

Trench gate field-stop IGBT, H series 650 V, 30 A high speed

Datasheet - production data

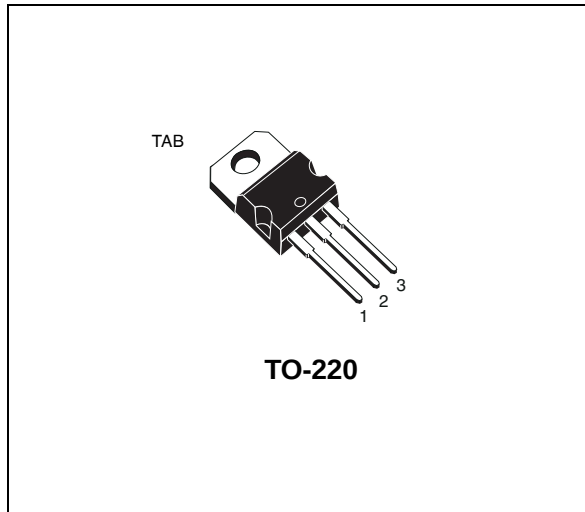
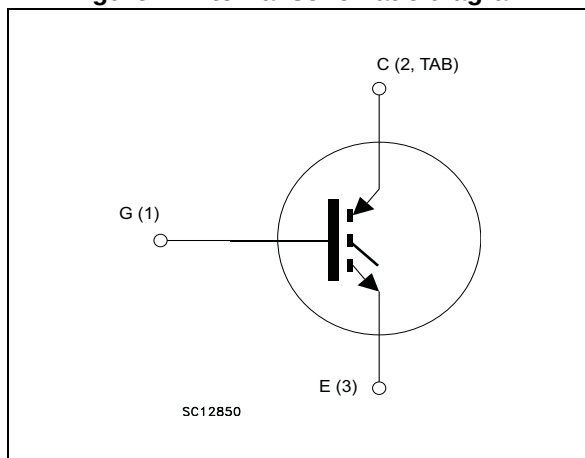


Figure 1. Internal schematic diagram



Features

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

Applications

- Inverter
- UPS
- PFC

Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. This IGBT series offers the optimum compromise between conduction and switching losses, maximizing the efficiency of very high frequency converters. Furthermore, a positive $V_{CE(sat)}$ temperature coefficient and very tight parameter distribution result in easier paralleling operation.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STGP30H65F	GP30H65F	TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$)	650	V
I_C	Continuous collector current at $T_C = 25\text{ °C}$	60	A
I_C	Continuous collector current at $T_C = 100\text{ °C}$	30	A
$I_{CP}^{(1)}$	Pulsed collector current	120	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	260	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature	- 55 to 175	

1. Pulse width limited by maximum junction temperature.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case	0.58	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 2\text{ mA}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$		2.0	2.4	V
		$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$ $T_J = 175\text{ °C}$		2.4		V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	5.0	6.0	7.0	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 650\text{ V}$			25	μA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$			250	nA

Table 5. Dynamic

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	3600	-	pF
C_{oes}	Output capacitance			130		pF
C_{res}	Reverse transfer capacitance			65		pF
Q_g	Total gate charge	$V_{CC} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$ (see Figure 20: Gate charge test circuit)	-	105	-	nC
Q_{ge}	Gate-emitter charge		-	30	-	nC
Q_{gc}	Gate-collector charge		-	35	-	nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	50	-	ns
t_r	Current rise time			15		ns
$(di/dt)_{on}$	Turn-on current slope			1600		A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	47	-	ns
t_r	Current rise time			17		ns
$(di/dt)_{on}$	Turn-on current slope			1400		A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	20	-	ns
$t_{d(off)}$	Turn-off delay time			160		ns
t_f	Current fall time			60		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	22	-	ns
$t_{d(off)}$	Turn-off delay time			146		ns
t_f	Current fall time			88		ns
t_{sc}	Short circuit withstand time	$V_{CC} \leq 360\text{ V}$, $V_{GE} = 15\text{ V}$	3	6	-	μ s

