APM4568K

Dual Enhancement Mode MOSFET (N- and P-Channel)

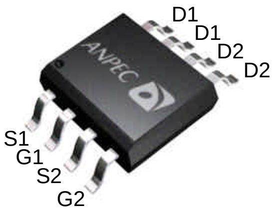
Features

- N-Channel
  40V/6.5A,
  $R_{DS(ON)}$ = 20mΩ (typ.) @ V_{GS} = 10V
  $R_{DS(ON)}$ = 28mΩ (typ.) @ V_{GS} = 4.5V
- P-Channel
  -40V/-5A,
  $R_{DS(ON)}$ = 35mΩ (typ.) @ V_{GS} =-10V
  $R_{DS(ON)}$ = 48mΩ (typ.) @ V_{GS} =-4.5V
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

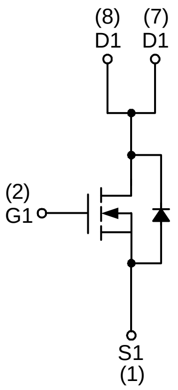
Applications

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

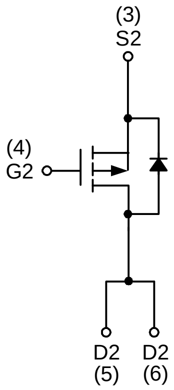
Pin Description



Top View of SOP – 8



N-Channel MOSFET



P-Channel MOSFET

Ordering and Marking Information

APM4568 □□-□□ □ Assembly Material Handling Code Temperature Range Package Code	Package Code K : SOP-8 Operating Junction Temperature Range C : -55 to 150 °C Handling Code TR : Tape & Reel Assembly Material G : Halogen and Lead Free Device
APM4568 K : APM4568 XXXXX ●	XXXXX - Date Code

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. 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 defines “Green” to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

Absolute Maximum Ratings (T$_A$ = 25°C unless otherwise noted)

Symbol	Parameter		Rating		Unit
			N Channel	P Channel	
V_{DSS}	Drain-Source Voltage		40	-40	V
V_{GSS}	Gate-Source Voltage		±20	±20	
I_D*	Continuous Drain Current	V_{GS}=10V (N) V_{GS}=-10V (P)	6.5	-5	A
I_{DM}*	Pulsed Drain Current		25	-20	
I_S*	Diode Continuous Forward Current		2.5	-2.5	A
T_J	Maximum Junction Temperature		150		°C
T_{STG}	Storage Temperature Range		-55 to 150		
P_D*	Power Dissipation	T_A=25°C	2		W
		T_A=100°C	0.8		
$R_{\theta JA}$*	Thermal Resistance-Junction to Ambient		62.5		°C/W

Note : *Surface Mounted on 1in^2 pad area, t ≤ 10sec.

Electrical Characteristics (T$_A$ = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions		APM4568K			Unit
				Min.	Typ.	Max.	
Static Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V, I_{DS}=250μA	N-Ch	40	-	-	V
		V_{GS}=0V, I_{DS}=-250μA	P-Ch	-40	-	-	
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=32V, V_{GS}=0V	N-Ch	-	-	1	μA
		T_J=85°C		-	-	30	
		V_{DS}=-32V, V_{GS}=0V	P-Ch	-	-	-1	
		T_J=85°C		-	-	-30	
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250μA	N-Ch	1.3	2	2.5	V
		V_{DS}=V_{GS}, I_{DS}=-250μA	P-Ch	-1.3	-1.9	-2.5	
I_{GSS}	Gate Leakage Current	V_{GS}=±20V, V_{DS}=0V	N-Ch	-	-	±100	nA
		V_{GS}=±20V, V_{DS}=0V	P-Ch	-	-	±100	
$R_{DS(ON)}$ [a]	Drain-Source On-State Resistance	V_{GS}=10V, I_{DS}=6.5A	N-Ch	-	20	28	mΩ
		V_{GS}=-10V, I_{DS}=-5A	P-Ch	-	35	48	
		V_{GS}=4.5V, I_{DS}=4.5A	N-Ch	-	28	42	
		V_{GS}=-4.5V, I_{DS}=-3A	P-Ch	-	48	68	

Electrical Characteristics (Cont.) (T_A = 25°C unless otherwise noted)

