# P-Channel Power MOSFET

-40V, -22A, 15mΩ

## FEATURES

- Low $R_{DS(ON)}$ to minimize conductive losses
- Logic level
- Low gate charge for fast power switching
- 100% UIS and $R_g$ tested
- Compliant to RoHS directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

## KEY PERFORMANCE PARAMETERS

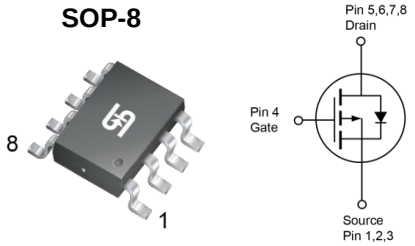
| PARAMETER | | VALUE | UNIT |
|---|---|---|---|
| $V_{DS}$ | | -40 | V |
| $R_{DS(on)}$ (max) | $V_{GS}$ = -10V | 15 | mΩ |
| | $V_{GS}$ = -4.5V | 21 | |
| $Q_g$ | | 23 | nC |

## APPLICATIONS

- POL
- Load Switch
- Motor Drives

Pb-Free RoHS COMPLIANT HALOGEN FREE

**SOP-8**




**Note:** MSL 1 (Moisture Sensitivity Level) per J-STD-020

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

| PARAMETER | | SYMBOL | LIMIT | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current (Note 1) | $T_C$ = 25°C | $I_D$ | -22 | A |
| | $T_A$ = 25°C | | -9 | |
| Pulsed Drain Current | | $I_{DM}$ | -88 | A |
| Single Pulse Avalanche Current (Note 2) | | $I_{AS}$ | -27 | A |
| Single Pulse Avalanche Energy (Note 2) | | $E_{AS}$ | 109 | mJ |
| Total Power Dissipation | $T_C$ = 25°C | $P_D$ | 12.5 | W |
| | $T_C$ = 125°C | | 2.5 | |
| Total Power Dissipation | $T_A$ = 25°C | $P_D$ | 2.2 | W |
| | $T_A$ = 125°C | | 0.4 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | - 55 to +150 | °C |

## THERMAL PERFORMANCE

| PARAMETER | SYMBOL | LIMIT | UNIT |
|---|---|---|---|
| Junction to Case Thermal Resistance | $R_{\Theta JC}$ | 10 | °C/W |
| Junction to Ambient Thermal Resistance | $R_{\Theta JA}$ | 57 | °C/W |

**Thermal Performance Note:** $R_{\Theta JA}$ 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.

| **ELECTRICAL SPECIFICATIONS** ($T_A$ = 25°C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITIONS** | **SYMBOL** | **MIN** | **TYP** | **MAX** | **UNIT** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = -250μA | $BV_{DSS}$ | -40 | -- | -- | V |
| Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = -250μA | $V_{GS(TH)}$ | -1 | -1.65 | -2.5 | V |
| Gate-Source Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Drain-Source Leakage Current | $V_{GS}$ = 0V, $V_{DS}$ = -40V | $I_{DSS}$ | -- | -- | -1 | μA |
| | $V_{GS}$ = 0V, $V_{DS}$ = -32V<br>$T_J$ = 125°C | | -- | -- | -100 | |
| Drain-Source On-State Resistance (Note 3) | $V_{GS}$ = -10V, $I_D$ = -9A | $R_{DS(on)}$ | -- | 11 | 15 | mΩ |
| | $V_{GS}$ = -4.5V, $I_D$ = -8A | | -- | 15 | 21 | |
| Forward Transconductance (Note 3) | $V_{DS}$ = -5V, $I_D$ = -9A | $g_{fs}$ | -- | 29 | -- | S |
| **Dynamic** (Note 4) | | | | | | |
| Total Gate Charge | $V_{GS}$ = -10V,<br>$V_{DS}$ = -20V, $I_D$ = 9A | $Q_g$ | -- | 48 | -- | nC |
| Total Gate Charge | $V_{GS}$ = -4.5V,<br>$V_{DS}$ = -20V, $I_D$ = -9A | $Q_g$ | -- | 23 | -- | |
| Gate-Source Charge | | $Q_{gs}$ | -- | 9 | -- | |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 8.5 | -- | |
| Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = -20V<br>f = 1.0MHz | $C_{iss}$ | -- | 2783 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 269 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 142 | -- | |
| Gate Resistance | f = 1.0MHz | $R_g$ | 2 | 6 | 12 | Ω |
| **Switching** (Note 4) | | | | | | |
| Turn-On Delay Time | $V_{GS}$ = -10V, $V_{DS}$ = -20V,<br>$I_D$ = -9A, $R_G$ = 2Ω, | $t_{d(on)}$ | -- | 7 | -- | ns |
| Turn-On Rise Time | | $t_r$ | -- | 45 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 67 | -- | |
| Turn-Off Fall Time | | $t_f$ | -- | 59 | -- | |
| **Source-Drain Diode** | | | | | | |
| Forward Voltage (Note 3) | $V_{GS}$ = 0V, $I_S$ = -9A | $V_{SD}$ | -- | -- | -1 | V |
| Reverse Recovery Time | $I_S$ = -9A ,<br>dI/dt = 100A/μs | $t_{rr}$ | -- | 19 | -- | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | -- | 11 | -- | nC |

