STF40NF03L
STP40NF03L

N-channel 30 V, 0.018 Ω, 40 A TO-220, TO-220FP STripFET™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STF40NF03L	30 V	0.022 Ω	23 A
STP40NF03L	30 V	0.022 Ω	40 A

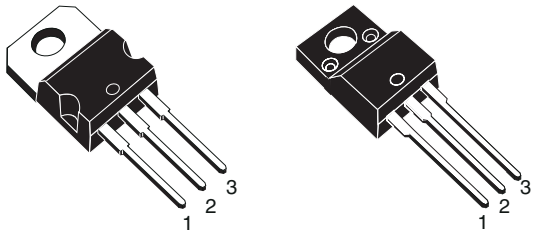
- Low threshold device

Application

- Switching applications

Description

This Power MOSFET is the latest development of STMicroelectronics unique "single feature size" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.



TO-220 TO-220FP

Figure 1. Internal schematic diagram

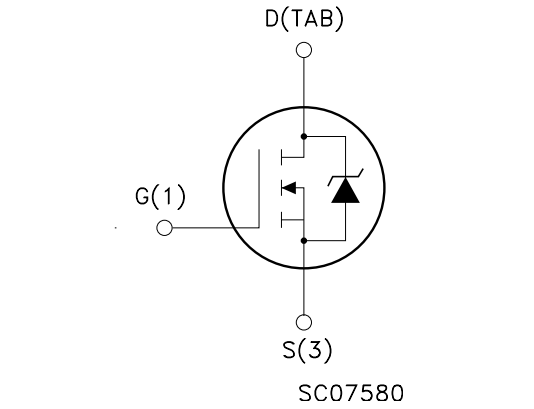


Table 1. Device summary

Order codes	Marking	Package	Packaging
STF40NF03L	F40NF03L	TO-220FP	Tube
STP40NF03L	P40NF03L	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	30		V
V_{GS}	Gate- source voltage	± 16		V
I_D	Drain current (continuous) at T_C = 25 °C	40	23	A
I_D	Drain current (continuous) at T_C = 100 °C	28	16	A
I_{DM}(1)	Drain current (pulsed)	160	92	A
P_{tot}	Total dissipation at T_C = 25 °C	70	25	W
	Derating factor	0.46		W/°C
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s;T_C=25 °C)		2500	V
E_{AS} (2)	Single pulse avalanche energy	250		mJ
T_{stg}	Storage temperature	-55 to 175		°C
T_j	Max. operating junction temperature			

1. Pulse width limited by safe operating area.
2. Starting T_j = 25 °C, I_D = 20 A, V_{DD} = 15 V

Table 3. Thermal data

Symbol	Parameter	Package	Value		Unit
			Typ.	Max.	
Rthj-c	Thermal resistance junction-case	TO-220	1.8	2.1	°C/W
		TO-220FP		6	
Rthj-amb	Thermal resistance junction-ambient max			62.5	°C/W
T_J	Maximum lead temperature for soldering purpose			300	°C

2 Electrical characteristics

(T_{CASE}=25 °C unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 250 µA, V_{GS} =0	30			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = max ratings V_{DS} = max ratings, T_C = 125 °C			1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ±16 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 20 A V_{GS} = 4.5 V, I_D = 20 A		0.018 0.028	0.022 0.035	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 10 V, I_D = 20 A	-	20	-	S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	770 255 60	-	pF pF pF
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 15 V, I_D = 20 A R_G = 4.7 Ω V_{GS} = 4.5 V (see *Figure 16*)	-	14 80 25 16	-	ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 15 V, I_D = 40 A, V_{GS} = 4.5 V (see *Figure 17*)	-	10.5 4 4.5	15	nC nC nC

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

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		40 160	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 40 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 40 A, di/dt = 100 A/µs, V_{DD} = 15 V, T_j = 150 °C (see *Figure 18*)	-	34.5 30 2		ns nC A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220

