

## Description:

This N+P Channel MOSFET uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge.

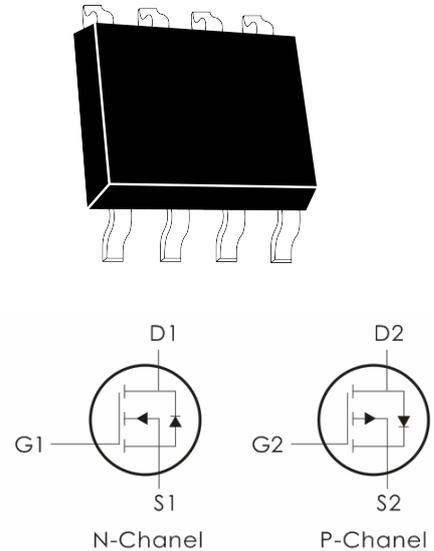
It can be used in a wide variety of applications.

## Features:

N-Channel:  $V_{DS}=30V, I_D=15A, R_{DS(ON)} < 13m\ \Omega @ V_{GS}=10V$

P-Channel:  $V_{DS}=-30V, I_D=-15A, R_{DS(ON)} < 20m\ \Omega @ V_{GS}=-10V$

- 1)
- 2) Low gate charge.
- 3) Green device available.
- 4) Advanced high cell density trench technology for ultra low  $R_{DS(ON)}$ .
- 5) Excellent package for good heat dissipation.



## Absolute Maximum Ratings: ( $T_C=25^\circ C$ unless otherwise noted)

Symbol	Parameter	N-Channel	P-Channel	Units
$V_{DS}$	Drain-Source Voltage	30	-30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D$	Continuous Drain Current- $T_C=25^\circ C$	15	-15	A
	Continuous Drain Current- $T_C=100^\circ C$	9.5	-9.5	
$I_{DM}$	Pulsed Drain Current <sup>note1</sup>	64	64	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>note2</sup>	35	35	mJ
$P_D$	Power Dissipation - $T_C=25^\circ C$	7	7	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		$^\circ C$

## Thermal Characteristics:

Symbol	Parameter	N-CH	P-CH	Units
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	17.8	17.8	$^\circ C/W$

## Package Marking and Ordering Information:

Part NO.	Marking	Package
JH4616B	4616B	DFN3*3-8D

## N-Channel Electrical Characteristics: ( $T_C=25^\circ\text{C}$ unless otherwise noted)

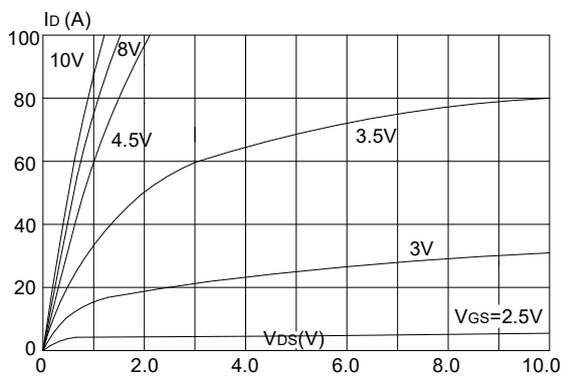
Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\ \mu\text{A}$	30	---	---	V
$I_{DSS}$	Drain-Source Leakage Current	$V_{GS}=0V, V_{DS}=30V$	---	---	1	$\mu\text{A}$
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Source Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\ \mu\text{A}$	1	1.5	2.5	V
$R_{DS(ON)}$	Drain-Source On Resistance <sup>note3</sup>	$V_{GS}=10V, I_D=20A$	---	10	13	m $\Omega$
		$V_{GS}=4.5V, I_D=10A$	---	14	19	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	---	1005	---	pF
$C_{oss}$	Output Capacitance		---	140	---	
$C_{rss}$	Reverse Transfer Capacitance		---	116	---	
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=15V, V_{GS}=10V$ $R_{GEN}=3\ \Omega, I_D=20A$	---	6	---	ns
$t_r$	Rise Time		---	5	---	ns
$t_{d(off)}$	Turn-Off Delay Time		---	25	---	ns
$t_f$	Fall Time		---	7	---	ns
$Q_g$	Total Gate Charge	$V_{DS}=15V, V_{GS}=10V, I_D=10A$	---	19	---	nC
$Q_{gs}$	Gate-Source Charge		---	6.3	---	nC
$Q_{gd}$	Gate-Drain "Miller" Charge		---	4.5	---	nC
<b>Drain-Source Diode Characteristics</b>						
$I_S$	Continuous Source Current	$V_D=V_{DS}=0V$	---	---	15	A
$I_{SM}$	Pulsed Source Current	$V_D=V_{DS}=0V$	---	---	64	A

