



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



V_{DSS}	600V
$R_{DS(on)}$ (Max.)	0.09 Ω
I_D	46A
P_D	120W

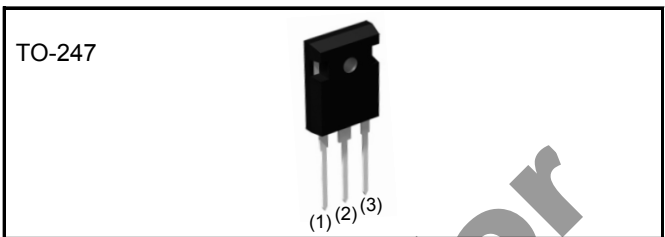
●Features

- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Gate-source voltage (V_{GSS}) guaranteed to be $\pm 30V$.
- 4) Drive circuits can be simple.
- 5) Parallel use is easy.
- 6) Pb-free lead plating ; RoHS compliant

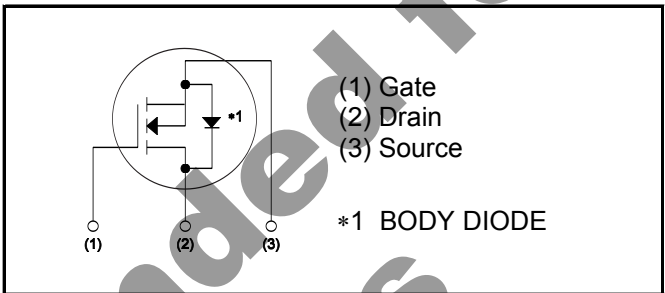
●Application

Switching Power Supply

●Outline



●Inner circuit



●Packaging specifications

Type	Packaging	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	450
	Taping code	C9
	Marking	R6046ANZ1

●Absolute maximum ratings ($T_a = 25^\circ C$)

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	600	V
Continuous drain current	I_D *1	± 46	A
	I_D *1	± 22.3	A
Pulsed drain current	$I_{D,pulse}$ *2	± 115	A
Gate - Source voltage	V_{GSS}	± 30	V
Avalanche energy, single pulse	E_{AS} *3	142	mJ
Avalanche energy, repetitive	E_{AR} *4	5.4	mJ
Avalanche current	I_{AR} *3	23	A
Power dissipation ($T_c = 25^\circ C$)	P_D	120	W
Junction temperature	T_j	150	$^\circ C$
Range of storage temperature	T_{stg}	-55 to +150	$^\circ C$
Reverse diode dv/dt	dv/dt *5	15	V/ns

●Absolute maximum ratings

Parameter	Symbol	Conditions	Values	Unit
Drain - Source voltage slope	dv/dt	$V_{DS} = 480V, I_D = 46A$ $T_j = 125^\circ C$	50	V/ns

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	-	1.04	$^\circ C/W$
Thermal resistance, junction - ambient	R_{thJA}	-	-	30	$^\circ C/W$
Soldering temperature, wavesoldering for 10s	T_{sold}	-	-	265	$^\circ C$

●Electrical characteristics($T_a = 25^\circ C$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	600	-	-	V
Drain - Source avalanche breakdown voltage	$V_{(BR)DS}$	$V_{GS} = 0V, I_D = 23A$	-	700	-	V
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V$ $T_j = 25^\circ C$	-	0.1	100	μA
		$T_j = 125^\circ C$	-	-	1000	
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	± 100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	2.5	-	4.5	V
Static drain - source on - state resistance	$R_{DS(on)}^{*6}$	$V_{GS} = 10V, I_D = 23A$ $T_j = 25^\circ C$	-	0.069	0.09	Ω
		$T_j = 125^\circ C$	-	0.145	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	2.2	-	Ω

●Electrical characteristics($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs}^{*6}	$V_{DS} = 10\text{V}, I_D = 23\text{A}$	19	33	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$	-	6000	-	pF
Output capacitance	C_{oss}	$V_{DS} = 25\text{V}$	-	3900	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	83	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 480\text{V}$	-	188	-	pF
Effective output capacitance, time related	$C_{o(tr)}$		-	640	-	
Turn - on delay time	$t_{d(on)}^{*6}$	$V_{DD} \approx 300\text{V}, V_{GS} = 10\text{V}$ $I_D = 23\text{A}$ $R_L = 13\Omega$ $R_G = 10\Omega$	-	65	-	ns
Rise time	t_r^{*6}		-	120	-	
Turn - off delay time	$t_{d(off)}^{*6}$		-	260	520	
Fall time	t_f^{*6}		-	100	200	

●Gate Charge characteristics($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g^{*6}	$V_{DD} \approx 300\text{V}$	-	150	-	nC
Gate - Source charge	Q_{gs}^{*6}	$I_D = 46\text{A}$	-	35	-	
Gate - Drain charge	Q_{gd}^{*6}	$V_{GS} = 10\text{V}$	-	56	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 300\text{V}, I_D = 46\text{A}$	-	5.9	-	V

*1 Limited only by maximum temperature allowed.

*2 $P_W \leq 10\mu\text{s}$, Duty cycle $\leq 1\%$

*3 $L \approx 500\mu\text{H}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, starting $T_j = 25^\circ\text{C}$

*4 $L \approx 500\mu\text{H}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, starting $T_j = 25^\circ\text{C}$, $f = 10\text{kHz}$

*5 Reference measurement circuits Fig.5-1.

