STGF30NC60S
STGP30NC60S, STGWF30NC60S

30 A, 600 V, fast IGBT

Features

- Optimized performance for medium operating frequencies up to 5 kHz in hard switching
- Low on-voltage drop ($V_{CE(sat)}$)
- High current capability

Application

Motor drive

Description

This device utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.

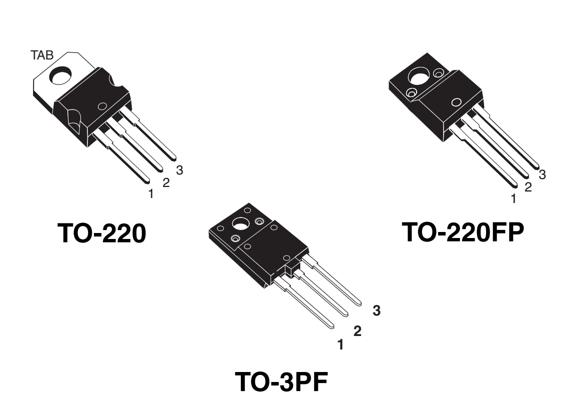


Figure 1. Internal schematic diagram

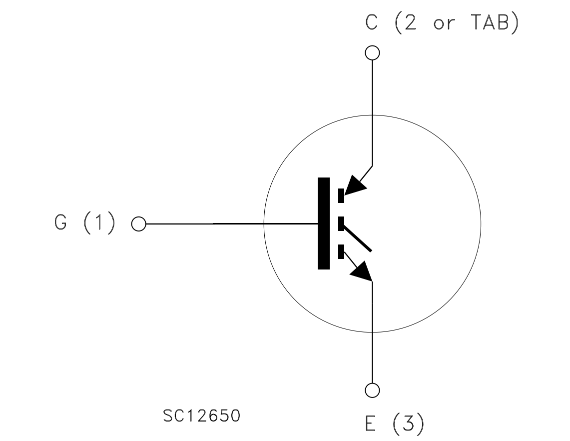


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGF30NC60S	GF30NC60S	TO-220FP	Tube
STGP30NC60S	GP30NC60S	TO-220	
STGWF30NC60S	GWF30NC60S	TO-3PF	

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-220	TO-220FP	TO-3PF	
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600			V
I_C (1)	Continuous collector current at T_C = 25 °C	55	22	35	A
I_C (1)	Continuous collector current at T_C = 100 °C	35	11	18	A
I_{CL} (2)	Turn-off latching current	150			A
I_{CP} (3)	Pulsed collector current	150			A
V_{GE}	Gate-emitter voltage	±20			V
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s;T_C=25 °C)		2500		V
P_{TOT}	Total dissipation at T_C = 25 °C	175	40	79	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
		TO-220	TO-220FP	TO-3PF	
$R_{thj-case}$	Thermal resistance junction-case	0.7	3.1	1.58	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5		50	°C/W

2 Electrical characteristics

(T_J= 25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C= 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C = 20 A V_{GE}= 15 V, I_C = 20 A,T_J=150 °C		1.5 1.4	1.9	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 600 V V_{CE} = 600 V, T_J= 150 °C			150 1	µA mA
I_{GES}	Gate-emitter cut-off current (V_{CE} = 0)	V_{GE}= ±20 V			±100	nA
g_{fs} (1)	Forward transconductance	V_{CE} = 15 V, I_C = 20 A		10		S

1. Pulsed: 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	-	2200 185 48.5	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 480 V, I_C = 20 A, V_{GE} = 15 V *Figure 19*	-	96 14 44.5	-	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} = 480 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V *Figure 18*	-	21.5 8.5 2280	-	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} = 480 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125 °C *Figure 18*	-	20.5 9.5 2150	-	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} = 480 V, I_C = 20 A, R_{GE} = 10 Ω, V_{GE} = 15 V *Figure 18*	-	85 180 200	-	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} = 480 V, I_C = 20 A, R_{GE} = 10 Ω, V_{GE} = 15 V T_J = 125 °C *Figure 18*	-	155 260 295	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Eon E_{off} (1) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 480 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, *Figure 18*	-	300 1275 1575	-	µJ µJ µJ
Eon E_{off} (1) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 480 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125 °C *Figure 18*	-	430 1965 2395	-	µJ µJ µJ

