# Quality Engineering Test Report

MODEL : QP375-5D 378 W AC-DC QUAD OUTPUT SWITCHING POWER SUPPLY

V1 : +5 V/ 30 A V2 : +12 V/ 9 A

V3 : 12 V/ 4 A V4 : 24 V/ 3 A

## (1) INPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | INPUT VOLTAGE RANGE | 85 VAC~ 264 VAC (Typ) | I/P:TESTING<br>O/P:FULL LOAD<br>Ta:25°C | 62 V~ 264 V | P |
| | | | I/P:<br>LOW-LINE-3V= 82 V<br>HIGH-LINE+15%= 300 V<br>O/P:FULL/MIN LOAD<br>ON: 1 Sec. OFF: 5 Sec.<br>300 TIMES<br>( AC POWER ON/OFF ) | TEST: OK | |
| 2 | INPUT FREQUENCY RANGE | 47 HZ ~ 63 HZ(Typ)<br>NO DAMAGE OSC | I/P: 115 VAC ~ 264 VAC<br>O/P:FULL~MIN LOAD<br>Ta:25°C | TEST: OK | P |
| 3 | INPUT CURRENT | 230V/ 3 A(Max)<br>115V/ 6 A(Max) | I/P: 230/115 VAC<br>O/P:FULL LOAD | I = 2.16 A/ 230 VAC<br>I = 4.39 A/ 115 VAC | P |
| 4 | INRUSH CURRENT | 230 V/ 45 A(Max)<br>COLD START | I/P: 230 VAC<br>O/P:FULL LOAD<br>Ta:25°C | I = 28 A/ 230 VAC | P |
| 5 | LINE REGULATION | V1: +0.5 %~ -0.5 %(Max)<br>V2: +0.5 %~ -0.5 %(Max)<br>V3: +0.5 %~ -0.5 %(Max)<br>V4: +0.5 %~ -0.5 %(Max) | I/P: 264 VAC ~ 115 VAC<br>O/P:FULL LOAD<br>Ta:25°C | V1: 0 %~ 0 %<br>V2: 0 %~ 0 %<br>V3: 0 %~ 0 %<br>V4: 0 %~ 0 % | P |
| 6 | EFFICIENCY | 78 %(Typ) | I/P: 230 VAC<br>O/P:FULL LOAD<br>Ta:25°C | 80.2 % | P |
| 7 | POWER FACTOR | 230 V/ 0.96(Typ)<br>115 V/ 0.98 (Typ) | I/P: 230 / 115 VAC<br>O/P:FULL LOAD<br>Ta:25°C | PF= 0.96 / 230 VAC<br>PF= 0.99 / 115 VAC | P |

## (2) OUTPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | SET UP TIME | 230 VAC/ 800 ms(Max)<br>---- VAC/ ---- ms(Max) | I/P: 230/115 VAC<br>O/P:FULL LOAD<br>Ta:25°C | 230VAC/ 161ms<br>115VAC/ 169 ms | P |
| 2 | RISE TIME | 230VAC/ 50 ms(Max)<br>---- VAC/ ---- ms(Max) | I/P: 230/115 VAC<br>O/P:FULL LOAD<br>Ta:25°C | 230VAC/ 14 ms<br>115VAC/ 15 ms | P |
| 3 | HOLD UP TIME | 230VAC/ 20 ms(Max)<br>---- VAC/ ---- ms(Max) | I/P: 230/115 VAC<br>O/P:FULL LOAD<br>Ta:25°C | 230VAC/ 31 ms<br>115VAC/ 31 ms | P |
| 4 | OVER/UNDERSHOOT TEST | < +5%(Max) | I/P: 230 VAC<br>O/P:FULL LOAD<br>Ta:25°C | TEST: <5% | P |

