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Contact us

International IƏR Rectifier

IR3310(S)

PROGRAMMABLE CURRENT SENSING HIGH SIDE SWITCH

Features
- Load current feedback
- Programmable over current shutdown
- Active clamp
- E.S.D protection
- Input referenced to Vcc
- Over temperatue shutdown
- Reverse battery protection

Description

The IR 3310(S) is a Fully Protected 4 terminal high side switch. The input signal is referenced to Vcc. When the input voltage Vcc - Vin is higher than the specified Vih threshold, the output power MOSFET is turned-on. When Vcc - Vin is lower than the specified Vil threshold, the output MOSFET is turned-off. A sense current proportional to the current in the power Mosfet is sourced to the Ifb pin. Over-current shutdown occurs when Vfb - Vin > 4.5 V. The current shutdown threshold is adjusted by selecting the proper RIfb. Either over-current and over-temperature latches off the switch. The device is reset by pulling the input pin high. Other integrated protections (ESD, reverse battery, active clamp) make the IR 3310(S) very rugged and suitable for the automotive environment.
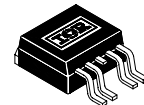
Product Summary

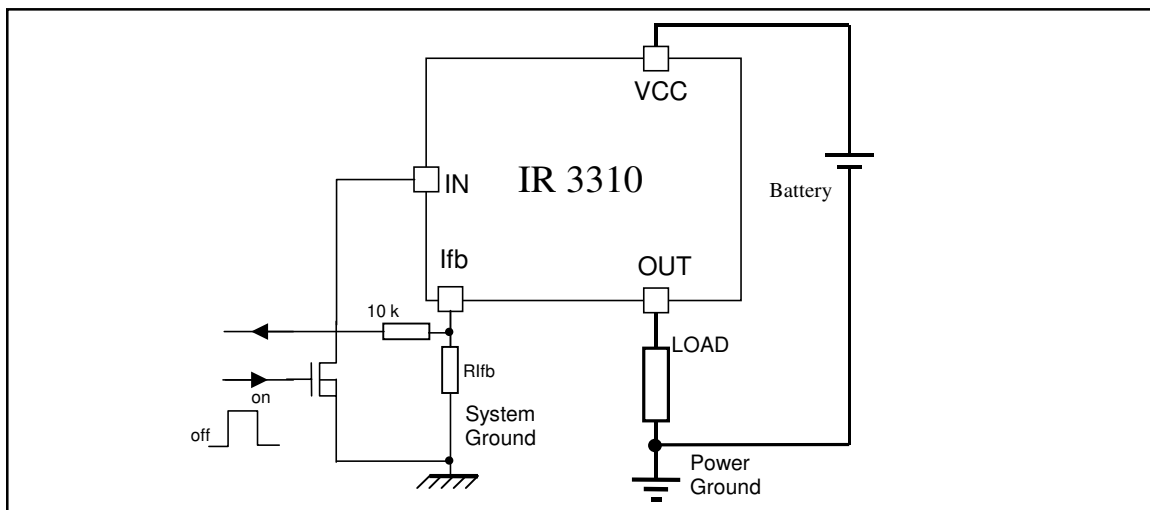|	
$R_{ds(on)}$	$7m\Omega$ max.
$V_{cc.op.}$	6 to 28V
Current ratio	8800
$I_{shutdown}$	10 to 100A
Active clamp	35V
Load Dump	40V

Package
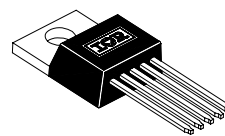
5 Lead TO220
IR3310

5 Lead
D2Pak (SMD220)
IR3310S

Typical Connection

IR3310(S)

