

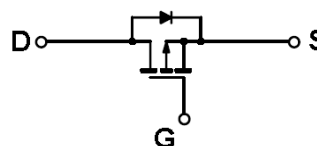
**SOT-23**

**Pin Definition:**

1. Gate
2. Source
3. Drain

**PRODUCT SUMMARY**

| $V_{DS}$ (V) | $R_{DS(on)}$ (m $\Omega$ ) | $I_D$ (A) |
|--------------|----------------------------|-----------|
| -20          | 70 @ $V_{GS} = -4.5V$      | -3.3      |
|              | 90 @ $V_{GS} = -2.5V$      | -2.0      |
|              | 130 @ $V_{GS} = -1.8V$     | -1.0      |

**Block Diagram**


P-Channel MOSFET

**Features**

- Advance Trench Process Technology
- High Density Cell Design for Ultra Low On-resistance

**Application**

- Load Switch
- PA Switch

**Ordering Information**

| Part No.     | Package | Packing         |
|--------------|---------|-----------------|
| TSM2313CX RF | SOT-23  | 3Kpcs / 7" Reel |

**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, $V_{GS} @ 4.5V$ .                 | $I_D$          | -3.3         | A          |
| Pulsed Drain Current, $V_{GS} @ 4.5V$                       | $I_{DM}$       | -20          | A          |
| Continuous Source Current (Diode Conduction) <sup>a,b</sup> | $I_S$          | -1.7         | A          |
| Maximum Power Dissipation                                   | $P_D$          | 2            | W          |
|                                                             |                | 1.3          |            |
| 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 Case Thermal Resistance                  | $R_{\theta JC}$ | 75    | $^\circ C/W$ |
| Junction to Ambient Thermal Resistance (PCB mounted) | $R_{\theta JA}$ | 120   | $^\circ C/W$ |

**Notes:**

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

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

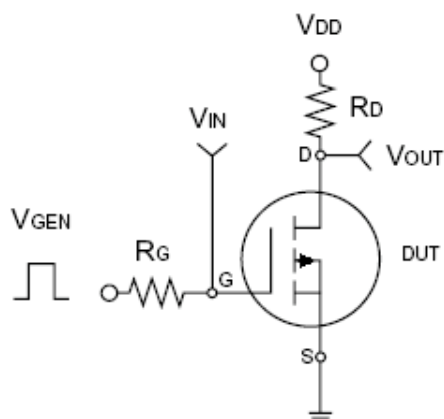
| Parameter                                     | Conditions                                                                           | Symbol       | Min  | Typ  | Max       | Unit       |
|-----------------------------------------------|--------------------------------------------------------------------------------------|--------------|------|------|-----------|------------|
| Static                                        |                                                                                      |              |      |      |           |            |
| 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 | --   | -1.4      | V          |
| Gate Body Leakage                             | $V_{GS} = \pm 12V, V_{DS} = 0V$                                                      | $I_{GSS}$    | --   | --   | $\pm 100$ | nA         |
| Zero Gate Voltage Drain Current               | $V_{DS} = -20V, V_{GS} = 0V$                                                         | $I_{DSS}$    | --   | --   | -1.0      | $\mu A$    |
| On-State Drain Current <sup>a</sup>           | $V_{DS} = -5V, V_{GS} = -4.5V$                                                       | $I_{D(ON)}$  | -15  | --   | --        | A          |
| Drain-Source On-State Resistance <sup>a</sup> | $V_{GS} = -4.5V, I_D = -3.3A$                                                        | $R_{DS(ON)}$ | --   | 55   | 70        | m $\Omega$ |
