

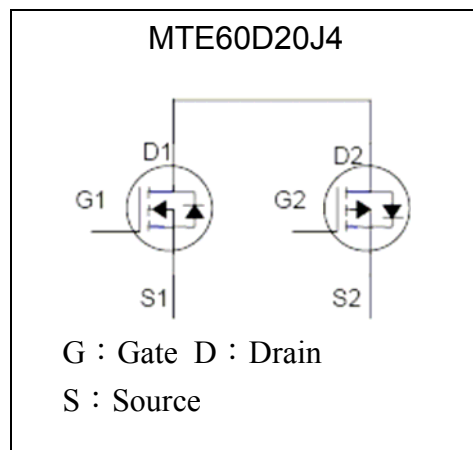
N & P-Channel Enhancement Mode Power MOSFET

Features

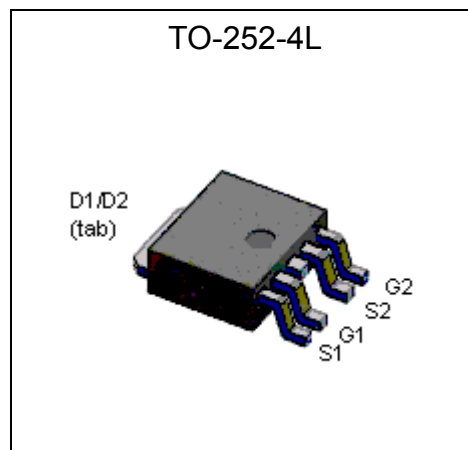
- Low Gate Charge
- Simple Drive Requirement
- RoHS compliant & Halogen-free package

	N-CH	P-CH
BV_{DSS}	60V	-60V
$I_D @ V_{GS}=10V(-10V), T_A=25^{\circ}C$	5.2A	-4.2A
$I_D @ V_{GS}=10V(-10V), T_C=25^{\circ}C$	21A	-18A
$R_{DS(on)}(typ.) @ V_{GS}=(-)10V$	20.9 m Ω	39.8 m Ω
$R_{DS(on)}(typ.) @ V_{GS}=(-)4.5V$	30.1 m Ω	53.2 m Ω

Equivalent Circuit



Outline



Absolute Maximum Ratings ($T_A=25^{\circ}C$, unless otherwise noted)

Parameter	Symbol	Limits		Unit
		N-channel	P-channel	
Drain-Source Voltage	V _{DS}	60	-60	V
Gate-Source Voltage	V _{GS}	±20	±20	
Continuous Drain Current @ T _C =25°C, V _{GS} =10V(-10V) (Note1)	I _D	21	-18	A
Continuous Drain Current @ T _C =100°C, V _{GS} =10V(-10V) (Note1)		14.9	-13.1	
Continuous Drain Current @ T _A =25°C, V _{GS} =10V(-10V) (Note4)		5.2	-4.2	
Continuous Drain Current @ T _A =70°C, V _{GS} =10V(-10V) (Note4)		4.2	-3.1	
Pulsed Drain Current *1 (Note3)	I _{DM}	30	-30	
Avalanche Current	I _{AS}	6.5	-9.3	
Avalanche Energy @ L=0.5mH, V _{GS} =10V(-10V), I _{AS} =6.5A(-9.3A)	E _{AS}	10.6	21.6	mJ
Total Power Dissipation (T _C =25°C) (Note1)	P _D	25		W
Total Power Dissipation (T _C =100°C) (Note1)		12.5		
Total Power Dissipation (T _A =25°C) (Note2)	P _{DSM}	2.4		
Total Power Dissipation (T _A =70°C) (Note2)		1.7		
Operating Junction and Storage Temperature Range	T _j , T _{stg}	-55~+175		°C

Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{th,j-c}$	6	°C/W
Thermal Resistance, Junction-to-ambient, max (Note2)	$R_{th,j-a}$	62.5	
Thermal Resistance, Junction-to-ambient, max (Note4)		90	

- Note : 1.The power dissipation P_D is based on $T_{J(MAX)}=175^{\circ}\text{C}$, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1 in²FR-4 board with 2 oz. copper, in a still air environment with $T_A=25^{\circ}\text{C}$. The power dissipation P_{DSM} is based on $R_{\theta JA}$ and the maximum allowed junction temperature of 150°C . The value in any given application depends on the user's specific board design.
3. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}=175^{\circ}\text{C}$. Ratings are based on low frequency and low duty cycles to keep initial $T_J=25^{\circ}\text{C}$.
4. When mounted on the minimum pad size recommended (PCB mount), $t \leq 10\text{s}$.

N-CH Characteristics ($T_c=25^{\circ}\text{C}$, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	60	-	-	V	V _{GS} =0V, I _D =250μA
V _{GS(th)}	1.0	-	2.5		V _{DS} =V _{GS} , I _D =250μA
I _{GSS}	-	-	±100	nA	V _{GS} =±20V, V _{DS} =0V
I _{DSS}	-	-	1	μA	V _{DS} =32V, V _{GS} =0V
	-	-	10		V _{DS} =30V, V _{GS} =0V, T _j =55°C
R _{DS(ON)} *1	-	20.9	28	mΩ	V _{GS} =10V, I _D =10A
	-	30.1	38		V _{GS} =4.5V, I _D =4A
G _{FS} *1	-	7.7	-	S	V _{DS} =5V, I _D =5A
Dynamic					
Q _g *1	-	11.2	-	nC	V _{DS} =20V, I _D =5A, V _{GS} =10V
Q _{gs} *1	-	2.3	-		
Q _{gd} *1	-	2.1	-		
t _{d(ON)} *1	-	7	-	ns	V _{DS} =20V, I _D =1A, V _{GS} =10V, R _G =6Ω
tr *1	-	17	-		
t _{d(OFF)} *1	-	23.8	-		
t _f *1	-	6.6	-		
C _{iss}	-	604	-	pF	V _{DS} =15V, V _{GS} =0V, f=1MHz
C _{oss}	-	56	-		
C _{rss}	-	45	-		
Source-Drain Diode					
I _S *1	-	-	5	A	
I _{SM} *2	-	-	30		
V _{SD} *1	-	0.74	1	V	I _S =1A, V _{GS} =0V
trr *1	-	5.9	-	ns	I _F =5A, V _{GS} =0, dI _F /dt=100A/μs
Q _{rr} *1	-	2.4	-	nC	

Note : *1.Pulse Test : Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$

*2.Pulse width limited by maximum junction temperature.

P-CH Characteristics (Tc=25°C, unless otherwise specified)

