

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

Symbol	Parameter	N Channel	P Channel	Unit
V_{DSS}	Drain-Source Voltage	36	-36	V
V_{GSS}	Gate-Source Voltage	± 16	± 16	
I_D^*	Continuous Drain Current	5	-4	A
I_{DM}^*	Pulsed Drain Current			
I_S^*	Diode Continuous Forward Current	1.7	-1.7	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		$^\circ\text{C/W}$

Note:

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

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

Symbol	Parameter	Test Condition	APM4538K			Unit	
			Min.	Typ.	Max.		
Static Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$	N-Ch	36		V	
		$V_{GS}=0\text{V}, I_{DS}=-250\mu\text{A}$	P-Ch	-36			
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=30\text{V}, V_{GS}=0\text{V}$ $T_J=85^\circ\text{C}$	N-Ch		1	μA	
					30		
		$V_{DS}=-30\text{V}, V_{GS}=0\text{V}$ $T_J=85^\circ\text{C}$	P-Ch		-1		
					-30		
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	N-Ch	0.7	1.1	1.5	V
		$V_{DS}=V_{GS}, I_{DS}=-250\mu\text{A}$	P-Ch	-1	-1.5	-2	
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 16\text{V}, V_{DS}=0\text{V}$	N-Ch			± 100	nA
			P-Ch			± 100	
$R_{DS(ON)}^a$	Drain-Source On-State Resistance	$V_{GS}=10\text{V}, I_{DS}=5\text{A}$	N-Ch		50	65	m Ω
		$V_{GS}=-10\text{V}, I_{DS}=-4\text{A}$	P-Ch		60	80	
		$V_{GS}=4.5\text{V}, I_{DS}=4\text{A}$	N-Ch		60	80	
		$V_{GS}=-4.5\text{V}, I_{DS}=-3\text{A}$	P-Ch		80	100	

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

Symbol	Parameter	Test Condition	APM4538K			Unit	
			Min.	Typ.	Max.		
Diode Characteristics							
V_{SD}^a	Diode Forward Voltage	$I_{SD}=1.7\text{A}, V_{GS}=0\text{V}$	N-Ch		0.8	1.3	V
		$I_{SD}=-1.7\text{A}, V_{GS}=0\text{V}$	P-Ch		-0.8	-1.3	
Dynamic Characteristics^b							
R_G	Gate Resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, F=1\text{MHz}$	N-Ch		2.8		Ω
			P-Ch		11		
C_{iss}	Input Capacitance	N-Channel $V_{GS}=0\text{V}, V_{DS}=25\text{V},$ Frequency=1.0MHz	N-Ch		450		pF
			P-Ch		770		
C_{oss}	Output Capacitance	P-Channel	N-Ch		65		
			P-Ch		120		
C_{rss}	Reverse Transfer Capacitance	$V_{GS}=0\text{V}, V_{DS}=-25\text{V},$	N-Ch		25		
			P-Ch		80		
$t_{d(ON)}$	Turn-on Delay Time	N-Channel $V_{DD}=15\text{V}, R_L=15\Omega,$ $I_{DS}=1\text{A}, V_{GEN}=10\text{V},$ $R_G=6\Omega$	N-Ch		10	15	ns
			P-Ch		10	20	
T_r	Turn-on Rise Time		N-Ch		8	20	
			P-Ch		15	30	
$t_{d(OFF)}$	Turn-off Delay Time	P-Channel $V_{DD}=-15\text{V}, R_L=15\Omega,$ $I_{DS}=-1\text{A}, V_{GEN}=-10\text{V},$ $R_G=6\Omega$	N-Ch		20	28	
			P-Ch		25	50	
T_f	Turn-off Fall Time		N-Ch		5	15	
			P-Ch		15	30	
Gate Charge Characteristics^b							
Q_g	Total Gate Charge	N-Channel $V_{DS}=15\text{V}, V_{GS}=10\text{V},$ $I_{DS}=5\text{A}$	N-Ch		15	21	nC
			P-Ch		26	35	
Q_{gs}	Gate-Source Charge	P-Channel $V_{DS}=-15\text{V}, V_{GS}=-10\text{V},$ $I_{DS}=-4\text{A}$	N-Ch		4.5		
			P-Ch		5.1		
Q_{gd}	Gate-Drain Charge		N-Ch		2.1		
			P-Ch		3.3		

