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

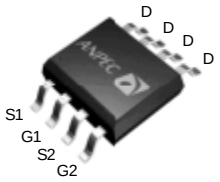
Features

- N-Channel
  20V/9A,
  $R_{DS(ON)}$ =12mΩ(typ.) @ V_{GS} = 4.5V
  $R_{DS(ON)}$ =18mΩ(typ.) @ V_{GS} = 2.5V
- P-Channel
  -20V/-6A,
  $R_{DS(ON)}$ =30mΩ(typ.) @ V_{GS} =-4.5V
  $R_{DS(ON)}$ =50mΩ(typ.) @ V_{GS} =-2.5V
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

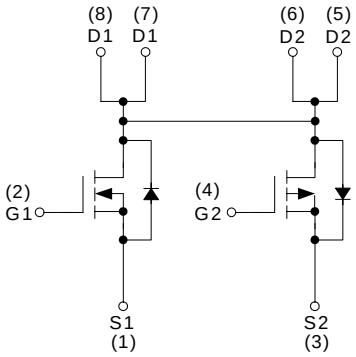
Applications

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

Pin Description



Top View of SOP – 8



N-P Channel MOSFET

Ordering and Marking Information

APM9932C □□-□□ □

- Lead Free Code
- Handling Code
- Temp. Range
- Package Code

Package Code
K : SOP-8
Operating Junction Temp. Range
C : -55 to 150°C
Handling Code
TU : Tube TR : Tape & Reel
Lead Free Code
L : Lead Free Device Blank : Original Device

APM9932C K : APM9932C XXXXX

XXXXX - Date Code

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte in plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldiering 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.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Symbol	Parameter		N Channel	P Channel	Unit
V_{DSS}	Drain-Source Voltage		20	-20	V
V_{GSS}	Gate-Source Voltage		±16	±12	
I_D*	Continuous Drain Current	9	9	-6	A
I_{DM}*	300µs Pulsed Drain Current	30	30	-20	
I_S*	Diode Continuous Forward Current		1.5	-1.2	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 Condition		APM9932CK			Unit
				Min.	Typ.	Max.	
Static Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V, I_{DS}=250µA	N-Ch	20			V
		V_{GS}=0V, I_{DS}=-250µA	P-Ch	-20			
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=16V, V_{GS}=0V	N-Ch			1	µA
		V_{DS}=-16V, V_{GS}=0V	P-Ch			-1	
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250µA	N-Ch	0.55	0.7	1.5	V
		V_{DS}=V_{GS}, I_{DS}=-250µA	P-Ch	-0.45	-0.6	-1	
I_{GSS}	Gate Leakage Current	V_{GS}=±16V, V_{DS}=0V	N-Ch			±100	nA
		V_{GS}=±12V, V_{DS}=0V	P-Ch			±100	
$R_{DS(ON)}$ [a]	Drain-Source On-State Resistance	V_{GS}=4.5V, I_{DS}=9A	N-Ch		12	18	mΩ
		V_{GS}=-4.5V, I_{DS}=-6A	P-Ch		30	45	
		V_{GS}=2.5V, I_{DS}=6A	N-Ch		18	27	
		V_{GS}=-2.5V, I_{DS}=-4A	P-Ch		50	65	
V_{SD} [a]	Diode Forward Voltage	I_{SD}=1.5A, V_{GS}=0V	N-Ch		0.75	1.3	V
		I_{SD}=-1.2A, V_{GS}=0V	P-Ch		-0.8	-1.3	

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

Symbol	Parameter	Test Condition		APM9932CK Min.	APM9932CK Typ.	APM9932CK Max.	Unit
Dynamic Characteristics [b]							
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		1205		pF
			P-Ch		1210		
C_{oss}	Output Capacitance		N-Ch		310		
			P-Ch		310		
C_{rss}	Reverse Transfer Capacitance		N-Ch		210		
			P-Ch		205		
$t_{d(ON)}$	Turn-on Delay Time	N-Channel V_{DD}=10V, R_L=10Ω, I_{DS}=1A, V_{GEN}=4.5V, R_G=6Ω P-Channel V_{DD}=-10V, R_L=10Ω, I_{DS}=-1A, V_{GEN}=-4.5V, R_G=6Ω	N-Ch		8	15	ns
			P-Ch		7	13	
T_r	Turn-on Rise Time		N-Ch		10	17	
			P-Ch		9	16	
$t_{d(OFF)}$	Turn-off Delay Time		N-Ch		29	43	
			P-Ch		27	42	
T_f	Turn-off Fall Time		N-Ch		7	11	
			P-Ch		6	9	
Gate Charge Characteristics [b]							
Q_g	Total Gate Charge	N-Channel V_{DS}=10V, V_{GS}=4.5V, I_{DS}=6A P-Channel V_{DS}=-10V, V_{GS}=-4.5V, I_{DS}=-5A	N-Ch		14	22	nC
			P-Ch		17	25	
Q_{gs}	Gate-Source Charge		N-Ch		5		
			P-Ch		5.2		
Q_{gd}	Gate-Drain Charge		N-Ch		2.8		
			P-Ch		3.6		

