

## Dual N-Channel Enhancement Mode MOSFET

### Features

- Channel 1  
30V/7A,  
 $R_{DS(ON)} = 22m\Omega$  (typ.) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 26m\Omega$  (typ.) @  $V_{GS} = 4.5V$
- Channel 2  
30V/10A,  
 $R_{DS(ON)} = 12m\Omega$  (typ.) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 16m\Omega$  (typ.) @  $V_{GS} = 4.5V$
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

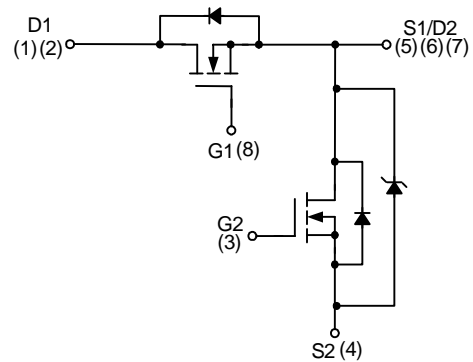
### Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems

### Pin Description



Top View of SOP – 8



N-Channel MOSFET

### Ordering and Marking Information

<p>APM4910 <span style="font-family: monospace;">□□-□□□</span></p> <div style="margin-left: 20px;"> <p>└─ Lead Free Code</p> <p>└─ Handling Code</p> <p>└─ Temp. Range</p> <p>└─ Package Code</p> </div>	<p>Package Code K : SOP-8</p> <p>Operating Junction Temp. Range C : -55 to 150°C</p> <p>Handling Code TU : Tube    TR : Tape &amp; Reel</p> <p>Lead Free Code L : Lead Free Device</p>
<p>APM4910 K : <span style="border: 1px solid black; padding: 2px 5px; font-family: monospace;">APM4910 XXXXX</span></p>	<p>XXXXXX - Date Code</p>

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldering operations. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

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

Symbol	Parameter	Channel 1	Channel 2	Unit
$V_{DSS}$	Drain-Source Voltage	30	30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 16$	$\pm 20$	
$I_D^*$	Continuous Drain Current	7	10	A
$I_{DM}^*$	Pulsed Drain Current	25	35	
$I_S^*$	Diode Continuous Forward Current	2.5	3	A
$T_J$	Maximum Junction Temperature	150		$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 150		
$P_D^*$	Power Dissipation	$T_A=25^\circ\text{C}$	2	W
		$T_A=100^\circ\text{C}$	0.8	
$R_{\theta JA}^*$	Thermal Resistance-Junction to Ambient	62.5		$^\circ\text{C}/\text{W}$

Note:

\*Surface Mounted on  $1\text{in}^2$  pad area,  $t \leq 10\text{sec}$ .

## Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

### Channel 1

Symbol	Parameter	Test Condition	Channel 1			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V T <sub>J</sub> =85°C			1 30	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1	1.5	2	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±16V, V <sub>DS</sub> =0V			±100	nA
R <sub>DS(ON)</sub> <sup>a</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V, I <sub>DS</sub> =7A V <sub>GS</sub> =4.5V, I <sub>DS</sub> =5A		22 26	28 34	mΩ
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>SD</sub> =2.5A, V <sub>GS</sub> =0V		0.8	1.1	V
<b>Gate Charge Characteristics<sup>b</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =7A		10	14	nC
Q <sub>gs</sub>	Gate-Source Charge			1.5		
Q <sub>gd</sub>	Gate-Drain Charge			5		
<b>Dynamic Characteristics<sup>b</sup></b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz		1.5		Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, Frequency=1.0MHz		880		pF
C <sub>oss</sub>	Output Capacitance			125		
C <sub>rss</sub>	Reverse Transfer Capacitance			90		
t <sub>d(ON)</sub>	Turn-on Delay Time		V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω, I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V, R <sub>G</sub> =6Ω		6	12
t <sub>r</sub>	Turn-on Rise Time			11	21	
t <sub>d(OFF)</sub>	Turn-off Delay Time			27	50	
t <sub>f</sub>	Turn-off Fall Time			5	10	

Notes:

- a : Pulse test ; pulse width≤300μs, duty cycle≤2%.
- b : Guaranteed by design, not subject to production testing.

**Electrical Characteristics (Cont.)** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

**Channel 2**

Symbol	Parameter	Test Condition	Channel 2			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=24V, V_{GS}=0V$			50	$\mu A$
		$T_J=85^\circ\text{C}$			5	mA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1.3	1.8	2.5	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=10A$		12	15	m $\Omega$
		$V_{GS}=4.5V, I_{DS}=7A$		16	21	
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=1A, V_{GS}=0V$			0.52	V
<b>Gate Charge Characteristics<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=15V, V_{GS}=4.5V, I_{DS}=10A$		16	22	nC
$Q_{gs}$	Gate-Source Charge			3.7		
$Q_{gd}$	Gate-Drain Charge			8.5		
<b>Dynamic Characteristics<sup>b</sup></b>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$		1.7		$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=15V, \text{Frequency}=1.0\text{MHz}$		1610		pF
$C_{oss}$	Output Capacitance			255		
$C_{riss}$	Reverse Transfer Capacitance			160		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=15V, R_L=15\Omega, I_{DS}=1A, V_{GEN}=10V, R_G=6\Omega$		10	19	ns
$t_r$	Turn-on Rise Time			11	21	
$t_{d(OFF)}$	Turn-off Delay Time			39	71	
$t_f$	Turn-off Fall Time			12	23	

