

N-Channel Enhancement Mode Power MOSFET

MTN4N65I3

BV_{DSS} : 650V
R_{DS(ON)} : 3.0Ω (typ.)
I_D : 4A**Description**

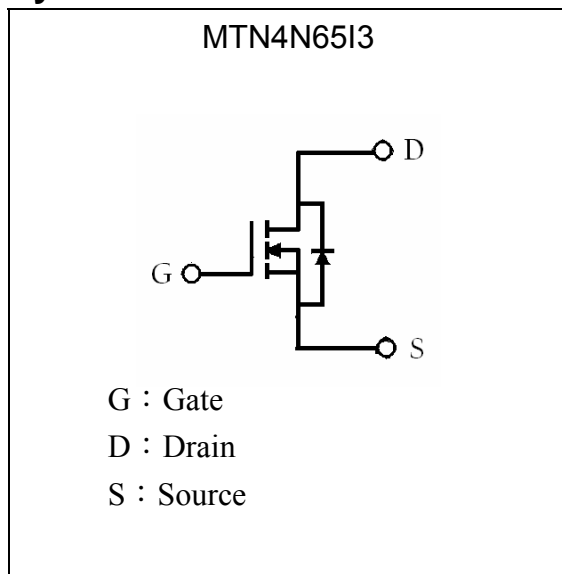
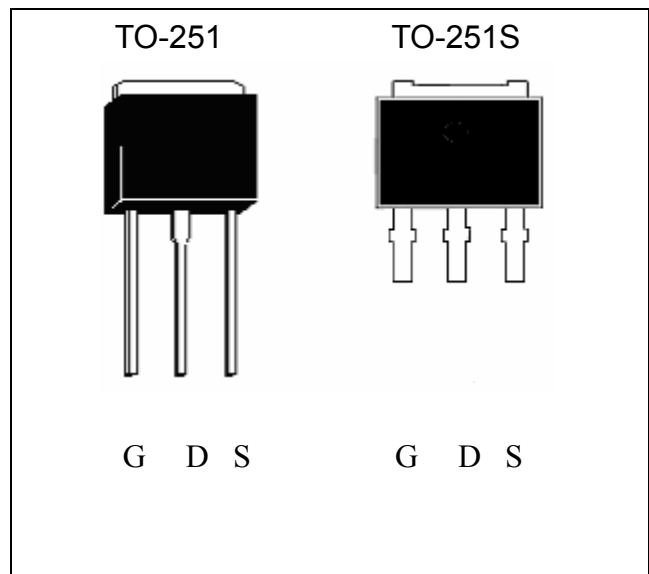
The MTN4N65I3 is a N-channel enhancement-mode MOSFET, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-251 package is universally preferred for all commercial-industrial applications

Features

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

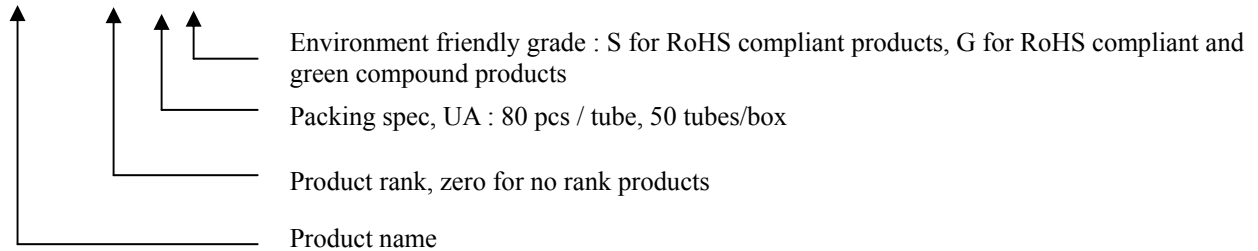
Applications

- Open Framed Power Supply
- Adapter
- STB

Symbol**Outline**

**Ordering Information**

Device	Package	Shipping
MTN4N65I3-0-UA-G	TO-251 (RoHS compliant and halogen-free package)	80 pcs/tube, 50 tubes/box
MTN4N65I3S-0-UA-G	TO-251S (RoHS compliant 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}	650	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current	I_D	4	A
Continuous Drain Current @ $T_C=100^\circ\text{C}$	I_D	2.4	A
Pulsed Drain Current @ $V_{GS}=10\text{V}$ (Note 1)	I_{DM}	16	A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	69	mJ
Avalanche Current (Note 1)	I_{AR}	4	A
Repetitive Avalanche Energy (Note 1)	E_{AR}	4.8	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	$^\circ\text{C}$
Total Power Dissipation ($T_A=25^\circ\text{C}$)	P_D	1.14	W
Total Power Dissipation ($T_C=25^\circ\text{C}$)		48	W
Linear Derating Factor		0.38	W/ $^\circ\text{C}$
Operating Junction and Storage Temperature	T_j, T_{stg}	-55~+150	$^\circ\text{C}$

