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June 2014

FDA20N50_F109

N-Channel UniFET™ MOSFET

500 V, 20 A, 230 mΩ

Features

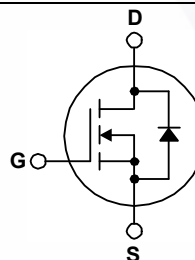
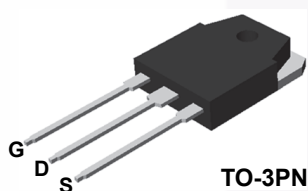
- $R_{DS(on)} = 230 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 10 \text{ A}$
- Low Gate Charge (Typ. 45.6 nC)
- Low C_{rss} (Typ. 27 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability

Applications

- PDP TV
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter		FDA20N50_F109	Unit
V_{DSS}	Drain-Source Voltage		500	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	22	A
		- Continuous ($T_C = 100^\circ\text{C}$)	13.2	A
I_{DM}	Drain Current	- Pulsed (Note 1)	88	A
V_{GSS}	Gate-Source voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	1110	mJ
I_{AR}	Avalanche Current	(Note 1)	22	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	28.0	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	280	W
		- Derate above 25°C	2.3	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FDA20N50_F109	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.44	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDA20N50	FDA20N50_F109	TO-3PN	Tube	N/A	30 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25°C	500	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.50	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500V, V _{GS} = 0V V _{DS} = 400V, T _C = 125°C	-- --	-- --	1 10	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 11A	--	0.20	0.23	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 11A	--	24.6	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	2400	3120	pF
C _{oss}	Output Capacitance		--	355	465	pF
C _{rss}	Reverse Transfer Capacitance		--	27	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 250V, I _D = 20A R _G = 25Ω (Note 4)	--	95	200	ns
t _r	Turn-On Rise Time		--	375	760	ns
t _{d(off)}	Turn-Off Delay Time		--	100	210	ns
t _f	Turn-Off Fall Time		--	105	220	ns
Q _g	Total Gate Charge	V _{DS} = 400V, I _D = 20A V _{GS} = 10V (Note 4)	--	45.6	59.5	nC
Q _{gs}	Gate-Source Charge		--	14.8	--	nC
Q _{gd}	Gate-Drain Charge		--	21.6	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	20	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	80	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 22A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 20A	--	507	--	ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt =100A/μs	--	7.20	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 4.1\text{mH}$, $I_{AS} = 22A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 22A$, $di/dt \leq 200A/\mu s$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Characteristics