| | | | | | |
|---|---|---|---|---|---|
| 5 | OUTPUT VOLTAGE ADJUST RANGE | CH1: +10 %~ -5 % (TYP)<br>CH2: +10 %~ -5 % (TYP)<br>CH3: +10 %~ -5 % (TYP)<br>CH4: +10 %~ -5 % (TYP) | I/P: 85 / ---- VAC<br>O/P:MIN LOAD<br>Ta:25°C | V1: -11 %~ +27 %<br>V2: -15 %~ +14 %<br>V3: -14 %~ +16 %<br>V4: -15 %~ +16 % | P |
| | | | I/P: 85 VAC<br>O/P:FULL LOAD<br>( AC Turn ON/OFF in Vout Hi/Low Limit ) | NO Damage | P |
| 6 | LOAD REGULATION | V1: +0.8 %~ -0.8 %(Max)<br>V2: +0.8 %~ -0.8 %(Max)<br>V3: +0.8 %~ -0.8 %(Max)<br>V4: +0.8 %~ -0.8 %(Max) | I/P: 230 VAC<br>O/P:FULL ~MIN LOAD<br>Ta:25°C | V1: +0.2 %~ -0.2 %<br>V2: +0 %~ 0 %<br>V3: +0.05 %~ -0.1 %<br>V4: +0.15 %~ -0.25 % | P |
| 7 | OUTPUT VOLTAGE TOLERANCE | V1: +1 %~ -1 %(Max)<br>V2: +1 %~ -1 %(Max)<br>V3: +1 %~ -1 %(Max))<br>V4: +1 %~ -1 %(Max) | I/P: 230 VAC ~ 115 VAC<br>O/P:FULL/ Min % LOAD<br>Ta:25°C | V1: +0.37 %~ -0.3 %<br>V2: +0.1 %~ +0.1 %<br>V3: +0.3 %~ -0.1 %<br>V4: +0.3 %~ -0.1 % | P |
| 8 | RIPPLE & NOISE | V1: 100 mVp-p (Typ)<br>V2: 120 mVp-p (Typ)<br>V3: 120 mVp-p (Typ)<br>V4: 240 mVp-p (Typ) | I/P: 230 VAC<br>O/P:FULL LOAD<br>Ta:25°C | V1: 28 mVp-p<br>V2: 21 mVp-pP<br>V3: 9 mVp-p<br>V4: 19 mVp-p | P |
| 9 | DYNAMIC LOAD | CH1: 1000 mVp-p | I/P: 230 VAC<br>O/P:FULL / Min LOAD<br>90% DUTY/1KHZ<br>Ta:25°C | 270 mVp-p | P |

## (3) PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | OVER VOLTAGE PROTECTION | CH1: 5.75 V~ 6.75 V(Typ) | I/P: 230 / 115 VAC<br>O/P:MIN LOAD<br>Ta:25ºC | 6.6 V/ 230 VAC<br>6.6 V/ 115 VAC<br>Shunt down -Repower ON | P |
| 2 | OVER LOAD PROTECTION | 105 %~ 135 %(Typ) | I/P: 230/115 VAC<br>O/P:TESTING<br>Ta:25ºC | 124 %/ 230 VAC<br>122 %/ 115 VAC<br>* Pulse by pulse | P |
| 3 | SHORT PROTECTION | SHORT EVERY OUTPUT<br>1 HOUR NO DAMAGE | I/P: 264 VAC<br>O/P: 100% LOAD<br>Ta:25ºC | NO DAMAGE<br>* Pulse by pulse | P |
| 4 | OVER TEMPERATURE PROTECTION | SPEC:Ta<br>80 °C O.T.P.<br>NO DAMAGE | I/P: 230 VAC<br>O/P:FULL LOAD | 81 °C/ 230 VAC<br>O.T.P. Active<br>Shunt down -Repower ON | P |

## (4) CONTROL FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | REMOTE SENSE | > 0.25 V | I/P: 230 VAC<br>O/P:FULL LOAD<br>Ta:25ºC | >0.4 V | P |
| 2 | REMOTE CONTROL | 0 V~ 0.8V POWER ON<br>4 V~ 10 V POWER OFF | I/P: 230 VAC<br>O/P:FULL LOAD<br>Ta:25ºC | <2.7 V POWER ON<br>>2.7 V POWER OFF | P |
| 3 | POWER GOOD SIGNAL | DELAY 10ms ~ 500ms | I/P: 230/115 VAC<br>O/P:FULL LOAD<br>Ta:25ºC | 51 ms/ 230VAC<br>63 ms/ 115VAC | P |
| 4 | POWER FAIL SIGNAL | > 1ms | I/P: 230/115 VAC<br>O/P:FULL LOAD<br>Ta:25ºC | 16 ms/ 230VAC<br>15 ms/ 115VAC | P |