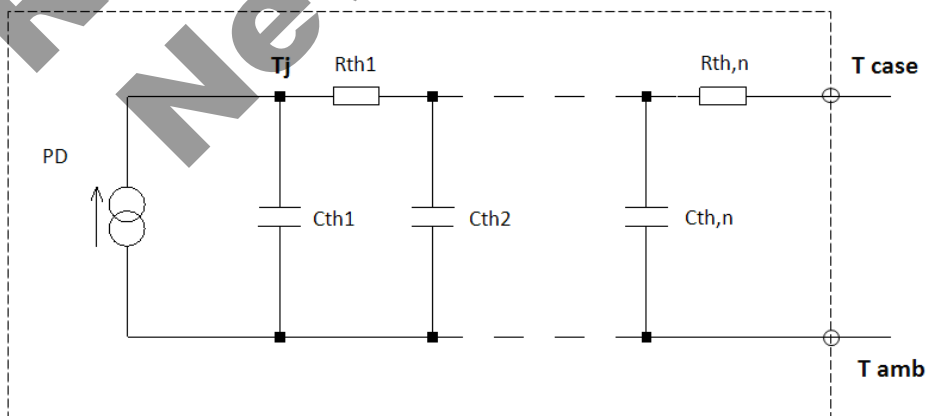
*6 Pulsed

●Body diode electrical characteristics (Source-Drain)($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S^{*1}	$T_c = 25^\circ\text{C}$	-	-	46	A
Inverse diode direct current, pulsed	I_{SM}^{*2}		-	-	115	A
Forward voltage	V_{SD}^{*6}	$V_{GS} = 0\text{V}, I_S = 46\text{A}$	-	-	1.5	V
Reverse recovery time	t_{rr}^{*6}	$I_S = 46\text{A}$ $di/dt = 100\text{A}/\mu\text{s}$	-	692	-	ns
Reverse recovery charge	Q_{rr}^{*6}		-	15	-	μC
Peak reverse recovery current	I_{rrm}^{*6}		-	45	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	$T_j = 25^\circ\text{C}$	-	940	-	$\text{A}/\mu\text{s}$

●Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
R_{th1}	0.055	K/W	C_{th1}	0.0236	Ws/K
R_{th2}	0.164		C_{th2}	0.134	
R_{th3}	0.821		C_{th3}	1.09	



●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

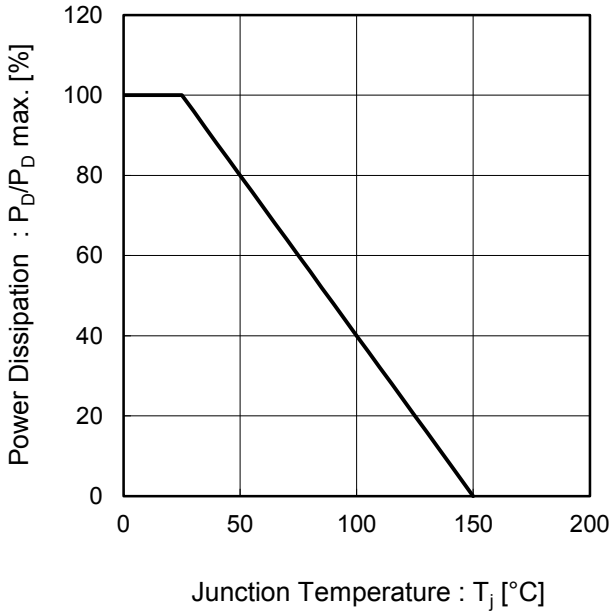


Fig.2 Maximum Safe Operating Area

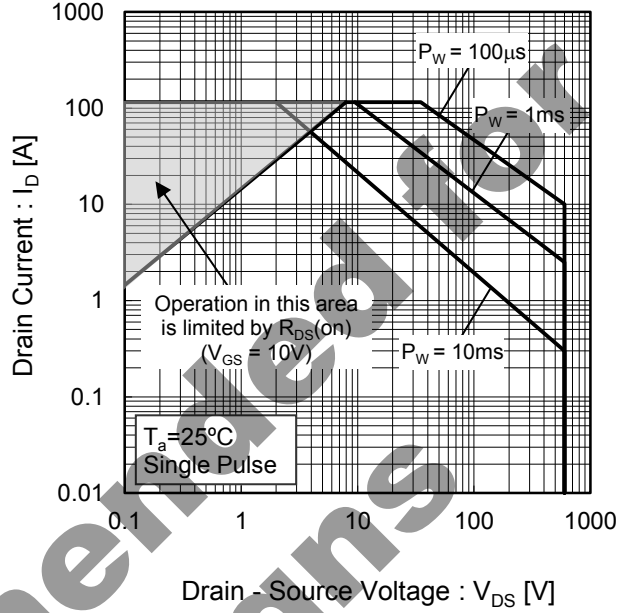
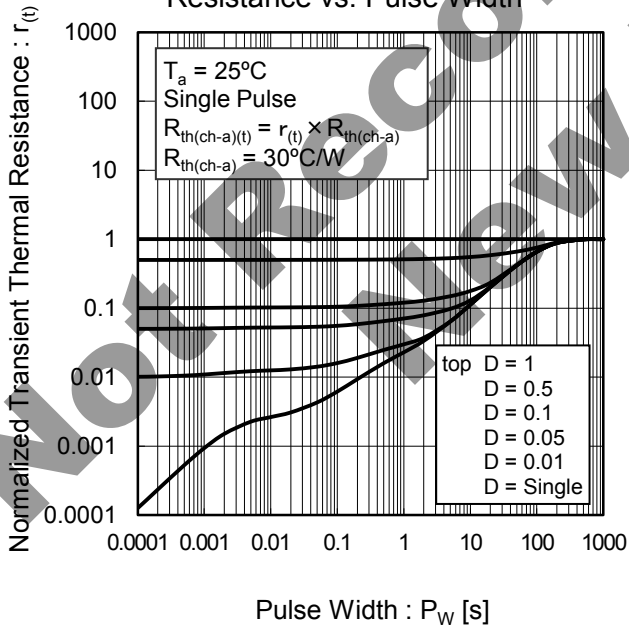