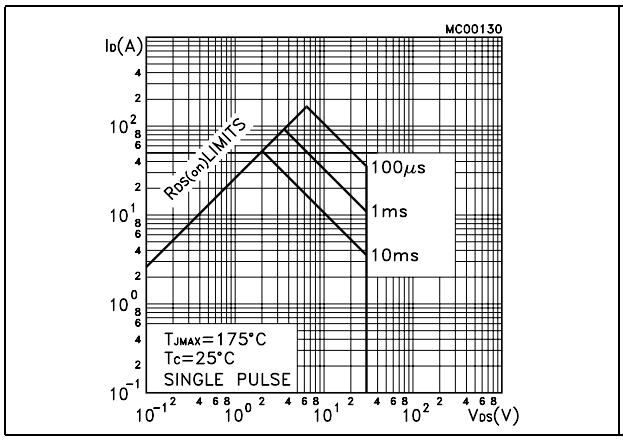


Figure 3. Thermal impedance for TO-220

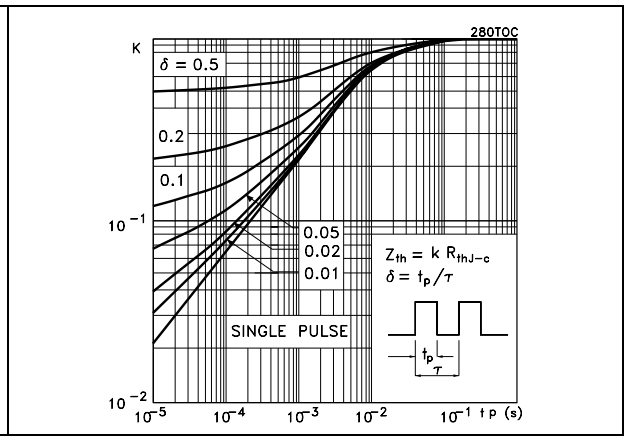


Figure 4. Safe operating area for TO-220FP

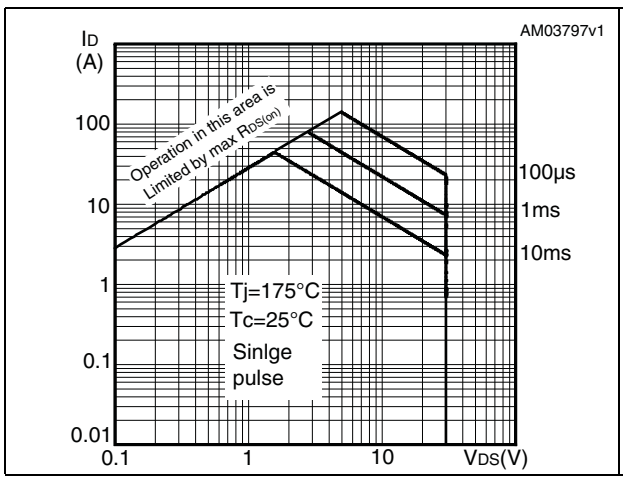


Figure 5. Thermal impedance for TO-220FP

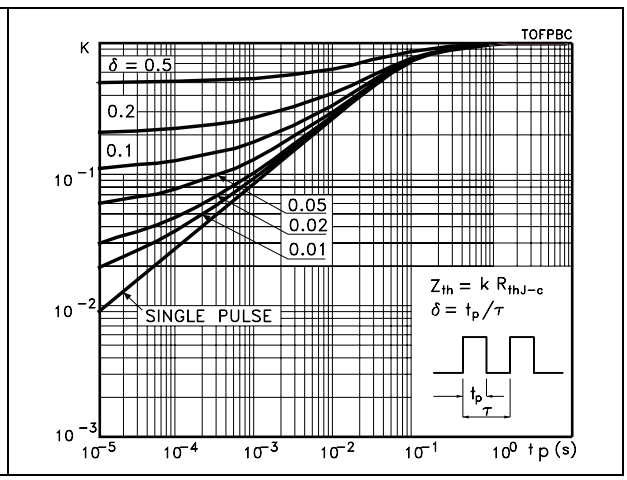


Figure 6. Output characteristics

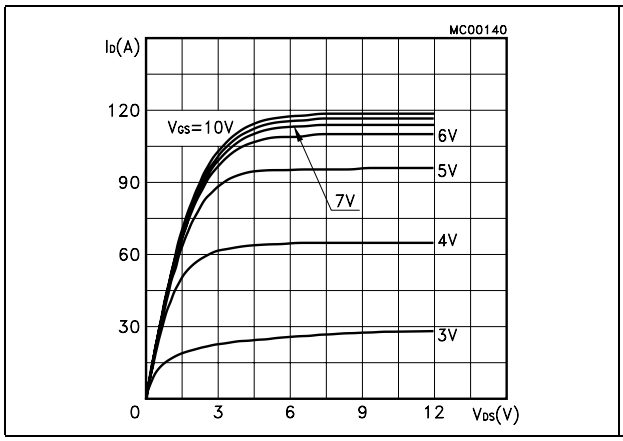


