

PE4141

Product Specification

UltraCMOS® Ultra-linear Broadband Quad MOSFET Array



Features

- Ultimate quad MOSFET array
- Very high linearity
- Low magnetic
- Ideal for mixer applications
- Up and down conversion
- Low conversion loss
- High local oscillator (LO) isolation
- Package: 8-lead MSOP, ideal for magnetic environments

Applications

The PE4141 is ideally suited for broadband analog multiplexer design in:

- Medical instrumentation
- Magnetic Resonance Imaging (MRI)
- Data acquisition and ADC/DAC muxing
- RF modulation/demodulation
- Precision instrumentation
- Analog or digital video switch matrices

Product description

The PE4141 is an ultra-high-linearity passive broadband quad MOSFET array with high dynamic range performance capable of operation up to 1.0 GHz. This quad array operates with differential signals at all RF, LO, and IF ports, allowing an analog multiplexer to be built that uses LO ports as digital controls, and RF and IF ports as single-ended or differential inputs and outputs. The PE4141 switches the differential input to the differential output at the LO switching rate. Packaged in an 8-lead mini small outline package (MSOP), the PE4141 is ideal for highly magnetic environments, such as Magnetic Resonance Imaging (MRI). The PE4141 MOSFET array core is also ideal for a wide range of MOSFET array products, including module-level solutions that incorporate baluns or other single-ended matching structures that enable three-port operation.

The PE4141 is manufactured on pSemi's UltraCMOS® process, a patented variation of silicon-on-insulator (SOI) technology on a sapphire substrate, offering the performance of GaAs with the economy and integration of conventional CMOS.

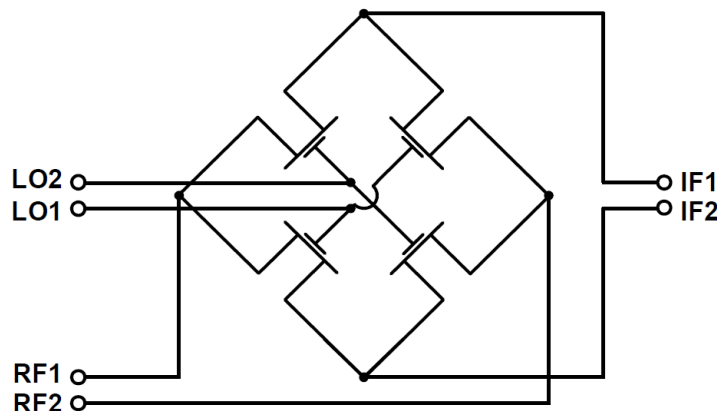


Figure 1. PE4141 functional diagram

Absolute maximum ratings

Exceeding the absolute maximum ratings listed in Table 1 could cause permanent damage. Restrict operation to the limits in Table 2. Operation between the operating range maximum and the absolute maximum for extended periods could reduce reliability.

ESD precautions

When handling this UltraCMOS device, observe the same precautions as with any other ESD-sensitive devices. Although this device contains circuitry to protect it from damage due to ESD, do not exceed the rating listed in Table 1.

Latch-up immunity

Unlike conventional CMOS devices, UltraCMOS devices are immune to latch-up.

Table 1. Absolute maximum ratings

Parameter or condition	Symbol	Min	Max	Unit
Storage temperature range	T _{ST}	-65	150	°C
Operating temperature range	T _{OP}	0	70	°C
Maximum DC plus peak AC voltage across drain-source	V _{DC + AC}	–	± 3.3	V
Maximum DC plus peak AC voltage across gate-drain or gate-source	V _{DC + AC}	–	± 4.2	V
ESD sensitive device	V _{ESD}	–	100	V

Electrical specifications

Table 2 lists the PE4141 AC and DC electrical specifications at +25 °C, unless otherwise specified.

Table 2. Electrical specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operating frequency(*)	F _{TYP}	–	DC	–	1.0	GHz
Drain-source voltage	V _{DS}	V _{GS} = +3V, I _{DS} = 40 mA	260	320	380	mV
Drain-source voltage match	V _{DS} match	–	–	12	40	mV
Threshold voltage	V _T	V _{DS} = 0.1V, per ASTM F617-00	–	-100	–	mV
Drain-source ON resistance	R _{DS}	V _{GS} = +3V, I _{DS} = 40 mA	6.5	7.75	9.5	Ω
Note: * Typical untested operating frequency range of quad MOSFET transistors.						

PCS application

This section describes the PE4141 operation in a typical PCS application.

