



MIC2790/1/3

**Supervisor with High-Accuracy,
Ultra-Fast Propagation Delay, and
Capacitor-Programmable Reset Delay**

General Description

The MIC2790/1/3 is ideal for monitoring highly-accurate core voltages that require rapid response in the event of a fault condition. The voltage supervisor IC features a manual reset input, enable input (MIC2793 only), a capacitor-programmable reset timeout delay and both an active-low and active-high reset output.

The MIC2790/1/3 monitors system voltages that are in the range of 0.4V to 5.5V, with a typical sense accuracy of 0.5% at +25°C and $\pm 1.0\%$ across -40°C to $+125^{\circ}\text{C}$. The IC asserts a reset output when the sense voltage drops below the threshold or when the manual reset is pulled to a logic low. The active-low reset stays low for the duration of the reset timeout delay once the sense voltage returns to normal and the manual reset transitions to a logic high state. The reset timeout delay period is programmable from 1ms to 10s with an external capacitor.

The MIC2790/1/3 operates from a low supply voltage of 1.5V to 5.5V, and is rated to operate over the temperature range of -40°C to $+125^{\circ}\text{C}$. The MIC2790 is available in a 6-pin TSOT-23 package or a 6-pin $2\text{mm} \times 2\text{mm} \times 0.55\text{mm}$ DFN package. The MIC2791 is available in a tiny 6-pin $1.6\text{mm} \times 1.6\text{mm} \times 0.55\text{mm}$ DFN package. The MIC2793 is available in a 8-pin $2\text{mm} \times 2\text{mm} \times 0.55\text{mm}$ DFN package.

Datasheets and support documentation are available on Micrel's web site at: www.micrel.com.

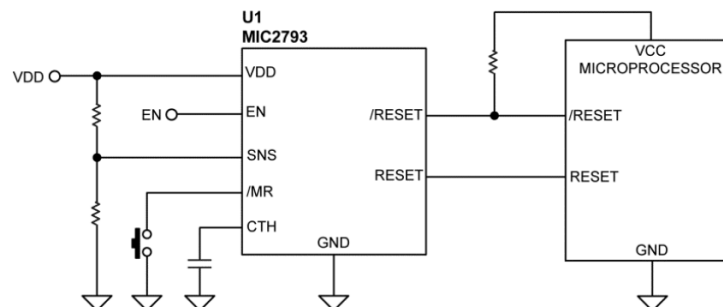
Features

- 1.5V to 5.5V operating supply voltage range
- Ultra-fast propagation delay ($1\mu\text{s}$ typically)
- 0.4V reference voltage (SNS pin)
 - $\pm 1.0\%$ threshold accuracy from -40°C to $+125^{\circ}\text{C}$
 - Monitored voltage range from 0.4V to 5.5V
- Programmable reset timeout delay (from 1ms to 10s)
- Manual reset input with an internal pull-up resistor
- Active-high enable input pin (MIC2793 only)
- The MIC2790/1/3 features multiple output options:
 - Open-drain active-low (/RESET)
 - Push-pull active-low (/RESET)
 - Push-pull active-high (RESET)
- -40°C to 125°C junction temperature range
- 6-pin TSOT-23 (MIC2790)
- 6-pin $2\text{mm} \times 2\text{mm}$ Thin DFN (MIC2790)
- 6-pin $1.6\text{mm} \times 1.6\text{mm}$ Thin DFN (MIC2791)
- 8-pin $2\text{mm} \times 2\text{mm}$ Thin DFN (MIC2793)

Applications

- Telecom
- Computer/servers
- Medical equipment
- Portable
- Set-top boxes
- Critical microprocessor monitoring

Typical Application



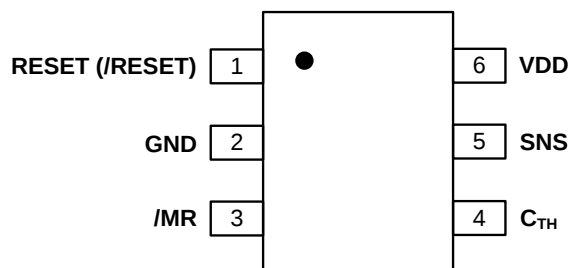
Ordering Information

Part Number	Marking Code	Threshold Voltage (SNS) ⁽¹⁾	/RESET Output (Active-Low)	RESET Output (Active-High)	Enable Pin Feature	Junction Temperature Range	Package ^(2, 3)
MIC2790N-04VD6	9ND	0.4V	Open-Drain	–	–	–40°C to +125°C	6-pin TSOT-23
MIC2790L-04VD6	9LD	0.4V	Push-Pull	–	–	–40°C to +125°C	6-pin TSOT-23
MIC2790H-04VD6	9HA	0.4V	–	Push-Pull	–	–40°C to +125°C	6-pin TSOT-23
MIC2790N-04VMT	9NA	0.4V	Open-Drain	–	–	–40°C to +125°C	6-pin 2mm × 2mm TDFN
MIC2791N-04VMT	1N	0.4V	Open-Drain	–	–	–40°C to +125°C	6-pin 1.6mm × 1.6mm TDFN
MIC2791L-04VMT	1L	0.4V	Push-Pull	–	–	–40°C to +125°C	6-pin 1.6mm × 1.6mm TDFN
MIC2791H-04VMT	XH	0.4V	–	Push-Pull	–	–40°C to +125°C	6-pin 1.6mm × 1.6mm TDFN
MIC2793LH-04VMT	3LH	0.4V	Push-Pull	Push-Pull	Yes	–40°C to +125°C	8-pin 2mm × 2mm TDFN
MIC2793NH-04VMT	3NH	0.4V	Open-Drain	Push-Pull	Yes	–40°C to +125°C	8-pin 2mm × 2mm TDFN

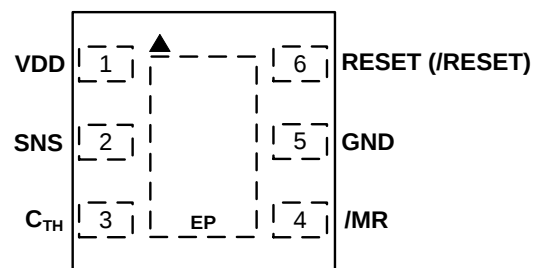
Notes:

- Other voltage options are available. Contact Micrel for details.
- Thin DFN pin 1 identifier = "▲".
- Thin DFN is a GREEN RoHS compliant package. Lead finish is NiPdAu. Mold compound is Halogen free.

