

1 of 24 Switches

Logic Diagram

FEATURES:

- 24 independently switchable power FETs
- Low equivalent on resistance (200 mΩ typ)
- 2A switching current per channel
- No derating required to 90°C
- Total dose hardness: depending upon space mission in RAD-PAK®
- Package: 176-pin quad flat pack

DESCRIPTION:

Maxwell Technologies 24SW multi-chip module (MCM) 24 channel MOSFET driver uses Maxwell Technologies' patented radiation-hardened RAD-PAK® MCM packaging technology. The 24SW is a radiation hardened MOSFET driver for space applications.

The 24SW incorporates twenty-four independent p-channel MOSFETs, along with interface components, that can switch up to 2A per channel. The R_{DS-ON} of the MOSFET is typically less than 200mΩ.

Maxwell Technologies' patented RAD-PAK® packaging technology incorporates radiation shielding in the micro-circuit package. It eliminates the need for box shielding while improving the TID performance in most space environments. This product is available with screening up to Maxwell Technologies self-defined Class K.

TABLE 1. 24SW PINOUT DESCRIPTION

| PIN | NAME | FUNCTION | NOTES |
|-----|-----------|-------------------------|---|
| 1 | Pkg-Gnd | Case Ground | This pin is for grounding the case(lid) |
| 2 | TP1B | | |
| 3 | TP7D | | |
| 4 | TP1D | | |
| 5 | TP8D | | |
| 6 | TP2D | | |
| 7 | TP7E | | |
| 8 | TP1E | | |
| 9 | TP8E | | |
| 10 | SS_CMD_5 | Switch 5 Control Input | TTL voltage level switch input |
| 11 | SS_CMD_4 | Switch 4 Control Input | TTL voltage level switch input |
| 12 | SS_CMD_3 | Switch 3 Control Input | TTL voltage level switch input |
| 13 | TP2E | | |
| 14 | SS_CMD_2 | Switch 2 Control Input | TTL voltage level switch input |
| 15 | SS_CMD_1 | Switch 1 Control Input | TTL voltage level switch input |
| 16 | TP2B | | |
| 17 | SS_CMD_0 | Switch 0 Control Input | TTL voltage level switch input |
| 18 | TP38A | | |
| 19 | TP46A | | |
| 20 | TP38C | | |
| 21 | TP2C | | |
| 22 | TP2A | | |
| 23 | VDD | +15V Power Supply | |
| 24 | TP38B | | |
| 25 | GND | Analog Ground | |
| 26 | VSS | -15V Power Supply | |
| 27 | TP38D | | |
| 28 | TP44D | | |
| 29 | SS_CMD_12 | Switch 12 Control Input | TTL voltage level switch input |
| 30 | TP37D | | |
| 31 | SS_CMD_13 | Switch 13 Control Input | TTL voltage level switch input |
| 32 | SS_CMD_14 | Switch 14 Control Input | TTL voltage level switch input |

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| PIN | NAME | FUNCTION | NOTES |
|-----|-----------|-------------------------|---|
| 33 | TP43D | | |
| 34 | SS_CMD_15 | Switch 15 Control Input | TTL voltage level switch input |
| 35 | SS_CMD_16 | Switch 16 Control Input | TTL voltage level switch input |
| 36 | SS_CMD_17 | Switch 17 Control Input | TTL voltage level switch input |
| 37 | TP44C | | |
| 38 | TP44A | | |
| 39 | TP44B | | |
| 40 | TP37C | | |
| 41 | TP43E | | |
| 42 | TP37E | | |
| 43 | TP44E | | |
| 44 | TP38E | | |
| 45 | LD14_OUT | Switch 14 Low Side | FET Drain |
| 46 | LD14_IN | Switch 14 High Side | FET Source |
| 47 | PKG_GND | Case Ground | This pin is for grounding the case(lid) |
| 48 | LD15_OUT | Switch 15 Low Side | FET Drain |
| 49 | LD15_IN | Switch 15 High Side | FET Source |
| 50 | TP37A | | |
| 51 | LD12_OUT | Switch 12 Low Side | FET Drain |
| 52 | LD12_IN | Switch 12 High Side | FET Source |
| 53 | TP37B | | |
| 54 | LD18_OUT | Switch 18 Low Side | FET Drain |
| 55 | LD18_IN | Switch 18 High Side | FET Source |
| 56 | TP43A | | |
| 57 | LD13_OUT | Switch 13 Low Side | FET Drain |
| 58 | LD13_IN | Switch 13 High Side | FET Source |
| 59 | TP9A | | |
| 60 | TP3E | | |
| 61 | TP4E | | |
| 62 | TP10E | | |
| 63 | LD17_OUT | Switch 17 Low Side | FET Drain |
| 64 | LD17_IN | Switch 17 High Side | FET Source |
| 65 | TP10D | | |
| 66 | LD19_OUT | Switch 19 Low Side | FET Drain |
| 67 | LD19_IN | Switch 19 High Side | FET Source |
| 68 | TP4D | | |
| 69 | LD16_OUT | Switch 16 Low Side | FET Drain |

