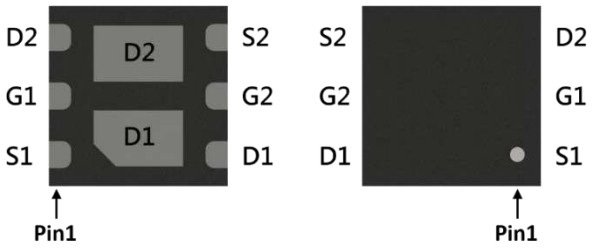
N- AND P-Channel Enhancement Mode Power MOSFET

Features:

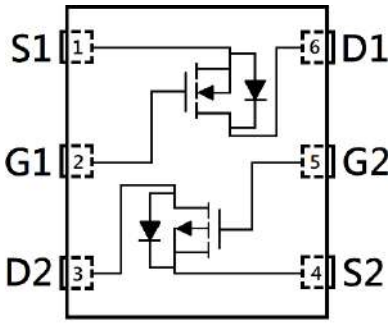
- Simple drive requirement
- Low On Resistance
- Low Gate Charge
- Fast switching speed

DFN2×2-6L



	N-CH	P-CH
BV_{DSS}	14V	-14V
I_D@V_{GS}=(-)4.5V, T_C=25℃	11A	-7.6A
I_D@V_{GS}=(-)4.5V, T_A=25℃	6.5A	-4.5A
$R_{DS(ON)}$ typ.@V_{GS}=(-)4.5V	17mΩ	38mΩ
$R_{DS(ON)}$ typ.@V_{GS}=(-)2.5V	20mΩ	50mΩ
$R_{DS(ON)}$ typ.@V_{GS}=(-)1.8V	28mΩ	65mΩ
$R_{DS(ON)}$ typ.@V_{GS}=(-)1.5V	42mΩ	100mΩ

Equivalent Circuit



G : Gate S : Source D : Drain

Ordering Information

Device	Package	Shipping
KWC3588C	DFN2×2-6L (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}	14	-14	V
Gate-Source Voltage		V_{GS}	±8	±8	
Continuous Drain Current @ V_{GS}=(-)4.5V, T_C=25°C	*a	I_D	11	-7.6	A
Continuous Drain Current @ V_{GS}=(-)4.5V, T_C=100°C	*a		7	-4.8	
Continuous Drain Current @ V_{GS}=(-)4.5V, T_A=25°C	*b		6.5	-4.5	
Continuous Drain Current @ V_{GS}=(-)4.5V, T_A=70°C	*b		5.2	-3.6	
Pulsed Drain Current	*c	I_{DM}	40	-30	
Continuous Body Diode Forward Current @ T_C=25°C	*a	I_S	3.3	-3.3	
Avalanche Current @ L=0.1mH		I_{AS}	8	-8	
Avalanche Energy @ L=0.5mH		E_{AS}	6	6	mJ
Total Power Dissipation	T_C=25°C *a	P_D	4		W
	T_C=100°C *a		1.6		
	T_A=25°C *b		1.4		
	T_A=70°C *b		0.9		
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		$R_{\theta JC}$	31	°C/W
Thermal Resistance, Junction-to-ambient	*b	$R_{\theta JA}$	90	

Note:

*a. The power dissipation P_D is based on $T_{J(MAX)}$=150℃, 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 $R_{\theta JA}$ is measured with the device mounted on 1 in^2 FR -4 board with 2 oz. copper, in a still air environment with T_A=25℃. The power dissipation P_D is based on $R_{\theta JA}$ and the maximum allowed junction temperature of 150℃. 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℃. Ratings are based on low frequency and low duty cycles to keep initial T_J=25℃.

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

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV_{DSS}	14	-	-	V	V_{GS}=0V, I_D=250μA
$V_{GS(th)}$	0.3	-	1		V_{DS}=V_{GS}, I_D=250μA
G_{FS}	-	7.5	-	S	V_{DS}=5V, I_D=3A
I_{GSS}	-	-	±100	nA	V_{GS}=±8V, V_{DS}=0V
I_{DSS}	-	-	1	μA	V_{DS}=10V, V_{GS}=0V
$R_{DS(ON)}$	-	17	21	mΩ	V_{GS}=4.5V, I_D=5A
	-	20	27		V_{GS}=2.5V, I_D=4.6A
	-	28	42		V_{GS}=1.8V, I_D=1A
	-	42	84		V_{GS}=1.5V, I_D=1A
Dynamic					
Ciss	-	470	-	pF	V_{DS}=10V, V_{GS}=0V, f=1MHz
Coss	-	100	-		
Crss	-	90	-		
Rg	-	2.2	-	Ω	f=1MHz
Qg *1, 2	-	6.7	-	nC	V_{DS}=10V, I_D=2A, V_{GS}=4.5V
Qgs *1, 2	-	0.8	-		
Qgd *1, 2	-	1.9	-		
$t_{d(ON)}$ *1, 2	-	4	-	ns	V_{DS}=10V, I_D=1A, V_{GS}=4.5V, R_{GS}=6Ω
tr *1, 2	-	17	-		
$t_{d(OFF)}$ *1, 2	-	28	-		
t_f *1, 2	-	6	-		
Source-Drain Diode					
V_{SD} *1	-	0.84	1.2	V	I_S=3A, V_{GS}=0V
trr	-	6	-	ns	I_F=2A, dI_F/dt=100A/μs
Qrr	-	1.5	-	nC	

Note:
*1. Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%
*2. Independent of operating temperature

