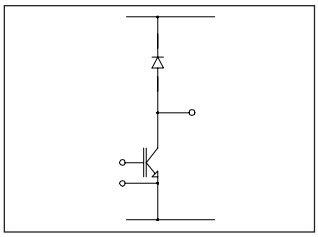
International
IOR Rectifier

50MT060ULS

"LOW SIDE CHOPPER" IGBT MTP — Ultrafast Speed IGBT

Features

- Gen. 4 Ultrafast Speed IGBT Technology
- HEXFRED ™ Diode with UltraSoft Reverse Recovery
- Very Low Conduction and Switching Losses
- Optional SMT Thermistor (NTC)
- Aluminum Nitride DBC
- Very Low Stray Inductance Design for High Speed Operation
- UL approved (file E78996)



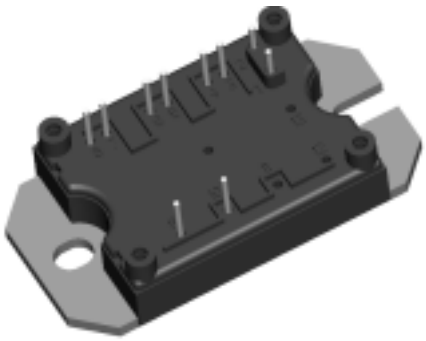
V_{CES} = 600V

I_C = 100A,

T_C = 25°C

Benefits

- Optimized for Welding, UPS and SMPS Applications
- Operating Frequencies > 20 kHz Hard Switching, >200 kHz Resonant Mode
- Low EMI, requires Less Snubbing
- Direct Mounting to Heatsink
- PCB Solderable Terminals
- Very Low Junction-to-Case Thermal Resistance



MTP

Absolute Maximum Ratings

	Parameters			Max	Units
V_{CES}	Collector-to-Emitter Voltage			600	V
I_C	Continuos Collector Current		@ T_C = 25°C	100	A
			@ T_C = 122°C	50	
I_{CM}	Pulsed Collector Current			200	
I_{LM}	Peak Switching Current			200	
I_F	Diode Continuous Forward Current		@ T_C = 100°C	48	
I_{FM}	Peak Diode Forward Current			200	
V_{GE}	Gate-to-Emitter Voltage			± 20	V
V_{ISOL}	RMS Isolation Voltage, Any Terminal to Case, t = 1 min			2500	
P_D	Maximum Power Dissipation	IGBT	@ T_C = 25°C	445	W
			@ T_C = 100°C	175	
		Diode	@ T_C = 25°C	205	
			@ T_C = 100°C	83	

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameters	Min	Typ	Max	Units	Test Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600			V	V_{GE} = 0V, I_C = 250µA
$V_{CE(on)}$	Collector-to-Emitter Voltage		1.69	2.31		V_{GE} = 15V, I_C = 50A
			1.96	2.55		V_{GE} = 15V, I_C = 100A
			1.88	2.24		V_{GE} = 15V, I_C = 100A, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3		6		I_C = 0.5mA
B_{VR}	Diode Reverse Breakdown Voltage	600				I_R = 200µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage		- 13		mV/°C	V_{CE} = V_{GE}, I_C = 500µA
g_{fe}	Forward Transconductance	22	29		S	V_{CE} = 50V, I_C = 100A
I_{CES}	Collector-to-Emiter Leaking Current			0.25	mA	V_{GE} = 0V, V_{CE} = 600V
				6		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop		1.64	1.82	V	I_F = 100A, V_{GE} = 0V
			1.56	1.74		I_F = 100A, V_{GE} = 0V, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current			± 250	nA	V_{GE} = ± 20V

