N-Channel Enhancement Mode Power MOSFET

MTN5N50FP

BV_{DSS} : 500V
$R_{DS(ON)\ max.}$: 1.6Ω
I_D : 4.5A

Description

The MTN5N50FP is a N-channel enhancement-mode MOSFET, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness.
The TO-220FP package is universally preferred for all commercial-industrial applications

Features

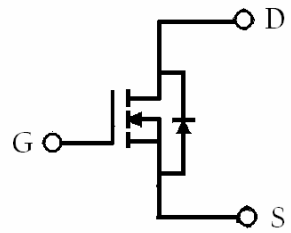
- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- Insulating package, front/back side insulating voltage=2500V(AC)
- RoHS compliant package

Applications

- Open Framed Power Supply
- Adapter
- STB

Symbol

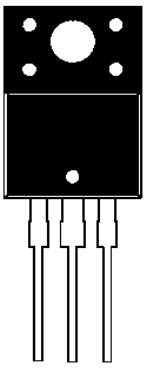
MTN5N50FP



G：Gate
D：Drain
S：Source

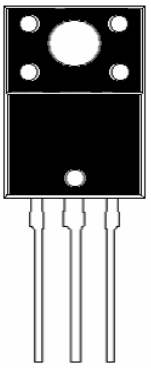
Outline

TO-220FP (C forming)



G D S

TO-220FP (S forming)



G D S

Absolute Maximum Ratings (T_C=25°C)

Parameter	Symbol	Limits	Unit
Drain-Source Voltage	V_{DS}	500	V
Gate-Source Voltage	V_{GS}	±30	V
Continuous Drain Current	I_D	4.5*	A
Continuous Drain Current @T_C=100°C	I_D	2.7*	A
Pulsed Drain Current @ V_{GS}=10V (Note 1)	I_{DM}	18 *	A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	90	mJ
Avalanche Current (Note 1)	I_{AR}	4.5	A
Repetitive Avalanche Energy (Note 1)	E_{AR}	8.5	mJ
Peak Diode Recovery dv/dt (Note 3)	dv/dt	4.5	V/ns
Maximum Temperature for Soldering @ Lead at 0.125 in(0.318mm) from case for 10 seconds	T_L	300	°C
Total Power Dissipation (T_A=25℃)	P_D	2	W
Total Power Dissipation (T_C=25℃)		28	W
Linear Derating Factor		0.22	W/°C
Operating Junction and Storage Temperature	Tj, Tstg	-55~+150	°C

* Drain current limited by maximum junction temperature.

Note : 1.Repetitive rating; pulse width limited by maximum junction temperature.

2. I_{AS}=4.5A, V_{DD}=50V, L=8mH, R_G=25Ω, starting T_J=+25℃.

3. I_{SD}≤4.5A, dI/dt≤100A/μs, V_{DD}≤BV_{DSS}, starting T_J=+25℃.

Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{th,j-c}$	4.5	°C/W
Thermal Resistance, Junction-to-ambient, max	$R_{th,j-a}$	62.5	°C/W

Characteristics (T_C=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV_{DSS}	500	-	-	V	V_{GS}=0, I_D=250μA, Tj=25℃
$\Delta BV_{DSS}/\Delta Tj$	-	0.4	-	V/°C	Reference to 25°C, I_D=250μA
$V_{GS(th)}$	2.0	-	4.0	V	V_{DS} = V_{GS}, I_D=250μA
*G_{FS}	-	2	-	S	V_{DS} =15V, I_D=2.25A
I_{GSS}	-	-	±100	nA	V_{GS}=±30
I_{DSS}	-	-	1	μA	V_{DS} =500V, V_{GS} =0
	-	-	10	μA	V_{DS} =400V, V_{GS} =0, T_C=125°C
*$R_{DS(ON)}$	-	-	1.6	Ω	V_{GS} =10V, I_D=2.25A
Dynamic					
*Qg	-	20	-	nC	I_D=4.5A, V_{DD}=400V, V_{GS}=10V
*Qgs	-	3.8	-		
*Qgd	-	10.6	-		
*$t_{d(ON)}$	-	18	-	ns	V_{DD}=250V, I_D=4.5A, V_{GS}=10V, R_G=25Ω
*tr	-	21	-		
*$t_{d(OFF)}$	-	33	-		
*t_f	-	20	-		
Ciss	-	738	-	pF	V_{GS}=0V, V_{DS}=25V, f=1MHz
Coss	-	74	-		
Crss	-	8	-		
Source-Drain Diode					
*V_{SD}	-	-	1.5	V	I_S=4.5A, V_{GS}=0V
*I_S	-	-	4.5	A	
*I_{SM}	-	-	18		
*trr	-	280	-	ns	V_{GS}=0, I_F=4.5A, dI/dt=100A/μs
*Qrr	-	2	-	μC	

