# N-Channel Power MOSFET

600V, 8A, 0.6Ω

## FEATURES

- Super-Junction technology
- High performance due to small figure-of-merit
- High ruggedness performance
- High commutation performance

## APPLICATION

- Power Supply
- Lighting

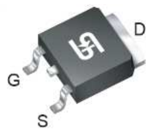
| KEY PERFORMANCE PARAMETERS | | |
|---|---|---|
| **PARAMETER** | **VALUE** | **UNIT** |
| $V_{DS}$ | 600 | V |
| $R_{DS(on)}$ (max) | 0.6 | Ω |
| $Q_g$ | 13 | nC |

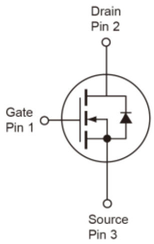
Pb-Free RoHS COMPLIANT HALOGEN FREE

**ITO-220**


**TO-251 (IPAK)**


**TO-252 (DPAK)**




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

**ABSOLUTE MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted)

| PARAMETER | | SYMBOL | ITO-220 | IPAK/DPAK | UNIT |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 600 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | | V |
| Continuous Drain Current (Note 1) | $T_C$ = 25°C | $I_D$ | 8 | | A |
| | $T_C$ = 100°C | | 4.8 | | |
| Pulsed Drain Current (Note 2) | | $I_{DM}$ | 24 | | A |
| Total Power Dissipation @ $T_C$ = 25°C | | $P_{DTOT}$ | 32 | 83 | W |
| Single Pulsed Avalanche Energy (Note 3) | | $E_{AS}$ | 100 | | mJ |
| Single Pulsed Avalanche Current (Note 3) | | $I_{AS}$ | 2 | | A |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | - 55 to +150 | | °C |

**THERMAL PERFORMANCE**

| PARAMETER | SYMBOL | ITO-220 | IPAK/DPAK | UNIT |
|---|---|---|---|---|
| Junction to Case Thermal Resistance | $R_{ΘJC}$ | 3.9 | 1.5 | °C/W |
| Junction to Ambient Thermal Resistance | $R_{ΘJA}$ | 62 | | °C/W |

**Notes:** $R_{ΘJA}$ 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. $R_{ΘJA}$ is guaranteed by design while $R_{ΘCA}$ is determined by the user's board design. $R_{ΘJA}$ 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 4) | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250µA | $BV_{DSS}$ | 600 | -- | -- | V |
| Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | $V_{GS(TH)}$ | 2.0 | 3.0 | 4.0 | V |
| Gate Body Leakage | $V_{GS}$ = ±30V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Zero Gate Voltage Drain Current | $V_{DS}$ = 600V, $V_{GS}$ = 0V | $I_{DSS}$ | -- | -- | 1 | µA |
| Drain-Source On-State Resistance | $V_{GS}$ = 10V, $I_D$ = 4A | $R_{DS(on)}$ | -- | 0.49 | 0.6 | Ω |
| **Dynamic** (Note 5) | | | | | | |
| Total Gate Charge | $V_{DS}$ = 380V, $I_D$ = 8A, $V_{GS}$ = 10V | $Q_g$ | -- | 13 | -- | nC |
| Gate-Source Charge | | $Q_{gs}$ | -- | 3 | -- | |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 4 | -- | |
| Input Capacitance | $V_{DS}$ = 100V, $V_{GS}$ = 0V, f = 1.0MHz | $C_{iss}$ | -- | 743 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 66 | -- | |
| Gate Resistance | F = 1MHz, open drain | $R_g$ | -- | 3.2 | -- | Ω |
| **Switching** (Note 6) | | | | | | |
| Turn-On Delay Time | $V_{DD}$ = 380V, $R_{GEN}$ = 25Ω, $I_D$ = 8A, $V_{GS}$ = 10V, | $t_{d(on)}$ | -- | 21 | -- | ns |
| Turn-On Rise Time | | $t_r$ | -- | 15 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 40 | -- | |
| Turn-Off Fall Time | | $t_f$ | -- | 9 | -- | |
| **Source-Drain Diode** (Note 4) | | | | | | |
| Forward On Voltage | $I_S$ = 8A, $V_{GS}$ = 0V | $V_{SD}$ | -- | -- | 1.4 | V |
| Reverse Recovery Time | $V_R$=200V, $I_S$ = 4A dI$_F$/dt = 100A/µs | $t_{rr}$ | -- | 185 | -- | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | -- | 1.4 | -- | µC |

