

IPB50R140CP-VB Datasheet

N-Channel 500-V (D-S) Super Junction MOSFET

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	500	
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 10$ V	0.115
Q_g (Max.) (nC)	86	
Q_{gs} (nC)	14	
Q_{gd} (nC)	25	
Configuration	Single	

FEATURES

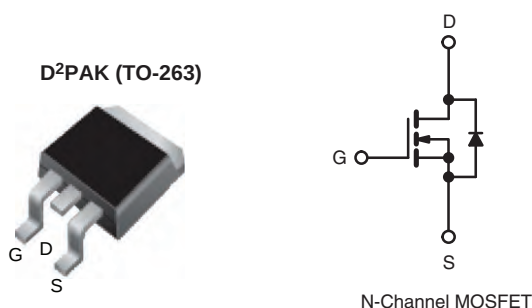
- Low figure-of-merit (FOM): $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Low gate charge (Q_g)
- Avalanche energy rated (UIS)



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APPLICATIONS

- Hard switched topologies
- Power factor correction power supplies (PFC)
- Switch mode power supplies (SMPS)
- Computing
 - PC silver box / ATX power supplies
- Lighting
 - Two stage LED lighting



ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	500	V
Gate-Source Voltage			V_{GS}	± 30	
Continuous Drain Current ($T_J = 150\text{ }^{\circ}\text{C}$)	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	30	A
		$T_C = 100\text{ }^{\circ}\text{C}$		18	
Pulsed Drain Current ^a			I_{DM}	105	
Linear Derating Factor				0.2	W/°C
Single Pulse Avalanche Energy ^b			E_{AS}	273	mJ
Maximum Power Dissipation			P_D	280	W
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +150	°C
Drain-Source Voltage Slope	$V_{DS} = 0\text{ V to }80\text{ \% }V_{DS}$		dV/dt	65	V/ns
Reverse Diode dV/dt ^d				25	
Soldering Recommendations (Peak Temperature) ^c	for 10 s			300	°C

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature.
 b. $V_{DS} = 50$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 4.4$ A.
 c. 1.6 mm from case.
 d. $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.5	

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		500	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.59	-	V/°C
Gate-Source Threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
		V _{GS} = ± 30 V		-	-	± 1	μA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 500 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 400 V, V _{GS} = 0 V, T _J = 125 °C		-	-	25	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 12 A	-	0.115	-	Ω
Forward Transconductance	g _{fs}	V _{DS} = 30 V, I _D = 12 A		-	6.6	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	1980	-	pF
Output Capacitance	C _{oss}			-	105	-	
Reverse Transfer Capacitance	C _{rss}			-	8	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		-	105	-	
Effective Output Capacitance, Time Related ^b	C _{o(tr)}			-	285	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 12 A, V _{DS} = 400 V	-	57	86	nC
Gate-Source Charge	Q _{gs}			-	14	-	
Gate-Drain Charge	Q _{gd}			-	25	-	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 400 V, I _D = 12 A R _g = 9.1 Ω, V _{GS} = 10 V		-	19	38	ns
Rise Time	t _r			-	36	72	
Turn-Off Delay Time	t _{d(off)}			-	57	86	
Fall Time	t _f			-	29	58	
Gate Input Resistance	R _g	f = 1 MHz, open drain		-	0.56	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	12	A
Pulsed Diode Forward Current	I _{SM}			-	-	50	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 16.5 A, V _{GS} = 0 V		-	-	1.2	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S , di/dt = 100 A/μs, V _R = 25 V		-	338	-	ns
Reverse Recovery Charge	Q _{rr}			-	5.3	-	μC
Reverse Recovery Current	I _{RRM}			-	29	-	A

Notes

- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
 b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

