

## N-Channel Power MOSFET

600V, 1A, 10Ω

### FEATURES

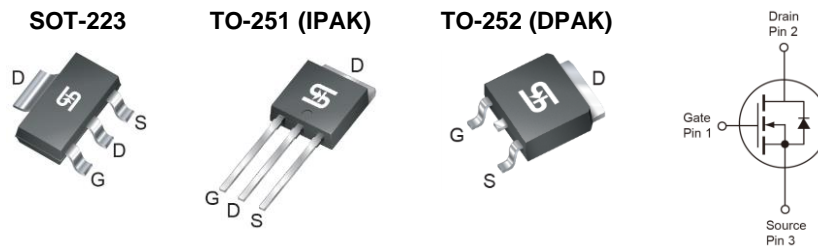
- Advanced planar process
- 100% avalanche tested
- Low  $R_{DS(ON)}$  8Ω (Typ.)
- Low gate charge typical @ 6.1 nC (Typ.)
- Low  $C_{rss}$  typical @4.2pF (Typ.)

### KEY PERFORMANCE PARAMETERS

| PARAMETER          | VALUE | UNIT |
|--------------------|-------|------|
| $V_{DS}$           | 600   | V    |
| $R_{DS(on)}$ (max) | 10    | Ω    |
| $Q_g$              | 6.1   | nC   |

### APPLICATION

- Power Supply
- Lighting
- Charger



**Notes:** MSL 3 (Moisture Sensitivity Level) for TO-252 (D-PAK), SOT-223 per J-STD-020

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| PARAMETER   | SYMBOL         | IPAK/DPAK                 | SOT-223 | UNIT |
|---|----------------|---------------------------|---------|------|
| Drain-Source Voltage                                | $V_{DS}$       | 600                       |         | V    |
| Gate-Source Voltage                                 | $V_{GS}$       | ±30                       |         | V    |
| Continuous Drain Current <sup>(Note 1)</sup>        | $I_D$          | $T_C = 25^\circ\text{C}$  | 1       | A    |
|   |                | $T_C = 100^\circ\text{C}$ | 0.7     |      |
| Pulsed Drain Current <sup>(Note 2)</sup>            | $I_{DM}$       | 4                         |         | A    |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$  | $P_{DTOT}$     | 39                        | 2.1     | W    |
| Single Pulsed Avalanche Energy <sup>(Note 3)</sup>  | $E_{AS}$       | 5                         |         | mJ   |
| Single Pulsed Avalanche Current <sup>(Note 3)</sup> | $I_{AS}$       | 1                         |         | A    |
| Peak Diode Recovery $dv/dt$ <sup>(Note 4)</sup>     | $dv/dt$        | 4.5                       |         | V/ns |
| Operating Junction and Storage Temperature Range    | $T_J, T_{STG}$ | - 55 to +150              |         | °C   |

### THERMAL PERFORMANCE

| PARAMETER                              | SYMBOL          | IPAK/DPAK | SOT-223 | UNIT |
|--|-----------------|-----------|---------|------|
| Junction to Case Thermal Resistance    | $R_{\theta JC}$ | 2.87      | --      | °C/W |
| Junction to Ambient Thermal Resistance | $R_{\theta JA}$ | 110       | 60      | °C/W |

**Notes:**  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances. The case thermal reference is defined at the solder mounting surface of the drain pins.  $R_{\theta JA}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.  $R_{\theta JA}$  shown below for single device operation on FR-4 PCB in still air.

