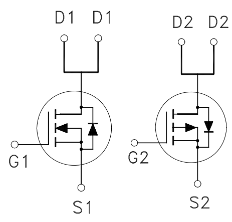
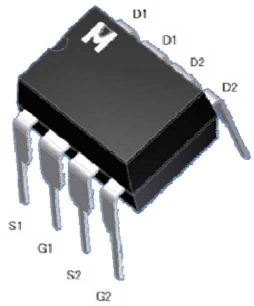
N & P-Channel Logic Level Enhancement Mode Field Effect Transistor

Product Summary:

	N-CH	P-CH
BV_{DSS}	30V	-30V
R_{DSON} (MAX.)	21mΩ	35mΩ
I_D	7.5A	-6A





UIS, Rg 100% Tested

Pb-Free Lead Plating & Halogen Free

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C Unless Otherwise Noted)

PARAMETERS/TEST CONDITIONS		SYMBOL	LIMITS		UNIT
			N-CH	P-CH	
Gate-Source Voltage		V_{GS}	±20	±20	V
Continuous Drain Current	T_C = 25 °C	I_D	7.5	-6	A
	T_C = 100 °C		5.5	-5	
Pulsed Drain Current[1]		I_{DM}	30	-24	
Avalanche Current		I_{AS}	10	-10	
Avalanche Energy	L = 0.1mH, ID=7.5A, RG=25Ω(N) L = 0.1mH, ID=-6A, RG=25Ω(P)	E_{AS}	2.8	1.8	mJ
Repetitive Avalanche Energy[2]	L = 0.05mH	E_{AR}	1.4	0.9	
Power Dissipation	T_C = 25 °C	P_D	5		W
	T_C = 100 °C		2		
Operating Junction & Storage Temperature Range		T_j, T_{stg}	-55 to 150		°C

100% UIS testing in condition of V_D=15V, L=0.1mH, V_G=10V, I_L=7.5A, Rated V_{DS}=30V N-CH

100% UIS testing in condition of V_D=15V, L=0.1mH, V_G=-10V, I_L=-6A, Rated V_{DS}=-30V P-CH

THERMAL RESISTANCE RATINGS

THERMAL RESISTANCE	SYMBOL	TYPICAL	MAXIMUM	UNIT
Junction-to-Case	$R_{\theta JC}$		25	°C / W
Junction-to-Ambient[3]	$R_{\theta JA}$		62.5	

[1]Pulse width limited by maximum junction temperature.

[2]Duty cycle ≤ 1%

[3]62.5°C / W when mounted on a 1 in^2 pad of 2 oz copper.

ELECTRICAL CHARACTERISTICS (T_C = 25 °C, Unless Otherwise Noted)

PARAMETER	SYMBOL	TEST CONDITIONS		LIMITS MIN	TYP	MAX	UNIT
STATIC							
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 250μA	N-CH	30			V
		V_{GS} = 0V, I_D = -250μA	P-CH	-30			
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	N-CH	1	1.5	3	
		V_{DS} = V_{GS}, I_D = -250μA	P-CH	-1	-1.5	-3	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0V, V_{GS} = ±20V	N-CH			±100	nA
		V_{DS} = 0V, V_{GS} = ±20V	P-CH			±100	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 24V, V_{GS} = 0V	N-CH			1	μA
		V_{DS} = -24V, V_{GS} = 0V	P-CH			-1	
		V_{DS} = 20V, V_{GS} = 0V, T_J = 125 °C	N-CH			25	
		V_{DS} = -20V, V_{GS} = 0V, T_J = 125 °C	P-CH			-25	
On-State Drain Current[1]	$I_{D(ON)}$	V_{DS} = 10V, V_{GS} = 10V	N-CH	7.5			A
		V_{DS} = -5V, V_{GS} = -10V	P-CH	-6			
Drain-Source On-State Resistance[1]	$R_{DS(ON)}$	V_{GS} = 10V, I_D = 7.5A	N-CH		18	21	mΩ
		V_{GS} = -10V, I_D = -6A	P-CH		26	35	
		V_{GS} = 4.5V, I_D = 5.5A	N-CH		34	42	
		V_{GS} = -4.5V, I_D = -5A	P-CH		45	60	
Forward Transconductance[1]	g_{fs}	V_{DS} = 5V, I_D = 7.5A	N-CH		16		S
		V_{DS} = -5V, I_D = -6A	P-CH		12		
DYNAMIC							
Input Capacitance	C_{iss}	N-CH V_{GS} = 0V, V_{DS} = 15V, f = 1MHz P=CH V_{GS} = 0V, V_{DS} = -15V, f = 1MHz	N-CH		520		pF
			P-CH		910		
Output Capacitance	C_{oss}		N-CH		88		
			P-CH		143		
Reverse Transfer Capacitance	C_{rss}		N-CH		62		
			P-CH		108		

