



**Pin Definition:**

1. Gate
2. Source
3. Drain

**Key Parameter Performance**

Parameter	Value	Unit
$V_{DS}$	20	V
$R_{DS(on)}$ (max)	$V_{GS} = 4.5V$	33
	$V_{GS} = 2.5V$	40
	$V_{GS} = 1.8V$	51
$Q_g$	11	nC

**Features**

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

**Application**

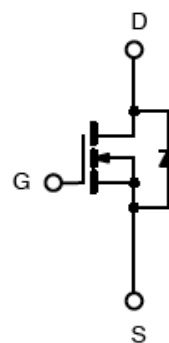
- Load Switch
- PA Switch

**Ordering Information**

Part No.	Package	Packing
TSM2312CX RFG	SOT-23	3,000pcs / 7" Reel

**Note:** "G" denotes for Halogen- and Antimony-free as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds

**Block Diagram**



N-Channel MOSFET

**Absolute Maximum Ratings** ( $T_C = 25^\circ C$ , unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	V
Continuous Drain Current	$I_D$	4.9	A
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	15	A
Continuous Source Current (Diode Conduction) <sup>(Note 2)</sup>	$I_S$	1.0	A
Maximum Power Dissipation	$P_D$	$T_a = 25^\circ C$	0.75
		$T_a = 75^\circ C$	0.48
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ C$

**Thermal Performance**

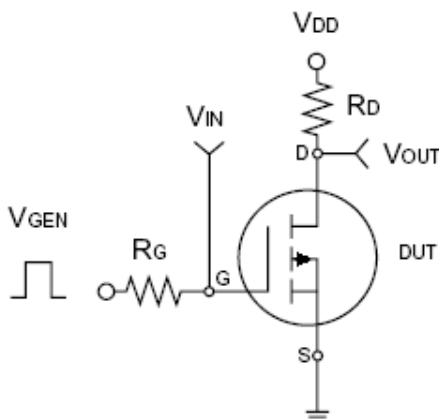
Parameter	Symbol	Limit	Unit
Thermal Resistance Junction to Lead	$R_{\theta JL}$	75	$^\circ C/W$
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	140	$^\circ C/W$

### Electrical Specifications

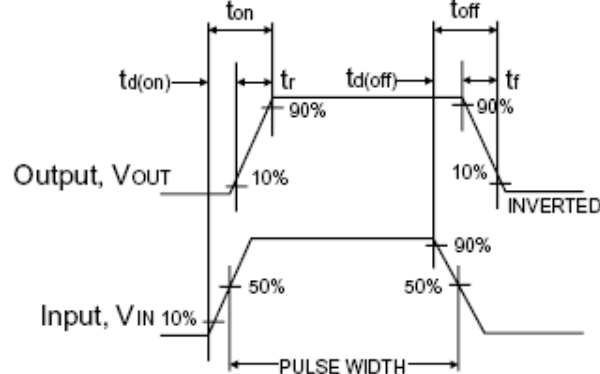
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b> <sup>(Note 3)</sup>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	20	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	0.45	0.65	1.0	V
Gate Body Leakage	$V_{GS} = \pm 8V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = 16V, V_{GS} = 0V$	$I_{DSS}$	--	--	1.0	$\mu A$
On-State Drain Current	$V_{DS} = 10V, V_{GS} = 4.5V$	$I_{D(ON)}$	15	--	--	A
Drain-Source On-State Resistance	$V_{GS} = 4.5V, I_D = 4.9A$	$R_{DS(ON)}$	--	27	33	m $\Omega$
	$V_{GS} = 2.5V, I_D = 4.4A$		--	33	40	
	$V_{GS} = 1.8V, I_D = 3.9A$		--	42	51	
Forward Transconductance	$V_{DS} = 15V, I_D = 5.0A$	$g_{fs}$	--	40	--	S
Diode Forward Voltage	$I_S = 1.0A, V_{GS} = 0V$	$V_{SD}$	--	0.8	1.2	V
<b>Dynamic</b> <sup>(Note 4)</sup>						
Total Gate Charge	$V_{DS} = 10V, I_D = 5.0A,$ $V_{GS} = 4.5V$	$Q_g$	--	11	14	nC
Gate-Source Charge		$Q_{gs}$	--	1.5	--	
Gate-Drain Charge		$Q_{gd}$	--	2.1	--	
Input Capacitance	$V_{DS} = 10V, V_{GS} = 0V,$ $f = 1.0MHz$	$C_{iss}$	--	500	--	pF
Output Capacitance		$C_{oss}$	--	300	--	
Reverse Transfer Capacitance		$C_{rss}$	--	140	--	
<b>Switching</b> <sup>(Note 5)</sup>						
Turn-On Delay Time	$V_{DD} = 10V, R_L = 10\Omega,$ $I_D = 1A, V_{GEN} = 4.5V,$ $R_G = 6\Omega$	$t_{d(on)}$	--	15	25	ns
Turn-On Rise Time		$t_r$	--	40	60	
Turn-Off Delay Time		$t_{d(off)}$	--	48	70	
Turn-Off Fall Time		$t_f$	--	31	45	

