

N- AND P-Channel Enhancement Mode Power MOSFET

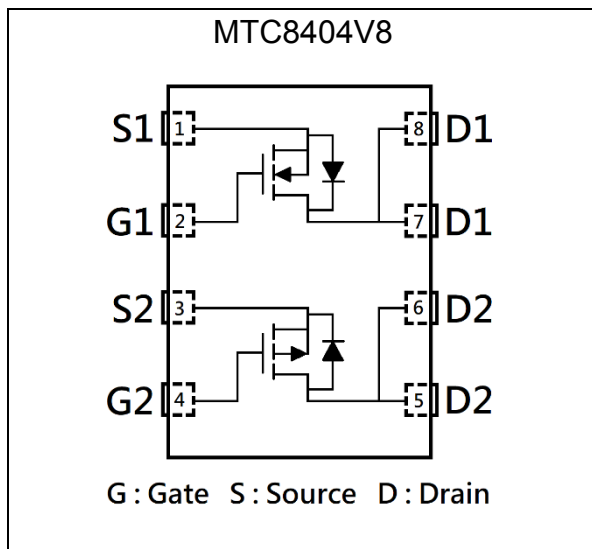
MTC8404V8

Features

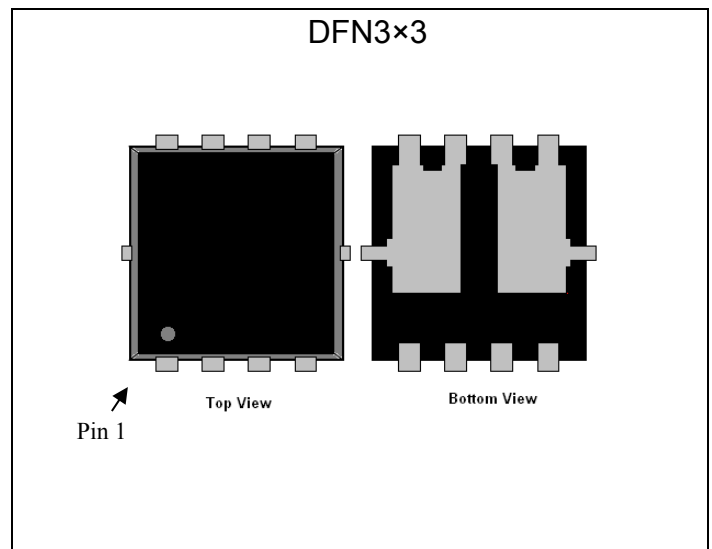
- Low Gate Charge
- Fast Switching Characteristic

	N-CH	P-CH
BV_{DSS}	30V	-30V
$I_D@V_{GS}=(-)10V, T_C=25^\circ C$	13A	-13A
$I_D@V_{GS}=(-)10V, T_A=25^\circ C$	6.7A	-5.8A
$R_{DS(ON) typ. @ V_{GS}=(-)10V}$	16mΩ	27mΩ
$R_{DS(ON) typ. @ V_{GS}=(-)4.5V}$	22mΩ	38mΩ

Equivalent Circuit

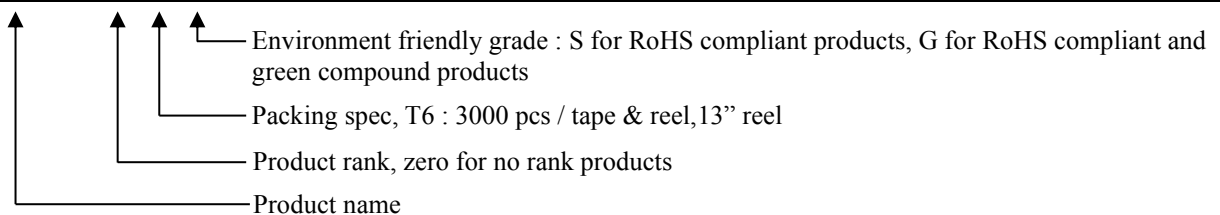


Outline



Ordering Information

Device	Package	Shipping
MTC8404V8-0-T6-G	DFN3×3 (RoHS compliant & Halogen-free package)	3000 pcs / Tape & Reel





Absolute Maximum Ratings (TA=25°C)

Parameter	Symbol	Limits		Unit	
		N-CH	P-CH		
Drain-Source Voltage	V _{DS}	30	-30	V	
Gate-Source Voltage	V _{GS}	±20	±20		
Continuous Drain Current @ V _{GS} =(-)10V, T _C =25°C (silicon limit) *a	I _D	19	-14	A	
Continuous Drain Current @ V _{GS} =(-)10V, T _C =25°C (package limit) *a		13	-13		
Continuous Drain Current @ V _{GS} =(-)10V, T _C =100°C *a		12	-8.9		
Continuous Drain Current @ V _{GS} =(-)10V, T _A =25°C *b		6.7	-5.8		
Continuous Drain Current @ V _{GS} =(-)10V, T _A =70°C *b		5.4	-4.6		
Pulsed Drain Current *c	I _{DM}	52	-52		
Continuous Body Diode Forward Current @ T _C =25°C *a	I _S	13	-11		
Pulsed Body Diode Forward Current @ T _C =25°C *a	I _{SM}	52	-44		
Avalanche Current @ L=0.1mH	I _{AS}	10	-12		
Avalanche Energy @ L=0.5mH	E _{AS}	9	12		mJ
Total Power Dissipation	P _D	T _C =25°C *a	16	13.3	W
		T _C =100°C *a	6.4	5.3	
		T _A =25°C *b	2	2.1	
		T _A =70°C *b	1.3	1.3	
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}	7.7	9.4	°C/W
Thermal Resistance, Junction-to-ambient *b	R _{θJA}	62	60	

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)}	1	-	2.5		V _{DS} =V _{GS} , I _D =250μA
G _{FS}	-	5	-	S	V _{DS} =10V, I _D =3A
I _{GSS}	-	-	±100	nA	V _{GS} =±20V, V _{DS} =0V
I _{DSS}	-	-	1	μA	V _{DS} =24V, V _{GS} =0V
R _{DS(ON)}	-	16	21	mΩ	V _{GS} =10V, I _D =6A
	-	22	31		V _{GS} =4.5V, I _D =4A
Dynamic					
C _{iss}	-	510	-	pF	V _{DS} =15V, V _{GS} =0V, f=1MHz
C _{oss}	-	75	-		
C _{rss}	-	58	-		
R _g	-	4.5	-	Ω	f=1MHz
Q _g *1, 2	-	6	-	nC	V _{DS} =15V, I _D =6A, V _{GS} =4.5V
Q _g *1, 2	-	13	-		
Q _{gs} *1, 2	-	1.6	-		
Q _{gd} *1, 2	-	2.5	-		
t _{d(ON)} *1, 2	-	5.6	-	ns	V _{DS} =15V, I _D =6A, V _{GS} =10V, R _{GS} =1Ω
t _r *1, 2	-	7.5	-		
t _{d(OFF)} *1, 2	-	26	-		
t _f *1, 2	-	4.5	-		
Source-Drain Diode					
V _{SD} *1	-	0.78	1.2	V	I _S =2.3A, V _{GS} =0V
t _{rr}	-	7	-	ns	I _F =6A, dI _F /dt=100A/μs
Q _{rr}	-	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)}	-1	-	-2.5		V _{DS} =V _{GS} , I _D =-250μA
G _{FS}	-	6.8	-	S	V _{DS} =-10V, I _D =-5A
I _{GSS}	-	-	±100	nA	V _{GS} =±20V, V _{DS} =0V
I _{DSS}	-	-	-1	μA	V _{DS} =-24V, V _{GS} =0V
R _{DS(ON)}	-	27	35	mΩ	V _{GS} =-10V, I _D =-6A
	-	38	53		V _{GS} =-4.5V, I _D =-4A
Dynamic					
C _{iss}	-	925	-	pF	V _{DS} =-15V, V _{GS} =0V, f=1MHz
C _{oss}	-	110	-		
C _{rss}	-	90	-		
R _g	-	22	-	Ω	f=1MHz
Q _g *1, 2	-	10.2	-	nC	V _{DS} =-15V, I _D =-6A, V _{GS} =-4.5V
Q _g *1, 2	-	21	-		
Q _{gs} *1, 2	-	3.6	-		
Q _{gd} *1, 2	-	4.5	-		
t _{d(ON)} *1, 2	-	6.8	-	ns	V _{DS} =-15V, I _D =-3.5A, V _{GS} =-10V, R _{GS} =10Ω
t _r *1, 2	-	17	-		
t _{d(OFF)} *1, 2	-	94	-		
t _f *1, 2	-	48	-		
Source-Drain Diode					
V _{SD} *1	-	-0.76	-1.2	V	I _S =-1A, V _{GS} =0V
t _{rr}	-	9.5	-	ns	I _F =-6A, dI _F /dt=100A/μs
Q _{rr}	-	4.5	-	nC	

