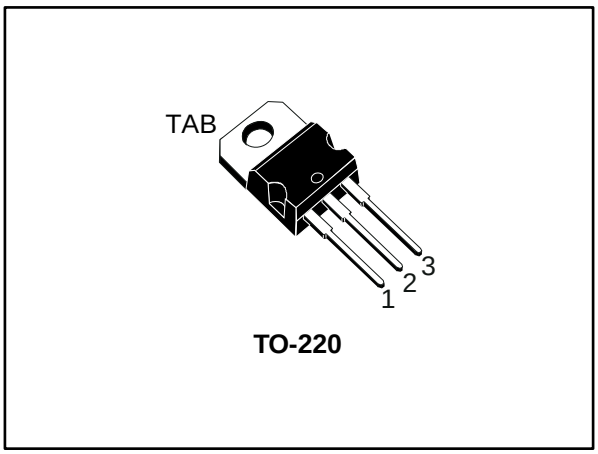
STGP10M65DF2

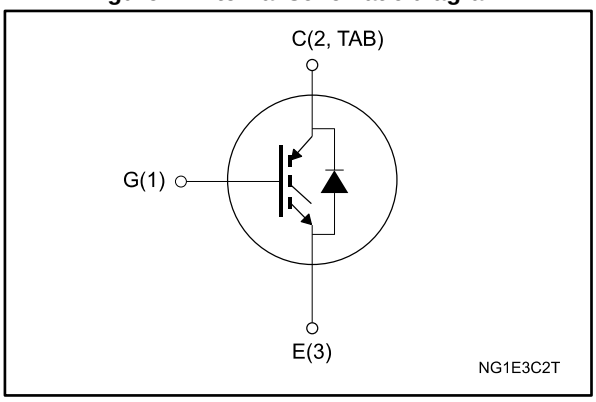
Trench gate field-stop IGBT, M series 650 V, 10 A low-loss in TO-220 package

Datasheet - production data



TO-220

Figure 1: Internal schematic diagram



Features

- 6 µs of short-circuit withstand time
- $V_{CE(sat)}$ = 1.55 V (typ.) @ I_C = 10 A
- Tight parameter distribution
- Safer paralleling
- Positive $V_{CE(sat)}$ temperature coefficient
- Low thermal resistance
- Soft and very fast recovery antiparallel diode
- Maximum junction temperature: T_J = 175 °C

Applications

- Motor control
- UPS
- PFC
- General purpose inverter

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
STGP10M65DF2	G10M65DF2	TO-220	Tube

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	20	A
	Continuous collector current at T_C = 100 °C	10	
I_{CP}(1)	Pulsed collector current	40	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Continuous forward current at T_C = 25 °C	20	A
	Continuous forward current at T_C = 100 °C	10	
I_{FP}(1)	Pulsed forward current	40	A
P_{TOT}	Total dissipation at T_C = 25 °C	115	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range	- 55 to 175	

Notes:

(1)Pulse width limited by maximum junction temperature.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	1.3	°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 = 250 µA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 10 A		1.55	2.0	V
		V_{GE} = 15 V, I_C = 10 A, T_J = 125 °C		1.9		
		V_{GE} = 15 V, I_C = 10 A, T_J = 175 °C		2.1		
V_F	Forward on-voltage	I_F = 10 A		1.5	2.25	V
		I_F = 10 A, T_J = 125 °C		1.3		
		I_F = 10 A, T_J = 175 °C		1.2		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 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	-	840	-	pF
C_{oes}	Output capacitance		-	63	-	
C_{res}	Reverse transfer capacitance		-	16	-	
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 10 A, V_{GE} = 0 to 15 V (see *Figure 30: " Gate charge test circuit"*)	-	28	-	nC
Q_{ge}	Gate-emitter charge		-	6	-	
Q_{gc}	Gate-collector charge		-	12	-	

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 = 10 A, V_{GE} = 15 V, R_G = 22 Ω (see *Figure 29: " Test circuit for inductive load switching"*)		19	-	ns
t_r	Current rise time			7.4	-	ns
$(di/dt)_{on}$	Turn-on current slope			1086	-	A/µs
$t_{d(off)}$	Turn-off-delay time			91	-	ns
t_f	Current fall time			92	-	ns
E_{on} (1)	Turn-on switching energy			0.12	-	mJ
E_{off} (2)	Turn-off switching energy			0.27	-	mJ
E_{ts}	Total switching energy			0.39	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 10 A, V_{GE} = 15 V, R_G = 22 Ω, T_J = 175 °C (see *Figure 29: " Test circuit for inductive load switching"*)		18	-	ns
t_r	Current rise time			9	-	ns
$(di/dt)_{on}$	Turn-on current slope			890	-	A/µs
$t_{d(off)}$	Turn-off-delay time			90	-	ns
t_f	Current fall time			170	-	ns
E_{on} (1)	Turn-on switching energy			0.26	-	mJ
E_{off} (2)	Turn-off switching energy			0.4	-	mJ
E_{ts}	Total switching energy			0.66	-	mJ
t_{sc}	Short-circuit withstand time	$V_{CC} \leq$ 400 V, V_{GE} = 13 V, T_{Jstart} = 150 °C	10		-	µs
		$V_{CC} \leq$ 400 V, V_{GE} = 15 V, T_{Jstart} = 150 °C	6		-	µs

