NXP Semiconductors
Technical Data

Document Number: AFIC31025N
Rev. 0, 10/2017

RF LDMOS Integrated Power Amplifiers

The AFIC31025N integrated circuit is designed with on-chip matching that makes it usable from 2400 to 3100 MHz. This multi-stage device is designed to support CW and pulse applications.

Typical Performance: In 2400–3100 MHz reference circuit, V_{DD} = 32 Vdc

Frequency (MHz)	Signal Type	P_{out} (W)	G_{ps} (dB)	η_D (%)
2400–2500	CW	25	30.0	45.5
2700–3100	Pulse (300 μsec, 15% Duty Cycle)	25 Peak	22.0	40.0

AFIC31025N
AFIC31025GN

2400–3100 MHz, 25 W PEAK, 32 V AIRFAST RF LDMOS INTEGRATED POWER AMPLIFIERS

TO-270WB-17 PLASTIC AFIC31025N

TO-270WBG-17 PLASTIC AFIC31025GN

Features

- On-chip matching (50 ohm input, DC blocked)
- Integrated quiescent current temperature compensation with enable/disable function (1)
- Qualified up to a maximum of 32 V_{DD} operation
- Integrated ESD protection

Typical Applications

- Civil S-Band radar
- Weather radar
- Maritime radar
- Industrial heating
- Data links
- Plasma generation

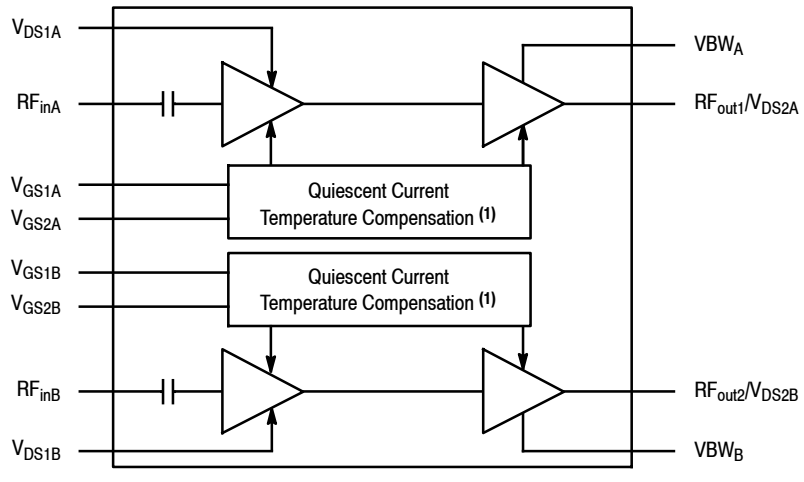
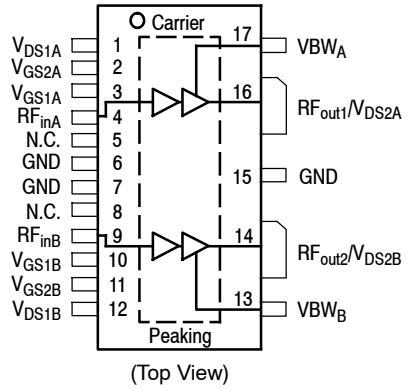


Figure 1. Functional Block Diagram



(Top View)

Note: Exposed backside of the package is the source terminal for the transistor.

Figure 2. Pin Connections

1. Refer to AN1977, *Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family*, and to AN1987, *Quiescent Current Control for the RF Integrated Circuit Device Family.* Go to http://www.nxp.com/RF and search for AN1977 or AN1987.

