STGD3NC120H

7 A, 1200 V very fast IGBT

Datasheet — production data

Features

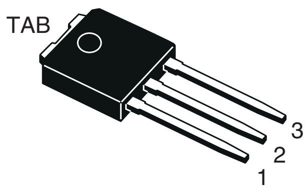
- High voltage capability
- High speed

Applications

- Home appliance
- Lighting

Description

This device is a very fast IGBT developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. This device is well-suited for resonant or soft-switching applications.



IPAK (TO251)

Figure 1. Internal schematic diagram

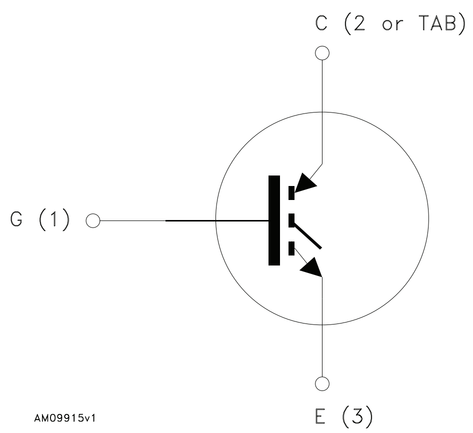


Table 1. Device summary

Order code	Marking	Package	Packaging
STGD3NC120H-1	GD3NC120H	IPAK (TO251)	Tube

This is information on a product in full production.

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	1200	V
I_C (1)	Continuous collector current at T_C = 25 °C	16	A
I_C (1)	Continuous collector current at T_C = 100 °C	9	A
I_{CL} (2)	Turn-off latching current	14	A
I_{CP} (3)	Pulsed collector current	20	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total dissipation at T_C = 25 °C	105	W
T_J	Operating junction temperature	-55 to 150	°C

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2. V_{clamp} = 80% V_{CES}, T_j = 150 °C, R_G = 10 Ω, V_{GE} = 15 V
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	1.2	°C/W
R_{thJA}	Thermal resistance junction-ambient	100	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified.

Table 4. Static electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C = 1 mA	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 3 A V_{GE} = 15 V, I_C = 3 A, T_J=125 °C		2.3 2.2	2.8	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	2		5	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 1200 V V_{CE} = 1200 V, T_J=125 °C			50 1	µA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ± 20 V			± 100	nA
g_{fs} (1)	Forward transconductance	V_{CE} = 25 V, I_C = 3 A		4		S

1. Pulse duration: 300 µs, duty cycle 1.5%

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}=0	-	470 45 6	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 960 V, I_C= 3 A,V_{GE}=15 V	-	24 3 10	-	nC nC nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 18)*	-	15 3.5 880	-	ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125 °C *(see Figure 18)*	-	14.5 4 770	-	ns ns A/µs
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 18)*	-	72 118 250	-	ns ns ns
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125 °C *(see Figure 18)*	-	132 210 470	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 18)*	-	236 290 526	-	µJ µJ µJ
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125 °C *(see Figure 18)*	-	360 620 980	-	µJ µJ µJ

1. Eon is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature (25 °C and 125 °C)
2. Turn-off losses include also the tail of the collector current

