R5007ANJ

Nch 500V 7A Power MOSFET

Datasheet

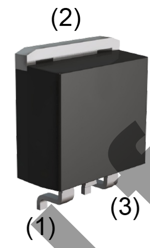
V_{DSS}	500V
$R_{DS(on)}$(Max.)	1.05Ω
I_D	±7A
P_D	40W

●Outline

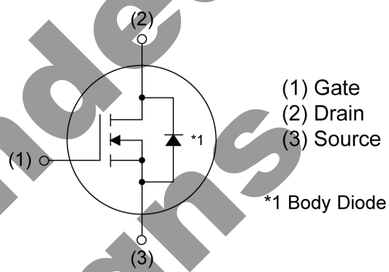
LPT(S)

SC-83

TO-263



●Inner circuit



●Features

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

●Packaging specifications

Type	Packing	Embossed Tape
	Reel size (mm)	330
	Tape width (mm)	24
	Basic ordering unit (pcs)	1000
	Taping code	TL
	Marking	R5007ANJ

●Application

Switching Power Supply

●Absolute maximum ratings (T_a = 25°C)

Parameter		Symbol	Value	Unit
Drain - Source voltage		V_{DSS}	500	V
Continuous drain current	T_C = 25°C	I_D *1	±7	A
	T_C = 100°C	I_D *1	±3.4	A
Pulsed drain current		$I_{D,pulse}$ *2	±28	A
Gate - Source voltage		V_{GSS}	±30	V
Avalanche energy, single pulse		E_{AS} *3	3.5	mJ
Avalanche energy, repetitive		E_{AR} *4	2.8	mJ
Avalanche current		I_{AR} *3	3.5	A
Power dissipation (T_c = 25°C)		P_D	40	W
Junction temperature		T_j	150	℃
Range of storage temperature		T_{stg}	-55 to +150	℃
Reverse diode dv/dt		dv/dt	15	V/ns

●Absolute maximum ratings

Parameter	Symbol	Conditions	Values	Unit
Drain - Source voltage slope	dv/dt	V_{DS} = 400V, I_D = 7A T_j = 125°C	50	V/ns

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	-	3.13	°C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	80	°C/W
Soldering temperature, wavesoldering for 10s	T_{sold}	-	-	265	°C

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 1mA	500	-	-	V
Drain - Source avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS} = 0V, I_D = 3.5A	-	580	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS} = 500V, V_{GS} = 0V T_j = 25°C	-	0.1	100	μA
		T_j = 125°C	-	-	1000	
Gate - Source leakage current	I_{GSS}	V_{GS} = ±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 = 3.5A T_j = 25°C	-	0.8	1.05	Ω
		T_j = 125°C	-	1.66	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	7.3	-	Ω

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} *6	V_{DS} = 10V, I_D = 3.5A	2.5	4.5	-	S
Input capacitance	C_{iss}	V_{GS} = 0V	-	500	-	
Output capacitance	C_{oss}	V_{DS} = 25V	-	300	-	pF
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	23	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V, V_{DS} = 0V to 400V	-	22.4	-	pF
Effective output capacitance, time related	$C_{o(tr)}$		-	65.0	-	
Turn - on delay time	$t_{d(on)}$ *6	V_{DD} ≃ 250V, V_{GS} = 10V	-	20	-	
Rise time	t_r *6	I_D = 3.5A	-	22	-	ns
Turn - off delay time	$t_{d(off)}$ *6	R_L ≃ 71.4Ω	-	50	100	
Fall time	t_f *6	R_G = 10Ω	-	25	50	

●Gate charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *6	V_{DD} ≃ 250V	-	13	-	
Gate - Source charge	Q_{gs} *6	I_D = 7A	-	3.5	-	nC
Gate - Drain charge	Q_{gd} *6	V_{GS} = 10V	-	5.5	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD} ≃ 250V, I_D = 7A	-	5.9	-	V

*1 Limited only by maximum temperature allowed.

*2 Pw ≤ 10μs, Duty cycle ≤ 1%

*3 L≃500μH, V_{DD}=50V, R_G=25Ω, starting T_j=25°C

*4 L≃500μH, V_{DD}=50V, R_G=25Ω, starting T_j=25°C, f=10kHz

*5 Reference measurement circuits Fig.5-1.

*6 Pulsed

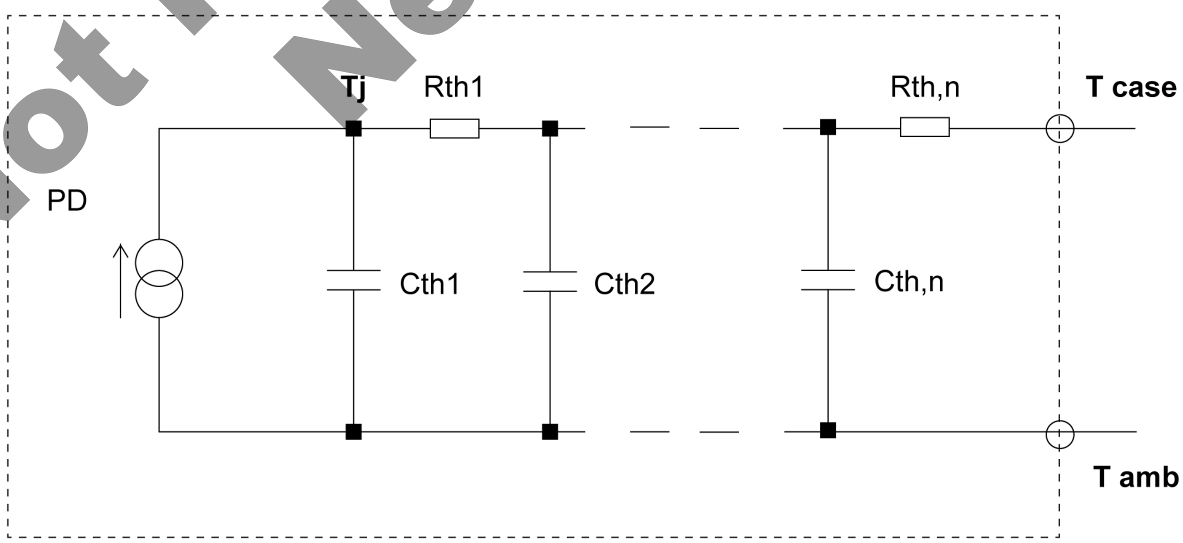
●Body diode electrical characteristics (Source-Drain) (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S *1	T_C = 25°C	-	-	7	A
Inverse diode direct current, pulsed	I_{SM} *2	T_C = 25°C	-	-	28	A
Forward voltage	V_{SD} *6	V_{GS} = 0V, I_S = 7A	-	-	1.5	V
Reverse recovery time	t_{rr} *6	I_S = 7A di/dt = 100A/μs	-	302	-	ns
Reverse recovery charge	Q_{rr} *6	I_S = 7A di/dt = 100A/μs	-	2.02	-	μC
Peak reverse recovery current	I_{rrm} *6	I_S = 7A di/dt = 100A/μs	-	13	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	T_j = 25°C	-	250	-	A/μs