**Notes:**

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

## ORDERING INFORMATION

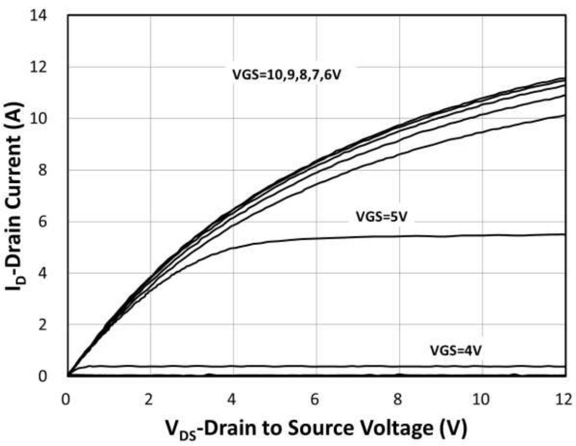
| PART NO. | PACKAGE | PACKING |
|---|---|---|
| TSM60N600CI C0G | ITO-220 | 50pcs / Tube |
| TSM60N600CH C5G | TO-251 (IPAK) | 75pcs / Tube |
| TSM60N600CP ROG | TO-252 (DPAK) | 2,500pcs / 13" Reel |

**Note:**

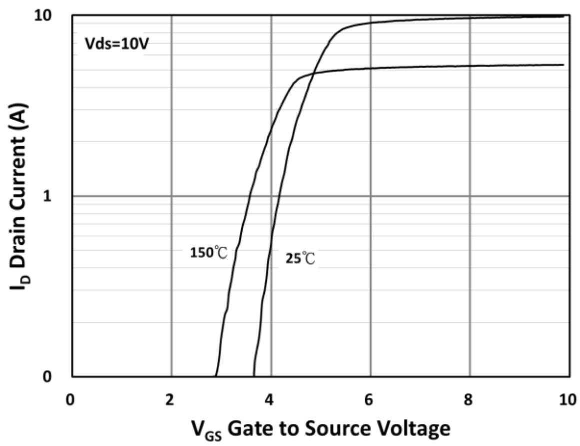
1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