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are referenced to Vcc lead. (T$_{Ambient}$ = 25°C unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
Vcc - Vin max	Maximum input voltage	-16	50	
Vcc-VIfb max	Maximum Ifb voltage	-0.3	50	V
Vcc - Vout max.	Maximum output voltage	-0.3	33	
Ids cont.	Diode max. permanent current (Rth = 60 °C/W) (1)	—	2.8	
Ids1 cont	Diode max. permanent current (Rth = 5 °C/W) (1)	—	35	A
Ids pulsed	Diode max. pulsed current (1)	—	100	
ESD 1	Electrostatic discharge (human body model)C=100pF, R=1500Ω	—	4	
ESD 2	Electrostatic discharge (machine model)C=200pF, R=0Ω, L=10μH	—	0.5	kV
Pd	Power dissipation (Rth = 60 °C/W)	—	2	W
TJ max.	Max. storage and junction temperature	-40	150	°C
Min RIfb	Minimum resistor on the Ifb pin	0.3	—	kΩ
Ifb max	Max. Ifb current	-20	+20	mA

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
R$_{th}$ 1	Thermal resistance junction to Ambient - TO220	60	—	
R$_{th}$ 2	Thermal resistance junction to case - TO220	0.7	—	
R$_{th}$ 1	Thermal resistance with standard footprint - SMD220	60	—	°C/ W
R$_{th}$ 2	Thermal resistance with 1" square footprint - SMD220	35	—	
R$_{th}$ 3	Thermal resistance junction to case - SMD220	0.7	—	

Recommended Operating Conditions

These values are given for a quick design. For operation outside these conditions, please consult the application notes.

Symbol	Parameter	Min.	Max.	Units
Vcc -Vin	Continuous input voltage	6	28	
Vcc -VIfb	Continuous Ifb pin voltage	0.3	28	V
Vcc	Supply to power ground voltage	6	28	
Iout	Continuous output current (Rth/amb < 5 °C/W, Tj = 125°C)	—	23	
Iout 85°C amb.	Continuous output current (Rth/amb < 60 °C/W, Tj = 125°C)	—	6.5	A
RIfb	Ifb resistor to program Isd and scale (2 & 3)	0.5	3.5	kΩ
Pulse min.	Minimum turn-on pulse width	1	—	ms
Fmax	Maximum operating frequency	—	500	
Fmax Prot.	Maximum frequency with protections activated	—	200	Hz

1) Limited by junction temperature. Pulsed current is also limited by wiring
2) <500 Ohm or shorting Ifb to gnd may damage the part with Isd around 120A
3) >5000 Ohm or leaving Ifb open will shutdown the part. No current will flow in the load.

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Protection Characteristics

$T_j = 25^oC$ (unless otherwise specified), RIfb = 500 to 5kOhm.

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
VIfb -Vin @ Isd	Over-current shutdown threshold	4	4.5	5.4	V	
Tsd	Over-temp. shutdown threshold	—	165	—	°C	see Fig. 7
Treset	Protection reset time	—	50	300	μS	see Fig. 7
OV	Over voltage shutdown (not latched)	33	36	41	V	
Isdf	Fixed over current shutdown	100	120	140	A	VIfb<Vin
Isd_1k	Adjustable over current shutdown 1K	30	40	50	A	RIfb=1k
Min.Pulse	Minimum pulse width (no WAIT state)	200	500	1200	μs	see Fig. 6
WAIT	WAIT function timer	0.5	1.2	3.5	ms	see Figs. 6 and 7
Rev.Rds$_{on}$	Rds(on) reverse battery protection	4	6.2	10	mΩ	Vcc-Vin=-12V, Iload=15A

Static Electrical Characteristics

($T_j = 25^oC$, V_{CC} = 14V unless otherwise specified.)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Iq	Total quiescent current (Iout +Ifb)	—	22	50	μA	Vcc-Vin=0, Vcc-Vout=12V Vcc-VIfb=12V
Iin	Input current	1.5	4	6	mA	Vcc-Vin=14V
Vih	High level input threshold voltage (4)	—	5	5.5		
Vil	Low level input threshold voltage (4)	3.5	4	—	V	
Vhys	Input hysterisis = Vih-Vil	0.4	1	1.5		
Iout qs	Output quiescent current	—	9	15	μA	Vcc-Vin=0; Vcc-VIfb=0; Vcc-Vout=12V
Rds1 on	ON state resistance (5)	4	5.5	7		Iout=30A, Vcc-Vin=14V
Rds2 on	ON state resistance (5)	4	5.7	10	mΩ	Iout=17A, Vcc -Vin=6V
Rds3 on	ON state resistance (5)	7	10.5	13.5		Iout=30A, $T_j = 150^oC$
Vclamp1	Vcc to Vout active clamp voltage	33	35	—		Iout = 10mA
Vclamp2	Vcc to Vout active clamp voltage	—	36	40	V	Iout=30A,Vcc-VIfb<20V
Vsd	Body diode forward voltage	—	0.85	1		Iout=5A
Vaval.	Vcc to Vout avalanche voltage	40	43	50		Iout=100mA,Vcc-Vfb> 35V