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 = 10 A, V_R = 400 V, V_{GE} = 15 V, di/dt = 1000 A/µs (see *Figure 29: " Test circuit for inductive load switching"*)	-	96	-	ns
Q_{rr}	Reverse recovery charge		-	373	-	nC
I_{rrm}	Reverse recovery current		-	13	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	661	-	A/µs
E_{rr}	Reverse recovery energy		-	52	-	µJ
t_{rr}	Reverse recovery time	I_F = 10 A, V_R = 400 V, V_{GE} = 15 V, di/dt = 1000 A/µs, T_J = 175 °C (see *Figure 29: " Test circuit for inductive load switching"*)	-	201	-	ns
Q_{rr}	Reverse recovery charge		-	1352	-	nC
I_{rrm}	Reverse recovery current		-	19	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	405	-	A/µs
E_{rr}	Reverse recovery energy		-	150	-	µJ

2.1 Electrical characteristics (curves)

Figure 2: Power dissipation vs. case temperature

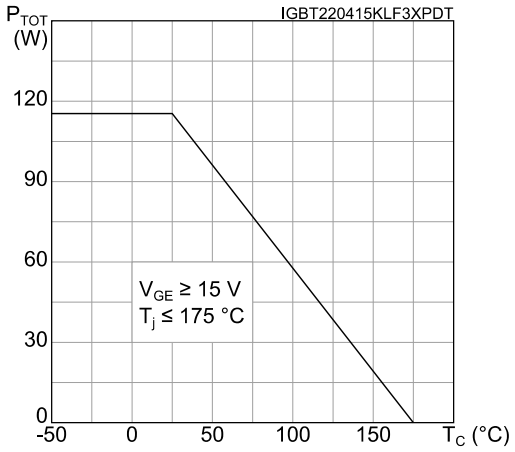


Figure 3: Collector current vs. case temperature

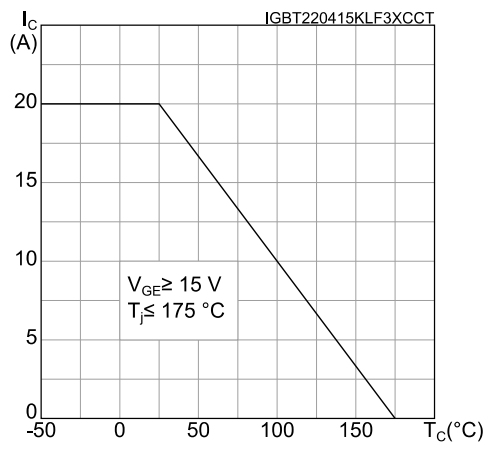


Figure 4: Output characteristics (T_J = 25 °C)

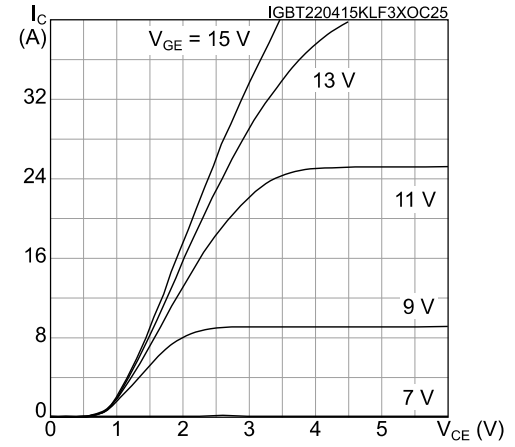


Figure 5: Output characteristics (T_J = 175 °C)

