

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.

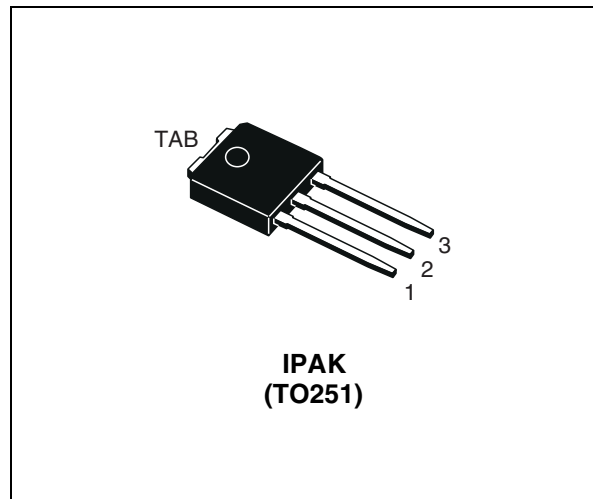


Figure 1. Internal schematic diagram

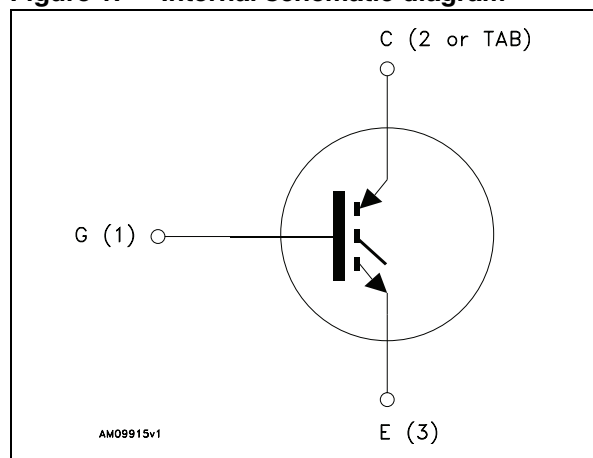


Table 1. Device summary

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

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$)	1200	V
$I_C^{(1)}$	Continuous collector current at $T_C = 25\text{ °C}$	16	A
$I_C^{(1)}$	Continuous collector current at $T_C = 100\text{ °C}$	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 $T_C = 25\text{ °C}$	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. $V_{clamp} = 80\% V_{CES}$, $T_j = 150\text{ °C}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$
 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
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 800\text{ V}, I_C = 3\text{ A}$	-	15	-	ns
t_r	Current rise time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ (see Figure 18)	-	3.5	-	ns
$(di/dt)_{on}$	Turn-on current slope			880		A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 800\text{ V}, I_C = 3\text{ A}$	-	14.5	-	ns
t_r	Current rise time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ $T_J = 125\text{ }^\circ\text{C}$ (see Figure 18)	-	4	-	ns
$(di/dt)_{on}$	Turn-on current slope			770		A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 800\text{ V}, I_C = 3\text{ A}$	-	72	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ (see Figure 18)	-	118	-	ns
t_f	Current fall time			250		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 800\text{ V}, I_C = 3\text{ A}$	-	132	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ $T_J = 125\text{ }^\circ\text{C}$ (see Figure 18)	-	210	-	ns
t_f	Current fall time			470		ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 800\text{ V}, I_C = 3\text{ A}$	-	236	-	μ J
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ (see Figure 18)	-	290	-	μ J
E_{ts}	Total switching losses			526		μ J
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 800\text{ V}, I_C = 3\text{ A}$	-	360	-	μ J
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ $T_J = 125\text{ }^\circ\text{C}$ (see Figure 18)	-	620	-	μ J
E_{ts}	Total switching losses			980		μ J