Notes:

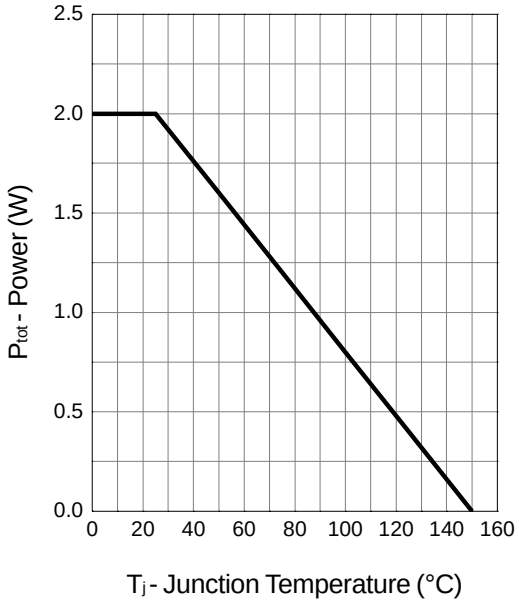
a : Pulse test ; pulse width ≤300μs, duty cycle ≤ 2%.

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

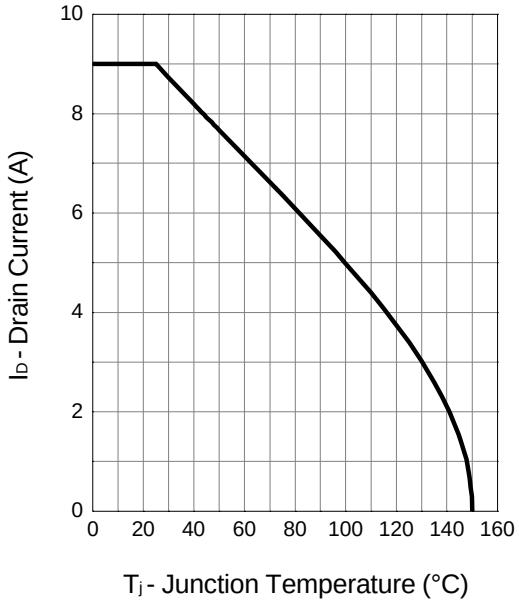
Typical Characteristics

N-Channel

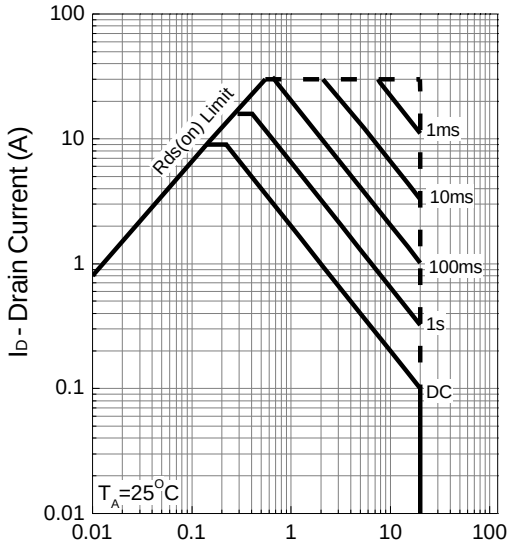
Power Dissipation



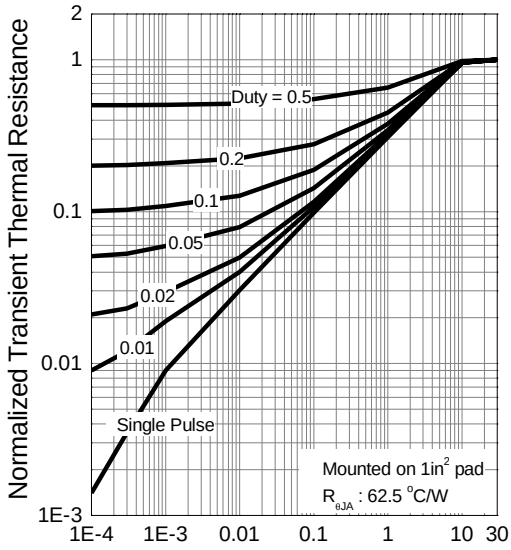
Drain Current



Safe Operation Area

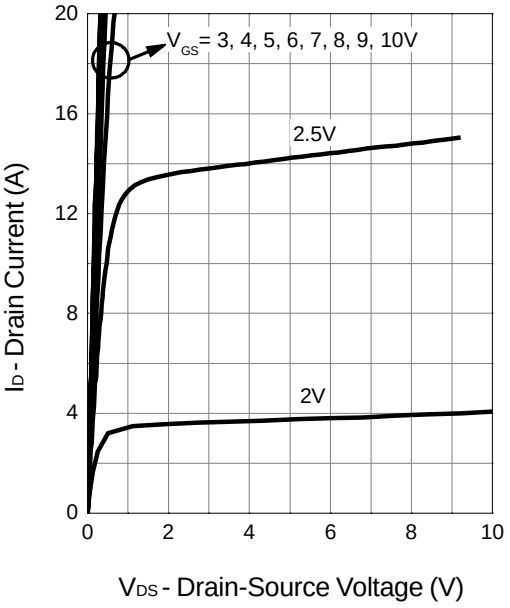


Thermal Transient Impedance

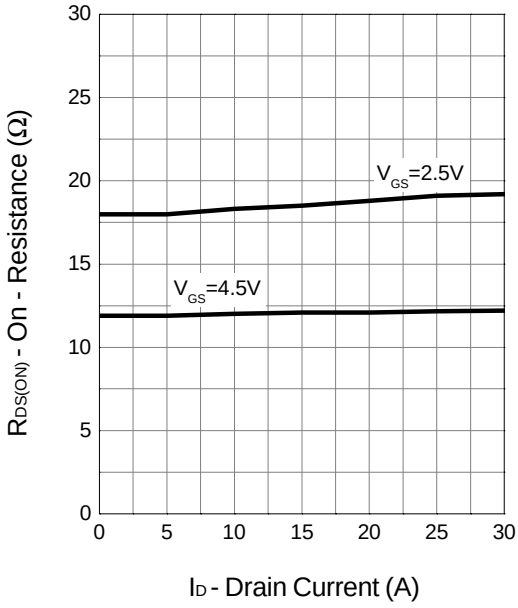


Typical Characteristics (Cont.)

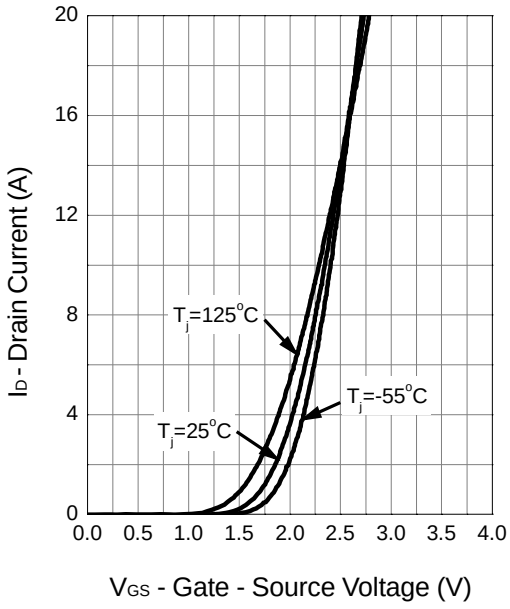
Output Characteristics



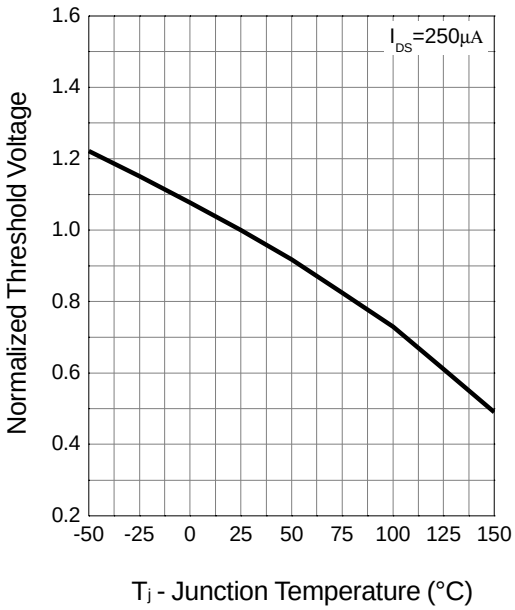
Drain-Source On Resistance



Transfer Characteristics

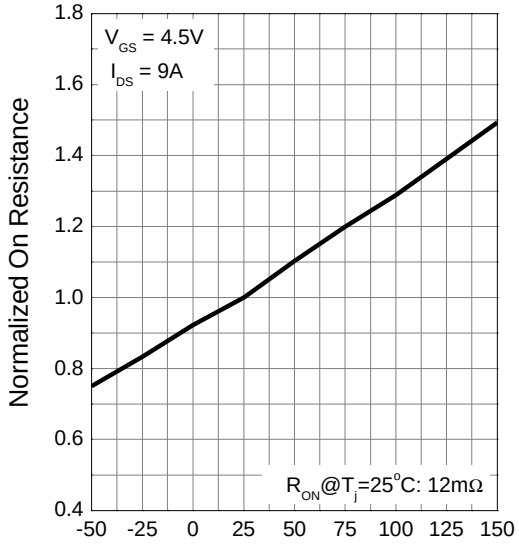


Gate Threshold Voltage

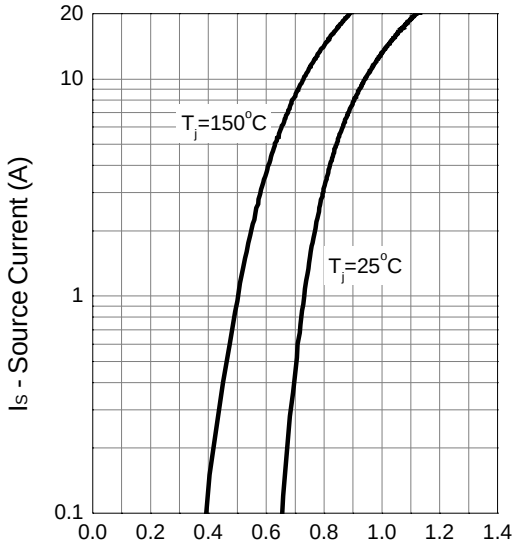


Typical Characteristics (Cont.)

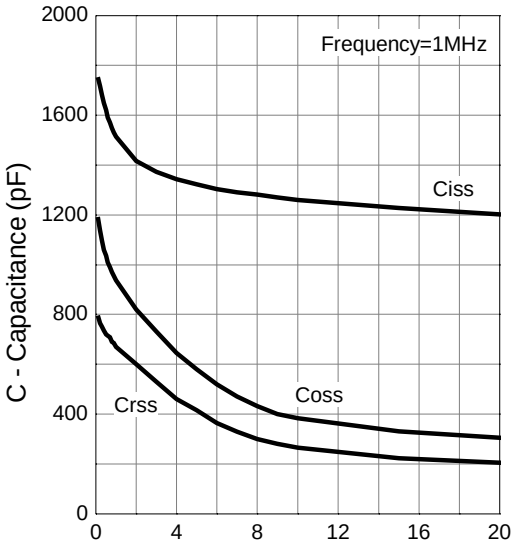
Drain-Source On Resistance



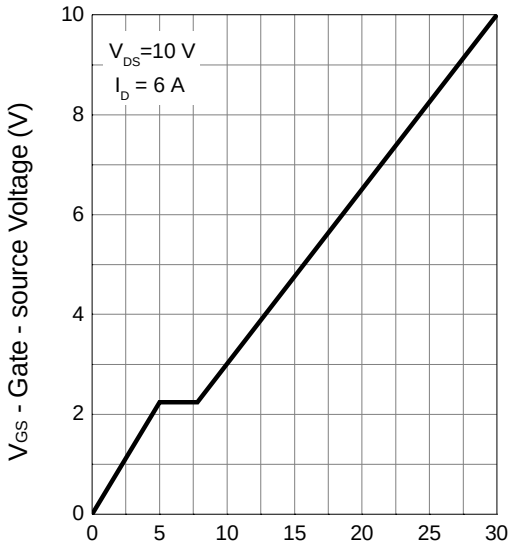
Source-Drain Diode Forward



Capacitance



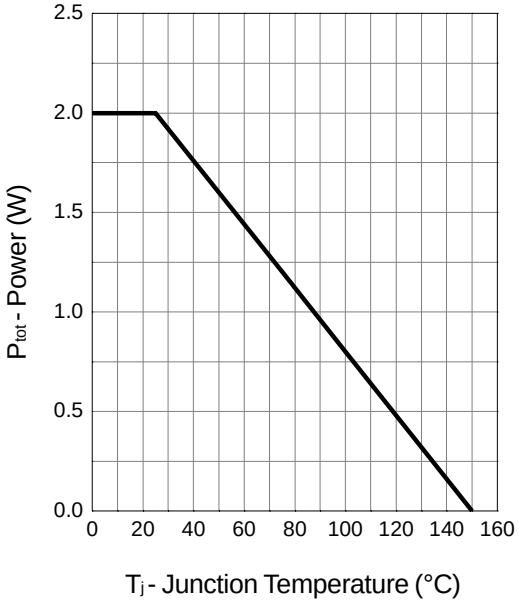
Gate Charge



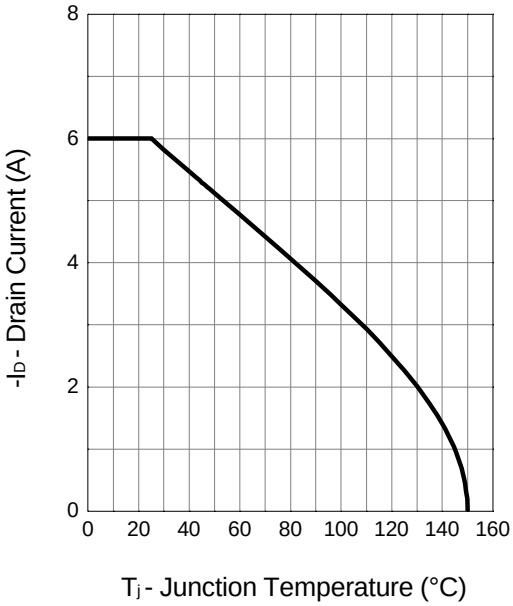
Typical Characteristics (Cont.)

