



# P-DUKE POWER

## MCF-028 Series

EMI filter and transient protector

# 3

YEARS  
WARRANTY

ROHS  
COMPLIANT

REACH  
COMPLIANT



Railway



Defense



Industry



Automation



Datacom



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV

NON  
-isolation

4 : 1  
Wide  
Input  
Range

MIL-STD  
1275E  
Compliant

MIL-STD  
461G

INRUSH  
CURRENT  
LIMIT

REVERSE  
POLARITY  
PROTECTION

REMOTE  
ON  
OFF

OCP

OTP

OVP

SCP

UVP

## PART NUMBER STRUCTURE

MCF

Series Name

- 028

Input  
Voltage  
(VDC)

015

Output  
Current  
(A)

001

Serial  
Number

-

TH

Assembly  
Options

028: 9~36

005:5

008:8

010:10

015:15

☐: None

TH: No thread\*

\*The module can't equip Heat-sink with TH option.

## TECHNICAL SPECIFICATION All specifications are typical at nominal input, full load and 25°C unless otherwise noted

| Model Number   | Input Range | Maximum Output Current | Maximum Output Power | Input Current @ No Load | Efficiency | Maximum Capacitor Load |
|----------------|-------------|------------------------|----------------------|-------------------------|------------|------------------------|
|                | VDC         | A                      | W                    | mA                      | %          | μF                     |
| MCF-028005-001 | 9 ~ 36      | 5                      | 45                   | 6                       | 97         | 1000                   |
| MCF-028008-001 | 9 ~ 36      | 8                      | 75                   | 6                       | 98         | 1000                   |
| MCF-028010-001 | 9 ~ 36      | 10                     | 150                  | 6                       | 98         | 1000                   |
| MCF-028015-001 | 9 ~ 36      | 15                     | 250                  | 6                       | 98         | 1000                   |

| INPUT SPECIFICATIONS          |                                                                              |                       |                                          |      |      |      |
|-------------------------------|------------------------------------------------------------------------------|-----------------------|------------------------------------------|------|------|------|
| Parameter                     | Conditions                                                                   |                       | Min.                                     | Typ. | Max. | Unit |
| Operating input voltage range |                                                                              |                       | 9                                        | 28   | 36   | VDC  |
| Inrush current                | With 1000μF connected to the output                                          |                       |                                          | 5    |      | A    |
| Start up voltage              |                                                                              |                       |                                          |      | 9    | VDC  |
| Shutdown voltage              |                                                                              |                       | 5.5                                      | 6    | 6.5  | VDC  |
| Remote ON/OFF                 | Referred to -Vin pin                                                         | DC-DC ON<br>DC-DC OFF | Open or Short or 0 ~ 1.2VDC<br>4 ~ 12VDC |      |      |      |
| Transient voltage             | 1 second, max.                                                               |                       |                                          |      | 50   | VDC  |
|                               | 50 ms, max.                                                                  |                       |                                          |      | 100  | VDC  |
| Spikes                        | 70μs, 2J                                                                     |                       | -250                                     |      | +250 | VDC  |
| Reverse polarity protection   | Internal series MOSFET is held in an off state to avoid reverse current flow |                       | -36                                      |      | 0    | VDC  |

| OUTPUT SPECIFICATIONS    |                              |                       |                                 |       |      |      |
|--------------------------|------------------------------|-----------------------|---------------------------------|-------|------|------|
| Parameter                | Conditions                   |                       | Min.                            | Typ.  | Max. | Unit |
| Output voltage           |                              |                       |                                 | Vin-1 | Vin  | VDC  |
| Clamping voltage         | Input transient voltage mode | MCF-028005、MCF-028008 |                                 | 40    |      | VDC  |
|                          |                              | MCF-028010、MCF-028015 |                                 | 46    |      | VDC  |
| Over load protection     | Hiccup mode                  | MCF-028005            |                                 | 12.5  |      | A    |
|                          |                              | MCF-028008            |                                 | 20    |      | A    |
|                          |                              | MCF-028010            |                                 | 22.5  |      | A    |
|                          |                              | MCF-028015            |                                 | 35    |      | A    |
| Short circuit protection |                              |                       | Continuous, automatics recovery |       |      |      |