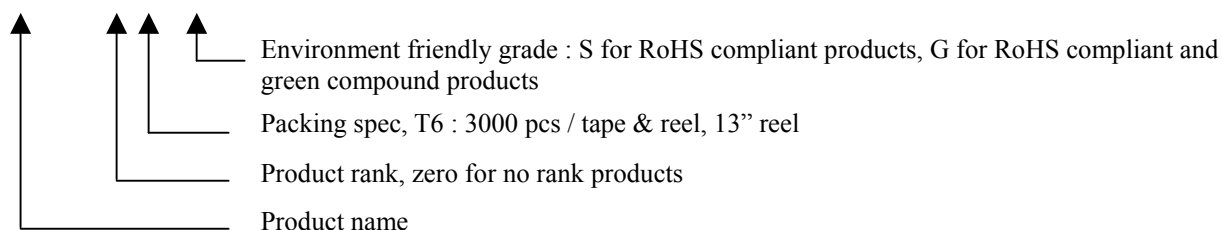
Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	-60	-	-	V	V _{GS} =0V, I _D =-250μA
V _{GS(th)}	-1.0	-	-2.5		V _{DS} =V _{GS} , I _D =-250μA
I _{GSS}	-	-	±100	nA	V _{GS} =±20V, V _{DS} =0V
I _{DSS}	-	-	-1	μA	V _{DS} =-32V, V _{GS} =0V
	-	-	-10		V _{DS} =-30V, V _{GS} =0V, T _j =55°C
R _{DS(ON)} *1	-	39.8	53.2	mΩ	V _{GS} =-10V, I _D =-7A
	-	49.2	69		V _{GS} =-4.5V, I _D =-4A
G _{FS} *1	-	10	-	S	V _{DS} =-5V, I _D =-4.9A
Dynamic					
Q _g *1	-	19.2	-	nC	V _{DS} =-20V, I _D =-4.9A, V _{GS} =-10V
Q _{gs} *1	-	3.2	-		
Q _{gd} *1	-	2.9	-		
t _{d(ON)} *1	-	7	-	ns	V _{DS} =-20V, I _D =-1A, V _{GS} =-10V, R _G =6Ω
t _r *1	-	16.6	-		
t _{d(OFF)} *1	-	87	-		
t _f *1	-	64.4	-		
C _{iss}	-	1053	-	pF	V _{DS} =-15V, V _{GS} =0V, f=1MHz
C _{oss}	-	98	-		
C _{rss}	-	74	-		
Source-Drain Diode					
I _S *1	-	-	-4.2	A	
I _{SM} *2	-	-	-30		
V _{SD} *1	-	-0.74	-1	V	I _S =-1A, V _{GS} =0V
t _{rr} *1	-	8.3	-	ns	I _F =-5A, V _{GS} =0, dI _F /dt=100A/μs
O _{rr} *1	-	3.4	-	nC	

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

*2.Pulse width limited by maximum junction temperature.

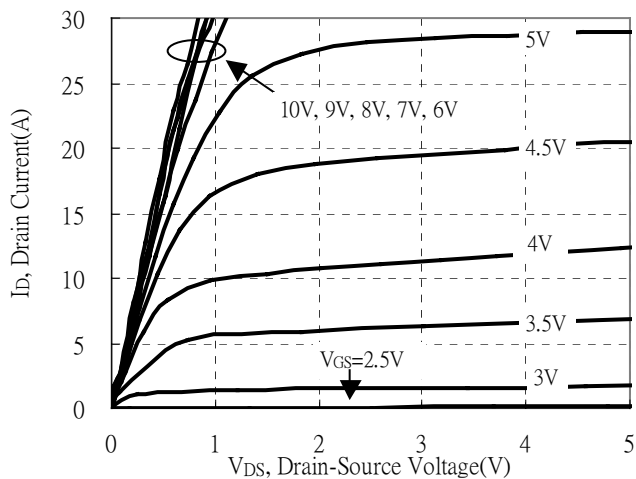
Ordering Information

Device	Package	Shipping
MTE60D20J4-0-T6-G	TO-252 (RoHS compliant & Halogen-free package)	3000 pcs / Tape & Reel

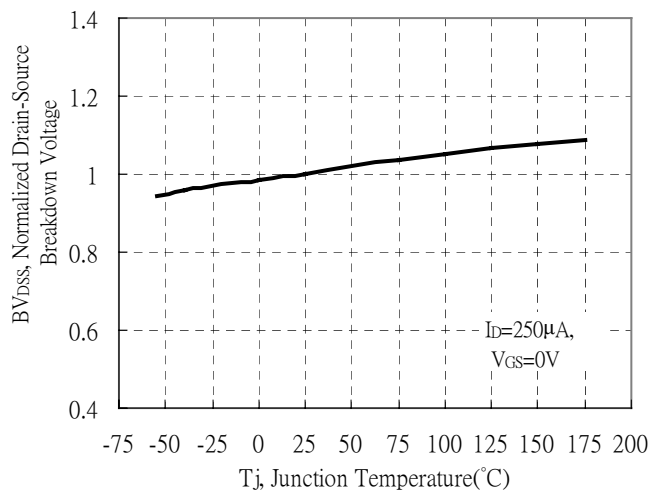


Q1, N-CH Typical Characteristics

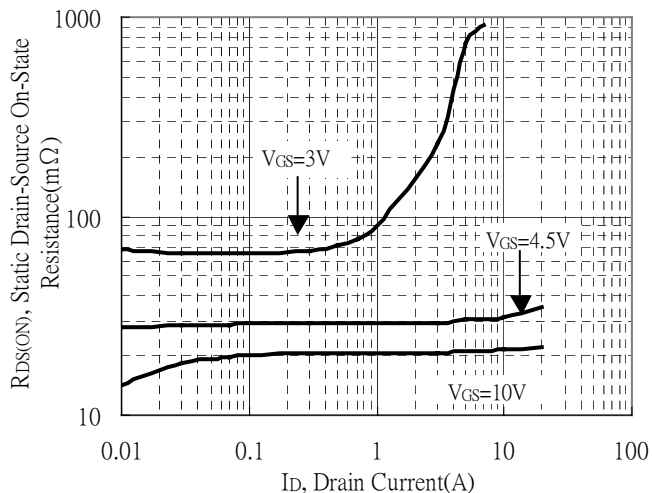
Typical Output Characteristics



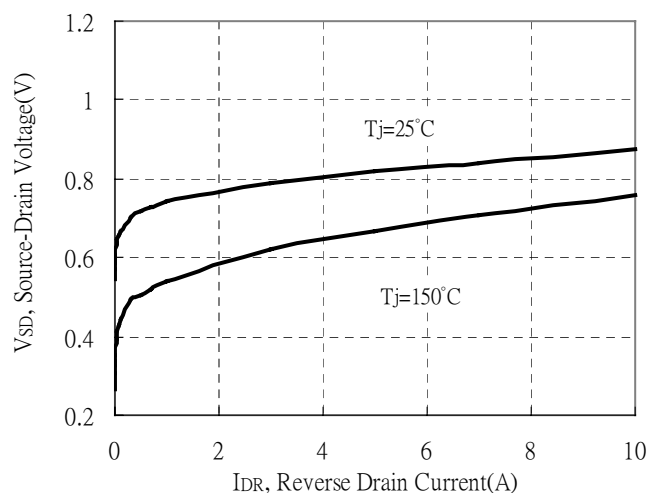
Brekdown Voltage vs Ambient Temperature



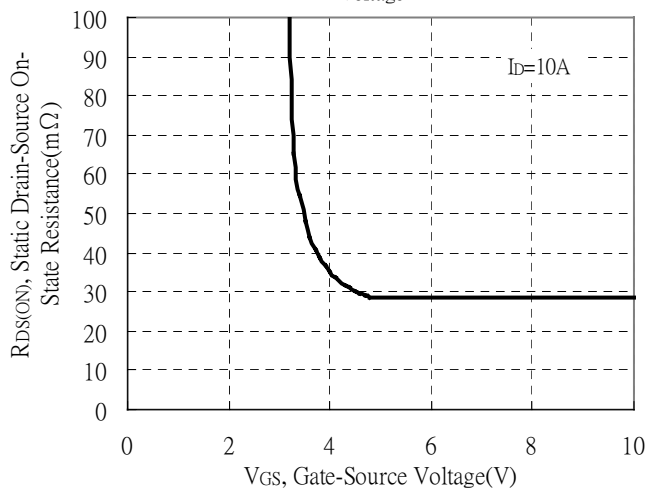
Static Drain-Source On-State resistance vs Drain Current



