


**Pin Definition:**

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

**PRODUCT SUMMARY**

$V_{DS}$ (V)	$R_{DS(on)}$ (m $\Omega$ )	$I_D$ (A)
-60	155 @ $V_{GS} = -10V$	-3.5
	200 @ $V_{GS} = 4.5V$	-3.1

**Features**

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

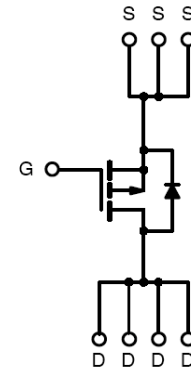
**Application**

- Load Switch
- PA Switch

**Ordering Information**

Part No.	Package	Packing
TSM9409CS RLG	SOP-8	2.5Kpcs / 13" Reel

**Note:** "G" denote for Halogen Free Product

**Block Diagram**


P-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	-3.5	A
Pulsed Drain Current	$I_{DM}$	-30	A
Continuous Source Current (Diode Conduction) <sup>a,b</sup>	$I_S$	-2.5	A
Maximum Power Dissipation	$P_D$	$T_A = 25^\circ C$	3.0
		$T_A = 70^\circ C$	2.1
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	$R_{\theta JC}$	30	$^\circ C/W$
Junction to Ambient Thermal Resistance (PCB mounted)	$R_{\theta JA}$	50	$^\circ C/W$

**Notes:**

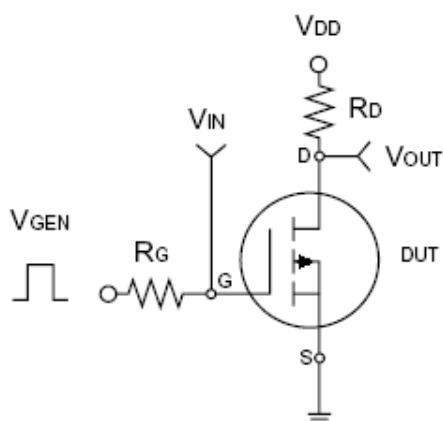
- Pulse width limited by the Maximum junction temperature
- Surface Mounted on FR4 Board,  $t \leq 10$  sec.

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

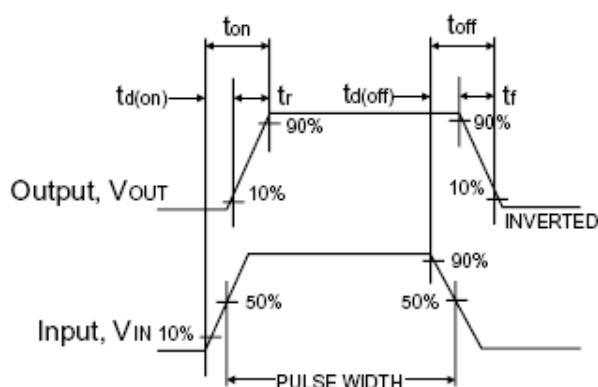
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	$BV_{DSS}$	-60	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	$V_{GS(TH)}$	-1.0	--	--	V
Gate Body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = -60V, V_{GS} = 0V$	$I_{DSS}$	--	--	-1.0	$\mu A$
On-State Drain Current <sup>a</sup>	$V_{DS} = -5V, V_{GS} = -10V$	$I_{D(ON)}$	-20	--	--	A
Drain-Source On-State Resistance <sup>a</sup>	$V_{GS} = -10V, I_D = -3.5A$	$R_{DS(ON)}$	--	125	155	m $\Omega$
	$V_{GS} = -4.5V, I_D = -3.1A$		--	153	200	
Forward Transconductance <sup>a</sup>	$V_{DS} = -15V, I_D = -3.5A$	$g_{fs}$	--	8	--	S
Diode Forward Voltage	$I_S = -2.5A, V_{GS} = 0V$	$V_{SD}$	--	-1.25	-1.5	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$V_{DS} = -15V, I_D = -3.5A,$ $V_{GS} = -10V$	$Q_g$	--	6	--	nC
Gate-Source Charge		$Q_{gs}$	--	1.7	--	
Gate-Drain Charge		$Q_{gd}$	--	1.5	--	
Input Capacitance	$V_{DS} = -30V, V_{GS} = 0V,$ $f = 1.0MHz$	$C_{iss}$	--	540	--	pF
Output Capacitance		$C_{oss}$	--	60	--	
Reverse Transfer Capacitance		$C_{rss}$	--	30	--	
<b>Switching<sup>c</sup></b>						
Turn-On Delay Time	$V_{DD} = -15V, R_L = 15\Omega,$ $I_D = -1A, V_{GEN} = -10V,$ $R_G = 6\Omega$	$t_{d(on)}$	--	7	--	nS
Turn-On Rise Time		$t_r$	--	9	--	
Turn-Off Delay Time		$t_{d(off)}$	--	19	--	
Turn-Off Fall Time		$t_f$	--	4	--	