●Typical transient thermal characteristics

Symbol	Value	Unit
R_{th1}	0.153	K/W
R_{th2}	0.633	K/W
R_{th3}	0.634	K/W

Symbol	Value	Unit
C_{th1}	0.00111	Ws/K
C_{th2}	0.00326	Ws/K
C_{th3}	0.157	Ws/K



●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

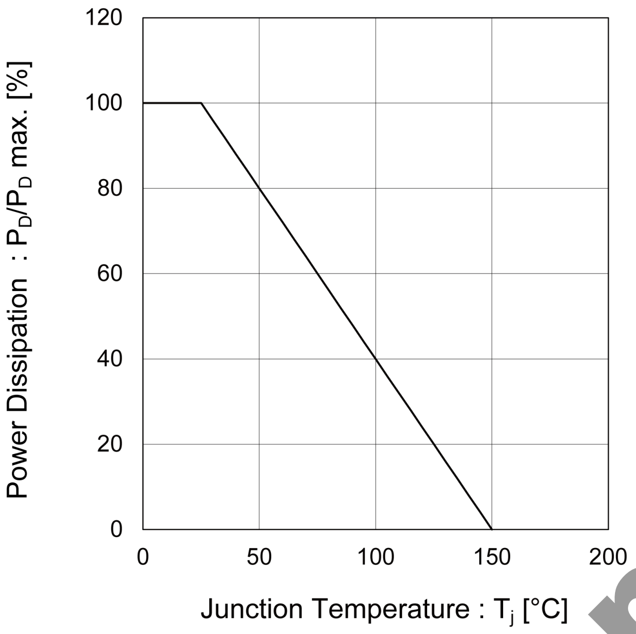


Fig.2 Maximum Safe Operating Area

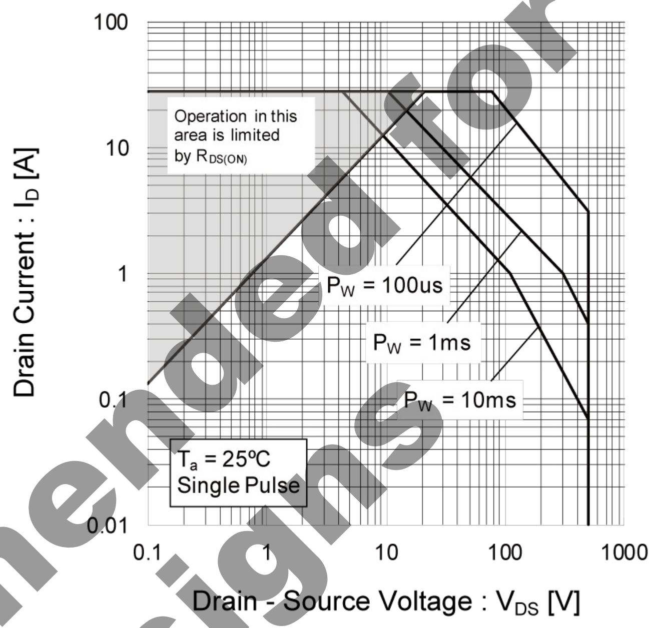
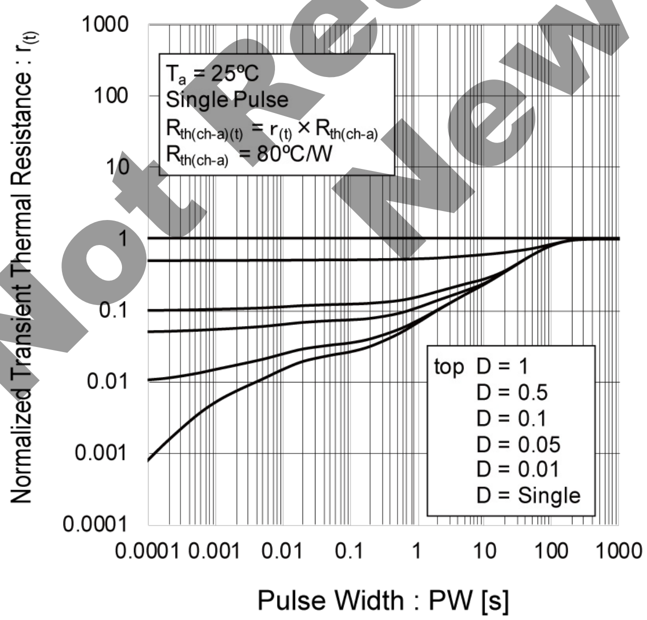


