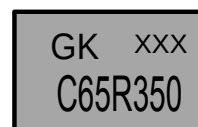


## Features

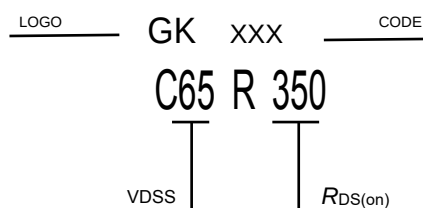
Ultra low  $R_{DS(on)}$   
Ultra low gate charge (typ.  $Q_g=20.6nC$ )  
100% UIS tested  
RoHS compliant

$V_{DSS}$  650 V  
 $I_D$  11.4 A  
 $R_{DS(on)}$  0.35  $\Omega$

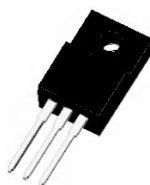


## Applications

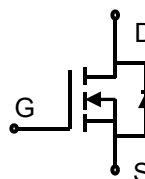
Power factor correction (PFC).  
Switched mode power supplies (SMPS).  
Uninterruptible power supply (UPS).



ITO-220AB



Equivalent Circuit



## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

**Absolute Maximum Ratings** (@  $T = 25^{\circ}C$  unless otherwise specified)

| Parameter                                                                                     | Symbol         | Value       | Unit        |
|-----------------------------------------------------------------------------------------------|----------------|-------------|-------------|
| Drain-Source Voltage                                                                          | $V_{DSS}$      | 650         | V           |
| Continuous drain current <sup>1)</sup><br>( $T_C = 25^{\circ}C$ )<br>( $T_C = 100^{\circ}C$ ) | $I_D$          | 11.4<br>7.2 | A<br>A      |
| Pulsed drain current <sup>2)</sup>                                                            | $I_{DM}$       | 45.6        | A           |
| Gate-Source voltage                                                                           | $V_{GSS}$      | $\pm 30$    | V           |
| Avalanche energy, single pulse <sup>3)</sup>                                                  | $E_{AS}$       | 270         | mJ          |
| Power Dissipation                                                                             | $P_D$          | 30          | W           |
| Operating and Storage Temperature Range                                                       | $T_J, T_{STG}$ | -55 to +150 | $^{\circ}C$ |
| Continuous diode forward current                                                              | $I_S$          | 11.4        | A           |
| Diode pulse current                                                                           | $I_{S,pulse}$  | 45.6        | A           |

## ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$ , unless otherwise specified)

| Parameter                        | Symbol               | Test Condition                                                                                | Min. | Typ.   | Max. | Unit |
|----------------------------------|----------------------|-----------------------------------------------------------------------------------------------|------|--------|------|------|
| Static characteristics           |                      |                                                                                               |      |        |      |      |
| Drain-source breakdown voltage   | BV <sub>DSS</sub>    | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA                                                    | 650  | -      | -    | V    |
| Gate threshold voltage           | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA                                      | 2.5  | 3.58   | 4.5  | V    |
| Drain cut-off current            | I <sub>DSS</sub>     | V <sub>DS</sub> =650V, V <sub>GS</sub> =0 V, T <sub>J</sub> =25°C                             | -    | -      | 1    | μA   |
| Gate leakage current, Forward    | I <sub>GSSF</sub>    | V <sub>GS</sub> =30V, V <sub>DS</sub> =0 V                                                    | -    | -      | 100  | nA   |
| Gate leakage current, Reverse    | I <sub>GSSR</sub>    | V <sub>GS</sub> =-30V, V <sub>DS</sub> =0 V                                                   | -    | -      | -100 | nA   |
| Drain-source on-state resistance | R <sub>DS(on)</sub>  | V <sub>GS</sub> =10V, I <sub>D</sub> =5.5A                                                    | -    |        |      |      |
|                                  |                      | T <sub>J</sub> = 25°C                                                                         | -    | 0.35   | 0.39 | Ω    |
|                                  |                      | T <sub>J</sub> = 150°C                                                                        | -    | 0.91   | -    |      |
| Gate resistance                  | R <sub>G</sub>       | f=1 MHz, open drain                                                                           | -    | 5.79   | -    | Ω    |
| Dynamic characteristics          |                      |                                                                                               |      |        |      |      |
| Input capacitance                | C <sub>iss</sub>     | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V,<br>f=250kHz                                       | -    | 900.43 | -    | pF   |
| Output capacitance               | C <sub>oss</sub>     |                                                                                               | -    | 37.41  | -    |      |
| Reverse transfer capacitance     | C <sub>rss</sub>     |                                                                                               | -    | 0.46   | -    |      |
| Turn-on delay time               | t <sub>d(on)</sub>   | V <sub>DD</sub> =400V, I <sub>D</sub> =5.5A<br><br>R <sub>G</sub> = 10Ω, V <sub>GS</sub> =10V | -    | 46.8   | -    | ns   |
| Rise time                        | t <sub>r</sub>       |                                                                                               | -    | 10.6   | -    |      |
| Turn-off delay time              | t <sub>d(off)</sub>  |                                                                                               | -    | 40.2   | -    |      |
| Fall time                        | t <sub>f</sub>       |                                                                                               | -    | 7.0    | -    |      |
| Gate charge characteristics      |                      |                                                                                               |      |        |      |      |
| Gate to source charge            | Q <sub>gs</sub>      | V <sub>DD</sub> =520V, I <sub>D</sub> =5.5A,<br><br>V <sub>GS</sub> =0 to 10 V                | -    | 4.6    | -    | nC   |
| Gate to drain charge             | Q <sub>gd</sub>      |                                                                                               | -    | 8.5    | -    |      |
| Gate charge total                | Q <sub>g</sub>       |                                                                                               | -    | 20.6   | -    |      |
| Gate plateau voltage             | V <sub>plateau</sub> |                                                                                               | -    | 5.3    | -    | V    |
| Reverse diode characteristics    |                      |                                                                                               |      |        |      |      |
| Diode forward voltage            | V <sub>SD</sub>      | V <sub>GS</sub> =0 V, I <sub>F</sub> =5.5A                                                    | -    | -      | 1.1  | V    |
| Reverse recovery time            | t <sub>rr</sub>      | V <sub>R</sub> =400V, I <sub>F</sub> =5.5A,<br><br>dI <sub>F</sub> /dt=100 A/μs               | -    | 240.2  | -    | ns   |
| Reverse recovery charge          | Q <sub>rr</sub>      |                                                                                               | -    | 1962.9 | -    | nC   |
| Peak reverse recovery current    | I <sub>rrm</sub>     |                                                                                               | -    | 18.35  | -    | A    |

### Notes:

- Limited by maximum junction temperature and duty cycle, TO-220 equivalent.
- Limited by maximum junction temperature, maximum duty cycle is 0.75.
- $I_{AS}=3A, L=60\text{ mH}, V_{DD}=60V$ , Starting  $T_J=25^{\circ}\text{C}$ .
- The value of  $R_{thJA}$  is measured by placing the device in a still air box which is one cubic foot.

## Thermal Characteristics

| Parameter                                                                              | Symbol          | Value | Unit                        |
|----------------------------------------------------------------------------------------|-----------------|-------|-----------------------------|
| Thermal Resistance, Junction-to-Case                                                   | $R_{\theta JC}$ | 4.2   | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient, minimal Footprint <sup>4)</sup>               | $R_{\theta JA}$ | 62    | $^{\circ}\text{C}/\text{W}$ |
| Soldering temperature, wave soldering only allowed at leads. (1.6mm from case for 10s) | $T_{sold}$      | 260   | $^{\circ}\text{C}$          |