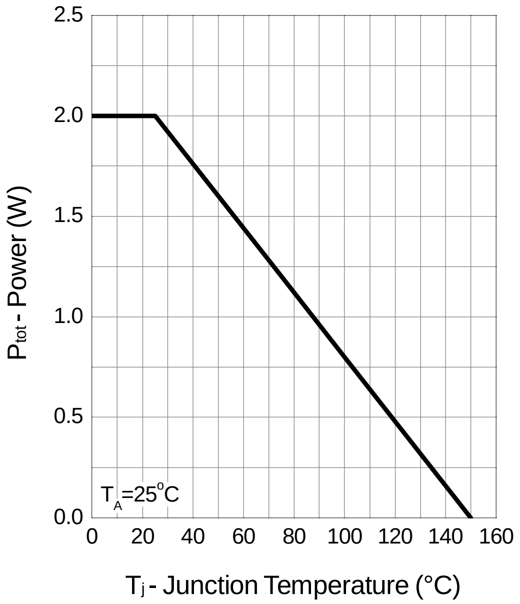
Symbol	Parameter	Test Conditions		APM4568K			Unit
				Min.	Typ.	Max.	
Diode Characteristics							
V_{SD}[a]	Diode Forward Voltage	I_{SD}=2A, V_{GS}=0V	N-Ch	-	0.8	1.1	V
		I_{SD}=-2A, V_{GS}=0V	P-Ch	-	-0.8	-1.1	
Dynamic Characteristics [b]							
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	N-Ch	-	2	-	Ω
			P-Ch	-	8	-	
C_{iss}	Input Capacitance	N-Channel V_{GS}=0V, V_{DS}=20V, Frequency=1.0MHz P-Channel V_{GS}=0V, V_{DS}=-20V, Frequency=1.0MHz	N-Ch	-	980	-	pF
			P-Ch	-	1095	-	
C_{oss}	Output Capacitance		N-Ch	-	110	-	
			P-Ch	-	125	-	
C_{rss}	Reverse Transfer Capacitance		N-Ch	-	75	-	
			P-Ch	-	70	-	
$t_{d(ON)}$	Turn-on Delay Time	N-Channel V_{DD}=20V, R_L=20Ω, I_{DS}=1A, V_{GEN}=10V, R_G=6Ω P-Channel V_{DD}=-20V, R_L=20Ω, I_{DS}=-1A, V_{GEN}=-10V, R_G=6Ω	N-Ch	-	16	30	ns
			P-Ch	-	12	23	
T_r	Turn-on Rise Time		N-Ch	-	19	35	
			P-Ch	-	21	39	
$t_{d(OFF)}$	Turn-off Delay Time		N-Ch	-	30	55	
			P-Ch	-	43	78	
T_f	Turn-off Fall Time		N-Ch	-	6	12	
			P-Ch	-	11	21	
t_{rr}	Reverse Recovery Time	N-Channel I_{SD}=6.5A, dI_{SD}/dt =100A/µs P-Channel I_{SD}=-5A, dI_{SD}/dt =100A/µs	N-Ch	-	20	-	ns
			P-Ch	-	19	-	
Q_{rr}	Reverse Recovery Charge		N-Ch	-	14	-	nC
			P-Ch	-	12	-	
Gate Charge Characteristics [b]							
Q_g	Total Gate Charge	N-Channel V_{DS}=20V, V_{GS}=10V, I_{DS}=6.5A P-Channel V_{DS}=-20V, V_{GS}=-10V, I_{DS}=-5A	N-Ch	-	20	28	nC
			P-Ch	-	20	28	
Q_{gs}	Gate-Source Charge		N-Ch	-	3	-	
			P-Ch	-	3.5	-	
Q_{gd}	Gate-Drain Charge		N-Ch	-	6	-	
			P-Ch	-	3.5	-	

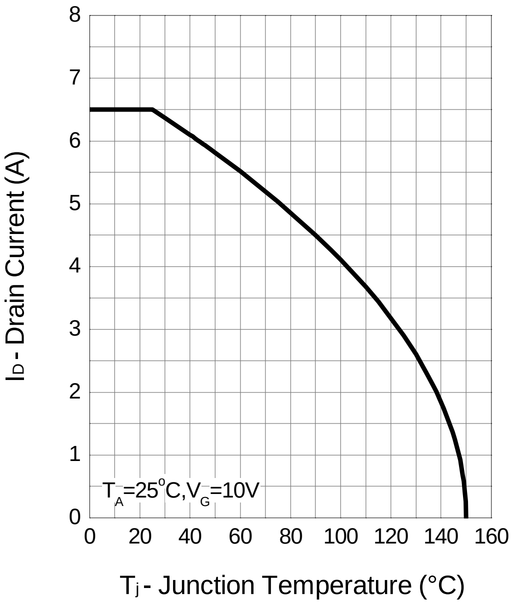
Note a : Pulse test ; pulse width≤300ms, duty cycle≤2%.

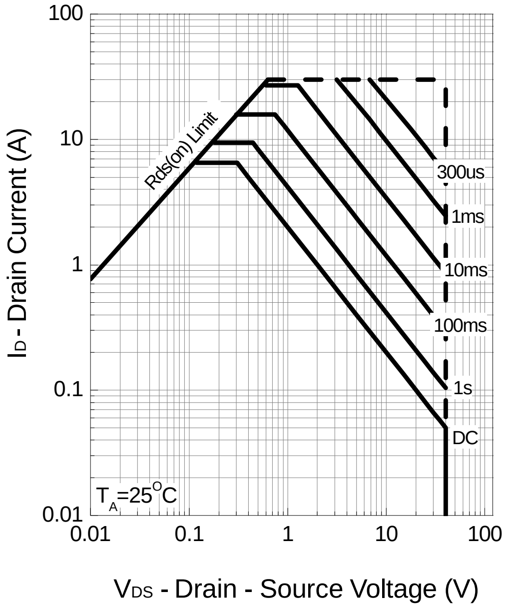
Note b : Guaranteed by design, not subject to production testing.

