# International IƆR Rectifier
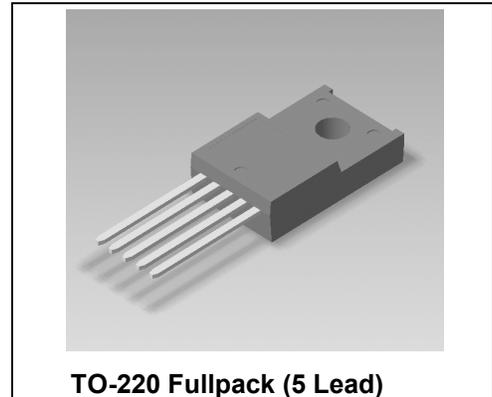
# IRIS-G6351S

# INTEGRATED SWITCHER

## Features

• Oscillator is provided on the monolithic control with adopting On-Chip-Trimming technology.

• Small temperature characteristics variation by adopting a comparator to compensate for temperature on the control part.

• Low start-up circuit current (50uA max)

• Built-in Active Low-Pass Filter for stabilizing the operation in case of light load

• Avalanche energy guaranteed MOSFET with high VDSS

   • The built-in power MOSFET simplifies the surge absorption circuit since the MOSFET guarantees the avalanche energy.

   • No VDSS de-rating is required.

• Built-in constant voltage drive circuit

• Various kinds of protection functions

   • Pulse-by-pulse Overcurrent Protection (OCP)

   • Overvoltage Protection with latch mode (OVP)

   • Thermal Shutdown with latch mode (TSD)

## Package Outline

**TO-220 Fullpack (5 Lead)**

## Key Specifications

| Type | MOSFET VDSS(V) | RDS(ON) MAX | AC input(V) | Pout(W) Note 1 |
|---|---|---|---|---|
| | | | $230\pm15\%$ | 65 |
| IRIS-G6351S | 650 | $3.95\,\Omega$ | 85 to 264 | 30 |

Note 1: The Pout (W) represents the thermal rating at PRC Operation, and the peak power output is obtained by approximately 120 to 140% of the above listed. When the output voltage is low and ON-duty is narrow, the Pout (W) shall become lower than that of above.

## Descriptions

IRIS-G6351S is a hybrid IC consists from power MOSFET and a controller IC, designed for PRC fly-back converter type SMPS (Switching Mode Power Supply) applications. This IC realizes downsizing and standardizing of a power supply system reducing external components count and simplifying the circuit designs.

(Note). PRC is abbreviation of "Pulse Ratio Control" (On-width control with fixed OFF-time).

## Typical Connection Diagram
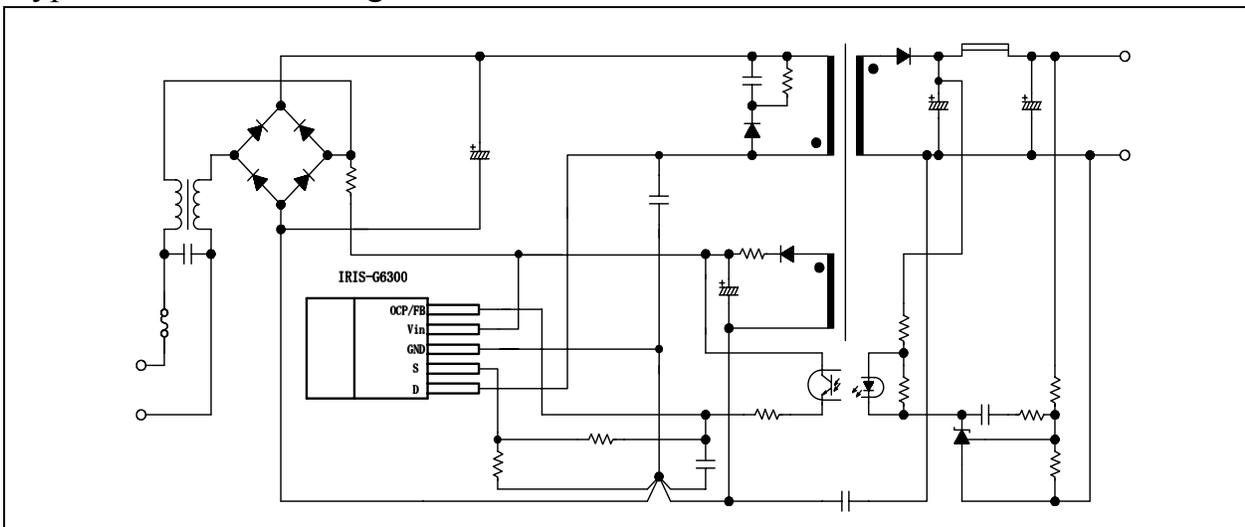
## Absolute Maximum Ratings (Ta=25ºC)

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to terminals stated, all currents are defined positive into any lead. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

