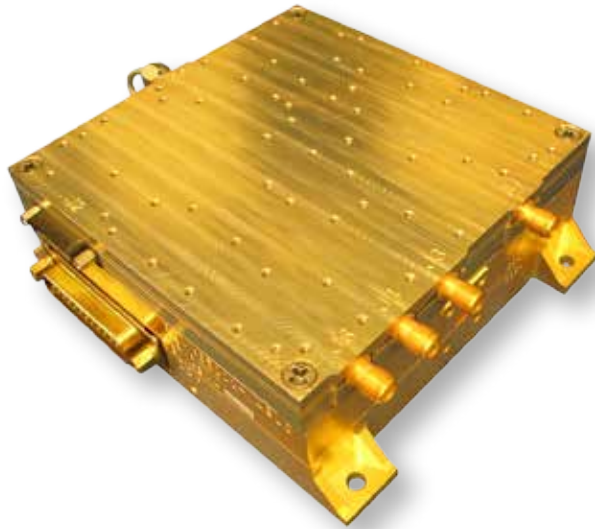


KA-BAND BLOCK UPCONVERTER With HPA



Typical Applications

- Satellite communications
 - Commercial
 - Military

General Description

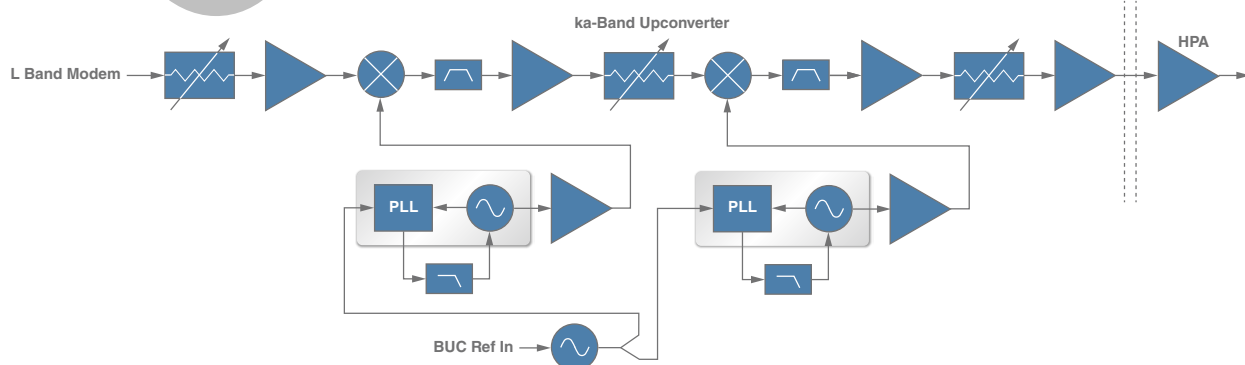
The HMC7056 is a fully integrated Ka-Band Block Upconverter with HPA. The unit is designed for single carrier use in satellite communications. It covers both Commercial and Military bands and is designed to meet military environmental conditions.

| Parameter | Typical |
|---------------------------------|---------------------|
| Input Frequency Range (GHz) | 1 - 2 |
| Output Frequency Range (GHz) | 29 - 31 |
| Conversion Gain (dB) | 65 |
| Gain Flatness -1 GHz (dB) | 3 |
| Gain Flatness -10 MHz (dB) | 0.7 |
| Input Power (dBm) | -30 - +5 |
| Output Linear Power (PSK) (dBm) | +37 |
| Phase Noise (dBc/Hz) | |
| 10 Hz | -50 |
| 100 Hz | -66 |
| 1 kHz | -93 |
| 10 kHz | -92 |
| 100 kHz | -94 |
| 1 MHz | -104 |
| 10 MHz | -118 |
| Spurious (dBc) | -60 |
| AM/PM Conversion (Deg/dB) | 2 |
| BUC DC Power (VDC @ AMP) | 5.75V @ 2.25 A |
| HPA DC Power (VDC @ AMP) | 5.0V @ 14.0 A |
| Size (in) | 4.2" x 4.2" x 1.63" |

Features

- Compact Design
- Dual L Band Inputs
- Dual up conversion to ensure no phase inversion
- WR28 Output with Isolator
- PA Enable
- Digital Gain control
- Thermal Monitoring and Gain Compensation
- Size: 5.72" x 4.51" x 1.63"
- Weight: 2.11 lbs
- Designed for Military Environments

