

**N-Channel Enhancement Mode Power MOSFET**

# MTN4N65CI3

<b>BV<sub>DSS</sub></b>	<b>650V</b>
<b>I<sub>D</sub> @ V<sub>GS</sub>=10V, T<sub>C</sub>=25°C</b>	<b>4A</b>
<b>I<sub>D</sub> @ V<sub>GS</sub>=10V, T<sub>C</sub>=100°C</b>	<b>2.4A</b>
<b>R<sub>DS(ON)</sub>@ V<sub>GS</sub>=10V, I<sub>D</sub>=2A</b>	<b>1.8Ω (typ)</b>

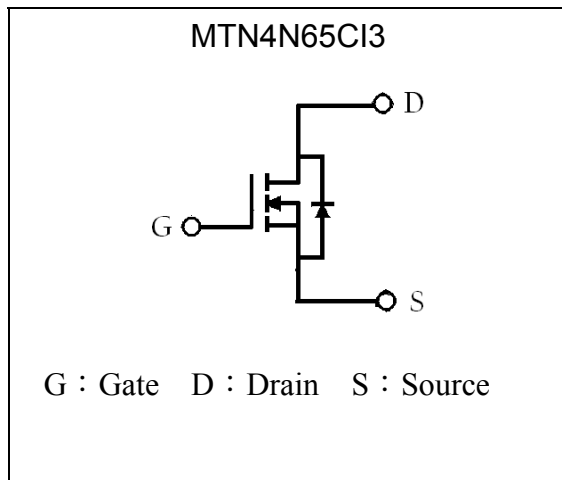
**Features**

- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- Pb-free Lead Plating and Halogen-free Package

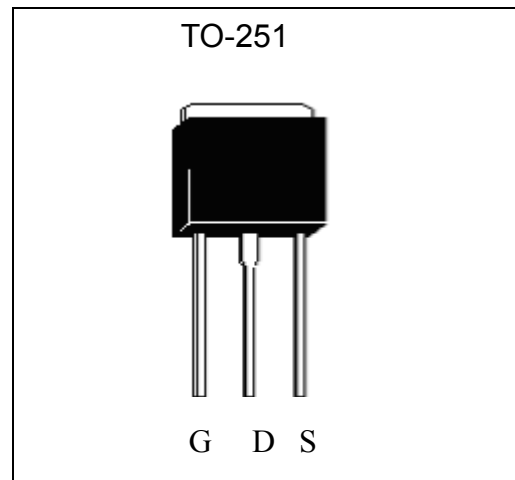
**Applications**

- Open Framed Power Supply
- Adapter
- STB

**Symbol**

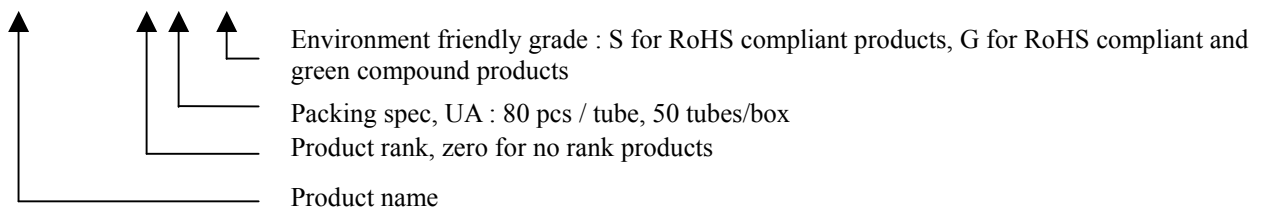


**Outline**



**Ordering Information**

Device	Package	Shipping
MTN4N65CI3-0-UA-G	TO-251 (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	$V_{GS}$	$\pm 30$	
Continuous Drain Current @ $V_{GS}=10\text{V}$ , $T_C=25^{\circ}\text{C}$	$I_D$	4*	A
Continuous Drain Current @ $V_{GS}=10\text{V}$ , $T_C=100^{\circ}\text{C}$		2.4*	
Pulsed Drain Current @ $V_{GS}=10\text{V}$ (Note 1)	$I_{DM}$	16*	
Avalanche Current (Note 1)	$I_{AS}$	2	
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	16	mJ
Repetitive Avalanche Energy (Note 1)	$E_{AR}$	4.8	
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 ( $T_C=25^{\circ}\text{C}$ )	$P_D$	48	W
Linear Derating Factor		0.38	W/ $^{\circ}\text{C}$
Operating Junction and Storage Temperature	$T_j, T_{stg}$	-55~+150	$^{\circ}\text{C}$

\*Drain current limited by maximum junction temperature

\*100% UIS testing in condition of  $V_{DD}=50\text{V}$ ,  $L=8\text{mH}$ ,  $V_G=10\text{V}$ ,  $I_L=2\text{A}$ , Rated  $V_{DS}=650\text{V}$ 

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

2.  $I_{AS}=2\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $L=8\text{mH}$ ,  $V_G=10\text{V}$ , starting  $T_j=+25^{\circ}\text{C}$ .**Thermal Data**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{\theta JC}$	2.6	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-ambient, max (Note 1)	$R_{\theta JA}$	50	
Thermal Resistance, Junction-to-ambient, max (Note 2)		110	

1. When the device is mounted on 1 in<sup>2</sup>FR-4 board with 2 oz. copper, in a still air environment with  $T_A=25^{\circ}\text{C}$ .2. When the device is mounted on the minimum pad size recommended (PCB mount) with  $T_A=25^{\circ}\text{C}$ .



