

FEATURES

- Miniature Package (SOT-23L)
- Low Start-up Voltage [0.6 V (typ.)]
- Few External Components
- Adjustable Output Voltage (1.5 to 15 V)
- Wide Input Voltage Range (0.6 to 14 V)

APPLICATIONS

- Pagers
- Cassette Recorders
- Cordless Telephones
- Portable Instrumentation
- Radio Control Systems
- Mobile Radios
- Battery Operated Equipment
- Local Area Network (LAN) Receivers

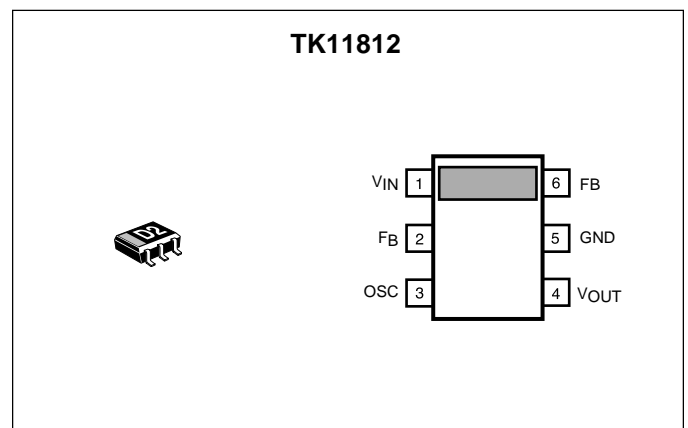
DESCRIPTION

The TK11812 is a low power, low input voltage step-up DC-DC converter.

This device can be set to an output of 1.5 to 15 V DC using two resistors. The output current is dependent upon the input voltage and ranges from 8 mA at 1.6 V to 24 mA at 3.5 V. The efficiency is over 80% for an output current of 4 mA to 32 mA with a 3.5 V input and 5 V output.

The frequency of the built-in relaxation oscillator is set by external components. The internal voltage regulator provides a stable output voltage. Optimized Toko inductor components are available.

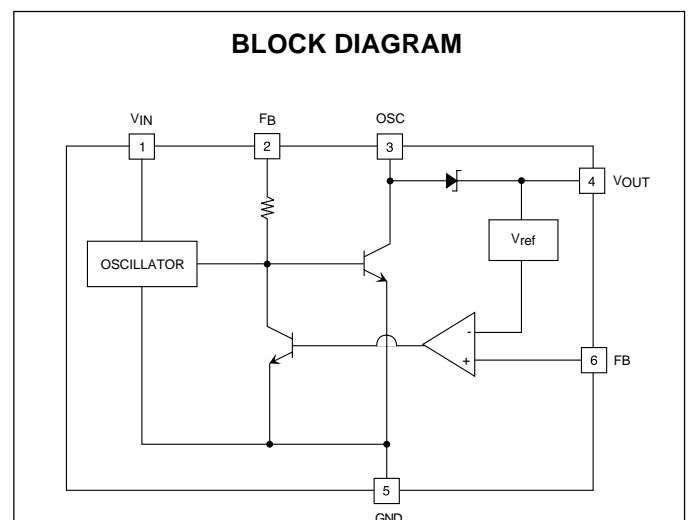
The TK11812 is available in a miniature 6-pin SOT-23L surface mount package.



ORDERING INFORMATION

TK11812M Tape/Reel Code

TAPE/REEL CODE
TL: Tape Left



TK11812

ABSOLUTE MAXIMUM RATINGS

Input Voltage 16 V
 Output Voltage 15 V
 Power Dissipation (Note 1) 400 mW
 Junction Temperature 150 °C

Storage Temperature Range -55 to +150 °C
 Operating Temperature Range -10 to +65 °C
 Lead Soldering Temperature (10 s) 235 °C

