

*The Gemini Series is a high current three quarter brick DC/DC converter with:*

- 1.5 to 2.5 Volt, 55 Amp Output
- 3.3 or 5V Input Option
- No Heat Sinking Required
- 4 Pin Programmable Output Voltage
- 87% Efficient: 3.3V<sub>in</sub> and 2.5V<sub>out</sub> @ 40A
- 84% Efficient: 5V<sub>in</sub> and 2.5V<sub>out</sub> @ 55A
- 137.5 Watts @ 100° Baseplate
- 33 Watts/cu. inch
- 2.3" x 3" x 0.6"
- Fixed Frequency Operation
- Automatic OVP Tracking to Voltage Trim
- Current Limiting with Auto-Recovery
- Power Good Signal
- Two Year Warranty

## CONTROL FUNCTIONS

- Remote Sense
- Output Enable

## PROTECTION FEATURES

- Over Temperature Protection
- Over Voltage Protection
- Over Current Protection

## TYPICAL CHARACTERISTICS

- Output Setpoint Accuracy:  $\pm 1\%$
- Load & Line Regulation:  $\pm 0.5\%$
- Total Regulation:  $\pm 5\%$
- Noise & Ripple: 100 mV<sub>p-p</sub>
- Output Trim

# SPECIFICATIONS

## General Specifications

Operating Temperature	0°C to +45°C (@200LFM)	
Storage Temperature	-20°C to +100°C	
Relative Humidity	10% to 95% RH, Non-condensing	
Vibration	10-500Hz 0.75g peak	
Weight	75gm, typical (GPEV6-3V3-40) 200gm, typical (-S, -L)	
Material Flammability	UL94V-0	
MTBF	MIL-HDBK-217	1.2million hours*

\* Note: 50% load; 200LFM, 45°C ambient

## Input Characteristics

Operating Air Temperatures from 0°C to +45°C with 200 LFM,  $D_0$ ,  $D_1$ ,  $D_2$ ,  $D_3$  pins low state unless otherwise specified.

Parameter			Test Condition	Requirement		Unit
Name	Var	Symbol		Min	Max	
Input Voltage	3V3-40	$V_I$	$I_O = 40A$	3.37	3.8	V
	-S, -L	$V_I$	$I_O = 55A$	4.5	5.25	V
Input Low Line Power-On V		$V_{Ion}$	Module Power On	-	3.35	V
No Load Input Power		$P_{IL}$	$V_I = V_{Inom}$	-	6	W
Input Capacitor (external to the converter)	3V3-40		20 (330 $\mu$ F)	6600	-	$\mu$ F
	-S, -L		12 (330 $\mu$ F)	3900	-	$\mu$ F
Input Current	3V3-40	$I_I$	$V_I = 3.43V$ , $I_O = 40A$ , $V_O = 2.5V$	-	35.2	A
	-S, -L	$I_I$	$V_I = 5V$ , $I_O = 55A$ , $V_O = 2.5V$	-	35	A
Efficiency (with Local Sense)	3V3-40	N	$V_I = 3.43V$ , $I_O = 40A$ , $V_O = 2.5V$	83	-	%
	-S, -L	N	$V_I = 5V$ , $I_O = 55A$ , $V_O = 2.5V$	79	-	%
Reflected Input Ripple	3V3-40	$dI_I$	$V_I = 3.43V$ , $I_O = 40A$ , (Note 1) $C_{IN} = 20$ (330 $\mu$ F Tantalum) ESR = 60 m $\Omega$	-	6.0	A <sub>p-p</sub>
	-S, -L	$dI_I$	$V_I = 5V$ , $I_O = 55A$ , (Note 1) $C_{IN} = 12$ (330 $\mu$ F Tantalum) ESR = 60 m $\Omega$	-	11.0	A <sub>p-p</sub>
Switching Frequency		$F_S$		250 Typ		KHz

Note 1: Measure input reflected current which is drawn from input capacitor  $C_{IN}$  by converter. Place 3" loop between  $C_{IN}$  and  $V_{IN}$  of the converter.

# SPECIFICATIONS

## Output Characteristics

Over the complete baseplate temperatures and input voltage ranges,  $D_0$ ,  $D_1$ ,  $D_2$ ,  $D_3$  pins low state unless otherwise specified.

