STGWT15H60F

Trench gate field-stop IGBT, H series 600 V, 15 A high speed

Datasheet - production data

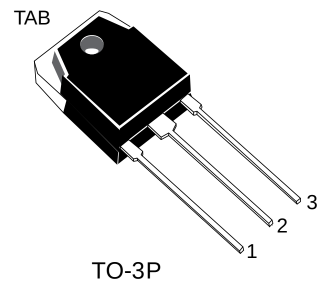
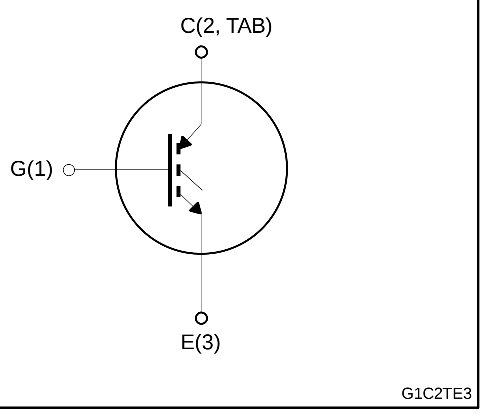


Figure 1: Internal schematic diagram



Features

- High speed switching
- Tight parameter distribution
- Safe paralleling
- Low thermal resistance
- Short-circuit rated

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 H series of IGBTs, which represents an optimum compromise between conduction and switching losses to maximize the efficiency of high switching frequency converters. 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	Packing
STGWT15H60F	G15H60F	TO-3P	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	600	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
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	°C

Notes:

(1)Pulse width is limited by maximum junction temperature.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case	1.3	°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 V, I_C = 2 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 15 A		1.6	2	V
		V_{GE} = 15 V, I_C = 15 A, T_J = 125 °C		1.7		
		V_{GE} = 15 V, I_C = 15 A, T_J = 175 °C		1.8		
$V_{GE(th)}$	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, V_{CE} = 600 V			25	µA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, 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 V	-	1952	-	pF
C_{oes}	Output capacitance		-	78	-	pF
C_{res}	Reverse transfer capacitance		-	45	-	pF
Q_g	Total gate charge	V_{CC} = 480 V, I_C = 15 A, V_{GE} = 0 to 15 V (see *Figure 24: "Gate charge test circuit"*)	-	81	-	nC
Q_{ge}	Gate-emitter charge		-	8	-	nC
Q_{gc}	Gate-collector charge		-	42	-	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 = 15 A, V_{GE} = 15 V, R_G = 10 Ω		24.5	-	ns
t_r	Current rise time			8.2	-	ns
(di/dt)on	Turn-on current slope			1470	-	A/μs
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 15 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 175 °C (see *Figure 23: "Test circuit for inductive load switching"*)		25	-	ns
t_r	Current rise time			9	-	ns
(di/dt)on	Turn-on current slope			1370	-	A/μs
$t_{r(Voff)}$	Off voltage rise time	V_{CE} = 400 V, I_C = 15 A, V_{GE} = 15 V, R_G = 10 Ω,		18	-	ns
$t_{d(off)}$	Turn-off delay time			118	-	ns
t_f	Current fall time			69	-	ns
$t_{r(Voff)}$	Off voltage rise time	V_{CE} = 400 V, I_C = 15 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 175 °C (see *Figure 23: "Test circuit for inductive load switching"*)		27	-	ns
$t_{d(off)}$	Turn-off delay time			124	-	ns
t_f	Current fall time			101	-	ns
t_{sc}	Short-circuit withstand time	V_{CC} ≤ 360 V, V_{GE} = 15 V, R_G = 10 Ω	3	5	-	μs

Table 7: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on} (1)	Turn-on switching energy	V_{CE} = 400 V, I_C = 15 A, R_G = 10 Ω, V_{GE} = 15 V	-	136	-	μJ
E_{off} (2)	Turn-off switching energy		-	207	-	μJ
E_{ts}	Total switching energy		-	343	-	μJ
E_{on} (1)	Turn-on switching energy	V_{CE} = 400 V, I_C = 15 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 175 °C	-	224	-	μJ
E_{off} (2)	Turn-off switching energy		-	329	-	μJ
E_{ts}	Total switching energy		-	553	-	μJ

Notes:

(1)Including the reverse recovery of the external diode. The diode is the same of the co-packed STGP15H60DF.

