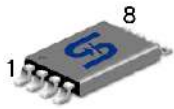


# TSM6968SD

## 20V Dual N-Channel MOSFET w/ESD Protected

**TSSOP-8**

**Pin Definition:**

- |             |             |
|-------------|-------------|
| 1. Drain 1  | 8. Drain 2  |
| 2. Source 1 | 7. Source 2 |
| 3. Source 1 | 6. Source 2 |
| 4. Gate 1   | 5. Gate 2   |

**PRODUCT SUMMARY**

| $V_{DS}$ (V) | $R_{DS(on)}$ (m $\Omega$ ) | $I_D$ (A) |
|--------------|----------------------------|-----------|
| 20           | 22 @ $V_{GS} = 4.5V$       | 6.5       |
|              | 29 @ $V_{GS} = 2.5V$       | 5.5       |

**Features**

- Advance Trench Process Technology
- High Density Cell Design for Ultra Low On-resistance
- ESD Protect 2KV

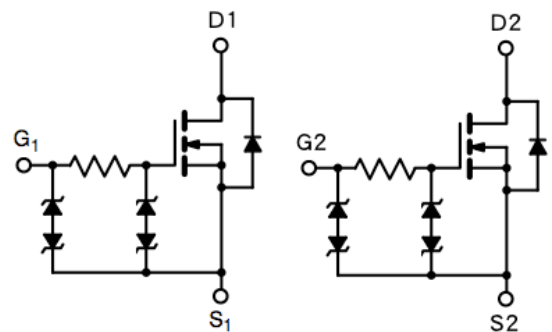
**Application**

- Specially Designed for Li-on Battery Packs
- Battery Switch Application

**Ordering Information**

| Part No.        | Package | Packing          |
|-----------------|---------|------------------|
| TSM6968SDCA RVG | TSSOP-8 | 3Kpcs / 13" Reel |

**Note:** "G" denotes for Halogen Free

**Block Diagram**


Dual N-Channel MOSFET

**Absolute Maximum Rating** ( $T_a = 25^\circ C$  unless otherwise noted)

| Parameter   | Symbol         | Limit              | Unit       |
|---|----------------|--------------------|------------|
| Drain-Source Voltage  | $V_{DS}$       | 20                 | V          |
| Gate-Source Voltage   | $V_{GS}$       | $\pm 12$           | V          |
| Continuous Drain Current, $V_{GS} @ 4.5V$ .                 | $I_D$          | 6.5                | A          |
| Pulsed Drain Current, $V_{GS} @ 4.5V$                       | $I_{DM}$       | 30                 | A          |
| Continuous Source Current (Diode Conduction) <sup>a,b</sup> | $I_S$          | 1.4                | A          |
| Maximum Power Dissipation                                   | $P_D$          | $T_a = 25^\circ C$ | 1.04       |
|   |                | $T_a = 75^\circ C$ | 0.625      |
| Operating Junction Temperature                              | $T_J$          | +150               | $^\circ C$ |
| Operating Junction and Storage Temperature Range            | $T_J, T_{STG}$ | -55 to +150        | $^\circ C$ |

**Thermal Performance**

| Parameter  | Symbol            | Limit | Unit         |
|--|-------------------|-------|--------------|
| Junction to Foot (Drain) Thermal Resistance          | $R_{\theta_{JF}}$ | 83    | $^\circ C/W$ |
| Junction to Ambient Thermal Resistance (PCB mounted) | $R_{\theta_{JA}}$ | 120   | $^\circ C/W$ |

Notes:

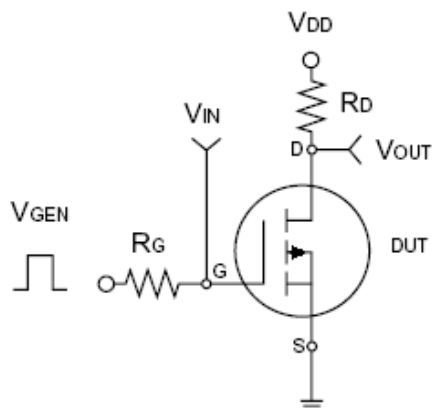
- Pulse width limited by the Maximum junction temperature
- Surface Mounted on FR4 Board,  $t \leq 5$  sec.