- Note : 1.Repetitive rating; pulse width limited by maximum junction temperature.
2. $I_{AS}=4\text{A}$, $V_{DD}=50\text{V}$, $L=8\text{mH}$, $R_G=25\ \Omega$, 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	$R_{th,j-c}$	2.6	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-ambient, max	$R_{th,j-a}$	110	$^\circ\text{C}/\text{W}$



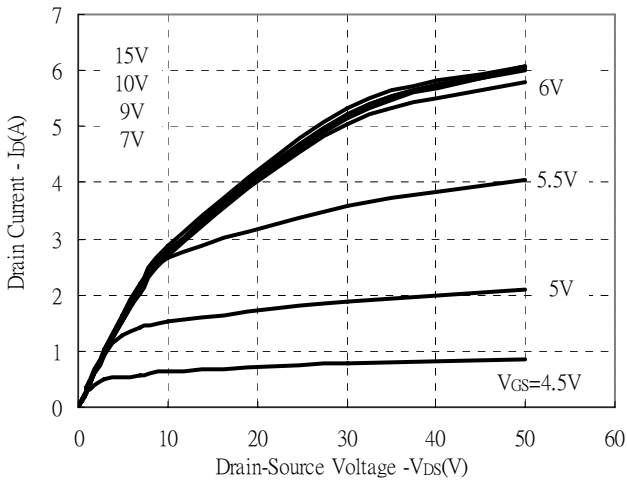
Characteristics (Tc=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	650	-	-	V	V _{GS} =0, I _D =250μA, T _j =25°C
ΔBV _{DSS} /ΔT _j	-	0.6	-	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}	-	2.3	-	S	V _{DS} =15V, I _D =2A
I _{GSS}	-	-	±100	nA	V _{GS} =±30
I _{DSS}	-	-	1	μA	V _{DS} =650V, V _{GS} =0
	-	-	10	μA	V _{DS} =520V, V _{GS} =0, T _C =125°C
*R _{DS(ON)}	-	3.0	3.5	Ω	V _{GS} =10V, I _D =2A
Dynamic					
*Q _g	-	11	-	nC	I _D =4A, V _{DD} =520V, V _{GS} =10V
*Q _{gs}	-	2.6	-		
*Q _{gd}	-	4.6	-		
*t _{d(ON)}	-	15	-	ns	V _{DD} =325V, I _D =4A, V _{GS} =10V, R _G =25Ω
*t _r	-	33	-		
*t _{d(OFF)}	-	30	-		
*t _f	-	37	-		
C _{iss}	-	568	-	pF	V _{GS} =0V, V _{DS} =25V, f=1MHz
C _{oss}	-	51	-		
C _{rss}	-	9.6	-		
Source-Drain Diode					
*V _{SD}	-	-	1.5	V	I _S =4A, V _{GS} =0V
*I _S	-	-	4	A	
*I _{SM}	-	-	16		
*t _{rr}	-	280	-	ns	V _{GS} =0, I _F =4A, dI/dt=100A/μs
*Q _{rr}	-	2	-	μC	

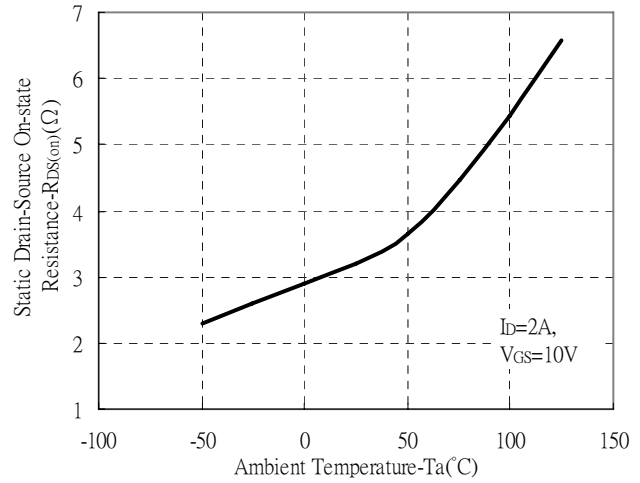
*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