| Symbol | Definition | Terminals | Max. Ratings | Units | Note |
|---|---|---|---|---|---|
| $I_{Dpeak}$ | Drain Current                *1 | 1-2 | 2.7 | A | Single Pulse |
| $I_{DMAX}$ | Maximum switching current  *5 | 1-2 | 2.7 | A | $V_{2-3}=0.82V$ $Ta=-20\sim+125℃$ |
| $E_{AS}$ | Single pulse avalanche energy   *2 | 1-2 | 92 | mJ | Single Pulse $V_{DD}=99V, L=20mH$ $I_{L\,peak}=2.7A$ |
| Vin | Input voltage for control part | 4-3 | 35 | V | |
| Vth | O.C.P/F.B Pin voltage | 5-3 | 6 | V | |
| $P_{D1}$ | Power dissipation for MOSFET *3 | 1-2 | 24 | W | With infintite heatsink |
| | | | 1.5 | W | Without heatsink |
| $P_{D2}$ | Power dissipation for control part (Control IC) *4 | 4-3 | 0.14 | W | Specified by $Vin \times Iin$ |
| $T_F$ | Internal frame temperature in operation | - | $-20\sim+125$ | ℃ | Refer to recommended operating temperature |
| Top | Operating ambient temperature | - | $-20\sim+125$ | ℃ | |
| Tstg | Storage temperature | - | $-40\sim+125$ | ℃ | |
| Tch | Channel temperature | - | 150 | ℃ | |

*1 Refer to MOS FET A.S.O curve

*2 MOS FET Tch-EAS curve

*3 Refer to MOS FET Ta-PD1 curve

*4 Refer to TF-PD2 curve for Control IC (See page 5)

*5 Maximum switching current.

Fig.1

$V_{2\text{-}3}$
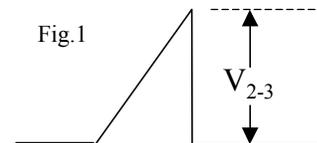
 The maximum switching current is the Drain current determined by the drive voltage of the IC and threshold voltage (Vth) of MOS FET. Therefore, in the event that voltage drop occurs between Pin 2 and Pin 3 due to patterning, the maximum switching current decreases as shown by $V_{2\text{-}3}$ in Fig.1 Accordingly please use this device within the decrease value, referring to the derating curve of the maximum switching current.

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**I⊕R** Rectifier

## Electrical Characteristics (for Control IC)

Electrical characteristics for control part (Ta=25℃, Vin=20V,unless otherwise specified)

| Symbol | Definition | Ratings | | | Units | Test Conditions |
|---|---|---|---|---|---|---|
| | | MIN | TYP | MAX | | |
| $V_{in(ON)}$ | Operation start voltage | 15.8 | 17.6 | 19.4 | V | Vin=0→19.4V |
| $V_{in(OFF)}$ | Operation stop voltage   *6 | 9.1 | 10.1 | 11.1 | V | Vin=19.4→9.1V |
| $I_{in(ON)}$ | Circuit current in operation | - | - | 5 | mA | - |
| $I_{in(OFF)}$ | Circuit current in non-operation | - | - | 50 | μA | Vin=15V |
| $T_{OFF(MAX)}$ | Maximum OFF time | 12 | 15 | 18 | μsec | - |
| $V_{th}$ | O.C.P/F.B Pin threshold voltage | 0.7 | 0.76 | 0.82 | V | - |
| $I_{OCP/FB}$ | O.C.P/F.B Pin extraction current | 0.7 | 0.8 | 0.9 | mA | - |
| $V_{in(OVP)}$ | O.V.P operation voltage | 23.2 | 25.5 | 27.8 | V | Vin=0→27.8V |
| $I_{in(H)}$ | Latch circuit sustaining current *7 | - | - | 70 | μA | Vin=27.8→(Vin(OFF)-0.3)V |
| $V_{in(La.OFF)}$ | Latch circuit release voltage    *6,7 | 7.9 | - | 10.5 | V | Vin=27.8→7.9V |
| $T_{j(TSD)}$ | Thermal shutdown operating temperature | 135 | - | - | ℃ | - |

