

**N-Channel Enhancement Mode Power MOSFET**

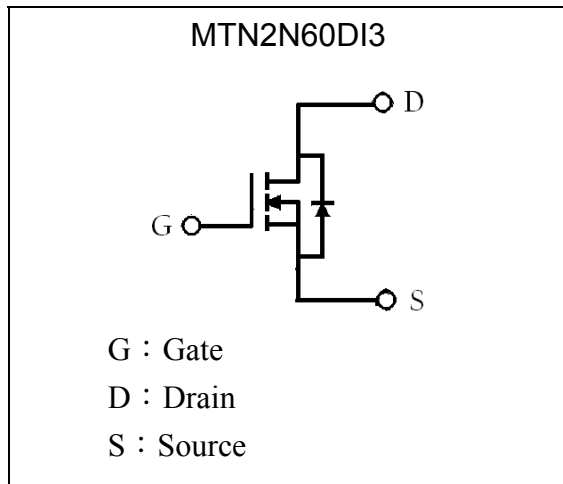
# MTN2N60DI3

|  |      |
|--|------|
| $BV_{DSS}$                             | 600V |
| $I_D @ V_{GS}=10V, T_C=25^\circ C$     | 2A   |
| $R_{DS(on)(TYP)} @ V_{GS}=10V, I_D=1A$ | 3.7Ω |

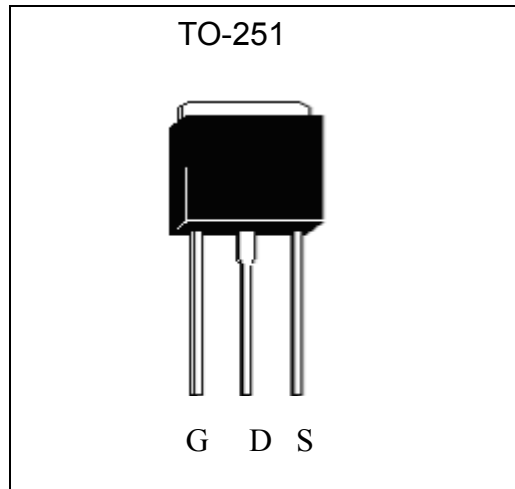
**Features**

- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant package

**Symbol**

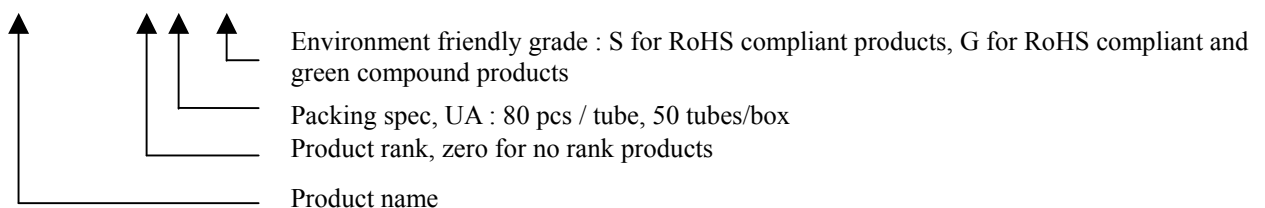


**Outline**



**Ordering Information**

| Device            | Package   | Shipping                  |
|-------------------|---|---------------------------|
| MTN2N60DI3-0-UA-G | TO-251<br>(RoHS compliant and halogen-free package) | 80 pcs/tube, 50 tubes/box |



**Absolute Maximum Ratings** ( $T_C=25^{\circ}\text{C}$ )

| Parameter   | Symbol         | Limits   | Unit                        |
|---|----------------|----------|-----------------------------|
| Drain-Source Voltage  | $V_{DS}$       | 600      | V                           |
| Gate-Source Voltage   | $V_{GS}$       | $\pm 30$ |                             |
| Continuous Drain Current @ $V_{GS}=10\text{V}$ , $T_C=25^{\circ}\text{C}$                           | $I_D$          | 2        | A                           |
| Continuous Drain Current @ $V_{GS}=10\text{V}$ , $T_C=100^{\circ}\text{C}$                          |                | 1.3      |                             |
| Pulsed Drain Current (Note 1)   | $I_{DM}$       | 8        |                             |
| Single Pulse Avalanche Current (Note 1)   | $I_{AS}$       | 2        |                             |
| Single Pulse Avalanche Energy @ $L=80\text{mH}$ , $I_D=2\text{Amps}$ , $V_{DD}=50\text{V}$ (Note 2) | $E_{AS}$       | 160      | mJ                          |
| Repetitive Avalanche Energy (Note 1)  | $E_{AR}$       | 4.4      |                             |
| Maximum Temperature for Soldering @ Lead at 0.125 in(0.318mm) from case for 10 seconds              | $T_L$          | 300      | $^{\circ}\text{C}$          |
| Total Power Dissipation ( $T_A=25^{\circ}\text{C}$ )  | $P_D$          | 1.14     | W                           |
| Total Power Dissipation ( $T_C=25^{\circ}\text{C}$ )  |                | 44       |                             |
| Linear Derating Factor  |                | 0.35     | $\text{W}/^{\circ}\text{C}$ |
| Operating Junction and Storage Temperature  | $T_j, T_{stg}$ | -55~+150 | $^{\circ}\text{C}$          |

Note : 1.Pulse width limited by maximum junction temperature.

2.100% tested by conditions of  $L=40\text{mH}$ ,  $I_{AS}=2\text{A}$ ,  $V_{GS}=10\text{V}$ ,  $V_{DD}=50\text{V}$ .

