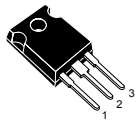
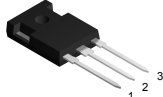


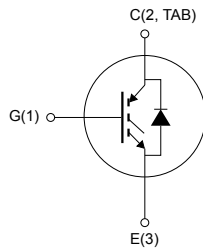
Trench gate field-stop 650 V, 30 A low-loss M series IGBTs in TO-247 and TO-247 long leads packages



TO-247



TO-247 long leads



NG1E3C2T



Features

- 6 μ s of minimum short-circuit withstand time
- Low $V_{CE(sat)} = 1.55$ V (typ.) @ $I_C = 30$ A
- Tight parameter distribution
- Safer paralleling
- Low thermal resistance
- Soft and very fast-recovery antiparallel diode

Applications

- Motor control
- UPS
- PFC

Description

These devices are IGBTs developed using an advanced proprietary trench gate field-stop structure. The devices are 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 are essential. Furthermore, the positive $V_{CE(sat)}$ temperature coefficient and the tight parameter distribution result in safer paralleling operation.

Product status links

[STGW30M65DF2](#)

[STGWA30M65DF2](#)

Product summary

Order code	STGW30M65DF2
Marking	G30M65DF2
Package	TO-247
Packing	Tube
Order code	STGWA30M65DF2
Marking	G30M65DF2
Package	TO-247 long leads
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0\text{ V}$)	650	V
I_C	Continuous collector current at $T_C = 25\text{ °C}$	60	A
	Continuous collector current at $T_C = 100\text{ °C}$	30	
$I_{CP}^{(1)}$	Pulsed collector current	120	A
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Continuous forward current at $T_C = 25\text{ °C}$	60	A
	Continuous forward current at $T_C = 100\text{ °C}$	30	
$I_{FP}^{(1)}$	Pulsed collector current	120	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	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	50	°C/W

2 Electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}$, $I_C = 250\text{ }\mu\text{A}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$		1.55	2.0	V
		$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$, $T_J = 125\text{ °C}$		1.95		
		$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$, $T_J = 175\text{ °C}$		2.1		
V_F	Forward on-voltage	$I_F = 30\text{ A}$		1.86	2.65	V
		$I_F = 30\text{ A}$, $T_J = 125\text{ °C}$		1.6		
		$I_F = 30\text{ A}$, $T_J = 175\text{ °C}$		1.5		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 500\text{ }\mu\text{A}$	5	6	7	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 650\text{ V}$			25	μA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 250	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	2490	-	pF
C_{oes}	Output capacitance		-	143	-	pF
C_{res}	Reverse transfer capacitance		-	46	-	pF
Q_g	Total gate charge	$V_{CC} = 520\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 29. Gate charge test circuit)	-	80	-	nC
Q_{ge}	Gate-emitter charge		-	18	-	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	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ (see 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/ μ s
$t_{d(off)}$	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	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 175\text{ }^\circ\text{C}$ (see 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/ μ s
$t_{d(off)}$	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	$V_{CC} = 400\text{ V}$, $V_{GE} = 13\text{ V}$, starting $T_J \leq 150\text{ }^\circ\text{C}$	10		-	μ s
		$V_{CC} = 400\text{ V}$, $V_{GE} = 15\text{ V}$, starting $T_J \leq 150\text{ }^\circ\text{C}$	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	$I_F = 30\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$ (see 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/ μ s
E_{rr}	Reverse recovery energy		-	115	-	μ J
t_{rr}	Reverse recovery time	$I_F = 30\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $T_J = 175\text{ }^\circ\text{C}$ (see 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/ μ s
E_{rr}	Reverse recovery energy		-	320	-	μ J