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	0.35	-	mJ
$E_{off}^{(2)}$	Turn-off switching losses		-	0.40	-	mJ
E_{ts}	Total switching losses		-	0.75	-	mJ
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	0.61	-	mJ
$E_{off}^{(2)}$	Turn-off switching losses		-	0.84	-	mJ
E_{ts}	Total switching losses		-	1.45	-	mJ

1. Energy losses include reverse recovery of the external diode. The diode is the same of the co-packed STGP30H60DF.

2. Turn-off losses include also the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics ($T_J = 25^{\circ}\text{C}$)

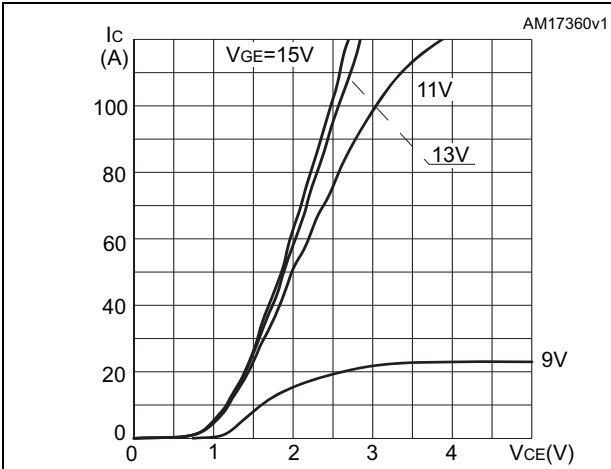


Figure 3. Output characteristics ($T_J = 175^{\circ}\text{C}$)