**Thermal Data**

| Parameter                                    | Symbol          | Value | Unit                        |
|--|-----------------|-------|-----------------------------|
| Thermal Resistance, Junction-to-case, max    | $R_{\theta JC}$ | 2.87  | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-ambient, max | $R_{\theta JA}$ | 110   |                             |



**Characteristics (Tc=25°C, unless otherwise specified)**

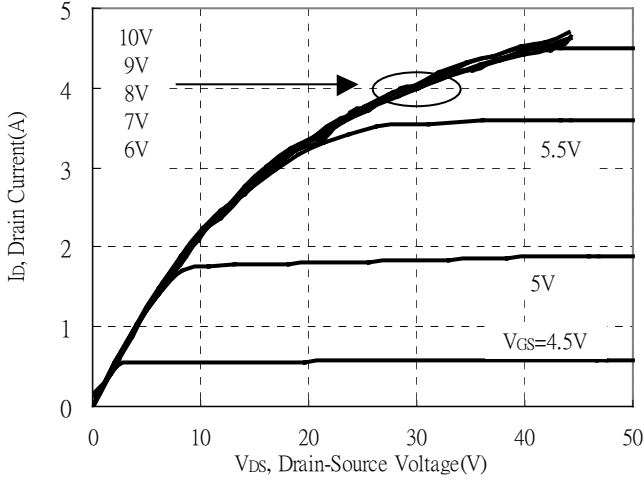
| Symbol                              | Min. | Typ. | Max. | Unit | Test Conditions  |
|-------------------------------------|------|------|------|------|--|
| <b>Static</b>                       |      |      |      |      |  |
| BV <sub>DSS</sub>                   | 600  | -    | -    | V    | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA   |
| ΔBV <sub>DSS</sub> /ΔT <sub>j</sub> | -    | 0.6  | -    | V/°C | Reference to 25°C, I <sub>D</sub> =250μA   |
| V <sub>GS(th)</sub>                 | 2.0  | -    | 4.0  | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA                                |
| *G <sub>FS</sub>                    | -    | 2.3  | -    | S    | V <sub>DS</sub> =15V, I <sub>D</sub> =1A   |
| I <sub>GSS</sub>                    | -    | -    | ±100 | nA   | V <sub>GS</sub> =±30V  |
| I <sub>DSS</sub>                    | -    | -    | 1    | μA   | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V   |
|                                     | -    | -    | 10   |      | V <sub>DS</sub> =480V, V <sub>GS</sub> =0V, T <sub>j</sub> =125°C                        |
| *R <sub>DS(ON)</sub>                | -    | 3.7  | 4.7  | Ω    | V <sub>GS</sub> =10V, I <sub>D</sub> =1A   |
| <b>Dynamic</b>                      |      |      |      |      |  |
| *Q <sub>g</sub>                     | -    | 9.2  | 13.8 | nC   | I <sub>D</sub> =2A, V <sub>DD</sub> =480V, V <sub>GS</sub> =10V                          |
| *Q <sub>gs</sub>                    | -    | 2.2  | -    |      |  |
| *Q <sub>gd</sub>                    | -    | 3.6  | -    |      |  |
| *t <sub>d(ON)</sub>                 | -    | 7.2  | 10.8 | ns   | V <sub>DD</sub> =300V, I <sub>D</sub> =2A, V <sub>GS</sub> =10V,<br>R <sub>G</sub> =25 Ω |
| *t <sub>r</sub>                     | -    | 8    | 12   |      |  |
| *t <sub>d(OFF)</sub>                | -    | 17   | 25.5 |      |  |
| *t <sub>f</sub>                     | -    | 9.8  | 14.7 |      |  |
| C <sub>iss</sub>                    | -    | 274  | 411  | pF   | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz  |
| C <sub>oss</sub>                    | -    | 36   | 54   |      |  |
| C <sub>rss</sub>                    | -    | 10   | 15   |      |  |
| <b>Source-Drain Diode</b>           |      |      |      |      |  |
| *V <sub>SD</sub>                    | -    | -    | 1.5  | V    | I <sub>S</sub> =2A, V <sub>GS</sub> =0V  |
| *I <sub>S</sub>                     | -    | -    | 2    | A    |  |
| *I <sub>SM</sub>                    | -    | -    | 8    |      |  |
| *t <sub>rr</sub>                    | -    | 422  | -    | ns   | V <sub>GS</sub> =0V, I <sub>F</sub> =2A, dI <sub>F</sub> /dt=100A/μs                     |
| *Q <sub>rr</sub>                    | -    | 850  | -    | nC   |  |