Figure 7. Transfer characteristics

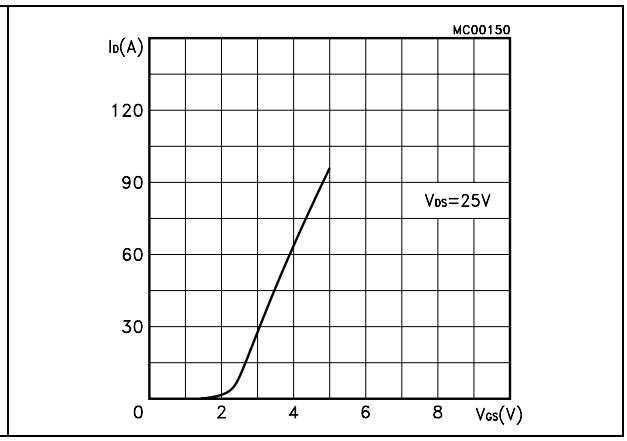


Figure 8. Transconductance

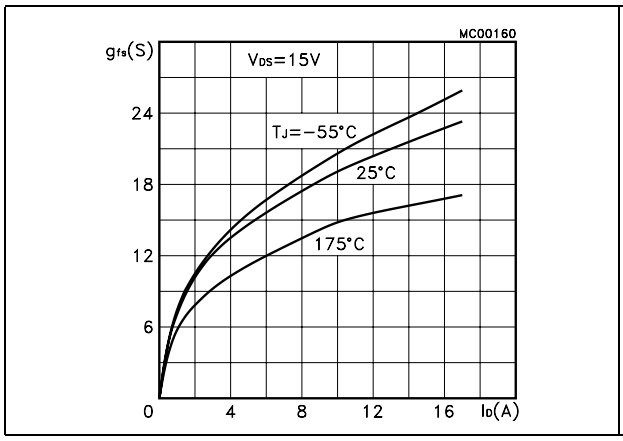


Figure 9. Static drain-source on resistance

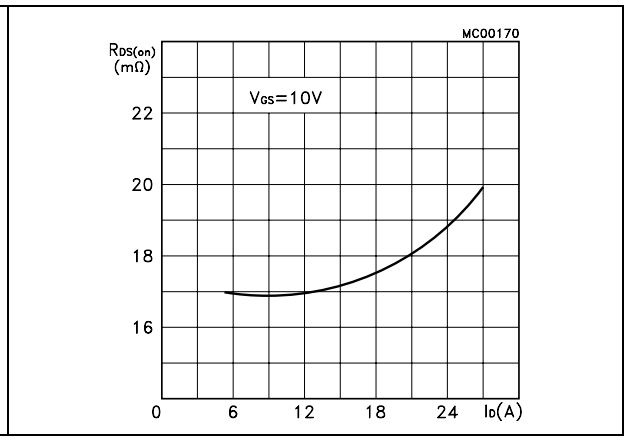


Figure 10. Gate charge vs. gate-source voltage

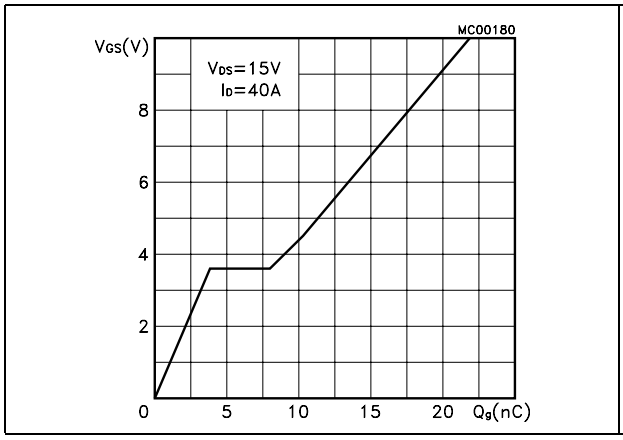


Figure 11. Capacitance variations