Parameter			Test Condition	Requirement			Unit
Name	Var	Symbol		Min	Typ	Max	
Output Voltage Set Point	3V3–40	$V_{Onom}$	$V_I = 3.43V, I_O = 20A$	2.475	2.500	2.525	V
	–S, –L	$V_{Onom}$	$V_I = 5.0V, I_O = 30A$	2.475	2.500	2.525	V
Rated Output Current	3V3–40	$I_O$	$V_O = V_{Onom}$	0	–	40	A
	–S, –L	$I_O$	$V_O = V_{Onom}$	0	–	55	A
Line & Load Regulation	3V3–40		$V_I = 3.37\text{--}3.8V, I_O = 0\text{--}40A$	–	–	12.5	mV
	–S, –L		$V_I = 4.5\text{--}5.25V, I_O = 0\text{--}55A$	–	–	12.5	mV
Noise and Ripple	3V3–40		$V_I = 3.43V, I_O = 40A$ $C_O = 330\mu F, 0.47\mu F$	–	100	120	mV <sub>P-P</sub>
	–S, –L		$V_I = 5.0V, I_O = 55A$ $C_O = 330\mu F, 0.47\mu F$	–	100	120	mV <sub>P-P</sub>
Total Regulation (Load, Line, Short term and Long term Dynamic Temp Drift)	3V3–40		$V_I = 3.37\text{--}3.8V, I_O = 0\text{--}40A$ $C_O = 20 (470\mu F)$	2.375	2.500	2.625	V
	–S, –L		$V_I = 4.5\text{--}5.25V, I_O = 0\text{--}55A$ $C_O = 20 (470\mu F)$	2.375	2.500	2.625	V
Remote Sense Compensation Round Trip			$V_I = V_{I \text{ min}}, I_O = \text{full load}$	–	–	100	mV
Static Output Overvoltage Protection (Nom) Latching			$V_I = V_{I \text{ nom}}, I_O = 5A$	107	–	120	% $V_O$
Output Voltage Protection Response Time		$t_{OVP}$	$V_I = V_{I \text{ nom}}, I_O = 5A$	–	–	50	$\mu S$
Current Limit (Nom)	3V3–40	$I_L$	$V_I = 3.43V, V_O = 2.5V$	42	–	–	A
	–S, –L	$I_L$	$V_I = 5.0V, V_O = 2.5V$	57	–	–	A
Short Circuit Current	3V3–40	$I_{SC}$	$V_I = 3.43V, V_O < 0.6V$	–	–	55	Arms
	–S, –L	$I_{SC}$	$V_I = 5.0V, V_O < 0.6V$	–	–	70	Arms
Over–temperature Shutdown ( $T_{\text{baseplate}}$ )				–	110	125	°C
Load Transient Response, $V_O$ deviation from steady state (settling time to $\pm 1\%$ )		$V_{OPK}$ Notes 1, 2, 3	$I_O = 10\text{--}38A @ 28A\mu S (di/dt)$ $V_I = 3.3V (3V3\text{--}40)$ $V_I = 5.0V (–S, –L)$ $V_O = 2.5V \text{ pos. or neg. step}$ $C_O = 28\text{--}470\mu F \text{ Cap}$ (470 $\mu F$ , ESR=55m $\Omega$ ) $C_{IN}=12\text{--}330\mu F \text{ Cap}$ (330 $\mu F$ , ESR=60m $\Omega$ )	–	–	3	% $V_O$
				–	–	1200	$\mu S$
Turn–on Time		$t_{on}$	$V_I = V_{I \text{ min}} \text{ to } V_{I \text{ max}}, I_O = 0\text{--}40A$ (See figures on page 5)	20	–	120	mS
Turn–on Risetime (10–90%)		$t_{rise}$		8	–	30	mS
Output Filter Capacitance		$C_{out}$	$V_I = 5.0V, I_O = I_{O \text{ max}}$	330		13,200	$\mu F$
Voltage Trim		$V_{trim}$	$V_I = V_{I \text{ nom}}, I_O = I_{O \text{ max}}/2$ $V_O = 2.5V, \text{ Short Pin 1 \& 10}$	94.5	95.5	96.5	% $V_{Onom}$

Notes: 1. The converter output voltage shall be stable when (13,200 $\mu F$  total) tantalum low ESR filter capacitors are connected across the output of the converter.