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	–0.5, +65	Vdc
Gate–Source Voltage	V_{GS}	–0.5, +10	Vdc
Operating Voltage	V_{DD}	32, +0	Vdc
Storage Temperature Range	T_{stg}	–65 to +150	°C
Case Operating Temperature Range	T_C	–40 to +150	°C
Operating Junction Temperature Range (1)	T_J	–40 to +225	°C
Input Power	P_{in}	20	dBm

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2)	Unit
Thermal Resistance, Junction to Case Case Temperature 81°C, DC, Total P_D = 29.3 W Stage 1, 28 Vdc, P_D = 3.8 W Stage 2, 28 Vdc, P_D = 25.5 W	$R_{\theta JC}$	 5.85 1.92	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22–A114)	1B
Charge Device Model (per JESD22–C101)	II

Table 4. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD22–A113, IPC/JEDEC J–STD–020	3	260	°C

Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Stage 1 – Off Characteristics (3)					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 32 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate–Source Leakage Current (V_{GS} = 1.0 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
Stage 1 – On Characteristics					
Gate Threshold Voltage (3) (V_{DS} = 10 Vdc, I_D = 2.5 μAdc)	$V_{GS(th)}$	0.8	1.2	1.6	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, $I_{DQ1(A+B)}$ = 59 mAdc)	$V_{GS(Q)}$	—	2.0	—	Vdc
Fixture Gate Quiescent Voltage (V_{DD} = 28 Vdc, $I_{DQ1(A+B)}$ = 59 mAdc, Measured in Functional Test)	$V_{GG(Q)}$	4.6	5.3	6.1	Vdc

1. Continuous use at maximum temperature will affect MTTF.
2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.nxp.com/RF and search for AN1955.
3. Each side of device measured separately.

(continued)

Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Stage 2 - Off Characteristics (1)					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 32 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 1.0 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
Stage 2 - On Characteristics					
Gate Threshold Voltage (1) (V_{DS} = 10 Vdc, I_D = 16 μAdc)	$V_{GS(th)}$	0.8	1.2	1.6	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, $I_{DQ2(A+B)}$ = 157 mAdc)	$V_{GS(Q)}$	—	1.9	—	Vdc
Fixture Gate Quiescent Voltage (V_{DD} = 28 Vdc, $I_{DQ2(A+B)}$ = 157 mAdc, Measured in Functional Test)	$V_{GG(Q)}$	4.3	5.0	5.8	Vdc
Drain-Source On-Voltage (1) (V_{GS} = 10 Vdc, I_D = 200 mAdc)	$V_{DS(on)}$	0.1	0.22	1.5	Vdc

1. Each side of device measured separately.

(continued)

Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

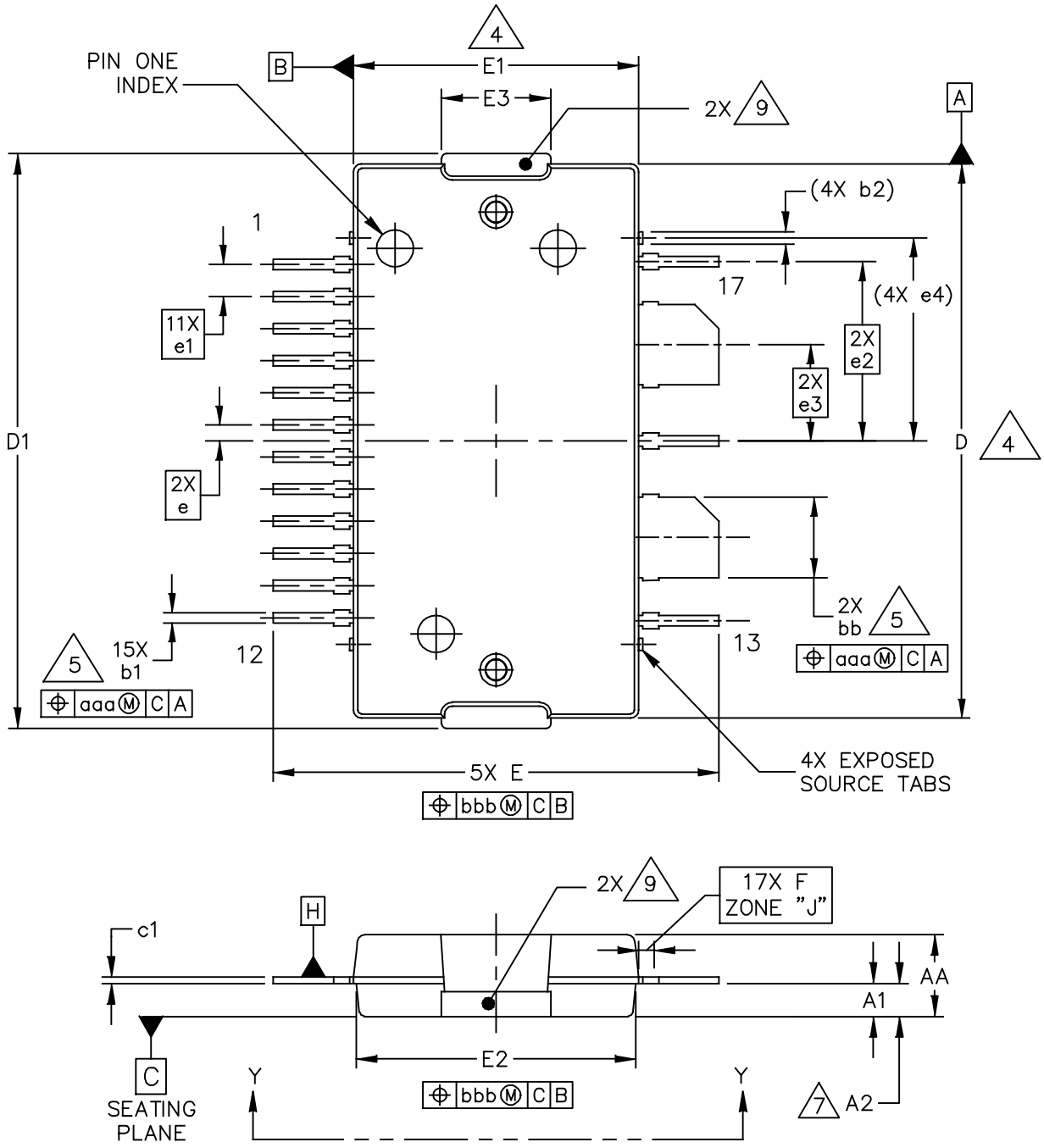
Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (1,2) (In NXP Production Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, $I_{DQ1(A+B)}$ = 59 mA, $I_{DQ2(A+B)}$ = 157 mA, P_{out} = 3.2 W Avg., f = 2690 MHz, Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset.					
Power Gain	G_{ps}	30.5	31.9	34.5	dB
Power Added Efficiency	PAE	18.0	19.7	—	%
Load Mismatch (In NXP Production Test Fixture, 50 ohm system) $I_{DQ1(A+B)}$ = 59 mA, $I_{DQ2(A+B)}$ = 157 mA, f = 2600 MHz					
VSWR 10:1 at 32 Vdc, 36 W CW Output Power (3 dB Input Overdrive from 25 W CW Rated Power)	No Device Degradation				

Table 6. Ordering Information

Device	Tape and Reel Information	Package
AFIC31025NR1	R1 Suffix = 500 Units, 44 mm Tape Width, 13-Reel	TO-270WB-17
AFIC31025GNR1		TO-270WBG-17

1. Part internally input and output matched.
2. Measurements made with device in straight lead configuration before any lead forming operation is applied. Lead forming is used for gull wing (GN) parts.

