

### Pin Definition:

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

### Key Parameter Performance

Parameter	Value	Unit
$V_{DS}$	-20	V
$R_{DS(on)}$ (max)	$V_{GS} = -4.5V$	60
	$V_{GS} = -2.7V$	78
	$V_{GS} = -2.5V$	85
$Q_g$	6	nC

### Features

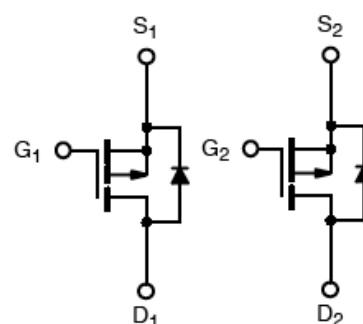
- Advance Trench Process Technology
- High Density Cell Design for Ultra Low On-resistance

### Ordering Information

Part No.	Package	Packing
TSM9933DCS RLG	SOP-8	2.5kps / 13" 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



Dual P-Channel MOSFET

### Absolute Maximum Ratings ( $T_A=25^{\circ}C$ 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.	$I_D$	-4.7	A
Pulsed Drain Current, $V_{GS}$ @ 4.5V	$I_{DM}$	-20	A
Continuous Source Current (Diode Conduction) <sup>(Note 1,2)</sup>	$I_S$	-2.5	A
Maximum Power Dissipation	$P_D$	$T_A=25^{\circ}C$	2
		$T_A=70^{\circ}C$	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	$R_{\theta JC}$	30	$^{\circ}C/W$
Junction to Ambient Thermal Resistance (PCB mounted)	$R_{\theta JA}$	62.5	$^{\circ}C/W$

### Electrical Specifications (T<sub>J</sub>=25°C unless otherwise noted)

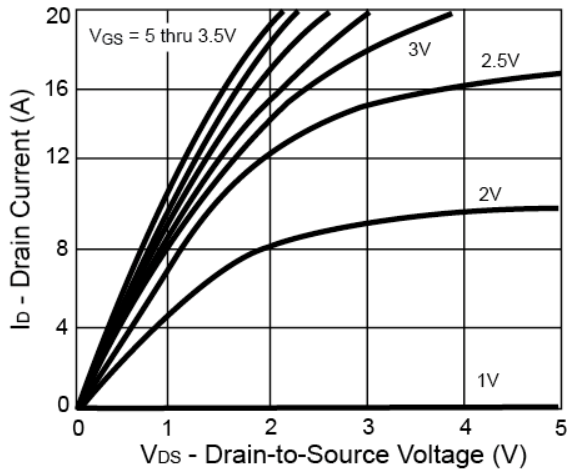
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b> (Note 3)						
Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	BV <sub>DSS</sub>	-20	--	--	V
Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	V <sub>GS(TH)</sub>	-0.6	--	-1.4	V
Gate Body Leakage	V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V	I <sub>GSS</sub>	--	--	±100	nA
Zero Gate Voltage Drain Current	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V	I <sub>DSS</sub>	--	--	-1.0	μA
On-State Drain Current	V <sub>DS</sub> = -5V, V <sub>GS</sub> = -4.5V	I <sub>D(ON)</sub>	-15	--	--	A
Drain-Source On-State Resistance	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -4.7A	R <sub>DS(ON)</sub>	--	48	60	mΩ
	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -2.9A		--	47	58	
	V <sub>GS</sub> = -2.7V, I <sub>D</sub> = -1.5A		--	60	78	
	V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -3.8A		--	65	85	
Forward Transconductance	V <sub>DS</sub> = -10V, I <sub>D</sub> = -4.7A	g <sub>fs</sub>	--	11	--	S
Diode Forward Voltage	I <sub>S</sub> = -1.7A, V <sub>GS</sub> = 0V	V <sub>SD</sub>	--	-0.8	-1.2	V
<b>Dynamic</b> (Note 4,5)						
Total Gate Charge	V <sub>DS</sub> = -10V, I <sub>D</sub> = -4.7A, V <sub>GS</sub> = -4.5V	Q <sub>g</sub>	--	6	9	nC
Gate-Source Charge		Q <sub>gs</sub>	--	1.4	--	
Gate-Drain Charge		Q <sub>gd</sub>	--	1.9	--	
Input Capacitance	V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V, f = 1.0MHz	C <sub>iss</sub>	--	640	--	pF
Output Capacitance		C <sub>oss</sub>	--	180	--	
Reverse Transfer Capacitance		C <sub>rss</sub>	--	90	--	
<b>Switching</b> (Note 4,5)						
Turn-On Delay Time	V <sub>DD</sub> = -10V, R <sub>L</sub> = 10Ω, I <sub>D</sub> = -1A, V <sub>GEN</sub> = -4.5V, R <sub>G</sub> = 6Ω	t <sub>d(on)</sub>	--	22	35	ns
Turn-On Rise Time		t <sub>r</sub>	--	35	55	
Turn-Off Delay Time		t <sub>d(off)</sub>	--	45	70	
Turn-Off Fall Time		t <sub>f</sub>	--	25	50	

