



N-Channel Enhancement Mode Power MOSFET MTN12N60BFP

BV_{DSS} : 600V
R_{DS(ON)} : 0.46Ω typ.
I_D : 12A

Description

The MTN12N60BFP 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

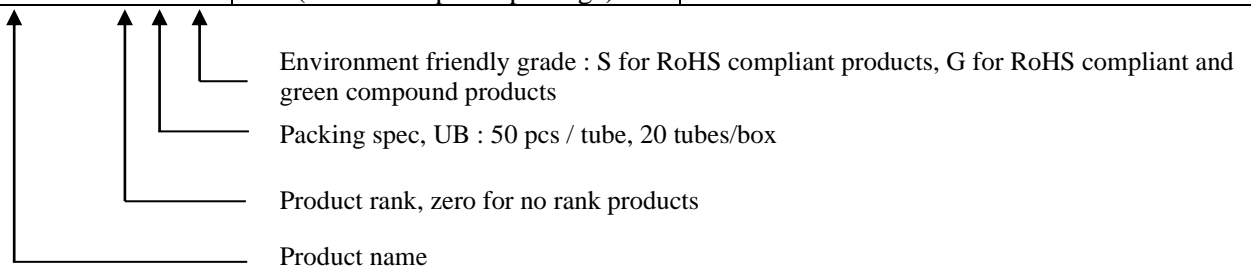
- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant package

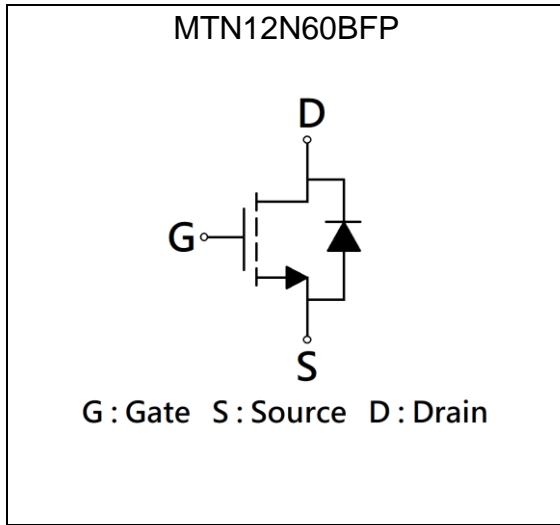
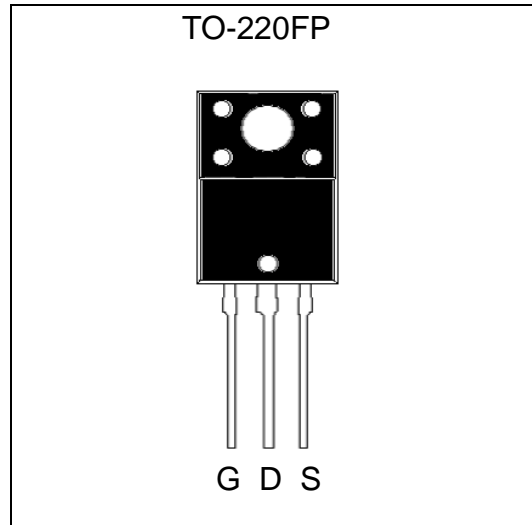
Applications

- Ballast
- Inverter

Ordering Information

Device	Package	Shipping
MTN12N60BFP-0-UB-S	TO-220FP (RoHS compliant package)	50 pcs/tube, 20 tubes/box, 5 boxes / carton



Symbol

Outline

Absolute Maximum Ratings (T_C=25°C)

Parameter	Symbol	Limits	Unit
Drain-Source Voltage (Note 1)	V _{DS}	600	V
Gate-Source Voltage	V _{GS}	±30	V
Continuous Drain Current @T _C =100°C, V _{GS} =10V	I _D	12*	A
Continuous Drain Current @T _C =100°C, V _{GS} =10V		7.4*	A
Pulsed Drain Current @ V _{GS} =10V (Note 2)	I _{DM}	48*	A
Single Pulse Avalanche Energy (Note 3)	E _{AS}	870	mJ
Avalanche Current (Note 2)	I _{AR}	12	A
Repetitive Avalanche Energy (Note 2)	E _{AR}	22.5	mJ
Peak Diode Recovery dv/dt (Note 4)	dv/dt	3.5	V/ns
Maximum Temperature for Soldering @ Lead at 0.125 in(3.175mm) from case for 10 seconds	T _L	300	°C
Total Power Dissipation (T _C =25°C)	P _D	62.5	W
Linear Derating Factor above 25°C		0.5	W/°C
Operating Junction and Storage Temperature	T _J , T _{stg}	-55~+150	°C

* Drain current limited by maximum junction temperature.

