

MOSFET – N-Channel, UniFET™

650 V, 15 A, 440 mΩ

FDPF15N65

Description

UniFET™ MOSFET is onsemi'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.

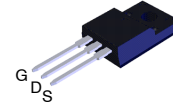
Features

- $R_{DS(on)} = 360 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 7.5 \text{ A}$
- Low Gate Charge (Typ. 48.5 nC)
- Low C_{rss} (Typ. 23.6 pF)
- 100% Avalanche Tested

Applications

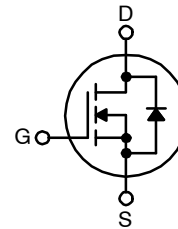
- LCD / LED / PDP TV and Monitor
- Uninterruptible Power Supply

V_{DSS}	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
650 V	440 mΩ @ 10 V	15 A

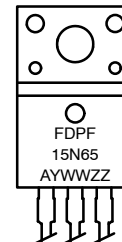


TO-220 Fullpack,
3-Lead /
TO-220F-3SG
CASE 221AT

N-CHANNEL MOSFET



MARKING DIAGRAM



FDPF15N65	= Specific Device Code
A	= Assembly Location
YWW	= Date Code (Year & Week)
ZZ	= Assembly Lot

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

FDPF15N65

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter		Rating	Unit
V _{DSS}	Drain–Source Voltage		650	V
I _D	Drain Current	– Continuous (T _C = 25°C) – Continuous (T _C = 100°C)	15* 9.5*	A A
I _{DM}	Drain Current	– Pulsed (Note 1)	60*	A
V _{GSS}	Gate–Source Voltage		±30	V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		637	mJ
I _{AR}	Avalanche Current (Note 1)		15	A
E _{AR}	Repetitive Avalanche Energy (Note 1)		25.0	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P _D	Power Dissipation	(T _C = 25°C) – Derate Above 25°C	38.5 0.3	W W/°C
T _J , T _{STG}	Operating and Storage Temperature Range		–55 to +150	°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

*Drain current limited by maximum junction temperature.

1. Repetitive rating; pulse–width limited by maximum junction temperature.
2. L = 5.23 mH, I_{AS} = 15 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 15 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction–to–Case, Max.	3.3	°C/W
R _{θJA}	Thermal Resistance, Junction–to–Ambient, Max.	62.5	°C/W

FDPF15N65

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA, T _J = 25°C	650	–	–	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	–	0.65	–	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V V _{DS} = 520 V, T _C = 125°C	–	–	1 10	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V	–	–	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = –30 V, V _{DS} = 0V	–	–	–100	nA

ON CHARACTERISTICS

V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	3.0	–	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 7.5 A	–	0.36	0.44	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 7.5 A	–	19.2	–	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	–	2380	3095	pF
C _{oss}	Output Capacitance		–	295	385	pF
C _{rss}	Reverse Transfer Capacitance		–	23.6	35.5	pF

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 325 V, I _D = 15 A, V _{GS} = 10 V, R _G = 21.7 Ω (Note 4)	–	65	140	ns
t _r	Turn-On Rise Time		–	125	260	ns
t _{d(off)}	Turn-Off Delay Time		–	105	220	ns
t _f	Turn-Off Fall Time		–	65	140	ns
Q _g	Total Gate Charge	V _{DS} = 520 V, I _D = 15 A, V _{GS} = 10 V (Note 4)	–	48.5	63.0	nC
Q _{gs}	Gate-Source Charge		–	14.0	–	nC
Q _{gd}	Gate-Drain Charge		–	21.2	–	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Drain–Source Diode Forward Current		–	–	15*	A
I _{SM}	Maximum Pulsed Drain–Source Diode Forward Current		–	–	60	A
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 15 A	–	–	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 15 A, dI _F /dt = 100 A/μs	–	496	–	ns
Q _{rr}	Reverse Recovery Charge		–	5.69	–	μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

