

General Description

The **AO4616** is the highest performance trench N-ch and P-ch MOSFETs with extreme high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The **AO4616** meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

Features

Advanced high cell density Trench technology

Super Low Gate Charge

Excellent CdV/dt effect decline

100% EAS Guaranteed

Green Device Available

Applications

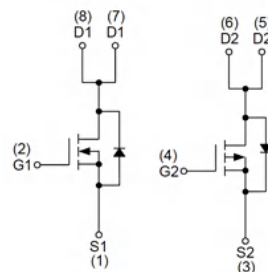
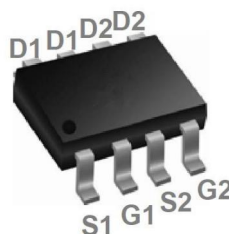
Power management in half bridge and inverters

DC-DC Converter

Load Switch

V_{DS} 30/-30 V
 I_D 9.0/-9.0 A
 $R_{DS(ON)}$ 15/18 m Ω

GK xxx
4616



MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
V_{DS}	Drain-Source Voltage	30	-30	V
V_{GS}	Gate-Source Voltage	± 20	± 20	V
$I_D@T_C=25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10V^1$	9	-9	A
$I_D@T_C=100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10V^1$	7	-6	A
I_{DM}	Pulsed Drain Current ²	28	-35	A
EAS	Single Pulse Avalanche Energy ³	72	62	mJ
I_{AS}	Avalanche Current	28	-32	A
$P_D@T_C=25^\circ\text{C}$	Total Power Dissipation ⁴	2.5	3.08	W
T_{STG}	Storage Temperature Range	-55 to 150	-55 to 150	$^\circ\text{C}$
T_J	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^\circ\text{C}$

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	---	45	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	30	$^\circ\text{C/W}$

N-Channel Electrical Characteristics (T_J=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =250uA	30	---	---	V
ΔBV _{DSS} /ΔT _J	BVDSS Temperature Coefficient	Reference to 25°C, I _D =1mA	---	0.034	---	V/°C
R _{DS(ON)}	Static Drain-Source On-Resistance ²	V _{GS} =10V, I _D =6A	---	15	20	mΩ
		V _{GS} =4.5V, I _D =5A	---	25	31	
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =250uA	1.0	1.5	2.5	V
ΔV _{GS(th)}	V _{GS(th)} Temperature Coefficient		---	-5.8	---	mV/°C
I _{DSS}	Drain-Source Leakage Current	V _{DS} =30V, V _{GS} =0V, T _J =25°C	---	---	1	uA
		V _{DS} =30V, V _{GS} =0V, T _J =55°C	---	---	5	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±20V, V _{DS} =0V	---	---	±100	nA
g _{fs}	Forward Transconductance	V _{DS} =15V, I _D =5A	---	10	---	S
R _g	Gate Resistance	V _{DS} =24V, V _{GS} =0V, f=1MHz	---	2.5	---	Ω
Q _g	Total Gate Charge (4.5V)	V _{DS} =20V, V _{GS} =4.5V, I _D =6A	---	7.2	---	nC
Q _{gs}	Gate-Source Charge		---	1.4	---	
Q _{gd}	Gate-Drain Charge		---	2.2	---	
T _{d(on)}	Turn-On Delay Time	V _{DD} =12V, V _{GS} =10V, R _G =3.3Ω I _D =5A	---	3.9	---	ns
T _r	Rise Time		---	9.2	---	
T _{d(off)}	Turn-Off Delay Time		---	14.5	---	
T _f	Fall Time		---	6.0	---	
C _{iss}	Input Capacitance	V _{DS} =25V, V _{GS} =0V, f=1MHz	---	370	---	pF
C _{oss}	Output Capacitance		---	54	---	
C _{rss}	Reverse Transfer Capacitance		---	40	---	

Guaranteed Avalanche Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
EAS	Single Pulse Avalanche Energy ⁵	V _{DD} =25V, L=0.1mH, I _{AS} =10A	16	---	---	mJ