Notes:

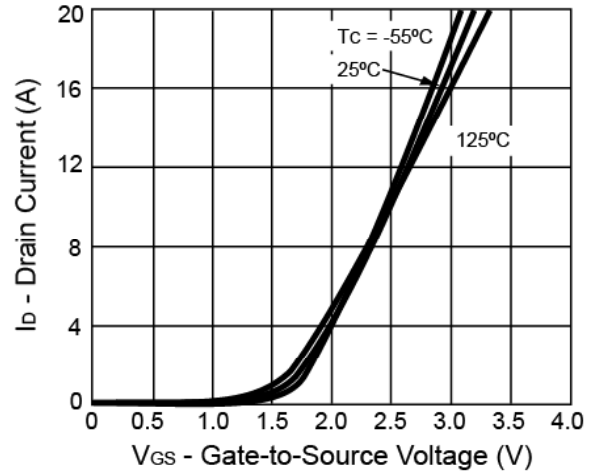
1. Pulse width limited by the Maximum junction temperature
2. Surface Mounted on FR4 Board, t ≤ 5 sec.
3. pulse test: PW ≤ 300μs, duty cycle ≤ 2%
4. For DESIGN AID ONLY, not subject to production testing.
5. Switching time is essentially independent of operating temperature.

### Electrical Characteristics Curves

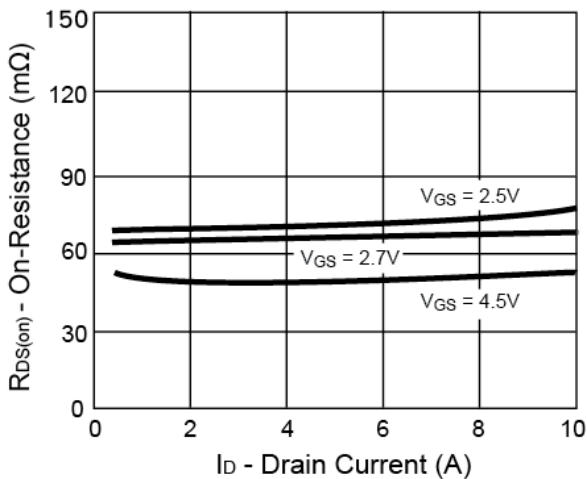
**Output Characteristics**



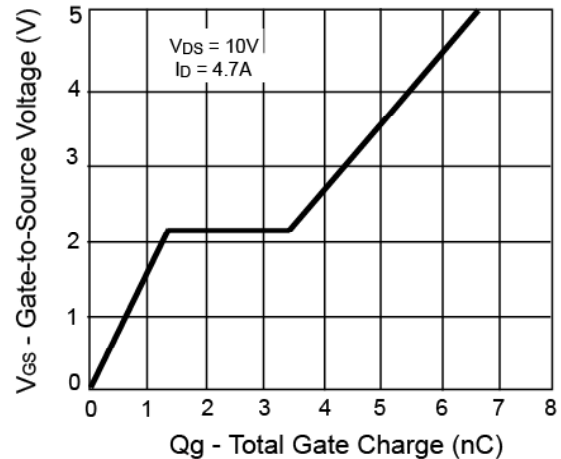
