BORN SEMICONDUCTOR

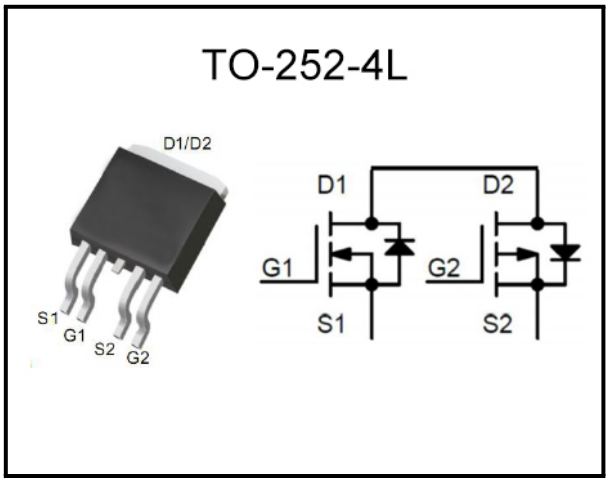
BMI404D1538

N+P-Channel MOSFET

Features

- **N-Channel:**
- V_{DS}=40V,I_D=30A
- $R_{DS(ON)}$@V_{GS}=10V,I_D=8A,TYP=12mΩ
- $R_{DS(ON)}$@V_{GS}=4.5V,I_D=4A,TYP=17mΩ
- **P-Channel:**
- $V_{(BR)DSS}$=-40V,I_D=-18A
- $R_{DS(ON)}$@V_{GS}=-10V,I_D=-8A,TYP=28mΩ
- $R_{DS(ON)}$@V_{GS}=-4.5V,I_D=-4A,TYP=38mΩ

Package



General Description

Complementary Enhancement MOSFET in a TO-252-4L Package.The BMI404D1538 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge can be used in a wide variety of applications.

Applications

- Power faction correction (PFC)
- Uninterruptible power supply (UPS)
- Switched mode power supplies (SMPS)
- LED lighting power

Absolute Maximum Ratings (T_J=25°C unless otherwise specified)

Symbol	Parameter		N-Channel	P-Channel	Units
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage		40	-40	V
V_{GS}	Gate - Source Voltage		±20	±20	V
I_D	Continuous Drain Current	T_C=25°C	30	-18	A
I_{DM}	Pulse Drain Current (1)		120	-72	A
P_D	Power Dissipation	T_C=25°C	35		W
T_J,T_{stg}	Junction and Storage temperature range		-55 to +150		°C
T_L	Max. lead temperature for soldering purposes, 1/8” from case for 5 seconds		300		°C
$R_{\theta JC}$	Thermal Resistance From Junction to Case		3.5		°C/W
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient		62.5		°C/W

Revision: 2022-Jan-1-A

BMI404D1538

N+P-Channel MOSFET

N-Channel Electrical Characteristics (T_J=25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Static Electrical Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0, I_D=250uA	40	–	–	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40V, V_{GS}=0	–	–	1	uA
Gate-Body Leakage Current	I_{GSS}	V_{GS} = ±20V, V_{DS}=0	–	–	±100	nA
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D=250uA	1.5	1.9	2.5	V
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=8A	–	12	15	mΩ
		V_{GS}=4.5V, I_D=4A	–	17	25	
Forward Transconductance	g_{fs}	V_{DS}=5V, I_D=10A	10	14.7	20	S
Dynamic Electrical Characteristics						
Input capacitance	C_{iss}	V_{DS} =20V,	–	1512	–	pF
Output capacitance	C_{oss}	V_{GS} =0V,	–	208	–	
Reverse transfer capacitance	C_{rss}	f = 1MHz	–	142	–	
Gate to Drain Charge	Q_g	V_{DS}=20V,	–	23	–	nC
Gate to Source Charge	Q_{gs}	V_{GS}=10V,	–	5.1	–	
Gate to Drain Charge	Q_{gd}	I_D=10A (2,3)	–	4.6	–	
Switching Characteristics						
Turn-on delay time	$T_{d(on)}$	V_{DD}=20V,	–	5.8	–	ns
Turn-on Rise time	T_r	V_{GS}=10V,	–	12.5	–	
Turn -Off Delay Time	$T_{d(off)}$	R_G =3Ω (2,3)	–	21	–	
Turn -Off Fall time	T_f		–	6.7	–	
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=10A	–	0.86	1.4	V
Continuous Source Current	I_S	Integral Reverse P-N Junction	–	–	30	A
Pulsed Source Current	I_{SM}	Diode in the MOSFET	–	–	120	

Notes:

(1) Pluse width limited by maximum junction temperature.