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

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

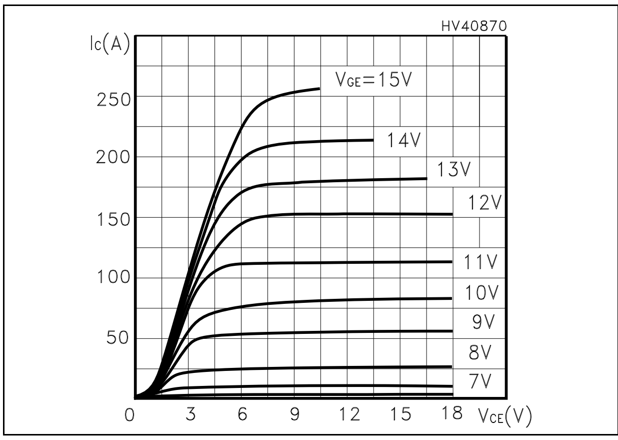


Figure 3. Transfer characteristics

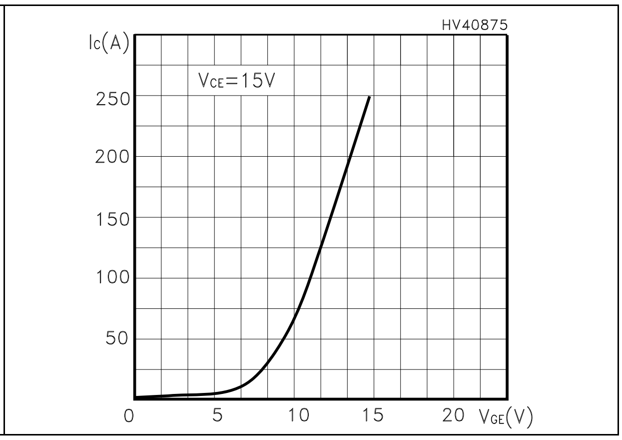


Figure 4. Transconductance

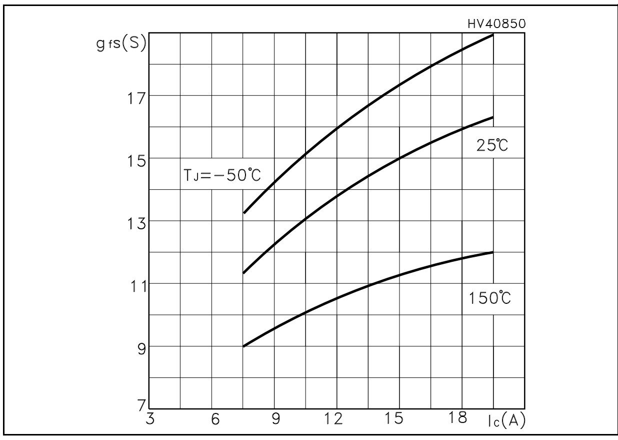


Figure 5. Collector-emitter on voltage vs temperature