(2)Including the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 2: Power dissipation vs. case temperature

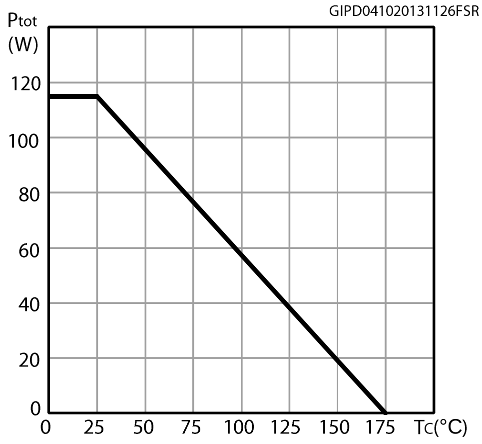


Figure 3: Collector current vs. case temperature

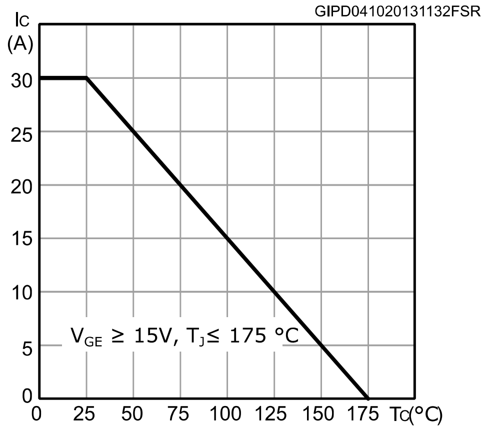


Figure 4: Output characteristics (T_J = 25°C)

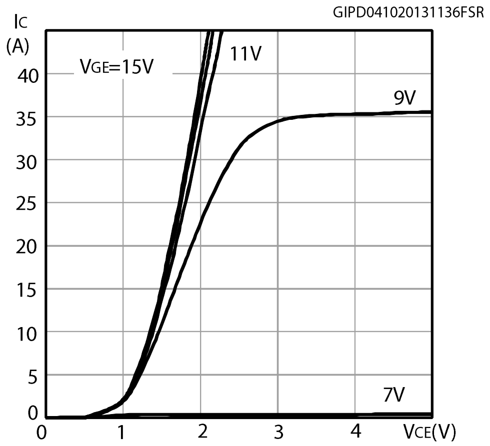


Figure 5: Output characteristics (T_J = 175°C)