Switching Electrical Characteristics

V_{CC} = 14V, Resistive Load = 0.4Ω, $T_j = 25^oC$, (unless otherwise specified).

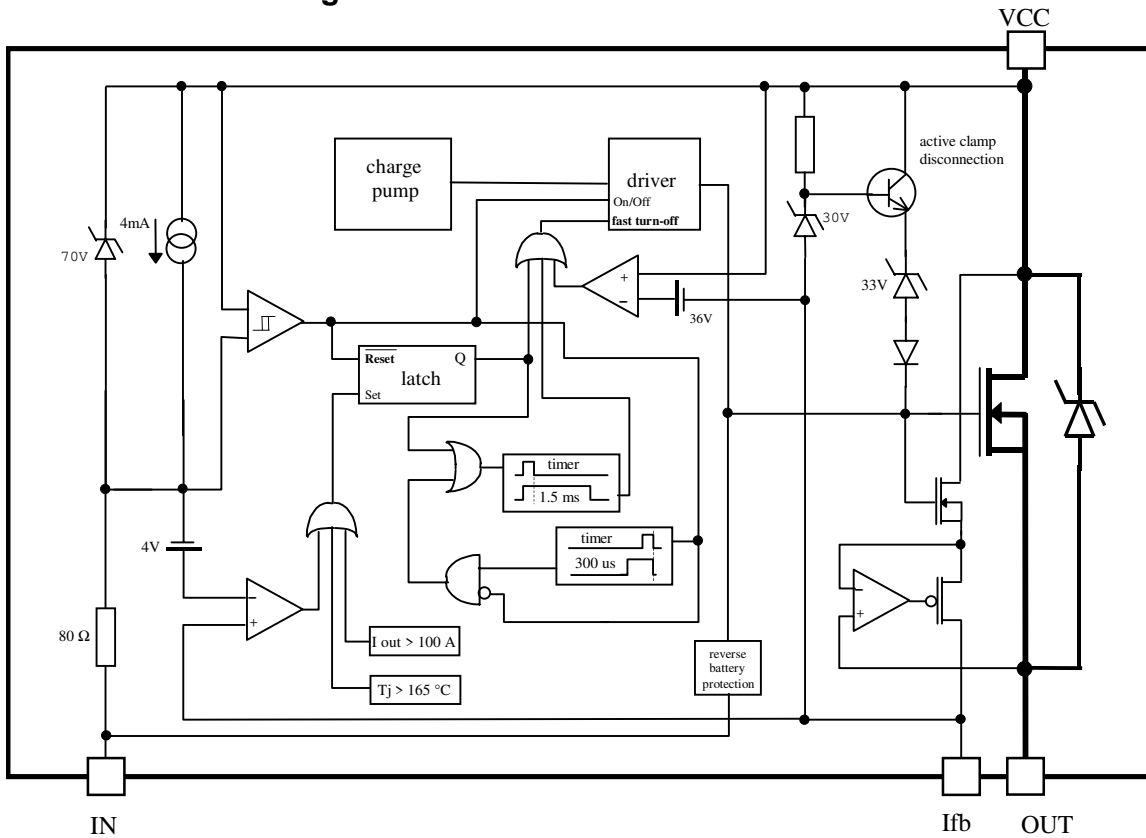| Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Td$_{on}$	Turn-on delay time to Vcc-Vout= 0.9 Vcc	1	8	30		
T$_{r1}$	Rise time to Vcc-Vout=5V	0.4	2	10	μs	
T$_{r2}$	Rise time to V_{CC} -V_{out} = 0.1V_{CC}	10	30	100		see figure 2
E$_{on}$	Turn ON energy	—	3	6	mJ	
Td$_{off}$	Turn-off delay to V_{CC} -V_{out} = 0.1V_{CC}	10	30	100	μs	
T$_f$	Fall time to Vcc-Vout = 0.9 V_{CC}	—	15	—		see figure 3
E$_{off}$	Turn OFF energy	—	2	4	mJ	