## RATING AND CHARACTERISTIC CURVES

Fig 1: Output Characteristics

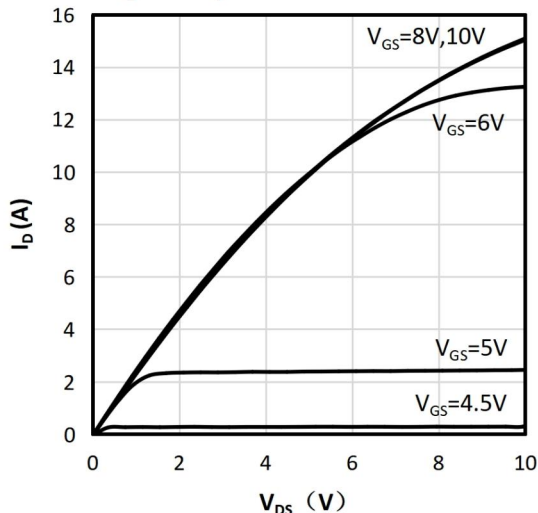


Fig 2: Transfer Characteristics

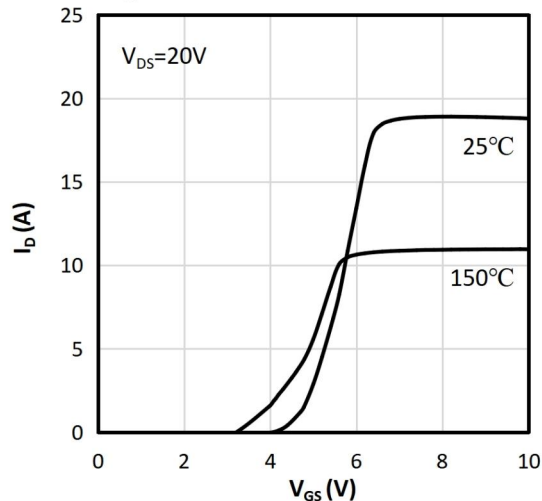


Fig 3:  $R_{DS(on)}$  vs Drain Current