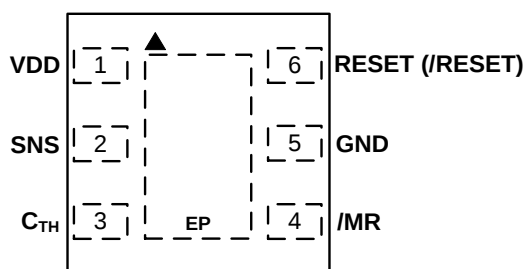
Pin Configuration



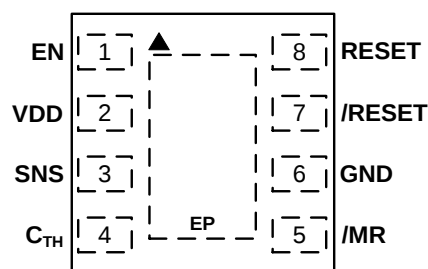
6-Pin TSOT (D6)
(Top View)



6-Pin 1.6mm x 1.6mm TDFN (MT)
(Top View)



6-Pin 2mm x 2mm TDFN (MT)
(Top View)



8-Pin 2mm x 2mm TDFN (MT)
(Top View)

Pin Description

Pin Number TSOT-23 (6L)	Pin Number 1.6 × 1.6 (6L)	Pin Number 2 × 2 (6L)	Pin Number 2 × 2 (8L)	Pin Name	Pin Function
1	6	6	7	/RESET	/RESET is an active-low output pin and is available in an open-drain or push-pull configuration. In the open-drain configuration, a pull-up resistor to VDD is required and /RESET pin is asserted low when /MR is set to a logic low or the SNS voltage decreases below the threshold voltage. /RESET will remain low for the reset timeout delay after $SNS > (V_{TH} + V_{HYST})$ and /MR is set to a logic high. The push-pull configuration does not require a pull-up resistor and behaves exactly the same as the open-drain configuration.
1	6	6	8	RESET	Reset is an active-high push-pull output and is asserted high when /MR is set to a logic low or the SNS voltage decreases below the threshold voltage. RESET will remain high for the reset timeout delay after $SNS > (V_{TH} + V_{HYST})$ and /MR is set to a logic high.
2	5	5	6	GND	Supply Ground.
3	4	4	5	/MR	Manual reset is an active-low input logic level pin and is internally pulled to VDD through a 90kΩ pull-up resistor. Pulling the /MR input to a logic low asserts RESET and /RESET pins. /RESET will remain low and RESET will remain high for the reset timeout delay after /MR is pulled to logic high.
4	3	3	4	CTH	Programmable timeout delay. Connect a capacitor to ground to set a user defined reset delay time.
5	2	2	3	SNS	Voltage monitor input. Connect sense pin to the voltage to be monitored through a resistor divider. When this voltage decreases below the threshold voltage, V_{TH} , /RESET is asserted low and RESET is asserted high.
6	1	1	2	VDD	Supply voltage pin. Bypass with a 1μF capacitor from this pin to GND.
–	–	–	1	EN	Enable input function is only available in the MIC2793 version. This pin enables the /MR input function and RESET and /RESET outputs. When EN is in a logic low state, the reset outputs are de-asserted. The EN pin has an internal 90kΩ pull-up resistor to VDD.
–	EP	EP	EP	ePad	Exposed Pad. Connect to ground plane.

Absolute Maximum Ratings⁽⁴⁾

Supply Voltage (V_{DD}) -0.3V to +6.0V
 SNS -0.3V to 4.5V
 /MR, EN, C_{TH} -0.3V to V_{DD}
 RESET, /RESET -0.3V to V_{DD}
 Lead Temperature (soldering, 10s) 260°C
 Storage Temperature (T_S) -55°C to +150°C
 ESD Ratings⁽⁶⁾ ESD Sensitive

Operating Ratings⁽⁵⁾

Supply Voltage (V_{DD}) +1.5V to +5.5V
 SNS 0V to 4.0V
 /MR, EN, C_{TH} 0V to V_{DD}
 RESET, /RESET 0V to V_{DD}
 Junction Temperature (T_J) -40°C to +125°C
 Junction Thermal Resistance
 6-pin, TSOT-23 (θ_{JA}) 177.2°C/W
 6-pin, 1.6mm × 1.6mm TDFN (θ_{JA}) 92.4°C/W
 6-pin, 2mm × 2mm TDFN (θ_{JA}) 90°C/W
 8-pin, 2mm × 2mm TDFN (θ_{JA}) 90°C/W

Electrical Characteristics⁽⁷⁾

$V_{DD} = 3.3V$; $R_{/RESET} = 100k\Omega$; $C_{TH} = 1nF$; $T_A = 25^\circ C$, **bold** values indicate $-40^\circ C \leq T_A \leq +125^\circ C$, unless noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
Supply Specifications						
V _{DD}	Supply Voltage	/RESET Output Valid	1.5		5.5	V
I _{DD}	Supply Current	V _{DD} = EN = /MR = 3.3V RESET and /RESET not asserted		40	70	μA
		V _{DD} = EN = /MR = 5V RESET and /RESET not asserted		50	80	
Sense Specifications						
V _{TH}	Sense Threshold Voltage			0.4		V
	Sense Threshold Accuracy		-1.0		+1.0	%
V _{HYST}	Hysteresis	Sense rising	-2.5	± 1.5	+2.5	%
I _{SNS}	Sense Input Bias Current		-15		+15	nA
RESET & /RESET Output Specifications						
t _{p,SNS}	SNS to RESET and /RESET Propagation Delay ⁽⁸⁾	SNS = V _{TH} × 1.05 to V _{TH} × 0.95		1	2.2	μs
V _{OL}	/RESET Logic Low Output Voltage	I _{OL} = 1mA (open-drain only)			0.3	V
V _{OH}	RESET Logic High Output Voltage	I _{OH} ≤ 1mA (push-pull only)	>0.9 × V _{DD}			V
I _{OH}	/RESET Leakage Current	/RESET not asserted (open-drain only)			1	μA
t _d	RESET and /RESET Timeout Delay	C _{TH} = 100pF	0.45	1.05	1.8	ms
		C _{TH} = 180nF	0.5	1.2	1.9	s

Notes:

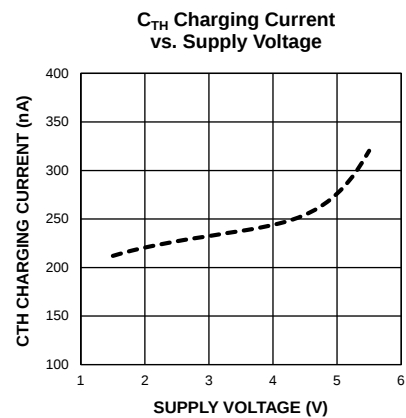
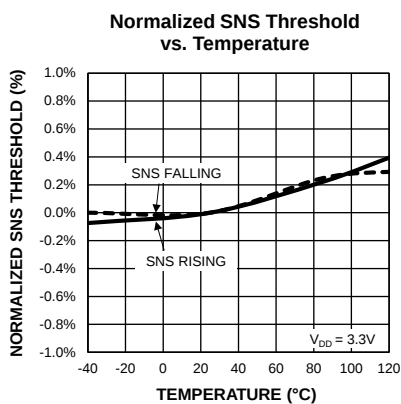
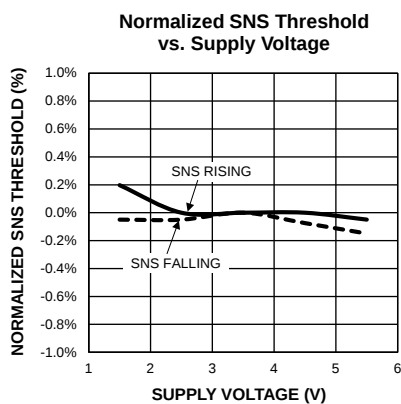
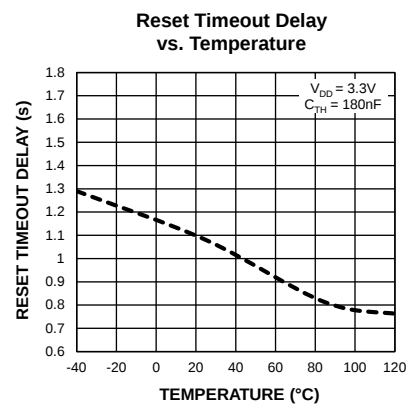
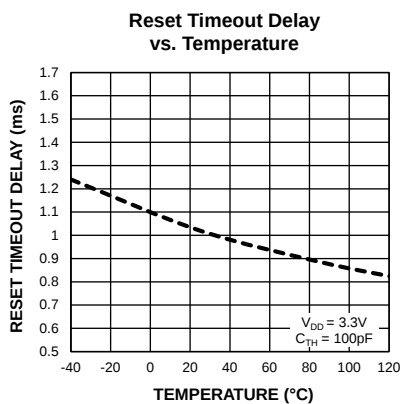
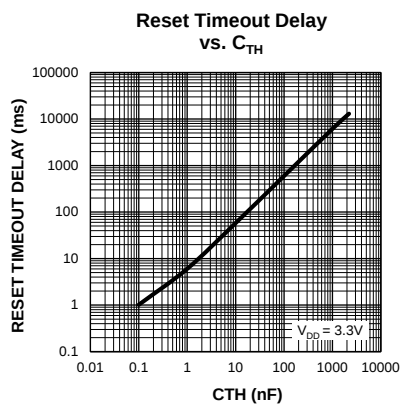
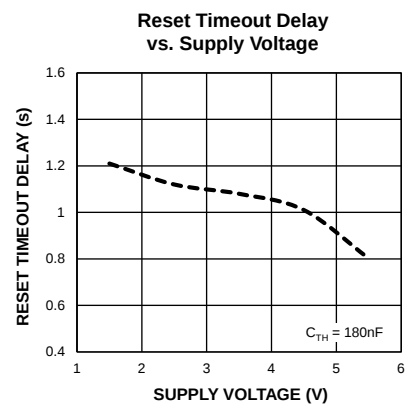
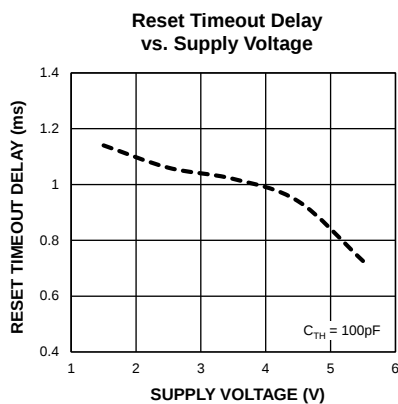
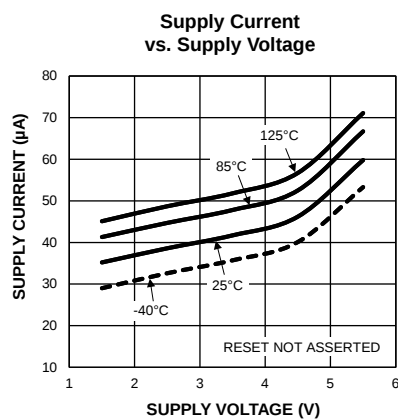
- Exceeding the absolute maximum ratings may damage the device.
- The device is not guaranteed to function outside its operating ratings.
- Devices are ESD sensitive. Handling precautions are recommended. Human body model, 1.5k Ω in series with 100pF.
- Specification for packaged product only.
- SNS to RESET and or /RESET propagation delay is the delay time for SNS voltage to transition from $V_{TH} \times 1.05$ to $V_{TH} \times 0.95$ to RESET and or /RESET.

Electrical Characteristics⁽⁷⁾ (Continued)

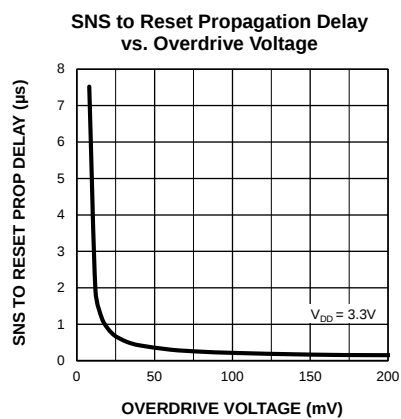
$V_{DD} = 3.3V$; $R_{/RESET} = 100k\Omega$; $C_{TH} = 1nF$; $T_A = 25^\circ C$, **bold** values indicate $-40^\circ C \leq T_A \leq +125^\circ C$, unless noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
/MR Input Specifications						
$R_{/MR}$	/MR Internal Pull-Up Resistance			90		k Ω
$t_{p,/MR}$	/MR to RESET and /RESET Propagation Delay			100		ns
V_{IL}	/MR Logic Low Input Voltage				0.5	V
V_{IH}	/MR Logic High Input Voltage		1.2			V
EN Input Specifications (MIC2793 only)						
R_{EN}	EN Internal Pull-Up Resistance			90		k Ω
$t_{p,EN}$	EN to RESET and /RESET Propagation Delay	/MR = logic low		100		ns
V_{ENL}	EN Logic Low Input Voltage				0.5	V
V_{ENH}	EN Logic High Input Voltage		1.2			V

Typical Characteristics



Typical Characteristics (Continued)