2.1 Electrical characteristics (curves)

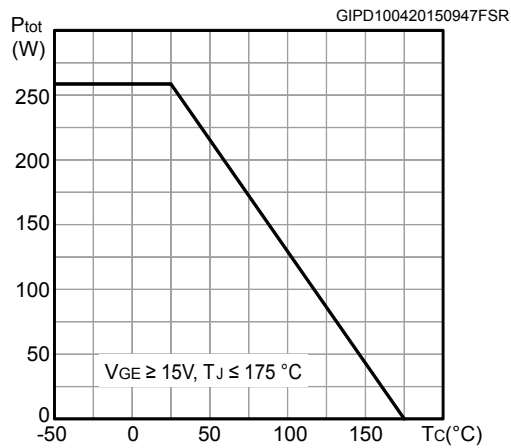
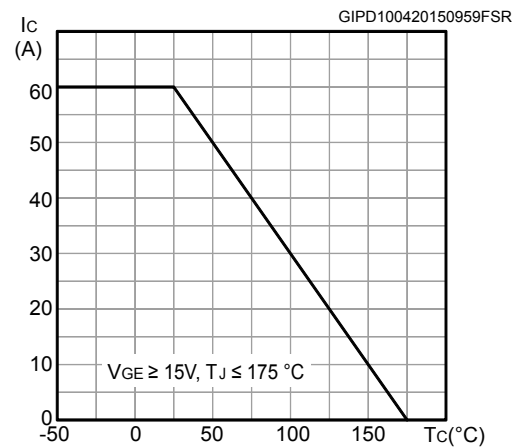
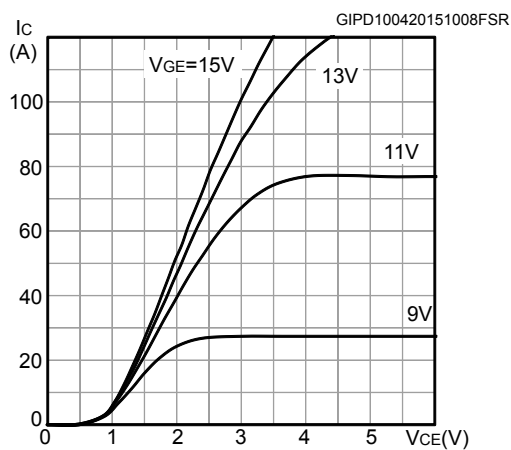
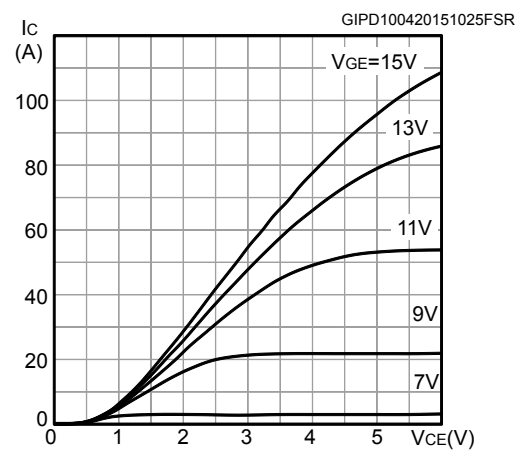
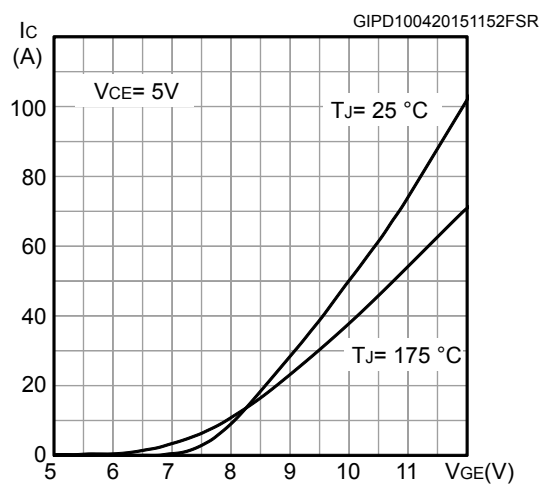
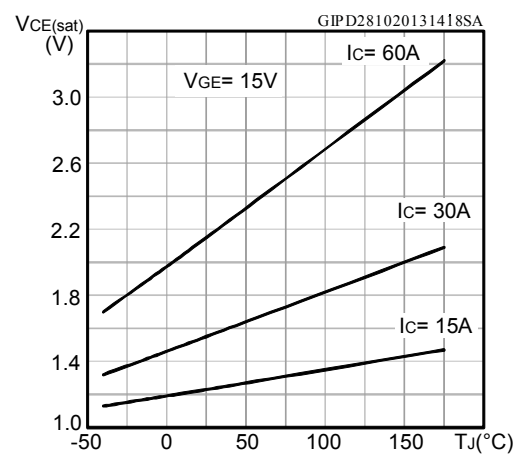
Figure 1. Total power dissipation vs temperature

Figure 2. Maximum continuous collector current vs case temperature

Figure 3. Typical output characteristics ($T_J = 25^\circ C$)

Figure 4. Typical output characteristics ($T_J = 175^\circ C$)

