

4513GD-VB Datasheet

N- and P-Channel 30 V (D-S) MOSFET

PRODUCT SUMMARY

	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
N-Channel	30	0.018 at $V_{GS} = 10$ V	8 ^e	6.2
		0.020 at $V_{GS} = 8$ V	8 ^e	
		0.024 at $V_{GS} = 4.5$ V	8 ^e	
P-Channel	- 30	0.032 at $V_{GS} = - 10$ V	- 8 ^e	18.5
		0.034 at $V_{GS} = - 8$ V	- 8 ^e	
		0.040 at $V_{GS} = - 4.5$ V	- 7.5	

FEATURES

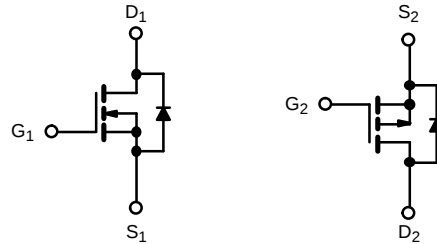
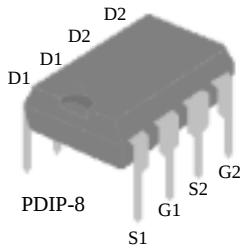
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Motor Drive
- Mobile Power Bank



ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °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	
Continuous Drain Current ($T_J = 150$ °C)	$T_C = 25$ °C	I_D	8 ^e	- 8 ^e	A
	$T_C = 70$ °C		6.8	- 6.8	
	$T_A = 25$ °C		6.8 ^{b, c}	- 6.6 ^{b, c}	
	$T_A = 70$ °C		5.4 ^{b, c}	- 5.3 ^{b, c}	
Pulsed Drain Current (10 μ s Pulse Width)		I_{DM}	40	- 40	
Source-Drain Current Diode Current	$T_C = 25$ °C	I_S	2.6	- 2.6	
	$T_A = 25$ °C		1.6 ^{b, c}	- 1.6 ^{b, c}	
Pulsed Source-Drain Current		I_{SM}	40	- 40	mJ
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	10	- 20	
Single Pulse Avalanche Energy		E_{AS}	5	20	W
Maximum Power Dissipation	$T_C = 25$ °C	P_D	3.1	3.2	
	$T_C = 70$ °C		2	2.1	
	$T_A = 25$ °C		2 ^{b, c}	2 ^{b, c}	
	$T_A = 70$ °C		1.28 ^{b, c}	1.28 ^{b, c}	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	N-Channel		P-Channel		Unit
			Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient ^{b, d}	$t \leq 10$ s	R_{thJA}	50	62.5	47	62.5	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	30	40	29	38	

Notes:

a. Based on $T_C = 25$ °C.

b. Surface mounted on 1" x 1" FR4 board.

c. $t = 10$ s.

d. Maximum under steady state conditions is 120 °C/W (n-channel) and 110 °C/W (p-channel).

e. Package limited.

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)							
Parameter	Symbol	Test Conditions		Min.	Typ. ^a	Max.	Unit
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	N-Ch	30			V
		V _{GS} = 0 V, I _D = - 250 μA	P-Ch	- 30			
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA	N-Ch		40		mV/°C
		I _D = - 250 μA	P-Ch		- 34		
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	N-Ch		- 4.1		
		I _D = - 250 μA	P-Ch		5		
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch	1.0		2.0	V
		V _{DS} = V _{GS} , I _D = - 250 μA	P-Ch	- 1.0		- 2.0	
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 12 V	N-Ch			± 100	nA
		V _{DS} = 0 V, V _{GS} = ± 12 V	P-Ch			± 100	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V	N-Ch			1	μA
		V _{DS} = - 30 V, V _{GS} = 0 V	P-Ch			- 1	
		V _{DS} = 30 V, V _{GS} = 0 V, T _J = 55 °C	N-Ch			10	
		V _{DS} = - 30 V, V _{GS} = 0 V, T _J = 55 °C	P-Ch			- 10	
On-State Drain Current ^b	I _{D(on)}	V _{DS} = 5 V, V _{GS} = 10 V	N-Ch	20			A
		V _{DS} = - 5 V, V _{GS} = - 10 V	P-Ch	- 20			
Drain-Source On-State Resistance ^b	R _{DS(on)}	V _{GS} = 10 V, I _D = 6.8 A	N-Ch		0.018		Ω
		V _{GS} = - 10 V, I _D = - 8 A	P-Ch		0.032		
		V _{GS} = 8 V, I _D = 6.7 A	N-Ch		0.020		
		V _{GS} = - 8 V, I _D = - 6.5 A	P-Ch		0.034		
		V _{GS} = 4.5 V, I _D = 6.6 A	N-Ch		0.024		
		V _{GS} = - 4.5 V, I _D = - 5 A	P-Ch		0.040		
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 6.8 A	N-Ch		27		S
		V _{DS} = - 15 V, I _D = - 6.7 A	P-Ch		25		
Dynamic ^a							
Input Capacitance	C _{iss}	N-Channel V _{DS} = 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch		510		pF
			P-Ch		620		
Output Capacitance	C _{oss}	P-Channel V _{DS} = - 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch		95		
			P-Ch		115		
Reverse Transfer Capacitance	C _{rss}		N-Ch		33		
			P-Ch		57		
Total Gate Charge	Q _g	V _{DS} = 20 V, V _{GS} = 10 V, I _D = 10 A	N-Ch		6	10	nC
		V _{DS} = - 20 V, V _{GS} = - 10 V, I _D = - 10 A	P-Ch		41.5	63	
Gate-Source Charge	Q _{gs}	N-Channel V _{DS} = 20 V, V _{GS} = 4.5 V, I _D = 10 A	N-Ch		5.8	7	
			P-Ch		16	22	
Gate-Drain Charge	Q _{gd}	P-Channel V _{DS} = - 20 V, V _{GS} = - 4.5 V, I _D = - 10 A	N-Ch		1.6		
			P-Ch		4.3		
Gate Resistance	R _g	f = 1 MHz	N-Ch	0.3	1.1	2.3	Ω
			P-Ch	1.2	5.7	9.6	

