



Silicon N-Channel Power MOSFET



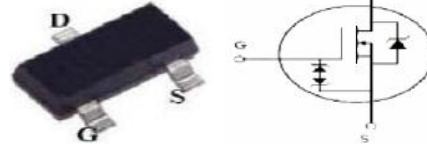
F601D-G

Features:

- | N-Channel
- | ESD improved Capability
- | Depletion Mode
- | dv/dt rated
- | Pb-free lead plating; ROHS compliant
- | Halogen Free

V_{DSX}	600	V
$I_{DSS,min}$	0.012	A
$R_{DS(ON),max}$	300	Ω

Package : SOT-23



Absolute ($T_c = 25^\circ\text{C}$ unless otherwise specified):

Symbol	Parameter	Rating	Units
V_{DSX}	Drain-to-Source Voltage	600	V
I_D	Continuous Drain Current	0.030	A
	Continuous Drain Current $T_c = 70^\circ\text{C}$	0.024	A
I_{DM}^{a1}	Pulsed Drain Current	0.120	A
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt^{a2}	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	0.5	W
$V_{ESD(G-S)}$	Gate source ESD (HBM-C= 100pF, R=1.5k Ω)	1200	V
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150, -55 to 150	$^\circ\text{C}$

Electrical Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise specified):

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{DSX}	Drain to Source Breakdown Voltage	$V_{GS} = -5\text{V}, I_D = 250\mu\text{A}$	600	--	--	V
$I_{D(off)}$	Off-state Drain to Source Current	$V_{DS} = 600\text{V}, V_{GS} = -5\text{V}$	--	--	0.1	μA
		$V_{DS} = 480\text{V}, V_{GS} = -5\text{V}$ $T_a = 125^\circ\text{C}$			10	μA
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS} = +20\text{V}$	--	--	10	μA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS} = -20\text{V}$	--	--	-10	μA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_{DSS}	On-state drain current	$V_{GS}=0V, V_{DS}=25V$	12			mA
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=0V, I_D=3mA$	--	100	300	Ω
		$V_{GS}=10V, I_D=16mA$		85	300	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=3V, I_D=8.0\mu A$	-2.7		-1.0	V

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g_{fs}	Forward Trans conductance	$V_{DS}=50V, I_D=0.01A$		0.005	--	S
C_{iss}	Input Capacitance	$V_{GS}=-5V, V_{DS}=25V$ $f=1.0MHz$	--	15.5		pF
C_{oss}	Output Capacitance		--	4.7		
C_{rss}	Reverse Transfer Capacitance		--	1.6		

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=0.01A, V_{DD}=300V$ $V_{GS}=-5...7V$ $R_G=6.0\Omega$	--	6.6	--	ns
t_r	Rise Time		--	21.6	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	6.2	--	
t_f	Fall Time		--	96.4	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)	$T_a=25^\circ C$	--	--	0.025	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	0.100	A
V_{SD}	Diode Forward Voltage	$I_F=16mA, V_{GS}=-5V$	--	--	1.2	V

Symbol	Parameter	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient	250	$^\circ C/W$

Gate-source Zener diode						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{GSO}	Gate-source breakdown voltage	$I_{GS} = \pm 1 \text{mA (Open Drain)}$	20			V
The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.						

^{a1}: Repetitive rating; pulse width limited by maximum junction temperature

^{a2}: $I_F = 0.01 \text{A}$, $di/dt \leq 100 \text{A/us}$, $V_{DD} \leq BV_{DS}$, Start $T_J = 25^\circ\text{C}$

^{a3}: Recommend soldering temperature defined by IPC/JEDEC J-STD 020

Characteristics Curve:

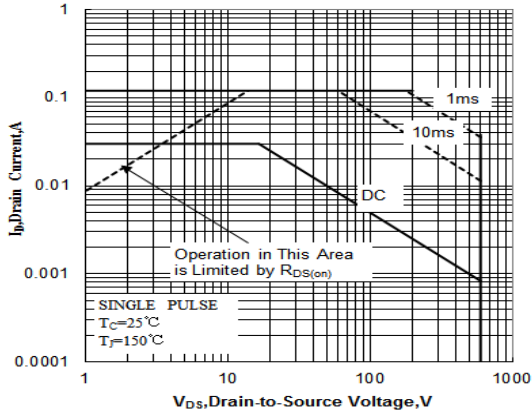


Figure 1 Maximum Forward Bias Safe Operating Area

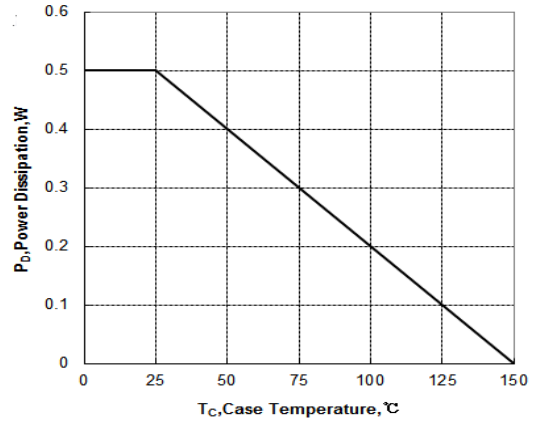


Figure 2 Maximum Power dissipation vs Case Temperature

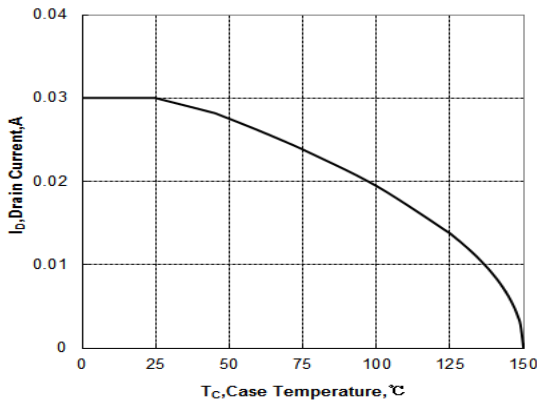


Figure 3 Maximum Continuous Drain Current vs Case Temperature

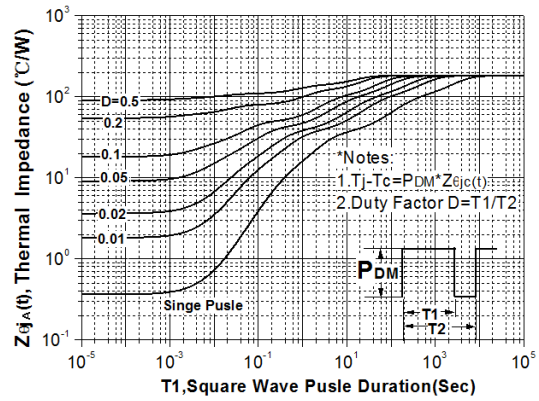


Figure 4 Max. transient Thermal Impedance R_{thJA}

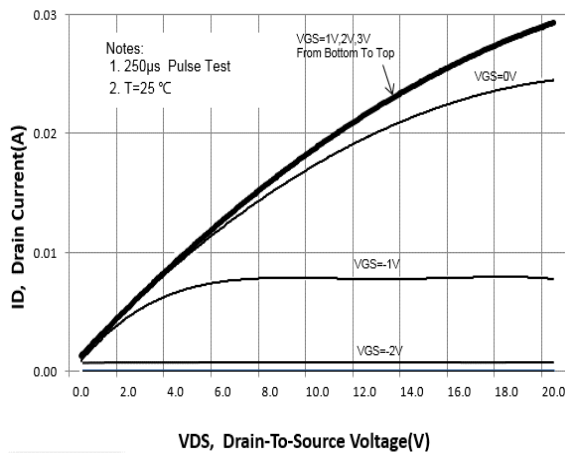


Figure 5 Typical Output Characteristics

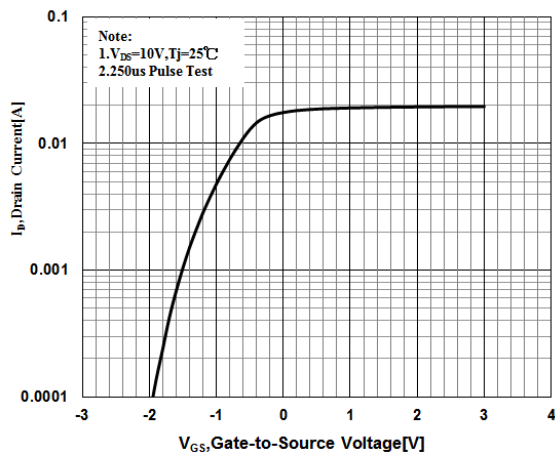


Figure 6 Typical Transfer Characteristics

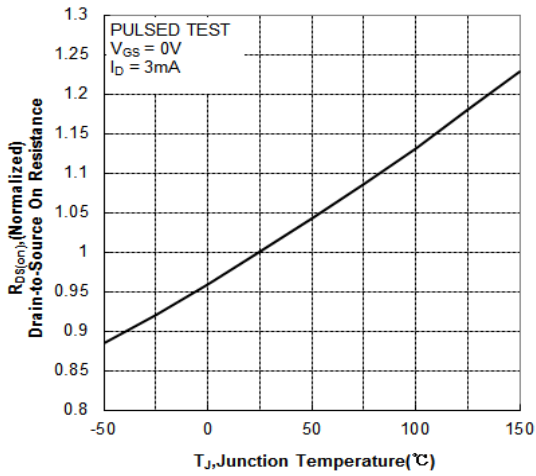


Figure 7 Typical Drain to Source on Resistance vs Junction Temperature

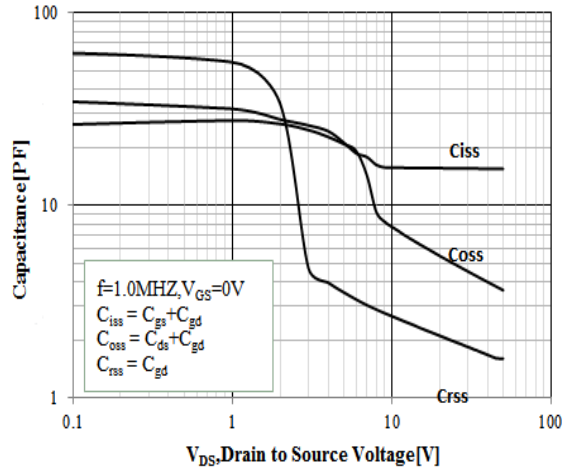


