N-Channel Enhancement Mode Power MOSFET

MTN1N65I3

BV_{DSS} : 650V
$R_{DS(ON)}$: 9.5Ω
I_D : 1.0A

Description

The MTN1N65I3 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

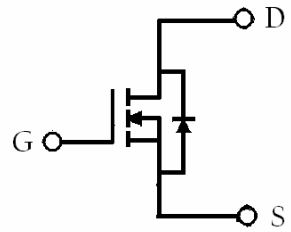
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant package

Applications

- Cell phone charger
- Standby power

Symbol

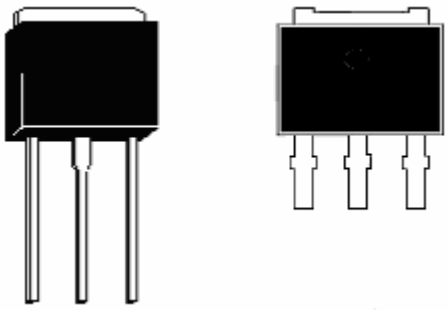
MTN1N65I3



G：Gate
D：Drain
S：Source

Outline

TO-251AB TO-251AA



G D S G D S

Absolute Maximum Ratings (T_C=25°C)

Parameter	Symbol	Limits	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	±30	V
Continuous Drain Current	I_D	1.0	A
Continuous Drain Current @T_C=100°C	I_D	0.6	A
Pulsed Drain Current @ V_{GS}=10V (Note 1)	I_{DM}	4.0	A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	43	mJ
Avalanche Current (Note 1)	I_{AR}	1.0	A
Repetitive Avalanche Energy (Note 1)	E_{AR}	2.8	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	°C
Total Power Dissipation (T_A=25℃)	P_D	1.14	W
Total Power Dissipation (T_C=25℃)		28	W
Linear Derating Factor		0.2	W/°C
Operating Junction and Storage Temperature	Tj, Tstg	-55~+150	°C

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

2. I_{AS}=1.0A, V_{DD}=50V, L=80mH, R_G=25Ω, starting TJ=+25℃.

3. I_{SD}≤1.0A, dI/dt≤100A/μs, V_{DD}≤BV_{DSS}, starting TJ=+25℃.

Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{th,j\text{-}c}$	4.46	°C/W
Thermal Resistance, Junction-to-ambient, max	$R_{th,j\text{-}a}$	110	°C/W

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

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV_{DSS}	650	-	-	V	V_{GS}=0, I_D=250μA, Tj=25℃
$\Delta BV_{DSS}/\Delta Tj$	-	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}	-	1	-	S	V_{DS} =15V, I_D=0.5A
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
*$R_{DS(ON)}$	-	-	9.5	Ω	V_{GS} =10V, I_D=0.5A
Dynamic					
*Qg	-	4.5	6.7	nC	I_D=1A, V_{DD}=300V, V_{GS}=10V
*Qgs	-	0.9	1.3		
*Qgd	-	1.3	1.9		
*$t_{d(ON)}$	-	22.5	-	ns	V_{DD}=300V, I_D=1A, V_{GS}=10V, R_G=25Ω, R_D=300Ω
*tr	-	27	-		
*$t_{d(OFF)}$	-	11.5	-		
*t_f	-	27	-		
Ciss	-	150	225	pF	V_{GS}=0V, V_{DS}=25V, f=1MHz
Coss	-	20	30		
Crss	-	4.3	6.4		
Source-Drain Diode					
*V_{SD}	-	-	1.5	V	I_S=1.0A, V_{GS}=0V
*I_S	-	-	1.0	A	
*I_{SM}	-	-	4.0		
*trr	-	160	-	ns	V_{GS}=0, I_F=1A, dI/dt=100A/μs
*Qrr	-	0.59	-	μC	

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

Ordering Information

Device	Package	Shipping	Marking
MTN1N65I3	TO-251 (RoHS compliant)	80 pcs / tube, 50 tubes / box	1N65