\*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

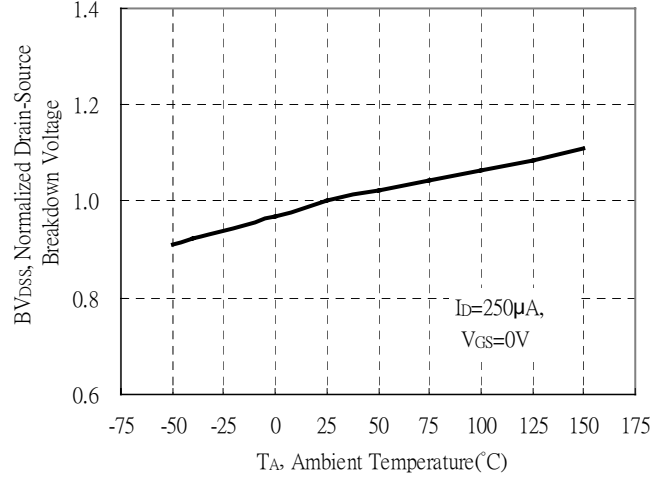


**Typical Characteristics**

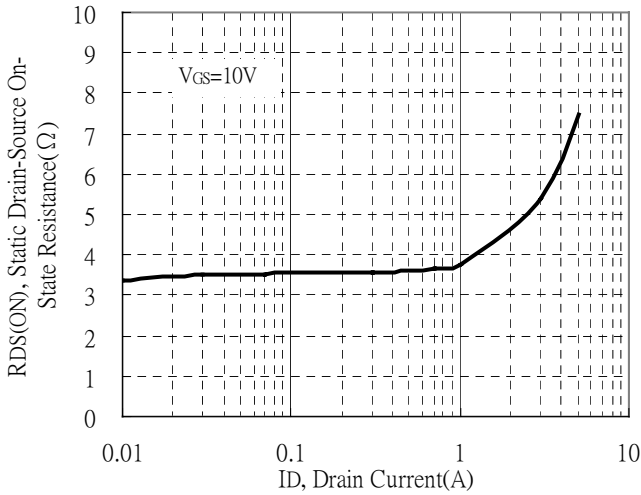
Typical Output Characteristics



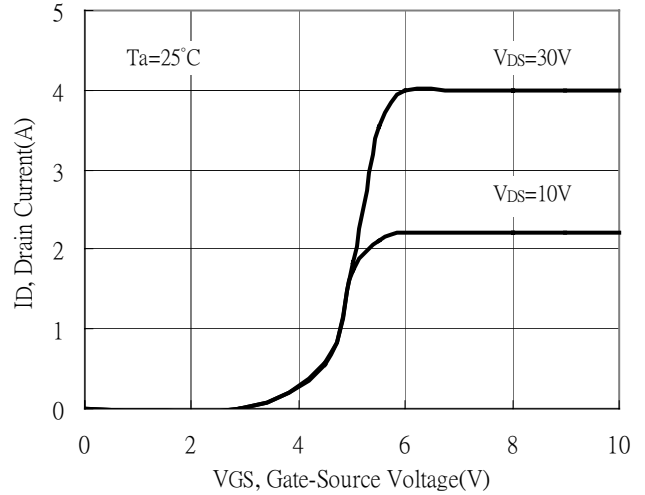
Brekdown Voltage vs Ambient Temperature



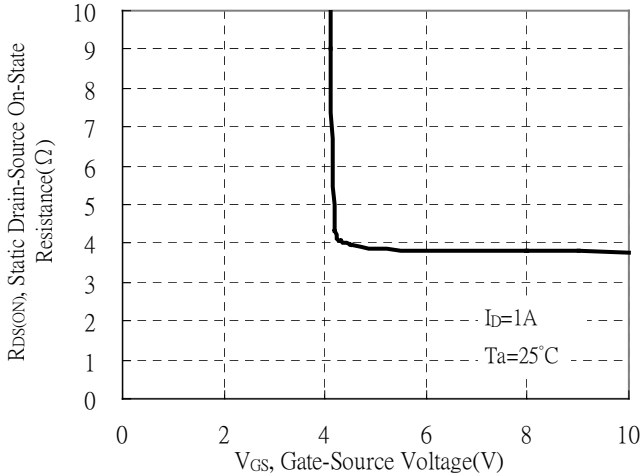
Static Drain-Source On-State resistance vs Drain Current



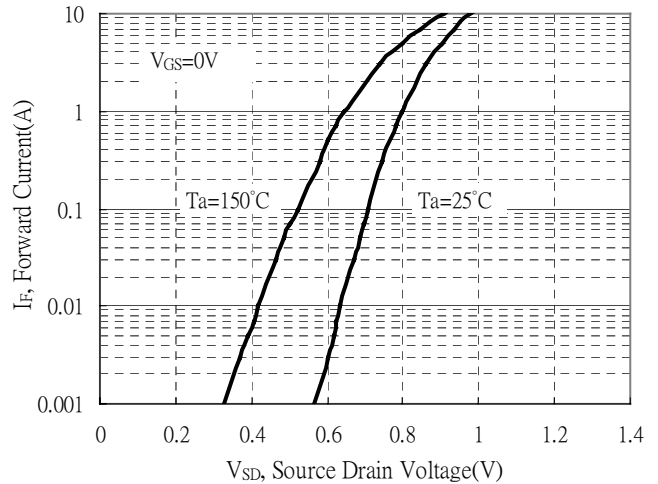
Drain Current vs Gate-Source Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