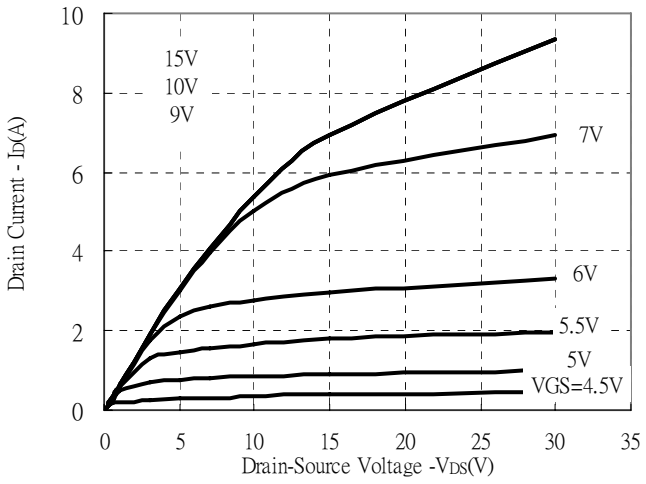
*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

Ordering Information

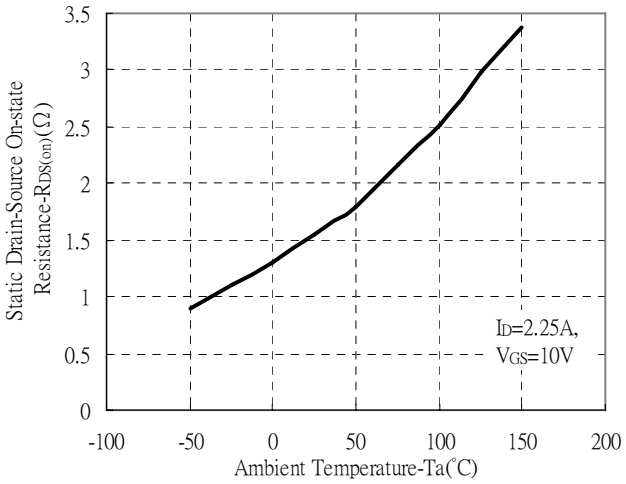
Device	Package	Shipping
MTN5N50FP	TO-220FP(C forming) (RoHS compliant)	50 pcs/tube, 20 tubes/box, 4 boxes / carton
MTN5N50FPS	TO-220FP(S forming) (RoHS compliant)	50 pcs/tube, 20 tubes/box, 4 boxes / carton

Typical Characteristics

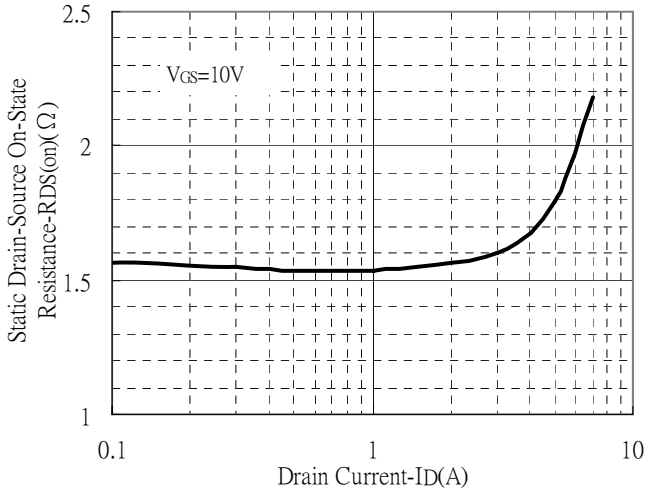
Typical Output Characteristics



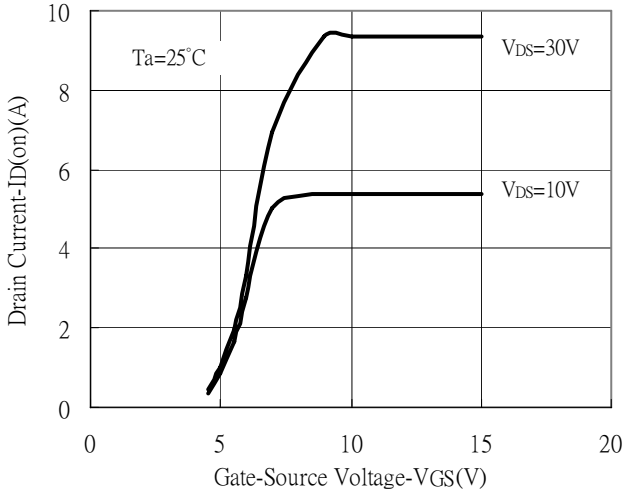
Static Drain-Source On-resistance vs Ambient Temperature



