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ON Semiconductor®

## FDFMA2P029Z

### Integrated P-Channel PowerTrench® MOSFET and Schottky Diode

-20V, -3.1A, 95mΩ

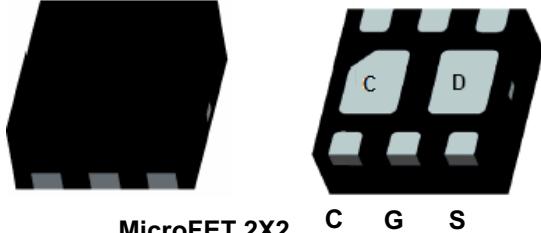
#### Features

##### MOSFET

- Max  $r_{DS(on)}$  = 95mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -3.1A$
- Max  $r_{DS(on)}$  = 141mΩ at  $V_{GS} = -2.5V$ ,  $I_D = -2.5A$
- HBM ESD protection level > 2.5kV (Note 3)

##### Schottky

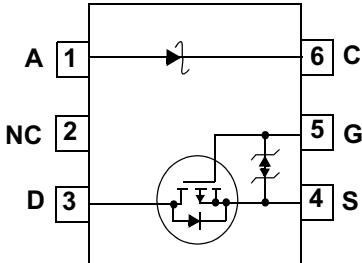
- $V_F < 0.37V$  @ 500mA
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- RoHS Compliant



Pin 1

A NC D

C G S



#### MOSFET Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	$\pm 12$	V
$I_D$	Drain Current -Continuous	(Note 1a)	A
	-Pulsed		
$P_D$	Power Dissipation	(Note 1a)	W
	(Note 1b)		
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C
$V_{RRM}$	Schottky Repetitive Peak Reverse Voltage	20	V
$I_O$	Schottky Average Forward Current	2	A

#### Thermal Characteristics

$R_{0JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	86	°C/W
$R_{0JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	173	
$R_{0JA}$	Thermal Resistance, Junction to Ambient	(Note 1c)	86	
$R_{0JA}$	Thermal Resistance, Junction to Ambient	(Note 1d)	140	

#### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
.P29	FDFMA2P029Z	MicroFET 2X2	7"	8mm	3000 units

## Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$\text{BV}_{\text{DSS}}$	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-20			V
$\frac{\Delta \text{BV}_{\text{DSS}}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-12		$\text{mV}/^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{V}, V_{GS} = 0\text{V}$			-1	$\mu\text{A}$
$I_{\text{GSS}}$	Gate to Source Leakage Current	$V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$			$\pm 10$	$\mu\text{A}$

## On Characteristics

$V_{GS(\text{th})}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-0.6	-1.0	-1.5	V
$\frac{\Delta V_{GS(\text{th})}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		4		$\text{mV}/^\circ\text{C}$
$r_{DS(\text{on})}$	Static Drain to Source On-Resistance	$V_{GS} = -4.5\text{V}, I_D = -3.1\text{A}$		60	95	$\text{m}\Omega$
		$V_{GS} = -2.5\text{V}, I_D = -2.5\text{A}$		88	141	
		$V_{GS} = -4.5\text{V}, I_D = -3.1\text{A}, T_J = 125^\circ\text{C}$		87	140	
$g_{FS}$	Forward Transconductance	$V_{DS} = -10\text{V}, I_D = -3.1\text{A}$		-11		S

## Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		540	720	pF
$C_{oss}$	Output Capacitance			120	160	pF
$C_{rss}$	Reverse Transfer Capacitance			100	150	pF

## Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}, I_D = -1\text{A}$ $V_{GS} = -4.5\text{V}, R_{\text{GEN}} = 6\Omega$		13	24	ns
$t_r$	Rise Time			11	20	ns
$t_{d(off)}$	Turn-Off Delay Time			37	59	ns
$t_f$	Fall Time			36	58	ns
$Q_{g(\text{TOT})}$	Total Gate Charge	$V_{DD} = -10\text{V}, I_D = -3.1\text{A}$ $V_{GS} = -4.5\text{V}$		7	10	nC
$Q_{gs}$	Gate to Source Gate Charge			1.1		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2.4		nC

## Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-1.1	A	
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -1.1\text{A}$ (Note 2)		-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -3.1\text{A}, di/dt = 100\text{A}/\mu\text{s}$		25		ns
$Q_{rr}$	Reverse Recovery Charge			9		nC

