Switch, I/O and IC Reliability Report

November, 2004

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1.0 INTRODUCTION

The November, 2004 Reliability Report has been expanded to include test results for switch devices, input/output and IC devices. The report contains the accumulated data obtained on power MOSFET transistors, IGBTs, Schottky diodes, Fast Recovery Epitaxial Diodes (FREDS), Input Rectifiers, SCRs and ICs built at International Rectifier Corporation's facilities as well as International Rectifier subcontractors.

Section 2 contains a description of the ENVIRONMENTAL STRESS TESTS which are performed and the observed failure modes.

Section 3, THE MATRIX QUALIFICATION PHILOSOPHY, is a presentation of the philosophy of reliability testing that allows one to extrapolate the reliability of devices based upon the results of similar devices. By following this rationale, International Rectifier is able to assess the reliability of thousands of separate devices based on a smaller sample size.

Section 4 of the present report contains an update on the latest results of our LONG TERM RELIABILITY TESTING PROGRAM. The data is separated initially by function (transistors, diodes and ICs) and further subdivided down to the individual part number. The data presented in the tables are limited to devices with date codes on, or after, 0224. This provides a minimum 24 month rolling average from quarter to quarter.

Section 5 presents acceleration factors which have been obtained for high temperature reverse bias (HTRB), gate stress acceleration due to applied gate bias voltage and thermal acceleration, power cycling capability, voltage acceleration under high humidity environmental stress, applied bias acceleration under HTRB conditions and applied bias acceleration for N-channel and P-channel gate stress.

Additional switch, I/O and IC reliability information can be obtained by contacting the Technical Assistance Center(s)

Technical Assistance Centers			
	North America	Europe	Asia
Phone	310 252 7105	++44 20 8645 8015	++65 6838 4632
FAX	310 252 7903	++44 20 8645 8086	++ 65 6733 7994

SECTION 2.0

TYPICAL ENVIRONMENTAL STRESS AND FAILURE MODES

2.1 ENVIRONMENTAL STRESS TESTS FOR DISCRETE DEVICES

2.1.1 HIGH TEMPERATURE REVERSE BIAS (HTRB)

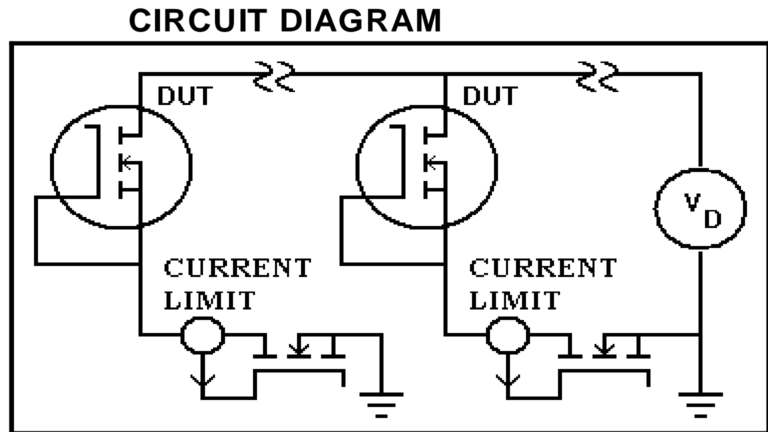
CONDITIONS:

Temperature: T = 150°C or 175°C

Duration: 1000 hours (typical)

Bias: $V_S = V_G = 0V$
V_D = Maximum rated BV_{DSS} for voltage ratings up to 500V; 80% of maximum rated BV_{DSS} for voltage ratings from 600V to 1000V

CIRCUIT DIAGRAM



PURPOSE:

The purpose of high temperature reverse bias burn-in is to stress the devices with applied bias in the blocking mode (cut-off mode) while at elevated junction temperatures. This will accelerate any blocking voltage degradation process.

FAILURE MODES:

The primary failure mode for HTRB stress is a gradual degradation of the breakdown characteristics or BV_{DSS}. This degradation has been attributed to the presence of foreign materials and polar/ionic contaminants. These materials, migrating under application of electric field at high temperature, can perturb the electric field termination structure.

A secondary failure mode, threshold voltage degradation has been present in HTRB stress with less frequency than the primary failure mode. The mechanism responsible for this degradation is under investigation.

Extreme care must be exercised in the course of a long term test to avoid potential hazards such as electrostatic discharge or electrical overstress to the gate during test. Failures arising from this abuse can be virtually indistinguishable from true HTRB failures which result from the actual stress test.

SENSITIVE PARAMETERS:

TRANSISTORS: BV_{DSS}, I_{DSS}, I_{GSS}, $V_{GS(th)}$, V_{CES}, $V_{CE(ON)}$, V_{GE}, I_{GES}, I_{CES}

DIODES: V_R, I_R

,

2.1.2 GATE STRESS (TRANSISTORS)

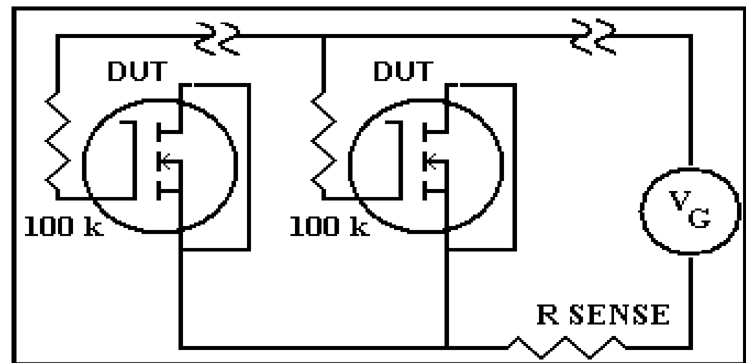
CONDITIONS:

Temperature: T = 150°C or 175°C

Duration: 1000 hours (typical)

Bias (typical): $V_S = V_D = 0V$
V_G = +20 V (N-channel)
V_G = -20 V (P-channel)

CIRCUIT DIAGRAM



PURPOSE:

The purpose of long term high temperature gate stress is to stress the devices with applied bias to the gate while at elevated junction temperatures. This will accelerate what is known as time-dependent dielectric breakdown (TDDB) of the gate structure.

FAILURE MODES:

The primary failure mode for long term gate stress is a rupture of the gate oxide, causing either a resistive short between gate-to-source or gate-to-drain or what appears to be a low breakdown diode between the gate and source.

The oxide breakdown or TDDB has been attributed to the degradation in time of existing defects in the thermally grown oxide. These defects can take the form of localized thickness variations, structural anomalies or the presence of particulate within the oxide.

Extreme care must be exercised in the course of a long term test to avoid potential hazards such as electrostatic discharge or electrical overstress to the gate during test. Failures arising from this abuse are virtually indistinguishable from true TDDB's which result from the actual stress test.

Another failure mode occasionally observed is degradation of the threshold parameter, $V_{GS(th)}$, due to the presence of highly mobile ions such as Sodium ions within the gate oxide. Under the influence of bias at high temperatures, these ions will move through the oxide toward the negative surface and once sufficient number have accumulated, the FET channel in the vicinity can begin to invert, lowering the effective threshold voltage. This failure mode is very rare with HEXFETs due to inherent features in the design and due to cleanliness of wafer fabrication.

SENSITIVE PARAMETERS: I_{GSS}, $V_{GS(th)}$, V_{GE},, I_{GES},

2.1.3 POWER CYCLING

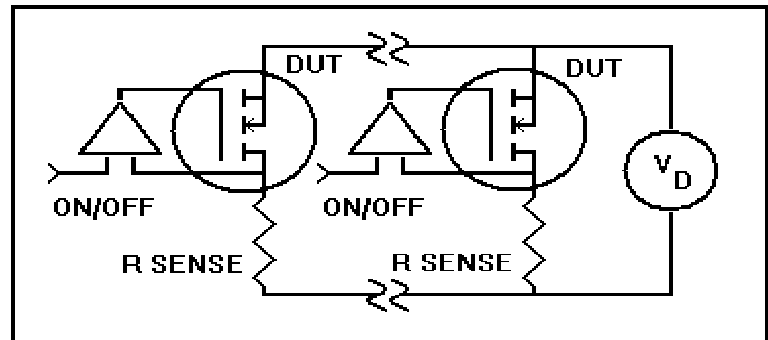
CONDITIONS:

Temperature T_{min} = 30°C
T_{max} = 30°C + ΔT
ΔT = 70°C or 100°C

Duration: 5,000 to 10,000 cycles

Bias: $V_S = 0$
V_G = 11V(on)/0V(off)
V_D = 30V to 60V

CIRCUIT DIAGRAM



PURPOSE:

The purpose of power cycling is to simulate the thermal and current pulsing stresses which devices will encounter in actual circuit applications when either the equipment is turned on and off or the power is applied to the device in short bursts interspersed with quiescent, low power periods. The simulation is achieved by the on/off application of power to each device while they are in the active linear region.

FAILURE MODES:

The primary failure mode for power cycling is a thermal fatigue of the silicon/metal interfaces and metal/metal interfaces. The fatigue, due to the thermo-mechanical stresses from the heating and cooling, will cause electrical or thermal performance to degrade.

If the degradation occurs at the header/die interface, then the thermal impedance, Θ_{jC}, will begin to increase well before any electrical effect is seen. If the degradation occurs at the wire bond/die interface or the wire bond/post interface, then the on resistance, $R_{DS(on)}$, will slowly increase or become unstable with time. The thermal impedance, when measured during this time may appear to decrease or change erratically.

The mechanical stresses from the application of power can also propagate fractures in the silicon when the die is thermally mismatched to the solder/heat sink system. These fractures will manifest themselves in the form of shorted gates or degraded breakdown characteristics (BV_{DSS}).

SENSITIVE PARAMETERS:

TRANSISTORS: I_{GSS}, BV_{DSS}, Θ_{JC}, $R_{DS(on)}$, V_{CES}, $V_{CE(ON)}$, I_{GES}
DIODES: V_F

2.1.4 TEMPERATURE CYCLING

CONDITIONS:

Temperature alternatives:

T_{min} = -55°C
T_{max} = +150°C
ΔT = 205°C

T_{min} = -40°C
T_{max} = +125°C
ΔT = 165°C

Duration: 1000 cycles (typical)

Bias: No bias applied during test

PURPOSE:

The purpose of temperature cycling is to simulate thermal stresses which devices will encounter in the actual circuit applications (as with power cycling) in combination with potentially extreme operating ambient temperatures. Some equipment is destined to be used in extreme environments, and subject to daily temperature cycles.

FAILURE MODES:

The primary failure mode for temperature cycling is a thermal fatigue of the silicon/metal interfaces and metal/metal interfaces. The fatigue, as in the case of power cycling in section 2.3, results from thermomechanical stresses due to heating and cooling and will cause electrical or thermal performance to degrade.

If the degradation occurs at the header/die interface, then the thermal impedance, Θ_{JC}, will begin to increase well before any electrical effect is seen.

If the degradation occurs at the wire bond/die interface or the wire bond/bond post interface, then the on resistance, $R_{DS(on)}$, will slowly increase or become unstable with time. The thermal impedance, when measured during this time may appear to decrease or change erratically.

The mechanical stresses from the temperature can also propagate fractures in the silicon when the die is thermally mismatched to the solder/heat sink system. These fractures will manifest themselves in the form of shorted gates or degraded breakdown characteristics (BV_{DSS}).

SENSITIVE PARAMETERS:

TRANSISTORS: I_{GSS}, BV_{DSS}, Θ_{JC}, $R_{DS(on)}$, V_{CES}, $V_{CE(ON)}$, I_{GES}.

2.1.5 TEMPERATURE & HUMIDITY (85°C/85%RH)

CONDITIONS:

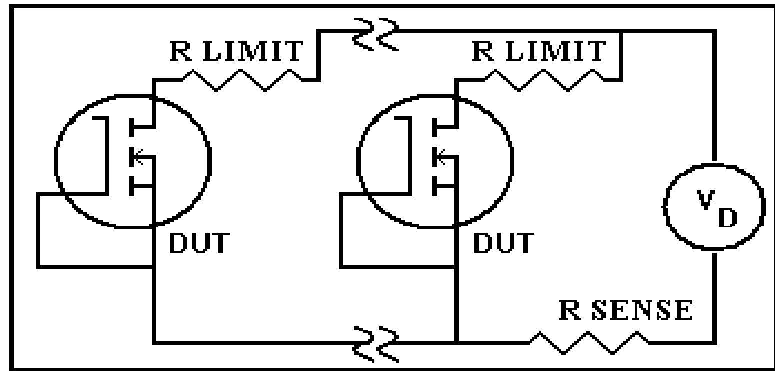
Temperature: T = +85°C

Duration: 1000 hours (typical)

Relative Humidity: 85%

Bias: $V_G = V_S = 0$ V
V_D = 100% of maximum rated BV_{DSS} up to 100 V: 100V for all devices with rated BV_{DSS} greater than 100V.

CIRCUIT DIAGRAM



PURPOSE:

The purpose of temperature-humidity-bias testing is to subject non-hermetic encapsulated devices to temperature and humidity extremes with bias on the drain. This test is a method of examining the ability of a non-hermetic package to withstand the deleterious effects of a humid environment. The devices are placed in a temperature and humidity chamber at ambient pressure and are biased in a cut-off mode.

FAILURE MODES:

There are two primary failure modes which have been observed. The first failure mode comes about as a result of the ingression of water molecules into the active area on the surface of the die. Once sufficient water has accumulated in the region of the electric field termination structure on the HEXFET, the perturbation of that field begins to degrade the breakdown characteristics of the device.

The second failure mode that has been observed is due to cathodic corrosion of the Aluminum source bonding pad. As with the first failure mode, water will ingress to the top of the die. There, in the presence of applied bias, an electric current through the few monolayers of water will begin to cause the bond pad to dissolve. Eventually, the corrosion will proceed to the point where the current capability of the device is impaired and parameters such as $R_{DS(on)}$ and V_{SD} begin to increase and become unstable.

The dominance of either of these failure modes is basically determined by the amount of bias present during the test. Under low bias conditions, the corrosion proceeds slowly, so the first failure mode will dominate. Alternatively, if a high bias is applied to the drain, the corrosion will proceed very rapidly and the device will fail due to on-resistance before the breakdown characteristic can degrade.

SENSITIVE PARAMETERS:

TRANSISTORS: BV_{DSS}, $R_{DS(on)}$, V_{SD}, V_{CES}, $V_{CE(ON)}$,
DIODES: V_R, I_R

2.2 ENVIRONMENTAL STRESS TESTS FOR IC DEVICES

2.2.1 HIGH TEMPERATURE BIAS (HTB)

CONDITIONS:

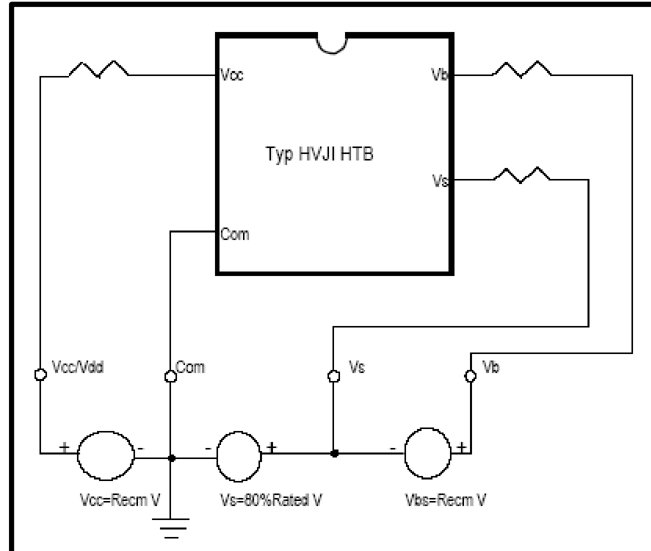
Temperature: T = 150°C

Duration: 1000 hours (typical)

Bias:

V_{CC}/V_{DD} = Recommended Voltages
Vbs = Recommended Voltages
Vs = 80% Rated Voltage

CIRCUIT DIAGRAM



PURPOSE:

The purpose of high temperature reverse bias burn-in is to stress the devices with applied bias in the blocking mode (cut-off mode) while at elevated junction temperatures. This will accelerate any blocking voltage degradation process.

FAILURE MODES:

The primary failure mode for HTB stress is a gradual degradation of the breakdown characteristics or BV_{DS}. This degradation has been attributed to the presence of foreign materials and polar/ionic contaminants. These materials, migrating under application of electric field at high temperature, can perturb the electric field termination structure.

A secondary failure mode, threshold voltage degradation has been present in HTB stress with less frequency than the primary failure mode. The mechanism responsible for this degradation is under investigation.

Extreme care must be exercised in the course of a long-term test to avoid potential hazards such as electrostatic discharge or electrical overstress to the gate during test. Failures arising from this abuse can be virtually indistinguishable from true HTB failures, which result from the actual stress test.

SENSITIVE PARAMETERS: Bv/I_leak, Iqcc, Iqbs, Vccuv, Vbsuv

2.2.2 HIGH TEMPERATURE OPERATING LIFE (HTOL)

CONDITIONS:

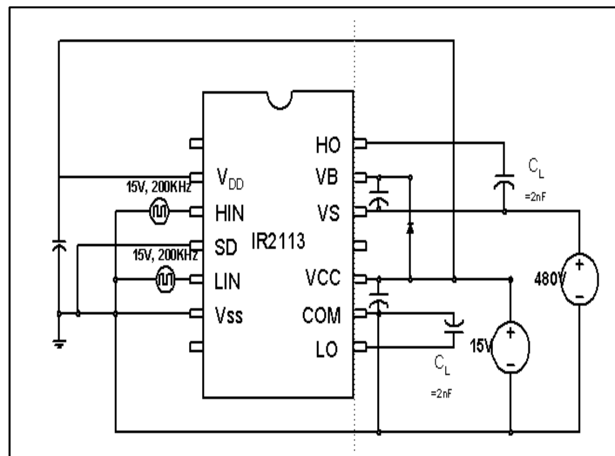
Temperature: T = 125°C

Duration: 1000 hours (typical)

Bias:

V_{CC}/V_{DD} = Recommended Voltages
Vbs = Recommended Voltages
Vs = 80% Rated Voltage
Vin= Recommended Voltages/200KHz

TYPICAL CIRCUIT DIAGRAM



PURPOSE:

The purpose of HTOL is to stress the devices with applied bias (and dynamic stimulus if applicable) while at elevated junction temperatures. This will accelerate temperature/voltage failure mechanisms and detect those resulting from manufacturing defects. This test redistributes mobile ions by means of temperature/voltage stress, which may result in junction leakage when sufficient ionic contamination is present and accelerate failures resulting from encapsulated and/or die-coated impurities.

FAILURE MODES:

Ionic contamination, diffusion defects, oxide defects, metallization defects, surface inversion and surface charge movement, irregularities in the crystal lattice structure, assembly induced foreign material, and blocking voltage degradation.