Figure 1. On-Region Characteristics

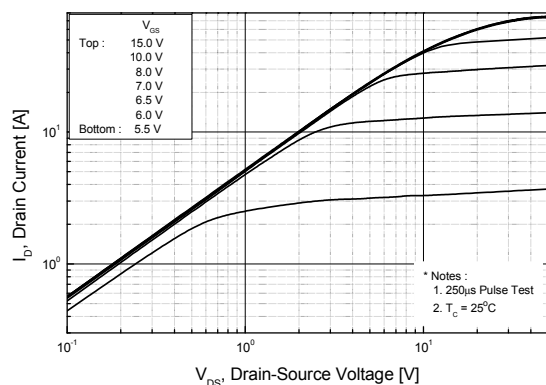


Figure 2. Transfer Characteristics

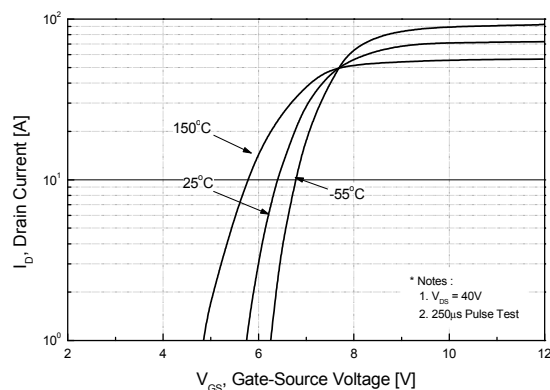


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

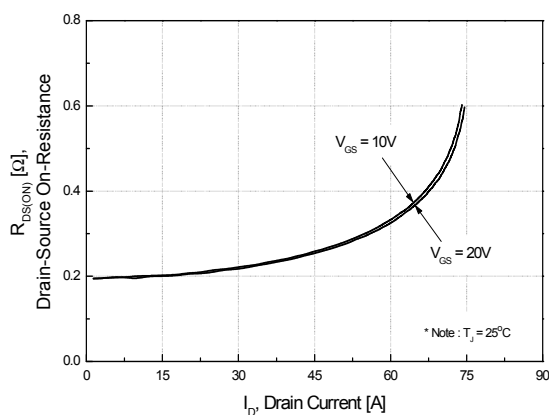


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

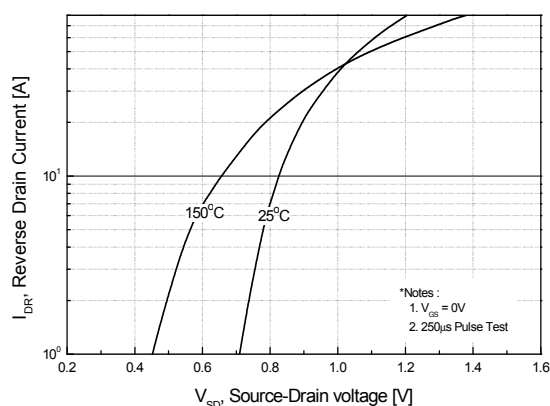


Figure 5. Capacitance Characteristics

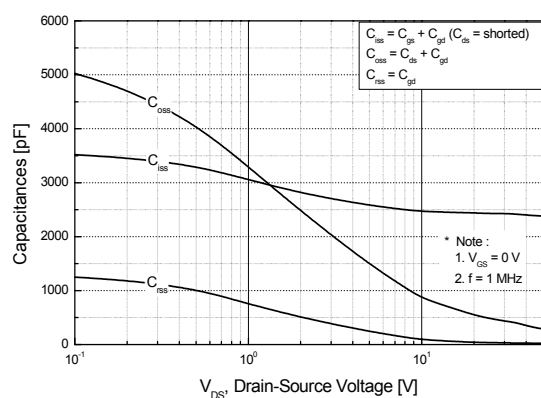
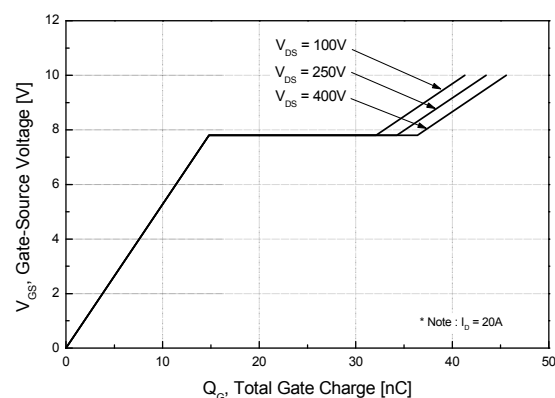