(2) Pulse Test: Pulse width≤300μs, Duty cycle≤2%.

(3) Essentially independent of operating temperature.

P-Channel Electrical Characteristics (T_J=25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Static Electrical Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D=-250uA	-40	–	–	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-40V, V_{GS}=0V	–	–	-1	uA
Gate-Body Leakage Current	I_{GSS}	V_{GS} = ±20V, V_{DS}=0V	–	–	±100	nA
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D=-250uA	-1.5	-1.9	-2.4	V
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D=-8A	–	28	38	mΩ
		V_{GS}=-4.5V, I_D=-4A	–	38	52	
Forward Transconductance	g_{fs}	V_{DS}=-5V, I_D=-10A	12	16.8	22	S
Dynamic Electrical Characteristics						
Input capacitance	C_{iss}	V_{DS} =-20V,	–	1217	–	pF
Output capacitance	C_{oss}	V_{GS} =0V,	–	198	–	
Reverse transfer capacitance	C_{rss}	f = 1MHz	–	125	–	
Gate to Drain Charge	Q_g	V_{DS}=-20V,	–	23.5	–	nC
Gate to Source Charge	Q_{gs}	V_{GS}=-10V,	–	3.7	–	
Gate to Drain Charge	Q_{gd}	I_D=-7A (2,3)	–	3.1	–	
Switching Characteristics						
Turn-on delay time	$T_{d(on)}$	V_{DD}=-20V,	–	11.5	–	ns
Turn-on Rise time	T_r	V_{GS}=-10V,	–	13.8	–	
Turn -Off Delay Time	$T_{d(off)}$	R_G =6.0Ω (2,3)	–	32.7	–	
Turn -Off Fall time	T_f		–	17.9	–	
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=-10A	–	-0.91	-1.4	V
Continuous Source Current	I_S	Integral Reverse P-N Junction	–	–	-18	A
Pulsed Source Current	I_{SM}	Diode in the MOSFET	–	–	-72	

Notes:

(1) Pluse width limited by maximum junction temperature.

(2) Pulse Test: Pulse width≤300μs, Duty cycle≤2%.

(3) Essentially independent of operating temperature.