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

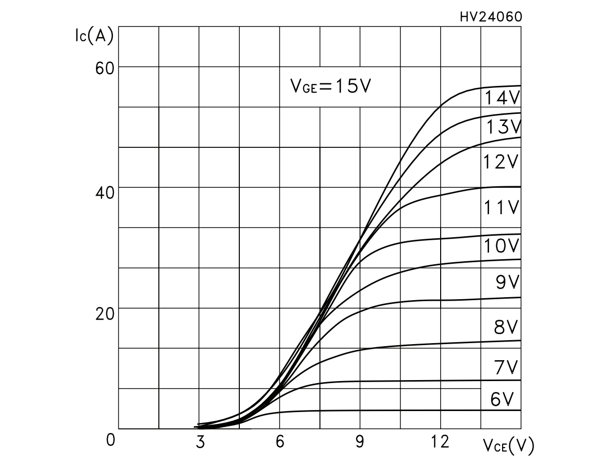


Figure 3. Transfer characteristics

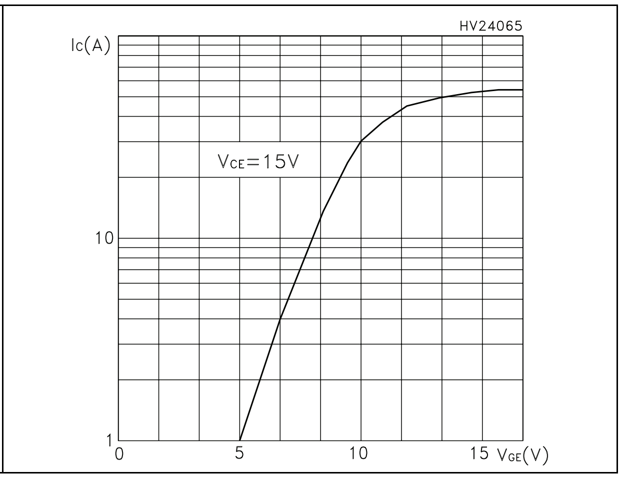


Figure 4. Transconductance

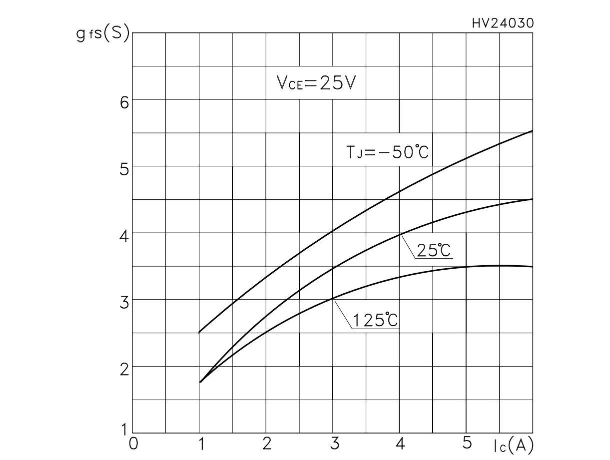


Figure 5. Collector-emitter on voltage vs. temperature

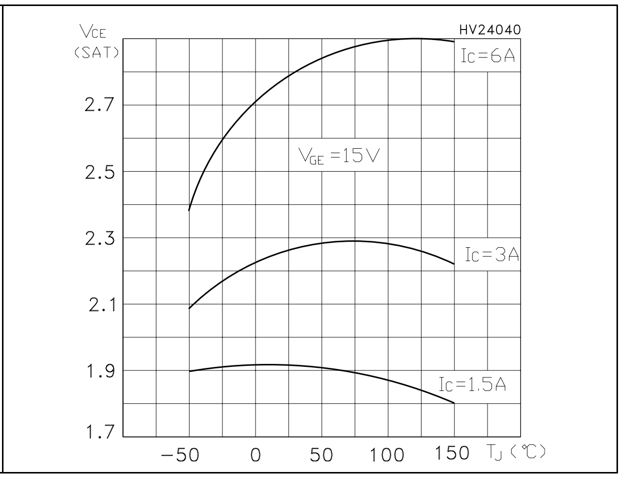