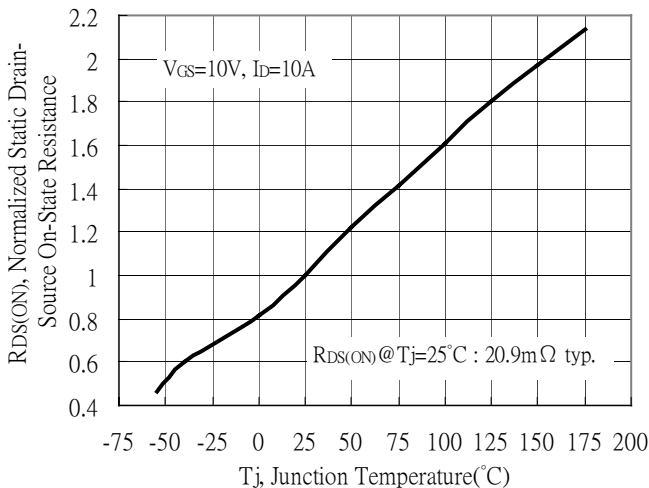
Reverse Drain Current vs Source-Drain Voltage



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

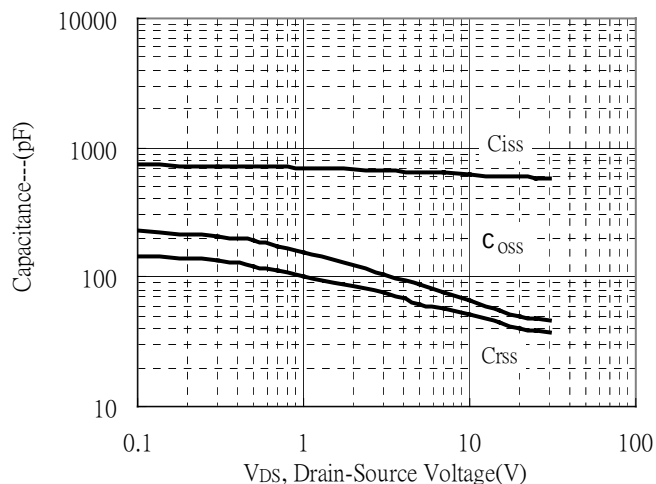


Drain-Source On-State Resistance vs Junction Temperature

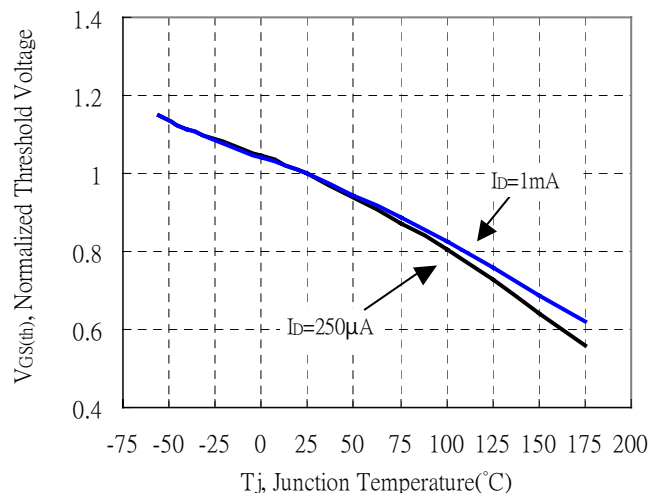


Q1, N-CH Typical Characteristics(Cont.)

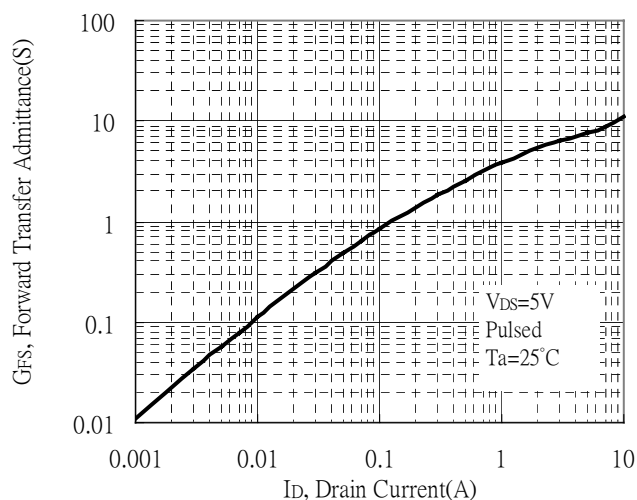
Capacitance vs Drain-to-Source Voltage



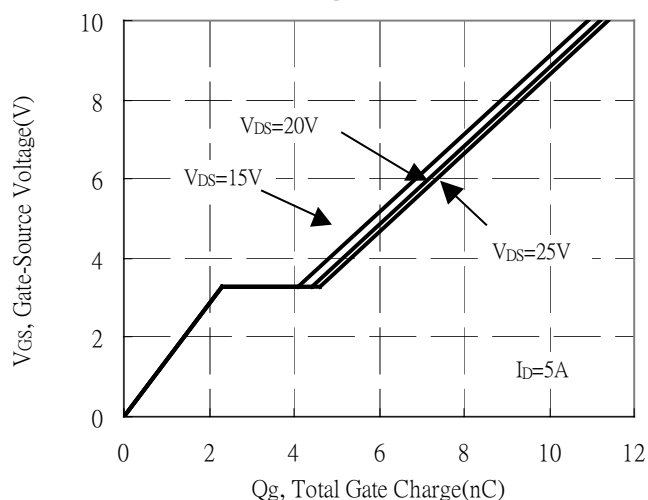
Threshold Voltage vs Junction Temperature



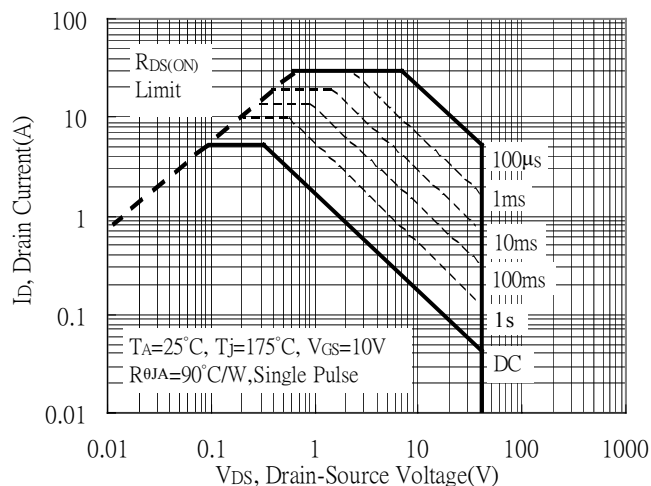
Forward Transfer Admittance vs Drain Current



