Freescale Semiconductor
Technical Data

Document Number: MRFG35003N
Rev. 5, 1/2008

RoHS

MRFG35003NT1 replaced by MRFG35003ANT1.

Gallium Arsenide PHEMT

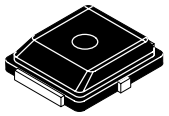
RF Power Field Effect Transistor

MRFG35003NT1

3.5 GHz, 3 W, 12 V
POWER FET
GaAs PHEMT

Designed for WLL/MMDS/BWA or UMTS driver applications with frequencies from 1.8 to 3.6 GHz. Device is unmatched and is suitable for use in Class AB linear base station applications.

- Typical W-CDMA Performance: -42 dBc ACPR, 3.55 GHz, 12 Volts, I_{DQ} = 55 mA, 5 MHz Offset/3.84 MHz BW, 64 DPCH (8.5 dB P/A @ 0.01% Probability)
  - Output Power — 300 mWatt
  - Power Gain — 11.5 dB
  - Efficiency — 25%
- 3 Watts P1dB @ 3.55 GHz
- Excellent Phase Linearity and Group Delay Characteristics
- High Gain, High Efficiency and High Linearity
- N Suffix Indicates Lead-Free Terminations. RoHS Compliant.
- In Tape and Reel. T1 Suffix = 1000 Units per 12 mm, 7 inch Reel.



CASE 466-03, STYLE 1
PLD-1.5
PLASTIC

ARCHIVE INFORMATION

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	8.1 (2) 0.05 (2)	W W/°C
Gate-Source Voltage	V_{GS}	-5	Vdc
RF Input Power	P_{in}	29	dBm
Storage Temperature Range	T_{stg}	-65 to +150	°C
Channel Temperature (1)	T_{ch}	175	°C
Operating Case Temperature Range	T_C	-20 to +85	°C

Table 2. Thermal Characteristics

Characteristic		Symbol	Value	Unit
Thermal Resistance, Junction to Case	Class AB	$R_{\theta JC}$	18.5 (2)	°C/W

Table 3. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD 22-A113, IPC/JEDEC J-STD-020	1	260	°C

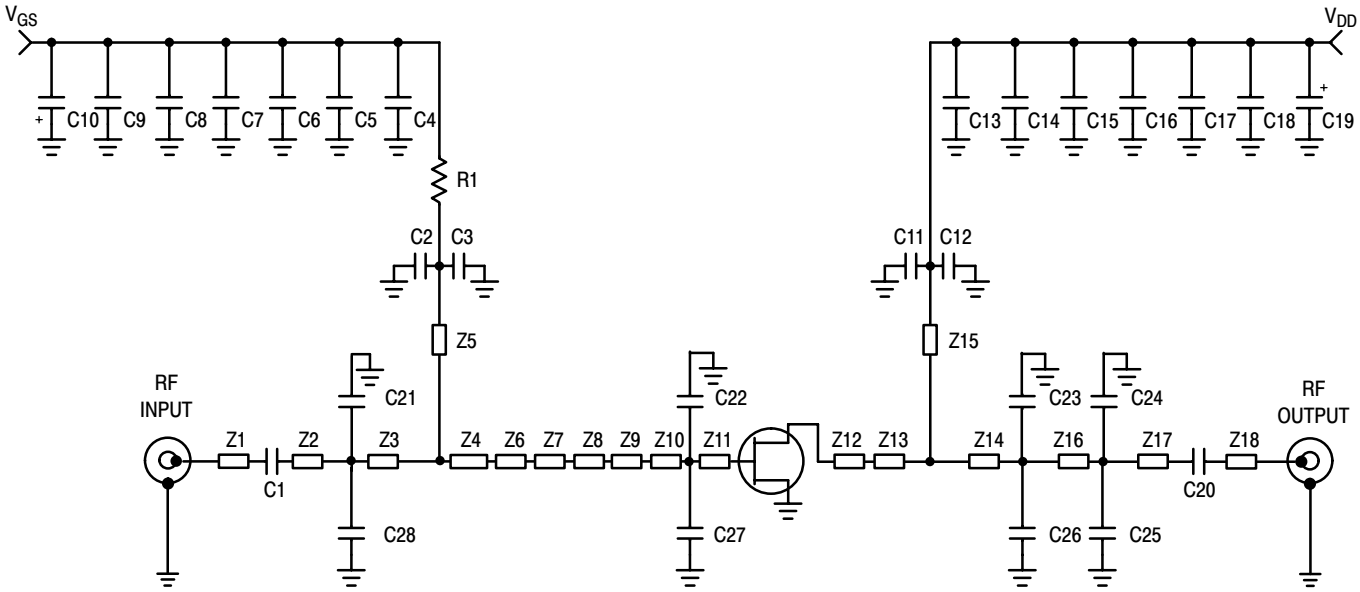
1. For reliable operation, the operating channel temperature should not exceed 150°C.
2. Simulated.

