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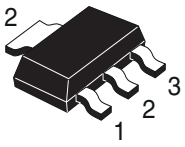
STN4NF06L

N-channel 60 V, 0.07 Ω, 4 A SOT-223 STripFET™ II Power MOSFET

Features

Order code	V_{DSS}	$R_{DS(on)}$ max	I_D
STN4NF06L	60 V	< 0.1 Ω	4 A

- Exceptional dv/dt capability
- Avalanche rugged technology
- 100% avalanche tested
- Low threshold drive



SOT-223

Applications

- Switching application
  - Automotive

Description

This device is a N-channel STripFET™ II Power MOSFET that 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.

Figure 1. Internal schematic diagram

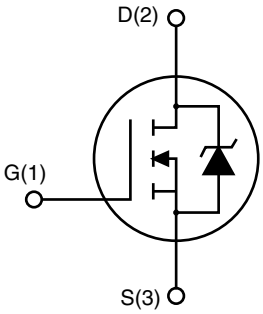


Table 1. Device summary

Order code	Marking	Package	Packaging
STN4NF06L	4NF06L	SOT-223	Tape and reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	60	V
V_{GS}	Gate-source voltage	± 16	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	4	A
I_D	Drain current (continuous) at T_C=100 °C	2.9	A
I_{DM} (2)	Drain current (pulsed)	16	A
P_{TOT}	Total dissipation at T_C = 25 °C	3.3	W
	Derating factor	0.026	W/°C
dv/dt (3)	Peak diode recovery voltage slope	10	V/ns
E_{AS} (4)	Single pulse avalanche energy	200	mJ
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150	°C

1. Current limited by the package.
2. Pulse width limited by safe operating area.
3. $I_{SD} \leq 3$ A, di/dt $\leq$ 150 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX.}$
4. Starting T_J = 25 °C, I_D = 4 A, V_{DD} = 30 V.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
Rthj-pcb (1)	Thermal resistance junction-PCB max.	38	°C/W
Rthj-pcb (2)	Thermal resistance junction-PCB max.	100	°C/W
T_l (3)	Maximum lead temperature for soldering purpose typ.	260	°C

1. When Mounted on FR-4 board with 1 inch^2 pad, 2 oz. of Cu. and t <10 sec.
2. When mounted on minimum recommended footprint.
3. For 10 sec. 1.6 mm from case.

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	60			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating @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		2.8	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 1.5 A V_{GS}= 5 V, I_D= 1.5 A		0.07 0.085	0.10 0.12	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS}= 15 V, I_D=1.5 A	-	3		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f=1 MHz, V_{GS}= 0	-	340 63 30		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 48 V, I_D = 3 A V_{GS} = 5 V *(see Figure 15)*	-	7 1.5 2.8	9	nC nC nC

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

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time rise time	V_{DD}= 30 V, I_D= 1.5 A, R_G= 4.7 Ω, V_{GS}= 5 V *(see Figure 14)*	-	9 25	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time fall time	V_{DD}= 30 V, I_D= 1.5 A, R_G= 4.7 Ω, V_{GS}= 5 V *(see Figure 14)*	-	20 10	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		4 16	A A
V_{SD} (2)	Forward on voltage	I_{SD}= 4 A, V_{GS}=0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}= 4 A, di/dt = 100 A/µs, V_{DD}= 25 V, Tj= 150 °C *(see Figure 16)*	-	50 88 3.5		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