Typical Characteristics

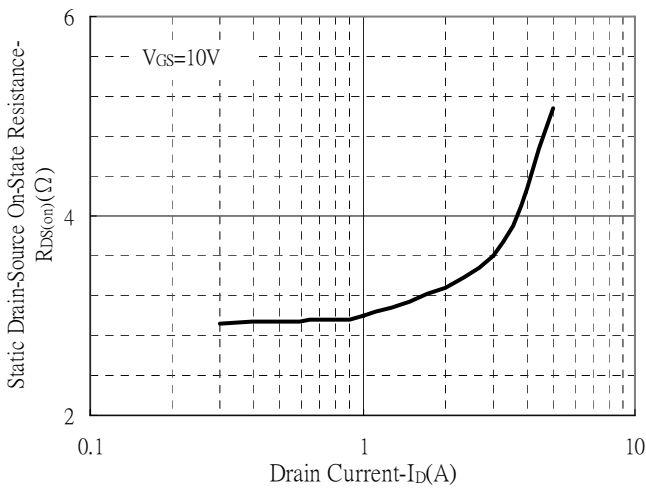
Typical Output Characteristics



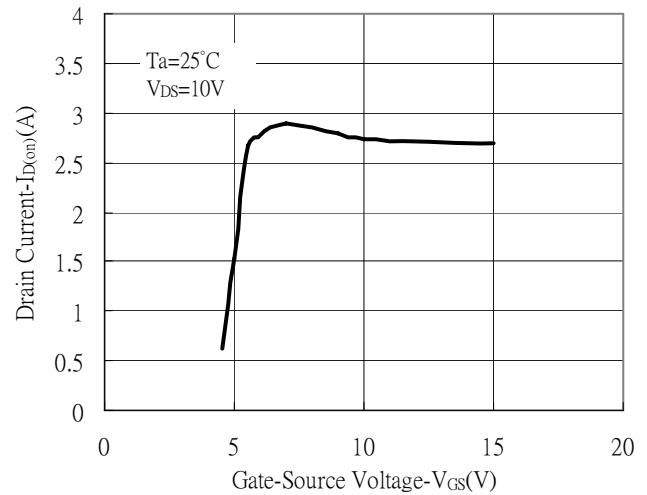
Static Drain-Source On-resistance vs Ambient Temperature



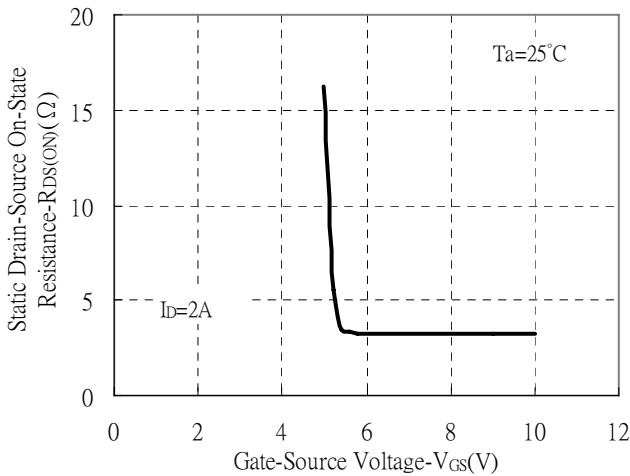
Static Drain-Source On-State resistance vs Drain Current



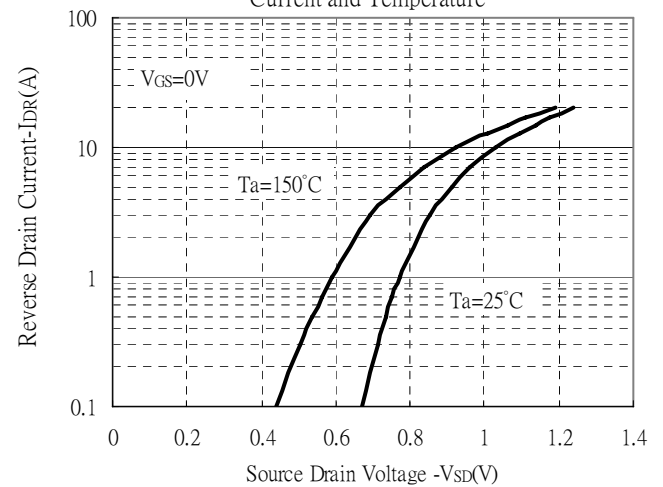
Drain Current vs Gate-Source Voltage



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

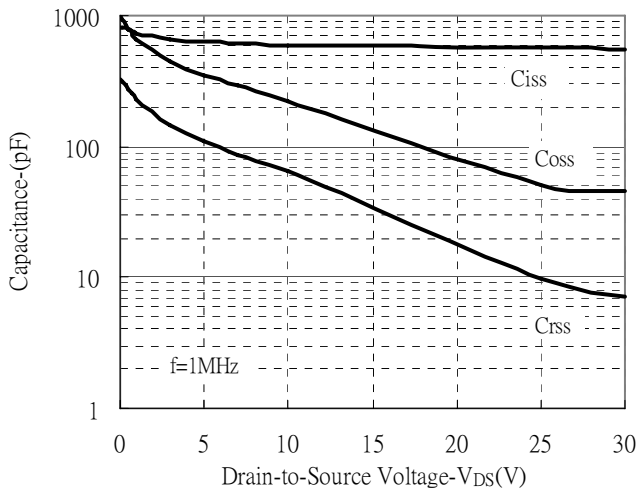


Body Diode Forward Voltage Variation with Source Current and Temperature

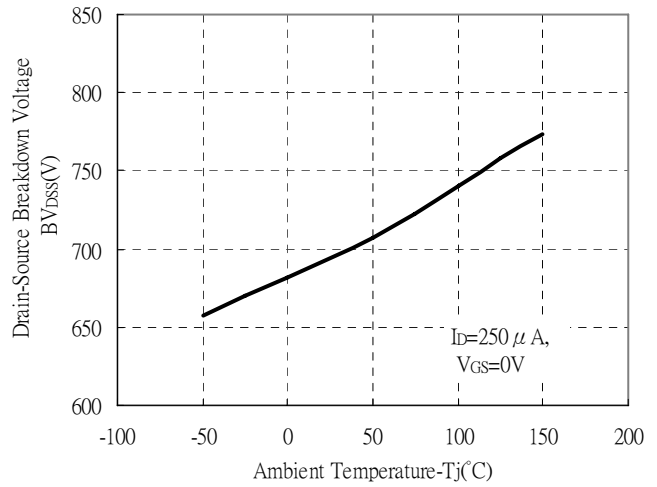


Typical Characteristics(Cont.)