**Notes:**

1. Silicon limited current only.
2. L = 0.3mH, $V_{GS}$ = -10V, $V_{DD}$ = -25V, $R_G$ = 25Ω, $I_{AS}$ = -27A, Starting $T_J$ = 25°C
3. Pulse test: Pulse Width ≤ 300μs, duty cycle ≤ 2%.
4. Switching time is essentially independent of operating temperature.

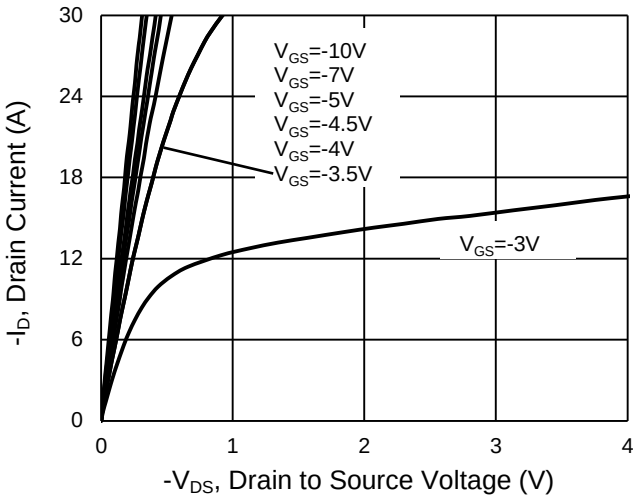
## ORDERING INFORMATION

| PART NO. | PACKAGE | PACKING |
|---|---|---|
| TSM150P04LCS RLG | SOP-8 | 2,500pcs / 13” Reel |

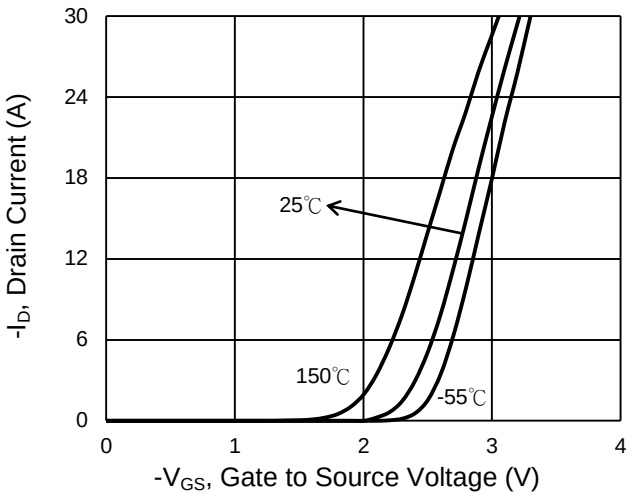
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

