

N-Channel Enhancement Mode Power MOSFET

MTN4N60BI3

BV_{DSS}	600V
$I_D @ V_{GS}=10V, T_C=25^\circ C$	4.0A
$R_{DS(on)(TYP)} @ V_{GS}=10V, I_D=2A$	1.7Ω

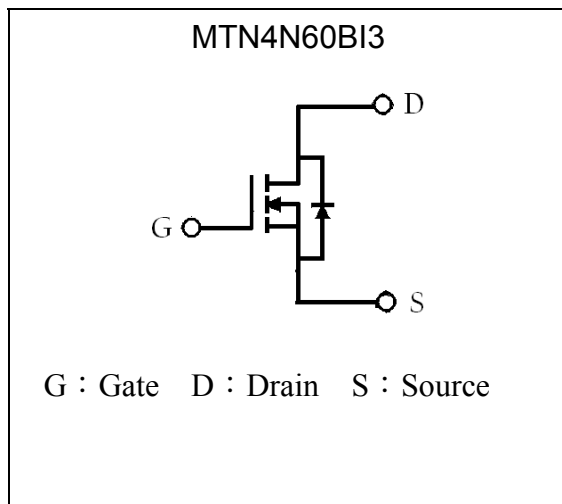
Features

- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- Pb-free lead plating and halogen-free package

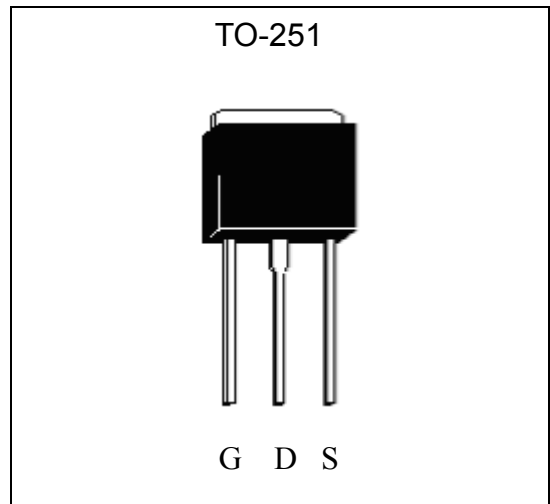
Applications

- Open Framed Power Supply
- Adapter
- STB

Symbol

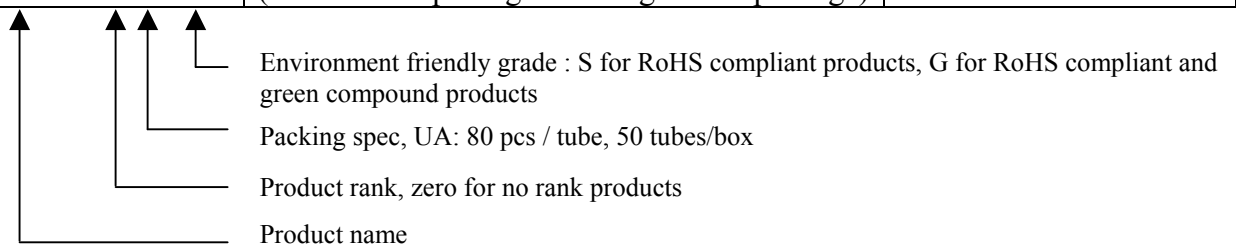


Outline



Ordering Information

Device	Package	Shipping
MTN4N60BI3-0-UA-G	TO-251 (Pb-free lead plating and halogen-free package)	80 pcs/tube, 50 tubes/box



**Absolute Maximum Ratings** ($T_C=25^{\circ}\text{C}$)

Parameter	Symbol	Limits	Unit
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current @ $V_{GS}=10\text{V}$, $T_C=25^{\circ}\text{C}$	I_D	4*	A
Continuous Drain Current @ $V_{GS}=10\text{V}$, $T_C=100^{\circ}\text{C}$	I_D	2.4*	
Pulsed Drain Current @ $V_{GS}=10\text{V}$ (Note 1)	I_{DM}	16*	
Avalanche Current (Note 1)	I_{AS}	4	
Single Pulse Avalanche Energy (Note 2)	E_{AS}	34.9	mJ
Repetitive Avalanche Energy (Note 1)	E_{AR}	5	
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	$^{\circ}\text{C}$
Total Power Dissipation ($T_C=25^{\circ}\text{C}$)	P_d	50	W
Linear Derating Factor		0.4	W/ $^{\circ}\text{C}$
Operating Junction and Storage Temperature	T_j, T_{stg}	-55~+150	$^{\circ}\text{C}$

*Drain current limited by maximum junction temperature

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

2. $I_{AS}=4\text{A}$, $V_{DD}=50\text{V}$, $L=4\text{mH}$, $V_G=10\text{V}$, starting $T_J=+25^{\circ}\text{C}$.3. $I_{SD}\leq 4\text{A}$, $dI/dt\leq 100\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, starting $T_J=+25^{\circ}\text{C}$.**Thermal Data**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{th,j-c}$	2.5	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-ambient, max	$R_{th,j-a}$	110	