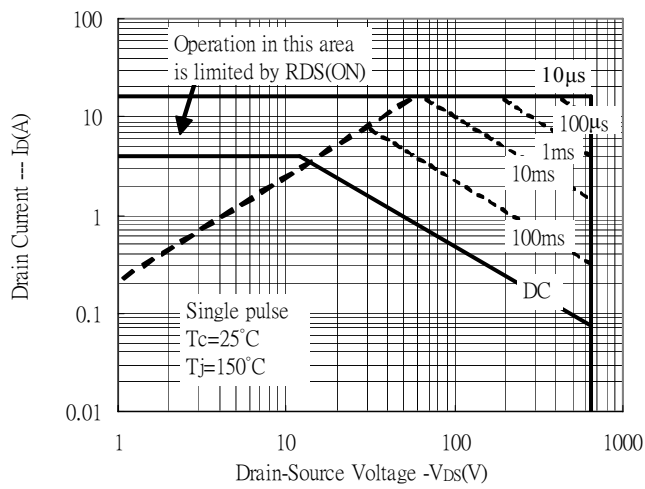
Capacitance vs Reverse Voltage



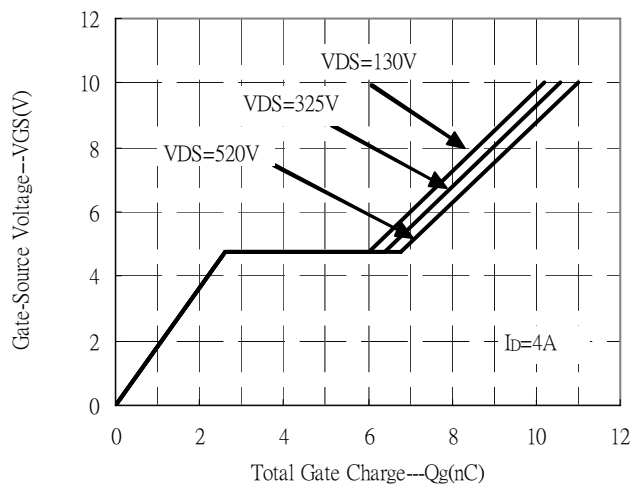
Brekdown Voltage vs Ambient Temperature



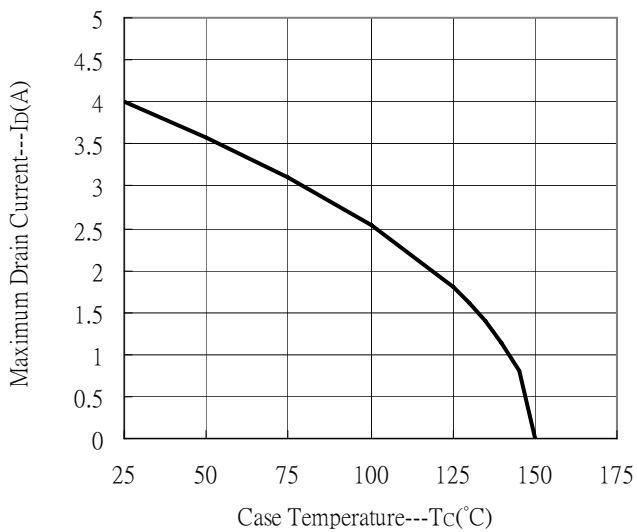
Maximum Safe Operating Area



Gate Charge Characteristics

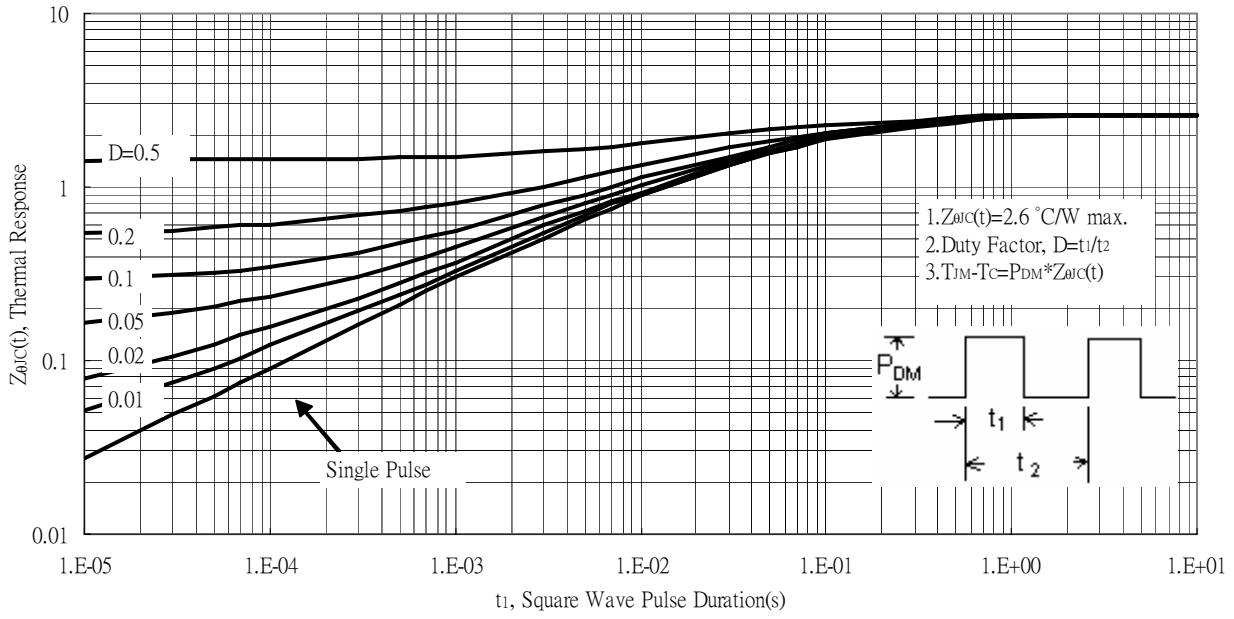


Maximum Drain Current vs Case Temperature

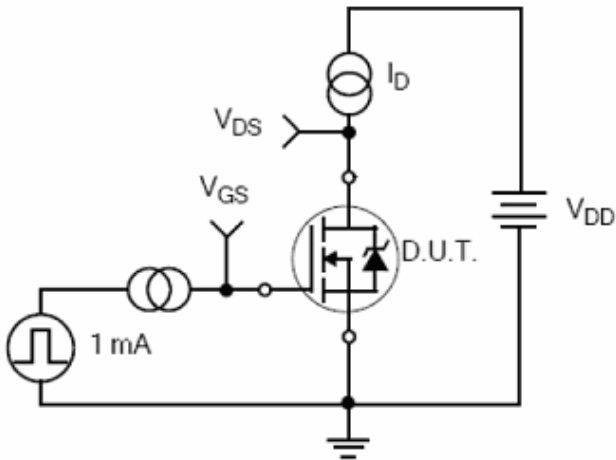


Typical Characteristics(Cont.)