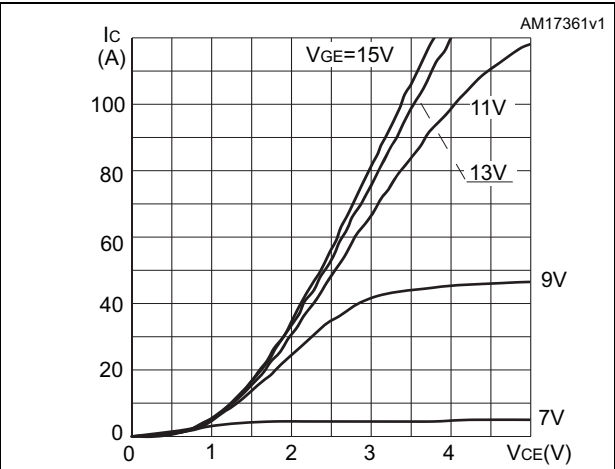


Figure 4. Transfer characteristics

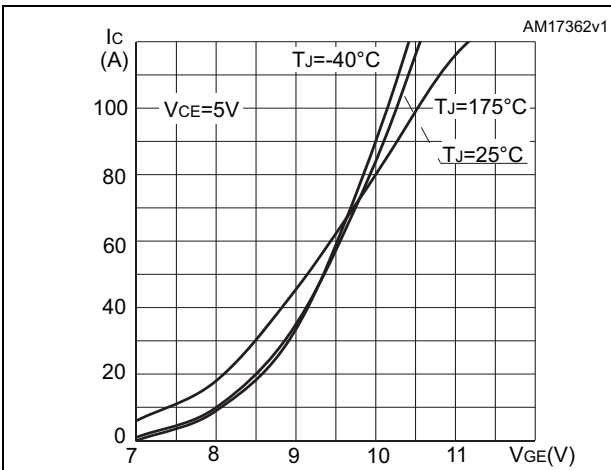


Figure 5. Normalized $V_{GE(th)}$ vs. junction temperature

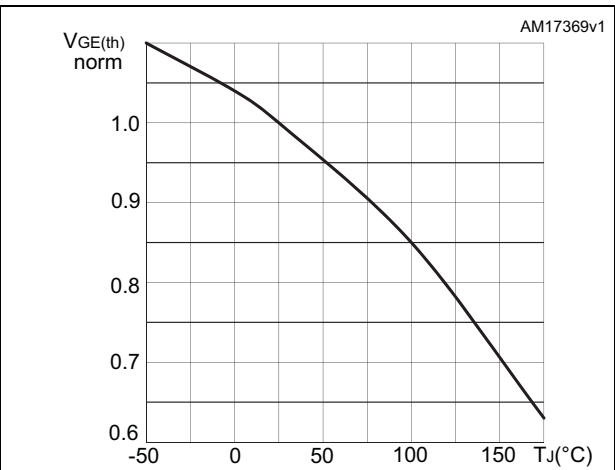


Figure 6. Power dissipation vs. case temperature

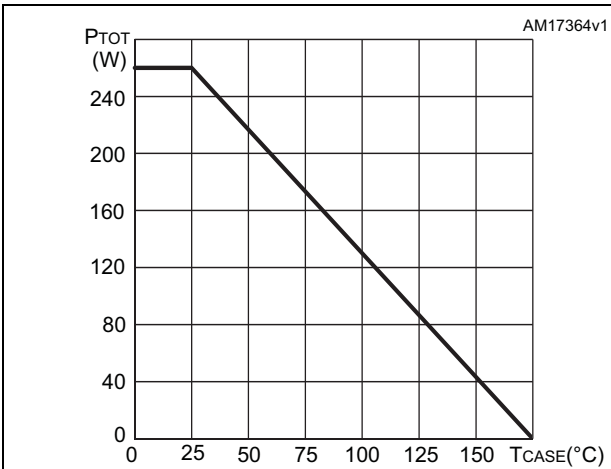


Figure 7. Collector current vs. frequency

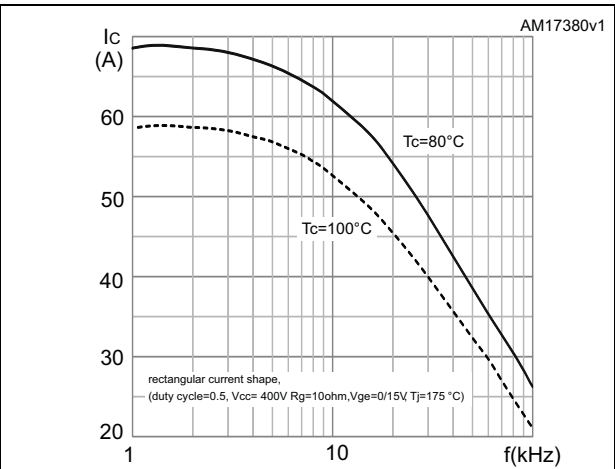


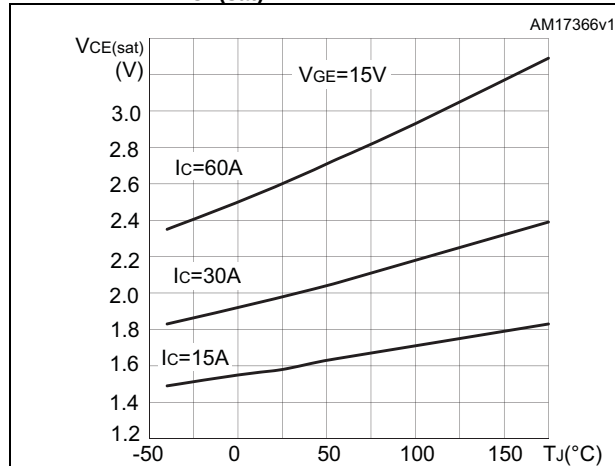
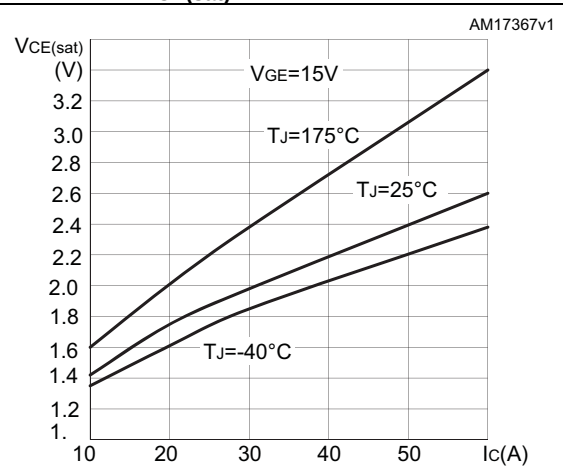
Figure 8. $V_{CE(sat)}$ vs. junction temperatureFigure 9. $V_{CE(sat)}$ vs. collector current