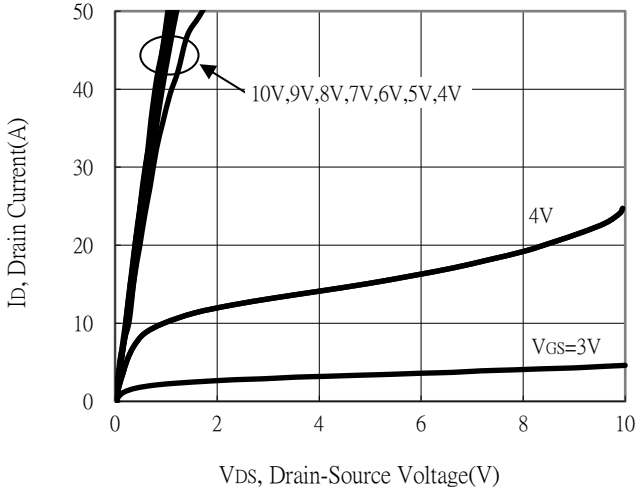
Note:

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

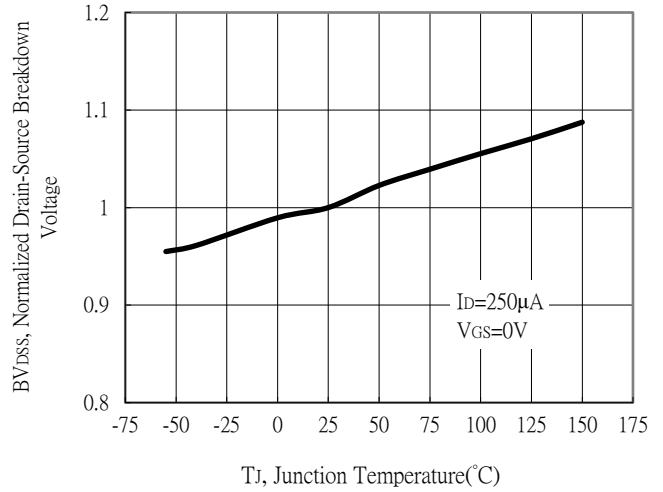
*2. Independent of operating temperature

Typical Characteristics : Q1(N-channel)

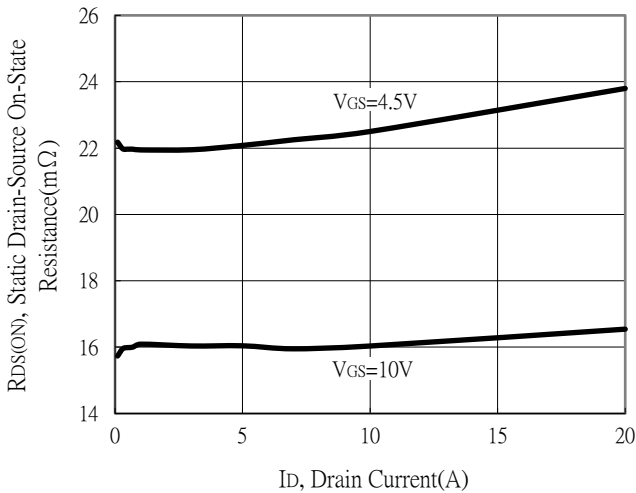
Typical Output Characteristics



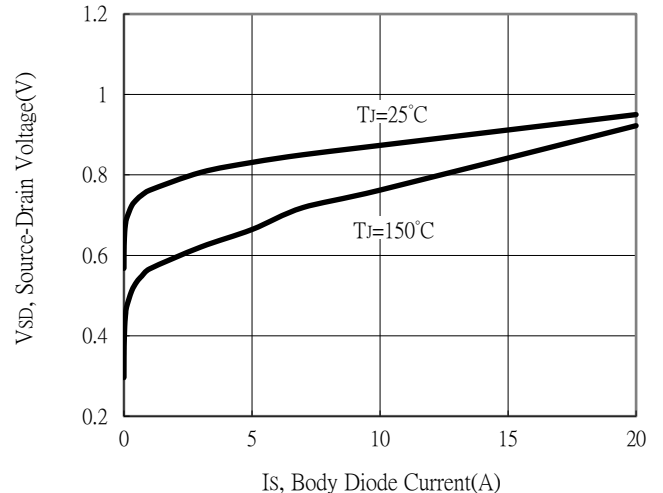
Breakdown Voltage vs Ambient Temperature



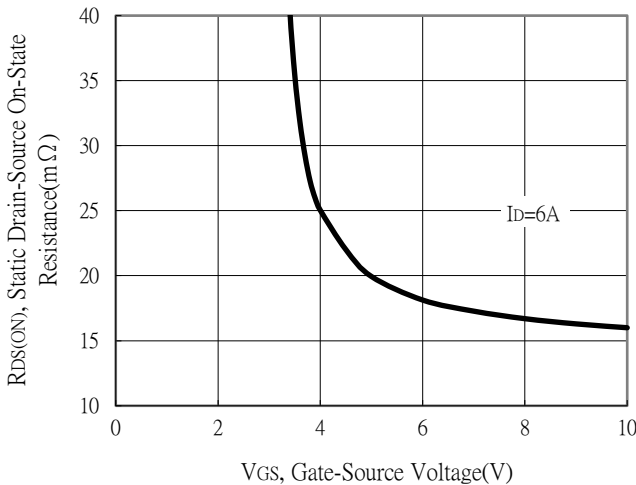
Static Drain-Source On-State resistance vs Drain Current



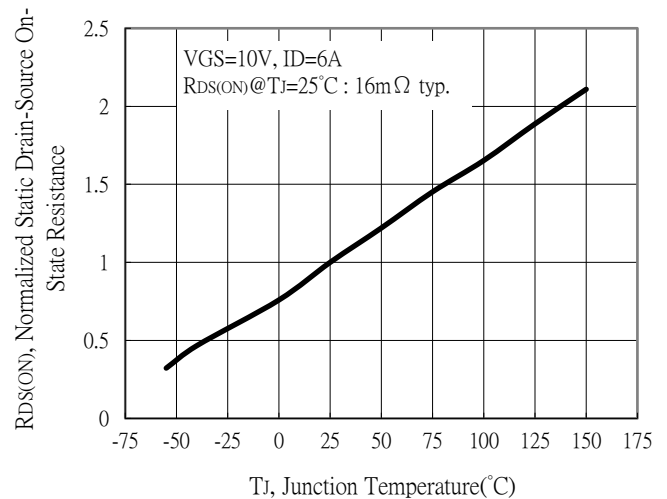
Body Diode Current vs Source-Drain Voltage



