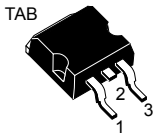
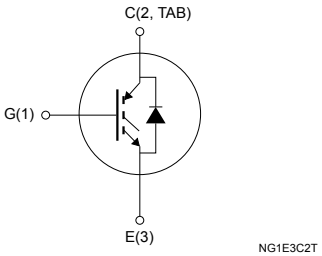
Trench gate field-stop 650 V, 30 A low-loss M series IGBT in a D²PAK package



D²PAK



Features

- Maximum junction temperature: T_J = 175 °C
- 6 µs of minimum short-circuit withstand time
- $V_{CE(sat)}$ = 1.55 V (typ.) at I_C = 30 A
- Tight parameter distribution
- Safer paralleling
- Positive $V_{CE(sat)}$ temperature coefficient
- Low thermal resistance
- Soft and very fast-recovery antiparallel diode

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 the low-loss and the short-circuit functionality is essential. Furthermore, the positive $V_{CE(sat)}$ temperature coefficient and the tight parameter distribution result in safer paralleling operation.

Product status link
STGB30M65DF2

Product summary	
Order code	STGB30M65DF2
Marking	G30M65DF2
Package	D²PAK
Packing	Tape and reel

1 Electrical ratings

Table 1. 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 (t_p ≤ 1 µs)	120	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Continuous forward current at T_C = 25 °C	60	A
	Continuous forward current at T_C = 100 °C	30	
I_{FP}(1)	Pulsed collector current (t_p ≤ 1 µs)	120	A
P_{TOT}	Total power dissipation at T_C = 25 °C	258	W
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range	-55 to 175	°C

1. *Pulse width limited by maximum junction temperature.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case, IGBT	0.58	°C/W
	Thermal resistance, junction-to-case, diode	1.47	
R_{thJA}	Thermal resistance, junction-to-ambient	62.5	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified.

Table 3. 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 = 30 A	-	1.55	2.0	V
		V_{GE} = 15 V, I_C = 30 A, T_J = 125 °C	-	1.95	-	
		V_{GE} = 15 V, I_C = 30 A, T_J = 175 °C	-	2.1	-	
V_F	Forward on-voltage	I_F = 30 A	-	1.85	2.65	V
		I_F = 30 A, T_J = 125 °C	-	1.6	-	
		I_F = 30 A, T_J = 175 °C	-	1.5	-	
$V_{GE(th)}$	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 4. 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	-	2490	-	pF
C_{oes}	Output capacitance		-	143	-	pF
C_{res}	Reverse transfer capacitance		-	46	-	pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 30 A, V_{GE} = 0 to 15 V (see the Figure 29. Gate charge test circuit)	-	80	-	nC
Q_{ge}	Gate-emitter charge		-	13	-	nC
Q_{gc}	Gate-collector charge		-	32	-	nC

Table 5. 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 = 30 A, V_{GE} = 15 V, R_G = 12 Ω (see the Figure 28. Test circuit for inductive load switching)	-	31.6	-	ns
t_r	Current rise time		-	13.4	-	ns
$di/dt_{(on)}$	Turn-on current slope		-	1791	-	A/µs
$t_{d(off)}$	Turn-off delay time		-	115	-	ns
t_f	Current fall time		-	110	-	ns
E_{on} (1)	Turn-on switching energy		-	0.3	-	mJ
E_{off} (2)	Turn-off switching energy		-	0.96	-	mJ
E_{ts}	Total switching energy		-	1.26	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 30 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 175 °C (see the Figure 28. Test circuit for inductive load switching)	-	30	-	ns
t_r	Current rise time		-	17	-	ns
$di/dt_{(on)}$	Turn-on current slope		-	1435	-	A/µs
$t_{d(off)}$	Turn-off delay time		-	116	-	ns
t_f	Current fall time		-	194	-	ns
E_{on} (1)	Turn-on switching energy		-	0.67	-	mJ
E_{off} (2)	Turn-off switching energy		-	1.36	-	mJ
E_{ts}	Total switching energy		-	2.03	-	mJ
t_{sc}	Short-circuit withstand time	V_{CC} = 400 V, V_{GE} = 13 V, starting $T_J \leq$ 150 °C	10	-	-	µs
		V_{CC} = 400 V, V_{GE} = 15 V, starting $T_J \leq$ 150 °C	6	-	-	

1. *Including the reverse recovery of the diode.*
2. *Including the tail of the collector current.*

Table 6. 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, V_{GE} = 15 V, di/dt = 1000 A/µs (see the Figure 28. Test circuit for inductive load switching)	-	140	-	ns
Q_{rr}	Reverse recovery charge		-	880	-	nC
I_{rrm}	Reverse recovery current		-	17	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	650	-	A/µs
E_{rr}	Reverse recovery energy		-	115	-	µJ
t_{rr}	Reverse recovery time	I_F = 30 A, V_R = 400 V, V_{GE} = 15 V, di/dt = 1000 A/µs, T_J = 175 °C (see the Figure 28. Test circuit for inductive load switching)	-	244	-	ns
Q_{rr}	Reverse recovery charge		-	2743	-	nC
I_{rrm}	Reverse recovery current		-	25	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	220	-	A/µs
E_{rr}	Reverse recovery energy		-	320	-	µJ