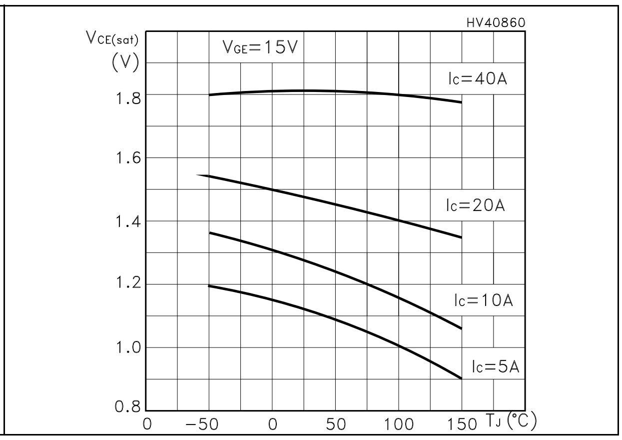


Figure 6. Gate charge vs gate-source voltage

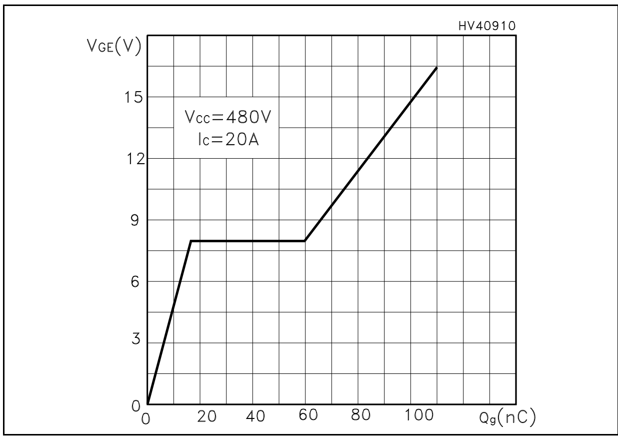


Figure 7. Capacitance variations

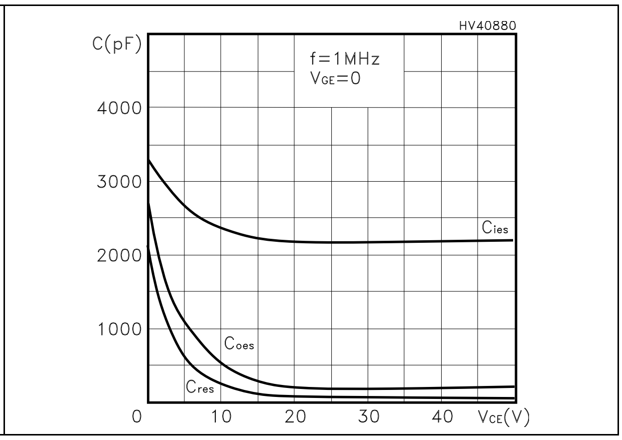


Figure 8. Normalized gate threshold voltage vs temperature

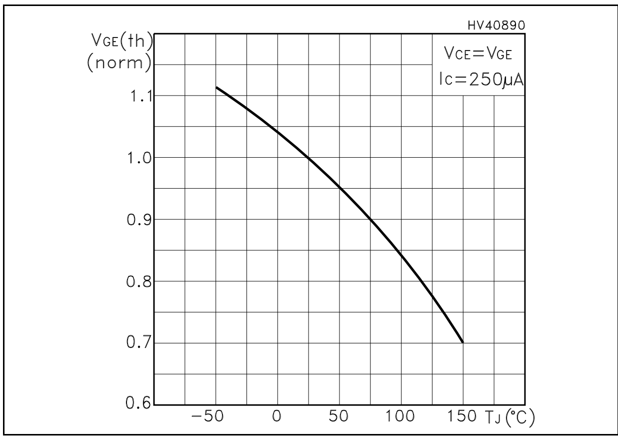


Figure 9. Collector-emitter on voltage vs collector current

