

**Dual N-CHANNEL ENHANCEMENT MODE POWER MOSFET**

# MTDN9946Q8

$BV_{DSS}$	30V
$I_D$	5A
$R_{DSON(MAX)}$	35m $\Omega$

**Description**

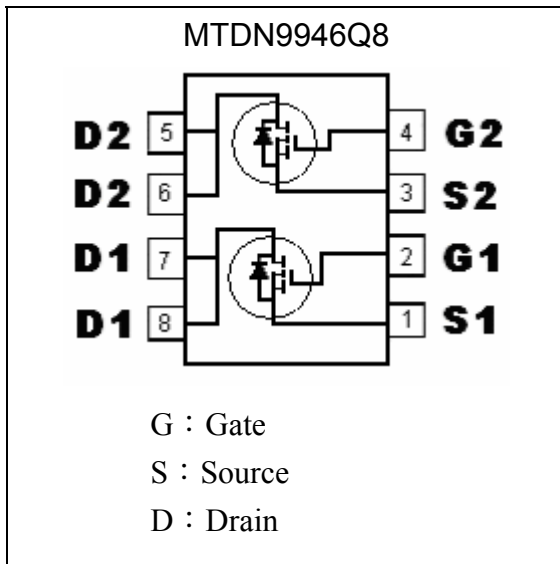
The MTDN9946Q8 provides the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness.

The SOP-8 package is universally preferred for all commercial-industrial surface mount applications and suited for low voltage applications such as DC/DC converters.

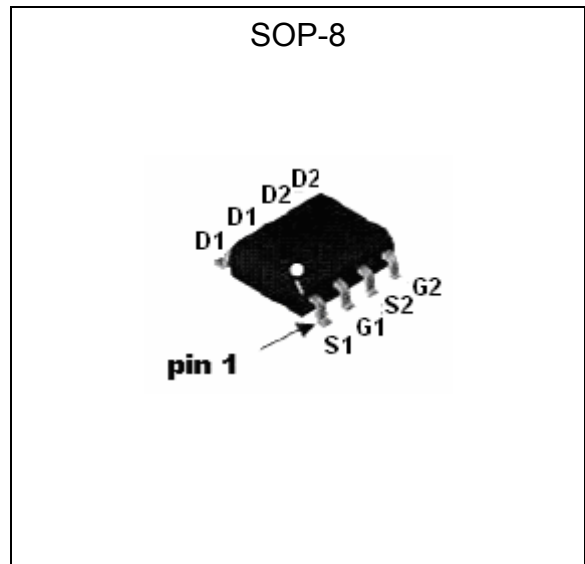
**Features**

- $R_{DS(ON)}=35m\Omega @ V_{GS}=4.5V, I_D=5A$
- Simple drive requirement
- Low on-resistance
- Fast switching speed
- Capable of 2.5V gate drive
- Pb-free lead plating package

**Equivalent Circuit**



**Outline**



**Ordering Information**

Device	Package	Shipping
MTDN9946Q8	SOP-8 (Pb-free package)	3000 pcs / Tape & Reel



**Absolute Maximum Ratings (Ta=25°C)**

Parameter	Symbol	Limits	Unit
Drain-Source Voltage	V <sub>DS</sub>	30	V
Gate-Source Voltage	V <sub>GS</sub>	±12	V
Continuous Drain Current @ V <sub>GS</sub> =4.5V, T <sub>A</sub> =25 °C (Note 1)	I <sub>D</sub>	5	A
Continuous Drain Current @ V <sub>GS</sub> =4.5V, T <sub>A</sub> =70 °C (Note 1)	I <sub>D</sub>	4	A
Pulsed Drain Current (Note 2&3)	I <sub>DM</sub>	20	A
Total Power Dissipation @ T <sub>A</sub> =25 °C	P <sub>d</sub>	2	W
Linear Derating Factor		0.016	W / °C
Operating Junction and Storage Temperature Range	T <sub>j</sub> , T <sub>stg</sub>	-55~+150	°C
Thermal Resistance, Junction-to-Ambient (Note 1)	R <sub>th,ja</sub>	62.5	°C/W