<b>V<sub>SD</sub></b>	Source-Drain Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =22A	---	---	1.2	V
<b>t<sub>rr</sub></b>	Reverse Recovery Time	I <sub>F</sub> =10A, di/dt=100A/μs	---	7	---	nS
<b>Q<sub>rr</sub></b>	Reverse Recovery Charge		---	6.3	---	nC

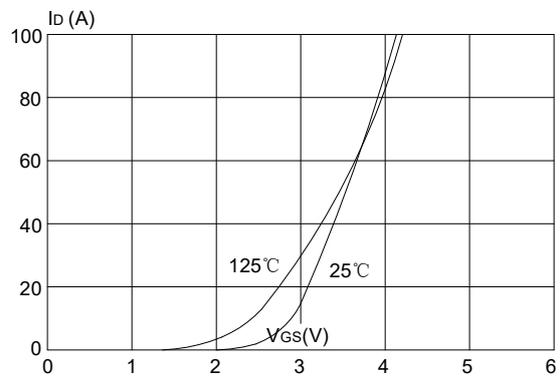
### Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. E<sub>AS</sub> condition: T<sub>J</sub>=25°C, V<sub>GS</sub>=10V, R<sub>G</sub>=25Ω, L=0.5mH, I<sub>AS</sub>=9.8A
3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 0.5%

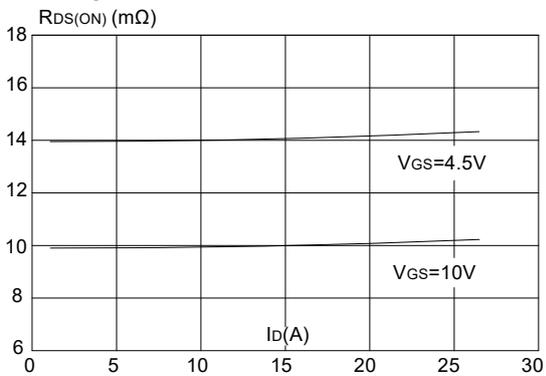
### Typical Performance Characteristics-N



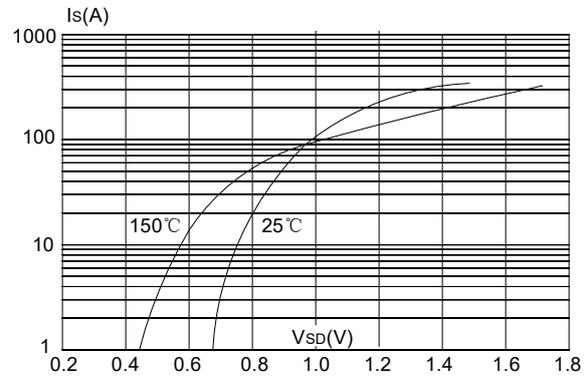
**Figure 1:** Output Characteristics



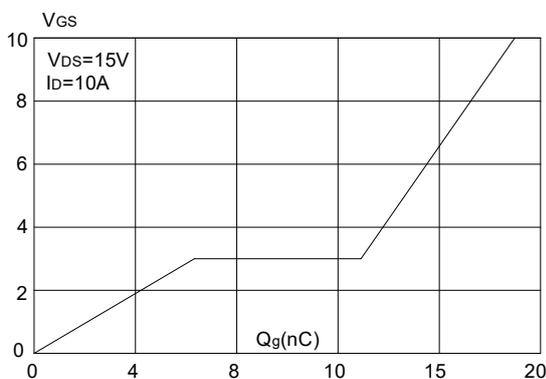
**Figure 2:** Typical Transfer Characteristics