4) Input thresholds are measured directly between the input pin and the tab. Any parasitic resistance in common between the load current path and the input signal path can significantly affect the thresholds.
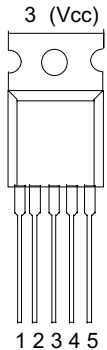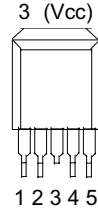5) Rds(on) is measured between the Tab and the Out pin, 5mm away from the package.

IR3310(S)

International
IOR Rectifier

Current Sense Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Ratio	I load / Ilfb current ratio	7,500	8,800	10,000	—	T_j = 25ºC ,Rfb = 500Ω, I = 70A
Ratio_TC	Iload/Ifb variation over temperature	-5	0	+5	%	T_j = -40 T0 +150ºC
offset	Load current diagnostic offset	-1.3	0	+1.3	A	I = 2A
Trst	Ifb response time (low signal)	—	5	15	µs	90% of the I load step

Functional Block Diagram

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Lead Assignments

3 (Vcc)

1 - In
2 - Ifb
3 - Vcc (tab)
4 - NC
5 - Out

3 (Vcc)

1 2 3 4 5

1 2 3 4 5

5 Lead - TO220

5 Lead - D^{2}PAK (SMD220)

IR3310	IR3310S
Part Number	

Vcc-Vin
Vcc-Vin max
Vcc-Vin1 max
Vcc-Vin (op)
Vih
Vil
Vhys

Vcc

$\overline{\text{In}}$ IR3310

Iin
Iin max
Iin1,2
Iin(on)

VIfb   Ifb   Out

Ifb

Vcc-Vout
Vcc-Vout max
Vclamp1
Vclamp2

Iout
Iout max
-Ids cont.
-Ids pulsed
Iout 85°C
Isd
Iq
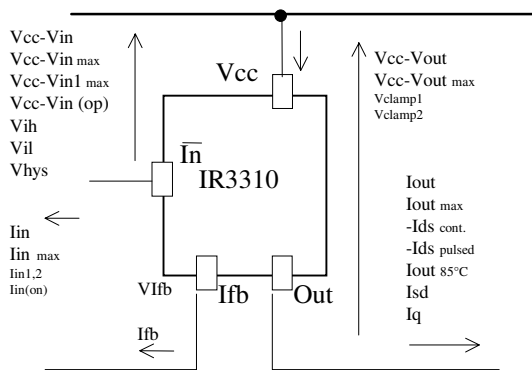
Figure 1 - Voltages and currents definitions

Vcc-Vin

Vcc
90%

Vcc-Vout

5V
10 %

DV/dt(on)

Td on
Tr1
Tr2
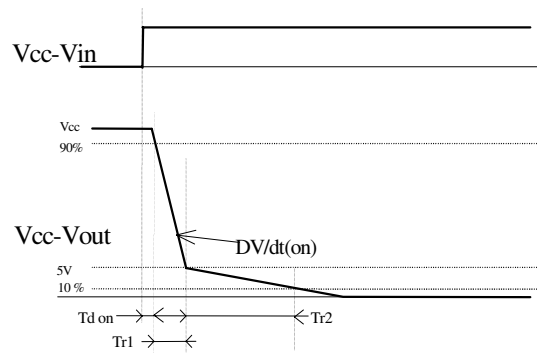
Figure 2 - Switching time definitions (turn-on)
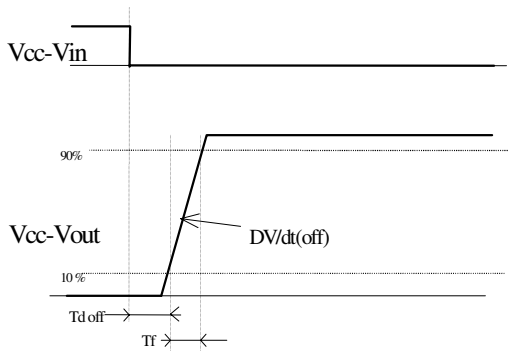
Figure 3 - Switching time definitions (turn-off)