N-Channel Typical Characteristics

Figure 1: Switching Test Circuit

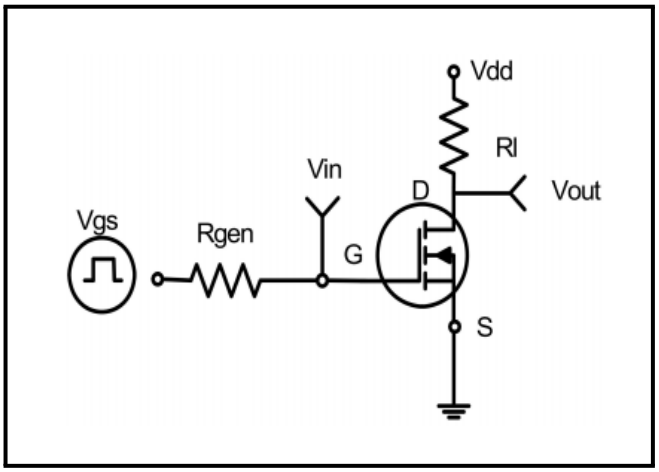


Figure 2: Switching Waveforms

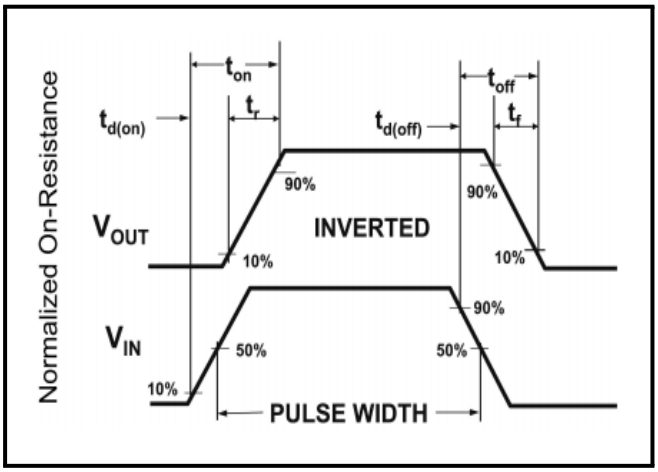


Figure 3: Output Characteristics

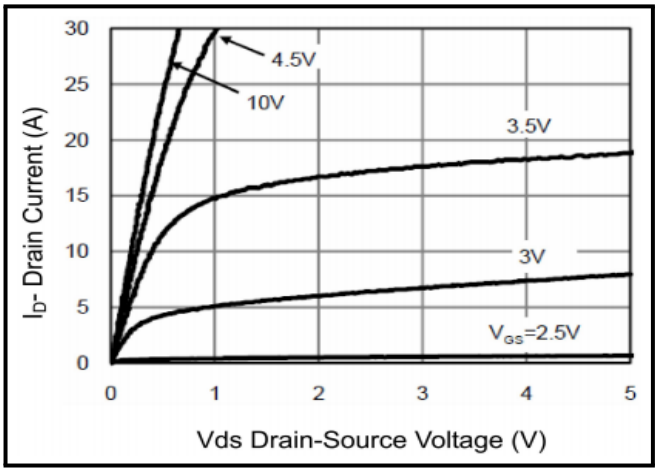


Figure 4: Transfer Characteristics

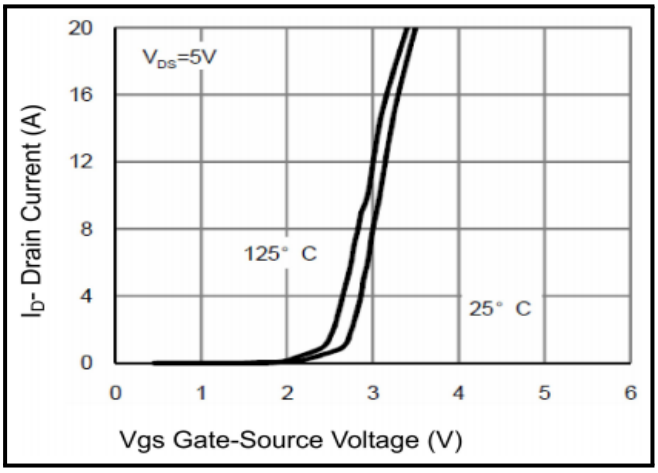


Figure 5: Drain-Source On-Resistance vs I_D

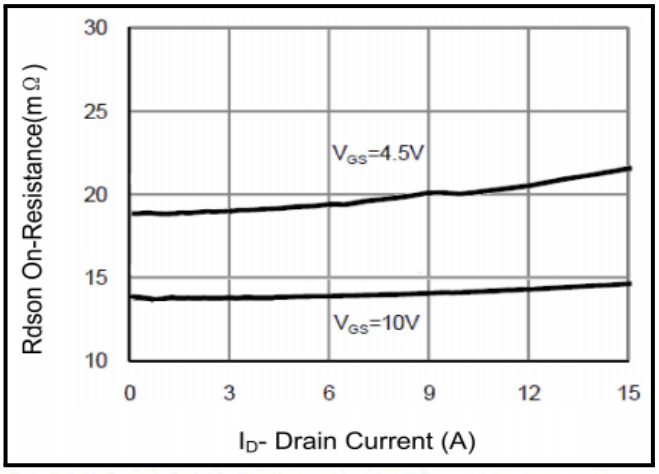
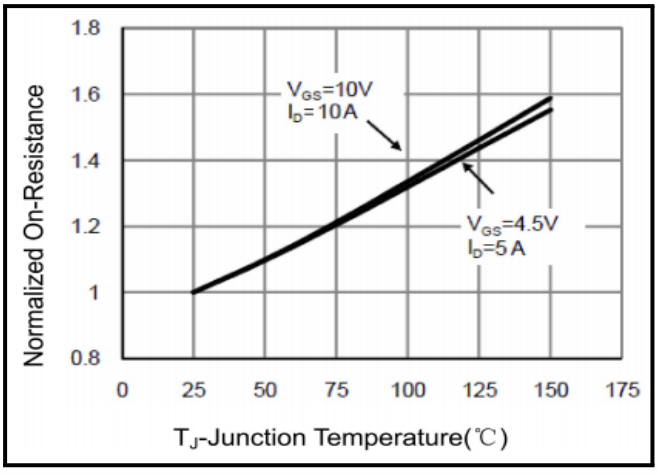