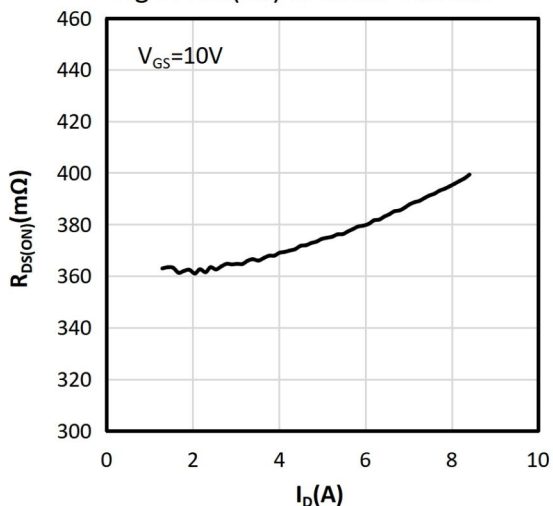


Fig 4:  $R_{DS(on)}$  vs. Temperature

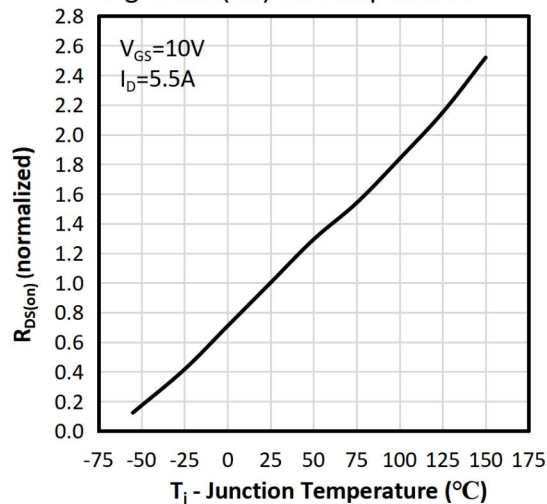


Fig 5: Breakdown Voltage vs. Temperature

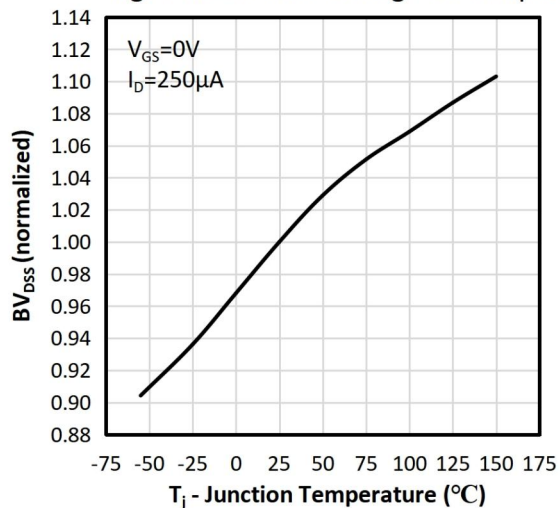
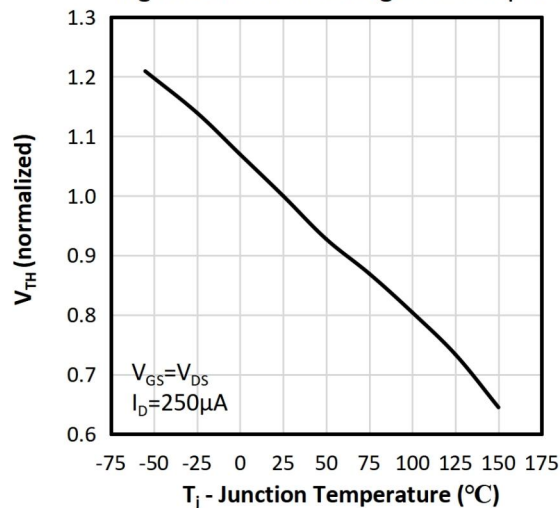


