REV LTR	DESCRIPTION	DATE	APPVD.
-	Orig. Release	4/12/22	MLG

XE64N SERIES

(XE64N-N00, XE64N-L00, XE64N-A00)

HC/ACMOS OSCILLATORS

FOR SPACE & HI-REL APPLICATIONS

450 KHz to 125 MHz

(7 x 9 mm, J-Leads, SMD, 2.5V, 3.3V & 5.0V)

QCI & SCREENING PER EEE-INST-002

(Refer to Page 5 for Reduced QCI Models XE64E, XE64B & XE64P)

REV STATUS OF SHEETS	REV																
	SHEET NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

APPROVALS	DATE	XSIS ELECTRONICS, INC. 12620 W. 63rd Street, Shawnee, KS 66216 USA	
PREP. S. Gupta	4/12/22	XE64N SERIES HC/ACMOS OSCILLATORS	
ENG. M. Gupta	4/12/22		
Q. A. M. Gupta	4/12/22		
CUST. ENG.		FSC NO. 57051	DWG. NO. XE64N
CUST Q A.		SCALE N/A	SHEET 1 OF 10

1. SCOPE:

XE64N Series, HC/ACMOS, high reliability hybrid microcircuit crystal oscillators are designed, produced and tested by Xsis Electronics, Inc. as MIL-PRF-55310, Class "S" equivalent devices for use in high reliability industrial, military, avionics and space applications. These devices are of hybrid microcircuit technology conforming to MIL-PRF-55310, Type 1, Class 2 oscillators.

100% Screening and QCI are performed per **EEE-INST-002.**

1.1 ALTERNATE MODELS: Alternate models, **XE64E, XE64B and XE64P** with reduced QCI and/or reduced screening and shorter lead times are also offered as explained on page 5.

2. APPLICABLE DOCUMENTS:

MIL-PRF-55310F	Oscillator, Crystal Controlled, General Specifications for
MIL-PRF-38534K	Hybrid Microcircuits, General Specifications for
MIL-STD-883L	Test Methods and Procedures for Microelectronics
EEE-INST-002	Instructions for EEE Parts Selection, Screening, Qualification and Derating

3. REQUIREMENTS:

3.1 General: The individual item requirements shall be as specified herein.

3.2 Package: Ceramic, 90% Min. AL_2O_3., Weight: 0.6 Gms Max., Thermal Resistance, θ_{JC}: 28 °C / Watt.

3.2.1 Lead Material & Finish: Kovar, 50 to 70 micro-inches gold over 100 to 250 micro-inches nickel. Hot Solder tinning with Sn63/Pb37 solder per MIL-PRF-55310 is optional at an additional cost.

3.2.2 Reflow Soldering: Reflow soldering at 260 °C for 10 seconds shall not degrade the performance.

3.3 Hermeticity: Resistance welded, hermetically sealed, leak rate of $1(10)^{-8}$ atm-cc/s Max.

3.4 Marking: As a minimum, the parts shall be marked with Xsis P/N, ESD symbol, date code and serial number.

3.5 Absolute Maximum Ratings: Unless otherwise specified, absolute maximum ratings shall be as follows:

Supply Voltage	Refer to Table I
Operating Free-Air Temperature Range	-55°C to +125°C
Storage Temperature	-55°C to +125°C

3.6 Electrical Characteristics: See Table I

3.6.1 Total Dose Radiation: Hybrid Microcircuit Crystal Oscillators shall be capable of meeting the electrical characteristics of Para. 3.6 after being exposed to total ionizing dose radiation of 100 krads as per MIL-STD-883, method 1019.

3.7 Hybrid Elements:

3.7.1 Quartz Crystals: A high-grade cultured quartz crystal shall be used. As an option, Xsis will use premium Q swept quartz crystal at an additional charge, refer to part numbering example in paragraph 6 to specify swept quartz crystal. Crystal element evaluation shall be in accordance with MIL-PRF-55310.

3.7.2 Crystal Mounting: The Crystal element shall be mounted at 4 points in such a manner as to provide adequate ruggedness and performance under extreme environments specified herein.

3.7.3 Passive Elements: Established Reliability (ER) QPL components, failure level R minimum shall be used or element lot evaluation shall be as per MIL-PRF-55310, class S, or MIL-PRF-38534, Appendix C, Class K as applicable.