Figure 10. Forward bias safe operating area

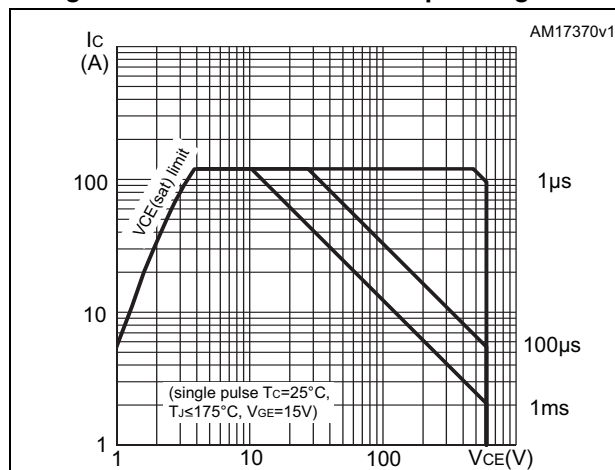


Figure 11. Thermal impedance

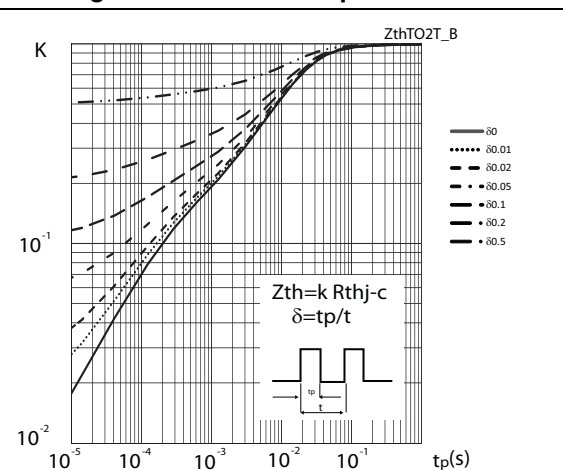


Figure 12. Gate charge vs. gate-emitter voltage

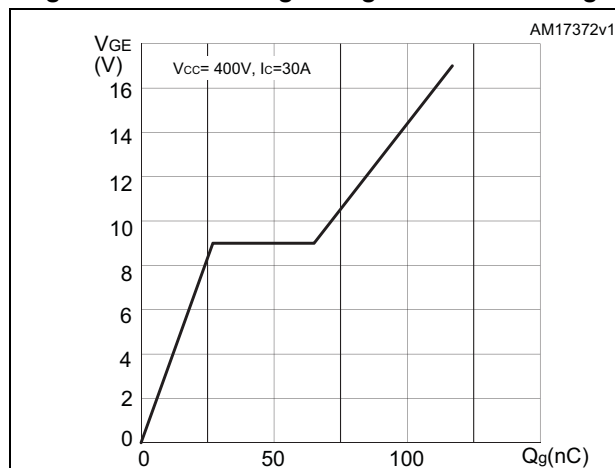
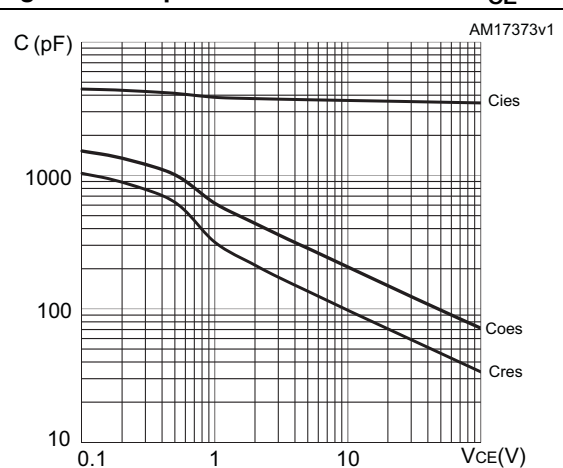
Figure 13. Capacitance variations vs. V_{CE} 

