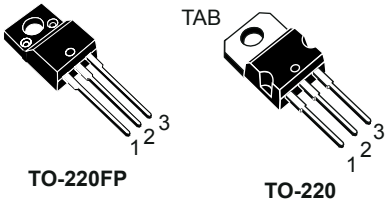
STGF30NC60S, STGP30NC60S

Datasheet

30 A, 600 V, fast IGBT



TO-220FP TO-220

Features

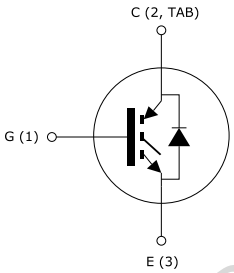
- Optimized performance for medium operating frequencies up to 5 kHz in hard switching
- Low on-voltage drop ($V_{CE(sat)}$)
- High current capability

Applications

- Motor drive

Description

These devices utilize the advanced PowerMESH process resulting in an excellent trade-off between switching performance and low on-state behavior.



Product status link
STGF30NC60S
STGP30NC60S

Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	600		V
I_C(1)	Continuous collector current at T_C = 25 °C	55	22	A
	Continuous collector current at T_C = 100 °C	35	11	
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)		2.5	kV
P_{TOT}	Total power dissipation at T_C = 25 °C	175	40	W
T_J	Operating junction temperature range	- 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 2. Thermal data

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
R_{thJC}	Thermal resistance junction-case	0.7	3.1	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5		°C/W

Obsolete Product(s) - Obsolete Product(s)

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0 V, I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 20 A		1.5	1.9	V
		V_{GE} = 15 V, I_C = 20 A, T_J = 150 °C		1.4		
$V_{GE(th)}$	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, V_{CE} = 600 V			150	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C			1	mA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, 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 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	2200	-	pF
C_{oes}	Output capacitance		-	185	-	
C_{res}	Reverse transfer capacitance		-	48.5	-	
Q_g	Total gate charge	V_{CC} = 480 V, I_C = 20 A, V_{GE} = 15 V (see Figure 18. Gate charge test circuit)	-	96	-	nC
Q_{ge}	Gate-emitter charge		-	14	-	
Q_{gc}	Gate-collector charge		-	44.5	-	

Obsolete Product(s) - Obsolete Product(s)

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 480 V, I_C = 20 A,	-	21.5	-	ns
t_r	Current rise time	R_G = 10 Ω, V_{GE} = 15 V	-	8.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 17. Test circuit for inductive load switching)	-	2280	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 480 V, I_C = 20 A,	-	20.5	-	ns
t_r	Current rise time	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	9.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 17. Test circuit for inductive load switching)	-	2150	-	A/µs
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 480 V, I_C = 20 A,	-	85	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 10 Ω, V_{GE} = 15 V	-	180	-	ns
t_f	Current fall time	(see Figure 17. Test circuit for inductive load switching)	-	200	-	ns
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 480 V, I_C = 20 A,	-	155	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	260	-	ns
t_f	Current fall time	(see Figure 17. Test circuit for inductive load switching)	-	295	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{CE} = 480 V, I_C = 20 A,	-	300	-	µJ
E_{off}	Turn-off switching energy	R_G = 10 Ω, V_{GE} = 15 V	-	1275	-	µJ
E_{ts}	Total switching energy	(see Figure 17. Test circuit for inductive load switching)	-	1575	-	µJ
E_{on}	Turn-on switching energy	V_{CE} = 480 V, I_C = 20 A,	-	430		µJ
E_{off}	Turn-off switching energy	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	1965		µJ
E_{ts}	Total switching energy	(see Figure 17. Test circuit for inductive load switching)	-	2395		µJ

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

Obsolete Product(s) - Obsolete Product(s)