Characteristic Curves

Figure 1. On-Region Characteristics

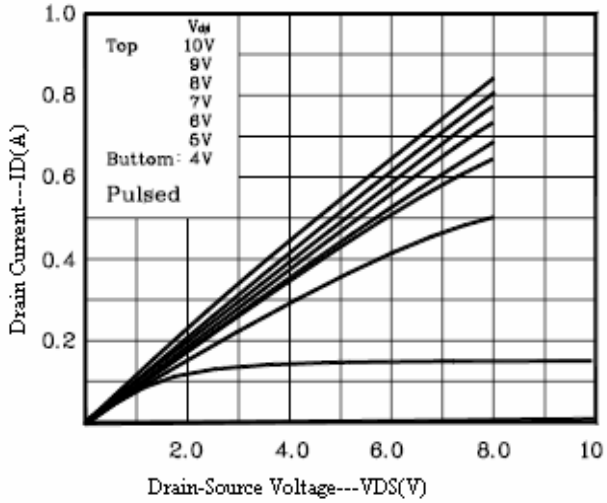


Figure 2. Transfer Characteristics

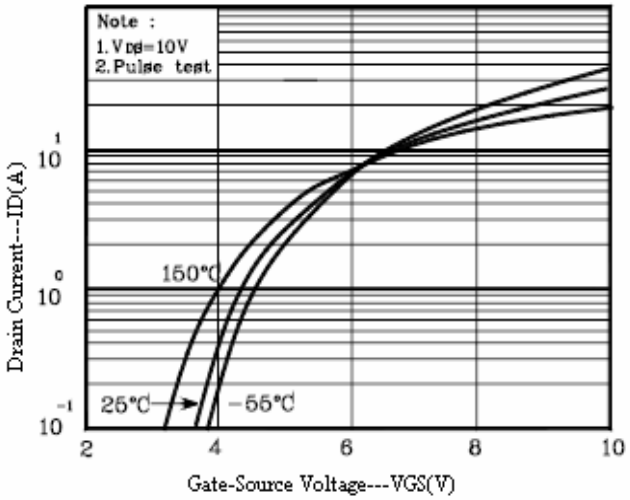


Figure 3. On-resistance Variation vs. Drain Current and Gate Charge

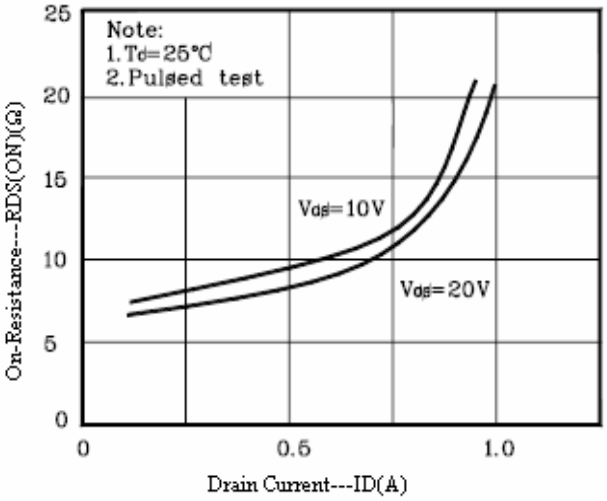