*6 The relation of $V_{IN(OFF)}$＞$V_{IN(La.OFF)}$ is applied for each product
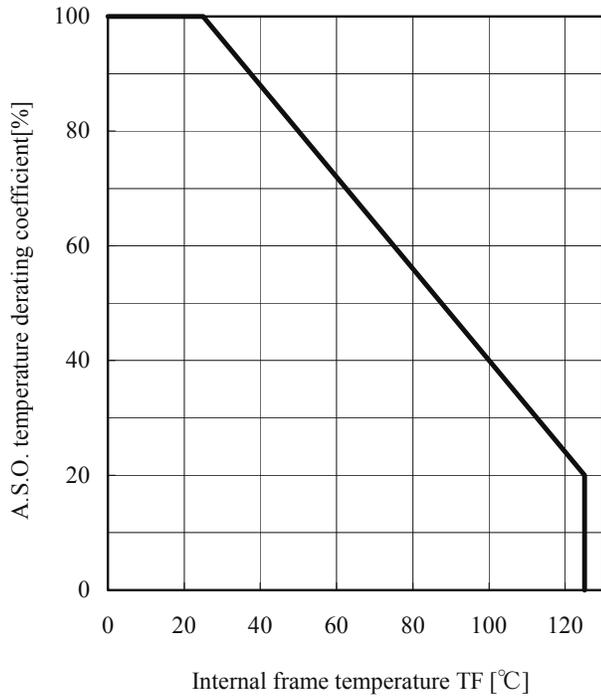*7 The latch circuit means a circuit operated O.V.P and T.S.D.

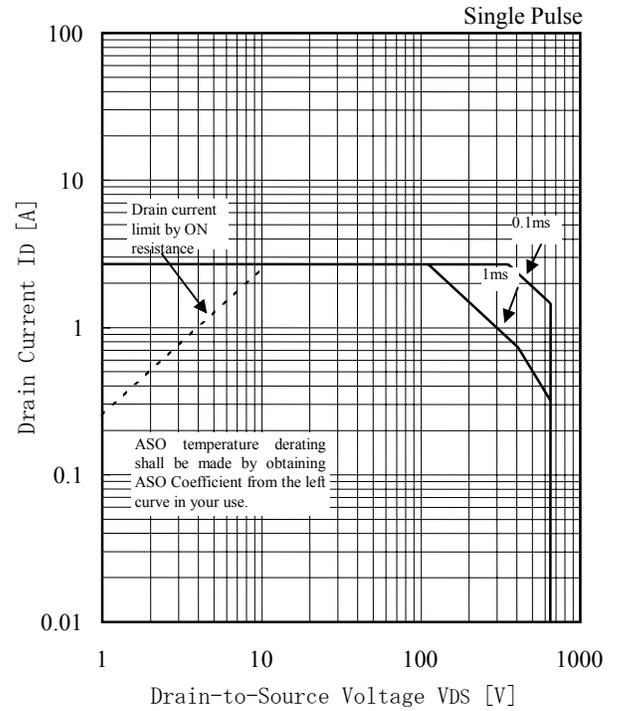## Electrical Characteristics (for MOSFET)

(Ta=25℃) unless otherwise specified

| Symbol | Definition | Ratings | | | Units | Test Conditions |
|---|---|---|---|---|---|---|
| | | MIN | TYP | MAX | | |
| $V_{DSS}$ | Drain-to-Source breakdown voltage | 650 | - | - | V | ID=300μA V3-2=0V(short) |
| $I_{DSS}$ | Drain leakage current | - | - | 300 | μA | VDS=650V V3-2=0V(short) |
| $R_{DS(ON)}$ | On-resistance | - | - | 3.95 | Ω | V3-2=10V ID=0.6A |
| tf | Switching time | - | - | 250 | nsec | - |
| $\theta_{ch-F}$ | Thermal resistance | - | - | 2.4 | ℃/W | Between channel and internal frame |

