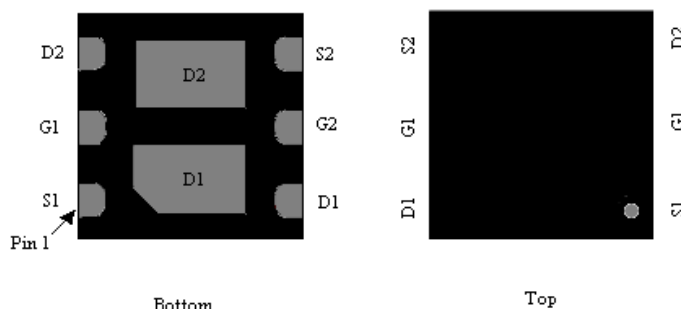


N- And P-Channel Enhancement Mode MOSFET

Features:

- Simple drive requirement
- Pb-free lead plating and halogen-free package
- Low on-resistance
- Fast switching speed
- Low gate charge

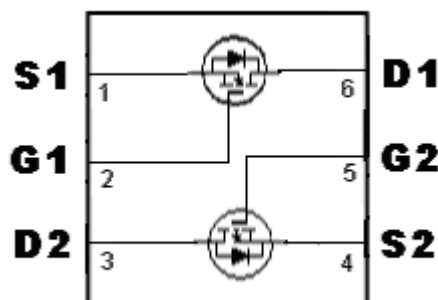


DFN2x2-6L

Description:

The KWPD3588 consists of a N-channel and a P-channel enhancement-mode MOSFET in a single DFN2*2-6L package, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The DFN2*2-6L package is universally preferred for all commercial-industrial surface mount applications.



G : Gate S : Source D : Drain

	N-CH	P-CH
BV_{DSS}	14V	-14V
I_D	6A($V_{GS}=4.5V$)	-4A($V_{GS}=-4.5V$)
$R_{DS(on)}$ (TYP.)	16.6m Ω ($V_{GS}=4.5V$)	43m Ω ($V_{GS}=-4.5V$)
	23.7m Ω ($V_{GS}=2.5V$)	63.6m Ω ($V_{GS}=-2.5V$)
	38.5m Ω ($V_{GS}=1.8V$)	86.5m Ω ($V_{GS}=-1.8V$)
	66.3m Ω ($V_{GS}=1.5V$)	153.3m Ω ($V_{GS}=-1.5V$)

Ordering Information

Device	Package	Shipping
KWPD3588	DFN2x2-6L (Pb-free lead plating and halogen-free package)	3000 pcs / Tape & Reel

Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit
		N-channel	P-channel	
Drain-Source Breakdown Voltage	BV _{DSS}	14	-14	V
Gate-Source Voltage	V _{GS}	±8	±8	
Continuous Drain Current @T _A =25 °C (Note 1)	I _D	6.0	-4.0	A
Continuous Drain Current @T _A =70 °C (Note 1)		4.8	-3.2	
Pulsed Drain Current (Note 2)	I _{DM}	30	-20	
Total Power Dissipation (Note 1)	P _D	1.38		W
Linear Derating Factor		0.01		W / °C
Operating Junction and Storage Temperature	T _j , T _{stg}	-55~+150		°C

Note : 1.Surface mounted on 1 in² copper pad of FR-4 board, t≤5 sec
2.Pulse width limited by maximum junction temperature

Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	R _{θJC}	80	°C/W
Thermal Resistance, Junction-to-ambient, max	R _{θJA}	90 (Note)	

Note : Surface mounted on 1 in² copper pad of FR-4 board, t≤5 sec; 195°C/W when mounted on minimum copper pad

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

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	14	-	-	V	V _{GS} =0V, I _D =250μA
ΔBV _{DSS} /ΔT _j	-	8	-	mV/°C	Reference to 25°C, I _D =1mA
V _{GS(th)}	0.5	0.7	1.2	V	V _{DS} =V _{GS} , I _D =250μA
I _{GSS}	-	-	±100	nA	V _{GS} =±8V, V _{DS} =0V
I _{DSS}	-	-	1	μA	V _{DS} =12V, V _{GS} =0V
	-	-	10		V _{DS} =10V, V _{GS} =0V, T _j =70°C
*R _{DS(ON)}	-	16.6	26	mΩ	V _{GS} =4.5V, I _D =5A
	-	23.7	33		V _{GS} =2.5V, I _D =4.6A
	-	38.5	74		V _{GS} =1.8V, I _D =4.1A
	-	66.3	114		V _{GS} =1.5V, I _D =2A
*G _{FS}	-	5.6	-	S	V _{DS} =5V, I _D =3A
Dynamic					
C _{iss}	-	407	-	pF	V _{DS} =10V, V _{GS} =0V, f=1MHz
C _{oss}	-	115	-		
C _{rss}	-	100	-		
*t _{d(ON)}	-	5	-	ns	V _{DS} =10V, I _D =1A, V _{GS} =5V, R _G =3.3Ω
*t _r	-	18.8	-		
*t _{d(OFF)}	-	49.6	-		
*t _f	-	30.8	-		

*Qg	-	6.5	-	nC	V _{DS} =10V, I _D =3A, V _{GS} =4.5V
*Qgs	-	0.7	-		
*Qgd	-	2.3	-		
Rg	-	1	-	Ω	f=1MHz
Source-Drain Diode					
*V _{SD}	-	0.87	1.2	V	V _{GS} =0V, I _S =5.2A
*trr	-	12	-	ns	I _F =3A, V _{GS} =0V, dI _F /dt=100A/μs
*Qrr	-	2.3	-	nC	