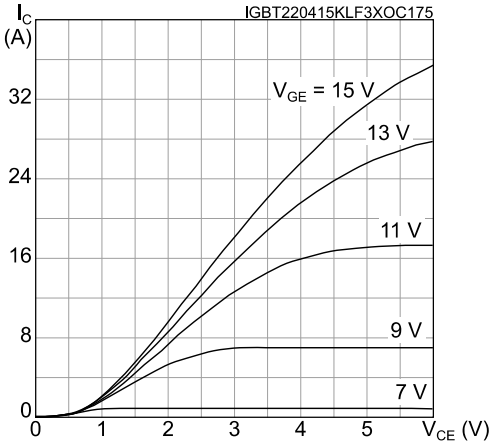


Figure 6: $V_{CE(sat)}$ vs. junction temperature

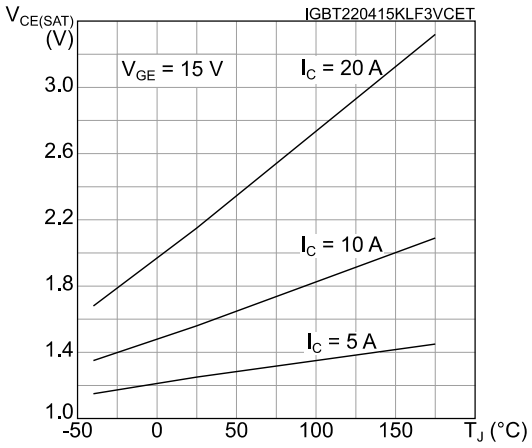


Figure 7: $V_{CE(sat)}$ vs. collector current

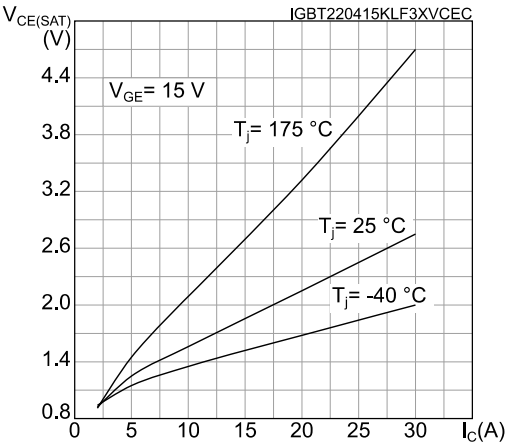


Figure 8: Collector current vs. switching frequency

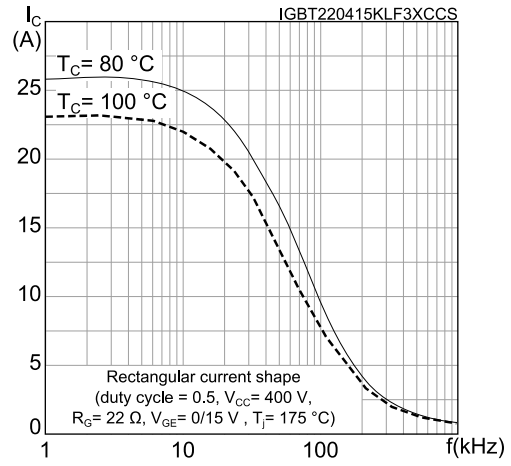


Figure 9: Forward bias safe operating area

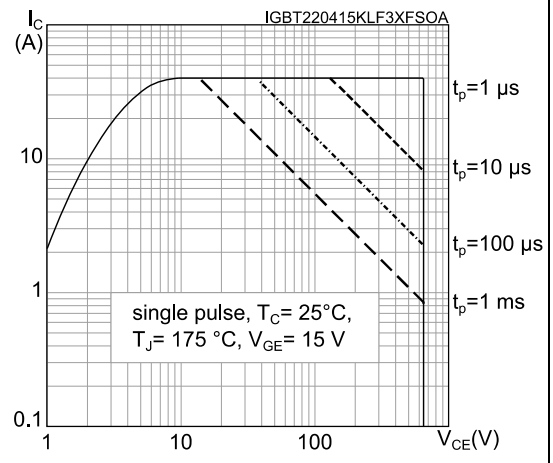


Figure 10: Transfer characteristics

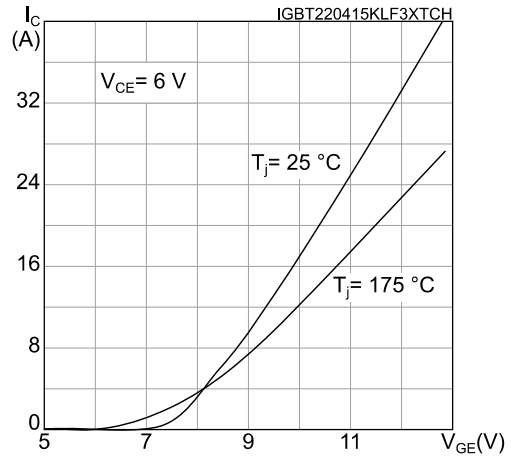


Figure 11: Diode V_F vs. forward current