Figure 6: Drain-Source On-Resistance vs T_J



N-Channel Typical Characteristics

Figure 7: $R_{DS(ON)}$ vs V_{GS}

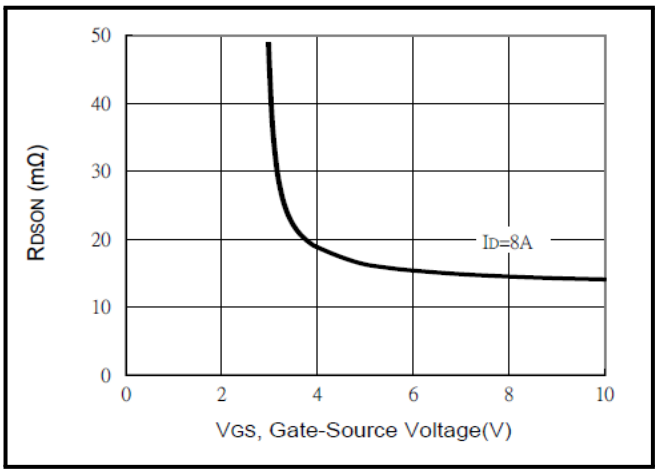


Figure 8: Power Dissipation

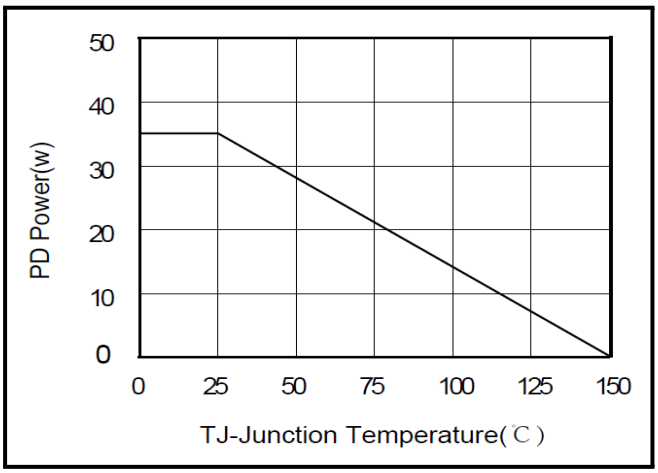


Figure 9: Gate Charge