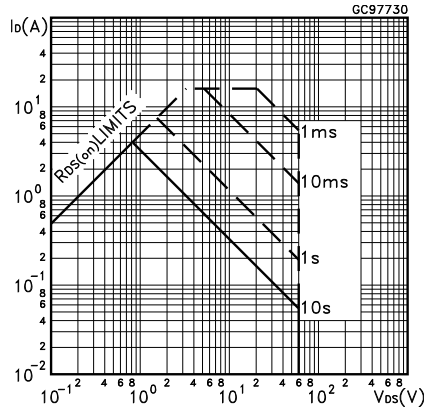


Figure 3. Thermal impedance

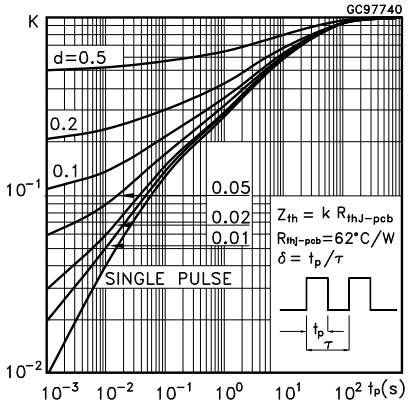


Figure 4. Output characteristics

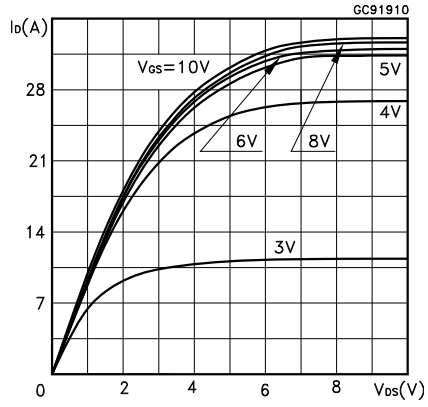


Figure 5. Transfer characteristics

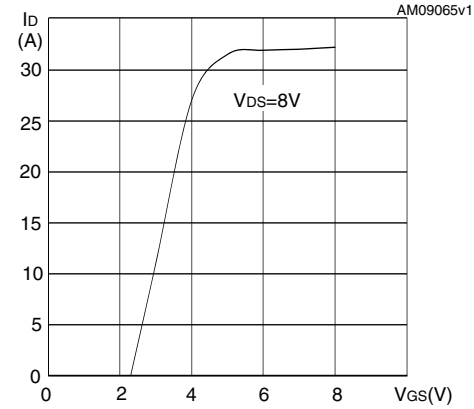


Figure 6. Transconductance

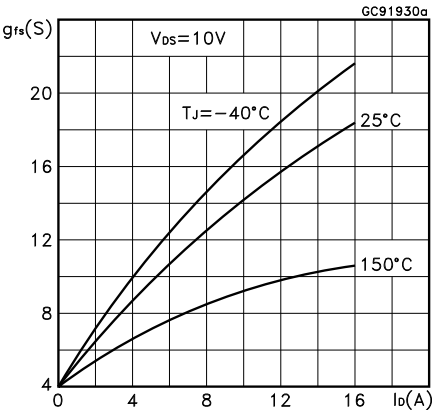


Figure 7. Static drain-source on resistance

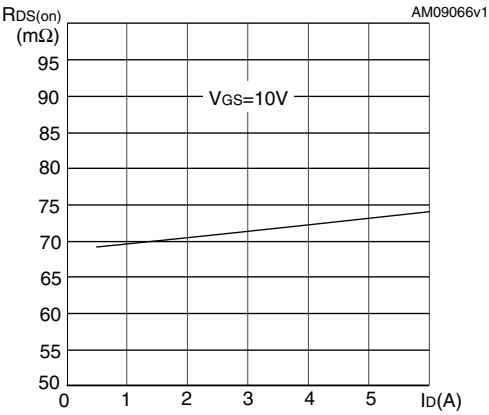


Figure 8. Gate charge vs. gate-source voltage