#### 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.



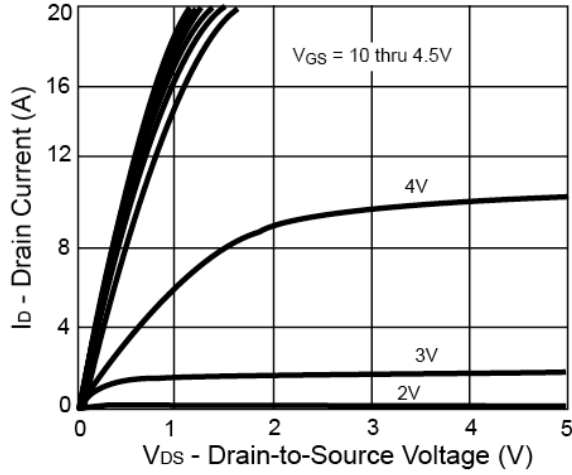
Switching Test Circuit



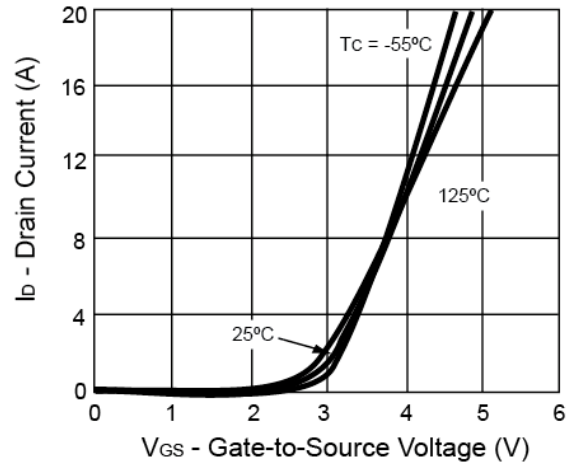
Switchin Waveforms

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

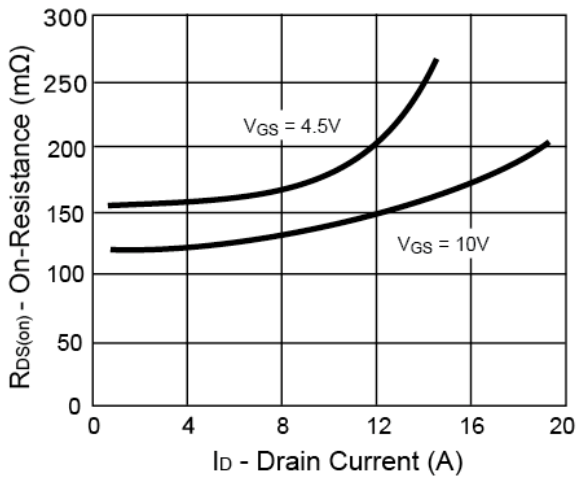
**Output Characteristics**



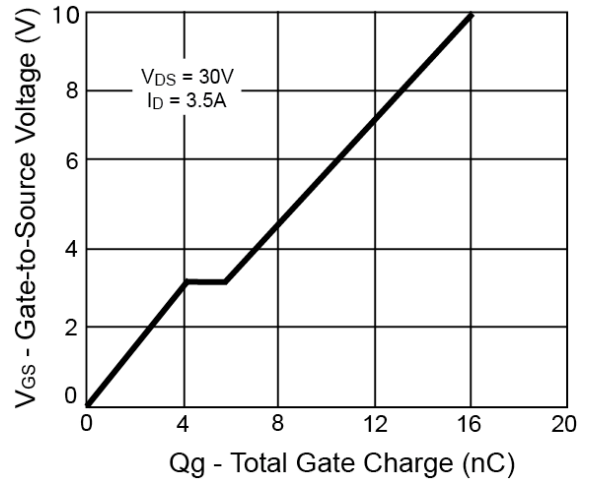
**Transfer Characteristics**



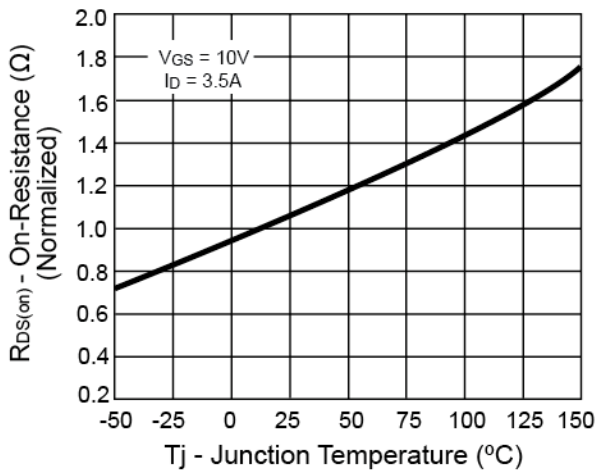
