

N and P-Channel Enhancement Mode Power MOSFET

Description

The MSR013X03D4 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

Features

N-Channel

- $V_{DS} = 30V, I_D = 30A$
 $R_{DS(ON)} < 13m\Omega @ V_{GS} = 10V$
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = 4.5V$

- High Power and current handling capability
- Lead free product is acquired
- Surface Mount Package

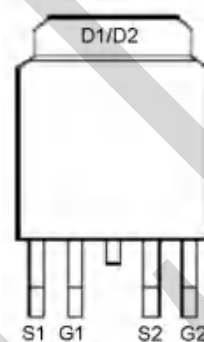
P-Channel

- $V_{DS} = -30V, I_D = -20A$
 $R_{DS(ON)} < 30m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 42m\Omega @ V_{GS} = -4.5V$

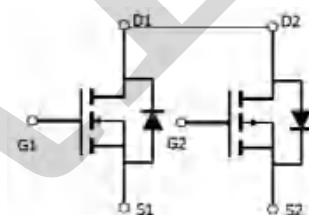
- High Power and current handling capability
- Lead free product is acquired
- Surface Mount Package

MSR013X03D4

TO-252-4L



pin assignment



Schematic diagram

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

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V_{DS}	30	-30	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current	I_D	30	-20	A
		20	-13	
Pulsed Drain Current ^(Note 1)	I_{DM}	50	-50	A
Maximum Power Dissipation	P_D	20.8	20.8	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	N-Ch	6.0	$^\circ C/W$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	P-Ch	6.0	$^\circ C/W$

N-CH Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	30	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=30V, V_{GS}=0V$	--	--	1	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	--	--	± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.5	2.2	V
$R_{DS(on)}$	Drain-Source On-State Resistance ^(note2)	$V_{GS}=10V, I_D=10A$	--	10	13	m Ω
		$V_{GS}=4.5V, I_D=5A$	--	14	18	m Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS}=15V,$ $V_{GS}=0V,$ $f=1.0MHz$	--	551	--	pF
C_{oss}	Output Capacitance		--	108	--	pF
C_{rss}	Reverse Transfer Capacitance		--	93	--	pF
Q_g	Total Gate Charge	$V_{GS}=10V,$ $V_{DS}=15V,$ $I_D=10A$	--	15	--	nC
Q_{gs}	Gate-Source Charge		--	4.7	--	nC
Q_{gd}	Gate-Drain Charge		--	3.6	--	nC

Switching Times

$t_{d(on)}$	Turn-on Delay Time	$V_{GS}=10V,$ $V_{DS}=30V,$ $I_D=20A,$ $R_{GEN}=3\Omega$	--	5	--	nS
t_r	Turn-on Rise Time		--	8	--	nS
$t_{d(off)}$	Turn-Off Delay Time		--	21	--	nS
t_f	Turn-Off Fall Time		--	7	--	nS

Source-Drain Diode Characteristics

I_S	Source-Drain Current(Body Diode)		--	--	30	A
V_{SD}	Forward on Voltage	$V_{GS}=0V, I_S=20A$	--	--	1.2	V

Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 0.5\%$

P-CH Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	30	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-30V, V_{GS}=0V$	--	--	-1	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	--	--	± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1	-1.5	-2.2	V
$R_{DS(ON)}$	Drain-Source On-State Resistance ^(note2)	$V_{GS}=-10V, I_D=-7A$	--	24	30	m Ω
		$V_{GS}=-4.5V, I_D=-4A$	--	36	42	m Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS}=-15V,$ $V_{GS}=0V,$ $f=1.0MHz$	--	982	--	pF
C_{oss}	Output Capacitance		--	135	--	pF
C_{rss}	Reverse Transfer Capacitance		--	109	--	pF
Q_g	Total Gate Charge	$V_{GS}=-10V,$ $V_{DS}=-15V,$ $I_D=-4A$	--	10	--	nC
Q_{gs}	Gate-Source Charge		--	2	--	nC
Q_{gd}	Gate-Drain Charge		--	2.7	--	nC

Switching Times

$t_{d(on)}$	Turn-on Delay Time	$V_{GS}=-10V,$ $V_{DS}=-15V,$ $I_D=-7A,$ $R_{GEN}=2.5\Omega$	--	11	--	nS
t_r	Turn-on Rise Time		--	19	--	nS
$t_{d(off)}$	Turn-Off Delay Time		--	45	--	nS
t_f	Turn-Off Fall Time		--	26	--	nS