P-Channel

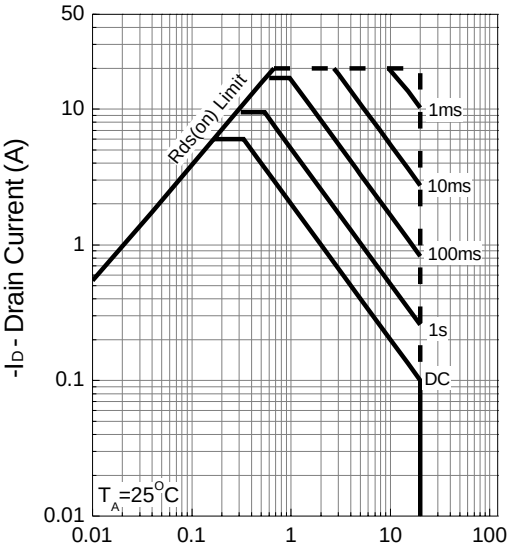
Power Dissipation



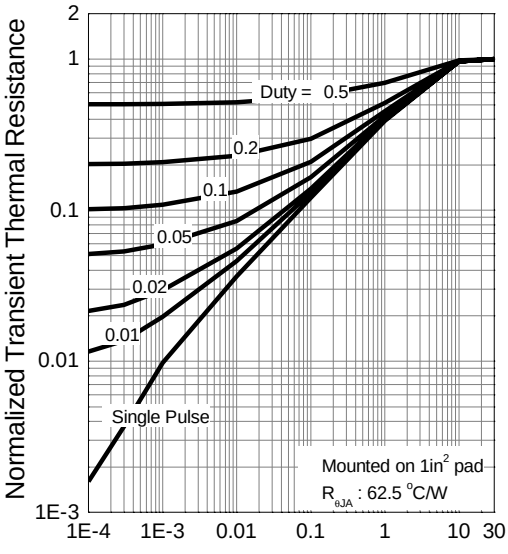
Drain Current



Safe Operation Area

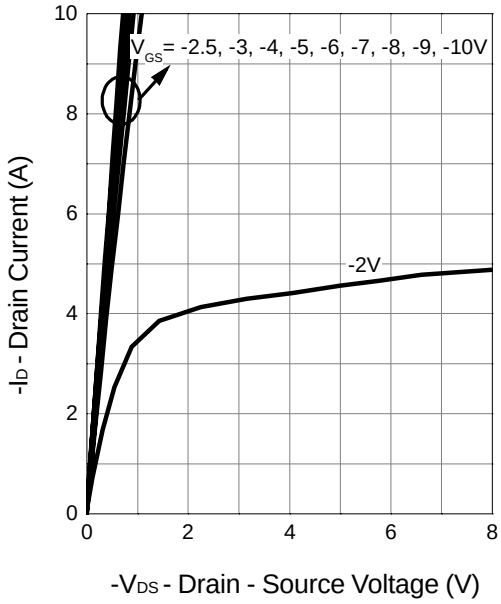


Thermal Transient Impedance

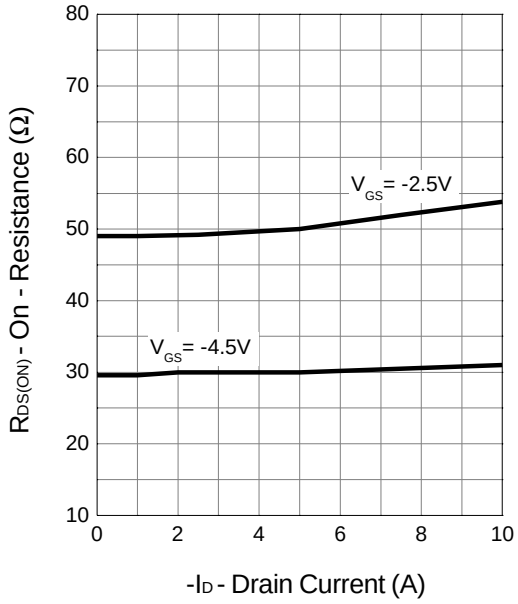


Typical Characteristics (Cont.)