- Note :
1. T_J=+25°C to +150°C.
 2. Repetitive rating; pulse width limited by maximum junction temperature.
 3. I_{AS}=12A, V_{DD}=50V, L=11mH, R_G=25Ω, starting T_J=+25°C.
 4. I_{SD}=12A, dI/dt<100A/μs, V_{DD}<BV_{DSS}, T_J=+150°C.

Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	R _{th,j-c}	2.0	°C/W
Thermal Resistance, Junction-to-ambient, max	R _{th,j-a}	62.5	°C/W



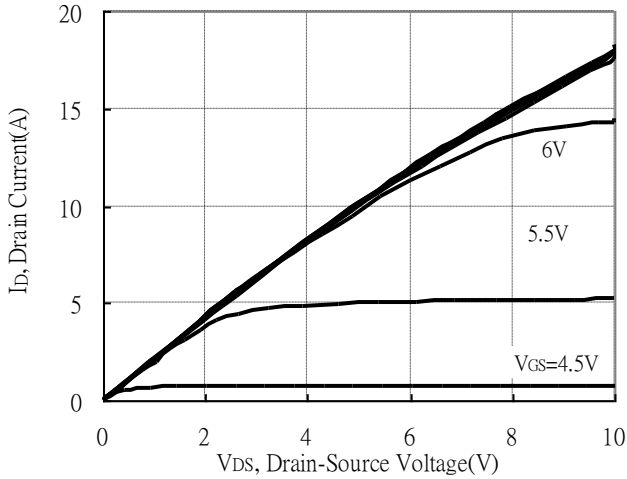
Characteristics (Tj=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	600	-	-	V	V _{GS} =0V, I _D =250μA
ΔBV _{DSS} /ΔT _j	-	0.5	-	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}	-	15	-	S	V _{DS} =15V, I _D =6A
I _{GSS}	-	-	±100	nA	V _{GS} =±30V
I _{DSS}	-	-	1	μA	V _{DS} =600V, V _{GS} =0V
	-	-	25		V _{DS} =480V, V _{GS} =0V, T _j =125°C
*R _{DS(ON)}	-	0.46	0.65	Ω	V _{GS} =10V, I _D =6A
Dynamic					
*Q _g	-	52.8	80	nC	I _D =12A, V _{DD} =400V, V _{GS} =10V
*Q _{gs}	-	9.3	-		
*Q _{gd}	-	22.5	-		
*t _{d(ON)}	-	22	44	ns	V _{DD} =300V, I _D =12A, V _{GS} =10V, R _G =25Ω
*t _r	-	49	98		
*t _{d(OFF)}	-	166	332		
*t _f	-	71	142		
C _{iss}	-	1895	2842	pF	V _{GS} =0V, V _{DS} =25V, f=1MHz
C _{oss}	-	187	280		
C _{rss}	-	38	57		
Source-Drain Diode					
*I _S	-	-	12	A	
*I _{SM}	-	-	48		
*V _{SD}	-	-	1.5	V	I _S =12A, V _{GS} =0V
*t _{rr}	-	443	-	ns	V _{GS} =0, I _F =12A, dI/dt=100A/μs
*Q _{rr}	-	3.8	-	μC	

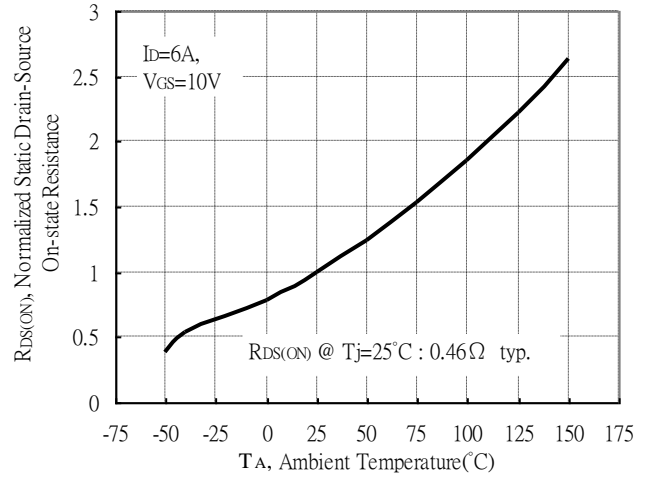
*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

