

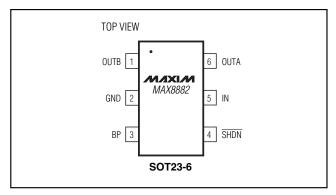
General Description

The MAX8882/MAX8883 dual, low-noise, low-dropout linear regulators operate from a +2.5V to +6.5V input and deliver up to 160mA each of continuous current. Both versions offer low output noise and low dropout of only 72mV at 80mA. Designed with an internal Pchannel MOSFET pass transistor, the MAX8882/ MAX8883 maintain a low 165µA supply current (both LDOs on), independent of the load current and dropout voltage. Other features include short-circuit protection and thermal-shutdown protection. The MAX8882 has a single shutdown input and provides an external reference bypass pin to improve noise performance. The MAX8883 includes two independent logic-controlled shutdown inputs. The MAX8882/MAX8883 are both available in a miniature 6-pin SOT23 package.

Applications

μP/DSP Core/IO Power Cellular and PCS Telephones PDAs and Palmtop Computers Notebook Computers Digital Cameras Hand-Held Instruments

Pin Configurations



Pin Configurations continued at end of data sheet.

Features

- **♦ Two LDOs in Tiny SOT23**
- ♦ Up to 160mA Output Current (each LDO)
- ♦ 40µV_{RMS} Output Noise (MAX8882)
- ♦ 72mV Dropout at 80mA Load
- ♦ Low 165µA Operating Supply Current
- ♦ 62dB PSRR (greater than 56dB to 100kHz)
- **♦ Independent Low-Power Shutdown Controls** (MAX8883)
- ♦ Thermal-Overload and Short-Circuit Protection
- **♦ Output Current Limit**

Selector Guide

PART	Vouta	V _{OUTB}	TOP MARK
MAX8882EUTJJ	2.85	2.85	AANR
MAX8882EUTAQ	3.3	2.5	AAPW
MAX8882EUTA5	3.3	1.8	AARY
MAX8882EUTQ5	2.5	1.8	AAPX
MAX8882EUTGG	3.0	3.0	AAZT
MAX8883EUTJJ	2.85	2.85	AANS
MAX8883EUTAQ	3.3	2.5	AAPY
MAX8883EUTA5	3.3	1.8	AARZ
MAX8883EUTQ5	2.5	1.8	AAPZ
MAX8883EUTGG	3.0	3.0	AAZU

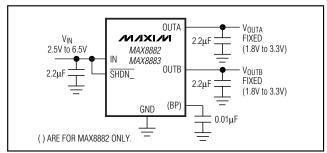
^{***}Other combinations between 1.8V and 3.3V are available in 100mV increments. Contact factory for other versions. Minimum order quantity is 50,000 units.

Ordering Information

PART	SHUT- DOWN	TEMP RANGE	PIN- PACKAGE
MAX8882EUT*	Single	-40°C to +85°C	6 SOT23-6
MAX8883EUT*	Dual	-40°C to +85°C	6 SOT23-6

^{*}See Selector Guide

Typical Operating Circuit



MIXIM

Maxim Integrated Products 1

ABSOLUTE MAXIMUM RATINGS

IN, SHDNA, SHDNA, SHDNB, BP to GND0.3V to +7.0V	C
OUTA, OUTB to GND0.3V to (V _{IN} + 0.3V)	J
Output Short-Circuit DurationContinuous	S
Continuous Power Dissipation ($T_A = +70^{\circ}C$)	L
6-Pin SOT23 (derate 8.7mW/°C above +70°C)695mW	

Operating Temperature Range	40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	
Lead Temperature (soldering, 10s)	+300°C