2.1 Electrical characteristics (curves)

Figure 1. Total power dissipation vs temperature

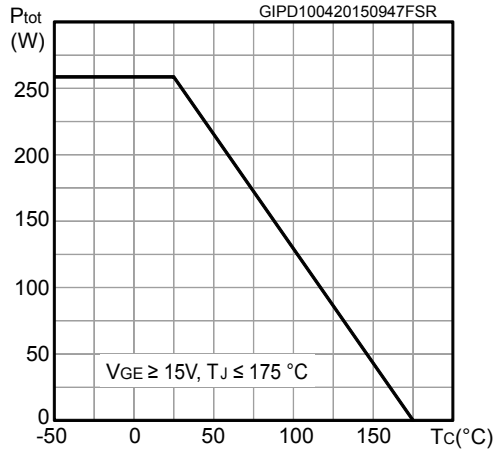


Figure 2. Collector current vs temperature

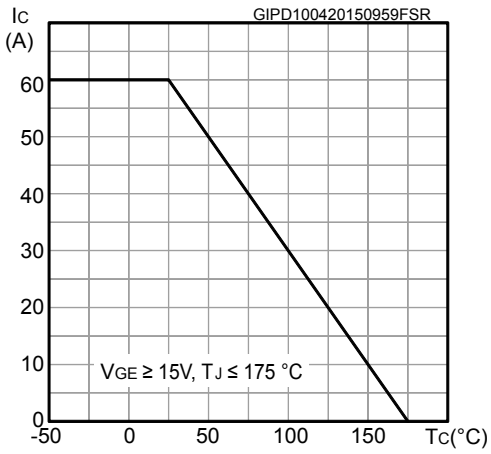


Figure 3. Typical output characteristics (T_J = 25 °C)

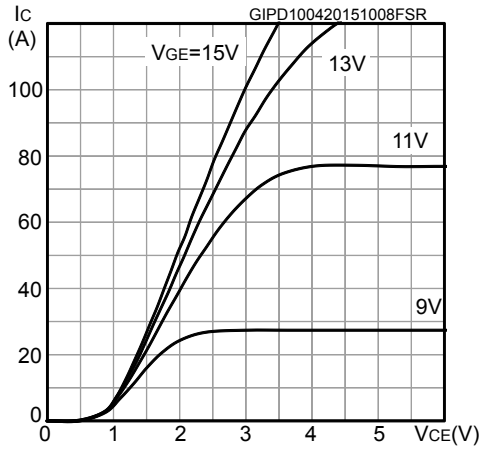


Figure 4. Typical output characteristics (T_J = 175 °C)