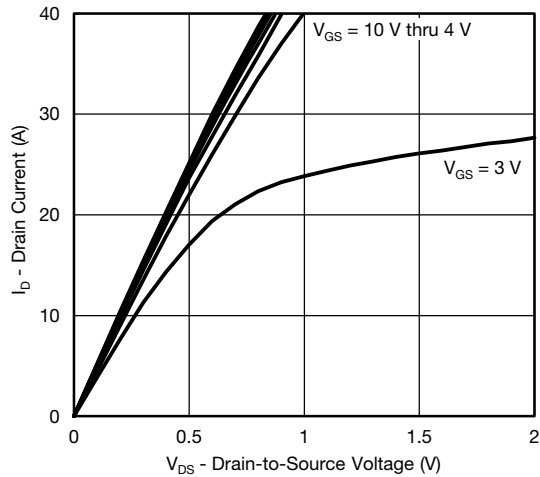
SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)								
Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit		
Dynamic ^a								
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 20 V, R _L = 3.7 Ω I _D ≅ 5.4 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch		4	8	ns	
			P-Ch		10	16		
Rise Time	t _r		N-Ch		10	17		
			P-Ch		9	15		
Turn-Off Delay Time	t _{d(off)}	P-Channel V _{DD} = - 20 V, R _L = 2 Ω I _D ≅ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω	N-Ch		16	22		
			P-Ch		23	26		
Fall Time	t _f		N-Ch		5	9		
			P-Ch		10	16		
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 20 V, R _L = 3.7 Ω I _D ≅ 5.4 A, V _{GEN} = 4.5 V, R _g = 1 Ω	N-Ch		10	16	ns	
			P-Ch		26	35		
Rise Time	t _r		N-Ch		11	20		
			P-Ch		16	26		
Turn-Off Delay Time	t _{d(off)}	P-Channel V _{DD} = - 20 V, R _L = 2 Ω I _D ≅ - 10 A, V _{GEN} = - 4.5 V, R _g = 1 Ω	N-Ch		13	22		
			P-Ch		16	26		
Fall Time	t _f		N-Ch		5	9		
			P-Ch		16	26		
Drain-Source Body Diode Characteristics								
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C	N-Ch			2.6	A	
			P-Ch			- 2.6		
Pulse Diode Forward Current ^a	I _{SM}		N-Ch			40		
			P-Ch			- 40		
Body Diode Voltage	V _{SD}	I _S = 5.4 A	N-Ch		0.81	1.2	V	
		I _S = - 2 A	P-Ch		- 0.77	- 1.2		
Body Diode Reverse Recovery Time	t _{rr}	N-Channel I _F = 5 A, dI/dt = 100 A/μs, T _J = 25 °C	N-Ch		12	25	ns	
			P-Ch		31	57		
Body Diode Reverse Recovery Charge	Q _{rr}		P-Channel I _F = - 5 A, dI/dt = - 100 A/μs, T _J = 25 °C	N-Ch		10	17	nC
				P-Ch		29	47	
Reverse Recovery Fall Time	t _a	N-Ch			10		ns	
		P-Ch			13			
Reverse Recovery Rise Time	t _b	N-Ch		7				
		P-Ch		23				

Notes:

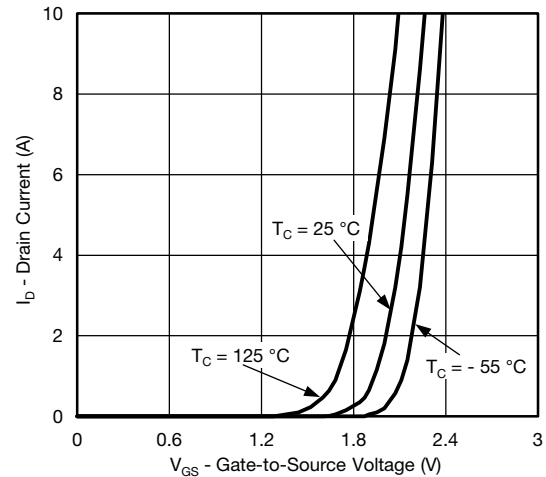
a. Guaranteed by design, not subject to production testing.

b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

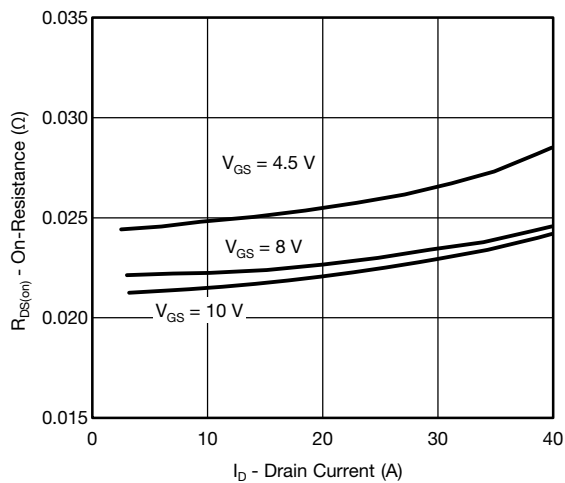
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