freescale semiconductor

Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Saturated Drain Current (V_{DS} = 3.5 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	1.3	—	Adc
Off State Leakage Current (V_{GS} = -0.4 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	< 1.0	100	μAdc
Off State Drain Current (V_{DS} = 12 Vdc, V_{GS} = -2.5 Vdc)	I_{DSO}	—	—	450	μAdc
Off State Current (V_{DS} = 28.5 Vdc, V_{GS} = -2.5 Vdc)	I_{DSX}	—	< 1.0	7	mAdc
Gate-Source Cut-off Voltage (V_{DS} = 3.5 Vdc, I_{DS} = 6.5 mA)	$V_{GS(th)}$	-1.2	-0.9	-0.7	Vdc
Quiescent Gate Voltage (V_{DS} = 12 Vdc, I_D = 55 mA)	$V_{GS(Q)}$	-1.2	-0.9	-0.7	Vdc
Power Gain (V_{DD} = 12 Vdc, I_{DQ} = 55 mA, f = 3.55 GHz)	G_{ps}	10	11.5	—	dB
Output Power, 1 dB Compression Point (V_{DD} = 12 Vdc, I_{DQ} = 55 mA, f = 3.55 GHz)	P_{1dB}	—	3	—	W
Drain Efficiency (V_{DD} = 12 Vdc, I_{DQ} = 55 mA, P_{out} = 0.30 W Avg., f = 3.55 GHz)	η_D	23	25	—	%
Adjacent Channel Power Ratio (V_{DD} = 12 Vdc, P_{out} = 0.30 W Avg., I_{DQ} = 55 mA, f = 3.55 GHz, W-CDMA, 8.5 P/A @ 0.01% Probability, 64 CH, 3.84 MCPS)	ACPR	—	-42	-40	dBc