Figure 6. Collector-emitter on voltage vs. collector current

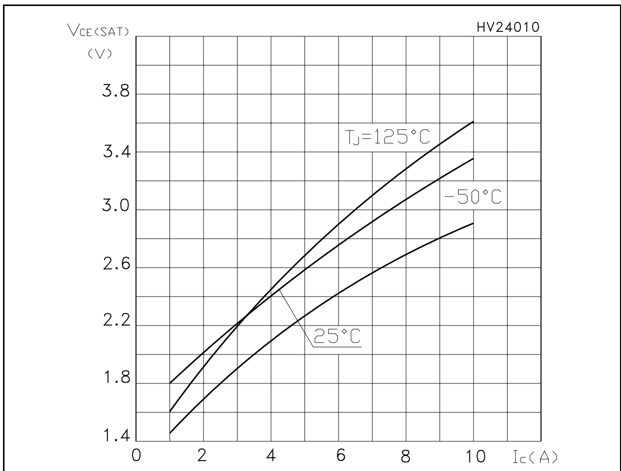


Figure 7. Normalized gate threshold voltage vs. temperature

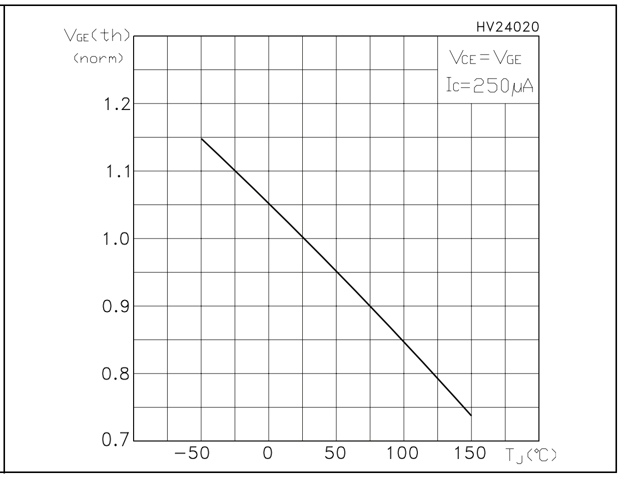


Figure 8. Normalized breakdown voltage vs. temperature

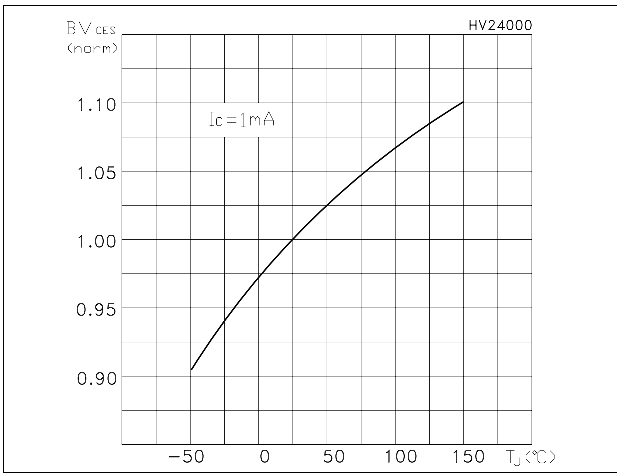


Figure 9. Gate charge vs. gate-source voltage