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

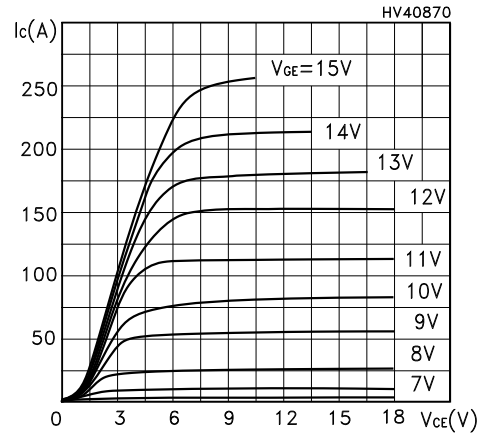


Figure 2. Transfer characteristics

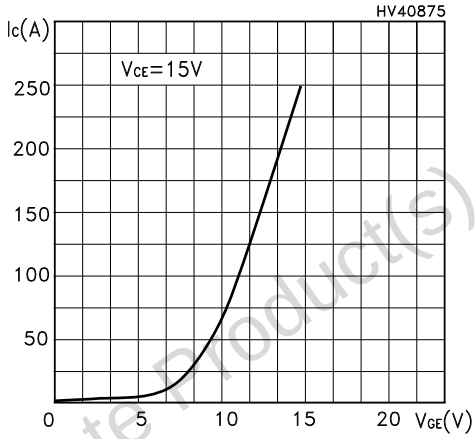


Figure 3. Transconductance

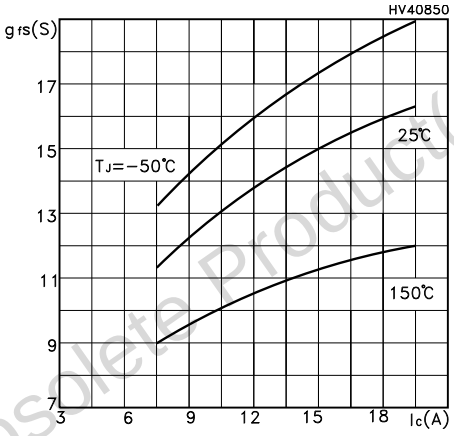


Figure 4. Collector-emitter on voltage vs temperature

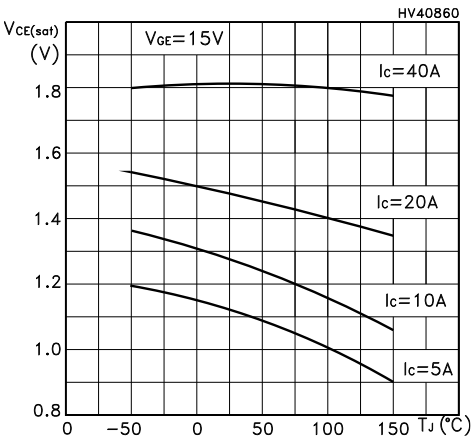


Figure 5. Gate charge vs gate-source voltage

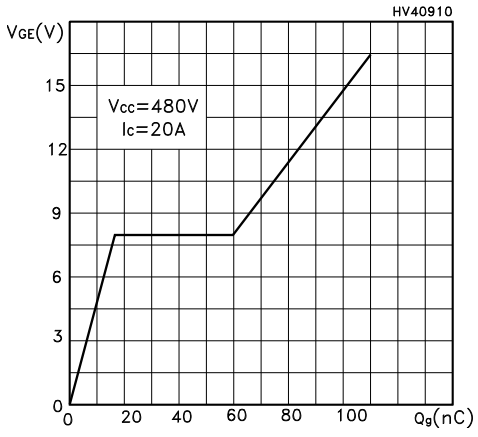


Figure 6. Capacitance variations

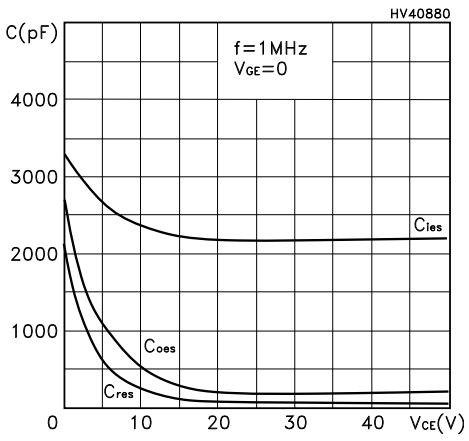


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Figure 7. Normalized gate threshold voltage vs temperature