TABLE 1. 24SW PINOUT DESCRIPTION

| PIN | NAME | FUNCTION | NOTES |
|-----|-----------|-------------------------|--------------------------------|
| 70 | LD16_IN | Switch 16 High Side | FET Source |
| 71 | TP3D | | |
| 72 | LD23_OUT | Switch 23 Low Side | FET Drain |
| 73 | LD23_IN | Switch 23 High Side | FET Source |
| 74 | TP9D | | |
| 75 | TP41A | | |
| 76 | TP41C | | |
| 77 | TP46D | | |
| 78 | LD21_OUT | Switch 21 Low Side | FET Drain |
| 79 | LD21_IN | Switch 21 High Side | FET Source |
| 80 | TP40D | | |
| 81 | LD22_OUT | Switch 22 Low Side | FET Drain |
| 82 | LD22_IN | Switch 22 High Side | FET Source |
| 83 | TP39D | | |
| 84 | TP45D | | |
| 85 | LD20_OUT | Switch 20 Low Side | FET Drain |
| 86 | LD20_IN | Switch 20 High Side | FET Source |
| 87 | TP45E | | |
| 88 | TP39E | | |
| 89 | TP40E | | |
| 90 | TP46E | | |
| 91 | TP48D | | |
| 92 | TP42D | | |
| 93 | TP47D | | |
| 94 | TP41D | | |
| 95 | TP41E | | |
| 96 | TP47E | | |
| 97 | TP42E | | |
| 98 | SS_CMD_18 | Switch 18 Control Input | TTL voltage level switch input |
| 99 | SS_CMD_19 | Switch 19 Control Input | TTL voltage level switch input |
| 100 | SS_CMD_20 | Switch 20 Control Input | TTL voltage level switch input |
| 101 | TP48E | | |
| 102 | SS_CMD_21 | Switch 21 Control Input | TTL voltage level switch input |
| 103 | SS_CMD_22 | Switch 22 Control Input | TTL voltage level switch input |
| 104 | TP12B | | |
| 105 | SS_CMD_23 | Switch 23 Control Input | TTL voltage level switch input |
| 106 | TP12A | | |

TABLE 1. 24SW PINOUT DESCRIPTION

| PIN | NAME | FUNCTION | NOTES |
|-----|-----------|-------------------------|--------------------------------|
| 107 | TP48A | | |
| 108 | VSS | -15V Power Supply | |
| 109 | GND | Analog Ground | |
| 110 | TP10C | | |
| 111 | VDD | +15V Power Supply | |
| 112 | TP10A | | |
| 113 | TP48B | | |
| 114 | TP12C | | |
| 115 | TP10B | | |
| 116 | TP12D | | |
| 117 | SS_CMD_11 | Switch 11 Control Input | TTL voltage level switch input |
| 118 | TP6D | | |
| 119 | SS_CMD_10 | Switch 10 Control Input | TTL voltage level switch input |
| 120 | SS_CMD_9 | Switch 9 Control Input | TTL voltage level switch input |
| 121 | TP11D | | |
| 122 | SS_CMD_8 | Switch 8 Control Input | TTL voltage level switch input |
| 123 | SS_CMD_7 | Switch 7 Control Input | TTL voltage level switch input |
| 124 | SS_CMD_6 | Switch 6 Control Input | TTL voltage level switch input |
| 125 | TP5D | | |
| 126 | TP12E | | |
| 127 | TP6E | | |
| 128 | TP11E | | |
| 129 | TP5E | | |
| 130 | TP6C | | |
| 131 | TP6A | | |
| 132 | TP6B | | |
| 133 | LD11_OUT | Switch 11 Low Side | FET Drain |
| 134 | LD11_IN | Switch 11 High Side | FET Source |
| 135 | TP11C | | |
| 136 | LD10_OUT | Switch 10 Low Side | FET Drain |
| 137 | LD10_IN | Switch 10 High Side | FET Source |
| 138 | TP11A | | |
| 139 | LD9_OUT | Switch 9 Low Side | FET Drain |
| 140 | LD19_IN | Switch 9 High Side | FET Source |
| 141 | TP11B | | |
| 142 | LD7_OUT | Switch 7 Low Side | FET Drain |
| 143 | LD7_IN | Switch 7 High Side | FET Source |

