REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	Update boilerplate to current MIL-PRF-38535 requirements. - PHN	14-01-09	Thomas M. Hess
B	Update boilerplate to current MIL-PRF-38535 requirements. - PHN	21-07-15	Muhammad A. Akbar

CURRENT DESIGN ACTIVITY CAGE CODE 16236
HAS CHANGED NAMES TO:
DLA LAND AND MARITIME
COLUMBUS, OHIO 43218-3990

Prepared in accordance with ASME Y14.24

Vendor item drawing

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REV STATUS OF PAGES	**REV**	B	B	B	B	B	B	B	B	B	B	B							
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PMIC N/A	**PREPARED BY** Charles F. Saffle	**DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43218-3990**
Original date of drawing YY-MM-DD 06-05-30	**CHECKED BY** Charles F. Saffle	**TITLE** MICROCIRCUIT, DIGITAL, PROCESSOR SUPERVISORY CIRCUITS WITH WINDOW-WATCHDOG, MONOLITHIC SILICON
	APPROVED BY Thomas M. Hess	
	SIZE A / **CODE IDENT. NO.** 16236	**DWG NO.** V62/06627
	REV B	**PAGE** 1 **OF** 11

1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance processor supervisory circuit with window-watchdog microcircuit, with an operating temperature range of -55°C to +125°C.

1.2 Vendor Item Drawing Administrative Control Number. The manufacturer's PIN is the item of identification. The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation:

V62/06627	-	01	X	E
Drawing number		Device type (See 1.2.1)	Case outline (See 1.2.2)	Lead finish (See 1.2.3)

1.2.1 Device type(s).

Device type	Generic	Circuit function
01	TPS3813K33-EP	Processor supervisory circuit with window-watchdog

1.2.2 Case outline(s). The case outline(s) are as specified herein.

Outline letter	Number of pins	JEDEC PUB 95	Package style
X	6	MO-178	Plastic small outline

1.2.3 Lead finishes. The lead finishes are as specified below or other lead finishes as provided by the device manufacturer:

Finish designator	Material
A	Hot solder dip
B	Tin-lead plate
C	Gold plate
D	Palladium
E	Gold flash palladium
F	Tin-lead alloy
Z	Other

1.3 Absolute maximum ratings. 1/

Supply voltage (V_{DD})	7 V 2/
RESET (V_{DD})	-0.3 V to V_{DD} + 0.3 V
All other pins (V_{DD})	-0.3 V to 7 V 2/
Maximum low output current (I_{OL})	5 mA
Maximum high output current (I_{OH})	-5 mA
Input clamp current (I_{IK}), ($V_I < 0$ or $V_I > V_{DD}$)	±20 mA
Output clamp current (I_{OK}), ($V_O < 0$ or $V_O > V_{DD}$)	±20 mA
Maximum continuous total power dissipation (Case X):	
$T_A < 25°C$	437 mW
$T_A = 70°C$	280 mW
$T_A = 85°C$	227 mW
Derating factor above $T_A = 25°C$	3.5 mW/°C
Operating free-air temperature range (T_A)	-55°C to +125°C
Storage temperature range (T_{STG})	-65°C to +150°C
Soldering temperature	+260°C

1.4 Recommended operating conditions.

Supply voltage range (V_{DD})	2 V to 6 V
Input voltage range (V_I)	0 V to V_{DD} + 0.3 V
Minimum high-level input voltage (V_{IH})	0.7 x V_{DD}
Maximum low-level input voltage (V_{IL})	0.3 x V_{DD}
Maximum input transition rise and fall rate ($\Delta t/\Delta V$)	100 ns/V
Minimum pulse width of WDI trigger pulse (t_w)	50 ns
Operating free-air temperature range (T_A)	-55°C to +125°C

1/ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

2/ All voltage values are with respect to GND. For reliable operation, the device must not be operated at 7 V for more than t = 1000 h continuously.

2. APPLICABLE DOCUMENTS

JEDEC – SOLID STATE TECHNOLOGY ASSOCIATION (JEDEC)

JEP95 – Registered and Standard Outlines for Semiconductor Devices

(Copies of these documents are available online at https://www.jedec.org).