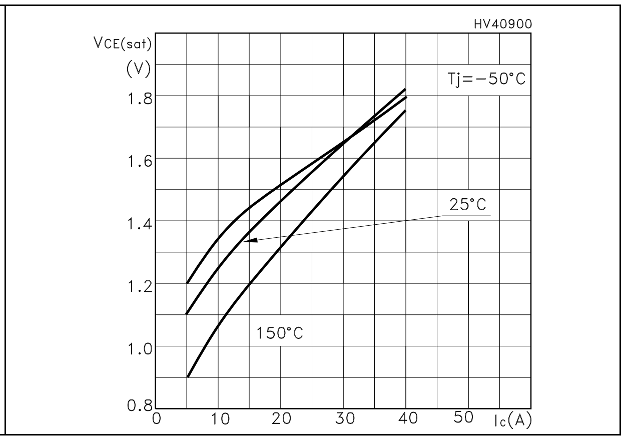


Figure 10. Normalized breakdown voltage vs temperature

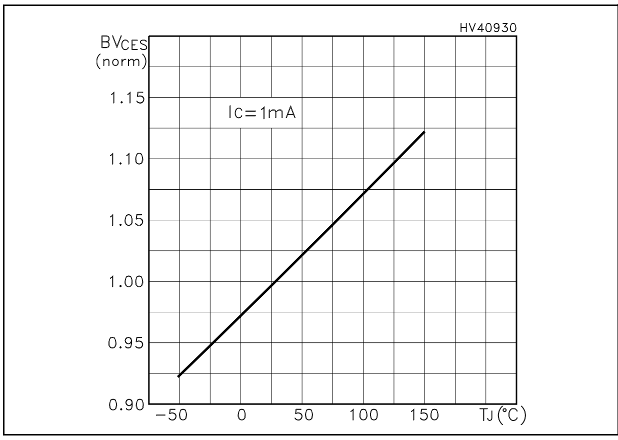


Figure 11. Switching losses vs temperature

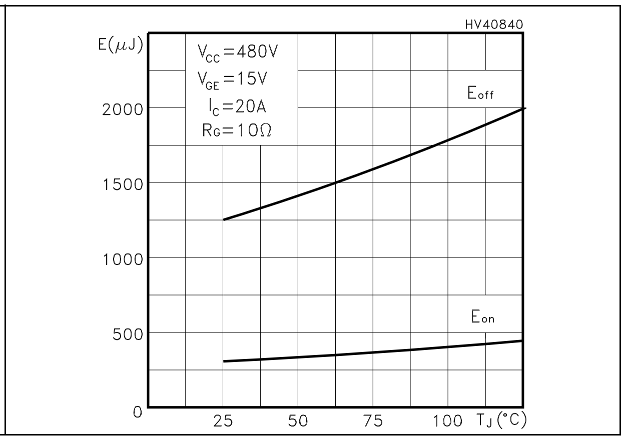


Figure 12. Switching losses vs gate resistance

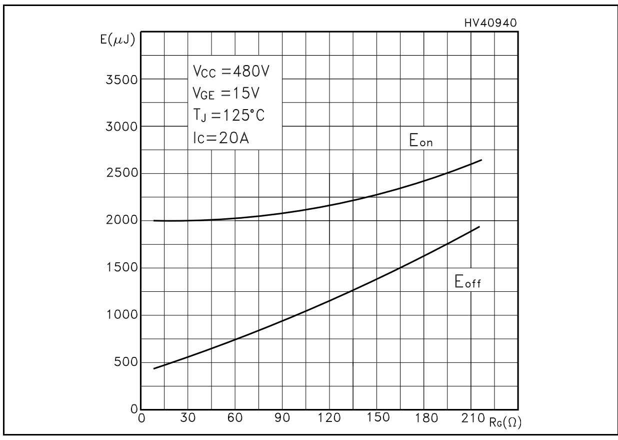


