

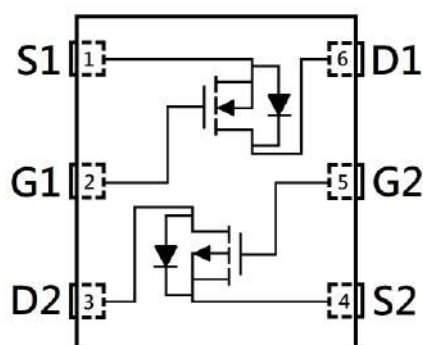
N- AND P-Channel Enhancement Mode Power MOSFET

Features

- Simple drive requirement
- Low Gate Charge
- Fast switching speed

	N-CH	P-CH
BV_{DSS}	30V	-30V
$I_D @ V_{GS}=(-)4.5V, T_C=25^{\circ}C$	5.7A	-4.2A
$I_D @ V_{GS}=(-)4.5V, T_A=25^{\circ}C$	3.3A	-2.4A
$R_{DS(ON)typ.} @ V_{GS}=(-)4.5V$	45m Ω	104m Ω
$R_{DS(ON)typ.} @ V_{GS}=(-)2.5V$	60m Ω	133m Ω

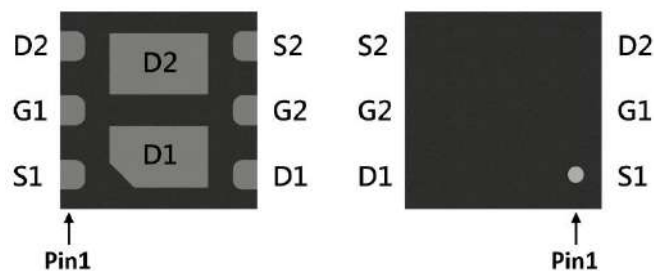
Equivalent Circuit



G : Gate S : Source D : Drain

Outline

DFN2x2-6L



Ordering Information

Device	Package	Shipping
KWC6601DF-0-T1-G	DFN2x2-6L (Pb-free lead plating and halogen-free package)	3000 pcs / Tape & Reel

Absolute Maximum Ratings (T_A=25°C)

Parameter		Symbol	Limits		Unit
			N-CH	P-CH	
Drain-Source Voltage		V _{DS}	30	-30	V
Gate-Source Voltage		V _{GS}	±12	±12	
Continuous Drain Current @ V _{GS} =(-)4.5V, T _C =25°C		I _D	5.7	-4.2	A
Continuous Drain Current @ V _{GS} =(-)4.5V, T _C =100°C			3.6	-2.7	
Continuous Drain Current @ V _{GS} =(-)4.5V, T _A =25°C			3.3	-2.4	
Continuous Drain Current @ V _{GS} =(-)4.5V, T _A =70°C			2.6	-1.9	
Pulsed Drain Current		I _{DM}	22.8	-16.8	
Continuous Body Diode Forward Current @ T _C =25°C		I _S	3.2	-3.2	
Pulsed Body Diode Forward Current @ T _C =25°C		I _{SM}	12.8	-12.8	
Avalanche Current @ L=0.1mH		I _{AS}	7	-7	mJ
Avalanche Energy @ L=0.5mH		E _{AS}	4	4	
Total Power Dissipation	T _C =25°C	P _D	3.9		W
	T _C =100°C		1.6		
	T _A =25°C		1.3		
	T _A =70°C		0.8		
Operating Junction and Storage Temperature Range		T _J , T _{stg}	-55~+150		°C

Thermal Data

Parameter	Symbol	Steady State	Unit
Thermal Resistance, Junction-to-case	R _{θJC}	32	°C/W
Thermal Resistance, Junction-to-ambient	R _{θJA}	96	

Note:

- *a. The power dissipation P_D is based on T_{J(MAX)}=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
- *b. The value of R_{θJA} is measured with the device mounted on 1 in² FR-4 board with 2 oz. copper, in a still air environment with T_A=25°C. The power dissipation P_D is based on R_{θJA} and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design.
- *c. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150°C. Ratings are based on low frequency and low duty cycles to keep initial T_J=25°C.

N-Channel Electrical Characteristics (T_A=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	30	-	-	V	V _{GS} =0V, I _D =250μA
V _{GS(th)}	0.5	-	1.5		V _{DS} =V _{GS} , I _D =250μA
G _{FS}	-	2	-	S	V _{DS} =10V, I _D =1A
I _{GSS}	-	-	±100	nA	V _{GS} =±12V, V _{DS} =0V
I _{DSS}	-	-	1	μA	V _{DS} =24V, V _{GS} =0V
R _{DS(ON)}	-	45	65	mΩ	V _{GS} =4.5V, I _D =3A
	-	60	90		V _{GS} =2.5V, I _D =2A
Dynamic					
C _{iss}	-	315	-	pF	V _{DS} =15V, V _{GS} =0V, f=1MHz
C _{oss}	-	46	-		
C _{rss}	-	33	-		
R _g	-	2	-	Ω	f=1MHz
Q _g *1, 2	-	4.5	-	nC	V _{DS} =15V, I _D =3A, V _{GS} =4.5V
Q _g *1, 2	-	10	-		V _{DS} =15V, I _D =3A, V _{GS} =10V
Q _{gs} *1, 2	-	1.6	-		
Q _{gd} *1, 2	-	0.8	-		
t _{d(ON)} *1, 2	-	3.5	-	ns	V _{DS} =15V, I _D =3A, V _{GS} =10V, R _{GS} =6Ω
t _r *1, 2	-	16	-		
t _{d(OFF)} *1, 2	-	25	-		
t _f *1, 2	-	4.2	-		
Source-Drain Diode					
V _{SD} *1	-	0.8	1.2	V	I _S =1A, V _{GS} =0V
t _{rr}	-	7.7	-	ns	I _F =1A, dI _F /dt=100A/μs
Q _{rr}	-	3.3	-	nC	

Note:

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

*2. Independent of operating temperature

P-Channel Electrical Characteristics (T_A=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	-30	-	-	V	V _{GS} =0V, I _D =-250μA
V _{GS(th)}	-0.5	-	-1.5		V _{DS} =V _{GS} , I _D =-250μA
G _{FS}	-	2.2	-	S	V _{DS} =-10V, I _D =-1A
I _{GSS}	-	-	±100	nA	V _{GS} =±12V, V _{DS} =0V
I _{DSS}	-	-	-1	μA	V _{DS} =-24V, V _{GS} =0V
R _{DS(ON)}	-	104	145	mΩ	V _{GS} =-4.5V, I _D =-2A
	-	133	200		V _{GS} =-2.5V, I _D =-1A
Dynamic					
C _{iss}	-	475	-	pF	V _{DS} =-15V, V _{GS} =0V, f=1MHz
C _{oss}	-	36	-		
C _{rss}	-	36	-		
R _g	-	15	-	Ω	f=1MHz
Q _g *1, 2	-	6	-	nC	V _{DS} =-15V, I _D =-2A, V _{GS} =-4.5V
Q _g *1, 2	-	12.5	-		V _{DS} =-15V, I _D =-2A, V _{GS} =-10V
Q _{gs} *1, 2	-	1.1	-		
Q _{gd} *1, 2	-	1.9	-		
t _{d(ON)} *1, 2	-	4.4	-	ns	V _{DS} =-15V, I _D =-2A, V _{GS} =-10V, R _{GS} =6Ω
t _r *1, 2	-	16	-		
t _{d(OFF)} *1, 2	-	37	-		
t _f *1, 2	-	5	-		
Source-Drain Diode					
V _{SD} *1	-	-0.85	-1.2	V	I _S =-1A, V _{GS} =0V
t _{rr}	-	7	-	ns	I _F =-1A, dI _F /dt=100A/μs
Q _{rr}	-	3	-	nC	