ARCHIVE INFORMATION

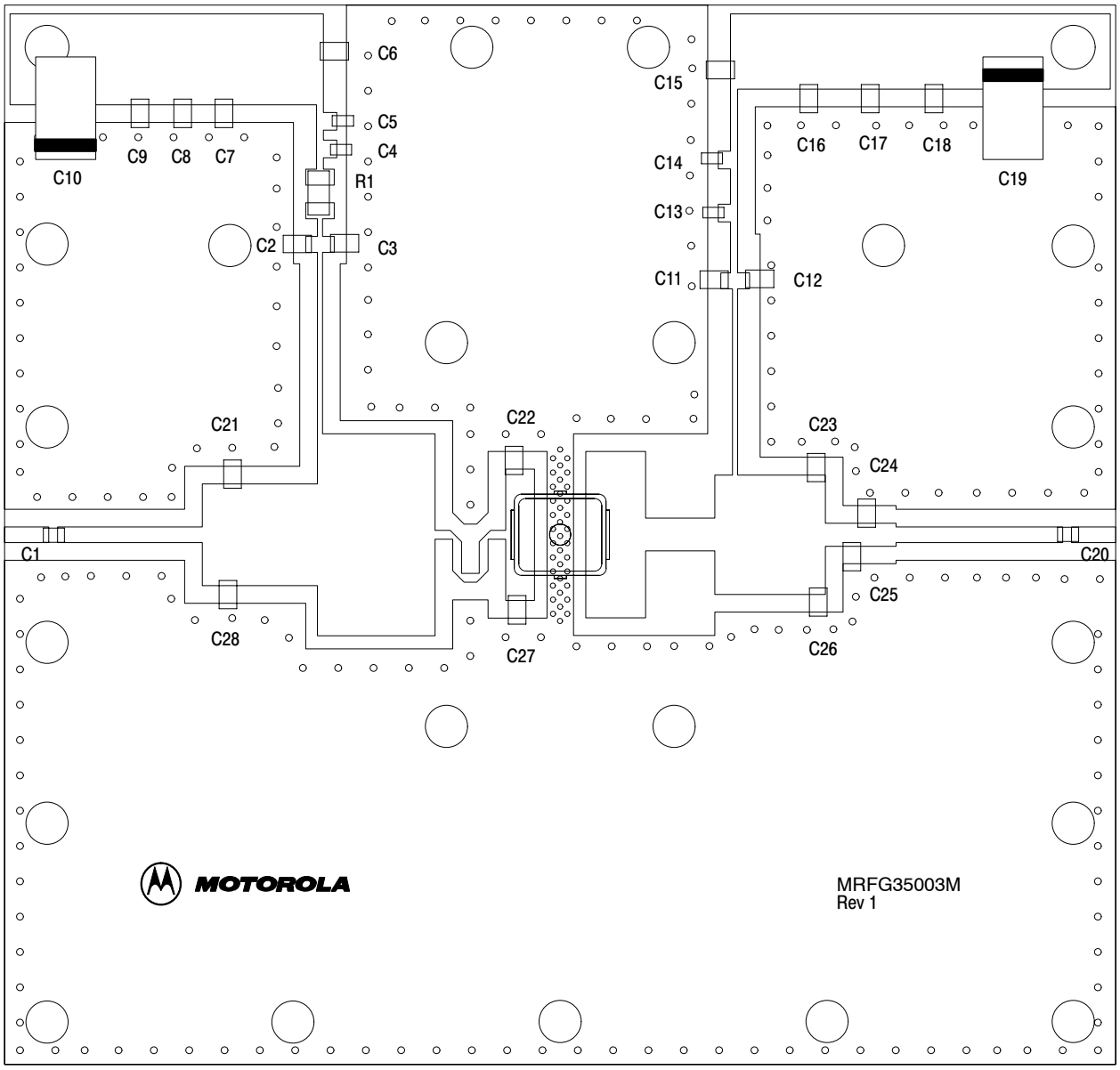


Z1, Z18	0.125″ x 0.044″ Microstrip	Z11	0.082″ x 0.372″ Microstrip
Z2	0.409″ x 0.044″ Microstrip	Z12	0.169″ x 0.471″ Microstrip
Z3	0.326″ x 0.288″ Microstrip	Z13	0.196″ x 0.093″ Microstrip
Z4	0.333″ x 0.572″ Microstrip	Z14	0.313″ x 0.338″ Microstrip
Z5, Z15	0.527″ x 0.015″ Microstrip	Z16	0.200″ x 0.065″ Microstrip
Z6, Z8, Z10	0.050″ x 0.025″ Microstrip	Z17	0.472″ x 0.044″ Microstrip
Z7, Z9	0.097″ x 0.025″ Microstrip	PCB	Rogers 4350, 0.020″, ε_r = 3.5