Fig 6: Threshold voltage vs. Temperature



## RATING AND CHARACTERISTIC CURVES

Fig 7: Body-Diode Characteristics

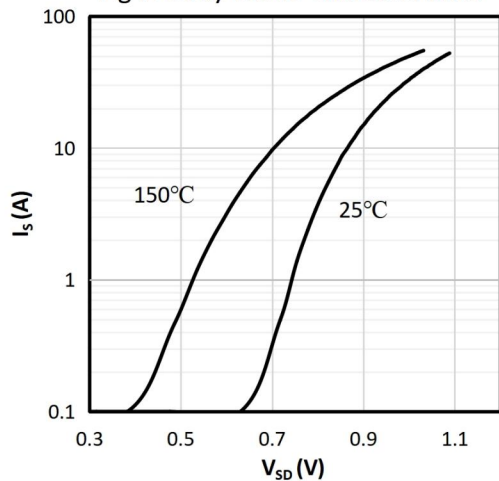


Fig 8: Capacitance Characteristics

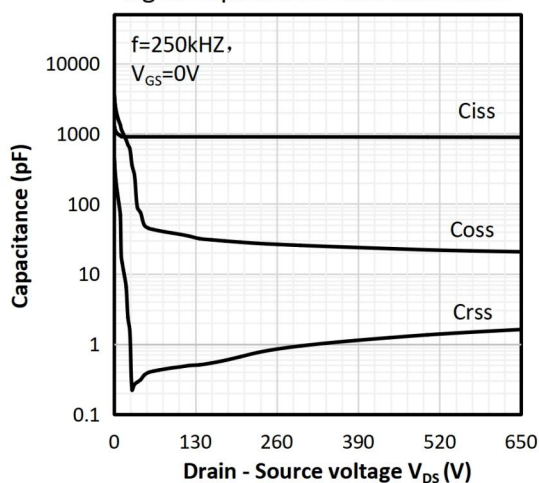


Fig 9: Gate charger Characteristics

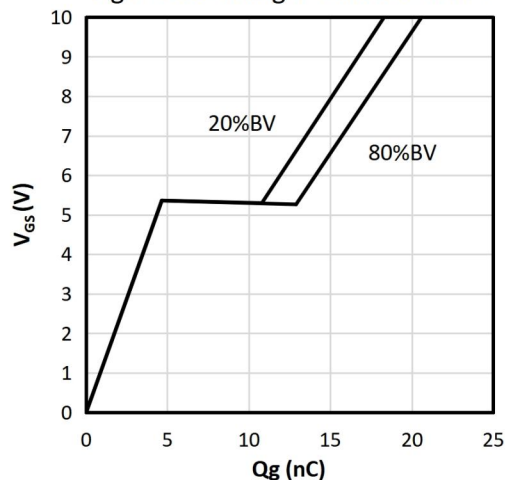


Fig 10: Drain Current Derating

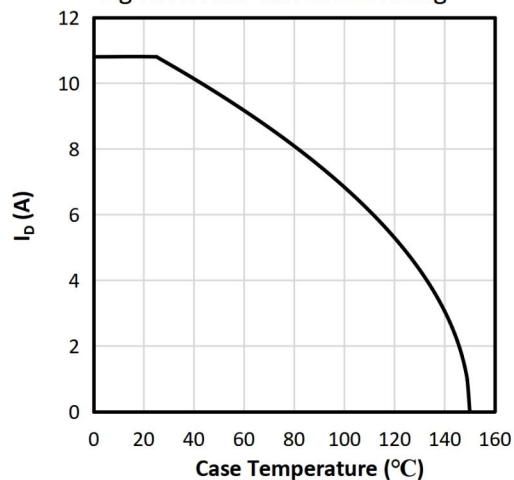