2. For 3.43 Input Voltage Rail having  $I_{O \text{ max}} = 40A$ , the minimum input filter capacitor required is 6600 $\mu F$  (use multiple 330 $\mu F$  tantalum capacitor having 60m $\Omega$  ESR.)

3. For 5.00 Input Voltage Rail having  $I_{O \text{ max}} = 55A$ , the minimum input filter capacitor required is 3960 $\mu F$  (use multiple 330 $\mu F$  tantalum capacitor having 60m $\Omega$  ESR.)

# SPECIFICATIONS

## Output Voltage Adjustments

Control Pin				Output Voltage Tolerance $\pm 1.2\%$
D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>	Volts DC
1	1	1	1	1.429
1	1	1	0	1.500
1	1	0	1	1.571
1	1	0	0	1.643
1	0	1	1	1.714
1	0	1	0	1.786
1	0	0	1	1.857
1	0	0	0	1.929
0	1	1	1	2.000
0	1	1	0	2.071
0	1	0	1	2.143
0	1	0	0	2.214
0	0	1	1	2.286
0	0	1	0	2.357
0	0	0	1	2.429
0	0	0	0	2.500

Note: the converter shall be tested for four bits logic control.

## Control Signal Characteristics

D<sub>0</sub>, D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> pins low state unless otherwise specified.

Parameter		Test Condition	Requirement			Unit
Name	Symbol		Min	Typ	Max	
Enable_H*		$V_I = V_{Inom}$ , $I_O = 20A$				
Enable_H Source Current			–	–	1.0	mA
Enable_H Voltage Low			–	–	0.8	V
Enable_H Voltage High			4.5	–	5.2	V
Enable_H High (Output Voltage)			2.475	2.500	2.525	V
Powergood_H High		$V_I = V_{Inom}$ , $I_O = 20A$	3.3	–	–	V
Powergood_H Low		$V_S = 5.0V$ , $R_L = 4K$	–	–	0.8	V
Fault_H High		$V_I = V_{Inom}$	4.0	–	5.1	V
Fault_H Low		$R_L = 4K$ TO $-SENSE$	–	–	0.8	V
Fault_H Source Current			1	–	–	mA

\* Use Open Collector Logic to control Enable function.

## CONTROL SIGNALS

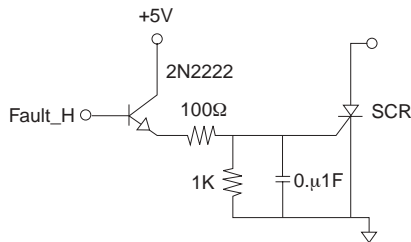
**Control Signal Characteristics:** Per Table on Page 4.

**Enable\_H:** This input signal is used to enable the output of the converter when activated (active High). The signal is referenced to either the output side (-Sense) or GND. It has an internal pull-up resistor. To disable the converter requires an open collector logic signal to pull it down.

**4 Bit Logic Signals:** The state of the 4 bit control signals controls the output voltage. Normally, the 4 bits are in a 'low state' and provide for a 2.5V output voltage. The output voltage may be programmed between 1.429 to 2.5V by setting appropriate logic bits 'high' through D0, D1, D2, and D3.

**Powergood\_H:** The Powergood signal is in a 'high' state when the output voltage is within +/- 7.5% of the output voltage programmed by the 4 bit logic inputs.

**OVPFault\_H:** This signal is in a 'high' state when the output voltage is greater than +/-15% of the output voltage programmed by the 4 bit logic inputs or exceeds the maximum operating temperature of the converter. This output is the open emitter of a transistor which pulls to +5V in the high state and is open in the low state. For driving logic, an appropriate pull down resistor from OVPFault\_H to - Sense is required. The OVPFault\_H is asserted high when OVPFault is activated. When driving an SCR to 'crow-bar' the input source from a Fault\_H signal, use the circuit below:



**Trim:** The output voltage may be lowered from the nominal programmed value by adding an external resistor from the TRIM pin (J1-10) to - Sense (J1-1). This is used to obtain output voltages between the programmed values. The maximum value the output may be trimmed is approximately -4.5% of Vprog. The resistor value may be calculated from the following formula:

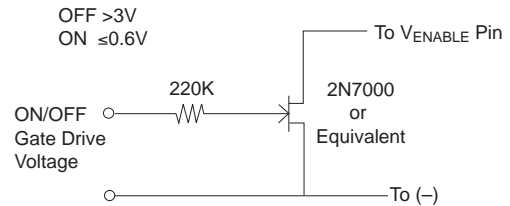
$$R_{ext} = \frac{(2490) (V_{trim})}{(3.49) (V_{prog} - V_{trim})} - 15000$$

Vtrim = Desired output voltage with Rext tied from TRIM pin to - SENSE.