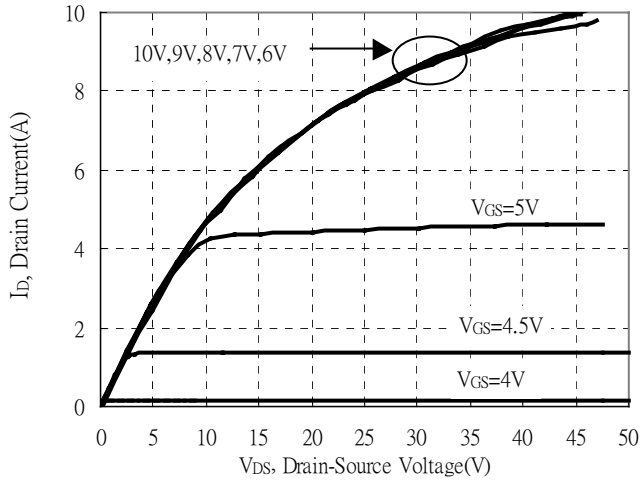
**Characteristics (Tc=25°C, unless otherwise specified)**

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
BV <sub>DSS</sub>	650	-	-	V	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA, T <sub>j</sub> =25°C
ΔBV <sub>DSS</sub> /ΔT <sub>j</sub>	-	0.6	-	V/°C	Reference to 25°C, I <sub>D</sub> =250μA
V <sub>GS(th)</sub>	2.0	-	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA
*G <sub>FS</sub>	-	5	-	S	V <sub>DS</sub> =15V, I <sub>D</sub> =2A
I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> =±30V
I <sub>DSS</sub>	-	-	1	μA	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V
	-	-	10		V <sub>DS</sub> =520V, V <sub>GS</sub> =0V, T <sub>j</sub> =125°C
*R <sub>DS(ON)</sub>	-	1.8	2.6	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =2A
<b>Dynamic</b>					
*Q <sub>g</sub>	-	16	-	nC	I <sub>D</sub> =4A, V <sub>DD</sub> =520V, V <sub>GS</sub> =10V
*Q <sub>gs</sub>	-	3.1	-		
*Q <sub>gd</sub>	-	5.5	-		
*t <sub>d(ON)</sub>	-	11	-	ns	V <sub>DD</sub> =325V, I <sub>D</sub> =4A, V <sub>GS</sub> =10V, R <sub>G</sub> =25Ω
*t <sub>r</sub>	-	8.6	-		
*t <sub>d(OFF)</sub>	-	35.4	-		
*t <sub>f</sub>	-	31.6	-		
C <sub>iss</sub>	-	621	-	pF	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz
C <sub>oss</sub>	-	61	-		
C <sub>rss</sub>	-	39	-		
<b>Source-Drain Diode</b>					
*I <sub>S</sub>	-	-	4	A	
*I <sub>SM</sub>	-	-	16		
*V <sub>SD</sub>	-	-	1.5	V	I <sub>S</sub> =2A, V <sub>GS</sub> =0V
*t <sub>rr</sub>	-	343	-	ns	V <sub>GS</sub> =0V, I <sub>F</sub> =4A, dI <sub>F</sub> /dt=100A/μs
*Q <sub>rr</sub>	-	1.59	-	μC	

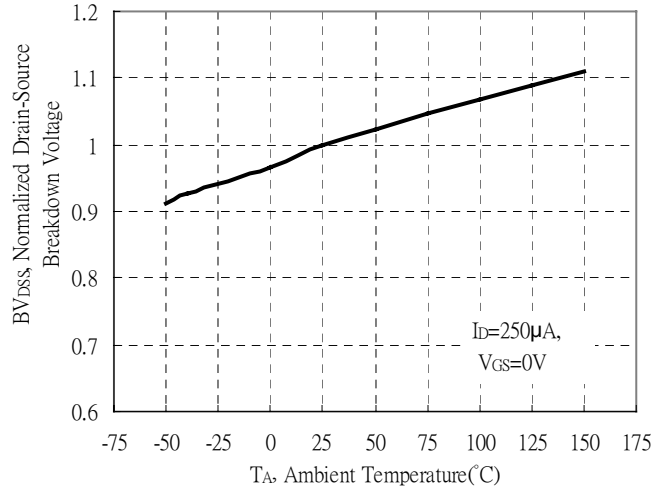
\*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