Source-Drain Diode Characteristics

I_S	Source-Drain Current(Body Diode)		--	--	-20	A
V_{SD}	Forward on Voltage	$V_{GS}=0V, I_S=-20A$	--	--	-1.2	V

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$

N- Channel Typical Characteristics

Figure1: Output Characteristics

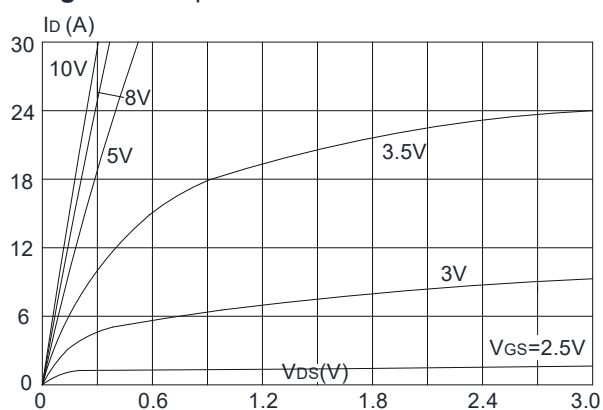


Figure 2: Typical Transfer Characteristics

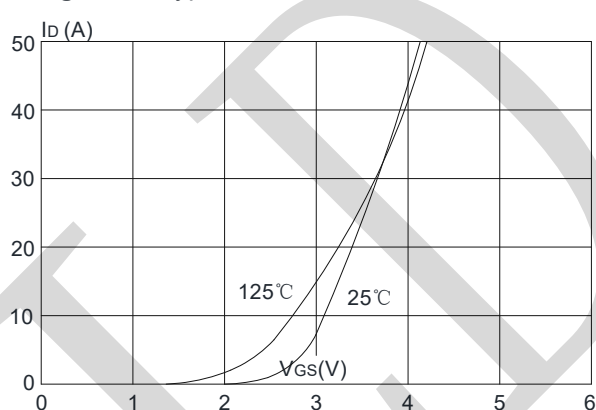


Figure 3: On-resistance vs. Drain Current

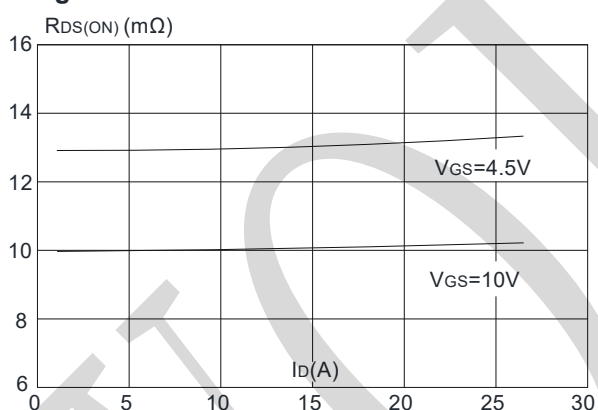


Figure 4: Body Diode Characteristics

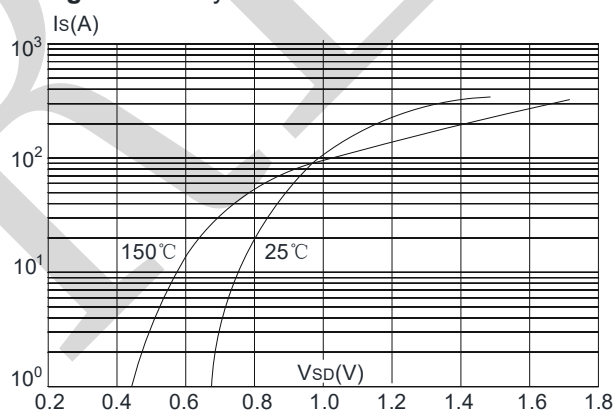


Figure 5: Gate Charge Characteristics

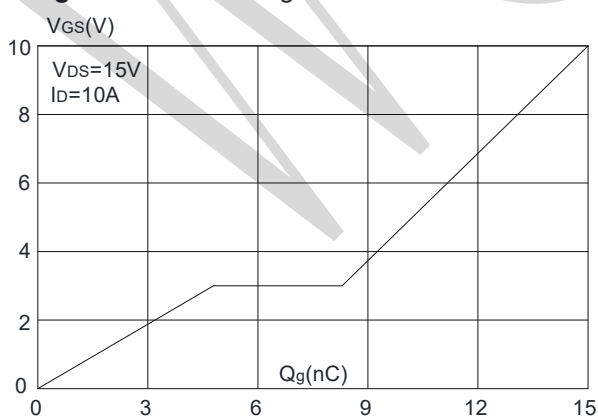
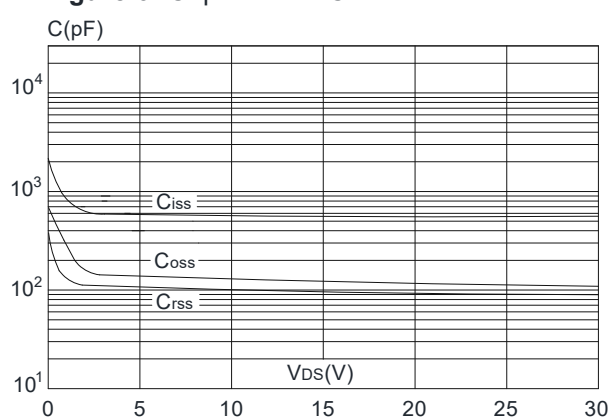