TK11812 ELECTRICAL CHARACTERISTICS

Test Conditions: $T_A = 25\text{ °C}$, $V_{OUT} = 3.0\text{ V}$, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Supply Voltage Range		0.6		14	V
V_{START}	Start-up Voltage	$I_{OUT} = 0\text{ mA}$		0.6	0.75	V
I_{IN}	Input Current	$V_{IN} = 1.1\text{ V}$, $I_{OUT} = 3\text{ mA}$	6	11	15	mA
		$V_{IN} = 1.4\text{ V}$, $I_{OUT} = 3\text{ mA}$	5	8.3	14	mA
V_{OUT}	Output Voltage	$V_{IN} = 1.1\text{ V}$, $I_{OUT} = 3\text{ mA}$, (Note 3)	2.85	3.0	3.15	V
		$V_{IN} = 1.4\text{ V}$, $I_{OUT} = 3\text{ mA}$, (Note 3)	2.85	3.0	3.15	V
I_{OUT}	Output Current	$V_{IN} = 1.1\text{ V}$	4.0	4.5		mA
		$V_{IN} = 1.4\text{ V}$	6.0	6.8		mA
Line Reg	Line Regulation	$I_{OUT} = 3\text{ mA}$, $1.1\text{ V} \leq V_{IN} \leq 2.2\text{ V}$		10	100	mV
Load Reg	Load Regulation	$V_{IN} = 1.1\text{ V}$, $0.5\text{ mA} \leq I_{OUT} \leq 3\text{ mA}$		45	130	mV
EFF	Efficiency	$V_{IN} = 1.4\text{ V}$, $I_{OUT} = 3\text{ mA}$	63	72		%
F_{OSC}	Oscillator Frequency	$V_{IN} = 1.4\text{ V}$, $I_{OUT} = 3\text{ mA}$ (Note 2)		300		kHz
$\Delta V_{OUT}/\Delta T$	Temperature Coefficient	$V_{IN} = 1.4\text{ V}$, $I_{OUT} = 3\text{ mA}$		0.4		mV/°C
V_{ref}	Reference Voltage	$V_{IN} = 1.4\text{ V}$, $I_{OUT} = 3\text{ mA}$, (Note 4)		1.22		V

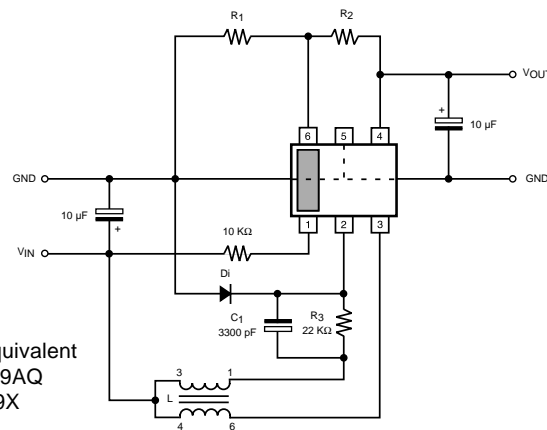
Note 1: Power dissipation is 400 mW when mounted as recommended. Derate at 3.2 mW/°C for operation above 25 °C. Power dissipation is 200 mW when in Free Air. Derate at 1.6 mW/°C for operation above 25°C.

Note 2: This IC is a frequency-controlled DC-DC converter, thus, the value is varied by condition.

Note 3: Output with R_1/R_2 set for 3.0 V nominal.

Note 4: Reference voltage is measured at FB pin (pin 6).

TEST CIRCUIT



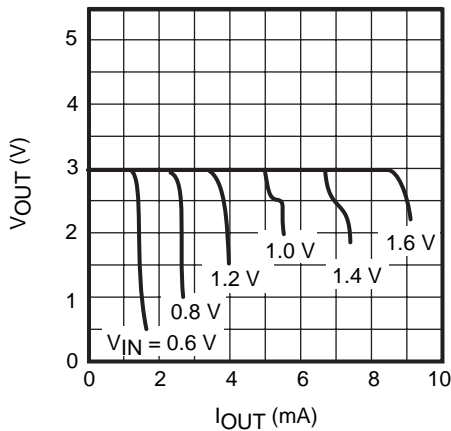
Note: Di: IS2837,38, or equivalent
 L: Toko 395KN-0369AQ
 Toko PS5CDL-1639X

Note: $V_{OUT} = V_{ref} [1 + (R_2 / R_1)]$
 $V_{ref} = 1.22 V$
 $R_1 = 100 k$ to $150 k$
 V_{ref} is the FB pin voltage.