Functional Block Diagram



**KA-BAND BLOCK UPCONVERTER
With HPA**
Electrical Specifications

| Parameter | Specification | | | Units | Notes |
|----------------------------|---------------|-------|-------|--------|------------------------|
| | Min. | Typ. | Max. | | |
| Input IF frequency | 1 | | 2 | GHz | |
| Frequency range (MIL) | 30 | | 31 | GHz | Military band |
| Frequency range (COMM) | 29 | | 30 | GHz | Commercial band |
| Reference frequency | | 10 | | MHz | |
| Reference input power | -5 | | 5 | dBm | |
| Reference output power | -7.5 | | 5 | dBm | |
| Input IF Power | | | 5 | dBm | |
| Conversion gain | 64 | | 66 | dB | |
| Gain flatness – 1Ghz | | | 3 | dB | |
| Gain flatness – 40Mhz | | | 0.7 | dB | |
| Gain variation (over temp) | | | ±1.0 | dB | |
| Gain stability | | | ±0.25 | dB/24h | |
| Gain control | 30 | | | dB | |
| Group delay - 40MHz | | | ±0.25 | nSec | |
| Group delay - 10MHz | | | ±0.1 | nSec | |
| Internal TX (VSWR) | | 2:1 | | | |
| External TX (VSWR) | | 2:1 | | | |
| 10MHz reference (VSWR) | | 2:1 | | | |
| 100MHz reference (VSWR) | | 2:1 | | | |
| RF output (VSWR) | | 1.5:1 | | | With external Isolator |
| Linear power | | 37 | | dBm | PSK |
| P1dB | | 38.5 | | dBm | |
| TX maximum power (Psat) | | 39.5 | | dBm | 3dB compression |
| Output IP3 | | 47.5 | | dBm | |
| Power added efficiency | 8 | | | % | |
| LO leakage | | | -20 | dBm | |
| Image rejection | | | -60 | dBc | |
| signal related spurious | | | -60 | dBc | |
| Non-signal related spurs | | | -40 | dBm | |
| TX single sideband spurs | | | -40 | dBm | |
| Phase Noise | | | | | |
| 10Hz | | -50 | | dBc/Hz | |
| 100Hz | | -66 | | dBc/Hz | |
| 1KHz | | -93 | | dBc/Hz | |
| 10KHz | | -92 | | dBc/Hz | |
| 100KHz | | -94 | | dBc/Hz | |

**KA-BAND BLOCK UPCONVERTER
With HPA**
Electrical Specifications

| Parameter | Specification | | | Units | Notes |
|----------------------------|---------------|------|------|--------|-------|
| | Min. | Typ. | Max. | | |
| 1MHz | | -104 | | dBc/Hz | |
| 10MHz | | -118 | | dBc/Hz | |
| AM/PM conversion | 0 | | 2 | Deg/dB | |
| PA mute attenuation | 40 | | | dB | |
| PA mute settling time | | 50 | 150 | μs | |
| Int IF to Ext IF isolation | 70 | | | dB | |
| VDD (BUC) | 5.5 | | 5.9 | VDC | |
| +21V | 19.5 | | 23 | VDC | |
| VDD (HPA) | 4.9 | | 5.1 | VDC | |
| -5V | -5.1 | | -4.9 | VDC | |
| IDD (BUC) | | | 2.5 | A | |
| I (+21V) | | | 50 | mA | |
| I (-5V) | | | 75 | mA | |
| IDD (HPA) | | | 14.3 | A | |
| DC power Max (RF) | | | 89 | W | |
| DC power (HPA mute) | | | 21 | W | |
| HPA Temp sense | 0 | | 0.78 | V | |
| VDD_HPA_SENSE/RTN | 4.9 | | 5.1 | V | |

