

## P-Channel Power MOSFET

-20V, -4.7A, 50mΩ

### FEATURES

- Halogen-free
- Suited for 1.8V drive applications
- Low profile package

### APPLICATION

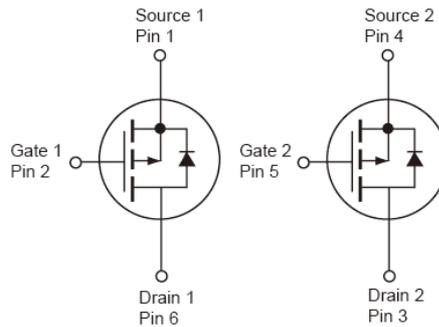
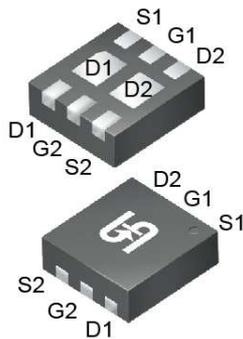
- Battery Pack
- Load Switch

### KEY PERFORMANCE PARAMETERS

PARAMETER	VALUE	UNIT
$V_{DS}$	-20	V
$R_{DS(on)}$ (max)	$V_{GS} = -4.5V$	50
	$V_{GS} = -2.5V$	65
	$V_{GS} = -1.8V$	85
$Q_g$	9.6	nC



TDFN2x2



**Notes:** Moisture sensitivity level: level 3. Per J-STD-020

### 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	$V_{GS}$	$\pm 10$	V
Continuous Drain Current <sup>(Note 1)</sup>	$I_D$	$T_C = 25^\circ C$	-4.7
		$T_C = 100^\circ C$	-2.82
Pulsed Drain Current <sup>(Note 2)</sup>	$I_{DM}$	-18.8	A
Total Power Dissipation @ $T_C = 25^\circ C$	$P_{DTOT}$	0.62	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ C$

### THERMAL PERFORMANCE

PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	200	$^\circ C/W$

**Notes:**  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances.  $R_{\theta JA}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.  $R_{\theta JA}$  shown below for single device operation on FR-4 PCB in still air.

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
<b>Static</b> (Note 3)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	$BV_{DSS}$	-20	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	$V_{GS(TH)}$	-0.3	-0.6	-0.8	V
Gate Body Leakage	$V_{GS} = \pm 10V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = -20V, V_{GS} = 0V$	$I_{DSS}$	--	--	-1	$\mu A$
Drain-Source On-State Resistance	$V_{GS} = -4.5V, I_D = -3A$	$R_{DS(ON)}$	--	42	50	m $\Omega$
	$V_{GS} = -2.5V, I_D = -2A$		--	57	65	
	$V_{GS} = -1.8V, I_D = -1A$		--	75	85	
Forward Transconductance	$V_{DS} = -10V, I_D = -3A$	$g_{fs}$	--	7	--	S
<b>Dynamic</b> (Note 4)						
Total Gate Charge	$V_{DS} = -10V, I_D = -3.0A,$ $V_{GS} = -4.5V$	$Q_g$	--	9.6	13	nC
Gate-Source Charge		$Q_{gs}$	--	1.6	2	
Gate-Drain Charge		$Q_{gd}$	--	2	4	
Input Capacitance	$V_{DS} = -10V, V_{GS} = 0V,$ $f = 1.0\text{MHz}$	$C_{iss}$	--	850	1230	pF
Output Capacitance		$C_{oss}$	--	70	100	
Reverse Transfer Capacitance		$C_{rss}$	--	55	80	
<b>Switching</b> (Note 5)						
Turn-On Delay Time	$V_{DD} = -10V,$ $R_{GEN} = 25\Omega,$ $I_D = -1A, V_{GS} = -4.5V,$	$t_{d(on)}$	--	6	11	ns
Turn-On Rise Time		$t_r$	--	21.6	41	
Turn-Off Delay Time		$t_{d(off)}$	--	51	97	
Turn-Off Fall Time		$t_f$	--	13.8	26	
<b>Source-Drain Diode</b> (Note 3)						
Continuous Source Current	$V_G = V_D = 0V,$ Force Current	$I_S$	--	--	-4.7	A
Pulsed Source Current		$I_{SM}$	--	--	-18.8	A
Forward On Voltage	$I_S = -1.0A, V_{GS} = 0V$	$V_{SD}$	--	--	-1.0	V

**Notes:**

1. Current limited by package
2. Pulse width limited by the maximum junction temperature
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.