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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(VIN = +3.6V, SHDN = SHDNA = SHDNB = IN, TA = -40°C to +85°C, unless otherwise noted. Typical values are at TA = +25°C.) (Note 1)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage			2.5		6.5	V
Undervoltage Lockout Threshold	V _{IN} _ rising, hysteresis 40mV typical		2.15	2.25	2.40	V
	$T_A = +25$ °C, $I_{OUT} = 1$ mA		-1		1	
Output Voltage Accuracy	I _{OUT} _ = 1mA		-2		2	%
	$I_{OUT} = 100 \mu A \text{ to } 160 \text{mA}$		-3		2	
Maximum Output Current	Continuous		160			mA
Current Limit			160		550	mA
Ground Current	No Load, V _{IN} = 6.5V			165	265	μΑ
Ground Gurrent	I _{OUT} _ = 80mA, both LDOs			170		μΑ
Shutdown Supply Current	SHDN_ = GND, T _A = +25°C			0.01	1	<u> </u> μΑ
Shutdown Supply Current	SHDN_ = GND			0.1		μΑ
SHDN Input Threshold	V _{IH}		1.6			<u> </u>
SHDN_IIIput Tilleshold	V_{IL}				0.4	V
SHDN_ Input Bias Current	SHDN_ = GND or IN, TA = +25°C		0.01	100	nA	
SHDN_ IIIput bias Current	SHDN_ = GND or IN			0.05		IIA
D	I _{OUT} _ = 1mA			1		
Dropout Voltage (Notes 2, 3)	I _{OUT} _ = 40mA			36		mV
(110163 2, 0)	I _{OUT} _ = 80mA			72	144	
Line Regulation	$V_{IN} = (V_{OUT} + 0.4V \text{ or } 2.5V) \text{ to } + 6.5V,$ $I_{OUT} = 1\text{mA}$		-0.2	0	0.2	%/V
Output Voltage Noise	10Hz to 100kHz, $C_{BP}=0.01\mu\text{F},~C_{OUT}=4.7\mu\text{F},$ $I_{OUT}=1\text{mA}$	MAX8882		40		μV _{RMS}
,	10Hz to 100kHz, $C_{OUT} = 4.7 \mu F$, $I_{OUT} = 10 mA$	MAX8883		320		F. 111410

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ELECTRICAL CHARACTERISTICS (continued)

(V_{IN} = +3.6V, SHDN = SHDNA = SHDNB = IN, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Output Voltage AC DCDD	100Hz, $C_{BP} = 0.01\mu F$, $C_{OUT} = 4.7\mu F$	MAX8882		62		٩D
Output Voltage AC PSRR	100Hz, C _{OUT} = 4.7μF	MAX8883		60		dB
Thermal Shutdown Temperature				160		°C
Thermal Shutdown Hysteresis				10		°C

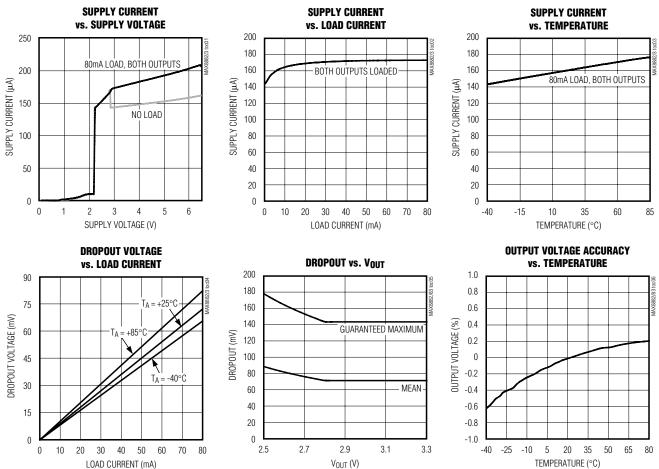
Note 1: All units are 100% production tested at T_A = +25°C. Limits over the operating temperature range are guaranteed by design.

Note 2: The dropout voltage is defined as V_{IN} - V_{OUT} when V_{IN} = V_{OUT} (NOM). Specification only applies when V_{OUT} ≥ 2.5V.

Note 3: See the Typical Operating Characteristics for guaranteed specifications at voltages other than 3.3V.

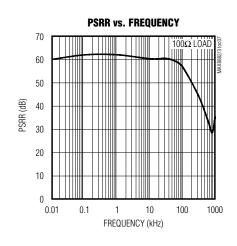
Typical Operating Characteristics

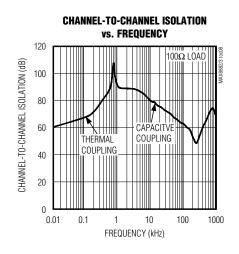
 $(V_{OUT} = 2.85V, I_{OUT} = 80mA, V_{IN} = +3.6V, C_{OUT} = 2.2\mu F, C_{BP} = 0.01\mu F, and C_{IN} = 2.2\mu F, unless otherwise noted.)$

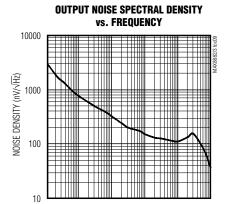


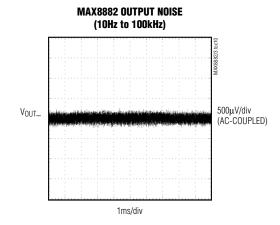
Typical Operating Characteristics (continued)

