QPD3601

200 W, 50 V 3.4 – 3.6 GHz GaN RF Power Transistor

Product Description

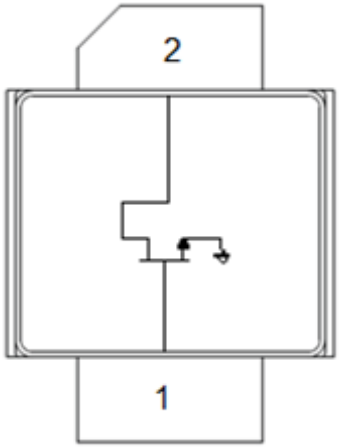
The QPD3601 is a discrete GaN on SiC HEMT which operates from 3.4 – 3.6 GHz. The device is a single stage matched power amplifier transistor.

The QPD3601 can be used in Doherty architecture for the final stage of a base station power amplifier for macrocell high efficiency systems.

QPD3601 can deliver P_{SAT} of 206 W at +50 V operation.

ROHS compliant.

Functional Block Diagram



2 Lead NI400 Package

Product Features

- Operating Frequency Range: 3.4 – 3.6 GHz
- Operating Drain Voltage: +50 V
- Output Power (P_{SAT}): 206 W
- Drain Efficiency: 57.9%
- Efficiency-Tuned P3dB Gain: 16.3 dB
- 2-lead, earless, ceramic flange NI400 package

Applications

- W-CDMA / LTE
- Macrocell Base Station
- Active Antenna
- General Purpose Applications

Ordering Information

Part No.	ECCN	Description
QPD3601	3A001.b.3.a.3	200 W, 3.4 – 3.6 GHz, GaN Discrete

Standard T/R size = 250 pieces on 13” reel

Absolute Maximum Ratings

Parameter	Value / Range
Gate Voltage (V_G)	−10 V
Drain Voltage (V_D)	+55 V
RF Input Power Over Drive above P_{IN} at 48 dBm P_{OUT}, 50 Ω, T = 25 °C	8 dB
VSWR Mismatch, P1dB Pulse (20 % duty cycle, 100 µ width), T = 25 °C	10:1
Storage Temperature	−65 to +150°C

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Operating Temperature	−40	–	–	°C
Gate Current (I_G)	–	–	15	mA
Gate Voltage (V_G)	−3.3	−2.7	−2.5	V
Drain Voltage (V_D)	–	50	–	V
Quiescent Current (I_{DQ})	–	360	–	mA
T_{CH} for >10^6 hours MTTF	–	–	225	°C

Electrical performance is measured under conditions noted in the electrical specifications table. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Parameter	Conditions	Min	Typ	Max	Units
Frequency Range		3400	–	3600	MHz
Quiescent Current		–	360	–	mA
Gain	P3dB	15.0	16.3	–	dB
P3dB		52.5	53.1	–	dBm
Drain Efficiency	P3dB	51.0	57.9	–	%
Gate Leakage	V_D = +50 V, V_G = −5 V	−10.0	−3.5	–	mA

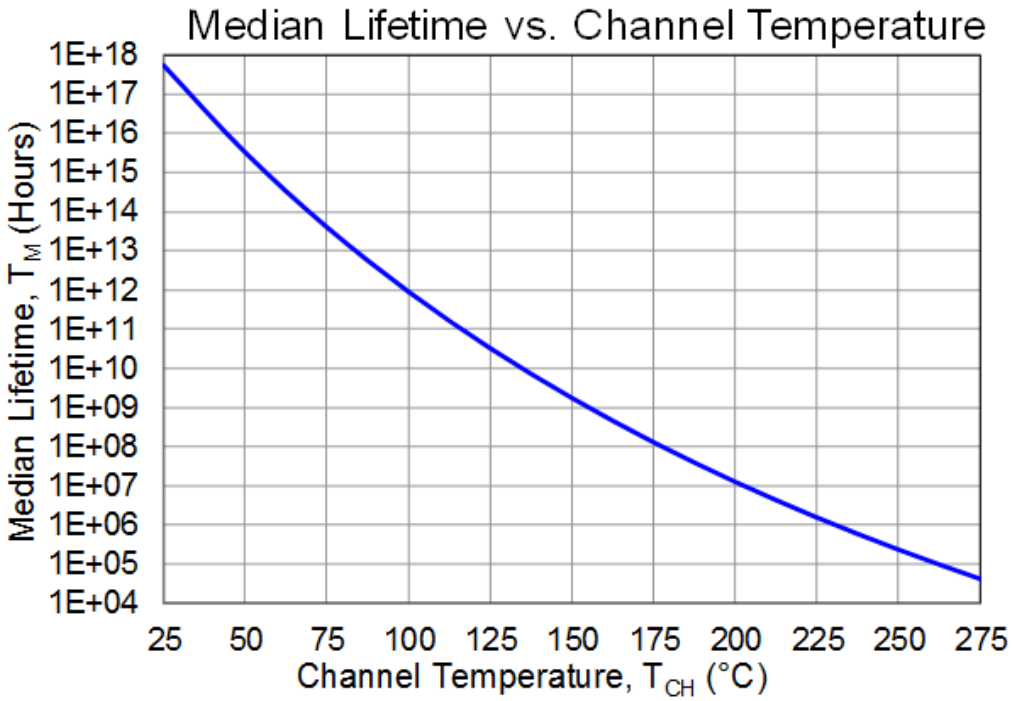
Test conditions unless otherwise noted: V_D = +50 V, I_{DQ} = 360 mA, T = 25°C, Pulsed (10 % duty cycle, 100 µs width), on Class AB single-ended EVB

Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance at Average Power (θ_{JC})	T_{CASE} = 85°C, T_{CH} = 175°C CW: P_{DISS} = 60.9 W, P_{OUT} = 56 W	1.47	°C/W

Notes:
1. Thermal resistance measured to package backside.
2. Based on expected carrier amplifier efficiency of Doherty.
3. Pout assumes 20% peaking amplifier contribution of total average Doherty rated power.

Median Lifetime



RF Characterization – Power-Tuned Load Pull Performance

Frequency (MHz)	Source Impedance	Load Impedance	Gain @ P3dB (dB)	P3dB (dBm)	Drain Efficiency (%)
3400	11.50 – j*15.57	7.76 – j*0.96	16.2	53.2	53.3
3500	18.05 – j*10.41	6.01 – j*0.73	16.6	53.3	55.4
3600	13.17 – j*1.70	6.01 – j*0.73	16.7	53.4	60.4

Test conditions unless otherwise noted: V_D = +50 V, I_{DQ} = 360 mA, T = 25°C, Pulsed 10% duty cycle, 100 µs width)

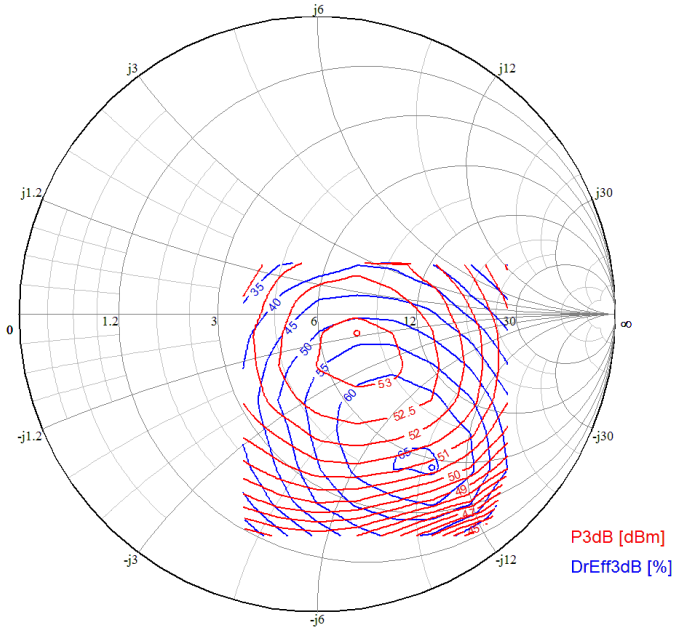
RF Characterization – Efficiency-Tuned Carrier Load Pull Performance

Frequency (MHz)	Source Impedance	Load Impedance	Gain @ P3dB (dB)	P3dB (dBm)	Drain Efficiency (%)
3400	11.50 – j*15.57	5.38 – j*9.66	19.0	50.7	65.9
3500	18.05 – j*10.41	6.47 – j*6.83	19.2	51.7	67.2
3600	13.17 + j*1.70	8.05 – j*5.51	18.7	52.0	69.9