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



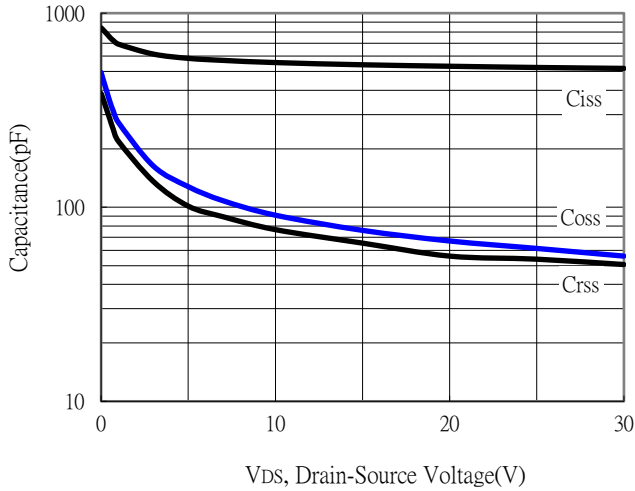
Drain-Source On-State Resistance vs Junction Temperature



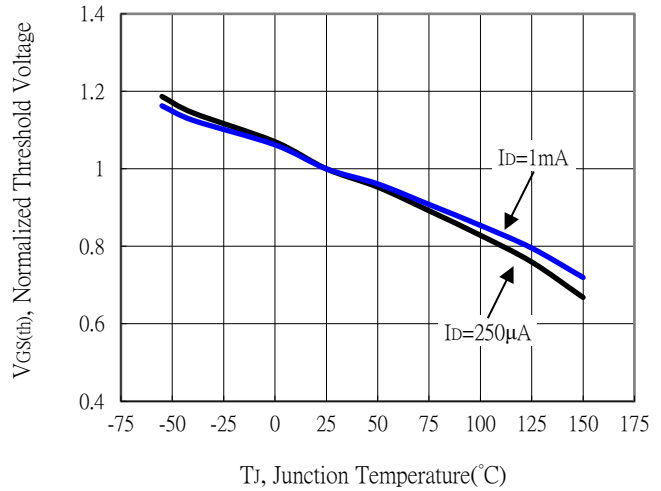


Typical Characteristics (Cont.) : Q1(N-channel)

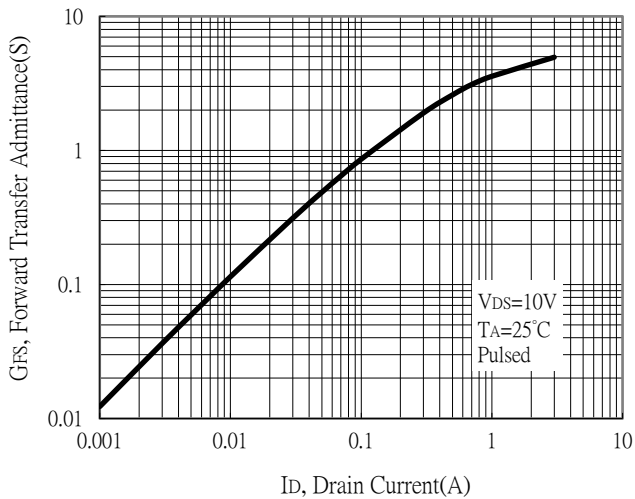
Capacitance vs Drain-to-Source Voltage



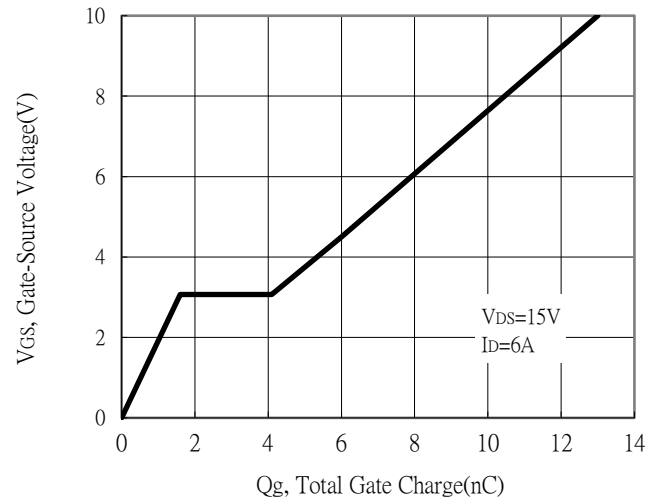
Threshold Voltage vs Junction Temperature



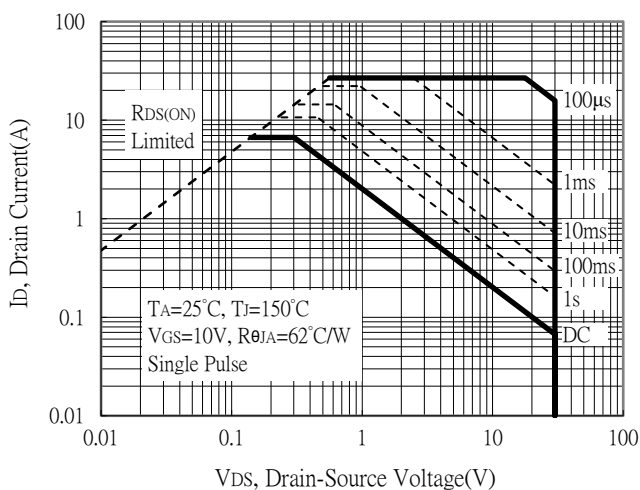
Forward Transfer Admittance vs Drain Current



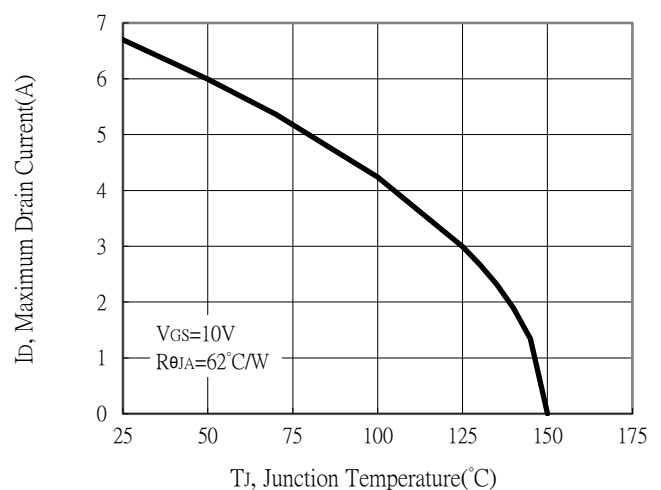
Gate Charge Characteristics



Maximum Safe Operating Area



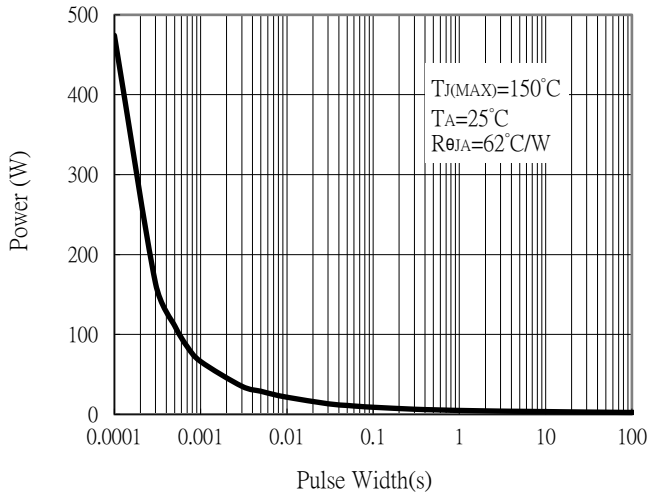
Maximum Drain Current vs Junction Temperature