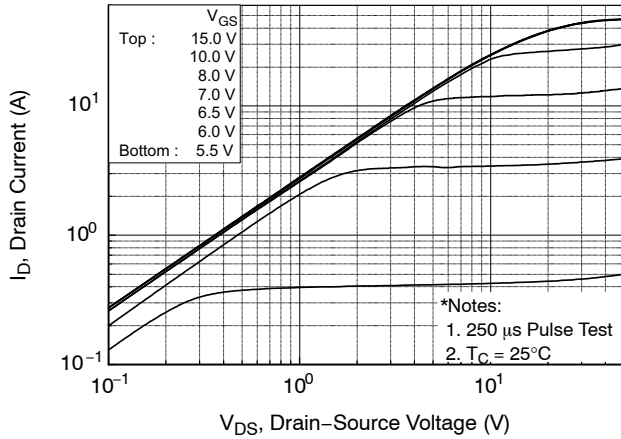


Figure 1. On-Region Characteristics

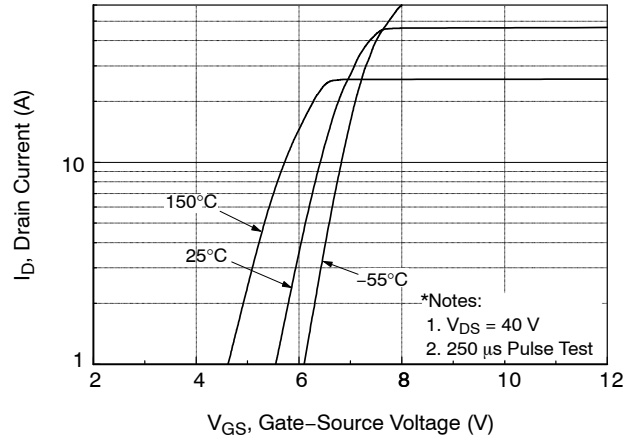


Figure 2. Transfer Characteristics

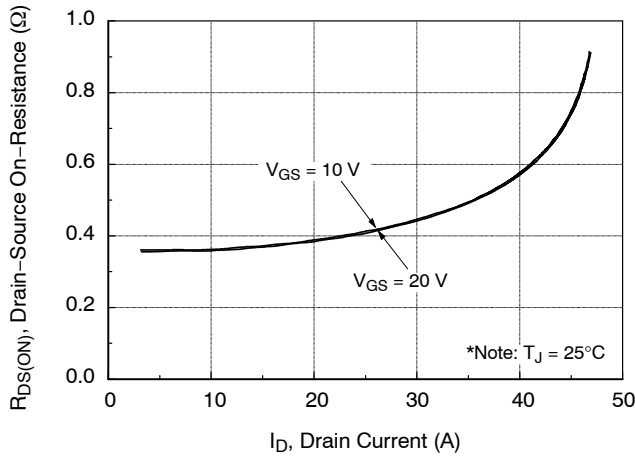


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

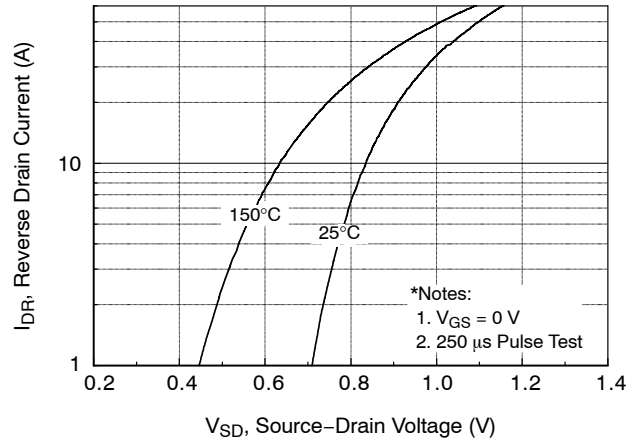


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