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I _S	Continuous Source Current ^{1,6}	V _G =V _D =0V, Force Current	---	---	9	A
I _{SM}	Pulsed Source Current ^{2,6}		---	---	20	A
V _{SD}	Diode Forward Voltage ²	V _{GS} =0V, I _S =5A, T _J =25°C	---	---	1.2	V

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper, t<10sec.
- 2.The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
- 3.The EAS data shows Max. rating. The test condition is V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=10A
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The Min. value is 100% EAS tested guarantee.
- 6.The data is theoretically the same as I_D and I_{DM}, in real applications, should be limited by total power dissipation.

P-Channel Electrical Characteristics (T_J=25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D = -250μA	-30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = -30V, V _{GS} =0V,	-	-	-1	μA
I _{GSS}	Gate to Body Leakage Current	V _{DS} =0V, V _{GS} = ±20V	-	-	±100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D = -250μA	-1.0	-1.5	-2.5	V
R _{DS(on)}	Static Drain-Source on-Resistance note3	V _{GS} = -10V, I _D = -7A	-	18	25	mΩ
		V _{GS} = -4.5V, I _D = -4A	-	28	40	
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = -15V, V _{GS} =0V, f=1.0MHz	-	982	-	pF
C _{oss}	Output Capacitance		-	135	-	pF
C _{rss}	Reverse Transfer Capacitance		-	109	-	pF
Q _g	Total Gate Charge	V _{DS} = -15V, I _D = -4A, V _{GS} = -10V	-	10	-	nC
Q _{gs}	Gate-Source Charge		-	2	-	nC
Q _{gd}	Gate-Drain(“Miller”) Charge		-	2.7	-	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DD} = -15V, I _D = -7A, V _{GS} = -10V, R _{GEN} =2.5Ω	-	11	-	ns
t _r	Turn-on Rise Time		-	19	-	ns
t _{d(off)}	Turn-off Delay Time		-	45	-	ns
t _f	Turn-off Fall Time		-	26	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	-9	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-28	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} =0V, I _S = -7A	-	-0.8	-1.2	V