Figure 8 Typical Capacitance vs Drain to Source Voltage

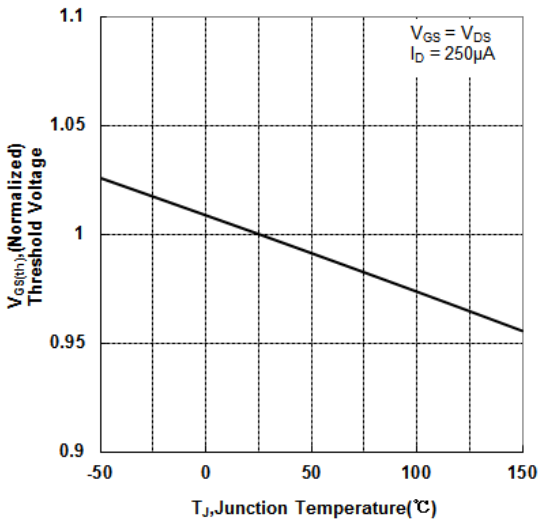


Figure 9 Typical Threshold Voltage vs Junction Temperature

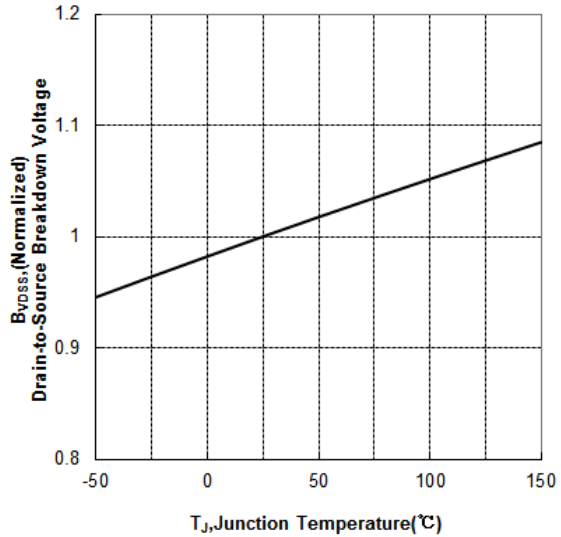


Figure 10 Typical Breakdown Voltage vs Junction Temperature

Test Circuit and Waveform

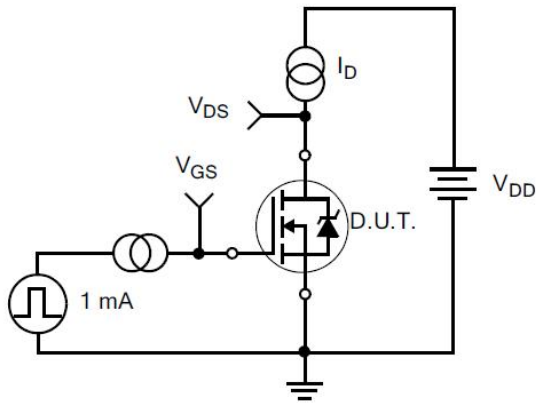


Figure 11. Gate Charge Test Circuit

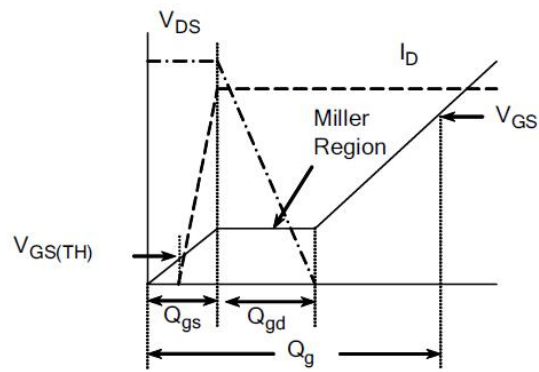


Figure 12. Gate Charge Waveforms

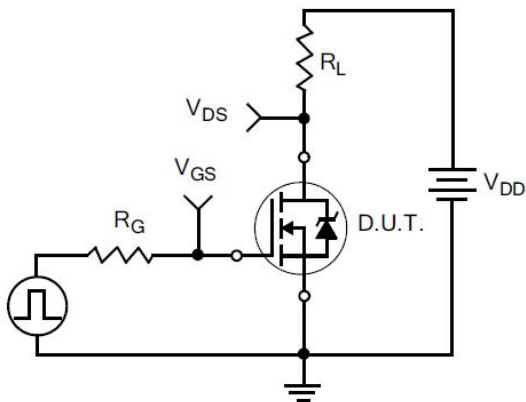


Figure 13. Resistive Switching Test Circuit

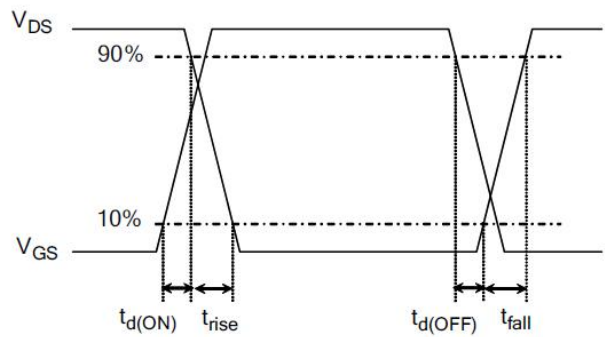


Figure 14. Resistive Switching Waveforms

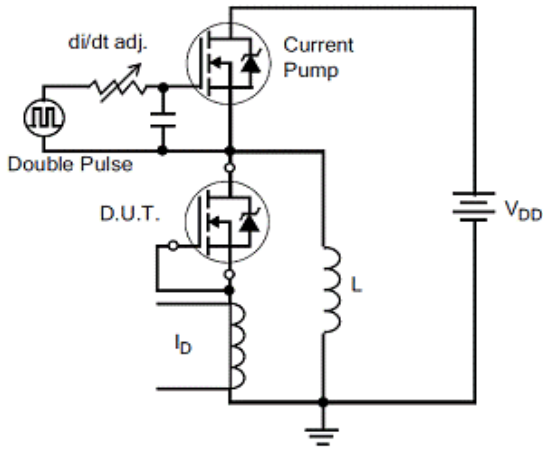