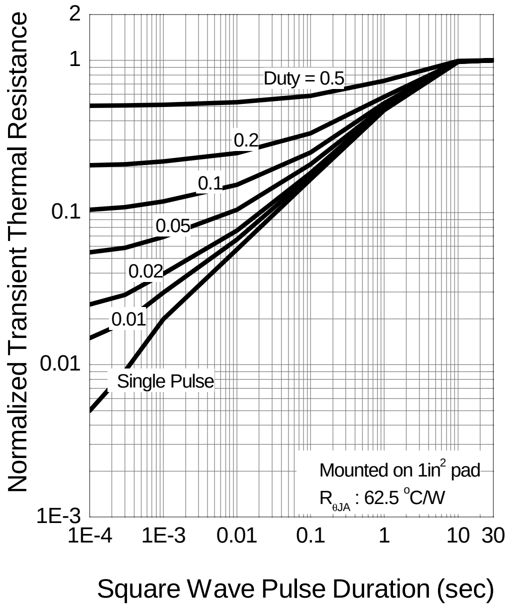
Typical Operating Characteristics

N-Channel


Power Dissipation

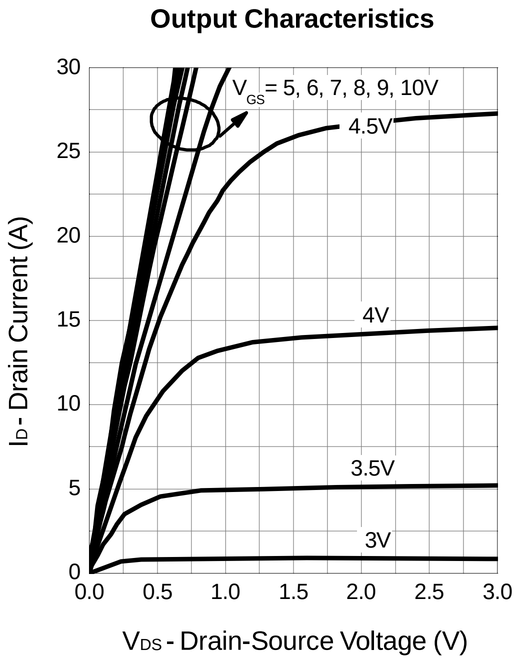

Drain Current

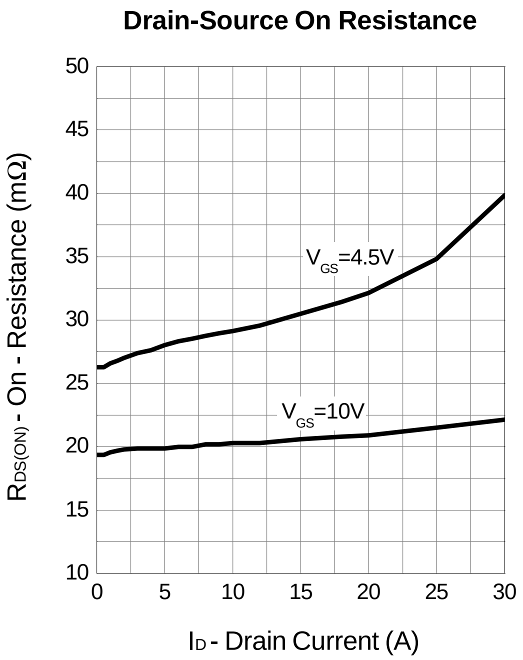

Safe Operation Area

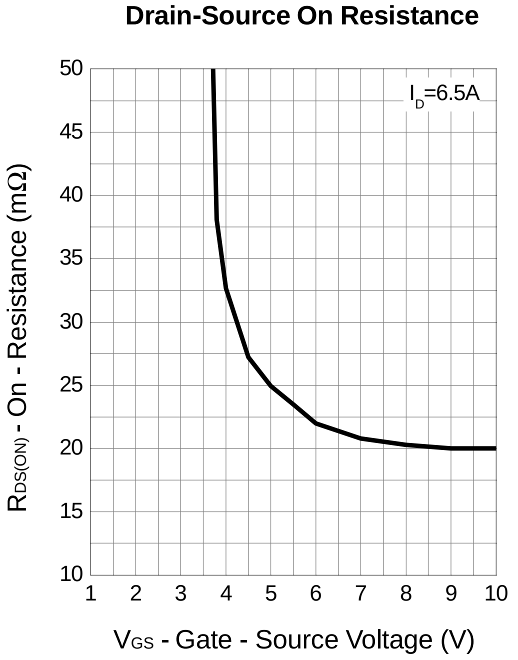

Thermal Transient Impedance

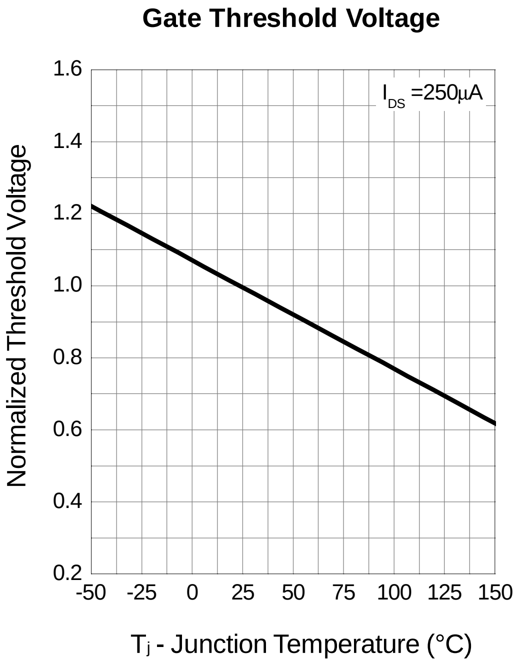
Typical Operating Characteristics (Cont.)