|                                               | $V_{GS} = -2.5V, I_D = -2.0A$                                                        |              | --   | 70   | 90        |            |
|                                               | $V_{GS} = -1.8V, I_D = -1.0A$                                                        |              | --   | 120  | 130       |            |
| Forward Transconductance <sup>a</sup>         | $V_{DS} = -10V, I_D = -4.7A$                                                         | $g_{fs}$     | --   | 11   | --        | S          |
| Diode Forward Voltage                         | $I_S = -1.7A, V_{GS} = 0V$                                                           | $V_{SD}$     | --   | -0.8 | -1.2      | V          |
| Dynamic <sup>b</sup>                          |                                                                                      |              |      |      |           |            |
| Total Gate Charge                             | $V_{DS} = -10V, I_D = -4.7A,$<br>$V_{GS} = -4.5V$                                    | $Q_g$        | --   | 6    | 9         | nC         |
| Gate-Source Charge                            |                                                                                      | $Q_{gs}$     | --   | 1.4  | --        |            |
| Gate-Drain Charge                             |                                                                                      | $Q_{gd}$     | --   | 1.9  | --        |            |
| Input Capacitance                             | $V_{DS} = -10V, V_{GS} = 0V,$<br>$f = 1.0MHz$                                        | $C_{iss}$    | --   | 640  | --        | pF         |
| Output Capacitance                            |                                                                                      | $C_{oss}$    | --   | 180  | --        |            |
| Reverse Transfer Capacitance                  |                                                                                      | $C_{rss}$    | --   | 90   | --        |            |
| Switching <sup>c</sup>                        |                                                                                      |              |      |      |           |            |
| Turn-On Delay Time                            | $V_{DD} = -10V, R_L = 10\Omega,$<br>$I_D = -1A, V_{GEN} = -4.5V,$<br>$R_G = 6\Omega$ | $t_{d(on)}$  | --   | 22   | 35        | nS         |
| Turn-On Rise Time                             |                                                                                      | $t_r$        | --   | 35   | 55        |            |
| Turn-Off Delay Time                           |                                                                                      | $t_{d(off)}$ | --   | 45   | 70        |            |
| Turn-Off Fall Time                            |                                                                                      | $t_f$        | --   | 25   | 50        |            |