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs. Inductive Load

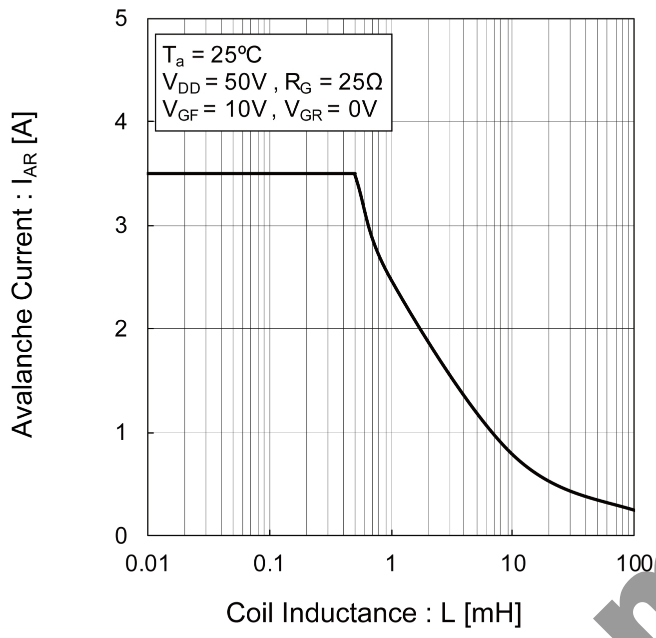


Fig.5 Avalanche Power Losses

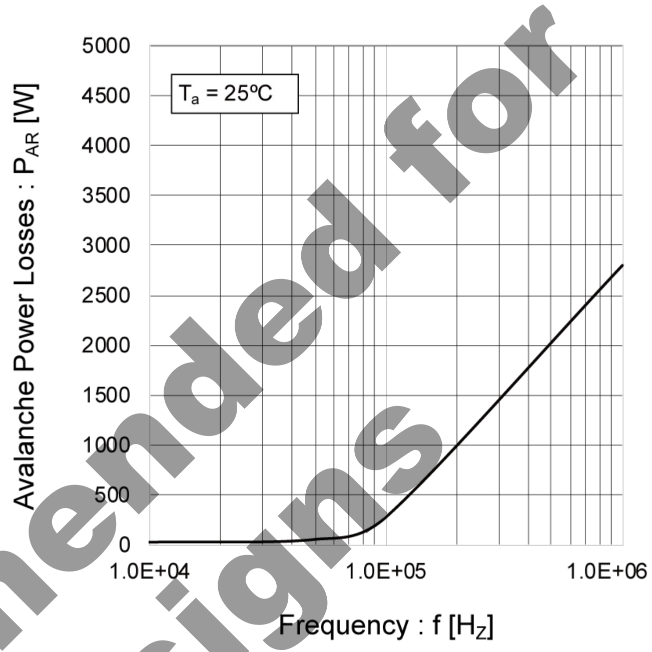
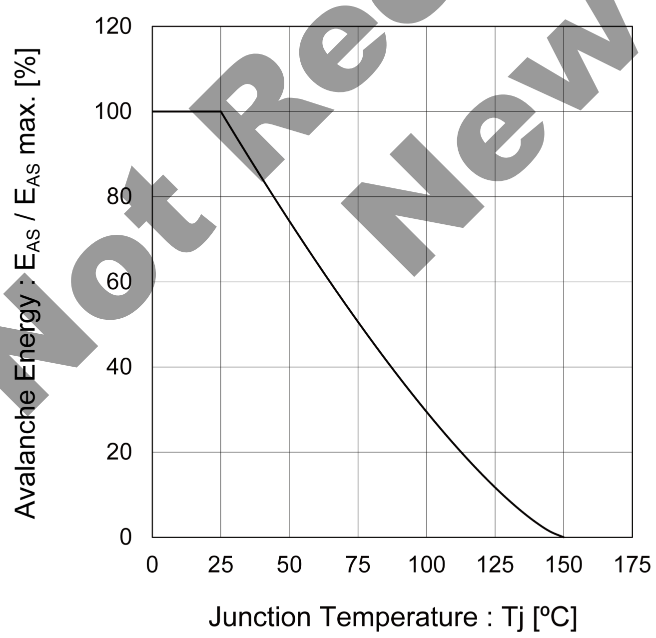


Fig.6 Avalanche Energy Derating Curve vs. Junction Temperature



●Electrical characteristic curves

Fig.7 Typical Output Characteristics(I)

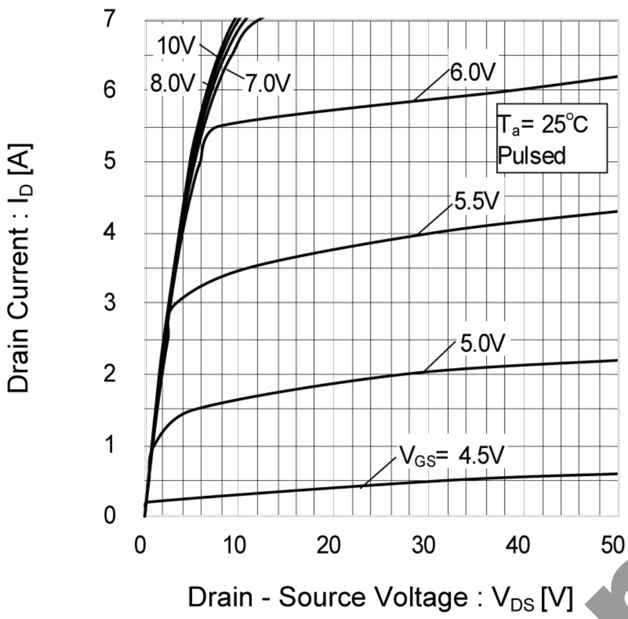


Fig.8 Typical Output Characteristics(II)

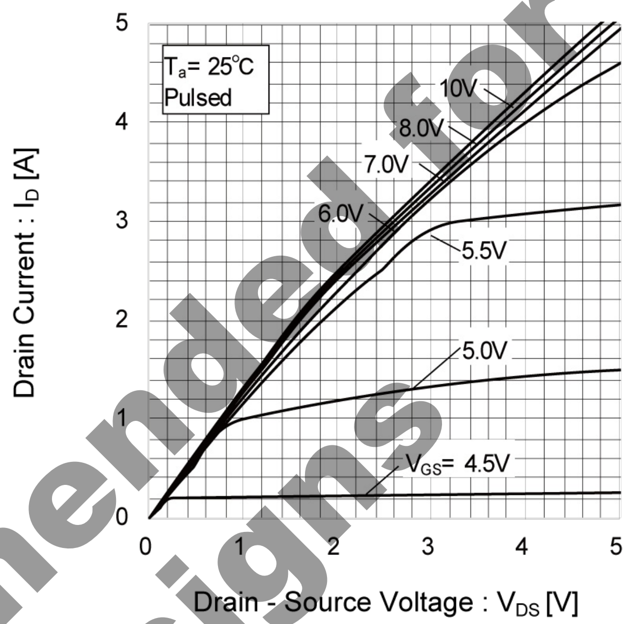


Fig.9 Tj = 150°C Typical Output Characteristics (I)