**KA-BAND BLOCK UPCONVERTER
With HPA**

Figure 1. Small Signal Gain

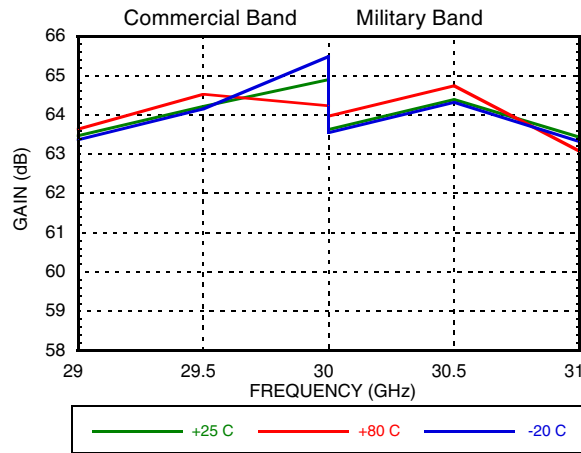


Figure 2. Output P1dB & PAE

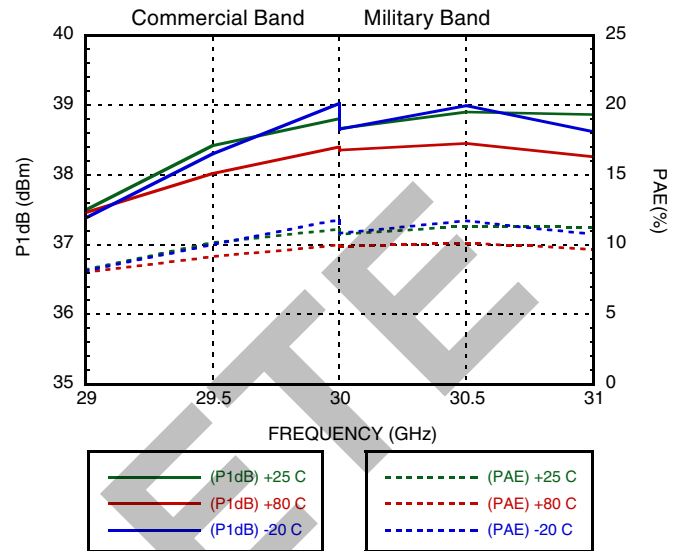


Figure 3. Saturated Output Power

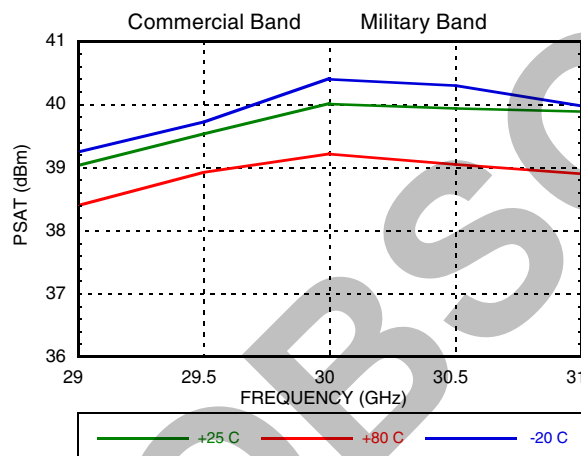


Figure 4. Linear Power (SRG)