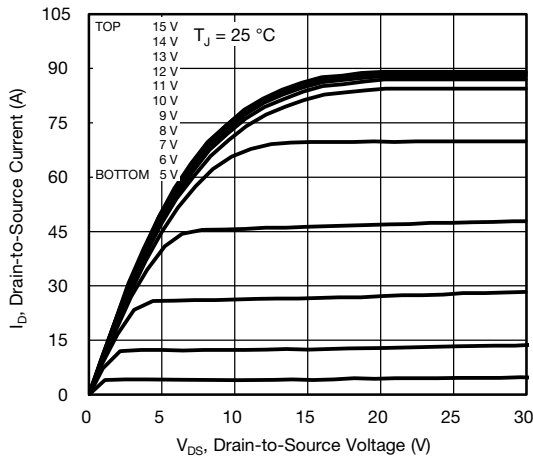


Fig. 1 - Typical Output Characteristics

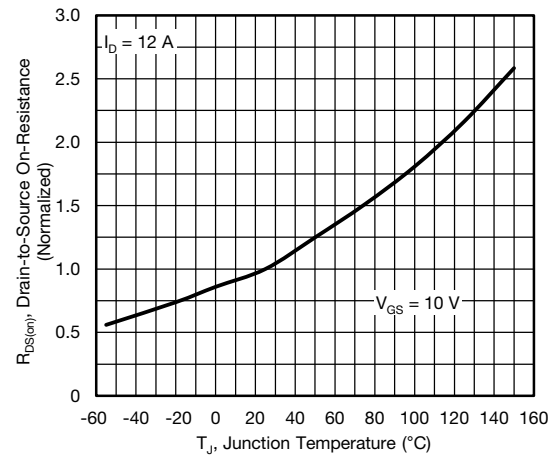


Fig. 4 - Normalized On-Resistance vs. Temperature

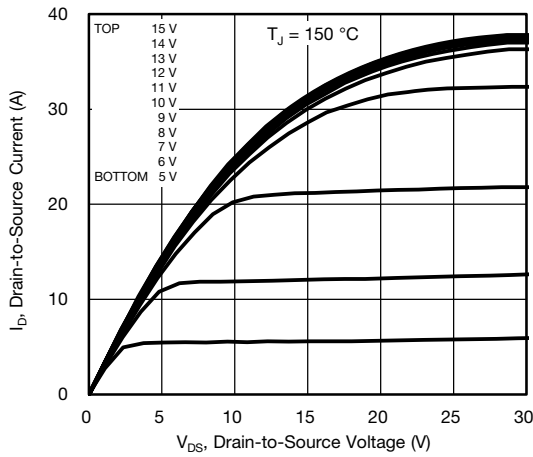


Fig. 2 - Typical Output Characteristics

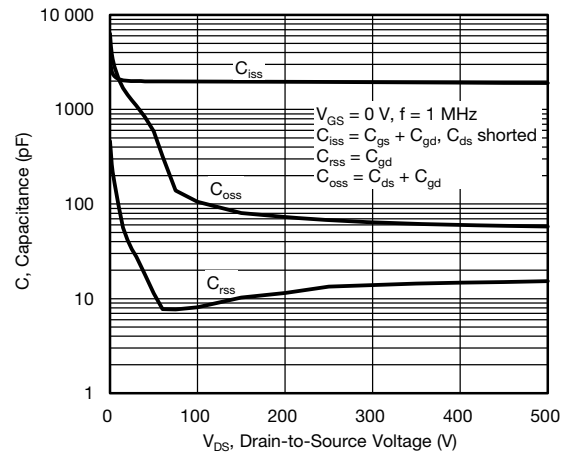


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

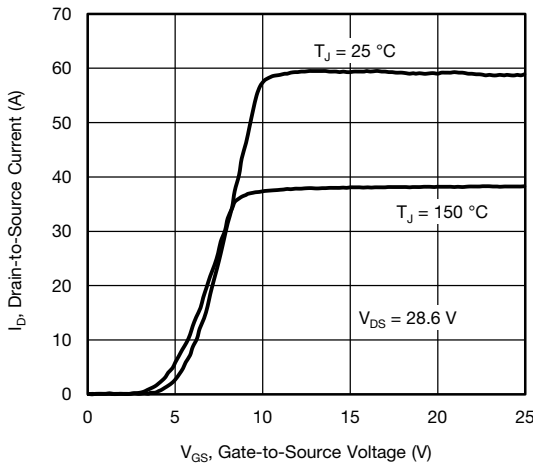