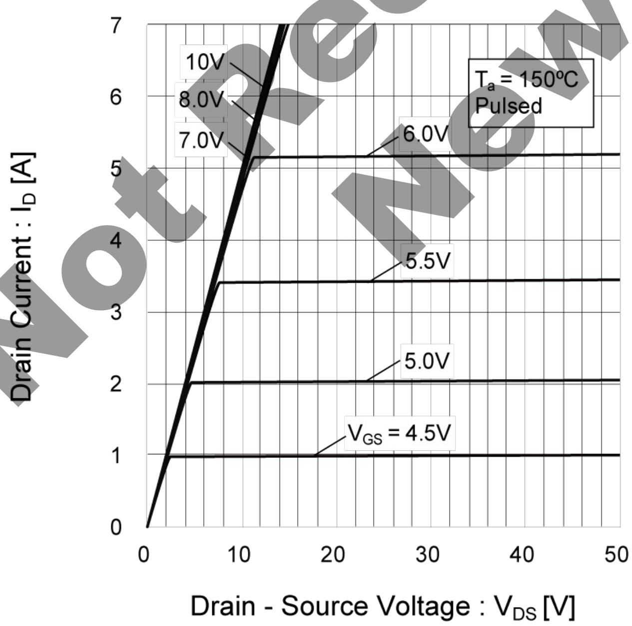
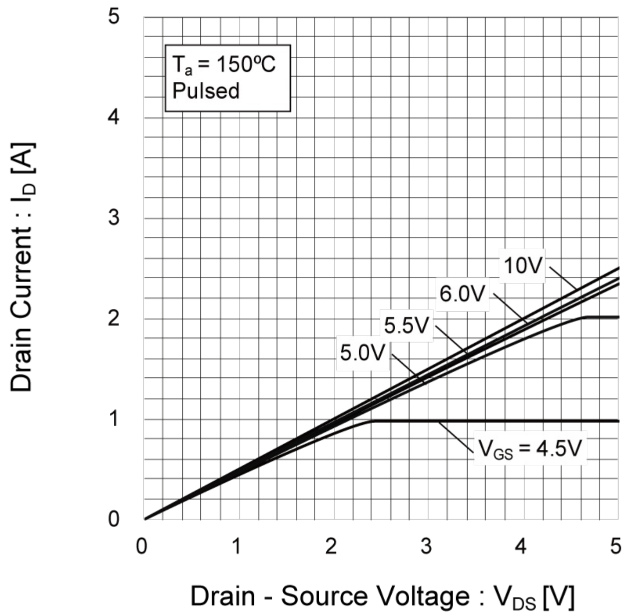


Fig.10 Tj = 150°C Typical Output Characteristics (II)