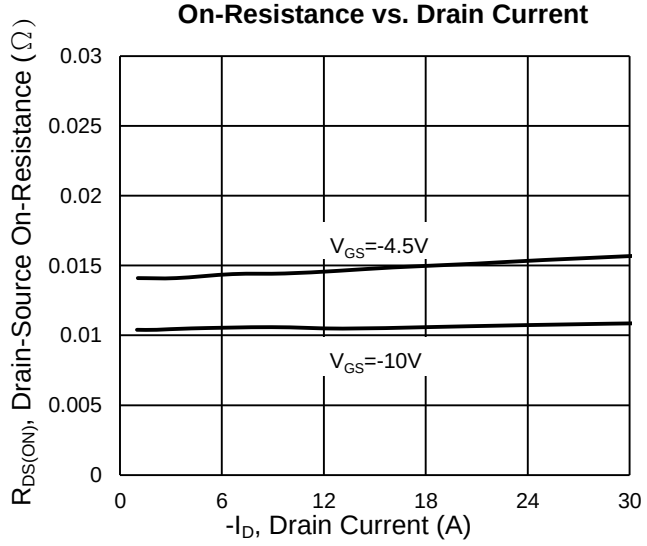
**Output Characteristics**



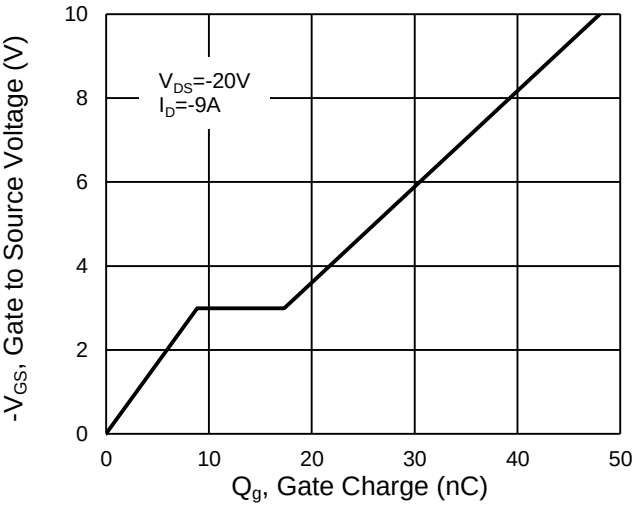

**Transfer Characteristics**



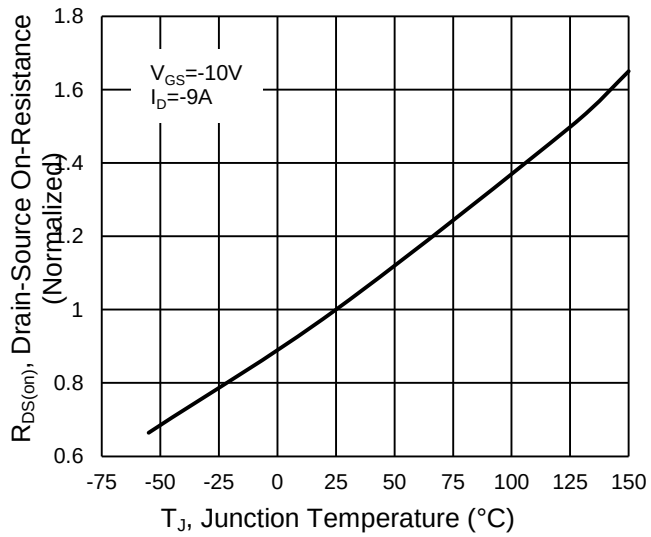

**On-Resistance vs. Drain Current**



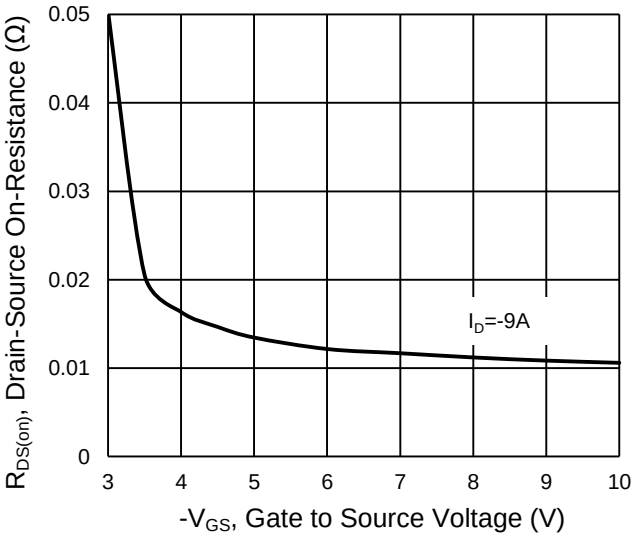

**Gate-Source Voltage vs. Gate Charge**




**On-Resistance