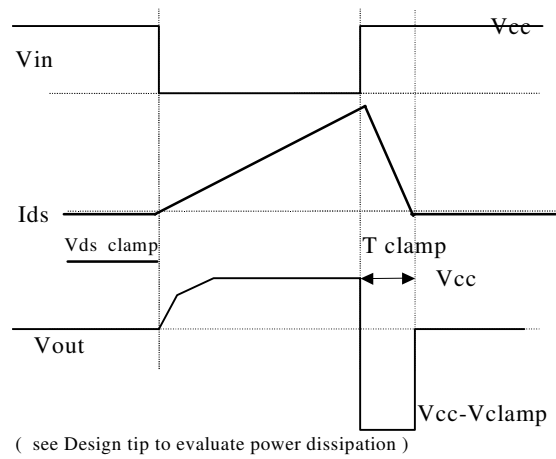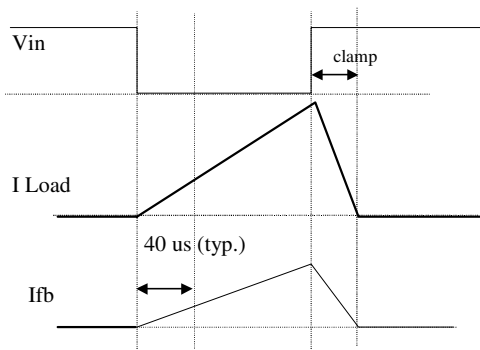(see Design tip to evaluate power dissipation)

Figure 4 - Active clamp waveforms

Precise measurement

Figure 5 - Current sense precision:
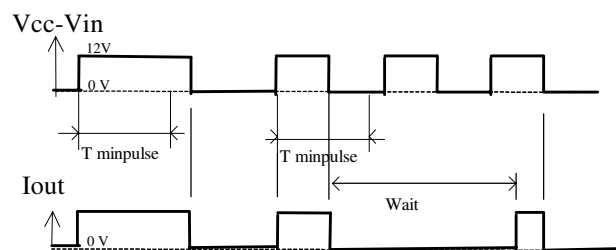Accurate measurement only when the power Mosfet is fully ON

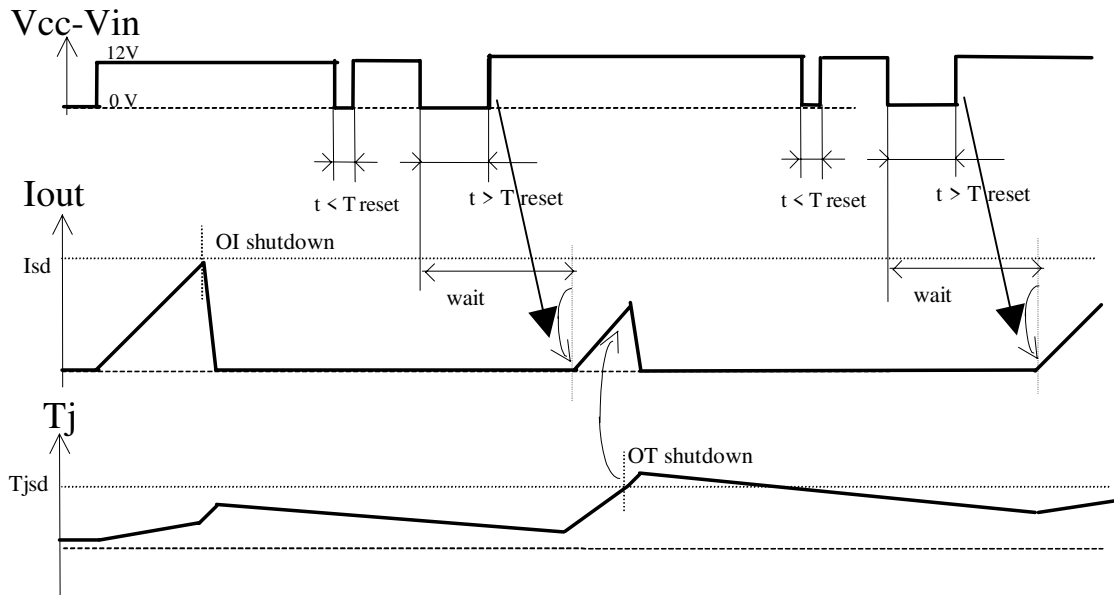
Figure 6 - Minimum pulse & WAIT
function