## ELECTRICAL CHARACTERISTICS CURVES
($T_C$ = 25°C unless otherwise noted)

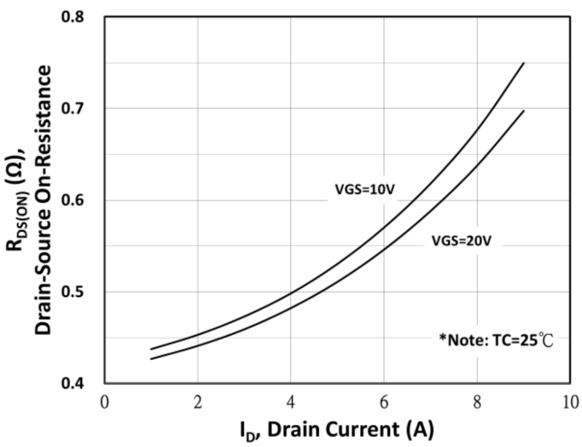
**Output Characteristics**



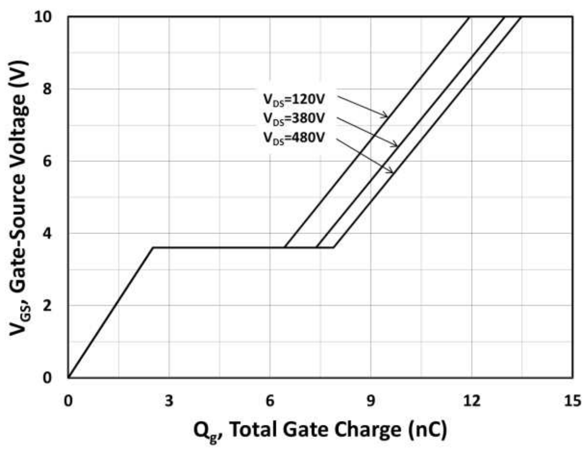

**Transfer Characteristics**



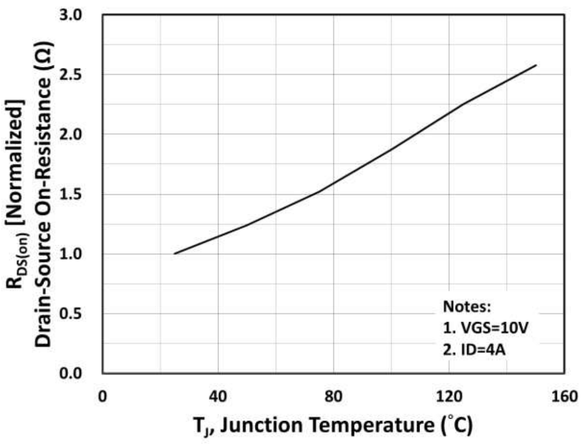

**On-Resistance vs. Drain Current**



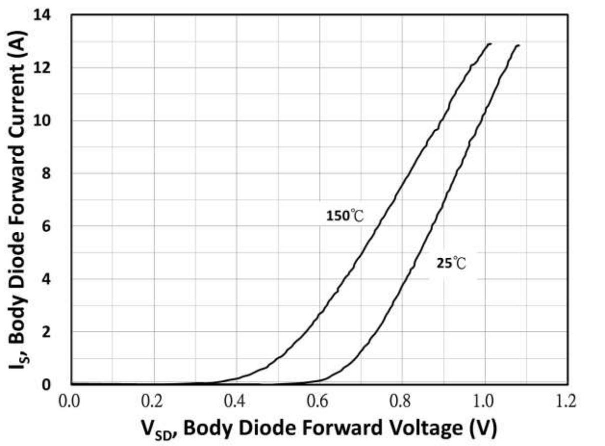

**Gate-Source Voltage vs. Gate Charge**




**On-Resistance vs. Junction Temperature**



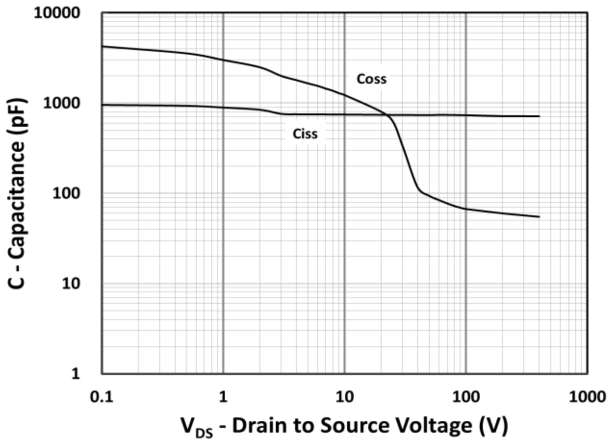

**Source-Drain Diode Forward Current vs. Voltage**



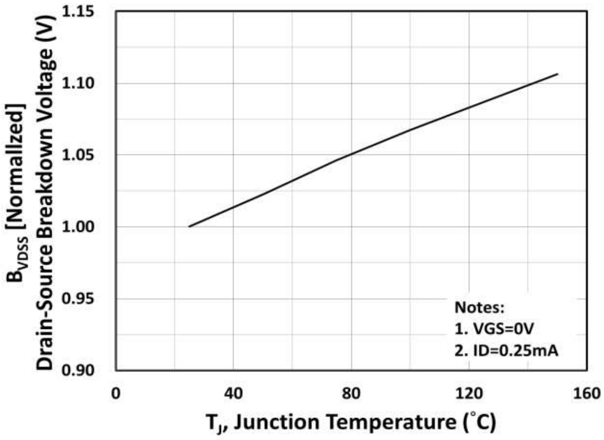
## ELECTRICAL CHARACTERISTICS CURVES

($T_C$ = 25°C unless otherwise noted)