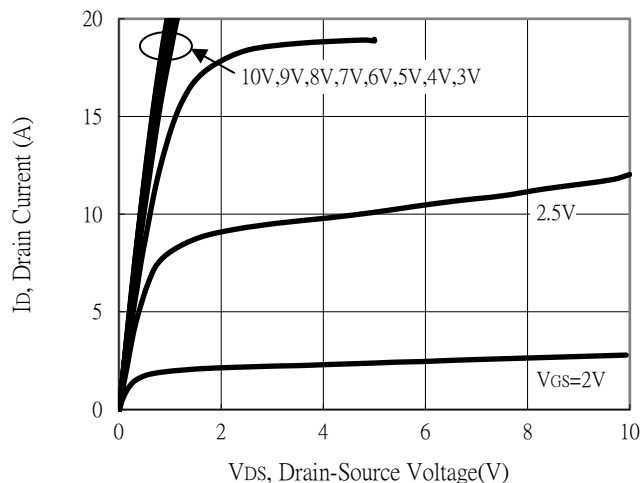
Note:

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

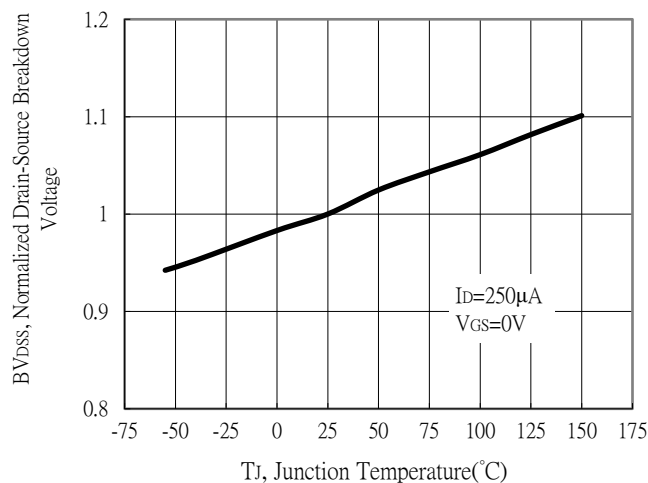
*2. Independent of operating temperature

Typical Characteristics : Q1(N-channel)

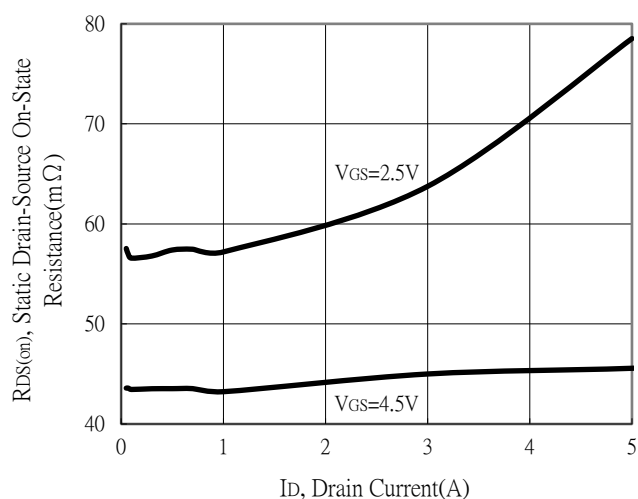
Typical Output Characteristics



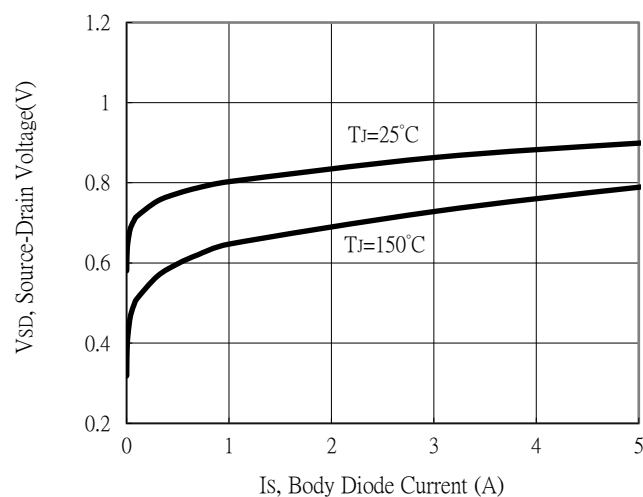
Breakdown Voltage vs Ambient Temperature



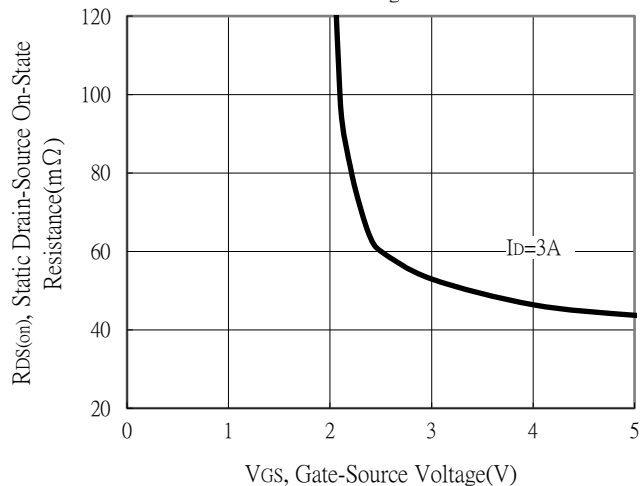
Static Drain-Source On-State resistance vs Drain Current



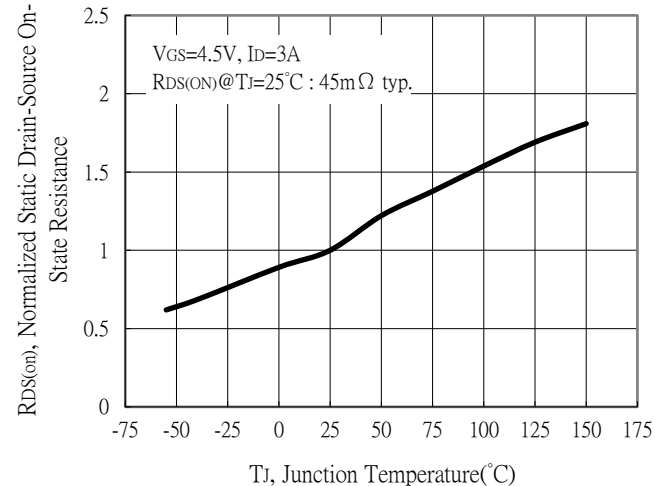
Body Diode Current vs Source-Drain Voltage