Figure 5. Typical transfer characteristics

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


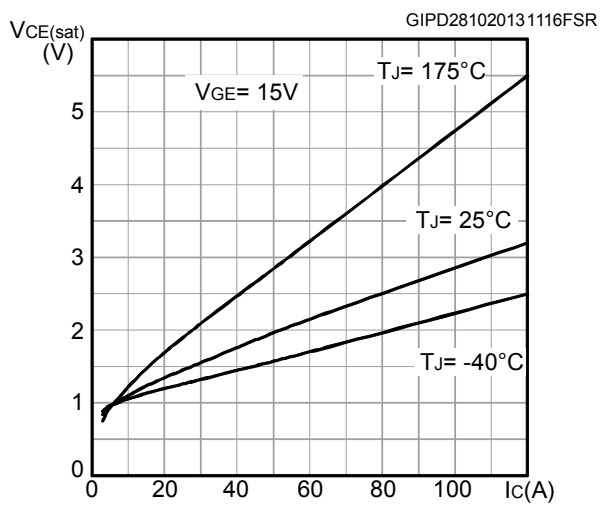
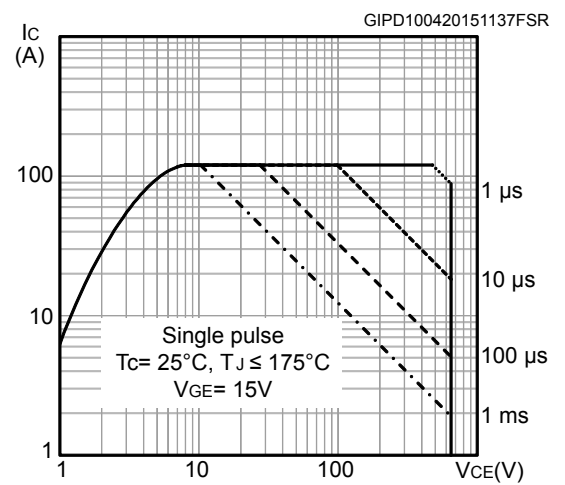
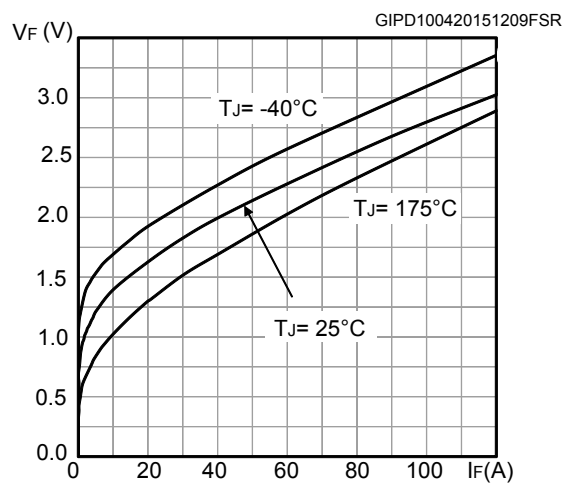
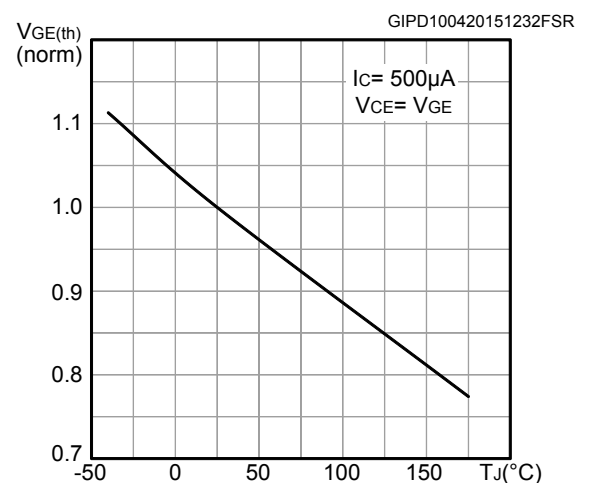
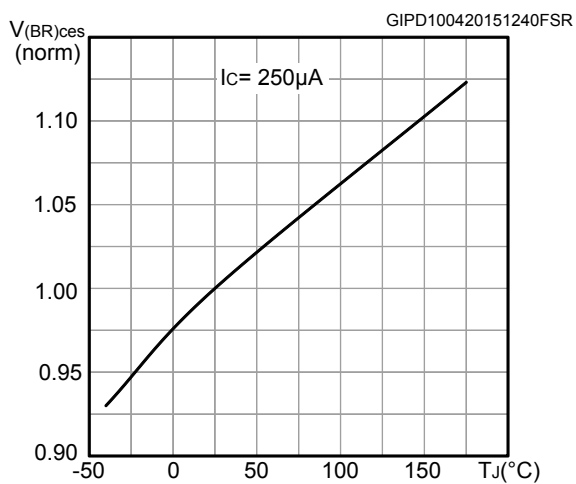
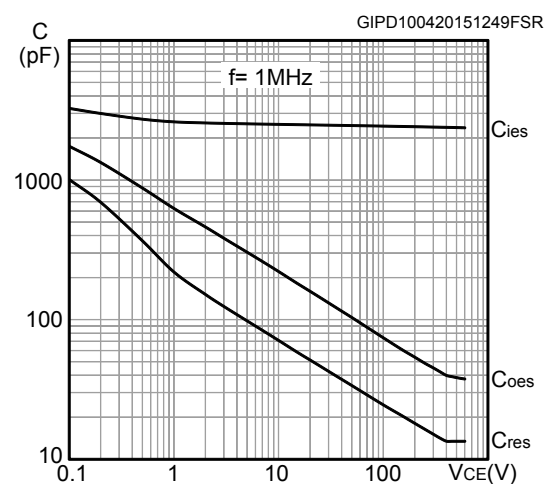
Figure 7. Typical $V_{CE(sat)}$ vs collector current