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameters	Min	Typ	Max	Units	Test Conditions
Q_g	Total Gate Charge (turn-on)		370	555	nC	I_C = 100A
Q_{ge}	Gate-Emitter Charge (turn-on)		64	96		V_{CC} = 480V
Q_{gc}	Gate-Collector Charge (turn-on)		163	245		V_{GE} = 15V
E_{on}	Turn-On Switching Loss		0.7	1.2	mJ	I_C = 50A, V_{CC} = 480V, V_{GE} = 15V,
E_{off}	Turn-Off Switching Loss		1.7	2.6		R_g = 5Ω
E_{ts}	Total Switching Loss		2.4	3.8		Energy losses include tail and diode reverse recovery
E_{on}	Turn-On Switching Loss		1.1	1.7	mJ	I_C = 50A, V_{CC} = 480V, V_{GE} = 15V
E_{off}	Turn-Off Switching Loss		2.5	3.8		R_g = 5Ω, T_J = 125°C
E_{ts}	Total Switching Loss		3.6	5.5		Energy losses include tail and diode reverse recovery
C_{ies}	Input Capacitance		9800	14700		V_{GE} = 0V
C_{oes}	Output Capacitance		602	903	pF	V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance		121	182		f = 1.0 MHz
C_t	Diode Junction Capacitance		118	177		V_r = 600V, f = 1.0 MHz
trr	Diode Reverse Recovery Time		99	150	ns	V_{CC} = 480V, I_C = 50A
Irr	Diode Peak Reverse Current		6.5	9.8	A	di/dt = 200A/µs
Qrr	Diode Recovery Charge		320	735	nC	R_g = 5Ω
$di_{(rec)}M/dt$	Diode PeakRate of Fall of Recovery During t_b		236		A/µs	

Thermistor Specifications (50MT060ULST only)

	Parameters	Min	Typ	Max	Units	Test Conditions
R_0 (1)	Resistance		30		kΩ	T_0 = 25°C
β (1) (2)	Sensitivity index of the thermistor material		4000		K	T_0 = 25°C T_1 = 85°C

(1) T_0,T_1 are thermistor's temperatures

(2) $\frac{R_0}{R_1} = \exp\left[\beta\left(\frac{1}{T_0} - \frac{1}{T_1}\right)\right]$, Temperatures in kelvin

Thermal- Mechanical Specifications

	Parameters		Min	Typ	Max	Units
T_J	Operating Junction Temperature Range		- 40		150	°C
T_{STG}	Storage Temperature Range		- 40		125	
R_{thJC}	Junction-to-Case	IGBT		0.18	0.28	°C/ W
		Diode		0.4	0.6	
R_{thCS}	Case-to-Sink (Heatsink Compound Thermal Conductivity = 1 W/mK)	Module		0.06		
T	Mounting torque to heatsink	(3)		3 ± 10%		Nm
Wt	Weight			66		g