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

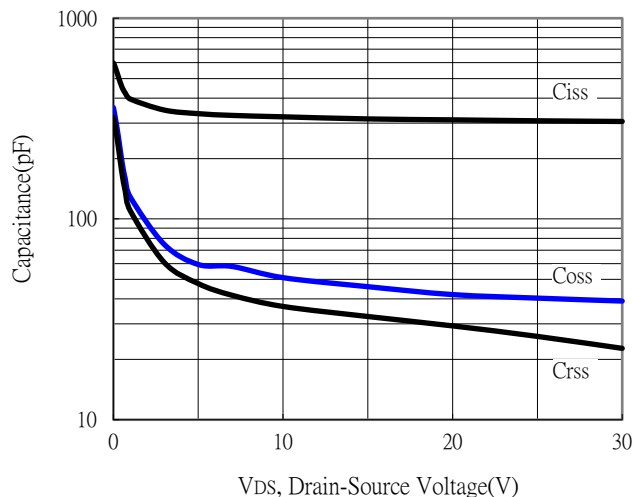


Drain-Source On-State Resistance vs Junction Temperature

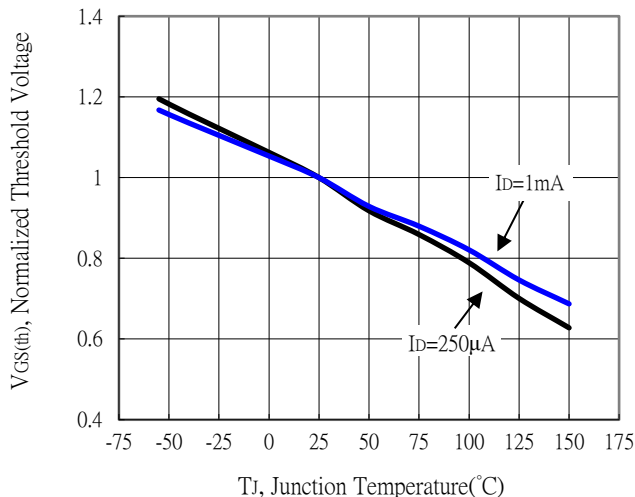


Typical Characteristics (Cont.) : Q1(N-channel)

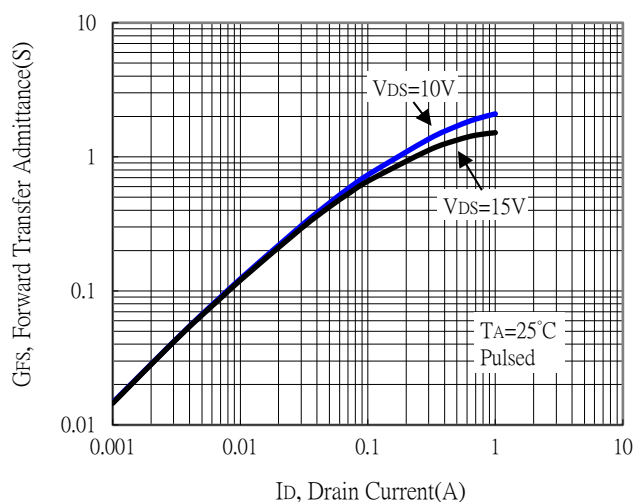
Capacitance vs Drain-to-Source Voltage



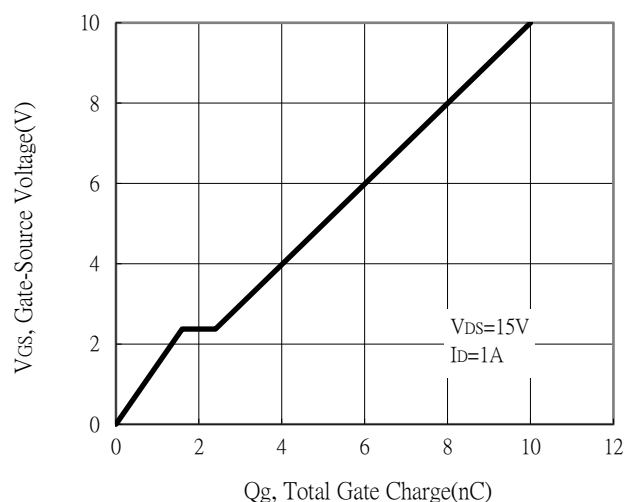
Threshold Voltage vs Junction Temperature



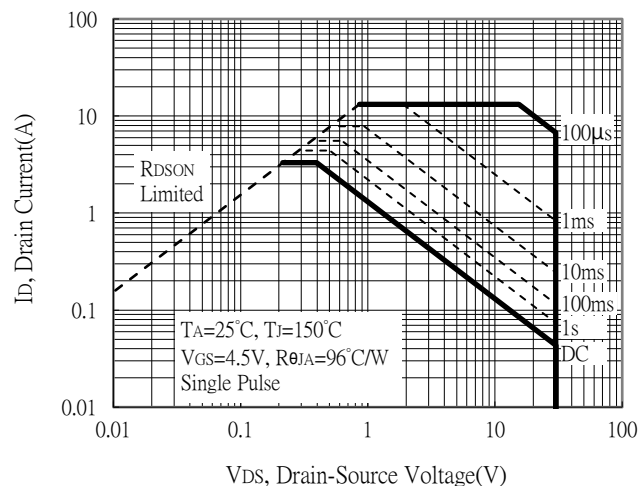
Forward Transfer Admittance vs Drain Current



