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MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

# MRF10350H*

# Microwave Pulse Power Transistor 350 Watts Peak NPN 1025–1150 MHz

Designed for 1025–1150 MHz pulse common base amplifiers.

- Guaranteed Performance at 1090 MHz
  - Output Power = 350 Watts Peak
  - Gain = 8.5 dB Min
- 100% Tested for Load Mismatch at All Phase Angles with 10:1 VSWR
- Characterized with Mode S Pulse Format
- Silicon Nitride Passivated
- Gold Metallized, Emitter Ballasted for Long Life
- Internal Input and Output Matching
- Hermetically Sealed Package

CPTO
Commercial Plus Technologies Operation

**AVAILABLE AS**

| | |
|---|---|
| **1) JANTX:** | **MRF10350HX** |
| **2) JANTXV:** | **MRF10350HXV** |
| **3) JANS:** | **MRF10350HS** |
| **4) COML+:** | **MRF10350HC** |
| **PACKAGE:** | **Case 355E-01** |

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage | $V_{CES}$ | 65 | Vdc |
| Collector-Base Voltage | $V_{CBO}$ | 65 | Vdc |
| Emitter-Base Voltage | $V_{EBO}$ | 3.5 | Vdc |
| Collector Current – Peak (1) | $I_C$ | 31 | Adc |
| Device Dissipation at $T_C$ = 25 °C (1 & 2)<br>Derate above 25 °C | $P_D$ | 1590<br>9.1 | W<br>W/ °C |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | - 55 to + 200 | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case (3) | $R_{\theta JC}$ | 0.11 | °C/W |

**NOTES:** (continued)

1. Under pulse RF operating conditions.
2. These devices are designed for RF operation. The total device dissipation rating applies only when operated as RF amplifier.
3. Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques. (Worst case $\theta_{JC}$ measured using Mode-S pulse train, 128 µs burst 0.5 µs on, 0.5 µs off repeating at 6.4 ms interval.)

*Motorola Preferred Device. **Preferred** devices are Motorola recommended choices for future use and best overall value.

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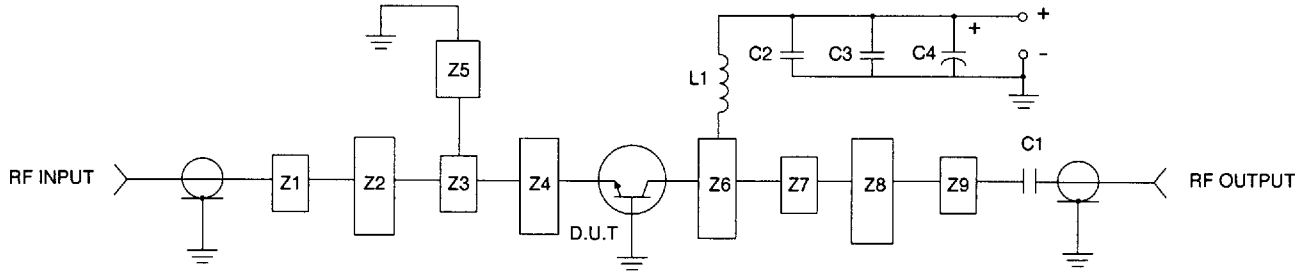
**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25 °C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| ***OFF CHARACTERISTICS*** | | | | |
| Collector-Emitter Breakdown Voltage ($I_C$ = 60 mAdc, $V_{BE}$ = 0) | $V_{(BR)CES}$ | 65 | – | Vdc |
| Collector-Base Breakdown Voltage ($I_C$ = 60 mAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 65 | – | Vdc |
| Emitter-Base Breakdown Voltage ($I_E$ = 10 mAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 3.5 | – | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 36 Vdc, $I_E$ = 0) | $I_{CBO}$ | – | 25 | mAdc |
| ***ON CHARACTERISTICS*** | | | | |
| DC Current Gain ($I_C$ = 5.0 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 20 | – | – |
| ***FUNCTIONAL TESTS*** | | | | |
| Common-Base Amplifier Power Gain ($V_{CC}$ = 50 Vdc, $P_{OUT}$ = 350 W Peak, f = 1090 MHz) | $G_{PB}$ | 8.5 | – | dB |
| Collector Efficiency ($V_{CC}$ = 50 Vdc, $P_{OUT}$ = 350 W Peak, f = 1090 MHz) | $\eta$ | 40 | – | % |
| Load Mismatch ($V_{CC}$ = 50 Vdc, $P_{OUT}$ = 350 W Peak, f = 1090 MHz, VSWR = 10:1 All Phase Angles) | $\psi$ | No Degradation in Output Power | | |