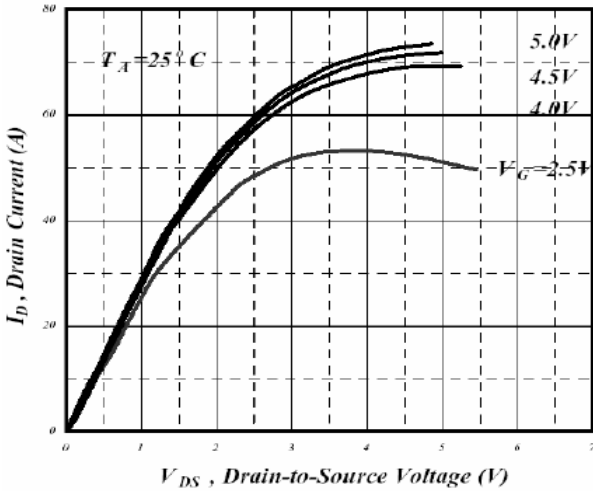
Note : 1. Surface mounted on 1 in<sup>2</sup> copper pad of FR-4 board; 135°C/W when mounted on minimum copper pad  
 2. Pulse width limited by maximum junction temperature.  
 3. Pulse width ≤ 300µs, duty cycle ≤ 2%

**Characteristics (T<sub>j</sub>=25°C, unless otherwise specified)**

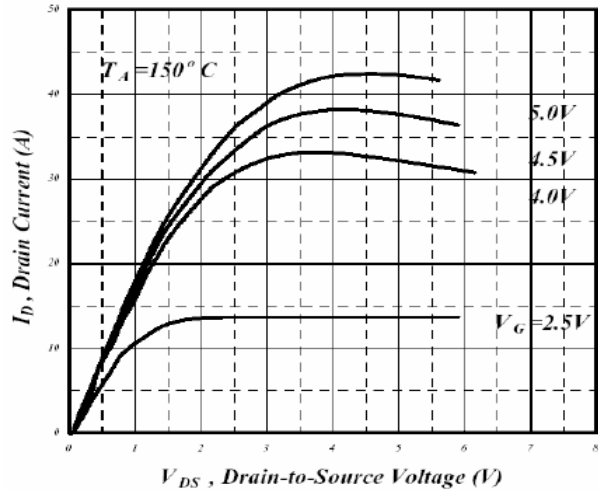
Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
B <sub>V</sub> D <sub>SS</sub>	30	-	-	V	V <sub>GS</sub> =0, I <sub>D</sub> =250µA
ΔB <sub>V</sub> D <sub>SS</sub> /ΔT <sub>j</sub>	-	0.1	-	V/°C	Reference to 25°C, I <sub>D</sub> =1mA
V <sub>GS(th)</sub>	0.5	-	1.2	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250µA
G <sub>FS</sub>	-	13	-	S	V <sub>DS</sub> =5V, I <sub>D</sub> =5A
I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> =±12V, V <sub>DS</sub> =0
I <sub>DSS</sub>	-	-	1	µA	V <sub>DS</sub> =30V, V <sub>GS</sub> =0
	-	-	25	µA	V <sub>DS</sub> =24V, V <sub>GS</sub> =0, T <sub>j</sub> =70°C
*R <sub>DS(ON)</sub>	-	-	30	mΩ	I <sub>D</sub> =5A, V <sub>GS</sub> =10V
	-	-	35		I <sub>D</sub> =5A, V <sub>GS</sub> =4.5V
	-	-	50		I <sub>D</sub> =2.6A, V <sub>GS</sub> =2.5V
	-	-	120		I <sub>D</sub> =1A, V <sub>GS</sub> =1.8V
<b>Dynamic</b>					
*Q <sub>g</sub>	-	8.5	15	nC	V <sub>DS</sub> =16V, I <sub>D</sub> =5A, V <sub>GS</sub> =4.5V
*Q <sub>gs</sub>	-	1.5	-		
*Q <sub>gd</sub>	-	3.2	-		
*t <sub>d(ON)</sub>	-	6	-	ns	V <sub>DS</sub> =15V, I <sub>D</sub> =5A, V <sub>GS</sub> =10V, R <sub>G</sub> =3.3 Ω, R <sub>D</sub> =3 Ω
*t <sub>r</sub>	-	20	-		
*t <sub>d(OFF)</sub>	-	20	-		
*t <sub>f</sub>	-	3	-		
C <sub>iss</sub>	-	660	1050	pF	V <sub>DS</sub> =25V, V <sub>GS</sub> =0, f=1MHz
C <sub>oss</sub>	-	90	-		
C <sub>rss</sub>	-	70	-		
<b>Source-Drain Diode</b>					
*V <sub>S</sub> D	-	-	1.2	V	I <sub>S</sub> =1.2A, V <sub>GS</sub> =0V
*t <sub>rr</sub>	-	14	-	ns	I <sub>S</sub> =5A, V <sub>GS</sub> =0V, dI/dt=100A/µs
*Q <sub>rr</sub>	-	7	-	nC	

