

# Generate a low power variant of a Bandgap for a EU SME in GF40nm

Amalia reduced the component area of this circuit by 57.5% while also meeting the requirements for current.

Specification	Requirement			Customer Design	Thalia Solution 1
	Minimum	Typical	Maximum		
Supply Current	-	180 $\mu$ A	-	180.29 $\mu$ A	157.42 $\mu$ A
Bandgap Circuit Current	-	75 $\mu$ A	-	75.38 $\mu$ A	52.615 $\mu$ A
StandBy Current	-	100 nA	-	10.05 nA	5.02 nA
VGB Variation Trimmed	-	1.199 V	1.202 V	1.199 V	1.197 V
VGB Variation Trimmed Minimum	-	1.199 V	1.202 V	1.198 V	1.196 V
VGB Variation Trimmed Maximum	-	1.199 V	1.202 V	1.2 V	1.198 V
VGB Variation Mismatch	0.3 %	-	-0.3 %	+/- 0.3 %	+/- 0.3 %
Bandgap Current Variation Mismatch	10 %	-	-10 %	-16.82% to 11.01%	-9.8% to 12.03%
Vbg Variation over Trim Current at 5 $\mu$ s, 7 $\mu$ s, 10 $\mu$ s, 15 $\mu$ s, 25 $\mu$ s, 35 $\mu$ s, 45 $\mu$ s	1.07 V	-	1.42 V	-1.19 V to 1.43 V	1.197 V - 1.203 V
Pmos Currents at 5 $\mu$ s, 7 $\mu$ s, 10 $\mu$ s, 15 $\mu$ s, 25 $\mu$ s, 35 $\mu$ s, 45 $\mu$ s	8.35 $\mu$ A	10 $\mu$ A	12.4 $\mu$ A	9.93 $\mu$ A - 9.99 $\mu$ A	9.98 $\mu$ A - 10.05 $\mu$ A
Nmos Currents at 5 $\mu$ s, 7 $\mu$ s, 10 $\mu$ s, 15 $\mu$ s, 25 $\mu$ s, 35 $\mu$ s, 45 $\mu$ s	4.17 $\mu$ A	4.99 $\mu$ A	6.16 $\mu$ A	4.98 $\mu$ A - 5.01 $\mu$ A	4.88 $\mu$ A - 5.93 $\mu$ A
Startup Time	2.13 $\mu$ s	2.29 $\mu$ s	2.96 $\mu$ s	2.311 $\mu$ s	2.179 $\mu$ s
Pmos Currents Settling Time	3.8 $\mu$ s	4.1 $\mu$ s	5.5 $\mu$ s	4.31 $\mu$ s	2.855 $\mu$ s
Nmos Currents Settling Time	3.8 $\mu$ s	4.1 $\mu$ s	5.5 $\mu$ s	4.02 $\mu$ s	2.992 $\mu$ s
PSRR (< 1 KHz)	-	-	-50 db	-65.59 db	-56.9 db
PSRR (< 100 KHz)	-	-	-30 db	-35.9 db	-37.9 db
PSRR (> 100 KHz)	-	-	-20 db	-29.9 db	-27.4 db
PSRR (> 10 MHz)	-	-	-20 db	-32.55 db	-52.8 db
Startup Circuit Phase Margin	89°	92°	95°	91.4°	89.01°
Startup Circuit Gain Margin	37 db	38 db	39 db	37.99 db	35.5 db
Bandgap Loop Phase Margin	73°	75°	77°	77.02°	69.46°
Bandgap Gain Margin	22 db	25 db	31 db	28.19 db	20.3 db
Component Area	-	-	-	22927 $\mu$ m <sup>2</sup>	9759 $\mu$ m <sup>2</sup>
Solutions Evaluated*	-	-	-	-	800**

\*Average number of simulated solutions required to reach the first optimised solution

\*\*Simulation time for each solution is approximately 1 minute. The total time using four simulators in parallel is 3 hours and 30 minutes