Gate Resistance	R_g	V_{GS} = 15mV, V_{DS} = 0V, f = 1MHz	N-CH		2.0		Ω
			P-CH		4.0		
Total Gate Charge[1,2]	$Q_g(V_{GS}=10V)$	N-CH V_{DS} = 15V, V_{GS} = 10V, I_D = 7.5A P-CH V_{DS} = -15V, V_{GS} = -10V, I_D = -6A	N-CH		11.5		nC
	$Q_g(V_{GS}=-10V)$		P-CH		13.3		
	$Q_g(V_{GS}=4.5V)$		N-CH		5		
	$Q_g(V_{GS}=-4.5V)$		P-CH		7		
Gate-Source Charge[1,2]	Q_{gs}		N-CH		1.6		
			P-CH		2.1		
Gate-Drain Charge[1,2]	Q_{gd}		N-CH		2.8		
			P-CH		3.2		
Turn-On Delay Time[1,2]	$t_{d(on)}$	N-CH V_{DS} = 15V, I_D = 1A, V_{GS} = 10V, R_{GS} = 6Ω P-CH V_{DS} = -15V, I_D = -1A, V_{GS} = -10V, R_{GS} = 6Ω	N-CH		11		nS
			P-CH		12		
Rise Time[1,2]	t_r		N-CH		16		
			P-CH		18		
Turn-Off Delay Time[1,2]	$t_{d(off)}$		N-CH		36		
			P-CH		38		
Fall Time[1,2]	t_f		N-CH		20		
			P-CH		22		
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (T_C = 25 °C)							
Continuous Current	I_S		N-CH			2.3	A
			P-CH			-2.3	
Pulsed Current[3]	I_{SM}		N-CH			9.2	
			P-CH			-9.2	
Forward Voltage[1]	V_{SD}	$I_F = I_S$, V_{GS} = 0V	N-CH			1.2	V
			P-CH			-1.2	
Reverse Recovery Time	t_{rr}	$I_F = I_S$, dI_F/dt = 100A / µS	N-CH		50		nS
			P-CH		55		
Peak Reverse Recovery Current	$I_{RM(REC)}$		N-CH		30		A
			P-CH		-24		
Reverse Recovery Charge	Q_{rr}		N-CH		2		nC
			P-CH		2.2		

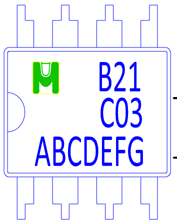
[1]Pulse test : Pulse Width ≤ 300 µsec, Duty Cycle ≤ 2%.

[2]Independent of operating temperature.

[3]Pulse width limited by maximum junction temperature.

Ordering & Marking Information:

