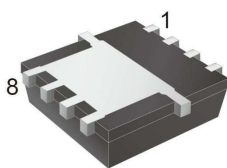


# TSM028N04PQ56

## 40V N-Channel MOSFET

PDFN56



**Pin Definition:**

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

**Key Parameter Performance**

Parameter	Value	Unit
$V_{DS}$	40	V
$R_{DS(on)}(max)$	2.8	mΩ
$Q_g$	78	nC

**Features**

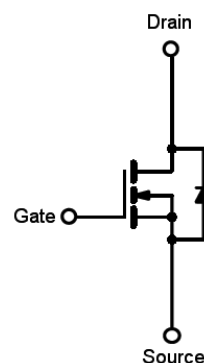
- Low On-Resistance
- Low Input Capacitance
- Low Gate Charge

**Ordering Information**

Part No.	Package	Packing
TSM028N04PQ56 RLG	PDFN56	2.5kpcs / 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**



N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>(Note 3)</sup>	$I_D$	$T_C=25^{\circ}C$	140
		$T_A=25^{\circ}C$	42
Drain Current-Pulsed <sup>(Note 1)</sup>	$I_{DM}$	550	A
Single Pulse Avalanche Energy: L=0.1mH	$E_{AS}$	201	mJ
Maximum Power Dissipation <sup>(Note 2)</sup>	$P_D$	$T_C=25^{\circ}C$	83
		$T_A=25^{\circ}C$	4.4
Storage Temperature Range	$T_{STG}$	-55 to +150	$^{\circ}C$
Operating Junction Temperature Range	$T_J$	-55 to +150	$^{\circ}C$

**Thermal Performance**

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	$R_{\theta JC}$	1.5	$^{\circ}C/W$
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	28	$^{\circ}C/W$

**Electrical Specifications** ( $T_J=25^{\circ}\text{C}$  unless otherwise noted)

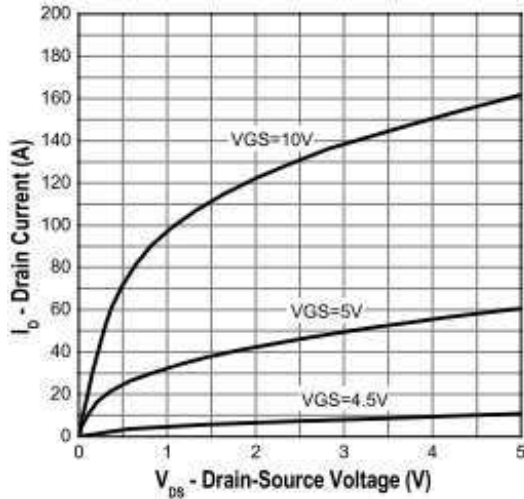
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	$BV_{DSS}$	40	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10\text{V}, I_D = 30\text{A}$	$R_{DS(ON)}$	--	2.1	2.8	m $\Omega$
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	2	3	4	V
Zero Gate Voltage Drain Current	$V_{DS} = 32\text{V}, V_{GS} = 0\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
Gate Body Leakage	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	$I_{GSS}$	--	--	$\pm 100$	nA
<b>Dynamic</b>						
Total Gate Charge	$V_{DD} = 20\text{V}, I_D = 30\text{A},$ $V_{GS} = 10\text{V}$	$Q_g$	--	78	--	nC
Gate-Source Charge		$Q_{gs}$	--	22	--	
Gate-Drain Charge		$Q_{gd}$	--	4.7	--	
Input Capacitance	$V_{DS} = 20\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$	$C_{iss}$	--	4222	--	pF
Output Capacitance		$C_{oss}$	--	889	--	
Reverse Transfer Capacitance		$C_{rss}$	--	398	--	
<b>Switching</b>						
Turn-On Delay Time	$V_{GS} = 10\text{V}, V_{DD} = 20\text{V},$ $R_G = 3\Omega, I_D = 13\text{A}$	$t_{d(on)}$	--	21	--	ns
Turn-On Rise Time		$t_r$	--	6	--	
Turn-Off Delay Time		$t_{d(off)}$	--	98	--	
Turn-Off Fall Time		$t_f$	--	17	--	
<b>Drain-Source Diode Characteristics and Maximum Rating</b>						
Drain-Source Diode Forward Voltage	$V_{GS}=0\text{V}, I_S=30\text{A}$	$V_{SD}$	--	--	1.3	V
Reverse Recovery Time	$I_S = 30\text{A}, di/dt = 100\text{A}/\mu\text{s}$	$t_{fr}$	--	32	--	ns
Reverse Recovery Charge		$Q_{fr}$	--	120	--	nC