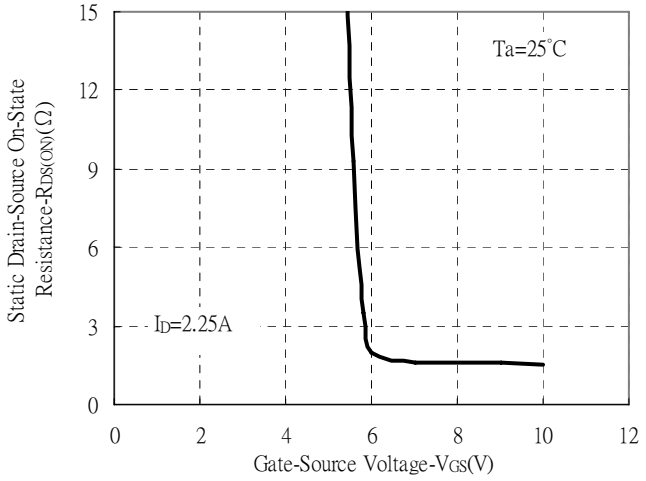
Static Drain-Source On-State resistance vs Drain Current



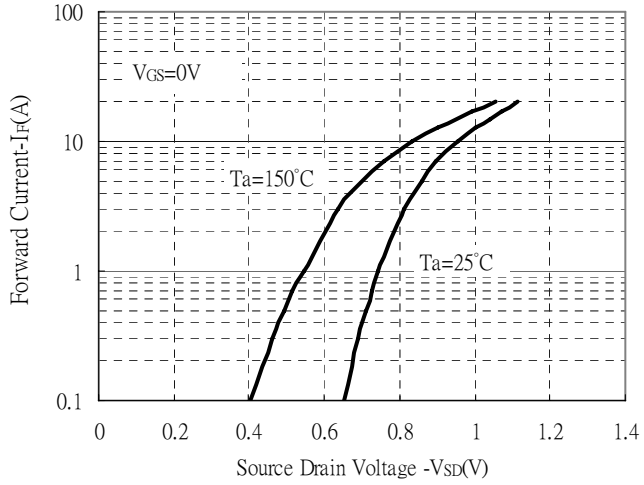
Drain Current vs Gate-Source Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

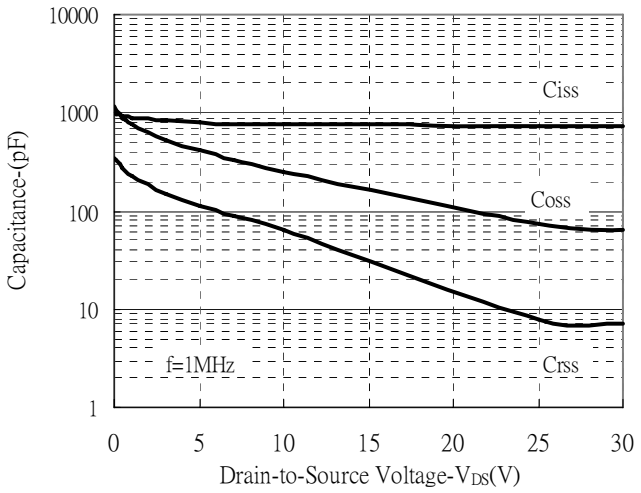


Forward Drain Current vs Source-Drain Voltage

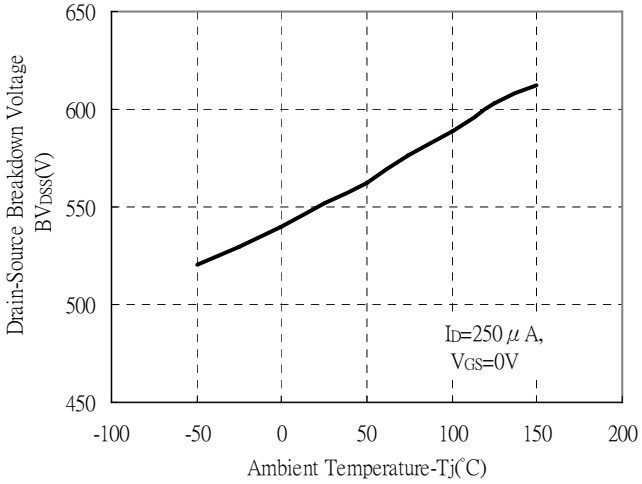


Typical Characteristics(Cont.)