Typical Characteristics

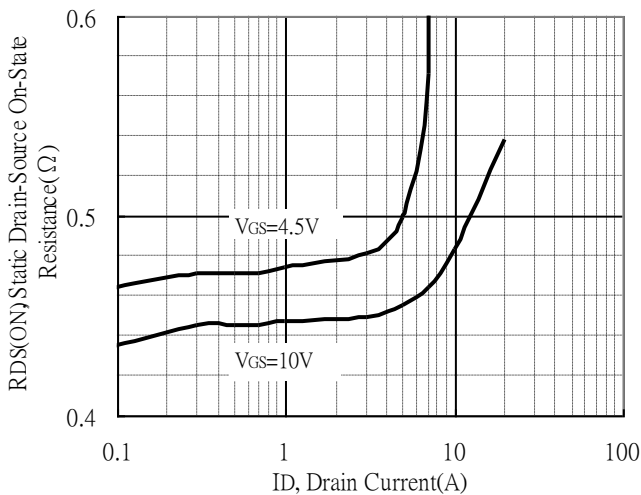
Typical Output Characteristics



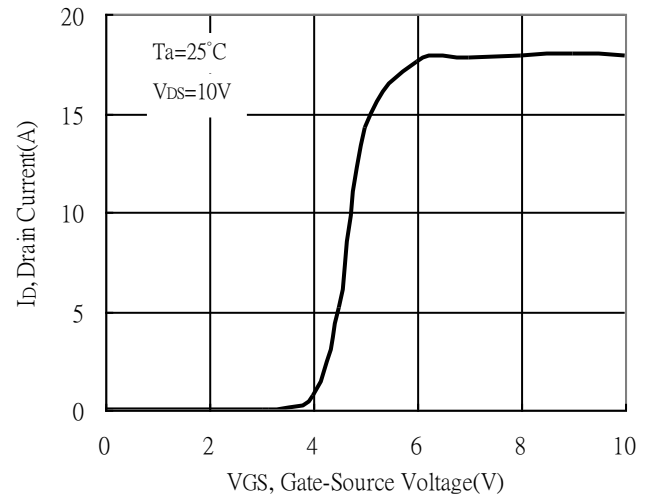
Static Drain-Source On-resistance vs Ambient Temperature



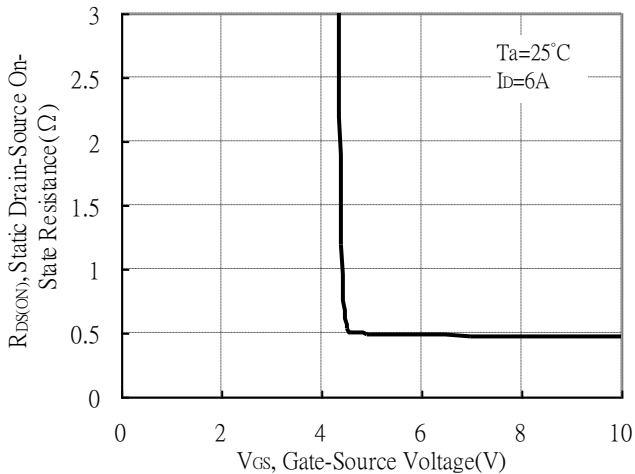
Static Drain-Source On-State resistance vs Drain Current