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

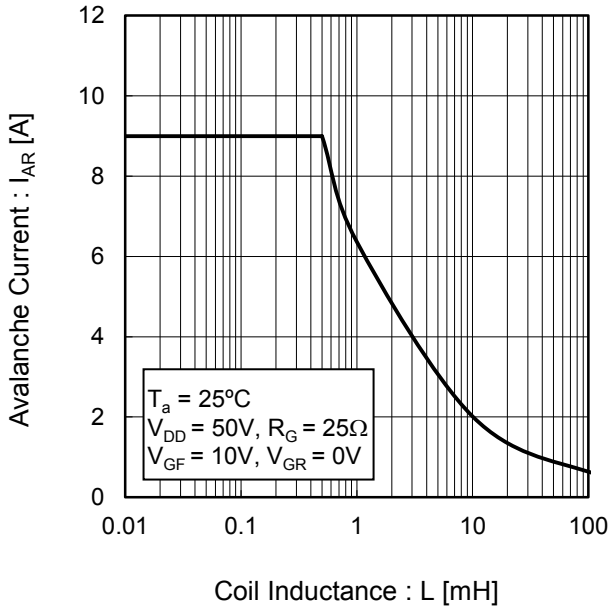


Fig.5 Avalanche Power Losses

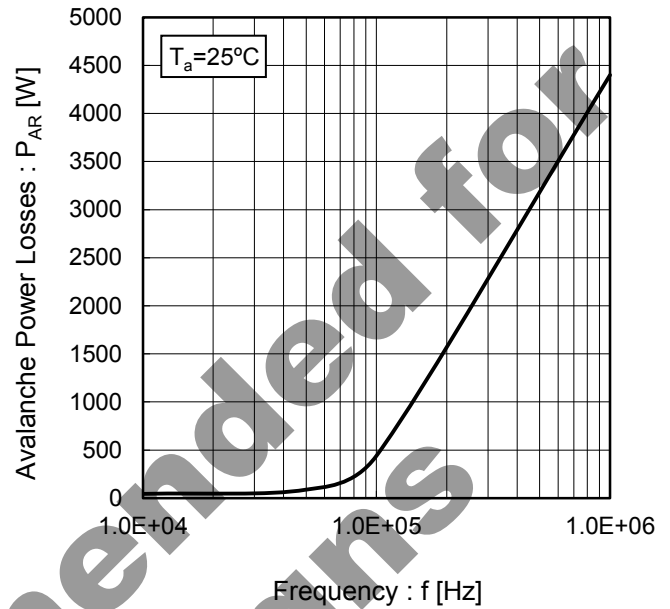
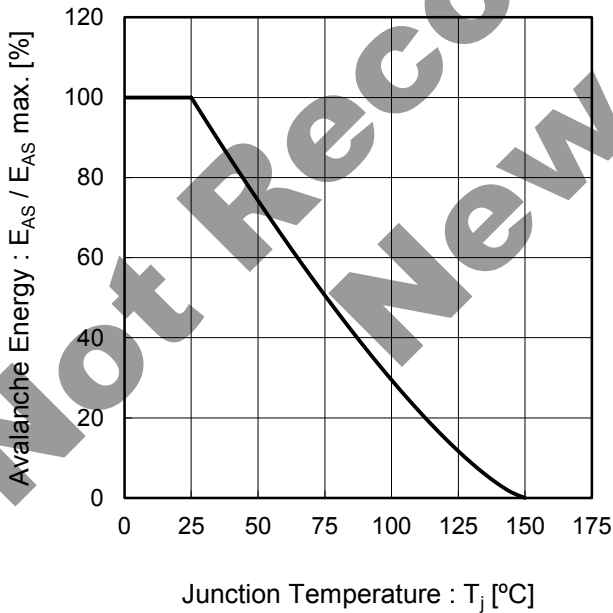


Fig.6 Avalanche Energy Derating Curve vs Junction Temperature



●Electrical characteristic curves

Fig.7 Typical Output Characteristics(I)

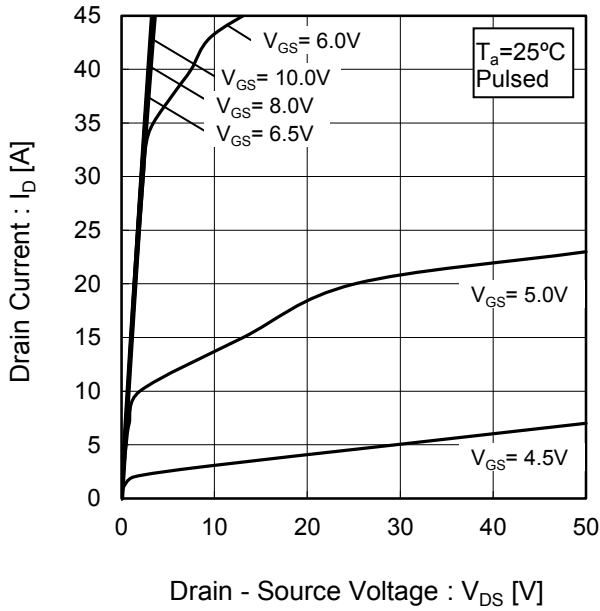


Fig.8 Typical Output Characteristics(II)

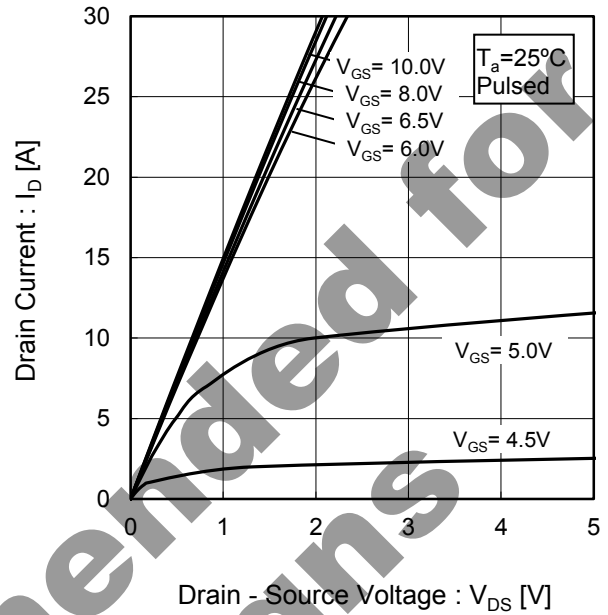


Fig.9 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(I)