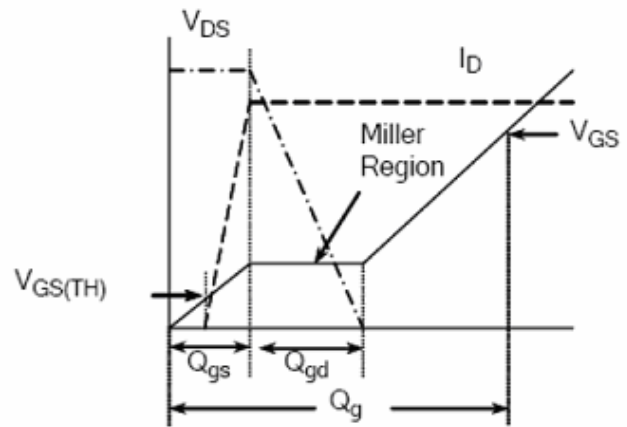
Transient Thermal Response Curves



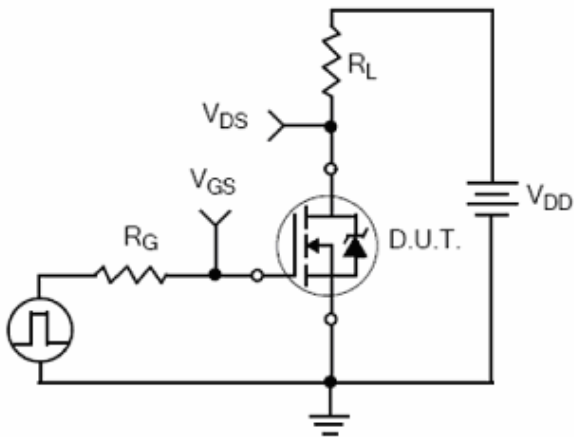
Test Circuit and Waveforms



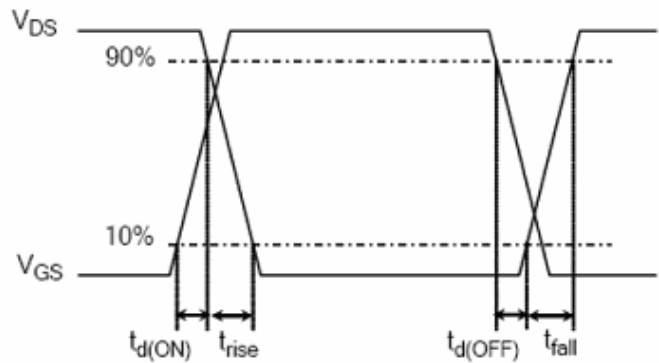
Gate Charge Test Circuit



Gate Charge Waveform

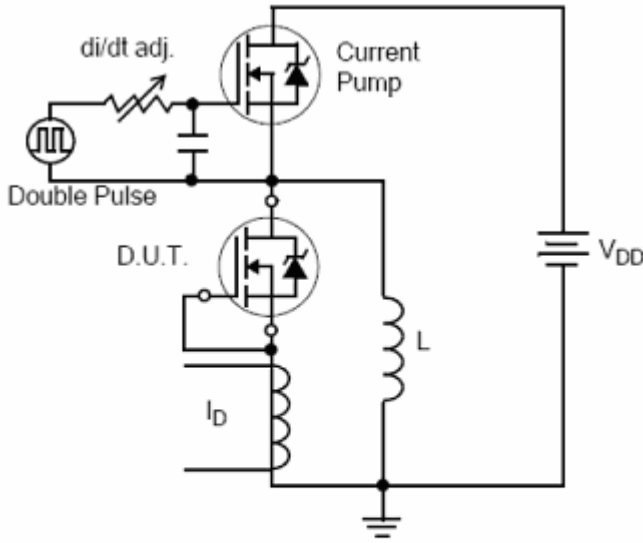


Resistive Switching Test Circuit

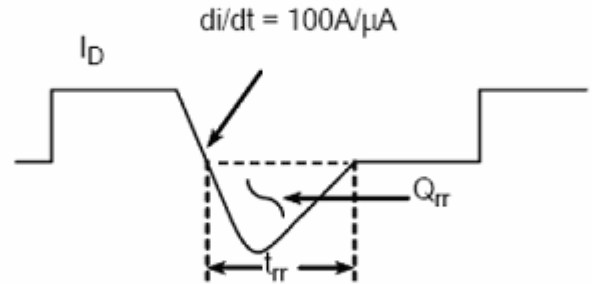


Resistive Switching Waveforms

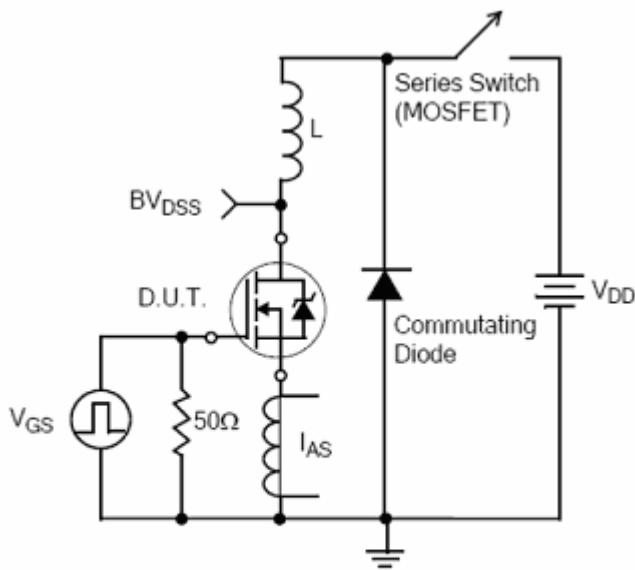
Test Circuit and Waveforms(Cont.)