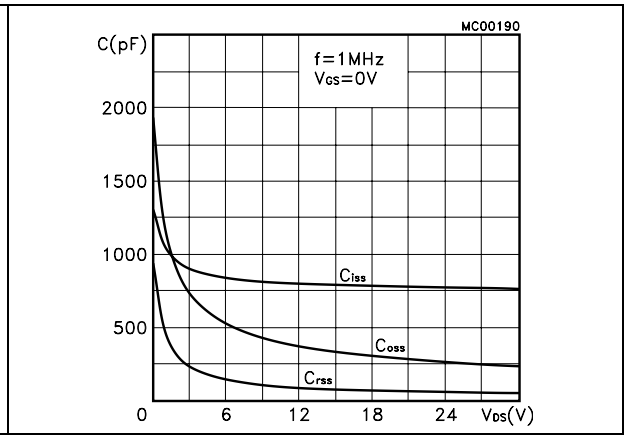


Figure 12. Normalized gate threshold voltage vs. temperature

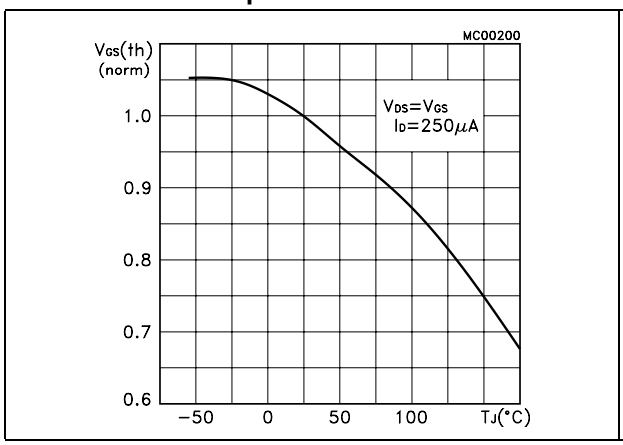


Figure 13. Normalized on resistance vs. temperature

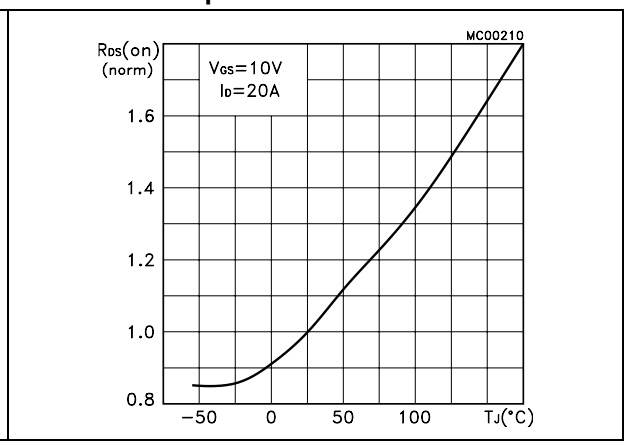


Figure 14. Source-drain diode forward characteristics

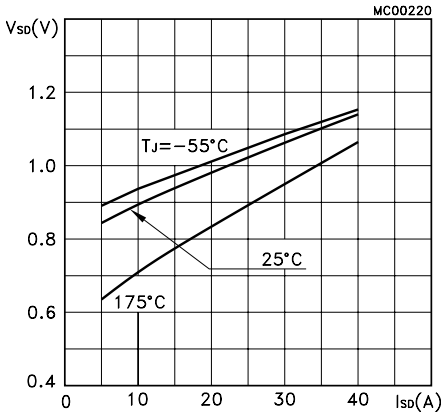
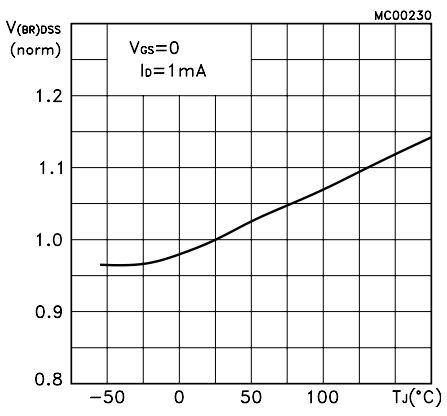