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

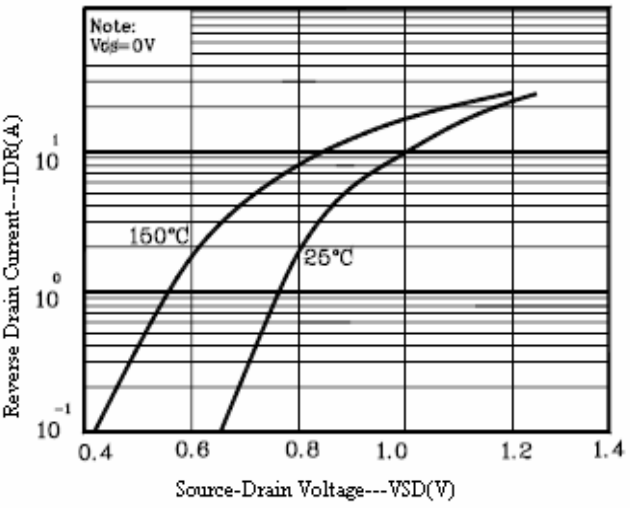


Figure 5. Capacitance Characteristics

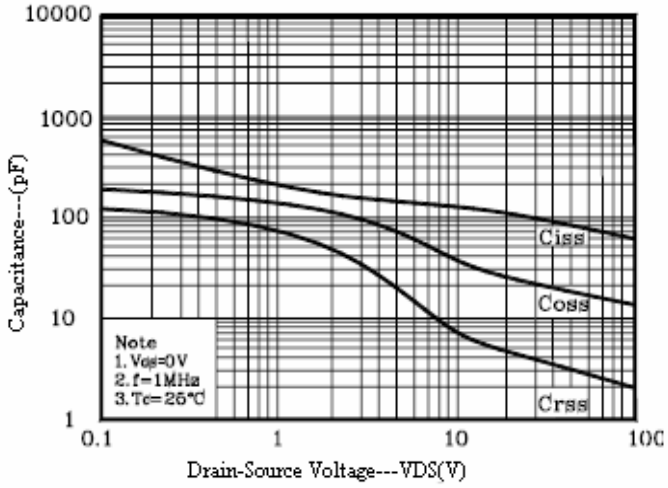
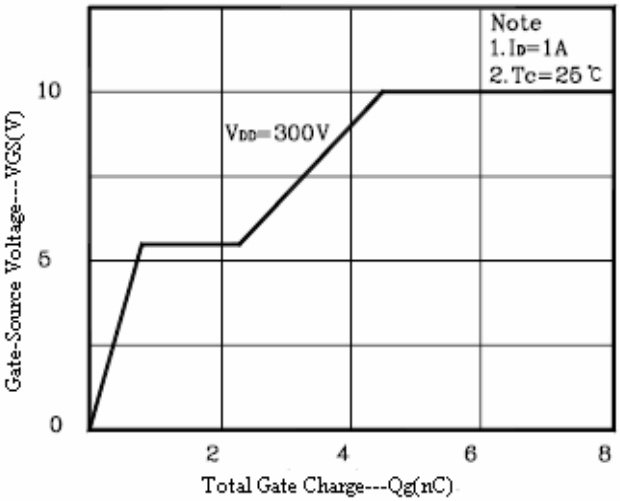


Figure 6. Gate Charge Characteristics



Characteristic Curves(Cont.)