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

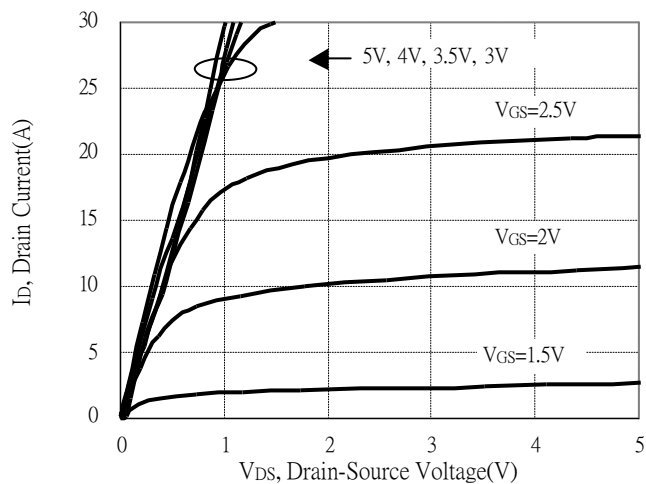
P-Channel Electrical Characteristics (T_j=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	-14	-	-	V	V _{GS} =0V, I _D =-250μA
ΔBV _{DSS} /ΔT _j	-	-5	-	mV/°C	Reference to 25°C, I _D =-250μA
V _{GS(th)}	-0.4	-	-1.0	V	V _{DS} =V _{GS} , I _D =-250μA
I _{GSS}	-	-	±100	nA	V _{GS} =±8V, V _{DS} =0V
I _{DSS}	-	-	-1	μA	V _{DS} =-12V, V _{GS} =0V
	-	-	-10		V _{DS} =-10V, V _{GS} =0V, T _j =70°C
*R _{DS(ON)}	-	43	56	mΩ	V _{GS} =-4.5V, I _D =-3.6A
	-	63.6	79		V _{GS} =-2.5V, I _D =-3.2A
	-	86.5	168		V _{GS} =-1.8V, I _D =-1A
	-	153.3	276		V _{GS} =-1.5V, I _D =-1A
*G _{FS}	-	5.6	-	S	V _{DS} =-5V, I _D =-2A
Dynamic					
C _{iss}	-	561	-	pF	V _{DS} =-10V, V _{GS} =0V, f=1MHz
C _{oss}	-	153	-		
C _{rss}	-	142	-		
*t _{d(ON)}	-	5	-	ns	V _{DS} =-10V, I _D =-1A, V _{GS} =-5V, R _G =3.3Ω
*t _r	-	18.8	-		
*t _{d(OFF)}	-	49.6	-		
*t _f	-	30.8	-		
*Qg	-	8	-	nC	V _{DS} =-10V, I _D =-2A, V _{GS} =-4.5V
*Qgs	-	1	-		
*Qgd	-	2.8	-		
Rg	-	9.3	-	Ω	f=1MHz
Source-Drain Diode					
*V _{SD}	-	-0.9	-1.2	V	V _{GS} =0V, I _S =-3.4A
*trr	-	27	-	ns	I _F =-2A, V _{GS} =0V, dI _F /dt=100A/μs
*Qrr	-	7	-	nC	

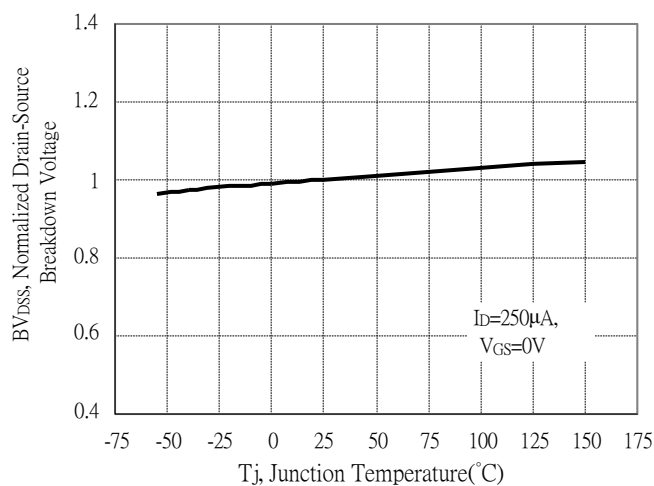
*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

N-channel Typical Characteristics

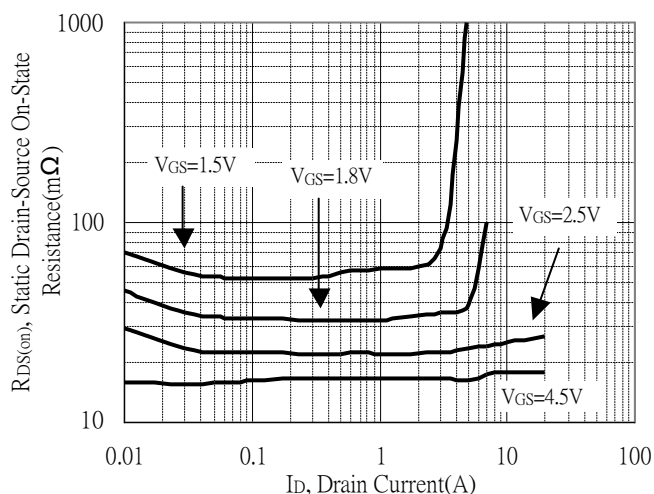
Typical Output Characteristics



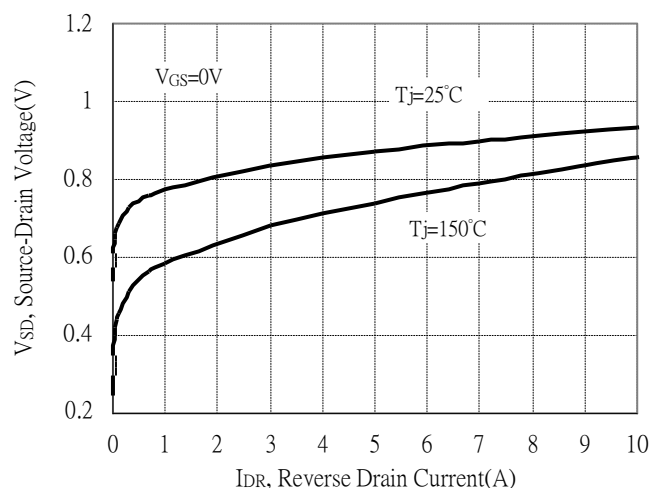
Breakdown Voltage vs Ambient Temperature