**Transfer Characteristics**



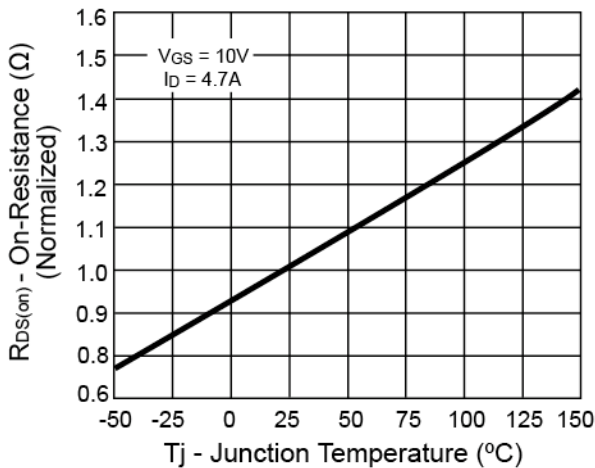
**On-Resistance vs. Drain Current**



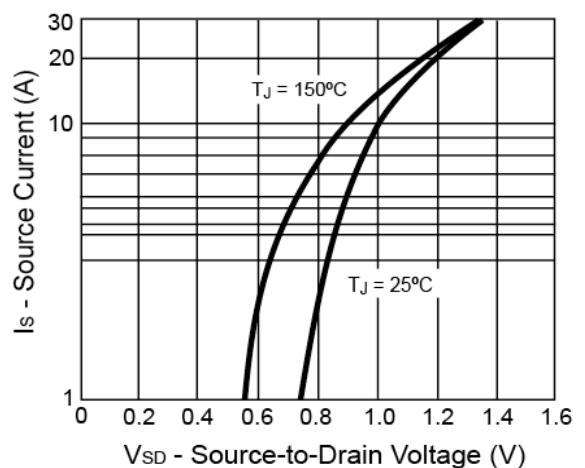
**Gate Charge**



**On-Resistance vs. Junction Temperature**

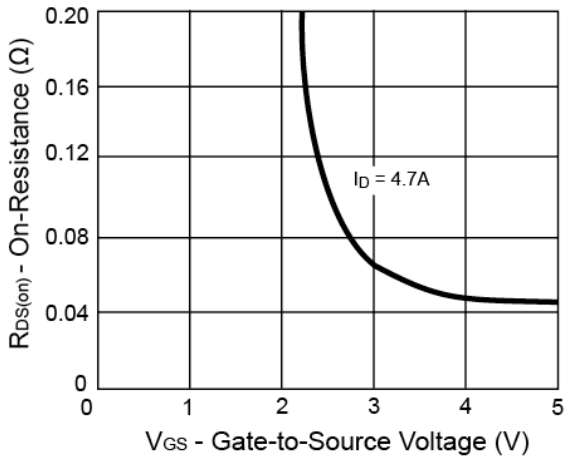


**Source-Drain Diode Forward Voltage**

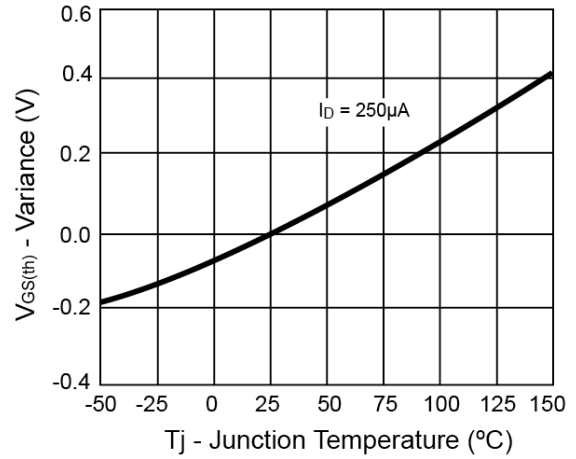


### Electrical Characteristics Curves

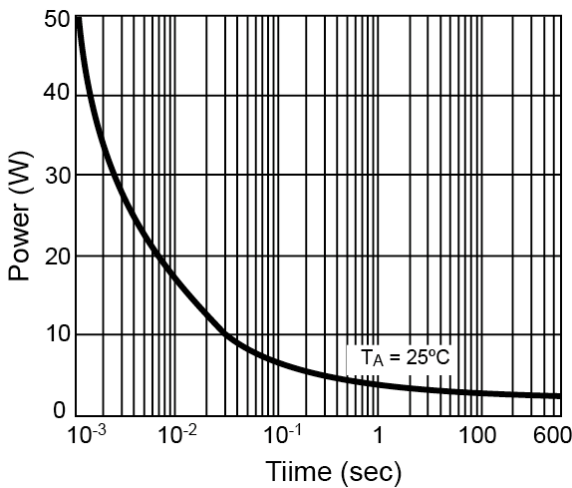
**On-Resistance vs. Gate-Source Voltage**