Fig. 3 - Typical Transfer Characteristics

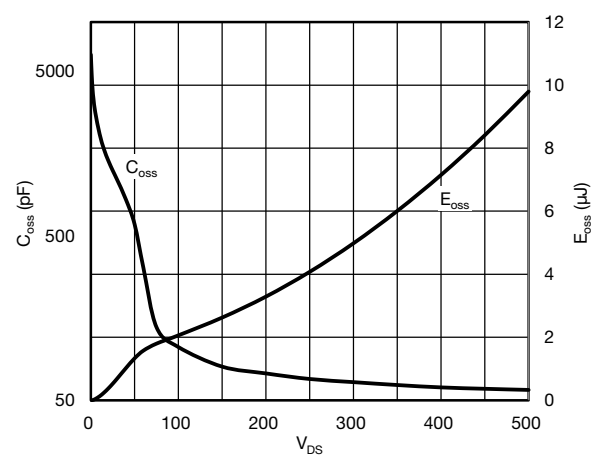


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}

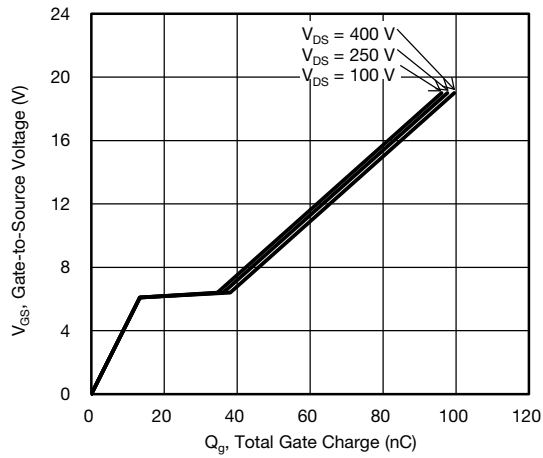


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

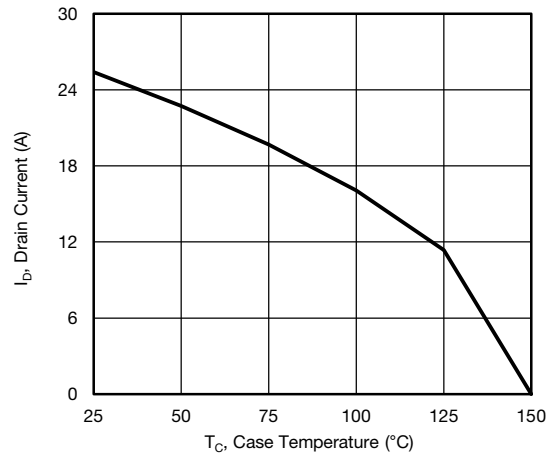


Fig. 10 - Maximum Drain Current vs. Case Temperature

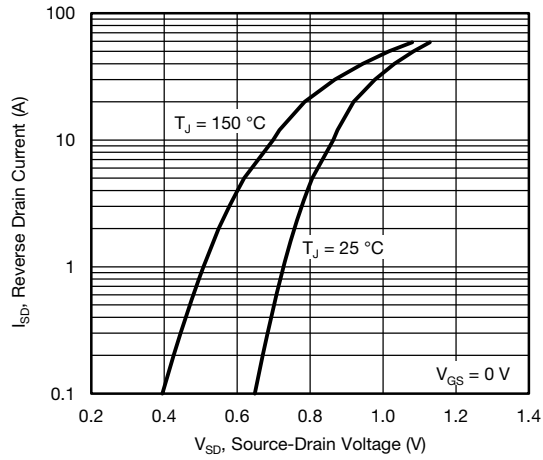


Fig. 8 - Typical Source-Drain Diode Forward Voltage