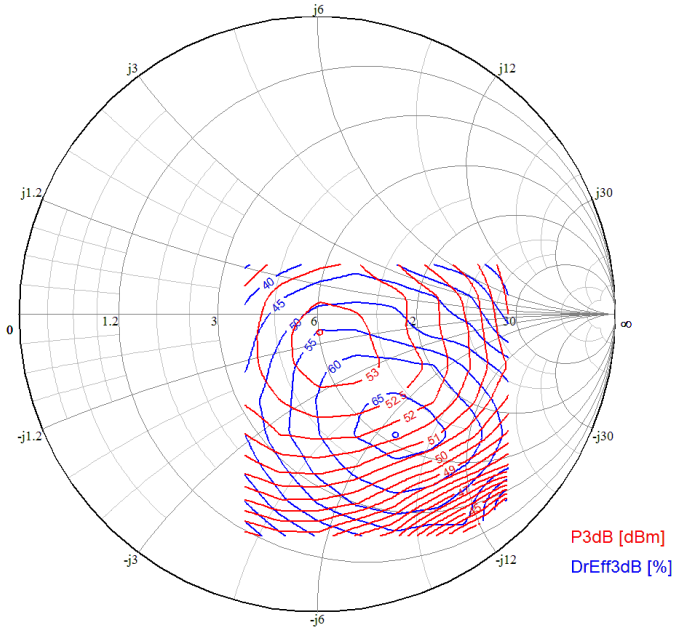
Test conditions unless otherwise noted: V_D = +50 V, I_{DQ} = 360 mA, T = 25°C, Pulsed 10% duty cycle, 100 µs width)

