

**SOP-8**

**Pin Definition:**

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

**PRODUCT SUMMARY**

$V_{DS}$ (V)	$R_{DS(on)}$ (m $\Omega$ )	$I_D$ (A)
-20	90 @ $V_{GS} = -4.5V$	-3.9
	110 @ $V_{GS} = -2.5V$	-3.2
	150 @ $V_{GS} = -1.8V$	-2.6

**Features**

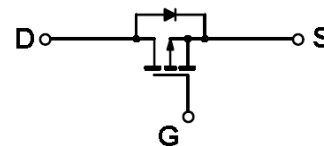
- Advance Trench Process Technology
- High Density Cell Design for Ultra Low On-resistance

**Application**

- DC-DC Conversion
- Asynchronous Buck Converter

**Ordering Information**

Part No.	Package	Packing
TSM4433CS RL	SOP-8	2.5Kpcs / 13" Reel

**Block Diagram**


P-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	V
Continuous Drain Current, $V_{GS} @ 4.5V$ .	$I_D$	-3.9	A
Pulsed Drain Current, $V_{GS} @ 4.5V$	$I_{DM}$	-10	A
Continuous Source Current (Diode Conduction) <sup>a,b</sup>	$I_S$	-1.2	A
Maximum Power Dissipation	$P_D$	$T_a = 25^\circ C$	2.5
		$T_a = 75^\circ C$	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 Foot (Drain) Thermal Resistance	$R_{\theta_{JF}}$	19	$^\circ C/W$
Junction to Ambient Thermal Resistance (PCB mounted)	$R_{\theta_{JA}}$	40	$^\circ C/W$

**Notes:**

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

### Electrical Specifications

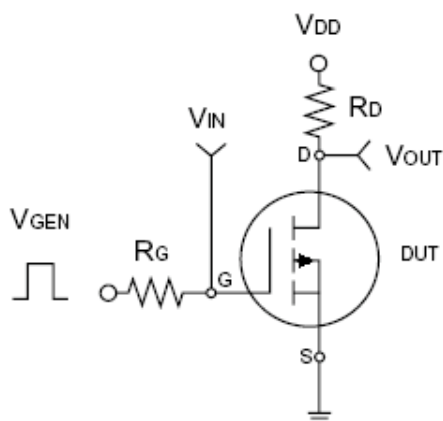
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	$BV_{DSS}$	-20	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	$V_{GS(TH)}$	-0.45	--	-0.95	V
Gate Body Leakage	$V_{GS} = \pm 8V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = -16V, V_{GS} = 0V$	$I_{DSS}$	--	--	-1.0	$\mu A$
On-State Drain Current <sup>a</sup>	$V_{DS} \leq -5V, V_{GS} = -4.5V$	$I_{D(ON)}$	-6	--	--	A
Drain-Source On-State Resistance <sup>a</sup>	$V_{GS} = -4.5V, I_D = -3.9A$	$R_{DS(ON)}$	--	75	90	m $\Omega$
	$V_{GS} = -2.5V, I_D = -3.2A$		--	90	110	
	$V_{GS} = -1.8V, I_D = -2.6A$		--	105	150	
Forward Transconductance <sup>a</sup>	$V_{DS} = -5V, I_D = -4A$	$g_{fs}$	--	6.5	--	S
Diode Forward Voltage	$I_S = -0.9A, V_{GS} = 0V$	$V_{SD}$	--	-0.8	-1.2	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$V_{DS} = -6V, I_D = -3.9A,$ $V_{GS} = -4.5V$	$Q_g$	--	15.23	--	nC
Gate-Source Charge		$Q_{gs}$	--	5.49	--	
Gate-Drain Charge		$Q_{gd}$	--	2.74	--	
Input Capacitance	$V_{DS} = -6V, V_{GS} = 0V,$ $f = 1.0MHz$	$C_{iss}$	--	882.51	--	pF
Output Capacitance		$C_{oss}$	--	145.54	--	
Reverse Transfer Capacitance		$C_{rss}$	--	97.26	--	
<b>Switching<sup>c</sup></b>						
Turn-On Delay Time	$V_{DD} = -6V, R_L = 6\Omega,$ $I_D = -1A, V_{GEN} = -4.5V,$ $R_G = 6\Omega$	$t_{d(on)}$	--	17.28	--	nS
Turn-On Rise Time		$t_r$	--	3.73	--	
Turn-Off Delay Time		$t_{d(off)}$	--	36.05	--	
Turn-Off Fall Time		$t_f$	--	6.19	--	

