VC-801

CMOS Crystal Oscillator
Previous Vectron Model VCC4

Description

Vectron's VC-801 Crystal Oscillator (XO) is a quartz stabilized square wave generator with a CMOS output. The VC-801 uses fundamental or 3rd overtone crystals resulting in very low jitter performance, and a monolithic IC which improves reliability and reduces cost.

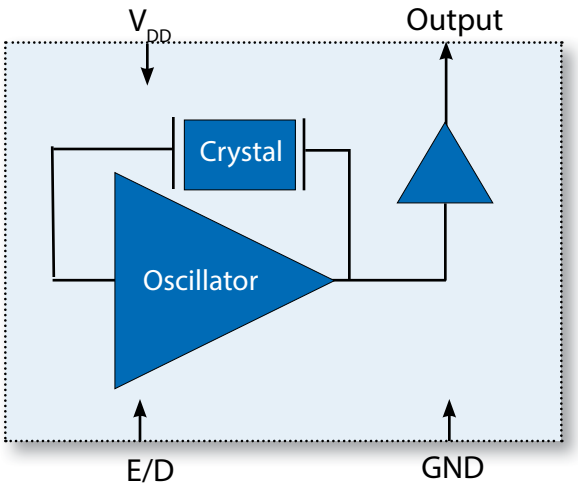
Features

- CMOS output XO
- Output Frequencies from 32.768kHz to 125.000MHz
- 5.0, 3.3, 2.5 or 1.8 V Operation
- Low Jitter Performance
- Output Disable Feature
- ±20ppm Frequency Stability Available
- Operating Temperature ranging from -55°C to +125°C
- Small Industry Standard Package, 3.2 x 5.0 x 1.3mm
- Product is compliant to RoHS directive and fully compatible with lead free assembly

Applications

- SONET/SDH/DWDM
- Ethernet, GE, SynchE
- Storage Area Networking
- Fiber Channel
- Digital Video
- Broadband Access
- Base Stations, Picocells

Block Diagram



Specifications

Table 1. Electrical Performance, 5V Option

Parameter	Symbol	Min	Typical	Max	Units
Supply Voltage					
Voltage[1]	V_{DD}	4.5	5.0	5.5	V
Max Voltage		-0.7		7	V
Current[2] ≤20.000MHz 20.001 to 50.000MHz 50.001 to 75.000MHz	I_{DD}			 10 30 40	 mA mA mA
Current, Output Disabled				30	uA
Frequency					
Nominal Frequency[3]	f_N	1.544		75.000	MHz
Stability[4,8] (Ordering Option)		±20, ±25, ±32, ±50, ±100			ppm
Output					
Output Logic Levels[2] Output Logic High Output Logic Low Output Logic High Drive Output Logic Low Drive	 V_{OH} V_{OL} I_{OH} I_{OL}	 0.9*V_{DD} 16 16		 0.1*V_{DD} 	 V V mA mA
Load				15	pF
Output Rise /Fall Time[2] <20.000MHz 20.000 to 50.000MHz 50.001 to 75.000MHz	t_R/t_F			 8 5 2	 ns ns ns
Output Leakage, Output Disabled	I_Z			±10	uA
Duty Cycle[2,5]		45	50	55	%
Period Jitter[6] RMS Peak-Peak	ϕJ		 3.0 21		 ps ps
RMS Jitter, 12kHz-20MHz	ϕJ		0.5	1	ps
Enable/Disable					
Output Enable/Disable[7] Output Enable Output Disable	 V_{IH} V_{IL}	 4.0		 0.8	 V V
Disable time	t_D			100	ns
Enable Internal Pull-Up Resistor			100		Kohm
Start-Up Time	t_{SU}			8	ms
Operating Temp (Ordering Option)	T_{OP}	-10/70, -20/70, -40/85, -40/105, -40/125, -55/105, -55/125			°C

1] The power supply should have by-pass capacitors as close to the supply and to ground as possible, for example 0.1 and 0.01uF.
2] Parameters are tested with the test circuit shown in Fig 1.
3] See Standard Frequencies and Ordering Information tables for more specific information.
4] Includes initial accuracy, operating temperature, supply voltage, shock and vibration (not under operation) and aging for ±50 and ±100ppm options.
5] Duty Cycle is measured as On Time/Period, see Fig 2.
6] Broadband Period Jitter measured using Wavecrest SIA3300C, 90K samples, see Application Note for Typical Phase Noise and Jitter Performance.
7] The Output is Enabled if the Enable/Disable is left open.
8] Only ±50 and ±100 stability option available for -40/105 °C, -40/125 °C, -55/105 °C and -55/125 °C Operating temperature range.