| GENERAL SPECIFICATIONS |                                                      |                        |                                                                                                              |      |      |      |
|------------------------|------------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------|------|------|------|
| Parameter              | Conditions                                           |                        | Min.                                                                                                         | Typ. | Max. | Unit |
| Standard meets         | Compliance with standards voltage transient immunity |                        | MIL-STD-1275E Surge Susceptibility<br>MIL-STD-704F Surge Susceptibility<br>RTCA DO-160G Surge Susceptibility |      |      |      |
| Isolation voltage      | 1 minute                                             | Input (Output) to Case | 2250                                                                                                         |      |      | VDC  |
| Case material          |                                                      | MCF-028005             | Non-conductive black plastic                                                                                 |      |      |      |
|                        |                                                      | MCF-028008             | Copper                                                                                                       |      |      |      |
|                        |                                                      | MCF-028010、MCF-028015  | plastic                                                                                                      |      |      |      |
| Base material          |                                                      | MCF-028005             | Non-conductive black plastic                                                                                 |      |      |      |
|                        |                                                      | MCF-028008             | FR4 PCB                                                                                                      |      |      |      |
|                        |                                                      | MCF-028010、MCF-028015  | Aluminum base-plate                                                                                          |      |      |      |
| Potting material       |                                                      |                        | Silicone (UL94 V-0)                                                                                          |      |      |      |
| Weight                 |                                                      | MCF-028005             | 19.7g (0.69oz)                                                                                               |      |      |      |
|                        |                                                      | MCF-028008             | 28g (0.99oz)                                                                                                 |      |      |      |
|                        |                                                      | MCF-028010、MCF-028015  | 64g (2.26oz)                                                                                                 |      |      |      |
| MTBF                   | MIL-HDBK-217F, Full load                             | MCF-028005             | 2.718 x 10 <sup>6</sup> hrs                                                                                  |      |      |      |
|                        |                                                      | MCF-028008             | 1.146 x 10 <sup>6</sup> hrs                                                                                  |      |      |      |
|                        |                                                      | MCF-028010             | 1.307 x 10 <sup>6</sup> hrs                                                                                  |      |      |      |
|                        |                                                      | MCF-028015             | 6.095 x 10 <sup>5</sup> hrs                                                                                  |      |      |      |

## ENVIRONMENTAL SPECIFICATIONS

| Parameter                     | Conditions    | Min. | Typ. | Max. | Unit         |
|-------------------------------|---------------|------|------|------|--------------|
| Operating ambient temperature | With derating | -40  |      | +105 | °C           |
| Maximum case temperature      |               |      |      | 105  | °C           |
| Over temperature protection   |               |      | 115  |      | °C           |
| Storage temperature range     |               | -55  |      | +125 | °C           |
| Thermal shock                 |               |      |      |      | MIL-STD-810F |
| Vibration                     |               |      |      |      | MIL-STD-810F |
| Relative humidity             |               |      |      |      | 5% to 95% RH |

## EMC SPECIFICATIONS

| Parameter | Conditions                                                                                                                                   | Level        |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| EMI       | CE101-4 Curve #2 With external components<br>CE102-1 Basic curve<br>RE101-2 Navy<br>RE102-3 Fixed Wing internal,<br>≥ 25 Meters Nose to Tail | MIL-STD-461G |
| EMS       | CS101-1 Curve #2 With external components<br>CS114-1 Curve #5<br>CS115-1 Basic waveform<br>CS116-2 I <sub>max</sub> =10A                     | MIL-STD-461G |

### Note:

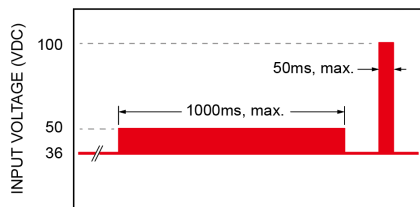
- The MCF-028 series is a DC front-end module that provides EMI filtering and transient protection. The module enables designers using P-DUKE's 24V DC/DC converters to meet conducted emission and conducted susceptibility per MIL-STD-461G.