N-Channel





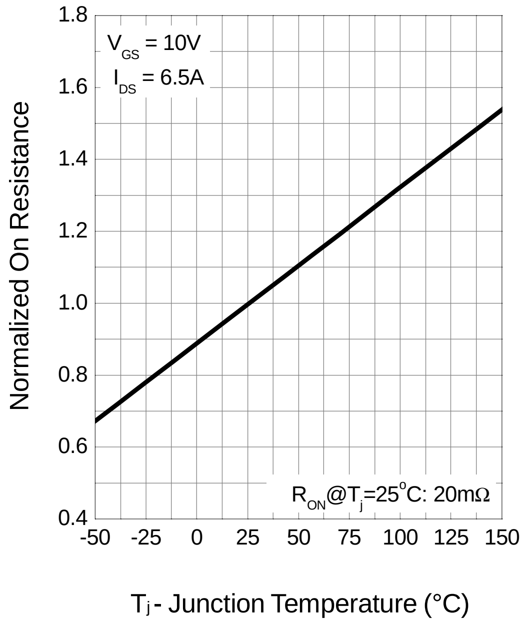




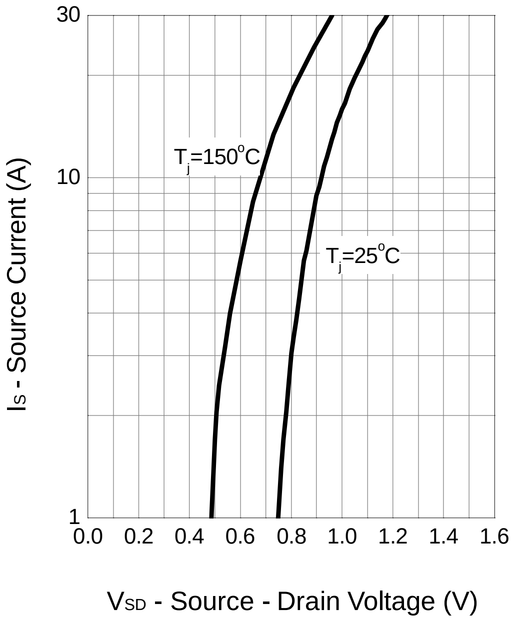
Typical Operating Characteristics (Cont.)

N-Channel

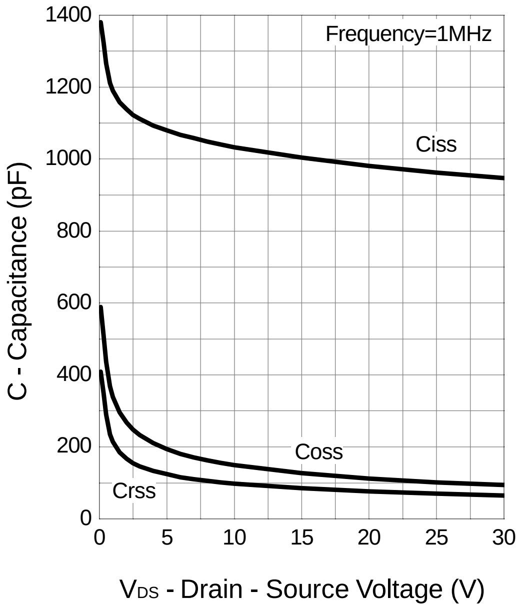
Drain-Source On Resistance



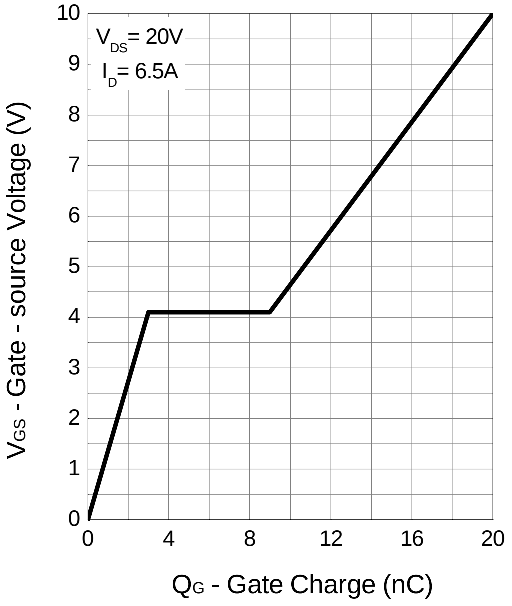
Source-Drain Diode Forward



Capacitance



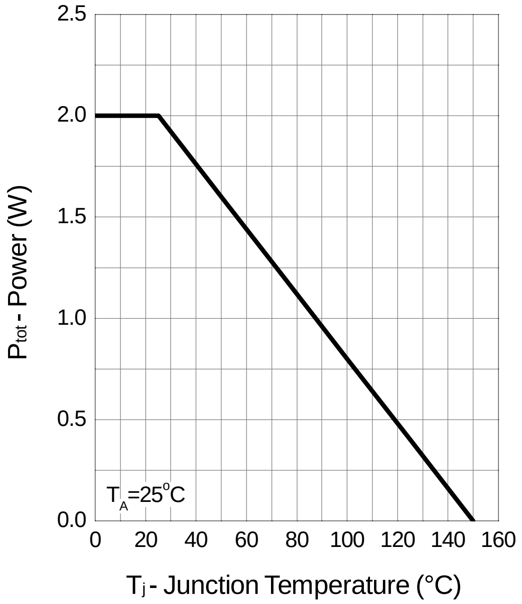
Gate Charge



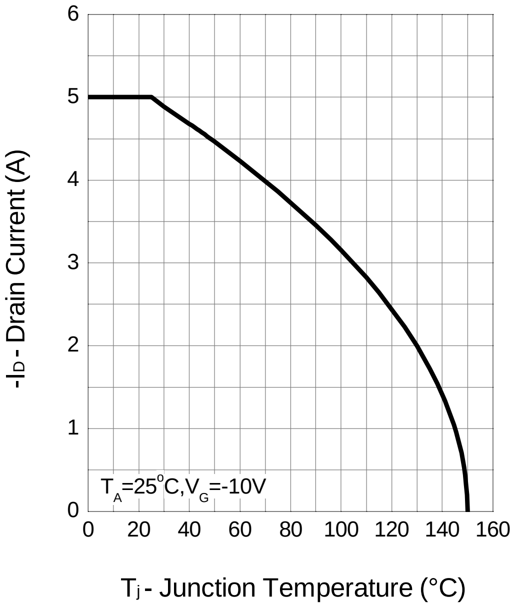
Typical Operating Characteristics (Cont.)