# IRIS-G6351S

IRIS-G6351S
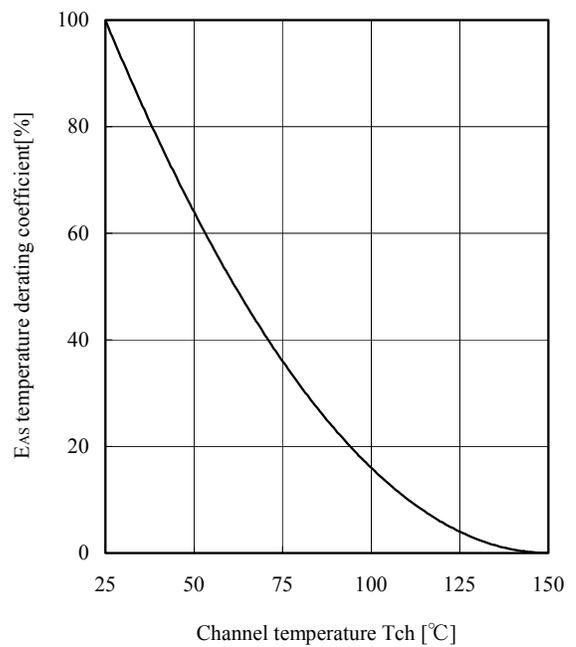A.S.O. temperature derating coefficient curve

IRIS-G6351S
MOSFET   A.S.O. Curve          Ta=25ºC

Single Pulse

Drain current limit by ON resistance

0.1ms

1ms

ASO temperature derating shall be made by obtaining ASO Coefficient from the left curve in your use.

A.S.O. temperature derating coefficient[%]

Internal frame temperature TF [℃]

Drain Current ID [A]

Drain-to-Source Voltage VDS [V]

IRIS-G6351S
Maximum Switching current derating curve
Ta= -20～+125℃
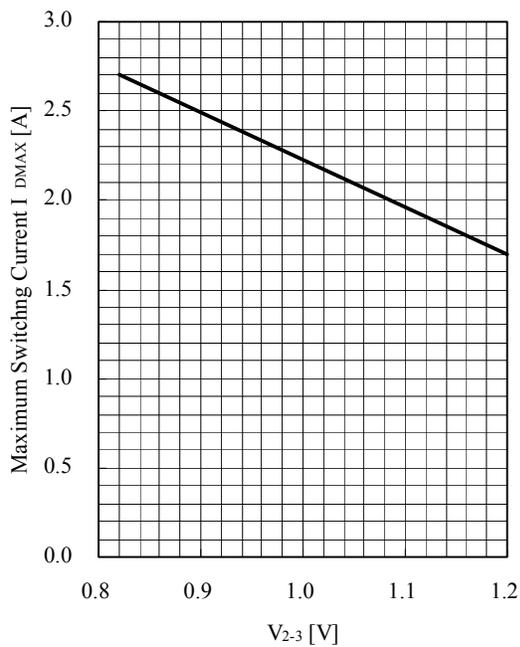
IRIS-G6351S
Avalanche energy derating curve

Maximum Switchng Current I DMAX [A]

$V_{2-3}$ [V]

EAS temperature derating coefficient[%]

Channel temperature Tch [℃]

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# IRIS-G6351S

IRIS-G6351S
MOSFET Ta-P$_{D1}$ Curve

P$_{D1}$=24[W]

With infinite heatsink

Without heatsink

P$_{D1}$=1.5[W]

Power dissipation P$_{D1}$[W]

Ambient temperature Ta[℃]
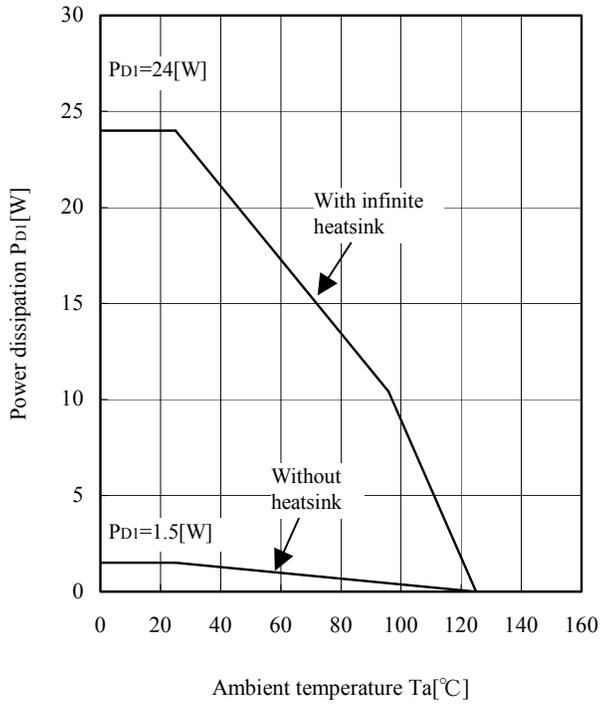
IRIS-G6351S
MIC TF-PD2 Curve