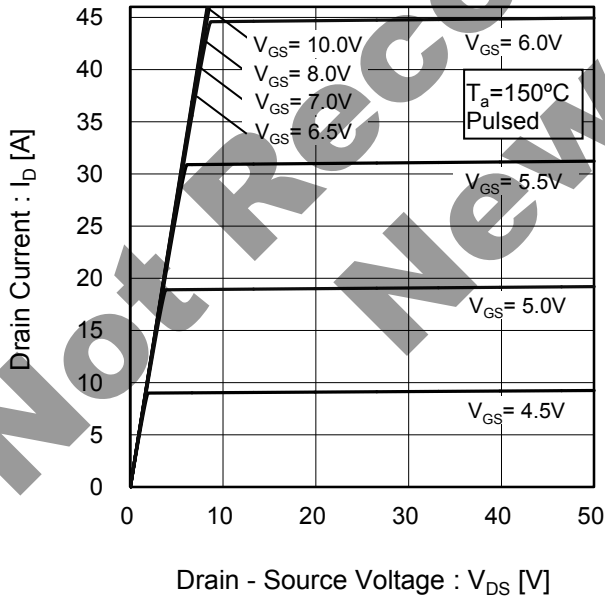
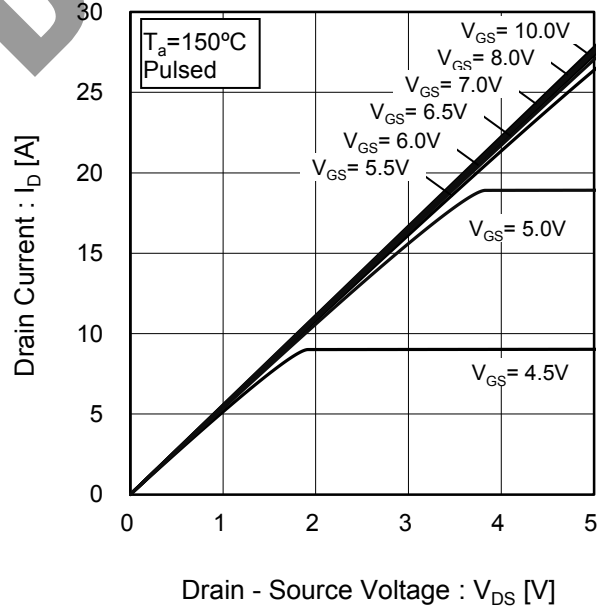


Fig.10 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.11 Breakdown Voltage vs. Junction Temperature