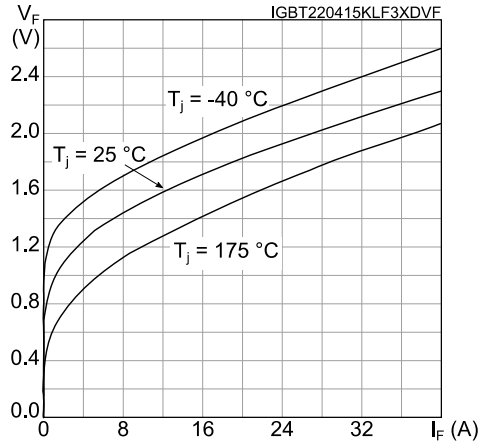


Figure 12: Normalized $V_{GE(th)}$ vs. junction temperature

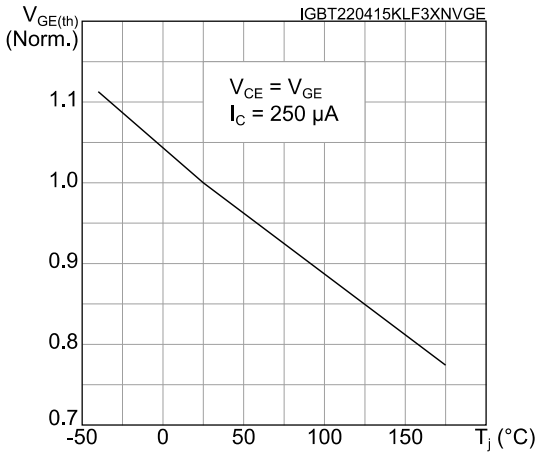


Figure 13: Normalized $V_{(BR)CES}$ vs. junction temperature

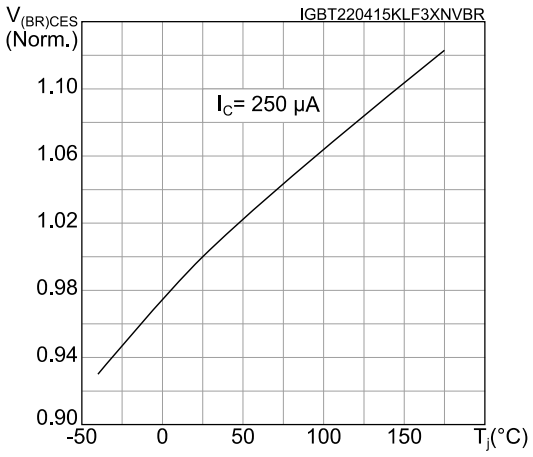


Figure 14: Capacitance variations

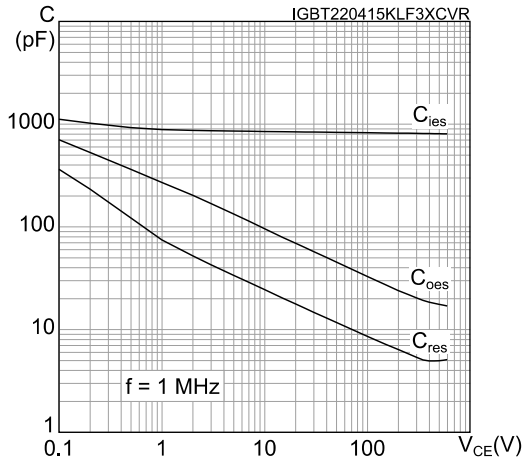


Figure 15: Gate charge vs. gate-emitter voltage

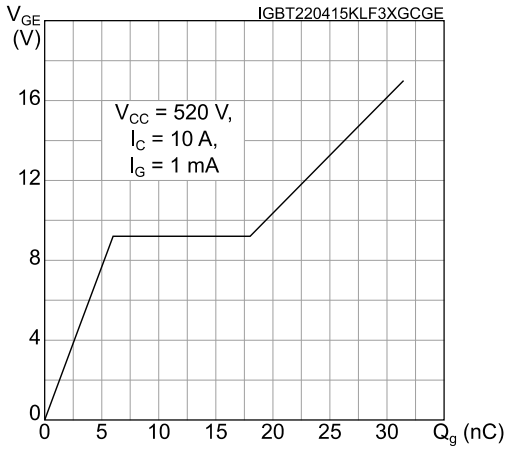


Figure 16: Switching energy vs. collector current

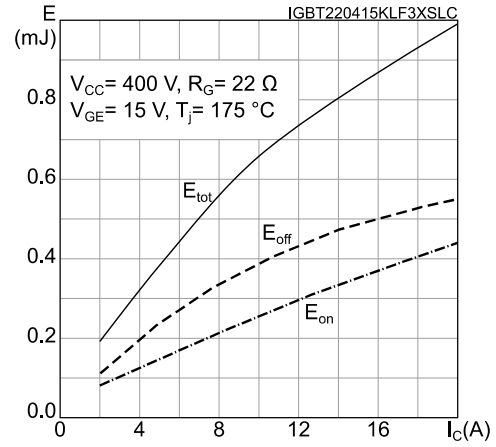


Figure 17: Switching energy vs. gate resistance