Figure 1. 3.5 GHz Test Circuit Schematic

Table 5. 3.5 GHz Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C20	7.5 pF Chip Capacitors	100A7R5JP150X	ATC
C2, C3, C11, C12	3.9 pF Chip Capacitors (0805)	08051J3R9BBT	AVX
C4, C13	10 pF Chip Capacitors	100A100JP500X	ATC
C5, C14	100 pF Chip Capacitors	100A101JP500X	ATC
C6, C15	100 pF Chip Capacitors	100B101JP500X	ATC
C7, C16	1000 pF Chip Capacitors	100B102JP500X	ATC
C8, C17	3.9 μF Chip Capacitors		ATC
C9, C18	0.1 μF Chip Capacitors		ATC
C10, C19	22 μF, 35 V Tantalum Surface Mount Capacitors		ATC
C21	0.7 pF Chip Capacitor (0805)	08051J0R7BBT	AVX
C22, C27	0.2 pF Chip Capacitors (0805)	08051J0R2BBT	AVX
C23, C28	0.8 pF Chip Capacitors (0805)	08051J0R8BBT	AVX
C24	1.0 pF Chip Capacitor	08051J1R0BBT	AVX
C25	1.2 pF Chip Capacitor	08051J1R2BBT	AVX
C26	0.5 pF Chip Capacitor	08051J0R5BBT	AVX
R1	100 Ω Chip Resistor		Newark



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. 3.5 GHz Test Circuit Component Layout

TYPICAL CHARACTERISTICS

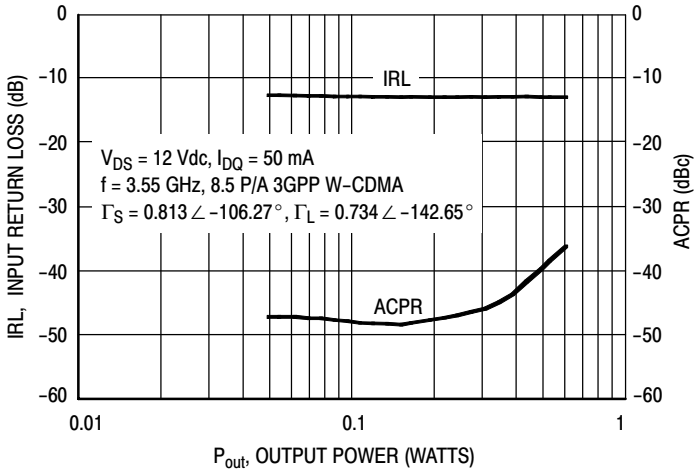


Figure 3. W-CDMA ACPR and Input Return Loss versus Output Power

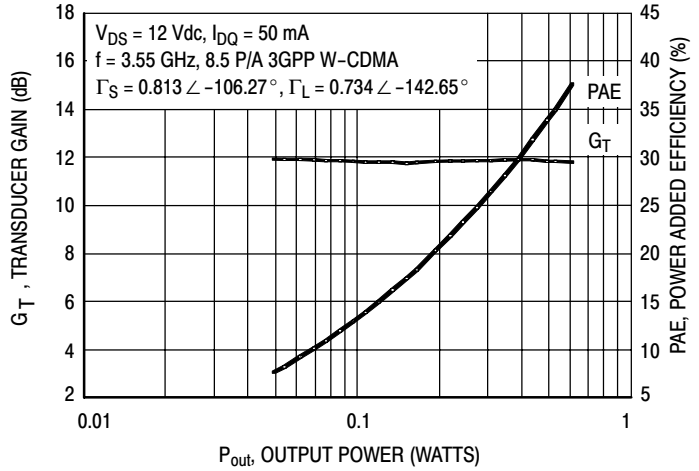


Figure 4. Transducer Gain and Power Added Efficiency versus Output Power

NOTE: All data is referenced to package lead interface. Γ_S and Γ_L are the impedances presented to the DUT. All data is generated from load pull, not from the test circuit shown.