TABLE 1. 24SW PINOUT DESCRIPTION

| PIN | NAME | FUNCTION | NOTES |
|-----|---------|--------------------|------------|
| 144 | TP5C | | |
| 145 | LD8_OUT | Switch 8 Low Side | FET Drain |
| 146 | LD8_IN | Switch 8 High Side | FET Source |
| 147 | TP5A | | |
| 148 | TP5B | | |
| 149 | TP9C | | |
| 150 | TP9A | | |
| 151 | LD4_OUT | Switch 4 Low Side | FET Drain |
| 152 | LD4_IN | Switch 4 High Side | FET Source |
| 153 | TP9B | | |
| 154 | LD6_OUT | Switch 6 Low Side | FET Drain |
| 155 | LD6_IN | Switch 6 High Side | FET Source |
| 156 | TP3C | | |
| 157 | LD5_OUT | Switch 5 Low Side | FET Drain |
| 158 | LD5_IN | Switch 5 High Side | FET Source |
| 159 | TP3A | | |
| 160 | LD2_OUT | Switch 2 Low Side | FET Drain |
| 161 | LD2_IN | Switch 2 High Side | FET Source |
| 162 | TP3B | | |
| 163 | TP8C | | |
| 164 | TP8A | | |
| 165 | TP8B | | |
| 166 | LD0_OUT | Switch 0 Low Side | FET Drain |
| 167 | LD0_IN | Switch 0 High Side | FET Source |
| 168 | TP7C | | |
| 169 | LD3_OUT | Switch 3 Low Side | FET Drain |
| 170 | LD3_IN | Switch 3 High Side | FET Source |
| 171 | TP7A | | |
| 172 | TP7B | | |
| 173 | LD1_OUT | Switch 1 Low Side | FET Drain |
| 174 | LD1_IN | Switch 1 High Side | FET Source |
| 175 | TP1C | | |
| 176 | TP1A | | |

TABLE 2. 24SW ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---|---------------|-------|------|------|
| Supply Voltage Range | V_{15V} | -- | 16.5 | V |
| | V_{-15V} | -16.5 | -- | V |
| Switch Input Voltage Range | | -1.0 | 40 | V |
| Storage Temperature Range | T_S | -55 | 125 | °C |
| Operational Temperature Range | T_A | -40 | 110 | °C |
| Maximum Power Dissipation Per Switch Per Module | P_D | -- | 2.04 | W |
| | | -- | 10.0 | |
| Thermal Resistance, Junction to Mounting Base of Case | Θ_{JC} | -- | 6.5 | °C/W |
| Junction Temperature | T_J | -- | 125 | °C |