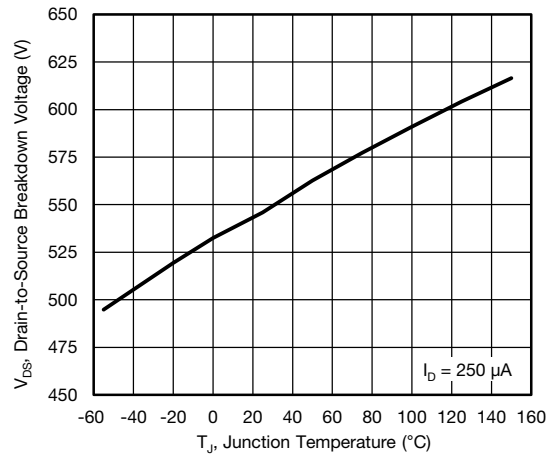


Fig. 11 - Typical Drain-to-Source Voltage vs. Temperature

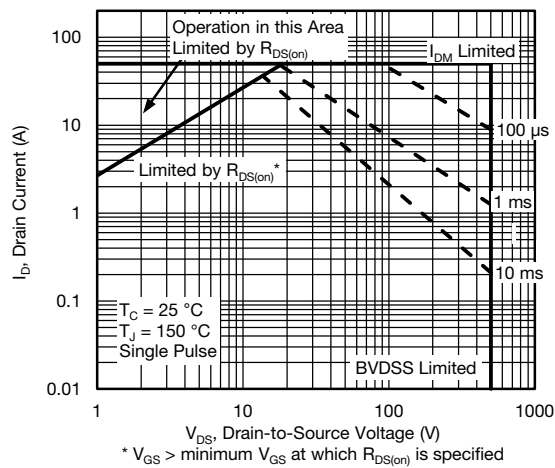


Fig. 9 - Maximum Safe Operating Area

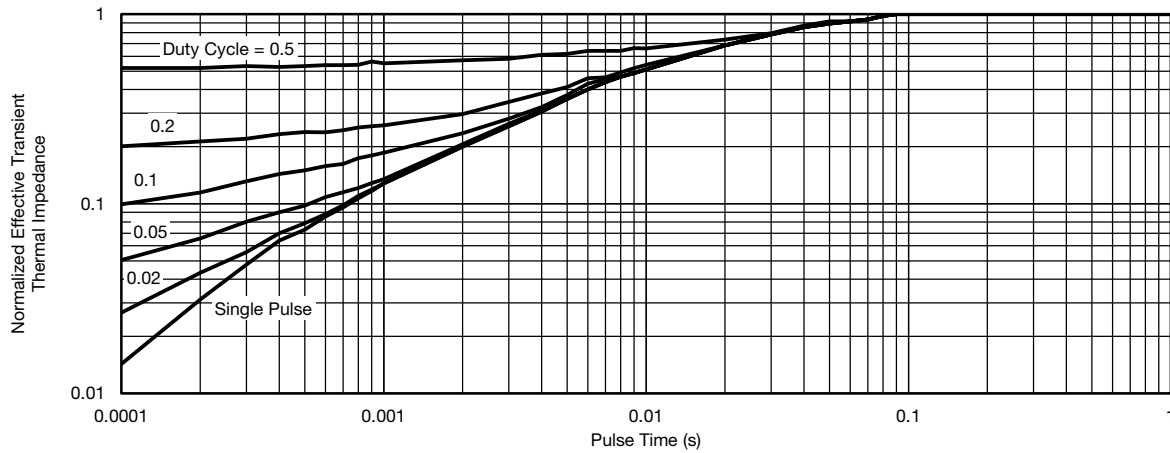


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

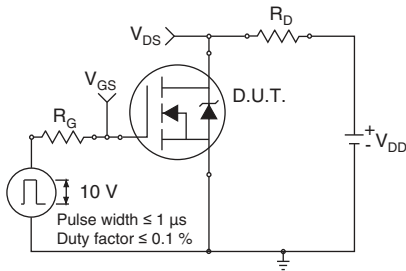


Fig. 13 - Switching Time Test Circuit

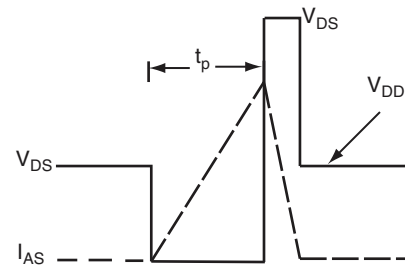