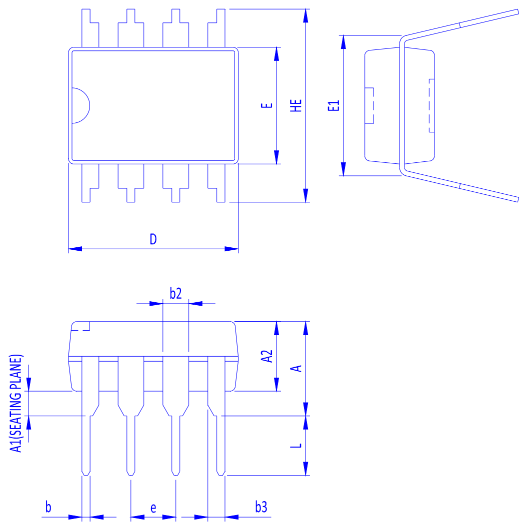
Device Name: EMB21C03S for DIP-8



B21C03: Device Name

ABCDSFG: Date Code

Outline Drawing

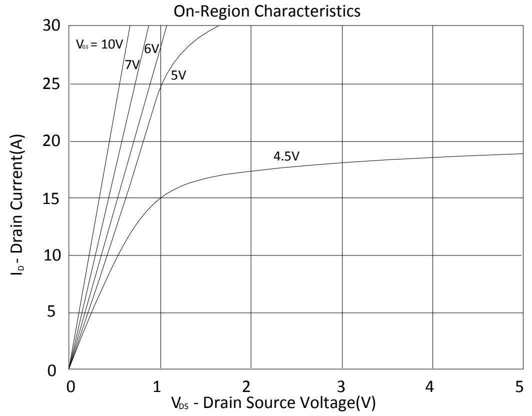


Dimension in mm

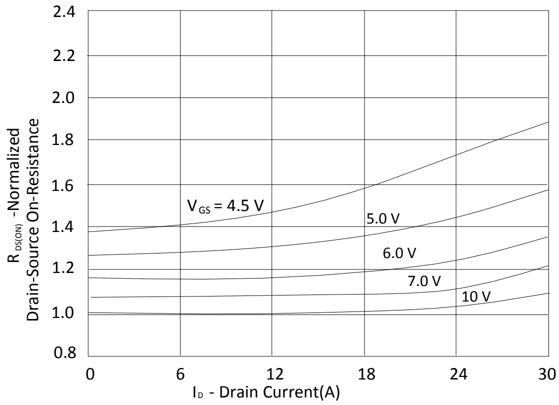
Dimension	A	B	C	D	E	F	G	H	I	J	K
in.	4.70	3.70	5.80	0.33		1.20	0.08	0.40	0.19	0.25	0°
Typ.					1.27						
Max.	5.10	4.10	6.20	0.51		1.62	0.28	0.83	0.26	0.50	8°

N-Channel

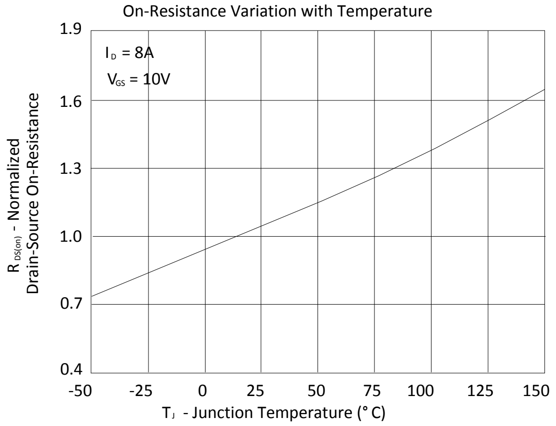
On-Region Characteristics



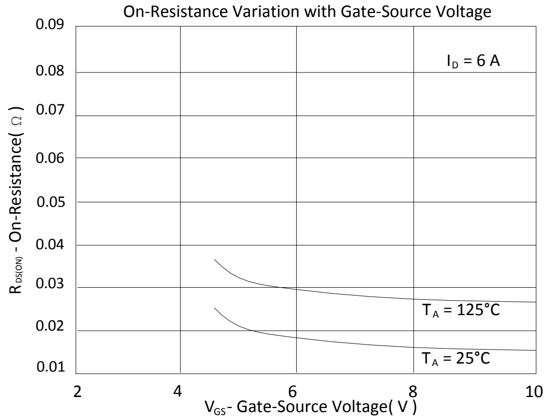
On-Resistance Variation with Drain Current and Gate Voltage