## Typical Characteristics

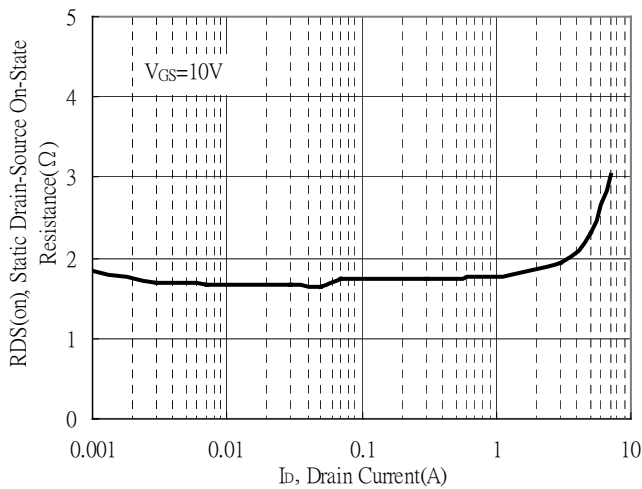
Typical Output Characteristics



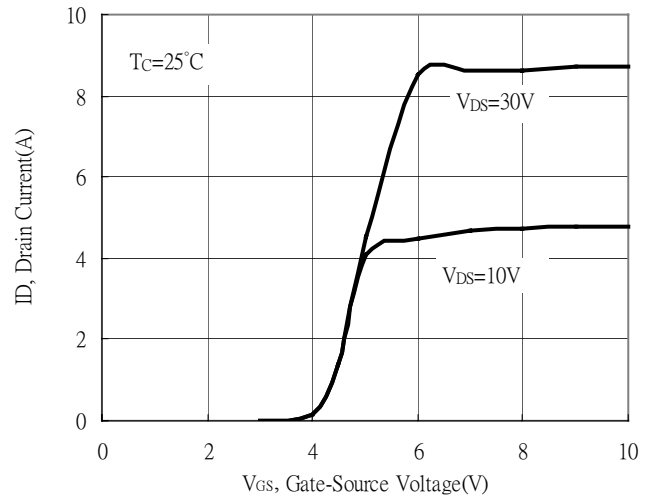
Brekdown Voltage vs Ambient Temperature



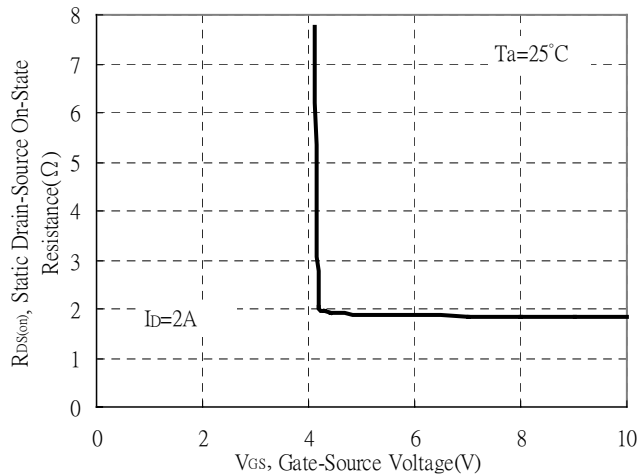
Static Drain-Source On-State resistance vs Drain Current