P-Channel

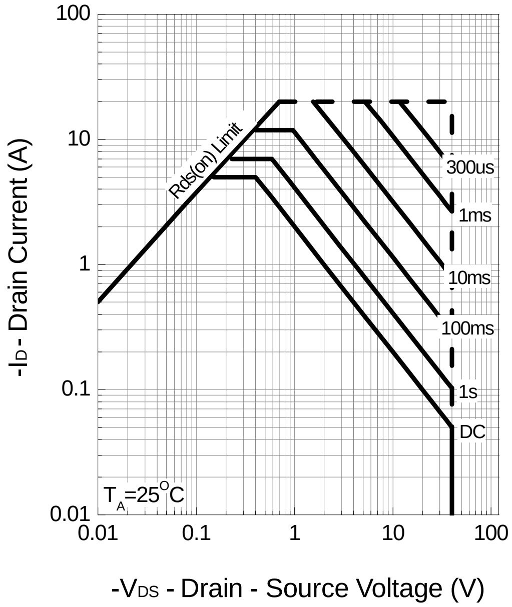
Power Dissipation



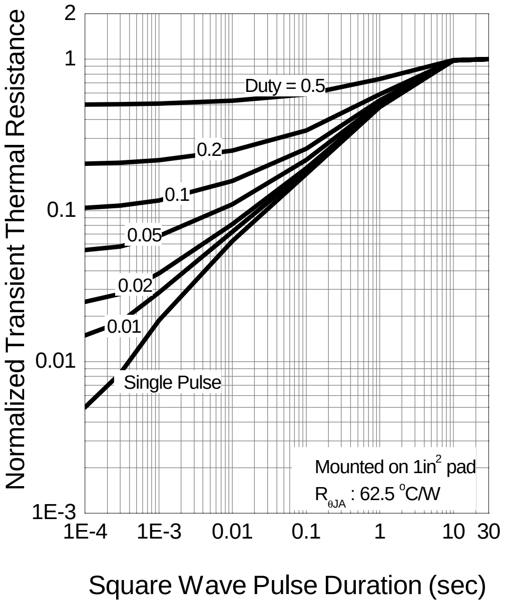
Drain Current



Safe Operation Area

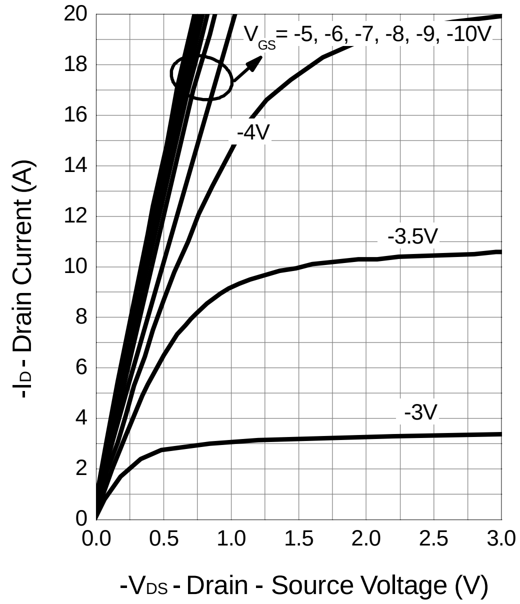


Thermal Transient Impedance

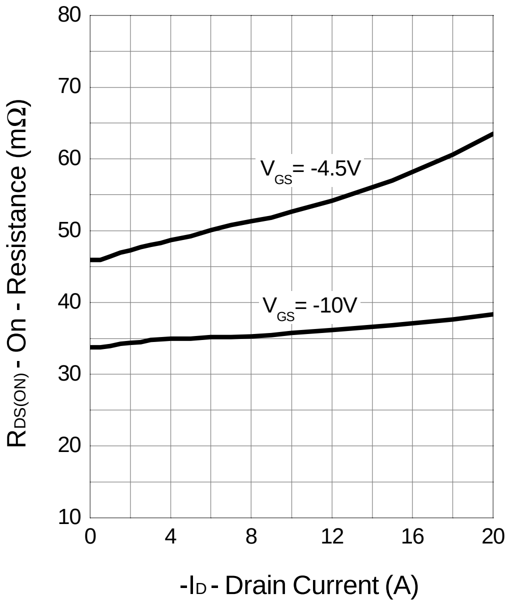


Typical Operating Characteristics (Cont.)