Figure 8. Forward bias safe operating area

Figure 9. Diode typical forward characteristics

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

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

Figure 12. Typical capacitance characteristics


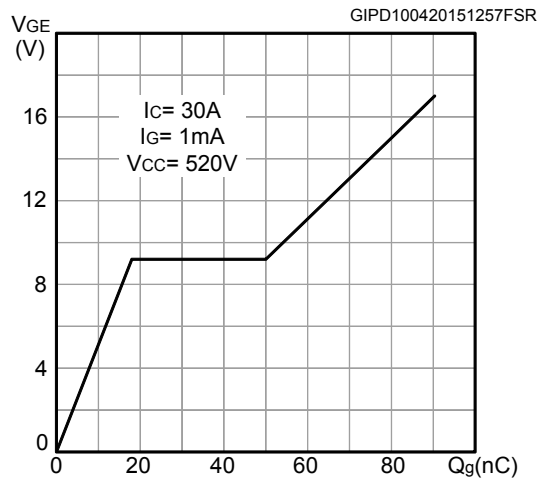
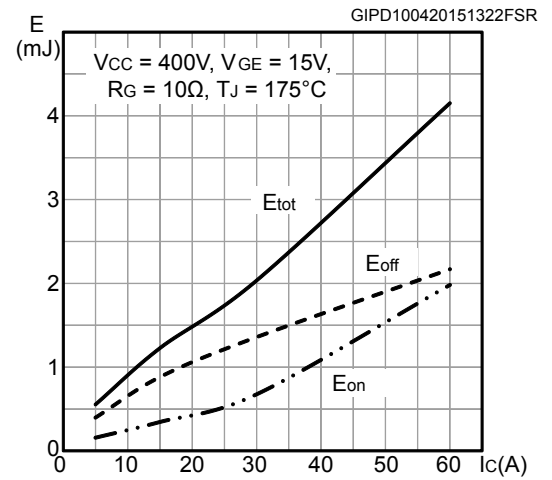
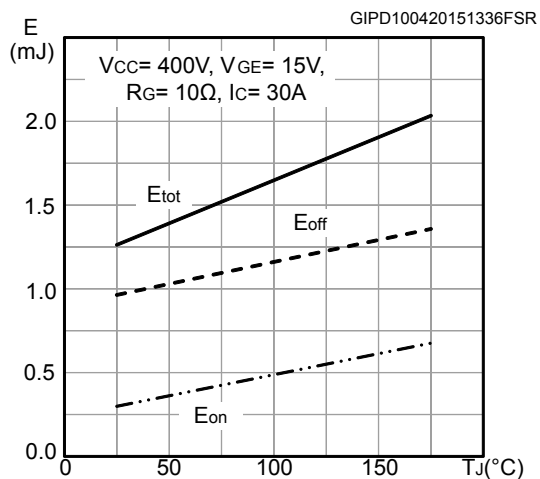
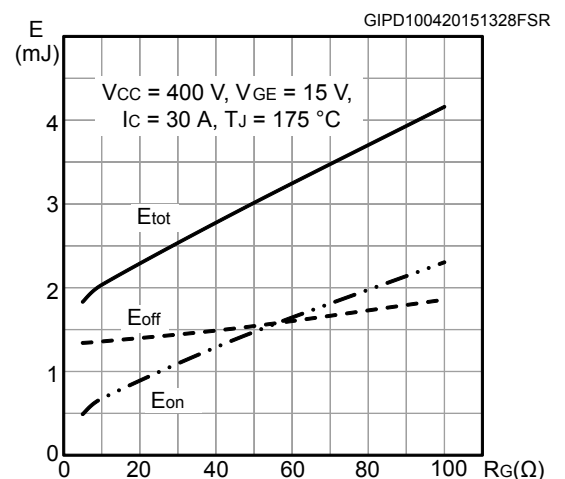
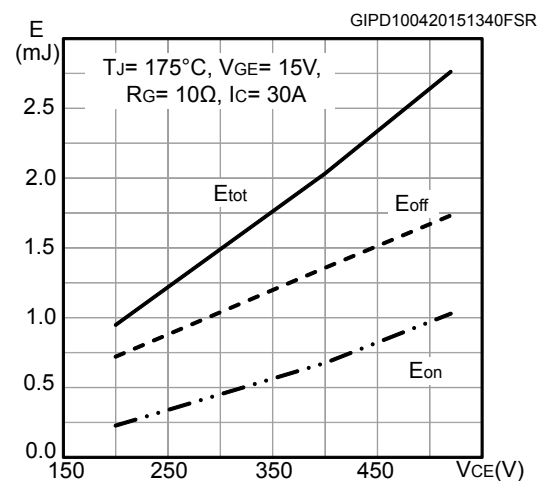
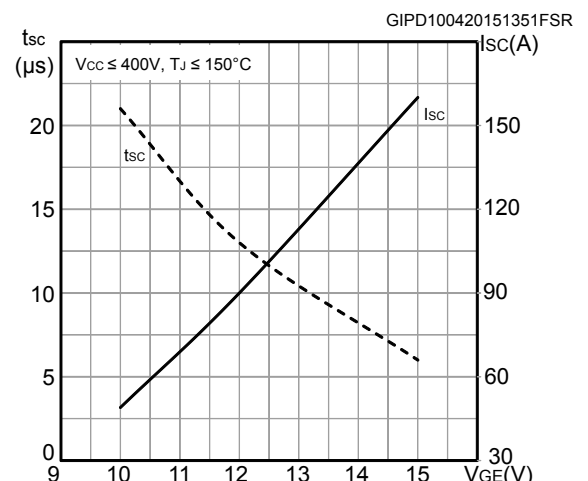
Figure 13. Typical gate charge characteristics