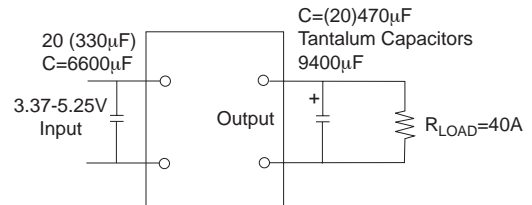
Vprog = Nominal programmed output voltage

**Notes:** 1. Vtrim must be less than Vprog.  
2. The trim pin does not change the OVP or Powergood\_H trip points. These are set by the 4 bit logic inputs

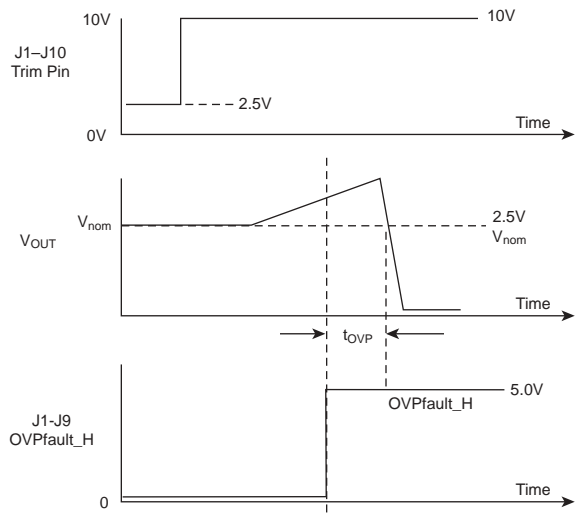
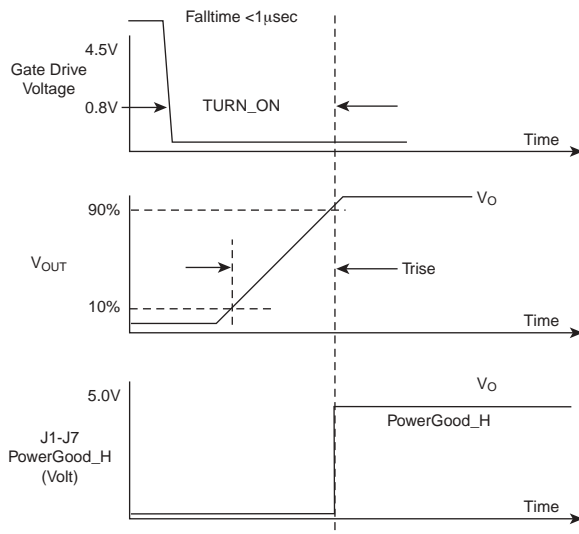
### Enable Circuit Turn On Time