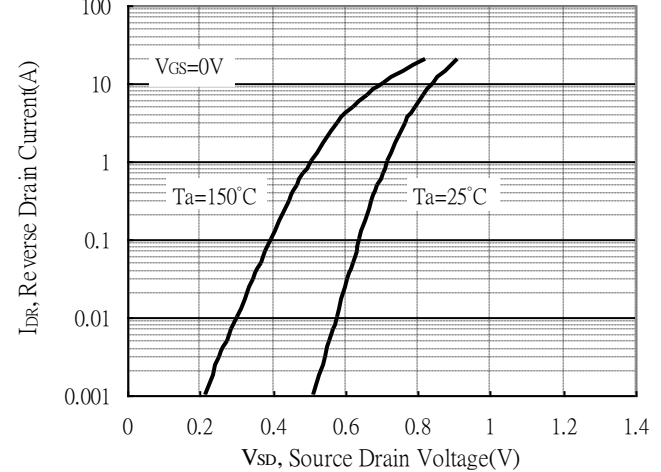
Drain Current vs Gate-Source Voltage



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

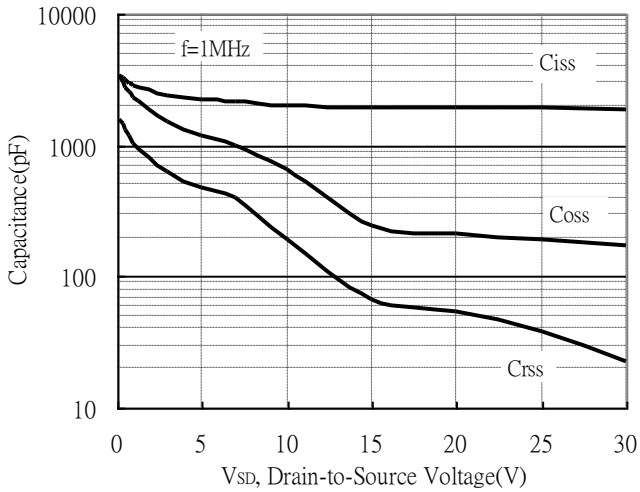


Body Diode Forward Voltage Variation vs Source Current and Temperature

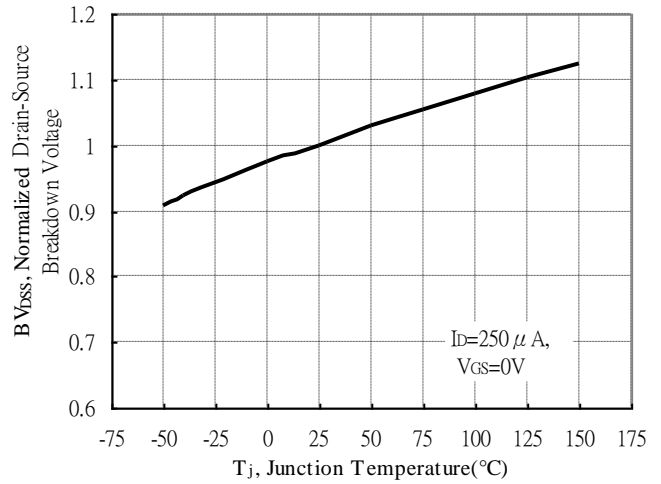


Typical Characteristics (Cont.)