Figure 14. Typical switching energy vs collector current

Figure 15. Typical switching energy vs temperature

Figure 16. Typical switching energy vs R_G

Figure 17. Switching energy vs. collector emitter voltage

Figure 18. Short-circuit time and current vs. V_{GE}


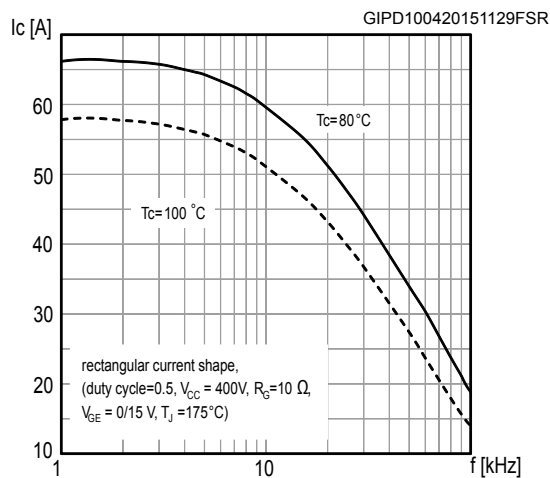
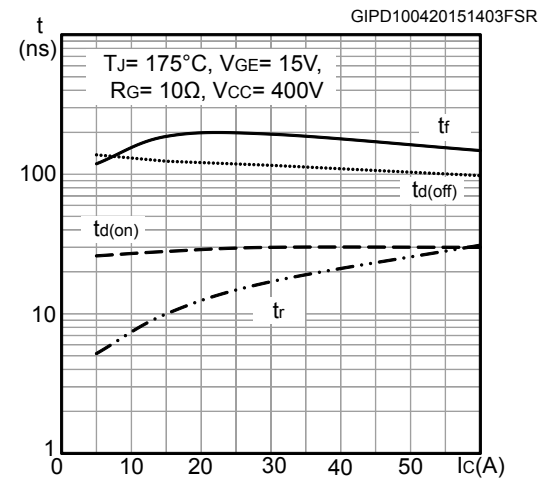
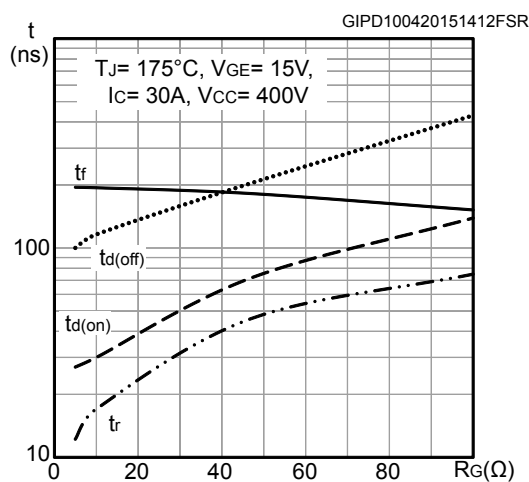
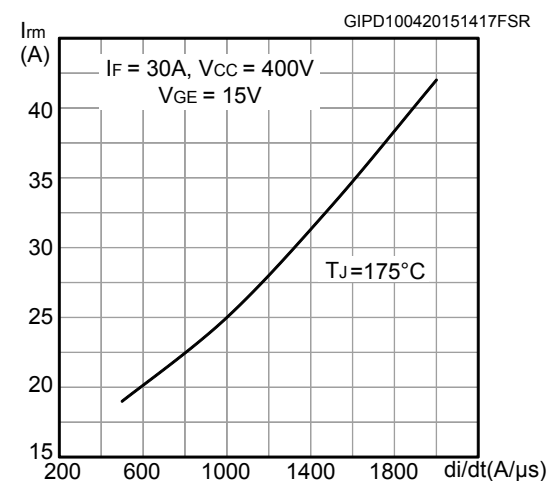