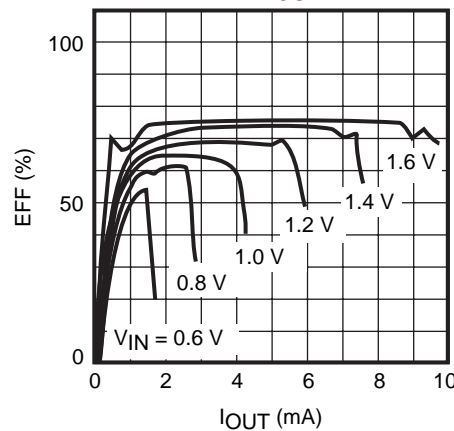
TYPICAL PERFORMANCE CHARACTERISTICS

$T_A = 25^\circ C$, unless otherwise specified.

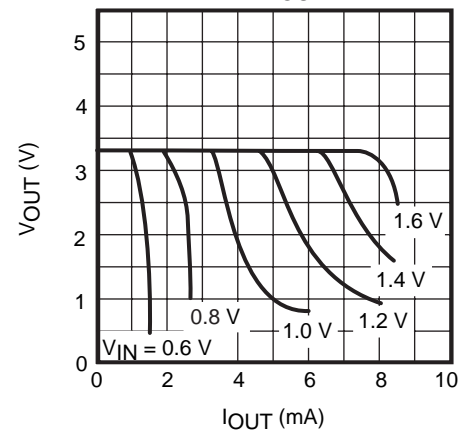
OUTPUT VOLTAGE vs. OUTPUT CURRENT ($V_{OUT} = 3.0 V$)



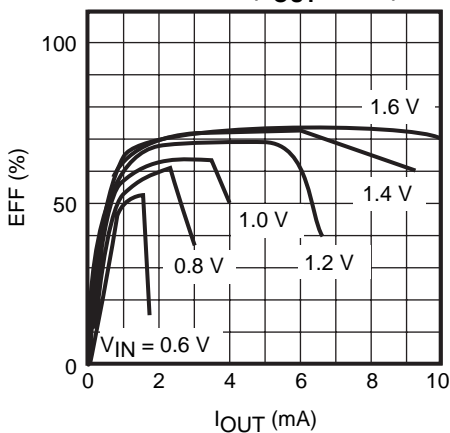
EFFICIENCY vs. OUTPUT CURRENT ($V_{OUT} = 3.0 V$)



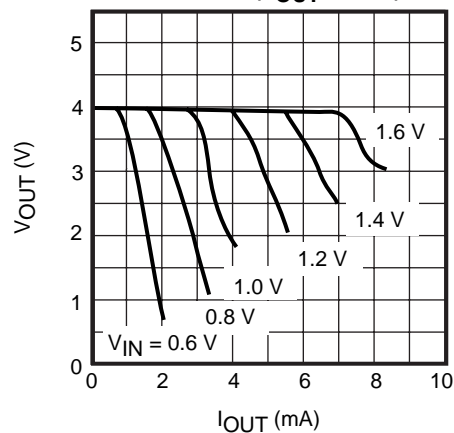
OUTPUT VOLTAGE vs. OUTPUT CURRENT ($V_{OUT} = 3.3 V$)



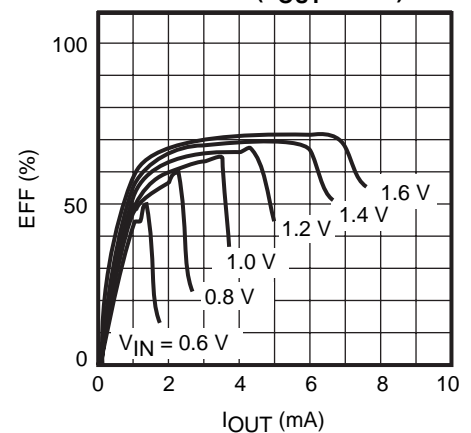
EFFICIENCY vs. OUTPUT CURRENT ($V_{OUT} = 3.3 V$)



OUTPUT VOLTAGE vs. OUTPUT CURRENT ($V_{OUT} = 4.0 V$)