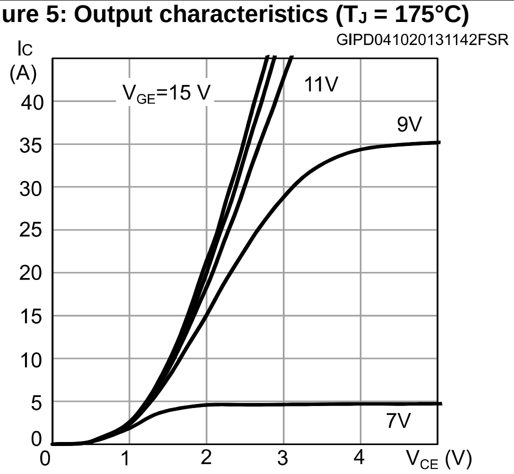


Figure 6: $V_{CE(sat)}$ vs. junction temperature

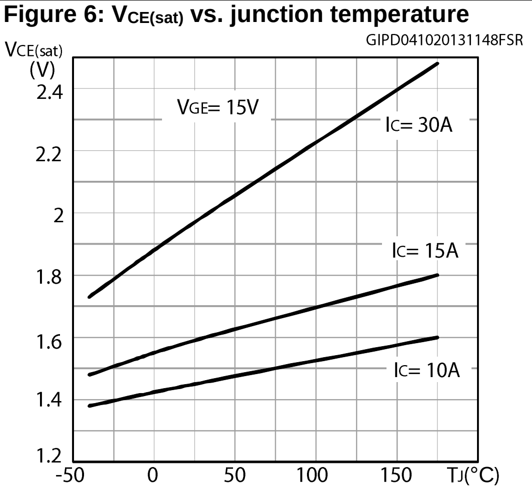


Figure 7: $V_{CE(sat)}$ vs. collector current

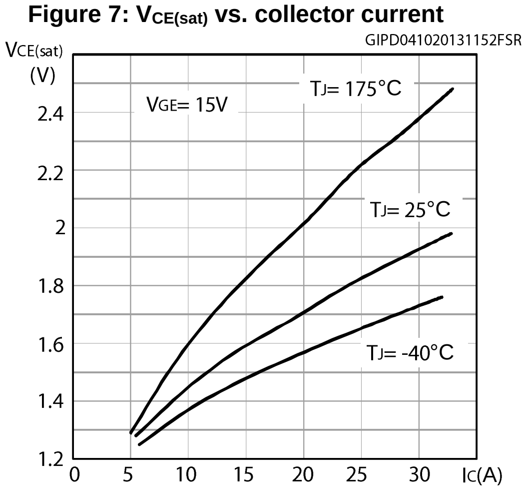


Figure 8: Collector current vs. switching frequency

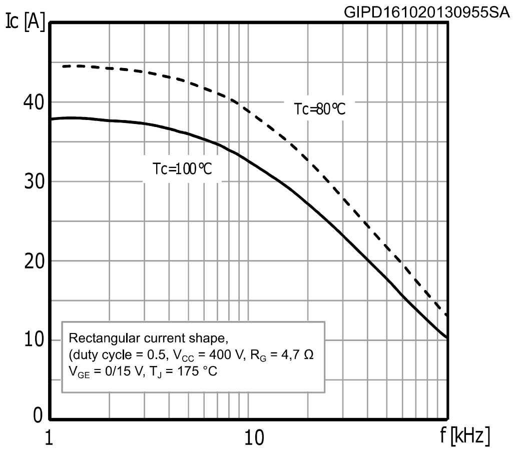


Figure 9: Forward bias safe operating area

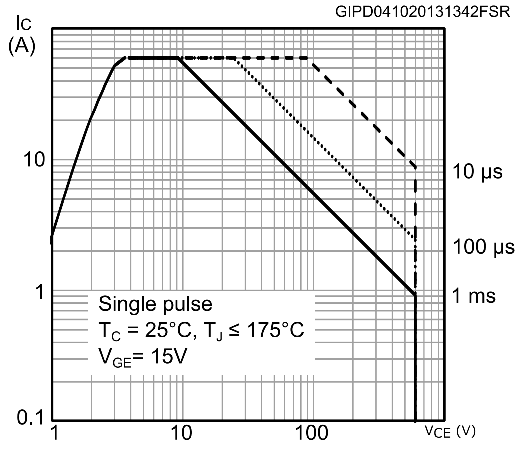


Figure 10: Transfer characteristics

