

**Features**

- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Moisture Sensitivity Level 1
- Halogen Free Available Upon Request By Adding Suffix "-HF"

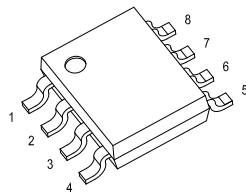
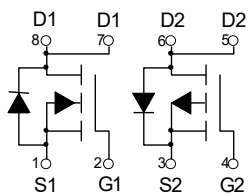
**Maximum Ratings**

- Operating Junction Temperature Range : -55°C to +150°C
- Storage Temperature Range: -55°C to +150°C
- Thermal Resistance: 62.5°C/W Junction to Ambient

Parameter	Symbol	Rating	Unit
Total Power Dissipation	P <sub>D</sub>	2.0	W
<b>N-Channel MOSFET</b>			
Drain-Source Voltage	V <sub>DS</sub>	60	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Continuous Drain Current <sup>(Note 1)</sup>	I <sub>D</sub>	4.5	A
Pulsed Drain Current <sup>(Note 2)</sup>	I <sub>DM</sub>	18	A
<b>P-Channel MOSFET</b>			
Drain-Source Voltage	V <sub>DS</sub>	-60	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Continuous Drain Current <sup>(Note 1)</sup>	I <sub>D</sub>	-3.5	A
Pulsed Drain Current <sup>(Note 2)</sup>	I <sub>DM</sub>	-14	A

Notes: 1.Surface Mounted on FR4 Board Using the Minimum Recommended Pad Size.  
2. Pulse Test : Pulse Width ≤ 300µs, Duty Cycle ≤ 2%.

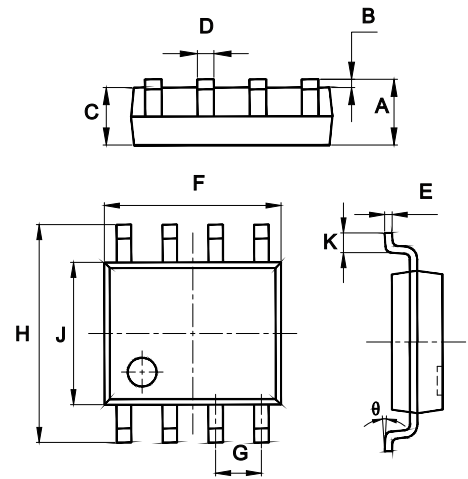
**Internal Structure:**



Marking: Q4559

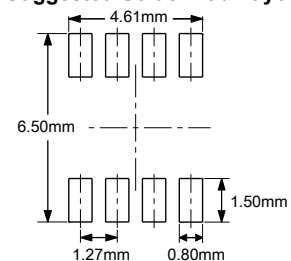
**Dual  
N&P-Channel  
MOSFET**

**SOP-8**



DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.053	0.069	1.35	1.75	
B	0.004	0.010	0.10	0.25	
C	0.053	0.061	1.35	1.55	
D	0.013	0.020	0.33	0.51	
E	0.007	0.010	0.17	0.25	
F	0.185	0.200	4.70	5.10	
G	0.050		1.270		TYP.
H	0.228	0.244	5.80	6.20	
J	0.150	0.157	3.80	4.00	
K	0.016	0.050	0.40	1.27	
θ	0°	8°	0°	8°	

**Suggested Solder Pad Layout**



**N-Channel MOSFET Electrical Characteristics @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	60			V
Gate-Source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 20V$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$			1	$\mu A$
Gate-Threshold Voltage <sup>(Note 2)</sup>	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1	2.1	3	V
Drain-Source On-Resistance <sup>(Note 2)</sup>	$R_{DS(on)}$	$V_{GS}=10V, I_D=4.3A$		40	58	m $\Omega$
		$V_{GS}=4.5V, I_D=3.9A$		55	72	
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=1.7A$			1.2	V
Forward Transconductance <sup>(Note 2)</sup>	$g_{FS}$	$V_{DS}=15V, I_D=4.3A$		15		S
<b>Dynamic Characteristics<sup>(Note 4)</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V, f=1MHz$		665		pF
Output Capacitance	$C_{oss}$			75		
Reverse Transfer Capacitance	$C_{rss}$			40		
Gate Resistance	$R_g$	$f=1MHz$			3	$\Omega$
<b>Switching Characteristics<sup>(Note 3,4)</sup></b>						
Total Gate Charge	$Q_g$	$V_{DD}=30V, V_{GS}=4.5V, I_D=4.3A$			9	nC
Gate-Source Charge	$Q_{gs}$			2.3		
Gate-Drain Charge	$Q_{gd}$			2.6		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD}=30V, V_{GEN}=4.5V, I_D=3.4A$ $R_L=8.8\Omega, R_G=1\Omega$			25	ns
Turn-On Rise Time	$t_r$				100	
Turn-Off Delay Time	$t_{d(off)}$				25	
Turn-Off Fall Time	$t_f$				15	