1. E_{on} 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

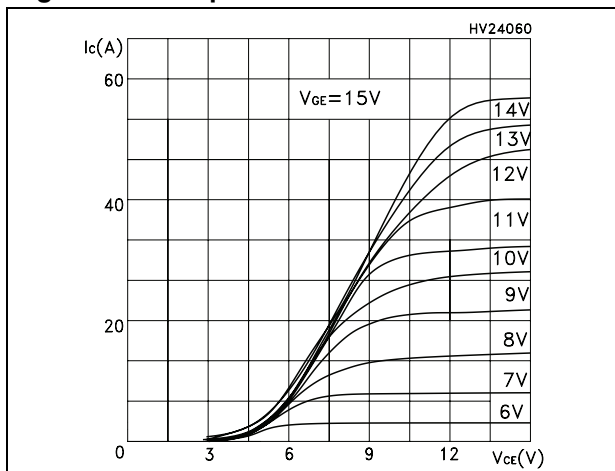


Figure 3. Transfer characteristics

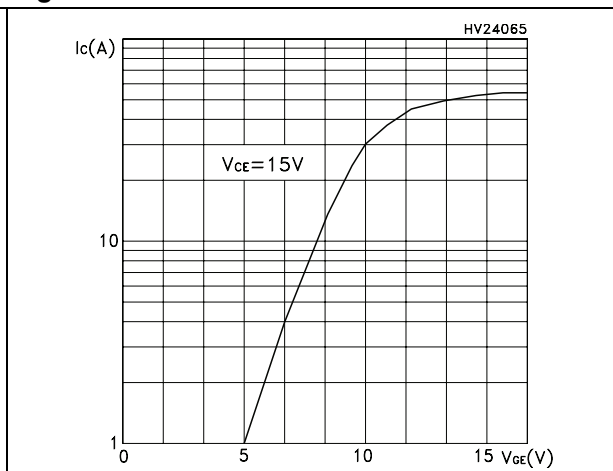


Figure 4. Transconductance

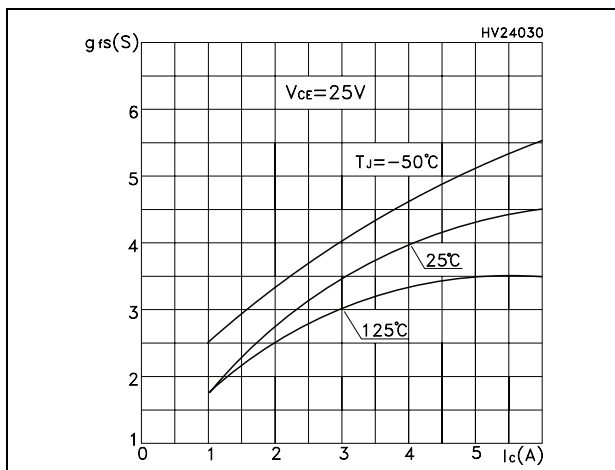


Figure 5. Collector-emitter on voltage vs. temperature

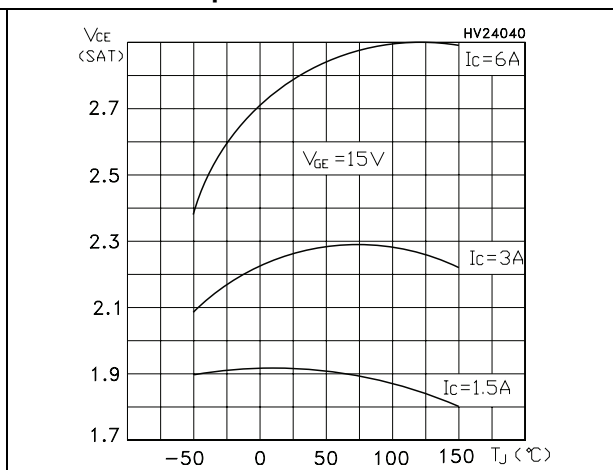