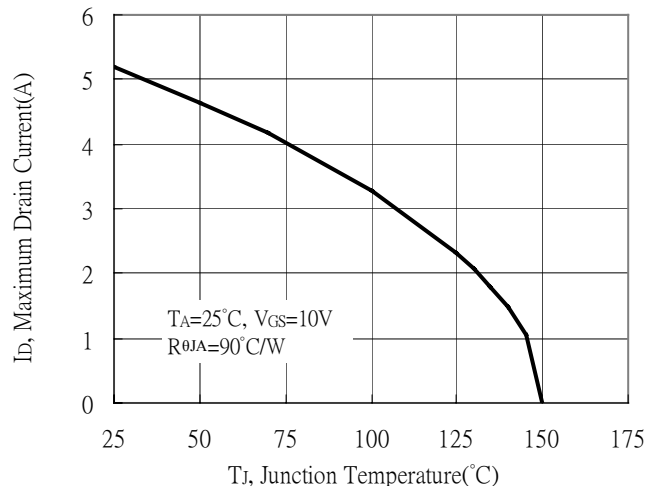
Gate Charge Characteristics



Maximum Safe Operating Area

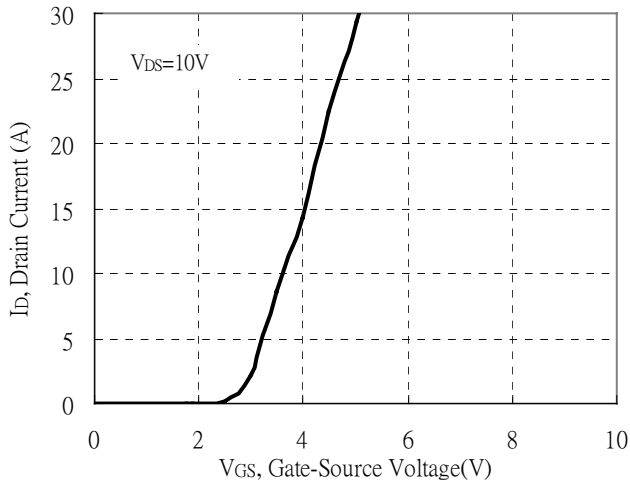


Maximum Drain Current vs Junction Temperature

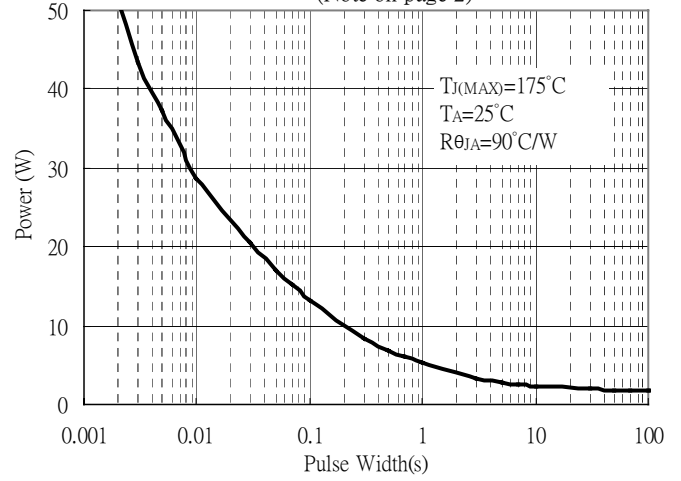


Q1, N-CH Typical Characteristics(Cont.)

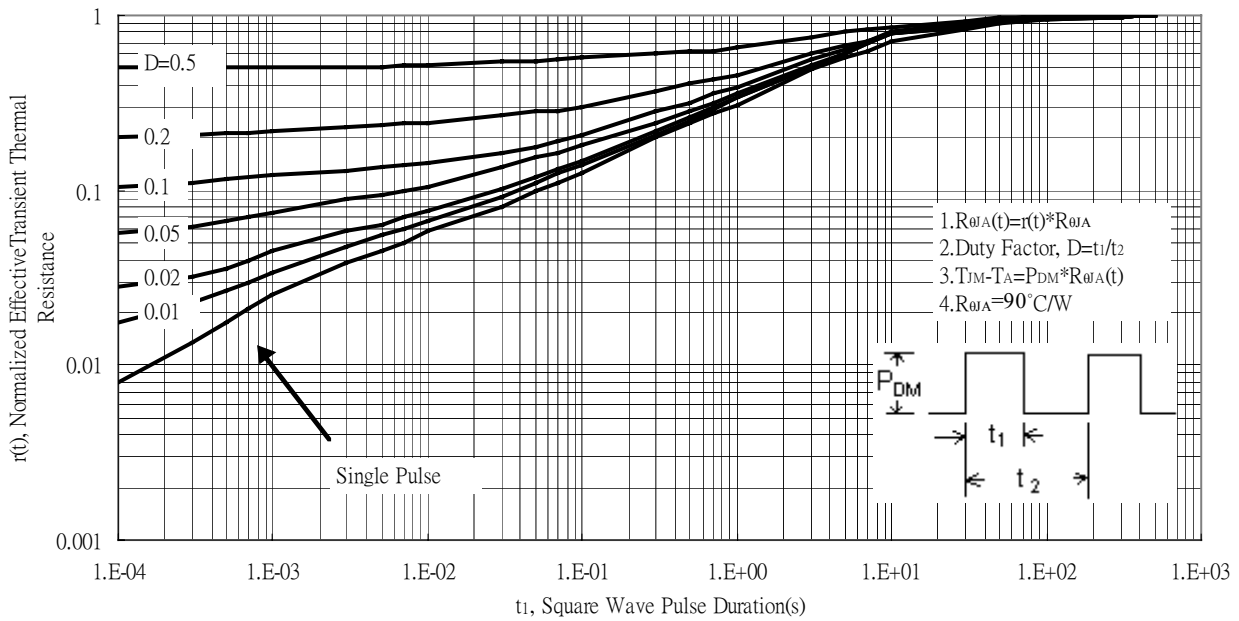
Typical Transfer Characteristics



Single Pulse Power Rating, Junction to Ambient
(Note on page 2)