**ASSURANCE TESTING** (Pre/Post Burn-In)
**Burn-In Test Conditions: $V_{CB} \geq$ 10 Vdc, $T_J$ = 162.5 °C + 12.5 °C**

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Collector Cutoff Current ($V_{CB}$ = 50 Vdc, $I_E$ = 0) | $I_{CBO}$ | – | 25 | mAdc |
| DC Current Gain ($I_C$ = 5.0 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 20 | – | – |




C1 – 75 pF 100 mil Chip Capacitor
C2 – 39 pF 100 mil Chip Capacitor
C3 – 0.1 μF
C4 – 100 μF, 100 Vdc, Electrolytic

L1 – 3 turns #18 AWG, 1/8" ID, 0.18 Long
Z1-Z9 – Microstrip, see details below
Board Material – 0.030" Glass Teflon®
2 Oz. Copper, $\epsilon_r$ = 2.55

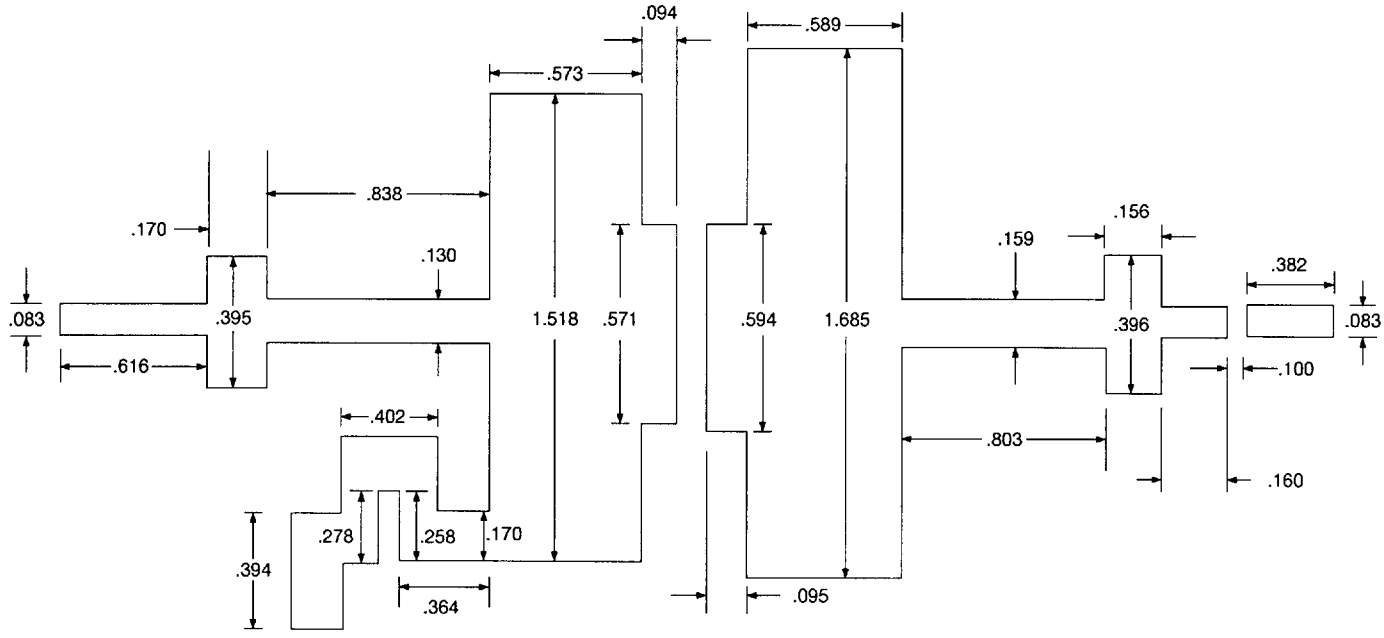
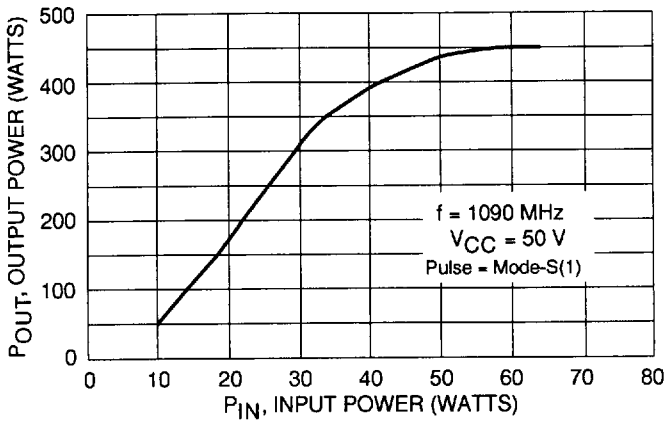
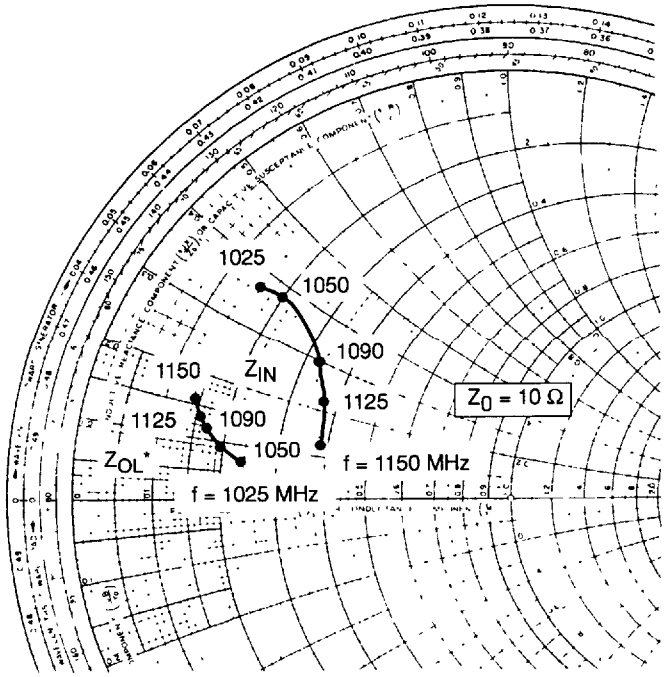