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

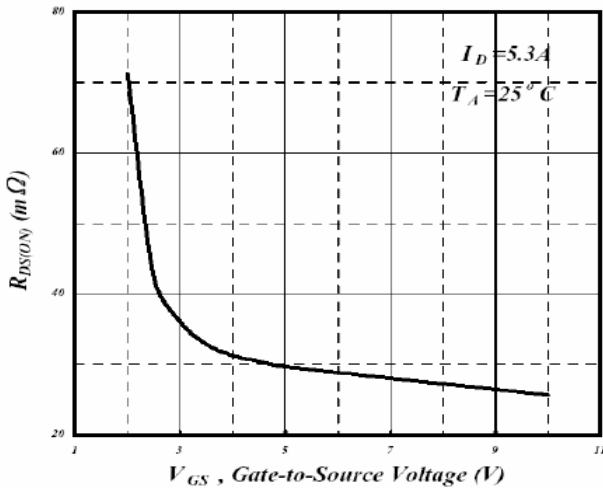
**Characteristic Curves**



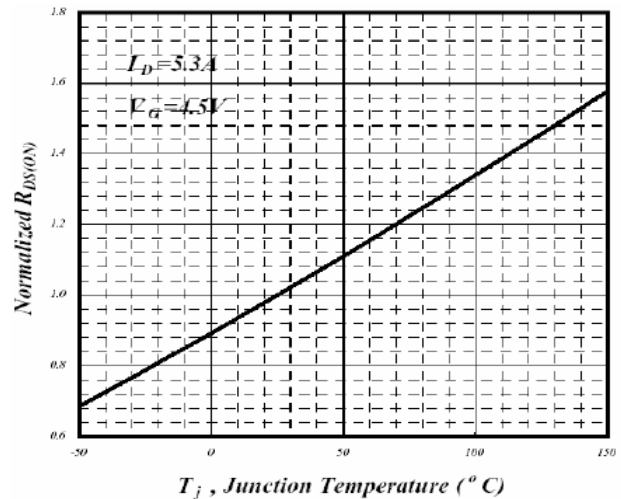
**Fig 1. Typical Output Characteristics**



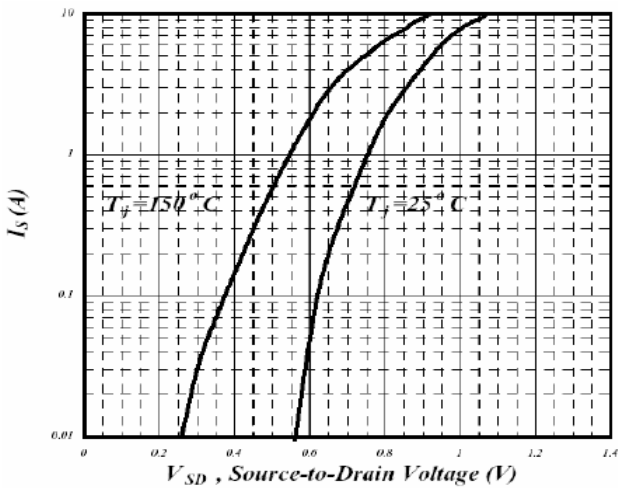
**Fig 2. Typical Output Characteristics**



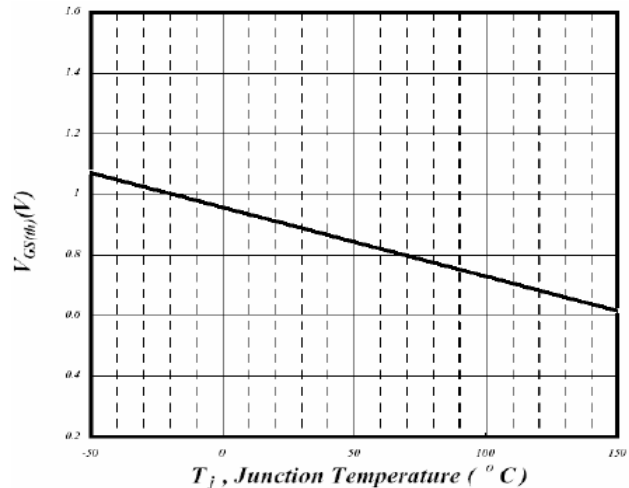
**Fig 3. On-Resistance v.s. Gate Voltage**