| Model Number   | 24V DC/DC Converter Series |
|----------------|----------------------------|
| MCF-028005-001 | RCD30W, RCD15W             |
| MCF-028008-001 | RED60W                     |
| MCF-028010-001 | HAE100W                    |
| MCF-028015-001 | HAE200W                    |

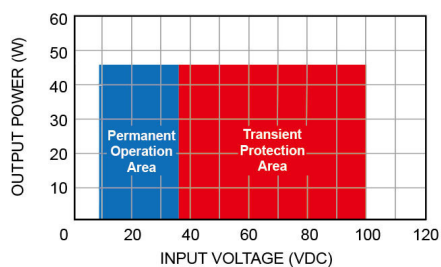
- The recommended external components are specified in the document of "EMC Considerations". Please contact P-DUKE for more detailed information.

**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

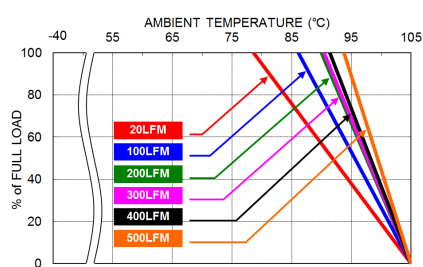
## CHARACTERISTIC CURVE



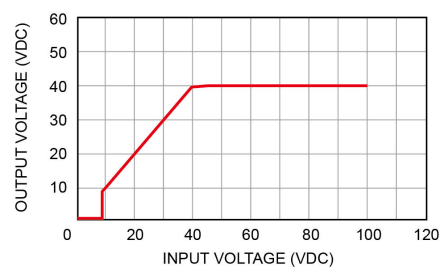
Transient Limitation



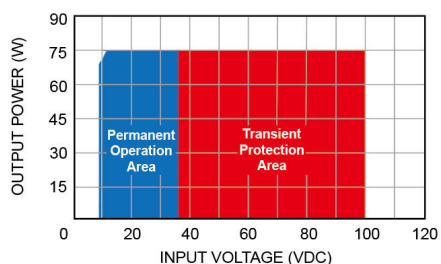
MCF-028005-001 Pout vs. Input Voltage



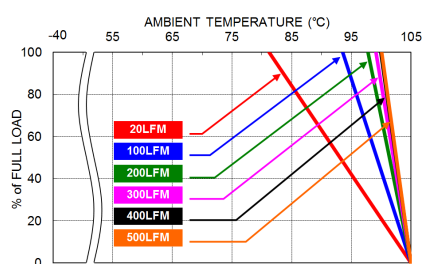
MCF-028005-001 Derating Curve



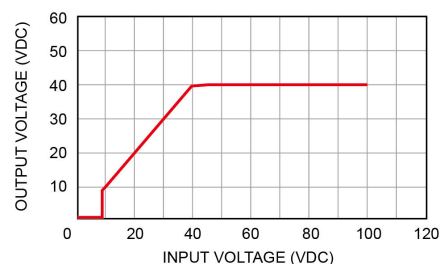
MCF-028005-001 Transfer Function