SENSITIVE PARAMETERS:

Bv/I_leak, Iqcc, Iqbs, Vccuv, Vbsuv

2.2.3 TEMPERATURE CYCLING

CONDITIONS:

Temperature alternatives:

T_{min} = -55°C		T_{min} = -40°C
T_{max} = +150°C	or	T_{max} = +125°C
ΔT = 205°C		ΔT = 165°C

Duration: 1000 cycles (typical)

Bias: No bias applied during test

PURPOSE:

The purpose of temperature cycling is to simulate thermal stresses, which devices will encounter in the actual circuit applications (as with power cycling) in combination with potentially extreme operating ambient temperatures. Some equipment is destined to be used in extreme environments, and subject to daily temperature cycles.

FAILURE MODES:

The primary failure mode for temperature cycling is a thermal fatigue of the silicon/metal interfaces and metal/metal interfaces. The fatigue results from thermomechanical stresses due to heating and cooling and will cause electrical or thermal performance to degrade.

If the degradation occurs at the header/die interface, then the thermal impedance, Θ_{JC}, will begin to increase well before any electrical effect is seen.

If the degradation occurs at the wire bond/die interface or the wire bond/bond post interface, then the on resistance, $R_{DS(on)}$, will slowly increase or become unstable with time. The thermal impedance, when measured during this time may appear to decrease or change erratically.

The mechanical stresses from the temperature can also propagate fractures in the silicon when the die is thermally mismatched to the solder/heat sink system. These fractures will manifest themselves in the form of shorted gates or degraded breakdown characteristics (BV_{DS}).

SENSITIVE PARAMETERS: I_leak, Iqcc, Iqbs

2.2.4 TEMPERATURE & HUMIDITY (85°C/85%RH)

CONDITIONS:

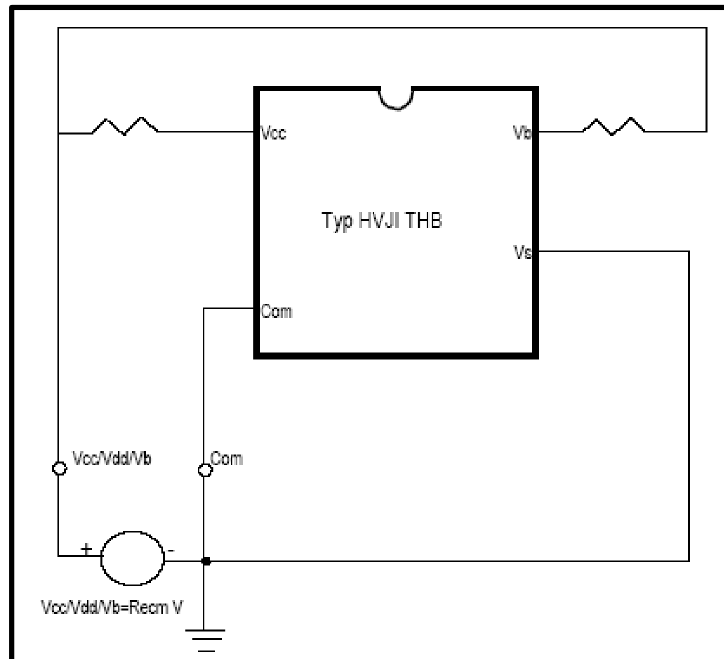
Temperature: T = +85°C

Duration: 1000 hours (typical)

Relative Humidity: 85%

Bias: Vcc/Vdd/Vb=Recommended Voltages

CIRCUIT DIAGRAM



PURPOSE:

The purpose of the Temperature Humidity Bias Test is to subject non-hermetic encapsulated devices to temperature and humidity extremes with biases on both logic and power sections of die. This test is a method of examining the ability of non-hermetic package to withstand the deleterious effect of humid environment. The devices are placed in a temperature and humidity chamber at ambient pressure and are biased in the blocking modes.

FAILURE MODES:

Moisture Ingression, Dendrite Growth, Chemical Corrosion, Electrolytic Corrosion from applied bias in presence of elevated humidity/temperature, Electrolytic Corrosion from dissimilar metals.

SENSITIVE PARAMETERS: Iqcc, Iqbs, Vcc_Clamp

3.0 THE MATRIX QUALIFICATION PHILOSOPHY

The matrix qualification philosophy uses the homogeneous nature of the Switch, I/O and IC designs. All part types in a given family or technology typically consist of identical structures replicated hundreds or thousands of times across the surface of a die and surrounded by an electric field termination structure. To illustrate the philosophy of matrix qualification, an analysis of the power MOSFET is presented.

Certain FET power transistors are made with small die that have a few hundred cells. Other devices have large die with thousands of cells. For this product family, the FET design is fundamentally the same from one part type to another.

There are small variations in the thickness of various layers, which must be considered. The chips' lengths and widths also vary. In principal, however, all devices should age the same way on those environmental stress tests used for qualification.

The matrix qualification philosophy allows us to exploit the homogeneity of the family. For a given environmental test, there will be one specific part type from the family which has been found or is expected to be found to have the highest failure rate. This is considered the worst case part. For example, the larger the die the more susceptible it is to thermomechanical stress, the larger the gate surface area (and hence the higher the probability of TDDB failure), and the larger the surface area of the field termination structure (a greater target of opportunity for micro contaminant effects). On tests which apply higher rated static dc reverse bias voltages (drain-to-source) have higher probabilities of failure. The higher probability failure is due to the higher field strength (in general).

Within a given family , for a given test, there is one part type which would be expected to see the least amount of stress. This part would be considered a best case part. An example would be the smallest die in the family with the lowest V_{DS} rating.

Once we have identified the worst case and best case part number, for a given test, we use the test data on these two part numbers to "bracket" the rest of the part types within the family. If the best and worst case parts pass the qualification, then all the other part types within the family are considered qualified by similarity. If we have chosen our family members well, then this approach is rational from a reliability physics perspective. The key is in selecting the families and family members correctly.

Some customers have questioned the need for even looking at the best case part type. After all, if the worst case part type successfully passes qualification, then all the other members of the family, which are lower stress cases by definition, should also be able to pass. The reason for incorporating the best case part types into the

CRITICAL ATTRIBUTES FOR CONSIDERATION IN MATRIX QUALIFICATION

A fundamental requirement to the application of the matrix qualification philosophy is identifying all of the critical device attributes. Once the critical attributes have been identified, it follows that the best case and worst case part types and the appropriate reliability tests are established for every category. It is necessary at that point to show all of the part types that are qualified based on the best and worst case part types. When this is complete, the next and final step is to perform the actual testing, collect the relevant data and present the results.

Our consideration of the reliability in this report will focus on the part types manufactured at International Rectifier and its subcontractors. For the most part, the reliability of the families is mutually exclusive based on the differences in packaging.

For each part family, there are two aspects of reliability that must be assessed- package level reliability and die level reliability. These two categories establish the foundation of the matrix testing. Further evaluation of the categories leads to the specific concerns involved and the appropriate reliability tests to assess performance. With the advent of new Silicon generations, some design changes give rise to the necessity of presenting data for each generation independently. Where this becomes a necessity, the part types are identified as additional worst-case devices.

DIE LEVEL

Concern #1: Field Distortion

The presence of polar molecules, such as water and ionic contaminants from the atmosphere, on top of the passivation surface and along the edge of the die, will distort the electric field when a high voltage is applied to the MOSFET, giving increased local leakage current and possible eventual thermal runaway. Failures occur in the random and wearout region, and can be accelerated by high temperature bias (HTRB, HTB). The critical factor involved with the HTRB/HTB test is the field strength that is applied to the device termination structure by the selected bias. Ideally, we want to apply the maximum possible bias to each device to create the highest possible stress and thus maximize the field strength.

The best case is the device with the lowest voltage rating type in the family because the bias applied in HTRB/HTB test creates the lowest field strength.

The worst case device types are those that produce the highest field strengths. The part types for test are the devices with the highest voltage rating (n- and p-channel for transistors) in the family.

Concern #2: Oxide Defects

defects lead to failures in the form of a gate-to-source short circuit. They can be activated by high-temperature gate-stress/bias (HTGS or HTGB) testing.

To test the dielectric strength of the gate oxide, the rated gate voltage is applied to the gate for several hundreds of hours while at elevated junction temperatures. This will accelerate what is known as time-dependent dielectric breakdown (TDDB) of the gate structure. There are four variables involved in the stress test for a given generation of silicon. They are the bias applied, the junction temperature applied, the duration of the stress and the thickness of the gate oxide.

The worst case device for this test is highly flexible. Since the basic structure of the gates remains the same for all part types in a family, we would take the worst case device as that device that is subjected to the greatest field strength at the highest temperature. Further, it would seem that there is a difference between logic level devices (with a gate thickness on the order of 500Å) and a standard transistors (gate oxide thickness around 1000Å), however, the logic level FET is stressed at 10V and the standard transistor at 20V (duration and junction temperature being the same).

PACKAGE LEVEL

Concern #3: Die Attach Fatigue

Die attach fatigue is normally caused by the differential thermal expansion between the die and the header and by the different thermal expansion coefficients of silicon and the header material. This shows up as cracking or separation of the die or voiding of the die attach, resulting in degraded on-resistance and/or thermal fatigue. Additionally, HEXSENSE devices can experience degradation/failure of the current sensing (ratio) capability. These failures largely occur in the wear out region. The susceptibility of a given die attach to thermal fatigue is normally ascertained with a thermomechanical stress test (power cycling or unbiased temperature cycling).

The best case device is that which has the least amount of internal physical stress imposed by die on the package, therefore it would be the smallest die size in the family.

The worst case device is that which has the most internal stress imposed on the package, in other words the largest die size in the family.

Concern #4: Wire Bond Fatigue and Wire Bond Induced Damage

This concern is similar to the previous one and shows up as a separated wire bond. The separation can occur either at the die-wire interface or on the post bond. Other concerns that arise are due to the inappropriate application of the bond wire to the die surface. In the case of devices that have a wire bond placed over active device

The best case device is that which has the smallest bond wires over a non-active area bond pad. This is usually the smallest hex size in the family that is greater than 60V rated (all 60V devices, n- and p-channel, and lower, are active area bonded).

The worst case is the device with the largest bond wires or multiple bond wires (i.e. two source wires) placed over an active area. This is usually a 60V device with the largest die size for the family.

Concern #5: Metal Corrosion

Under the environmental stress conditions of humidity/temperature/bias, it is expected that a die packaged in a non-hermetic package will be susceptible to one of two predominating failure modes: 1) excess leakage currents under reverse bias will increase to the point of causing a parametric failure of I_{DSS} or, 2) cathodic corrosion of the internal metallization will result in a parametric shift in the on-resistance, $R_{DS(on)}$ eventually resulting in an open circuit condition. The cause of both of these phenomena is the ingression of water into the plastic package from the ambient atmosphere to the chip surface, forming external surface leakage paths. This can lead to excessive drain current and eventually parametric failure. Internal package stresses can promote moisture ingression by corrupting the integrity of the mold compound and allowing moisture paths occur.

The application of reverse bias under blocking conditions ($V_G = V_S$) can result in cathodic corrosion of the source bond pad. As the corrosion proceeds, the aluminum source pad slowly dissolves causing intermittent continuity between the source wire and the top metallization of the chip. Eventually, the continuity goes altogether and the device presents an open circuit.

The best case device is that which has the smallest die with the lowest voltage rating.

The worst case device is that which has the largest die (primary factor) with the highest voltage rating (secondary factor; both n- and p- channel).

SECTION 4.1

LONG TERM RELIABILITY TEST RESULTS
DISCRETE PRODUCTS

4.1 Transistors

4.1.1 Temperature Cycle

Power MOSFET

Category	Part Number	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak (TO-263) & TO-262	IRFS11N50APBF	-55°C/150°C	0	80	1000	0	
	IRL3803S	-55°C/150°C	0	80	1000	0	
	IRFZ24NSPBF	-55°C/150°C	0	80	1000	0	
	IRLBD59N04E	-55°C/150°C	0	80	1000	0	
	IRLBD59N04E	-55°C/150°C	0	80	1000	0	
	IRLBD59N04E	-55°C/150°C	0	80	1000	0	
	IRFS31N20DPBF	-55°C/150°C	0	80	1000	0	
	IRFSL16N50K	-55°C/150°C	0	80	1000	0	
	IRFSL16N50K	-55°C/150°C	0	80	1000	0	
	IRFSL16N50K	-55°C/150°C	0	80	1000	0	
	IRFSL16N50K	-55°C/150°C	0	80	1000	0	
	IRF3710S	-55°C/150°C	0	35	1000	0	
	IRF1404S	-55°C/150°C	0	80	1000	0	
	IRF1402S	-55°C/150°C	0	80	1000	0	
	IRF1404S	-55°C/150°C	0	60	3000	0	
	IRF1404SPBF	-55°C/150°C	0	80	1000	0	
	IRF1404SPBF	-55°C/150°C	0	80	1000	0	
	IRF3808S	-55°C/150°C	0	80	1000	0	
	IRF3504S	-55°C/150°C	0	80	1000	0	
	IRF3808SPBF	-55°C/150°C	0	80	1000	0	
	IRFS4710PBF	-55°C/150°C	0	80	1000	0	
	IRFSL22N60C	-55°C/150°C	0	80	1000	0	
	IRFSL22N60C	-55°C/150°C	0	80	1000	0	
	IRFSL22N60C	-55°C/150°C	0	80	1000	0	
	IRF2804S	-55°C/150°C	0	80	1000	0	
	IRF2804S	-55°C/150°C	0	80	1000	0	
	IRF3710ZS	-55°C/150°C	0	80	1000	0	
	IRF3710ZS	-55°C/150°C	0	80	1000	0	
	IRF2804S	-55°C/150°C	0	80	1000	0	
	IRF3710ZS	-55°C/150°C	0	60	3000	0	
	IRF2804L	-55°C/150°C	0	80	1000	0	
	IRF1405ZL	-55°C/150°C	0	80	1000	0	
	IRF1404ZL	-55°C/150°C	0	79	1000	0	
	IRF1405ZS	-55°C/150°C	0	80	1000	0	
	IRF2804SPBF	-55°C/150°C	0	80	1000	0	
	IRFS3710ZSPBF	-55°C/150°C	0	79	1000	0	
	IRF2804SPBF	-55°C/150°C	0	80	1000	0	
	IRL7833S	-55°C/150°C	0	80	1000	0	
	IRL7833S	-55°C/150°C	0	80	1000	0	
	IRL7833S	-55°C/150°C	0	80	1000	0	
	IRL7833S	-55°C/150°C	0	80	1000	0	
	IRL7833SPBF	-55°C/150°C	0	80	1000	0	
	IRF3415SPBF	-55°C/150°C	0	79	1000	0	
	IRF9540L	-55°C/150°C	0	160	1000	0	
	IRF1404S	-55°C/150°C	0	240	1000	0	
	IRF28047P	-55°C/150°C	0	240	1000	0	
	IRF6215S	-55°C/150°C	0	160	1000	0	
	IRFS11N50A	-55°C/150°C	0	80	1000	0	
	IRF1404L	-55°C/150°C	0	160	1000	0	
	IRF8010S	-55°C/150°C	0	80	1000	0	
		Total		4472		0	
DirectFET	IRF6604	-40°C/125°C		140	1000	0	
	IRF6601	-40°C/125°C	0	160	1000	0	
	IRF6603	-40°C/125°C	0	190	1000	0	
	IRF6607	-40°C/125°C	0	40	1000	0	
	IRF6608	-40°C/125°C	0	140	1000	0	
	IRF6609	-40°C/125°C	0	77	1000	0	
	IRF6612	-40°C/125°C	0	90	1000	0	
	IRF6617	-40°C/125°C	0	160	1000	0	
	IRF6618	-40°C/125°C	0	4398	1000	0	
	IRF6620	-40°C/125°C	0	10	1000	0	
		Total		5405		0	

Power MOSFET (Continued)

Category	Part Number	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
DPak & IPak	IRLR110	-55°C/150°C	0	80	1000	0	
	IRLR110	-55°C/150°C	0	80	1000	0	
	IRFRC20	-55°C/150°C	0	80	1000	0	
	IRFR9310	-55°C/150°C	0	80	1000	0	
	IRG4RC20F	-55°C/150°C	0	80	1000	0	
	IRLR2705	-55°C/150°C	0	80	1000	0	
	IRLR014N	-55°C/150°C	0	80	1000	0	
	IRLR3410	-55°C/150°C	0	80	1000	0	
	IRLR3715	-55°C/150°C	0	80	1000	0	
	IRLR3714	-55°C/150°C	0	80	1000	0	
	IRLR3714	-55°C/150°C	0	80	1000	0	
	IRFR3711	-55°C/150°C	0	80	1000	0	
	IRFR3412	-55°C/150°C	0	80	1000	0	
	IRLR2908	-55°C/150°C	0	80	1000	0	
	IRFR3710Z	-55°C/150°C	0	80	1000	0	
	IRFR3710Z	-55°C/150°C	0	80	1000	0	
	IRFR4104	-55°C/150°C	0	80	1000	0	
	IRFR120Z	-55°C/150°C	0	80	1000	0	
	IRLR7833PBF	-55°C/150°C	0	80	1000	0	
	IRLR7833PBF	-55°C/150°C	0	80	1000	0	
	IRFR3710Z	-55°C/150°C	0	80	1000	0	
	IRLR7843	-55°C/150°C	0	80	1000	0	
	IRLR7843	-55°C/150°C	0	80	1000	0	
	IRLR7843	-55°C/150°C	0	80	1000	0	
	IRLR7843	-55°C/150°C	0	40	1000	0	
	IRLR7843	-55°C/150°C	0	40	1000	0	
	IRLR3714Z	-55°C/150°C	0	80	1000	0	
	IRLR7833	-55°C/150°C	0	80	1000	0	
	IRLR7833	-55°C/150°C	0	80	1000	0	
	IRLR7833	-55°C/150°C	0	80	1000	0	
	IRLR3715Z	-55°C/150°C	0	80	1000	0	
	IRLR7821	-55°C/150°C	0	80	1000	0	
	IRLR7821	-55°C/150°C	0	80	1000	0	
	IRLR7833	-55°C/150°C	0	80	1000	0	
	IRLR7833	-55°C/150°C	0	80	1000	0	
	IRLR7833	-55°C/150°C	0	80	1000	0	
	IRFR3711Z	-55°C/150°C	0	80	1000	0	
	IRLU2908	-55°C/150°C	0	80	1000	0	
	IRFU7N60C3	-55°C/150°C	0	80	1000	0	
	IRFU7N60C3	-55°C/150°C	0	80	1000	0	
	IRFU7N60C3	-55°C/150°C	0	80	1000	0	
	IRLR3105	-55°C/150°C	0	240	1000	0	
	IRFR120	-55°C/150°C	0	80	1000	0	
	IRFR3711	-55°C/150°C	0	80	1000	0	
	IRFR5505	-55°C/150°C	0	80	1000	0	
	IRFR9024N	-55°C/150°C	0	80	1000	0	
	IRLU7833	-55°C/150°C	0	80	1000	0	
	IRLU7833	-55°C/150°C	0	80	1000	0	
	IRLU7833	-55°C/150°C	0	80	1000	0	
		Total		4000		0	
Flip Chip	IRF6100	-40°C/125°C	0	60	1000	0	
	IRF6100	-40°C/125°C	0	60	1000	0	
	IRF6100	-55°C/150°C	0	60	1000	0	
	IRF6156	-40°C/125°C	0	55	1000	0	
	IRF6156	-40°C/125°C	0	55	1000	0	
	IRF6156	-40°C/125°C	0	55	1000	0	
		Total		345		0	
TO-220 Fullpak	IRFI740G	-55°C/150°C	0	80	1000	0	
	IRFIZ24N	-55°C/150°C	0	80	1000	0	
	IRLI2910	-55°C/150°C	0	80	1000	0	
	IRLI2910	-55°C/150°C	0	80	1000	0	
	IRFIB41N15D	-55°C/150°C	0	80	1000	0	
	IRFIB41N15D	-55°C/150°C	0	80	1000	0	
	IRFIZ48V	-55°C/150°C	0	80	1000	0	
	IRLI2203N	-55°C/150°C	0	80	1000	0	
	IRFIB22N60C3	-55°C/150°C	0	80	1000	0	
	IRFIB22N60C3	-55°C/150°C	0	80	1000	0	
	IRFIB22N60C3	-55°C/150°C	0	80	1000	0	
	IRLI3803	-55°C/150°C	0	80	1000	0	
	IRLI3803	-55°C/150°C	0	80	1000	0	
		Total		1040		0	