Figure 6: Capacitance Characteristics



N- Channel Typical Characteristics

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

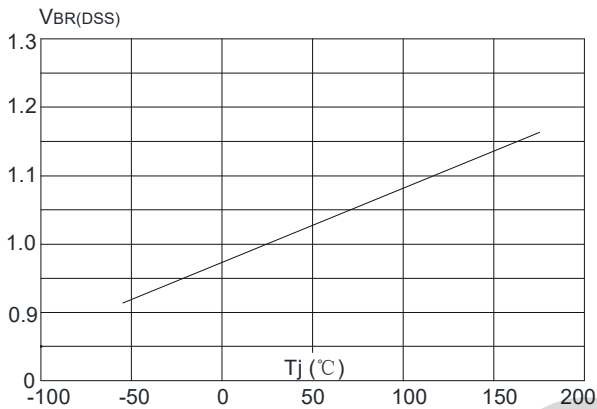


Figure 8: Normalized on Resistance vs. Junction Temperature

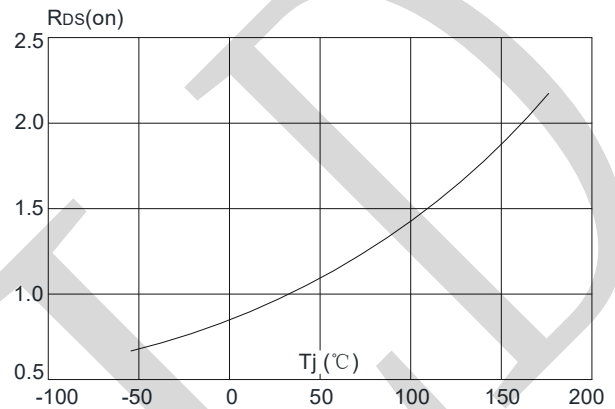


Figure 9: Maximum Safe Operating Area

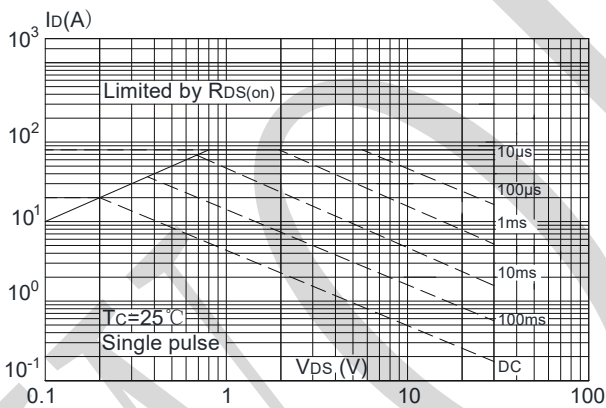


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

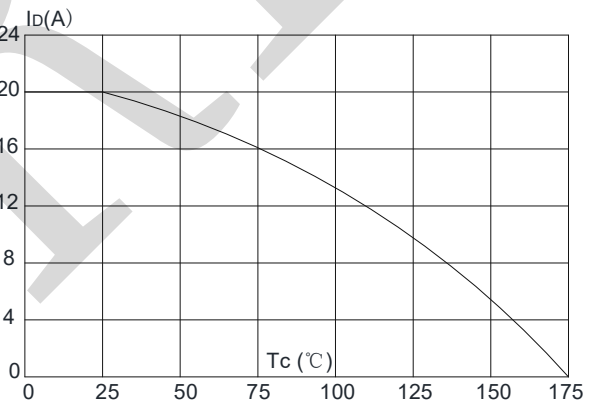
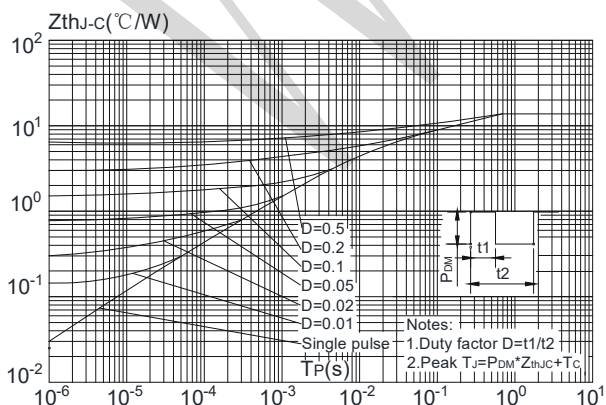