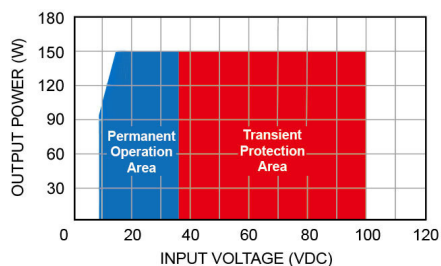
MCF-028008-001 Pout vs. Input Voltage



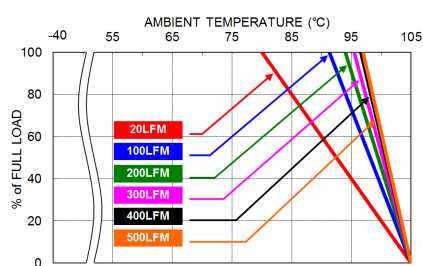
MCF-028008-001 Derating Curve



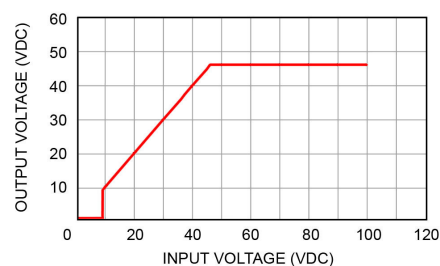
MCF-028008-001 Transfer Function



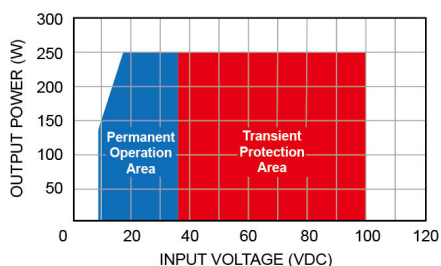
MCF-028010-001 Pout vs. Input Voltage



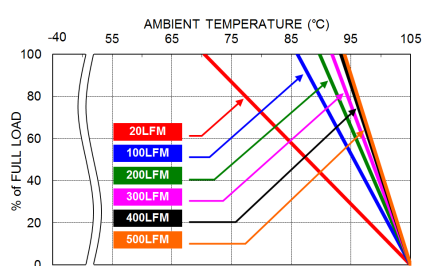
MCF-028010-001 Derating Curve



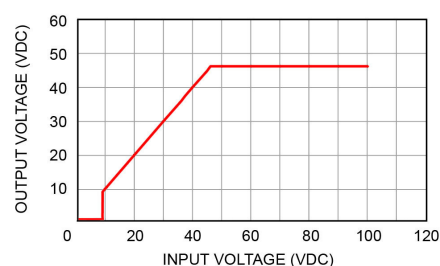
MCF-028010-001 Transfer Function



MCF-028015-001 Pout vs. Input Voltage



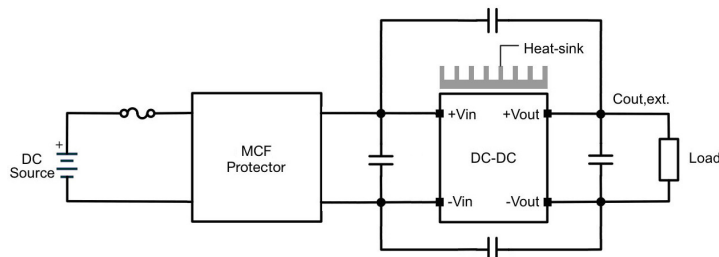
MCF-028015-001 Derating Curve



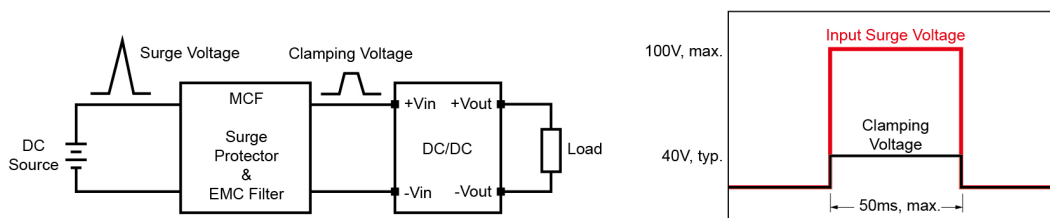
MCF-028015-001 Transfer Function

## TYPICAL APPLICATION

1. The schematic for typical application is shown as below.



2. Surge protector clamps over-voltage to a safe value in order to protect the power module from damaging. According to MIL-STD-1275E, the module should keep working during input surge occurs.