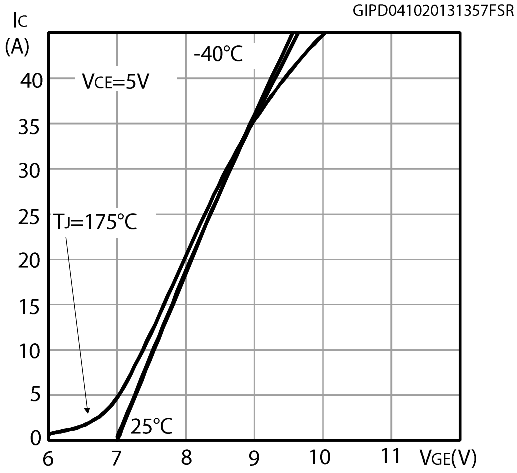


Figure 11: Normalized $V_{GE(th)}$ vs junction temperature

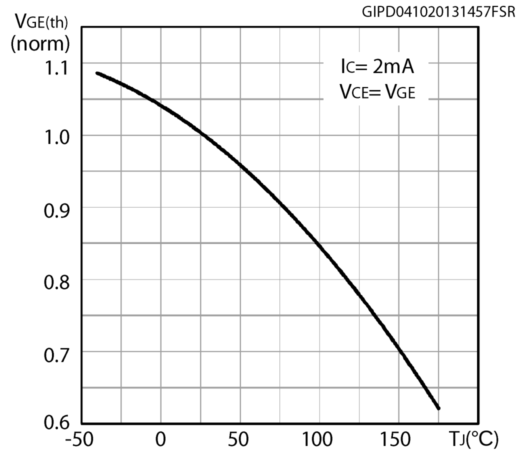


Figure 12: Normalized $V_{(BR)CES}$ vs. junction temperature

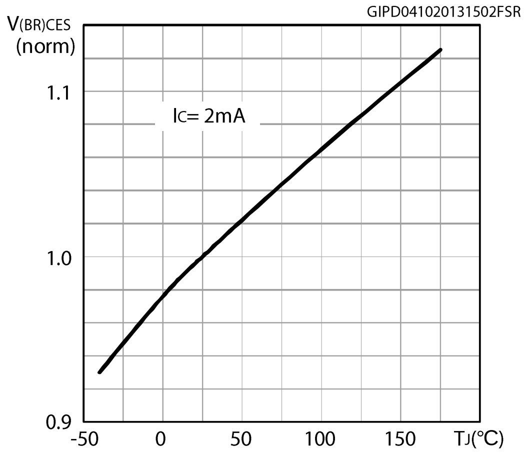


Figure 13: Capacitance variation

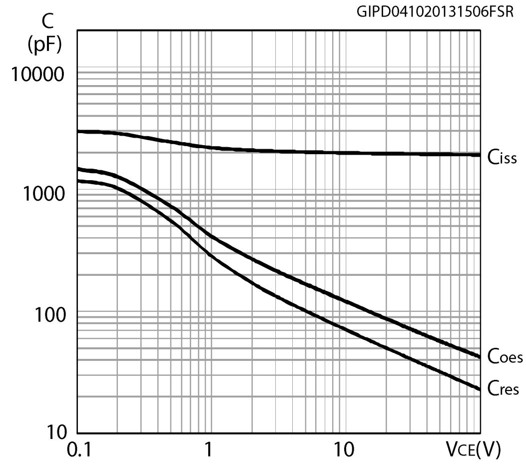


Figure 14: Gate charge vs. gate-emitter voltage

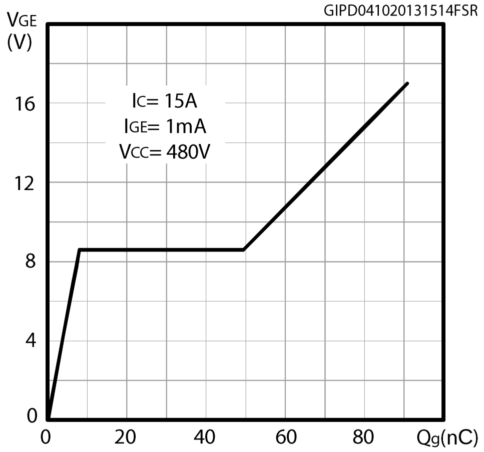


Figure 15: Switching energy vs collector current