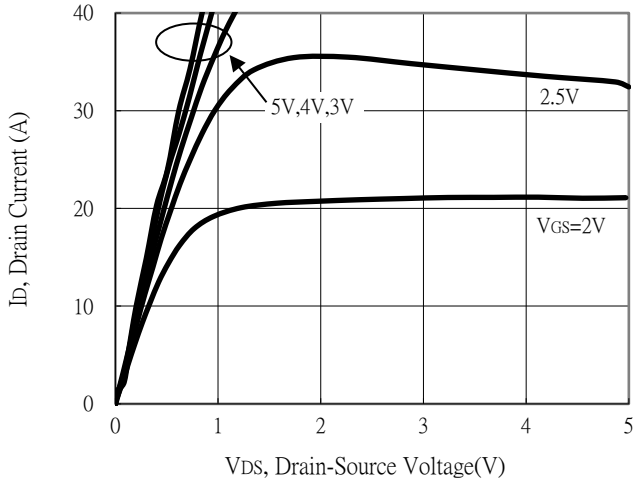
P-Channel Electrical Characteristics (T_A=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV_{DSS}	-14	-	-	V	V_{GS}=0V, I_D=-250μA
$V_{GS(th)}$	-0.3	-	-1		V_{DS}=V_{GS}, I_D=-250μA
G_{FS}	-	8.1	-	S	V_{DS}=-5V, I_D=-3A
I_{GSS}	-	-	±100	nA	V_{GS}=±8V, V_{DS}=0V
I_{DSS}	-	-	-1	μA	V_{DS}=-10V, V_{GS}=0V
$R_{DS(ON)}$	-	38	49	mΩ	V_{GS}=-4.5V, I_D=-3.6A
	-	50	65		V_{GS}=-2.5V, I_D=-3.2A
	-	65	98		V_{GS}=-1.8V, I_D=-0.5A
	-	100	200		V_{GS}=-1.5V, I_D=-0.5A
Dynamic					
Ciss	-	600	-	pF	V_{DS}=-10V, V_{GS}=0V, f=1MHz
Coss	-	120	-		
Crss	-	110	-		
Rg	-	6.2	-	Ω	f=1MHz
Qg *1, 2	-	8	-	nC	V_{DS}=-10V, I_D=-2A, V_{GS}=-4.5V
Qgs *1, 2	-	1	-		
Qgd *1, 2	-	2.3	-		
$t_{d(ON)}$ *1, 2	-	10	-	ns	V_{DS}=-10V, I_D=-4A, V_{GS}=-4.5V, R_{GS}=3.3Ω
tr *1, 2	-	20	-		
$t_{d(OFF)}$ *1, 2	-	35	-		
t_f *1, 2	-	17	-		
Source-Drain Diode					
V_{SD} *1	-	-0.85	-1.2	V	I_S=-2A, V_{GS}=0V
trr	-	10	-	ns	I_F=-2A, dI_F/dt=100A/μs
Qrr	-	2	-	nC	

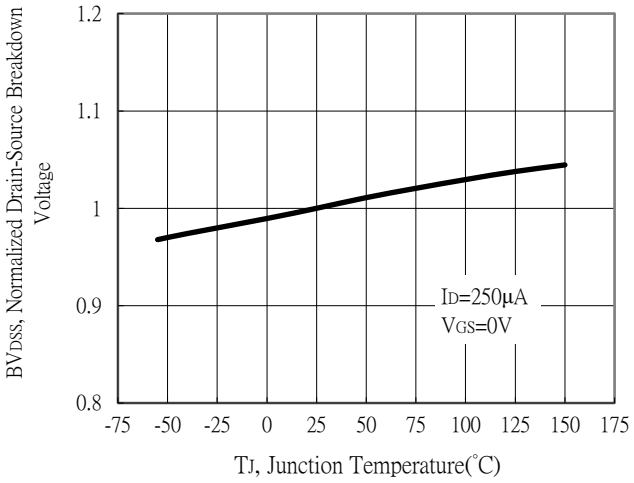
Note:
*1. Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%
*2. Independent of operating temperature

Typical Characteristics : Q1(N-channel)

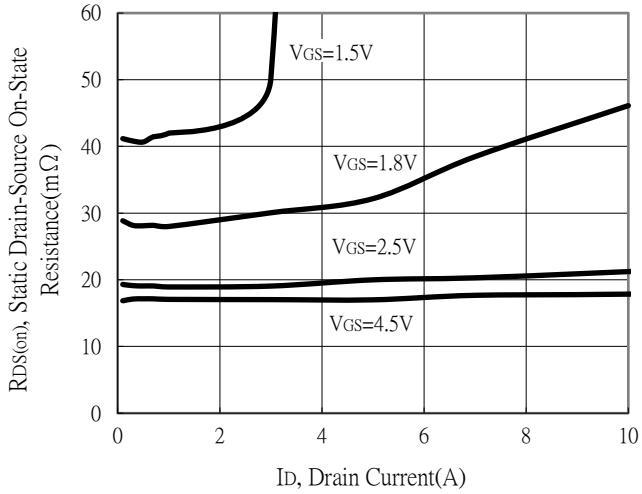
Typical Output Characteristics



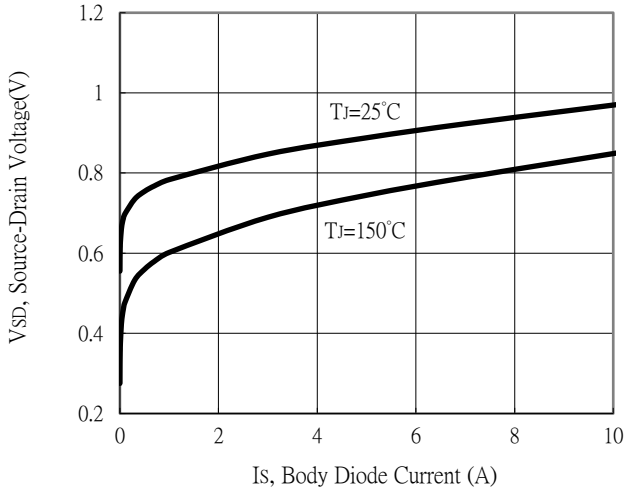
Breakdown Voltage vs Ambient Temperature



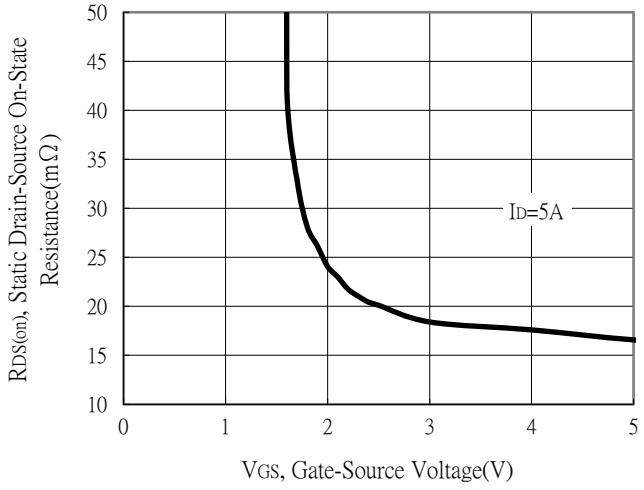
Static Drain-Source On-State resistance vs Drain Current



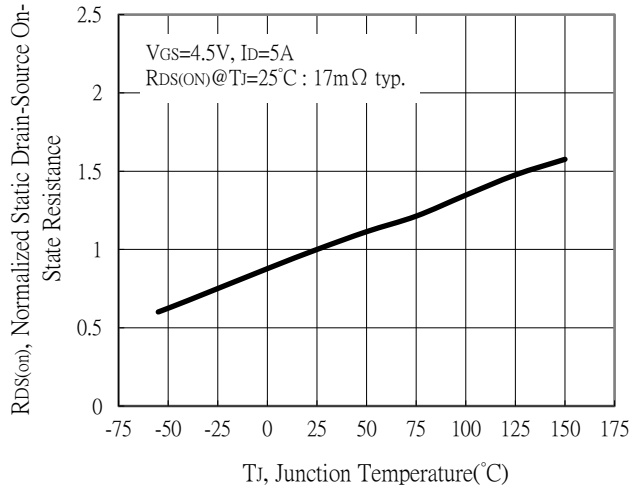
Body Diode Current vs Source-Drain Voltage