(3) A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads

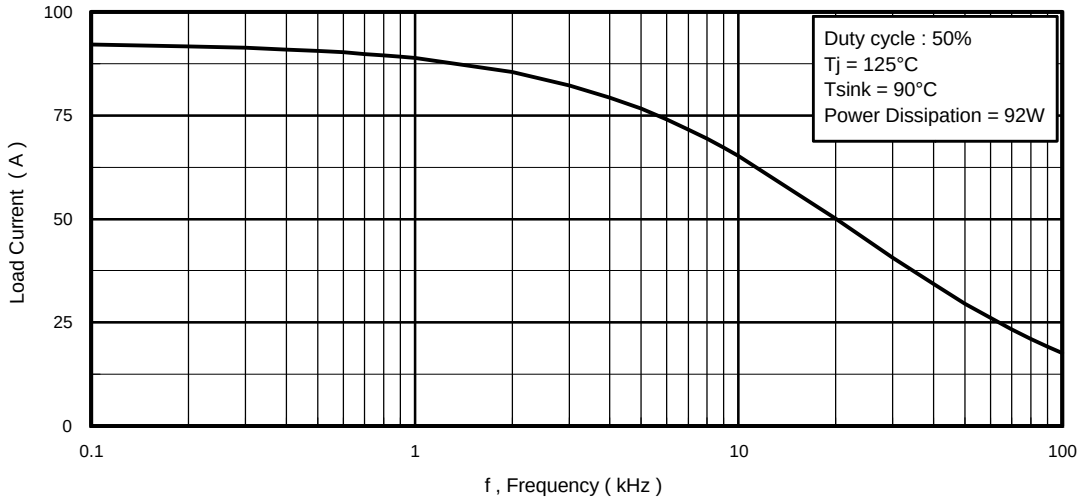


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

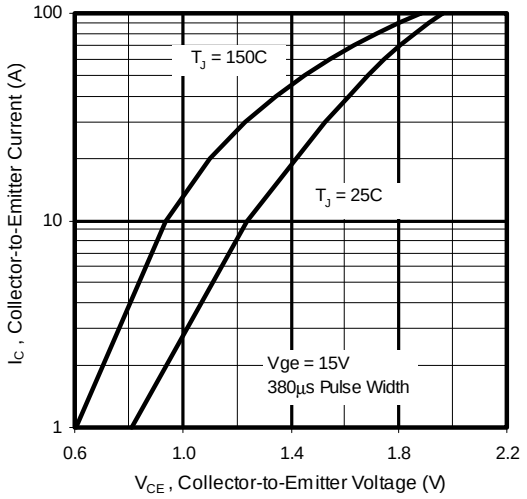


Fig. 2 - Typical Output Characteristics

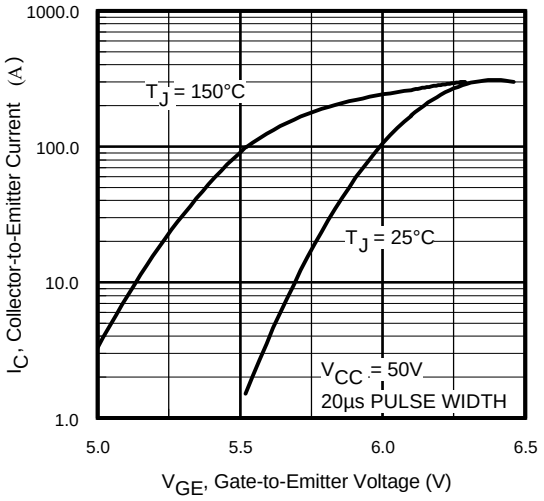


Fig. 3 - Typical Transfer Characteristics

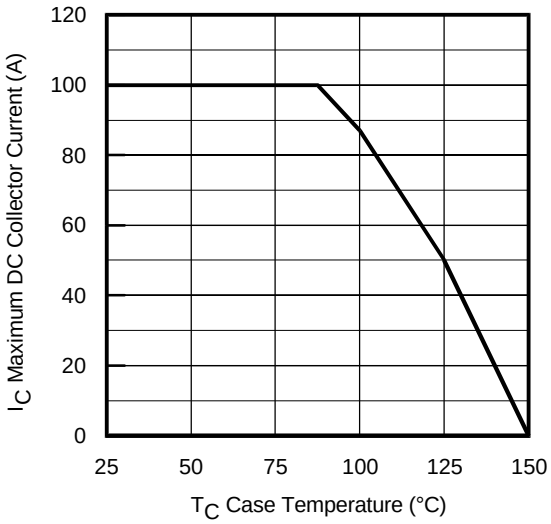


