

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

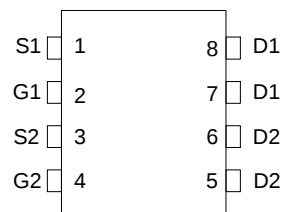
Features

- N-Channel
20V/3.5A,
 $R_{DS(ON)} = 45m\Omega (typ.) @ V_{GS} = 4.5V$
 $R_{DS(ON)} = 60m\Omega (typ.) @ V_{GS} = 2.5V$
 $R_{DS(ON)} = 90m\Omega (typ.) @ V_{GS} = 1.8V$
- P-Channel
-20V/-2.5A,
 $R_{DS(ON)} = 85m\Omega (typ.) @ V_{GS} = -4.5V$
 $R_{DS(ON)} = 120m\Omega (typ.) @ V_{GS} = -2.5V$
 $R_{DS(ON)} = 180m\Omega (typ.) @ V_{GS} = -1.8V$
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

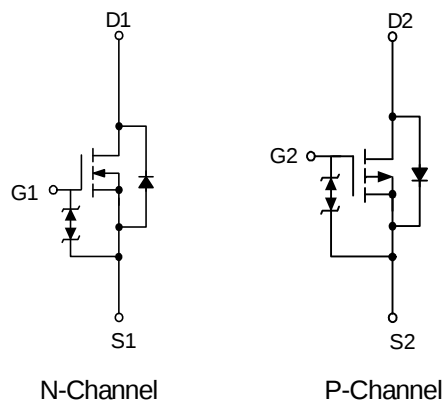
Applications

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

Pin Description



Top View of JSC70-8



Ordering and Marking Information

APM2104 □□-□□ □ Lead Free Code Handling Code Temp. Range Package Code	Package Code SG : JSC70-8 Operating Junction Temp. Range C : -55 to 150°C Handling Code TR : Tape & Reel Lead Free Code L : Lead Free Device
APM2104 SG :	M2104

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 soldering 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.

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.

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} =4.5V (N)	3.5	-2.5	A
I _{DM} *	Pulsed Drain Current	V _{GS} =-4.5V (P)	14	-10	
I _S *	Diode Continuous Forward Current		1.3	-1.3	A
T _J	Maximum Junction Temperature		150		°C
T _{STG}	Storage Temperature Range		-55 to 150		
P _D *	Power Dissipation	T _A =25°C	1.14		W
		T _A =100°C	0.45		
R _{θJA} *	Thermal Resistance-Junction to Ambient		110		°C/W

Note:

*Surface Mounted on 1in² pad area, t ≤ 5sec.

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

Symbol	Parameter	Test Condition	APM2104SG			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
				T _J =85°C			
		V _{DS} =-16V, V _{GS} =0V	P-Ch			-1	
				T _J =85°C			
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	N-Ch	0.5	0.7	1	V
		V _{DS} =V _{GS} , I _{DS} =-250μA	P-Ch	-0.5	-0.7	-1	
I _{GSS}	Gate Leakage Current	V _{GS} =±10V, V _{DS} =0V	N-Ch			±10	μA
		V _{GS} =±10V, V _{DS} =0V	P-Ch			±10	
V _{SD} ^a	Drain Forward Voltage	I _{DS} =1.3A, V _{GS} =0V	N-Ch		0.8	1.3	V
		I _{DS} =-1.3A, V _{GS} =0V	P-Ch		-0.8	-1.3	
R _{DS(ON)} ^a	Diode-Source On-State Resistance	V _{GS} =4.5V, I _{DS} =3.5A	N-Ch		45	60	mΩ
		V _{GS} =-4.5V, I _{DS} =-2.5A	P-Ch		85	110	
		V _{GS} =2.5V, I _{DS} =2.5A	N-Ch		60	85	
		V _{GS} =-2.5V, I _{DS} =-1.5A	P-Ch		120	165	
		V _{GS} =1.8V, I _{DS} =1.5A	N-Ch		90	140	
		V _{GS} =-1.8V, I _{DS} =-1A	P-Ch		180	275	

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

Symbol	Parameter	Test Condition	APM2104SG			Unit		
			Min.	Typ.	Max.			
Dynamic Characteristics ^b								
C _{iss}	Input Capacitance	N-Channel V _{GS} =0V, V _{DS} =10V, Frequency=1.0MHz	N-Ch		300		pF	
			P-Ch		390			
C _{oss}	Output Capacitance		N-Ch		70			
			P-Ch		50			
C _{rss}	Reverse Transfer Capacitance	N-Ch		60				
		P-Ch		40				
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	N-Ch		6	12	ns	
			P-Ch		10	19		
t _r	Turn-on Rise Time		N-Ch		20	37		
			P-Ch		21	39		
t _{d(OFF)}	Turn-off Delay Time		N-Ch		26	48		
			P-Ch		31	57		
t _f	Turn-off Fall Time		N-Ch		5	10		
			P-Ch		45	82		
t _{rr}	Reverse Recovery Time	N-Channel I _{DS} =3.5A, dI _{SD} /dt =100A/μs	N-Ch		16		nS	
			P-Ch		17			
Q _{rr}	Reverse Recovery Charge		P-Channel I _{DS} =-2.5A, dI _{SD} /dt =100A/μs	N-Ch		6		nC
				P-Ch		8		
Gate Charge Characteristics ^b								
Q _g	Total Gate Charge	N-Channel V _{DS} =10V, V _{GS} =4.5V, I _{DS} =3.5A		N-Ch		4.5	6	nC
			P-Ch		4.7	7		
Q _{gs}	Gate-Source Charge		N-Ch		0.9			
			P-Ch		1			
Q _{gd}	Gate-Drain Charge	P-Channel V _{DS} =-10V, V _{GS} =-4.5V, I _{DS} =-2.5A	N-Ch		0.9			
			P-Ch		1.6			