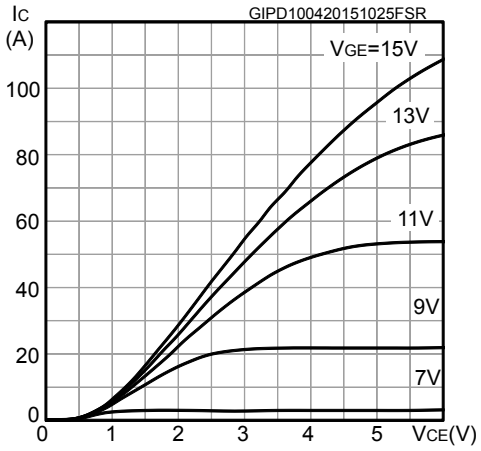


Figure 5. Typical transfer characteristics

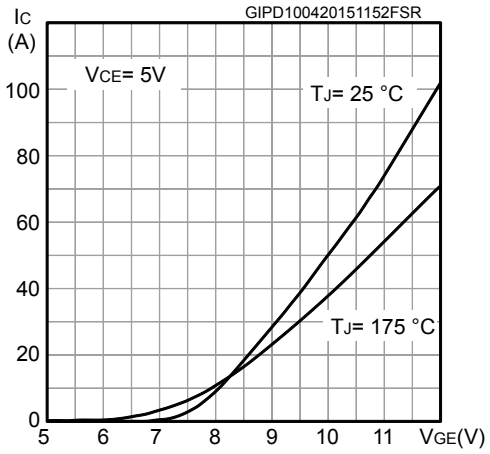


Figure 6. Typical $V_{CE(sat)}$ vs temperature

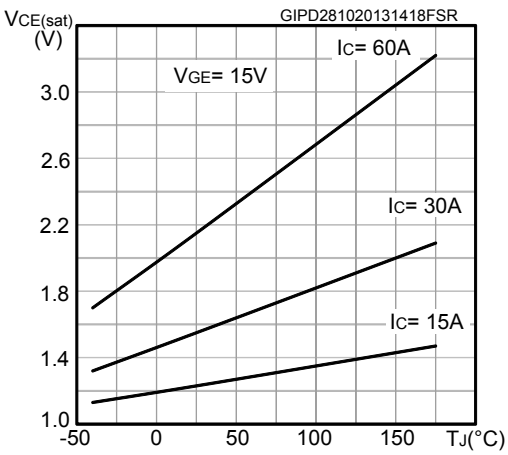


Figure 7. Typical $V_{CE(sat)}$ vs collector current

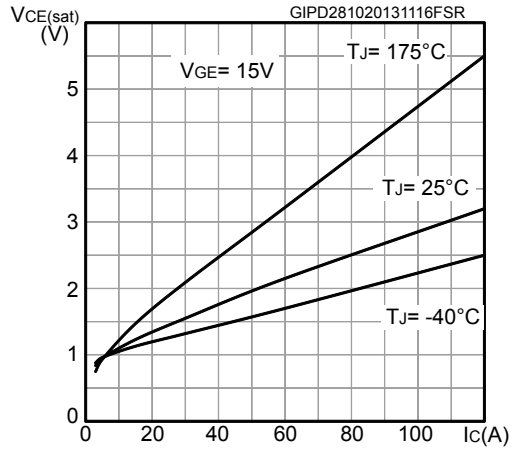


Figure 8. Collector current vs switching frequency

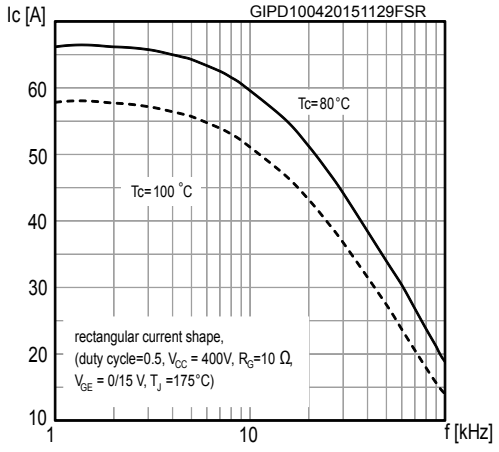


Figure 9. Forward bias safe operating area

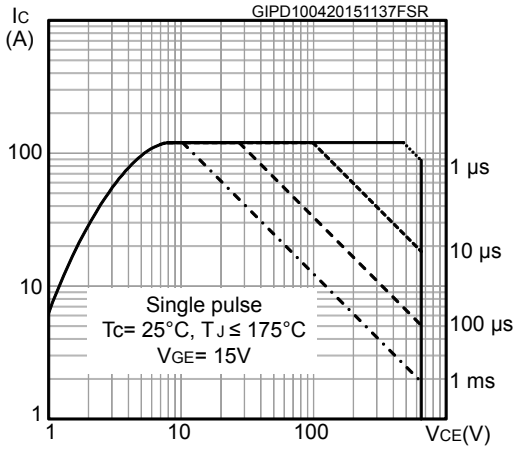


Figure 10. Diode typical forward characteristics

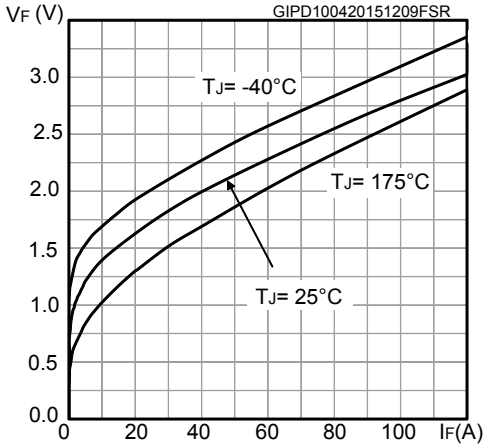


Figure 11. Normalized gate treshold vs temperature