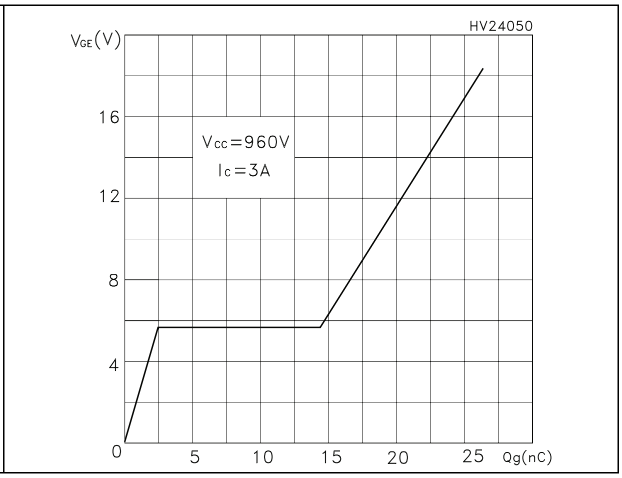


Figure 10. Capacitance variations

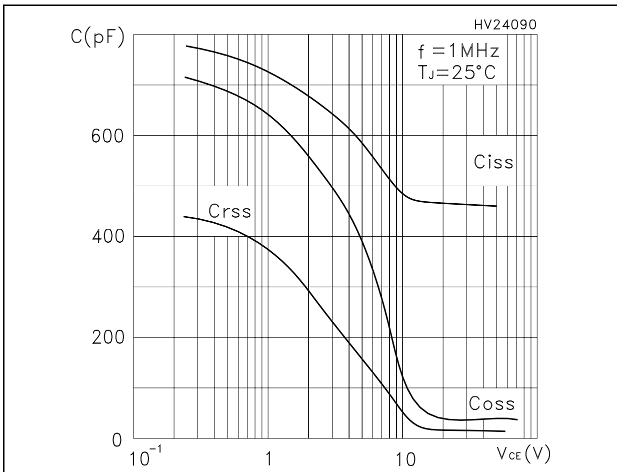


Figure 11. Switching losses vs. temperature

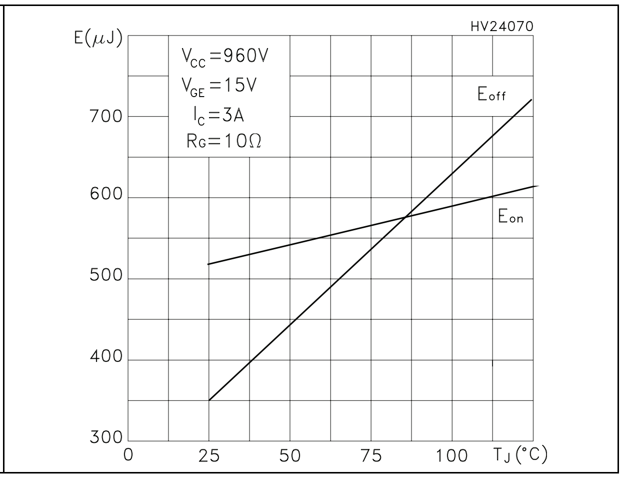


Figure 12. Switching losses vs. gate resistance

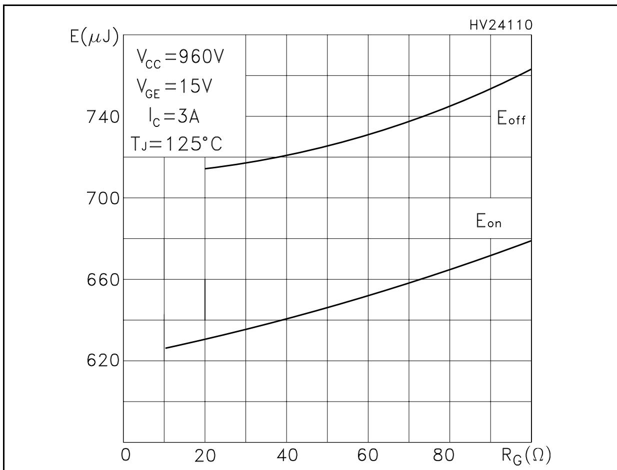