Load Pull Plots

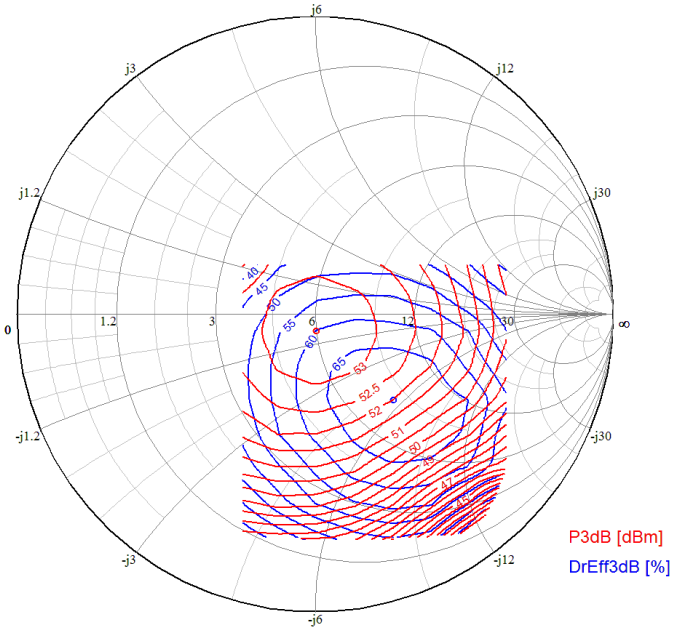
Load Pull at 3.4 GHz



Load Pull at 3.5 GHz

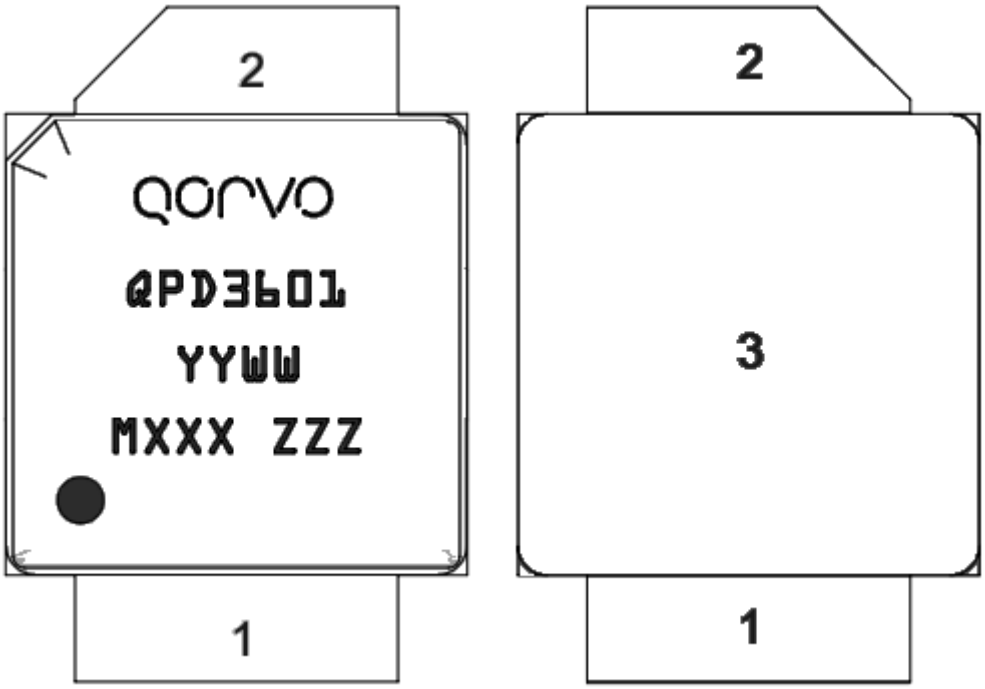


Load Pull at 3.6 GHz



Test conditions unless otherwise noted: V_D = +50 V, I_{DQ} = 360 mA, T = 25°C, Pulsed 10% duty cycle, 100 µs width)

Pin Configuration

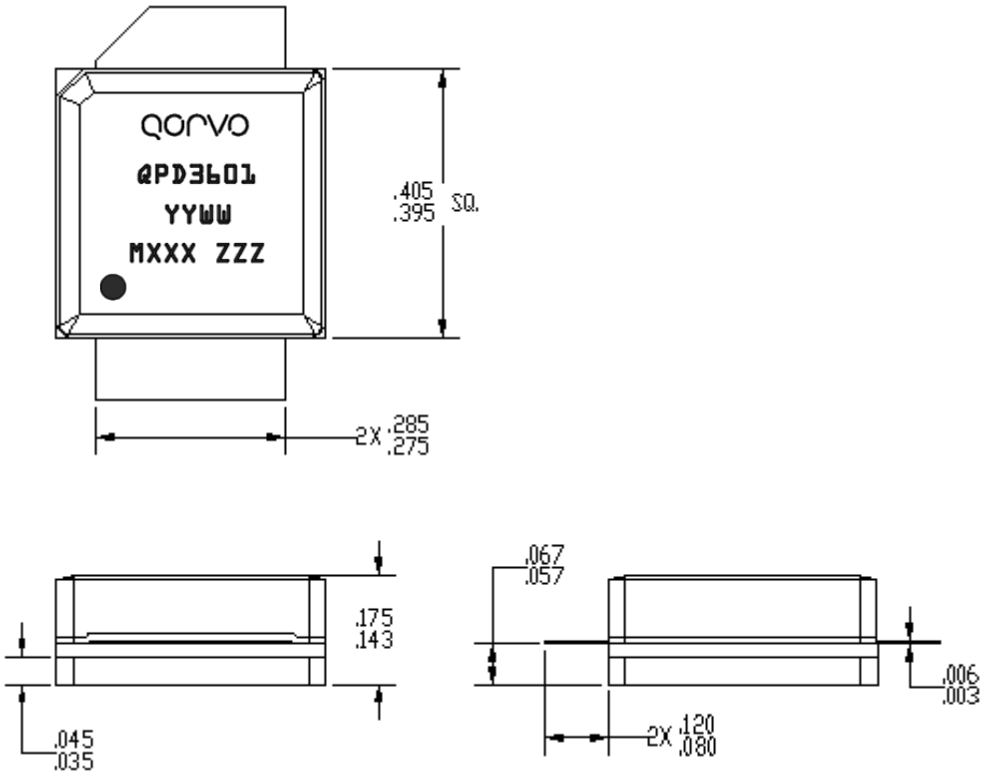


Pin Description

Pin No.	Label	Description
1	RF IN, V_G	RF Input, Gate Bias
2	RF OUT, V_D	RF Output, Drain Bias
3 (Backside Paddle)	RF/DC GND	RF/DC Ground