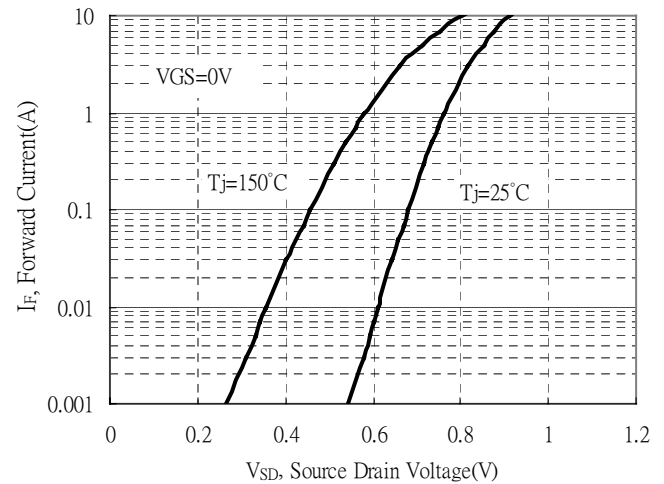
Drain Current vs Gate-Source Voltage



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

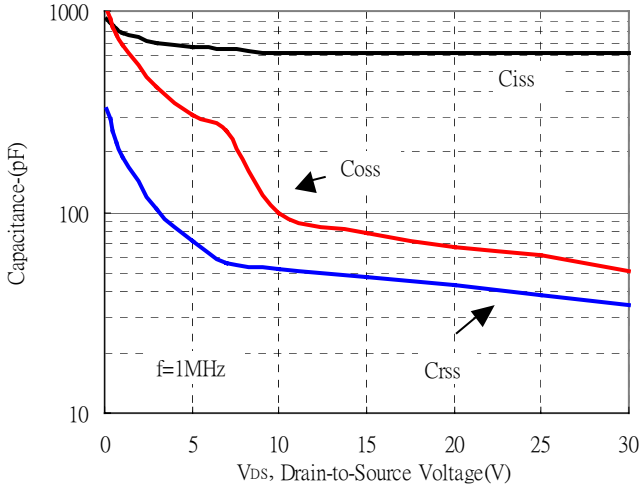


Forward Drain Current vs Source-Drain Voltage

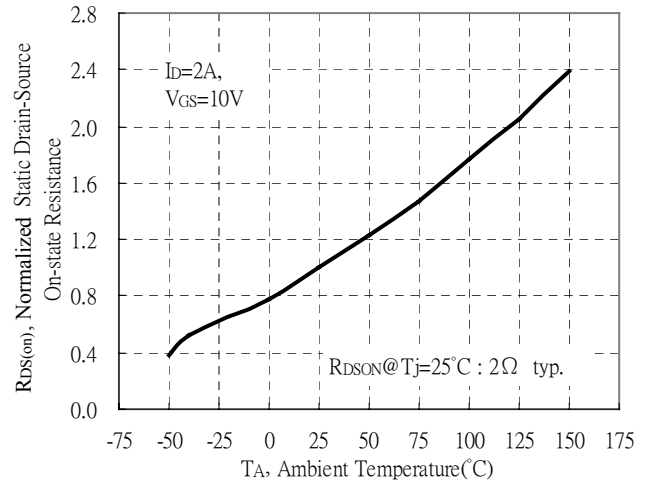


**Typical Characteristics(Cont.)**

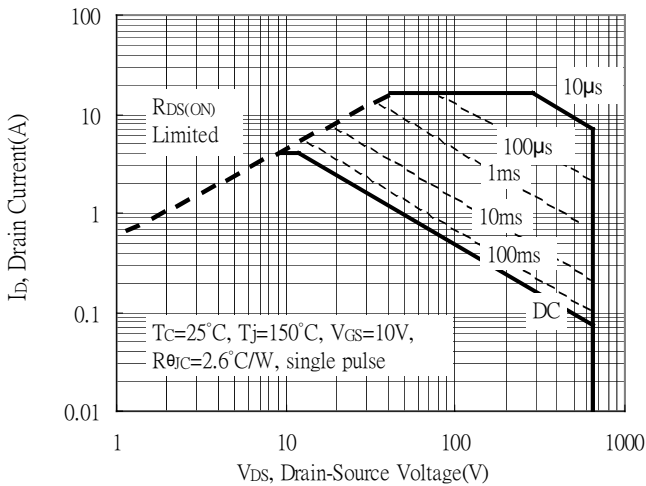
Capacitance vs Reverse Voltage



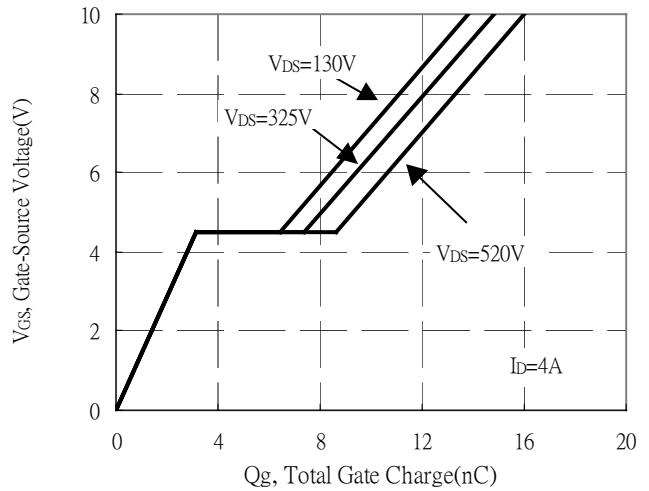
Static Drain-Source On-resistance vs Ambient Temperature