#### Notes:

1. Pulse width limited by the maximum junction temperature
2. Surface Mounted on FR4 Board  $t \leq 5$  sec.
3. Pulse test:  $PW \leq 300\mu s$ , duty cycle  $\leq 2\%$
4. For DESIGN AID ONLY, not subject to production testing.
5. Switching time is essentially independent of operating temperature.



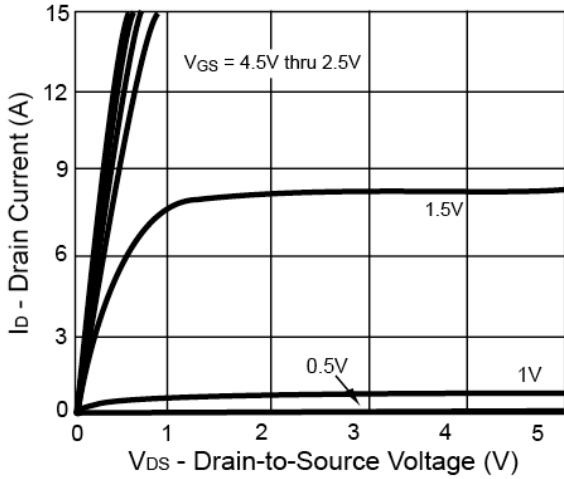
Switching Test Circuit



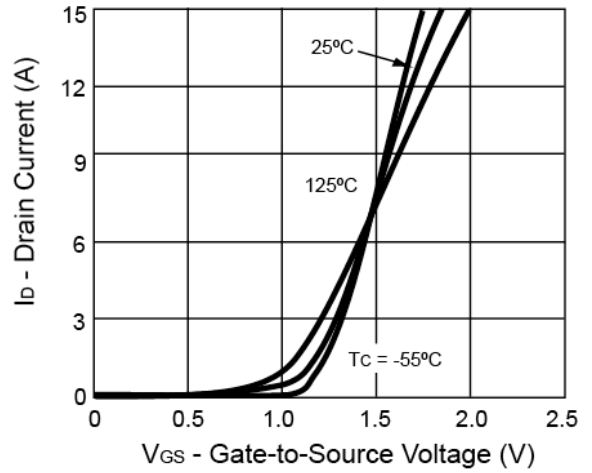
Switchin Waveforms

### Electrical Characteristics Curve

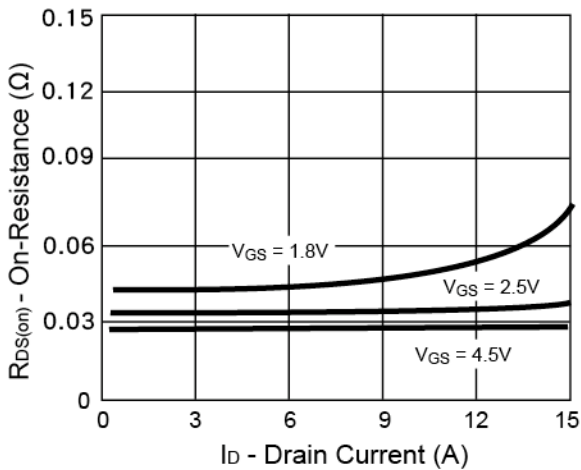