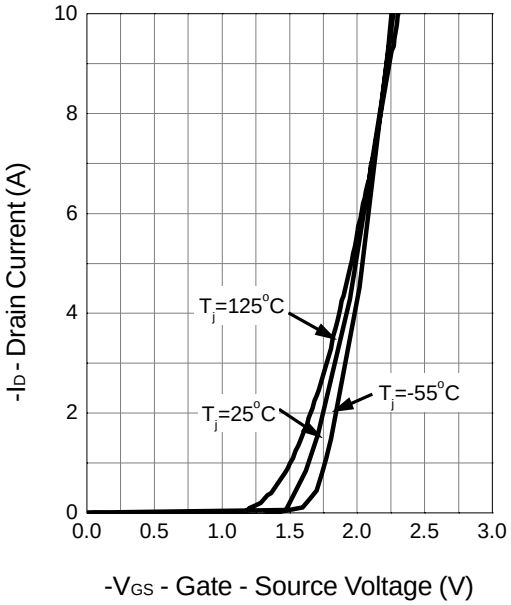
Output Characteristics



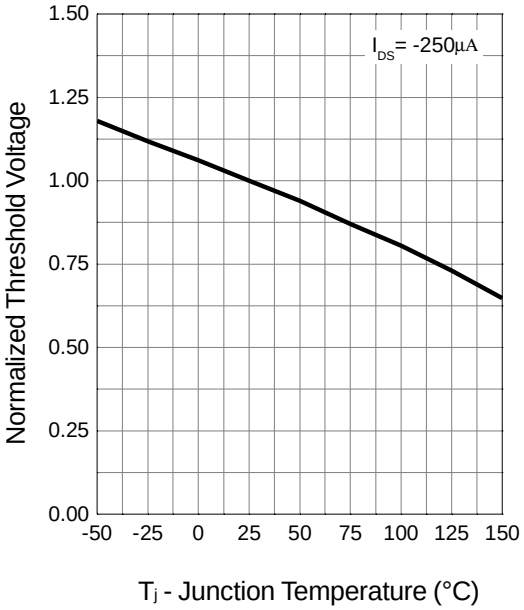
Drain-Source On Resistance



Transfer Characteristics

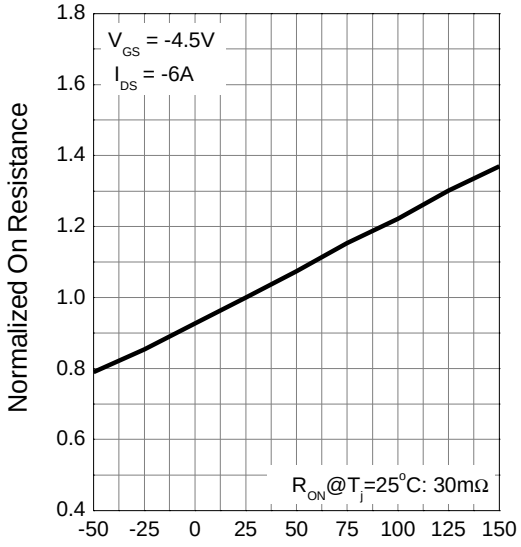


Gate Threshold Voltage

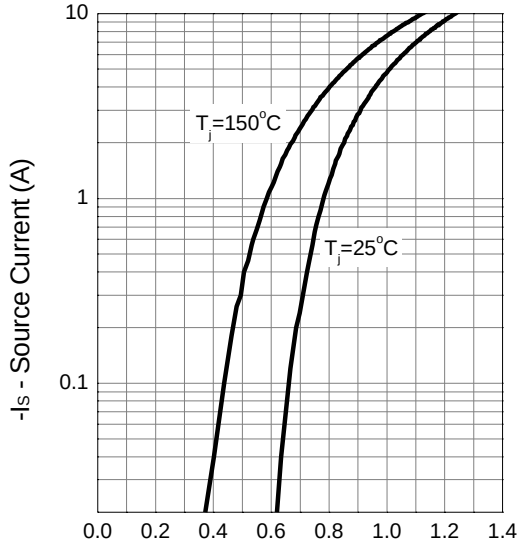


Typical Characteristics (Cont.)