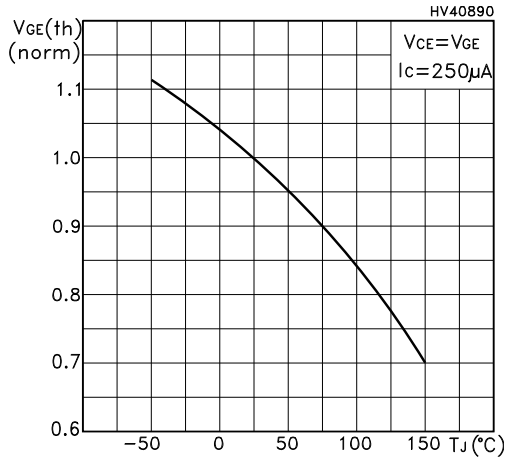

Figure 8. Collector-emitter on voltage vs collector current

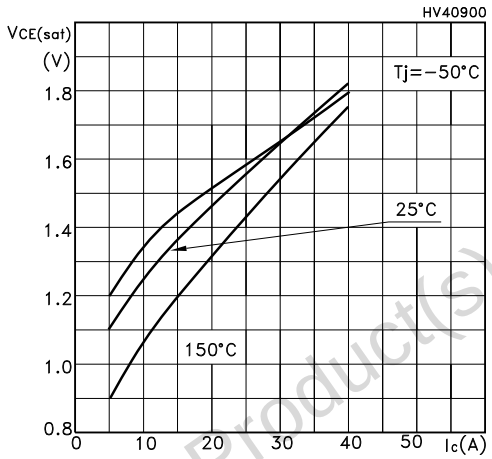

Figure 9. Normalized breakdown voltage vs temperature

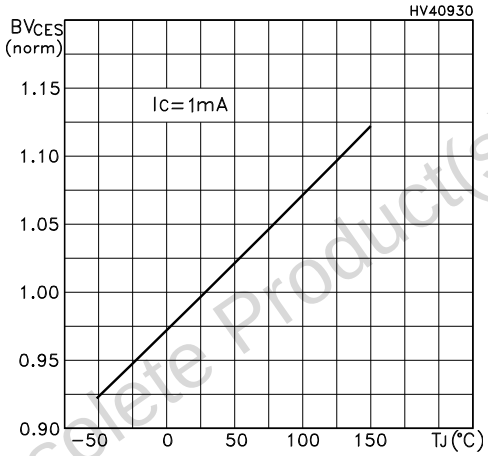

Figure 10. Switching losses vs temperature

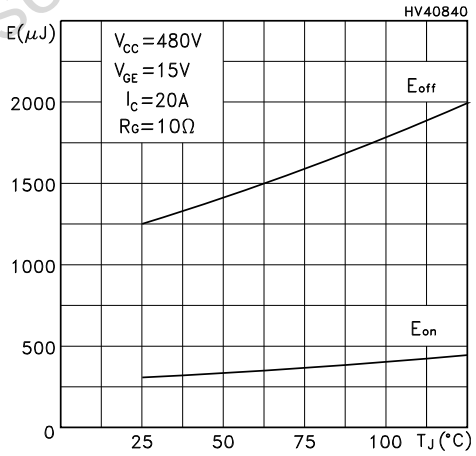

Figure 11. Switching losses vs gate resistance