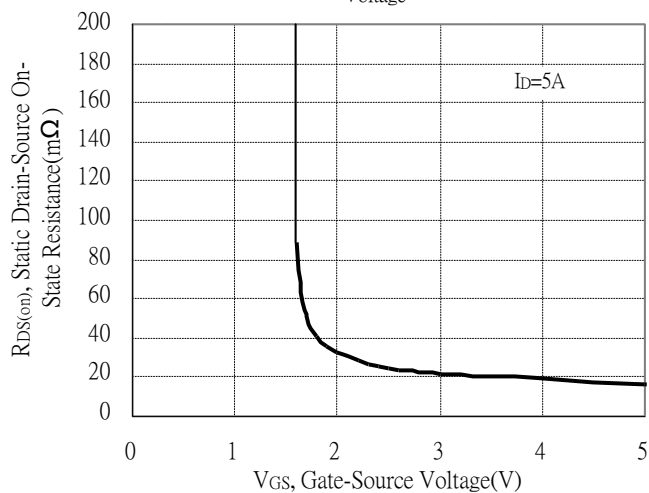
Static Drain-Source On-State resistance vs Drain Current



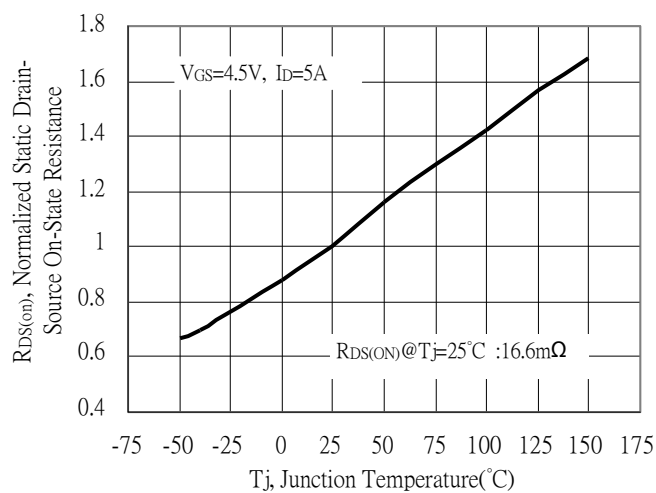
Reverse Drain Current vs Source-Drain Voltage



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

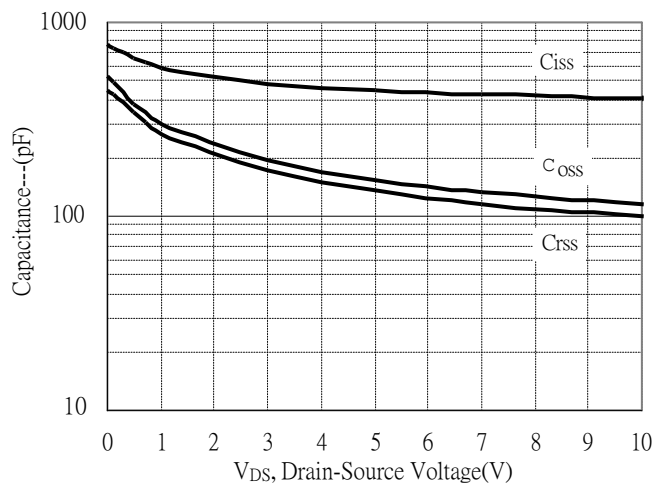


Drain-Source On-State Resistance vs Junction Temperature

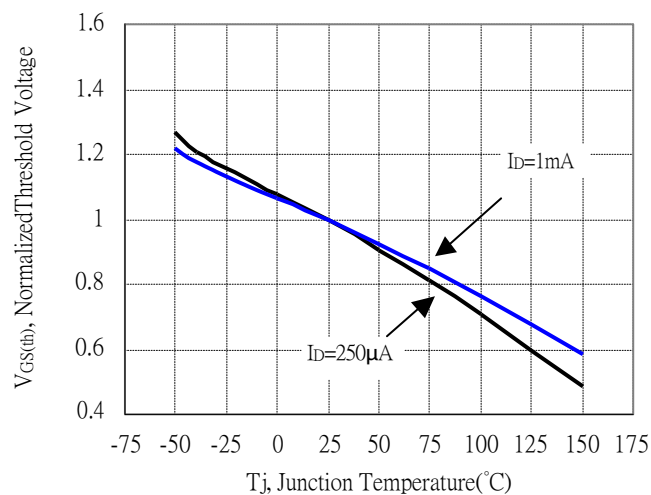


N-channel Typical Characteristics(Cont.)

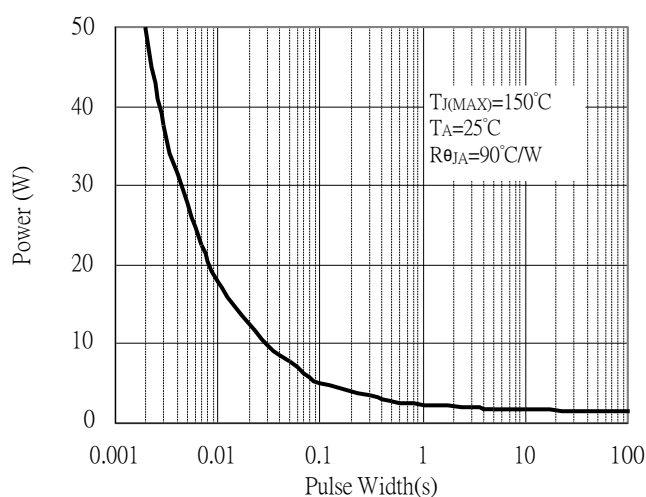
Capacitance vs Drain-to-Source Voltage



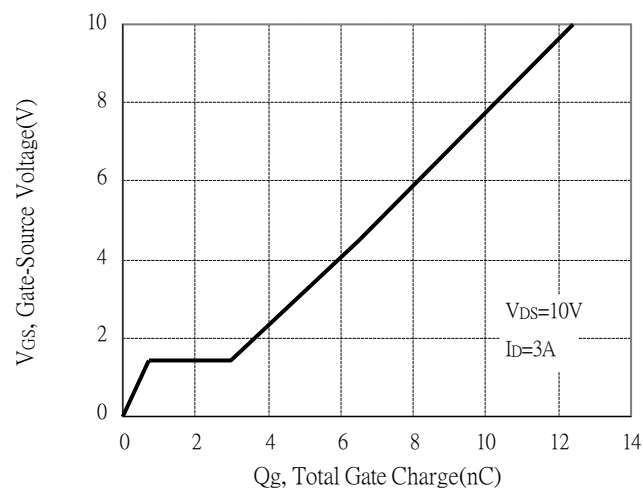
Threshold Voltage vs Junction Temperature