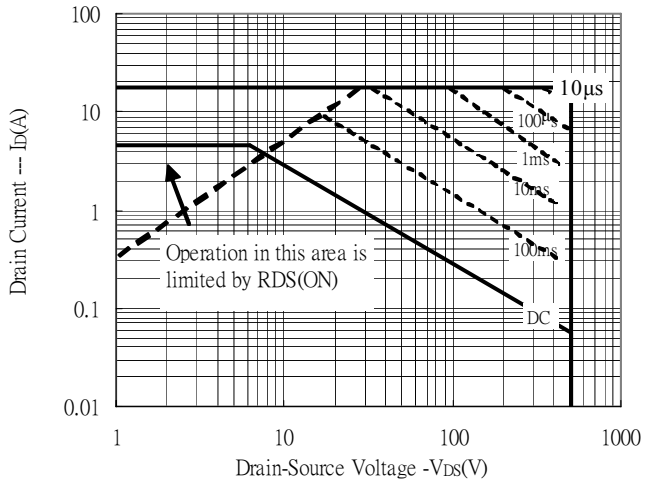
Capacitance vs Reverse Voltage



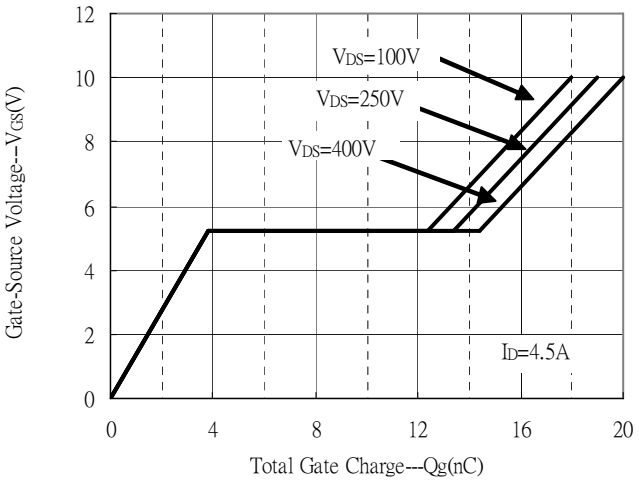
Brekdown Voltage vs Ambient Temperature



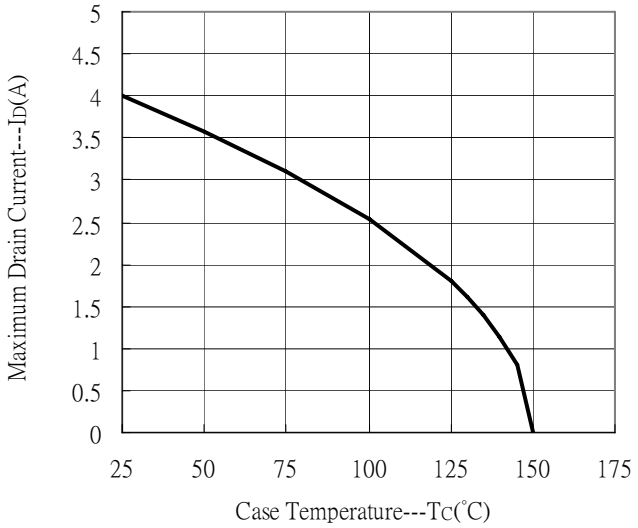
Maximum Safe Operating Area