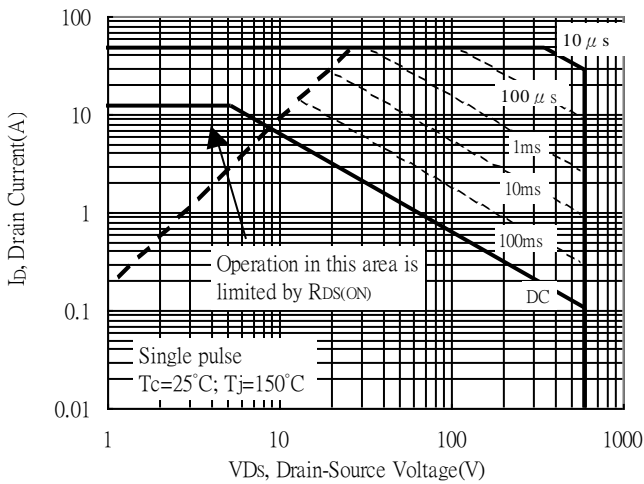
Capacitance vs Reverse Voltage



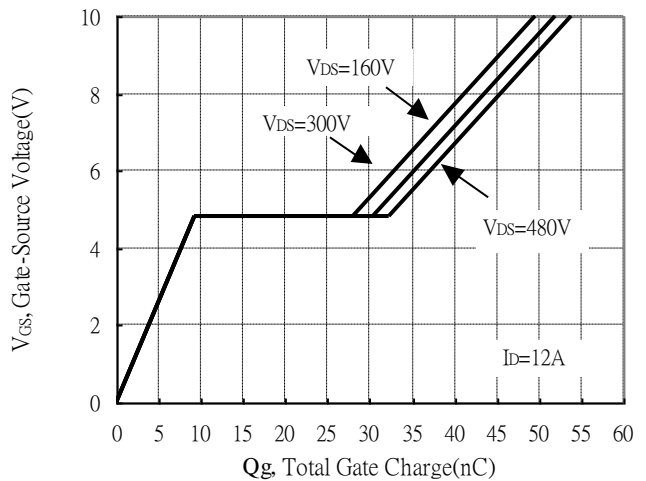
Brekdown Voltage vs Ambient Temperature



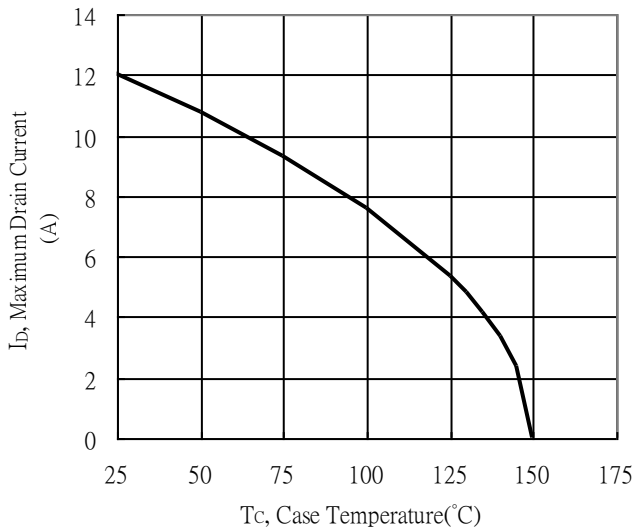
Maximum Safe Operating Area



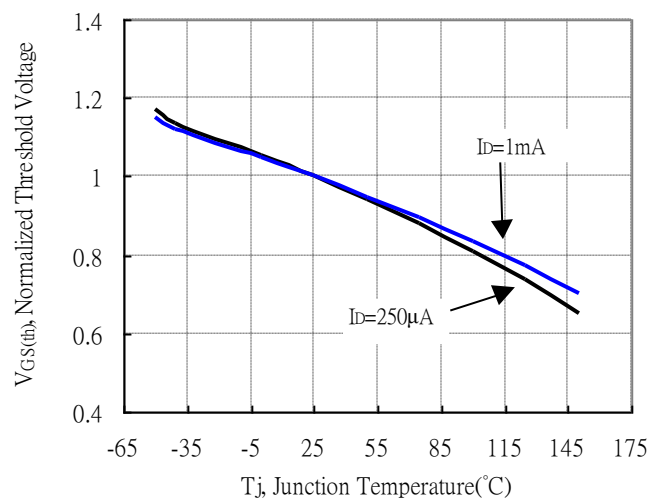
Gate Charge Characteristics



Maximum Drain Current vs Case Temperature

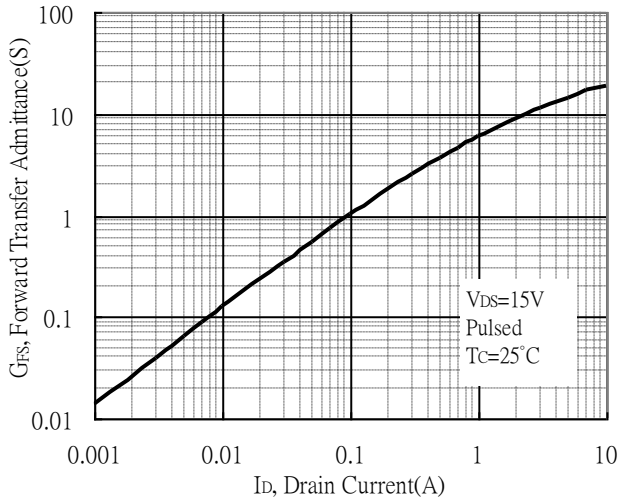


Threshold Voltage vs Junction Temperature

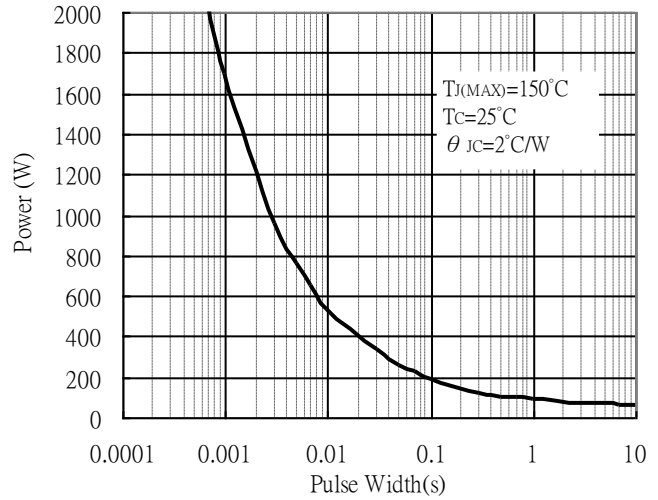


Typical Characteristics (Cont.)

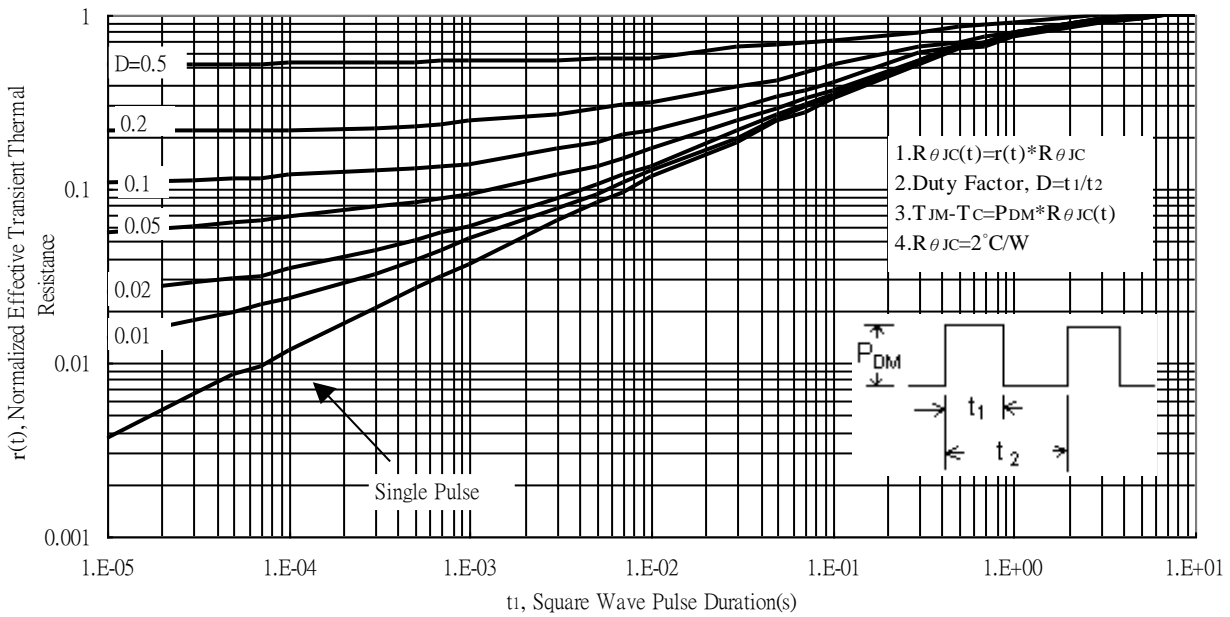
Forward Transfer Admittance vs Drain Current