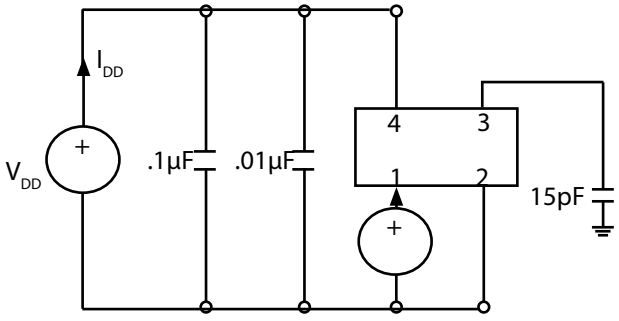


Fig 1: Test Circuit

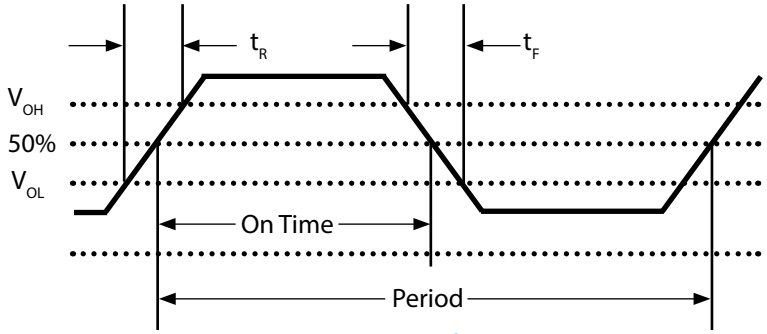


Fig 2: Waveform

Specifications

Table 2. Electrical Performance, 3.3V Option

Parameter	Symbol	Min	Typical	Max	Units
Supply Voltage					
Voltage[1]	V_{DD}	2.97	3.30	3.63	V
Max Voltage		-0.5		5.0	V
Current[2]	I_{DD}				
32.768kHz to 1.499MHz				5	mA
1.500 to 20.000 MHz				7	mA
20.001 to 50.000MHz				20	mA
50.001 to 100.000MHz				30	mA
100.001 to 125.000MHz				40	mA
Current, Output Disabled				30	uA
Frequency					
Nominal Frequency[3]	f_N	0.032		125.000	MHz
Stability[4,8] (Ordering Option)		±20, ±25, ±32, ±50, ±100			ppm
Output					
Output Logic Levels[2]					
Output Logic High	V_{OH}	0.9*V_{DD}			V
Output Logic Low	V_{OL}			0.1*V_{DD}	V
Output Logic High Drive	I_{OH}	8			mA
Output Logic Low Drive	I_{OL}	8			mA
Load				15	pF
Output Rise /Fall Time[2]	t_R/t_F				
32.768kHz to 345.6kHz				200	ns
345.6kHz to 20.000MHz				6	ns
20.001 to 50.000MHz				4	ns
50.001 to 75.000MHz				3	ns
75.001 to 125.000MHz				2	ns
Output Leakage, Output Disabled	I_Z			±10	uA
Duty Cycle[2,5]		45	50	55	%
Period Jitter[6]	ϕJ				
RMS			3.0		ps
Peak-Peak			21		ps
RMS Jitter, 12kHz-20MHz	ϕJ		0.5	1	ps
Enable/Disable					
Output Enable/Disable[7]					
Output Enable	V_{IH}	2.0			V
Output Disable	V_{IL}			0.5	V
Disable time	t_D			100	ns
Enable Internal Pull-Up Resistor			100		Kohm
Start-Up Time	t_{SU}			8	ms
Operating Temp (Ordering Option)	T_{OP}	-10/70, -20/70, -40/85, -40/105, -40/125, -55/105, -55/125			°C