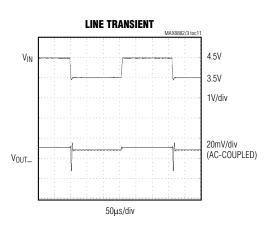
 $(V_{OUT} = 2.85V, I_{OUT} = 80mA, V_{IN} = +3.6V, C_{OUT} = 2.2\mu F, C_{BP} = 0.01\mu F, and C_{IN} = 2.2\mu F, unless otherwise noted.)$

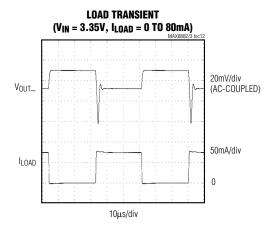






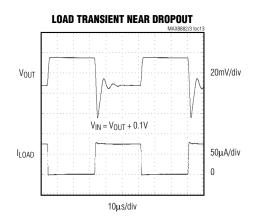


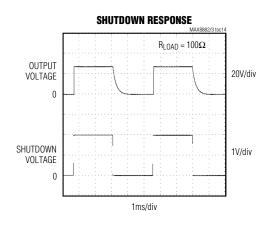




Typical Operating Characteristics (continued)

 $(V_{OUT} = 2.85V, I_{OUT} = 80mA, V_{IN} = +3.6V, C_{OUT} = 2.2\mu F, C_{BP} = 0.01\mu F, and C_{IN} = 2.2\mu F, unless otherwise noted.)$





Pin Description

Р	IN	NAME	FUNCTION
MAX8882	MAX8883	NAME	FUNCTION
1	1	OUTB	Regulator B Output. Sources up to 160mA continuous current. Bypass with a $2.2\mu F$ (<0.5 Ω typ ESR) capacitor to GND (see the <i>Capacitor Selection and Regulator Stability</i> section).
2	2	GND	Ground. This pin also functions as a heatsink. Solder to a large pad or the circuit-board ground plane to maximize thermal dissipation.
3	_	BP	Reference Noise Bypass. Bypass with a low-leakage 0.01µF ceramic capacitor for reduced noise at both outputs.
_	3	SHDNA	Shutdown A Input. A logic low shuts down regulator A. If SHDNA and SHDNB are both low, both regulators and the reference turn off, and supply current is reduced to 10nA. If either SHDNA or SHDNB is a logic high, the reference is on. Connect to IN for normal operation.
_	4	SHDNB	Shutdown B Input. A logic low shuts down regulator B. If SHDNA and SHDNB are both low, both regulators and the reference turn off, and supply current is reduced to 10nA. If either SHDNA or SHDNB is a logic high, the reference is on. Connect to IN for normal operation.
4	_	SHDN	Shutdown Input. A logic low shuts down both regulators and the reference, reducing the entire supply current to 10nA. Connect to IN for normal operation.
5	5	IN	Regulator Input. Supply voltage can range from +2.5V to +6.5V. This input also supplies the on-chip reference. Bypass with 2.2μF to GND (see the Capacitor Selection and Regulator Stability section).
6	6	OUTA	Regulator A Output. Sources up to 160mA continuous current. Bypass with a 2.2 μ F (<0.5 Ω typ ESR) capacitor to GND (see the <i>Capacitor Selection and Regulator Stability</i> section).

Detailed Description

The MAX8882/MAX8883 are low-noise, low-dropout, low-quiescent-current linear regulators designed primarily for battery-powered applications. These parts are available with preset output voltages ranging from 1.8V to 3.3V, and the parts can supply loads up to 160mA.

Shutdown

MAX8882

The MAX8882 has a single shutdown control input (SHDN). Drive SHDN low to shut down both outputs, reducing supply current to 10nA. Connect SHDN to a logic-high, or IN, for normal operation.

MAX8883

The MAX8883 has independent shutdown control inputs (SHDNA and SHDNB). Drive SHDNA low to shut down OUTA. Drive SHDNB low to shut down OUTB. Drive both SHDNA and SHDNB low to shut down the entire chip, reducing supply current to 10nA. Connect both SHDNA and SHDNB to a logic-high, or IN, for normal operation.

