel mechanical data

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 10: Document revision history

Date	Revision	Changes
14-Oct-2015	1	First release.
13-Nov-2015	2	Document status promoted from preliminary to production data.
22-Aug-2016	3	Updated *Table 2: "Absolute maximum ratings"* and *Table 6: "IGBT switching characteristics (inductive load)"*. Updated *Figure 16: "Switching energy vs. collector current"*, *Figure 17: "Switching energy vs. gate resistance"*, *Figure 18: "Switching energy vs. temperature"* and *Figure 19: "Switching energy vs. collector emitter voltage"*. Changed *Figure 11: "Diode VF vs. forward current"*.