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# 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 Crss typical @4.2pF (Typ.)

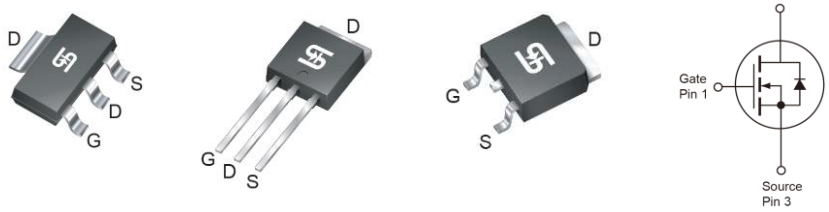
| KEY PERFORMANCE PARAMETERS | | |
|---|---|---|
| **PARAMETER** | **VALUE** | **UNIT** |
| $V_{DS}$ | 600 | V |
| $R_{DS(on)}$ (max) | 10 | Ω |
| $Q_g$ | 6.1 | nC |

## APPLICATION

- Power Supply
- Lighting
- Charger

Pb-Free RoHS COMPLIANT HALOGEN FREE

**SOT-223** **TO-251 (IPAK)** **TO-252 (DPAK)**




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

## ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°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 (Note 1) | $T_C$ = 25°C | $I_D$ | 1 | | A |
| | $T_C$ = 100°C | | 0.7 | | |
| Pulsed Drain Current (Note 2) | | $I_{DM}$ | 4 | | A |
| Total Power Dissipation @ $T_C$ = 25°C | | $P_{DTOT}$ | 39 | 2.1 | W |
| Single Pulsed Avalanche Energy (Note 3) | | $E_{AS}$ | 5 | | mJ |
| Single Pulsed Avalanche Current (Note 3) | | $I_{AS}$ | 1 | | A |
| Peak Diode Recovery dv/dt (Note 4) | | 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.

| **ELECTRICAL SPECIFICATIONS** ($T_A$ = 25°C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITIONS** | **SYMBOL** | **MIN** | **TYP** | **MAX** | **UNIT** |
| **Static** (Note 5) | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250μA | $BV_{DSS}$ | 600 | -- | -- | V |
| Drain-Source On-State Resistance | $V_{GS}$ = 10V, $I_D$ = 0.5A | $R_{DS(ON)}$ | -- | 8 | 10 | Ω |
| Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | $V_{GS(TH)}$ | 2.5 | 3.5 | 4.5 | V |
| Zero Gate Voltage Drain Current | $V_{DS}$ = 600V, $V_{GS}$ = 0V | $I_{DSS}$ | -- | -- | 10 | μA |
| Gate Body Leakage | $V_{GS}$ = ±30V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Forward Transfer Conductance | $V_{DS}$ = 10V, $I_D$ = 0.5A | $g_{fs}$ | -- | 0.8 | -- | S |
| **Dynamic** (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 = 1.0MHz | $C_{iss}$ | -- | 138 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 17.1 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 4.2 | -- | |
| Gate Resistance | F = 1MHz, open drain | $R_g$ | -- | 12.5 | -- | Ω |
| **Switching** (Note 7) | | | | | | |
| Turn-On Delay Time | $V_{DD}$ = 300V, $R_G$ =25Ω $I_D$ = 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 | -- | |
| **Source-Drain Diode** (Note 5) | | | | | | |
| Diode Forward Voltage | $I_S$ = 1A, $V_{GS}$ = 0V | $V_{SD}$ | -- | 0.9 | 1.4 | V |
| Source Current | Integral reverse diode In the MOSFET | $I_S$ | -- | -- | 1 | A |
| Source Current (Pulse) | | $I_{SM}$ | -- | -- | 4 | |

**Notes:**

1. Current limited by package.
2. Pulse width limited by the maximum junction temperature.
3. L = 10mH, $I_{AS}$ = 1A, $V_{DD}$ = 50V, $R_G$ = 25Ω, Starting $T_J$ = 25°C.
4. $I_{SD}$≤1A , $V_{DD}$≤$BV_{DSS}$ , di/dt≤200A/us , Starting $T_J$ = 25°C.
5. Pulse test: PW ≤ 300μs, duty cycle ≤ 2%.
6. For DESIGN AID ONLY, not subject to production testing.
7. Switching time is essentially independent of operating temperature.