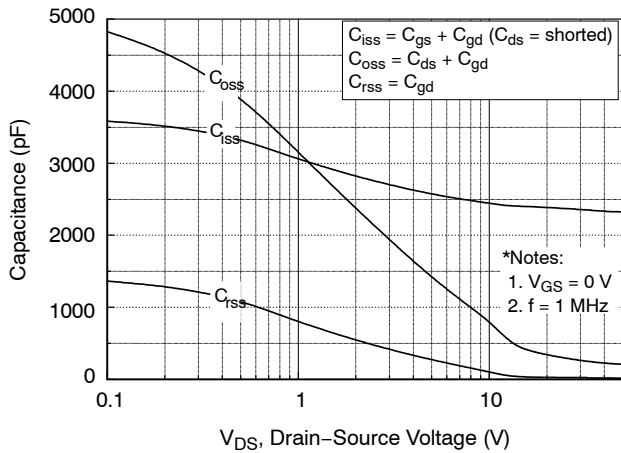


Figure 5. Capacitance Characteristics

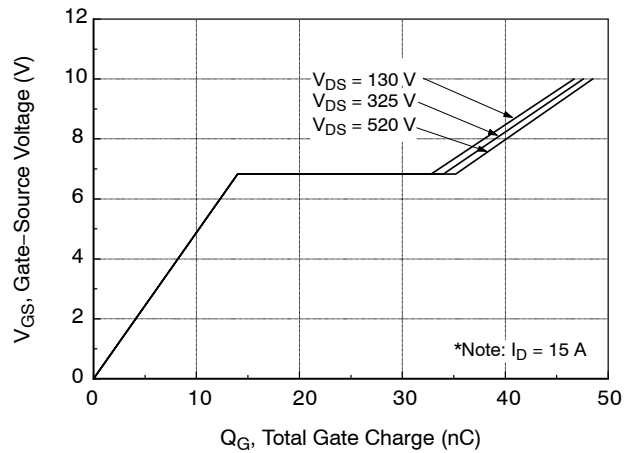


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

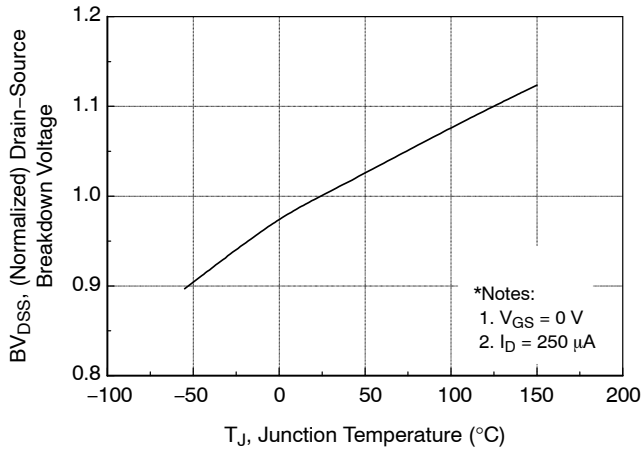


Figure 7. Breakdown Voltage Variation vs. Temperature

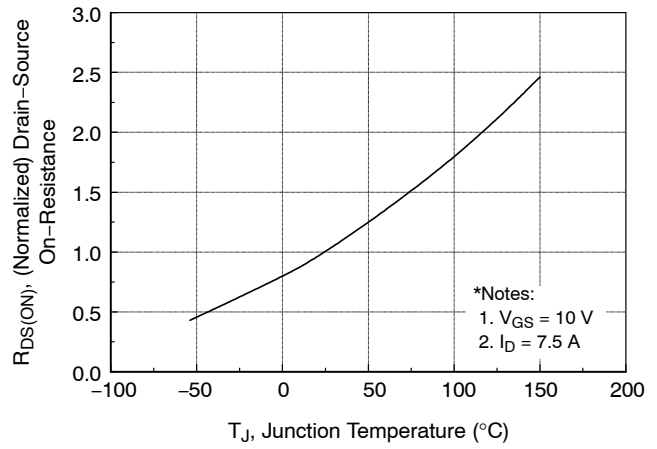


Figure 8. On-Resistance Variation vs. Temperature