## Schottky Diode Characteristics

$V_R$	Reverse Voltage	$I_R = 1\text{mA}$	$T_J = 25^\circ\text{C}$	20			V
$I_R$	Reverse Leakage	$V_R = 20\text{V}$	$T_J = 25^\circ\text{C}$		30	300	$\mu\text{A}$
$V_F$	Forward Voltage	$I_F = 500\text{mA}$	$T_J = 25^\circ\text{C}$		10	45	$\text{mA}$
			$T_J = 125^\circ\text{C}$				
		$I_F = 1\text{A}$	$T_J = 25^\circ\text{C}$		0.32	0.37	V
			$T_J = 125^\circ\text{C}$		0.21	0.26	
			$T_J = 25^\circ\text{C}$		0.37	0.435	
			$T_J = 125^\circ\text{C}$		0.28	0.33	

**Notes:**

1:  $R_{QJA}$  is determined with the device mounted on a 1 in<sup>2</sup> oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{QJC}$  is guaranteed by design while  $R_{QJA}$  is determined by the user's board design.

(a) MOSFET  $R_{QJA} = 86^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB

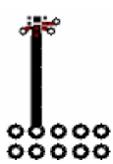
(b) MOSFET  $R_{QJA} = 173^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

(c) Schottky  $R_{QJA} = 86^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.

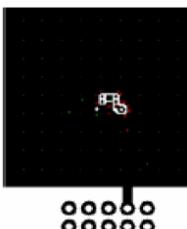
(d) Schottky  $R_{QJA} = 140^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.



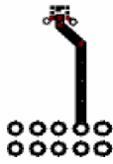
a)86°C/W  
when mounted  
on a 1in<sup>2</sup> pad of  
2 oz copper.



b)173°C/W  
when mounted  
on a minimum  
pad of 2 oz  
copper.



c)86°C/W when  
mounted on a  
1in<sup>2</sup> pad of 2 oz  
copper.



d)140°C/W  
when mounted  
on a minimum  
pad of 2 oz  
copper.

2: Pulse Test : Pulse Width < 300us, Duty Cycle < 2.0%

3. The diode connected between the gate and source serves only protection against ESD. No gate overvoltage rating is implied.