3.7.4 Microcircuit die shall be from lots that have passed the element evaluation per MIL-PRF-38534, Level K. In addition, ionizing radiation testing shall be performed at the oscillator level as explained in paragraph 3.7.5 herein.

3.7.5 For Output Frequencies up to 70 MHz for 2.5V parts, and up to 90 MHz for 3.3V & 5.0V parts, the microcircuit die shall be from NSC/FC 54ACT family. For higher output frequencies, the microcircuit die shall be from 0.8 µm BiCMOS Si family. The Microcircuit die shall be from wafer lots that have been successfully tested in the oscillator for ionizing radiation up to 100 krads. Xsis Electronics has also performed SET & SEL testing on both types of microcircuit die stated above. Both die are SEL immune for LET of up to 95 Mev-cm2/mg. Test reports are available on request.

3.7.6 Workmanship: Assembly, Rework and Process controls shall be in accordance with the requirements of MIL-PRF-55310 & MIL-PRF-38534 as applicable.

3.7.7 Lot Traceability: Production lot for these oscillators shall be homogenous. Each element used in the production lot shall be traceable to a single lot. Swept quartz shall be traceable to the quartz bar, and its applicable processing details.

3.7.8 Prohibited Materials: The following items shall not be used in these oscillators: Pure Tin (Sn >97%), Cadmium, Zinc, Mercury, Selenium, Silver as under plate, and Gold Plating without a nickel barrier.

3.7.9 Element Derating: All active and passive elements shall be derated in accordance with the applicable Hybrid microcircuit requirements of MIL-STD-975. Elements shall not operate in access of derated values.

3.7.10 Material Outgassing: All materials shall meet a TML of 1% Max. and a CVCM of 0.1% Max., when tested in accordance with ASTM E595.

4. QUALITY ASSURANCE PROVISIONS: The quality assurance provisions shall be as specified herein.

4.1 100% Screening: The 100% screening shall be performed in accordance with EEE-INST-002 and as specified in Table II. In addition, MIL-PRF-38534 Group B Option 1 in-line inspection for bond strength and die shear shall be performed at pre-seal inspection. PDA requirements for nondestructive bond pull, burn-in and frequency aging shall be as specified below.

4.2 PDA for Non-destruct Bond Pull: Unless otherwise specified, PDA shall be 2% of total number of wires or 1 wire whichever is greater.

4.3 PDA for Burn-in and Frequency Aging Failures: Unless otherwise specified, PDA for burn-in failures, applicable to +23 °C and/or +25 °C static tests only, and frequency aging failures combined shall be 5% or 1 part whichever is greater. In addition, delta calculations for input current shall be performed after burn-in at the specified nominal supply voltage. All parts that exceed the specified limits below shall be rejected and be counted for PDA.

Input Current	10% change Maximum
Frequency Aging/30 days	Refer to the specified limit in Table I

4.4 Qualification Inspection: Devices shall be capable of meeting the qualification inspection shown in Table III. When required by the purchase order, qualification inspection shall be performed as per Table III on sample units selected from the units that have successfully passed 100% screening specified herein. Number of sample units shall be as specified in Table III. With customer approval, generic qualification inspection data on similar parts may be used to satisfy this requirement, except for Subgroup 5 which needs to be performed on a lot specific basis unless otherwise specified by the customer.

4.5 DPA: When required by the purchase order, Destructive physical analysis as per GFSC S-311-M-70 shall be performed on a number of sample units as required by the purchase order by a laboratory approved by the customer.

4.6 Inspection and Test Data: Unless otherwise specified in the purchase order, the following Inspection and test data documentation shall be supplied with the parts.

(See Page 5 for the description of the Model Numbers XE64E, XE64B & XE64P)

Model XE64N:

Certificate of Conformance
Summary of Screening Test Results per Table II
PDA Calculations for Non-Destruct Bond Pull and Burn-in
Summary of Elements Lot Traceability
Electrical Tests data taken during 100% screening
Radiographic Inspection Certificate
Qualification data if required by the purchase order
DPA report if required by the purchase order
Qualification and DPA test samples as applicable

Model XE64E:

Certificate of Conformance
Summary of Screening Test Results per Table IV
Summary of Elements Lot Traceability
Group A per MIL-PRF-55310 Inspection Summary
Radiographic Inspection Certificate

Model XE64B:

Certificate of Conformance
Summary of Screening Test Results per Table IV
Group A per MIL-PRF-55310 Inspection Summary
Radiographic Inspection is not applicable, unless required by the Purchase Order, at additional cost.