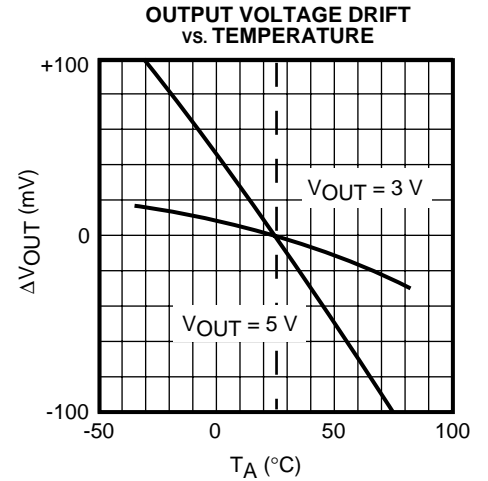
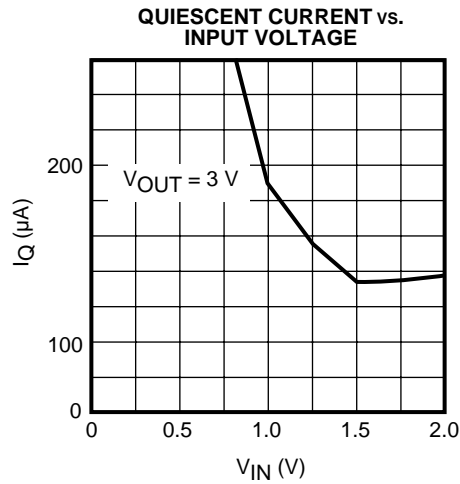
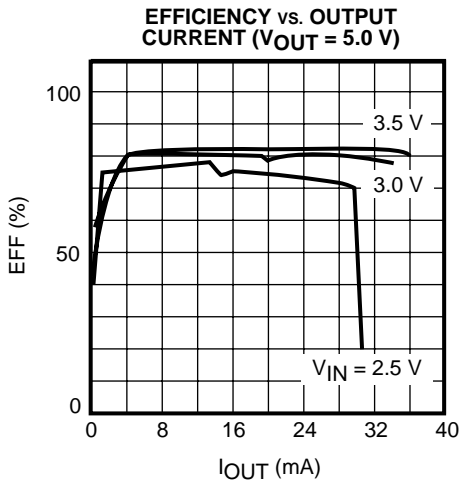
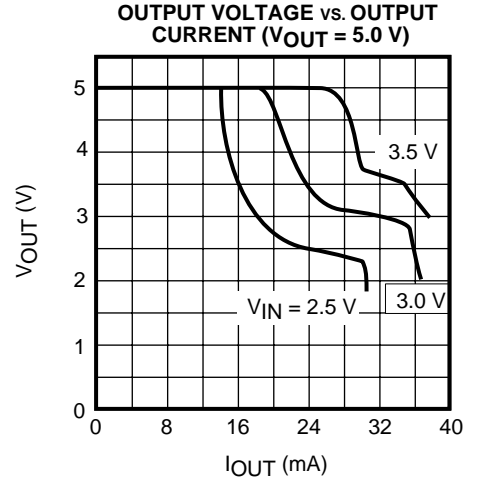
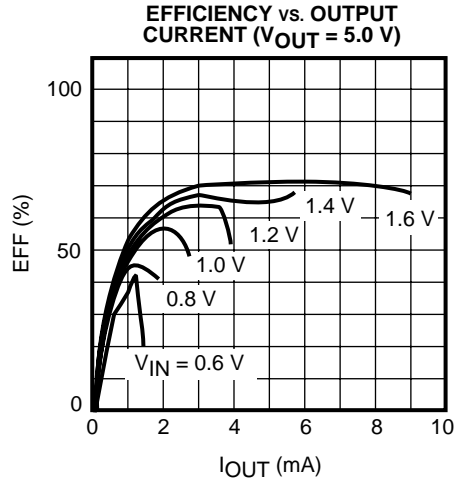
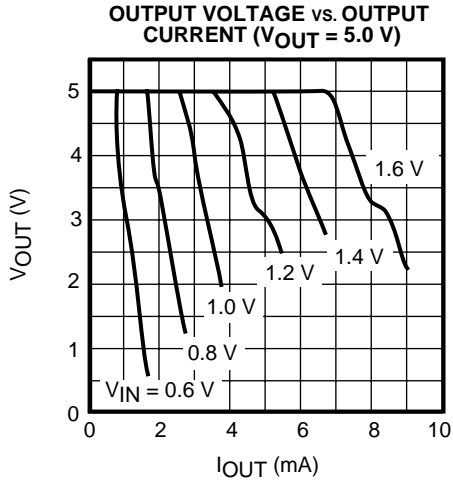


EFFICIENCY vs. OUTPUT CURRENT ($V_{OUT} = 4.0 V$)



TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

$T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified.