Notes:

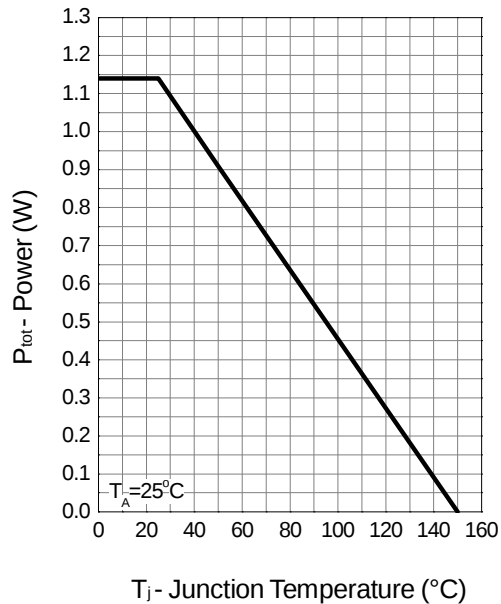
a : Pulse test ; pulse width ≤300μs, duty cycle ≤ 2%.

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

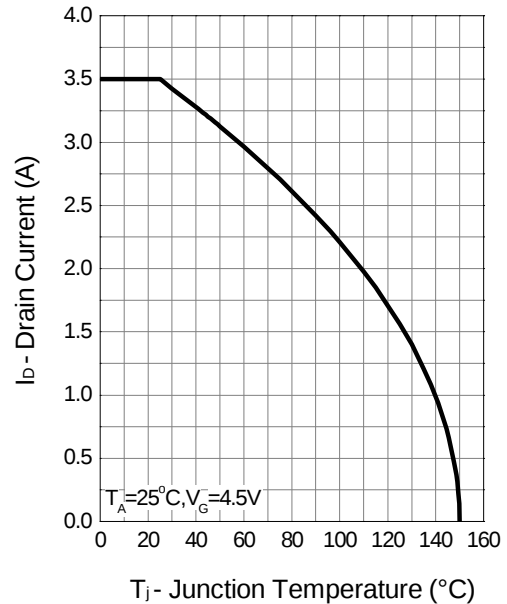
Typical Characteristics

N-Channel

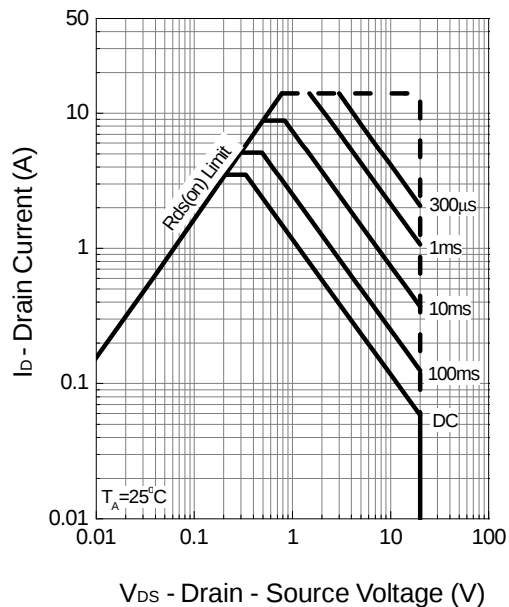
Power Dissipation



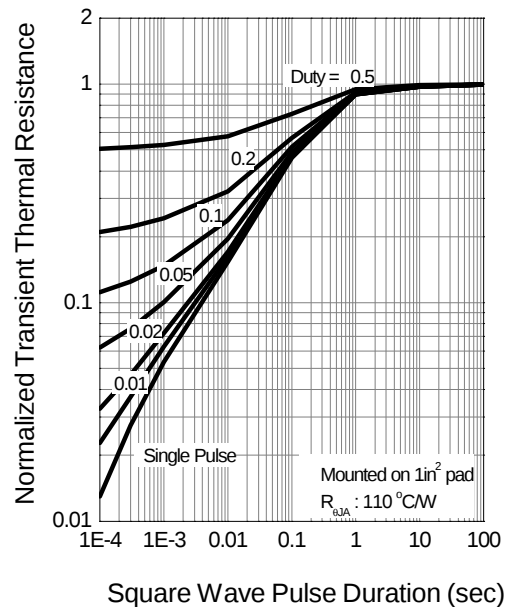
Drain Current



Safe Operation Area



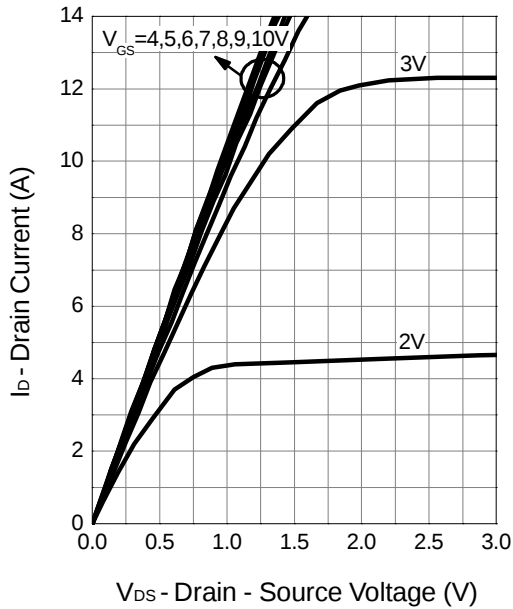