**P-Channel Electrical Characteristics @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-60			V
Gate-Source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 20V$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-60V, V_{GS}=0V$			-1	$\mu A$
Gate-Threshold Voltage <sup>(Note 2)</sup>	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1	-2.8	-3	V
Drain-Source On-Resistance <sup>(Note 2)</sup>	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-3.1A$		60	80	m $\Omega$
		$V_{GS}=-4.5V, I_D=-0.2A$		92	100	
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=-2A$			1.2	V
Forward Transconductance <sup>(Note2)</sup>	$g_{FS}$	$V_{DS}=-15V, I_D=-3.1A$		8.5		S
<b>Dynamic Characteristics<sup>(Note 3)</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-15V, V_{GS}=0V, f=1MHz$		650		pF
Output Capacitance	$C_{oss}$			95		
Reverse Transfer Capacitance	$C_{rss}$			60		
Gate Resistance	$R_g$	$f=1MHz$			20	$\Omega$
<b>Switching Characteristics<sup>(Note 3,4)</sup></b>						
Total Gate Charge	$Q_g$	$V_{DD}=-30V, V_{GS}=-4.5V, I_D=-3.1A$			12	nC
Gate-Source Charge	$Q_{gs}$			2.2		
Gate-Drain Charge	$Q_{gd}$			3.7		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD}=-30V, V_{GEN}=-4.5V, I_D=-2.4A$ $R_L=12.5\Omega, R_G=1\Omega$			45	ns
Turn-On Rise Time	$t_r$				105	
Turn-Off Delay Time	$t_{d(off)}$				60	
Turn-Off Fall Time	$t_f$				45	

Note 3. Switching Characteristics are Independent of Operating Junction Temperature.