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

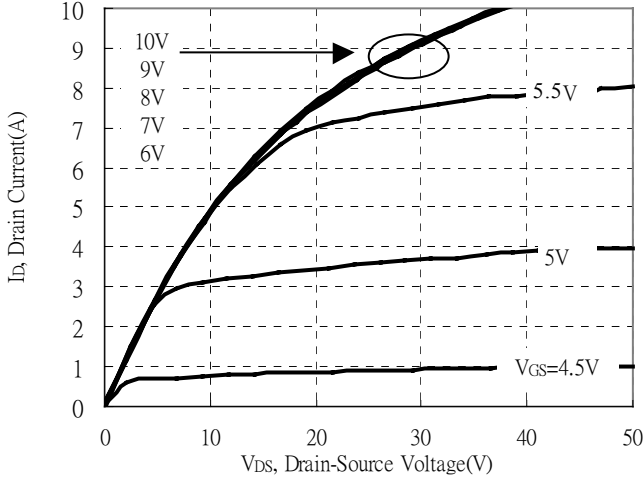
Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	600	-	-	V	V _{GS} =0V, I _D =250μA, T _j =25°C
ΔBV _{DSS} /ΔT _j	-	0.7	-	V/°C	Reference to 25°C, I _D =250μA
V _{GS(th)}	2.0	-	4.0	V	V _{DS} = V _{GS} , I _D =250μA
*G _{FS}	-	5	-	S	V _{DS} =15V, I _D =2A
I _{GSS}	-	-	±100	nA	V _{GS} =±30V
I _{DSS}	-	-	1	μA	V _{DS} =600V, V _{GS} =0V
	-	-	10		V _{DS} =480V, V _{GS} =0V, T _j =125°C
*R _{DS(ON)}	-	1.7	2.4	Ω	V _{GS} =10V, I _D =2A
Dynamic					
*Q _g	-	20.4	-	nC	I _D =4A, V _{DD} =480V, V _{GS} =10V
*Q _{gs}	-	3	-		
*Q _{gd}	-	10.2	-		
*t _{d(ON)}	-	10	-	ns	V _{DD} =300V, I _D =4A, V _{GS} =10V, R _G =25 Ω
*t _r	-	11.6	-		
*t _{d(OFF)}	-	48	-		
*t _f	-	38	-		
C _{iss}	-	545	-	pF	V _{GS} =0V, V _{DS} =25V, f=1MHz
C _{oss}	-	63	-		
C _{rss}	-	47	-		
Source-Drain Diode					
*I _S	-	-	4	A	
*I _{SM}	-	-	16		
*V _{SD}	-	-	1.5	V	I _S =4A, V _{GS} =0V
*t _{rr}	-	330	-	ns	V _{GS} =0V, I _F =4A, dI _F /dt=100A/μs
*Q _{rr}	-	1.3	-	μC	