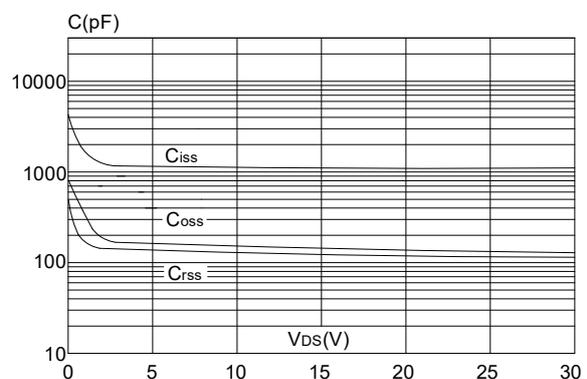
**Figure 3:** On-resistance vs. Drain Current



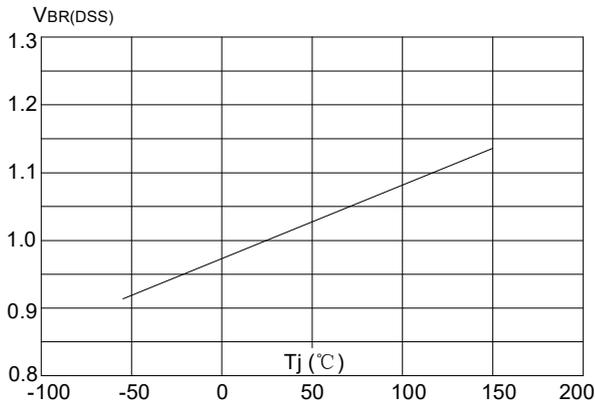
**Figure 4:** Body Diode Characteristics



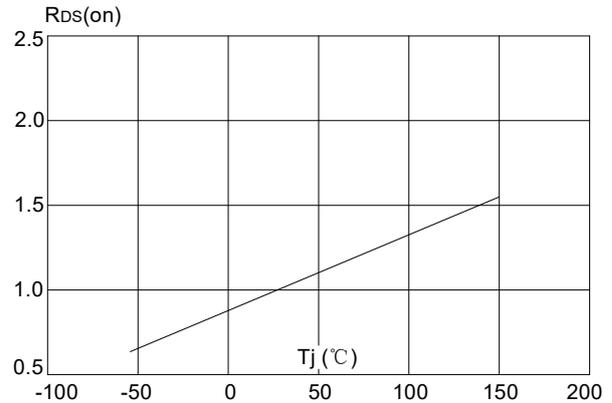
**Figure 5:** Gate Charge Characteristics



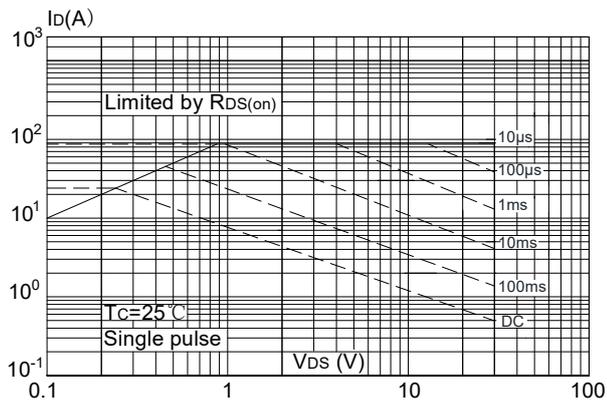
**Figure 6:** Capacitance Characteristics



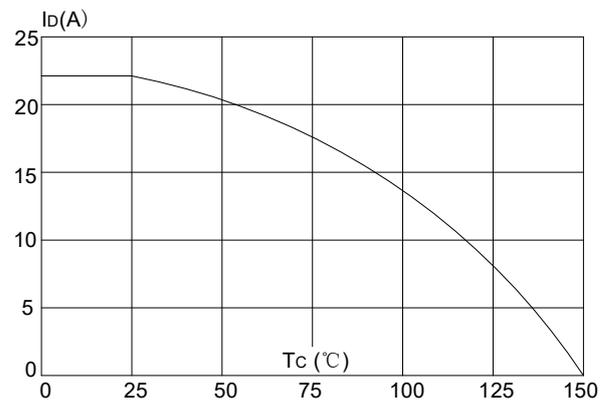
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