## (5) SAFETY TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | WITHSTAND VOLTAGE | I/P-O/P: 3.0 KVAC/min<br>I/P-FG: 1.5 KVAC/min<br>O/P-FG: 0.5 KVAC/min | I/P-O/P: 3.6 KVAC/min<br>I/P-FG: 1.8 KVAC/min<br>O/P-FG: 0.6 KVAC/min<br>Ta:25ºC | I/P-O/P: 9.9 mA<br>I/P-FG: 8 mA<br>O/P-FG: 8 mA<br>NO DAMAGE | P |
| 2 | ISOLATION RESISTANCE | I/P-O/P:500VDC >100M ohms<br>I/P-FG:500VDC >100M ohms<br>O/P-FG:500VDC >100M ohms | I/P-O/P: 500 VDC<br>I/P-FG: 500 VDC<br>O/P-FG: 500 VDC<br>Ta:25ºC | I/P-O/P: 3G ohms<br>I/P-FG: 4G ohms<br>O/P-FG: 1G ohms<br>NO DAMAGE | P |
| 3 | LEAKAGE CURRENT | < 2 mA /240VAC | I/P:(240VAC)*1.06/ (60HZ)<br>O/P:Min LOAD<br>Ta:25ºC | L-FG: 1.5 mA<br>N-FG: 1.5 mA | P |
| 4 | GROUNDING CONTINUITY | FG(PE) TO CHASSIS OR TRACE < 100 m ohms | 30 A / 2min<br>Ta:25ºC | 19 m ohms | P |
| 5 | APPROVAL | TUV:Certificate NO:R50014021<br>UL:File No:E183223 | | | |

## (6) E.M.C TEST

| NO | TEST ITEM | TEST CONDITION | SPECIFICATION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | HARMONIC | IEC61000-3-2<br>*CLASS A | I/P:230VAC/50HZ<br>O/P:FULL LOAD<br>Ta:25ºC | * PASS | P |
| 2 | CONDUCTION | EN55022<br>* CLASS A | I/P:230VAC (50HZ)<br>O/P:FULL/50% LOAD<br>Ta:25ºC | *PASS Under<br>Test by certified Lab | P |
| 3 | RADIATION | EN55022<br>_CLASS A<br>*CLASS B | I/P:230VAC (50HZ)<br>O/P:FULL/50% LOAD<br>Ta:25ºC | *PASS Under<br>_FAIL<br>Test by certified Lab | P |
| 4 | E.S.D | IEC61000-4-2<br>* LIGHT INDUSTRY | I/P:230VAC/50HZ<br>O/P:FULL LOAD | * CRITERIA A | P |

| | | | | | |
|---|---|---|---|---|---|
| | | AIR:8KV / Contac:4KV | Ta:25ºC | | |
| 5 | E.F.T | IEC61000-4-4<br>* INDUSTRY<br>INPUT:2KV | I/P:230VAC/50HZ<br>O/P:FULL LOAD<br>Ta:25ºC | * CRITERIA A | P |
| 6 | SURGE | IEC61000-4-5<br>* INDUSTRY<br>L-N:2KV<br>L,N-PE:4KV | I/P:230VAC/50HZ<br>O/P:FULL LOAD<br>Ta:25ºC | * CRITERIA B | P |
| 7 | Certificate By Interocean EMC Technology Corp Lab & Test Report Prepare | | | | |

## (7) ENVIRONMENT TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | TEMPERATURE RISE<br>TEST T rise OF PARTS | MODEL:QP375-5A<br>1.ROOM AMBIENT BURN-IN: 2 HRS<br>I/P: 230 VAC O/P: 100% LOAD Ta= 24.4 ºC<br>2.HIGH AMBIENT BURN-IN: 16 HRS<br>I/P: 230 VAC O/P: 100% LOAD Ta= 44.9 ºC | | | N/A |