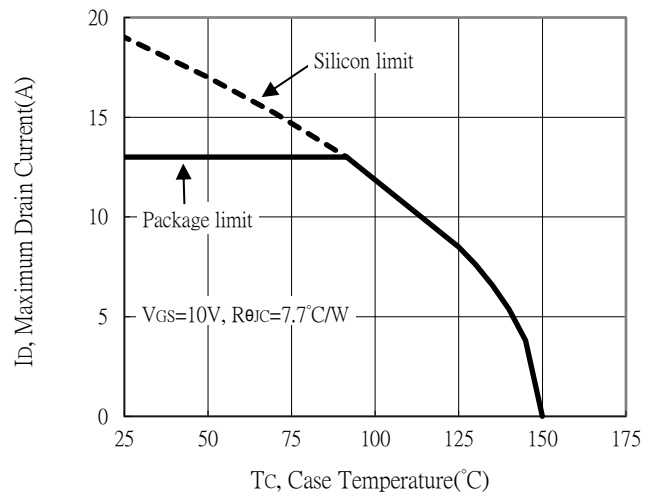


Typical Characteristics (Cont.) : Q1(N-channel)

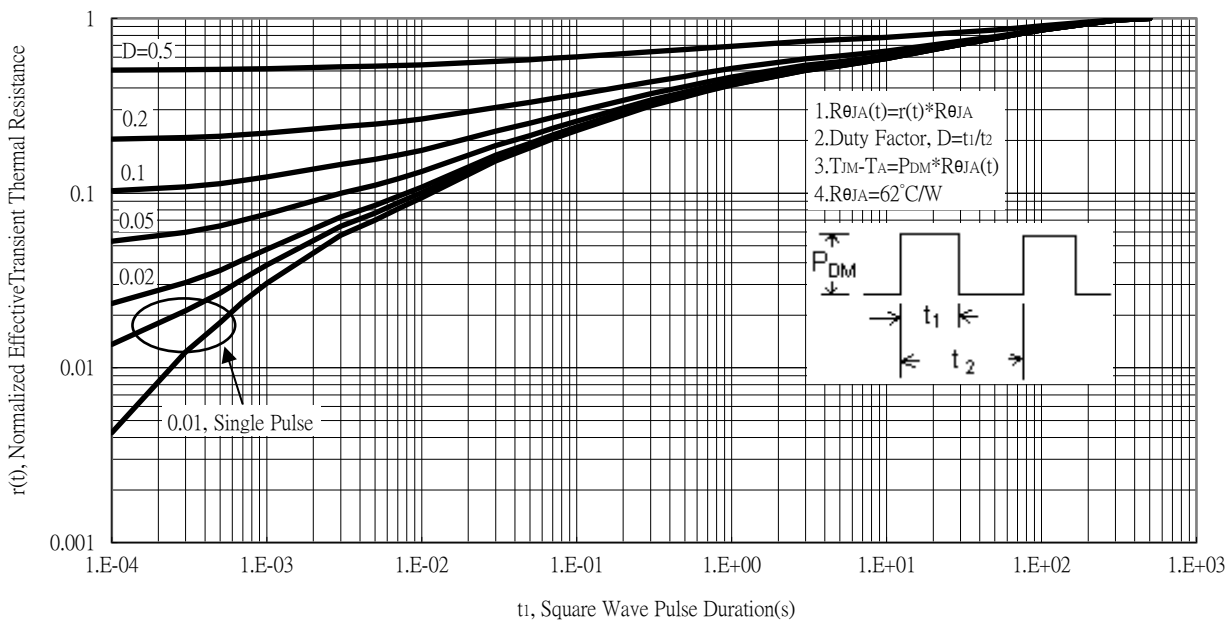
Single Pulse Power Rating, Junction to Ambient



Maximum Drain Current vs Case Temperature



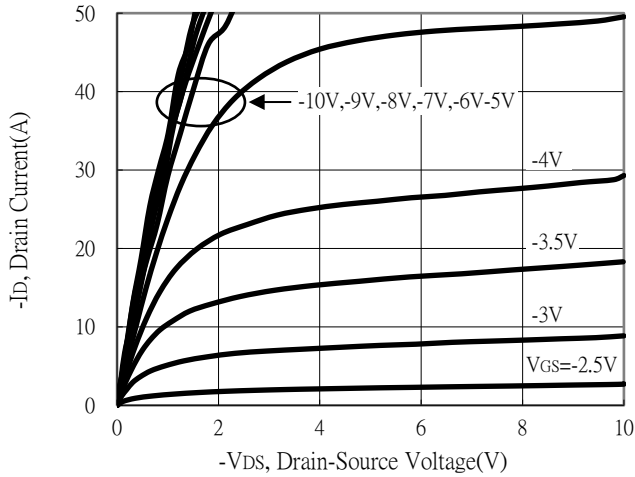
Transient Thermal Response Curves



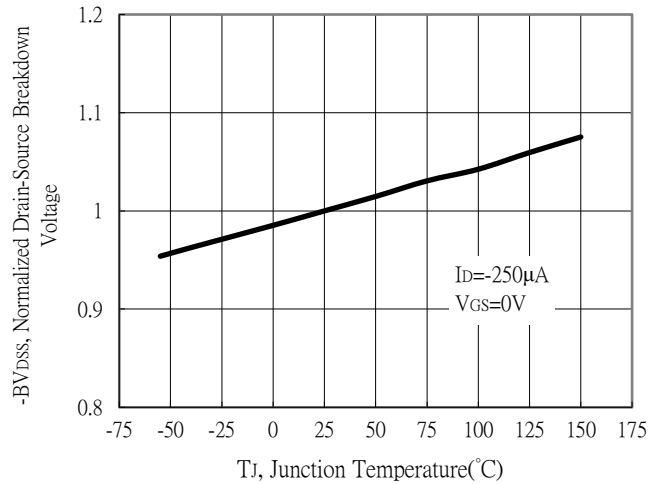


Typical Characteristics : Q2(P-channel)

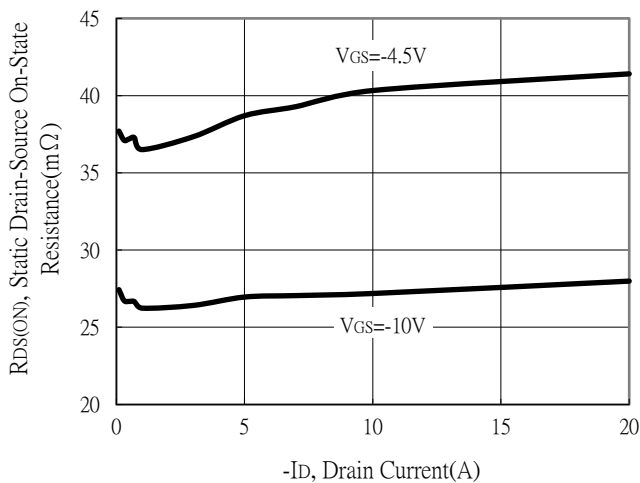
Typical Output Characteristics



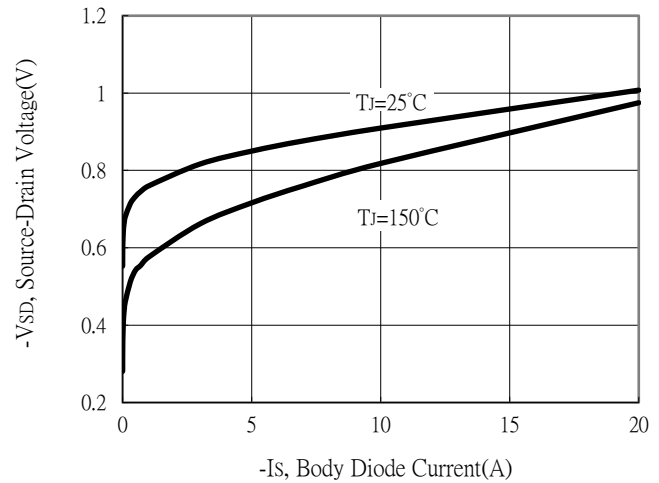
Breakdown Voltage vs Ambient Temperature