Fig. 4 - Maximum Collector Current vs. Case Temperature

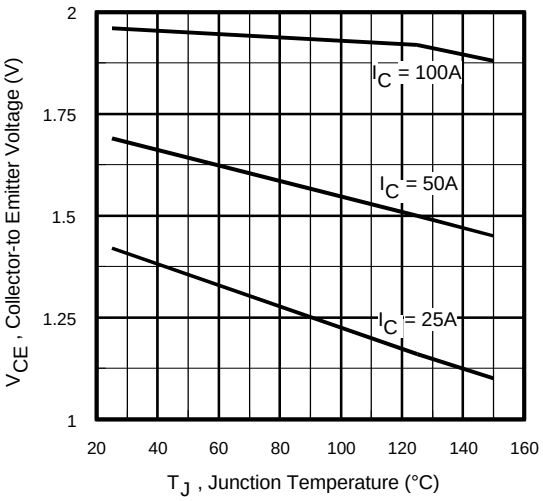


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

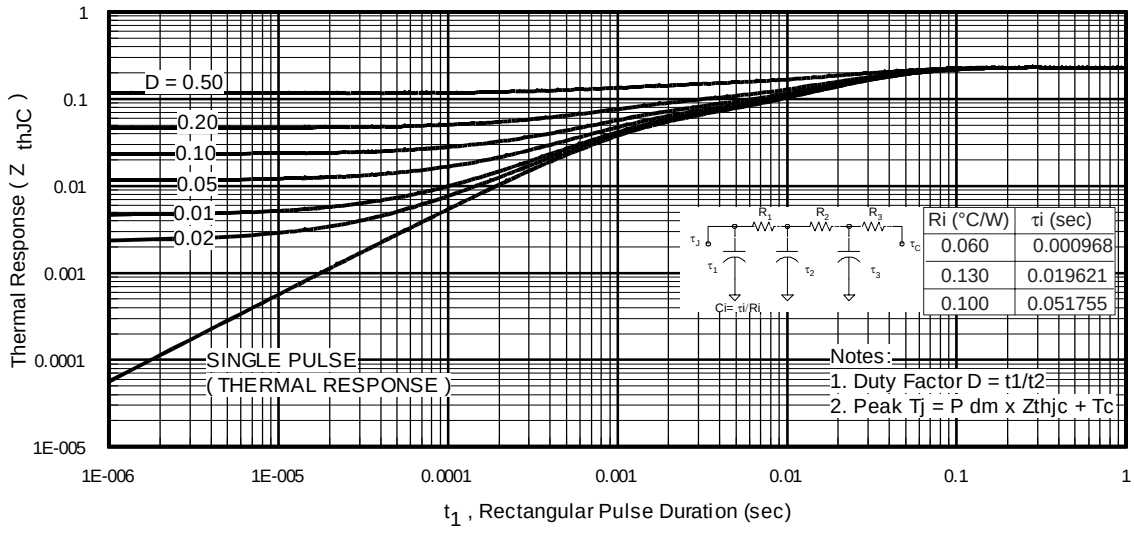


Fig. 6a Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

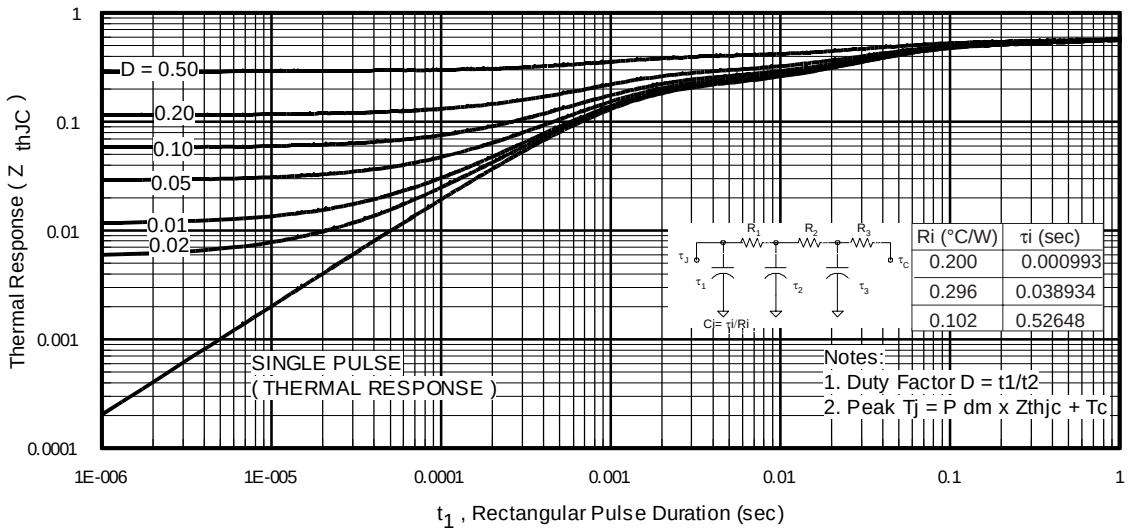


Fig. 6b Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

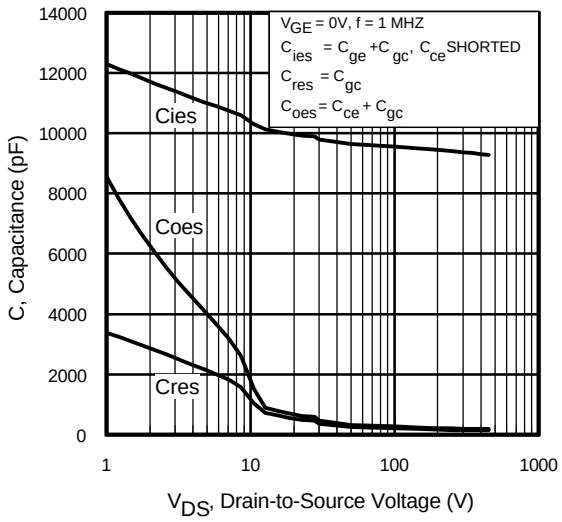