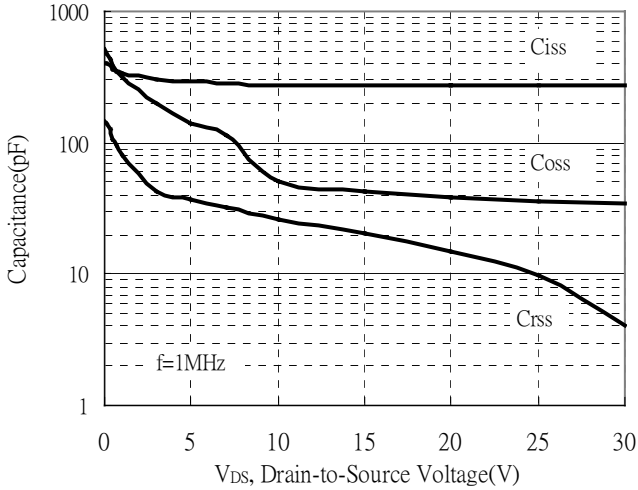


Forward Drain Current vs Source-Drain Voltage

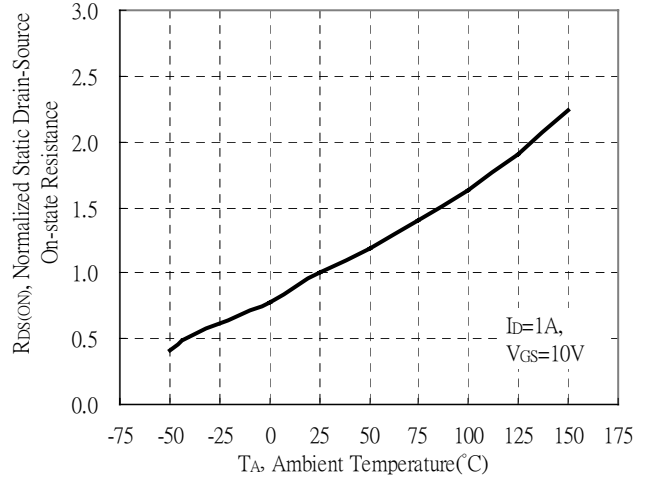


**Typical Characteristics(Cont.)**

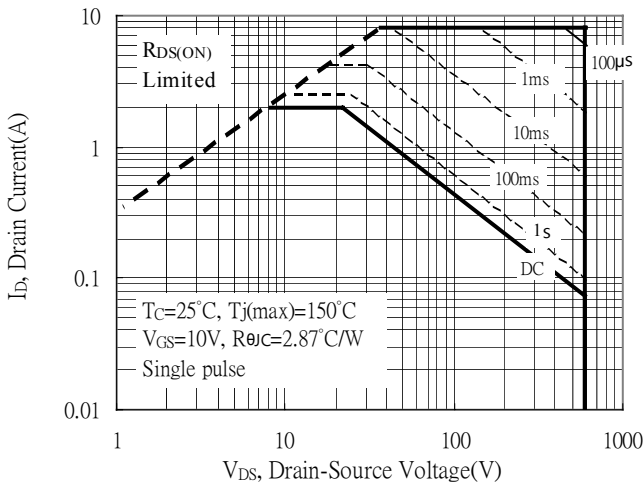
Capacitance vs Reverse Voltage



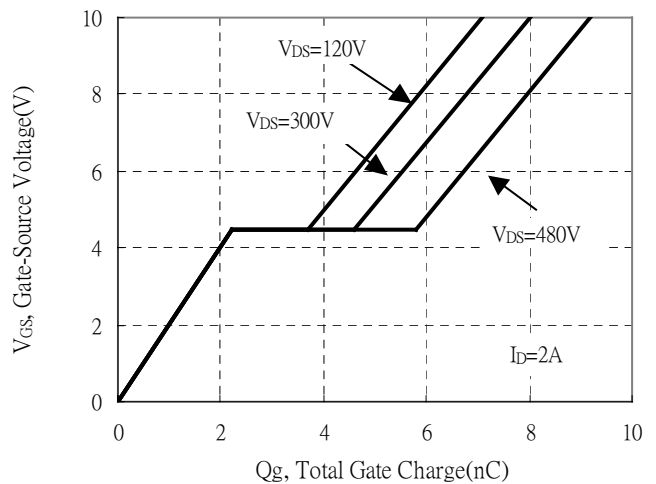
Static Drain-Source On-resistance vs Ambient Temperature