Figure 11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



P- Channel Typical Characteristics

Figure1: Output Characteristics

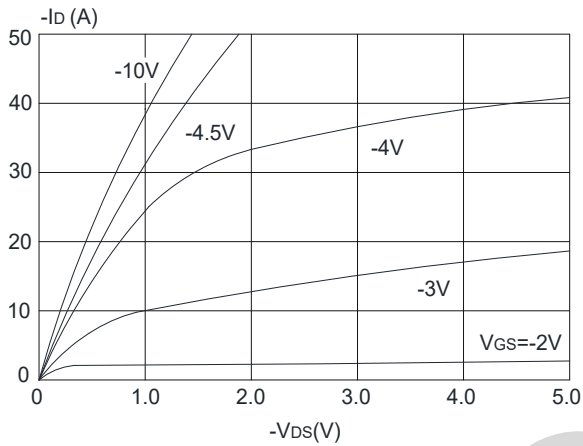


Figure 2: Typical Transfer Characteristics

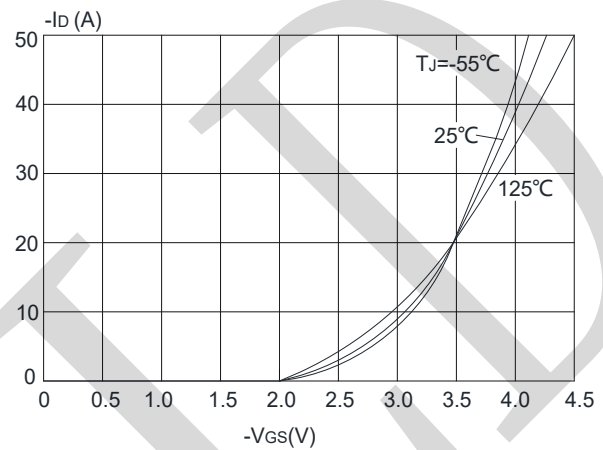


Figure 3: On-resistance vs. Drain Current

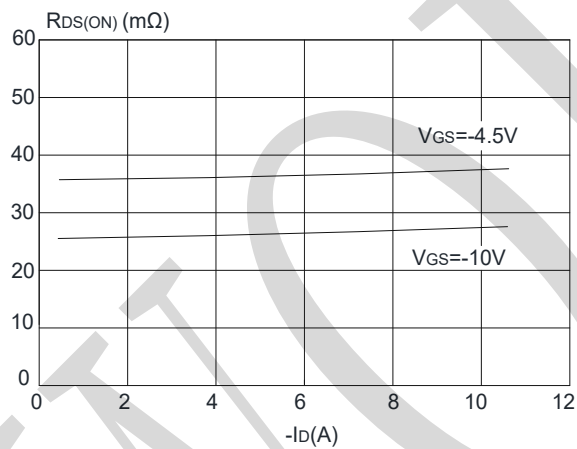


Figure 4: Body Diode Characteristics

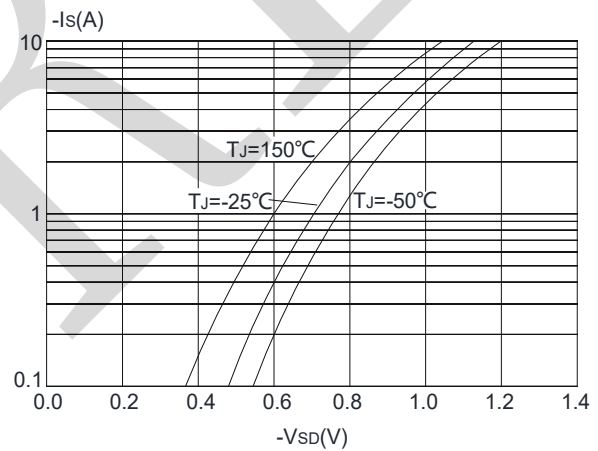


Figure 5: Gate Charge Characteristics

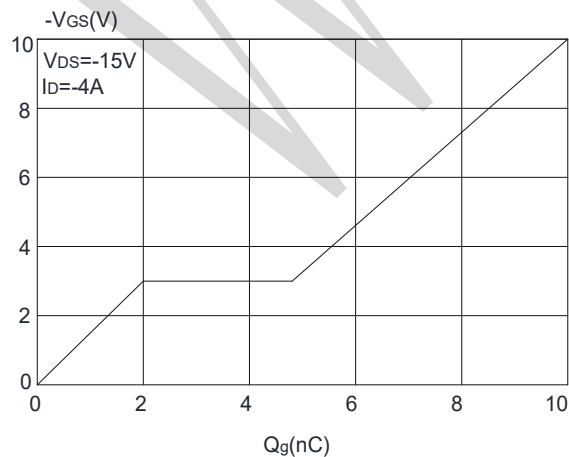
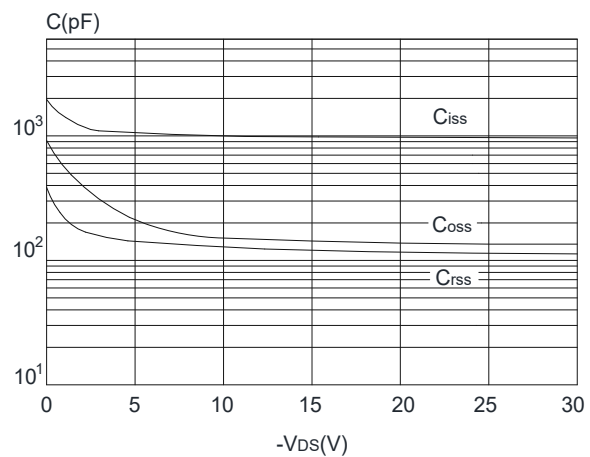