Figure 13. Switching losses vs. collector current

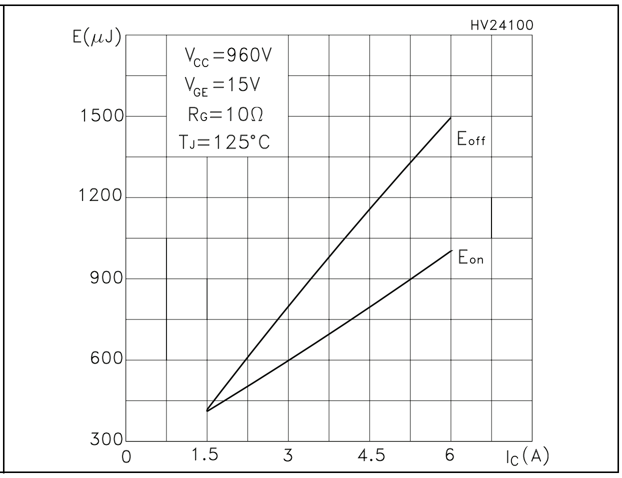


Figure 14. Power losses @ I_C = 3 A

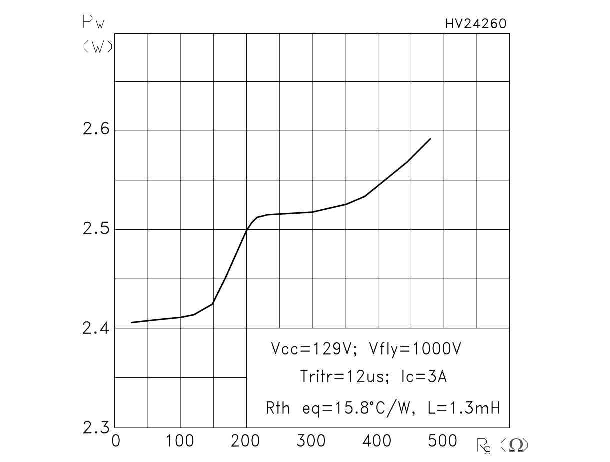


Figure 15. Power losses @ I_C = 2 A

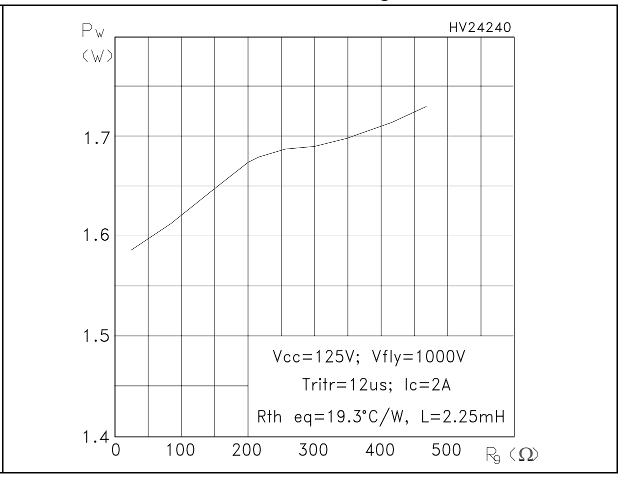


Figure 16. Turn-off SOA

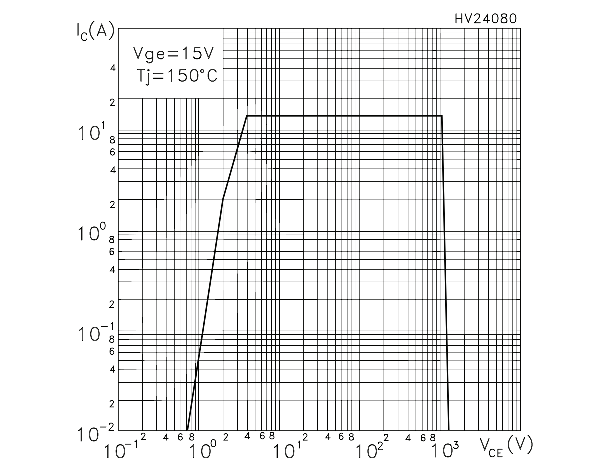
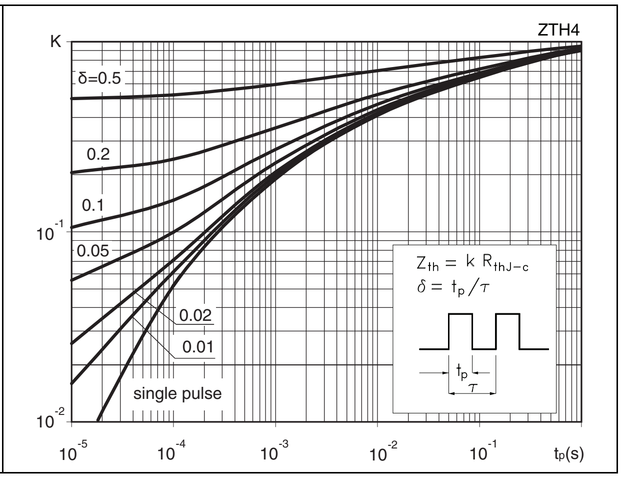