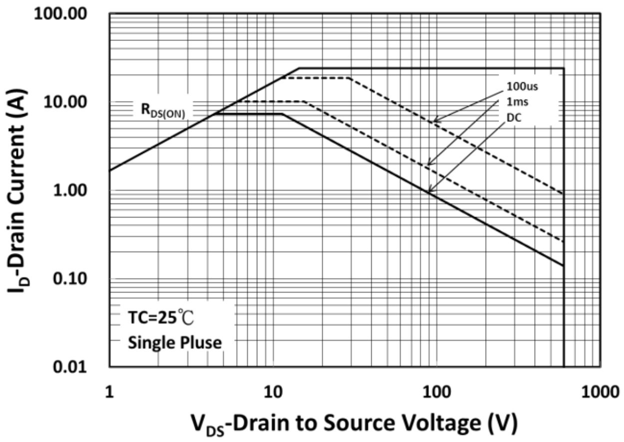
**Capacitance vs. Drain-Source Voltage**



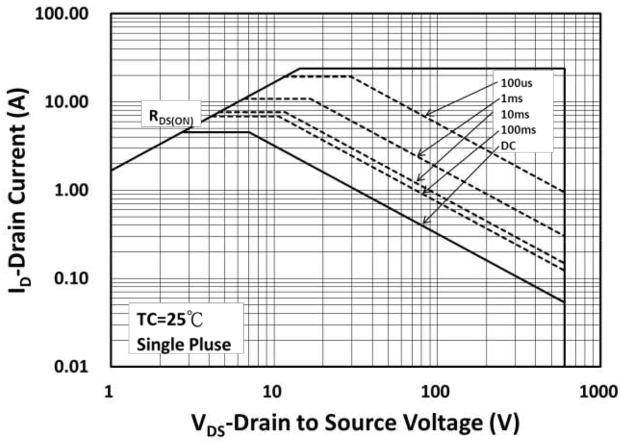

**$BV_{DSS}$ vs. Junction Temperature**




**Maximum Safe Operating Area (DPAK/IPAK)**




**Maximum Safe Operating Area (ITO-220)**



## ELECTRICAL CHARACTERISTICS CURVES

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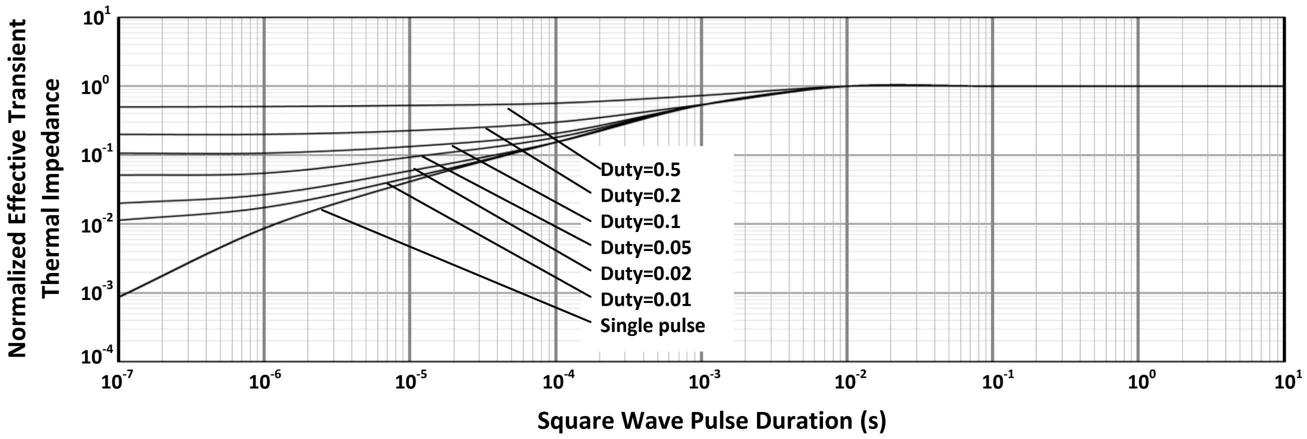
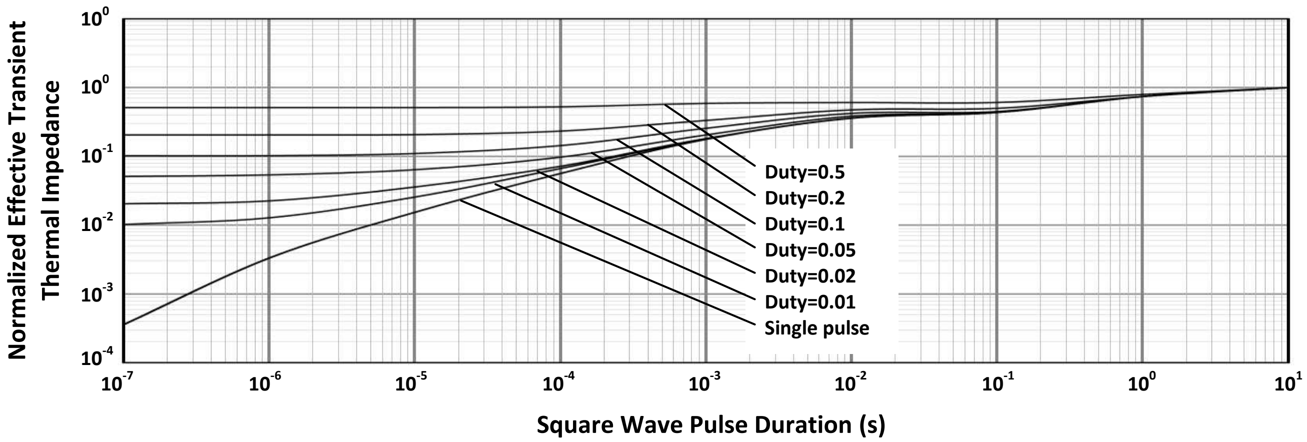
**Normalized Thermal Transient Impedance, Junction-to-Case (DPAK/IPAK)**