Thermal Transient Impedance



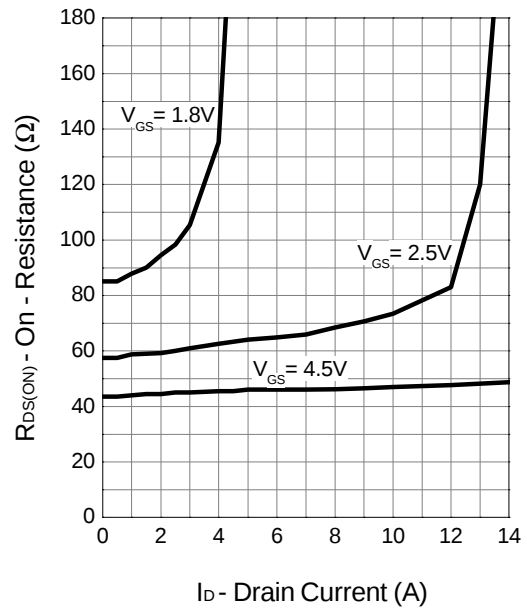
Typical Characteristics (Cont.)

N-Channel

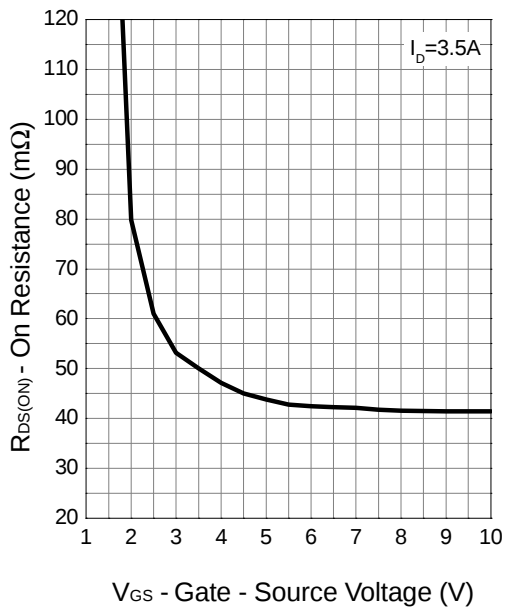
Output Characteristics



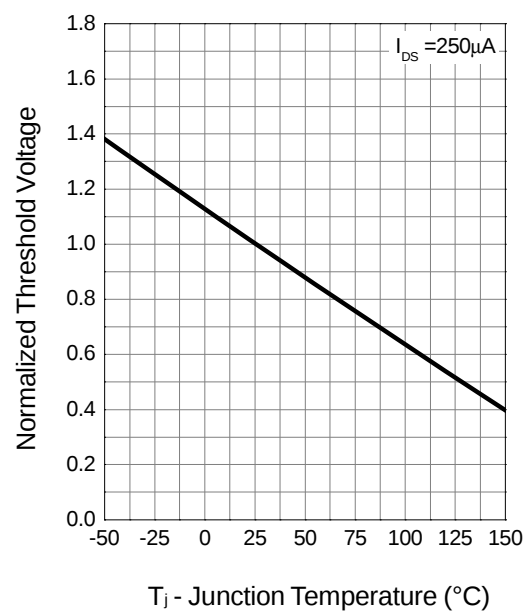
Drain-Source On Resistance



Drain-Source On Resistance



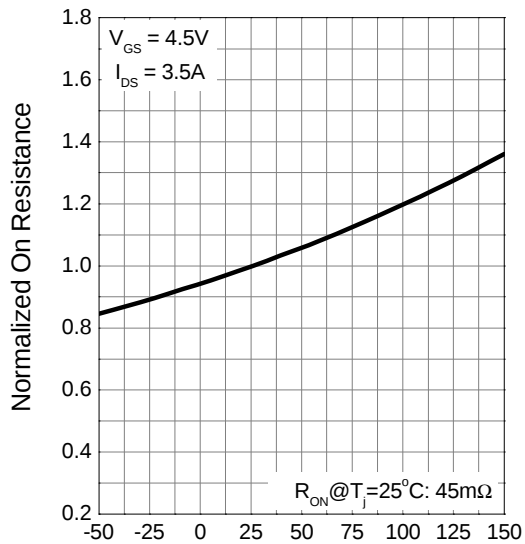
Gate Threshold Voltage



Typical Characteristics (Cont.)