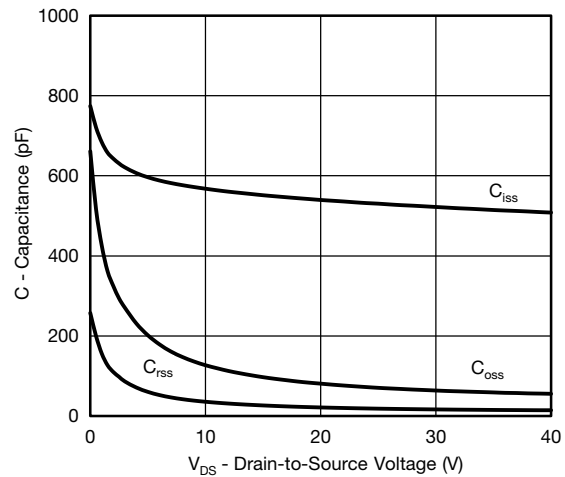
Output Characteristics



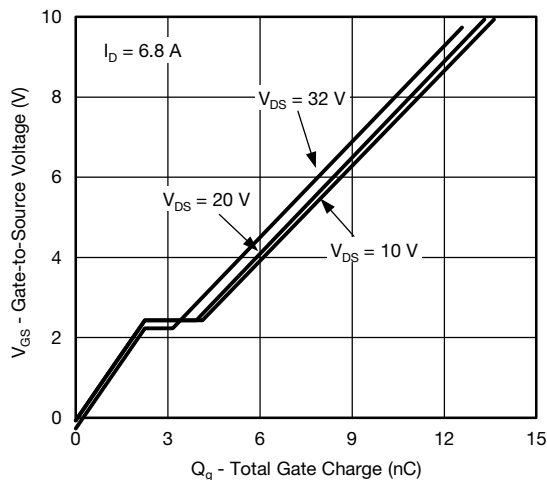
Transfer Characteristics



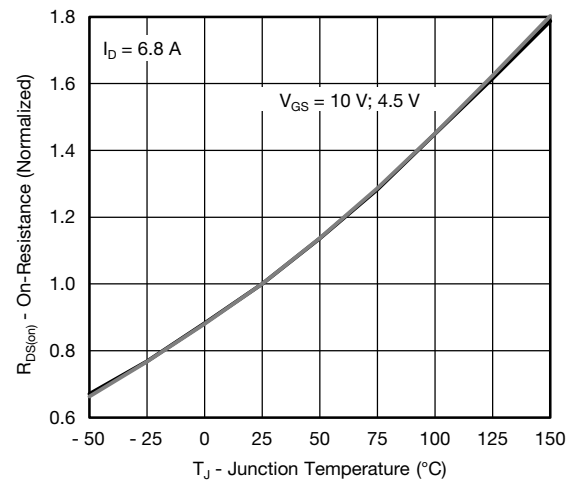
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

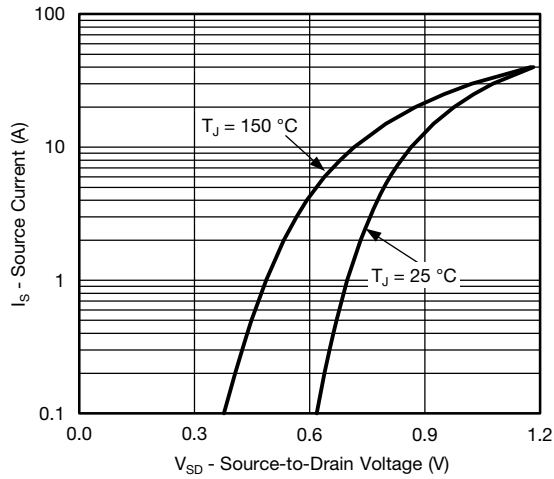


Gate Charge

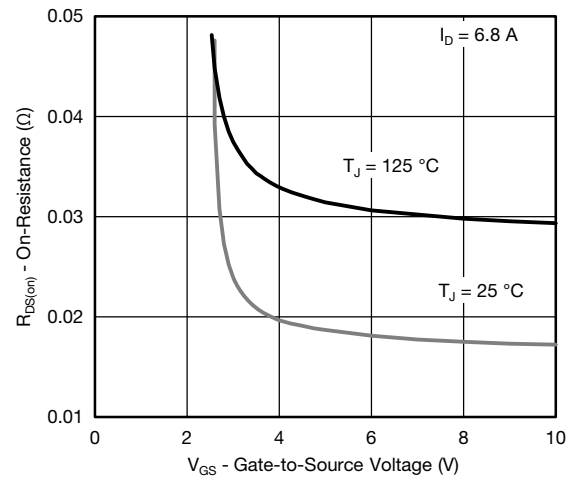


On-Resistance vs. Junction Temperature

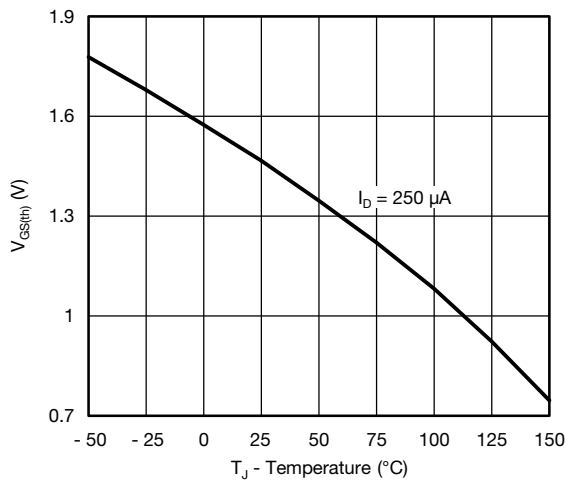
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