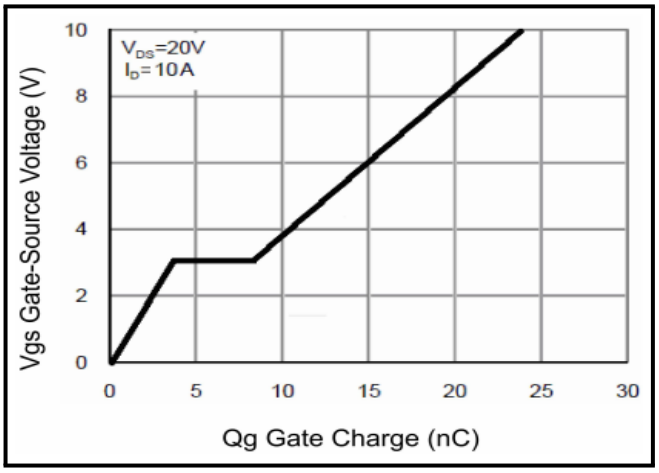


Figure 10: Source-Drain Diode Forward

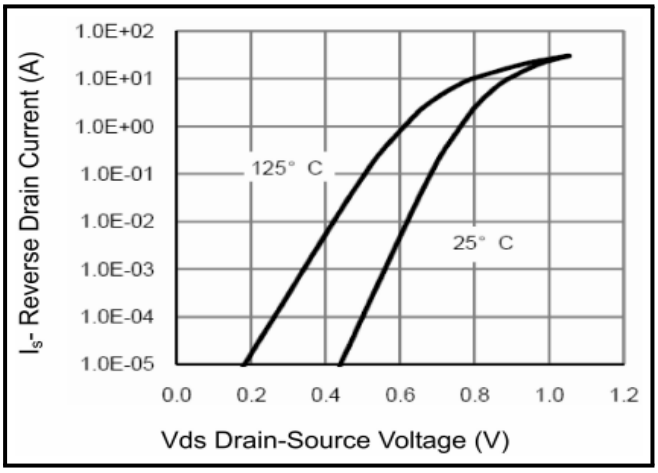


Figure 11: Capacitance vs V_{DS}

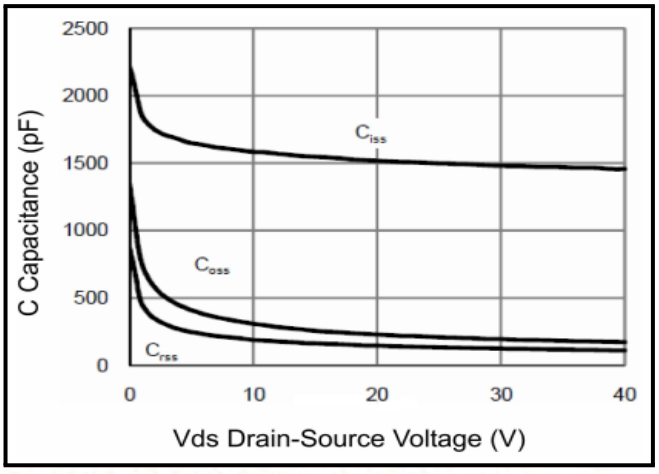
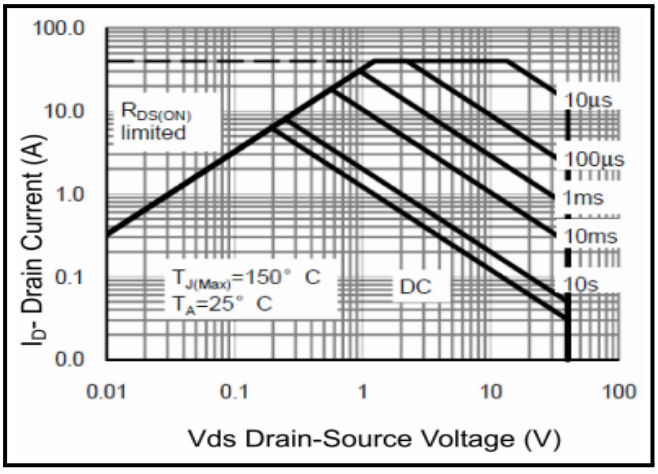