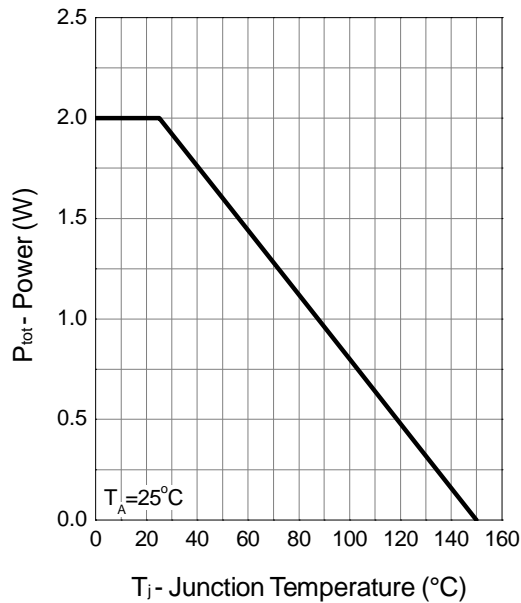
Notes:

- a : Pulse test ; pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ .
- b : Guaranteed by design, not subject to production testing.

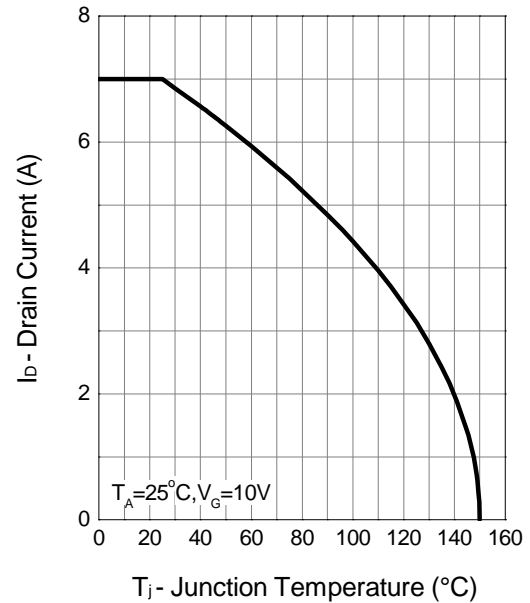
# Typical Characteristics

Channel 1

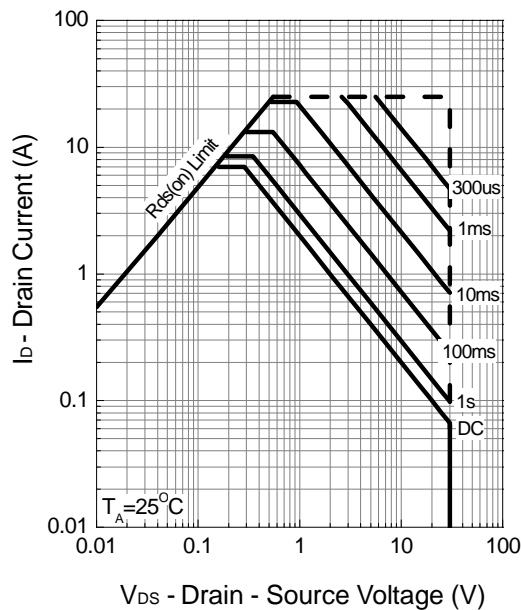
Power Dissipation



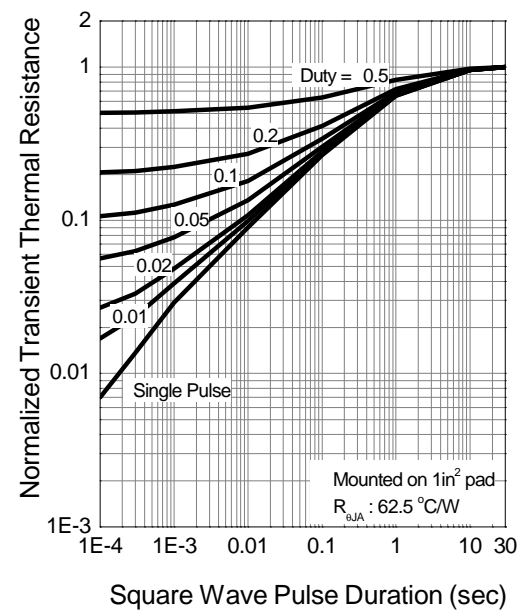
Drain Current



Safe Operation Area



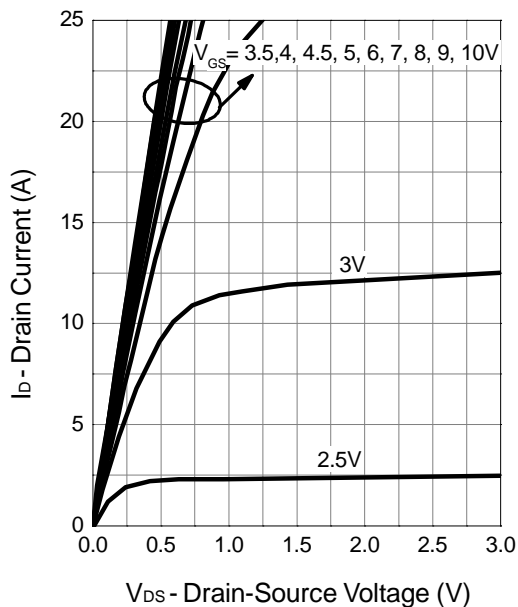
Thermal Transient Impedance



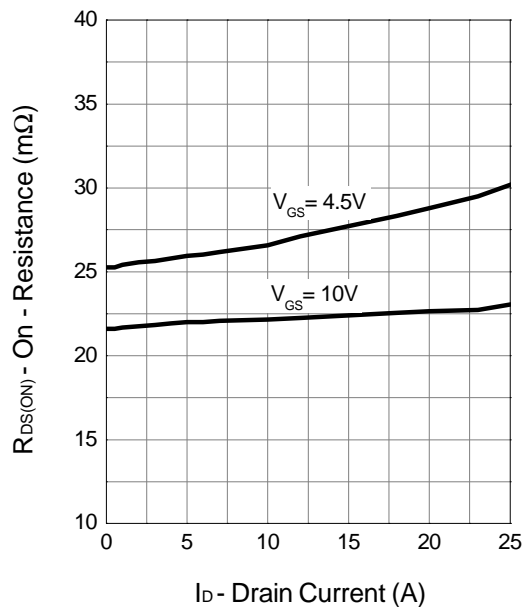
## Typical Characteristics (Cont.)