**On-Resistance vs. Drain Current**



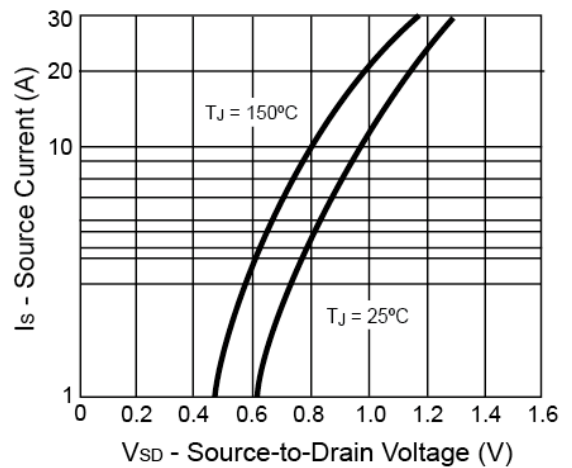
**Gate Charge**



**On-Resistance vs. Junction Temperature**

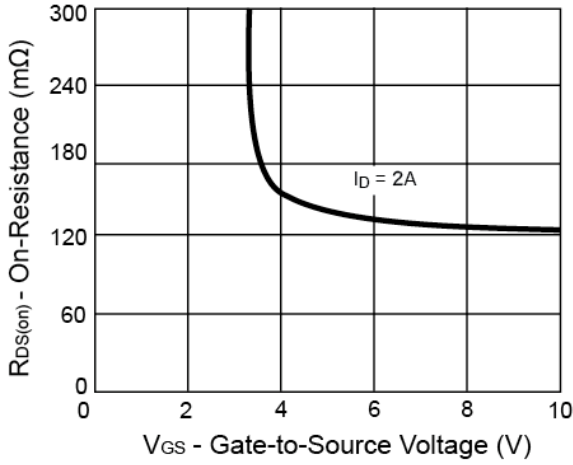


**Source-Drain Diode Forward Voltage**

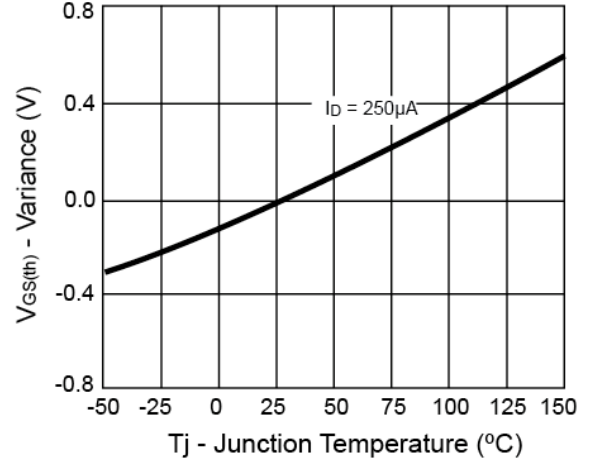


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

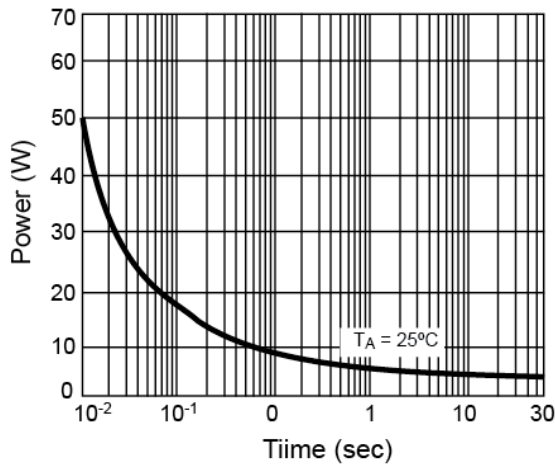
**On-Resistance vs. Gate-Source Voltage**