**Notes:**

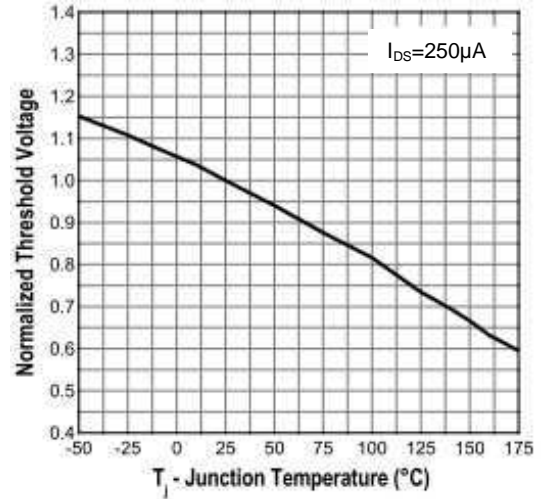
- Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances. The case thermal reference is defined at the solder mounting surface of the drain pins.  $R_{\theta JA}$  is guaranteed by design 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.
- The maximum current rating is limited by package.

### Electrical Characteristics Curves

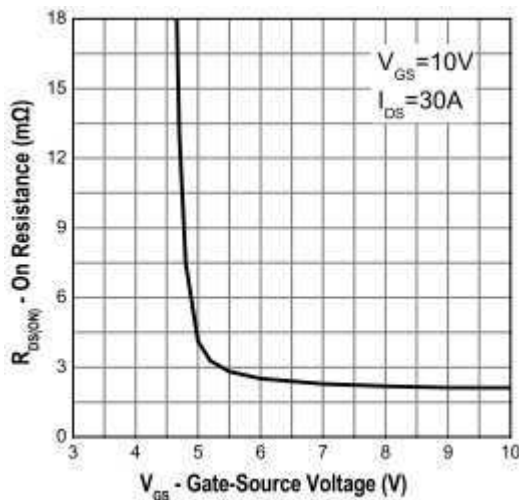
**Output Characteristics**



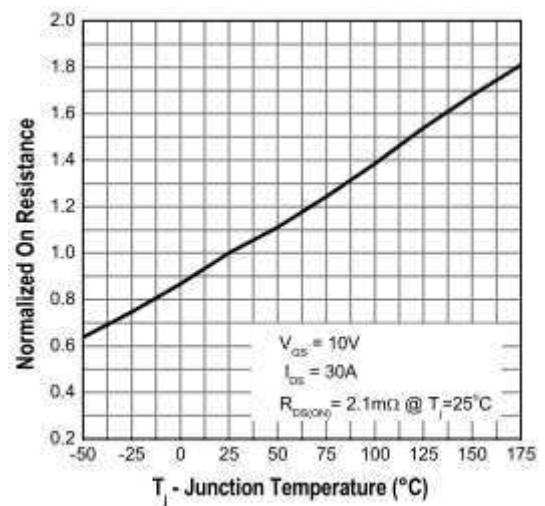