1] The power supply should have by-pass capacitors as close to the supply and to ground as possible, for example 0.1 and 0.01uF.
2] Parameters are tested with the test circuit shown in Fig 1.
3] See Standard Frequencies and Ordering Information tables for more specific information.
4] Includes initial accuracy, operating temperature, supply voltage, shock and vibration (not under operation) and aging for ±50 and ±100ppm options.
5] Duty Cycle is measured as On Time/Period, see Fig 2.
6] Broadband Period Jitter measured using Wavecrest SIA3300C, 90K samples, see Application Note for Typical Phase Noise and Jitter Performance.
7] The Output is Enabled if the Enable/Disable is left open.
8] Only ±50 and ±100 stability option available for -40/105 °C, -40/125 °C, -55/105 °C and -55/125 °C Operating temperature range.

Specifications

Table 3. Electrical Performance, 2.5V Option

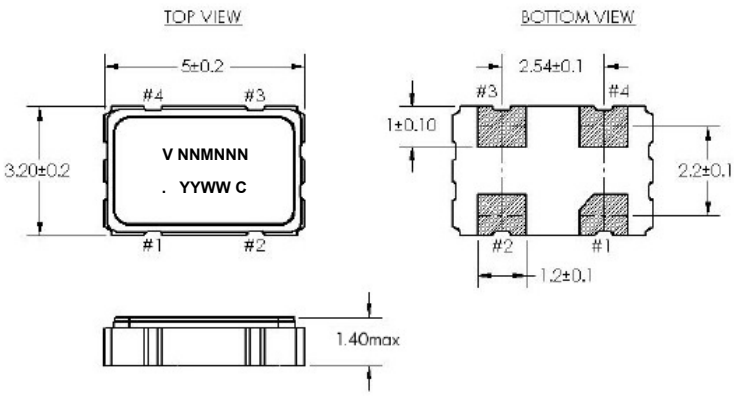
Parameter	Symbol	Min	Typical	Max	Units
Supply Voltage					
Voltage[1]	V_{DD}	2.25	2.50	2.75	V
Max Voltage		-0.5		5.0	V
Current[2]	I_{DD}				
32.768kHz to 1.499MHz				5	mA
1.500 to 20.000 MHz				7	mA
20.001 to 50.000MHz				15	mA
50.001 to 75.000MHz				20	mA
75.001 to 100.000MHz				25	mA
100.001 to 125.000MHz				30	mA
Current, Output Disabled				30	uA
Frequency					
Nominal Frequency[3]	f_N	0.032		125.000	MHz
Stability[4,9] (Ordering Option)		±20, ±25, ±32, ±50, ±100			ppm
Output					
Output Logic Levels[2]					
Output Logic High	V_{OH}	0.9*V_{DD}			V
Output Logic Low	V_{OL}			0.1*V_{DD}	V
Output Logic High Drive	I_{OH}	4			mA
Output Logic Low Drive	I_{OL}	4			mA
Output Logic High Drive[8]	I_{OH}	8			mA
Output Logic Low Drive[8]	I_{OL}	8			mA
Load	I_{OUT}			15	pF
Output Rise /Fall Time[2]	t_R/t_F				
32.768kHz to 345.6kHz				200	ns
345.6kHz to 20.000MHz				6	ns
20.001 to 50.000MHz				5	ns
50.001 to 75.000MHz				3	ns
75.001 to 125.000MHz				2	ns
Output Leakage, Output Disabled	I_Z			±10	uA
Duty Cycle[2,5]		45	50	55	%
Period Jitter[6]	ϕJ				
RMS			3.0		ps
Peak-Peak			21		ps
RMS Jitter, 12kHz-20MHz	ϕJ		0.5	1	ps
Enable/Disable					
Output Enable/Disable[7]					
Output Enable	V_{IH}	1.75			V
Output Disable	V_{IL}			0.5	V
Disable time	t_D			100	ns
Enable Internal Pull-Up Resistor			100		Kohm
Start-Up Time	t_{SU}			8	ms
Operating Temp (Ordering Option)	T_{OP}	-10/70, -20/70, -40/85, -40/105, -40/125, -55/105, -55/125			°C