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

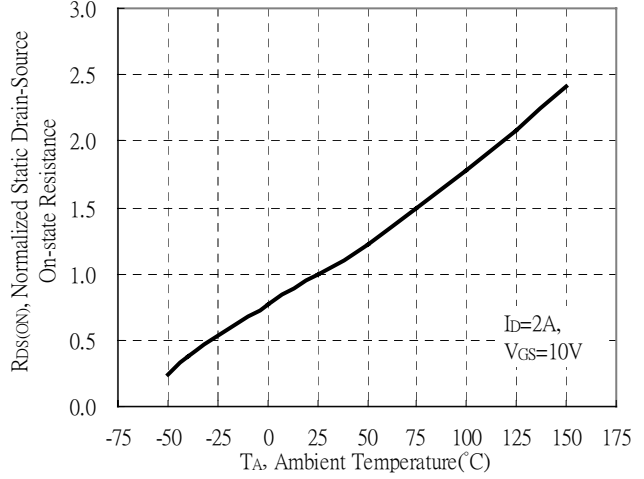


Typical Characteristics

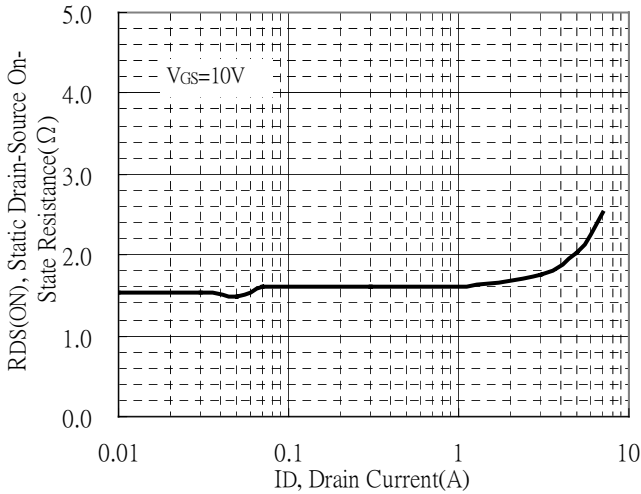
Typical Output Characteristics



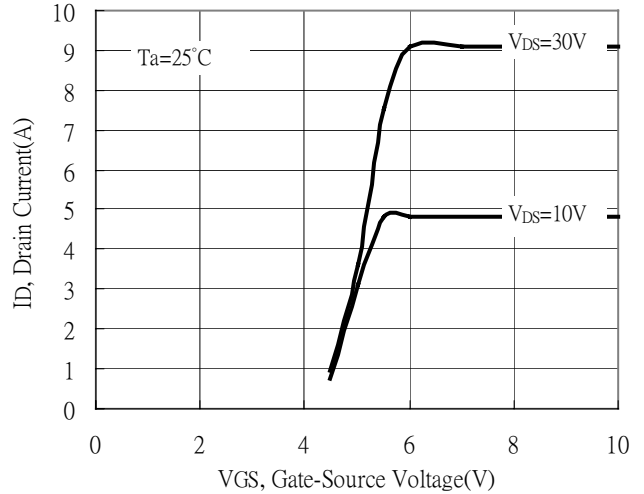
Static Drain-Source On-resistance vs Ambient Temperature



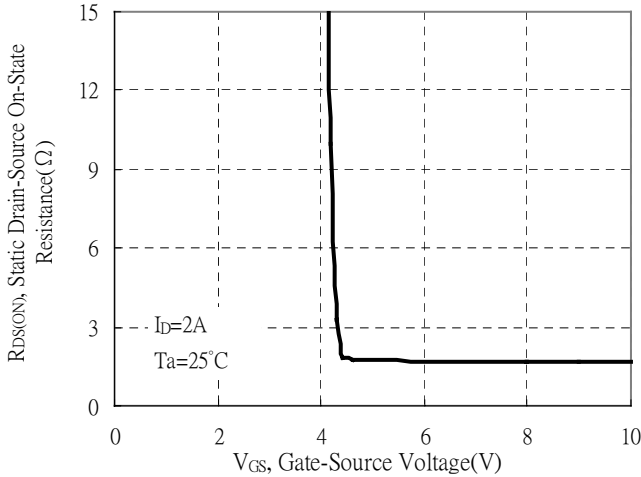
Static Drain-Source On-State resistance vs Drain Current



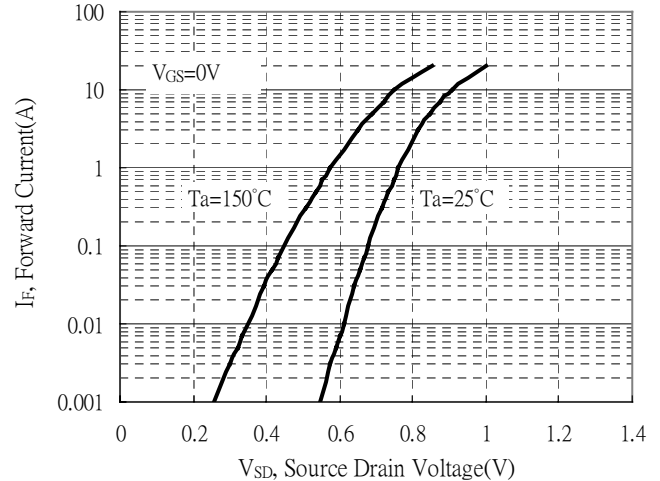
Drain Current vs Gate-Source Voltage



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

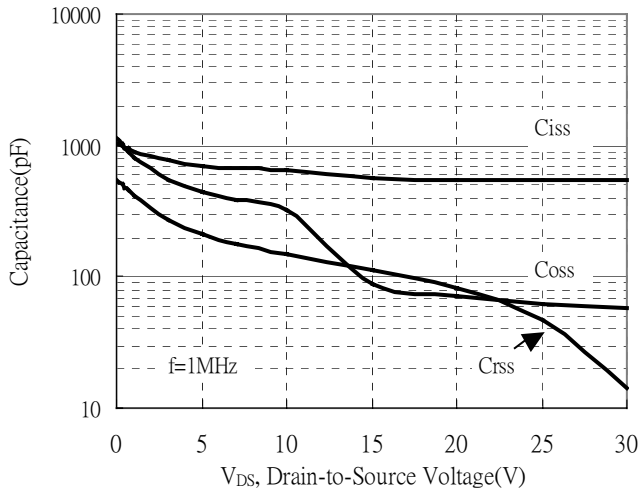


Forward Drain Current vs Source-Drain Voltage

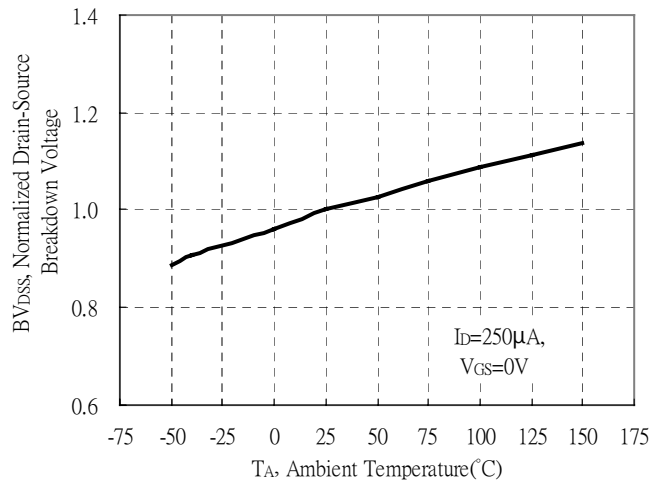


Typical Characteristics(Cont.)

