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MOTOROLA

MC13145

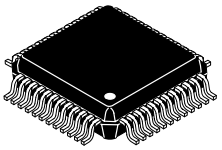
Product Preview

Low Power Integrated Receiver for ISM Band Applications

UHF WIDEBAND RECEIVER SUBSYSTEM (LNA, Mixer, VCO, Prescalar, IF Subsystem, Coilless Detector)

The MC13145 is a dual conversion integrated RF receiver intended for ISM band applications. It features a Low Noise Amplifier (LNA), two 50 Ω linear Mixers with linearity control, Voltage Controlled Oscillator (VCO), second LO amplifier, divide by 64/65 dual modulus Prescalar, split IF Amplifier and Limiter, RSSI output, Coilless FM/FSK Demodulator and power down control. Together with the transmit chip (MC13146) and the baseband chip (MC33410), a complete 900 MHz cordless phone system can be implemented. This device may be used in applications within 2.0 GHz since its RF bandwidth is greater than 2.4 GHz.

- Low (<1.8 dB @ 900 MHz) Noise Figure LNA with 14 dB Gain
- Externally Programmable Mixer linearity: IIP3 = 10(nom.) to +20 dBm (Mixer1); IIP3 = 10 (nom.) to 20 dBm (Mixer2)
- 50 Ω Mixer Input Impedance and Open Collector Output (Mixer 1 and Mixer 2); 50 Ω Second LO (LO2) Input Impedance
- Low Power 64/65 Dual Modulus Prescalar (MC12053 type)
- Split IF for Improved Filtering and Extended RSSI Range
- Internal 330 Ω Terminations for 10.7 MHz Filters
- Linear Coilless FM/FSK Demodulator with Externally Programmable Bandwidth, Center Frequency and Audio level
- 2.7 V to 6.5 V Operation, Low Current Drain (<30 mA @ 3.0 V) with Power Down Mode (<1.0 μA)
- 2.4 GHz RF, 1.0 GHz IF1 and 50 MHz IF2 Bandwidth



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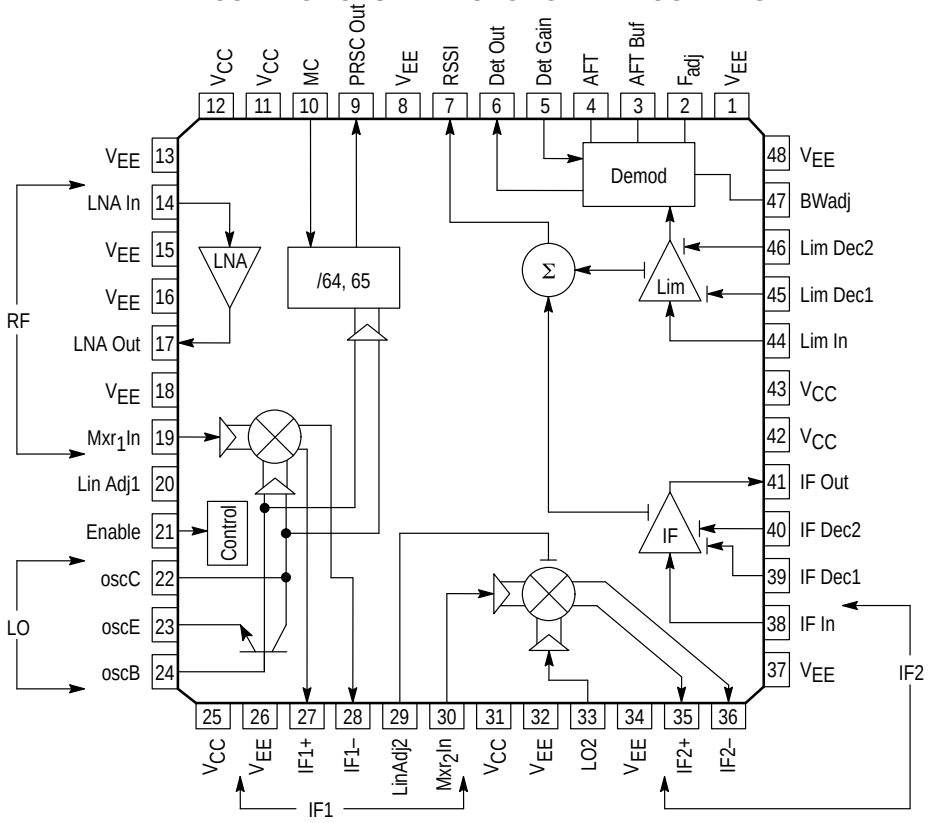
FTA SUFFIX
PLASTIC PACKAGE
CASE 932
(LQFP–48)