1] The power supply should have by-pass capacitors as close to the supply and to ground as possible, for example 0.1 and 0.01uF.
2] Parameters are tested with the test circuit shown in Fig 1.
3] See Standard Frequencies and Ordering Information tables for more specific information.
4] Includes initial accuracy, operating temperature, supply voltage, shock and vibration (not under operation) and aging for ±50 and ±100ppm options.
5] Duty Cycle is measured as On Time/Period, see Fig 2.
6] Broadband Period Jitter measured using Wavecrest SIA3300C, 90K samples, see Application Note for Typical Phase Noise and Jitter Performance.
7] The Output is Enabled if the Enable/Disable is left open.
8] For 3rd overtone crystal designs.
9] Only ±50 and ±100 stability option available for -40/105 °C, -40/125 °C, -55/105 °C and -55/125 °C Operating temperature range.

Table 4. Electrical Performance, 1.8V Option					
Parameter	Symbol	Min	Typical	Max	Units
Supply Voltage					
Voltage[1]	V_{DD}	1.71	1.80	1.89	V
Max Voltage		-0.5		3.6	V
Current[2] 1.544 to 20.000 MHz 20.001 to 70.000MHz 70.001 to 100.000MHz 100.001 to 125.000MHz	I_{DD}			 5 15 20 25	 mA mA mA mA
Current, Output Disabled				30	uA
Frequency					
Nominal Frequency[3]	f_N	1.544		125.000	MHz
Stability[4,9] (Ordering Option)		±20, ±25, ±32, ±50, ±100			ppm
Output					
Output Logic Levels[2] Output Logic High Output Logic Low Output Logic High Drive Output Logic Low Drive Output Logic High Drive[8] Output Logic Low Drive[8]	 V_{OH} V_{OL} I_{OH} I_{OL} I_{OH} I_{OL}	 0.9*V_{DD} 2.8 2.8 8 8		 0.1*V_{DD}	 V V mA mA mA mA
Load				15	pF
Output Rise /Fall Time[2] 1.544 to 20.000MHz 20.001 to 50.000MHz 50.001 to 125.000MHz	t_R/t_F			 6 5 3	 ns ns ns
Output Leakage, Output Disabled	I_Z			±10	uA
Duty Cycle[2,5]		45	50	55	%
Period Jitter[6] RMS Peak-Peak	ϕJ		 3.0 21		 ps ps
RMS Jitter, 12kHz-20MHz	ϕJ		0.5	1	ps
Enable/Disable					
Output Enable/Disable[7] Output Enable Output Disable	 V_{IH} V_{IL}	 1.26		 0.5	 V V
Disable time	t_D			100	ns
Enable Internal Pull-Up Resistor			1		Mohm
Start-Up Time	t_{SU}			8	ms
Operating Temp (Ordering Option)	T_{OP}	-10/70, -20/70, -40/85, -40/105, -40/125, -55/105, -55/125			°C

1] The power supply should have by-pass capacitors as close to the supply and to ground as possible, for example 0.1 and 0.01uF.
2] Parameters are tested with the test circuit shown in Fig 1.
3] See Standard Frequencies and Ordering Information tables for more specific information.
4] Includes initial accuracy, operating temperature, supply voltage, shock and vibration (not under operation) and aging for ±50 and ±100ppm options.
5] Duty Cycle is measured as On Time/Period, see Fig 2.
6] Broadband Period Jitter measured using Wavecrest SIA3300C, 90K samples, see Application Note for Typical Phase Noise and Jitter Performance.
7] The Output is Enabled if the Enable/Disable is left open.
8] For 3rd overtone crystal designs.
9] Only ±50 and ±100 stability option available for -40/105 °C, -40/125 °C, -55/105 °C and -55/125 °C Operating temperature range.