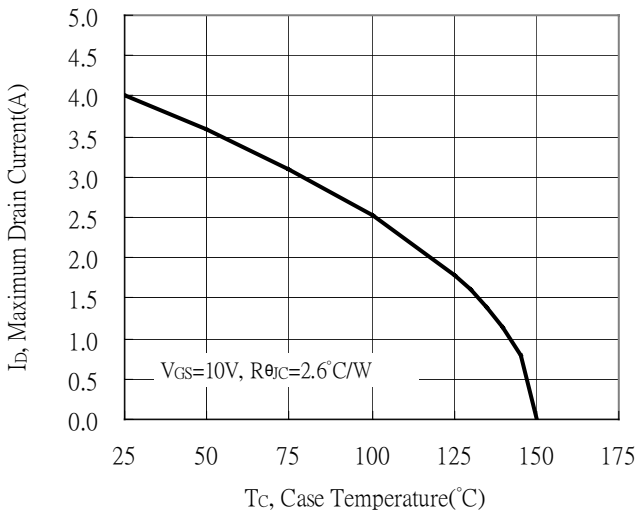
Maximum Safe Operating Area



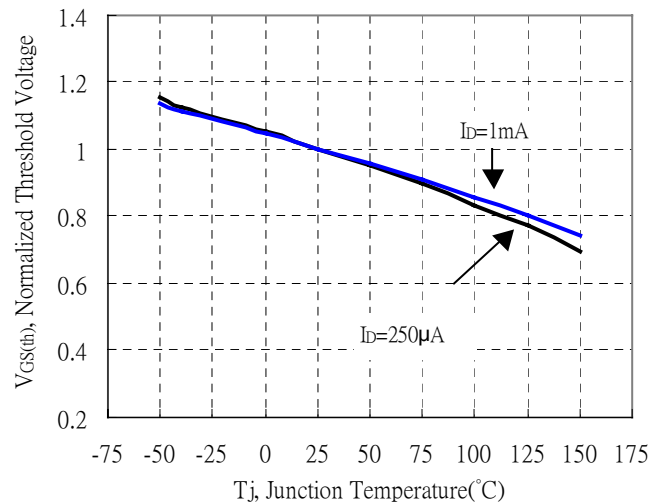
Gate Charge Characteristics



Maximum Drain Current vs Case Temperature



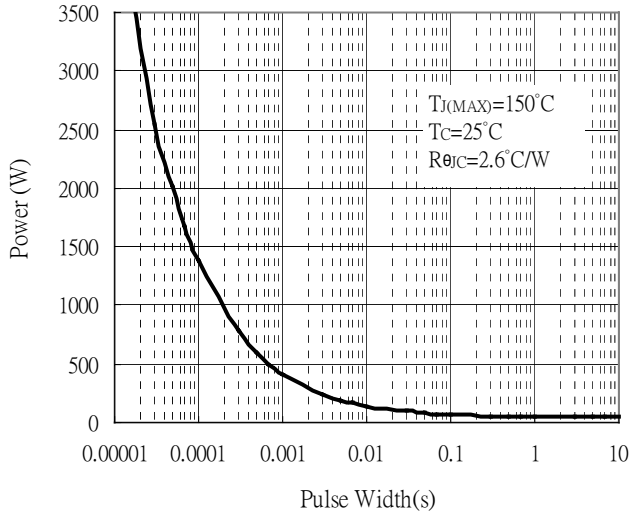
Threshold Voltage vs Junction Temperature