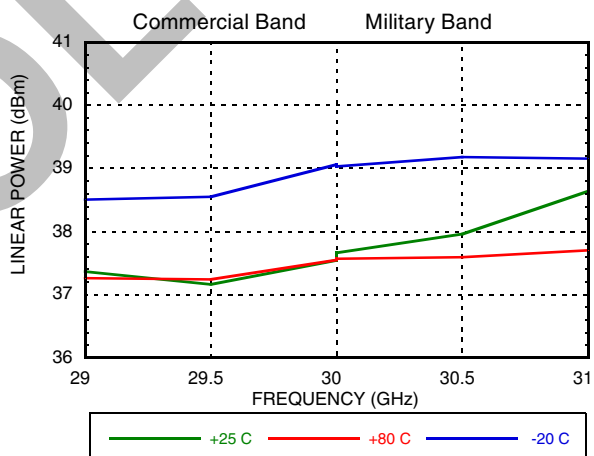


Figure 5. IP3

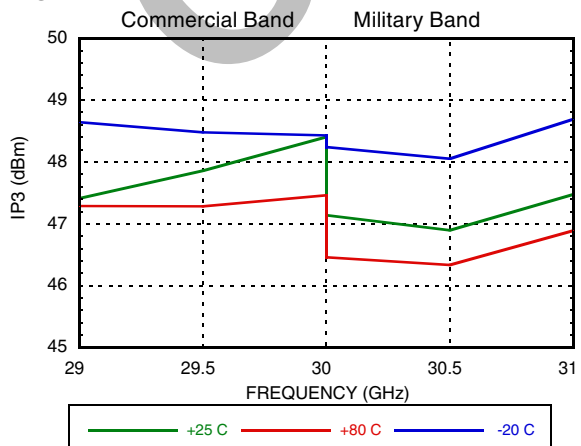
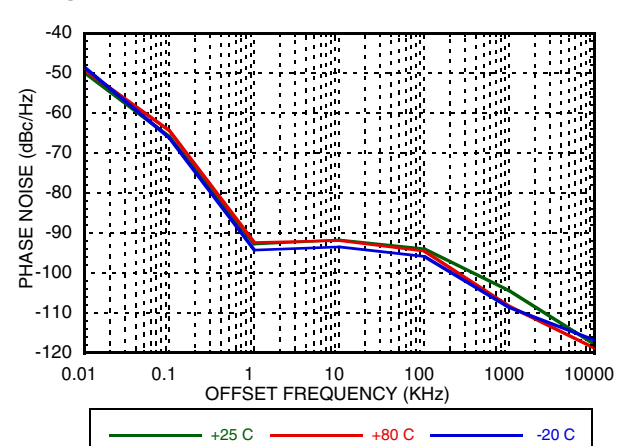
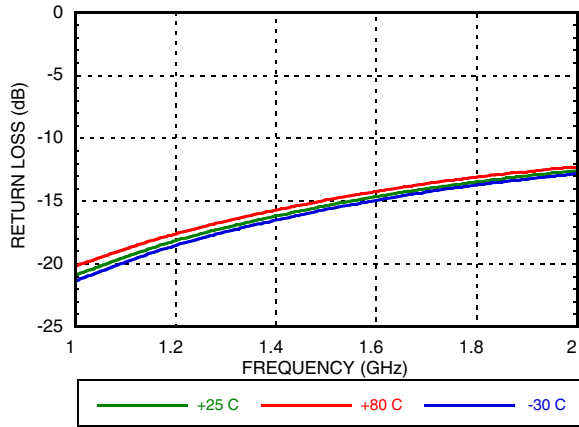


Figure 6. Phase Noise (carrier @ 30 GHz)

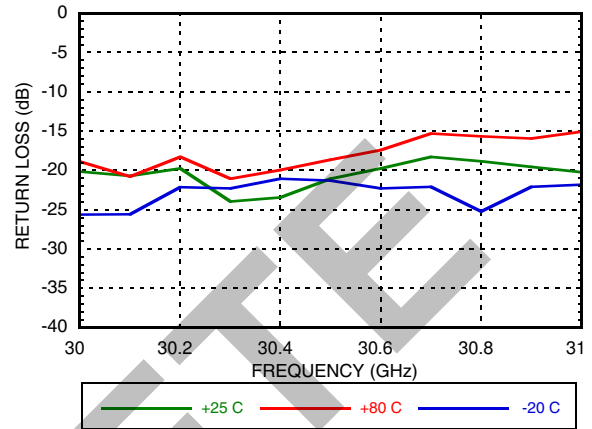


**KA-BAND BLOCK UPCONVERTER
With HPA**

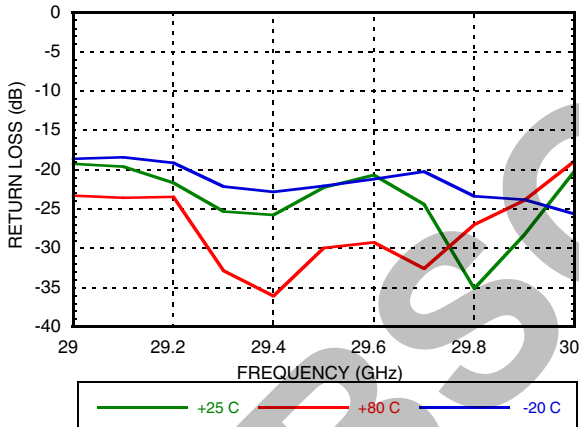
Figure 7. Input Return Losses



**Figure 9. Output Return Losses
(Military Band)**



**Figure 8. Output Return Losses
(Commercial Band)**



KA-BAND BLOCK UPCONVERTER With HPA

**Table 1. Absolute
Maximum Ratings**

| Parameter | Max Rating |
|------------------|---------------|
| VDD_HPA | +5.5V |
| -5VDC_HPA | -6V |
| VDD_BUC | +20V |
| 21VDC_BUC | +30V |
| -5VDC_BUC | -20V |
| Operating temp | -20 to +80°C |
| Storage temp | -55 to +125°C |
| Continuous Pdiss | 70 watt |
| ESD sensitivity | Class 1A |