Figure 7. Breakdown Voltage Variation vs. Temperature

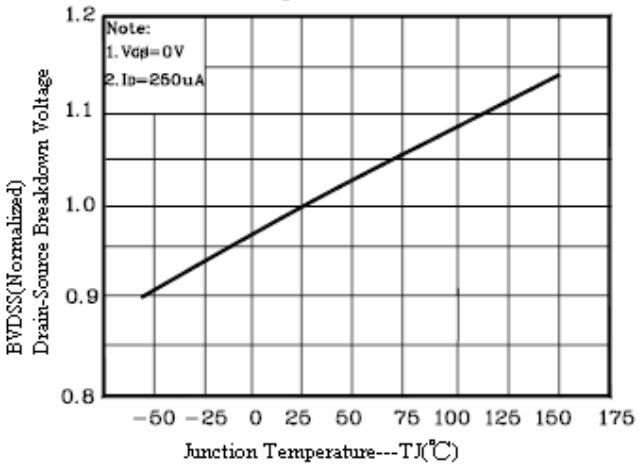


Figure 8. On-Resistance Variation vs. Temperature

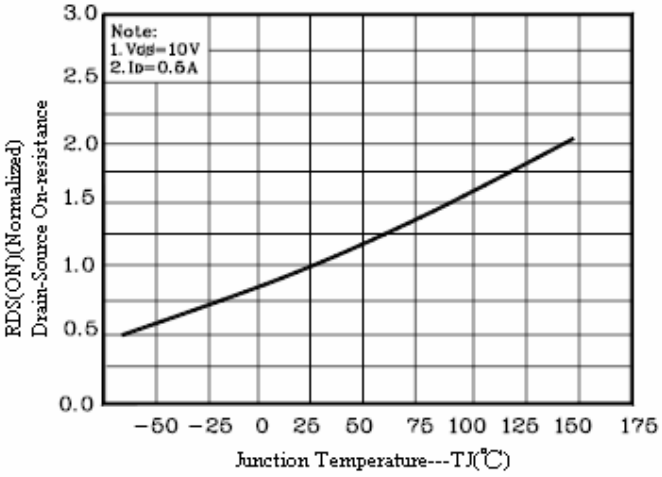


Figure 9. Maximum Drain Current vs. Case Temperature

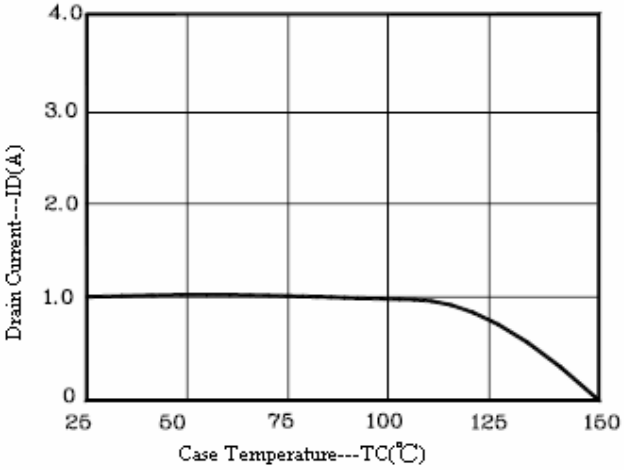
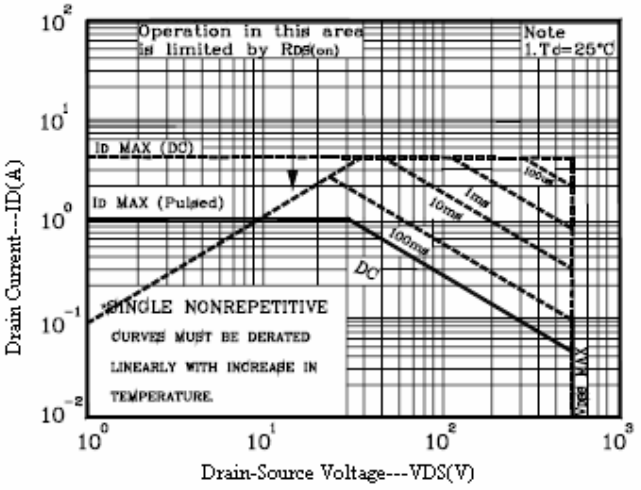
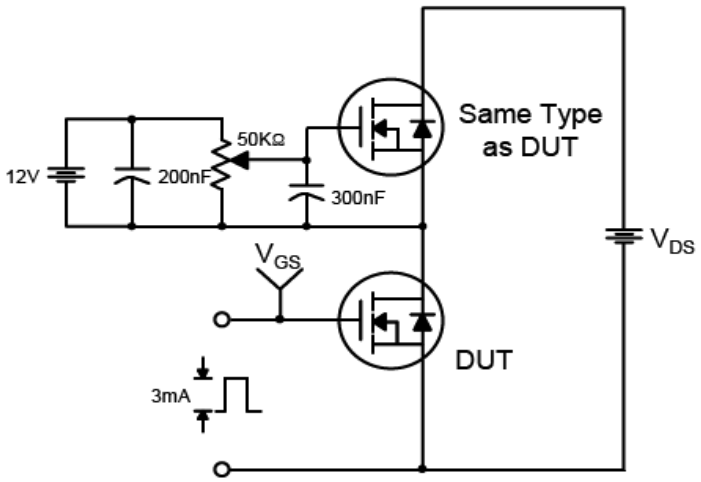