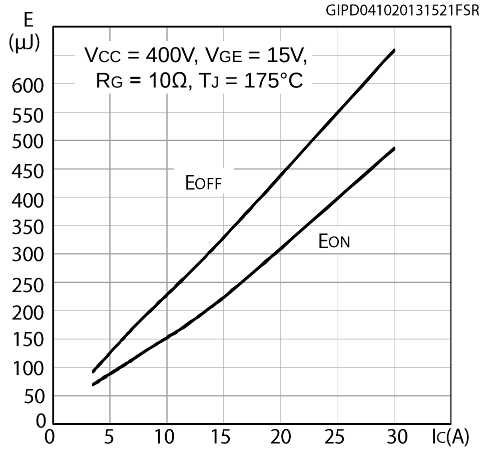


Figure 16: Switching energy vs gate resistance

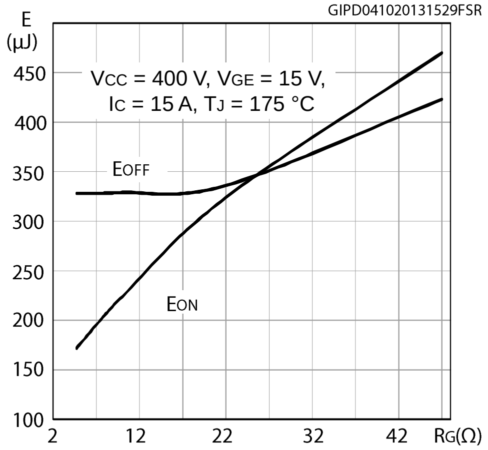


Figure 17: Switching energy vs temperature

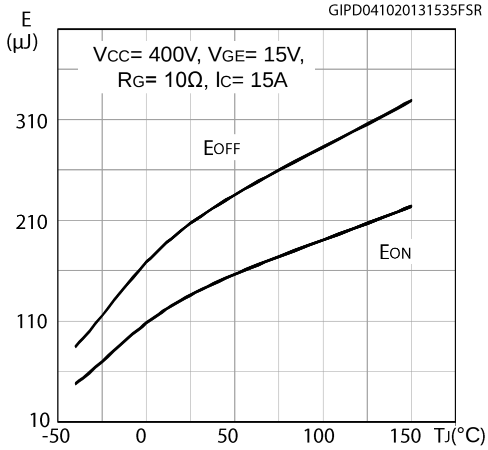


Figure 18: Switching energy vs collector-emitter voltage

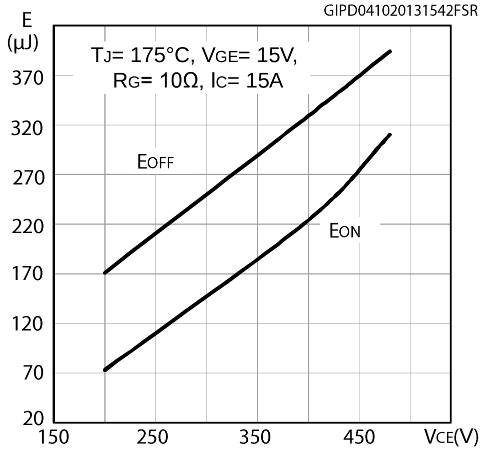


Figure 19: Short circuit time and current vs V_{GE}

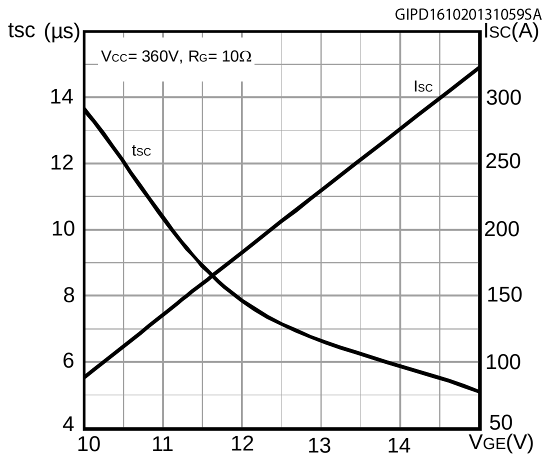


Figure 20: Switching times vs. collector current