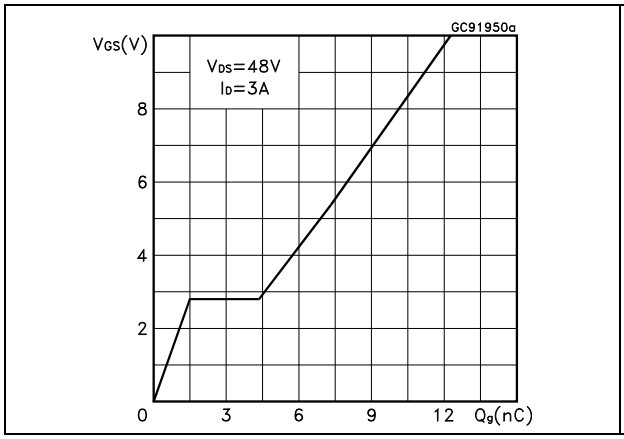


Figure 9. Capacitance variations

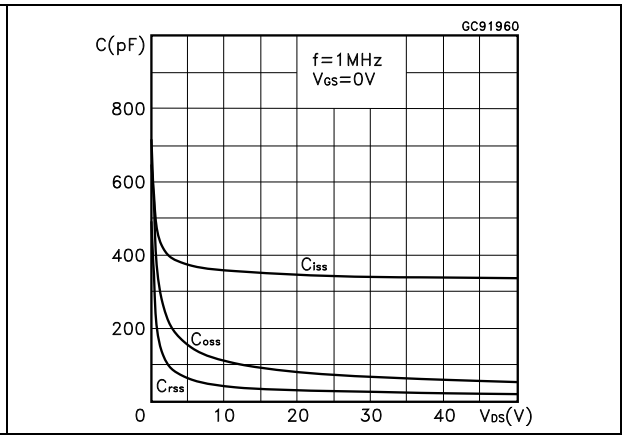


Figure 10. Normalized gate threshold voltage vs. temperature

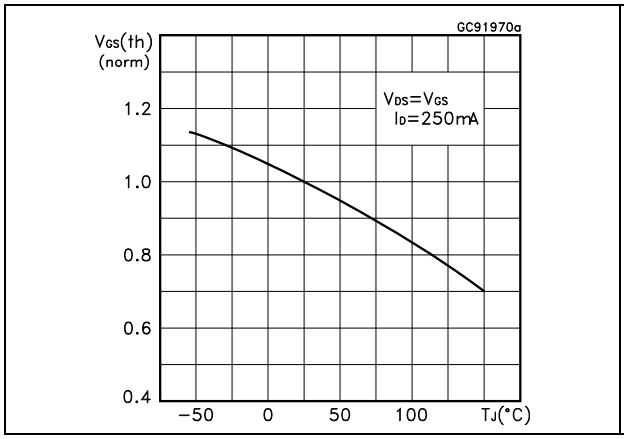


Figure 11. Normalized on resistance vs. temperature

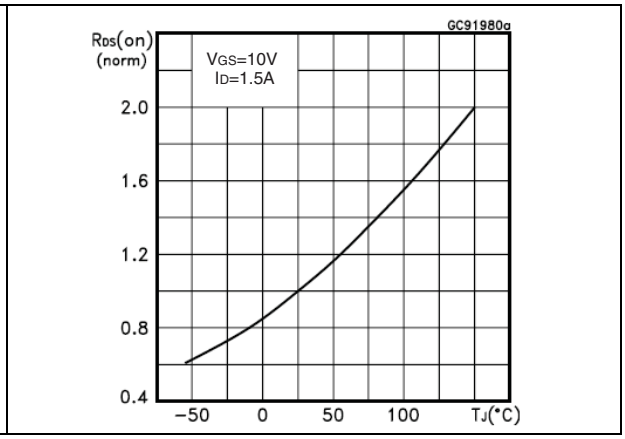


Figure 12. Source-drain diode forward characteristics

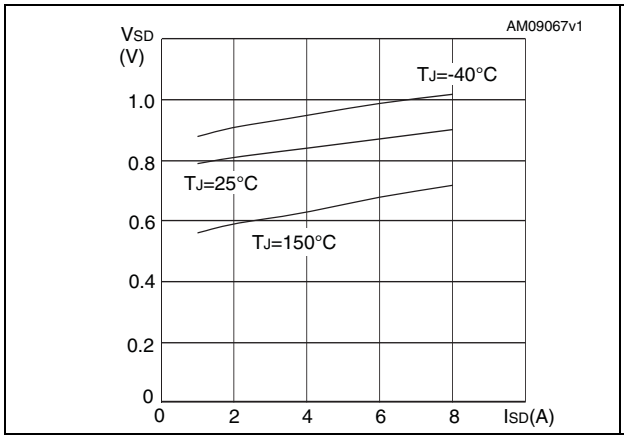
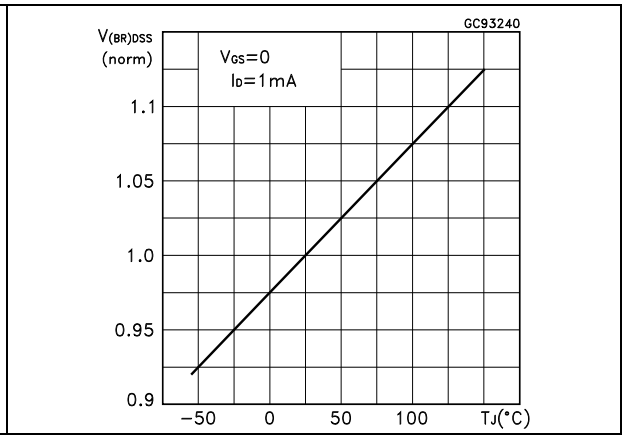