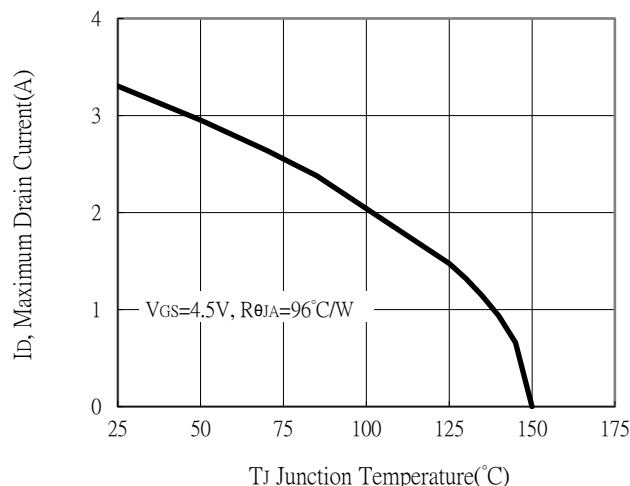
Gate Charge Characteristics



Maximum Safe Operating Area

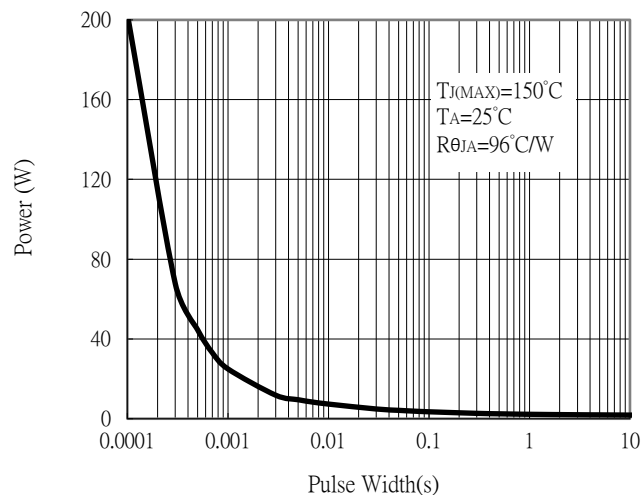


Maximum Drain Current vs Junction Temperature

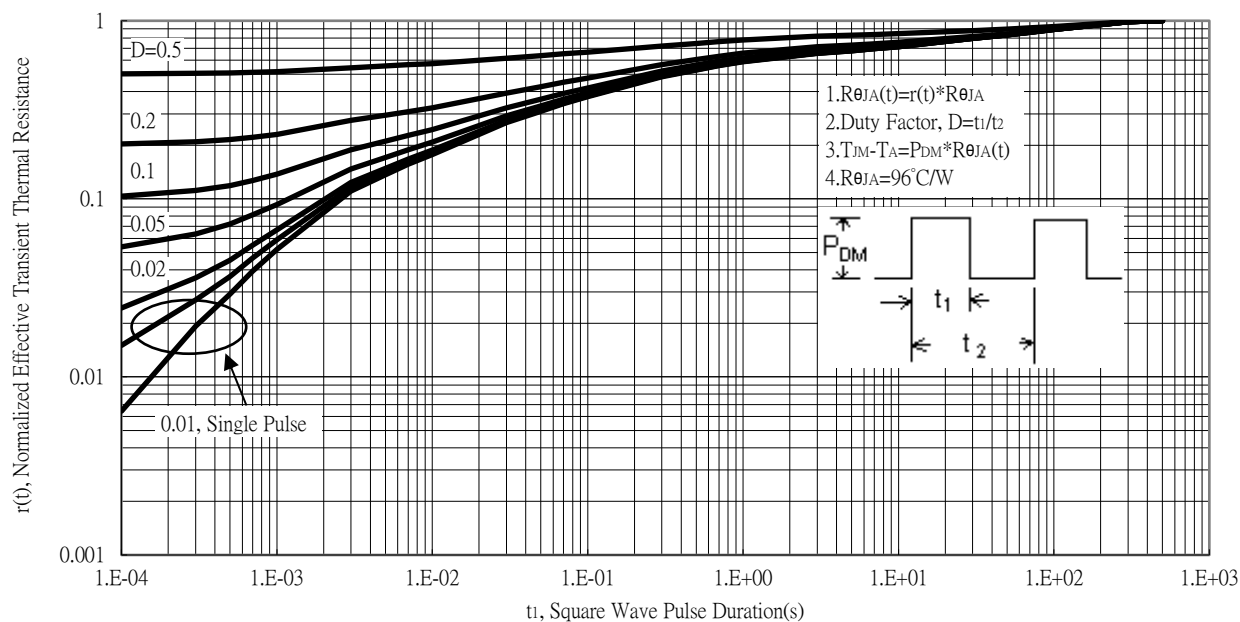


Typical Characteristics (Cont.) : Q1(N-channel)

Single Pulse Power Rating, Junction to Ambient

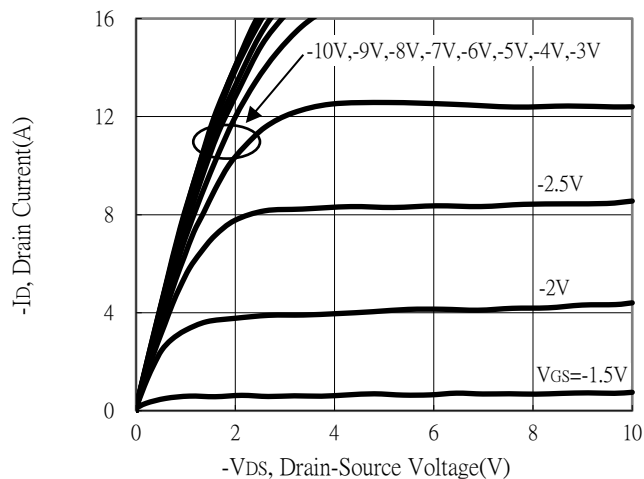


Transient Thermal Response Curves

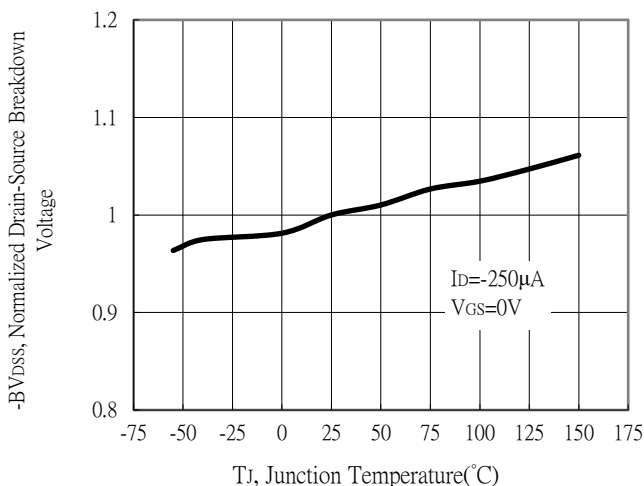


Typical Characteristics : Q2(P-channel)