Power MOSFET (Continued)

Category	Part Number	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
HEXDIP	IRLD120	-55°C/150°C	0	80	1000	0	
	IRFD9123	-55°C/150°C	0	80	1000	0	
	IRFDC20	-55°C/150°C	0	80	1000	0	
	IRFD014	-55°C/150°C	0	80	1000	0	
		Total		320		0	
Micro 3	IRLML5103PBF	-55°C/150°C	0	60	1000	0	
	IRLML2803PBF	-55°C/150°C	0	60	1000	0	
	IRLML2402PBF	-55°C/150°C	0	65	1000	0	
	IRLML5103PBF	-55°C/150°C	0	80	1000	0	
	IRLML2803PBF	-55°C/150°C	0	79	1000	0	
	IRLML2402PBF	-55°C/150°C	0	80	1000	0	
	IRLML2502PBF	-55°C/150°C	0	60	1000	0	
	IRLML6401PBF	-55°C/150°C	0	60	1000	0	
	IRLML6401	-55°C/150°C	0	79	1000	0	
	IRLML6402	-55°C/150°C	0	76	1000	0	
	IRLML2803	-55°C/150°C	0	40	1000	0	
	IRLML5103	-55°C/150°C	0	40	1000	0	
	IRLML6302	-55°C/150°C	0	40	1000	0	
	IRLML2502	-55°C/150°C	0	40	1000	0	
	IRLML2502	-55°C/150°C	0	40	1000	0	
		Total		899		0	
Micro 6	IRLMS6802	-55°C/150°C	0	80	1000	0	
SO-14	IRF7335D1	-55°C/150°C	0	60	1000	0	
	IRF7335D1	-55°C/150°C	0	60	1000	0	
	IRF7335D1	-55°C/150°C	0	60	1000	0	
	IRF7335D1	-55°C/150°C	0	60	1000	0	
	IRF7335D1	-55°C/150°C	0	60	1000	0	
	IRF7335D1	-55°C/150°C	0	60	1000	0	
	IRF7335D1	-55°C/150°C	0	60	1000	0	
	IRF7339D1	-55°C/150°C	0	60	1000	0	
	IRF7339D1	-55°C/150°C	0	60	1000	0	
	IRF7339D1	-55°C/150°C	0	54	1000	0	
	IRF7339D1	-55°C/150°C	0	60	1000	0	
		Total		654		0	
SO-8	IRF7341QPBF	-55°C/150°C	0	40	1000	0	
	IRF7314PBF	-55°C/150°C	0	40	1000	0	
	IRF7341QPBF	-55°C/150°C	0	40	1000	0	
	IRF7314PBF	-55°C/150°C	0	40	1000	0	
	IRF7805	-55°C/150°C	0	40	1000	0	
	IRF7805	-55°C/150°C	0	40	1000	0	
	IRF7463	-55°C/150°C	0	80	1000	0	
	IRF7463	-55°C/150°C	0	80	1000	0	
	IRF7484PBF	-55°C/150°C	0	80	1000	0	
	IRF7484PBF	-55°C/150°C	0	80	1000	0	
	IRF7456PBF	-55°C/150°C	0	80	1000	0	
	IRF7456PBF	-55°C/150°C	0	80	1000	0	
	IRF7456PBF	-55°C/150°C	0	80	1000	0	
	IRF7484	-55°C/150°C	0	80	1000	0	
	IRF7484	-55°C/150°C	0	80	1000	0	
	IRF7484	-55°C/150°C	0	80	1000	0	
	IRF7811W	-55°C/150°C	0	20	3000	0	
	IRF7811W	-55°C/150°C	0	25	1000	0	
	IRF7822	-55°C/150°C	0	80	1000	0	
	IRF7822	-55°C/150°C	0	80	1000	0	
	IRF7493	-55°C/150°C	0	80	1000	0	
	IRF7495	-55°C/150°C	0	80	1000	0	
	IRF7832	-55°C/150°C	0	80	1000	0	
	IRF7832	-55°C/150°C	0	80	1000	0	
	IRF7832	-55°C/150°C	0	80	1000	0	
	IRF7831	-55°C/150°C	0	79	1000	0	
	IRF7831	-55°C/150°C	0	79	1000	0	
	IRF7842	-55°C/150°C	0	80	1000	0	
	IRF7842	-55°C/150°C	0	80	1000	0	
	IRF7842	-55°C/150°C	0	80	1000	0	
	IRF1902	-55°C/150°C	0	80	1000	0	
	IRF7103	-55°C/150°C	0	120	1000	0	
	IRF7204	-55°C/150°C	0	40	1000	0	

Power MOSFET (Continued)

Category	Part Number	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
SO-8	IRF7316	-55°C/150°C	0	30	1000	0	
	IRF7341	-55°C/150°C	0	80	1000	0	
	IRF7342	-55°C/150°C	0	40	1000	0	
	IRF7404	-55°C/150°C	0	40	1000	0	
	IRF7413	-55°C/150°C	0	200	1000	0	
	IRF7453	-55°C/150°C	0	80	1000	0	
	IRF7456	-55°C/150°C	0	80	1000	0	
	IRF7463	-55°C/150°C	0	70	1000	0	
	IRF7484	-55°C/150°C	0	30	1000	0	
	IRF7832	-55°C/150°C	0	80	1000	0	
	IRF7492	-55°C/150°C	0	80	1000	0	
	IRF7492	-55°C/150°C	0	80	1000	0	
	IRF7492	-55°C/150°C	0	80	1000	0	
	IRL7821	-55°C/150°C	0	80	1000	0	
		Total		3333		0	
SOT-223	IRFL014	-55°C/150°C	0	80	1000	0	
	IRFL014PBF	-55°C/150°C	0	80	1000	0	
	IRFL9014PBF	-55°C/150°C	0	80	1000	0	
	IRFL214PBF	-55°C/150°C	0	80	1000	0	
	IRLL3303PBF	-55°C/150°C	0	80	1000	0	
	IRLL3303PBF	-55°C/150°C	0	80	1000	0	
	IRLL3303PBF	-55°C/150°C	0	80	1000	0	
	IRLL3303PBF	-55°C/150°C	0	80	1000	0	
	IRLL2705	-55°C/150°C	0	80	1000	0	
	IRLL2705PBF	-55°C/150°C	0	80	1000	0	
	IRFL024Z	-55°C/150°C	0	80	1000	0	
	IRFL024Z	-55°C/150°C	0	80	1000	0	
	IRFL120Z	-55°C/150°C	0	80	1000	0	
	IRFL120Z	-55°C/150°C	0	80	1000	0	
	IRFL120Z	-55°C/150°C	0	80	1000	0	
	IRLL2705	-55°C/150°C'	0	40	1000	0	
		Total		1240		0	
SUPER TO-220	IRFBA22N50A	-55°C/150°C	0	80	1000	0	
SUPER TO-247	IRG4PSC71K	-55°C/150°C	0	80	1000	0	
	IRFPS3815	-55°C/150°C	0	80	1000	0	
	IRPS37N50A	-55°C/150°C	0	80	1000	0	
		Total		240		0	
TO-220	IRF740	-55°C/150°C	0	40	1000	0	
	IRF830	-55°C/150°C	0	40	1000	0	
	IRFZ44N	-55°C/150°C	0	40	1000	0	
	IRF6218	-55°C/150°C	0	80	1000	0	
	IRF6218L	-55°C/150°C	0	80	1000	0	
	IRF6218L	-55°C/150°C	0	80	1000	0	
	IRF6218L	-55°C/150°C	0	80	1000	0	
	IRF6218L	-55°C/150°C	0	80	1000	0	
	IRFC10N65KB	-55°C/150°C	0	80	1000	0	
	IRFC10N65KB	-55°C/150°C	0	80	1000	0	
	IRF540N	-55°C/150°C	0	40	1000	0	
	IRF3205	-55°C/150°C	0	80	1000	0	
	IRF3205	-55°C/150°C	0	80	1000	0	
	IRF1404PBF	-55°C/150°C	0	80	1000	0	
	IRF3710	-55°C/150°C	0	80	1000	0	
	IRF3710	-55°C/150°C	0	80	1000	0	
	IRF3711	-55°C/150°C	0	80	1000	0	
	IRF3711	-55°C/150°C	0	80	1000	0	
	IRF3711	-55°C/150°C	0	80	1000	0	
	IRFB22N60C3	-55°C/150°C	0	80	1000	0	
	IRFB22N60C3	-55°C/150°C	0	80	1000	0	
	IRFB22N60C3	-55°C/150°C	0	80	1000	0	
	IRF3710Z	-55°C/150°C	0	80	1000	0	
	IRF3710Z	-55°C/150°C	0	80	750	0	
	IRF3710Z	-55°C/150°C	0	80	750	0	
	IRF2804	-55°C/150°C	0	80	1000	0	
	IRF120Z	-55°C/150°C	0	80	1000	0	
	IRL3714Z	-55°C/150°C	0	80	1000	0	
	IRFB22N60C3	-55°C/150°C	0	160	1000	0	
	IRF1404	-55°C/150°C	0	80	1000	0	
	IRF1404	-55°C/150°C	0	80	1000	0	
		Total		2400		0	

Power MOSFET (Continued)

Category	Part Number	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
TO-247	IRFP064	-55°C/150°C	0	80	1000	0	
	IRFP250N	-55°C/150°C	0	40	1000	0	
	IRFP2907	-55°C/150°C	0	80	1000	0	
	IRFP2907	-55°C/150°C	0	80	1000	0	
	IRFP4004	-55°C/150°C	0	80	1000	0	
	IRFP4004	-55°C/150°C	0	100	1000	0	
	IRFP4004	-55°C/150°C	0	100	1000	0	
	IRFP4510	-55°C/150°C	0	80	1000	0	
	IRFP4510	-55°C/150°C	0	80	1000	0	
	IRFP460	-55°C/150°C	0	59	1000	0	
	IRFP460LC	-55°C/150°C	0	38	1000	0	
		Total		817		0	

IGBT

Category	Part Number	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak (TO-263) & TO-262	IRGS14C40L	-55°C/150°C	0	80	1000	0	
	IRGS14C40L	-55°C/150°C	0	80	1000	0	
	IRGS14C40L	-55°C/150°C	0	80	1000	0	
	IRGS14C40L	-55°C/150°C	0	80	1000	0	
	IRGSL5B120KD	-55°C/150°C	0	80	1000	0	
	IRGSL5B120K	-55°C/150°C	0	80	1000	0	
	IRGSL5B120K	-55°C/150°C	0	80	1000	0	
	IRGS30B60K	-55°C/150°C	0	80	1000	0	
	IRGS30B60K	-55°C/150°C	0	80	1000	0	
	IRGB4B60KD1	-55°C/150°C	0	80	1000	0	
		Total		800		0	
TO-220 FULLPAK	IRGIB10B60KD1	-55°C/150°C	0	80	1000	0	
	IRGIB10B60KD1	-55°C/150°C	0	80	1000	0	
	IRGIB10B60K	-55°C/150°C	0	80	1000	0	
	IRGIB10B60K	-55°C/150°C	0	80	1000	0	
	IRGIB10B60K	-55°C/150°C	0	80	1000	0	
		Total		400		0	
TO-220	IRG4BC20F	-55°C/150°C	0	80	1000	0	
	IRG4BC20F	-55°C/150°C	0	80	1000	0	
	IRG4PC50U	-55°C/150°C	0	20	1000	0	
	IRFB16N60K	-55°C/150°C	0	80	1000	0	
		Total		260		0	
SUPER TO-220	IRGBA55A60WS	-55°C/150°C	0	80	1000	0	
SUPER TO-247	IRFPS37N50A	-55°C/150°C	0	79	1000	0	
	IRG4PSC71K	-55°C/150°C	0	80	1000	0	
	IRFPS40N60K	-55°C/150°C	0	80	1000	0	
	IRG4PSH71KD	-55°C/150°C	0	80	1000	0	
	IRGPS40B120UD	-55°C/150°C	0	80	1000	0	
	IRG4PSC71UD	-55°C/150°C	0	80	1000	0	
	IRG4PSC71UD	-55°C/150°C	0	80	1000	0	
	IRG4PSC71UD	-55°C/150°C	0	80	1000	0	
		Total		639		0	
TO-247	IRG4PC50WD	-55°C/150°C	0	80	1000	0	
	IRG4PC50WD	-55°C/150°C	0	80	1000	0	
	IRGB15B60KD	-55°C/150°C	0	80	1000	0	
	IRGB15B60KD	-55°C/150°C	0	80	1000	0	
	IRGB15B60KD	-55°C/150°C	0	80	1000	0	
	IRGB14C40L	-55°C/150°C	0	80	1000	0	
	IRGB14C40L	-55°C/150°C	0	80	1000	0	
	IRGB14C40L	-55°C/150°C	0	80	1000	0	
	IRGB14C40L	-55°C/150°C	0	80	1000	0	
	IRG4PC40UDPBF	-55°C/150°C	0	80	1000	0	
	IRGB30B60K	-55°C/150°C	0	80	1000	0	
	IRGB15B60KD	-55°C/150°C	0	80	1000	0	
	IRGP50B60PD1	-55°C/150°C	0	80	1000	0	
	IRGPC50WD	-55°C/150°C	0	80	1000	0	
	IRGP50B60PD1	-55°C/150°C	0	80	1000	0	
	IRGP50B60PD1	-55°C/150°C	0	80	1000	0	
	IRGP50B60PD1	-55°C/150°C	0	80	1000	0	
	IRGP50B60PD1	-55°C/150°C	0	80	1000	0	
		Total		1440			
SUPER TO-247	IRGPS40B120UD	-55°C/150°C	0	80	1000	0	
	IRGPS40B120UD	-55°C/150°C	0	80	1050	0	
	IRGPS40B120UD	-55°C/150°C	0	80	1050	0	
	IRGPS40B120UD	-55°C/150°C	0	40	1000	0	
	IRGPS40B120UD	-55°C/150°C	0	40	1000	0	
	IRGPS40B120UD	-55°C/150°C	0	160	1000	0	
		Total		480		0	

4.1.2 Temperature and Humidity Bias (H3TRB)

Power MOSFET

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak (TO-263) & TO-262: N-channel	IRFBG20LPBF	85°C/85%RH	100	79	1000	0	
	IRFS11N50APBF	85°C/85%RH	100	80	1000	0	
	IRL3803S	85°C/85%RH	24	80	1000	0	
	IRF3415SPBF	85°C/85%RH	100	79	1000	0	
	IRFS38N20DPBF	85°C/85%RH	100	79	1000	0	
	IRFS38N20DPBF	85°C/85%RH	100	80	1000	0	
	IRFSL16N50K	85°C/85%RH	100	80	1000	0	
	IRF1404S	85°C/85%RH	40	80	1000	0	
	IRF1404S	85°C/85%RH	32	80	1000	0	
	IRF1402S	85°C/85%RH	16	80	1000	0	
	IRF1402S	85°C/85%RH	16	80	1000	0	
	IRF1404SPBF	85°C/85%RH	32	80	1000	0	
	IRF1404SPBF	85°C/85%RH	32	80	1000	0	
	IRF3808S	85°C/85%RH	60	80	1000	0	
	IRF3504S	85°C/85%RH	32	80	1000	0	
	IRF3808SPBF	85°C/85%RH	60	80	1000	0	
	IRFSL22N60C	85°C/85%RH	100	80	1000	0	
	IRFSL22N60C	85°C/85%RH	100	80	1000	0	
	IRFSL22N60C	85°C/85%RH	100	80	1000	0	
	IRF2804S	85°C/85%RH	32	80	1000	0	
	IRF2804S	85°C/85%RH	32	80	1000	0	
	IRF3710ZS	85°C/85%RH	32	80	1000	0	
	IRF3710ZS	85°C/85%RH	80	80	1000	0	
	IRF2804S	85°C/85%RH	32	80	1000	0	
	IRFS3710ZSPBF	85°C/85%RH	100	80	1000	0	
	IRF2804SPBF	85°C/85%RH	32	80	1000	0	
	IRL7833S	85°C/85%RH	30	80	1000	0	
	IRL7833S	85°C/85%RH	30	80	1000	0	
	IRL7833S	85°C/85%RH	30	80	1000	0	
	IRL7833S	85°C/85%RH	24	80	1000	0	
	IRL7833SPBF	85°C/85%RH	30	80	1000	0	
	IRLBD59N04E	85°C/85%RH	32	80	1000	0	
	IRLBD59N04E	85°C/85%RH	32	80	1000	0	
	IRLBD59N04E	85°C/85%RH	32	80	1000	0	
	IRF1404S	85°C/85%RH	32	240	1000	0	
	IRF2804S7P	85°C/85%RH	32	240	1000	0	
	IRF6215S	85°C/85%RH	100	160	1000	0	
	IRFS11N50A	85°C/85%RH	100	80	1000	0	
	IRF8010SJS	85°C/85%RH	80	80	1000	0	
		Total		3517		0	
D2Pak (TO-263) & TO-262: P-channel	IRF9540L	85°C/85%RH	80	160	1000	0	
	IRF9640S	85°C/85%RH	100	460	1000	0	
		Total		620		0	
FlipChip	IRF6100	85°C/85%RH	16	55	500	0	
	IRF6100	85°C/85%RH	16	55	500	0	
	IRF6100	85°C/85%RH	16	55	500	0	
	IRF6100	85°C/85%RH	16	55	500	0	
	IRF6156	85°C/85%RH	16	55	500	0	
	IRF6156	85°C/85%RH	16	55	500	0	
	IRF6156	85°C/85%RH	16	55	500	0	
		Total		385		0	
DirectFET							
	IRF6604	85°C/85%RH	24	10	1000	0	
	IRF6604	85°C/85%RH	24	66	1000	0	
	IRF6604	85°C/85%RH	24	158	1000	0	
	IRF6604	85°C/85%RH	24	234	1000	0	
	IRF6603	85°C/85%RH	24	164	1000	0	
	IRF6607	85°C/85%RH	24	10	1000	0	
	IRF6608	85°C/85%RH	24	270	1000	1	Silicon defect
	IRF6609	85°C/85%RH	16	65	1000	0	
	IRF6612	85°C/85%RH	24	79	1000	0	
	IRF6618	85°C/85%RH	24	330	1000	0	
	IRF6620	85°C/85%RH	16	50	1000	0	
		Total		1202			