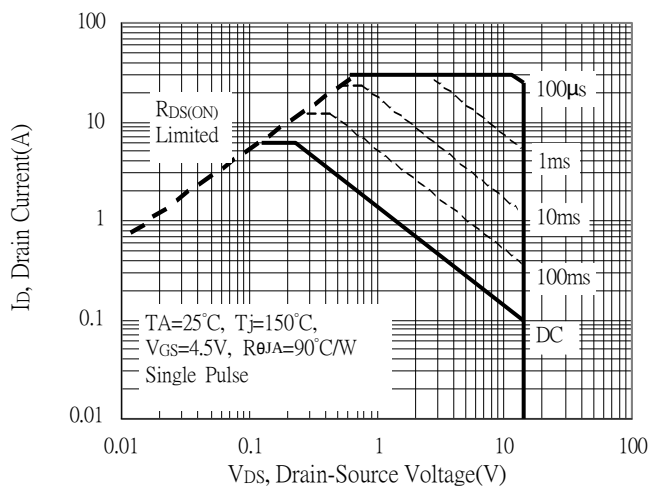
Single Pulse Power Rating, Junction to Ambient



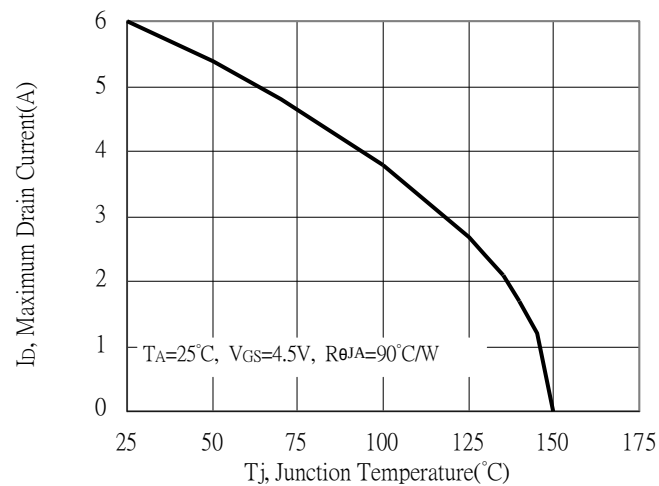
Gate Charge Characteristics



Maximum Safe Operating Area

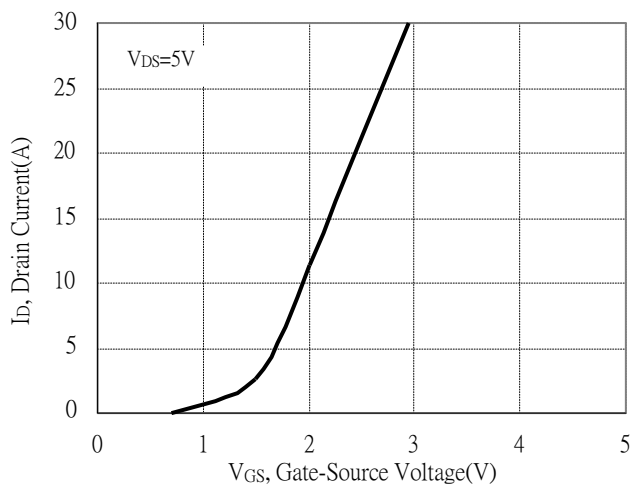


Maximum Drain Current vs Junction Temperature

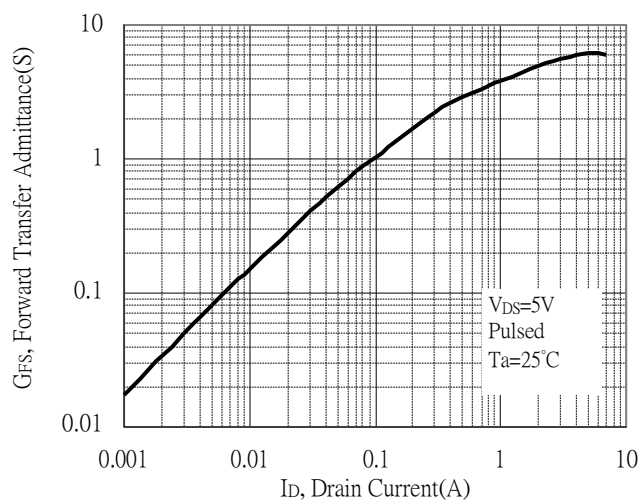


N-channel Typical Characteristics(Cont.)