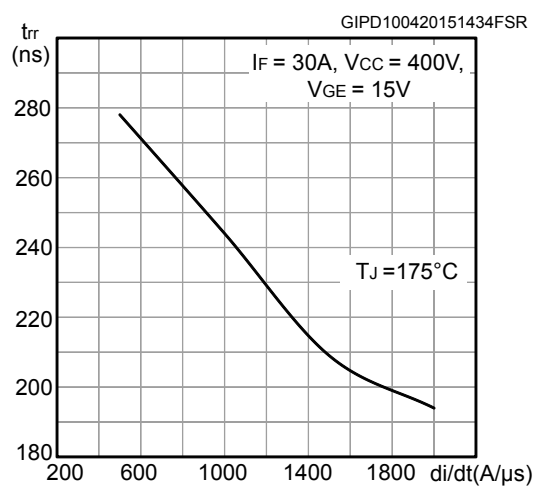
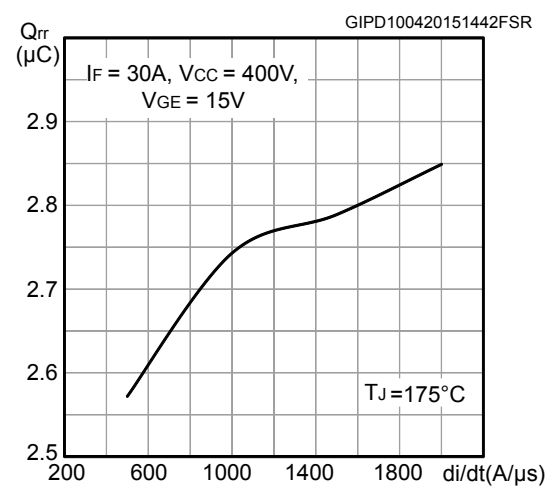
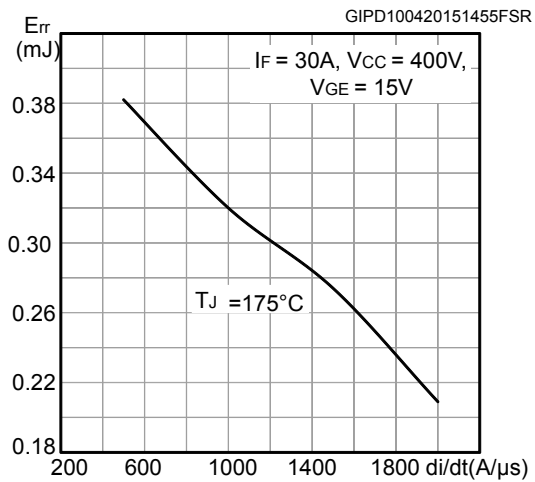
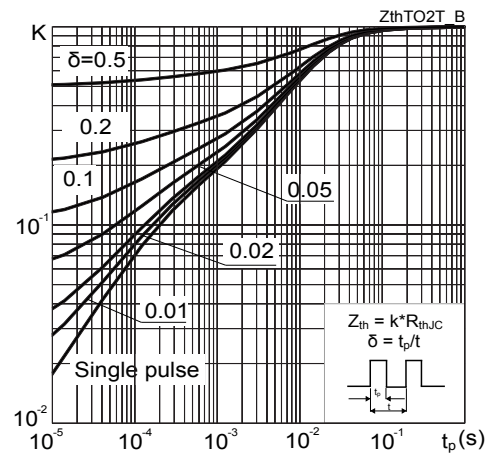
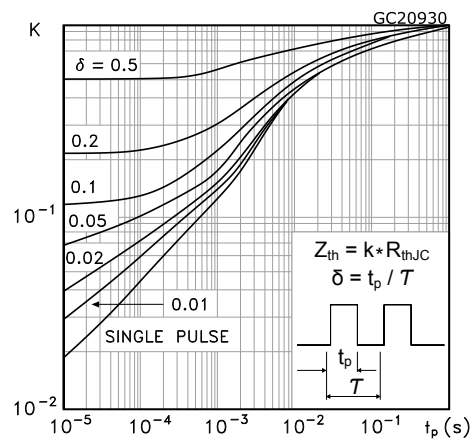
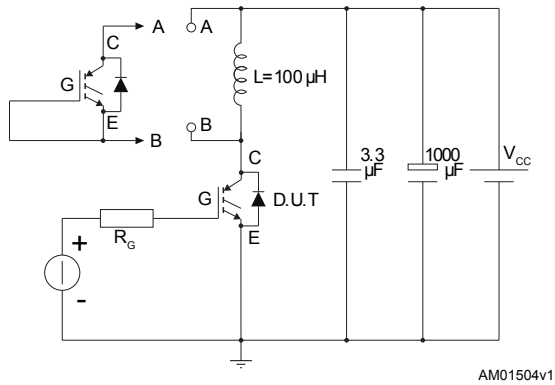
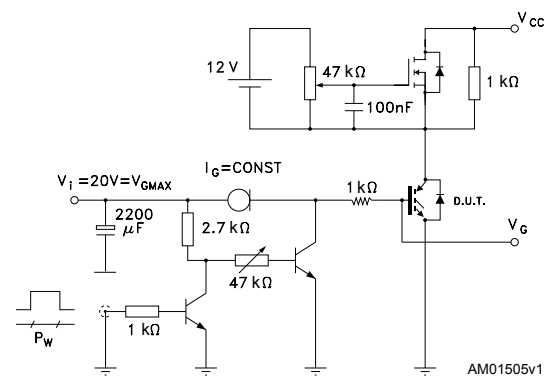
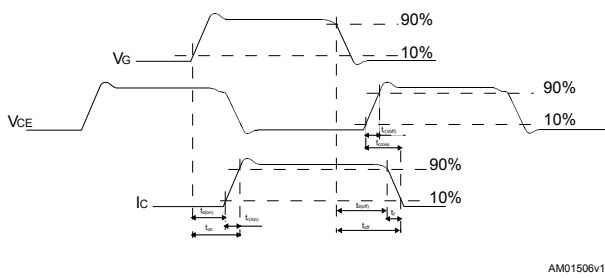
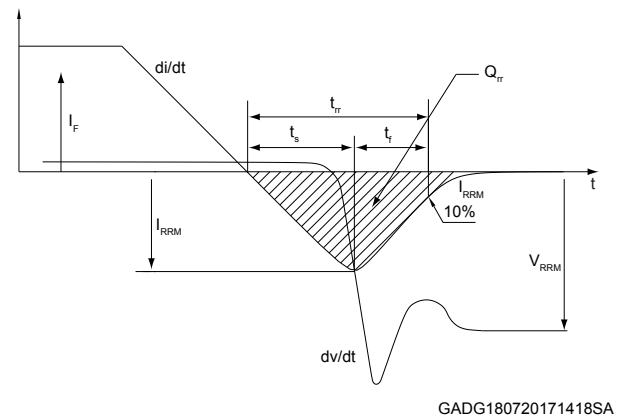
Figure 19. Collector current vs switching frequency