PACKAGE DIMENSIONS



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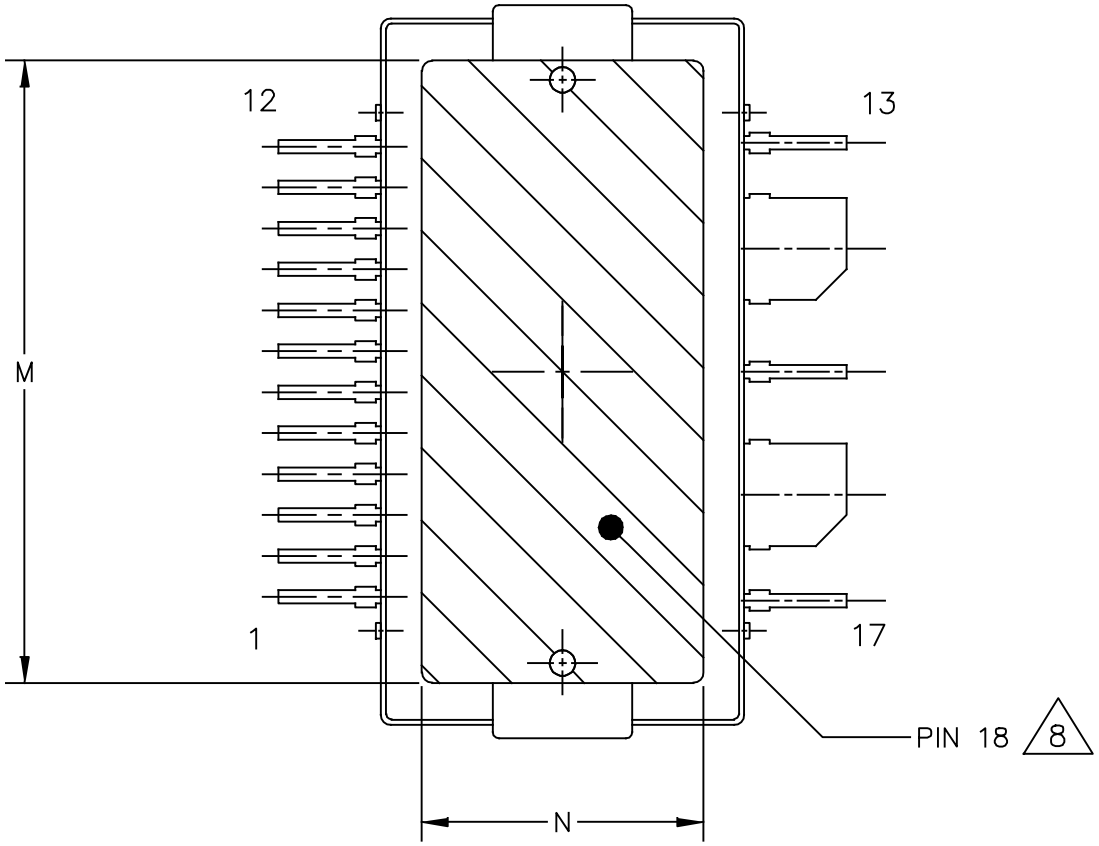

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	STANDARD: NON–JEDEC	
	SOT1730–1	21 JAN 2016

NOTES:

1. CONTROLLING DIMENSION: INCH

2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.

3. DATUM PLANE H IS LOCATED AT THE TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.

4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 INCH (0.15 MM) PER SIDE. DIMENSIONS D AND E1 DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H.

5. DIMENSIONS bb AND b1 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 INCH (0.13 MM) TOTAL IN EXCESS OF THE bb AND b1 DIMENSIONS AT MAXIMUM MATERIAL CONDITION.

6. DATUMS A AND B TO BE DETERMINED AT DATUM PLANE H.

7. DIMENSION A2 APPLIES WITHIN ZONE J ONLY.

8. HATCHING REPRESENTS THE EXPOSED AND SOLDERABLE AREA OF THE HEAT SLUG. DIMENSIONS M AND N REPRESENT THE VALUES BETWEEN THE TWO OPPOSITE POINTS ALONG THE EDGES OF EXPOSED AREA OF THE HEAT SLUG.