Figure 6: Capacitance Characteristics



P- Channel Typical Characteristics

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

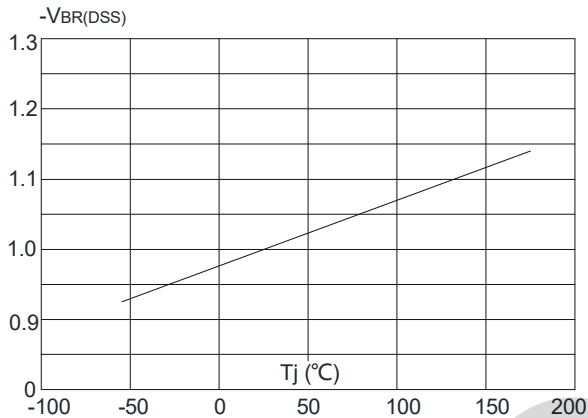


Figure 8: Normalized on Resistance vs. Junction Temperature

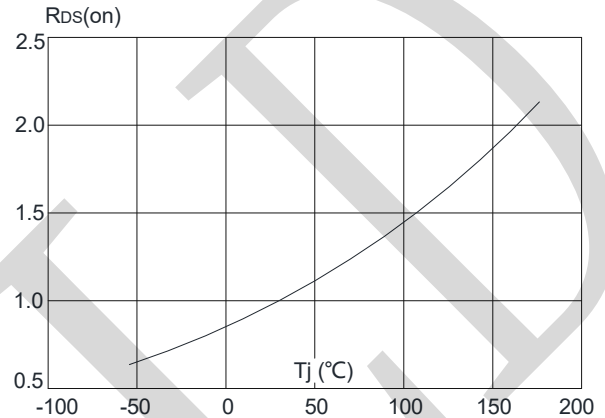


Figure 9: Maximum Safe Operating Area

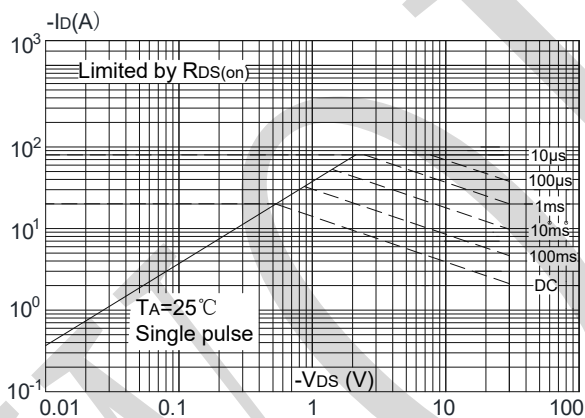


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

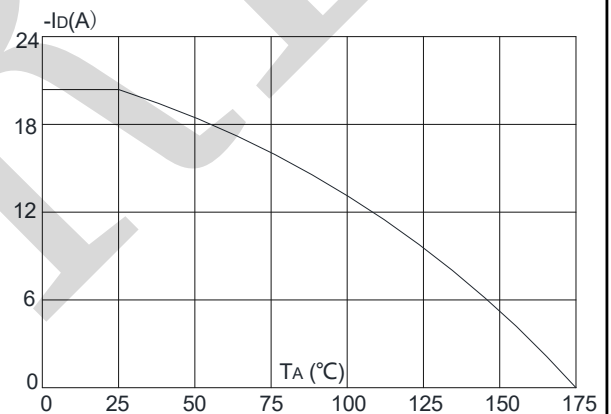