Figure 13. Switching losses vs collector current

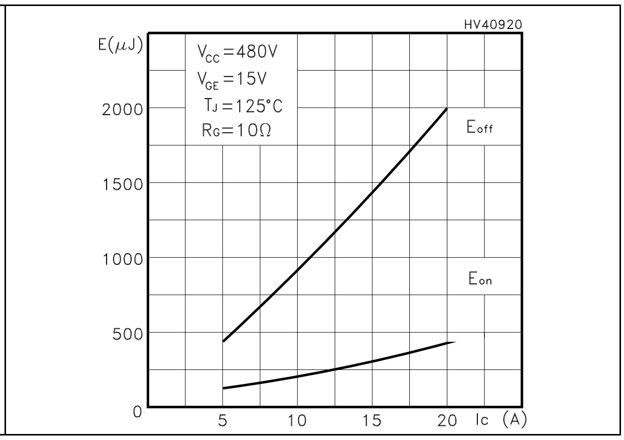


Figure 14. Thermal Impedance

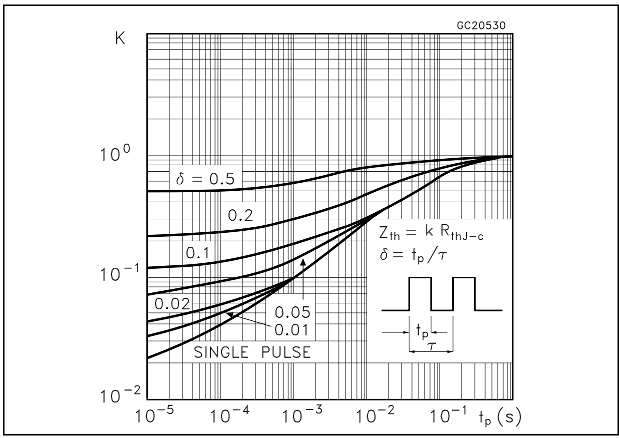


Figure 15. Turn-off SOA

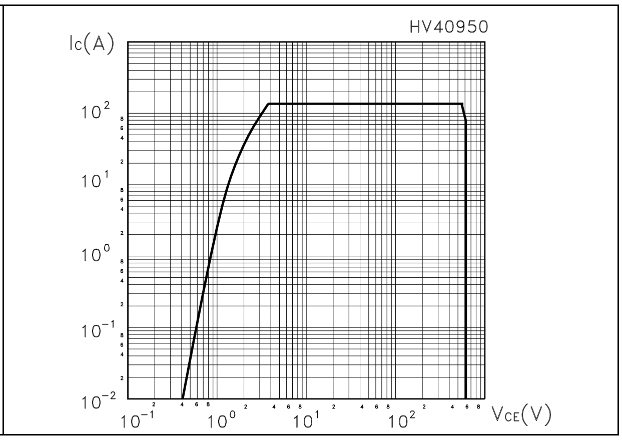


Figure 16. Thermal Impedance for TO-220FP

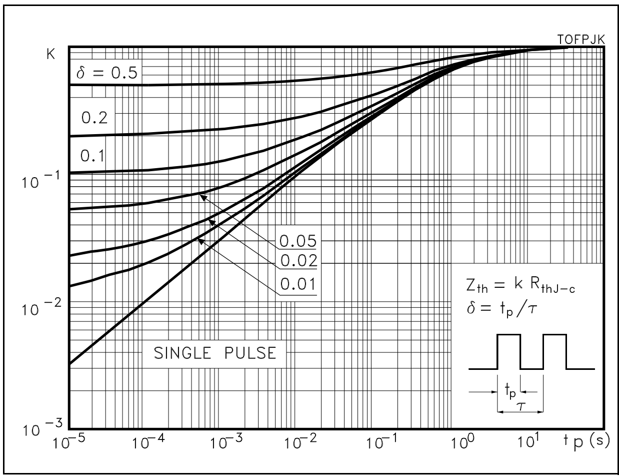
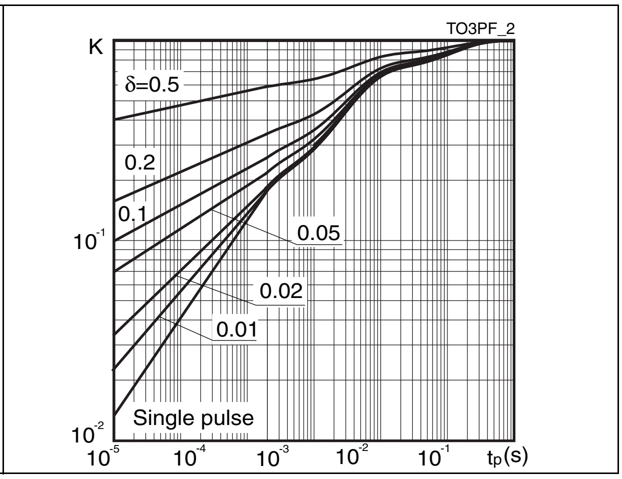