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
DPak & IPak: N-channel	IRLR110	85°C/85%RH	80	80	1000	0	
	IRLR110	85°C/85%RH	80	80	1000	0	
	IRFRC20	85°C/85%RH	100	80	1000	0	
	IRFR1N60A	85°C/85%RH	100	80	1000	0	
	IRG4RC20F	85°C/85%RH	100	80	1000	0	
	IRFR1205	85°C/85%RH	44	79	1000	0	
	IRFR1205	85°C/85%RH	44	80	1000	0	
	IRFR1205	85°C/85%RH	44	80	1000	0	
	IRLR2705	85°C/85%RH	44	80	1000	0	
	IRLR014N	85°C/85%RH	44	80	1000	0	
	IRLR014N	85°C/85%RH	44	80	1000	0	
	IRLR3410	85°C/85%RH	80	80	1000	0	
	IRLR3715	85°C/85%RH	16	80	1000	0	
	IRLR3715Z	85°C/85%RH	16	80	1000	0	
	IRLR3714	85°C/85%RH	16	80	1000	0	
	IRLR3714	85°C/85%RH	16	80	1000	0	
	IRFR3711	85°C/85%RH	16	80	1000	0	
	IRFR3505	85°C/85%RH	44	80	1000	0	
	IRFR3505	85°C/85%RH	44	80	1000	0	
	IRFR3505	85°C/85%RH	44	80	1000	0	
	IRFR3412	85°C/85%RH	80	80	1000	0	
	IRLR2908	85°C/85%RH	80	40	1000	0	
	IRFR3710Z	85°C/85%RH	80	80	1000	0	
	IRFR4104	85°C/85%RH	32	80	1000	0	
	IRFR4104	85°C/85%RH	32	80	1000	0	
	IRFR3710Z	85°C/85%RH	80	80	1000	0	
	IRFR3710Z	85°C/85%RH	80	80	1000	0	
	IRFR120Z	85°C/85%RH	80	80	1000	0	
	IRFR4104	85°C/85%RH	32	80	1000	0	
	IRFR4104	85°C/85%RH	32	80	1000	0	
	IRFR3710Z	85°C/85%RH	80	80	1000	0	
	IRFR3710Z	85°C/85%RH	80	80	1000	0	
	IRLR7843	85°C/85%RH	24	80	1000	0	
	IRLR7843	85°C/85%RH	24	80	1000	0	
	IRLR7843	85°C/85%RH	24	80	1000	0	
	IRLR7843	85°C/85%RH	24	40	1000	0	
	IRLR7843	85°C/85%RH	24	40	1000	0	
	IRLR3714Z	85°C/85%RH	16	80	1000	0	
	IRLR7833	85°C/85%RH	24	80	1000	0	
	IRLR7833	85°C/85%RH	24	80	1024	0	
	IRLR7833	85°C/85%RH	24	80	1024	0	
	IRLR3715Z	85°C/85%RH	16	80	1000	0	
	IRLR7821	85°C/85%RH	24	80	1000	0	
	IRLR7821	85°C/85%RH	24	80	1000	0	
	IRLR7833	85°C/85%RH	24	80	1000	0	
	IRLR7833	85°C/85%RH	24	80	1000	0	
	IRLR7833	85°C/85%RH	24	80	1000	0	
	IRFR3711Z	85°C/85%RH	16	80	1000	0	
	IRLR3107	85°C/85%RH	44	240	1000	0	
	IRFR120	85°C/85%RH	80	75	1000	0	
	IRFR3711	85°C/85%RH	16	80	1000	0	
	IRLR7833	85°C/85%RH	24	80	1000	0	
	IRLU2908	85°C/85%RH	64	80	1000	0	
	IRFU7N60C3	85°C/85%RH	100	80	1000	0	
	IRFU7N60C3	85°C/85%RH	100	80	1000	0	
	IRFU7N60C3	85°C/85%RH	100	80	1000	0	
	IRLR7833	85°C/85%RH	24	80	1000	0	
	IRFR5505	85°C/85%RH	44	80	1000	0	
	IRLU7833	85°C/85%RH	24	80	2000	0	
		Total		4754		0	
DPak & IPak P-channel	IRFR9214	85°C/85%RH	100	80	1000	0	
	IRFR9310	85°C/85%RH	100	80	1000	0	
	IRFR9024N	85°C/85%RH	44	80	1000	0	
	IRFR6215	85°C/85%RH	100	80	1000	0	
		Total		320		0	
TO-220 Fullpak: P-channel	IRFI9630G	85°C/85%RH	100	80	1000	0	

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
TO-220 Fullpak: N-channel	IRFIB7N50A	85°C/85%RH	100	40	1000	0	
	IRFI740G	85°C/85%RH	100	78	1000	0	
	IRFIZ24N	85°C/85%RH	44	80	1000	0	
	IRLI2910	85°C/85%RH	80	80	1000	0	
	IRLI2910	85°C/85%RH	80	80	1000	0	
	IRFIB41N15D	85°C/85%RH	100	80	1000	0	
	IRFIB41N15D	85°C/85%RH	100	80	1000	0	
	IRFIZ48V	85°C/85%RH	48	80	1000	0	
	IRLI2203N	85°C/85%RH	30	79	1000	0	
	IRFIB22N60C3	85°C/85%RH	100	78	1000	0	
	IRFIB22N60C3	85°C/85%RH	100	78	1000	0	
	IRFIB22N60C3	85°C/85%RH	100	79	1000	0	
	IRLI3803	85°C/85%RH	24	160	1000	0	
		Total		1072		0	
HEXDIP: N-channel	IRLD120	85°C/85%RH	80	80	1000	0	
	IRFDC20	85°C/85%RH	80	80	1000	0	
	IRFD420	85°C/85%RH	100	80	1000	0	
	IRFD014	85°C/85%RH	48	80	1000	0	
		Total		320		0	
HEXDIP: P-channel	IRFD9220	85°C/85%RH	100	80	1000	0	
	IRFD9123	85°C/85%RH	80	80	1000	0	
		Total		160		0	
Micro 3: N-channel	IRLML2803PBF	85°C/85%RH	24	60	1024	0	
	IRLML2402PBF	85°C/85%RH	16	70	1000	0	
	IRLML2803PBF	85°C/85%RH	24	80	1000	0	
	IRLML2402PBF	85°C/85%RH	16	79	1000	0	
	IRLML2502PBF	85°C/85%RH	16	60	1000	0	
	IRLML2803	85°C/85%RH	30	40	1000	0	
	IRLML2502	85°C/85%RH	20	39	1000	0	
	IRLML2502	85°C/85%RH	20	40	1000	0	
		Total		468		0	
Micro 3: P-channel	IRLML6401PBF	85°C/85%RH	9.6	59	1000	0	
	IRLML6401	85°C/85%RH	9.6	78	1000	0	
	IRLML5103PBF	85°C/85%RH	24	60	1000	0	
	IRLML5103PBF	85°C/85%RH	24	79	1000	0	
	IRLML5103	85°C/85%RH	30	40	1000	0	
	IRLML6302	85°C/85%RH	20	40	1000	0	
		Total		356		0	
Micro 6	IRLMS6802	85°C/85%RH	20	40	1000	0	
Micro 8	IRF7530	85°C/85%RH	20	80	1000	0	
SO-8: N-channel	IRF7341QPBF	85°C/85%RH	44	40	432	0	
	IRF7341QPBF	85°C/85%RH	44	40	1000	0	
	IRF7805	85°C/85%RH	30	40	1000	0	
	IRF7805	85°C/85%RH	30	40	1000	0	
	IRF7484PBF	85°C/85%RH	32	80	408	0	
	IRF7484PBF	85°C/85%RH	32	80	1000	0	
	IRF7456PBF	85°C/85%RH	16	80	1000	0	
	IRF7484	85°C/85%RH	32	80	1000	0	
	IRF7484	85°C/85%RH	32	80	1000	0	
	IRF7484	85°C/85%RH	32	80	1000	0	
	IRF7484	85°C/85%RH	32	80	1000	0	
	IRF7484	85°C/85%RH	32	75	1000	0	
	IRF7463	85°C/85%RH	24	80	1000	0	

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
SO-8: N-channel	IRF7811W	85°C/85%RH	30	25	1000	0	
	IRF7811W	85°C/85%RH	30	20	3000	0	
	IRF7822	85°C/85%RH	24	77	1000	0	
	IRF7822	85°C/85%RH	24	77	1000	0	
	IRF7822	85°C/85%RH	24	80	1000	0	
	IRF7493	85°C/85%RH	64	80	1000	0	
	IRF7495	85°C/85%RH	80	80	1000	0	
	IRF7495	85°C/85%RH	80	80	1000	0	
	IRF7832	85°C/85%RH	24	40	1000	0	
	IRF7832	85°C/85%RH	24	40	1000	0	
	IRF7832	85°C/85%RH	24	40	1000	0	
	IRF7831	85°C/85%RH	30	79	1000	0	
	IRF7831	85°C/85%RH	30	79	1000	0	
	IRF7842	85°C/85%RH	32	80	1000	0	
	IRF7103	85°C/85%RH	50	80	1000	0	
	IRF7341	85°C/85%RH	44	80	1000	0	
	IRF7413	85°C/85%RH	24	240	1000	0	
	IRF7413	85°C/85%RH	30	40	1000	0	
	IRF7453	85°C/85%RH	100	80	1000	0	
	IRF7456	85°C/85%RH	16	120	1000	0	
	IRF7463	85°C/85%RH	30	38	1000	0	
	IRF7832	85°C/85%RH	24	80	1000	0	
	IRF7492	85°C/85%RH	100	80	1024	0	
	IRF7492	85°C/85%RH	100	80	1000	0	
	IRF7492	85°C/85%RH	100	80	1000	0	
		Total		2750		0	
SO-14: N-channel	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	59	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
	IRF7335D1	85°C/85%RH	24	60	1000	0	
		Total		1079		0	
SO-8: P-channel	IRF7314PBF	85°C/85%RH	16	40	408	0	
	IRF7314PBF	85°C/85%RH	16	40	1000	0	
	IRF7328	85°C/85%RH	24	239	1000	0	
	IRF7204	85°C/85%RH	20	40	1000	0	
	IRF7316	85°C/85%RH	30	40	1000	0	
	IRF7342	85°C/85%RH	55	40	1000	0	
	IRF7404	85°C/85%RH	20	40	1000	0	
		Total		479		0	
SOT-223 N-channel	IRFL014	85°C/85%RH	48	80	1000	0	
	IRFL014PBF	85°C/85%RH	48	80	1000	0	
	IRFL214PBF	85°C/85%RH	100	80	1000	0	
	IRLL3303PBF	85°C/85%RH	24	80	1000	0	
	IRLL3303PBF	85°C/85%RH	24	80	1000	0	
	IRLL3303PBF	85°C/85%RH	24	80	1000	0	
	IRLL3303PBF	85°C/85%RH	24	80	1000	0	
	IRLL2705	85°C/85%RH	44	80	1000	0	
	IRLL2705PBF	85°C/85%RH	44	80	1000	0	
	IRFL024Z	85°C/85%RH	44	80	1000	0	
	IRFL120Z	85°C/85%RH	80	80	1000	0	
	IRFL120Z	85°C/85%RH	80	80	1000	0	
	IRLL2703	85°C/85%RH	30	40	1000	0	
		Total		1000			

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
SOT-223 P-channel	IRFL9014PBF	85°C/85%RH	48	80	1000	0	
SUPER TO-220	IRFBA22N50A	85°C/85%RH	100	80	1000	0	
	IRFBA22N50A	85°C/85%RH	100	80	1000	0	
		Total		160		0	
SUPER TO-247	IRFPS37N50A	85°C/85%RH	100	80	1000	0	
TO-220: N-channel	IRF740A	85°C/85%RH	100	40	1000	0	
	IRF830	85°C/85%RH	100	40	1000	0	
	IRF840A	85°C/85%RH	100	80	1000	0	
	IRFC8N65AB	85°C/85%RH	100	80	1000	0	
	IRFB11N50A	85°C/85%RH	100	40	1000	1	Particle contamination
	IRG4BC30KD	85°C/85%RH	100	78	1000	0	
	IRFZ44N	85°C/85%RH	55	78	1000	0	
	IRL1404	85°C/85%RH	32	80	1000	0	
	IRL1404	85°C/85%RH	32	80	1000	0	
	IRF3205	85°C/85%RH	44	80	1000	0	
	IRF3710	85°C/85%RH	80	80	1000	0	
	IRF3710	85°C/85%RH	80	80	1000	0	
	IRF3710	85°C/85%RH	80	80	1000	0	
	IRF3711	85°C/85%RH	16	80	1000	0	
	IRF3711	85°C/85%RH	16	80	1000	0	
	IRF3711	85°C/85%RH	16	80	1000	0	
	IRFB22N60C3	85°C/85%RH	100	79	1000	0	
	IRFB22N60C3	85°C/85%RH	100	79	1000	0	
	IRFB22N60C3	85°C/85%RH	100	79	1000	0	
	IRF2804	85°C/85%RH	32	80	620	0	
	IRF120Z	85°C/85%RH	80	77	1000	0	
	IRL3714Z	85°C/85%RH	16	77	1000	0	
	IRFC10N65KB	85°C/85%RH	100	80	1000	0	
	IRFC10N65KB	85°C/85%RH	100	80	1000	0	
	IRFC10N65KB	85°C/85%RH	100	80	1000	0	
	IRFB22N60C3	85°C/85%RH	100	158	1000	0	
	IRF530N	85°C/85%RH	80	317	1000	0	
	IRFC10N65KB	85°C/85%RH	100	160	1000	0	
	IRF1404	85°C/85%RH	32	80	1000	0	
	IRF1404	85°C/85%RH	32	80	1000	0	
		Total		2662		1	
TO-220: P-channel	IRF6215	85°C/85%RH	100	80	1000	0	
	IRF6218	85°C/85%RH	100	80	1000	0	
	IRF6218L	85°C/85%RH	0	80	1000	0	
	IRF6218L	85°C/85%RH	100	80	168	0	
	IRF6218L	85°C/85%RH	0	80	1000	0	
	IRF6218L	85°C/85%RH	0	80	1000	0	
	IRF4905	85°C/85%RH	44	160	1000	0	
		Total		640		0	
TO-247: N-channel	IRFP460A	85°C/85%RH	100	80	1000	0	
	IRFP4004	85°C/85%RH	32	80	1000	0	
	IRFP064	85°C/85%RH	48	80	1000	0	
	IRFP15N60L	85°C/85%RH	100	80	1000	0	
	IRFP2907	85°C/85%RH	60	80	1000	0	
	IRFP2907	85°C/85%RH	60	80	1000	0	
	IRFP4004	85°C/85%RH	32	80	1000	0	
	IRFP4004	85°C/85%RH	32	80	1000	0	
	IRFP4510	85°C/85%RH	80	80	1000	0	
	IRFP4510	85°C/85%RH	80	80	1000	0	
		Total		800		0	

IGBT

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak (TO-263) & TO-262	IRGSL5B120KD	85°C/85%RH	100	80	1000	0	
	IRGS30B60K	85°C/85%RH	100	80	1000	0	
	IRGS30B60K	85°C/85%RH	100	80	1000	0	
	IRGS14C40L	85°C/85%RH	100	80	1000	0	
	IRGS14C40L	85°C/85%RH	100	80	1000	0	
	IRGS14C40L	85°C/85%RH	100	80	1000	0	
	IRGS14C40L	85°C/85%RH	100	80	1000	0	
	IRGB4B60KD1	85°C/85%RH	100	79	1000	0	
		Total		639		0	
SUPER TO-220	IRGBA55A60WS	85°C/85%RH	100	80	1000	0	
SUPER TO-247	IRG4PSC71K	85°C/85%RH	100	80	1000	0	
	IRFPS40N60K	85°C/85%RH	24	80	1000	0	
	IRGPS40B120UD	85°C/85%RH	100	80	1000	0	
	IRGPS40B120UD	85°C/85%RH	100	80	1000	0	
	IRGPS40B120UD	85°C/85%RH	100	80	1000	0	
	IRGPS40B120UD	85°C/85%RH	100	40	1000	0	
	IRGPS40B120UD	85°C/85%RH	100	40	1000	0	
	IRFPS37N50A	85°C/85%RH	100	80	1000	0	
	IRGPS40B120UD	85°C/85%RH	100	80	1000	0	
	IRGPS40B120U	85°C/85%RH	100	80	1000	0	
	IRGPS40B120U	85°C/85%RH	100	80	1000	0	
	IRG4PSC71K	85°C/85%RH	100	80	1000	0	
		Total		880		0	
TO-220	IRGB15B60KD	85°C/85%RH	100	80	1000	0	
	IRGB15B60KD	85°C/85%RH	100	80	1000	0	
	IRGB14C40L	85°C/85%RH	100	80	1000	0	
	IRGB14C40L	85°C/85%RH	100	80	1000	0	
	IRGB14C40L	85°C/85%RH	100	80	1000	0	
	IRGB14C40L	85°C/85%RH	100	80	1000	0	
	IRGB30B60K	85°C/85%RH	100	80	1000	0	
	IRGB15B60KD	85°C/85%RH	100	80	1000	0	
	IRG4BC30KD	85°C/85%RH	100	157	1000	0	
	IRFB16N60K	85°C/85%RH	100	80	1000	0	
	IRG4BC20F	85°C/85%RH	100	80	1000	0	
	IRG4BC20F	85°C/85%RH	100	80	1000	0	
		Total		1037		0	
TO-247	IRG4PC50WD	85°C/85%RH	100	80	1000	0	
	IRG4PC50WD	85°C/85%RH	100	80	1000	0	
	IRG4PC40UD	85°C/85%RH	100	80	1000	0	
	IRGP50B60PD1	85°C/85%RH	100	80	1000	0	
	IRGP50B60PD1	85°C/85%RH	100	80	1000	0	
	IRGP50B60PD1	85°C/85%RH	100	80	1000	0	
	IRGP50B60PD1	85°C/85%RH	100	80	1000	0	
		Total		560		0	
DPak	IRGR3B60KD2	85°C/85%RH	100	80	1000	0	
	IRGR3B60KD2	85°C/85%RH	100	80	1000	0	
	IRGR3B60KD2	85°C/85%RH	100	80	1000	0	
		Total		240		0	
TO-220 Fullpak	IRGIB10B60KD1	85°C/85%RH	100	80	1000	0	
	IRGIB10B60K	85°C/85%RH	100	80	1000	1	Parametric shift due to ionic contamination
	IRGIB10B60K	85°C/85%RH	100	80	1000	0	
	IRGIB10B60K	85°C/85%RH	100	80	1000	0	
		Total		560		1	