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

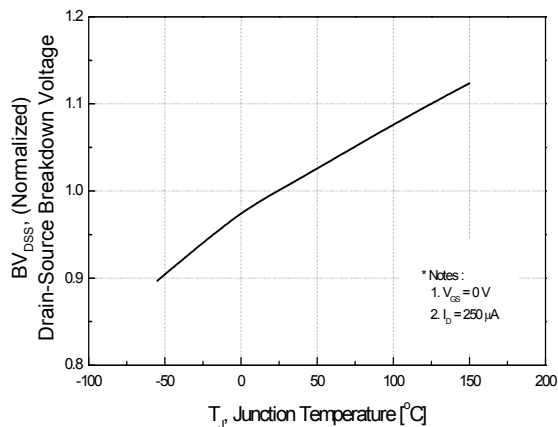


Figure 8. On-Resistance Variation vs. Temperature

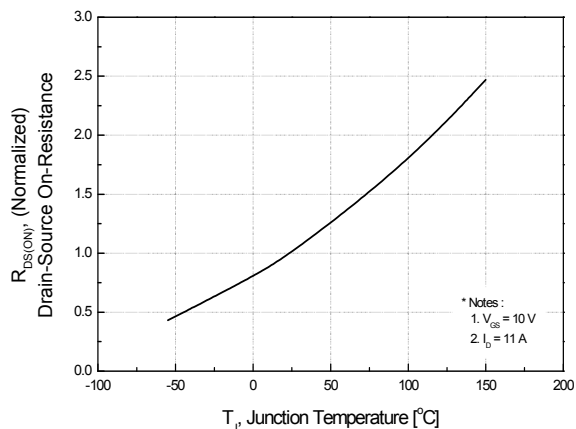


Figure 9. Safe Operating Area

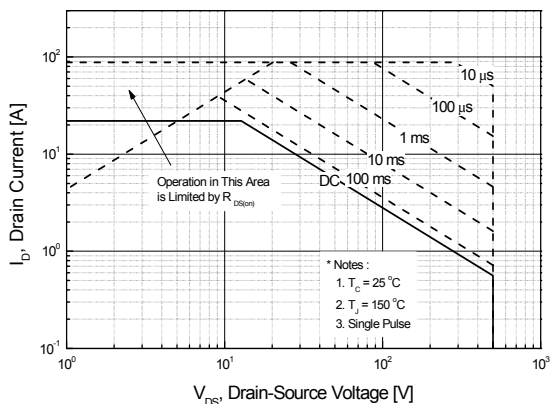


Figure 10. Maximum Drain Current vs. Case Temperature