3. REQUIREMENTS

3.1 Marking. Parts shall be permanently and legibly marked with the manufacturer's part number as shown in 6.3 herein and as follows:

A. Manufacturer's name, CAGE code, or logo
B. Pin 1 identifier
C. ESDS identification (optional)

3.2 Unit container. The unit container shall be marked with the manufacturer's part number and with items A and C (if applicable) above.

3.3 Electrical characteristics. The maximum and recommended operating conditions and electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.4 Design, construction, and physical dimension. The design, construction, and physical dimensions are as specified herein.

3.5 Diagrams.

3.5.1 Case outlines. The case outlines shall be as shown in 1.2.2 and figure 1.

3.5.2 Terminal connections. The terminal connections shall be as shown in figure 2.

3.5.3 Truth table. The truth table shall be as shown in figure 3.

3.5.4 Logic diagram. The logic diagram shall be as shown in figure 4.

3.5.5 Timing waveforms. The timing waveforms shall be as shown in figure 5.

TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions	Temperature, T_A	Device type	Limits Min	Limits Max	Unit
Electrical Characteristics							
Low-level output voltage	V_{OL}	V_{DD} = 2 V to 6 V, I_{OL} = 500 µA	-55°C to +125°C	01		0.2	V
		V_{DD} = 3.3 V, I_{OL} = 2 mA				0.4	
		V_{DD} = 6 V, I_{OL} = 4 mA				0.4	
Power-up reset voltage 2/		$V_{DD} \geq$ 1.1 V, I_{OL} = 50 µA	-55°C to +125°C			0.2	V
Negative-going input threshold voltage 3/	V_{IT}		+25°C		2.87	3	V
			-55°C to +125°C		2.8	3.1	
Hysteresis	Vhys		-55°C to +125°C		40 TYP		mV
High-level input current (WDI, WDR)	I_{IH}	WDI = V_{DD} = 6 V, WDR = V_{DD} = 6 V	+25°C		-100	100	nA
			-55°C to +125°C		-1000	1000	
High-level input current (WDT)		WDT = V_{DD} = 6 V, $V_{DD} > V_{IT}$, RESET = High	+25°C		-100	100	
			-55°C to +125°C		-1000	1000	
Low-level input current (WDI, WDR)	I_{IL}	WDI = 0 V, WDR = 0 V, V_{DD} = 6 V	+25°C		-100	100	nA
			-55°C to +125°C		-1000	1000	
Low-level input current (WDT)		WDT = 0 V, $V_{DD} > V_{IT}$, RESET = High	+25°C		-100	100	
			-55°C to +125°C		-1000	1000	
High-level output current	I_{OH}	$V_{DD} = V_{OH}$ = 6 V	+25°C			100	nA
			-55°C to +125°C			1000	
Supply current	I_{DD}	V_{DD} = 2 V output unconnected	-55°C to +125°C			13	µA
		V_{DD} = 5 V output unconnected				25	
Input capacitance	C_I	V_I = 0 V to V_{DD}	-55°C to +125°C		5 TYP		pF
Timing Requirements 4/							
Pulse width at V_{DD}	t_w	$V_{DD} = V_{IT}$ + 0.2 V, $V_{DD} = V_{IT}$ – 0.2 V	-40°C to +85°C	01	3		µs

