



# FDFMJ2P023Z

## Integrated P-Channel PowerTrench® MOSFET and Schottky Diode -20V, -2.9A, 112mΩ

### Features

#### MOSFET

- Max  $r_{DS(on)}$  = 112mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -2.9A$
- Max  $r_{DS(on)}$  = 160mΩ at  $V_{GS} = -2.5V$ ,  $I_D = -2.4A$
- Max  $r_{DS(on)}$  = 210mΩ at  $V_{GS} = -1.8V$ ,  $I_D = -2.1A$
- Max  $r_{DS(on)}$  = 300mΩ at  $V_{GS} = -1.5V$ ,  $I_D = -1.0A$
- Low gate charge, high power and current handline capability
- HBM ESD protection level > 1.5KV typical (Note 3)

#### Schottky

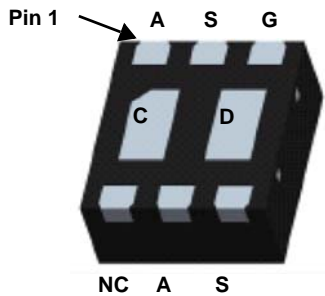
- $V_F < 400mV$  @ 100mA
- RoHS Compliant



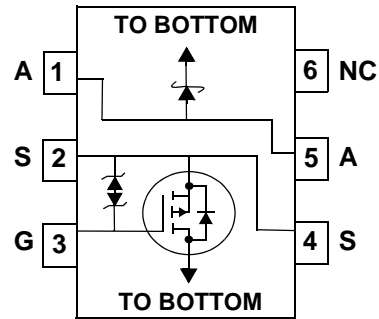
### General Description

This device is designed specifically as a single package solution for the battery charge switch in cellular handset and other ultra-portable applications. It features a MOSFET with low on-state resistance and an independently connected low forward voltage schottky diode for minimum conduction losses.

The SC-75 MicroFET package offers exceptional thermal performance for it's physical size and is well suited to linear mode applications.



SC-75 MicroFET



### 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	±8	V
$I_D$	Drain Current -Continuous	(Note 1a) -2.9	A
	-Pulsed	-12	
$P_D$	Power Dissipation	(Note 1a) 1.4	W
	Power Dissipation	(Note 1b) 0.7	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C
$V_{RRM}$	Schottky Repetitive Peak Reverse Voltage	30	V
$I_O$	Schottky Average Forward Current	1	A

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a) 89	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b) 182	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
.P23	FDFMJ2P023Z	SC-75 MicroFET	7"	8 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-13		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{V}, V_{GS} = 0\text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{V}, V_{DS} = 0\text{V}$			$\pm 10$	$\mu\text{A}$

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-0.4	-0.7	-1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		2.3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{V}, I_D = -2.9\text{A}$		93	112	m $\Omega$
		$V_{GS} = -2.5\text{V}, I_D = -2.4\text{A}$		128	160	
		$V_{GS} = -1.8\text{V}, I_D = -2.1\text{A}$		173	210	
		$V_{GS} = -1.5\text{V}, I_D = -1.0\text{A}$		217	300	
		$V_{GS} = -4.5\text{V}, I_D = -2.9\text{A}, T_J = 125^\circ\text{C}$		130	160	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{V}, I_D = -2.9\text{A}$		7		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		300	400	pF
$C_{oss}$	Output Capacitance			55	75	pF
$C_{rss}$	Reverse Transfer Capacitance			45	70	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}, I_D = -2.9\text{A}, V_{GS} = -4.5\text{V}, R_{GEN} = 6\Omega$		5	10	ns
$t_r$	Rise Time			4	10	ns
$t_{d(off)}$	Turn-Off Delay Time			23	37	ns
$t_f$	Fall Time			12	22	ns
$Q_g$	Total Gate Charge			4.6	6.5	nC
$Q_{gs}$	Gate to Source Charge	$V_{DD} = -5\text{V}, I_D = -2.9\text{A}, V_{GS} = -4.5\text{V}$		0.6		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			1.0		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	$V_{GS} = 0\text{V}, I_S = -1.1\text{A}$		-0.9	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -2.9\text{A}, di/dt = 100\text{A}/\mu\text{s}$		28	45	ns
$Q_{rr}$	Reverse Recovery Charge			15	27	nC