Channel 1

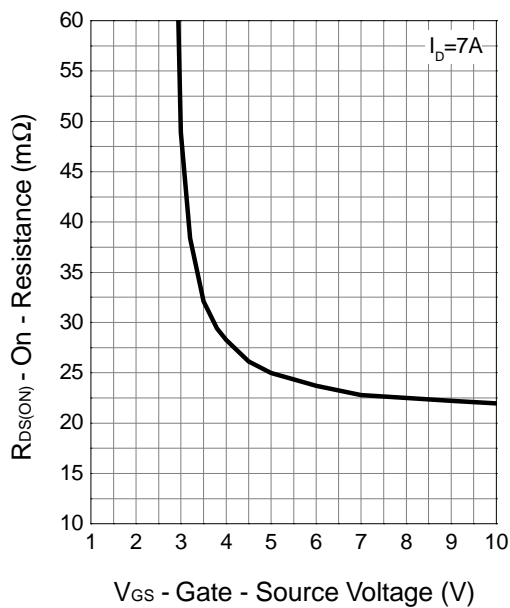
Output Characteristics



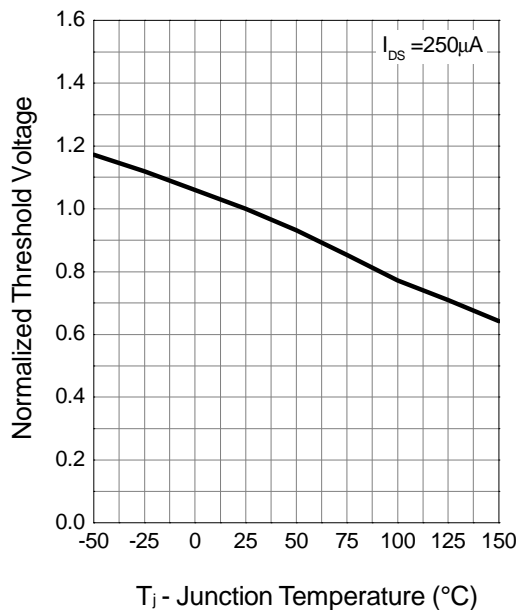
Drain-Source On Resistance



Drain-Source On Resistance



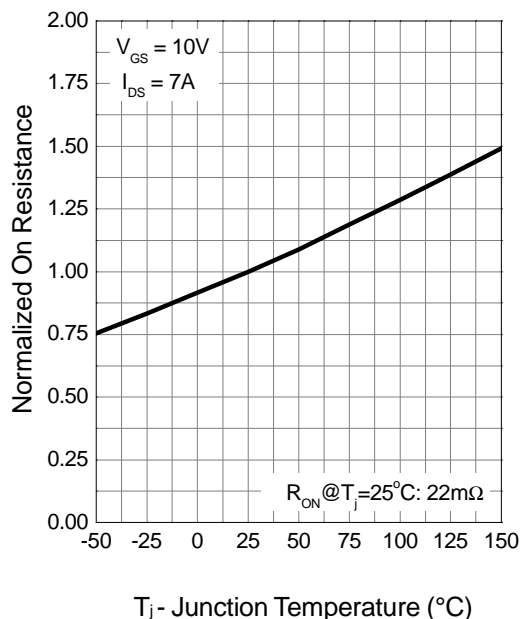
Gate Threshold Voltage



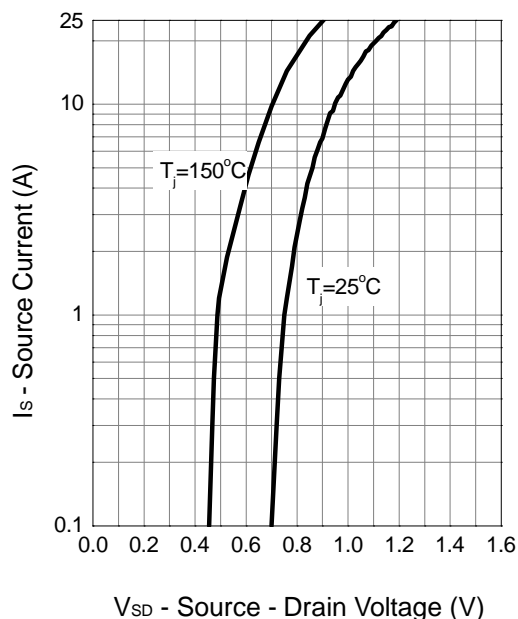