4.1.3 High Temperature Reverse Bias (HTRB)

Power MOSFET

Category	Part Number	Environmental Conditions (°C)	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
Flip Chip N-channel	IRF6156	150	16	165	1000	0		1.76E+07	52
Flip Chip P-channel	IRF6100	150	16	165	1000	0		1.76E+07	52
DirectFET Gen 7	IRF6601	150	16	158	1000	0		1.68E+07	54
DirectFET Gen 10	IRF6603	150	24	165	1000	0			
	IRF6604	150	24	88	1000	0			
	IRF6608	150	24	268	1000	0			
	IRF6609	150	16	70	1000	0			
			Total	591		0		6.30E+07	15
DirectFET Gen 10.5	IRF6612	150	24	80	1000	0			
	IRF6617	150	24	77	1000	0			
	IRF6618	150	24	431	1000	0			
	IRF6620	150	16	50	1000	0			
	IRF6691D	150	16	300	1000	0			
			Total	938		0		1.00E+08	9
D2Pak Gen 3 P-channel	IRF9640S/L	150	160	400	1000	0		1.18E+08	8
D2Pak Gen 3 N-channel									
	IRFS11N50APBF	150	400	79	1000	0			
	IRFBF20S	150	720	80	1000	0			
			Total	159		0		1.69E+07	54
D2Pak Gen 5 N-channel	IRF3415LPBF	175	120	79	1000	0			
	IRFS31N20DPBF	175	160	80	1000	0			
	IRLBD59N04E	175	32	238	1000	0			
			Total	635		0		3.27E+08	3
D2Pak Gen 5 P-channel	IRF6215S	175	120	160	1000	0		8.25E+07	11
D2Pak Gen 7	IRF1404LPBF	175	32	80	1000	0			
	IRF3808LPBF	175	60	80	1000	0			
	IRF1404S	175	32	320	1000	0			
	IRF8010SJS	175	80	79	1000	0			
			Total	559		0		2.88E+08	3
D2Pak Gen 8	IRFS4710	175	80	80	1000	0		4.13E+07	22
D2Pak Gen 9	IRFSL22N60C	150	480	240	1000	0		2.56E+07	36
D2Pak Gen 10.2	IRF2804S/L	175	32	556	1000	0			
	IRF1404ZL	175	32	158	1000	1	Ionic contamination		
	IRF1405ZL	175	44	160	1000	0			
	IRF3710ZS/L	175	80	160	1000	0			
			Total	1034		1		5.40E+08	2
D2Pak Gen 10.5	IRL7833S/L	175	24	479	1000	0		2.47E+08	4
DPak Gen 3 P-channel	IRFR9214	150	200	80	1000	0			
	IRFR9024N	175	48	80	1000	0			
	IRFU9220	175	160	160	1000	0			
			Total	480		0		2.15E+08	4
DPak Gen 3 N-channel									
	IRFRC20	175	480	80	1000	0			
	IRFR120	175	80	80	1000	0			
			Total	160		0		8.25E+07	11

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions (°C)	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
DPak Gen 5 N-channel									
	IRLR3410	175	80	80	1000	0			
	IRLR8503	175	24	80	1000	0			
			Total	160		0		8.25E+07	11
DPak Gen 5 P-channel	IRFR5505	175	44	80	1000	0		4.13E+07	22
DPak Gen 7	IRFR3711	175	16	160	1000	0			
	IRLU2908	175	64	80	1000	0			
			Total	240		0		1.24E+08	7
DPak Gen 8	IRFR3412	175	80	80	1000	0		4.13E+07	22
DPak & IPak Gen 9	IRFU7N60C3	150	480	240		0		2.56E+07	36
DPak Gen 10.2	IRLR2908	175	80	40	1000	0		2.17E+07	42
	IRFR3710Z	175	80	360	1000	0			
	IRFR4104	175	32	80	1000	0			
	IRFU120Z	175	80	80	1000	0			
			Total	560		0		2.91E+08	3
DPak Gen 10.5	IRLR/U7833	175	24	400	1000	0		2.06E+08	4
	IRLU7821	175	24	80	1000	0		4.13E+07	22
			Total	480		0		2.48E+08	4
TO-220 Fullpak Gen 3	IRFI740G	150	320	80	1000	0		8.53E+06	107
	IRFI9630G	150	160	80	1000	0		8.53E+06	107
			Total	160		0		1.71E+07	54
TO-220 Fullpak Gen 5	IRLI2910	175	80	157	1000	0			
	IRFIB41N15D	175	120	159	1000	0			
			Total	316		0		1.63E+08	6
TO-220 Fullpak Gen 7	IRFIZ48V	175	48	80	1000	0			
	IRLI2203N	175	24	80	1000	0			
			Total	160		0		8.25E+07	11
TO-220 Fullpak Gen 9	IRFIB22N60C3	150	480	239	1000	0		2.55E+07	36
HEXDIP	IRLD120	175	80	80	1000	0			
	IRFD9123	175	80	80	1000	0			
	IRFD310	150	320	80	1168	0			
	IRFDC20	150	480	85	1000	0			
	IRFD9220	150	160	80	1000	0			
	IRFD420	150	400	80	1000	0			
	IRFD014	175	48	80	1000	0			
			Total	565		0		1.60E+08	6
Micro 3 Gen 5 N-channel	IRLML2402	150	16	144	1000	0			
	IRLML2803PBF	150	24	140	1000	0			
	IRLML2803	150	30	40	1000	0			
			Total	424		0		3.03E+07	30
Micro 3 Gen 5 P-channel	IRLML6302	150	20	37	1000	0		4.00E+06	229
	IRLML5103PBF	150	24	138	1000	0			
	IRLML5103	150	30	40	1000	0			
			Total	215		0		2.31E+07	40

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions (°C)	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
Micro 6	IRLMS6802	150	20	40	1000	0		4.32E+06	212
Micro 3 Gen 8	IRLML2502PBF	150	16	60	1024	0			
	IRLML2502	150	20	80	1000	0			
	IRLML6401PBF	150	9.6	60	1000	0			
			Total	200		0		1.73E+07	53
SO-8 Gen 5 N-channel	IRF7805	150	30	80	1000	0			
	IRF7103	150	50	80	1000	0			
	IRF7341	150	44	40	1000	0			
	IRF7453	150	200	80	1000	0			
			Total	280		0		3.03E+07	30
SO-8 Gen 5 P-channel	IRF7204	150	20	40	1000	0			
	IRF7316	150	30	40	1000	0			
	IRF7342	150	55	40	1000	0			
	IRF7404	150	20	40	1000	0			
	IRF7413	150	30	40	1000	0			
			Total	200		0		2.18E+07	42
SO-8 Gen 7	IRF7463	150	24	200	1000	0			
	IRF7456PBF	150	16	160	1000	0			
	IRF7456	150	16	80	1000	0			
	IRF7484	150	32	280	1000	0			
			Total	800		0		7.69E+07	12
SO-8 Gen 8	IRF7328	150	24	80	1000	0		8.53E+06	107
SO-8 Gen 10	IRF7811W	150	30	45	1000	0			
	IRF7492	150	160	240	1000	0			
	IRF7822	150	24	560	1000	0			
			Total	845		0		9.02E+07	10
SO-8 Gen 10.2	IRF7493	150	80	80	1000	0		8.98E+06	102
	IRF7495	150	80	160	1000	0		1.71E+07	54
			Total	240		0		2.60E+07	35
SO-8 Gen 10.5	IRF7832	150	24	200	1000	0			
	IRF7831	150	24	157	1000	0			
	IRF7842	150	32	240	1000	0			
	IRL7821	150	24	80	1000	0			
			Total	677		0		7.22E+07	13
SOT-223 Gen 3	IRFL214PBF	150	200	80	1000	0			
	IRLL3303PBF	150	24	320	1000	0			
			Total	400		0		4.26E+07	21
SOT-223 Gen 5	IRLL2703	150	30	25	1000	0		2.72E+06	337
SOT-223 Gen 10.2	IRFL024Z	150	44	80	1000	0		8.53E+06	107
	IRFL120Z	150	80	160	1000	0		1.71E+07	54
			Total	240		0		2.56E+07	36
Super TO-220	IRFBA22N50A	150	400	160	1000	0		1.71E+07	54
Super TO-247	IRFPS3815	175	120	80	1000	0			
	IRFPS37N50A	150	400	79	1000	0			
			Total	159		0		4.97E+07	18

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions (°C)	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
TO-220 Gen 3	IRF740	150	320	40	1000	0			
	IRF830	150	400	40	1000	0			
	IRF840A	150	400	80	1000	0			
			Total	160		0		1.71E+07	54
TO-220 Gen 5 N-channel	IRFZ44N	175	44	40	1000	0			
	IRF530N	175	80	160	1000	0			
			Total	200		0		1.27E+08	7
TO-220 Gen 5 P-channel	IRF6215	175	120	160	1000	0		1.02E+08	9
	IRF4905	175	44	160	1000	0		9.50E+07	10
	IRF6218	175	120	240	1000	0		1.28E+08	7
			Total	560		0		3.25E+08	3
TO-220 Gen 6	IRFC10N65KB	150	520	159	1000	0		1.69E+07	54
TO-220 Gen 7	IRF540N	175	80	40	1000	0			
	IRF3205	175	44	160	1000	0			
	IRF3903	175	24	160	1000	0			
	IRF3710	175	80	320	1000	0			
	IRF3711	150	16	240	1000	0			
	IRL1404	175	32	240	1000	0			
			Total	1200		0		5.21E+08	2
TO-220 Gen 8	IRF5803	150	32	320	1000	0		3.41E+07	27
TO-220 Gen 9	IRFB22N60C3	150	480	720	1000	0		1.02E+08	9
TO-220 Gen 10.2	IRL1404Z	175	32	400	1000	0			
	IRF1404Z	175	32	160	1000	0			
	IRF120Z	175	80	80	1000	0			
	IRF2804	175	32	240	1000	0			
	IRFC2804B	175	32	160	1000	0			
			Total	1040		0		5.38E+08	2
TO-247 Gen 3	IRFP460A	150	400	80	1000	0			
	IRFP460	150	400	80	1000	0			
	IRFP064	175	48	80	1000	0			
	IRFPC60	150	480	80	1000	0			
			Total	320		0		6.68E+07	14
TO-247 Gen 6	IRFP15N60L	150	480	80	1000	0		8.53E+06	107
TO-247 Gen 8	IRFB4710	150	80	318	1000	0		3.39E+07	27
TO-247 Gen 10.2	IRFP4004	175	32	320	1000	0			
	IRFP4510	175	80	80	1000	0			
	IRFP4510	175	80	80	1000	0			
	IRFP4510	175	80	160	1000	0			
			Total	480		0		2.48E+08	4

IGBT

Category	Part Number	Environmental Conditions (°C)	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
D2Pak	IRGS30B60K	175	480	240	1000	0		5.83E+07	16
DPak	IRGR3B60KD2	150	480	156	1000	0			
	IRG4RC20F	150	480	79	1000	0			
			Total	235		0		2.51E+07	37
TO-220 Fullpak	IRGIB10B60KD1	150	480	80	1000	0			
	IRGIB10B60K	175	480	231	1000	0			
	IRGIB10B60KD	175	480	77	1000	0			
			Total	468				1.76E+08	5
Super TO-247	IRFPS37N50A	150	400	80	1000	0			
	IRGPS40B120U	150	960	80	1000	0			
			Total	160		0		1.71E+07	54
TO-220	IRG4BC30KD	150	480	76	1000	0		3.79E+07	24
TO-247	IRGP50B60PD1	150	480	320	1000	0		3.41E+07	27

4.1.4 High Temperature Gate Bias (HTGB)

Power MOSFET

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
Flip Chip N-channel	IRF6156	150	9.6	110	1000	0		3.54E+07	26
Flip Chip P-channel	IRF6100	150	9.6	170	1000	0		5.46E+07	17
D2Pak Gen 5 N-channel	IRLBD59N04E	175	16	399	1000	0			
	IRFS38N20DPBF	175	24	80	1000	0			
	IRFS31N20DPBF	175	24	80	1000	0			
	IRF3415LPBF	175	16	80	1000	0			
			Total	639				9.08E+08	1
D2Pak Gen 7	IRF1402S	175	20	80	1000				
	IRF1404LPBF	175	20	159	1000				
			Total	239		0		2.61E+09	1
D2Pak Gen 8	IRFL4710PBF	175	16	80	1000	0		1.04E+07	88
D2Pak Gen 9	IRFSL22N60C	150	20	240	1000	0		2.93E+07	31
D2Pak Gen 10.2	IRF3710ZS	175	20	239	1000	0		2.74E+08	3
	IRFC2804S	175	16	160	1000	0			
	IRF2804LPBF	175	20	80	1000	0			
	IRF2804S	175	16	400	1000	0			
			Total			0		4.77E+08	2
D2Pak Gen 10.5	IRL7833LPBF	175	16	80	1000	0		5.84E+06	157
DirectFET Gen 7	IRF6601	150	16	117	1000	0		3.76E+07	24
DirectFET Gen 10	IRF6604	150	9.6	129	1000	0			
	IRF6603	150	16	180	1000	0			
	IRF6607	150	9.6	10	1000	0			
	IRF6608	150	9.6	180	1000	0			
	IRF6609	150	16	68	1000	0			
			Total	567		0		8.76E+08	1
DirectFET Gen 10.5	IRF6612	150	16	77	1000	0			
	IRF6617	150	16	233	1000	0			
	IRF6618	150	16	1226	1000	10	Igss leakage		
			Total	1536		10		4.94E+08	23
DPak Gen 3	IRFRC20	150	20	80	1000	0			
	IRFR120	175	20	80	1000	0			
	IRFR9024N	175	20	80	1000	0			
	IRFU9220	175	20	160	1000	0			
			Total	400		0		1.02E+08	9
DPak Gen 5	IRLR8503	175	16	80	1000	0			
	IRFR5505	175	20	80	1000	0			
			Total	160		0		6.12E+08	1
DPak Gen 7	IRFR3711	175	20	79	1000	0			
	IRLR3105	175	16	240	1000	0			
			Total	319		0		1.35E+09	1

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
DPak Gen 10.2	IRLR2908	175	16	39	1000	0			
	IRFR3710Z	175	20	320	1000	0			
	IRFR4104	175	20	80	1000	0			
			Total	439		0		1.59E+08	6
DPak Gen 10.5	IRLR7843	175	16	240	1000	0			
	IRLR7833	175	16	239	1000	0			
	IRLU7821	175	20	80	1000	0			
			Total	559		0		8.56E+08	1
DPak/IPak Gen 9	IRFU7N60C3	150	20	240	1000	0		2.93E+07	31
Fullpak Gen 5	IRLI2910	175	16	160	1000	0			
	IRFIB41N15D	175	20	80	1000	0			
			Total	240		0		3.74E+08	2
Fullpak Gen 7	IRLI2203N	175	16	80	1000	0		4.89E+07	19
Fullpak Gen 9	IRFIB22N60C3	150	20	240	1000	0		2.93E+07	31
Hexdip	IRLD120	175	10	80	1000	0			
	IRFD9123	175	20	80	1000	0			
	IRFDC20	150	20	79	1000	0			
			Total	239		0		3.54E+07	26
Micro 3 Gen 5 N-channel	IRLML2803	150	16	179	1000	0			
	IRLML2402	150	9.6	145	1000	0			
			Total	324		0		2.61E+08	4
Micro 3 Gen 5 P-channel	IRLML5103	150	16	177	1000	0			
	IRLML6302	150	9.6	38	1000	0			
			Total	215		0		2.26E+08	4
Micro 3 Gen 8	IRLML6401PBF	150	6.4	60	1024	0			
	IRLML2502	150	12	140	1000	0			
			Total	200		0		3.33E+08	3
SO-8 Gen 5 N-channel	IRF7805	150	12	240	1000	0			
	IRF7103	150	20	80	1000	0			
	IRF7453	150	24	80	1000	0			
			Total	400				9.85E+07	9
SO-8 Gen 5 P-channel	IRF7204	150	12	40	1000	0			
	IRF7316	150	20	40	1000	0			
	IRF7342	150	20	40	1000	0			
	IRF7404	150	12	40	1000	0			
	IRF7413	150	20	40	1000	0			
			Total	200		0		6.43E+07	14
SO-8 Gen 7	IRF7463	150	12	280	1000	0			
	IRF7456	150	9.6	160	1000	0			
	IRF7484	150	8	280	1000	0			
			Total	720		0		1.69E+09	1
SO-8 Gen 10	IRF7811W	150	12	45	1000	0			
	IRF7822	150	9.6	400	1000	0			
	IRF7492	150	16	240	1000	0			
			Total	685		0		1.22E+08	8