Fig 11: Power Dissipation vs. Temperature

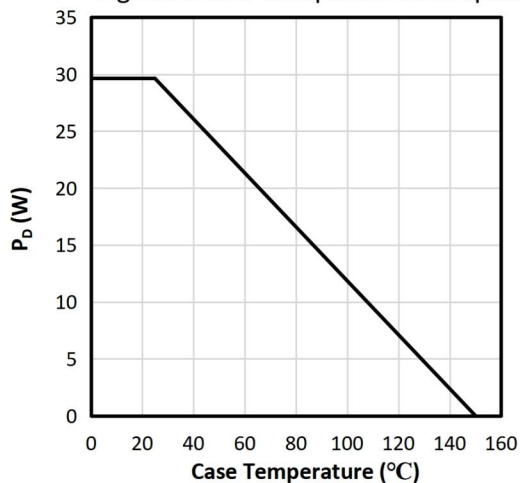
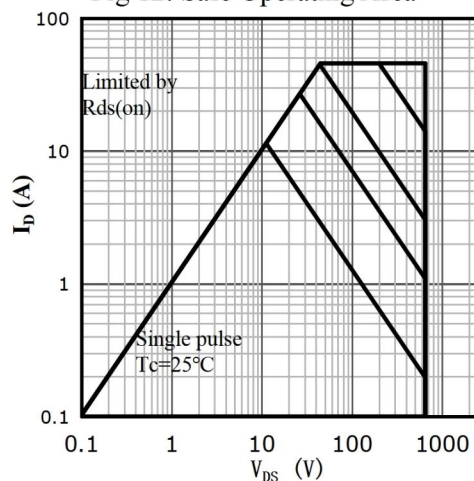
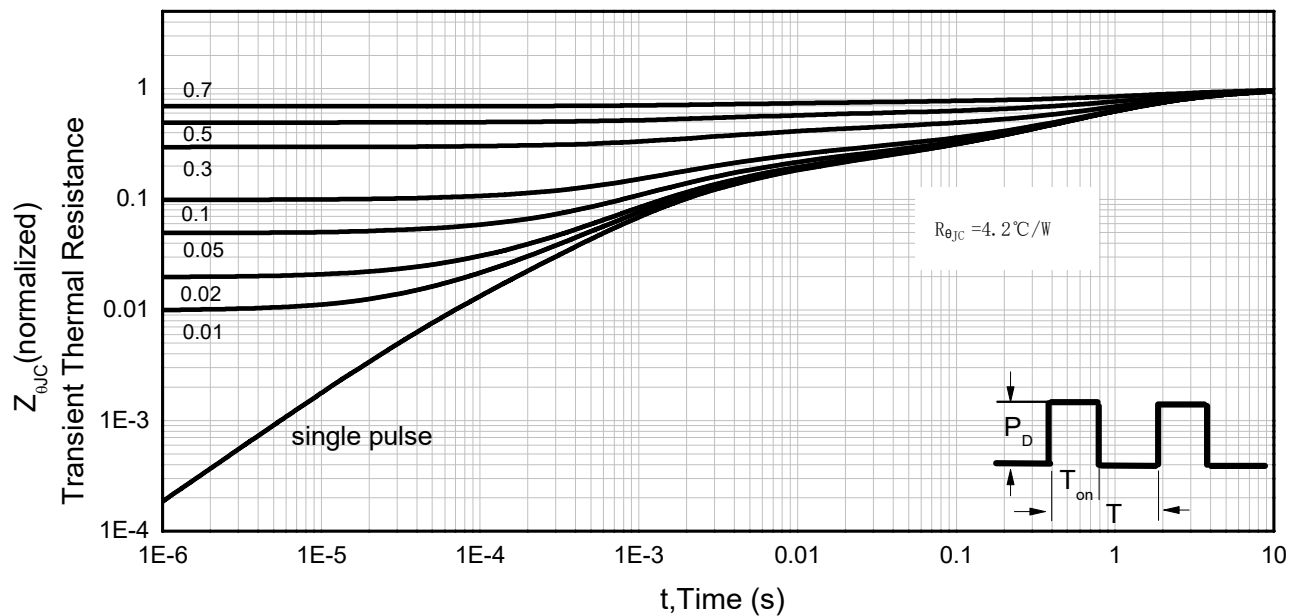


Fig 12: Safe Operating Area



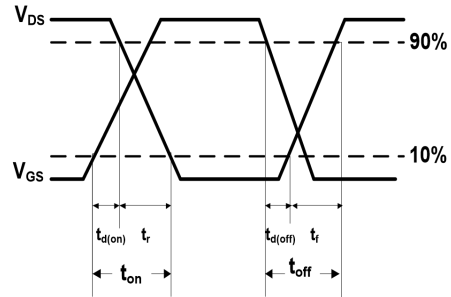
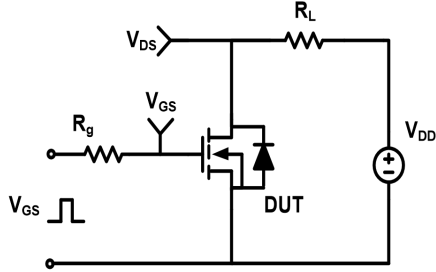
RATING AND CHARACTERISTIC CURVES

Fig 13: Normalized Maximum Transient Thermal Impedance ( $R_{thJC}$ )