Figure 17. Thermal Impedance for TO-3PF



3 Test circuits

Figure 18. Test circuit for inductive load switching

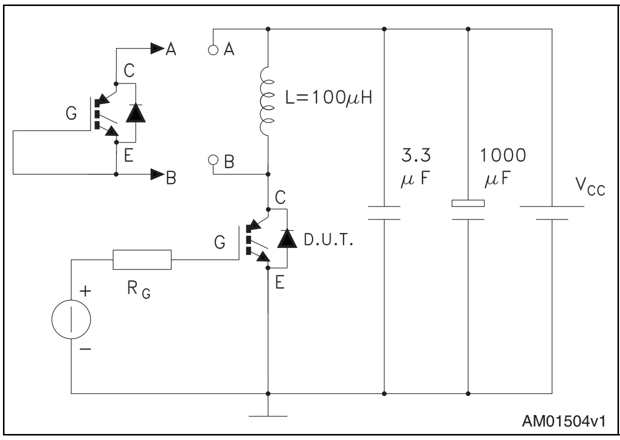


Figure 19. Gate charge test circuit

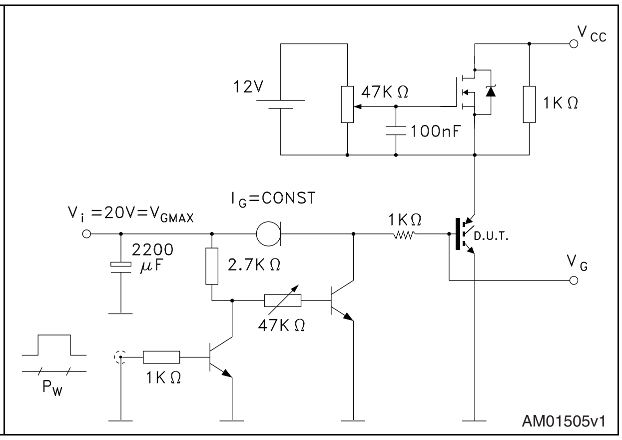
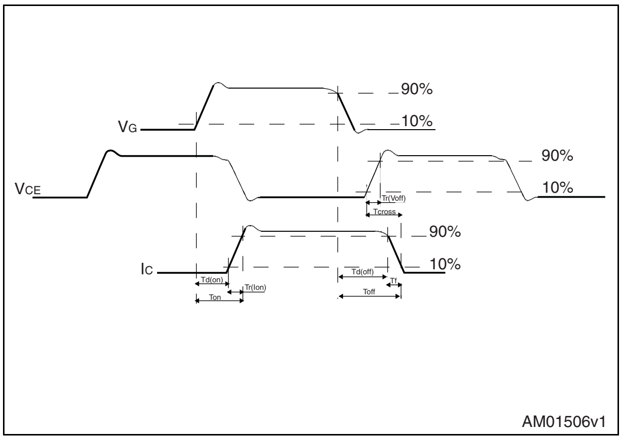