## Typical Characteristics (Cont.)

### Channel 1

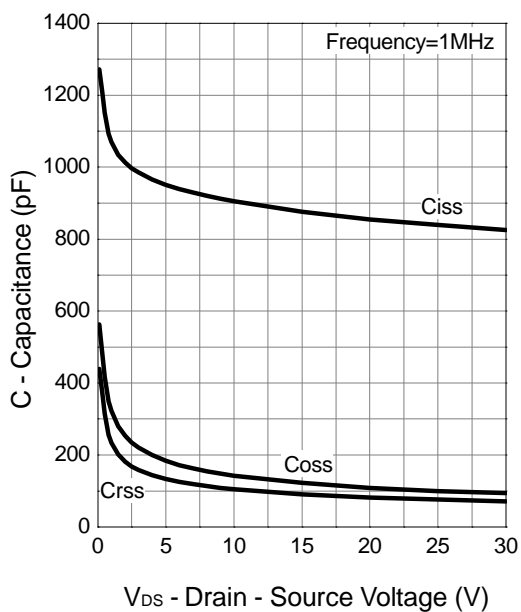
Drain-Source On Resistance



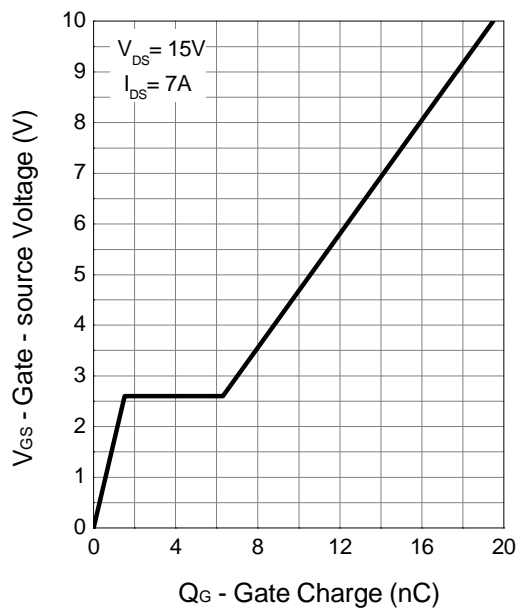
Source-Drain Diode Forward



Capacitance



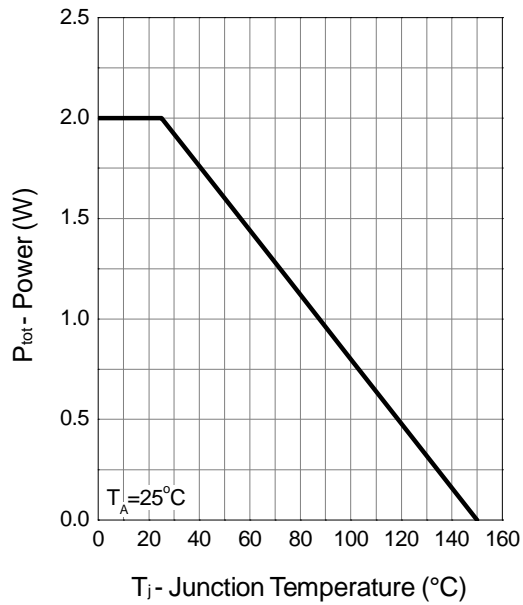
Gate Charge



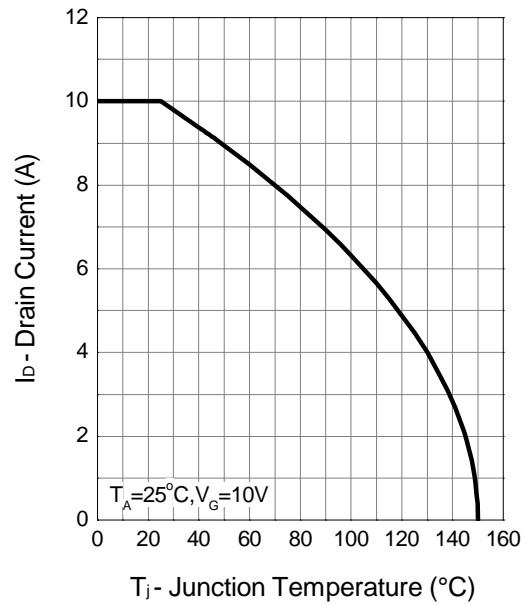
## Typical Characteristics (Cont.)