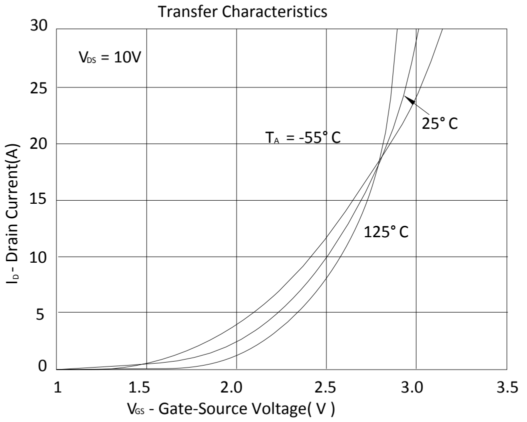
On-Resistance Variation with Temperature



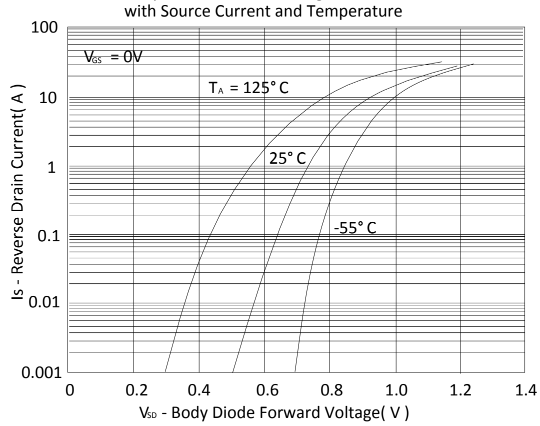
On-Resistance Variation with Gate-Source Voltage