Figure 13. Normalized breakdown voltage vs. temperature



3 Test circuit

Figure 14. Switching times test circuit for resistive load

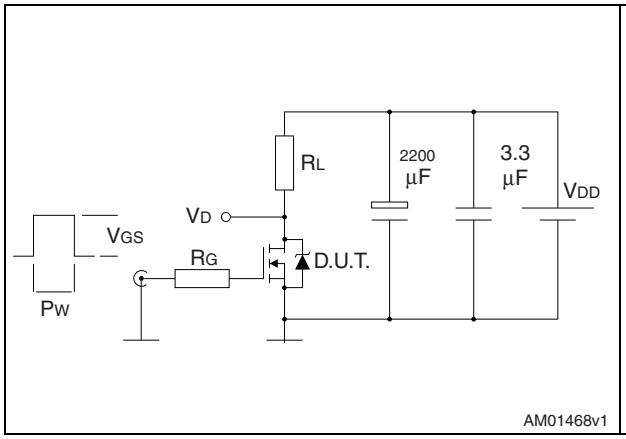


Figure 15. Gate charge test circuit

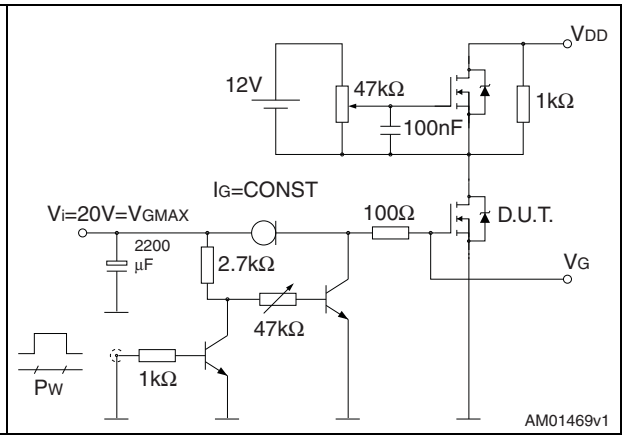


Figure 16. Test circuit for inductive load switching and diode recovery times

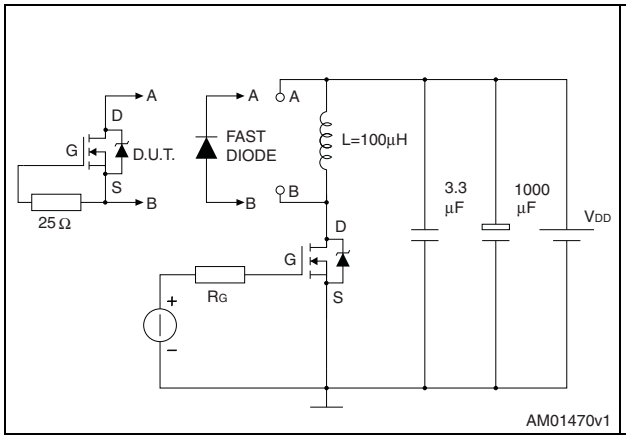


Figure 17. Unclamped Inductive load test circuit

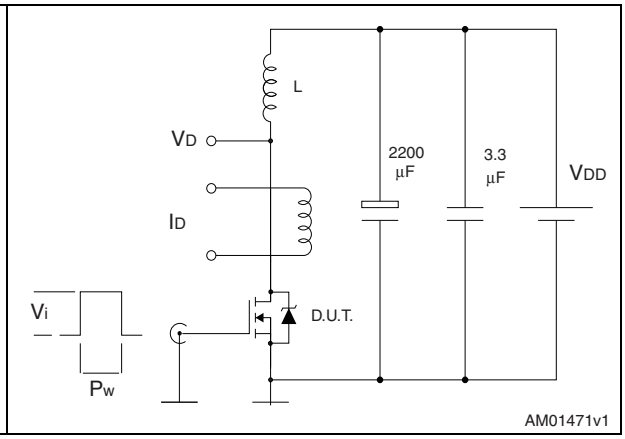


Figure 18. Unclamped inductive waveform

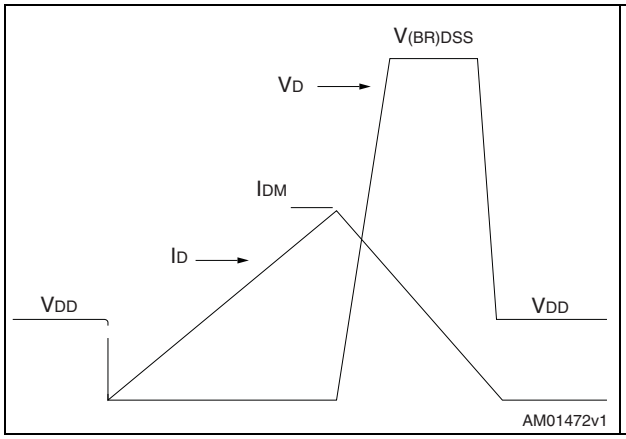
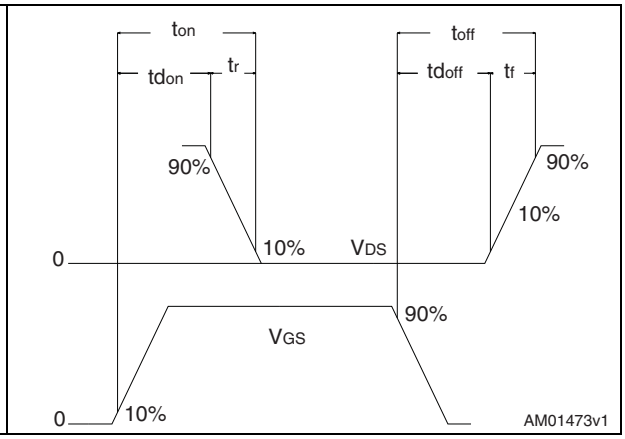


Figure 19. Switching time waveform