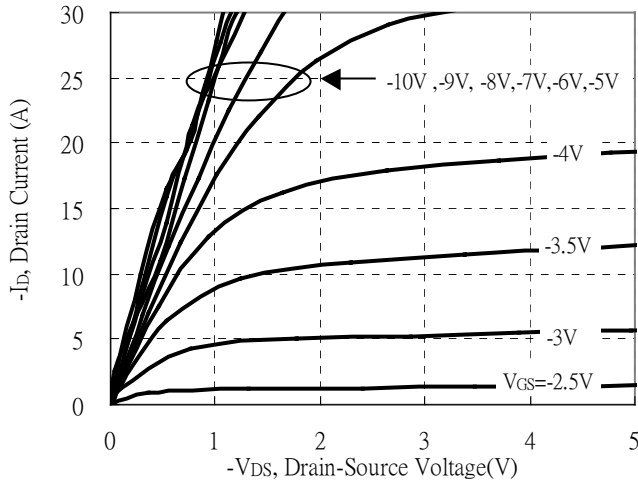


Transient Thermal Response Curves

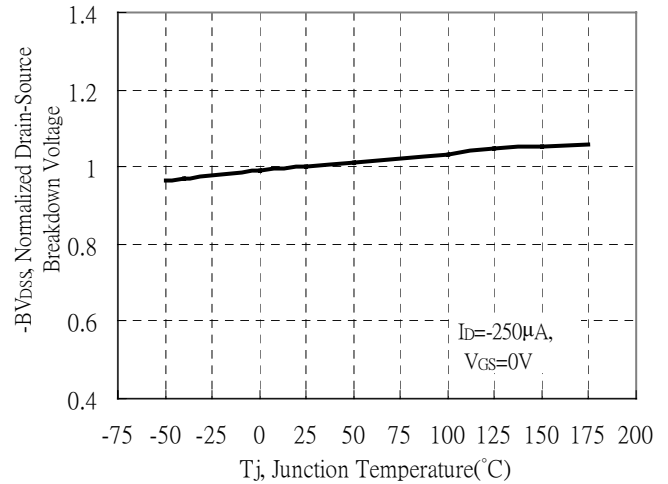


Q2, P-CH Typical Characteristics

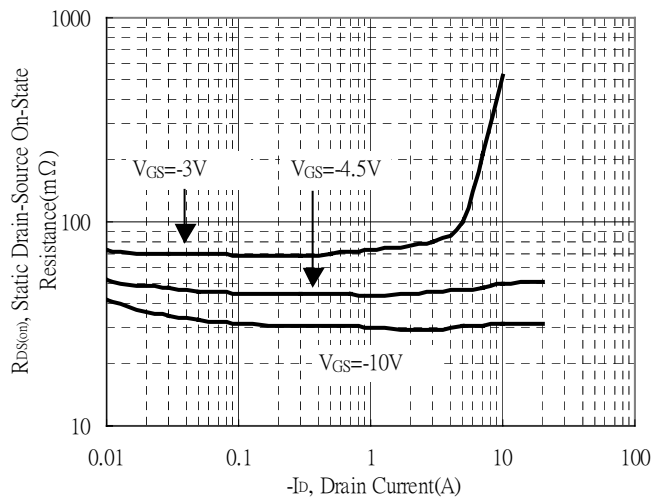
Typical Output Characteristics



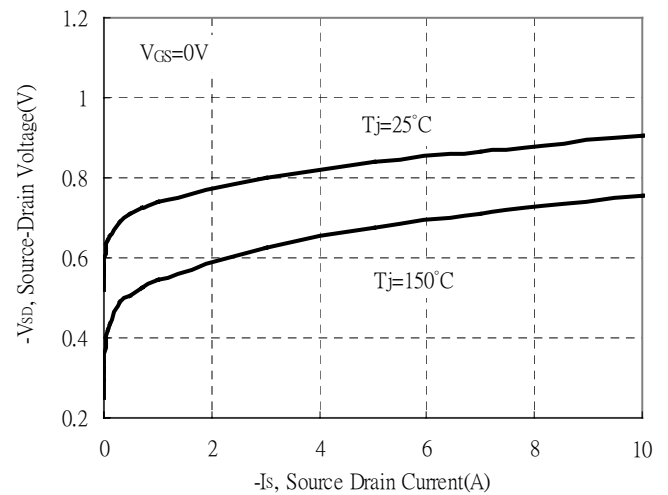
Breakdown Voltage vs Ambient Temperature



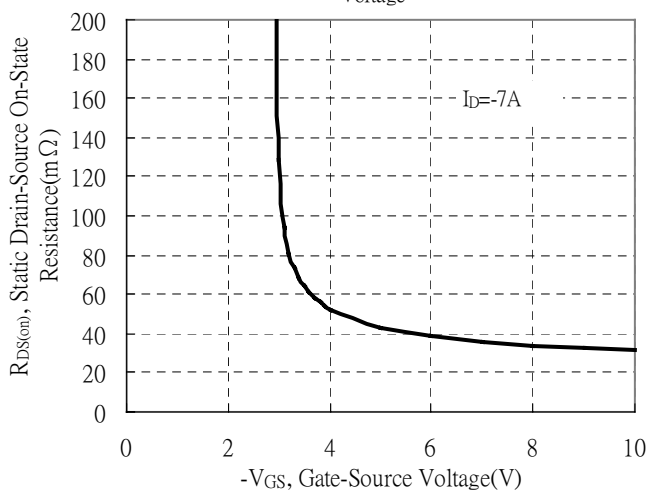
Static Drain-Source On-State resistance vs Drain Current



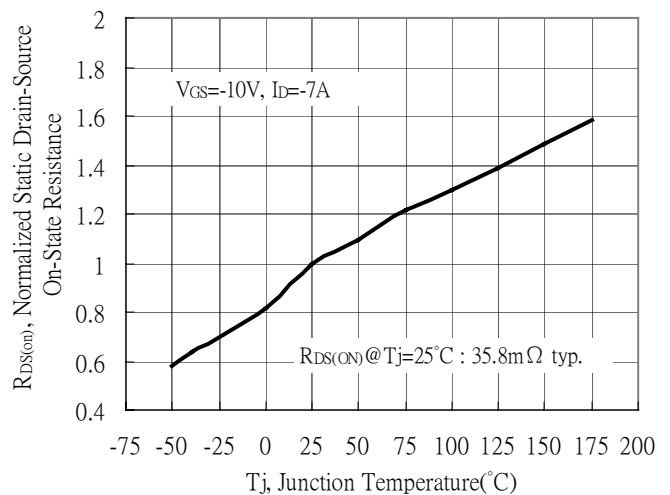
Source Drain Current vs Source-Drain Voltage



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

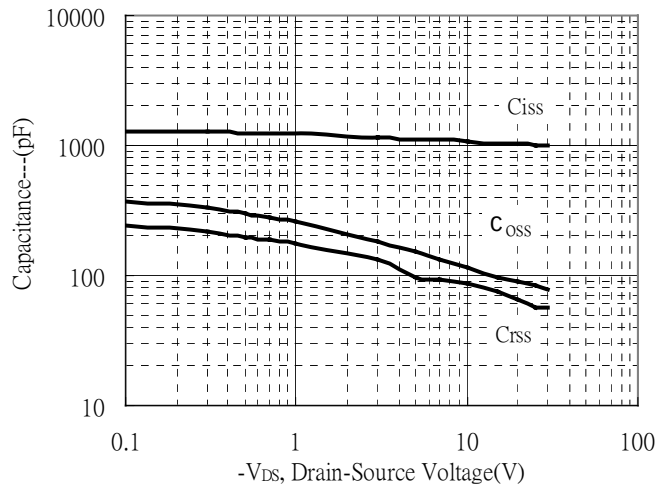


Drain-Source On-State Resistance vs Junction Temperature

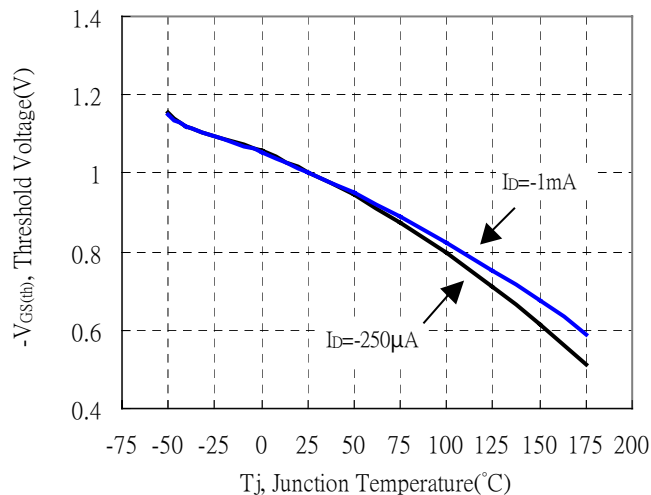


Q2, P-CH Typical Characteristics(Cont.)

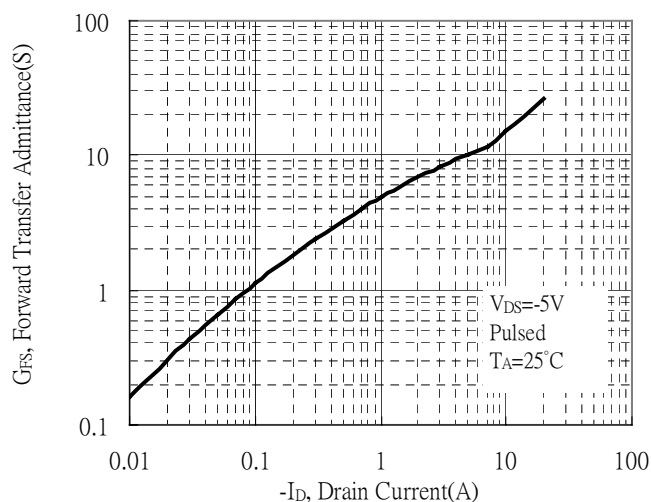
Capacitance vs Drain-to-Source Voltage



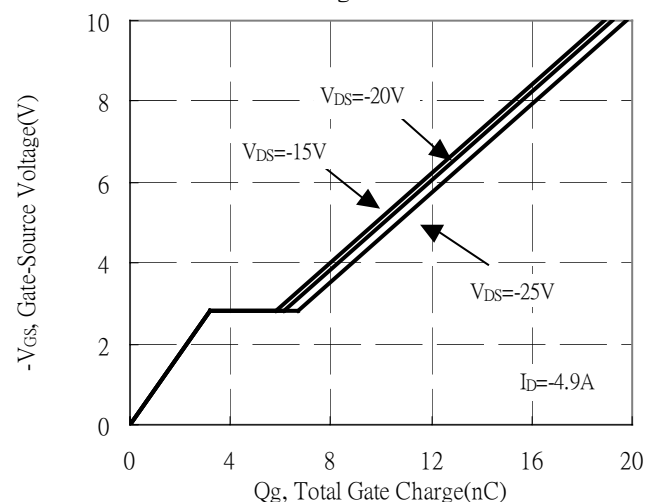
Threshold Voltage vs Junction Temperature