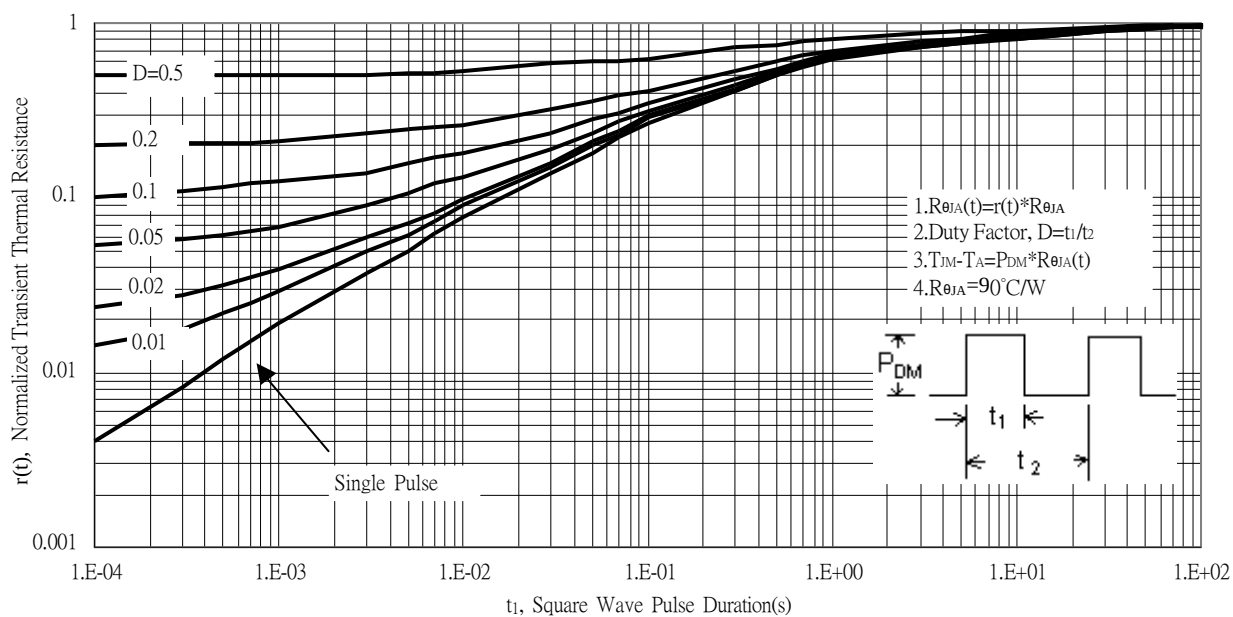
Typical Transfer Characteristics



Forward Transfer Admittance vs Drain Current

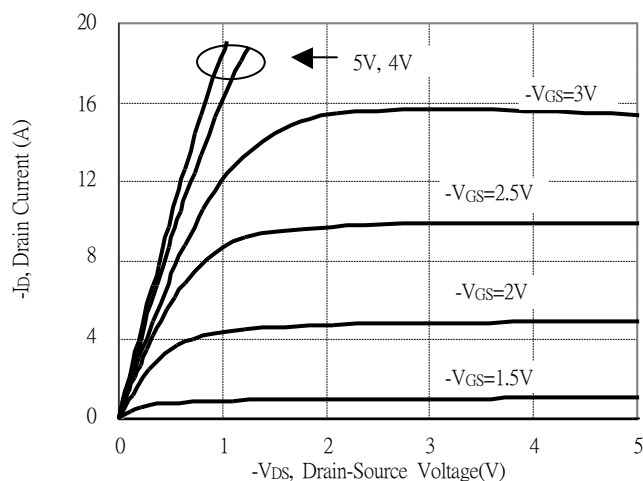


Transient Thermal Response Curves

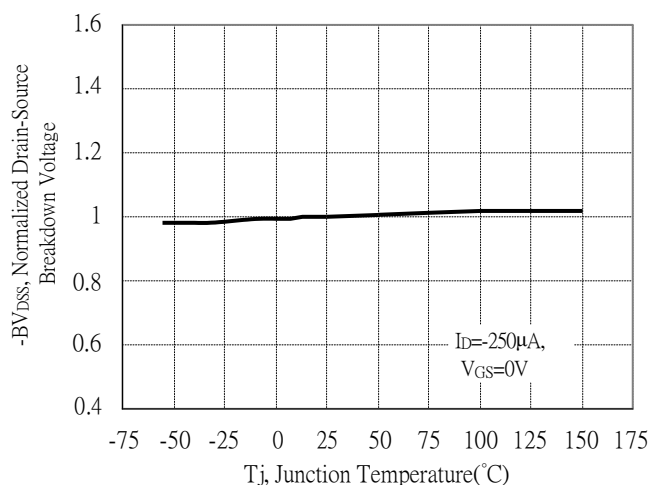


P-channel Typical Characteristics

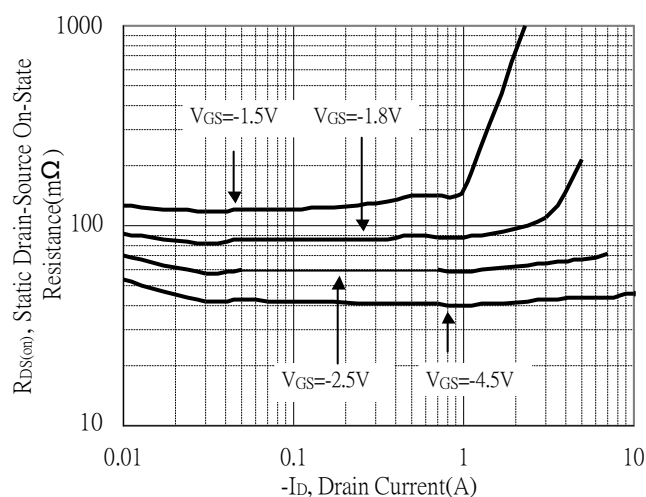
Typical Output Characteristics



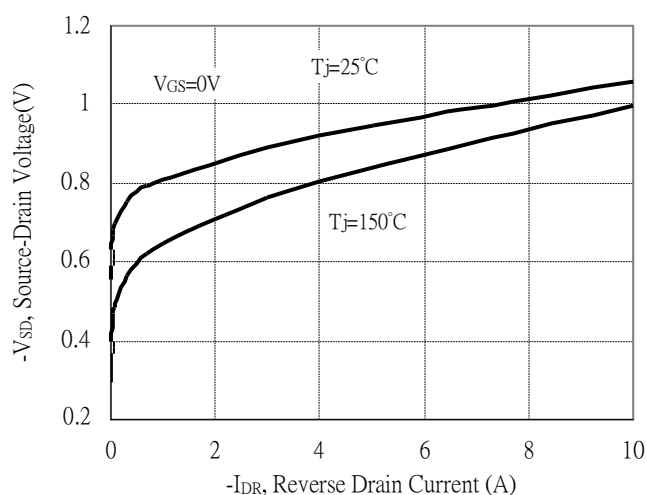
Breakdown Voltage vs Ambient Temperature



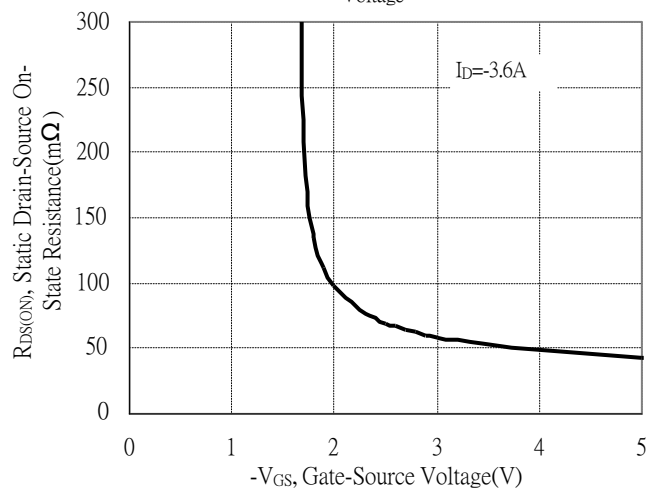
Static Drain-Source On-State resistance vs Drain Current