ADDITIONAL INFORMATION

APPLICATION INFORMATION

Maximize copper foil area connecting to all IC pins for optimum performance. Place input and output bypass capacitors close to the GND pin. For best transient behavior and lowest output impedance, use as large of a capacitor value as possible. The temperature coefficient of the capacitance and Equivalent Series Resistance (ESR) should be taken into account. These parameters can influence power supply noise and ripple rejection. In extreme cases, oscillation may occur. In order to maintain stability the output bypass capacitor value should be a minimum of 10 μF in the case of tantalum electrolytic, or 15 μF in the case of aluminum electrolytic.

HANDLING MOLDED RESIN PACKAGES

All plastic molded packages absorb some moisture from the air. If moisture absorption occurs prior to soldering the device into the printed circuit board, increased separation of the lead from the plastic molding may occur, degrading the moisture barrier characteristics of the device. This property of plastic molding compounds should not be overlooked, particularly in the case of very small packages where the plastic is very thin.

In order to preserve the original moisture barrier properties of the package, devices are stored and shipped in moisture proof bags filled with dry air. The bags should not be opened or damaged prior to actual use of the devices. If this is unavoidable, the devices should be stored in a low relative humidity environment (40 to 65%) or in an enclosed environment with desiccant.

INDUCTOR NOTES

The output current and efficiency are largely dependent on the coil used. A coil with lower DC resistance is generally better in efficiency than one with a higher DCR (DC Resistance). The recommended TOKO 395KN-0369 AQ is a 1:1 turns ratio transformer with an inductance of 110 μH , and Toko 395KN-0370UG is a 1:3 transformer ratio with the inductance of 60 μH : 600 μH . These coils or equivalent should be used. Smaller coils with higher DCR will not perform as well as the above coil, and the oscillator will not be stable.

FEEDBACK RC TIME CONSTANT

If a different coil is used other than the one mentioned, the RC time constant of the feedback loop will need to be adjusted for optimum performance. Generally, a lower resistance will give more output current. In fact, R can be zero; however, lower resistance will sacrifice efficiency at low output currents as the quiescent current increases. If the capacitance is increased beyond or below a certain value, the oscillator will become unstable. The optimum RC values depend upon the operating voltage range, output voltage and operating current, and should be chosen experimentally using the given values of 3300 pF and 22 K Ω as a starting point.