●Electrical characteristic curves

Fig.11 Breakdown Voltage vs. Junction Temperature

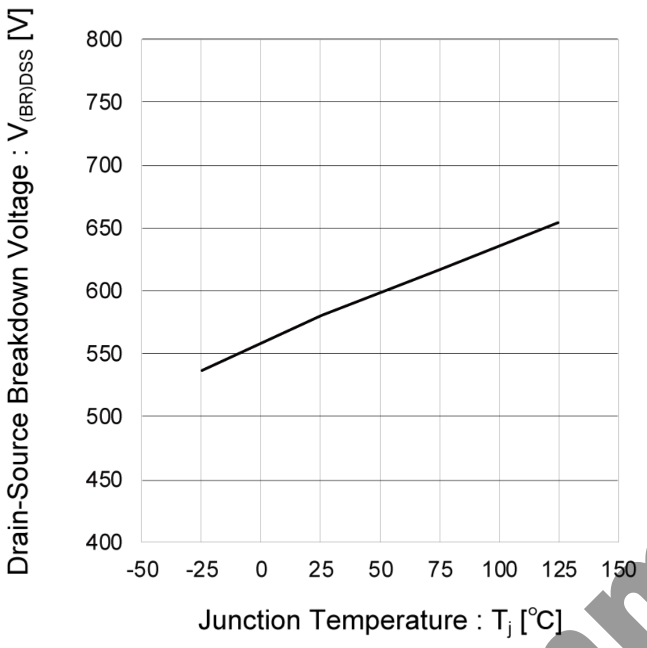


Fig.12 Typical Transfer Characteristics

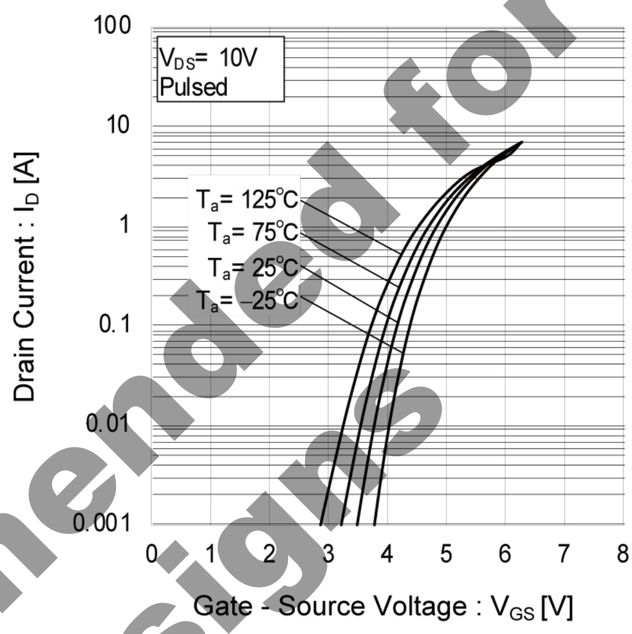


Fig.13 Gate Threshold Voltage vs. Junction Temperature

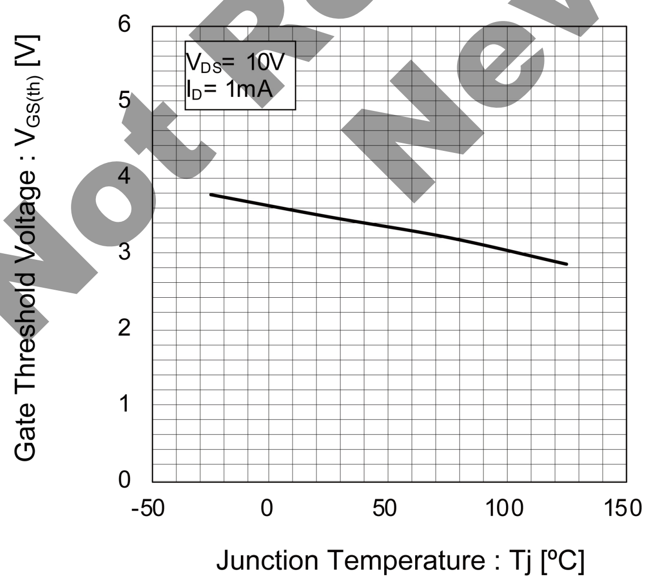
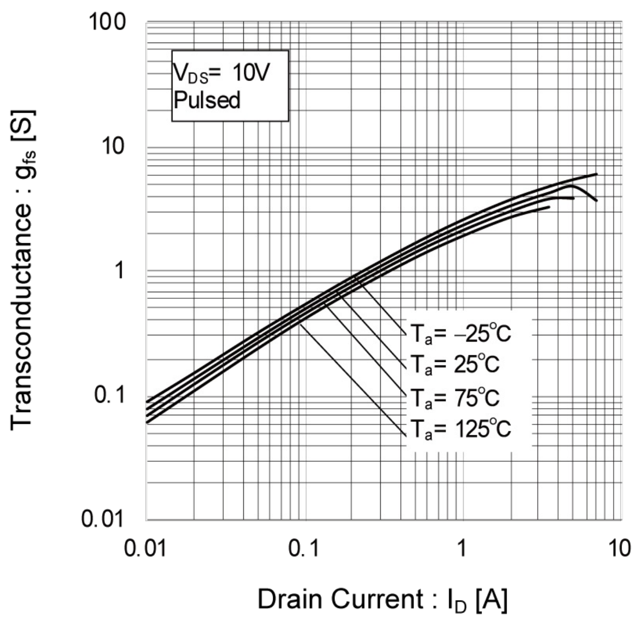


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

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

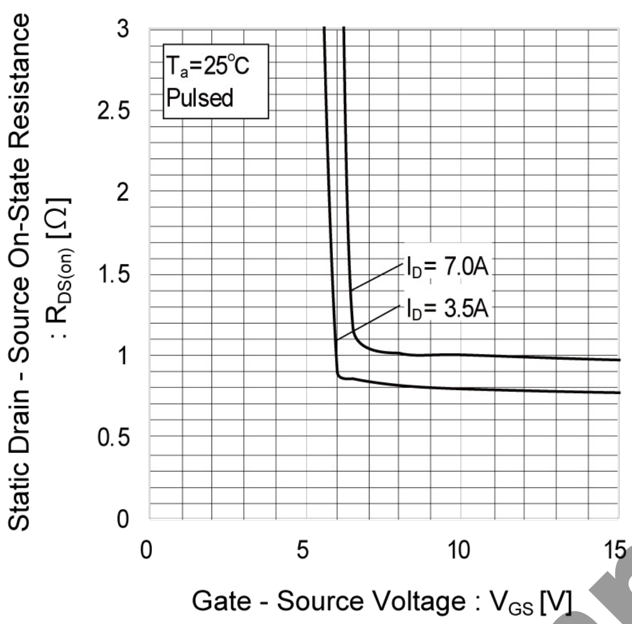


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

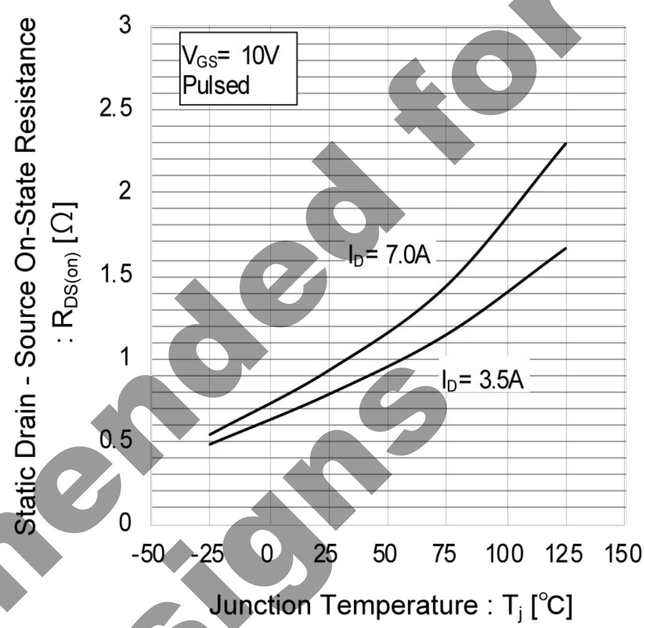
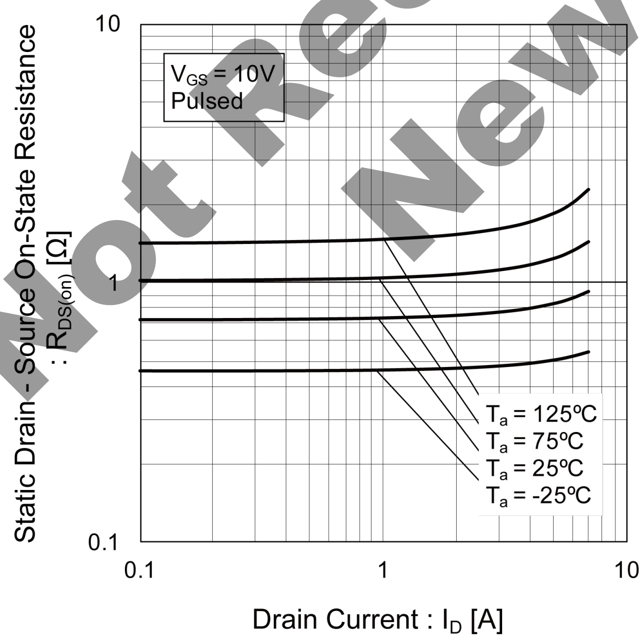


