



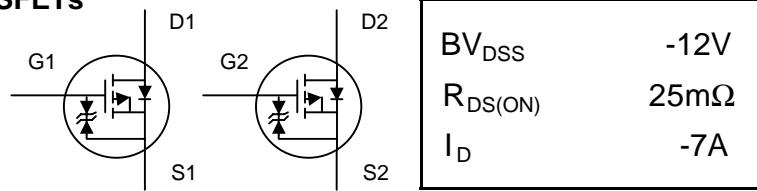
**Dual P-channel Enhancement-mode Power MOSFET**

**Independent, Symmetrical Dual MOSFETs**

**Support 1.8V Gate Drive**

**Low On-resistance**

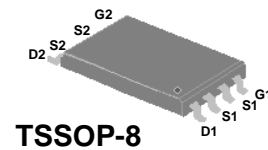
**RoHS-compliant, halogen-free**



**Description**

Advanced Power MOSFETs from APEC provide the designer with the best combination of fast switching, low on-resistance and cost-effectiveness.

The TSSOP-8 package is widely used for commercial and industrial applications, where space is at a premium.



**Absolute Maximum Ratings**

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-12	V
$V_{GS}$	Gate-Source Voltage	±8	V
$I_D$ at $T_A=25^{\circ}C$	Continuous Drain Current <sup>3</sup>	-7.0	A
$I_D$ at $T_A=70^{\circ}C$	Continuous Drain Current <sup>3</sup>	-5.0	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	-30	A
$P_D$ at $T_A=25^{\circ}C$	Total Power Dissipation	1	W
	Linear Derating Factor	0.01	W/°C
$T_{STG}$	Storage Temperature Range	-55 to 150	°C
$T_J$	Operating Junction Temperature Range	-55 to 150	°C

**Thermal Data**

Symbol	Parameter	Value	Unit
Rthj-a	Maximum Thermal Resistance, Junction-ambient	125	°C/W
Rthj-L	Maximum Thermal Resistance, Junction-lead	75	°C/W

**Ordering Information**

**AP9923GEO-HF-3TR** : in RoHS-compliant halogen-free TSSOP-8 shipped on tape and reel (3000pcs/reel)



**Electrical Specifications at  $T_j=25^\circ\text{C}$  (unless otherwise specified)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-12	-	-	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=-4.5V, I_D=-7A$	-	-	25	$m\Omega$
		$V_{GS}=-2.5V, I_D=-6A$	-	-	32	$m\Omega$
		$V_{GS}=-1.8V, I_D=-5A$	-	-	48	$m\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.3	-	-1	V
$g_{fs}$	Forward Transconductance	$V_{DS}=-5V, I_D=-7A$	-	7	-	S
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=-12V, V_{GS}=0V$	-	-	-1	$\mu A$
	Drain-Source Leakage Current ( $T_j=70^\circ\text{C}$ )	$V_{DS}=-9.6V, V_{GS}=0V$	-	-	-10	$\mu A$
$I_{GSS}$	Gate-Source Leakage	$V_{GS}=\pm 8V, V_{DS}=0V$	-	-	$\pm 30$	$\mu A$
$Q_g$	Total Gate Charge <sup>2</sup>	$I_D=-7A$	-	28	45	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=-6V$	-	3	-	nC
$Q_{gd}$	Gate-Drain ("Miller") Charge	$V_{GS}=-4.5V$	-	8	-	nC
$t_{d(on)}$	Turn-on Delay Time <sup>2</sup>	$V_{DS}=-6V$	-	12	-	ns
$t_r$	Rise Time	$I_D=-5A$	-	55	-	ns
$t_{d(off)}$	Turn-off Delay Time	$R_G=3.3\Omega, V_{GS}=-5V$	-	75	-	ns
$t_f$	Fall Time	$R_D=1.2\Omega$	-	100	-	ns
$C_{iss}$	Input Capacitance	$V_{GS}=0V$	-	2250	3600	pF
$C_{oss}$	Output Capacitance	$V_{DS}=-6V$	-	635	-	pF
$C_{rss}$	Reverse Transfer Capacitance	$f=1.0\text{MHz}$	-	565	-	pF
$R_g$	Gate Resistance	$f=1.0\text{MHz}$	-	5	7.5	$\Omega$

**Source-Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{SD}$	Forward On Voltage <sup>2</sup>	$T_j=25^\circ\text{C}, I_S=-0.84A, V_{GS}=0V$	-	-	-1.2	V
$t_{rr}$	Reverse Recovery Time <sup>2</sup>	$I_S=-7A, V_{GS}=0V,$	-	61	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt=100A/\mu s$	-	56	-	nC

**Notes:**

1. Pulse width limited by the maximum junction temperature.
2. Pulse test - pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board; 208°C/W when mounted on minimum copper pad.