Figure 15. Normalized B_{VDSS} vs. temperature



3 Test circuits

Figure 16. Switching times test circuit for resistive load

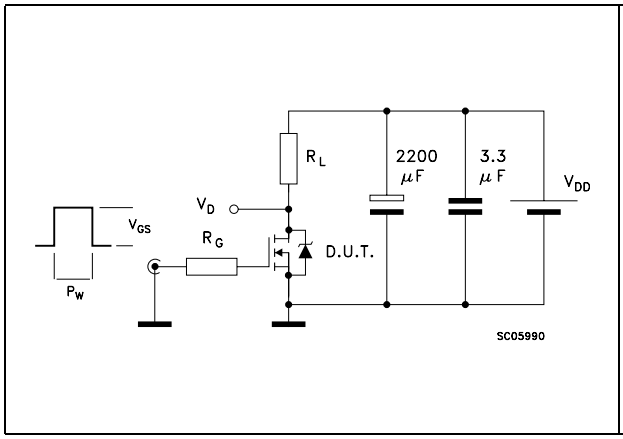


Figure 17. Gate charge test circuit

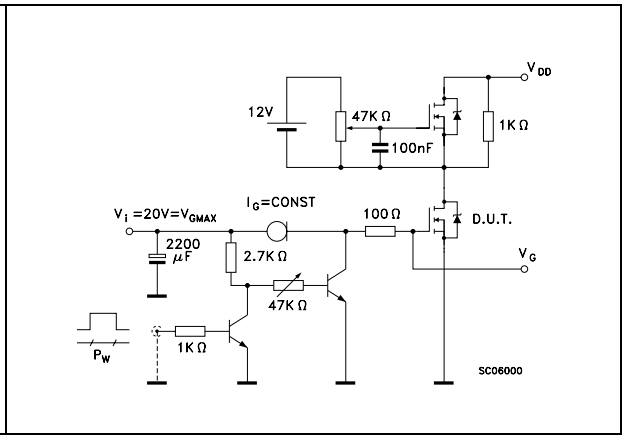


Figure 18. Test circuit for inductive load switching and diode recovery times