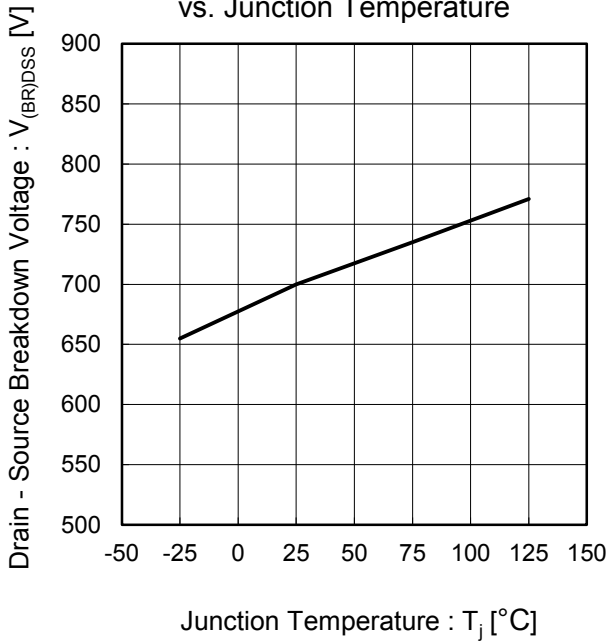


Fig.12 Typical Transfer Characteristics

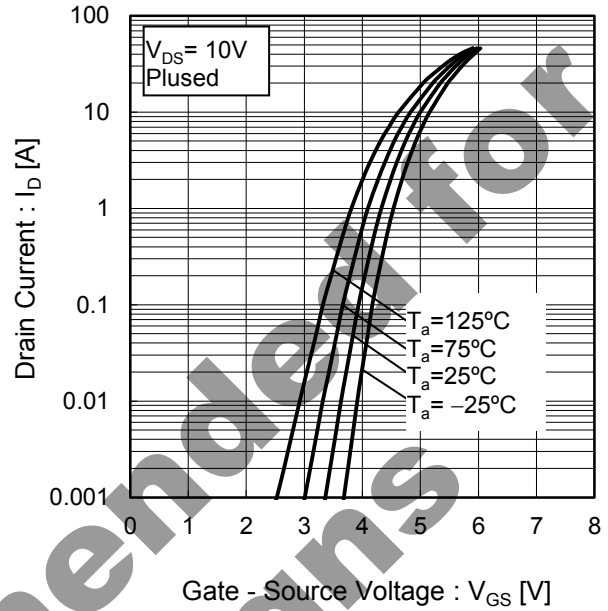


Fig.13 Gate Threshold Voltage vs. Junction Temperature

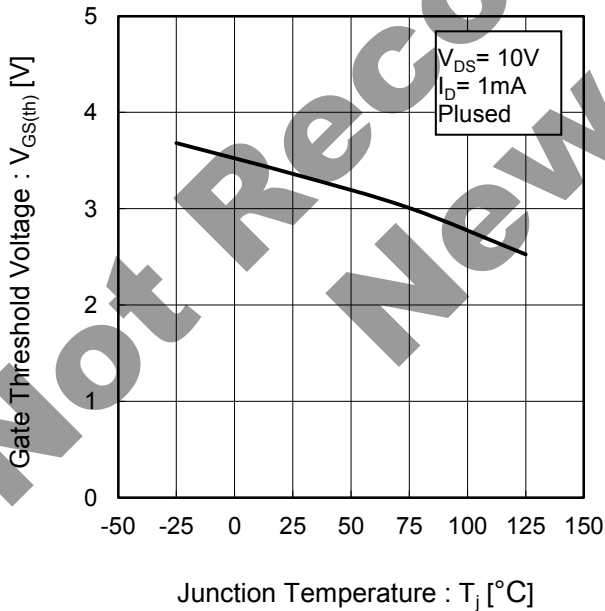
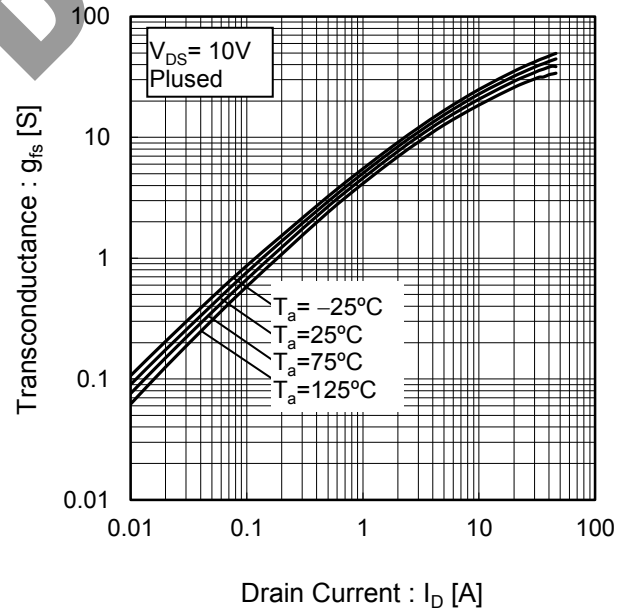


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.15 Static Drain - Source On - State Resistance vs. Gate Source Voltage

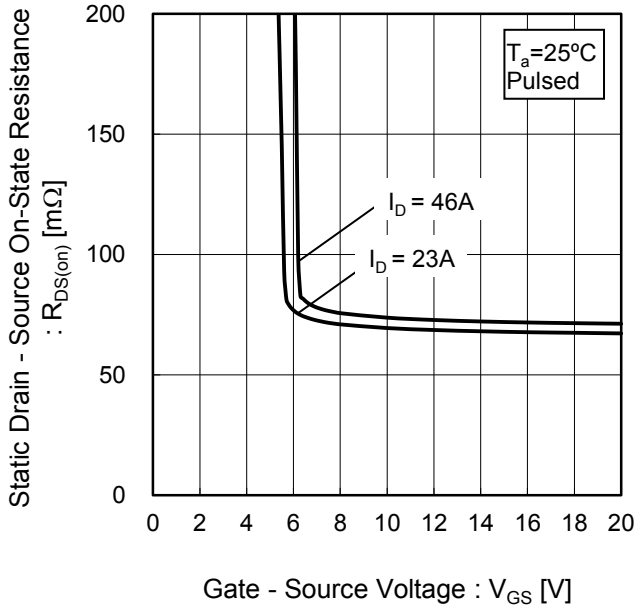


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

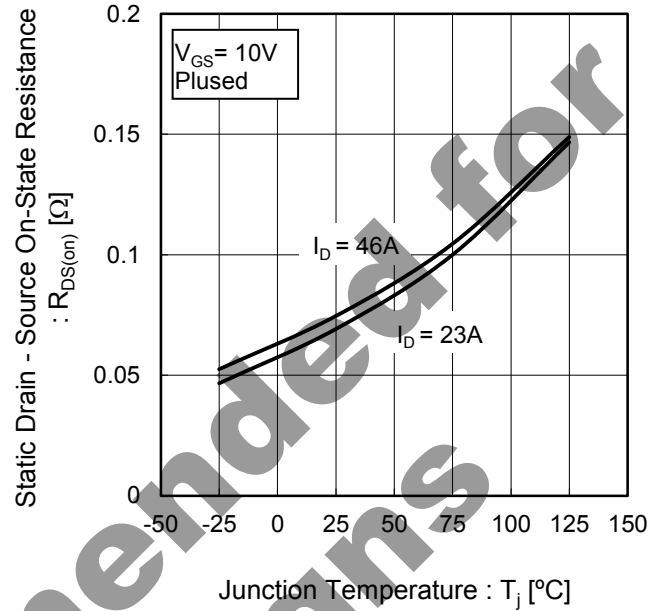
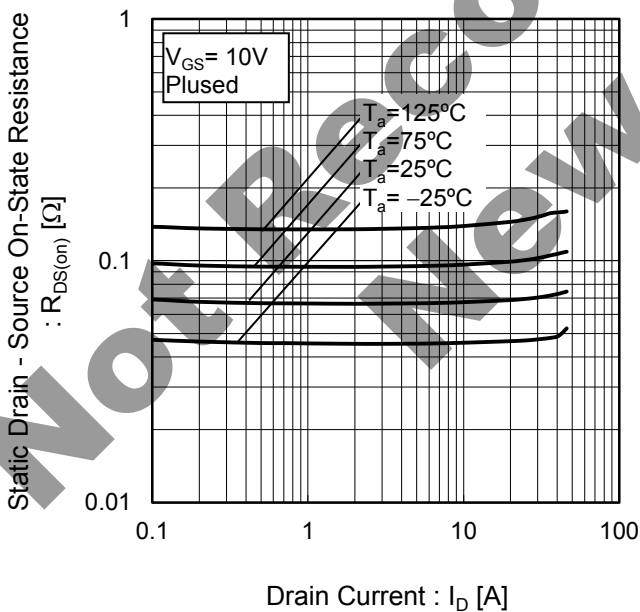