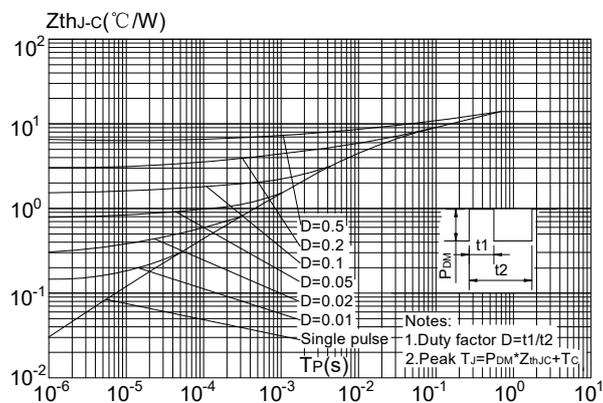
**Figure 8:** Normalized on Resistance vs. Junction Temperature



**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



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

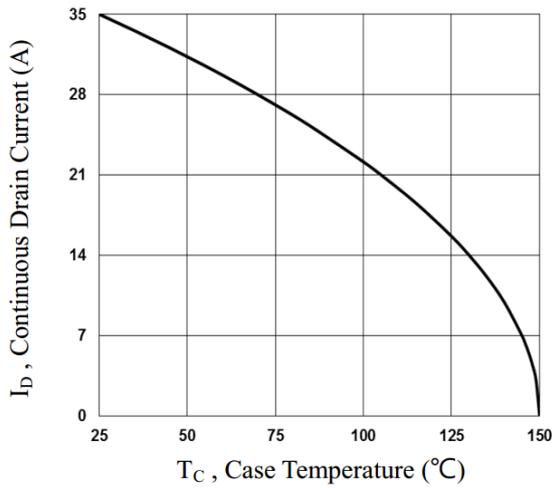
## P-Channel Electrical Characteristics: ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\ \mu\text{A}$	-30	---	---	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS}=0V, V_{DS}=-30V, T_J=25^\circ\text{C}$	---	---	-1	$\mu\text{A}$
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0A$	---	---	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	GATE-Source Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\ \mu\text{A}$	-1.0	-1.6	-2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS}=-10V, I_D=-8A$	---	16.5	20	m $\Omega$
		$V_{GS}=-4.5V, I_D=-5A$	---	25.6	32	
$G_{FS}$	Forward Transconductance	$V_{DS}=-10V, I_D=-3A$	---	6.8	---	S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	1250	1820	pF
$C_{oss}$	Output Capacitance		---	160	235	
$C_{rss}$	Reverse Transfer Capacitance		---	90	130	
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time <sup>2,3</sup>	$V_{DS}=-15V, I_D=-1A,$ $R_{GEN}=6\ \Omega, V_{GS}=-10V$	---	5.8	11	ns
$t_r$	Rise Time <sup>2,3</sup>		---	18.8	36	ns
$t_{d(off)}$	Turn-Off Delay Time <sup>2,3</sup>		---	46.9	89	ns
$t_f$	Fall Time <sup>2,3</sup>		---	12.3	23	ns
$Q_g$	Total Gate Charge <sup>2,3</sup>	$V_{GS}=4.5V, V_{DS}=15V,$ $I_D=5A$	---	11	17	nC
$Q_{gs}$	Gate-Source Charge <sup>2,3</sup>		---	3.4	6	nC
$Q_{gd}$	Gate-Drain "Miller" Charge <sup>2,3</sup>		---	4.2	8	nC
<b>Drain-Source Diode Characteristics</b>						
$V_{SD}$	Source-Drain Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$	---	---	-1	V
$I_S$	Continuous Drain to Source Diode	$V_D=V_G=0V$	---	---	-15	A
$I_{SM}$	Pulsed Drain to Source Diode	$V_D=V_G=0V$	---	---	-64	A

