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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



## Dual P-Channel MOSFET

-60V, -12A, 68mΩ

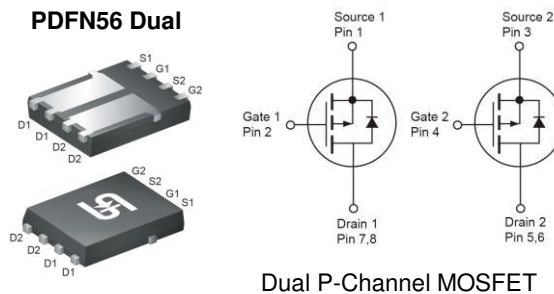
### FEATURES

- Fast switching
- Low thermal resistance package
- Low profile package
- Pb-free plating
- Compliant to RoHS directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

### APPLICATION

- Power Supply
- Motor Control

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
$V_{DS}$	-60	V
$R_{DS(on)}$ (max)	$V_{GS} = -10V$	68
	$V_{GS} = -4.5V$	110
$Q_g$	16.4	nC



Dual P-Channel MOSFET

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

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ C$ 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 <sup>(Note 1)</sup>	$I_D$	$T_C = 25^\circ C$	-12
		$T_C = 100^\circ C$	-8
Pulsed Drain Current <sup>(Note 2)</sup>	$I_{DM}$	-48	A
Total Power Dissipation @ $T_C = 25^\circ C$	$P_{TOT}$	3.5	W
Single Pulsed Avalanche Energy <sup>(Note 3)</sup>	$E_{AS}$	7.2	mJ
Single Pulsed Avalanche Current <sup>(Note 3)</sup>	$I_{AS}$	12	A
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	$R_{\theta JC}$	4.5	$^\circ C/W$
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	85	$^\circ C/W$

**Notes:**  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances. The case thermal reference is defined at the solder mounting surface of the drain pins.  $R_{\theta JA}$  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 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	$BV_{DSS}$	-60	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	$V_{GS(TH)}$	-1.2	-1.6	-2.5	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	$\mu A$
	$V_{DS} = -48V, T_C = 125^\circ\text{C}$		--	--	-10	
Drain-Source On-State Resistance	$V_{GS} = -10V, I_D = -6A$	$R_{DS(on)}$	--	54	68	m $\Omega$
	$V_{GS} = -4.5V, I_D = -3A$		--	90	110	
Forward Transconductance	$V_{DS} = -10V, I_D = -6A$	$g_{fs}$	--	8.5	--	S
<b>Dynamic</b> (Note 5)						
Total Gate Charge	$V_{DS} = -30V, I_D = -6A,$ $V_{GS} = -10V$	$Q_g$	--	16.4	--	nC
Gate-Source Charge		$Q_{gs}$	--	2.8	--	
Gate-Drain Charge		$Q_{gd}$	--	3.6	--	
Input Capacitance	$V_{DS} = -30V, V_{GS} = 0V,$ $f = 1.0\text{MHz}$	$C_{iss}$	--	870	--	pF
Output Capacitance		$C_{oss}$	--	70	--	
Reverse Transfer Capacitance		$C_{rss}$	--	42	--	
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{DD} = -30V, I_D = -1A,$ $R_{GEN} = 6\Omega$	$t_{d(on)}$	--	8.3	--	ns
Turn-On Rise Time		$t_r$	--	42.4	--	
Turn-Off Delay Time		$t_{d(off)}$	--	64.6	--	
Turn-Off Fall Time		$t_f$	--	16.4	--	
<b>Source-Drain Diode</b> (Note 4)						
Maximum Continuous Drain-Source Diode Forward Current	Integral reverse diode in the MOSFET	$I_S$	--	--	-12	A
Maximum Pulse Drain-Source Diode Forward Current		$I_{SM}$	--	--	-48	A
Diode-Source Forward Voltage	$V_{GS} = 0V, I_S = -1A$	$V_{SD}$	--	--	-1	V

**Notes:**

1. Current limited by package
2. Pulse width limited by the maximum junction temperature
3.  $L = 0.1\text{mH}, I_{AS} = -12A, V_{DD} = -25V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
4. Pulse test:  $PW \leq 300\mu s, \text{duty cycle} \leq 2\%$
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

**ORDERING INFORMATION (EXAMPLE)**

<b>PART NO.</b>	<b>PACKAGE</b>	<b>PACKING</b>
TSM680P06DPQ56 RLG	PDFN56 Dual	2,500pcs / 13"Reel