Figure 14. Collector current vs. case temperature

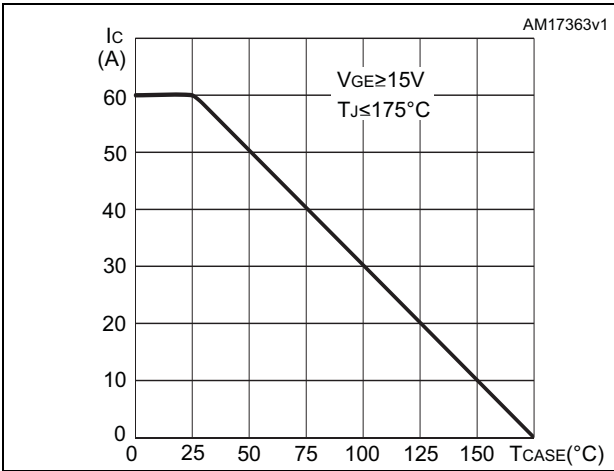


Figure 15. Switching losses vs. gate resistance

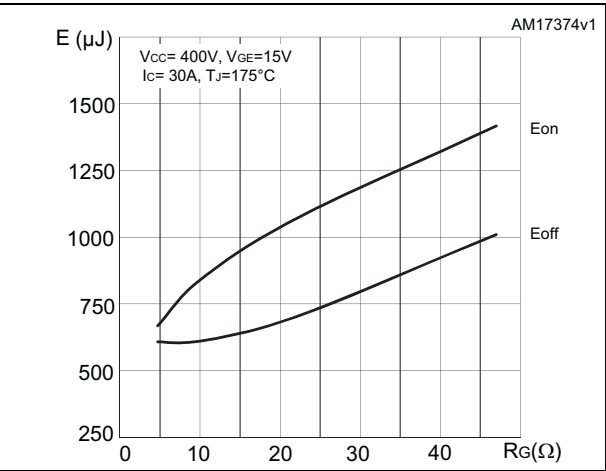


Figure 16. Switching losses vs. collector current

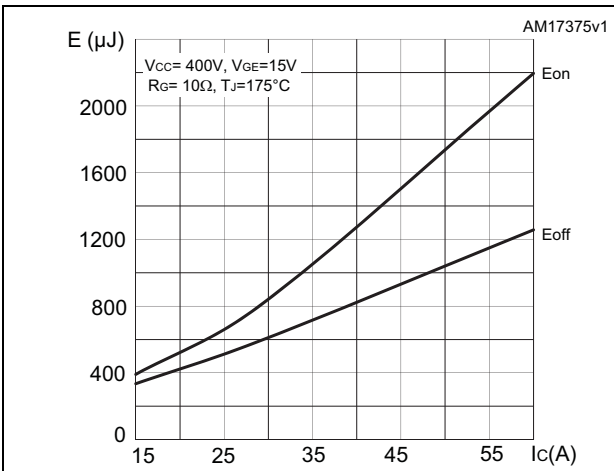


Figure 17. Switching losses vs temperature

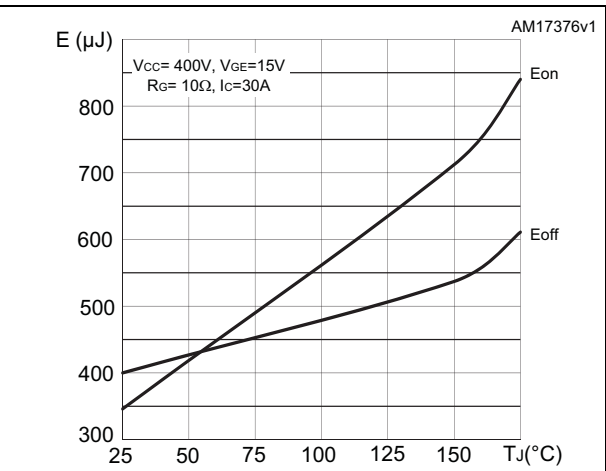