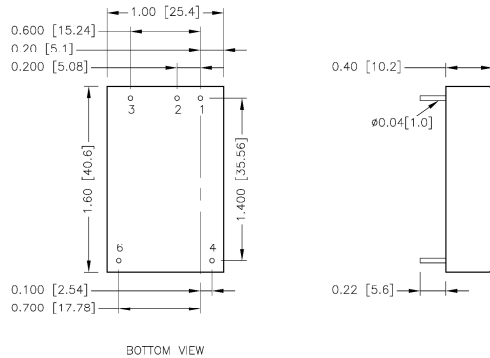


3. This surge protector can be used for 28V battery system of MIL-STD-1275E application. Input range of DC/DC converters also has to meet 24V system input range.

| Standard              | Un<br>(VDC) | Permanent<br>Operating Input Range<br>(VDC) | Transient                  | Spike        |
|-----------------------|-------------|---------------------------------------------|----------------------------|--------------|
| MIL-STD-1275E         | 28          | 23 – 33                                     | 40V / 500ms<br>100V / 50ms | ±250V / 70μs |
| MIL-STD-704F          | 28          | 22 – 29                                     | 50V / 50ms                 | N/A          |
| RTCA DO-160G Cat. A/Z | 28          | 20.5 – 32.2                                 | 80V / 100ms                | ±600V / 10μs |

## MECHANICAL DRAWING

### MCF-028005-001

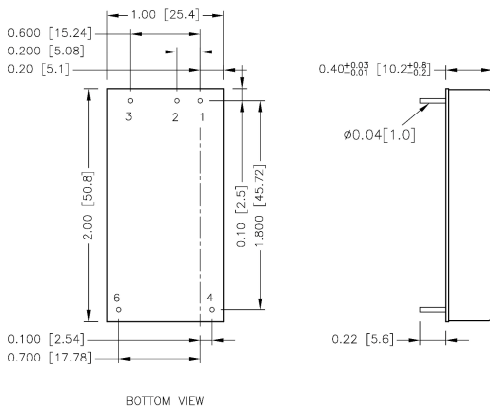


### PIN CONNECTION

| PIN | DEFINE | DIAMETER  |
|-----|--------|-----------|
| 1   | +Vin   | 0.04 Inch |
| 2   | Ctrl   | 0.04 Inch |
| 3   | -Vin   | 0.04 Inch |
| 4   | +Vout  | 0.04 Inch |
| 6   | -Vout  | 0.04 Inch |

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.010 [x.xx±0.25]
3. Pin dimension tolerance ±0.004[0.10]

### MCF-028008-001

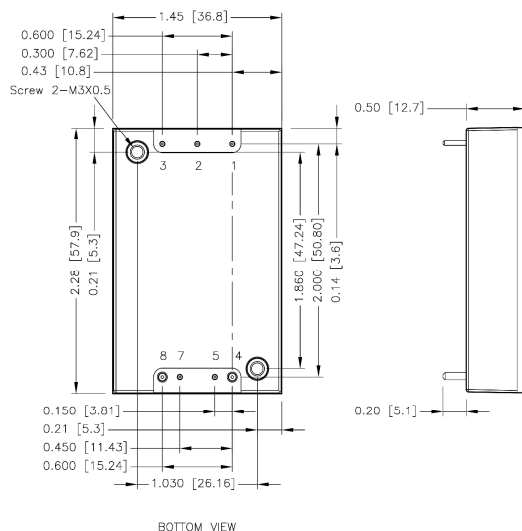


### PIN CONNECTION

| PIN | DEFINE | DIAMETER  |
|-----|--------|-----------|
| 1   | +Vin   | 0.04 Inch |
| 2   | Ctrl   | 0.04 Inch |
| 3   | -Vin   | 0.04 Inch |
| 4   | +Vout  | 0.04 Inch |
| 6   | -Vout  | 0.04 Inch |

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.010 [x.xx±0.25]
3. Pin dimension tolerance ±0.004[0.10]

### MCF-028010-001, MCF-028015-001



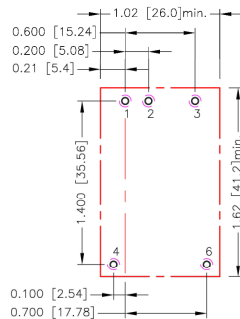
### PIN CONNECTION

| PIN | DEFINE | DIAMETER  |
|-----|--------|-----------|
| 1   | - Vin  | 0.04 Inch |
| 2   | Ctrl   | 0.04 Inch |
| 3   | + Vin  | 0.04 Inch |
| 4   | - Vout | 0.06 Inch |
| 5   | - Emi  | 0.04 Inch |
| 7   | + Emi  | 0.04 Inch |
| 8   | + Vout | 0.06 Inch |