Notes:

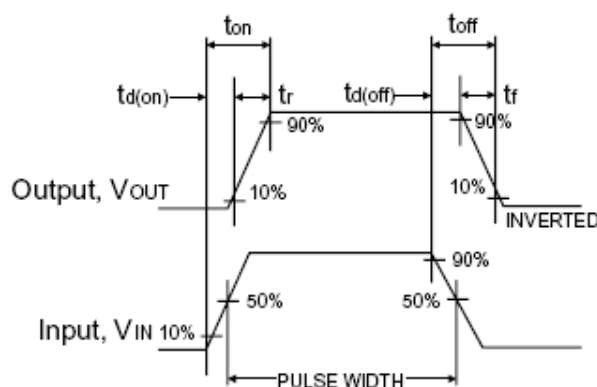
a. pulse test:  $PW \leq 300\mu s$ , duty cycle  $\leq 2\%$

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

b. Switching time is essentially independent of operating temperature.



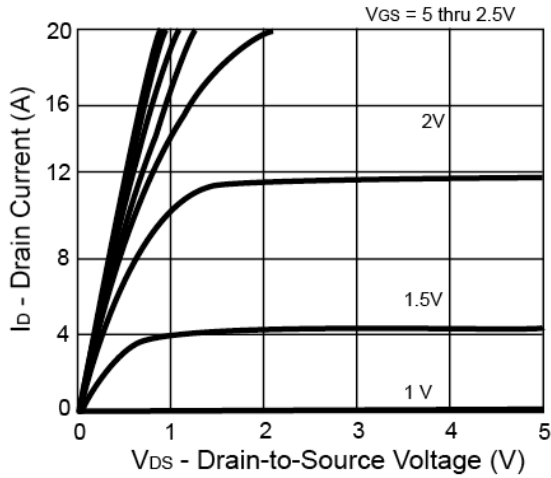
Switching Test Circuit



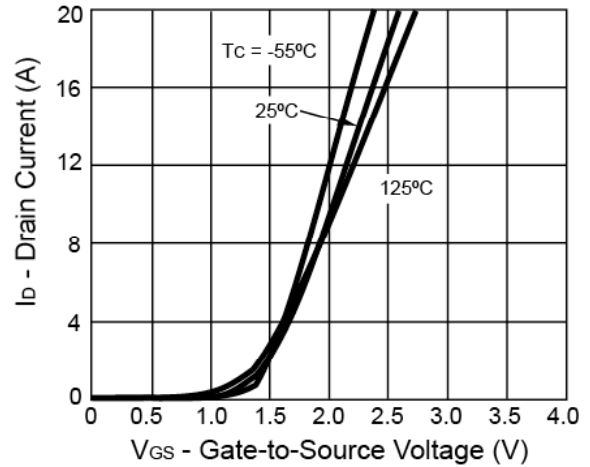
Switchin Waveforms

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

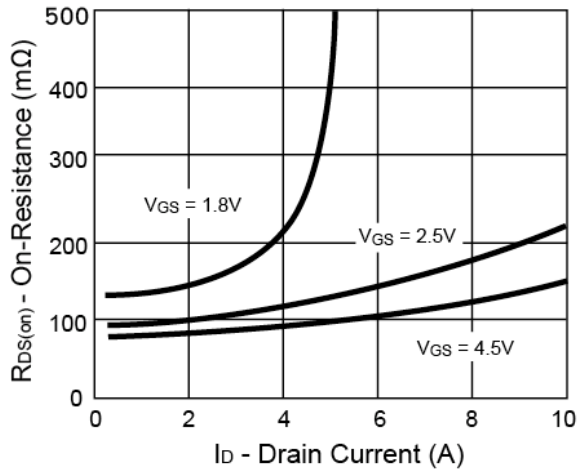
**Output Characteristics**



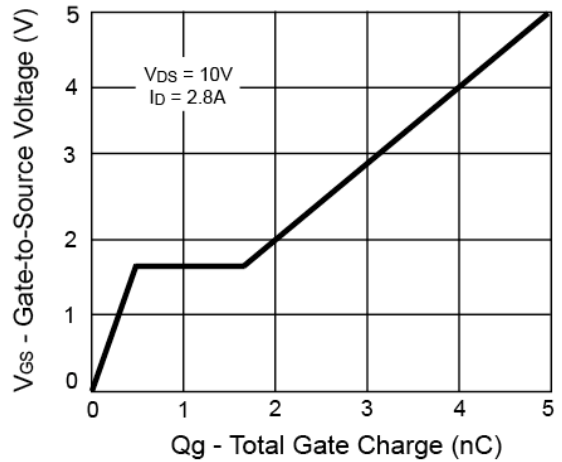