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

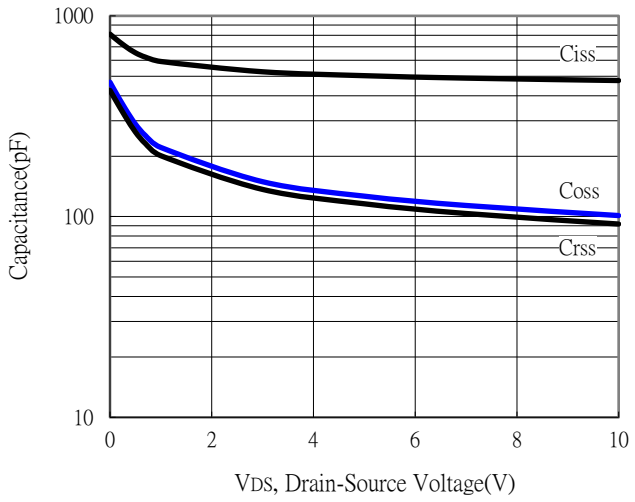


Drain-Source On-State Resistance vs Junction Temperature

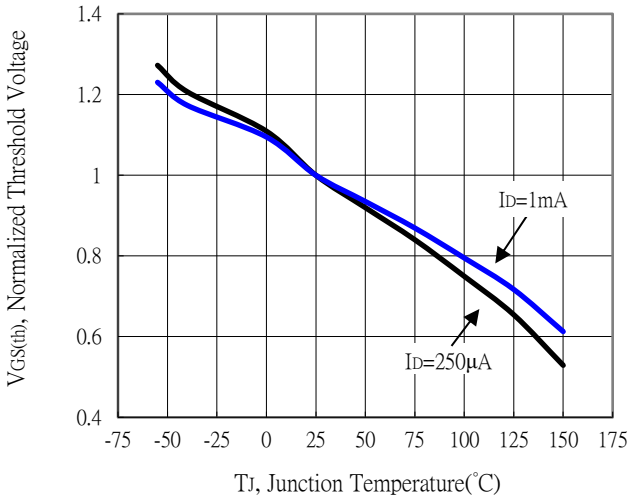


Typical Characteristics (Cont.) : Q1(N-channel)

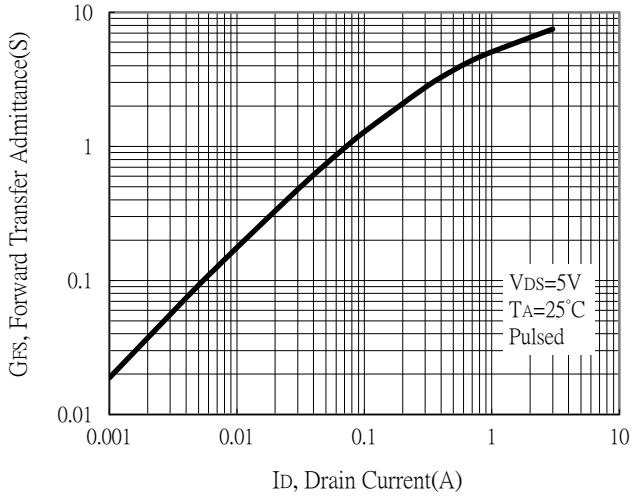
Capacitance vs Drain-to-Source Voltage



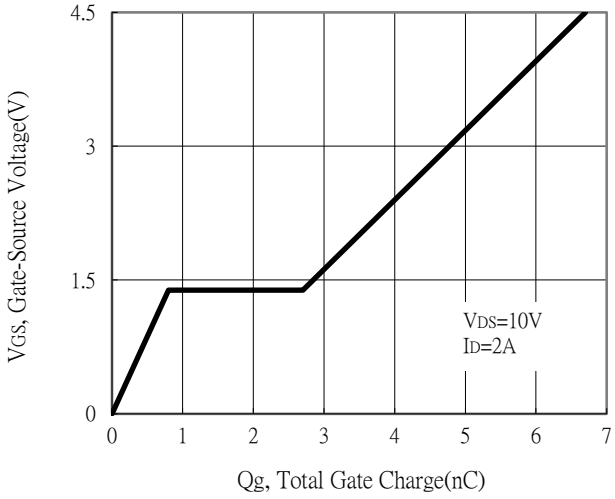
Threshold Voltage vs Junction Temperature



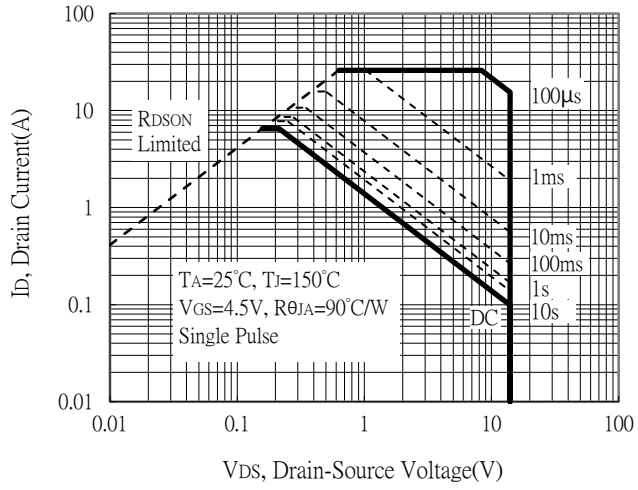
Forward Transfer Admittance vs Drain Current