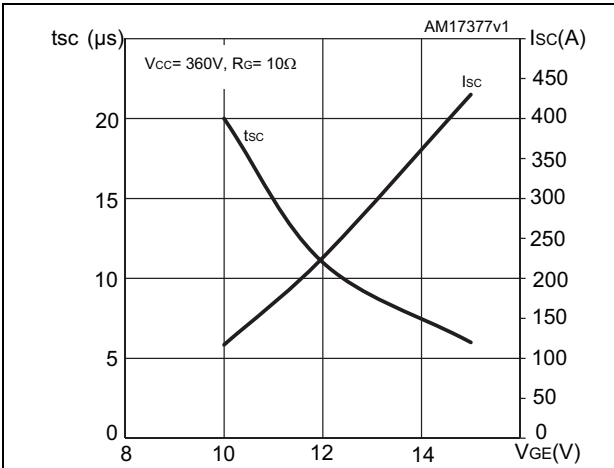


Figure 18. Short circuit time and current vs. V_{GE}



3 Test circuits

Figure 19. Test circuit for inductive load switching

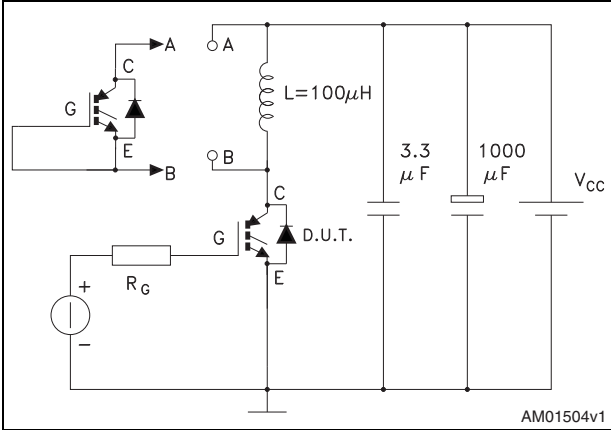


Figure 20. Gate charge test circuit

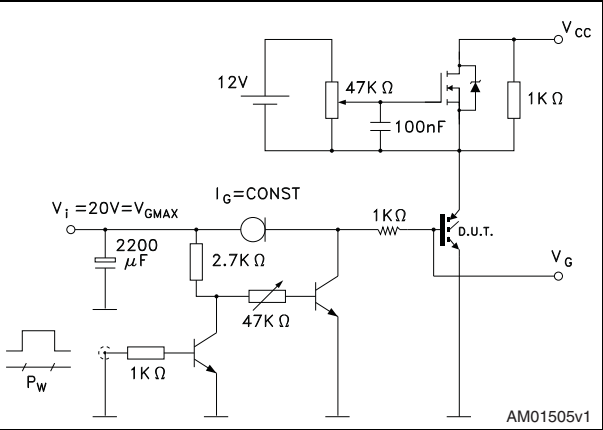
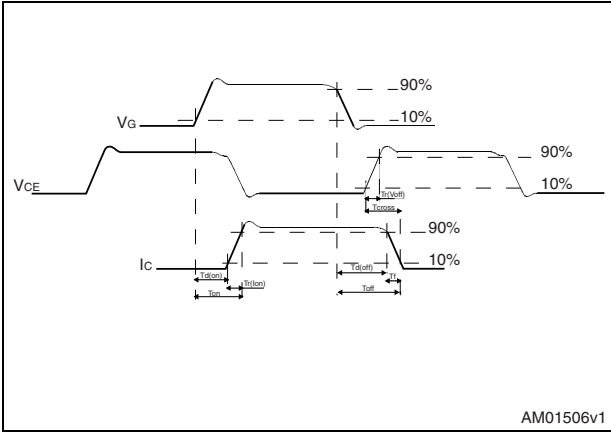