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
SO-8 Gen 10.2	IRF7493	150	16	80	1000	0			
	IRF7495	150	16	160	1000	0			
			Total	400		0		2.20E+07	42
SO-8 Gen 10.5	IRF7831	150	12	238	1000	0			
	IRF7832	150	16	240	1000	0			
			Total	558		0		2.03E+08	5
SOT-223 Gen 3	IRFL214PBF	150	20	80	1000	0			
	IRLL3303	150	16	320	1000	0			
			Total	400		0		5.72E+07	16
SOT-223 Gen 5	IRLL2703	150	16	40	1000	0		5.93E+06	154
SOT-223 Gen 10.2	IRFL024Z	150	20	80	1000	0			
	IRFL120Z	150	20	160	1000	0			
			Total	240				6.12E+07	15
TO-220 Gen 3	IRF740	150	20	40	1000	0			
	IRF830	150	20	40	1000	0			
	IRF9540L	175	20	160	1000	0			
			Total	240		0		4.70E+07	19
TO-220 Gen 5	IRFZ44N	175	20	40	1000	0		2.45E+07	37
	IRF6215	175	20	160	1000	0		9.79E+07	9
	IRF6218	175	20	560	1000	0		2.45E+08	4
	IRF4905	175	20	160	1000	0		9.79E+07	9
			Total	920		0		4.65E+08	2
TO-220 Gen 6	IRFC10N65KB	150	20	160	1000	0		1.96E+07	47
TO-220 Gen 7	IRF540N	175	20	40	1000	0			
	IRL1404	175	16	239	1000	0			
	IRF3903	175	20	239	1000	0			
	IRF3710	175	20	320	1000	0			
	IRF3711	150	20	240	1000	0			
	IRF530N	175	16	240	1000	0			
			Total	998		0		1.53E+09	1
TO-220 Gen 9	IRFC22N60C3	150	20	160	1000	0		1.96E+07	47
TO-220 Gen 10.2	IRF2804	175	20	240	1000	0			
	IRFC2804B	175	20	160	1000	0			
	IRF3710Z	175	20	560	1000	0			
	IRL1404Z	175	16	560	1000	0			
			Total	1520		0		2.63E+09	1
TO-220 Gen 9	IRFB22N60C3	150	20	240	1000	0		2.93E+07	31
TO-247 Gen 3	IRFP460	175	30	80	1000	0		7.94E+07	12
TO-247 Gen 8	IRFB4710	150	20	480	1000	0		4.08E+07	22
TO-247 Gen 10.2	IRFP4510	175	20	240	1000	0			
	IRFP4004	175	20	320	1000	0			
			Total	560		0		3.03E+08	3

IGBT

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
D2Pak	IRGS14C40L	150	20	240	1000	0			
	IRGS30B60K	150	20	240	1000	0			
	IRGS4B60KD1	150	20	160	1000	0			
			Total	640		0		2.31E+08	4
TO-220	IRGB30B60K	175	20	80	1000	0			
	IRGB14C40L	150	20	320	1000	0			
	IRG4BC30KD	150	16	80	1000	0			
	IRFB16N60K	150	30	80	1000	0			
			Total	560				2.28E+08	4
DPak	IRGR3B60KD2	150	20	240	1000	0		2.93E+07	31
TO-220 Fullpak	IRGIB10B60KD1	150	20	80	1000	0		9.78E+06	94
	IRGIB10B60KD	175	20	77	1000	0		1.58E+07	58
	IRGIB15B60KD	175	20	77	1000	0		1.58E+07	58
	IRGIB6B60KD	175	20	77	1000	0		1.58E+07	58
			Total	311		0		5.72E+07	16
Super TO-220	IRGBA55A60WS	150	20	80	1000	0		7.32E+06	125
TO-247	IRGP50B60PD1	150	20	320	1000	0		3.65E+07	25
	IRG4PC50WD	150	16	160	1000	0		6.13E+06	149
			Total	480		0		4.27E+07	21
Super TO-247	IRG4PSC71K	150	20	80	1000	0		9.78E+06	94
	IRFPS40N60K	150	24	80	1000	0		3.07E+06	299
	IRG4PSH71KD	150	20	80	1000	0		9.78E+06	94
	IRFPS37N50A	150	20	80	1000	0		1.41E+06	648
	IRGPS40B120UD	150	20	80	1000	0		2.57E+07	36
	IRGPS40B120U	150	20	159	1000	0		1.94E+07	47
	IRG4PSC71K	150	20	80	1000	0		9.78E+06	94
			Total	639		0		7.90E+07	12

4.1.5 Power Cycle (IOL)

Power MOSFET

Category	Part Number	Temperature Excursion	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak(TO-263) & TO-262	IRFS11N50APBF	Delta T = 100°C	80	8572	0	
	IRF3415LPBF	Delta T = 100°C	80	8572	0	
	IRFSL16N50K	Delta T = 100°C	80	8572	0	
	IRFSL16N50K	Delta T = 100°C	80	8572	0	
	IRFSL16N50K	Delta T = 100°C	80	8572	0	
	IRFSL16N50K	Delta T = 100°C	80	8572	0	
	IRF1404SPBF	Delta T = 100°C	77	8572	0	
	IRFSL22N60C	Delta T = 100°C	27	8572	0	
	IRFSL22N60C	Delta T = 100°C	27	8572	0	
	IRFSL22N60C	Delta T = 100°C	26	8572	0	
	IRF2804S	Delta T = 100°C	35	1000	0	
	IRF2804S	Delta T = 100°C	35	1000	0	
	IRF2804S	Delta T = 100°C	35	1000	0	
	IRF2804S	Delta T = 100°C	35	1000	0	
	IRF2804L	Delta T = 100°C	80	8572	0	
	IRF1404ZL	Delta T = 100°C	80	8572	0	
	IRF1405ZL	Delta T = 100°C	80	8572	0	
	IRF2804SPBF	Delta T = 100°C	80	8572	0	
	IRL7833S	Delta T = 100°C	40	8572	0	
	IRL7833S	Delta T = 100°C	80	8572	0	
	IRLBD59N04E	Delta T = 100°C	30	8572	0	
	IRLBD59N04E	Delta T = 100°C	30	8572	0	
	IRLBD59N04E	Delta T = 100°C	30	8572	0	
	IRF2804S7P	Delta T=100°C	240	8572	0	
	IRFS11N50A	Delta T=100°C	80	8572	0	
		Total	1627		0	
DPak & I-Pak	IRLR110	Delta T = 100°C	80	15000	0	
	IRFR1N60A	Delta T = 100°C	80	15000	0	
	IRLR2705	Delta T = 100°C	80	15000	0	
	IRFR3711	Delta T = 100°C	80	15000	0	
	IRLR3715	Delta T = 100°C	80	15000	0	
	IRFR3710Z	Delta T = 100°C	80	15000	0	
	IRFR120Z	Delta T = 100°C	80	15000	0	
	IRLR7843	Delta T = 100°C	30	15000	0	
	IRLR7843	Delta T = 100°C	30	15000	0	
	IRLR3714Z	Delta T = 100°C	79	15000	0	
	IRLR7833	Delta T = 100°C	79	15000	0	
	IRLR7833	Delta T = 100°C	30	15000	0	
	IRLR7833	Delta T = 100°C	30	15000	0	
	IRLR7833	Delta T = 100°C	80	15000	0	
	IRKR7821	Delta T = 100°C	78	15000	0	
	IRFU7N60C3	Delta T = 100°C	27	15000	0	
	IRFU7N60C3	Delta T = 100°C	27	15000	0	
	IRFU7N60C3	Delta T = 100°C	26	15000	0	
	IRLR3105	Delta T = 100°C	90	15000	0	
	IRLR7821	100°C	80	15000	0	
	IRLR7833	100°C	79	15000	0	
	IRLU7833	100°C	80	15000	0	
		Total	1405		0	
TO-220 Fullpak	IRFIB7N50A	Delta T = 100°C	40	8572	0	
	IRLI2910	Delta T = 100°C	40	8572	0	
	IRLI2910	Delta T = 100°C	40	8572	0	
	IRFIB41N15D	Delta T = 100°C	80	9588	0	
	IRFIB8N50K	Delta T = 100°C	80	8572	0	
	IRFIZ48V	Delta T = 100°C	80	8572	0	
	IRLI2203N	Delta T = 100°C	80	8572	0	
	IRFIB22N60C3	Delta T = 100°C	27	8572	0	
	IRFIB22N60C3	Delta T = 100°C	27	8572	0	
	IRFIB22N60C3	Delta T = 100°C	26	8572	0	
		Total	520		0	
HEXDIP	IRLD120	Delta T = 100°C	80	15000	0	
	IRFD9123	Delta T = 100°C	79	15000	0	
	IRFDC20	Delta T = 100°C	80	15000	0	
		Total	239		0	

Power MOSFET (Continued)

Category	Part Number	Temperature Excursion	Test Quantity	Test duration	# of failures	Failure Mode
SO-8	IRF7484	Delta T = 100°C	30	15000	0	
	IRF7484	Delta T = 100°C	30	15000	0	
	IRF7484	Delta T = 100°C	30	15000	0	
	IRF7832	Delta T = 100°C	80	15000	0	
		Total	170		0	
SOT-223	IRLL3303PBF	Delta T = 100°C	30	15000	0	
	IRLL3303PBF	Delta T = 100°C	30	15000	0	
	IRLL3303PBF	Delta T = 100°C	30	15000	0	
	IRFL024Z	Delta T = 100°C	80	15000	0	
	IRFL120Z	Delta T = 100°C	80	15000	0	
	IRFL120Z	Delta T = 100°C	80	1500	0	
		Total	330		0	
Super TO-220	IRFBA22N50A	Delta T = 100°C	40	5000	0	
	IRFBA22N50A	Delta T = 100°C	40	5000	0	
		Total	80		0	
Super TO-247	IRFPS3815	Delta T = 100°C	80	5000	0	
TO-220	IRF6218L	Delta T = 100°C	80	8572	0	
	IRF6218L	Delta T = 100°C	79	8572	0	
	IRF6218L	Delta T = 100°C	80	8572	0	
	IRF6218L	Delta T = 100°C	80	8576	0	
	IRF6218	Delta T = 100°C	80	8572	0	
	IRF3710	Delta T = 100°C	80	8572	0	
	IRL1404	Delta T = 100°C	80	8572	0	
	IRL1404	Delta T = 100°C	79	8572	0	
	IRL1404	Delta T = 100°C	80	8572	0	
	IRF3205	Delta T = 100°C	80	8572	0	
	IRF3710	Delta T = 100°C	80	8572	0	
	IRF3710	Delta T = 100°C	80	8572	0	
	IRF3710	Delta T = 100°C	80	8572	0	
	IRF3711	Delta T = 100°C	30	8572	0	
	IRF3711	Delta T = 100°C	30	8572	0	
	IRF3711	Delta T = 100°C	30	8572	0	
	IRFB22N60C3	Delta T = 100°C	30	8572	0	
	IRFB22N60C3	Delta T = 100°C	30	8572	0	
	IRFB22N60C3	Delta T = 100°C	30	8572	0	
	IRF2804	Delta T = 100°C	80	2072	0	
	IRF120Z	Delta T = 100°C	80	8572	0	
	IRL3714Z	Delta T = 100°C	80	8572	0	
	IRF840A	Delta T = 100°C	80	8572	0	
	IRFB11N50A	Delta T = 100°C	39	8572	0	
	IRFB22N60C3	Delta T = 100°C	160	8572	0	
	IRF4905	Delta T = 100°C	80	8572	0	
	IRF530N	Delta T = 100°C	160	8572	0	
	IRF6215	Delta T = 100°C	80	8572	0	
		Total	2057		0	
TO-247	IRFP460A	Delta T = 100°C	80	5000	0	
	IRFP064	Delta T = 100°C	80	5000	0	
	IRFP15N60L	Delta T = 100°C	80	5000	0	
	IRFP4510	Delta T = 100°C	80	5000	0	
	IRFP4510	Delta T = 100°C	80	5000	0	
	IRFP4510	Delta T = 100°C	80	5000	0	
		Total	480		0	

IGBT

Category	Part Number	Temperature Excursion	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak	IRGS14C40L	Delta T = 100°C	80	8572	0	
	IRGS14C40L	Delta T = 100°C	80	8572	0	
	IRGSL5B120KD	Delta T = 100°C	80	8572	0	
	IRGS30B60K	Delta T = 100°C	30	8572	0	
	IRGS30B60K	Delta T = 100°C	80	8572	0	
		Total	350		0	
DPak	IRGR3B60KD2	Delta T = 100°C	30	15000	0	
	IRGR3B60KD2	Delta T = 100°C	30	15000	0	
	IRGR3B60KD2	Delta T = 100°C	30	15000	0	
		Total	90		0	
TO-220 Fullpak	IRGIB10B60KD1	Delta T = 100°C	80	8572	0	
	IRGIB10B60K	Delta T = 100°C	80	8572	0	
		Total	160		0	
Super TO-220	IRGBA55A60WS	Delta T = 100°C	79	5000	0	
Super TO-247	IRGPS40B120UD	Delta T = 100°C	80	5000	0	
	IRGPS40B120U	Delta T = 100°C	80	5000	0	
	IRFPS37N50A	Delta T = 100°C	80	5000	0	
	IRG4PSC71K	Delta T = 100°C	80	5000	0	
	IRG4PSC71UD	Delta T = 100°C	30	5000	0	
	IRG4PSC71UD	Delta T = 100°C	30	5000	0	
	IRG4PSC71UD	Delta T = 100°C	30	5000	0	
		Total	410		0	
TO-220	IRGB15B60KD	Delta T = 100°C	30	8572	0	
	IRGB15B60KD	Delta T = 100°C	30	8572	0	
	IRGB14C40L	Delta T = 100°C	80	8572	0	
	IRGB14C40L	Delta T = 100°C	80	8572	0	
	IRGB30B60K	Delta T = 100°C	80	8572	0	
	IRGB15B60KD	Delta T = 100°C	30	8572	0	
	IRG4BC30KD	Delta T = 100°C	80	8572	0	
	IRFB16N60K	Delta T = 100°C	80	8572	0	
		Total	490		0	
TO-247	IRG4PC50WD	Delta T = 100°C	78	5000	0	
	IRG4PC50WD	Delta T = 100°C	80	5000	0	
	IRGP50B60PD1	Delta T = 100°C	80	5000	0	
	IRGP50B60PD1	Delta T = 100°C	30	5000	0	
	IRGP50B60PD1	Delta T = 100°C	30	5000	0	
	IRGP50B60PD1	Delta T = 100°C	30	5000	0	
		Total	328		0	

4.1.6 Autoclave

Power MOSFET

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak (TO-263) & TO-262	IRFS11N50APBF	121°C/15PSIG	0	80	96	0	
	IRL3803S	121°C/15PSIG	0	80	96	0	
	IRFZ24NSPBF	121°C/15PSIG	0	80	96	0	
	IRFS31N20DPBF	121°C/15PSIG	0	78	96	0	
	IRFS31N20DPBF	121°C/15PSIG	0	100	96	0	
	IRFS38N20DPBF	121°C/15PSIG	0	80	96	0	
	IRFSL16N50K	121°C/15PSIG	0	80	96	0	
	IRFSL16N50K	121°C/15PSIG	0	80	96	0	
	IRFSL16N50K	121°C/15PSIG	0	80	96	0	
	IRF1404S	121°C/15PSIG	0	80	96	0	
	IRF1402S	121°C/15PSIG	0	80	96	0	
	IRF1404S	121°C/15PSIG	0	60	192	0	
	IRF1404SPBF	121°C/15PSIG	0	80	96	0	
	IRF3808S	121°C/15PSIG	0	80	96	0	
	IRF3504S	121°C/15PSIG	0	80	96	0	
	IRF3808SPBF	121°C/15PSIG	0	80	96	0	
	IRFS4710	121°C/15PSIG	0	80	96	0	
	IRFSL22N60C	121°C/15PSIG	0	80	96	0	
	IRFSL22N60C	121°C/15PSIG	0	80	96	0	
	IRFSL22N60C	121°C/15PSIG	0	80	96	0	
	IRF2804S	121°C/15PSIG	0	80	96	0	
	IRF3710ZS	121°C/15PSIG	0	80	96	0	
	IRF3710ZS	121°C/15PSIG	0	80	96	0	
	IRF2804S	121°C/15PSIG	0	80	96	0	
	IRF3710ZS	121°C/15PSIG	0	60	192	0	
	IRF3710ZSPBF	121°C/15PSIG	0	80	96	0	
	IRF2804SPBF	121°C/15PSIG	0	80	96	0	
	IRL7833S	121°C/15PSIG	0	80	96	0	
	IRL7833S	121°C/15PSIG	0	80	96	0	
	IRL7833SPBF	121°C/15PSIG	0	80	96	0	
	IRF3415SPBF	121°C/15PSIG	0	79	96	0	
	IRFBG20LPBF	121°C/15PSIG	0	80	96	0	
	IRF9640LPBF	121°C/15PSIG	0	80	96	0	
	IRF5210LPBF	121°C/15PSIG	0	80	96	0	
	IRLBD59N04E	121°C/15PSIG	0	80	96	0	
	IRLBD59N04E	121°C/15PSIG	0	80	96	0	
	IRLBD59N04E	121°C/15PSIG	0	80	96	0	
	IRF2804S7P	121°C/15PSIG	0	240	96	0	
	IRF1404S	121°C/15PSIG	0	240	96	0	
	IRF6215S	121°C/15PSIG	0	80	96	0	
	IRFS11N50A	121°C/15PSIG	0	80	96	0	
	IRFBF20S	121°C/15PSIG	0	80	96	0	
	IRF9640S	121°C/15PSIG	0	160	96	0	
	IRF8010SJS	121°C/15PSIG	0	80	96	0	
		Total		3897		0	
DPak & IPak	IRFR9214	121°C/15PSIG	0	80	96	0	
	IRFR9310	121°C/100%RH/15PSIG	0	79	96	0	
	IRFR1N60A	121°C/15PSIG	0	80	96	0	
	IRG4RC20F	121°C/15PSIG	0	80	96	0	
	IRFR1205	121°C/15PSIG	0	80	96	0	
	IRFR1205	121°C/15PSIG	0	80	96	0	
	IRFR1205	121°C/15PSIG	0	80	96	0	
	IRLR3410	121°C/15PSIG	0	80	96	0	
	IRFR6215	121°C/15PSIG	0	80	96	0	
	IRLR3715	121°C/15PSIG	0	80	96	0	
	IRLR3714	121°C/15PSIG	0	80	96	0	
	IRLR3714	121°C/15PSIG	0	80	96	0	
	IRFR3711	121°C/15PSIG	0	80	96	0	
	IRLR2908	121°C/15PSIG	0	80	96	0	
	IRFR3505	121°C/15PSIG	0	80	96	0	
	IRFR3505	121°C/15PSIG	0	80	96	0	
	IRLR2908	121°C/15PSIG	0	40	96	0	
	IRFR3710Z	121°C/15PSIG	0	80	96	0	
	IRFR4104	121°C/15PSIG	0	80	96	0	
	IRFR3710Z	121°C/15PSIG	0	80	96	0	
	IRFR4104	121°C/15PSIG	0	80	96	0	
	IRFR3710Z	121°C/15PSIG	0	80	96	0	
	IRFR4104	121°C/15PSIG	0	80	96	0	
	IRFR3710Z	121°C/15PSIG	0	80	96	0	
	IRFR120Z	121°C/15PSIG	0	80	96	0	

