

# TSM650P03CX

## 30V P-Channel Power MOSFET

### SOT-23



#### Pin Definition:

1. Gate
2. Source
3. Drain

#### Note:

MSL 1 (Moisture Sensitivity Level)  
per J-STD-020

### Key Parameter Performance

Parameter	Value	Unit
$V_{DS}$	-30	V
$R_{DS(on)}$ (max)	$V_{GS} = -10V$	65
	$V_{GS} = -4.5V$	75
	$V_{GS} = -2.5V$	100
$Q_g$	8	nC

### Features

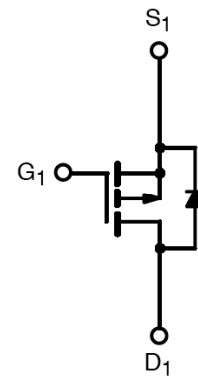
- Fast Switching
- Suited for -2.5V Gate Drive Applications
- Halogen-free

### Ordering Information

Ordering code	Package	Packing
TSM650P03CX RFG	SOT-23	3kcs / 7" Reel

Note: Halogen-free according to IEC 61249-2-21 definition

### Block Diagram



P-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Continuous Drain Current	$I_D$	$T_C = 25^\circ C$	-4.1
		$T_C = 100^\circ C$	-2.6
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	-16.4	A
Power Dissipation @ $T_C = 25^\circ C$	$P_D$	1.56	W
Operating Junction Temperature	$T_J$	150	$^\circ C$
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ C$

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	80	$^\circ C/W$

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

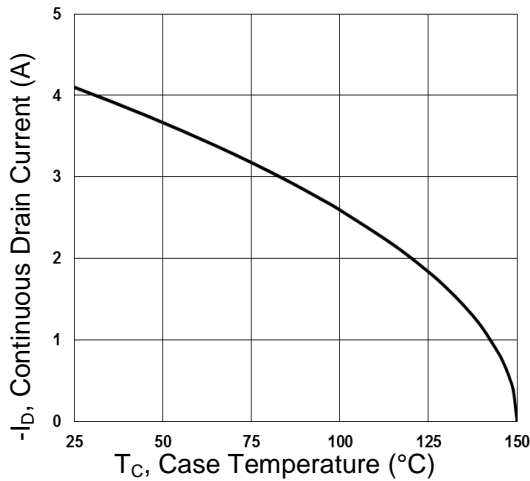
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	BV <sub>DSS</sub>	-30	--	--	V
Drain-Source On-State Resistance	V <sub>GS</sub> = -10V, I <sub>D</sub> = -4A	R <sub>DS(on)</sub>	--	55	65	mΩ
	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A		--	65	75	
	V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2A		--	85	100	
Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	V <sub>GS(TH)</sub>	-0.4	-0.7	-0.9	V
Zero Gate Voltage Drain Current	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V	I <sub>DSS</sub>	--	--	-1	μA
	V <sub>DS</sub> = -24V, T <sub>J</sub> = 125°C		--	--	-10	
Gate Body Leakage	V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V	I <sub>GSS</sub>	--	--	±100	nA
Forward Transconductance <sup>(Note 2)</sup>	V <sub>DS</sub> = -10V, I <sub>D</sub> = -3A	g <sub>fs</sub>	--	5.4	--	S
<b>Dynamic</b>						
Total Gate Charge <sup>(Note 2,3)</sup>	V <sub>DS</sub> = -15V, I <sub>D</sub> = -4A, V <sub>GS</sub> = -4.5V	Q <sub>g</sub>	--	8	--	nC
Gate-Source Charge <sup>(Note 2,3)</sup>		Q <sub>gs</sub>	--	1.9	--	
Gate-Drain Charge <sup>(Note 2,3)</sup>		Q <sub>gd</sub>	--	1.4	--	
Input Capacitance	V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V, f = 1.0MHz	C <sub>iss</sub>	--	810	--	pF
Output Capacitance		C <sub>oss</sub>	--	85	--	
Reverse Transfer Capacitance		C <sub>rss</sub>	--	50	--	
<b>Switching</b>						
Turn-On Delay Time <sup>(Note 2,3)</sup>	V <sub>DD</sub> = -15V, I <sub>D</sub> = -1A, V <sub>GS</sub> = -10V, R <sub>GEN</sub> = 6Ω	t <sub>d(on)</sub>	--	5.4	--	ns
Turn-On Rise Time <sup>(Note 2,3)</sup>		t <sub>r</sub>	--	19.4	--	
Turn-Off Delay Time <sup>(Note 2,3)</sup>		t <sub>d(off)</sub>	--	45.9	--	
Turn-Off Fall Time <sup>(Note 2,3)</sup>		t <sub>f</sub>	--	12.4	--	
<b>Source-Drain Diode Ratings and Characteristic</b>						
Maximum Continuous Drain-Source Diode Forward Current	Integral reverse diode in the MOSFET	I <sub>S</sub>	--	--	-4.1	A
Maximum Pulse Drain-Source Diode Forward Current		I <sub>SM</sub>	--	--	-16.4	A
Diode-Source Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A	V <sub>SD</sub>	--	--	-1	V