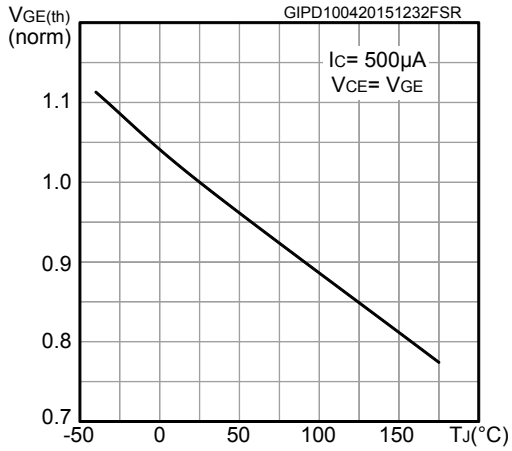


Figure 12. Normalized $V_{(BR)CES}$ vs junction temperature

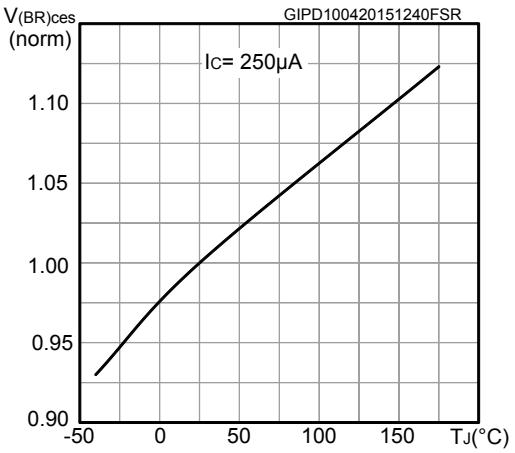


Figure 13. Typical capacitance characteristics

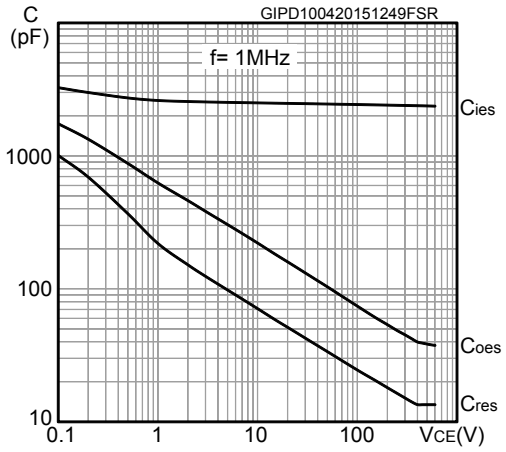


Figure 14. Typical gate charge characteristics

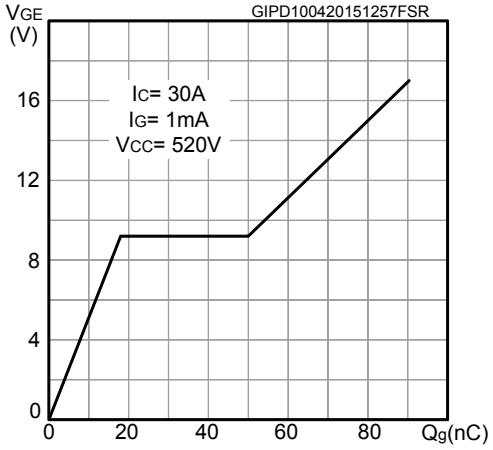


Figure 15. Typical switching energy vs collector current

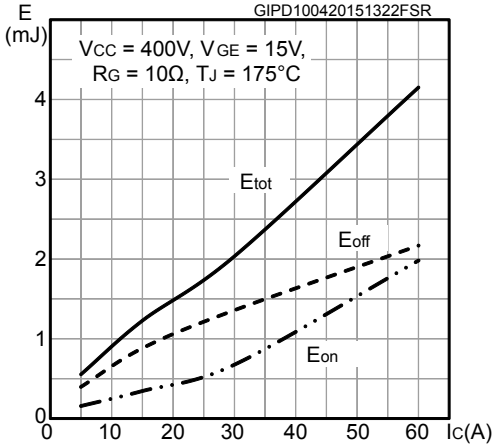


Figure 16. Typical switching energy vs temperature

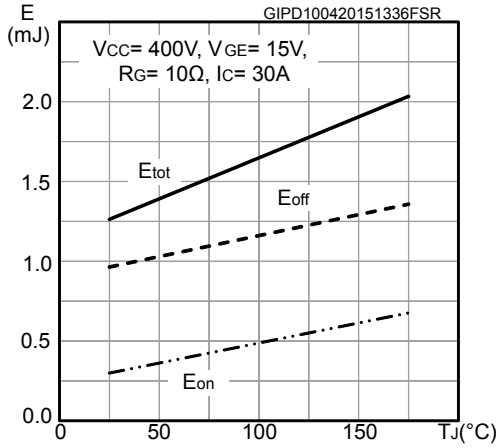


Figure 17. Typical switching energy vs collector emitter voltage

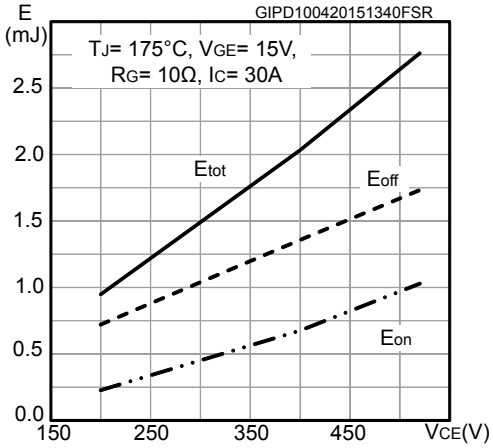