Internal P-Channel Pass Transistor

The MAX8882/MAX8883 feature two 1Ω P-channel MOSFET pass transistors. A P-channel MOSFET provides several advantages over similar designs using PNP pass transistors, including longer battery life. It requires no base drive, which reduces quiescent current significantly. PNP-based regulators waste considerable current in dropout when the pass transistor saturates, and they also use high base-drive currents under large loads. The MAX8882/MAX8883 do not suffer from these problems and only consume 165µA of quiescent current whether in dropout, light-load, or heavy-load applications (see the Typical Operating Characteristics). While a PNP-based regulator has dropout voltage that is independent of the load, a Pchannel MOSFET's dropout voltage is proportional to load current, providing for low dropout voltage at heavy loads and extremely low dropout voltage at lighter loads.

Current Limit

The MAX8882/MAX8883 contain two independent current limiters, one for each regulator, which monitor and control the pass transistor's gate voltage, limiting the guaranteed maximum output current to 160mA minimum. The output can be shorted to ground for an indefinite time without damaging the part.

Thermal-Overload Protection

Thermal-overload protection limits total power dissipation in the MAX8882/MAX8883. When the junction tem-

perature exceeds $T_J = +160^{\circ}C$, the thermal sensor signals the shutdown logic, turning off the pass transistor and allowing the IC to cool. The thermal sensor will turn the pass transistor on again after the IC's junction temperature cools by $10^{\circ}C$, resulting in a pulsed output during continuous thermal-overload conditions.

Thermal-overload protection is designed to protect the MAX8882/MAX8883 in the event of fault conditions. For continual operation, do not exceed the absolute maximum junction-temperature rating of $T_J = +150^{\circ}C$.

Operating Region and Power Dissipation

The MAX8882/MAX8883's maximum power dissipation depends on the thermal resistance of the case and circuit board, the temperature difference between the die junction and ambient air, and the rate of air flow. The power dissipation across the device is $P = I_{OUT} (V_{IN} - V_{OUT})$ (Figure 1). The maximum power dissipation is:

$$P_{MAX} = (T_J - T_A) / (T_{JB} + T_{BA})$$

where T_J - T_A is the temperature difference between the MAX8882/MAX8883 die junction and the surrounding air, T_{JB} (or T_{JC}) is the thermal resistance of the package, and T_{BA} is the thermal resistance through the printed circuit board, copper traces, and other materials to the surrounding air.

The GND pin of the MAX8882/MAX8883 performs the dual functions of providing an electrical connection to the ground and channeling heat away. Connect the GND pin to ground using a large pad or ground plane.

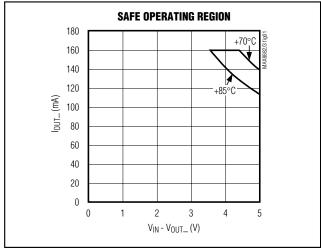


Figure 1. MAX8882/MAX8883 Safe Operating Region

Low-Noise Operation (MAX8882)

An external $0.01\mu F$ bypass capacitor at BP, in conjunction with an internal resistor, creates a lowpass filter. The MAX8882 exhibits $40\mu V_{RMS}$ of output voltage noise with $C_{BP}=0.01\mu F$ and $C_{OUT}=4.7\mu F$. (See the Output Noise Spectral Density graph in the *Typical Operating Characteristics*.)

Applications Information

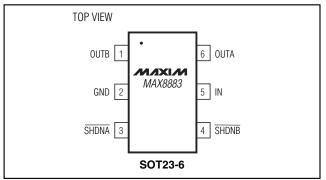
Capacitor Selection and Regulator Stability

Use a 2.2µF capacitor on the MAX8882/MAX8883 input and a 2.2µF capacitor on the outputs. Larger input capacitor values and lower ESRs provide better supplynoise rejection and line-transient response. To reduce noise, improve load transients, and for loads up to 160mA, use larger output capacitors (up to 10µF). For stable operation over the full temperature range and with load currents up to 80mA, use 2.2µF.

Note that some ceramic dielectrics exhibit large capacitance and ESR variation with temperature. With dielectrics such as Z5U and Y5V, it may be necessary to use 4.7µF or more to ensure stability at temperatures below -10°C. With X7R or X5R dielectrics, 2.2µF is sufficient at all operating temperatures. These regulators are optimized for ceramic capacitors, and tantalum capacitors are not recommended.

Use a 0.01µF bypass capacitor at BP (MAX8882) for low output voltage noise. Increasing the capacitance will slightly decrease the output noise, but increase the startup time. (See the Shutdown Response graph in the *Typical Operating Characteristics*.)