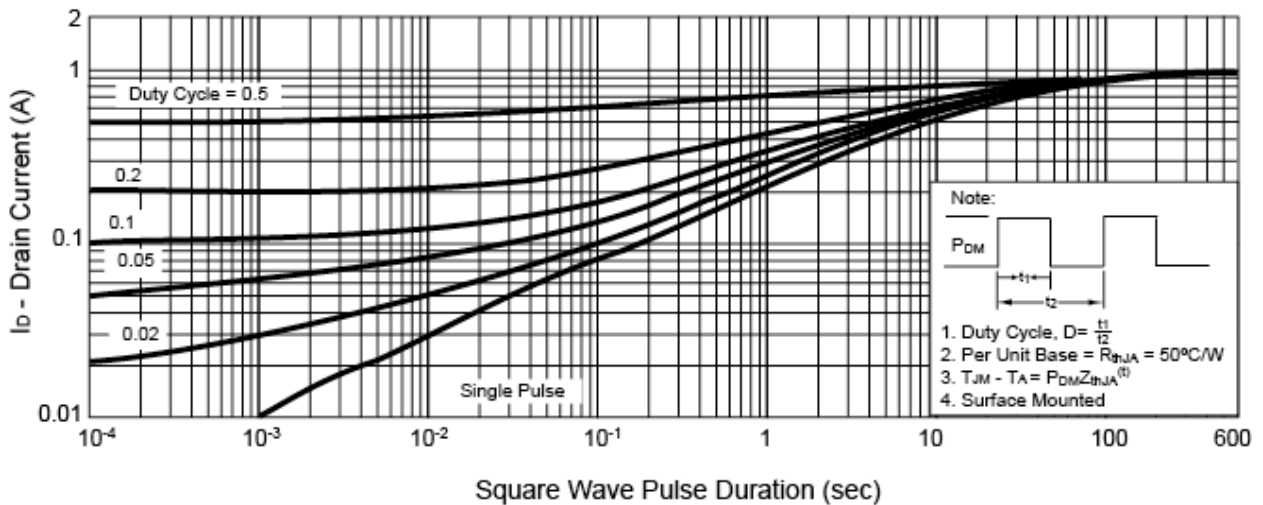
**Threshold Voltage**



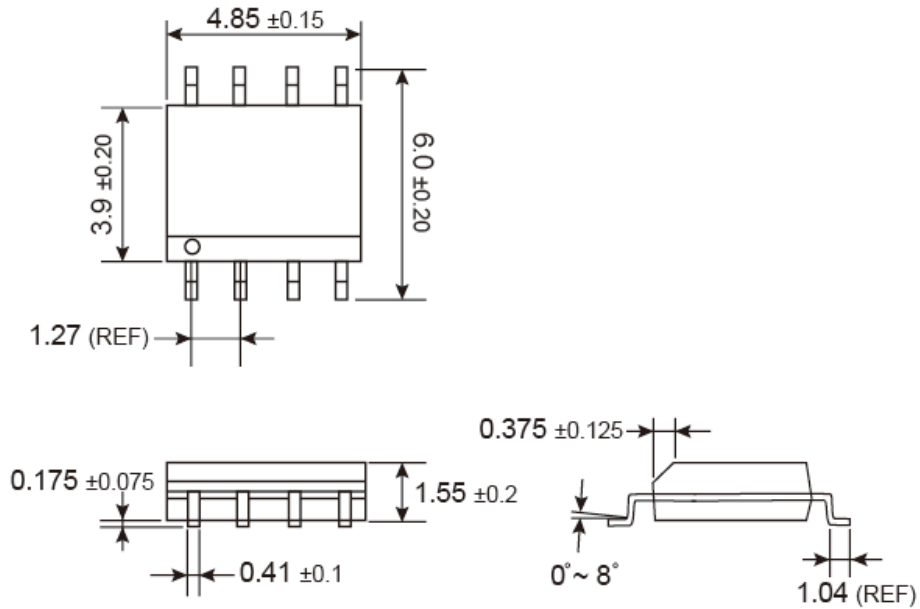
**Single Pulse Power**



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

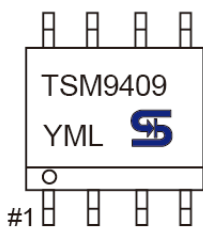


**SOP-8 Mechanical Drawing**



Unit: Millimeters

**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

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# TSM9409

60V P-Channel MOSFET