### Electrical Specifications (Ta = 25°C unless otherwise noted)

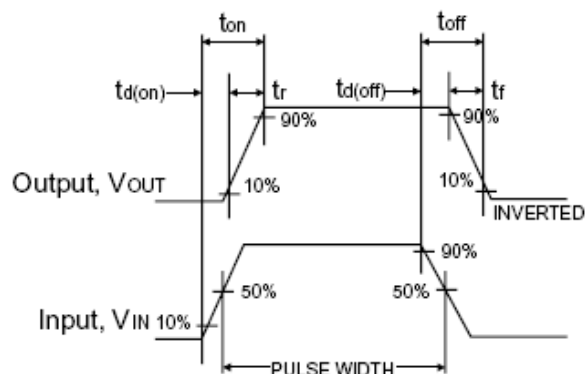
| Parameter                        | Conditions  | Symbol       | Min | Typ  | Max      | Unit       |
|----------------------------------|---|--------------|-----|------|----------|------------|
| <b>Static</b>                    |   |              |     |      |          |            |
| Drain-Source Breakdown Voltage   | $V_{GS} = 0V, I_D = 250\mu A$   | $BV_{DSS}$   | 20  | --   | --       | V          |
| Gate Threshold Voltage           | $V_{DS} = V_{GS}, I_D = 250\mu A$                                       | $V_{GS(TH)}$ | 0.6 | 0.8  | 1.0      | V          |
| Gate Body Leakage                | $V_{GS} = \pm 12V, V_{DS} = 0V$   | $I_{GSS}$    | --  | --   | $\pm 10$ | $\mu A$    |
| Zero Gate Voltage Drain Current  | $V_{DS} = 16V, V_{GS} = 0V$   | $I_{DSS}$    | --  | --   | 1.0      | $\mu A$    |
| On-State Drain Current           | $V_{DS} = 5V, V_{GS} = 4.5V$  | $I_{D(ON)}$  | 30  | --   | --       | A          |
| Drain-Source On-State Resistance | $V_{GS} = 4.5V, I_D = 6.5A$   | $R_{DS(ON)}$ | --  | 15   | 22       | m $\Omega$ |
|                                  | $V_{GS} = 2.5V, I_D = 5.5A$   |              | --  | 20   | 29       |            |
| Forward Transconductance         | $V_{DS} = 10V, I_D = 6.5A$  | $g_{fs}$     | --  | 30   | --       | S          |
| Diode Forward Voltage            | $I_S = 1.7A, V_{GS} = 0V$   | $V_{SD}$     | --  | 0.6  | 1.2      | V          |
| <b>Dynamic<sup>b</sup></b>       |   |              |     |      |          |            |
| Total Gate Charge                | $V_{DS} = 10V, I_D = 6.5A, V_{GS} = 4.5V$                               | $Q_g$        | --  | 15   | 20       | nC         |
| Gate-Source Charge               |   | $Q_{gs}$     | --  | 3.4  | --       |            |
| Gate-Drain Charge                |   | $Q_{gd}$     | --  | 1.2  | --       |            |
| Input Capacitance                | $V_{DS} = 10V, V_{GS} = 0V, f = 1.0MHz$                                 | $C_{iss}$    | --  | 950  | --       | pF         |
| Output Capacitance               |   | $C_{oss}$    | --  | 450  | --       |            |
| Reverse Transfer Capacitance     |   | $C_{rss}$    | --  | 135  | --       |            |
| <b>Switching<sup>c</sup></b>     |   |              |     |      |          |            |
| Turn-On Delay Time               | $V_{DD} = 10V, R_L = 10\Omega, I_D = 1A, V_{GEN} = 4.5V, R_G = 6\Omega$ | $t_{d(on)}$  | --  | 140  | 200      | nS         |
| Turn-On Rise Time                |   | $t_r$        | --  | 210  | 250      |            |
| Turn-Off Delay Time              |   | $t_{d(off)}$ | --  | 3700 | 4800     |            |
| Turn-Off Fall Time               |   | $t_f$        | --  | 2000 | 2600     |            |

**Notes:**

- a. pulse test:  $PW \leq 300\mu S$ , duty cycle  $\leq 2\%$
- b. For DESIGN AID ONLY, not subject to production testing.
- b. Switching time is essentially independent of operating temperature.