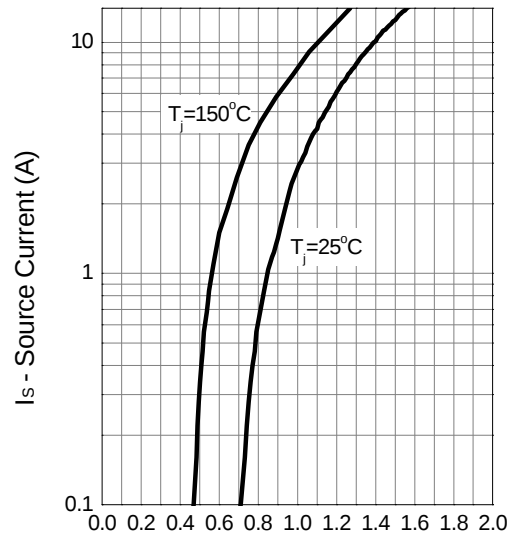
N-Channel

Drain-Source On Resistance



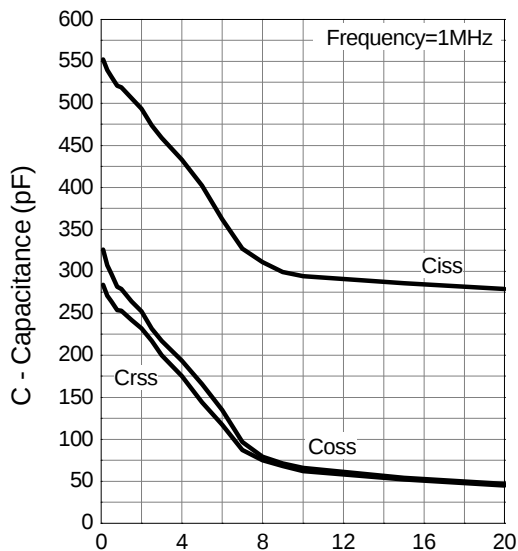
T_j - Junction Temperature ($^{\circ}\text{C}$)

Source-Drain Diode Forward



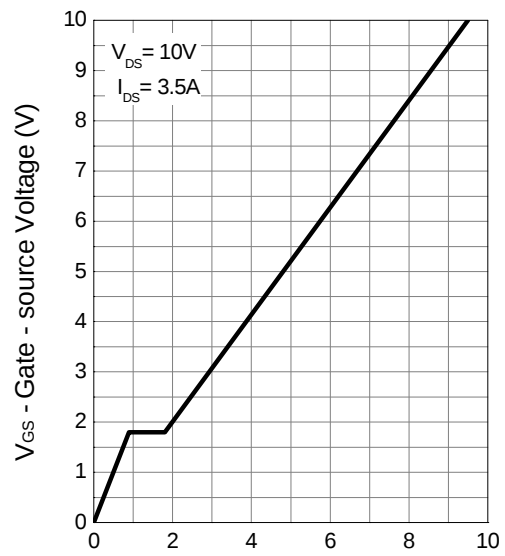
V_{SD} - Source - Drain Voltage (V)

Capacitance



V_{DS} - Drain - Source Voltage (V)

Gate Charge

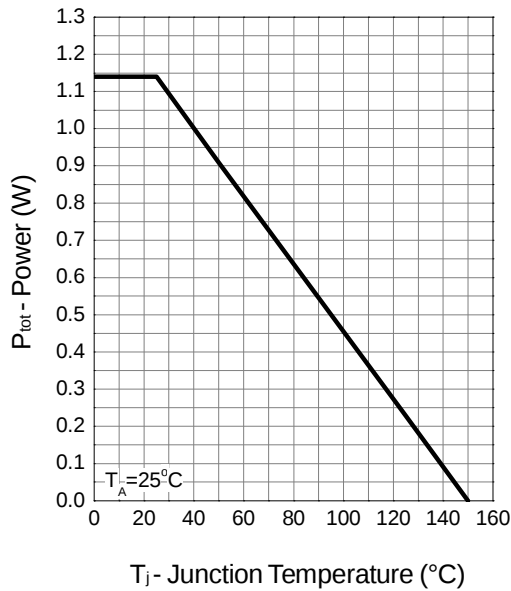


Q_G - Gate Charge (nC)