Fig. 16 - Unclamped Inductive Waveforms

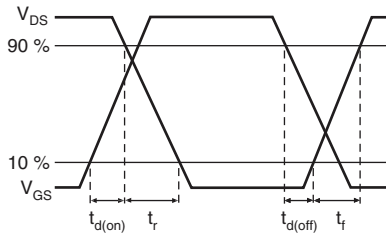


Fig. 14 - Switching Time Waveforms

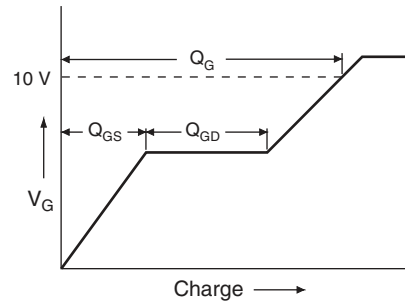


Fig. 17 - Basic Gate Charge Waveform

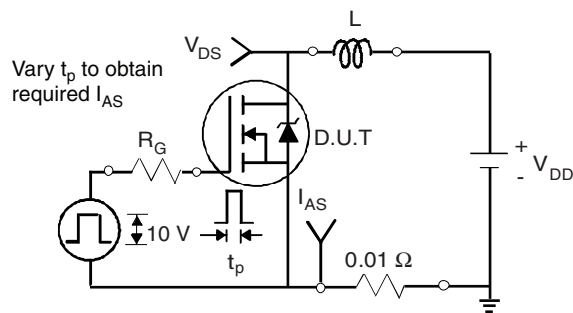


Fig. 15 - Unclamped Inductive Test Circuit

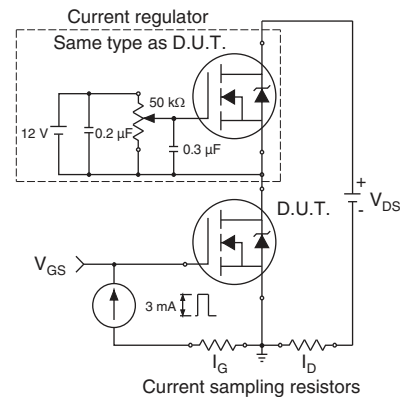
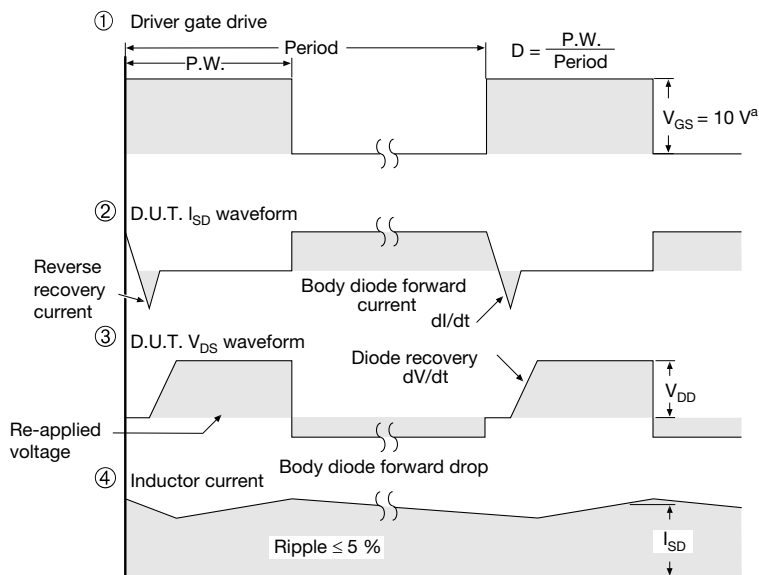
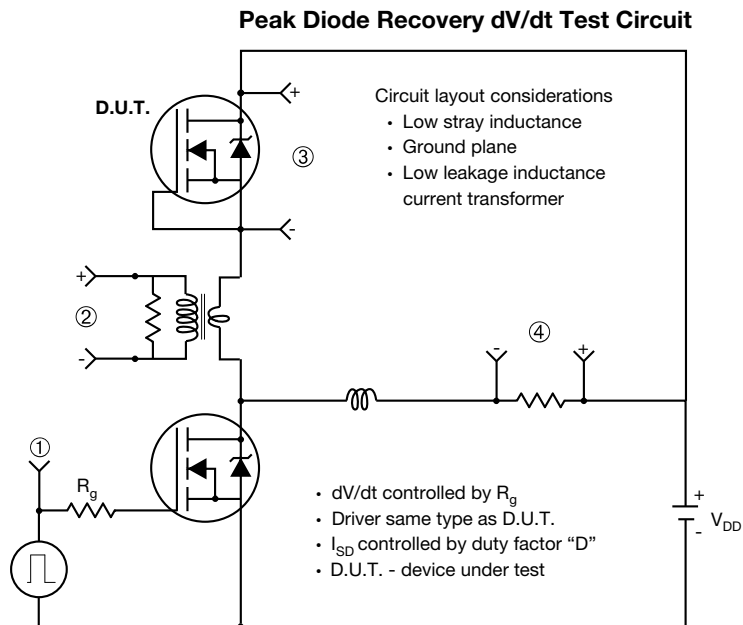