4. Guaranteed by Design, Not Subject to Production Testing.

## N-Channel MOSFET Curve Characteristics

Fig. 1 - Output Characteristics

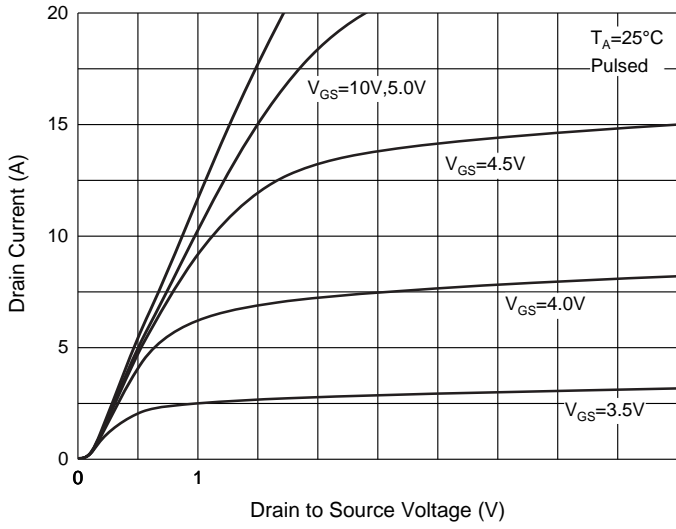


Fig. 2 - Transfer Characteristics

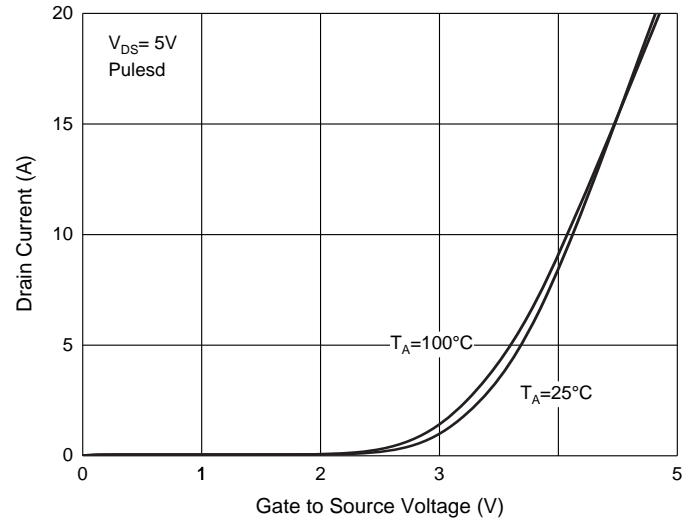


Fig. 3 -  $R_{DS(ON)} - I_D$

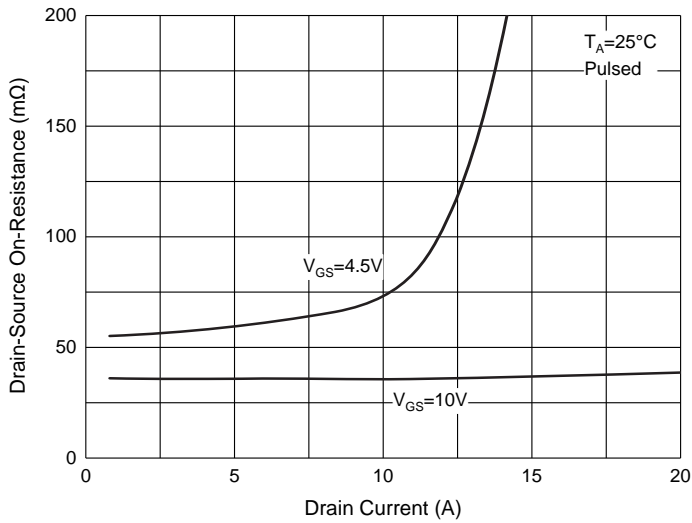


Fig. 4 -  $R_{DS(ON)} - V_{GS}$

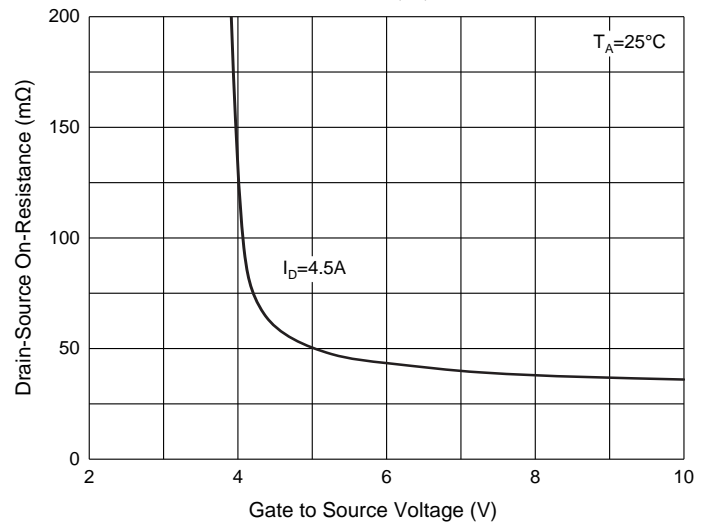


Fig. 5 -  $I_S - V_{SD}$

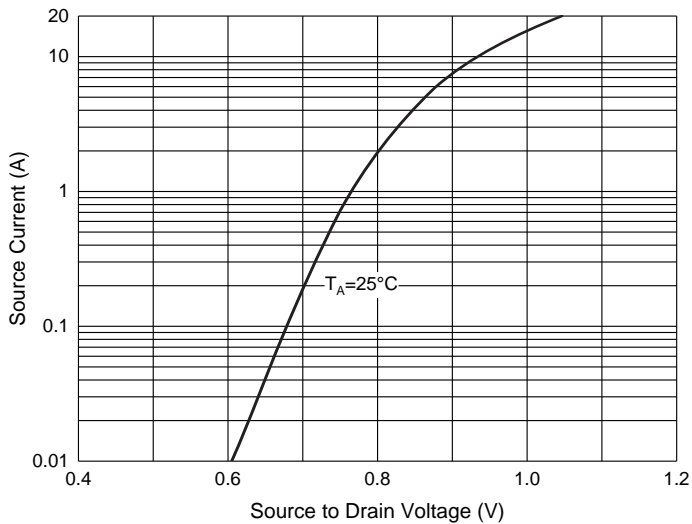
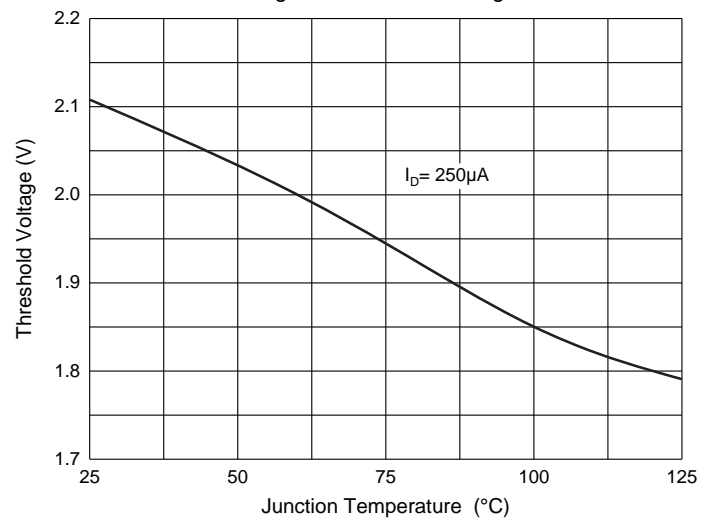