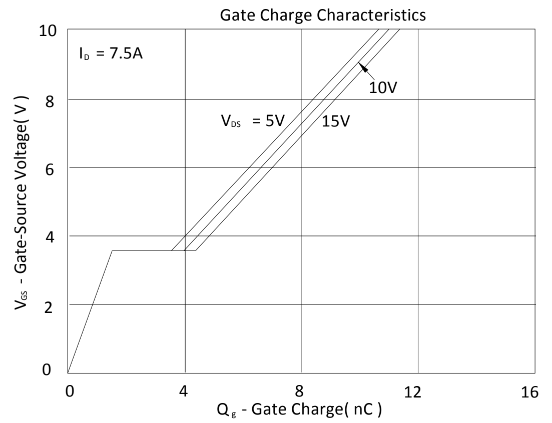


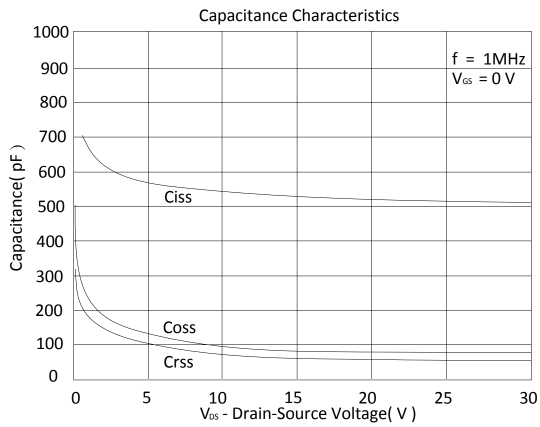
Transfer Characteristics

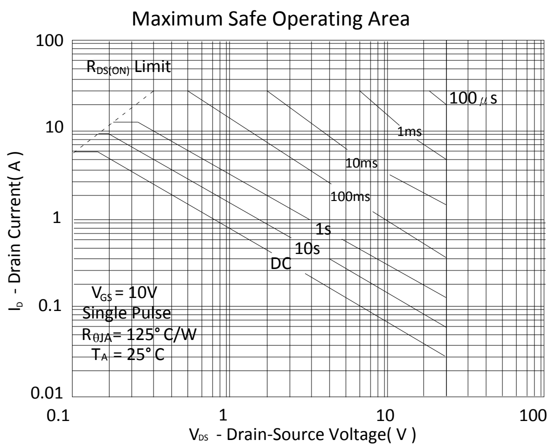


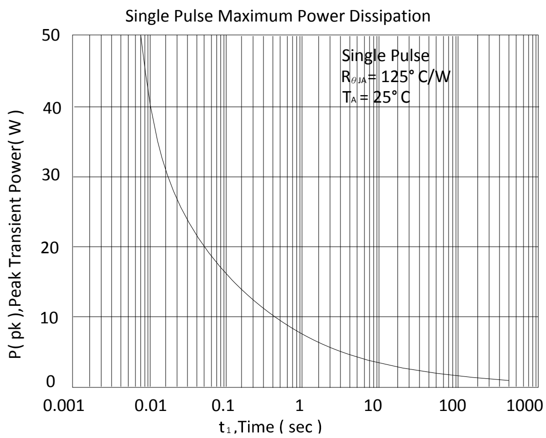
Body Diode Forward Voltage Variation
with Source Current and Temperature

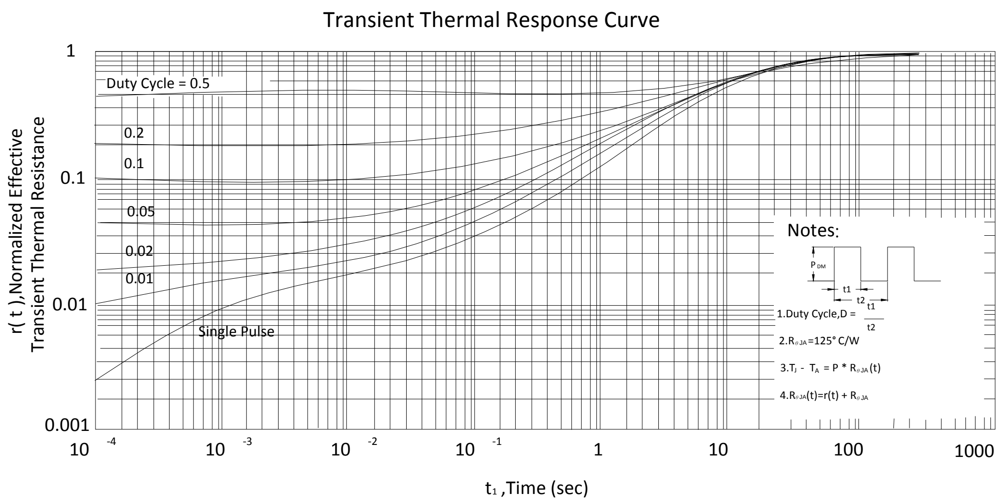



Gate Charge Characteristics
I_D = 7.5A
V_DS = 5V
10V
15V
V_GS - Gate-Source Voltage(V)
Q_g - Gate Charge(nC)
0
2
4
6
8
10
12
16

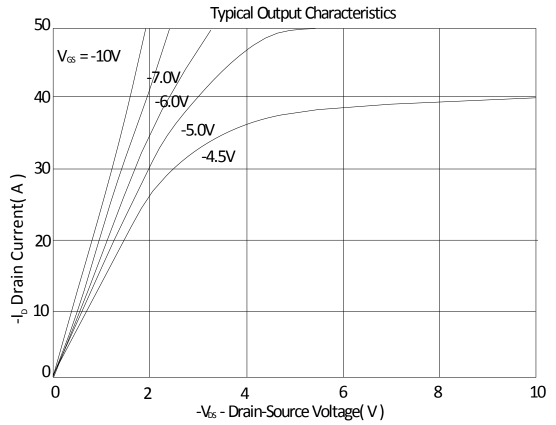

Capacitance Characteristics
f = 1MHz
V_GS = 0 V
Ciss
Coss
Crss
Capacitance(pF)
V_DS - Drain-Source Voltage(V)