Figure 20. Switching waveforms



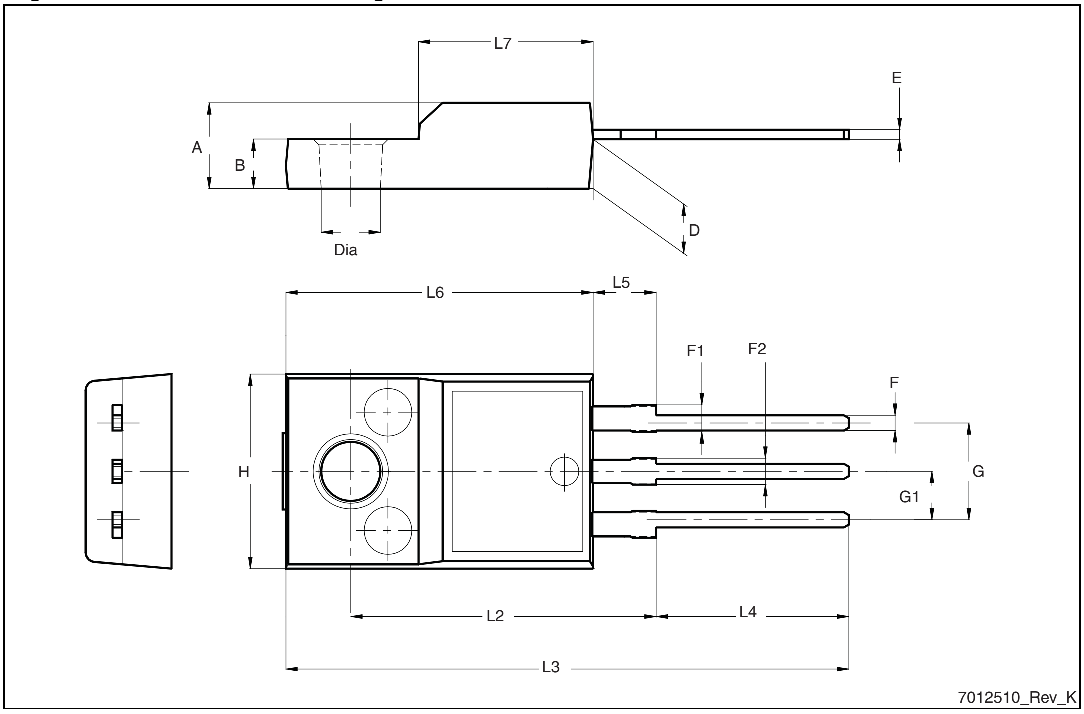
4 Package mechanical data

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. TO-220FP mechanical data

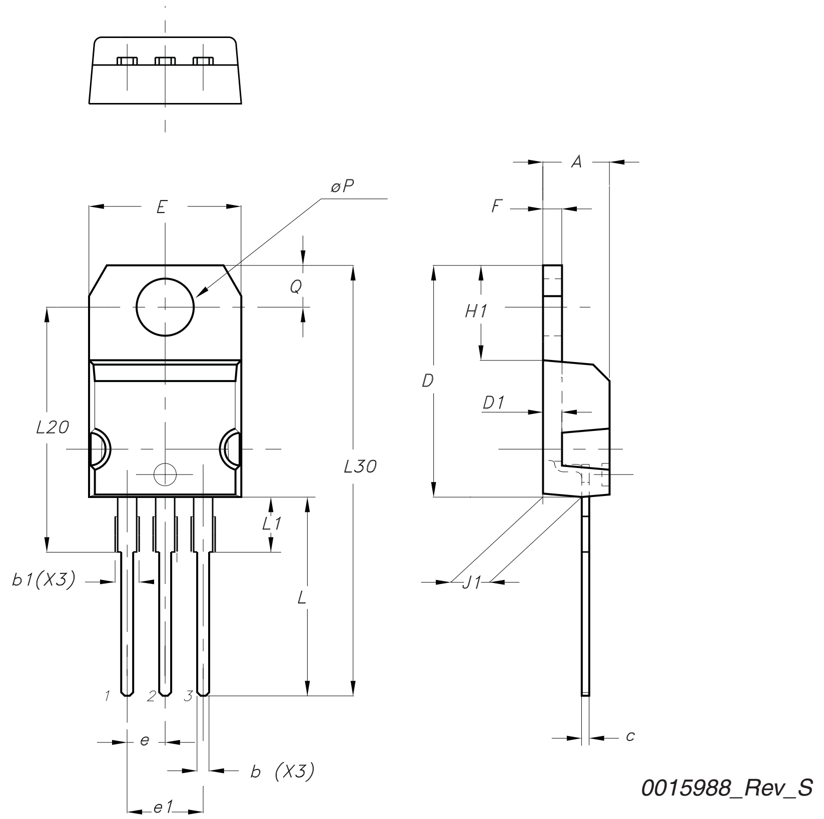
Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 21. TO-220FP drawing



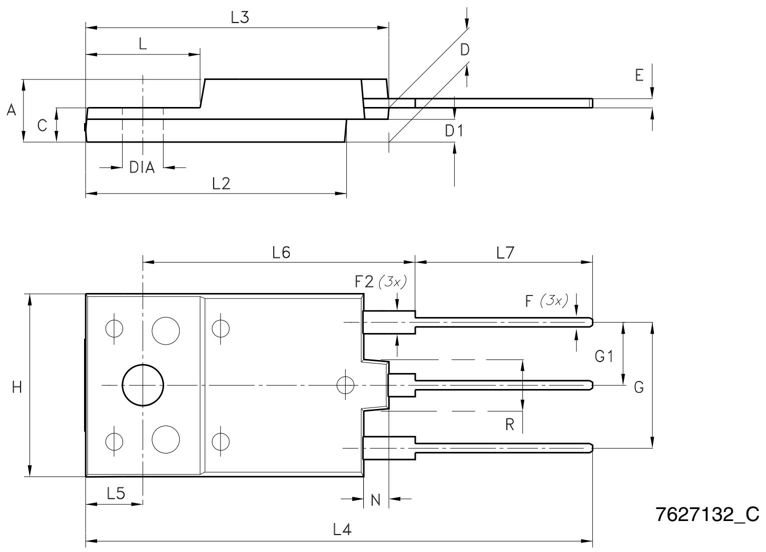
TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95



TO-3PF mechanical data

DIM.	mm.		
	min.	typ	max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
02-Jul-2007	1	Initial release
20-Nov-2007	2	Document status promoted from preliminary data to datasheet
04-May-2009	3	Added new package, mechanical data: TO-220FP
30-Jun-2010	4	Added new package, mechanical data: TO-3PF
11-Nov-2010	5	– Updated data for TO-3PF in *Table 2* and *Table 3* – Modified *Figure 17*