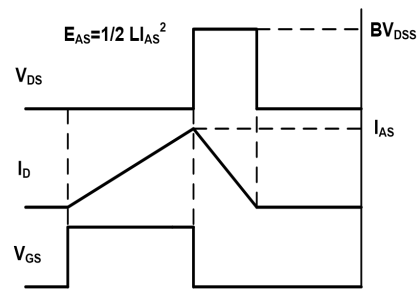
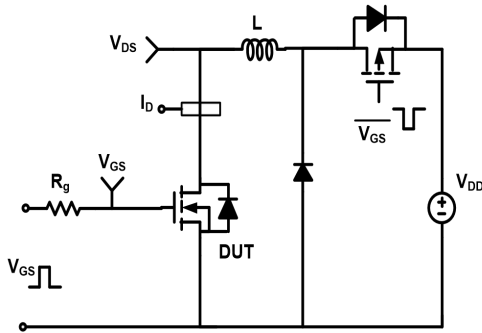


## Test Circuit

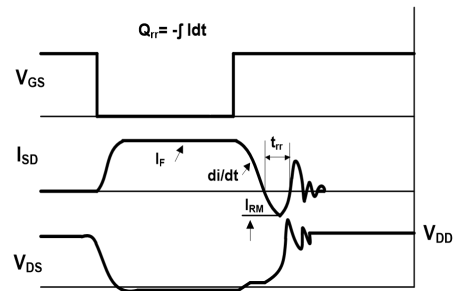
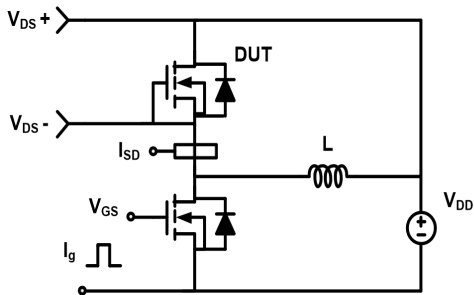
### Resistive Switching Test Circuit & Waveform



### Unclamped Inductive Switching (UIS) Test Circuit & Waveform

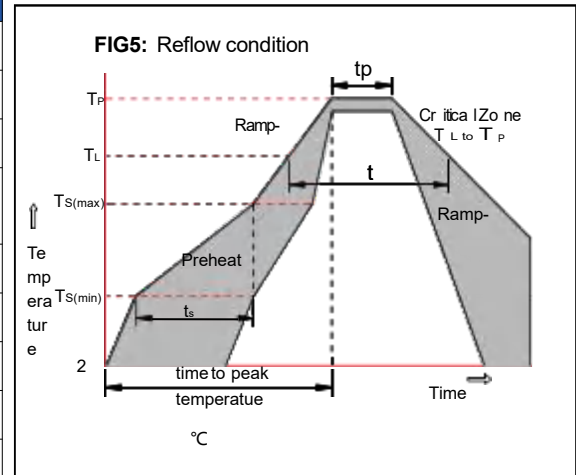


### Diode Recovery Test Circuit & Waveform



## Soldering parameters

| Reflow Condition                                        |                                   | Pb-Free assembly<br>(see as below) |
|---------------------------------------------------------|-----------------------------------|------------------------------------|
| Pre Heat                                                | -Temperature Min ( $T_{s(min)}$ ) | +150 °C                            |
|                                                         | -Temperature Max( $T_{s(max)}$ )  | +200 °C                            |
|                                                         | -Time (Min to Max) (ts)           | 60-180 secs.                       |
| Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3 °C/sec. Max                      |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3 °C/sec. Max                      |
| Reflow                                                  | -Temperature( $T_L$ )(Liquid us)  | +217 °C                            |
|                                                         | -Temperature( $t_L$ )             | 60-150 secs.                       |
| Peak Temp ( $T_P$ )                                     |                                   | +260(+0/-5) °C                     |
| Time within 5 °C of actual Peak Temp ( $t_P$ )          |                                   | 30 secs. Max                       |
| Ramp-down Rate                                          |                                   | 6 °C/sec. Max                      |
| Time 25 °C to Peak Temp ( $T_P$ )                       |                                   | 8 min. Max                         |
| Do not exceed                                           |                                   | +260 °C                            |



## Package Dimensions & Suggested Pad Layout