**Gate Threshold Voltage**



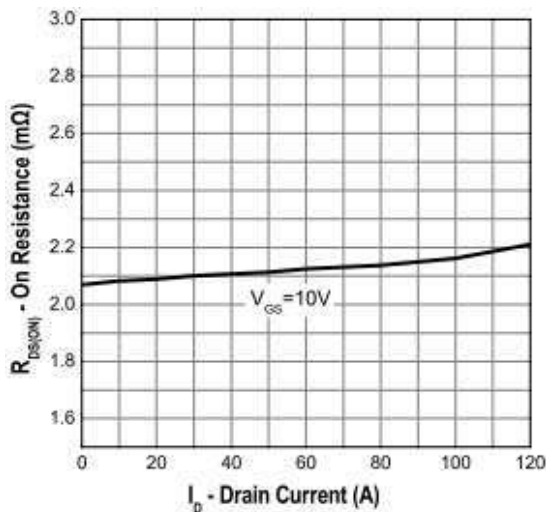
**Gate Source On Resistance**



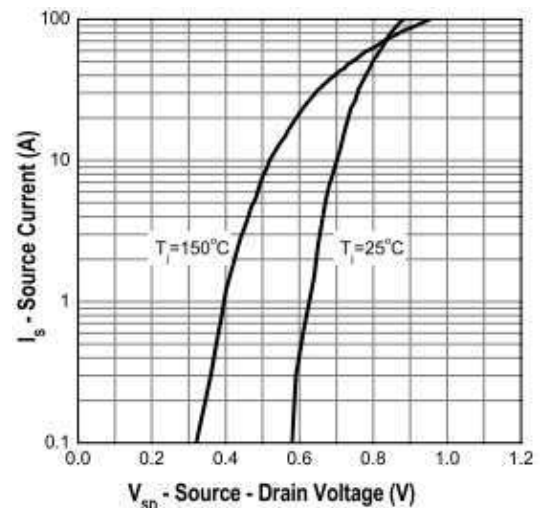
**Drain-Source On Resistance**



**Drain-Source On-Resistance**

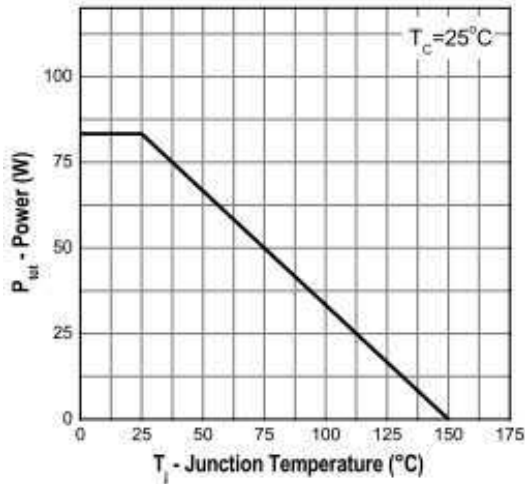


**Source-Drain Diode Forward Voltage**

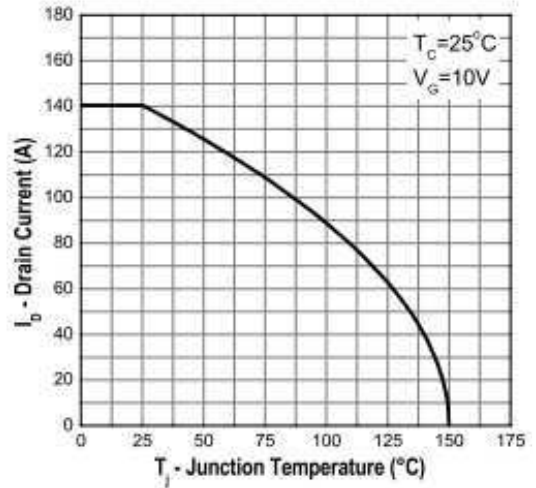


### Electrical Characteristics Curves

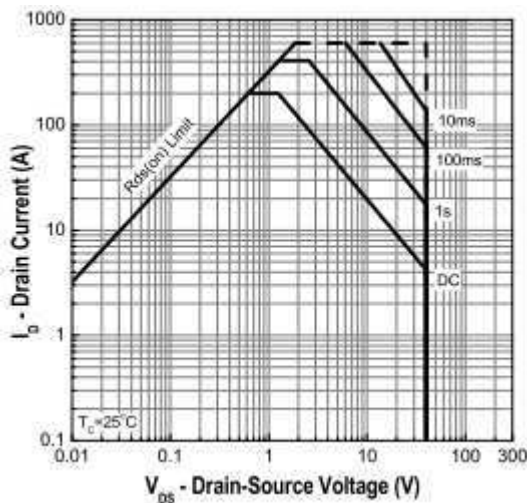
**Power Derating**



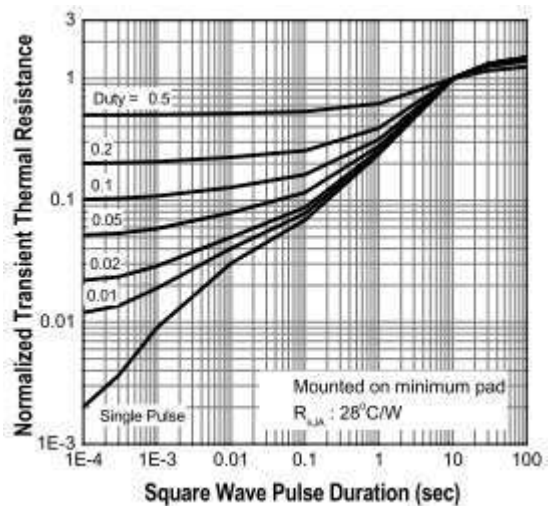
**Drain Current vs. Junction Temperature**