Timing Diagrams

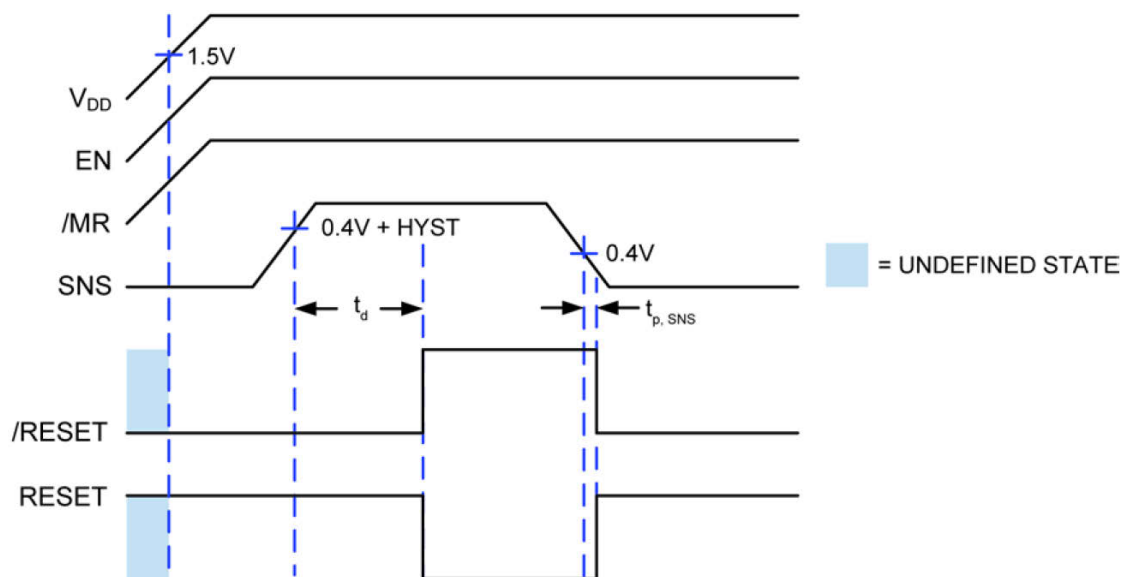


Figure 1. Timeout and Propagation Delay from Sense to RESET and /RESET

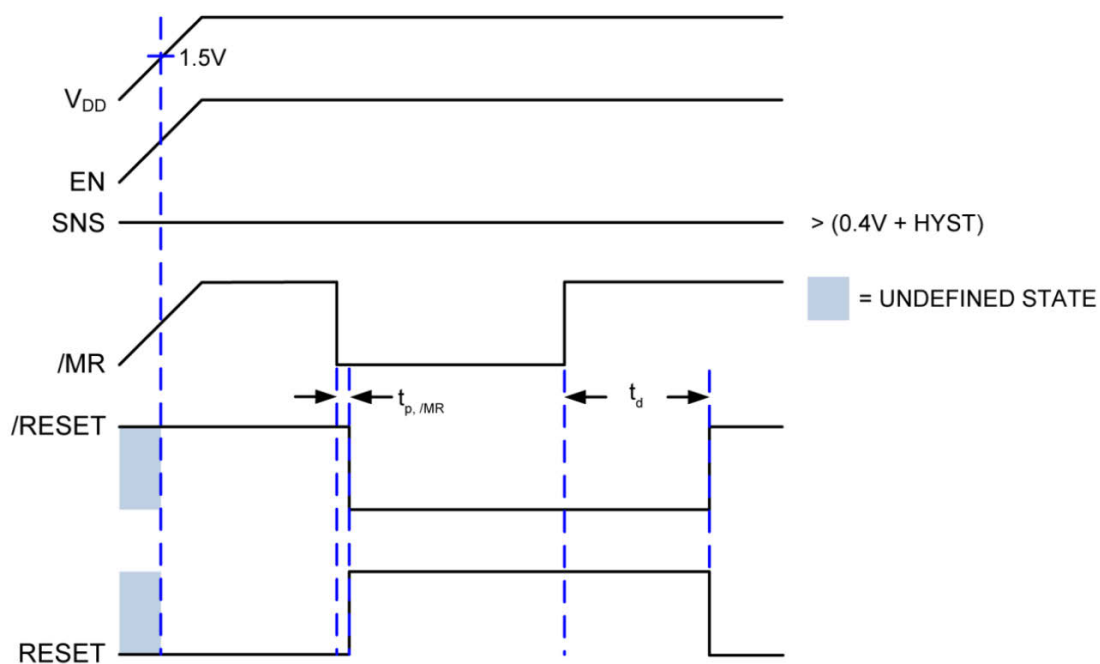


Figure 2. Timeout and Propagation Delay from /MR to RESET and /RESET

Timing Diagrams (Continued)