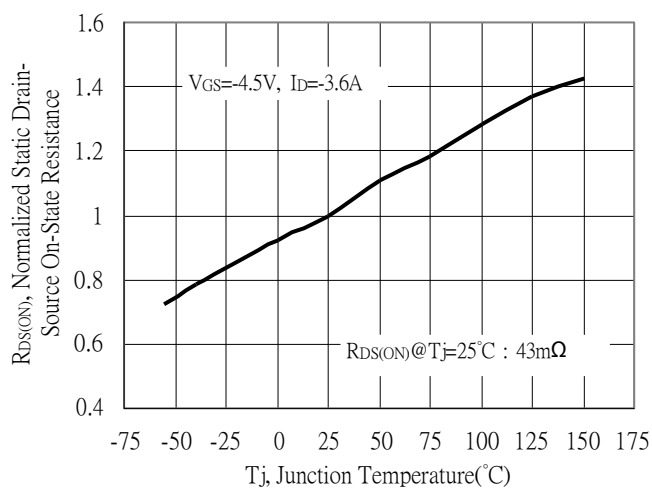
Reverse Drain Current vs Source-Drain Voltage



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

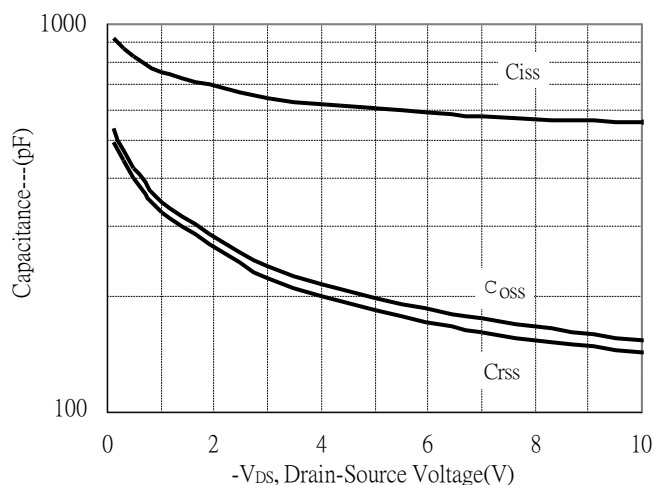


Drain-Source On-State Resistance vs Junction Temperature

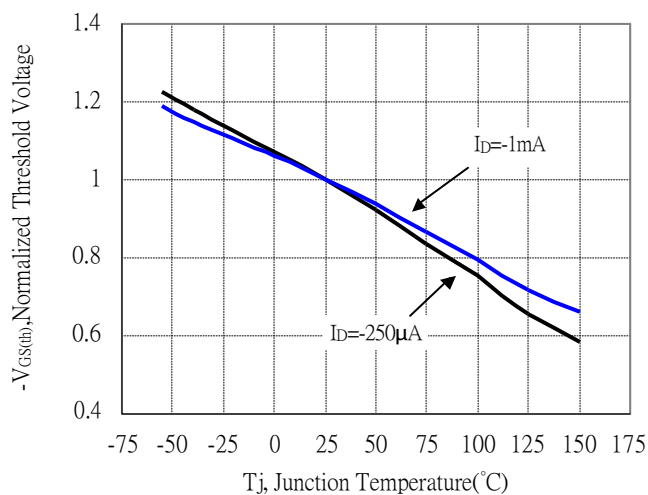


P-channel Typical Characteristics(Cont.)

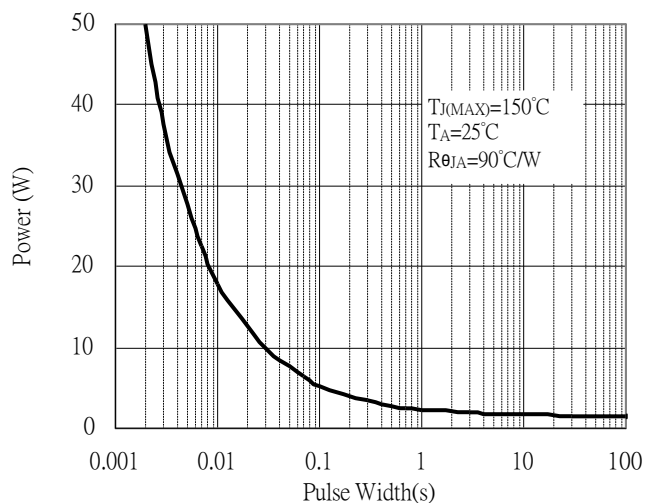
Capacitance vs Drain-to-Source Voltage



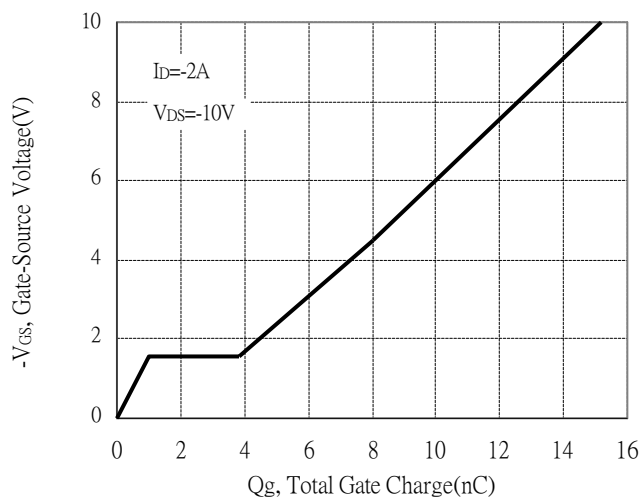
Threshold Voltage vs Junction Temperature



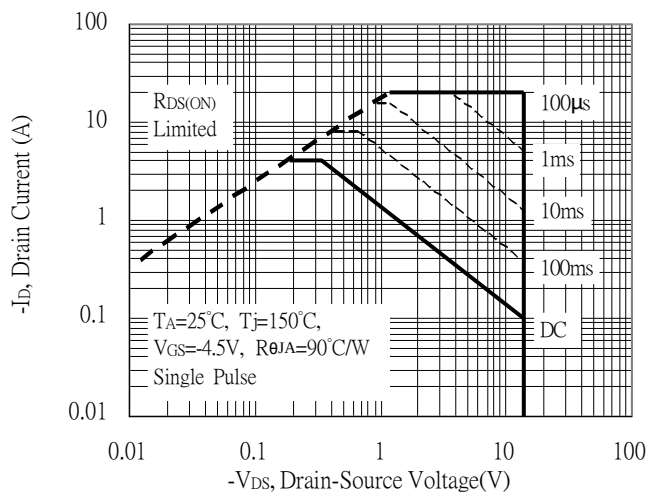
Single Pulse Power Rating, Junction to Ambient