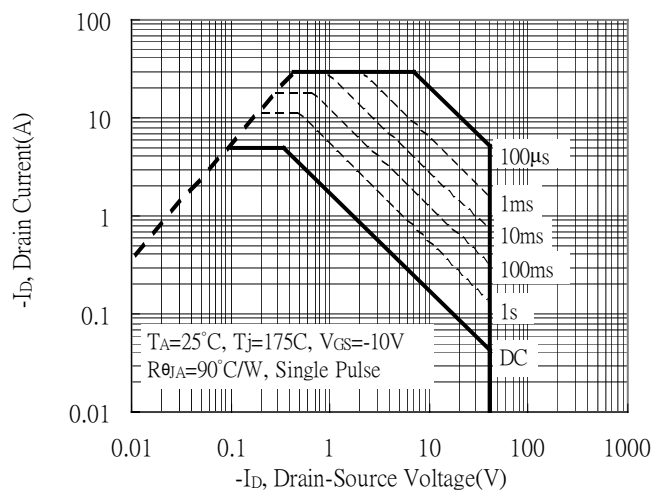
Forward Transfer Admittance vs Drain Current



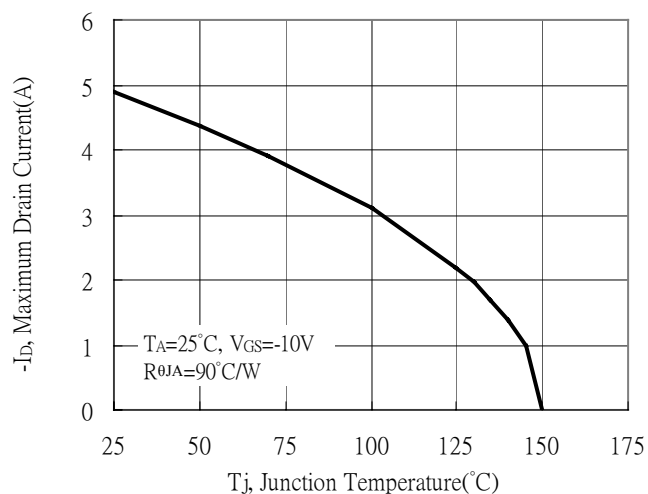
Gate Charge Characteristics



Maximum Safe Operating Area

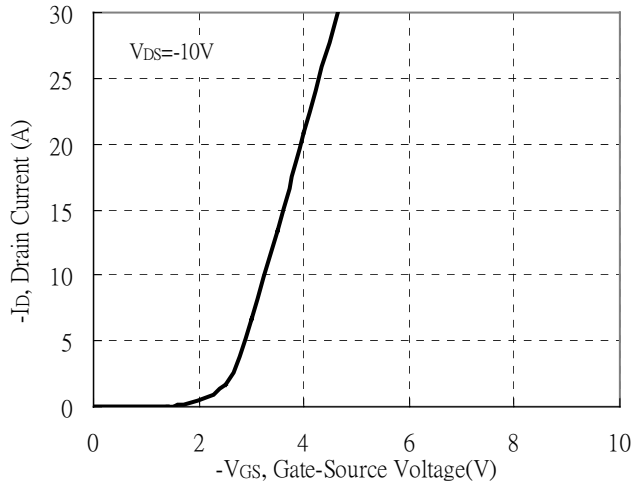


Maximum Drain Current vs Junction Temperature

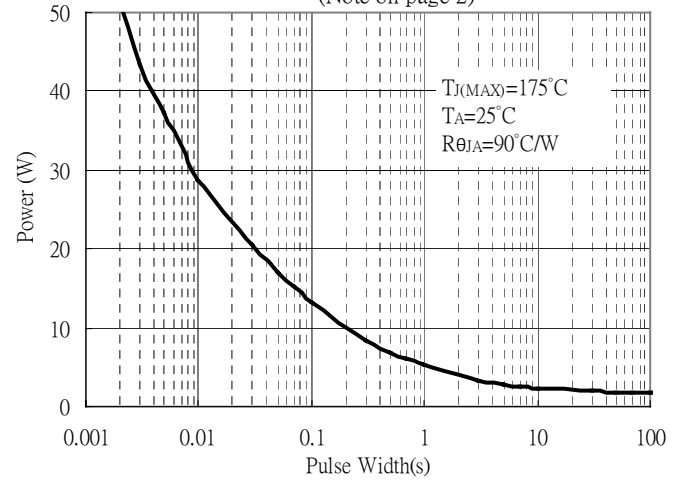


Q2, P-CH Typical Characteristics(Cont.)