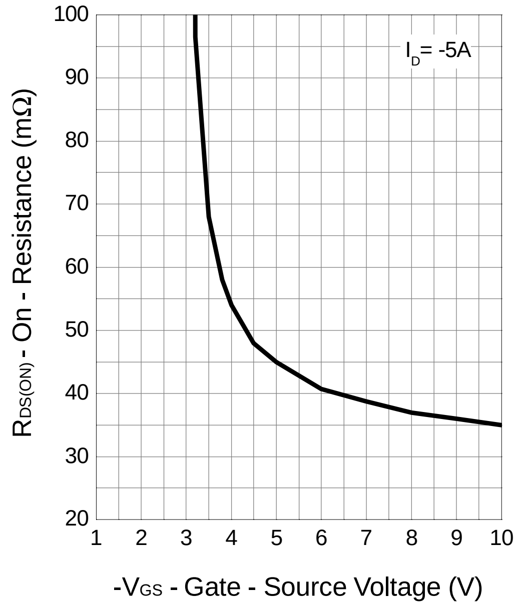
P-Channel



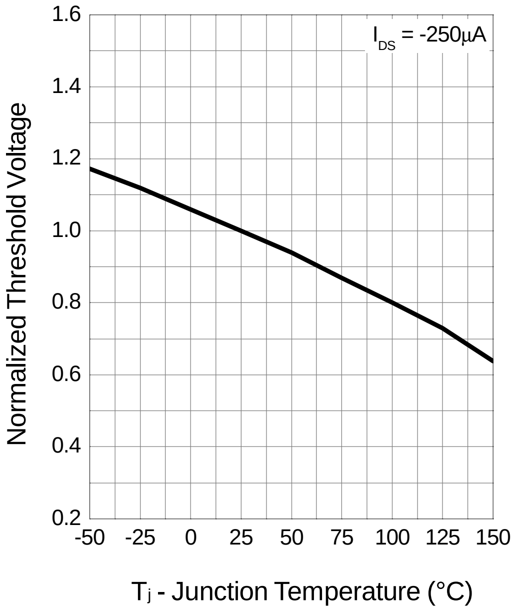
Output Characteristics



Drain-Source On Resistance



Drain-Source On Resistance

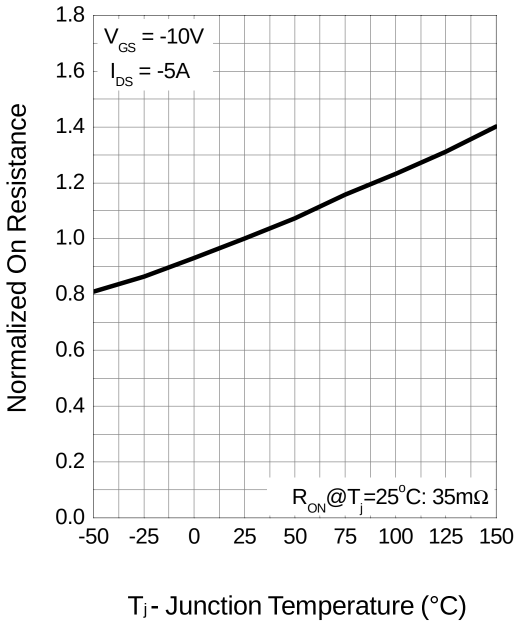


Gate Threshold Voltage

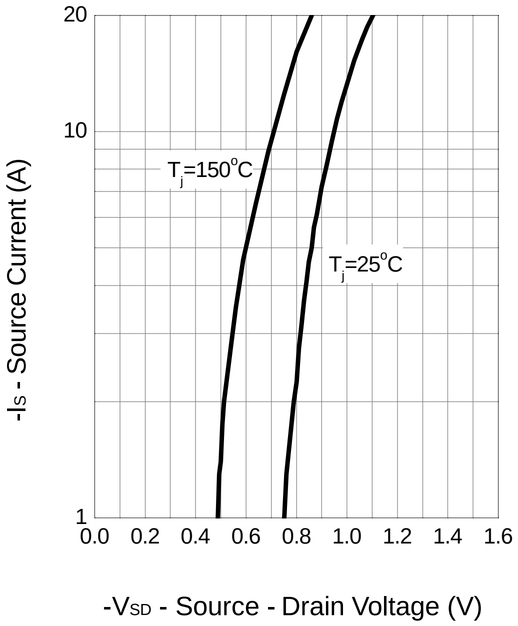
Typical Operating Characteristics (Cont.)