| NO | Position | P/N | TEMP Ta= 24.4ºC | TEMP Ta= 44.9 ºC |
|---|---|---|---|---|
| 1 | D1 | SMD 3A/600V | 31.3 | 48.7 |
| 2 | D60 | 1N5406 3A/600V | 63.0 | 82.5 |
| 3 | BD1 | KBJ608G 6A/800V | 36.6 | 54.6 |
| 4 | L1 | TR-288 | 35.7 | 53.3 |
| 5 | U2 | ML 4800CP | 28.1 | 45.9 |
| 6 | Q1 | IRFP460 20A/500V | 46.4 | 66.1 |
| 7 | Q2 | IRFR460 15A/500V | 44.0 | 64.4 |
| 8 | D3 | RHRP1560 15A/600V | 58.6 | 79.3 |
| 9 | Q5 | 2SK2652 6A/900V | 53.2 | 74.1 |
| 10 | Q4 | 2SK2652 6A/900V | 63 | 84.1 |
| 11 | TRC1 | BTA16-600B/6A | 45.7 | 64.2 |
| 12 | TSW1 | S7-22 80ºC | 46.1 | 65.8 |
| 13 | C5 | 470u/400V 85ºC | 36.0 | 53.2 |
| 14 | T1core | TF826 | 56.3 | 74.9 |
| 15 | T1coil | TF826 | 68.8 | 88.3 |

| | | | | | |
|---|---|---|---|---|---|
| 2 | OVER LOAD<br>BURN-IN TEST | NO DAMAGE<br>1.5 HOUR (MIN) | I/P: 230 VAC<br>O/P: 114 %<br>Ta:25ºC | TEST: OK | P |
| 3 | LOW<br>TEMPERATURE<br>TURN ON TEST | TURN ON AFTER 2.5<br>HOUR | I/P: 230 VAC<br>O/P: 100 %LOAD<br>Ta= -11.5 ºC | TEST: OK | P |
| 4 | HIGH HUMIDITY<br>HIGH TEMPERATURE<br>HIGH VOLTAGE<br>TURN ON TEST | AFTER 12 HOURS<br>IN CHAMBER ON<br>CONTROL 55ºC<br>NO DAMAGE | I/P: 230 VAC<br>O/P:FULL LOAD<br>Ta= 55 ºC<br>HUMIDITY= 95 %R.H | TEST: OK | P |
| 5 | TEMPERATURE<br>COEFFICIENT | + 0.03 %(0~50ºC) | I/P: 230 VAC<br>O/P:FULL LOAD | + 0.01 %(0~50ºC) | P |

## (8) M.T.B.F & LIFE CYCLE CALCULATION

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | CAPACITOR<br>LIFE CYCLE | SUPPOSE C 111 IS THE MOST CRITICAL COMPONENT<br>I/P:230 VAC O/P:FULL LOAD Ta= 25 °C LIFE TIME= 224553 HRS<br>I/P:230 VAC O/P:FULL LOAD Ta= 45 °C LIFE TIME= 61036 HRS | | | P |
| 2 | MTBF | MIL-HDBK-217F NOTICES2 PARTS COUNT<br>TOTAL FAILURE RATE: 75931 HRS | | | P |

## (9) VIBRATION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | VIBRATION TEST | 1 Carton & 1Set Operating at I/P:230VAC no load<br>(1) Waveform: Sine Wave<br>(2) Frequency:10~500Hz<br>(3) Sweep Time:10min/sweep cycle<br>(4) Acceleration:2G<br>(5) Test Time:1 hour in each axis (X.Y.Z)<br>Ta:25ºC | | TEST: ---- | N/A |

## (10) COMPONENT STRESS TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|---|---|---|---|---|---|
| 1 | Power Transistor<br>(D to S) or (C to E)<br>Peak Voltage | Q 5 Rated<br>2SK2850 : 900 V 6 A | I/P:High-Line +3V = 267 V<br>O/P: (1)Full Load Turn on<br>(2) Full Load<br>(3)Output Short<br>Ta:25ºC | (1) 724 V<br>(2) 796 V<br>(3) 880 V | P |
| 2 | Diode Peak Voltage | D 102 Rated<br>S30SC4M : 40 V 30 A | I/P:High-Line +3V = 267 V<br>O/P: (1)Full Load Turn on<br>(2) Full Load<br>(3)Output Short<br>Ta:25ºC | (1) 16.1 V<br>(2) 22.3 V<br>(3) 23.4 V | P |

| DATE | SAMPLE | TEST RESULT | TEST | APPROVAL |
|---|---|---|---|---|
| 2003/7/18 | ENGINEERING SAMPLE | PASS | Vincent Tseng | Max Lin |
| 2003/9/19 | PRODUCTION SAMPLE A210A14 | PASS | Vincent Tseng | Max Lin |
| 2004/3/31 | PRODUCTION SAMPLE A301B24 | PASS | Vincent Tseng | Max Lin |