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.010 [x.xx±0.25]
3. Pin dimension tolerance ±0.004[0.10]
4. The screw locked torque:MAX 3.5kgf-cm [0.34N-m]

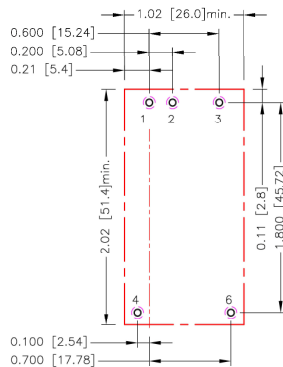
## RECOMMENDED PAD LAYOUT

### MCF-028005-001



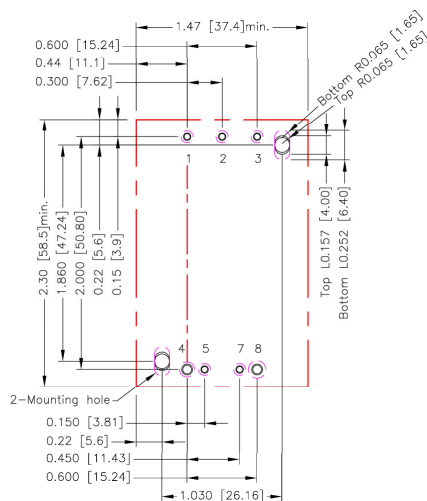
All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1.2.3.4.6:  $\varnothing 0.051$  [1.30]  
 Top view pad 1.2.3.4.6:  $\varnothing 0.064$  [1.63]  
 Bottom view pad 1.2.3.4.6:  $\varnothing 0.102$  [2.60]

### MCF-028008-001



All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1.2.3.4.6:  $\varnothing 0.051$  [1.30]  
 Top view pad 1.2.3.4.6:  $\varnothing 0.064$  [1.63]  
 Bottom view pad 1.2.3.4.6:  $\varnothing 0.102$  [2.60]

### MCF-028010-001, MCF-028015-001



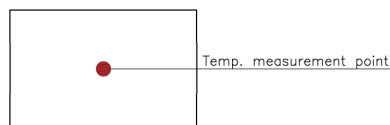
All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1.2.3.5.7:  $\varnothing 0.051$  [1.30]  
 Through hole 4.8:  $\varnothing 0.075$  [1.90]  
 Through hole of mounting:  $\varnothing 0.126$  [3.20]  
 Top view pad 1.2.3.5.7:  $\varnothing 0.064$  [1.63]  
 Top view pad 4.8:  $\varnothing 0.094$  [2.38]  
 Top view pad of mounting: Groove R0.065 [1.65] L0.157 [4.00]  
 Bottom view pad 1.2.3.5.7:  $\varnothing 0.102$  [2.60]  
 Bottom view pad 8:  $\varnothing 0.150$  [3.80]  
 Bottom view pad 4:  $\varnothing 0.130$  [3.30]  
 Bottom view pad of mounting: Groove R0.065 [1.65] L0.252 [6.40]

## THERMAL CONSIDERATIONS

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed "Maximum case temperature". When operating, adequate cooling must be provided to maintain the test point temperature at or below "Maximum case temperature". You can limit this temperature to a lower value for extremely high reliability.

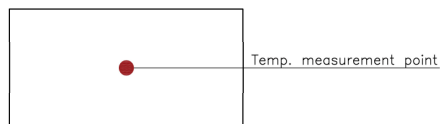
- Thermal test condition with vertical direction by natural convection (20LFM).

### MCF-028005-001



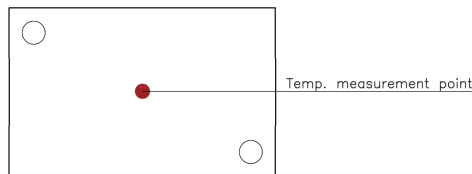
TOP VIEW

### MCF-028008-001



TOP VIEW

### MCF-028010-001, MCF-028015-001



BASE PLATE