Figure 18. Typical switching energy vs gate resistance

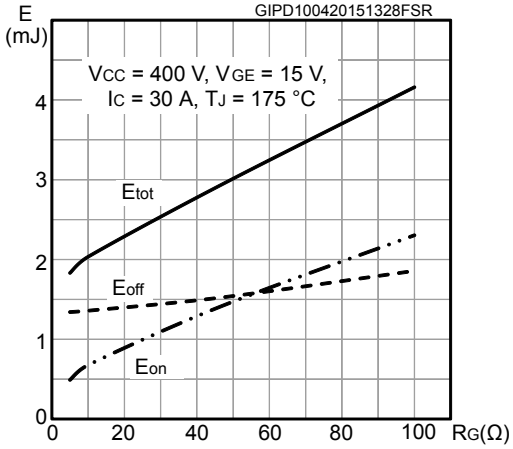


Figure 19. Short-circuit time and current vs V_{GE}

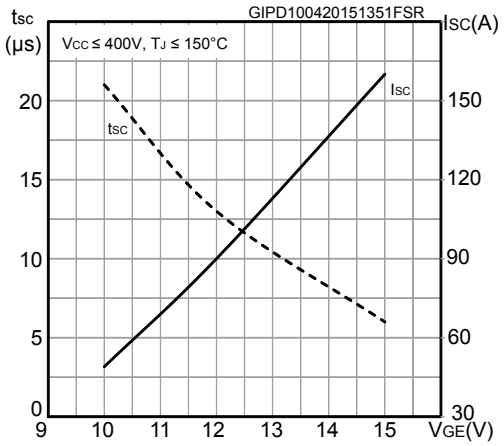


Figure 20. Typical switching times vs collector current

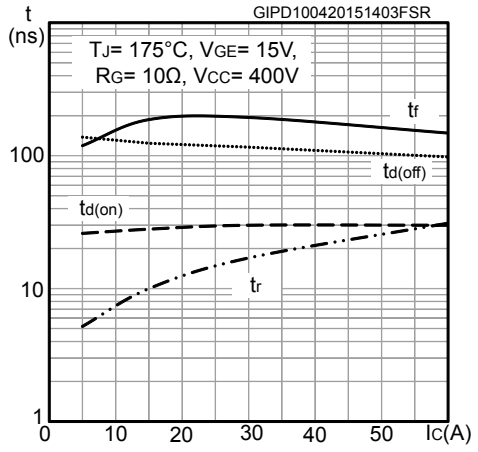


Figure 21. Typical switching times vs gate resistance

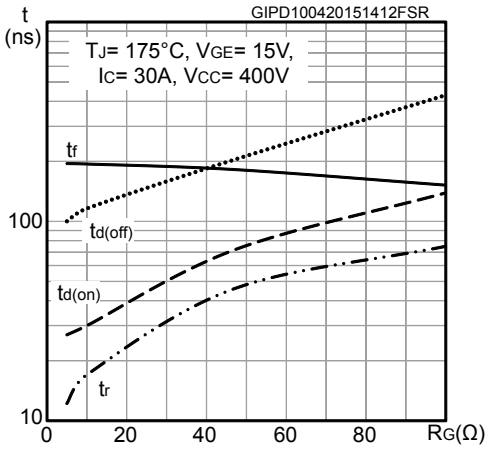


Figure 22. Typical reverse recovery current vs diode current slope

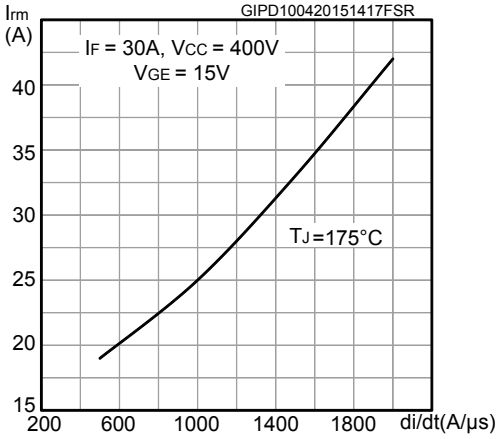


Figure 23. Typical reverse recovery time vs diode current slope

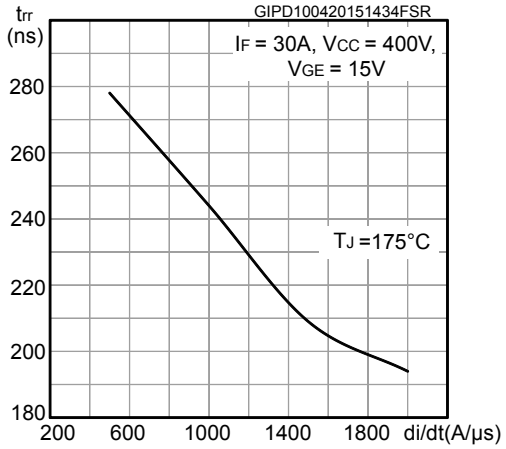


Figure 24. Typical reverse recovery charge vs diode current slope