## ORDERING INFORMATION

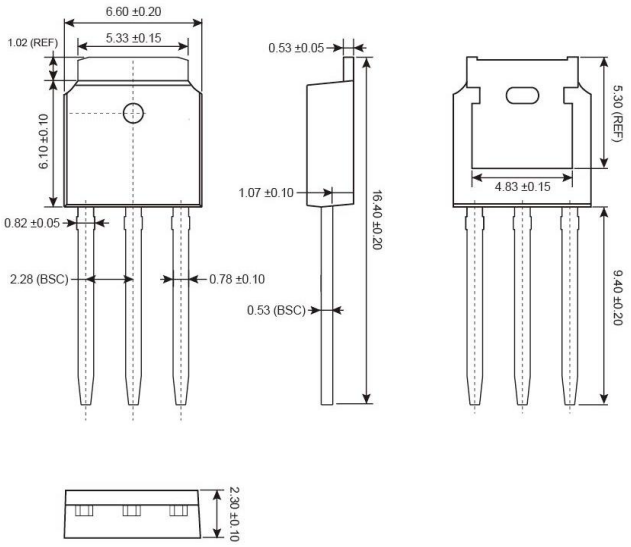
| PART NO. | PACKAGE | PACKING |
|---|---|---|
| TSM1NB60CH C5G | TO-251 | 75 pcs / Tube |
| TSM1NB60CP ROG | TO-252 | 2,500 pcs / 13” Reel |
| TSM1NB60CW RPG | SOT-223 | 2,500 pcs / 13” Reel |

**Note:**

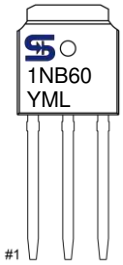
1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

**TO-251**




## MARKING DIAGRAM




**Y** = Year Code

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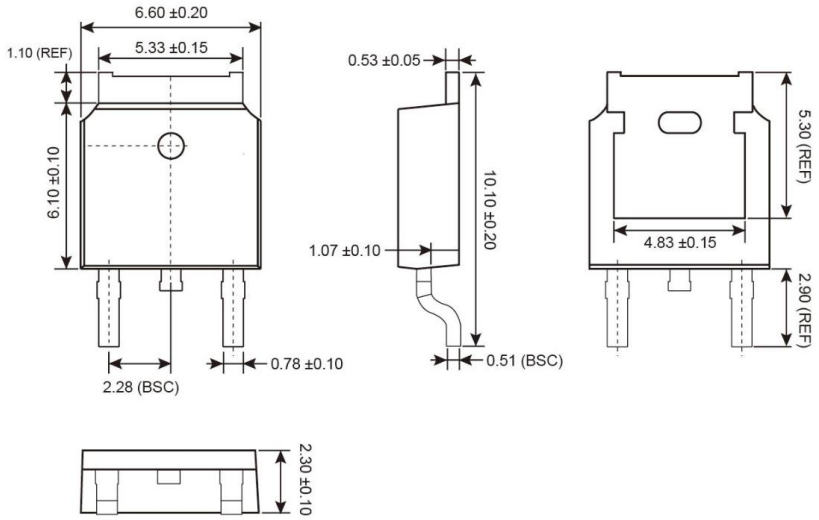
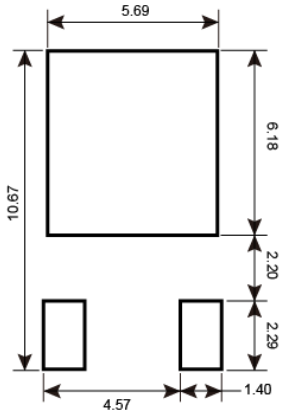
**TO-252**