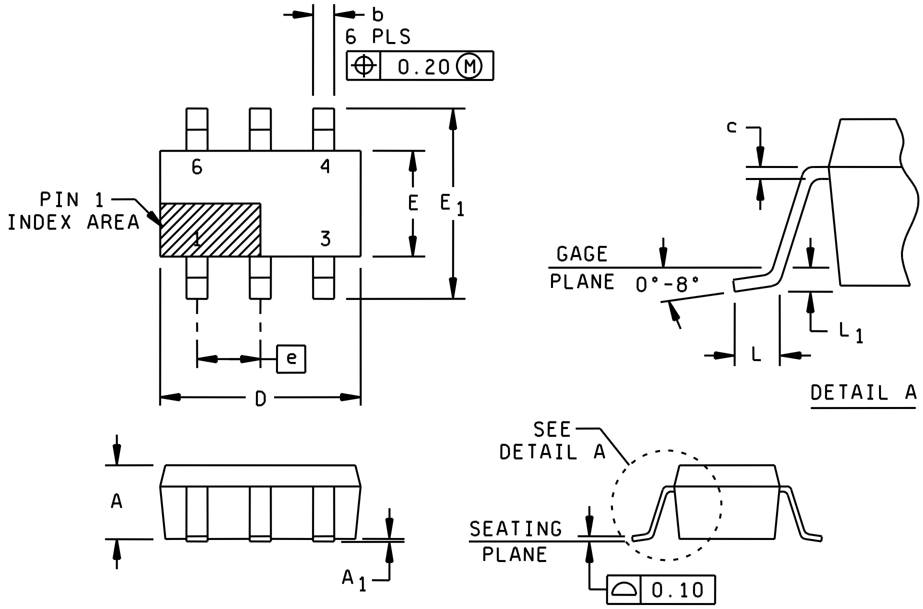
See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions	Temperature, T_A	Device type	Limits		Unit
					Min	Max	
Switching Characteristics 4/							
Delay time	t_d	$V_{DD} = V_{IT} + 0.2$ V See figure 5.	+25°C	01	20	30	ms
			-55°C to +125°C		15	40	
Watchdog time-out (Upper limit)	$t_{t(out)}$	WDT = 0 V	-55°C to +125°C		0.25 TYP		s
		WDT = V_{DD}			2.5 TYP		
		WDT = programmable 5/			6/ TYP		ms
Watchdog window ratio		WDR = 0 V, WDT = 0 V	-55°C to +125°C		1: 1.8		
		WDR = 0 V, WDT = V_{DD}			1:32		
		WDR = 0 V, WDT = programmable			1:25.8		
		WDR = V_{DD}, WDT = 0 V			1:124.9		
		WDR = V_{DD}, WDT = V_{DD}			1:127.7		
		WDR = V_{DD}, WDT = programmable			1:64.5		
Propagation delay time, high-to-low-level output (V_{DD} to $\overline{RESET}$ delay)	t_{PHL}	$V_{IL} = V_{IT} - 0.2$ V, $V_{IH} = V_{IT} + 0.2$ V	-55°C to +125°C		30 TYP		µs

1/ Testing and other quality control techniques are used to the extent deemed necessary to assure product performance over the specified temperature range. Product may not necessarily be tested across the full temperature range and all parameters may not necessarily be tested. In the absence of specific parametric testing, product performance is assured by characterization and/or design.
2/ The lowest supply voltage at which $\overline{RESET}$ becomes active. t_r, $V_{DD} \geq 15$ µs/V.
3/ To ensure the best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1 µF) should be placed near the supply terminals.
4/ R_L = 1 MΩ, C_L = 50 pF
5/ 155 pF < $C_{(ext)}$ < 63 nF
6/ (($C_{(ext)}$ / 15.55 pF) + 1) x 6.25 ms

Case X



Dimensions									
Symbol	Millimeters		Inches		Symbol	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	---	1.45	---	0.057	e	0.95 Nominal		0.037 Nominal	
A1	0.00	0.15	0.000	0.006	E	1.45	1.75	0.057	0.069
b	0.25	0.50	0.010	0.020	E1	2.60	3.00	0.102	0.118
c	0.08	0.22	0.003	0.009	L	0.30	0.55	0.012	0.022
D	2.75	3.05	0.108	0.120	L1	0.25 Nominal		0.010 Nominal	

NOTES:

1. All linear dimensions are millimeters (inches are shown for reference).
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 mm (0.006 inch) per side.
4. Leads 1, 2, 3 may be wider than leads 4, 5, 6 for package orientation.
5. Falls within JEDEC MO-178 variation AB, except minimum lead width.

FIGURE 1. Case outlines.

Device type:	01
Case outline:	X
Terminal number	Terminal symbol
1	WDI
2	GND
3	WDT
4	V_{DD}
5	WDR
6	$\overline{RESET}$

FIGURE 2. Terminal connections.

$V_{DD} > V_{IT}$	$\overline{RESET}$
0	L
1	H

FIGURE 3. Truth table.