Vcc-Vin

12V

0 V

t < T reset   t > T reset   t < T reset   t > T reset

Iout

Isd

OI shutdown

wait   wait

Tj

Tjsd

OT shutdown

Figure 7 - Protection Timing Diagrams

All curves are typical characteristics. Operation in hatched areas is not recommended. Tj=25^0C, RIfb=500 Ohm, Vcc=14V (unless otherwise specified).
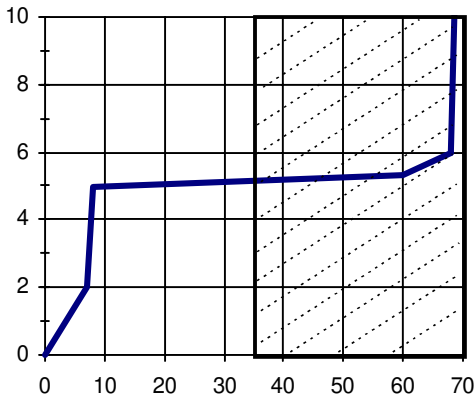
Figure 8 - Icc (mA) vs Vcc-Vin (V)
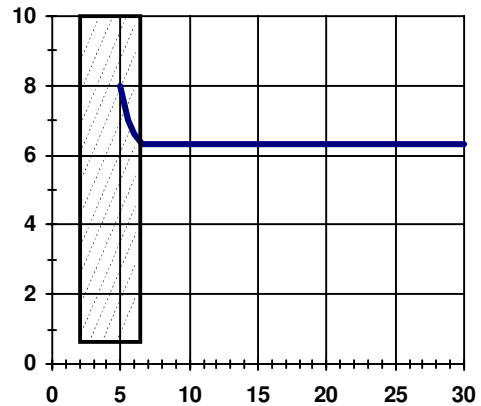
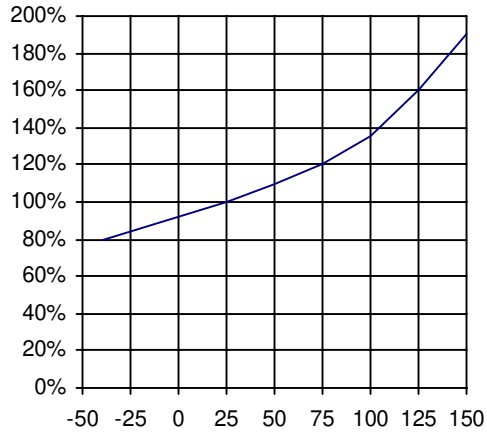Figure 9- Rds$_{on}$ (mΩ) vs Vcc-Vin (V)

IR3310(S)

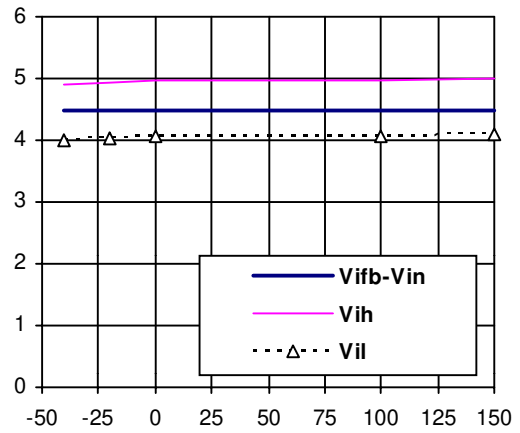Figure 10 -Normalized Rdson (%) vs Tj   (°C)