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

RATING AND CHARACTERISTIC CURVES

Typical Performance Characteristics-N

Figure1: Output Characteristics

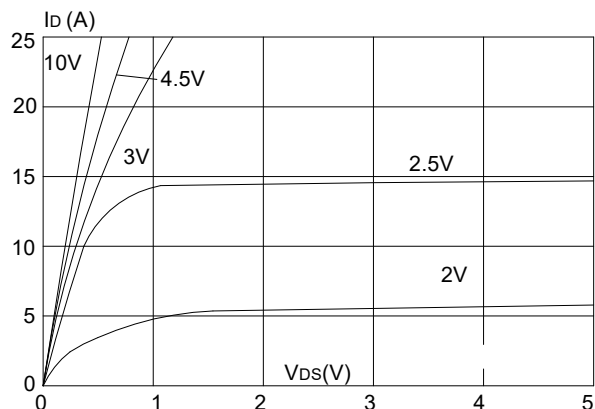


Figure 2: Typical Transfer Characteristics

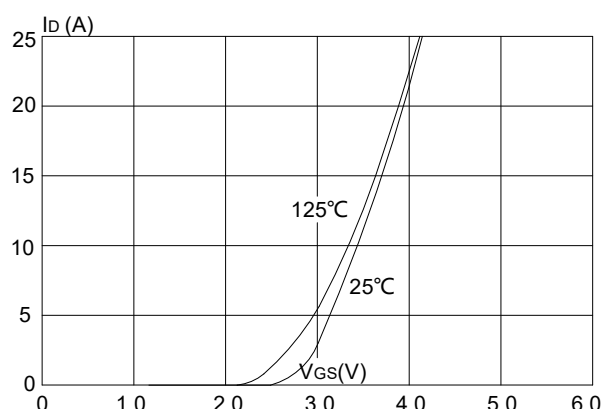


Figure 3: On-resistance vs. Drain Current

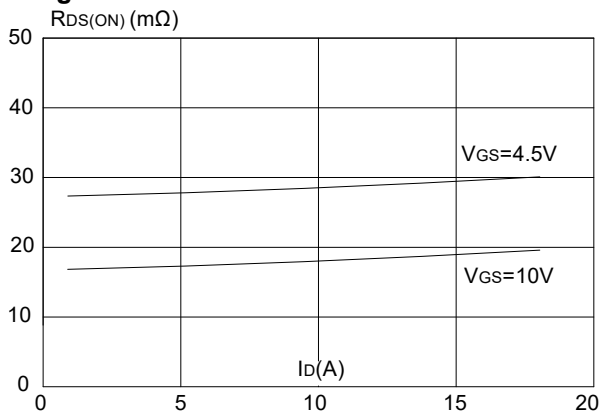


Figure 4: Body Diode Characteristics

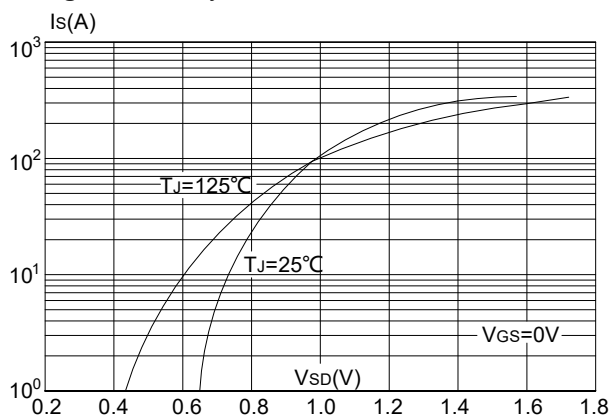


Figure 5: Gate Charge Characteristics

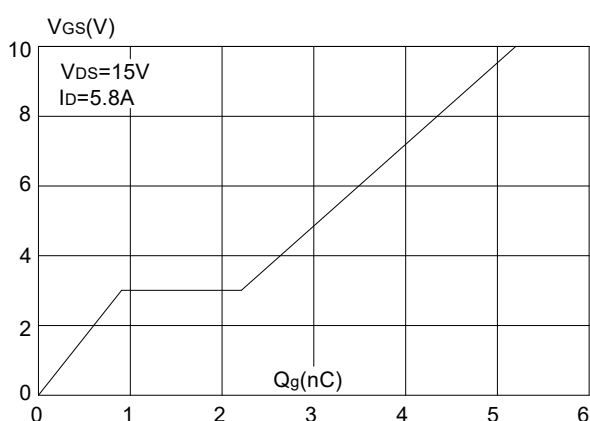
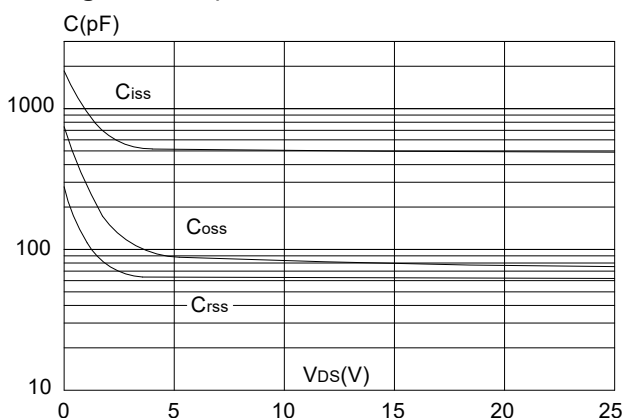