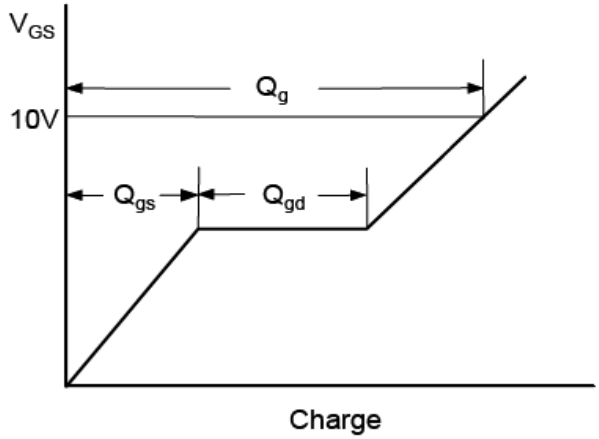
Figure 10. Maximum Safe Operating Area



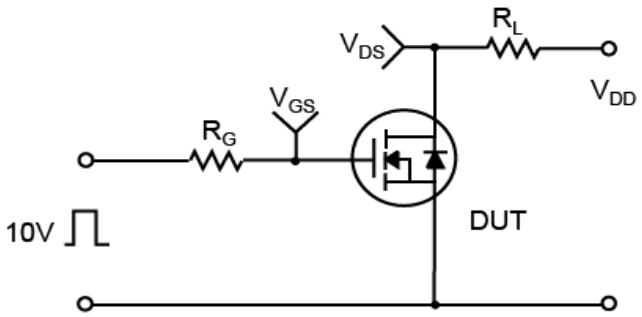
Test Circuits and Waveforms

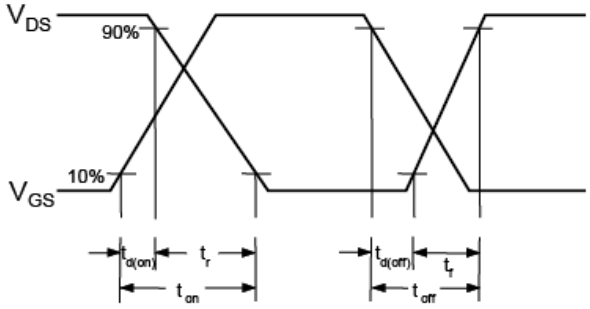
Gate Charge Test Circuit & Waveform



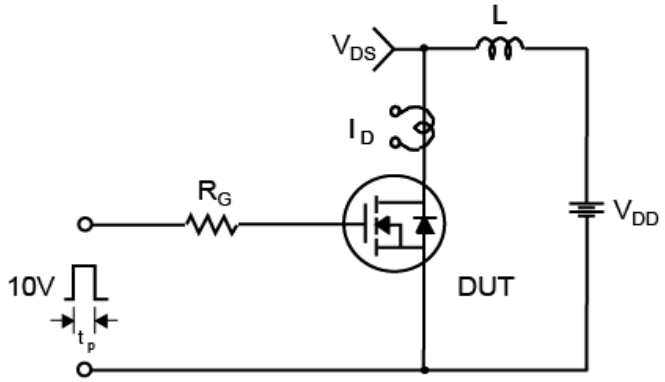