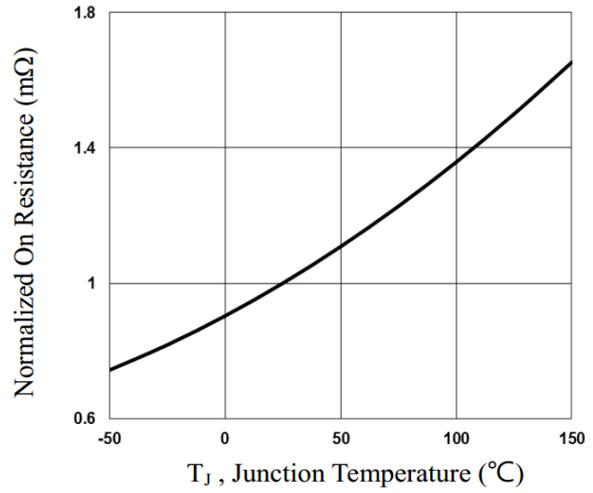
### Notes:

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width  $\leq 300\mu\text{s}$  , duty cycle  $\leq 2\%$ .
3. Essentially independent of operating temperature.

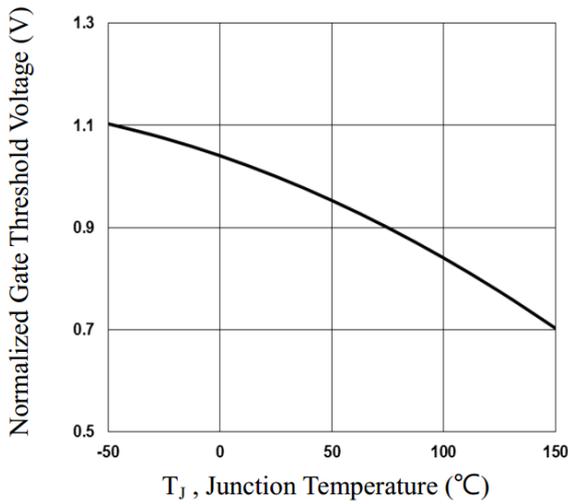
## Typical Performance Characteristics-P



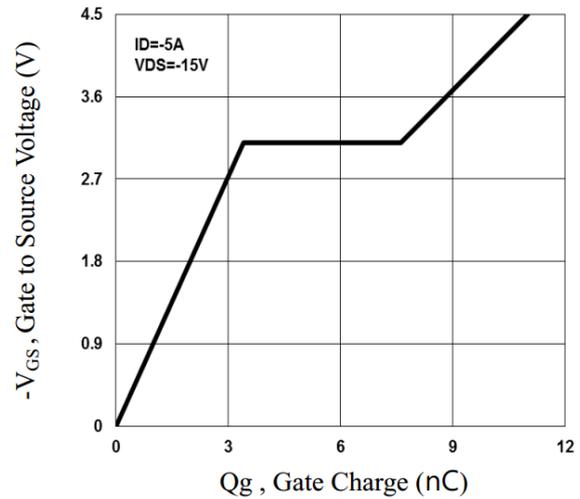
**Fig.1 Continuous Drain Current vs.  $T_C$**



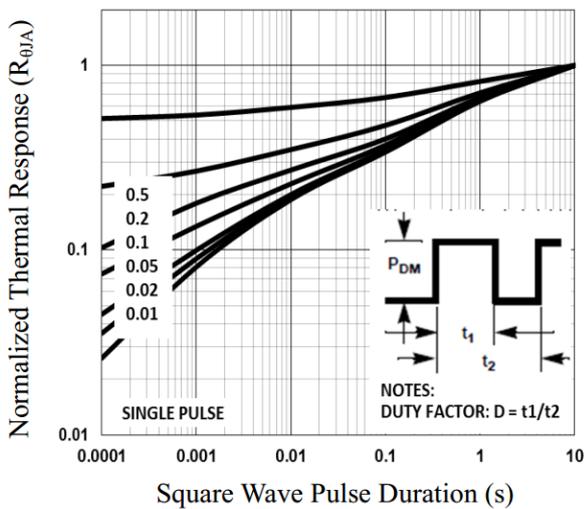
**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$**