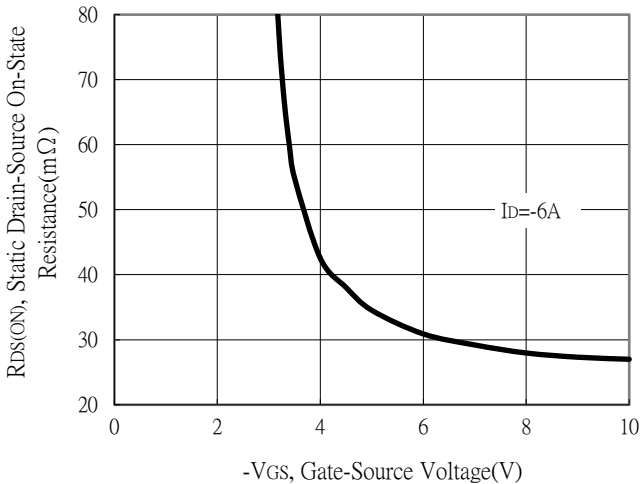
Static Drain-Source On-State resistance vs Drain Current



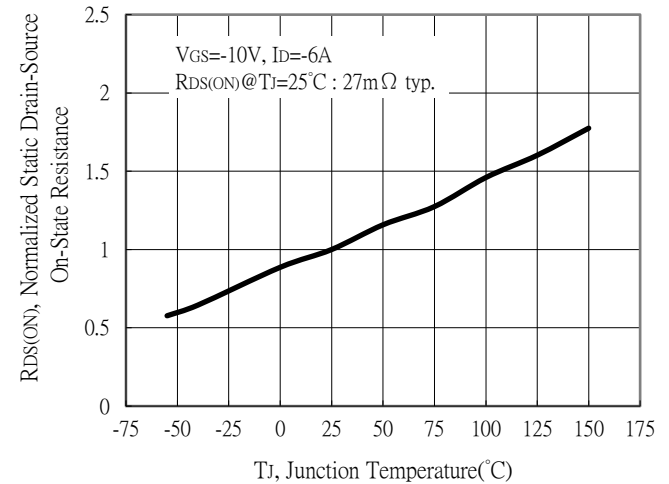
Body Diode Current vs Source-Drain Voltage



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



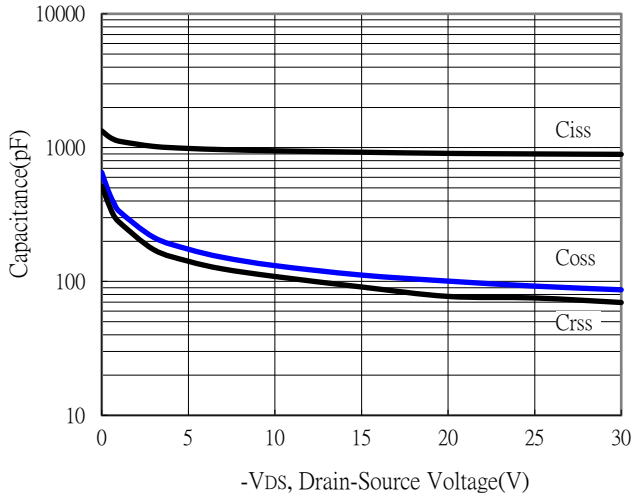
Drain-Source On-State Resistance vs Junction Temperature



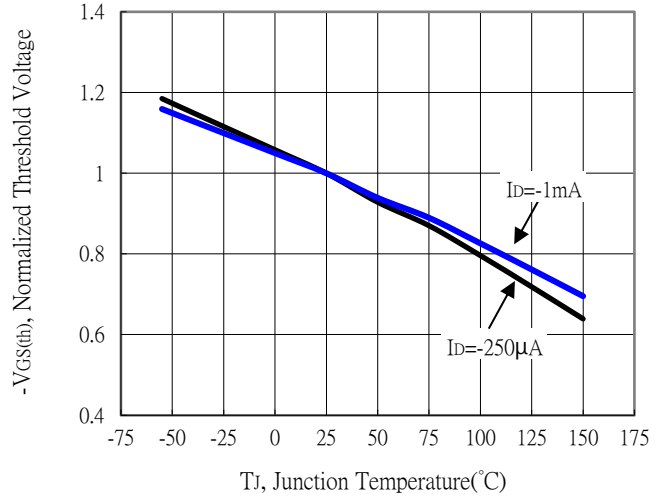


Typical Characteristics (Cont.) : Q2(P-channel)

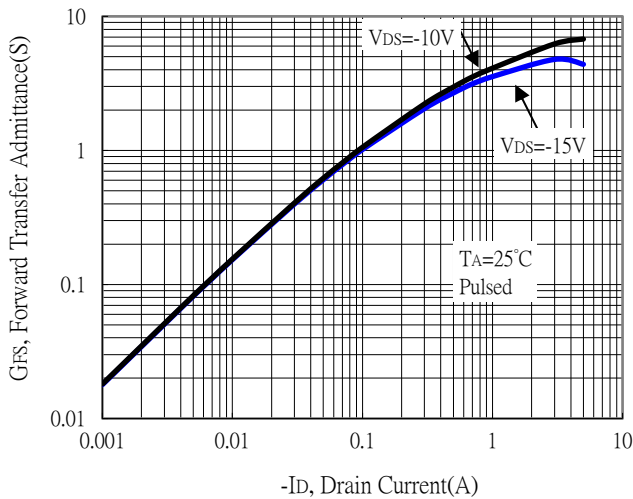
Capacitance vs Drain-to-Source Voltage



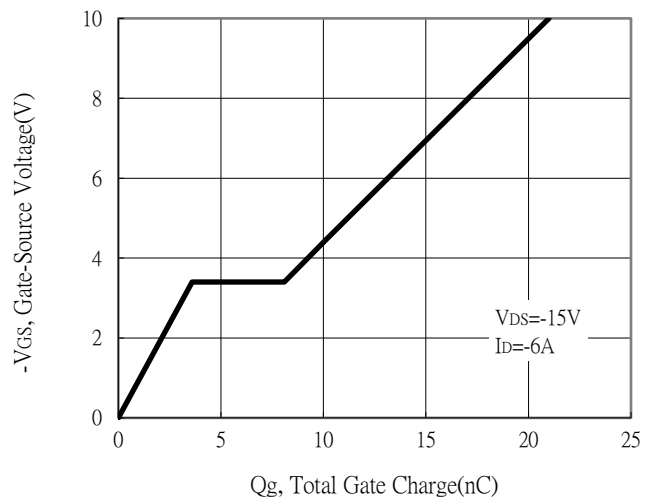
Threshold Voltage vs Junction Temperature



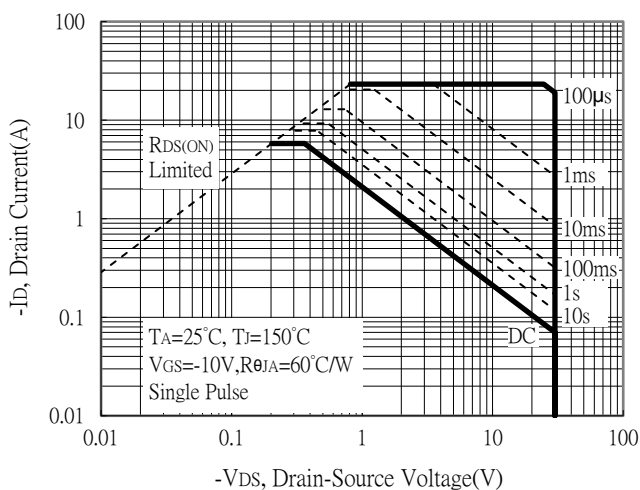
Forward Transfer Admittance vs Drain Current