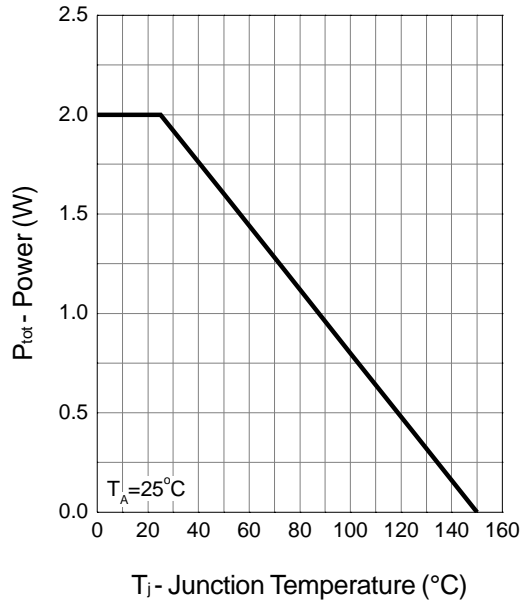
Notes:

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

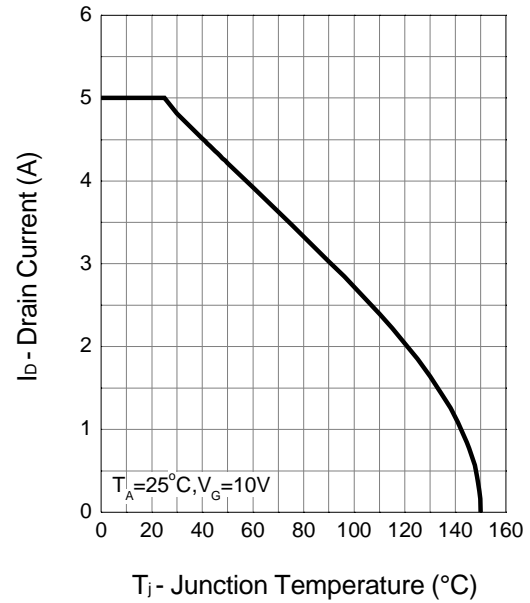
Typical Characteristics

N-Channel

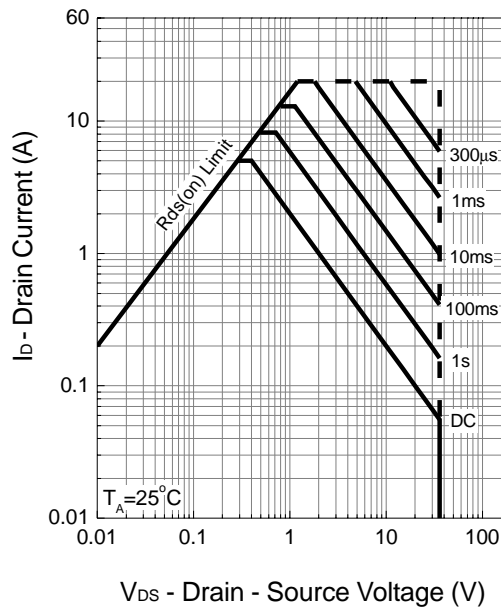
Power Dissipation



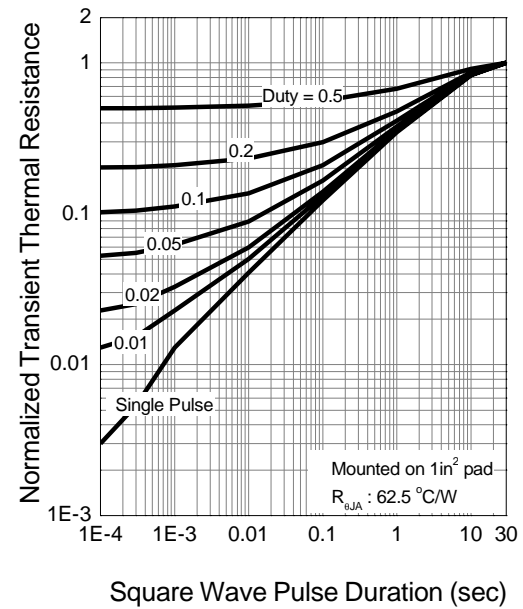
Drain Current



Safe Operation Area



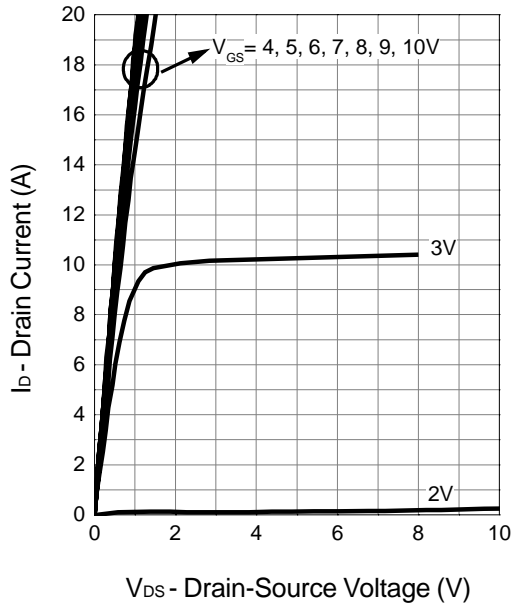
Thermal Transient Impedance



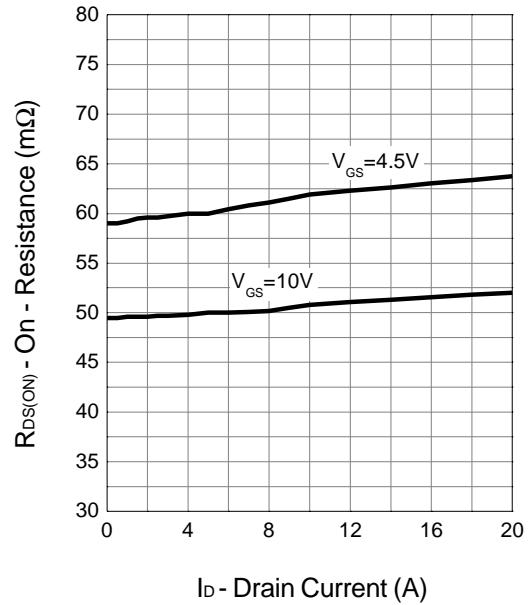
Typical Characteristics (Cont.)