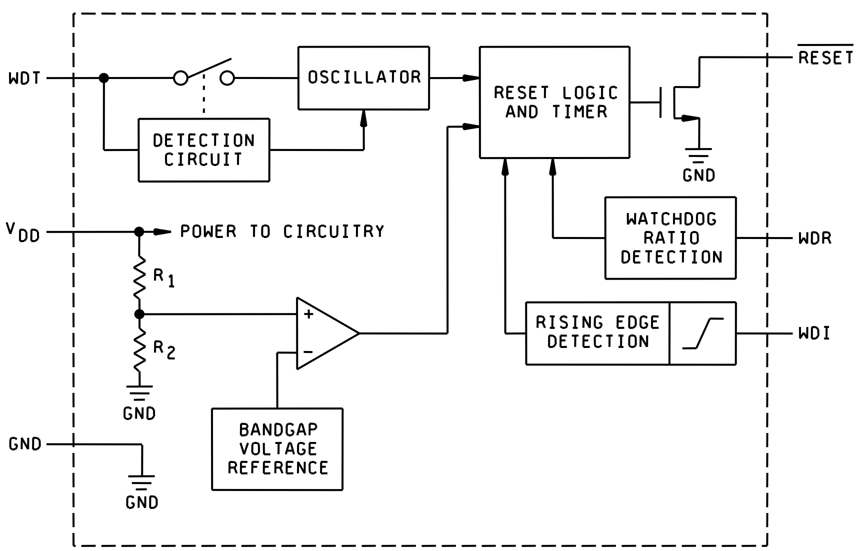


FIGURE 4. Logic diagram.

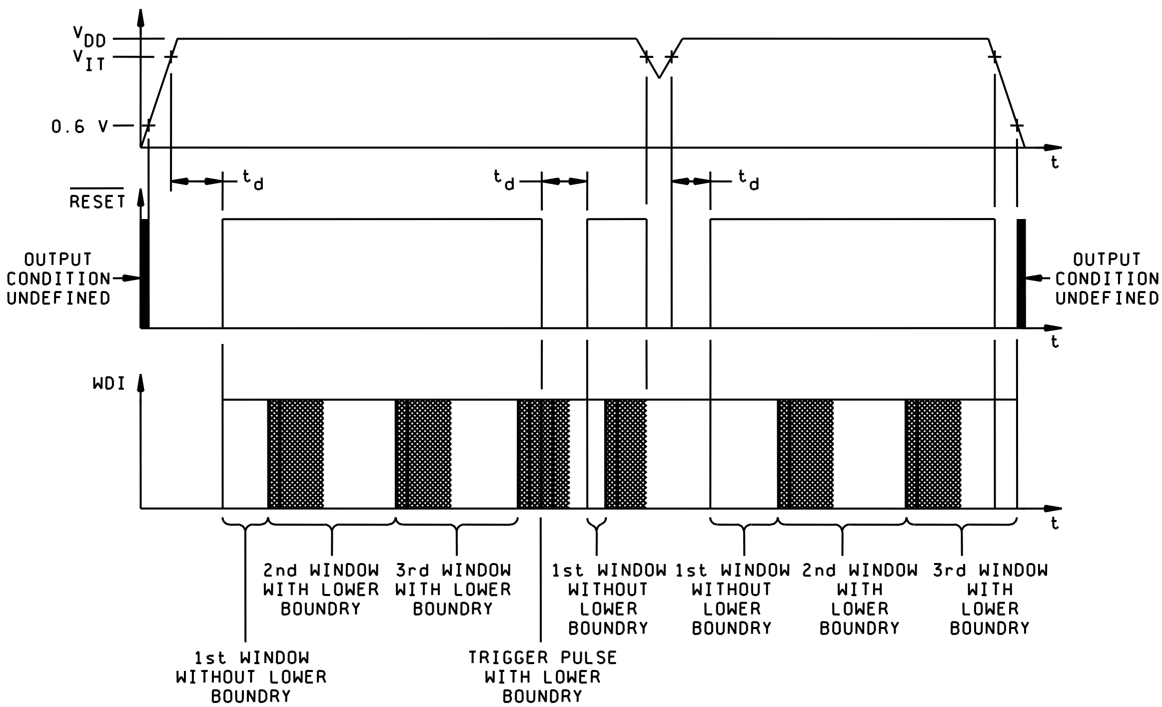


FIGURE 5. Timing waveforms.

4. VERIFICATION

4.1 Product assurance requirements. The manufacturer is responsible for performing all inspection and test requirements as indicated in their internal documentation. Such procedures should include proper handling of electrostatic sensitive devices, classification, packaging, and labeling of moisture sensitive devices, as applicable.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Preservation, packaging, labeling, and marking shall be in accordance with the manufacturer's standard commercial practices for electrostatic discharge sensitive devices.