Notes:

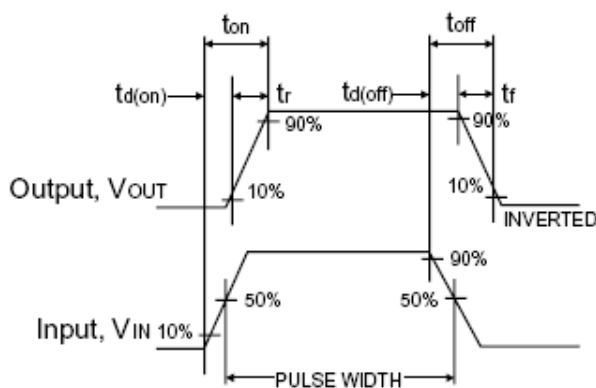
a. pulse test: PW  $\leq 300\mu S$ , duty cycle  $\leq 2\%$

b. For DESIGN AID ONLY, not subject to production testing.

b. Switching time is essentially independent of operating temperature.



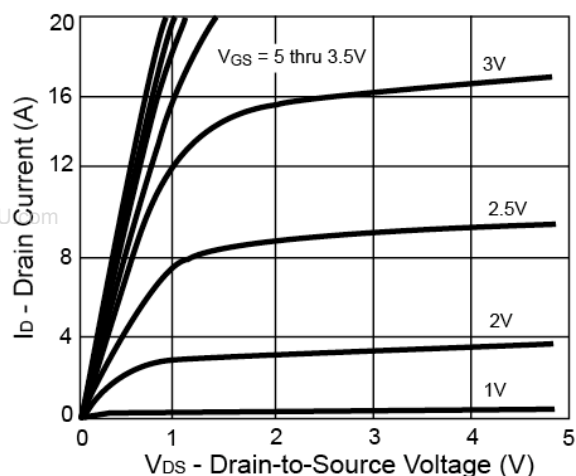
**Switching Test Circuit**



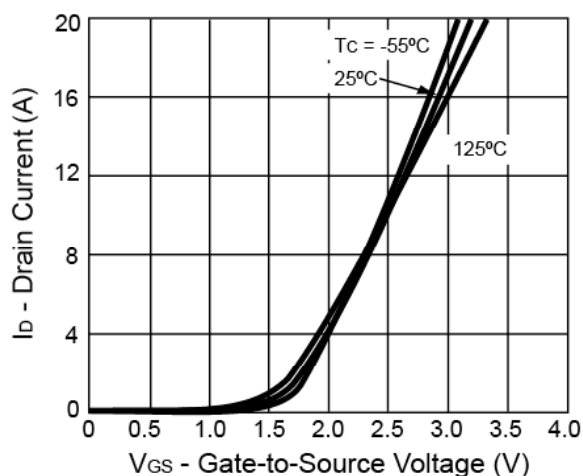
**Switchin Waveforms**

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

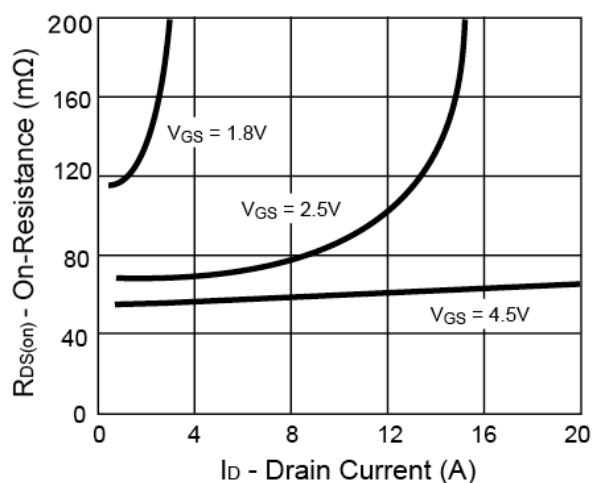
**Output Characteristics**



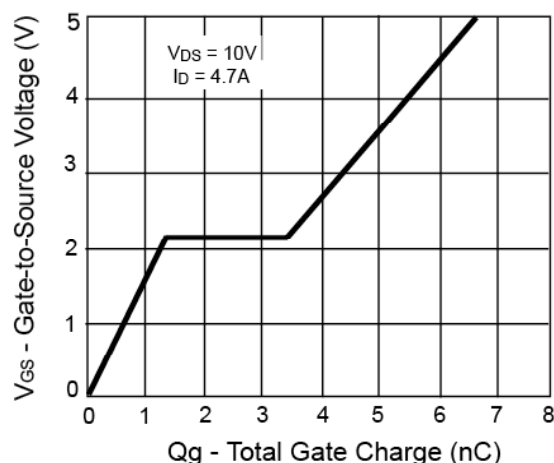