Model XE64P:

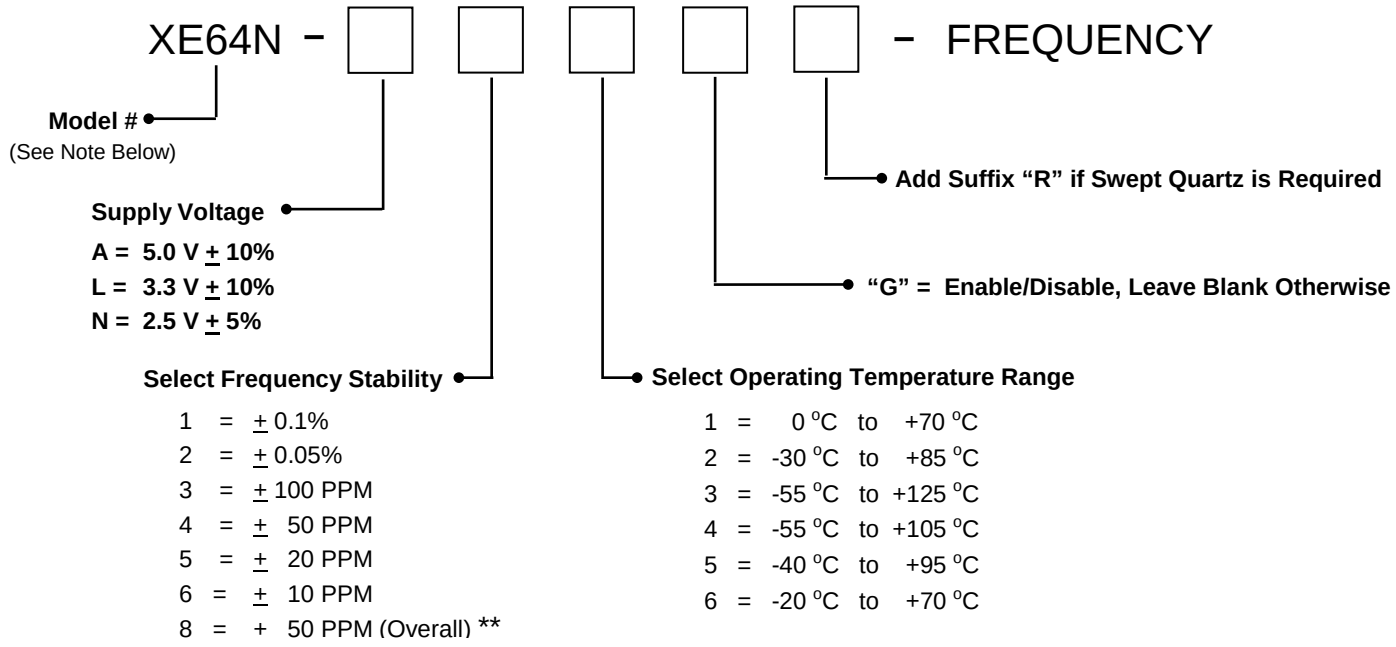
Certificate of Conformance

4.7 The following test and inspection options are available at customer request.

Customer Source Inspection for Pre-Cap and Final
DPA (Destructive Physical Analysis)
Qualification Inspection per Table III

5. PRESERVATION, PACKAGING AND PACKING: The oscillators shall be clean, dry and packaged in a manner to provide adequate protection against electrostatic discharge, corrosion, deterioration and physical damage during shipment.

6. PART NUMBERING EXAMPLE:



**** Option 8 provides ± 50 PPM frequency-temperature stability referenced to the specified nominal frequency including load & supply voltage variations of ± 10%.**

(Frequency Stability Options 5 & 6 are not available for all Temperature Range Options **)**

P/N Example: XE64N - L43 - 24.000 MHz = 24.000 MHz, 3.3V Oscillator, ± 50 PPM Frequency Stability over an operating temperature range of -55 °C to +125 °C.