**Fig 4. Normalized On-Resistance v.s. Junction Temperature**

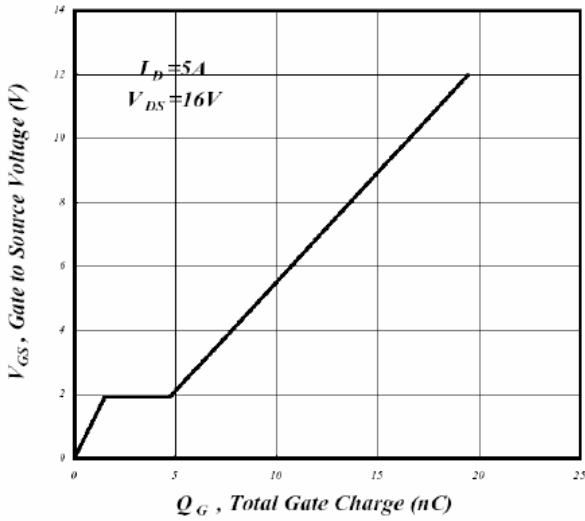


**Fig 5. Forward Characteristics of Reverse Diode**

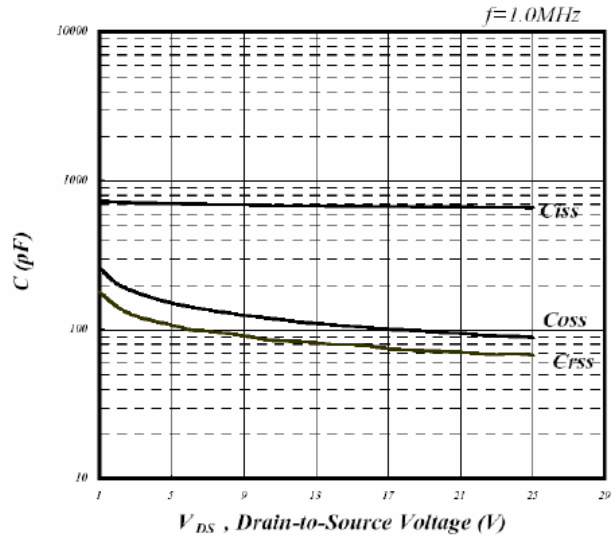


**Fig 6. Gate Threshold Voltage v.s. Junction Temperature**

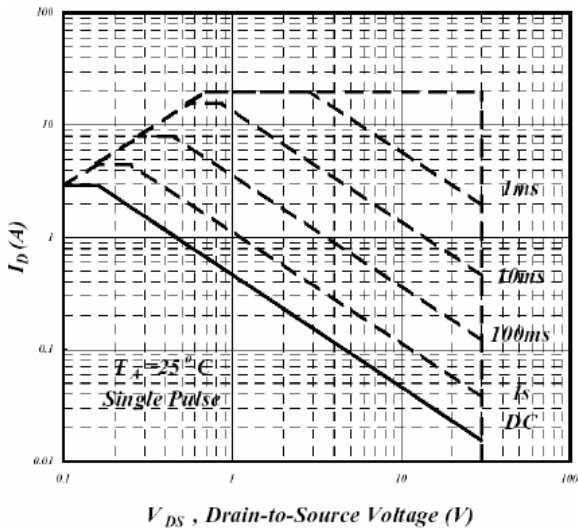
**Characteristic Curves(Cont.)**



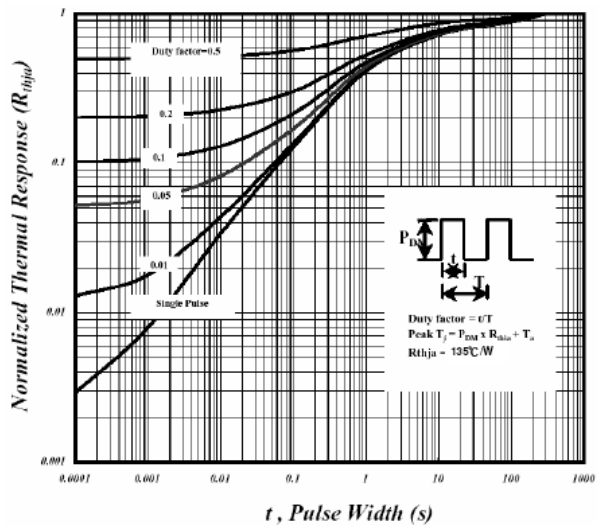
**Fig 7. Gate Charge Characteristics**



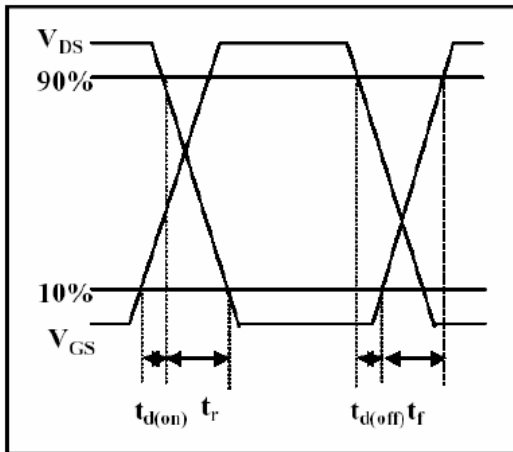
**Fig 8. Typical Capacitance Characteristics**