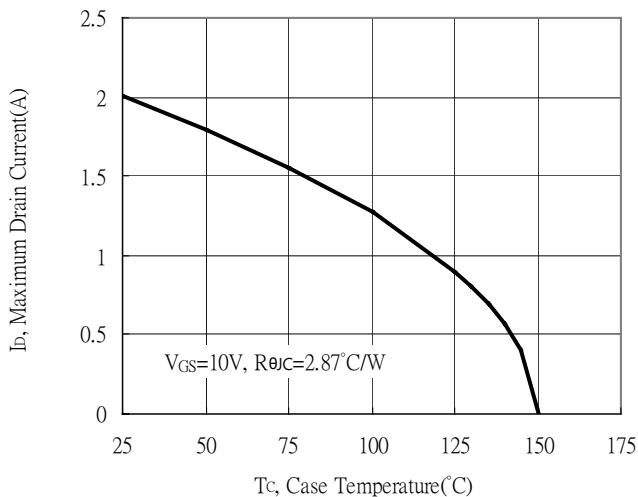
Maximum Safe Operating Area



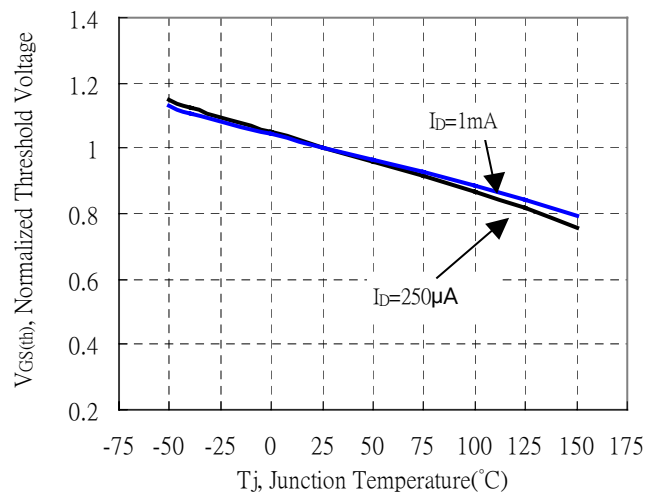
Gate Charge Characteristics



Maximum Drain Current vs Case Temperature

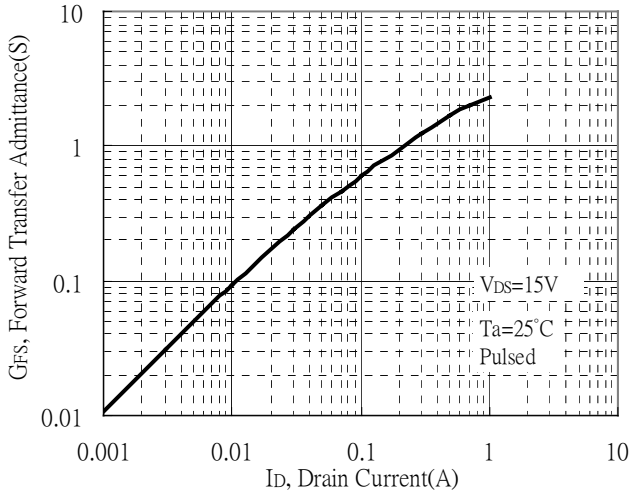


Threshold Voltage vs Junction Temperature

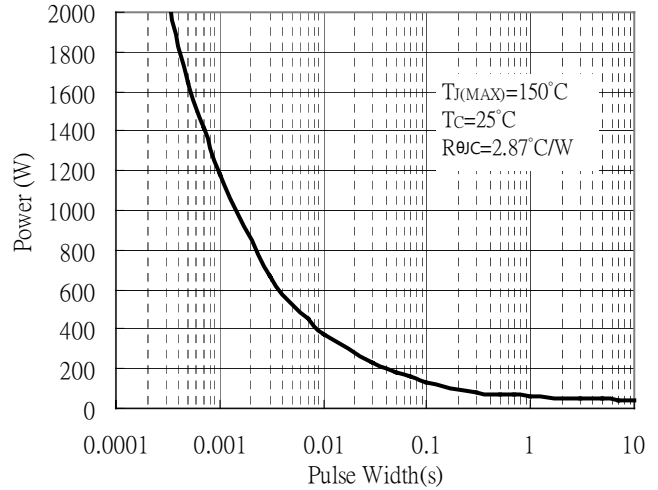


**Typical Characteristics(Cont.)**

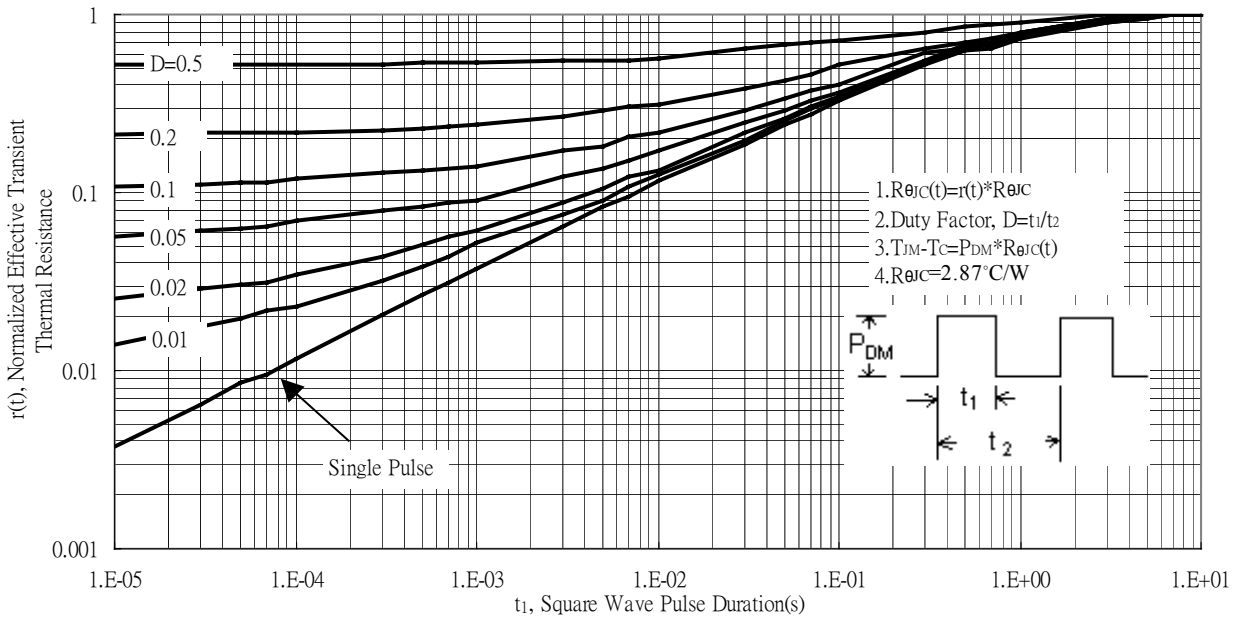
Forward Transfer Admittance vs Drain Current