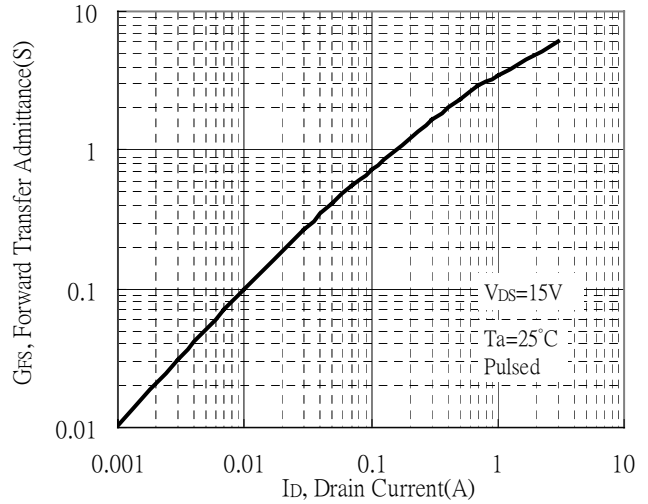


**Typical Characteristics(Cont.)**

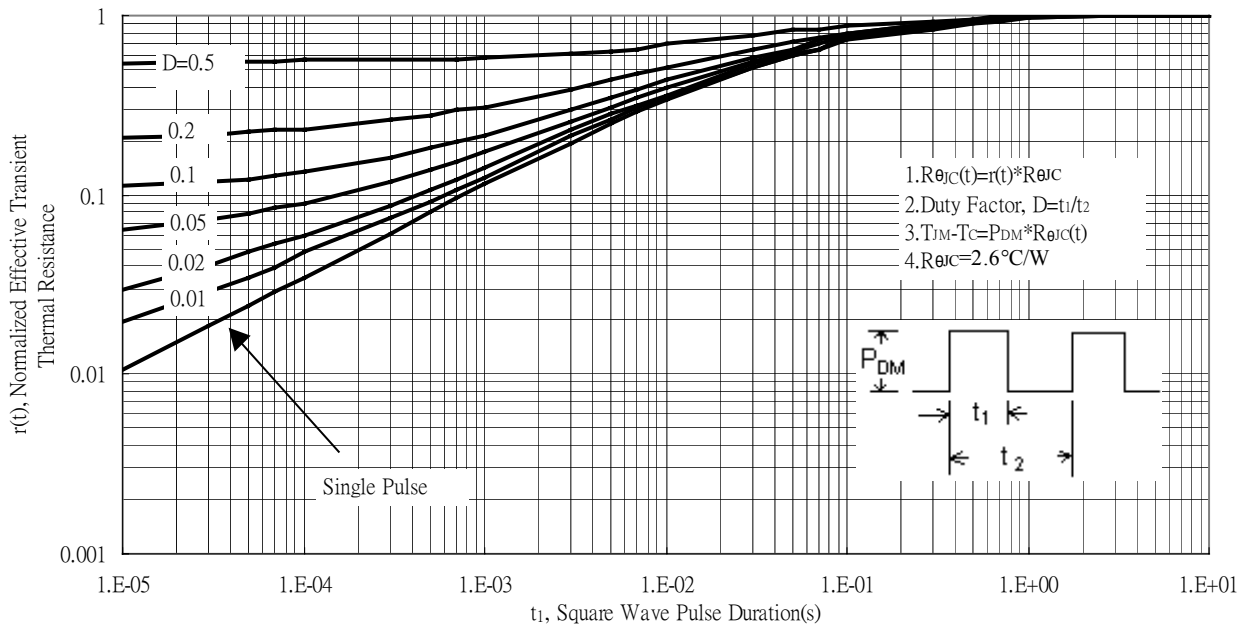
Single Pulse Power Rating, Junction to Case