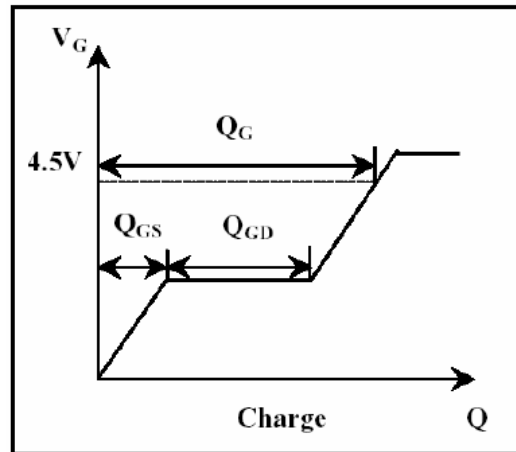
**Fig 9. Maximum Safe Operating Area**



**Fig 10. Effective Transient Thermal Impedance**

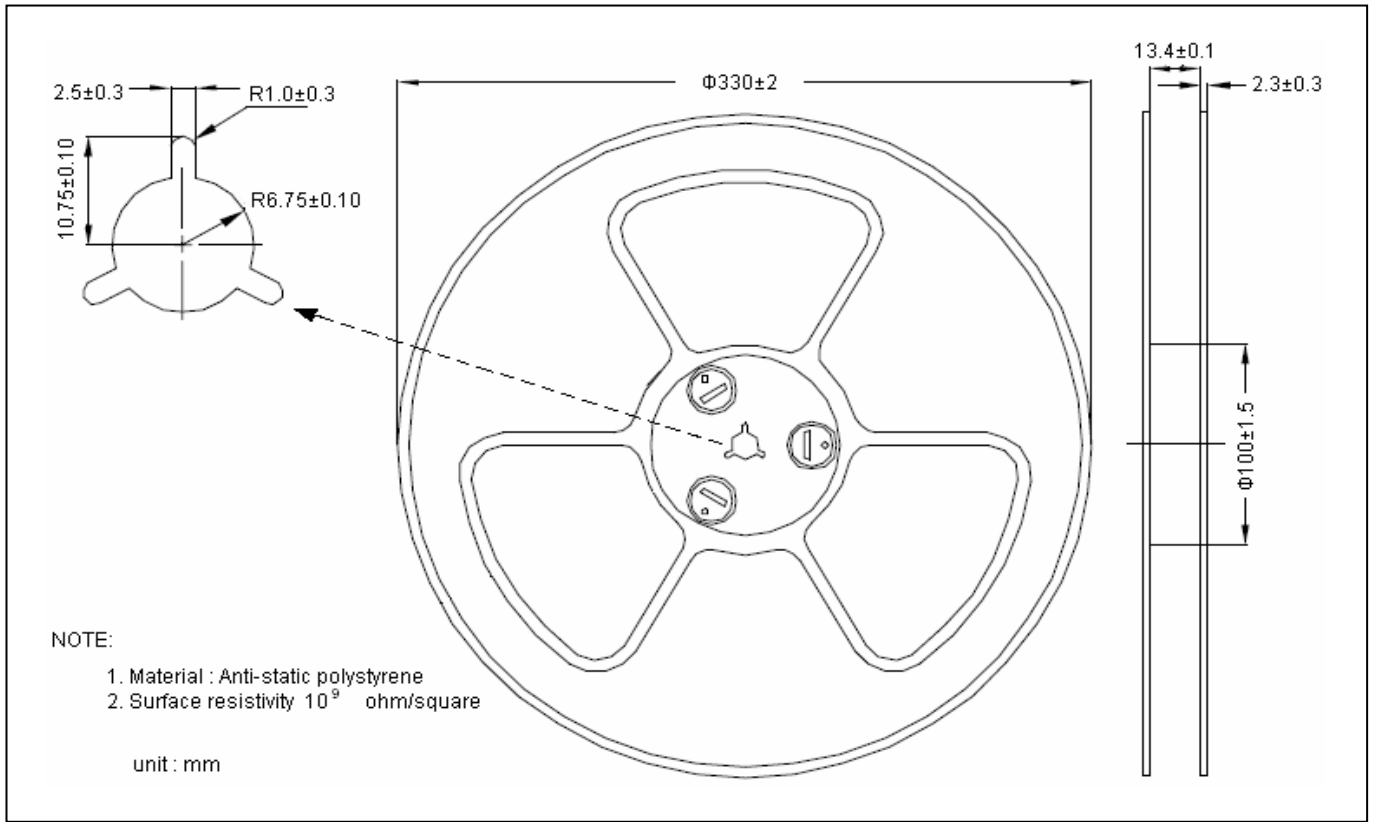


**Fig 11. Switching Time Waveform**

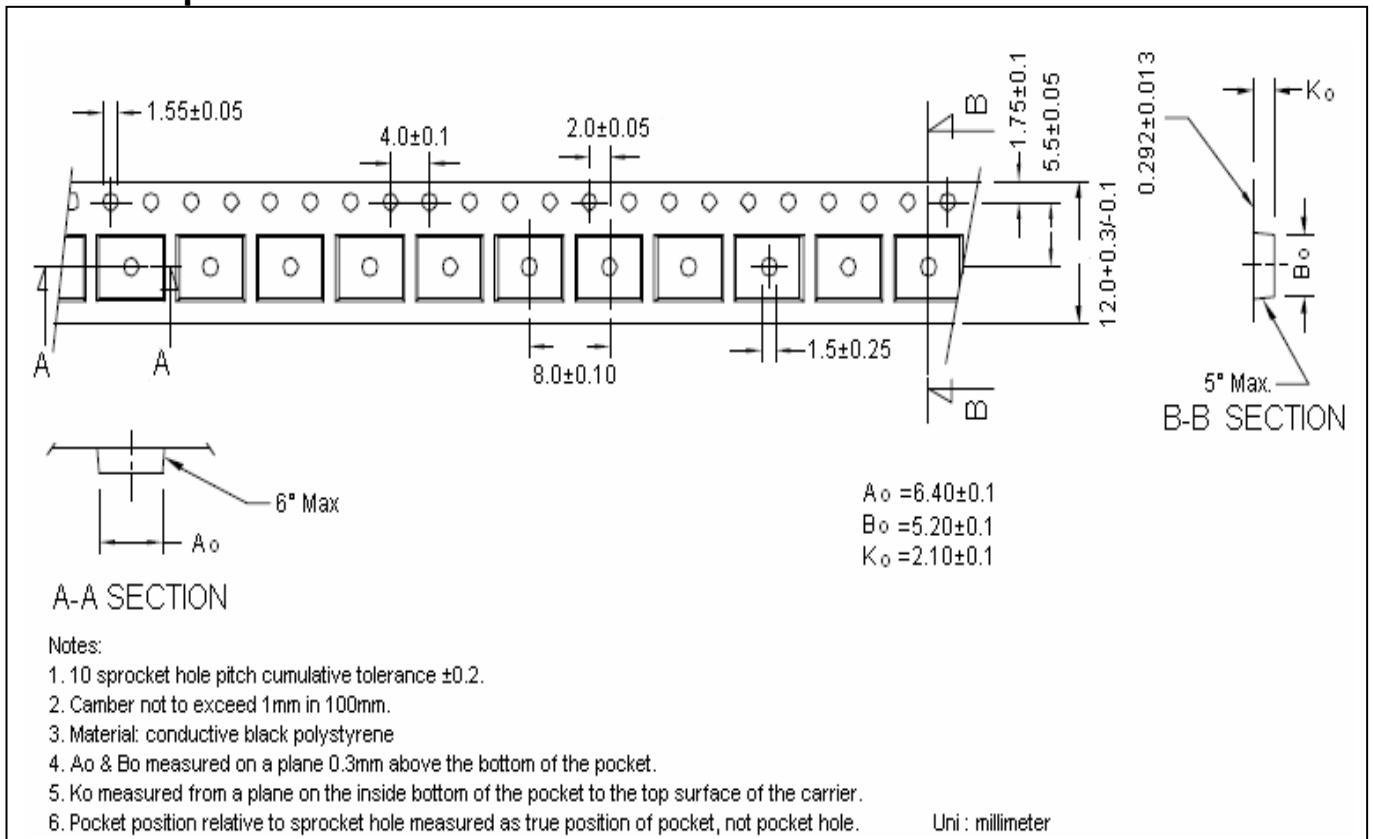


**Fig 12. Gate Charge Waveform**

**Reel Dimension**



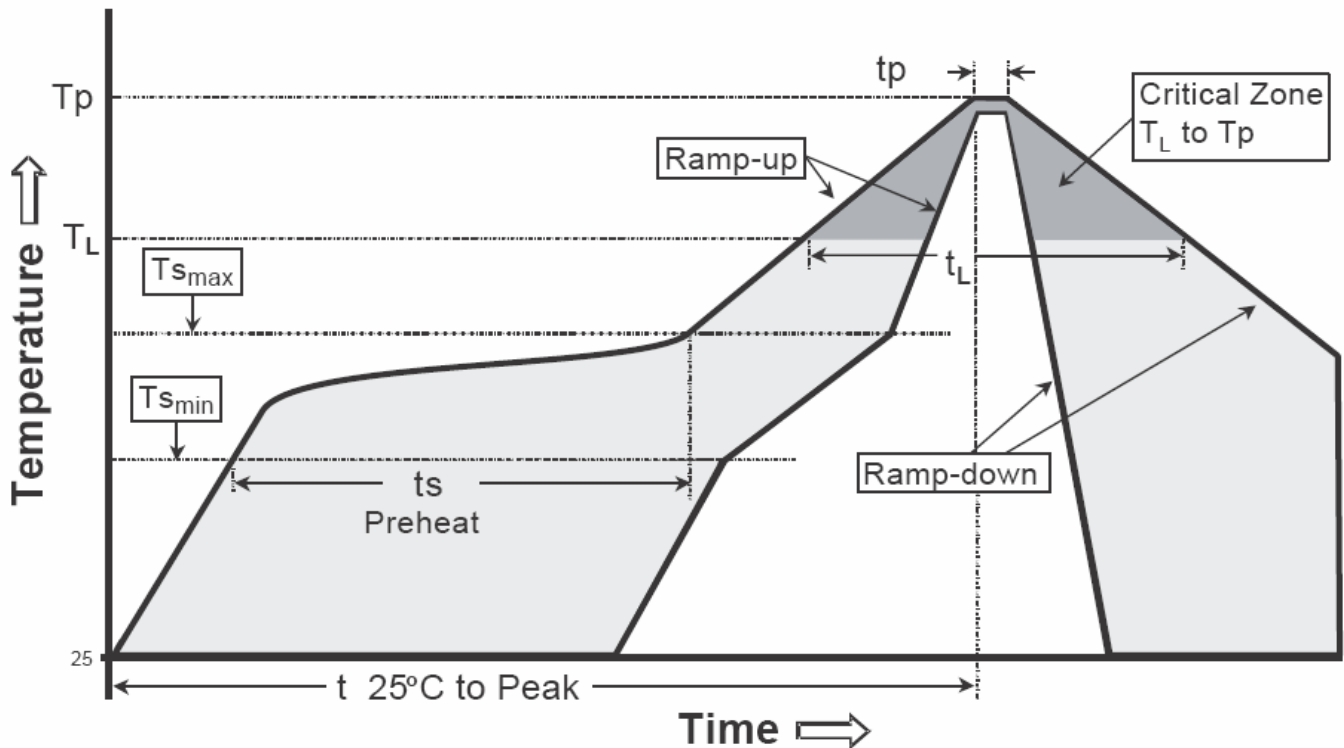
**Carrier Tape Dimension**



**Recommended wave soldering condition**

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