**Figure 1. Test Circuit**




(1) 128 μs burst 0.5 μs on, 0.5 μs off repeating at 6.4 ms interval

**Figure 2. Output Power versus Input Power**




$P_{OUT}$ = 350 W Pk, $V_{CC}$ = 50 V

| f MHz | $Z_{IN}$ OHMS | $Z_{OL}$* (1) OHMS |
|---|---|---|
| 1025 | 1.92 + j3.80 | 2.52 + j0.70 |
| 1050 | 2.44 + j3.92 | 2.18 + j0.85 |
| 1090 | 3.55 + j302 | 1.94 + j1.13 |
| 1125 | 4.11 + j2.27 | 1.80 + j1.22 |
| 1150 | 4.13 + j1.35 | 1.71 + j1.31 |

$Z_{OL}$* is the conjugate of the optimum load impedance into which the device operates at a given output power, voltage and frequency.

**Figure 3. Series Equivalent Input/Output Impedances**

## TABLE 1. SCREENING REQUIREMENTS

| SCREEN | METHOD | HX | HXV |
|---|---|---|---|
| 1. Internal visual inspection (precap) | 2072 | N/A | 100% |
| 2. High temperature non-operating life | 1032 | 100% | 100% |
| 3. Temperature cycling | 1051 | 100% | 100% |
| 4. Constant Acceleration (Gold wires only)(1) | 2006 | 100% | 100% |
| 5. Hermetic seal (Fine and Gross) | 1071 | 100% | 100% |
| 6. Establish Unit Identity | none | 100% | 100% |
| 7. Interim electrical parameters | as specified | 100% | 100% |
| 8. High temperature reverse bias (HTRB) | 1039 | 100% | 100% |
| 9. Interim electrical parameters | as specified | 100% | 100% |
| 10. Power burn-in | 1039 | 100% | 100% |
| 11. Final electrical parameters | as specified | 100% | 100% |
| 12. Hermetic seal (Fine and Gross) | 1071 | optional | optional |