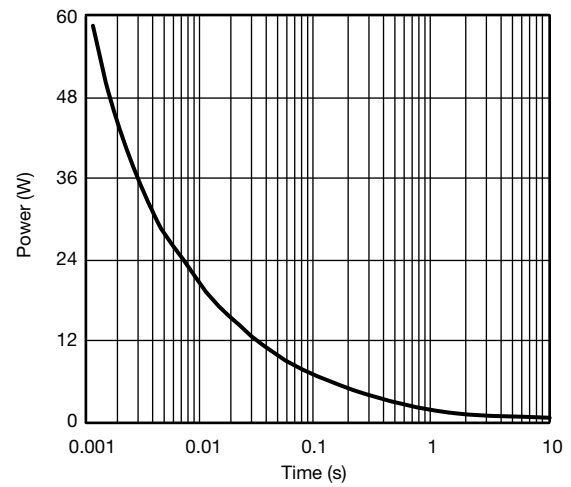
Source-Drain Diode Forward Voltage



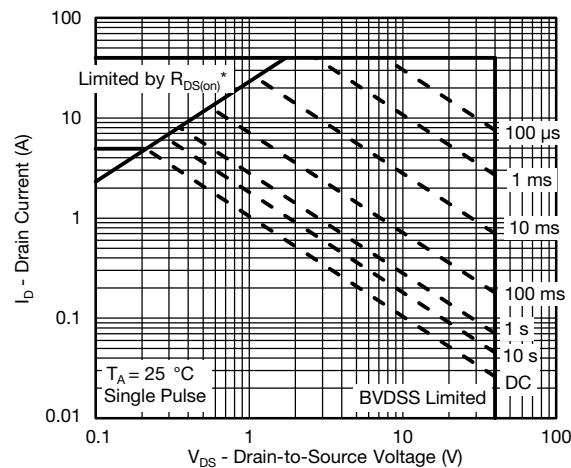
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

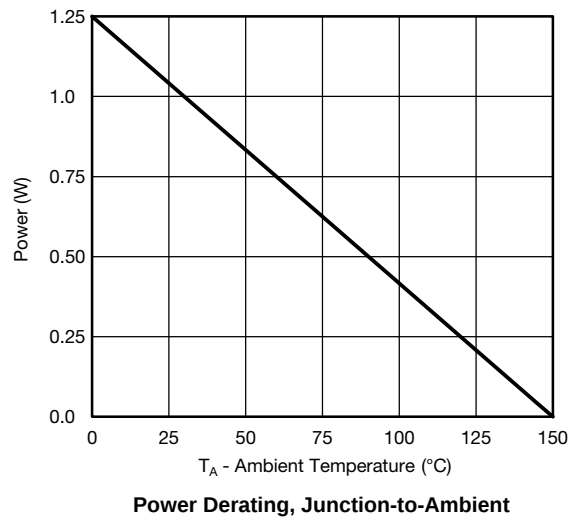
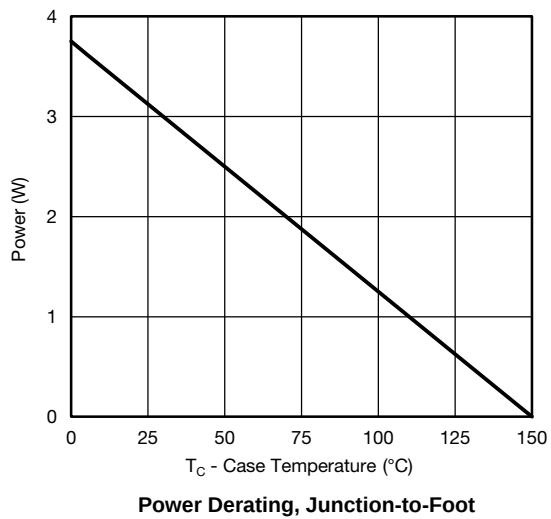
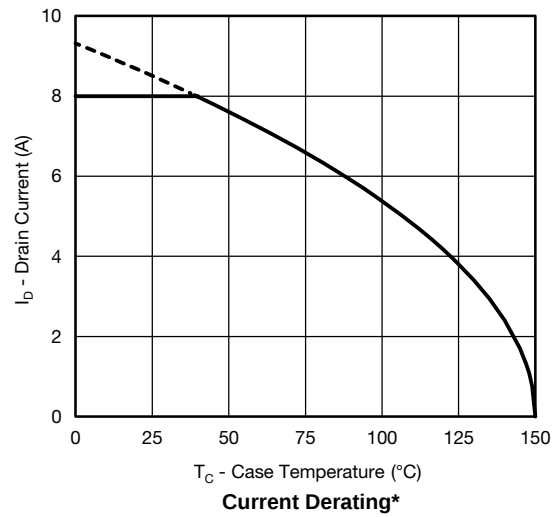