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

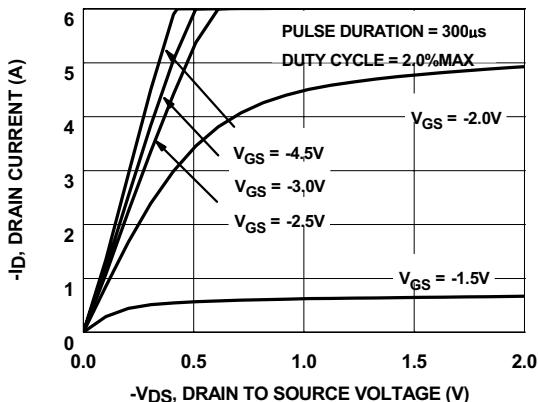


Figure 1. On Region Characteristics

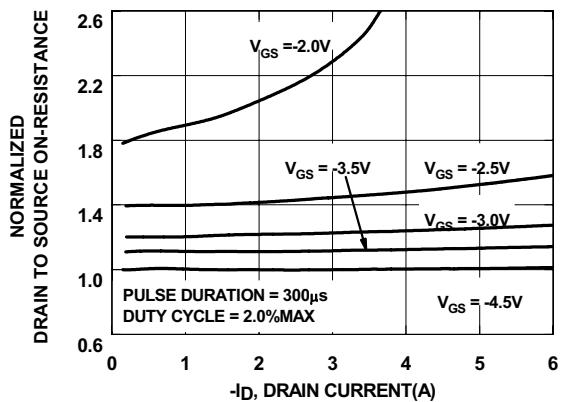


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

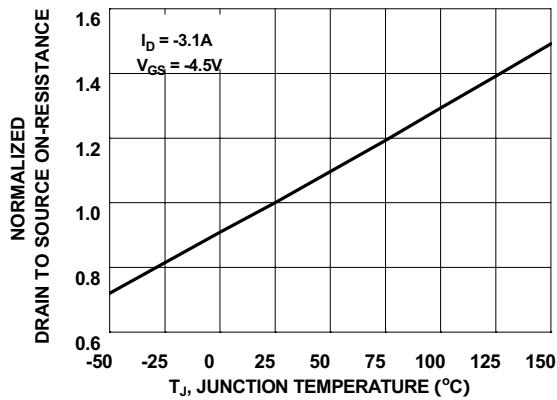


Figure 3. Normalized On-Resistance vs Junction Temperature

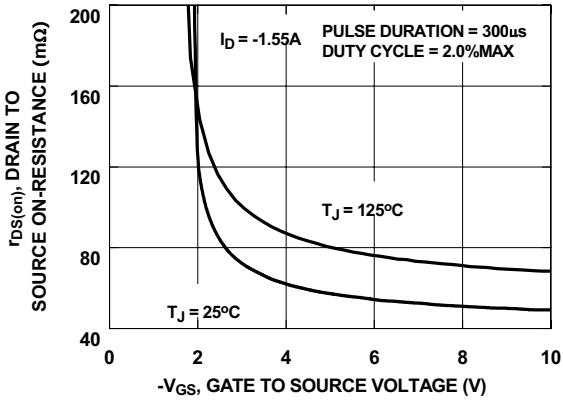


Figure 4. On-Resistance vs Gate to Source Voltage

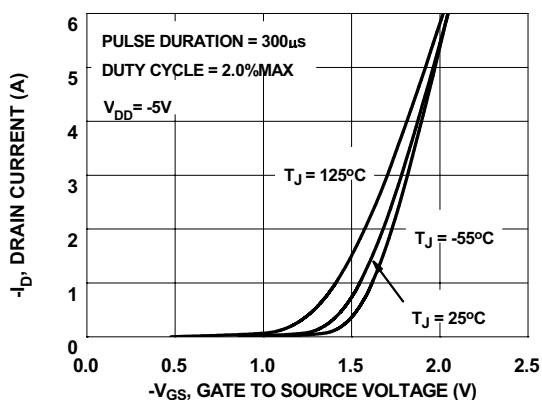


Figure 5. Transfer Characteristics