| <b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted) |   |              |     |      |           |          |
|---|---|--------------|-----|------|-----------|----------|
| PARAMETER   | CONDITIONS  | SYMBOL       | MIN | TYP  | MAX       | UNIT     |
| <b>Static</b> (Note 5)  |   |              |     |      |           |          |
| Drain-Source Breakdown Voltage  | $V_{GS} = 0V, I_D = 250\mu A$                           | $BV_{DSS}$   | 600 | --   | --        | V        |
| Drain-Source On-State Resistance  | $V_{GS} = 10V, I_D = 0.5A$                              | $R_{DS(ON)}$ | --  | 8    | 10        | $\Omega$ |
| Gate Threshold Voltage  | $V_{DS} = V_{GS}, I_D = 250\mu A$                       | $V_{GS(TH)}$ | 2.5 | 3.5  | 4.5       | V        |
| Zero Gate Voltage Drain Current   | $V_{DS} = 600V, V_{GS} = 0V$                            | $I_{DSS}$    | --  | --   | 10        | $\mu A$  |
| Gate Body Leakage   | $V_{GS} = \pm 30V, V_{DS} = 0V$                         | $I_{GSS}$    | --  | --   | $\pm 100$ | nA       |
| Forward Transfer Conductance  | $V_{DS} = 10V, I_D = 0.5A$                              | $g_{fs}$     | --  | 0.8  | --        | S        |
| <b>Dynamic</b> (Note 6)   |   |              |     |      |           |          |
| Total Gate Charge   | $V_{DS} = 480V, I_D = 1A, V_{GS} = 10V$                 | $Q_g$        | --  | 6.1  | --        | nC       |
| Gate-Source Charge  |   | $Q_{gs}$     | --  | 1.4  | --        |          |
| Gate-Drain Charge   |   | $Q_{gd}$     | --  | 3.3  | --        |          |
| Input Capacitance   | $V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{MHz}$          | $C_{iss}$    | --  | 138  | --        | pF       |
| Output Capacitance  |   | $C_{oss}$    | --  | 17.1 | --        |          |
| Reverse Transfer Capacitance  |   | $C_{rss}$    | --  | 4.2  | --        |          |
| Gate Resistance   | $F = 1\text{MHz}, \text{open drain}$                    | $R_g$        | --  | 12.5 | --        | $\Omega$ |
| <b>Switching</b> (Note 7)   |   |              |     |      |           |          |
| Turn-On Delay Time  | $V_{DD} = 300V, R_G = 25\Omega, I_D = 1A, V_{GS} = 10V$ | $t_{d(on)}$  | --  | 7.7  | --        | ns       |
| Turn-On Rise Time   |   | $t_r$        | --  | 6.8  | --        |          |
| Turn-Off Delay Time   |   | $t_{d(off)}$ | --  | 15.3 | --        |          |
| Turn-Off Fall Time  |   | $t_f$        | --  | 14.9 | --        |          |
| <b>Source-Drain Diode</b> (Note 5)  |   |              |     |      |           |          |
| Diode Forward Voltage   | $I_S = 1A, V_{GS} = 0V$                                 | $V_{SD}$     | --  | 0.9  | 1.4       | V        |
| Source Current  | Integral reverse diode<br>In the MOSFET                 | $I_S$        | --  | --   | 1         | A        |
| Source Current (Pulse)  |   | $I_{SM}$     | --  | --   | 4         |          |

**Notes:**

- Current limited by package.
- Pulse width limited by the maximum junction temperature.
- $L = 10\text{mH}, I_{AS} = 1A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$ .
- $I_{SD} \leq 1A, V_{DD} \leq BV_{DSS}, di/dt \leq 200A/\mu s, \text{Starting } T_J = 25^\circ\text{C}$ .
- Pulse test:  $PW \leq 300\mu s, \text{duty cycle} \leq 2\%$ .
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