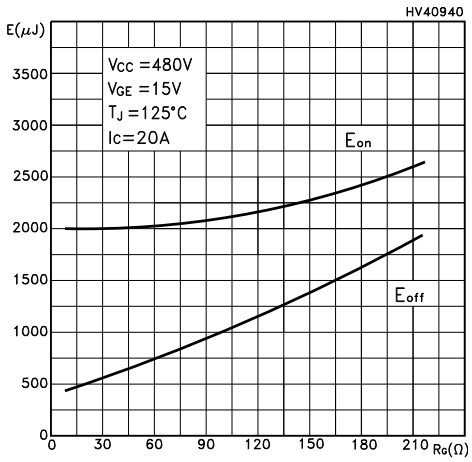

Figure 12. Switching losses vs collector current

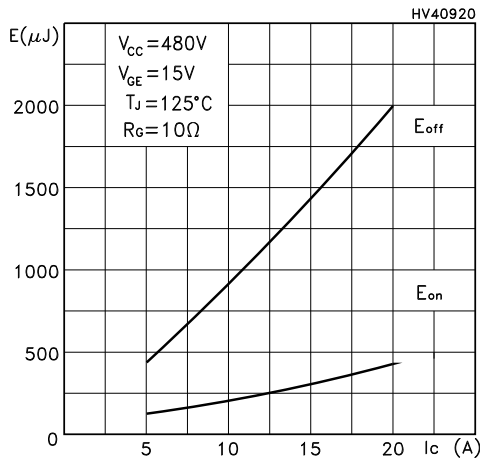

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Figure 13. Turn-off SOA

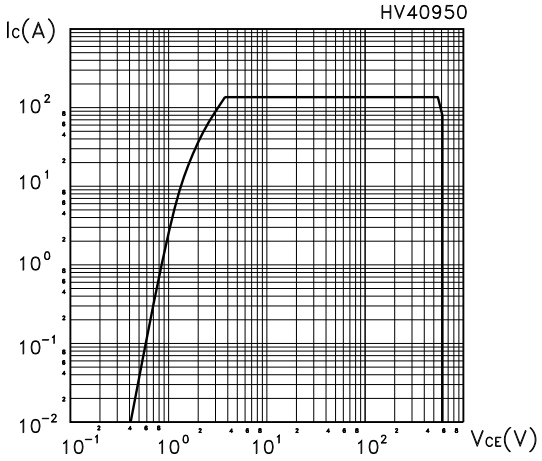


Figure 14. Thermal Impedance for TO-220

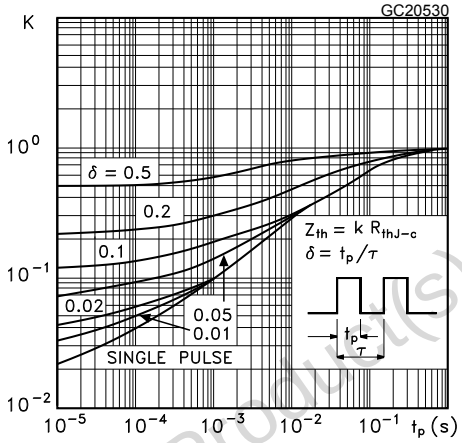
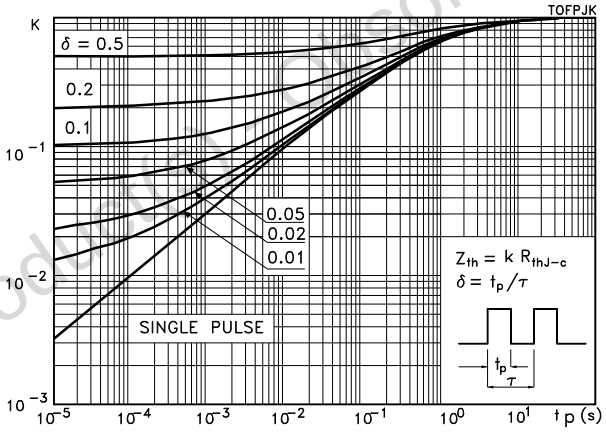