Single Pulse Power Rating, Junction to Case



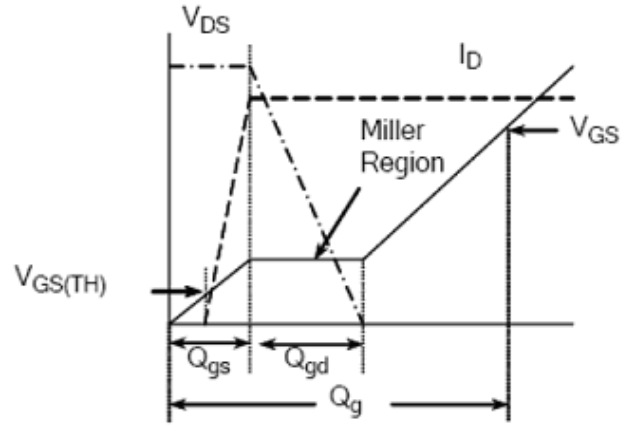
Transient Thermal Response Curves



Test Circuit and Waveforms



Gate Charge Test Circuit



Gate Charge Waveform

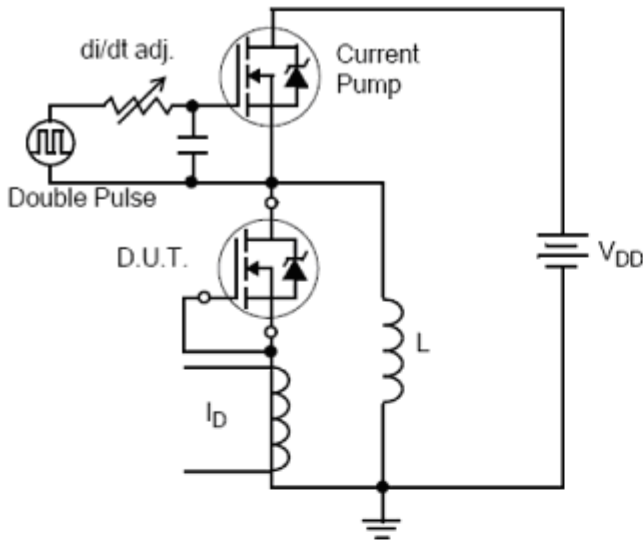


Resistive Switching Test Circuit

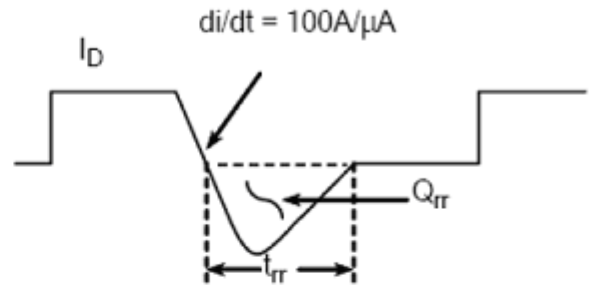


Resistive Switching Waveforms

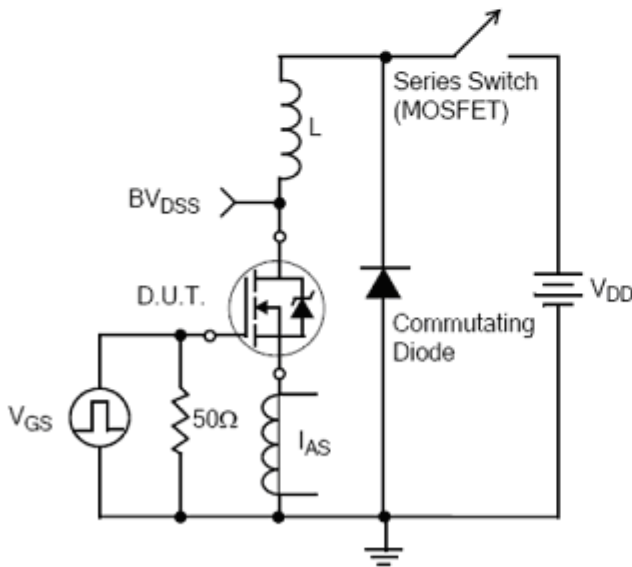
Test Circuit and Waveforms(Cont.)