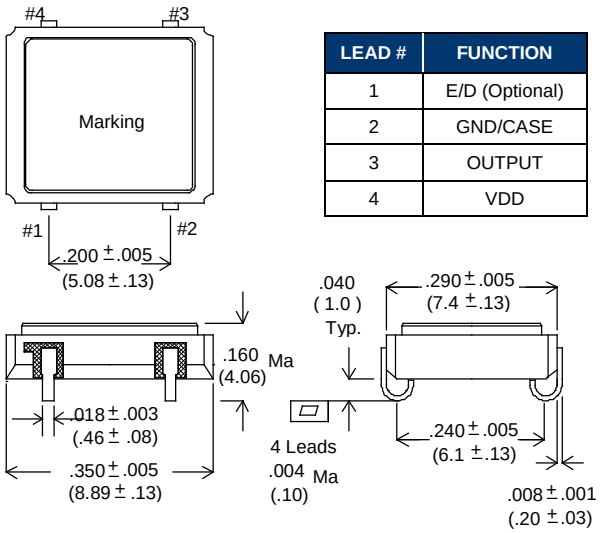
NOTE: Besides model **XE64N** above, the following additional models are available for applications that can accommodate reduced level of Elements, Screening and Quality Conformance inspection:

XE64E: **Model XE64E** uses the same design and elements as **Model XE64N** except as follows:
100% screening is as per Table IV herein
PDA for Burn-in is 10% or 1 unit whichever is greater
Delta measurements of paragraph 4.3 are not applicable
Group A inspection is as per MIL-PRF-55310, Class B

XE64B: **Model XE64B** is same as **Model XE64E** except as follows:
Active and Passive Elements are as per MIL-PRF-55310, Class B. Microcircuit die is similar to the one used in Model **XE64N** but is not from radiation tested wafer lot.
Radiographic Inspection is not applicable, unless required by the purchase order.

XE64P: **Model XE64P** is a form, fit and function equivalent prototype of **Model XE64N.**
Prototypes may use commercial grade elements.
100% screening and quality conformance inspection are not applicable.

7. PACKAGE OUTLINE:



LEAD #	FUNCTION
1	E/D (Optional)
2	GND/CASE
3	OUTPUT
4	VDD

Dimensions: Inches (mm).

E/D (Enable/Disable) Input: A "Low" level at the input disables the Output into a high impedance state.

E/D Input has internal pull-up, it can be left floating or connected to Vdd.

Figure 1 - Package Configuration & Pin Connections

TABLE I – Electrical Characteristics

Parameter	Spec. Limits		
	"N"	"L"	"A"
Frequency Range	450 KHz to 120 MHz	450 KHz to 125 MHz	450 KHz to 90 MHz
Input Voltage	+ 2.5 VDC ± 10%	+ 3.3 VDC ± 10%	+ 5 VDC ± 10%
Absolute Max. Applied Voltage	+ 5.0 VDC	+ 5.0 VDC	+ 7.0 VDC
Frequency Accuracy at 23°C	± 15 PPM Max.		
Freq. Stability Vs. Temperature	See Options in Paragraph 6.0		
Operating Temperature Range	See Options in Paragraph 6.0		
Input Current (no load)	2.5 mA Max. 450KHz - 5MHz 4 mA Max. 5MHz - 10MHz 6 mA Max. 10MHz - 20MHz 8 mA Max. 20MHz - 30MHz 12 mA Max. 30MHz - 40MHz 16 mA Max. 40MHz - 50MHz 25 mA Max. 50MHz - 70MHz 35 mA Max. 70MHz - 120MHz	3 mA Max. 450KHz - 5MHz 5 mA Max. 5MHz - 10MHz 8 mA Max. 10MHz - 20MHz 10 mA Max. 20MHz - 30MHz 15 mA Max. 30MHz - 40MHz 20 mA Max. 40MHz - 50MHz 35 mA Max. 50MHz - 100MHz 40 mA Max. 100MHz - 125MHz	5 mA Max. 450KHz - 5MHz 10 mA Max. 5MHz - 10MHz 20 mA Max. 10MHz - 20MHz 25 mA Max. 20MHz - 30MHz 30 mA Max. 30MHz - 40MHz 35 mA Max. 40MHz - 50MHz 50 mA Max. 50MHz - 90MHz
Output Waveform	Square Wave, HC/ACMOS		
Output Duty Cycle (at 50% Output Levels)	55/45% Max		
Output Load	10K || 15 pF		
High Output Level	0.9 VDD Min		
Low Output Level	0.1 VDD Max.		
Enable/Disable (Option G)	≥ 0.7Vdd or Open:Normal Output, ≤ 0.3 Vdd: High Impedance	≥ 2.2 V or Open:Normal Output, < 0.8 V High Impedance	
Rise & Fall Times (at 10 to 90% Output Levels)	5 nS Max Frequency ≤ 25 MHz 4 nS Max. Freq. 25.1 to 70 MHz 3 nS Max. Frequency > 70 MHz	5 nS Max. Frequency ≤ 25 MHz 4 nS Max. Freq. 25.1 to 45 MHz 3 nS Max. Frequency > 45 MHz	5 nS Max. Frequency ≤ 25 MHz 4 nS Max. Freq. 25.1 to 45 MHz 3 nS Max. Frequency > 45 MHz
Start-up Time	10 mS Max.		
Phase Jitter	0.3 pS rms typ, (10 KHz to 20 MHz Integrated)		
Frequency Stability Vs. Voltage	± 4 PPM Max for ± 10% change in Supply Voltage		
Frequency Aging @ 70°C	± 1.5 PPM Max./30 days, ± 5 PPM Max. First Year, ± 2.5 PPM Max. / Year thereafter		