9. THESE SURFACES OF THE HEAT SLUG ARE NOT PART OF THE SOLDERABLE SURFACES AND MAY REMAIN UNPLATED.

	INCH		MILLIMETER			INCH		MILLIMETER	
DIM	MIN	MAX	MIN	MAX	DIM	MIN	MAX	MIN	MAX
AA	.099	.105	2.51	2.67	bb	.097	.103	2.46	2.62
A1	.039	.043	0.99	1.09	b1	.010	.016	0.25	0.41
A2	.040	.042	1.02	1.07	b2	----	.019	----	0.48
D	.688	.692	17.48	17.58	c1	.007	.011	0.18	0.28
D1	.712	.720	18.08	18.29	e	.020 BSC		0.51 BSC	
E	.551	.559	14.00	14.20	e1	.040 BSC		1.02 BSC	
E1	.353	.357	8.97	9.07	e2	.223 BSC		5.66 BSC	
E2	.346	.350	8.79	8.89	e3	.120 BSC		3.05 BSC	
E3	.132	.140	3.35	3.56	e4	.253 INFO ONLY		6.43 INFO ONLY	
F	.025 BSC		0.64 BSC		aaa	.004		0.10	
M	.600	----	15.24	----	bbb	.008		0.20	
N	.270	----	6.86	----					

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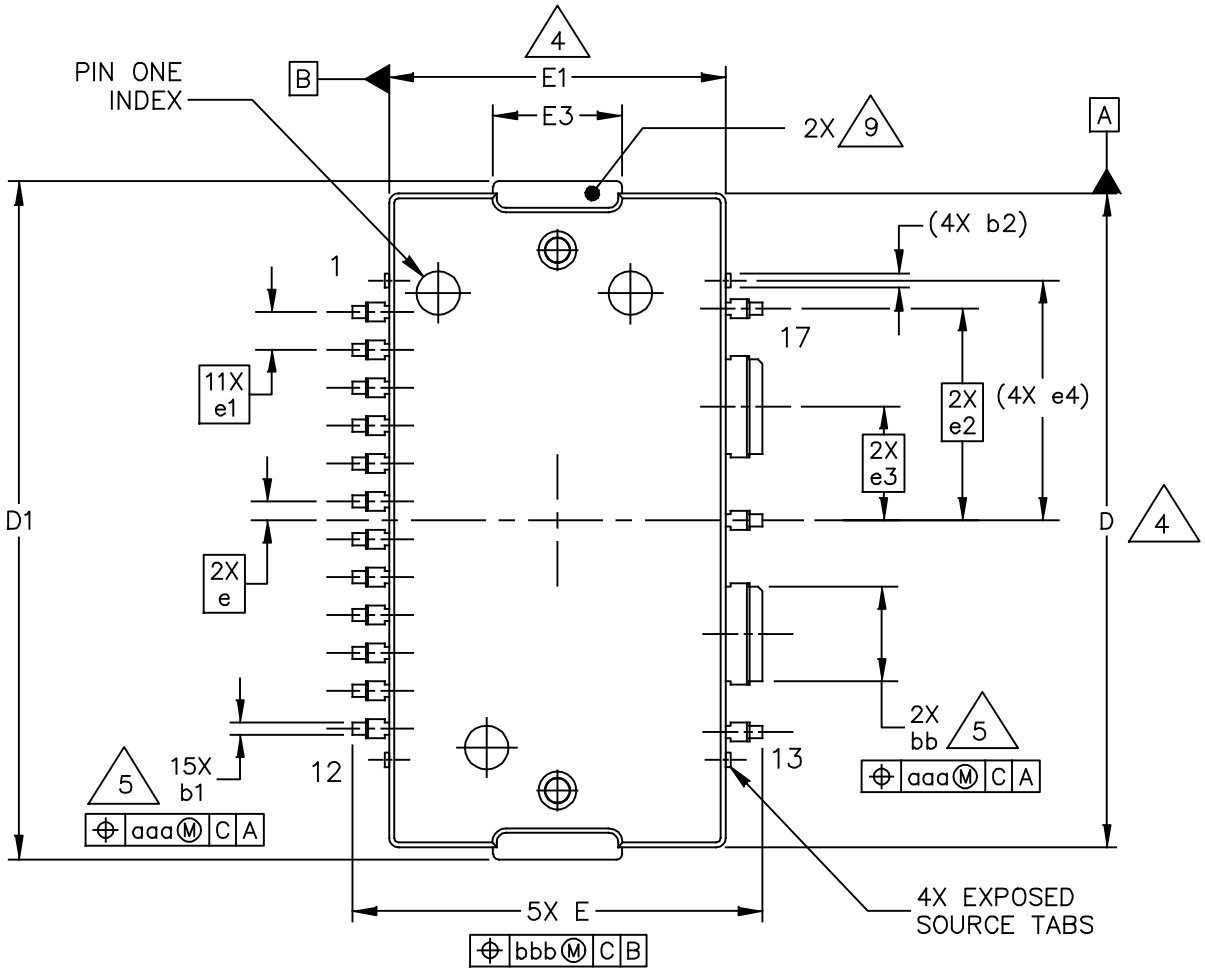