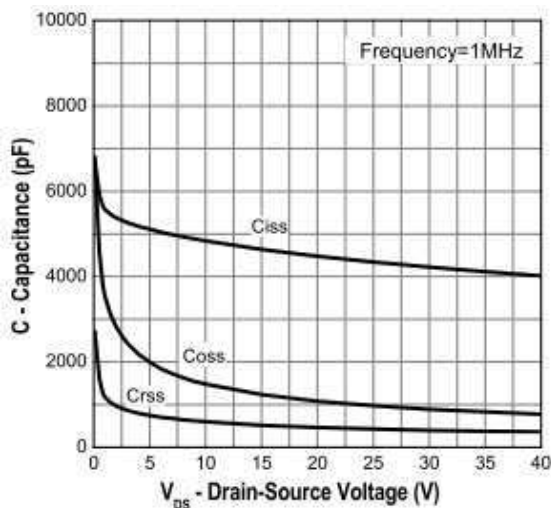
**Safe Operation Area**



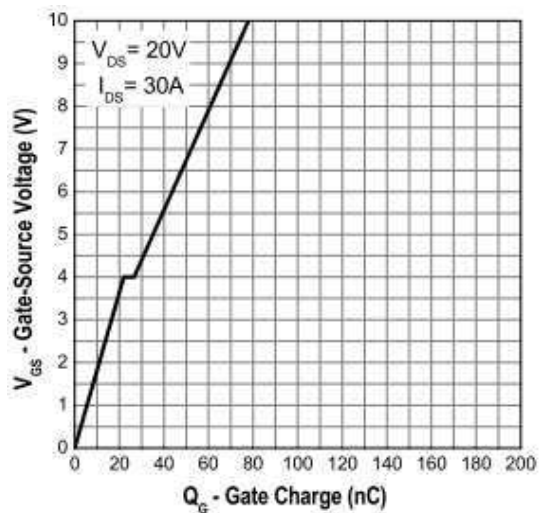
**Transient Thermal Impedance**



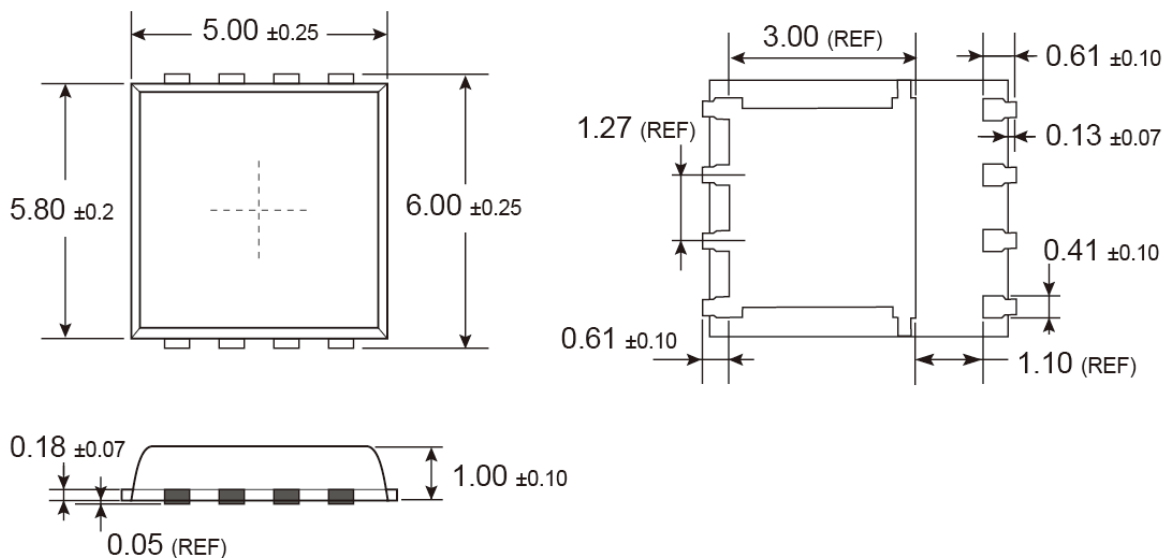
**Capacitance**



**Gate Charge**



**PDFN56 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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