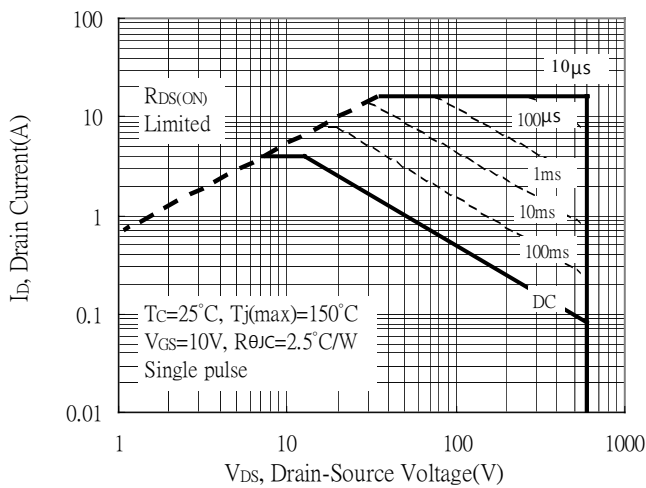
Capacitance vs Reverse Voltage



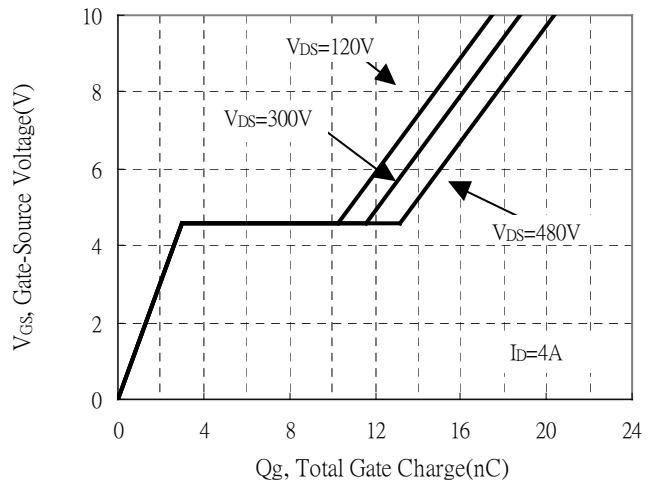
Brekdown Voltage vs Ambient Temperature



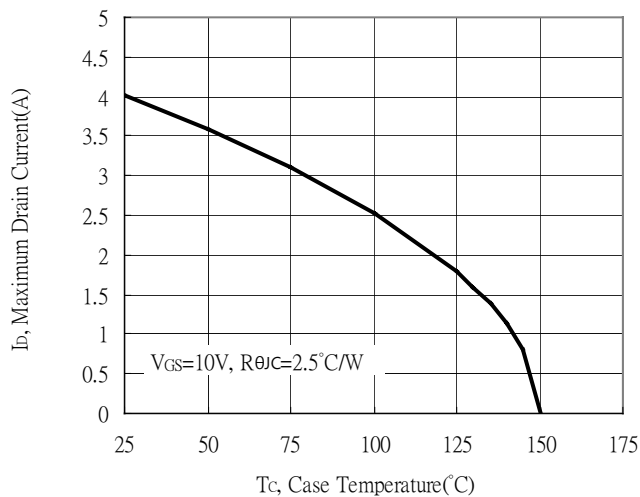
Maximum Safe Operating Area



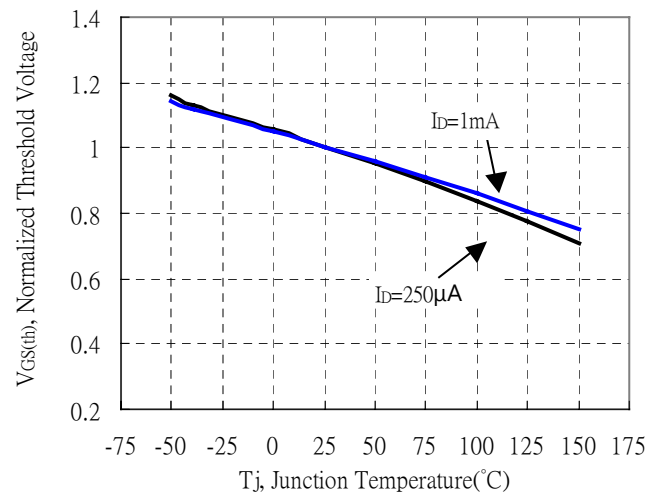
Gate Charge Characteristics



Maximum Drain Current vs Case Temperature