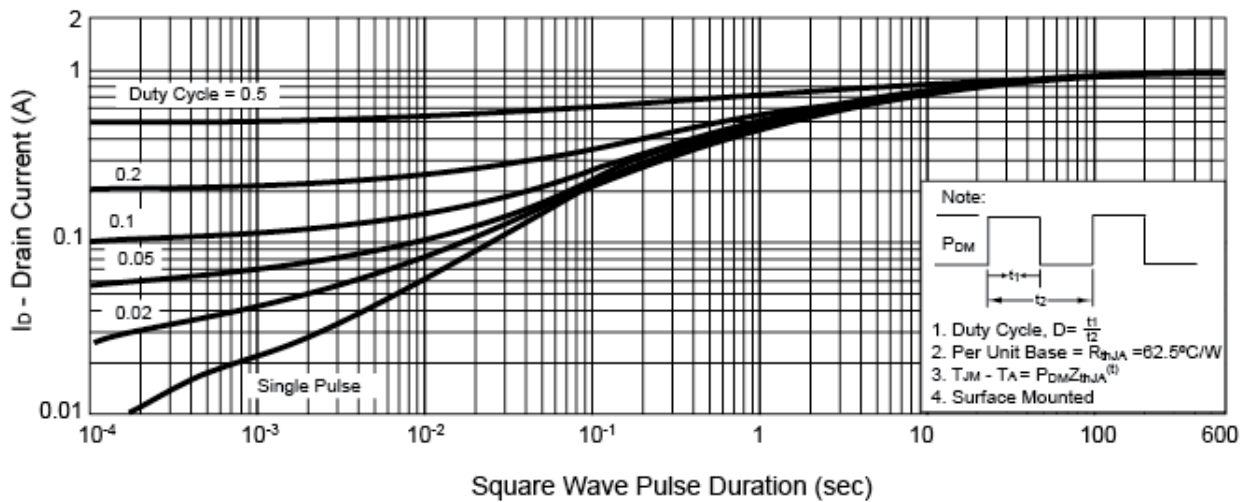
**Threshold Voltage**



**Single Pulse Power**

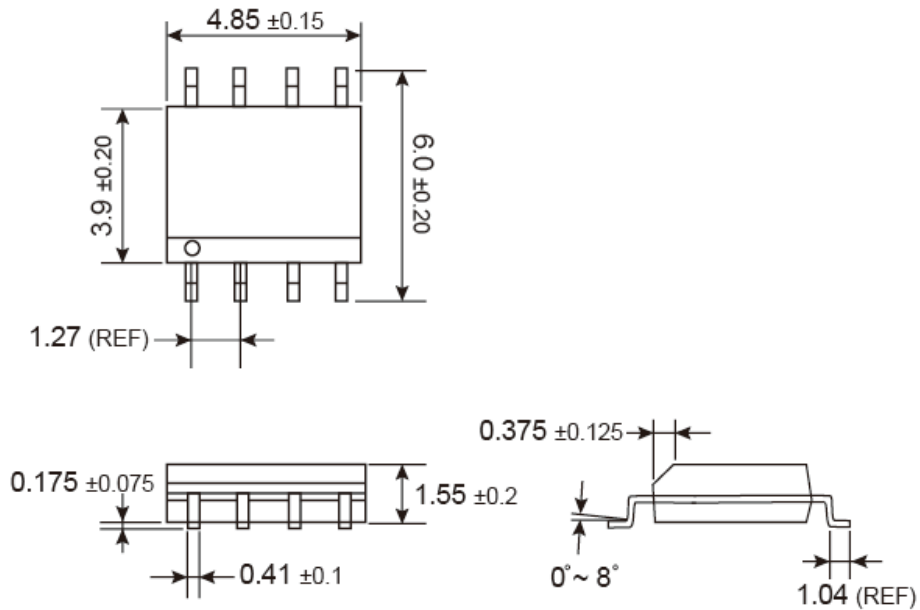


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



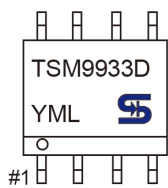


**SOP-8 Mechanical Drawing**



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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