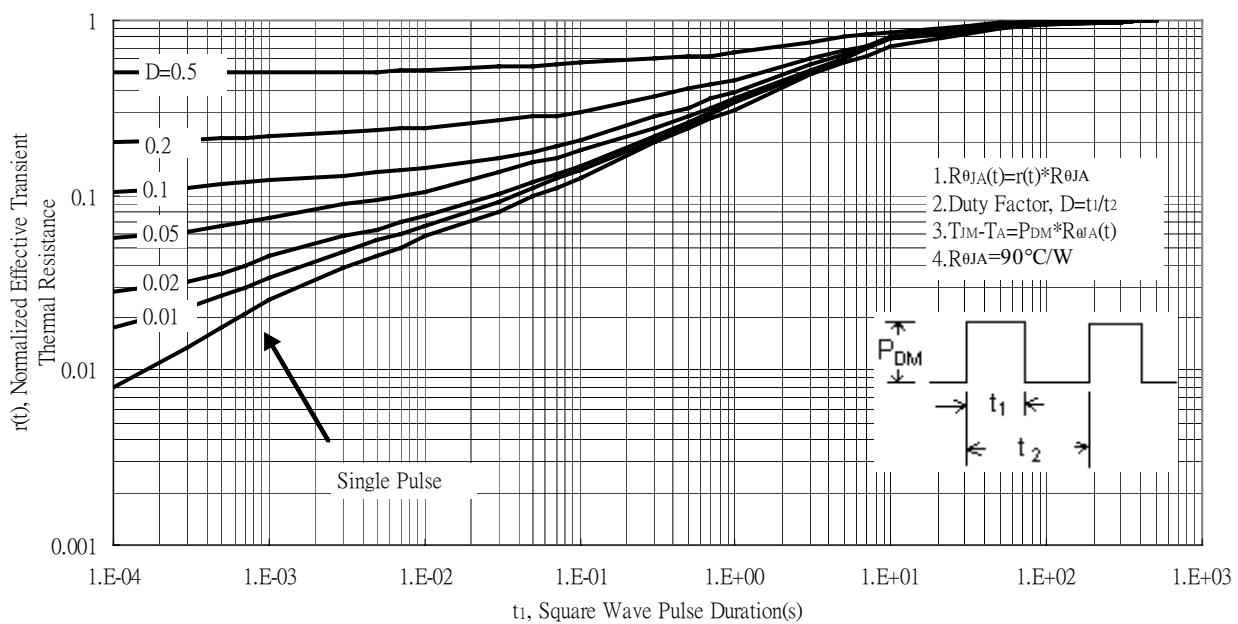
Typical Transfer Characteristics



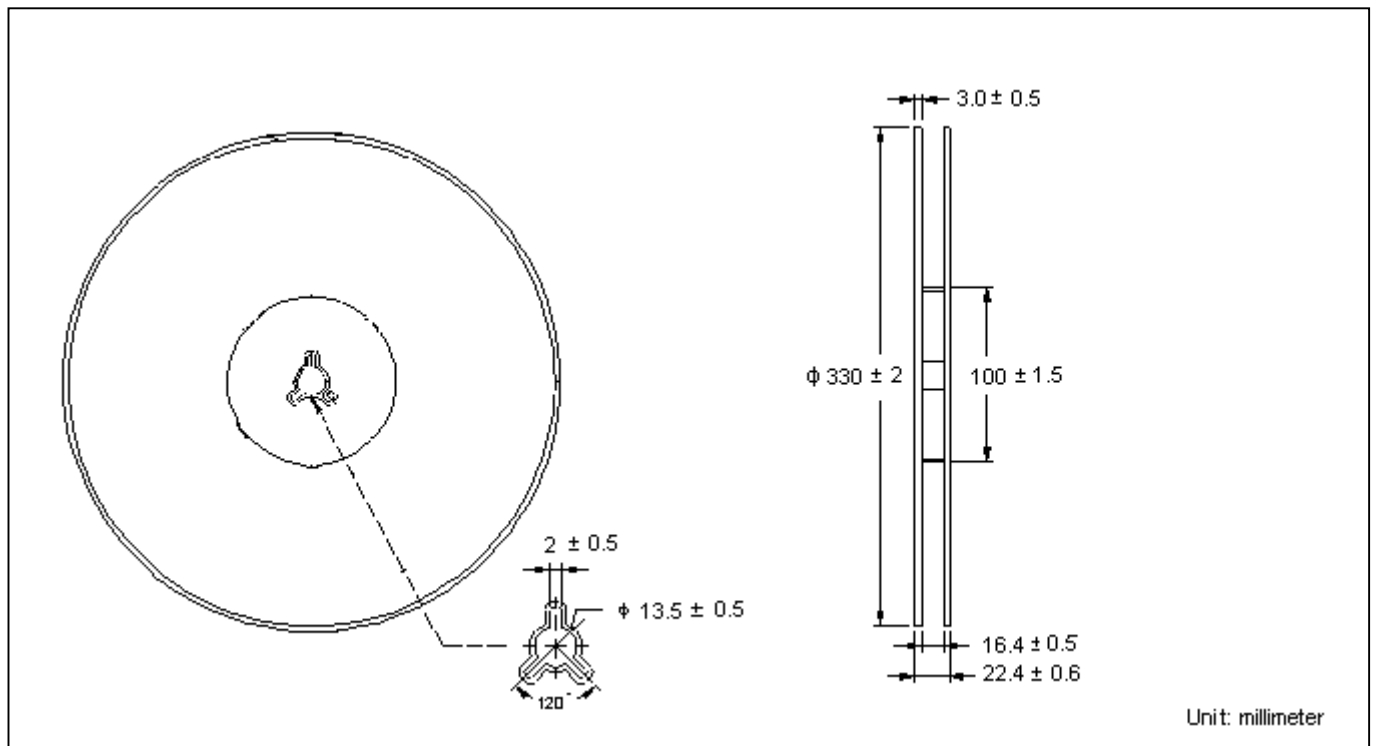
Single Pulse Power Rating, Junction to Ambient
(Note on page 2)