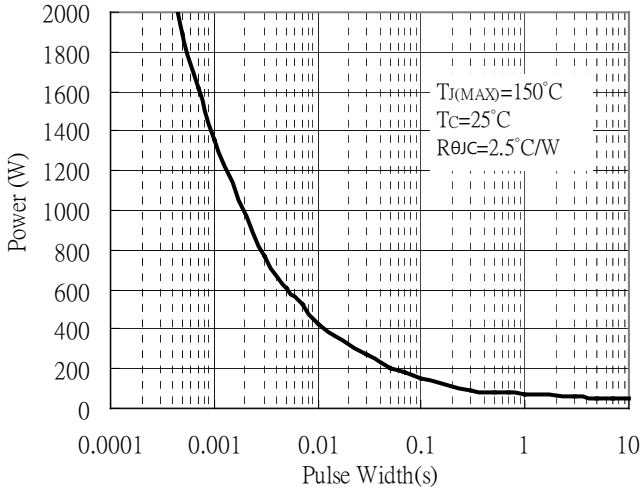


Threshold Voltage vs Junction Temperature

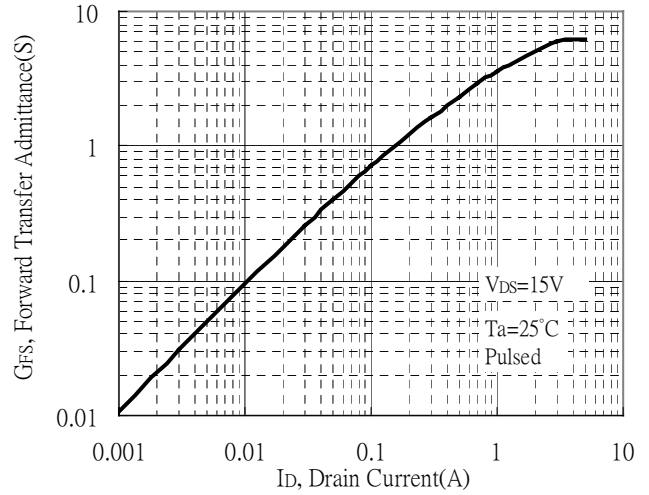


Typical Characteristics(Cont.)

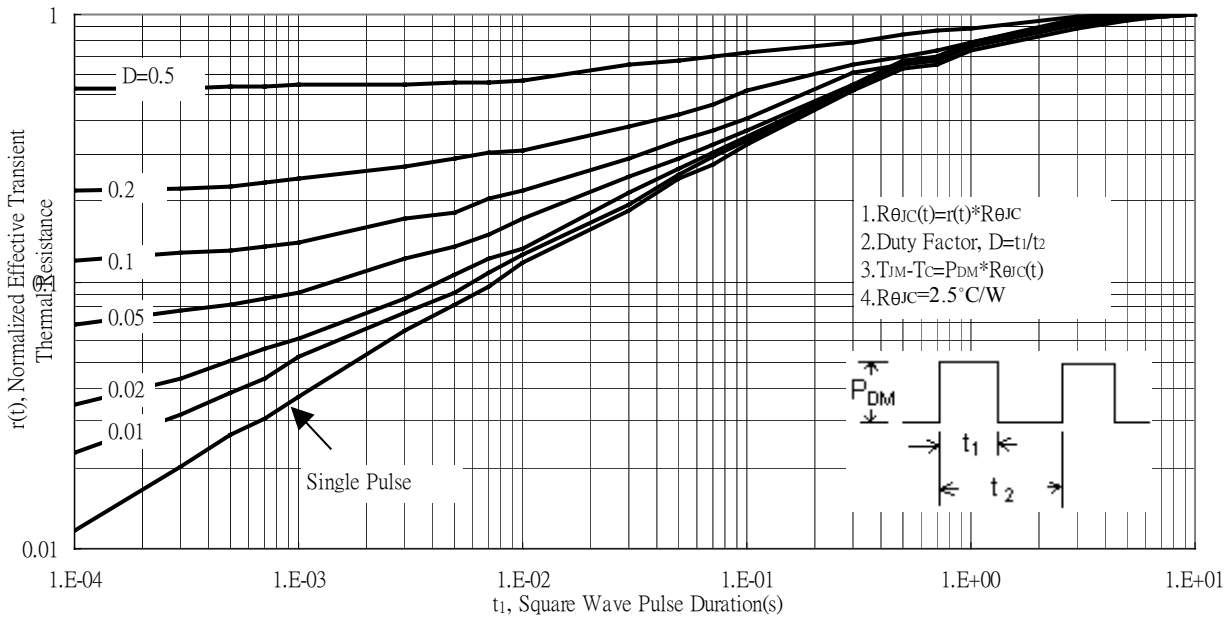
Single Pulse Power Rating, Junction to Case



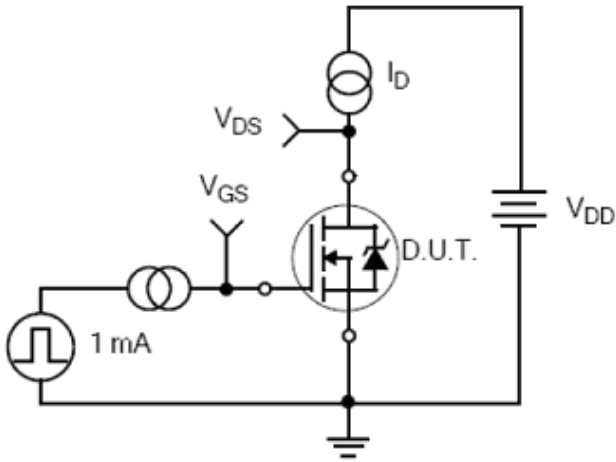
Forward Transfer Admittance vs Drain Current