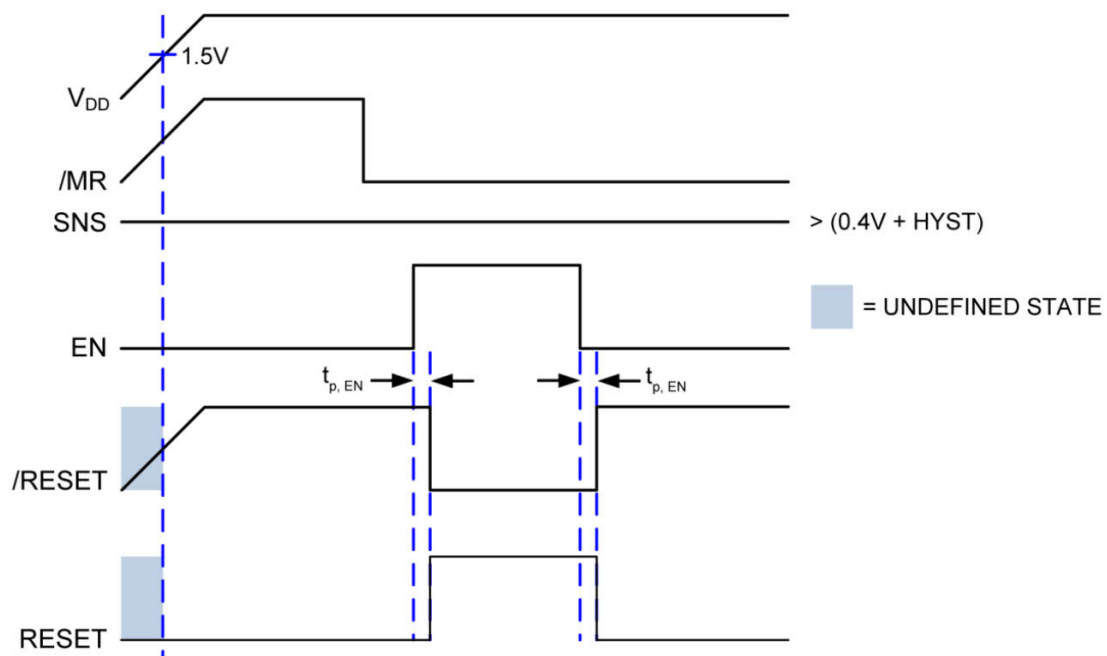


Figure 3. Hold and Propagation Delay from EN to RESET and /RESET

Functional Diagram

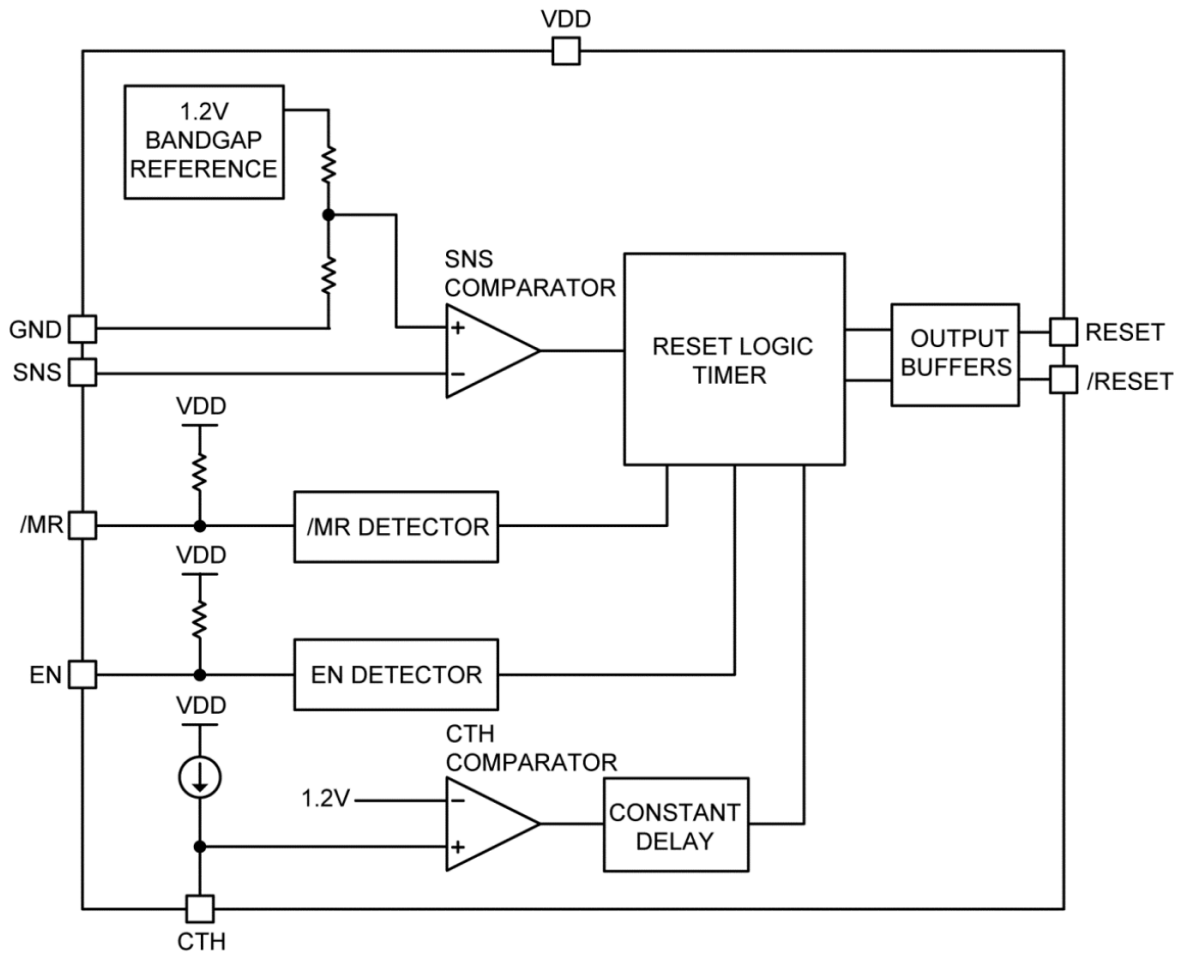


Figure 4. Simplified MIC2793 Functional Block Diagram

Functional Description

Design and Product Advantages

The MIC2790/1/3 is a highly-accurate supervisor circuit with an ultra-fast propagation delay of 2.2μs (maximum) over the temperature range of -40°C to +125°C. Additional features in the MIC2790/1/3 include a manual reset input pin, a capacitor-programmable reset timeout delay and both an active-low and active-high reset output. The capacitor-programmable reset delay help protect against accidental system glitch during a reset timeout.

VDD

The input supply (V_{DD}) provides power to the comparators and logic timers. V_{DD} operating range is 1.5V to 5.5V. A ceramic input capacitor of 1μF with a minimum voltage rating of 6.3V is recommended between VDD and GND. Refer to [PCB Layout Recommendations](#) for details.

EN

The enable (EN) pin feature is only available in the MIC2793 option and has an internal pull-up of 90kΩ resistor to VDD. A logic high signal on EN pin enables the reset logic outputs, while a logic low signal disables the reset outputs. See [Figure 3](#) in the [Timing Diagrams](#) section for more information.

CTH

C_{TH} is a programmable timeout delay pin. Connect a capacitor to ground to set a reset timeout delay ranging from 1ms to 10s. Refer to the Reset Timeout Delay vs. C_{TH} plot in the [Typical Characteristics](#) section for examples.

SNS

The sense (SNS) input pin monitors the user's voltage through a resistor divider network as shown in [Figure 5](#).

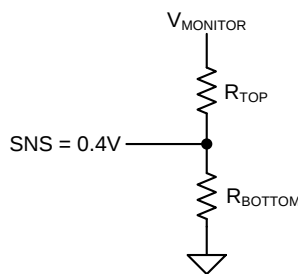


Figure 5. Resistor Divider on SNS pin

To set R_{TOP} and R_{BOTTOM} , use Equation 1 and set an arbitrary R_{TOP} value greater than 100kΩ and solve for R_{BOTTOM} or vice versa.

$$V_{MONITOR} = 0.4V \times \left(1 + \frac{R_{TOP}}{R_{BOTTOM}} \right) \quad \text{Eq. 1}$$

GND

The ground (GND) pin is the return path for VDD, logic gates, and output pins. Refer to [PCB Layout Recommendations](#) for details.

/MR

Manual reset (/MR) is an active-low input pin that is internally pulled to VDD with a 90kΩ resistor. When /MR is asserted to a logic-low level, /RESET will transition to a logic low state while RESET will transition to a logic high state. See the [Timing Diagrams](#) section for more information.

/RESET

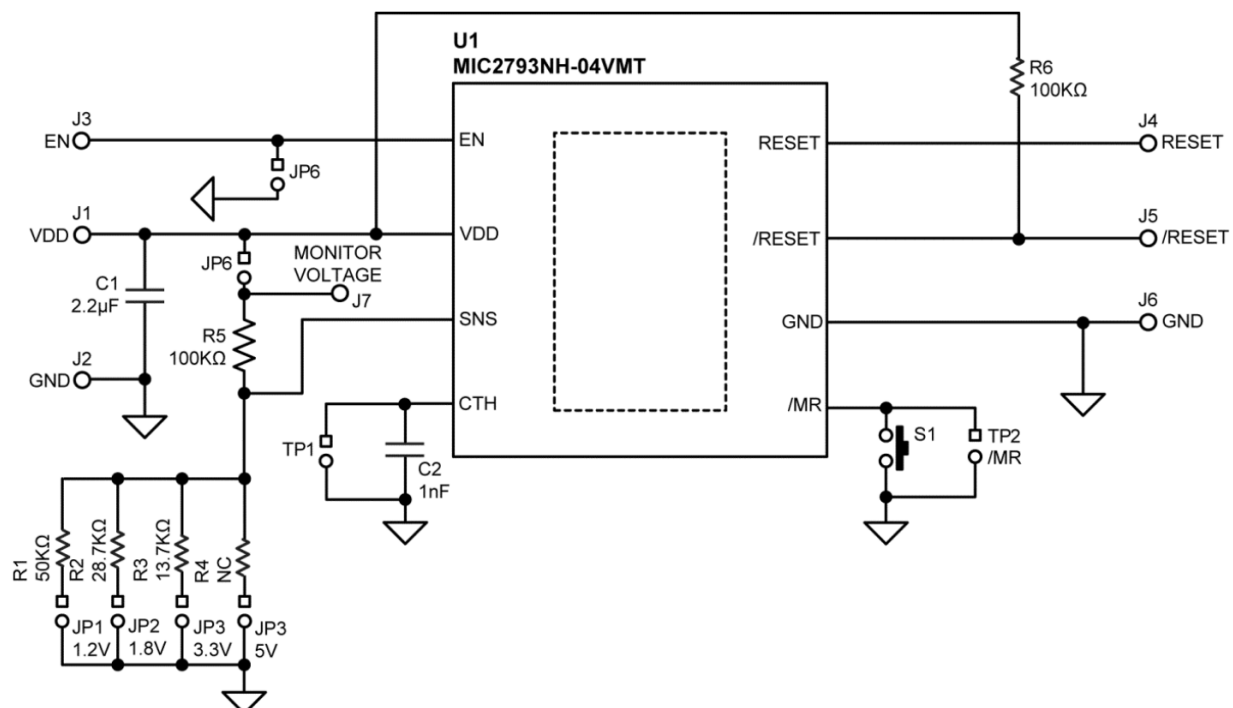
/RESET is an active-low output and is available in two output configurations: open-drain or push-pull. The open-drain configuration requires an external pull-up resistor, while the push-pull does not.