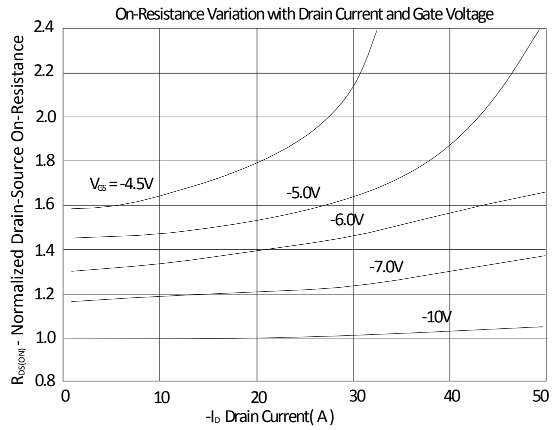

Maximum Safe Operating Area
R_DS(ON) Limit
100 μs
1ms
10ms
100ms
1s
10s
DC
V_GS = 10V
Single Pulse
RθJA= 125° C/W
T_A = 25° C
I_D - Drain Current(A)
V_DS - Drain-Source Voltage(V)

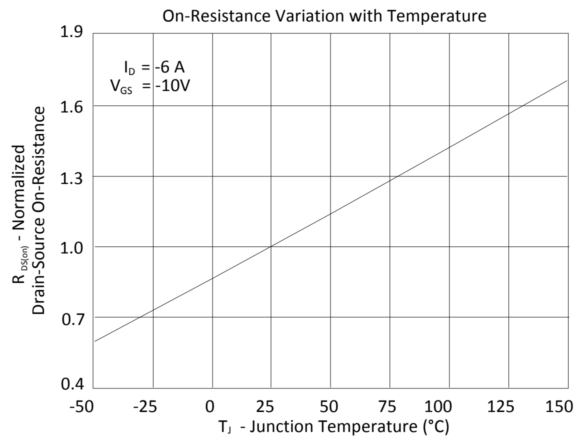

Single Pulse Maximum Power Dissipation
Single Pulse
RθJA= 125° C/W
T_A = 25° C
P(pk),Peak Transient Power(W)
t1 ,Time (sec)

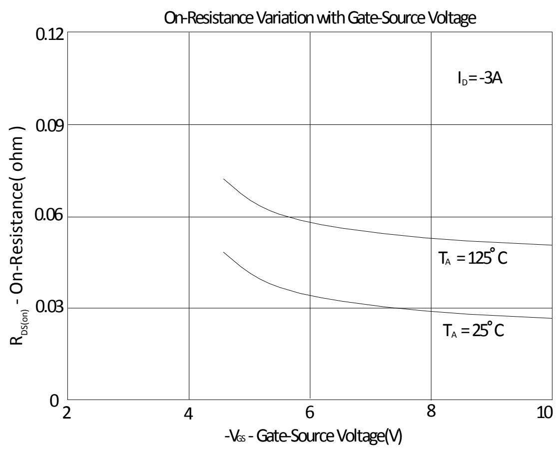

Transient Thermal Response Curve
Duty Cycle = 0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
Notes:
P_DM
t1
t2
1.Duty Cycle,D = t1/t2
2.RθJA=125° C/W
3.TJ - TA = P * RθJA(t)
4.RθJA(t)=r(t) + RθJA
r(t),Normalized Effective Transient Thermal Resistance
t1 ,Time (sec)