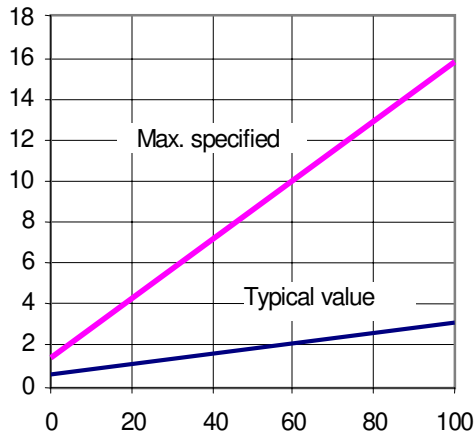Figure 11 - Vih, Vil & Vifb -Vin (V) vs Tj (°C)

Figure 12 - Error (+/-A) vs Iload (A)

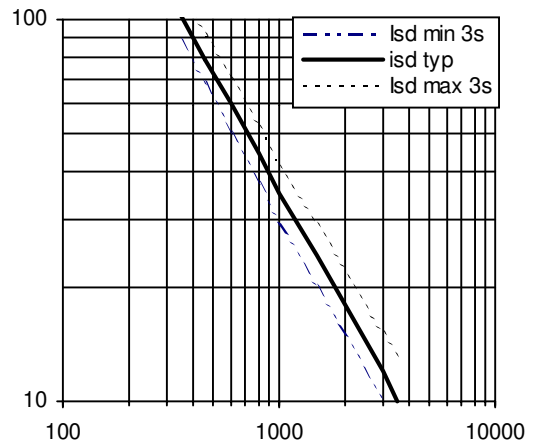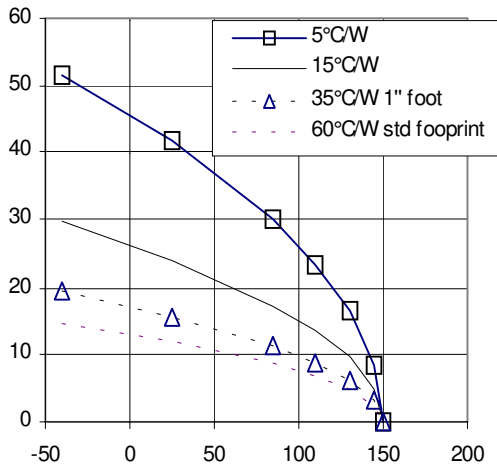Figure 13 - Isd (A) vs RIfb (Ohm)

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Figure 14 - Max. DC current (A) vs Temp. (°C)
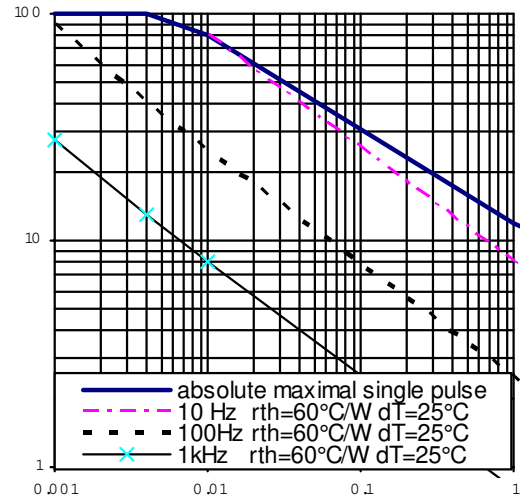
Figure 15 - Max. I (A) vs inductance (mH)
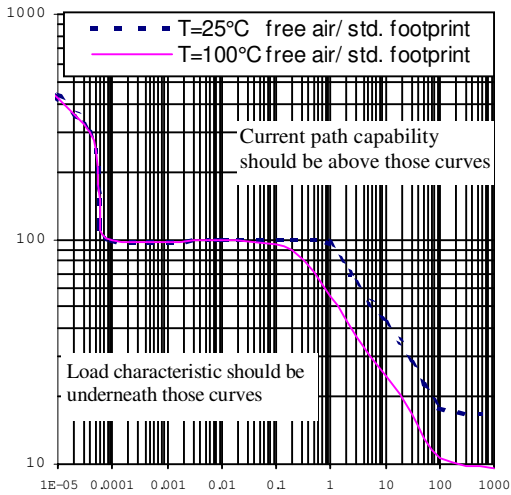
Figure 16 - I out (A) vs Protection resp. Time (s)