Figure 6. Collector-emitter on voltage vs. collector current

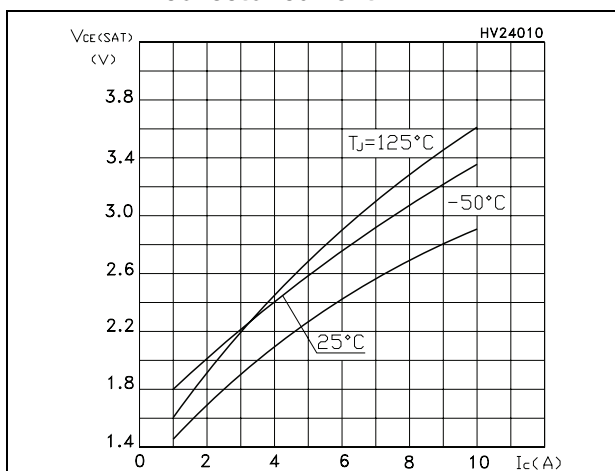


Figure 7. Normalized gate threshold voltage vs. temperature

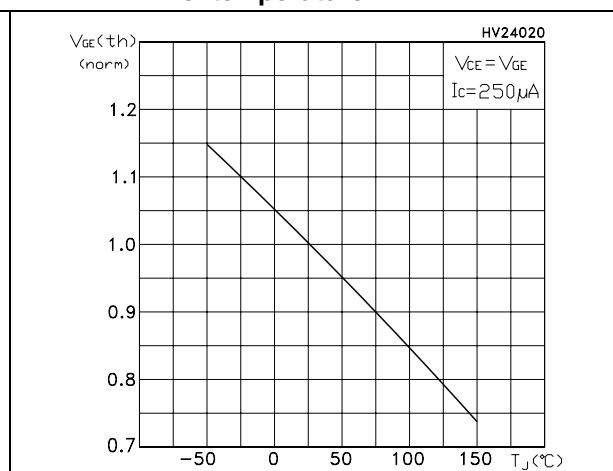


Figure 8. Normalized breakdown voltage vs. temperature

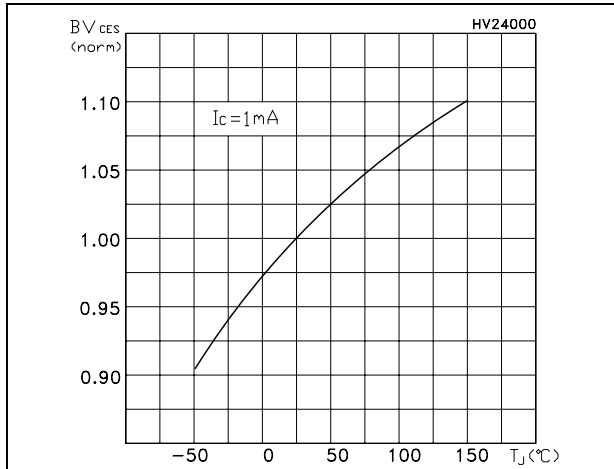


Figure 9. Gate charge vs. gate-source voltage