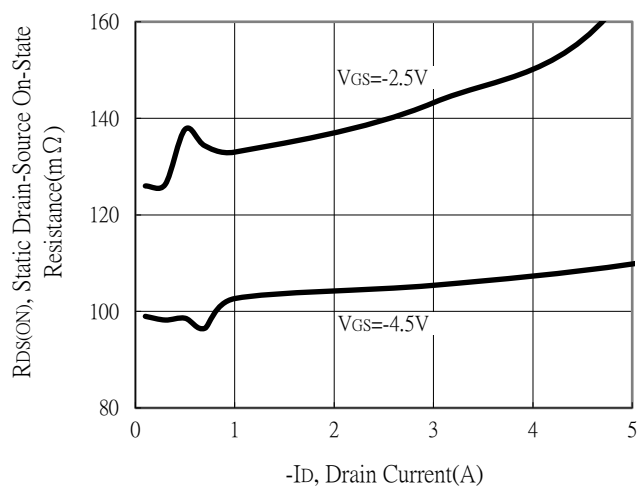
Typical Output Characteristics



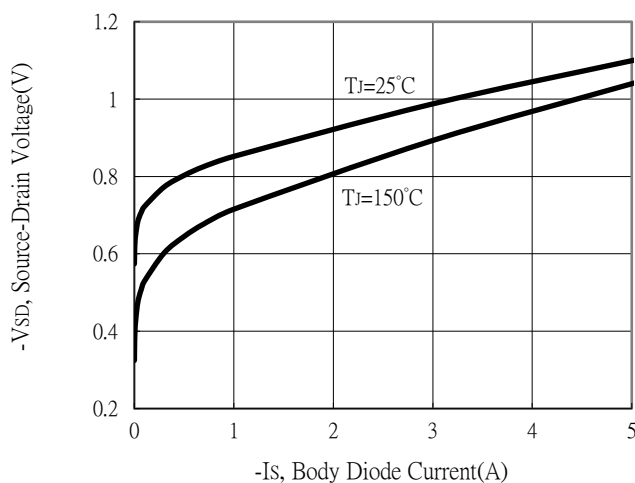
Breakdown Voltage vs Ambient Temperature



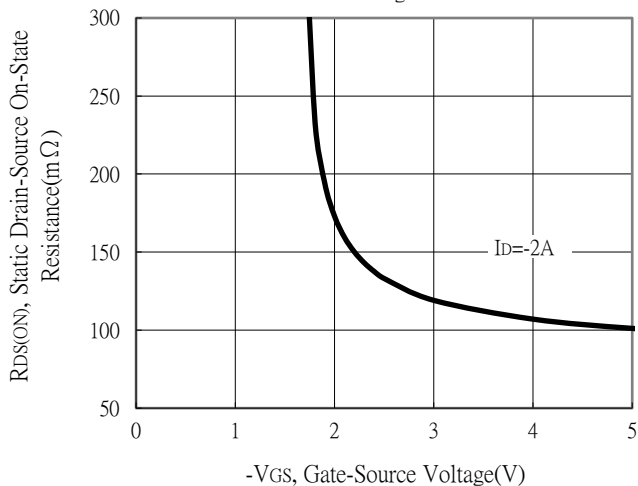
Static Drain-Source On-State resistance vs Drain Current



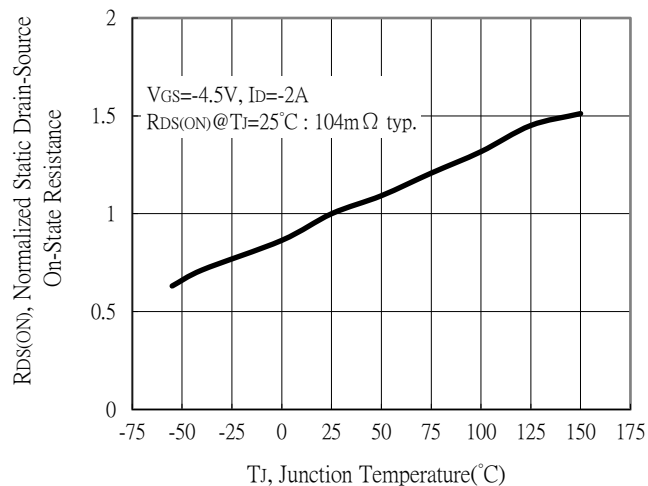
Body Diode Current vs Source-Drain Voltage



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

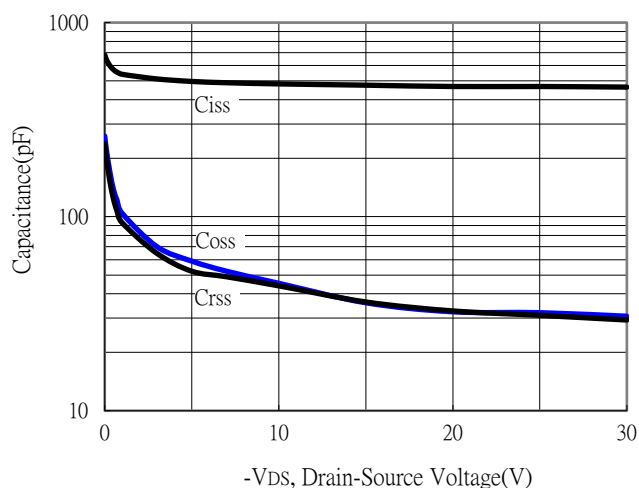


Drain-Source On-State Resistance vs Junction Temperature

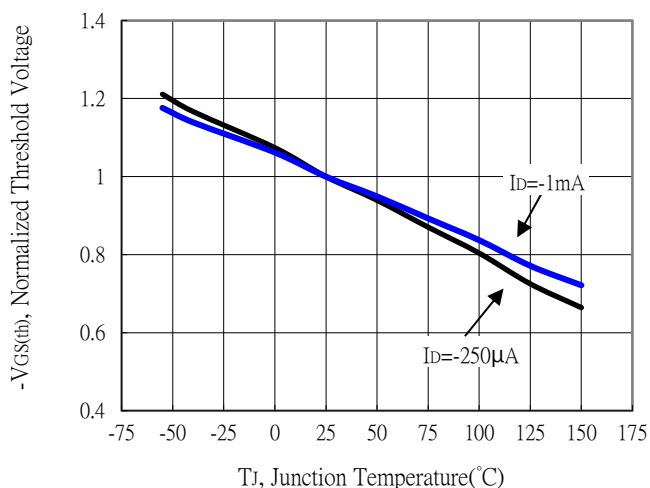


Typical Characteristics (Cont.) : Q2(P-channel)

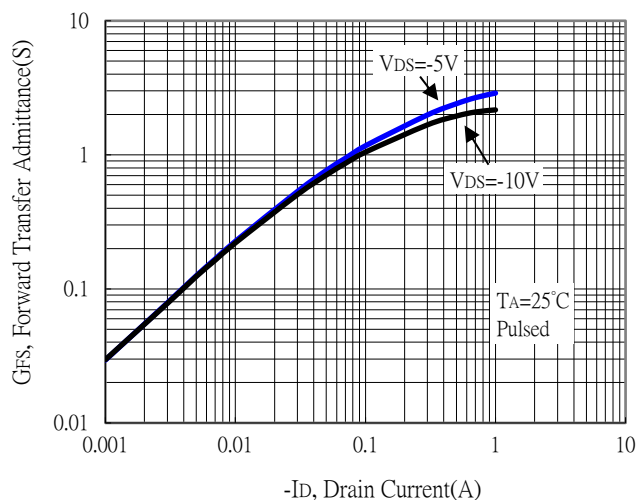
Capacitance vs Drain-to-Source Voltage



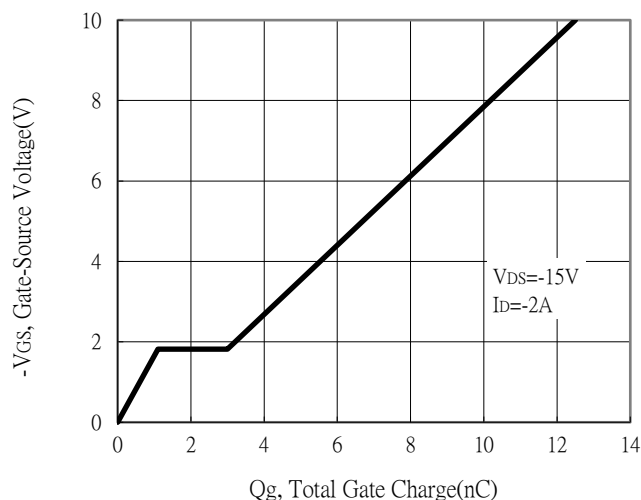
Threshold Voltage vs Junction Temperature