Single Pulse Power, Junction-to-Ambient

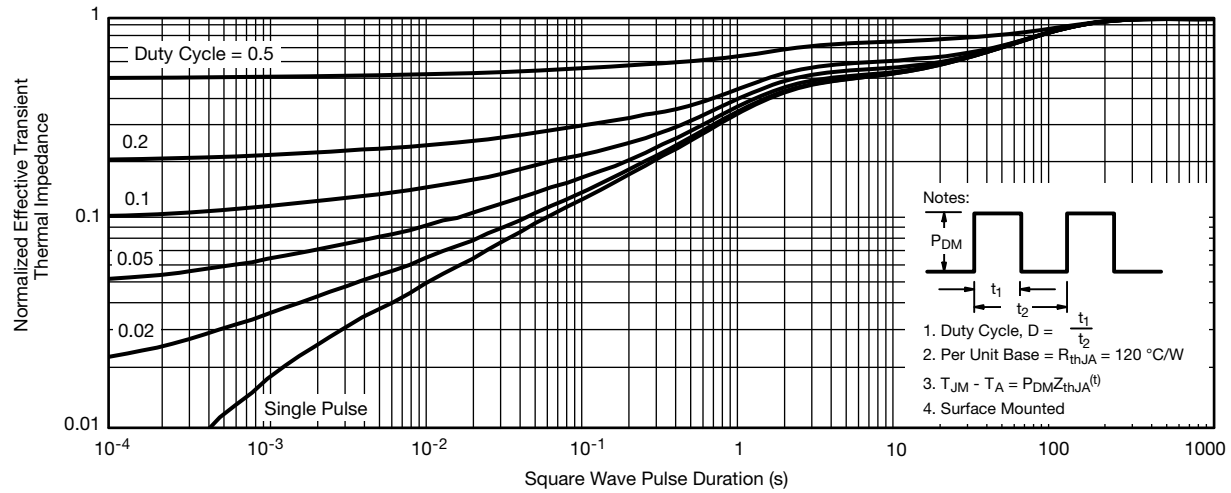
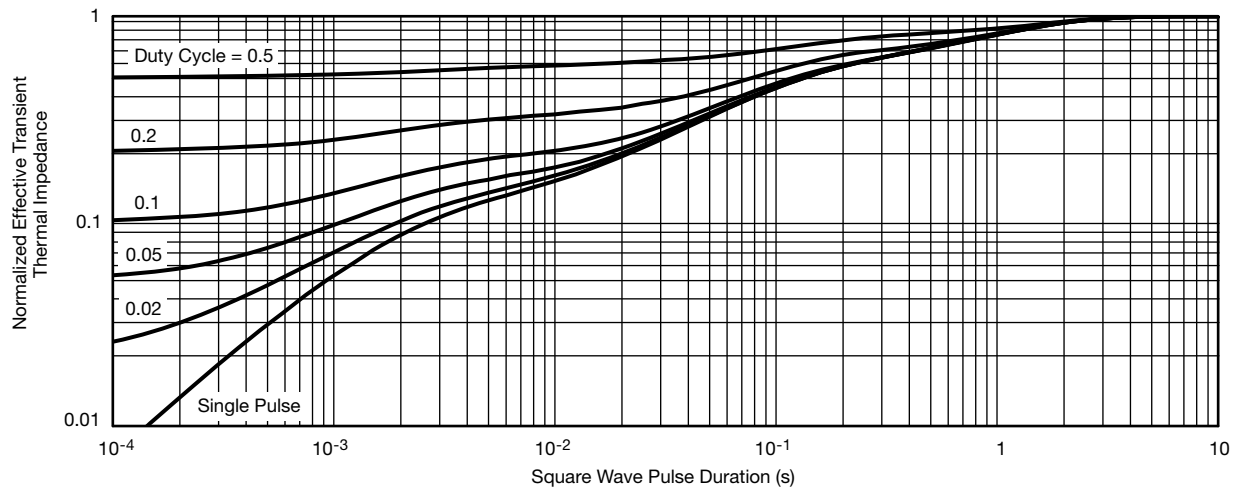


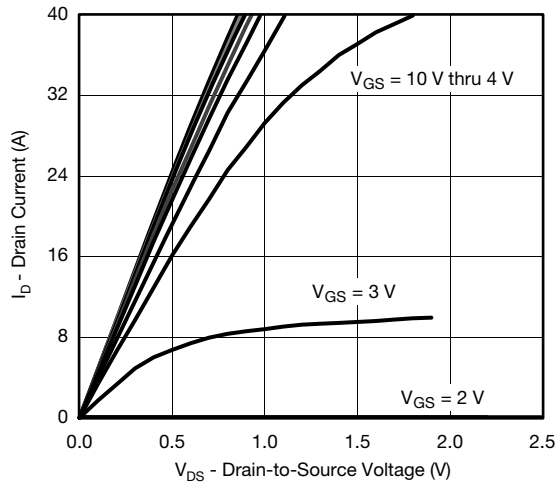
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

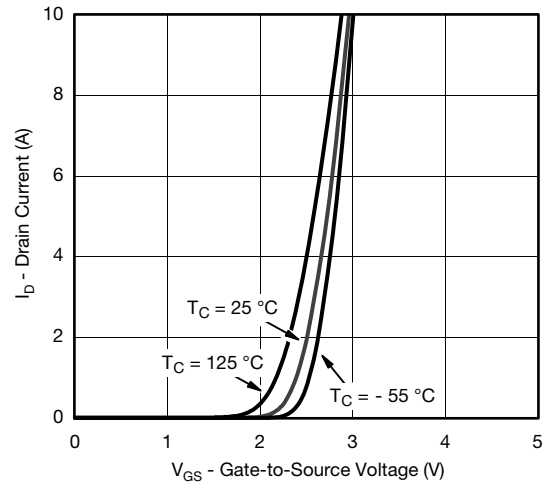
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


* The power dissipation P_D is based on $T_{J(max)} = 150\text{ °C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

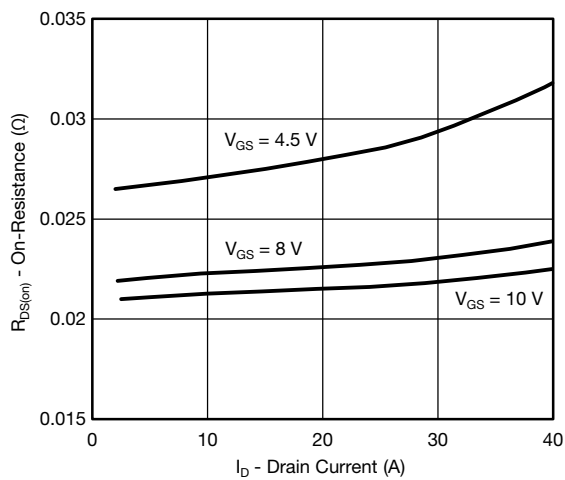
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Foot