Figure 15. Thermal Impedance for TO-220FP



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3 Test circuits

Figure 16. Test circuit for inductive load switching

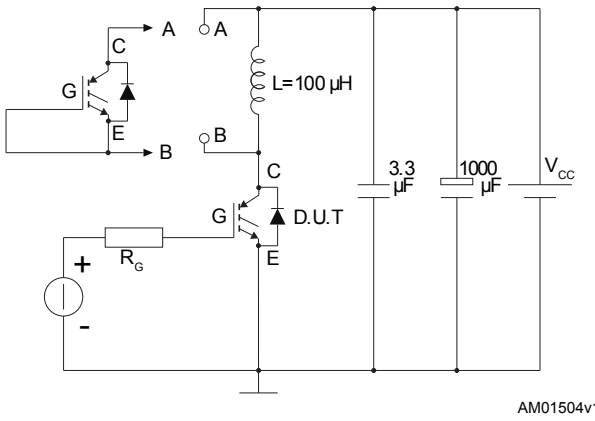


Figure 17. Gate charge test circuit

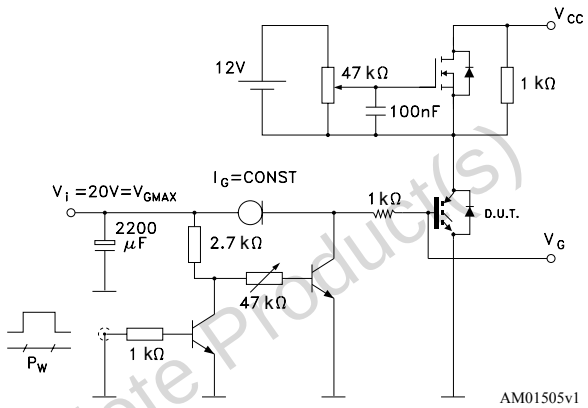
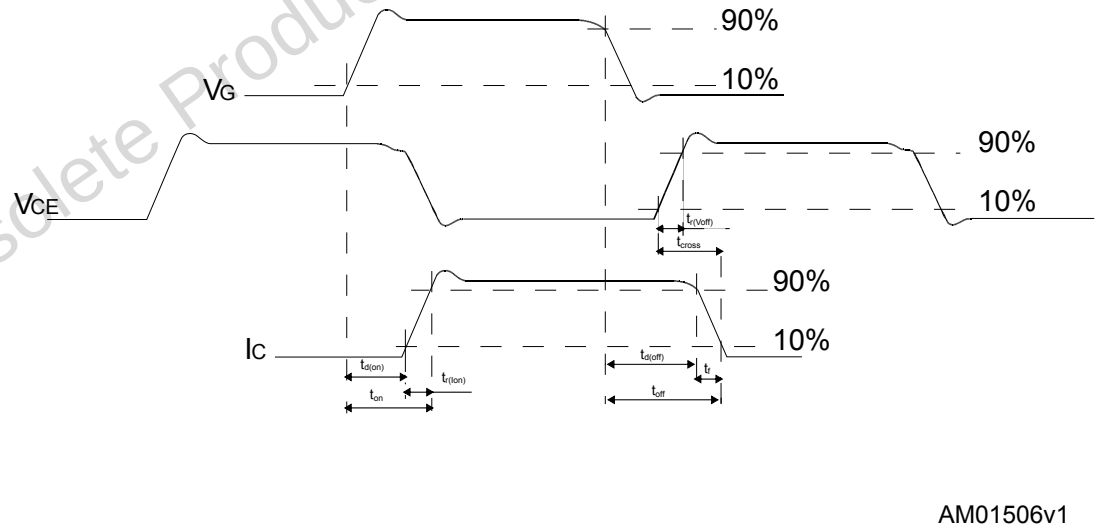