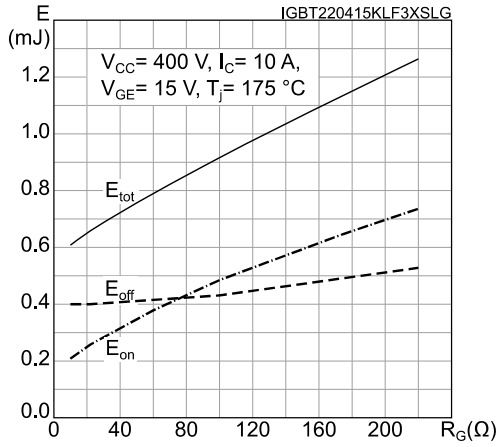


Figure 18: Switching energy vs. temperature

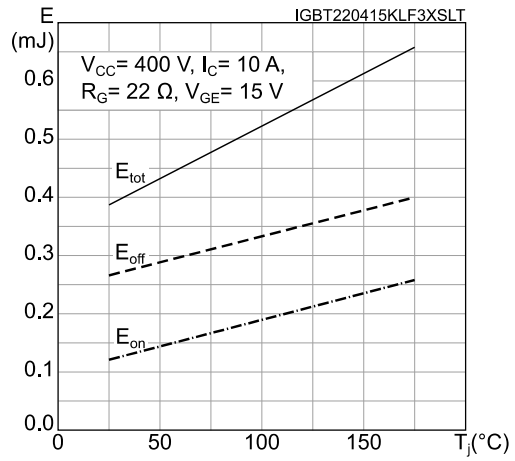


Figure 19: Switching energy vs. collector emitter voltage

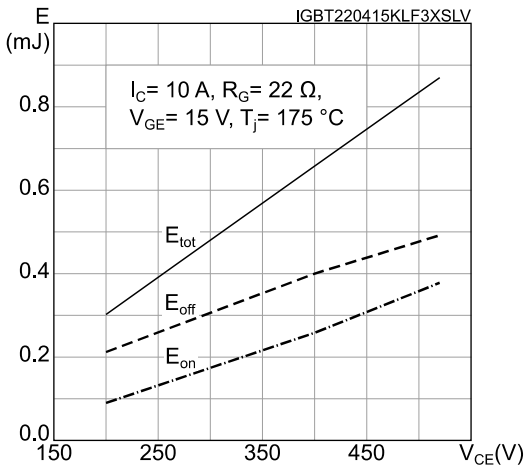


Figure 20: Short-circuit time and current vs. V_{GE}

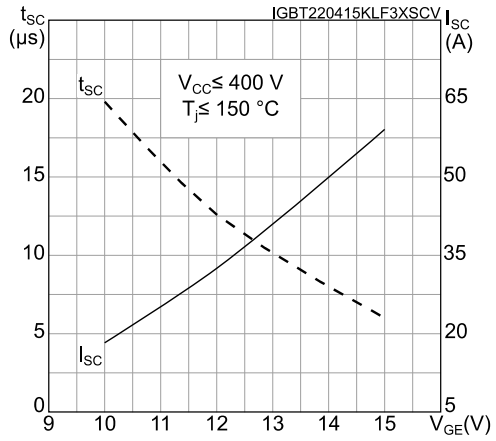


Figure 21: Switching times vs. collector current

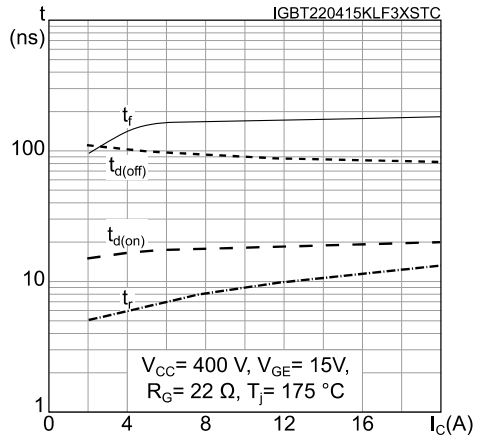


Figure 22: Switching times vs. gate resistance

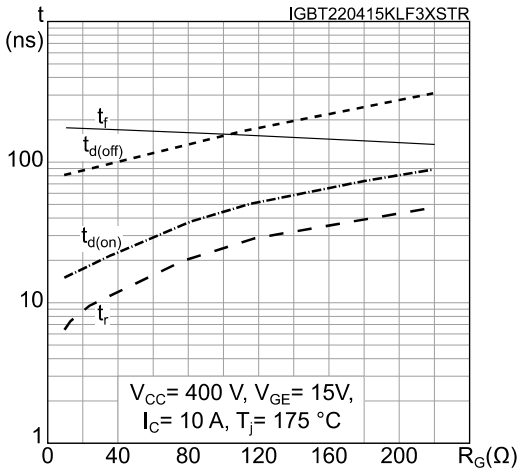