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

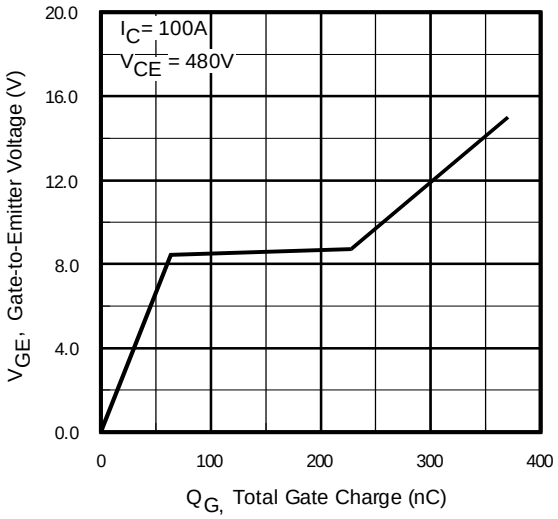


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

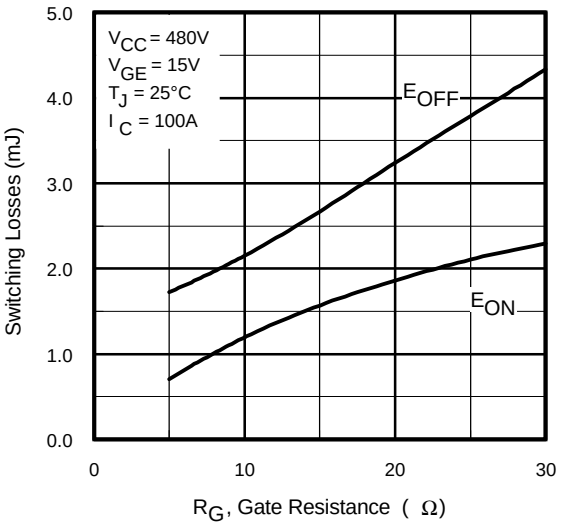


Fig. 9 - Typical Switching Losses vs. Gate Resistance

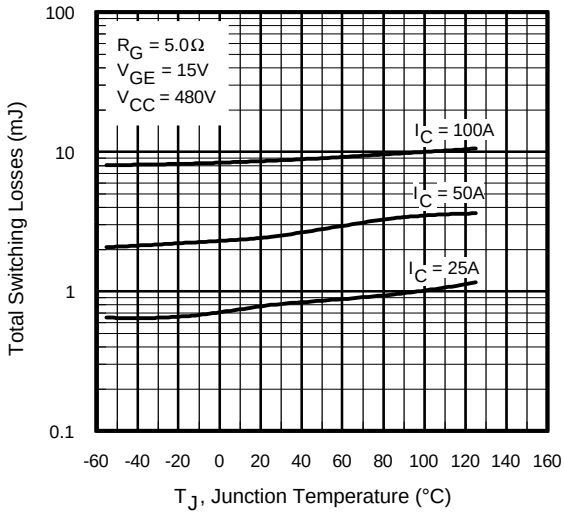


Fig. 10 - Typical Switching Losses vs. Junction Temperature

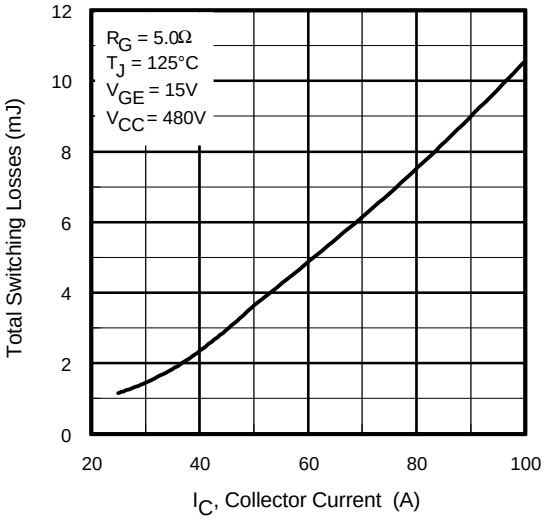