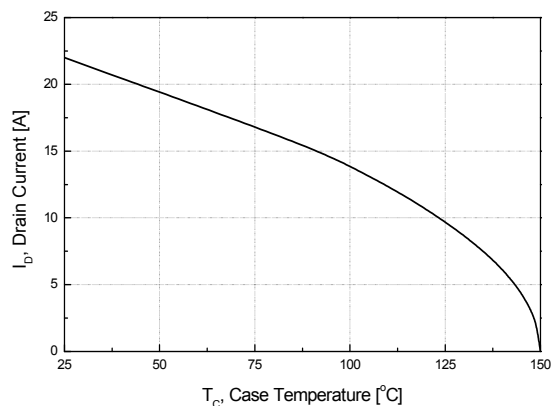


Figure 11. Transient Thermal Response Curve

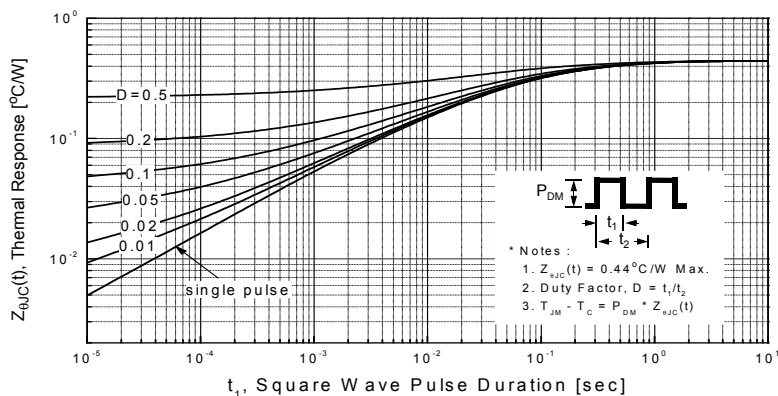


Figure 12. Gate Charge Test Circuit & Waveform

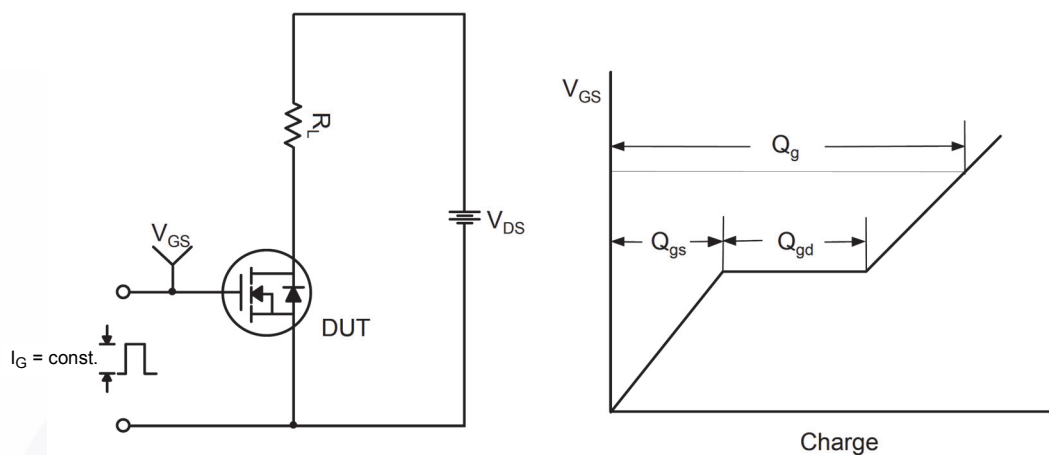


Figure 13. Resistive Switching Test Circuit & Waveforms

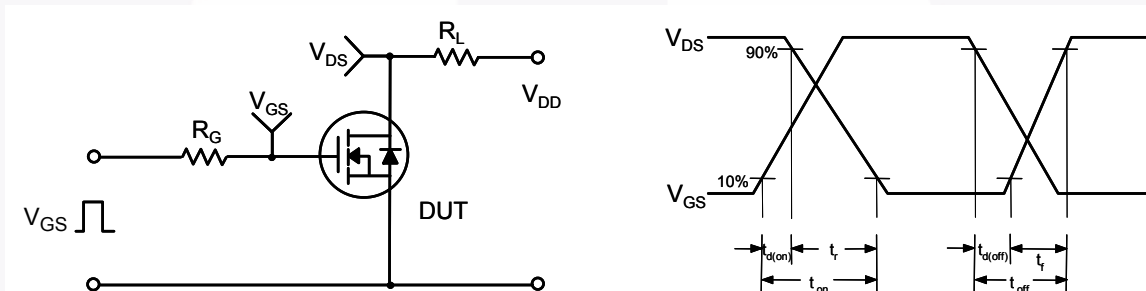
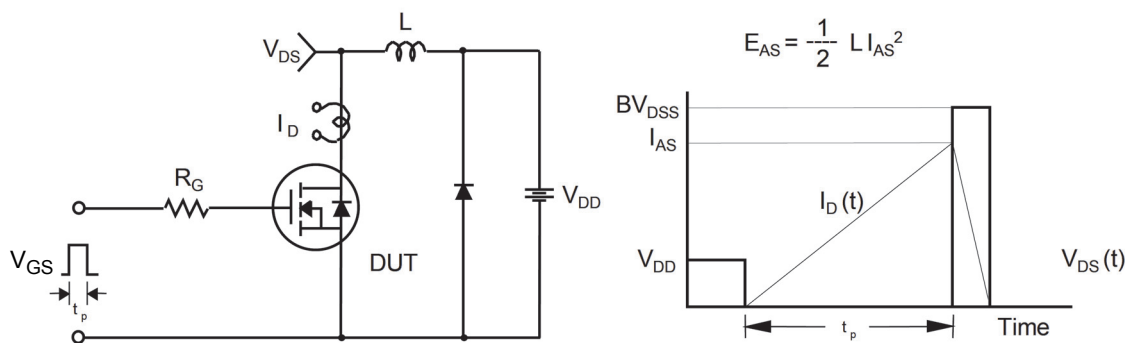