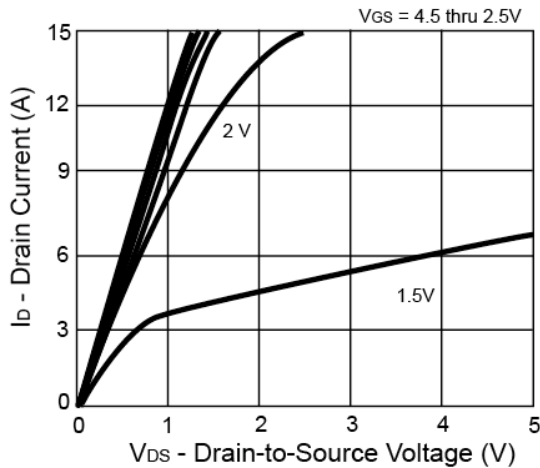
**Switching Test Circuit**



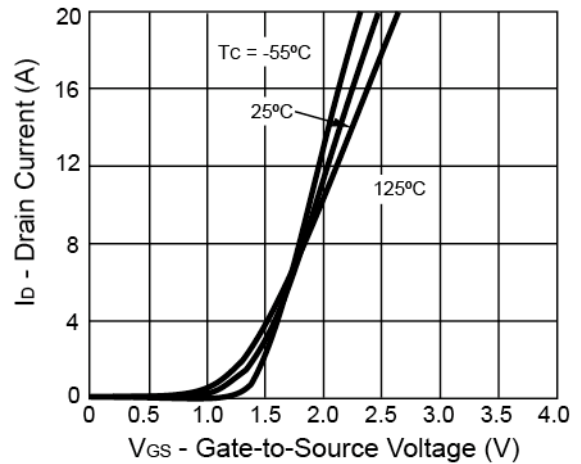
**Switchin Waveforms**

**Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)**

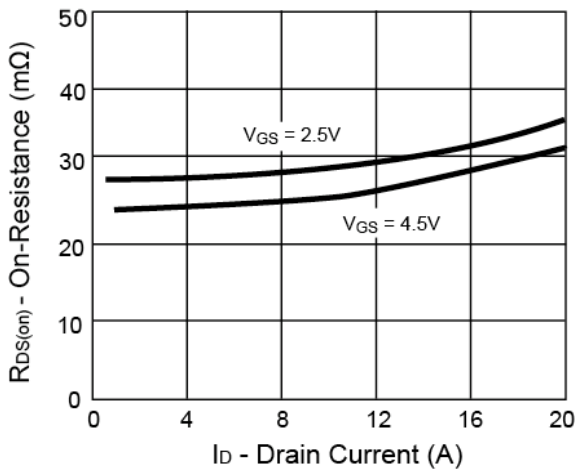
**Output Characteristics**



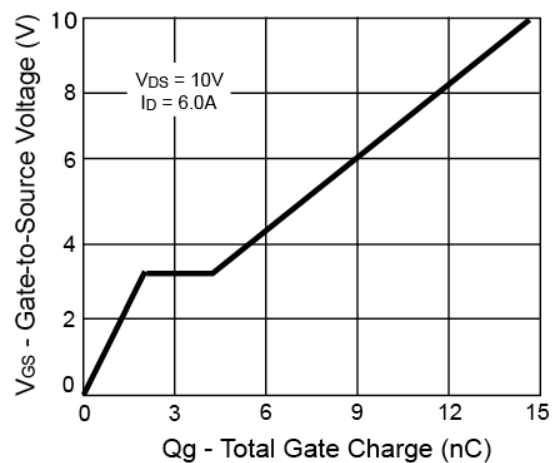
**Transfer Characteristics**



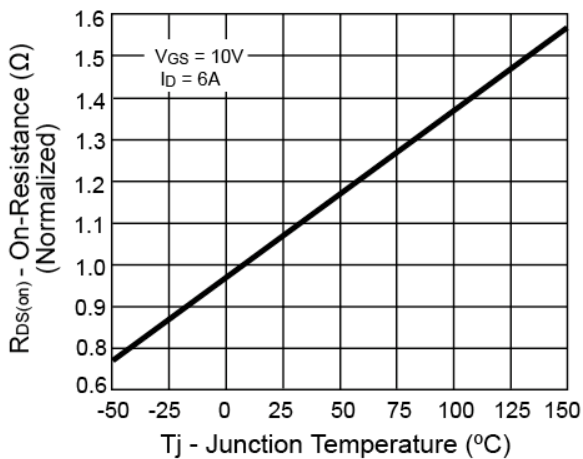