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

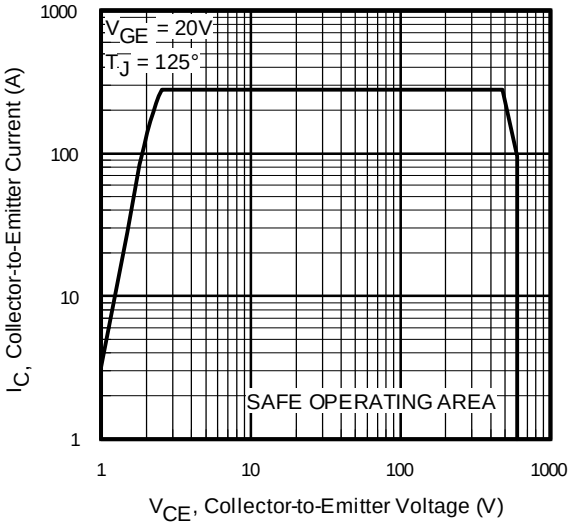


Fig. 12 - Turn-Off SOA

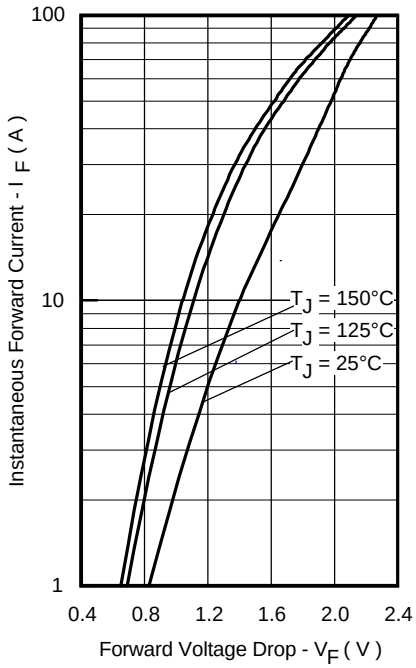


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

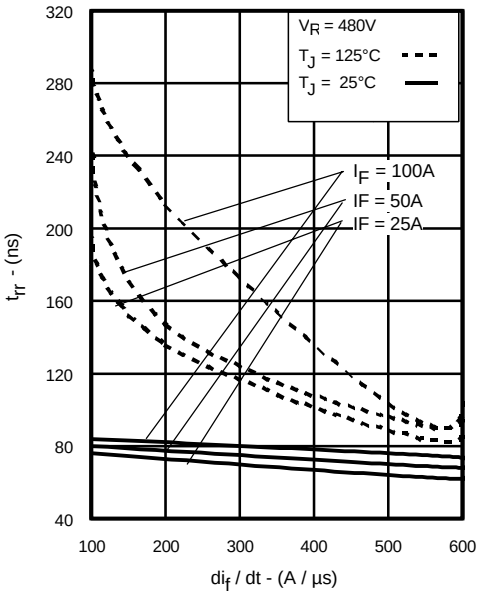


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

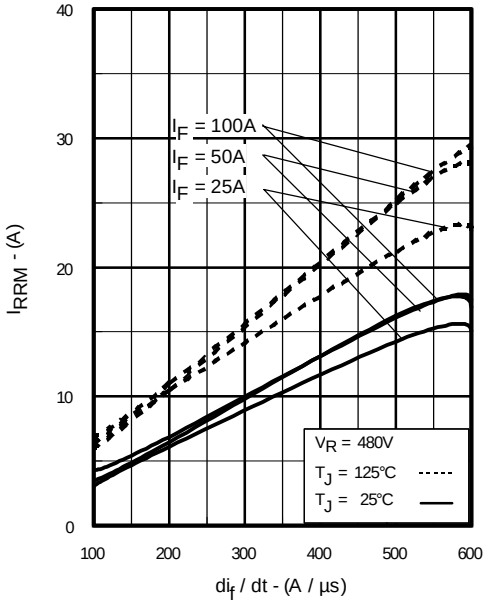


Fig. 15 - Typical Recovery Current vs. di_f/dt