**Transfer Characteristics**



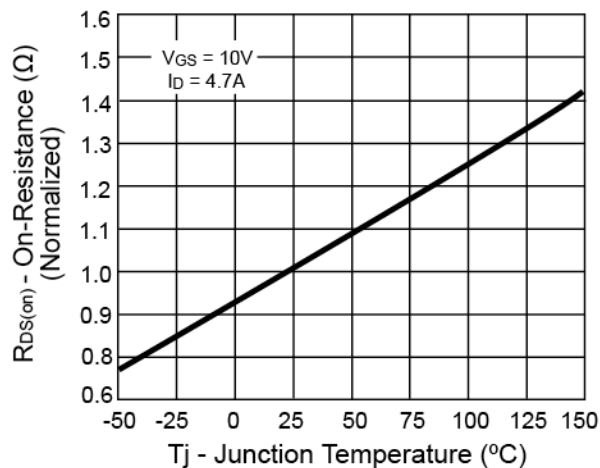
**On-Resistance vs. Drain Current**



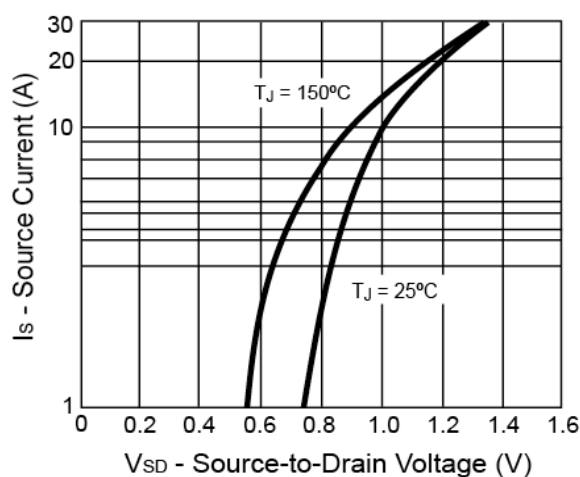
**Gate Charge**



**On-Resistance vs. Junction Temperature**

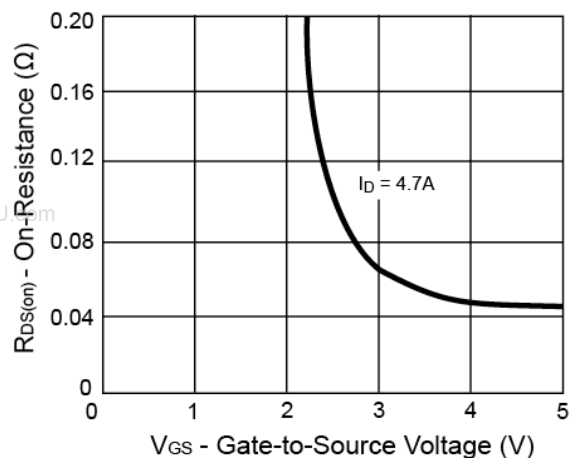


**Source-Drain Diode Forward Voltage**

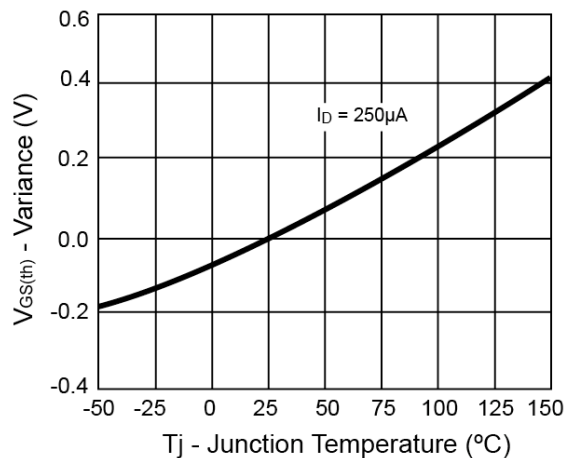


### Electrical Characteristics Curve ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

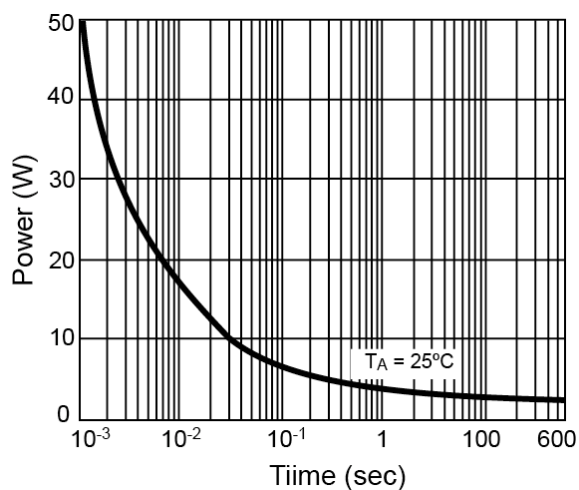
**On-Resistance vs. Gate-Source Voltage**