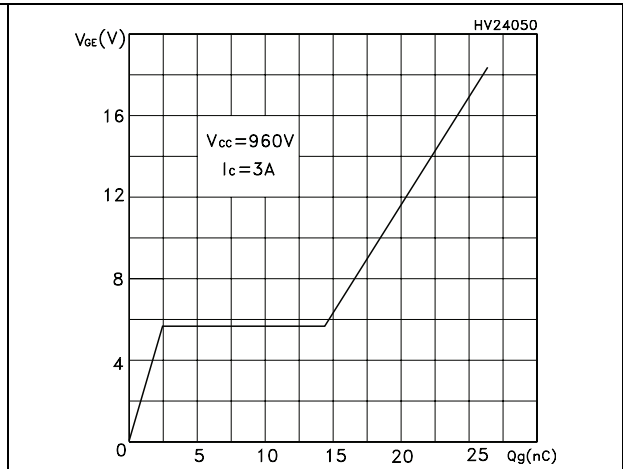


Figure 10. Capacitance variations

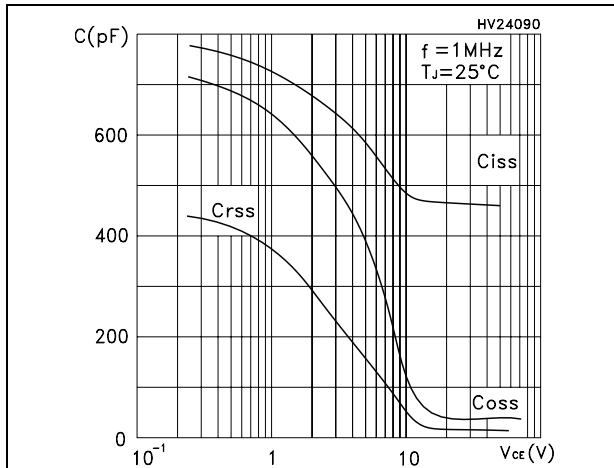


Figure 11. Switching losses vs. temperature

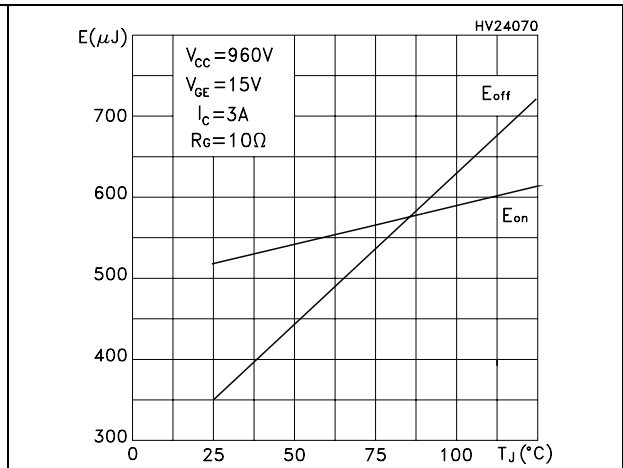


Figure 12. Switching losses vs. gate resistance

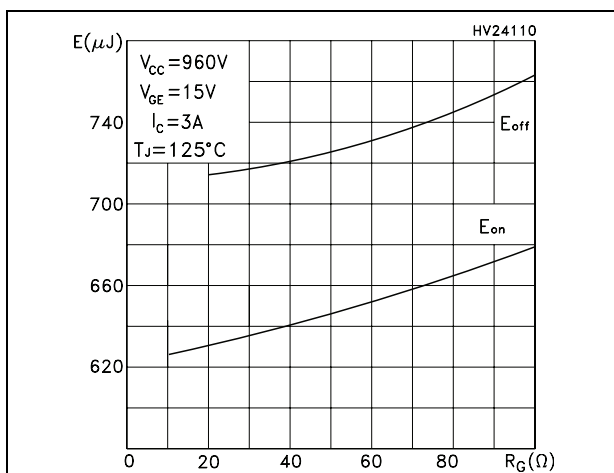


Figure 13. Switching losses vs. collector current