Fig. 6 - Threshold Voltage



## P-Channel MOSFET Curve Characteristics

Fig. 1 - Output Characteristics

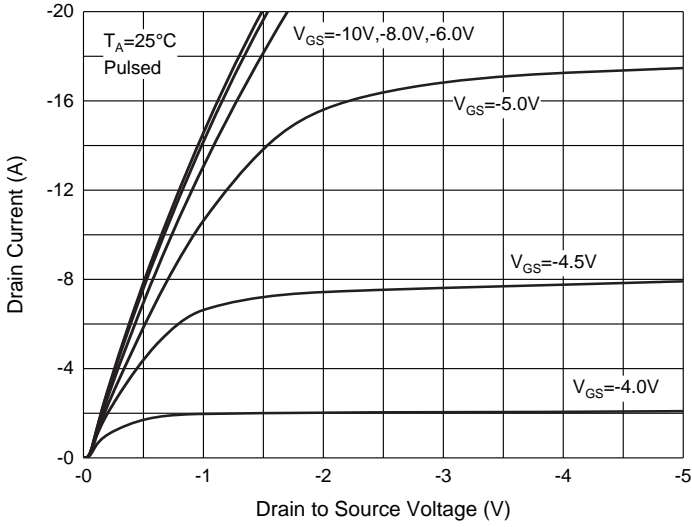


Fig. 2 - Transfer Characteristics

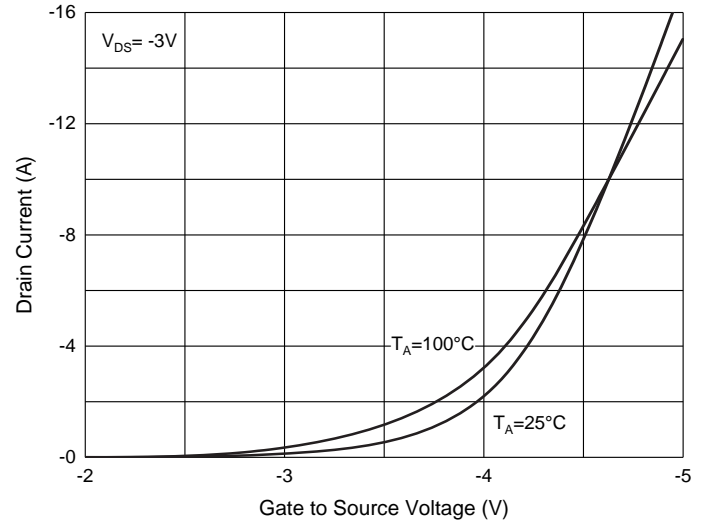


Fig. 3 -  $R_{DS(ON)} - I_D$

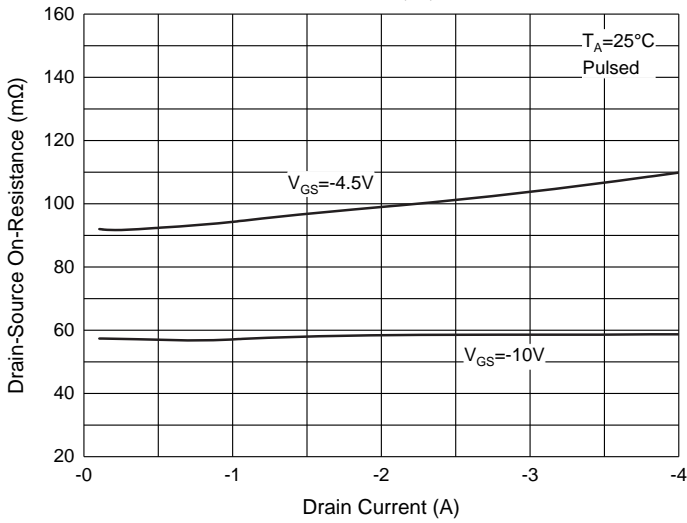


Fig. 4 -  $R_{DS(ON)} - V_{GS}$

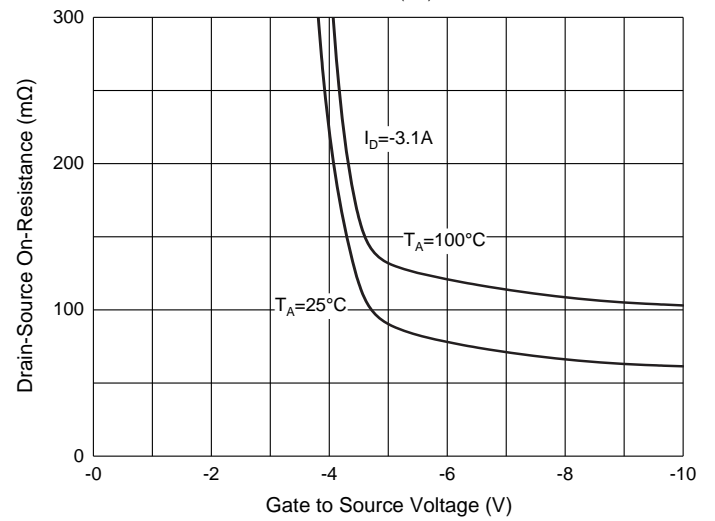