ORDERING INFORMATION

Device	Temperature Range	Package
XC13145FTA	–40° to +85°C	LQFP–48

ESD Sensitive — Handle with Care

PIN CONNECTIONS AND FUNCTIONAL BLOCK DIAGRAM



OVERALL RECEIVER SPECIFICATIONS

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}(max)	7.0	Vdc
Junction Temperature	T_J(max)	150	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Rating	Symbol	Value	Unit
Power Supply Voltage (T_A = 25°C)	V_{CC} V_{EE}	2.7 to 6.5 0	Vdc
Input Frequency	f_{in}	100 to 2000	MHz
Ambient Temperature Range	T_A	–40 to +85	°C
Maximum Input Signal Level: – with no damage – with minor performance degradation	P_{in}	 5.0 –10	dBm

RECEIVER DC ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc; No Input Signal, unless otherwise noted)

Characteristics	Symbol	Typical	Unit
Total Supply Current (Enable = V_{CC})	I_{total}	30	mA
Power Down Current (Enable = V_{EE})	I_{total}	<1.0	μA

RECEIVER AC ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc; F_{mod} = 1.0 kHz; F_{dev} = ±25 kHz; IF filter bandwidth = 150 kHz, unless otherwise noted)

Characteristics	Symbol	Typical		Unit MHz
		900	1900	
12 dB SINAD Sensitivity (with C–message filter at DetOut)		–115	TBD	dBm
30 dB SINAD Sensitivity (No IF filter distortion within ±40 kHz)		–100	TBD	dBm
SINAD Variation with IF Offset of ±40 kHz (No IF filter distortion within ±40 kHz)		5.0	TBD	dB
RSSI Dynamic Range		80	TBD	dB
Input 1.0 dB Compression Point(Measured at IF output)	$P_{in–1dB}$	–18	TBD	dBm
Input 3rd Order Intercept Point (Measured at IF output)	IIP3	–8.0	TBD	dBm
Demodulator Output Swing (5.0 k Load)		0.5	0.5	V_{pp}
Demodulator Bandwidth (±1.0 dB bandwidth)		100	100	kHz
Prescalar Output Level (10 kΩ//8.0 pF load)		0.5	0.5	V_{pp}
Modulus Control Input Level		0.5	0.5	V_{pp}
SNR @ –30 dBm Signal Input (<25 kHz deviation;with C–Message Filter)		50	TBD	dB
Total Harmonic Distortion (<25 kHz deviation;with C–Message Filter)		1.0	TBD	%
Spurious Response SINAD (RF In: –50 dBm)		12	TBD	dB

INDIVIDUAL BLOCK SPECIFICATIONS

LOW NOISE AMPLIFIER ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc, unless otherwise noted)

Characteristics	Symbol	Typical		Unit MHz
		900	1900	
Amplifier Gain	S21	14	TBD	dB
Noise Figure	NF	1.8	TBD	dB
1.0 dB Gain Compression Point	$P_{in–1dB}$	–8.0	TBD	dBm
3rd Order Intercept Point	IIP3	–5.0	TBD	dBm
Reverse Isolation	S12	–35	TBD	dB
Input Impedance (with externals)		50	50	Ω
Output Impedance (with externals)		50	50	Ω
Input Match (with externals)	S11	15	TBD	dB
Output Match (with externals)	S22	15	TBD	dB
LO1 to LNA Input Leakage		–45	TBD	dBm

FIRST MIXER ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc, unless otherwise noted)