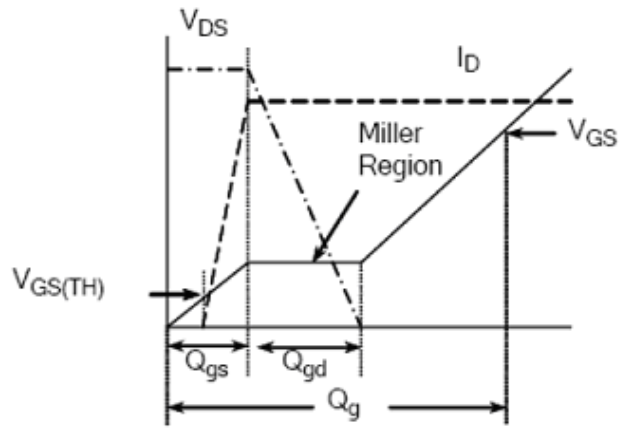
Transient Thermal Response Curves



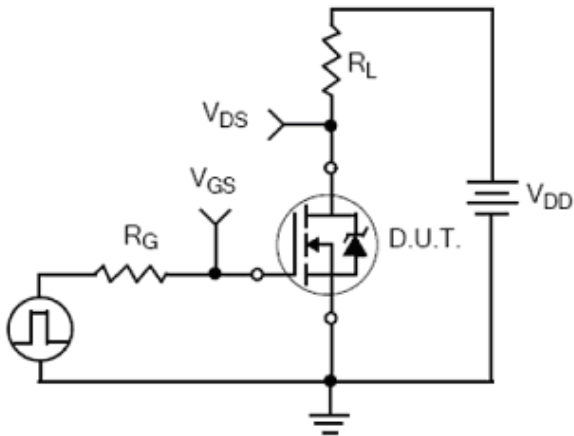
Test Circuits and Waveforms



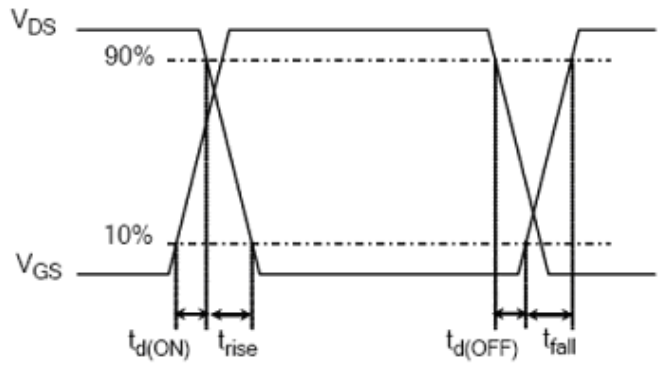
Gate Charge Test Circuit



Gate Charge Waveform

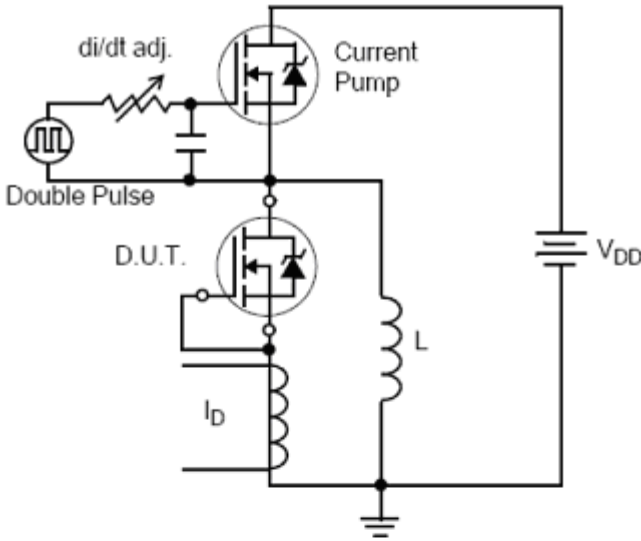


Resistive Switching Test Circuit

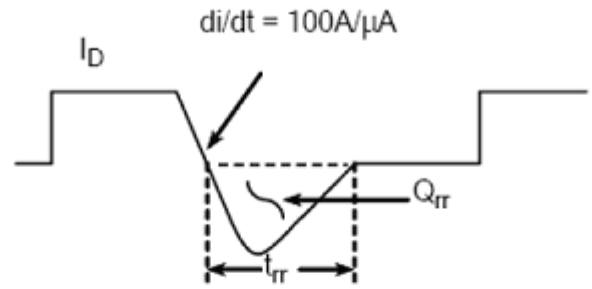


Resistive Switching Waveforms

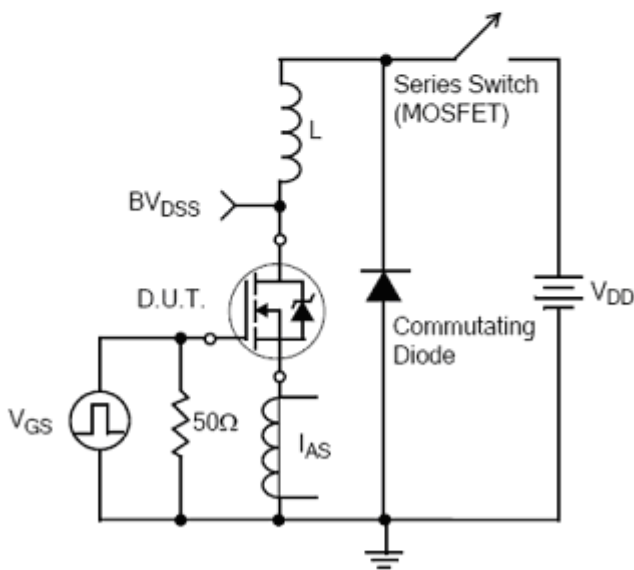
Test Circuits and Waveforms(Cont.)