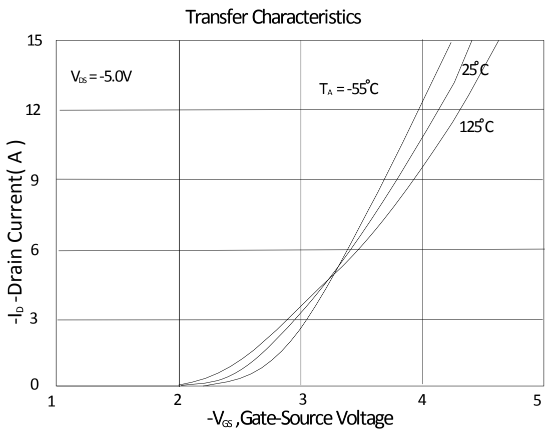
P-Channel

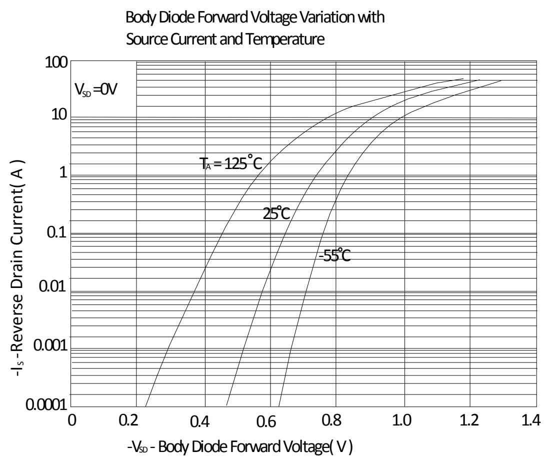

Typical Output Characteristics
VGS = -10V
-7.0V
-6.0V
-5.0V
-4.5V
-ID Drain Current(A)
-VDS - Drain-Source Voltage(V)

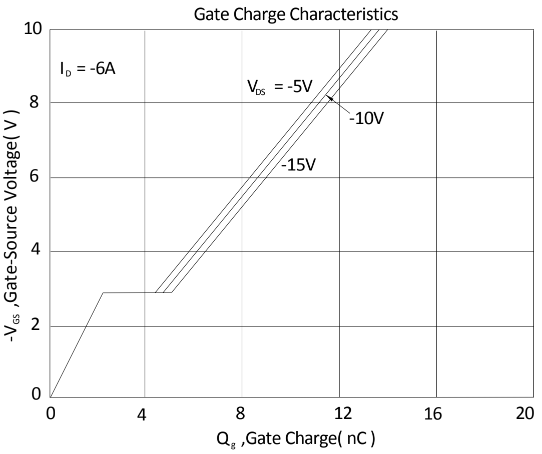

On-Resistance Variation with Drain Current and Gate Voltage
VGS = -4.5V
-5.0V
-6.0V
-7.0V
-10V
RDS(ON) - Normalized Drain-Source On-Resistance
-ID Drain Current(A)

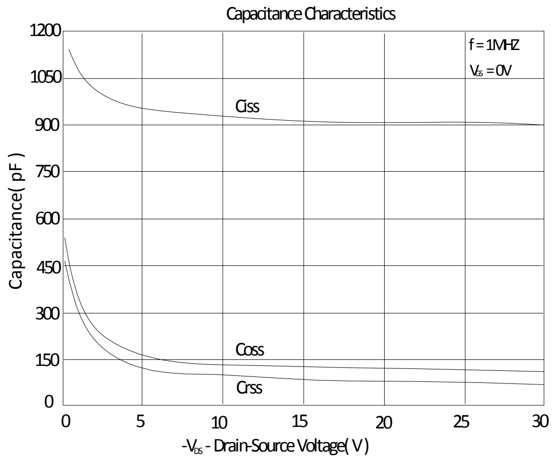

On-Resistance Variation with Temperature
ID = -6 A
VGS = -10V
RDS(on) - Normalized Drain-Source On-Resistance
TJ - Junction Temperature (°C)

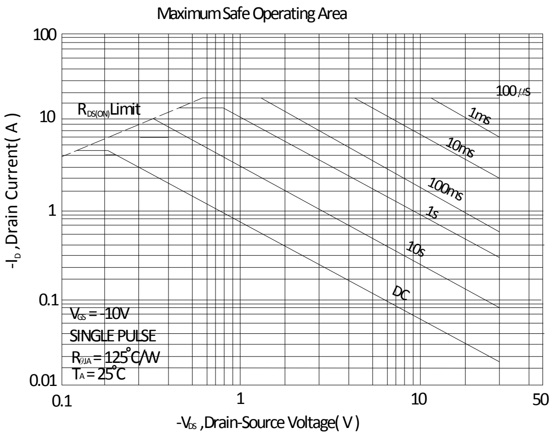

On-Resistance Variation with Gate-Source Voltage
ID=-3A
TA = 125°C
TA = 25°C
RDS(on) - On-Resistance(ohm)
-VGS - Gate-Source Voltage(V)