N-Channel

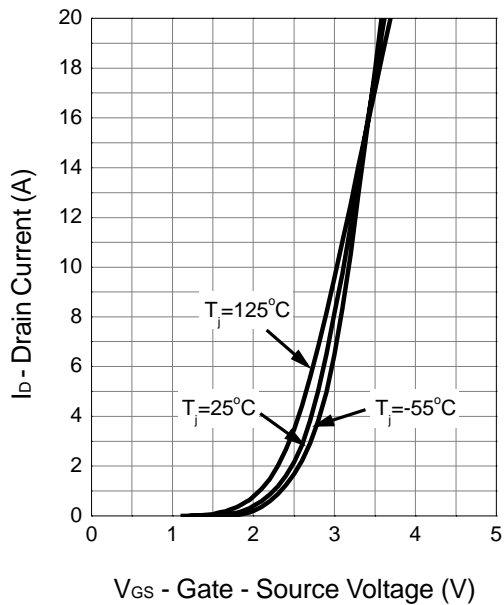
Output Characteristics



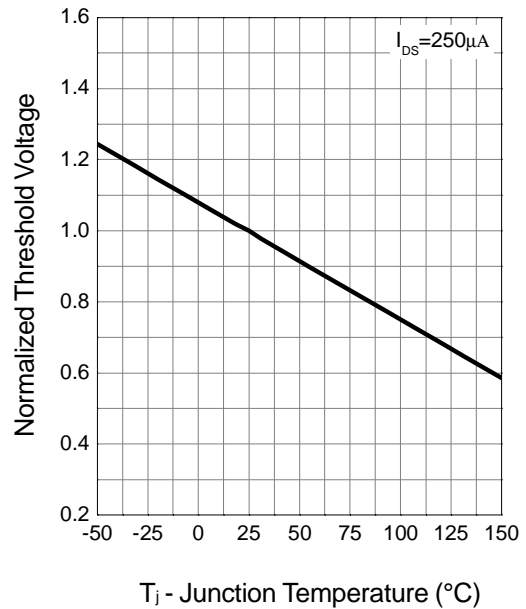
Drain-Source On Resistance



Transfer Characteristics



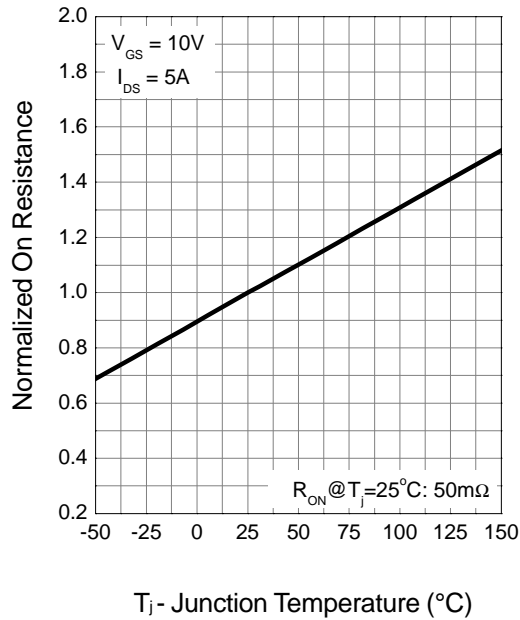
Gate Threshold Voltage



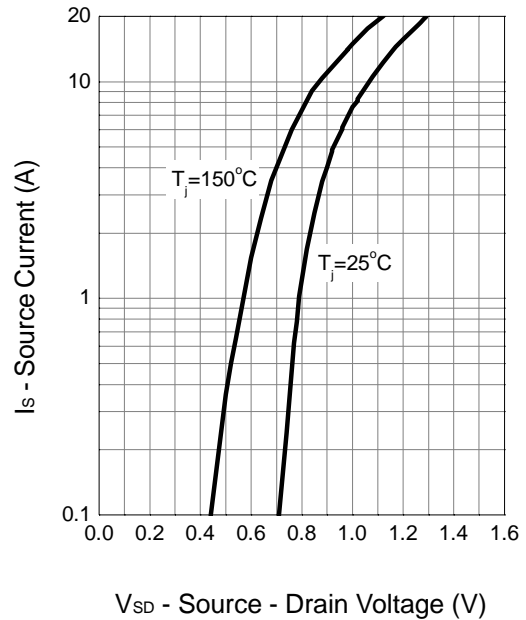
Typical Characteristics (Cont.)