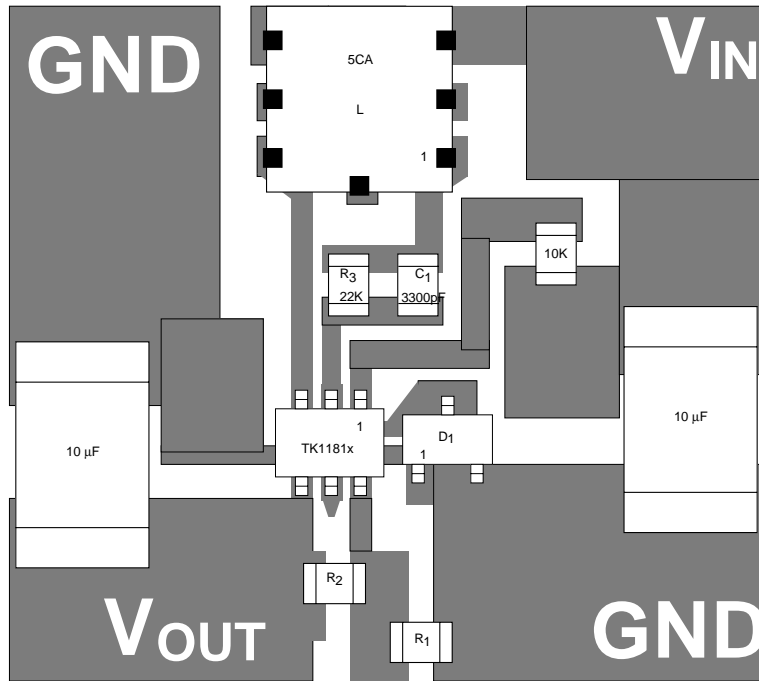
INPUT/OUTPUT DECOUPLING CAPACITORS

DC-DC converters generate a large ripple current on both the input and output of the circuit. The capacitors used should be as large as possible and have low impedance in the 300 kHz range. Since low temperatures cause capacitors to decrease capacitance and increase Equivalent Series Resistance (ESR) care should be taken to choose capacitors that have acceptable characteristics over the temperature range you intend to use. This should be done experimentally to verify results, as capacitor performance varies widely from manufacturer to manufacturer. Tantalum capacitors are generally the best choice and 10 μF should be adequate for most applications.

LOAD CHARACTERISTICS

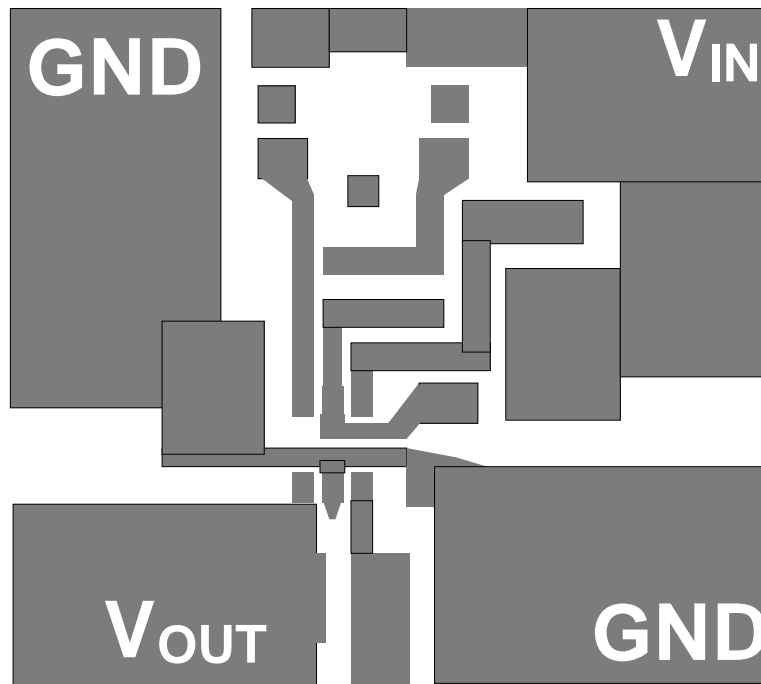
The TK11812 should not be allowed to start up under full load conditions. If this occurs, the output may not stabilize to the correct output voltage. This can be compensated for, somewhat, by adjusting the RC of the feedback loop or by decreasing the output decoupling capacitor. Maximum current can be drawn after the oscillator has started and the output has reached nominal output voltage. This is more critical with input voltages under 1.3V as the converter needs to generate sufficient output to ensure correct internal bandgap and bias voltages.