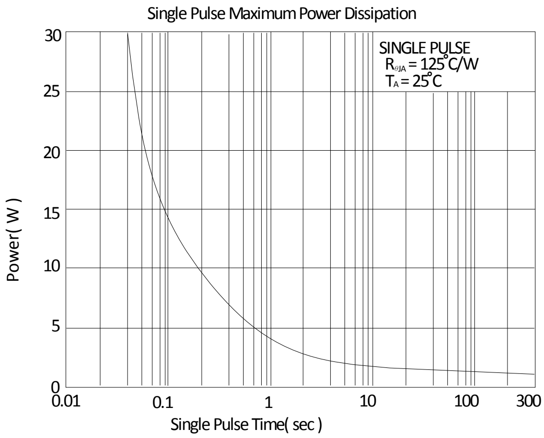

Transfer Characteristics
VDS = -5.0V
TA = -55°C
25°C
125°C
-ID -Drain Current(A)
-VGS ,Gate-Source Voltage

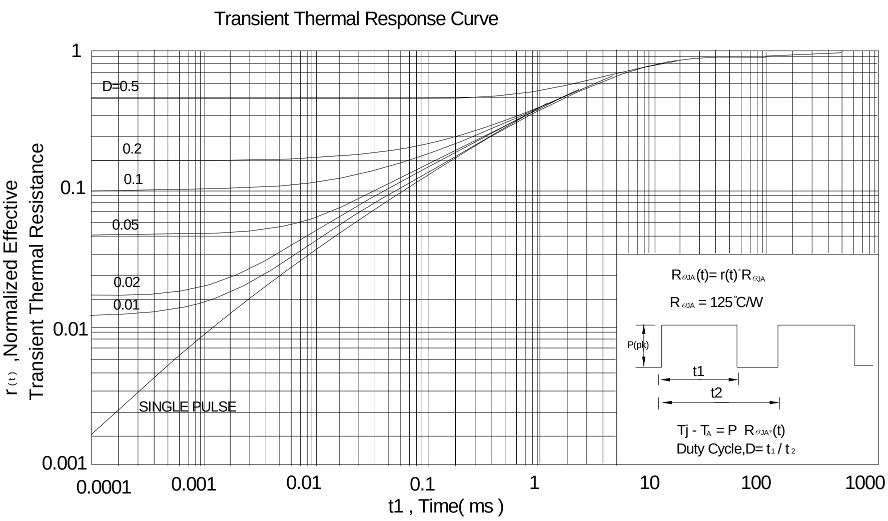

Body Diode Forward Voltage Variation with
Source Current and Temperature
VGS =0V
TA = 125°C
25°C
-55°C
-IS -Reverse Drain Current(A)
-VSD - Body Diode Forward Voltage(V)


Gate Charge Characteristics
I_D = -6A
V_DS = -5V
-10V
-15V
-V_GS ,Gate-Source Voltage(V)
Q_g ,Gate Charge(nC)


Capacitance Characteristics
f = 1MHZ
V_GS = 0V
Ciss
Coss
Crss
Capacitance(pF)
-V_DS - Drain-Source Voltage(V)


Maximum Safe Operating Area
R_DS(ON) Limit
100μs
1ms
10ms
100ms
1s
10s
DC
V_GS = -10V
SINGLE PULSE
R_θJA = 125°C/W
T_A = 25°C
-I_D ,Drain Current(A)
-V_DS ,Drain-Source Voltage(V)


Single Pulse Maximum Power Dissipation
SINGLE PULSE
R_θJA = 125°C/W
T_A = 25°C
Power(W)
Single Pulse Time(sec)


Transient Thermal Response Curve
D=0.5
0.2
0.1
0.05
0.02
0.01
SINGLE PULSE
R_θJA(t)= r(t)*R_θJA
R_θJA = 125°C/W
P(pk)
t1
t2
Tj - T_A = P R_θJA(t)
Duty Cycle,D= t1 / t2
r(t) ,Normalized Effective Transient Thermal Resistance
t1 , Time(ms)