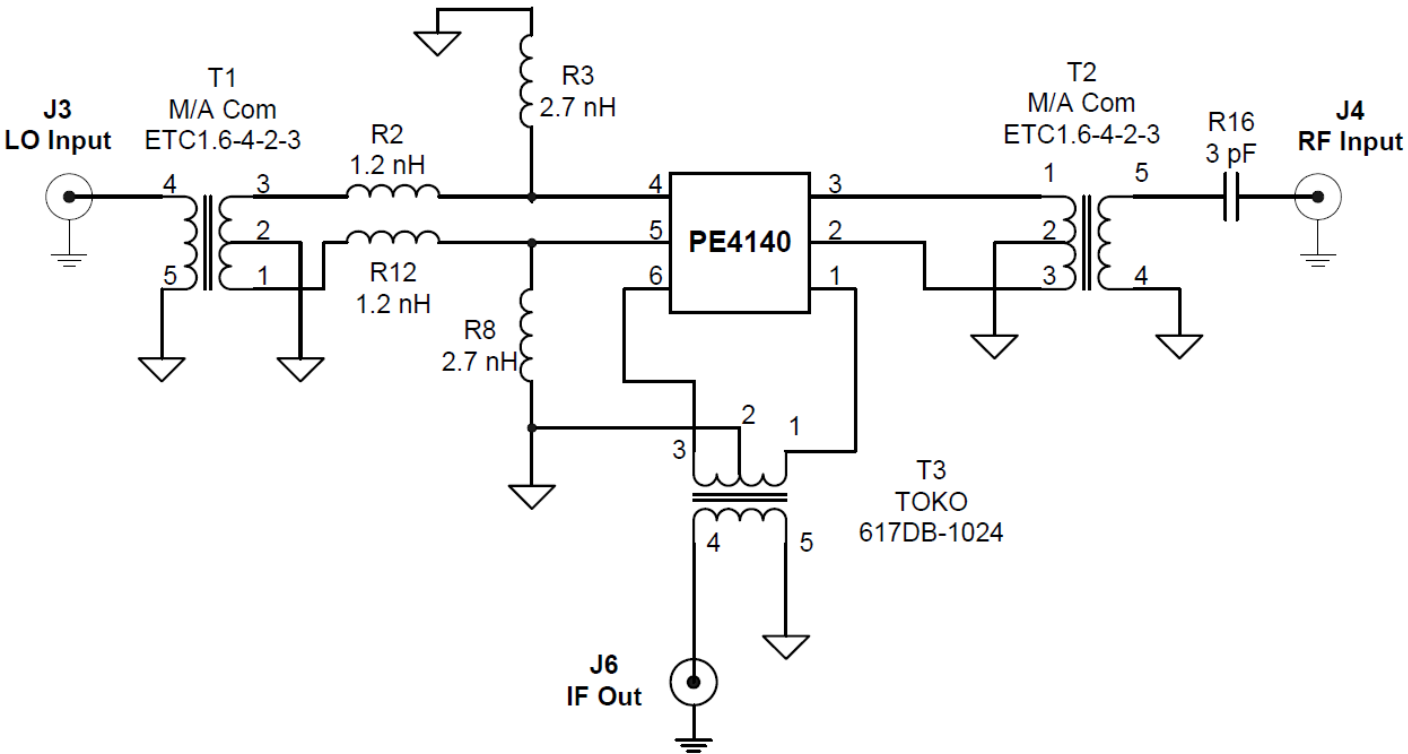


Figure 2. Typical PCS application schematic

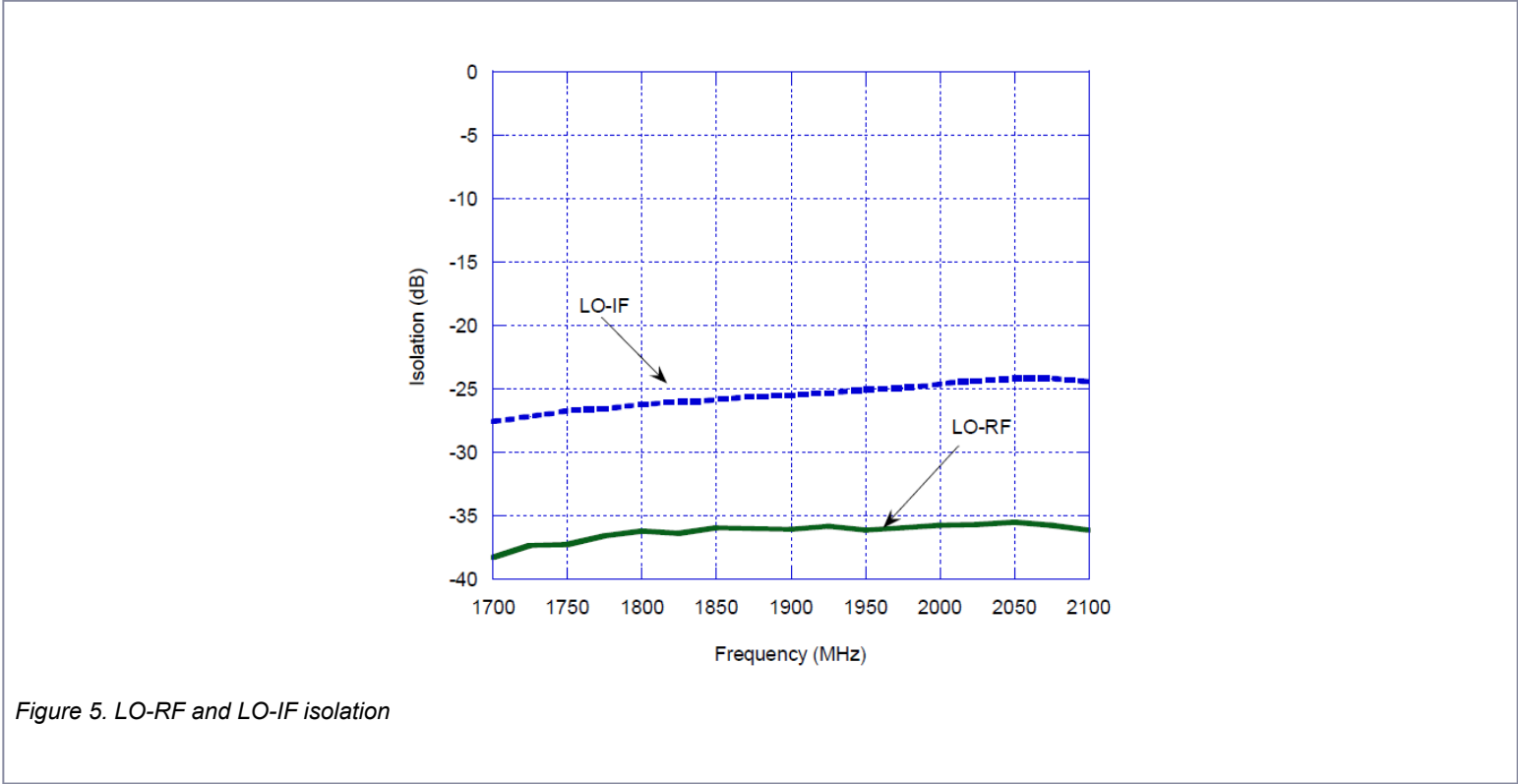
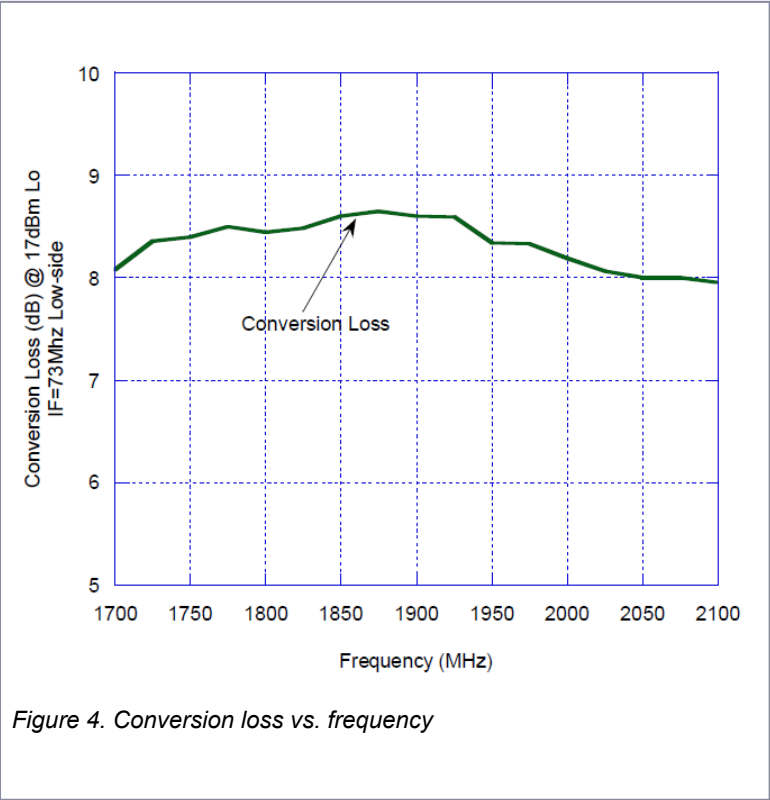
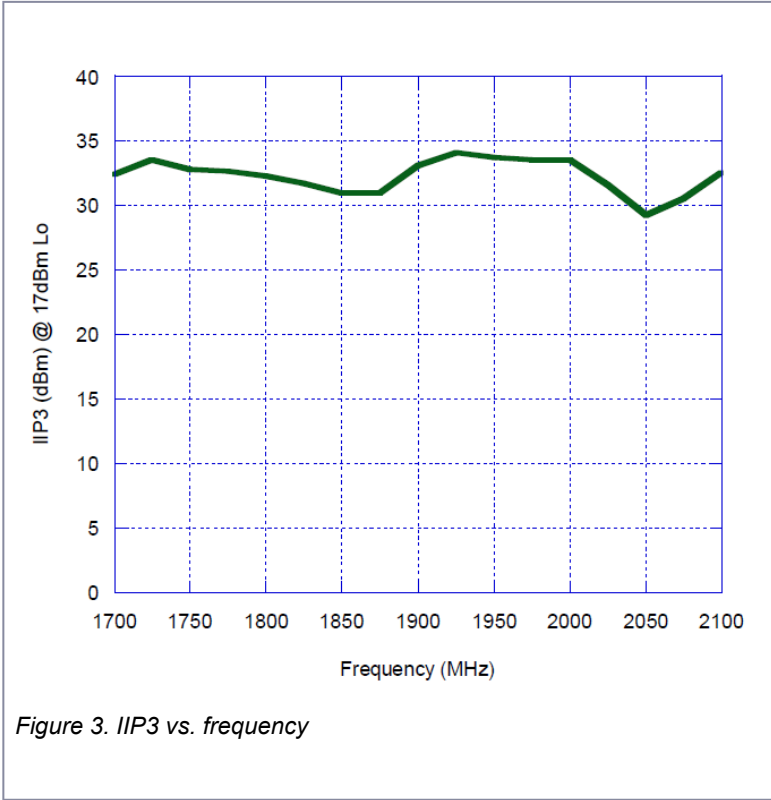
The Table 3 data was taken on an evaluation board that was narrowband tuned to cover the PCS band:

- IF = 73 MHz low side
- LO drive = 17 dBm

Table 3. Typical PCS application performance at +25 °C

Parameter	Minimum	Typical	Maximum	Units
Frequency range:				
- LO	1630	—	2130	MHz
- RF	1700	—	2200	
- IF	—	70	—	
Conversion loss (includes balun losses)	—	8.5	—	dB
Isolation:				
- LO-RF	—	36	—	dB
- LO-IF	—	26	—	
Input IP3	—	32	—	dBm
Input 1 dB compression	—	22	—	dBm

Figures 3–5 show the typical performance data at +25 °C, LO = 17 dBm, and IF = 73 MHz low side.



CATV application

This section describes the PE4141 operation in a typical CATV application.