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. Typical reverse recovery energy vs diode current slope

Figure 26. Normalized transient thermal impedance for IGBT

Figure 27. Normalized transient thermal impedance for diode


3 Test circuits

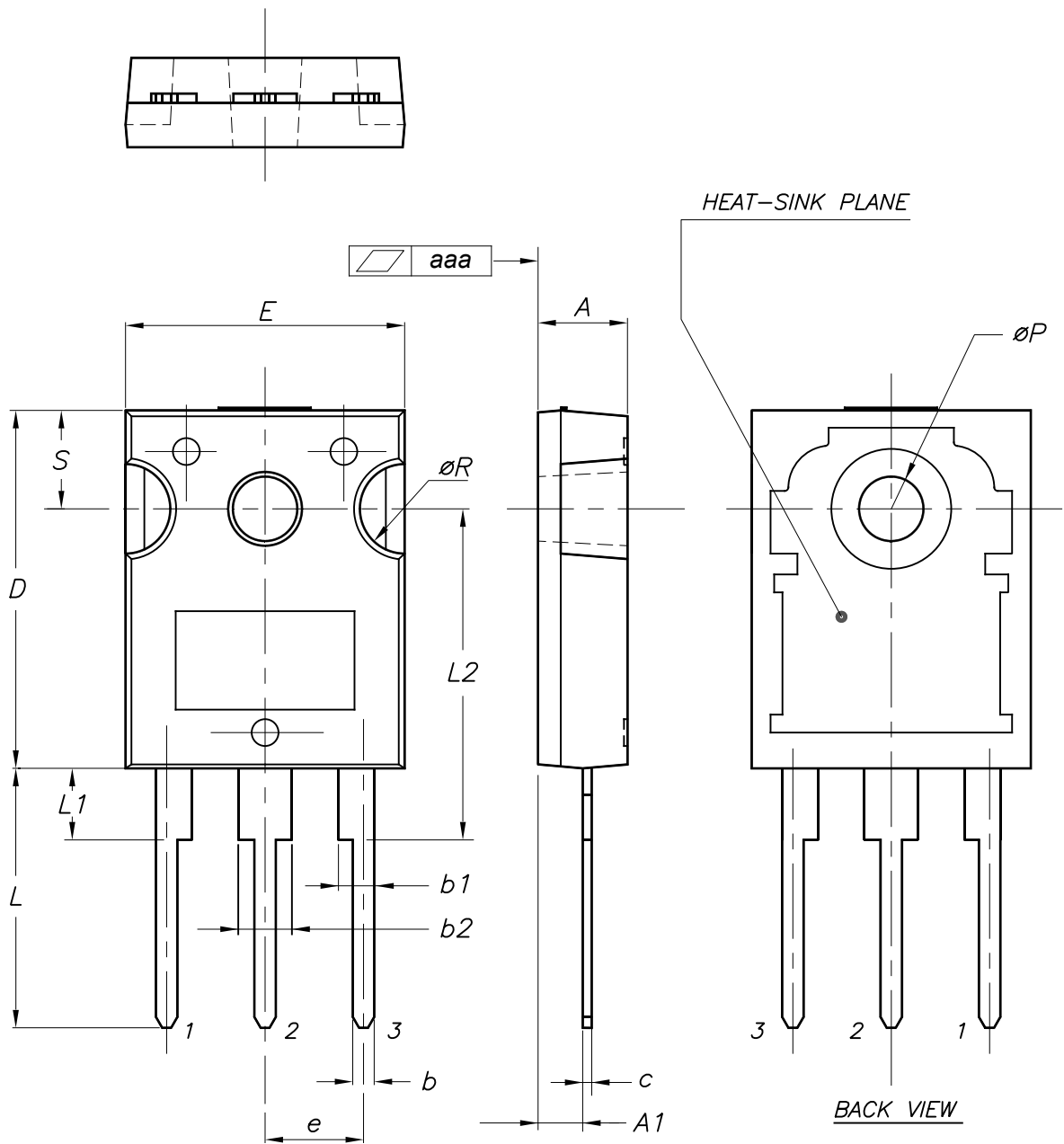
Figure 28. Test circuit for inductive load switching