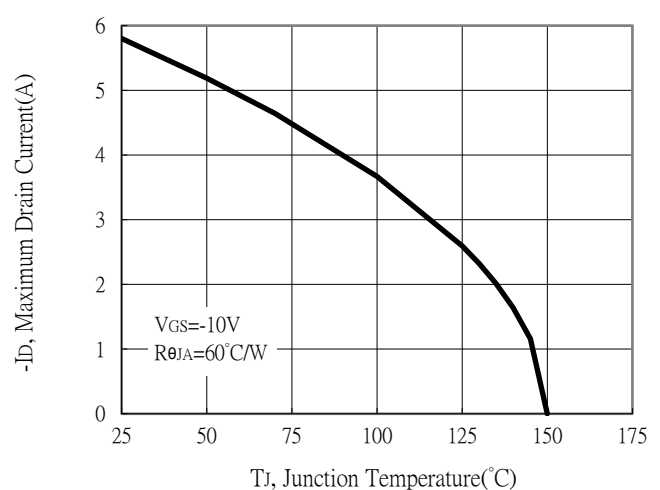
Gate Charge Characteristics



Maximum Safe Operating Area

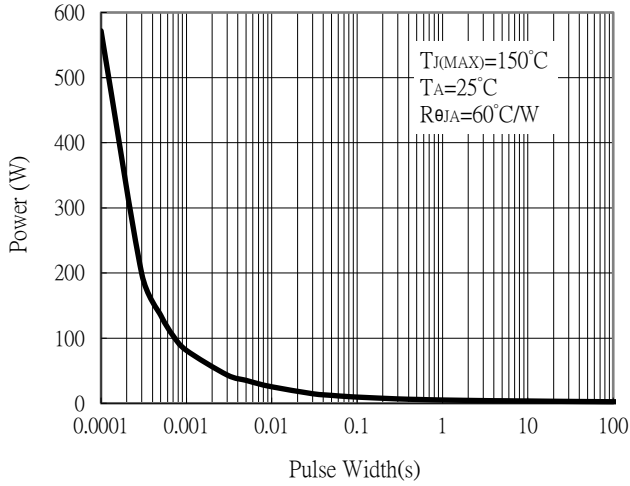


Maximum Drain Current vs Junction Temperature

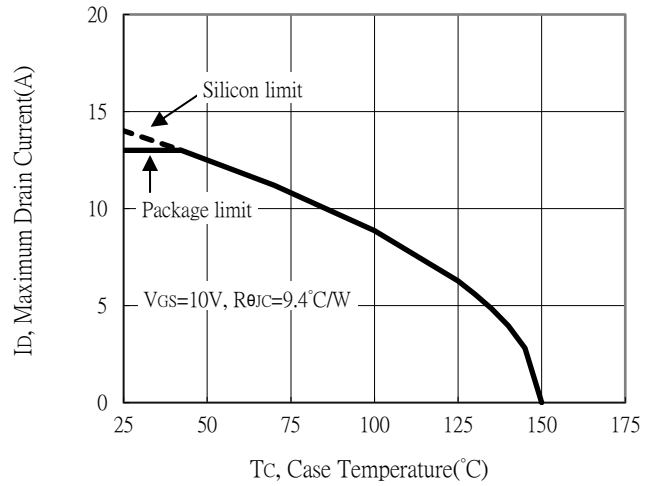


Typical Characteristics (Cont.) : Q2(P-channel)

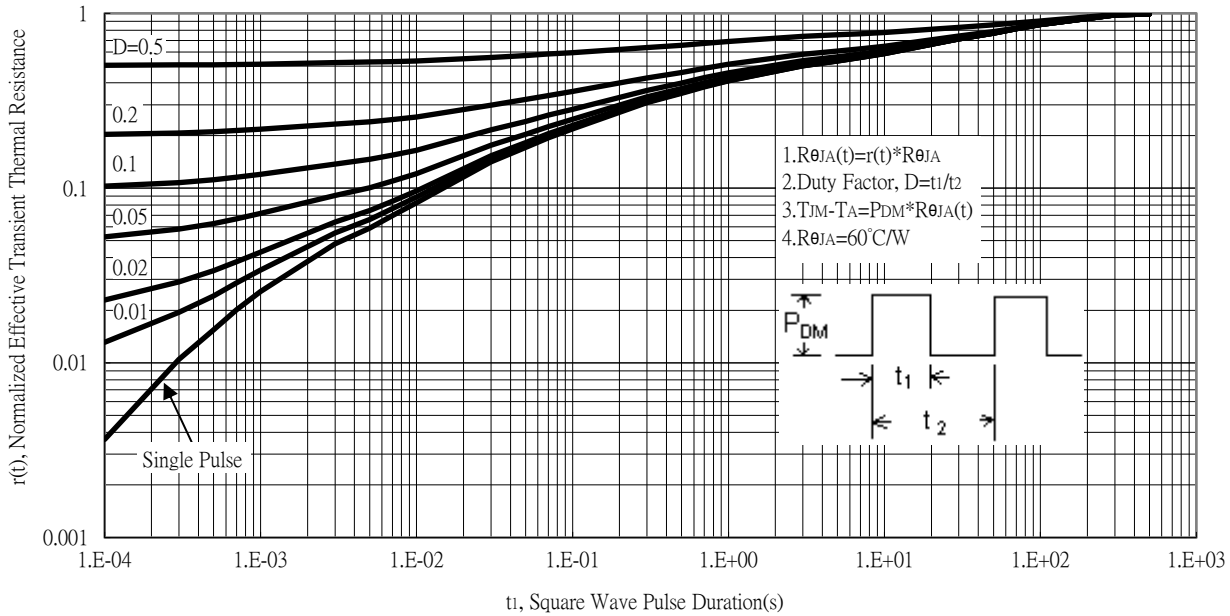
Single Pulse Power Rating, Junction to Ambient



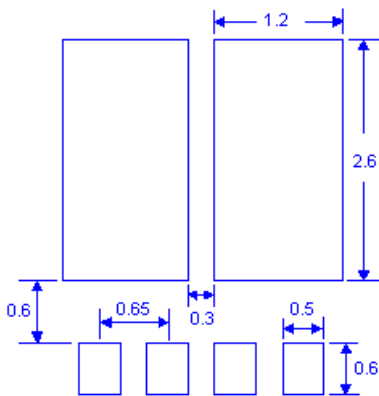
Maximum Drain Current vs Case Temperature