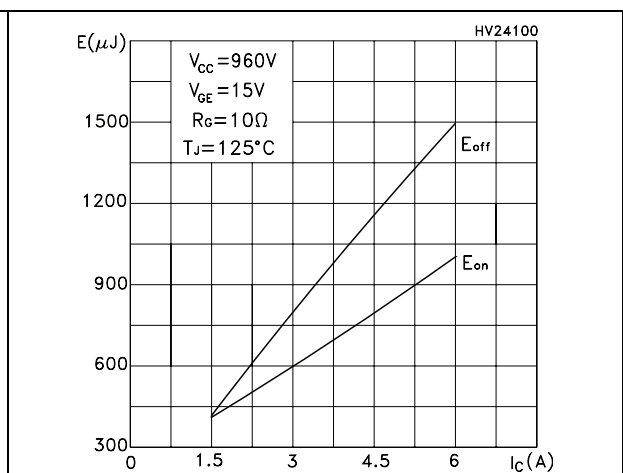


Figure 14. Power losses @ $I_C = 3\text{ A}$

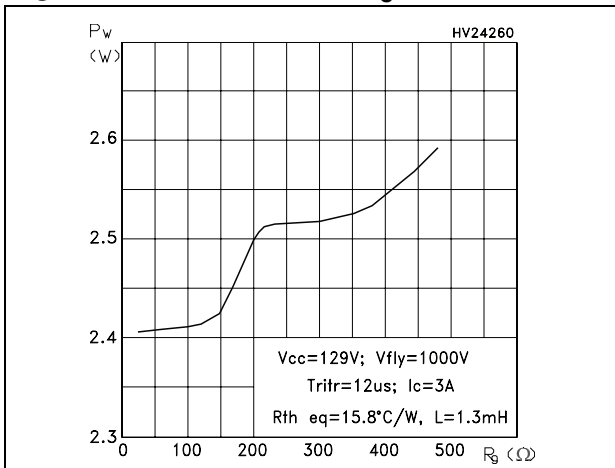


Figure 15. Power losses @ $I_C = 2\text{ A}$

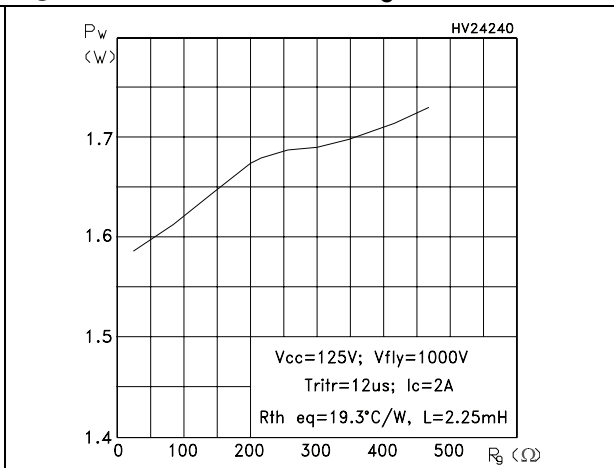


Figure 16. Turn-off SOA

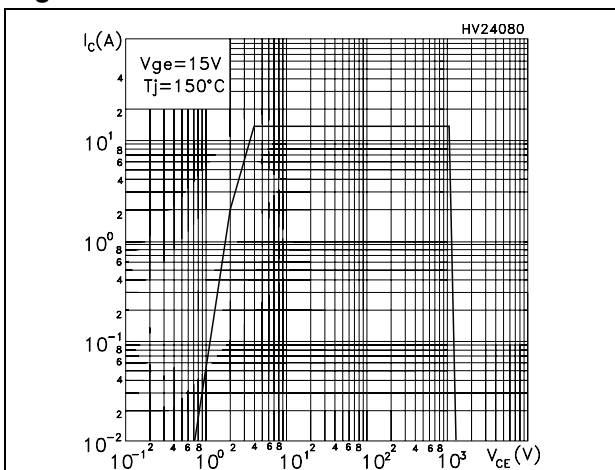
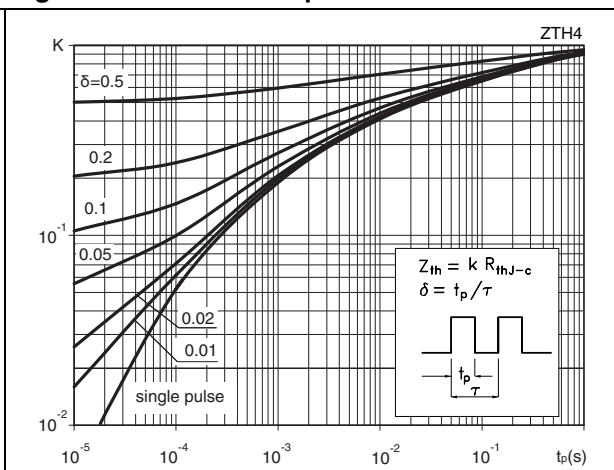