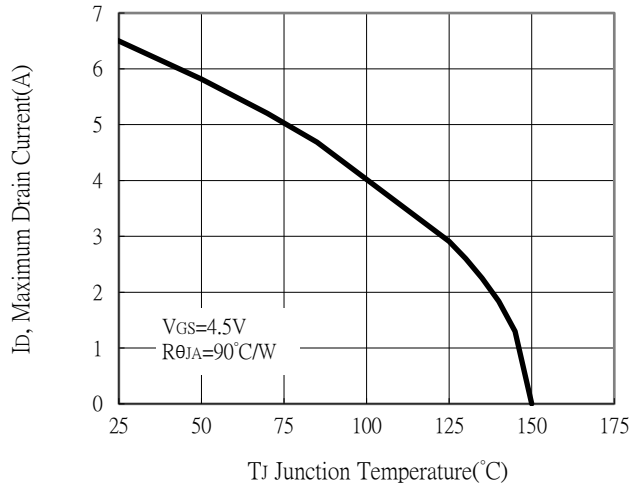
Gate Charge Characteristics



Maximum Safe Operating Area

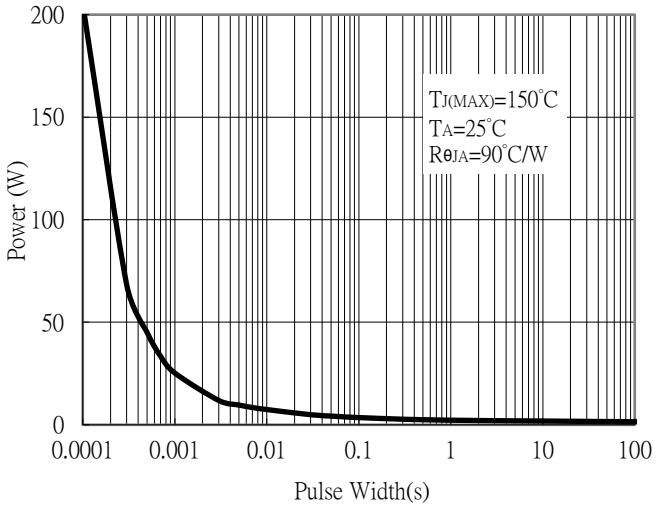


Maximum Drain Current vs Junction Temperature

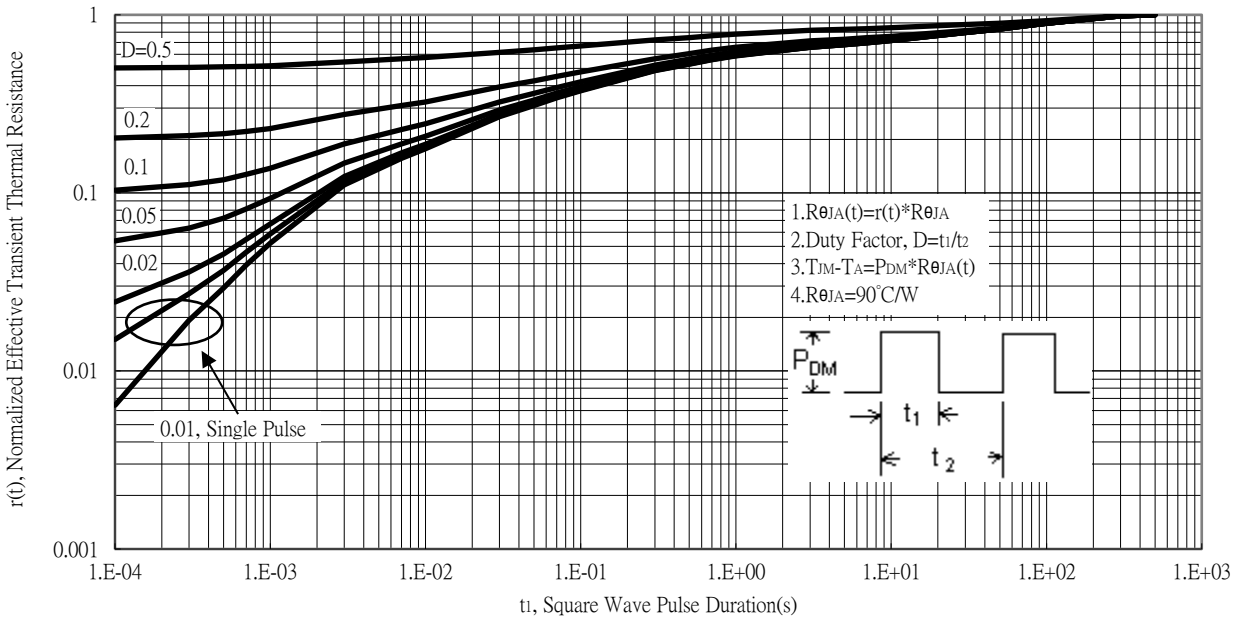


Typical Characteristics (Cont.) : Q1(N-channel)

Single Pulse Power Rating, Junction to Ambient

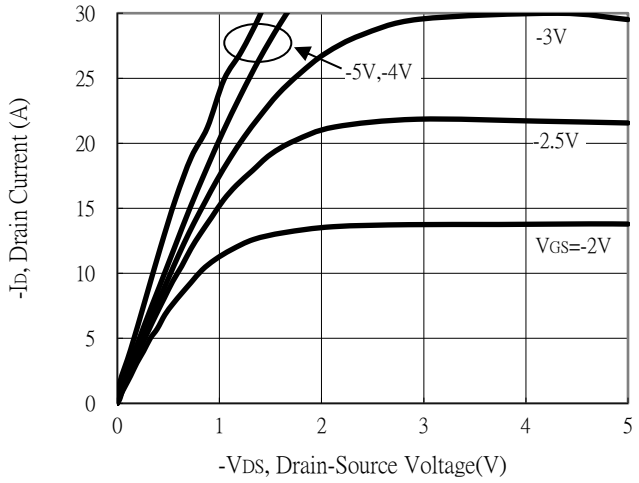


Transient Thermal Response Curves

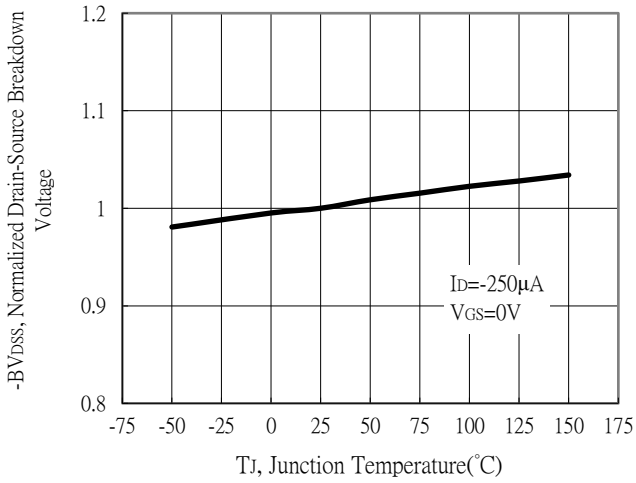


Typical Characteristics : Q2(P-channel)