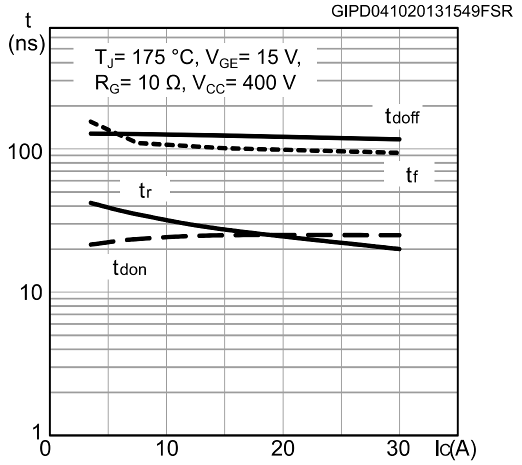


Figure 21: Switching times vs. gate resistance

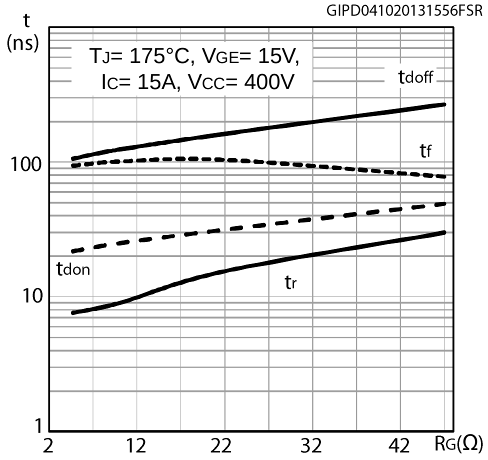
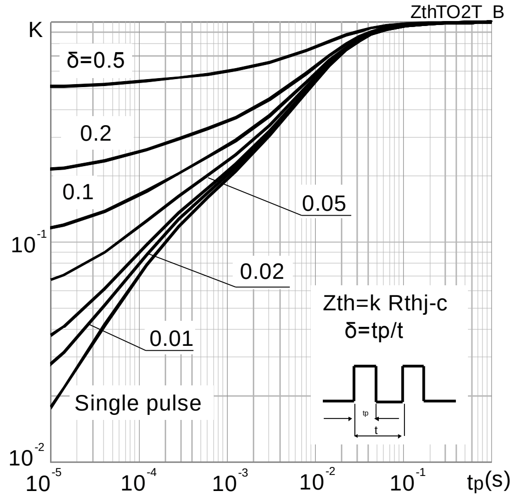


Figure 22: Thermal impedance



3 Test circuits

Figure 23: Test circuit for inductive load switching

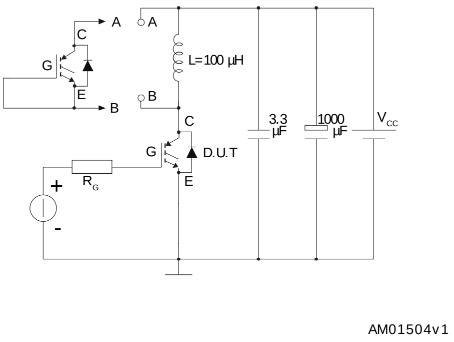


Figure 24: Gate charge test circuit

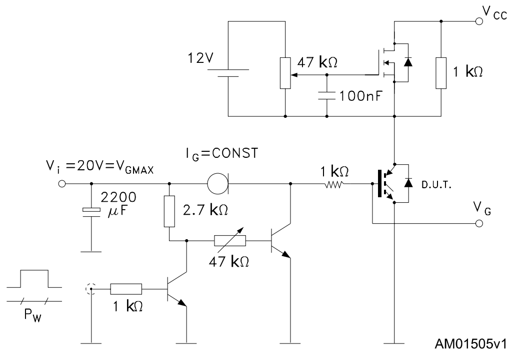
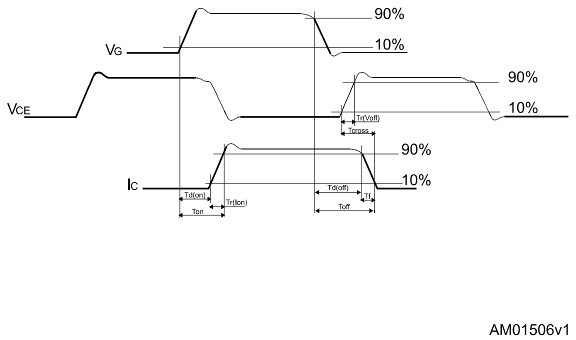