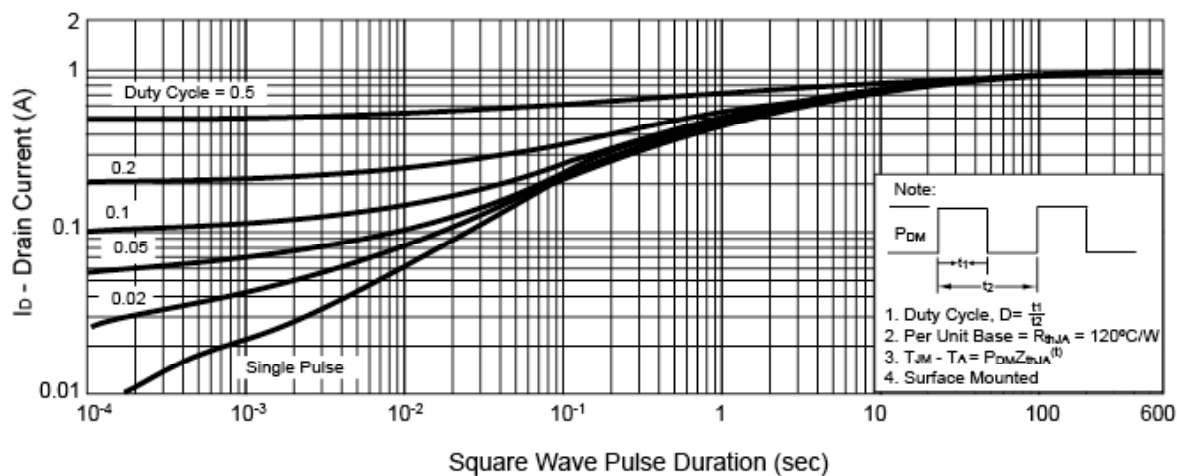
**Threshold Voltage**



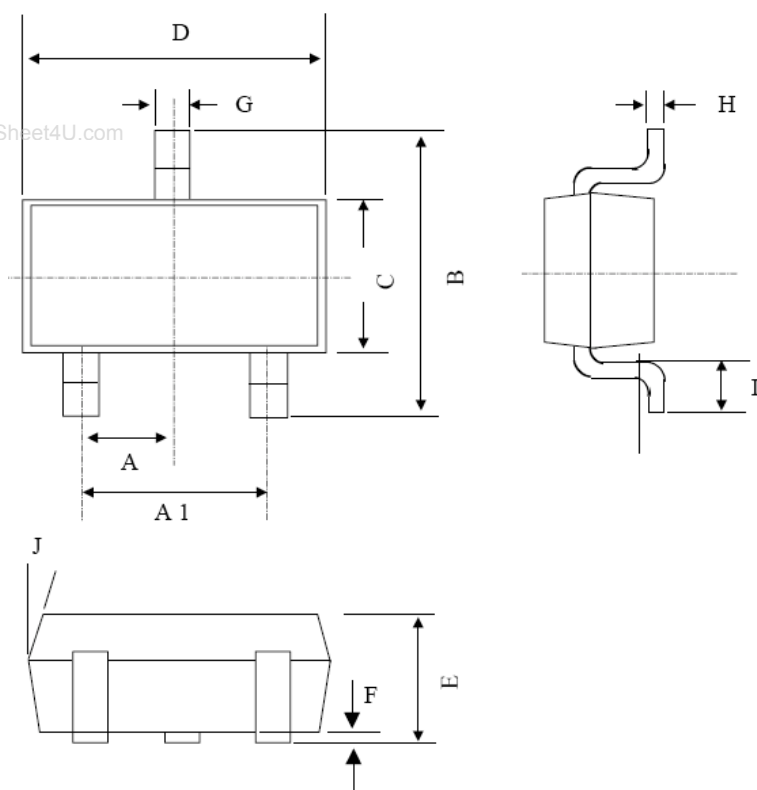
**Single Pulse Power**



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

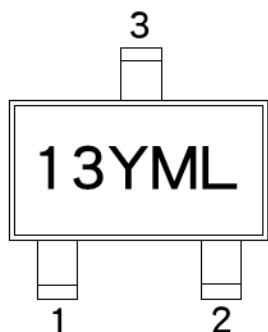


## SOT-23 Mechanical Drawing



| SOT-23 DIMENSION |             |      |           |       |
|------------------|-------------|------|-----------|-------|
| DIM              | MILLIMETERS |      | INCHES    |       |
|                  | MIN         | MAX  | MIN       | MAX.  |
| A                | 0.95 BSC    |      | 0.037 BSC |       |
| A1               | 1.9 BSC     |      | 0.074 BSC |       |
| B                | 2.60        | 3.00 | 0.102     | 0.118 |
| C                | 1.40        | 1.70 | 0.055     | 0.067 |
| D                | 2.80        | 3.10 | 0.110     | 0.122 |
| E                | 1.00        | 1.30 | 0.039     | 0.051 |
| F                | 0.00        | 0.10 | 0.000     | 0.004 |
| G                | 0.35        | 0.50 | 0.014     | 0.020 |
| H                | 0.10        | 0.20 | 0.004     | 0.008 |
| I                | 0.30        | 0.60 | 0.012     | 0.024 |
| J                | 5°          | 10°  | 5°        | 10°   |

## Marking Diagram



**13** = Device Code  
**Y** = Year Code  
**M** = Month Code  
 (A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)  
**L** = Lot Code

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