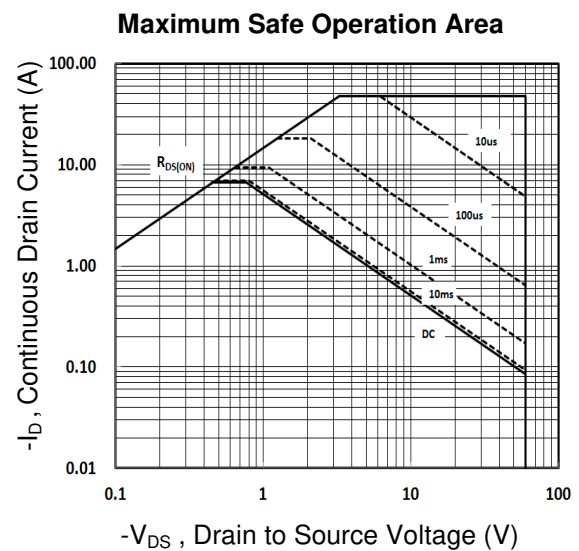
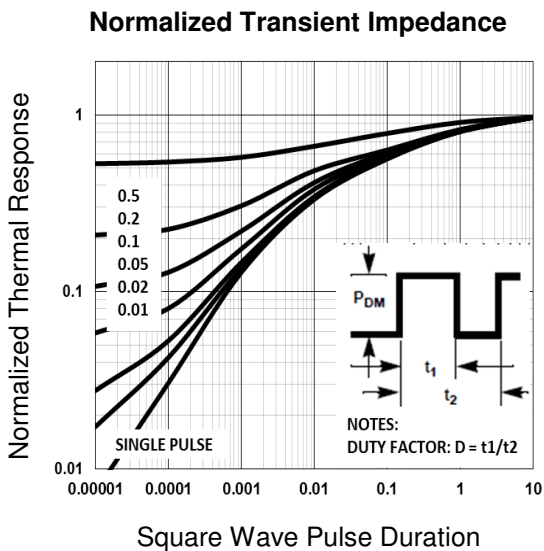
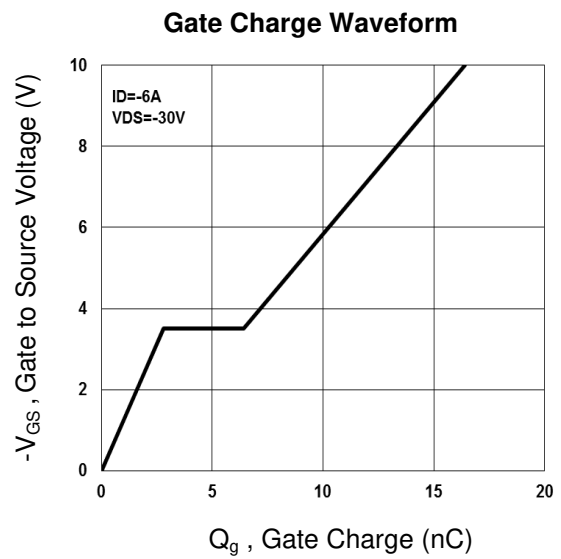
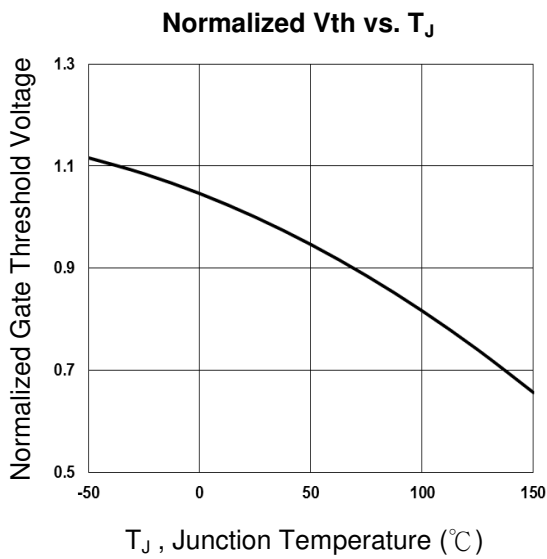
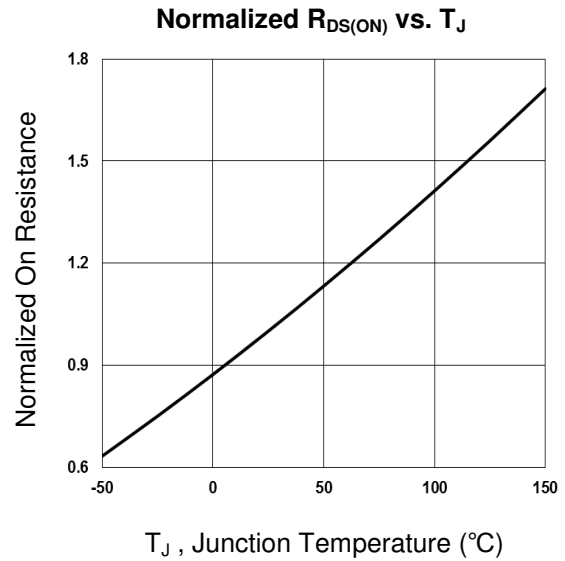
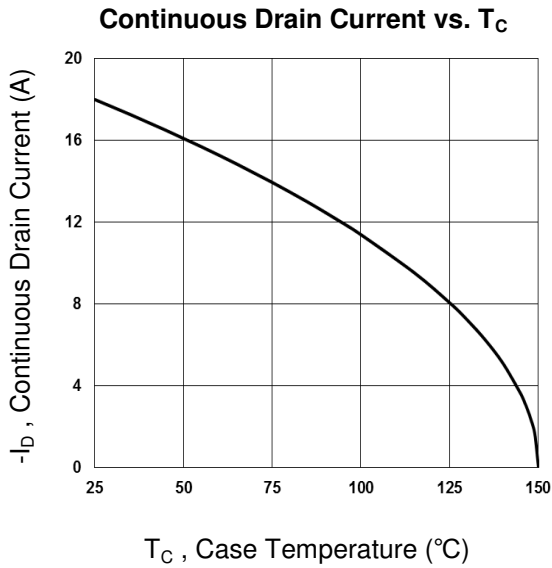
**Note:**