TABLE 3. 24SW RECOMMENDED OPERATING CONDITIONS

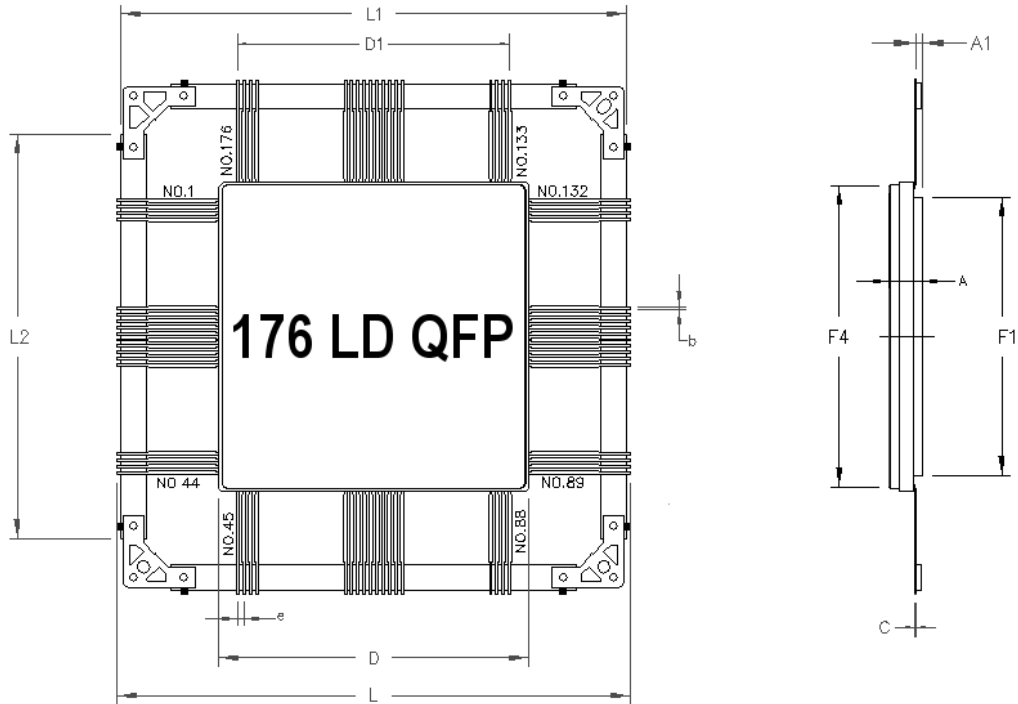
| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---|------------|------------|----------------|------|
| Supply Voltage Range | V_{15V} | 13.5 | 16.5 | V |
| | V_{-15V} | -13.5 | -16.5 | V |
| Control Input High Voltage | V_{IH} | 2.4 | $V_{5V} + 0.5$ | V |
| Control Input Low Voltage | V_{IL} | DGND - 0.5 | 0.8 | V |
| Operational Temperature Range (Case temperature) ¹ | T_A | -40 | 110 | °C |
| Power Dissipation | P_D | -- | 6.5 | W |

1. As long as the 125 °C junction temperature limit is not exceeded.

TABLE 4. 24SW ELECTRICAL CHARACTERISTICS
 ($V_{15V} = 15V$, $V_{-15V} = -15V$, $T_A = -40$ TO $110^\circ C$, UNLESS OTHERWISE SPECIFIED)

| PARAMETER | SYMBOL | CONDITIONS | SUBGROUPS | MIN | NOM | MAX | UNIT |
|--|----------------|---|-----------|-------|-----|------|--------------------|
| Control Input High Voltage | V_{IH} | Results in turning FET switch -ON (closed) | 1, 2, 3 | 2.4 | -- | -- | V |
| Control Input Low Voltage | V_{IL} | Results in turning FET switch -OFF (Open) | 1, 2, 3 | -- | -- | 0.8 | V |
| | I_{15V} | All 24 switches OFF | 1, 2, 3 | -- | -- | 3.0 | mA |
| | I_{-15V} | All 24 switches OFF | 1, 2, 3 | -- | -- | 3.0 | mA |
| | I_{15V} | For each switch that is ON ¹ | 1, 2, 3 | 135 | 200 | 240 | μA per switch |
| | I_{-15V} | For each switch that is ON ¹ | 1, 2, 3 | 310 | 475 | 590 | μA per switch |
| Switching Voltage (Ground side switching is acceptable) ² | V_{SW} | Referenced to Power Ground | 1, 2, 3 | -1.0 | 28 | 37 | V |
| Switching Current | $I_{SW-POWER}$ | Load Switching Range | 1, 2, 3 | 0.002 | -- | 2.0 | A |
| Equivalent ON resistance per switch | R_{ON} | Switch input voltage = 28V, Current = 2 amps | 1, 2, 3 | -- | 200 | 325 | $m\Omega$ |
| Switching Leakage Current for OFF state | I_{SWOFF} | Switch input voltage = 37V, T_j temperature = $125^\circ C$ | 1, 2, 3 | -- | -- | 0.25 | mA |
| Turn ON Time (Rise time) | t_{ON} | Switch input voltage = 28V, Load current = 1 amp | 1, 2, 3 | 100 | -- | 500 | μS |
| Turn OFF Time (Fall time) | t_{OFF} | Switch input voltage = 28V, load current = 0.1 amps | 1, 2, 3 | 50 | -- | 350 | μS |

1. Total current = current per SW x # of SW + bias current.
2. Power Gnd, DGND and AGND all must be within 0.7V of each other.