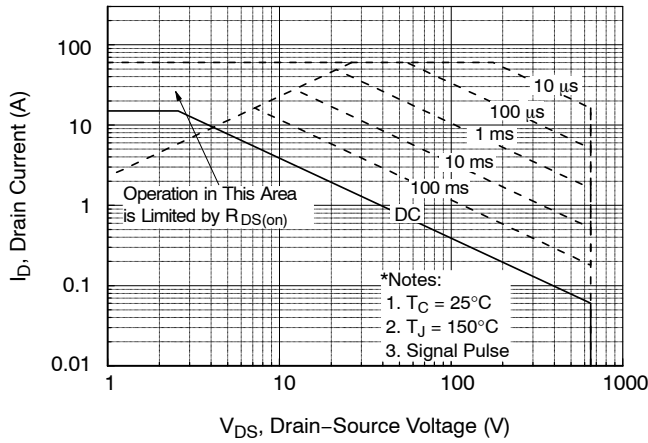


Figure 9. Safe Operating Area

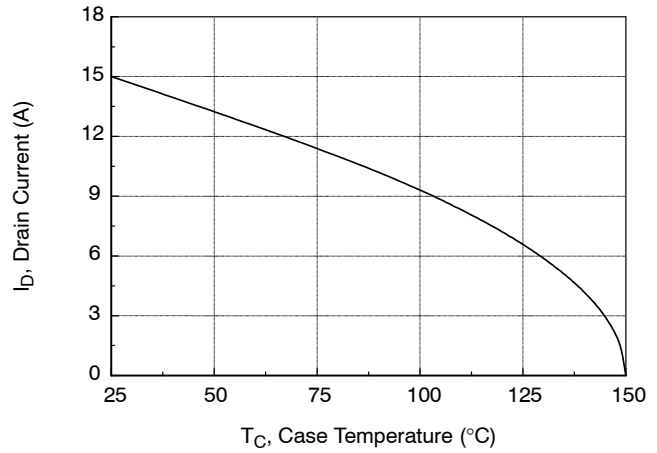


Figure 10. Maximum Drain Current vs. Case Temperature

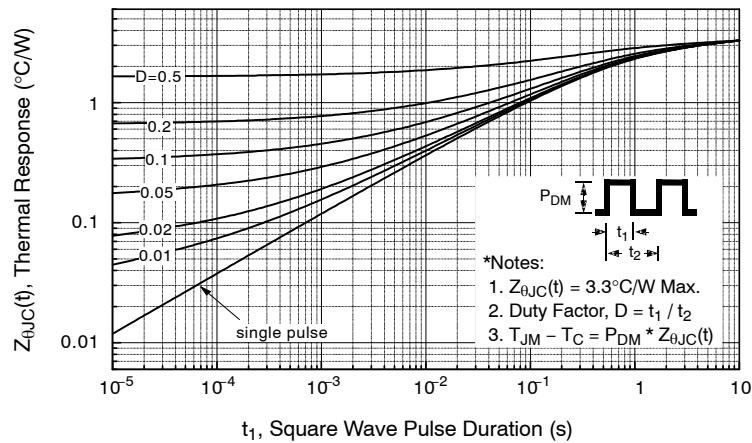
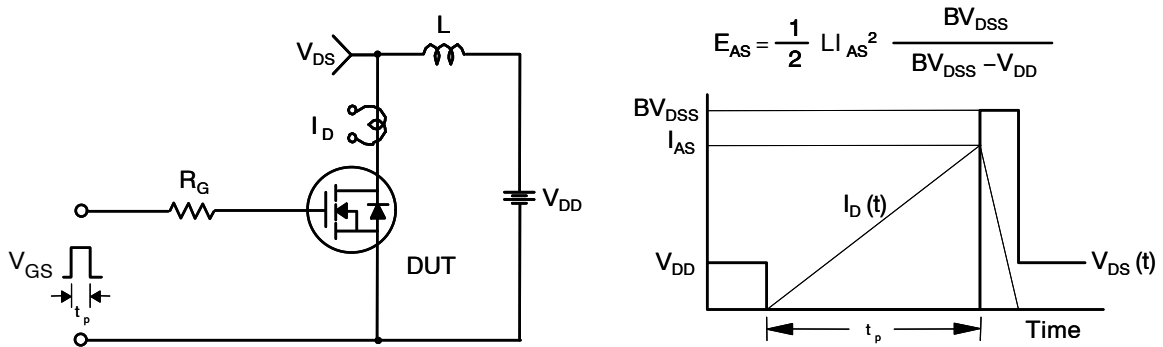
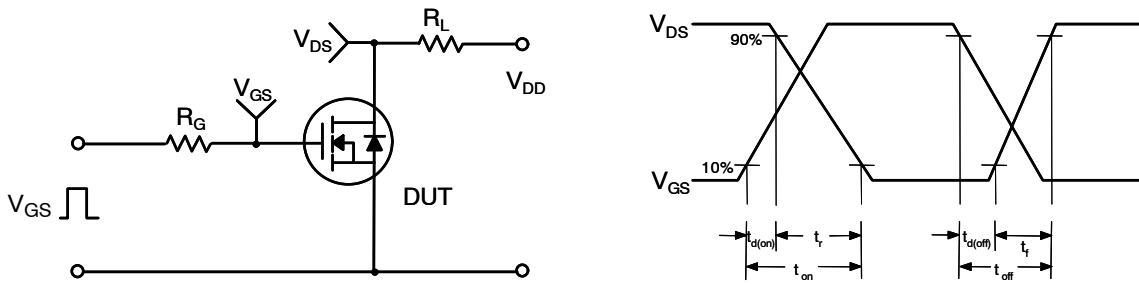
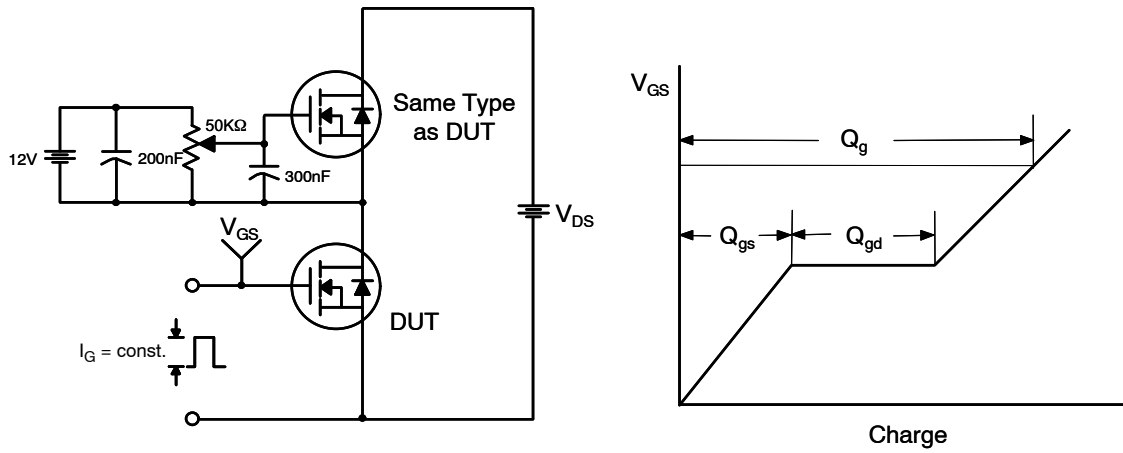