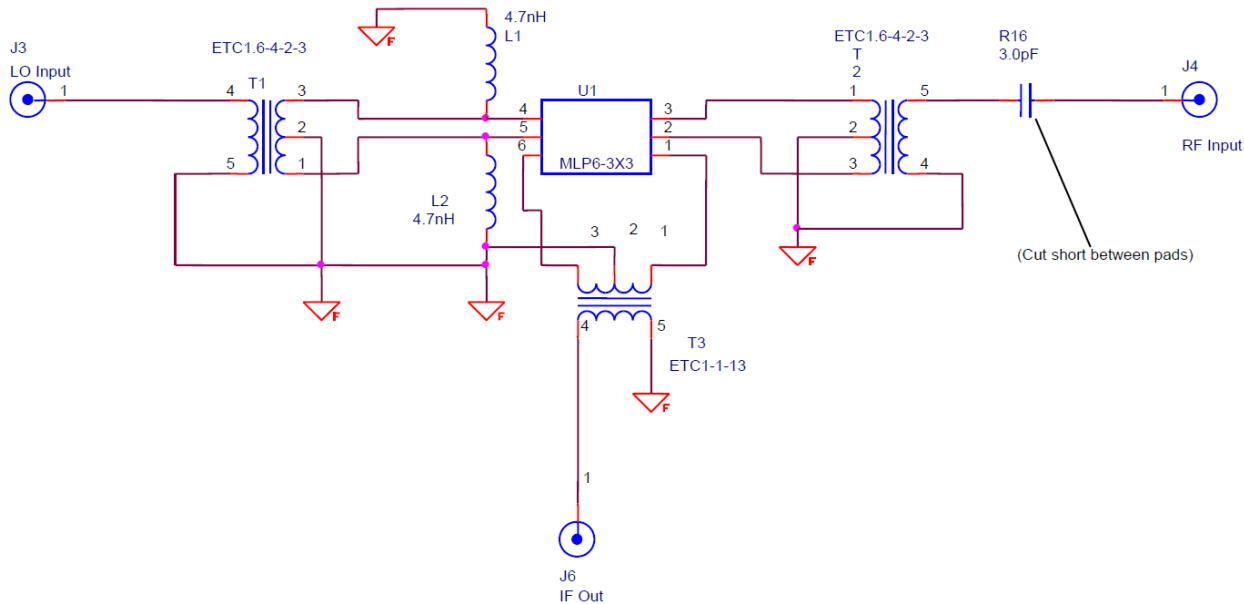


Figure 6. Typical CATV application schematic

- Notes:
- Reference designations refer to locations on the 101/0090 evaluation board.
 - L1 and L2 provide LO port matching for optimum performance. The typical gate capacitance is approximately 2.5 pF.