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.18 Typical Capacitance vs. Drain - Source Voltage

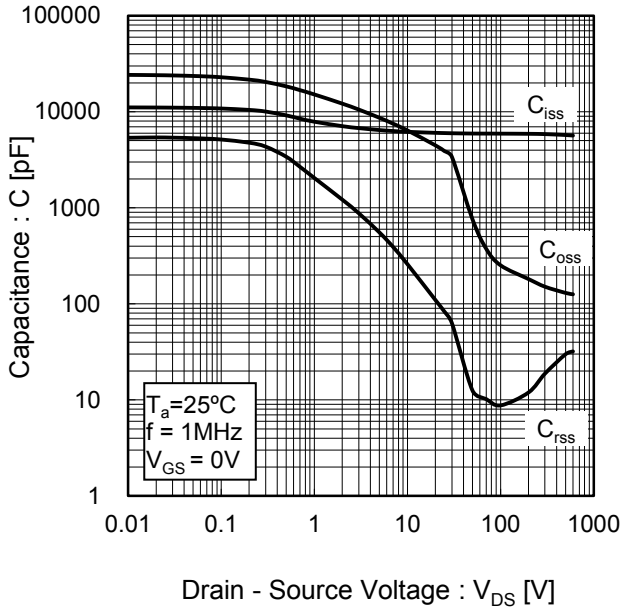


Fig.19 Coss Stored Energy

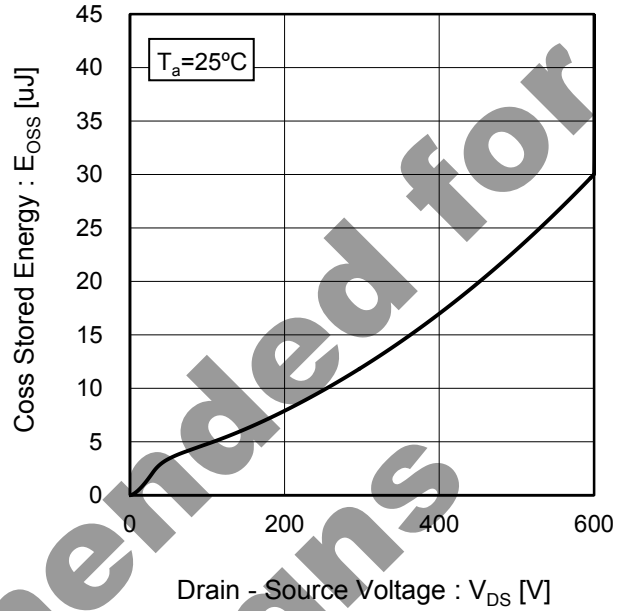


Fig.20 Switching Characteristics

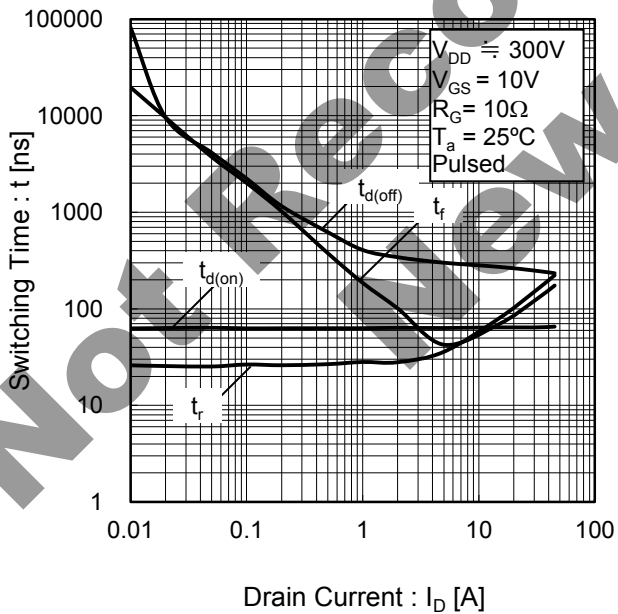
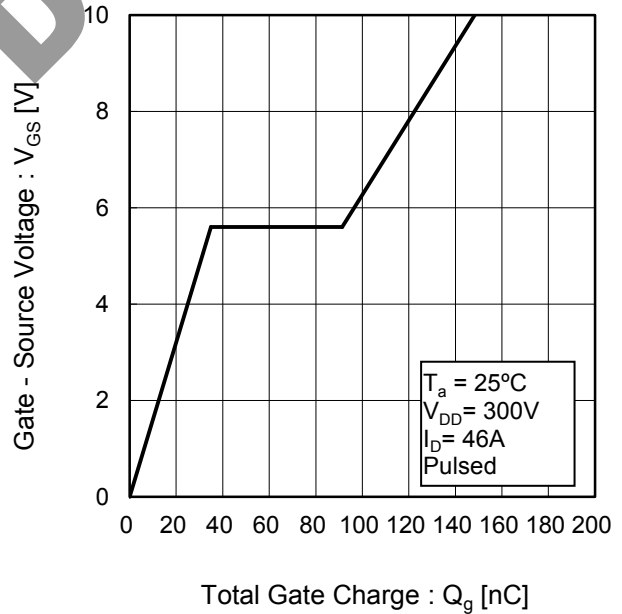


Fig.21 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.22 Inverse Diode Forward Current vs. Source - Drain Voltage