Resistive Switching Test Circuit & Waveforms

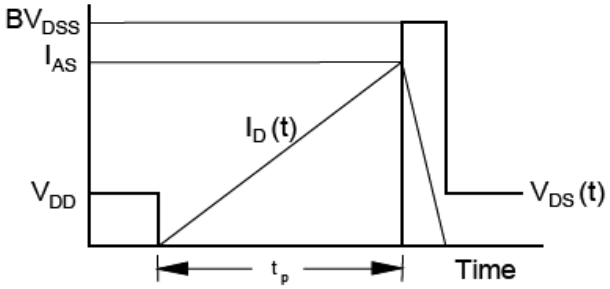




Unclamped Inductive Switching Test Circuit & Waveforms

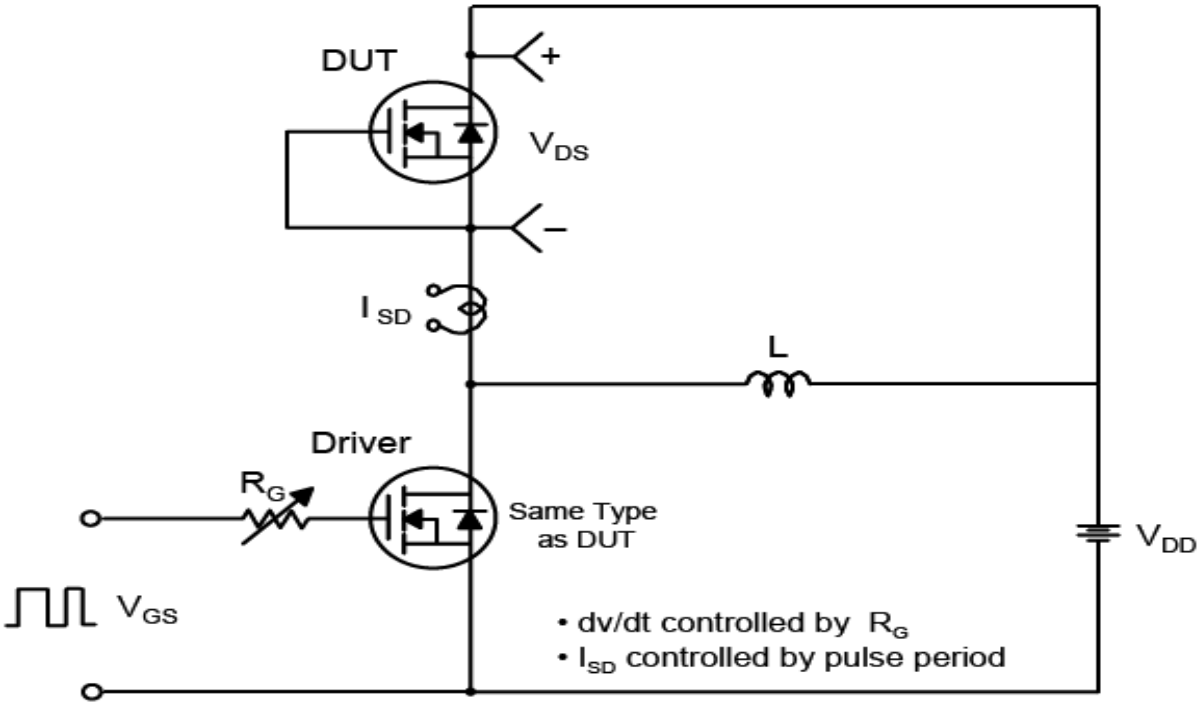


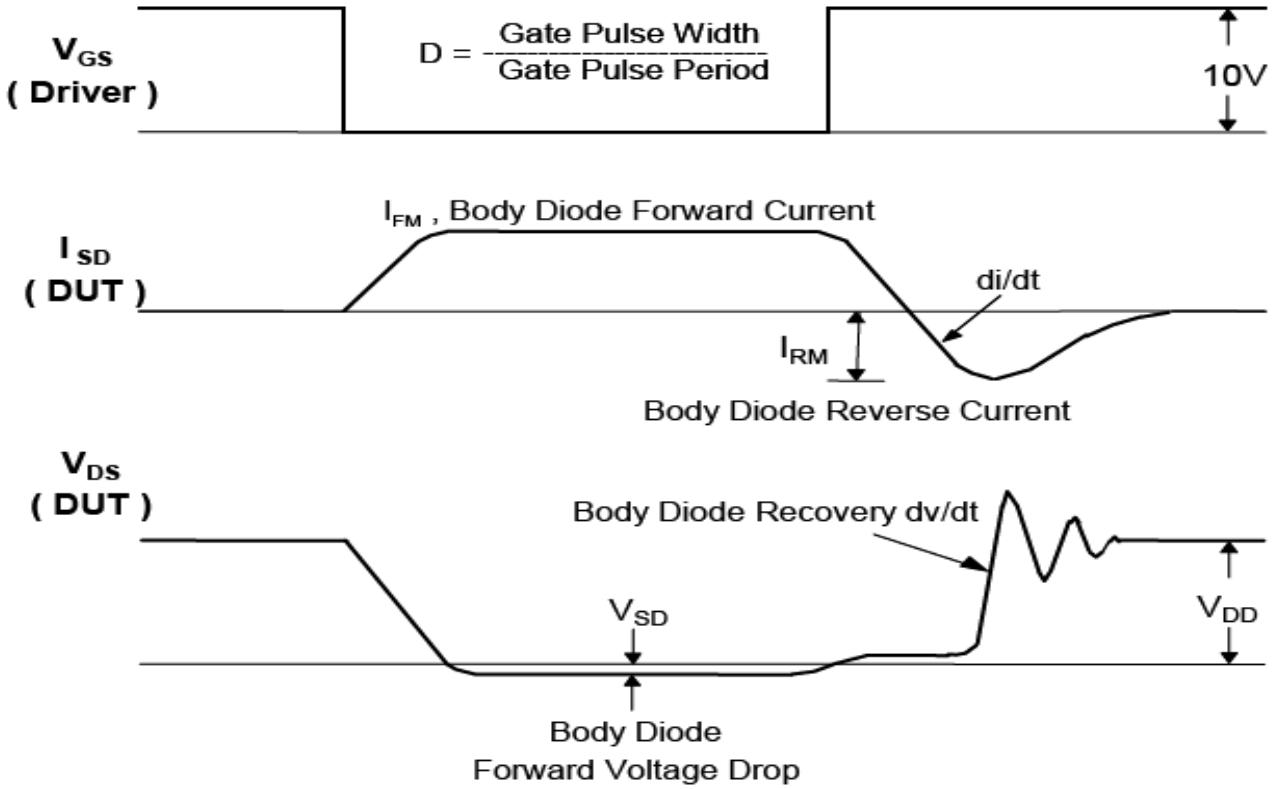
$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