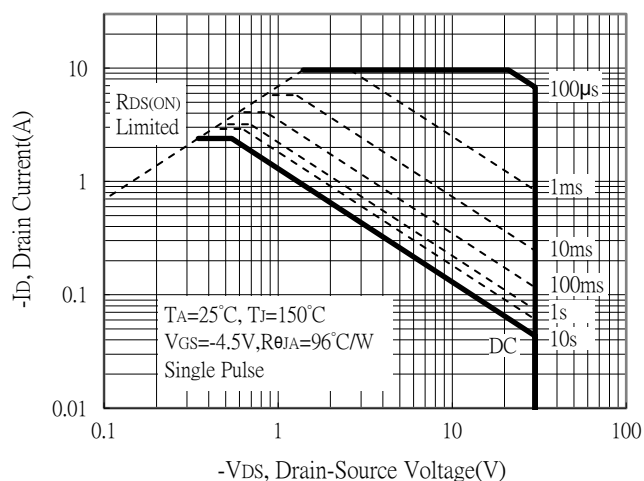
Forward Transfer Admittance vs Drain Current



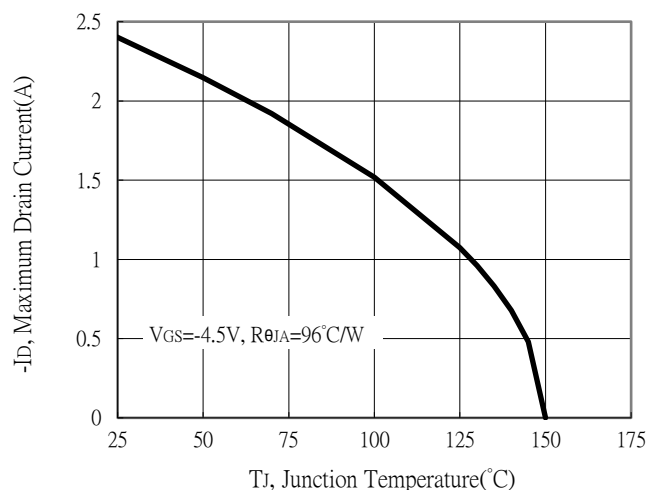
Gate Charge Characteristics



Maximum Safe Operating Area

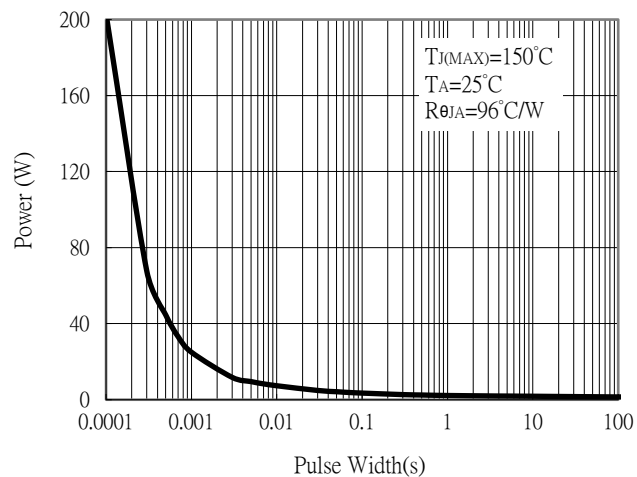


Maximum Drain Current vs Junction Temperature

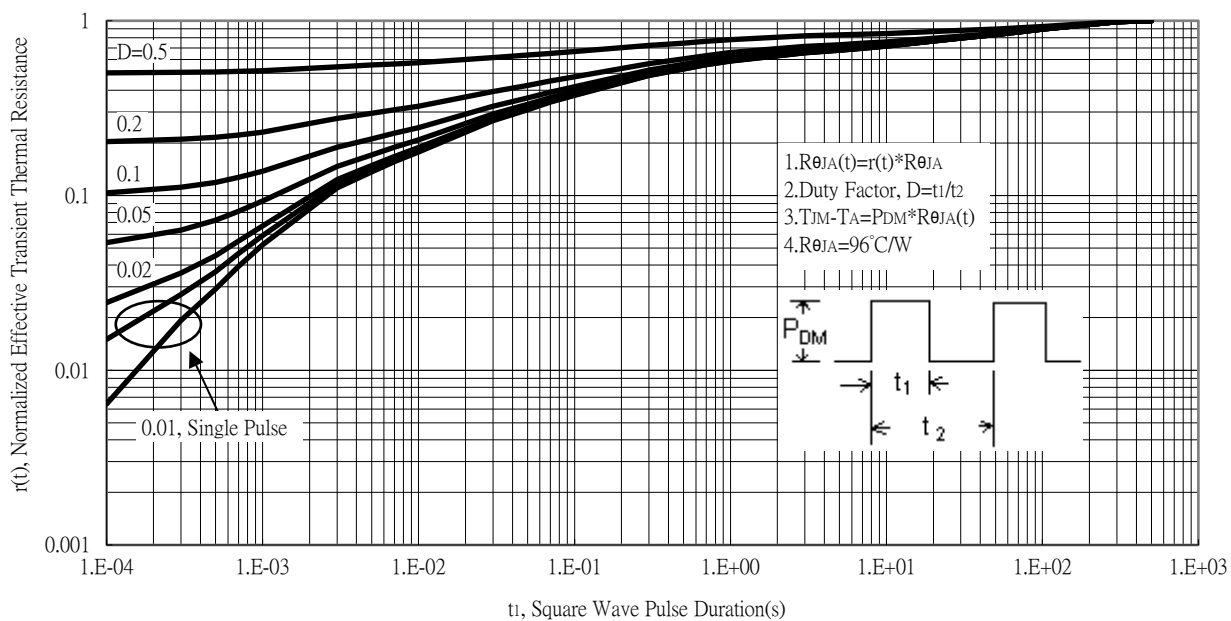


Typical Characteristics (Cont.) : Q2(P-channel)