**On-Resistance vs. Drain Current**



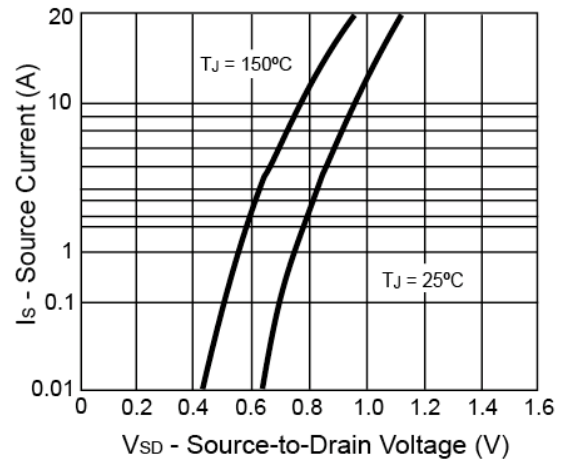
**Gate Charge**



**On-Resistance vs. Junction Temperature**

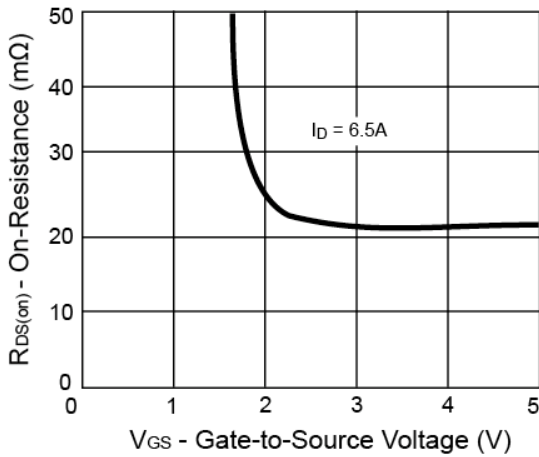


**Source-Drain Diode Forward Voltage**

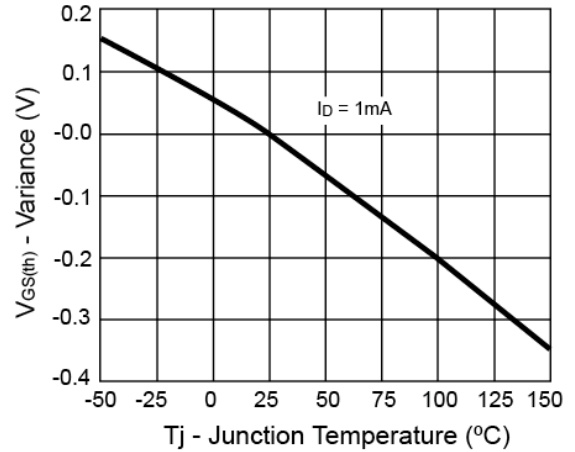


**Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)**

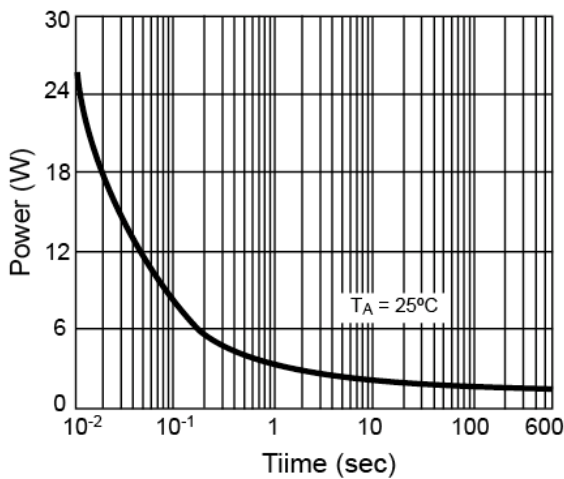
**On-Resistance vs. Gate-Source Voltage**