Figure 23: Reverse recovery current vs. diode current slope

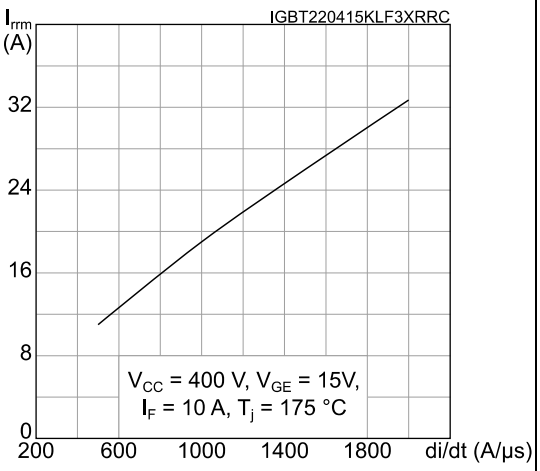


Figure 24: Reverse recovery time vs. diode current slope

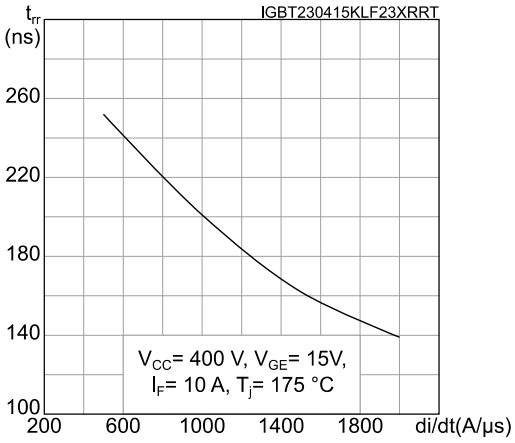


Figure 25: Reverse recovery charge vs. diode current slope

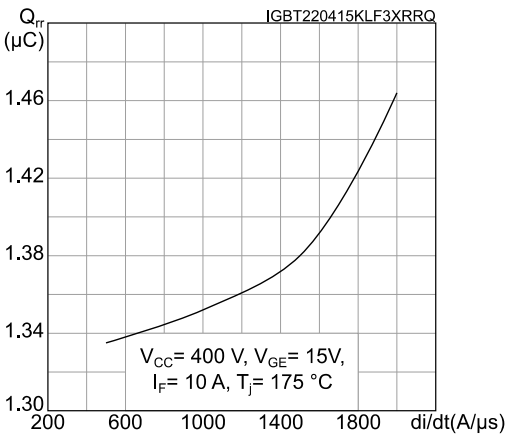


Figure 26: Reverse recovery energy vs. diode current slope

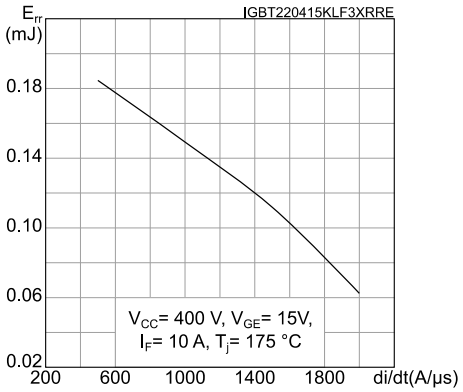


Figure 27: Thermal impedance for IGBT

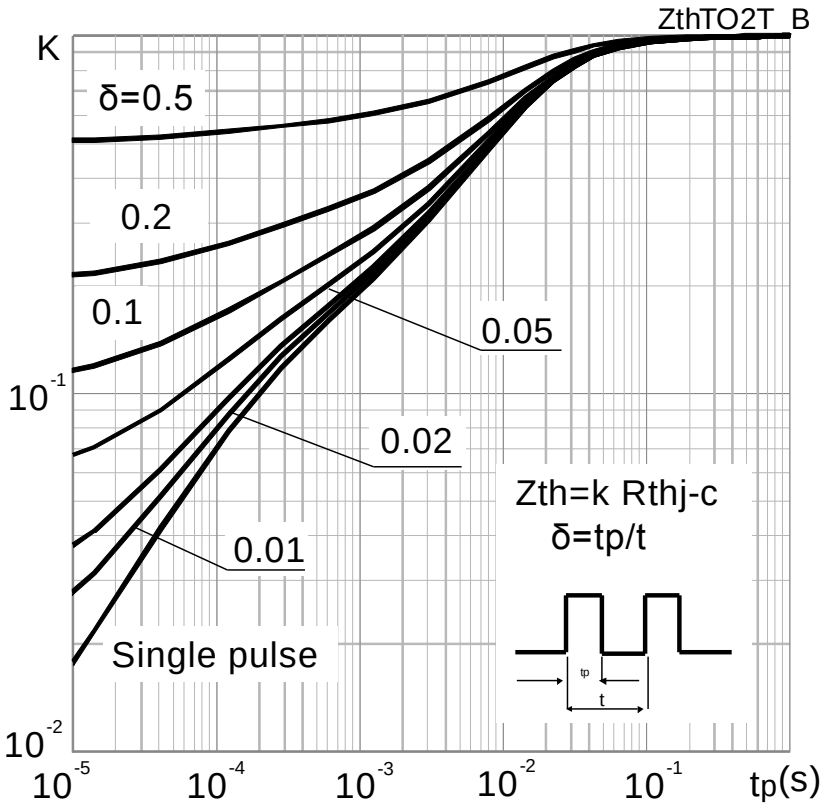
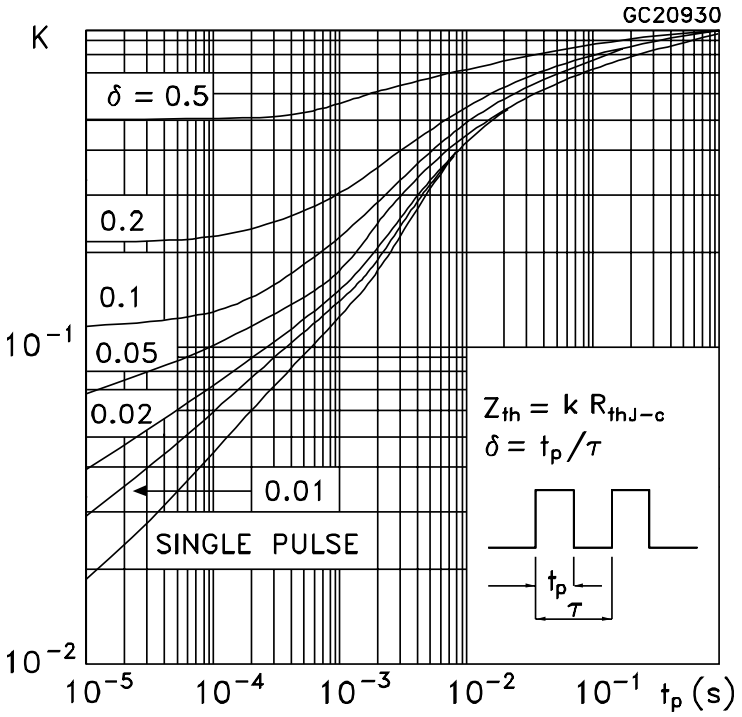