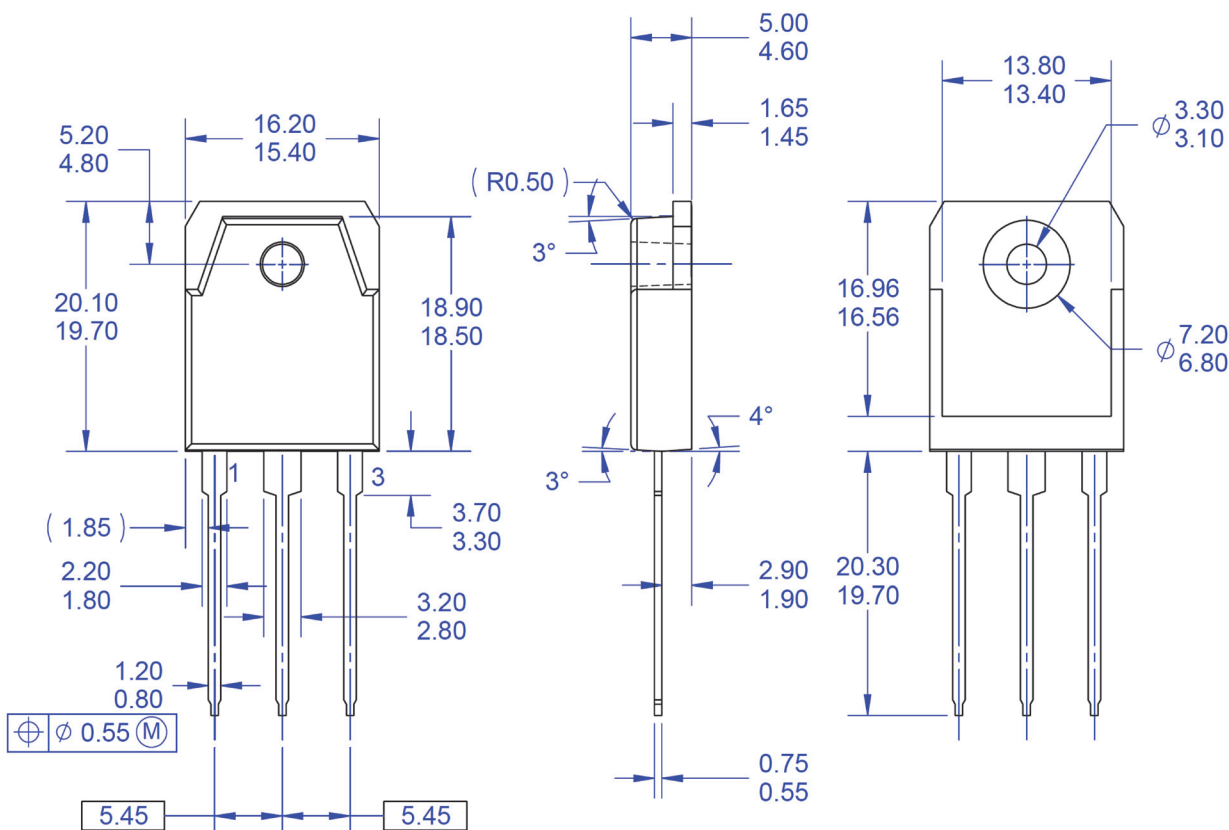
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



The circuit diagram shows a MOSFET (DUT) with its drain connected to a positive supply V_{DD} through an inductor L . The source is connected to ground through a resistor R_G and a MOSFET driver. The driver's gate is driven by a square wave V_{GS} . The drain current I_{SD} is measured. The DUT's body diode is represented by a diode symbol with a '+' sign on the drain side and a '-' sign on the source side. The voltage across the diode is V_{DS} .

The waveforms show the gate voltage V_{GS} (Driver) as a square wave with duty cycle $D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$ and amplitude $10V$. The drain current I_{SD} (DUT) shows a forward current I_{FM} during the gate pulse, followed by a reverse current I_{RM} during the recovery phase, with a di/dt slope. The drain-source voltage V_{DS} (DUT) shows a forward voltage drop V_{SD} during the pulse, followed by a recovery phase with a dv/dt slope, and a reverse voltage V_{DD} during the off-time.

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
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- E) DRAWING FILE NAME: TO3PN03AREV1.
- F) FAIRCHILD SEMICONDUCTOR.

Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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