## SUGGESTED PAD LAYOUT

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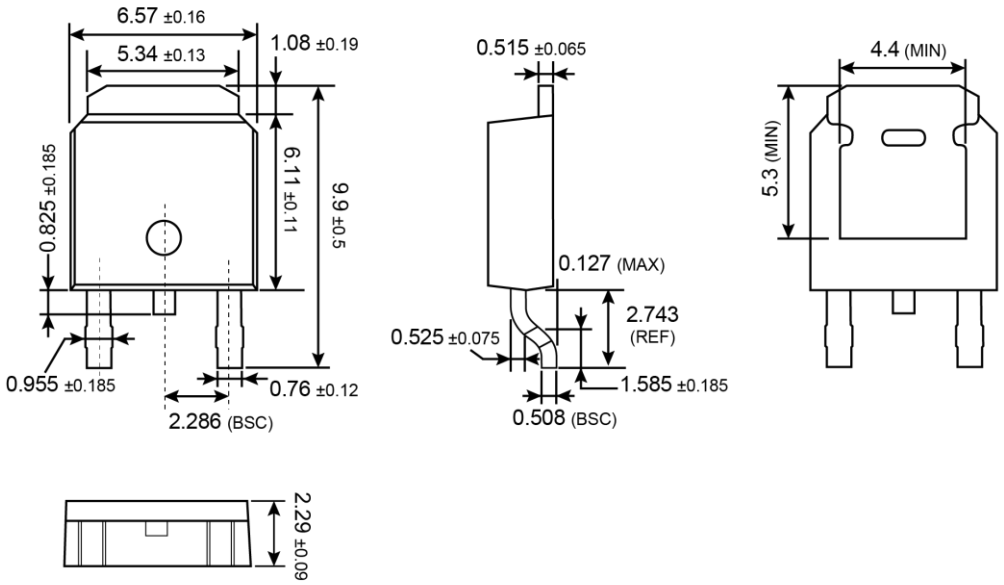


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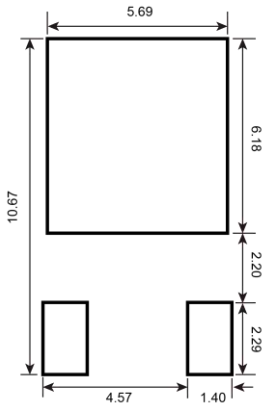


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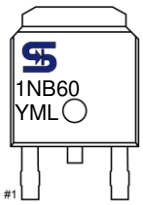


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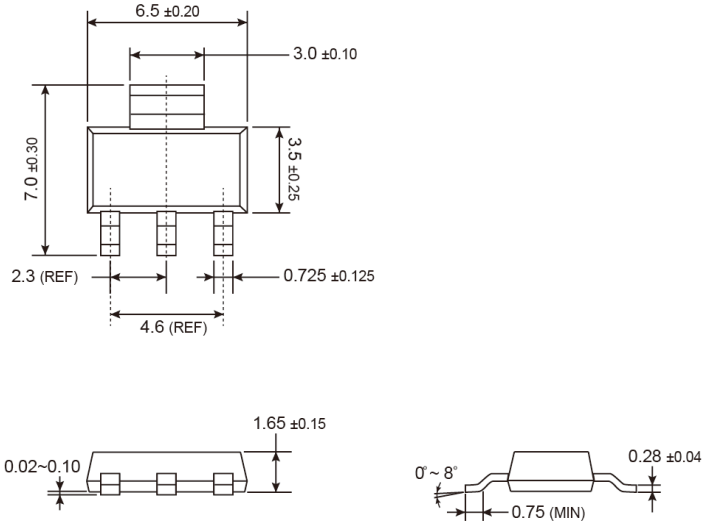
**SOT-223**

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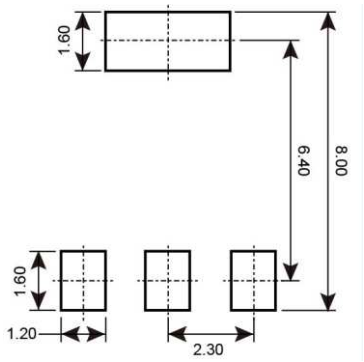


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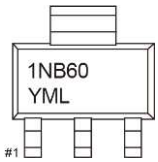


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