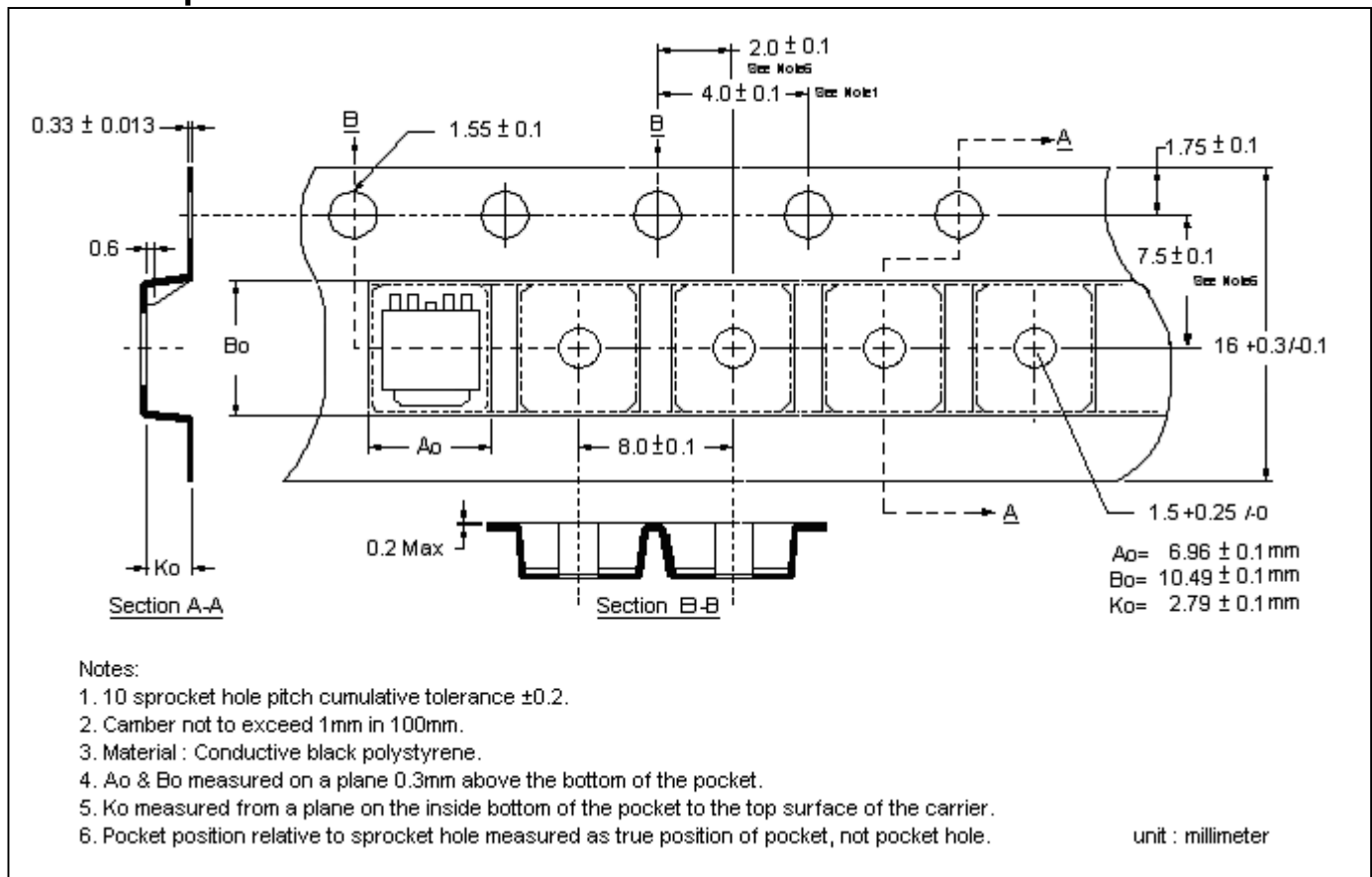
Transient Thermal Response Curves

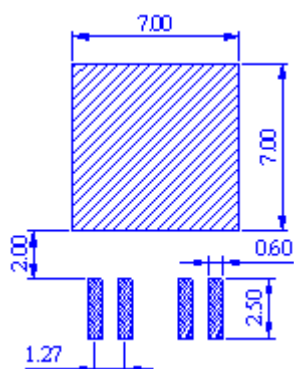


Reel Dimension



Carrier Tape Dimension



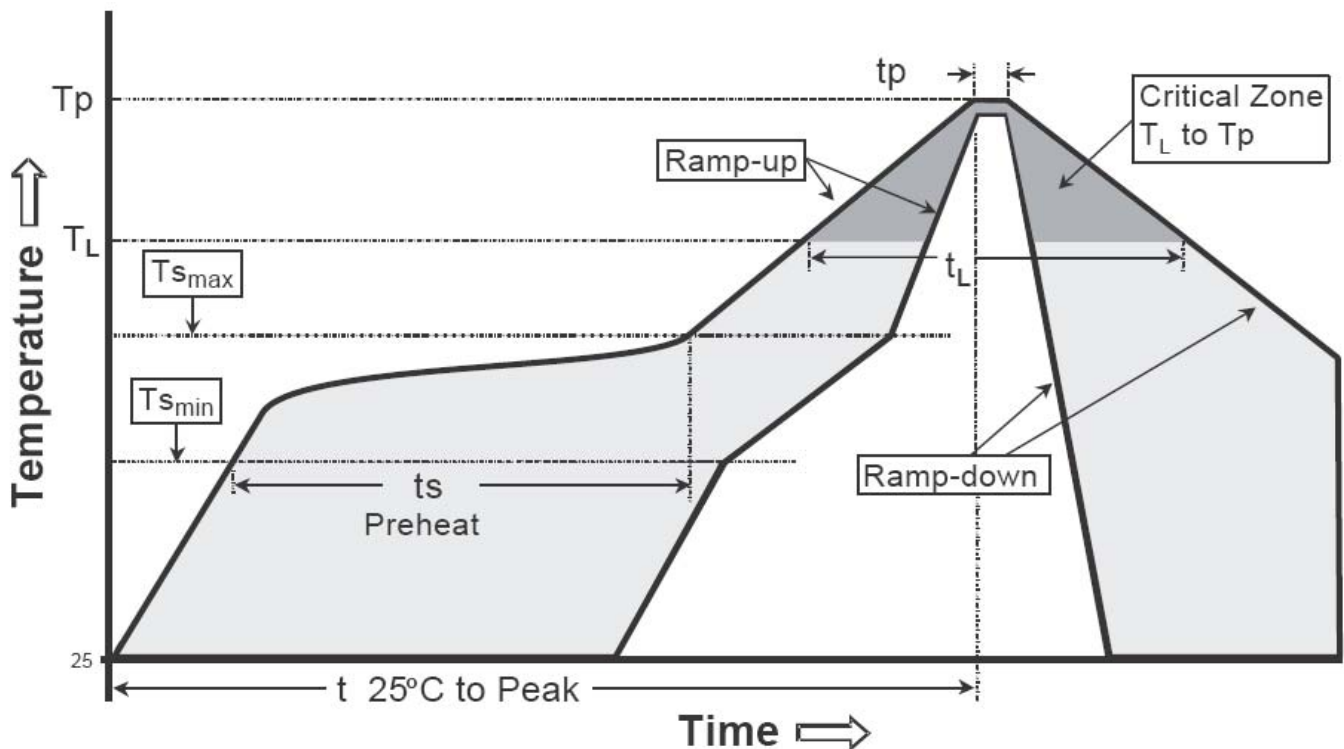
Recommended soldering footprint

Unit : mm

Recommended wave soldering condition

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

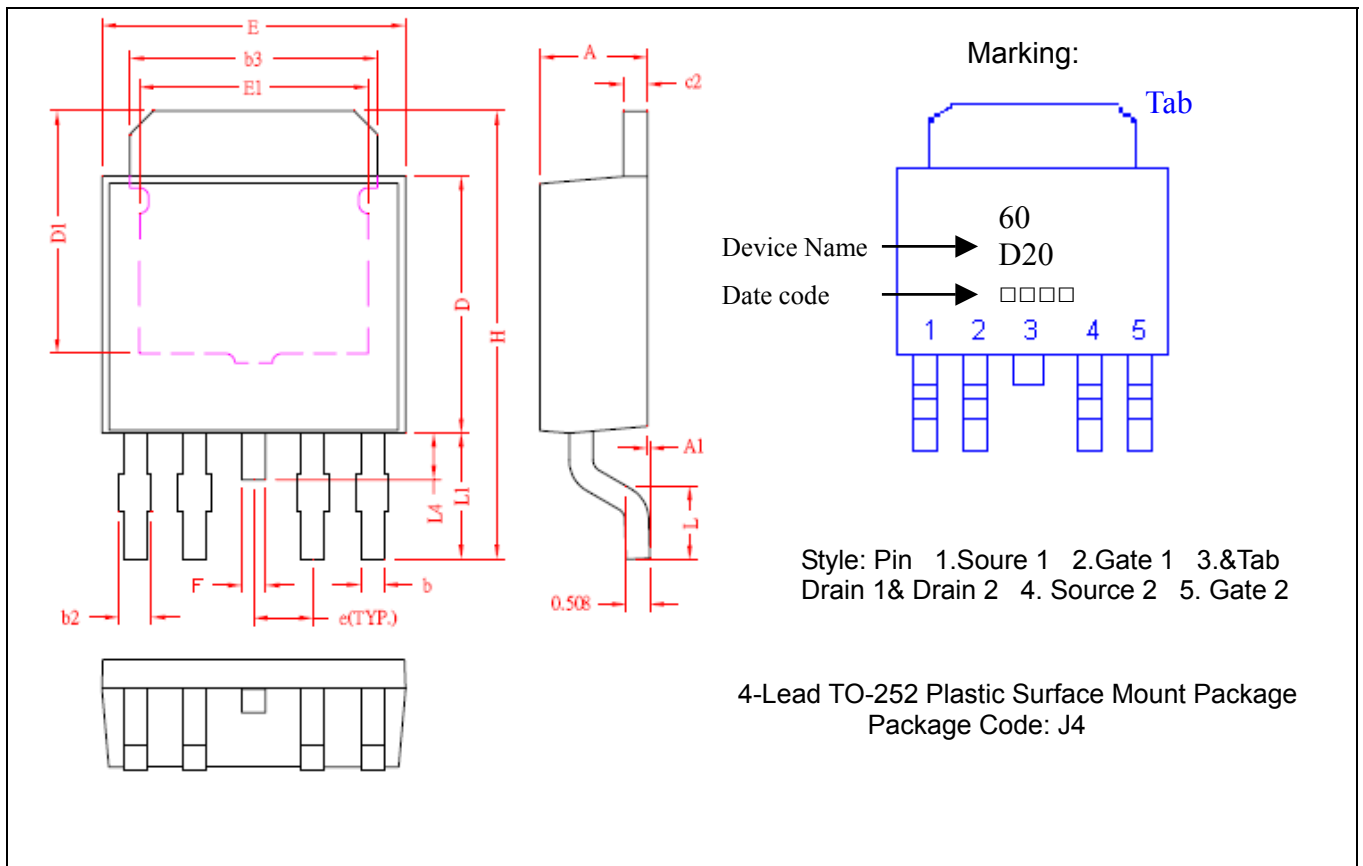
Recommended temperature profile for IR reflow



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)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (Tl)	183°C	217°C
- Time (tL)	60-150 seconds	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.

TO-252 Dimension



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.0866	0.0945	2.20	2.40	E	0.2520	0.2677	6.40	6.80
A1	0.0000	0.0059	0.00	0.15	E1	0.1500	-	3.81	-
b	0.0157	0.0236	0.40	0.60	e	0.0500	REF	1.27	REF
b2	0.0199	0.0315	0.50	0.80	F	0.0157	0.0236	0.40	0.60
b3	0.2047	0.2165	5.20	5.50	H	0.3701	0.4016	9.40	10.20
c2	0.0177	0.0217	0.45	0.55	L	0.0551	0.0697	1.40	1.77
D	0.2126	0.2283	5.40	5.80	L1	0.0945	0.1181	2.40	3.00
D1	0.1799	-	4.57	-	L4	0.0315	0.0472	0.80	1.20

Notes:

- Controlling dimension: millimeters.
- 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.