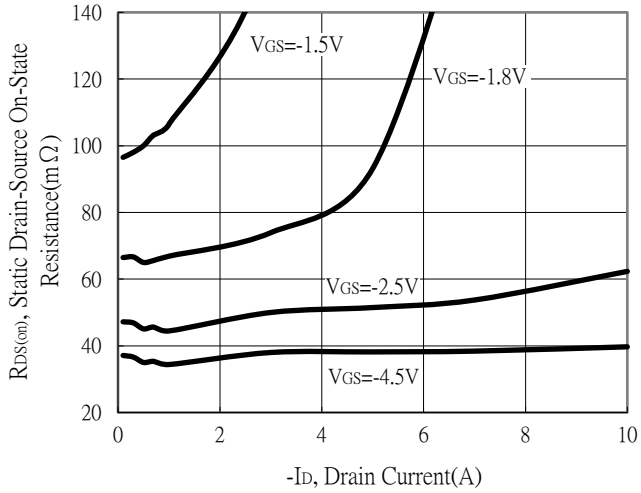
Typical Output Characteristics



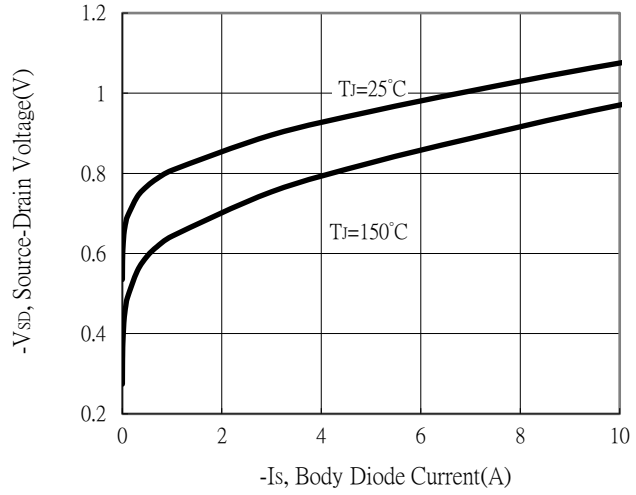
Breakdown Voltage vs Ambient Temperature



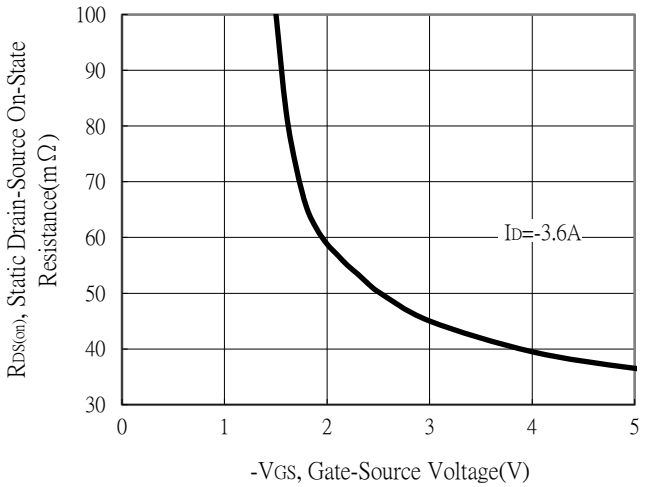
Static Drain-Source On-State resistance vs Drain Current



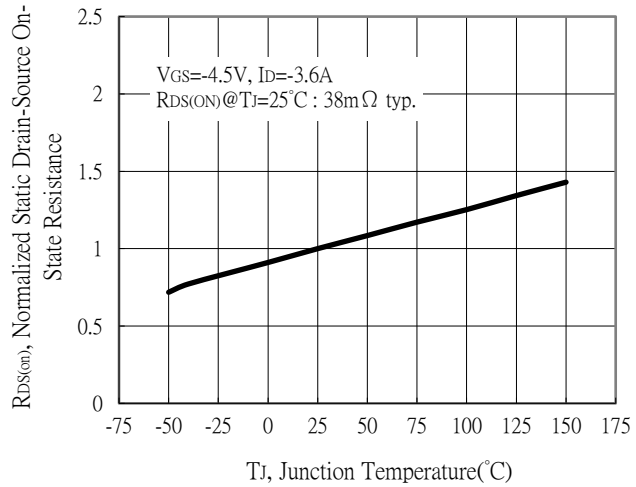
Body Diode Currentvs Source-Drain Voltage



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

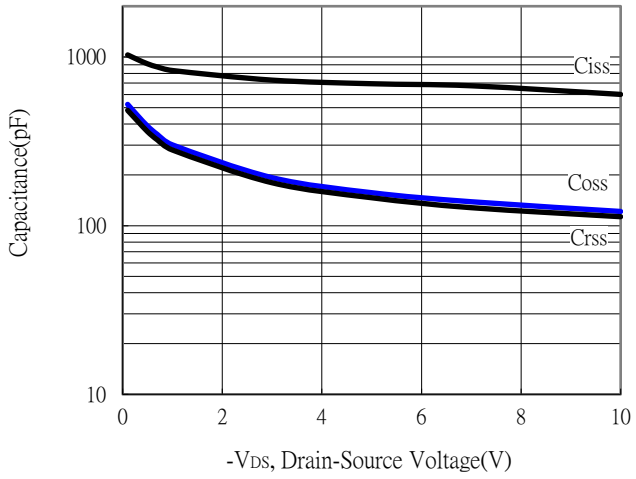


Drain-Source On-State Resistance vs Junction Temperature

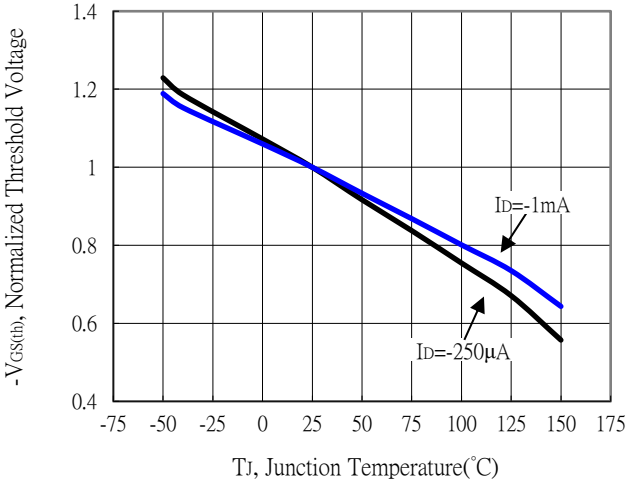


Typical Characteristics (Cont.) : Q2(P-channel)