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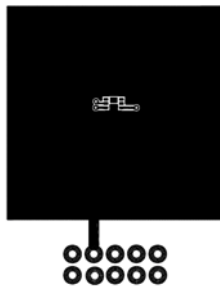
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Schottky Diode Characteristics**

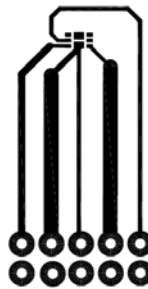
$V_R$	Reverse Voltage	$I_R = 100\text{mA}$	$T_J = 25^\circ\text{C}$	30		V
$I_R$	Reverse Leakage	$V_R = 10\text{V}$	$T_J = 25^\circ\text{C}$		0.39	2 $\mu\text{A}$
			$T_J = 85^\circ\text{C}$		0.04	0.2 mA
			$T_J = 125^\circ\text{C}$		0.4	2 mA
$I_R$	Reverse Leakage	$V_R = 20\text{V}$	$T_J = 25^\circ\text{C}$		0.86	4 $\mu\text{A}$
			$T_J = 85^\circ\text{C}$		0.06	0.3 mA
			$T_J = 125^\circ\text{C}$		0.62	3 mA
$V_F$	Forward Voltage	$I_F = 100\text{mA}$	$T_J = 25^\circ\text{C}$		380	400 mV
			$T_J = 85^\circ\text{C}$		300	350 mV
			$T_J = 125^\circ\text{C}$		250	300 mV
$V_F$	Forward Voltage	$I_F = 1\text{A}$	$T_J = 25^\circ\text{C}$		570	615 mV
			$T_J = 85^\circ\text{C}$		540	590 mV
			$T_J = 125^\circ\text{C}$		530	580 mV

**Notes:**

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



a. 89°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 182°C/W when mounted on a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty cycle < 2.0%.