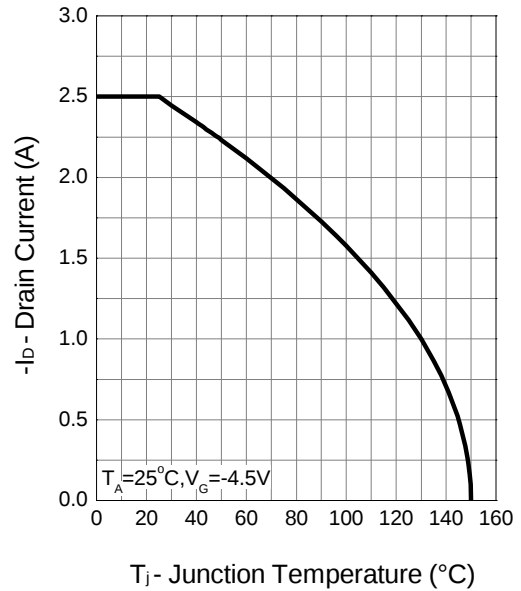
Typical Characteristics

P-Channel

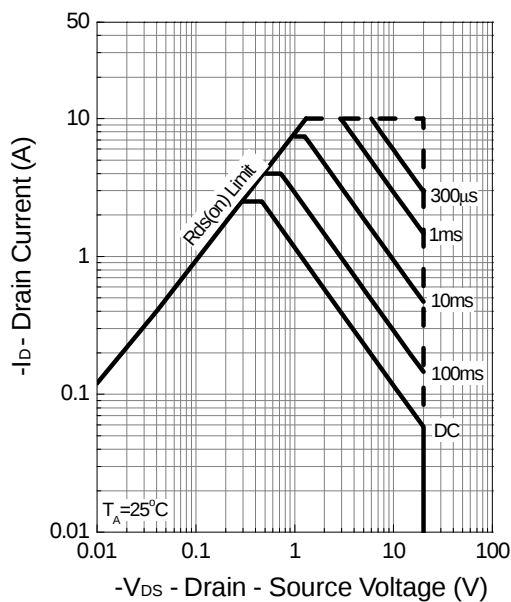
Power Dissipation



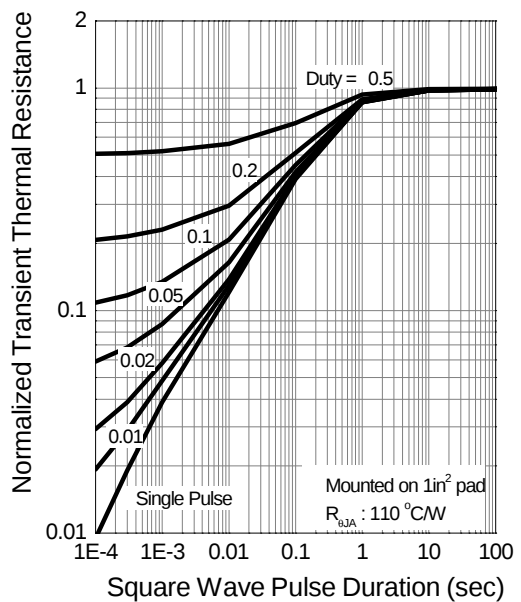
Drain Current



Safe Operation Area



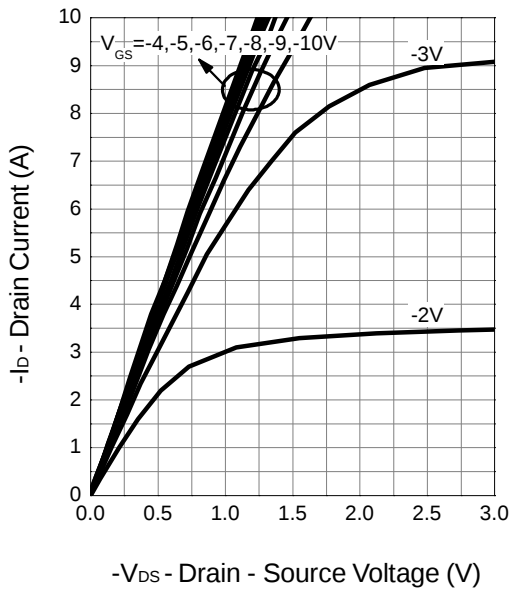
Thermal Transient Impedance



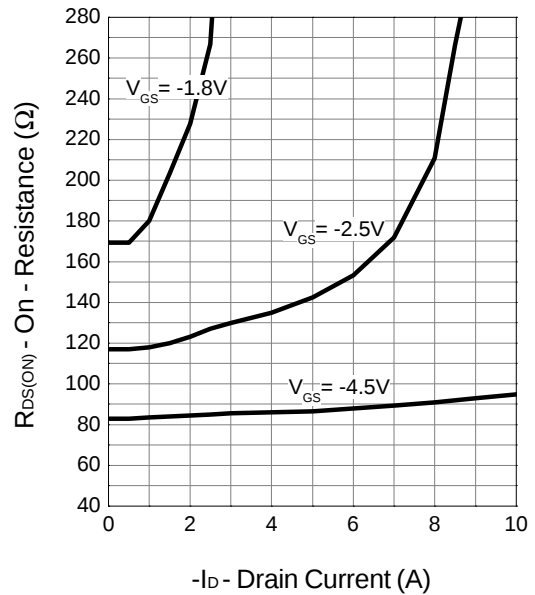
Typical Characteristics (Cont.)