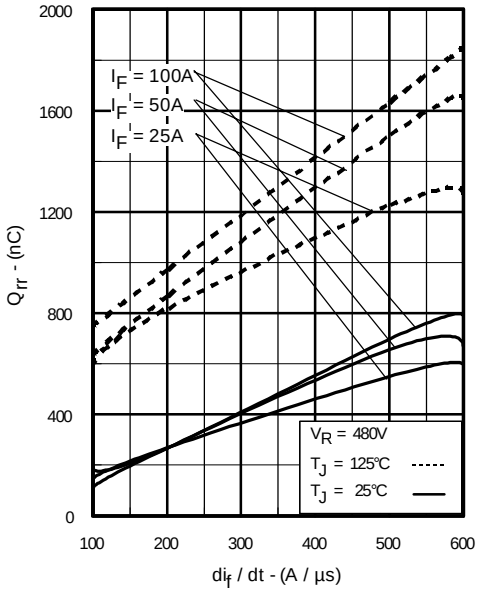


Fig. 16 - Typical Stored Charge vs. di_f/dt

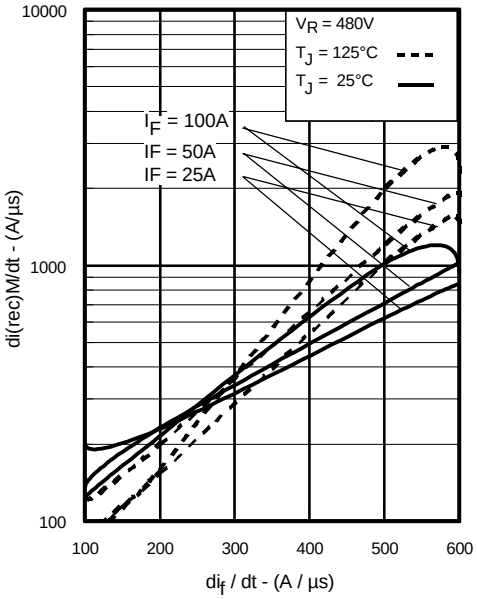
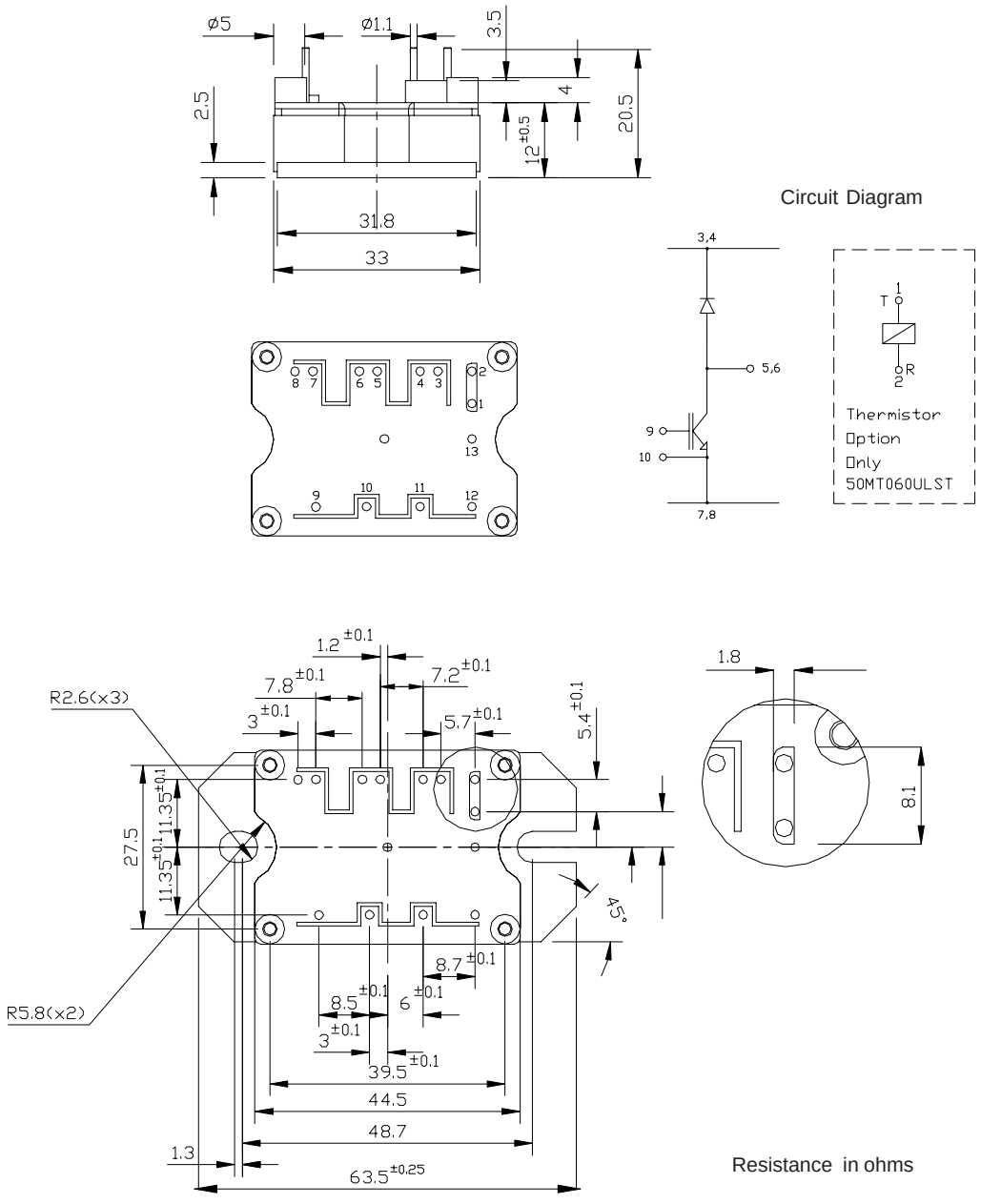


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

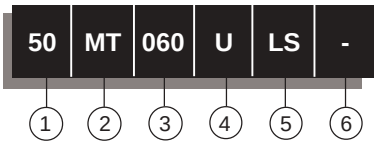
Outline Table



Dimensions in millimetres
Note: unused terminals are not assembled in the package

Ordering Information Table

Device Code



1	-	Current rating	(50 = 50A)
2	-	Essential Part Number	
3	-	Voltage code	(060 = 600V)
4	-	Speed/ Type	(U = Ultra Fast IGBT)
5	-	Circuit Configuration	(LS = Low Side Chopper)
6	-	Special Option	Empty = no special option T = Thermistor

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level.
Qualification Standards can be found on IR's Web site.

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