P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


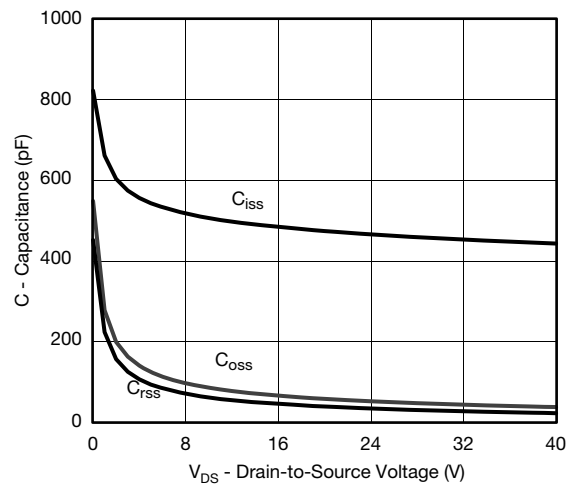
Output Characteristics



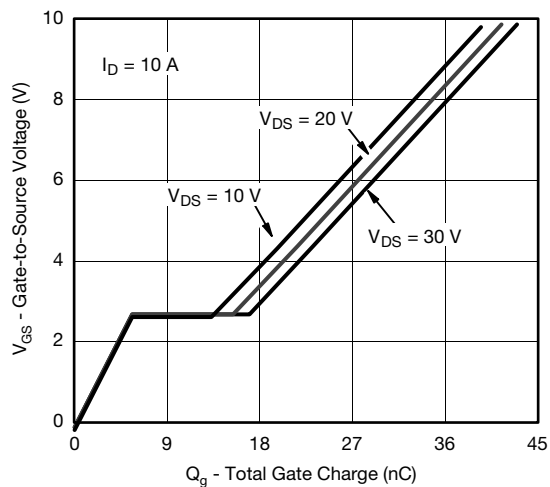
Transfer Characteristics



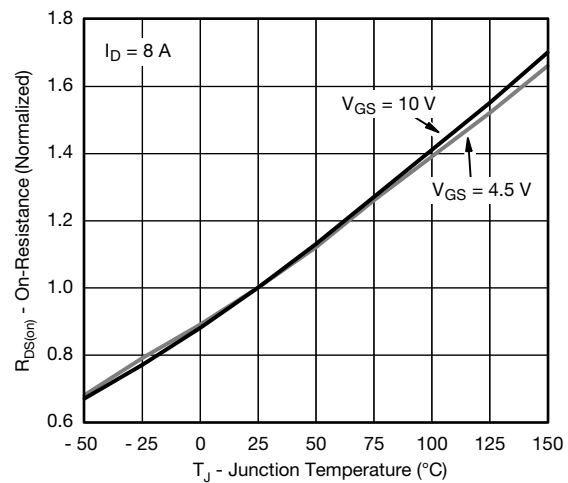
On-Resistance vs. Drain Current and Gate Voltage



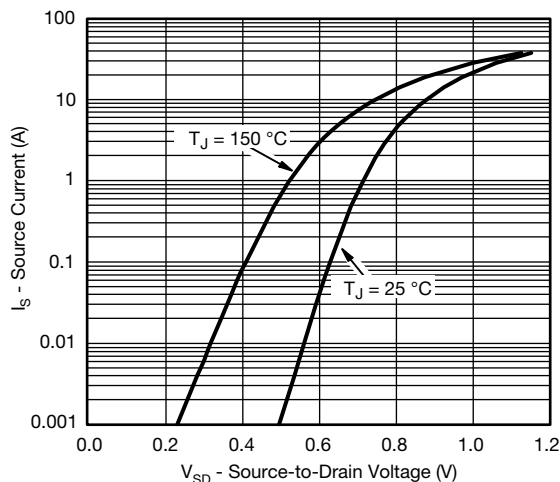
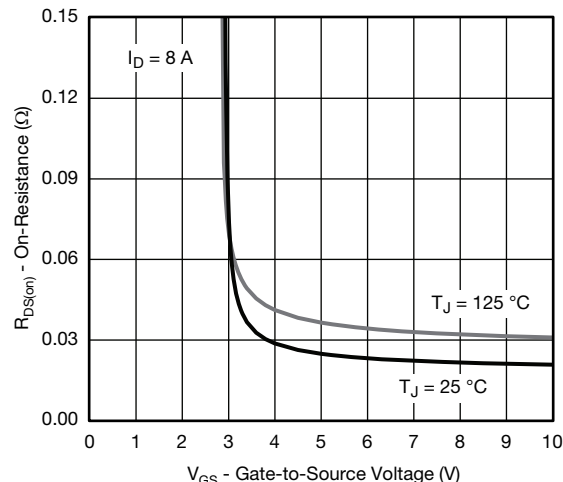
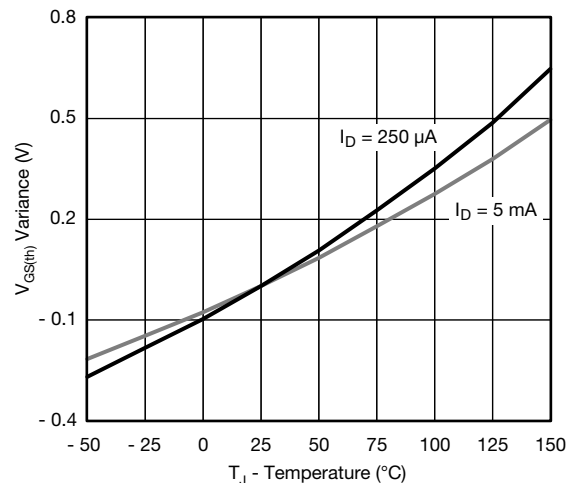
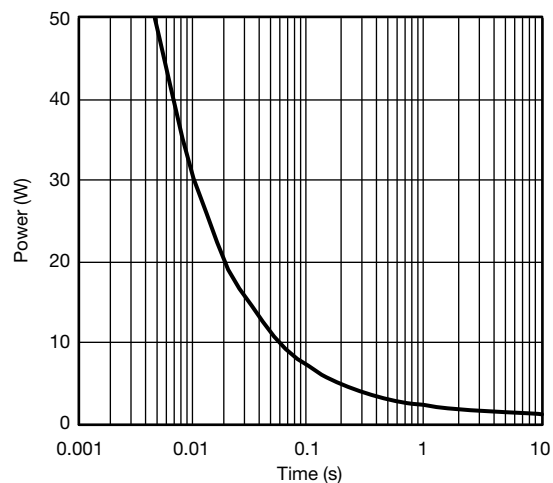
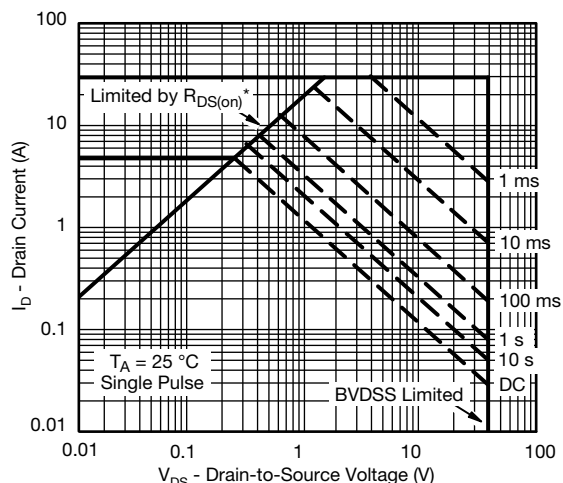
Capacitance