Outline Drawing & Pad Layout



All dimensions in mm

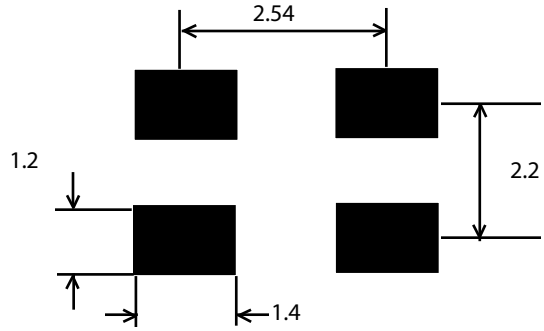


Table 5. Pin Out

Pin	Symbol	Function
1	E/D	Enable Disable
2	GND	Case and Electrical Ground
3	Output	Output
4	V_{DD}	Power Supply Voltage

Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VC-801 family is capable of meeting the following qualification tests:

Table 6. Environmental Compliance

Parameter	Conditions
Mechanical Shock	MIL-STD-883, Method 2002
Mechanical Vibration	MIL-STD-883, Method 2007
Solderability	MIL-STD-883, Method 2003
Gross and Fine Leak	MIL-STD-883, Method 1014
Resistance to Solvents	MIL-STD-883, Method 2015
Moisture Sensitivity Level	MSL 1
Contact Pads	Gold over Nickel

Although ESD protection circuitry has been designed into the VC-801 proper precautions should be taken when handling and mounting. VI employs a human body model (HBM) and a charged device model (CDM) for ESD susceptibility testing and design protection evaluation.

Table 7. ESD Ratings

Model	Minimum	Conditions
Human Body Model	1500V	MIL-STD-883, Method 3015
Charged Device Model	1000V	JESD22-C101

Stresses in excess of the absolute maximum ratings can permanently damage the device. Functional operation is not implied at these or any other conditions in excess of conditions represented in the operational sections of this datasheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability. Permanent damage is also possible if E/D is applied before V_{DD}.

Table 8. Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Storage Temperature	T_S	-55 to 125	°C
Soldering Temp/Time	T_{LS}	260 / 30	°C / sec

IR Reflow

The VC-801 is qualified to meet the JEDEC standard for Pb-Free assembly. The temperatures and time intervals listed are based on the Pb-Free small body requirements. The VC-801 device is hermetically sealed so an aqueous wash is not an issue.

Solderprofile:

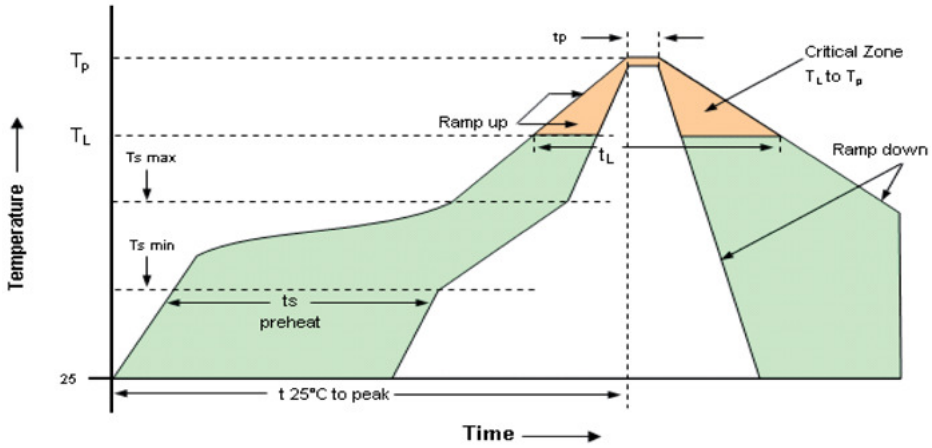


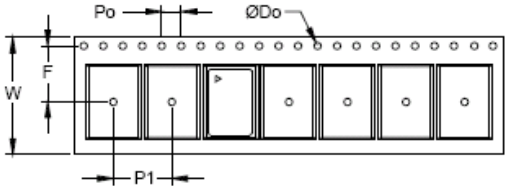
Table 9. Reflow Profile

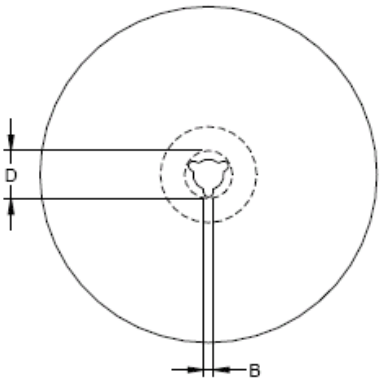
Parameter	Symbol	Value
PreHeat Time Ts-min Ts-max	t_S	60 sec Min, 260 sec Max 150°C 200°C
Ramp Up	R_{UP}	3 °C/sec Max
Time Above 217 °C	t_L	60 sec Min, 150 sec Max
Time To Peak Temperature	T_{AMB-P}	480 sec Max
Time at 260 °C	t_P	30 sec Max
Ramp Down	R_{DN}	6 °C/sec Max