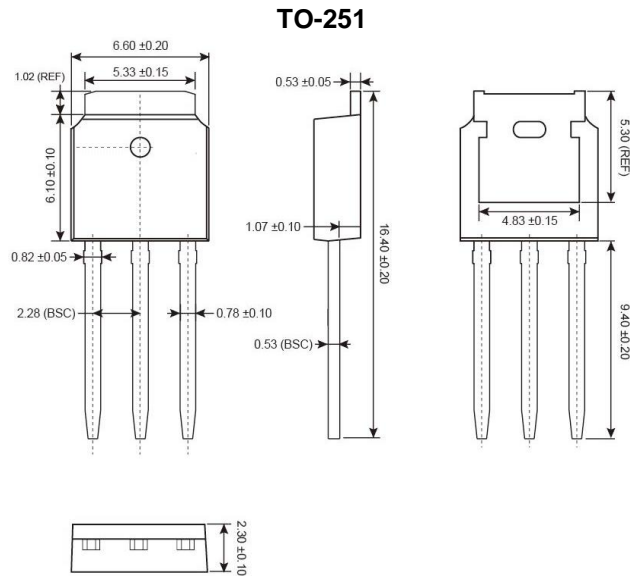
**ORDERING INFORMATION**

| <b>PART NO.</b> | <b>PACKAGE</b> | <b>PACKING</b>       |
|-----------------|----------------|----------------------|
| TSM1NB60CH C5G  | TO-251         | 75 pcs / Tube        |
| TSM1NB60CP ROG  | TO-252         | 2,500 pcs / 13" Reel |
| TSM1NB60CW RPG  | SOT-223        | 2,500 pcs / 13" Reel |

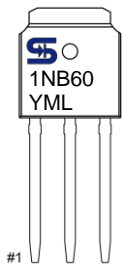
**Note:**

1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)



**MARKING DIAGRAM**



**Y** = Year Code

**M** = Month Code for Halogen Free Product

**O** =Jan    **P** =Feb    **Q** =Mar    **R** =Apr

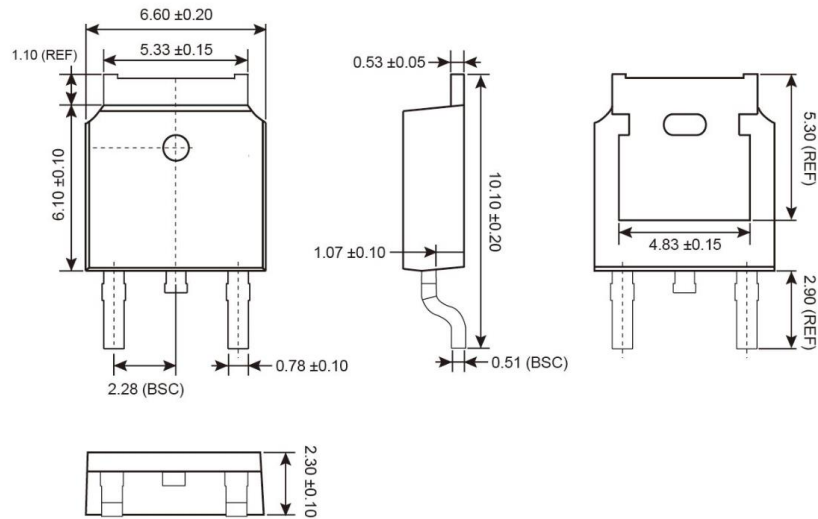
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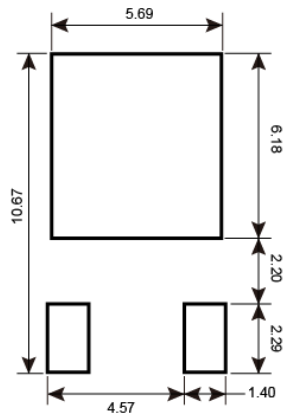
**L** = Lot Code (1~9, A~Z)