Single Pulse Power Rating, Junction to Case



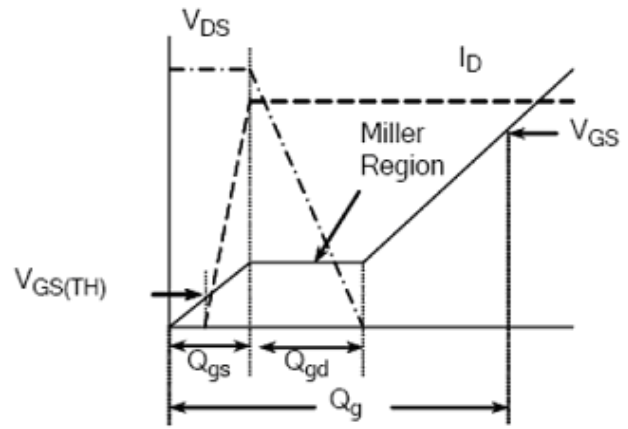
Transient Thermal Response Curves



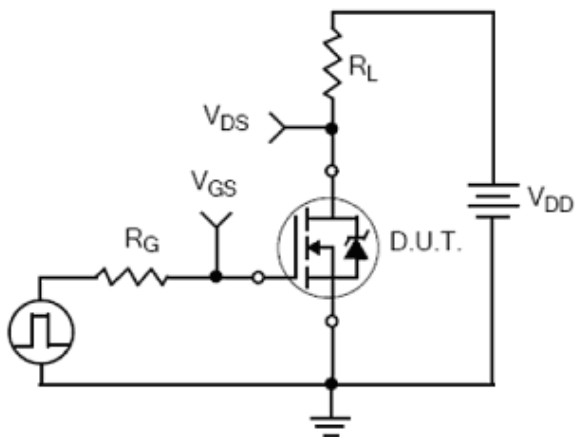
**Test Circuits and Waveforms**



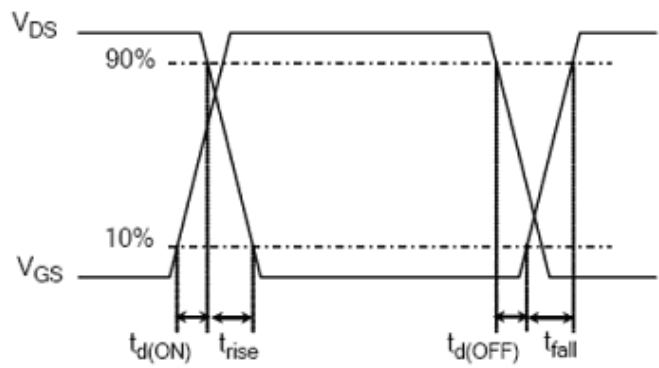
**Gate Charge Test Circuit**



**Gate Charge Waveform**

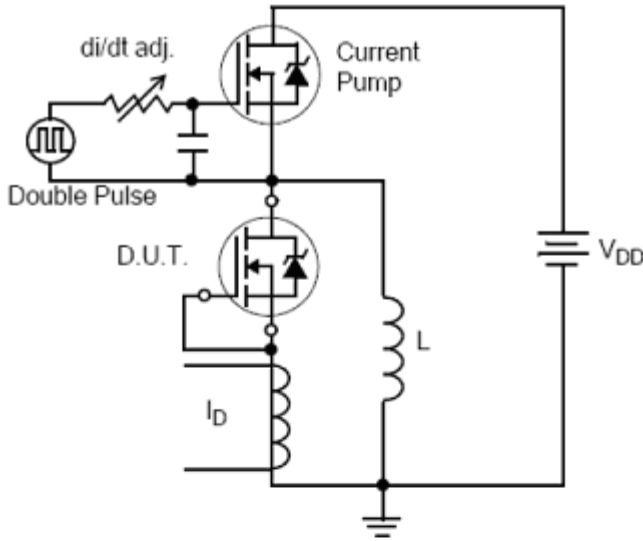


**Resistive Switching Test Circuit**



**Resistive Switching Waveforms**

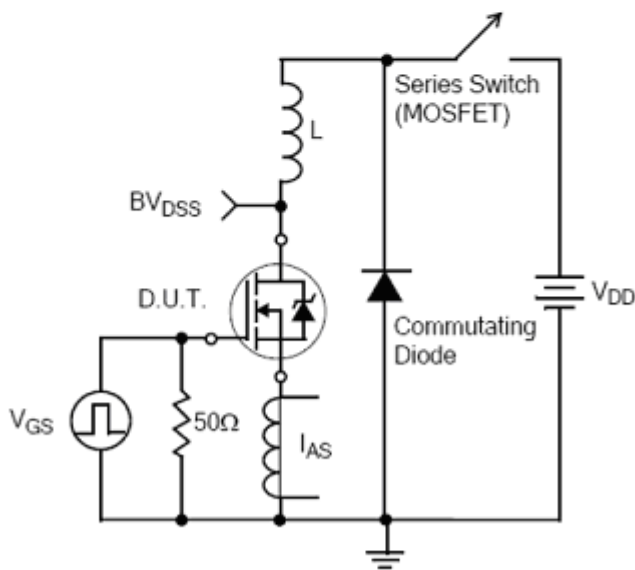