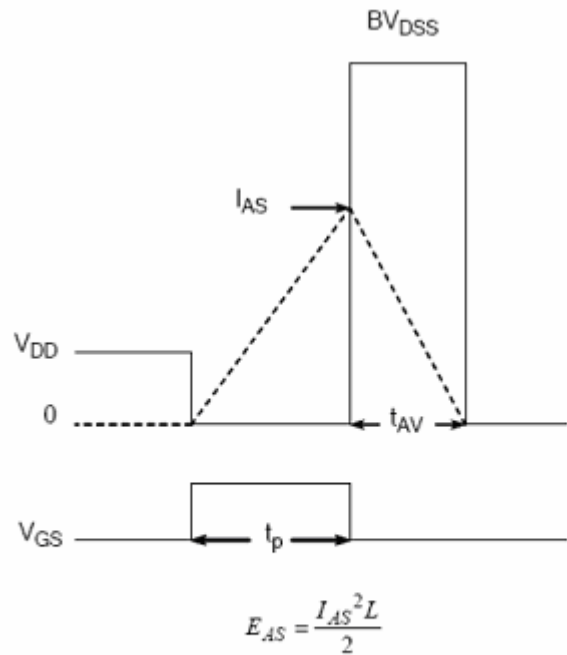
Diode Reverse Recovery Test Circuit



Diode Reverse Recovery Waveform



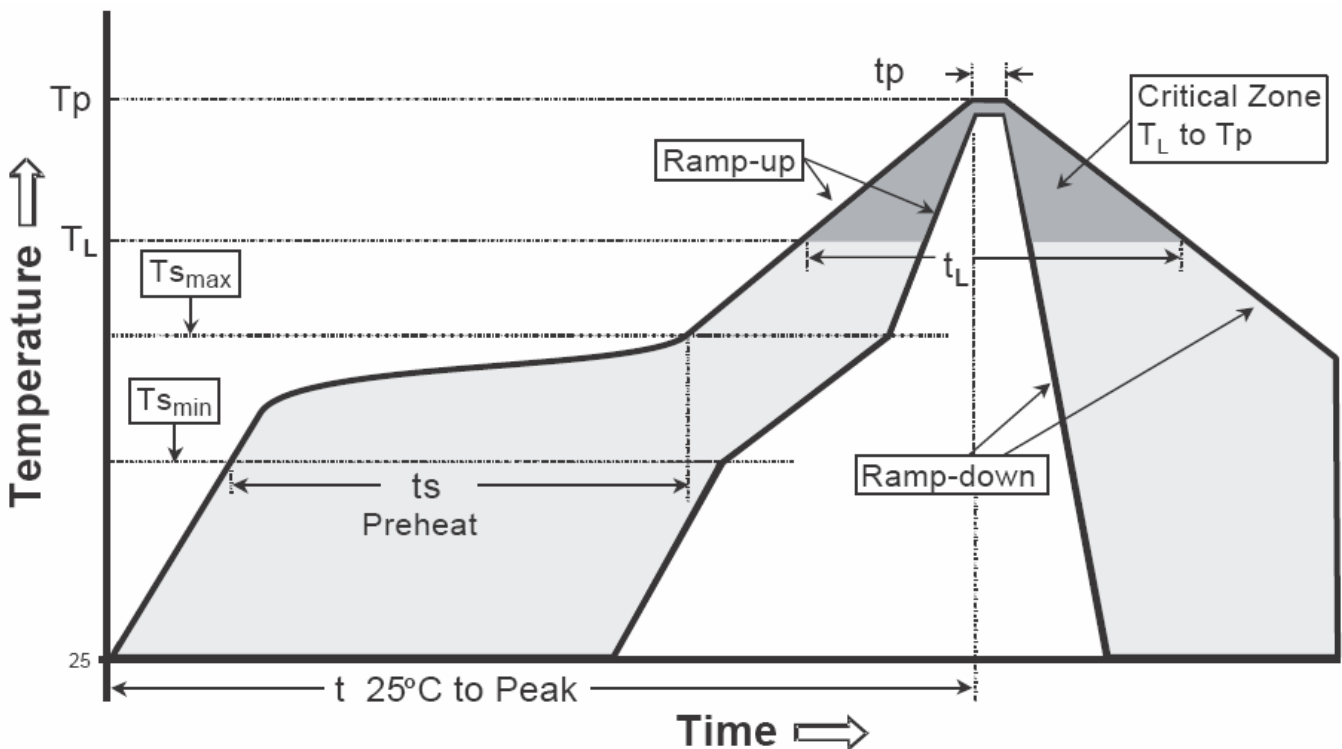
Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

Recommended wave soldering condition

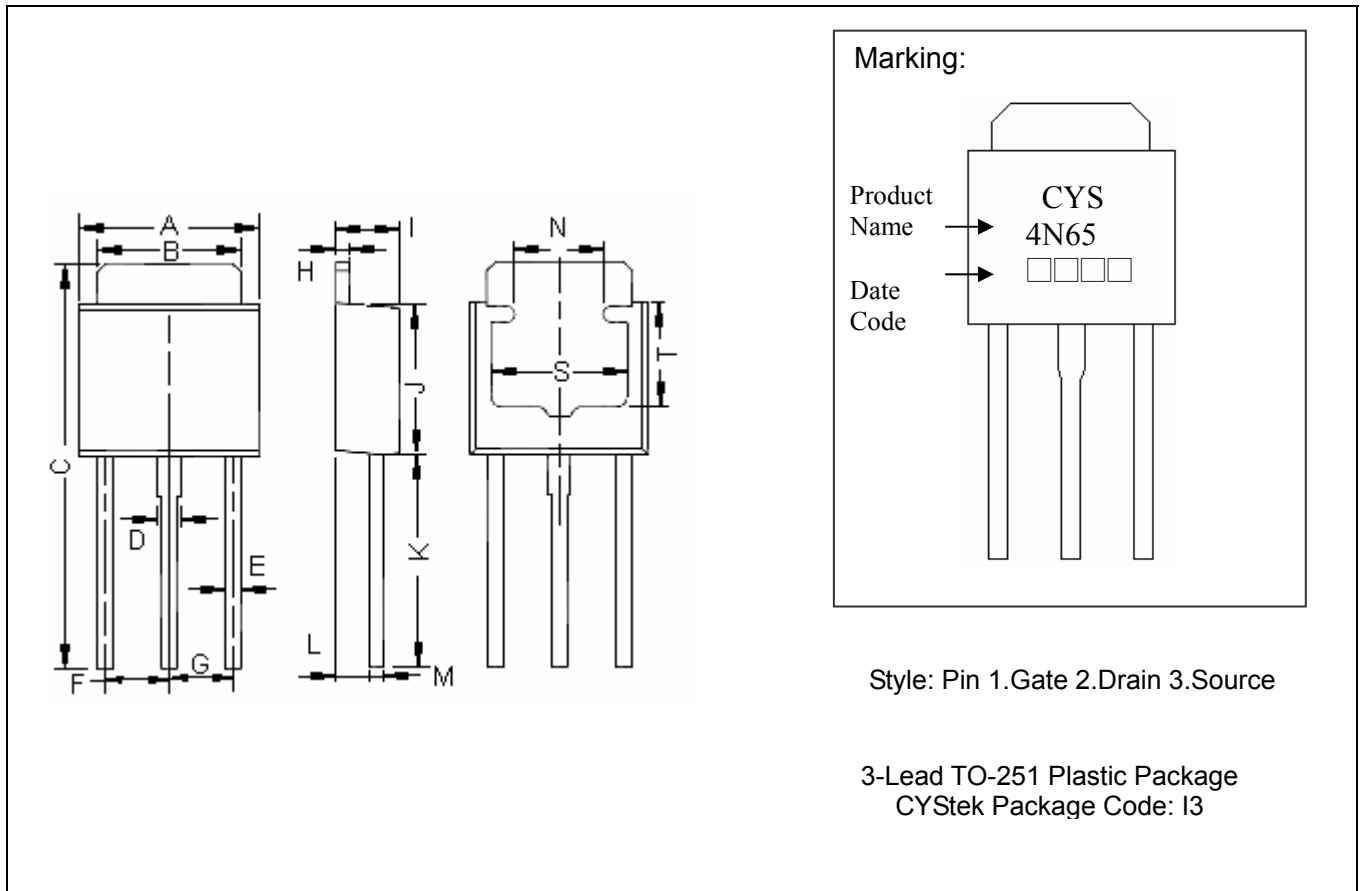
Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