## GROUP A TEST SEQUENCE

| Subgroups | | | |
|---|---|---|---|
| A1 | A2 | A3 | A4 |
| Type of Test | | | |
| Visual/Mechanical<br>Package:<br>Dimensions, Marking | DC Tests<br>$V_{(BR)CBO}$<br>$V_{(BR)CES}$<br>$V_{(BR)EBO}$<br>$I_{CBO}$<br>$h_{FE}$ | Hi/Lo Temp<br>Not Applicable | AC Tests<br><br>$G_{PB}$<br><br>$\eta$ |

## GROUP B TEST SEQUENCE

| Subgroups | | | | | |
|---|---|---|---|---|---|
| B1** | B2* | B3* | B4 | B5 | B6* |
| Type of Test | | | | | |
| Solderability (1)<br><br>Resistance to Solvents | Temp. Cycling<br><br>Hermetic Seal<br>Fine<br>Gross | Steady State Operating Life<br><br><br><br>Bond Strength | Decap Visual | Not Required | High Temp. Life (Non-Operating) |

* The tests in this subgroup are preceded and followed by $I_{CBO}$ and $h_{FE}$ electrical tests.

** Separate samples may be used for each test.

(1) Omit Steam Aging requirements.

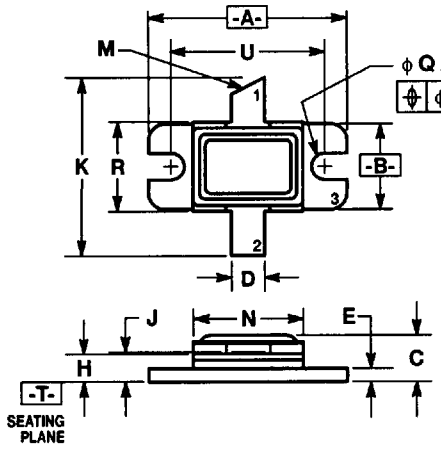
## GROUP C TEST SEQUENCE*

| Subgroups | | | | | |
|---|---|---|---|---|---|
| C1 | C2** | C3** | C4 | C5 | C6** |
| Type of Test | | | | | |
| Physical Dimensions | Thermal Shock (Glass Strain)<br>Terminal Strength<br>Hermetic Seal<br>Moist. Resistance | Mech. Shock<br><br>Vibration (Var. Freq.)<br>Const. Accel. | Salt Atmosphere | Not Applicable | Steady State Op Life |

* Group C is performed on the initial lot and requalification only.

** The tests in this subgroup are preceded and followed by $I_{CBO}$ and $h_{FE}$ electrical tests.

## OUTLINE DIMENSIONS




STYLE 1.
PIN 1. COLLECTOR
2. EMITTER
3. BASE

STYLE 2.
PIN 1. COLLECTOR
2. BASE
3. EMITTER

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 22.61 | 23.11 | 0.890 | 0.910 |
| B | 9.53 | 10.03 | 0.375 | 0.395 |
| C | 4.83 | 5.33 | 0.190 | 0.210 |
| D | 3.69 | 3.93 | 0.145 | 0.155 |
| E | 1.40 | 1.65 | 0.055 | 0.065 |
| H | 3.05 | 3.30 | 0.120 | 0.130 |
| J | 0.08 | 0.15 | 0.003 | 0.006 |
| K | 19.56 | 21.08 | 0.770 | 0.830 |
| M | 45° REF | | 45° REF | |
| N | 12.45 | 12.95 | 0.490 | 0.510 |
| Q | 2.93 | 3.17 | 0.115 | 0.125 |
| R | 10.04 | 10.28 | 0.395 | 0.405 |
| U | 17.78 BSC | | 0.700 BSC | |

**CASE 355E-01**



**Literature Distribution Centers:**
USA: Motorola Literature Distribution; P.O. Box 20912; Phoenix, Arizona 85036.
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