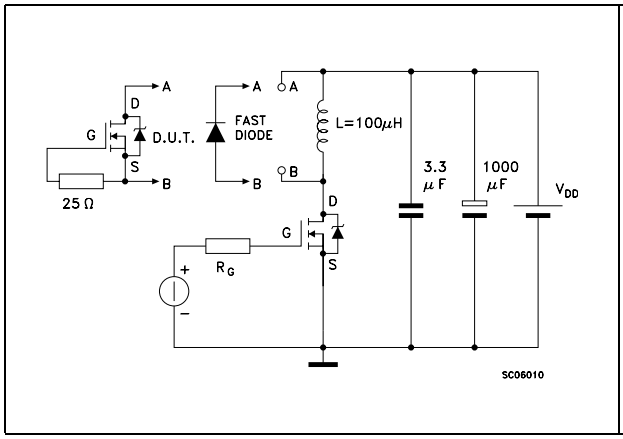


Figure 19. Unclamped inductive load test circuit

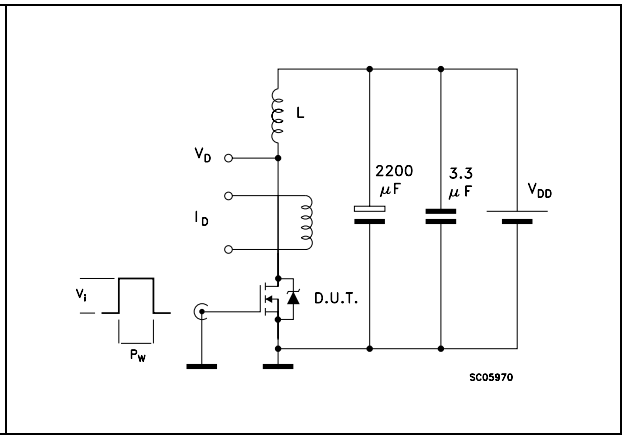


Figure 20. Unclamped inductive waveform

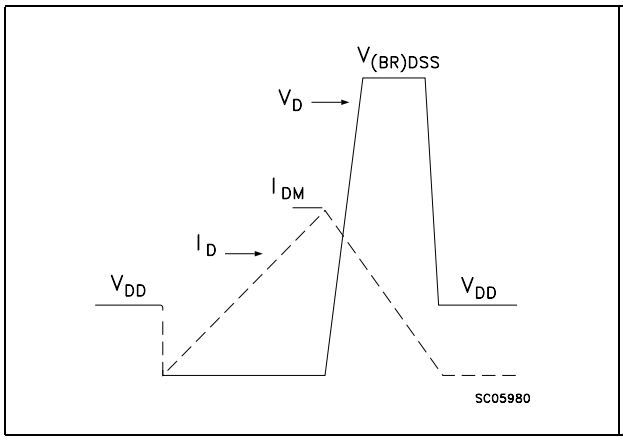
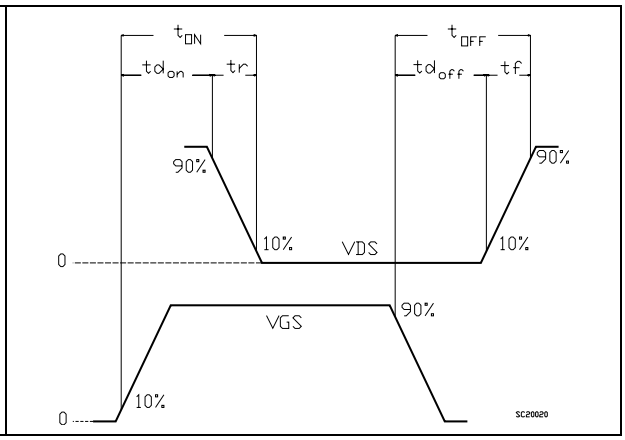