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

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

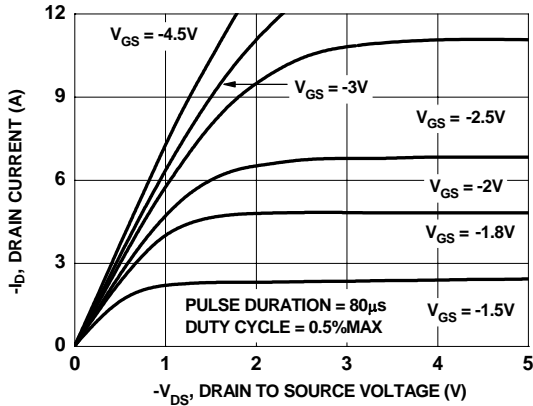


Figure 1. On-Region Characteristics

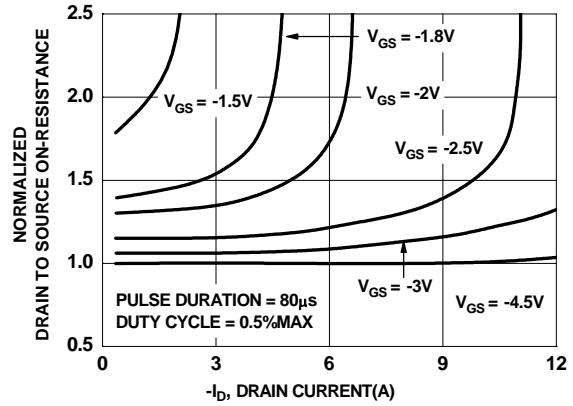


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

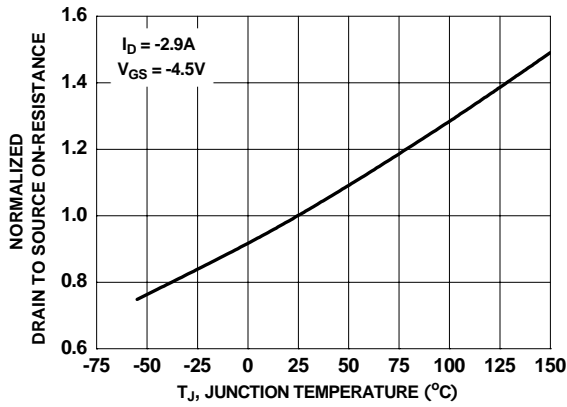


Figure 3. Normalized On-Resistance vs Junction Temperature

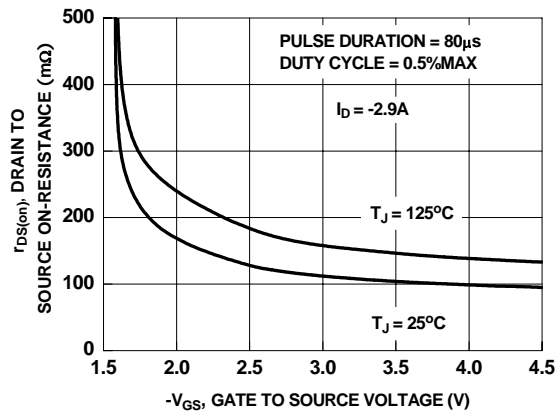


Figure 4. On-Resistance vs Gate to Source Voltage

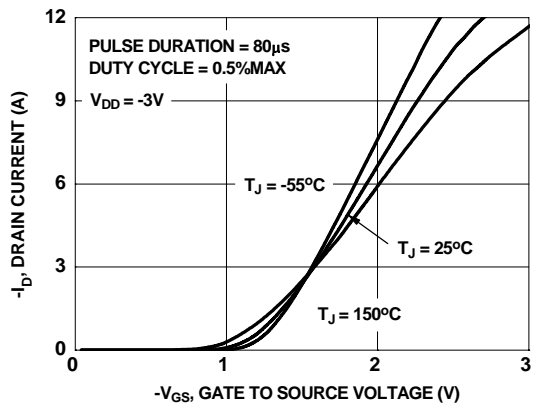


Figure 5. Transfer Characteristics

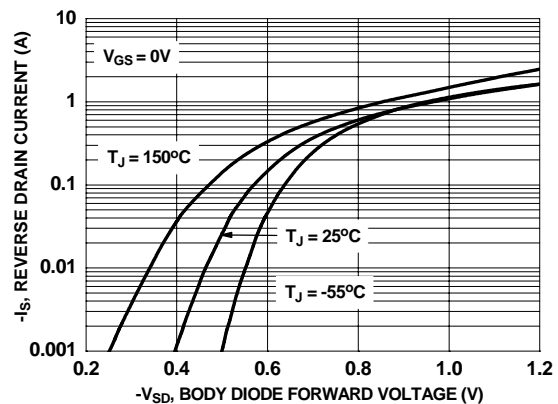