/RESET is asserted low when /MR is set to a logic-low or the SNS voltage decreases below the threshold voltage. /RESET will remain low for the programmed reset timeout delay after $SNS > (V_{TH} + V_{HYST})$ and /MR is set to a logic-high, and then /RESET will transition high to indicate normal regulation. See the [Timing Diagrams](#) section for more information.

RESET

RESET is an active-high push-pull output and is asserted high when /MR is set to a logic low or the SNS voltage decreases below the threshold voltage. RESET will remain high for the programmed reset timeout delay after $SNS > (V_{TH} + V_{HYST})$ and /MR is set to a logic high, and then RESET will transition low to indicate normal regulation. See the [Timing Diagrams](#) section for more information.

Typical Application Schematic



Bill of Materials

Item	Part Number	Manufacturer	Description	Qty.
C1	06036D225KAT2A	AVX ⁽⁹⁾	2.2μF, 6.3V, X5R, 0603	1
	GRM188R60J225KE19D	Murata ⁽¹⁰⁾		
	C1608X5R0J225KT	TDK ⁽¹¹⁾		
C2	01016D102KAT2A	AVX	1nF, 6.3V, X5R, 0603	1
	GRM155R60J102KA01D	Murata		
	C0402X5R0J102K020BC	TDK		
R1	CRCW060350K0FKEA	Vishay/Dale ⁽¹²⁾	50kΩ, 1%, 1/10W, 0603	1
R2	CRCW060328K7FKEA	Vishay/Dale	28.7kΩ, 1%, 1/10W, 0603	1
R3	CRCW060313K7FKEA	Vishay/Dale	13.7kΩ, 1%, 1/10W, 0603	1
R5, R6	CRCW06031003FKEA	Vishay/Dale	100kΩ, 1%, 1/10W, 0603	2
U1	MIC2793NH-04VMT	Micrel, Inc. ⁽¹³⁾	Supervisor with High-Accuracy, Ultra-Fast Propagation Delay, and Capacitor-Programmable Reset Delay	1

Notes:

9. AVX: www.avx.com.

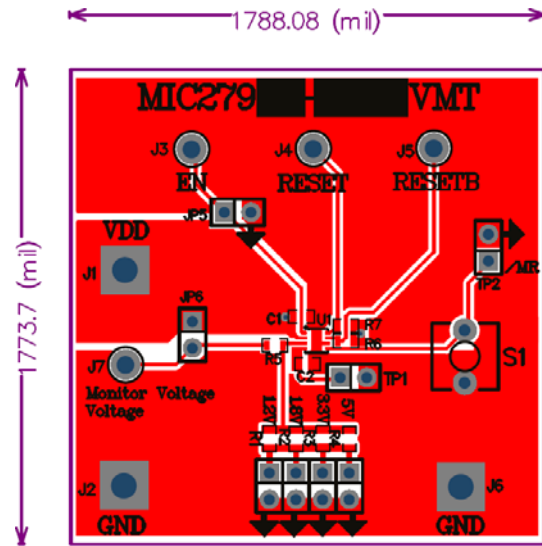
10. Murata: www.murata.com.

11. TDK: www.tdk.com.

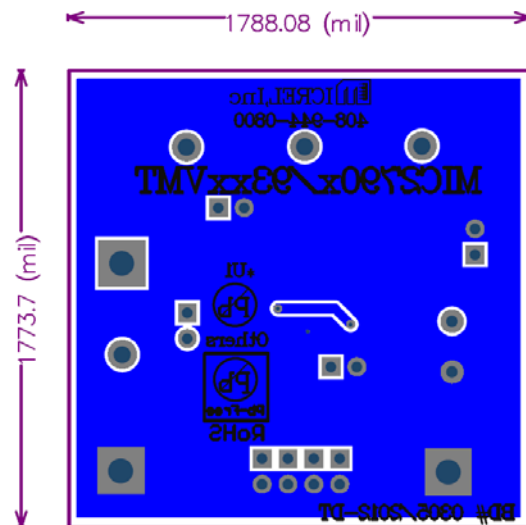
12. Vishay: www.vishay.com.

13. Micrel, Inc.: www.micrel.com.

PCB Layout Recommendations

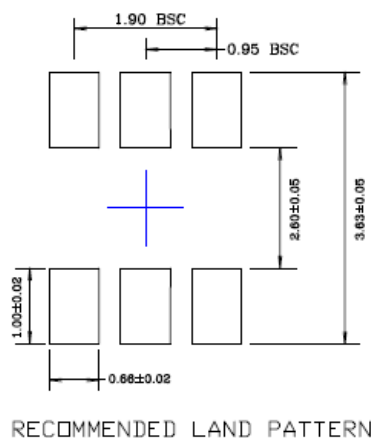
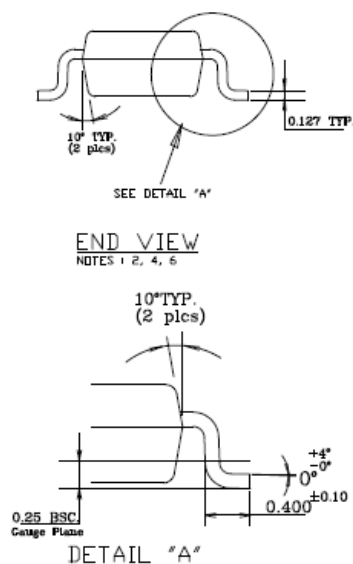
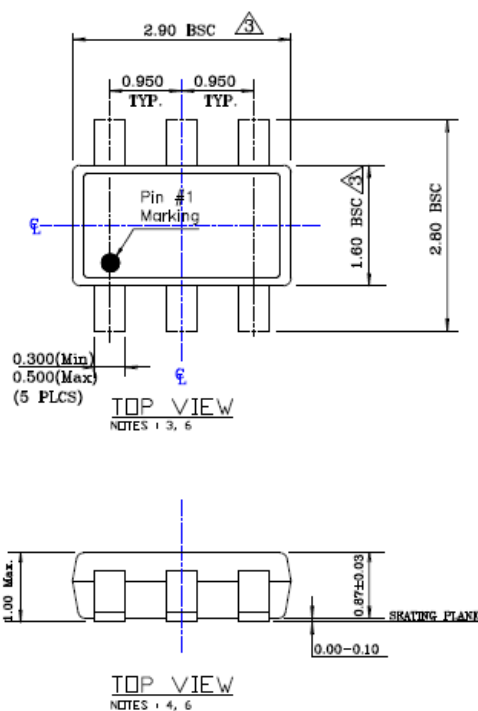