P$_{D2}$=0.14[W]

Power dissipation PD2[W]

Internal frame temperature TF[℃]
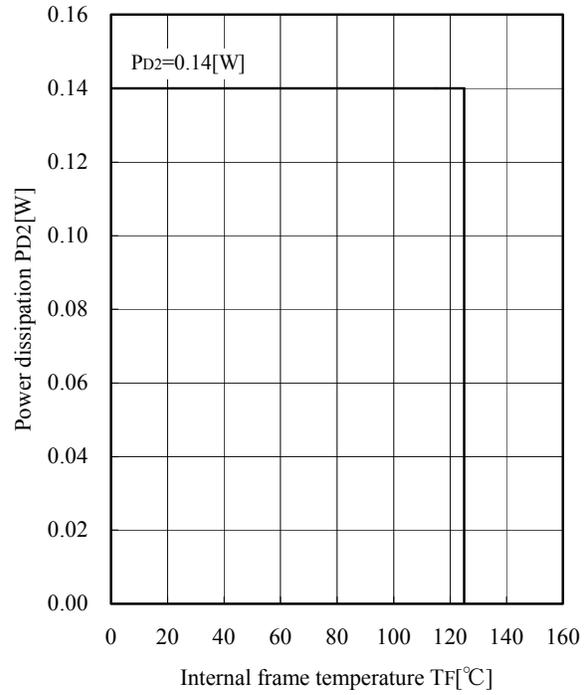
IRIS-G6351S
Transient thermal resistance curve

Transient thermal resistance θch-c[℃/W]

time t [sec]
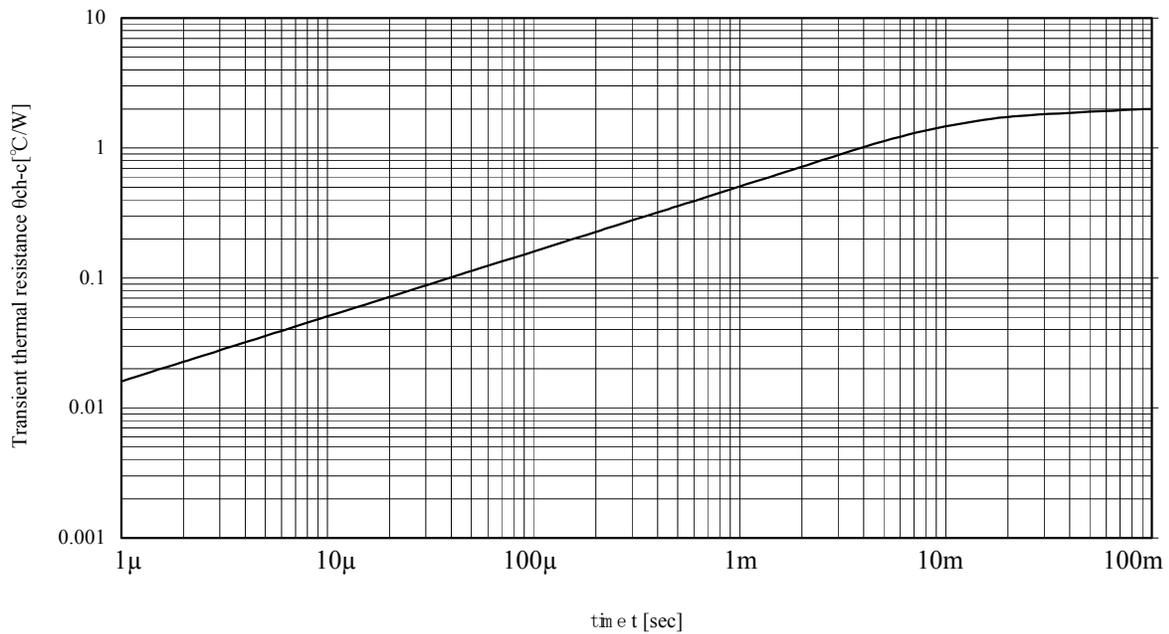
## Block Diagram
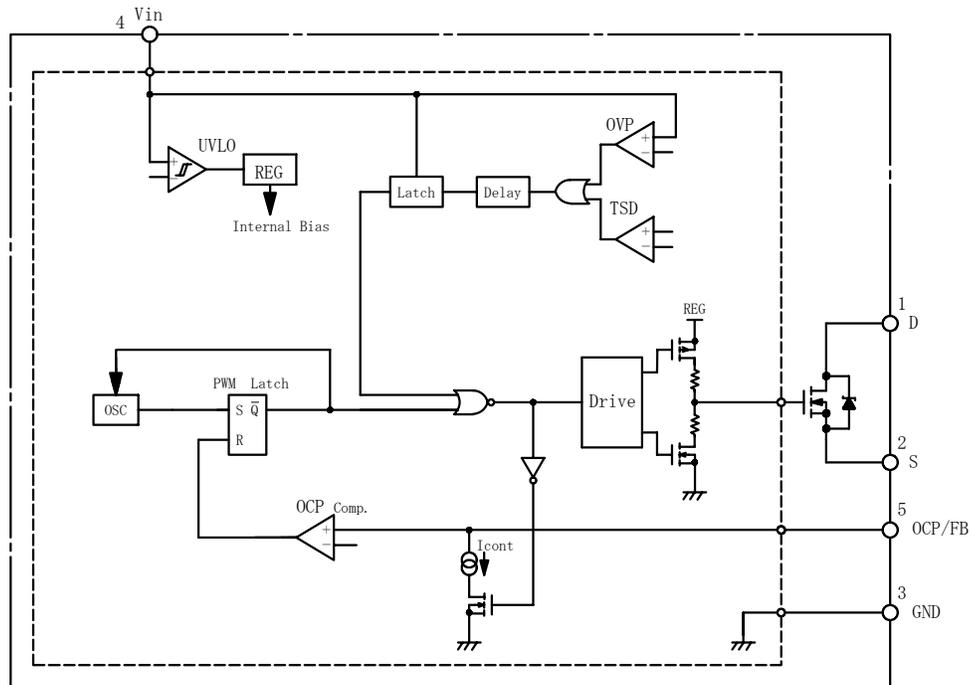