**Test Circuits and Waveforms(Cont.)**



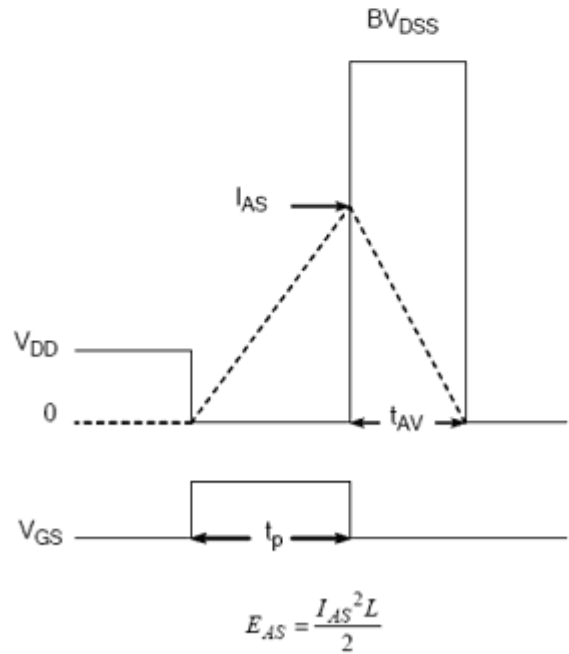
**Diode Reverse Recovery Test Circuit**



**Diode Reverse Recovery Waveform**



**Unclamped Inductive Switching Test Circuit**



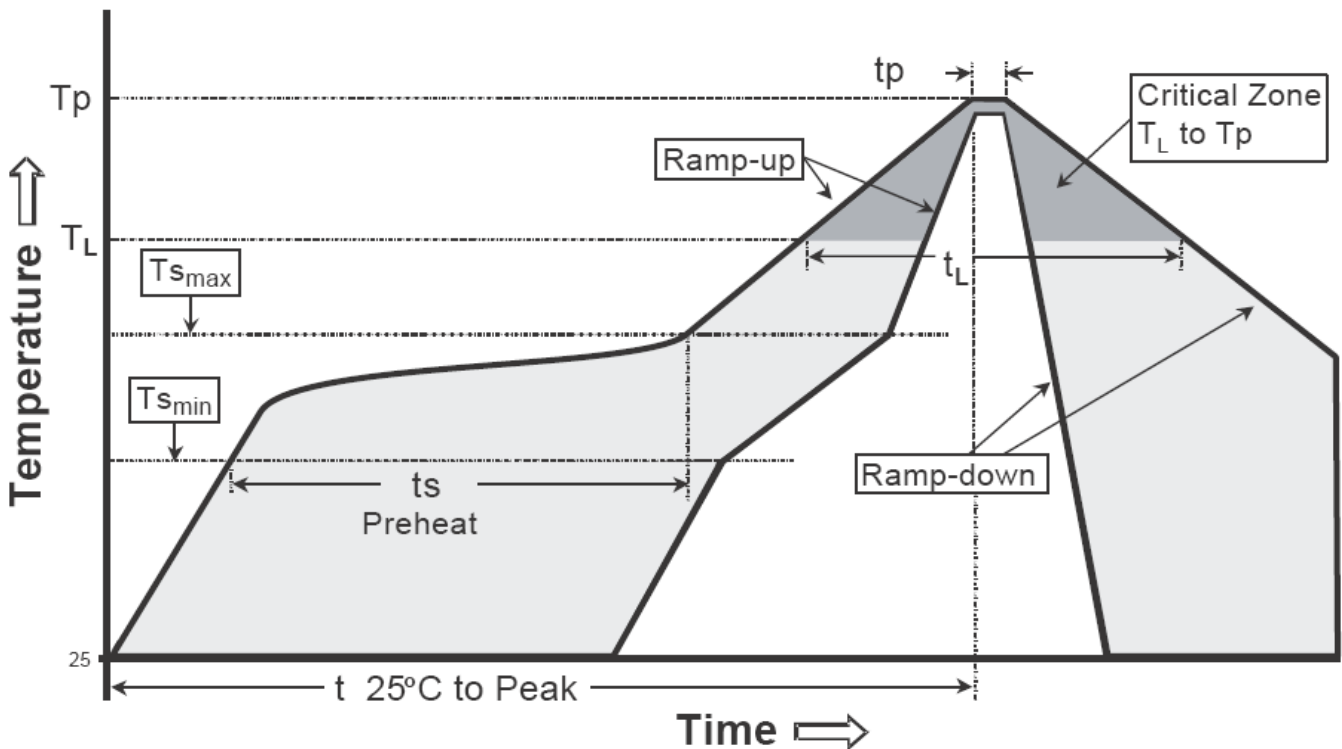
**Unclamped Inductive Switching Waveforms**



**Recommended wave soldering condition**

| Product         | Peak Temperature | Soldering Time  |
|-----------------|------------------|-----------------|
| Pb-free devices | 260 +0/-5 °C     | 5 +1/-1 seconds |