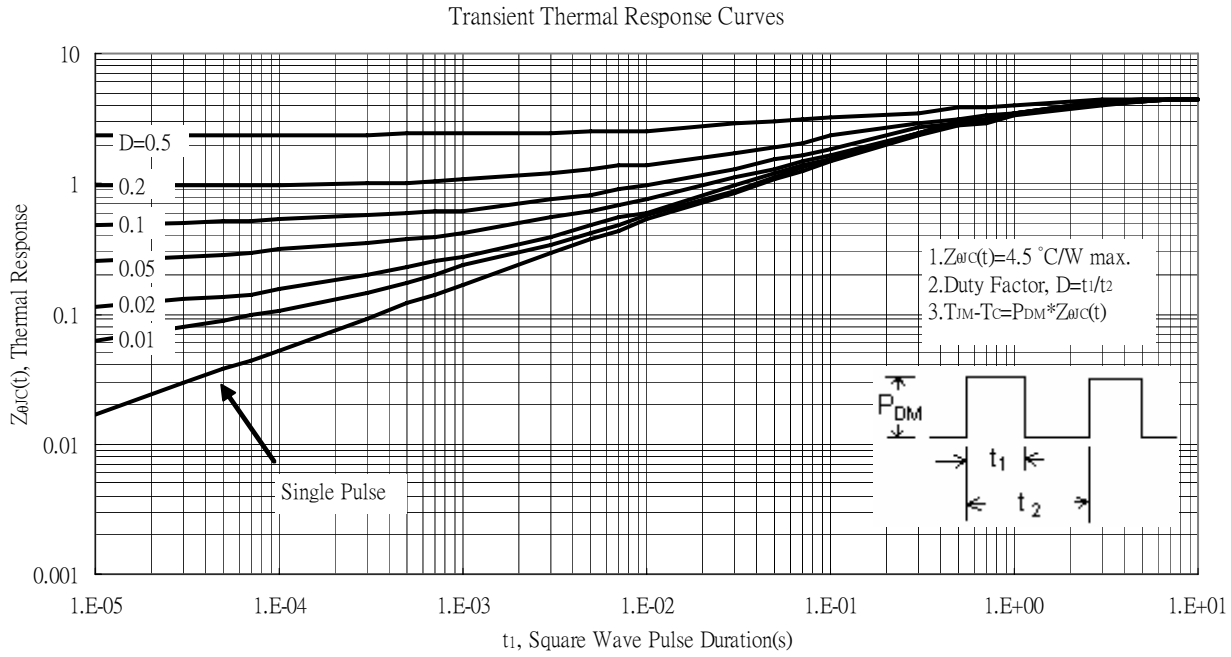
Gate Charge Characteristics



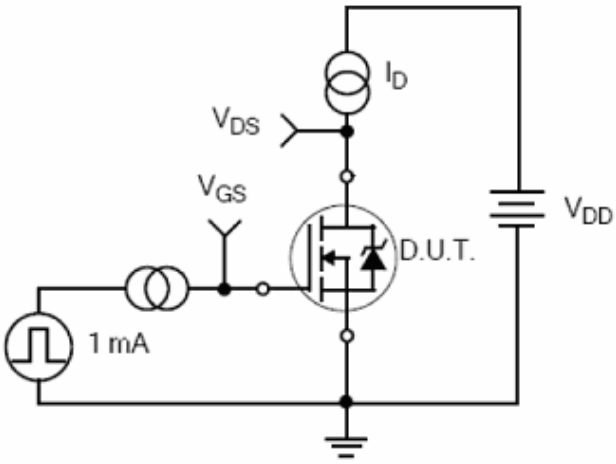
Maximum Drain Current vs Case Temperature



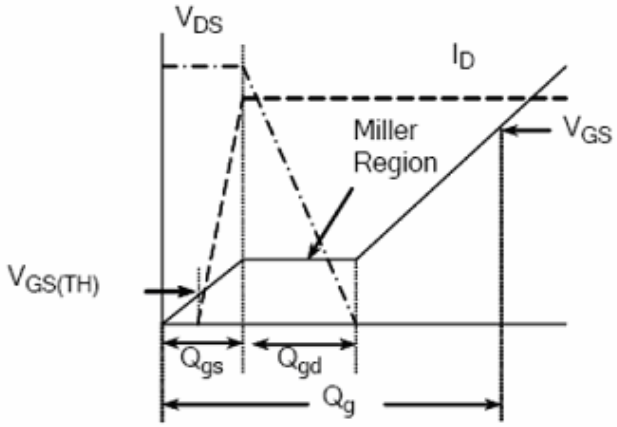
Typical Characteristics(Cont.)