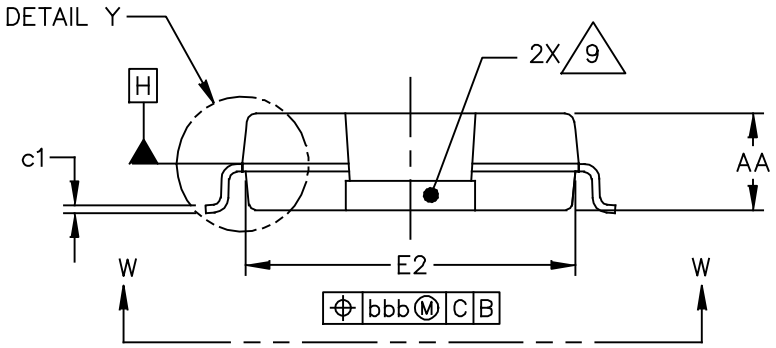

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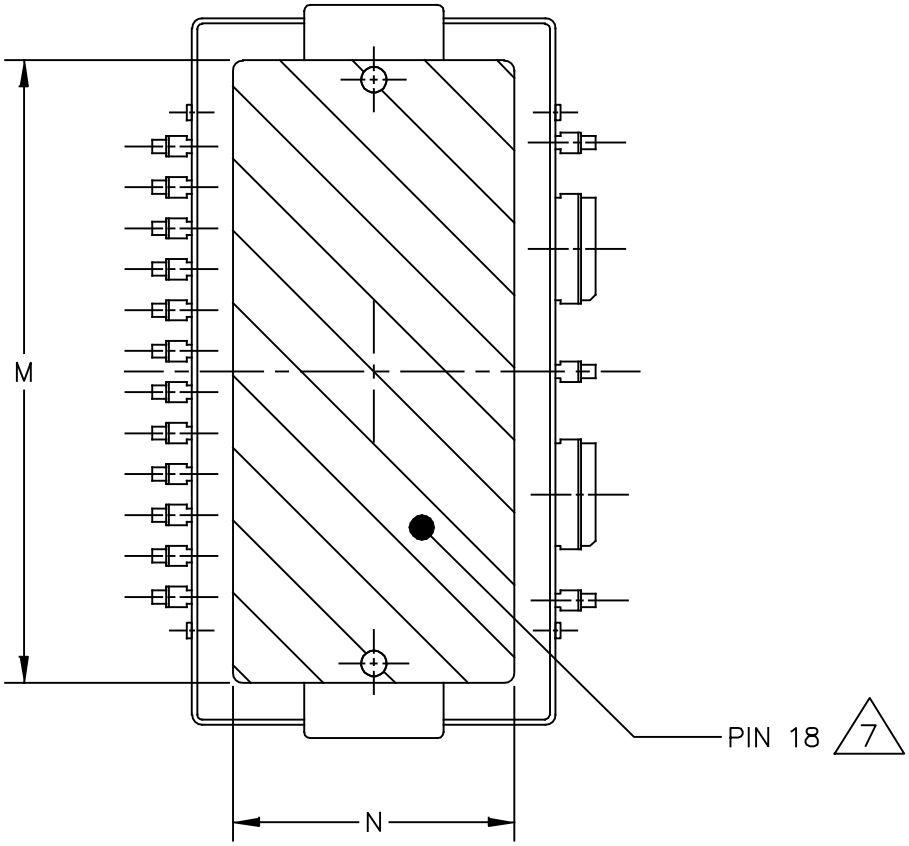