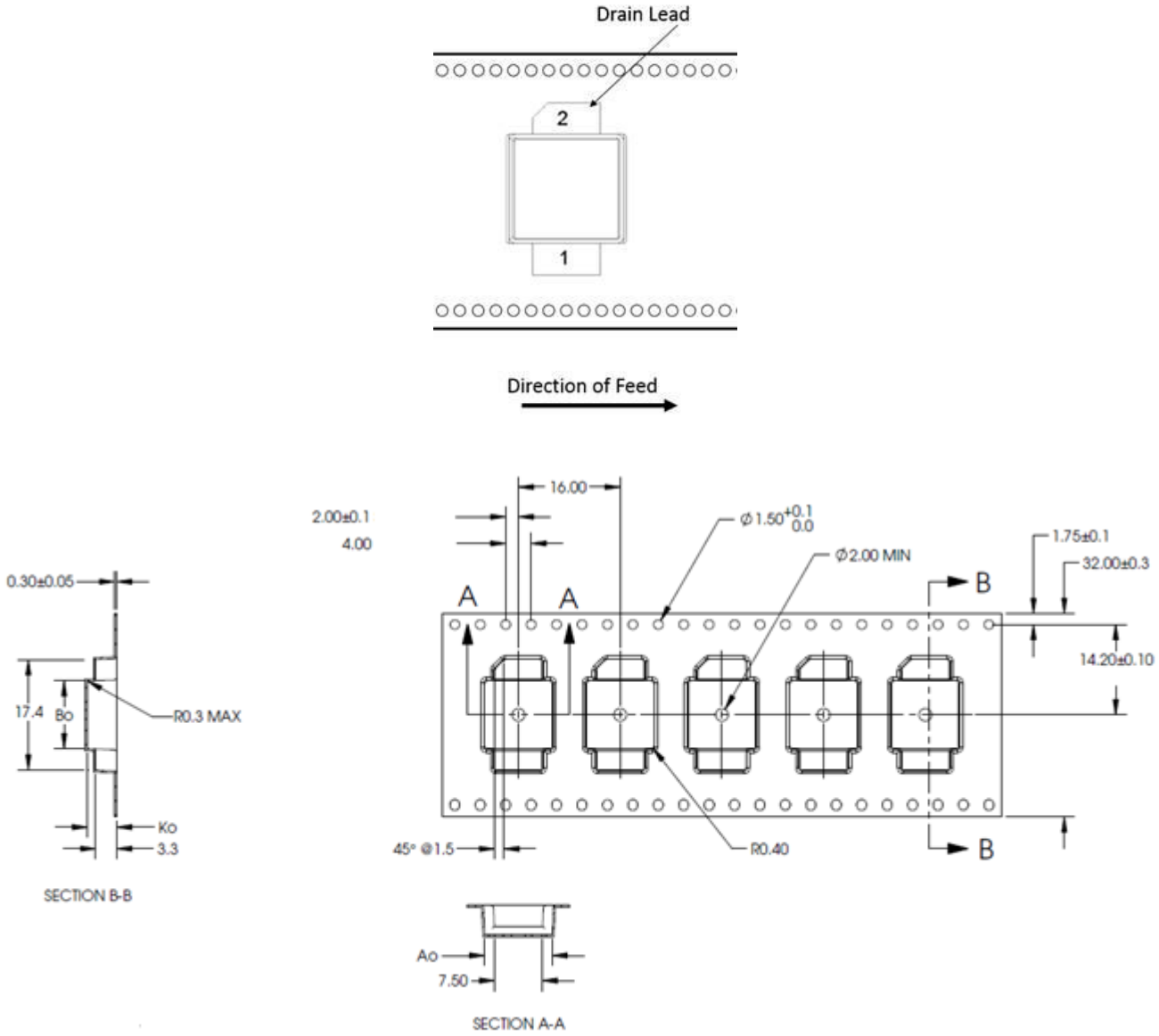
Package Marking and Dimensions

Marking: Qorvo Logo
Part Number and Package Version – QPD3601
Date Code – YYWW
Production Lot Number – MXXX
Serial Number – ZZZ



Notes:
1. All dimensions are in inches. Angles are in degrees.
2. Exposed metallization is NiAu plated.