### Channel 2

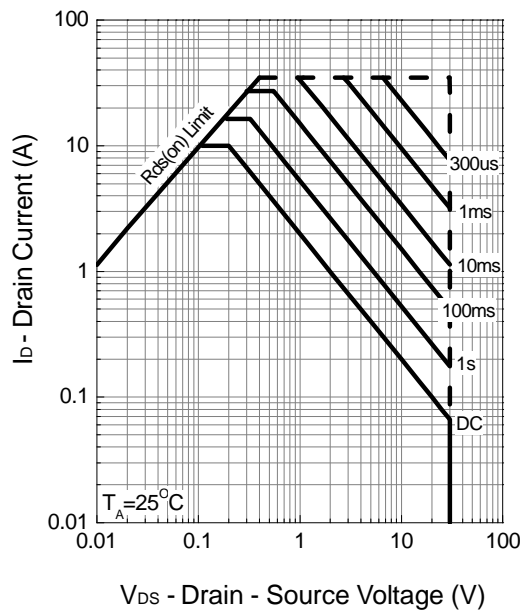
Power Dissipation



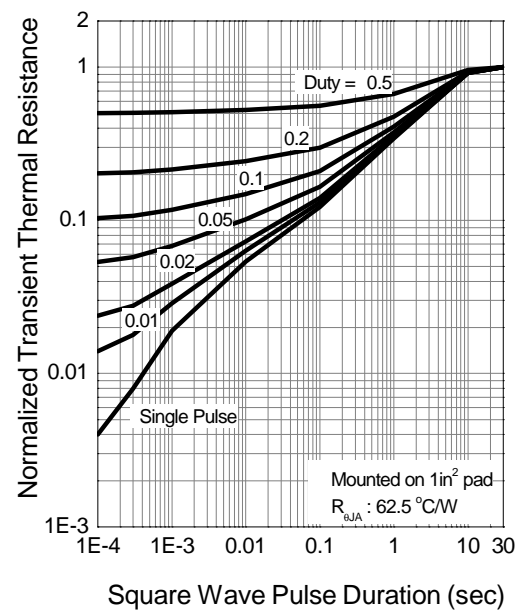
Drain Current



Safe Operation Area



Thermal Transient Impedance

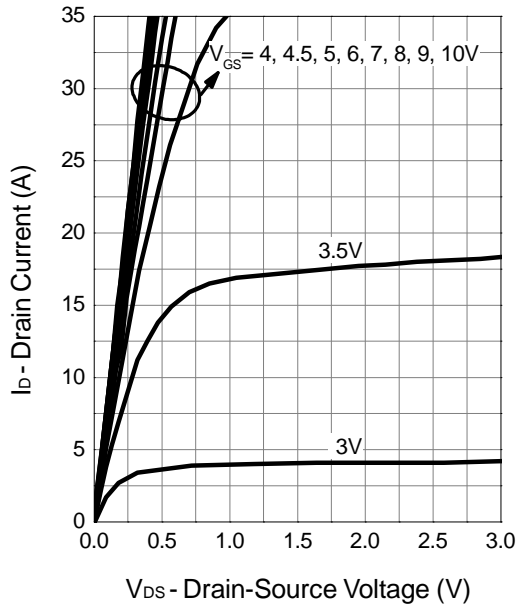




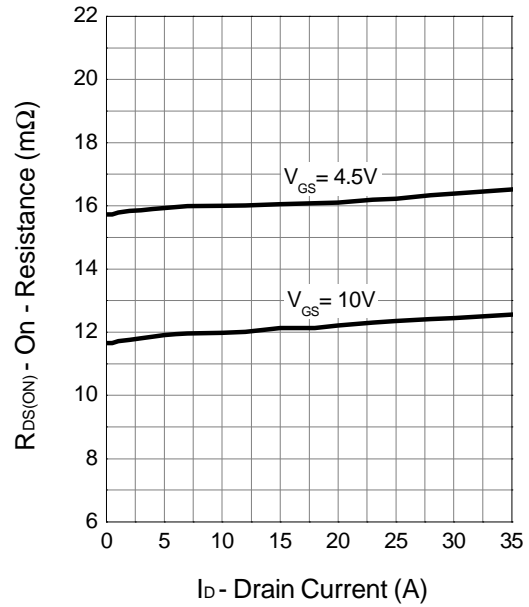
## Typical Characteristics (Cont.)