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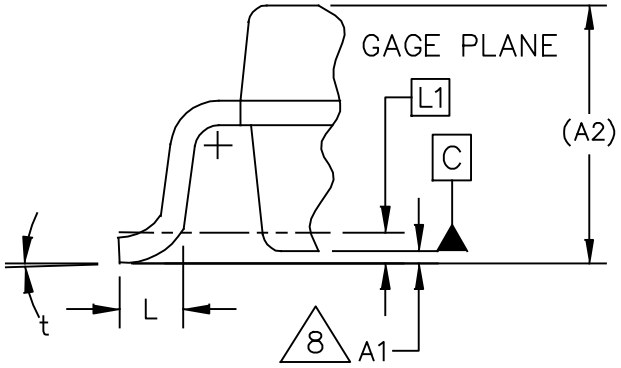

DETAIL "Y"

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6. DATUMS A AND B TO BE DETERMINED AT DATUM PLANE H.

7. HATCHING REPRESENTS THE EXPOSED AND SOLDERABLE AREA OF THE HEAT SLUG. DIMENSIONS M AND N REPRESENT THE VALUES BETWEEN THE TWO OPPOSITE POINTS ALONG THE EDGES OF EXPOSED AREA OF THE HEAT SLUG.

8. DIMENSION A1 IS MEASURED WITH REFERENCE TO DATUM C. THE POSITIVE VALUE IMPLIES THAT THE BOTTOM OF THE PACKAGE IS HIGHER THAN THE BOTTOM OF THE LEAD.

9. THESE SURFACES OF THE HEAT SLUG ARE NOT PART OF THE SOLDERABLE SURFACES AND MAY REMAIN UNPLATED.

	INCH		MILLIMETER			INCH		MILLIMETER	
DIM	MIN	MAX	MIN	MAX	DIM	MIN	MAX	MIN	MAX
AA	.099	.105	2.51	2.67	bb	.097	.103	2.46	2.62
A1	.001	.004	0.03	0.10	b1	.010	.016	0.25	0.41
A2	(.105)		(2.67)		b2	----	.019	----	0.48
D	.688	.692	17.48	17.58	c1	.007	.011	0.18	0.28
D1	.712	.720	18.08	18.29	e	.020 BSC		0.51 BSC	
E	.429	.437	10.90	11.10	e1	.040 BSC		1.02 BSC	
E1	.353	.357	8.97	9.07	e2	.223 BSC		5.66 BSC	
E2	.346	.350	8.79	8.89	e3	.120 BSC		3.05 BSC	
E3	.132	.140	3.35	3.56	e4	.253 INFO ONLY		6.43 INFO ONLY	
L	.018	.024	0.46	0.61	t	2°	8°	2°	8°
L1	.010 BSC		0.25 BSC		aaa	.004		0.10	
M	.600	----	15.24	----	bbb	.008		0.20	
N	.270	----	6.86	----					

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PRODUCT DOCUMENTATION

Refer to the following resources to aid your design process.

Application Notes

- AN1907: Solder Reflow Attach Method for High Power RF Devices in Plastic Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers
- AN1977: Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family
- AN1987: Quiescent Current Control for the RF Integrated Circuit Device Family

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

To Download Resources Specific to a Given Part Number:

1. Go to http://www.nxp.com/RF
2. Search by part number
3. Click part number link
4. Choose the desired resource from the drop down menu

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Oct. 2017	• Initial release of data sheet