Test Circuits and Waveforms(Cont.)

Peak Diode Recovery dv/dt Test Circuit & Waveforms

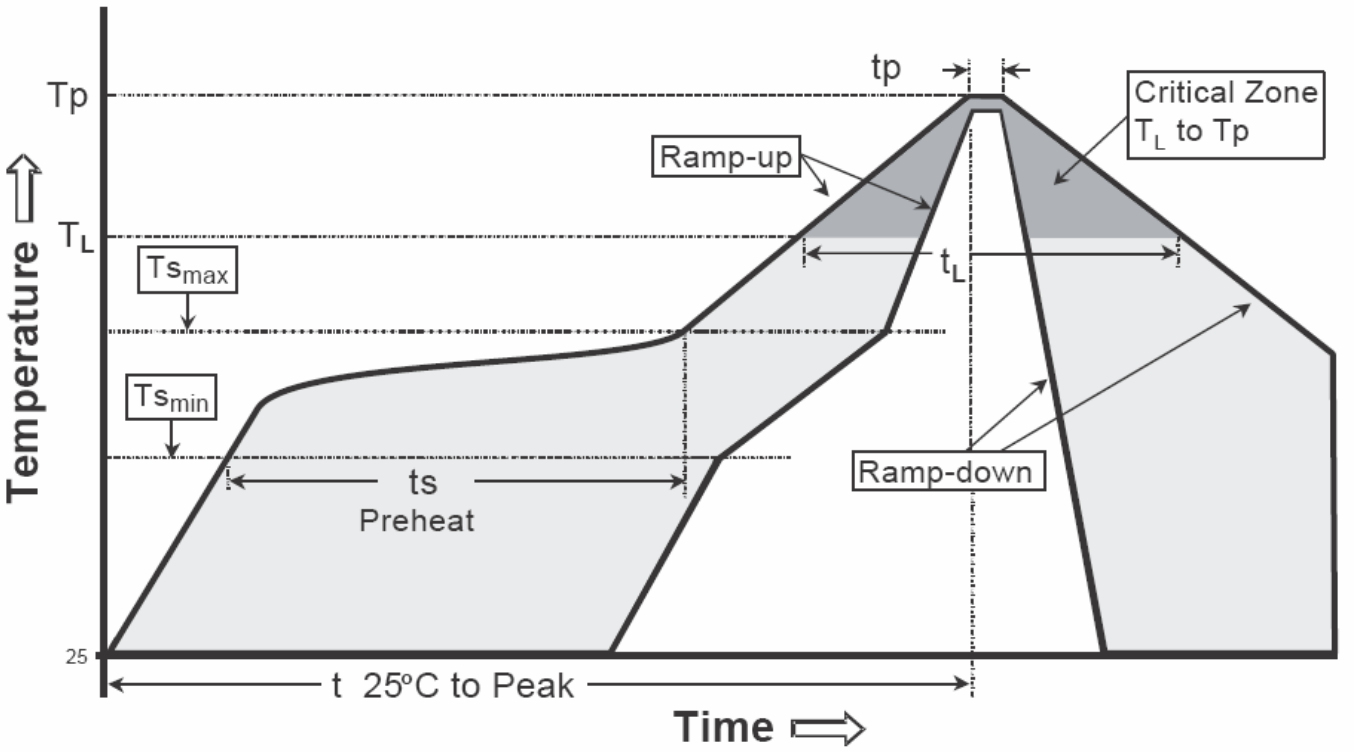




Recommended wave soldering condition

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

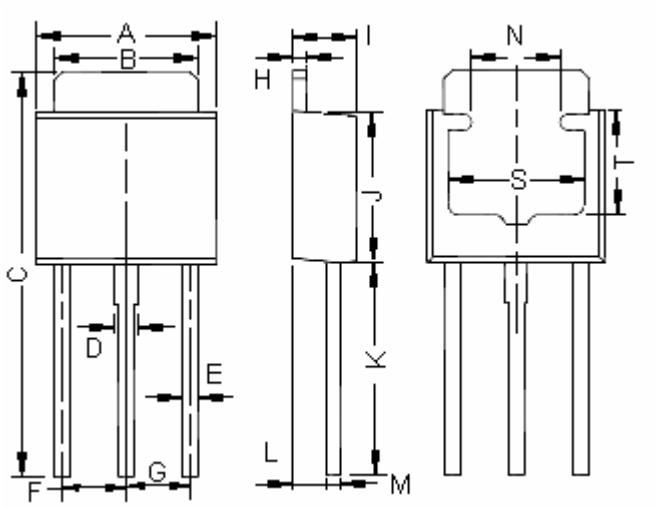
Recommended temperature profile for IR reflow

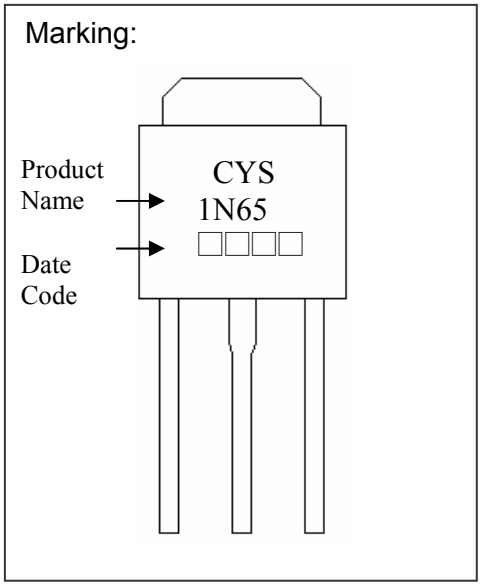


Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat −Temperature Min(T_S min) −Temperature Max(T_S max) −Time($t_{s\ min}$ to $t_{s\ max}$)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: −Temperature (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-251AB Dimension





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

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