Forward Transfer Admittance vs Drain Current



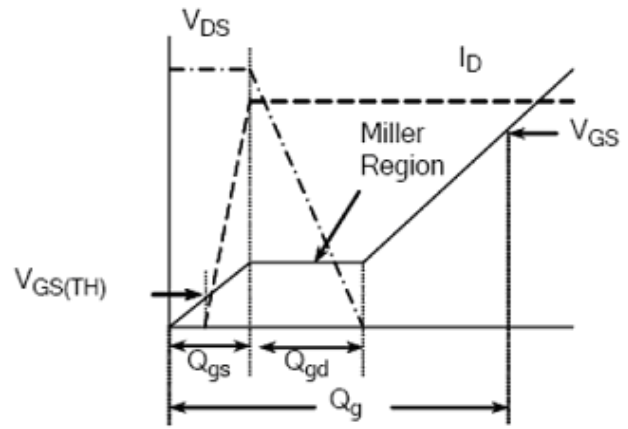
Transient Thermal Response Curves



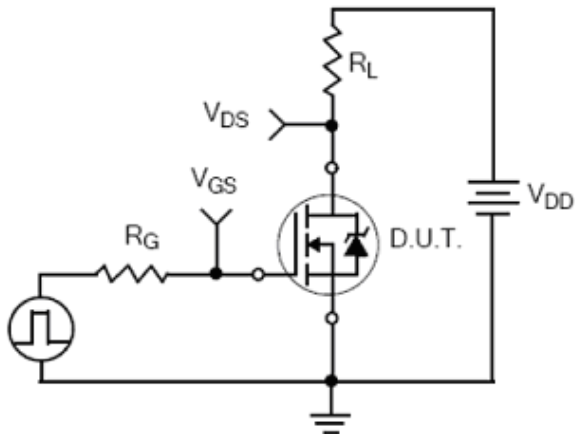
**Test Circuits and Waveforms**



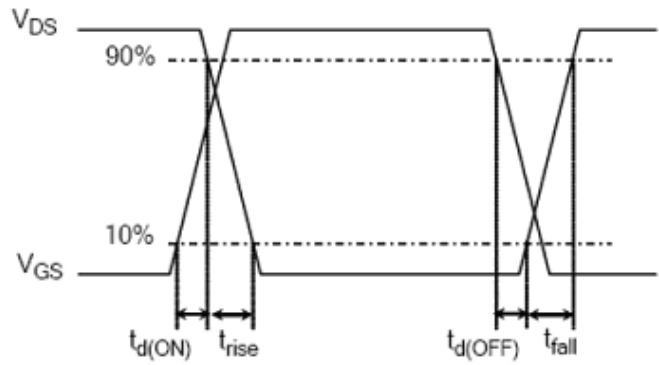
**Gate Charge Test Circuit**



**Gate Charge Waveform**



**Resistive Switching Test Circuit**



**Resistive Switching Waveforms**

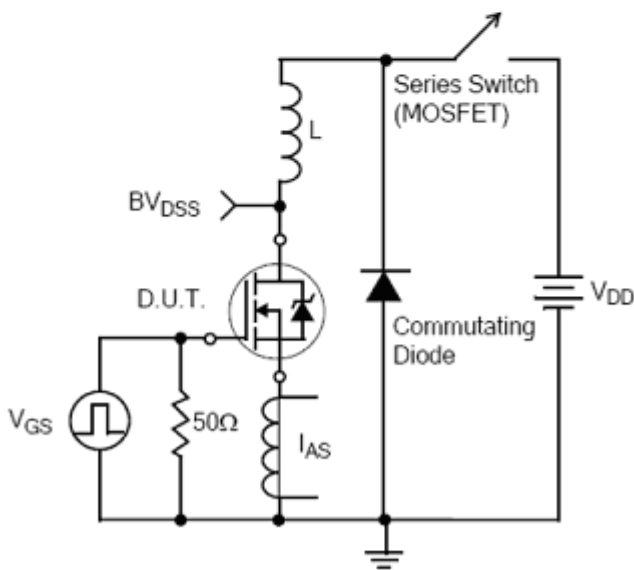
**Test Circuits and Waveforms(Cont.)**



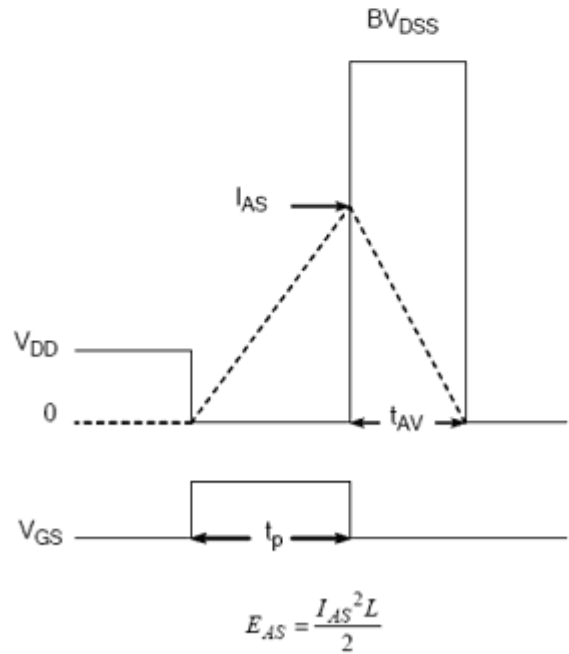
**Diode Reverse Recovery Test Circuit**



**Diode Reverse Recovery Waveform**



**Unclamped Inductive Switching Test Circuit**



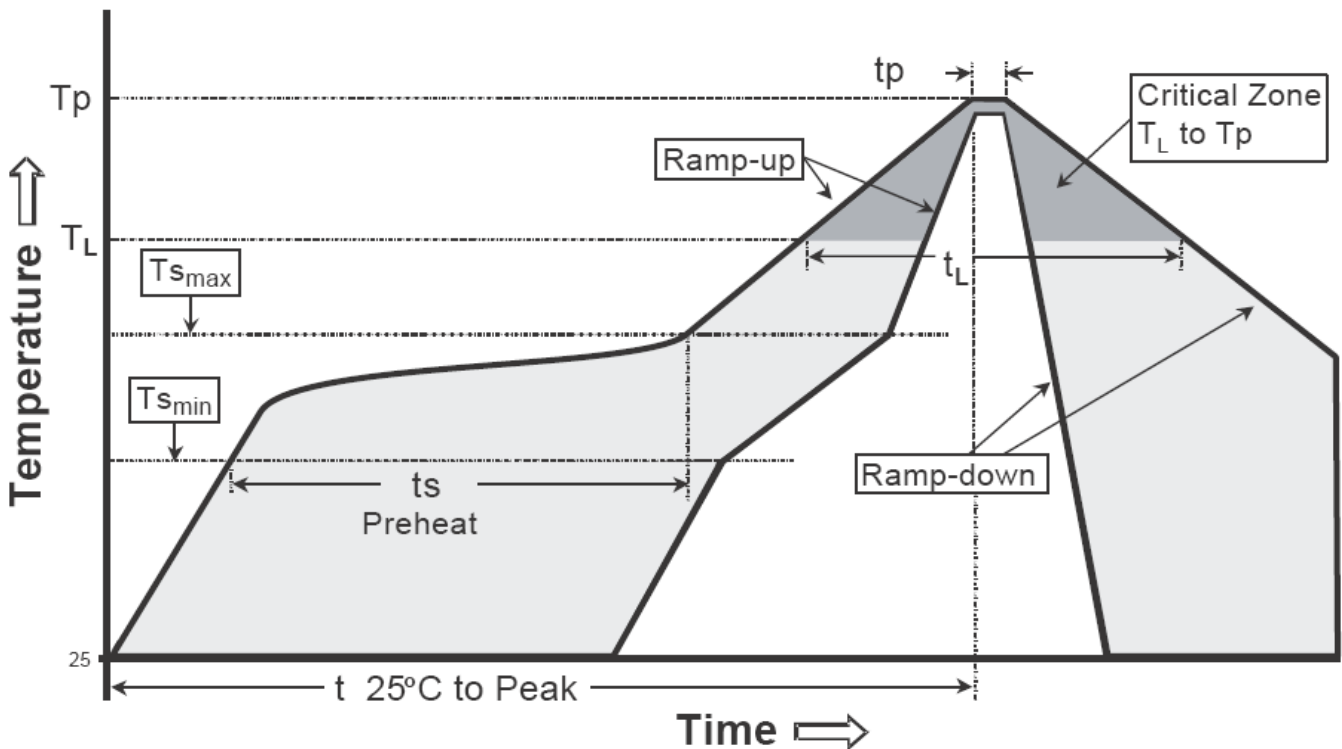
**Unclamped Inductive Switching Waveforms**