Figure 17. Thermal impedance



3 Test circuit

Figure 18. Test circuit for inductive load switching

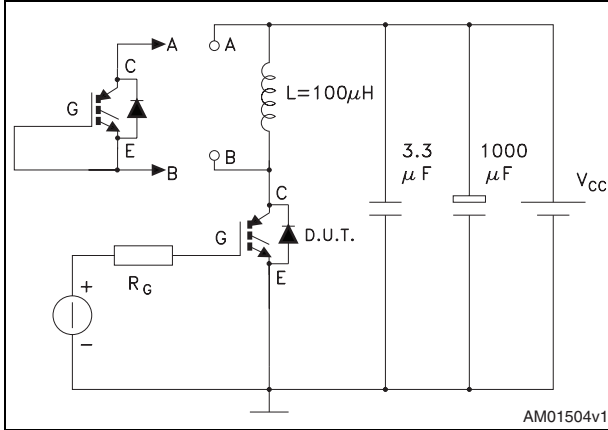


Figure 19. Gate charge test circuit

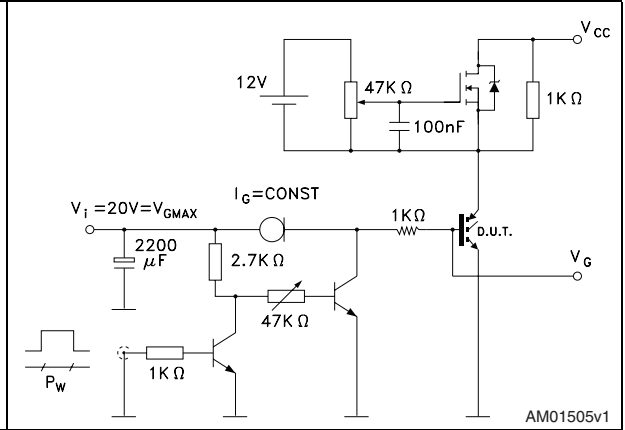
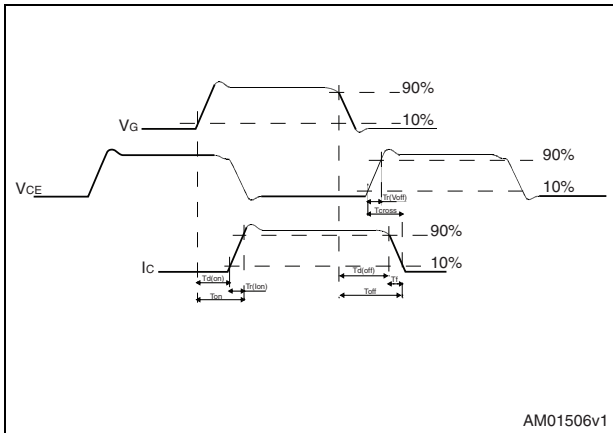


Figure 20. Switching waveform



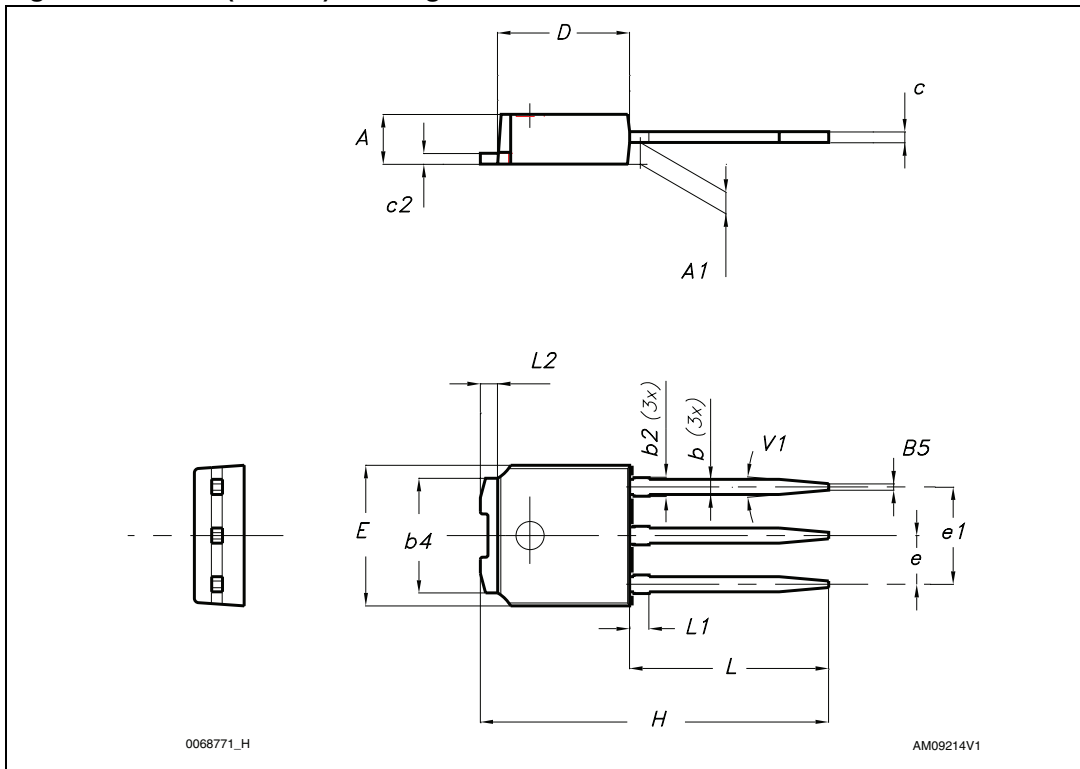
4 Package mechanical data

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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.

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