N-Channel

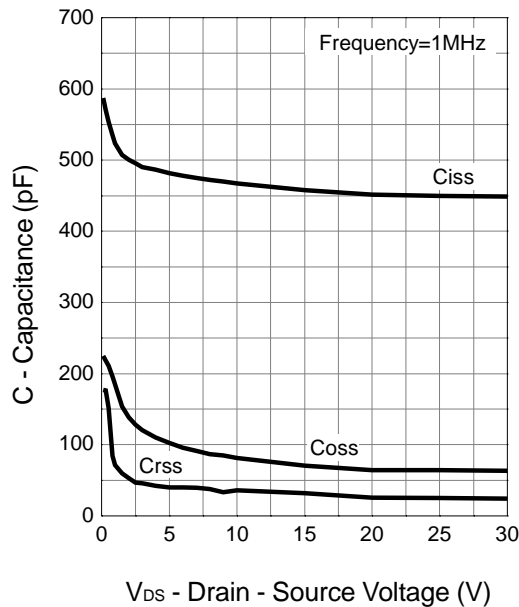
Drain-Source On Resistance



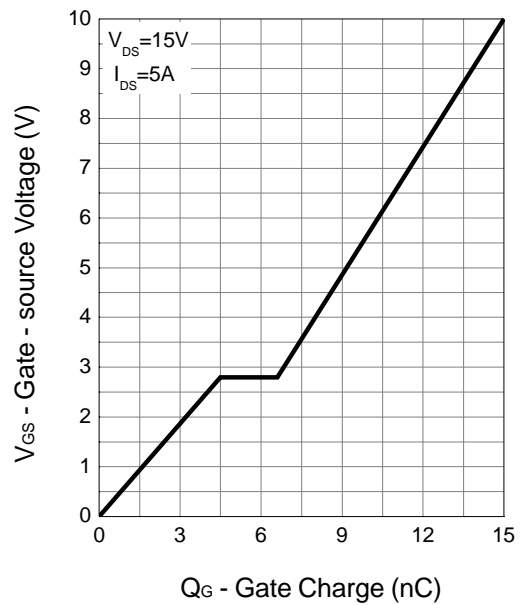
Source-Drain Diode Forward



Capacitance



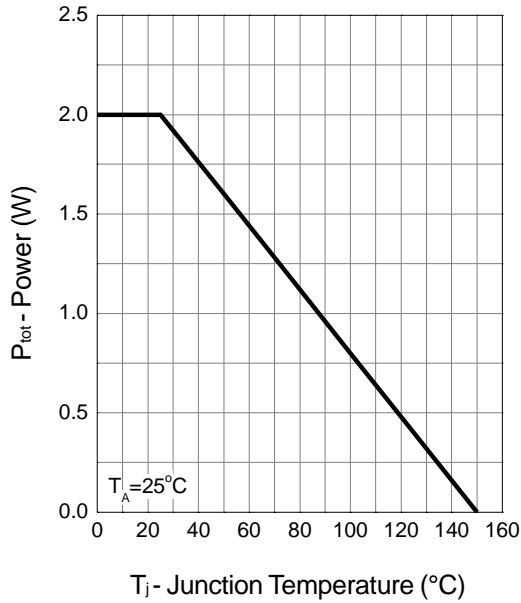
Gate Charge



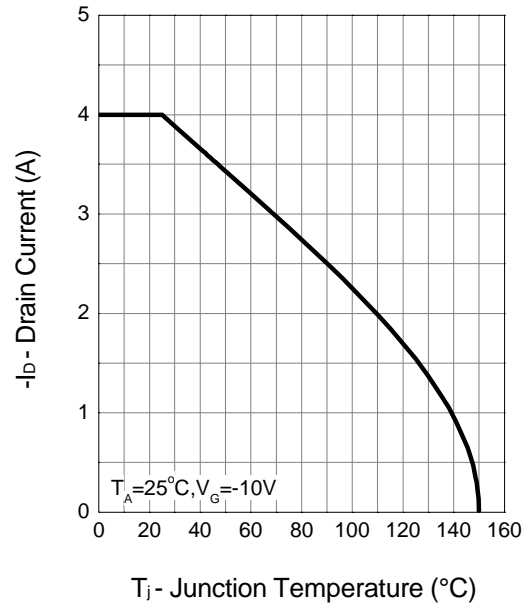
Typical Characteristics (Cont.)