Fig. 5 -  $I_S - V_{SD}$

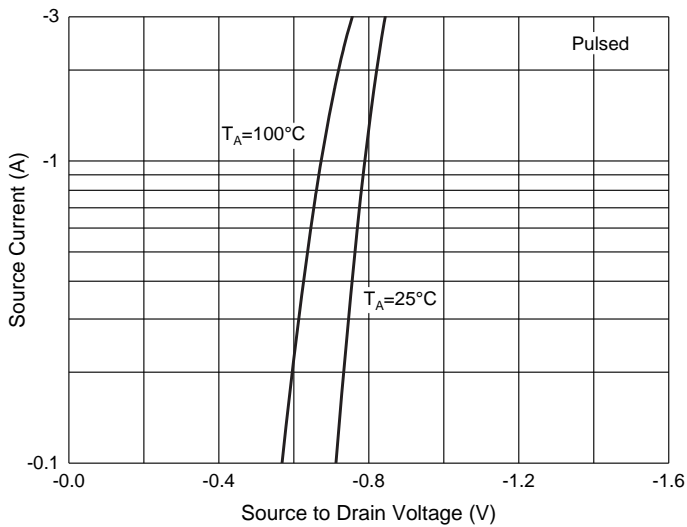
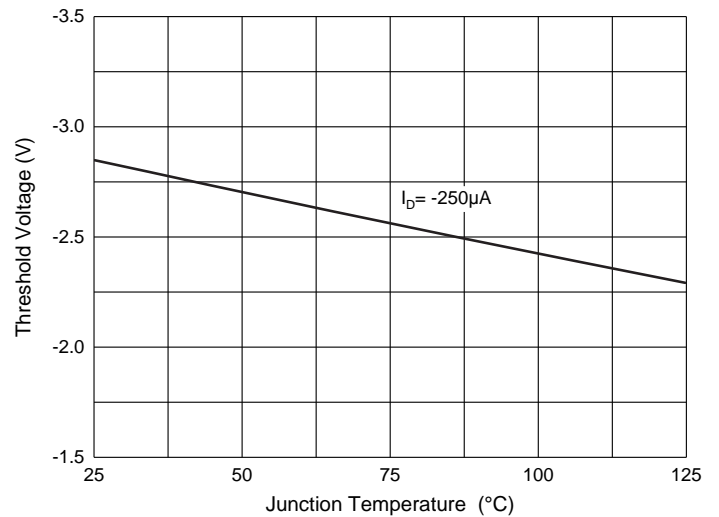


Fig. 6 - Threshold Voltage



## Ordering Information

Device	Packing
Part Number-TP	Tape&Reel: 4Kpcs/Reel

Note : Adding "-HF" Suffix For Halogen Free, eg. Part Number-TP-HF

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