Characteristics	Symbol	Typical		Unit MHz
		900	1900	
Power Conversion Gain (P_{in} = –30 dBm)	Pgc	0	TBD	dB
Noise Figure	NF	13	TBD	dB
1.0 dB Gain Compression Point	$P_{in–1dB}$	–1.0	TBD	dBm
3rd Order Intercept Point	IIP3	9.0	TBD	dBm
Input Impedance (single–ended)		50	50	Ω
Output Impedance (differential with externals)		50	50	Ω
Input Match		20	TBD	dB
Output Match (with externals)		20	TBD	dB
RF to IF1 Leakage		–38	TBD	dB
LO to IF1 Leakage		–33	TBD	dBm
LO to RF Leakage		–33	TBD	dBm
Mixer Out to IF in Leakage		–80	TBD	dB

SECOND MIXER ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc, unless otherwise noted)

Characteristics	Symbol	Typical	Unit
Noise Figure	NF	13	dB
1.0 dB Gain Compression Point	$P_{in–1dB}$	–1.0	dBm
3rd Order Intercept Point	IIP3	9.0	dBm
Input Impedance (single–ended)		50	Ω
Output Impedance (differential with externals)		330	Ω
Input Match		20	dB
Output Match (with externals)		20	dB

INDIVIDUAL BLOCK SPECIFICATIONS (continued)

LOCAL OSCILLATOR ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc, unless otherwise noted)

Characteristics	Symbol	Typical		Unit MHz
		900	1900	
LO Emitter Current (Enable = high)		2.0	TBD	mA
Phase Noise @ 10 kHz Offset		–80	–75	dBc/Hz
Modulation Sideband		–40	TBD	dBc

PRESCALAR ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc, unless otherwise noted)

Characteristics	Symbol	Typical		Unit MHz
		900	1900	
Divide Ratio				
– MC = low		65	65	
– MC = high		64	64	
Output Impedance		50	50	Ω
Prescalar Output Level (10 kΩ//8pF load)		0.5	0.5	V_{pp}
MC Input Level		0.5	0.5	V_{pp}
MC Current Input (optional)		200	200	μA_{pp}
Prescalar Out to IF Amp and Lim Amp Input Leakage		–85	TBD	dBm

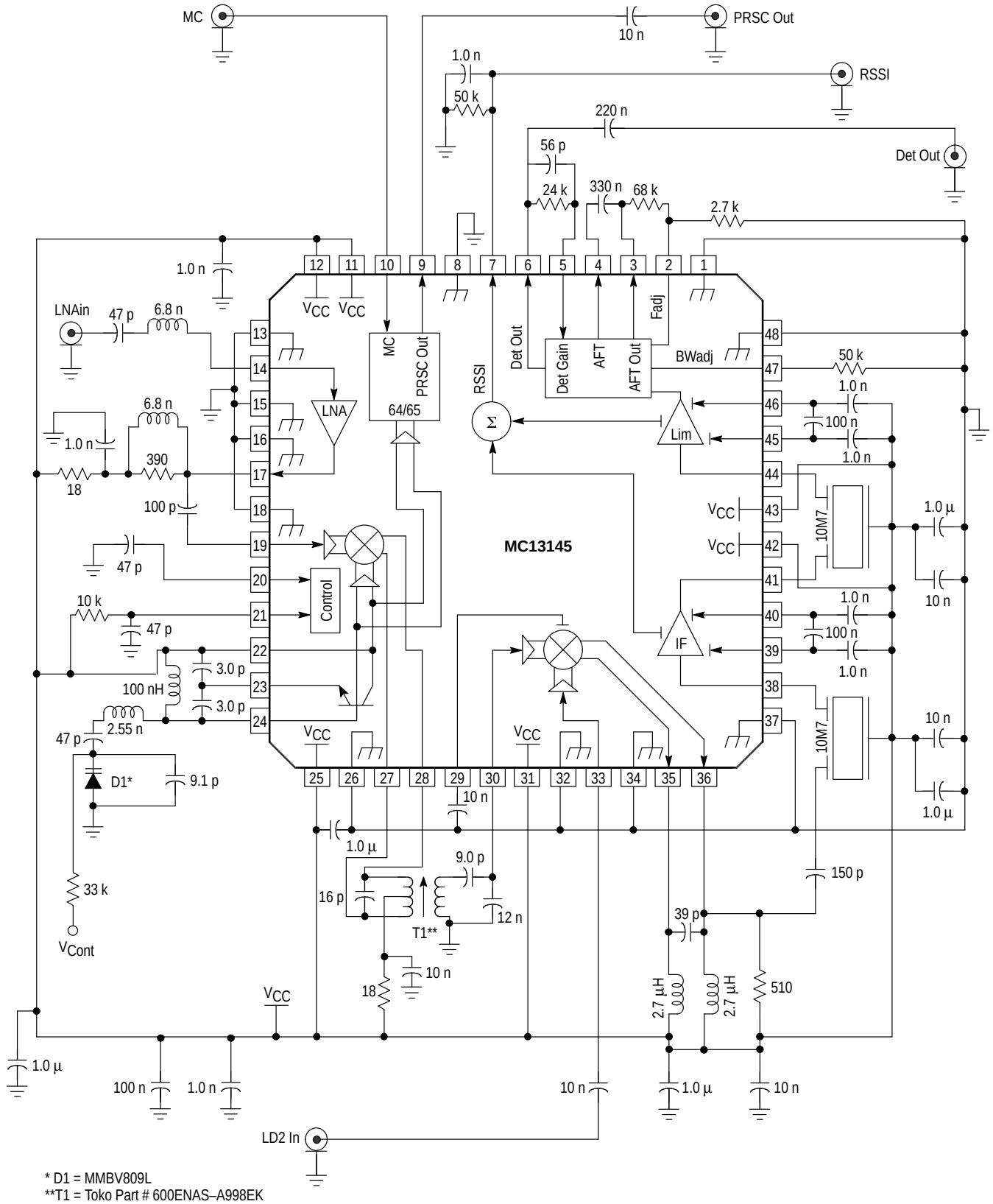
IF AND LIMITING AMPLIFIERS ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc, unless otherwise noted)