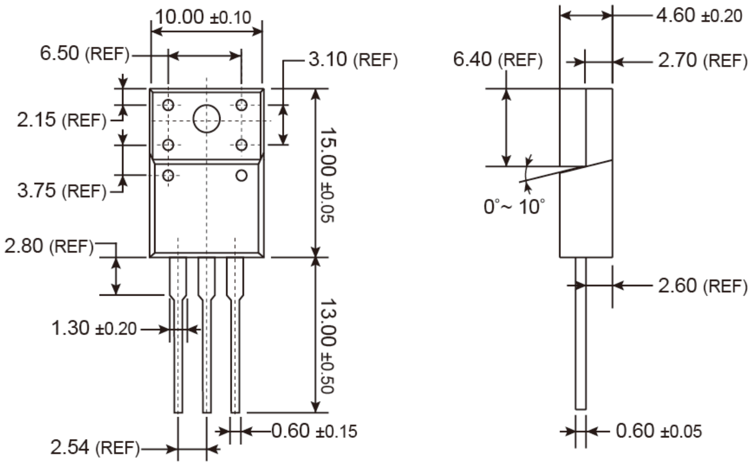



**Normalized Thermal Transient Impedance, Junction-to-Case (ITO-220)**

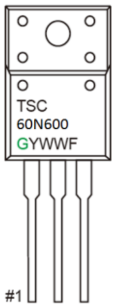


## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

**ITO-220**



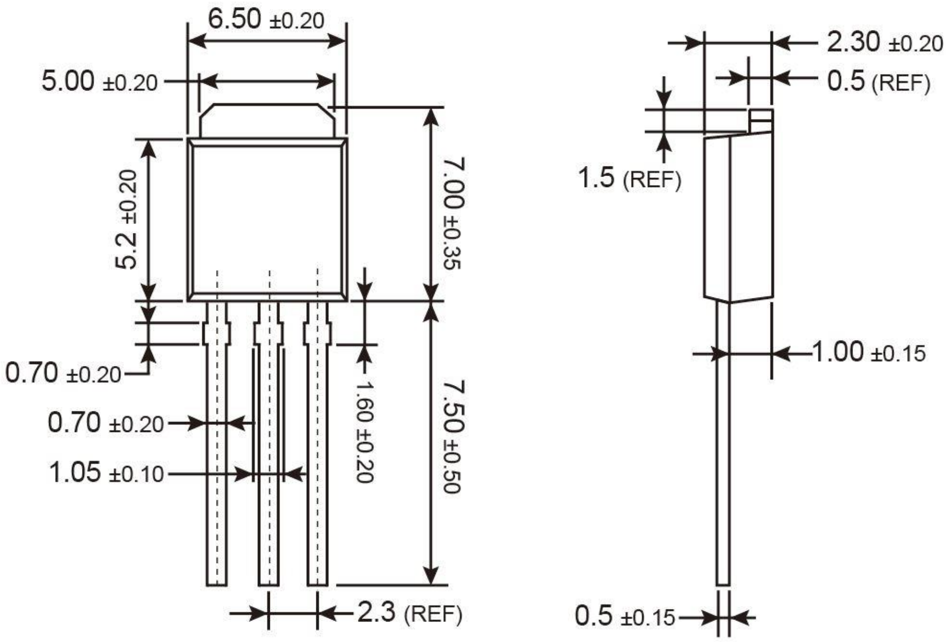

## MARKING DIAGRAM




**G** = Halogen Free
**Y** = Year Code
**WW** = Week Code (01~52)
**F** = Factory Code

## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

**TO-251 (IPAK)**

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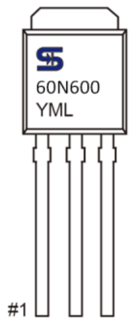


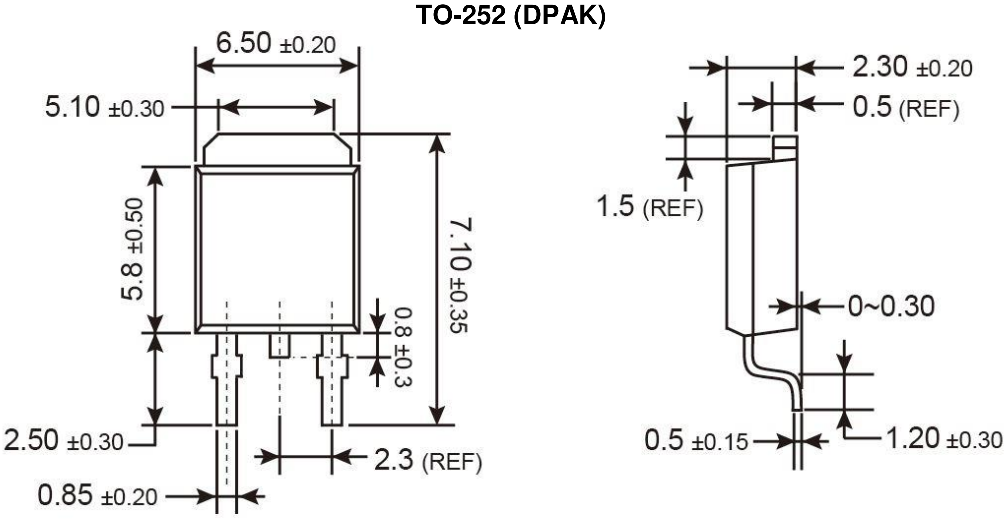

**Y** = Year Code
**M** = Month Code for Halogen Free Product

| | | | |
|---|---|---|---|
| **O** =Jan | **P** =Feb | **Q** =Mar | **R** =Apr |
| **S** =May | **T** =Jun | **U** =Jul | **V** =Aug |
| **W** =Sep | **X** =Oct | **Y** =Nov | **Z** =Dec |

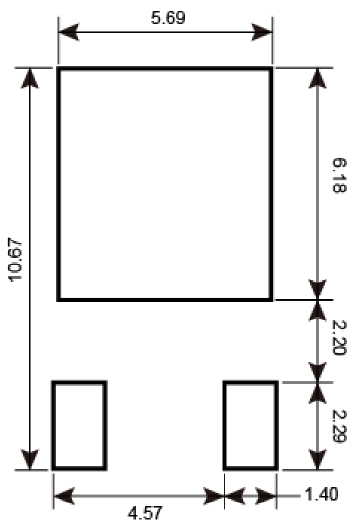
**L** = Lot Code (1~9, A~Z)

## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

**TO-252 (DPAK)**




## SUGGESTED PAD LAYOUT

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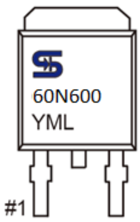


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## Notice