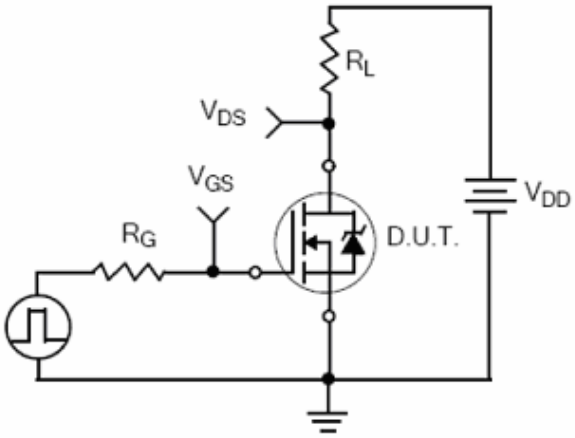
Test Circuit and Waveforms



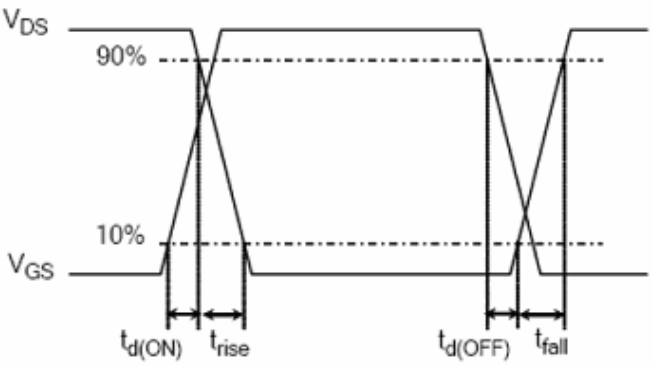
Gate Charge Test Circuit



Gate Charge Waveform

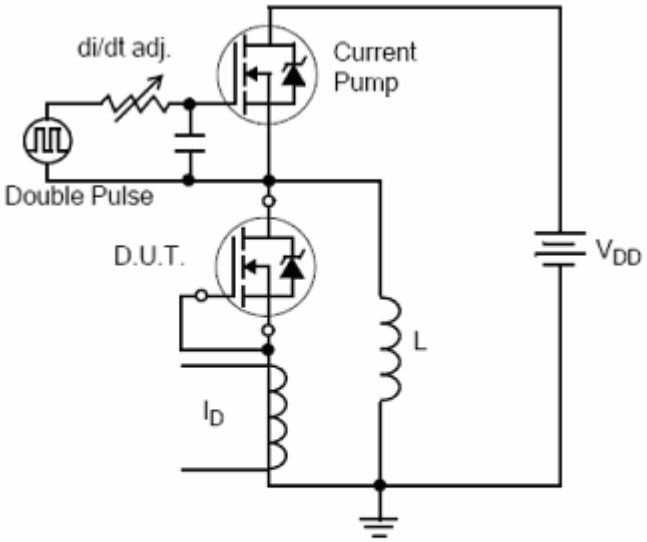


Resistive Switching Test Circuit

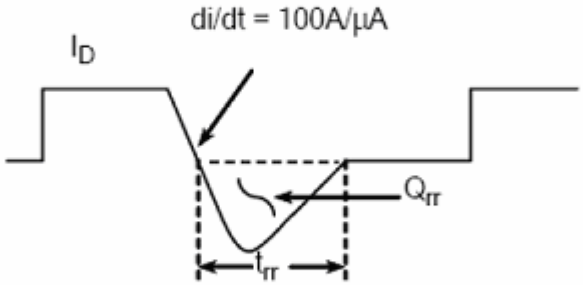


Resistive Switching Waveforms

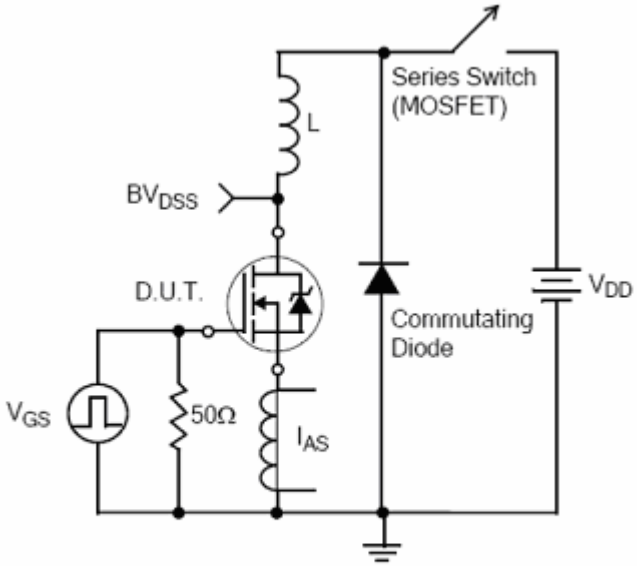
Test Circuit and Waveforms(Cont.)