Figure 17. Thermal impedance



3 Test circuit

Figure 18. Test circuit for inductive load switching

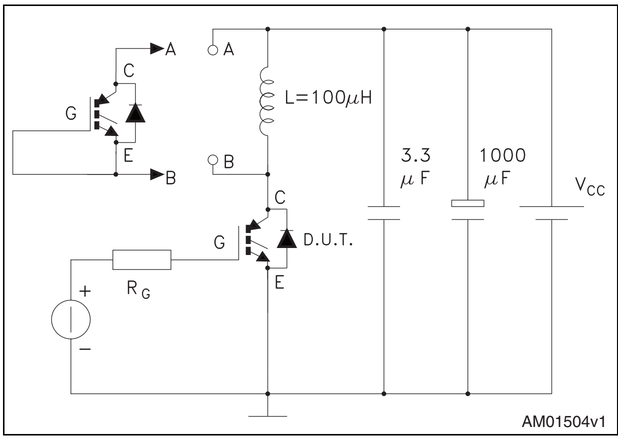


Figure 19. Gate charge test circuit

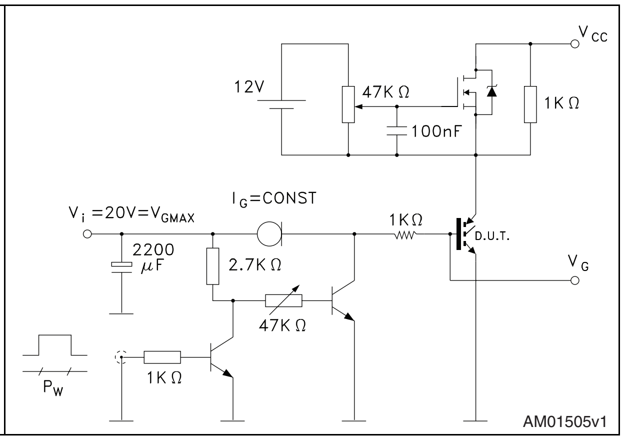
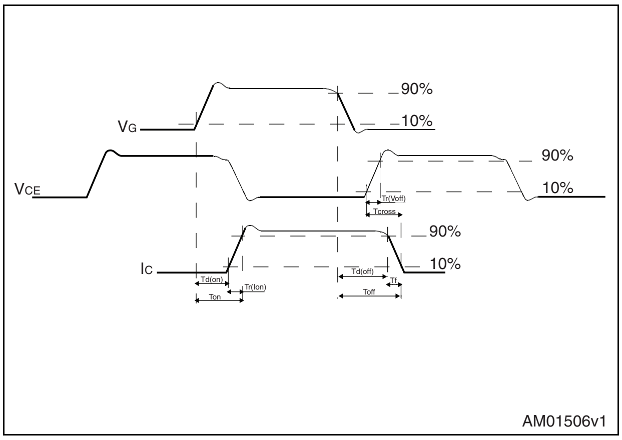


Figure 20. Switching waveform



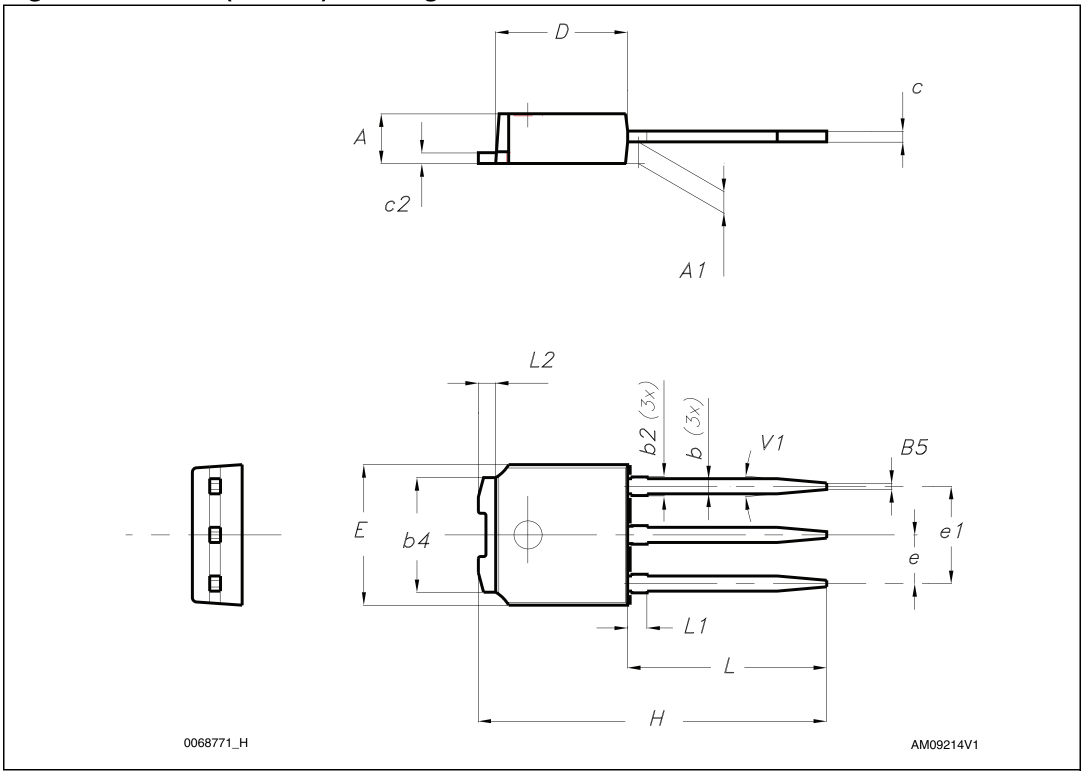
4 Package mechanical data

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.

Table 8. IPAK (TO-251) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.3	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10 °	

Figure 21. IPAK (TO-251) drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
27-Jun-2012	1	First release.

Please Read Carefully: