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

Features

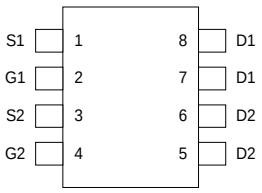
- N-Channel
  20V/15A, $R_{DS(ON)}$=12mΩ(typ.) @ V_{GS}=10V
  $R_{DS(ON)}$=17mΩ(typ.) @ V_{GS}=4.5V
  $R_{DS(ON)}$=25mΩ(typ.) @ V_{GS}=2.5V
- P-Channel
  -20V/-5A, $R_{DS(ON)}$=60mΩ(typ.) @ V_{GS}=-10V
  $R_{DS(ON)}$=72mΩ(typ.) @ V_{GS}=-4.5V
  $R_{DS(ON)}$=98mΩ(typ.) @ V_{GS}=-2.5V
- Super High Dense Cell Design for Extremely Low $R_{DS(ON)}$
- Reliable and Rugged
- SO-8 Package

Applications

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

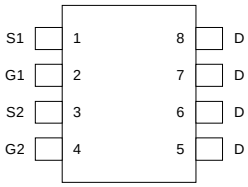
Pin Description

APM9930

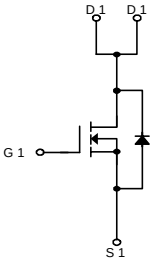


SO-8

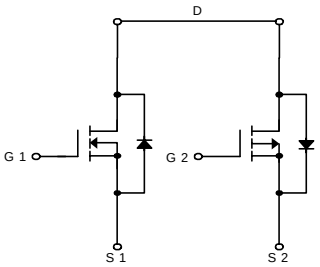
APM9930C



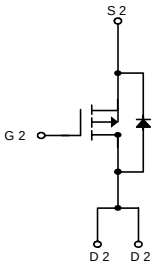
SO-8



N-Channel MOSFET



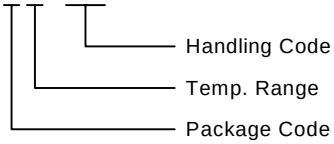
N- and P-Channel MOSFET



P-Channel MOSFET

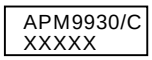
Ordering and Marking Information

APM9930/C □□-□□



Package Code
K : SO-8
Operation Junction Temp. Range
C : -55 to 150°C
Handling Code
TR : Tape & Reel

APM9930/C K :



XXXXX - Date Code

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.

Rev. A.1 - Sep., 2002

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*	Maximum Drain Current – Continuous		15	-5	A
I_{DM}	Maximum Drain Current – Pulsed		30	-10	
P_D	Maximum Power Dissipation	T_A=25°C	2.5	2.5	W
		T_A=100°C	1.0	1.0	
T_J	Maximum Junction Temperature		150		°C
T_{STG}	Storage Temperature Range		-55 to 150		°C
$R_{\theta jA}$	Thermal Resistance – Junction to Ambient		50		°C/W

* Surface Mounted on FR4 Board, t ≤ 10 sec.

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

Symbol	Parameter	Test Condition		APM9930/C			Unit
				Min.	Typ.	Max.	
Static							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V , I_{DS}=250µA	N-Ch	20			V
			P-Ch	-20			
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=18V , V_{GS}=0V	N-Ch			1	µA
		V_{DS}=-18V , V_{GS}=0V	P-Ch			-1	
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} , I_{DS}=250µA	N-Ch	0.6		1.3	V
		V_{DS}=V_{GS} , I_{DS}=-250µA	P-Ch	-0.6		-1.3	
I_{GSS}	Gate Leakage Current	V_{GS}=±12V , V_{DS}=0V	N-Ch			±100	nA
		V_{GS}=±10V , V_{DS}=0V	P-Ch			±100	
$R_{DS(ON)}$[a]	Drain-Source On-state Resistance	V_{GS}=10V , I_{DS}=15A	N-Ch		12	15	mΩ
		V_{GS}=4.5V , I_{DS}=5A			17	20	
		V_{GS}=2.5V , I_{DS}=2A			25	30	
		V_{GS}=-10V , I_{DS}=-5A	P-Ch		60	70	
		V_{GS}=-4.5V , I_{DS}=-3.2A			72	80	
		V_{GS}=-2.5V , I_{DS}=-1A			98	105	

Notes

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

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

Symbol	Parameter	Test Condition		APM9930/C Min.	APM9930/C Typ.	APM9930/C Max.	Unit
V_{SD}[a]	Diode Forward Voltage	I_{SD}=5A , V_{GS}=0V	N-Ch	0.6		1.3	V
		I_{SD}=-2A , V_{GS}=0V	P-Ch	-0.6		-1.3	
Dynamic[a]							
Q_g	Total Gate Charge	N-Channel V_{DS}=10V , I_{DS}= 6A V_{GS}=4.5V P-Channel V_{DS}=-10V , I_{DS}=-1A V_{GS}=-4.5V	N-Ch		14	22	nC
			P-Ch		6.8	16	
Q_{gs}	Gate-Source Charge		N-Ch		5		
			P-Ch		3.6		
Q_{gd}	Gate-Drain Charge		N-Ch		2.8		
			P-Ch		1.08		
$t_{d(ON)}$	Turn-on Delay Time	N-Channel V_{DD}=10V , I_{DS}=1A , V_{GEN}=4.5V , R_G=10Ω P-Channel V_{DD}=-10V , I_{DS}=-1A , V_{GEN}=-4.5V , R_G=10Ω	N-Ch		6	12	ns
			P-Ch		21	42	
T_r	Turn-on Rise Time		N-Ch		5	10	
			P-Ch		45	85	
$t_{d(OFF)}$	Turn-off Delay Time		N-Ch		16	40	
			P-Ch		36	80	
T_f	Turn-off Fall Time		N-Ch		5	20	
			P-Ch		20	40	
C_{iss}	Input Capacitance	V_{GS}=0V V_{DS}=15V Frequency=1.0MHz	N-Ch		1225		pF
			P-Ch		495		
C_{oss}	Output Capacitance		N-Ch		330		
			P-Ch		130		
C_{rss}	Reverse Transfer Capacitance		N-Ch		220		
			P-Ch		60		

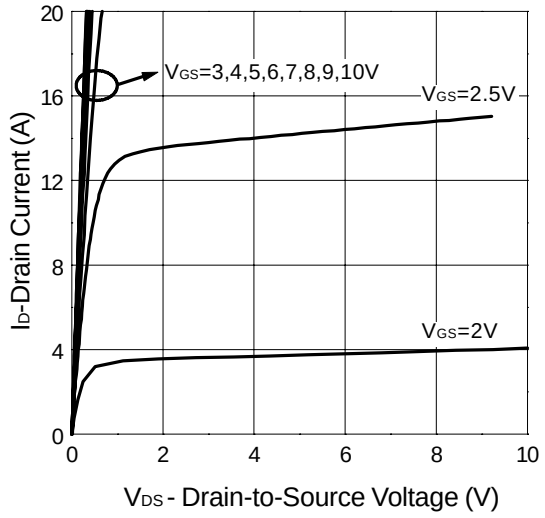
Notes

[a] : Guaranteed by design, not subject to production testing

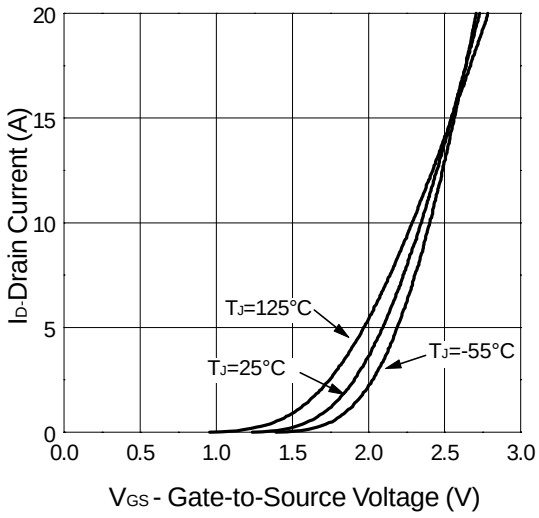
Typical Characteristics

N-Channel

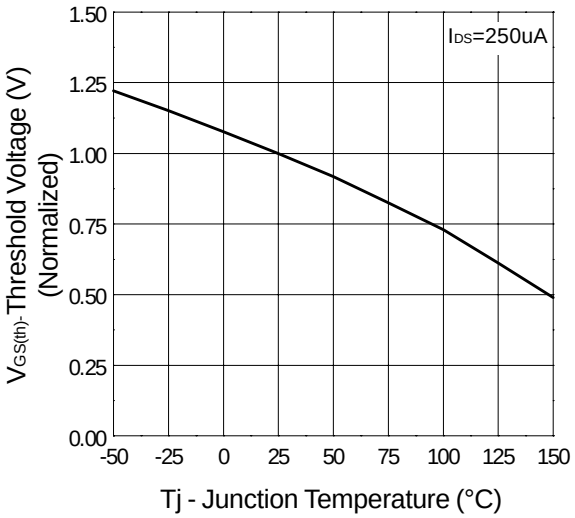
Output Characteristics



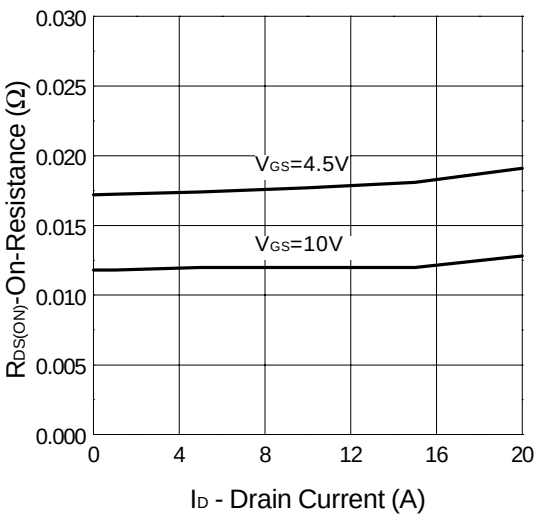
Transfer Characteristics



Threshold Voltage vs. Junction Temperature



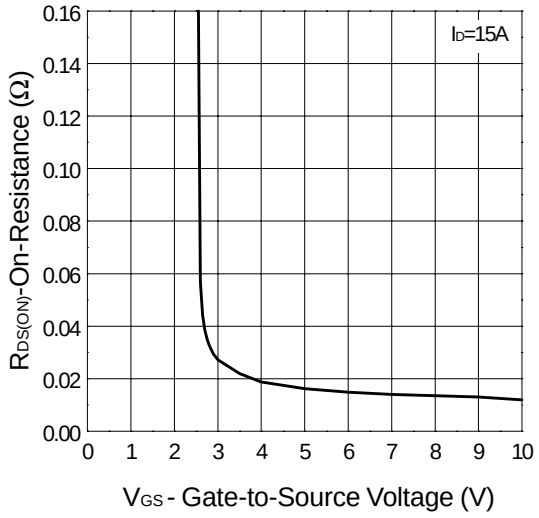
On-Resistance vs. Drain Current



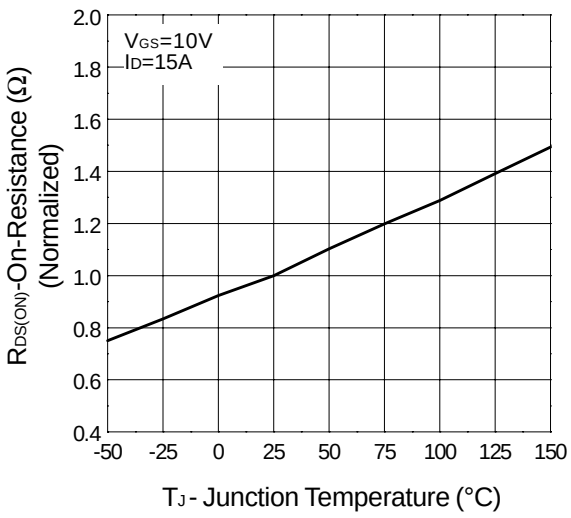
Typical Characteristics (Cont.)

N-Channel

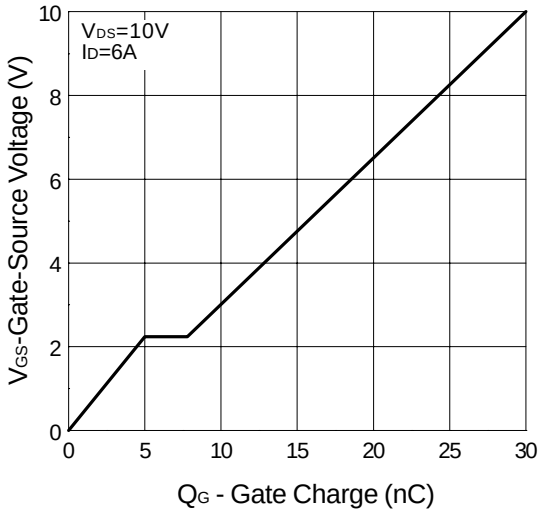
On-Resistance vs. Gate-to-Source Voltage



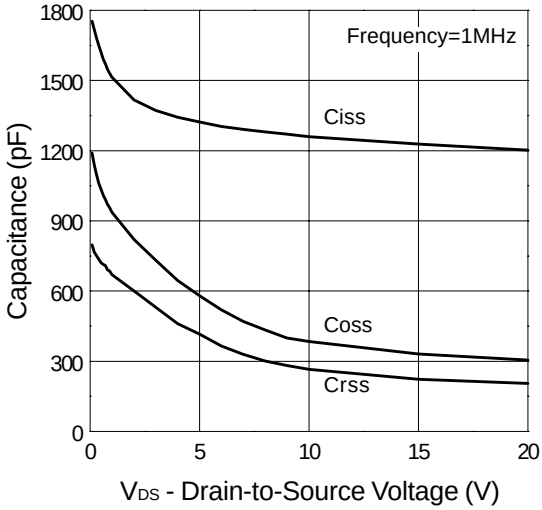
On-Resistance vs. Junction Temperature



Gate Charge



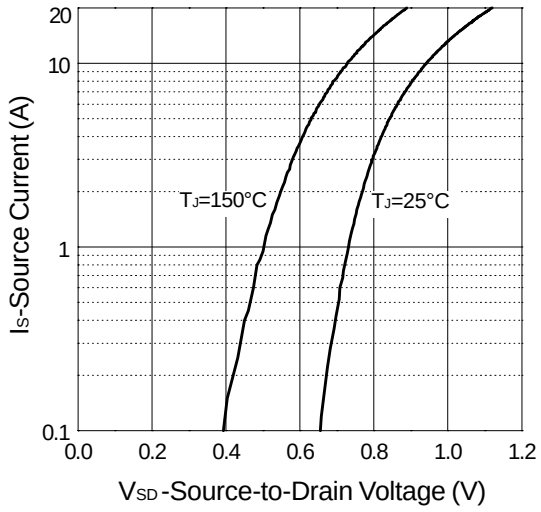
Capacitance



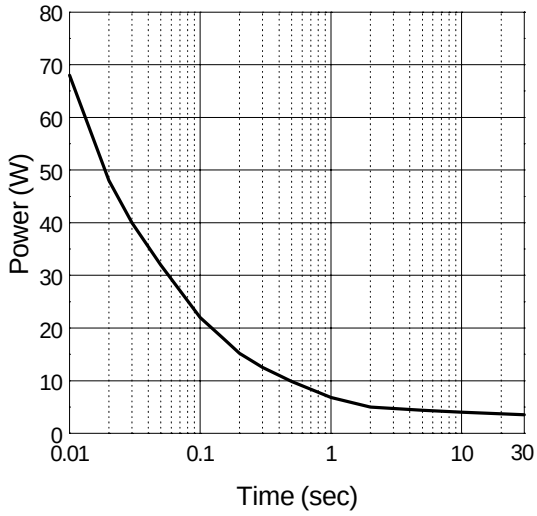
Typical Characteristics (Cont.)

N-Channel

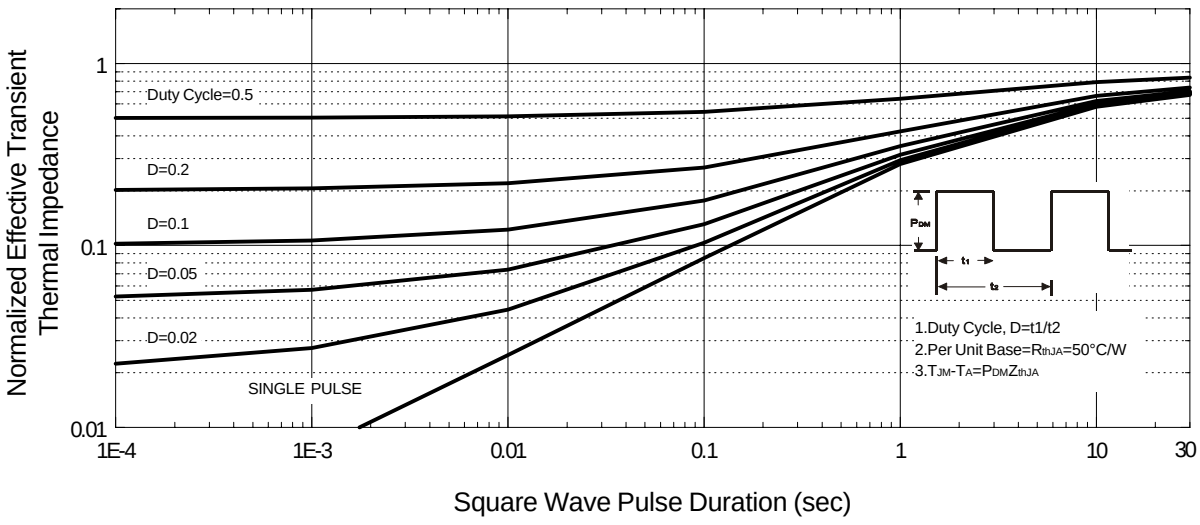
Source-Drain Diode Forward Voltage



Single Pulse Power



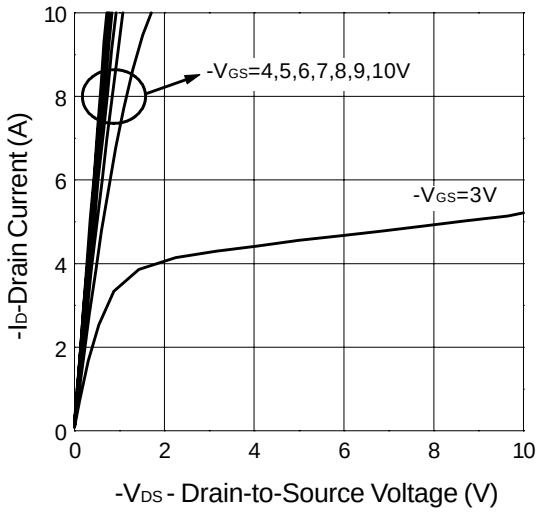
Normalized Thermal Transient Impedence, Junction to Ambient



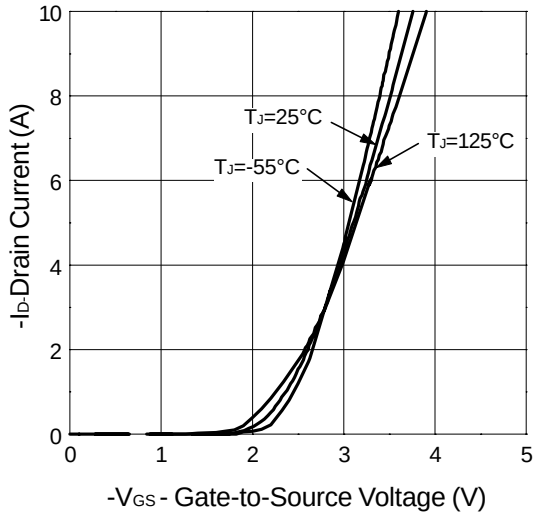
Typical Characteristics

P-Channel

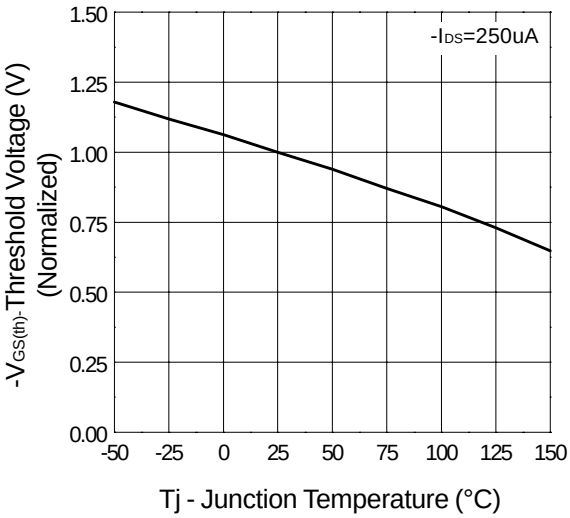
Output Characteristics



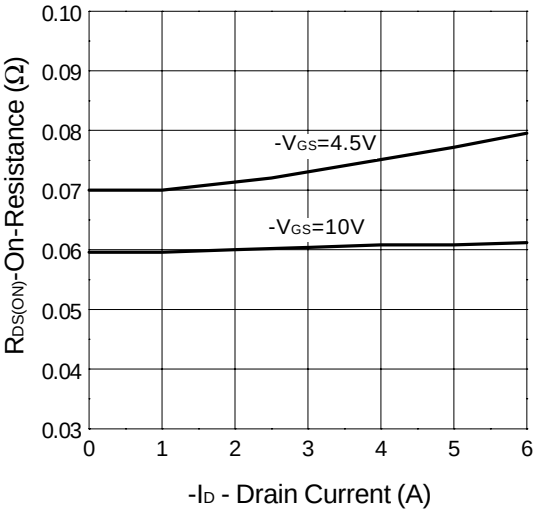
Transfer Characteristics



Threshold Voltage vs. Junction Temperature



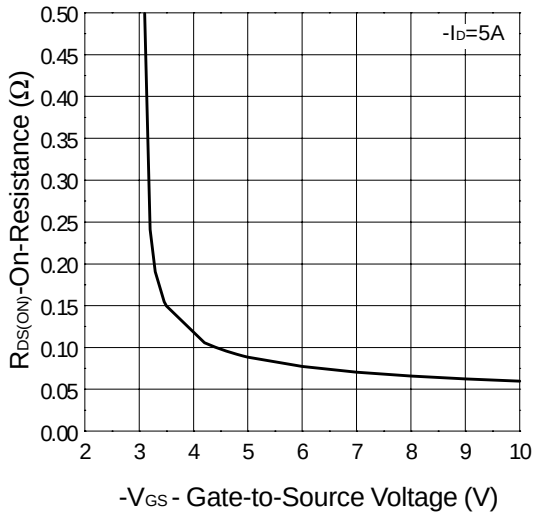
On-Resistance vs. Drain Current



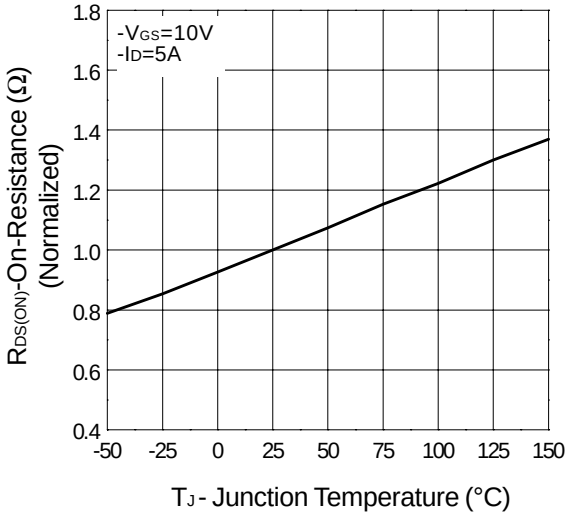
Typical Characteristics (Cont.)

P-Channel

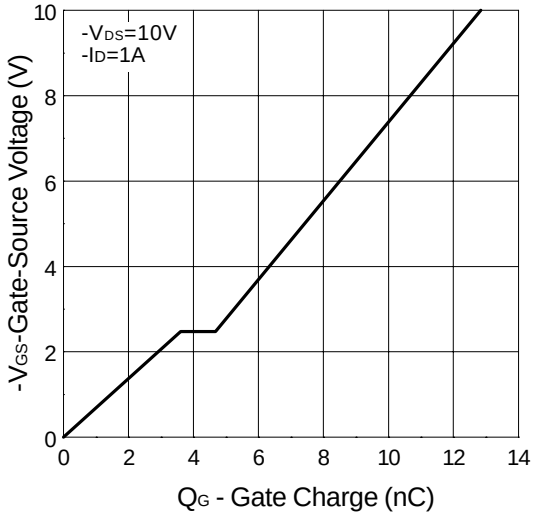
On-Resistance vs. Gate-to-Source Voltage



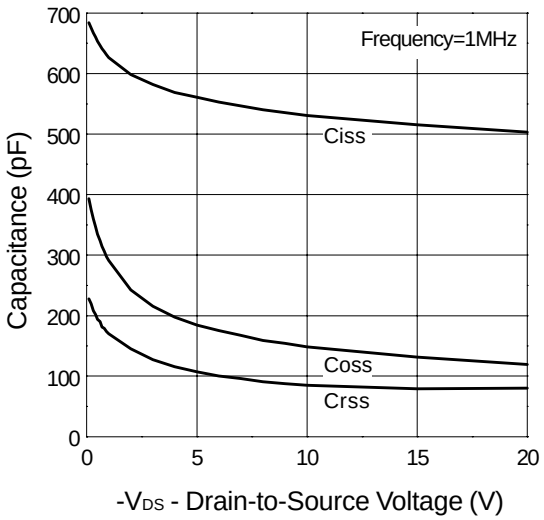
On-Resistance vs. Junction Temperature



Gate Charge



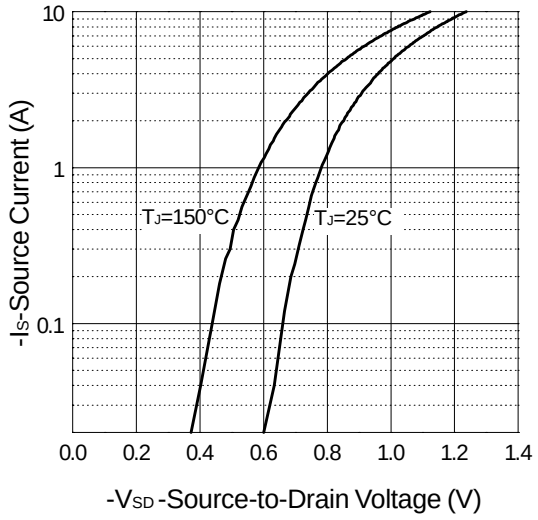
Capacitance



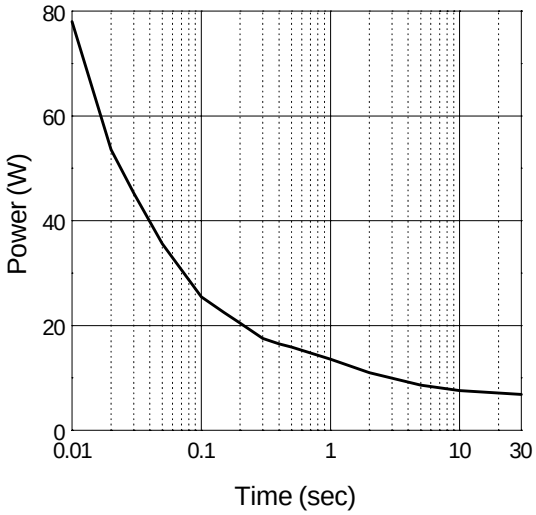
Typical Characteristics (Cont.)

P-Channel

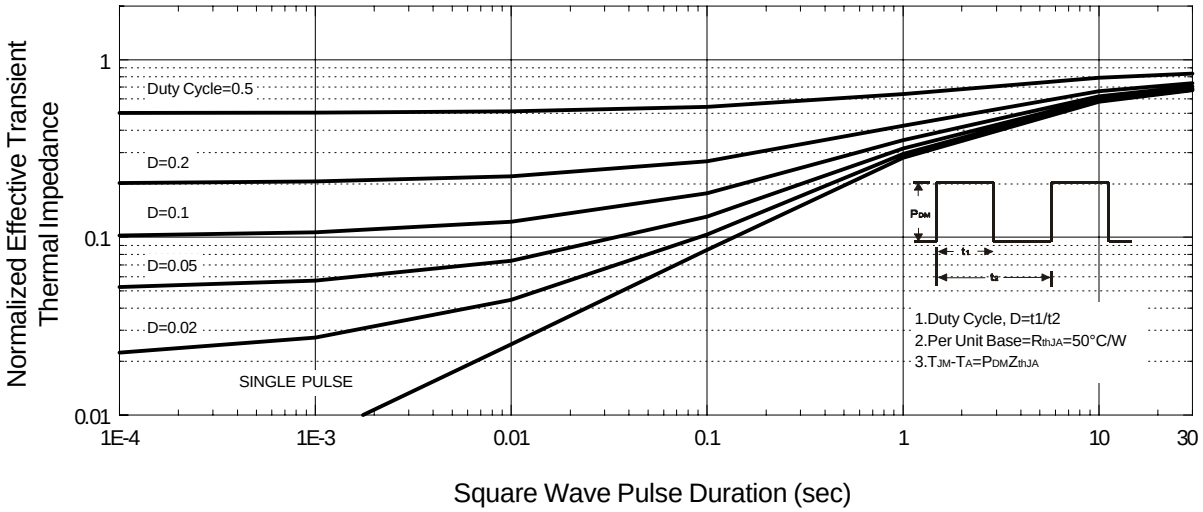
Source-Drain Diode Forward Voltage



Single Pulse Power

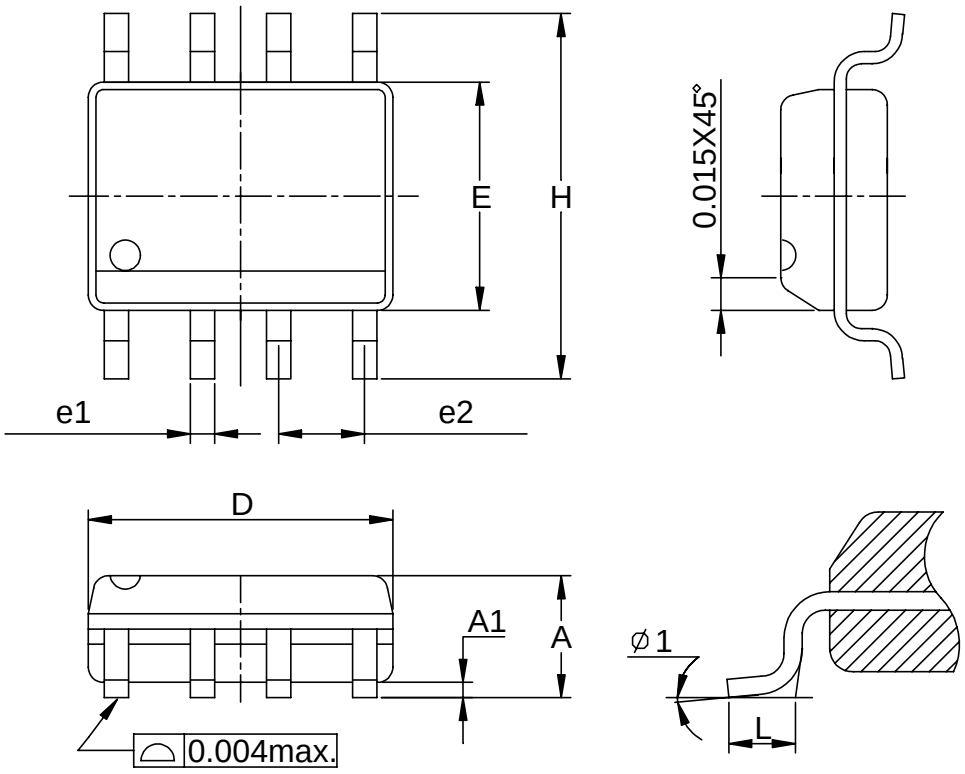


Normalized Thermal Transient Impedence, Junction to Ambient



Packaging Information

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



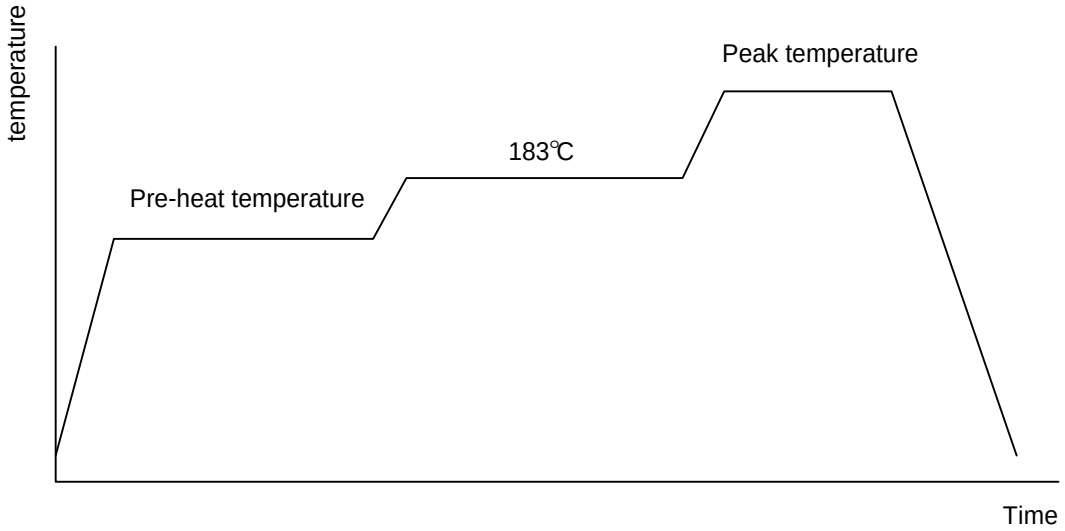
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
ϕ 1	8°		8°	

Physical Specifications

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

Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A APRIL 1999



Classification Reflow Profiles

	Convection or IR/ Convection	VPR
Average ramp-up rate(183°C to Peak)	3°C/second max.	10 °C /second max.
Preheat temperature 125 ± 25°C)	120 seconds max	
Temperature maintained above 183°C	60 – 150 seconds	
Time within 5°C of actual peak temperature	10 –20 seconds	60 seconds