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
DPak & IPak	IRLR7833PBF	121°C/15PSIG	0	80	96	0	
	IRLR7833PBF	121°C/15PSIG	0	80	96	0	
	IRLR7843	121°C/15PSIG	0	80	96	0	
	IRLR7843	121°C/15PSIG	0	80	96	0	
	IRLR7843	121°C/15PSIG	0	40	96	0	
	IRLR3714Z	121°C/15PSIG	0	80	96	0	
	IRLR7833	121°C/15PSIG	0	80	96	0	
	IRLR7833	121°C/15PSIG	0	80	96	0	
	IRLR7833	121°C/15PSIG	0	80	96	0	
	IRLR3715Z	121°C/15PSIG	0	80	96	0	
	IRLR7833	121°C/15PSIG	0	80	96	0	
	IRLR7833	121°C/100%RH/15PSIG	0	80	96	0	
	IRLR7833	121°C/100%RH/15PSIG	0	80	96	0	
	IRLR110	121°C/15PSIG	0	80	96	0	
	IRLR110	121°C/15PSIG	0	80	96	0	
	IRLR014N	121°C/15PSIG	0	80	96	0	
	IRLR014N	121°C/15PSIG	0	80	96	0	
	IRLR2705	121°C/15PSIG	0	80	96	0	
	IRLU2908	121°C/15PSIG	0	80	96	0	
	IRFU7N60C3	121°C/15PSIG	0	80	96	0	
	IRFU7N60C3	121°C/15PSIG	0	80	96	0	
	IRFU7N60C3	121°C/15PSIG	0	80	96	0	
	IRLR3105	121°C/15PSIG	0	319	96	0	
	IRFR120	121°C/15PSIG	0	80	96	0	
	IRFR3711	121°C/15PSIG	0	80	96	0	
	IRFR5505	121°C/15PSIG	0	80	96	0	
	IRFR9024N	121°C/15PSIG	0	79	96	0	
	IRLR7833	121°C/15PSIG	0	80	96	0	
	IRLR7833AA	121°C/15PSIG	0	80	96	0	
	IRLR8503	121°C/15PSIG	0	80	96	0	
	IRLU7833	121°C/15PSIG	0	80	96	0	
		Total		4637		0	
TO-220 Fullpak	IRFI740G	121°C/15PSIG	0	80	96	0	
	IRFI9630G	121°C/15PSIG	0	80	96	0	
	IRFIZ24N	121°C/15PSIG	0	80	96	0	
	IRLI2910	121°C/15PSIG	0	80	96	0	
	IRLI2910	121°C/15PSIG	0	80	96	0	
	IRFIB41N15D	121°C/15PSIG	0	80	96	0	
	IRFIZ48V	121°C/15PSIG	0	80	96	0	
	IRLI2203N	121°C/15PSIG	0	80	96	0	
	IRFIB22N60C3	121°C/15PSIG	0	80	96	0	
	IRFIB22N60C3	121°C/15PSIG	0	80	96	0	
	IRFIB22N60C3	121°C/15PSIG	0	80	96	0	
	IRLI3803	121°C/15PSIG	0	80	96	0	
	IRLI3803	121°C/15PSIG	0	80	96	0	
		Total		1040		0	
HEXDIP	IRFDC20	121°C/15PSIG	0	80	96	0	
SO-8	IRF7463	121°C/15PSIG	0	80	96	0	
	IRF7463	121°C/15PSIG	0	80	96	0	
	IRF7463	121°C/15PSIG	0	80	96	0	
	IRF7484PBF	121°C/15PSIG	0	79	96	0	
	IRF7484PBF	121°C/15PSIG	0	80	96	0	
	IRF7456PBF	121°C/15PSIG	0	80	96	0	
	IRF7456PBF	121°C/15PSIG	0	80	96	0	
	IRF7456PBF	121°C/15PSIG	0	80	96	0	
	IRF7484	121°C/15PSIG	0	80	96	0	
	IRF7484	121°C/15PSIG	0	80	96	0	
	IRF7484	121°C/15PSIG	0	80	96	0	
	IRF7484	121°C/15PSIG	0	80	96	0	
	IRF7484	121°C/15PSIG	0	80	96	0	
	IRF7484	121°C/15PSIG	0	75	48	0	
	IRF7832	121°C/15PSIG	0	40	96	0	
	IRF7832	121°C/15PSIG	0	40	96	0	
	IRF7832	121°C/15PSIG	0	40	96	0	
	IRF7831	121°C/15PSIG	0	79	96	0	
	IRF7831	121°C/15PSIG	0	79	96	0	
	IRF7842	121°C/15PSIG	0	80	96	0	
	IRF7842	121°C/15PSIG	0	80	96	0	
	IRF7842	121°C/15PSIG	0	80	96	0	

Power MOSFET (Continued)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
SO-8	IRF7341QPBF	121°C/15PSIG	0	40	96	0	
	IRF7341QPBF	121°C/15PSIG	0	40	96	0	
	IRF7314PBF	121°C/15PSIG	0	40	96	0	
	IRF7832	121°C/15PSIG	0	80	96	0	
	IRF7456	121°C/15PSIG	0	160	96	0	
	IRF7341	121°C/15PSIG	0	80	96	0	
	IRF7413	121°C/15PSIG	0	80	96	0	
	IRF1902	121°C/15PSIG	0	80	96	0	
SO-8 (Cont)	IRF7413	121°C/15PSIG	0	30	96	0	
	IRF7103	121°C/15PSIG	0	30	96	0	
	IRF7484	121°C/15PSIG	0	30	96	0	
	IRF7413	121°C/15PSIG	0	52	96	0	
	IRF7463	121°C/15PSIG	0	30	96	0	
	IRF7413	121°C/15PSIG	0	60	96	0	
	IRF7103Q	121°C/15PSIG	0	120	96	0	
	IRF7492	121°C/15PSIG	0	80	96	0	
	IRL7821	121°C/15PSIG	0	80	96	0	
		Total		2744		0	
SOT-223	IRFL9014PBF	121°C/15PSIG	0	80	96	0	
	IRFL014PBF	121°C/15PSIG	0	80	96	0	
	IRFL214PBF	121°C/15PSIG	0	80	96	0	
	IRLL3303PBF	121°C/15PSIG	0	80	96	0	
	IRLL3303PBF	121°C/15PSIG	0	79	96	0	
	IRLL3303PBF	121°C/15PSIG	0	80	96	0	
	IRLL3303PBF	121°C/15PSIG	0	78	96	0	
	IRLL2705PBF	121°C/15PSIG	0	80	96	0	
	IRLL3303PBF	121°C/15PSIG	0	80	96	0	
	IRLL3303PBF	121°C/15PSIG	0	80	96	0	
	IRLL3303PBF	121°C/15PSIG	0	80	96	0	
	IRFL024Z	121°C/15PSIG	0	80	96	0	
	IRFL120Z	121°C/15PSIG	0	80	96	0	
	IRFL120Z	121°C/15PSIG	0	80	96	0	
	IRLL2703	121°C/15PSIG	0	30	96	0	
	IRFL014	121°C/15PSIG	0	80	96	0	
	IRLL2705	121°C/15PSIG	0	80	96	0	
		Total		1307		0	
Super TO-220	IRFBA22N50A	121°C/15PSIG	0	79	96	0	
	IRFBA22N50A	121°C/15PSIG	0	80	96	0	
	IRGBA55A60WS	121°C/15PSIG	0	80	96	0	
		Total		239		0	
Super TO-247	IRFPS3815	121°C/15PSIG	0	80	96	0	
TO-220	IRF6218	121°C/15PSIG	0	80	96	0	
	IRF1404PBF	121°C/15PSIG	0	80	96	0	
	IRF1404PBF	121°C/15PSIG	0	80	96	0	
	IRFB22N60C3	121°C/15PSIG	0	80	96	0	
	IRFB22N60C3	121°C/15PSIG	0	80	96	0	
	IRFB22N60C3	121°C/15PSIG	0	80	96	0	
	IRF3710Z	121°C/15PSIG	0	80	96	0	
	IRF3710Z	121°C/15PSIG	0	80	96	0	
	IRF3710Z	121°C/15PSIG	0	80	96	0	
	IRF2804	121°C/15PSIG	0	80	96	0	
	IRF120Z	121°C/15PSIG	0	80	96	0	
	IRL3714Z	121°C/15PSIG	0	80	96	0	
	IRFB22N60C3	121°C/15PSIG	0	160	96	0	
	IRF1404	121°C/15PSIG	0	80	96	0	
	IRF1404	121°C/15PSIG	0	80	96	0	
		Total		1280		0	
TO-247	IRFP2907	121°C/15PSIG	0	80	96	0	
	IRFP4004	121°C/15PSIG	0	80	96	0	
	IRFP4004	121°C/15PSIG	0	80	96	0	
	IRFP4510	121°C/15PSIG	0	80	96	0	
	IRFP4510	121°C/15PSIG	0	80	96	0	
		Total		400		0	

IGBT

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D2Pak (TO-263) & TO-262	IRGS14C40L	121°C/15PSIG	0	80	96	0	
	IRGS14C40L	121°C/15PSIG	0	80	96	0	
	IRGS14C40L	121°C/15PSIG	0	80	96	0	
	IRGS30B60K	121°C/15PSIG	0	80	96	0	
	IRGS30B60K	121°C/15PSIG	0	80	96	0	
		Total		400		0	
TO-247	IRG4PC50WD	121°C/15PSIG	0	79	96	0	
	IRG4PC50WD	121°C/15PSIG	0	80	96	0	
	IRG4PC40UDPBF	121°C/15PSIG	0	80	96	0	
	IRGP50B60PD1	121°C/15PSIG	0	80	96	0	
	IRGP50B60PD1	121°C/15PSIG	0	80	96	0	
	IRGP50B60PD1	121°C/15PSIG	0	80	96	0	
	IRGP50B60PD1	121°C/15PSIG	0	80	96	0	
	IRGP50B60PD1	121°C/15PSIG	0	80	96	0	
	IRGP50B60PD1	121°C/15PSIG	0	80	96	0	
	IRGP20B60PD	121°C/15PSIG	0	80	96	0	
		Total		799		0	
DPak & IPak	IRGR3B60KD2	121°C/15PSIG	0	80	96	0	
TO-220 Fullpak	IRGIB10B60KD1	121°C/15PSIG	0	80	96	0	
	IRGIB10B60K	121°C/15PSIG	0	80	96	0	
	IRGIB10B60K	121°C/15PSIG	0	80	96	0	
	IRGIB10B60K	121°C/15PSIG	0	80	96	0	
		Total		320		0	
Super TO-247	IRFPS37N50A	121°C/15PSIG	0	80	96	0	
	IRG4PSC71K	121°C/15PSIG	0	80	96	0	
	IRG4PSC71K	121°C/15PSIG	0	80	96	0	
	IRFPS40N60K	121°C/15PSIG	0	80	96	0	
	IRG4PSH71KD	121°C/15PSIG	0	80	96	0	
	IRGPS40B120UD	121°C/15PSIG	0	80	96	0	
	IRGPS40B120UD	121°C/15PSIG	0	80	96	0	
	IRGPS40B120UD	121°C/15PSIG	0	40	96	0	
	IRGPS40B120UD	121°C/15PSIG	0	40	96	0	
	IRGPS40B120U	121°C/15PSIG	0	80	96	0	
	IRGPS40B120U	121°C/15PSIG	0	80	96	0	
	IRGP50B60PD1	121°C/15PSIG	0	80	96	0	
	IRG4PSC71UD	121°C/15PSIG	0	80	96	0	
	IRG4PSC71UD	121°C/15PSIG	0	80	96	0	
	IRG4PSC71UD	121°C/15PSIG	0	80	96	0	
		Total		1120		0	
TO-220	IRGB14C40L	121°C/15PSIG	0	80	96	0	
	IRGB14C40L	121°C/15PSIG	0	80	96	0	
	IRGB14C40L	121°C/15PSIG	0	80	96	0	
	IRGB30B60K	121°C/15PSIG	0	80	96	0	
	IRGB20B60PD	121°C/15PSIG	0	100	96	0	
	IRGB20B60PD	121°C/15PSIG	0	100	96	0	
	IRGP35B60PD	121°C/15PSIG	0	95	96	0	
	IRFB16N60K	121°C/15PSIG	0	80	96	0	
	IRG4BC20F	121°C/15PSIG	0	80	96	0	
	IRG4BC20F	121°C/15PSIG	0	80	96	0	
	IRGB20B60PD	121°C/15PSIG	0	100	96	0	
		Total		955		0	

4.2 Input/Output

4.2.1 Temperature Cycle

Category	Part Number	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D-67	HFA90NH40	-55°C/150°C	0	100	1000	0	
	HFA90NH40	-55°C/150°C	0	100	1000	0	
	HFA90NH40	-55°C/150°C	0	100	1000	0	
	HFA90NH40	-55°C/150°C	0	100	1000	0	
		Total		400		0	
TO-220	8ETH06	-55°C/150°C	0	80	1000	0	
	8ETH06	-55°C/150°C	0	80	1000	0	
	30ETH06	-55°C/150°C	0	80	1000	0	
	30ETH06	-55°C/150°C	0	80	1000	0	
	30CTH02	-55°C/150°C	0	80	1000	0	
	30CTH02	-55°C/150°C	0	80	1000	0	
	30CTH02	-55°C/150°C	0	80	1000	0	
	19TQ015	-55°C/150°C	0	80	1000	0	
	70CTQ100	-55°C/150°C	0	80	1000	0	
		Total		720		0	
TO-247	60APU04	-55°C/150°C	0	80	1000	0	
	MUR3020WT	-55°C/150°C	0	80	1000	0	
	30EPH03	-55°C/150°C	0	80	1000	0	
	72CPQ030	-55°C/150°C	0	80	1000	0	
	60APU04	-55°C/150°C'	0	160	1000	0	
		Total		480		0	
D2Pak	42CTQ030S	-55°C/150°C	0	80	1000	0	
DPak	12CWQ03FN	-55°C/150°C	0	80	1000	0	
FLIPCHIP	IR1H40CSP	-40°C/125°C	0	60	1000	0	
	IR140CSP	-40°C/125°C	0	60	1000	1	Deffect in Silicon
	IR140CSP	-40°C/125°C	0	60	1000	0	
	IR140CSP	-40°C/125°C	0	64	1000	0	
	IR140CSP	-40°C/125°C	0	66	1000	0	
	IR140CSP	-40°C/125°C	0	64	1000	0	
		Total		374		1	
SMA,B,C	20BQ030	-55°C/150°C	0	80	1000	0	
	10BQ040PBF	-55°C/'150'°C'	0	80	1000	0	
	30BQ015PBF	-55°C/'150'°C'	0	80	1000	0	
	30BQ015PBF	-55°C/150°C	0	80	1000	0	
	30BQ015PBF	-55°C/150°C	0	80	1000	0	
	30BQ100	-55°C/150°C	0	160	1000	0	
		Total		560		0	
TO-220 Fullpak	30CTQ100FP	-55°C/150°C	0	240	1000	0	
DPak & IPak	10WQ045FN	-55°C/150°C	0	80	1000	0	
	30WQ04FN	-55°C/150°C	0	80	1000	0	
		Total		160		0	

4.2.2 Temperature and Humidity Bias (H3TRB)

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
TO-220	8ETH06	85°C/85%RH	100	80	1000	0	
	MBR20100CT	85°C/85%RH	80	80	1000	0	
	30CTH02	85°C/85%RH	100	80	1000	0	
	30CTH02	85°C/85%RH	100	80	1000	0	
	30CTH02	85°C/85%RH	100	80	1000	0	
	30ETH06	85°C/85%RH	100	160	1000	0	
	70CTQ100	85°C/85%RH	80	160	1000	0	
		Total		720		0	
D2Pak (TO-263) & TO-262	42CTQ030S	85°C/85%RH	15	80	1000	0	
	42CTQ030S	85°C/85%RH	15	80	1000	0	
		Total		160		0	
FlipChip	IR1H40CSP	85°C/85%RH	32	55	500	0	
	IR140CSP	85°C/85%RH	32	55	500	0	
	IR140CSP	85°C/85%RH	32	55	500	0	
	IR140CSP	85°C/85%RH	32	55	500	0	
	IR140CSP	85°C/85%RH	32	55	500	0	
	IR140CSP	85°C/85%RH	32	55	500	0	
	IR1H40CSP	85°C/85%RH	32	55	500	0	
	IR1H40CSP	85°C/85%RH	32	55	500	0	
	IR1H40CSP	85°C/85%RH	32	55	500	0	
		Total		495		0	
TO-247	30EPH03	85°C/85%RH	100	80	1000	0	
	60APU06	85°C/85%RH	100	320	1000	0	
	MUR3020WT	85°C/85%RH	100	80	1000	0	
		Total		480		0	
	72CPQ030	85°C/85%RH	24	80	1000	0	
	20BQ030	85°C/85%RH	24	80	1500	0	
	30ETH06	85°C/85%RH	100	80	1000	0	
	30ETH06	85°C/85%RH	100	80	1000	0	
	60APU04	85°C/85%RH	100	80	1000	0	
	MUR3020WT	85°C/85%RH	100	80	1000	0	
		Total		480		0	
DPak	10WQ045FN	85°C/85%RH	36	80	1000	0	
	30WQ04FN	85°C/85%RH	32	80	1000	0	
	12CWQ03FN	85°C/85%RH	15	80	1000	0	
		Total		240		0	
SMA, B,C	10MQ100NPBF	85°C/85%RH	80	80	1000	0	
	10BQ040PBF	85°C/85%RH	32	80	1000	0	
	30BQ015PBF	85°C/85%RH	12	80	1000	0	
	30BQ015PBF	85°C/85%RH	12	80	1000	0	
	30BQ015PBF	85°C/85%RH	12	80	1000	0	
	30BQ100	85°C/85%RH	80	80	1000	0	
		Total		480		0	
TO-220 Fullpak	30CTQ100FP	85°C/85%RH	80	240	1000	0	

4.3.2 High Temperature Reverse Bias (HTRB)

Category	Part Number	Environmental Conditions (°C)	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 90°C	FIT Rate at 60% UCL
D2Pak	42CTQ030S	150	24	160	1000	0			
	20BQ030	150	24	80	1000	0			
			Total	240		0		2.56E+07	36
Flip Chip	IR140CSP	150	32	314	1000	0		3.35E+07	27
	IR1H40CSP	150	32	234	1000	0		2.49E+07	37
			Total	548		0		5.84E+07	16
TO-220	19TQ015	75	12	80	1128	0			
	8ETH06	150	480	80	1000	0			
	MBR20100CT	150	80	80	1000	0			
	8ETH06	150	480	80	1000	0			
	70CTQ100	150	80	80	1000	0			
	30ETH06	175	480	79	1000	0			
			Total	479		0		3.41E+07	27
DPak & IPak	10WQ045FN	175	32	80	1000	0			
	30WQ04FN	150	32	80	1000	0			
			Total	160		0		4.93E+07	19
TO-247	30EPH03	175	240	80	1000	0			
	60APU04	175	320	120	1000	0			
	60AP06	175	480	80	1000	0			
	MUR3020WT	175	160	119	1000	0			
			Total	399		0		2.06E+08	4