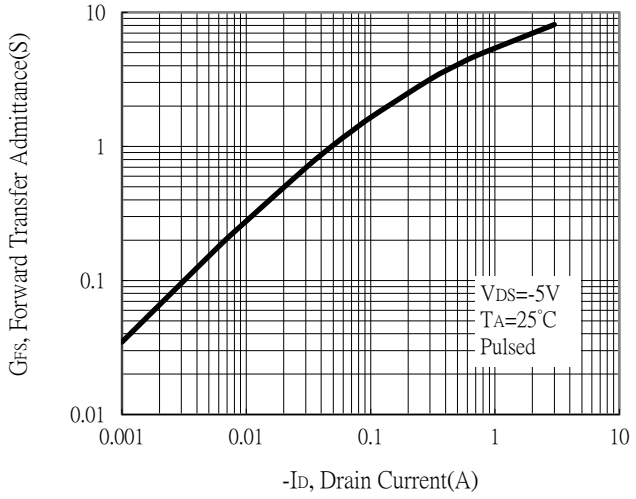
Capacitance vs Drain-to-Source Voltage



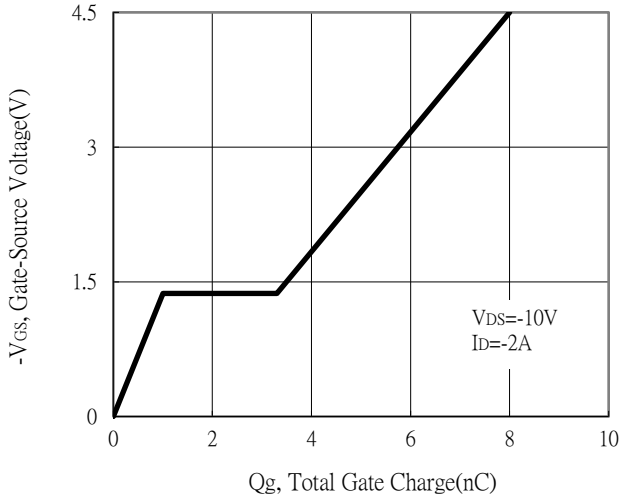
Threshold Voltage vs Junction Temperature



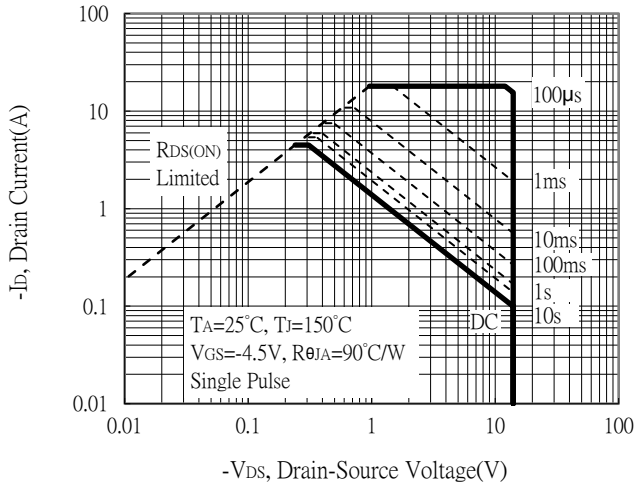
Forward Transfer Admittance vs Drain Current



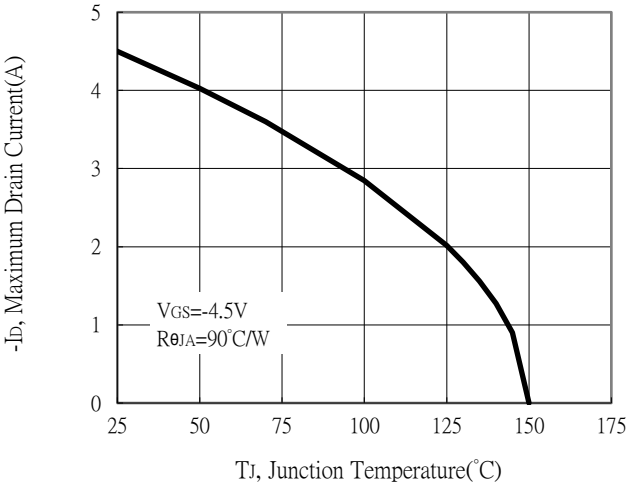
Gate Charge Characteristics



Maximum Safe Operating Area

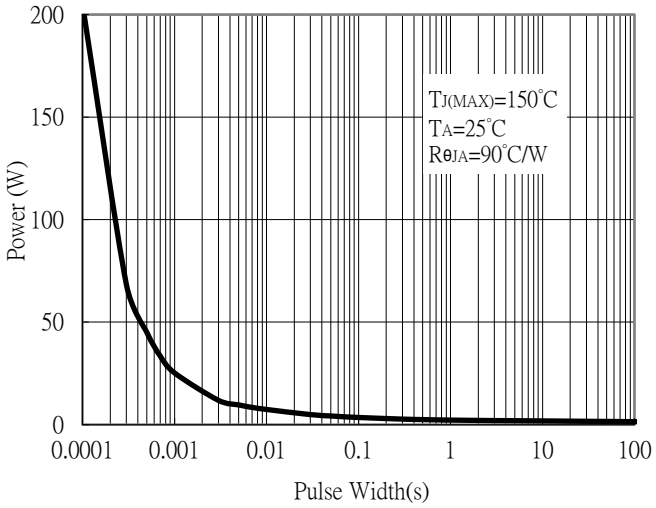


Maximum Drain Current vs Junction Temperature

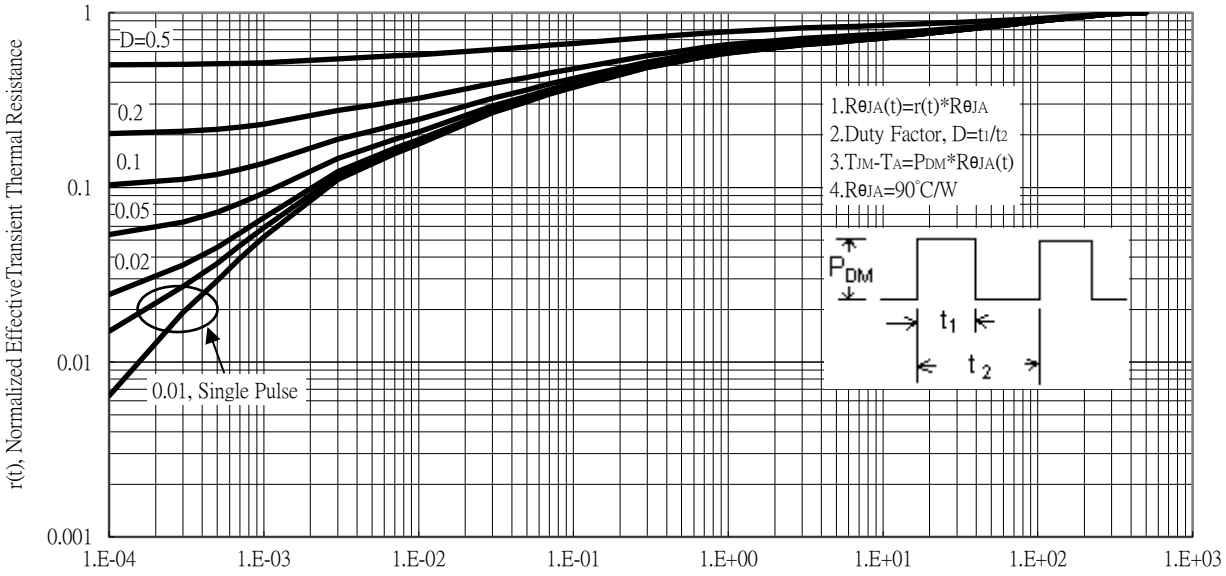


Typical Characteristics (Cont.) : Q2(P-channel)