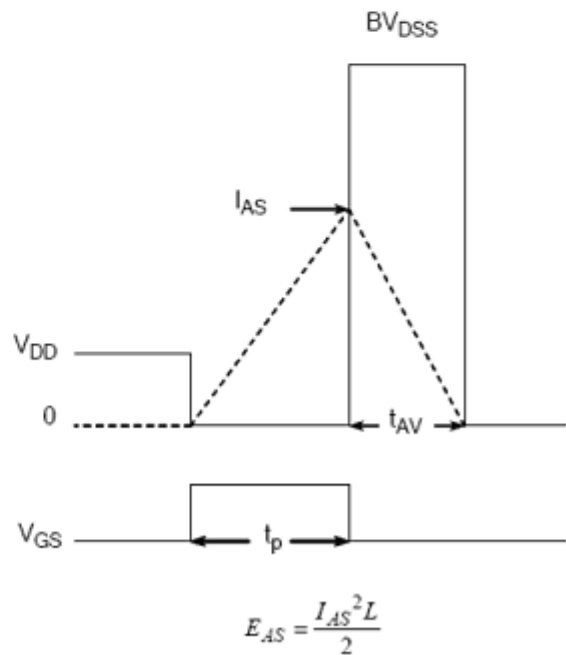
Diode Reverse Recovery Test Circuit



Diode Reverse Recovery Waveform



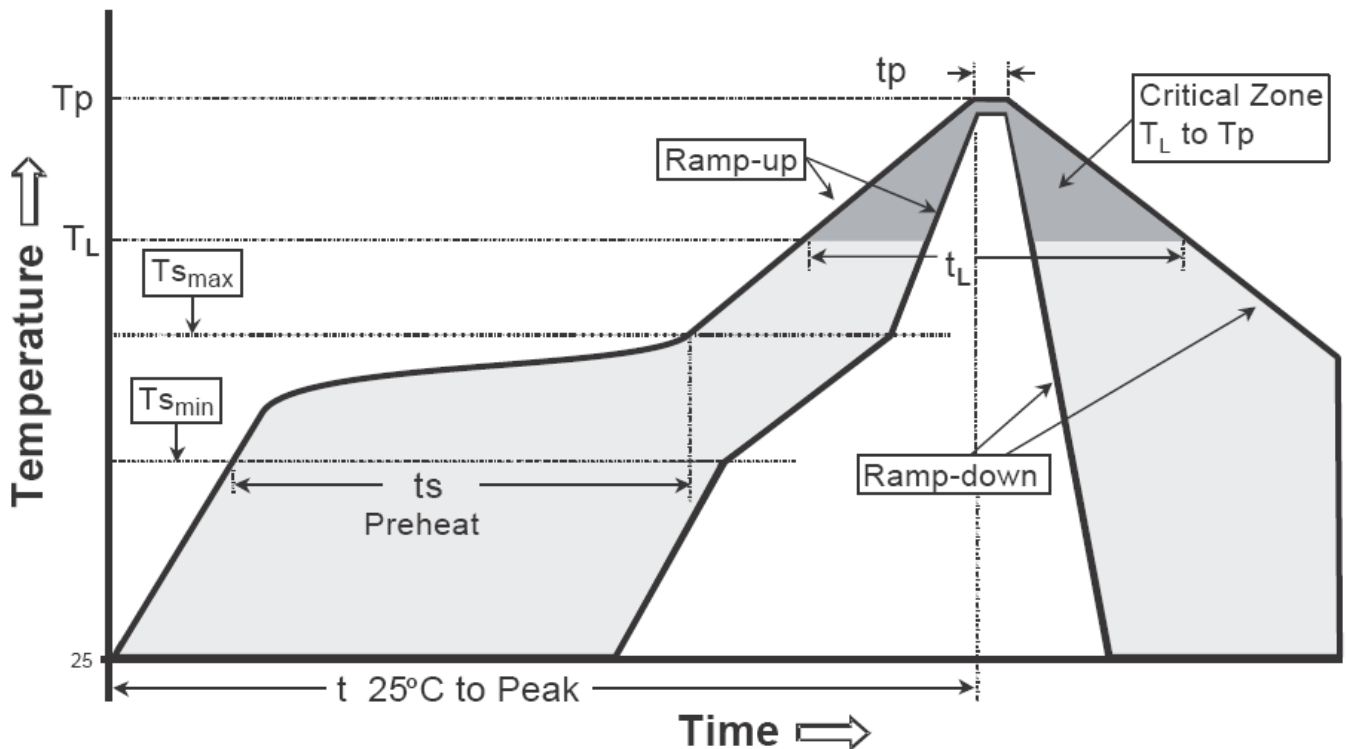
Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