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

USE OF THIS PRODUCT AS A CRITICAL COMPONENT IN LIFE SUPPORT OR OTHER SIMILAR SYSTEMS IS NOT AUTHORIZED.

APEC DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

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Typical Electrical Characteristics

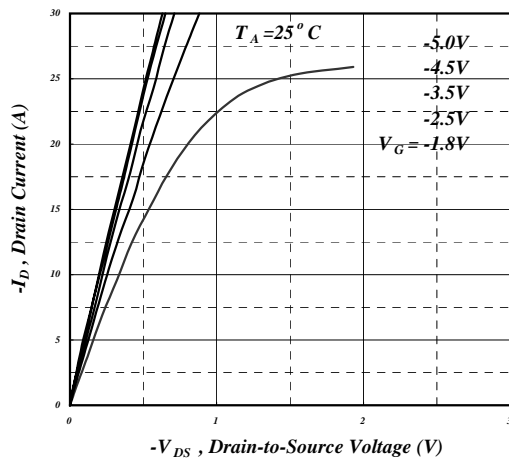


Fig 1. Typical Output Characteristics

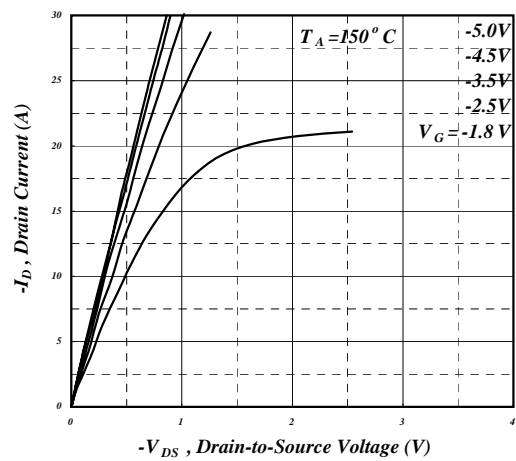


Fig 2. Typical Output Characteristics

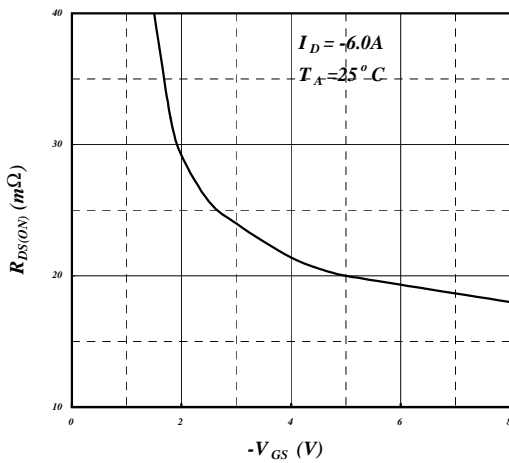


Fig 3. On-Resistance vs. Gate Voltage

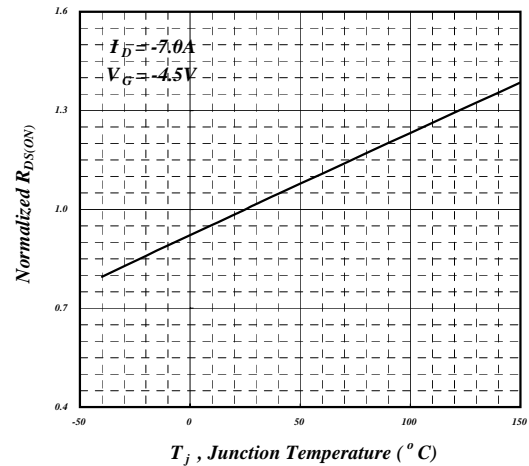


Fig 4. Normalized On-Resistance vs. Junction Temperature

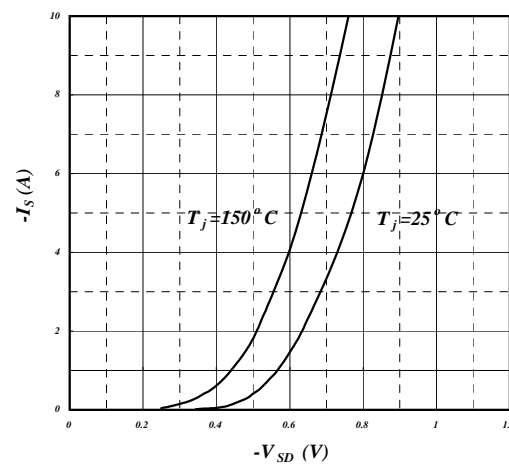


Fig 5. Forward Characteristic of Reverse Diode

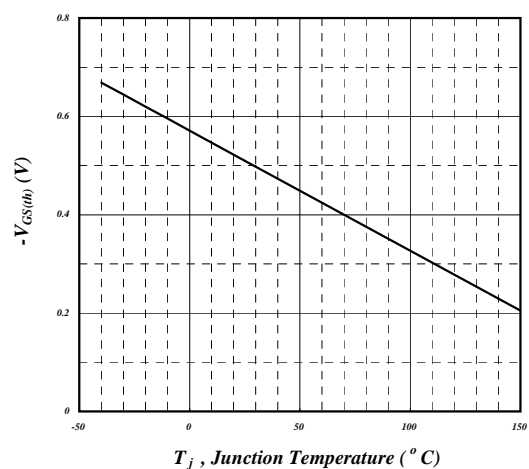


Fig 6. Gate Threshold Voltage vs. Junction Temperature



Typical Electrical Characteristics (cont.)