Figure 6: Capacitance Characteristics



RATING AND CHARACTERISTIC CURVES

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

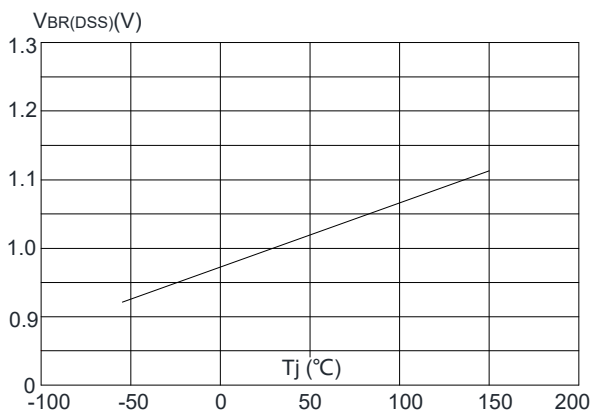


Figure 8: Normalized on Resistance vs. Junction Temperature

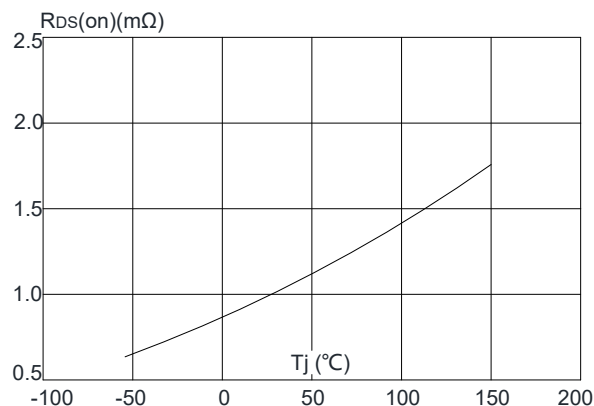


Figure 9: Maximum Safe Operating Area

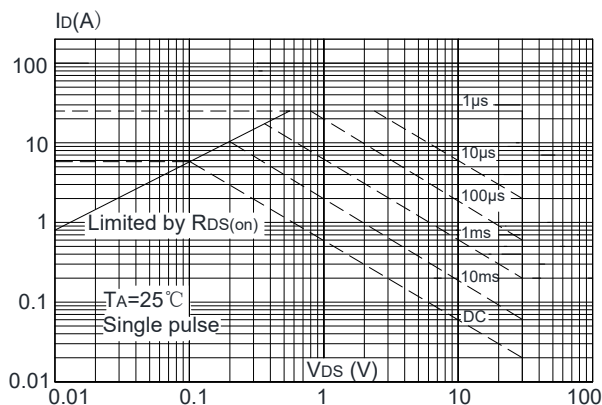


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

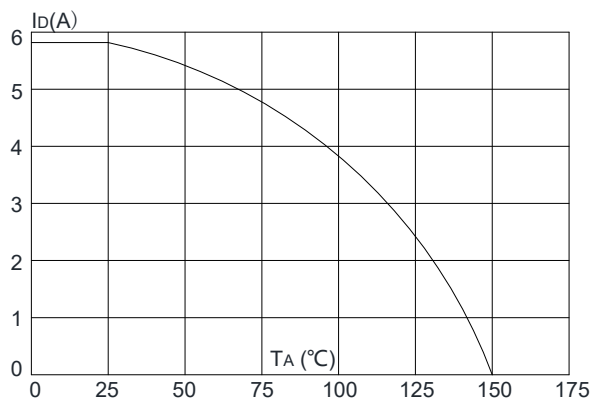
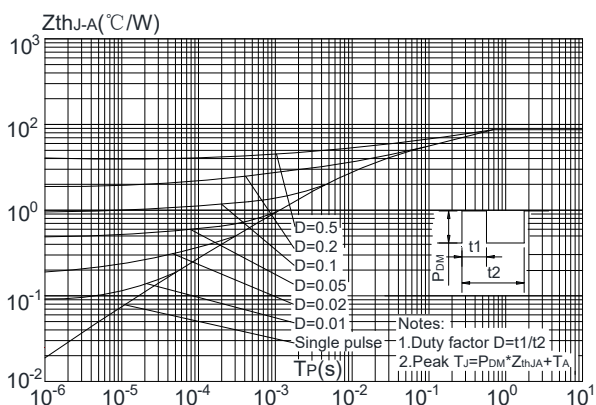