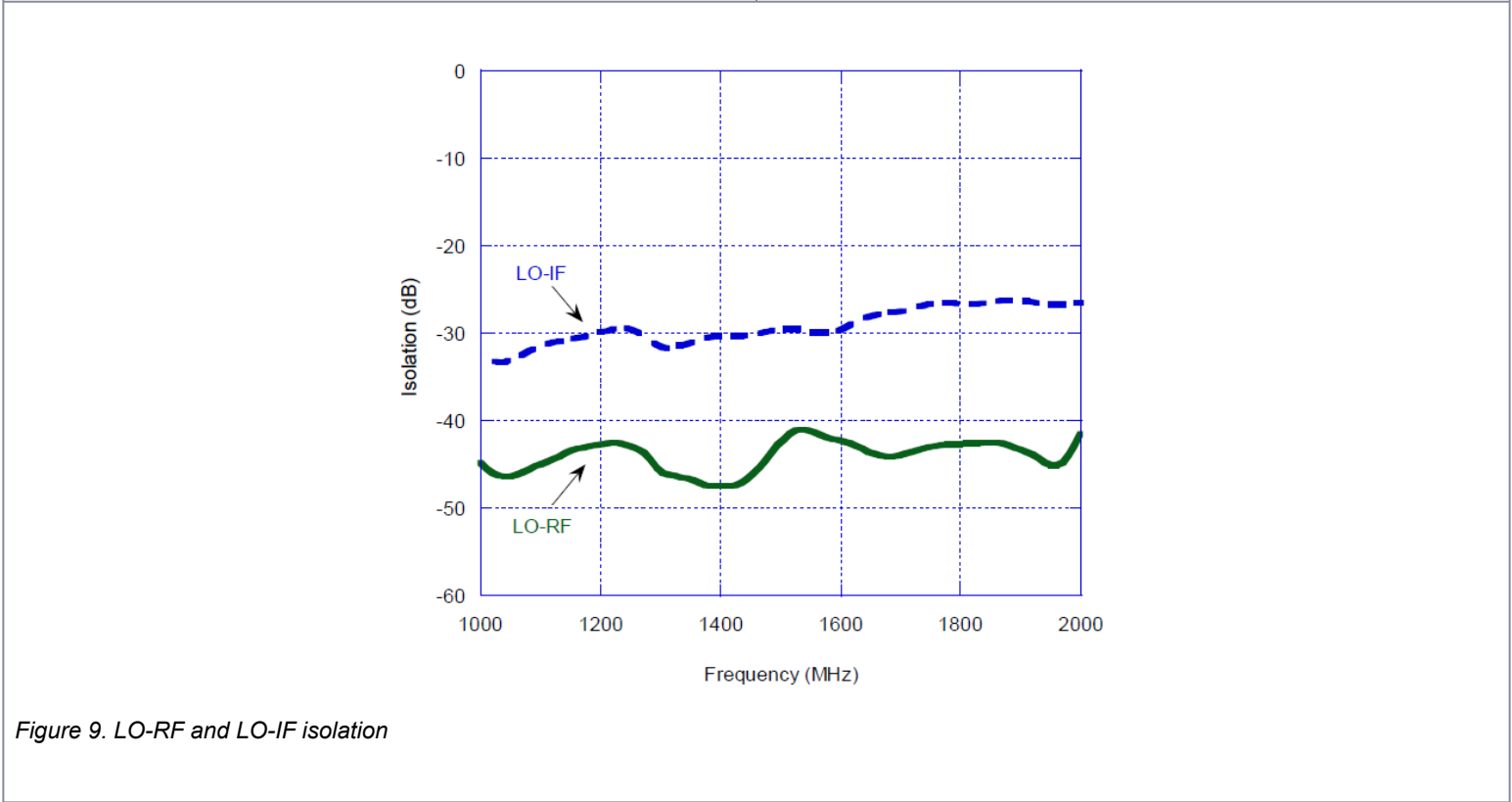
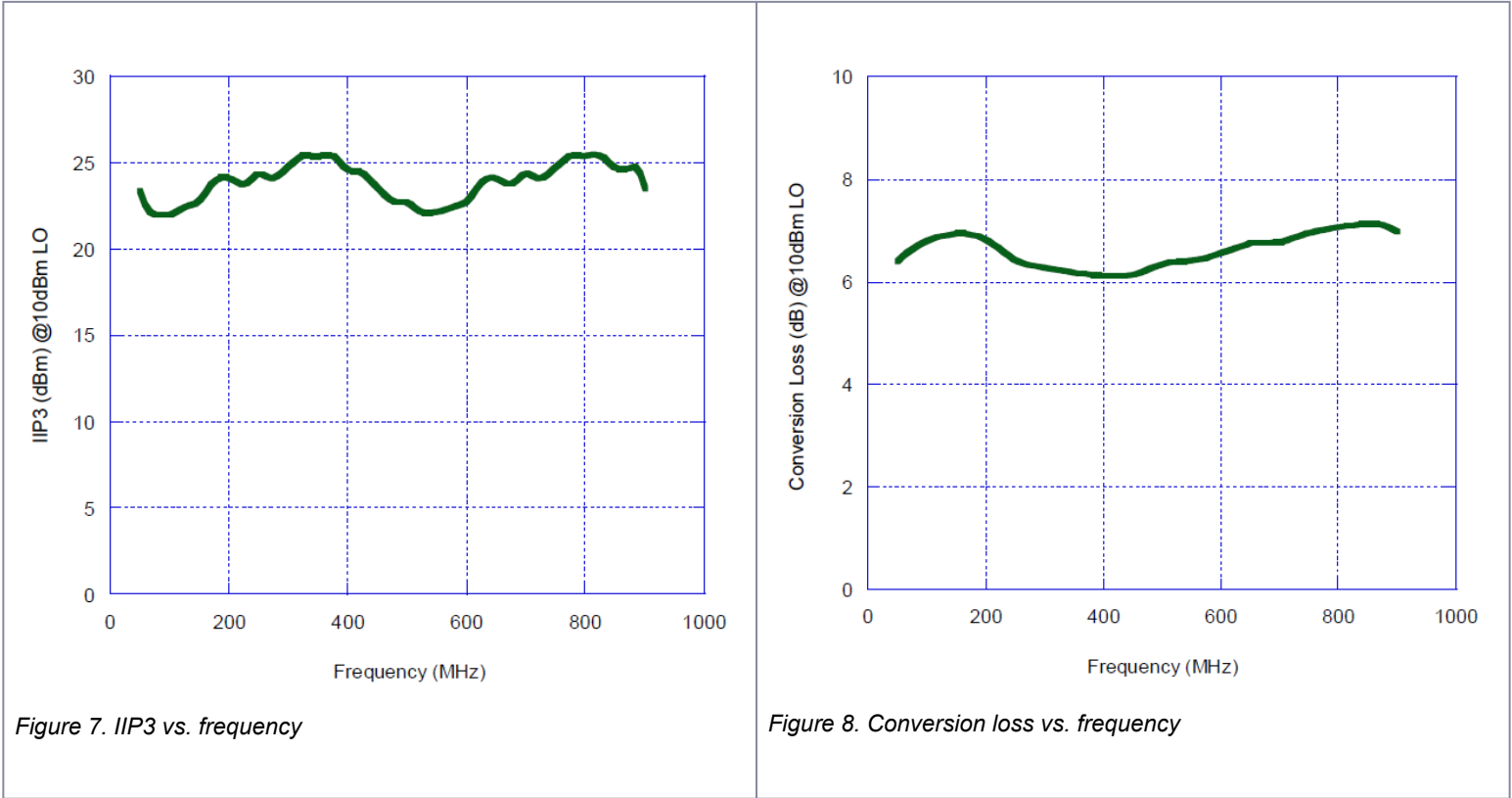
The Table 4 data was taken on an evaluation board tuned for a broadband CATV application:

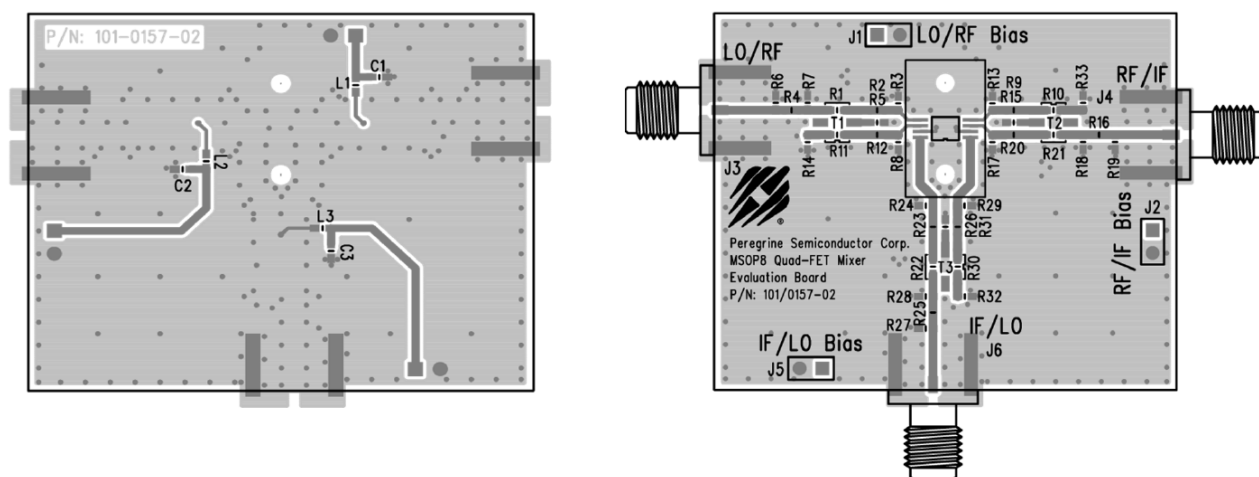
- IF = 1062 MHz
- RF drive = -5 dBm
- LO drive = 10 dBm