vs. Junction Temperature**



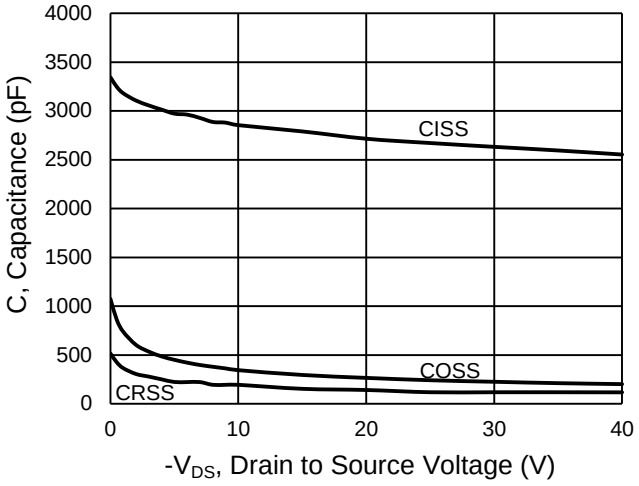

**On-Resistance vs. Gate-Source Voltage**



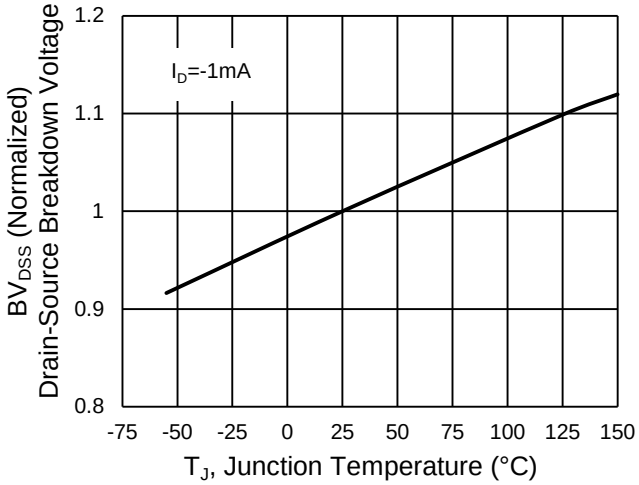
## CHARACTERISTICS CURVES

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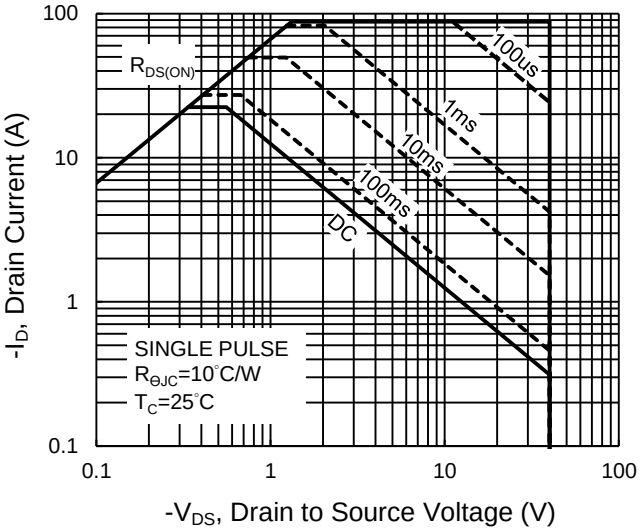
**Capacitance vs. Drain-Source Voltage**