Figure 12: Safe Operation Area



P-Channel Typical Characteristics

Figure 1: Output Characteristics

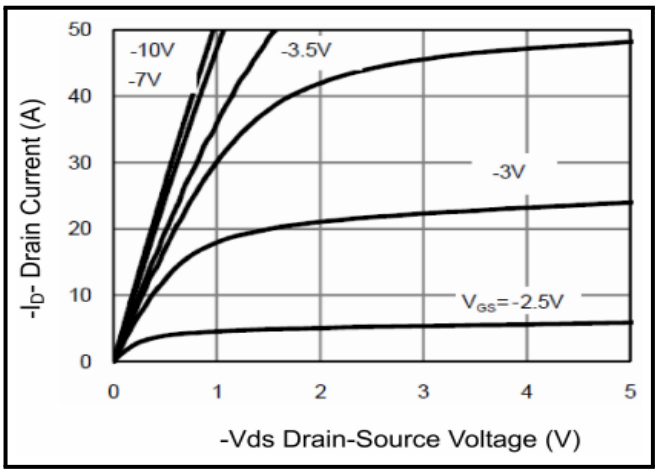


Figure 2: $R_{DS(ON)}$ vs Junction Temperature

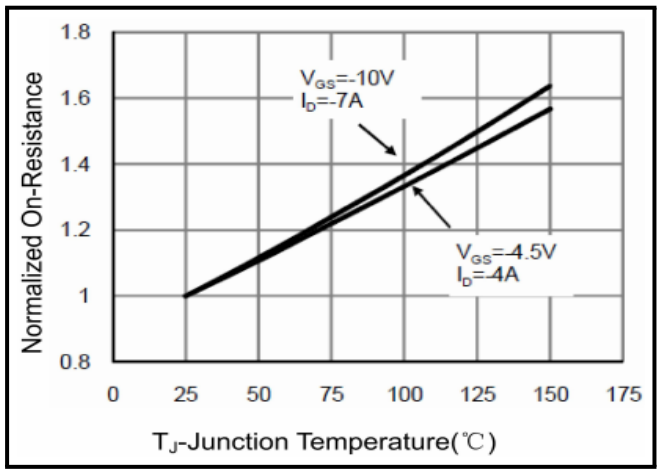


Figure 3: Transfer Characteristics

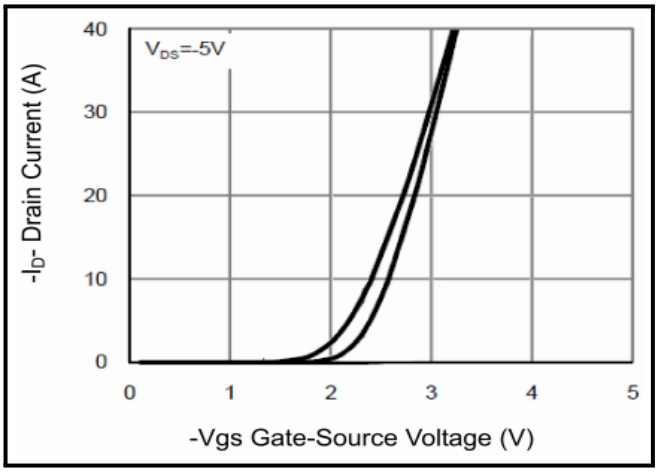


Figure 4: Gate Charge

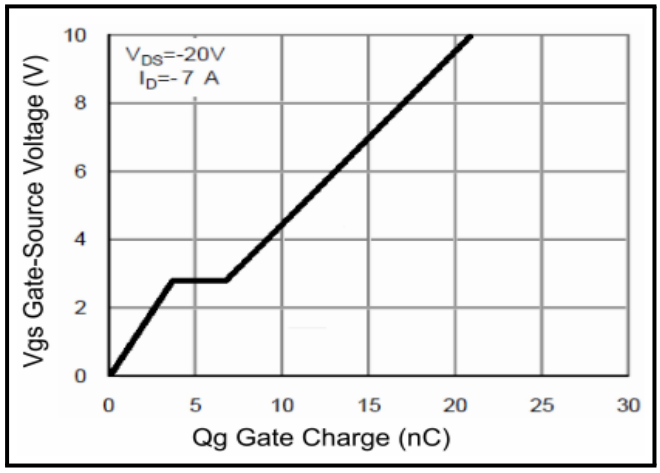


Figure 5: $R_{DS(ON)}$ vs Drain Current

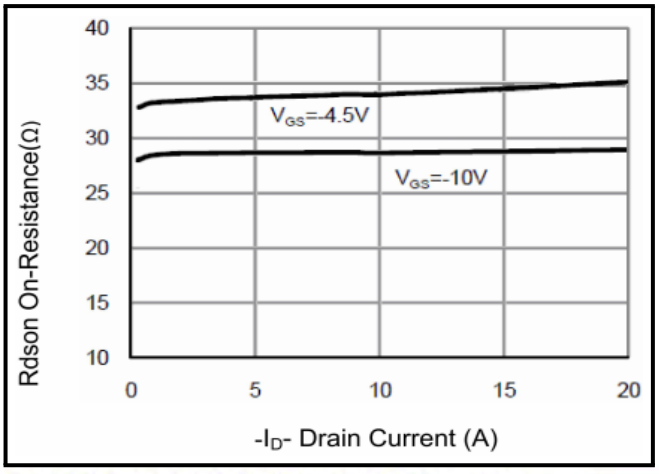
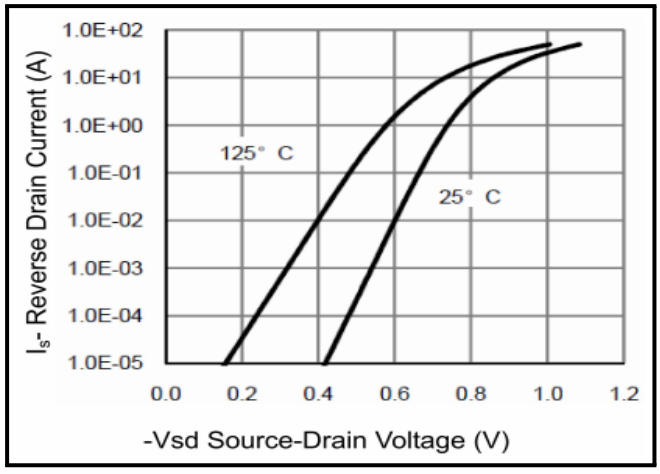