Figure 17 - Rth (°C/W) vs Time (s)

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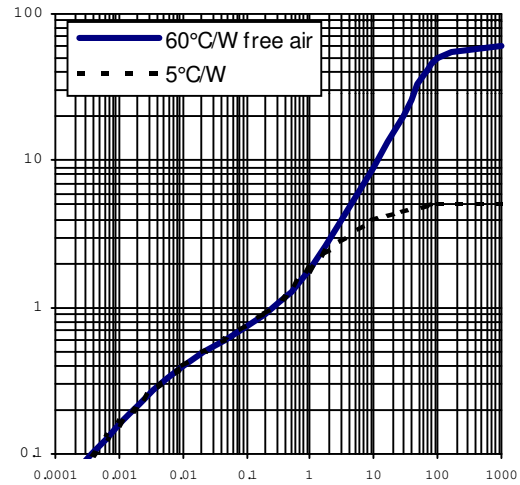
Case Outline - TO220 (5 lead)

10.54 [.415]
9.91 [.390]

A

Ø 3.96 [.156]
3.53 [.139]

2.94 [.116]
2.54 [.100]

6.60 [.260]
6.00 [.236]

15.87 [.625]
14.48 [.570]

C

1 2 3 4 5

14.09 [.555]
13.59 [.535]

5X 1.01 [.040]
0.51 [.020]

1.70 [.067]

4X

⊕ 0.25 [.010]Ⓜ B AⒸ C

B

4.82 [.190]
4.19 [.165]

1.39 [.055]
0.89 [.035]

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE SIMILAR TO JEDEC OUTLINE SERIES TS-001.

5X 0.63 [.025]
0.31 [.012]

2.92 [.115]
2.16 [.085]

IRGB 01-3042 01

Case Outline   5 Lead - D²PAK (SMD220)

NOTES:
1.0 DIMENSIONING AND TOLERANCE PER ANSI 14.5 M, 1982
     (DIMENSIONES Y TOLERANCIAS BASADAS EN ANSI 14.5 M, 1982)
2.0 CONTROLLING DIMENSIONS IN INCHES.
     (DIMENSIONES CONTROLADAS EN PULGADAS)
3.0 OUTLINE CONFORMS TO JEDEC OUTLINE 115-0178
     (DIBUJO CONFORME A JEDEC ^

4.0 DIMENSIONS DO NOT INCLUDE PLATING THICKNESS MAX. 0.16(.006) OR BURRS
     (LAS DIMENSIONES NO INCLUYEN ESPESOR DE PLATINADO
     MAX. 0.16(.006) O REBABAS)

5.0 DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES)
     (LAS DIMENSIONES SON MOSTRADAS EN MILIMETROS (PULGADAS))

6.0 PARALLELISM AND ANGULARITY MAX. 0.1(.004)
     (PARALELISMO Y ANGULARIDAD MAX. 0.1(.004))

115-0247 IRMX

IR3310(S)

Tape & Reel   5 Lead - D²PAK (SMD220)

1.60 [.063]
1.50 [.059]

4.10 [.161]
3.90 [.153]

∅ 1.60 [.063]
1.50 [.059]

0.368 [.0145]
0.342 [.0135]

TRR

1.85 [.073]
1.65 [.065]

11.60 [.457]
11.40 [.449]

15.42 [.609]
15.22 [.601]

24.30 [.957]
23.90 [.941]

FEED   DIRECTION

10.90 [.429]
10.70 [.421]

∅ 1.75 [.069]
1.25 [.049]

4.72 [.186]
4.52 [.178]

16.10 [.634]

∅ 13.52 [.532]
12.80 [.504]

∅ 60.00
[3.362]
MIN.

∅ 360.00
[14.173]
MAX.

NOTES:
1. OUTLINE CONFORMS TO EIA-481 & EIA-541.
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

26.40 [1.039]
24.40 [.961]

01-3071 00 / 01-3072 00

Note: For the most current drawings please refer to the IR website at:
http://www.irf.com/package/