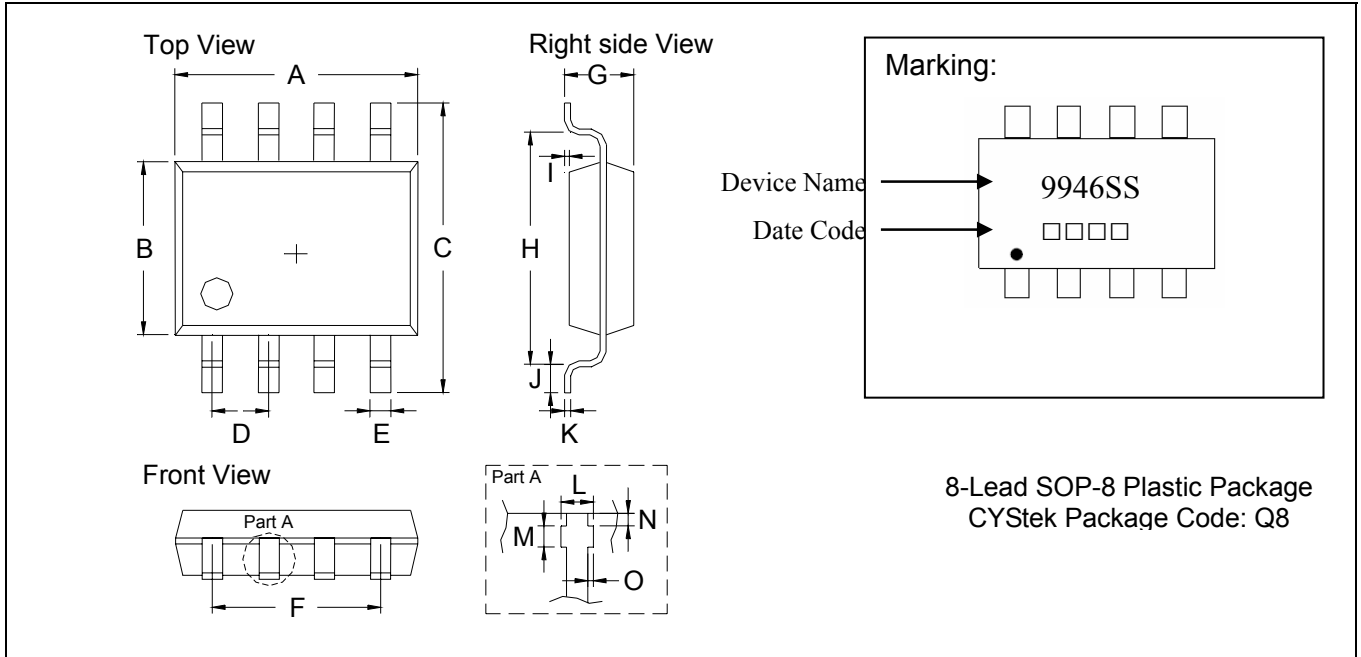
**Recommended temperature profile for IR reflow**



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T <sub>s min</sub> )	100°C	150°C
-Temperature Max(T <sub>s max</sub> )	150°C	200°C
-Time(t <sub>s min</sub> to t <sub>s max</sub> )	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T <sub>L</sub> )	183°C	217°C
- Time (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak Temperature(T <sub>P</sub> )	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.

**SOP-8 Dimension**



\*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1890	0.2007	4.80	5.10	I	0.0098	REF	0.25	REF
B	0.1496	0.1654	3.80	4.20	J	0.0118	0.0354	0.30	0.90
C	0.2283	0.2441	5.80	6.20	K	0.0074	0.0098	0.19	0.25
D	0.0480	0.0519	1.22	1.32	L	0.0145	0.0204	0.37	0.52
E	0.0138	0.0193	0.35	0.49	M	0.0118	0.0197	0.30	0.50
F	0.1472	0.1527	3.74	3.88	N	0.0031	0.0051	0.08	0.13
G	0.0531	0.0689	1.35	1.75	O	0.0000	0.0059	0.00	0.15
H	0.1889	0.2007	4.80	5.10					

- Notes:**
- Controlling dimension: millimeters.
  - Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
  - If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

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

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