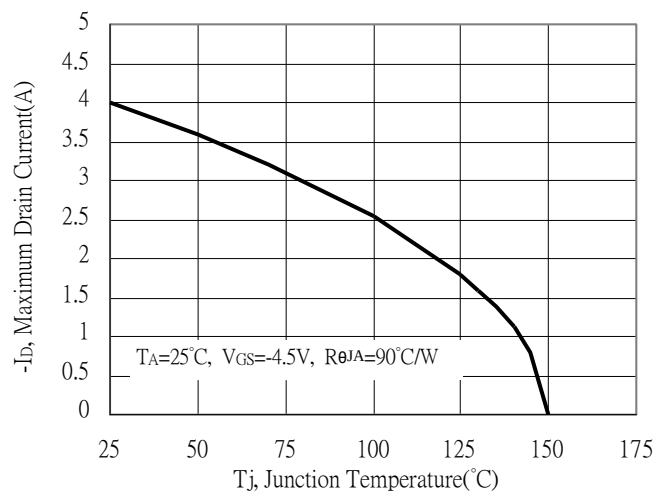
Gate Charge Characteristics



Maximum Safe Operating Area

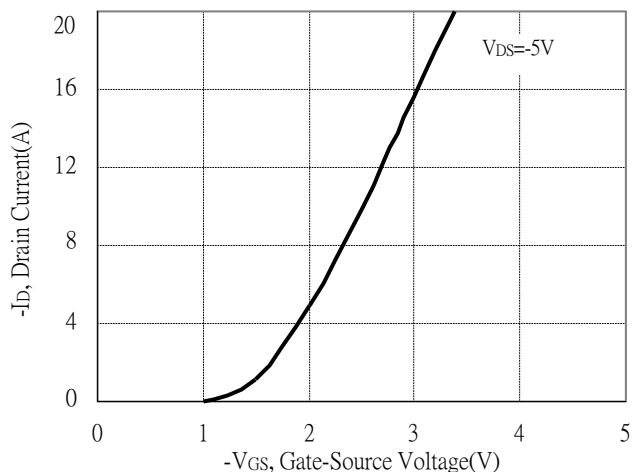


Maximum Drain Current vs Junction Temperature

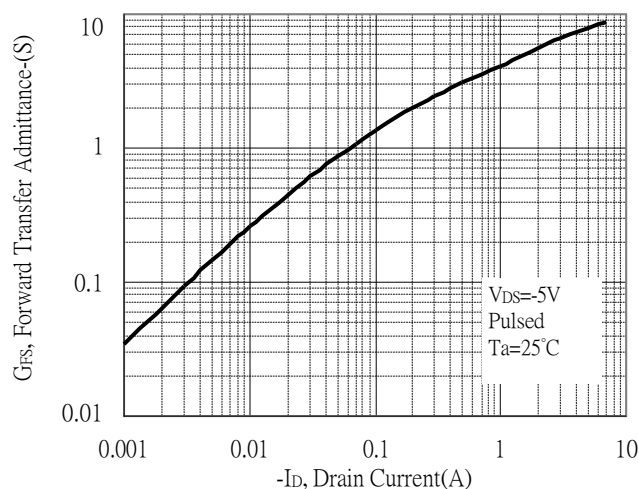


P-channel Typical Characteristics(Cont.)

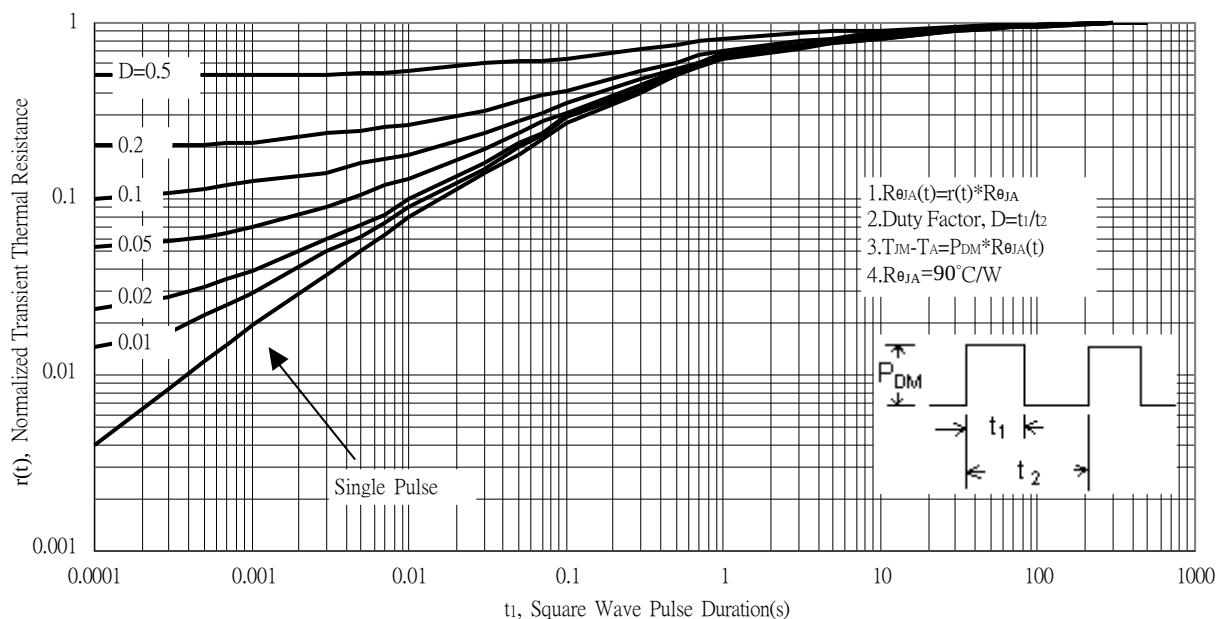
Typical Transfer Characteristics



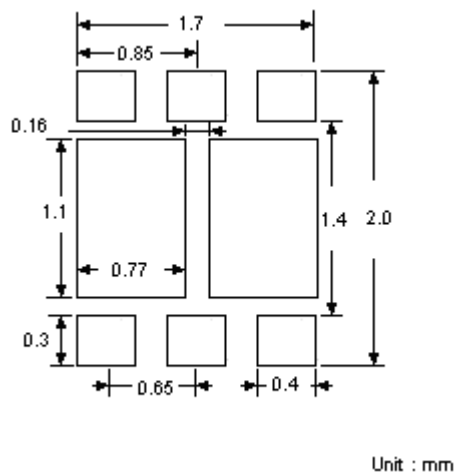
Forward Transfer Admittance vs Drain Current