Figure 28: Thermal impedance for diode



3 Test circuits

Figure 29: Test circuit for inductive load switching

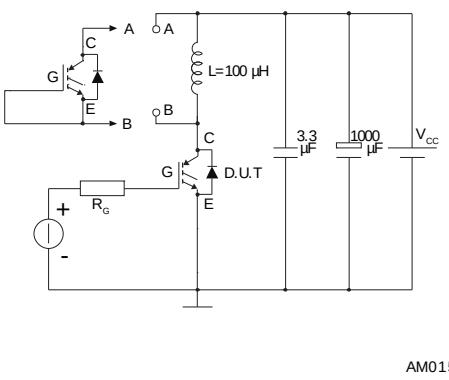


Figure 30: Gate charge test circuit

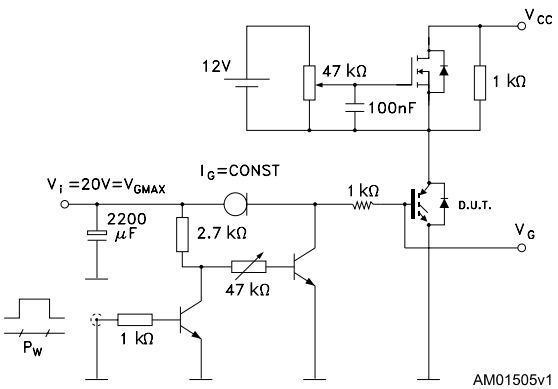


Figure 31: Switching waveform

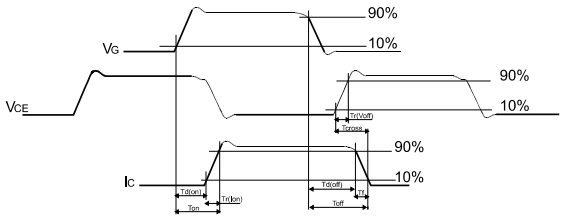
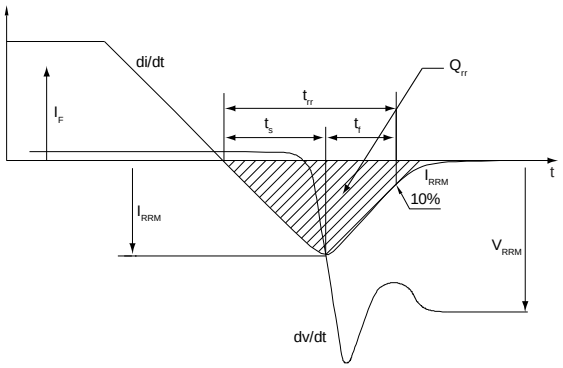


Figure 32: Diode reverse recovery waveform



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 TO-220 type A package information