Table 2. RF I/O Ports

| Port # | I/O | Function | Description |
|--------|-----|----------------------------------|--|
| J3 | I | L_LP_INT_TX MDM_INT_10MHz_REF | Internal modem input with 10MHz reference signal |
| J4 | I | L_LP_EXT_TX MDM_EXT_10MHz_REF | External modem input with 10MHz reference signal |
| J5 | O | HPA_RF_OUT | Unit RF output port (WR28) |
| J6 | O | BUC_10MHz_REF_OUT | 10 MHz reference signal output |
| J7 | I | BUC_100MHz_REF_IN | 100 MHz reference signal input |
| J8 | O | BUC_RF_OUT | Up-converter module (BUC) RF output port K(F) |
| J9 | I | HPA_RF_IN | Power amplifier module (HPA) RF input port K(F) |

Table 3. J1 HPA Connector Pin Out

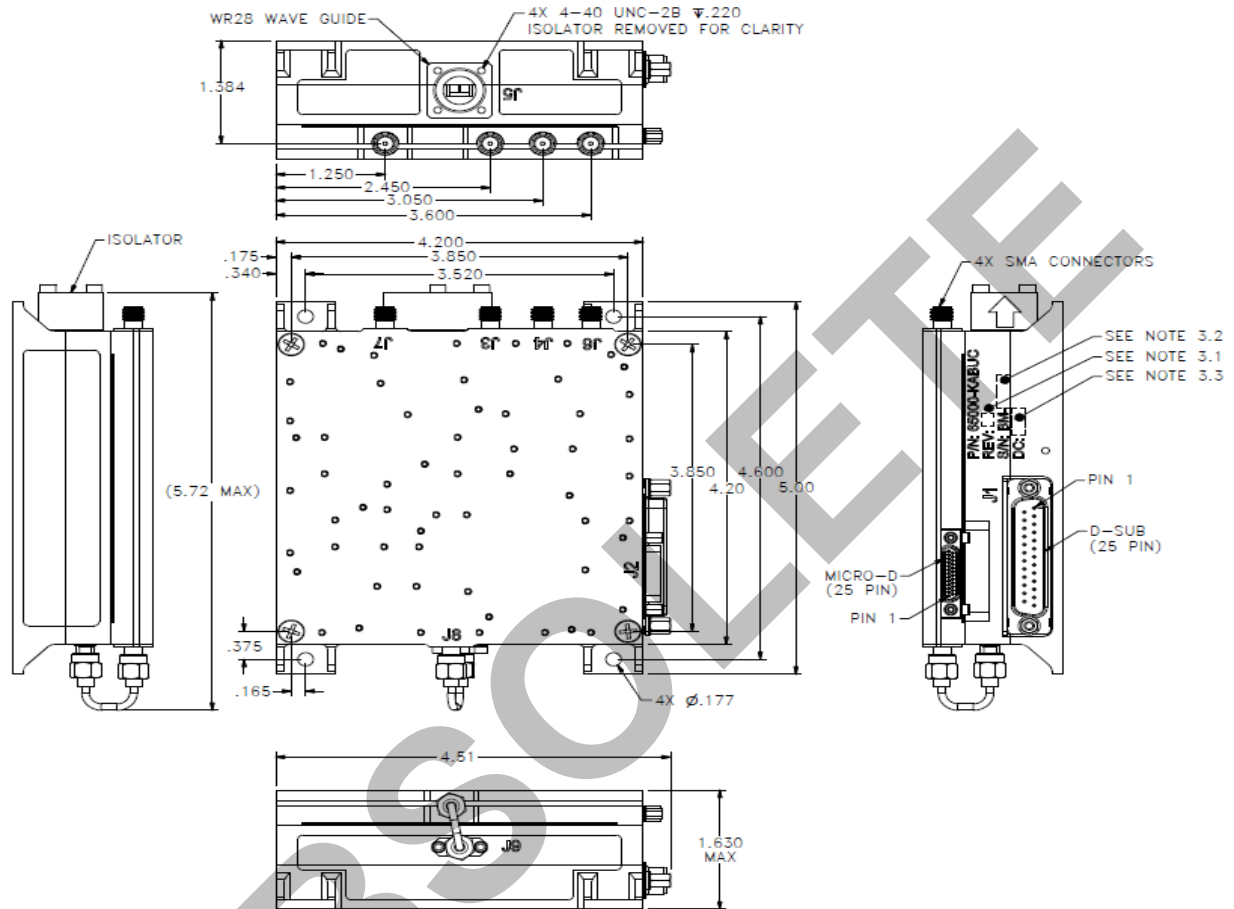
| Pin # | Signal/Voltage | Description |
|-------|-------------------|---|
| 1 | VDD_HPA | HPA drain Voltage |
| 2 | VDD_HPA | |
| 3 | VDD_HPA | |
| 4 | VDD_HPA | |
| 5 | VDD_HPA | |
| 6 | VDD_HPA | |
| 7 | VDD_HPA | |
| 8 | -5 VDC | HPA gate Voltage |
| 9 | GND | |
| 10 | VDD_HPA_SENSE_RTN | Ground |
| 11 | PV_SEQ_READY | Voltage sequence ready indicator. Low (-3.5V): unit ready to apply VDD. High (0V): unit not read |
| 12 | BUC_HPA_I2C_SDA | I ² C temperature sensor |
| 13 | GND | |
| 14 | GND | |
| 15 | GND | |
| 16 | GND | |
| 17 | GND | |
| 18 | GND | |
| 19 | GND | |
| 20 | GND | |
| 21 | TEMP_SENSE | Unit temperature (analog) |
| 22 | VDD_HPA_SENSE | Positive voltage sensed at unit DC port |
| 23 | HPA_MUTE | Output stage amplifier pinch off. High (3.3V): HPA mute, Low (0V): HPA enable |
| 24 | GND | |
| 25 | BUC_HPA_I2C_SCL | I ² C temperature sensor |