Figure 21. Switching time waveform

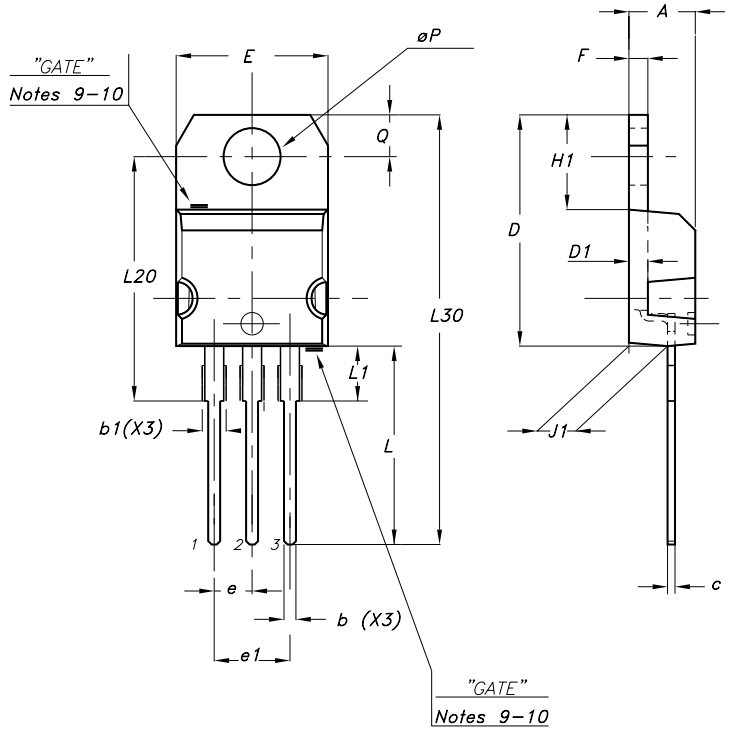


4 Package mechanical data

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.

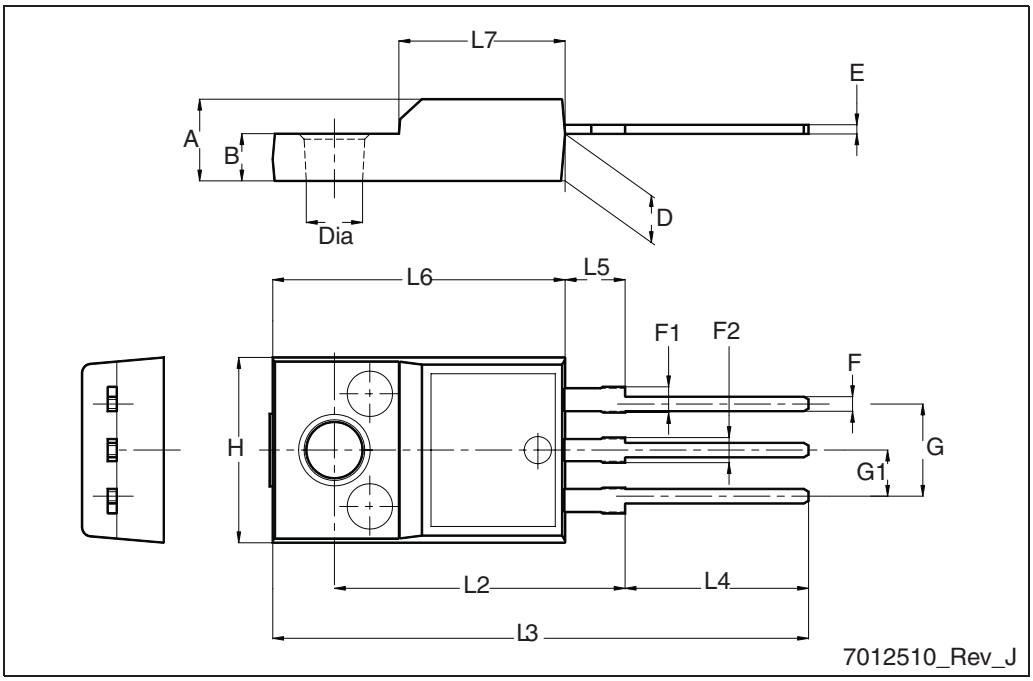
TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



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		1.5
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



5 Revision history

Table 7. Document revision history

Date	Revision	Changes
09-Sep-2004	1	Preliminary version
21-Jun-2005	2	Complete version with curves
16-Aug-2006	3	New template, no content change
21-Feb-2007	4	Typo mistake on page 1
20-Nov-2008	5	*Figure 9: Static drain-source on resistance* has been corrected.
14-Apr-2009	6	The device in TO-220FP has been added
03-Feb-2010	7	Updated *Table 3: Thermal data*.
22-Feb-2010	8	Updated *Table 3: Thermal data*.