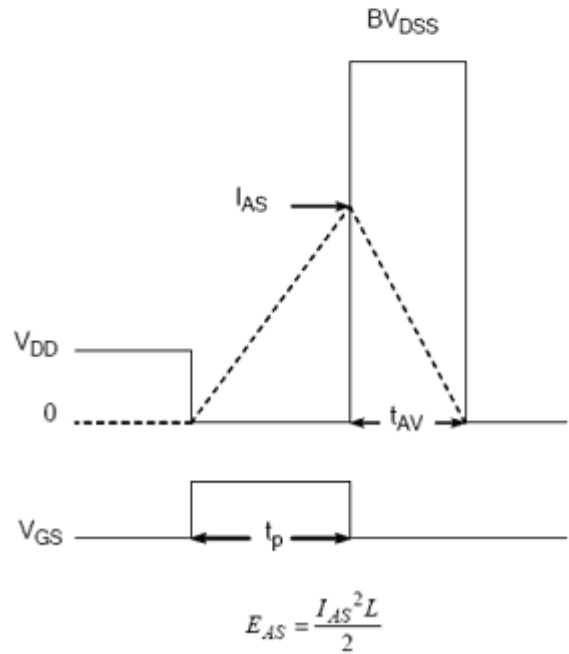
Diode Reverse Recovery Test Circuit



Diode Reverse Recovery Waveform



Unclamped Inductive Switching Test Circuit

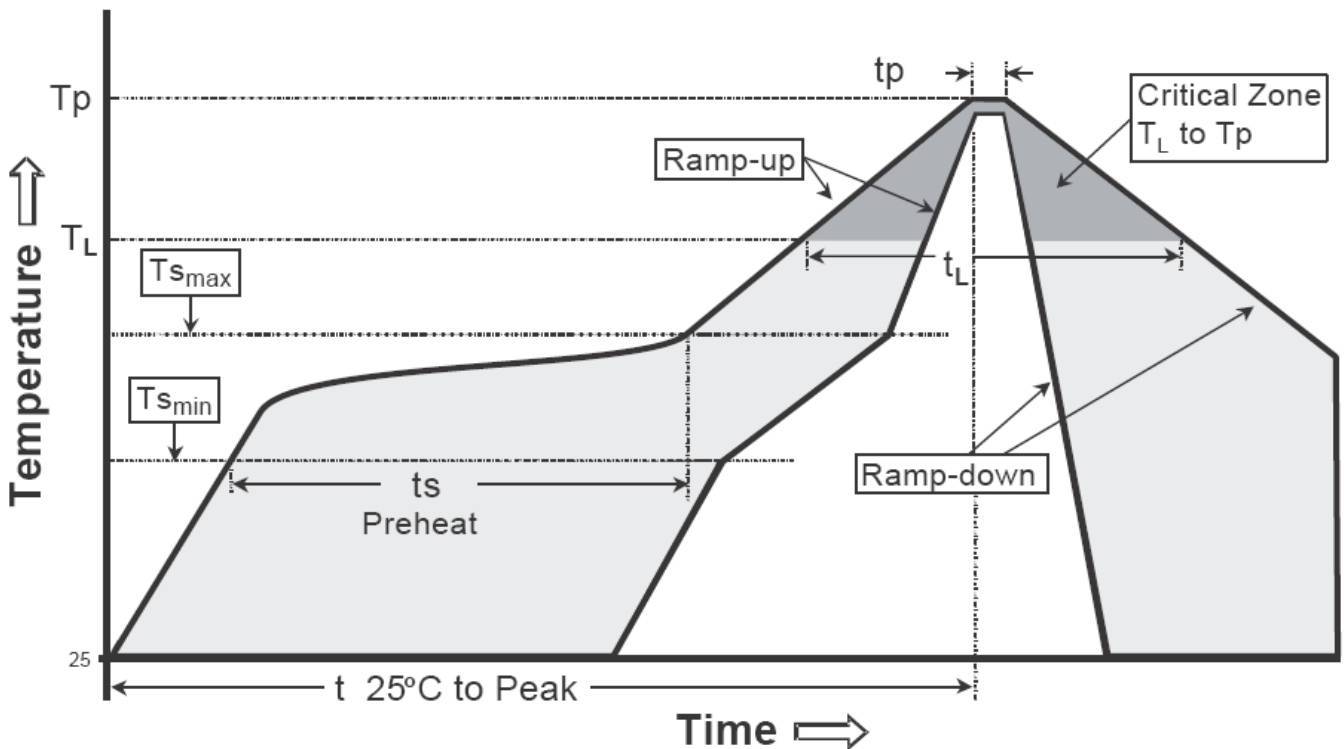


Unclamped Inductive Switching Waveforms

Recommended wave soldering condition

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

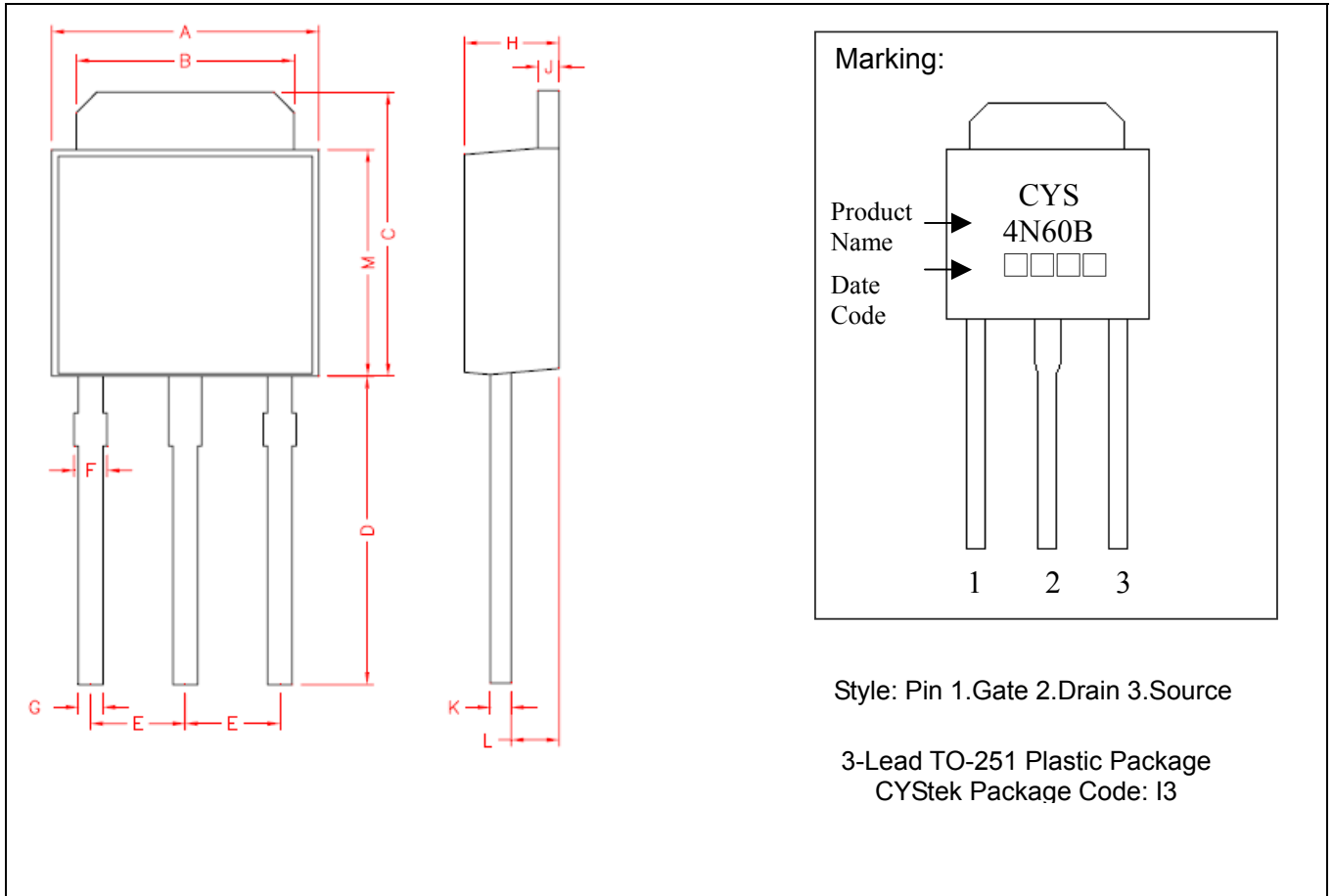
Recommended temperature profile for IR reflow



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-251 Dimension



DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	6.40	6.80	0.252	0.268	G	0.50	0.70	0.020	0.028
B	5.20	5.50	0.205	0.217	H	2.20	2.40	0.087	0.094
C	6.80	7.20	0.268	0.283	J	0.45	0.55	0.018	0.022
D	7.20	7.80	0.283	0.307	K	0.45	0.60	0.018	0.024
E	2.30 REF		0.091 REF		L	0.90	1.50	0.035	0.059
F	0.60	0.90	0.024	0.035	M	5.40	5.80	0.213	0.228

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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