Recommended wave soldering condition

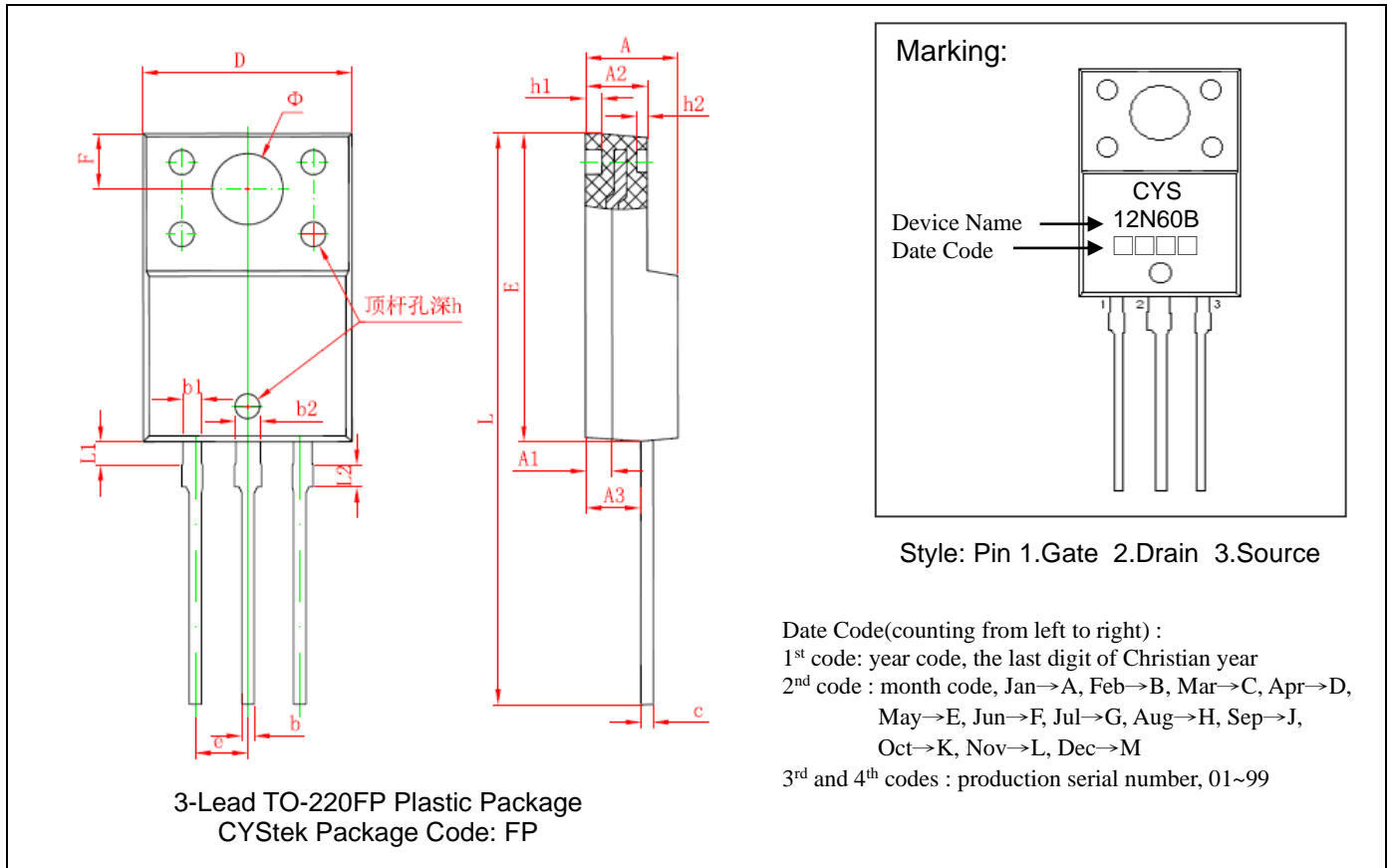
Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

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(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (TL)	183°C	217°C
- Time (tL)	60-150 seconds	60-150 seconds
Peak Temperature(TP)	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 Dimension



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

Marking:

Device Name → 12N60B
 Date Code → □□□□

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

Date Code(counting from left to right) :
 1st code: year code, the last digit of Christian year
 2nd code : month code, Jan→A, Feb→B, Mar→C, Apr→D,
 May→E, Jun→F, Jul→G, Aug→H, Sep→J,
 Oct→K, Nov→L, Dec→M
 3rd and 4th codes : production serial number, 01~99

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.169	0.185	4.35	4.65	e	0.100 TYP		2.54 TYP	
A1	0.051	REF	1.30	REF	F	0.106	REF	2.70	REF
A2	0.112	0.124	2.85	3.15	Φ	0.138	REF	3.50	REF
A3	0.102	0.110	2.60	2.80	h	0.000	0.012	0.00	0.30
b	0.020	0.030	0.50	0.75	h1	0.031	REF	0.80	REF
b1	0.031	0.041	0.80	1.05	h2	0.020	REF	0.50	REF
b2	0.043	0.053	1.10	1.35	L	1.102	1.118	28.00	28.40
c	0.020	0.030	0.50	0.75	L1	0.043	0.051	1.10	1.30
D	0.392	0.408	9.96	10.36	L2	0.036	0.043	0.92	1.08
E	0.583	0.598	14.80	15.20					

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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