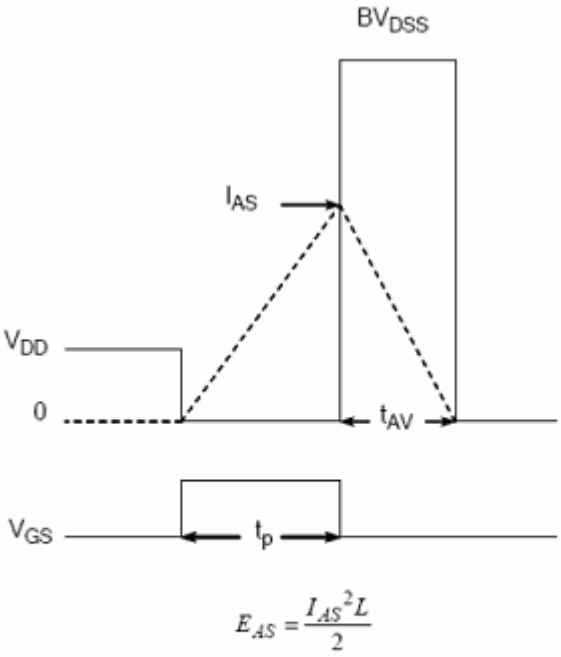
Diode Reverse Recovery Test Circuit



Diode Reverse Recovery Waveform



Unclamped Inductive Switching Test Circuit



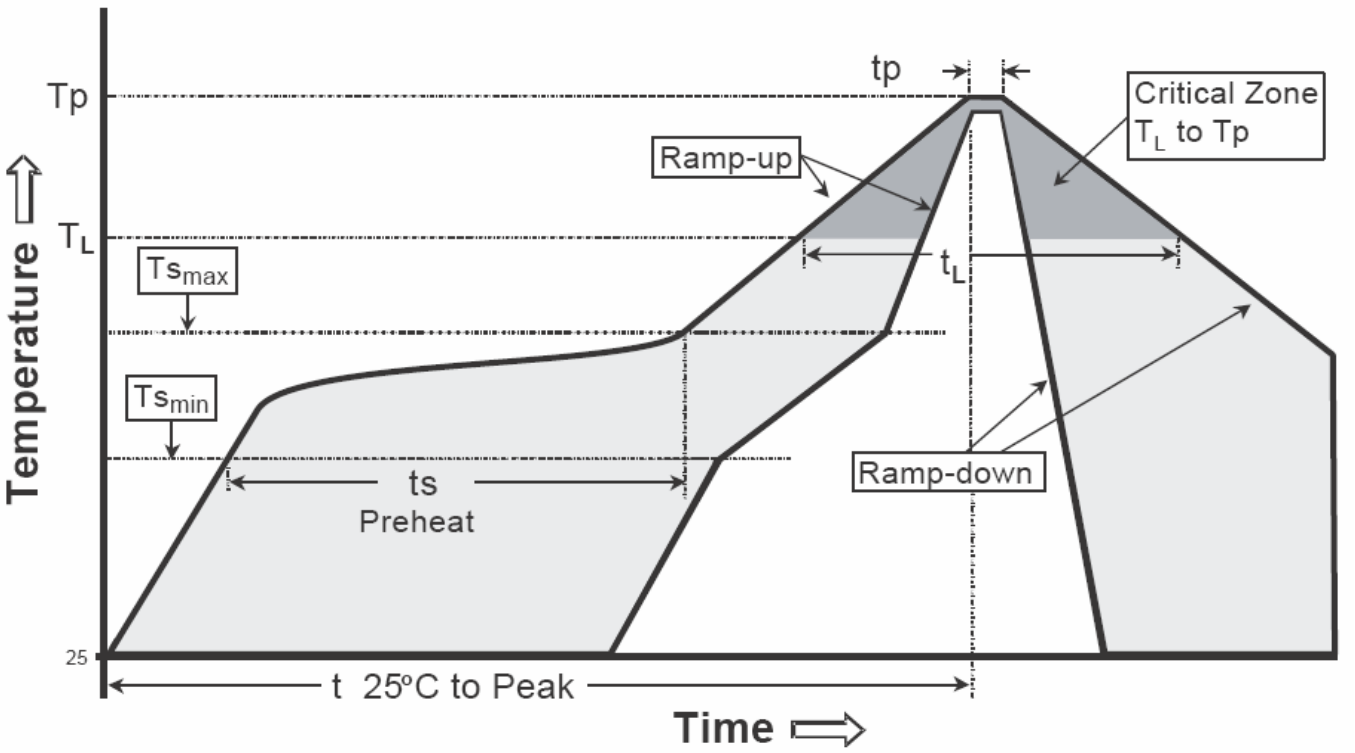
$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Unclamped Inductive Switching Waveforms

Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

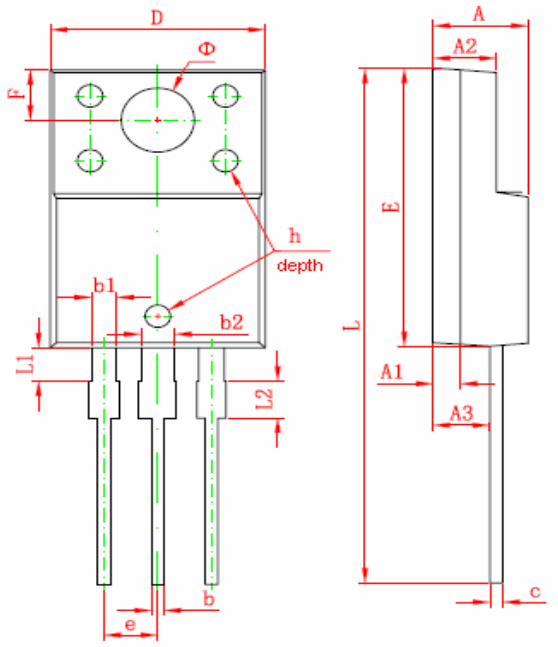
Recommended temperature profile for IR reflow



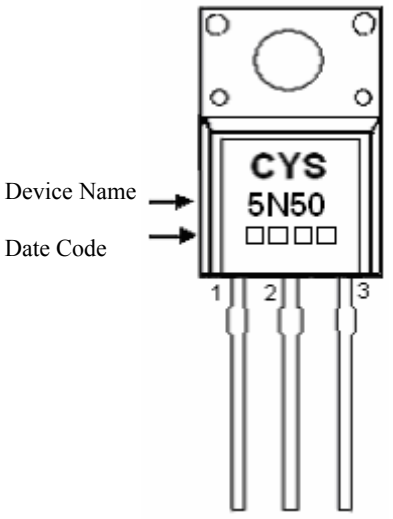
Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat −Temperature Min(T_S min) −Temperature Max(T_S max) −Time($t_{s\ min}$ to $t_{s\ max}$)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: −Temperature (T_L) − Time (t_L)	 183°C 60-150 seconds	 217°C 60-150 seconds
Peak Temperature(T_P)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	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.

Note : All temperatures refer to topside of the package, measured on the package body surface.