Top Layer



Bottom Layer

Package Information⁽¹⁴⁾ and Recommended Land Pattern (TSOT-23-6L)

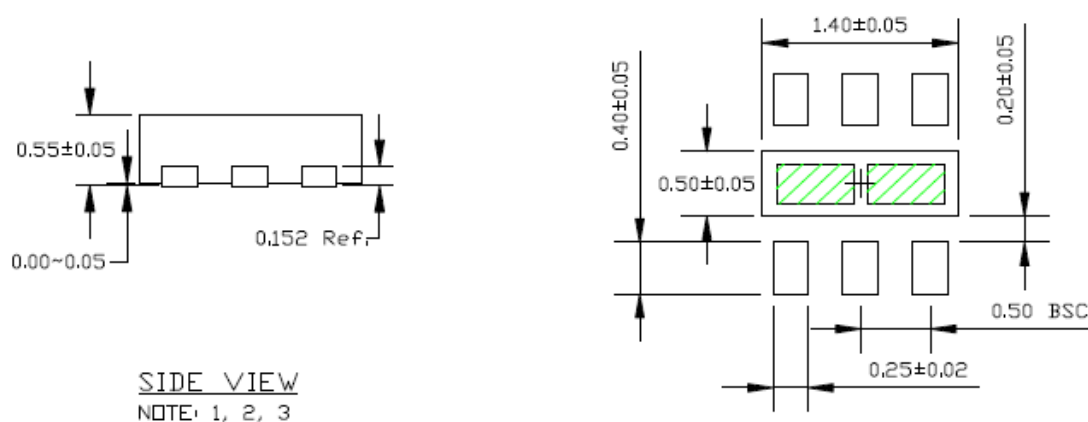
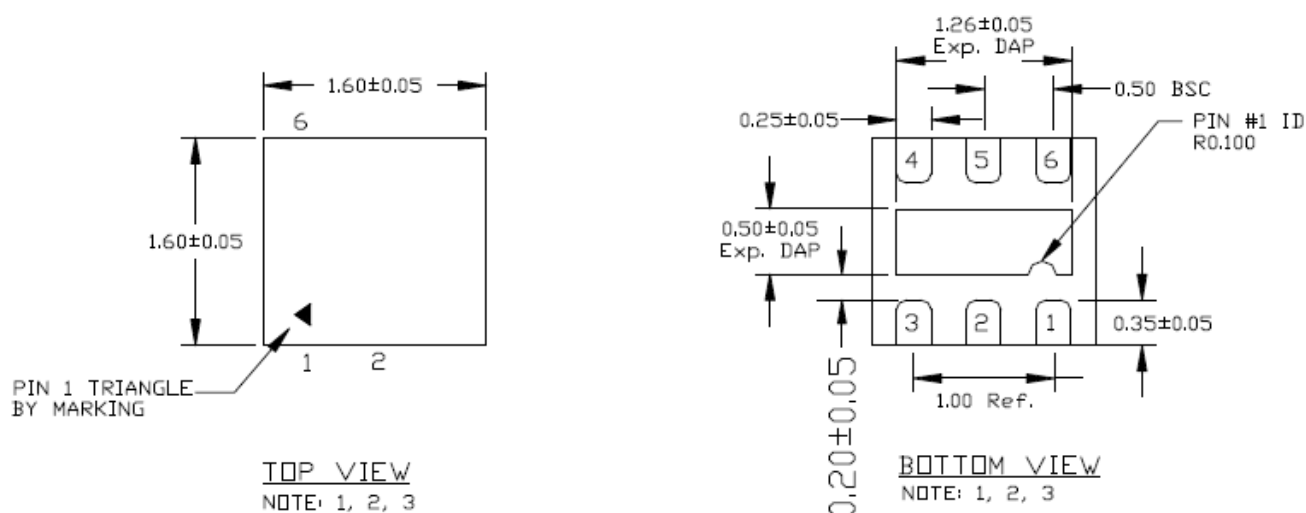


6-pin TSOT-23 (D6)

Note:

14. Package information is correct as of the publication date. For updates and most current information, go to www.micrel.com.

Package Information⁽¹⁴⁾ and Recommended Land Pattern (1.6mm × 1.6mm TDFN-6L)

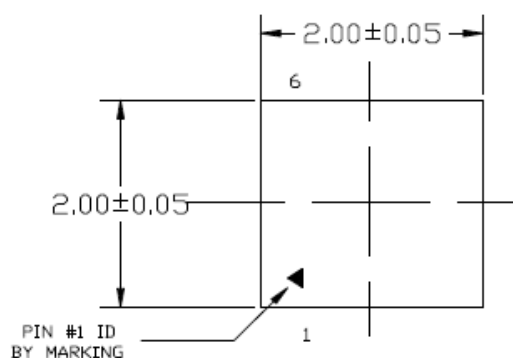


NOTE:

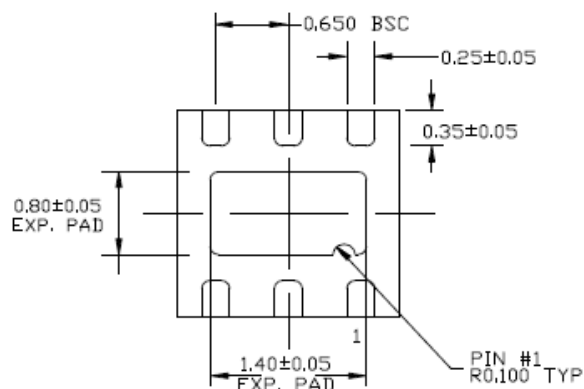
1. MAX PACKAGE WARPAGE IS 0.05 MM
2. MAX ALLOWABLE BURR IS 0.076MM IN ALL DIRECTIONS
3. PIN #1 IS ON TOP WILL BE LASER MARKED
4. GREEN SHADED AREA REPRESENT SOLDER STENCIL OPENING (OPTIONAL) FOR IMPROVED THERMAL PERFORMANCE. SIZE: 0.55×0.30 MM

6-pin 1.6mm × 1.6mm TDFN (MT)