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

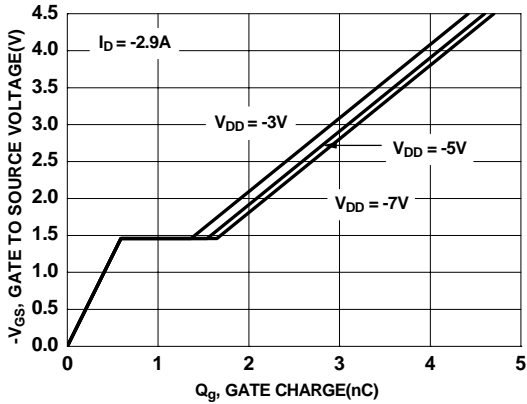


Figure 7. Gate Charge Characteristics

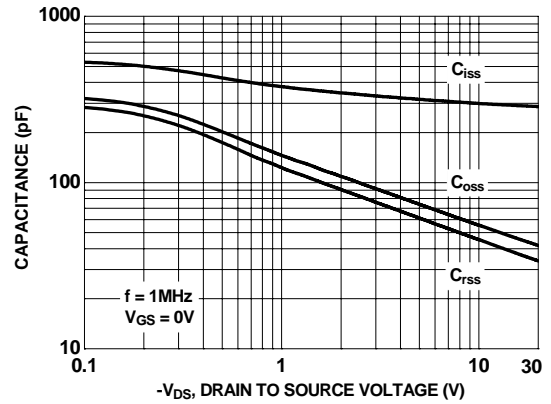


Figure 8. Capacitance vs Drain to Source Voltage

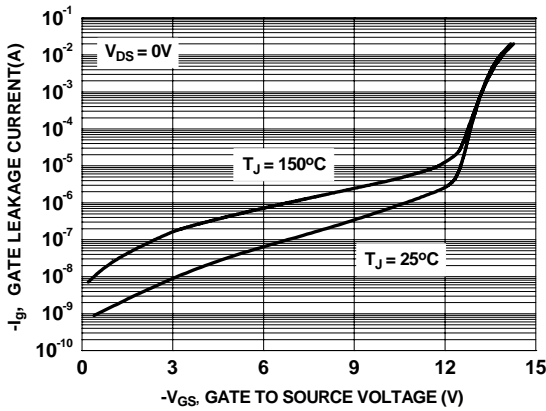


Figure 9. Gate Leakage Current vs Gate to Source Voltage

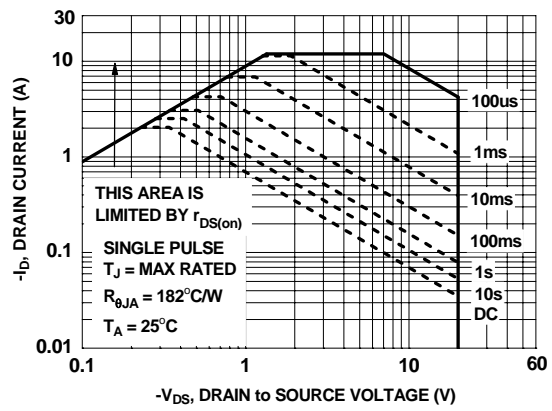


Figure 10. Forward Bias Safe Operating Area

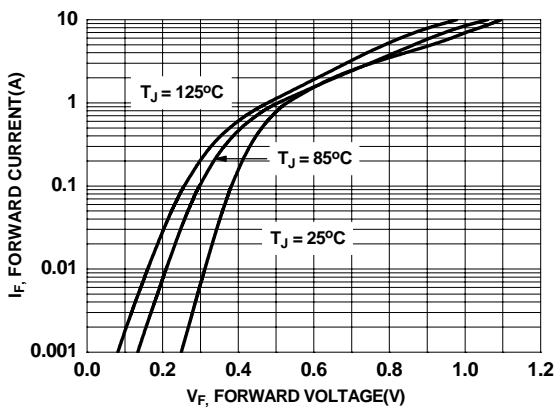


Figure 11. Schottky Diode Forward Voltage

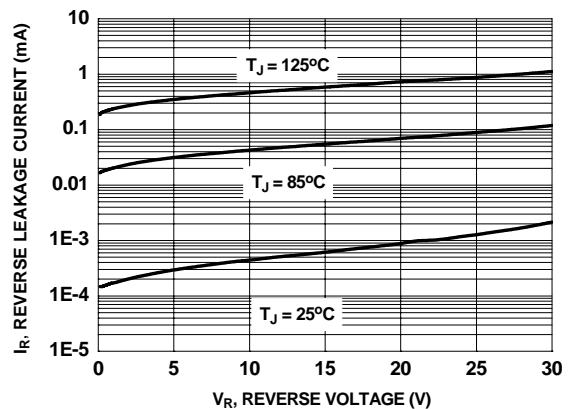
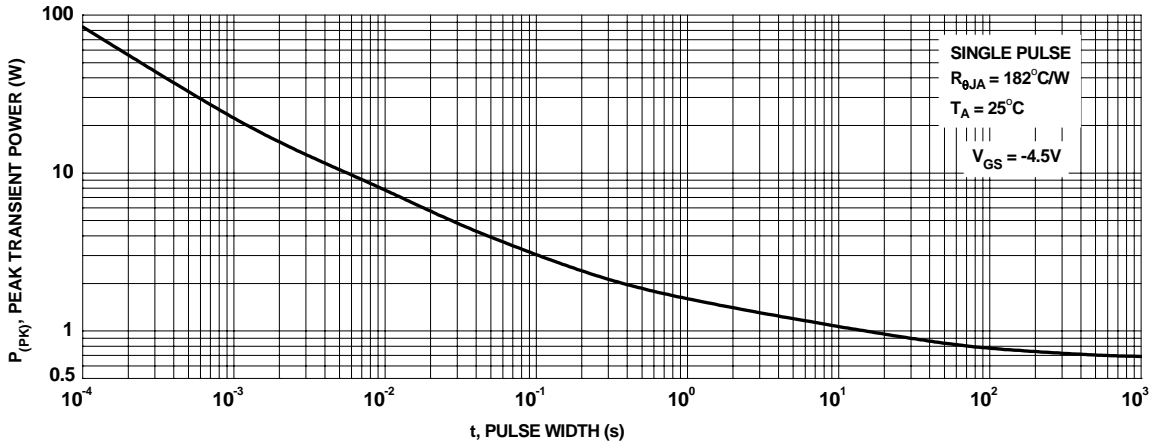