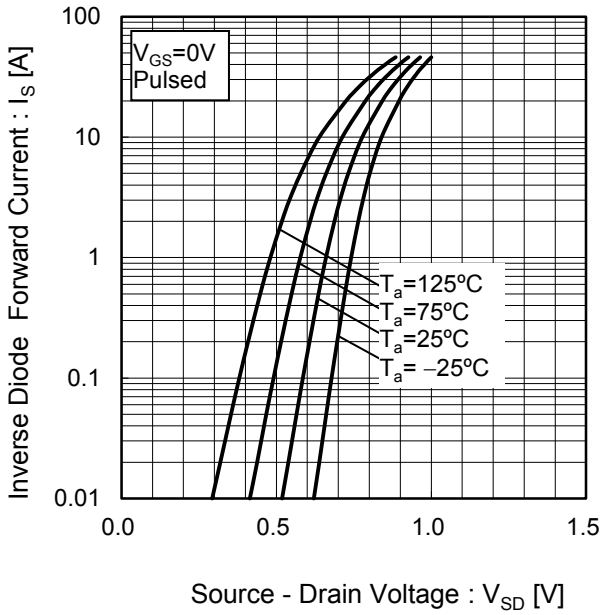
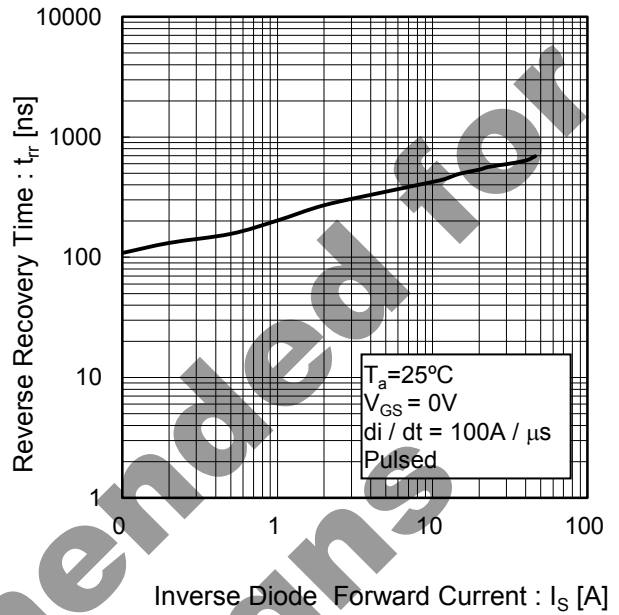