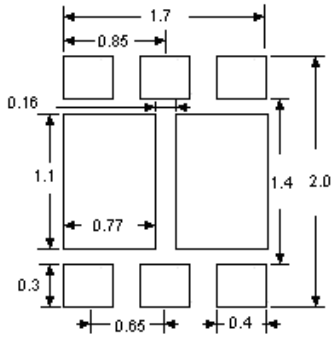
Single Pulse Power Rating, Junction to Ambient



Transient Thermal Response Curves

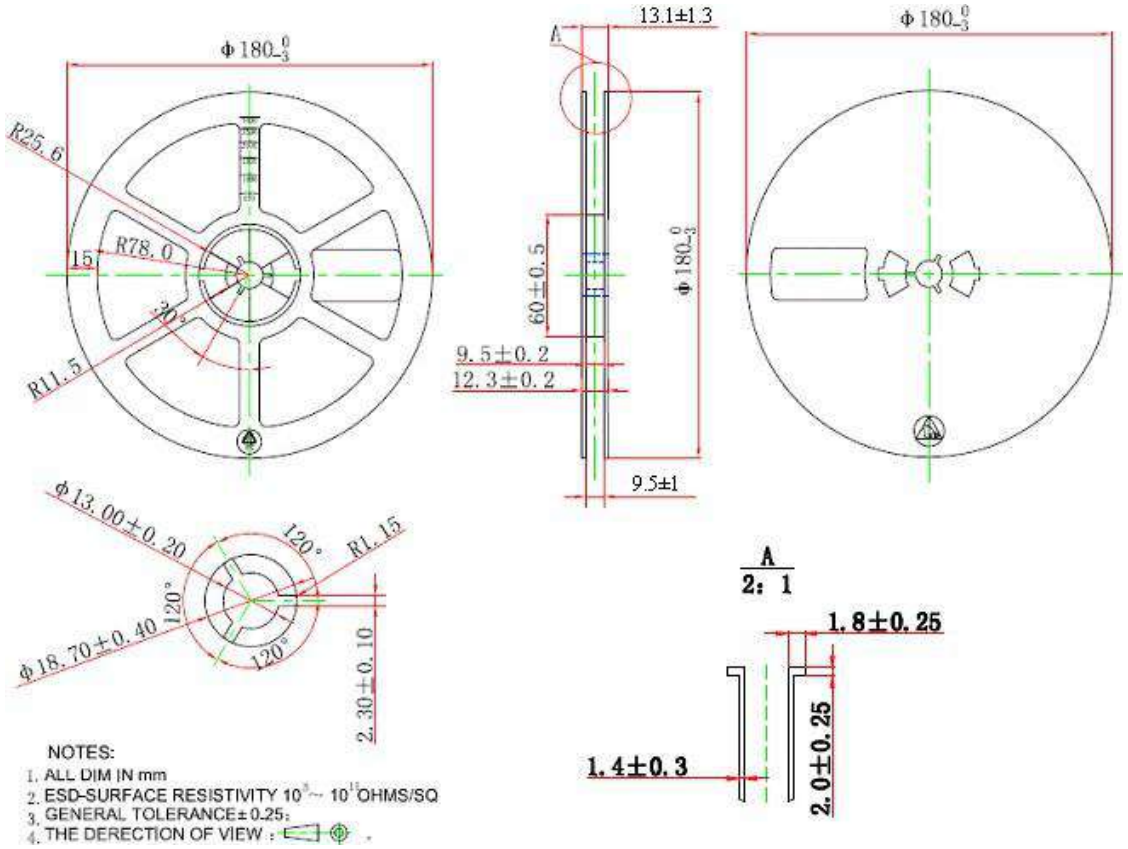


Recommended Soldering Footprint

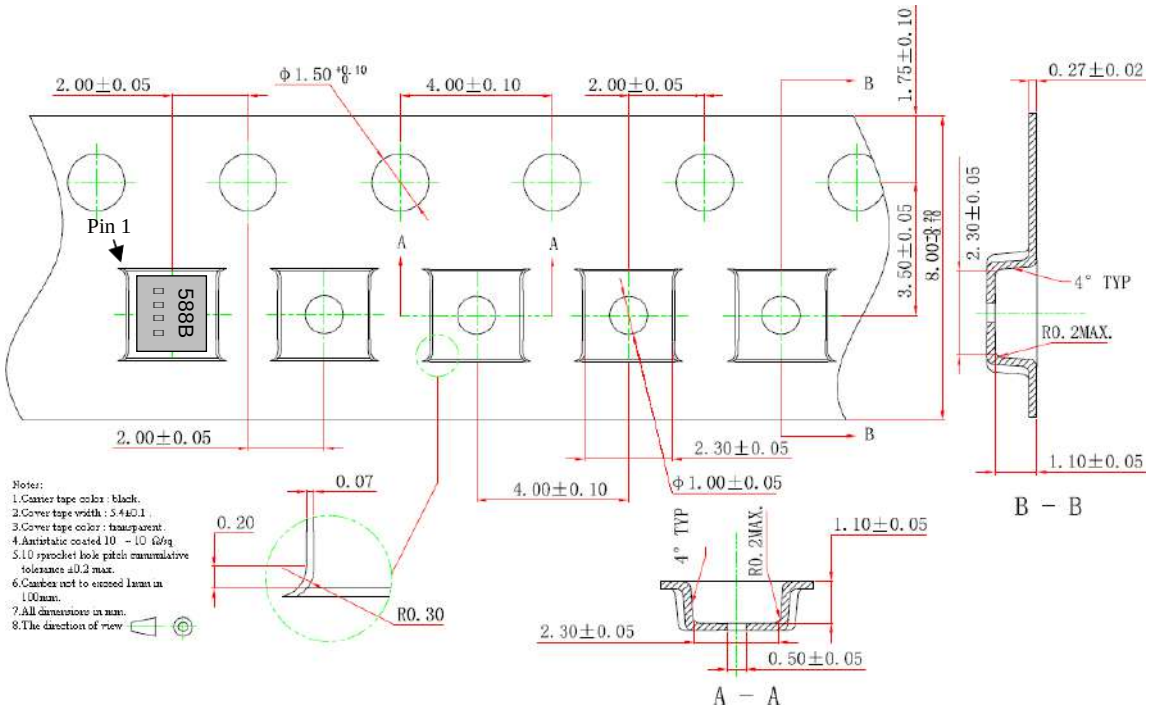


Unit : mm

Reel Dimension



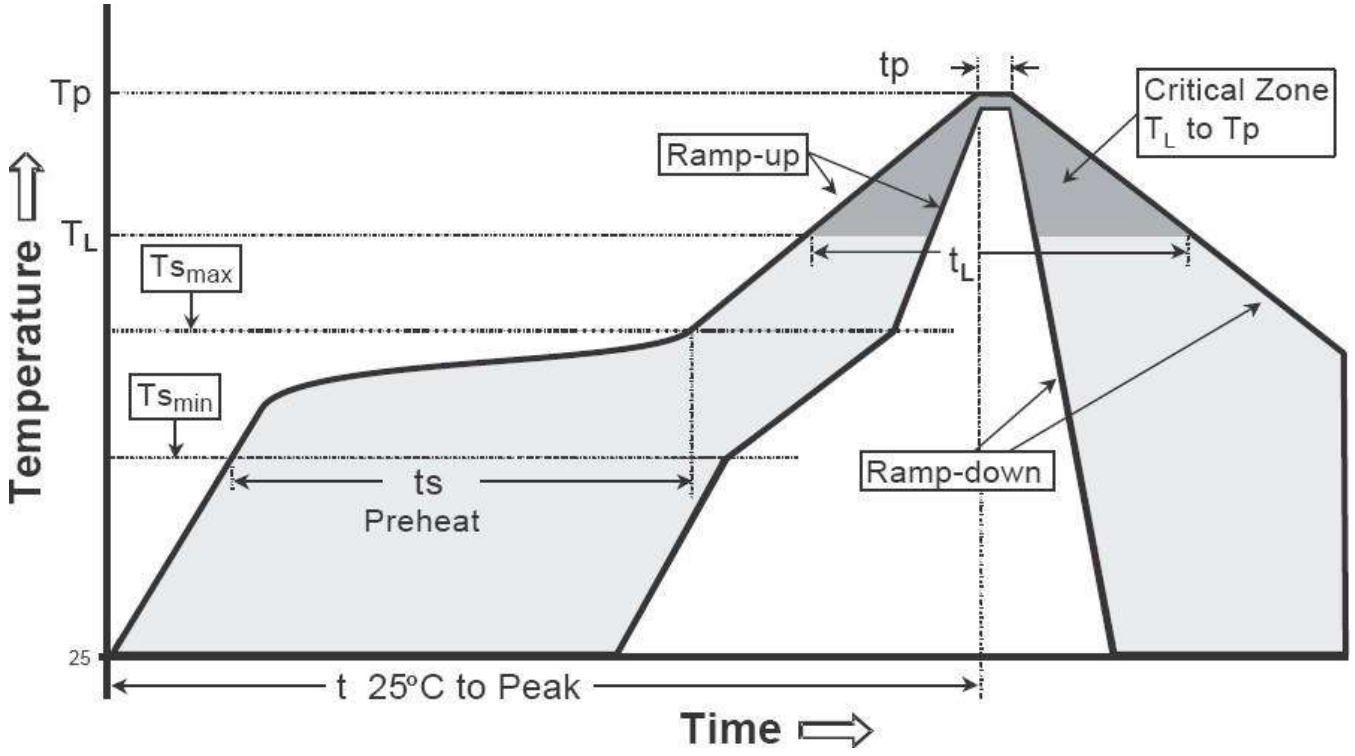
Carrier Tape Dimension



Recommended wave soldering condition

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

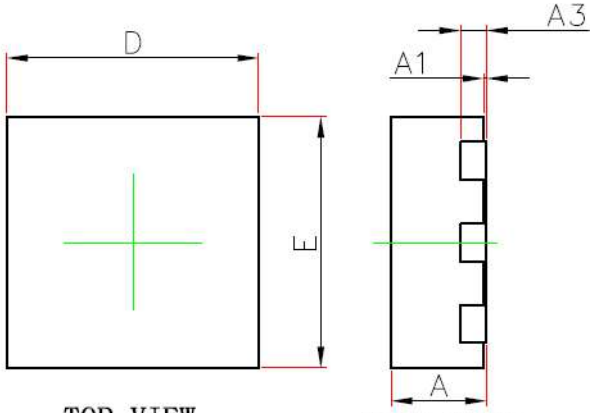
Recommended temperature profile for IR reflow

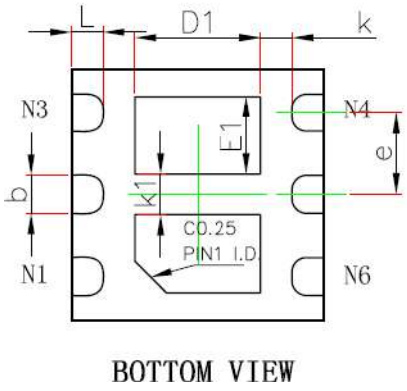


Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat −Temperature Min(Ts min) −Temperature Max(Ts max) −Time(ts min to ts max)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: −Temperature (TL) – Time (tL)	 183°C 60-150 seconds	 217°C 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.

