### Problem Advisory

**1. Title** (Class, Function, Type, etc.)
Linear Mode Application, Power MOSFET

**2. Document Number**
FV5-P-09-01A

**3. Date (DD-MMM-YY)**
23 APRIL 2009

**4. Manufacturer and Address**
International Rectifier, HiRel Products
205 Crawford Street
Leominster, MA 01453

**5. Part Number**
FSC 5961

**6. National Stock Number**
Not Applicable

**7. Specification**
MIL-PRF-19500

**8. Type Designator**
QPL-19500

**9. Lot Code Start**
Not Applicable

**10. Lot Code End**
Not Applicable

**11. Manufacturer's Point of Contact**
Milt Boden
(310) 726-8029
Mboden1@irf.com

**12. Cage**
69210

**13. Manufacturer's Fax**
(978) 537-4246

**14. MFR. POC Phone**
(310) 726-8029

**15. Manufacturer's E-mail**
Mboden1@irf.com

**16. Cross Reference Vendor**
Not Available

**17. Cross Reference Cage**
Not Available

**18. Cross Reference Part**
Not Available

**19. Problem Description / Discussion / Effect**
This revision provides new information from International Rectifier concerning the safe operating area curves. The attached curves have been updated with the DC mode curve. Page 1 contains original document. Page 2 through page 14 contain Amendment A. This document is complete.

This advisory follows numerous inquiries concerning the operating area of the MOSFET for voltages below the zero temperature coefficient point (sometimes referred to as the linear mode of operation). Devices operated below the zero temperature coefficient gate voltage could be susceptible to failure due to a non-uniform current distribution over the die. This results in a safe operating area (SOA) less than predicted by the thermal characteristic of the package. This condition has always existed in all power MOSFETs and has been discussed in the literature [1].

The safe operating area, as presented in datasheets and QPL slash sheets accounts for current focusing for pulses shorter or equal to 10msec. The SOA curves represented for Power MOSFETs do not provide sufficient information for circuit operation with pulses longer than 10msec or in Direct Current (DC) mode.

[1] References


**20. Action Taken/Planned**
International Rectifier (HiRel Products) plans to update their SOA curves to include a DC curve to further assist designers in utilizing our devices. If device application requires operating the Power MOSFET in the linear mode, then the MOSFET should be characterized to ensure proper and safe operation.

**21. Date Mfr. Notified**
Not Applicable

**22. Manufacturer's Response**

- [ ] Reply Attached
- [ ] Not Applicable
- [ ] No Reply

**23. Originator Address/Point of Contact**
Paul Hebert, International Rectifier – HiRel Products
(978) 514-6180
phebert@irf.com

**24. GIDEP Representative**
Paul Hebert

**25. Signature**

**26. Date**
22 APR. 2009
1. The following IR Power MOSFET safe operating area (SOA) curves have been updated with the Direct Current (DC) mode curve.

2. Additional parts SOA curves (with DC characterization) will be updated and maintained in the IR website under the Alerts & Notifications section - http://www.irf.com/product-info/hi-rel/alerts.html.

Part numbers contained in this GIDEP amendment include:

- IRHY57Z30CM – 2N7482T3
- IRHY57034CM – 2N7483T3
- IRHNA57260SE – 2N7473U2
- IRHNJ597034 – 2N7520U3
- IRHLNA77064 – 2N7604U2
- IRHM9260 – 2N7426

- IRHNJ67230 – 2N7591U3
- IRHNJ67130 – 2N7587U3
- IRHMS67264 – 2N7585T1
- IRHLNA797064 – 2N7622U2
- IRHMS597260 – 2N7549T1
- IRHN9250 – 2N7423U
IRHLNA77064 - SOA CURVE

Operation in this area limited by $R_{DS(on)}$

Conditions:
- $T_c = 25^\circ C$
- $T_j = 150^\circ C$
- Single Pulse

$V_{DS}$, Drain-to-Source Voltage (V)

$\text{ID}_{\text{DC}}$, Drain-to-Source Current (A)
IRHLNA797064 - SOA CURVE

Operation in this area limited by $R_{DS(on)}$.

- $I_D$, Drain-to-Source Current (A)
- $-V_{DS}$, Drain-to-Source Voltage (V)

$T_c = 25^\circ C$
$T_j = 150^\circ C$
Single Pulse

100µs, 1ms, 10ms
IRHM9260 - SOA CURVE

- Drain-to-Source Current (A)

- Drain-to-Source Voltage (V)

Operation in this area limited by $R_{DS(on)}$.

Tc = 25°C
Tj = 150°C
Single Pulse
IRHMS67264 - SOA CURVE

\[ I_D, \text{ Drain-to-Source Current (A)} \]

\[ V_{DS}, \text{ Drain-to-Source Voltage (V)} \]

OPERATION IN THIS AREA LIMITED BY \( R_{DS(on)} \)

- \( Tc = 25^\circ C \)
- \( Tj = 150^\circ C \)
- Single Pulse
- DC

- 100\( \mu \)s
- 1ms
- 10ms
IRHN9250 - SOA CURVE

OPERATION IN THIS AREA LIMITED BY $R_{DS(on)}$

$-I_D$, Drain-to-Source Current (A)

$-V_{DS}$, Drain-to-Source Voltage (V)

$T_c = 25^\circ C$

$T_J = 150^\circ C$

Single Pulse

100$\mu$s, 1ms, 10ms
IRHNA57260SE - SOA CURVE

Operation in this area limited by $R_{DS(on)}$.
IRHNJ67130 - SOA CURVE

Operation in this area limited by $R_{DS(on)}$.

$I_D$, Drain-to-Source Current (A)

$V_DS$, Drain-to-Source Voltage (V)

$T_c = 25^\circ C$

$T_i = 150^\circ C$

Single Pulse

$100 \mu s$

$1 ms$

$10 ms$

DC
IRHNJ597034 - SOA CURVE

-\text{D. Drain-to-Source Current (A)}

\begin{align*}
\text{-V}_{DS} & \quad \text{Drain-to-Source Voltage (V)} \\
0.1 & \quad 1 \quad 10 \quad 100 \\
1 & \quad 10 \quad 100
\end{align*}

\text{OPERATION IN THIS AREA LIMITED BY R}_{DS}^{(on)}.

\text{TC} = 25^\circ\text{C}
\text{Tj} = 150^\circ\text{C}
\text{Single Pulse}