Figure 21. Switching waveform



4 Package mechanical data

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Figure 22. TO-220 type A drawing

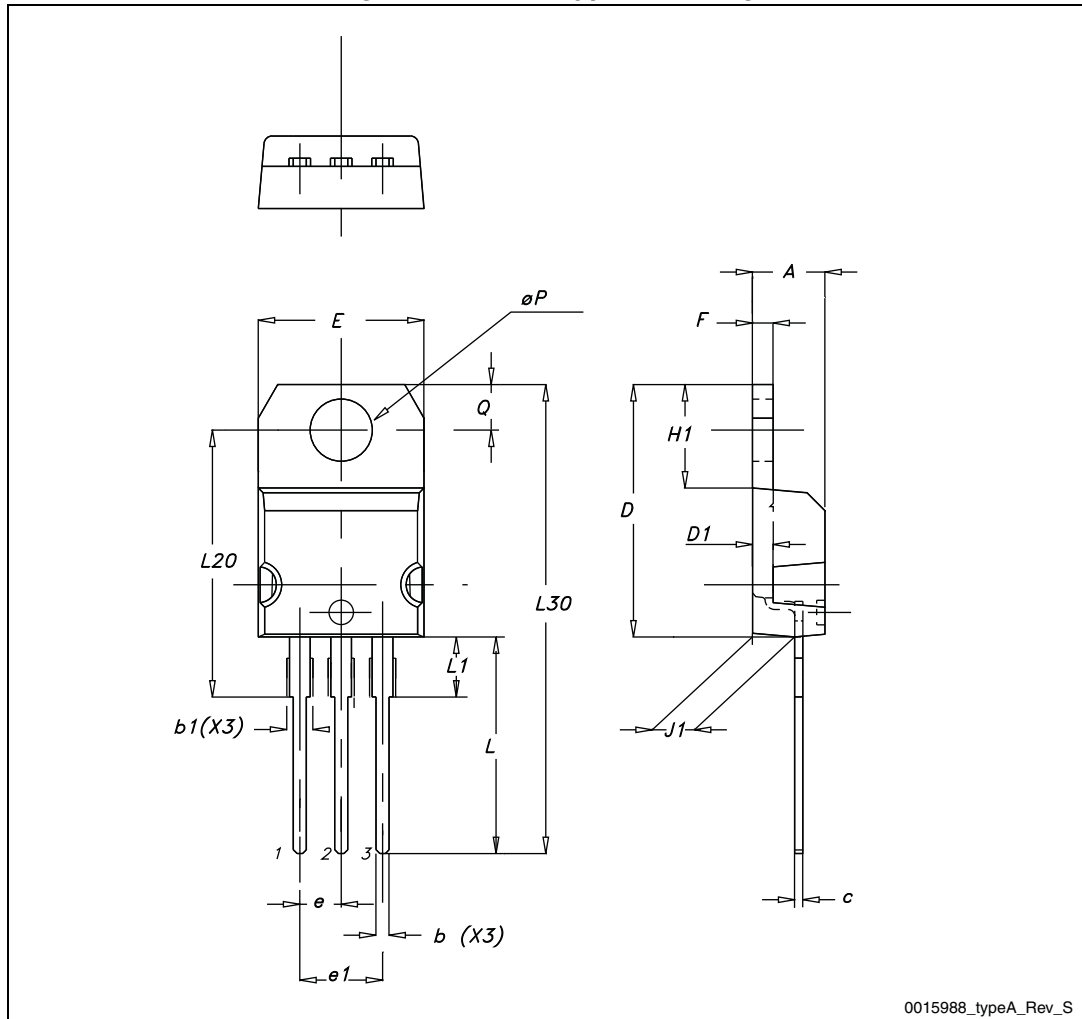


Table 8. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
16-Dec-2013	1	Initial release.

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