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

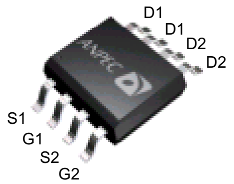
Features

- N-Channel
  20V/8A,
  $R_{DS(ON)}$ =22mΩ(typ.) @ V_{GS} = 4.5V
  $R_{DS(ON)}$ =30mΩ(typ.) @ V_{GS} = 2.5V
- P-Channel
  -20V/-4.3A,
  $R_{DS(ON)}$ =80mΩ(typ.) @ V_{GS} =-4.5V
  $R_{DS(ON)}$ =105mΩ(typ.) @ V_{GS} =-2.5V
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

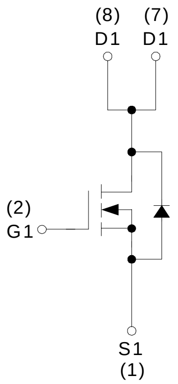
Applications

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

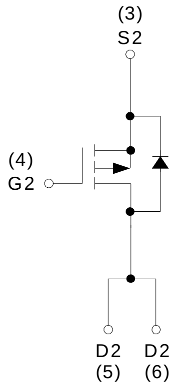
Pin Description



Top View of SOP – 8



N-Channel MOSFET



P-Channel MOSFET

Ordering and Marking Information

APM4500 □□-□□ □ 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
APM4500 K : APM4500 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		±12	±12	
I_D*	Continuous Drain Current	$V_{GS}=\pm 4.5V$	8	-4.3	A
I_{DM}*	Pulsed Drain Current		30	-16	
I_S*	Diode Continuous Forward Current		1.7	-1.25	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		APM4500K			Unit
				Min.	Typ.	Max.	
Static Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	N-Ch	20			V
		$V_{GS}=0V, I_{DS}=-250\mu A$	P-Ch	-20			
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=16V, V_{GS}=0V$	N-Ch			1	µA
		T_J=85°C				30	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-16V, V_{GS}=0V$	P-Ch			-1	
		T_J=85°C				-30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	N-Ch	0.5	0.6	1	V
		$V_{DS}=V_{GS}, I_{DS}=-250\mu A$	P-Ch	-0.45	-0.6	-1	
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	N-Ch			±100	nA
			P-Ch			±100	
$R_{DS(ON)}$[a]	Drain-Source On-State Resistance	$V_{GS}=4.5V, I_{DS}=8A$	N-Ch		22	26	mΩ
		$V_{GS}=-4.5V, I_{DS}=-4.3A$	P-Ch		80	90	
		$V_{GS}=2.5V, I_{DS}=5.2A$	N-Ch		30	36	
		$V_{GS}=-2.5V, I_{DS}=-2A$	P-Ch		105	115	

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

Symbol	Parameter	Test Condition		APM4500K			Unit
				Min.	Typ.	Max.	
Diode Characteristics							
V_{SD}[a]	Diode Forward Voltage	I_{SD}=1.7A, V_{GS}=0V	N-Ch		0.8	1.3	V
		I_{SD}=-1.25A, V_{GS}=0V	P-Ch		-0.7	-1.3	
Dynamic Characteristics[b]							
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	N-Ch		2.2		Ω
			P-Ch		10.5		
C_{iss}	Input Capacitance	N-Channel V_{GS}=0V, V_{DS}=15V, Frequency=1.0MHz P-Channel V_{GS}=0V, V_{DS}=-15V,	N-Ch		675		pF
			P-Ch		510		
C_{oss}	Output Capacitance		N-Ch		180		
			P-Ch		270		
C_{rss}	Reverse Transfer Capacitance		N-Ch		105		
			P-Ch		120		
$t_{d(ON)}$	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		16	30	ns
			P-Ch		13	24	
T_r	Turn-on Rise Time		N-Ch		40	73	
			P-Ch		36	66	
$t_{d(OFF)}$	Turn-off Delay Time		N-Ch		42	77	
			P-Ch		45	82	
T_f	Turn-off Fall Time		N-Ch		20	37	
			P-Ch		37	68	
Gate Charge Characteristics[b]							
Q_g	Total Gate Charge	N-Channel V_{DS}=10V, V_{GS}=4.5V, I_{DS}=8A P-Channel V_{DS}=-10V, V_{GS}=-4.5V, I_{DS}=-4.3A	N-Ch		12	16	nC
			P-Ch		9	12	
Q_{gs}	Gate-Source Charge		N-Ch		5.6		
			P-Ch		3		
Q_{gd}	Gate-Drain Charge		N-Ch		2.5		
			P-Ch		1		

Notes:

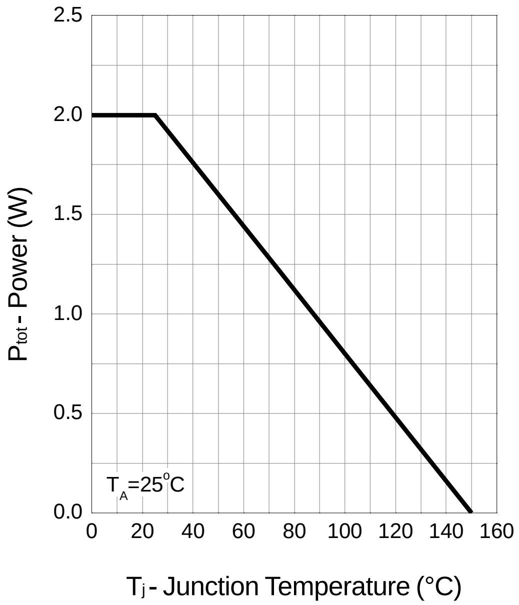
a : Pulse test ; pulse width≤300µs, duty cycle≤2%.

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

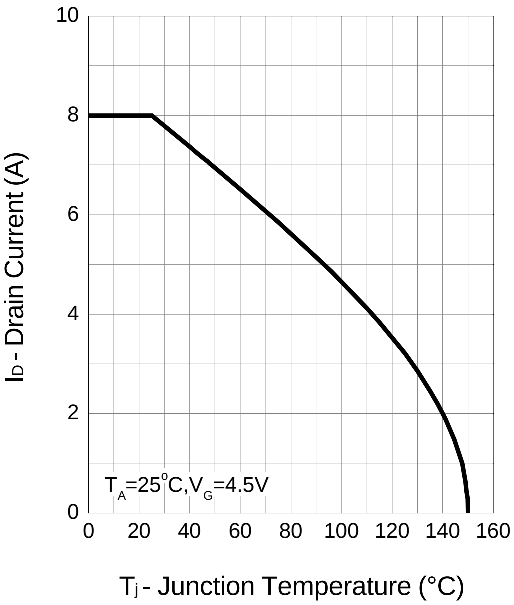
Typical Characteristics

N-Channel

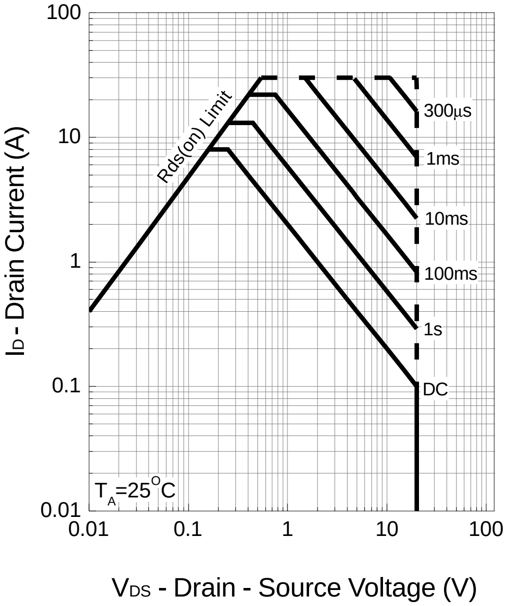
Power Dissipation



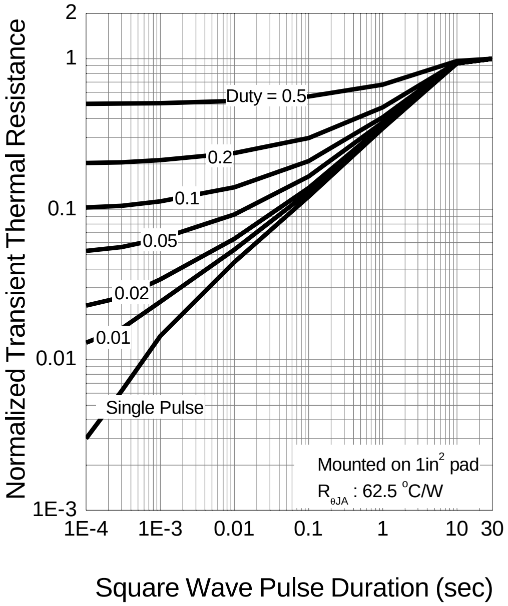
Drain Current



Safe Operation Area



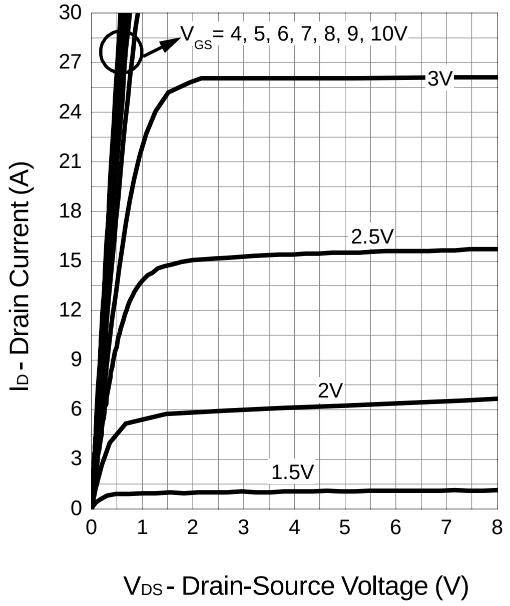
Thermal Transient Impedance



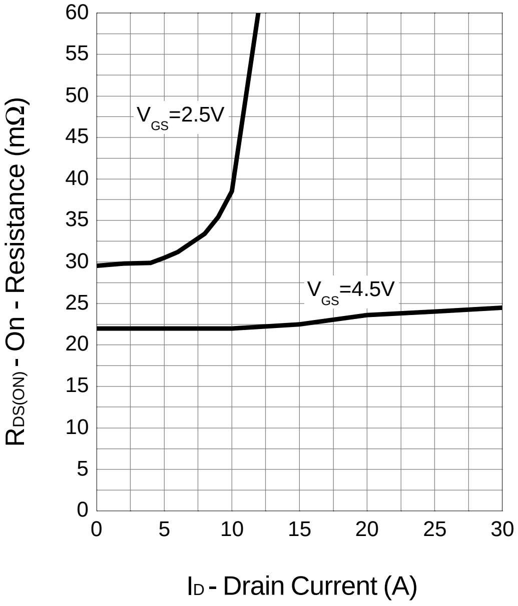
Typical Characteristics (Cont.)

N-Channel

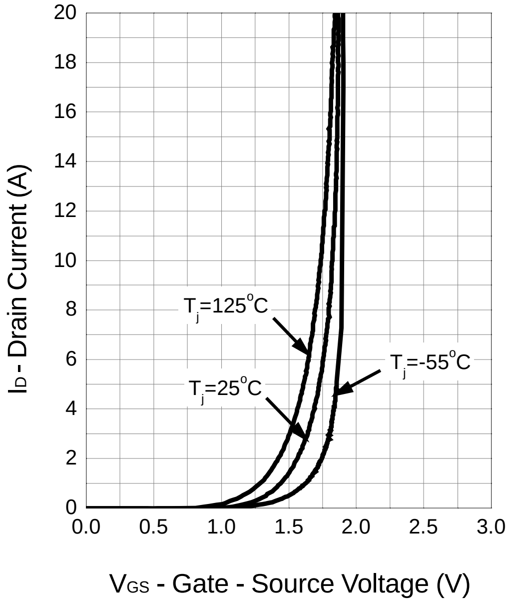
Output Characteristics



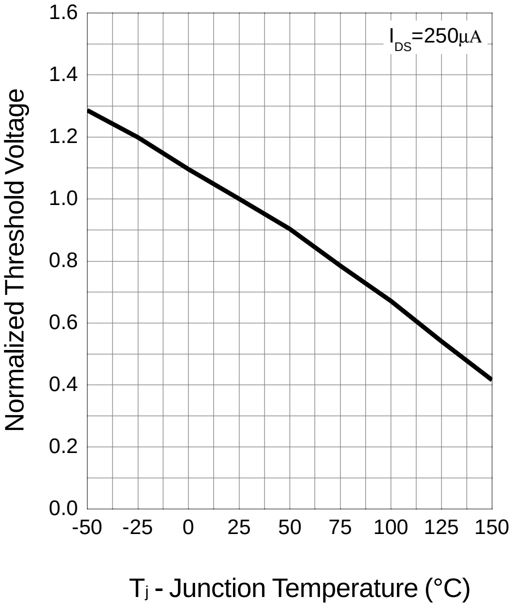
Drain-Source On Resistance



Transfer Characteristics



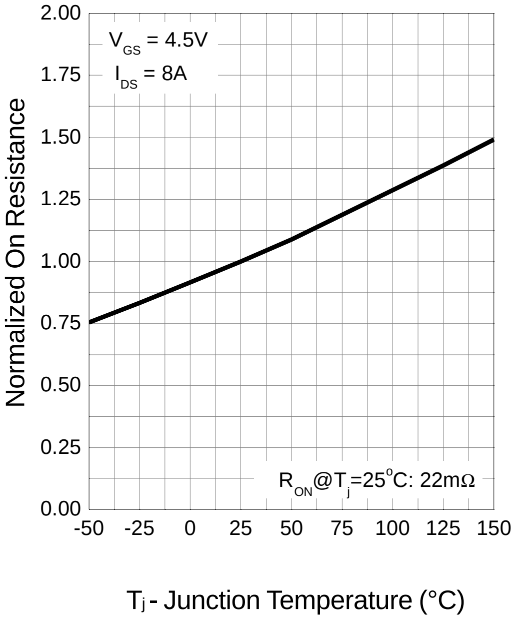
Gate Threshold Voltage



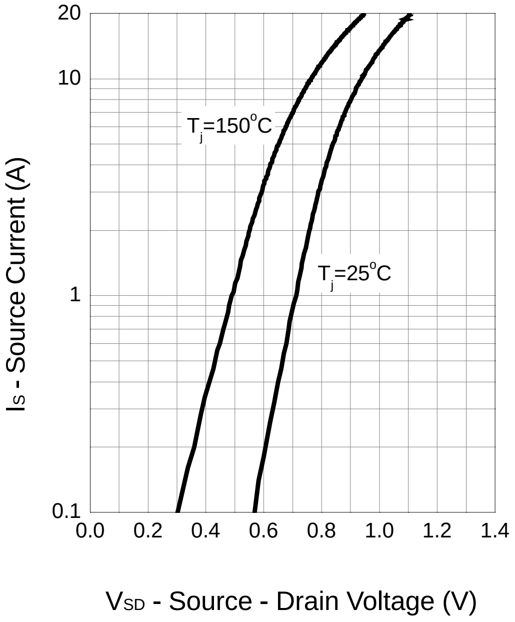
Typical Characteristics (Cont.)

N-Channel

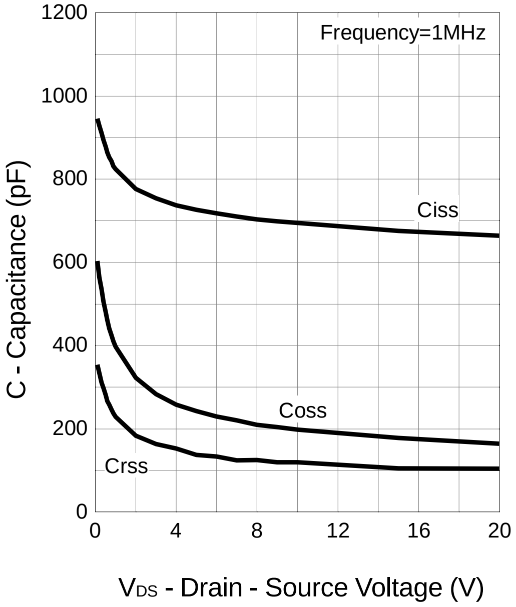
Drain-Source On Resistance



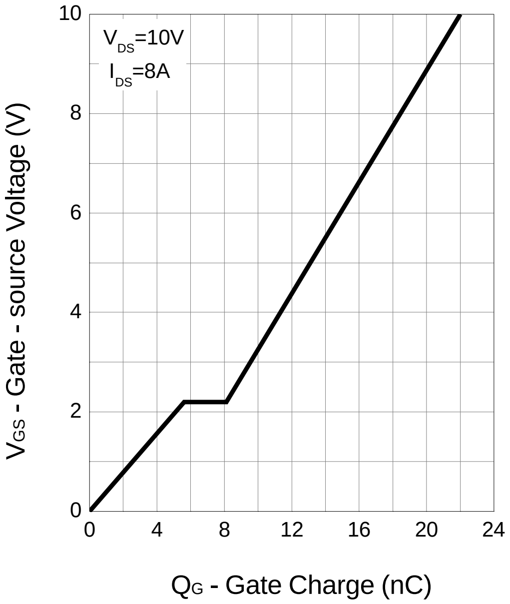
Source-Drain Diode Forward



Capacitance



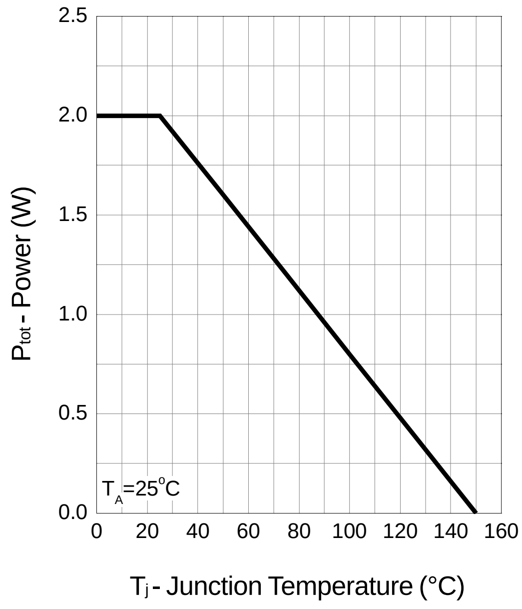
Gate Charge



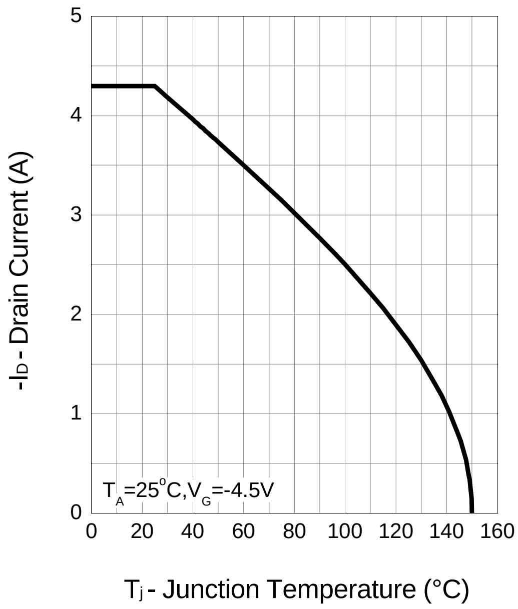
Typical Characteristics (Cont.)

P-Channel

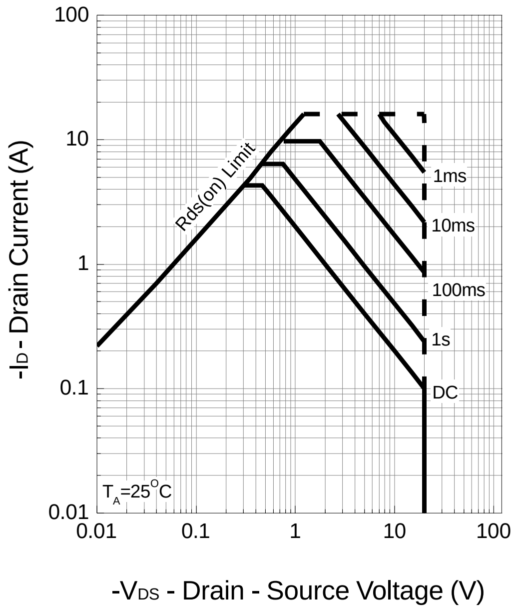
Power Dissipation



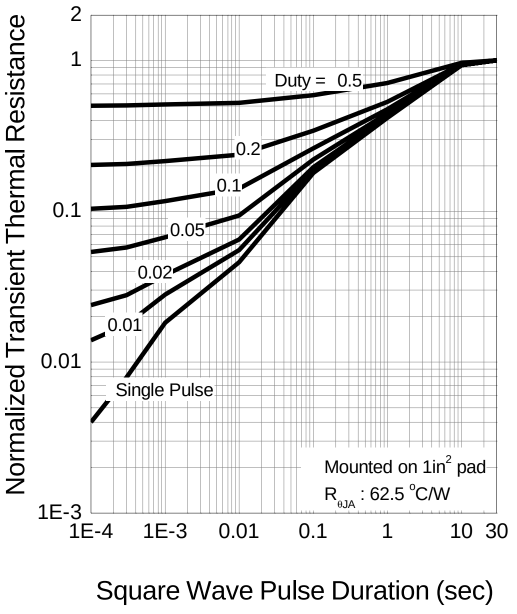
Drain Current



Safe Operation Area



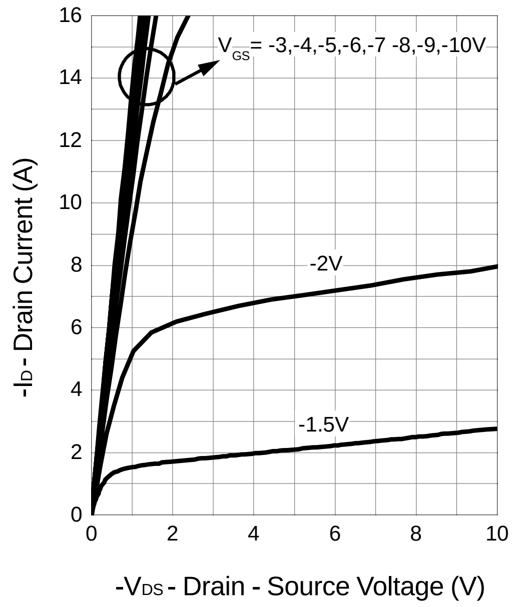
Thermal Transient Impedance



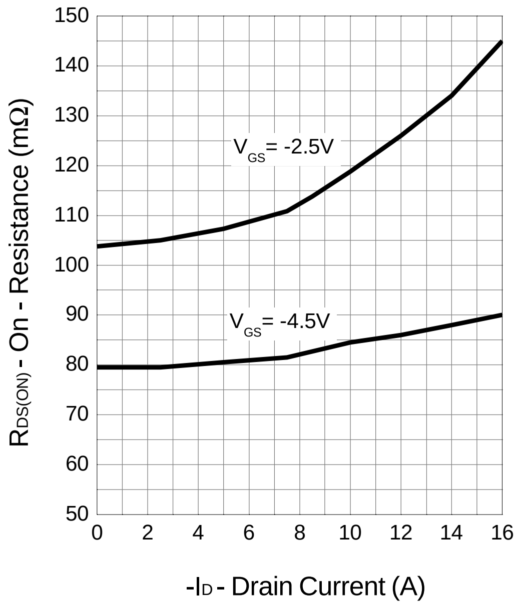
Typical Characteristics (Cont.)

P-Channel

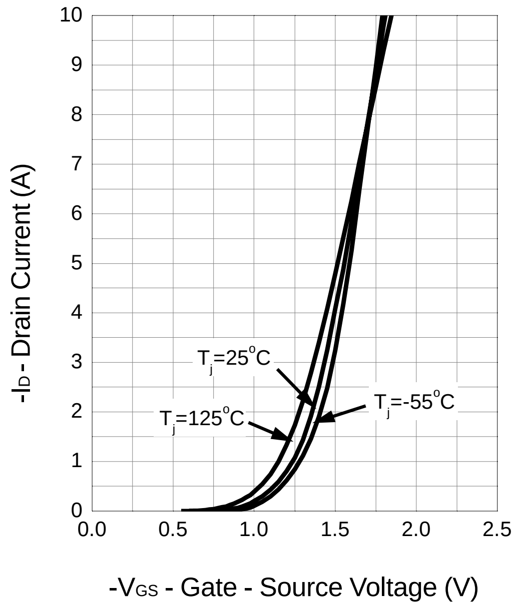
Output Characteristics



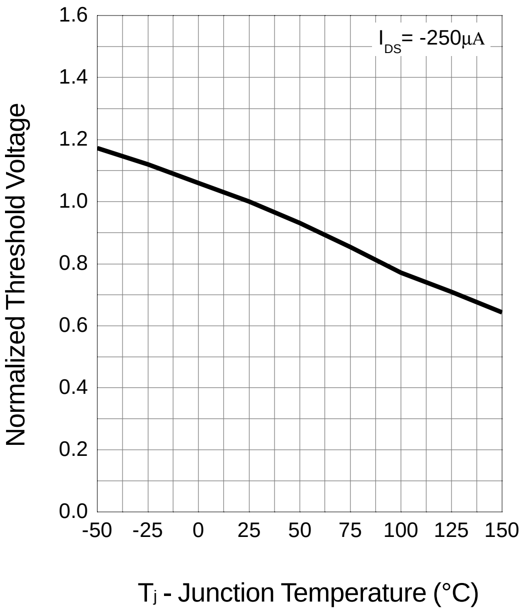
Drain-Source On Resistance



Transfer Characteristics

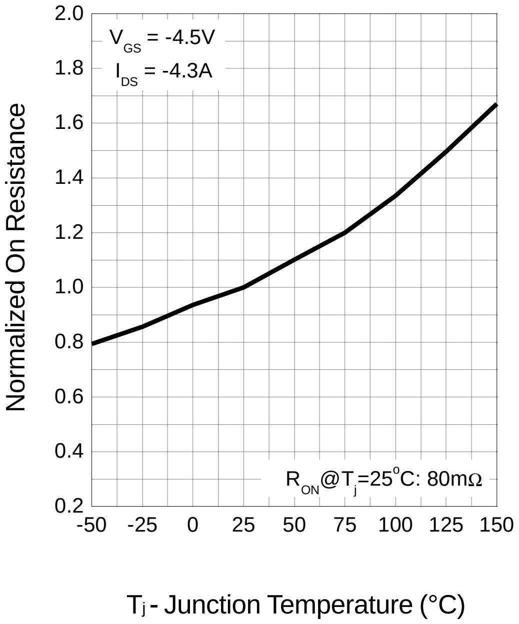


Gate Threshold Voltage

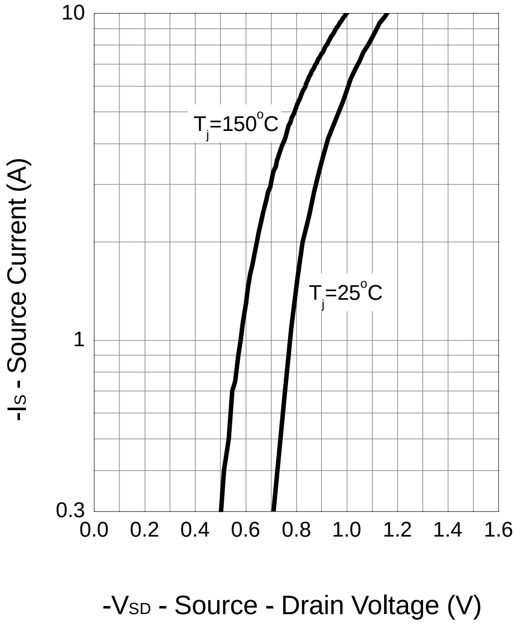


Typical Characteristics (Cont.)

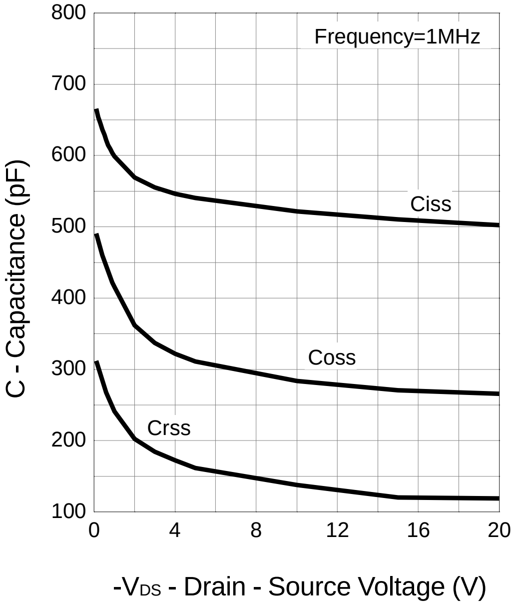
P-Channel



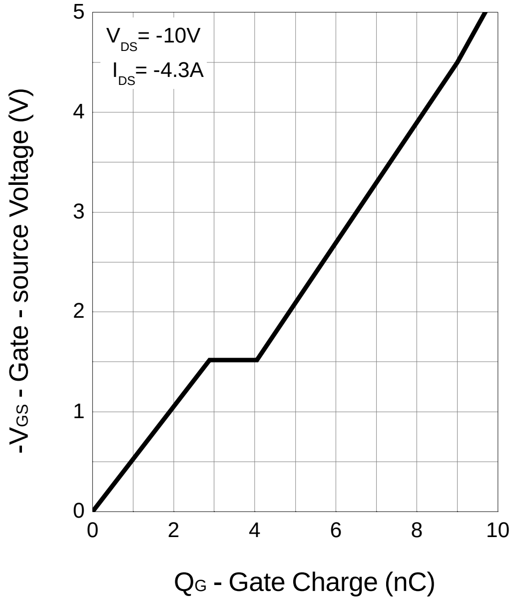
Drain-Source On Resistance



Source-Drain Diode Forward



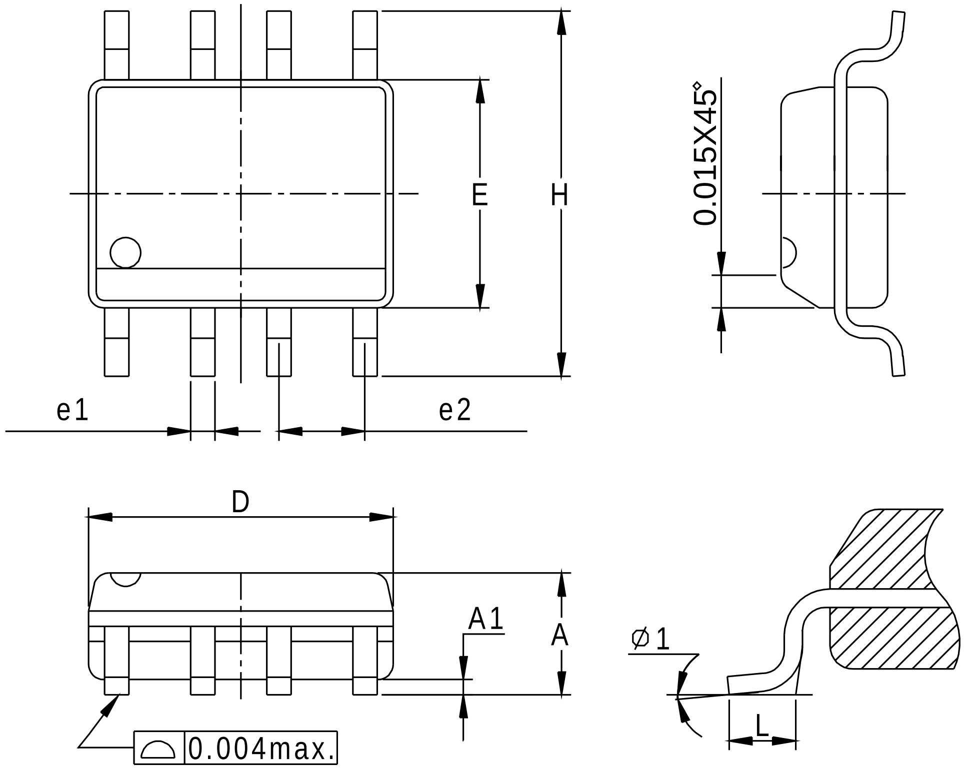
Capacitance



Gate Charge

Packaging Information

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

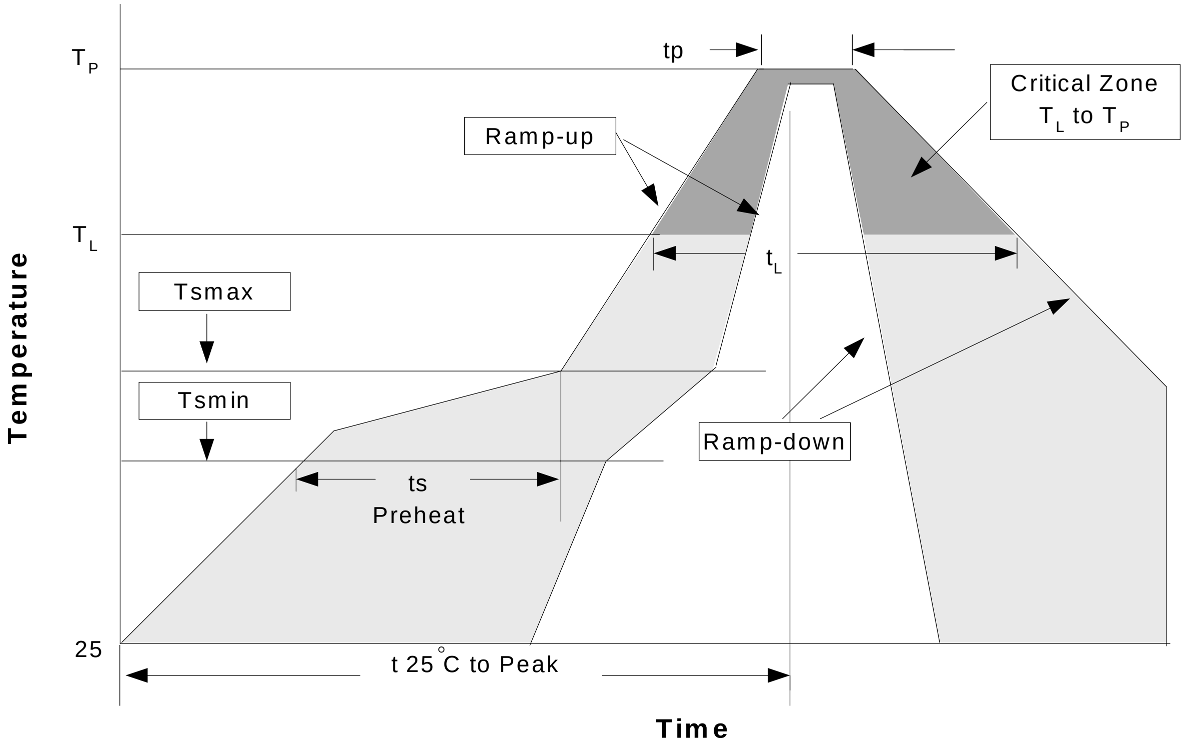


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
ϕ 1	8°		8°	

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)



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/Classificatioon 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.