**Transfer Characteristics**



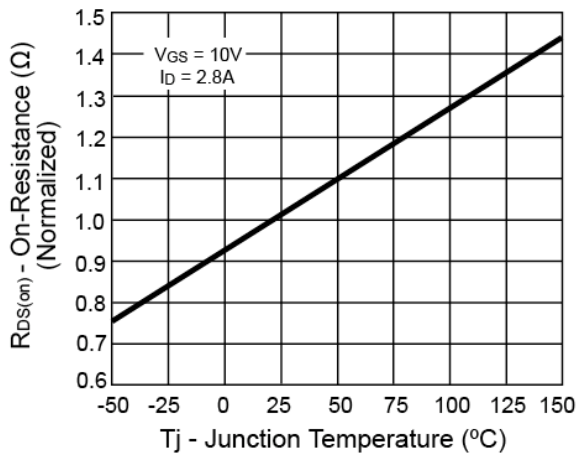
**On-Resistance vs. Drain Current**



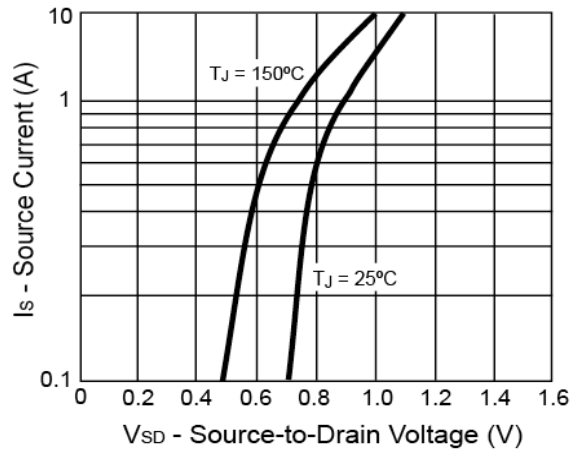
**Gate Charge**



**On-Resistance vs. Junction Temperature**

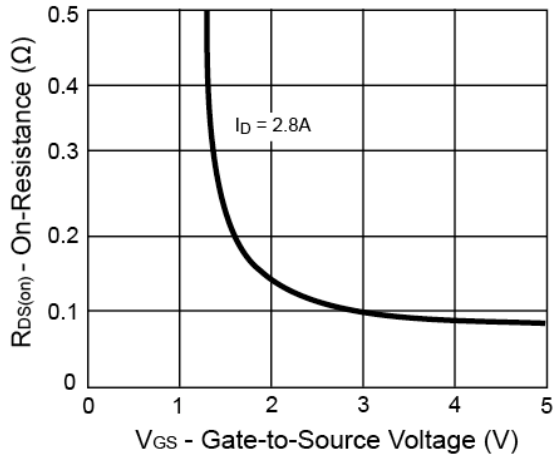


**Source-Drain Diode Forward Voltage**

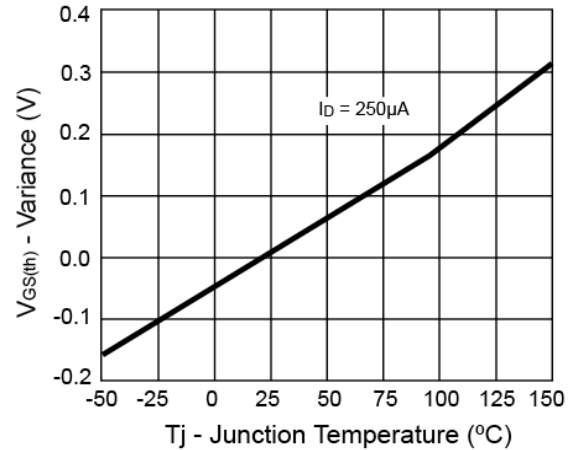


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

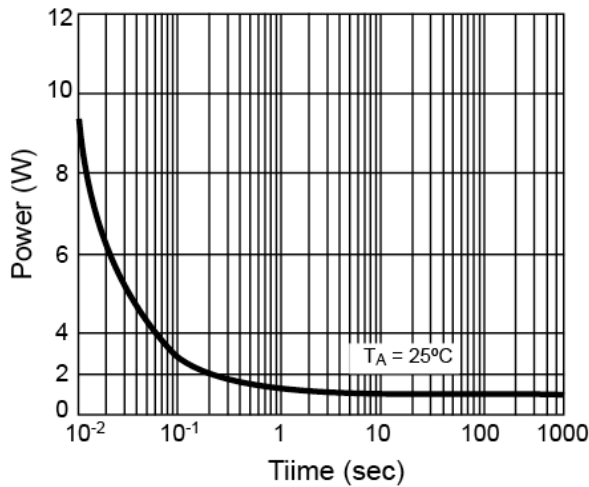
**On-Resistance vs. Gate-Source Voltage**