Table 6. Class AB Common Source S-Parameters at V_{DS} = 12 Vdc, I_{DQ} = 50 mA

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
0.50	0.879	-160.58	8.644	88.22	0.038	6.94	0.520	-161.47
0.55	0.879	-163.33	7.924	85.88	0.039	5.42	0.520	-163.29
0.60	0.877	-166.03	7.317	83.57	0.039	3.80	0.520	-165.21
0.65	0.876	-168.54	6.811	81.29	0.039	2.37	0.520	-167.01
0.70	0.877	-170.64	6.380	79.13	0.039	0.94	0.521	-168.58
0.75	0.875	-172.68	5.988	77.06	0.039	-0.41	0.520	-170.13
0.80	0.877	-174.56	5.653	75.00	0.040	-1.67	0.520	-171.60
0.85	0.876	-176.25	5.310	72.83	0.040	-2.81	0.520	-172.89
0.90	0.874	-177.90	5.058	71.00	0.040	-4.01	0.519	-174.37
0.95	0.875	-179.54	4.825	69.08	0.040	-5.15	0.520	-175.84
1.00	0.876	179.00	4.608	67.27	0.040	-6.31	0.520	-177.05
1.05	0.875	177.53	4.411	65.38	0.040	-7.28	0.519	-178.37
1.10	0.874	176.04	4.224	63.51	0.040	-8.43	0.520	-179.67
1.15	0.875	174.55	4.056	61.69	0.040	-9.47	0.521	179.15
1.20	0.874	173.13	3.894	59.88	0.040	-10.47	0.520	177.91
1.25	0.873	171.63	3.743	58.01	0.040	-11.78	0.521	176.52
1.30	0.876	170.20	3.609	56.26	0.040	-12.79	0.522	175.56
1.35	0.871	168.97	3.479	54.57	0.040	-13.72	0.520	174.80
1.40	0.878	167.17	3.355	52.76	0.040	-14.65	0.526	173.34
1.45	0.876	165.98	3.237	51.14	0.040	-15.48	0.526	172.88
1.50	0.874	162.45	3.118	49.25	0.040	-16.80	0.528	174.64
1.55	0.874	161.17	3.024	47.67	0.040	-17.76	0.529	173.65
1.60	0.874	160.09	2.929	46.14	0.040	-18.51	0.530	172.88
1.65	0.876	159.00	2.848	44.54	0.040	-19.27	0.530	172.31
1.70	0.878	157.85	2.767	42.99	0.039	-20.03	0.531	171.29
1.75	0.878	156.84	2.690	41.32	0.039	-20.89	0.533	170.58
1.80	0.878	155.94	2.625	39.82	0.039	-21.53	0.533	170.03
1.85	0.880	154.93	2.557	38.21	0.039	-22.22	0.533	168.95
1.90	0.879	154.05	2.492	36.74	0.039	-23.01	0.536	168.19
1.95	0.879	153.24	2.434	35.28	0.039	-23.74	0.535	167.63
2.00	0.881	152.32	2.379	33.68	0.039	-24.55	0.535	166.68
2.05	0.881	151.56	2.325	32.27	0.040	-25.32	0.538	165.91
2.10	0.880	150.85	2.279	30.90	0.040	-25.97	0.539	165.46
2.15	0.881	149.96	2.236	29.41	0.040	-26.76	0.537	164.56
2.20	0.881	149.27	2.191	27.93	0.040	-27.75	0.539	163.66
2.25	0.880	148.61	2.151	26.53	0.040	-28.56	0.541	163.24
2.30	0.880	147.74	2.121	24.99	0.040	-29.32	0.539	162.46
2.35	0.881	146.91	2.084	23.54	0.040	-29.95	0.539	161.41
2.40	0.879	146.12	2.051	22.12	0.040	-30.72	0.540	160.97
2.45	0.877	145.07	2.023	20.46	0.040	-31.44	0.539	160.26
2.50	0.876	144.07	1.992	18.93	0.040	-32.36	0.539	159.16
2.55	0.876	143.15	1.971	17.38	0.040	-32.95	0.541	158.56
2.60	0.873	142.10	1.948	15.95	0.041	-33.58	0.538	157.90
2.65	0.872	140.88	1.924	14.31	0.041	-34.41	0.538	156.83
2.70	0.872	139.83	1.901	12.69	0.041	-35.22	0.538	156.16
2.75	0.867	138.60	1.882	11.19	0.042	-36.04	0.537	155.70
2.80	0.868	137.26	1.864	9.40	0.042	-37.16	0.535	154.59