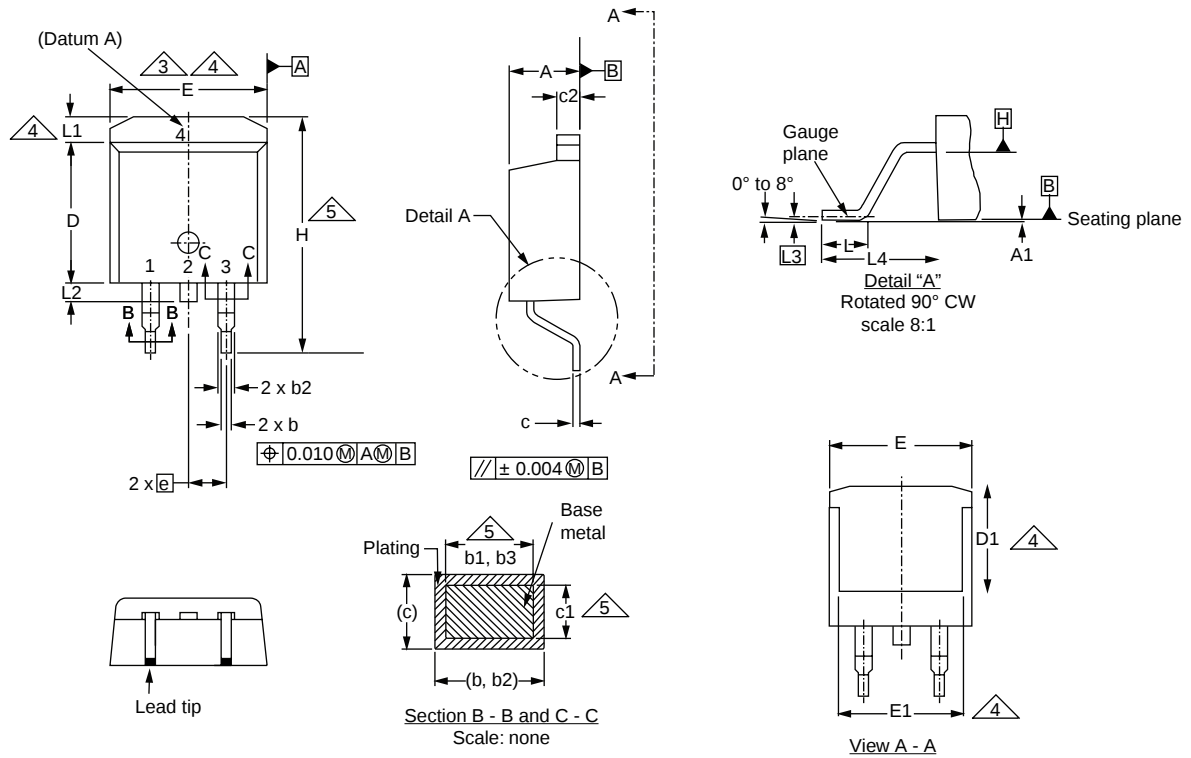
Fig. 18 - Gate Charge Test Circuit



Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 19 - For N-Channel

TO-263AB (HIGH VOLTAGE)

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

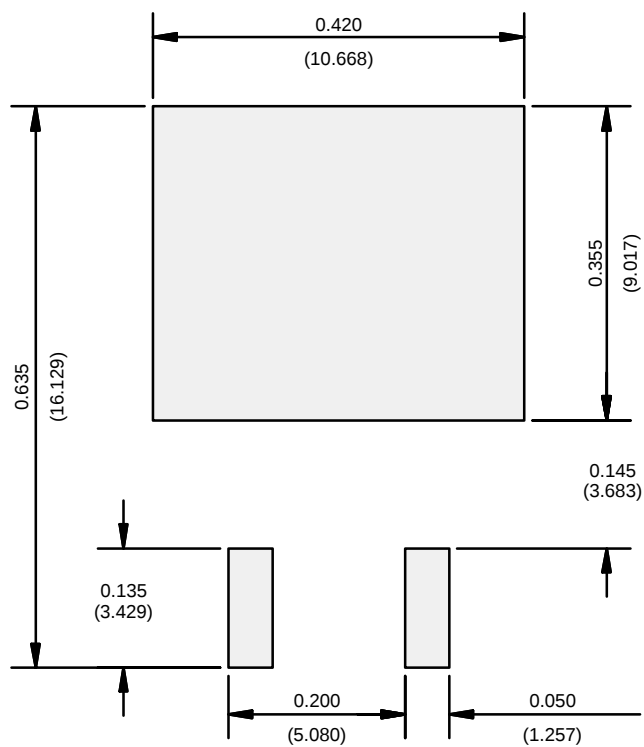
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

ECN: S-82110-Rev. A, 15-Sep-08
 DWG: 5970

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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