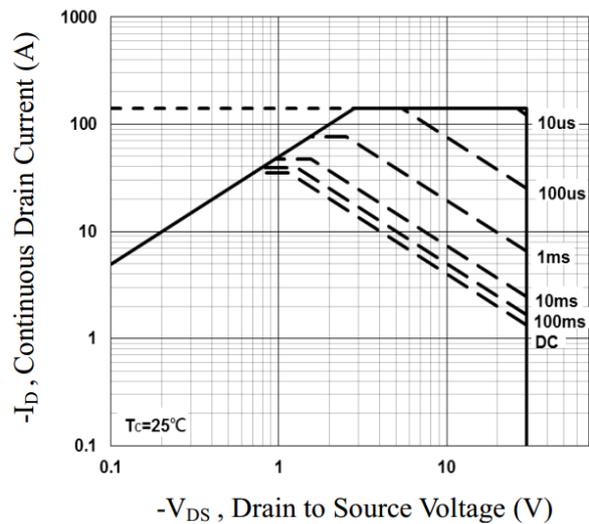
**Fig.3 Normalized  $V_{th}$  vs.  $T_J$**



**Fig.4 Gate Charge Waveform**



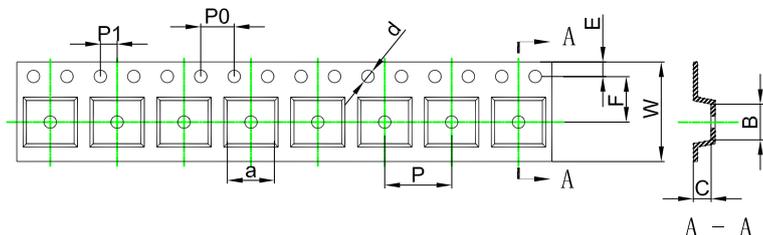
**Fig.5 Normalized Transient Impedance**