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Table 6. Class AB Common Source S-Parameters at V_{DS} = 12 Vdc, I_{DQ} = 50 mA (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
2.85	0.868	136.03	1.845	7.80	0.043	-38.56	0.537	153.86
2.90	0.866	134.67	1.828	6.20	0.043	-39.94	0.536	153.32
2.95	0.866	133.02	1.812	4.39	0.043	-41.41	0.534	152.08
3.00	0.868	131.47	1.795	2.53	0.043	-42.49	0.536	151.08
3.05	0.865	129.99	1.780	0.80	0.043	-43.57	0.535	150.49
3.10	0.864	128.11	1.766	-1.00	0.043	-44.68	0.532	149.20
3.15	0.865	126.39	1.745	-2.87	0.043	-45.67	0.533	148.09
3.20	0.864	124.86	1.728	-4.58	0.043	-46.62	0.533	147.42
3.25	0.861	122.97	1.714	-6.48	0.043	-47.78	0.531	146.29
3.30	0.863	121.30	1.697	-8.33	0.043	-49.02	0.532	145.13
3.35	0.862	119.77	1.681	-9.97	0.043	-49.91	0.532	144.52
3.40	0.860	117.84	1.665	-11.83	0.043	-50.93	0.529	143.46
3.45	0.862	116.26	1.648	-13.70	0.043	-51.73	0.529	142.35
3.50	0.861	114.65	1.630	-15.43	0.043	-52.55	0.530	141.50
3.55	0.860	112.77	1.620	-17.24	0.044	-53.64	0.527	140.51
3.60	0.862	111.19	1.602	-18.99	0.044	-54.74	0.525	139.19
3.65	0.861	109.76	1.584	-20.65	0.044	-55.56	0.525	138.23
3.70	0.860	108.08	1.572	-22.49	0.044	-56.84	0.524	137.30
3.75	0.861	106.70	1.557	-24.18	0.044	-58.11	0.523	136.00
3.80	0.862	105.31	1.544	-25.86	0.044	-59.31	0.524	134.95
3.85	0.862	103.85	1.533	-27.47	0.044	-60.49	0.523	134.13
3.90	0.861	102.50	1.519	-29.14	0.044	-61.50	0.521	132.71
3.95	0.862	101.16	1.508	-30.97	0.044	-62.41	0.522	131.61
4.00	0.861	99.84	1.499	-32.49	0.044	-63.14	0.520	130.97
4.05	0.861	98.44	1.494	-34.26	0.044	-64.07	0.518	129.57
4.10	0.861	97.12	1.482	-35.96	0.044	-64.91	0.518	128.23
4.15	0.859	96.07	1.474	-37.51	0.045	-65.77	0.515	127.49
4.20	0.858	94.61	1.471	-39.42	0.045	-67.06	0.512	125.93
4.25	0.859	93.26	1.463	-41.19	0.045	-68.21	0.512	124.32
4.30	0.859	92.06	1.458	-42.86	0.045	-69.40	0.511	123.47
4.35	0.857	90.72	1.457	-44.58	0.046	-70.54	0.507	122.03
4.40	0.857	89.22	1.450	-46.51	0.046	-71.95	0.508	120.25
4.45	0.855	87.99	1.446	-48.27	0.046	-73.34	0.508	119.27
4.50	0.855	86.49	1.453	-50.09	0.047	-74.58	0.504	117.72
4.55	0.855	84.61	1.448	-52.14	0.046	-75.92	0.503	115.65
4.60	0.854	83.10	1.449	-53.98	0.047	-76.82	0.501	114.46
4.65	0.853	81.10	1.454	-56.16	0.047	-78.14	0.495	112.83
4.70	0.851	78.94	1.450	-58.44	0.048	-79.84	0.492	110.59
4.75	0.851	77.09	1.450	-60.56	0.048	-81.55	0.491	109.01
4.80	0.848	74.85	1.450	-62.75	0.048	-83.28	0.486	107.24
4.85	0.849	72.60	1.448	-65.03	0.048	-84.88	0.483	105.01
4.90	0.845	70.48	1.443	-67.33	0.048	-86.30	0.482	103.27
4.95	0.841	68.09	1.443	-69.60	0.048	-87.72	0.477	101.51
5.00	0.841	65.50	1.442	-72.12	0.048	-89.22	0.474	99.28