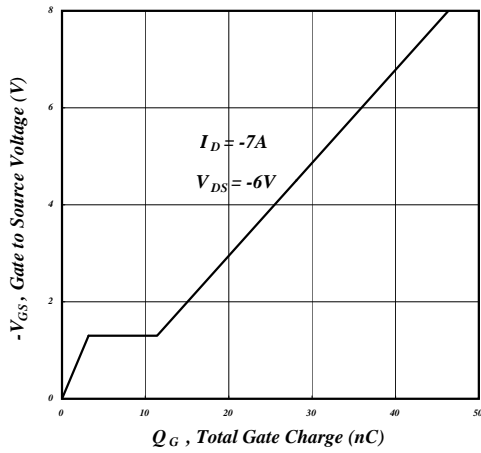


Fig 7. Gate Charge Characteristics

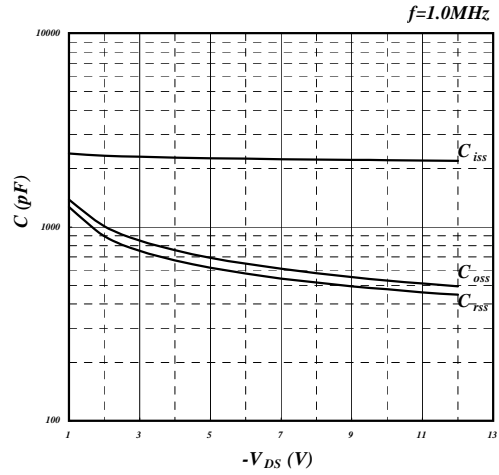


Fig 8. Typical Capacitance Characteristics

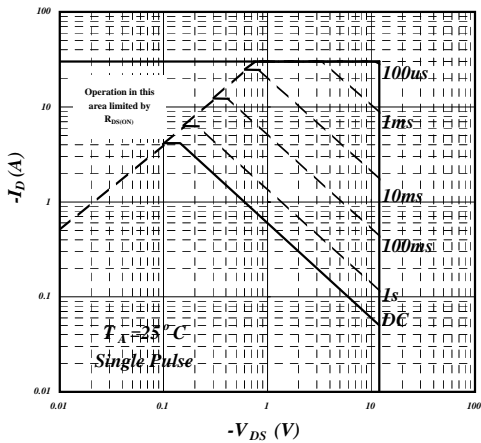


Fig 9. Maximum Safe Operating Area

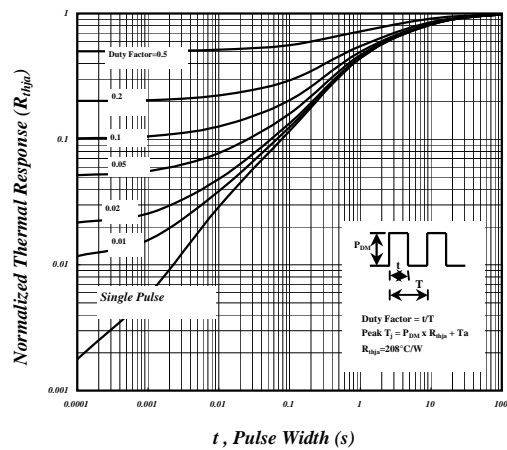


Fig 10. Effective Transient Thermal Impedance

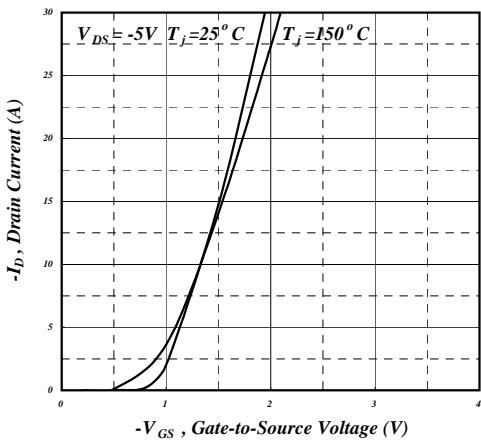


Fig 11. Transfer Characteristics

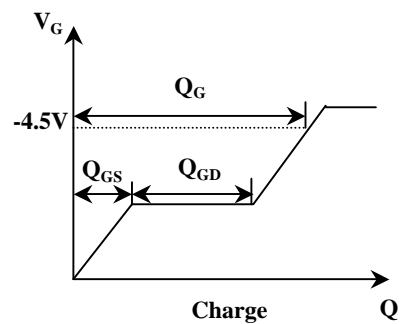
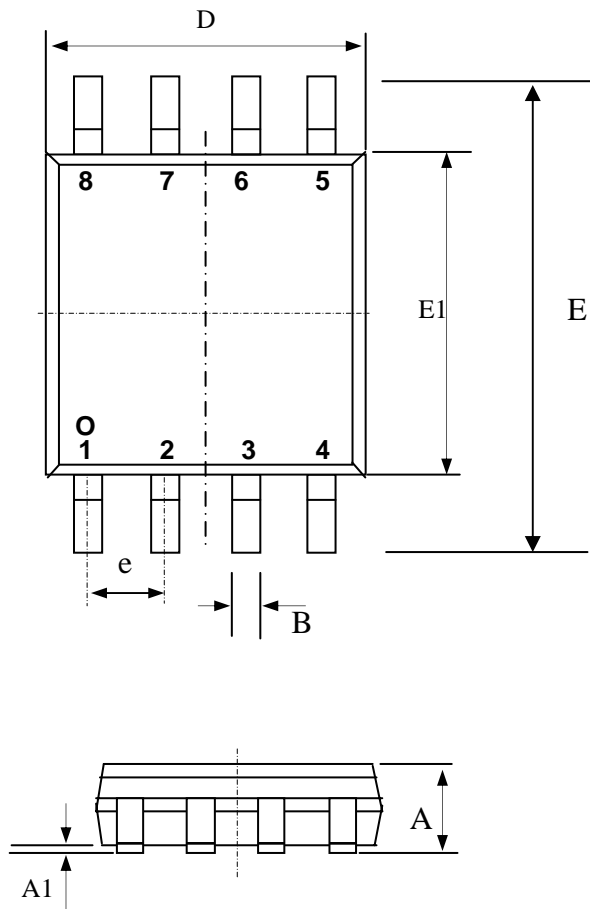


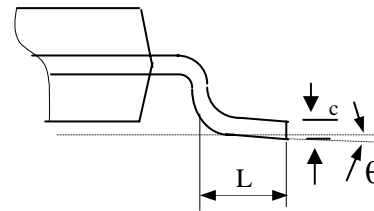
Fig 12. Gate Charge Waveform



**Package Dimensions: TSSOP-8**

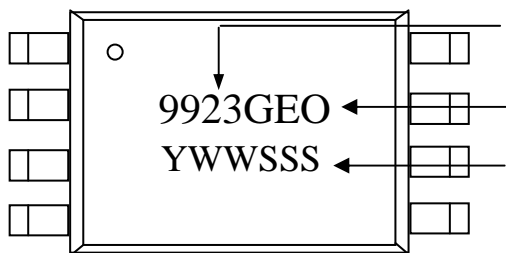


SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	---	---	1.20
A1	0.05	---	0.15
B	0.19	---	0.30
C	---	0.127	----
D	2.90	3.00	3.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
L	0.45	0.60	0.75
e	0.65 REF.		
θ	0°	----	8°



1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

**Marking Information:**



Product: AP9923  
 9923GEO ← GEO = RoHS-compliant halogen-free TSSOP-8 with Gate ESD protection  
 YWWSSS ← YWWSSS = Date/lot code  
 YWW = Year and work week of manufacture.  
 SSS = Lot code information.