P-Channel

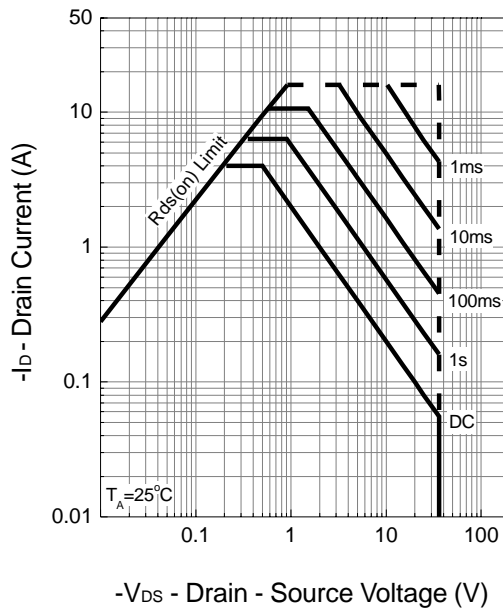
Power Dissipation



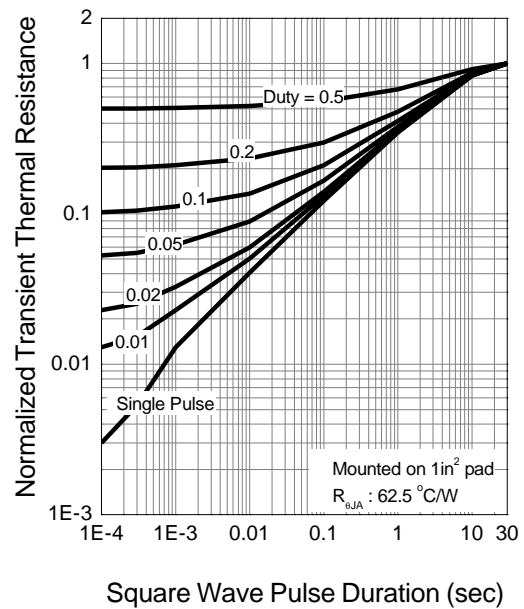
Drain Current



Safe Operation Area



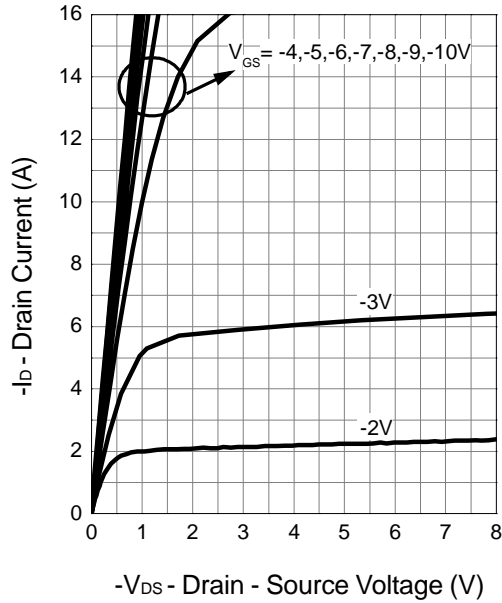
Thermal Transient Impedance



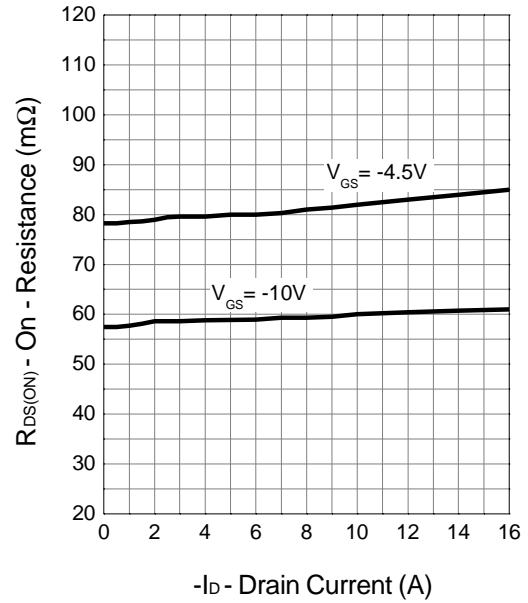
Typical Characteristics (Cont.)