P-Channel

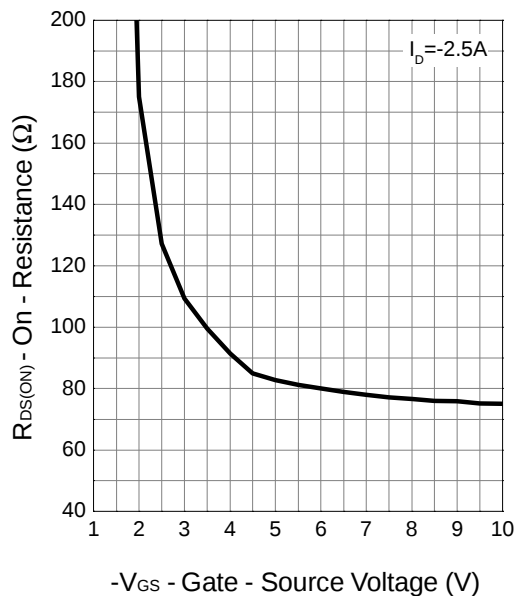
Output Characteristics



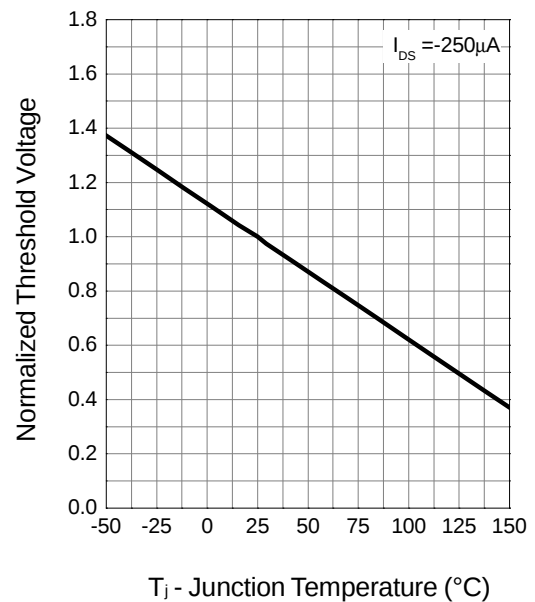
Drain-Source On Resistance



Drain-Source On Resistance



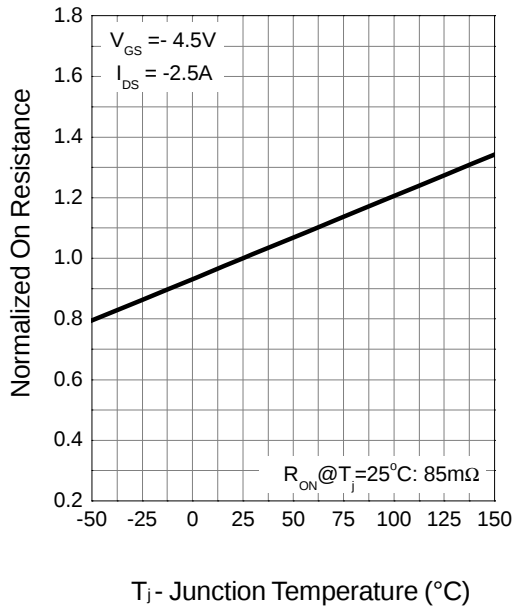
Gate Threshold Voltage



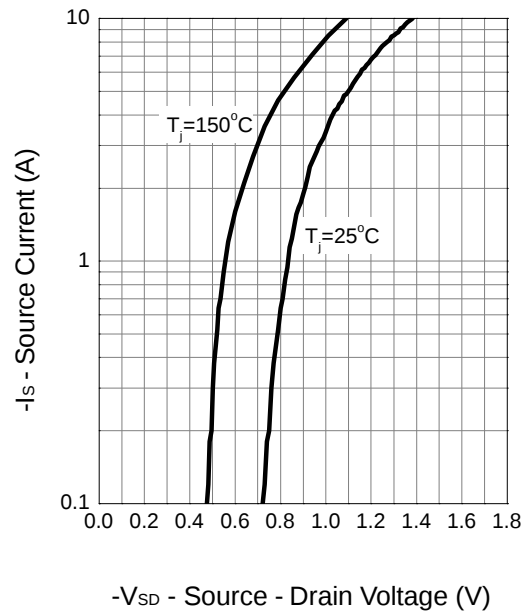
Typical Characteristics (Cont.)