Table 4. Typical CATV application performance at +25 °C

Parameter	Minimum	Typical	Maximum	Units
Frequency range:				
- LO	1116	—	1926	MHz
- RF	54	—	864	
- IF	—	1062	—	
Conversion loss	—	6.5	—	dB
Isolation:				
- LO-RF	—	40	—	dB
- LO-IF	—	28	—	
Input IP3	—	23	—	dBm
Input 1 dB compression	—	13	—	dBm

Figures 7–9 show the typical performance data at +25 °C, IF = 1062 MHz, RF drive = -5 dBm, and LO drive = 10 dBm.





The schematic diagram illustrates the internal circuitry of a 2.4 GHz 10W PA module, divided into two main sections: the LO (Local Oscillator) path on the left and the RF (Radio Frequency) path on the right.

LO Path (Left):

- LO Input:** Labeled "LO/RF" at the top left, connected to SMA Connector J3 (Side Mnt Short).
- LO Output:** Labeled "IF/LO" at the bottom left, connected to SMA Connector J6 (Side Mnt Short).
- Components:** The LO path includes several resistors (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R113, R114, R115, R116, R117, R118, R119, R120, R121, R122, R123, R124, R125, R126, R127, R128, R129, R130, R131, R132, R133, R134, R135, R136, R137, R138, R139, R140, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, R174, R175, R176, R177, R178, R179, R180, R181, R182, R183, R184, R185, R186, R187, R188, R189, R190, R191, R192, R193, R194, R195, R196, R197, R198, R199, R200, R201, R202, R203, R204, R205, R206, R207, R208, R209, R210, R211, R212, R213, R214, R215, R216, R217, R218, R219, R220, R221, R222, R223, R224, R225, R226, R227, R228, R229, R230, R231, R232, R233, R234, R235, R236, R237, R238, R239, R240, R241, R242, R243, R244, R245, R246, R247, R248, R249, R250, R251, R252, R253, R254, R255, R256, R257, R258, R259, R260, R261, R262, R263, R264, R265, R266, R267, R268, R269, R270, R271, R272, R273, R274, R275, R276, R277, R278, R279, R280, R281, R282, R283, R284, R285, R286, R287, R288, R289, R290, R291, R292, R293, R294, R295, R296, R297, R298, R299, R300, R301, R302, R303, R304, R305, R306, R307, R308, R309, R310, R311, R312, R313, R314, R315, R316, R317, R318, R319, R320, R321, R322, R323, R324, R325, R326, R327, R328, R329, R330, R331, R332, R333, R334, R335, R336, R337, R338, R339, R340, R341, R342, R343, R344, R345, R346, R347, R348, R349, R350, R351, R352, R353, R354, R355, R356, R357, R358, R359, R360, R361, R362, R363, R364, R365, R366, R367, R368, R369, R370, R371, R372, R373, R374, R375, R376, R377, R378, R379, R380, R381, R382, R383, R384, R385, R386, R387, R388, R389, R390, R391, R392, R393, R394, R395, R396, R397, R398, R399, R400, R401, R402, R403, R404, R405, R406, R407, R408, R409, R410, R411, R412, R413, R414, R415, R416, R417, R418, R419, R420, R421, R422, R423, R424, R425, R426, R427, R428, R429, R430, R431, R432, R433, R434, R435, R436, R437, R438, R439, R440, R441, R442, R443, R444, R445, R446, R447, R448, R449, R450, R451, R452, R453, R454, R455, R456, R457, R458, R459, R460, R461, R462, R463, R464, R465, R466, R467, R468, R469, R470, R471, R472, R473, R474, R475, R476, R477, R478, R479, R480, R481, R482, R483, R484, R485, R486, R487, R488, R489, R490, R491, R492, R493, R494, R495, R496, R497, R498, R499, R500, R501, R502, R503, R504, R505, R506, R507, R508, R509, R510, R511, R512, R513, R514, R515, R516, R517, R518, R519, R520, R521, R522, R523, R524, R525, R526, R527, R528, R529, R530, R531, R532, R533, R534, R535, R536, R537, R538, R539, R540, R541, R542, R543, R544, R545, R546, R547, R548, R549, R550, R551, R552, R553, R554, R555, R556, R557, R558, R559, R560, R561, R562, R563, R564, R565, R566, R567, R568, R569, R570, R571, R572, R573, R574, R575, R576, R577, R578, R579, R580, R581, R582, R583, R584, R585, R586, R587, R588, R589, R590, R591, R592, R593, R594, R595, R596, R597, R598, R599, R600, R601, R602, R603, R604, R605, R606, R607, R608, R609, R610, R611, R612, R613, R614, R615, R616, R617, R618, R619, R620, R621, R622, R623, R624, R625, R626, R627, R628, R629, R630, R631, R632, R633, R634, R635, R636, R637, R638, R639, R640, R641, R642, R643, R644, R645, R646, R647, R648, R649, R650, R651, R652, R653, R654, R655, R656, R657, R658, R659, R660, R661, R662, R663, R664, R665, R666, R667, R668, R669, R670, R671, R672, R673, R674, R675, R676, R677, R678, R679, R680, R681, R682, R683, R684, R685, R686, R687, R688, R689, R690, R691, R692, R693, R694, R695, R696, R697, R698, R699, R700, R701, R702, R703, R704, R705, R706, R707, R708, R709, R710, R711, R712, R713, R714, R715, R716, R717, R718, R719, R720, R721, R722, R723, R724, R725, R726, R727, R728, R729, R730, R731, R732, R733, R734, R735, R736, R737, R738, R739, R740, R741, R742, R743, R744, R745, R746, R747, R748, R749, R750, R751, R752, R753, R754, R755, R756, R757, R758, R759, R760, R761, R762, R763, R764, R765, R766, R767, R768, R769, R770, R771, R772, R773, R774, R775, R776, R777, R778, R779, R780, R781, R782, R783, R784, R785, R786, R787, R788, R789, R790, R791, R792, R793, R794, R795, R796, R797, R798, R799, R800