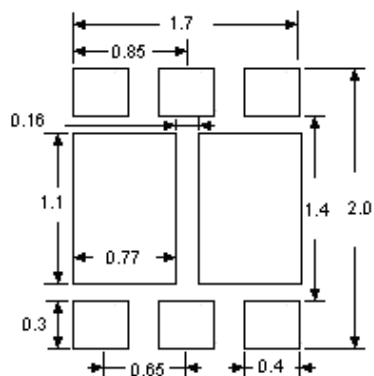
Single Pulse Power Rating, Junction to Ambient



Transient Thermal Response Curves

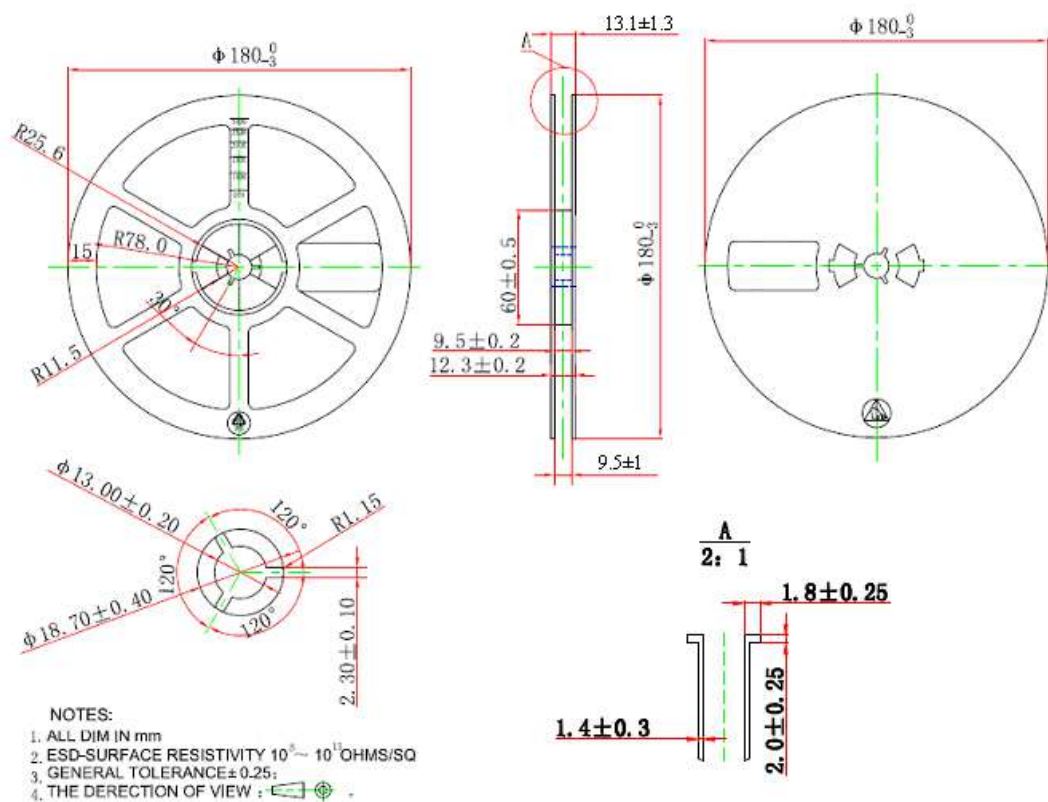


Recommended Soldering Footprint

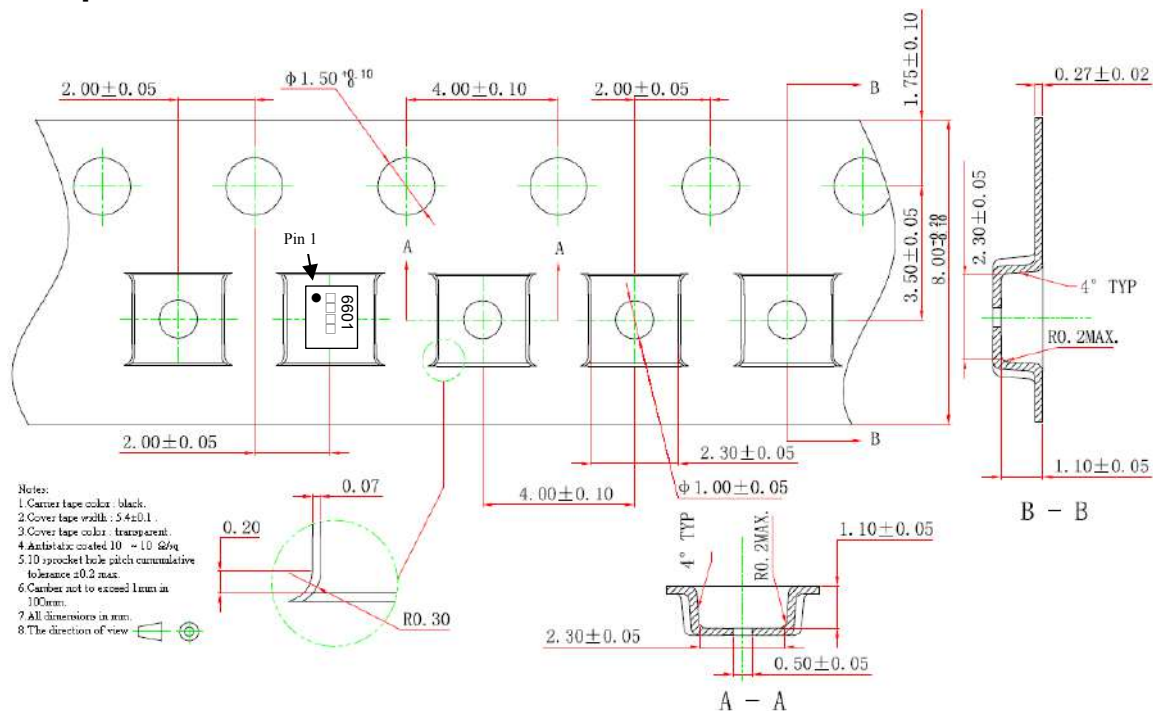


Unit : mm

Reel Dimension



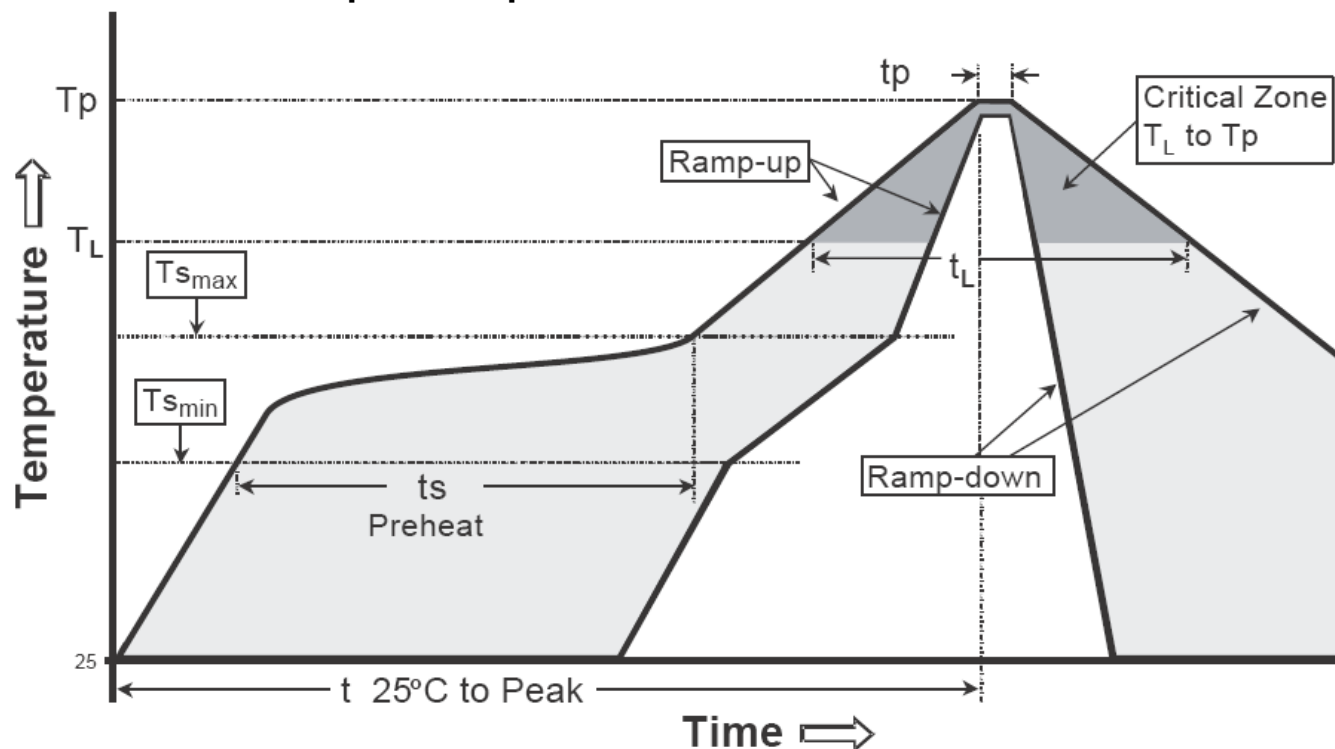
Carrier Tape Dimension



Recommended wave soldering condition

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

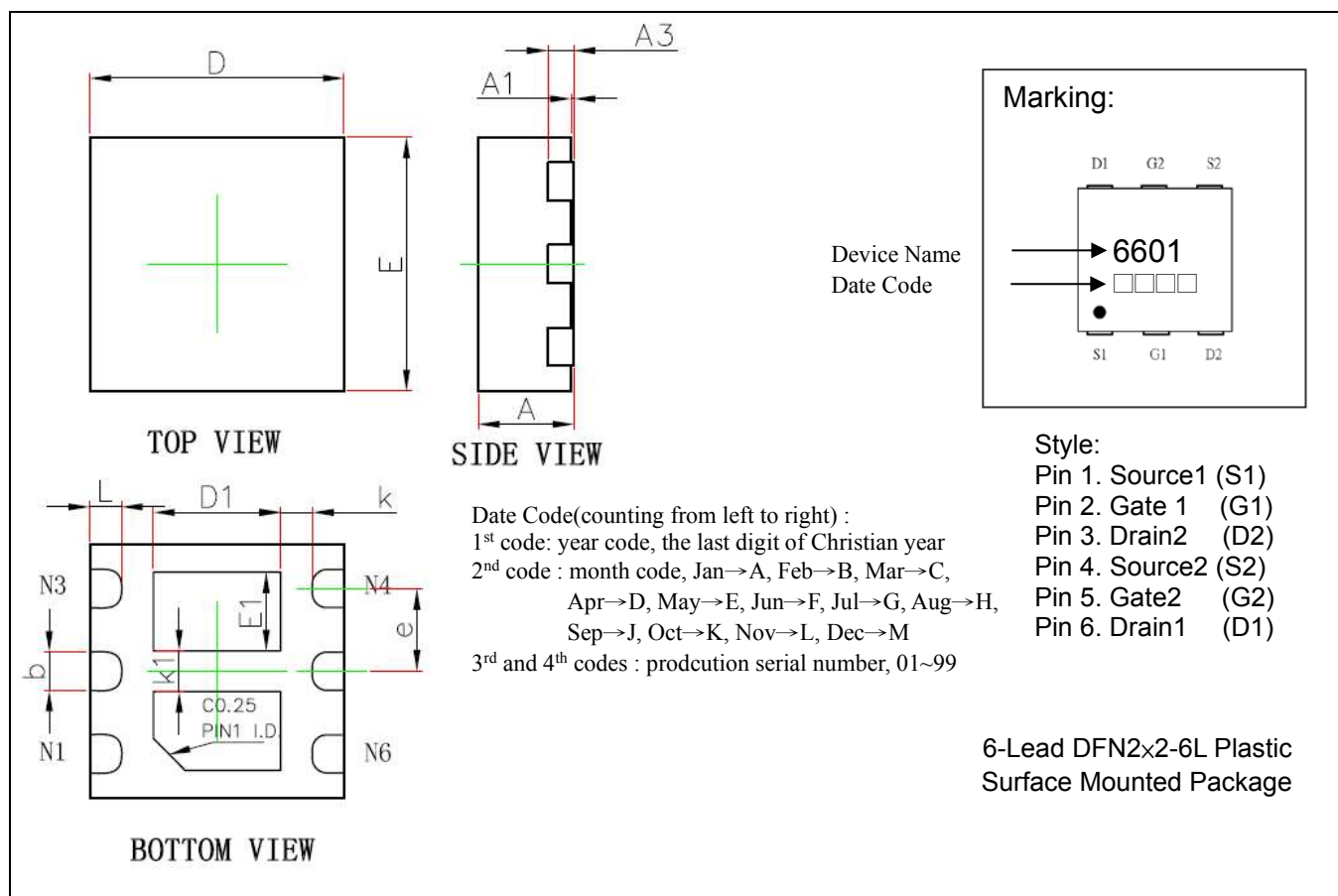
Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T _{s min})	100°C	150°C
-Temperature Max(T _{s max})	150°C	200°C
-Time(t _{s min} to t _{s max})	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T _L)	183°C	217°C
- Time (t _L)	60-150 seconds	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.

DFN2x2-6L Dimension



DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031	E1	0.520	0.720	0.020	0.028
A1	0.000	0.050	0.000	0.002	b	0.250	0.350	0.010	0.014
A3	0.203 REF.		0.008 REF.		e	0.650 TYP.		0.026 TYP.	
D	1.900	2.100	0.075	0.083	k	0.250 REF.		0.010 REF.	
E	1.900	2.100	0.075	0.083	k1	0.320 REF.		0.013 REF.	
D1	0.900	1.100	0.035	0.043	L	0.200	0.300	0.008	0.012

Notes: 1. Controlling dimension: millimeters.

2. Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.

Material:

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