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 TO-247 package information

Figure 32. TO-247 package outline



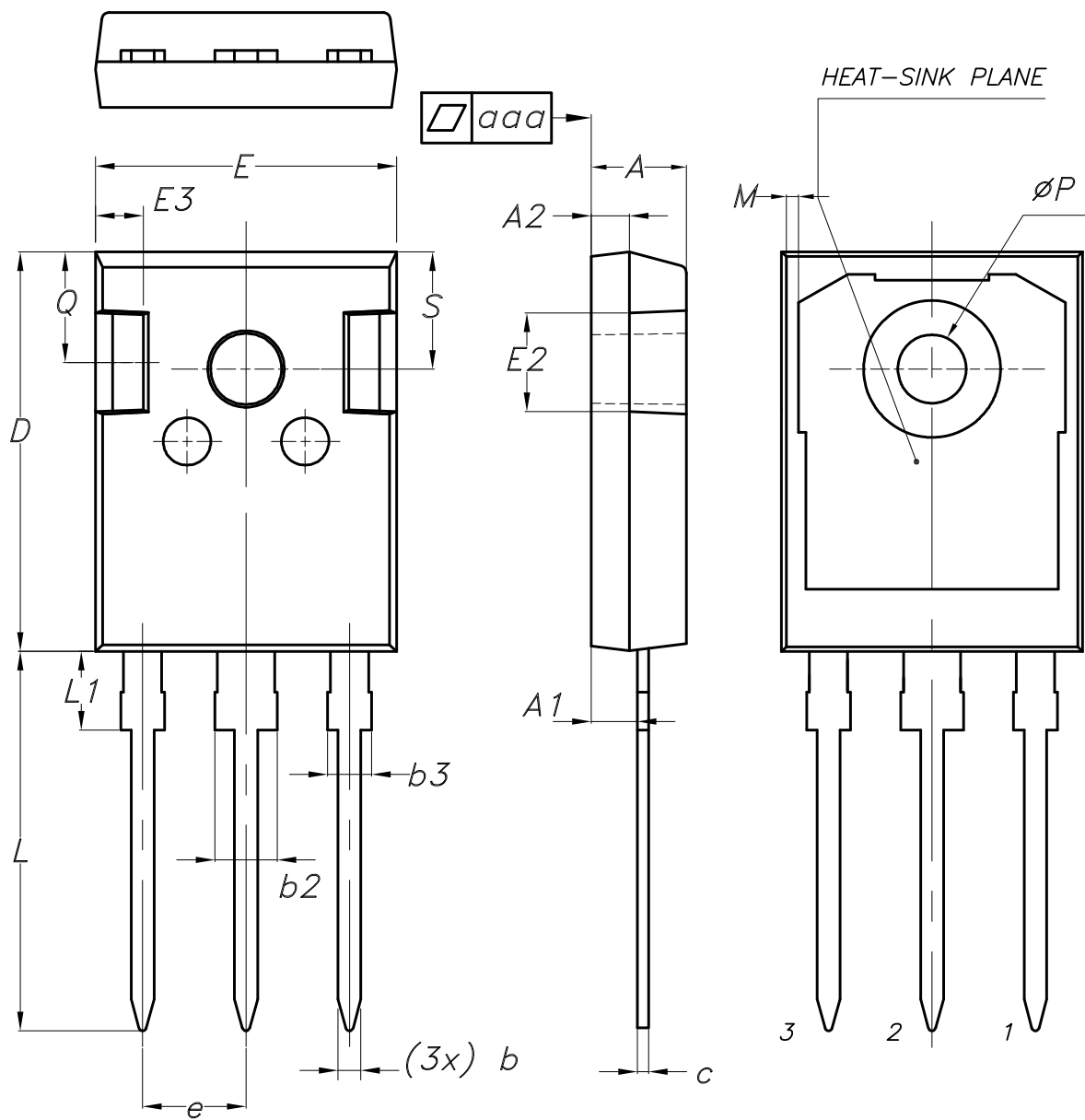
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Table 7. TO-247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70
aaa		0.04	0.10

4.2 TO-247 long leads package information

Figure 33. TO-247 long leads package outline



BACK VIEW

8463846_5

Table 8. TO-247 long leads package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16		1.26
b2			3.25
b3			2.25
c	0.59		0.66
D	20.90	21.00	21.10
E	15.70	15.80	15.90
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1			4.30
M	0.35		0.95
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25
aaa		0.04	0.10

Revision history

Table 9. Document revision history

Date	Revision	Changes
04-May-2015	1	First release.
14-Sep-2015	2	Updated features in cover page and added new t_{SC} condition in in <i>Table 6: "IGBT switching characteristics (inductive load)"</i> .
18-Dec-2015	3	Added part number STGW30M65DF2 Added <i>Section 4.1: "TO-247 package information"</i> Minor text changes.
20-May-2016	4	Updated features in cover page. Minor text changes
11-Apr-2017	5	Updated document title. Updated <i>Table 4: "Static characteristics"</i> , <i>Table 6: "IGBT switching characteristics (inductive load)"</i> and <i>Table 7: "Diode switching characteristics (inductive load)"</i> . Updated <i>Section 4: "Package information"</i> . Minor text changes
08-Nov-2024	6	Updated Section 4.1: TO-247 package information and Section 4.2: TO-247 long leads package information . Minor text changes.



Contents

1	Electrical ratings	2
2	Electrical characteristics.....	3
2.1	Electrical characteristics (curves)	5
3	Test circuits	10
4	Package information.....	11
4.1	TO-247 package information	11
4.2	TO-247 long leads package information.....	13
	Revision history	15

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