TO-220FP (C Forming) Dimension



Marking:



3-Lead TO-220FP Plastic Package
CYStek Package Code: FP

Style: Pin 1.Gate 2.Drain 3.Source

*Typical

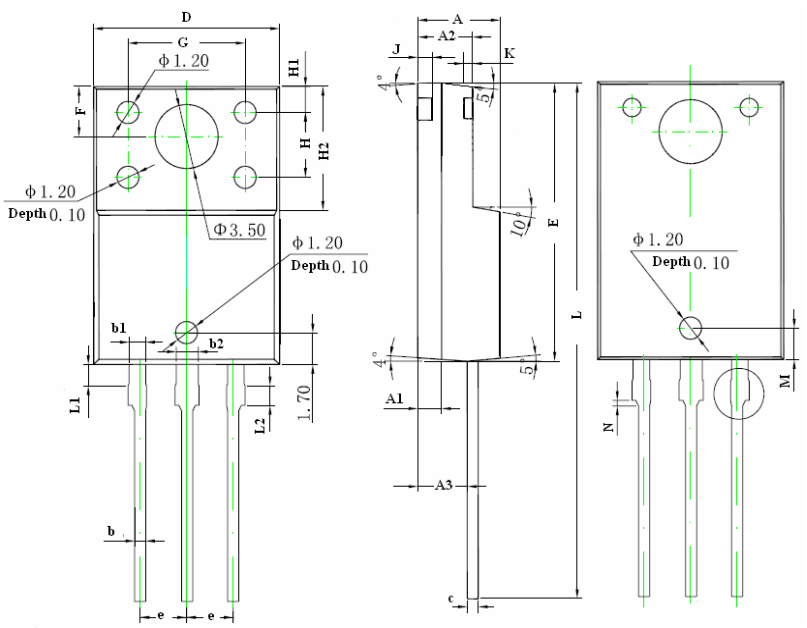
DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.169	0.185	4.300	4.700	E	0.583	0.598	14.800	15.200
A1	0.051 REF		1.300 REF		e	0.100*		2.540*	
A2	0.110	0.126	2.800	3.200	F	0.106 REF		2.700 REF	
A3	0.098	0.114	2.500	2.900	Φ	0.138 REF		3.500 REF	
b	0.020	0.030	0.500	0.750	h	0.000	0.012	0.000	0.300
b1	0.043	0.053	1.100	1.350	L	1.102	1.118	28.000	28.400
b2	0.059	0.069	1.500	1.750	L1	0.067	0.075	1.700	1.900
c	0.020	0.030	0.500	0.750	L2	0.075	0.083	1.900	2.100
D	0.392	0.408	9.960	10.360					

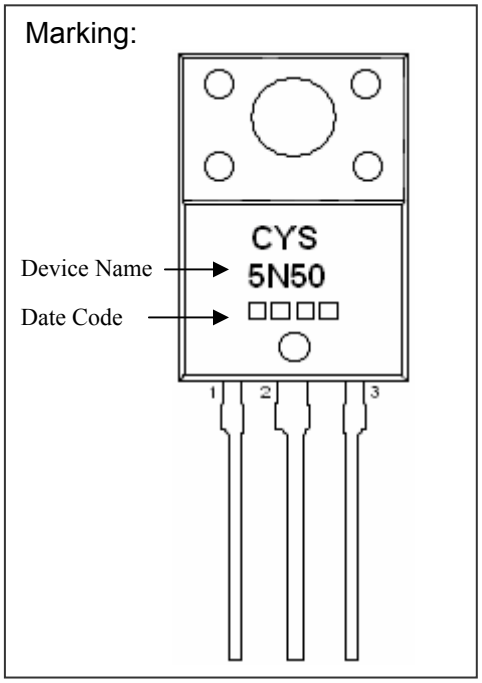
Notes: 1.Controlling dimension: millimeters.
2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

Material:

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

TO-220FP (S Forming) Dimension





3-Lead TO-220FP Plastic Package
CYStek Package Code: FP

Style: Pin 1.Gate 2.Drain 3.Source

*Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.171	0.183	4.35	4.65	G	0.246	0.258	6.25	6.55
A1	0.051 REF		1.300 REF		H	0.138 REF		3.50 REF	
A2	0.112	0.124	2.85	3.15	H1	0.055 REF		1.40 REF	
A3	0.102	0.110	2.60	2.80	H2	0.256	0.272	6.50	6.90
b	0.020	0.030	0.50	0.75	J	0.031 REF		0.80 REF	
b1	0.031	0.041	0.80	1.05	K	0.020		0.50 REF	
b2	0.047 REF		1.20 REF		L	1.102	1.118	28.00	28.40
c	0.020	0.030	0.500	0.750	L1	0.043	0.051	1.10	1.30
D	0.396	0.404	10.06	10.26	L2	0.036	0.043	0.92	1.08
E	0.583	0.598	14.80	15.20	M	0.067 REF		1.70 REF	
e	0.100 *		2.54*		N	0.012 REF		0.30 REF	
F	0.106 REF		2.70 REF						

Notes: 1.Controlling dimension: millimeters.
2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

Material:

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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