Figure 15. Diode Reverse Recovery Test Circuit

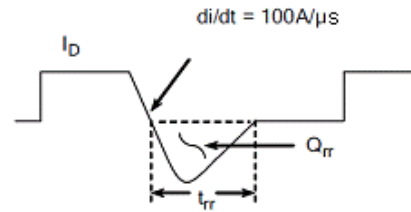


Figure 16. Diode Reverse Recovery Waveform

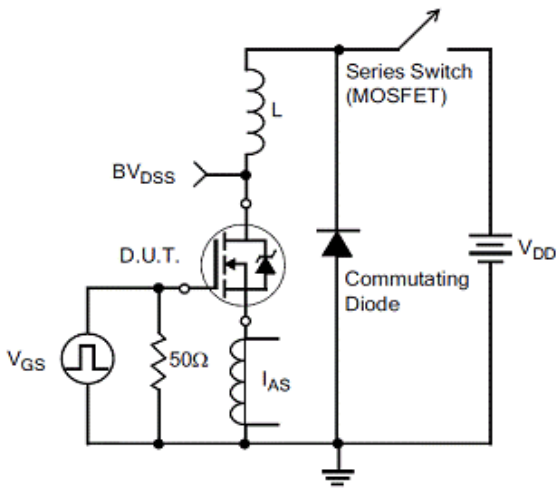


Figure 17. Unclamped Inductive Switching Test Circuit

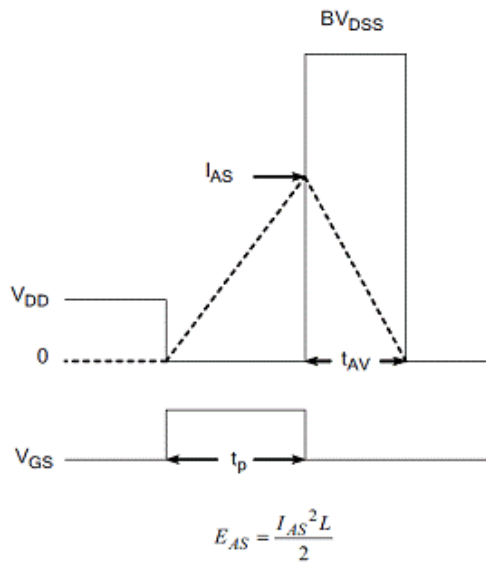
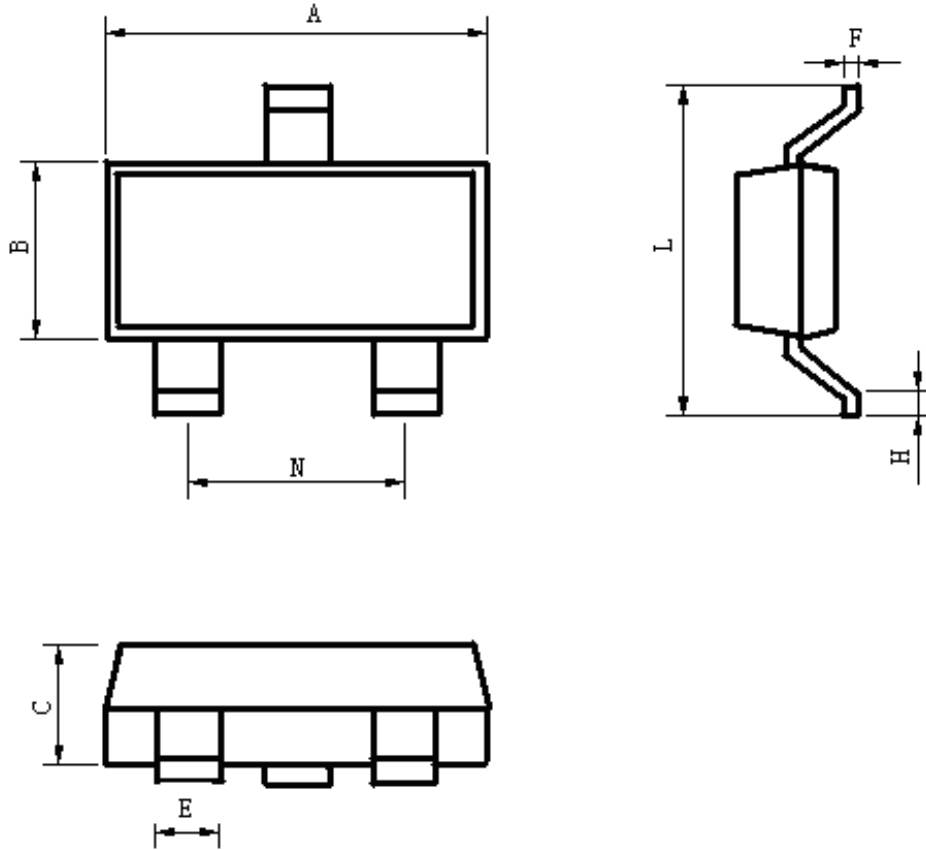


Figure 18. Unclamped Inductive Switching Waveform

Package Information:



Items	Values(mm)	
	MIN	MAX
A	2.70	3.10
B	1.10	1.50
C	0.90	1.10
E	0.25	0.55
F	0.07	0.23
H	0.25	0.55
L	2.20	2.60
N	1.80	2.00

SOT-23 Package

The name and content of poisonous and harmful material in products

Part's Name	Hazardous Substance									
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE	DIBP	DEHP	DBP	BBP
Limit	≤0.1%	≤0.1%	≤0.01 %	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%
Lead Frame	○	○	○	○	○	○	○	○	○	○
Molding	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
Wire Bonding	○	○	○	○	○	○	○	○	○	○
Electric glue	○	○	○	○	○	○	○	○	○	○
Note	○: Means the hazardous material is under the criterion of 2011/65/EU. ×: Means the hazardous material exceeds the criterion of 2011/65/EU. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS.									

Warnings

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heatsink, please pay attention to the torsional moment and the smoothness of the heatsink.
3. VDMOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

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