Peak temperature range	220 +5/-0°C or 235 +5/-0°C	215-219°C or 235 +5/-0°C
Ramp-down rate	6 °C /second max.	10 °C /second max.
Time 25°C to peak temperature	6 minutes max.	

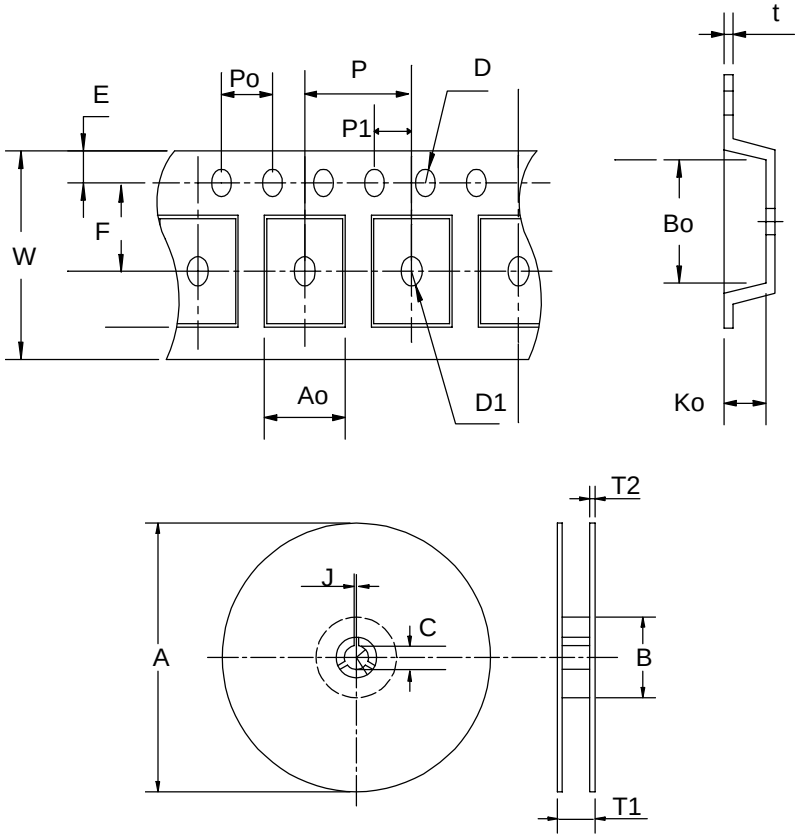
Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm³	pkg. thickness < 2.5mm and pkg. volume < 350mm³
Convection 220 +5/-0 °C		Convection 235 +5/-0 °C
VPR 215-219 °C		VPR 235 +5/-0 °C
IR/Convection 220 +5/-0 °C		IR/Convection 235 +5/-0 °C

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+ 0.15	2 ± 0.5	12.4 ± 0.2	2 ± 0.2	12± 0. 3	8± 0.1	1.75±0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5± 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

Cover Tape Dimensions

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

Customer Service

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Tel : 886-2-89191368
Fax : 886-2-89191369