**KA-BAND BLOCK UPCONVERTER
With HPA**
Table 4. J2 BUC Connector Pin Out

| Pin # | Signal/Voltage | Description |
|-------|--|--|
| 1 | VDD_BUC | BUC positive voltage supply |
| 2 | VDD_BUC | |
| 3 | VDD_BUC | |
| 4 | 21VDC | BUC positive voltage supply to PLLs |
| 5 | GND | |
| 6 | SPARE | |
| 7 | MDM_SELECT | Modem input selection. High (3.3V): internal modem, Low (0V): external modem |
| 8 | BUC_LO_LOCK | PLL lock indication. High (3.3V): unlocked, Low (0V): locked |
| 9 | TX_GAIN_CNTL_LE | Gain control signal latch enable |
| 10 | GND | |
| 11 | RESERVED FOR VENDOR USE: (RS232_RXD0) | |
| 12 | BUC_HPA_12C_SDA | I ² C bus data |
| 13 | GND | |
| 14 | GND | |
| 15 | GND | |
| 16 | GND | |
| 17 | -5VDC | BUC negative voltage supply |
| 18 | HPA_MUTE | |
| 19 | GND | |
| 20 | TX_BAND_SELECT | Transmitter band selection. High (3.3V): commercial band 29-30GHz, Low (0V): military band 30-31GHz |
| 21 | TX_GAIN_CNTL_SERIN | Gain control signal serial input |
| 22 | TX_GAIN_CNTL_CLK | Gain control signal clock |
| 23 | RESERVED FOR VENDOR USE: (RS232_RXD0) | |
| 24 | GND | |
| 25 | BUC_HPA_12C_SCL | I ² C bus clock |

**KA-BAND BLOCK UPCONVERTER
With HPA**

Outline Drawing



NOTES:

- 1.0 MATERIAL: ALUMINUM.
- 2.0 FINISH:
 - 2.1 POWER AMPLIFIER HOUSING: SILVER PER ASTM B700 OVER NICKEL PER MIL-C-26074.
 - 2.2 UPCONVERTER BASEPLATE AND COVER: CHEMICAL CONVERSION COAT PER MIL-DTL-5541, TYPE II, CLASS 3.
- 3.0 PRODUCT MARKING TO BE ENGRAVED, AND LOCATED APPROXIMATELY AS SHOWN.
 - 3.1 REVISION TO BE MARKED IN ACCORDANCE WITH REVISION DOCUMENT TM-HDS-002 SPECIFIED BY PURCHASE CONTRACT.
 - 3.2 UNITS TO BE SERIALLY MARKED IN ACCORDANCE WITH PURCHASE CONTRACT WHERE "X" = SEQUENTIAL NUMBERS.
 - 3.3 DATE CODE MARKING TO SHOW DATE IN "MMYY" FORMAT.

Package Information

| Size | Weight |
|-------------------|----------|
| 5.72"x4.51"x1.63" | 2.11 lbs |