### Output Load Conditions (Turn On)

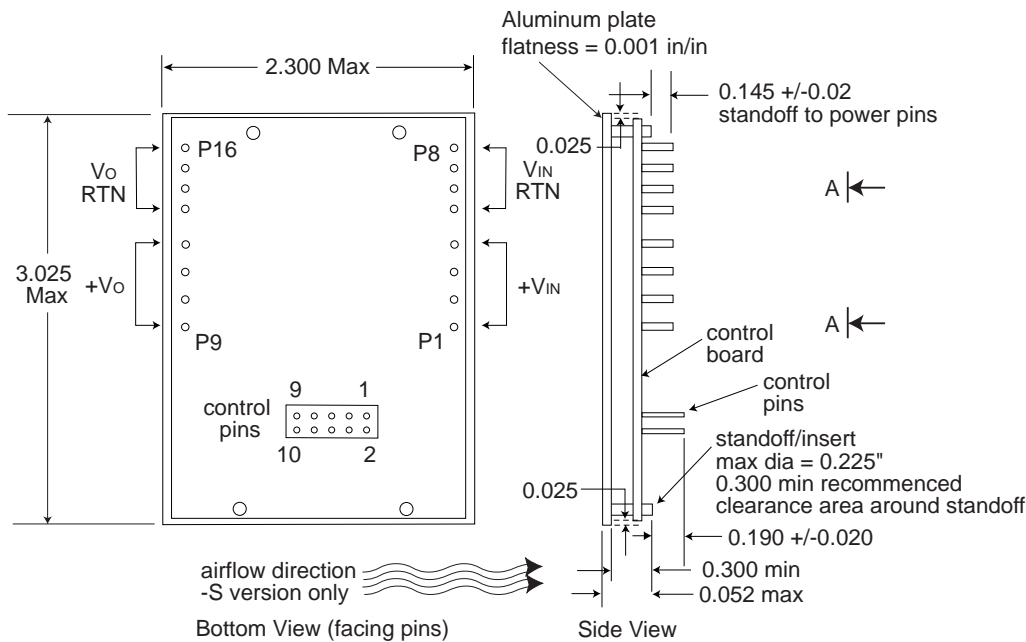


### Turn On Time



# PACKAGE DETAIL

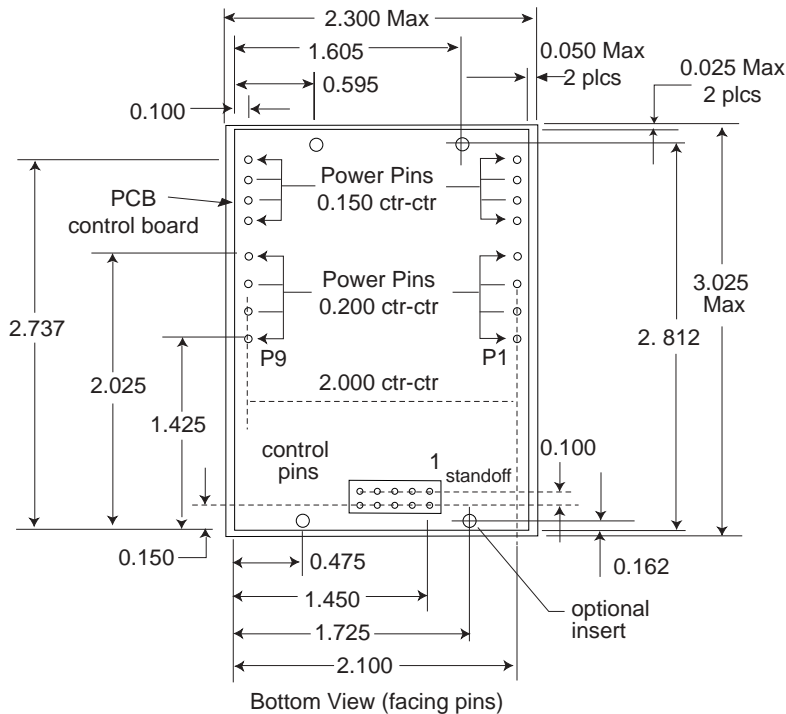
## CONFIGURATION / DIMENSIONS



- Notes:
1. GPEV6-3V3-40 only: No heatsink, max height = 0.52"
  2. Variations -S, -L only: 0.88" heatsink attached to plate. Max height w/ heatsink = 1.4"
  3. Components on side 2 shall be 0.030" min. below the standoff.

## Pin Assignments

Power Pins (60 mils)	
Pin	Designation
P1	Vin
P2	Vin
P3	Vin
P4	Vin
P5	Vin RTN
P6	Vin RTN
P7	Vin RTN
P8	Vin RTN
P9	Vo
P10	Vo
P11	Vo
P12	Vo
P13	Vo RTN
P14	Vo RTN
P15	Vo RTN
P16	Vo RTN