Transient Thermal Response Curves

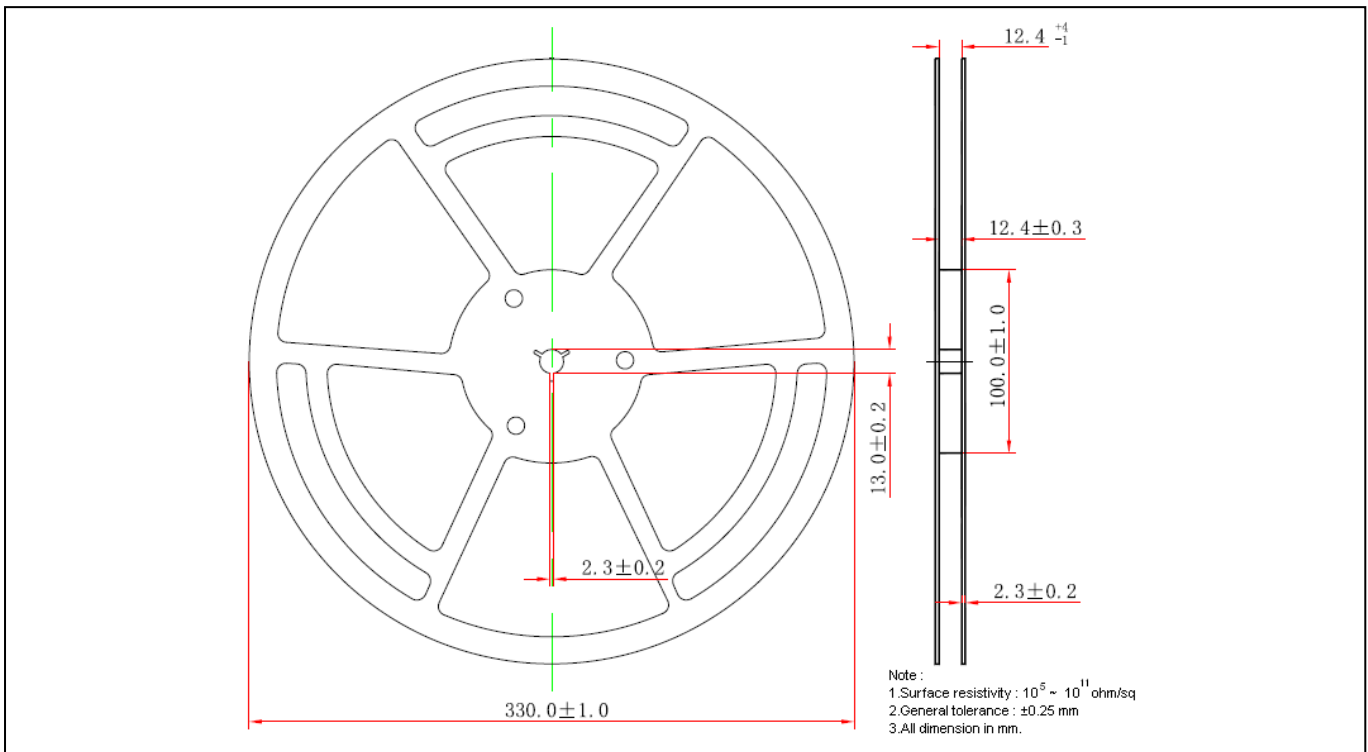


Recommended Soldering Footprint

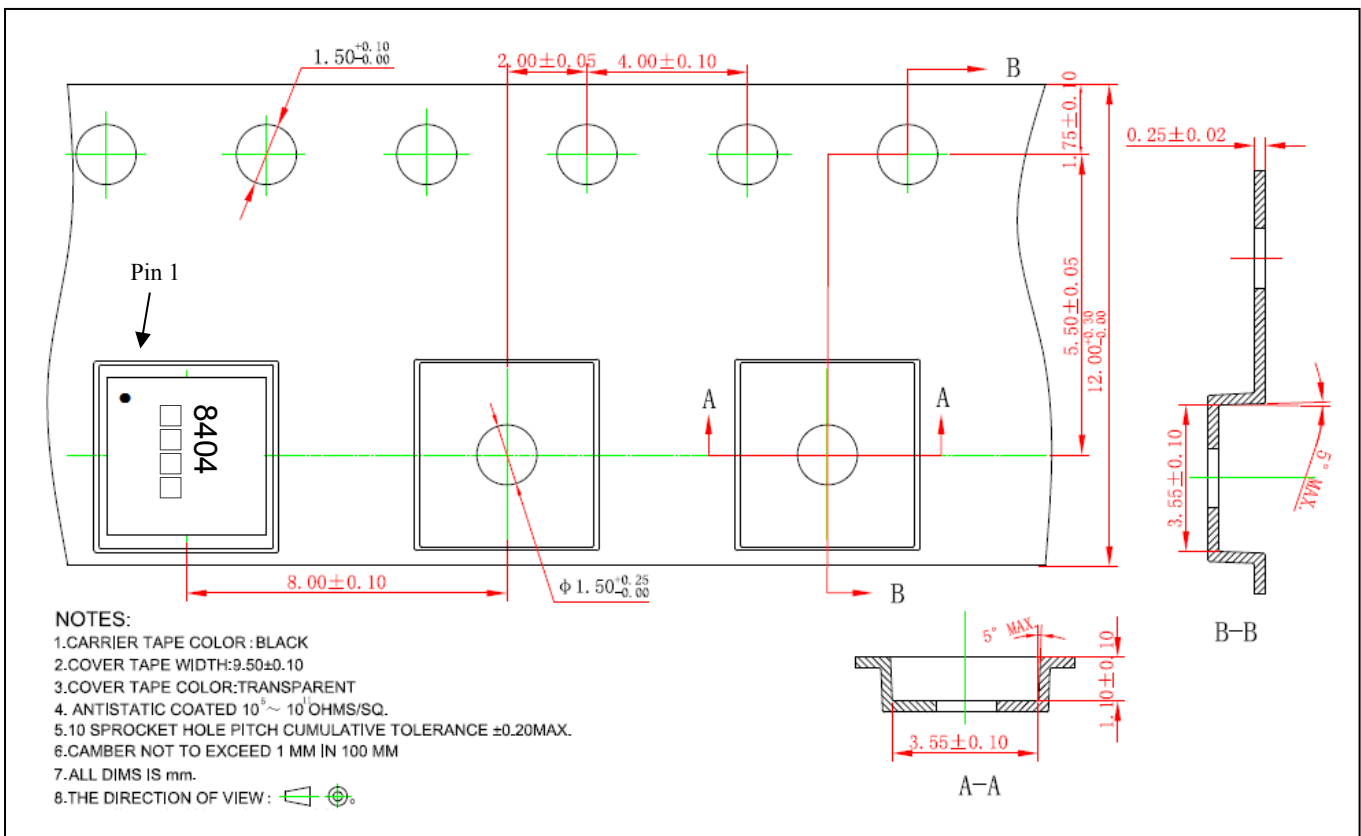


Unit : mm

Reel Dimension



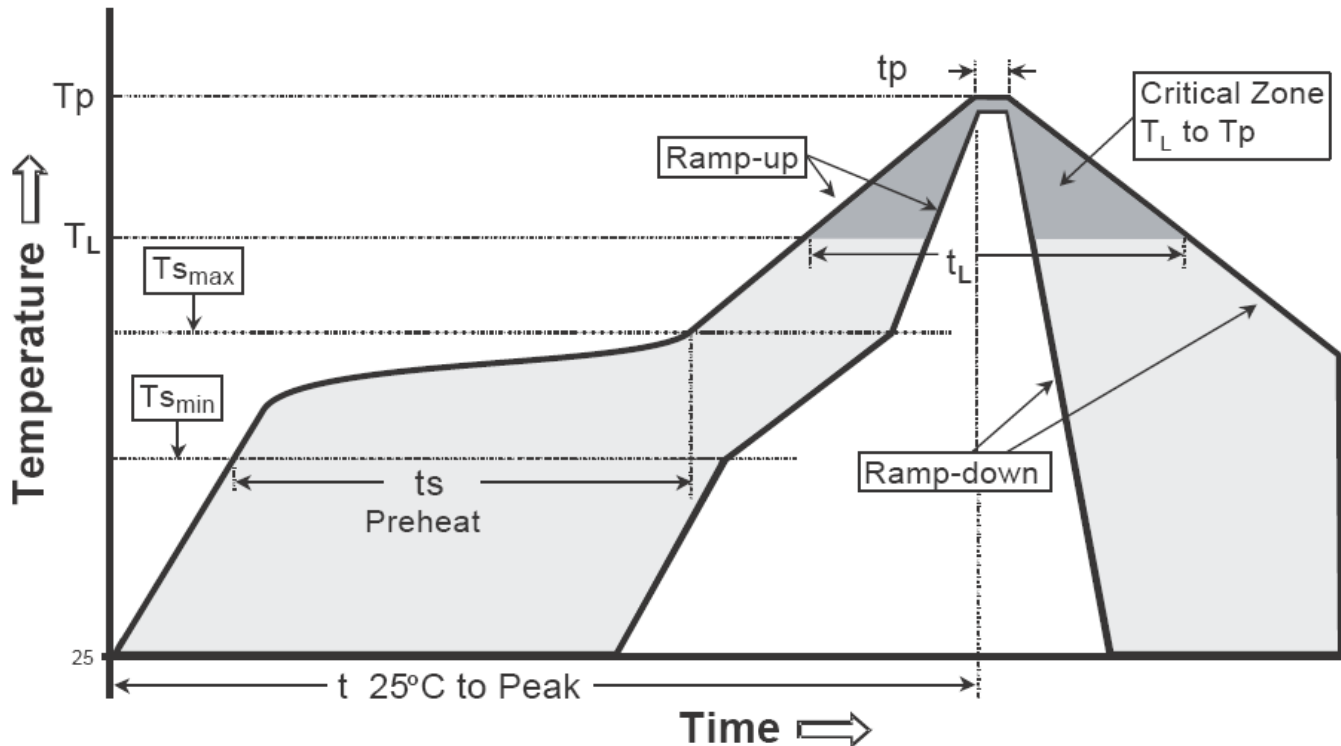
Carrier Tape Dimension



Recommended wave soldering condition

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

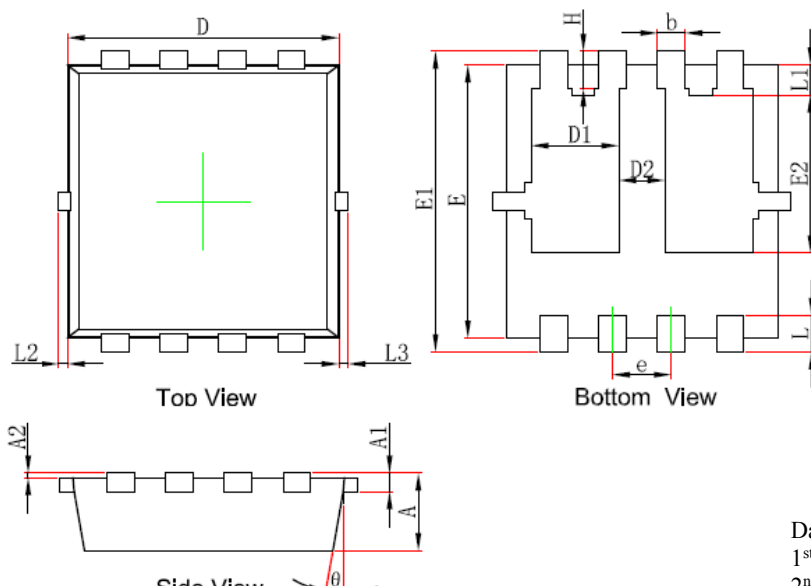
Recommended temperature profile for IR reflow



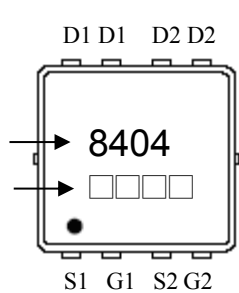
Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T _{s min})	100°C	150°C
-Temperature Max(T _{s max})	150°C	200°C
-Time(t _{s min} to t _{s max})	60-120 seconds	60-180 seconds
Time maintained above:		
-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(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 :1. All temperatures refer to topside of the package, measured on the package body surface.
 2. For devices mounted on FR-4 PCB of 1.6mm or equivalent grade PCB. If other grade PCB is used, care should be taken to match the coefficients of thermal expansion between components and PCB. If they are not matched well, the solder joints may crack or the bodies of the parts may crack or shatter as the assembly cools.

DFN3x3 Dimension (C forming)



Marking:



Device Code → **8404**

Date Code → [] [] [] []

S1 G1 S2 G2

8-Lead DFN3x3 Plastic Package
 CYStek Package Code: V8

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

DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.650	0.850	0.026	0.033	b	0.200	0.400	0.008	0.016