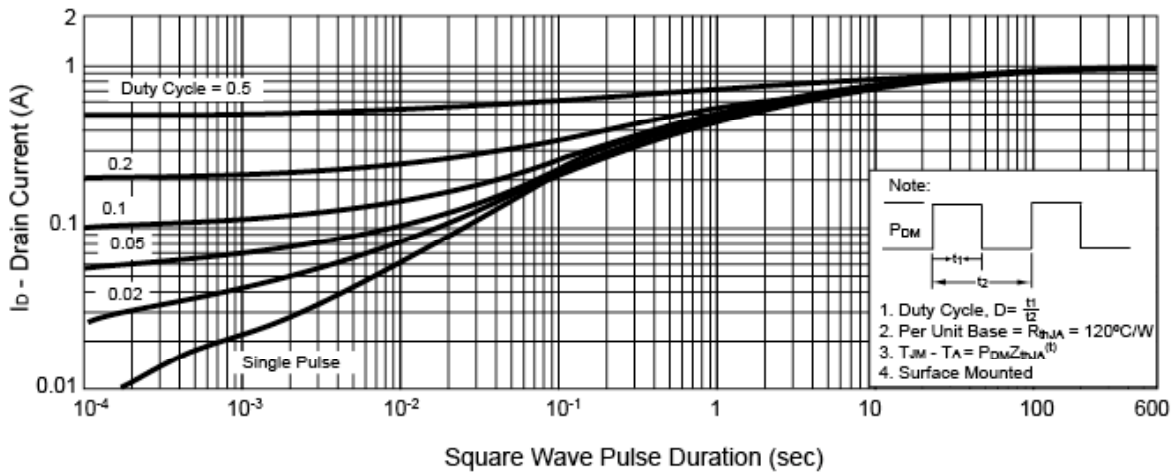
**Threshold Voltage**



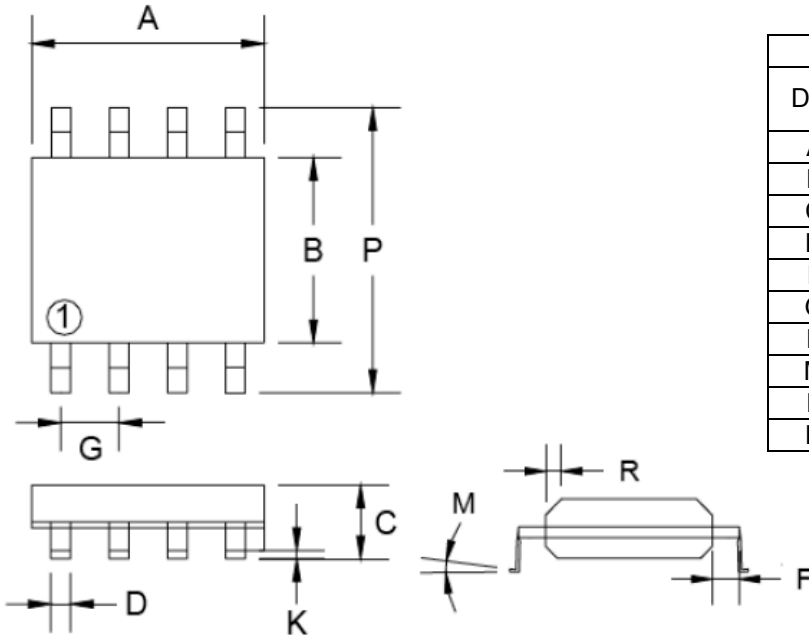
**Single Pulse Power**



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

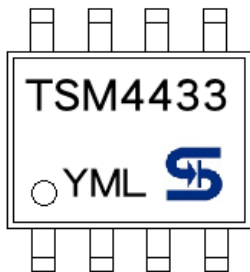


**SOP-8 Mechanical Drawing**



DIM	SOP-8 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX.
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27BSC		0.05BSC	
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

**Marking Diagram**



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

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# TSM4433

20V P-Channel MOSFET