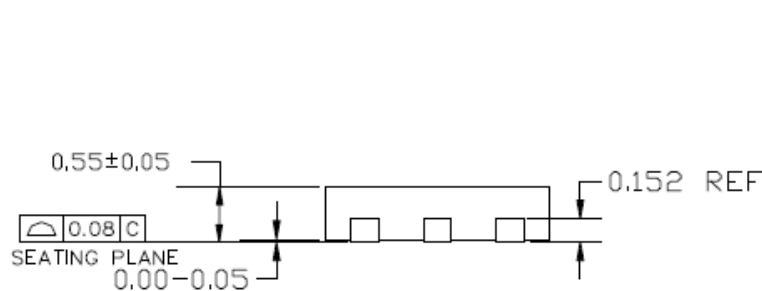
Package Information⁽¹⁴⁾ and Recommended Land Pattern (2mm × 2mm TDFN-6L)



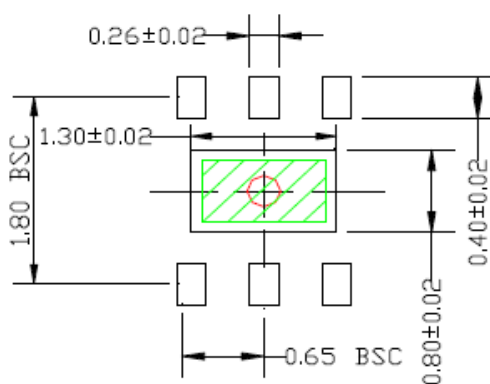
TOP VIEW
NOTE: 1, 2, 3



BOTTOM VIEW
NOTE: 1, 2, 3



END VIEW
NOTE: 1, 2, 3



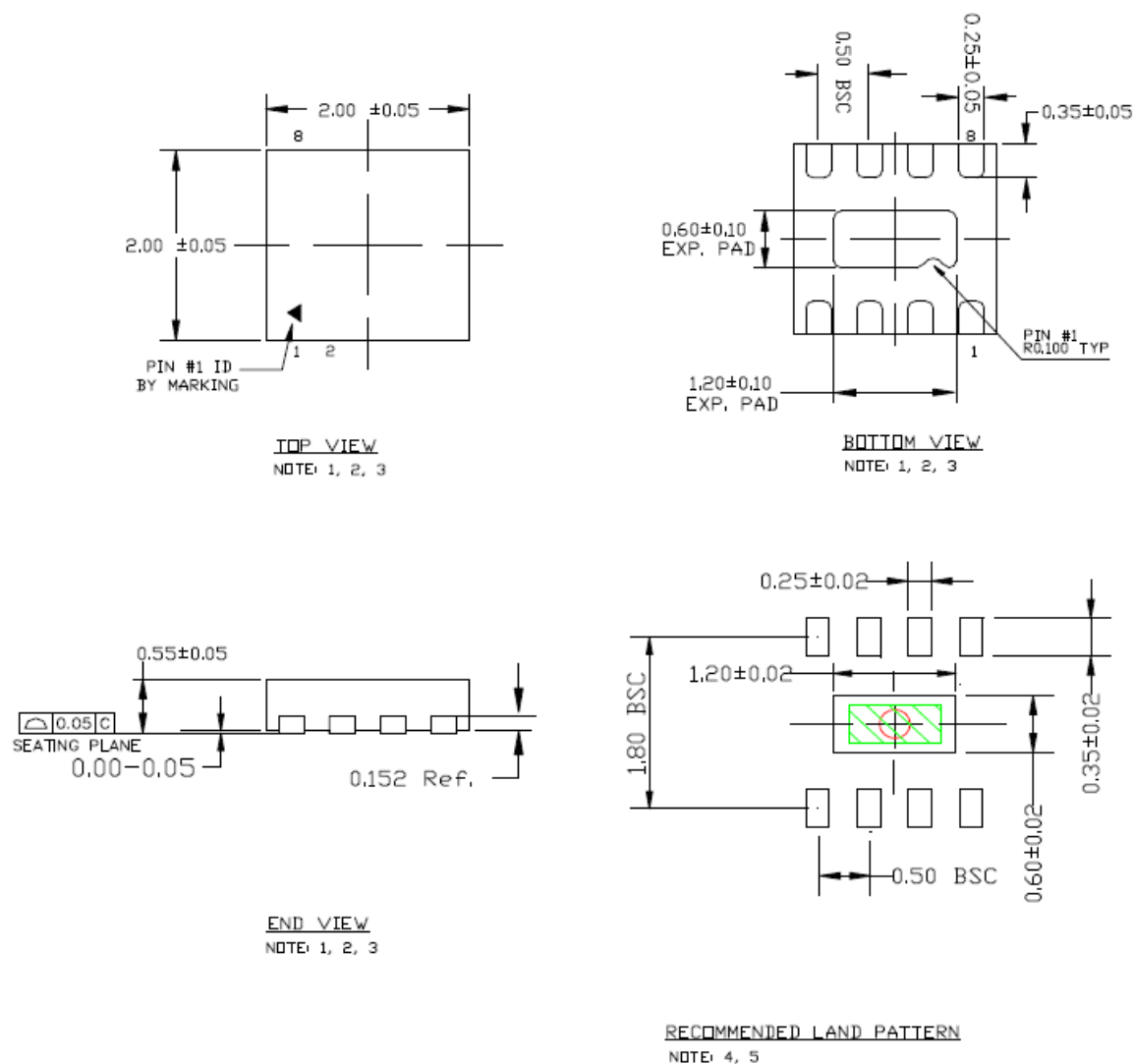
RECOMMENDED LAND PATTERN
NOTE: 4, 5

NOTE:

1. MAX PACKAGE WARPAGE IS 0.08 MM
2. MAX ALLOWABLE BURR IS 0.076MM IN ALL DIRECTIONS
3. PIN #1 IS ON TOP WILL BE LASER MARKED
4. RED CIRCLE IN LAND PATTERN REPRESENTS THERMAL VIA. SIZE SHOULD BE 0.30-0.3 MM IN DIAMETER AND SHOULD BE CONNECTED TO GND FOR MAX THERMAL PERFORMANCE
5. GREEN RECTANGLES (SHADED AREA) REPRESENTS SOLDER STENCIL OPENING ON EXPOSED PAD AREA. SIZE SHOULD BE 1.10x0.60 MM.

6-pin 2mm × 2mm TDFN (MT)

Package Information⁽¹⁴⁾ and Recommended Land Pattern (2mm × 2mm TDFN-8L)



- NOTE:
1. MAX PACKAGE WARPAGE IS 0.05 MM
 2. MAX ALLOWABLE BURR IS 0.076MM IN ALL DIRECTIONS
 3. PIN #1 IS ON TOP WILL BE LASER MARKED
 4. RED CIRCLE IN LAND PATTERN REPRESENTS THERMAL VIA, SIZE SHOULD BE 0.30-0.3 MM IN DIAMETER AND SHOULD BE CONNECTED TO GND FOR MAX THERMAL PERFORMANCE
 5. GREEN RECTANGLES (SHADED AREA) REPRESENTS SOLDER STENCIL OPENING ON EXPOSED PAD AREA, SIZE SHOULD BE 0.40x0.90 MM.

8-pin 2mm × 2mm TDFN (MT)

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Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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