Pin Configurations (continued)



PSRR and Operation from Sources Other than Batteries

The MAX8882/MAX8883 are designed to deliver low dropout voltages and low quiescent currents in battery-powered systems. Power-supply rejection is 62dB at low frequencies and rolls off above 100kHz. (See the PSRR vs. Frequency graph in the *Typical Operating Characteristics*.)

When operating from sources other than batteries, improved supply-noise rejection and transient response can be achieved by increasing the values of the input and output bypass capacitors and through passive filtering techniques.

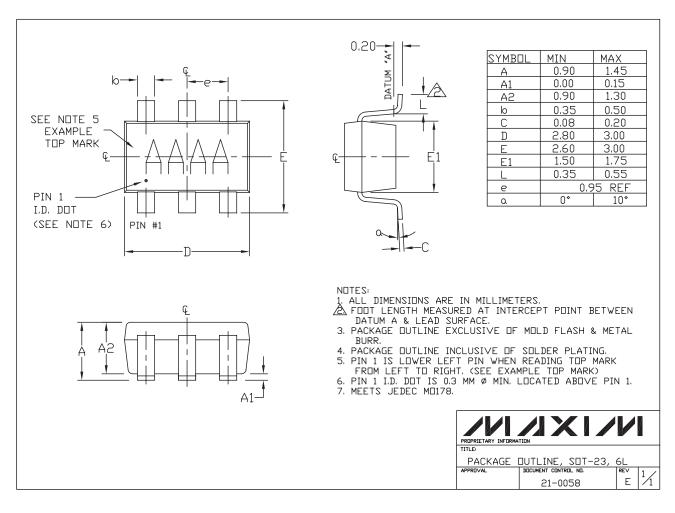
Dropout Voltage

A regulator's minimum input-output voltage differential (or dropout voltage) determines the lowest usable supply voltage. In battery-powered systems, this determines the useful end-of-life battery voltage. Because the MAX8882/MAX8883 use a P-channel MOSFET pass transistor, their dropout voltage is a function of drain-to-source on-resistance (RDS(ON)) multiplied by the load current (see the *Typical Operating Characteristics*).

Chip Information

TRANSISTOR COUNT: 493
PROCESS: BICMOS

Package Information



Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.









NHAT'S NEV

RODUCTS

SOLUTIONS

DESIGN

A PPNOTES

SUPPORT

BUY

COMPAN'

MEMBERS

MAX8882

Part Number Table

Notes:

- 1. See the MAX8882 QuickView Data Sheet for further information on this product family or download the MAX8882 full data sheet (PDF, 252kB).
- 2. Other options and links for purchasing parts are listed at: http://www.maxim-ic.com/sales.
- 3. Didn't Find What You Need? Ask our applications engineers. Expert assistance in finding parts, usually within one business day.
- 4. Part number suffixes: T or T&R = tape and reel; + = RoHS/lead-free; # = RoHS/lead-exempt. More: See full data sheet or Part Naming Conventions.
- 5. * Some packages have variations, listed on the drawing. "PkgCode/Variation" tells which variation the product uses.

Part Number	Free Sample	Buy Direct	Package: TYPE PINS SIZE DRAWING CODE/VAR *	Temp	RoHS/Lead-Free? Materials Analysis
MAX8882EUT				-40C to +85C	RoHS/Lead-Free: No
MAX8882EUT-T				-40C to +85C	RoHS/Lead-Free: No
MAX8882EUTQ5			SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTA5			SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTAQ+			SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTAQ			SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTGG+			SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis

MAX8882EUTGG	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTJ5+	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTJ5	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTJJ+	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTJJ	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTQ5+	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTA5+	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTA5-T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTGG-T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTJ5-T		-40C to +85C	RoHS/Lead-Free: No
MAX8882EUTJJ-T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTQ5-T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
MAX8882EUTQ5+T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTA5+T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTAQ+T		-40C to +85C	RoHS/Lead-Free: Yes
MAX8882EUTGG+T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis

MAX8882EUTJ5+T		-40C to +85C	RoHS/Lead-Free: Yes
MAX8882EUTJJ+T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S+3*	-40C to +85C	RoHS/Lead-Free: Yes Materials Analysis
MAX8882EUTAQ-T	SOT-23;6 pin; Dwg: 21-0058I (PDF) Use pkgcode/variation: U6S-3*	-40C to +85C	RoHS/Lead-Free: No Materials Analysis
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