**Output Characteristics**



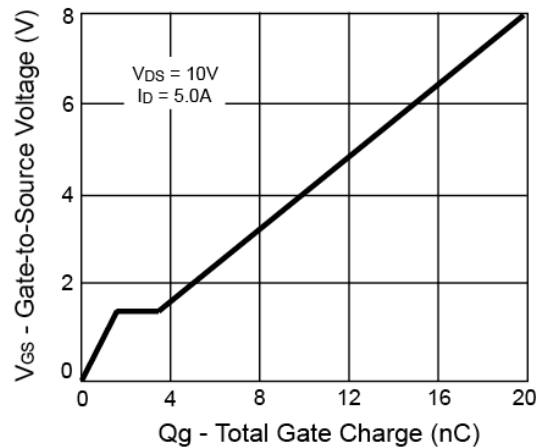
**Transfer Characteristics**



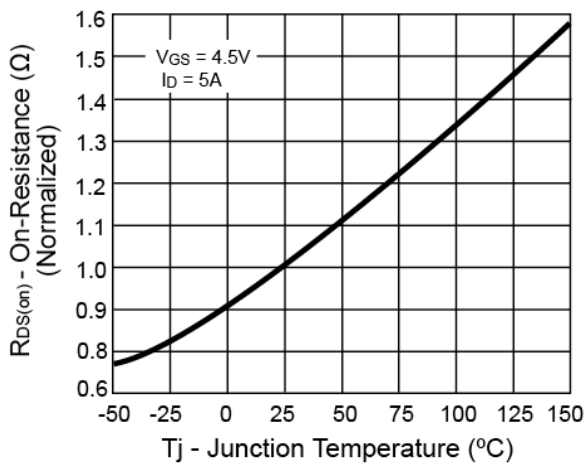
**On-Resistance vs. Drain Current**



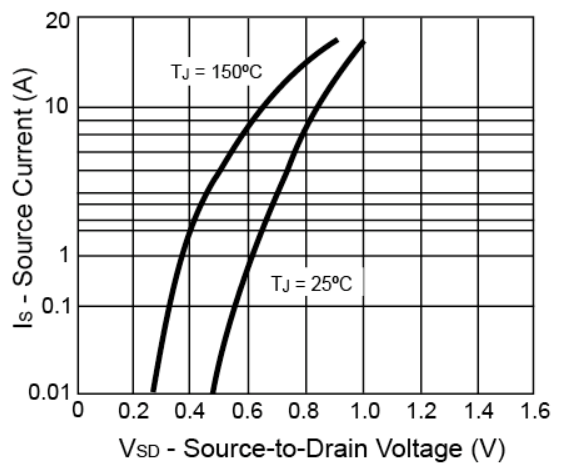
**Gate Charge**



**On-Resistance vs. Junction Temperature**

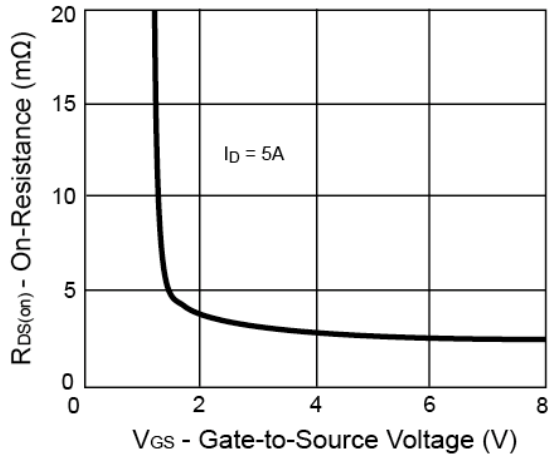


**Source-Drain Diode Forward Voltage**

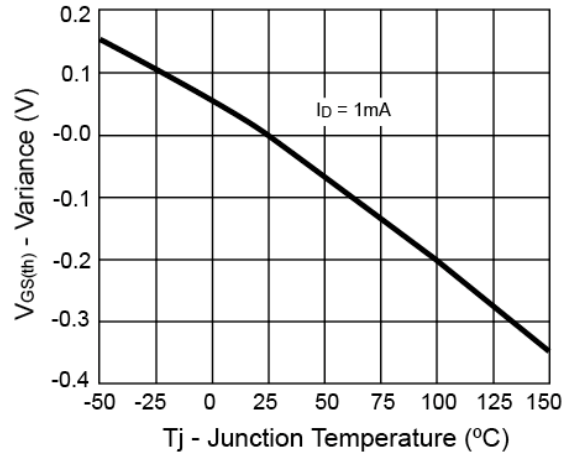


**Electrical Characteristics Curve**

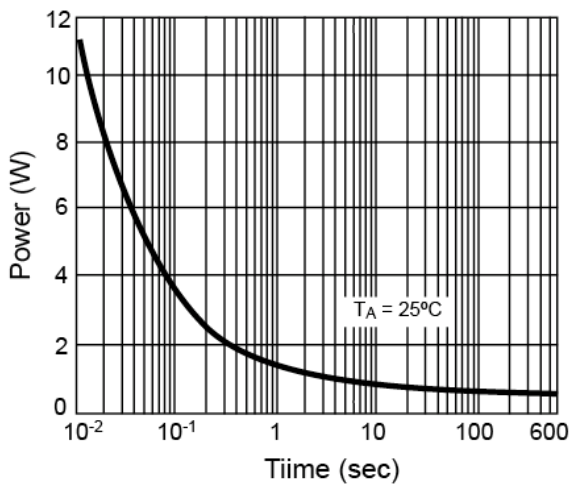
**On-Resistance vs. Gate-Source Voltage**