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



RATING AND CHARACTERISTIC CURVES

Typical Performance Characteristics P

Figure1: Output Characteristics

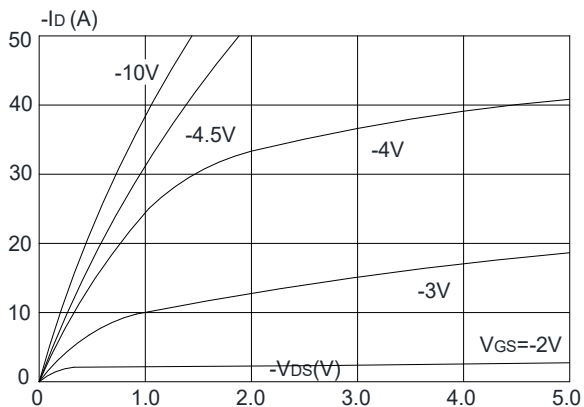


Figure 2: Typical Transfer Characteristics

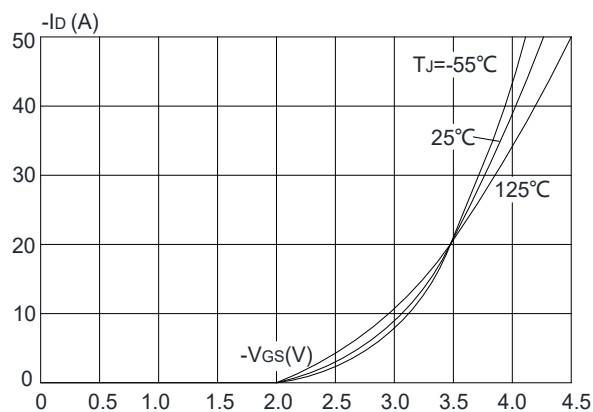


Figure 3: On-resistance vs. Drain Current

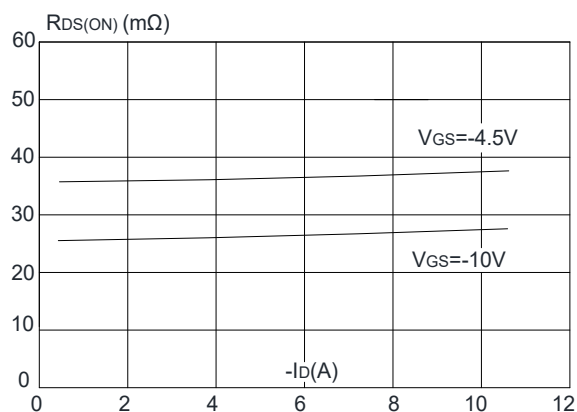


Figure 4: Body Diode Characteristics

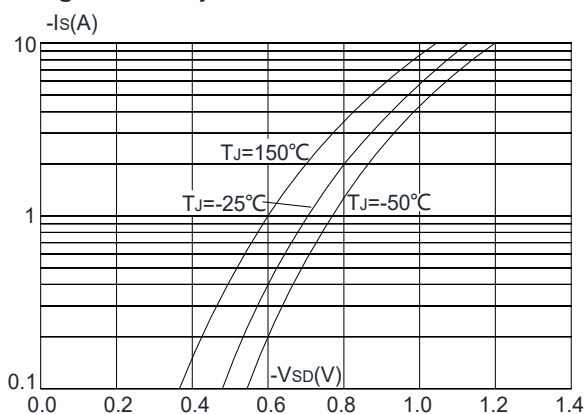


Figure 5: Gate Charge Characteristics

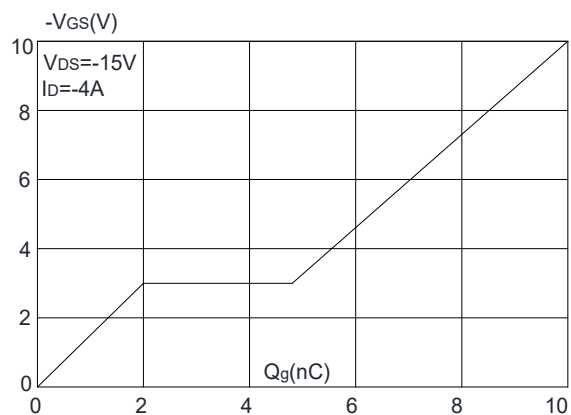
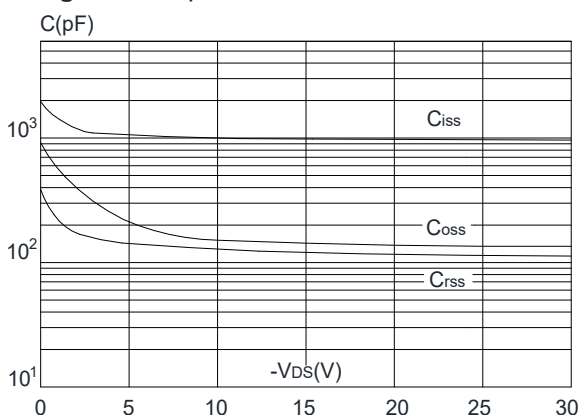