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-251 Dimension



Marking:

Product Name → CYS
 4N65
 Date Code → □ □ □ □

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

3-Lead TO-251 Plastic Package
 CYStek Package Code: I3

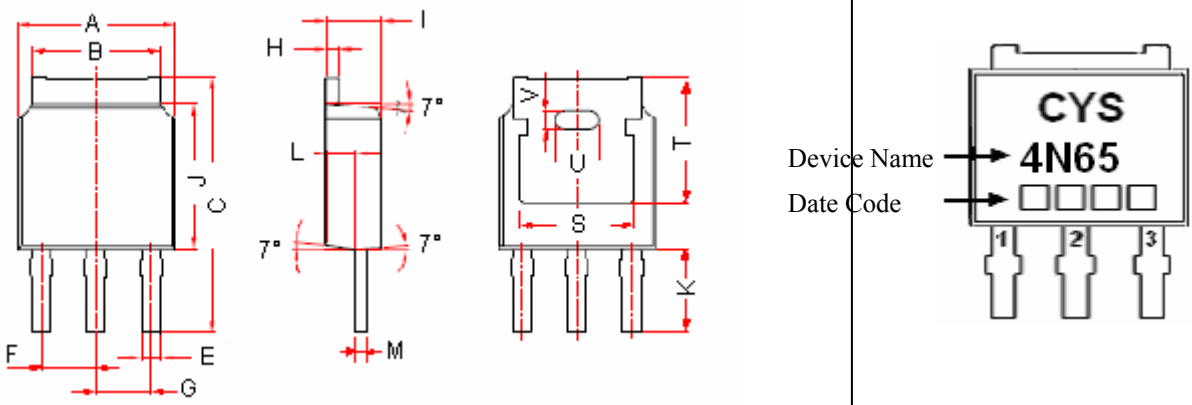
DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.2500	0.2618	6.35	6.65	I	0.0866	0.0945	2.20	2.40
B	0.2047	0.2126	5.20	5.40	J	0.2126	0.2244	5.40	5.70
C	0.5709	0.5866	14.50	14.90	K	0.2992	0.3071	7.60	7.80
D	0.0276	0.0354	0.70	0.90	L	0.0453	0.0492	1.15	1.25
E	0.0199	0.0276	0.50	0.70	M	0.0169	0.0228	0.43	0.58
F	0.0886	0.0925	2.25	2.35	N	0.1181	REF	3.00	REF
G	0.0886	0.0925	2.25	2.35	S	0.1969	REF	5.00	REF
H	0.0169	0.0228	0.43	0.58	T	0.1496	REF	3.80	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.

TO-251S Dimension



Marking :

Device Name → **4N65**
 Date Code → □ □ □ □

3-Lead TO-251S Plastic Package
 CYStek Package Code: I3

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

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.2559	0.2638	6.50	6.70	J	0.2362	0.2441	6.00	6.20
B	0.2020	0.2126	5.13	5.46	K	0.1299	0.1457	3.30	3.70
C	0.4094	0.4331	10.40	11.00	L	0.0358	0.0437	0.91	1.11
E	0.0280	0.0319	0.71	0.81	M	0.0181	0.0220	0.46	0.56
F	0.0858	0.0941	2.18	2.39	S	0.1902	REF	4.83	REF
G	0.0858	0.0941	2.18	2.39	T	0.2106	REF	5.35	REF
H	0.0181	0.0220	0.46	0.56	U	0.0701	REF	1.78	REF
I	0.0902	0.0937	2.29	2.38	V	0.0299	REF	0.76	REF

Notes: 1.Controlling dimension: inch.
 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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