**Fig.6 Maximum Safe Operation Area**

## SOP8 Tape and Reel Information

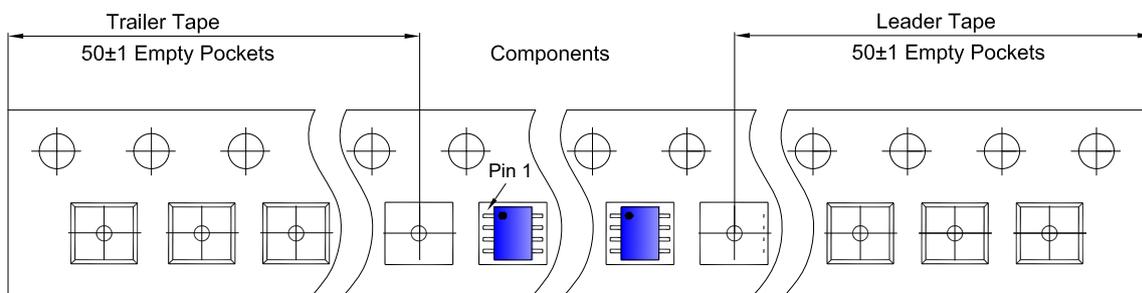
### Embossed Carrier Tape



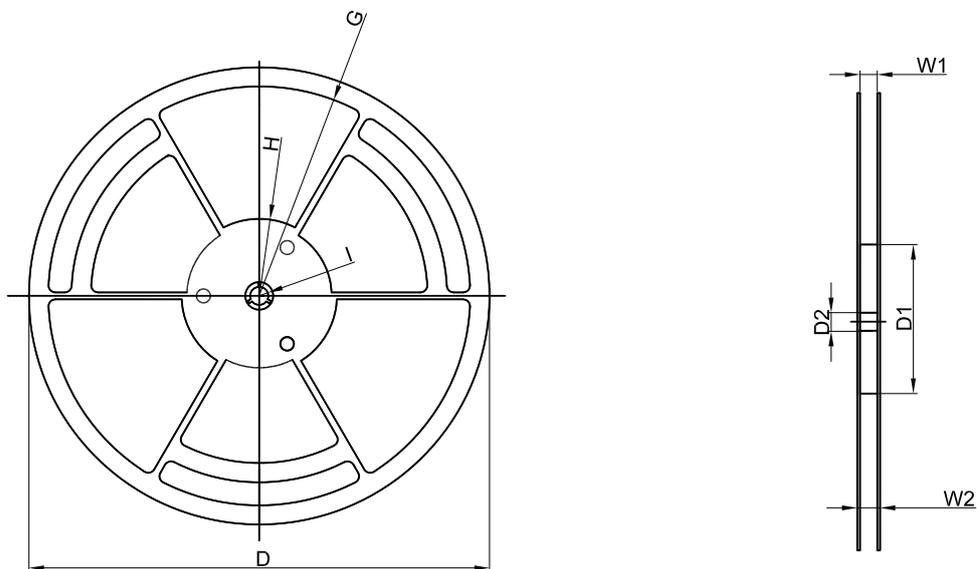
Dimensions are in millimeter

Pkg type	a	B	C	d	E	F	P0	P	P1	W
SOP8	6.40	5.40	2.10	Ø1.50	1.75	5.50	4.00	8.00	2.00	12.00

### Tape Leader and Trailer



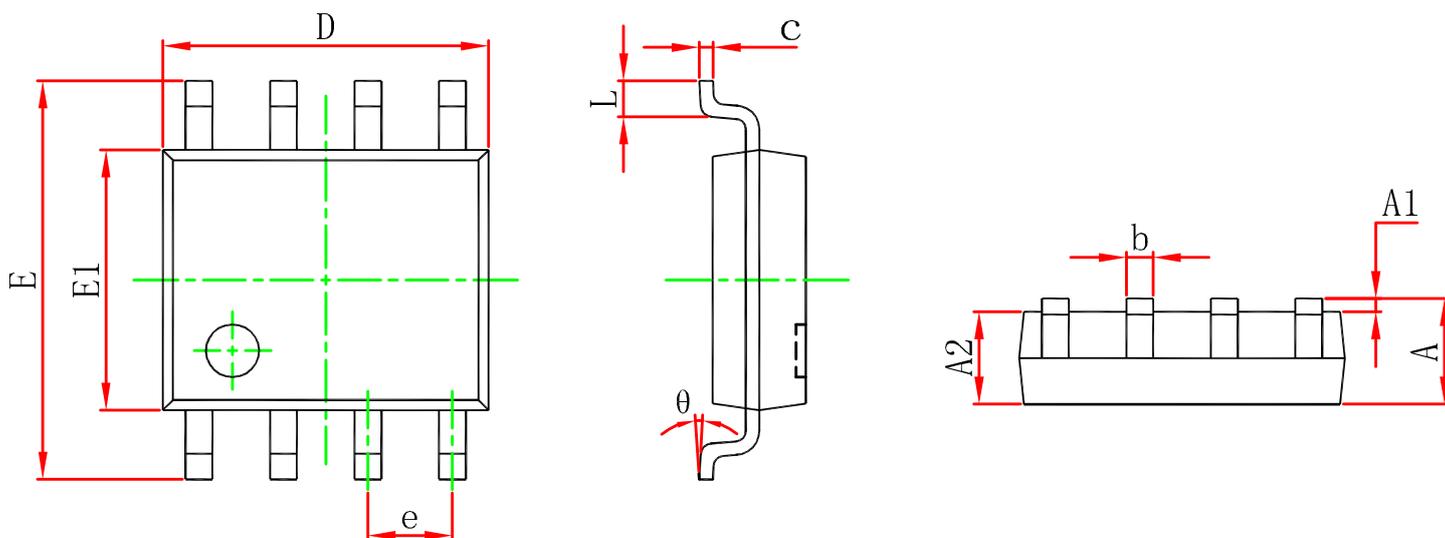
### Reel



Dimensions are in millimeter

Reel Option	D	D1	D2	G	H	I	W1	W2
13" Dia	Ø330.00	100.00	13.00	R151.00	R56.00	R6.50	12.40	17.60

REEL	Reel Size	Box	Box Size(mm)	Carton	Carton Size(mm)	G.W.(kg)
3,000 pcs	13 inch	6,000 pcs	360×360×65	48,000 pcs	565×380×390	



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	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	4.700	5.100	0.185	0.201
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°

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