4.2.4 Power Cycling

Category	Part Number	Temperature Excursion	Test Quantity	Test duration	# of failures	Failure Mode
SMA,B,C	30BQ015PBF	Delta T = 100°C	27	15000	0	
	30BQ015PBF	Delta T = 100°C	27	15000	0	
	30BQ015PBF	Delta T = 100°C	26	15000	0	
	30BQ015PBF	Delta T = 100°C	80	15000	0	
		Total	160		0	
TO-220 Fullpak	30CTQ100FP	Delta T = 100°C	240	8572	0	
TO-220	30ETH06	Delta T = 100°C	80	8572	0	
	70CTQ1000	Delta T = 100°C	80	8572	0	
		Total	160		0	
TO-247	60APU04	Delta T = 100°C	240	5000	0	
	MUR3020WT	Delta T = 100°C	160	5000	0	
		Total	400		0	

4.2.5 Autoclave

Category	Part Number	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
D-61	82CNQ030A	121°C/15PSIG	0	80	96	0	
D2Pak	42CTQ030S	121°C/15PSIG	0	80	96	0	
DPak	12CWQ03FN	121°C/15PSIG	0	80	96	0	
	20BQ030	121°C/15PSIG	0	80	96	0	
	10WQ045FN	121°C/15PSIG	0	80	96	0	
	30WQ04FN	121°C/15PSIG	0	80	96	0	
		Total		320		0	
SMA, B, C	10BQ040PBF	121°C/15PSIG	0	80	96	0	
	30BQ015PBF	121°C/15PSIG	0	80	96	0	
	30BQ015PBF	121°C/15PSIG	0	80	96	0	
	30BQ015PBF	121°C/15PSIG	0	80	96	0	
		Total		320		0	
TO-220	30CTH02	121°C/15PSIG	0	80	96	0	
	30CTH02	121°C/15PSIG	0	80	96	0	
	30CTH02	121°C/15PSIG	0	80	96	0	
	30CTH02	121°C/15PSIG	0	80	96	0	
	MBR20100CT	121°C/15PSIG	0	80	96	0	
	19TQ015	121°C/15PSIG	0	80	96	0	
	8ETH06	121°C/15PSIG	0	80	96	0	
	8ETH06	121°C/15PSIG	0	80	96	0	
	70CTQ100	121°C/15PSIG	0	80	96	0	
		Total		720		0	
TO-247	80CPQ150	121°C/15PSIG	0	80	96	0	
	80CPQ150	121°C/15PSIG	0	80	96	0	
	72CPQ030	121°C/15PSIG	0	80	96	0	
	80CPQ150	121°C/15PSIG	0	80	96	0	
	80CPQ150	121°C/15PSIG	0	80	96	0	
		Total		400		0	
TO-220 Fullpak	30CTQ100FP	121°C/15PSIG	0	240	96	0	

SECTION 4.2

LONG TERM RELIABILITY TEST RESULTS
LVIC PRODUCTS

4.3 LVIC

4.3.1 Temperature Cycle

Category	Part Number	Number of Pins	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
DPAK	IRU1206-25	3	-55C to 150C	0	157	1000	0	
MLPM	IRU1011-33CH	6	-55C to 150C	0	471	1000	0	
MLPM	IRU1502-33	6	-55C to 150C	0	311	1000	0	
MLPQ	IR3086M	20	-55C to 150C	0	334	1000	0	
MLPQ	IR3088M	20	-55C to 150C	0	77	1000	0	
MLPQ	IRU3072CH	20	-55C to 150C	0	221	1000	0	
MLPQ	IR3081M	28	-55C to 150C	0	256	1000	0	
MLPQ	IR3080M	32	-55C to 150C	0	154	1000	0	
MLPQ	IR3083M	32	-55C to 150C	0	76	1000	0	
MLPQ	IR3092M	48	-55C to 150C	0	170	1000	0	
MLPQ	IR3093M	48	-55C to 150C	0	180	1000	0	
PowerFLEX	IRU1239SCCP	7	-55C to 150C	0	466	1000	0	
QSOP	IRU3073CQ	16	-55C to 150C	0	152	1000	0	
SOIC-N	IR5001CS	8	-55C to 150C	0	479	1000	0	
SOIC-N	IRU3037CS	8	-55C to 150C	0	180	1000	0	
SOIC-N	IRU3137CS	8	-55C to 150C	0	480	1000	0	
SOIC-N	IRU3138CS	14	-55C to 150C	0	155	1000	0	
SOT-223	IRU1206-25	3	-55C to 150C	0	154	1000	0	
SOT-23	IRU3065CL	6	-55C to 150C	0	232	1000	0	
TSSOP	IRU3146CF	28	-55C to 150C	0	231	1000	0	
			Total			4936	0	

4.3.2 Temperature and Humidity Bias (H3TRB)

Category	Part Number	# of pins	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
DPAK	IRU1206-25	3	85C, 85%RH	5	157	1000	0	
MLPM	IRU1011-33CH	6	85C, 85%RH	2.5	390	1000	0	
MLPM	IRU1502-33	6	85C, 85%RH	5	231	1000	1	FA inconclusive
MLPQ	IR3086M	20	85C, 85%RH	12/4	370	1000	0	
MLPQ	IR3087M	20	85C, 85%RH	12/4	137	1000	0	
MLPQ	IR3088M	20	85C, 85%RH	12/4	59	1000	0	
MLPQ	IRU3072CH	20	85C, 85%RH	5	231	1000	0	
MLPQ	IR3081M	28	85C, 85%RH	12/5.5	245	1000	0	
MLPQ	IR3080M	32	85C, 85%RH	12/5.5	154	1000	0	
MLPQ	IR3083M	32	85C, 85%RH	12/5.5	69	1000	0	
MLPQ	IR3092M	48	85C, 85%RH	9	200	1000	0	
MLPQ	IR3093M	48	85C, 85%RH	9	178	1000	0	
PowerFLEX	IRU1239SCCP	7	85C, 85%RH	2	463	1000	0	
QSOP	IRU3073CQ	16	85C, 85%RH	5	154	1000	0	
SOIC-N	IR5001CS	8	85C, 85%RH	5/48	468	1000	0	
SOIC-N	IRU3037CS	8	85C, 85%RH	5	180	1000	0	
SOIC-N	IRU3137CS	8	85C, 85%RH	5	476	1000	0	
SOIC-N	IRU3138CS	14	85C, 85%RH	5	156	1000	0	
SOT-223	IRU1206-25	3	85C, 85%RH	0	314	1000	0	
SOT-23	IRU3065CL	6	85C, 85%RH	5	232	1000	0	
TSSOP	IRU3146CF	28	85C, 85%RH	5	217	1000	0	
			Total			5081	1	

4.3.3 High Temperature Operating Life (HTOL)

Process	Category	Part Number	# of Pins	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 75°C	FIT Rate at 60% UCL
LVIC1	MLPM	IRU1011-33CH	6	125	5	393	1000	0		7.37E+06	
LVIC1	PowerFLEX	IRU1239SCCP	7	125	5/12	219	1000	0		4.11E+06	
						612		0		1.15E+07	80
LVIC2	MLPQ	IR3086M	20	150	12/4	366	1000	0		2.29E+07	
LVIC2	MLPQ	IR3087M	20	150	12/4	135	1000	0		8.46E+06	
LVIC2	MLPQ	IR3088M	20	150	12/4	127	1000	0		7.96E+06	
LVIC2	MLPQ	IR3092M	48	150	14/21/28	138	1000	0		8.64E+06	
LVIC2	MLPQ	IR3093M	48	150	14/24/21	157	1000	1	Marginal parametric failure	9.83E+06	
				Total		923		1		5.78E+07	35
LVIC3	MLPQ	IR3080M	32	150	12/5.5	154	1000	0		9.65E+06	
LVIC3	MLPQ	IR3081M	28	150	12/5.5	245	1000	0		1.53E+07	
LVIC3	MLPQ	IR3083M	32	150	12/5.5	77	1000	0		4.82E+06	
LVIC3	SOIC-N	IRU3037CS	8	125	5	169	1000	0		3.17E+06	
LVIC3	MLPQ	IRU3072CH	20	125	5/0.8	226	1000	0		4.24E+06	
LVIC3	QSOP	IRU3073CQ	16	125	5/0.8	154	1000	0		2.89E+06	
LVIC3	SOIC-N	IRU3137CS	8	125	5	158	1000	0		2.96E+06	
LVIC3	SOIC-N	IRU3138CS	14	125	5	153	1000	0		2.87E+06	
LVIC3	TSSOP	IRU3146CF	28	125	10	230	1000	1	Random process defect	4.31E+06	
				Total		1566		1		5.03E+07	40
LVIC4	SOIC-N	IR5001CS	8	125	5/100	445	1000	0	0	8.35E+06	
LVIC4	MLPM	IRU1502-33	6	125	5	120	1000	0	0	2.25E+06	
				Total			565		0	1.06E+07	86

4.3.4 Autoclave

Category	Part Number		Number of Pins	Environmental Conditions		Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
DPAK	IRU1206-25		3	21C, 100%RH, 15PSIG		0	157	96	0	
MLPM	IRU1011-33CH		6	21C, 100%RH, 15PSIG		0	471	96	0	
MLPM	IRU1502CH		6	21C, 100%RH, 15PSIG		0	80	96	0	
MLPQ	IR3086M		20	21C, 100%RH, 15PSIG		0	231	96	0	
MLPQ	IRU3072CH		20	21C, 100%RH, 15PSIG		0	231	96	0	
MLPQ	IR3081M		28	21C, 100%RH, 15PSIG		0	77	96	0	
MLPQ	IR3080M		32	21C, 100%RH, 15PSIG		0	154	96	0	
MLPQ	IR3083M		32	21C, 100%RH, 15PSIG		0	77	96	1	Moisture ingression
PowerFLEX	IRU1239SCCP		7	21C, 100%RH, 15PSIG		0	466	96	0	
QSOP	IRU3073CQ		16	21C, 100%RH, 15PSIG		0	154	96	1	Moisture ingression
SOIC-N	IR5001CS		8	21C, 100%RH, 15PSIG		0	480	96	0	
SOIC-N	IRU3137CS		8	21C, 100%RH, 15PSIG		0	240	96	0	
SOIC-N	IRU3138CS		14	21C, 100%RH, 15PSIG		0	154	96	0	
SOT-223	IRU1206-25		3	21C, 100%RH, 15PSIG		0	154	96	0	
SOT-23	IRU3065CL		6	21C, 100%RH, 15PSIG		0	233	96	0	
TSSOP	IRU3146CF		28	21C, 100%RH, 15PSIG		0	231	96	0	
				Total			3590		2	

SECTION 4.3

LONG TERM RELIABILITY TEST RESULTS
HVIC PRODUCTS

4.4 HVIC

4.4.1 Temperature Cycle

Process/Generation	Category	Part Number	# of Pins	Temperature Excursion	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
HVJI/Gen2	PDIP	IR2010	14	-55°C/150°C	0	79	1000	0	
HVJI/Gen2	SOIC-W	IR2010S	16	-55°C/150°C	0	77	1000	0	
HVJI/Gen2	SOIC-N	IR2011S	8	-55°C/150°C	0	77	1000	0	
HVJI/Gen2	SOIC-N	IR2085S	8	-55°C/150°C	0	80	1000	0	
HVJI/Gen2	PDIP	IR2106	8	-55°C/150°C	0	160	1000	0	
HVJI/Gen2	SOIC-N	IR2106S	8	-55°C/150°C	0	160	1000	0	
HVJI/Gen2	PDIP	IR21084	14	-55°C/150°C	0	160	1000	0	
HVJI/Gen2	SOIC-N	IR21084S	14	-55°C/150°C	0	160	1000	0	
HVJI/Gen1	SOIC-W	IR2110S	16	-55°C/150°C	0	77	1000	0	
HVJI/Gen1	PDIP	IR2113	14	-55°C/150°C	0	160	1000	0	
HVJI/Gen1	SOIC-W	IR2113S	16	-55°C/150°C	0	77	1000	1	Passivation crack
HVJI/Gen1	SOIC-W	IR2130S	28	-55°C/150°C	0	157	1000	0	
HVJI/Gen2	SOIC-W	IR2135S	28	-55°C/150°C	0	77	1000	0	
HVJI/Gen2	SOIC-W	IR2136S	28	-55°C/150°C	0	237	1000	0	
HVJI/Gen2	PDIP	IR2153	8	-55°C/150°C	0	160	1000	0	
HVJI/Gen2	SOIC-N	IR2153S	8	-55°C/150°C	0	160	1000	0	
HVJI/Gen2	SOIC-N	IR2156S	14	-55°C/150°C	0	80	1000	0	
HVJI/Gen2	SOIC-N	IR2520DS	8	-55°C/150°C	0	80	1000	0	
							Total	1	

4.4.2 Temperature and Humidity Bias (H3TRB)

Process/Generation	Category	Part Number	# of Pins	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
HVJI/Gen2	PDIP	IR2010	14	85°C/85%RH	20/20	80	1000	0	
HVJI/Gen2	SOIC-W	IR2010S	16	85°C/85%RH	20/20	154	1000	0	
HVJI/Gen2	SOIC-N	IR2085S	8	85°C/85%RH	10/10	77	1000	0	
HVJI/Gen2	SOIC-N	IR2106S	8	85°C/85%RH	20/20	80	1000	0	
HVJI/Gen2	SOIC-N	IR21084S	14	85°C/85%RH	20/20	160	1000	0	
HVJI/Gen1	SOIC-W	IR2110S	16	85°C/85%RH	20/20	77	1000	0	
HVJI/Gen1	PDIP	IR2113	14	85°C/85%RH	20/20	80	1000	0	
HVJI/Gen1	SOIC-W	IR2113S	16	85°C/85%RH	20/20	154	500	0	
HVJI/Gen1	SOIC-W	IR2130S	28	85°C/85%RH	20/20	157	1000	0	
HVJI/Gen2	SOIC-W	IR2135S	28	85°C/85%RH	20/20	77	1000	0	
HVJI/Gen2	SOIC-W	IR2136S	28	85°C/85%RH	20/20	237	1000	0	
HVJI/Gen2	PDIP	IR2153	8	85°C/85%RH	14/14	80	1000	1	Bond wire lift
HVJI/Gen2	SOIC-N	IR2153S	8	85°C/85%RH	14/14	80	1000	0	
HVJI/Gen2	SOIC-N	IR2156S	14	85°C/85%RH	20/20	80	1000	0	
HVJI/Gen2	PDIP	IR2213	14	85°C/85%RH	20/20	80	1000	0	
HVJI/Gen2	SOIC-N	IR2520DS	8	85°C/85%RH	14/14	77	1000	0	
							Total	1	

4.4.3 High Temperature Bias Test

Process/Generation	Category	Part Number	# of Pins	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode	EDH @ 75°C	FIT Rate at 60% UCL
HVJI/Gen2	PDIP	IR2010	14	150	20/20/400	80	1000	0		5.01E+06	
HVJI/Gen2	SOIC-W	IR2010S	16	150	20/20/400	77	1000	0		4.82E+06	
HVJI/Gen2	PDIP	IR2106	8	150	20/20/480	80	1000	1	Ionic contamamination	5.01E+06	
HVJI/Gen2	SOIC-N	IR2106S	8	150	20/20/480	80	1000	0		5.01E+06	
HVJI/Gen2	PDIP	IR21084	14	150	20/20/480	78	1000	0		4.89E+06	
HVJI/Gen2	SOIC-N	IR21084S	14	150	20/20/480	160	1000	0		1.00E+07	
HVJI/Gen2	SOIC-W	IR2136S	28	150	20/20/480	228	1000	0		1.43E+07	
HVJI/Gen2	SOIC-N	IR2166S	16	150	14/14/480	239	1000	0		1.50E+07	
HVJI/Gen2	PDIP	IR2213	14	150	20/20/960	80	500	0		2.51E+06	
HVJI/Gen2	SOIC-N	IR2520DS	8	150	14/14/480	76	1000	0		4.76E+06	
							Total	1		7.13E+07	28

4.4.4 Autoclave

Process/Generation	Category	Part Number	# of Pins	Environmental Conditions	Applied Voltage	Test Quantity	Test duration	# of failures	Failure Mode
HVJI/Gen2	PDIP	IR2010	14	121°C/15PSIG	0	80	96	0	
HVJI/Gen2	SOIC-W	IR2010S	16	121°C/15PSIG	0	77	96	0	
HVJI/Gen2	SOIC-N	IR2011S	8	121°C/15PSIG	0	77	96	0	
HVJI/Gen2	SOIC-N	IR2085S	8	121°C/15PSIG	0	80	96	0	
HVJI/Gen2	PDIP	IR2106	8	121°C/15PSIG	0	160	96	0	
HVJI/Gen2	SOIC-N	IR2106S	8	121°C/15PSIG	0	240	96	0	
HVJI/Gen2	PDIP	IR21084	14	121°C/15PSIG	0	160	96	0	
HVJI/Gen2	SOIC-N	IR21084S	14	121°C/15PSIG	0	250	96	1	Moisture ingression
HVJI/Gen1	SOIC-W	IR2110S	16	121°C/15PSIG	0	77	96	0	
HVJI/Gen1	PDIP	IR2113	14	121°C/15PSIG	0	80	96	0	
HVJI/Gen1	SOIC-W	IR2113S	16	121°C/15PSIG	0	77	96	0	
HVJI/Gen1	SOIC-W	IR2130S	28	121°C/15PSIG	0	155	96	2	Moisture ingression
HVJI/Gen2	SOIC-W	IR2135S	28	121°C/15PSIG	0	77	96	0	
HVJI/Gen2	SOIC-W	IR2136S	28	121°C/15PSIG	0	237	96	0	
HVJI/Gen2	PDIP	IR2153	8	121°C/15PSIG	0	160	96	1	Moisture ingression
HVJI/Gen2	SOIC-N	IR2153S	8	121°C/15PSIG	0	160	96	0	
HVJI/Gen2	SOIC-N	IR2156S	14	121°C/15PSIG	0	80	96	0	
HVJI/Gen1	PDIP	IR2213	14	121°C/15PSIG	0	320	96	0	
HVJI/Gen2	SOIC-N	IR2520DS	8	121°C/15PSIG	0	80	96	0	
							Total	4	

5.0 SUMMARY OF RESULTS: ACCELERATED LIFE STRESS TESTING

The current results of experiments completed or being conducted at International Rectifier to determine the appropriate accelerated life stress models are presented in the following sections. The table below lists those experiments which have been completed and appear in the referenced Reliability Reports. Where applicable, the values of the activation energies reported in the corresponding references are included.

Acceleration Experiments	Activation Energy
HTRB - Thermal Acceleration	1.03 eV
HTRB - Bias Acceleration	311 V
Gate Stress- Thermal Acceleration	0.4 eV
Gate Stress- Bias Acceleration	0.065 MV/cm
Gate Stress - Bias Acceleration (n-channel)	0.108 MV/cm
Gate Stress - Bias Acceleration (p-channel)	0.048 MV/cm
Power Cycling / TO-220	0.31-0.4 eV