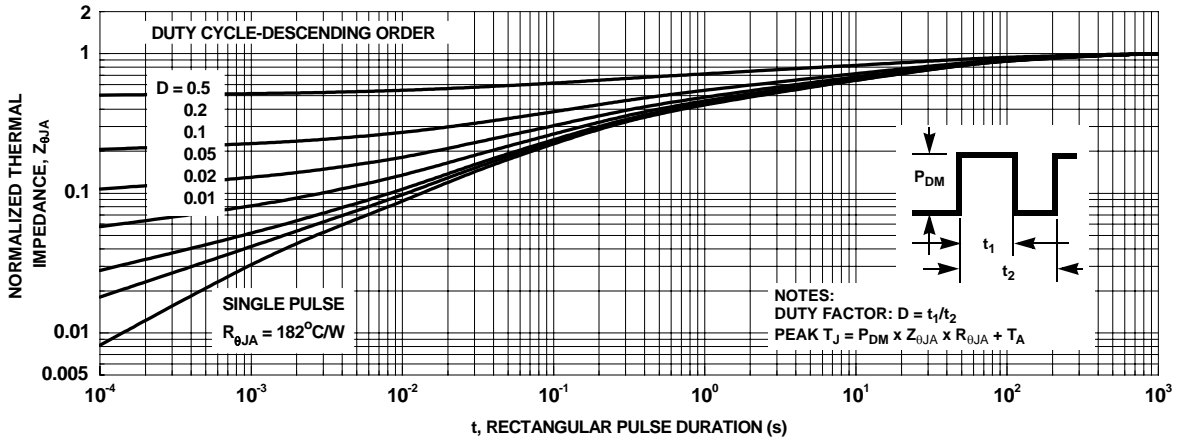
Figure 12. Schottky Diode Reverse Current

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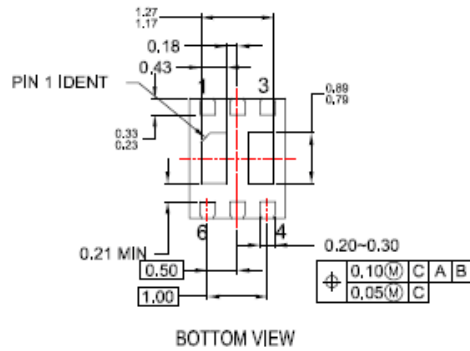
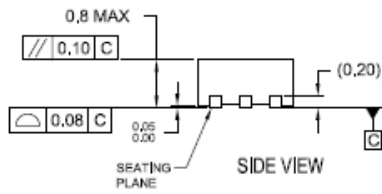
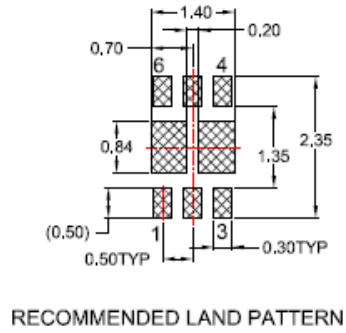
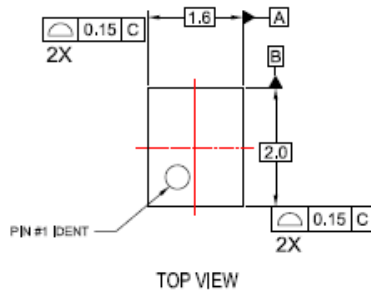
**Figure 13. Single Pulse Maximum Power Dissipation**



**Figure 14. Transient Thermal Response Curve**

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## Dimensional Outline and Pad Layout





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