Figure 18. Switching waveform



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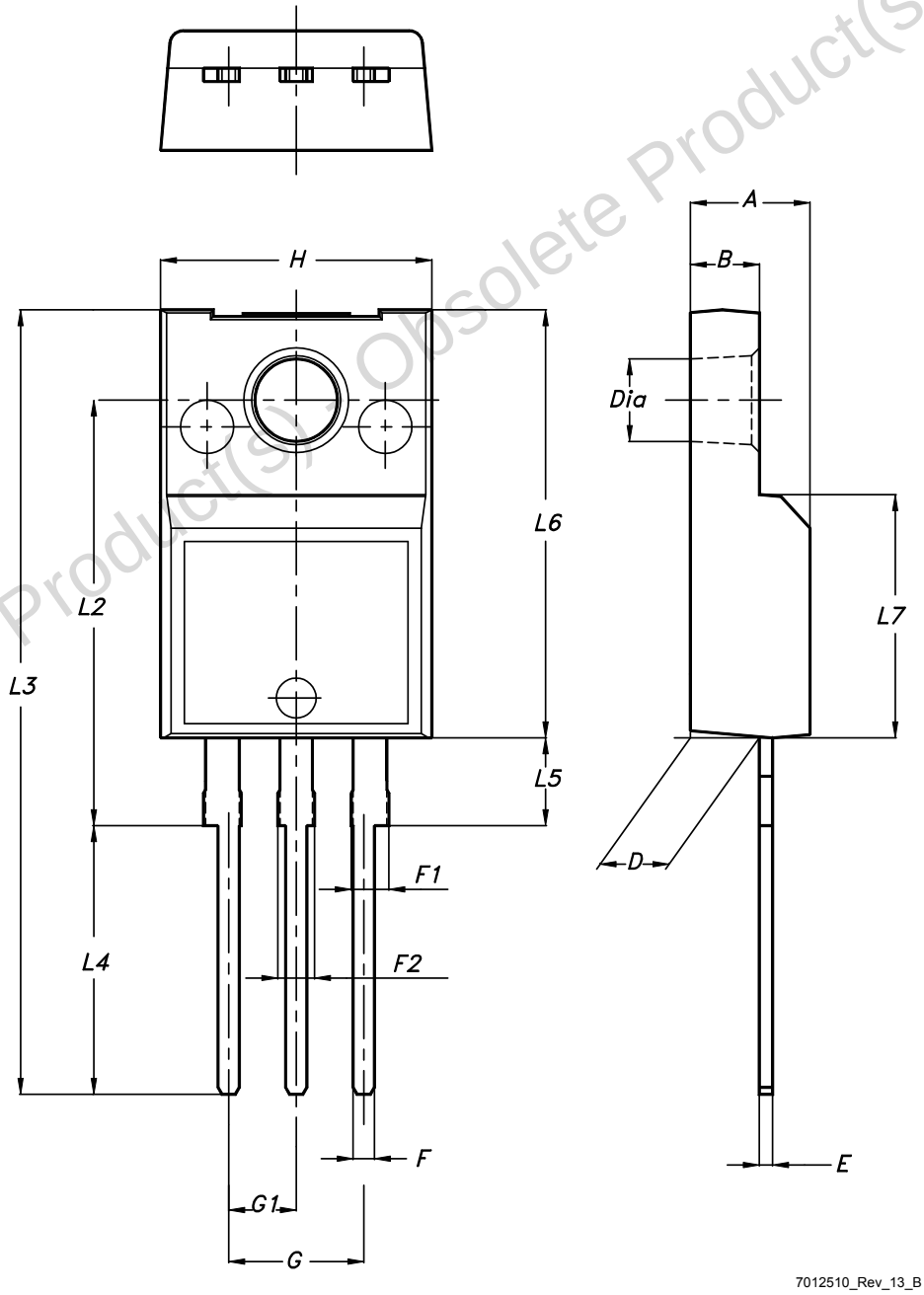
4 Package information

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-220FP package information

Figure 19. **TO-220FP package outline**



Obsolete Product(s) - Obsolete Product(s)