**Recommended wave soldering condition**

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

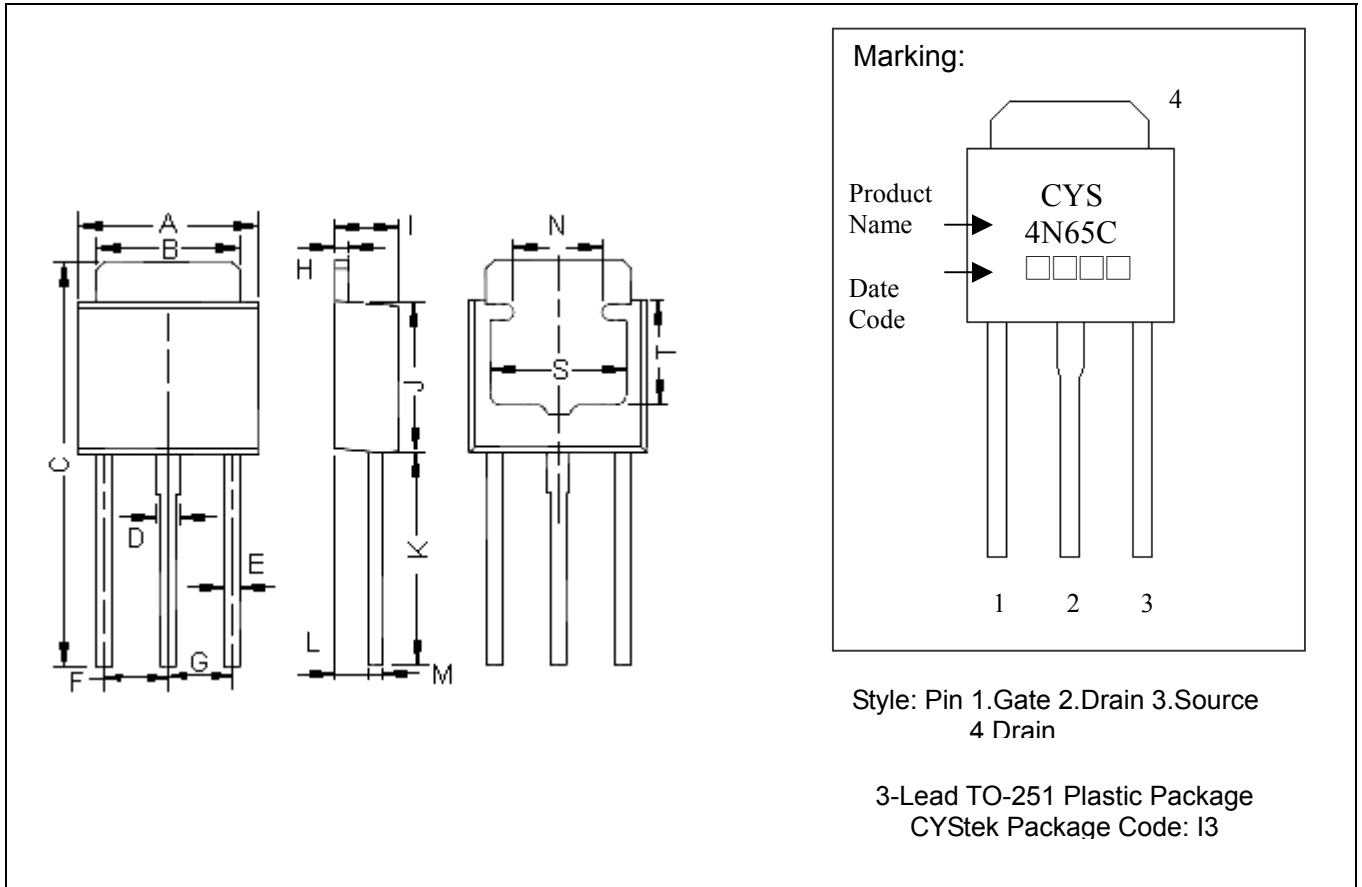
**Recommended temperature profile for IR reflow**



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**



**Marking:**

Product Name → **CYS 4N65C**

Date Code → □ □ □ □

Style: Pin 1.Gate 2.Drain 3.Source 4 Drain

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

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