6. NOTES

IMPLEMENTED WINDOW-WATCHDOG SETTINGS

There are two different ways to set up the watchdog window. The first way is to use the implemented timing which is a default setting. Or, the default settings can be activated by wiring the WDT and WDR pin to V_{DD} or GND. There are a total of four different timings available with these settings which are listed in the table below.

SELECTED OPERATION MODE		WINDOW FRAME	LOWER WINDOW FRAME
WDT = 0 V	WDR = 0 V	Max = 0.3 s	Max = 9.46 ms
		Typ = 0.25 s	Typ = 7.86 ms
		Min = 0.2 s	Min = 6.27 ms
	WDR = V_{DD}	Max = 0.3 s	Max = 2.43 ms
		Typ = 0.25 s	Typ = 2 ms
		Min = 0.2 s	Min = 1.58 ms
WDT = V_{DD}	WDR = 0 V	Max = 0.3 s	Max = 93.8 ms
		Typ = 0.25 s	Typ = 78.2 ms
		Min = 0.2 s	Min = 62.5 ms
	WDR = V_{DD}	Max = 0.3 s	Max =23.5 ms
		Typ = 0.25 s	Typ = 19.6 ms
		Min = 0.2 s	Min = 15.6 ms

To visualize the values named in the table, a timing diagram (see figure 6) was prepared. The timing diagram is used to describe the upper and lower boundary settings. For an application, the important boundaries are the $t_{boundary, max}$ and $t_{window, min}$. Within these values, the watchdog timer should be retriggered to avoid a timeout condition or a boundary violation in the event of a trigger pulse in the lower boundary. The values in the table above are typical and worst case conditions. They are valid over the whole temperature range of -55°C to +125°C.

In the shaded area of figure 6, it cannot be predicted if the device will detect a violation or not and release a reset. This is also the case between the boundary tolerance of $t_{boundary, min}$ and $t_{boundary, max}$ as well as between $t_{window, min}$ and $t_{window, max}$. It is important to set up the trigger pulses accordingly to avoid violations in these areas.

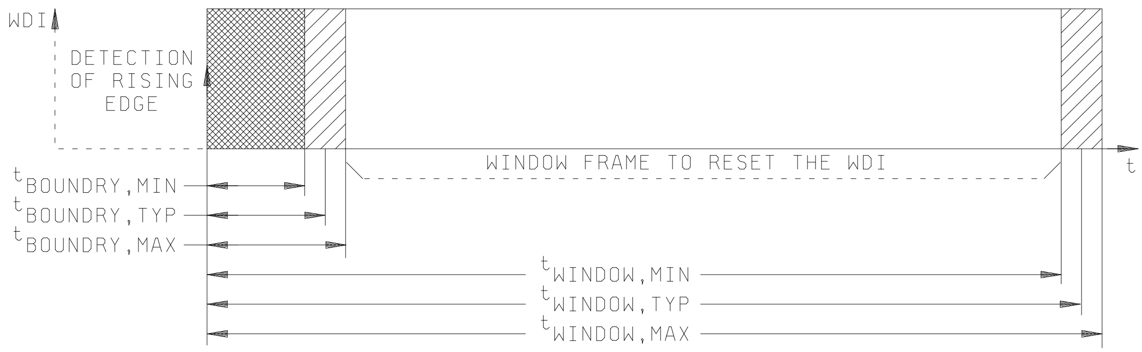


FIGURE 6. Upper and lower boundary visualization.

6.1 ESDS. Devices are electrostatic discharge sensitive and are classified as ESDS class 1 minimum.

6.2 Configuration control. The data contained herein is based on the salient characteristics of the device manufacturer's data book. The device manufacturer reserves the right to make changes without notice. This drawing will be modified as changes are provided.

6.3 Suggested source(s) of supply. Identification of the suggested source(s) of supply herein is not to be construed as a guarantee of present or continued availability as a source of supply for the item. DLA Land and Maritime maintains an online database of all current sources of supply at https://landandmaritimeapps.dla.mil/programs/smcr/.

Vendor item drawing administrative control number 1/	Device manufacturer CAGE code	Vendor part number	Threshold voltage	Top-side marking
V62/06627-01XE	01295	TPS3813K33MDBVREP	2.93 V	PLGM

1/ The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation.

CAGE code	Source of supply
01295	Texas Instruments, Inc. Semiconductor Group 8505 Forest Lane P.O. Box 660199 Dallas, TX 75243