EVALUATION BOARD LAYOUT



AP010-99

TOKO

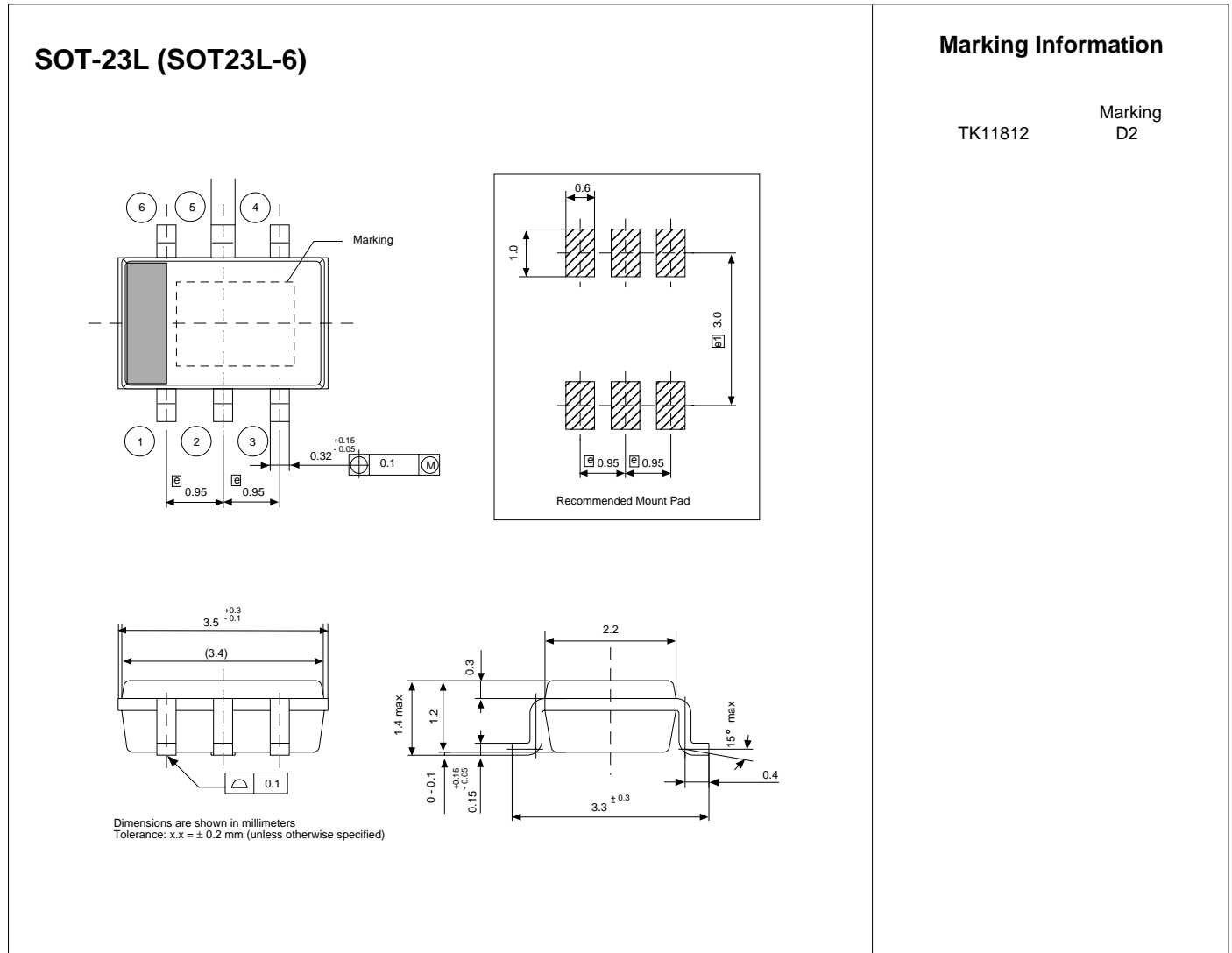


AP010-99

TOKO

NOTES

PACKAGE OUTLINE



Toko America, Inc. Headquarters
 1250 Feehanville Drive, Mount Prospect, Illinois 60056
 Tel: (847) 297-0070 Fax: (847) 699-7864

TOKO AMERICA REGIONAL OFFICES

Midwest Regional Office
 Toko America, Inc.
 1250 Feehanville Drive
 Mount Prospect, IL 60056
 Tel: (847) 297-0070
 Fax: (847) 699-7864

Western Regional Office
 Toko America, Inc.
 2480 North First Street, Suite 260
 San Jose, CA 95131
 Tel: (408) 432-8281
 Fax: (408) 943-9790

Eastern Regional Office
 Toko America, Inc.
 107 Mill Plain Road
 Danbury, CT 06811
 Tel: (203) 748-6871
 Fax: (203) 797-1223

Semiconductor Technical Support
 Toko Design Center
 4755 Forge Road
 Colorado Springs, CO 80907
 Tel: (719) 528-2200
 Fax: (719) 528-2375

Visit our Internet site at <http://www.tokoam.com>

The information furnished by TOKO, Inc. is believed to be accurate and reliable. However, TOKO reserves the right to make changes or improvements in the design, specification or manufacture of its products without further notice. TOKO does not assume any liability arising from the application or use of any product or circuit described herein, nor for any infringements of patents or other rights of third parties which may result from the use of its products. No license is granted by implication or otherwise under any patent or patent rights of TOKO, Inc.