P-Channel

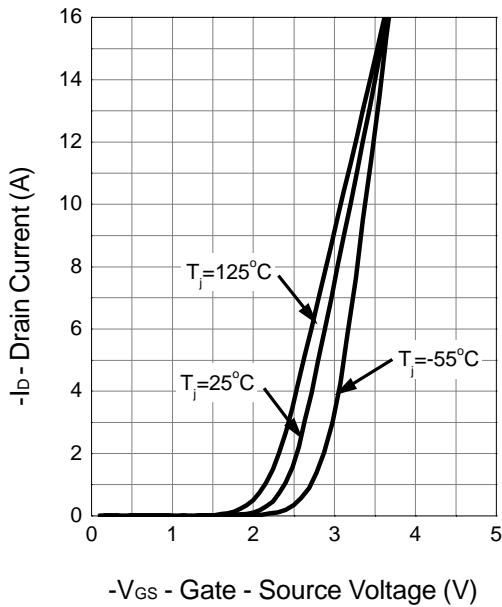
Output Characteristics



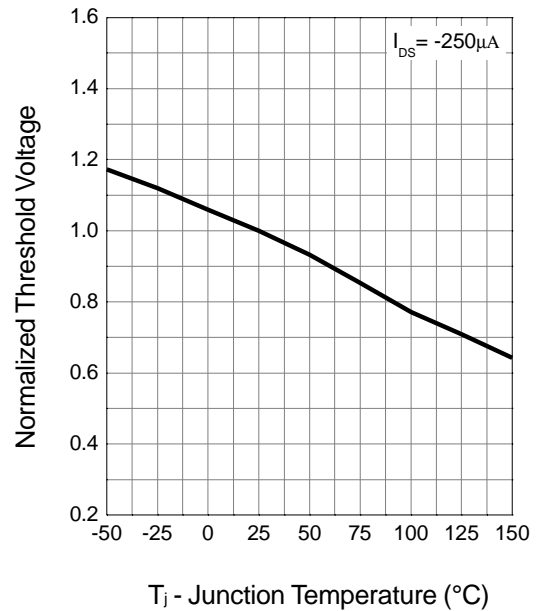
Drain-Source On Resistance



Transfer Characteristics



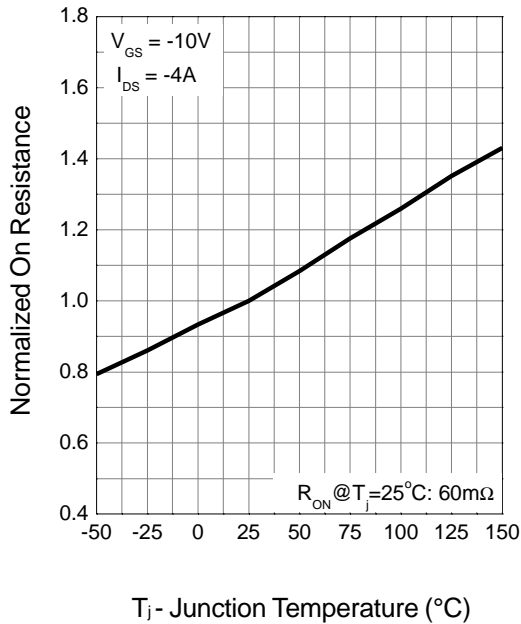
Gate Threshold Voltage



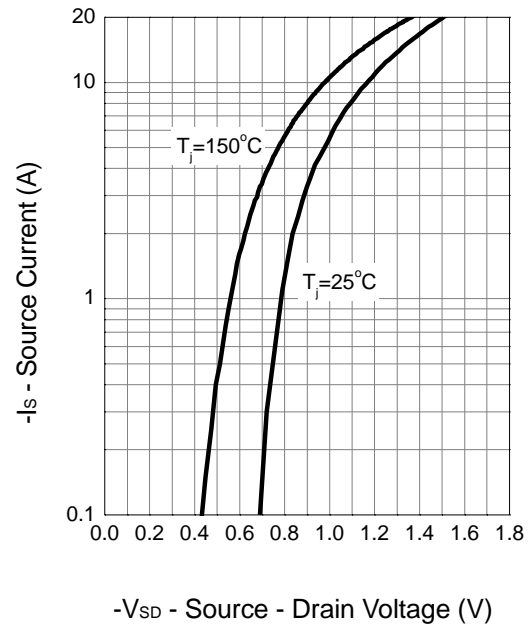
Typical Characteristics (Cont.)