**ORDERING INFORMATION**

<b>PART NO.</b>	<b>PACKAGE</b>	<b>PACKING</b>
TSM500P02DCQ RFG	TDFN 2x2	3,000pcs / 7" Reel

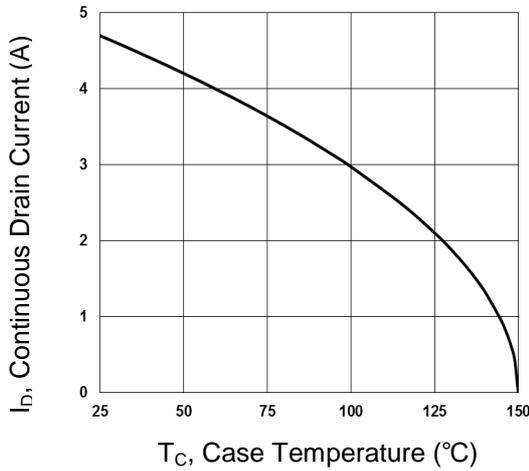
**Note:**

1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

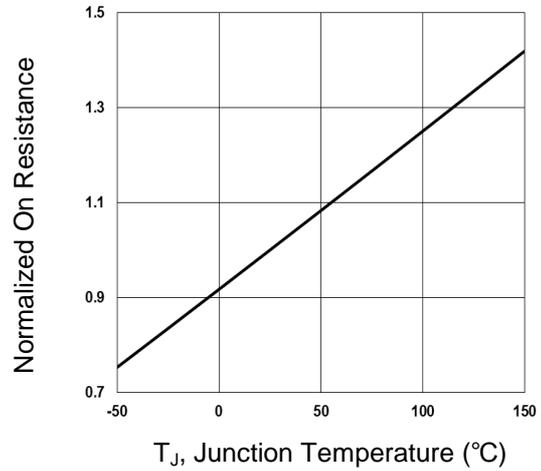
**CHARACTERISTICS CURVES**

( $T_C = 25^\circ\text{C}$  unless otherwise noted)

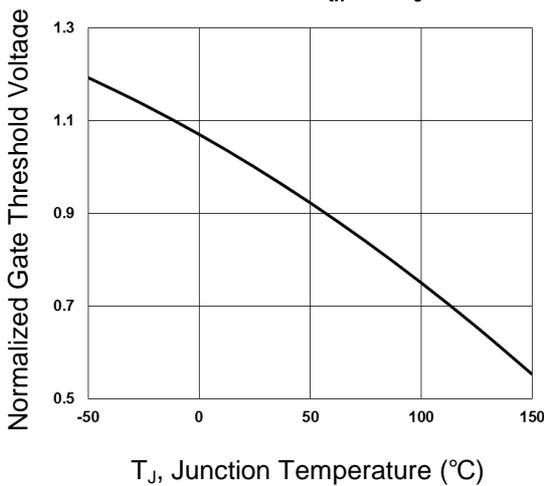
**Continuous Drain Current vs.  $T_C$**



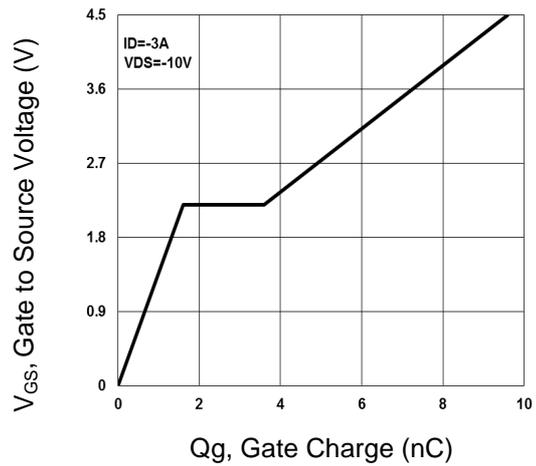
**Normalized  $R_{DS(on)}$  vs.  $T_J$**