Figure 11. Evaluation board schematic using pSemi specification 102-0512-02

- Use the 101-0157-02 PCB.
- Do not install U1 according to the Pin 1 indicator on the PCB silkscreen. Install U1 rotated by 180°.

Pin configuration

Figure 12 shows the PE4141 pin configuration for the 8-lead MSOP package, and Table 5 lists the description for each pin.

Table 5. Pin descriptions

Pin no.	Pin name	Description
1	IF1	IF output connection (drain)
2	GND	Ground
3	RF1	RF input connection (source)
4	RF2	RF input connection (source)
5	LO2	LO input connection (gate)
6	LO1	LO input connection (gate)
7	GND	Ground
8	IF2	IF output connection (drain)

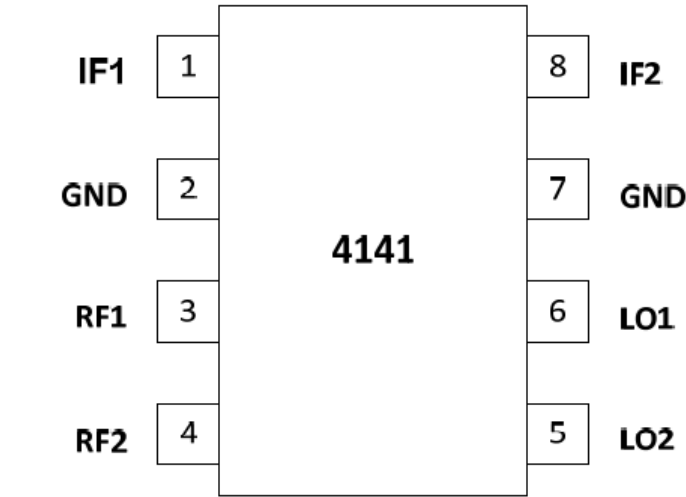


Figure 12. Pin configuration, top view

Packaging information

This section provides the PE4141 packaging drawing and tape-and-reel information.