## Lead Assignments
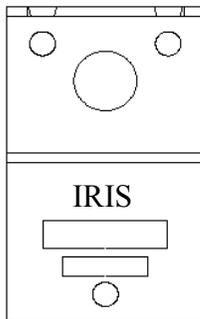


| Pin No. | Symbol | Description | Function |
|---------|--------|-------------|----------|
| 1 | D | Drain Pin | MOSFET drain |
| 2 | S | Source Pin | MOSFET source |
| 3 | GND | Ground Pin | Ground |
| 4 | Vin | Power supply Pin | Input of power supply for control circuit |
| 5 | OCP/FB | Overcurrent / Feedback Pin | Input of overcurrent detection signal / constant voltage control signal |

## Other Functions

O.V.P. – Overvoltage Protection Circuit

T.S.D. – Thermal Shutdown Circuit

International **IƆR** Rectifier

## Case Outline



φ3. 2 ±0. 2

4 ±0. 2

7. 9 ±0. 2

16. 9 ±0. 3

IRIS

a

b

0. 94 ±0. 15

0. 85 $^{+0.2}_{-0.1}$

4xp1. 7±0. 1=(6. 8)

10 ±0. 2

1  2  3  4  5

4. 2 ±0. 2

2. 8 ±0. 2

2. 6 ±0. 1

2−(R1)

R−end

4. 1 ±0. 5

(4. 6)

8. 7 ±0. 5

0. 45 $^{+0.2}_{-0.1}$

5. 08 ±0. 6

0. 7    0. 7

a : Type Number   G6351S
b : Lot Number
1st letter : The last digit of year
2nd letter : Month
      1 to 9 for Jan. to Sept.,
      O for Oct. N for Nov. D for Dec.
3rd & 4th letter : Day
Arabic Numerals
5th letter : Registration Symbol

Weight : Approx. 2.3g
Dimensions in mm
DWG.No. : TG3A-1128

Material of Pin : Cu
Treatment of Pin : Ni plating + solder dip

Data and specifications subject to change without notice.

International **IƆR** Rectifier

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