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.18 Typical Capacitance vs. Drain - Source Voltage

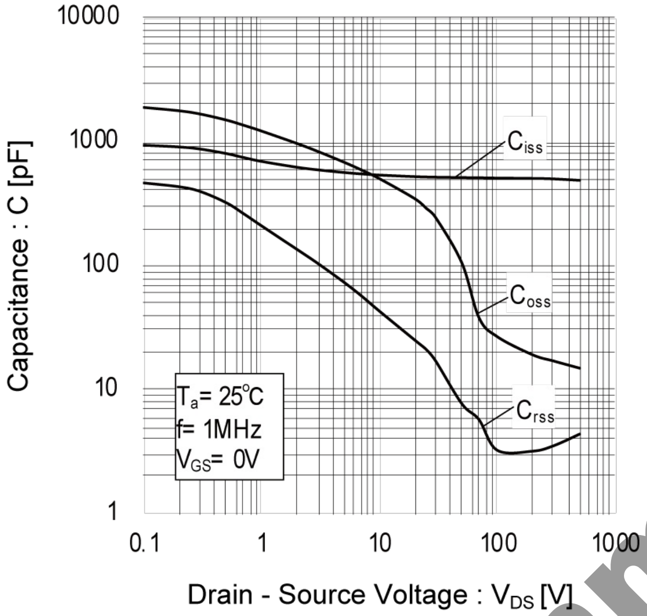


Fig.19 Coss Stored Energy

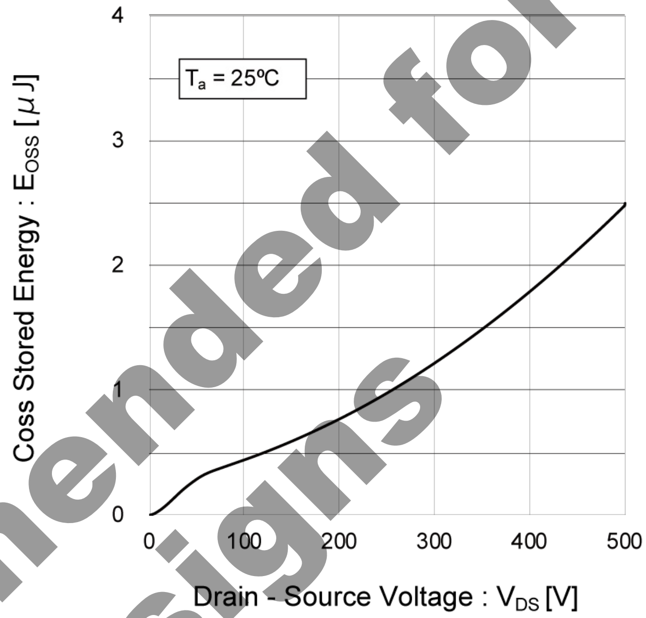


Fig.20 Switching Characteristics

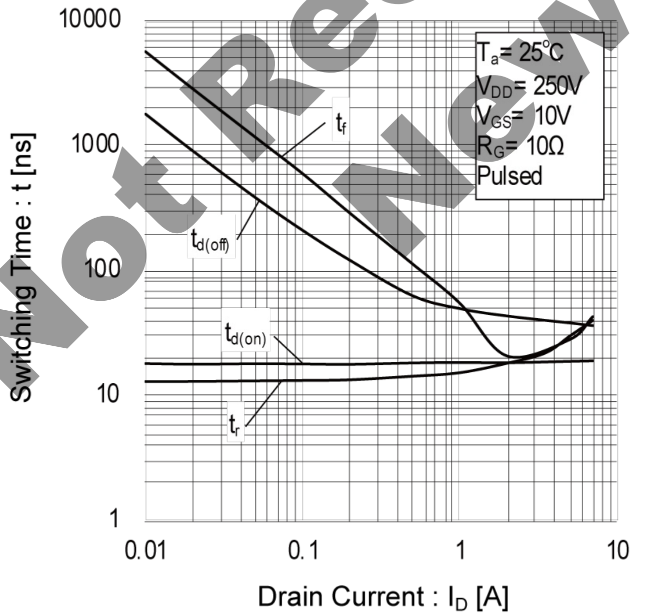
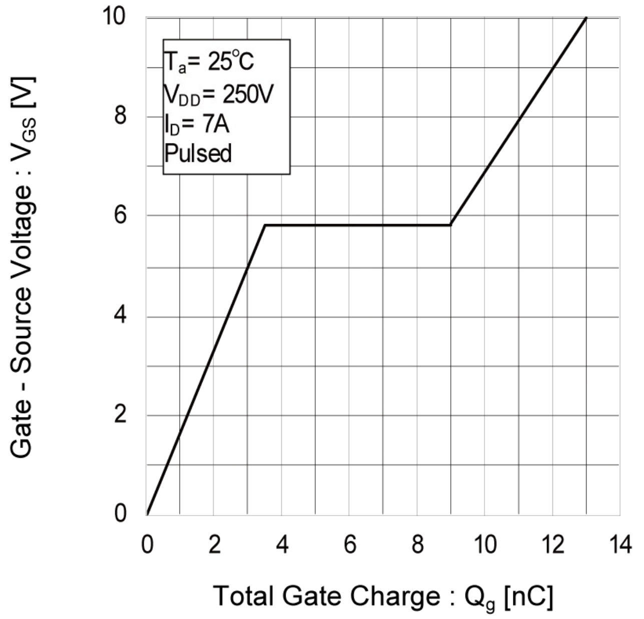