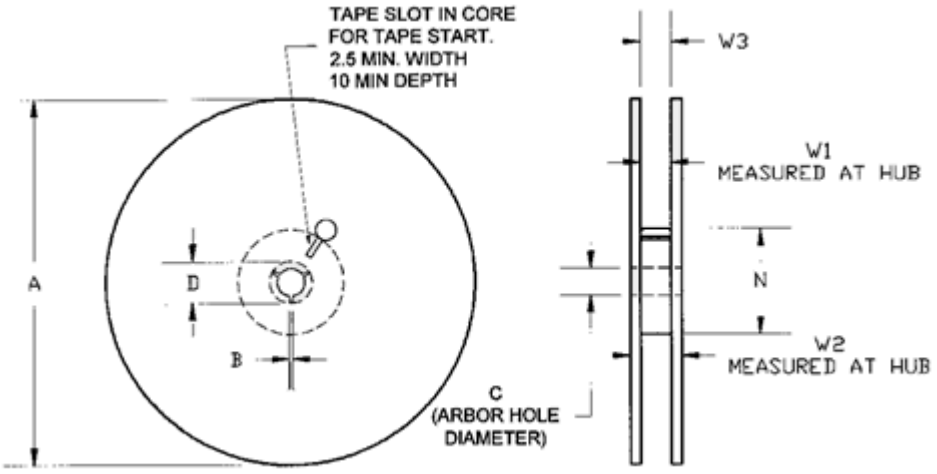
Tape and Reel Information – Carrier and Cover Tape Dimensions



Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.417	10.60
	Width	B0	0.419	10.65
	Depth	K0	0.181	4.60
	Pitch	P1	0.630	16
Centerline Distance	Cavity to Perforation – Length Direction	P2	0.079	2.00
	Cavity to Perforation – Width Direction	F	0.559	14.20
Cover Tape	Width	C	1.004	25.50
Carrier Tape	Width	W	1.260	32

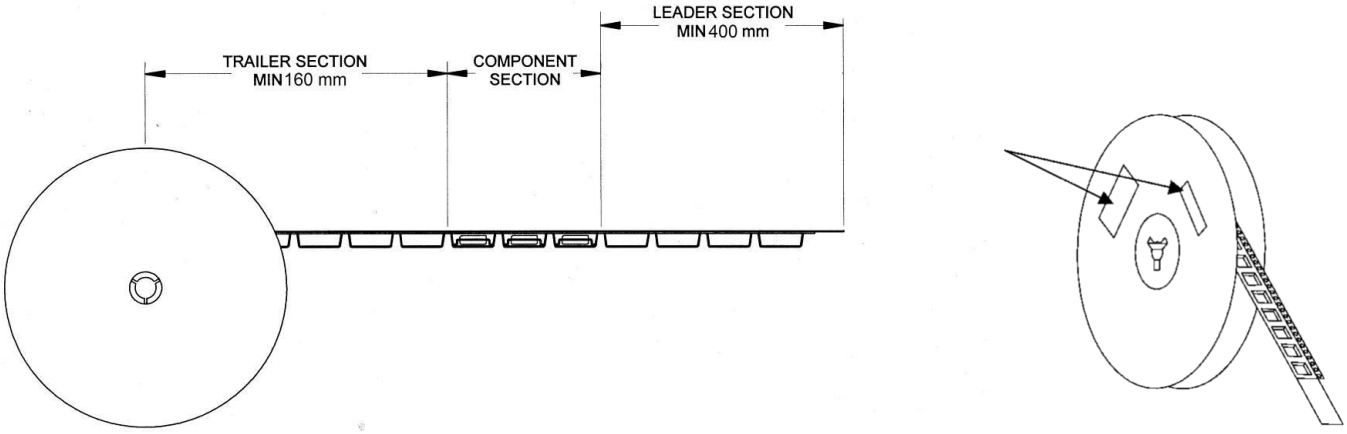
Tape and Reel Information – Reel Dimensions

Standard T/R size = 250 pieces on a 13” reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	12.992	330.0
	Thickness	W2	1.504	38.2
	Space Between Flange	W1	1.291	32.8
Hub	Outer Diameter	N	4.016	102.0
	Arbor Hole Diameter	C	0.512	13.0
	Key Slit Width	B	0.079	2.0
	Key Slit Diameter	D	0.787	20.0

Tape and Reel Information – Tape Length and Label Placement



Notes:
1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481-1-A.
2. Labels are placed on the flange opposite the sprockets in the carrier tape.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B	JEDEC Standard JS-001-2012
ESD – Charged Device Model (CDM)	Class C3	JEDEC Standard JESD22-C101F
MSL – 260 °C Convection Reflow	MSL3	JEDEC standard IPC/JEDEC J-STD-020.

Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260 °C maximum reflow temperature) and tin/lead (245 °C maximum reflow temperature) soldering processes.

Contact plating: NiAu

RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU. This product also has the following attributes:

- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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