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^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

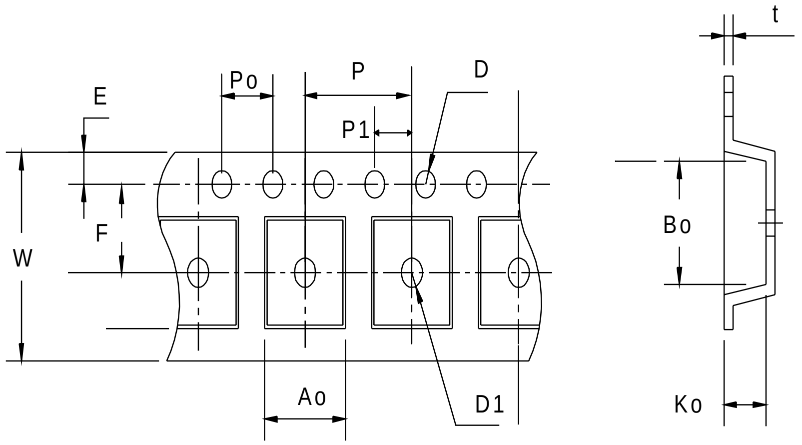
Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

*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.

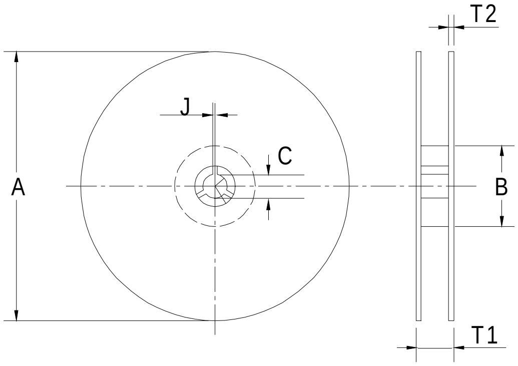
Reliability Test Program

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



Carrier Tape & Reel Dimensions(Cont.)



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

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