Tape and Reel

Table 10 . Tape and Reel Dimensions

Tape Dimensions (mm)						Reel Dimensions (mm)							
Dimension	**W**	**F**	**Do**	**Po**	**P1**	**A**	**B**	**C**	**D**	**N**	**W1**	**W2**	**# Per Reel**
Tolerance	**Typ**	**Typ**	**Typ**	**Typ**	**Typ**	**Typ**	**Min**	**Typ**	**Min**	**Min**	**Typ**	**Max**	
VC-801	16	7.5	1.5	4	8	180	2	13	21	60	17	21	1000





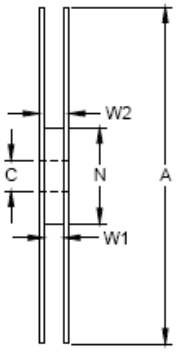


Table 11. Standard Output Frequencies (MHz)							
9.8304	10.000	11.0590	11.0596	11.2896	12.000	12.272	12.288
12.353	13.000	13.500	13.560	14.318	14.7456	16.000	16.376
16.384	16.777216	16.800	17.734	17.734475	18.432	19.440	19.660
19.800	20.000	20.480	22.000	22.5792	24.000	24.5453	24.576
25.000	26.000	27.000	27,120	28.686	28.375	30.000	32.000
32.768	33.000	33.333	34.368	36.000	37.056	47.500	40.000
42.500	44.000	44.736	48.000	48.090	50.000	54.000	60.000
62.500	66.000	66.666	75.000	80.000	100.000	125.000	

Ordering Information

VC-801- E A W- K A A N- xxMxxxxxx

Product
Crystal Oscillator

Package
3.2x5 Ceramic

Power Supply
D: +5.0Vdc
E: +3.3Vdc
H: +2.5Vdc
J: +1.8Vdc

Output
A: CMOS

Temp Range
W: -10/70°C
J: -20/70°C
E: -40/85°C
F: -40/105°C (±50 and ±100ppm)
7: -40/125°C (±50 and ±100ppm)
B: -55/105°C (±50 and ±100ppm)
C: -55/125°C (±50 and ±100ppm)

Stability
E: ±20ppm
F: ±25ppm
H: ±32ppm
K: ±50ppm
S: ±100ppm

Enable/Disable
A: Enable/Disable, Enable High

Load
A: 15pF
B: 30pF
C: 50pF

Custom Options
N: Standard Option

Frequency
M for MHz or
K for kHz (32.768 kHz is available)

Example: VC-801-EAW-KAAN-125M000000

**Note: not all combination of options are available. Other specifications may be available upon request. Please consult with factory.*

* Add **_SNPBDIP** for tin lead solder dip
Example: VC-801-EAW-KAAN-125M000000_SNPBDIP

Revision History

Revision Date	Approved	Description
October 17, 2014	VN	Modified package drawing to reflect 1.40mm maximum height. Added Revision History Table.
January 20, 2015	VN	Included ordering options for -40/105°C, -40/125°C and -55/105°C Operating temperature ranges
August 10, 2018	FB	Update log and ordering information, Add SNPBDIP ordering information,

Microsemi, a wholly owned subsidiary of Microchip Technology Inc. (Nasdaq: MCHP), offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Learn more at www.microsemi.com.

Microsemi Headquarters
One Enterprise, Aliso Viejo, CA 92656 USA
Within the USA: +1 (800) 713-4113
Outside the USA: +1 (949) 380-6100
Sales: +1 (949) 380-6136
Fax: +1 (949) 215-4996
email: sales.support@microsemi.com
www.microsemi.com