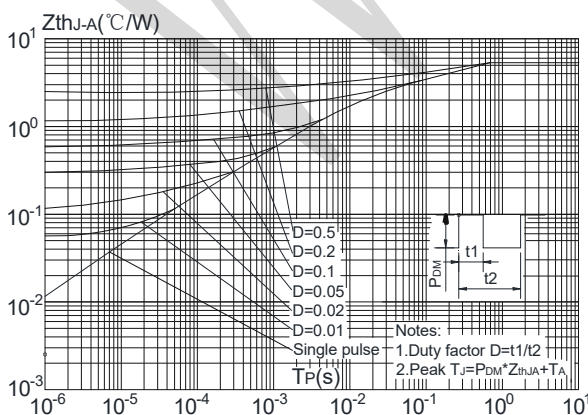


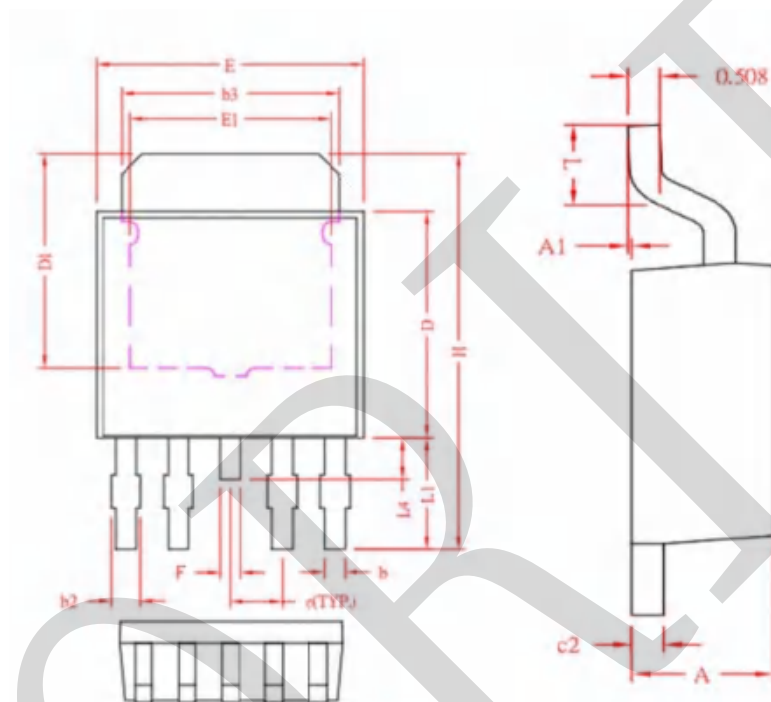
Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



PACKAGE OUTLINE DIMENSIONS

Note:unit mm

TO-252-4L



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0	0.08	0.15
b	0.45	0.53	0.60
b2	0.50	0.65	0.80
b3	5.20	5.35	5.50
c2	0.45	0.50	0.55
D	5.40	5.60	5.80
D1	4.57	-	-
E	6.40	6.60	6.80
E1	3.81	-	-
e	1.27 REF.		
F	0.40	0.50	0.60
H	9.40	9.80	10.20
L	1.40	1.59	1.77
L1	2.40	2.70	3.00
L4	0.80	1.00	1.20