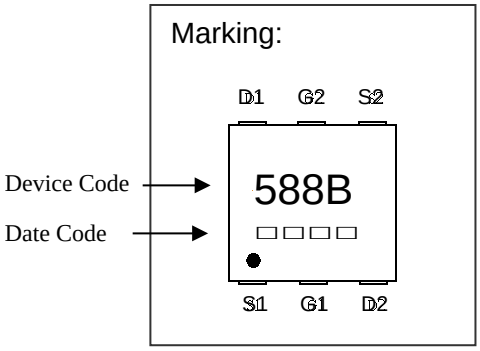
Note : All temperatures refer to topside of the package, measured on the package body surface.

DFN2×2-6L Dimension





Date Code(counting from left to right) :
1st code: year code, the last digit of Christian year
2nd code : month code, Jan→A, Feb→B, Mar→C,
Apr→D, May→E, Jun→F, Jul→G, Aug→H,
Sep→J, Oct→K, Nov→L, Dec→M
3rd and 4th codes : production serial number, 01~99



Style:
Pin 1. Source1 (S1)
Pin 2. Gate 1 (G1)
Pin 3. Drain2 (D2)
Pin 4. Source2 (S2)
Pin 5. Gate2 (G2)
Pin 6. Drain1 (D1)

6-Lead DFN2×2-6L Plastic
Surface Mounted Package C

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