Channel 2

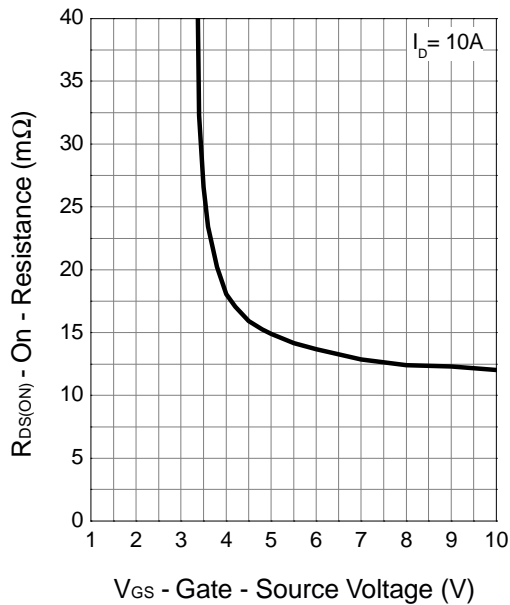
Output Characteristics



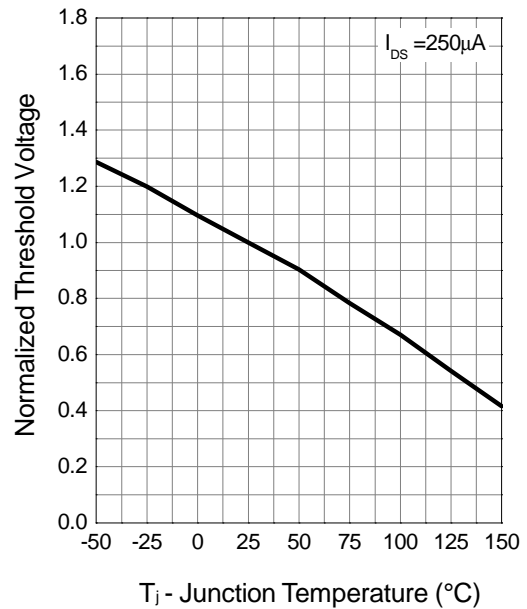
Drain-Source On Resistance



Drain-Source On Resistance



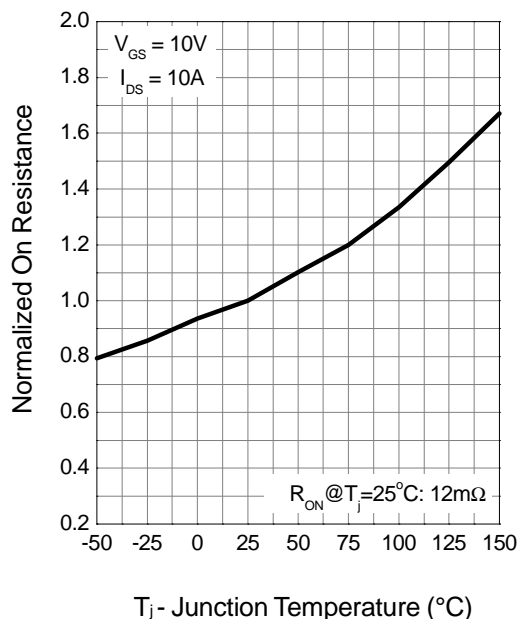
Gate Threshold Voltage



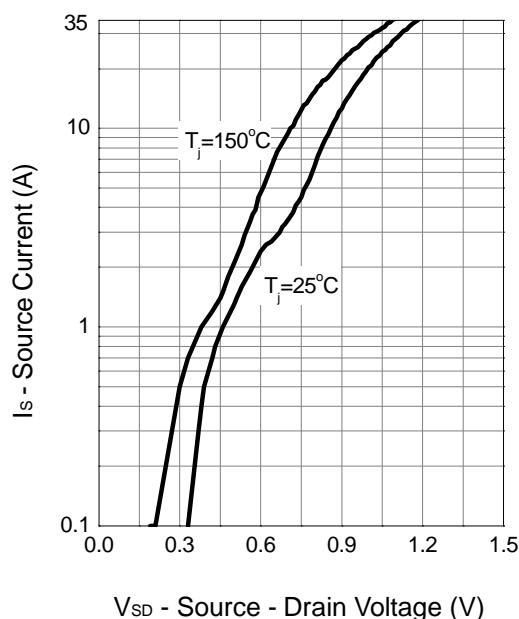
## Typical Characteristics (Cont.)