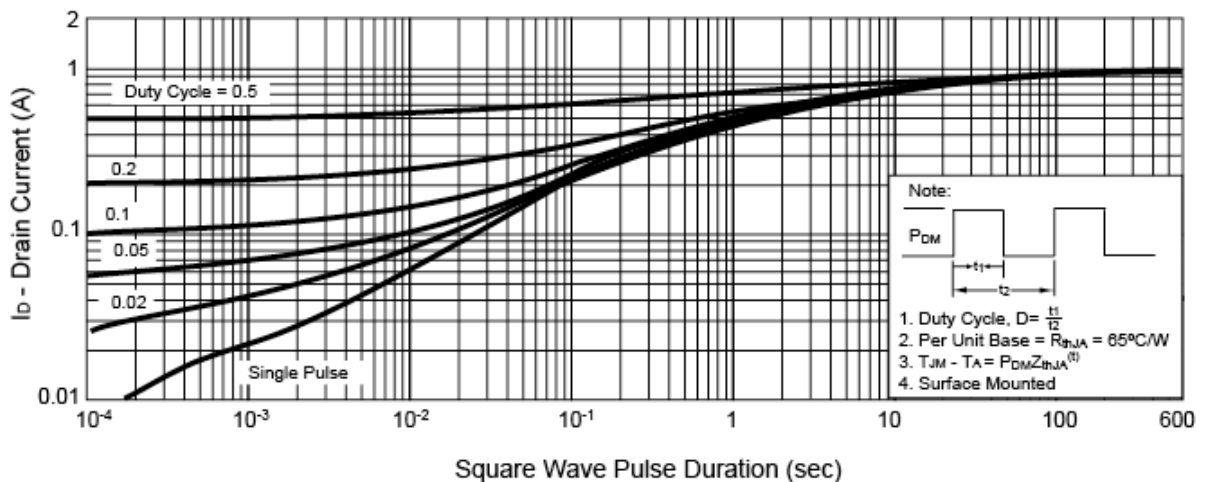
**Threshold Voltage**



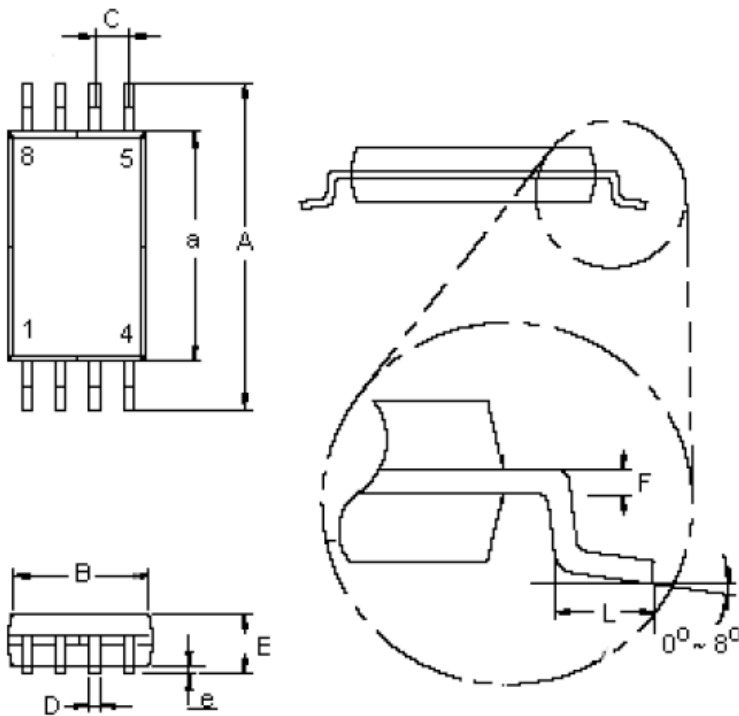
**Single Pulse Power**



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

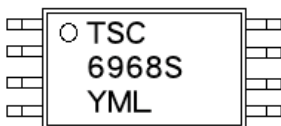


### TSSOP-8 Mechanical Drawing



| TSSOP-8 DIMENSION |             |      |             |       |
|-------------------|-------------|------|-------------|-------|
| DIM               | MILLIMETERS |      | INCHES      |       |
|                   | MIN         | MAX  | MIN         | MAX   |
| A                 | 6.20        | 6.60 | 0.244       | 0.260 |
| a                 | 4.30        | 4.50 | 0.170       | 0.177 |
| B                 | 2.90        | 3.10 | 0.114       | 0.122 |
| C                 | 0.65 (typ)  |      | 0.025 (typ) |       |
| D                 | 0.25        | 0.30 | 0.010       | 0.019 |
| E                 | 1.05        | 1.20 | 0.041       | 0.049 |
| e                 | 0.05        | 0.15 | 0.002       | 0.009 |
| F                 | 0.127       |      | 0.005       |       |
| L                 | 0.50        | 0.70 | 0.020       | 0.028 |

### Marking Diagram



**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



# TSM6968SD

## 20V Dual N-Channel MOSFET w/ESD Protected

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