ARCHIVE INFORMATION

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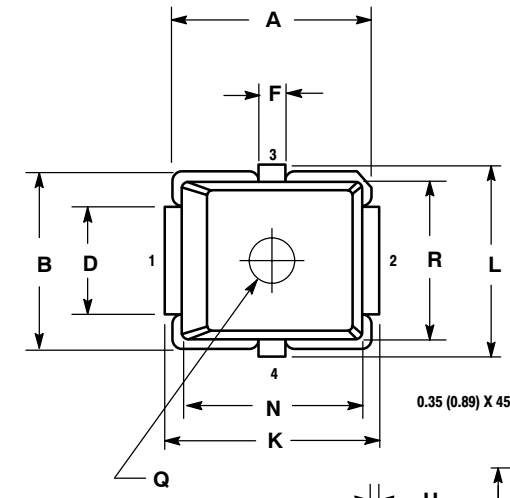
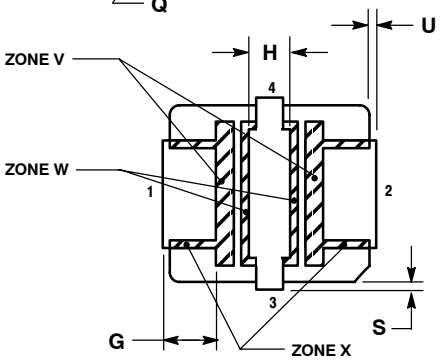
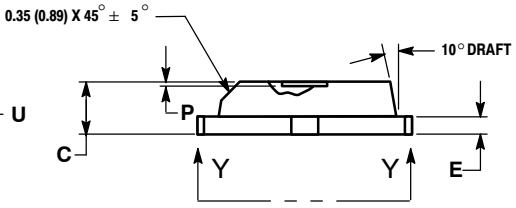
PACKAGE DIMENSIONS





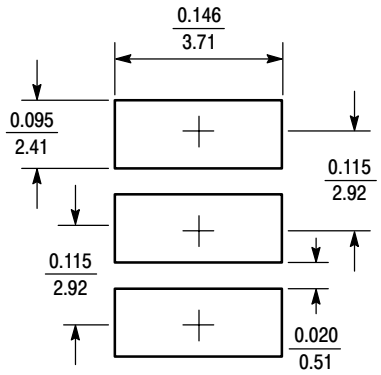
VIEW Y-Y



NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1984.
2. CONTROLLING DIMENSION: INCH
3. RESIN BLEED/FLASH ALLOWABLE IN ZONE V, W, AND X.

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE
4. SOURCE

CASE 466-03
ISSUE D
PLD-1.5
PLASTIC



(inches / mm)

SOLDER FOOTPRINT

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.255	0.265	6.48	6.73
B	0.225	0.235	5.72	5.97
C	0.065	0.072	1.65	1.83
D	0.130	0.150	3.30	3.81
E	0.021	0.026	0.53	0.66
F	0.026	0.044	0.66	1.12
G	0.050	0.070	1.27	1.78
H	0.045	0.063	1.14	1.60
J	0.160	0.180	4.06	4.57
K	0.273	0.285	6.93	7.24
L	0.245	0.255	6.22	6.48
N	0.230	0.240	5.84	6.10
P	0.000	0.008	0.00	0.20
Q	0.055	0.063	1.40	1.60
R	0.200	0.210	5.08	5.33
S	0.006	0.012	0.15	0.31
U	0.006	0.012	0.15	0.31
ZONE V	0.000	0.021	0.00	0.53
ZONE W	0.000	0.010	0.00	0.25
ZONE X	0.000	0.010	0.00	0.25

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
5	Jan. 2008	• Listed replacement part, p. 1 • Added Revision History, p. 9

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