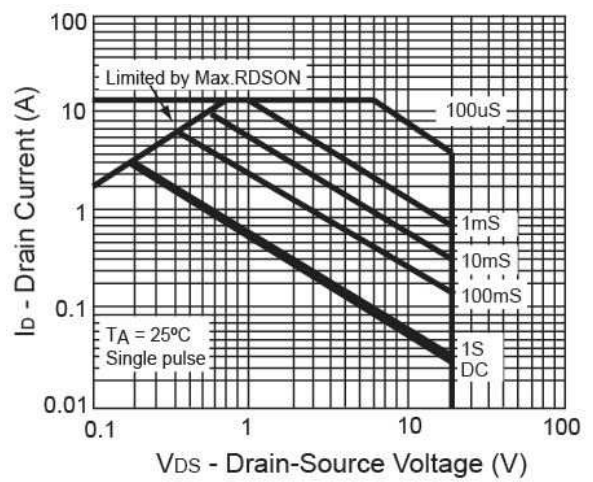
**Threshold Voltage**



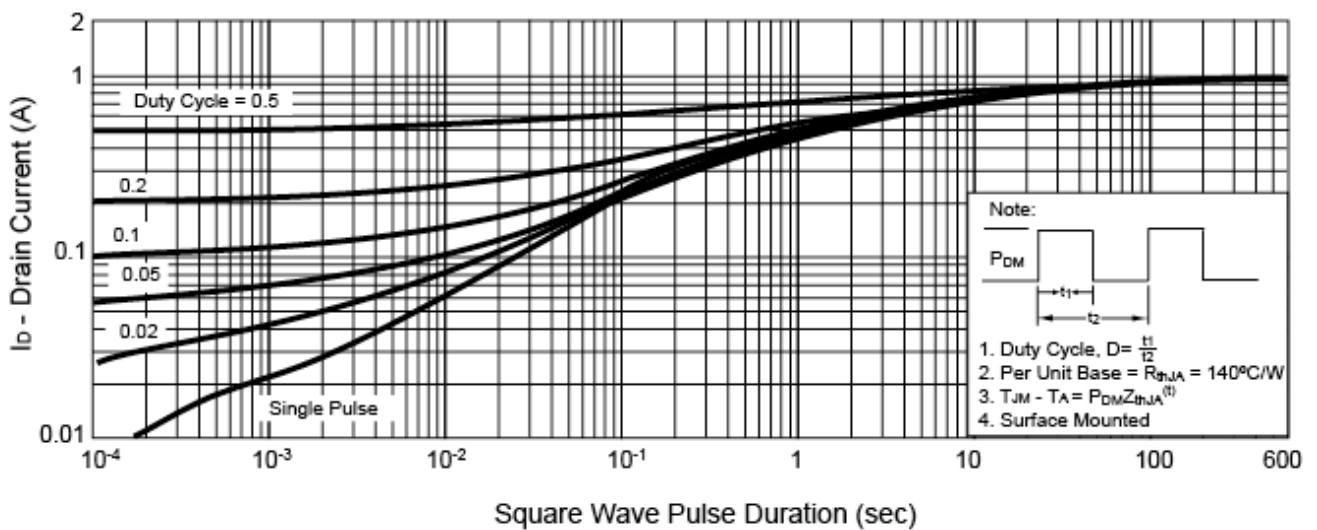
**Single Pulse Power**



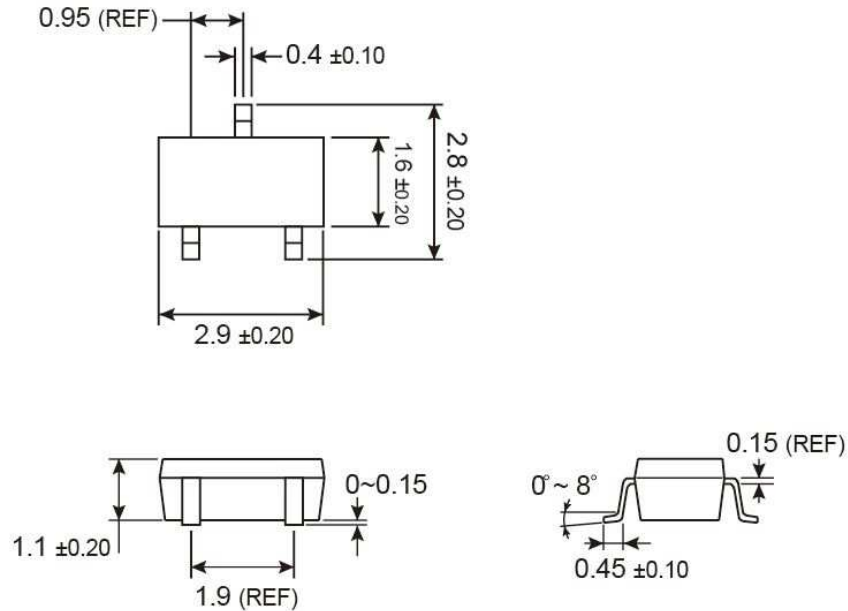
**Safety Operation Area**



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

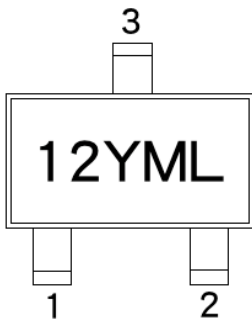


**SOT-23 Mechanical Drawing**



Unit: Millimeters

**Marking Diagram**



- 12** = Device Code
- 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

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