Fig.23 Reverse Recovery Time vs. Inverse Diode Forward Current



Not Recommended for New Design

●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

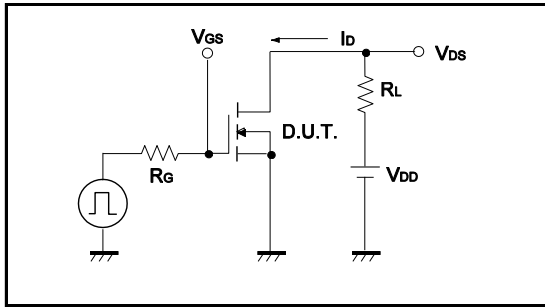


Fig.1-2 Switching Waveforms

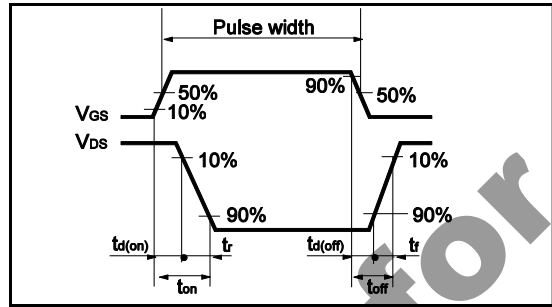


Fig.2-1 Gate Charge Measurement Circuit

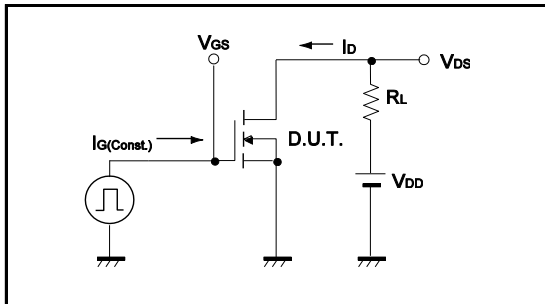


Fig.2-2 Gate Charge Waveform

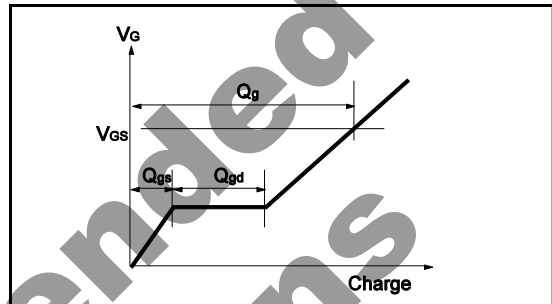


Fig.3-1 Avalanche Measurement Circuit

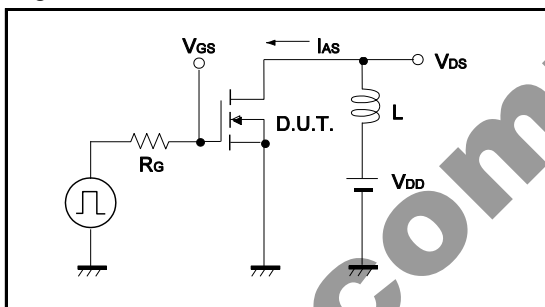


Fig.3-2 Avalanche Waveform

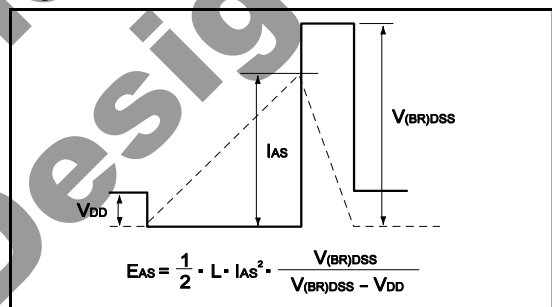


Fig.4-1 dv/dt Measurement Circuit

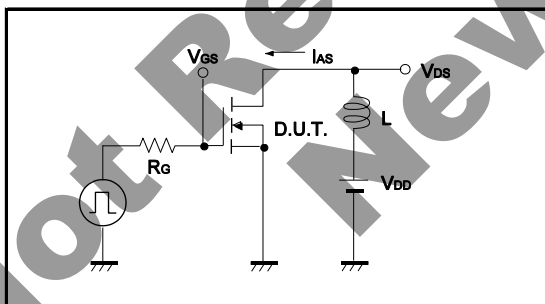


Fig.4-2 dv/dt Waveform

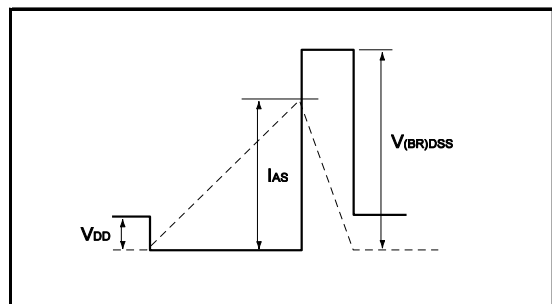


Fig.5-1 di/dt Measurement Circuit

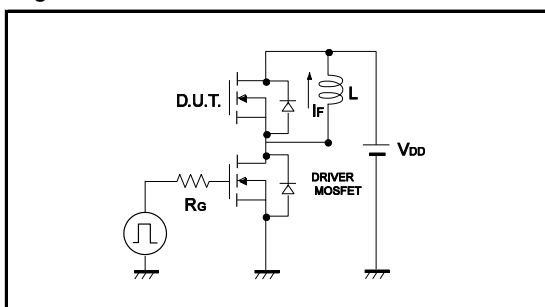
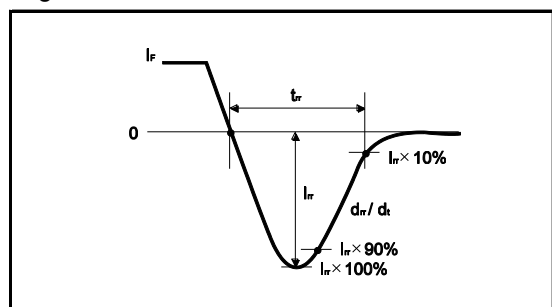
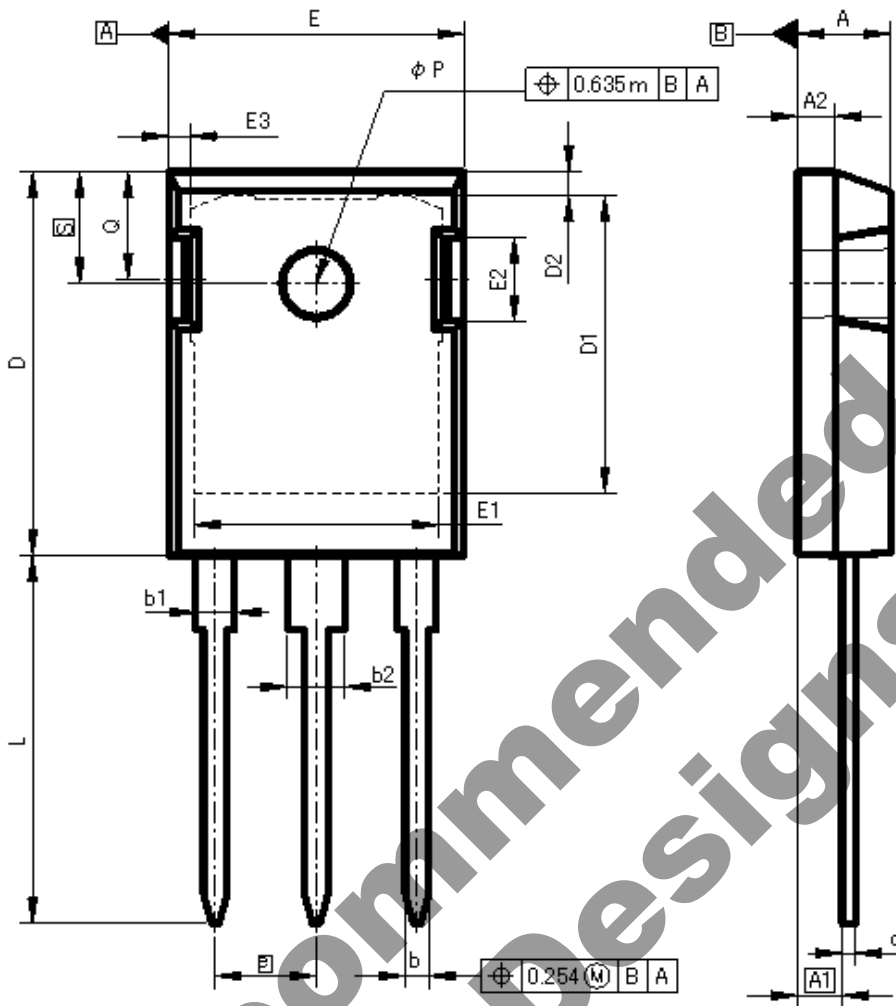


Fig.5-2 di/dt Waveform



●Dimensions (Unit : mm)

TO-247



DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.29	2.54	0.090	0.100
A2	1.91	2.16	0.075	0.085
b	1.14	1.40	0.045	0.055
b1	1.91	2.20	0.075	0.087
b2	2.92	3.20	0.115	0.126
c	0.61	0.80	0.024	0.031
D	20.80	21.34	0.819	0.840
D1	17.43	17.83	0.686	0.702
E	15.75	16.13	0.620	0.635
e	5.45		0.215	
N	3.00		3.000	
L	19.81	20.57	0.780	0.810
L1	3.81	4.32	0.150	0.170
ΦP	3.55	3.65	0.140	0.144
Q	5.59	6.20	0.220	0.244
S	6.15		0.240	

Dimension in mm / inches

Notes

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