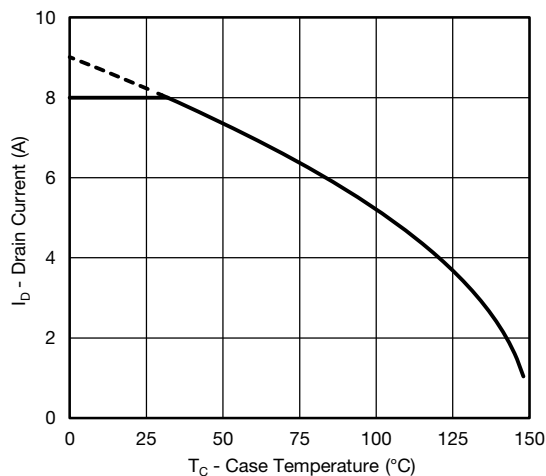
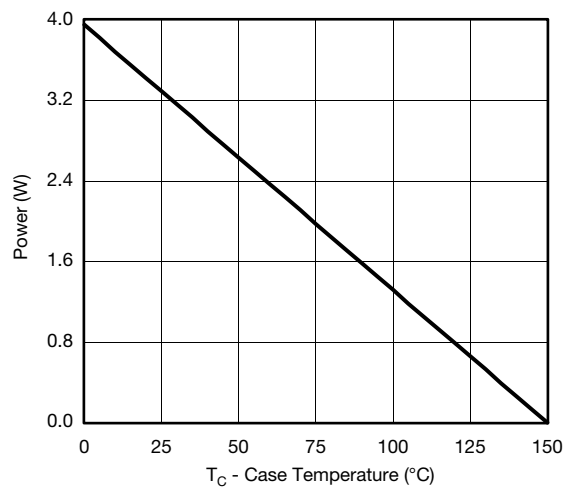
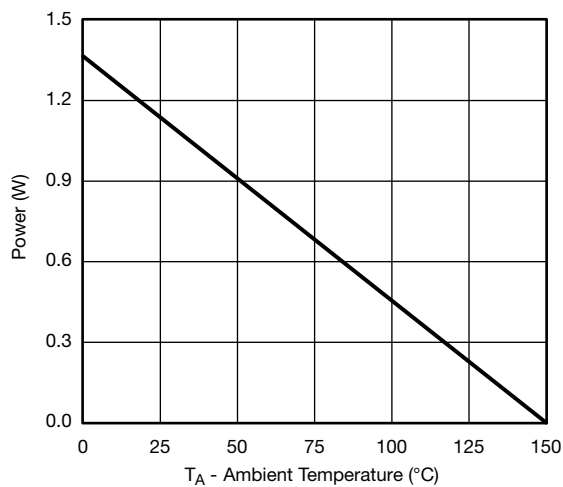
Gate Charge