P-Channel

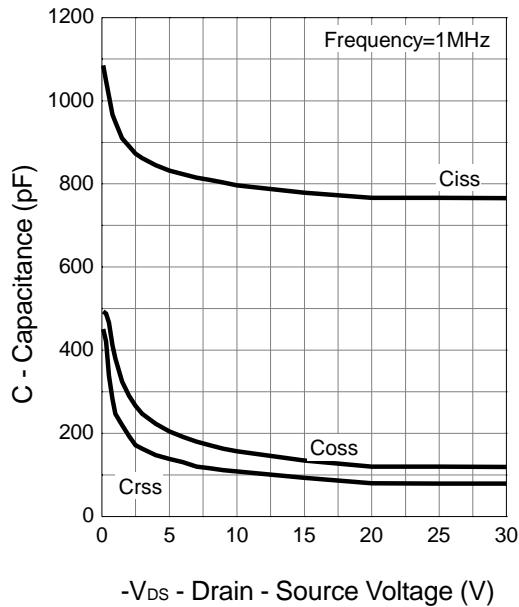
Drain-Source On Resistance



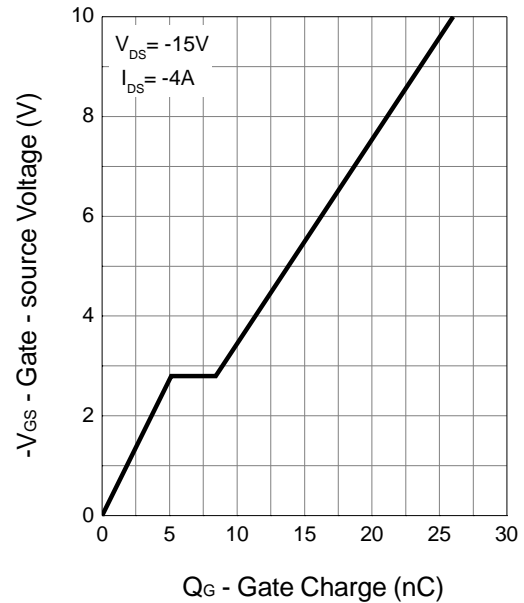
Source-Drain Diode Forward



Capacitance

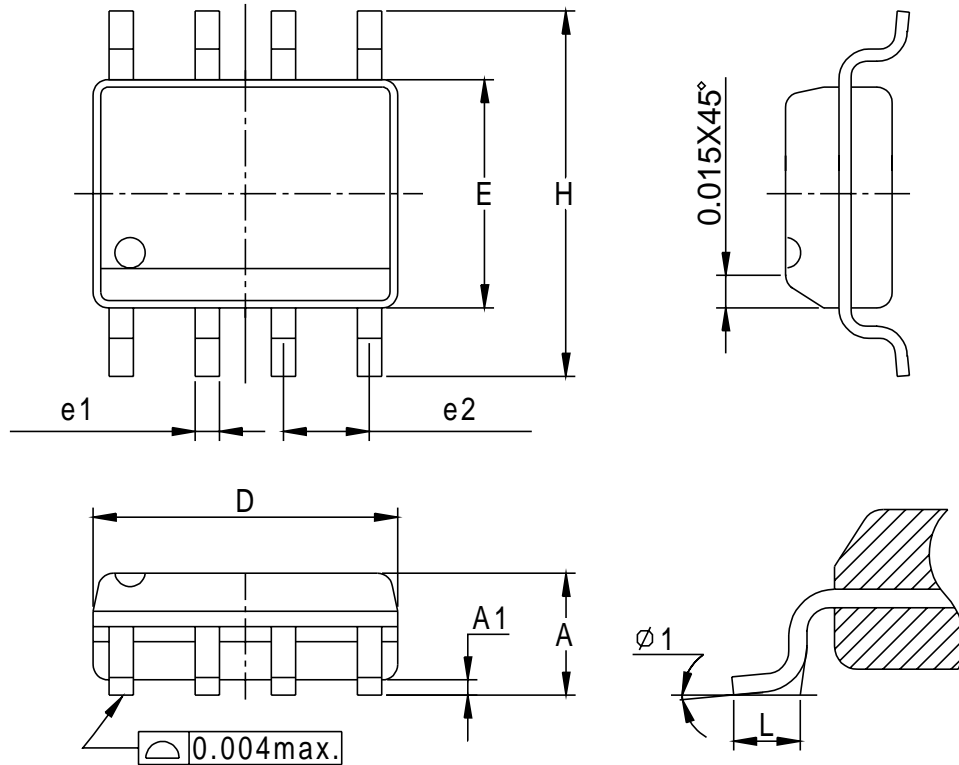


Gate Charge



Packaging Information

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

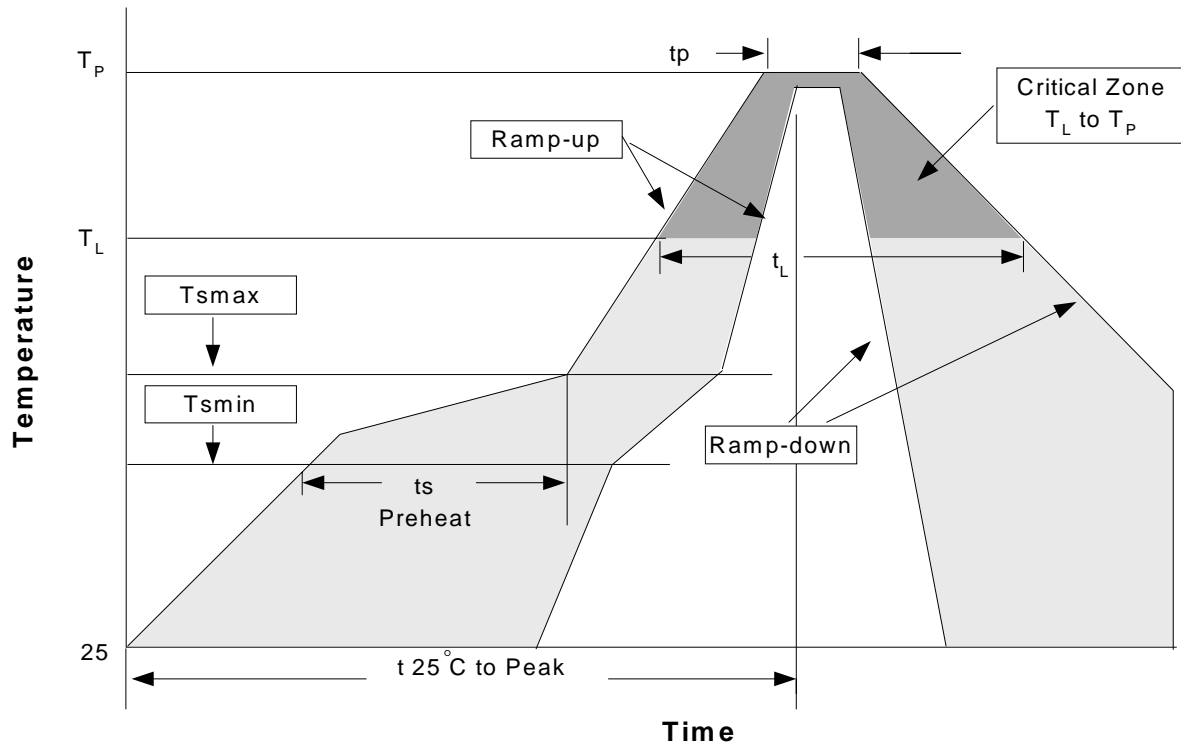


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
φ 1	8°		8°	

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 (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 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

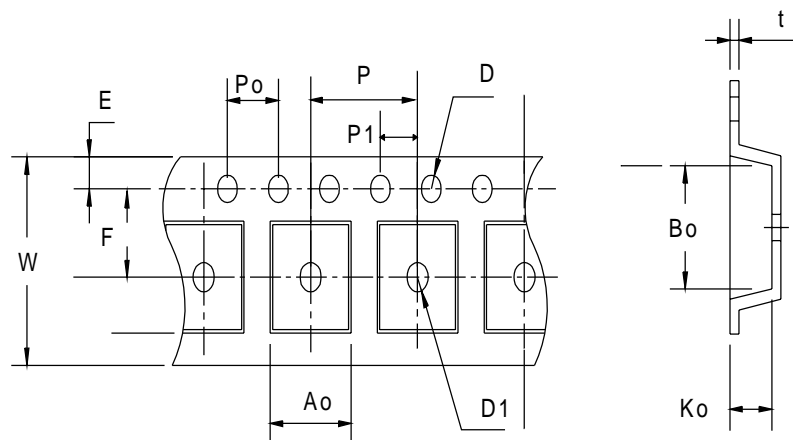
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

*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.

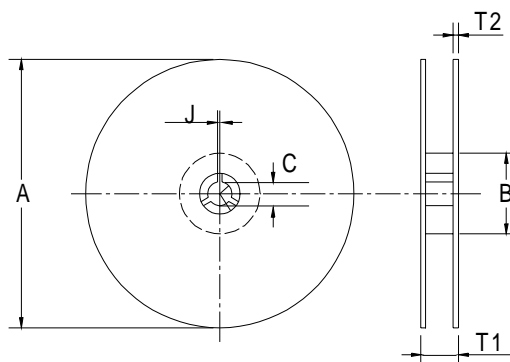
Reliability Test Program

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 + 0.15	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

Customer Service

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