Figure 6: Capacitance Characteristics



RATING AND CHARACTERISTIC CURVES

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

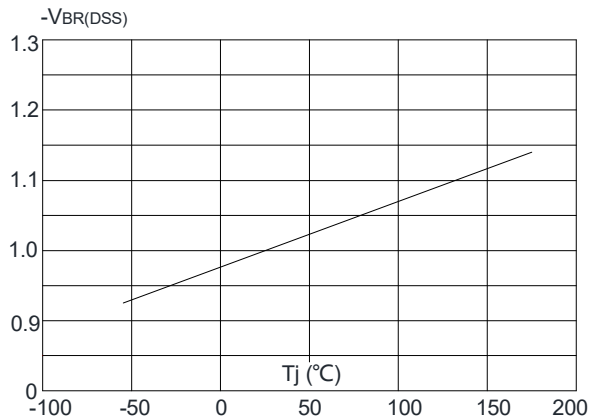


Figure 8: Normalized on Resistance vs. Junction Temperature

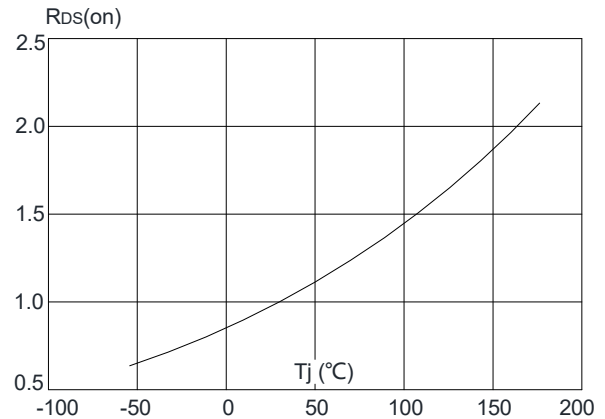


Figure 9: Maximum Safe Operating Area

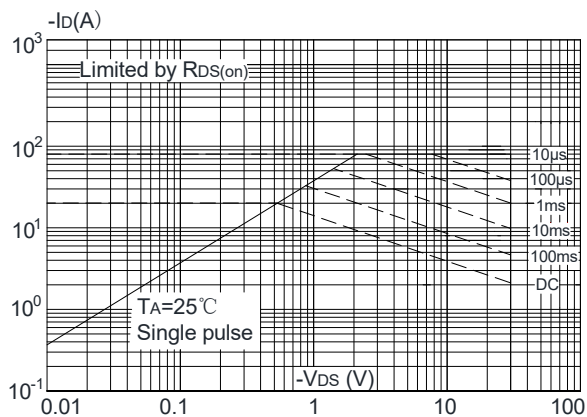


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

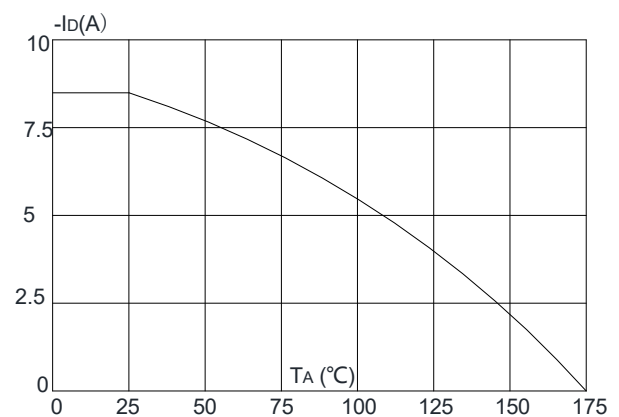
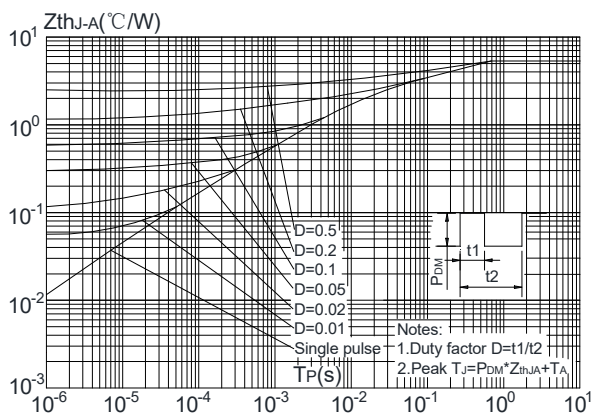
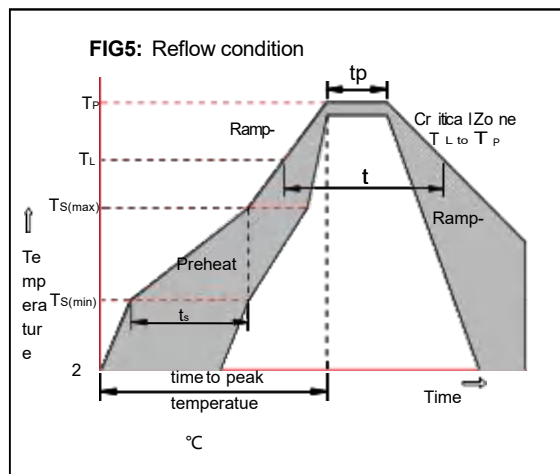


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



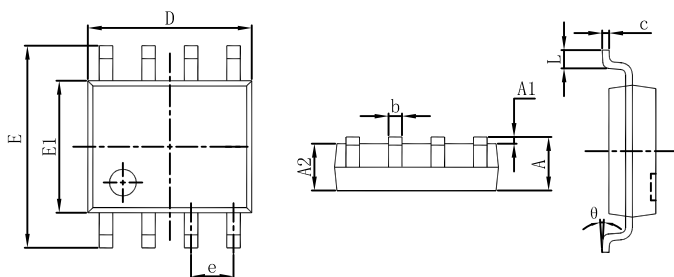
Soldering parameters

Reflow Condition		Pb-Free assembly (see as bellow)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150°C
	-Temperature Max($T_{s(max)}$)	+200°C
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3°C/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217°C
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_P)		+260(+0/-5)°C
Time within 5°C of actual Peak Temp (t_P)		30 secs. Max
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp (T_P)		8 min. Max
Do not exceed		+260°C