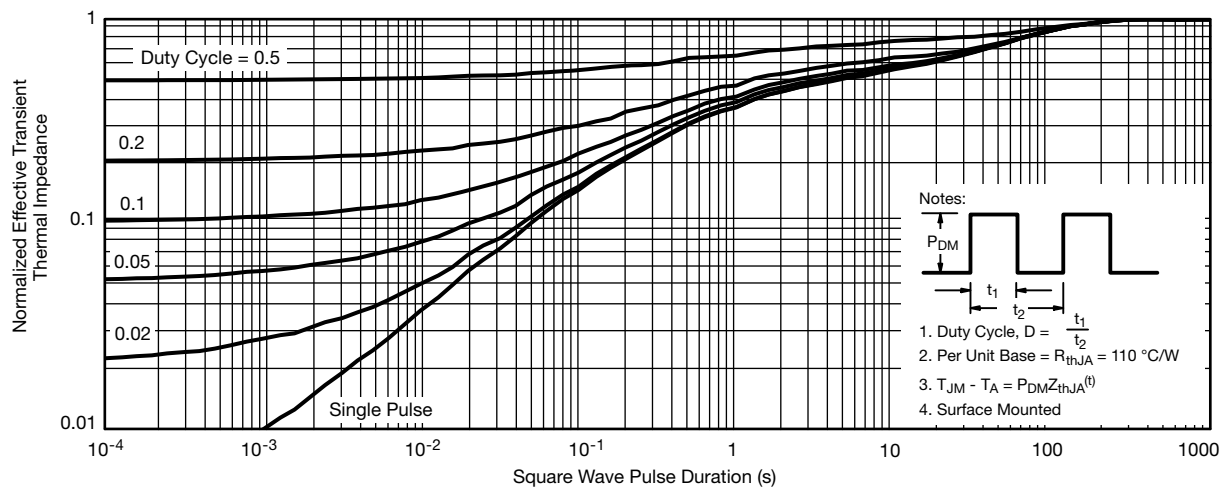
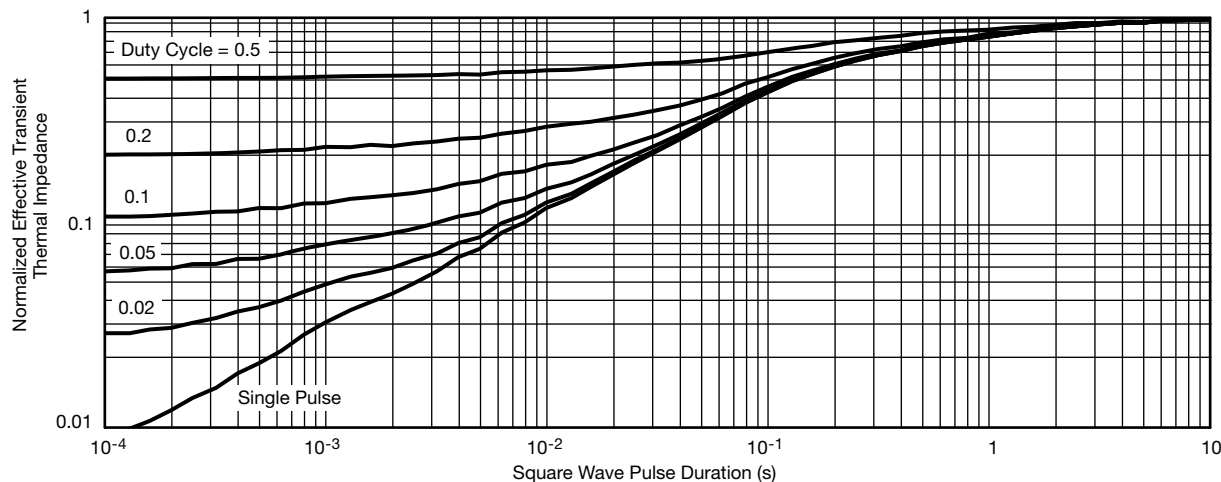
On-Resistance vs. Junction Temperature

P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage

Single Pulse Power, Junction-to-Ambient


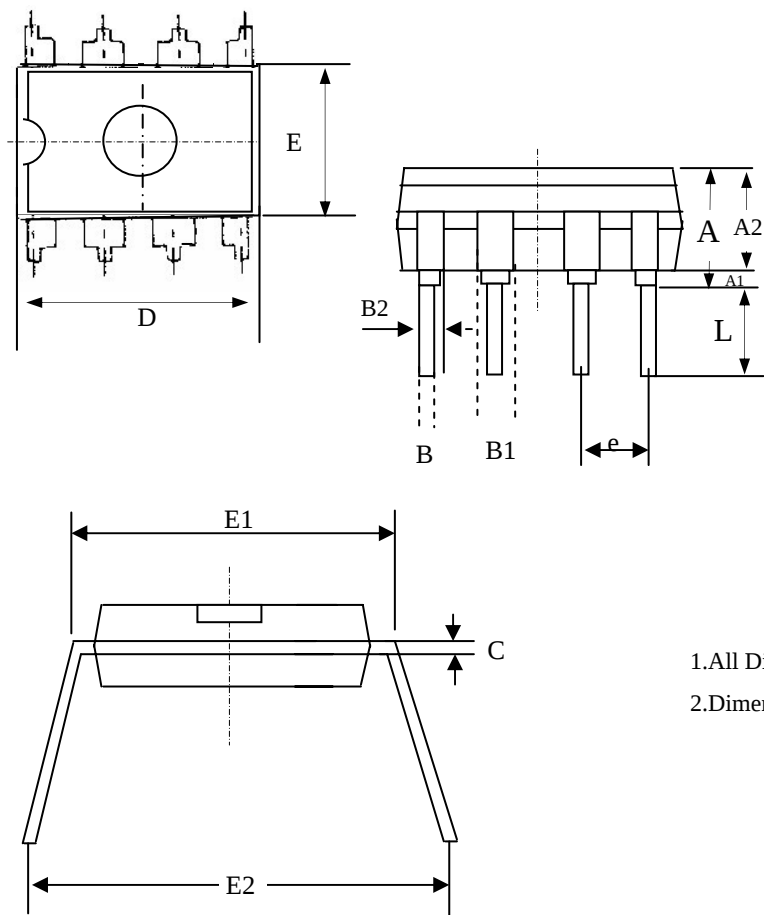
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Ambient

P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating*

Power Derating, Junction-to-Foot

Power Derating, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)} = 150\text{ °C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Foot

Package Outline : PDIP-8



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	3.60	4.50	5.40
A1	0.38	----	----
A2	2.90	3.95	5.00
B	0.36	0.46	0.56
B1	1.10	1.45	1.80
B2	0.76	0.98	1.20
C	0.20	0.28	0.36
D	9.00	9.60	10.20
E	6.10	6.65	7.20
E1	7.62	7.94	8.26
E2	8.30	9.65	11.00
e	2.540 BSC		
L	3.18	----	----

- 1.All Dimensions Are in Millimeters.
- 2.Dimension Does Not Include Mold Protrusions.

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