P-Channel

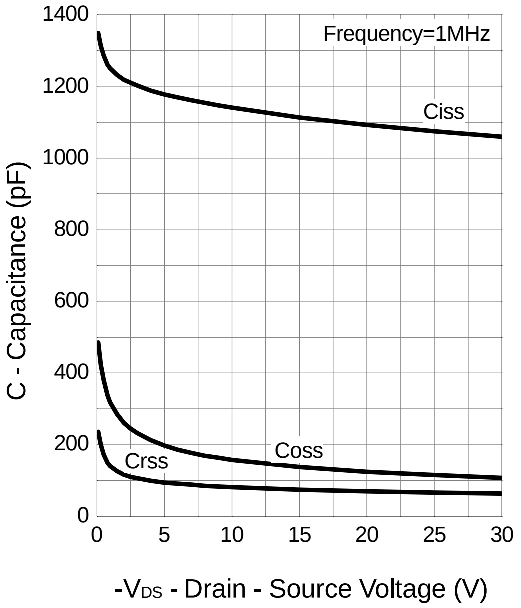
Drain-Source On Resistance



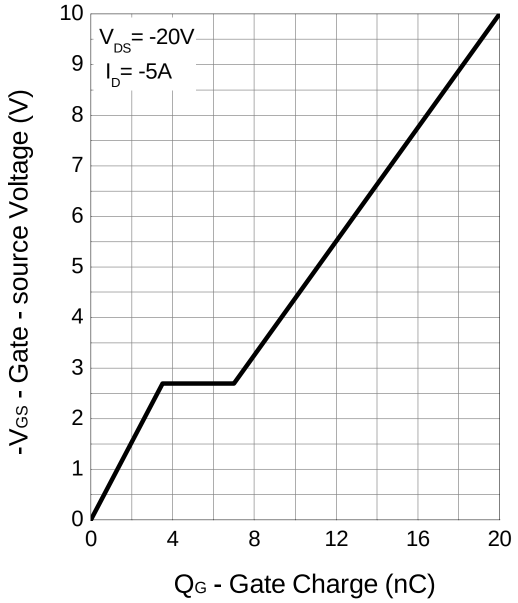
Source-Drain Diode Forward



Capacitance

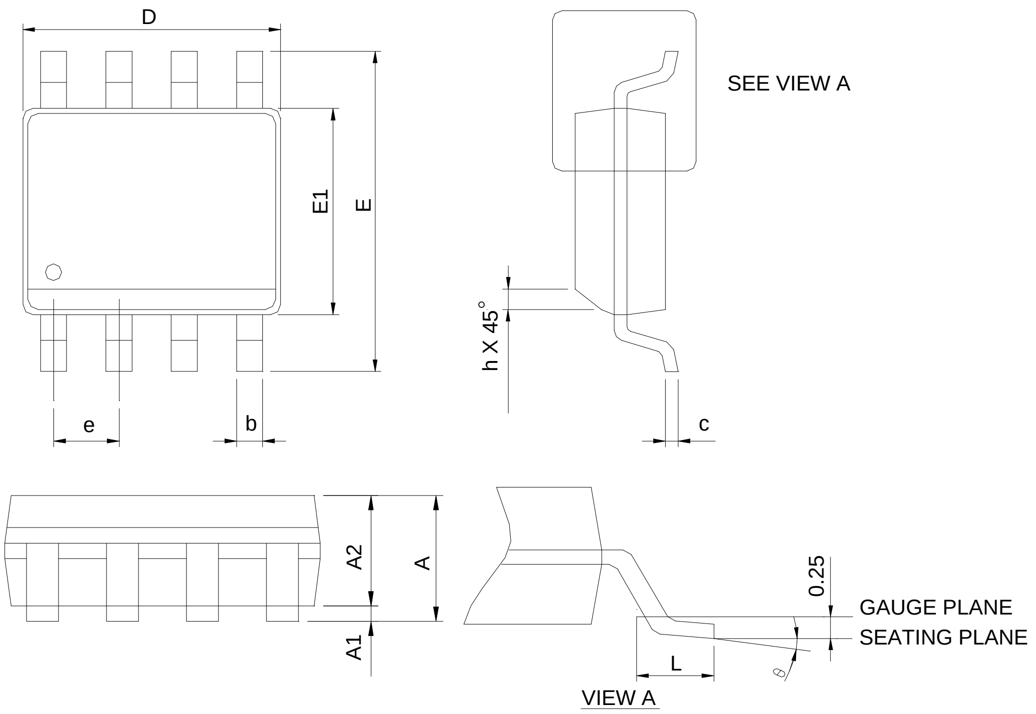


Gate Charge



Package Information

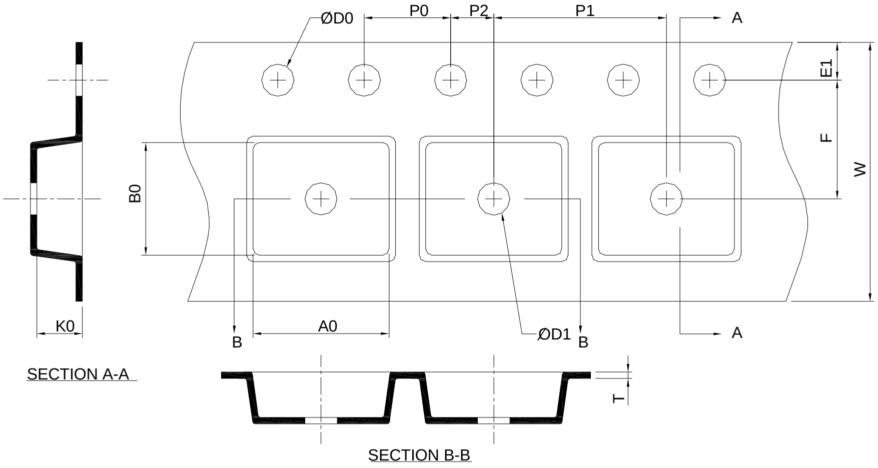
SOP-8

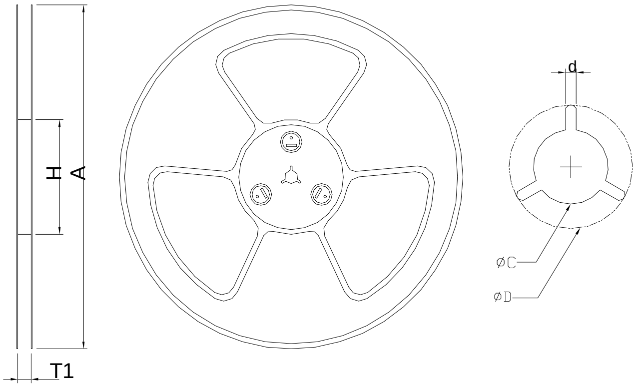


S Y M B O L	SOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.75		0.069
A1	0.10	0.25	0.004	0.010
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

Note: 1. Follow JEDEC MS-012 AA.
2. Dimension “D” does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
3. Dimension “E” does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.