Characteristics	Symbol	Typical	Unit
IF and Lim Amplifier Bandwidth		40	MHz
IF Amplifier Gain		40	dB
IF Amplifier Noise Figure		7.0	dB
IF Input & Output Impedance		330	Ω
IF Amp Input & Output Match		20	dB
Limiting Amplifier Gain		85	dB
Lim Amp Input Impedance		330	Ω
Lim Amp Input Match		15	dB
IF Amp Output to Lim Amp Input Leakage (at 10.7 MHz)		80	dB
RSSI Dynamic Range		80	dB
RSSI Slope		0.5	μA/dB
RSSI Current Range		0 to 40	μA
RSSI Response Time		1.0	μs

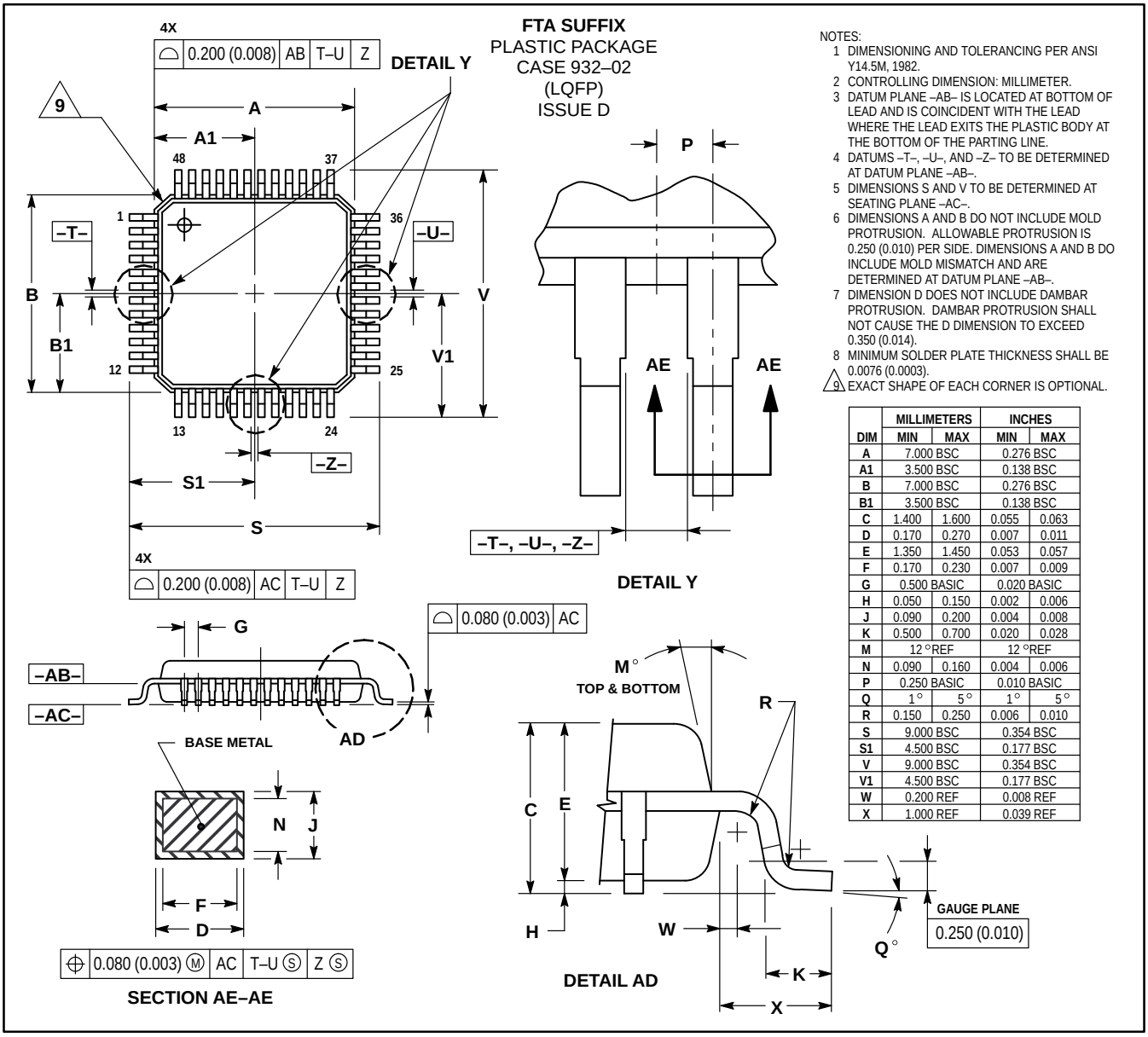
COILLESS DEMODULATOR ELECTRICAL CHARACTERISTICS (T_A = 25°C; V_{CC} = 3.0 Vdc, unless otherwise noted)

Characteristics	Symbol	Typical	Unit
Demodulator Output (at 25 kHz deviation)	DetOut	0.5	V_{pp}
Center Frequency		10.7	MHz
Frequency Adjust		< 20	MHz
Bandwidth Adjust		100 to 600	kHz
Output Impedance		2000	Ω
Settling Time (assert Enable pin)		TBD	ms

Figure 1. Application Diagram



OUTLINE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DATUM PLANE –AB– IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
4. DATUMS –T–, –U–, AND –Z– TO BE DETERMINED AT DATUM PLANE –AB–.
5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE –AC–.
6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –AB–.
7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.350 (0.014).
8. MINIMUM SOLDER PLATE THICKNESS SHALL BE 0.0076 (0.0003).
9. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	7.000 BSC		0.276 BSC	
A1	3.500 BSC		0.138 BSC	
B	7.000 BSC		0.276 BSC	
B1	3.500 BSC		0.138 BSC	
C	1.400	1.600	0.055	0.063
D	0.170	0.270	0.007	0.011
E	1.350	1.450	0.053	0.057
F	0.170	0.230	0.007	0.009
G	0.500 BASIC		0.020 BASIC	
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.500	0.700	0.020	0.028
M	12 °REF		12 °REF	
N	0.090	0.160	0.004	0.006
P	0.250 BASIC		0.010 BASIC	
Q	1 °	5 °	1 °	5 °
R	0.150	0.250	0.006	0.010
S	9.000 BSC		0.354 BSC	
S1	4.500 BSC		0.177 BSC	
V	9.000 BSC		0.354 BSC	
V1	4.500 BSC		0.177 BSC	
W	0.200 REF		0.008 REF	
X	1.000 REF		0.039 REF	

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