Package drawing

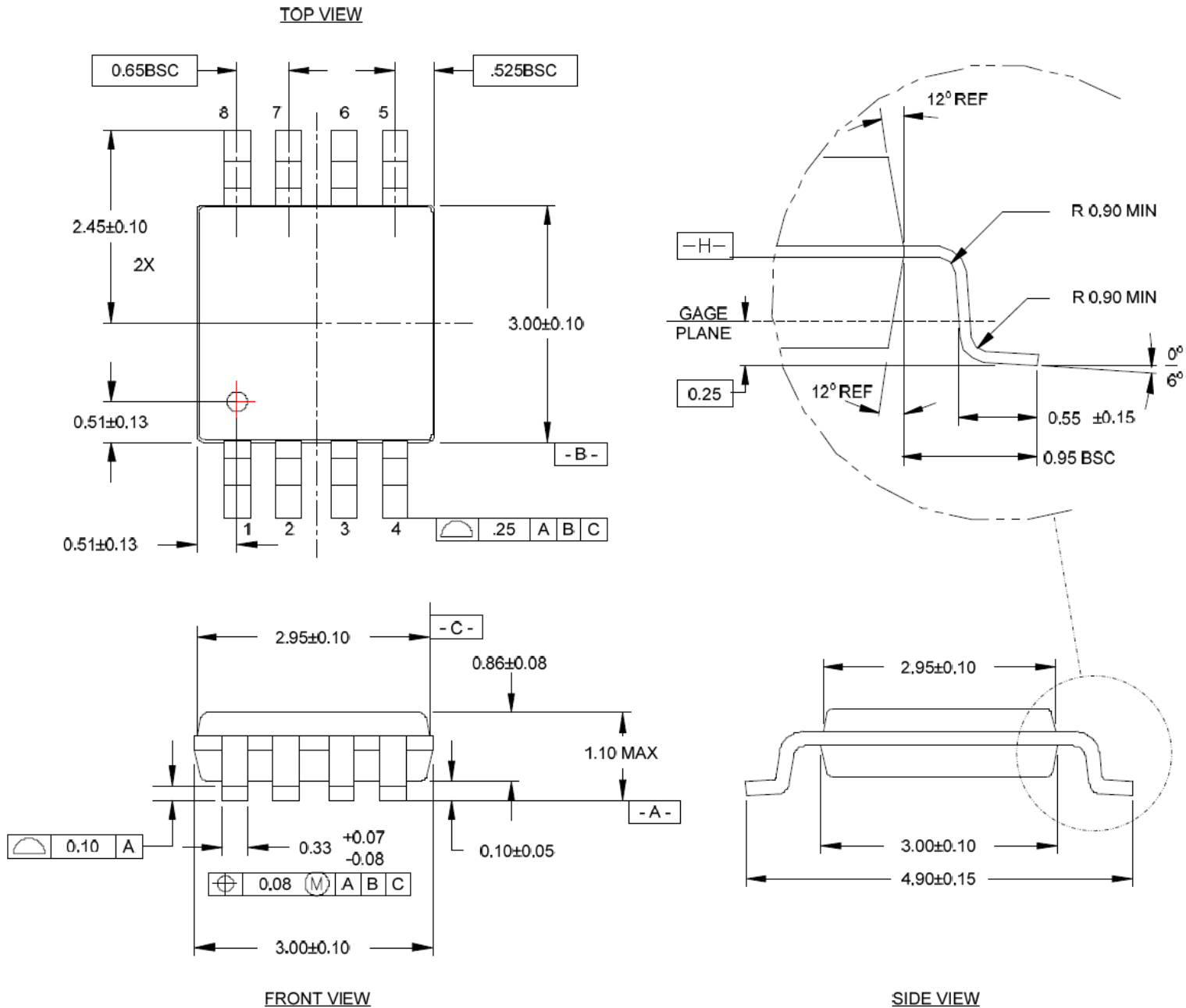


Figure 13. Package mechanical drawing for the 8-lead MSOP

Tape and reel specification

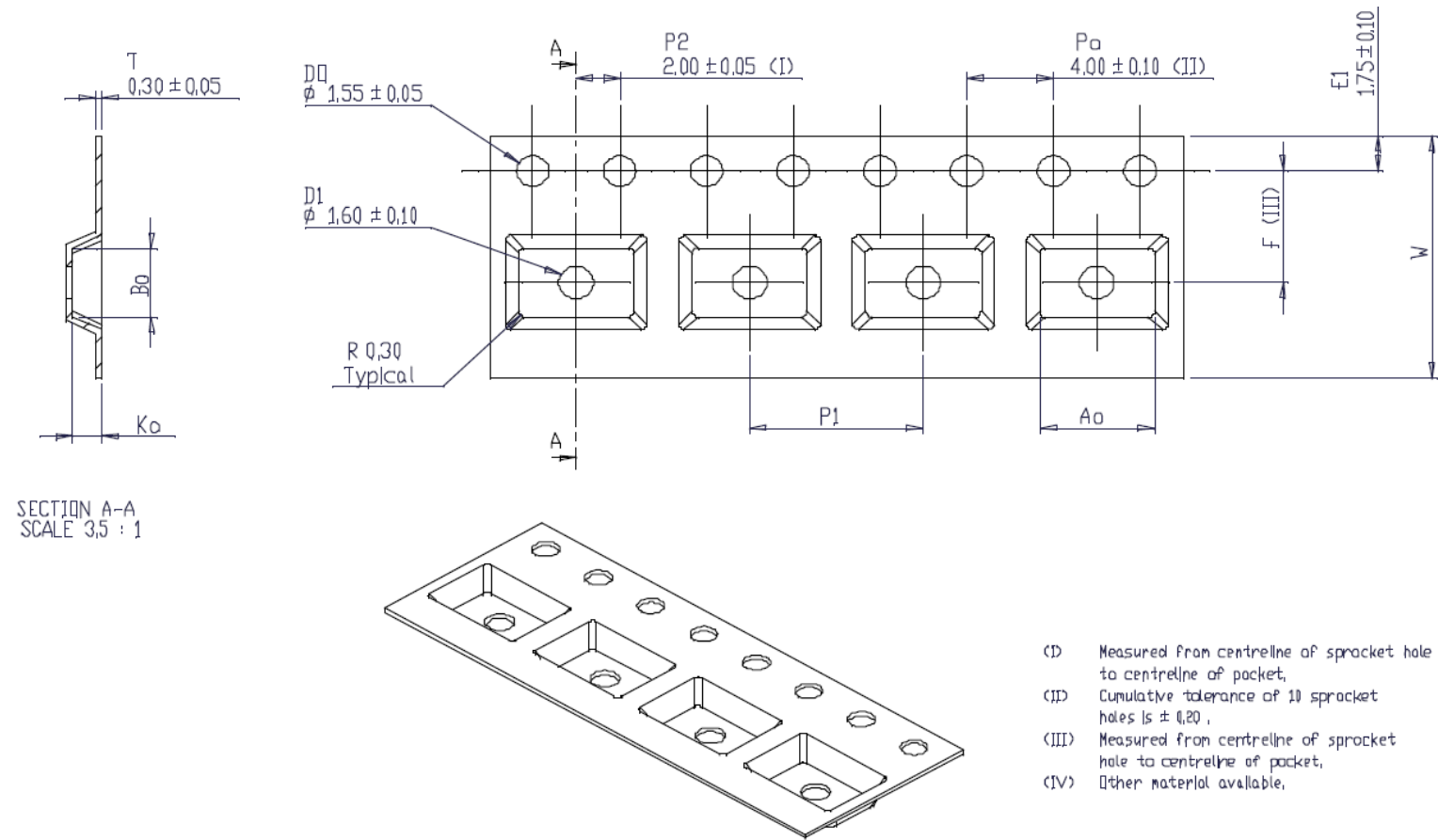


Figure 14. Tape and reel specification for the 8-lead MSOP

- Notes:
- The diagram is not drawn to scale.
 - The units are in millimeters (mm).

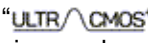
Table 6. Tape and reel dimensions

Carrier tape dimensions		
Pocket	Nominal	Tolerance
Ao	5.30	± 0.1
Bo	3.40	± 0.1
Ko	1.40	± 0.1
P1	8	± 0.1
W	12	± 0.3
F	5.50	± 0.05

Ordering information

Order code	Description	Packaging	Shipping method
PE4141B-W	PE4141 quad MOSFET array	Green 8-lead MSOP	2000 units/T&R
EK4141-02	PE4141 evaluation kit	Evaluation kit	1/box

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