Figure 25: Switching waveform



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-3P package information

Figure 26: TO-3P package outline

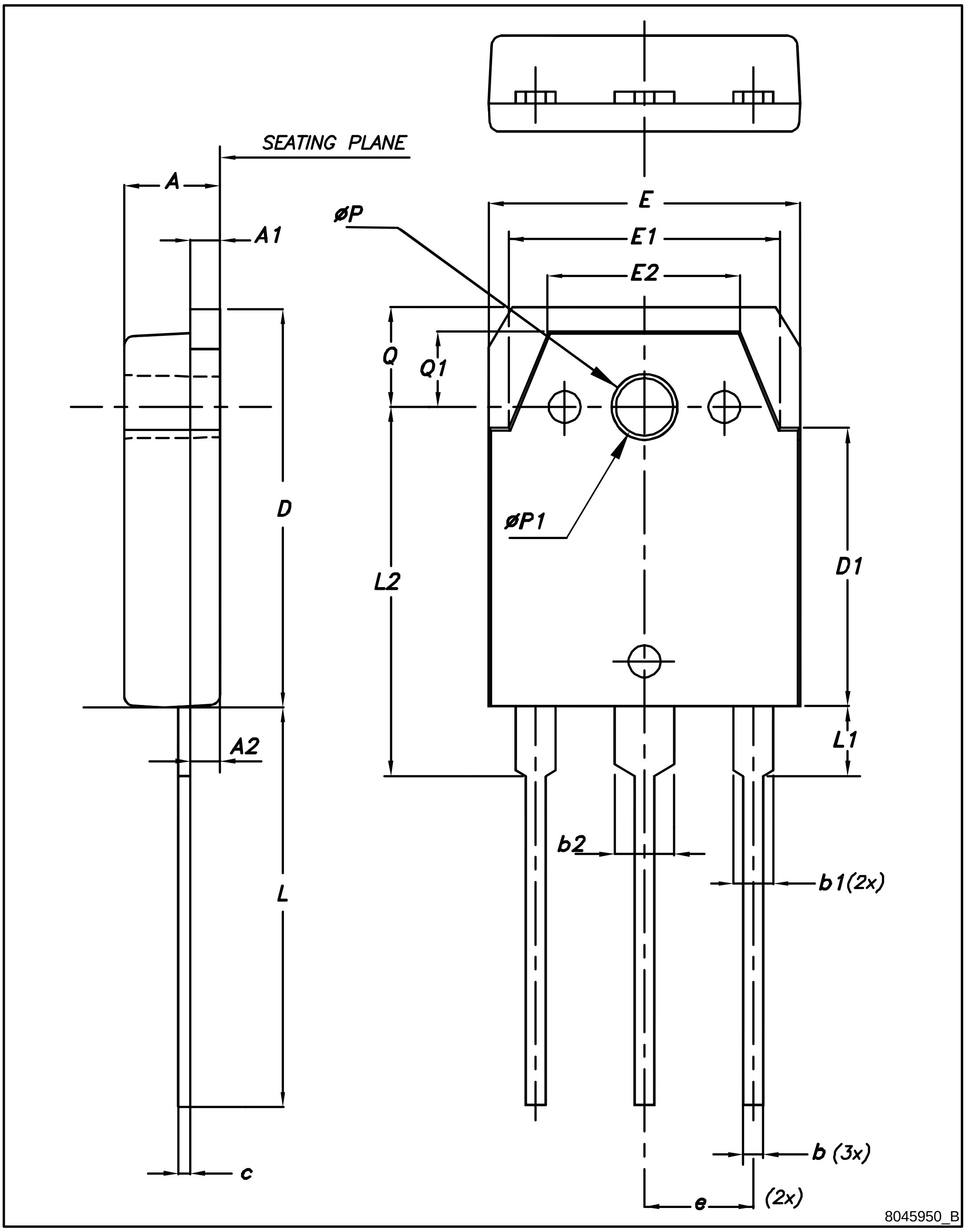


Table 8: TO-3P package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.60	4.80	5.00
A1	1.45	1.50	1.65
A2	1.20	1.40	1.60
b	0.80	1.00	1.20
b1	1.80	2.00	2.20
b2	2.80	3.00	3.20
c	0.55	0.60	0.75
D	19.70	19.90	20.10
D1	13.70	13.90	14.10
E	15.40	15.60	15.80
E1	13.40	13.60	13.80
E2	9.40	9.60	9.90
e	5.15	5.45	5.75
L	19.80	20.00	20.20
L1	3.30	3.50	3.70
L2	18.20	18.40	18.60
ØP	3.30	3.40	3.50
ØP1	3.10	3.20	3.30
Q	4.80	5.00	5.20
Q1	3.60	3.80	4

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
10-Feb-2017	1	First release

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
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