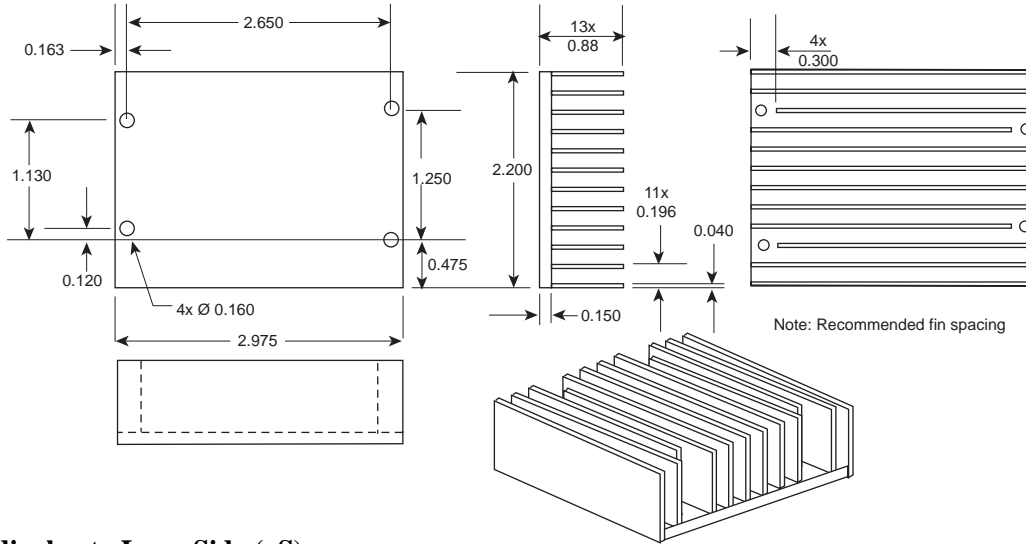
- Notes:
- Standoff is used for mounting the heatsink on the plate of the converter. Use 4 - 40 screws.
  - Control pins: 0.025 sq pin, 2x 10 pos.
  - Power pins: 0.060 +/- 0.005 diameter

Signal Pins (25 mils sq.)	
Pin	Designation
J1-1	-Sense
J1-2	+Sense
J1-3	D0
J1-4	D1
J1-5	D2
J1-6	D3
J1-7	PowerGood_H
J1-8	Enable_H
J1-9	OVFPault_H
J1-10	Trim

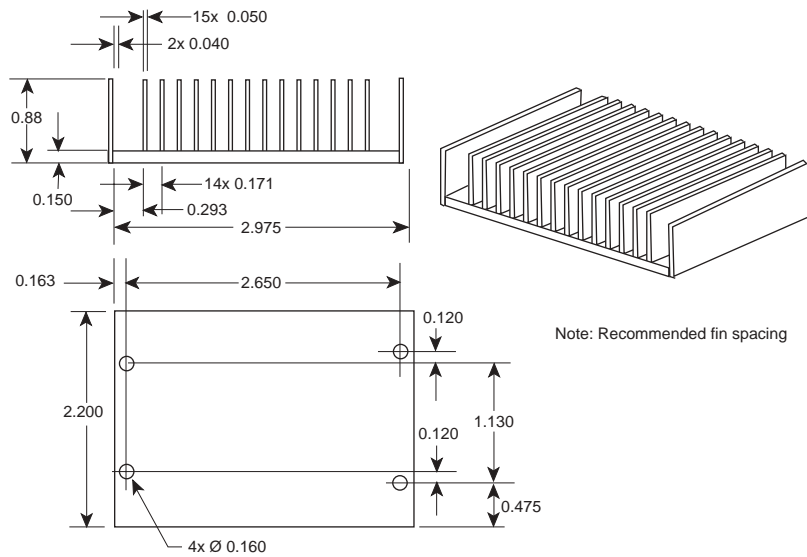
# PACKAGE DETAIL

## HEATSINK VARIATIONS

### Fins Parallel to Long Side (-L)



### Fins Perpendicular to Long Side (-S)



## ORDERING INFORMATION

Model Number	Input Voltage	Output Voltage	Max Current	Efficiency (Typ)
<b>GPEV6-3V3-40</b>	3.3–5.25V	2.5 V	40 A	87 %
<b>GPEV6-5V0-55-S*</b>	4.5–5.25 V	2.5 V	55 A	84%
<b>GPEV6-5V0-55-L*</b>	4.5–5.25V	2.5 V	55 A	84%

\* -S: short heatsink fins (perpendicular to long side)

-L: long heatsink fins (parallel to long side)

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