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

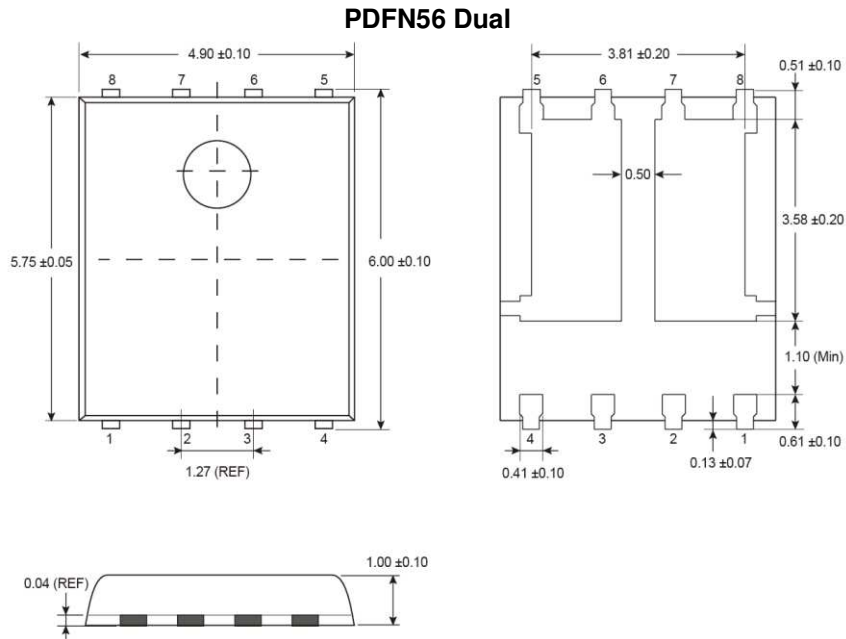


**CHARACTERISTICS CURVES**

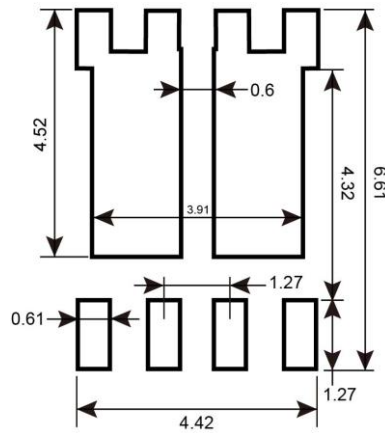
( $T_C = 25^\circ\text{C}$  unless otherwise noted)



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



**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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