Figure 33: TO-220 type A package outline

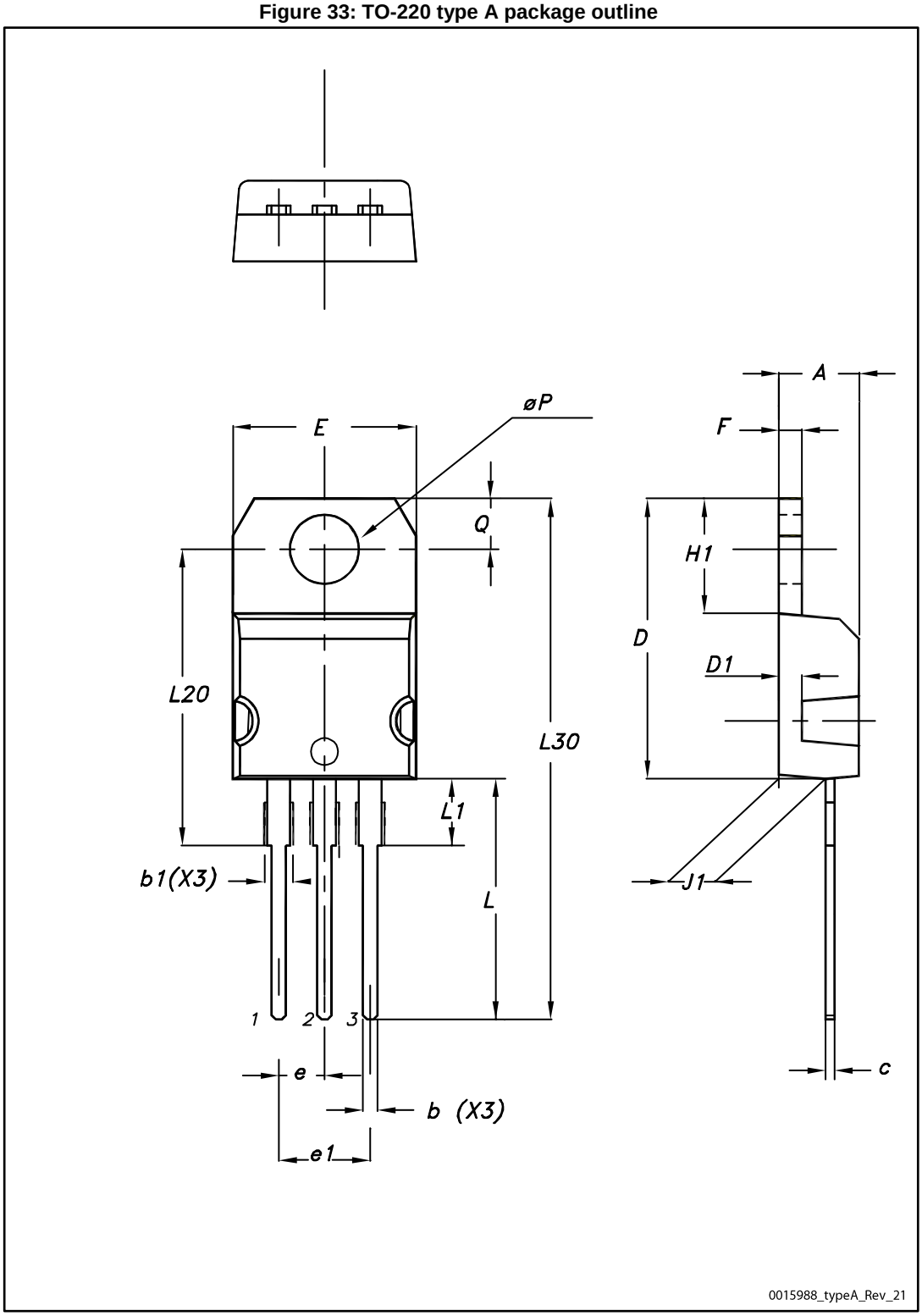


Table 8: TO-220 type A mechanical data

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 9: Document revision history

Date	Revision	Changes
10-Feb-2015	1	First release.
23-Apr-2015	2	Minor text edits throughout document Document status promoted to 'Production data' In Section 2 Electrical characteristics: - updated Table 4: Static characteristics - updated Table 5: Dynamic characteristics - updated Table 6: IGBT switching characteristics (inductive load) - updated Table 7: Diode switching characteristics (inductive load) Added Section 2.1 Electrical characteristics (curves)
31-Jul-2015	3	Updated Table 7: Diode switching characteristics (inductive load)
19-Oct-2015	4	Updated *Table 5: "Dynamic characteristics"* and *Table 6: "IGBT switching characteristics (inductive load)".* Updated *Figure 8: "Collector current vs. switching frequency".*
07-Apr-2017	5	Modified title, features and applications on cover page Modified *Table 4: "Static characteristics"*, *Table 6: "IGBT switching characteristics (inductive load)"* and *Table 7: "Diode switching characteristics (inductive load)"* Minor text changes.

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for IGBT Transistors ***category:***

Click to view products by STMicroelectronics ***manufacturer:***

Other Similar products are found below :

748152A APT20GT60BRDQ1G NGTB10N60FG STGFW20V60DF APT30GP60BG APT45GR65B2DU30 GT50JR22(STA1ES) TIG058E8-TL-H VS-CPV364M4KPBF NGTB25N120FL2WAG NGTG40N120FL2WG RJH60F3DPQ-A0#T0 APT40GR120B2SCD10 APT15GT120BRG APT20GT60BRG NGTB75N65FL2WAG NGTG15N120FL2WG IXA30RG1200DHGLB IXA40RG1200DHGLB APT70GR65B2DU40 NTE3320 IHFW40N65R5SXKSA1 APT70GR120J APT35GP120JDQ2 IKZA40N65RH5XKSA1 IKFW75N65ES5XKSA1 IKFW50N65ES5XKSA1 IKFW50N65EH5XKSA1 IKFW40N65ES5XKSA1 IKFW60N65ES5XKSA1 IMBG120R090M1HXTMA1 IMBG120R220M1HXTMA1 XD15H120CX1 XD25H120CX0 XP15PJS120CL1B1 IGW30N60H3FKSA1 STGWA8M120DF3 IGW08T120FKSA1 IGW75N60H3FKSA1 HGTG40N60B3 FGH60N60SMD_F085 FGH75T65UPD STGWA15H120F2 IKA10N60TXKSA1 IKW25N120T2FKSA1 IKP20N60TXKSA1 IHW20N65R5XKSA1 IDW40E65D2FKSA1 APT70GR120JD60 AOD5B60D