A1	0.152	REF	0.006	REF	e	0.550	0.750	0.022	0.030
A2	0.000	0.050	0.000	0.002	L	0.300	0.500	0.012	0.020
D	2.900	3.100	0.114	0.122	L1	0.180	0.480	0.007	0.019
D1	0.935	1.135	0.037	0.045	L2	0.100	TYP	0.004	TYP
D2	0.280	0.480	0.011	0.019	L3	0.100	TYP	0.004	TYP
E	2.900	3.100	0.114	0.122	H	0.315	0.515	0.012	0.020
E1	3.150	3.450	0.124	0.136	θ	9°	13°	9°	13°
E2	1.535	1.935	0.060	0.076					

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.

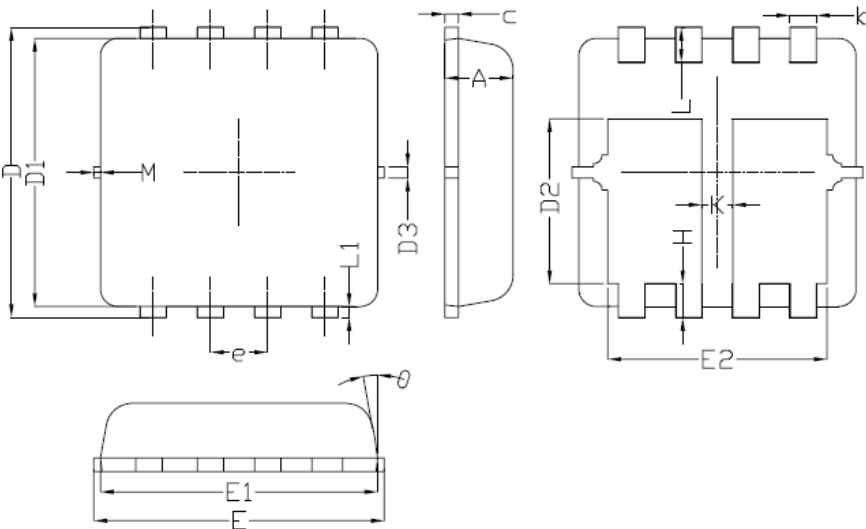
Material:

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

Important Notice:

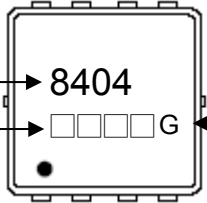
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DFN3x3 Dimension (G forming)



Marking:

D1 D1 D2 D2



Device Code → 8404
 Date Code → □□□□ G
 Assembly Site code:
 blank → Site 1 _____
 G → Site 2

8-Lead DFN3x3 Plastic Package
 CYStek Package Code: V8

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

DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.70	0.80	0.028	0.031	E2	2.39	2.59	0.094	0.102
b	0.25	0.35	0.010	0.014	e	0.65	BSC	0.026	BSC
c	0.10	0.25	0.004	0.010	H	0.30	0.50	0.012	0.020
D	3.25	3.45	0.128	0.136	L	0.30	0.50	0.012	0.020
D1	3.00	3.20	0.118	0.126	L1	0.13	TYP.	0.005	TYP.
D2	1.78	1.98	0.070	0.078	K	0.30	-	0.012	-
D3	0.13	TYP.	0.005	TYP.	θ	-	12°	-	12°
E	3.00	3.40	0.118	0.134	M	-	0.15	-	0.006
E1	3.00	3.20	0.118	0.126					

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Material:

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

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