Transient Thermal Response Curves



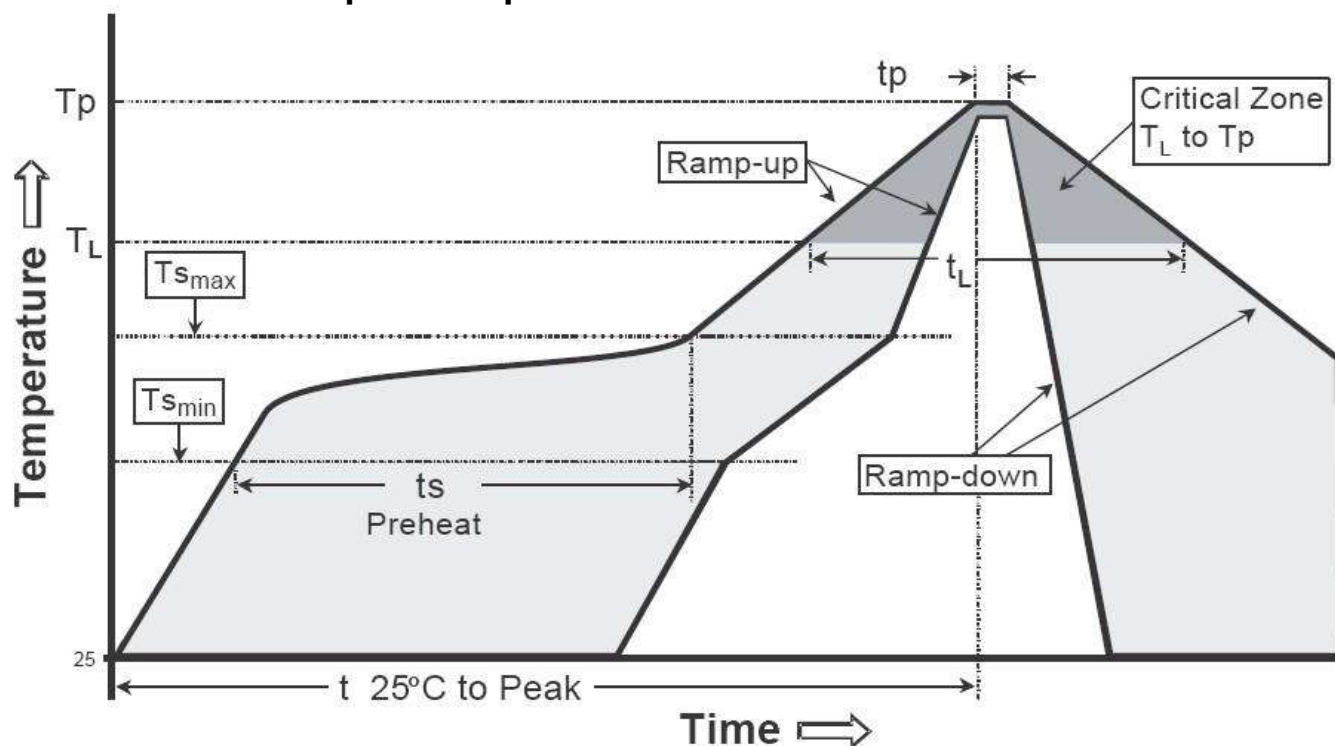
Recommended Soldering Footprint



Recommended wave soldering condition

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

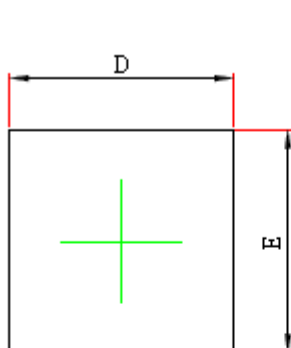
Recommended temperature profile for IR reflow



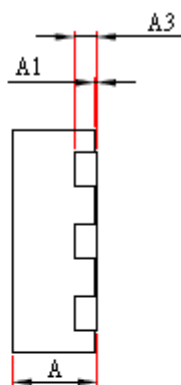
Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T_{smax} to T_p)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T_{smin})	100°C	150°C
-Temperature Max(T_{smax})	150°C	200°C
-Time(t_{smin} to t_{smax})	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (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(t_p)	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.

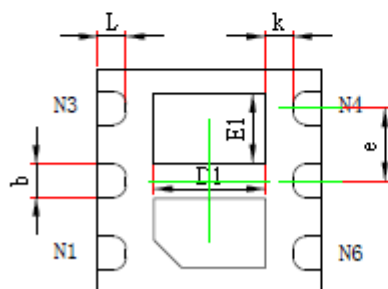
DFN2x2-6L Dimension



TOP VIEW



SIDE VIEW

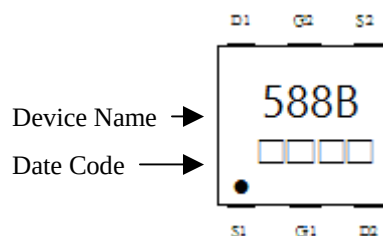


BOTTOM VIEW

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)

Marking:



6-Lead DFN2x2-6L Plastic
 Surface Mounted Package
 Code: DFA6

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	k	0.200	-	0.008	-
A3	0.203	REF	0.008	REF	b	0.250	0.350	0.010	0.014
D	1.900	2.100	0.075	0.083	e	0.650	TYP	0.026	TYP
E	1.900	2.100	0.075	0.083	L	0.200	0.300	0.008	0.012
D1	0.900	1.100	0.035	0.043					