Contact Xsis Engineering for any other special requirements.

Table II - Model XE64N, Screening (100%)

Test - Inspection	Test Method – Condition
Nondestructive Bond Pull	MIL-STD-883, Method 2023
Internal Visual	MIL-STD-883, Method 2017, Level S
Stabilization Bake (Prior to Seal) 1/	MIL-STD-883, Method 1008, Condition C (+150 °C), 48 hours minimum
Thermal Shock	MIL-STD-883, Method 1011, Condition A
Temperature Cycling	MIL-STD-883, Method 1010, Condition C
Constant Acceleration	MIL-STD-883, Method 2001, Condition A Y_1 axis only (5000 G)
Seal (Fine and Gross Leak)	MIL-STD-883, Method 1014, Cond. A or B for Fine Leak & Cond. C for Gross Leak
Particle Impact Noise Detection (PIND)	MIL-STD-883, Method 2020, Condition A
Radiographic Inspection Radiographic Inspection	MIL-STD-883, Method 2012, Class S
Pre Burn-in Electrical Tests: Record as applicable	Refer to Table II-a below
Burn-in	+125 °C, Nominal Supply Voltage and Burn-in load, 320 Hours Minimum
Post Burn-in Electrical Tests: Record as applicable	Refer to Table II-a below
Frequency Aging	MIL-PRF-55310, Para. 4.8.35
PDA Calculation	5% PDA
Additional Electrical Measurements	Refer to Table II-b
External Visual	MIL-STD-883, Method 2009

1/ Vacuum bake and maintain oscillators in dry nitrogen per MIL-PRF-55310.

Table II-a - Pre & Post Burn-in Electrical Tests

Test Parameter	MIL-PRF-55310 Method	Pre BI 24 ± 1 °C	Post BI 24 ± 1 °C	Post BI Low Temp	Post BI High Temp
Input Current	4.8.5	✓	✓	✓	✓
Output Frequency	4.8.6	✓	✓	✓	✓
Frequency Vs. Temperature Stability	4.8.10.1	✓	✓	✓	✓
Frequency Vs. Supply Voltage	4.8.14	✓	✓	✓	✓
Output Voltage Levels	4.8.21.3	✓	✓	✓	✓
Output Rise & Fall Times	4.8.22	✓	✓	✓	✓
Output Duty Cycle	4.8.23	✓	✓	✓	✓
Start-up time	4.8.29	✓	✓	✓	✓
Tristate, if applicable	4.8.28	✓	✓	✓	✓