Figure 11. Transient Thermal Response Curve



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 . A gate driver provides a square-wave gate voltage V_{GS} to the gate. The drain current I_{SD} is measured. The MOSFET is labeled "Same Type as DUT".

Key parameters and notes in the diagram:

- V_{DS} : Drain-Source Voltage
- I_{SD} : Source-Drain Current
- R_G : Gate Resistor
- V_{GS} : Gate-Source Voltage
- V_{DD} : Drain Supply Voltage
- L : Inductor
- Notes:
 - dv/dt controlled by R_G
 - I_{SD} controlled by pulse period

The waveforms below the circuit show the timing and characteristics of the body diode:

- V_{GS} (Driver)**: A square wave with a pulse width $D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$ and a peak voltage of 10V.
- I_{SD} (DUT)**: Shows the forward current I_{FM} during the gate pulse, followed by a reverse recovery transient. The reverse current is labeled I_{RM} . The slope of the reverse current is labeled di/dt .
- V_{DS} (DUT)**: Shows the drain-source voltage during the reverse recovery. It includes the reverse recovery voltage V_{SD} and the recovery dv/dt during the turn-off transient. The peak reverse voltage is V_{DD} .

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FDPF15N65

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Shipping
FDPF15N65	FDPF15N65	TO-220 Fullpack, 3-Lead / TO-220F-3SG CASE 221AT	1,000 Units / Tube

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TO-220 Fullpack, 3-Lead / TO-220F-3SG
CASE 221AT
ISSUE B

DATE 19 JAN 2021



Scale 1:1



OPTION1



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.56	2.76	2.96
A2	2.34	2.54	2.74
b	0.70	0.80	0.90
b2	~	~	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.60	15.80	16.00
E	9.96	10.16	10.36
e	2.34	2.54	2.74
F	~	0.84	~
H1	6.48	6.68	6.88
L	12.78	12.98	13.18
L1	3.03	3.23	3.43
Ø P	2.98	3.18	3.38
Ø P1	~	1.00	~
Q	3.20	3.30	3.40

NOTES:

A. DIMENSION AND TOLERANCE AS ASME Y14.5-2009

B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUCTIONS.

C. OPTION 1 - WITH SUPPORT PIN HOLE

OPTION 2 - NO SUPPORT PIN HOLE

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