Figure 6: Source-Drain Diode Forward



P-Channel Typical Characteristics

Figure 7: Capacitance vs V_{DS}

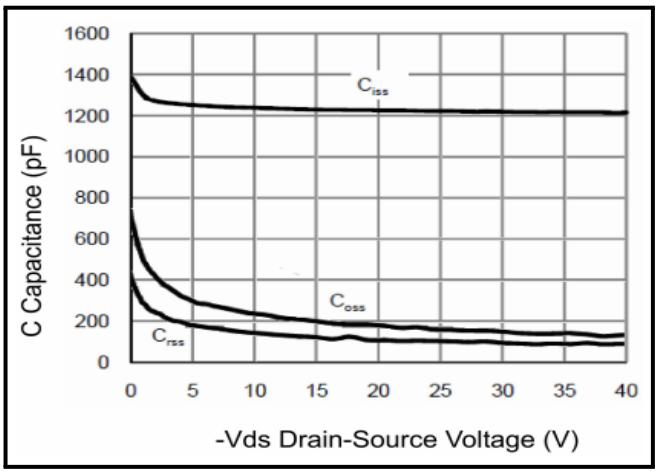


Figure 8: Power Dissipation

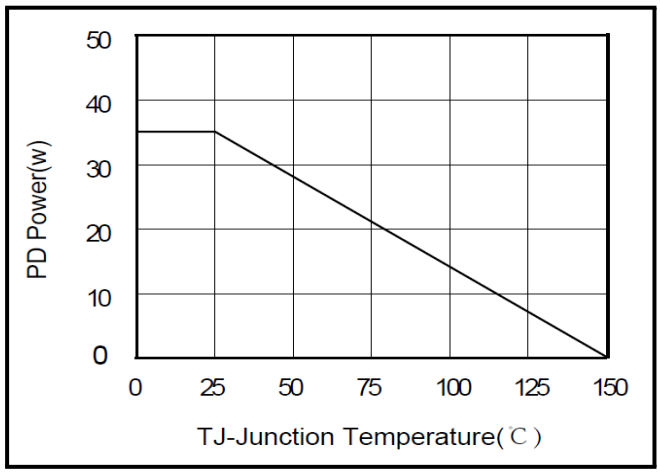


Figure 9: Safe Operation Area

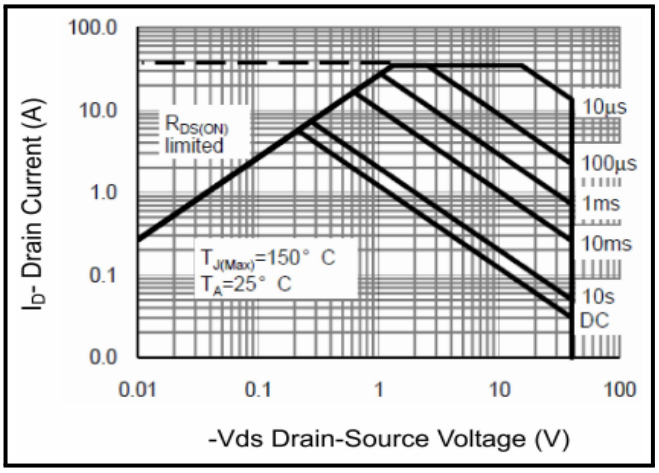
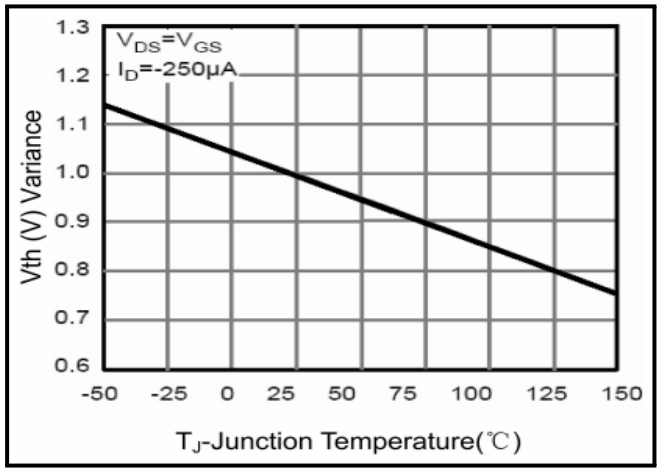


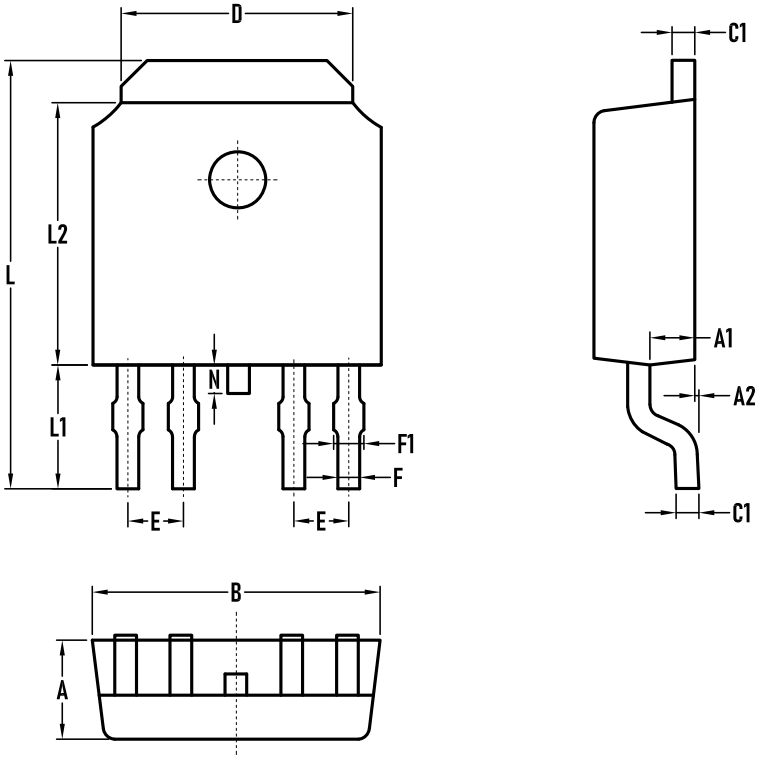
Figure 10: $V_{GS(th)}$ vs Junction Temperature



BMI404D1538

N+P-Channel MOSFET

Packaging Tape - TO-252-4L



SYMBOL	MIN	TYP	MAX
A	2.20	2.30	2.40
A1	0.90	1.00	1.10
A2	0.05	0.15	0.20
B	6.50	6.60	6.70
C	0.46	0.50	0.54
C1	0.46	0.50	0.54
D	5.22	5.32	5.42
E		1.27 typ.	
F	0.40	0.50	0.60
F1	0.50	0.60	0.70
L	9.77	9.97	10.17
L1	2.67	2.87	3.07
L2	6.02	6.10	6.18
N	0.55	0.65	0.75