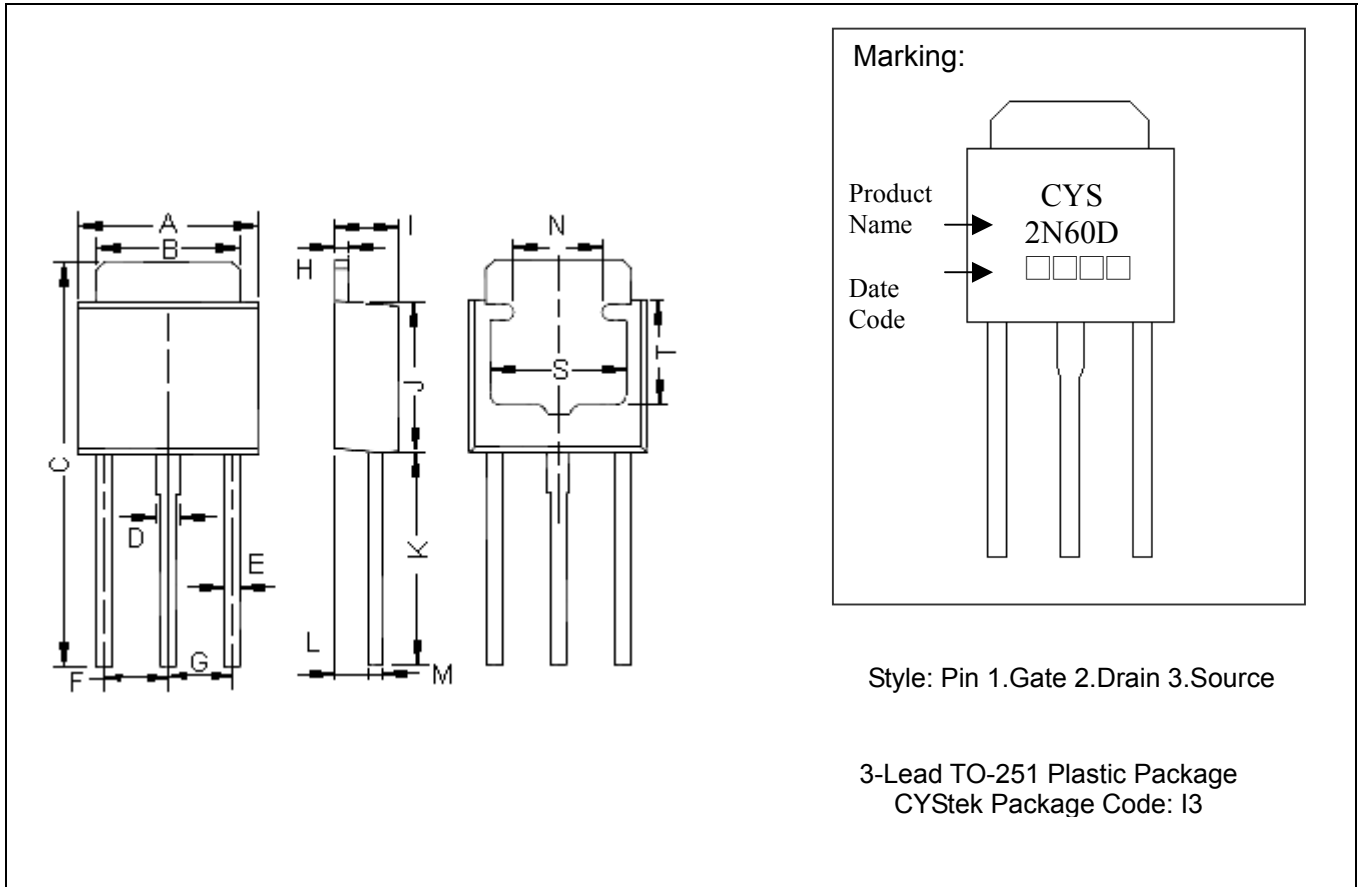
**Recommended temperature profile for IR reflow**



| Profile feature   | Sn-Pb eutectic Assembly | Pb-free Assembly |
|---|-------------------------|------------------|
| Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> ) | 3°C/second max.         | 3°C/second max.  |
| Preheat   |                         |                  |
| -Temperature Min(T <sub>s min</sub> )                       | 100°C                   | 150°C            |
| -Temperature Max(T <sub>s max</sub> )                       | 150°C                   | 200°C            |
| -Time(t <sub>s min</sub> to t <sub>s max</sub> )            | 60-120 seconds          | 60-180 seconds   |
| Time maintained above:                                      |                         |                  |
| -Temperature (T <sub>L</sub> )                              | 183°C                   | 217°C            |
| - Time (t <sub>L</sub> )                                    | 60-150 seconds          | 60-150 seconds   |
| Peak Temperature(T <sub>P</sub> )                           | 240 +0/-5 °C            | 260 +0/-5 °C     |
| Time within 5°C of actual peak temperature(t <sub>p</sub> ) | 10-30 seconds           | 20-40 seconds    |
| Ramp down rate  | 6°C/second max.         | 6°C/second max.  |
| Time 25 °C to peak temperature                              | 6 minutes max.          | 8 minutes max.   |

Note : All temperatures refer to topside of the package, measured on the package body surface.

**TO-251 Dimension**



Marking:

Product Name → CYS  
 2N60D  
 Date Code → □□□□

Style: Pin 1.Gate 2.Drain 3.Source

3-Lead TO-251 Plastic Package  
 CYStek Package Code: I3

| DIM | Inches |        | Millimeters |       | DIM | Inches |        | Millimeters |      |
|-----|--------|--------|-------------|-------|-----|--------|--------|-------------|------|
|     | Min.   | Max.   | Min.        | Max.  |     | Min.   | Max.   | Min.        | Max. |
| A   | 0.2500 | 0.2618 | 6.35        | 6.65  | I   | 0.0866 | 0.0945 | 2.20        | 2.40 |
| B   | 0.2047 | 0.2126 | 5.20        | 5.40  | J   | 0.2126 | 0.2244 | 5.40        | 5.70 |
| C   | 0.5709 | 0.5866 | 14.50       | 14.90 | K   | 0.2992 | 0.3071 | 7.60        | 7.80 |
| D   | 0.0276 | 0.0354 | 0.70        | 0.90  | L   | 0.0453 | 0.0492 | 1.15        | 1.25 |
| E   | 0.0199 | 0.0276 | 0.50        | 0.70  | M   | 0.0169 | 0.0228 | 0.43        | 0.58 |
| F   | 0.0886 | 0.0925 | 2.25        | 2.35  | N   | 0.1181 | REF    | 3.00        | REF  |
| G   | 0.0886 | 0.0925 | 2.25        | 2.35  | S   | 0.1969 | REF    | 5.00        | REF  |
| H   | 0.0169 | 0.0228 | 0.43        | 0.58  | T   | 0.1496 | REF    | 3.80        | REF  |

Notes: 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: Pure tin plated
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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