P-Channel

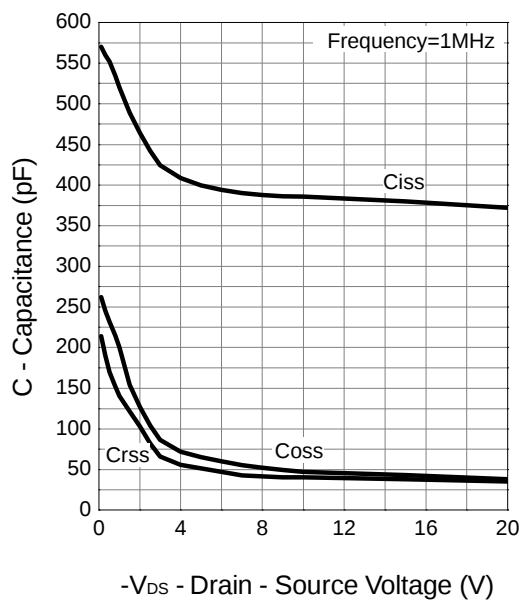
Drain-Source On Resistance



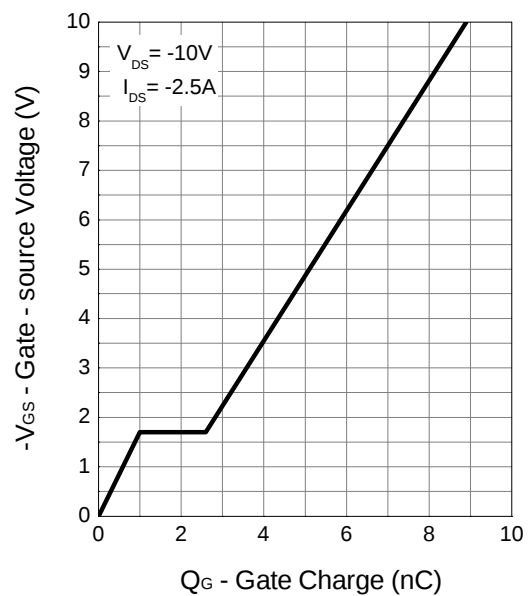
Source-Drain Diode Forward



Capacitance

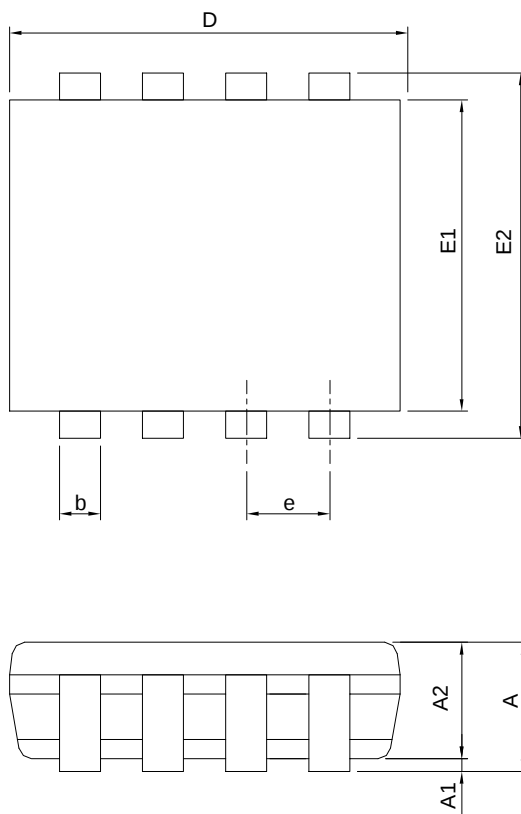


Gate Charge



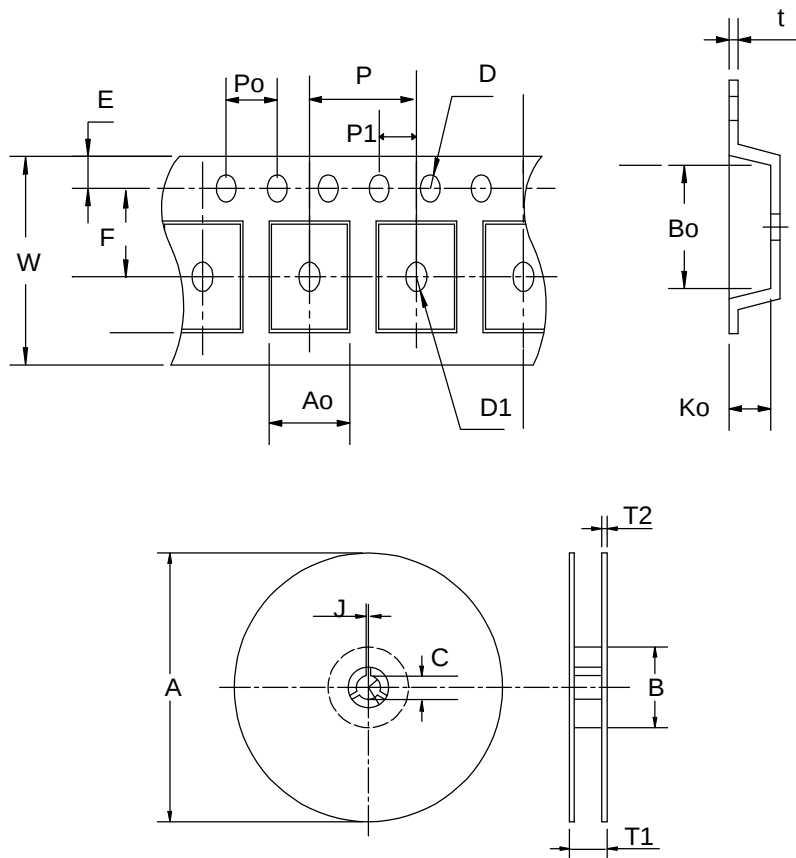
Package Information

JSC70-8



SYMBOL	JSC70-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.10		0.043
A1	0.00	0.10	0.000	0.004
A2	0.70	1.00	0.028	0.039
b	0.15	0.30	0.006	0.012
c	0.10	0.20	0.004	0.008
D	1.80	2.20	0.071	0.087
E	1.80	2.40	0.071	0.094
E1	1.65	1.85	0.065	0.073
E2	2.00	2.40	0.079	0.094
e	0.50 BSC		0.020 BSC	
θ	0°	8°	0°	8°
L	0.35	0.55	0.014	0.022

Carrier Tape & Reel Dimensions



Application	A	B	C	J	T1	T2	W	P	E