176 PIN RAD-PAK® QUAD FLAT PACKAGE

| SYMBOL | DIMENSION | | |
|--------|-----------|----------|-------|
| | Min | Nom | Max |
| A | 0.239 | 0.264 | 0.289 |
| b | 0.028 | 0.030 | 0.032 |
| c | 0.010 | 0.012 | 0.014 |
| D | 2.425 | 2.450 SQ | 2.475 |
| D1 | 2.150 | | |
| e | 0.050 BSC | | |
| L | 4.025 | 4.040 | 4.045 |
| L1 | 3.985 | 4.000 | 4.005 |
| L2 | 3.168 | 3.200 | 3.232 |
| A1 | 0.051 | 0.058 | 0.065 |
| F1 | 2.195 | 2.200 | 2.205 |
| F4 | 2.395 | 2.400 | 2.405 |
| N | 176 | | |

Q176-01

Note: All dimensions in inches

Important Notice:

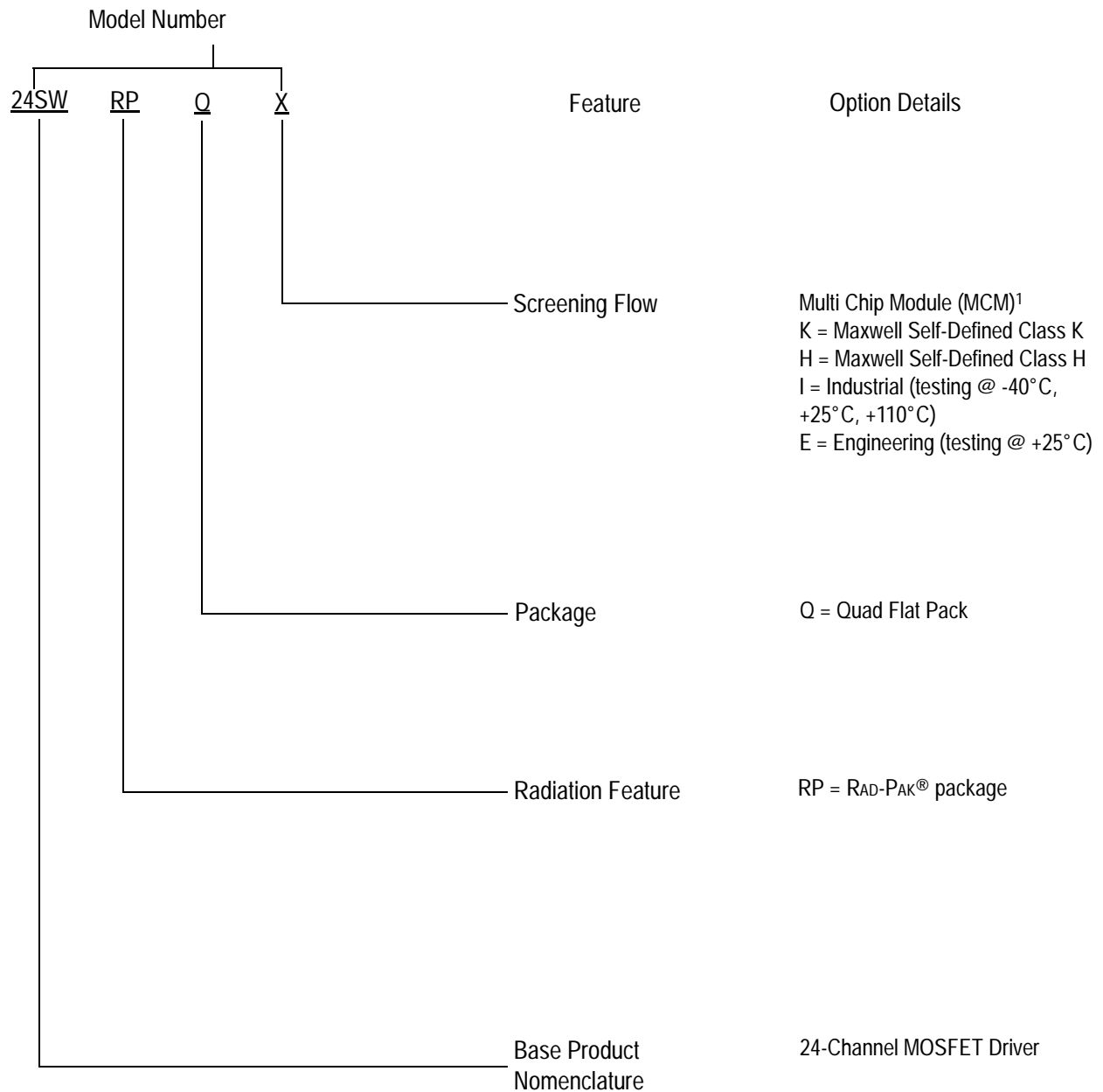
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Product Ordering Options



1) Products are manufactured and screened to Maxwell Technologies self-defined Class H and Class K flows.