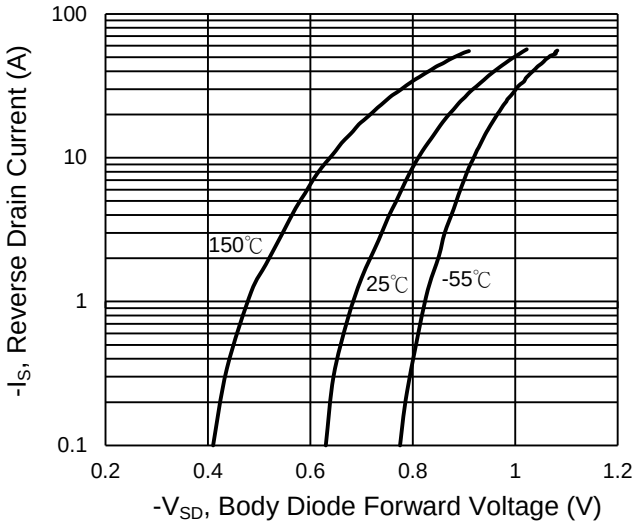

**$BV_{DSS}$ vs. Junction Temperature**



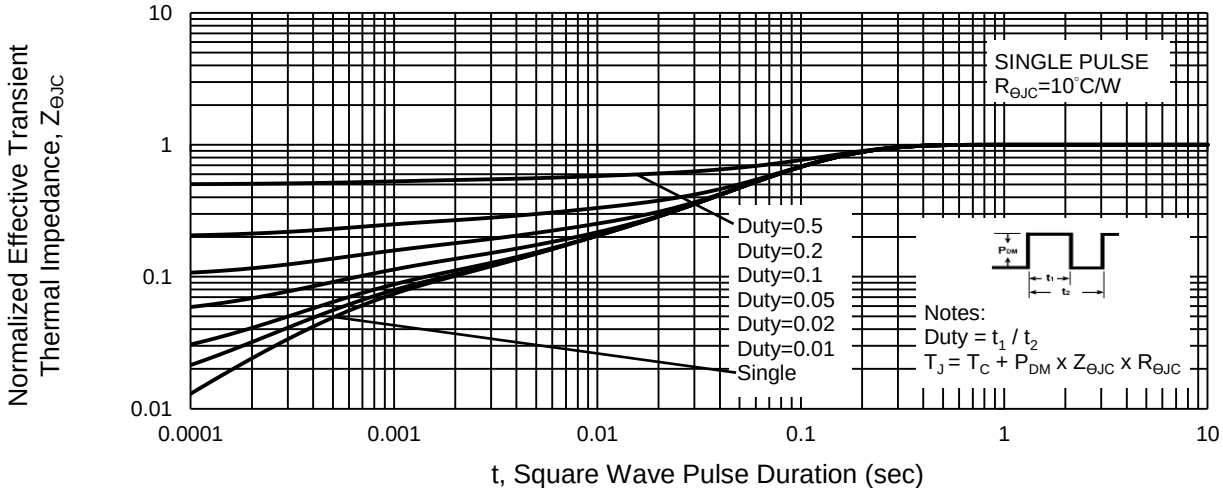

**Maximum Safe Operating Area, Junction-to-Case**




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

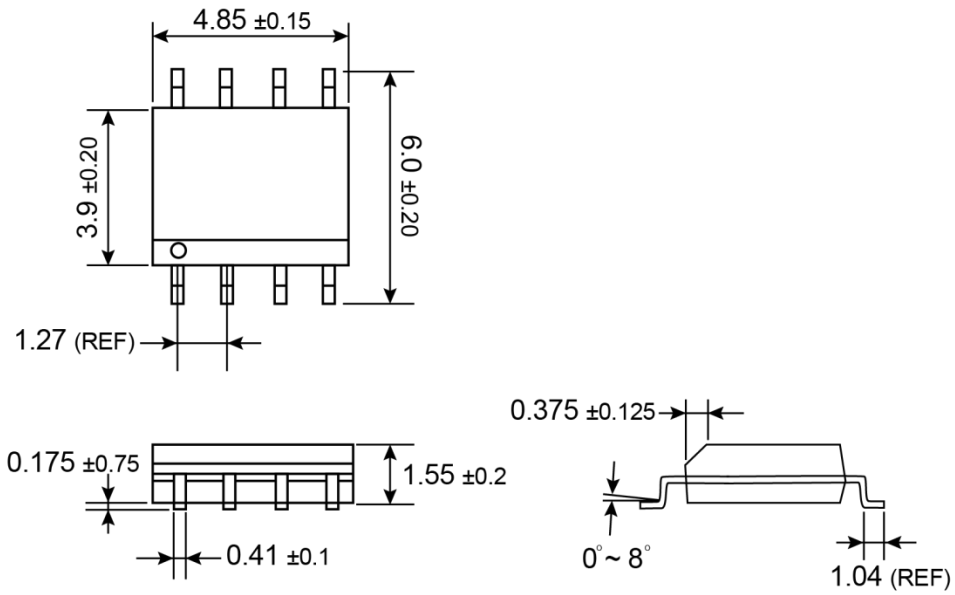



**Normalized Thermal Transient Impedance, Junction-to-Case**

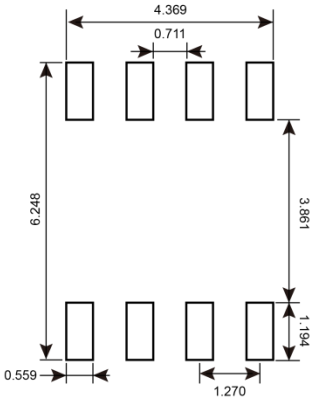


## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

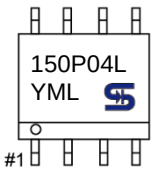
**SOP-8**




## SUGGESTED PAD LAYOUT (Unit: Millimeters)




## MARKING DIAGRAM




**Y** = Year Code

**M** = Month Code

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **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)

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