JSC70-8	178.0 $\pm$ 1.00	72.0 $\pm$ 1.00	13.0 $\pm$ 0.20	2.5 $\pm$ 0.15	8.4 $\pm$ 0.20	1.5 $\pm$ 0.30	8.0 $\pm$ 0.10	4.0 $\pm$ 0.10	1.75 $\pm$ 0.10
	F	D	D1	P0	P1	A0	B0	K0	t
	3.5 $\pm$ 0.05	1.55 $\pm$ 0.05	1.05 $\pm$ 0.05	4.0 $\pm$ 0.10	2.0 $\pm$ 0.10	2.4 $\pm$ 0.10	2.5 $\pm$ 0.10	1.3 $\pm$ 0.10	0.235 $\pm$ 0.03

(mm)

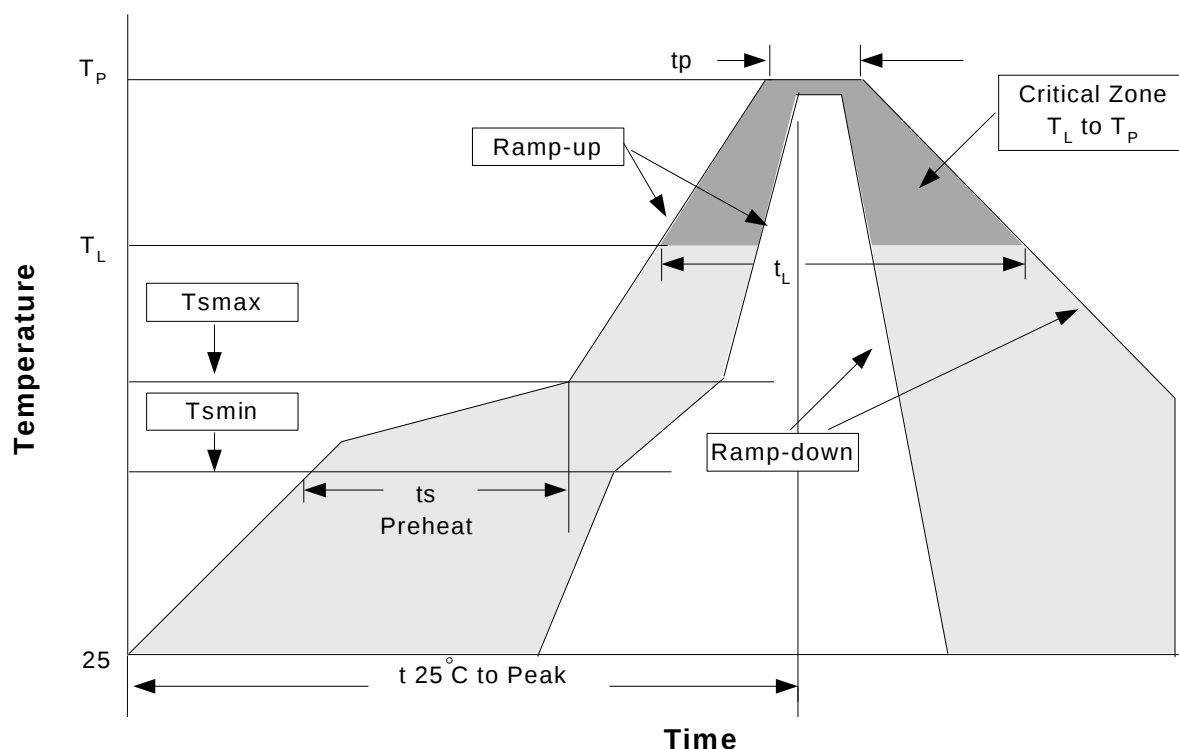
Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
JSC70-8	8	5.3	3000

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_{min}) - Temperature Max (T_{max}) - Time (min to max) (t_s)	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 (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

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