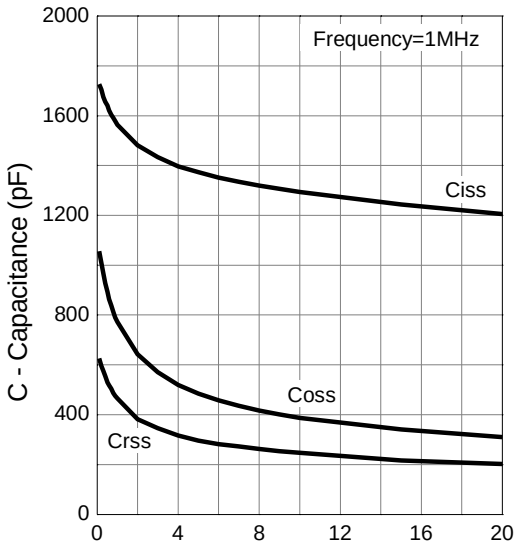
Drain-Source On Resistance



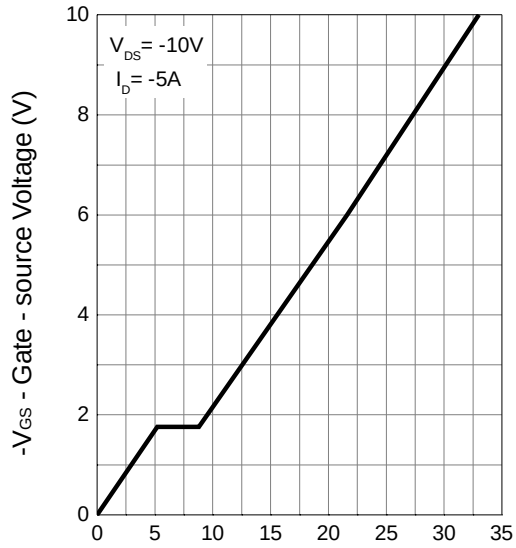
Source-Drain Diode Forward



Capacitance

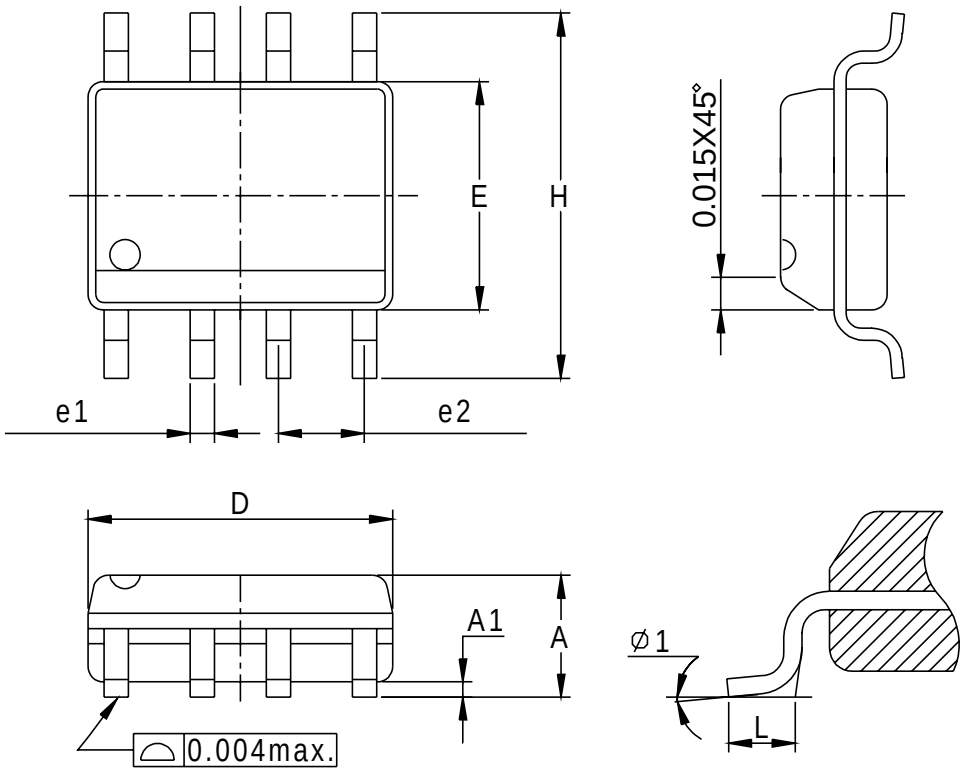


Gate Charge



Packaging Information

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

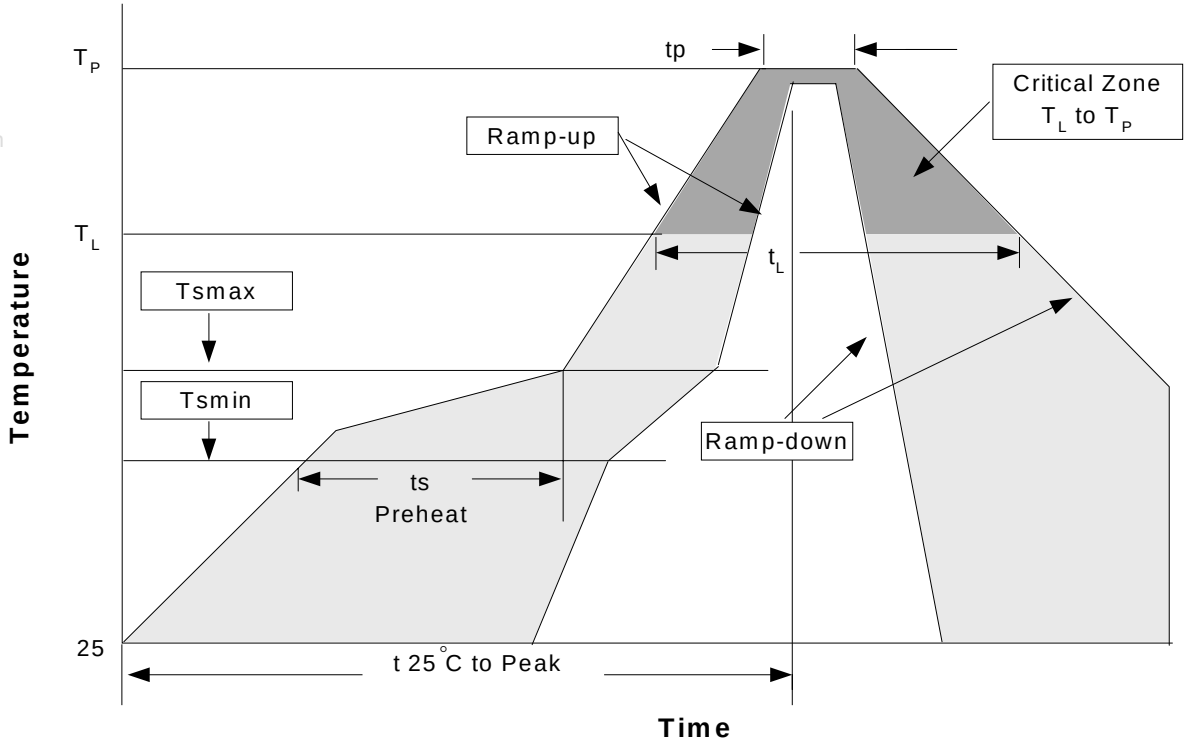


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
ϕ 1	8°		8°	

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)



Classificatin Reflow Profiles

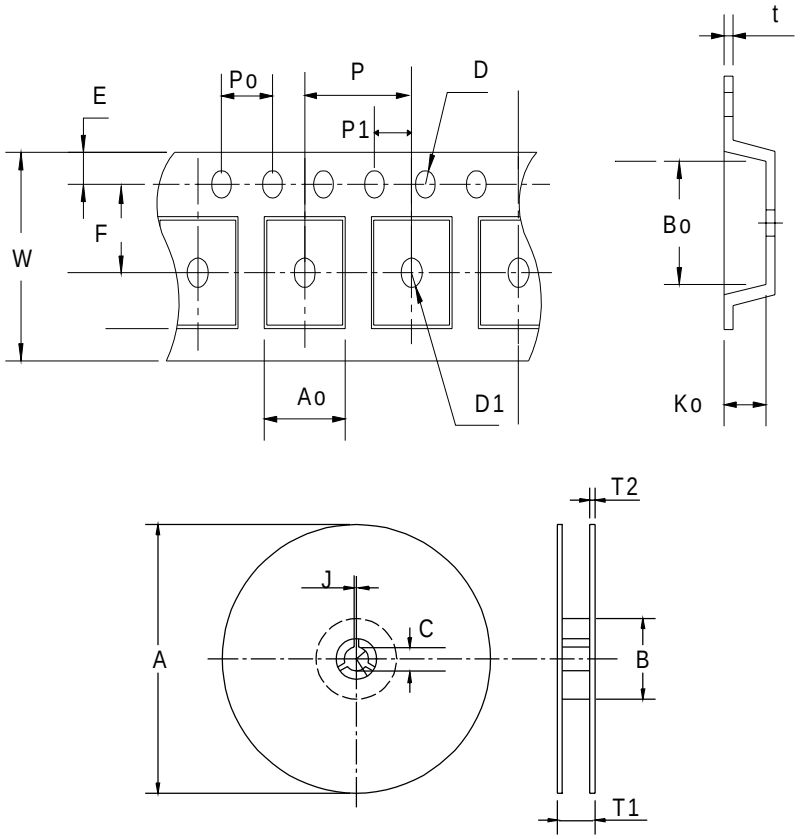
Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate (T_L to T_P)	3°C/second max.		3°C/second max.	
Preheat - Temperature Min (Tsmin) - Temperature Mix (Tsmax) - Time (min to max)(ts)	100°C 150°C 60-120 seconds		150°C 200°C 60-180 seconds	
Tsmax to T_L - Ramp-up Rate			3°C/second max	
Tsmax to T_L - Temperature(T_L) - Time (t_L)	183°C 60-150 seconds		217°C 60-150 seconds	
Peak Temperature(Tp)	225 +0/-5°C	240 +0/-5°C	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actual Peak Temperature(tp)	10-30 seconds	10-30 seconds	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.

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

Carrier Tape & Reel Dimensions



Application	A	B	C	J	T1	T2	W	P	E
SOP-8	330±1	62 ± 1.5	12.75 + 0.1 5	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

Customer Service

Anpec Electronics Corp.

Head Office :

5F, No. 2 Li-Hsin Road, SBIP,

Hsin-Chu, Taiwan, R.O.C.

Tel : 886-3-5642000

Fax : 886-3-5642050

Taipei Branch :

7F, No. 137, Lane 235, Pac Chiao Rd.,

Hsin Tien City, Taipei Hsien, Taiwan, R. O. C.

Tel : 886-2-89191368

Fax : 886-2-89191369