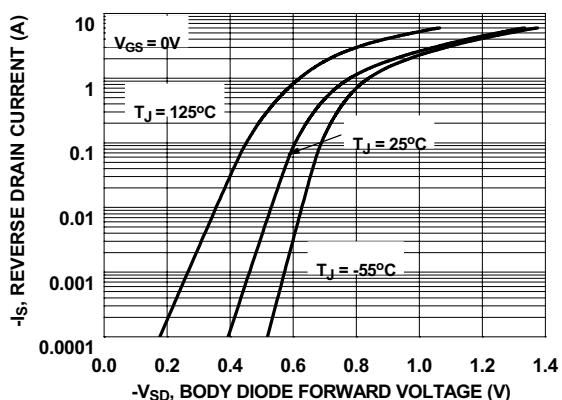


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

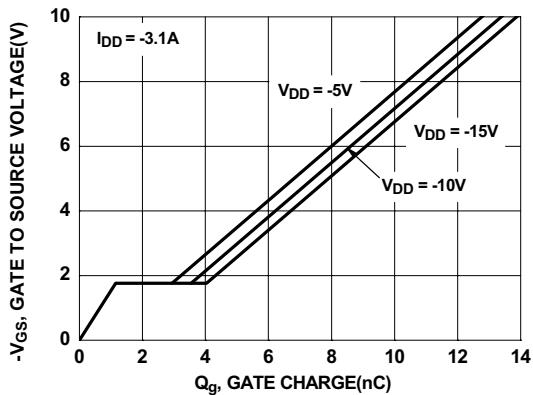


Figure 7. Gate Charge Characteristics

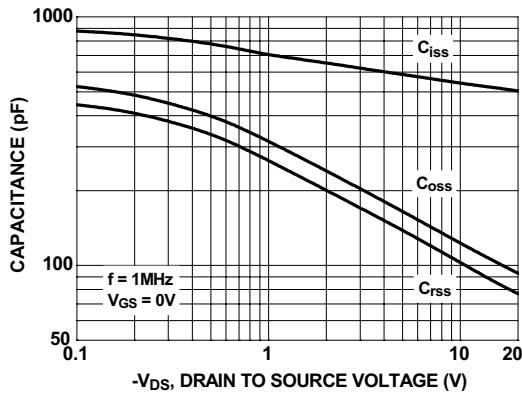


Figure 8. Capacitance Characteristics

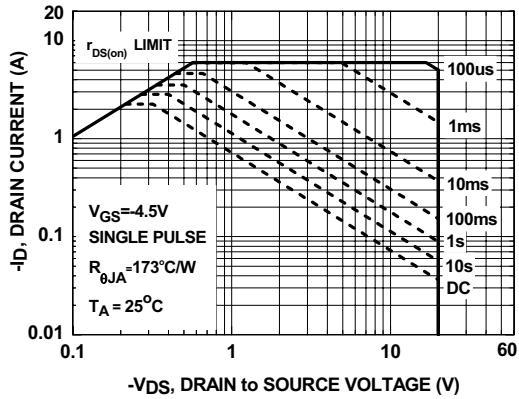


Figure 9. Forward Bias Safe Operating Area

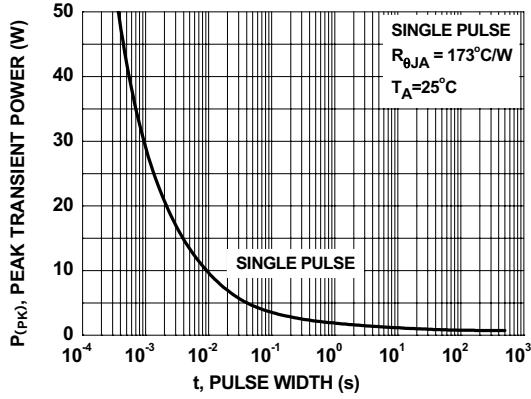


Figure 10. Single Pulse Maximum Power Dissipation

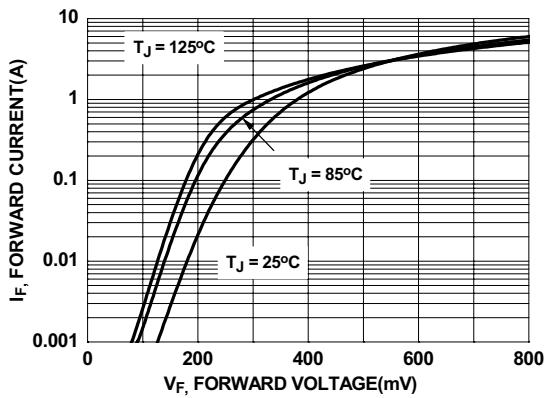


Figure 11. Schottky Diode Forward Voltage