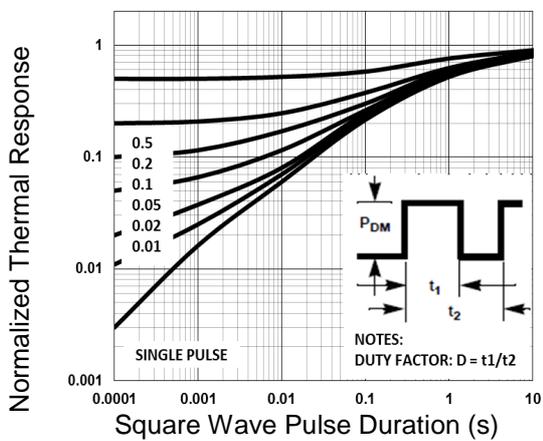
**Normalized  $V_{th}$  vs.  $T_J$**



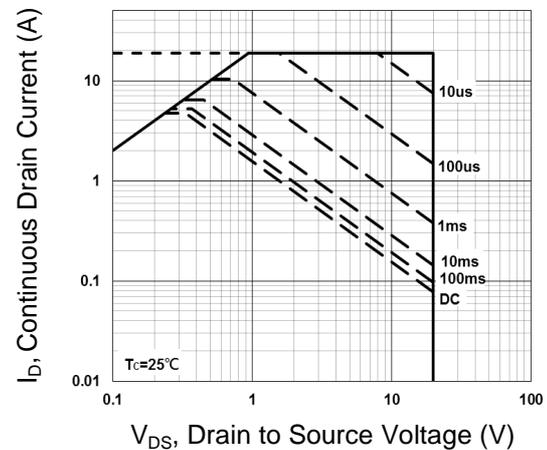
**Gate Charge Waveform**



**Normalized Transient Impedance**

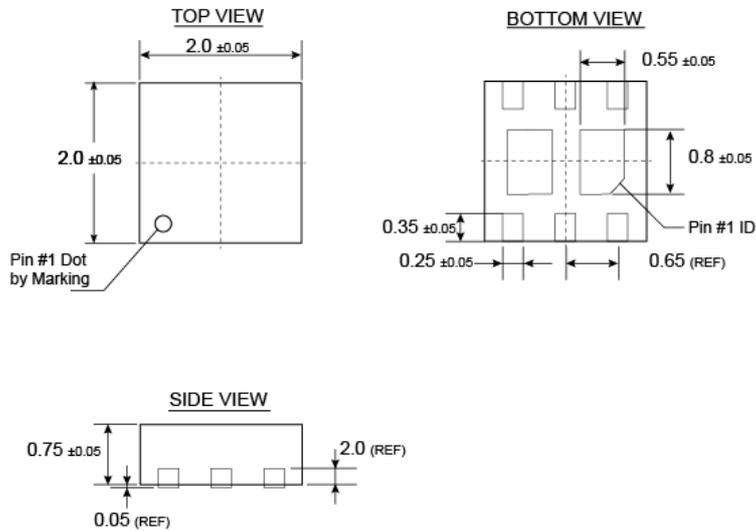


**Maximum Safe Operation Area**

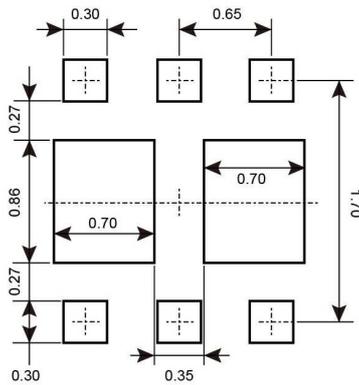


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

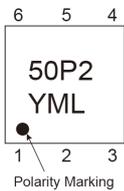
**TDFN2x2**



**SUGGESTED PAD LAYOUT** (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 (1~9, A~Z)

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