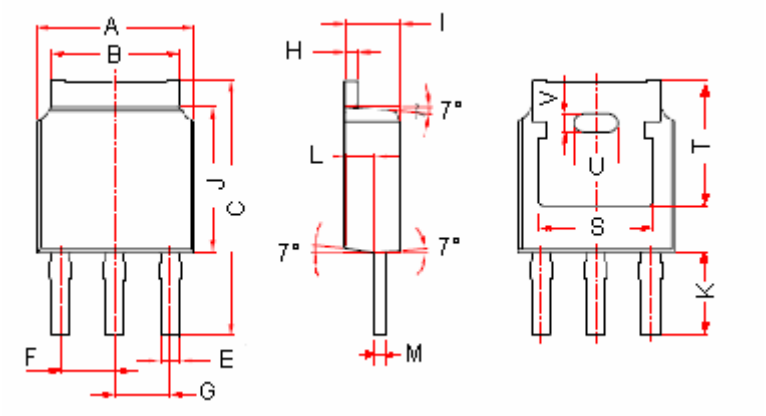
DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.2500	0.2618	6.35	6.65	I	0.0866	0.0945	2.20	2.40
B	0.2047	0.2126	5.20	5.40	J	0.2126	0.2244	5.40	5.70
C	0.5709	0.5866	14.50	14.90	K	0.2992	0.3071	7.60	7.80
D	0.0276	0.0354	0.70	0.90	L	0.0453	0.0492	1.15	1.25
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.

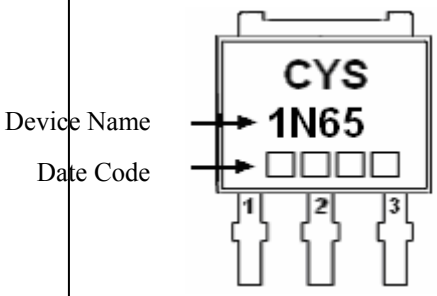
Material:

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

TO-251AA Dimension



Marking :



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

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

*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.2559	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.