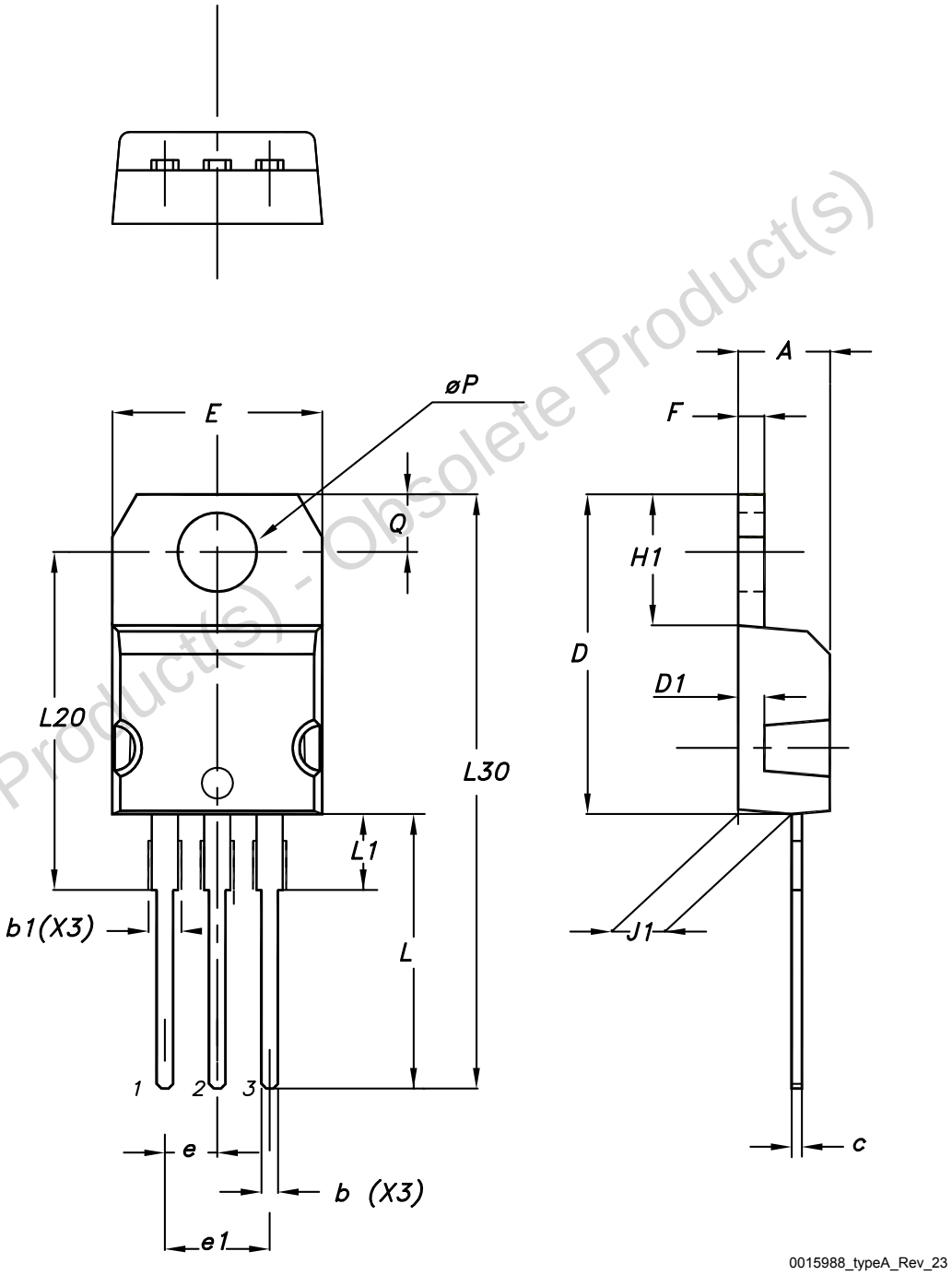
Table 7. **TO-220FP package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

Obsolete Product(s) - Obsolete Product(s)

4.2 TO-220 type A package information

Figure 20. TO-220 type A package outline



Obsolete Product(s) - Obsolete Product(s)

Table 8. **TO-220 type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

Obsolete Product(s) - Obsolete Product(s)

5 Ordering information

Table 9. **Order codes**

Order code	Marking	Package	Packing
STGF30NC60S	GF30NC60S	TO-220FP	Tube
STGP30NC60S	GP30NC60S	TO-220	

Obsolete Product(s) - Obsolete Product(s)

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
12-May-2020	1	First release. Part numbers previously included in datasheet DS5369.

Obsolete Product(s) - Obsolete Product(s)

Contents

Obsolete Product(s) - Obsolete Product(s)

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