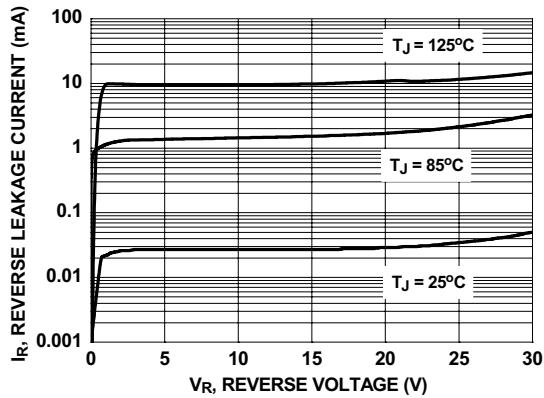


Figure 12. Schottky Diode Reverse Current

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

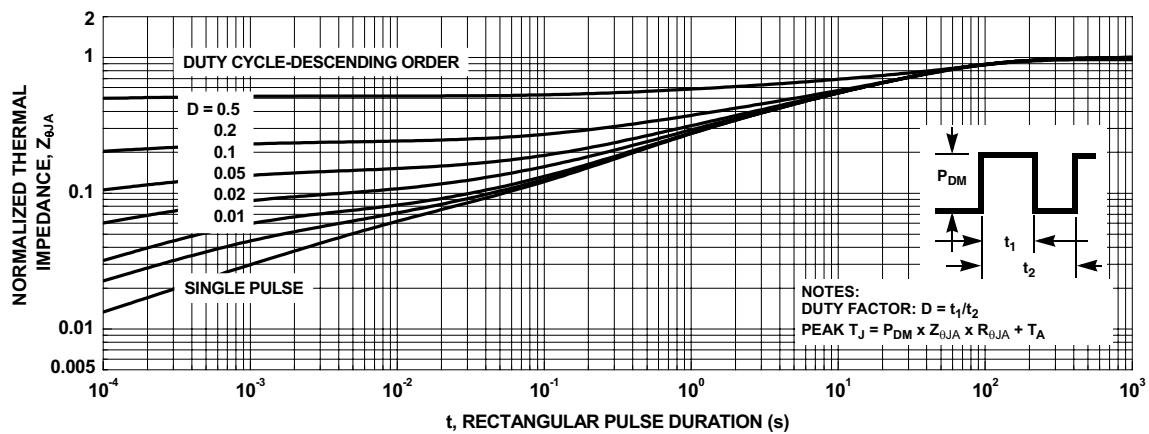
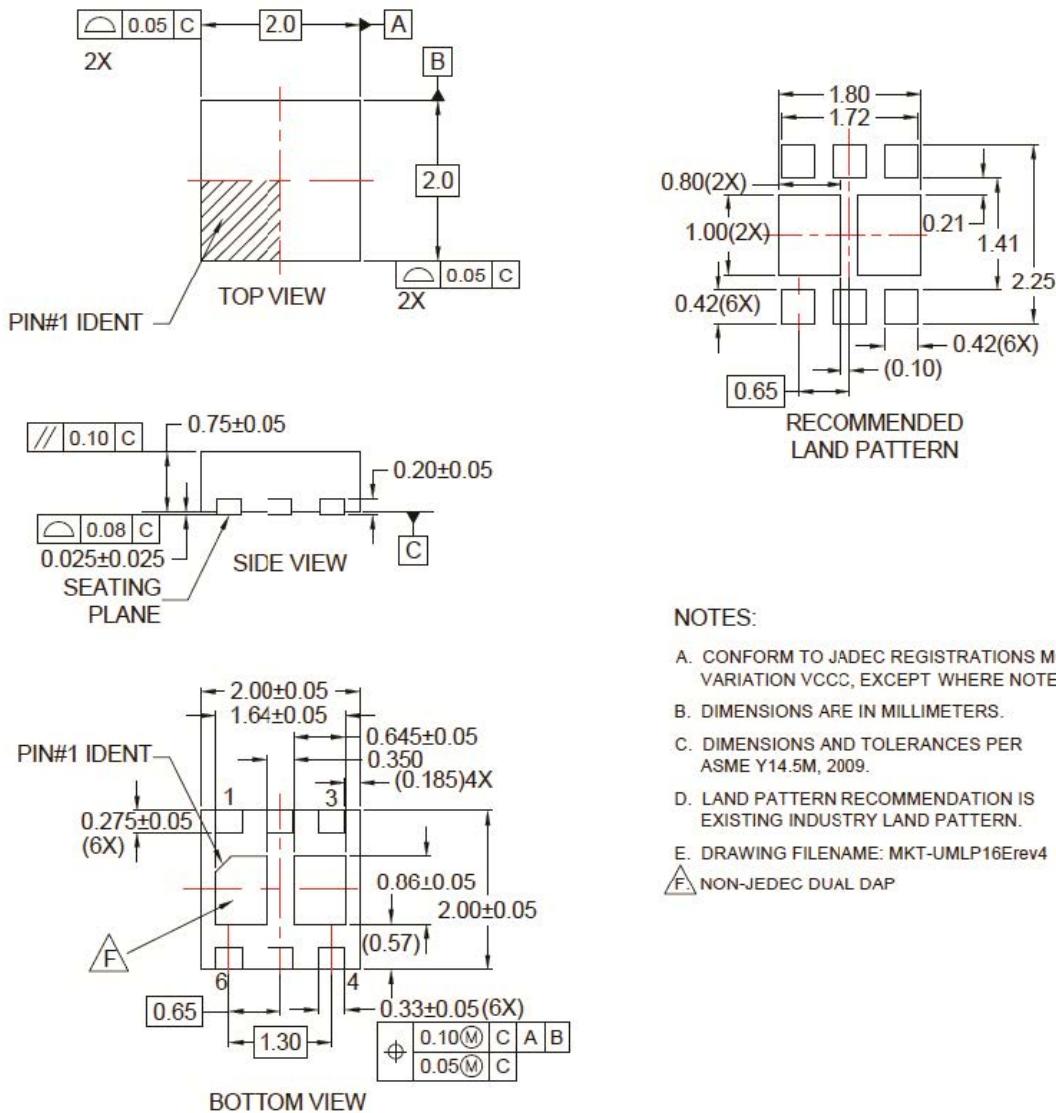


Figure 13. Transient Thermal Response Curve

## Dimensional Outline and Pad Layout



### NOTES:

- CONFORM TO JEDEC REGISTRATIONS MO-229, VARIATION VCCC, EXCEPT WHERE NOTED.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
- DRAWING FILENAME: MKT-UMLP16Erev4

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