#### Note:

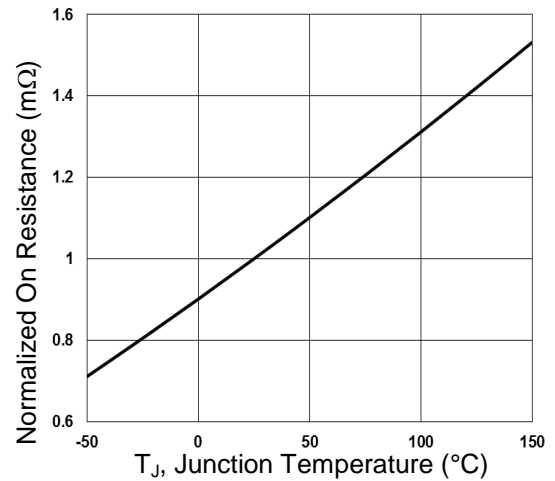
1. Pulse width limited by safe operating area
2. Pulse test: pulse width ≤ 300μs, duty cycle ≤ 2%
3. Switching time is essentially independent of operating temperature.

### Electrical Characteristics Curve

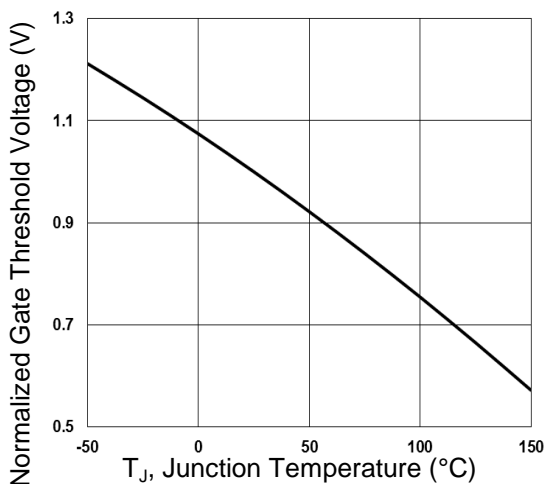
**Continuous Drain Current vs.  $T_C$**



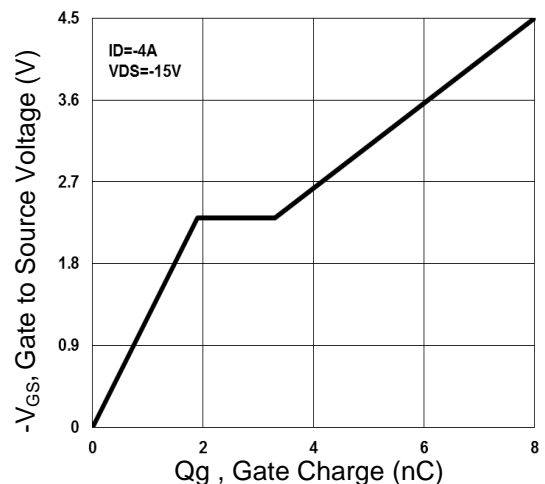
**Normalized R<sub>DS(on)</sub> vs. T<sub>J</sub>**



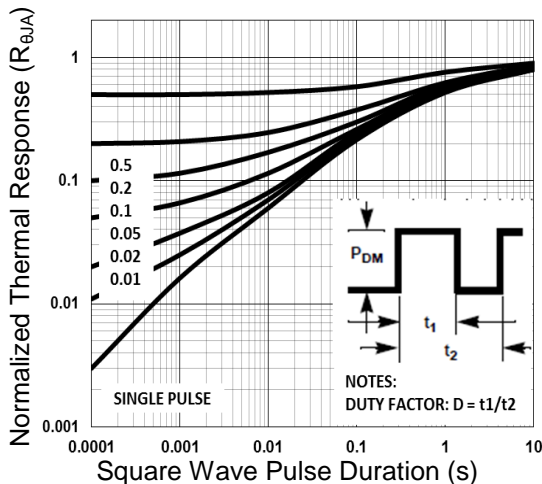
**Threshold Voltage vs. Junction Temperature**