### Channel 2

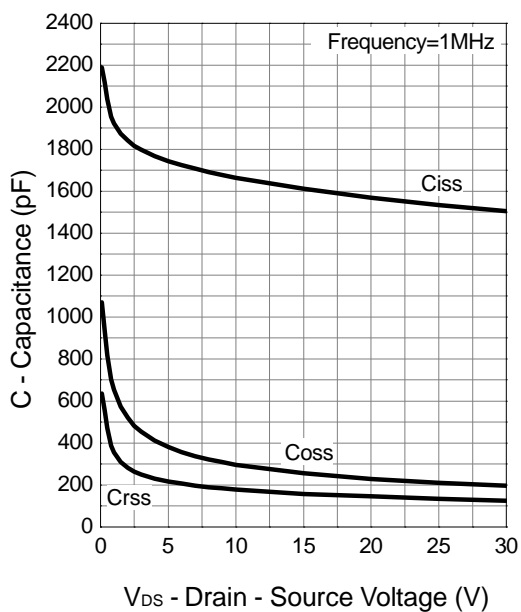
**Drain-Source On Resistance**



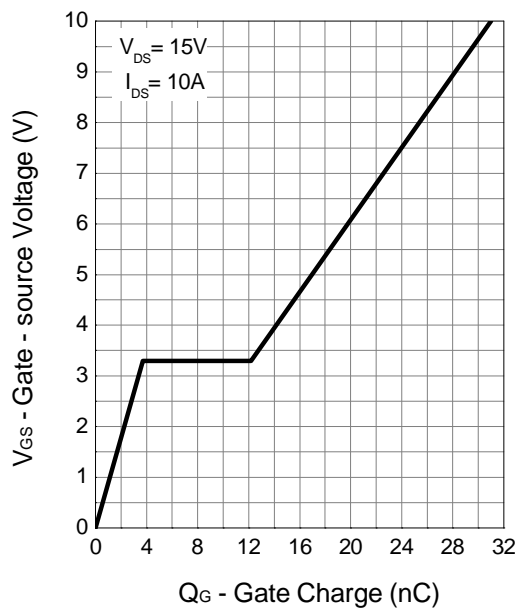
**Source-Drain Diode Forward**



**Capacitance**

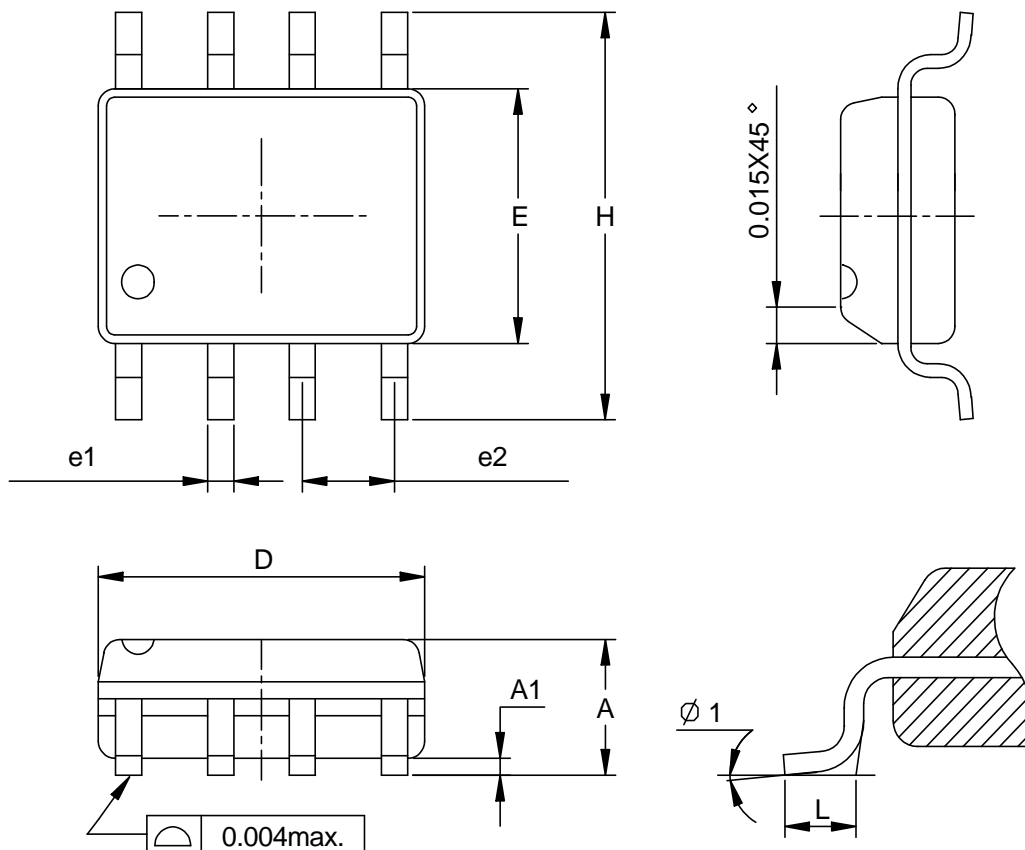


**Gate Charge**



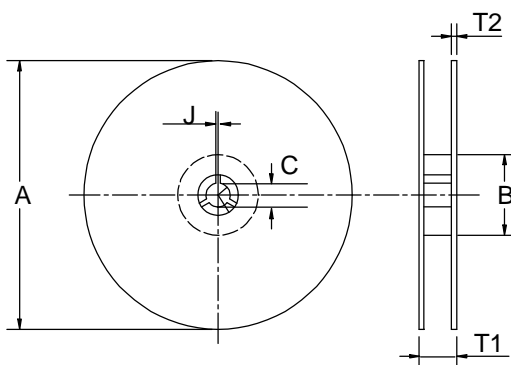
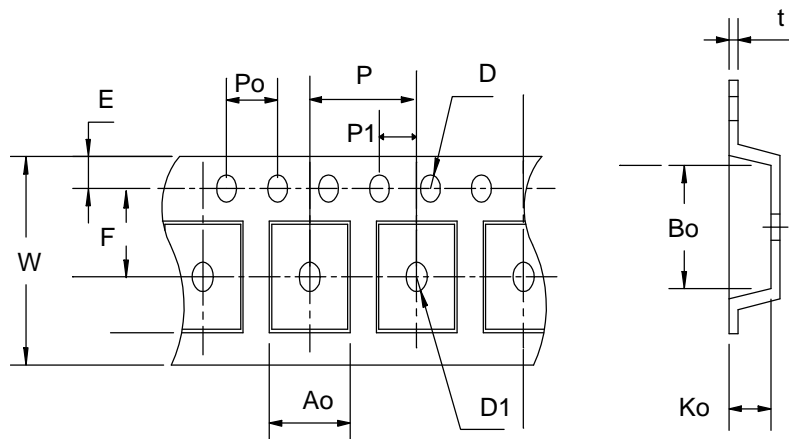
## Packaging Information