Carrier Tape & Reel Dimensions





Application	A	H	T1	C	d	D	W	E1	F
SOP-8	330.0± 2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.05
	P0	**P1**	**P2**	**D0**	**D1**	**T**	**A0**	**B0**	**K0**
	4.0±0.10	8.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.40±0.20	5.20±0.20	2.10±0.20

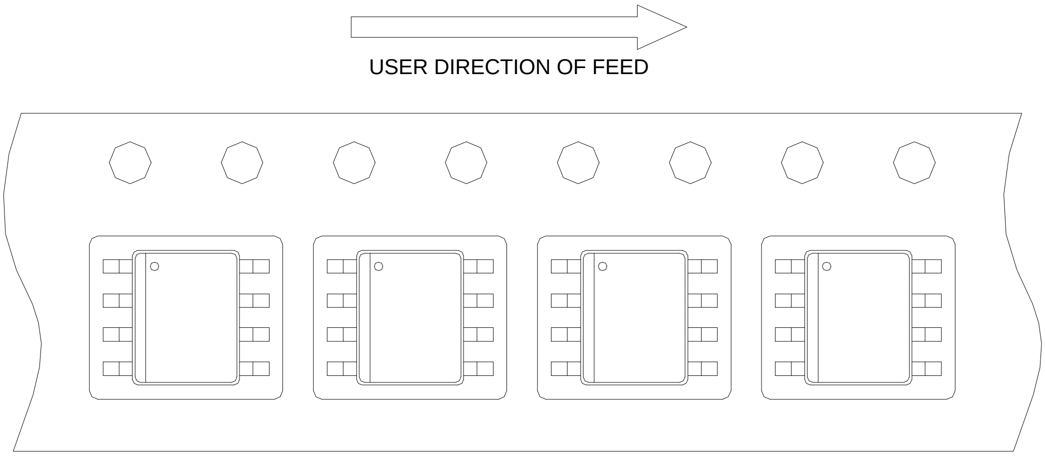
(mm)

Devices Per Unit

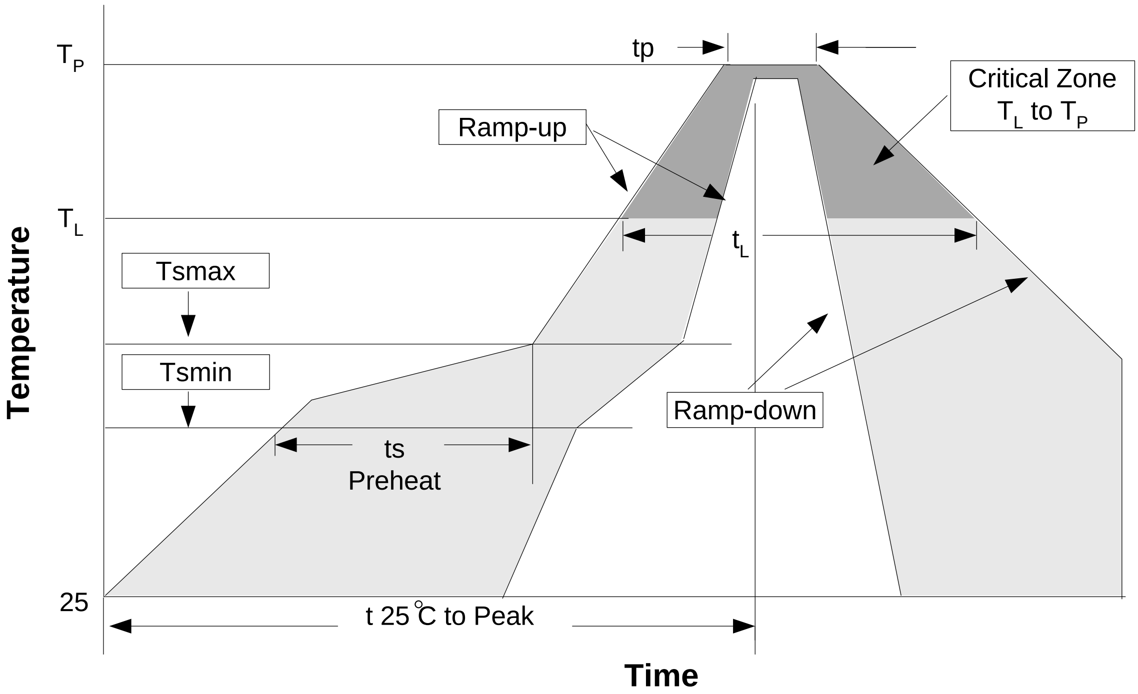
Package Type	Unit	Quantity
SOP-8	Tape & Reel	2500

Taping Direction Information

SOP-8



Reflow Condition (IR/Convection or VPR Reflow)



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

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 (Tsmin) - Temperature Max (Tsmax) - Time (min to max) (ts)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classification Temperature (Tp)	See table 1	See table 2
Time within 5°C of actual Peak Temperature (tp)	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.

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

Table 1. SnPb Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	**Volume mm^3 <350**	**Volume mm^3 ≥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^3 <350**	**Volume mm^3 350-2000**	**Volume mm^3 >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.

Customer Service

Anpec Electronics Corp.

Head Office :
No.6, Dusing 1st Road, SBIP,
Hsin-Chu, Taiwan, R.O.C.
Tel : 886-3-5642000
Fax : 886-3-5642050

Taipei Branch :
2F, No. 11, Lane 218, Sec 2 Jhongsing Rd.,
Sindain City, Taipei County 23146, Taiwan
Tel : 886-2-2910-3838
Fax : 886-2-2917-3838