Table II-b - Additional Electrical Measurements

Test Parameter	MIL-PRF-55310 Method	24 ± 1 °C	Low Temp	High Temp
Input Current	4.8.5	✓	✓	✓
Output Frequency	4.8.6	✓	✓	✓
Frequency Vs. Temperature Stability	4.8.10.1	Measure the output frequency at a minimum of 11 equispaced points over the specified operating temperature range.		
Frequency Vs. Supply Voltage	4.8.14	✓	✓	✓
Output Voltage Levels	4.8.21.3	✓	✓	✓
Output Rise & Fall Times	4.8.22	✓	✓	✓
Output Duty Cycle	4.8.23	✓	✓	✓
Start-up time	4.8.29	✓	✓	✓
Enable/Disable, if applicable	4.8.28	✓	✓	✓
Supply Voltage		✓		
Overvoltage Survivability		✓		

. Table III - Qualification Inspection 3/

Test / Inspection	Test Methods	Qty
Group 1 1/ Frequency Aging	MIL-PRF-55310, Para. 4.8.35	8(0)
Group 2 2/ Vibration (Sinusoidal, non-operating) Shock (Non-operating)	 MIL-STD-202, Method 204, Cond. G and MIL-PRF-55310, Para. 4.8.39.1 MIL-STD-202, Method 213, Cond. G and MIL-PRF-55310, Para. 4.8.41	8(0)
Group 3 2/ Thermal Shock	 MIL-STD-202, Method 107 and MIL-PRF-55310, Para. 4.8.45	4(0)
Group 4 2/ Resistance to Soldering Heat Moisture Resistance Terminal Strength Solderability Resistance to Solvents	 MIL-STD-202, Method 210 and MIL-PRF-55310, Para. 4.8.49 MIL-STD-202, Method 106 and MIL-PRF-55310, Para. 4.8.50 MIL-STD-883, Method 2004, Cond. D and MIL-PRF-55310, Para. 4.8.52 MIL-STD-202, Method 208, each pad MIL-STD-202, Method 215	2(0)
Group 5 Internal Water Vapor Content	 MIL-STD-883, Method 1018, 5000 PPM at 100 °C	5(1) or 3(0)

1/ Aging Data from Screening may be used in lieu of testing.

2/ Samples for this Subgroup come from Group 1 samples.

3/ Generic data less than 1 year old is acceptable as a basis for qualification if it satisfies the requirements specified herein, however, Subgroup 5 must be performed on a lot specific basis.

Table IV - Models XE64E & XE64B, Screening (100%)

Test - Inspection	Test Method – Condition
Nondestructive Bond Pull	MIL-STD-883, Method 2023
Internal Visual	MIL-STD-883, Method 2017, Level B
Stabilization Bake (Prior to Seal) 1/	MIL-STD-883, Method 1008, Condition C (+150 °C) 24 hours minimum
Temperature Cycling	MIL-STD-883, Method 1010, Condition B
Constant Acceleration	MIL-STD-883, Method 2001, Condition A Y_1 axis only (5000 G)
Seal (Fine & Gross)	MIL-PRF-55310, Para. 4.8.2.2.2
Particle Impact Noise Detection (PIND)	MIL-STD-883, Method 2020, Condition A
Radiographic Inspection **(Model XE7E only) 2/**	MIL-STD-883, Method 2012, Class S
Pre Burn-in Electrical Tests	Refer to Table IV-a below
Burn-in	+125 °C, Nominal Supply Voltage and Burn-in load 160 Hours Minimum
Post Burn-in Electrical Tests	Refer to Table IV-a below
External Visual	MIL-STD-883, Method 2009

1/ Vacuum bake and maintain oscillators in dry nitrogen per MIL-PRF-55310.

2/ Radiographic Inspection is applicable to Model XE64E only

Table IV-a – Pre & Post Burn-in Electrical Tests

Test Parameter	MIL-PRF-55310 Method	Pre BI 24 ± 1 °C	Post BI 24 ± 1 °C	Post BI Low Temp	Post BI High Temp
Input Current	4.8.5	✓	✓	✓	✓
Output Frequency at 23 to 25 °C	4.8.6	✓	✓	✓	✓
Frequency Vs. Temperature Stability	4.8.10.1	✓	✓	✓	✓
Frequency Vs. Supply Voltage	4.8.14	✓	✓	✓	✓
Output Voltage Levels	4.8.21.3	✓	✓	✓	✓
Output Rise & Fall Times	4.8.22	✓	✓	✓	✓
Output Duty Cycle	4.8.23	✓	✓	✓	✓
Start-up time	4.8.29	✓	✓	✓	✓
Enable/Disable, if applicable	4.8.28	✓	✓	✓	✓