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

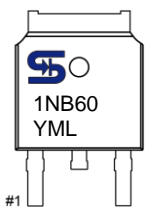
**TO-252**



**SUGGESTED PAD LAYOUT**



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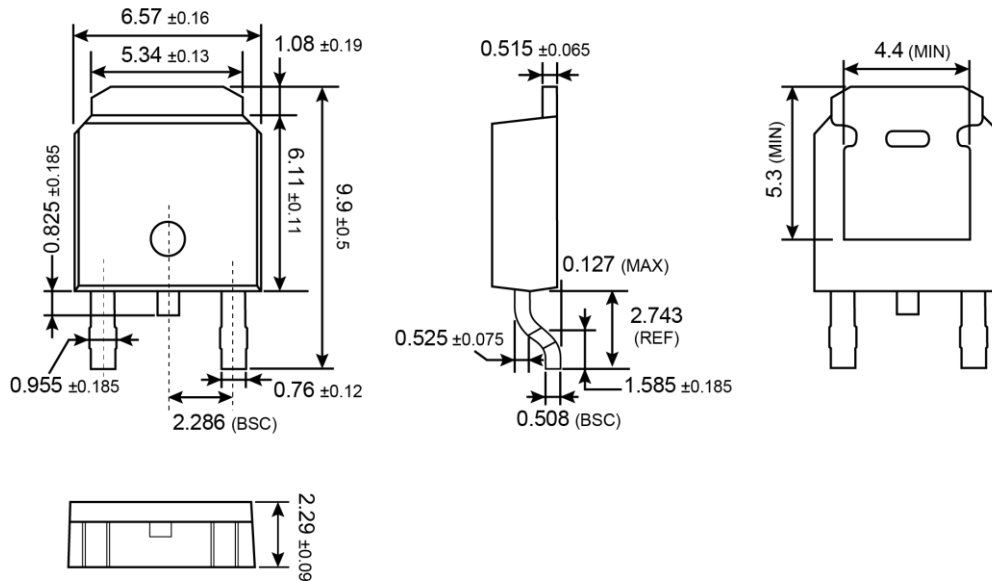
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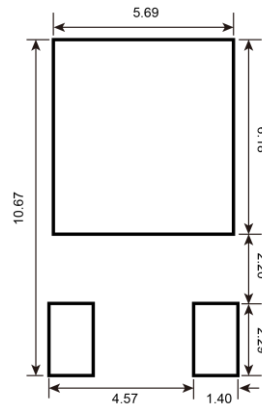
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**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**TO-252**



**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



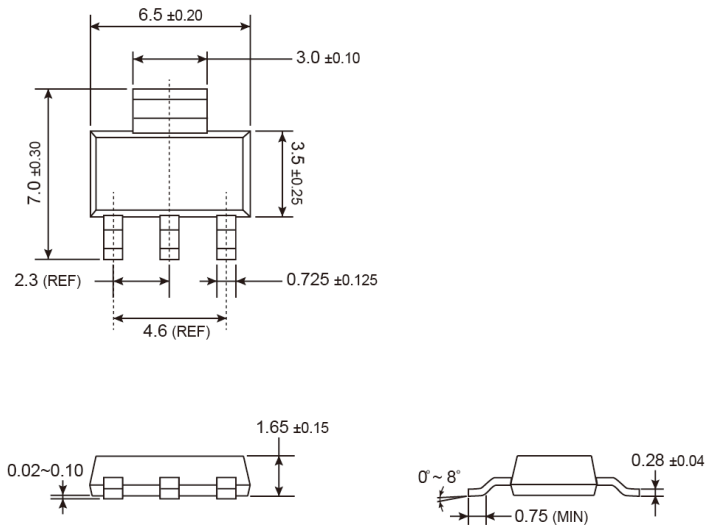
**MARKING DIAGRAM**



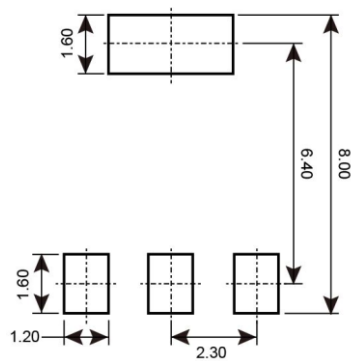
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**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

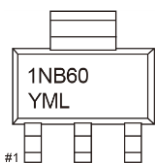
**SOT-223**



**SUGGESTED PAD LAYOUT**



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