Fig.21 Dynamic Input Characteristics



●Electrical characteristic curves

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

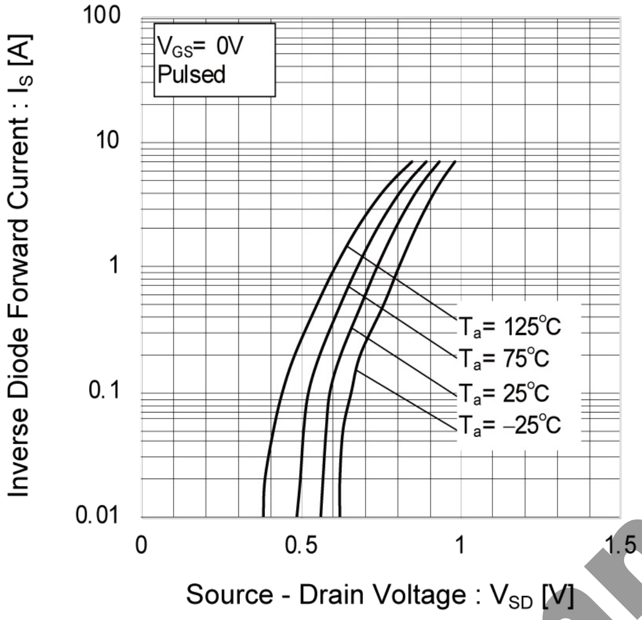
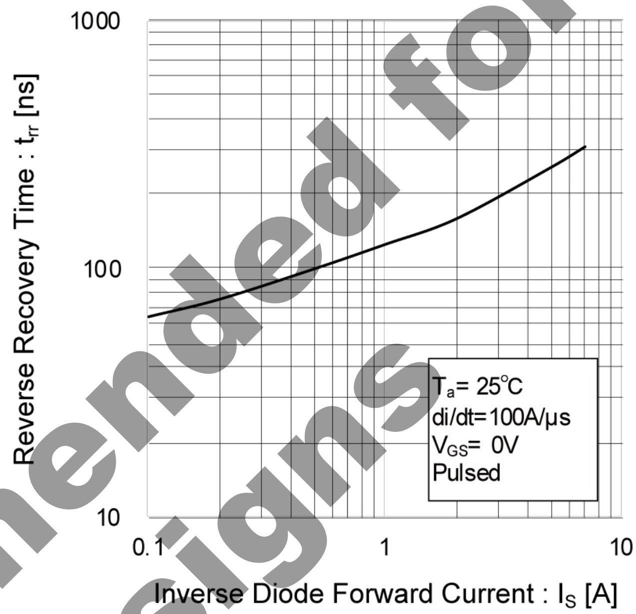


Fig.23 Reverse Recovery Time vs. Inverse Diode Forward Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