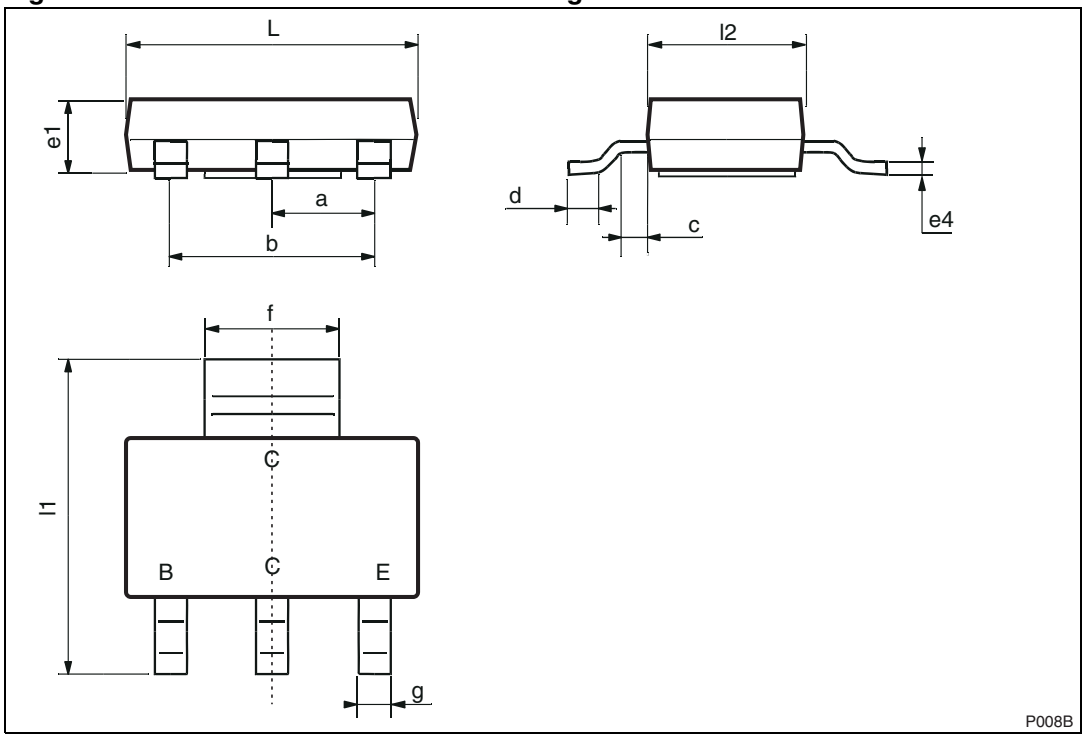
4 Package mechanical data

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.

Table 8. SOT-223 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
a	2.27	2.3	2.33
b	4.57	4.6	4.63
c	0.2	0.4	0.6
d	0.63	0.65	0.67
e1	1.5	1.6	1.7
e4			0.32
f	2.9	3	3.1
g	0.67	0.7	0.73
l1	6.7	7	7.3
l2	3.5	3.5	3.7
L	6.3	6.5	6.7

Figure 20. SOT-223 mechanical data drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
22-Apr-2008	1	Initial version.
29-Apr-2011	2	*Figure 5*, *Figure 7*, *Figure 11* and *Figure 12* have been updated.

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