SOP-8 pin (Reference JEDEC Registration MS-012)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
φ 1	0°	8°	0°	8°

### Carrier Tape & Reel Dimensions



Application	A	B	C	J	T1	T2	W	P	E
SOP-8	330±1	62 ± 1.5	12.75 + 0.15	2 + 0.5	12.4 +0.2	2± 0.2	12 + 0.3 - 0.1	8± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.1	1.55±0.1	1.55+ 0.25	4.0 ± 0.1	2.0 ± 0.1	6.4 ± 0.1	5.2± 0.1	2.1± 0.1	0.3±0.013

(mm)

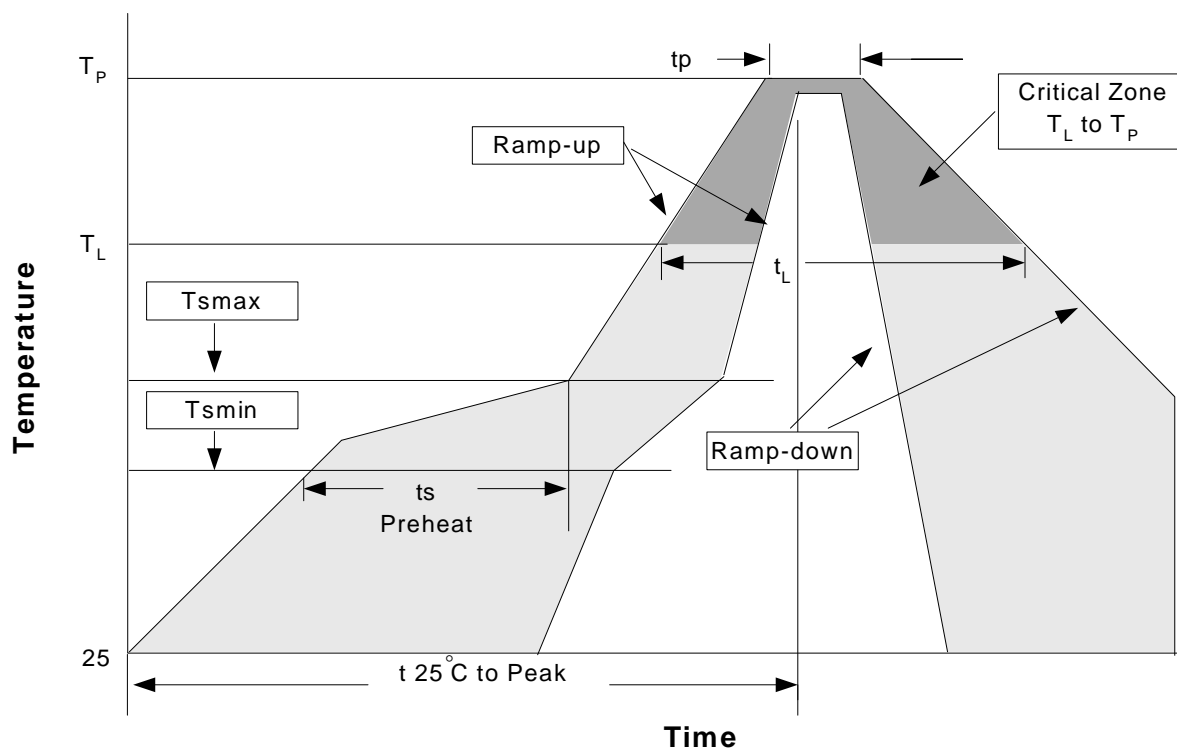
### Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOP- 8	12	9.3	2500

## Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.

### Reflow Condition (IR/Convection or VPR Reflow)



### Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	3°C/second max.	3°C/second max.
Preheat		
- Temperature Min ( $T_{smin}$ )	100°C	150°C
- Temperature Max ( $T_{smax}$ )	150°C	200°C
- Time (min to max) ( $t_s$ )	60-120 seconds	60-180 seconds
Time maintained above:		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60-150 seconds	60-150 seconds
Peak/Classification Temperature ( $T_p$ )	See table 1	See table 2
Time within 5°C of actual Peak Temperature ( $t_p$ )	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

Notes: All temperatures refer to topside of the package .Measured on the body surface.

## Classification Reflow Profiles(Cont.)

Table 1. SnPb Entectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	240 +0/-5°C	225 +0/-5°C
≥2.5 mm	225 +0/-5°C	225 +0/-5°C

Table 2. Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

\*Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

## Reliability Test Program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C, 5 SEC
HOLT	MIL-STD 883D-1005.7	1000 Hrs Bias @ 125°C
PCT	JESD-22-B, A102	168 Hrs, 100% RH, 121°C
TST	MIL-STD 883D-1011.9	-65°C ~ 150°C, 200 Cycles

## Customer Service

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