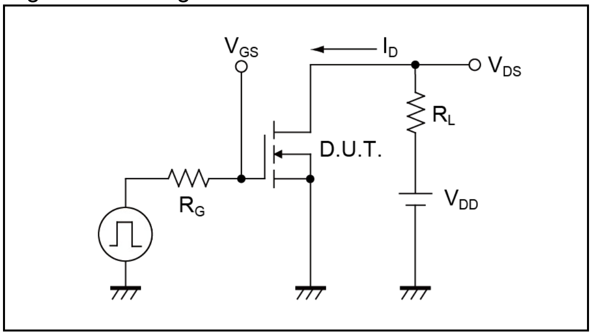


Fig.1-2 Switching Waveforms

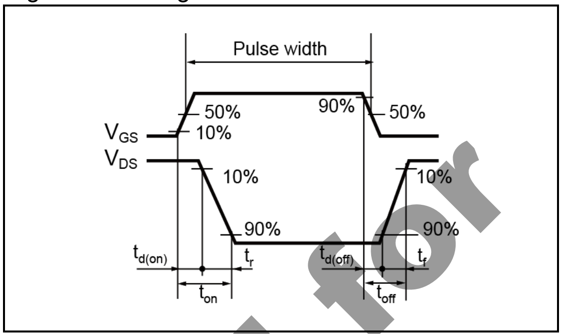


Fig.2-1 Gate Charge Measurement Circuit

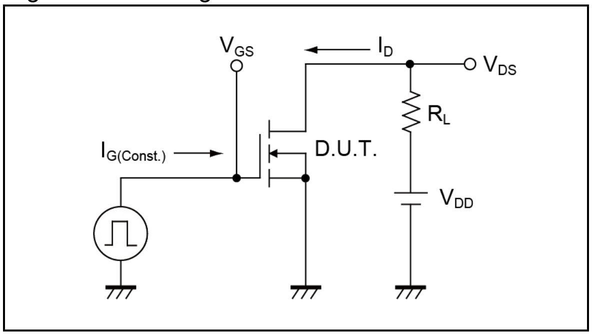


Fig.2-2 Gate Charge Waveform

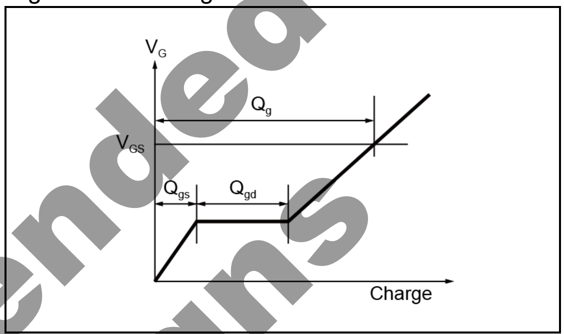


Fig.3-1 Avalanche Measurement Circuit

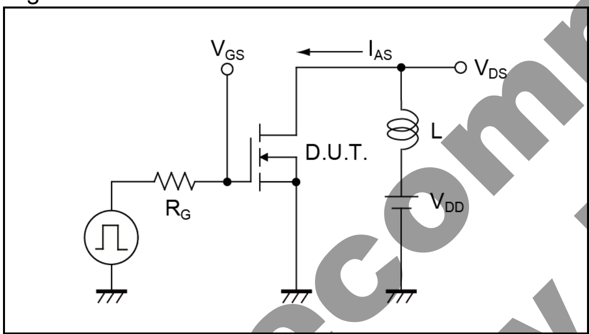


Fig.3-2 Avalanche Waveform

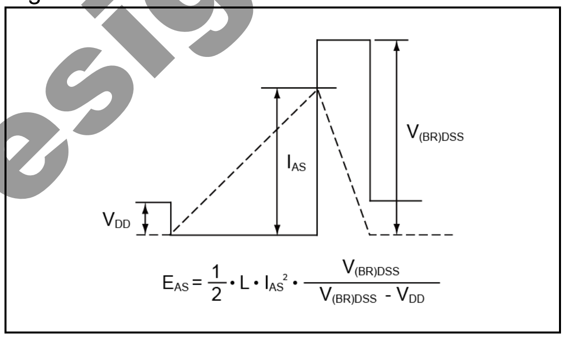


Fig.4-1 dv/dt Measurement Circuit

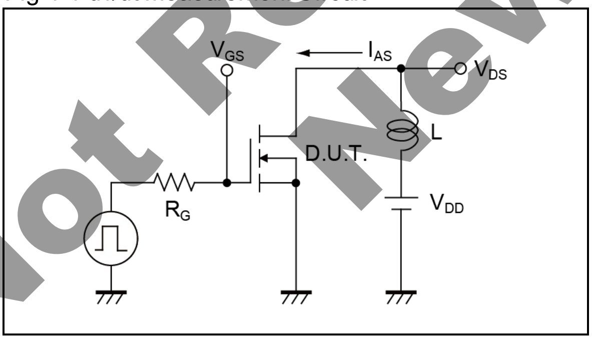


Fig.4-2 dv/dt Waveform

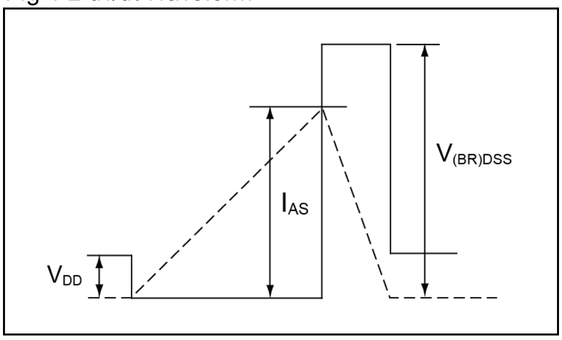


Fig.5-1 di/dt Measurement Circuit

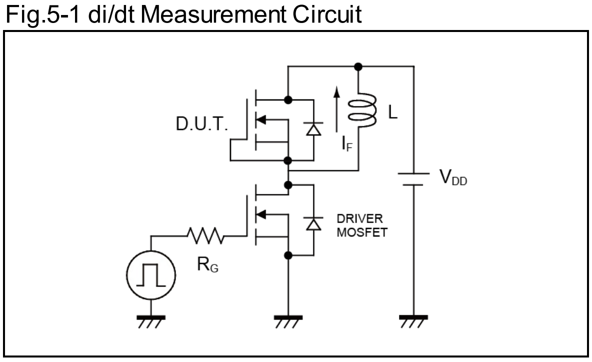
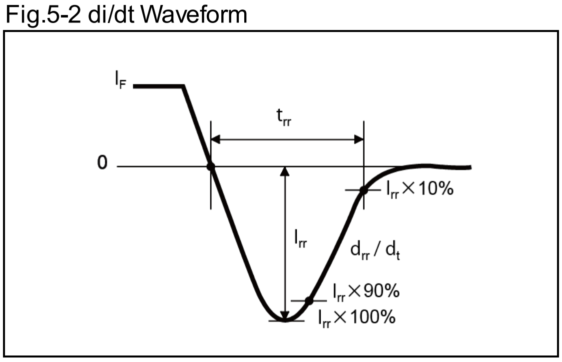
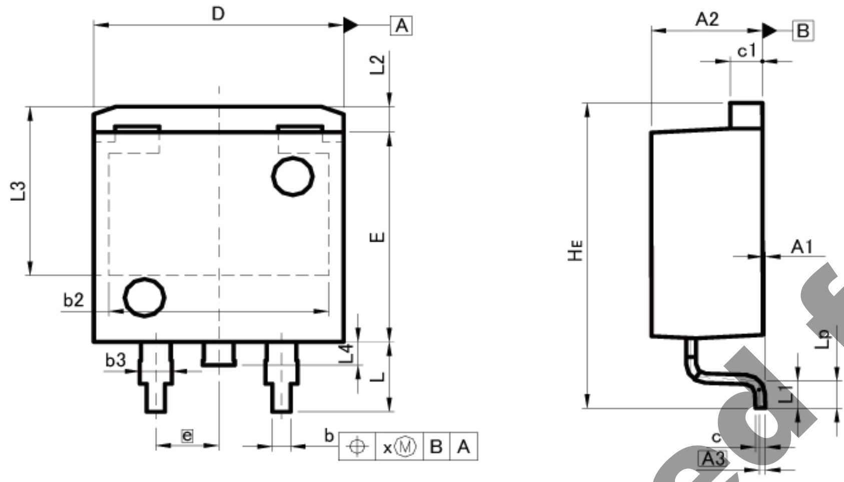


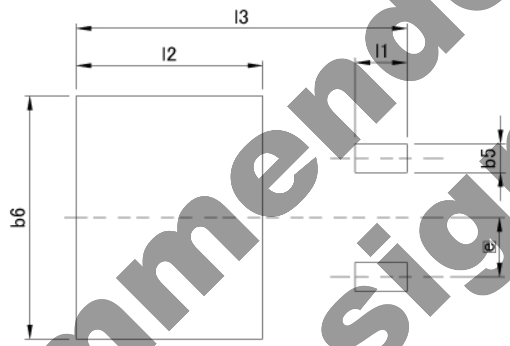
Fig.5-2 di/dt Waveform



●Dimensions

LPTS
< TO-263 >
(D2PAK)





Pattern of terminal position areas
[Not a pattern of soldering pads]

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A1	0.00	0.30	0.000	0.012
A2	4.30	4.70	0.169	0.185
A3	0.25		0.010	
b	0.68	0.98	0.027	0.039
b2	8.90		0.350	
b3	1.14	1.44	0.045	0.057
c	0.30	0.60	0.012	0.024
c1	1.10	1.50	0.043	0.059
D	9.80	10.40	0.386	0.409
E	8.80	9.20	0.346	0.362
e	2.54		0.100	
HE	12.80	13.40	0.504	0.528
L	2.70	3.30	0.106	0.130
L1	0.90	1.50	0.035	0.059
L2	1.10		0.043	
L3	7.25		0.285	
L4	1.00		0.039	
Lp	0.90	1.50	0.035	0.059
x	–	0.25	–	0.010

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b5	–	1.23	–	0.049
b6	–	10.40	–	0.409
l1	–	2.10	–	0.083
l2	–	7.55	–	0.297
l3	–	13.40	–	0.528

Dimension in mm/inches

Notes

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