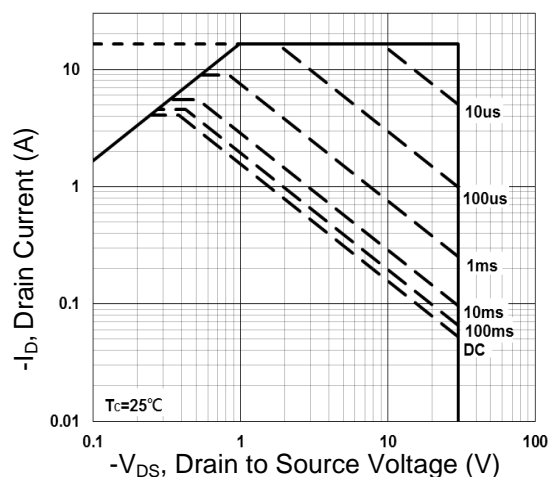
**Gate Charge Waveform**



**Normalized Thermal Transient Impedance Curve**

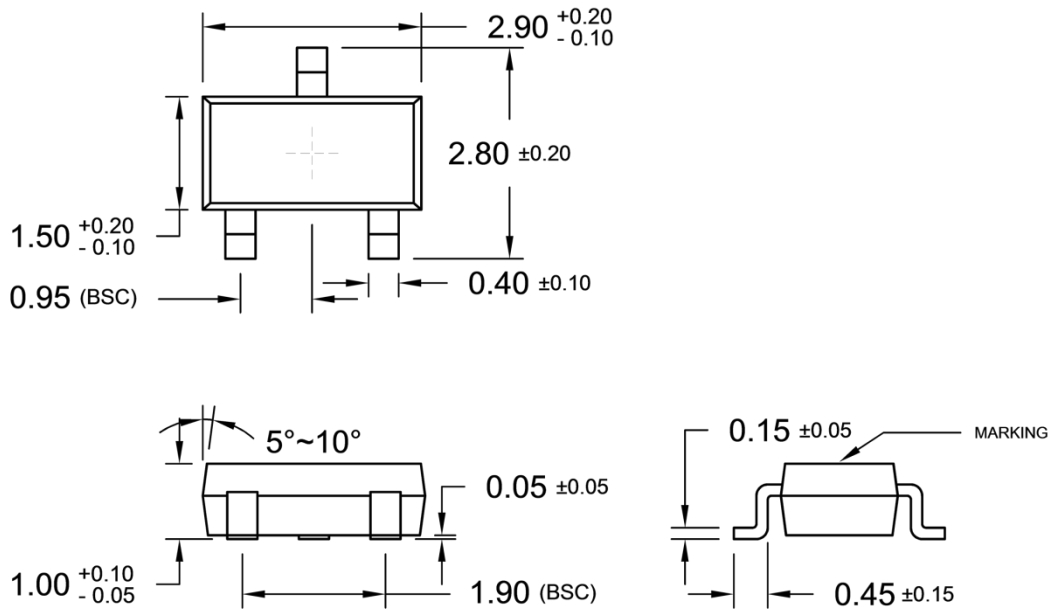


**Maximum Safe Operating Area**



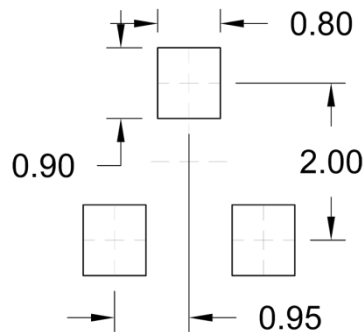


### SOT-23 Mechanical Drawing

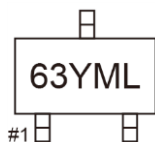


Unit: Millimeters

### SUGGESTED PAD LAYOUT (Unit: Millimeters)



### Marking Diagram



- 63** = Device Code
- Y** = Year Code
- M** = Month Code for Halogen Free Product  
 (O=Jan, P=Feb, Q=Mar, R=Apl, S=May, T=Jun, U=Jul, V=Aug, W=Sep, X=Oct, Y=Nov, Z=Dec)
- L** = Lot Code

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