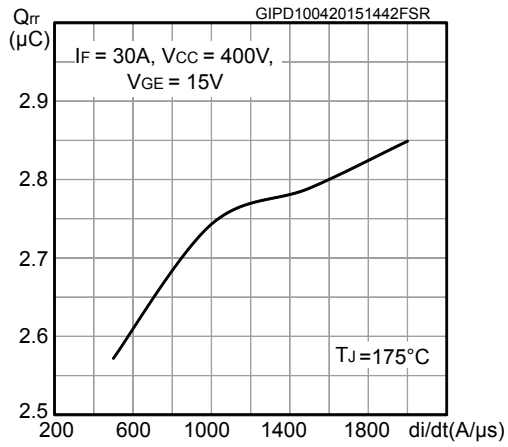


Figure 25. Reverse recovery energy vs diode current slope

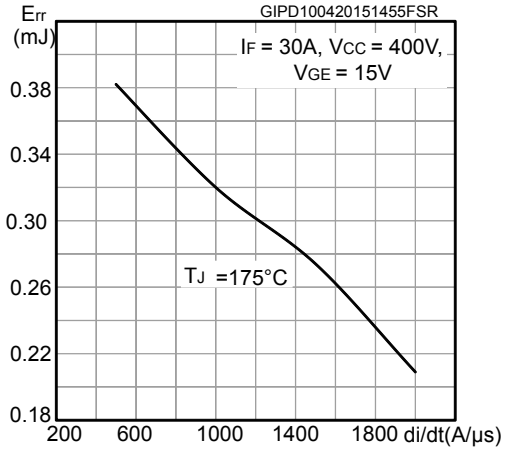


Figure 26. IGBT normalized transient thermal impedance

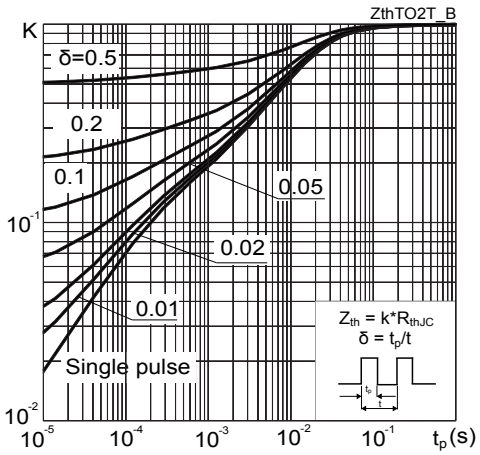
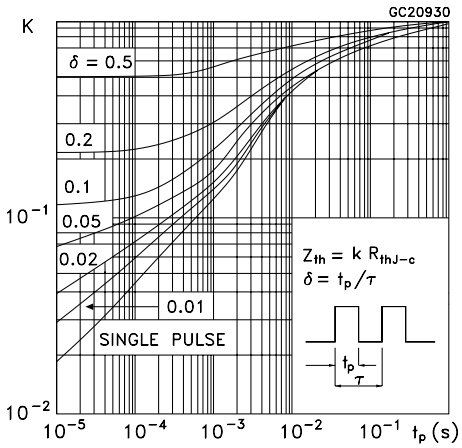


Figure 27. Diode normalized transient thermal impedance



3 Test circuits

Figure 28. Test circuit for inductive load switching

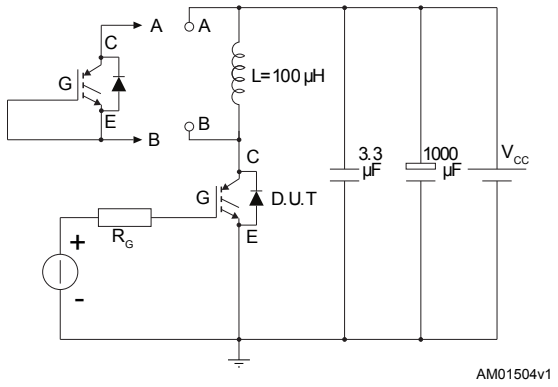


Figure 29. Gate charge test circuit

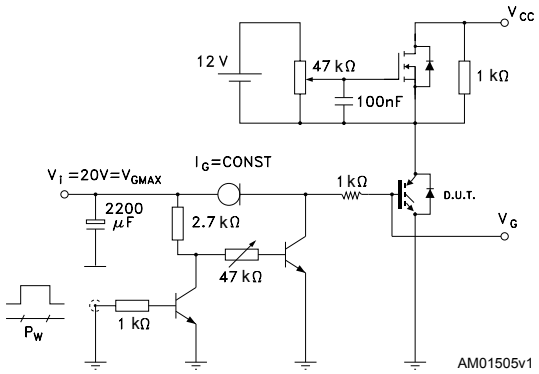


Figure 30. Switching waveform

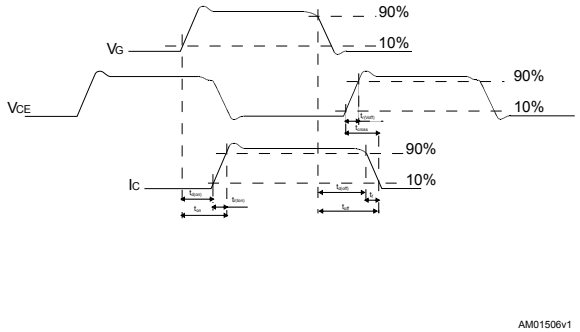
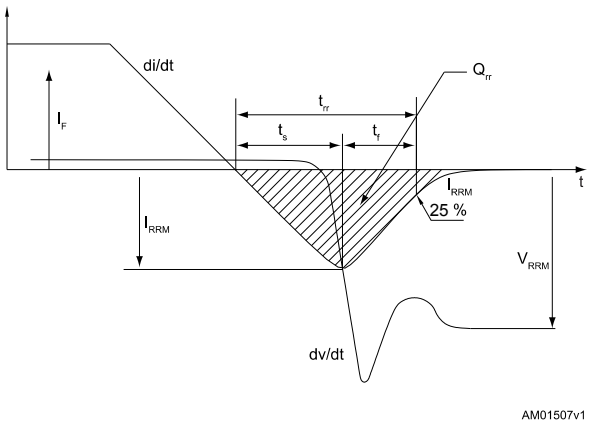