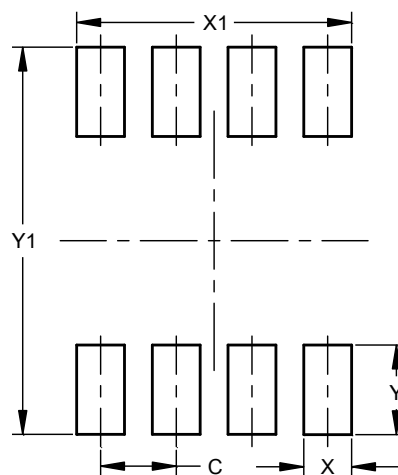


Package Dimensions & Suggested Pad Layout

SOP-8



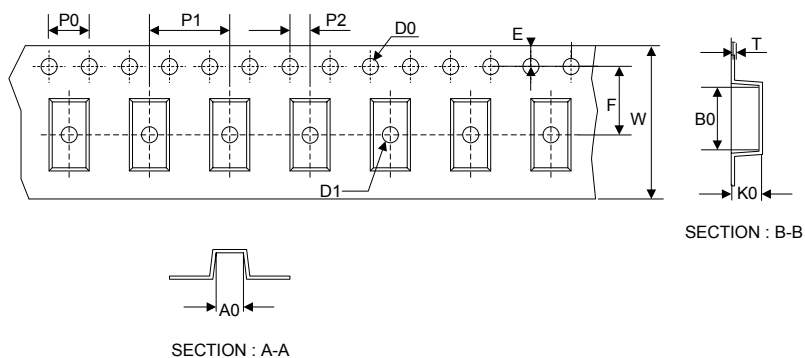
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270 (BSC)		0.050 (BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



Dimensions	Value (in mm)
C	1.27
X	0.70
X1	4.51
Y	2.00
Y1	7.00

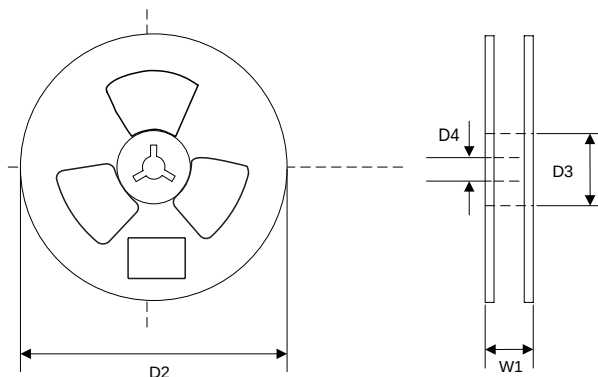
Tape & reel specification

Tape



Symbol	Dimension (mm)
P0	4.00±0.20
P1	8.00±0.20
P2	2.00±0.20
D0	1.55±0.20
D1	1.55±0.20
E	1.75±0.15
F	5.50±0.20
W	12.00±0.20
A0	7.00±0.20
B0	5.70±0.20
K0	1.35±0.20
T	0.23±0.20

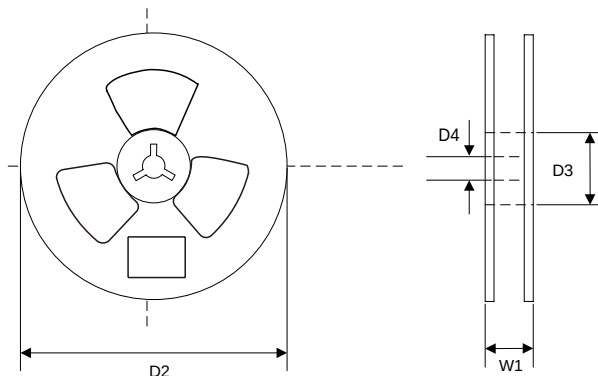
13" Reel



D2	330.0±5.0
D3	73Min.
D4	13.5±2.5
W1	16.0±3.0

Quantity: 3000PCS

13" Reel



D2	330.0±5.0
D3	73Min.
D4	13.5±2.5
W1	16.0±3.0

Quantity: 4000PCS