Figure 31. Diode reverse recovery waveform

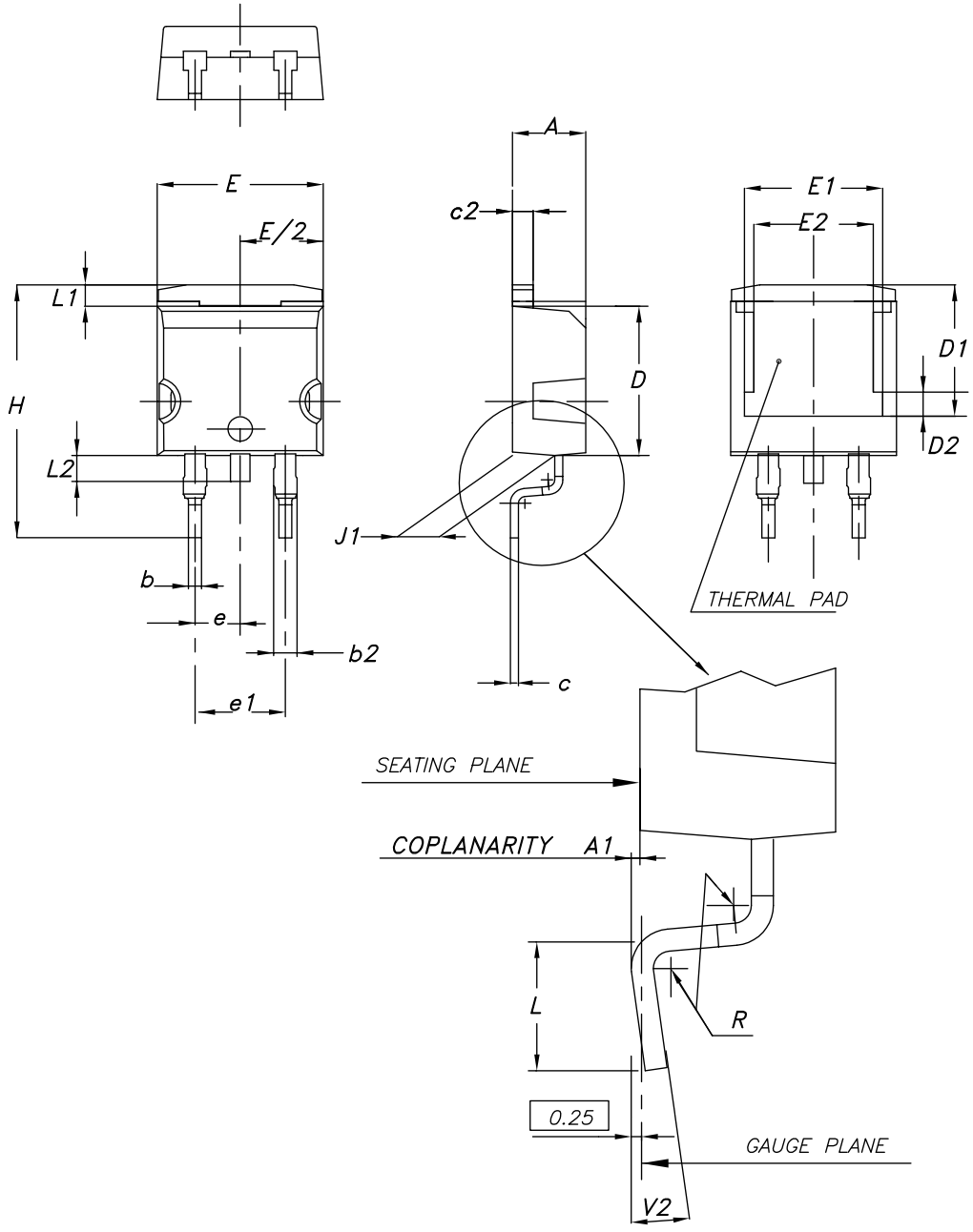


4 Package information

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 A2 package information

Figure 32. **D²PAK (TO-263) type A2 package outline**

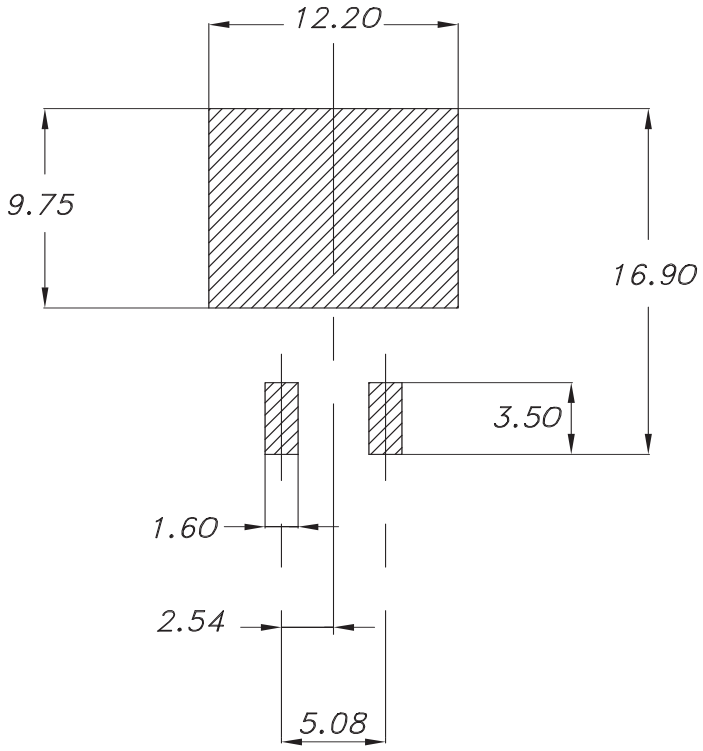


0079457_A2_27

Table 7. D²PAK (TO-263) type A2 package mechanical data

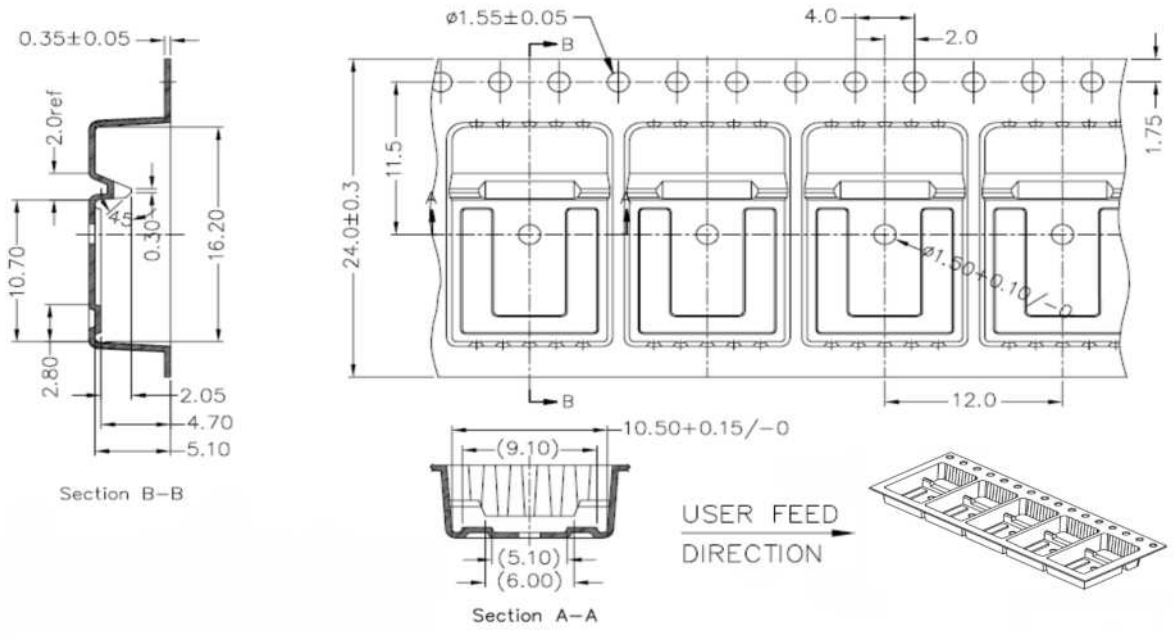
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.70	8.90	9.10
E2	7.30	7.50	7.70
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 33. D²PAK (TO-263) recommended footprint (dimensions are in mm)



4.2 D²PAK packing information

Figure 34. D²PAK tape drawing (dimensions are in mm)



Revision history

Table 8. **Document revision history**

Date	Revision	Changes
10-Feb-2015	1	First release.
13-Apr-2015	2	Document status promoted from preliminary to production data. Updated *Section 2: Electrical characteristics*. Added *Section 2.1: 1.1 Electrical characteristics (curve)*.
11-Apr-2017	3	Updated document title. Updated *Table 4: Static characteristics*, *Table 6: IGBT switching characteristics (inductive load)* and *Table 7: Diode switching characteristics (inductive load)*. Updated *Figure 13: Normalized V(BR)CES vs. junction temperature*. Updated *Section 4.1: D²PAK (TO-263) type A package information*. Minor text changes
07-May-2025	4	Updated Section 4: Package information.

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